Non-Newtonian flow in Rotating Mixer

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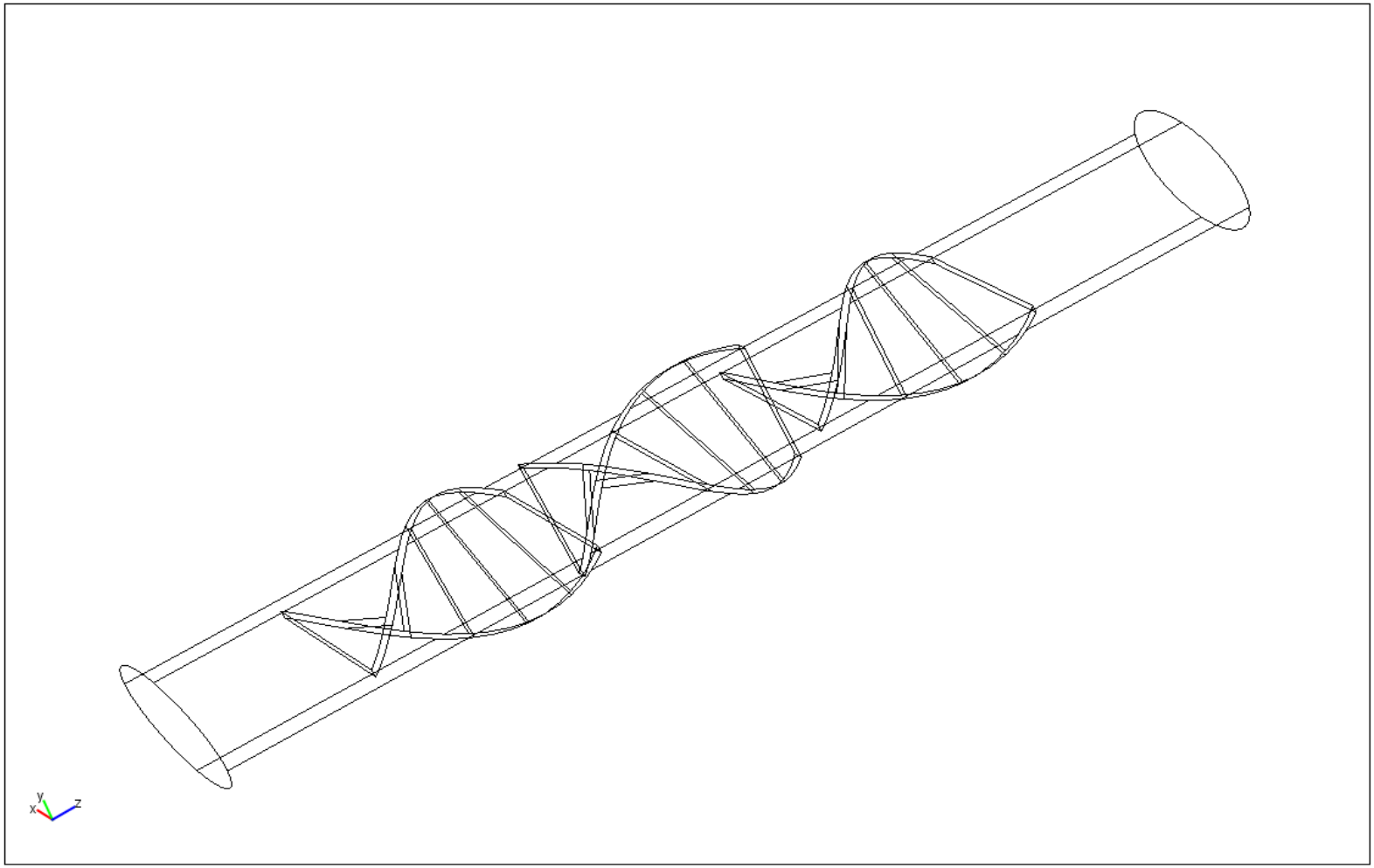
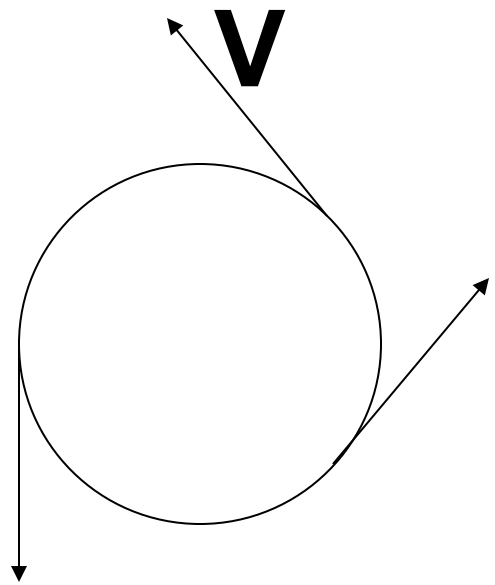
Objective

- Study the effect of Concentration in a Rotating Mixer
- Comparing with Static Laminar Mixer
- Provide Best Mixing Profile

Geometry



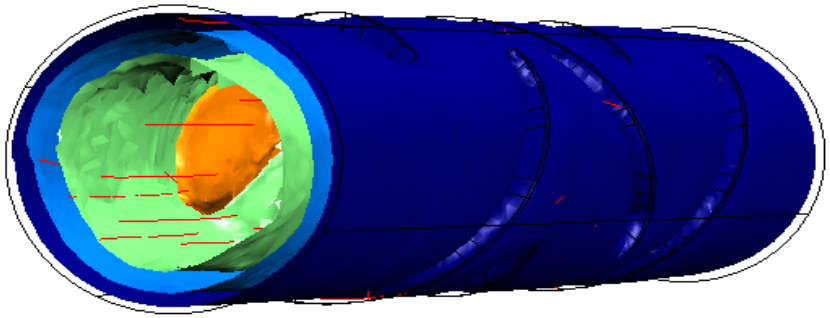
Method

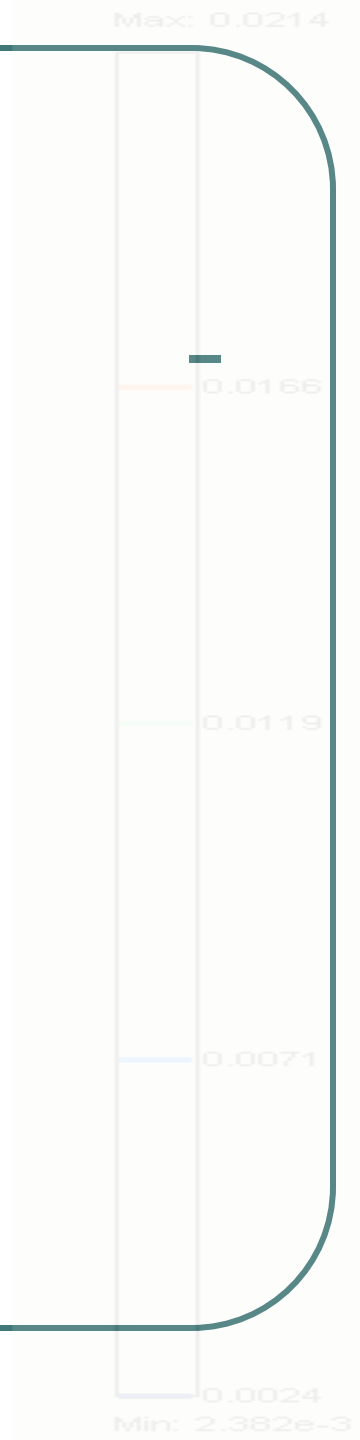


$$V_x = \frac{y}{\sqrt{y^2 + x^2}} \cdot V$$

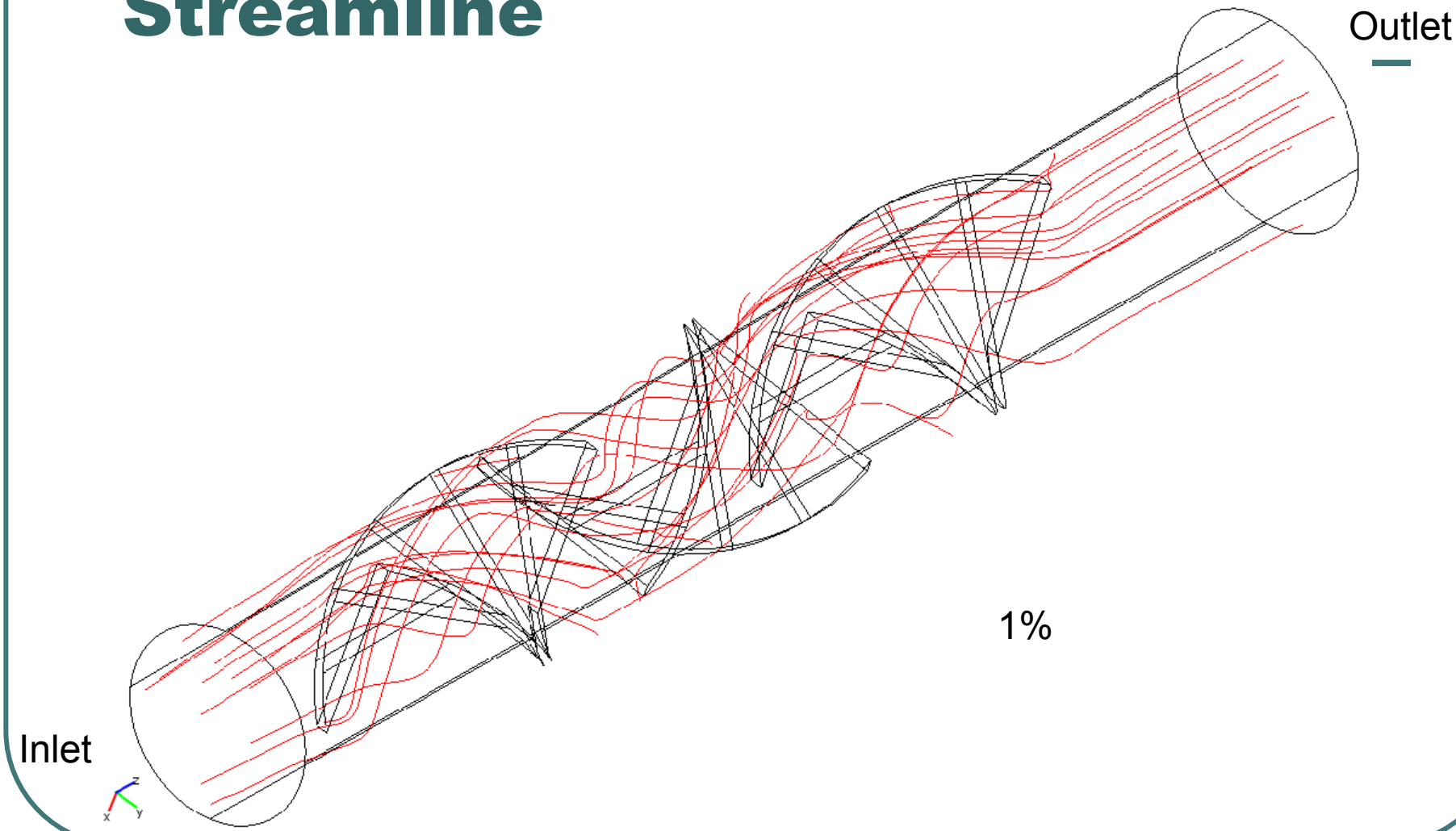
$$V_y = \frac{x}{\sqrt{y^2 + x^2}} \cdot V$$

Velocity Profile

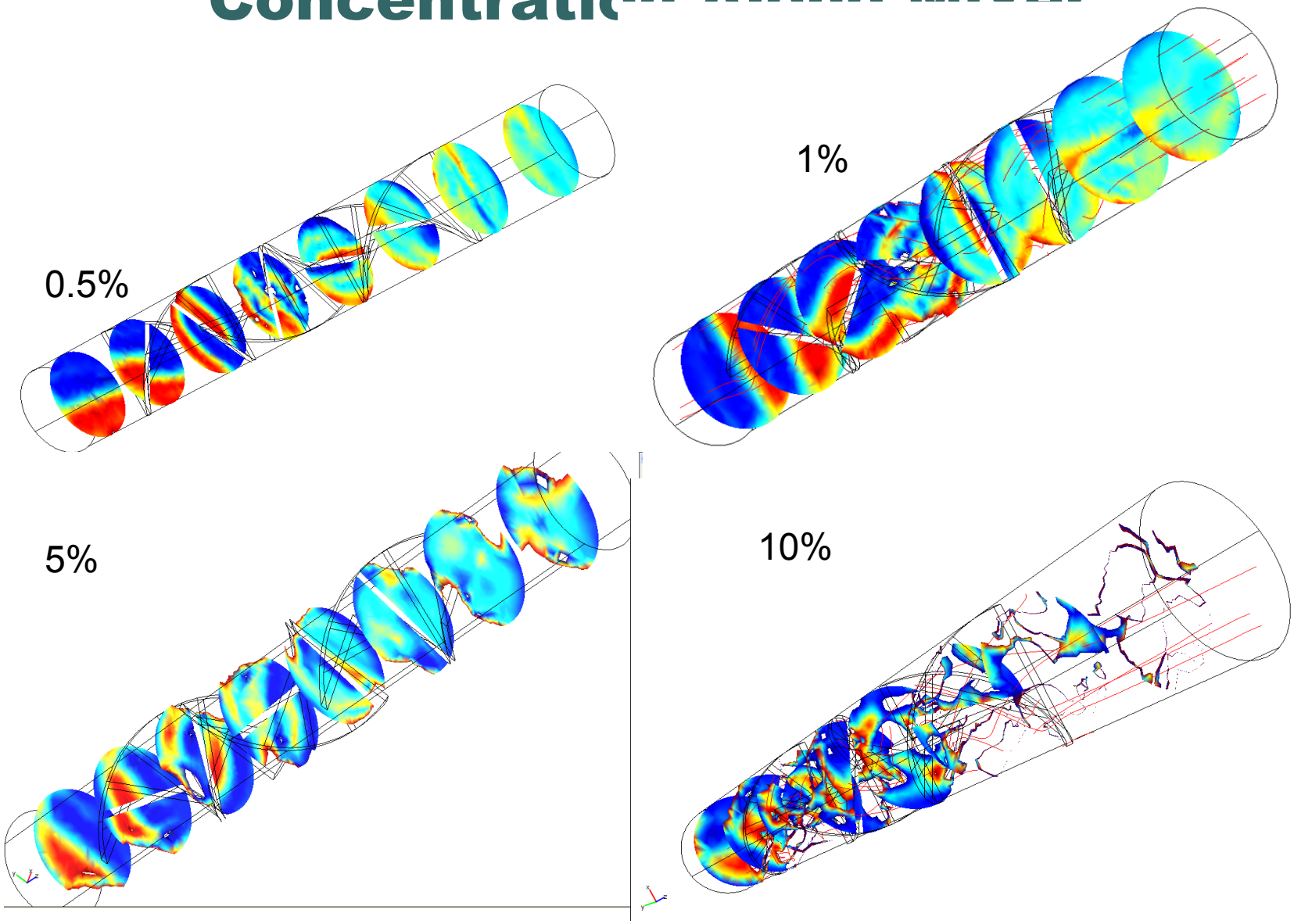




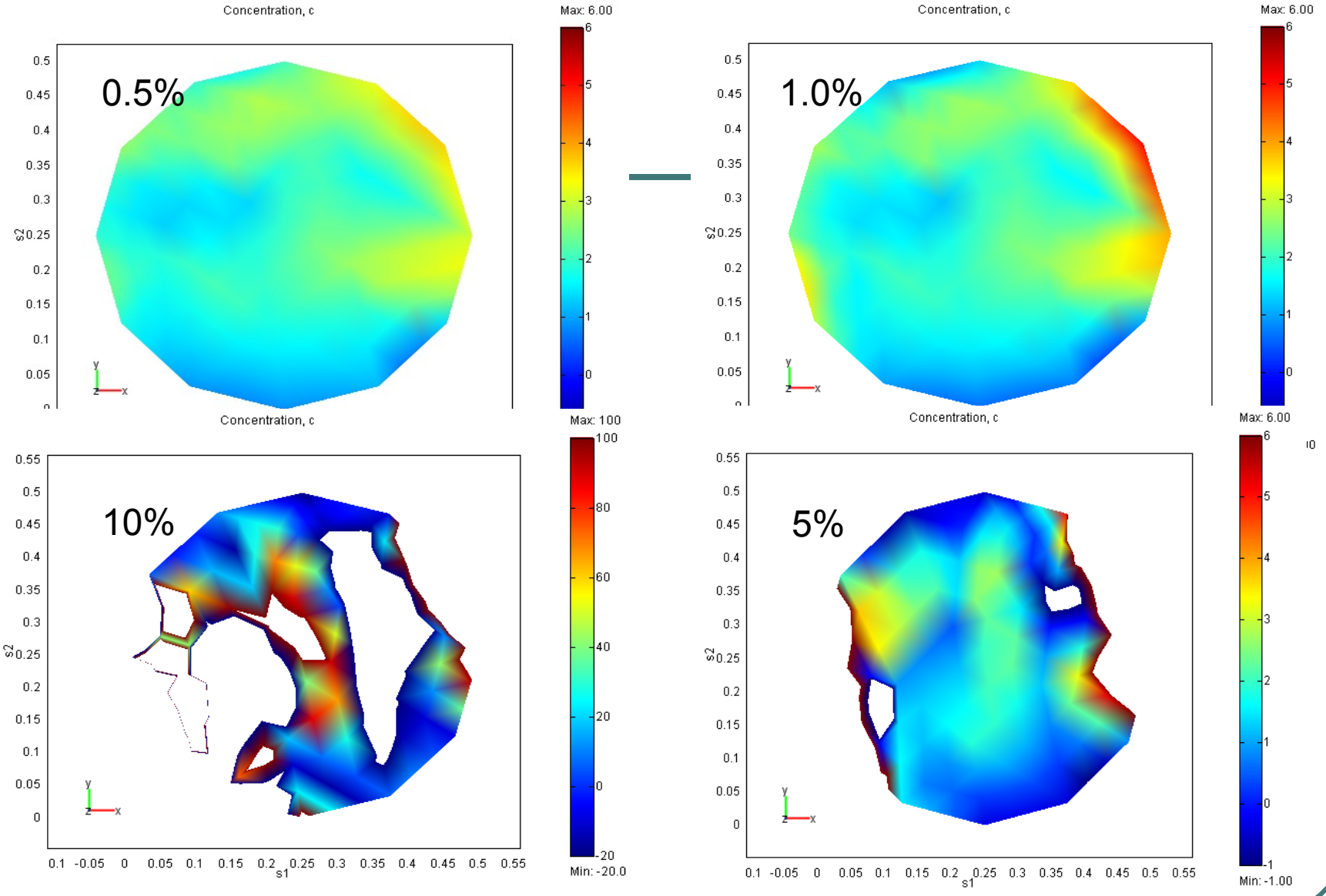
Streamline



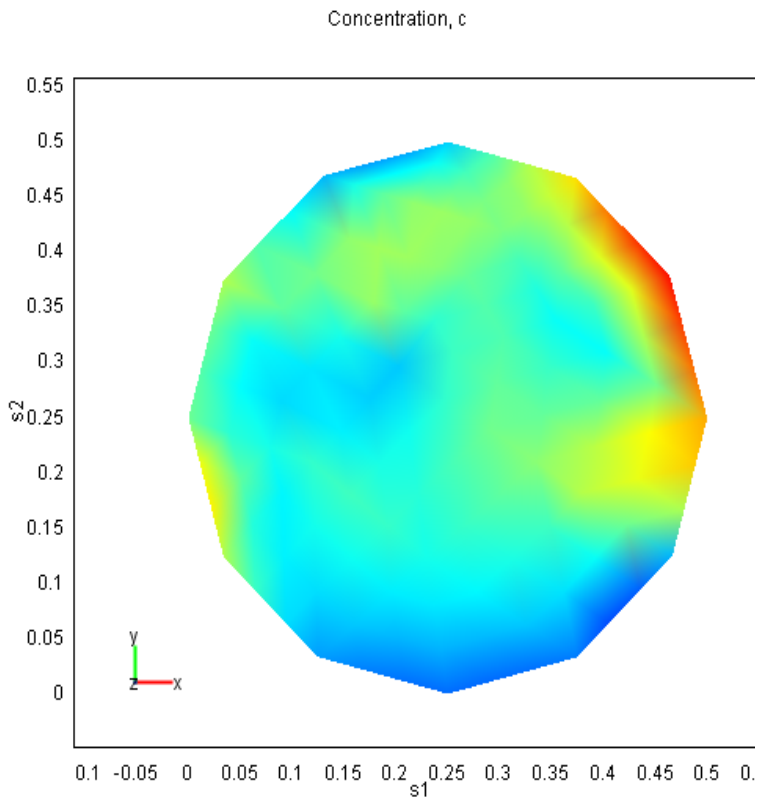
Concentration Along Mixer



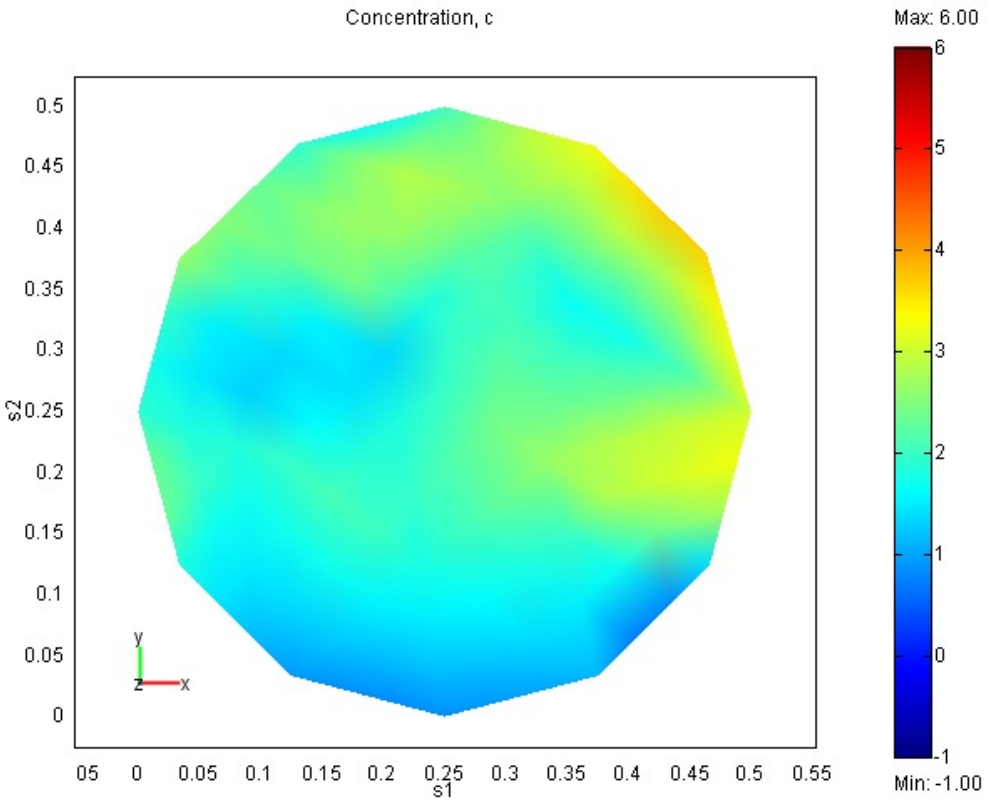
Concentration at Outlet



Concentration of two velocities

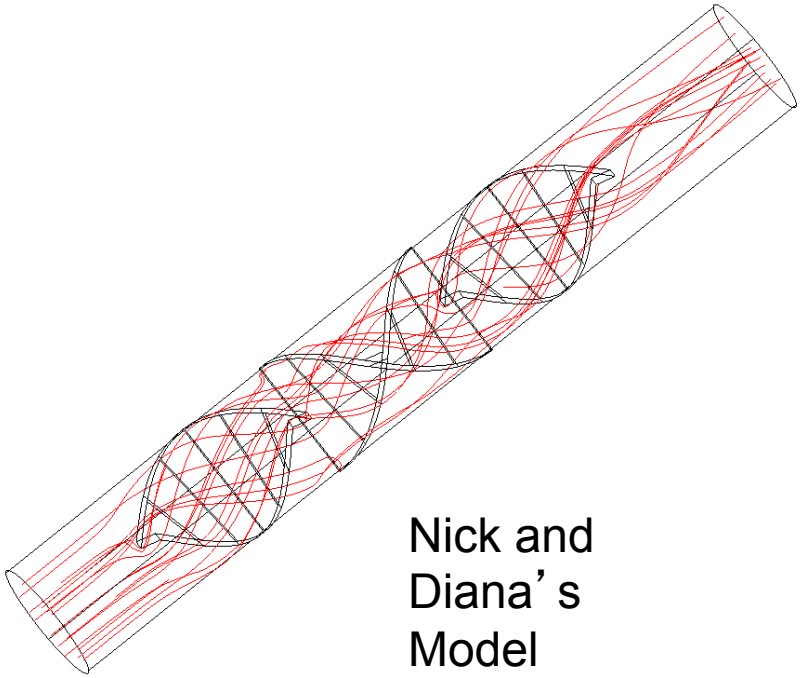


V = 1%

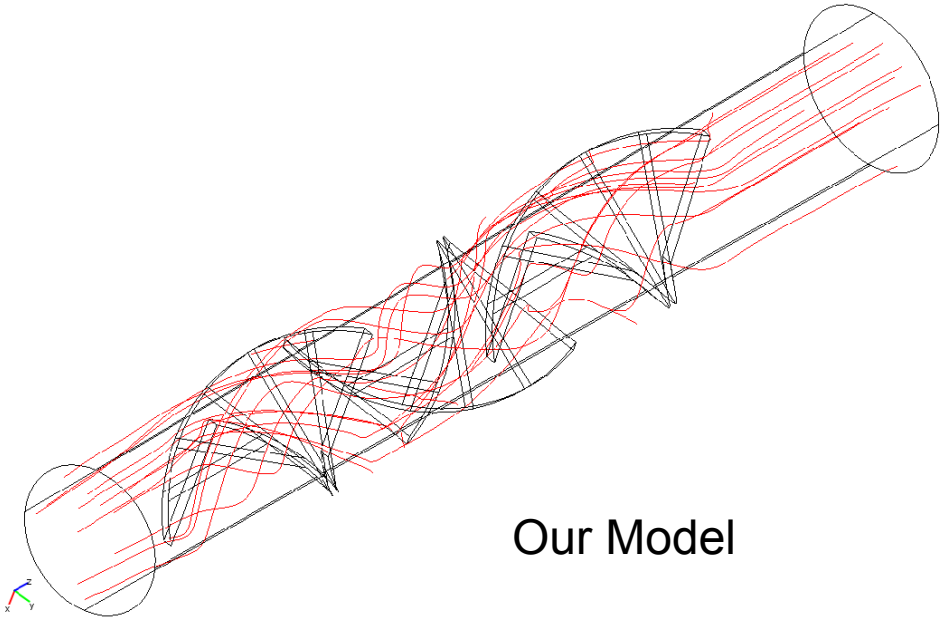


V = 0.5%

Streamline of Two Mixer

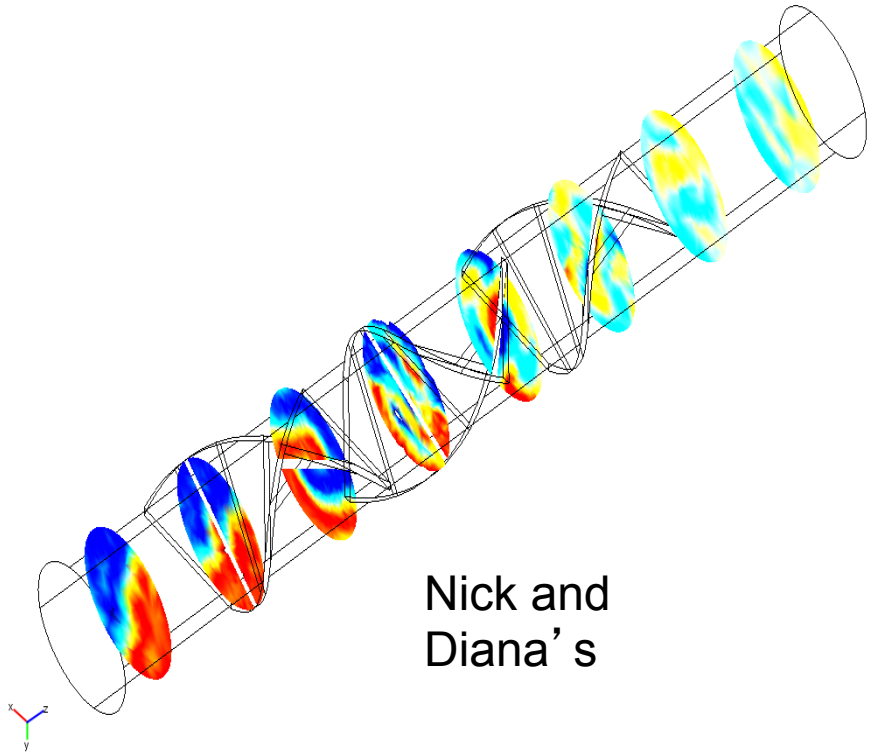


Nick and Diana's Model

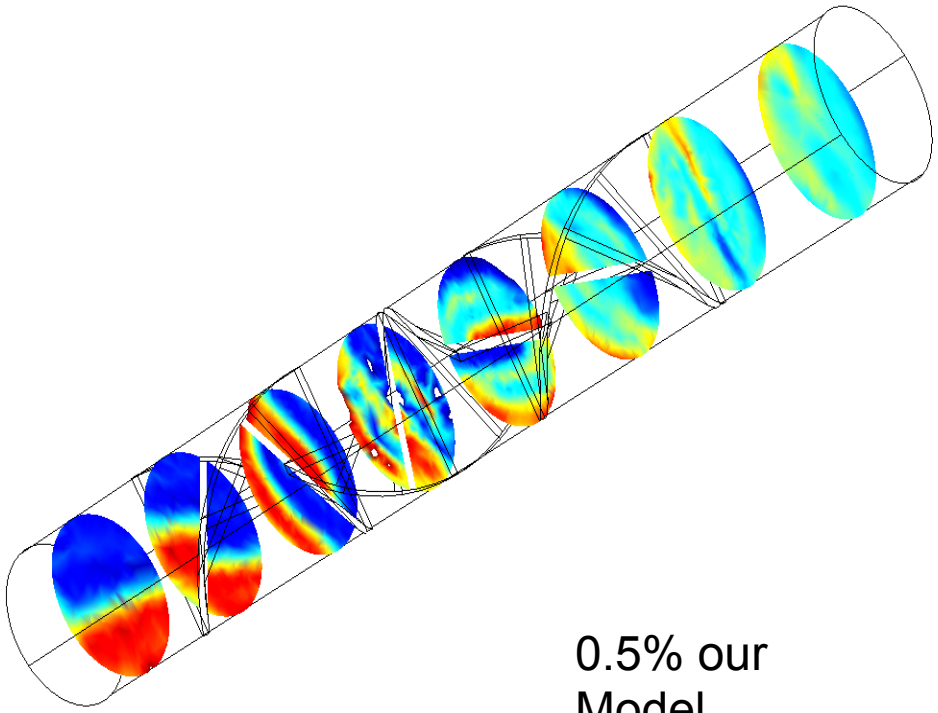


Our Model

Slices Along Mixer

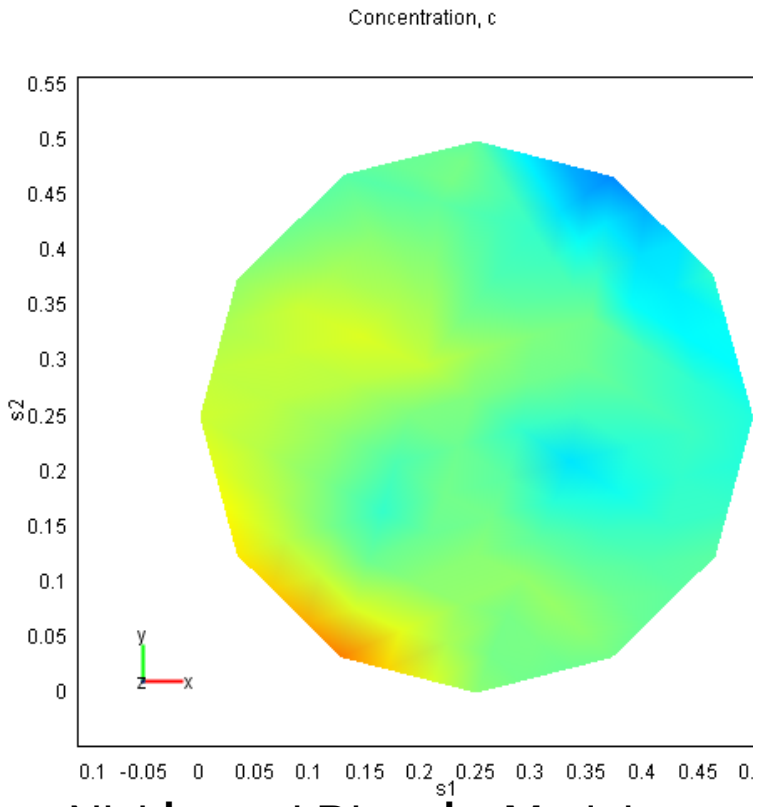


Nick and Diana's

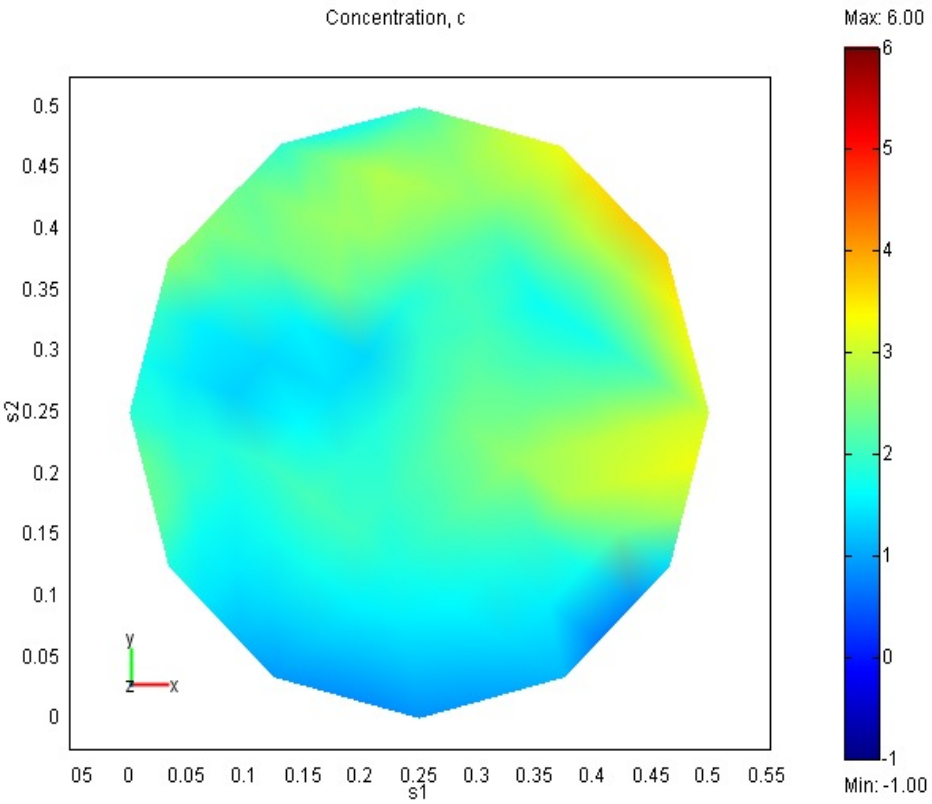


0.5% our Model

Relate to other group's work

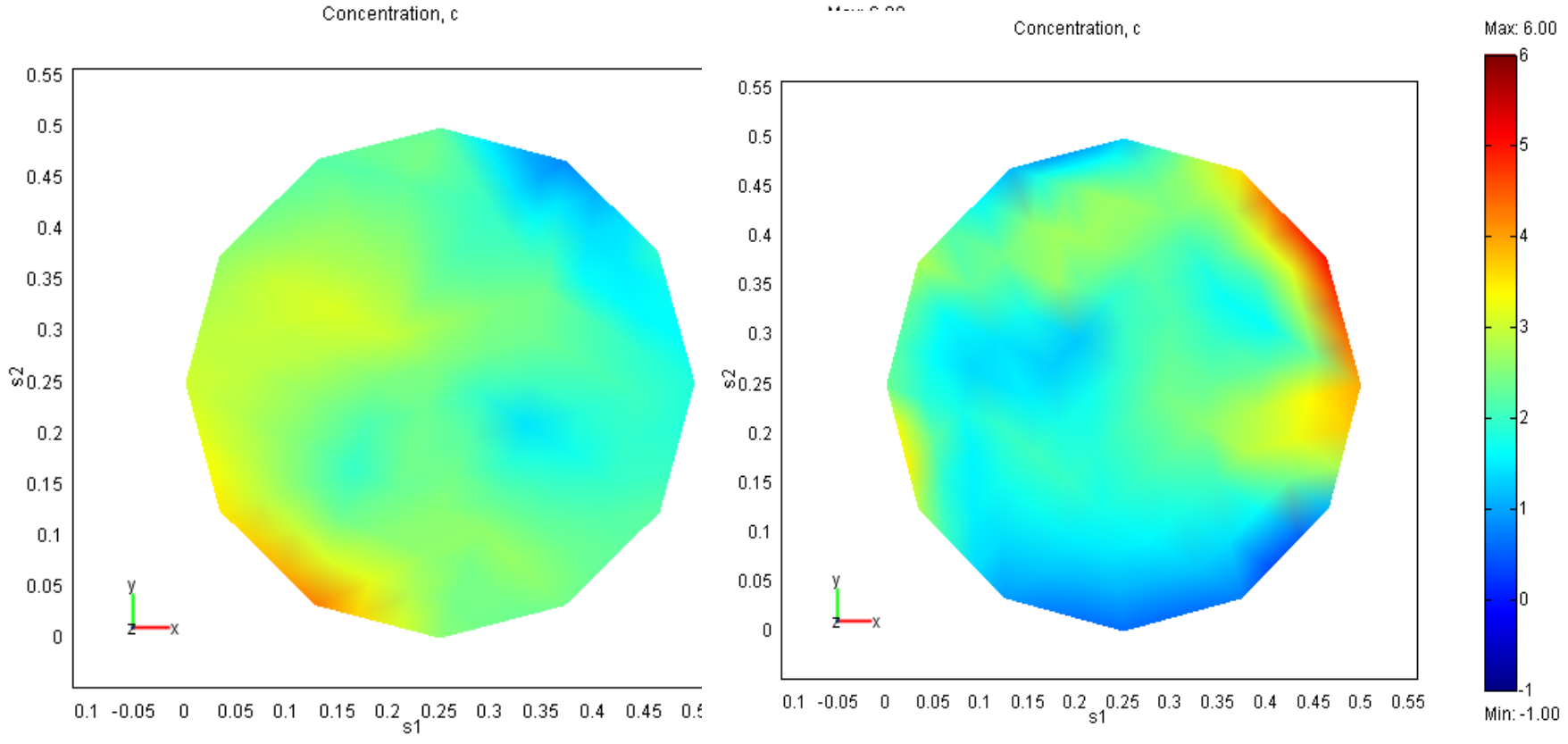


Nick's and Diana's Model



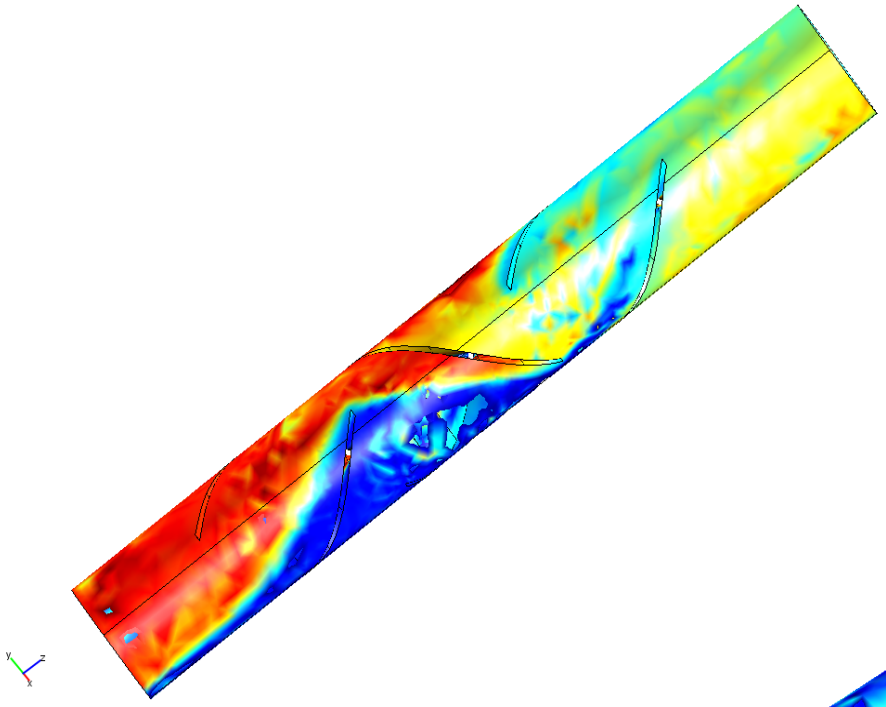
0.5% Our Model

Comparison

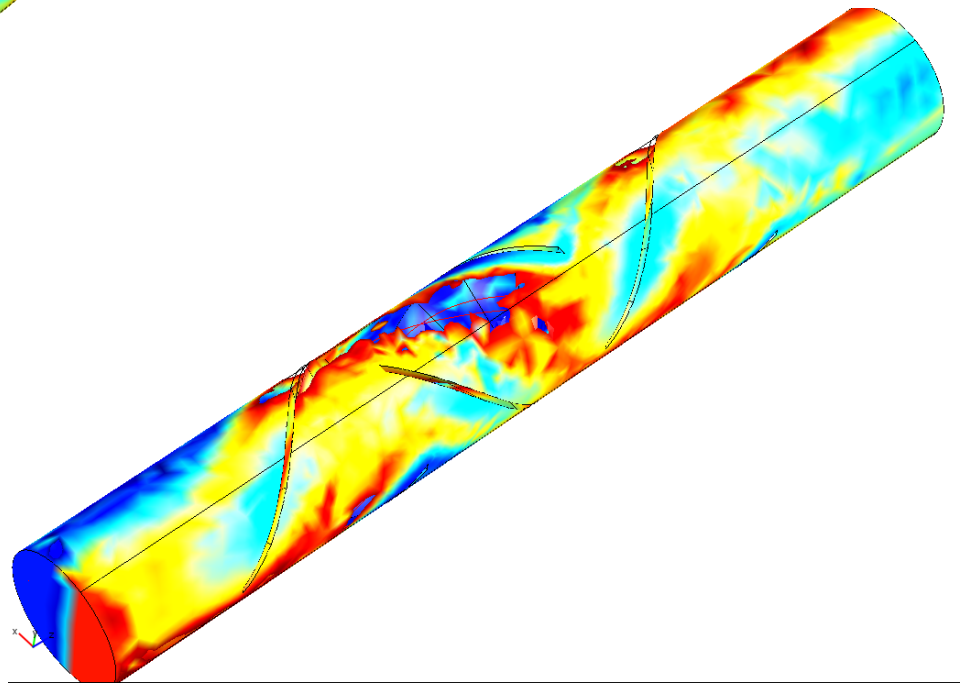


1%

Boundary Concentration



Our Model



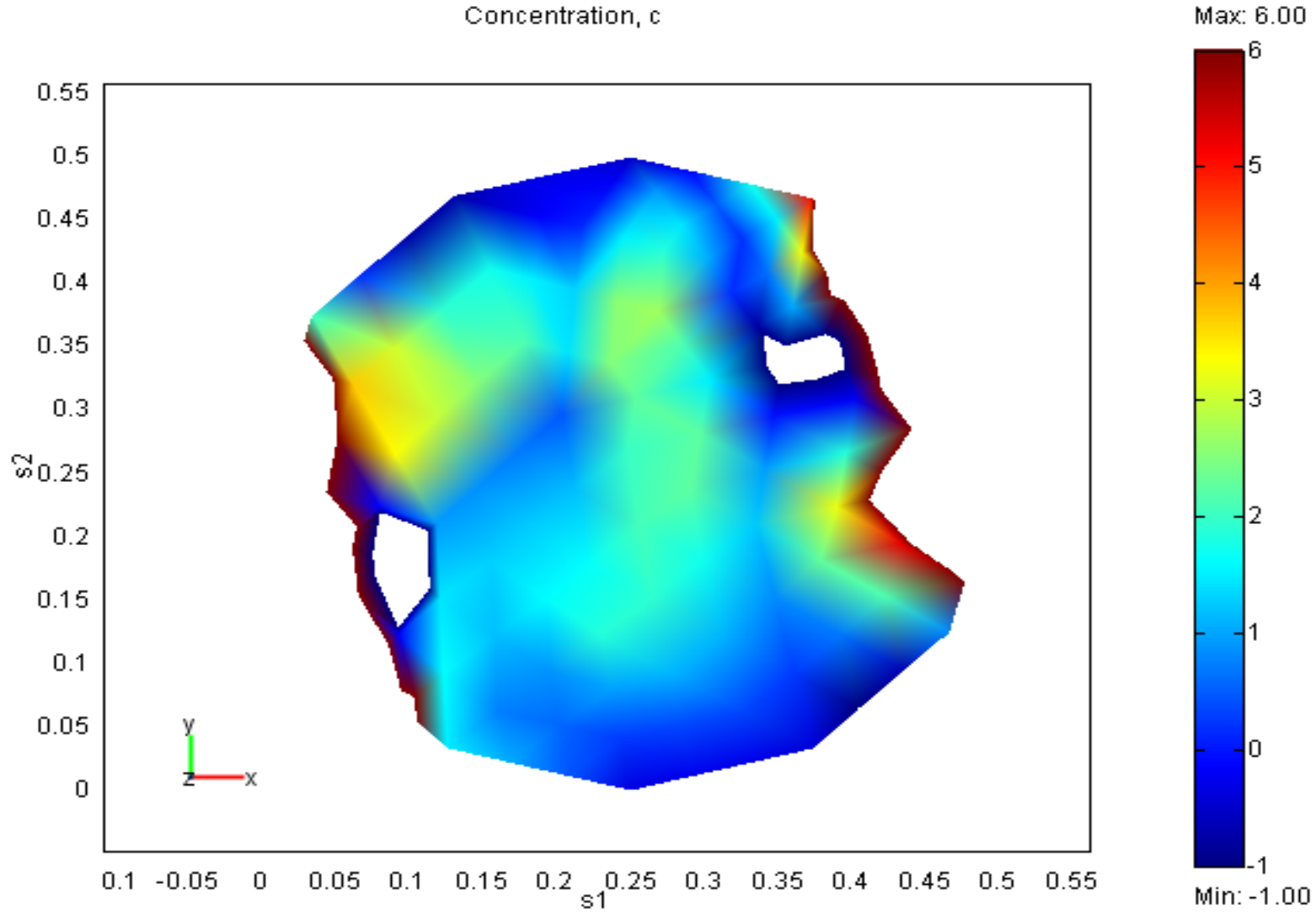
Conclusion

- Rotating the mixer does improve the mixing condition.
  - Particularly in between blades
  - Not mix well around the outlet region
  - Spin with 10% of the fluid velocity cause separation and concentration instead of mixing
  - Well mixing about around 0.1% to 0.5%.

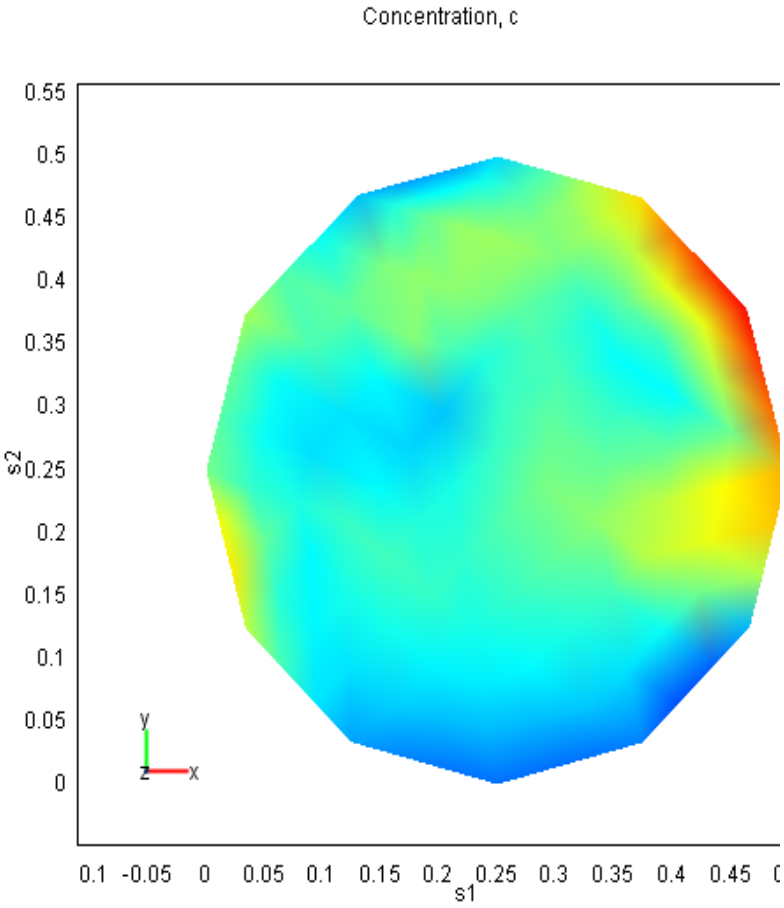
Recommendations

Questions

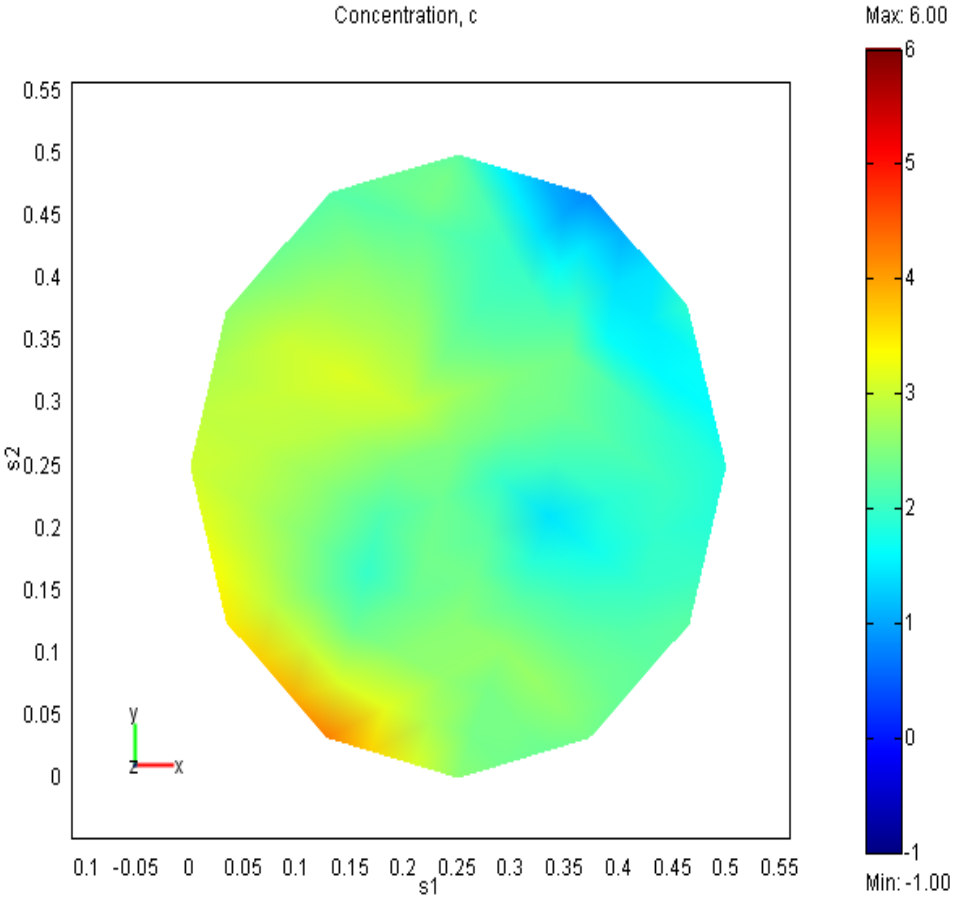
Concentration with V = 0.0005



Relate to other group's work

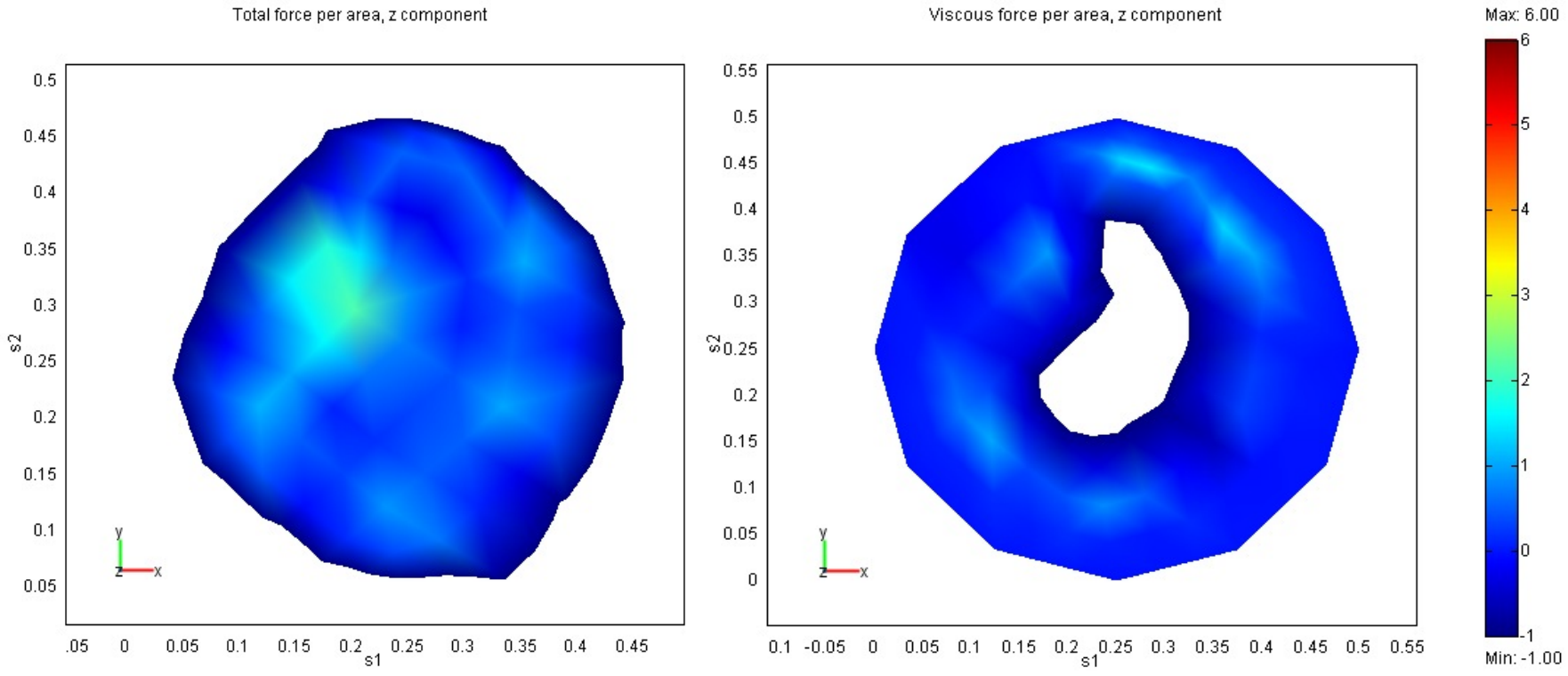


Nick's and Diana V= 0.0005

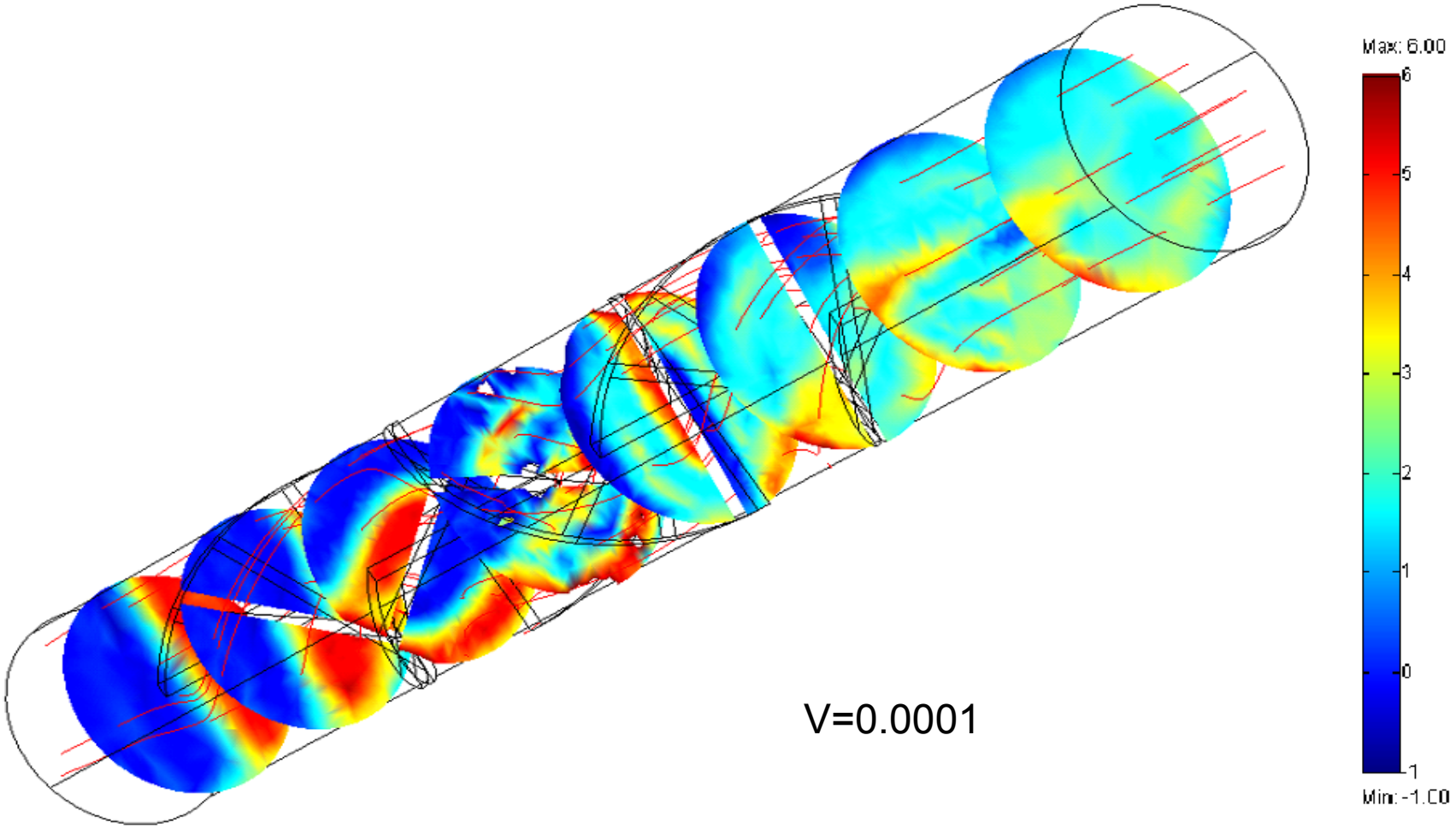


Nick's and Diana's Model

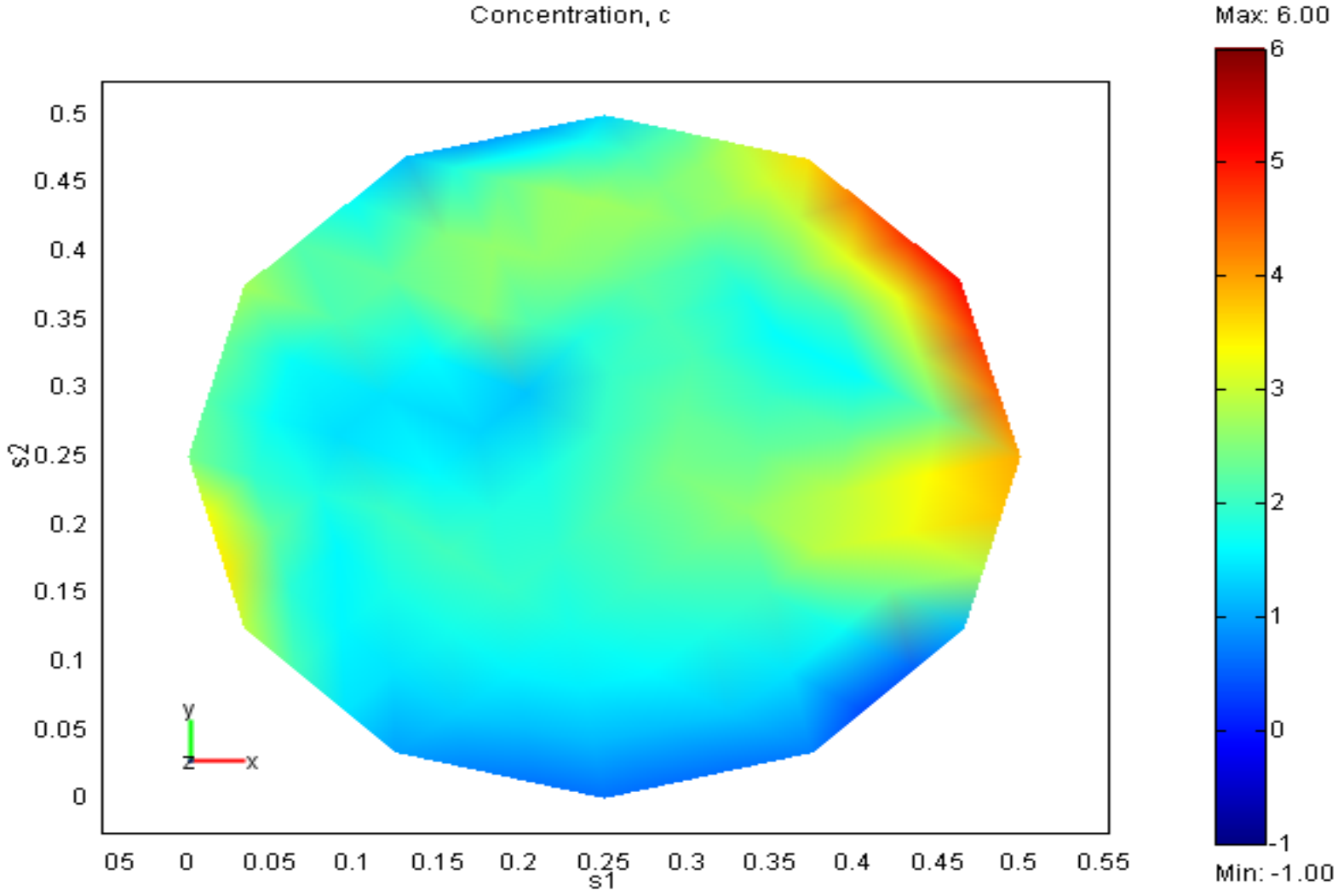
V=0.00005


Total force per area, z component
Viscous force per area, z component
Max: 6.00
Min: -1.00
s1
s2

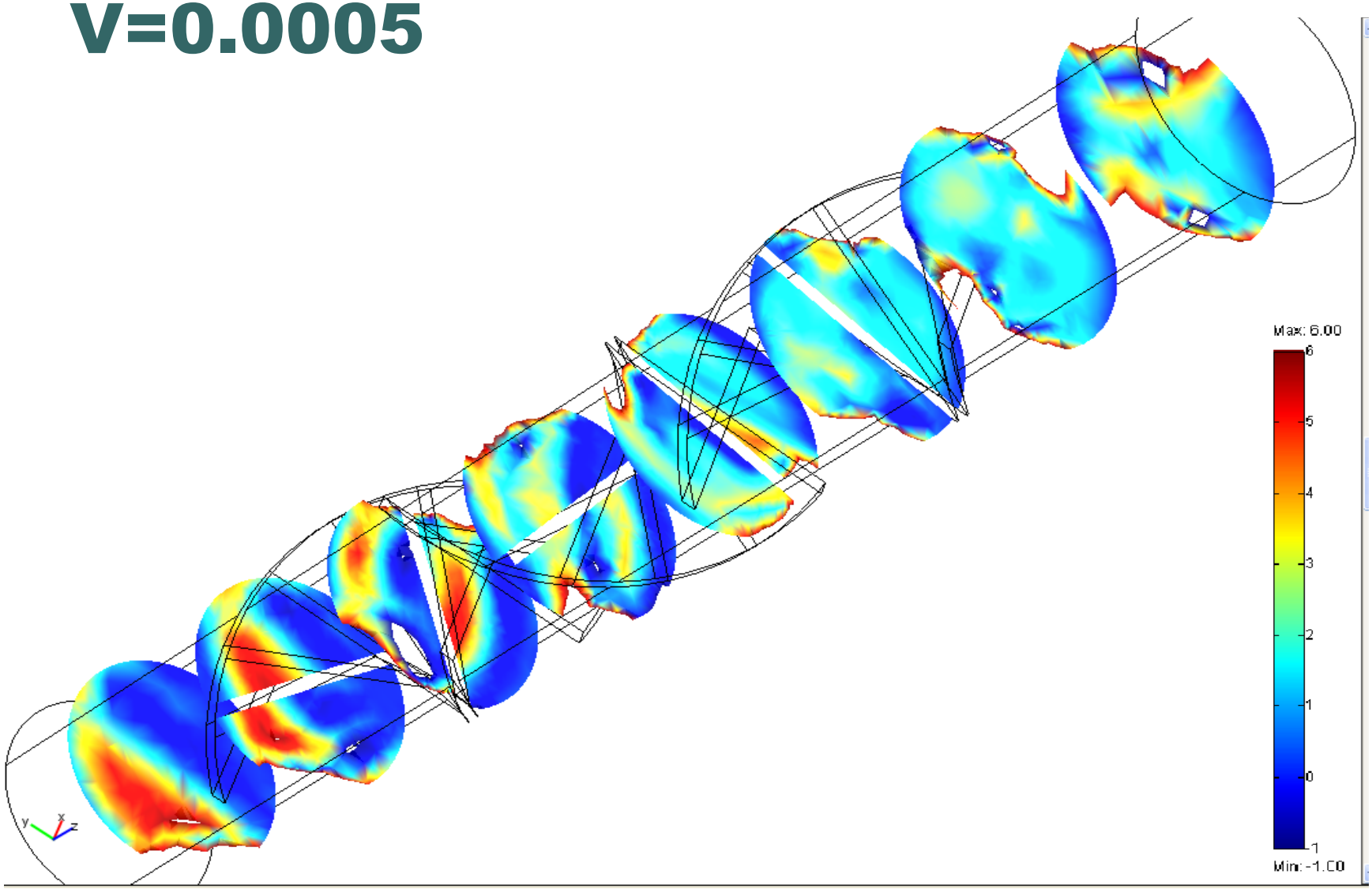
Rotating speed is about 0.1% flow speed



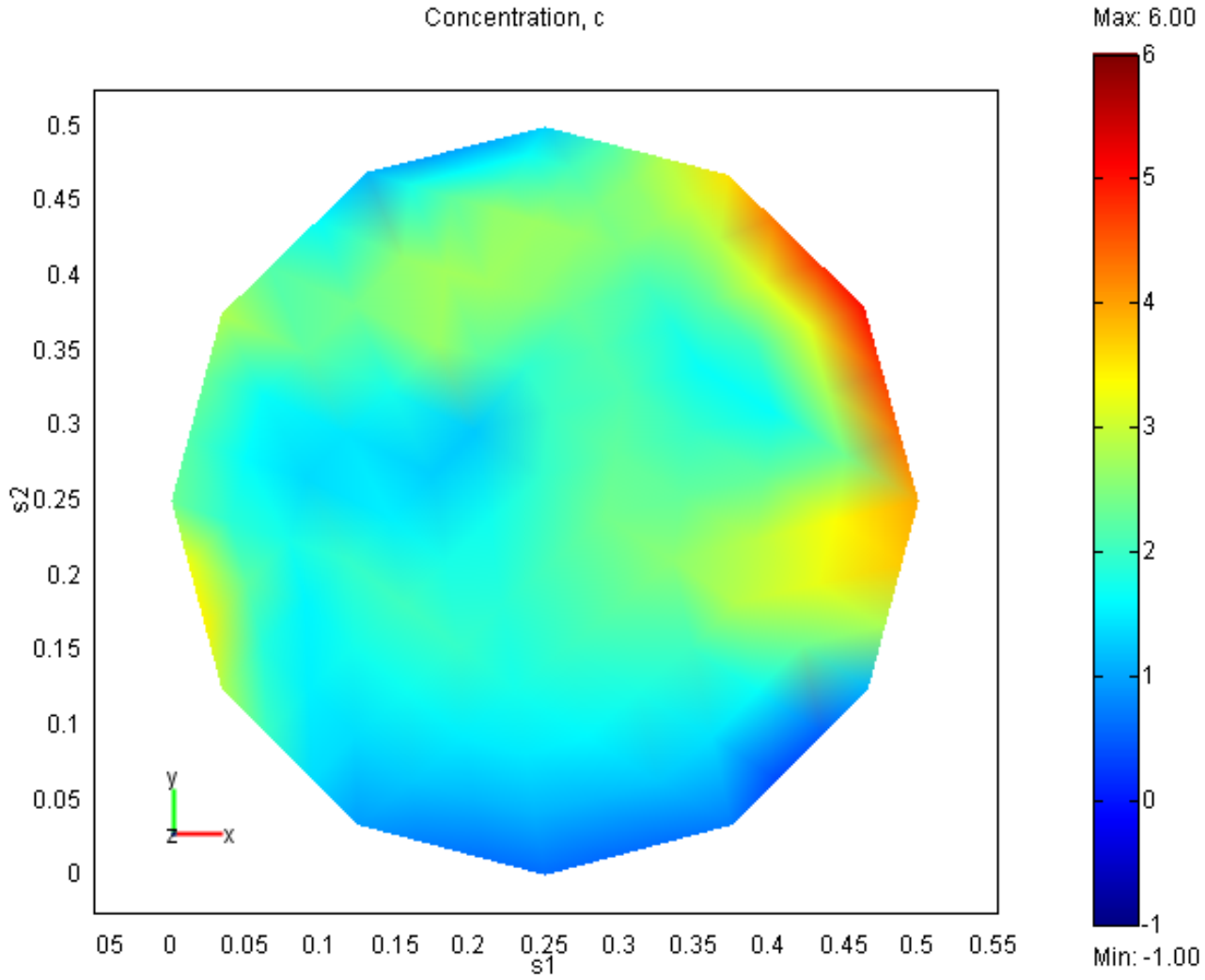
Outlet Concentration



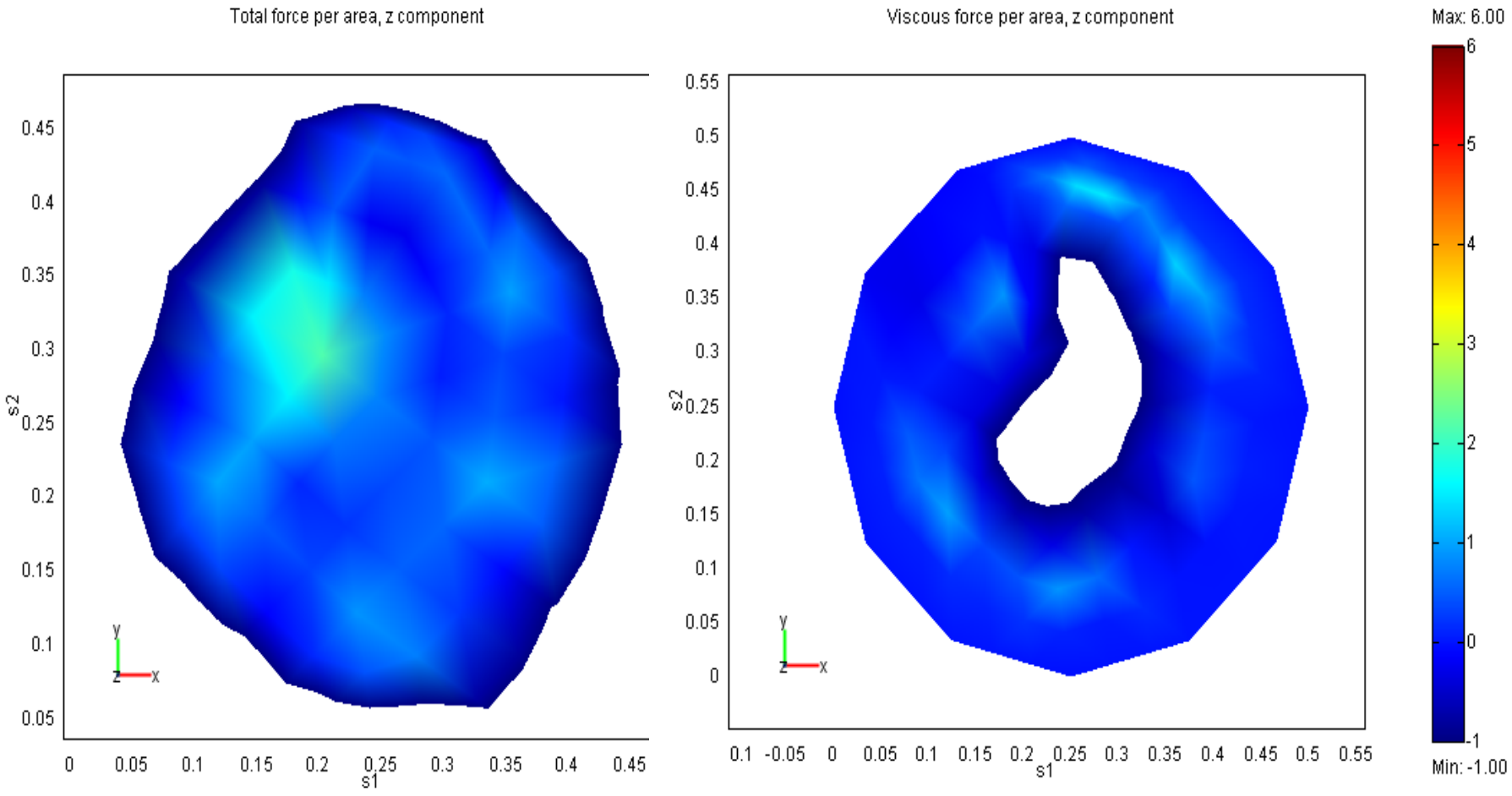
V=0.0005



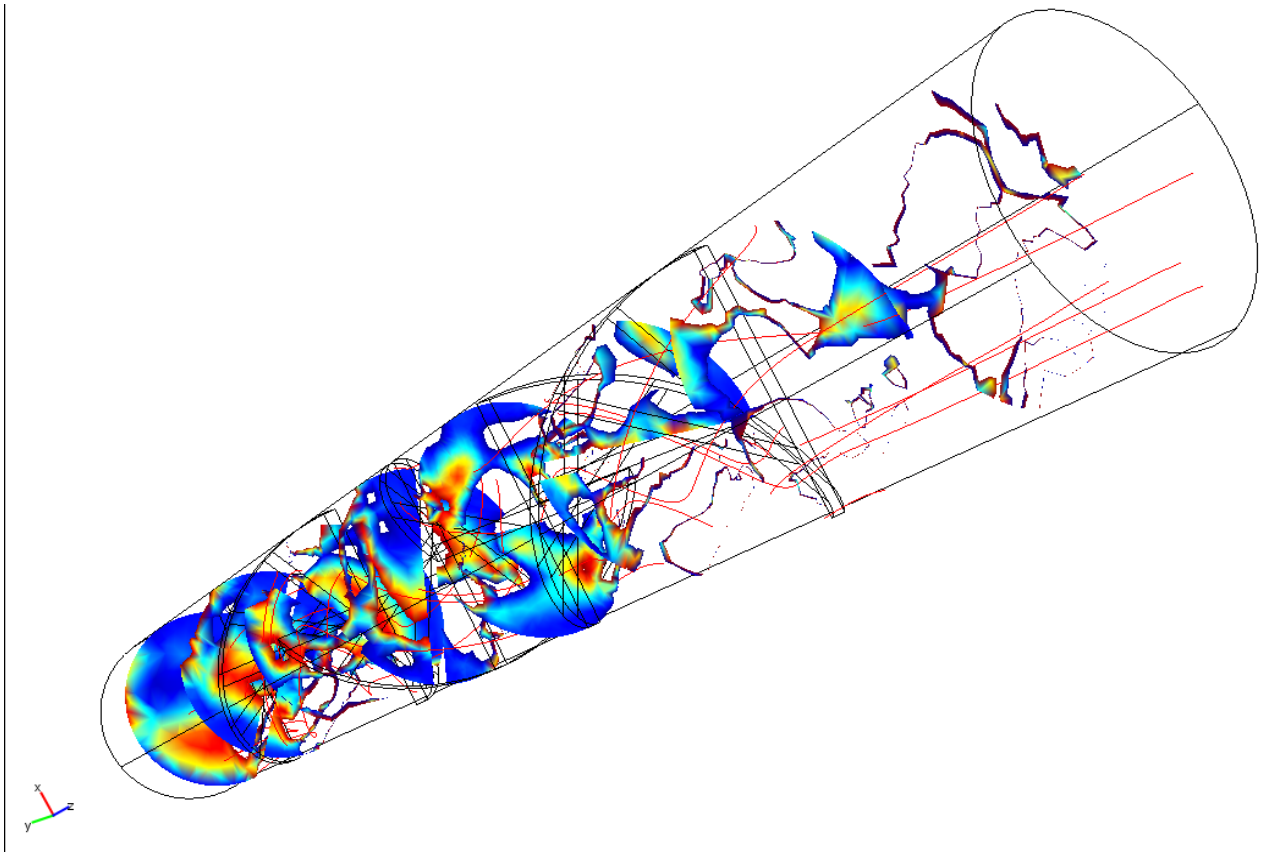
V= 0.001


Concentration, c
Max: 6.00
6
5
4
3
2
1
0
-1
Min: -1.00
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
s2
05
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
0.45
0.5
0.55
s1
y
z
x

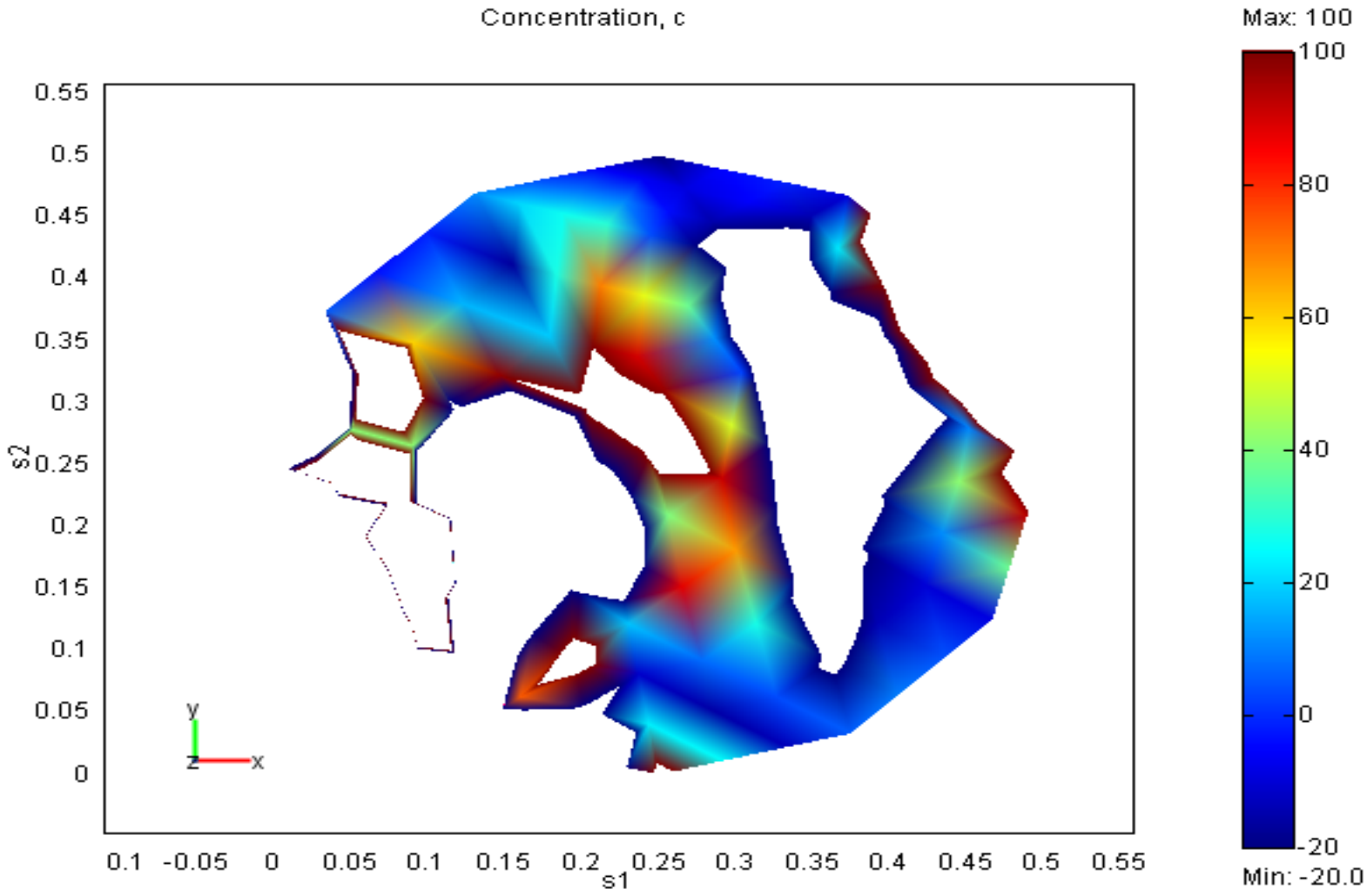
V = 0.0005


Total force per area, z component
Viscous force per area, z component
Max: 6.00
Min: -1.00
s1
s2

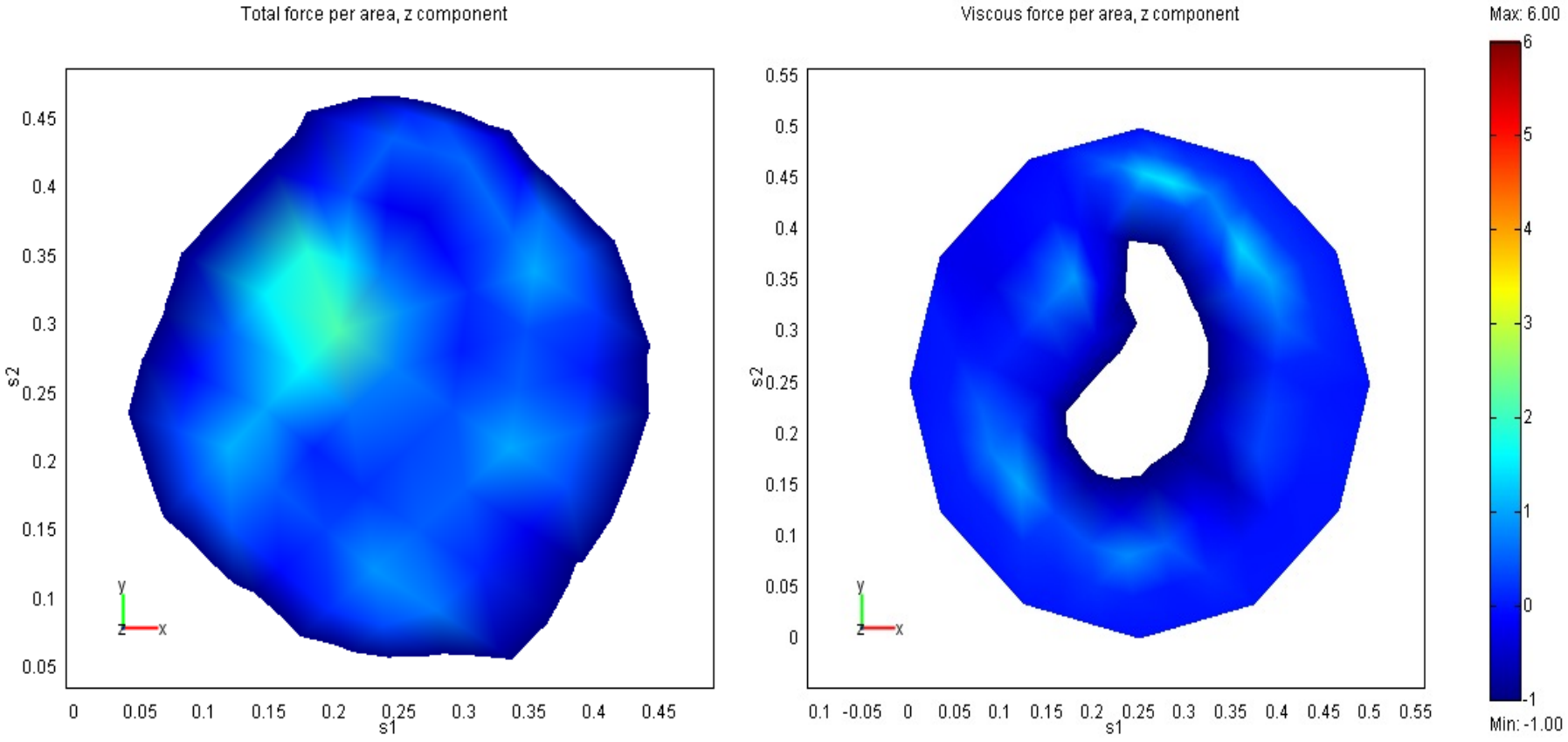
Rotating Mixer V= 0.001



V= 0.001


Concentration, c
Max: 100
100
80
60
40
20
0
-20
Min: -20.0
s2
0.55
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
y
z
x
0.1 -0.05 0 0.05 0.1 0.15 0.2 0.25 0.3 0.35 0.4 0.45 0.5 0.55
s1

V=0.0001


Total force per area, z component
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Max: 6.00
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s1
s2