

How to Calculate the Event Time

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The DAQ card has a simple 41.667 MHz oscillator, that ticks every 24 ns ($=1/41667000$). This device is not an accurate time keeper (the actual time pulse of the oscillator is sensitive to temperature and may drift considerably).

The GPS produces a timing pulse, called 1PPS (1pulse per second). The actual GPS output is a number giving the date and time down to milliseconds. The time part, as recorded by the DAQ card, is slightly off. This offset, which can be either positive or negative, is however calculated and recorded. This *delay* must be added (or subtracted) to the time of the GPS output (remember, this is a number, down to milliseconds). Once this correction is made, the GPS clock reading is then *rounded* to the nearest *integer second* (forget the milliseconds!).

Those groups who are using the same DAQ card and GPS unit have now their 1PPS seconds synchronized.

To establish the event time, the DAQ card logs the number of oscillator pulses counted after a synchronized 1PPS.

This number of oscillator cycles since the last 1PPS pulse, is divided by the number of oscillator cycles in the last two 1PPS pulses (a number close to, but not exactly equal, because of temperature fluctuations, to 41667000).

This will give us the Event Time, down to about 24 ns, after the synchronized 1PPS pulse .

EXAMPLE:

Trigger Time HEX	4 channels Up-Down triggers	1PPS HEX	hh:mm:ss .sss	Date	V	Delay (ms)
7EEED53B	A3 36 3F 00 01 00 01	7C6A6587	175402.082	010604	V00	+0887

Add delay to ss.sss and round to nearest integer:

$$\text{Synch Second} = \text{INT} (2.082 + 0.887) = 3$$

Convert HEX to DEC

$$\text{Trigger time: } 7EEED53B_{\text{HEX}} = 2129581371_{10}$$

$$\text{Last 1PPS: } 7EE62DDD_{\text{HEX}} = 2129014237_{10}$$

$$\text{Previous 1PPS (shown alone in the table): } 7C6A6587_{\text{HEX}} = 2087347591_{10}$$

Calculate clock rate (within two 1PPS):

$$R = (\text{Last 1PPS} - \text{Previous 1PPS}) = 41,666,646 \text{ pulses/sec}$$

$$\text{Event time} = (\text{date}) + (\text{hh: mm}) + (\text{Synch Second}) + \left(\frac{\text{Trigger time} - \text{Last 1PPS}}{R} \right) =$$

$$= \text{Jan 06 2004 at 17:54:3.013611222}$$