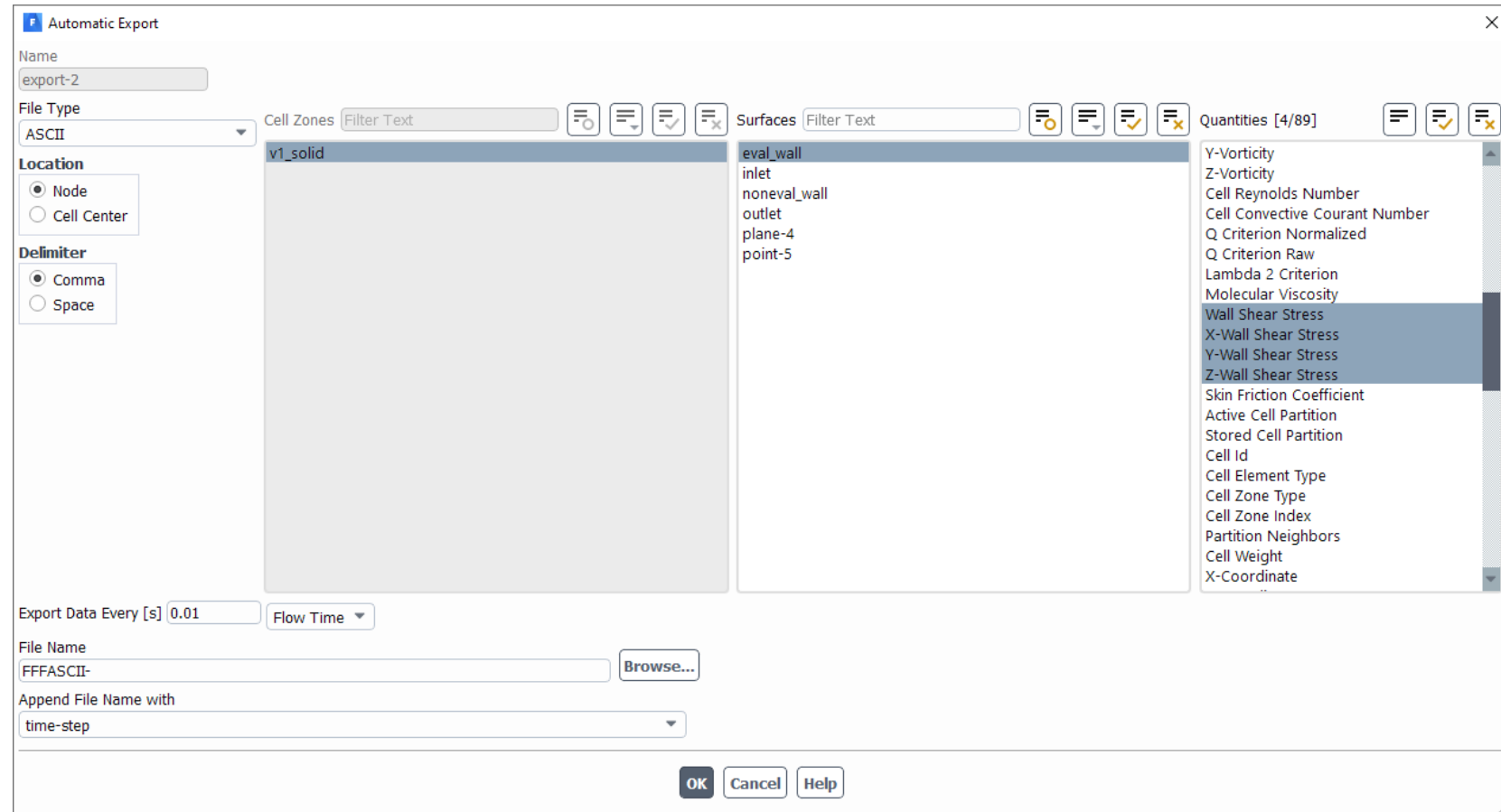
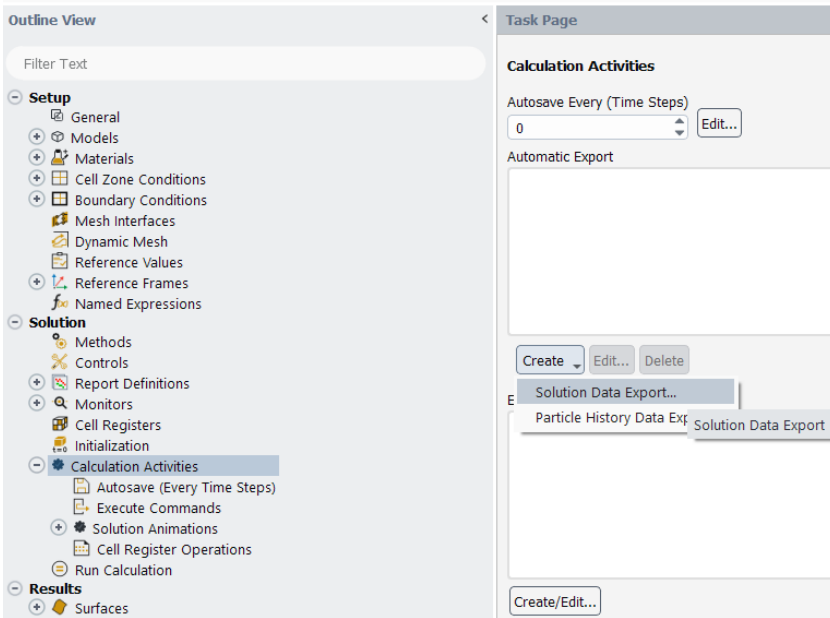


Hemodynamic Fluent Calculation Guide

By: Asad Mirza

For: CV-PEUTICS

Setting Up Fluent Export



Calculation Activities → Create → Solution Data Export

File Type: ASCII

Location: Node

Delimiter: Comma

Surface: Surface whose OSI/TAWSS you're interested in

Quantities: Wall Shear Stress and XYZ Wall Shear Stress

Exported Data

Name	Date modified	Type	Size
FFFTxtV2--0001	3/28/2021 3:28 PM	File	304 KB
FFFTxtV2--0002	3/28/2021 3:28 PM	File	304 KB
FFFTxtV2--0003	3/28/2021 3:28 PM	File	304 KB
FFFTxtV2--0004	3/28/2021 3:28 PM	File	304 KB
FFFTxtV2--0005	3/28/2021 3:28 PM	File	304 KB
FFFTxtV2--0006	3/28/2021 3:28 PM	File	304 KB
FFFTxtV2--0007	3/28/2021 3:28 PM	File	304 KB
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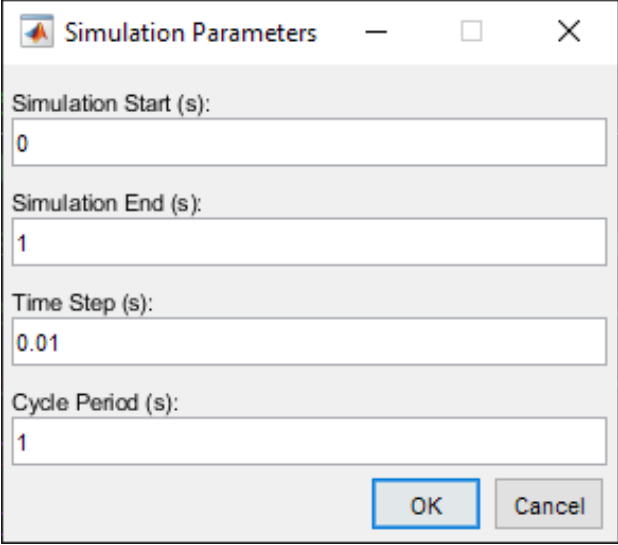
FFFTxtV2--0001 - Notepad

File Edit Format View Help

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Post-Processing: Setting Parameters

- The MATLAB script titled “Fluent_Post_Processing.m” must be run to process the exported data.
- It will ask you for the following:
 - Simulation Start Time
 - Simulation End Time
 - Time Step Size
 - Cycle Period
- You will then be asked which results you wish to plot: TAWSS, OSI, RRT, or transWSS



Simulation Parameters

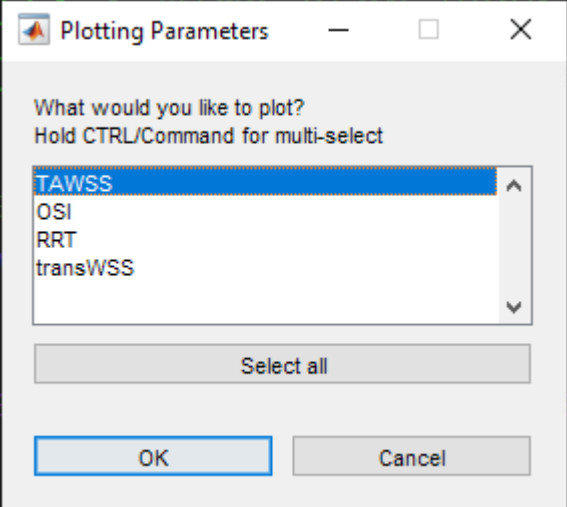
Simulation Start (s):
0

Simulation End (s):
1

Time Step (s):
0.01

Cycle Period (s):
1

OK Cancel



Plotting Parameters

What would you like to plot?
Hold CTRL/Command for multi-select

TAWSS
OSI
RRT
transWSS

Select all

OK Cancel

Post-Processing: TAWSS/OSI/RRT/transWSS

$$TAWSS = \frac{1}{T} \int_0^T |\vec{\tau}_w| dt$$

Measures average WSS on a surface over time.

$$OSI = \frac{1}{2} \left(1 - \frac{\left| \int_0^T \vec{\tau}_w dt \right|}{TAWSS} \right)$$

Measures average of the degree of forward/backward fluid movement on a surface over time.

$$RRT \sim \frac{1}{TAWSS(1 - 2OSI)}$$

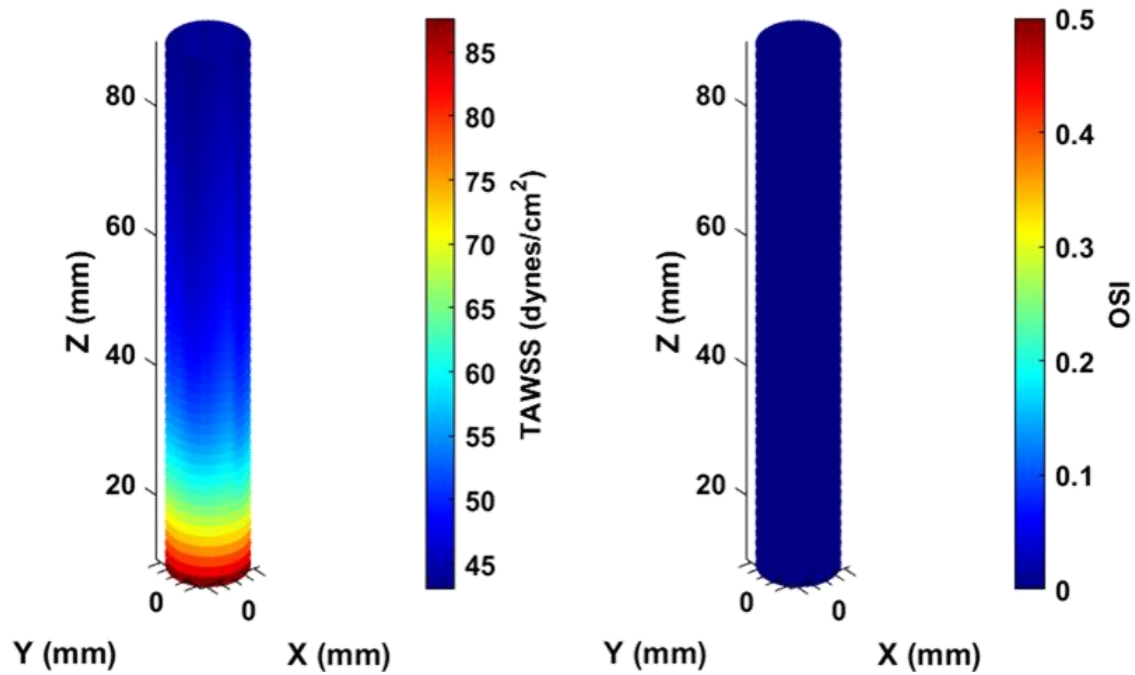
Measures a fluid particle's relative time spent in a particular location on a surface over time.

$$transWSS = \frac{1}{T} \int_0^T \left| \vec{\tau}_w \cdot \left(\vec{n} \times \frac{\int_0^T \vec{\tau}_w dt}{\left| \int_0^T \vec{\tau}_w dt \right|} \right) \right| dt$$

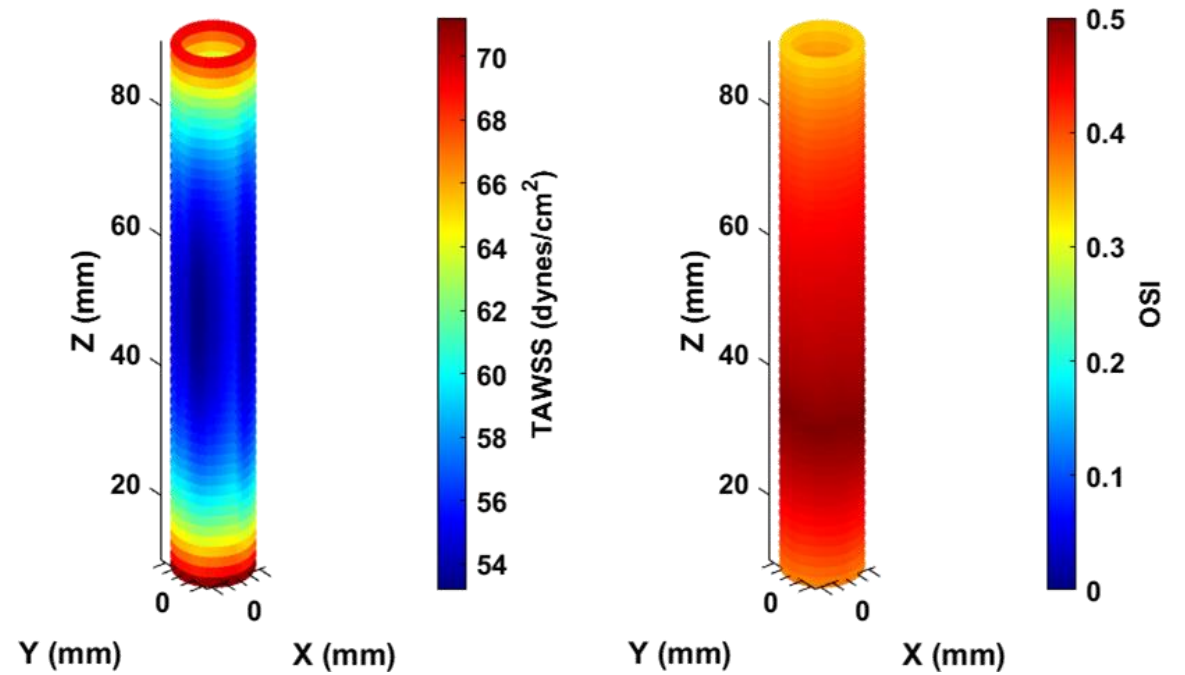
Measures multidirectional WSS on a surface over time.

Post-Processing: TAWSS/OSI Plotting

Ex: +1 m/s Inlet

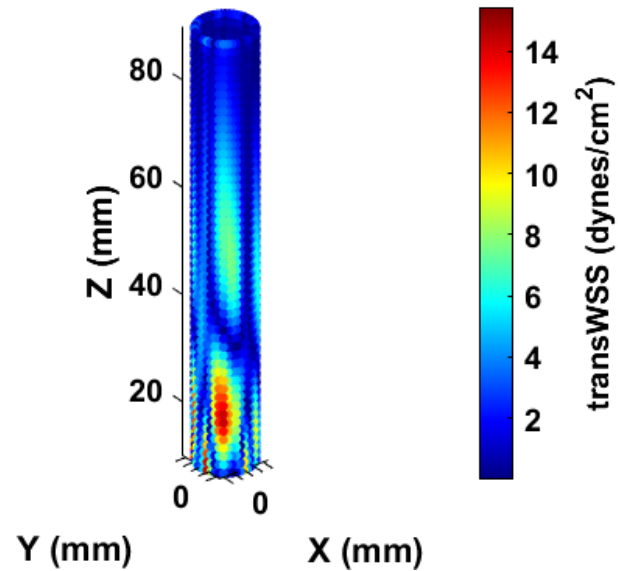
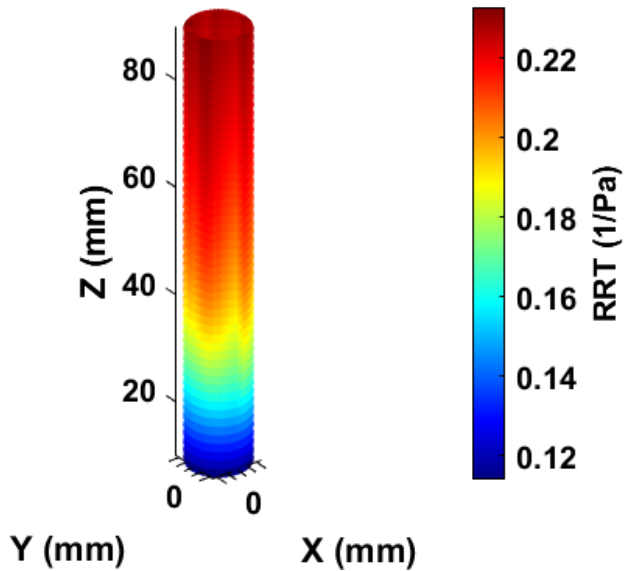


Ex: +/- 1 m/s Inlet

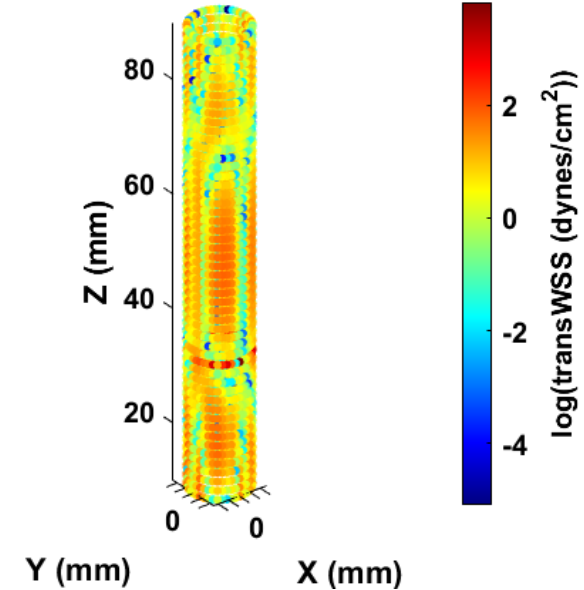
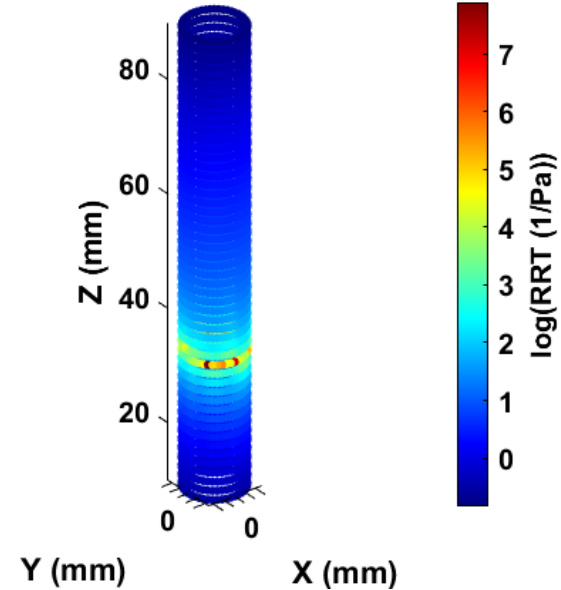


Post-Processing: RRT/transWSS

Ex: +1 m/s Inlet

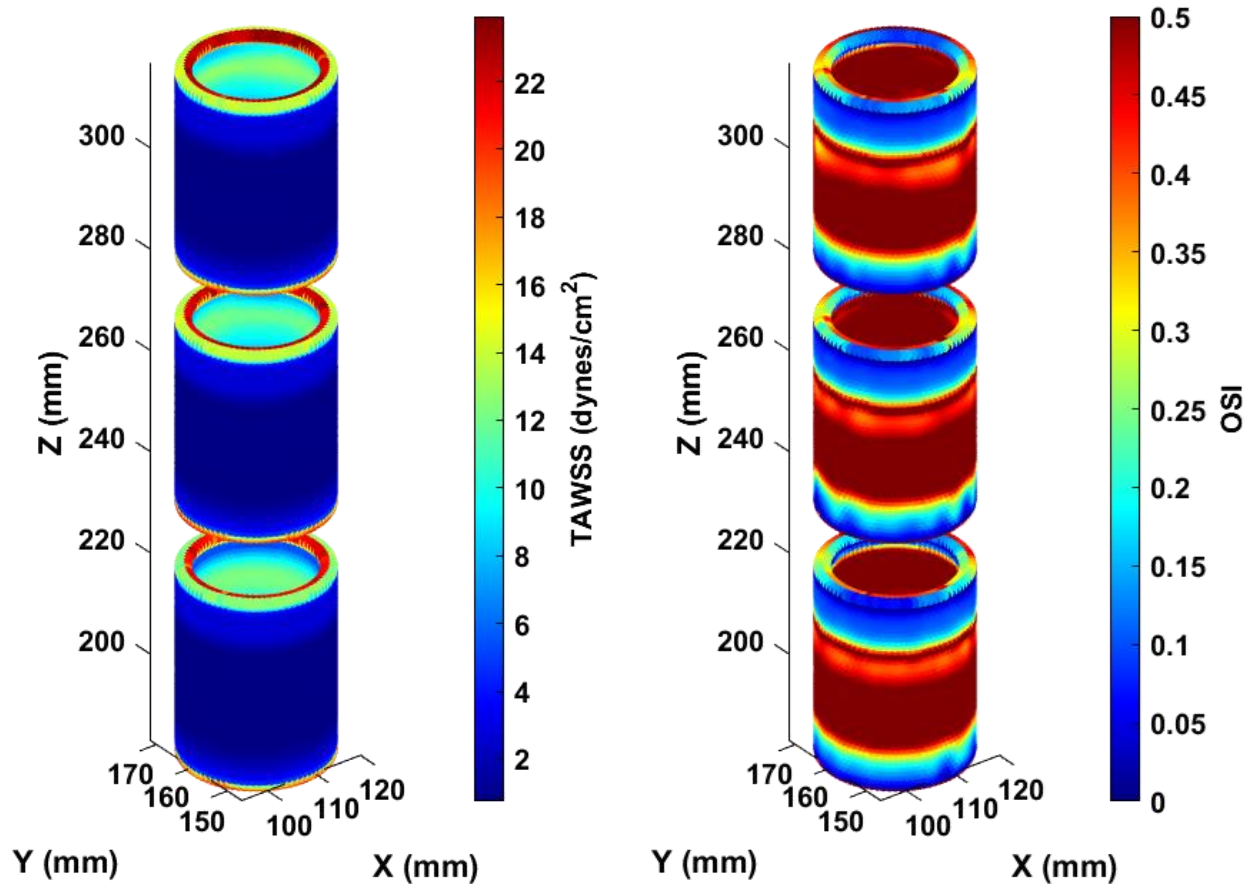


Ex: +/- 1 m/s Inlet

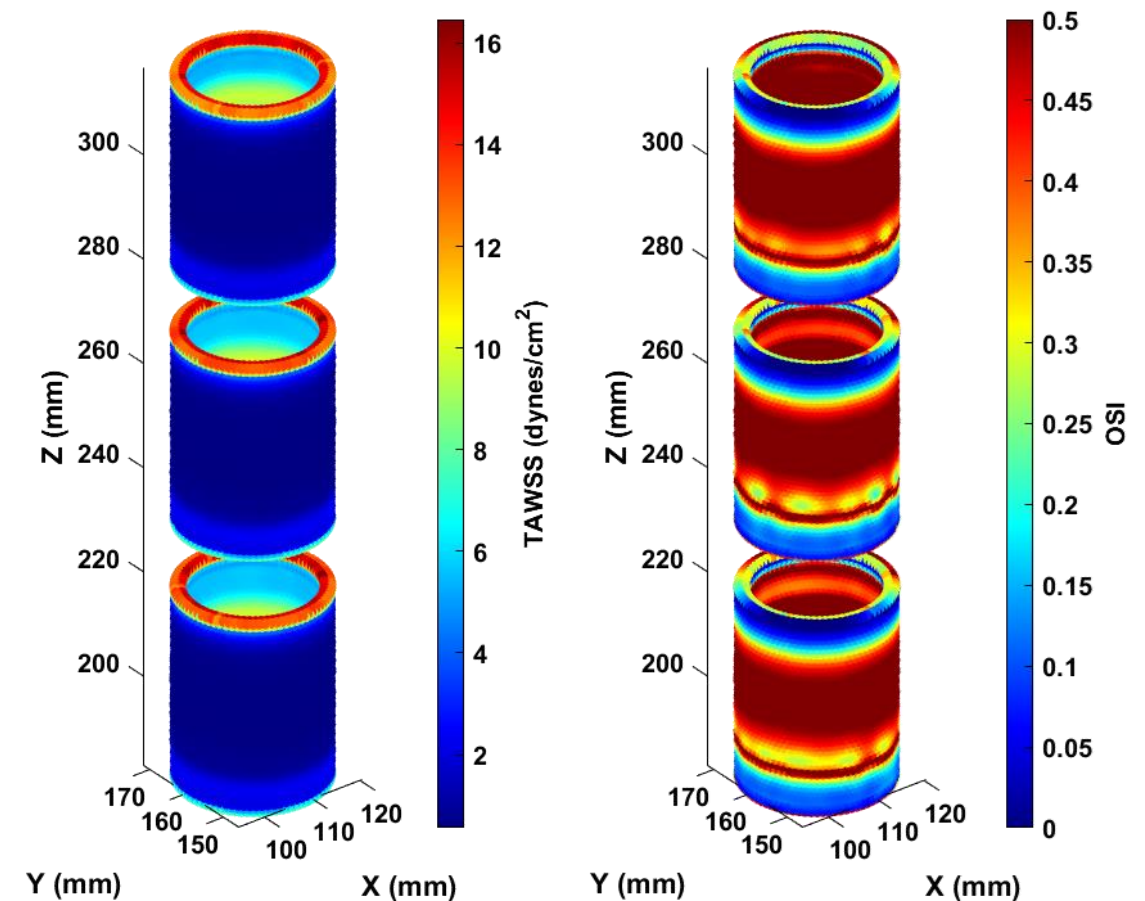


Post-Processing: More Examples (TAWSS/OSI)

Ex: S35/4 Waveform

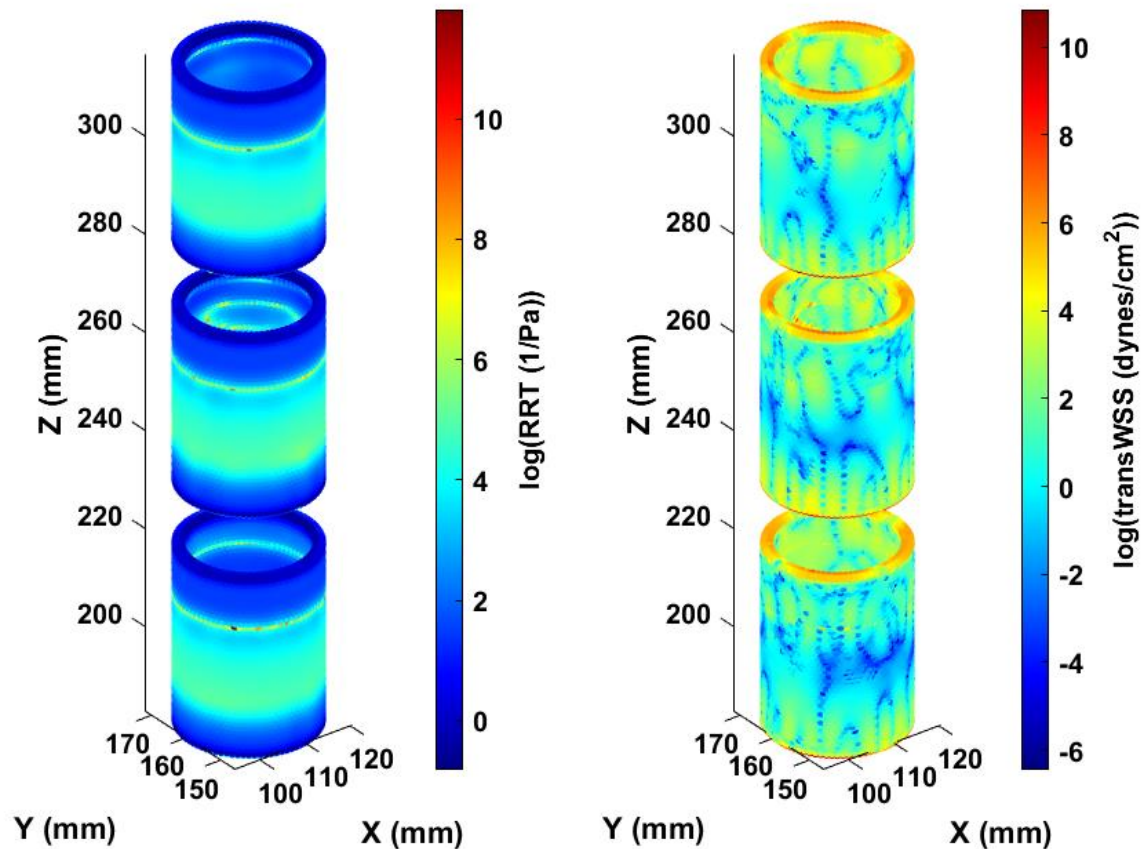


Ex: Inlet Squared by 4 Waveform

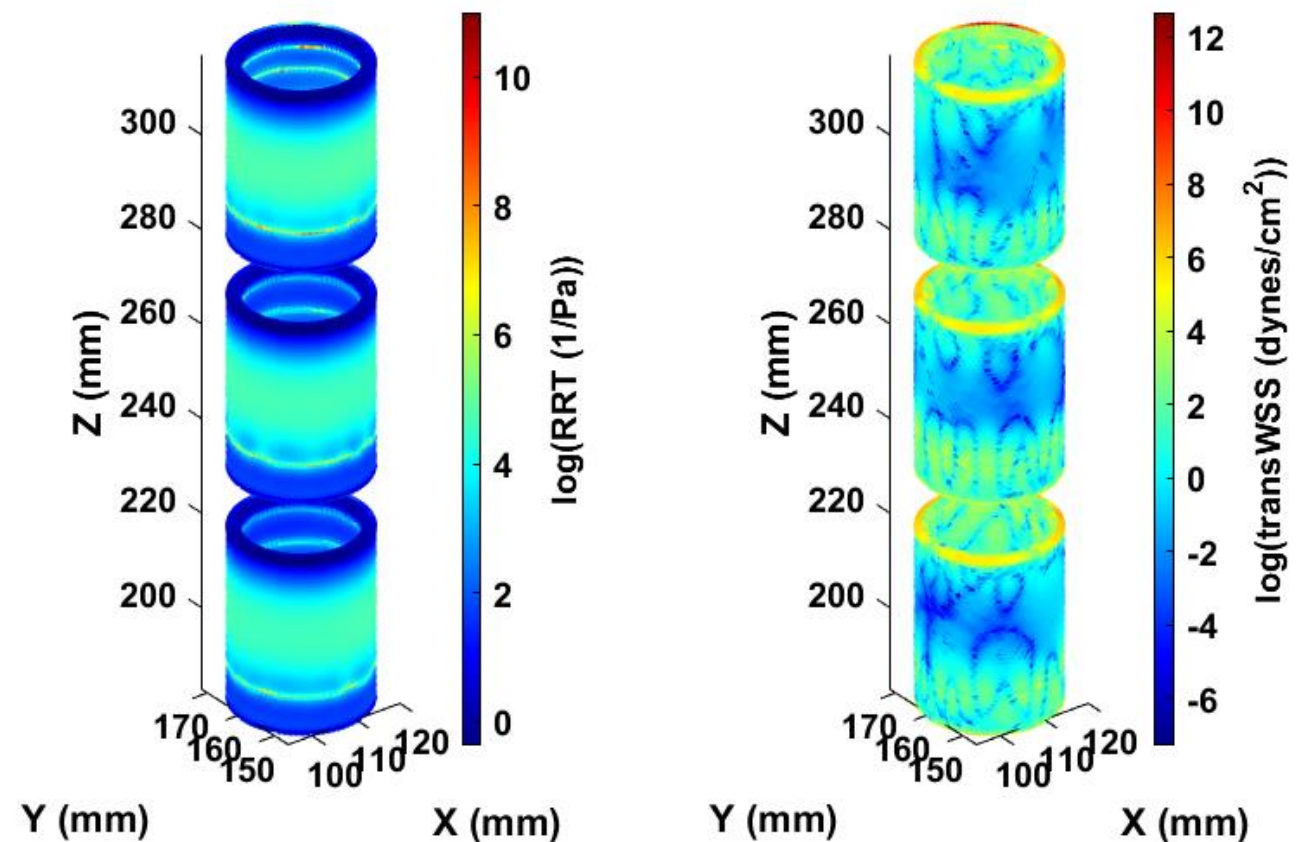


Post-Processing: More Examples (RRT/transWSS)

Ex: S35/4 Waveform



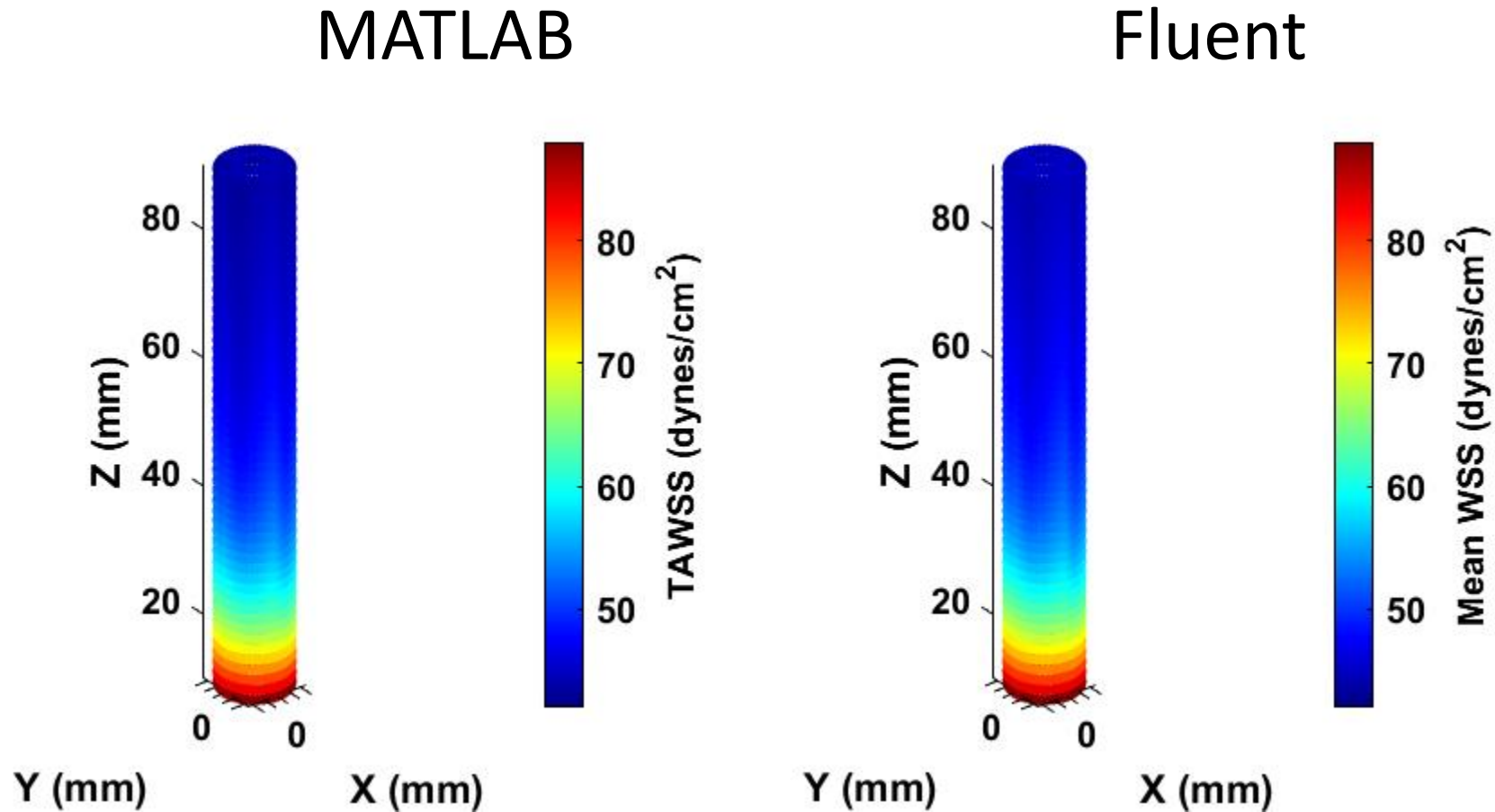
Ex: Inlet Squared by 4 Waveform



Future Improvements

- Proper surface/element plotting rather than point cloud
- ~~• Faster processing of many points~~
- Reporting of Average +/- Standard Deviation for the exported surface
- ~~• Creation of interactive GUI to simplify data processing.~~
- Export GUI as exe to allow function outside of MATLAB

Comparing MATLAB TAWSS with Fluent Mean WSS



Error Between Means = 1.305%