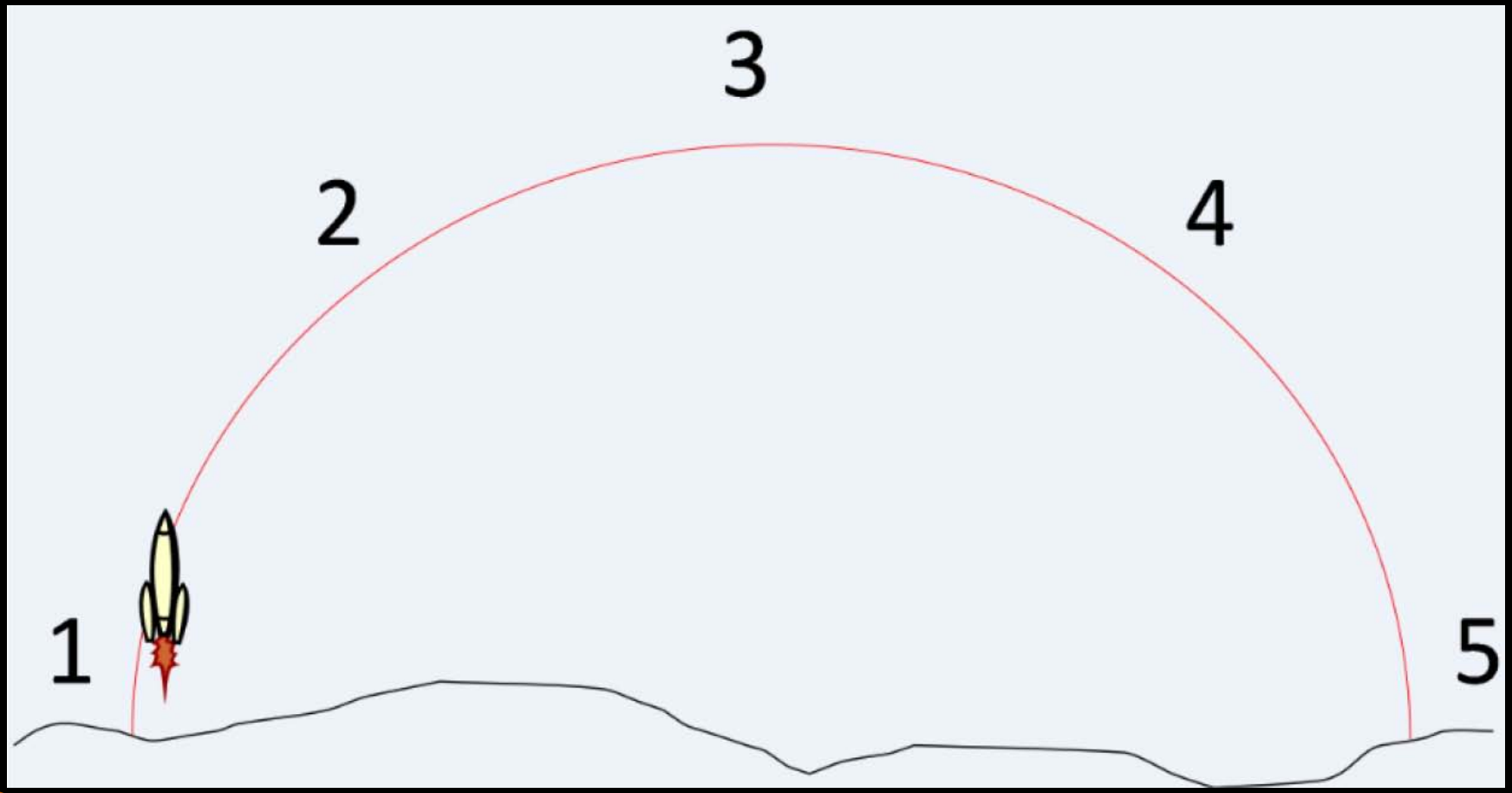
Mars Hopper Thermal Analysis

Presented by
CJ Koll
P.I. Andrew Klein

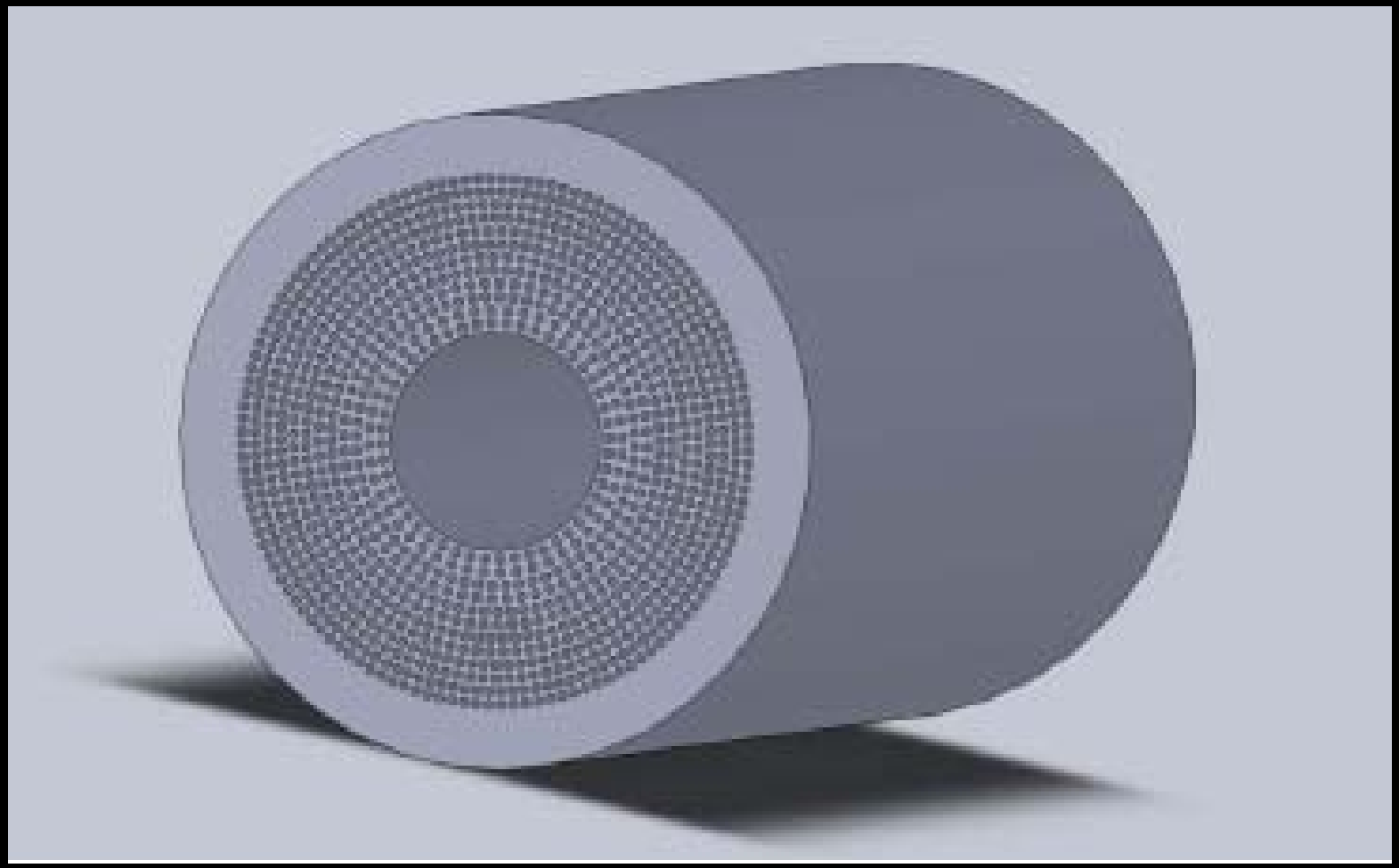
Summary of the Presentation

- Objective
  - Look at the models and their geometries
- Findings
  - Four elementary models to assess understanding
- Future Simulations
  - Single Channel
  - Two Channel
  - Four Channel

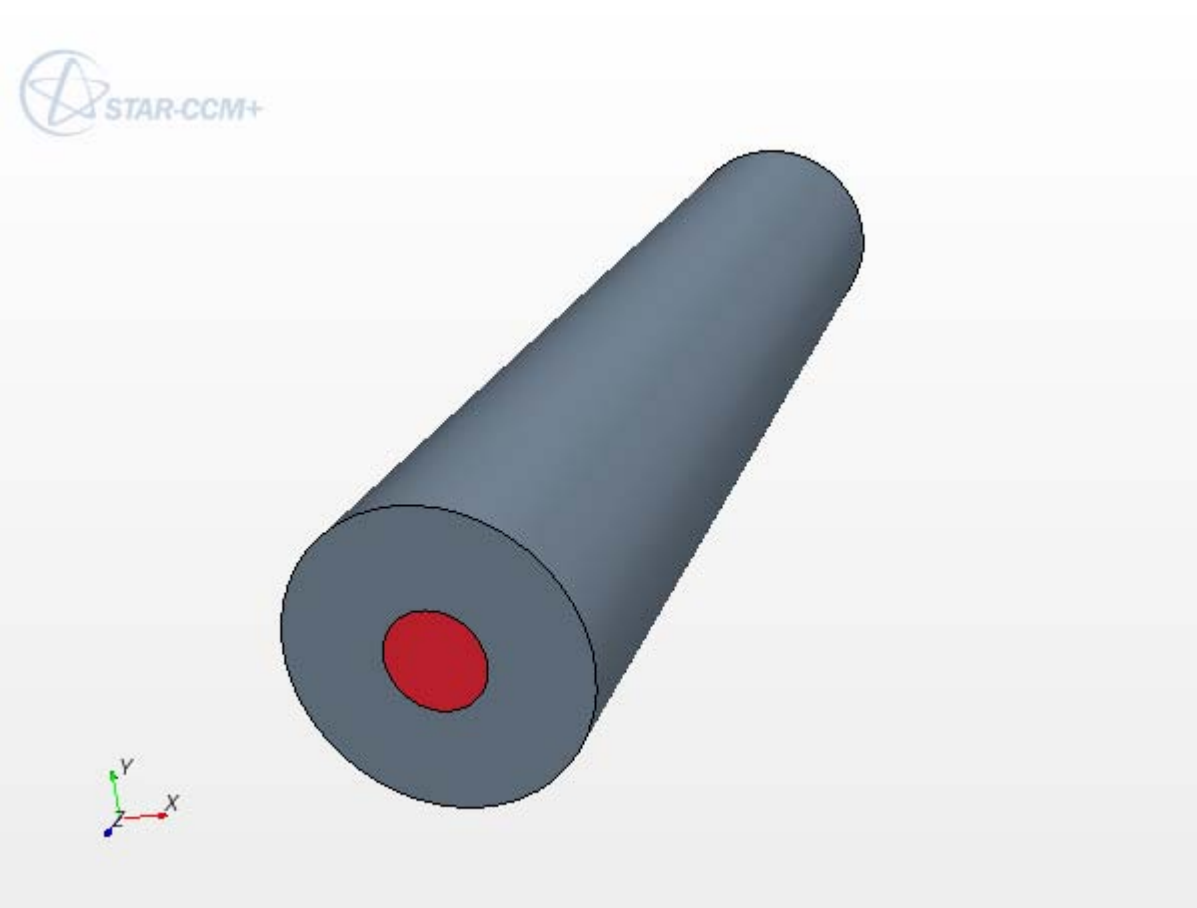
Mars Hopper Operation Cycle



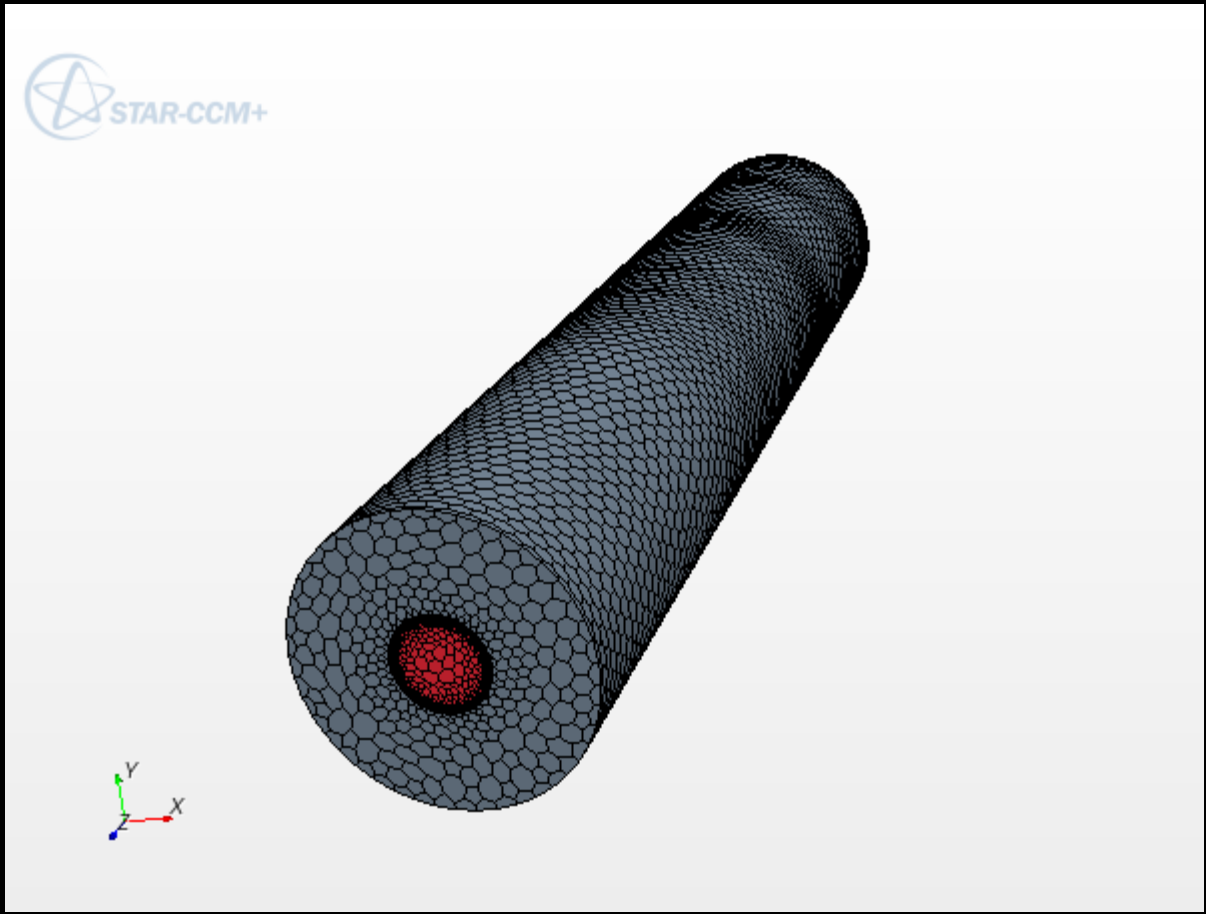
Objective



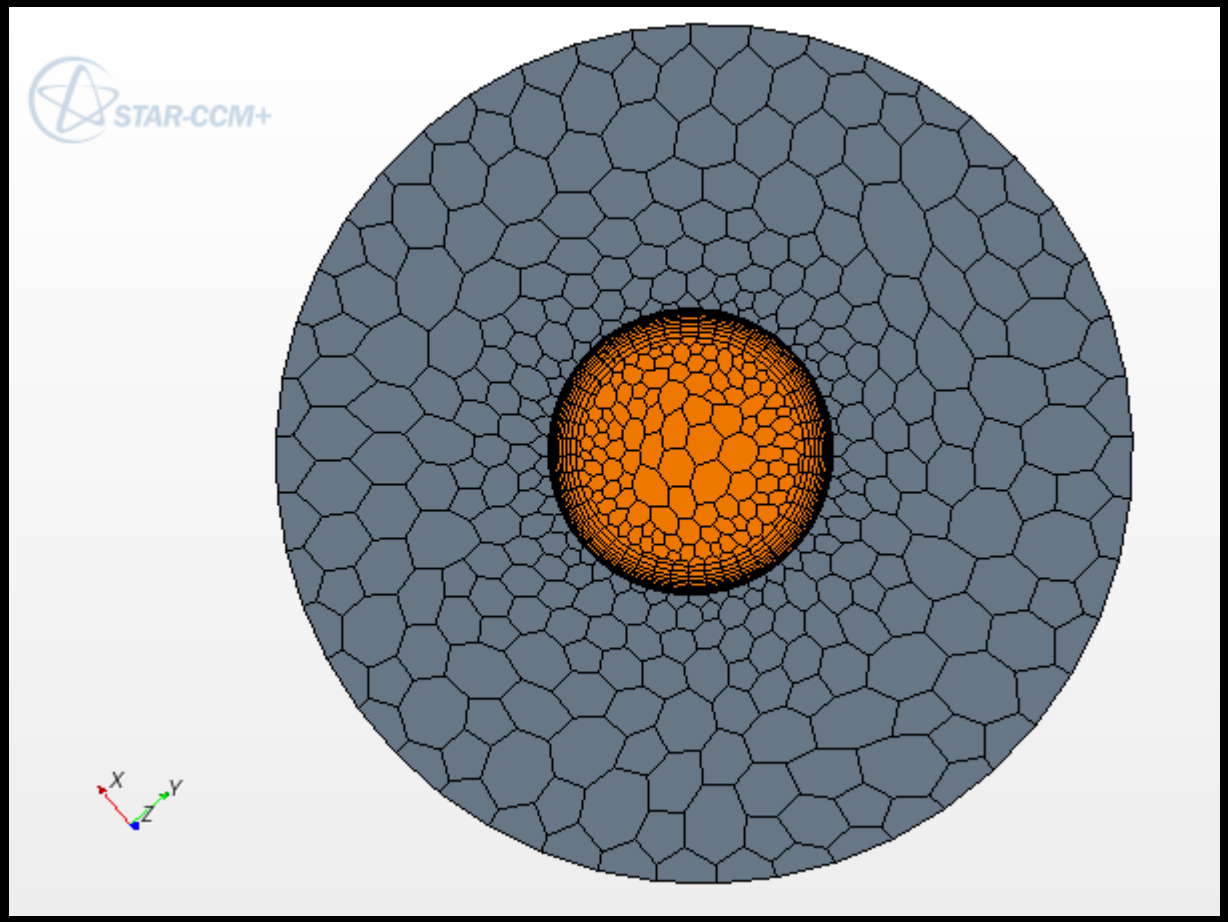
Findings



Geometry and Mesh



Geometry and Mesh

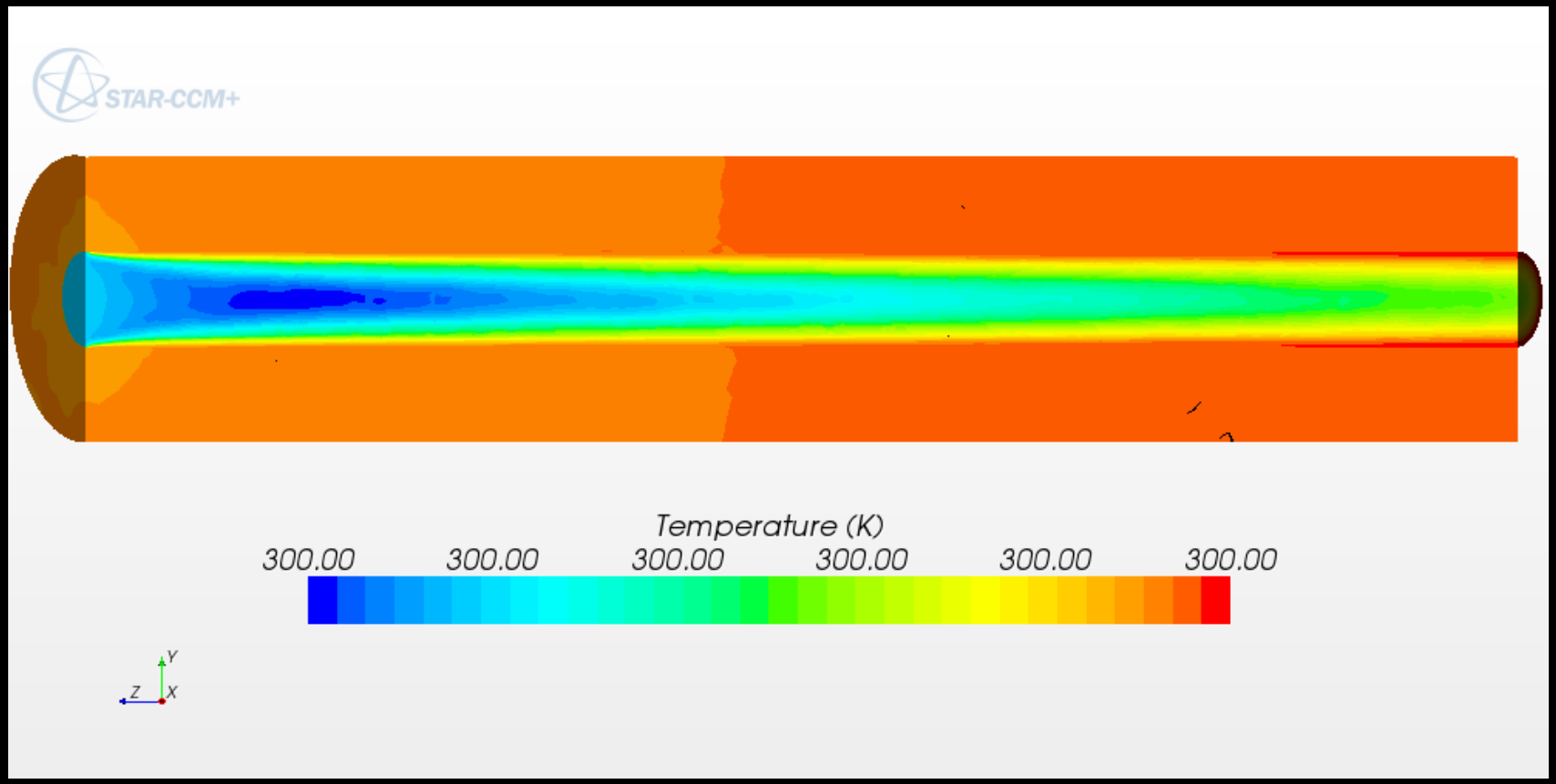


Current Findings

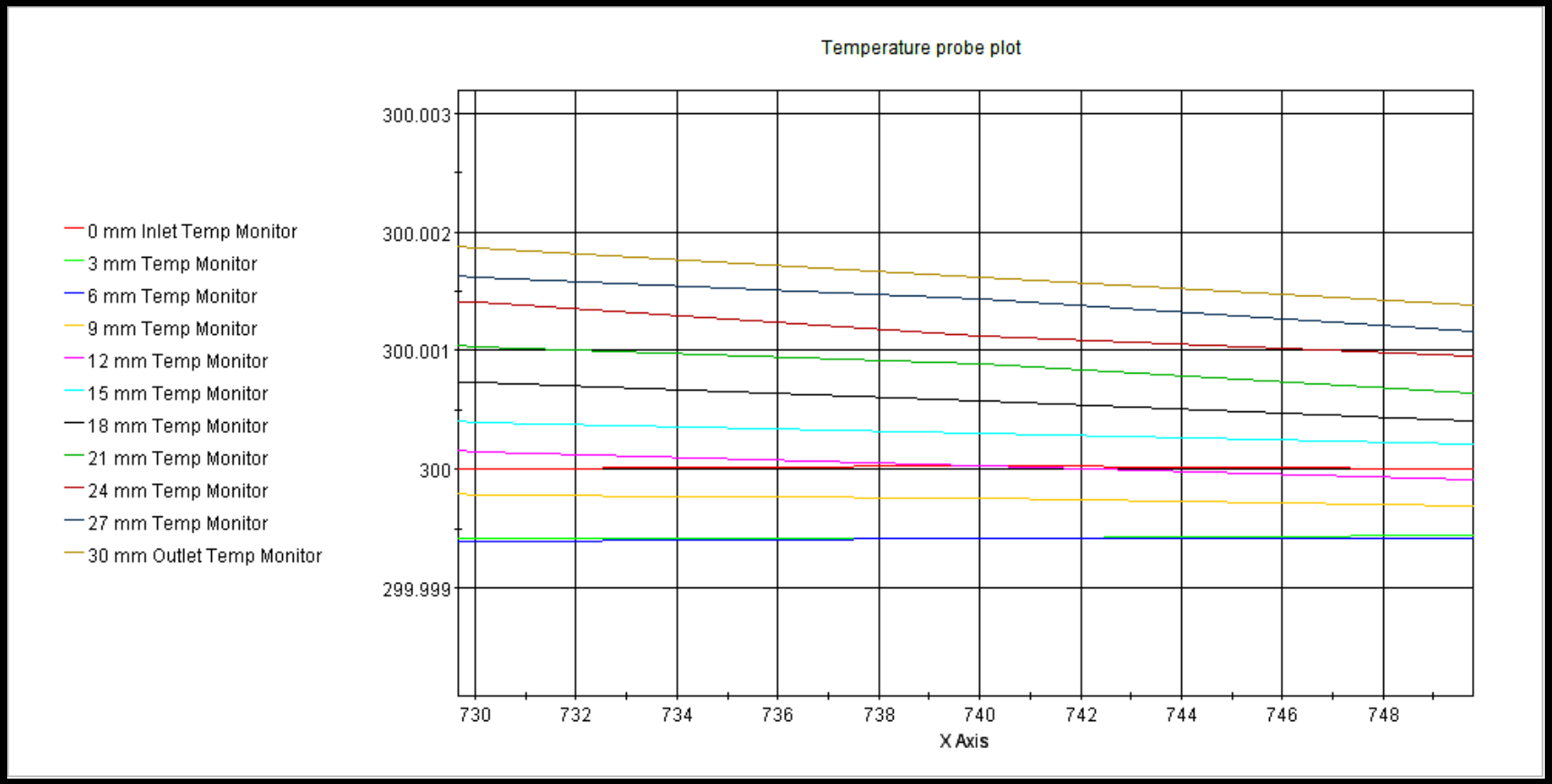
Simulation 1

- Stainless Steel Capacitor
- CO_2 Fluid (Ideal Gas)
- 750 K Capacitor Initial Temperature
- 1 m/s
- 100 Pa
- Steady State

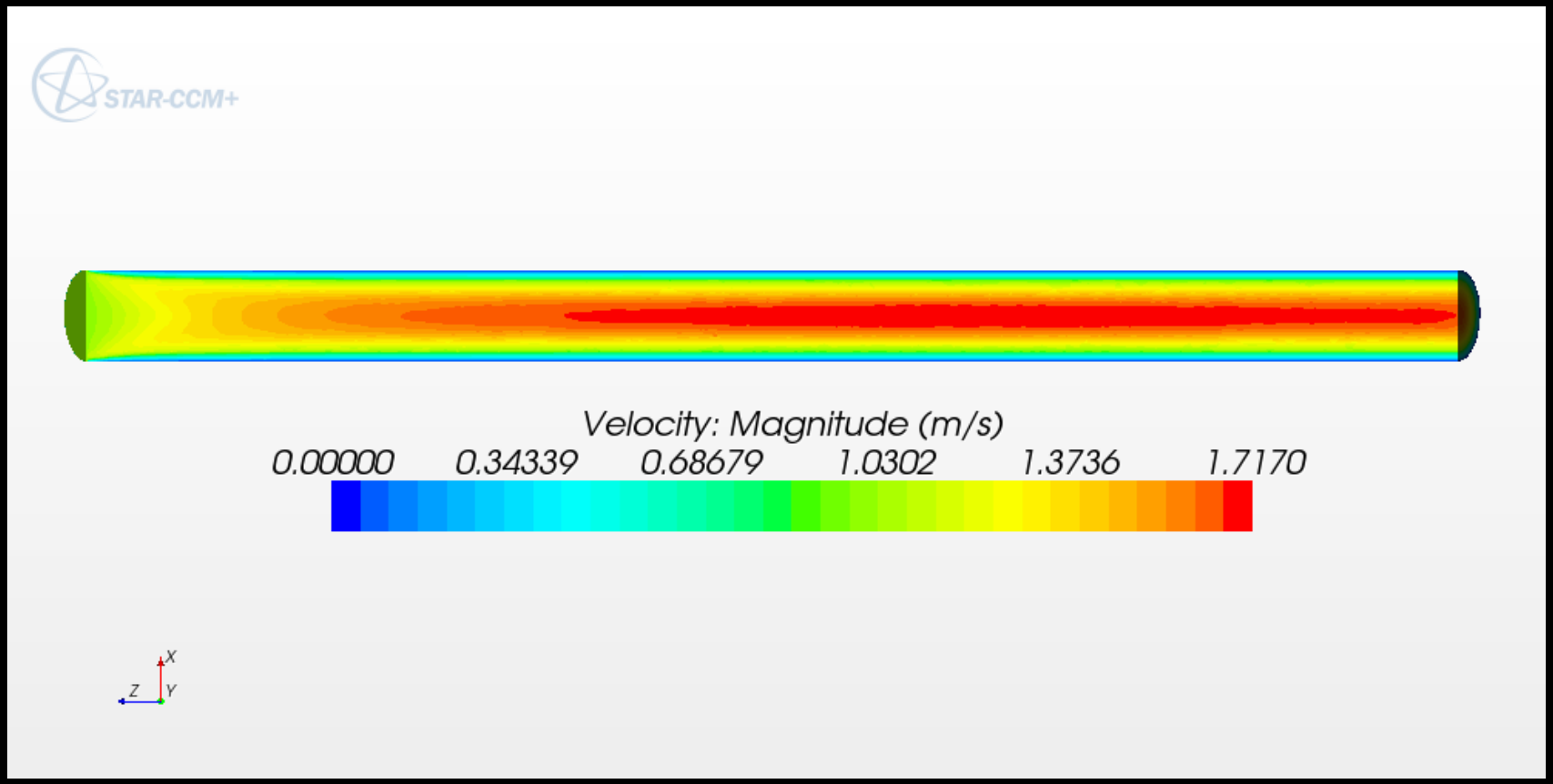
Simulation 1: Temperature Profile



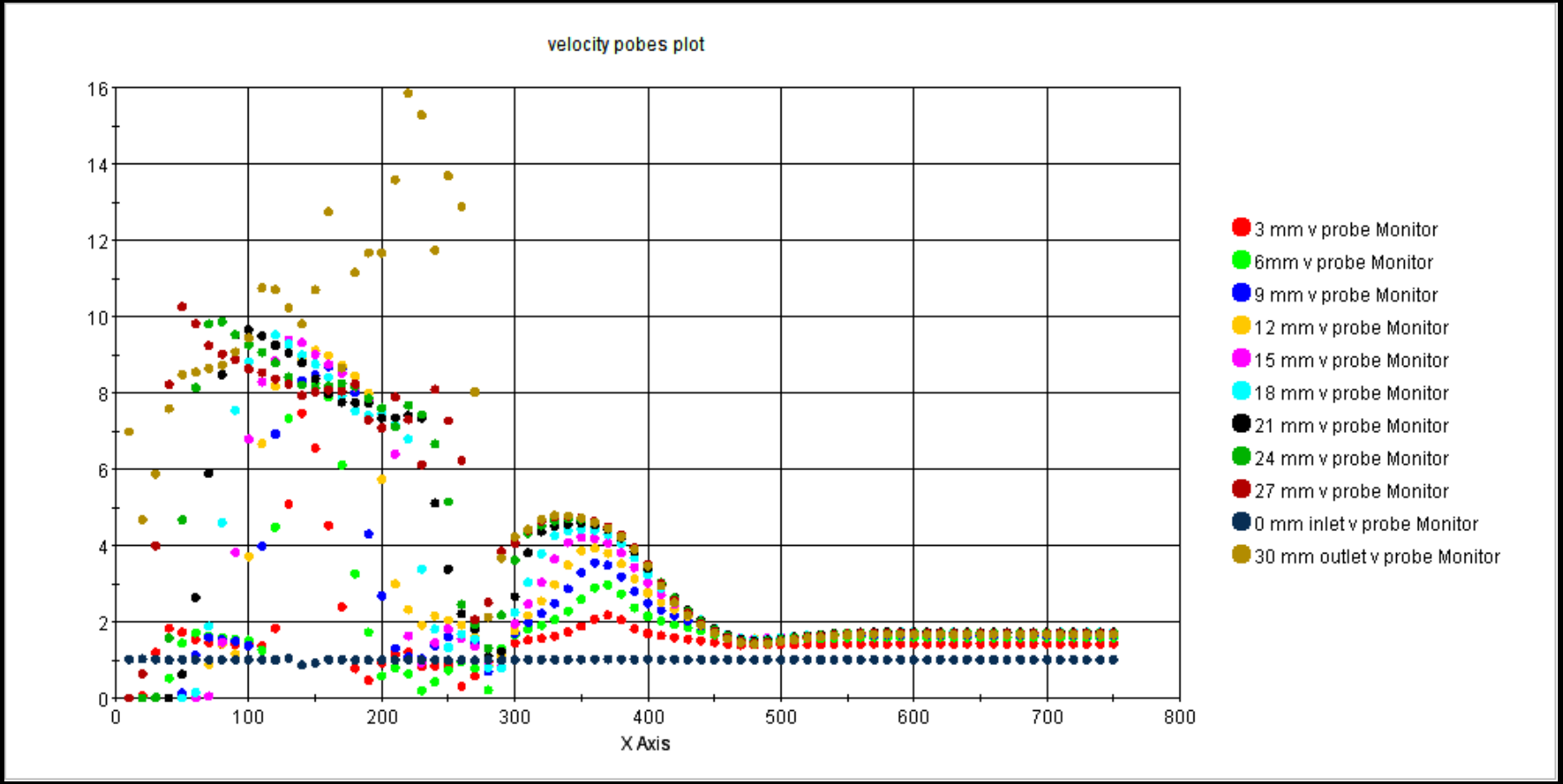
Simulation 1: Temperature Plot



Simulation 1: Velocity Profile



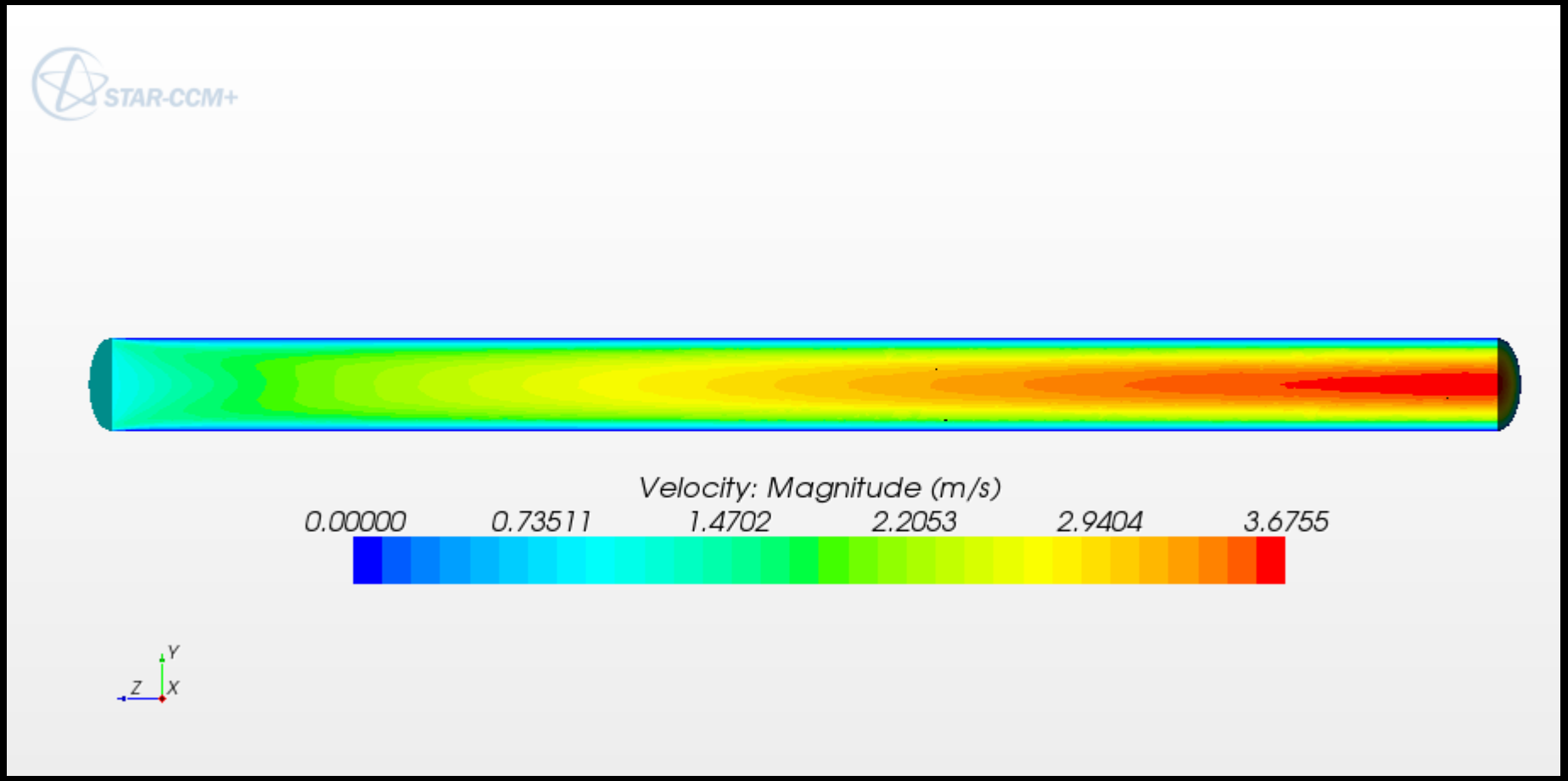
Simulation 1: Velocity Plot



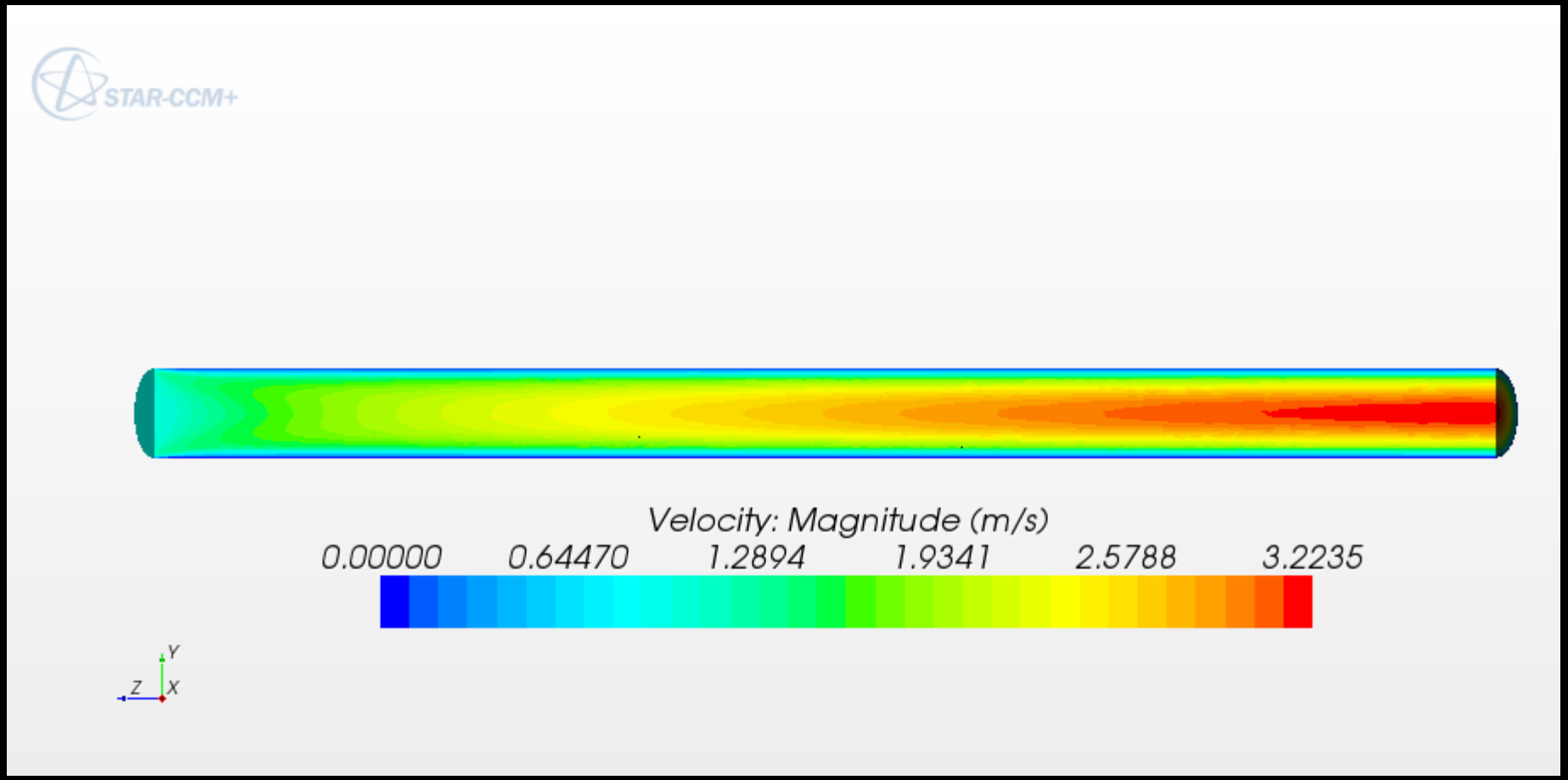
Simulation 2

- Stainless Steel Capacitor
- CO_2 Fluid (Ideal Gas)
- 750 K Capacitor Initial Temperature
- 1 m/s
- 100 Pa
- Unsteady

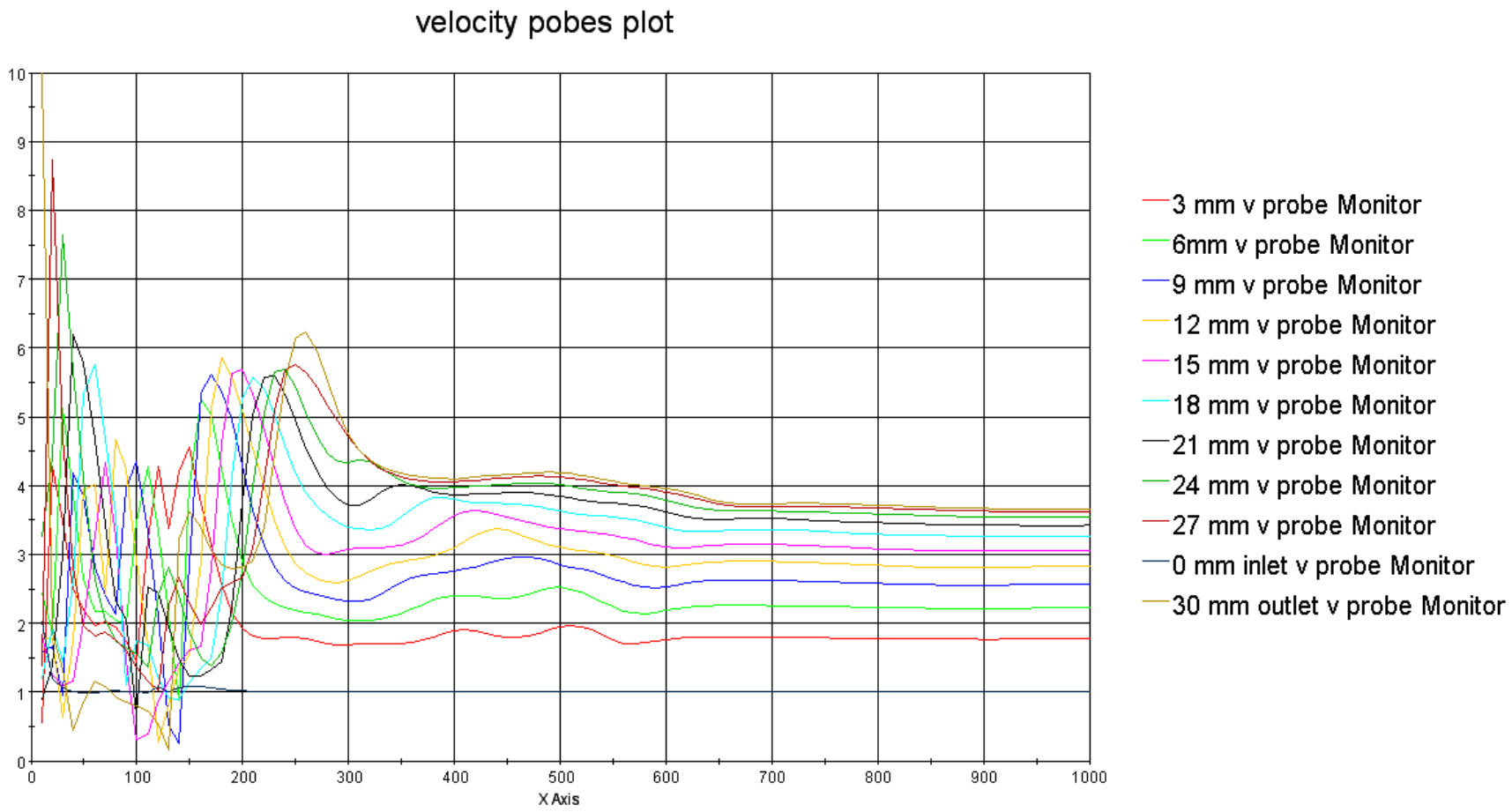
Velocity at the Beginning



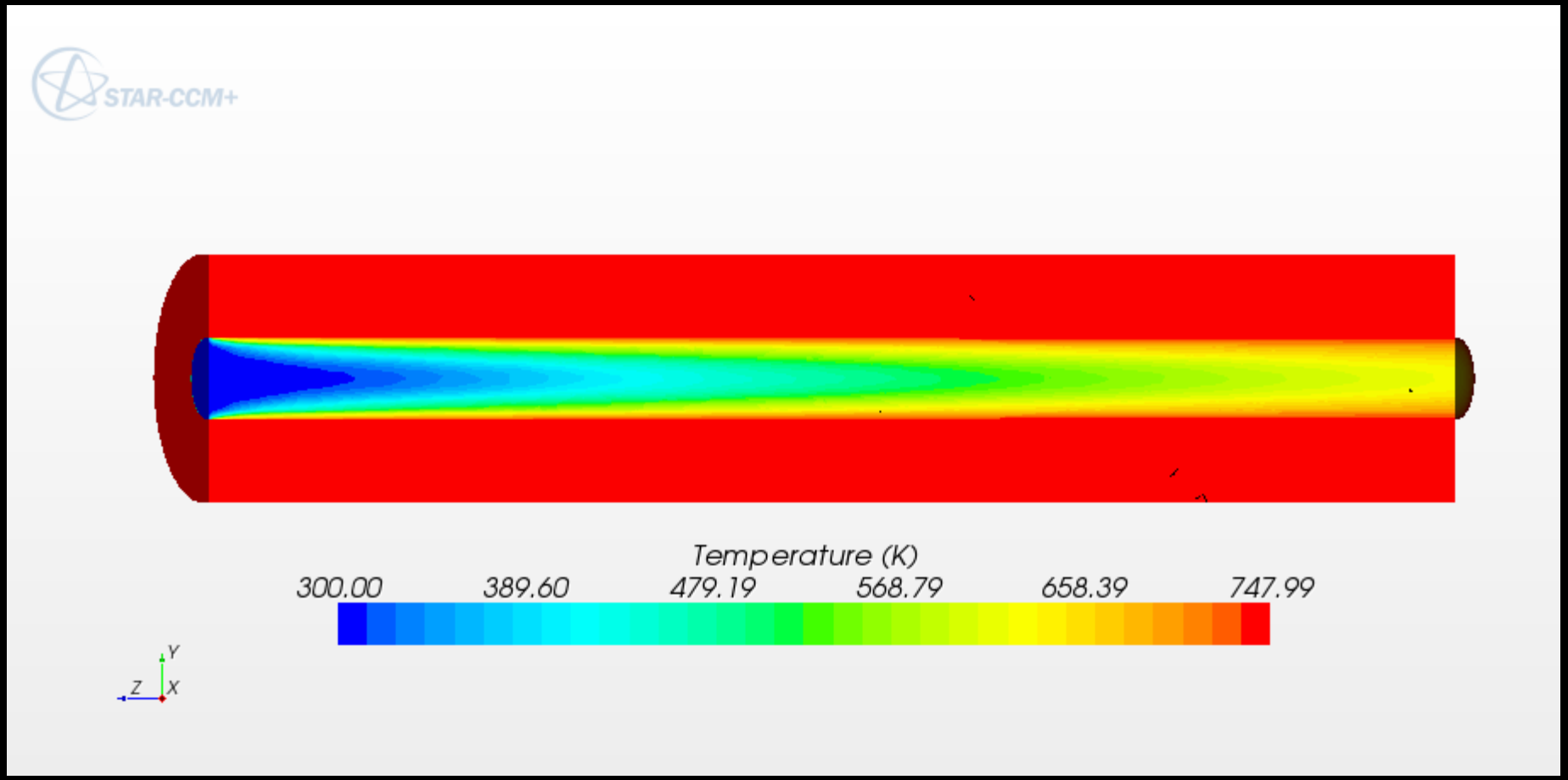
Velocity at the End



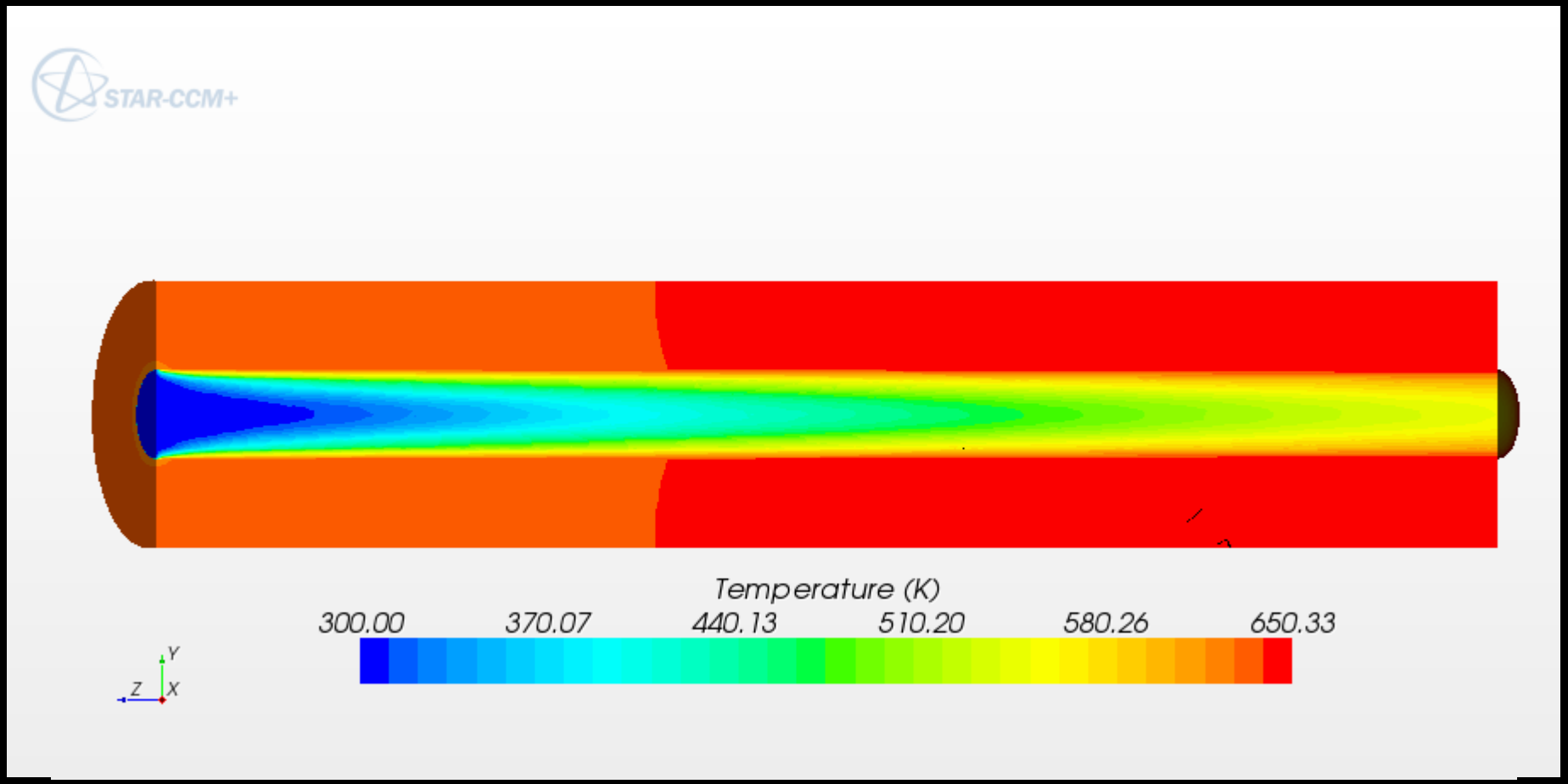
Velocity Plot



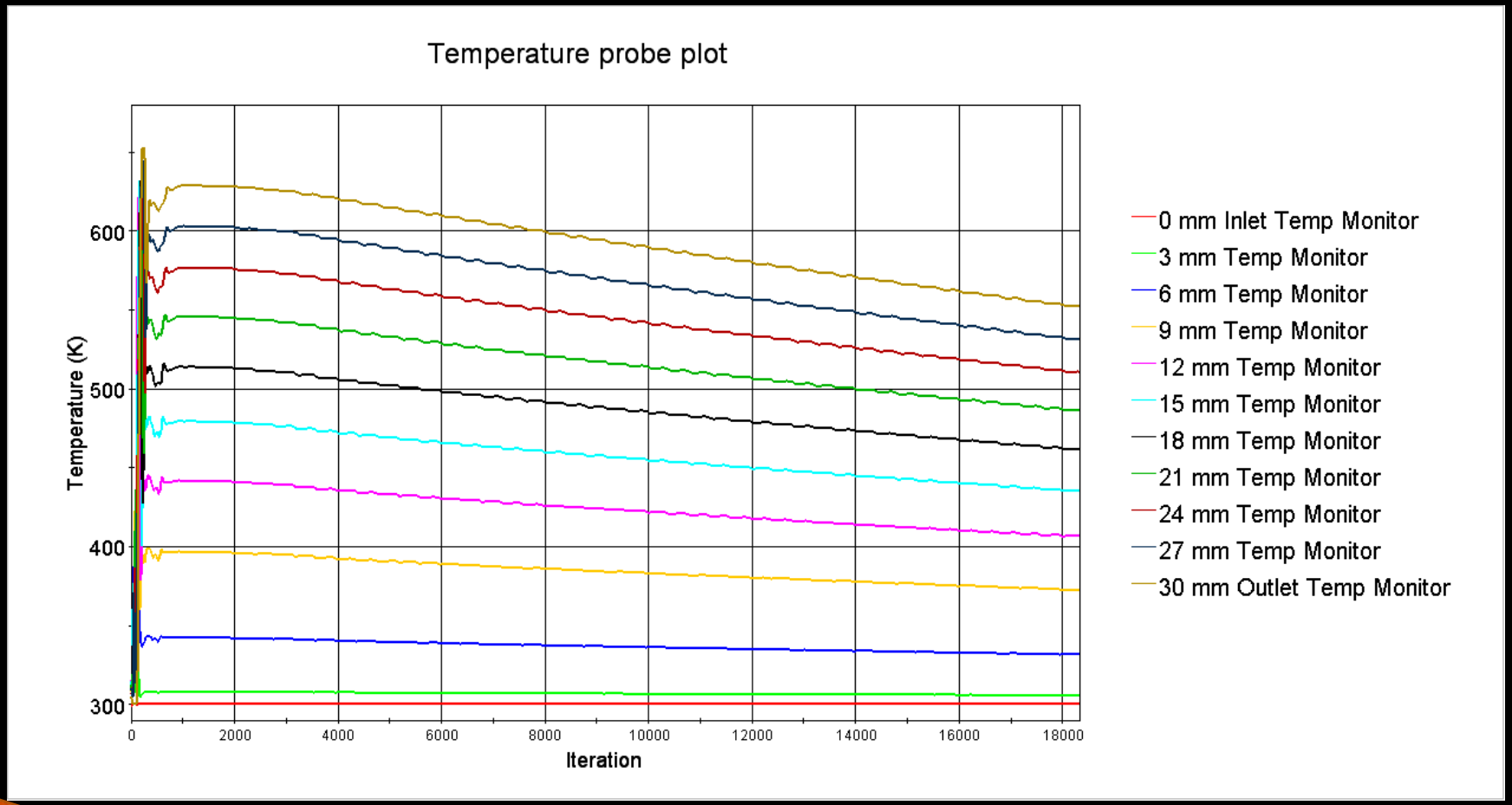
Temperature at the Beginning



Temperature at the End



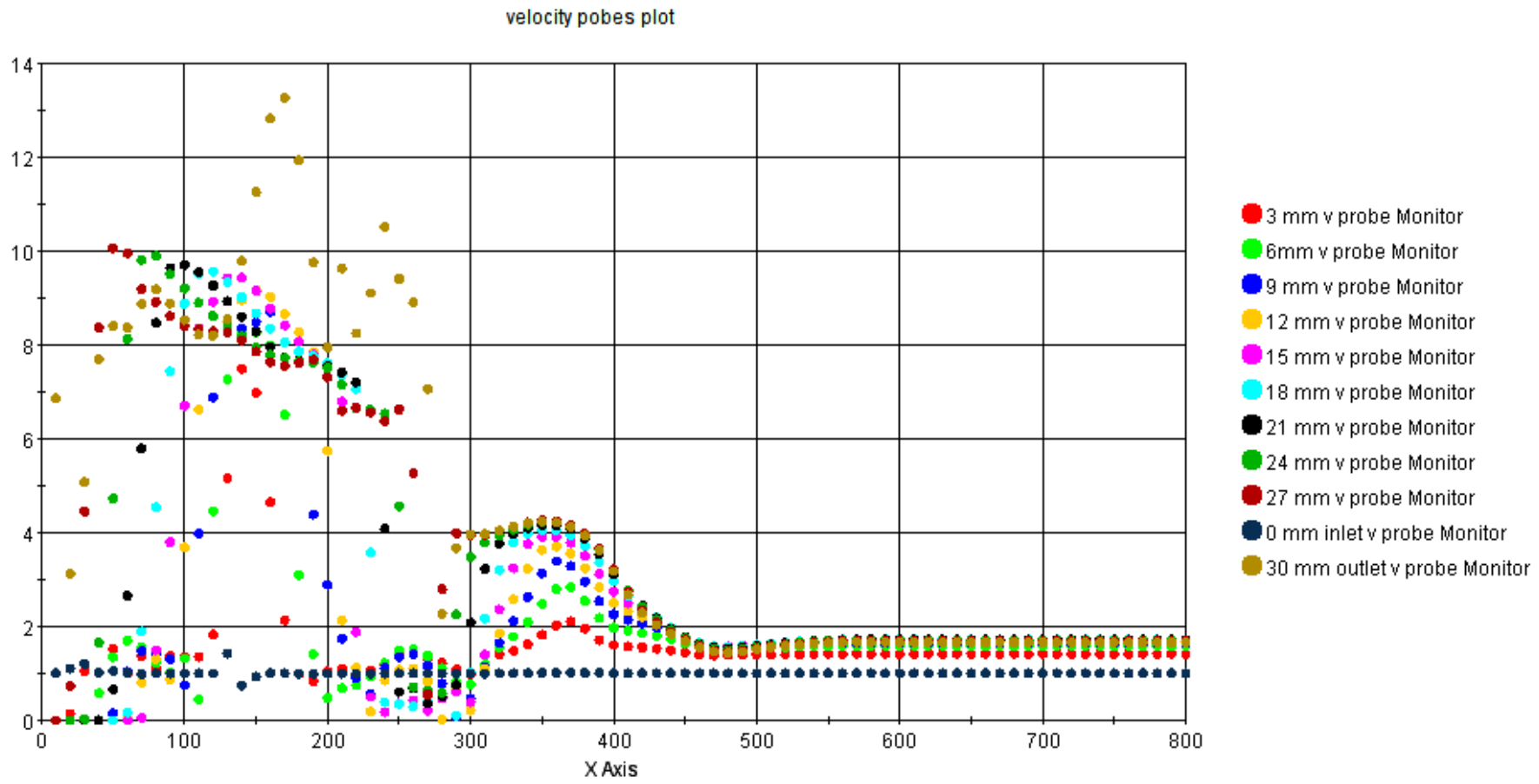
Temperature Plot



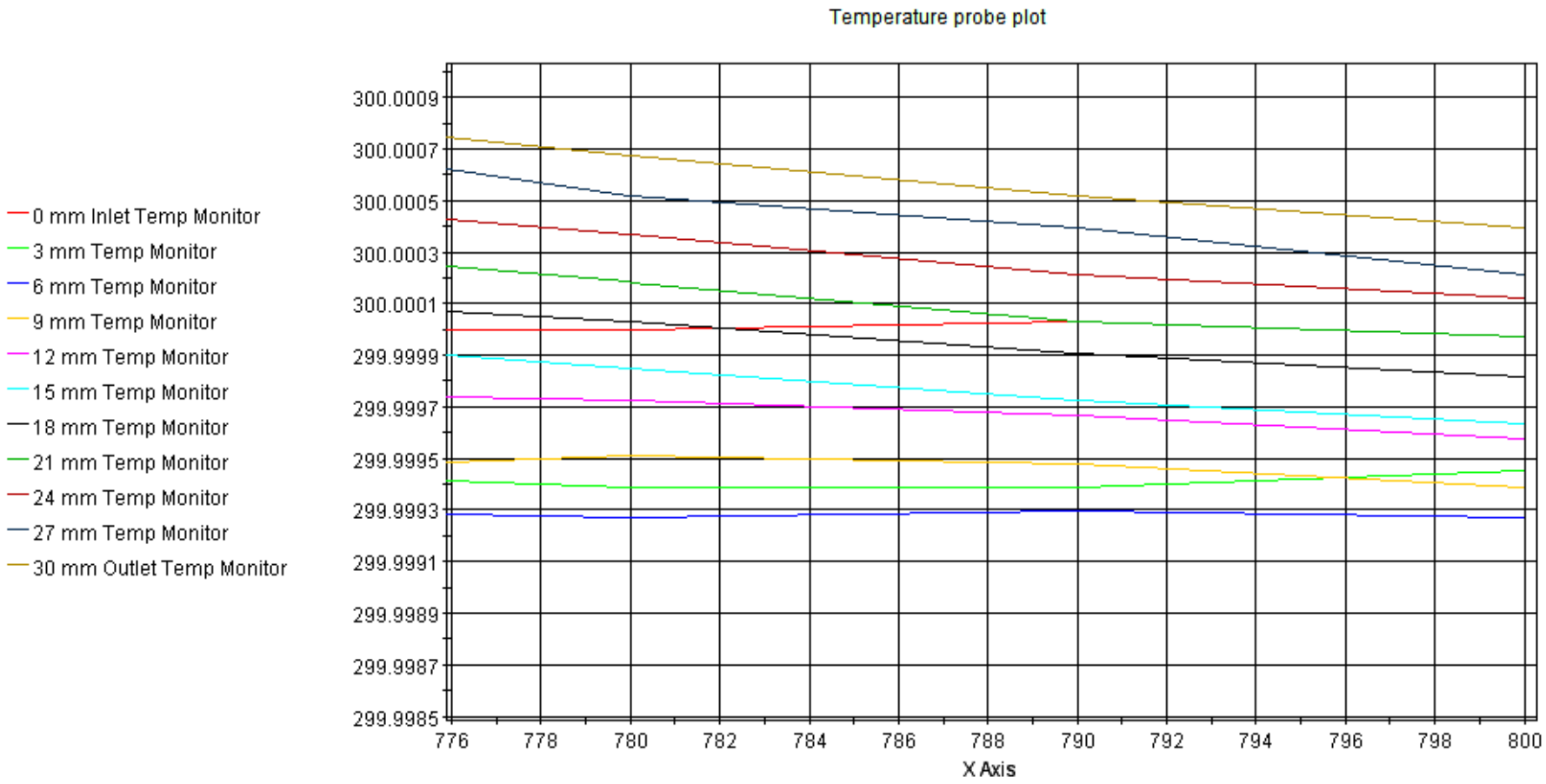
Simulation 3

- Beryllium Capacitor
- CO_2 Fluid (Ideal Gas)
- 1200 K Initial Temperature for capacitor
- 1 m/s
- 100 Pa
- Steady State

Simulation 3: Velocity Profile



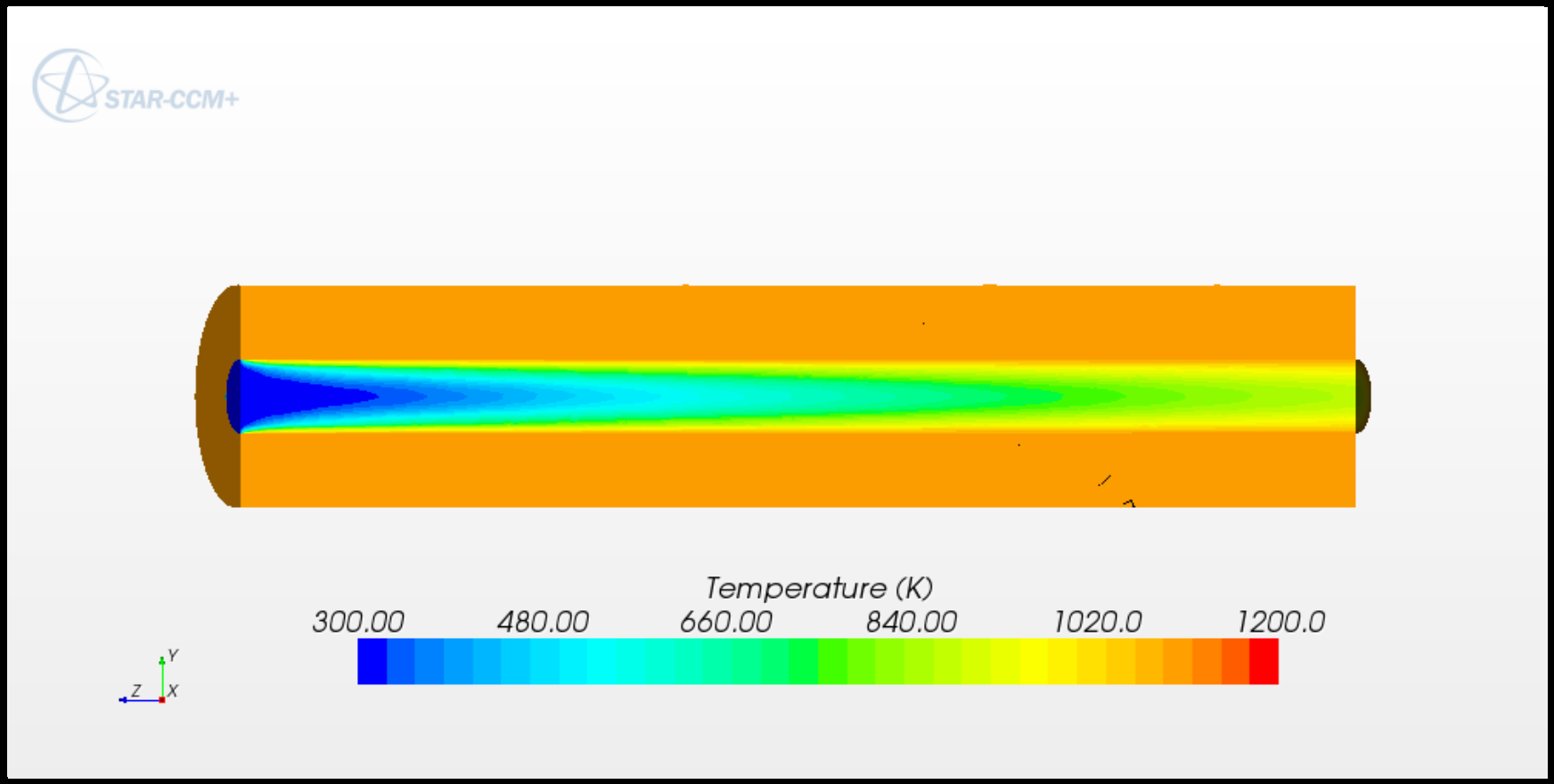
Simulation 3: Temperature Profile



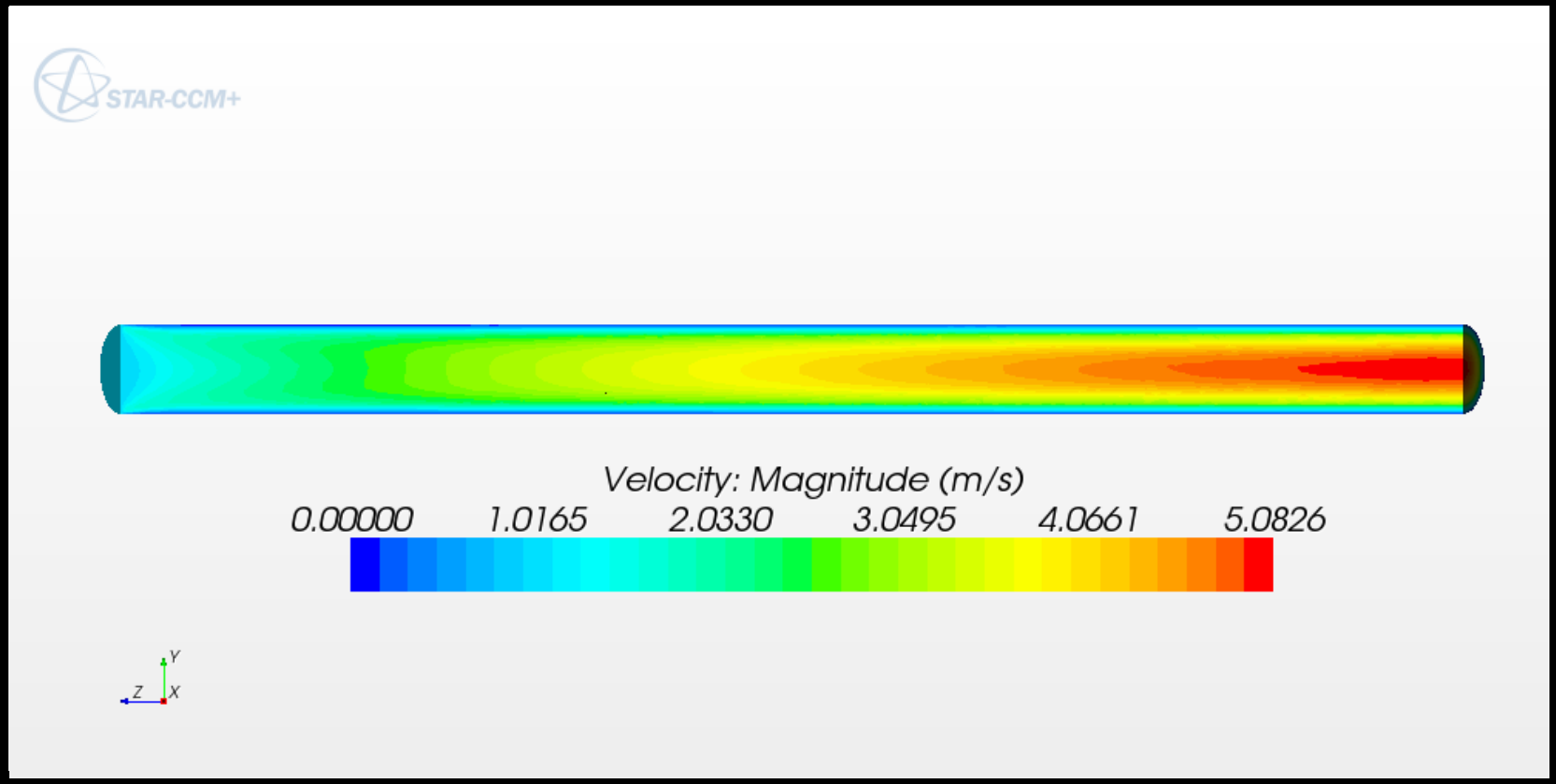
Simulation 4

- Beryllium Capacitor
- CO_2 Fluid (Ideal Gas)
- 1200 K Initial Temperature for capacitor
- 1 m/s
- 100 Pa
- Unsteady

Simulation 4: Temperature Profile



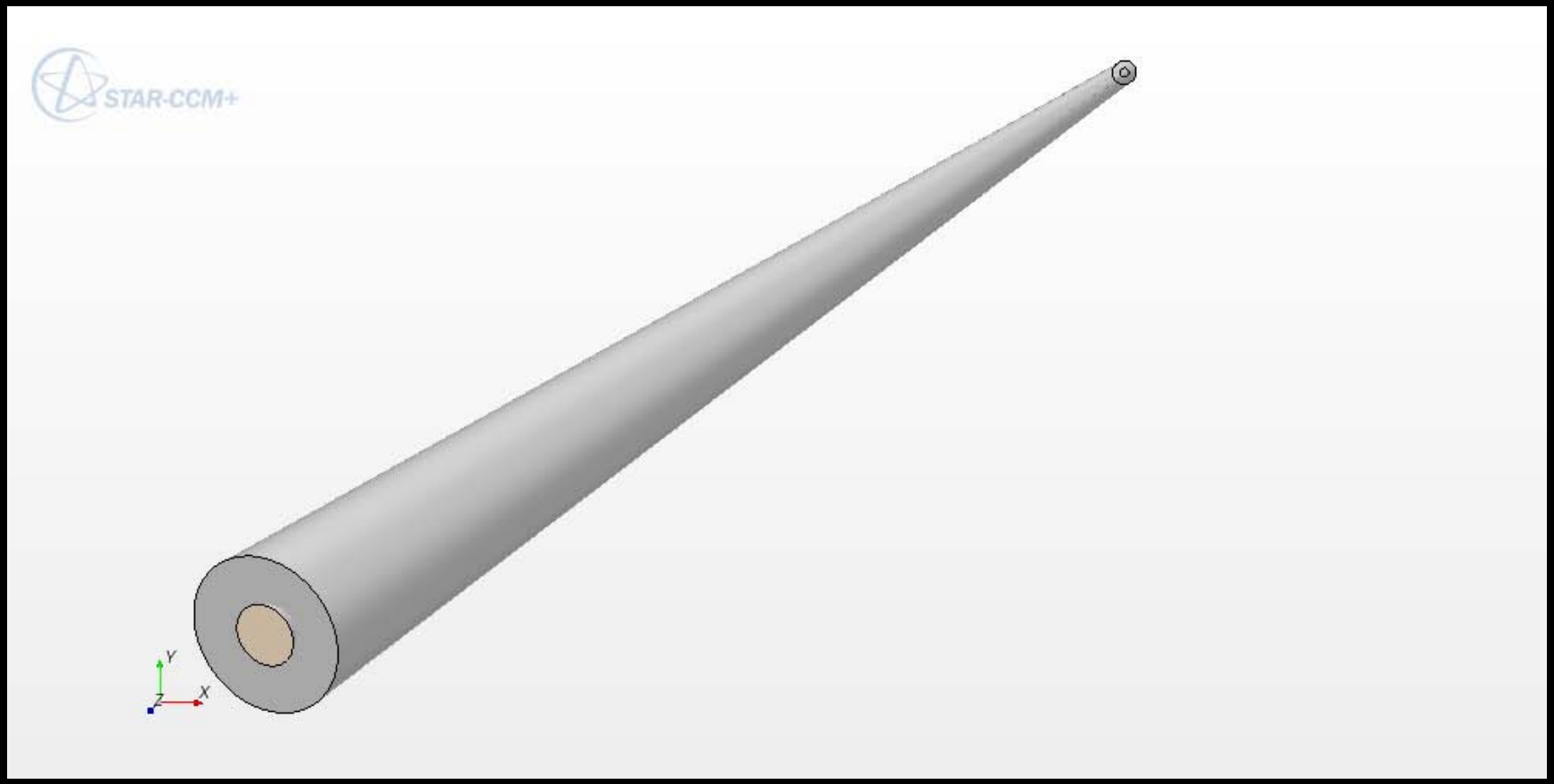
Simulation 4: Velocity Profile



Future

- Single Channel Model

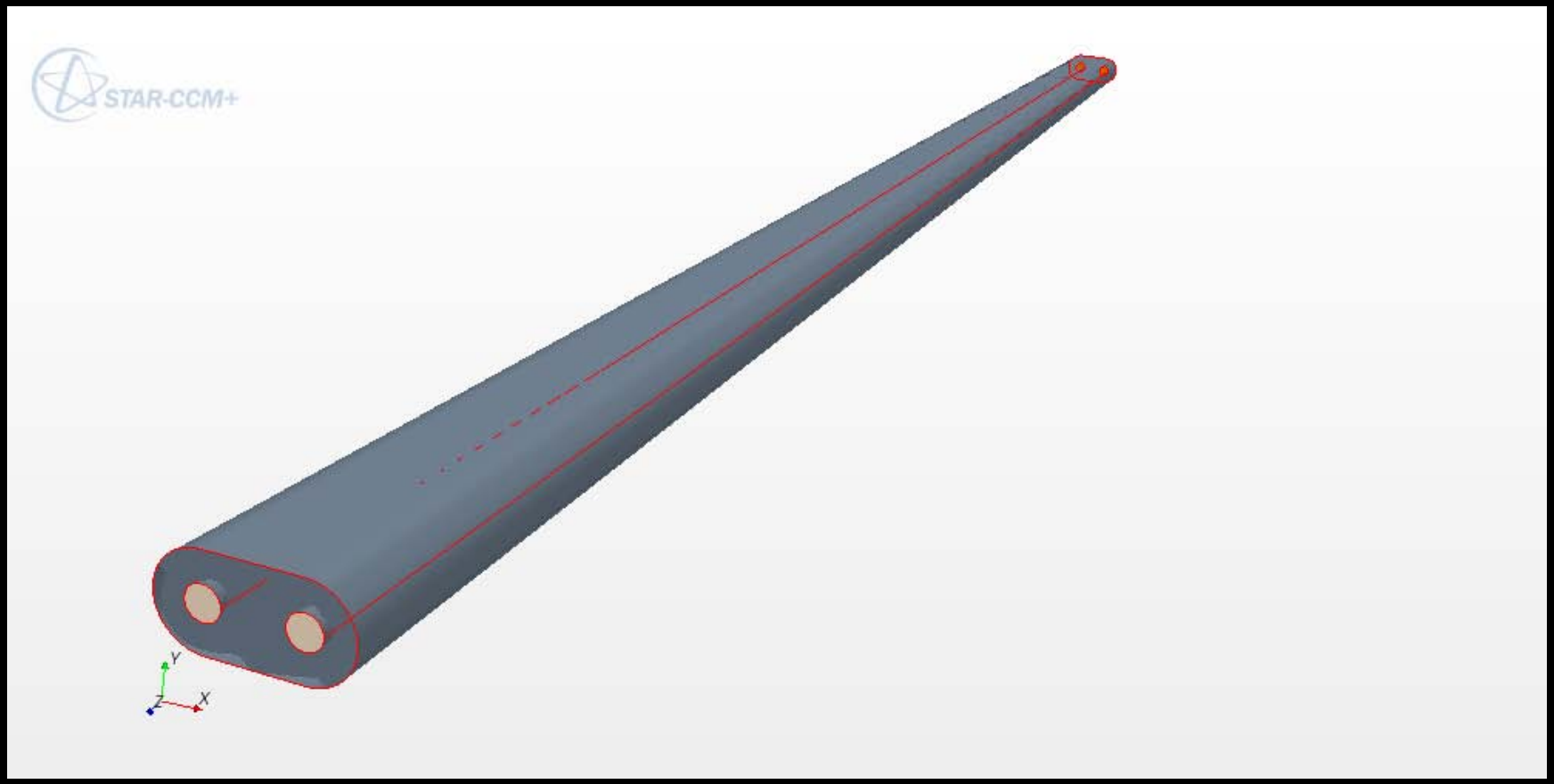
Future: Single Channel Model



Future

- Single Channel Model
- Two Channel Model

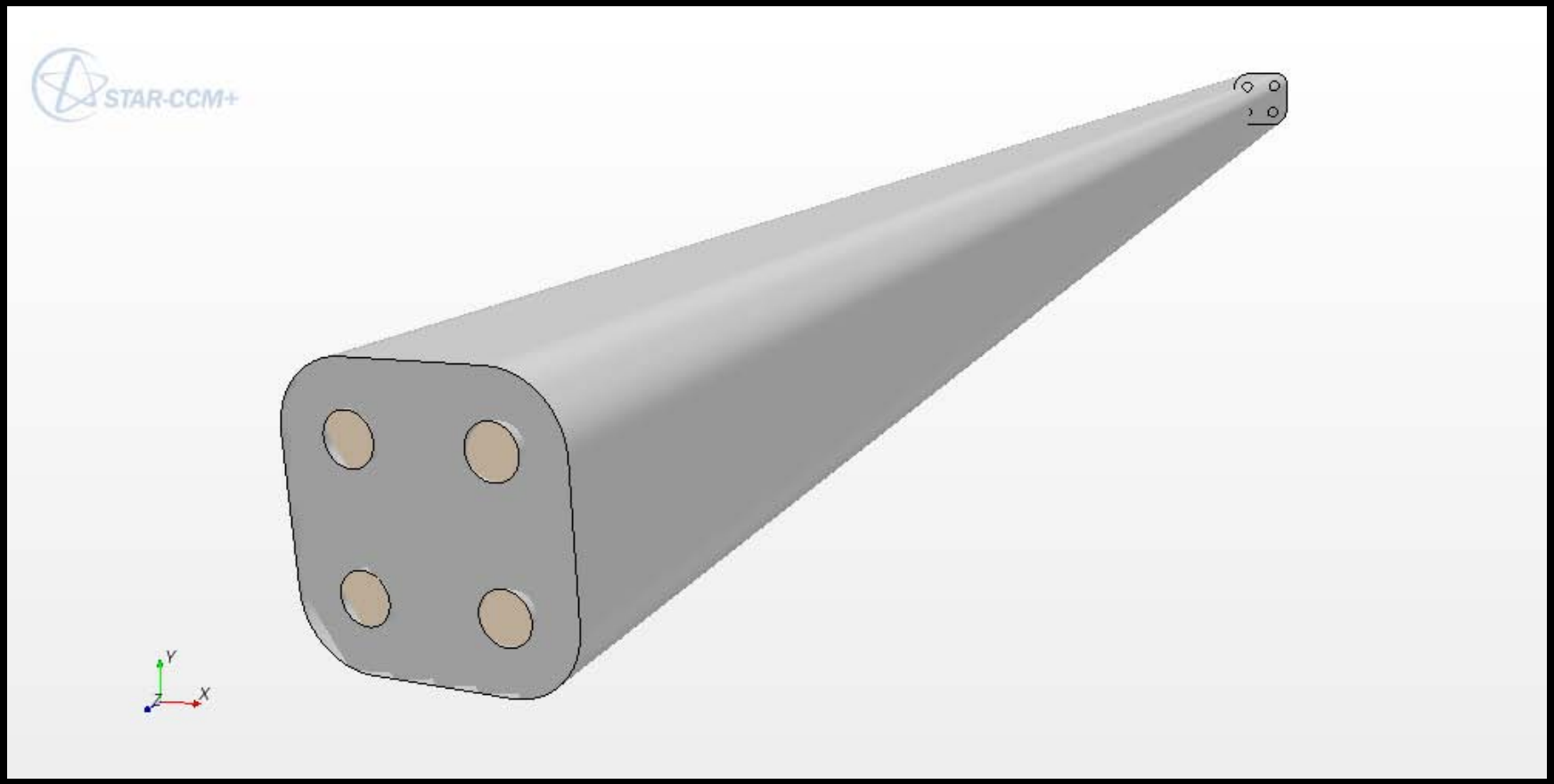
Future: Two Channel Model

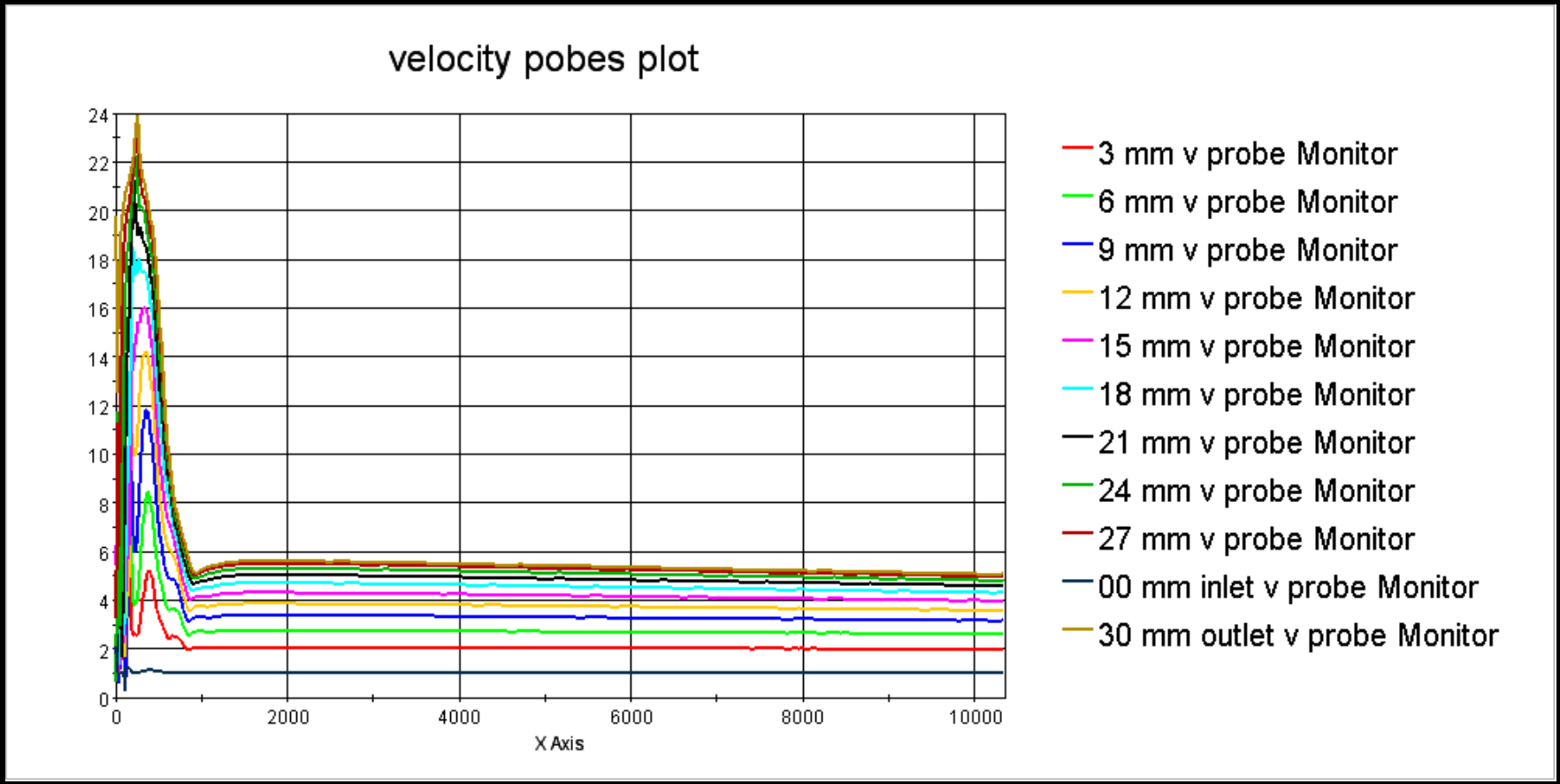


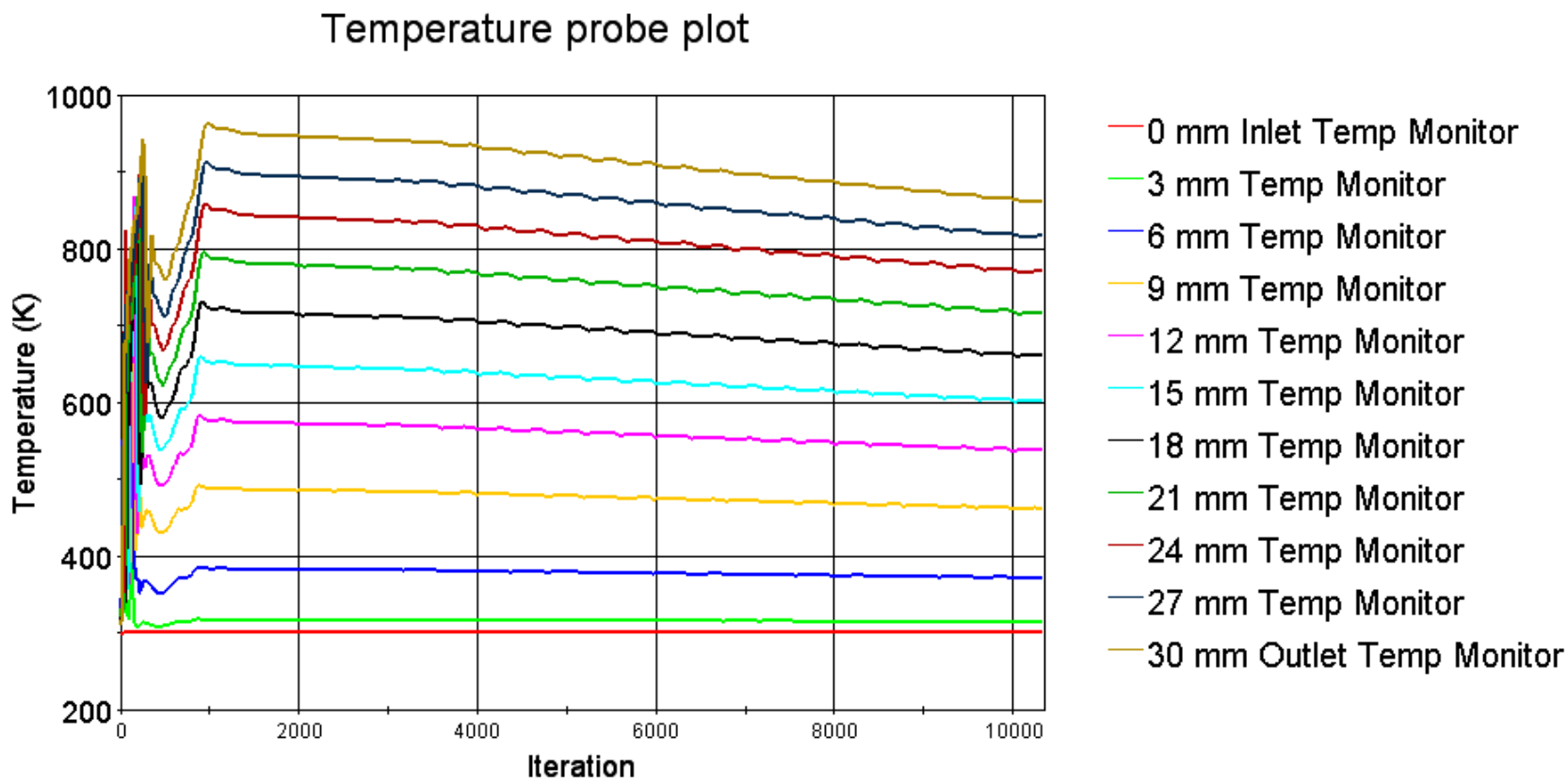
Future

- Single Channel Model
- Two Channel Model
- Four Channel Model

Future: Four Channel Model




velocity pobes plot
24
22
20
18
16
14
12
10
8
6
4
2
0
0
2000
4000
6000
8000
10000
X Axis
3 mm v probe Monitor
6 mm v probe Monitor
9 mm v probe Monitor
12 mm v probe Monitor
15 mm v probe Monitor
18 mm v probe Monitor
21 mm v probe Monitor
24 mm v probe Monitor
27 mm v probe Monitor
00 mm inlet v probe Monitor
30 mm outlet v probe Monitor


Temperature probe plot
Temperature (K)
1000
800
600
400
200
0
2000
4000
6000
8000
10000
Iteration
0 mm Inlet Temp Monitor
3 mm Temp Monitor
6 mm Temp Monitor
9 mm Temp Monitor
12 mm Temp Monitor
15 mm Temp Monitor
18 mm Temp Monitor
21 mm Temp Monitor
24 mm Temp Monitor
27 mm Temp Monitor
30 mm Outlet Temp Monitor