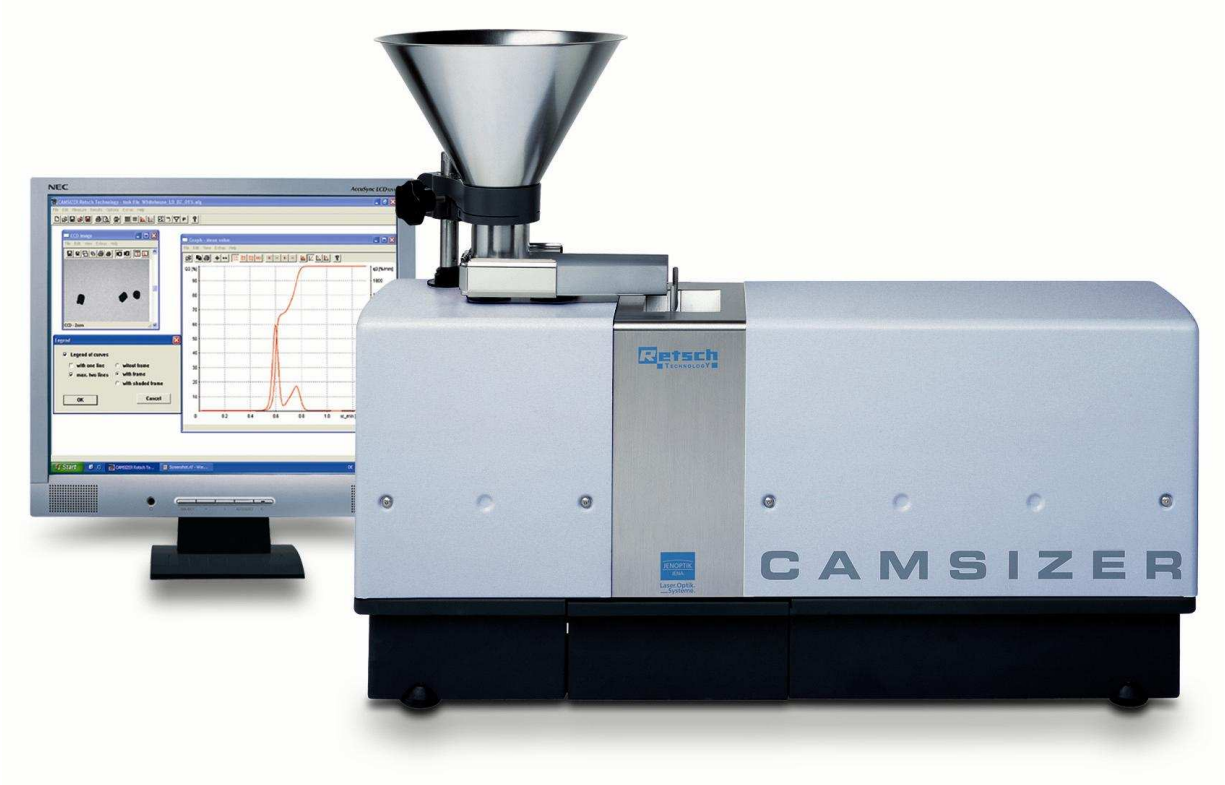

Operating Instructions / Manual
Particle Size Analysis System
CAMSIZER®

Retsch® TECHNOLOGY

JENOPTIK GERMANY

 Doc.Nr. CAMSIZER V0115

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0 ADVICE FOR USING THIS MANUAL

Dear user,

Please read the following manual carefully before you start working with the CAMSIZER® particle measurement system. The information in this manual is essential to make optimum use of the features and advantages of the instrument, and to prevent injuries of persons or damages to the system resulting from operating errors.

The CAMSIZER® is a precise and sensitive instrument for the measurement of the shapes, sizes and transparency values of grains. Please handle it with the appropriate care.

Please read the first chapter “Safety instructions” carefully to prevent any injuries of people or damages to the instrument, and make sure that any person working with the instrument has read and understood these instructions.

The manual does not include repair instructions. Any repairs are explicitly reserved to customer service and authorized staff. A non-compliance with this advice and an arbitrary carrying-out of repairs can lead to the expiry of warranty claims. Please contact your distribution partner or Retsch Technology GmbH for repair orders of the CAMSIZER®.

This manual contains all necessary information for the application fields of the CAMSIZER®, and for the safe and appropriate operation of the instrument.

As the CAMSIZER® offers a broad variety of elaborate functions, this manual has been designed as a tutorial providing instructions for the installation of the instrument and for the measurement process, and as a reference book which can be consulted for looking up the functions of each single menu item.

The manual is structured into the following sections:

Chapter 1	Safety instructions
Chapter 2	Technical information
Chapter 3	Instructions for the installation and commissioning
Chapter 4	Structure of the software user interface and description of the password-protected modes
Chapter 5	Preparations and measurement
Chapter 6	Short tutorial to carrying out a measurement procedure
Chapter 7	Reference book: Description of the software functions
Chapter 8	Appendix: Characteristics

Please consult the tutorial (Chapter 6) if you are not yet familiar with all of the functions of the CAMSIZER®. In this chapter, all steps performed in a measurement procedure are described in detail.

If you are familiar with working with the CAMSIZER® and you would like to look up special functions, please refer to chapter 7. This chapter is structured according to the software, and each function is described in detail.

This manual was produced with the appropriate care. No liability will be accepted for injuries of persons or damage to the CAMSIZER®, to accessories of the CAMSIZER® or to any other items arising from a non-compliance with the instructions contained herein.

Jena & Haan, May 2007

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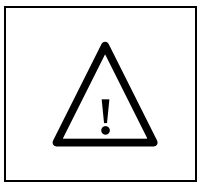
Copyright information

1 SAFETY INFORMATION

The CAMSIZER® is a precise high performance particle measuring system by Retsch Technology GmbH. It is a state-of-the-art sensitive technical instrument; please follow the safety regulations for transportation, assembly and operation described in this chapter. In this way, any damage to the CAMSIZER® or its component parts can be prevented.



The CAMSIZER® is suitable for free flowing dry and harmless material. Please make sure that all regulations for hazardous goods and all information contained in the safety data sheets of the analyzed materials are observed.

If used in compliance with the operation instructions, the instrument can be operated safely and efficiently.

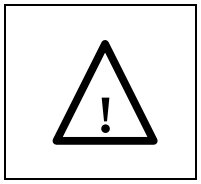
1.1 General safety instructions

1.1.1 Personal safety

As the operator of the CAMSIZER®, you are responsible for the safety of your employees and of yourself. Do not carry out repairs by yourself. Please observe the following safety rules to prevent any personal injury caused by improper use. Make sure that

- every person working with the CAMSIZER® has read and understood the safety regulations and operation instructions, and is familiar with the safe and intended use of the instrument,
- every person working with the CAMSIZER® has always access to the manual of this instrument,
- all safety regulations for the material to be analysed are observed, especially when working with critical substances,
- new employees receive training and instructions to the safe and appropriate operation of the instrument before starting to work with the CAMSIZER®,
- unauthorized persons do not get access to the CAMSIZER®,

- your employees confirm that they have been introduced to the safe and appropriate operation of the instrument and have understood these regulations. A suitable form is included in the appendix of this manual.



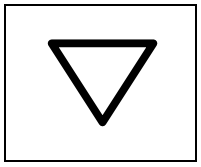
No liability will be accepted in any case of physical injury resulting from the non-compliance with the safety instructions contained in this manual.

1.1.2 Device safety

If working with critical or reactive substances, all parts of the instrument that have been in contact with these substances have to be cleaned thoroughly before and after measurement. Observe the health and safety instructions of the material to be analysed.

The particle measurement system CAMSIZER® has been designed as one measuring unit and may be used only in its original version. Any modification requires prior consultation and permission of Retsch Technology. An arbitrary change of the CAMSIZER® might render the CE-compliance of the instrument ineffective.

The installation of additional hardware (for example sound cards) and software on the PC can risk your warranty claims and reduce the performance of the data acquisition system. Please contact Retsch Technology in case of any questions.



No liability will be accepted in any case of damage resulting from the non-compliance with the safety instructions provided in this manual.

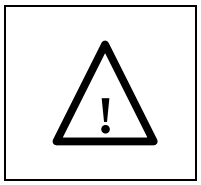
1.2 Repairs

Any repairs are explicitly reserved to Retsch Technology customer service and authorized staff. A non-compliance with this advice and an arbitrary carrying-out of repairs can lead to the expiry of warranty claims.

Do not make any changes to the CAMSIZER®, and do only use such spare parts and accessories that are explicitly recommended and permitted by Retsch Technology. Failure to comply will render the statement of conformity with the European Directives ineffective.

Please contact your supplier, the local representative of Retsch Technology or Retsch Technology GmbH for repair orders for the CAMSIZER® or for questions concerning spare parts and accessories.

The disposal of the entire unit or of parts of the unit must be made in accordance with the local regulations (like WEEE or others).



Failure to comply with the safety advice will render the statement of conformity with the European Directives ineffective.

- Non-compliance can lead to an expiry of warranty claims.
- No liability will be accepted for damages or personal injuries arising from the unauthorized arbitrary carrying-out of repairs.

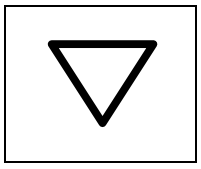
1.3 Storage and transportation

1.3.1 Packaging

The packaging of the CAMSIZER® depends on the means of transportation and complies with the general packaging guidelines.
The CAMSIZER® packaging conforms to the packaging norm FEFCO 0203 from KDW 2.7´ (one-way).

The packaging has the following weight and dimensions:

Length	1000 mm
Width	590 mm
Height	615 mm
CAMSIZER®	48 kg
CAMSIZER®, computer, monitor and keyboard	60 kg



Please retain the packaging of the CAMSIZER® for the duration of the warranty period. The return of the CAMSIZER® with an incomplete packaging may lead to damage of the instrument and an expiry of the warranty claims.

1.3.2 Transportation

- Avoid any shocks during transportation (i.e. by throwing, shaking or knocking against the CAMSIZER®) to prevent damages to the instrument.

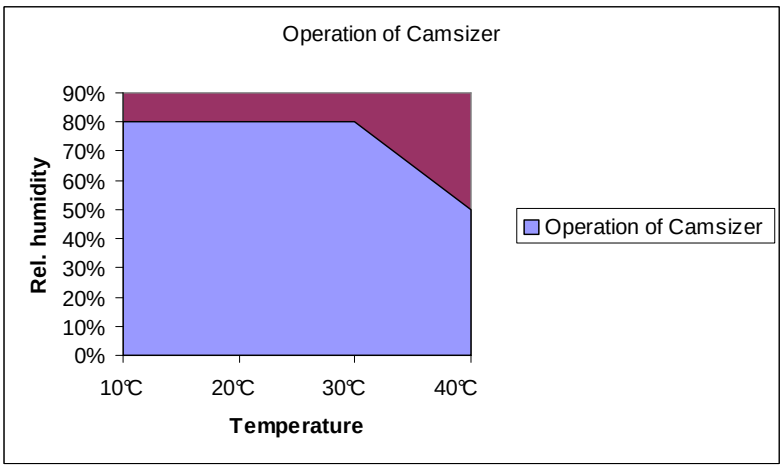
- When exposed to high temperature variation, the CAMSIZER® has to be protected against condensation water.

- Please make sure to store the CAMSIZER® in a dry environment, also during intermediate storage.

▽	Irreversible damage can be caused to the electronic and mechanic parts if the advice for storage and transportation are not observed.

1.4 Operation conditions

- Environment temperature: 10°C … 40°C
- Air humidity:
  - 80% maximum relative humidity at temperatures up to 30°C
  - Linear decrease of humidity down to 50% at environment temperatures from 31°C … 40°C



The diagram illustrates the environment conditions (temperature and relative humidity) under which the operation of the CAMSIZER® is permitted. Do not use the instrument if temperatures or humidity exceed the values of the area marked blue in the diagram.

- Height of assembly and operation: maximum 3000 m above sea level.
- Operating location: place the CAMSIZER® onto a firm ground. The instrument has to be placed shock-free onto an even horizontal plane.
- Light conditions: avoid strong direct external light on the particle shaft / measurement shaft or on the cameras.

▽	Irreversible damage can be caused to the electronic and mechanic parts if the advice for the operation conditions is not observed. Performance data can deviate to an unknown extent.

2 TECHNICAL INFORMATION ABOUT THE CAMSIZER®

2.1 The application range of the CAMSIZER®

The CAMSIZER® is an opto-electronic instrument for the measurement and analysis of grain sizes, shapes and transparency properties of free flowing bulk material. With the CAMSIZER®, the distribution of particle sizes and shapes can be analysed at a high resolution and without contact. The wide measurement range from 30 µm to 30 mm makes the instrument suitable for a wide variety of applications, and offers an alternative to the conventional laborious sieve analysis.

Typical sample materials are:

- Salt / sugar
- Plastics
- Catalysts
- Abrasives
- Carbon products
- Sand
- Carbon black / coal
- Coffee
- Refractory products
- Foodstuffs
- Polystyrene
- Glass, ceramics
- Fertilizers
- Drugs
- Metal powder

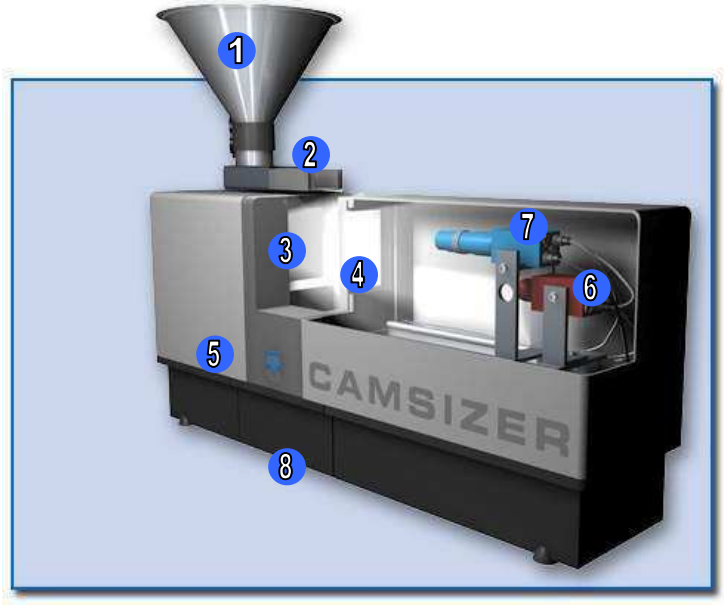
Typical application fields are quality control, research and production control. For the use in industrial environment, Retsch Technology offers integrated solutions for the application in continuous process control.

CAMSIZER® is suitable for free flowing dry and harmless material. Please make sure that all regulations for hazardous goods and all information contained in the safety data sheets of the materials are observed.

2.2 The measuring process with the CAMSIZER®

The measuring principle of the CAMSIZER® is based on Dynamic Digital Image Processing described in ISO 13322-2. Particle size analysis with the CAMSIZER® has been automated to the greatest possible extent, and manual working steps have been reduced to a minimum.

The CAMSIZER® is structured into the following units:



The system comprises the following basic elements for the realisation of particle size and shape analysis to carry out the measuring.

1. Dosage funnel
2. Dosage feeder
3. Planar illumination unit
4. Measurement shaft
5. Electronic assembly (funnel and feeding hardware)
6. Camera CCD-Basic
7. Camera CCD-Zoom
8. Sample collection container

- Dosage Feeder DR 100-75 RT with storage funnel for feeding the sample material

The sample material is supplied to the device through the storage funnel, either manually or automatically using AutoSampler. Through the dosage feeder DR 100-75 RT, the sample is transported to the measuring area in the measurement shaft. The quantity of the sample material falling into the shaft is defined by the automatic height adjustment of the funnel and the vibration amplitude of the feeder, both controlled by the computer.

- Measurement shaft

The sample falls through the measurement area in the shaft where the planar illumination unit and the CCD-cameras are located opposite of each other.

- CCD-cameras for generating the images (standard setting)
    - Basic camera CCD-B for measuring large particles: 300 µm - 30 mm
    - Zoom-camera CCD-Z for measuring small particles: 30 µm – 3 mm

During the measurement process, the CCD-image with both cameras can be activated with the respective buttons (please see chapter 4.2 “The structure of the software user interface”). The cameras are equipped with different lens systems, each one optimised for the respective magnification.

- Planar illumination unit

The CCD-cameras and the planar illumination unit are located opposite of each other to guarantee an optimum illumination of the image scene.

- Computer for the control of the system and the analysis of the measurement data

All device functions for the measurement process and analysis are controlled with the CAMSIZER® analysis software installed on the computer included in your delivery. Measurement parameters like the height adjustment of the funnel, the feeder vibration amplitude, the shadowed area, and the shape and size parameters of interest can be set prior to the measurement process. Images are processed in real time (~30 Hz with each camera).

- Vacuum unit for keeping clean the optical path

The vacuum unit can be activated automatically during the measurement process to keep clean the optical path in the measurement shaft. Using low pressure, the sample material is drawn through the shaft to the sample collection container from where it can be easily removed.

2.3 Technical data and measurement specifications of the CAMSIZER®

Instrument data	
Protection type	IP 50
Dimensions (length x width x height)	ca. 850 x 350 x 650 mm including funnel ca. 852 x 315 x 515 mm without funnel
Weight	CAMSIZER® 48 kg CAMSIZER®, PC, monitor, keyboard, mouse 60 kg
Required floor space (length x width)	2000 x 700 mm no safety distances are required
Measurement data	
Measuring method	Dynamic digital image processing
Acquisition rate	~ 60 images/sec.
Image quality	More than 780.000 pixel per image (corresponds to more than 45 Mio. pixels per second)
Grain size range (min … max)	30 µm … 30 mm
Measuring times	Appr. 2 … 10 min. depending on the material quantity, the grain size, the width of the dosage feeder and the measuring statistics
Quantity of measured material	Depends on the grain size of the sample material. For fine powders, a teaspoon of material is sufficient, whereas funnels for up to 3.5 litres of sample material are necessary, for example for coarse gravel.
Nominal power consumption	60 W
Emissions (noise characteristics)	Emissions at 1 m distance: between 35 and 52 dB (A) depending on the vibration intensity of the dosage feeder and the properties of the sample material
Image analysis station	Computer including operation system, monitor, keyboard, mouse, network card, PC-interface card for hardware communication, analysis software
Environment parameters	
Environment temperature	10 °C … 40 °C
Air humidity	80% maximum relative humidity (10 … 31°C); linear decrease to 50 % relative humidity (31°C … 40°C)
Height of assembly	Max. 3000 m above sea level

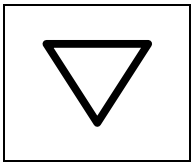
3 INSTALLATION AND COMMISSIONING

3.1 Delivery scope

CAMSIZER®-instrument
Planar illumination unit
Digital camera basic Cam-B for measuring particle sizes from 300 µm – 30 mm (standard setting)
Digital camera zoom Cam-Z for measuring particle sizes from 30 µm – 3 mm (standard setting)
Continuous air flow options (vacuum ejector and dust protection)
Dosage funnel
Dosage feeder
Automatically controlled dosage feeder (inside)
Dosage feeder holder (connected with two screws on the top)
Guide plate for fine samples
Level gauge (water or spirit) to align the CAMSIZER®
High performance computer
Windows XP professional
19´´- Monitor, keyboard and mouse
PC-interface card (framegrabber) for hardware-communication (installed)
Set of tools: Allen keys
Spare dust filter
CD-ROM
Modern 32-bit measuring and analysis software
Emulation of existing methods (such as sieving) is possible
Manual
Optional accessories
AutoHeight control system
Calibration reticule
Filter for air supply

Please check that the delivery is complete and undamaged, and that any additional accessories you have ordered are included.

Please check also that the CAMSIZER® works flawlessly and without any problems.

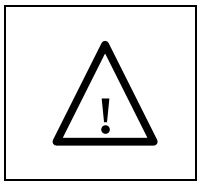


If the product shipment is found to be incomplete and/or to have suffered damage during transportation, the deliverer and Retsch Technology GmbH must be promptly notified (within 24 hours). Complaints received after this deadline may not be taken into account.

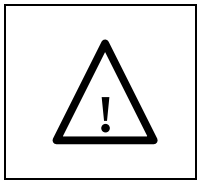
3.2 Assembly

Place the CAMSIZER® onto a firm, shock-free and even horizontal ground. Remove the packaging.

For transportation safety reasons, some component parts of the CAMSIZER® are delivered in separate packaging and have to be mounted to the instrument. The mounting of the parts is described in the following chapter.



Disconnect the CAMSIZER® from the power supply during the assembly, otherwise there is the danger of personal injury through electric shock.

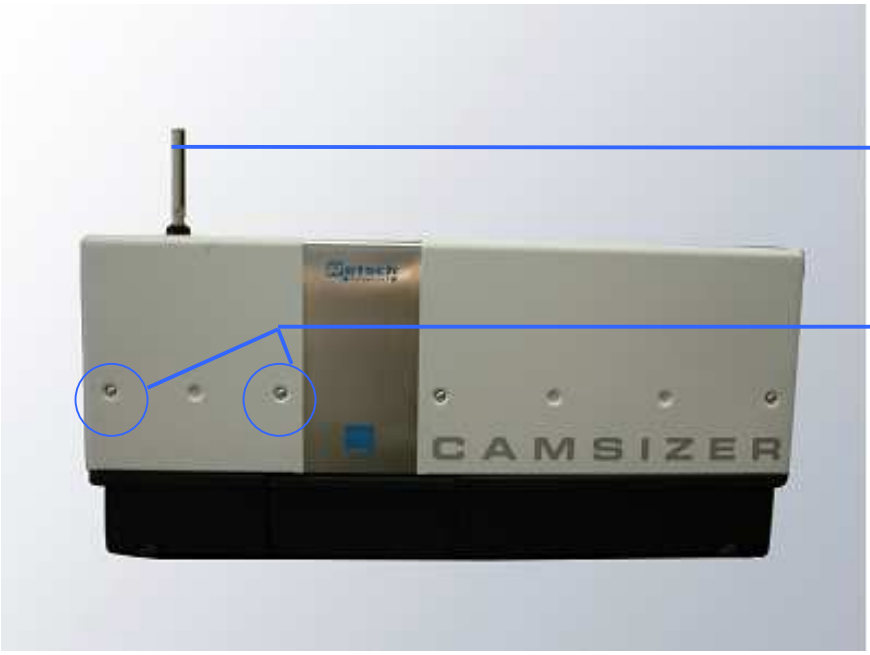


Please follow each step exactly as described, otherwise personal injury or damages to the instrument can be caused.

3.2.1 Removal of the transportation locks

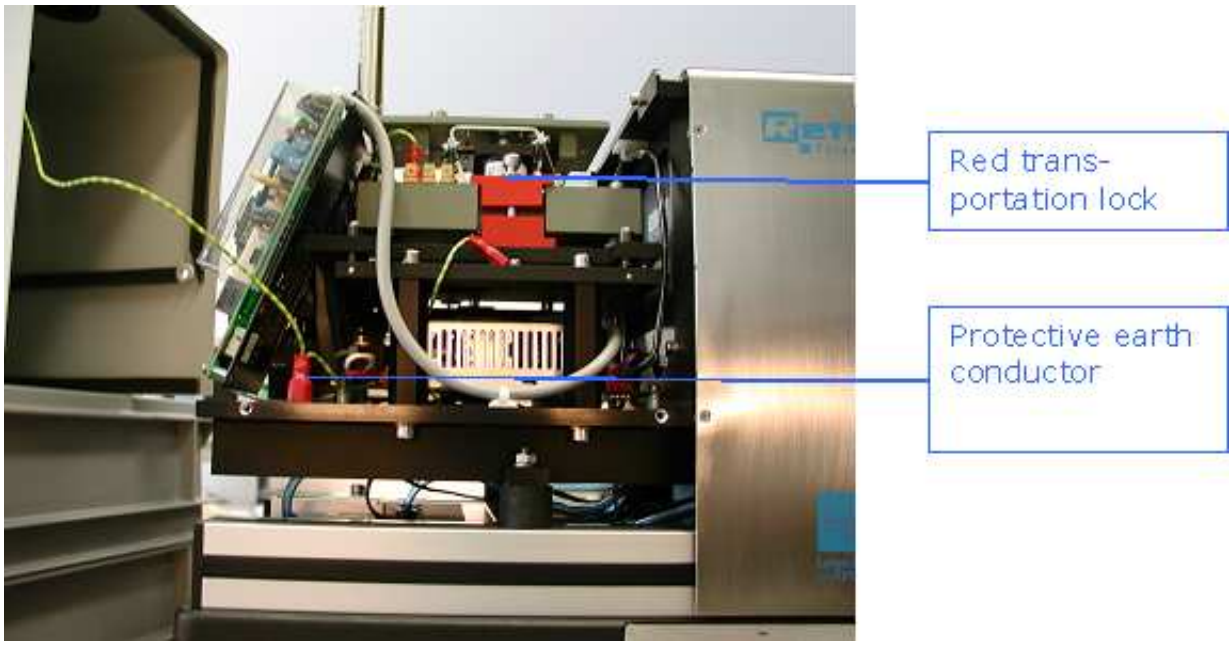
The vibration unit of the dosage feeder has been locked with red transportation locks to protect it from damage during transportation. The transportation locks have to be removed from the dosage feeder before starting to operate the CAMSIZER®.

Remove the four screws and the flat washers from the shorter jacket (housing) of the casing and remove the jacket. Put some ethyl alcohol on the cylindrical funnel mounting to facilitate the removal of the casing.



Remove the casing holding it horizontal. Please make sure not to damage the sealing tape.

⚠	Disconnect the CAMSIZER® from the power supply during the removal of the transportation locks, otherwise there is the danger of personal injury through electric shock.

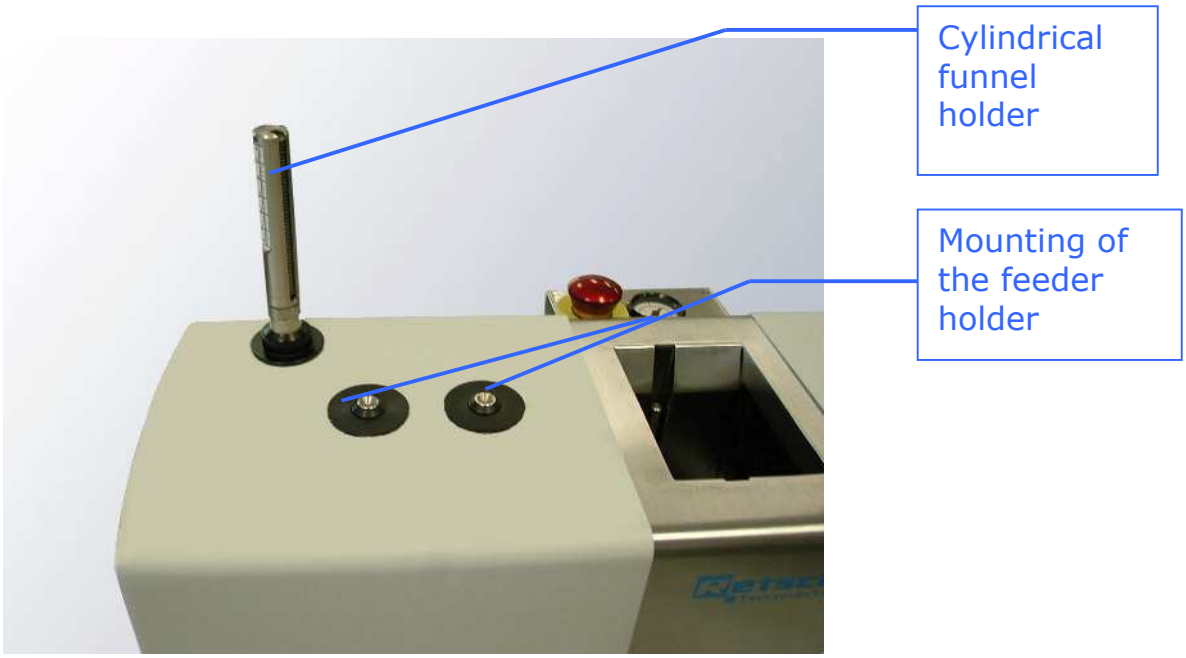


The casing and the instrument are connected with a protective earth conductor. Disconnect the earth conductor during the disassembly by removing the plug from the instrument (please see image above). Remove the two red transportation locks from each side of the vibration unit (use the 5mm Allen-key).

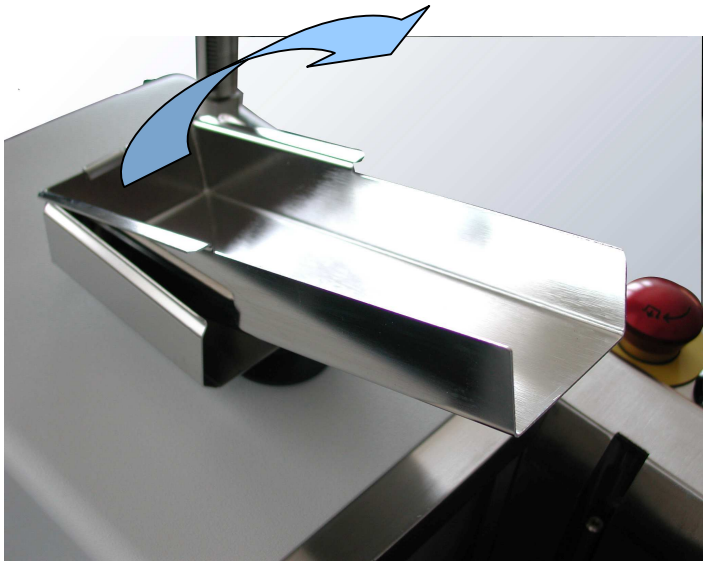
Replug the earth conductor to the contact of the CAMSIZER®, put some ethyl alcohol on the cylindrical funnel mounting, and replace the casing. Make sure not to damage the earth conductor and the sealing tape when replacing the casing. Refasten the casing with the screws and the flat nylon washers.

3.2.2 Mounting of the dosage feeder

The dosage feeder has to be fixed to the upper side of the casing.



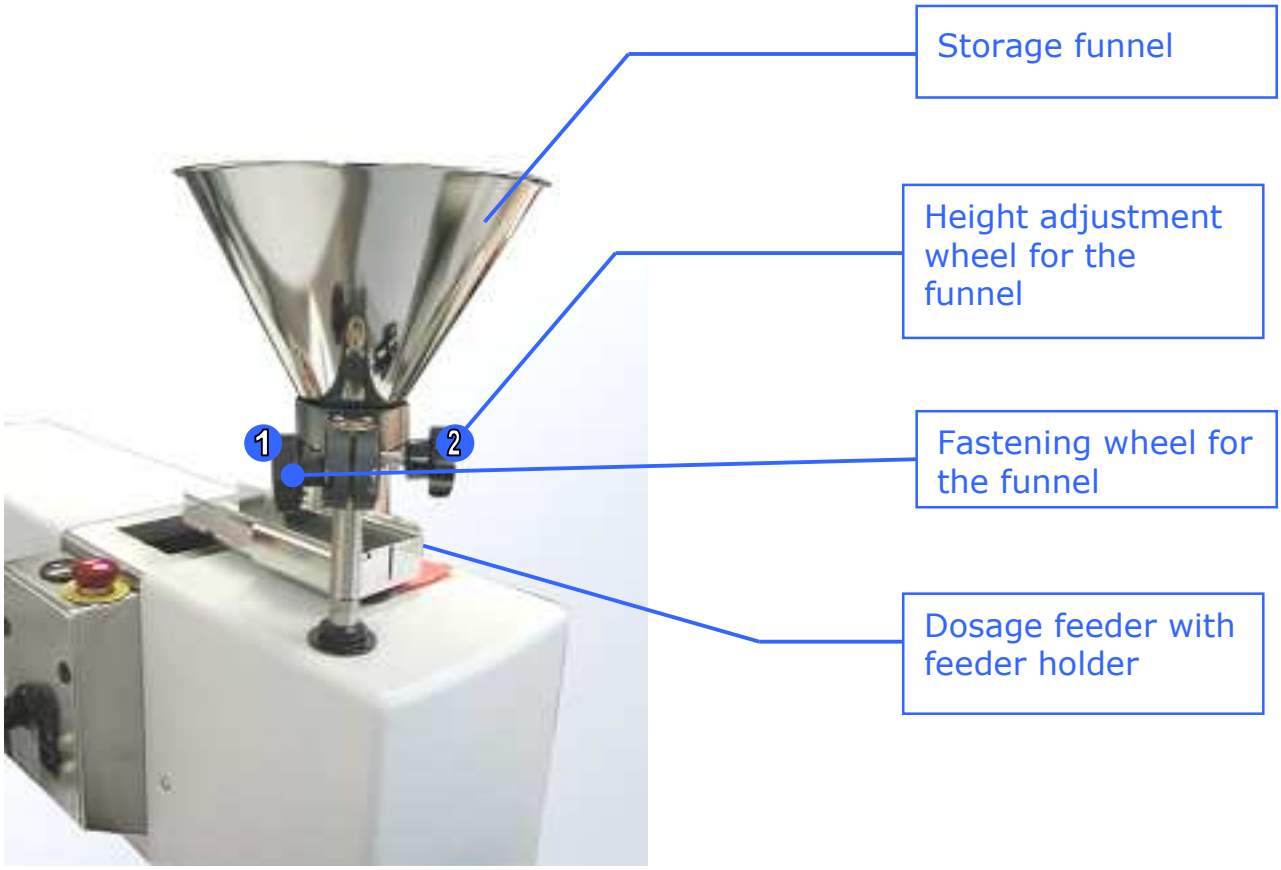
Remove the two screws, and place the holder in the appropriate way. Fix the holder with the screws.



The dosage feeder can now be easily placed into the holder. Place the feeder into the two clamps of the holder turn it clockwise and press downwards until the feeder is locked.

3.2.3 Mounting of the funnel

The funnel is mounted to the cylindrical funnel mounting.



- Two wheels are attached to the funnel. The fastening wheel (1) is used for fastening or loosening the funnel. The height adjustment wheel (2) is used for the height adjustment of the funnel, and is

equipped with a cogwheel that is connected to the cylindrical mounting.

- To adjust the height of the dosage funnel, loosen the dosage funnel and turn the front wheel until the desired height is reached. Refasten the funnel using the back wheel.

Please note
The distance between the funnel and the dosage feeder should amount to the 2 to 3-fold maximum particle size in the sample. The quantity of the material to be measured has to be inserted into the funnel.

3.2.4 Mounting of the guide plate (guidance sheet)

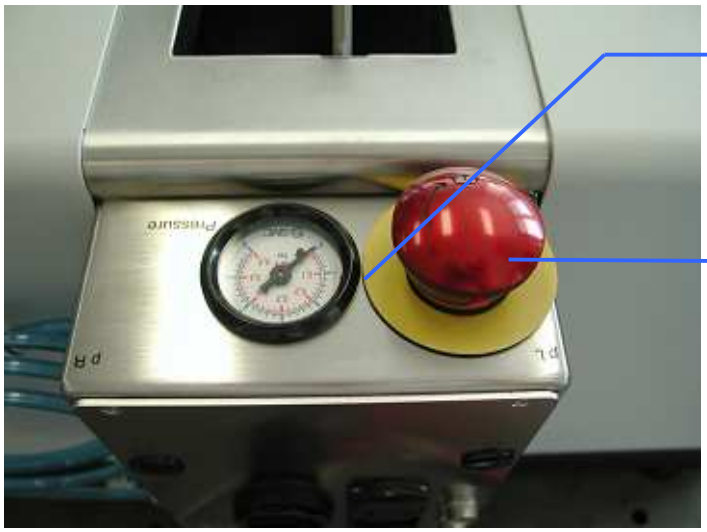
For very fine sample material, or for materials whose orientation during the phase of the free fall has to be aligned, a guide plate can be used. For example, the orientation of longish particles can be aligned so that all particles in the sample assume the same orientation during the fall.

Fix the guide plate onto the two cylindrical holdings on each side of the shaft.

Please set the opening of the guide plate slightly larger than the largest particle diameter in the sample to prevent the blocking of the guide plate during measurement. However, the distance should be as small as possible. The long lines on the scale are the middle or zero position of the plate. Open and close it symmetrically that the long lines are always in the middle.

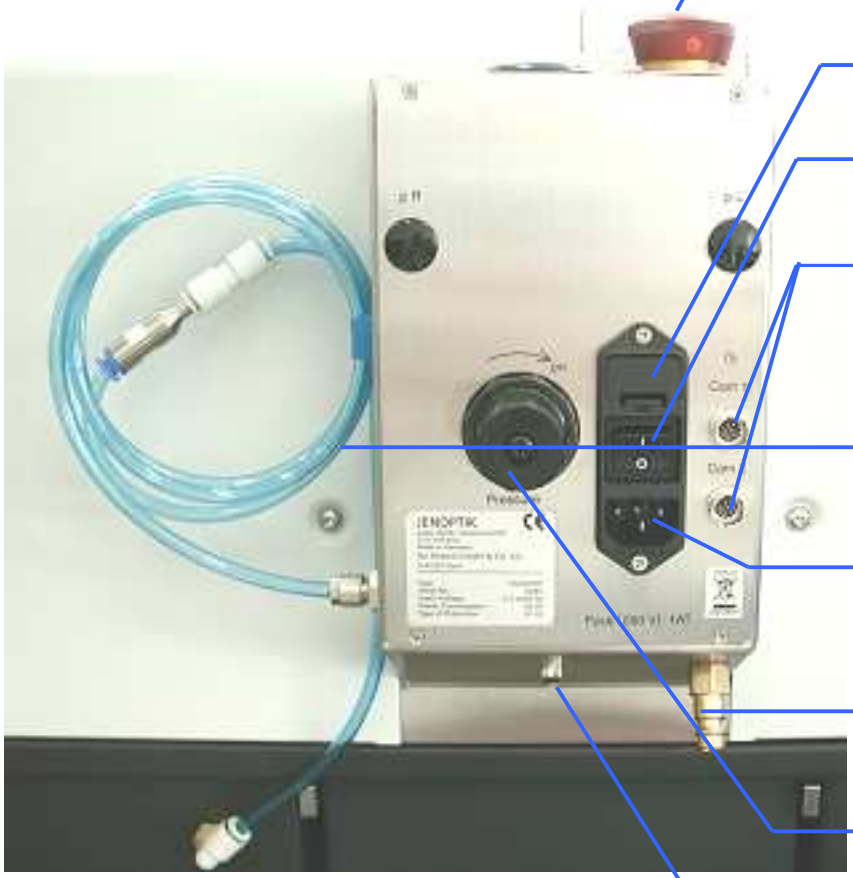
3.2.5 Cable connections of the CAMSIZER® and the PC

3.2.5.1 Connections at the CAMSIZER®



Manometer
(Display of air pressure)

Emergency Stop button



Fuse

Main control switch

Camera connections
Camera 1 / (FG 1 computer)
Camera 2 / (FG 2 computer)

Pressured air hose

Power supply

Pressured air supply

Pressured air control

Connection for the feeder cable

Emergency stop button

The emergency stop button has the purpose of a quick stop and lock of the height control of the funnel. It is especially suitable for emergency cases when the funnel movement has to be stopped to prevent injuries.
If you wish to operate the automatic funnel height control, release the emergency push button by turning it clockwise and pulling it up.

Fuse

The fuse is installed behind a protective cover. Disconnect the CAMSIZER® from the power supply, then open the protective cover before replacing the fuse (see photo above).

Main control switch

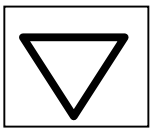
Use the main control switch to power up the instrument.

Camera connections

The camera connection cables (Frame grabber FG 1 and FG 2) are included in your delivery. Connect the cables to the respective camera outputs on the back of the PC included in your delivery. The cable ends for the CAMSIZER are labeled "CAM 1" and "CAM 2"; the cable ends for the PC side are labeled "FG 1" and "FG 2".

Power supply cable

The voltage and frequency of the CAMSIZER® are printed on the type label. Please make sure that the values on the type label correspond to the values of your local mains supply. Connect the power supply cable to the CAMSIZER® and to the power supply.



Failure to comply with the type label specifications may damage electric and mechanical components. We will not assume liability for any damage caused by non-compliance with this advice.

Compressed air supply

Connect the compressed air supply hose to the CAMSIZER® and to the connection of your compressed air supply network. To prevent a contamination of the glasses of the illuminating chamber and camera chamber, the CAMSIZER® is equipped with a vacuum system at the lower end of the measurement shaft. For this reason, the compressed air supply should pass a higher-grade filter combination (maintenance unit) before being supplied to the pressure inlet. We recommend filters that can remove particles larger than 0.01 µm (99.99 % for 0.01 µm particle size). The filtered air should contain less than 0.01 mg/m^3 of oil.

Air pressure control

With the air pressure control, the pressure of the compressed air can be adjusted. To keep the glasses clean, the air pressure should ideally not exceed 2 bar.

Pressured air hose

The pressured air hose provides for the airflow in the measurement shaft and therefore for the removal of most residues of sample material which may contaminate the glasses of the optical path.

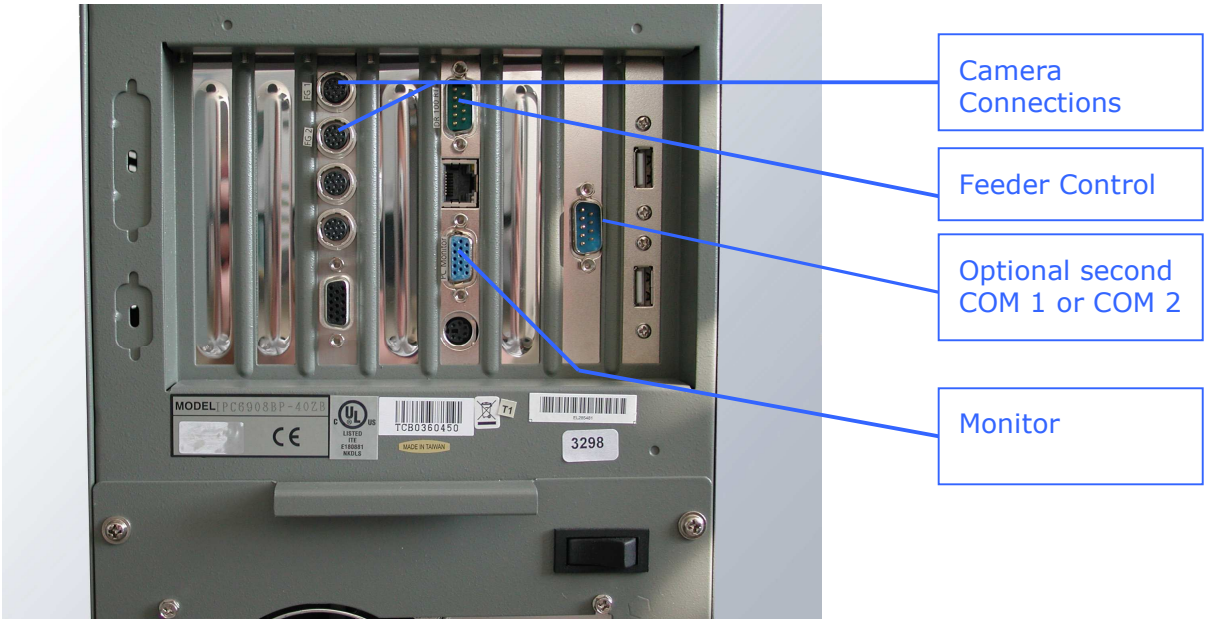
Feeder control connector

The feeder control cable is included in your delivery, and must be connected to the respective socket at the back of the PC (see photo in chapter 3.2.5.2.).

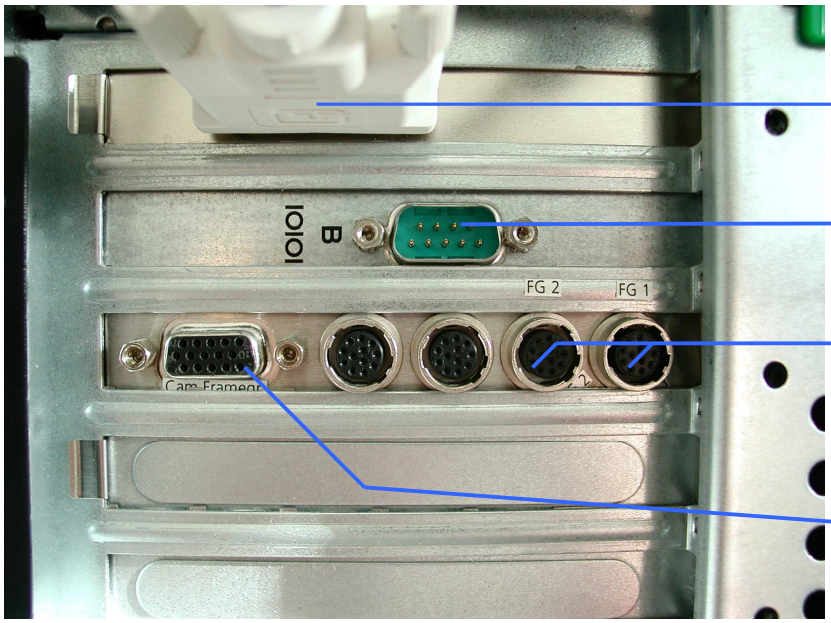
3.2.5.2 Connections at the computer

3.2.5.2.1 Connections at the ELTEC-PC

The cable connectors of the feeder and the framegrabber are labeled. Also, the sockets for the respective cables on the computers delivered by Retsch Technology are labeled.



3.2.5.2.2 Connections at other PCs



Monitor display

Feeder control via COM-port

Camera Connections
HR 58 or HR 70 cameras

Camera Framegrabber
XC 8500 cameras

3.3 Software Installation

3.3.1 Files and directories

3.3.1.1 Overview over the files and directories

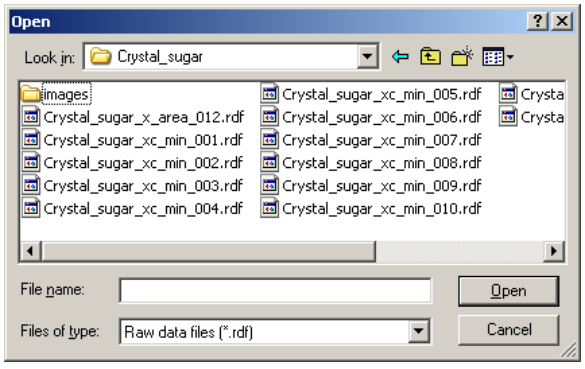
Normally the CAMSIZER software is installed in C:\Program files\CAMSIZER

CAMDAT	In the folder CAMDAT, the measurement results are stored. • Measurement data are stored as RDF-files in subdirectories • Images recorded are stored as BMP-files (in a subfolder "images") • Export files are stored as XLE, XLD (Excel readable ASCII formatted) or CCG (Retsch formatted)
CAMSYS	In the folder CAMSYS, information about the measurement tasks and references are stored: • Size and shape class definitions: GKL-files • Measurement task files (methods): AFG-files • Reference files: REF-, RE0-, RE2- files • Size-class-dependent reference files: RP0, RP2

	and RP3-files-files • Fitting-files: FIT-files (Q_3-fitting), FTE-files (elementary fitting), MFT-files (meta-fitting)
CFG_COPY	In this folder, the previously used configuration files of the CAMSIZER® are stored with the information about the date and time of usage.
Working directory of the CAMSIZER® (for example CAMSIZER or CAMSIZER-Version-4)	The working directory of the CAMSIZER®-software includes the following files: Camsizer.exe, camsizer.cfg, camsizer.hlp, camsizer.lex, camsizer.cf0, elpceye516.dll, elpceye3_hr70.dat, Ccdimage.dll, Feeder.dll, Messend.wav, Logo.bmp, English.dll, German.dll, Spanish.dll, Japanese.dll, (or other language files) elhard.dll
Framegrabber-software	The framegrabber-software can be found in the directory: C: \ PROGRAMS \ ELTEC
MESSEND.WAV	At the end of a CAMSIZER measurement a sound will appear through a sound card of the computer. The sound has to be saved as WAV-file and has the name “messend.wav”.

The above-mentioned folders are created automatically when the software is installed. The names of the files (e.g. measurement task files) used for the individual measurement procedures can be selected individually.

3.3.1.2 Measurement results and size class files



The measurement results of the CAMSIZER® are saved as RDF-files in the subdirectory …\CAMDAT. Further subdirectories in the CAMDAT can be generated in correspondence with the definitions in the respective task files.

The files necessary for the measurement and the evaluation of the results (*.afg, *.gkl, *.fit, *.ref) are saved in the subdirectory …\ CAMSYS.

*.afg – Task file

*.gkl – Size class file

*.fit – Fitting file

*.ref – Reference file

If the subdirectories … \ CAMDAT and …\CAMSYS are not available, they will be generated when the program is started.

- Whenever the software is closed, the configuration "camsizer.cfg" is saved in the main CAMSIZER folder and an additional copy of this configuration file is copied to the folder

  …\ CFG_Copy with date and time (camsizer_DDMMYY_HHMM.cfg)

  for example:
  The file "camsizer_040706_1602.cfg" was generated on July 4th, 2006 at 04:02. p.m.

3.3.2 Installation of the CAMSIZER®-software

3.3.2.1 General information

Usually, the CAMSIZER®-software has been pre-installed on the computer included in your delivery. For the description of the software installation from a CD please see chapter 3.3.2.2 "Installation from a CD-ROM".

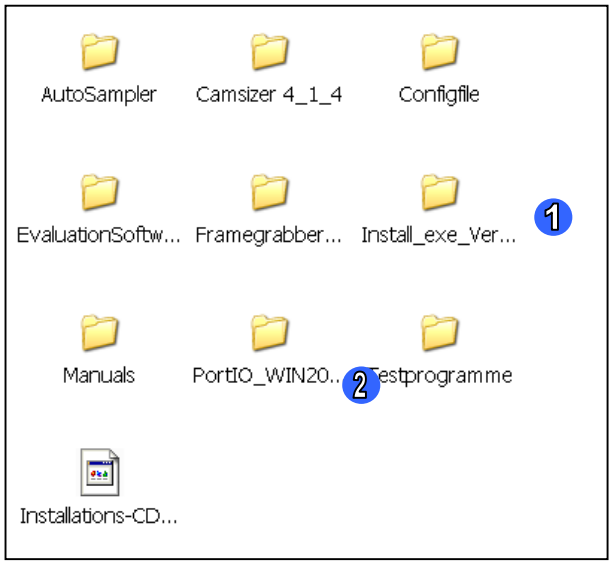
- The working directory of the CAMSIZER®-software can be found under C: \ PROGRAMS \ CAMSIZER. If you wish to run the program using a different working directory, please copy these files to the desired directory.

- If you wish to install new software or to update the CAMSIZER®-software, we recommend creating a new directory for this software. If existing measurements or task files are to be used as templates or for comparison purposes, please copy them into the new program directory.

- We recommend copying the configuration file on a disk at regular intervals. The configuration file is stored in the main program directory under the name "camsizer.cfg".

It is also recommended to save backup files of the result files and the CAMSYS-folder to avoid the loss of the data in case of a HDD crash. RDF-result files can be saved automatically using "Dual saving" (please see chapter 6.3.6 "The register card `Save task file´") to an external directory.

3.3.2.2 Installation from a CD-ROM



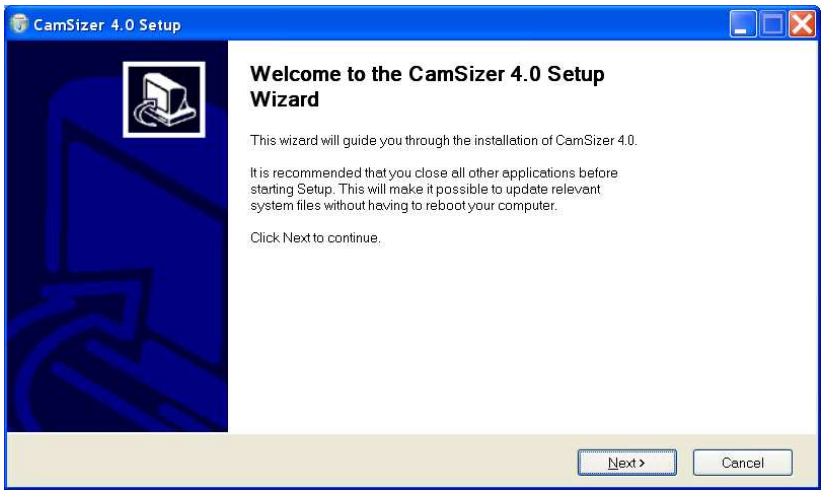
On the supplied CD-ROM you will find these files.

If you wish to re-install the software from a CD-ROM, please install the framegrabber-software first. Afterwards, install the CCD-camera-software from the CD-ROM included in your delivery.

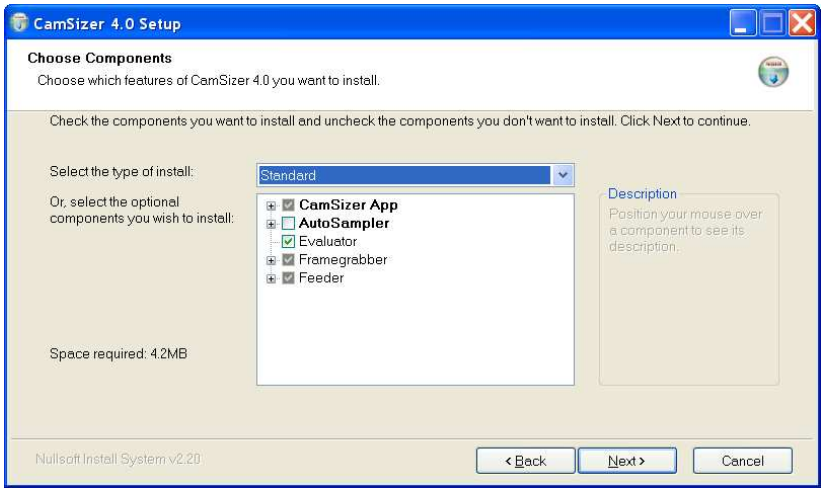
If the framegrabber PCEYE-quadro is installed under a WINDOWS operating system, the respective SETUP-file corresponding to the operating system (Win 2000, Win XP) must be used.

1 Open the folder Install_exe, and the subfolder Ver_4_1a. The following files are visible.

Afterwards, install the CAMSIZER®-software by using the SETUP.EXE – program on the CAMSIZER®-disc. Double-click on the disc-icon. The setup-routine will be started, and will guide the user through the setup.



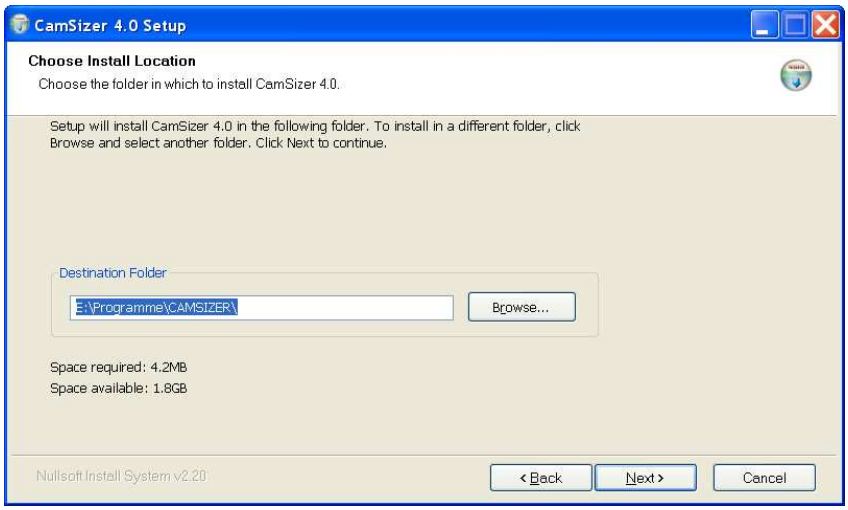
Click [Next].



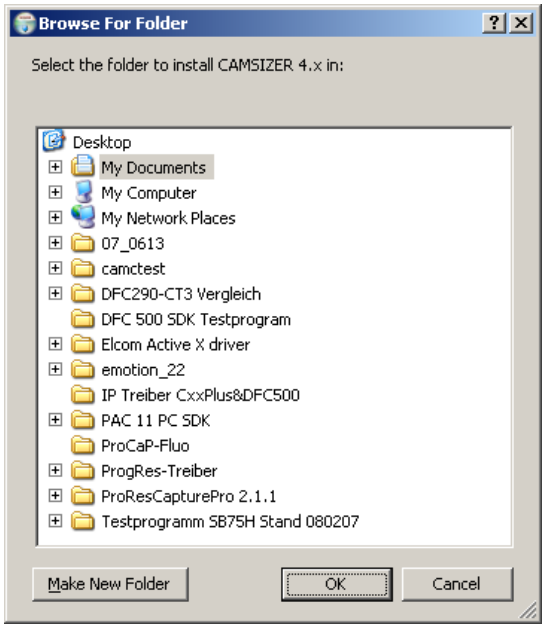
Select the type of installation. The following installations can be selected:

- **Standard** – standard installation of the CAMSIZER® for measurements (CAMSIZER® model II with LED, after April 2006)
- **Simulation**- installation of the simulation software (without the CAMSIZER® instrument)
- **Special** – select the DLL-types individually in the window below (old CAMSIZER® or feeder type or CAMSIZER® with AutoSampler).

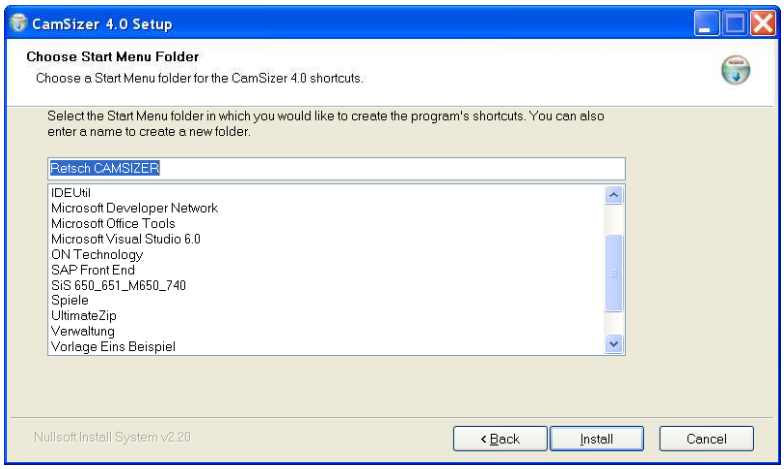
Choose the components and click [Next].



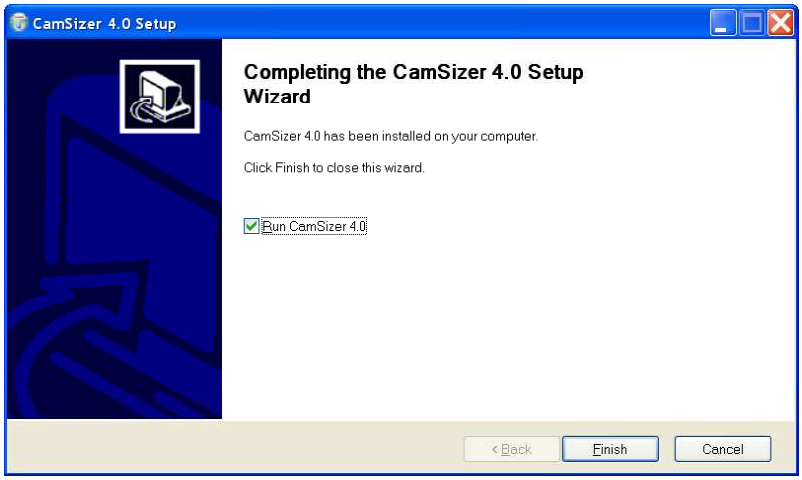
Select the destination folder. By a click on [Browse], you can select the drive and the folder individually in the dialogue "Browse for folder".



Choose the folder or create a new folder. Click [OK].



Choose the start menu folder. Click [Install]. The CAMSIZER® 4.x – software will be installed.



Click [Finish] to close the Wizard. You can start working with the CAMSIZER®.

3.3.3 Installation of the PortIO.SYS driver

The driver has to be installed on computers working with Windows 2000 and Windows XP operating system.

2. Click onto the PortIO-folder

- The driver PortIO.SYS has to be installed following the advice on the CAMSIZER-disc (TXT-file in the PortIO-folder).
- **Do not use the SETUP.EXE file!**
- The installation has to be carried out using the device manager and the PortIO.INF file.

3.3.4 Additional advice

If the 256-colour-mode has been set on the graphics card, it may occur that programs running in the background change the colour palette automatically. In this case, incorrect colours may be displayed when using the function "CCD-image". Any other functions, for example the accurate measurement by the software, will not be affected. Please do either close the respective programs, or select another colour mode for the graphics card (HICOLOR or TRUECOLOR-Mode).

If you wish to change your operating system, please contact the customer service who will provide you with the suitable driver and software. Please follow the installation advice on the CD-ROM.

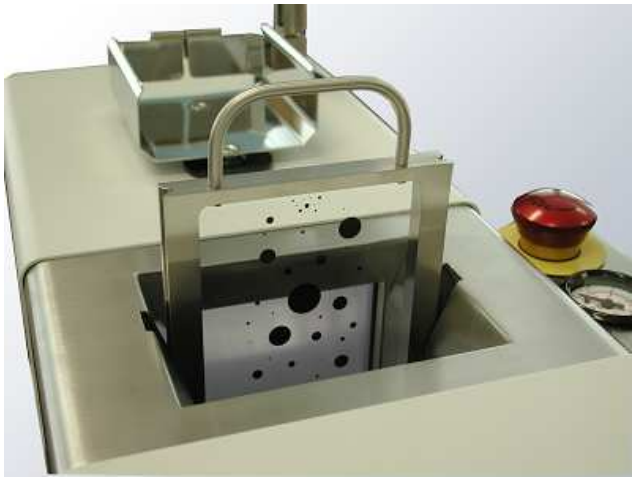
3.4 Calibration and maintenance

3.4.1 Calibration

The CAMSIZER® has been calibrated by the manufacturer. Re-calibration might become necessary occasionally, for example after the transportation of the instrument or if required by quality management regulations.

For re-calibration, a tested calibration reticule can be ordered from the manufacturer as an optional accessory (please see delivery scope "Calibration standard reticule").

To calibrate the instrument using the calibration standard, please remove the metal rails in the measurement shaft. Make sure the glass window is facing the side of the light source (left side). Remove the feeder before inserting the calibration standard to avoid scratches.



To re-calibrate the instrument with the calibration standard, select the menu item │-Extras │ Calibration -│ in the CAMSIZER® software.

You will be guided by the software through the calibration process step by step. Insert the calibration standard when required by the software. For further information, please refer to chapter 7.6.8 "The menu `Extras – Calibration´".

3.4.2 Cleaning

If sample materials are very fine or contain a high proportion of dust, the airflow option should be used. The contamination of the illumination unit

and the chute can be avoided by using the vacuum function. Minor pollution does not affect measurement results, as a background measurement is performed with each measurement. In this way, deviations and errors caused by minor dust contamination are compensated by the system.

Occasionally, all parts that are in contact with the sample material, like funnel, dosage feeder, guide plate, measurement shaft and sample collection container should be cleaned, especially if the material contains a high proportion of dust or if the sample material type is changed. The cleaning may be performed with compressed air and with a dry and soft brush. A vacuum cleaner may also be suitable for cleaning the CAMSIZER®.

The cover glass of the illumination unit and the protection glass cover in front of the camera unit can be cleaned with ethyl alcohol.

To use compressed air for cleaning the instrument, please follow these steps:

- Disconnect the compressed air hose from the separator.
- In the menu “Extras”, select “Pressure” to activate the compressed air flow.
- Clean the instrument with compressed air. By turning the pressure wheel and by controlling the air pressure on the manometer the air pressure can be regulated.

If extensive cleaning is carried out, please put the instrument out of operation and disconnect the instrument from the power supply.

Do not use running water to clean the CAMSIZER®.
There is a life-threatening danger of an electric shock!
Do only use a slightly moistened piece of cloth. Organic solvents are prohibited.

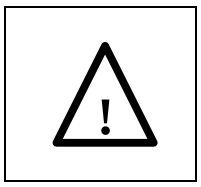
The CAMSIZER® complies with the IP 50 internal protection standard.

3.4.3 Maintenance

The CAMSIZER® works maintenance-free to the largest possible extent. Depending on the material to be measured, the filter of the exhaustion unit should be cleaned or exchanged regularly.

The filter is located on the back of the instrument under the larger casing. To replace the filter, loosen the thumbscrew, open the filter cover and pull out the filter. Replace it by a new or clean filter.

Black lid



Please follow the safety instructions for handling the sample material.

3.4.4 Necessary checks

The recommendations for the control of measurement means have to be observed.

The instrument can be re-calibrated by the user whenever this is considered necessary (please see chapters 7.6.8 "The menu `Extras – Calibration´" and 3.4.1 "Calibration" for further information about the calibration).

4 THE SOFTWARE USER INTERFACE

4.1 Password-protection

4.1.1 The different software modes

The CAMSIZER® software comprises three different modes, each of which has a defined set of functions. Each software mode constitutes a different level of accessibility to the software operation and configuration.

- The **measurement mode** permits the carrying-out of routine measurements. The definition of parameters or of the configuration of the software settings is not possible.

- The **parameter mode** permits the definition of measurement parameters and display settings, which are not available in the measurement mode. In the parameter mode, task files, reference files, fitting files and fraction limits can be defined. These are used for carrying out measurements in the measurement and parameter mode, and are applied in the evaluation of the results. For further information, please refer to the respective chapters for the description of the functions and chapter 7.6.16.1 "The menu `Extras - Password protection´".

- The **higher modes** are limited to customer service.

  When the password protection is deactivated, the program runs always in the parameter mode. When the password protection is activated, the measurement mode will be active when the program is started. The password protection can be activated or deactivated in the parameter mode.

  Please note
  This manual describes the functions for the measurement and the parameter mode.

4.1.2 Functions available in the different modes

Each of the different software modes permits access to a defined set of functions. In the following, the functions available in the measurement mode are highlighted yellow; the functions available in the parameter mode are highlighted green.

4.1.2.1 The menu "File"

Menu item	Measurement mode	Parameter mode
New task file		x
Load task file		x
Load task file / Edit		x
Open measurement file	x	x
Read image	x	x
Save task file		x
Save measurement file		x
Export		x
Print report	x	x
Print preview	x	x
Print setup	x	x
Screen font		x
Printer font like screen font		x
Printer font		x
Exit	x	x

4.1.2.2 The Menu “Edit”

Menu item	Measurement mode	Parameter mode
Copy Q3(x)	x	x

4.1.2.3 The menu “Measure”

Menu item	Measurement mode	Parameter mode
Measure	x	x

Please note
The settings defined on the dialogue window “Measure” differ in both modes. For a more detailed description, please refer to chapter 7.6.16.2. “Password-protection - Measurement mode”.

4.1.2.4 The menu “Results”

Menu item	Measurement mode	Parameter mode
Table	x	x
Graph	x	x
Graph / Shape characteristics	x	x
Characteristics	x	x
Calculate Average	x	x
Trend Analysis	x	x
Daily report	x	x
Combine sieve and Camsizer results (optional)	x	x

4.1.2.5 The menu ”Options”

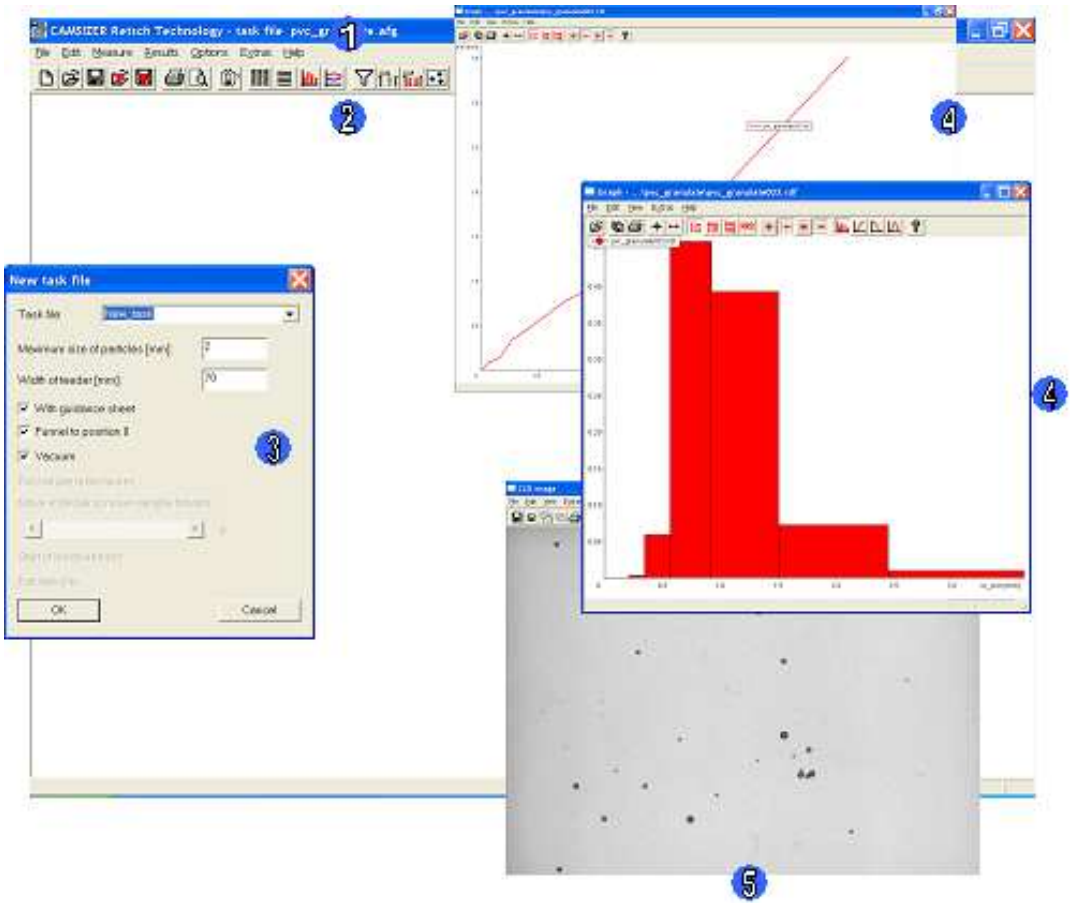
Menu item	Measurement mode	Parameter mode
Size classes	x	x
Volume classes	x	x
Classes for shape characteristics	x	x
Overview class files	x	x
Input reference distribution		x
Create fitting file		x
Info fitting file		x
Input fraction limits		x

4.1.2.6 The menu “Extras”

Menu item	Measurement mode	Parameter mode
CCD-image	x	x
Feeder	x	x
Feeder and dimming configuration	x	x
Funnel	x	x
Pressure	x	x
Balance setup	x	x
Measure for SPHT-correction		x
Calibration		x
Image evaluation	x	x

Toolbar	x	x
Status bar	x	x
Save windows automatically	x	x
Apply standard	x	x
Restore standard	x	x
Language	x	x
Password	x	x
Change password		x

4.2 The structure of the software user interface



The software user interface of the CAMSIZER®-software is structured into a menu bar, an icon bar, a main window and several "sub-windows" where the measurement results can be displayed and evaluated.

The main functions of the software user interface and the analysis windows are summarized in this chapter to provide an orientation in the software. Each software function and analysis window will be described in more detail in a separate chapter, please refer to the respective sections in chapter 7.

The software user interface is structured into the following areas:

1 **Menu bar**

In the menu bar, different functions for the measurement, the editing of the task files and the analysis of the measurement results are available. The menu will be described in detail in chapter 7.

2 **Icon bar**

In the icon bar, several frequent functions are quickly accessible without navigation in the menu.

3 **Main window**

In the main window, the dialogue windows are opened where the functions and settings can be defined.

4 **Analysis windows**

In the analysis windows, the measurement characteristics and other results are displayed. Each analysis window offers a menu bar with functions for editing the display of parameters and results.

The analysis windows are opened with a click on the respective icons in the icon bar or in the menu ⎪Results⎪. The following analysis windows are available:

- Table
- Characteristics
- Graph
- Graph / shape characteristics

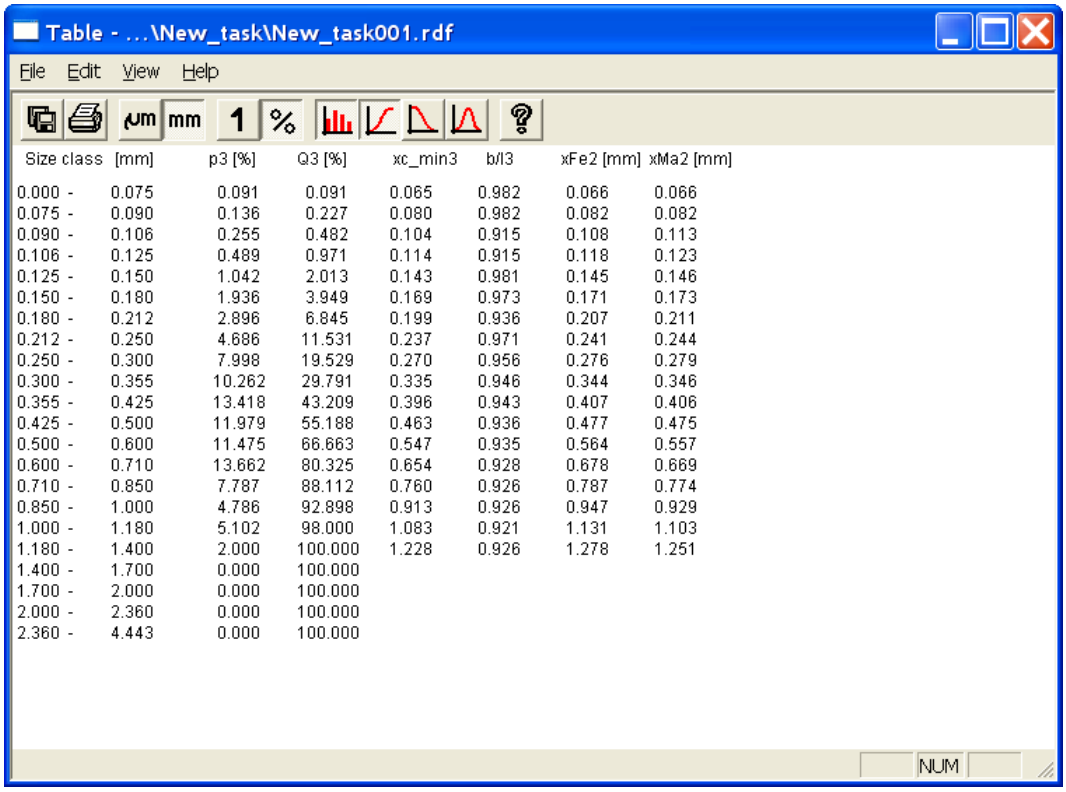
The analysis windows are available after a measurement process has been performed. For a more detailed description, please see chapter 7.4 "The menu `Results´".

5 **CCD-Image-Window**

Display of the images of particles recorded by CCD-Basic or CCD-Zoom camera.

4.3 The sub-windows and their main functions

4.3.1 The window “Table”

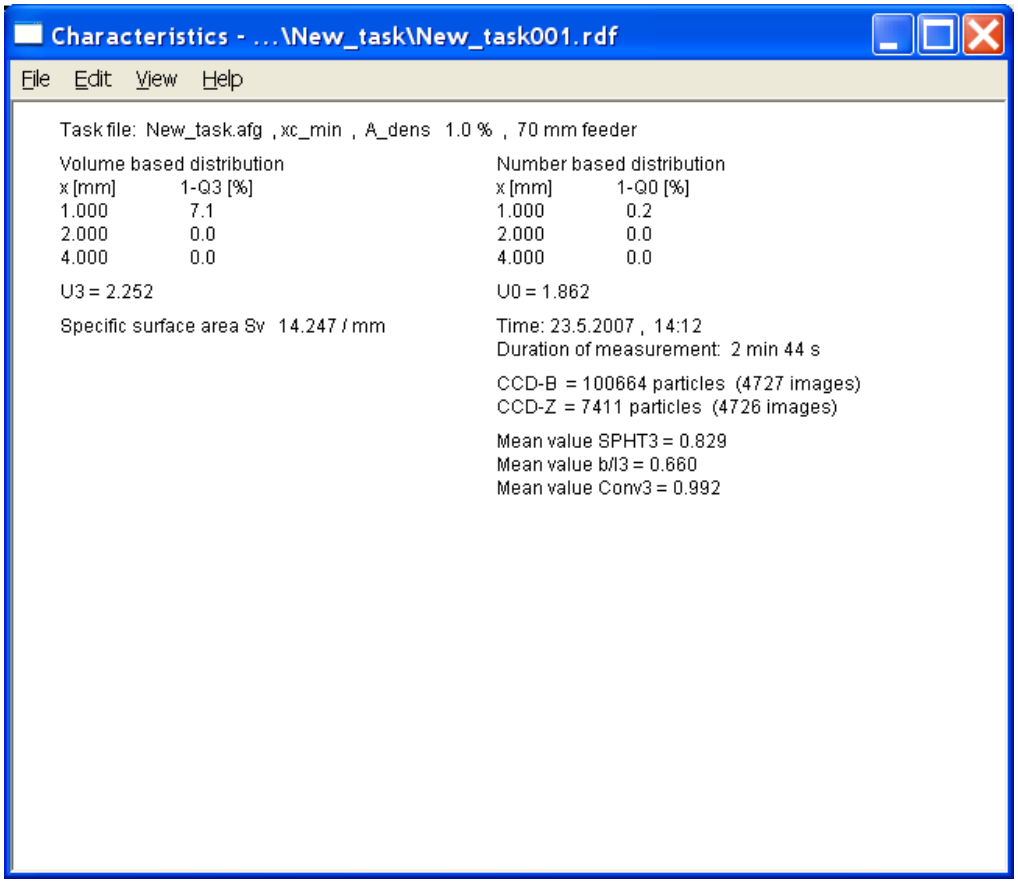


Size class	[mm]	p3 [%]	Q3 [%]	xc_min3	b/l3	xFe2 [mm]	xMa2 [mm]
0.000 -	0.075	0.091	0.091	0.065	0.982	0.066	0.066
0.075 -	0.090	0.136	0.227	0.080	0.982	0.082	0.082
0.090 -	0.106	0.255	0.482	0.104	0.915	0.108	0.113
0.106 -	0.125	0.489	0.971	0.114	0.915	0.118	0.123
0.125 -	0.150	1.042	2.013	0.143	0.981	0.145	0.146
0.150 -	0.180	1.936	3.949	0.169	0.973	0.171	0.173
0.180 -	0.212	2.896	6.845	0.199	0.936	0.207	0.211
0.212 -	0.250	4.686	11.531	0.237	0.971	0.241	0.244
0.250 -	0.300	7.998	19.529	0.270	0.956	0.276	0.279
0.300 -	0.355	10.262	29.791	0.335	0.946	0.344	0.346
0.355 -	0.425	13.418	43.209	0.396	0.943	0.407	0.406
0.425 -	0.500	11.979	55.188	0.463	0.936	0.477	0.475
0.500 -	0.600	11.475	66.663	0.547	0.935	0.564	0.557
0.600 -	0.710	13.662	80.325	0.654	0.928	0.678	0.669
0.710 -	0.850	7.787	88.112	0.760	0.926	0.787	0.774
0.850 -	1.000	4.786	92.898	0.913	0.926	0.947	0.929
1.000 -	1.180	5.102	98.000	1.083	0.921	1.131	1.103
1.180 -	1.400	2.000	100.000	1.228	0.926	1.278	1.251
1.400 -	1.700	0.000	100.000				
1.700 -	2.000	0.000	100.000				
2.000 -	2.360	0.000	100.000				
2.360 -	4.443	0.000	100.000				

The window “Table” displays the grain size distributions and the shape and transparency properties in the size classes. These values can be measured with the CAMSIZER® in one measurement process or can be averaged over several measurement procedures.

For a more detailed description of the table window please see chapter 7.4.1 “The menu `Results - Table’ ”.

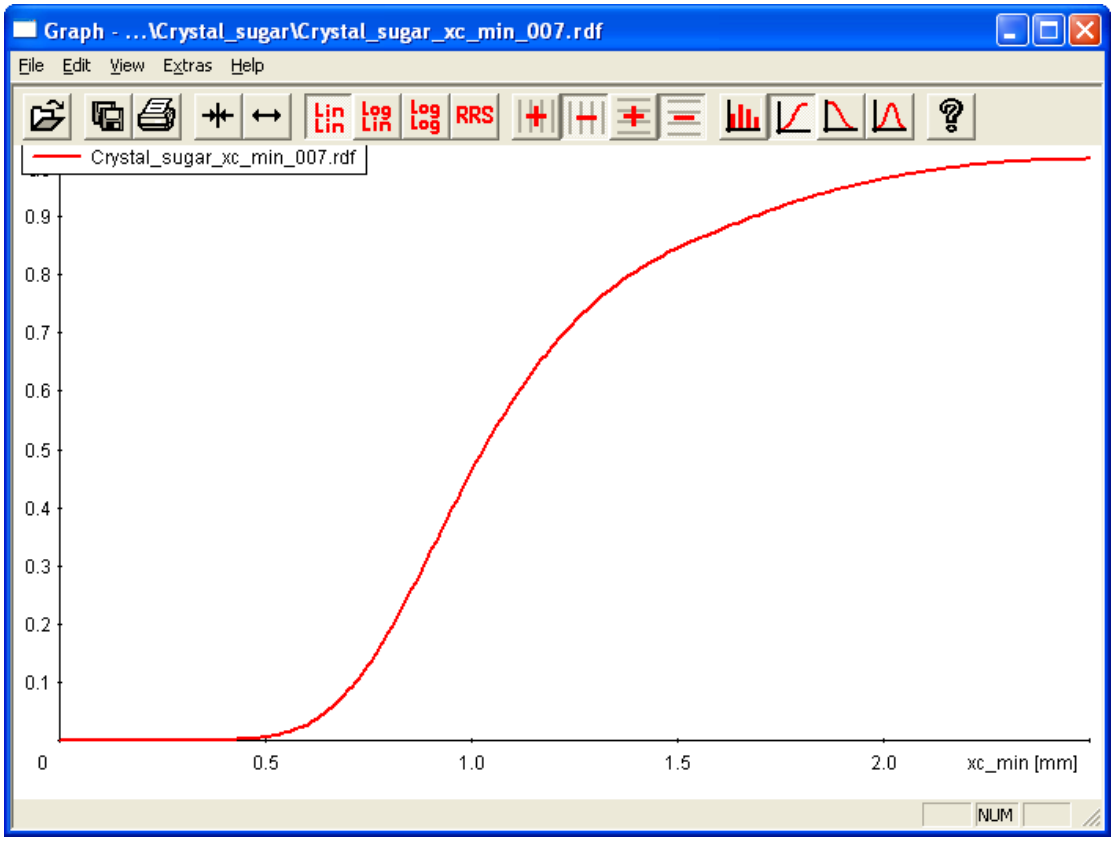
4.3.2 The window “Characteristics”



The window “Characteristics” displays the characteristics of the grain size distributions, the shape values and transparency properties that have been measured in one measurement procedure or that have been averaged over several measurements.

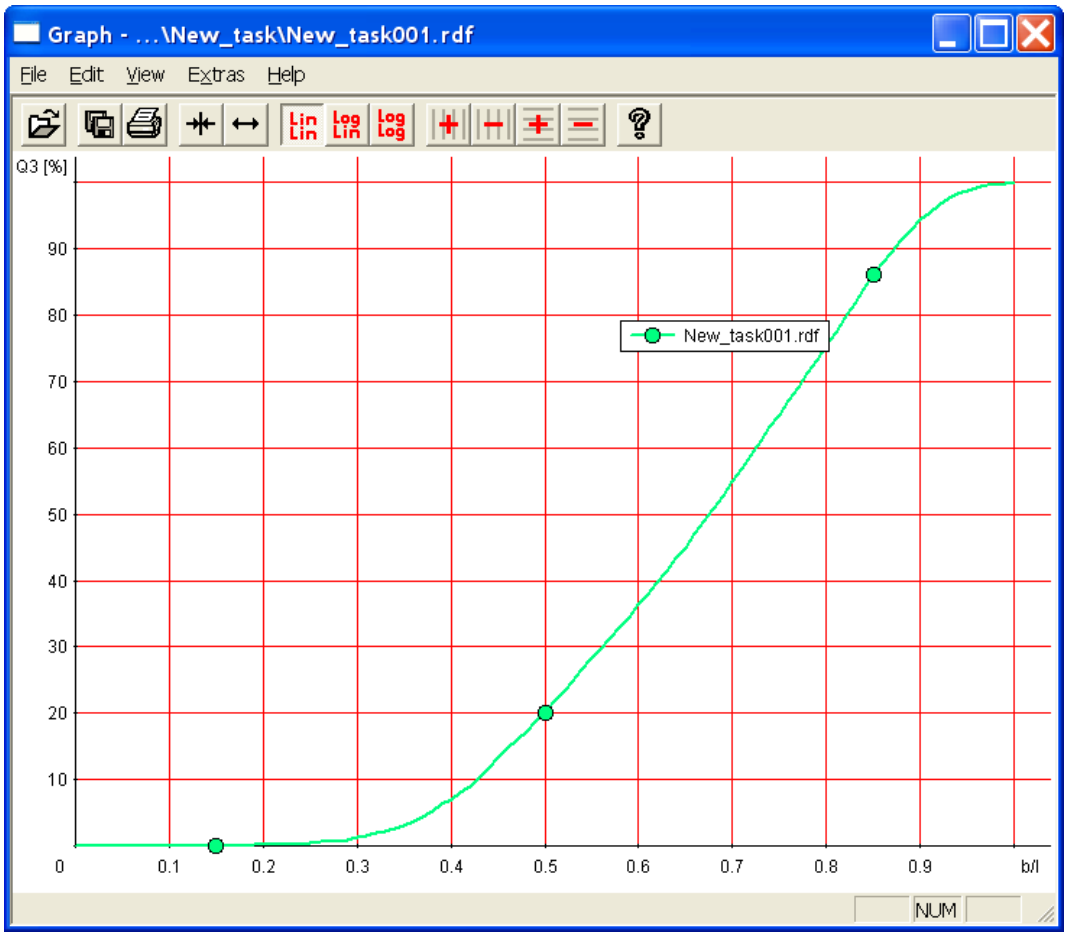
The characteristics to be displayed can be selected individually in the menu |-View|Characteristics-|. Please see chapter 7.4.4 “The window `Characteristics´” for a more detailed description of this window.

4.3.3 The window "Graph"



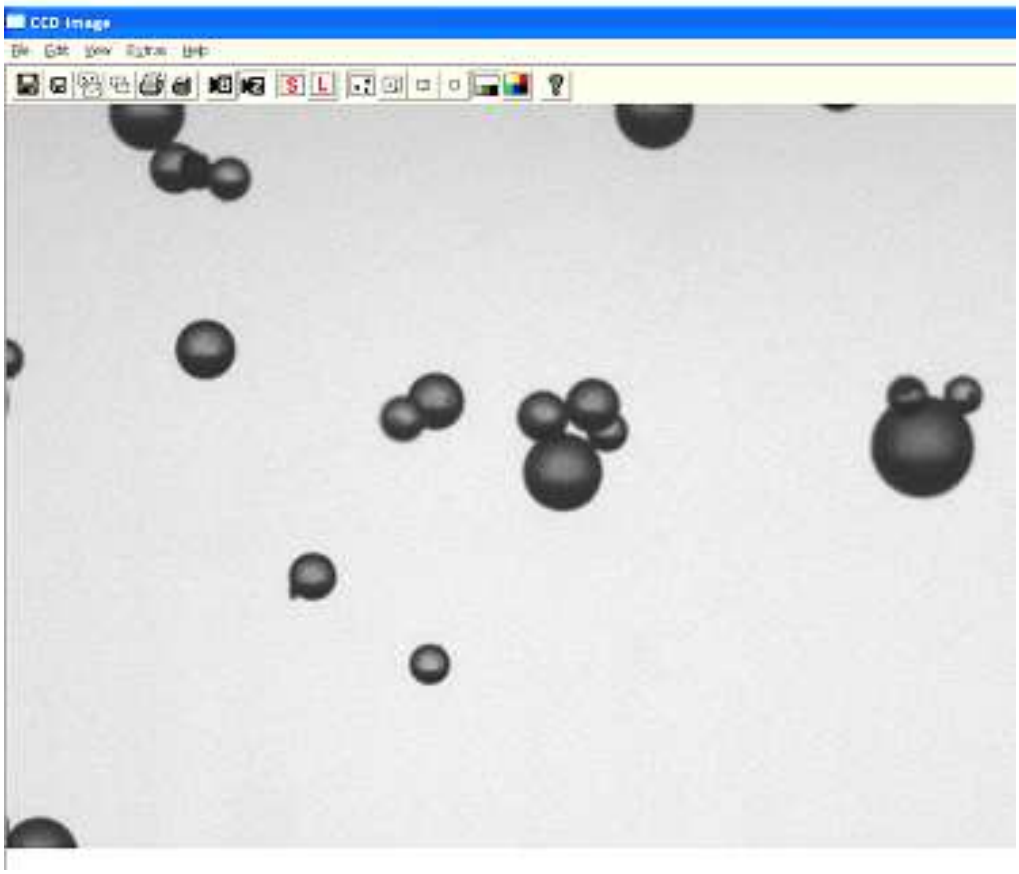
In the window "Graph", the grain size distributions or transparency properties of one measurement procedure or averaged over several measurements are graphically visualised. If averaged values are represented, the label "mean value" appears. The graph window can be edited using the icon bar and the menu functions, please see chapter 7.4.2 "The menu `Results – Graph´".

4.3.4 The window “Graph, shape characteristics”



In the window “Graph, shape characteristics”, the shape values of one measurement procedure or averaged over several measurements are graphically visualized. If averaged values are represented, the label “mean value” appears. The visualized shape characteristics and the display of the x- and y-axis can be edited in the menu, please see chapter 7.4.3 “The menu `Results – Graph, shape characteristics´”.

4.3.5 The window “CCD-Image”

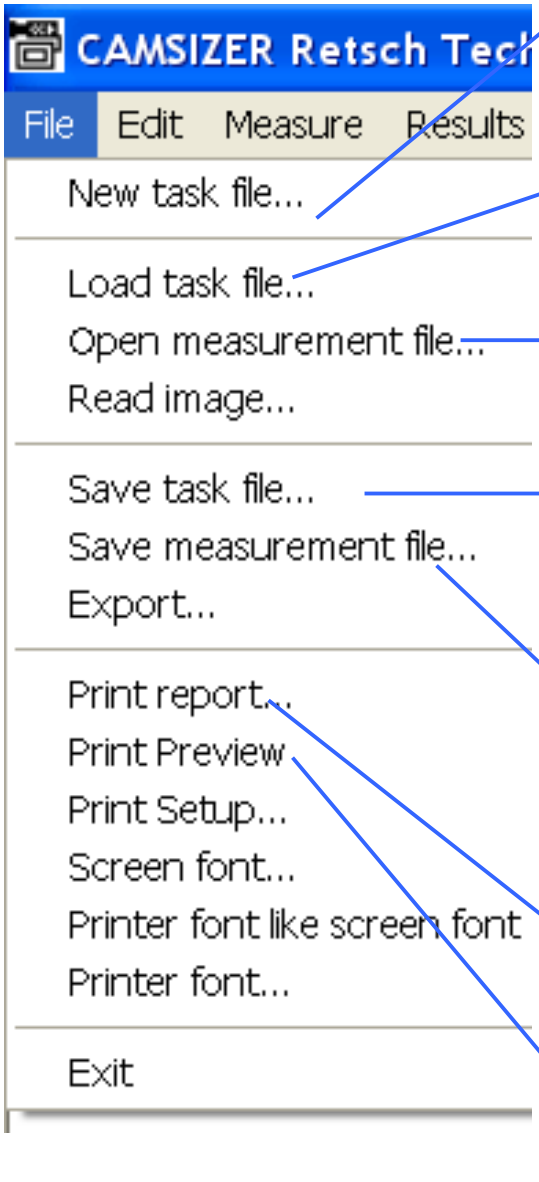


In the window “CCD-image”, the particles in the measurement shaft detected by the cameras CCD-B or CCD-Z can be viewed.

Images can be viewed live during measurement or by activating the manual feeder control (please see chapter 7.6.1 “The menu `Extras - CCD-image´”), or they can be loaded and evaluated (please see chapter 7.6.9 “The menu `Extras - Image evaluation´”).

4.4 The icon bar in the main software window

In the icon bar, the most frequently used functions are easily accessible. These functions are also available from the menu. For a more detailed description of the icon bar, please refer to chapter 7 " The CAMSIZER® software menu".



Create a new task file
Guides the user to create new measurement task file and to find the right parameters.

Load task file
Loads a task file. The task file can be edited and changed.

Open measurement file
Opens measurement results of a preceding measurement procedure.

Save task file
Saves a task file. The file name can be selected in the window "Save task file".

Save measurement file
Saves measurement results (for example average results). In the dialogue, the file name and folder can be defined or selected.

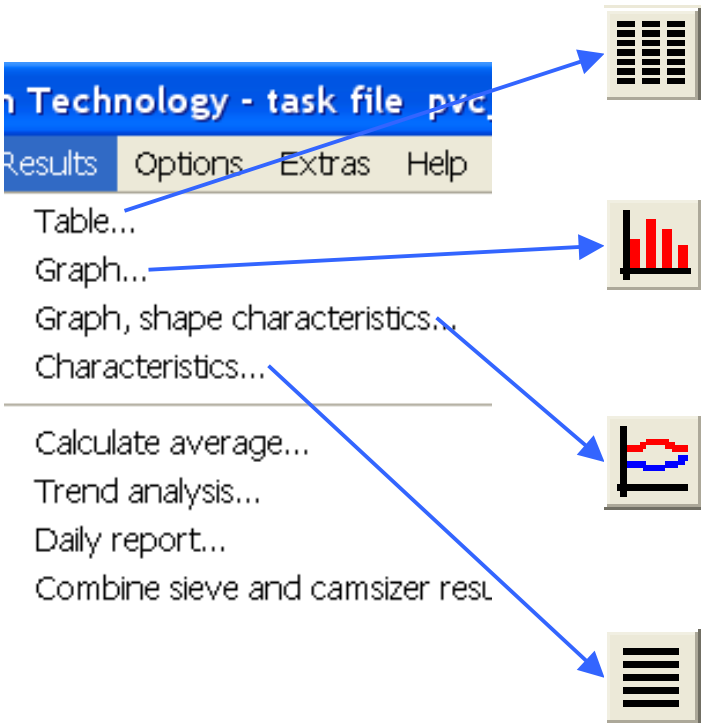
Print report
Prints the measurement report.

Print preview
Opens print preview of measurement results.

Measure

Starts a new measurement procedure. The window "Start measurement" is opened where the task file, the size class file and other options can be defined or selected.

To use the functions "Table", "Graph", "Graph, shape characteristics" and "Characteristics", a raw data file from a previously performed measurement procedure has to be available.



Table

Displays measurement results in a table.

Graph

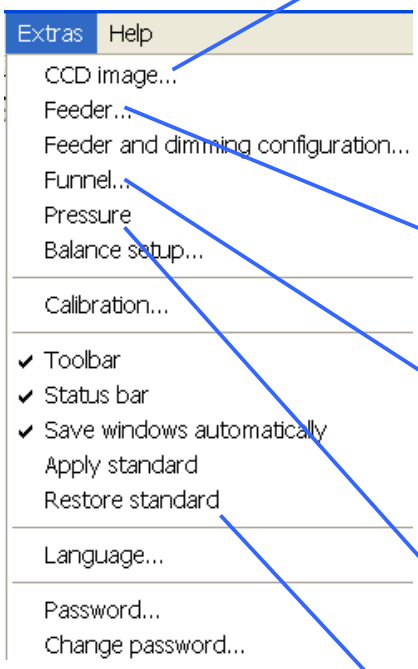
Displays measurement results in a graph.

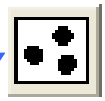
Graph, shape characteristics

Evaluates the shape characteristics of a measurement procedure in a diagram.

Characteristics

Presents the characteristics of a previously performed measurement.





CCD-Image

Opens the CCD-image window.

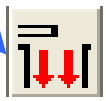
A CCD-image of the particles can be viewed during the measurement process or for adjustment purposes. The window allows to toggle between both cameras (Basic and Zoom).

Feeder

Opens a window for the manual feeder control.

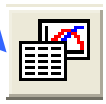
Funnel

Adjusts the funnel height or performs a reference run for the funnel.



Pressure

Activates or deactivates the exhaustion.



Restore Standard

Restores the standard alignment of the sub-windows.

Help

Opens the help menu and displays information for the CAMSIZER® software.

5 PREPARATIONS

5.1 Assembly check

Please check that the necessary installation and assembly steps as described in chapter 3 have been performed in the appropriate way:

- Mounting of the funnel and the dosage feeder
- Mounting of the guide plate (if necessary)
- Installation of the cable connections
- Installation of the software
- Calibration

Put the main control switch into the position "ON" to put the instrument into operation. Afterwards, double-click onto the desktop-icon to open the CAMSIZER® software.

→ The software user interface for the CAMSIZER® software is opened.

In this window, the previously opened task file is opened and displayed. You can use it or modify it. If you wish to start a new measurement task with a new material, please click │-File│New taskfile-│ (please see chapter 6.2 "Create a new task file").

5.2 Evaluation of the sample material

Before starting the measurement, the evaluation of the sample material and especially of the particle size is necessary.

Particle size and properties

The particle size should correspond to the measurement range of the CAMSIZER®. If the sample material is very dusty, please select the airflow option during the measurement to prevent the contamination of the glass screens and the swirling of fine particles.

Use of the guide plate for special particle shapes

For dusty materials or particles with a preferred orientation during the phase of the free fall through the shaft, a guide plate has to be used. For fines it is the standard plate with two stainless steel sheets. To orientate extrudates you may order and use a guide plate with one flexible sheet.

Please set the opening of the guide plate slightly larger than the largest particle diameter in the sample to prevent a blocking of the guide plate during the measurement. However, the distance should be as small as possible.

Agglomerated sample material

Sample particles may form agglomerates due to humidity, electrostatic forces etc. The running properties of the material on the dosage feeder improved by the use of Aluminium hard coat funnel and feeder. An auxiliary agent may have to be added to the sample to improve the behaviour and to reduce the adhesive forces (for example Aerosil® R972 or Alu-C®, CAS-Reg.-Nr.: 1344-28-1, Producer: Degussa AG, D-60297 Frankfurt/Main).

To reduce the electrostatic forces among the particles, an ioniser can be used optionally.

5.3 Reference run of the funnel

Occasionally, a reference run of the funnel is necessary to adjust its position towards the dosage feeder. When a new measurement task is defined or when working with the CAMSIZER® for the first time, a reference run is recommended.

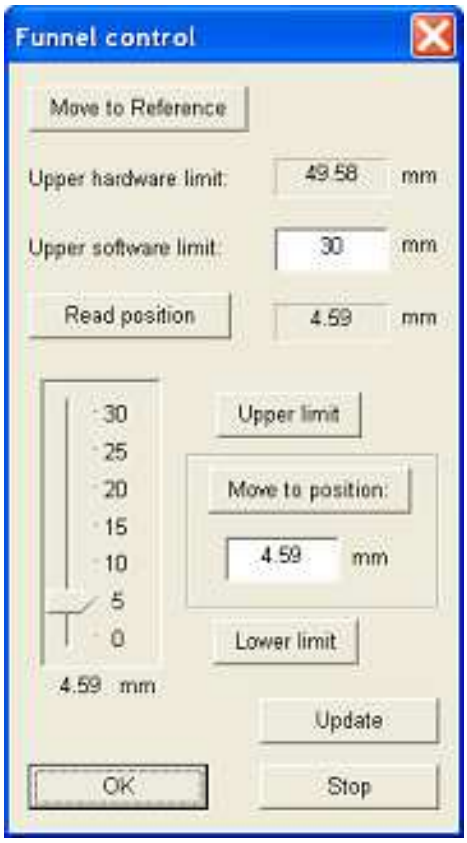
For a detailed description of the window "funnel control" and the performance of the reference run, please see chapter 7.6.4 "The menu `Extras – Funnel´".

Please note
This feature is only available when the option "AutoHeight" was ordered.

To perform the reference run for the funnel height adjustment, please follow the steps described and illustrated in the following chapter.

Please click on the funnel icon in the menu bar of the main software window. The menu "funnel control" is opened.

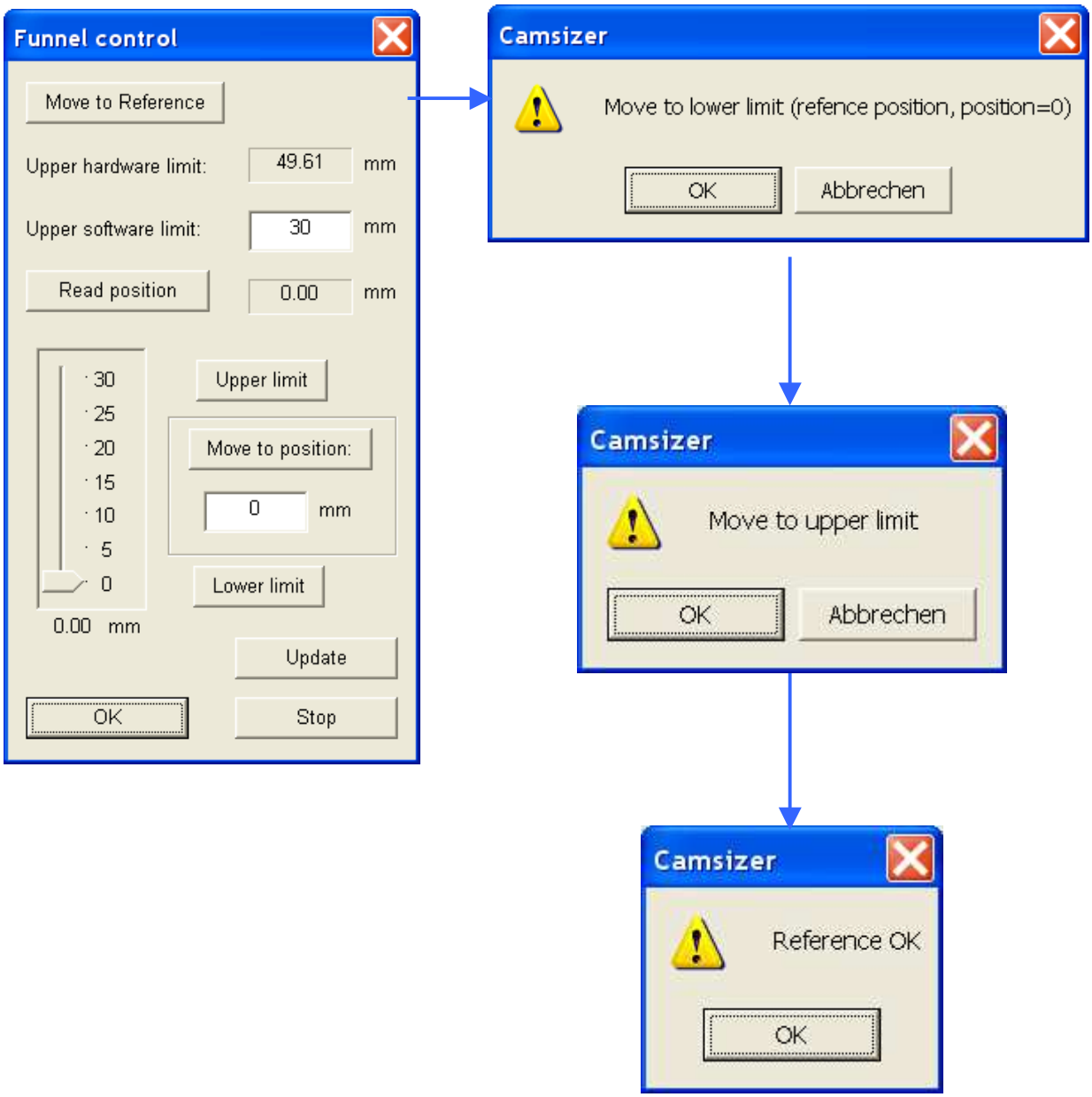
To prevent a collision between the funnel and the feeder, please remove the funnel from the funnel holder or loosen the connection between the funnel and the funnel holder before proceeding.



- Click [Move to Reference]. Confirm the moving to the lower limit/zero position in the subsequently opened dialogue (reference position) by a click on [OK].
- The funnel holder moves to the lower reference. In this position, please fix the funnel to the funnel holder so that the funnel slightly contacts the surface of the feeder. Use the fastening wheel of the funnel holder.
- A dialogue window opens in which the move to the upper limit has to be confirmed. Click [OK]. The funnel holder moves to the upper limit.
- Please click [OK] if the window "Reference Ok" appears. The reference run is successfully completed and the measurement can be started now.

Please note
The funnel will always move from the zero position to the maximum possible height. Please make sure that the path of the funnel is not limited by any mechanic obstacle, e.g. if working with an AutoSampler. The upper software limit will only affect the movements during measurement!

Please note
After the reference run, the funnel will remain in the upper position. When a measurement is started, the funnel will be moved to the required position, please see chapter 6.3.1 "The register card `Feeder and funnel parameters´".


Funnel control
Move to Reference
Upper hardware limit:
49.61
mm
Upper software limit:
30
mm
Read position
0.00
mm
30
25
20
15
10
5
0
0.00 mm
Upper limit
Move to position:
0
mm
Lower limit
Update
OK
Stop
Camsizer
Move to lower limit (refence position, position=0)
OK
Abbrechen
Camsizer
Move to upper limit
OK
Abbrechen
Camsizer
Reference OK
OK

6 TUTORIAL TO PARTICLE MEASUREMENT WITH THE CAMSIZER®

6.1 Introduction

The following chapters provide a tutorial to the particle measurement with the CAMSIZER®, and will guide the user through each step of the measurement process.

The new CAMSIZER®-software contains a "Wizard-Tool" which facilitates the measurement procedure with the CAMSIZER®.

The measurement procedure with the CAMSIZER® generally comprises the following steps:

- The creation of a task file
- The carrying-out of the measurement
- The evaluation of the measurement results

These steps will be described in detail in this chapter. It is recommended for users which are not yet familiar with all of the software functions and possible settings of the CAMSIZER® to use the "Wizard" and to follow the steps as described in this tutorial.

For users who are already familiar with the CAMSIZER®-software and would like to look up certain special functions, chapter 7 "The CAMSIZER® software menu" in this manual provides a reference book where each menu option is described and can be looked up.

6.2 Create a new task file

Whenever a measurement is started, a task file (AFG-file) has to be available. In this task file, the measurement parameters and characteristics, the classes and the parameters for the display of the measurement results are defined. When using the "Wizard-Tool", the software automatically defines the basic settings for the subsequent particle analysis.

Task files can be newly created or existing task files can be edited:

- A new task file is usually created when the CAMSIZER® is operated for the first time and / or when a new material is measured.

- An existing task file can be loaded and edited if a measurement procedure with this material has already been performed before, and if certain parameters are to be changed. To load a saved task file, click │-File│Load task file-│, and click [Edit] in the opened dialogue window.

An existing task file is usually loaded and edited if

- A measurement procedure is repeated using the same task file.
- Settings, characteristics or measurement parameters of the task file are to be changed.
- The display of the results of the measurement is to be modified.

In this chapter, the definition of a new task file by using the "Wizard"-tool will be explained. If you wish to load and edit an existing task file, please continue with chapter 6.3 "Edit measuring parameters".

A new task file should be created if an entirely new measurement task is started, for example when a new material is measured. Before the creation of the task file, the wizard conducts a test measurement in which the basic settings for the subsequent particle analysis are automatically defined.

A "test measurement" is carried out to adapt the conveying performance of the feeder automatically to the sample material and to preset important measurement parameters. The user can change these parameters after the test measurement in the opened register card deck (please see chapter 6.3 "Edit measuring parameters".).

6.2.1 Preparations

Make sure that the funnel reference run has been performed (please see chapter 5 "Reference run of the funnel"). Select "New task file" in the menu "File" or click the respective button in the icon bar. The dialogue window "New task file" is opened.

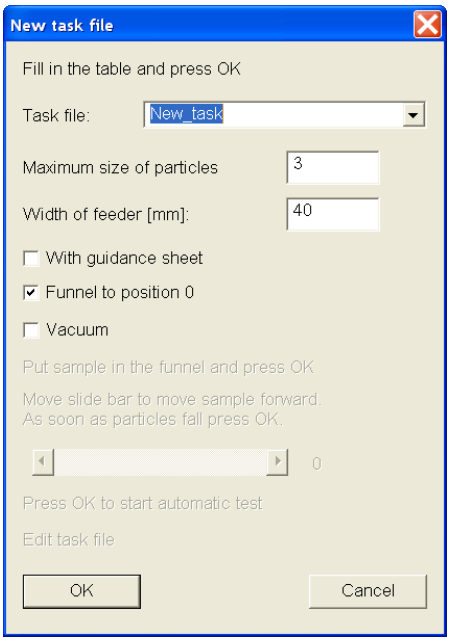
In the window "New task file":

Choose a name for the task file (e.g. the sample name), the maximum size of the particles and the width of the feeder.

Mark the checkboxes, if the respective options are used:

- With guidance sheet
- Funnel to position 0
- Vacuum (exhaustion)

Press [OK]. Follow the advice appearing in the window.

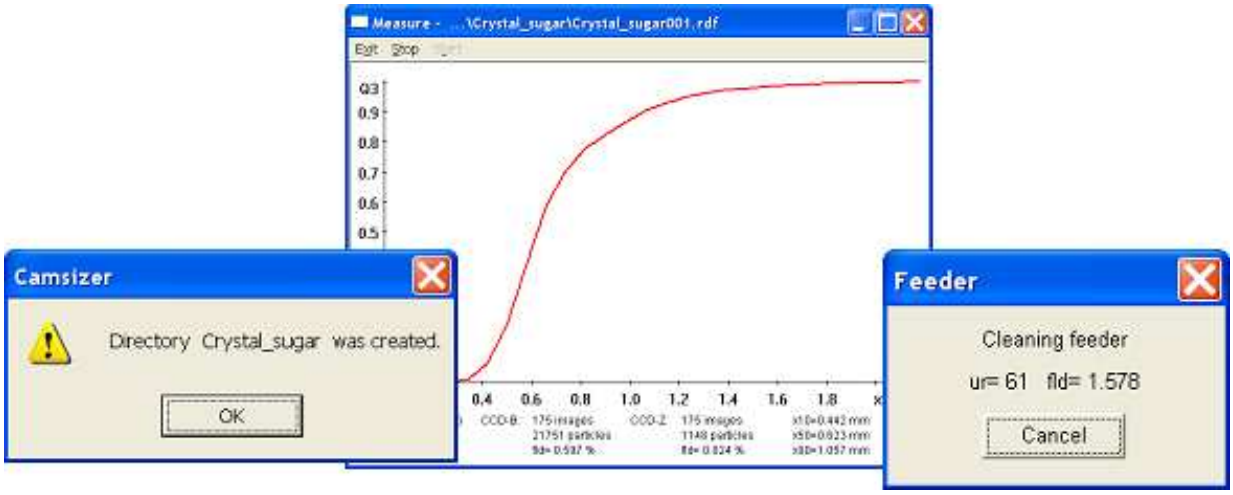


The sample can now be put into the funnel. Click [OK].
The slide bar now becomes active and should be moved to the right until the first particles fall into the shaft. The value displayed here will not influence the measurement results. It is only used for the transportation of the sample to the shaft prior to the test measurement.

Press [OK]. The automatic test measurement will be started.

6.2.2 Start a test measurement for the optimization of funnel and feeder parameters

The sample is measured for several seconds to define the optimum measurement settings automatically. A measurement window opens where the graphic representation of the sample measurement is displayed. In the dialogue window, the creation of the file and possibly the creation of sub-directories for the result file have to be confirmed before the measurement starts.



After the completion of the test measurement, a window appears stating that the feeder will be cleaned automatically. The automatic feeder cleaning can take several seconds, depending on the amount of sample material. The process can be cancelled by a click on [Cancel].

When the test measurement is completed, the measurement parameters can be edited. Click the button [OK] in the dialogue "New task file" to edit the task file.

6.3 Edit measuring parameters

When the test measurement is completed, the task file can be edited. To edit a task file, please click [OK] in the window "New task file". The "Wizard" opens a window with two decks of register cards for the editing of the measurement parameters and the display parameters. Either one or the other deck of register cards is visible.

The register cards "Measurement conditions"

- Feeder and funnel parameters
- Cameras (Measurement parameters)
- Save images (optional)
- Settings
- Warnings (optional)
- Save task file

The register cards "Parameters for display"

- Size classes
- Volume classes Q(V) (optional)
- Shape characteristic classes
- Table
- Characteristics
- Graph
- Graph / Shape characteristics
- Save task file

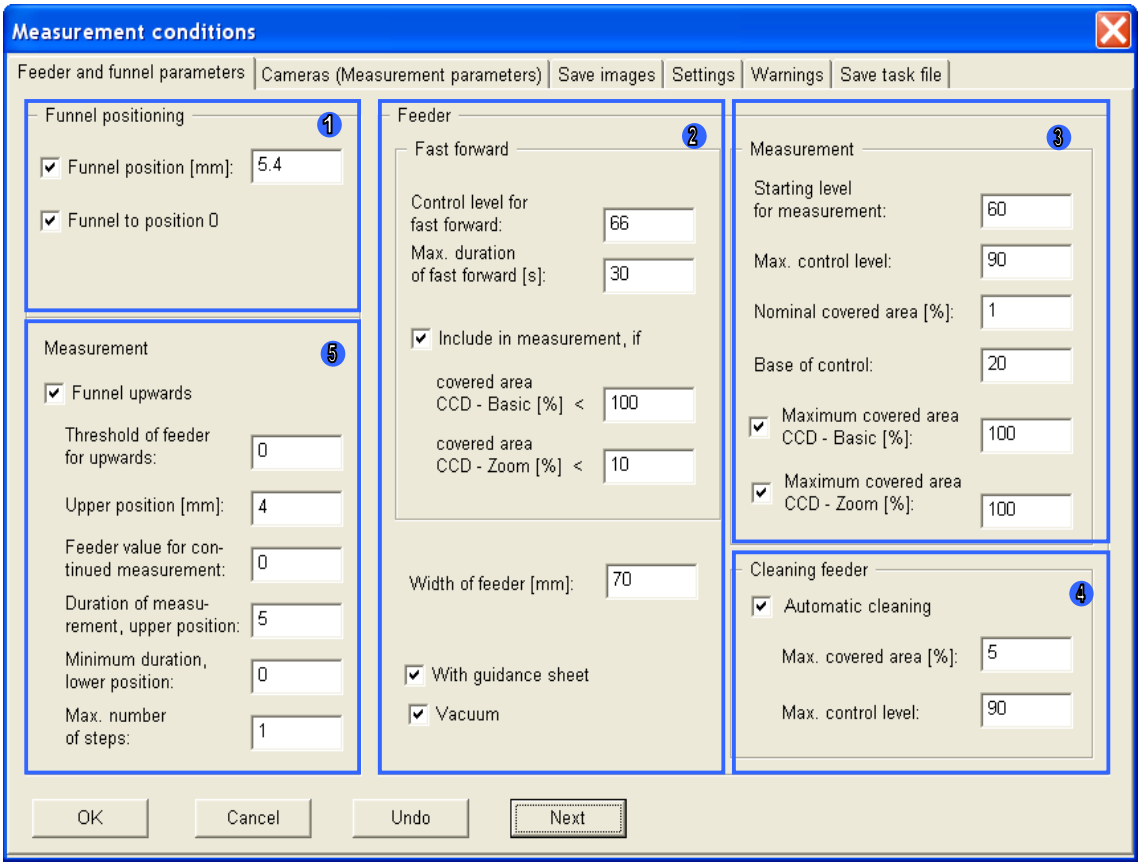
The editing of the display parameters is recommended after the measurement. The register card deck "measurement parameters" is also available when the menu item │-Options│Measurement parameters-│ is opened. Please see chapter 7.5.1 "The menu `Options – measurement parameters´" for a detailed description of each register card.

- With [Next] or [Enter], the next register card can be opened (except "Save task file").
- With [Undo], the changes on the actual register card are reset.
- With [Cancel], all changes are reset and the register card deck is closed.
- With [OK], the register card "Save task file" can be opened.

Please note

To apply the changes made on the register cards, they have to be saved to the task file on the register card "Save task file". Please press [OK] on the register cards or open the card "Save task file" manually, and click [OK] on the card "Save task file".

6.3.1 The register card "Feeder and funnel parameters"



In this register card, the feeder, funnel and some related measurement parameters can be edited.

1 Funnel positioning

- Correct the funnel position in the input box if required.
- Mark the second checkbox to activate the funnel movement to the zero position at the start of the measurement.

Please note

The automatic funnel adjustment is only carried out if the functions "Funnel position" and "Funnel to position 0" have both been activated.

② Feeder

- Insert the feeder control level and the maximum duration of the advance period of the material.
- The maximum control level of the advance period is automatically set 5 units higher than the starting control level for the measurement.
- Set the definitions for the covered area of those images recorded by CCD-Basic and CCD-Zoom that are to be included into the measurement.
- The correct feeder width has to be inserted, the use of a guidance sheet has to be activated and the exhaustion should be activated if not yet done in the window "Start measurement".

③ Measurement (Funnel and feeder settings)

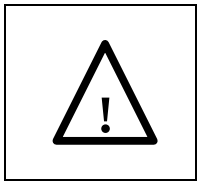
Insert the control level for carrying-out the measurement start and the maximum covered area of the recorded images for each camera.

④ Cleaning feeder

Activate the automatic cleaning of the feeder at a certain covered area and control level (important for CAMSIZER® online).

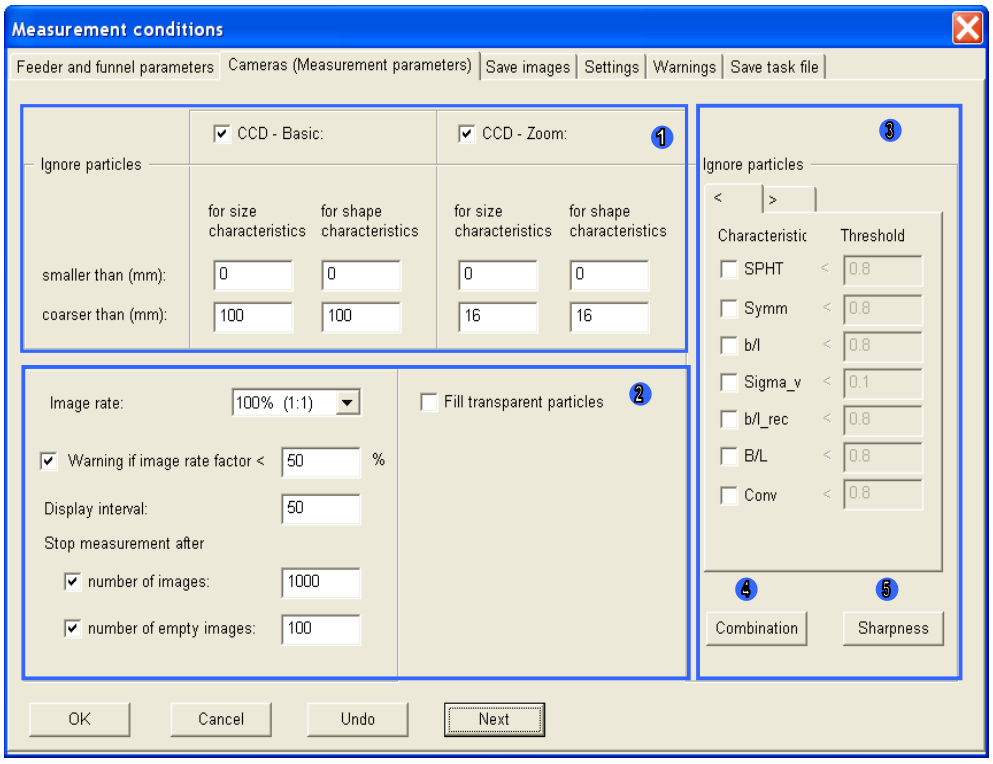
⑤ Measurement (Funnel upwards, funnel and feeder setting)

Define the funnel and feeder settings during measurement. This is e.g. useful if measuring fibres that could stick in the funnel.



The CAMSIZER® is suitable for free flowing dry and harmless material. Please make sure that all regulations for hazardous goods and all information contained in the safety data sheets of the analysed materials are observed.

6.3.2 The register card "Cameras (Measurement parameters)"



In the register card" Cameras (Measurement parameters)", the measurement parameters of the particles can be defined.

1 Define the size limits of the particles that are to be ignored by CCD-Basic and CCD-Zoom.

2 Set image rate, warning and display interval. Set the maximum number of images / empty images for the measurement. After recording this number of images, the measurement will be stopped. Mark the checkbox if transparent particles should be filled automatically.

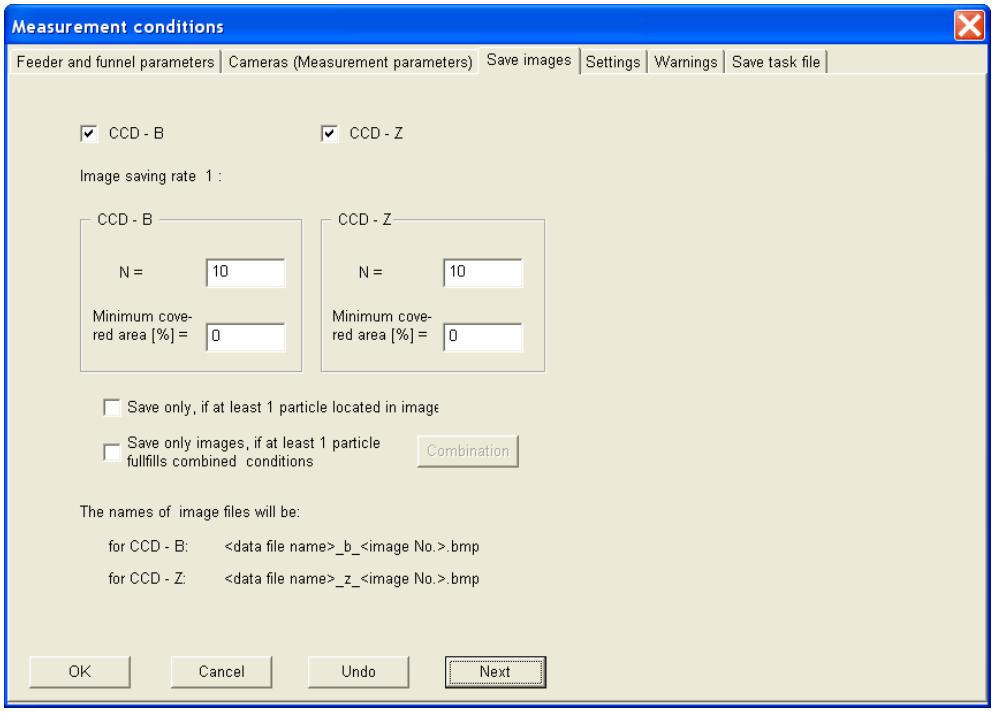
3 Ignore particles: Define the characteristics for the particles ignored by the cameras by shape and / or transparency.

4 Set combined characteristics for the particles to be ignored by the cameras. A dialogue will open where the combined characteristics can be defined. Please see chapter 7.5.1.1.4 "Set combinations for parameters for particles that will be ignored" for further information.

5 With a click on the button [Sharpness], a window opens in which the upper sharpness value for the particles to be ignored can be defined. All particles whose sharpness level is below this value will be ignored. Please see chapter 7.5.1.1.5 "The button `Sharpness´" for further information.

6.3.3 The register card "Save images" (optional)

Set the saving definitions of CCD images.



On this file card, the saving of the images recorded with CCD-Basic or CCD-Zoom can be activated. Please note that this function requires much free hard disk space (about 735 KB per image). When the storage capacity is exhausted, the measurement will be stopped.

The images will be saved in a subfolder "Images" in the folder CAMDAT. The register card will be described in more detail in chapter 7.5.1.3 "The register card `Save images´".

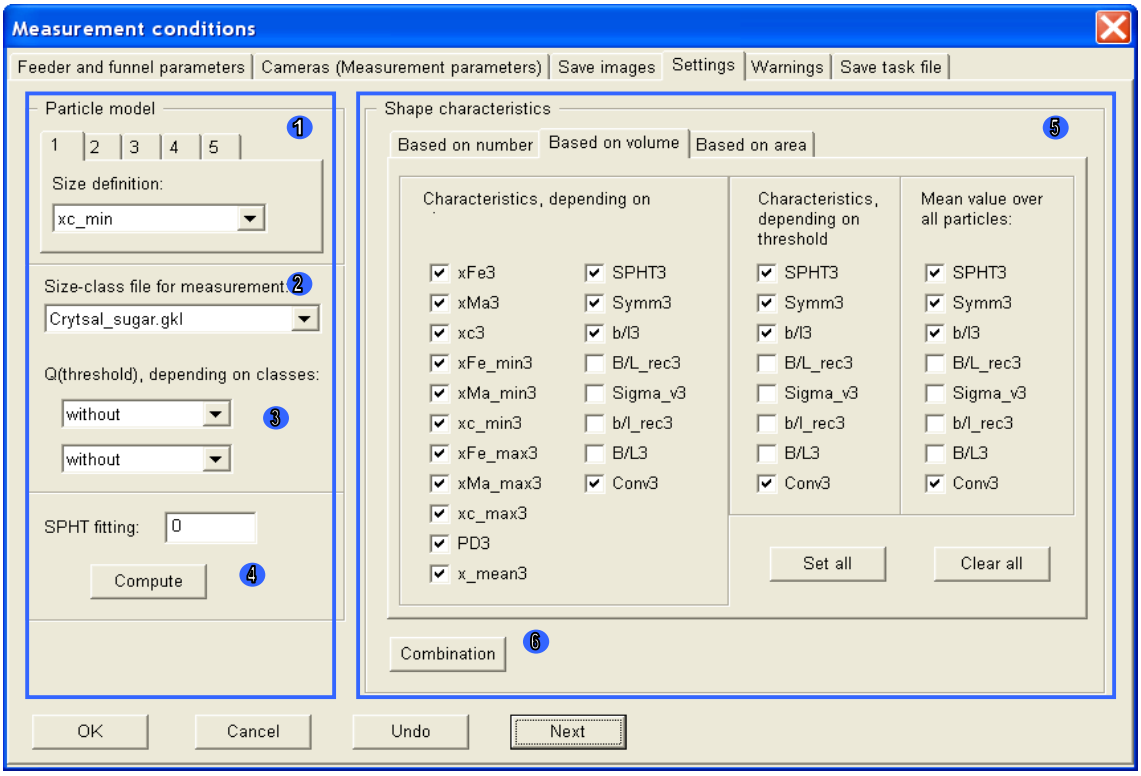
N=	Defines the ratio between all images and the images to be saved. If N is set to 4, then every fourth image will be saved.
Minimum covered area (%)	Define the minimum covered area (shading) of the images that will be saved.

Mark the checkbox "Save only, if at least one particle located in the image" to avoid the recording of empty images.

Mark the checkbox "Save only images if at least one particle fulfills the combined conditions" and set the combination value for defining the combined conditions by clicking on the respective button.

6.3.4 The register card "Settings"

In this register card, the settings for the particle size and shape definition for the measurement can be defined. The register card will be explained in detail in chapter 7.5.1.4 "The register card `Settings´".



① Particle model

The "size" of a particle projection or image can be defined in different ways. The CAMSIZER® can measure up to 5 different particle "size definitions", i.e. particle models according to whom the measured shape characteristics are classified. These parameters will be explained in more detail in chapter 7.5.1.4.1 "Settings – Select particle model" and in chapter 8 "Characteristics".

Please note that each particle size model results in a different distribution (i.e. a Q_3 or cumulative distribution of particle volume). Each particle size model allows measuring a different property of the particle projection.

The data of each selected particle size model are stored in a separate raw data file (*.rdf) with the file name (taskfile_particlemodel.rdf). The raw data files are stored in the CAMDAT-folder of the measurement file, for example:

- Camsizer\CAMDAT\pvc_granulate\pvc_granulate_xc_min_001.rdf.

The number at the end of the file name indicates the count of the repetition of the measurement procedure of this task file. If the measurement is performed for a second time, the file name will be:

- Camsizer\CAMDAT\pvc_granulate\pvc_granulate_ xc_min_002.rdf.

② Size class file

Select the class file in which the size classes have been defined. It is necessary for the measurement preview and for "Q (threshold), depending on classes". Normally, the name of the task file will be used for the corresponding size class file *sizeclass*.gkl. You can also select another class file for your measurement procedure on the measurement start window.

③ Class-dependent Q-(-threshold) value (optional)

Here you can select a class-dependent Q- (-threshold) value. Depending on the selected value, the cumulative distribution or the cumulative distribution of residue of this threshold will be shown (please see chapter 7.4.1.2.3.1.4 ""Characteristics – Q-threshold, depending on classes" for more detailed information).

Two Q-thresholds for the shape or transparency definitions of the particles can be selected. The thresholds of this value can be edited after the measurement in the menu "View" of the window "Table" (please see chapter 6.5.1.4 "The register card `Table`". Set combinations for parameters for particles that will be ignored").

If the size classes used for display (after the measurement) are different from those used in the measurement, the values will be interpolated, and can differ slightly from the real values.

4 **SPHT-fitting**

SPHT-fitting (optional) has been configured for the compensation of the sphericity deviation between CCD-Basic and CCD-Zoom. These deviations are caused by the different pixel resolutions of the two cameras. For spherical particles, the SPHT-value is 0 and an SPHT-fitting is not necessary.

Please note

The correct value for an SPHT-fitting of non-spherical particles can be found by comparing the two raw data files recorded by the two cameras. Click [Compute]. Select the raw data files recorded with CCD-B and CCD-Z in the dialogue windows.

Please see chapter 7.6.7 "The menu `Extras – Measure for SPHT-correction´" for a more detailed explanation of this function.

5 Define shape characteristics for the measurement procedure. Depending on your software settings, the measurement characteristics depending on area, volume or number can be selected.

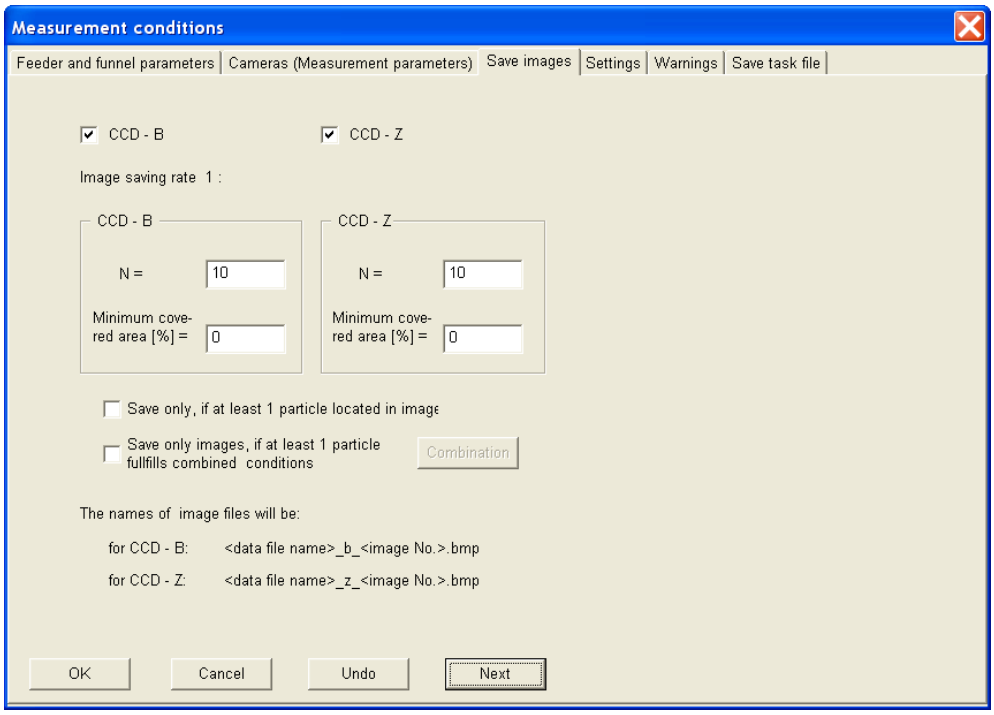
Only those characteristics will be recorded in the raw data files that are defined in this window before the measurement. Please note that class-dependent characteristics influence the size of the raw data file; therefore please select carefully which shape characteristics you would like to record.

6 **The button "Combination"**

Set a combination of the characteristics that are detected by the cameras. Only the particles whose characteristics correspond to the values inserted in this table will be recorded in the raw data file. Please see chapter 7.5.1.4.6 "Settings – The button [Combination]" for a detailed explanation of this function.

6.3.5 The register card "Save images" (optional)

Set the saving definitions of CCD images.



On this file card, the saving of the images recorded by CCD-Basic or CCD-Zoom can be activated. Please note that this function requires much free hard disk space (about 735 KB per image). When the storage capacity is exhausted, the measurement will be cancelled.

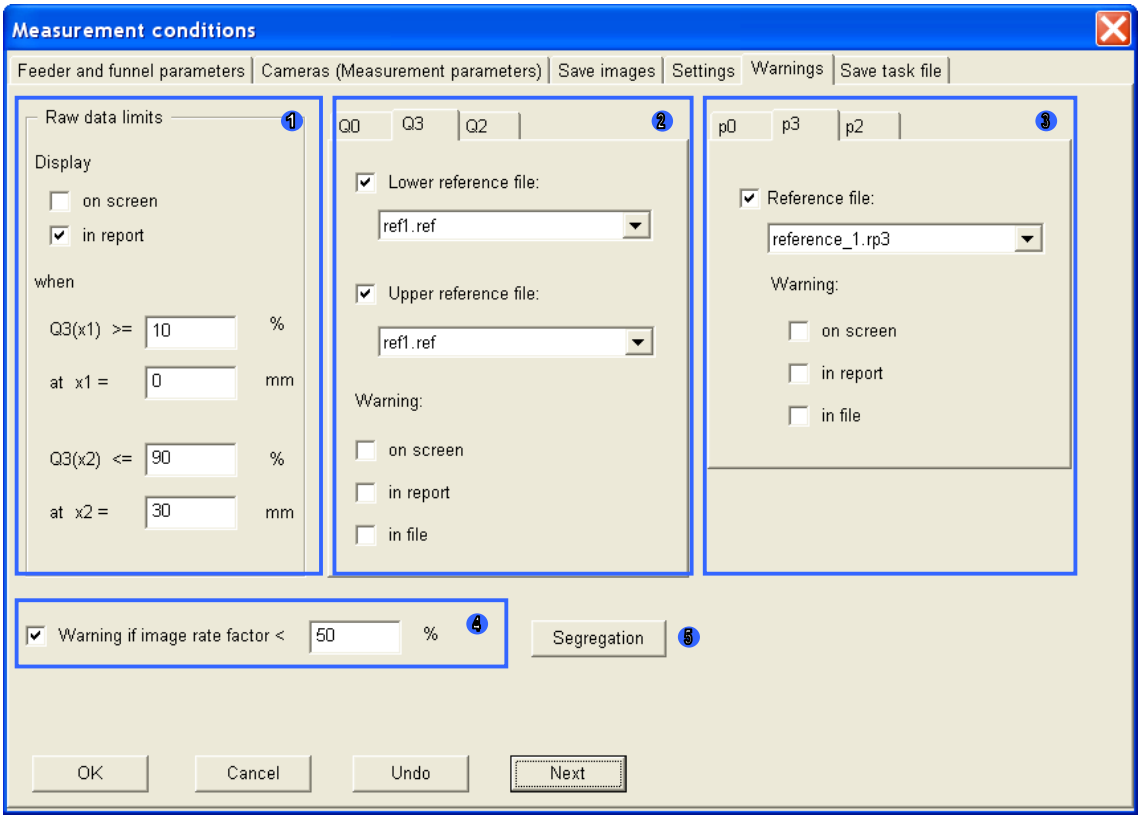
The images will be saved in a subfolder "Images" in the folder CAMDAT. The register card will be described in more detail in chapter 7.5.1.3 "The register card `Save images´".

N=	Defines the ratio between all images and the images to be saved. If N is set to 4, then every fourth image will be saved.
Minimum covered area (%)	Define the minimum covered area (shading) of the images that will be saved.

Mark the checkbox "Save only, if at least one particle located in the image" to avoid the recording of empty images.

Mark the checkbox "Save only images if at least one particle fulfills the combined conditions" and set the combination value for defining the combined conditions by clicking on the respective button.

6.3.6 The register card “Warnings” (optional)



Activate warnings to check the deviation of the recorded results from certain tolerance values. The warning can be activated on screen, in report or in the file. Please see chapter 7.5.1.5 “The register card `Warnings`”. for a more detailed explanation.

1 Raw data limits

Set volume-based limits for cumulative distribution. A warning appears if $Q_3(x1) \geqq Q_3$ limit$_1$ and/or $Q_3(x2) \leqq Q_3$ limit$_2$.

2 Q3 , Q0 or Q2-limits (cumulative distribution)

A warning will be issued if the measured Q_3, Q_0 or Q_2-values fall below or exceed the values of a selected reference file (“Upper reference file / Lower reference file”). The reference file can be selected by a click on the arrow button in the drop-down menu. The warning also appears when the raw data file is loaded by selecting |-File|Open measurement file-| in the main software menu. If the results are exported to an EXCEL- file, the warning will be written in the headline.

Please note

To activate this warning function, at least one reference file has to be defined. Please see chapter 7.5.1.5 "The register card `Warnings`" and 7.51.6 "The register card `Save task file´" for a more detailed explanation.

3 **p_3 , p_0 or p_2 (fractions)**

A warning will be issued if the reference data p_3 , p_0 or p_2 are infringed. Select the reference file in the respective box.

Please note:

To use this function, a reference file has to be created. To create the reference file, please click |-Options|Input fraction limits-| (please see chapter 7.5.9.)

4 **Warning if image rate factor < [ ]**

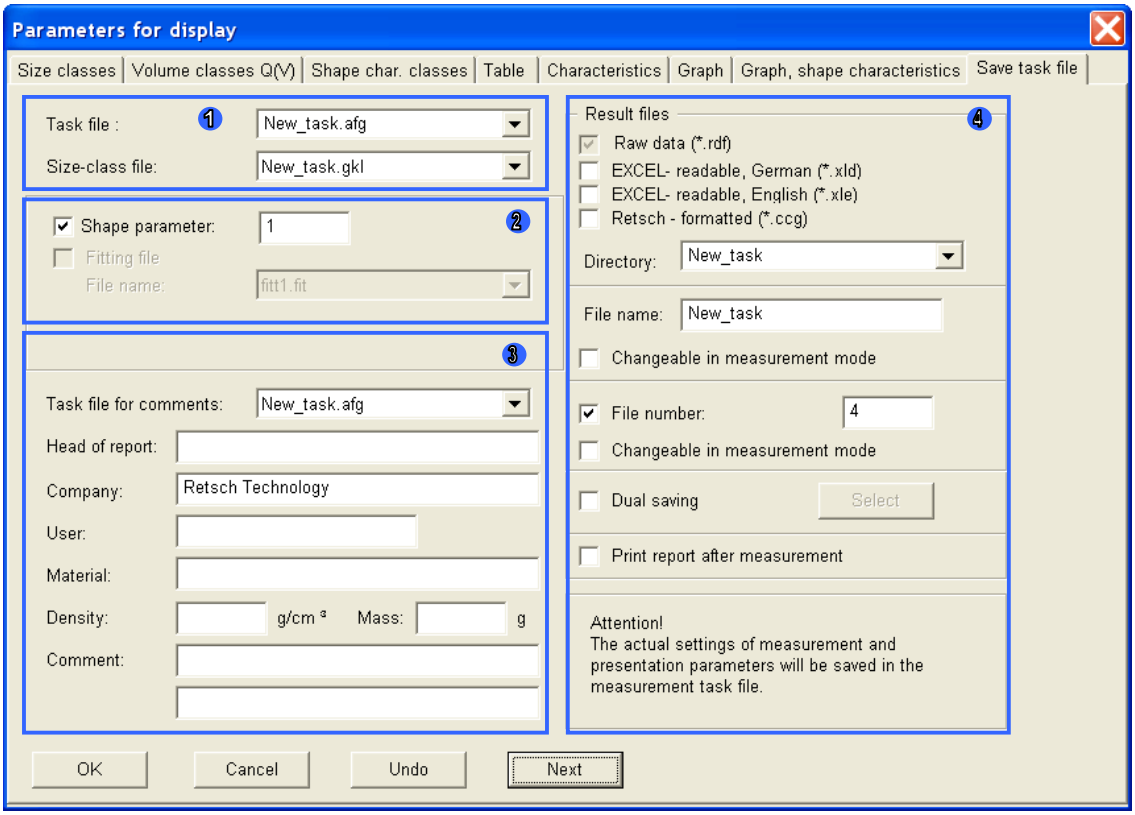
A warning will be issued if the number of images recorded per second falls below a certain percentage of the maximum possible image rate. A typical warning threshold is 95%.

5 **Segregation**

Set a segregation warning if you would like to inspect the segregation behaviour of certain sample material. Some materials have physical properties that may cause a segregation or agglomeration of the sample. This option is only used in rare cases if you need to know the tendency for the segregation of products (for example if you have a broad size distribution).

6.3.7 The register card "Save task file"

After editing the measurement parameters, please open the card "Save task file". This register card is available in the window "Measurement conditions" and in the window "Parameters for display". It is also available in the menu bar |-File|Save task file-|. To apply any changes set on the other file cards, the register card "Save task file" has to be used.



1 Select the task file and the size class file where the previously selected measurement parameters will be saved. These files will be used in the measurement procedure and for the display of the data. When a new task file has been created, the task file name and the size class file have been already defined (please see chapter 6.2 "Create a new task file"), however the settings can be saved under another file using this register card.

2 **Shape parameter and fitting file**

In the task file, not only the parameters for the measurement, but also the parameters for the processing and display of the data will be defined. Shape parameter and fitting file alter the display, the export or the printing-out of the data. The shape parameter shifts the x-axis by multiplication with a factor.

With a fitting file, the measurement results can be adjusted to a comparison file (reference file) Q_3 (x), for example a sieve result file. Please select the respective fitting file in the drop-down-menu.

Either a shape parameter or a fitting file can be used. Please mark the respective checkbox and select a fitting file. For the availability of this function, the fitting file has to be created under |-Options|Fitting file-|, please see chapter 7.5.7.

3 Edit the labelling of the report. The input boxes "Header of the report", "Company", "User", "Material" and "Comment" can be edited.
If you wish to compute the specific surface S_m or the relative density rD, the input of the density or the mass of the sample material is necessary, otherwise the calculation of these values will not be possible.

4 **Result files**
Select the export files for the measurement task, the directory and the file name of the result files. Select whether the file name and number are changeable in the measurement mode. When "File number" is marked, a number will be added to the measurement result files. When "dual saving" is marked, a second directory for the storage of the result files can be selected. To activate an automatic print out, please check "Print report after measurement".

Please note
After the measurement parameters have been set, it is recommended to perform the measurement procedure before editing the display parameters. Most of the functions of the display parameters are available after the measurement process. All settings can be re-edited after the measurement process and will be updated in the measurement report.

6.4 Measure the sample

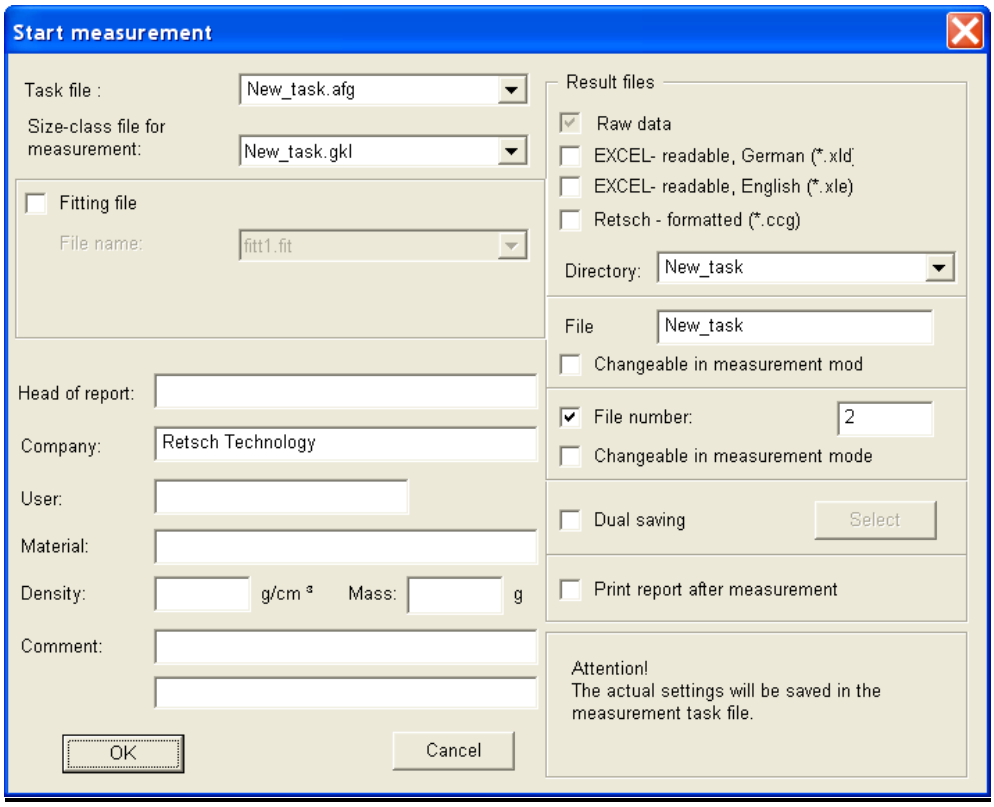
6.4.1 Start measurement

After the task file has been saved, the measurement of the material can be started. A measurement process is started by selecting
|-Measure-| in the menu or by a click on the respective icon: 

The funnel will be moved to the zero-position if this function has been defined, and the window "Start measurement" will be opened. In this window, the following settings can be defined (please see also previous chapter):

- Task file
- Size class file
- Fitting file
- Storage location of the result files
- Export files: file name
- File number
- Dual saving
- Report

Please note
If a new task file is defined, the size class files and the result files will be changed automatically. The files can however be re-edited by the user.

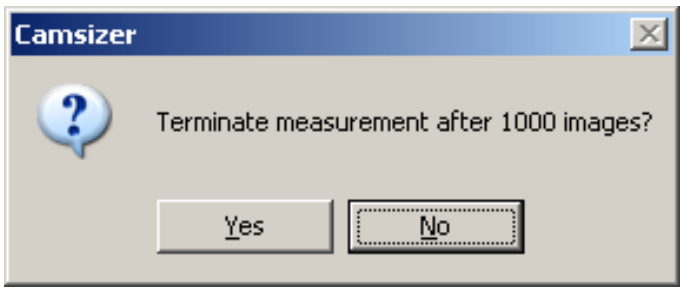


Select the task file, the report labeling and the result files.
Click [OK] to start the measurement process.

The measurement process is started. The raw data according to the particle models defined on the register card "Settings" in the window "Measurement conditions" will be recorded as RDF-files in the respective directory.

During the measurement, a graph preview window appears showing the progress of the measurement process. In the menu bar, the measurement procedure can be interrupted (Stop) and continued (Start / F4), or terminated (Exit).

When the defined number of images or empty images (e.g. 1000) is reached for each camera (defined on the register card "Cameras (Measurement parameters)" in the register card deck "Measurement conditions" (please see chapter 6.3.2), a dialogue window appears:



Click [Yes] to finish and save the measurement.
Click [No] to continue measurement until another 1000 empty images.

When the measurement procedure is finished, the graph window appears in which the first particle model defined on the register card “Settings” is displayed. The other particle models can be selected by |-File|Read comparison file-]|, please see chapter “Graph”.

6.4.2 Repeating a measurement procedure

If a measurement procedure of the same task file is repeated, the file number of the RDF-file will be updated automatically in the respective box in the window “Start measurement” (For example “2” will appear for the second measurement”). Please see chapter 7.3.2 “The menu `Edit`” for further information.

6.5 Evaluate the measurement results

After a measurement procedure has been performed, the display of the measurement results can be edited and the results can be evaluated. The evaluation of the measurement results comprises two different procedures:

- The editing of the display parameters of the results. Here the "Wizard" will guide you through the different file cards.

- The combined evaluation and analysis of the results of several files: average, trend analysis, daily report, combination of CAMSIZER® and sieve data. These functions are available from the menu bar.

After the measurement process, the display parameters of the measured results can be viewed and edited before the measurement report is printed or the file is manually exported to another program. During measurement, the data of the selected characteristics are collected and saved internally in RDF-format. These raw data files are saved at a very high resolution: more than 1000 classes are saved, therefore the classes can be edited retroactively after the measurement procedure.

After the measurement, the graph window appears where the particle size distribution of the first particle model is displayed.

- If you wish to start immediately to edit the graph display, please continue with chapter 7.4.2 "The menu `Results – Graph`".

- If you wish to view and edit the size classes first, please click |-Options|Size classes-| in the main software window. The wizard will re-open; you can navigate between the different register cards and edit the display parameters.

6.5.1 Define display parameters

The window "Parameters for display" comprises the following register cards:

- Size classes
- Volume classes (optional)
- Shape characteristics classes
- Table: display of the measured values in a table
- Characteristics: display of the desired values
- Graph: display of the measured values in a graph
- Graph/shape characteristics: graphic display of the shape characteristics

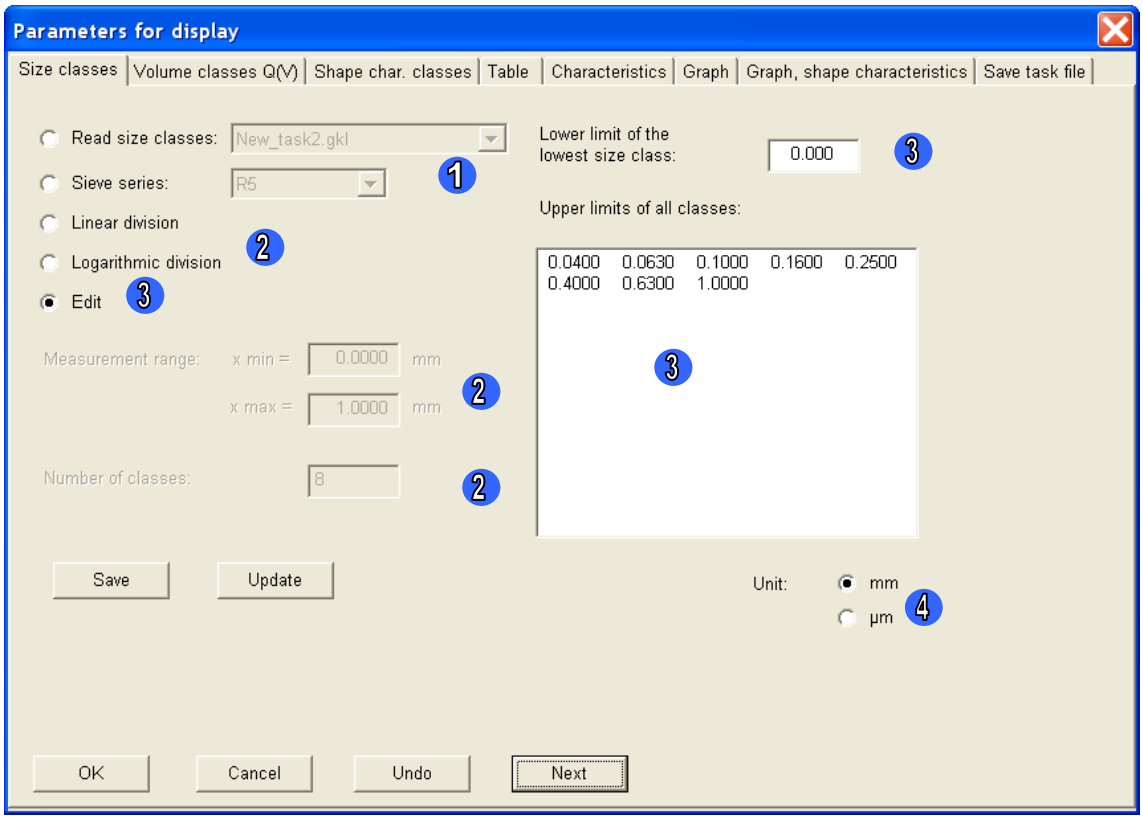
Before a measurement is started, at least one ***size class file*** must be available. The size class file has been created by inserting the file name into the respective input box in the register card "Save task file".

The ***volume class file*** and the ***shape characteristics file*** must be available. If no volume class and shape characteristics files are available, a dialogue window asks for the input of the respective file names.

In the window "***Characteristics***", the characteristics of the grain size distributions can be displayed that have been measured in one measurement procedure or averaged over several measurement procedures.

In the windows "***Table", "Graph"*** and ***"Graph/shape characteristics"***, the display of the results can be edited. Simultaneously, the display in the report is updated.

6.5.1.1 The register card "Size classes"



The size classes can be defined in the following ways:

1 **Read size classes / sieve series:** Select the size classes from a previously saved file ("Read size classes") or select a sieve series. Usually, the class file for the current task file is displayed using the name of the task file (*sizeclassfile*.gkl). If you wish to use another size class file, please select it in the respective drop-down-menu. Either a size class file or a sieve series can be selected.

2 **Select the linear or logarithmic division of the classes:** The input boxes "Measurement range" and "Number of classes" will become active. Please insert these values for each type of class division.

3 **Edit**: When this checkbox is marked, the upper limits of all classes of the respective class division type and the lower limit of the lowest size class can be edited manually in the respective edit windows.

4 Select the units for the display of the values.

Click [Update] to apply the settings. Click [Save] to save the settings.

6.5.1.2 The register card “Volume classes for Q3(V)” (optional)

The representation of the particle size distribution (x-axis) can be based on size or on volume. The calculation of the particle volume is based on the dimensions detected in the measurement process and the volume model of an ellipsoid.

Please note
It is recommended to assign a suitable name to the size class files to enable the user to easily identify the individual files of the size, volume or shape characteristics!

In the window “Volume classes”, the classes for the volume distribution can be defined.

The window “Volume classes” is structured similar to the window “Size classes” and offers the following setting options:

1 **Read size classes**
Read the classes for a volume representation on the x-axis from a file that has been previously saved. Usually, the volume class file for the current task file is displayed (*sizeclassfile*.gkl). If you wish to use another size class file, please select it from the drop-down-menu. The selection of a sieve series is not available here.

2 **Linear / logarithmic division:**
Activate the checkboxes for the linear and logarithmic division. In the input boxes, set the measurement range for the division (minimum and maximum volume).

3 **Edit**
Select “Edit” to edit the upper limits of the classes and the lower limit of the lowest volume class. The edit-window becomes active for each class type.

4 **Unit**
The unit available here is mm^3.

Click [Update] to apply the settings. Click [Save] to save the settings.

6.5.1.3 The register card "Shape characteristics classes"

In the register card "Shape characteristic classes", the definitions for the shape and transparency characteristic classes can be set. The window is structured similar to the window "Size classes", however the options "Sieve series" and "Units" are not available.

Read size classes
Use the class file of the current task (*sizeclassfile*.gkl) or select a saved task file from the drop-down-menu.

Linear / logarithmic division:
Activate the checkboxes for the linear and logarithmic division. In the input boxes, set the measurement range (minimum and maximum grain size) for the division.

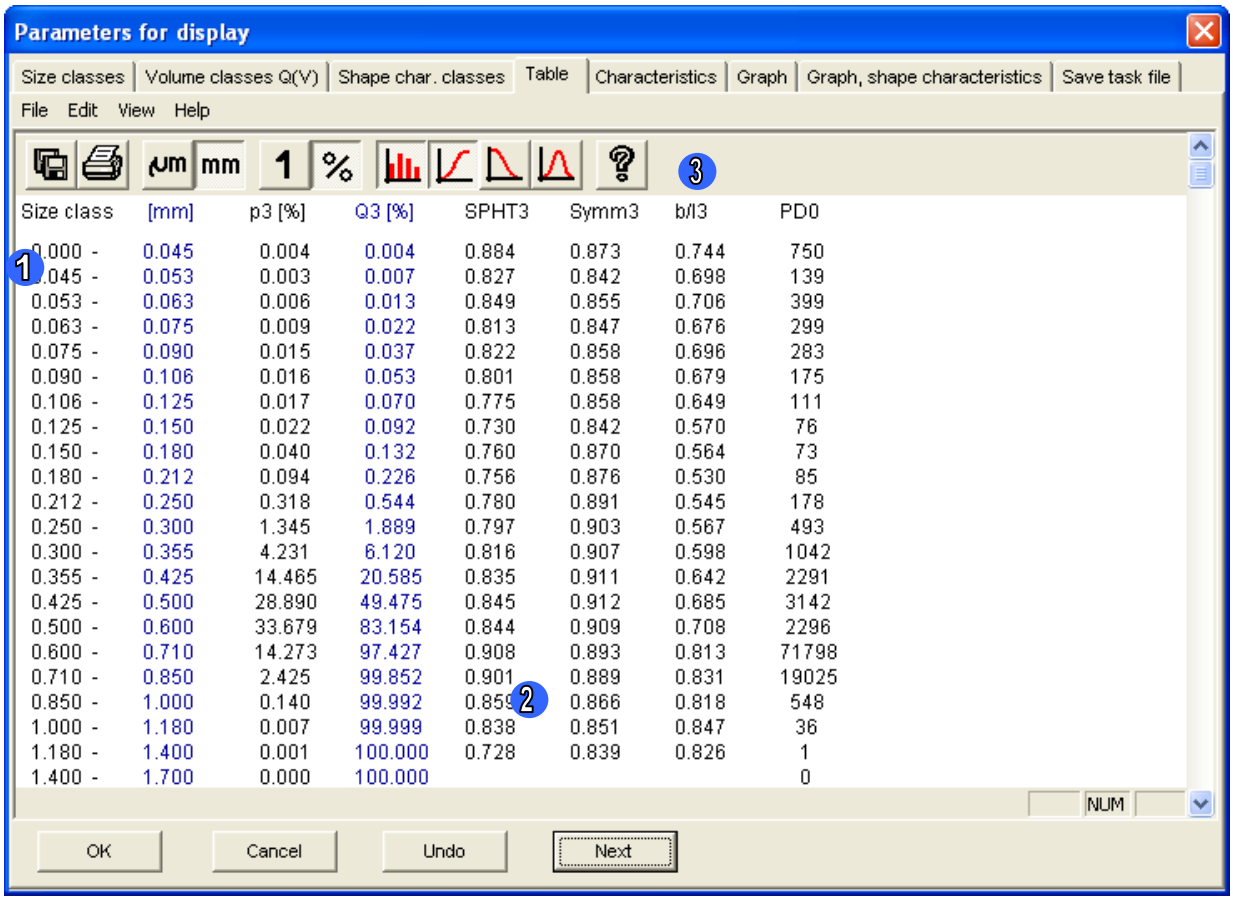
Edit
Select "edit" to edit the upper limits of the classes and the lower limit of the lowest shape or transparency class. The edit-window becomes active for each class type. In the "Q_r over Parameter" representation, only values from 0 …1 are possible.

Click [Update] to apply the settings. Click [Save] to save the settings.

6.5.1.4 The register card “Table”

In the register card “Table”, the units and the presentation of the measured values in the report can be defined.

After the measurement, the display of the measurement results (raw data) can be edited.



1 Size classes

2 Characteristics for the measurement results. In the columns the measurement data will be displayed.

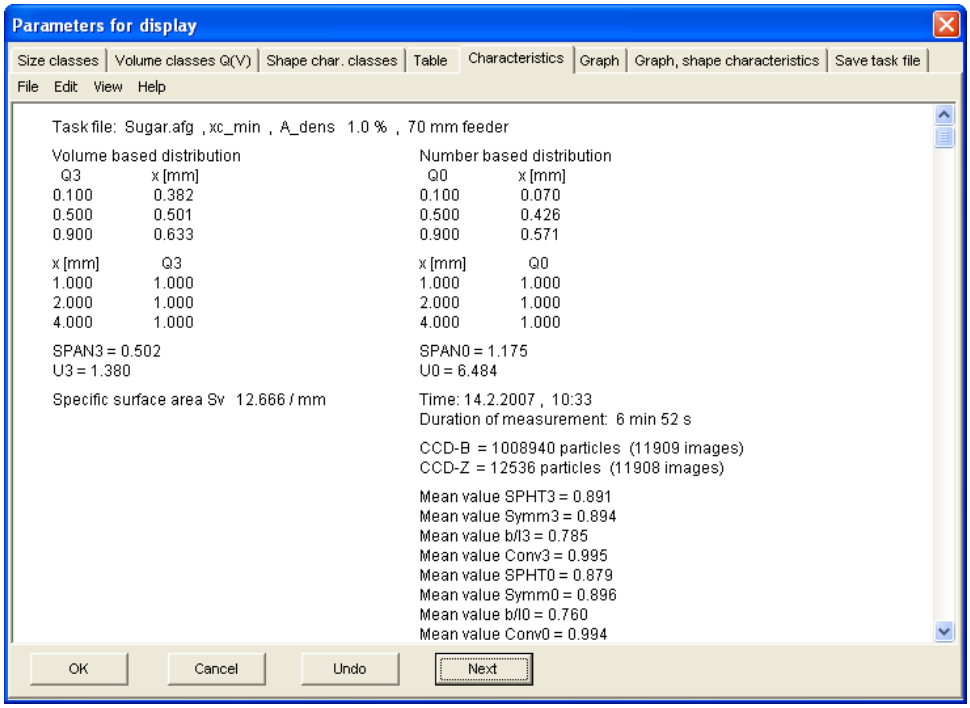
3 Icon and menu bar

Define the settings for the display of the measurement report in the icon bar:

- Unit (µm or mm)
- Scale in % or between 0...1
- Fractions 
- Cumulative distribution 
- Cumulative distribution of residue 
- Frequency distribution 

In the menu |-View|Characteristics-|, a table window can be opened where the columns for the table and the text files can be defined that will appear in the measurement report. Furthermore, reference data and the size limits for the display can be edited. Please see chapter 7.4.1 "The menu `Results – Table´" for a detailed description of the table window.

6.5.1.5 The register card "Characteristics"



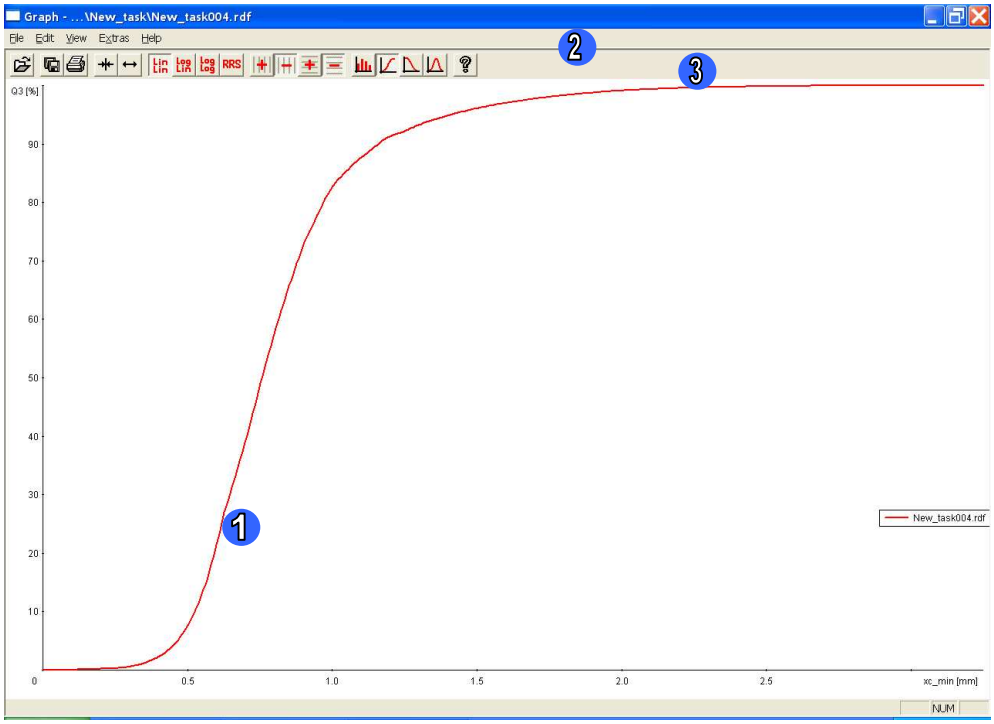
In the register card “Characteristics”, it can be checked whether all of the characteristics are displayed as desired. These characteristics have been set in on the register card“ Settings”.

If you wish to edit these characteristics or their display, please use the menu “View” in this window.

In the window “Characteristics”, the characteristics displayed in the report are shown. Please make sure that all characteristics are displayed as desired and add or remove characteristics if necessary. Please see chapter 7.4.4 “The window `Characteristics´” for a detailed description of the window “Characteristics” and its functions.

6.5.1.6 The window “Graph”

In the window “Graph”, the grain size distribution of one measurement procedure or of several measurement procedures (averaged) are displayed. The file name of the presented measurement is given in the title bar. When averaged values are presented, this is indicated by “Mean value” in the headline.



1 Graph window showing the cumulative distribution of particle model. Other particle models (e.g. $Q_{mass}(mesh)$ results from sieving) can be selected by loading a reference file.

2 Menu bar

3 Icon bar

Show a section of the graph

By clicking with the right mouse button and drawing a rectangle, a section of the graph can be shown and enlarged (Zoom).

With a click on the button, the standard display can be restored.

With a click on this button, the area can be enlarged.

Read a comparison file

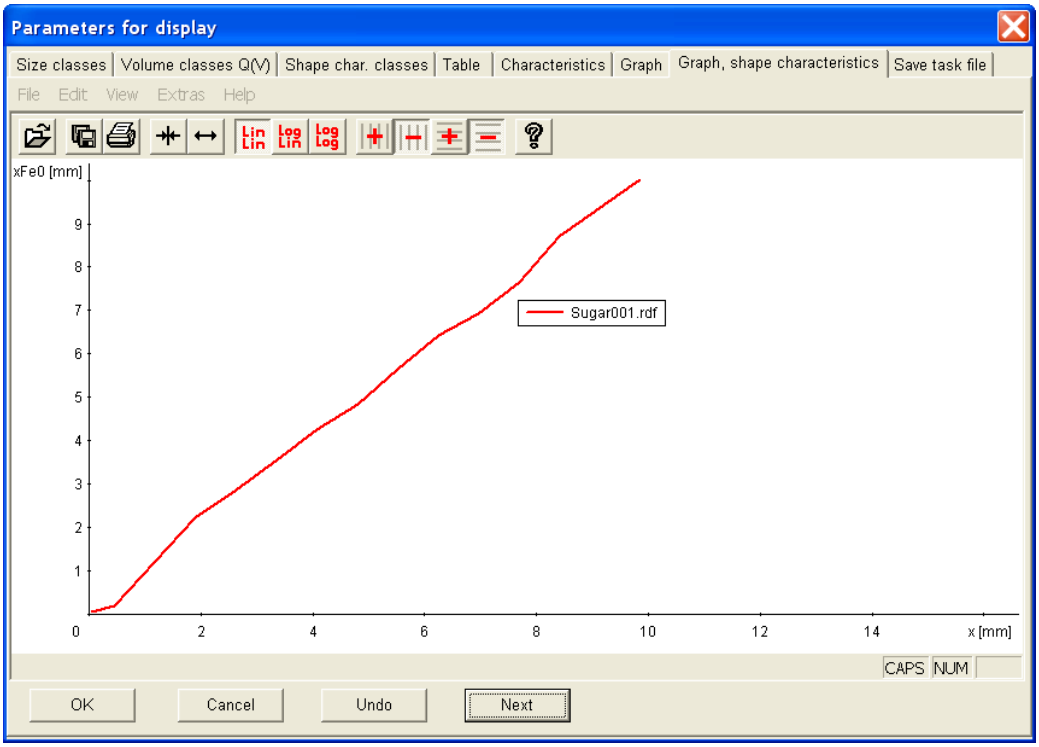
To view a comparison file, please select |-File|Read comparison file-|. Select the comparison file in the respective dialogue box.

Set display parameters

Use the toolbar to set the display parameters of the graph window. To select the units, please click|-View|Units-|. Mark the respective checkboxes in the dialogue window. Colours, types of curves, types of bars, grid and legend can be selected in the menu "Extras".

The graph window and its menu functions will be explained in detail in chapter 7.4.2 "The menu `Results – Graph´".

6.5.1.7 The register card "Graph, shape characteristics"



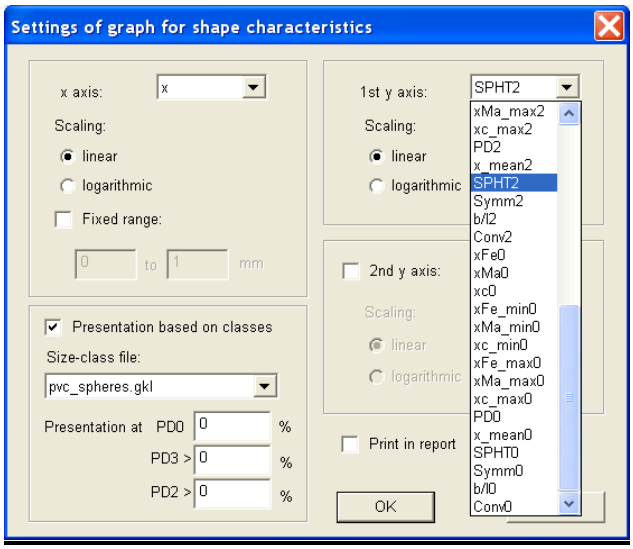
In the shape characteristics window, the shape or transparency characteristics are displayed. These shape characteristics can be measured in one measurement process or can be averaged over several

measurement processes. The file name is shown in the header of the window. If averaged values are represented, “Mean value” appears in the header.

Similar to the window “Graph”, a section of the shape characteristics graph can be shown and a comparison file can be read.

View shape characteristics

To display certain shape characteristics in the window, please click |-View|Characteristics-|. The window “Settings of graph for shape characteristics” is opened.



In the window, the x- and the y-axis can be configured in the drop-down menus. The representation is automatically defined with the selection of the x-axis: Two ways of configuration are possible:

- If “x” is selected in the drop-down menu, the representation depends on the classes, e.g. SPHT 3 (x).
- If a shape characteristic is selected, the representation is based on thresholds, e.g. Q_3(SPHT).

If the checkbox “representation based on classes” is marked, the class-dependent characteristics are displayed as a step graphic. This has the advantage that the width of the classes can be visualized and empty classes are not shown. Otherwise, the y-values will be assigned to the centres of the classes that will be connected by a graph.

- To print the graph for the shape characteristics in the report, please mark the checkbox “Print in report”.

If class-dependent characteristics are not sufficiently statistically verified, the thresholds for PD_0, PD_3 and PD_2 can be inserted in %. The characteristics based on number, volume or area will only be displayed if their proportion is larger than the inserted threshold.

Set display parameters

- To select the units, please click|-View|Units-|. Mark the respective checkboxes in the dialogue window.
- Colours, types of curves, types of bars, grid and legend can be selected in the menu "Extras".
- Set the display of the window using the toolbar.

The window will be explained in detail in chapter 7.4.3 "The window `Graph, shape characteristics´".

6.5.1.8 The register card "Save task file"

After editing these settings, please open the card "Save task file".
This register card is also available in the window "Measurement conditions", and offers the same functions for saving the display parameters. It is also available from the menu bar |-File|Save task file-|.

The modifications made to the display parameters should be saved using the functions of this file card. The main functions of this window will be summarized, for a more detailed description, please refer to chapter 6.3.6 "The register card `Save task file´".

- Save the task file and the size class file that will be used for the recorded data. If another file than the pre-selected file shall be used, please select it in the respective drop-down menu.

- If desired, select the use of a shape parameter or a fitting file. For the availability of this function, the fitting file has to be created under |-Options|Fitting file-|, please see chapter 7 "The CAMSIZER® software menu" for a more detailed description of this function.

- Select the saving options and the export files. With a checkmark in the box "Dual Saving" and a click on the button [Select], the file format and storage place of a second file can be selected.

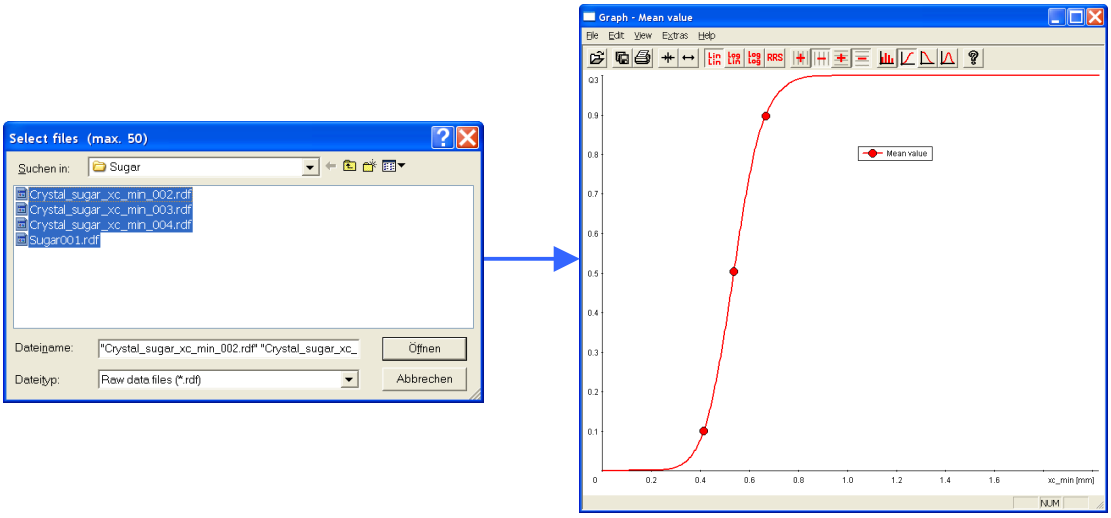
- Insert and edit the labeling of the report.

The display parameters are saved in the selected files and will be available next time the task file is loaded.

6.5.2 Evaluation of combined Results

6.5.2.1 Calculate average

Calculate the average of several raw data files.
Click |-Results|Average-|. The window "Select files" is opened. The maximum number of the files to be selected appears in the header of the box. Select the respective files (mark the files by drawing a rectangle with the left mouse button or by using the CTRL-button) and click [Open]. The graph window opens in which the mean value is displayed.



If you wish to display the mean value of the files that have been measured with different measurement tasks (which have been copied into the same folder), the task file of the first file in the list will be used. A warning appears:

After the files have been read, the averaged values can be displayed in the table window, the diagram window and the characteristics window. The title "Mean value" will appear in the headline of the window.

If the window is copied or printed, the file names will be shown at the beginning.

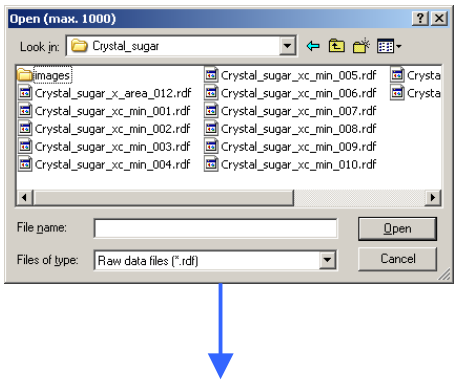
Please note

The file names will be shown if the graph window is copied or printed. They will not appear in the report window available in the icon bar of the main software user interface. If more than 50 raw data files are selected, the calculation of the mean values will be terminated after the reading of the 50th file.

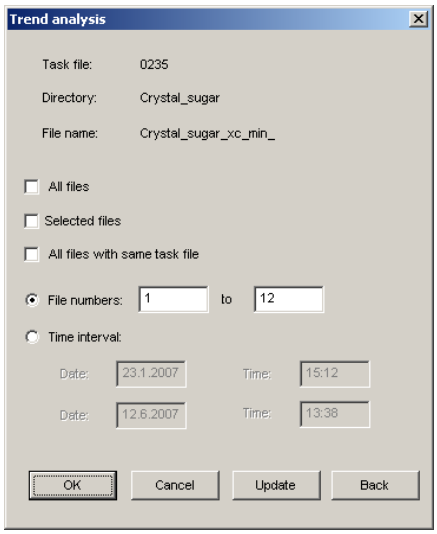
The results of the mean value calculation are deleted when the window is closed if they are not saved as a measurement file. Use the menu function -File | Save measurement file-.

6.5.2.2 Trend analysis

In a trend analysis, the results of up to 1000 single measurements can be evaluated that are available as raw data files in a subdirectory. These files can be a measurement series, selected files of a directory or all files of a directory.



Please select the files in the dialogue box “Open”. Use the CTRL-button or draw a rectangle to select the files. Click [Open].



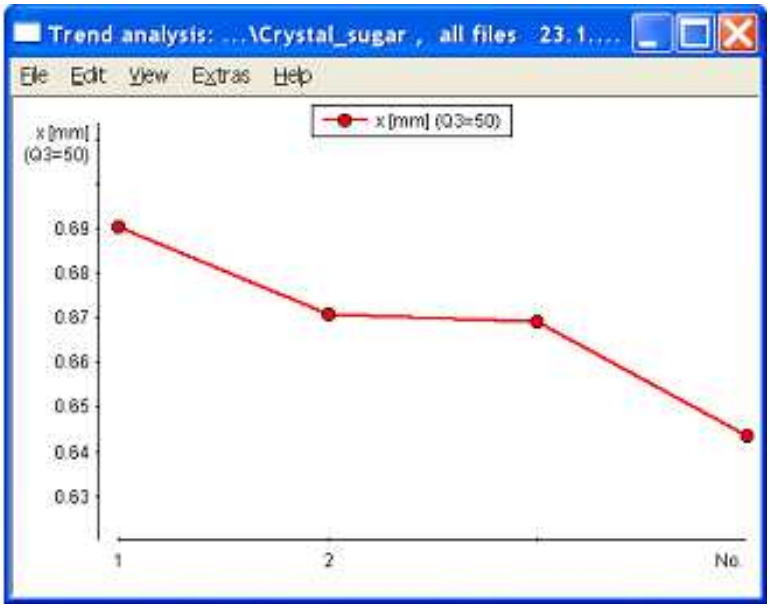
In the dialogue box “Trend analysis”, please select whether all files, the marked files or the files measured with the same task file should be used.

- Select the time interval in which the measured data have been collected for which you would like to create a trend analysis.
- Click [Ok].

Two windows are opened:

File list:
In the left window, the numbers and names of the files included in the trend analysis are displayed.

Graph window:
In the graph window, the development of the particle size distribution over a defined sequence of measurements is displayed.



- Y-axis: particle size at Q(x) = 50
- X-axis: File number

Set characteristics for the display of the trend analysis graph under |-View|Characteristics-|.

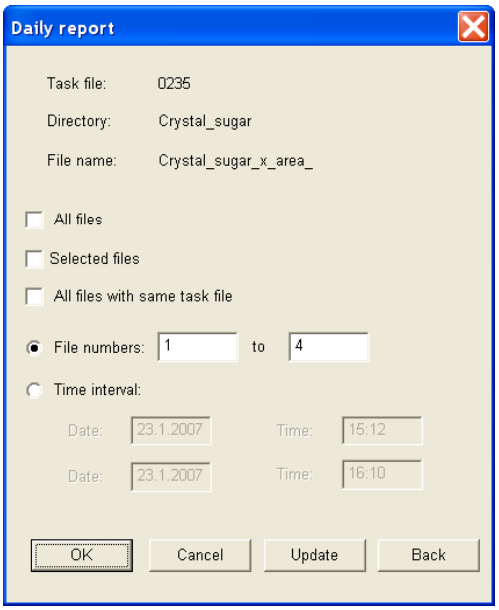
Define graphic display settings (colours, types of curves, grid) in the menu "Extra". If defined in the software settings, it is possible to display the trend analysis automatically after the measurement is finished.

6.5.2.3 Daily report

In the daily report, the results of several single measurements can be evaluated which are available as raw data files in a subdirectory. These files can be a measurement series, selected files of a directory or all files of a directory.

A dialogue window opens in which the files can be selected. Please select the files by drawing a rectangle with the left mouse button or by using the CTRL-button. Click [Open].

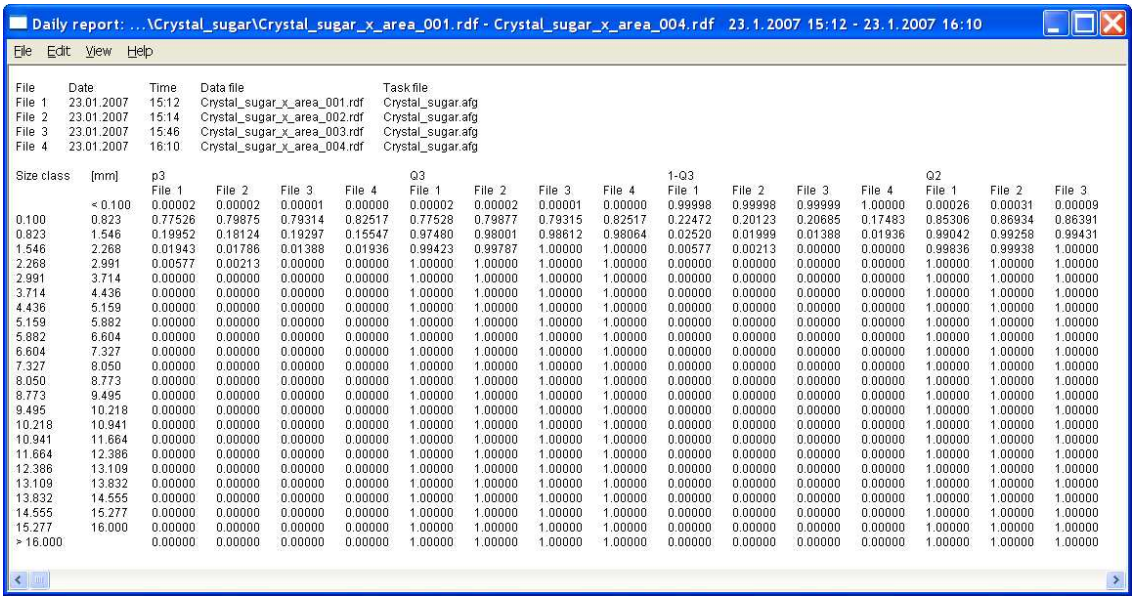
The dialogue window "Daily report" is opened.



The data can either be entered as a numerical range, as a time range, all files or as a selection of files.

Please insert the files in the directory or insert the numbers of the files you would like to analyze, or the time interval. Click [OK].

The daily report window will be opened where the measurement results of the selected files are displayed in a table. The characteristics and the units in this window can be changed by a click on |-View | characteristics-|.



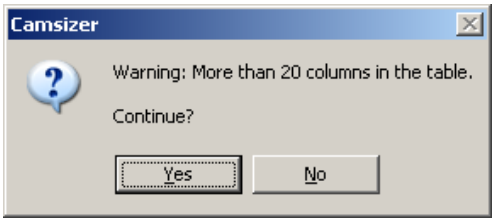
Daily report: ...\Crystal_sugar\Crystal_sugar_x_area_001.rdf - Crystal_sugar_x_area_004.rdf 23.1.2007 15:12 - 23.1.2007 16:10

File Edit View Help

File	Date	Time	Data file	Task file
File 1	23.01.2007	15:12	Crystal_sugar_x_area_001.rdf	Crystal_sugar.afg
File 2	23.01.2007	15:14	Crystal_sugar_x_area_002.rdf	Crystal_sugar.afg
File 3	23.01.2007	15:46	Crystal_sugar_x_area_003.rdf	Crystal_sugar.afg
File 4	23.01.2007	16:10	Crystal_sugar_x_area_004.rdf	Crystal_sugar.afg

Size class	[mm]	p3				Q3				1-Q3				Q2		
		File 1	File 2	File 3	File 4	File 1	File 2	File 3	File 4	File 1	File 2	File 3	File 4	File 1	File 2	File 3
	< 0.100	0.00002	0.00002	0.00001	0.00000	0.00002	0.00002	0.00001	0.00000	0.99998	0.99998	0.99999	1.00000	0.00026	0.00031	0.00009
0.100	0.823	0.77526	0.79875	0.79314	0.82517	0.77528	0.79877	0.79315	0.82517	0.22472	0.20123	0.20685	0.17483	0.85306	0.86934	0.86391
0.823	1.546	0.19952	0.18124	0.19297	0.15547	0.97480	0.98001	0.98612	0.98064	0.02520	0.01999	0.01388	0.01936	0.99042	0.99258	0.99431
1.546	2.268	0.01943	0.01786	0.01388	0.01936	0.99423	0.99787	1.00000	1.00000	0.00577	0.00213	0.00000	0.00000	0.99836	0.99938	1.00000
2.268	2.991	0.00577	0.00213	0.00000	0.00000	1.00000	1.00000	1.00000	1.00000	0.00000	0.00000	0.00000	0.00000	1.00000	1.00000	1.00000
2.991	3.714	0.00000	0.00000	0.00000	0.00000	1.00000	1.00000	1.00000	1.00000	0.00000	0.00000	0.00000	0.00000	1.00000	1.00000	1.00000
3.714	4.436	0.00000	0.00000	0.00000	0.00000	1.00000	1.00000	1.00000	1.00000	0.00000	0.00000	0.00000	0.00000	1.00000	1.00000	1.00000
4.436	5.159	0.00000	0.00000	0.00000	0.00000	1.00000	1.00000	1.00000	1.00000	0.00000	0.00000	0.00000	0.00000	1.00000	1.00000	1.00000
5.159	5.882	0.00000	0.00000	0.00000	0.00000	1.00000	1.00000	1.00000	1.00000	0.00000	0.00000	0.00000	0.00000	1.00000	1.00000	1.00000
5.882	6.604	0.00000	0.00000	0.00000	0.00000	1.00000	1.00000	1.00000	1.00000	0.00000	0.00000	0.00000	0.00000	1.00000	1.00000	1.00000
6.604	7.327	0.00000	0.00000	0.00000	0.00000	1.00000	1.00000	1.00000	1.00000	0.00000	0.00000	0.00000	0.00000	1.00000	1.00000	1.00000
7.327	8.050	0.00000	0.00000	0.00000	0.00000	1.00000	1.00000	1.00000	1.00000	0.00000	0.00000	0.00000	0.00000	1.00000	1.00000	1.00000
8.050	8.773	0.00000	0.00000	0.00000	0.00000	1.00000	1.00000	1.00000	1.00000	0.00000	0.00000	0.00000	0.00000	1.00000	1.00000	1.00000
8.773	9.495	0.00000	0.00000	0.00000	0.00000	1.00000	1.00000	1.00000	1.00000	0.00000	0.00000	0.00000	0.00000	1.00000	1.00000	1.00000
9.495	10.218	0.00000	0.00000	0.00000	0.00000	1.00000	1.00000	1.00000	1.00000	0.00000	0.00000	0.00000	0.00000	1.00000	1.00000	1.00000
10.218	10.941	0.00000	0.00000	0.00000	0.00000	1.00000	1.00000	1.00000	1.00000	0.00000	0.00000	0.00000	0.00000	1.00000	1.00000	1.00000
10.941	11.664	0.00000	0.00000	0.00000	0.00000	1.00000	1.00000	1.00000	1.00000	0.00000	0.00000	0.00000	0.00000	1.00000	1.00000	1.00000
11.664	12.386	0.00000	0.00000	0.00000	0.00000	1.00000	1.00000	1.00000	1.00000	0.00000	0.00000	0.00000	0.00000	1.00000	1.00000	1.00000
12.386	13.109	0.00000	0.00000	0.00000	0.00000	1.00000	1.00000	1.00000	1.00000	0.00000	0.00000	0.00000	0.00000	1.00000	1.00000	1.00000
13.109	13.832	0.00000	0.00000	0.00000	0.00000	1.00000	1.00000	1.00000	1.00000	0.00000	0.00000	0.00000	0.00000	1.00000	1.00000	1.00000
13.832	14.555	0.00000	0.00000	0.00000	0.00000	1.00000	1.00000	1.00000	1.00000	0.00000	0.00000	0.00000	0.00000	1.00000	1.00000	1.00000
14.555	15.277	0.00000	0.00000	0.00000	0.00000	1.00000	1.00000	1.00000	1.00000	0.00000	0.00000	0.00000	0.00000	1.00000	1.00000	1.00000
15.277	16.000	0.00000	0.00000	0.00000	0.00000	1.00000	1.00000	1.00000	1.00000	0.00000	0.00000	0.00000	0.00000	1.00000	1.00000	1.00000
> 16.000		0.00000	0.00000	0.00000	0.00000	1.00000	1.00000	1.00000	1.00000	0.00000	0.00000	0.00000	0.00000	1.00000	1.00000	1.00000

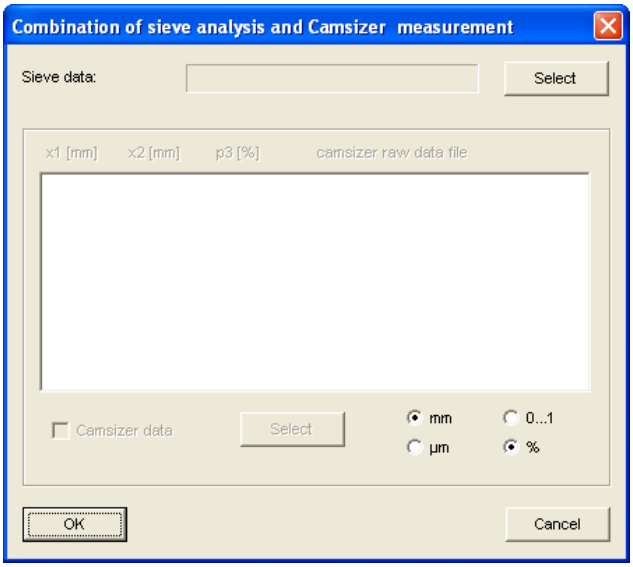
If the daily report contains more than 20 columns, a warning will be issued.



6.5.2.4 Combination of sieve and CAMSIZER® analysis

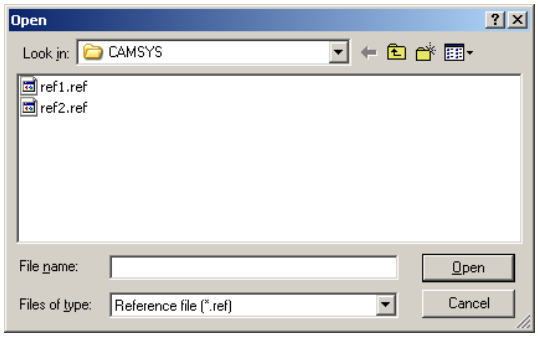
Using this menu function, the results of the CAMSIZER®-measurement can be combined with a sieve analysis. It is suitable for carrying out representative measurements of samples with a wide size distribution in an acceptable time.

The window "Combination of sieve analysis and CAMSIZER®-measurement" is opened.

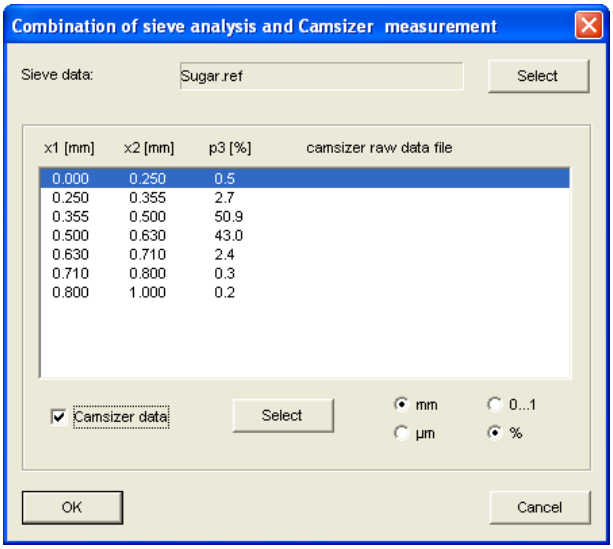


In the window "Combination of sieve analysis and CAMSIZER®-measurement":

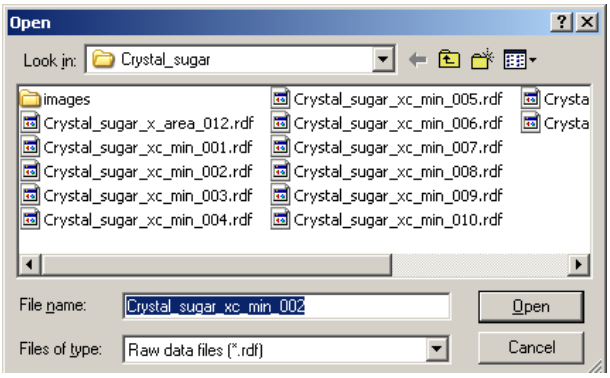
- Click the button [Select] to select the sieve data. A dialogue window opens in which the sieve data files stored in the directory CAMSYS are presented.



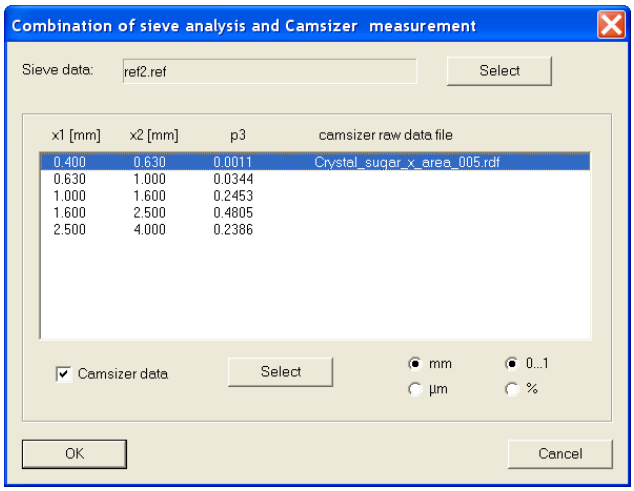
Select the reference data file. Click [Open]. The values of the sieve file are presented in the window.



Select the display of the units in the lower right area of the window. Activate the checkbox "Camsizer data" and click the button [Select]. A window opens in which the result files stored in the CAMDAT-directory are displayed.

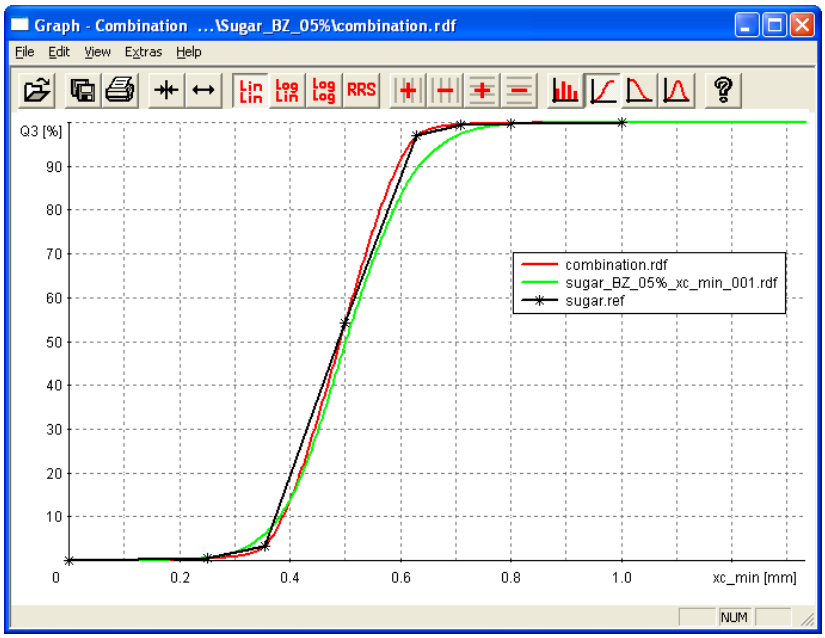


Select the CAMSIZER® raw data file. Click [Open].



The CAMSIZER® raw data file is shown in the window "CAMSIZER® raw data file".

Click [OK]. The window "Graph – Combination" opens in which the combined sieve and CAMSIZER®-results are presented



The menu and the icon bar in the window "Graph – Combination" offer the same options like in the graph window. Please refer to chapter 7.4.2 "The menu `Results - Graph´" for a more detailed description.

Please note
In the legend, the result file of the combined files will be presented as "Combination".

Please note
To visually compare the original CAMSIZER® results and the combined results, open the original CAMSIZER® measurement as a comparison file. A click with the right mouse button on the original CAMSIZER® result file name in the legend will remove the graph of the non-combined results.

7 THE CAMSIZER® SOFTWARE MENU

The following chapters of the manual provide a reference book with a detailed description of the functions of each menu item. The chapters are arranged according to the menu structure of the software.

Some of the menu functions, especially those that are essential for carrying out a measurement task, have already been referred to in chapter 6. In this chapter, each menu item will be described in more detail.

The available menu items can vary according to the selected mode. Please refer to chapter 4.1.2 “Menu functions available in different software modes” for a more detailed description.

7.1 The menu “File”

The menu “File” contains the following items:

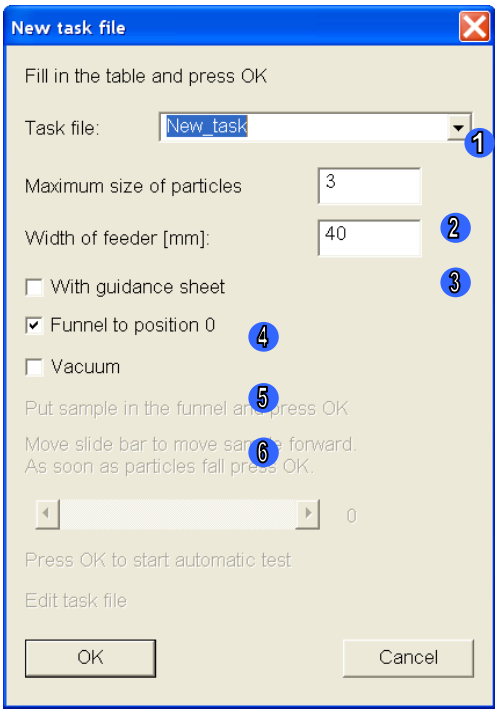
- New task file
- Load task file
- Open measurement file
- Read image
- Save task file
- Save measurement file
- Export
- Print report
- Print preview
- Print setup
- Screen font
- Printer font like screen font
- Printer font
- Exit

7.1.1 The menu “File - New task file”

Create a new task file. The window “New task file” is opened. This option is useful for example if a new material is measured. Please refer also to chapter 6 for the definition of a task file and the carrying-out of a measurement task.

7.1.1.1 The window “New task file”

1. Insert the name for the new task file (e.g. “New_task”).
2. Insert the approximate maximum size of the particles in the sample).
3. Insert the width of the feeder in mm.
4. Mark the use of the guidance sheet (if used).
5. Activate the funnel movement to zero position.
6. Activate use of the airflow.



Task file

Define the file name for the task file (e.g. “New_task”). The task file will be saved under this name in the directory CAMSYS.

Maximum particle size

Insert the approximate maximum particle size of the sample.

Width of the feeder

Insert the width of the feeder. Several feeders are available (75mm, 70mm, 60mm, 40mm, 18mm, 15mm).

Guidance sheet (Guide plate)
If a guidance plate is used during the measurement, please mark this checkbox. Make sure that the opening of the guide sheet is large enough for the largest particles in the sample to pass, in order to prevent a blocking of the opening during the measurement.

Funnel to position 0
If the funnel is to be moved into the “zero position” before the start of the measurement, please check this box. The zero position is useful if small particles are measured, if a better dispersion is to be achieved or if the filling of the sample into the funnel is to be facilitated. The funnel height will be adjusted automatically with respect to the maximum particle size during the actual measurement.

Please note
This feature is only available when the option “AutoHeight” was ordered.

Vacuum
If the sample contains a high proportion of fines, please mark the checkbox “Vacuum” to activate the airflow. Please make sure to turn on the pressured air supply.

7.1.1.2 Create a task file

Fill in the information described above and press [OK].

The line “Put sample into the funnel” will become active. Put the sample into the funnel and press [OK].

The slide bar becomes active. Move the slide bar until the first particles fall into the shaft. The value displayed here has no influence on the measurement file. As soon as the first particles fall into the shaft, press [OK].

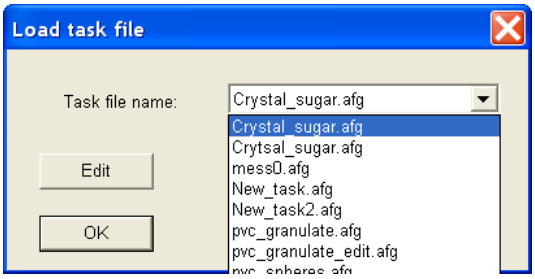
Now a test measurement starts, and the following files are used or created:

Taskfile:	Camsizer\CAMSYS\New_task.afg
Size class file:	Camsizer\CAMSYS\New_task.gkl
Raw data directory:	Camsizer\CAMDAT\New_task
	After a following “real” measurement, the raw data file will be created and saved in this CAMDAT-directory: Camsizer\CAMDAT\New_task*New_task*.rdf.

When the test measurement is completed, the task file can be edited with a click on [Edit], please see chapter 6.3 “Edit measuring parameters” for further information about editing the task file.

7.1.2 The menu “File - Load task file“

Load a saved task file to be edited, modified and/or used for a measurement task.



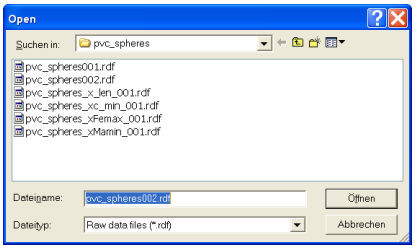
To load a task file:

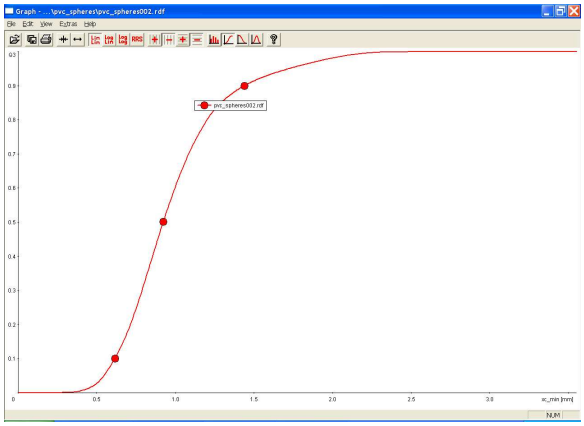
Click [OK] to load the task file. The file name appears in the headline of the main software window. The task file can now be used for a measurement task or can be edited or modified.

To edit a task file:

Click [Edit] in the dialogue window “Load task file” to edit or modify the task file. The window “Measurement conditions” will be opened, and the “wizard” will guide the user through each step of the editing process.

7.1.3 The menu “File - Open measurement file“



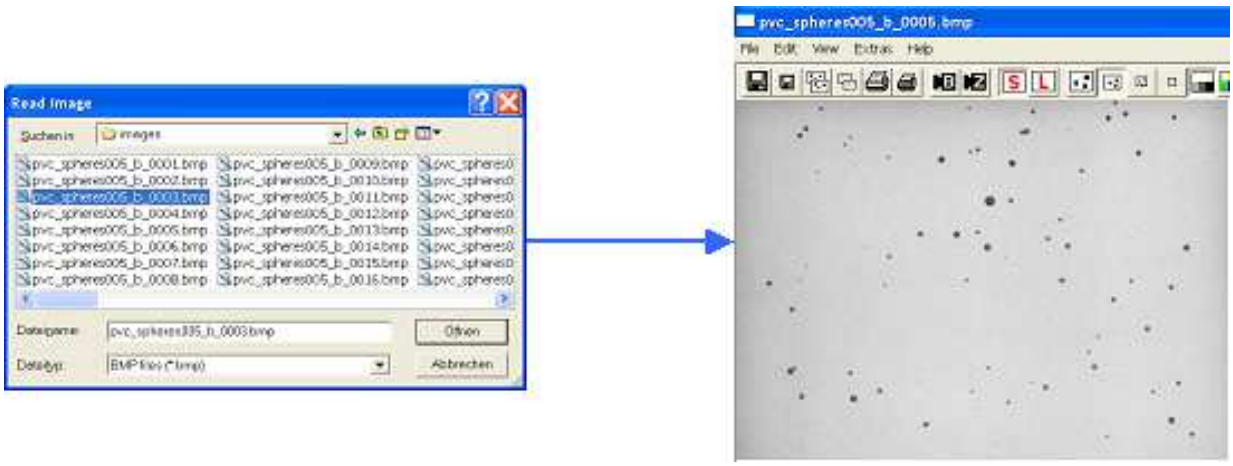


Open a saved measurement file. A dialogue window opens in which the measurement file can be selected. Select the measurement file and click [Open]. The graph window is opened in which the measurement file is displayed.

7.1.4 The menu “File - Read image“

View a saved image. The images can be saved by checking the boxes on the register card “Save images” in the window “Measurement conditions” before the start of the measurement. Please open the window “Measurement conditions” / “Save images” (|-Options|Measurement parameters-|) and activate the saving of the images.

When selecting the menu function “Read image”, a window opens displaying the folders and directories of the images saved in previously performed measurement tasks.

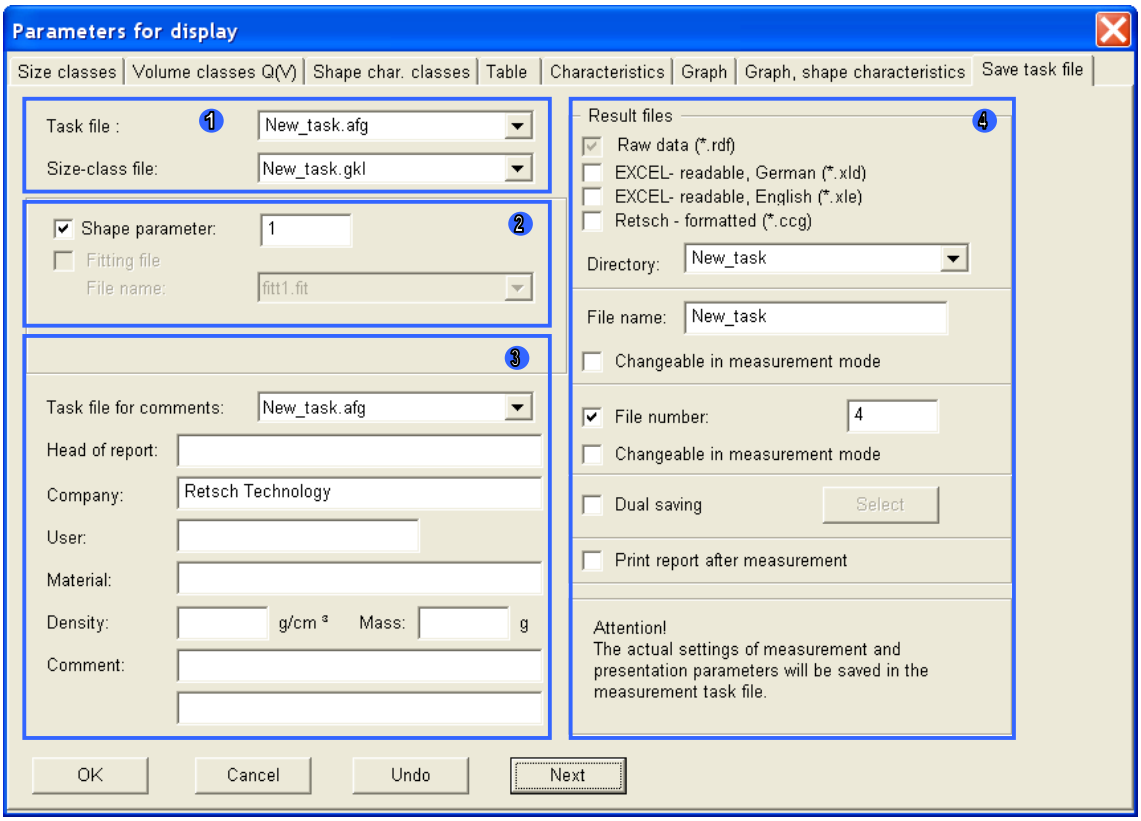


Select the directory of the measurement task. A folder "images" will be available if the images have been stored in this directory. Select the image in the directory. Click [Open]. The image is displayed.

7.1.5 The menu "File - Save task file"

This register card is available in the window "Measurement conditions" and in the window "Parameters for display". It is also available by selecting |-File|Save task file-|from the menu bar.

The task file should be saved after the measurement parameters have been defined or edited.



The following parameters can be set in "Save task file":

1 Select a size class file for the measurement preview and a task file or type in a new name for this task file.

These files will be used in the measurement procedure and for the display. Using the option "New task file", the task file name and the size-class file are pre-selected; they have been defined when the task file was created, but they can be changed here.

If you wish to save the edited and modified acquisition parameters under a different file name, select the suitable file in the drop-down-menu or type in a new task file name.

2 Shape parameter and fitting file

The task file does not only define the parameters for the measurement, but also the parameters for the processing and display of the data. Therefore several display parameters are also saved in the task file. Shape parameter and fitting file alter the display, export or print out of the data. The shape parameter shifts the x-axis values by easy multiplication with a factor (dilation).

With a fitting file, the display of the measurement results can be adjusted to a comparison file (reference file) Q_3 (x), for example a sieve result file. Please select the respective fitting file in the drop-down-menu.

Either a shape parameter or a fitting file can be used. Please mark the respective checkbox and select a fitting file. For the availability of this function, the fitting file has to be created under |-Options|Create fitting file-|, please see chapter 7.5.7.

3 Result files

Select export files for the measurement task, and select the options for saving the files

Export files (results files)	Raw data (*.rdf) EXCEL-readable, German (*.xld) EXCEL-readable, English (*.xle) Retsch formatted (*.ccg)
Input box “Directory”:	Insert the name of the directory in which the data will be saved.
Input box “File name”:	Insert the name of the file into the text box. The file will be saved under this name.
Changeable in measurement mode:	When this checkbox is marked, the filename can be modified in the measurement mode when the measurement is started.
File number	When this checkbox is marked, a 3 digits number will

be added to the name of the measurement result file if the measurement is repeated with the same task file.

After the first measurement, the files saved in the directory will have the name:
\CAMDAT\New_task\ New_task_004.rdf
\CAMDAT\ New_task\ New_task_004.xle

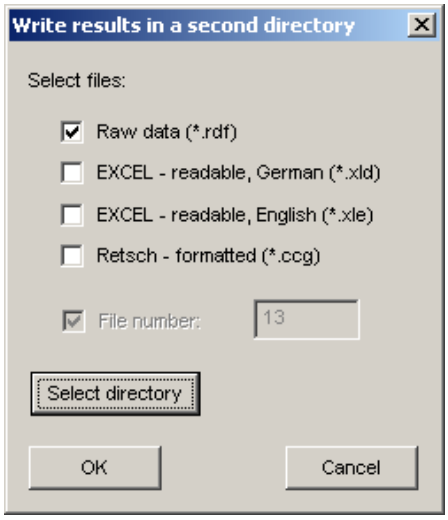
In the following measurements, the number will be counted up:
\CAMDAT\ New_task\ New_task_005.rdf
\CAMDAT\ New_task\ New_task_005.xle

If “File number” is not marked, the result files will be overwritten if the measurement task is repeated and the upcoming message “File “…” already exists. Overwrite?” is answered with “Yes” or you type in a new name for the result file to be saved.

Checkbox file number “Changeable in measurement mode”	When the checkbox is not marked, the file number cannot be changed in the measurement mode. When the file is repeated with the same measurement task / file number, the measurement file is overwritten.

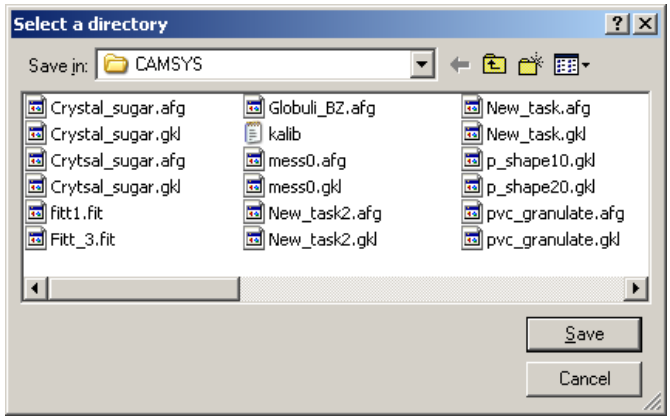
Dual saving:

Save the measurement result files additionally in a second directory. Mark the checkbox and click [Select]. The window “Write results in a second directory” is opened.



Select the file format for saving the files in this directory.

Click [Select directory].



Select the second directory in which the files will be saved additionally.

Please note

The register card “Save task file” and the window “Start measurement” (please see chapter 7.3 “The menu `Measure`”) look identical. However there is a difference:

In the window “Start measurement”, you can select a task file and carry out a measurement with this task file. In the register card “Save task file”, the changes made to the edited task file on the register cards can be saved, and the existing task file will be overwritten.

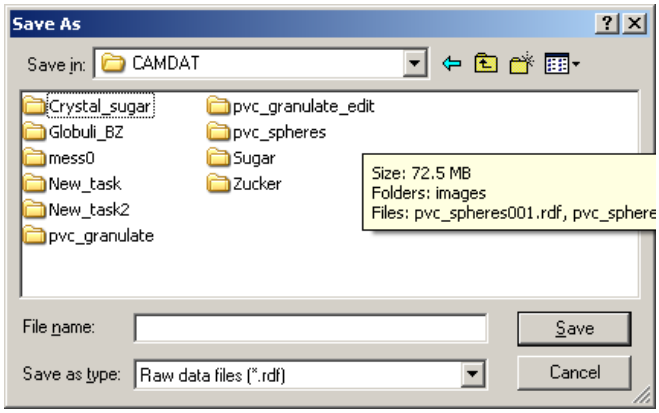
4 Edit the labelling of the report

Define the content of the comments for the report printout. The input boxes “Head of report”, “Company”, “User”, “Material” and “Comment” can be edited.

If you wish to compute the specific surface S_m or the relative density rD, the input of the density or the mass of the sample material is necessary, otherwise the calculation of these values will not be possible.

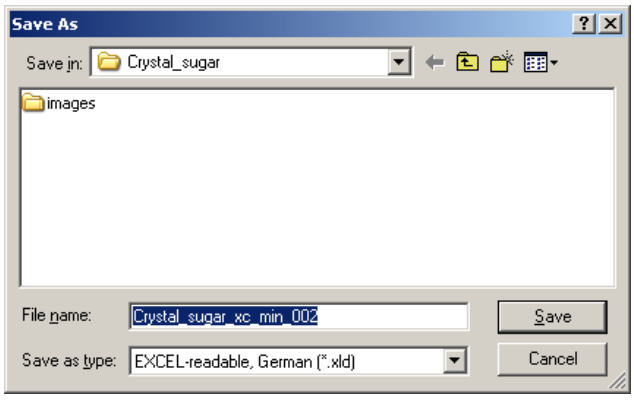
Please note: After the measurement parameters have been set, it is recommended to perform the measurement procedure before editing the display parameters. Most of the functions of the display parameters are available after the measurement process. All functions (S_m and rD) can be re-edited after the measurement process and will be updated in the measurement report.

7.1.6 The menu "File - Save measurement file"



Save the measurement data as a raw data file in RDF-format. A window opens in which the directory and file name can be selected under which the file can be saved.

7.1.7 The menu "File - Export"



The measurement data will be saved. The format can be selected in the dialogue window:

- EXCEL readable German (*.xld)
- EXCEL readable English (*.xle)
- RETSCH formatted (*.ccg)
- NSP-file (*.nsp)
- ASPECT RATIO-file (*.sig)

Excel-Files

The XLD and XLE- files are structured similar, however the dots in the XLE-files have been replaced by commas in the XLD-files.

The columns and the units are selected in the window "Table", all characteristics that are selected here appear as columns in the export file.

The first two columns are the lower and the upper limits of the measurement classes. The values $Q_3(x)$, $1\text{-}Q_3(x)$, $Q_0(x)$ and $1\text{-}Q_0(x)$ refer to the upper limit of the class. The values $q_3(x)$ and $q_0(x)$ refer to the middle of the respective class. The measurement classes are amended automatically if particles are detected whose sizes are outside of these classes.

The RETSCH formatted file

The RETSCH formatted file has two columns. The first column is the particle size in mm, the second column is the $Q_3(x)$-value in the area from 0 …1 (not in %). The numbers are displayed using commas.

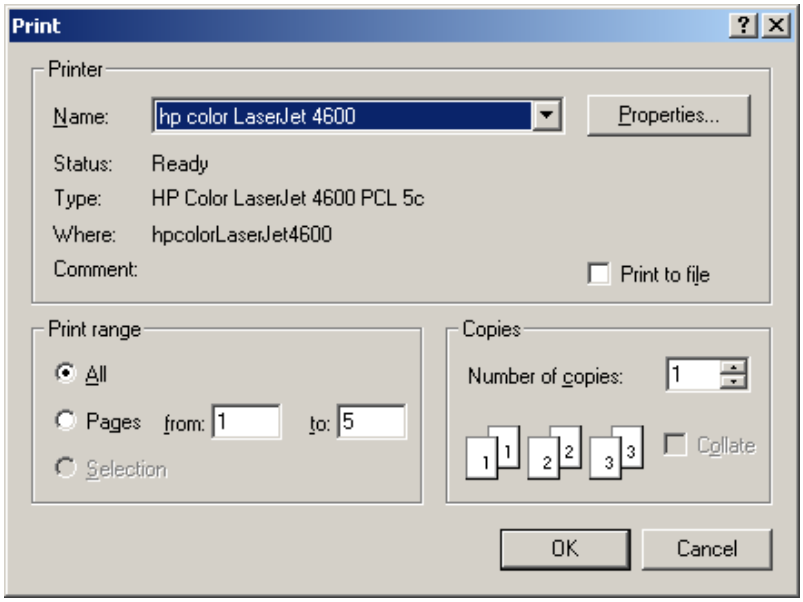
The NSP-file

The NSP-file consists of two columns. In the first column, the sphericity SPHT appears, in the second column, the numerical proportion $Q_o(SPHT)$ of the particles whose sphericity ≤ the value of the first column.

The SIG-file

The SIG-file consists of two columns. The first column is the ratio (b/l) rec and the second column is the numerical proportion $Q_o((b/l)\ rec)$ of the particles whose relation ≤ the value of the first column.

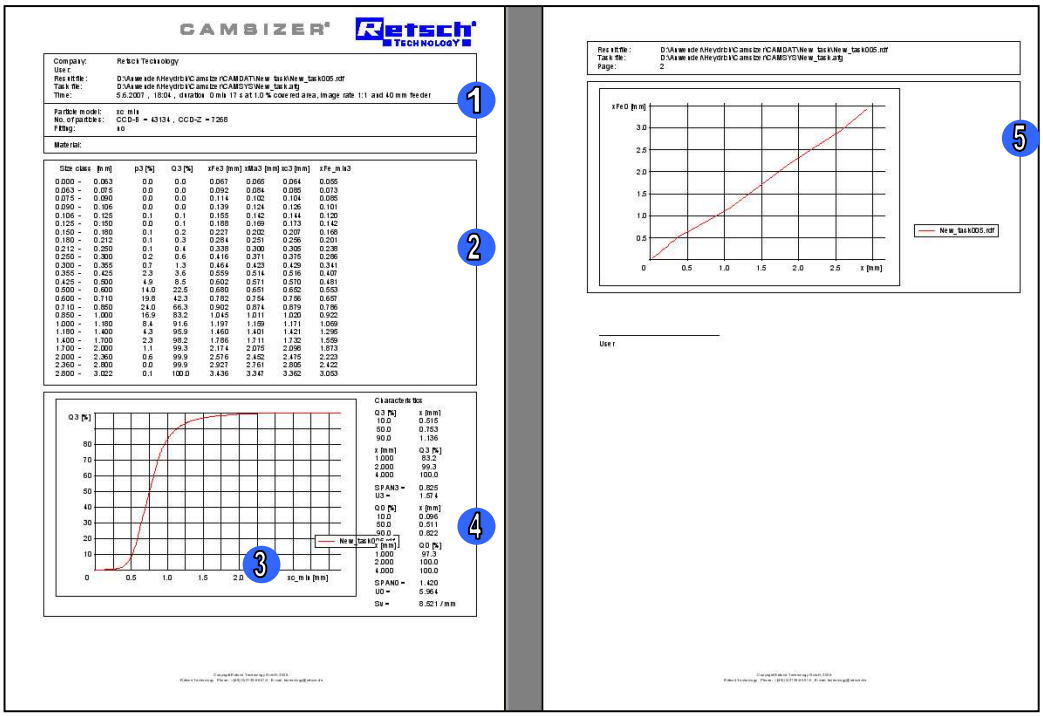
7.1.8 The menu “File - Print report”



The measured data are printed in the report.

7.1.9 The menu “File - Print preview“

Display print preview of the report. The measurement report consists of 5 parts:



1. Header: information about the measurement conditions, file name, company etc

2. Table: corresponds to the table window

3. Graph (Size): the diagram is displayed as defined in the window “Graph”.

4. Characteristics: corresponds to the characteristics in the respective window, however the order is changed.

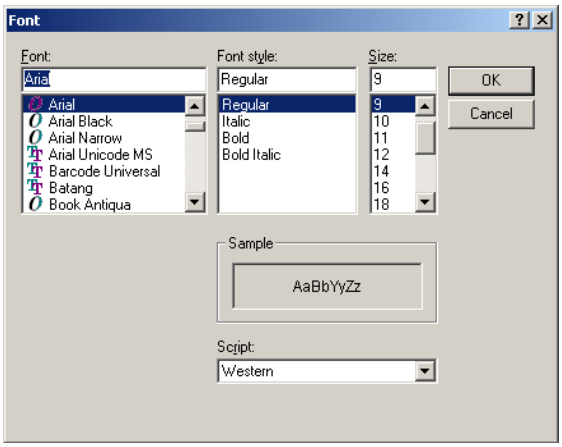
5. Shape characteristics graph: corresponds to the respective window.

Please note
The display of the “table”, “characteristics”, “graph” and “graph, shape characteristics” in the print preview has to be activated in the respective windows: Select in the menus |-View|Characteristics-| and activate the checkbox “Print in report” in the respective dialogue window. The same is valid for the print out.

7.1.10 The menu “File - Print setup”

Configure the printer before the report is printed.

7.1.11 The menu “File - Screen font”



Set the screen font. A window opens where the settings for the screen font can be defined. Click [OK] to apply the settings.

7.1.12 The menu “File - Printer font like screen font”

Set the screen font. A checkmark before the menu bar indicates that this function has been activated. Please click again to reset this function.

7.1.13 The menu “File - Printer font”

Set printer font. A window opens in which the settings can be defined.

7.1.14 The menu “File – Exit”

Exit program

7.2 The menu “Edit“

The menu “Edit” contains one menu item:

- Copy $Q_3(x)$

The menu “Edit” contains the menu item “Copy $Q_3(x)$”. In the menu “Edit”, the values of x and $Q_3(x)$ are copied to the clipboard. The particle size x is given in mm and $Q_3(x)$ is given in the range between 0 and 1 (not in %).

Example:

x [mm]	Q3
0,000	0,0000
0,355	0,0033
0,425	0,0136
0,500	0,0334
0,600	0,0908
0,710	0,1880
0,850	0,3642
1,000	0,5689
1,180	0,7336
1,400	0,8414
1,700	0,9099
2,000	0,9575
2,360	0,9881
2,800	0,9992
3,350	1,0000

7.3 The menu “Measure“

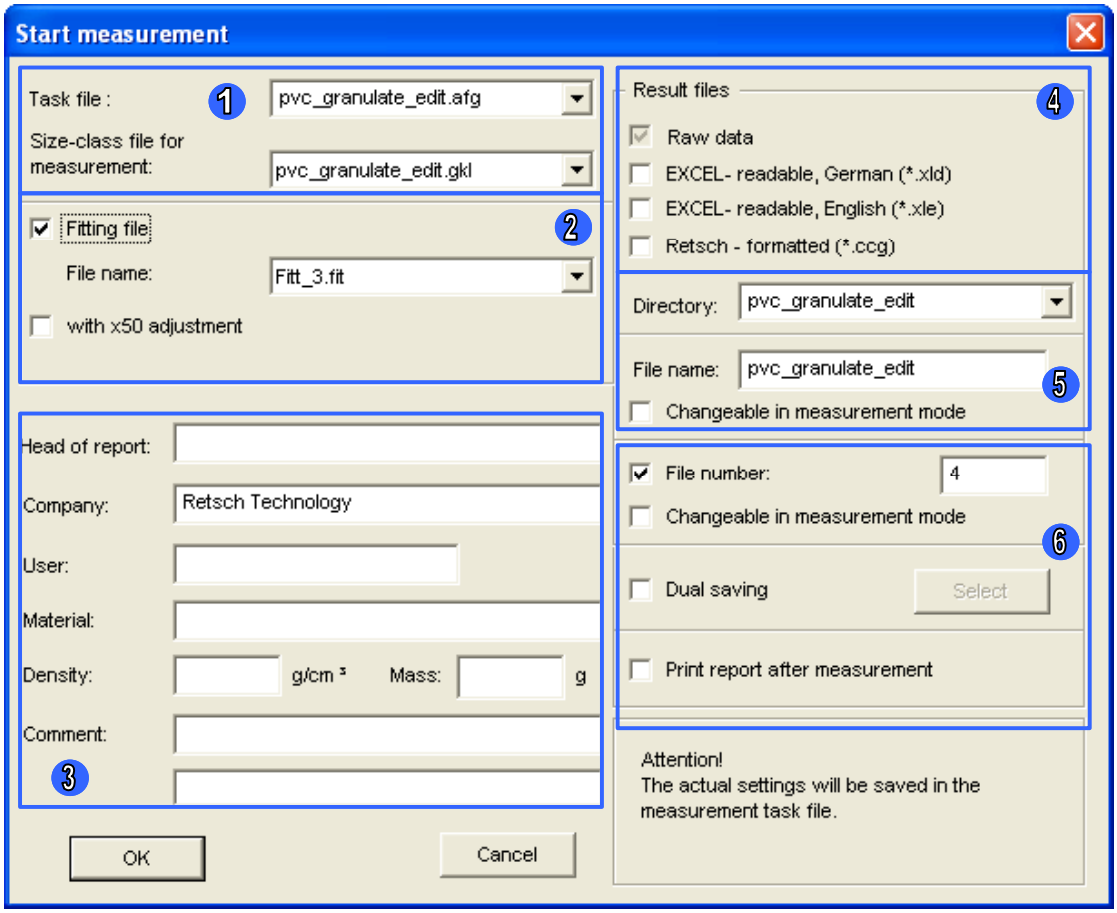
7.3.1 Start sample measurement

The menu “Measure” contains one menu item:

- Measure

If you are working in the measurement mode, please refer to chapter 7.6.16.2 “Password protection – measurement mode” for a description of this window.

When the menu item “Measure” is clicked, the window “Start measurement” is opened. When working in the parameter mode, the following settings can be defined on this window:



1. Insert the name of the task file and select the size class file for the preview and the measurement.

2. Select a fitting file if necessary. A fitting file has to be created in advance (please see chapter 7.5.7 “The menu `Options - Create fitting file´”). The available fitting files are displayed when the arrow button is clicked.

   Checkbox “with x50-adjustment”: If Q3-fitting is used and when this checkbox is marked, Q3-fitting file, which had been defined for a certain size range can be used for a sample with another size range that has the same size distribution.

3. Define the header and the comments for the measurement report: The following comments can be inserted: headline, company, user, material, density, mass and comment.

4. Define the export files for the measurement results.

5. Set the directory and define a file name for the automatic saving of the measurement results. If the checkbox “Changeable in measurement mode” is activated, the file name can be changed by the user who operates the CAMSIZER® in the measurement mode.

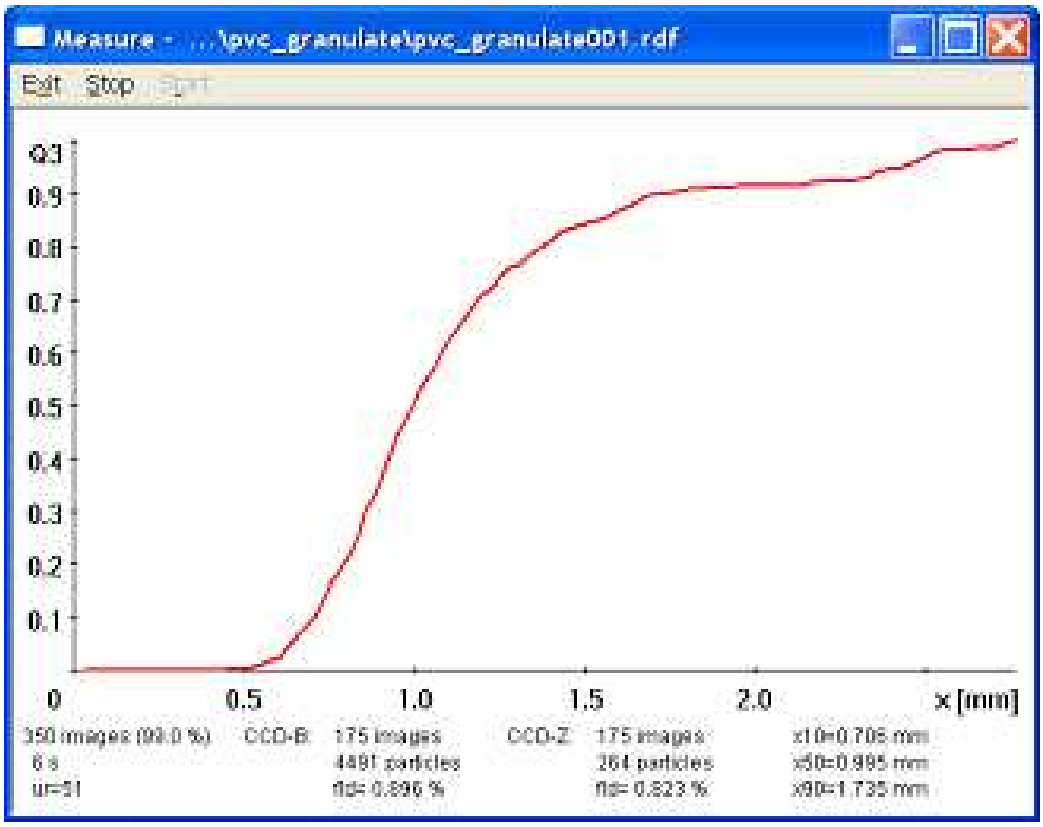
6. File number: When this checkbox is marked, a 3-digit number will be added to the measurement result file if the measurement is repeated with the same measurement task. After the first measurement, the file saved in the directory will have the name:

   - \CAMDAT\pvc_granulate_edit\ pvc_granulate_edit **004**.rdf

   When the measurement is repeated using the same task file and raw data file name, the number will be counted up:

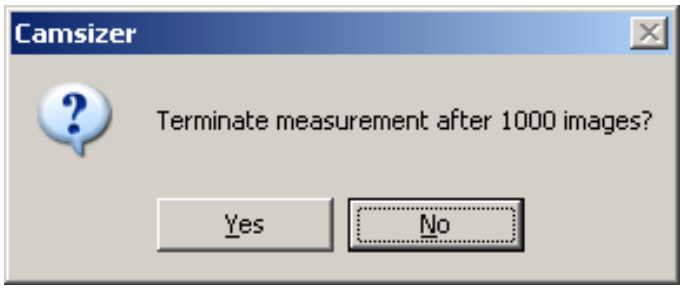
   - \CAMDAT\ pvc_granulate_edit \ pvc_granulate_edit **005**.rdf

   If the checkbox is not activated and the measurement is repeated using the same task file, the previous file with the same name will be overwritten.



During the measurement, a graph window appears where the measurement results are recorded and displayed as a preview. In the menu bar, the measurement procedure can be interrupted (Stop) and continued (Start), or quit (Exit).

It is suggested to use the option “Stop measurement after empty images [~150]”. When the number of images (e.g. 1000) or the number of empty images (e.g. 150) is reached for each camera (defined on the register card “Cameras (Measurement parameters)” in the window “Measurement conditions”, please see chapter 6.2), a dialogue window appears:



Click [Yes] to terminate the measurement. Click [No] to continue the measurement and record another 1000 images.

When the measurement procedure is terminated, the graph window appears in which the first particle model is displayed.
The other particle models can be selected by |-File|Read comparison file-|, please see chapter “Graph”.

Please note

The register card “Save task file” and the dialogue box “Start measurement” look identical. However there is a difference:

In the window “Start measurement”, you can select a task file and carry out a measurement with this task file. In the window “Save task file”, the changes made to the edited task file on the register cards can be saved, and the existing task file will be overwritten.

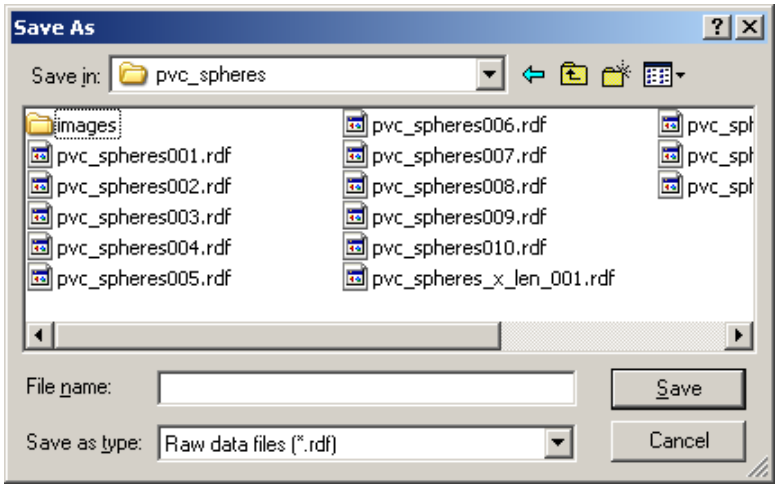
7.3.2 Repeating a measurement procedure

If a measurement procedure is repeated using the same task file, the file number of the RDF-file will be updated automatically in the box “File number” in the window “Start measurement” (For example “002” will appear for the second measurement process) if the checkbox “File number” is marked.

If you would like to overwrite a preceding measurement file, please insert the respective file number and click [OK].

The measurement will be started. After the termination of the measurement procedure, the system asks for confirming the overwriting of each RDF- or ASCII-file (e.g. *.xld, *.xle, etc).

Click [Yes] if you want to overwrite the file. Click [No] if you would like to select a new file name.



Please enter the file name in the respective window. The files will be saved using this name.

7.4 The menu “Results“

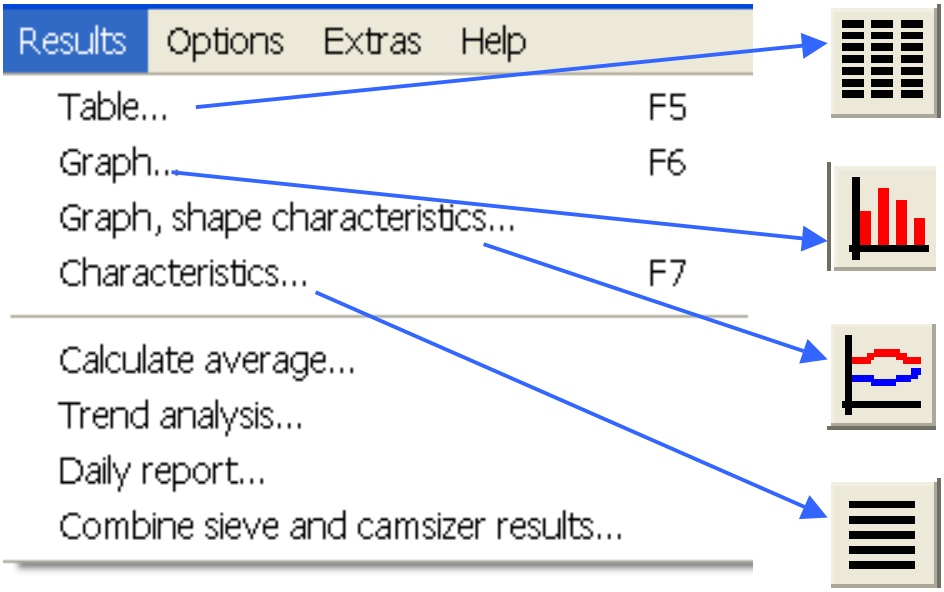
The menu “Results” contains the following functions for the display and the evaluation of the measurement results:

Edit the display of the measurement results:

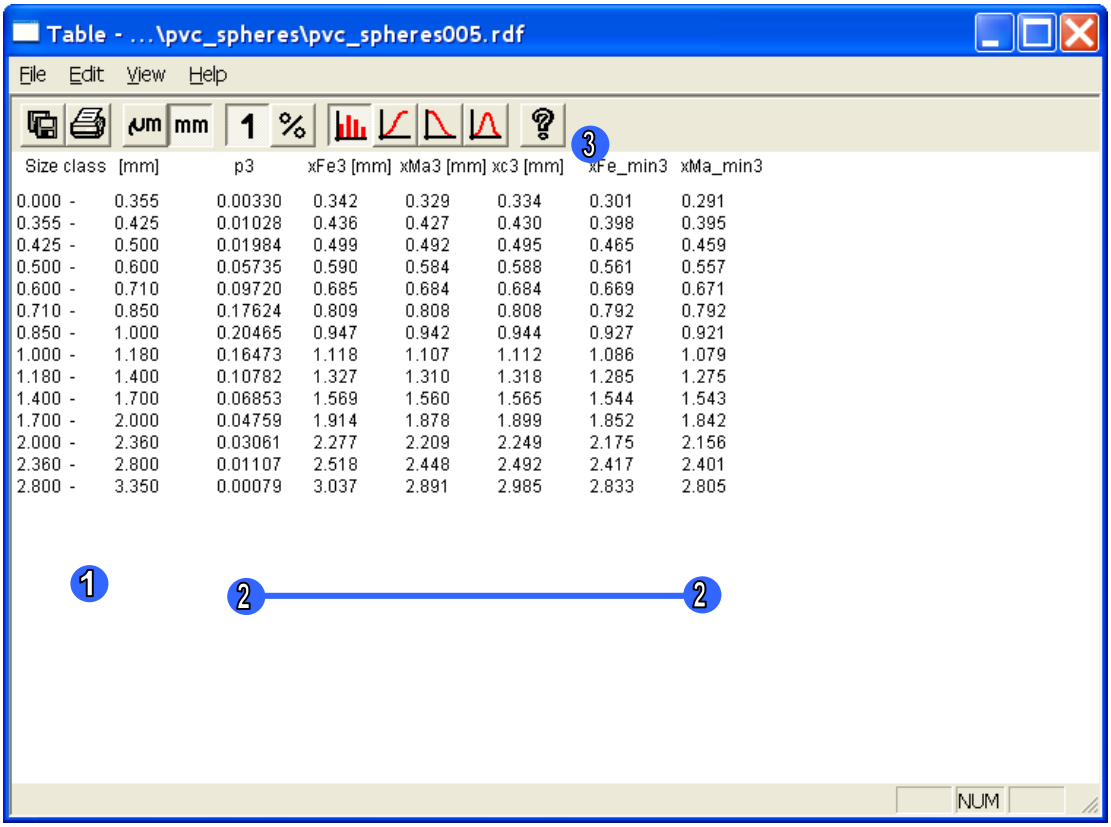
- Table
- Graph
- Graph, shape characteristics
- Characteristics

Evaluation of combined results and display of statistical results and trends:

- Calculate average
- Trend analysis
- Daily report
- Combine sieve and CAMSIZER® results



7.4.1 The menu “Results – Table “



1 Size class limits: The first two columns always show the size class limits.

2 Displays the values of the characteristics. The display of the results in the table is limited to 6 columns (8 columns in total).

3 Icon bar

In the window “Table”, the grain size distributions and shape characteristics measured with the CAMSIZER® are displayed. These data can be collected in one measurement procedure or can be averaged from several measurements. The availability of a raw data file is necessary.

The file name of the measurement results appears in the title bar. If an averaged measurement is shown, the label “Mean value” appears in the header. The table window is limited to 8 columns. If more columns have been configured, the columns on the right side will be omitted in the display.

Please note

If the table window is copied to ASCII or if the measurement data are exported to EXCEL, all collected measurement data will be displayed. The number of columns is not limited here.

The values of the size distribution in the table window can be displayed as p(x1,x2), Q(x), 1-Q(x) or q(x)-distribution, which can be selected using the respective buttons in the icon bar.

- The values of $Q_3(x)$, $1-Q_3(x)$, $Q_0(x)$, $1-Q_0(x)$ refer to the upper class limit.

- The values of $q_3(x)$ and $q_0(x)$ refer to the upper limit of the class. All other values refer to the class range. The measurement classes will be amended if particles are outside of the defined range.

If a sieve series (fractions) has been defined, the table range is limited upwards or downwards by the corresponding x-value. The sieve series can be selected and edited on the register card “Size classes” in the window “Parameters for display”.

7.4.1.1 The icon bar in the window “Table”

Copy the table displayed on the screen to the clipboard.

Print the table.

Select the display of the size in µm.

Select the display of the size in mm.

Display of the proportions of the particle size distributions on a 0…1-scale.

Display of the proportions of the particle size distributions in %.

Display of the particle size distribution as a bar diagram (histogram) p(x).

Display of the particle size distribution as a cumulated distribution Q(x).

Display of the particle size distribution as a cumulative distribution of residue 1- Q(x).

Display of the particle size distribution as a frequency distribution q(x).

7.4.1.2 The menu bar in the window “Table”

7.4.1.2.1 The menu “File” in the window “Table”

The menu “File” contains the following menu items:

- Print
- Exit

7.4.1.2.1.1 The menu “File – Print“

Print the table window. The print window opens where the printer settings can be chosen.

7.4.1.2.1.2 The menu “File – Exit”

Exit the table window.

7.4.1.2.2 The menu “Edit” in the window “Table”

The menu “Copy” contains the following menu items:

- Copy
- Copy (Text)

7.4.1.2.2.1 The menu “Edit – Copy”

The table as displayed on the screen is copied to the clipboard (graphic). The name of the raw data file or the names of the several raw data files included in the average are displayed in the header.

7.4.1.2.2.2 The menu “Edit – Copy (Text)”

The table configured in the menu |-View|Characteristics-| is copied in ASCII-format to the clipboard. The name of the raw data file or the file names of the averaged raw data files are displayed at the top of the table. The tabulator separates the individual elements. Numerical values are written using commas. This copy can easily be exported to MS-Excel or MS-Word.

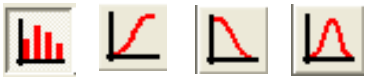
7.4.1.2.3 The menu “View” in the window “Table”

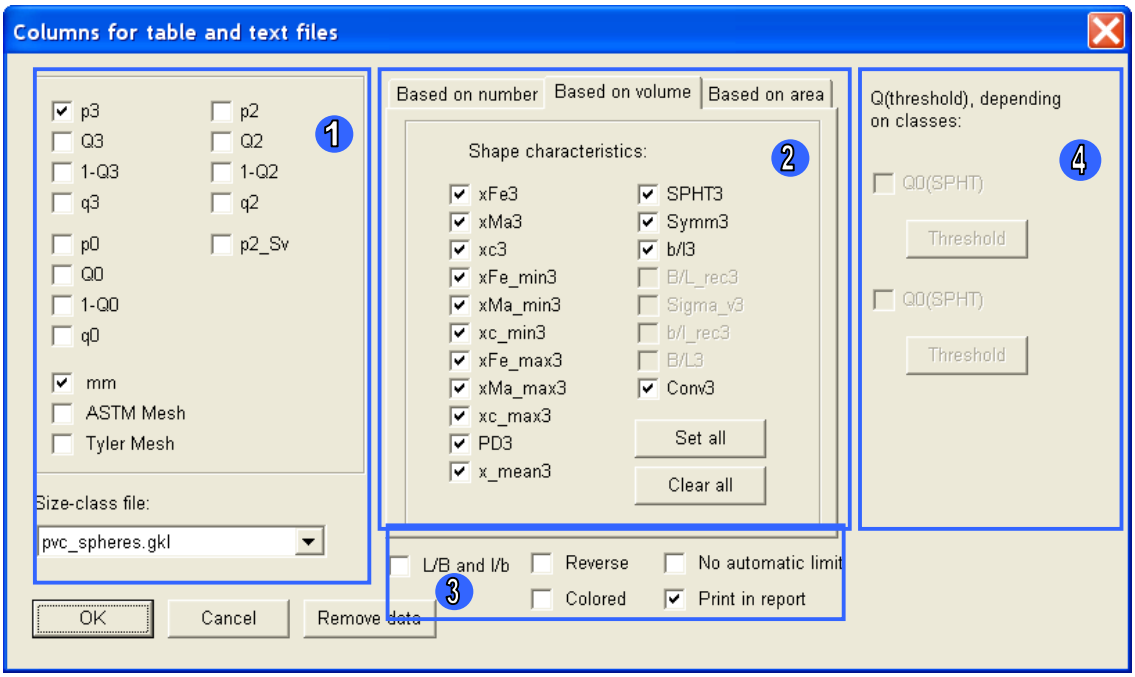
The menu “View” contains the following menu items:

- Characteristics
- Fraction limits
- Size limits for display
- Units
- Show Q(x)
- Show Q(V)

7.4.1.2.3.1 Menu “View – Characteristics”

Select the table columns in the table window. The distribution characteristics calculated by volume can also be adjusted by using the buttons:





Only those shape characteristics can be displayed in the table, which have been measured and saved in a raw data file before. Before starting the measurement, it is necessary to set the shape characteristics on the register card “Settings” in the window “Measurement conditions” (|Options|Measurement parameters-|).

1 7.4.1.2.3.1.1 Characteristics - Distribution and size class file

Select the type of distribution for the values of the x-axis based on number (p_0, Q_0, q_0, $1\text{-}Q_0$), area (p_2, Q_2, $1\text{-}Q_2$, q_2) or volume (p_3, Q_3, $1\text{-}Q_3$, q_3).

The specific surface p2_Sv shows the part of the sum of the surfaces of each size class related to the total sum of all surfaces.

If “ASTM mesh” or “Tyler mesh” has been selected, the respective mesh-values of the upper class limits are displayed in two additional columns.

Select the size class file for the display in the table.

2 7.4.1.2.3.1.2 Characteristics - Shape characteristics

Only those shape characteristics can be selected that have been measured in a preceding measurement procedure. The grey-shaded characteristics have not been measured, and cannot been determined from the available data. The availability of the characteristics depends on the software configuration.

If you wish to activate all grey checkboxes for a new measurement, please click [Set all].

3 7.4.1.2.3.1.3 Characteristics - Checkboxes

L/B and l/b:	Calculation of the values length/breadth instead of breadth/length (width/length)
Reverse:	Display of the table in reverse order beginning with the largest classes
Coloured:	The upper limits of the classes and the columns, which refer to these limits, are marked blue. All other columns that refer to the lower limits or class range are displayed in black.
No automatic limit:	Particles that exceed the upper limit of the size class, are not displayed using their exact value but for example as “>3 mm”.
Print in report:	Print the table in the measurement report.

4 7.4.1.2.3.1.4 Characteristics - Q-Threshold, depending on classes

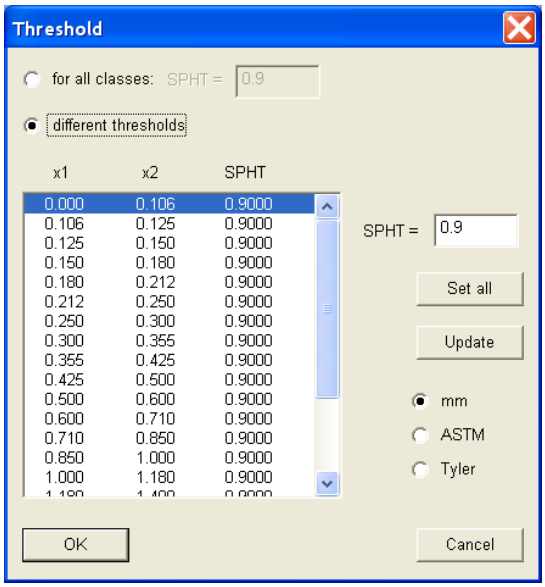
For each class, the percentage of particles that have reached this Q-threshold is displayed. Depending on the characteristic, the Q(x) or 1-Q(x)-threshold will be shown in the table.

- For B/L, b/l and Sigma (V), the 1-Q value will be shown
- For Conv, Symm, SPHT, B/L_rec and b/l_rec the Q-value will be shown

Please note

The Q-threshold and the characteristic under “Settings” have to be defined **before** the measurement.

To set the “Q (threshold) depending on classes”, mark the checkboxes and click [Threshold]. The window “Threshold” is opened.

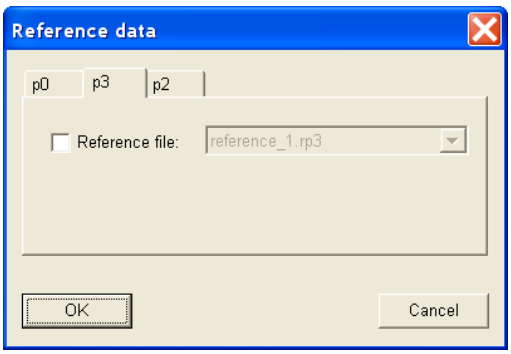


The threshold can be selected for all classes, or different thresholds can be inserted for each class.

To select the threshold for all classes, mark the checkbox and insert the threshold into the input box.

To define different thresholds for individual classes, mark the respective class in the display window and insert the threshold in the input box on the right side. Click [Update] to apply the value.
When [Set all] is clicked, the value is applied to all classes.

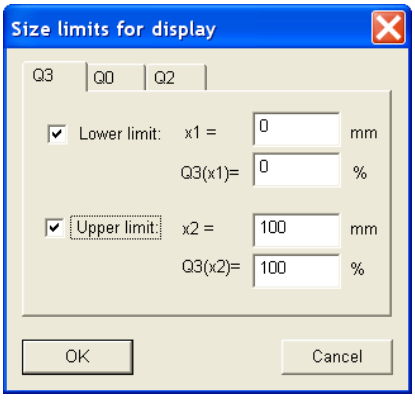
7.4.1.2.3.2 The menu “View- Fraction limits”



In the window “Reference data”, the fraction limits that have been entered before can be selected and displayed in the table window. For this menu item, the availability of fraction limits is necessary.

To create the reference fractions, please select |-Options|Input fraction limits-|(see chapter 7.5.9). Mark the check box “Fraction limits” and click on the arrow button. The available fraction limits (RP-files) will be displayed in a drop-down menu. Select the fraction limits which are displayed in the table.

7.4.1.2.3.3 The menu “View - Size limits for display”

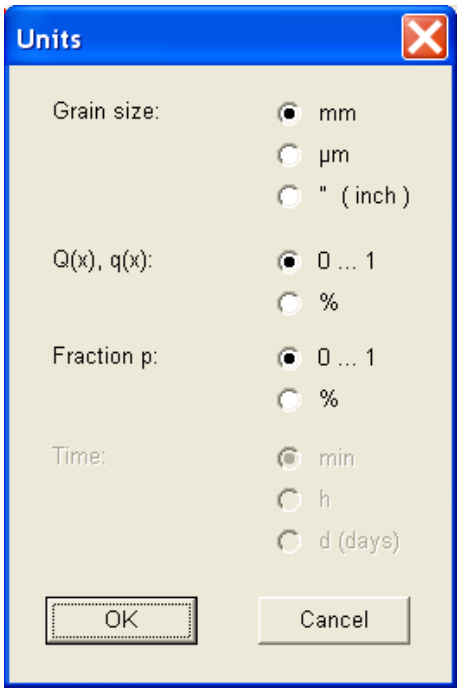


Set the upper or/and the lower size limit for the display. Set the particle size (x1) and the proportion of this particle size in the sample Q3(x1). The distribution in the table will be adapted to these limits.

This function is useful for example if it is known that a certain percentage of the sample will exceed or fall below certain boundaries (for example if a high proportion of fines is included in a sample). The size limits for the display can be set for Q_0, Q_2 and Q_3.

7.4.1.2.3.4 The menu “View – Units”

Set the units for the display.



Grain size	Display grain size in mm, µm or inch (”)
Q(x), q(x)	Display on a numerical scale or in %
Fraction p	Display on a numerical scale or in %
Time	The function ”time” is only active if a trend analysis is performed (see chapter 7.4.6. “Trend analysis”).

7.4.1.2.3.5 The menu “View - Show Q (x)”

The values in the table represent a distribution function of the particle size x.

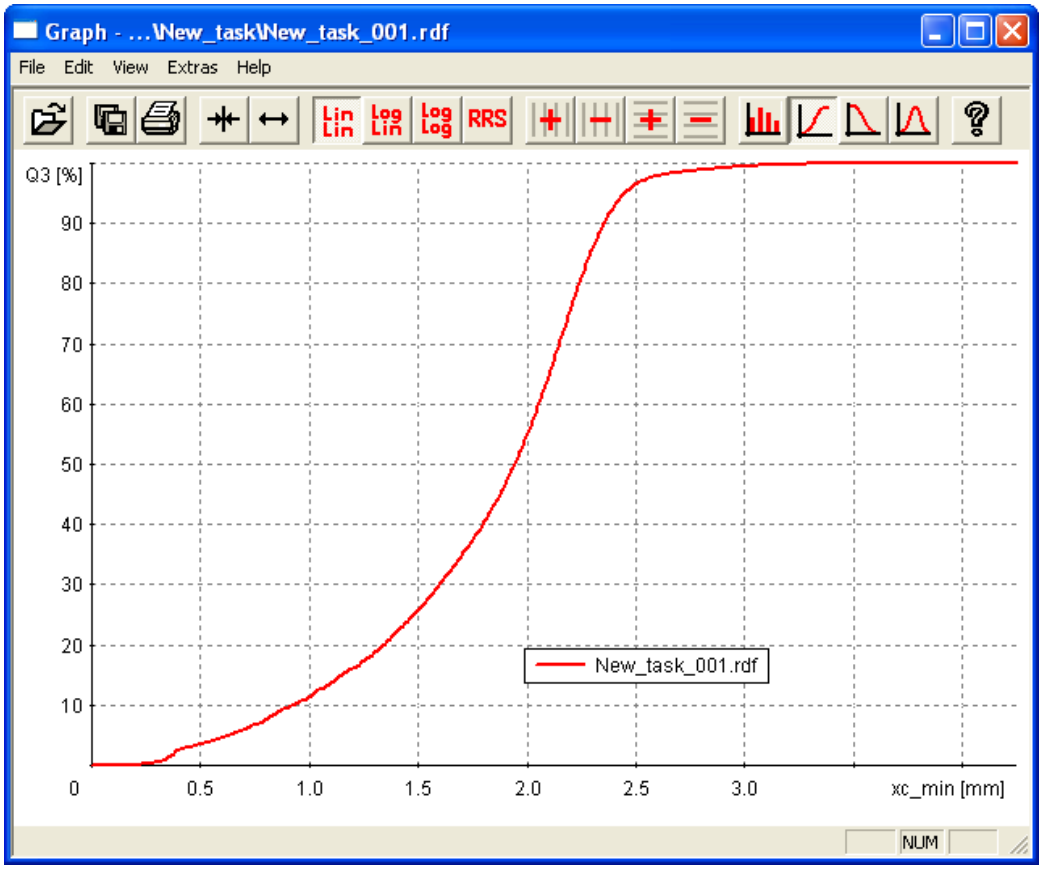
7.4.1.2.3.6 The menu “View - Show Q (V)”

The values in the table represent a distribution function of the particle volume V.

7.4.1.2.4 The menu “Help” in the window “Table”

Displays online help for this function.

7.4.2 The menu “Results - Graph”



In the graph window, the grain size distributions measured with the CAMSIZER® in one measurement or averaged over several measurement procedures are displayed.

The name of the result file is displayed in the headline and the legend of the window. If averaged files are displayed, “mean value” is indicated.

The display area can be changed in x-direction. By a click with the right mouse button and the drawing of a rectangle, a section can be displayed (zoom).

7.4.2.1. The icon bar in the window “Graph”

The icon bar contains the following functions (from left to right):

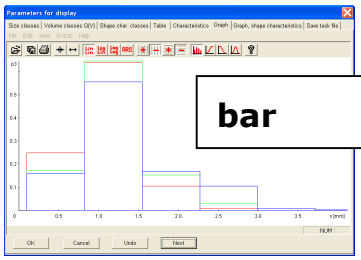
Read comparison file: load a comparison file (e.g. another particle model, another measurement result).

Copy graph window to the WINDOWS clipboard. The graph window can be exported into another program.

Print: print graph window

Adaptation of the x-axis: the x-axis is adapted to the range of the measured particle sizes.

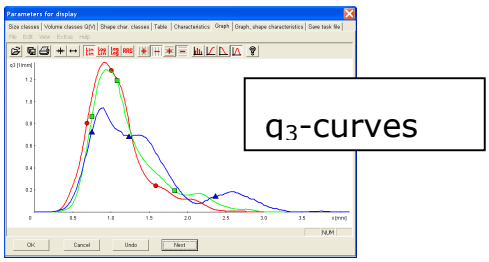
Enlarge the range of the x- and y-axis (zoom out).



x-axis linear, y-axis linear

x-axis logarithmic, y-axis linear

x-axis logarithmic, y-axis logarithmic

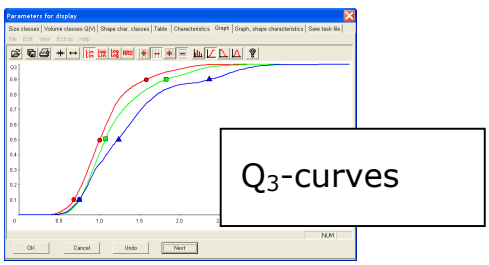


RRSB-grid

Add vertical grid lines.

Delete vertical grid lines.

Add horizontal grid lines.




Delete horizontal grid lines

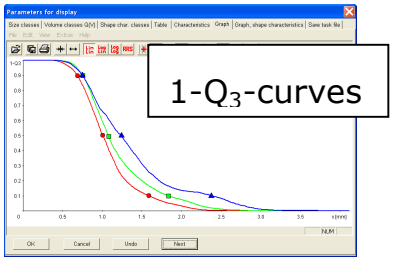

Bar diagram p (histogram).


Left y-axis: cumulative distribution curve Q_3


Left y-axis: cumulative distribution of residue 1-Q_3


Left y-axis: distribution frequency curve q_3


Help



7.4.2.2 The menu in the window “Graph”

7.4.2.2.1 The menu “File” in the window “Graph”

The menu “File” in the window “Graph” contains three menu items:

- Read comparison file
- Print
- Exit

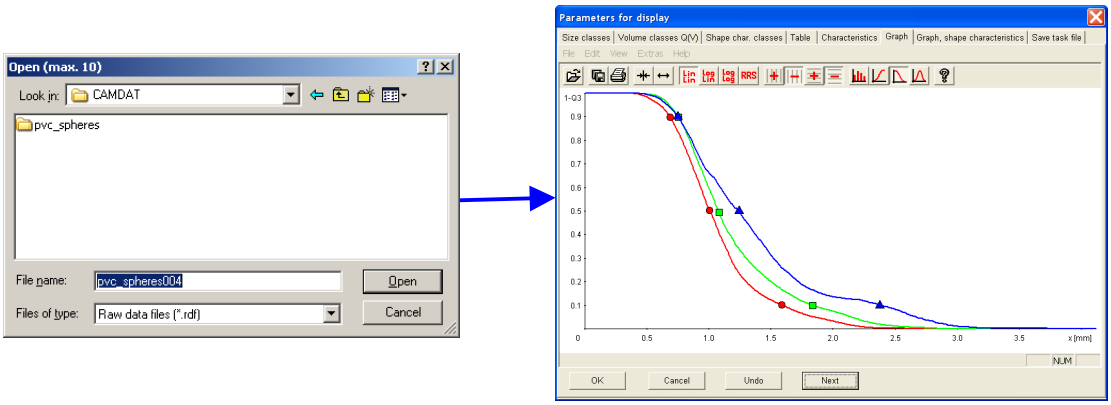
7.4.2.2.1.1 The menu “File - Read comparison file”

In addition to the last-performed or loaded measurement, one or more (max. 9) comparison files can be read in. These are displayed in the graph window. With a click with the right mouse button on the comparison file in the legend, the reference file can be removed from the window.

The raw data are read together with the measurement task. This means that the shape parameter or the fitting file is taken into consideration of the display.

If a different measurement task is loaded when the diagram window is still open, then all measurement values in the graph window will be evaluated using this different measurement task.

Click │-File│Read comparison file-│. In the window “Open”, please select the folder and file of the raw data. Click [Open]. The comparison file(s) will be displayed along with the graph in the graph window. The currently loaded task file will be applied to these comparison files.



The comparison files are also loaded in the graph / shape characteristics window.

7.4.2.2.1.2 The menu “File - Print”

Print graph window.

7.4.2.2.1.3 The menu “File - Exit”

Close graph window.

7.4.2.2.2 The menu “Edit” in the window “Graph”

Copy the graph as displayed on the screen in metafile format to the clipboard. The name of the raw data file represented by the graph is displayed in the header and the legend.

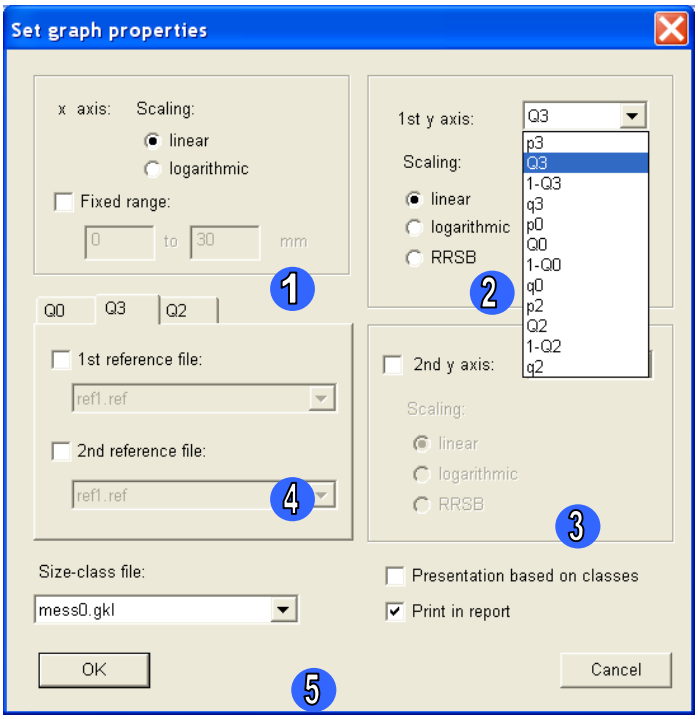
7.4.2.2.3 The menu “View” in the window “Graph”

The menu “View” in the window “Graph” contains the following menu items:

- Characteristics
- Fraction limits
- Size limits for display
- Units

- Show Q(x)
- Show Q(v)

7.4.2.2.3.1 The menu "View - Characteristics"



Define the settings for the display in the graph. In particular, the configuration of the axes can be set in the window "Set graph properties".

1 Select the scaling of the x-axis. A linear or logarithmic scaling is possible. Also, a fixed range (minimum and maximum x-value displayed) can be selected.

2 Define the settings for the y-axis. Select the type of distribution in the drop-down-menu. Select the linear, logarithmic or RRSB-scaling of the axis.

Please note that the RRSB-scaling is only possible for the $Q_0(x)$, $Q_2(x)$ and $Q_3(x)$ selection.

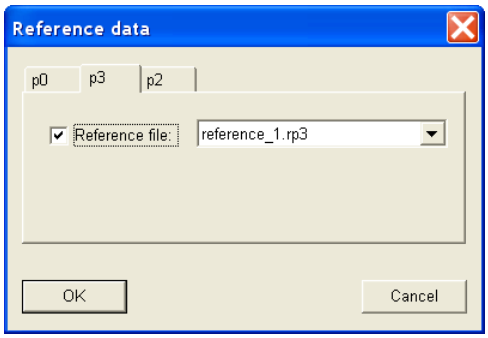
3 Select a second y-axis for which the same settings as described above can be defined. The second y-axis will be shown on the right hand side of the graph. For example, select Q_3 for the 1^{st} y-axis, q_3 for the 2^{nd} y-axis .

4 Select the reference files for a Q_0, Q_2 and Q_3-distribution (*.ref, in the directory CAMSYS). Please note that a reference file has to be created before (please see chapter 7.5.6 "Input reference distribution").

5 Select the size class file for the presentation of the graph (and table) based on classes.

Please note that the properties of the graph window can also be modified after the measurement process. The report will be updated automatically.

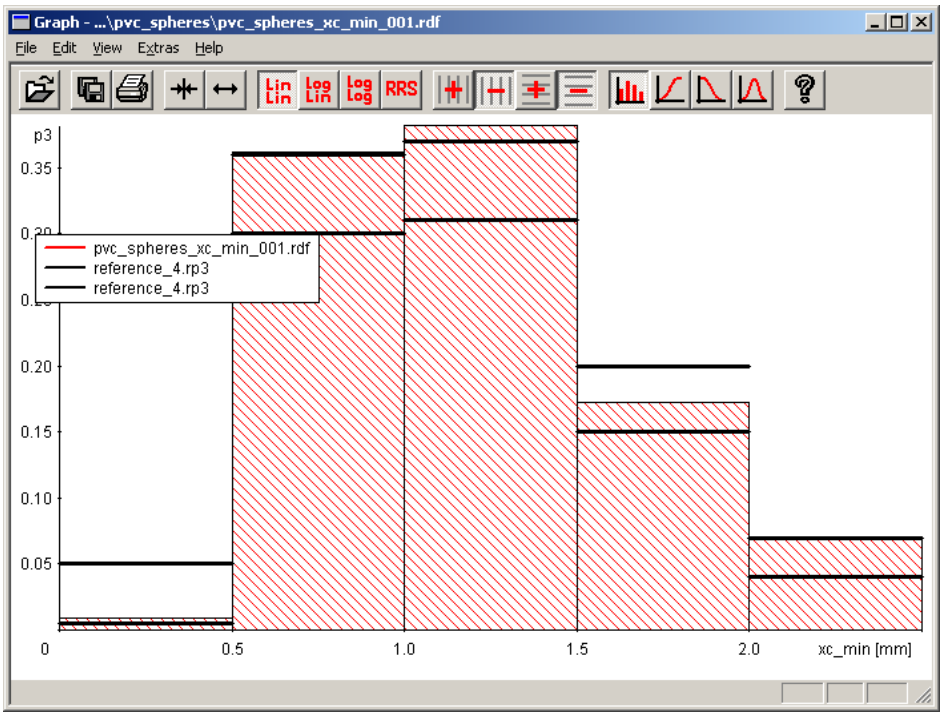
7.4.2.2.3.2 The menu “View – Fraction limits”



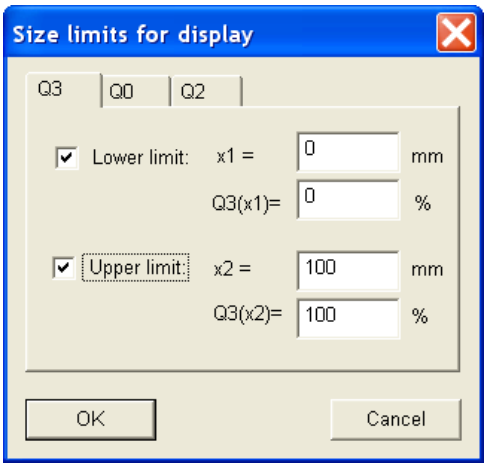
Here, fraction limits that have been created before can be read in and displayed in the graph window p3. For this menu option, the availability of fraction limits is necessary. To input fraction limits, please select ⎸-Options⎸Input fraction limits-⎸(see chapter 7.5.9).

Mark the check box “Fraction limits” and click on the arrow button. The available fraction limits (RP-files) will be displayed in a drop-down menu. Select the fraction limits in the drop-down menu that will be displayed in the graph window.

The fraction limits are displayed in the graph window as horizontal lines if the graph window is displayed as a bar diagram (p_3).



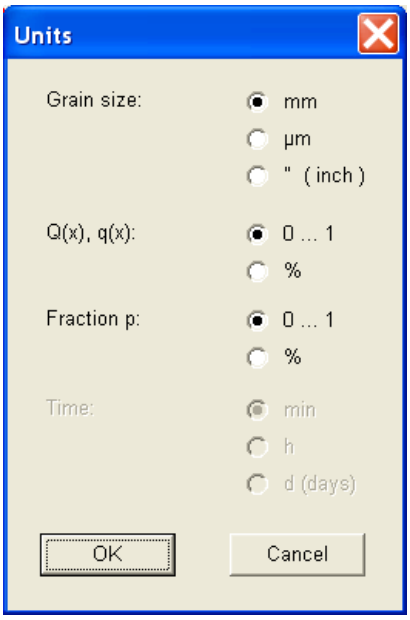
7.4.2.2.3.3 The menu “View – Size limits for display”



Set the upper and/or the lower size limits for the display. Set the particle size (x1) and the proportion of this particle size in the sample Q3(x1). If the measured values are outside of these boundaries, they will not be displayed. The size limits for the display are set for the Q0- (=number based), Q2- (=area-based) and Q3- (=volume-based) distribution on the respective tab.

7.4.2.2.3.4 The menu “View - Units”

Grain size	Display grain size in mm, µm or inch (“)
Q(x), q(x)	Display on a numerical scale or in %
Fraction p	Display on a numerical scale or in %
Time	The function ”time” is only active if a trend analysis is performed (see chapter 7.4.6. “Trend analysis”).



7.4.2.2.3.5 The menu “View - Show Q (x)”

The values in the table represent a distribution function of the particle size x.

7.4.2.2.3.6 The menu “View - Show Q (V)”

The values in the table represent a distribution function of the particle volume V.

7.4.2.2.4 The menu “Extras” in the window “Graph”

In the menu “Extras”, the settings for the display of the graph can be defined. These display functions can be modified after the measurement as well.

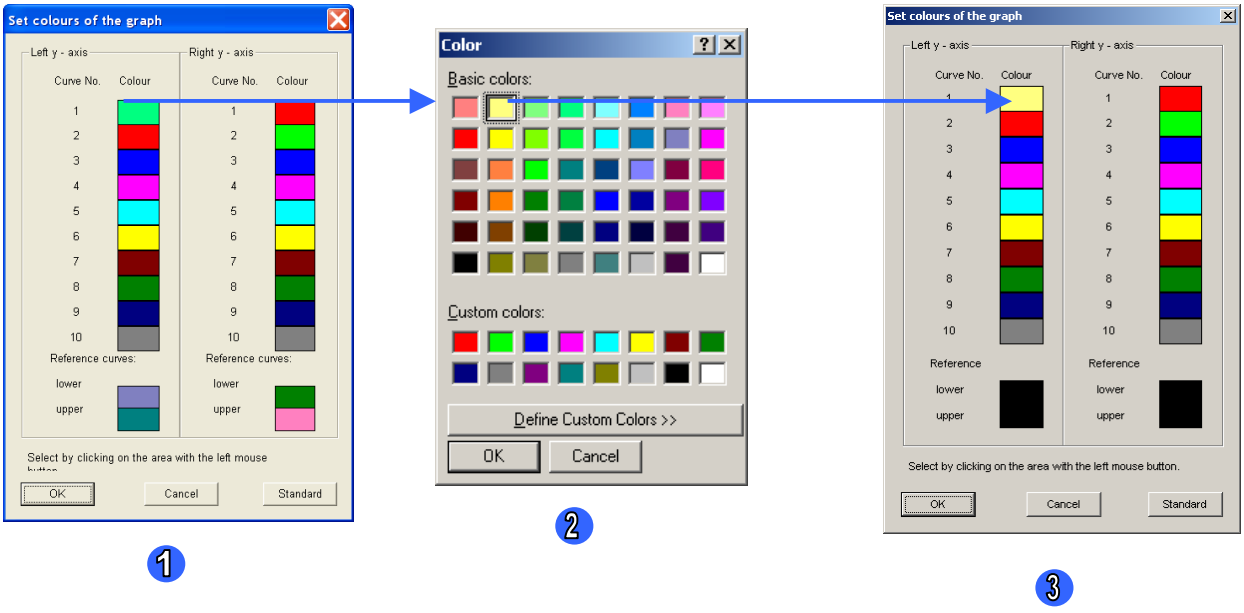
The menu “Extras” in the window “Graph” contains the following menu items:

- Colours
- Type of curves

- Type of bars
- Grid
- Legend
- Type of reference curves

7.4.2.2.4.1 The menu “Extras – Colours“

Select the colours for the graph. The dialogue box for the selection of the colours for the graphs is opened. The colour for each graph can be freely selected. By a click on the button [Standard], the standard colours are restored.



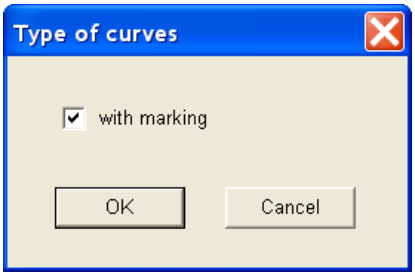
1 To define the colour of a curve, please click on the colour box of the respective curve number (e.g. curve no 1 / green box).

2 A window opens where the colours can be selected. Click on a box with the colour you would like to choose for the curve (e.g. here: yellow). Click [OK].

3 The colour appears now in the respective box.

The colours for the reference curves can be set in a similar way. Click on the respective box of the reference curve in the lower area of the box. Standard colours can be set by a click on the button [Standard].

7.4.2.2.4.2 The menu "Extras – Type of curves"

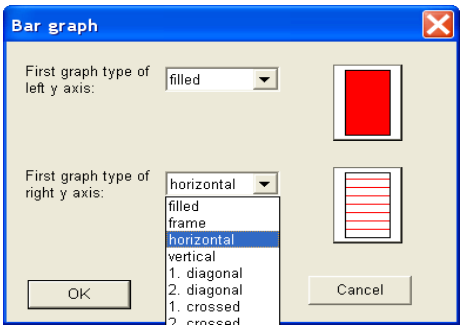


In the dialogue box, mark the checkbox to activate the display of the graphs with symbols. These symbols appear at the positions of the Q(x)=10, Q(x)=50 and Q(x)=90.

Please note

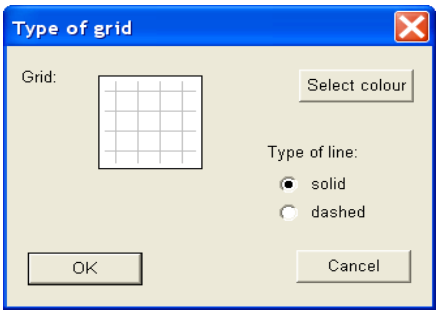
The markings appear only at these positions if "Presentation based on classes" is not checked, and a display of Q_3 is chosen.

7.4.2.2.4.3 The menu "Extras – Type of bars"



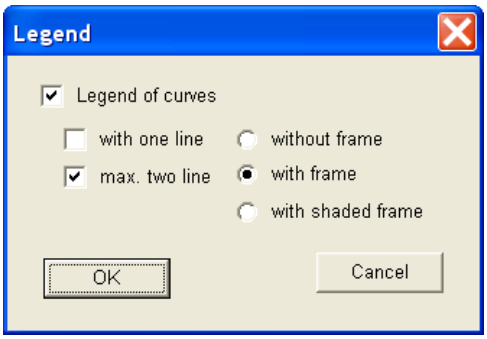
Set the display of the bars which represent the fractions in the bar diagram. Select the display in the drop-down menu.

7.4.2.2.4.4 The menu "Extras – Type of grid"



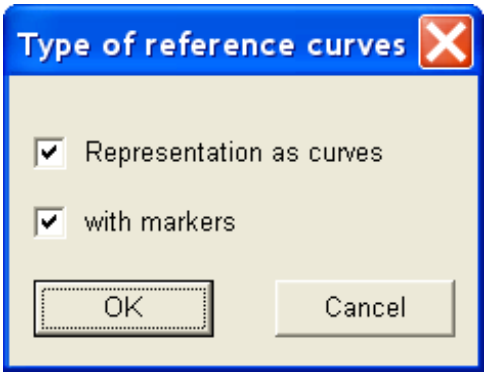
Select the type of grid lines and the colour for the grid.

7.4.2.2.4.5 The menu “Extras – Legend“



Activate or deactivate the display of the legend in the graph window.
Define settings for the display of the legend in the window.

7.4.2.2.4.6 The menu “Extras – Type of reference curves“

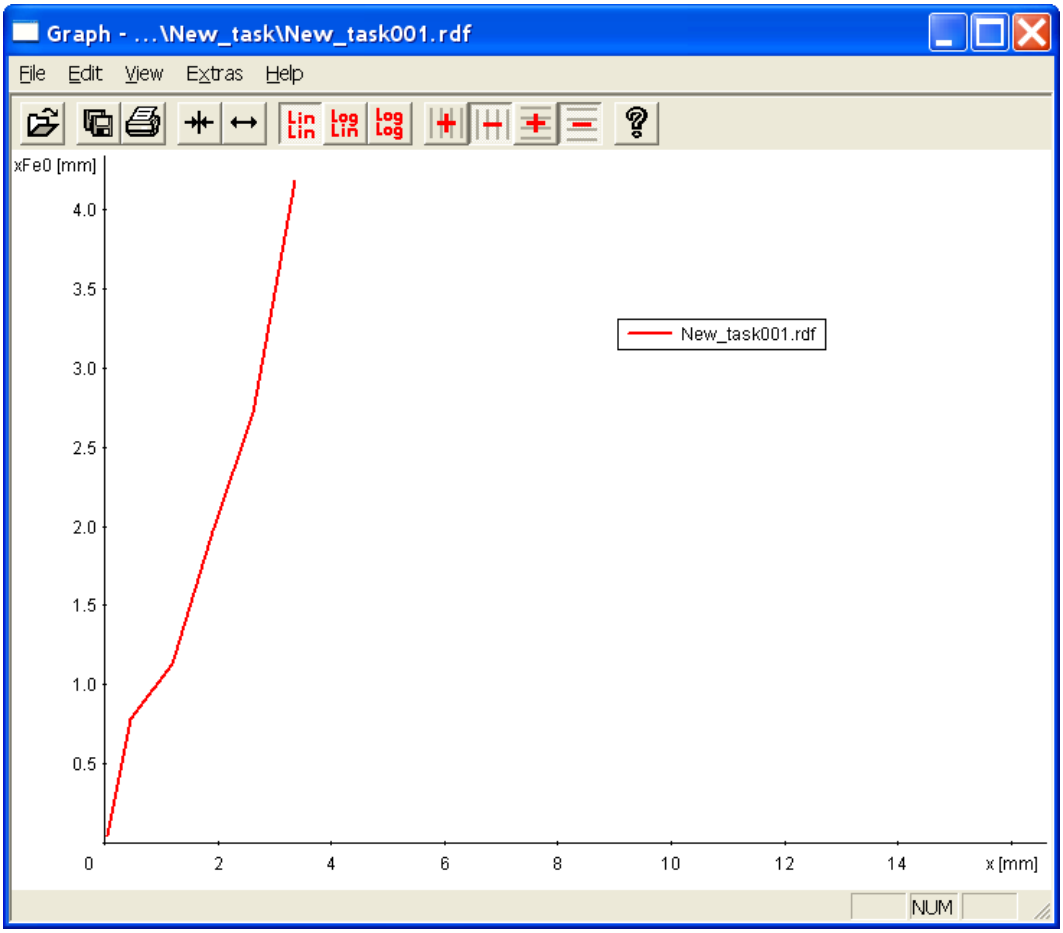


Mark the checkboxes to select the display settings for the reference curves. Select whether the reference files are displayed as graphs, single dots or graphs with dots.

7.4.2.2.5 The menu “Help” in the window “Graph”

Displays online help for this function.

7.4.3 The menu “Results - Graph, shape characteristics“

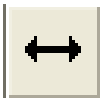
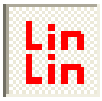
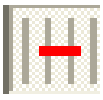


In the window “Graph, shape characteristics”, the distribution of the shape characteristics can be displayed. The file name is shown in the header of the window. If averaged values are represented, “Mean value” appears in the header. The parameters and the range displayed on the x-axis and the y-axis can be modified.

Show a section of the shape characteristics graph

By a click with the right mouse button and the drawing of the rectangle, a section of the shape characteristics graph can be shown and enlarged (zoom in).

7.4.3.1 The icon bar in the window “Graph, shape characteristics”

	Read a comparison file.
	Copy the graph displayed on the screen to the clipboard.
	Print the graph.
	With a click on this button the standard display can be restored.
	With a click on this button, the area can be enlarged
	X-axis linear, y-axis linear
	X-axis logarithmic, y-axis linear
	X-axis logarithmic, y-axis logarithmic
	Add vertical grid lines
	Delete vertical grid lines

	Add horizontal grid lines
	Delete horizontal grid lines
	Online help

7.4.3.2 The menu in the window “Graph, shape characteristics”

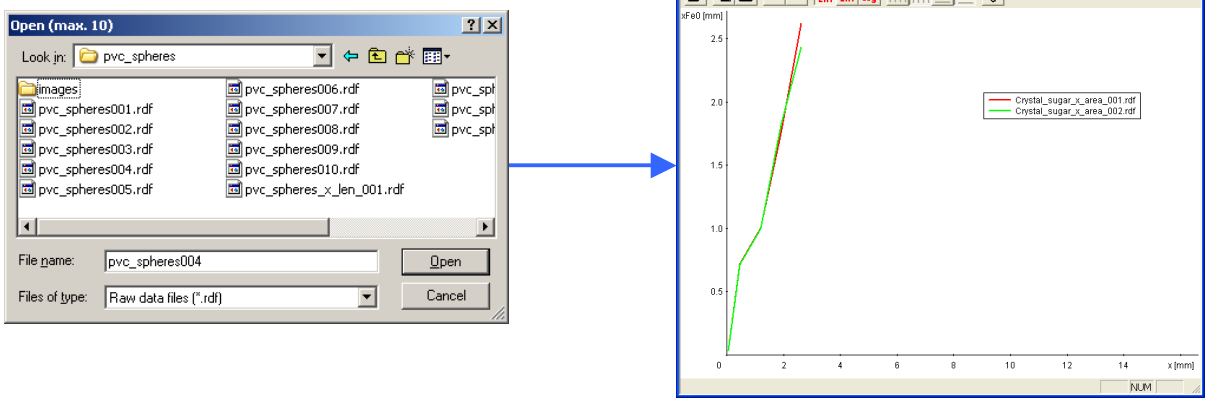
7.4.3.2.1 The menu “File” in the window “Graph, shape characteristics”

The menu “File” contains the following menu items:

- Read comparison file
- Print
- Exit

7.4.3.2.1.1 The menu “File - Read comparison file”

To view a comparison file, please click in the menu |-File|Read comparison file-|. Select the comparison file in the respective dialogue box.



7.4.3.2.1.2 The menu “File - Print “

Print window “Graph, shape characteristics”.

7.4.3.2.1.3 The menu “File - Exit“

Close the window “Graph, shape characteristics”.

7.4.3.2.2 The menu “Edit” in the window “Graph, shape characteristics”

The menu “Edit” contains one menu item

- Copy

Copy the graph as displayed to the clipboard. The name of the raw data file or of the raw data files included in the average are displayed in the header.

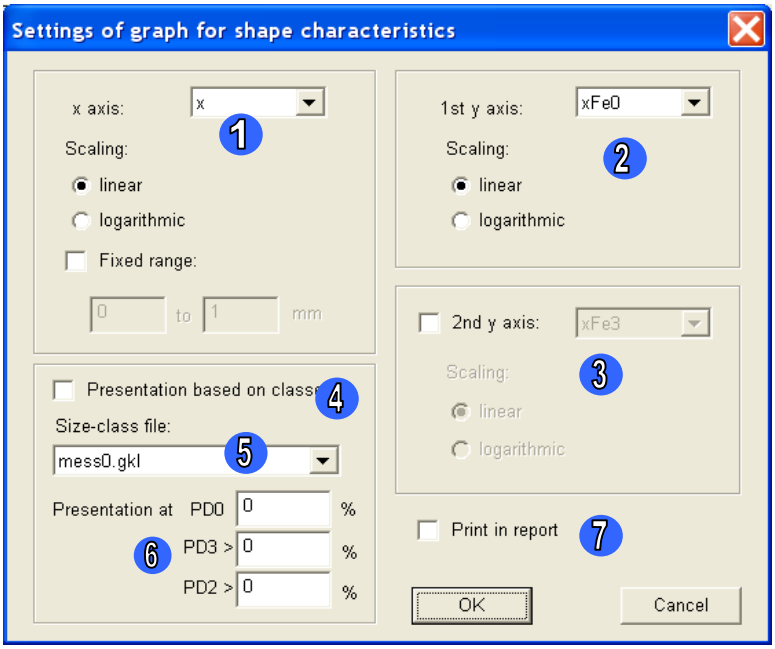
7.4.3.2.3 The menu “View” in the window “Graph, shape characteristics”

The menu “View” contains the following menu items:

- Characteristics
- Units

7.4.3.2.3.1 The menu “View – Characteristics”

Define the settings for the display in the diagram. In particular, the configuration of the axes can be set here. The window “Settings of graph for shape characteristics” is opened:

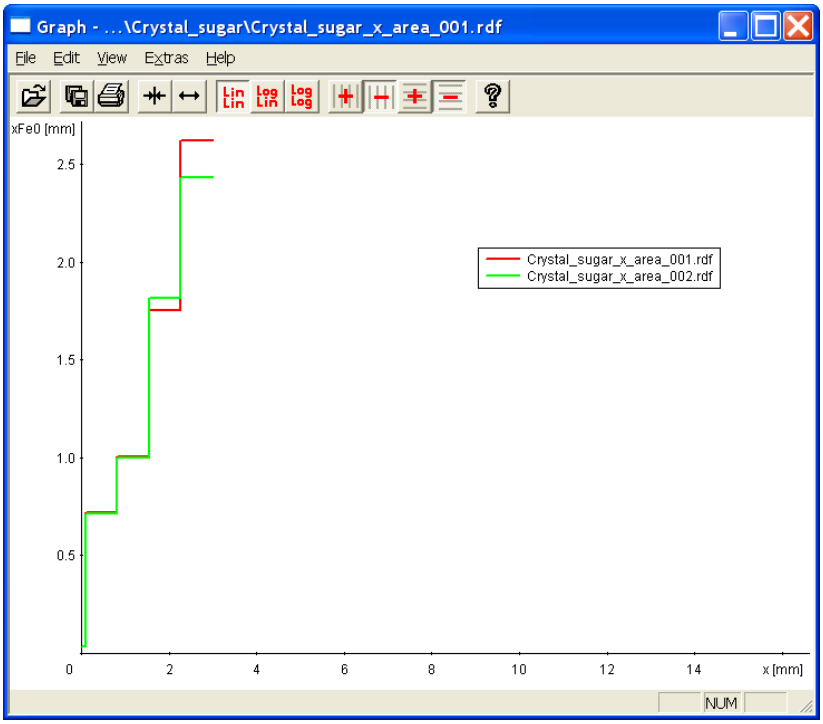


1 Select the scaling of the x-axis. For the x-axis, the particle size “x” or a shape characteristic (e.g. SPHT) can be defined. A linear or logarithmic scaling of the x-axis is possible. Also, a fixed range (minimum and maximum x-value displayed) can be selected. Select the type of the distribution in the drop-down-menu.

2 Define settings for the y-axis. Dependent on the choice for the x-axis you can choose between shape characteristics (if the x-axis represents the particle size), or the number-, area- or volume-dependent quantity Q (if x-axis represents a shape characteristic). Select the type of the distribution in the drop-down-menu.

3 Select a second y-axis for which the settings can be defined as described above. The second y-axis will be shown on the right side of the graph.

4 For “Presentation based on classes”, mark the respective checkbox. This option is only available if the x-axis represents the particle size.



5 Select the class file for the display of the shape characteristics.

If the diagram represents a size-dependent shape distribution (x-axis = particle size, y-axis = shape characteristics (e.g. b/l) then a size class file is used.

If a shape parameter is selected for the x-axis (e.g. b/l) and y-axis represents a distribution (e.g. Q_3), then a shape class file has to be selected. The shape class files are created on the register card “Graph, shape characteristics”.

Also, the checkbox “Presentation based on classes” is not available here.

6 Enter thresholds for PD_0, PD_3, PD_2 in % to suppress the presentation of reference sizes, which are statistically not interesting or secured (for example, exclude single particles or few agglomerated particles).

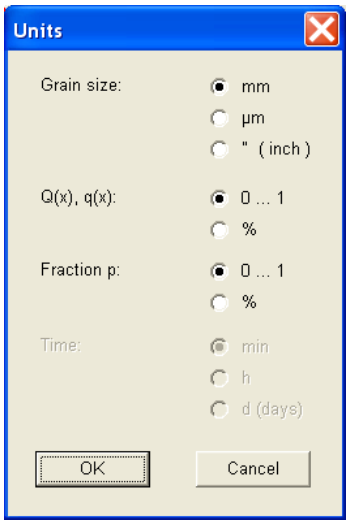
PD_0: reference sizes depending on the number
PD_3: reference sizes depending on the volume
PD_2: reference sizes depending on the area

Reference sizes depending on volume, area and number are only made if the proportion of $PD_{3,2,0}$ in each class is greater than the threshold.

7 When the checkbox “Print in report” is marked, the shape characteristics graph will be printed in the report. When the respective option is selected, the graph will be printed based on classes. The shape characteristics graph included in the report can be viewed in the print preview of the report, please select -File Print preview-.

7.4.3.2.3.2 The menu “View – Units”

Grain size	Display grain size in mm, µm or inch
Q(x), q(x)	Display on a numerical scale or in %
Fraction p	Display on a numerical scale or in %
Time	The function ”time” is only active if a trend analysis is performed (see chapter 7.4.6 “Trend analysis”).



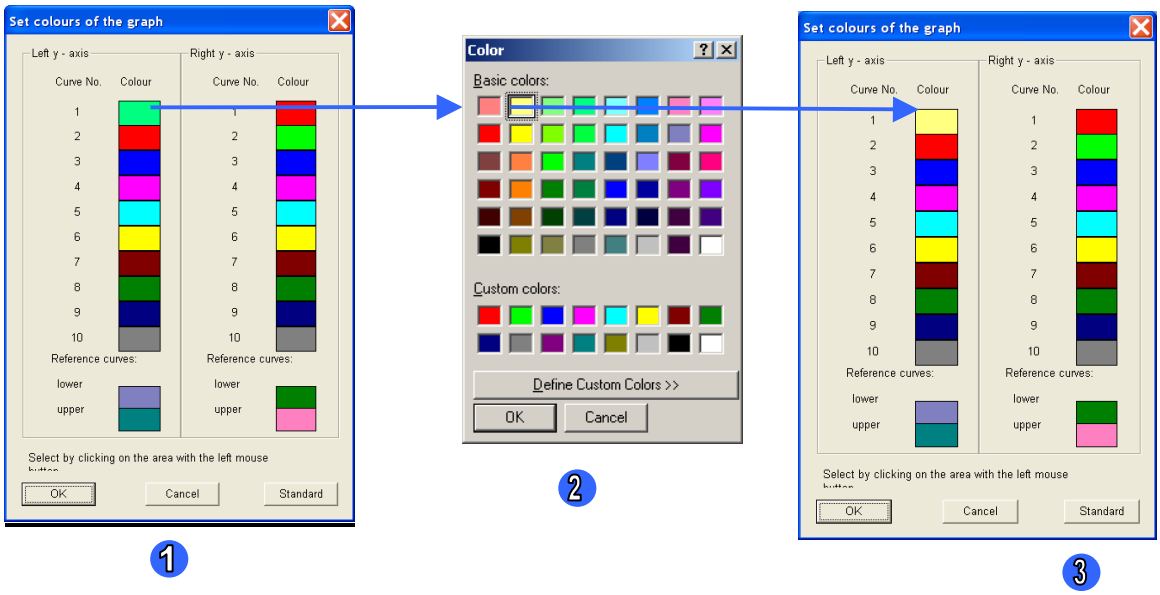
7.4.3.2.4 The menu “Extras” in the window “Graph – Shape characteristics”

In the menu “Extras”, the definition of the display parameters for the shape characteristics graph can be defined.

The menu “Extras” offers the following menu items:

- Colours
- Type of curves
- Type of bars
- Grid
- Legend
- Help

7.4.3.2.4.1 The menu “Extras - Colours”



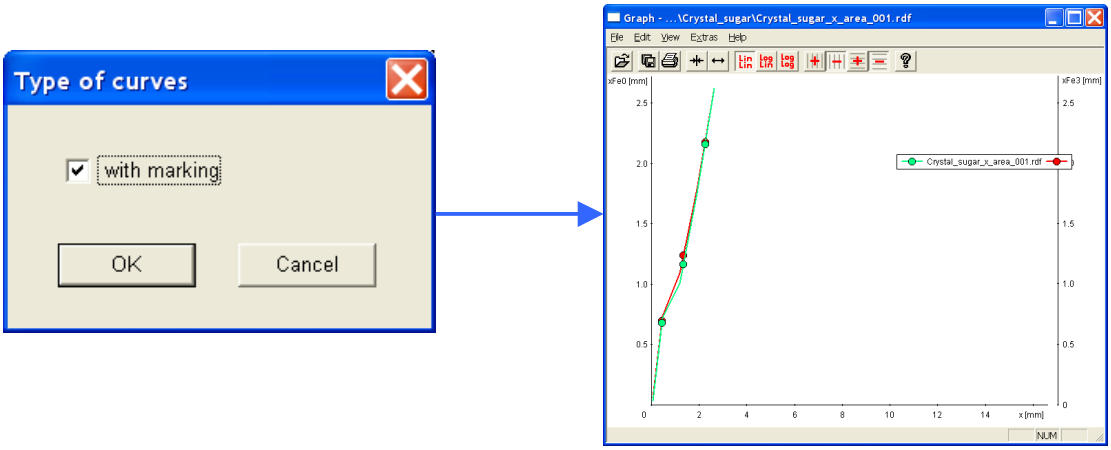
Open a dialogue box for the setting of the colours in the graph window. The colour of each curve and each bar can be freely selected.

1. To define the colour of a curve, please click on the colour box of the respective curve number (e.g. curve no 1 / green box).

2. A window opens where the colours can be selected. Click on a box with the colour you would like to choose for the curve (e.g. here: yellow). Click [OK]. The colour appears now in the respective box.

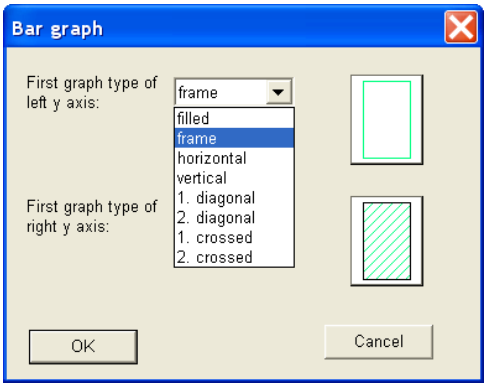
3. The colours for the reference curves can be set in a similar way. Click on the respective box of the reference curve in the lower area of the box. Standard colours can be set by a click on the button [Standard].

7.4.3.2.4.2 The menu “Extras – Type of curves”



Using this menu item, it can be defined whether the graphs will be marked with signs. As signs, circles, squares and triangles are used.
Mark the checkbox to activate the display of the graphs with signs.

7.4.3.2.4.3 The menu “Extras – Type of bars”

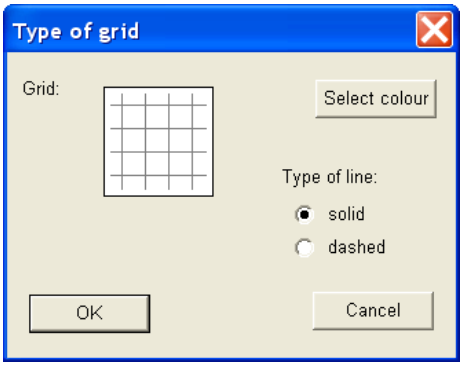


In this dialogue window, the settings for the bars representing the fractions can be defined. If “frame” is selected, the bars are displayed in the graph colour. If no settings are defined, the bar has the curve colour and the frame colour is black.

Please note

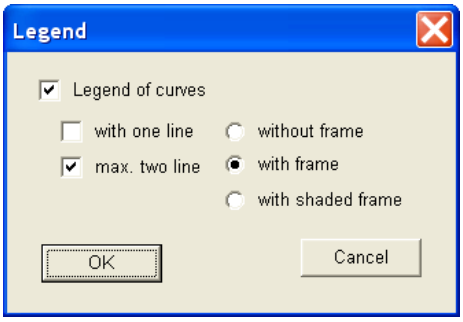
To display the shape characteristics graph as a bar diagram, the display of fractions has to be defined for the Y-axis. To select the display of fractions, please click |-View|Characteristics| and select “p3” for the display of the Y-axis.

7.4.3.2.4.4 The menu “Extras – Grid”



Select the colour and the line type for a grid. These colours and line types will be applied to the window when the display of horizontal or vertical grid lines is selected in the menu bar of the window using the respective buttons in the icon bar.

7.4.3.2.4.5 The menu “Extras – Legend”

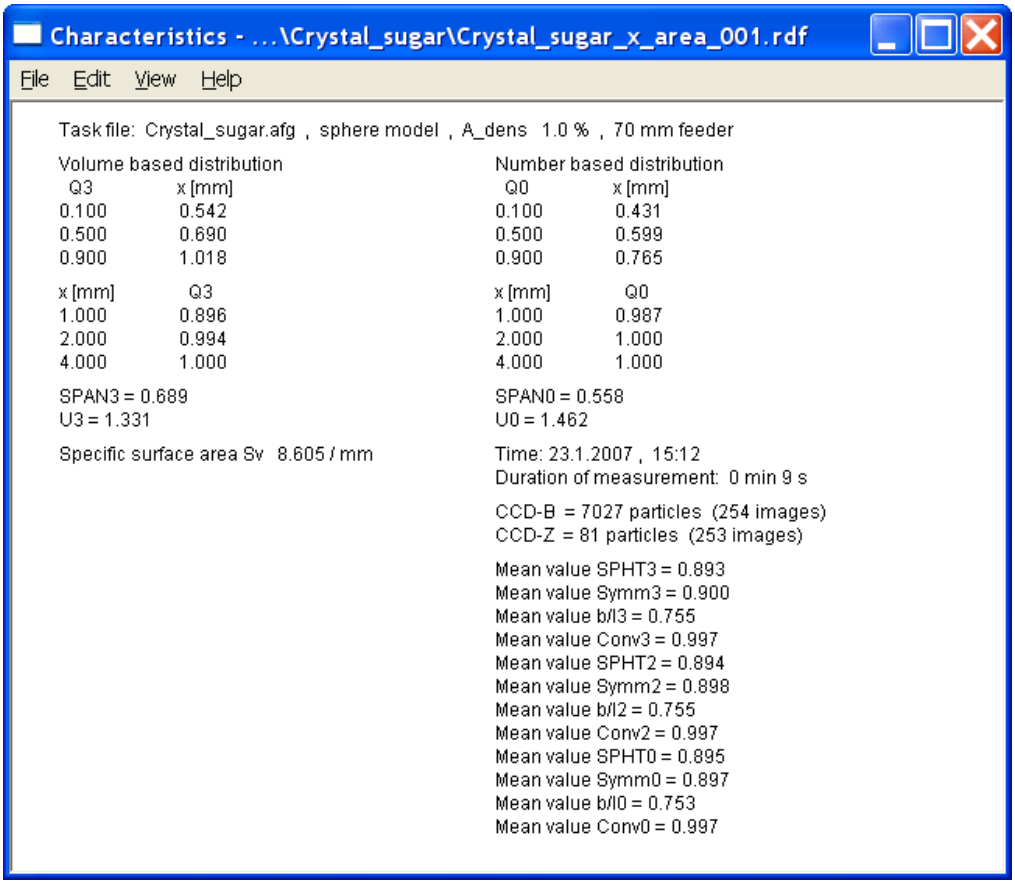


Using this menu item, the display of the legend can be defined. The legend will be displayed only if the checkbox “Legend of curves” is activated.

7.4.3.2.4.6 The menu “Extras – Help”

Displays online help for this function.

7.4.4 The menu “Results – Characteristics“



In the window “Characteristics”, only those characteristics can be displayed which have been measured before. The file name is shown in the headline of the window.

The characteristics to be measured are set on the register card “Settings” in the menu ⎸-Options ⎸Measurement parameters-⎸.

The file name is shown in the headline of the window.

7.4.4.1 The menu in the window “Characteristics”

7.4.4.1.1 The menu “File” in the window “Characteristics”

The menu “File” contains the following menu items:

- Print
- Exit

7.4.4.1.1.1 The menu “File – Print”

Print the characteristics window. The window for the selection of the printer is opened.

7.4.4.1.1.2 The menu “File – Exit”

Exit the window “Characteristics”.

7.4.4.1.2 The menu “Edit” in the window “Characteristics”

The menu “Edit” contains the following menu items:

- Copy
- Copy Text
- Show characteristics
- Show measurement conditions

7.4.4.1.2.1 The menu “Edit - Copy“

Copy the displayed window to the clipboard. The name of the raw data file or the names of all raw data files (if averaged values are analysed) are shown at the top.

7.4.4.1.2.2 The menu “Edit - Copy (Text)”

The characteristics are copied in ASCII-format to the clipboard. One line contains the characteristic name and the value of the characteristic. The elements of one line are separated by tabulators. Numerical values are displayed using commas. In this way, the data can easily be exported to EXCEL.

7.4.4.1.2.3 The menu “Edit - Show characteristics”

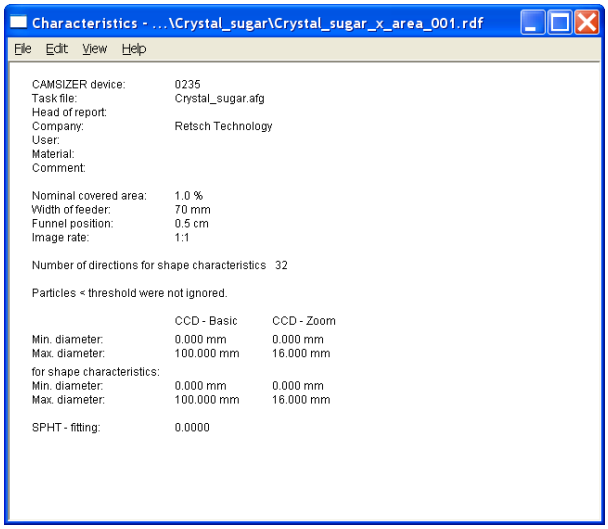
The characteristics are shown in the window. A checkmark before the menu bar appears if this function is active.

7.4.4.1.2.4 The menu “Edit - Show measurement conditions”

The measurement conditions are displayed. If “Edit comments” has been activated in the software configuration, the comments in the comment lines can be modified and the modifications can be saved in the measurement file (see chapter 7.1.6 “The menu `File - Save measurement file´”).

The following fields can be modified by a double-click on the respective text field:

- Head of report
- Company
- User
- Material
- Comment



To save the changes permanently in the measurement file, they have to be saved using the menu function ⎸-File ⎸Save file-⎸.

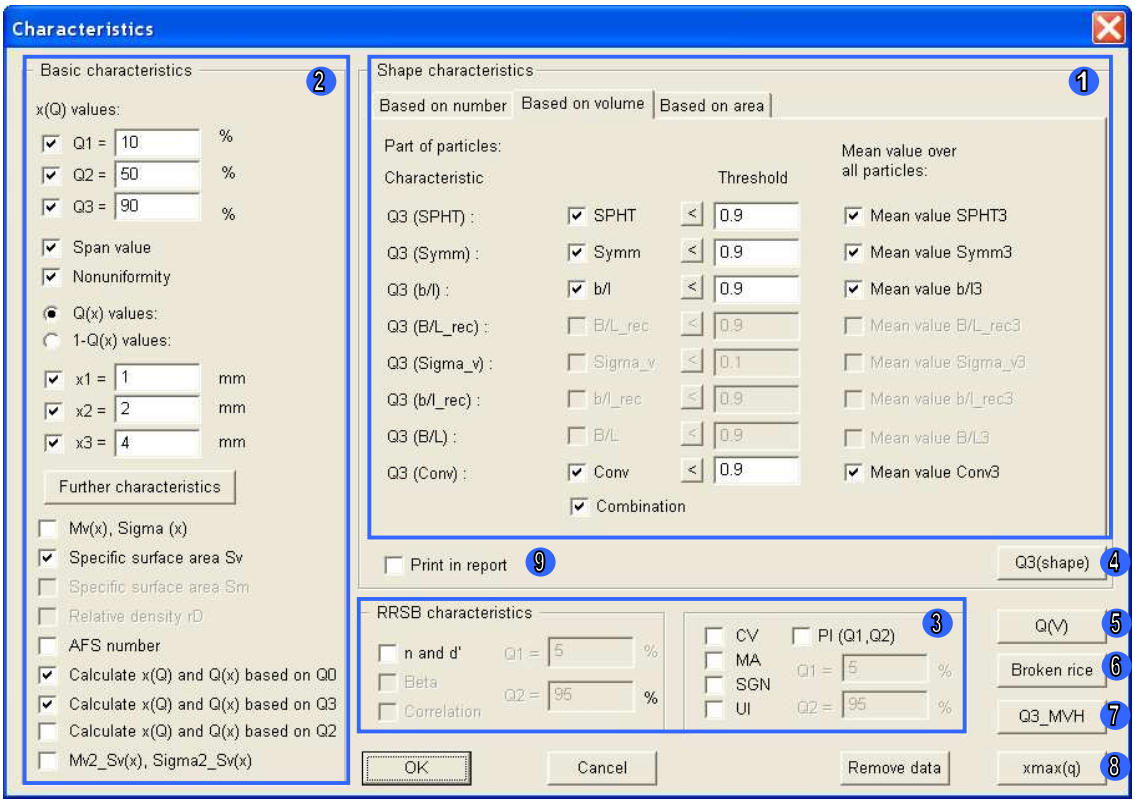
7.4.4.1.3 The menu “View” in the window “Characteristics”

The menu “View” in the window “Characteristics” contains the following menu items:

- Characteristics
- Size limits for display
- Units
- Help

7.4.4.1.3.1 The menu “View – Characteristics”

In the window “Characteristics”, the characteristics can be edited.



1 7.4.4.1.3.1.1 Characteristics - the area “Shape characteristics”

Insert thresholds for the shape characteristics. Select the shape characteristics by marking the checkboxes. Only the checkboxes of those shape characteristics will be active and can be selected that have been measured in a preceding measurement procedure.

Click on the buttons [<] or [>] to select Q_3 or 1-Q_3 of the respective shape characteristic in the entire sample. The proportion of the particles will be displayed whose shape characteristic values are above (1-Q) or below (Q) a certain threshold.

Also, the display of the mean values of certain shape characteristics for all particles in the sample can be selected.

2 7.4.4.1.3.1.2 Characteristics – the area “Basic characteristics”

x(Q)-values	In the cumulative distribution, the x-values will be displayed whose size correspond to or fall below by a certain percentage of the sample. - Insert the percentage thresholds.
SPAN-value	Display of the SPAN-value, please see chapter 8 “Characteristics”.
Non-uniformity	Display non-uniformity of the particles, please see chapter 8 “Characteristics”.

Q(x)-values or 1-Q(x)-values	Select the display of the Q(x) values as a cumulative distribution or as a cumulative distribution of residue. - Insert the x-values into the boxes. - The proportion of those particles in the sample whose size is above or below these values will be displayed.
Further characteristics	A window opens in which 10 further values of each Q(x), 1-Q(x), x(Q) and p_3(x1,x2) can be determined together with 10 data points or fractions that can be selected independent from the selected sieve classes. With the [Standard] button, the default values can be reset by the software. Select the checkbox “Print in report” to print these values in the measurement report.
Mv(x)	Mean value of x, determined from the distribution of particles
Sigma (x)	Standard deviation of x, determined from the distribution of particles

Specific surface area Sm	Calculate specific surface area based on mass
Specific surface area Sv	Calculate and display specific surface area based on volume
Relative density rD	Calculate and display relative density of the material. $S = \frac{m}{V_{Cam}}$ The mass of the sample has to be inserted in the window “Start measurement” or “Save task file”.
AFS-number	Grain size number (used for measurements of sand for furnace)
Calculate Q(x) and x(Q) based on Q_0, Q_3, Q_2	Select whether the values are displayed based on particle number, particle projection surface or particle volume.
Mv2_Sv(x), Sigma2_Sv(x)	Mean value and standard deviation of the specific surface

7.4.4.1.3.1.3 Characteristics - the area RRSB- and further characteristics

In the RRSB-curve, the grain size is presented double-logarithmically, and the distribution curve is approximated to a straight line.
If these values are selected, they will appear in the measurement report.
The values have the following meanings:

N	Slope of the RRSB-line
d’	x-value which is reached by the line at a y-value of 0,632
correlation	Correlation between the RRSB-line and Q(x) at a range between Q1 and Q2. Please define Q1 and Q2 in the respective input boxes.
ß	Angle between the RRSB-line and the y-axis ß=90°-arc tan(n) (n=Slope of the RRSB-line)

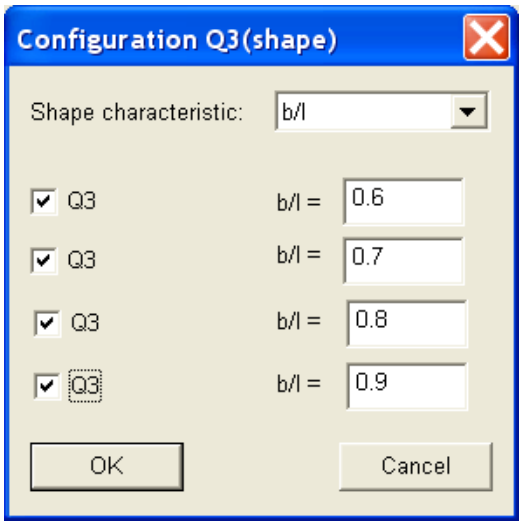
The RRSB-curve can be viewed in the window “Graph” by a click on the button “RRS” in the icon bar of the window “Graph”.

The following further characteristics are available:

CV	Coefficient of variation (used for measurements of sugar)
MA	Mean aperture = D_{50}-value=median-diameter x_{50} (used for measurements of sugar)
SGN	Size Guide Number, please see appendix of this manual (used for measurements of fertilizer)
UI	Uniformity Index; please see the characteristics described in the appendix of this manual (used for measurements of fertilizer)
PI (Q_1, Q_2)	Polydispersity index please see the characteristics described in the appendix of this manual and insert Q_1 and Q_2 manually.

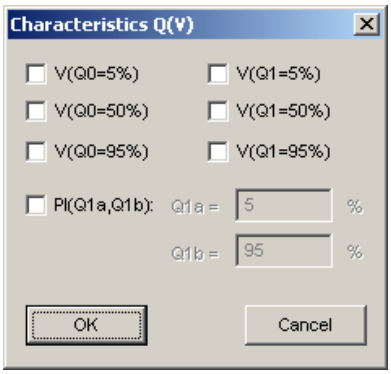
For a detailed explanation of the characteristics, please refer to chapter 8 "Characteristics" in this manual.

4 7.4.4.1.3.1.4 Characteristics - the button Q_3 (Shape)



Select the display of Q_3(Shape). In the drop down-menu in the upper box, the shape characteristic can be selected. Only those Q_3-values are displayed whose percentage in the sample falls below the shape threshold in the boxes.

5 7.4.4.1.3.1.5 Characteristics - the button [Q(V)]



Select the display of the cumulative distribution depending on volume Q(V). Mark the checkboxes to display the Q(V)-values. Select the display of the polydispersity index and define Q1a and Q1b to calculate this ratio.

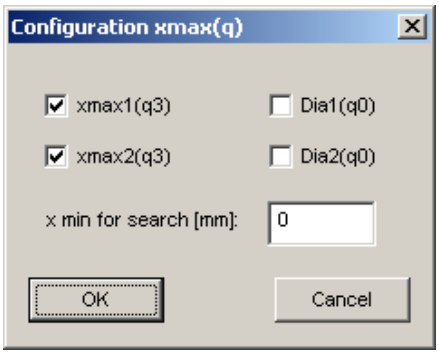
6 7.4.4.1.3.1.6 Characteristics - the button [Broken Rice]

"Broken Rice" permits the analysis of grains of rice and the calculation of the proportion of broken grains in a sample. It is a special feature, and is only available if the software is configured adequately. If you have ordered the software version including this feature, an appendix will be supplied to you where this feature is explained in more detail.

7 7.4.4.1.3.1.7 Characteristics - the button [Q_3 MVH]

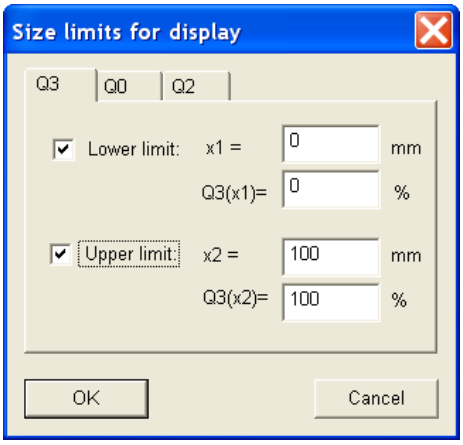
This feature can be used to detect and correlate the correct quantity of one kind of particles in a mixture of two components. The two different compounds must have at least one distinguishable shape characteristic (for example round and angular particles). If you have ordered this feature with your software version, you will be supplied with an appendix where the parameters are explained.

7.4.4.1.3.1.8 Characteristics - the button [xmax (q)]



Configure the display of the peaks of the frequency function. Mark the checkboxes. In the box “x min for search”, a minimum value for those particles included in the evaluation can be inserted. Particles with a size below this value will be excluded from the search of the peaks. This function is especially useful for samples with a high proportion of fines or dust.

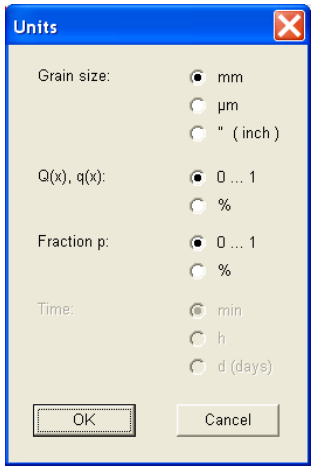
7.4.4.1.3.2 The menu “View



Set the upper and the lower size limits for the display. Set the particle size (x1) and the proportion of this particle size in the sample Q(x1). If the measured values are outside of these boundaries, they will be excluded. The size limits for the display are set for Q_0 (number-based), Q_2 (area-based) and Q_3 (volume based) distribution.

7.4.4.1.3.3 The menu “View” - Units

Grain size	Display grain size in mm or µm or inch
Q(x), q(x)	Display on a numerical scale or in %
Fraction p	Display on a numerical scale or in %
Time	The function ”time” is only active if a trend analysis is performed (see chapter 7.4.6 “Trend analysis”).



7.4.4.1.4 The menu “Help” in the window “Characteristics”

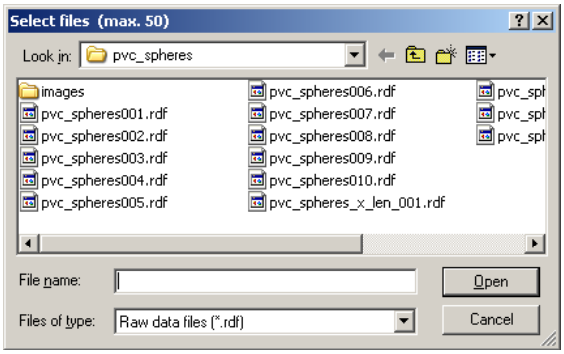
Displays online help.

7.4.5 The menu “Results - Calculate average”

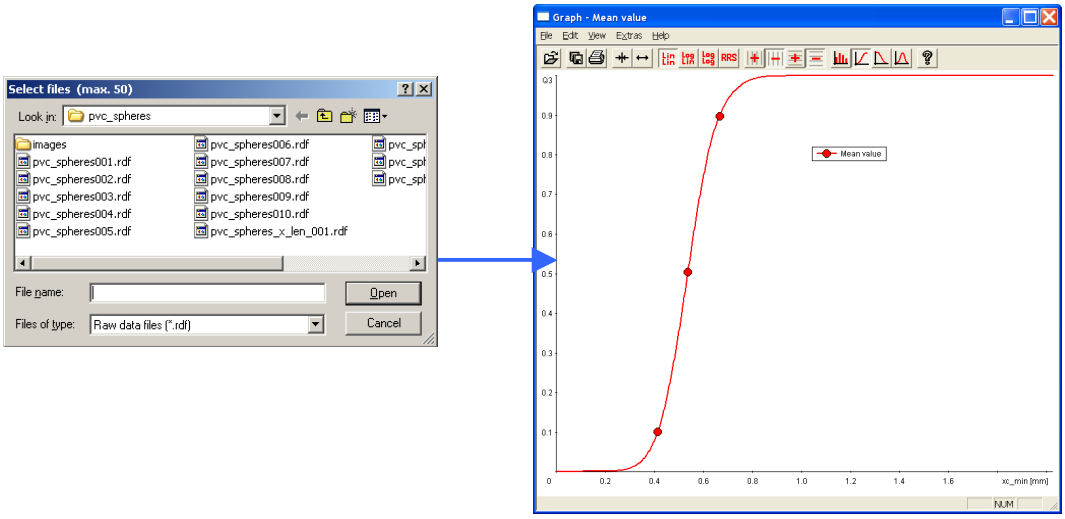
Calculate the average of a series of raw data files. Depending on the software configuration, up to 1000 files can be included into this average calculation. The maximum number of files is given in the headline of this dialogue box.

Please note
If more than the maximum of the raw data files are selected, the calculation of the mean values will be stopped after reading the maximum file number!

Click |-Results|Calculate average-|. The window “Select files (max 50)” is opened. Here, the files can be selected that are to be included into the average calculation.



In the dialogue box, the raw data files included in the average calculation can be selected. Mark the files and click [Open]. The graph window opens in which the mean value is displayed.



The task file of the first raw data file is used for generating the average. After reading the files, the mean values can be displayed in the table window, in the graph window and in the characteristics window, and they can be saved, copied and printed.

“Mean value” will appear in the headline of the window.

To save the averaged mean values, click |-File | Save measurement file- | in the main menu.

Please note

The file names used for the average will be shown if the graph, table, characteristics and shape characteristics graph is copied or printed. The file names are also visible in |-Results | Characteristics | Edit | Show measurement conditions- |.

They will not appear in the measurement report preview and printout available in the icon bar of the main software user interface.

If you calculate the average of files that have been measured with different measurement tasks, a warning appears. Click [OK] to continue.

Please note

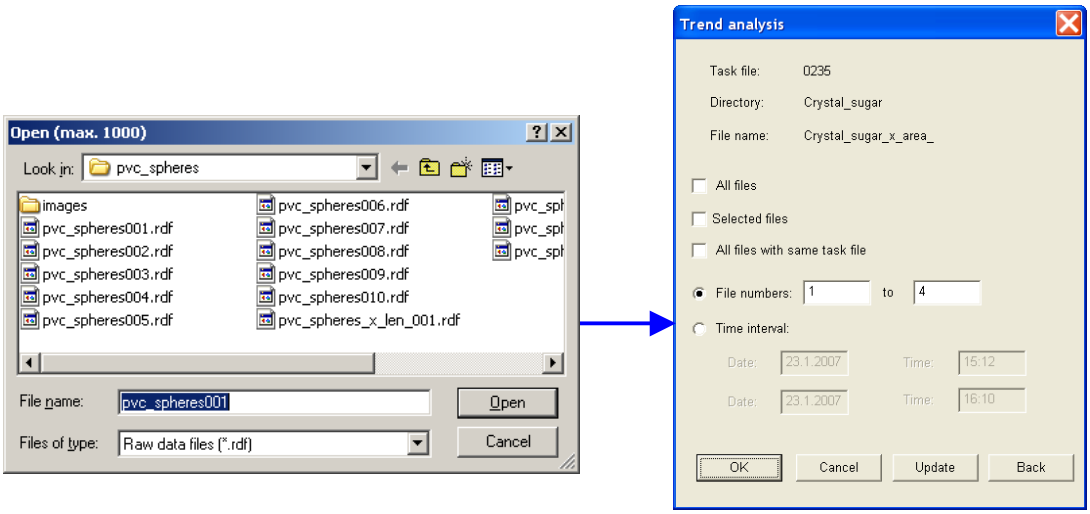
Please make sure that the averaged files from different measurement tasks have been measured using similar measurement conditions, otherwise your averaged file may not contain meaningful results!

If the results of the mean value calculation are not saved, they will be deleted when

- A new measurement is carried out,
- A new raw data file is read by │-File│Open measurement file-│,
- A trend analysis is carried out,
- The program is left.

7.4.6 The menu “Results - Trend analysis”

In a trend analysis, the results of up to 1000 single measurements can be evaluated that are available as raw data files in a subdirectory. These files can be a measurement series, selected files of a directory or all files of a directory.



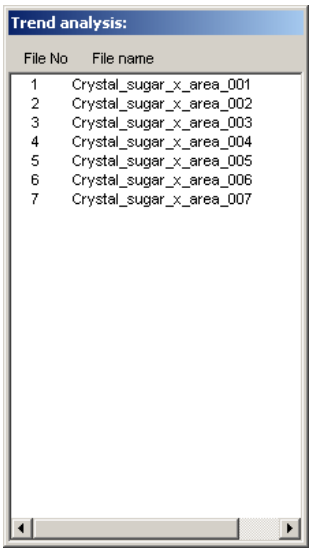
Please select the files in the dialogue box “Open”. Select the files and click [Open]. In the dialogue box “Trend analysis”, please select whether all files, the selected files or the files measured with the same task file should be included in the trend analysis.

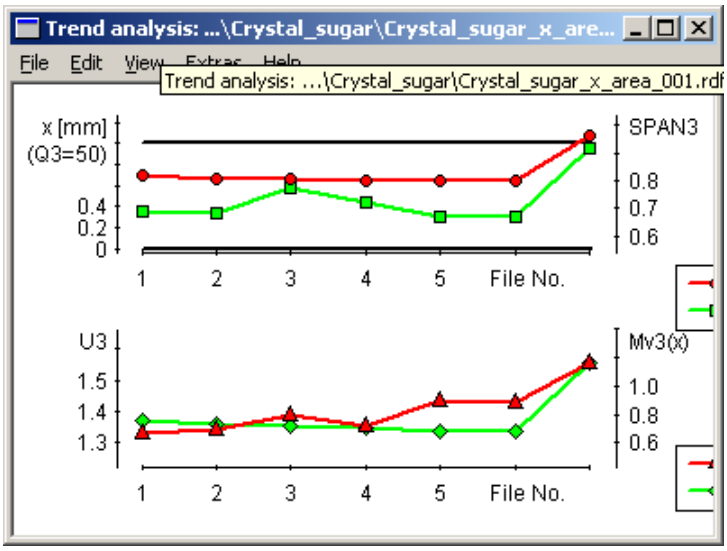
Alternatively, select the time interval of the recorded data or the file numbers for which you would like to create the trend analysis.

Please note

Make sure to select the same size definition (for example x_area) to create the trend analysis, otherwise the windows “time interval” and “file numbers” will not be active. The results may not be meaningful.

Click [Ok]. The file list and the trend analysis window are displayed.





File list

In the left window, the numbers and names of the files are displayed from which the trend analysis has been created.

Graph window

In the graph window, the developing of the particle size distribution over a defined sequence of measurements is displayed:

Y-axis: Characteristics

X-axis: Developing of the measurement sequence

For example:

- Y-axis: particle size at Q(x) = 50
- X-axis: File number

Set characteristics for the display of the trend analysis graph under ⎪-View⎪Characteristics-⎪.

Define graphic display settings (colours, types of curves, grid) in the menu “Extra”.

7.4.6.1 The window “Trend analysis”

7.4.6.1.1 The menu “File” in the window “Trend analysis”

The menu “File” contains the following menu items:

- Print
- Exit

7.4.6.1.1.1 The menu “File - Print“

Print trend analysis window. When the checkbox “Print inclusive assignments” is marked in the window “Characteristics for trend analysis”, the file list will be included into the printout. This window will be opened in the menu ⎸-View⎸Characteristics-⎸in the trend analysis window.

7.4.6.1.1.2 The menu “File - Exit“

Exit trend analysis window.

7.4.6.1.2 The menu “Edit” in the window “Trend analysis”

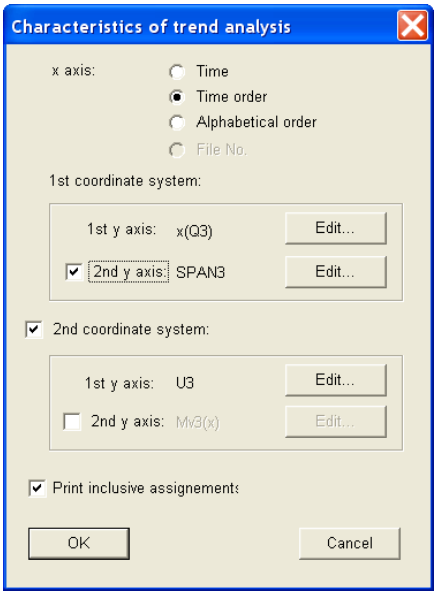
Copy: Copy the window as a metafile to the clipboard. The diagram window can be exported to other programs.

7.4.6.1.3 The menu “View” in the window “Trend analysis”

7.4.6.1.3.1 The menu “View – Characteristics”

Set the characteristics for the trend analysis window. In the window, a second y-axis and a second coordinate system with another two y-axes can be defined.

The window “Characteristics of trend analysis” is opened.



Set the order of the x-axis. Define the values for the x- and y-axis for the first and the second coordinate system by a click on the button [Edit] behind the respective axis.

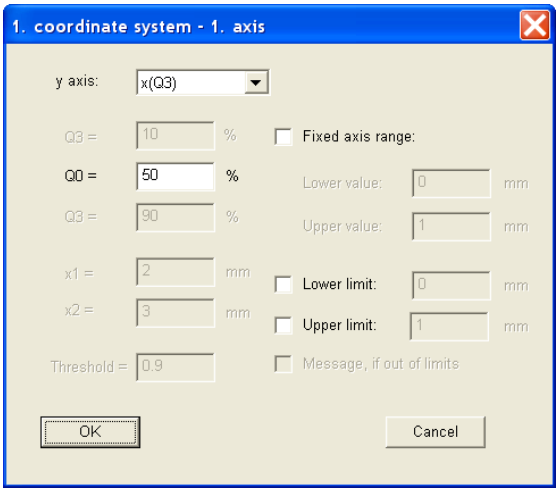
X-axis

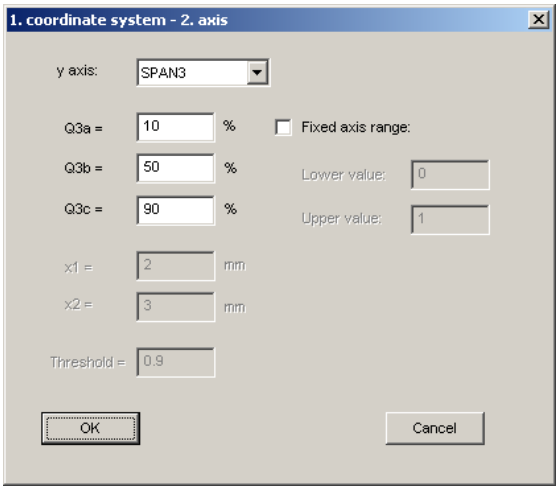
Set the scaling of the x-axis:

- Time of recording (in min, hours and days, which can be defined in the window “Units”),
- Time order (order according to which the files were recorded)
- Alphabetical order (according to the file name)
- Order according to the file number

1st coordinate system

For the first coordinate system, two y-axes can be defined. Both y-axes can be edited by a click on the button [Edit] behind the respective axis. The windows of the two axes will however contain different setting options.





The following settings can be defined in the windows for the first coordinate system:

Y-axis:

Select the characteristic to be displayed on the y-axis in the drop-down menu. Depending on the selected characteristics displayed on the axis, other boxes become active.

Fixed axis range

- Define a fixed axis range. Mark the checkbox “Fixed axis range” and insert the lower and the upper value of this axis range in the respective input boxes.

- Definition of a lower and an upper limit. At both positions, a line will appear in the coordinate systems of the trend analysis window.

If the checkbox “Message if out of limits” is active, a warning message will be issued if the recorded results are out of the defined limits.

If **NSP** (non-spherical particles) has been selected in the drop-down menu of the box “Y-axis”, the input box “Threshold” in the lower area becomes active and the NSP-value can be inserted.

The NSP-value shows the proportion of particles whose sphericity is smaller than a certain threshold. This threshold can be inserted into the input box. The NSP is based on particle number.

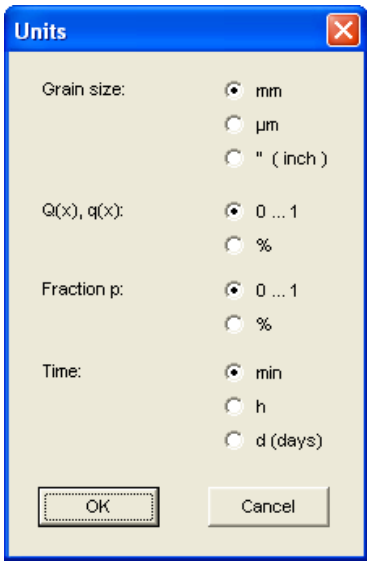
Please note

The lower and upper limit and the message appearing when the data are out of the limits cannot be defined in the window for the second y-axis.

In a similar way, the settings for the second coordinate system can be defined.

7.4.6.1.3.2 The menu “View – Units”

Grain size	Display grain size in mm or µm or inch
Q(x), q(x)	Display on a numerical scale or in %
Fraction p	Display on a numerical scale or in %
Time	Select the time period for the trend analysis.



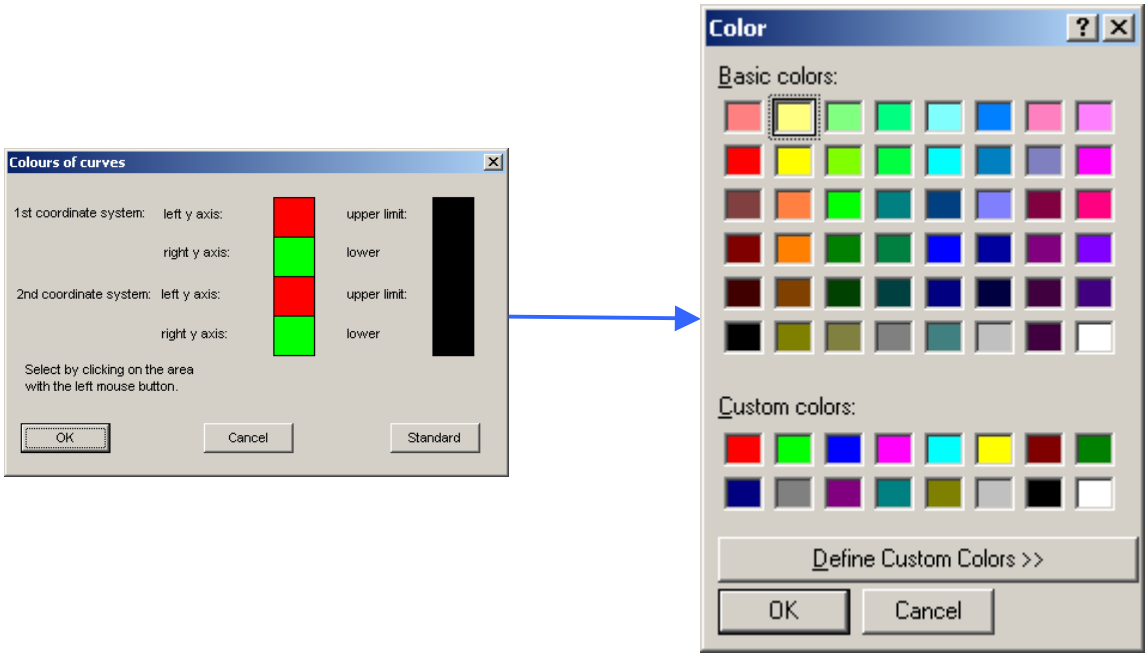
7.4.6.1.4 The menu “Extras” in the window “Trend analysis”

The menu “Extras” contains the following menu items:

- Colours
- Type of curves
- Grid

7.4.6.1.4.1 The menu “Extras - Colours of curves”

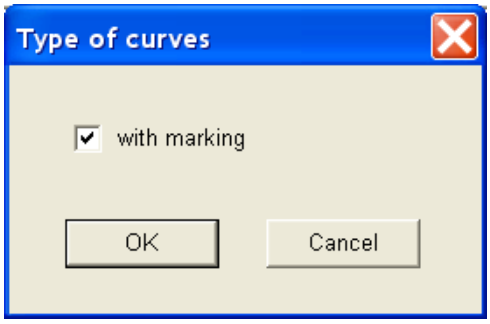
Select the colours for the axes of the coordinate system and the lines of the upper and the lower limit.



Double-click on the box. The window “Color” is opened. Select the colour in the respective box and click [OK].

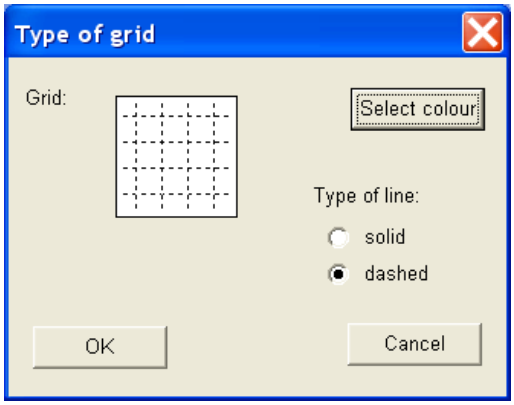
In the window “Colours of curves”, click [OK] to apply the settings. The colours can be applied as standard colours when the button [Standard] is clicked.

7.4.6.1.4.2 The menu “Extras –Type of curves”



Select whether the curves are displayed with markings. Click [OK] to confirm your selection.

7.4.6.1.4.3 The menu “Extras - Grid”



Select the display of the grid in the window “Trend analysis”. The line type and the colour can be selected. If no colour is selected, the grid is displayed in black.

7.4.6.1.5 The menu “Help” in the window “Trend analysis”

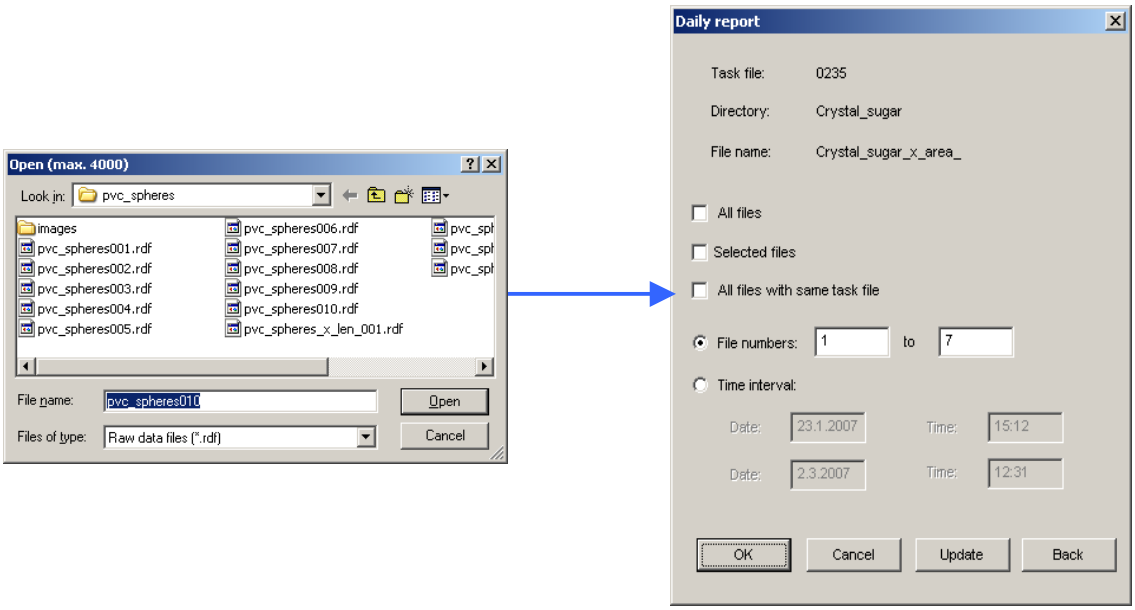
Call online help for this function.

7.4.7 The menu “Results - Daily report”

This menu item is used for the tabular evaluation of measurement files saved in a folder. The following options are available for the selection of the files for the analysis in a daily report:

- All files
- Selected files
- All files with the same task file

7.4.7.1 Select files for a daily report



Please select the files in the dialogue box and click [Open].

In the dialogue box “**Daily report**”, please select whether all files, the marked files or the files measured with the same task file should be measured.

- When the option “**All files**” is marked, all files stored in the subfolder are included into the daily report. These files can also be the result files of different measurement tasks.

- If “**Selected files”** is marked, only the selected files will be included.

- When the option “**All files with the same task file**” is selected, only those files are to be included that have been measured using the same task file.

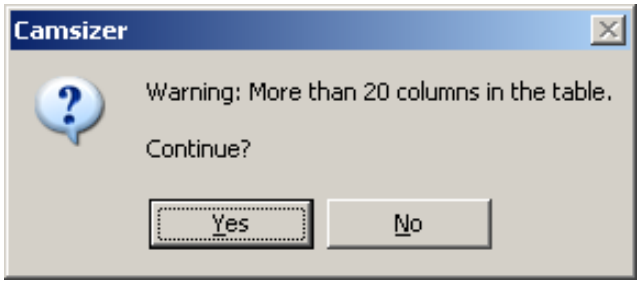
  - Please select the time interval of the recorded data or the file numbers you would like to record in the daily report.

  - Click [Update]. Then click [OK].

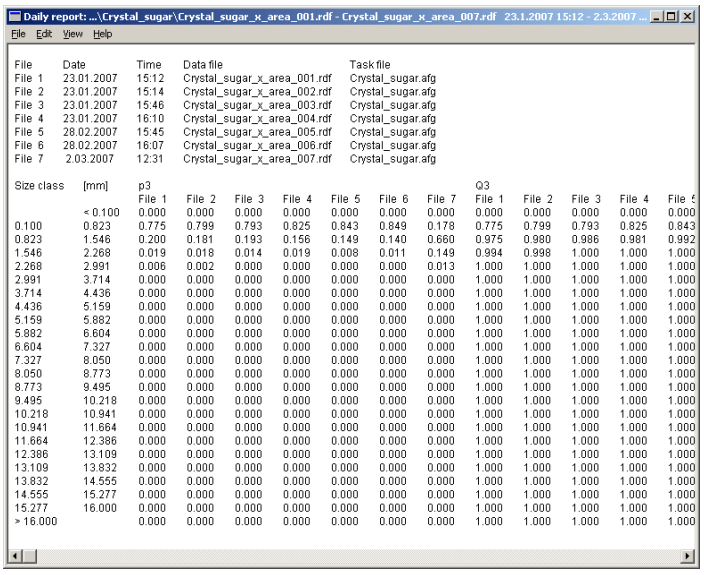
Please note

The windows “time interval” and “file numbers” will only be active if files with the same particle model have been selected (for example x_area).

If more than 20 columns are to be displayed in the table, a warning message will be issued. If the table consists of more than 20 columns, the table window will be less clearly structured, and the table cannot be printed completely on one A4-sheet.



Click [**Yes**] to continue. The table window “**Daily report**” is opened and displays the measurement results of the selected result files.


Daily report: ...\Crystal_sugar\Crystal_sugar_x_area_001.rdf - Crystal_sugar_x_area_007.rdf 23.1.2007 15:12 - 2.3.2007 ...

File Edit View Help

File	Date	Time	Data file	Task file
File 1	23.01.2007	15:12	Crystal_sugar_x_area_001.rdf	Crystal_sugar.afg
File 2	23.01.2007	15:14	Crystal_sugar_x_area_002.rdf	Crystal_sugar.afg
File 3	23.01.2007	15:46	Crystal_sugar_x_area_003.rdf	Crystal_sugar.afg
File 4	23.01.2007	16:10	Crystal_sugar_x_area_004.rdf	Crystal_sugar.afg
File 5	28.02.2007	15:45	Crystal_sugar_x_area_005.rdf	Crystal_sugar.afg
File 6	28.02.2007	16:07	Crystal_sugar_x_area_006.rdf	Crystal_sugar.afg
File 7	2.03.2007	12:31	Crystal_sugar_x_area_007.rdf	Crystal_sugar.afg

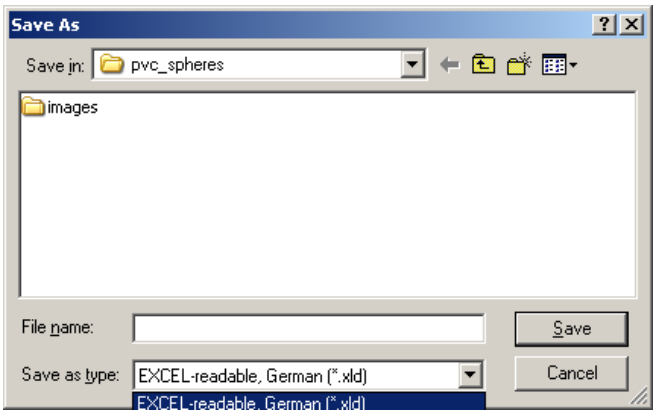
Size class	[mm]	p3							Q3				
		File 1	File 2	File 3	File 4	File 5	File 6	File 7	File 1	File 2	File 3	File 4	File 5
	< 0.100	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0.100	0.823	0.775	0.799	0.793	0.825	0.843	0.849	0.178	0.775	0.799	0.793	0.825	0.843
0.823	1.546	0.200	0.181	0.193	0.156	0.149	0.140	0.660	0.975	0.980	0.986	0.981	0.992
1.546	2.268	0.019	0.018	0.014	0.019	0.008	0.011	0.149	0.994	0.998	1.000	1.000	1.000
2.268	2.991	0.006	0.002	0.000	0.000	0.000	0.000	0.013	1.000	1.000	1.000	1.000	1.000
2.991	3.714	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	1.000	1.000	1.000	1.000
3.714	4.436	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	1.000	1.000	1.000	1.000
4.436	5.159	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	1.000	1.000	1.000	1.000
5.159	5.882	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	1.000	1.000	1.000	1.000
5.882	6.604	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	1.000	1.000	1.000	1.000
6.604	7.327	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	1.000	1.000	1.000	1.000
7.327	8.050	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	1.000	1.000	1.000	1.000
8.050	8.773	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	1.000	1.000	1.000	1.000
8.773	9.495	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	1.000	1.000	1.000	1.000
9.495	10.218	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	1.000	1.000	1.000	1.000
10.218	10.941	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	1.000	1.000	1.000	1.000
10.941	11.664	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	1.000	1.000	1.000	1.000
11.664	12.386	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	1.000	1.000	1.000	1.000
12.386	13.109	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	1.000	1.000	1.000	1.000
13.109	13.832	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	1.000	1.000	1.000	1.000
13.832	14.555	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	1.000	1.000	1.000	1.000
14.555	15.277	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	1.000	1.000	1.000	1.000
15.277	16.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	1.000	1.000	1.000	1.000
> 16.000		0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	1.000	1.000	1.000	1.000

In the window “Daily Report”, move the scroll bar to the right side to view all columns in the table.

7.4.7.2 The menu bar in the window “Daily report”

7.4.7.2.1 The menu “File” in the window “Daily report”

Export: Export the table to another format. The table can be saved in XLD- and XLE-format. The folder can be selected and the file name can be defined in the opened dialogue window.



Print: Print the daily report.

Exit: Exit the window.

7.4.7.2.2 The menu “Edit” in the window “Daily report”

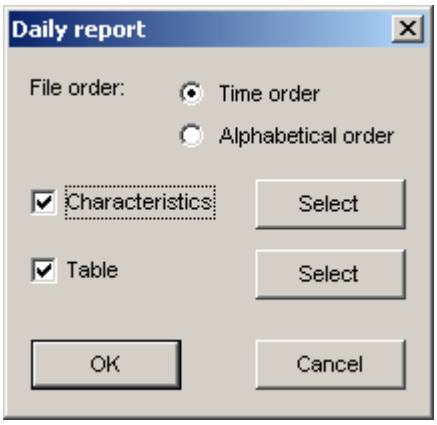
Copy: Copy the table to the clipboard (ASCII-format).

7.4.7.2.3 The menu “View” in the window “Daily report”

The menu “View” contains two menu items: “Characteristics” and “Units”.

7.4.7.2.3.1 The menu “View” – Characteristics”

When the menu item “Characteristics” is selected, the dialogue window “Daily report” opens where the file order, the characteristics and the table display can be edited or selected.

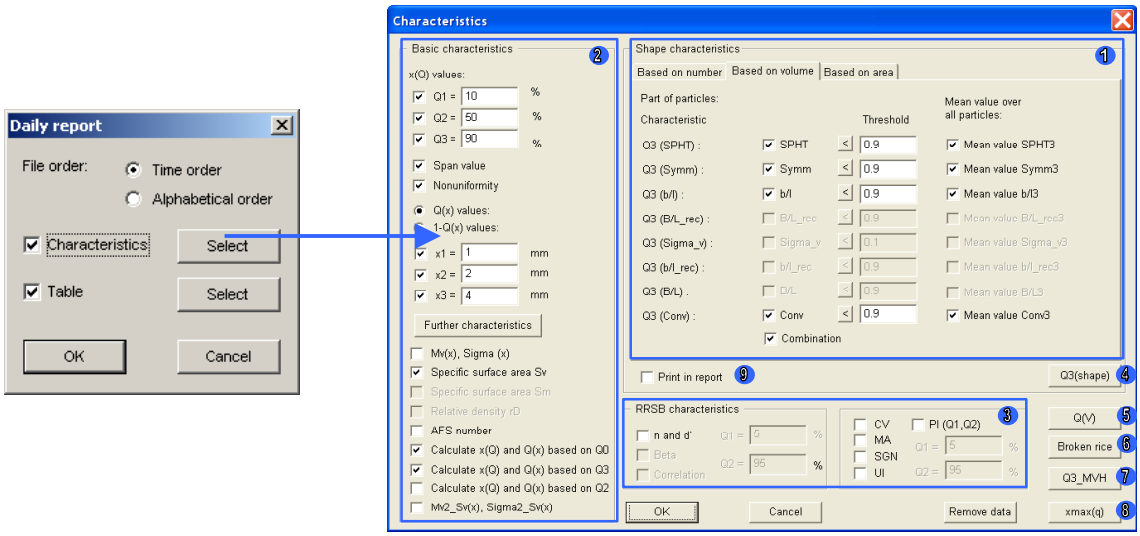


The file order can be displayed according to the recording time (“Time order”) or according to the file name (“Alphabetical order”).

The characteristics and the table can be edited. Mark the respective checkboxes. The buttons [Select] will become active.

7.4.7.2.3.1.1 Characteristics - Edit characteristics

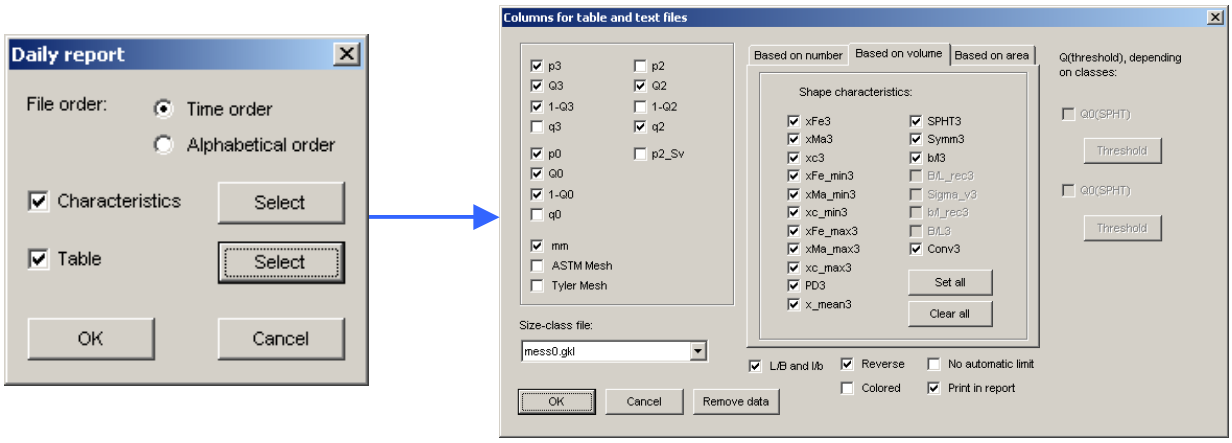
When the button [Select] is clicked, the window “Characteristics” is opened in which the characteristics can be edited.



The window is identical with the window “Characteristics” in the menu “View” of the window “Characteristics”, please see chapter 7.4.4.1.3.1 for a detailed description of this window.

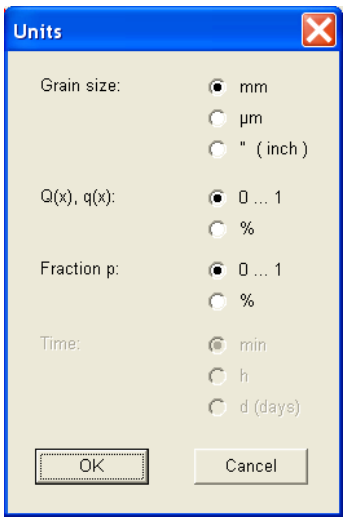
7.4.7.2.3.1.2 Characteristics - Edit table

When the checkbox "Table" is marked and the button "Select" is clicked, the window "Columns for table and text files" is opened. In this window, the table displaying the daily report can be edited.



The window "Columns for table and text files" is identical to the window in the menu "View – Characteristics" in the menu bar of the window "Table". Please see chapter 7.4.1.2.3.1 "The menu `View – Characteristics´" for a more detailed description of the functions of this window.

7.4.7.2.3.2 The menu "View – Units"



Grain size	Select display of the grain size in mm or µm or inch
Q (x), q (x)	Select the display of the distribution in % or on a scale from 0…1
Fraction p	Select the display of the fractions on a scale from 0…1 or in %
Time	The function "time" is only active if a trend analysis is performed (see chapter 7.4.6. "Trend analysis").

7.4.7.2.4 The menu "Help" in the window "Daily report"

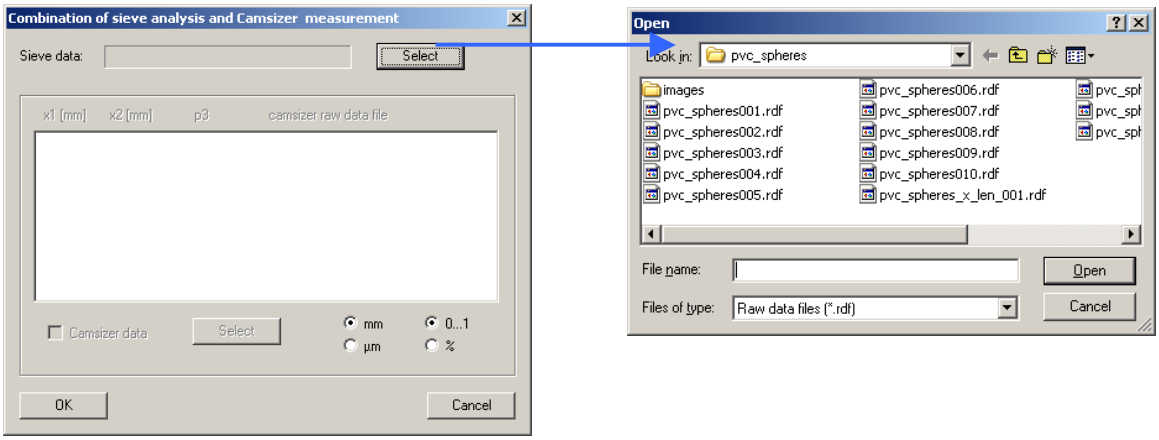
Call online help for this function.

7.4.8 The menu “Results - Combine sieve and CAMSIZER®-results”

This menu item permits the combination of the results of a CAMSIZER® measurement with the results of a sieve analysis.

With a click onto the menu item, the window “Combination of sieve analysis and CAMSIZER® measurement” is opened.

7.4.8.1 Select the sieve data

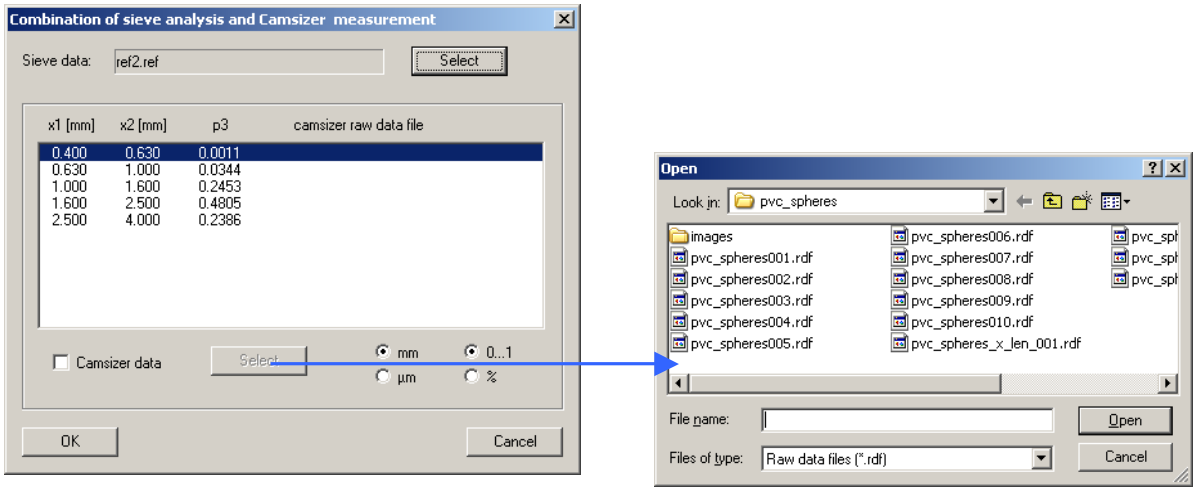


Click the button [Select]. Sieve data have to be available as a reference file, which will usually be saved in the directory “CAMSYS”. The data can be saved as an REF-file or as an EXCEL or TXT-file.

In the window “Open” the directory and the file can be selected. The classes of the reference file (x1 and x2-values) and the p3-values will be shown in the display window.

In the lower right part of the display window, please select the units (mm or µm) for the display of the particle size (x-axis) and the scale on the y-axis (% or a scale from 0…1).

7.4.8.2 Select the CAMSIZER®-data



With each sieve class, a CAMSIZER®-file can be combined.

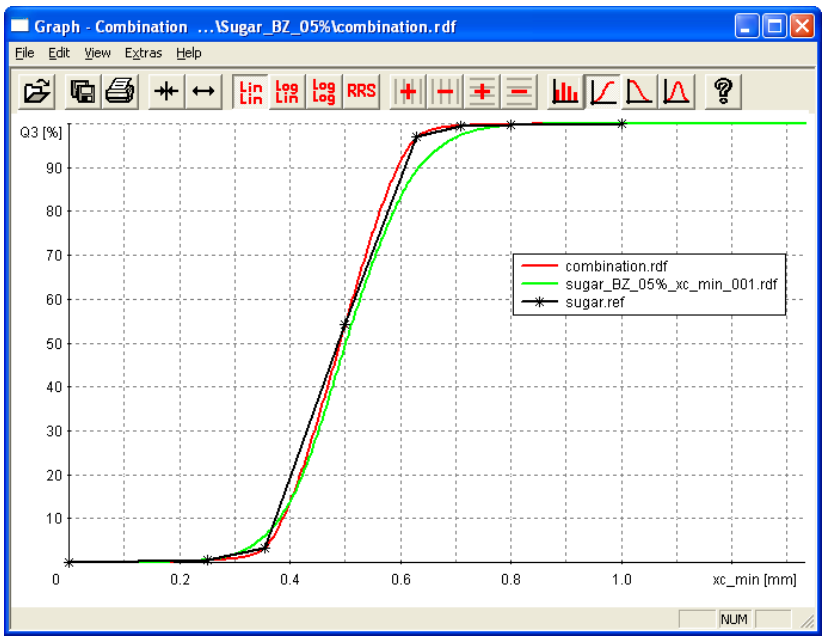
- Mark the size fraction of the sieve data in the display window,
- Mark the checkbox “**Camsizer data**” and click [**Select**]. A window opens where the CAMSIZER® file can be selected.
- Select the directory and the RDF-file you would like to combine with the sieve data file.
- Click [Open].

The CAMSIZER®-file will be displayed next to the sieve data file in the display window.

- With each sieve fraction a CAMSIZER® file can be combined.

When the selection of the files to be combined is complete, click [OK]. The window “Graph – Combination” will be opened.

7.4.8.3 The window “Graph – Combination”



In the window “**Graph – Combination**”, the combined results are represented in a graph window. “Combination” is displayed appear in the headline of the window.

The results can be displayed as a bar diagram, a cumulative distribution (Q(x)), a cumulative distribution of residue (1-Q(x)) or as a frequency distribution (q(x))”. The functions are similar here.

The display of the results in this window can be changed using the icon bar and the menu functions, and they can be saved, copied and printed. To save the combined results, click ⎸-File⎸Save measurement file-⎸in the main menu. For a more detailed explanation of the functions of the menu items and the icons, please refer to chapter 7.4.2 “The menu `Results - Graph”.

For the evaluation of the combined results, a table window and a characteristics window are available. Both contain similar menu functions like the “usual” table window (please see chapter 7.4.1“The menu `Results – Table´”) and characteristics window (please see chapter 7.4.4 “The menu `Results – Characteristics´”.). A shape characteristics window is not available, as the sieve data do not contain information about the particle shape.

7.5 The menu “Options“

In the menu “Options”, the parameters for a measurement task can be set and edited, and reference data can be inserted.

The menu “Options” offers the following menu items:

- Measurement parameters
- Size classes
- Volume classes for Q (V) (optional)
- Classes for shape characteristics
- Overview class files

- Input reference distribution
- Create fitting file
- Info fitting file
- Input fraction limits

The menu item “Measurement parameters” opens a deck of register cards in which the measurement parameters can be defined. Please see also chapter 6.3 “Edit measuring parameters”. The register cards will be described in detail in chapter 7.5.1 “The menu `Options Measurement parameters´”.

“Size classes”, “Volume classes for Q(V)” and “Classes for shape characteristics” are part of the display parameters which are also available if the “Wizard”-Tool is used. From the main software menu, each of the windows can be opened individually by a click on the respective menu item.

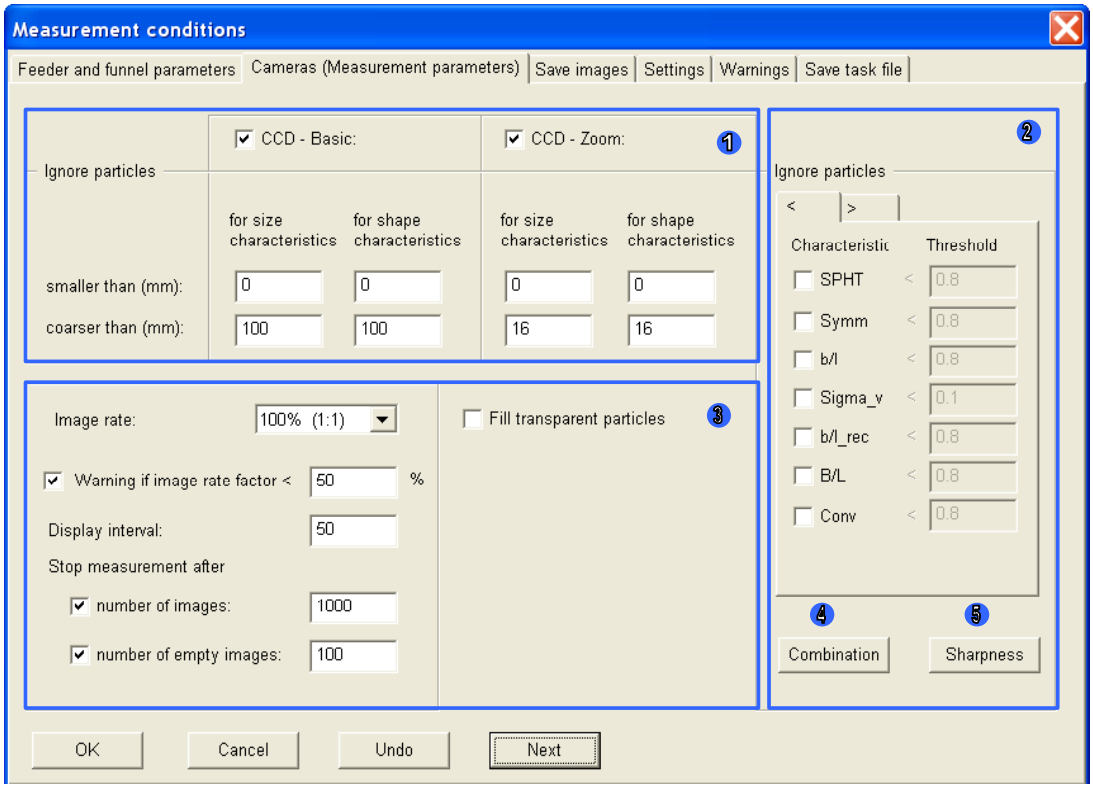
7.5.1 The menu “Options - Measurement parameters”

With the menu item “Measurement parameters”, the register card deck “Measurement conditions” is opened. The card “Cameras (Measurement parameters)” is visible first and can be edited. The other cards can be opened by navigation:

- With [Next] or [Enter], the next register card can be opened (except “Save task file”).
- With [Undo], the changes on the actual register card are reset.
- With [Cancel], all changes are reset and the register card deck is left.
- With [OK], the register card “Save task file” can be opened.

Each of the cards will be described in the following.

7.5.1.1 The register card “Cameras / Measurement parameters”



CCD-Basic & CCD-Zoom

Ignore particles

Define image rate

Set combination for particles ignored

Set sharpness for particles ignored

7.5.1.1.1 Define size of the particle ignored by CCD-Basic and CCD-Zoom

In this area, the recording of particles by CCD-Basic and CCD-Zoom can be activated. Mark the checkboxes of the respective camera. When these checkboxes have been activated, the lower and the upper limit for the size and the shape characteristics of the particles to be recorded by CCD-Basic and CCD-Zoom can be selected.

All particles that exceed (“coarser than”) or fall below (“smaller than”) these limits will be ignored in the measurement. Activate these settings by marking the checkboxes.

7.5.1.1.2 Set characteristics for particles ignored in files

- Define the settings of the particles to be ignored in the measurement result files. By a click on the tab [<] or [>], the threshold type can be selected. If particle parameters exceed or fall below these limits, they will be excluded in the raw data file.

Mark the checkbox of the parameter. The input box will become active, please insert the threshold.

7.5.1.1.3 Define the image rate

Image rate	Select the image rate from the drop-down menu. The standard value is 1:1 (100%). This may be altered if the processing speed is insufficient because of too many fine particles.
Warning	Activate a warning if the image rate factor falls below a defined value. Insert this value in the checkbox.
Display interval	Define the interval for the display of the images on you computer. The image display can be activated by a click on the respective button in the icon bar.
Fill transparent particles	When transparent particles are measured, it might occur that white areas exist in the middle of their projection. These areas will usually not be recognized as part of the particle and will be excluded from the measurement. If the option “Fill transparent particles” is activated, these white areas which are surrounded by a shadow projection will be filled automatically and thus will be included into the measurement.

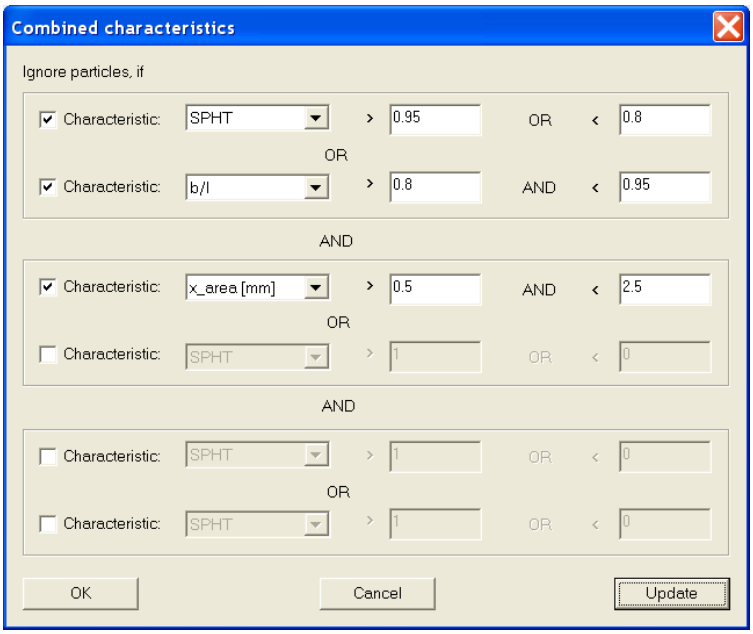
Stop measurement after

Number of images	Select the number of images to be recorded with CCD-Basic and CCD-Zoom. When the number is reached, the image recording will be stopped. The number will be divided between both cameras, i.e. if a total number of 1000 images is selected, 500 images will be recorded with each camera.
Number of empty images	An empty image is a camera recording with no detected particles. When the defined number of empty images (e.g. 150) will be reached, the measurement will be stopped. Answer the software query with [Yes] to terminate the measurement or [No] to continue, for example if some sample material is still left on the feeder. (Note: insert a value of typically between 150 and 500.)

7.5.1.1.4 Set combinations for parameters for particles that will be ignored

- Click the button [Combination]. The window “Combined characteristics” is opened.

In the window “Combined characteristics”:



- Mark the checkboxes to activate the input boxes for the characteristics. In the drop-down menu, select the characteristic. By a click on [Update], the combination will change to “AND” or “OR” depending on the entered thresholds so that this condition makes sense.

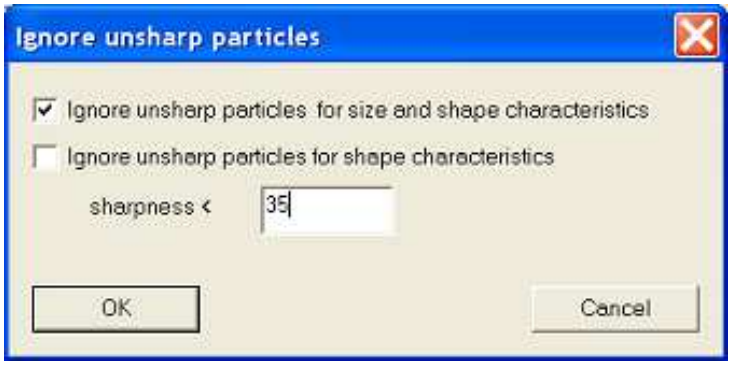
- In the example above, particles will be ignored which fulfill the condition:

(((SPHT > 0.95) OR (SPHT < 0.8) OR (b/l > 0.8) AND (b/l< 0.95))) AND ((x_area>0.5) AND (x_area < 2.5))

Particles that fulfill that condition will be ignored in the result files.

7.5.1.1.5 The button “Sharpness” in the register card “Cameras / Measurement parameters”

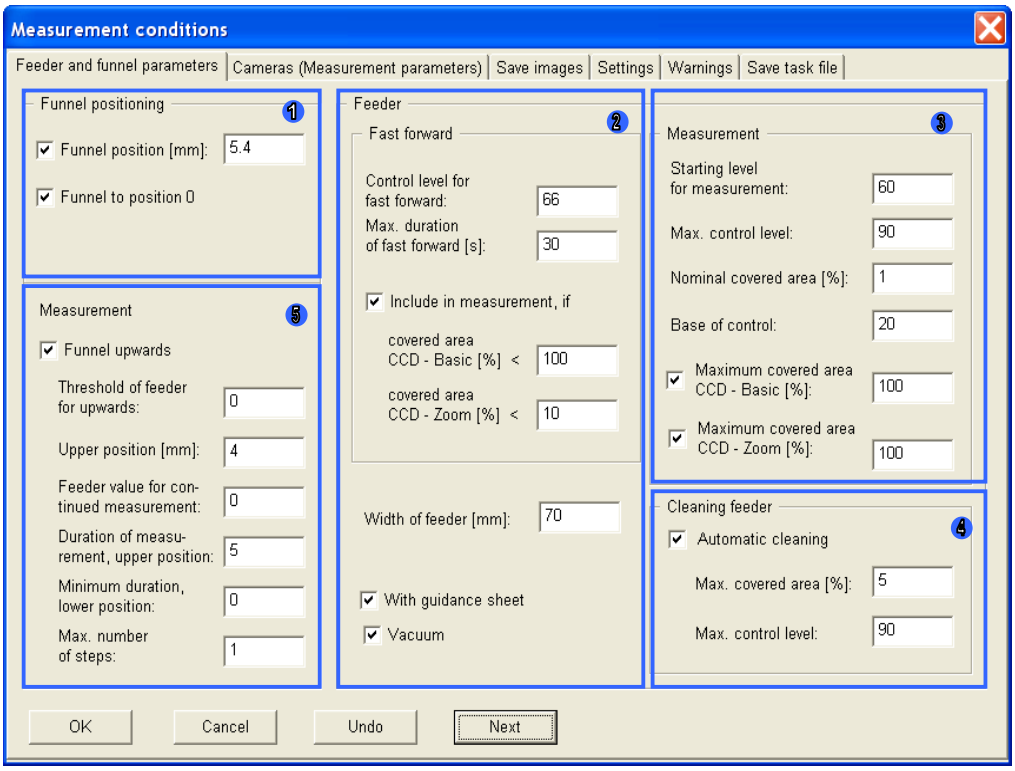
Click the button [Sharpness]. The window “Ignore unsharp particles” will be opened.



In the input box, set the value for the particle sharpness.
The value for the particle sharpness is derived from the edge sharpness of the particle. The maximum value for particle sharpness is 50. A normal value for particle sharpness is between 30 and 40.

All particles with a sharpness value smaller than the inserted value will be ignored in the measurement.

7.5.1.2 The register card “Feeder and funnel parameters”



1 Funnel positioning

The upper checkbox enables the automatic movement of the funnel to the preset funnel position. Correct the funnel position in the input box if required.

Mark the second checkbox to activate the funnel movement to the zero position at the start of the measurement.

2 Feeder

Fast forward	
Control level for fast forward	Set value for the feeder control level during the advance of the material from the funnel to the shaft (before the image acquisition). The control level for fast forward should be about 5 units higher than the starting level. Usually, this value is determined automatically by the test measurement.
Maximum duration of fast forward	Set the maximum duration of the advance period (in seconds) to feed the particles before the start of the actual measurement.
Include in measurement if	
Covered area CCD-Basic	A few particles might already fall into the shaft during the advance period. The particles may be discarded or included into the measurement if these checkboxes are marked.
Covered area CCD-Zoom	Set the level of covered image area at which the measurement can be included. Mark the checkbox of the respective camera. (Note: this option ensures that all particles are measured. Set this value higher than nominal covered area, for example basic 3% and zoom 5%.)
Width of feeder	Insert the width of the feeder in the input box.
Guidance sheet	Indicate the use of the guidance sheet
Vacuum	Indicate the use of the airflow.

❸ Measurement

Starting level for measurement	Feeder start value for the measurement. The feeder start value is determined automatically during the test measurement or when a new task file is defined.
Maximum control level	Maximum level for the feeder control. Avoid settings that cause uncontrolled bouncing of the particles at the end of the measurement process.
Nominal covered area (%)	Insert nominal shading (i.e. the percentage of the area covered with particles (shadowed) in relation to the total camera acquisition area).
Base of control	Insert number of images of which the average for the feeder control will be calculated (images per second).
Max. covered area CCD-Basic and CCD-Zoom	Insert maximum particle density in % for the CCD-Basic and the CCD-Zoom camera. Note: images with a covered area exceeding the entered value will be excluded from the evaluation! Suitable for fine particles.

Please note

There is a feedback loop between the feeder and the covered area, i.e. the feeder control level will be adapted if a certain level of covered area is exceeded.

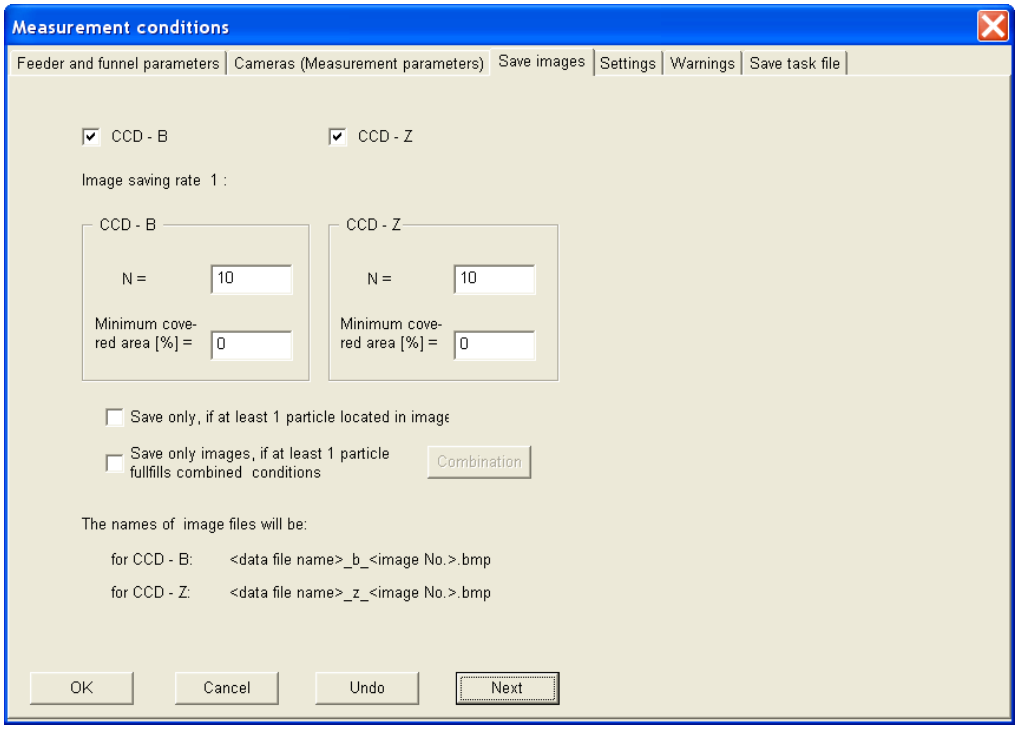
4 Cleaning feeder

Automatic cleaning 	Activate or deactivate the automatic cleaning after the measurement process. If the automatic cleaning has been deactivated, the feeder can also be cleaned manually. Click the respective button in the icon bar.
Maximum covered area	Insert the maximum covered area during the cleaning process.
Maximum control level	Insert the maximum feeder control during the cleaning process.

5 Measurement (Funnel and Feeder setting)

Threshold of feeder for upwards	Define the value of the feeder control at which the funnel will be run upwards.
Upper position (mm)	Define the height of the funnel in the upper position.
Feeder value for continued measurement	Define the feeder control value for the continued measurement.
Duration of measurement, upper position	Define the duration of the measurement while the funnel is in the upwards position.
Minimum duration, lower position	Define the minimum duration of the period the feeder lasts in the lower position.
Max. number of steps	Define the maximum number of performing this process (upwards and downwards movement of the funnel).

7.5.1.3 The register card “ Save images” (optional)



On this file card, the saving of the images recorded by CCD-Basic or CCD-Zoom can be activated.

Please note that this function requires much free hard disk space (about 735 KB per image). When the storage capacity is exhausted, the measurement will be cancelled.

The images will be saved in the folders of the task files under the subfolder “images”.

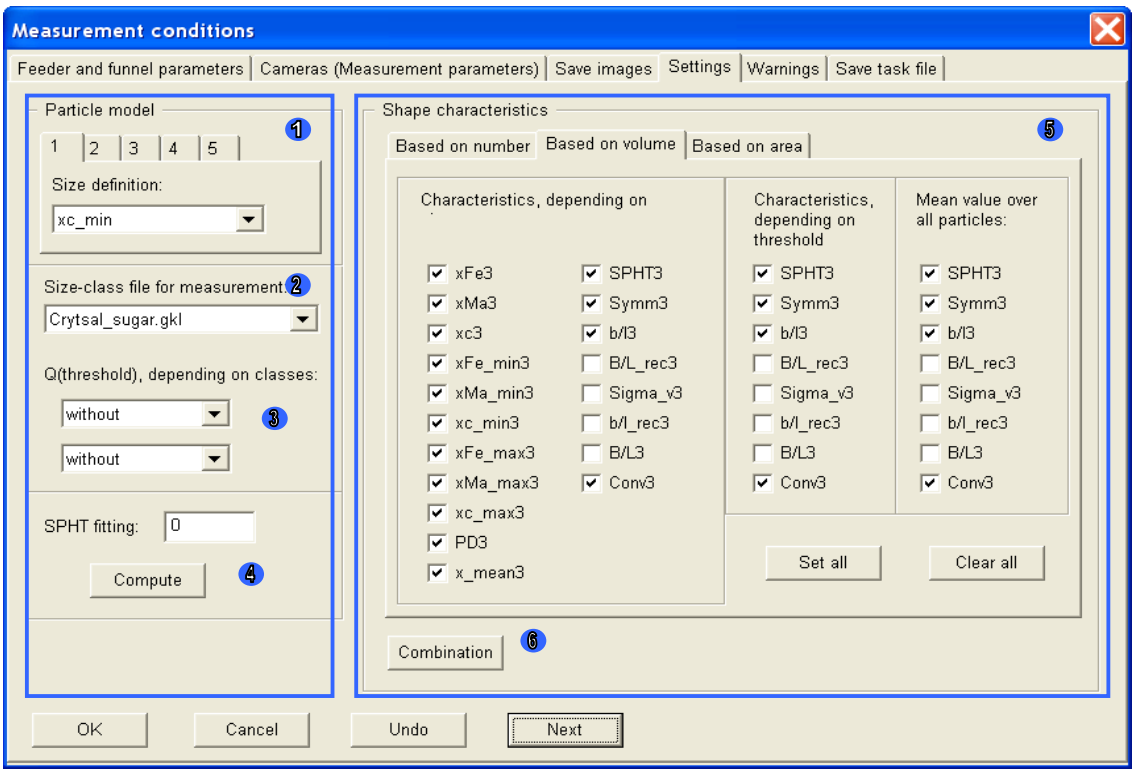
Single images can be saved during the measurement process by opening the live image and clicking the symbol “Save image” during measurement. For further details, please see chapter 7.6.1 “The menu `Extras - CCD-image´”.

N=	Defines the ratio between all images and the images to be saved. If N is set to 4, then every fourth image will be saved.
Minimum covered area (%)	Define the minimum covered area (shading) of the images that will be saved. In this way, the saving of empty images will be avoided.

When the checkbox “Save only, if at least one particle located in the image” is activated, images without any particles will not be saved.

Mark the checkbox “Save only, if at least one particle in the image fulfills the following condition“ to define the conditions of the particles to be saved in measurement. With a click on the button [Combination], the window “ignore particles, if” is opened in which the conditions of these particles can be defined. Please refer to chapter 7.5.1.1.4 “Set combinations for particles that will be ignored” for a description of this window.

7.5.1.4 The register card “Settings”



1. Particle model
2. Select size class file
3. Q-Threshold
4. SPHT-fitting
5. Shape characteristics
6. Combination

7.5.1.4.1 Settings – Select particle model

The “size” of a particle can be defined in different ways. The CAMSIZER® can measure up to 5 different particle “size values” in one step according to the following definitions:

x_area	From the shadow projections of the particle the equivalent diameter of a circle with an equivalent area is computed.
xc_min	Minimum chord; particle classification according to the minimum extension
xFe_min, Fe_max	Minimum and maximum Feret diameter (minimum and maximum extension)
xMa_min, xMa_max	Minimum and maximum Martin diameter
x_length	Diameter derived from the largest Feret and the smallest Martin-diameter
x_stretch	Stretched lengths of orientated extrudates
x_mesh	Minimum square around the particle projection (sieve analysis)
xMa_rec	Minimum ratio of xMa and xFe (vertically positioned to each other)

These parameters will be explained in more detail in chapter 8 “Characteristics”.

Up to five particle models can be selected for one measurement procedure. Please note that each particle size model results in a different distribution. Each particle size model allows measuring a different property of the

particle. The choice of the particle size model depends on the application, for example xc_min is a meaningful parameter to compare the CAMSIZER® results with sieve analysis data, whereas x_FeMax is often used for length measurements of extrudates.

The data of each selected particle size model are stored in a separate raw data file (*.rdf) with the filename (taskfile_particlemodel.rdf). The raw data files are stored in the CAMDAT-folder of the measurement file, for example:

Camsizer\CAMDAT\pvc_pheres\pvc_spheres_xc_min_001.rdf.

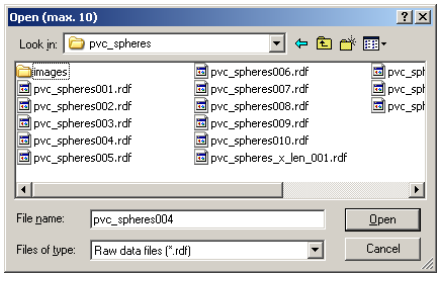
The number at the end of the file name indicates the count of the repetition of the measurement procedure of this task file. If the measurement is carried out for a second time, the file name will be:

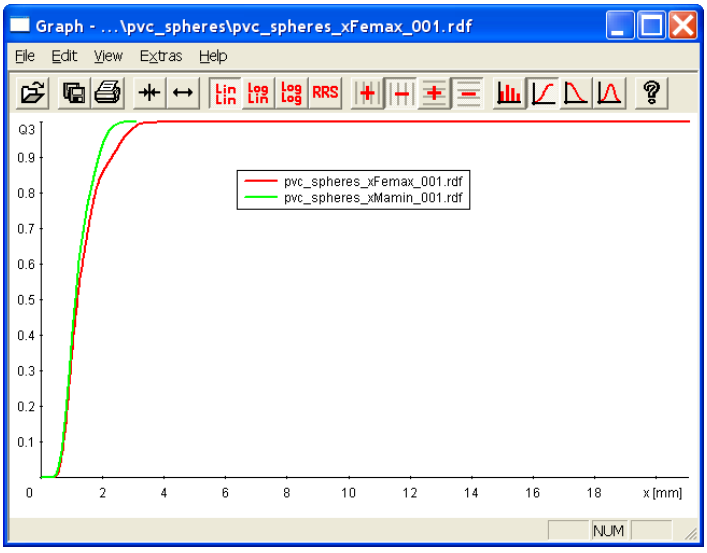
CAMDAT\pvc_ spheres\pvc_ spheres_ xc_min_002.rdf.

After the measurement, the particle size model 1 is displayed in the graphical display window. The other particle models can be selected in the graph window by a click on

|-File|Read comparison file-|, for example:

- CAMDAT\pvc_spheres\pvc_spheres_x_area_001.rdf.





7.5.1.4.2 Settings - Select size class file

Select the class file where the size classes have been defined. In the task file, the measurement parameters and conditions (for example particle size model etc.) are saved. Different measurements can be performed with the same task file.

7.5.1.4.3 Settings - Q-threshold value

Here you can select a class-dependent Q-threshold-value. This function is optional.

Depending on the selected value, the cumulative distribution or the cumulative distribution of residue of this threshold will be shown (please see chapter 7.4.1.2.3.1.4 “Characteristics – Q-threshold, depending on classes” for more detailed information).

Two Q-thresholds can be selected. These shape characteristics are saved in the classes that are defined in the size class file. The thresholds of this value can be edited after the measurement in the menu “View” of the window “Table”.

If the size classes are changed during the analysis of the results (after the measurement), the values will be interpolated, and can differ slightly from the original values.

7.5.1.4.4 Settings - SPHT-fitting

SPHT-fitting (not available in every software version) has been configured for the compensation of the sphericity deviation between the cameras CCD-Basic and CCD-Zoom. These deviations are caused by the different pixel resolutions of the two cameras.

Please note
This function is available after a measurement. Two raw data files of a previously performed measurement will be read. Click [Compute]. Select the raw data files recorded with CCD-B and CCD-Z in the dialogue windows.

Please see chapter 7.6.7 “The menu `Extras - Measure for SPHT-correction´” for a more detailed explanation of this function.

7.5.1.4.5 Settings - Shape characteristics

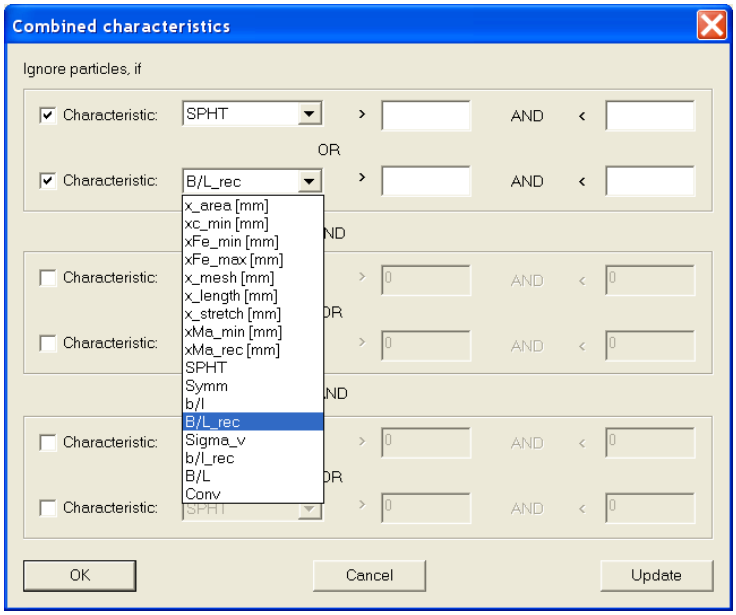
Define shape characteristics that will be measured in the following measurement procedure. Depending on your software version, the measurement of characteristics depending on area, volume or number can be selected.

Only those characteristics will be recorded in the raw data files that are defined in this window before the measurement. Please note that class-dependent characteristics influence the size of the raw data file; therefore select carefully which shape characteristics you would like to record.

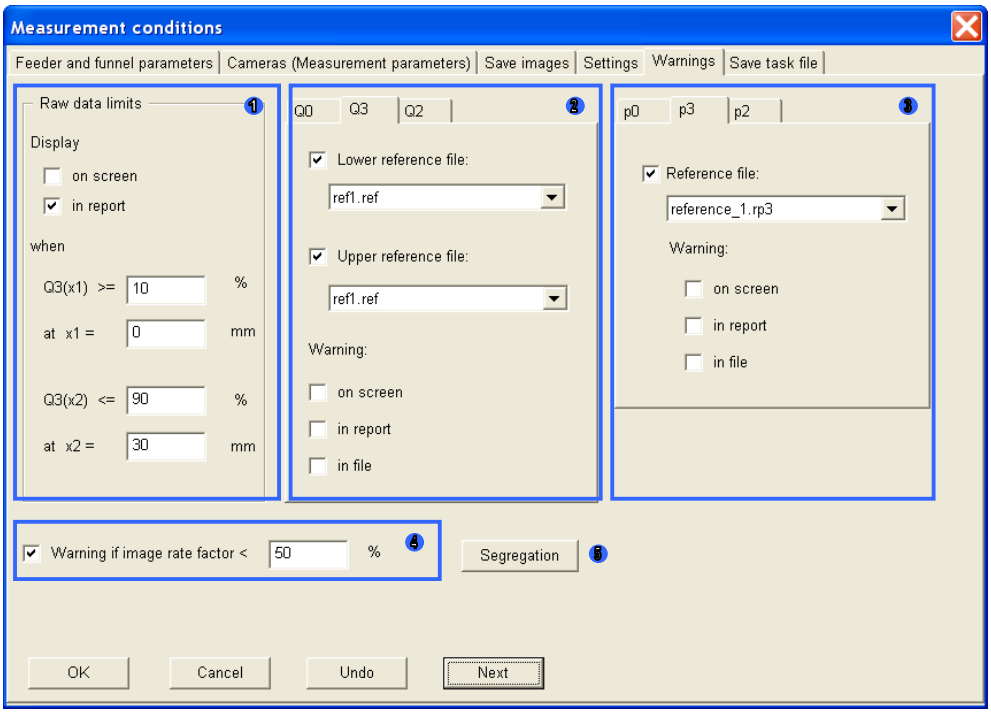
7.5.1.4.6 Settings - The button [Combination]

Set a combination of characteristics that are detected by the cameras. Only the particles whose characteristics correspond to the values inserted in this table will be recorded in the raw data file.

Mark the checkboxes to activate the input boxes. In the drop-down menu, select the characteristic. By a click on [Update], the combination will change to "AND" or "OR" depending on the entered thresholds so that this condition makes sense.



7.5.1.5 The register card “Warnings” (optional)



Activate warnings if the recorded results deviate from certain tolerance values.

1	Raw data limits
2	Reference files for Q_0 (x), Q_2(x), Q_3(x)
3	Fraction limits for p_3 , p_0 or p_2 (fractions)
4	Warning if image rate factor <
5	Segregation

7.5.1.5.1 Warnings - Raw data limits

Set volume-based limits for cumulative distribution. A warning appears on screen or in the report if Q_3 (x1) ≧ and /or Q_3 (x2) ≦ x(*the inserted value*). In this way , an alarm will be issued if a certain size (in mm) exceeds or falls below a certain proportion of the sample.

In the checkboxes in the "Display"-area, it can be selected whether the alarm appears on the screen and/or in the report. This function applies to the raw data. Shape parameters or fitting files are not taken into consideration.

7.5.1.5.2 Warnings - Reference files

A warning will be issued if the measured Q_3, Q_0 or Q_2-distributions fall below or exceed a selected reference file ("Upper reference file / Lower reference file"). The reference file can be selected by a click on the scroll bar. It can also be selected whether this warning will appear on the screen, in the report or in the file.

The warning also appears when the result files are loaded by selecting|-File|Open measurement file-|. If the results are exported to an EXCEL-file, the warning will be written in the headline. This function can also be applied to result files which have been fitted or to which a shape parameter has been applied.

Please note
To activate this warning function, a reference file has to be defined.
If this warning is activated it can be shown on the screen after the measurement or in the report. To create a reference file, please click |-Options | Input reference distribution-|(Please see chapter 7.5.6 for a more detailed explanation).

7.5.1.5.3 Warnings - p_3 , p_0 or p_2 (fractions)

A warning will be issued if the reference data p_3, p_3 or p_2
are infringed. Please select in the checkboxes whether the warning will appear on the screen, in the report or in the file. Select the reference file in the respective box.

This function can also be applied to result files which have been fitted or to which a shape parameter has been applied.

Please note
To use this function, a reference file has to be created. To create the reference file, please click │-Options│Input fraction limits-│, (please see chapter 7.5.9)

7.5.1.5.4 Warning if image rate factor <

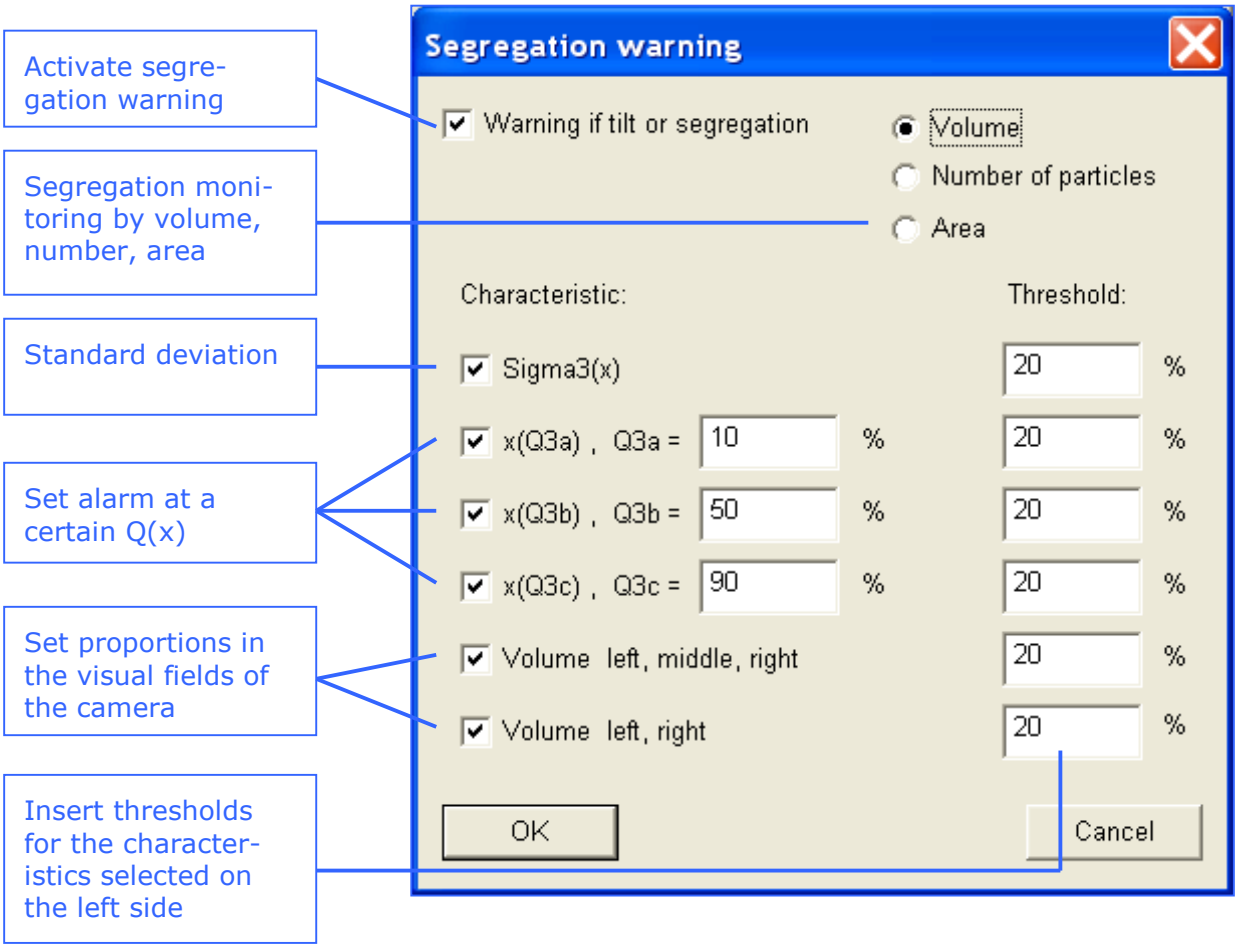
A warning will be issued if the number of images recorded per second falls below a certain percentage of the maximum possible image rate. A typical warning threshold is 95%. If the image rate is too low the measurement results might be wrong.

A low image rate might be caused by one of the following reasons:

- Too many fine particles with a high covered area value (acquisition too fast).
- Reduced processor capacity due to other software running on the PC.
- Reduced processor capacity due to other processor tasks such as data storage or graphics tasks such as frequent mouse actions.

7.5.1.5.5 Warnings - Segregation

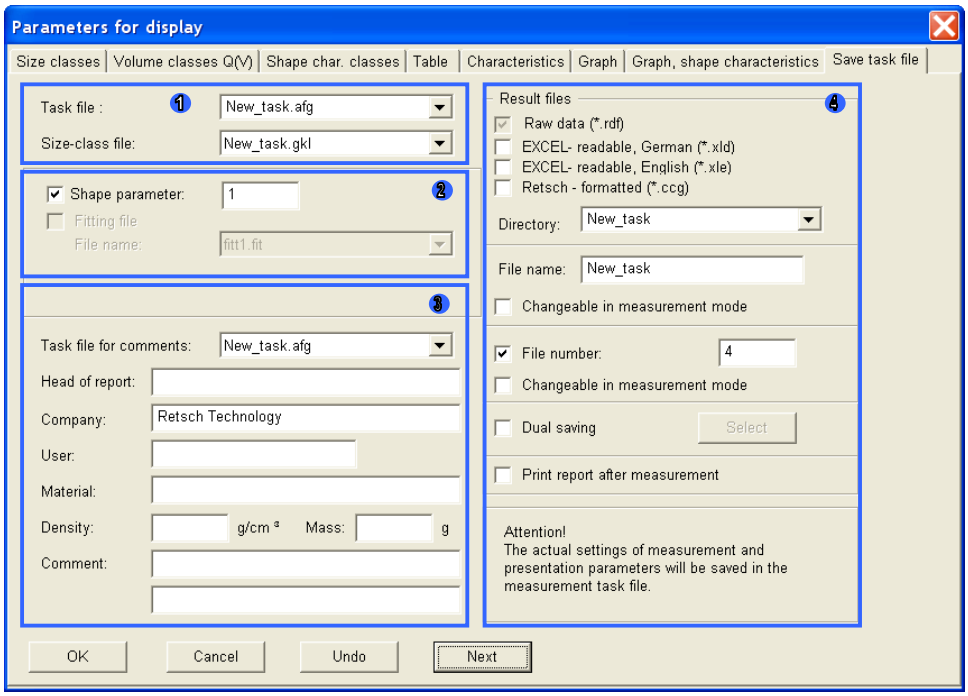
Set a segregation warning. Some materials have physical properties that may cause a segregation or agglomeration of the sample. In the dialogue window, the segregation warning concerning certain characteristics can be set. The user can set certain tolerance limits. If those limits are exceeded, a segregation warning is issued. This option is only used in rare cases.



7.5.1.6 The register card "Save task file"

After editing the measurement parameters, please open the card "Save task file". This register card is available in the window "Measurement conditions" and in the window "Display parameters". It is also available from the menu bar by selecting
|-File|Save task file-|.

The task file should be saved after the measurement conditions have been defined.



1	Select task file and size class file for the measurement and the preview.
2	Shape parameter or fitting file
3	Head of report
4	Result files

7.5.1.6.1 Save task file - Select task file and size class file

Select the task file and size class file under which the previously selected measurement parameters will be saved. These files will be used in the measurement procedure. Usually, the task file name and the size-class file are pre-selected; they have been defined when the task file was created (please see chapter 6.2 “Create a new task file”).

If you wish to save the edited acquisition parameters in another file, select the files in the drop-down-menus or enter a new task file name.

7.5.1.6.2 Save task file - Shape parameter and fitting file

The task file does not only define the parameters for the measurement, but also the parameters for the processing and display of the data. Therefore several display parameters are also stored with the task file.

Either a shape parameter or a fitting file can be inserted to alter the display of the data. Please mark the respective checkbox to select one of these options.

The shape parameter is a constant factor according to which the CAMSIZER®-distribution graph will be shifted on the x-axis. The scaling on the x-axis is multiplied with the shape parameter.

With a fitting file, the measurement results can be adjusted to a comparison file (reference file) Q_3 (x), for example a sieve result file. Please select the respective fitting file in the drop-down-menu.
For the availability of this function, the fitting file has to be created under |-Options|Fitting file-|, please see chapter 7.5.7).

7.5.1.6.3 Save task file - Head of report

Edit the labeling of the report. The input boxes “Header of the report”, “Company”, “User”, “Material” and “Comment” can be edited.

If you wish to compute the specific surface S_m and the relative density rD, the input of the density of the material is necessary, otherwise the calculation of these values will not be possible.

Please note
After the measurement parameters have been set, it is recommended to perform the measurement procedure before editing the display parameters. Most of the functions of the display parameters are available after the measurement process. All functions can be re-edited after the measurement process and will be updated in the measurement report.

7.5.1.6.4 Save task file - Result files

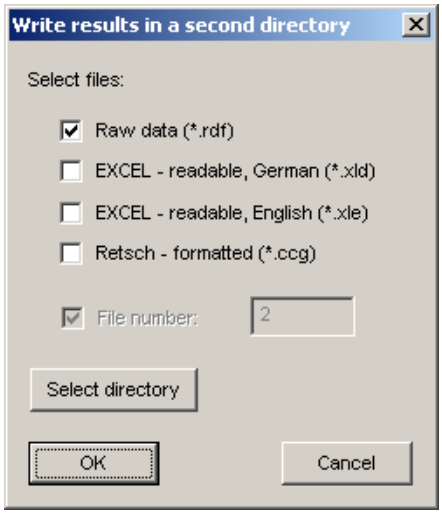
Select export files for the measurement task, and select the options for saving the files:

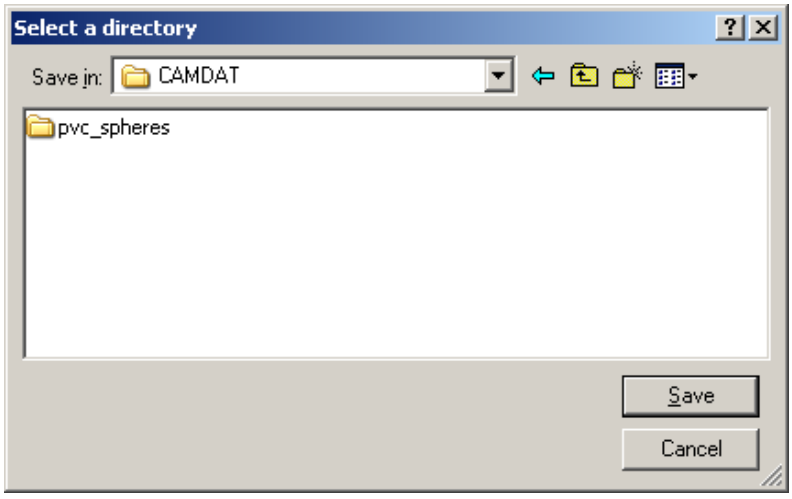
Export files	Raw data (*-rdf) EXCEL-readable, German (*.xld) EXCEL-readable, English (*.xle) Retsch formatted (*.ccg)
Input box “Directory”:	Insert the name of the directory under which the data will be stored.
Input box “File name”:	Insert the name of the file into the text box. The file will be saved using this name.
Changeable in measurement mode:	When this checkbox is marked, the filename and file number can be modified in the measurement mode when the measurement is started.
File number	When this checkbox is marked, a number will be added to the measurement result file if the measurement is repeated with the same task. After the first measurement, the files stored in the directory will have the name: \Camdat\Crystal sugar\ Crystal sugar1.rdf \Camdat\Crystal sugar\ Crystal sugar1.xle

Checkbox file number “Changeable in measurement mode”	In the following measurements, the number will be counted up: \Camdat\Crystal sugar\ Crystal sugar2.rdf \Camdat\Crystal sugar\ Crystal sugar2.xle If “File number” is not marked, the result files will be overwritten if the measurement task is repeated and the upcoming message “File already exists. Overwrite?” is answered with “Yes”.
	If the checkbox is not marked, the file number cannot be added to the file name in the measurement mode, and the file will be overwritten if the measurement is repeated with the same measurement task.

Dual saving:

Save the measurement result files additionally in a second directory. Mark the checkbox and click [Select]. The window “Write results in a second directory” is opened.





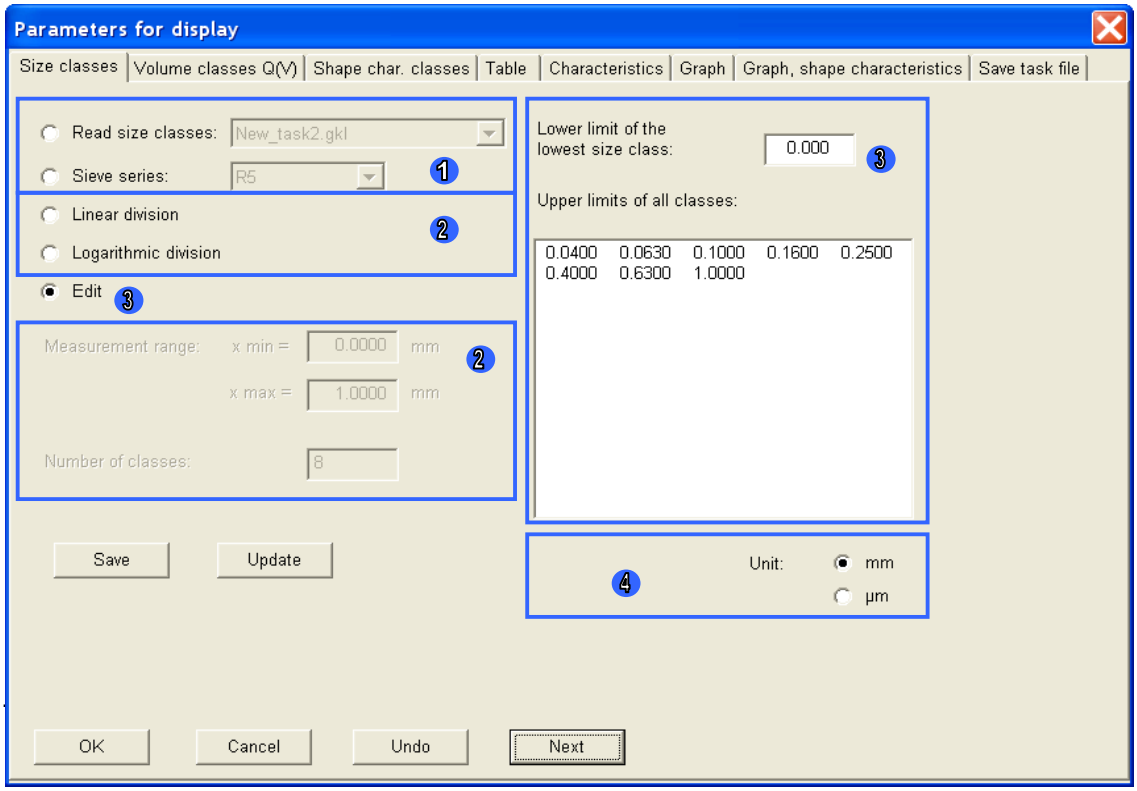
In the window “Write results in a second directory”, select the files that are to be saved in a second directory by marking the checkboxes. Click [Select directory]. The window “Select a directory” is opened. Select the directory in which the respective files are to be stored.

Please note
The register card "Save task file" and the window "Start measurement" (please see next chapter) look identical. However there is a difference:

In the window "Start measurement", you can select a task file and carry out a measurement using this task file. In the register card "Save task file", the changes made to the edited task file on the register cards "Measurement conditions" and "Parameters for display" can be saved, and the existing task file will be overwritten.

7.5.2. The menu "Options - Size classes"

Edit the size classes. The register card "Size classes" in the window "Parameters for display" is opened.



1 **Read size classes / sieve series:** Select the size classes from a previously saved file ("Read size classes") or select a sieve series. Usually, the class file for the current task file is displayed (*taskfile*.gkl). If you wish to use another class file, please select it in the respective drop-down-menu. Either a size class file or a sieve series can be selected.

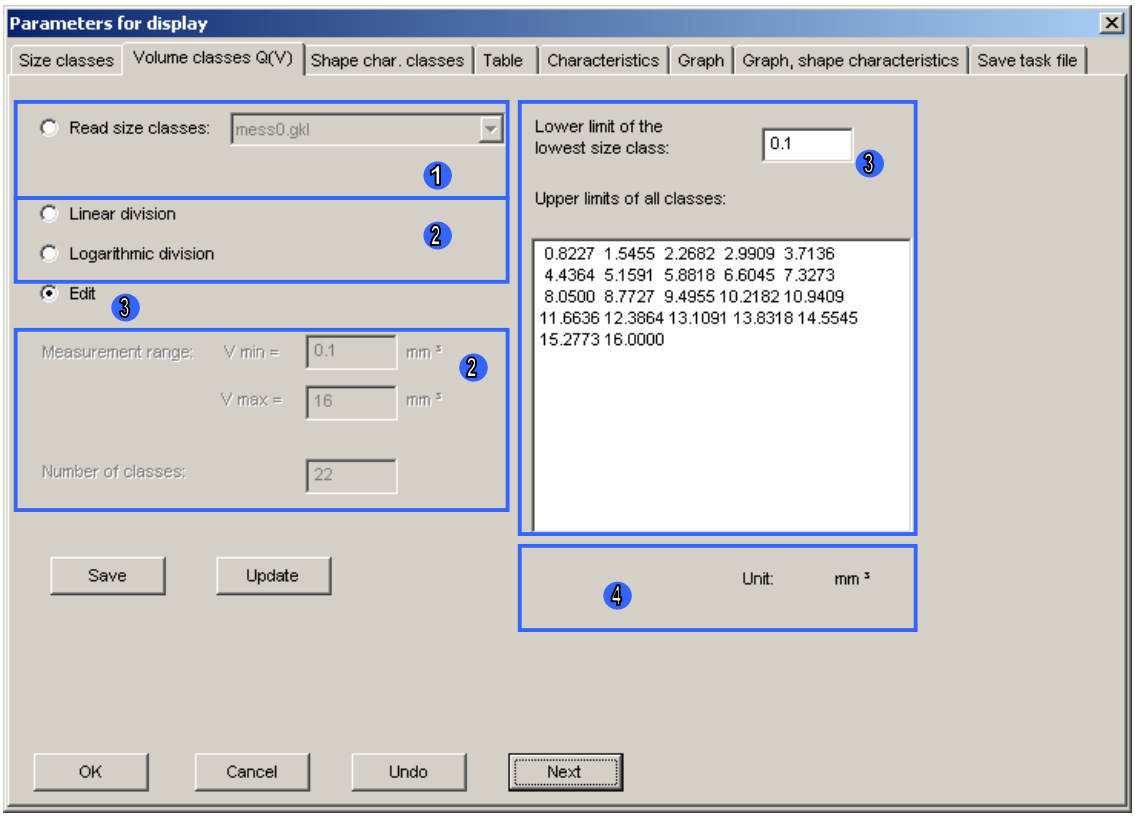
2 **Select the linear or logarithmic division of the classes**. The input boxes "Measurement range" and "Number of classes" will become active. Please insert these values for each type of class division.

3 **Edit**: When this checkbox is marked, the upper limits of all classes of the respective class division type and the lower limit of the lowest size class can be edited manually in the respective edit windows.

4 Select the **units** for the display of the values.
Click [Update] to apply the settings.

7.5.3 The menu "Options - Volume classes" (optional)

The representation of the particle distribution can be based on size or on volume. The calculation of the particle volume is based on the dimensions detected in the measurement process and a certain defined volume model. Please note that this individual definition of the volume model depends on the availability of a special configuration in your software version.



In the window “Volume classes”, the classes for the volume distribution can be defined.

The window “Volume classes” is structured similar to the window “size classes” and offers the following setting options:

1 **Read size classes**
Read the classes for a volume representation from a file that has been previously saved. Usually, the volume class file (GKL-file) for the current task file is displayed. If you wish to use another class file, please select it from the drop-down-menu. The selection of a sieve series is not available here.

2 **Linear / logarithmic division**
Activate the checkboxes for the linear and logarithmic division. In the input boxes, set the measurement range for the division (minimum and maximum volume).

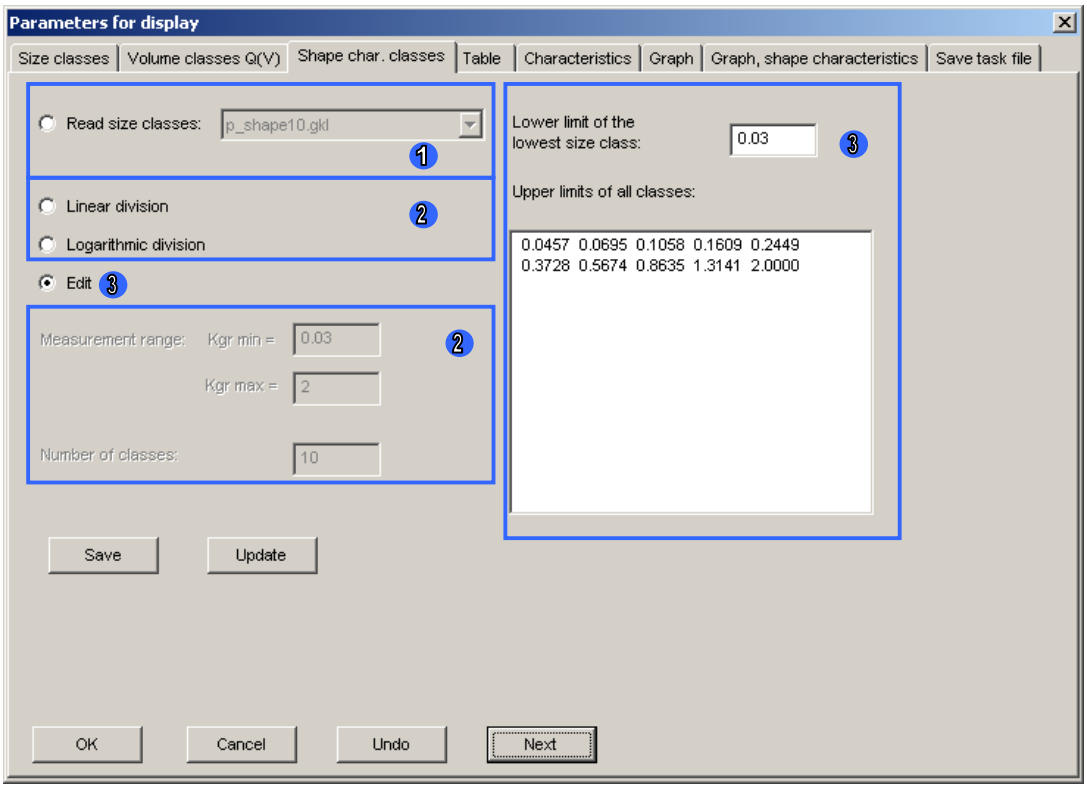
3 **Edit**
Select “edit” to edit the upper limits of the classes and the lower limit of the lowest volume class. The edit-window becomes active for each class type.

4 **Unit**
The unit available here is mm^3.

Click [Update] to apply the settings. Click [Save] to save the settings.

Please note
It is recommended to assign a suitable name to the size class files to enable the user to easily identify the individual files of the size, volume or shape characteristics

7.5.4 The menu “Options - Classes for shape characteristics“



In particle measurement, the particle size and the volume and shape characteristics can be measured. In the window “Shape classes”, the parameters for the display of the shape characteristics classes can be edited.

The window is structured similar to the window “Size classes”, however the options “Sieve series” and “Units” are not available.

1 **Read size classes**

Use the class file of the current task or select a saved task file from the drop-down-menu.

2 **Linear / logarithmic division:**

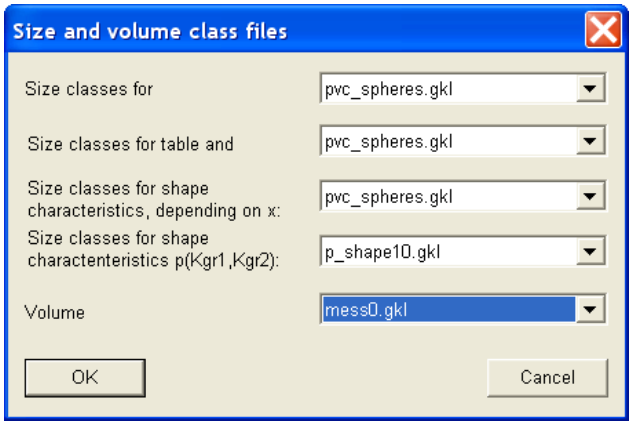
Activate the checkboxes for the linear and logarithmic division. In the input boxes, set the measurement range (minimum and maximum grain size) for the division.

3 **Edit**

Select “edit” to edit the upper limits of the classes and the lower limit of the lowest class. The edit-window becomes active for each class type.

Click [Update] to apply the settings. Click [Save] to save the settings.

7.5.5 The menu “Options - Overview class files“



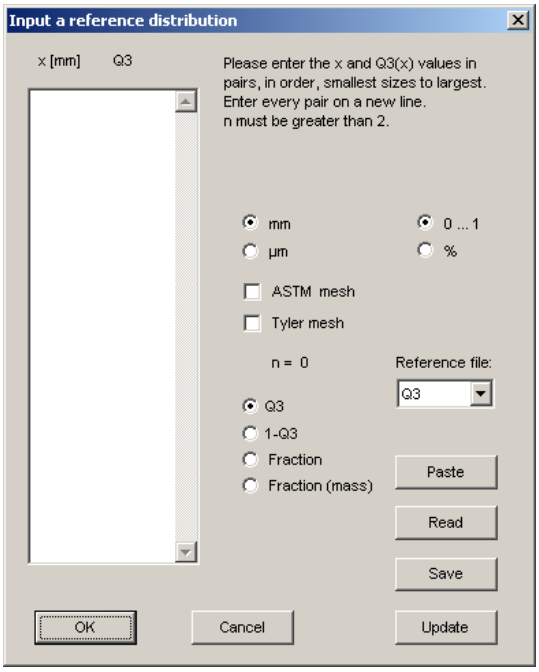
View the size class files and the volume class file used for the measurement task.

Please note

In this menu, the files cannot be changed. If you would like to select other files, please select them on the respective file cards and save the task file on the register card “Save task file”. The task files will be updated in the dialogue “Overview class files”.

7.5.6 The menu "Options - Input reference distribution"

A reference distribution is a cumulative distribution that can be entered to compare the CAMSIZER®-results with the data of a reference file.



This reference distribution can be loaded in the window "Graph" in the menu │-View │Characteristics-│ (please see chapter 7.4.2 "The menu ' Results – Graph ´").

To insert a reference distribution, please click onto the menu item "Input reference distribution". The window "Input a reference distribution" will be opened.

To input a reference distribution

1. In the window "Input a reference distribution", define the settings for the x-axis and the y-axis of the coordinate system: select the units of the particle size display in µm or in mm (x-axis), and the scaling of the y-axis in % or on a scale from 0…1.

2. If you wish to insert the reference distribution of an ASTM or a Tyler Mesh, please mark the respective checkboxes.

3. Mark the insertion of the reference data as a cumulative distribution (Q_3), a cumulative distribution of residue ($1-Q_3$), as fractions or as mass-related fractions. In the drop-down menu on the right side, the particle size based on number (Q_0), area (Q_2) or volume (Q_3) can be selected (except from mass-related fractions).

7.5.6.1 Input reference distribution - Manual insertion

Insert the x- and the y-value separated by a blank space in the edit field, i.e. the blank space on the left side (use a dot for a comma). The y-value depends on the selection of the scale in % or on a scale from 0…1.

x-value		**y-value**	
µm	mm		
500	0.5	15	**y-axis in %**
500	0.5	0.15	**y-axis 0…1**

The order of the inserted values depends on the distribution type selected in the drop down menu.

Q3 (x)	• Enter the particle diameter x in ascending order • Enter the cumulative distribution $Q_3(x)$. $Q_3(x)$ has to be strictly monotonously ascending, i.e. the same values are not permitted.
1-Q3 (x)	• Enter the particle diameter x in ascending order • Enter the residue $1-Q_3(x)$ in a strictly monotonously descending order, i.e. the same values are not permitted.
Fraction p	• Enter the particle diameter x in descending order • Enter the fractions $p_3(x)$. The total sum of the fractions must amount to 1.
Fraction (mass)	• Enter the lower class limits of the particle diameter x in descending order. • Enter the fractions $p_3(x)$ as a mass. Enter the mass of material lying on the single sieves.

7.5.6.2 Input reference distribution - Paste a distribution

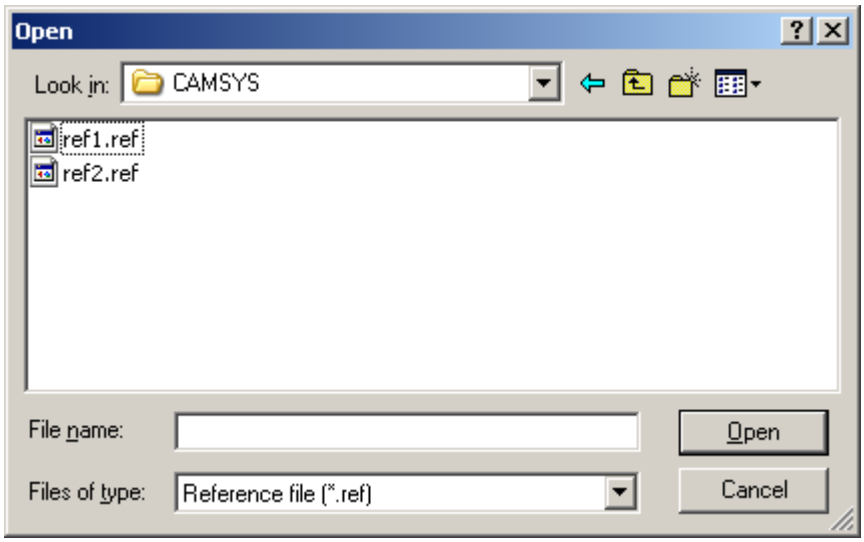
Paste a distribution that had been copied to the clipboard into the edit field. Use the button [**Paste**]. With a click on [**Save**], this distribution will be saved as a reference distribution and can be loaded.

7.5.6.3 Input reference distribution - Edit a saved reference distribution

By a click on the button [Read], a saved reference file can be loaded in the edit window, and can be edited if necessary. The reference files in *.ref-format are stored in the folder “CAMSYS”.

The following file formats can be read:

- Retsch-file (*.ccg)
- Size-class-file (*.gkl)
- Reference file (*.ref)
- Text file (*.txt). The text file must be arranged in 2 columns containing x and Q(x). The x-value must be increasing.



Click [Open] to load the file in the edit window. Any data in the field will be overwritten.

- Tabs or spaces are interpreted as separators
- Commas or dots are interpreted as decimal points
- Comment lines must not include any numbers

If [Update] is clicked, the software will check for correct input of the file. Click [Save] to save the file.

7.5.7 The menu "Options - Create a fitting file"

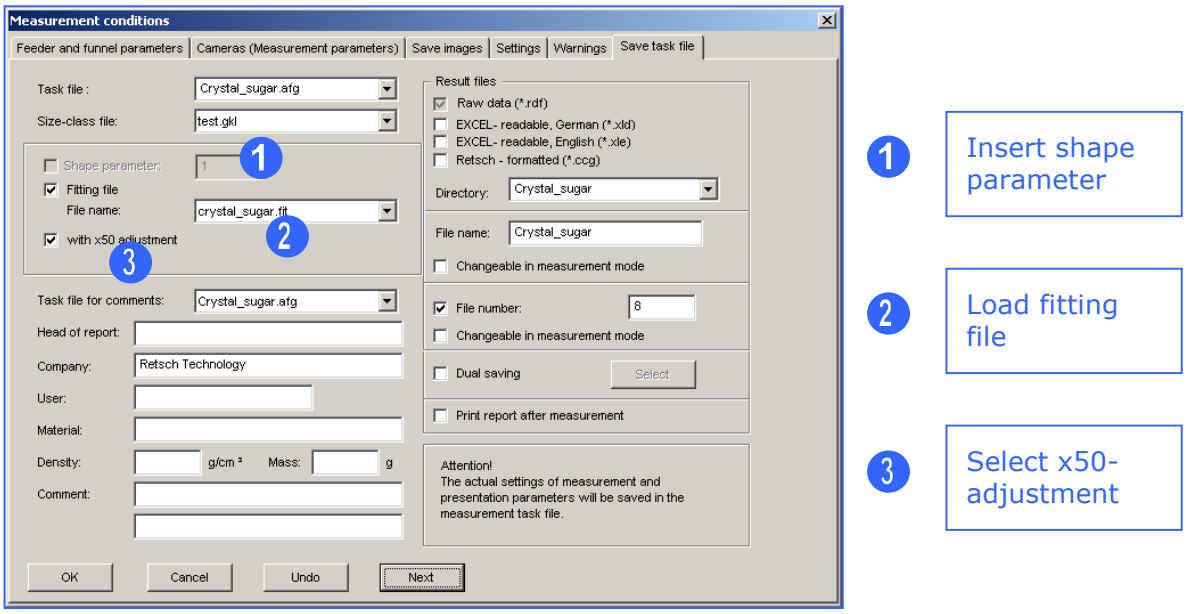
Fitting is used to match the results of a CAMSIZER® analysis with the data collected using a different method, e.g. sieve analysis. The measurement with the CAMSIZER® bears the advantages of being more precise and less laborious, however the analysis results may diverge from those of sieve analysis.

The reason is that the size of the particle measured with the CAMSIZER® is measured as a physical dimension that can be equated with the size of a sieve mesh: This dimension is the smallest maximum chord $x_{c\ min}$. Particle images are taken with random views because of rotation, as the particles fall under gravity. A three-dimensional particle has multiple 2-D views depending on its orientation and shape.

Due to this fact, the size distribution of non-spherical particles is measured broader than for example when measured with sieve analysis. One exception is the particle model of ellipsoids and spheres that can be inserted if the software is configured adequately. Here the results of $x_{c\ min}$ measurements are directly comparable with the results obtained by sieving (depending on the particle shape and the particle size).

By fitting, the results of the CAMSIZER® can be adjusted towards the results of sieve analysis. In this way, the results of a CAMSIZER®-measurement will contain similar information like sieve analysis. This function is especially suitable for customers that have been using sieve analysis recently and would like the results of the CAMSIZER®-measurement to be comparable with these sieve analysis results.

To fit the results of a CAMSIZER®-measurement, either a fitting file can be created, or a shape parameter can be inserted. Fitting file or shape parameter will be selected in the window "**Save task file**" before or after measurement.



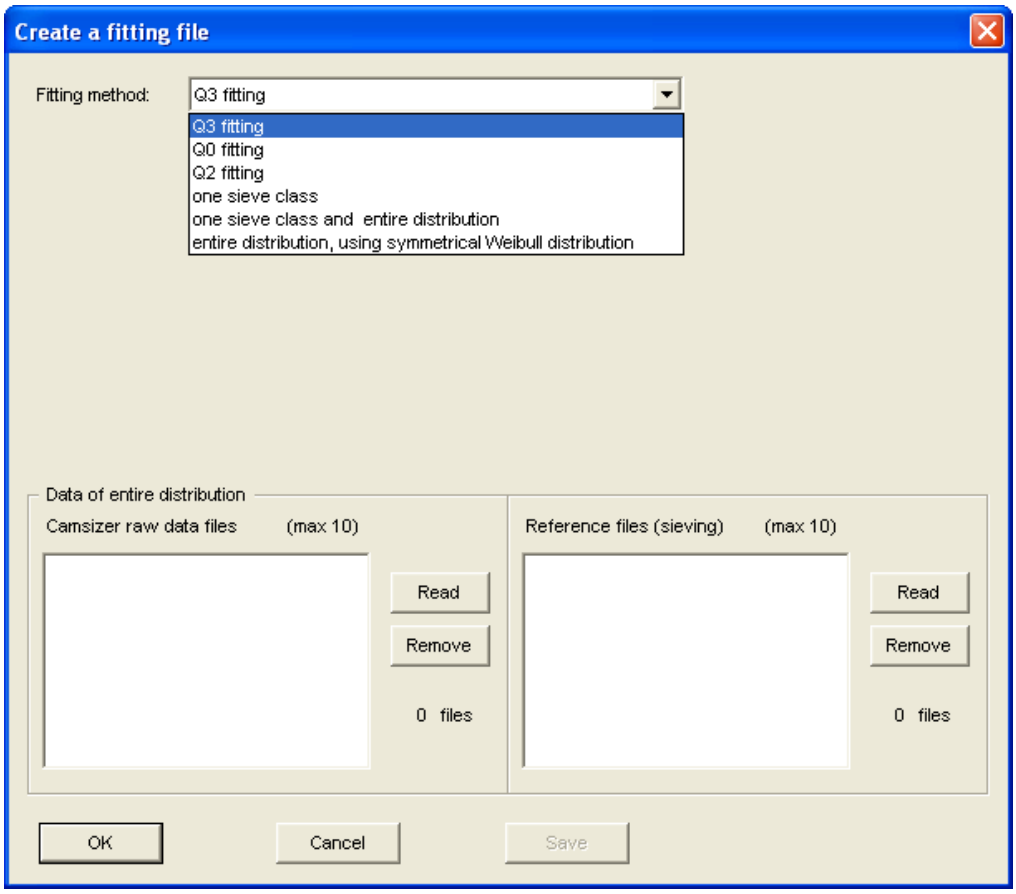
7.5.7.1 Fitting using a shape parameter

On the register card “Save task file”, mark the checkbox and insert the shape parameter. The shape parameter is a constant factor according to which the CAMSIZER®-distribution graph will be shifted on the x-axis. The scaling on the x-axis is multiplied with the shape parameter.

7.5.7.2 Fitting using a reference distribution

When the menu item “Fitting file” is selected, the window “Create a fitting file” is opened offering different functions for the creation of a fitting file:

- Q(0)-fitting
- Q(2)-fitting
- Q(3)-fitting
- One sieve class
- One sieve class and entire distribution
- Entire distribution, using symmetrical Weibull distribution

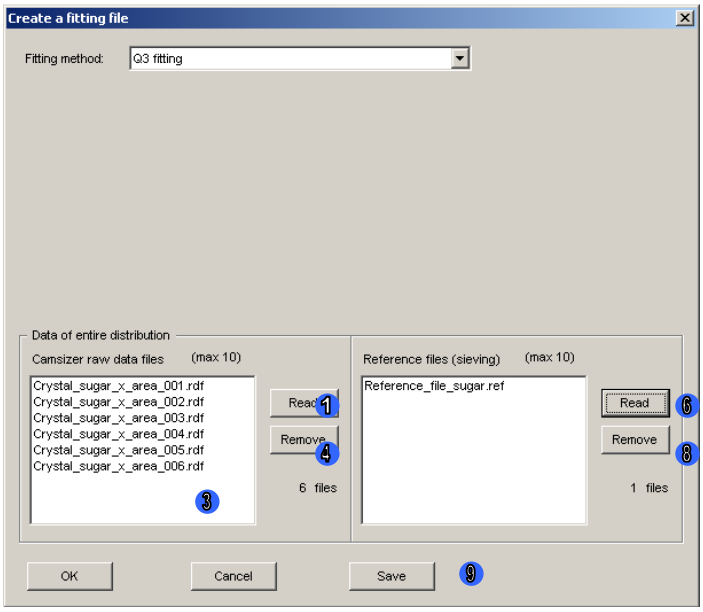


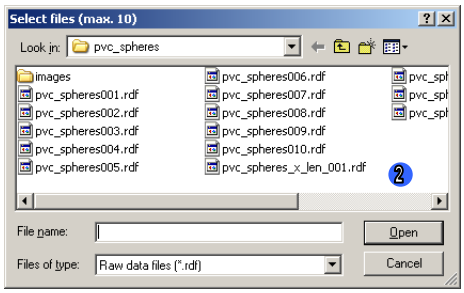
7.5.7.2.1 Fitting using a reference file: Q(0)-, Q(2) and Q(3)-fitting

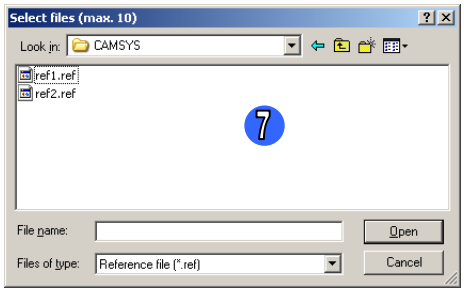
When a fitting file is created using a saved reference file, each class will be displaced individually. The reference file has to be created using |-Options|Input reference distribution-| (please see chapter 7.5.6).

Please note
When the reference distribution is inserted, please make sure that the minimum and maximum x-value is not inserted for 0 and 100%, but for 10 and 90%. The reason is that normally, a limited number of sieve classes is used, (usually up to 8 sieve classes), and that therefore no exact information is available about the absolute size of the smallest and the largest particle.

Therefore, the particle size that passes the sieve meshes at 100% may also be smaller than this value (e.g. a mesh of 2.0 mm is passed by particles of 2.0 mm, but also by the particles of 1.9 mm).
In this way, a higher sensitivity is reached for the coarse and fine particles in the distribution.







1. Click the button [Read] next to the edit box “data of entire distribution”.

2. The dialogue “Select files” is opened where the raw data files stored in the folder “CAMDAT” are displayed. Select one or several raw data files. The number of files to be selected depends on the software version.

3. The files will be displayed in the edit box “Camsizer raw data files”.

4. With a click on the button [Remove], selected files can be removed. Mark the file you want to remove, then click the button [Remove].

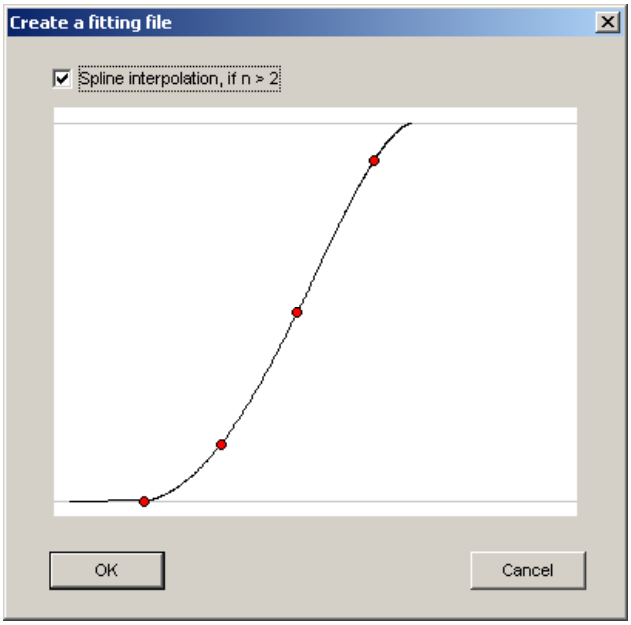
5. When all of the CAMSIZER® result files have been selected, the reference file according to which the raw data files should be fitted has to be selected in the right edit box.

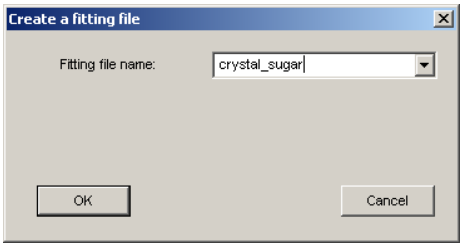
6. Click the button [Read] in the right edit box for “reference files (sieving)”.

7. The dialogue will be displayed where the reference files can be selected. Select the reference files and click on [Ok] in the dialogue. The reference files will appear in the right edit box.

8. The reference files can be removed by a click on the button [Remove].

9 Click the button [Save] to compute the fitting data. A window appears in which the graph of the fitting file is presented.





10 Mark the checkbox to activate the spline interpolation of the file. Normally, a fitting file without a spline interpolation is preferred.

Click [OK]. In the dialogue box, the name of the fitting file can be inserted. The file will be saved in *.fit-format in the directory CAMSYS. The file contains the calculation parameters for fitting.

Please note

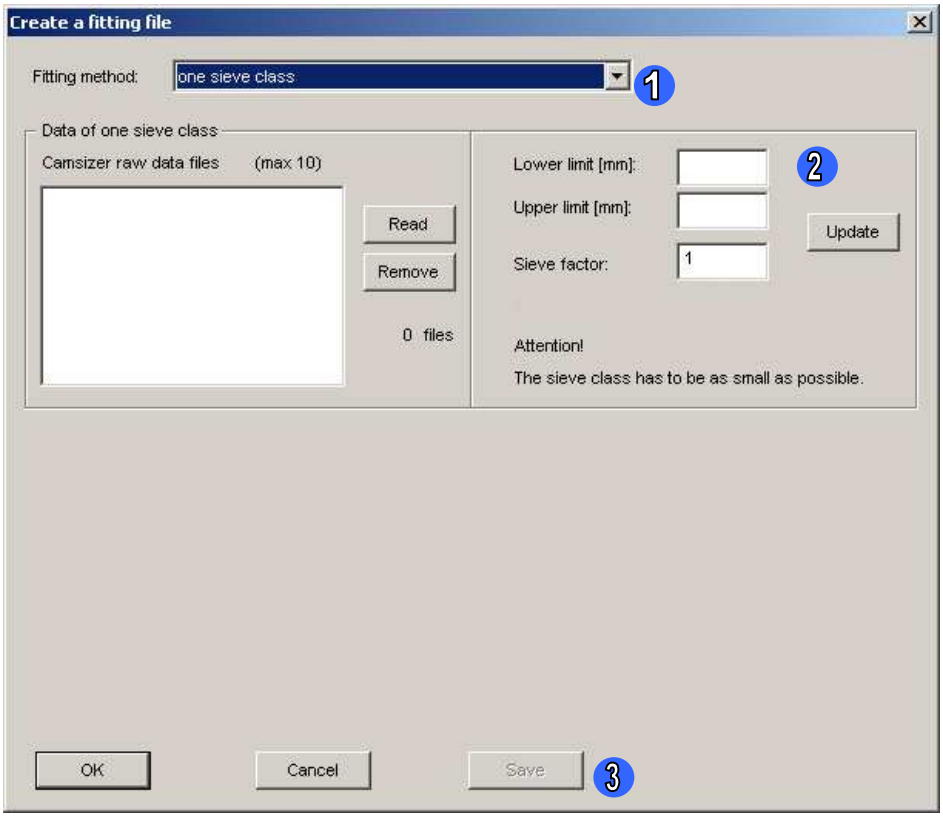
The Q_3, Q_0 and Q_2 fittings are simple fit algorithms. For more advanced algorithms, please refer to the elementary fitting (see following chapters) or the metafitting (separate documentation).

The shape of the particles may be different for different samples, or individual samples may have different Q_3 (x) distribution widths. Therefore certain variances between matched ("fitted") CAMSIZER® results and results obtained with the help of reference procedures (e.g. sieving) cannot be ruled out. So it cannot be guaranteed that the results of a fitted measurement coincide with those of a reference procedure.

7.5.7.2.2 Elementary fitting – One sieve class

Using the option "One sieve class", the information of one single sieve class is used to fit a whole distribution. This function is suitable for samples with a particle size independent from the particle shape.

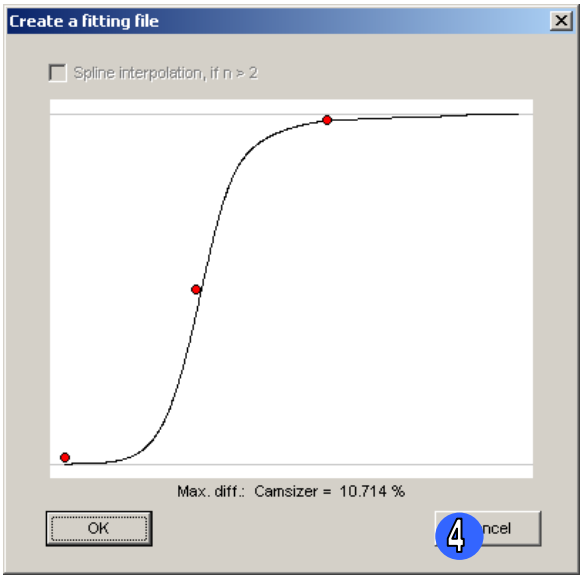
To use this function, a sieve analysis of a sample has to be carried out before. The particles of one sieve class (e.g. 0.5 … 0.6 mm) have to be analysed with the CAMSIZER® and saved as an RDF-file.



1 In the window, "One sieve class" has to be selected as a fitting method. Click [Read] to load the raw data file in the display window.

2 In the right area, the lower and the upper limit of the sieve class can be selected. The sieve factor 1 is the standard. If during sieving the sifting-out degree has not reached 100%, or if the sieve meshes do not any longer correspond to the specified size, the fitted CAMSIZER® result on the x-axis can be positioned correctly according to the sieve factor. Click [Update].

3 Click [Save] to save the fitting file. The fitting data will be computed. The fitting file will be displayed in a graph window.



4 In the lower part of this window, the maximum deviation of the CAMSIZER® data from the sieving results are displayed.

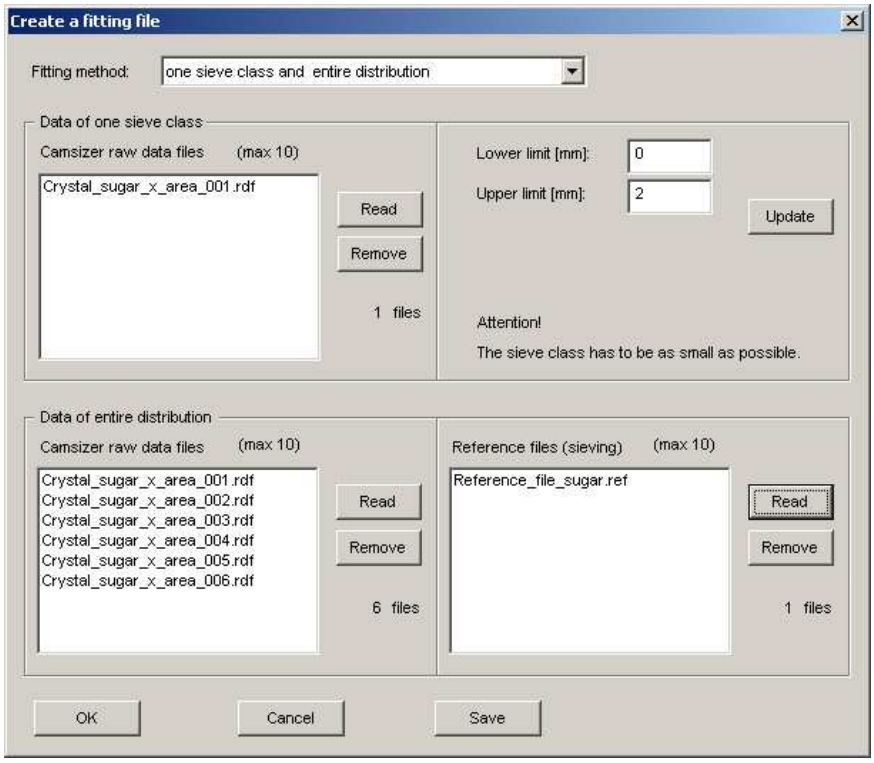
Click [OK]. A window appears in which the name can be inserted under which the fitting file is saved. The fitting file can be loaded in the window "Save task file".

7.5.7.2.3 One sieve class and entire distribution

For most applications, the fitting method "one sieve class and entire distribution" will be the most suitable method.

The combination of one sieve class and an entire distribution with a fitting file has the advantage that the shape characteristic that becomes apparent in one class, and the distribution width of the entire distribution are combined.

Once a fitting file has been defined using this algorithm, it can be applied to any measurement of the same sample material, even with a different distribution width or D50 value. However, the fitting algorithm may calculate misleading results if the fitting file is applied to samples with a different particle shape.

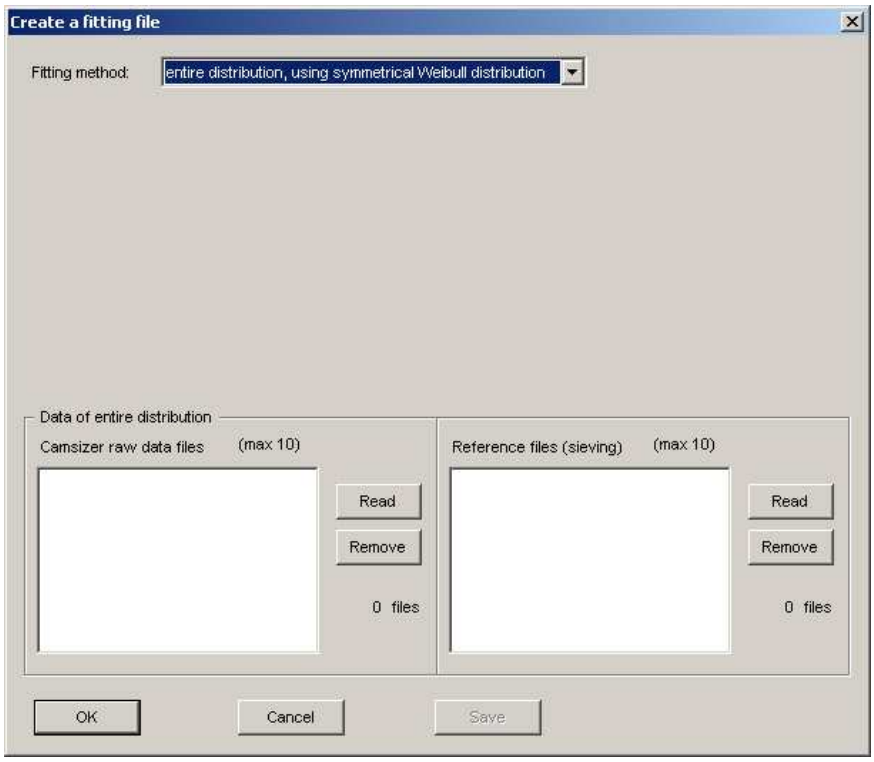


In the upper window, click [Read] to load the sieve class. The sieve class has to be measured with the CAMSIZER® before. In the lower box, select the CAMSIZER® raw data files. In the right box, select the reference file derived from sieving. Click [Save]. The fitting file will be created and saved.

7.5.7.2.4 Entire distribution using Weibull-distribution

Also, a fitting file can be created from an entire distribution using a Weibull-distribution. In this case, no prior separation of sieve classes is necessary. A sieve data file has to be available.

This fitting method is recommended for samples with symmetrical distributions, for example sugar or other angular particles.



For the procedure of creating the fitting file, please refer to chapter 7.5.7.2.1 “Fitting using a reference file”. The particle sample is measured with the CAMSIZER® and saved as a raw data file.

This raw data file is loaded in the window in the left area by a click on [Read]. By a click on [Remove], the data can be removed.

Click [Read] in the window in the right area to load the reference files. The reference files are loaded and appear in the display window.

Click [Save] to save the fitting file. The fitting file will be computed and saved, and can be selected in the window “Save task file”.

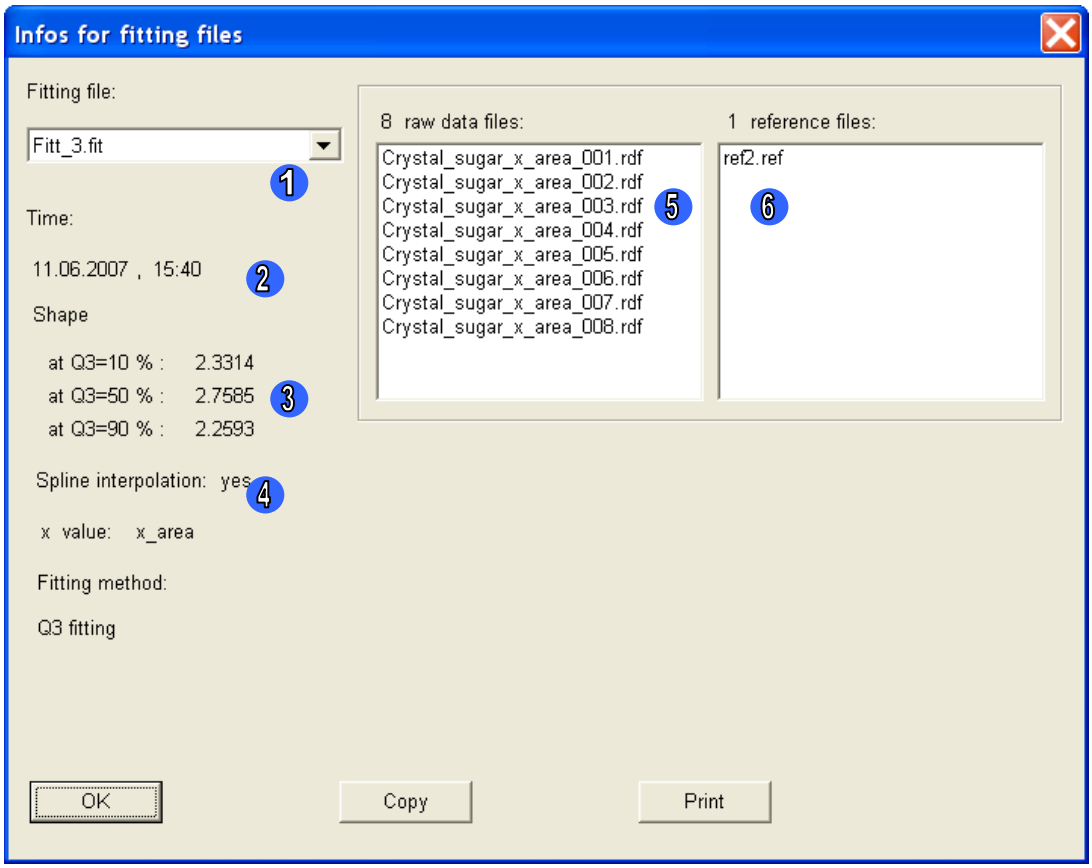
Please note

Fitting using Weibull-distributions should only be used for symmetrical distributions.

7.5.8 The menu "Options – Infos for fitting file"

With this menu item, information about the fitting file can be displayed.

The window "Infos for fitting files" is opened.



The following information are contained in the display window:

1. Fitting file: select the fitting file in the drop-down menu

2. Date and time of the creation of the fitting file

3. Form parameters that would be required for adjusting the measuring curves to the reference curves at Q_3=10 %, 50 % and 90 %

4. Indicate the use of a spline interpolation
   Show x_value (particle model)
   Show fitting method

5. Show raw data files included in the measurement.

⑥ Show name of the reference file.

With a click on [Copy], the data of the fitting file can be copied to the clipboard and pasted into other applications.

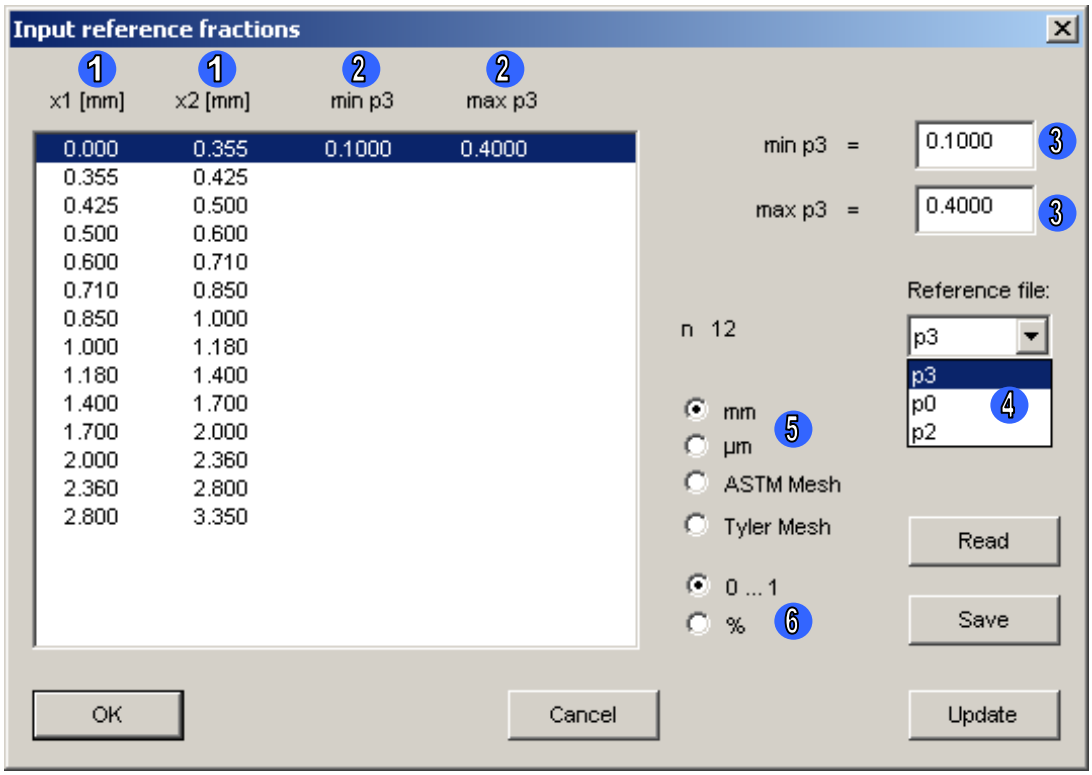
With [Print], the information about the fitting file can be printed.

7.5.9 The menu "Options - Input fraction limits"

This menu item is used for monitoring fractions. Fraction limits can be inserted and viewed by a click on |-View|Reference data-| in the graph window when the p_3-distribution of the data is selected. Fraction monitoring can be dependent on the number of particles, the area or the volume.

The input of the fraction limits is useful for example in quality control, when certain fractions of the sample should not exceed or fall below certain limits.

The reference fractions can be inserted in the window "Input reference fractions":



1 The lower (x1) and the upper (x2) limit of the fractions are displayed here. These values correspond to the size class file chosen in the window "Parameters for presentation" (register card "size classes" for the table presentation).

2 The minimum (min p_3) and the maximum (max p_3) fraction limits are displayed here.

3. The minimum (min p_3=) and the maximum (max p_3=) fraction limit values can be inserted here. Click [Update].

4. Select the number-based (p_0), area-based (p_2) or volume-based (p_3) reference fraction.

5. Select the display of the x-value in µm or mm. Select Tyler mesh or ASTM-mesh if necessary.

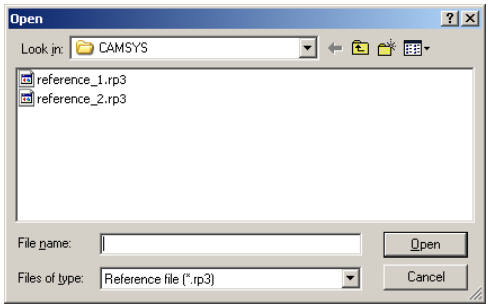
6. Select the display of the y-axis in % or as a scale from 0…1.

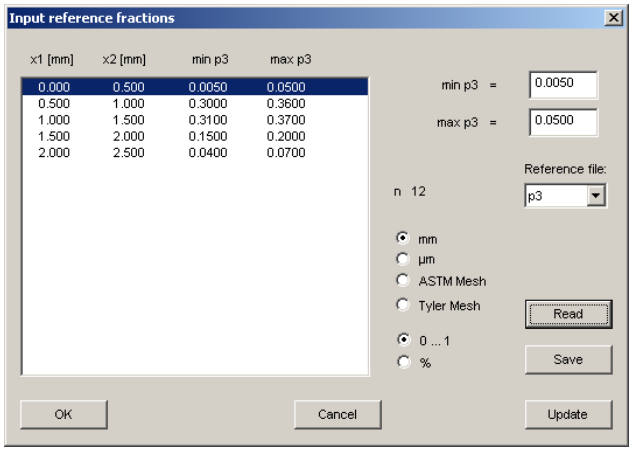
To insert the fraction limits:

Select the reference file type. Mark the line of the class in the display window. Insert the upper and the lower limit into the input box.
Click [Update]. The fraction limits will be displayed in the window. Mark the next line to create the fraction limits for the next fraction.

To read and edit a reference class file:

Click on the button [Read]. A window will open in which the reference fractions are stored. The reference class files are stored in the folder CAMSYS. Select the *.rp-file and click [Open]. The file will be displayed in the window and can be edited.

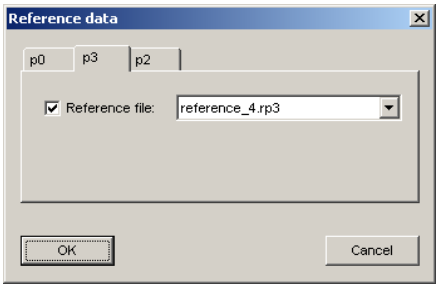


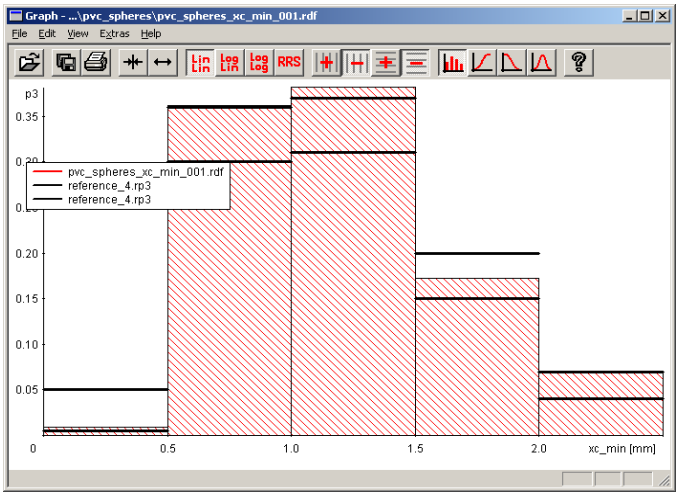


Click [Update] to update the entries. Click [Save] to save the entries.

To display the fraction limits:

In the graph window, select the display of the p_3-distribution.
Select |-View|Reference data-|.





Mark the checkbox “Reference file”. Select the respective tab for a p_2, p_0 or p_3-distribution. Click [OK]. The reference files for each distribution will be displayed and can be selected in the drop-down menu that opens with a click on the arrow button. The fraction limits will be displayed in the graph window. The choice of the characteristic of the y-axis must correspond to the chosen reference file (i.e. p_3 or p_0.).

7.6 The menu “Extras”

7.6.1 The menu “Extras - CCD-Image”

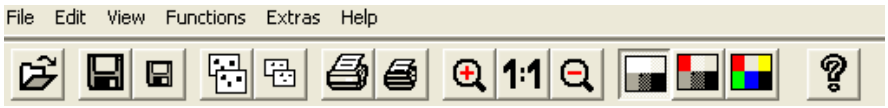
With the function CCD-image, the particles in the measurement shaft recorded by the cameras CCD-Basic and CCD-Zoom can be viewed. The CCD-image can be opened from the menu “Extras” or with a click on the respective icon.

The CCD-image can be viewed in two different modes:

- Saved images can be loaded and viewed (please refer to chapter 7.6.9 “Menu `Extras – Image evaluation´”).
- Live mode of CCD-images: viewing of images in the measurement shaft
  - o View images during measurement
  - o View images in the chute by using manual feeder control

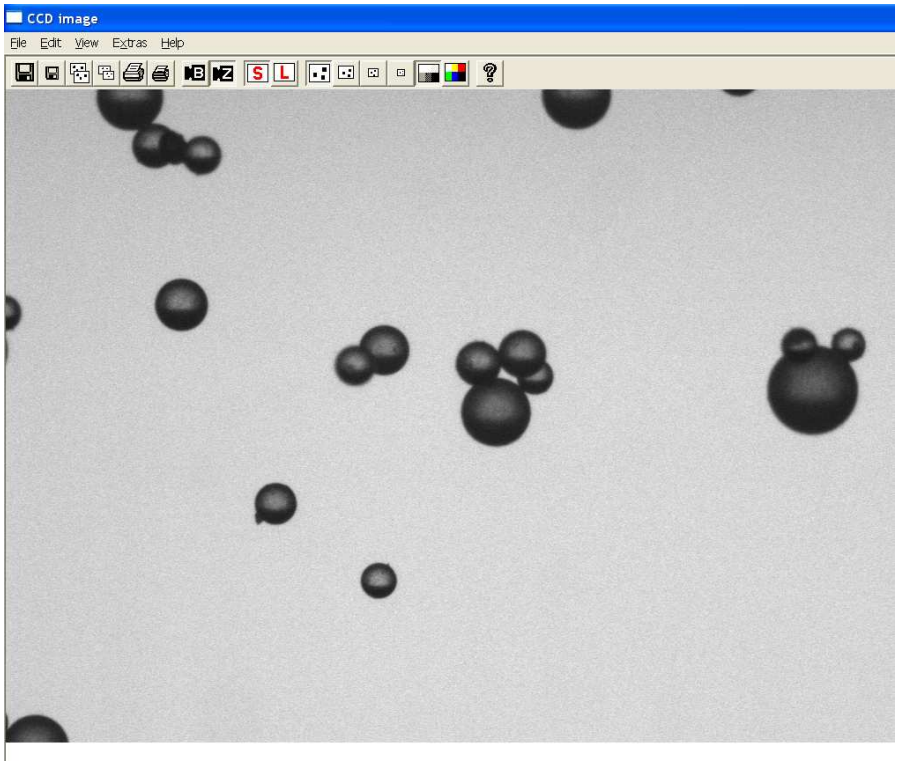
In this chapter, the live CCD-image (measurement or manual feeder control) will be described.

Saved CCD-images can be loaded and evaluated with a click on |-File |Read image- |. The menu and the icon bar of the loaded CCD-image and the live CCD-image are different.



Menu and icon bar of a loaded CCD-image

Menu and icon bar of the live CCD-image



7.6.1.1 CCD-Image - View particles in the shaft (manual feeder control)

To monitor the particles in the shaft, please activate the manual feeder control to move the particles into the shaft or start a particle measurement procedure.

By a click on “L” (live) or “S” (snap), the live image transfer of the camera can be activated or stopped.

When the particles fall into the chute, please click the icon “CCD-image” or click the menu -Extras CCD-image- . The CCD-image –window is opened.

7.6.1.2 CCD-Image - View particles during measurement

The CCD-image can be opened during measurement by a click on the respective icon. For a more detailed description, please see chapter 6.4 “Measure the sample”.

The following functions are **not available during measurement**:

- Snap / Live
- Grey / Pseudo colour (image display is always grey)
- Dark / Light
- Part of images

7.6.1.3 Menu and icon bar in the window “CCD-image”

In the following, the menu and icon bar of the window “CCD-image” will be described. The icons corresponding to the menu items will be shown if available.

7.6.1.3.1 The menu “File” in the window “CCD-image”

Read image	Open a saved image. The images saved during measurement are stored in a subfolder “Images” in the folder of the respective measurement task in the directory CAMDAT.
	Save an image. The folder of the currently used task file can be used or another folder can be selected.
	Save an image region. The folder of the currently opened task file can be used or another folder can be defined.
	Both functions can be used for saving individual images when monitoring images during measurement or in the feeder chute. The following formats are available for saving images: • BMP (8 bit, 256 colours) • PCX (8 bit, 256 colours) • Binary files (BID)
	Print image
	Print image region
Exit	Close the CCD-image window.

7.6.1.3.2 The menu “Copy” in the window “CCD-image”

	Copy image Copy image to the clipboard
	Copy image region Copy image region to the clipboard. Draw a rectangle around the image region you would like to copy to the clipboard.

Please note
An image region can be defined by enlargement or reduction of the image window, by shifting the scroll bars and by changing the image scale.

From the clipboard, images can be pasted into other applications.

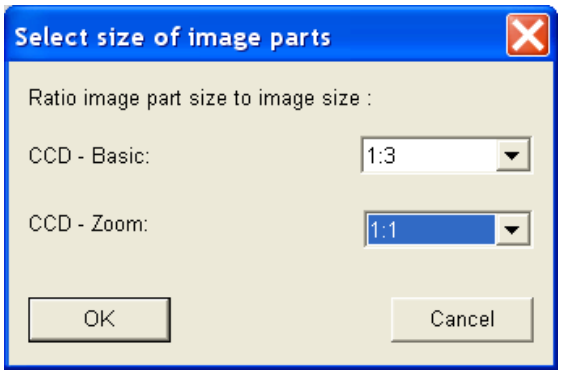
7.6.1.3.3 The menu “View” in the window “CCD-image”

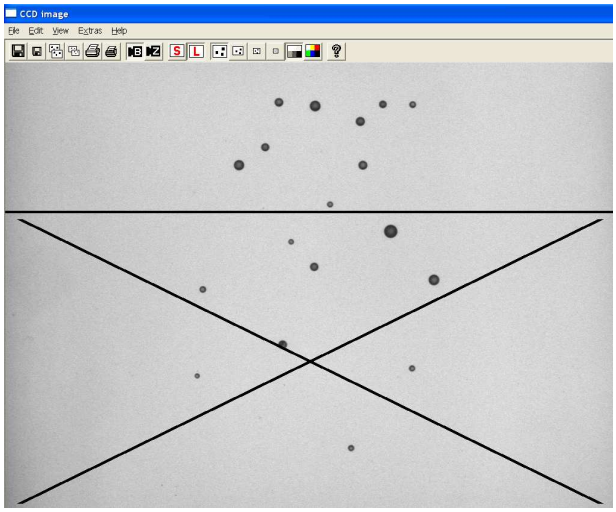
	**Live**: Activate live image transfer
	**Snap**: The live image transfer is “frozen”. The image can be saved by a click on the respective icon or via │-File│Save image-│.
	Display image recorded with **CCD-Basic**.
	Display image recorded with **CCD-Zoom**.
	Enlarge or reduce image size. The following scales are available: Factor 1; Factor 0.5; Factor 0.33; Factor 0.25
With scale (no icon)	Show a **scale** in the image display to reference the size of the particles.
	**Grey levels** Show the image in greyscale. This colour option is set by default.
	**Coloured** Display image in pseudo colours.
	Display online help.

7.6.1.3.4 The menu “Extras” in the window “CCD-image”

In the menu “Extras”, no icons are available.

Toolbar	Show or hide toolbar (=icon bar).
Status bar	Show or hide status bar.
The following functions are only available when working with in the manual feeder control, not in measurement mode.	
Dark	Reduce light intensity.
Light	Enhance light intensity.
Part of images	Limit the field of view of the cameras. Dependent on the settings, only the particles in this special part of the field are evaluated. If for example a scale of 1:3 is selected, the upper third of the image will be evaluated. This function is for example useful for evaluating bar-shaped particles or for counting particles in an image.





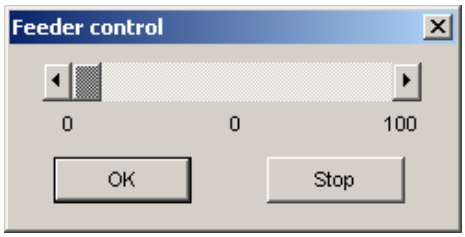
7.6.2 The menu “Extras - Feeder“

This menu item enables the manual regulation of the feeder control.

The menu item is suitable for the following functions:

- Monitoring samples in the chute
- Cleaning feeder after measurement
- Moving the sample to the border of the dosage feeder before measurement

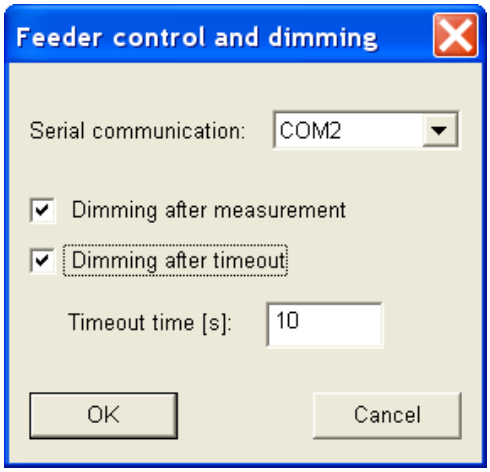
The window “Feeder control” is opened.



Move the slide bar until the desired intensity of the feeder control is reached. Click [Stop] when the dosage feeder is emptied or when the material has reached the border of the feeder.

Click [OK] to close the window.

7.6.3 The menu “Extras - Feeder and dimming configuration“



Select the serial communication interface (COM1 or COM2) and define the settings for dimming. Normally the software recognizes which COM port is used. To save energy and to extend the lifetime of the illumination unit, the illumination can be dimmed when no measurement is carried out with the CAMSIZER®.

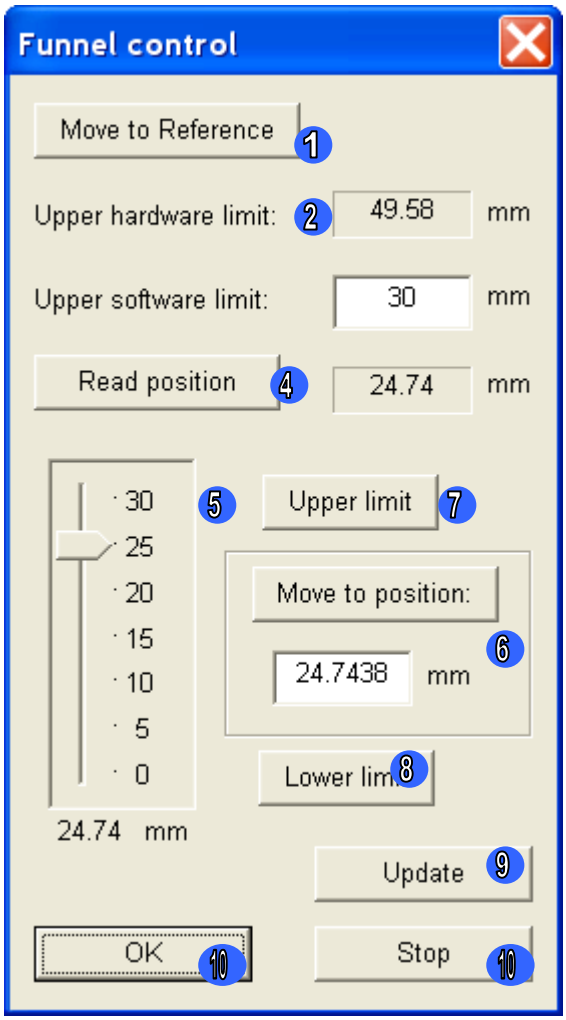
Dimming after measurement and / or dimming after a timeout can be activated. If “Dimming after timeout” has been selected, a timeout interval has to be inserted in the input box. After an inactivity of the CAMSIZER® of this time period, the illumination unit will be dimmed (here: after 10 seconds). If no checkbox is marked, the dimming function is deactivated.

7.6.4 The menu “Extras – Funnel”

Perform a reference run of the funnel or set the funnel position in the appearing dialogue window. The window can also be opened by a click on the funnel button in the icon bar.

Typical occasions for a reference run are:

- First measurement of a sample with the CAMSIZER®
- After a new software installation or software update
- After activation of the emergency push button
- After exchange of the funnel or feeder



To prevent a collision between the funnel and the feeder, please remove the funnel from the funnel holder or loosen the connection between the funnel and the funnel holder before proceeding.

To perform a reference run of the funnel, please click the button [Move to Reference] and follow the instructions in the appearing dialogue boxes. Please see also chapter 5.3 “Reference run of the funnel”.

The buttons and text boxes in the window assume the following functions:

1	Button [Move to reference]:	Start the automatic height adjustment of the funnel.
2	Input box “Upper hardware limit”	Displays the maximum height to which the funnel can be set on the funnel holder. The maximum funnel height cannot be edited by the user.
3	Input box “Upper software limit”:	Individual insertion of the maximum possible height of the funnel. If a reference run is performed, the funnel will be run not higher than this limit.
4	Read position	Display the actual position of the funnel.
5	Scale	Define the funnel position individually by moving the bar. The maximum of the scale is defined according to the settings made in the input box “upper software limit”. In the example, 30mm have been defined as a maximum.
6	Move to position	By entering the height (in mm) and clicking this button, the funnel will be lifted to the entered height.
7	Button [Upper limit]	Click this button to move the funnel to the upper limit.
8	Button [Lower limit]	Click this button to move the funnel to the lower limit.
9	Button [Update]	Update the scale after the definition of the upper and the lower limit.
10	Buttons [OK] and [Stop]	Leave the menu after completing the reference run by [OK] or cancel the reference run by [Stop].

Perform the reference run for the funnel height adjustment

- Click [Move to reference]. Confirm the moving to the lower limit/zero position in the subsequently opened dialogue (reference position) by a click on [OK].

- The funnel holder moves to the lower reference. In this position, please fix the funnel to the funnel holder so that the funnel slightly contacts the surface of the feeder. Use the fastening wheel.

- A dialogue window opens in which the move to the upper limit has to be confirmed. Click [OK]. The funnel holder moves to the upper limit.

Please note
The funnel will always move from the zero position to the maximum possible height. Please make sure that the path of the funnel is not blocked by mechanic obstacles.
The upper software limit applies only for the particle measurement, not for the reference run.

- Please click [OK] in the window “Reference Ok”. The reference run is completed and the measurement can be started now.

Please note: after the reference run the funnel will remain in the upper position. When a measurement is started, the funnel will be moved to required position.

7.6.5 The menu “Extras - Pressure“ 

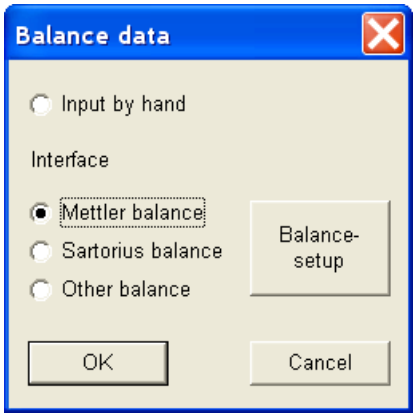
Activate or deactivate the airflow option. The function is also available by a click on the respective button in the icon bar.

7.6.6 The menu “Extras - Balance setup“

With the function “Balance Setup”, the communication between a balance and the CAMSIZER®-software can be enabled. In this way, the weighting data are directly transferred from the balance to the CAMSIZER®-software, and do not have to be inserted manually.

The balance has to be connected to the computer with a serial interface. The weighting data will appear in the window “Mass” in the window “Start measurement”.

To set up the balance, click the menu item |-Extras|Balance Setup-|. The dialogue window “Balance data” is opened.

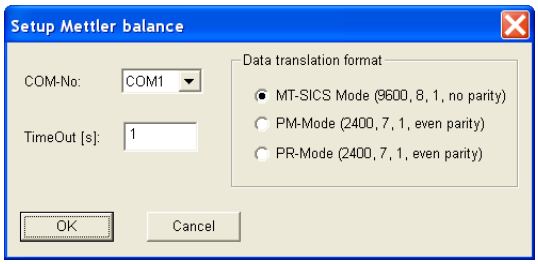


In the window “Balance data”:

When the checkbox “Input by hand” is marked, the communication between the balance and the software is deactivated and the mass of the sample has to be manually inserted in the window “Start measurement”.

To activate the communication, select the balance in the region ”Interface”: the two most common balance types, Mettler and Sartorius balance, are predefined. If you are working with another balance type, the respective checkbox has to be marked and the data of the balance have to be inserted. Click “Balance-setup” to start the balance setup.

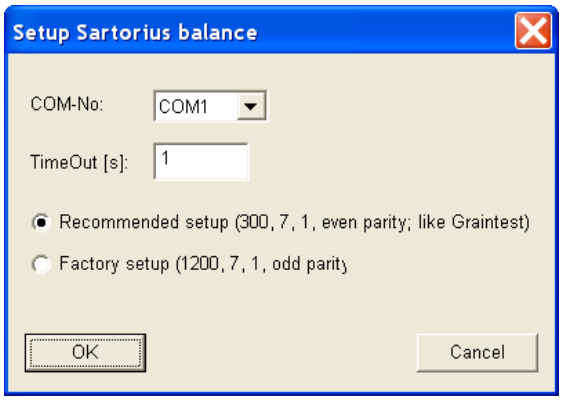
7.6.6.1 Setup Mettler Balance



In the window “COM-No”, select the serial interface for the communication with the balance.

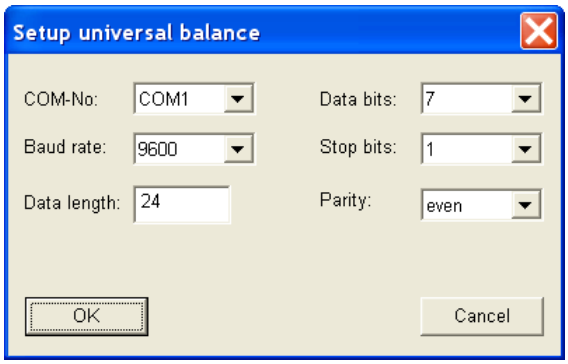
In the window “TimeOut”, select the timeout (in seconds). In the right area of the window, the data translation format can be defined. Click [Ok] to apply the settings.

7.6.6.2 Setup Sartorius Balance



The communication interface and the timeout in seconds have to be inserted.

7.6.6.3 Setup Other Balance



In the window “Setup universal balance”, the definitions for another balance type can be set. Click [Ok] to apply the settings. For the correct entries of the checkboxes please refer to the operation manual of your balance.

7.6.7 The menu “Extras - Measure for SPHT-Correction”

An SPHT-factor can be inserted as a reference for the sphericity of the particles. With this SPHT-fitting, sphericity deviations caused by the differences of the pixel resolution of the cameras CCD-Basic and the CCD-Zoom can be corrected. To calculate this SPHT-factor, one measurement performed only with the camera CCD-Basic and one measurement performed only with the camera CCD-Zoom is needed. These measurements can be carried out using the function “Measure for SPHT-Correction”.

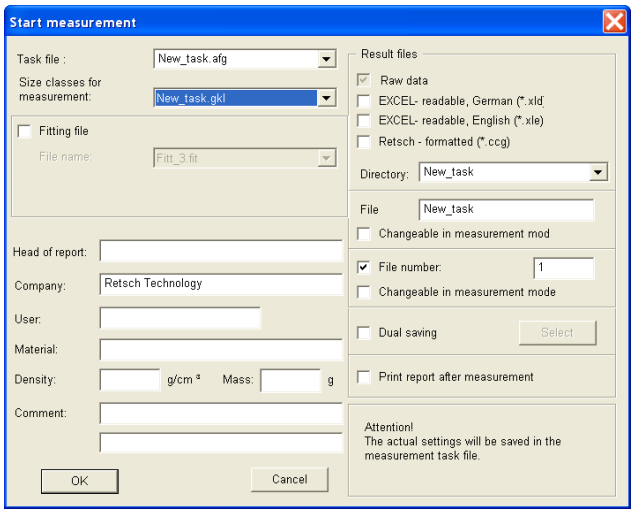
To carry out a measurement for SPHT-correction, the availability of a task file for the respective sample is necessary. Load the saved task file or create a new task file for the material. To create a task file, click │-File│New task file-│ and follow the advice in the dialogue boxes, please refer to chapter 6.2 “Create a new task file”.

Please make sure that the measurement with both cameras is activated on the register card “Cameras / Measurement parameters”. To collect meaningful statistical data, make sure that sufficient data are collected by measurement. A minimum of 1000 particles should be detected by the cameras CCD-basic and CCD-zoom.

When the task file has been loaded and / or edited, the measurement for SPHT-correction can be started.

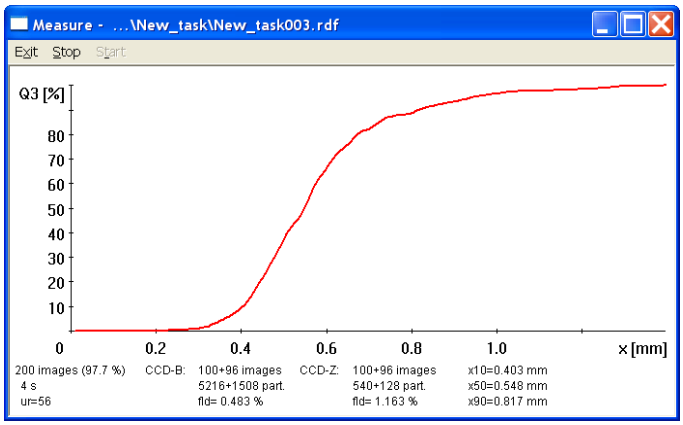
7.6.7.1 Start measurement for SPHT-correction

Click “Measure for SPHT-correction”. The window “Start measurement” is opened.



Select task file and file name, insert the data for the head of the report. Click [OK].

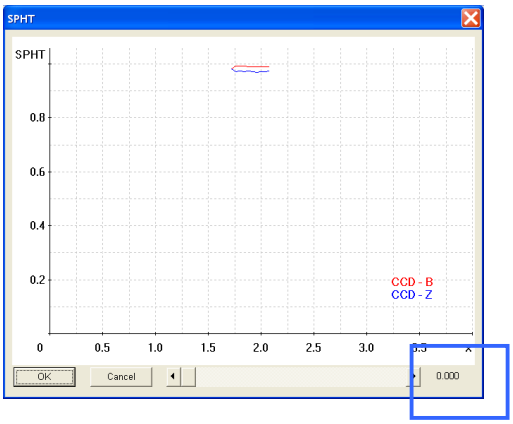
The measurement is started, and the measurement window is opened.



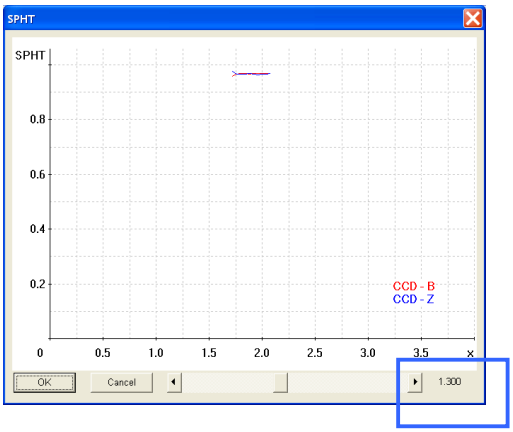
In this window, the progress of the measurement can be viewed. When the defined number of images is reached, the finishing of the measurement has to be confirmed.

Adjust the measurement graphs by CCD-Basic and CCD-Zoom

The numbers of images and particles recorded are visible in the footer of the display window. After the measurement is finished, the feeder is cleaned and the window “SPHT” is opened.

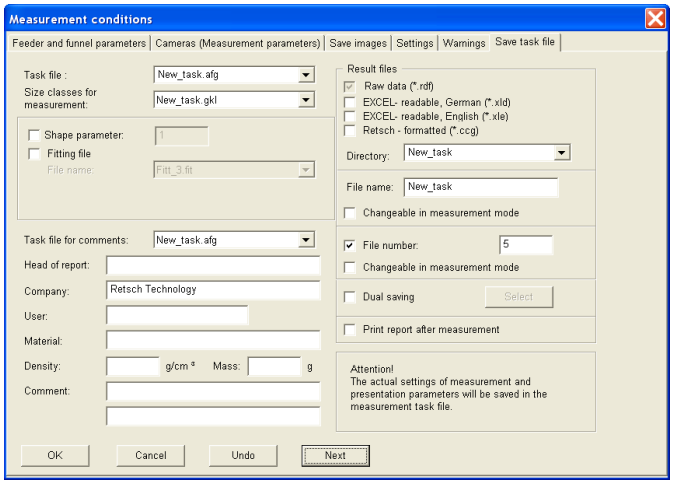


The graphs of the SPHT-factor recorded by the cameras CCD-Basic and CCD_Zoom are displayed. The SPHT – factor is displayed in the lower right corner (as the graphs have not been corrected, the value is “0”).



Move the slider control to adjust the two graphs. When the graphs are exactly one over another, the fitting is complete and the factor can be seen in the lower right corner of the window.
When the adjustment is completed, click [OK].

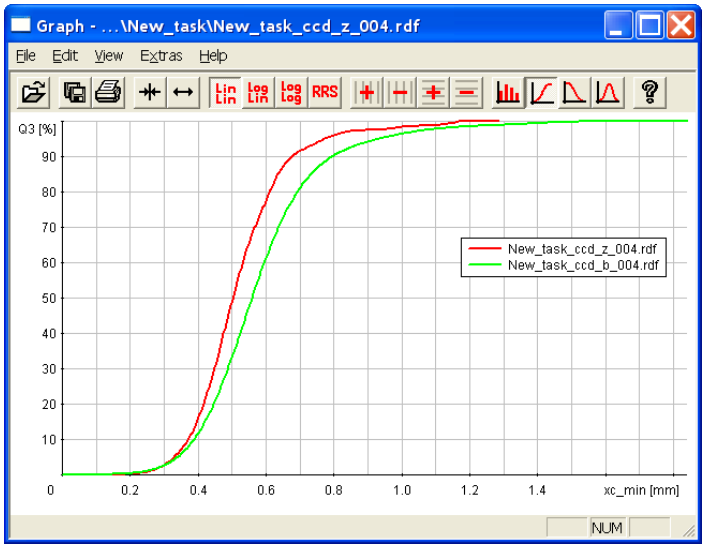
Save SPHT-factor with the task file



After the SPHT-adjustment has been confirmed, the register card „Save task file” is opened. Click [OK] to save the SPHT-factor with the respective task file.

7.6.7.2 The graph window of the SPHT-measurement

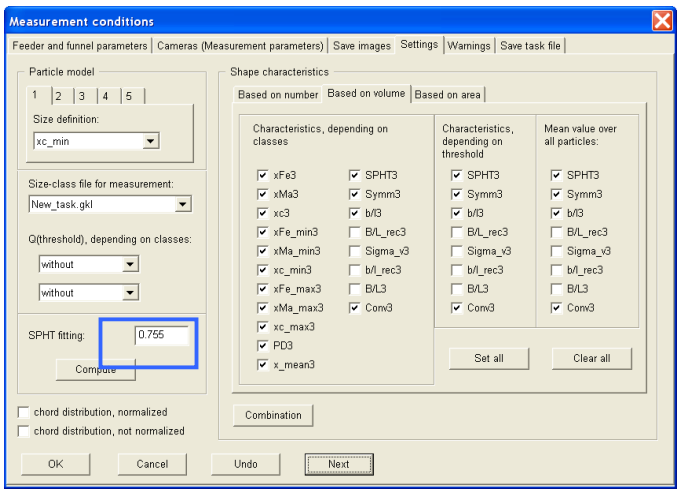
After the factor has been saved, the window “Graph” opens where the SPHT-factor recorded with the camera CCD-Basic is shown. The menu and the icon bar of this graphic display window offers the same functions like the window “Graph”, please see chapter 7.4.2. for further information.



With a click on |-File|Read comparison file-| a window opens in which the comparison file, e.g. the SPHT-factor as recorded with the camera CCD-Basic can be selected and loaded.

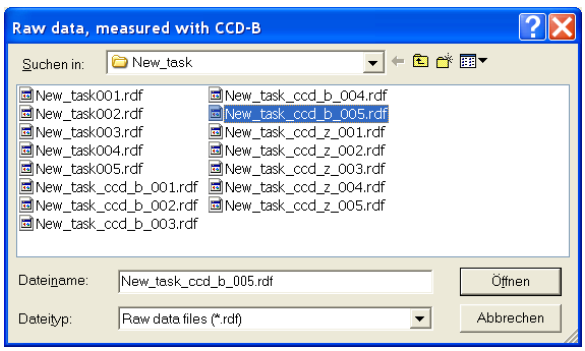
It can be saved by selecting |-File|Save measurement file-| in the main software menu.

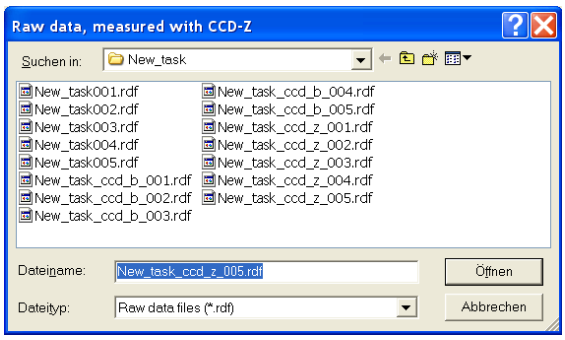
7.6.7.3 Use SPHT-fitting for particle measurement



When a measurement is carried out using the task file in which the factor has been saved (here: “New task”), the factor appears in the window “SPHT-fitting” on the register card “Settings”.

If you use another task file, “0” appears in the window “SPHT-fitting”. If you wish to apply this SPHT-factor to this measurement task, click [Compute]. The windows “Raw data measured with CCD-B” and “Raw data measured with CCD-Z” open subsequently. The files can be selected in these windows.





Afterwards, the window “SPHT” opens where the graphs of the measurements with CCD-Basic and CCD-Zoom are shown and can be adjusted. The corrected SPHT-value will appear in the respective window.

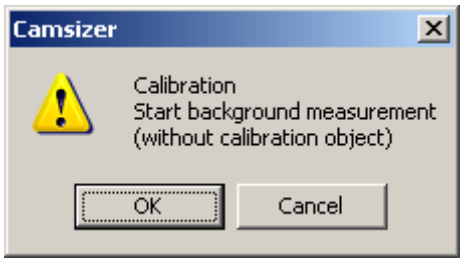
The measurement can now be started using the SPHT correction. After the measurement, the corrected SPHT-value will appear in the table-window.

7.6.8 The menu “Extras – Calibration”

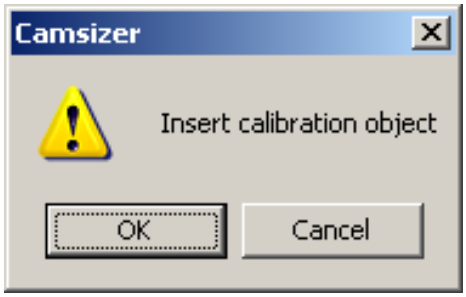
This menu item is used for the calibration and adjustment of the CAMSIZER®. Please use the calibration standard included in your delivery (optional accessory). The calibration process comprises two steps:

- The first step is a measurement of an empty frame without a calibration standard.
- The second step is the calibration by means of the calibration standard.

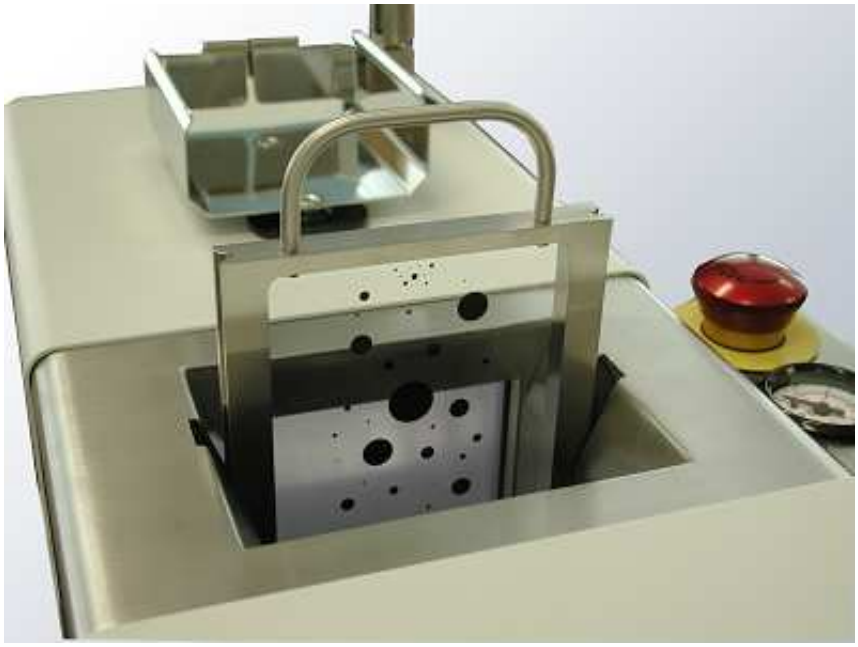
After the menu item “Calibration” has been selected, the window “Calibration” is opened.



Click [Ok] to continue. When the background measurement is completed, the calibration with the standard can be performed.

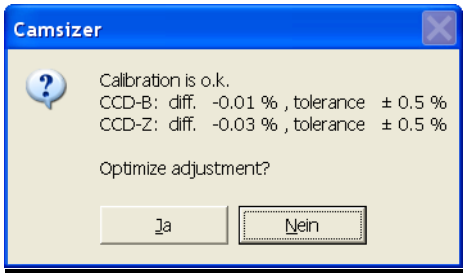


Remove the metal rails from the feeder chute and insert the calibration standard.



Make sure the glass window is facing the side of the light source. Remove the feeder before inserting the calibration standard to avoid scratches on the calibration object. Click [OK] when the standard is inserted.

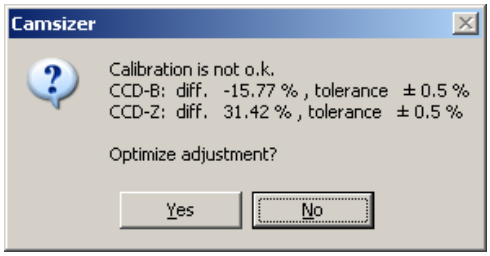
The CAMSIZER® is being calibrated. When the calibration is completed, the measured display scales appear in a dialogue window.



Click [Yes] to optimize the adjustment.

A record of the calibration process can be printed. Click [Yes] to print the record. Click [No] to cancel the printing.

A system message appears to remove the calibration standard. Click [Ok] when the calibration standard has been removed. The CAMSIZER® is calibrated now.



If the calibration was not successful, this warning message will appear. Click “Yes” to optimize the adjustment.

A message will appear stating that the adjustment is not possible. In this case, we recommend contacting customer service.

7.6.9 The menu “Extras - Image evaluation”

With the menu item „Image evaluation”, images can be evaluated that have been saved as BMP-files during measurement (please see the register card “Save images” in the menu “Measurement conditions”). These images are stored usually in the CAMDAT-directory in the folder of the raw data under a subfolder “images”.

Please note

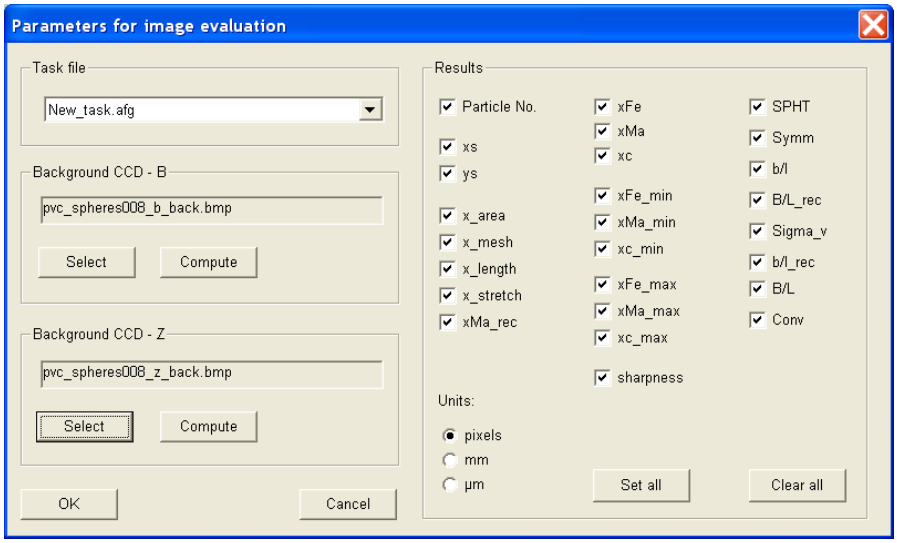
In the window CCD-image, images can be loaded and viewed or evaluated. When the menu function |-File|Read image-| is used, images can be read, but an evaluation is not possible. To evaluate an image, the function |-Function|Image evaluation-| has to be used.

7.6.9.1 Carrying out an image evaluation

7.6.9.1.1 Select background and results

To evaluate images, a background has to be available. If no background is available, please select |-Functions|Parameters-|. In the menu “Functions”, please select “Parameters”.

In the window “Parameters for image evaluation”, the task file and the backgrounds for CCD-Basic or CCD-Zoom and the results displayed in the image evaluation can be selected.



When the automatic image saving has been used during measurement (register card “Save images”), a background image for the respective camera will be saved with the images. This background image can be found at the end of the file list of the respective camera, and has the ending “back” to the file name instead of the image number:

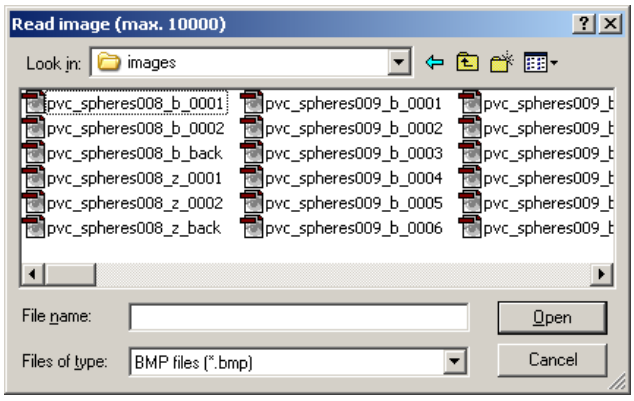
pvc_spheres005_b_back.bmp (*CCD-Basic)*
pvc_spheres005_z_back.bmp (CCD-Zoom)

Please select the background by a click on [Select]. The window “Read image” opens, in which the background can be chosen for CCD-Basic and CCD-Zoom.

When the images have been saved during measurement without activating the automatic image saving function, the background is not saved and has to be calculated for each camera. Click [Compute]. The window “Read image (max. 10000)” opens. Select several images, from which the background image will be computed.

7.6.9.1.2 Evaluate images

When the background is available, the images can be evaluated. Select |-Functions|Image evaluation-|. The window “Read image (max. 10000) opens.



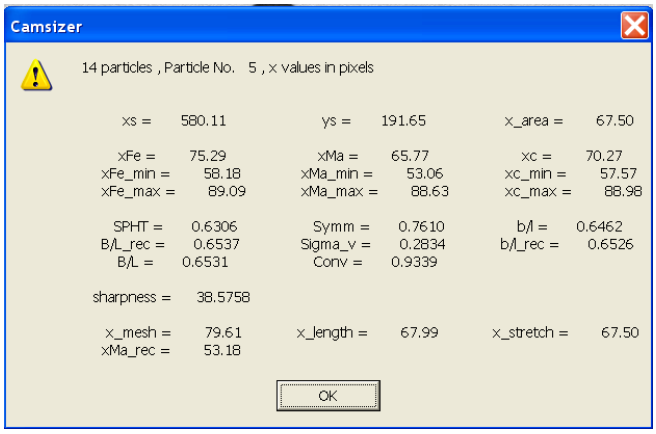
Several images can be selected that are loaded simultaneously.
To select several images: Mark the images with (CTRL & Click) or draw a rectangle around the files in the dialogue window and can be evaluated successively.

The images will be loaded in the window “CCD-image”.

In the menu bar, you can switch between the background and the image using the icons:

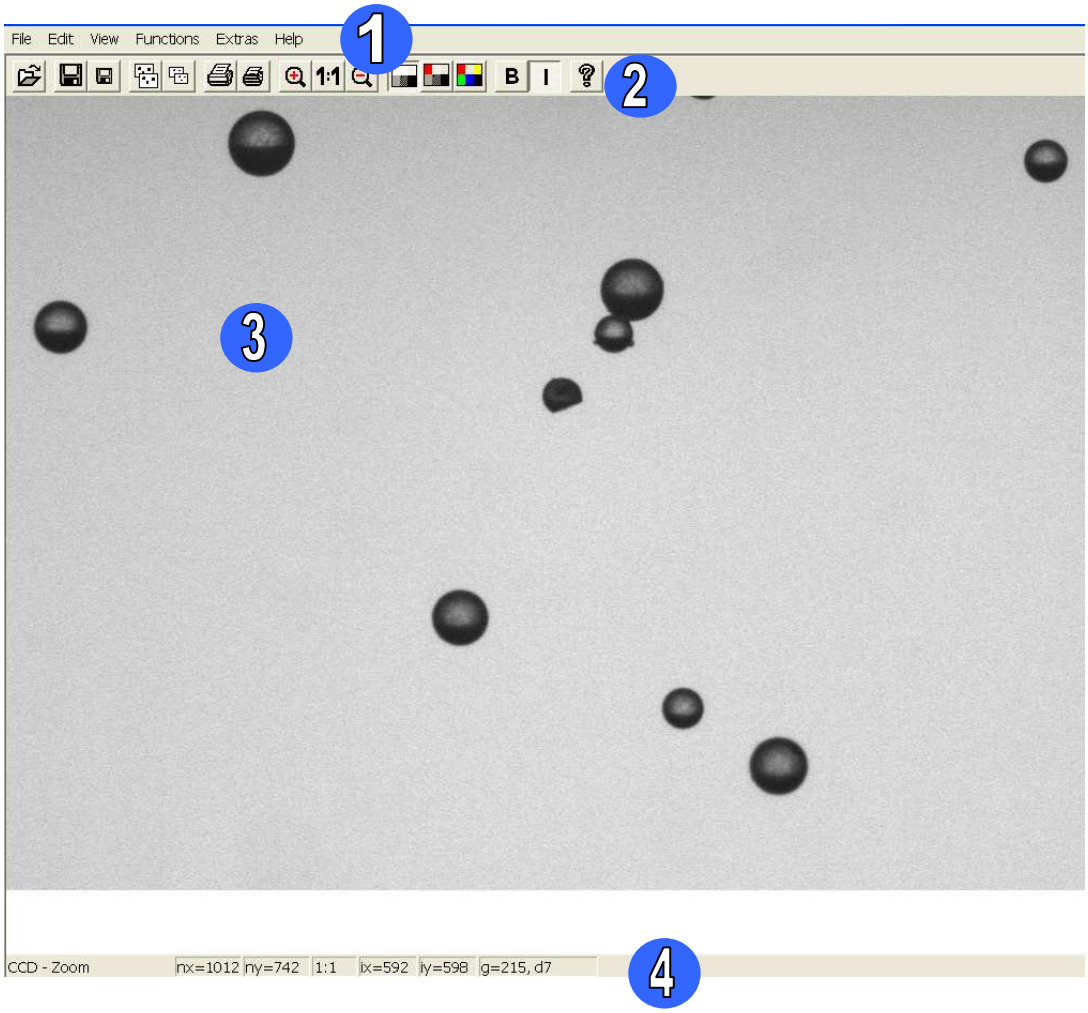
Several images can be selected that are loaded simultaneously.
You can navigate among the images in this window using the arrow keys (up/down or right/left) and the keys image up/image down.
The key [Pos1] will guide you to the first image, the key [End] to the last image.

When the image is selected, you can open an image evaluation window by a click on the particle with the right mouse key. The values selected in the window “Parameters for image evaluation” are displayed in this window.



Further images can be evaluated by a click on “Image evaluation” in the menu “Functions” and by selecting the respective images in the window. These values can be saved by selecting the menu item
|-Functions|Result File-|.

7.6.9.2 Description of window “Image evaluation”



The window “Image evaluation” is structured into the following areas:

1. Menu bar
2. Icon bar
3. Image / particles
4. Status bar

7.6.9.2.1 The menu “File” in the window “Image evaluation”

The menu “File” contains the following functions. The functions are also available from the icon bar, the respective icons are shown.

	Read image Open one or several saved images in the window.
	Save image Save an image that has been loaded and edited. The directory and file name can be freely selected.
	Save image region An image region is an image that has been enlarged or reduced in size by a click on the buttons “Zoom in” and “Zoom out”. When the image is zoomed in, only the area visible on the monitor is saved. When the image is zoomed out, the reduced image is saved, however the image can be enlarged again.
	Print image Print an image that had been loaded.
	Print image region Print an image region. Only the image area visible on your screen will be displayed.
	Exit Close the image evaluation window.

7.6.9.2.2 The menu “Edit” in the window “Image evaluation”

	Copy image Copy the image loaded to the clipboard. The image can be pasted into other applications.
	Copy image region Copy an image region to the clipboard. The image region can be pasted into other applications.

7.6.9.2.3 The menu “View” in the window “Image evaluation”

The menu “View” contains the following functions:

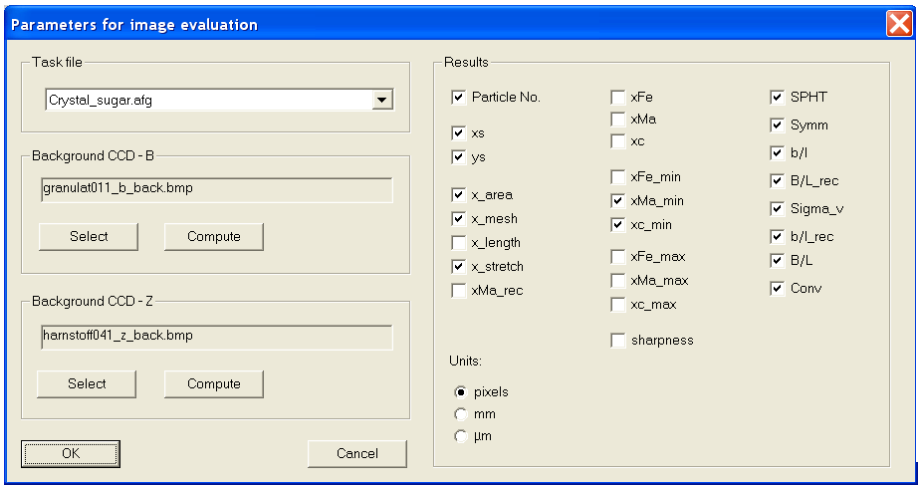
	Zoom out Zoom out the image / reduce the image size. The scale of the image is displayed in the status bar. The image can be scaled down to 1:30.
	Factor 1 Restore the 1:1 scale of the image.
	Zoom in Zoom in the image / enlarge the image size. The image can be scaled up to 2:1.
	Grey levels Display the image in grayscale. Grayscale is the colour palette applied to the images when they are recorded.
	Grey levels and red Display the images in grayscale. Areas overexposed will be highlighted red.
	Colours Display the image in pseudocolours.

7.6.9.2.4 The menu “Functions” in the window “Image evaluation”

For the menu “Functions”, no icons are available. The menu “Functions” contains the following menu items:

- Parameters
- Image evaluation
- Result file
- Image info

7.6.9.2.4.1 Functions - Parameters



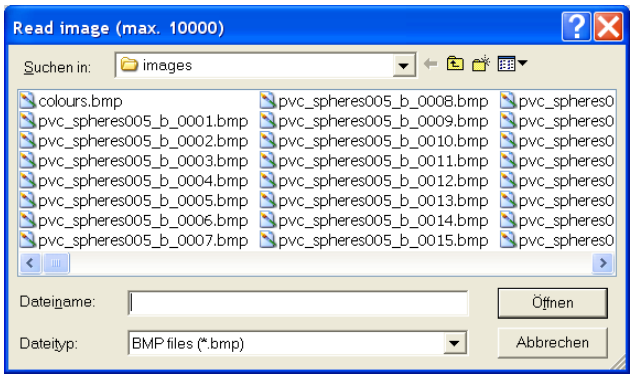
Set the parameters for the image evaluation.

Select the task file and the background files for CCD-basic and CCD-Zoom. The background files are stored with the BMP-images in the folder under CAMDAT. Usually, the background images can be found at the end of the file list of the respective camera under *Filename*_b_back.bmp.

Click [Open] to select the background. Select the background for both cameras. In the area "results", the parameters can be chosen which should be displayed. Click on a particle in the image with the right mouse button. A window is opened in which the values of the parameters selected are displayed for this particle:

These values can be saved by selecting the menu item |-Functions|Result File-|.

7.6.9.2.4.2 Functions - Image evaluation



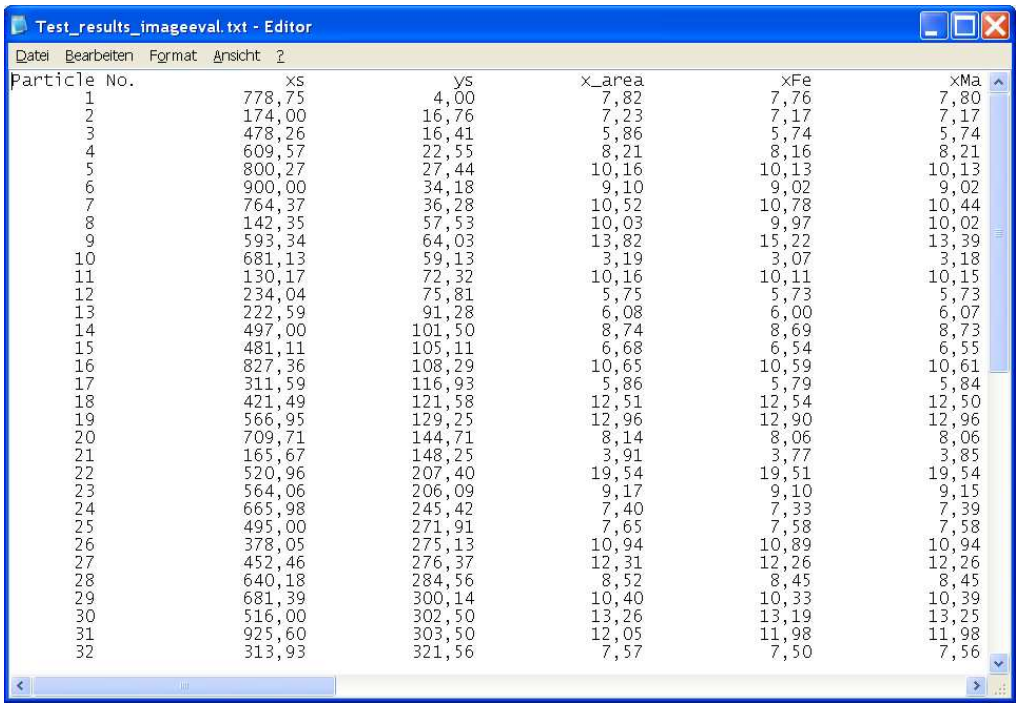
With this menu item, a new image can be read. The image will be selected in the folder "images" and can be immediately evaluated by a click with the right mouse button on the respective particle.
Select the image in the dialogue box.

Please note

When the menu item “Read image” is selected, the image is loaded in the display area. For this image, the background and the task file has to be defined before the particles can be evaluated.

When an image is selected in the dialogue box via the menu option “Image evaluation”, the image can be evaluated immediately.

7.6.9.2.4.3 Functions - Result files



Test_results_imageeval.txt - Editor

Datei Bearbeiten Format Ansicht ?

Particle No.	xs	ys	x_area	xFe	xMa
1	778,75	4,00	7,82	7,76	7,80
2	174,00	16,76	7,23	7,17	7,17
3	478,26	16,41	5,86	5,74	5,74
4	609,57	22,55	8,21	8,16	8,21
5	800,27	27,44	10,16	10,13	10,13
6	900,00	34,18	9,10	9,02	9,02
7	764,37	36,28	10,52	10,78	10,44
8	142,35	57,53	10,03	9,97	10,02
9	593,34	64,03	13,82	15,22	13,39
10	681,13	59,13	3,19	3,07	3,18
11	130,17	72,32	10,16	10,11	10,15
12	234,04	75,81	5,75	5,73	5,73
13	222,59	91,28	6,08	6,00	6,07
14	497,00	101,50	8,74	8,69	8,73
15	481,11	105,11	6,68	6,54	6,55
16	827,36	108,29	10,65	10,59	10,61
17	311,59	116,93	5,86	5,79	5,84
18	421,49	121,58	12,51	12,54	12,50
19	566,95	129,25	12,96	12,90	12,96
20	709,71	144,71	8,14	8,06	8,06
21	165,67	148,25	3,91	3,77	3,85
22	520,96	207,40	19,54	19,51	19,54
23	564,06	206,09	9,17	9,10	9,15
24	665,98	245,42	7,40	7,33	7,39
25	495,00	271,91	7,65	7,58	7,58
26	378,05	275,13	10,94	10,89	10,94
27	452,46	276,37	12,31	12,26	12,26
28	640,18	284,56	8,52	8,45	8,45
29	681,39	300,14	10,40	10,33	10,39
30	516,00	302,50	13,26	13,19	13,25
31	925,60	303,50	12,05	11,98	11,98
32	313,93	321,56	7,57	7,50	7,56

Save the result files as a *.txt or *.dat-file. The directory and the file name can be freely selected. The results of the image evaluation will be saved.

- *.txt-files can be opened by double-click on the file or by selecting the file in the dialogue box.
- *.dat-files can be opened using the editor.

The particles in the image are numbered consecutively from the upper left to the lower right corner in the image. The center of the particle is decisive for the position of the particle in the image. The particle number is displayed in the first column of the result file window.

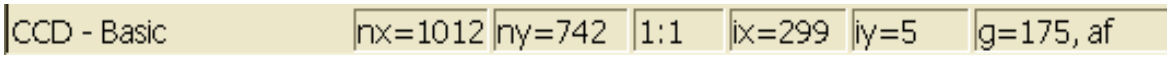
7.6.9.2.4.4 Functions - Image info

Display the information about the image. The serial number of the CAMSIZER® instrument, the software version, the camera with which the image has been recorded, the total pixel number of the image and the recording date and time of the image are displayed.

7.6.9.2.5 The menu “Extras” in the window “Image evaluation”

Select display of toolbar and status bar. A checkmark before the menu bar indicates that the function has been applied.

- Toolbar Show or hide toolbar.
- Status bar Show or hide status bar.



The status bar is structured into the following areas:

CCD-Basic / Zoom	Camera with which the images have been recorded.
nx and ny	Size of the image in pixel.
ix and iy	Coordinates of the position of the mouse pointer.
G	Grey level: decimal number, hexadecimal number

7.6.9.2.6 The menu “Help” in the window “Image evaluation”

 Call online help for this function.

7.6.10 The menu “Extras - Toolbar”

Show or hide the toolbar on the main software window. A checkmark before the menu bar indicates that this function is active.

7.6.11 The menu “Extras - Status bar“

Show or hide the status bar on the main software window. A checkmark before the menu bar indicates that this function is active.

7.6.12 The menu “Extras - Save windows automatically”

If this command is set, the position and the size of the windows will be saved when the program is closed. When the program is re-opened, the positions and sizes of the windows will be as defined. A checkmark before the menu bar indicates that the function is active.

7.6.13 The menu “Extras - Apply standard”

The position and the size of the open sub windows (table, graph, characteristics, graph-shape characteristics) will be set as default.

7.6.14 The menu “Extras - Restore standard”

When “Restore standard” is clicked, the standard alignment of the sub windows set under “Apply standard” will be restored.

7.6.15 The menu “Extras – Language”

Select the language for the CAMSIZER®-software. The window “Select language” is opened.

The following languages are available

- English
- French
- German
- Japanese

- Spanish

Select the language in the drop-down menu. Click [OK]. The language will be applied to the CAMSIZER®-software.

7.6.16 The menu “Extras – Password”

7.6.16.1 Password protection of the CAMSIZER® program

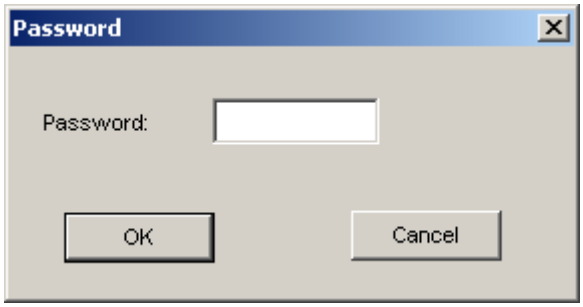
The CAMSIZER®-software has three modes, each of which is password-protected:

- Measurement mode for routine measurements; parameters for the measurement cannot be defined.
- Parameter mode for the creation of task files, fitting files, and comparison files, for the measurement and the calibration.
- Higher mode; this mode is reserved to customer service.

When the password protection is deactivated, the program runs always in the parameter mode. When the password protection has been activated, the measurement mode will be active when the program is started. The password protection can be activated or deactivated in the parameter mode.

7.6.16.1.1 Change from measurement to parameter mode

From the measurement mode, the parameter mode can be reached by entering the password. Select │-Extras│Password-│ and enter the password into the dialogue box:



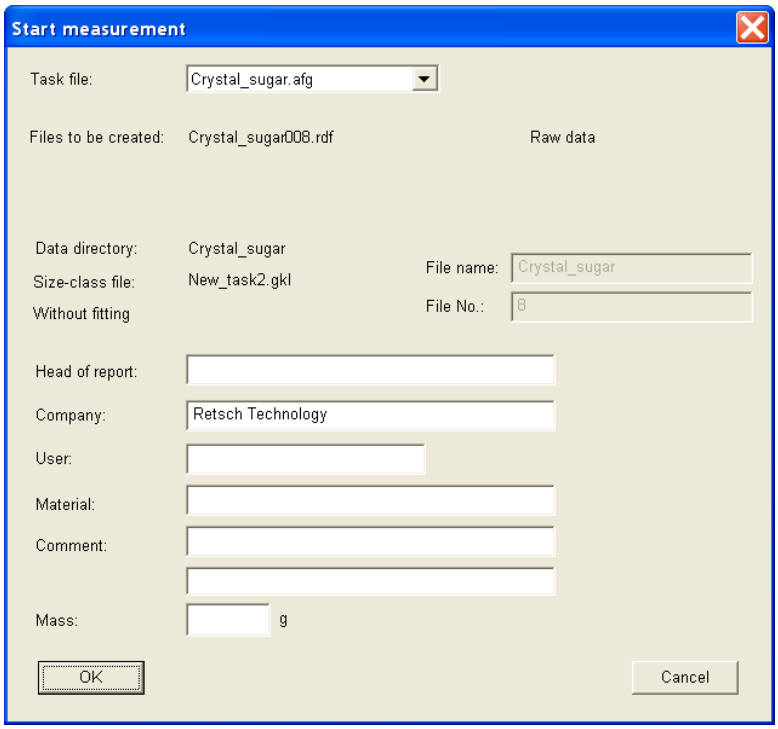
7.6.16.1.2 Activate or deactivate password protection

The password protection can be activated or deactivated by the user in the parameter mode. In the menu “Extras”, select the menu item “Change password”.

To activate the password protection, mark the checkbox “Password protection active”. The standard password is "password”. Insert a new, freely selectable password in the input box “New password”. Repeat the password in the box “Reference input”. Click [OK]. Please refer also to chapter 7.6.17 “The menu “Extras – Change password”.

7.6.16.2 Password protection - Measurement mode

In the measurement mode, routine measurements can be carried out, however the measurement parameters cannot be defined.



In the measurement mode, the window “Start measurement” is different from the parameter mode. The following settings can be defined by the user:

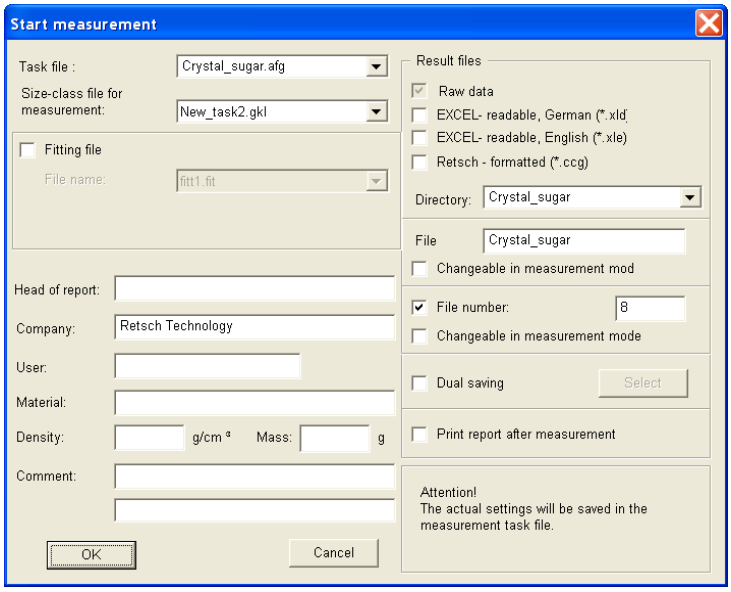
- Selection of the task file: file name and file number are adapted automatically, they cannot be edited by the user if the task file has been set up that way
- Head of the report
- Insertion of the mass of the measured material

7.6.16.3 Password protection - Parameter mode

In the “Parameter mode”, the following main window menu items are available that **cannot be used in the measurement mode**:

Menu File	Save task file
	Save measurement file
	Export
	Screen font
	Printer font like screen font
	Printer font
Menu Options	Measurement parameters
	Input reference distribution
	Create fitting file
	Info fitting file
	Input fraction limits
Extras	Calibration
	Change password

The window ”Start measurement” permits the individual editing of the measurement procedure by the user.



The following functions are available in the window

- Selection of the task file
- Selection of the size class file for the measurement
- Activation and selection of a fitting file
- Head of the report
- Insertion of the mass of the measured material
- Result files, export of the raw data files to other formats
- Selection of the directory for these result files
- File and file number
  - o If the checkbox “Changeable in measurement mode” is marked, the file name and file number can be changed by the users who operate the software in the measurement mode.
- Dual saving
- Print in report

7.6.16.4 Password protection - higher mode

The higher modes are reserved to authorized staff.

7.6.17 The menu “Extras - Change password”

With this menu item, the password can be changed in the parameter mode and the master mode.

Please refer to chapter 7.6.16.1.2 “Activate or deactivate password protection”.

7.7 The Menu „Help“

7.7.1 Help

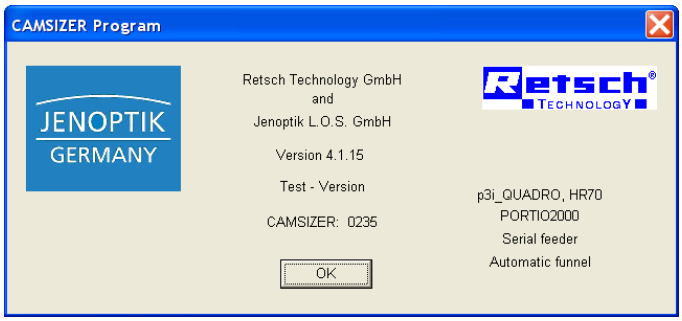
Call online help.

7.7.2 Dictionary

Display the translation of the terms in a list.

7.7.3 About

Display the manufacturer information and the version number of the CAMSIZER®-software in a window.



When you click on the JENOPTIK-Logo, the hardware and the drivers will be displayed in the right area of this window.

8 APPENDIX

8.1 Characteristics

8.1.1 Particle size distribution

x_{area}	**Particle diameter** calculated by the area of particle projection $x_{area} = \sqrt{\frac{4A}{\pi}}$ Diameter of the area equivalent circle with a volume of a sphere with the diameter of x_{area}
$x_{c\ min}$ min (x_c)	**Width, breadth** particle diameter which is the shortest chord of the measured set of maximum chords of a particle projection (for results close to screening/sieving)
$x_{Ma\ min}$ min (x_{Ma})	**Width, breadth** particle diameter, which is the shortest Martin diameter, which is dividing the area of the particle projection into two half (for results close to screening/sieving)
$x_{Fe\ min}$ min (x_{Fe})	**Width, breadth** particle diameter which is the shortest Feret diameter of the measured set of Feret diameter of a particle projection
$x_{Fe\ max}$ max (x_{Fe})	**Length** particle diameter which is the longest Feret diameter of the measured set of Feret diameter of a particle (for results close to microscopy)
x_{length} x_{leng2}	**Length** particle size, which is calculated from the longest Feret-diameter and the smallest chord or Martin– diameter of each particle projection $x_{length} = \sqrt{x_{Fe\max}^2 - x_{c\min}^2}$ $x_{leng2} = \sqrt{x_{Fe\max}^2 - x_{Ma\min}^2}$ (suitable for display of length distributions of cylinders, which are orientated by a guidance sheet (e.g. to substitute optical measurement systems like light table, calliper, microscope or static

	image analysis systems)

$x_{stretch}$	**Length** $x_{stretch} = \frac{A}{x_{Ma\_min}}$ particle size, which is calculated from the area of the particle projection divided by the diameter (Martin–diameter) of each particle projection, interesting for bended extrudates and short extrudates
x_{mesh}	**Side length** of the minimum square, containing the projection area of the particle
$Q_3(x)$	**Cumulative distribution (% passing)**, based on volume: volume proportion of particles smaller than x in proportion to the total volume
$1\text{-}Q_3(x)$	**Cumulative distribution of residue** $1\text{-}Q_3(x)$, based on volume
$p_3(x_1,x_2)$	**Fractions** p_3 (x_1,x_2) – volume proportion of particles in the range (x_1,x_2): $p_3(x_1,x_2) = Q_3(x_2) - Q_3(x_1)$
$q_3(x)$	**Frequency distribution** $q_3(x)$ based on volume: 1. Derivative of $Q_3(x)$ $\quad q_3(x) = \frac{dQ_3(x)}{dx}$
$Q_0(x)$	**Cumulative distribution** $Q_0(x)$, based on number of particles: number of particles smaller than x in proportion to the total number of particles
$1\text{-}Q_0(x)$	**Cumulative distribution of residue** $1\text{-}Q_0(x)$, based on number of particles
$p_0(x_1,x_2)$	**Fractions** $p_0(x_1,x_2)$ - number of particles in the range (x_1,x_2): $p_0(x_1,x_2) = Q_0(x_2) - Q_0(x_1)$
$q_0(x)$	**Frequency distribution** $q_0(x)$, based on number of particles: First derivative of $Q_0(x)$ $\quad q_0(x) = \frac{dQ_0(x)}{dx}$

8.1.2 Characteristics

$Q_3(x)$	**Q_3 value**, whereat a given particle diameter x is reached, based on volume
x (Q_3)	**x-value** whereat a given Q_3 value is reached, based on volume
$SPAN_3$	**Span value, based on volume:** $\text{Span}_3 = \frac{x(Q_{3,3}) - x(Q_{3,1})}{x(Q_{3,2})}$ Here the first index indicates that the values are based on volume. In the program the first index has been left off, since for $SPAN_3$ and $SPAN_0$ the same Q(x) values are used.
U_3	**Non-uniformity**, based on volume: $U_3 = \frac{x_{60}}{x_{10}}$ x_{10}: x value for Q_3 = 10 % x_{60}: x value for Q_3 = 60 %
Q_0 (x)	**Q_0 value**, whereat a given particle diameter x is reached, based on number
$x(Q_0)$	**x value**, whereat a given Q_0 value is reached, based on number
$SPAN_0$	**Span value, based on number of particles** $\text{Span}_0 = \frac{x(Q_{0,3}) - x(Q_{0,1})}{x(Q_{0,2})}$ Here the first index indicates that values are based on the number of particles. In the program the first index was left off as for $SPAN_3$ and $SPAN_0$ the same Q values are used.
U_0	**Nonuniformity, based on number of particles** $U_0 = \frac{x_{60}}{x_{10}}$ x_{10}: x value for Q_0 = 10 % x_{60}: x value for Q_0 = 60 %

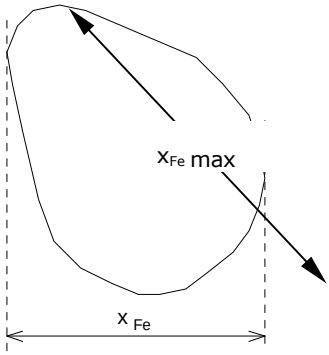
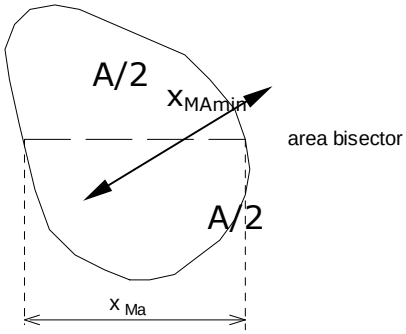
8.1.3 Indirect determination of the specific surfaces S_v and S_m

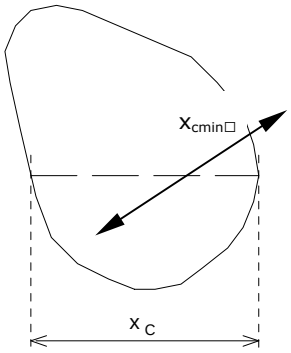
S_V	**Specific surface** $S_v = \frac{\text{surface of all particles}}{\text{volume of all particles}}$
S_m	**Specific surface** for a given specific density $S_m = \frac{\text{surface of all particles}}{\text{mass of all particles}}$

8.1.4 RRSB characteristics

n	**Slope of the RRSB line**
d'	**x value, whereat the line reaches a value of 0.632**
correlation	**Correlation** between the RRSB line and Q(x) in the range between Q_1 and Q_2
ß	Angle between the RRSB line and y – axis ß=90°-arc tan(n) (n=Slope of the RRSB-line)

8.1.5 Shape characteristics

x_{Fe}	**Feret diameter x_{Fe}** Distance between two tangents placed perpendicular to the measuring direction. For a convex particle the mean Feret diameter (mean value of all directions) is equal to the diameter of a circle with the same circumference. 
$x_{Fe\ max}$ $x_{Fe\ min}$	The longest Feret diameter out of the measured set of Feret diameters. The shortest Feret diameter out of the measured set of Feret diameters.
x_{Ma}	**Martin diameter x_{Ma}** Length of the area bisector in the measuring direction 
$x_{Ma\ min}$	The shortest Martin diameter out of the measured set of Martin diameters.

x_c	**maximum chord** x_c in measuring direction 
$x_{c\ min}$	The shortest chord out of the measured set of max. chords x_c. = breadth (width), which is very close to sieving.

SPHT	**Sphericity** $SPHT = \frac{4\pi A}{P^2}$ P – measured perimeter/circumference of a particle projection A – measured area covered by a particle projection For an ideal sphere SPHT is expected to be as 1. Otherwise it is smaller than 1.
$Symm_{0,2,3}$	**Symmetry** $Symm_{0,3} = \frac{1}{2}\left(1 + \min\left(\frac{r_1}{r_2}\right)\right)$ r_1 und r_2 are distances from the centre of area to the borders in the measuring direction. For asymmetric particles Symm is < 1. If the centre of area is outside the particle i.e. $\frac{r_1}{r_2} < 0$ Symm is < 0.5 $x_{Ma} = r_1 + r_2$ "Symm" is minimum value of measured set of symmetry values
$b/l_{0,2,3}$	$b/l_{0,2,3} = \frac{x_{c\ min}}{x_{Fe\ max}}$; $x_{c\ min}$ and $x_{Fe\ max}$ out of the measured set of x_c and x_{Fe} values
$(b/l)_{rec\ 0,2,3}$	$(b/l)_{rec0,2,3} = \min\left(\frac{x_c}{x_{Fe}}\right)$; min quotient of perpendicular x_c and x_{Fe} out of the measured set of x_c and x_{Fe} values.

$B/L_{0,2,3}$	$B/L_{0,3} = \frac{x_{Fe\ min}}{x_{Fe\ max}}$; $x_{Fe\ min}$ and $x_{Fe\ max}$ out of the measured set of x_{Fe} values
$(B/L)_{rec\ 0,2,3}$	$(B/L)_{rec0,3} = \min\left(\frac{x_{Fe1}}{x_{Fe2}}\right)$; min quotient of perpendicular x_{Fe1} and x_{Fe2} out of the measured set of x_{Fe} values.
$Conv_0$ $Conv_3$	**Convexity** = (square root) ratio of real area of the particle projection and convex area of particle projection (as if a rubber band was put around the particle projection)
$x_p = x_{mean}$	The Feret diameter, the Martin diameter, the max. chord and the sphericity for the various size classes are determined by calculating a **mean value, based on the number of particles within a size class**: $\bar{x} = \frac{1}{n}\sum_{i=1}^{n} x_i$ As the objects within a class can be distributed unevenly, the mean equivalent diameter of circles equal in area, xp, should be used as reference value for class-related information.
PD_0, PD_2, PD_3	Number of **p**article **d**etections, measure of the statistical reliability of the shape characteristics. The larger PD the more reliable is the value of x_{Fe}, x_{Ma}, x_c and SPHT.
$Sigma(v)_0$	**Standard deviation of the ratio** $\text{Sigma (v)} = \sqrt{\frac{1}{n}\sum_{i=1}^{n}(1 - v_i)^2}$ with the ratio $v_i = \frac{\max(x_{Fe}, x_c)}{\min(x_{Fe}, x_c)}$ of the particle no. i, in which the measuring directions of the "Feret diameter" and the "maximal chord" are perpendicular to each other.
Q_0(SPHT)= NSP_0 Q_3(SPHT)= NSP_3	**Proportion of non-spherical particles**, whose sphericity is smaller than a given threshold; based on number of particles or on volume
$Q_{0/3;}$ Symm; b/l,$(b/l)_{(rec)}$B/L, $(B/L)_{(rec)}$	**Proportion of particles or volume**, whose symmetry, or various b/l-ratios is smaller than a given threshold

$Mv_{0/2/3}(x)$	**Mean value** of a chosen characteristic, weighted; $x_{1,r} = \sum x\ q_r(x)\ \Delta x$
Sigma(x)	**Standard deviation** σ(x) from the mean value Mv(x)
Ps_Sv (x1,x2):	Fractions p2_Sv(x1,x2): part of the sum of the surfaces of each size class related to the total sum of all surfaces

8.1.6 Optional characteristics

rD	**r**elative **D**ensity, mass of sample divided by the volume of the sample measured with the CAMSIZER®
AFS-number	Grain fineness, for materials in a size range from 0.02 – 5.6 mm.
SGN	**S**ize **G**uide **N**umber Calculated diameter of the "average particle", expressed in millimeters and multiplied with 100 (for example: d_{50} = 0.123 mm => SGN = 12.3) $SGN = 100 \cdot x_{50}$ with $x_{50} = x(Q_3 = 50\%)$ in mm The calculation of SGN is based on the following size classes: 0.212, 0.300, 0.425, 0.600, 0.850, 1.18, 1.70, 2.36, 3.35, 4.75, 6.70mm If x_{50} falls into one of these size classes, than x_{50} is an interpolated value from the Q_3 value of the next lower and the next higher sieve. If x_{50} lies beyond 0.212 mm or 6.7 mm than x_{50} is the actual value determined by the CAMSIZER® and is not interpolated.
UI	**Uniformity Index** ratio of the size of "SMALL PARTICLES" to "LARGE PARTICLES" in the sample, expressed in percentage; UI is the ratio, times 100, of the two extreme sizes in the range of large particles at the 90% Q_3 level and fine particles at the 5% Q_3 level. UI =100 means that the particles have the same size, perfectly uniform; UI = 50 means that the small particles are half the size of the large particles in the sample $UI = 100 \frac{x_5}{x_{90}}$ with $x_5 = x(Q_3 = 5\%)$, $x_{90} = x(Q_3 = 90\%)$ The determination of x_5 and x_{90} follows the determination of x_{50} for

	the calculation of SGN
CV	**C**oefficient of **V**ariation the coefficient of variation is the standard deviation (SD) of the size distribution divided by the average; it is dimensionless $CV = 50 \frac{x_{84} - x_{16}}{x_{50}}$ with $x_{84} = x(Q_3 = 84\%)$, $x_{16} = x(Q_3 = 16\%)$, $x_{50} = x(Q_3 = 50\%)$
MA	**M**ean **A**perture = D_{50} value = Median Diameter x_{50}
PI	**P**olydispersity **I**ndex $PI(Q_1,Q_2) = \frac{x(Q_1)}{x(Q_2)}$
$Q_1(V)$	**Q_1 value**, whereat a **given particle volume** is reached, **based on volume**
$Q_0(V)$	**Q_0 value**, whereat a **given particle volume** is reached, **based on number**

8.2 Trouble shooting list

Error	Cause	What to do
Program cannot be started.	CCD-software or CAMSIZER® -software is not correctly installed.	Check whether the software has been installed correctly; if applicable, re-install the software.
	No images have been transferred.	Check that the CAMSIZER® is switched on (the light must be on). Check that the CCD-cameras are connected to the computer.
The illumination in the pseudo-colour mode shows large red areas.	The lighting unit is receiving illumination from an extraneous source.	Remove the influence of extraneous illumination.
A black edge is visible within the image frame.	A CCD-camera is badly adjusted.	Please contact customer services.
One-sided illumination (one side is noticeably darker).	The electric power supply to one of the two sides of the illumination has been interrupted or the lighting unit is defective.	Please contact customer services.
After the start of the measurement no material is fed.	Metering feeder is not connected.	Check connection.
	Start control level of the feeder is too low.	Increase feeder control level at the start.
The measure-ment is interrupted although no material has been measured	Chosen time for initial feed of the material is too short or the initial feeder control value is too small.	Increase time for initial feed. Increase initial feeder control value.
After the complete sample has passed through the	No termination condition has been set.	Set the terminating condition.

instrument the measurements are not discontinued	The optical path has become heavily contaminated during the measurement.	Clean; check flushing air.
After complete sample has been measured, the program closes automatically and no results are saved	PORTIO driver is corrupted or absent.	Re-install PORTIO driver.
The material is flowing predominately to one side	The instrument is not placed on an evenly horizontal plane.	Adjust positioning of the instrument using a water level.
The measured quantity per unit area grossly deviates from the target value (this can only be detected when both CCD cameras are being used for measuring	The wrong feeder width has been entered in the task file.	Set the correct feeder width under "Options" - "Task file".
HELP-File cannot be found.	The name of the HELP-file is different to program name of the CAMSIZER®.	Rename the HELP-file using the Windows explorer.
Autoheight shows no reaction at all.	Red security push button is pushed.	Release the security push button.
Autoheight shows errors when moving to the reference points.	Information about height position between the CAMSIZER® and the software is not the same.	Shut down the PC and the CAMSIZER® and restart.

8.3 Confirmation form

I have read the foreword and the chapter on safety.

_____
_____

Signature of the operator

_____
_____

Signature of the service technician