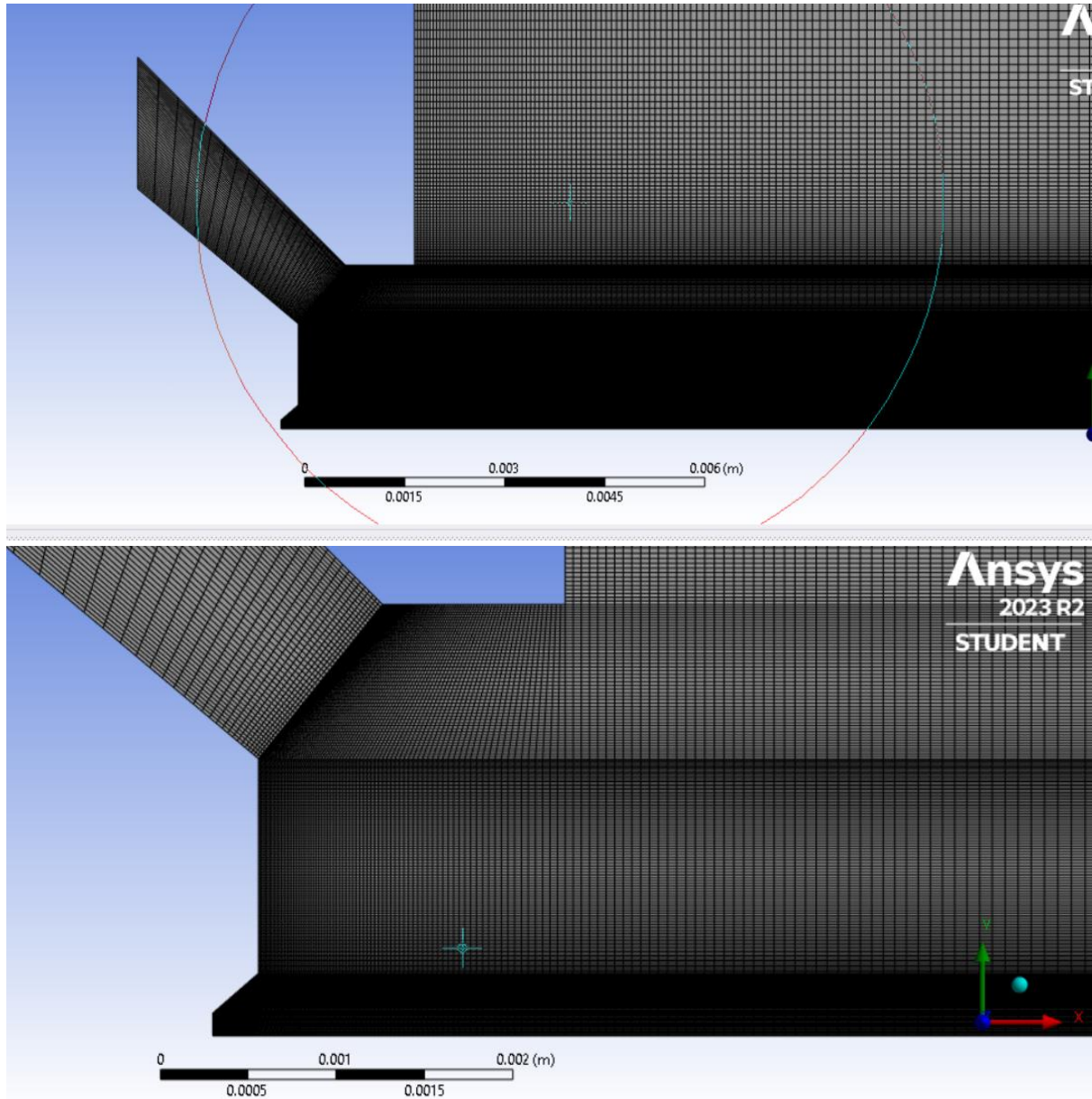


Mesh Model:



- + Solid
- Mixture
 - + methyl-alcohol-air
- + Cell Zone Conditions
- Boundary Conditions
 - Axis
 - axis (axis, id=8)
 - Inlet
 - inlet_injectortip (velocity-inlet, id=13)
 - inlet_jet (velocity-inlet, id=6)
 - inlet_pressure_farstream (pressure-inlet, id=11)
 - inlet_pressure_sedcondary (pressure-inlet, id=12)
 - Internal
 - interior-sys_surface (interior, id=1)
 - sys_surface (interior, id=2)
 - Outlet
 - outlet (pressure-outlet, id=7)
 - Wall
 - wall_injectorhead (wall, id=9)
 - wall_jetduct (wall, id=10)
- Mesh Interfaces

Species Mass Fractions

ch3oh

o2

Reference Values ?

Compute from
inlet_jet

Reference Values

Area [m²]

Density [kg/m³]

Enthalpy [J/kg]

Length [mm]

Pressure [Pa]

Temperature [K]

Velocity [m/s]

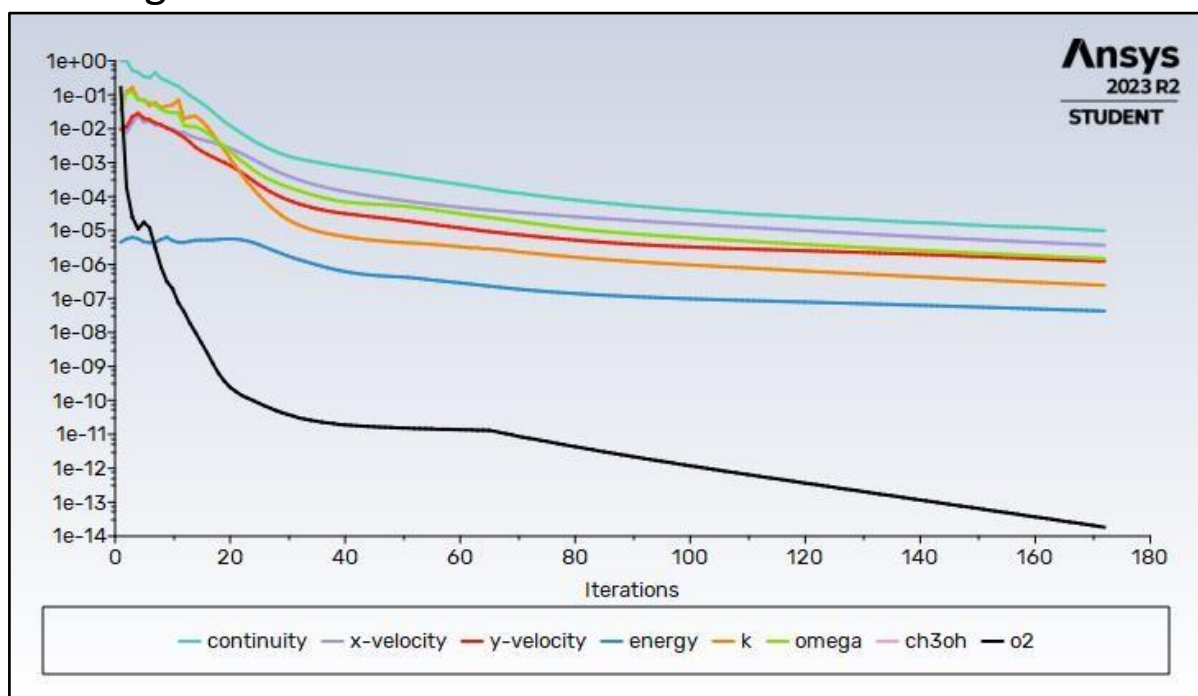
Viscosity [kg/(m s)]

Ratio of Specific Heats

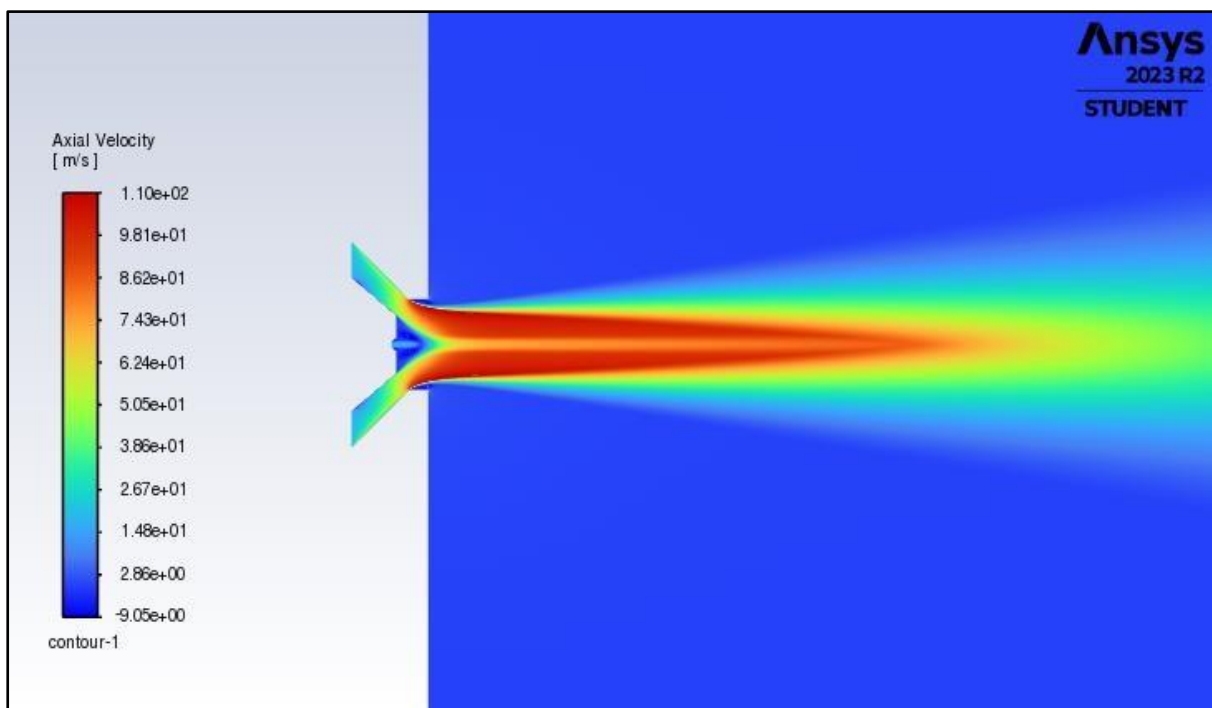
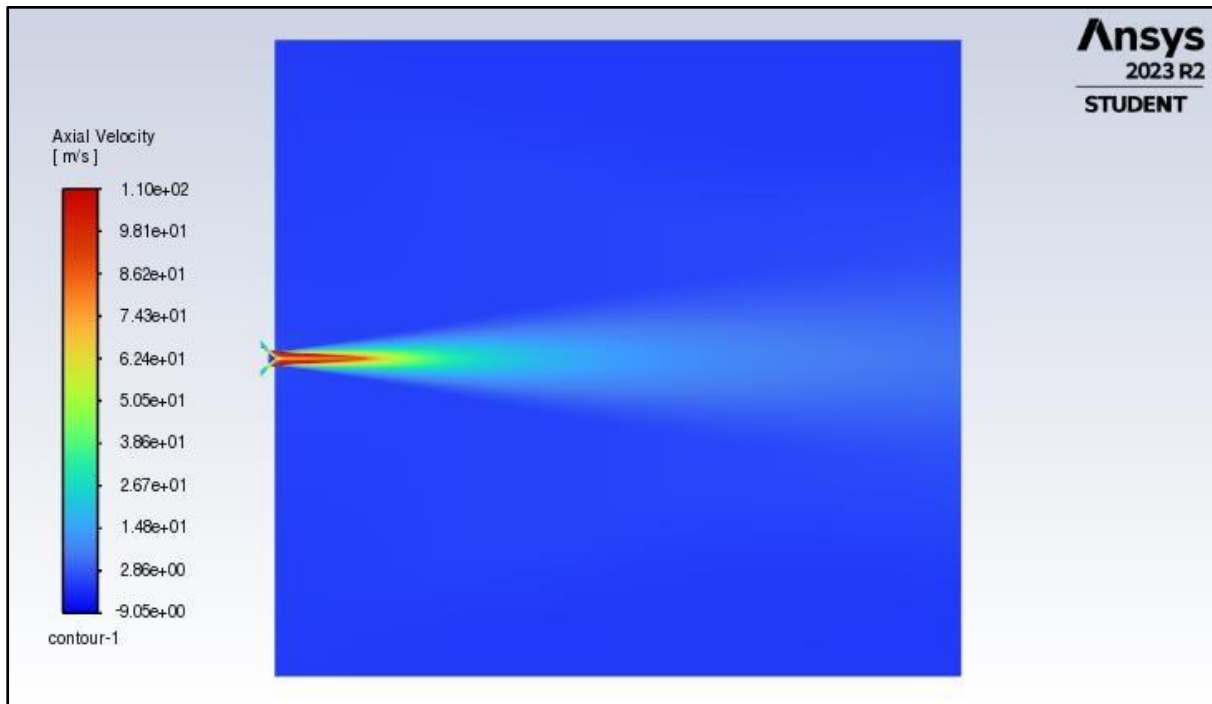
Yplus for Heat Tran. Coef.

Reference Zone
solid-sys_surface

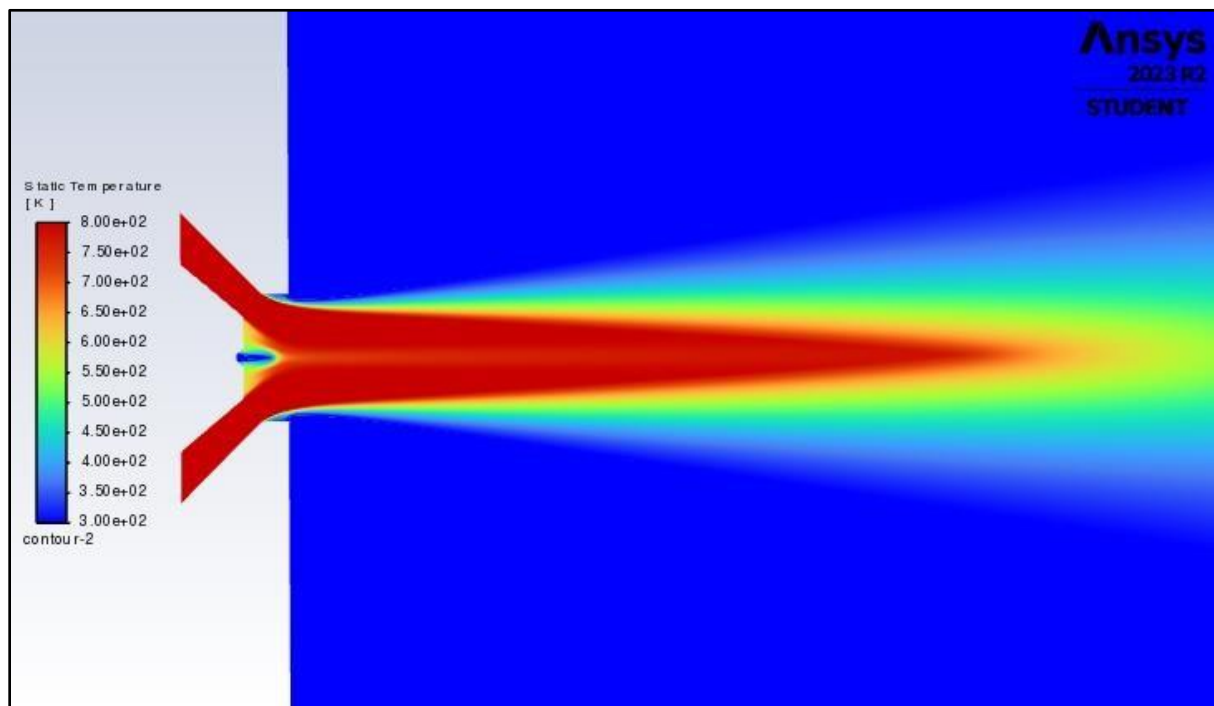
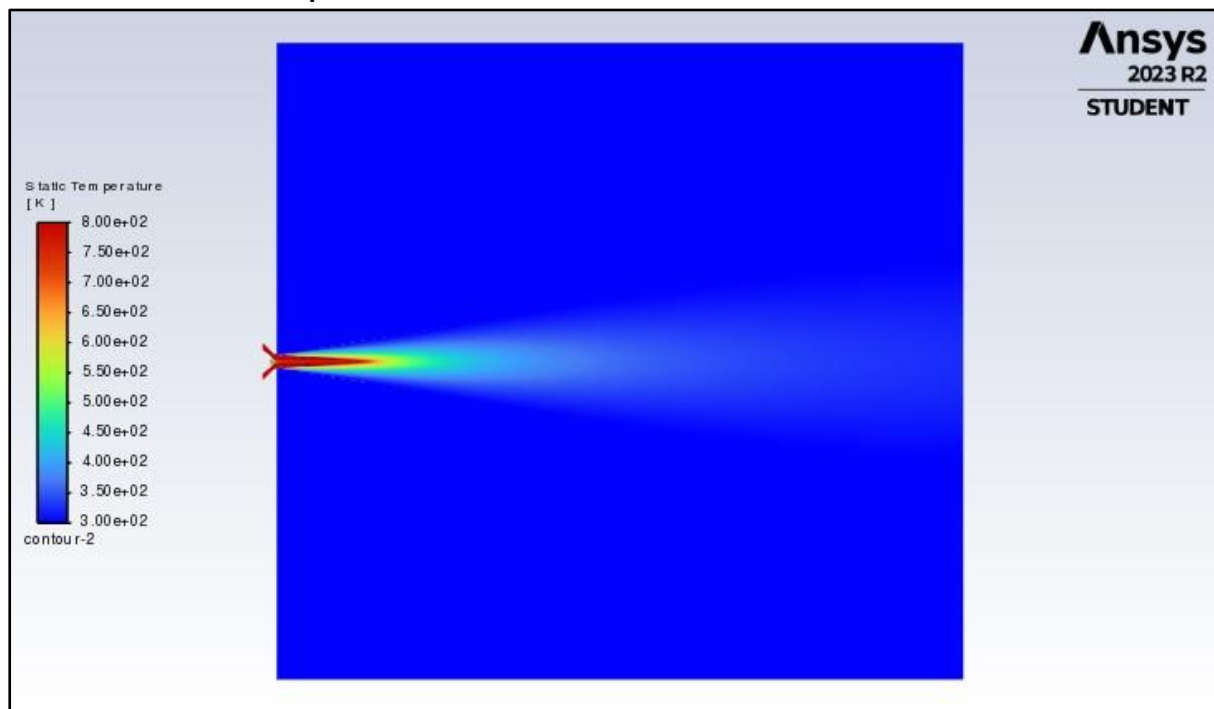
Convergence:



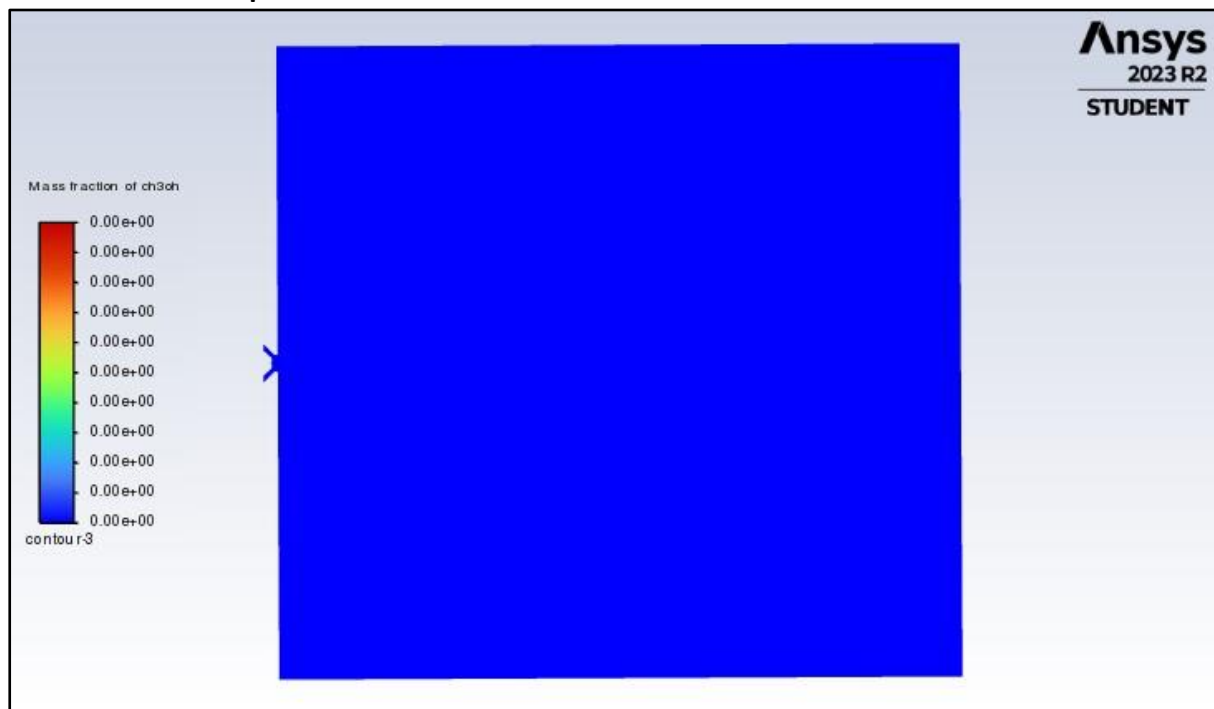
Contour of axial velocity:



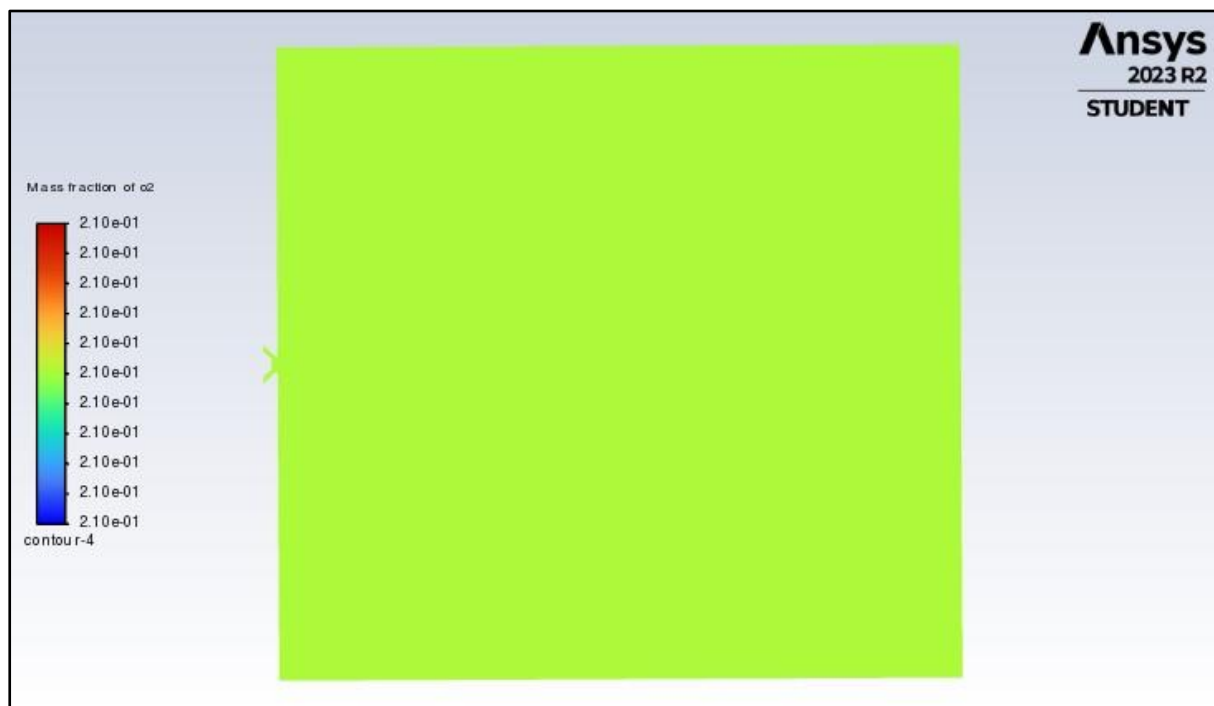
Contour of Temperature:



Contour of Species:

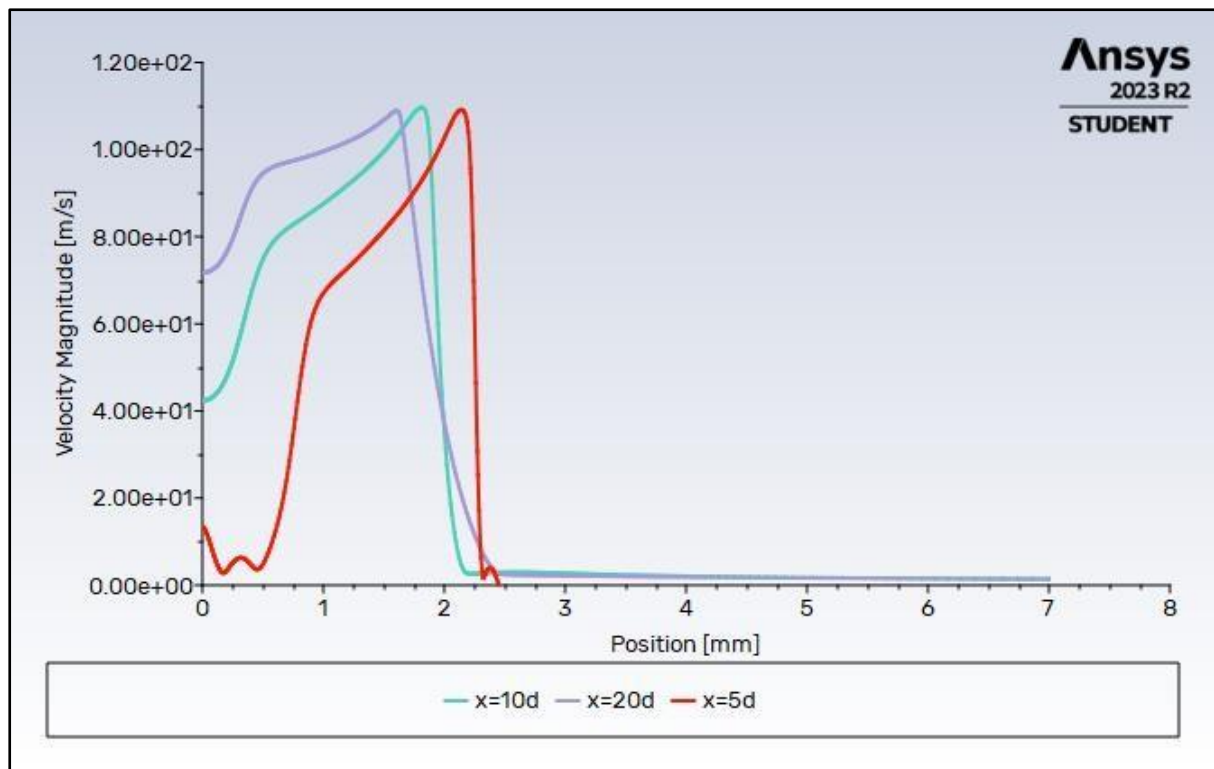


Contour of CH₃OH



Contour of O₂

Velocity at x = 5d, 10d, and 20d:



Model with droplet injection; with and without evaporation:

Injection Model Specifications

Set Injection Properties

Injection Name
m0001

Injection Type
surface

Injection Surfaces
Filter Text

axis
inlet_injectortip
inlet_jet
inlet_pressure_farstream
inlet_pressure_secondary
interior-sys_surface
outlet
solid-sys_surface
sys_surface

Particle Type
☐ Massless
☐ Inert
☒ Droplet
☐ Combusting
☐ Multicomponent

Laws
☐ Custom

Material
methanol-liquid

Diameter Distribution
uniform

Oxidizing Species

Discrete Phase Domain
none

Evaporating Species
ch3oh

Devolatilizing Species

Product Species

Point Properties
Physical Models
Turbulent Dispersion
Parcel
Wet Combustion
Components
UDF
Multiple Reactions

Variable	Value	
Diameter [mm]	0.1	▼
Temperature [K]	300	▼
Velocity Magnitude [m/s]	20	▼
Total Flow Rate [kg/s]	0.0001	▼

Stagger Options
☐ Stagger Positions
 Stagger Radius [mm]

Surface Options
☐ Scale Flow Rate by Face Area
☒ Inject Using Face Normal Direction
☐ Randomize Starting Points

Discrete Phase Model
 ✕

Interaction
☒ Interaction with Continuous Phase
☐ Update DPM Sources Every Flow Iteration
 DPM Iteration Interval

Particle Treatment
☐ Unsteady Particle Tracking

Contour Plots for DPM Variables
☐ Mean Values

Tracking Physical Models UDF Numerics Parallel

Tracking Options
☒ Accuracy Control
 Tolerance
 Max. Refinements
☐ Track in Absolute Frame

Tracking Scheme Selection
☒ Automated
 High Order Scheme
 Low Order Scheme
 Tracking Scheme

Coupled Heat-Mass Solution
☒ Droplet
☐ Combusting
☐ Multicomponent

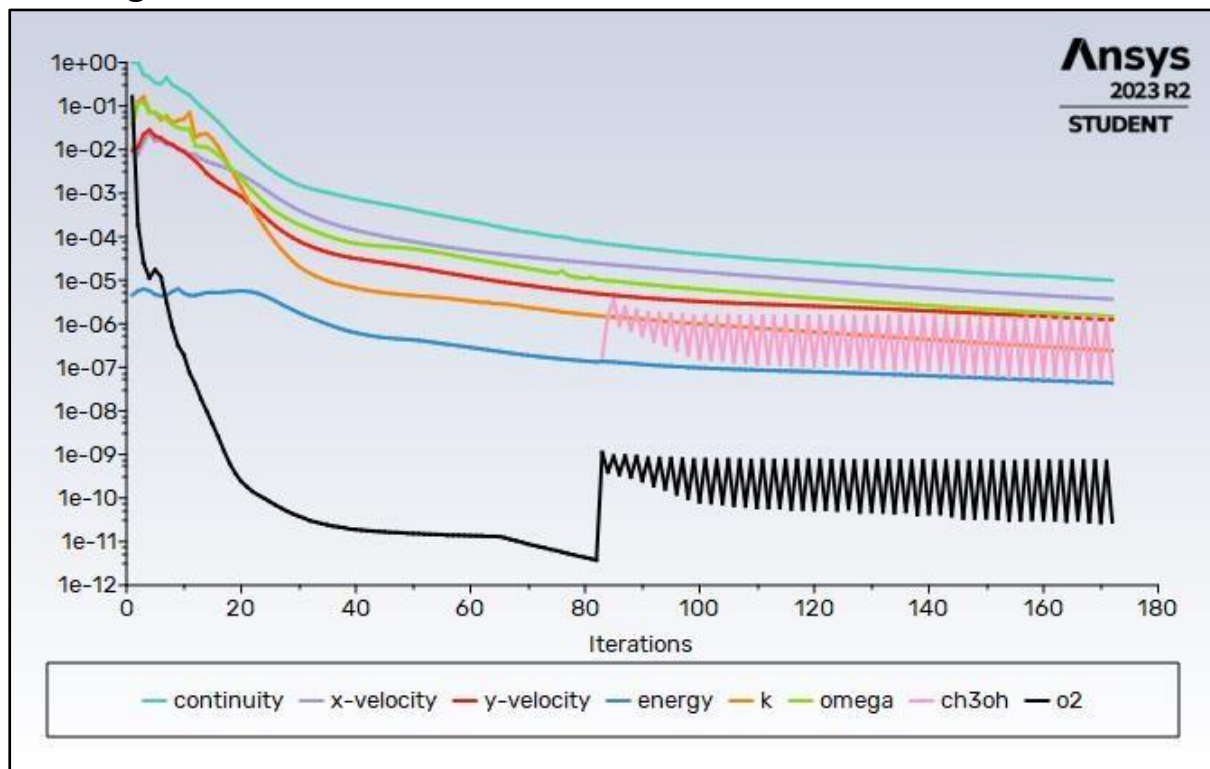
Vaporization Limiting Factors
 Mass
 Heat

Averaging
☐ Enable Node Based Averaging

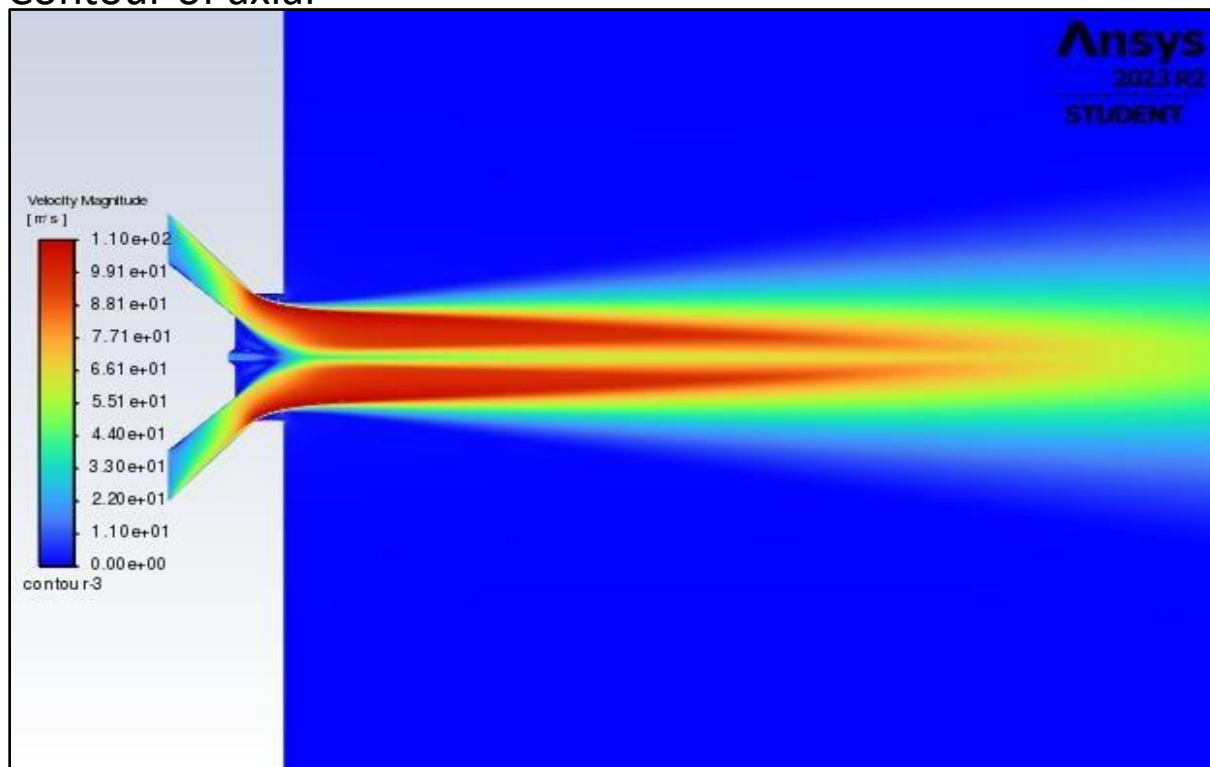
Source Terms
☐ Linearize Source Terms

Interaction Range
☐ Dynamic Interaction Range

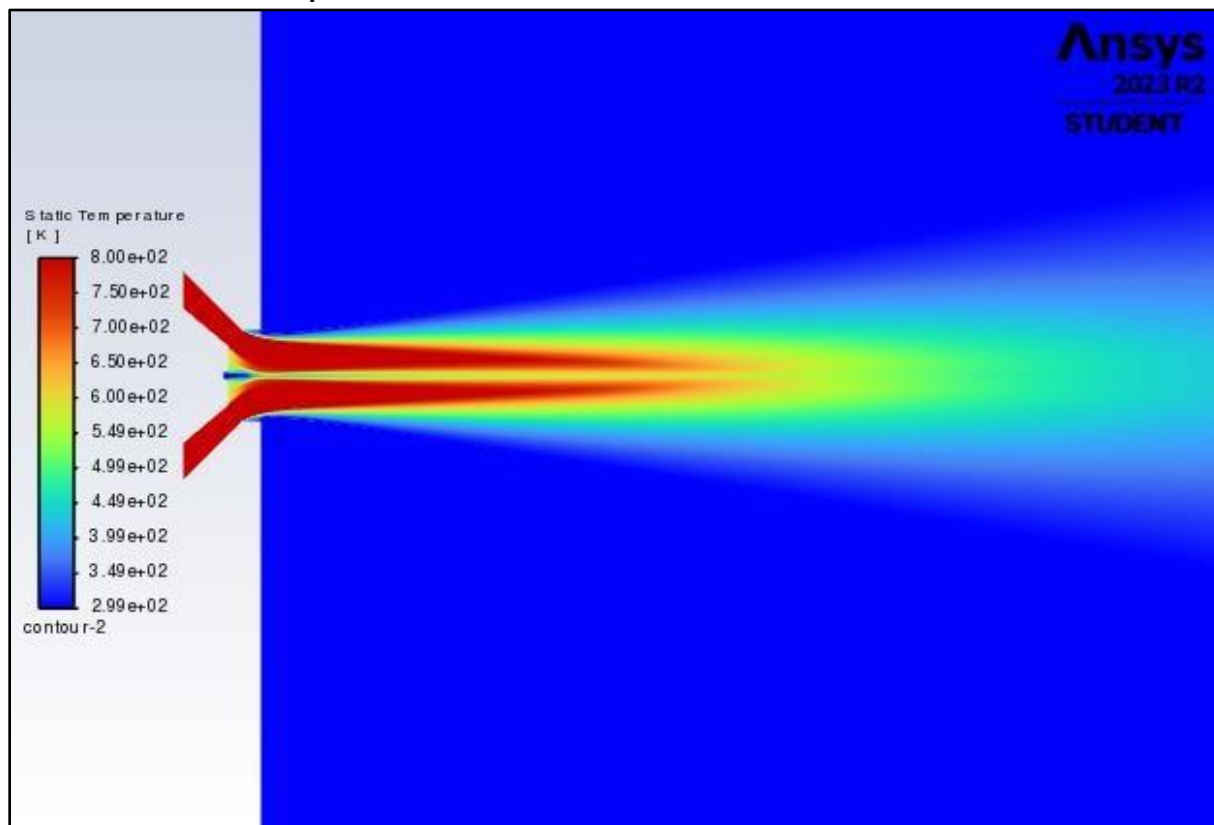
Convergence:



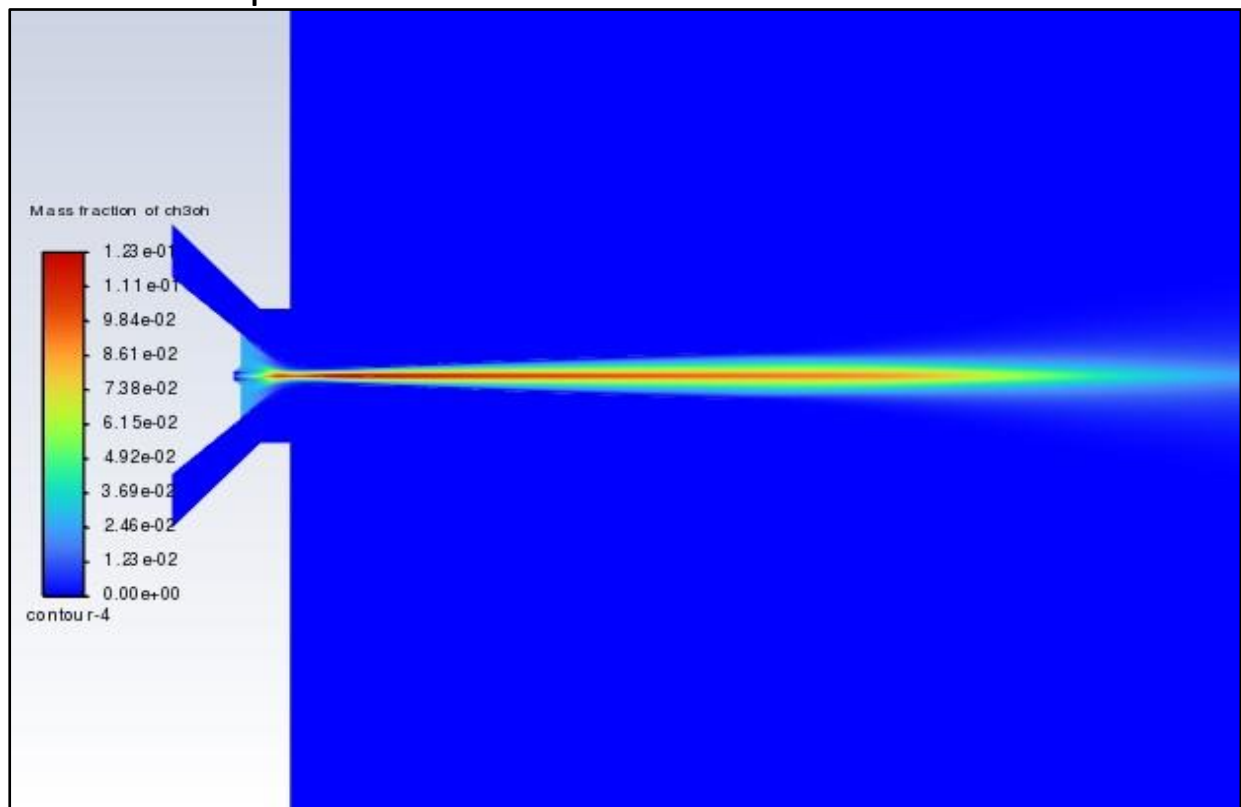
Contour of axial



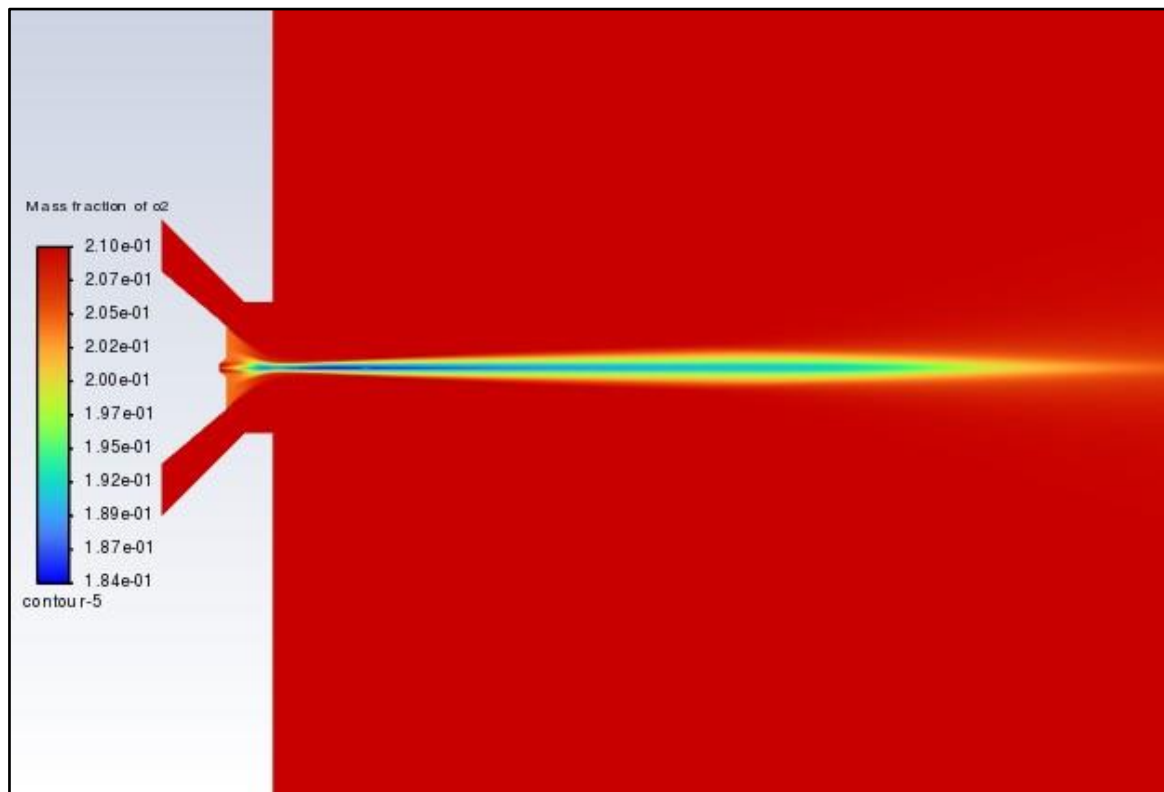
Contour of Temperature:



Contour of Species:

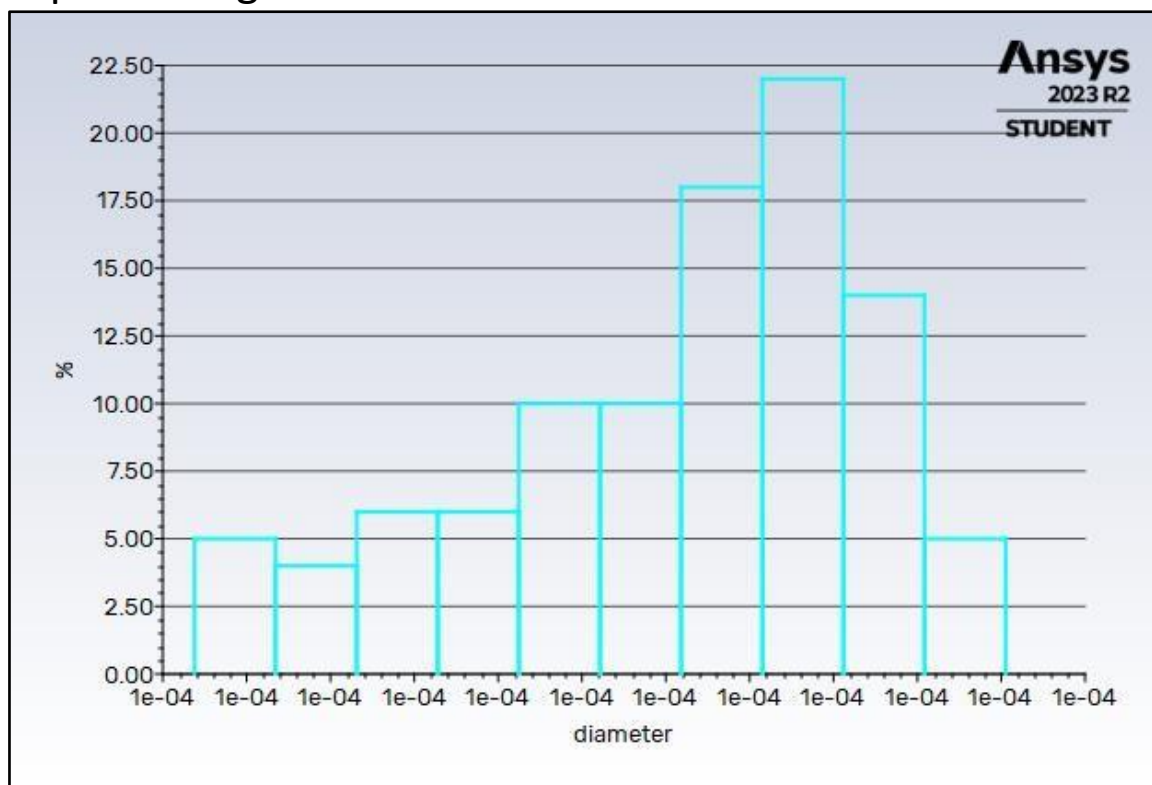


Contour of CH₃OH

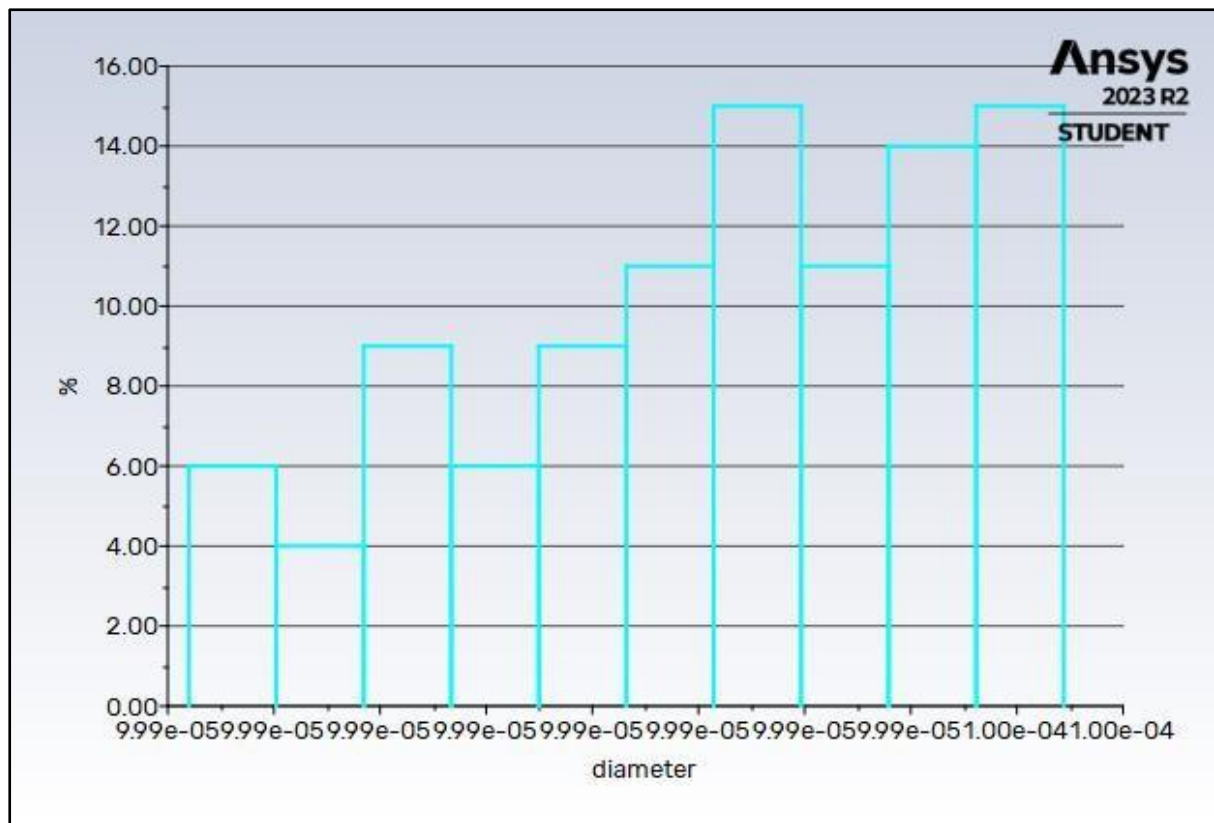


Contour of O₂

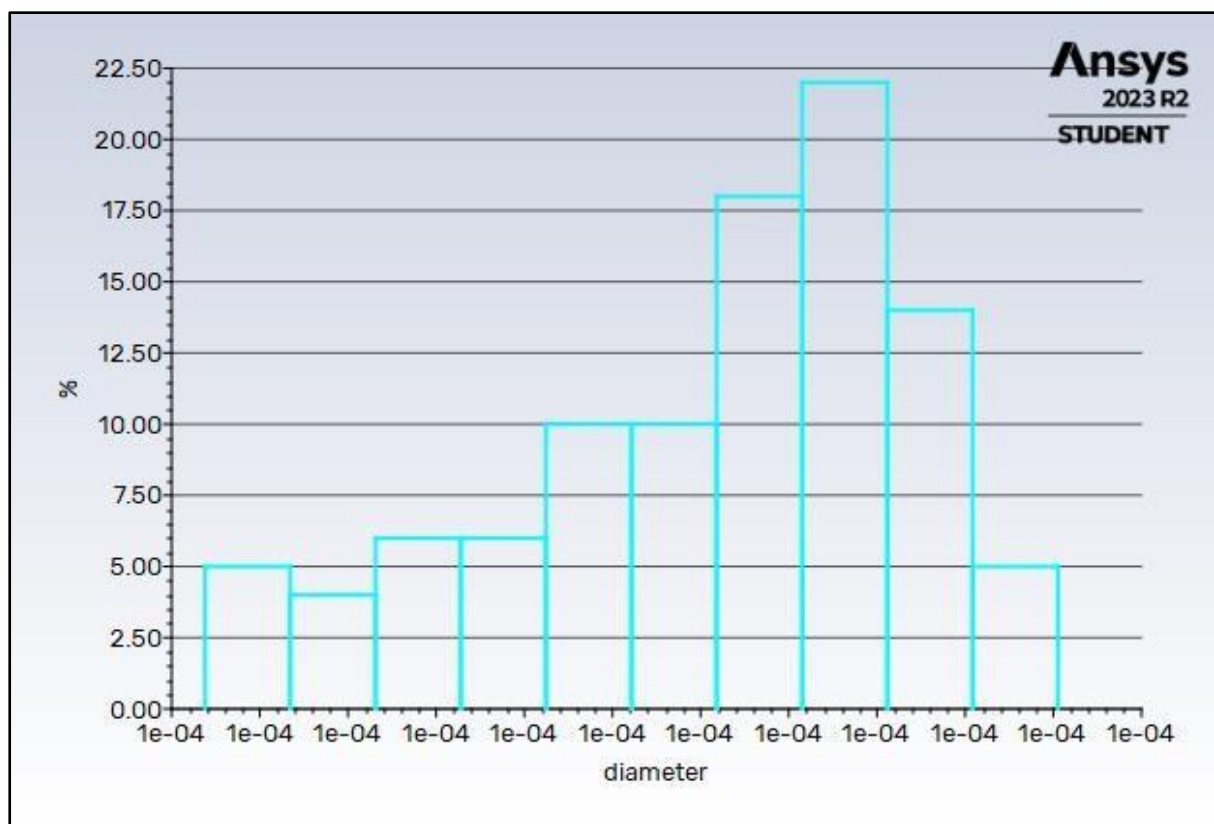
Droplet Histogram:



$$X = 5d$$

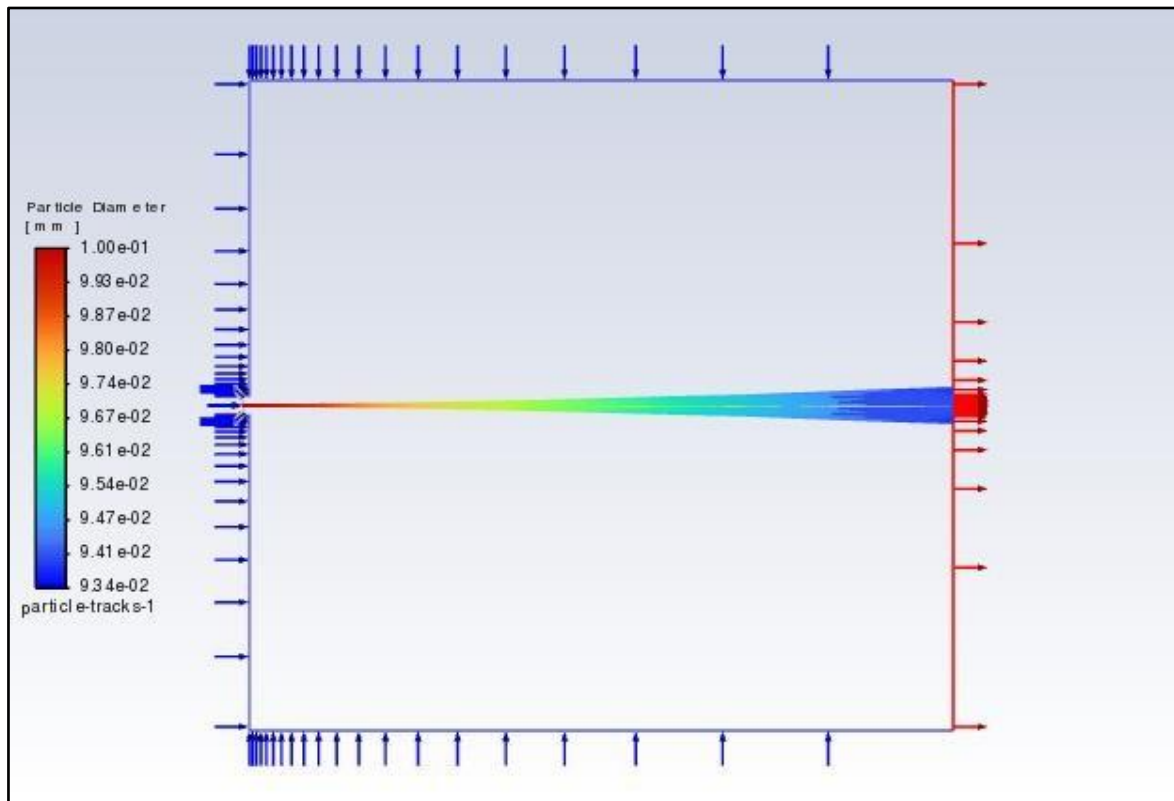


$X = 10d$

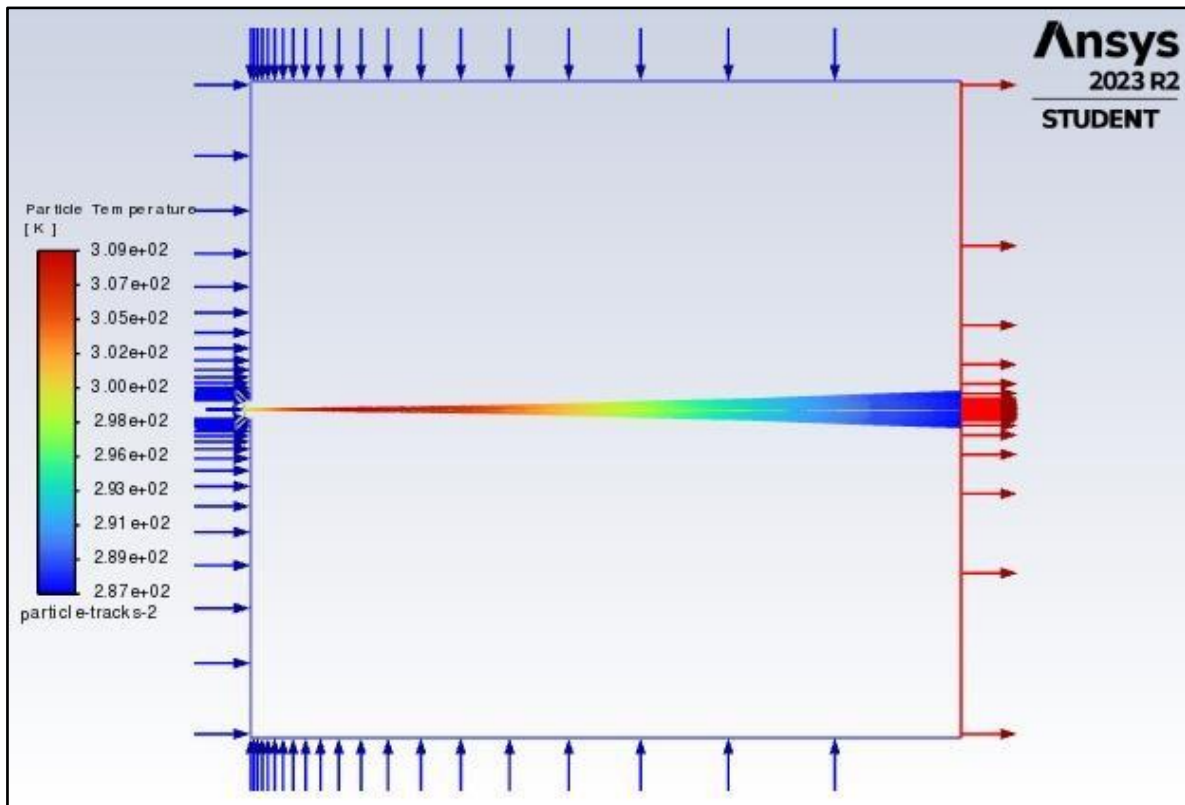


$X = 20d$

Droplet tracking graph:



Particle Diameter



Particle Temperature

Report of Mass and Energy Balance:

Mass Flow Rate	[kg/s]
inlet_injectortip	1.2369894e-06
inlet_jet	0.0004964833
inlet_pressure_farstream	0.011933179
inlet_pressure_sedcondary	0.013023025
outlet	-0.025475453
DPM Mass Source	1.751545e-05
Net	-4.0131467e-06
Total Heat Transfer Rate	[W]
inlet_injectortip	0.0023168773
inlet_jet	262.25823
inlet_pressure_farstream	22.350808
inlet_pressure_sedcondary	24.392085
outlet	-280.8105
DPM Enthalpy Source	-17.23917
Net	10.953775

Flux Reports

Options

☒ Mass Flow Rate
☐ Total Heat Transfer Rate
☐ Radiation Heat Transfer Rate
☐ Viscous Work Rate

Boundaries

axis
inlet_injectortip
inlet_jet
inlet_pressure_farstream
inlet_pressure_sedcondary
interior-sys_surface
outlet
sys_surface
wall_injectorhead
wall_jetduct

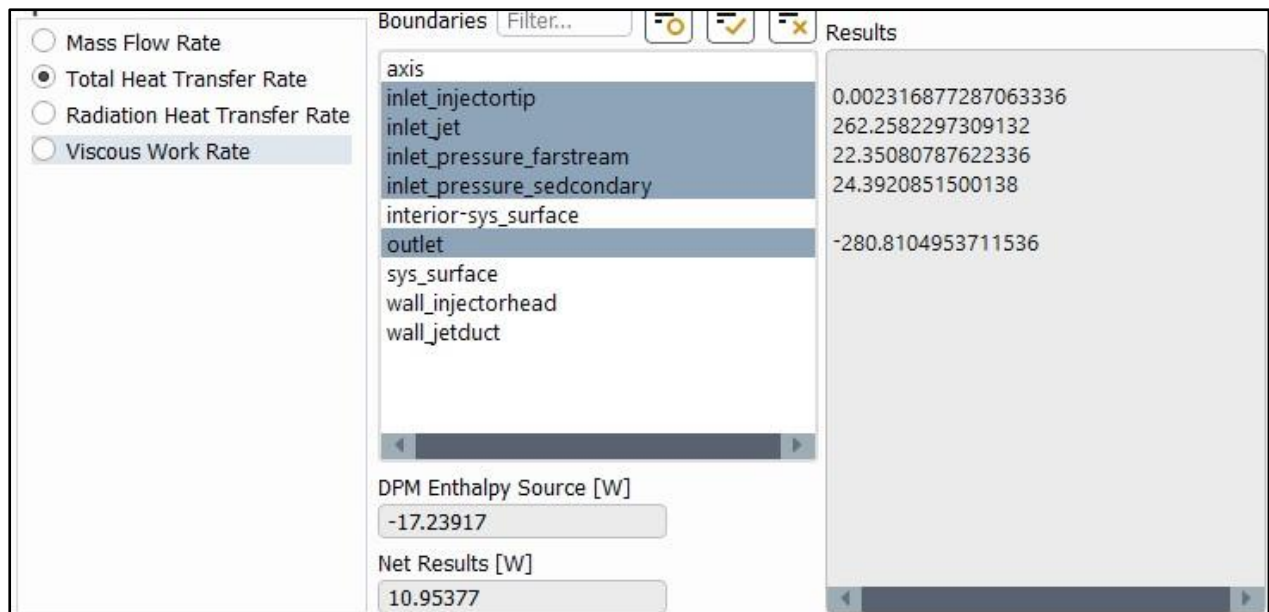
DPM Mass Source [kg/s]
1.751545e-05

Net Results [kg/s]
-4.013147e-06

Results

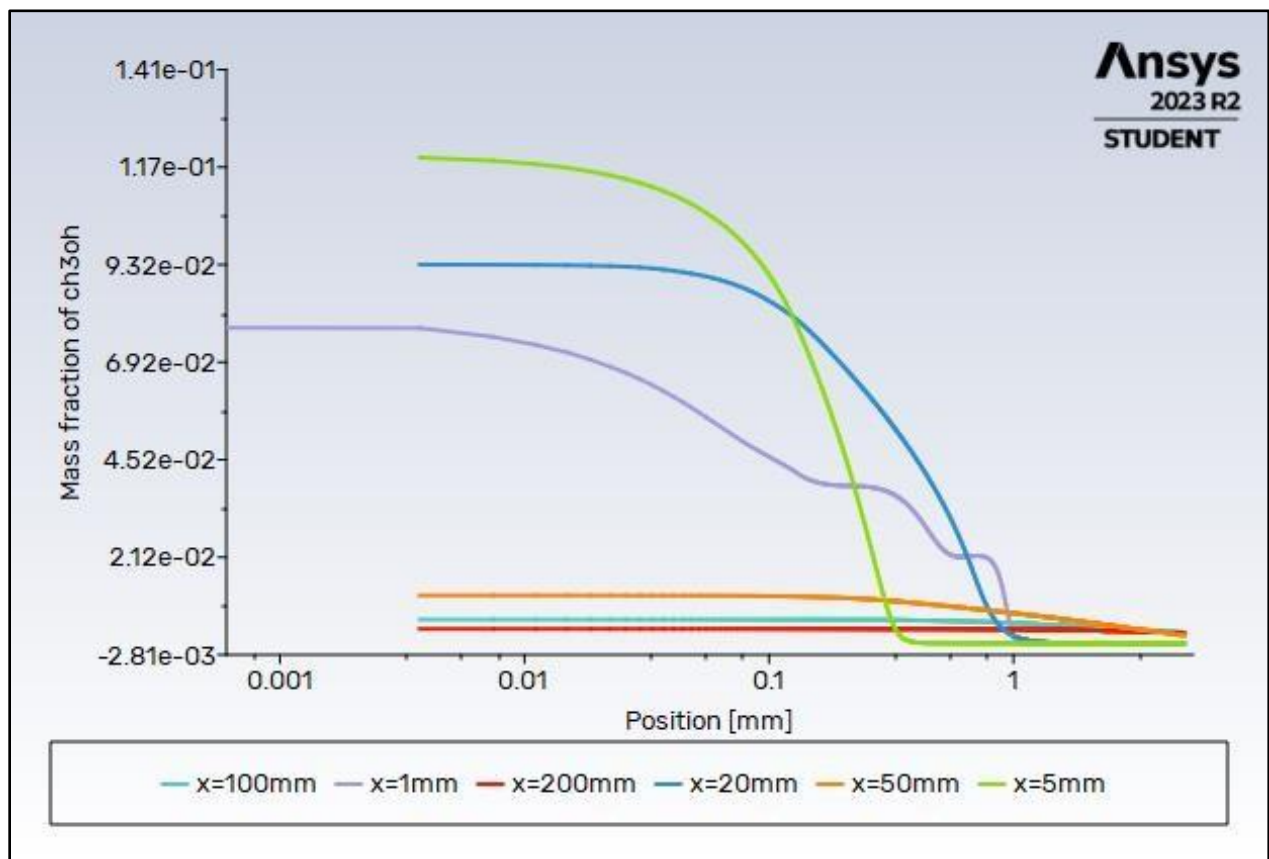
1.236989377144402e-06
0.0004964833026034997
0.0119331792269963
0.01302302473482013
-0.02547545285037779

Mass Balance Report



Energy Balance report

Mass Fraction of CH₃OH:



Summary:

The flow's maximum velocity is approximately 110 m/s, which falls short of Mach 0.3, where the velocity reaches 170.08 m/s.

When droplet particles are introduced, they absorb energy from the surrounding fluid, leading to a drop in temperature near the axis line.

Along the axis line, the injection of droplets causes a reduction in flow velocity compared to scenarios lacking injection. This decline may stem from droplets absorbing energy from nearby particles, triggering evaporation and subsequently reducing velocity in the surrounding region.

Increasing the reference pressure will diminish the evaporation rate as the thermal energy required to surpass the boiling point escalates.

Lowering pressure and elevating temperature will amplify the evaporation rate. Moreover, a heightened inlet mass flow rate will bolster evaporation.