Ansys Fluent Simulation Report

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Table of Contents

System Information

Application	Fluent
Settings	3d, double precision, density-based implicit, SST k-omega
Version	23.2.0-10213
Source Revision	aafc525902
Build Time	Aug 18 2023 08:23:03 EDT
CPU	Intel(R) Xeon(R) Gold 6242R
OS	Windows

Geometry and Mesh

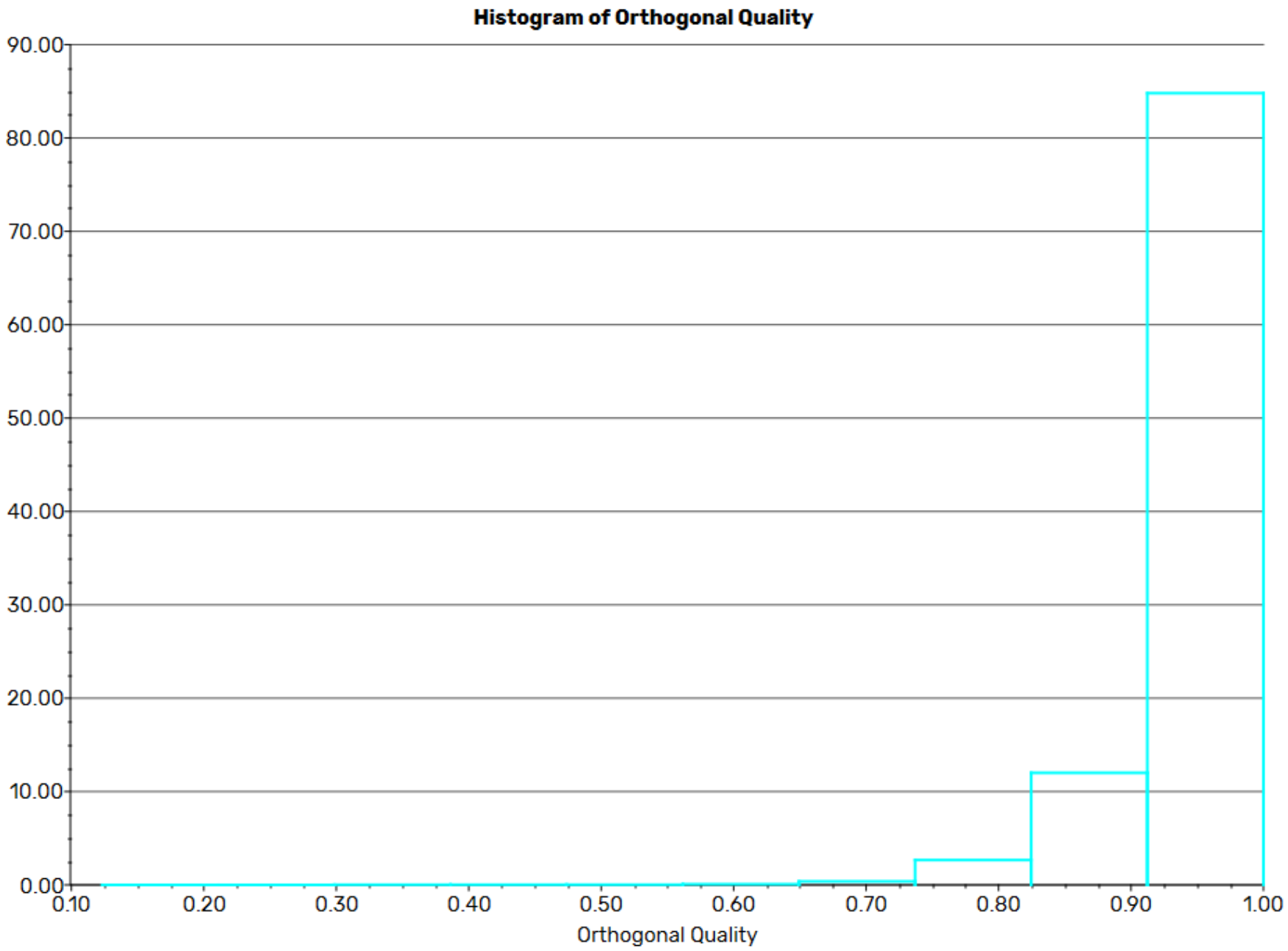
Mesh Size

Cells	Faces	Nodes
5540296	20851453	10106834

Mesh Quality

Name	Type	Min Orthogonal Quality	Max Aspect Ratio
enclosure-enclosure1	Mixed Cell	0.123239	503658.25

Orthogonal Quality



Simulation Setup

Physics

Models

Model	Settings
Space	3D

Model	Settings
Time	Steady
Viscous	SST k-omega turbulence model
Heat Transfer	Enabled

Material Properties

− Fluid	
− air	
Density	ideal gas
Cp (Specific Heat)	nasa 9 piecewise polynomial
Thermal Conductivity	piecewise linear
Viscosity	sutherland
Molecular Weight	28.966 kg/kmol
− Solid	
− aluminum	
Density	2719 kg/m^3
Cp (Specific Heat)	871 J/(kg K)
Thermal Conductivity	202.4 W/(m K)

Cell Zone Conditions

− Fluid	
− enclosure-enclosure1	
Material Name	air
Specify source terms?	no
Specify fixed values?	no
Frame Motion?	no
Laminar zone?	no
Porous zone?	no
3D Fan Zone?	no

Boundary Conditions

− Inlet	
− nozzle_exit	
Velocity Specification Method	Magnitude, Normal to Boundary
Reference Frame	Absolute
Velocity Magnitude [m/s]	2650
Supersonic/Initial Gauge Pressure [Pa]	2072
Temperature [K]	1840
Turbulent Specification Method	Intensity and Length Scale
Turbulent Intensity [%]	10
Turbulent Length Scale [m]	0.3
Outflow Gauge Pressure [Pa]	0
Note: Reinjected particles do not change their injection association	no
− far	

Gauge Pressure [Pa]	0
Mach Number	1.08
Temperature [K]	216.65
Coordinate System	Cartesian (X, Y, Z)
Component of Flow Direction (x,y,z)	(-1, 0, 0)
Turbulent Specification Method	Intensity and Viscosity Ratio
Turbulent Intensity [%]	5
Turbulent Viscosity Ratio	10
Note: Reinjected particles do not change their injection association	no
− inlet	
Gauge Pressure [Pa]	0
Mach Number	1.08
Temperature [K]	216.65
Coordinate System	Cartesian (X, Y, Z)
Component of Flow Direction (x,y,z)	(-1, 0, 0)
Turbulent Specification Method	Intensity and Viscosity Ratio
Turbulent Intensity [%]	5
Turbulent Viscosity Ratio	10
Note: Reinjected particles do not change their injection association	no
− Outlet	
− outlet	
Backflow Reference Frame	Absolute
Gauge Pressure [Pa]	0
Pressure Profile Multiplier	1
Backflow Total Temperature [K]	216.5
Backflow Direction Specification Method	Normal to Boundary
Turbulent Specification Method	Intensity and Viscosity Ratio
Backflow Turbulent Intensity [%]	5
Backflow Turbulent Viscosity Ratio	10
Note: Reinjected particles do not change their injection association	no
Acoustic Wave Model	Off
Backflow Pressure Specification	Total Pressure
Build artificial walls to prevent reverse flow?	no
Radial Equilibrium Pressure Distribution	no
Average Pressure Specification?	no
Specify targeted mass flow rate	no
− Symmetry	
symmetry	symmetry
− Wall	
− s01s02s03	
Wall Thickness [m]	0
Heat Generation Rate [W/m^3]	0
Material Name	aluminum
Thermal BC Type	Temperature
Temperature [K]	323

Wall Motion	Stationary Wall
Shear Boundary Condition	No Slip
Wall Surface Roughness	rough bc standard
Wall Roughness Height [m]	0.0001
Wall Roughness Constant	0.5
Convective Augmentation Factor	1
━ raceway2	
Wall Thickness [m]	0
Heat Generation Rate [W/m^3]	0
Material Name	aluminum
Thermal BC Type	Temperature
Temperature [K]	323
Wall Motion	Stationary Wall
Shear Boundary Condition	No Slip
Wall Surface Roughness	rough bc standard
Wall Roughness Height [m]	0.0001
Wall Roughness Constant	0.5
Convective Augmentation Factor	1
━ s04s05	
Wall Thickness [m]	0
Heat Generation Rate [W/m^3]	0
Material Name	aluminum
Thermal BC Type	Temperature
Temperature [K]	323
Wall Motion	Stationary Wall
Shear Boundary Condition	No Slip
Wall Surface Roughness	rough bc standard
Wall Roughness Height [m]	0.0001
Wall Roughness Constant	0.5
Convective Augmentation Factor	1
━ fin1	
Wall Thickness [m]	0
Heat Generation Rate [W/m^3]	0
Material Name	aluminum
Thermal BC Type	Temperature
Temperature [K]	323
Wall Motion	Stationary Wall
Shear Boundary Condition	No Slip
Wall Surface Roughness	rough bc standard
Wall Roughness Height [m]	0.0001
Wall Roughness Constant	0.5
Convective Augmentation Factor	1
━ base	
Wall Thickness [m]	0
Heat Generation Rate [W/m^3]	0

Material Name	aluminum
Thermal BC Type	Temperature
Temperature [K]	323
Wall Motion	Stationary Wall
Shear Boundary Condition	No Slip
Wall Surface Roughness	rough bc standard
Wall Roughness Height [m]	0.0001
Wall Roughness Constant	0.5
Convective Augmentation Factor	1
− pl_body	
Wall Thickness [m]	0
Heat Generation Rate [W/m^3]	0
Material Name	aluminum
Thermal BC Type	Temperature
Temperature [K]	323
Wall Motion	Stationary Wall
Shear Boundary Condition	No Slip
Wall Surface Roughness	rough bc standard
Wall Roughness Height [m]	0.0001
Wall Roughness Constant	0.5
Convective Augmentation Factor	1
− pl_nose	
Wall Thickness [m]	0
Heat Generation Rate [W/m^3]	0
Material Name	aluminum
Thermal BC Type	Temperature
Temperature [K]	323
Wall Motion	Stationary Wall
Shear Boundary Condition	No Slip
Wall Surface Roughness	rough bc standard
Wall Roughness Height [m]	0.0001
Wall Roughness Constant	0.5
Convective Augmentation Factor	1
− vernier_exit1	
Wall Thickness [m]	0
Heat Generation Rate [W/m^3]	0
Material Name	aluminum
Thermal BC Type	Temperature
Temperature [K]	323
Wall Motion	Stationary Wall
Shear Boundary Condition	No Slip
Wall Surface Roughness	rough bc standard
Wall Roughness Height [m]	0.0001
Wall Roughness Constant	0.5
Convective Augmentation Factor	1

— vernier_exit8	
Wall Thickness [m]	0
Heat Generation Rate [W/m^3]	0
Material Name	aluminum
Thermal BC Type	Temperature
Temperature [K]	323
Wall Motion	Stationary Wall
Shear Boundary Condition	No Slip
Wall Surface Roughness	rough bc standard
Wall Roughness Height [m]	0.0001
Wall Roughness Constant	0.5
Convective Augmentation Factor	1
— pl_fin1	
Wall Thickness [m]	0
Heat Generation Rate [W/m^3]	0
Material Name	aluminum
Thermal BC Type	Temperature
Temperature [K]	323
Wall Motion	Stationary Wall
Shear Boundary Condition	No Slip
Wall Surface Roughness	rough bc standard
Wall Roughness Height [m]	0.0001
Wall Roughness Constant	0.5
Convective Augmentation Factor	1
— nozzle_wall	
Wall Thickness [m]	0
Heat Generation Rate [W/m^3]	0
Material Name	aluminum
Thermal BC Type	Temperature
Temperature [K]	323
Wall Motion	Stationary Wall
Shear Boundary Condition	No Slip
Wall Surface Roughness	rough bc standard
Wall Roughness Height [m]	0.0001
Wall Roughness Constant	0.5
Convective Augmentation Factor	1

Reference Values

Area	0.44175 m^2
Density	0.3622478 kg/m^3
Enthalpy	217516.6 J/kg
Length	1.5 m
Pressure	0 Pa
Temperature	216.65 K

Velocity	318 m/s
Viscosity	1.652313e-05 kg/(m s)
Ratio of Specific Heats	1.4
Yplus for Heat Tran. Coef.	300
Reference Zone	enclosure-enclosure1

Solver Settings

— Equations	
Flow	True
Turbulence	True
— Numerics	
Absolute Velocity Formulation	True
— Under-Relaxation Factors	
Turbulent Kinetic Energy	0.8
Specific Dissipation Rate	0.8
Turbulent Viscosity	1
Solid	1
— Discretization Scheme	
Flow	Second Order Upwind
Turbulent Kinetic Energy	Second Order Upwind
Specific Dissipation Rate	Second Order Upwind
— Time Marching	
Solver	Implicit
Courant Number	40
— Solution Limits	
Minimum Absolute Pressure [Pa]	6.731715
Maximum Absolute Pressure [Pa]	2167274
Minimum Static Temperature [K]	10
Maximum Static Temperature [K]	4686.7
Minimum Turb. Kinetic Energy [m^2/s^2]	1e-14
Minimum Spec. Dissipation Rate [s^-1]	1e-20
Maximum Turb. Viscosity Ratio	1e+07

Run Information

Number of Machines	1
Number of Cores	36
Case Read	18.206 seconds
Data Read	14.796 seconds
Iteration	24937.3 seconds
AMG	13578.4 seconds
Virtual Current Memory	47.872 GB

Virtual Peak Memory	50.3653 GB
Memory Per M Cell	8.57778

Solution Status

Iterations: 956

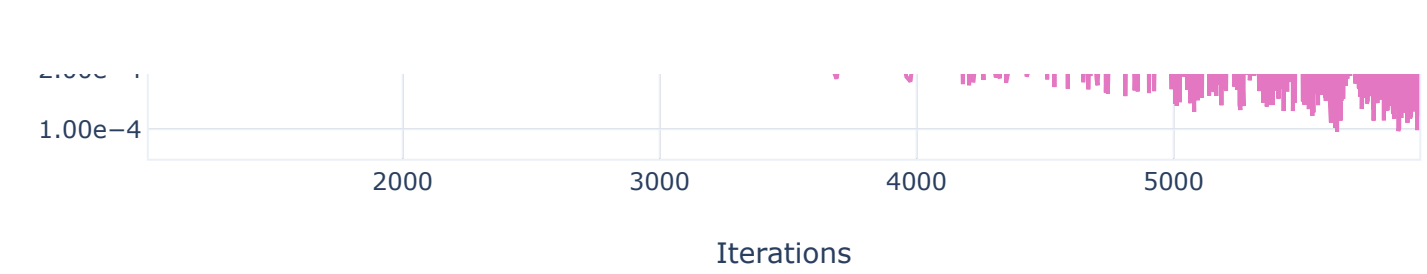
	Value	Absolute Criteria	Convergence Status
continuity	0.002474937	0.001	Not Converged
x-velocity	0.001747896	0.0001	Not Converged
y-velocity	0.001195793	0.0001	Not Converged
z-velocity	0.0005098218	0.0001	Not Converged
energy	0.002330829	0.0001	Not Converged
k	0.0008343247	0.0001	Not Converged
omega	0.001267204	0.001	Not Converged

Report Definitions

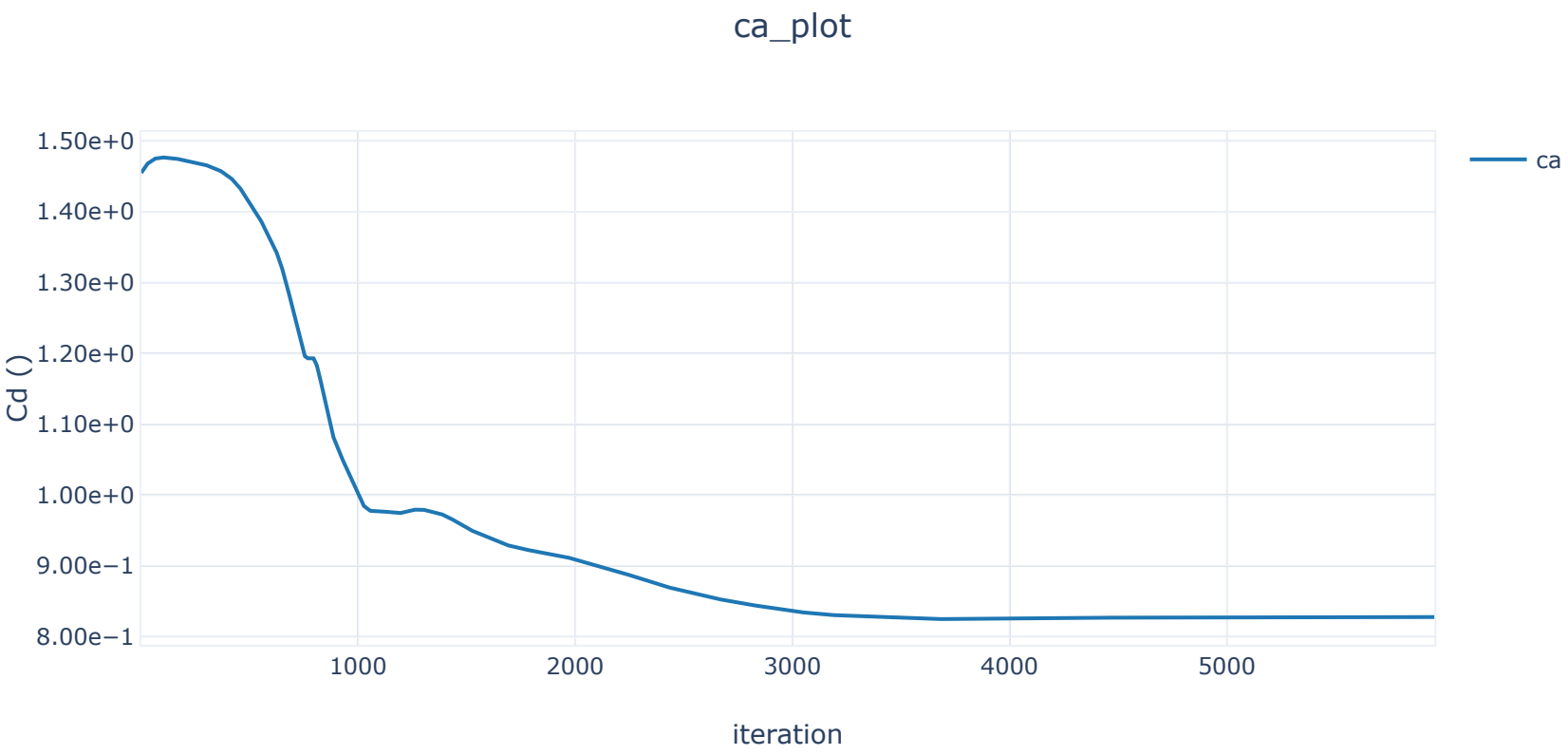
q_average	8806.652	W/m^2
cn_moment	-0.187969	
cm	0.5719479	
cy	0.04116483	
cn	0.9595893	
ca	0.8277517	
cfl-number	3	

Plots

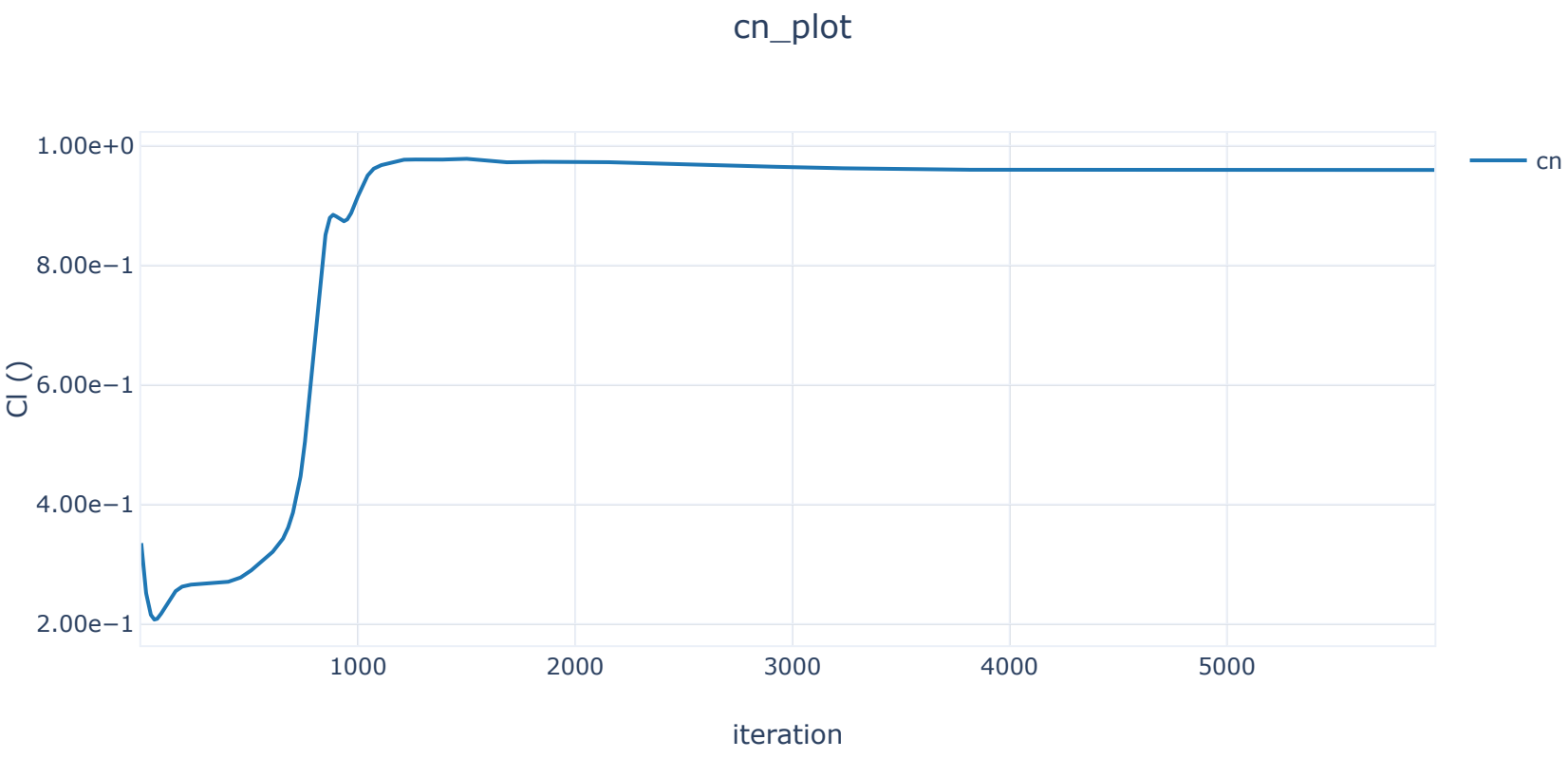
Residuals



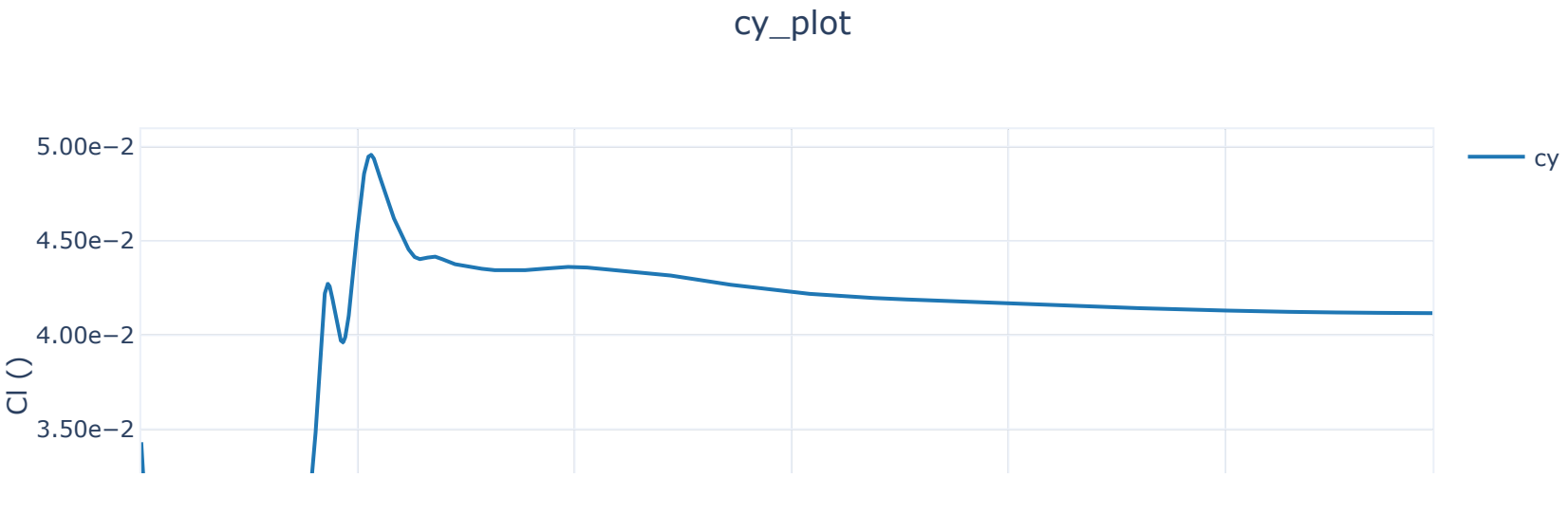
ca_plot

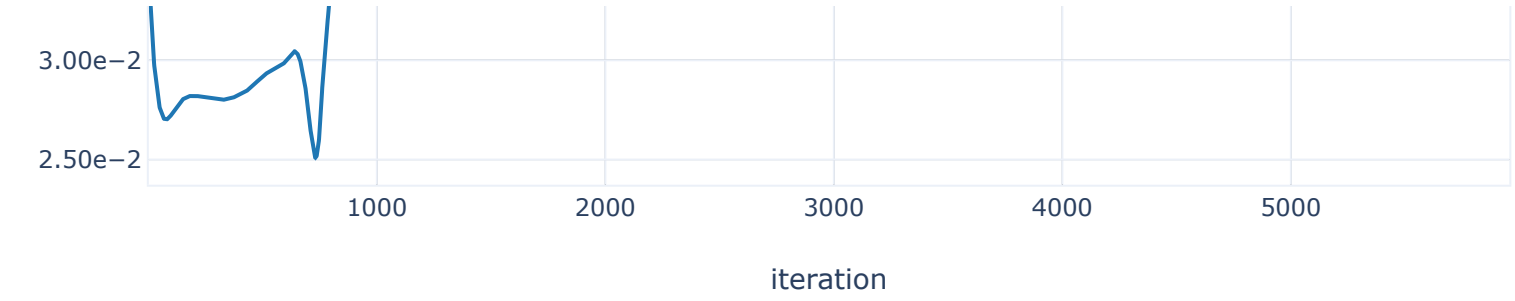


cn_plot

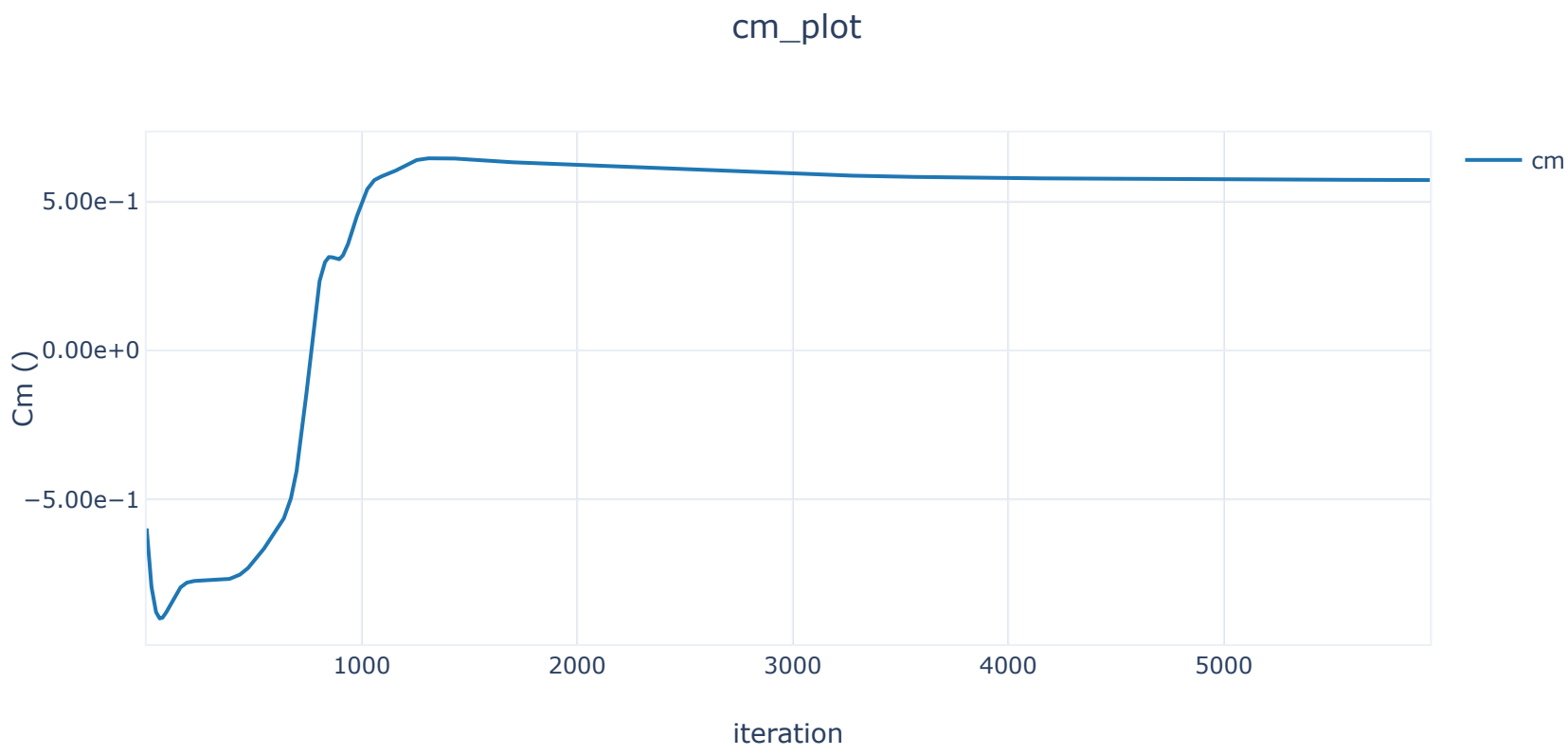


cy_plot

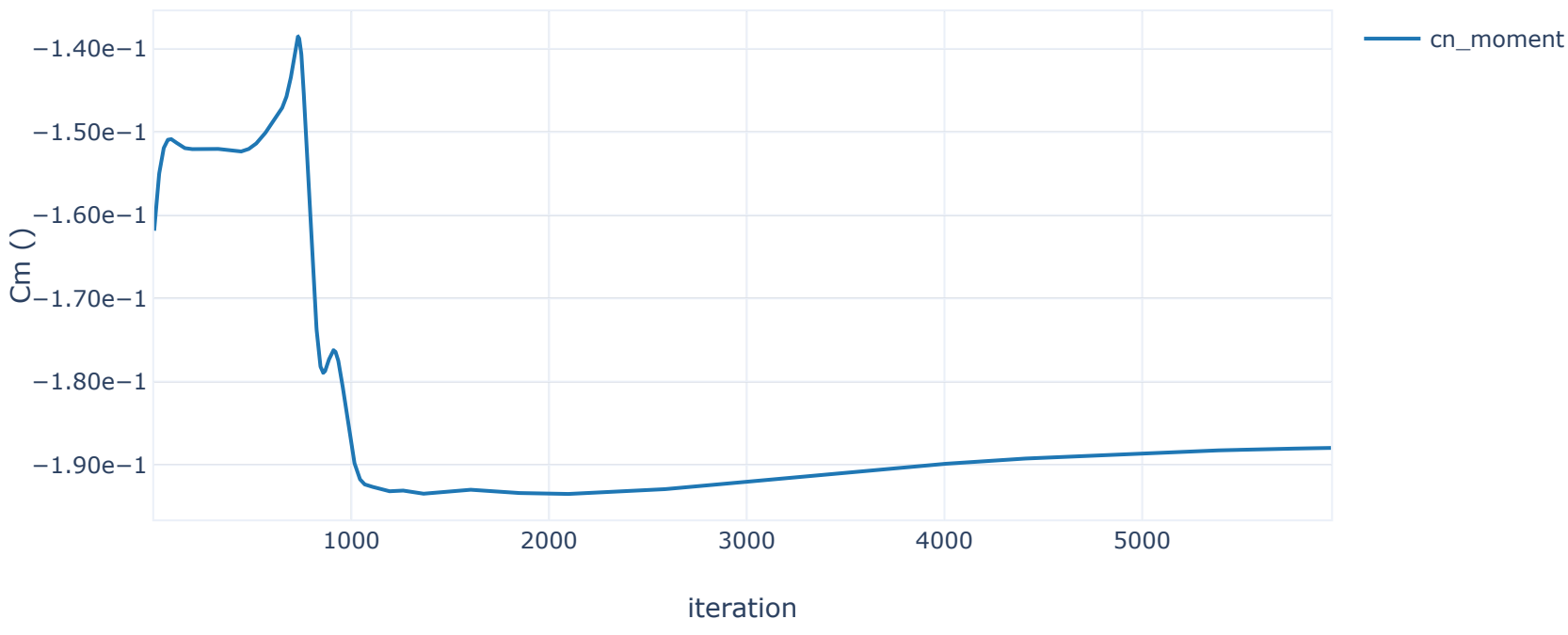




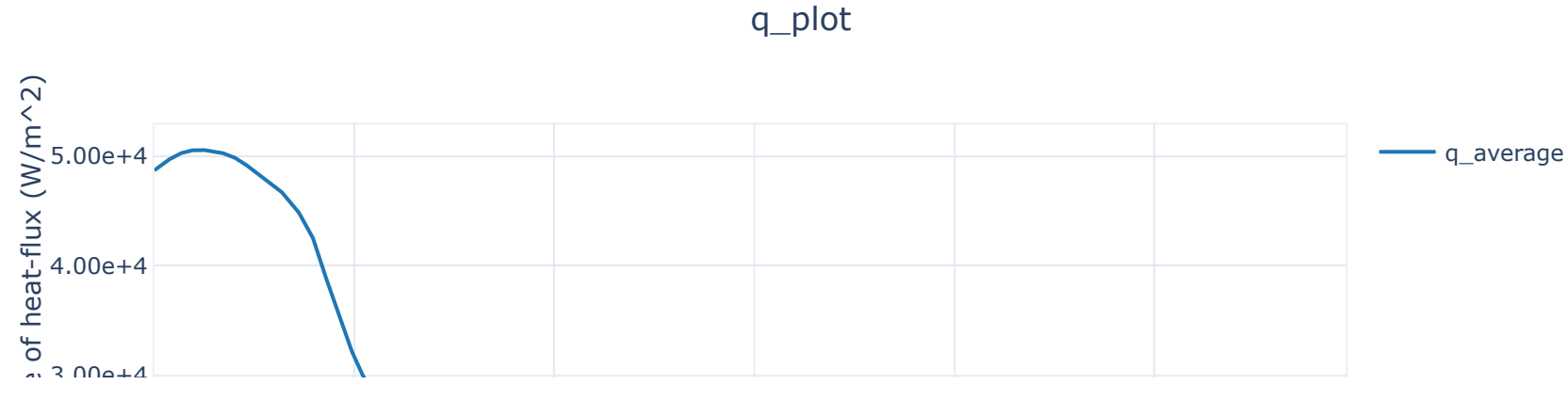
cm_plot

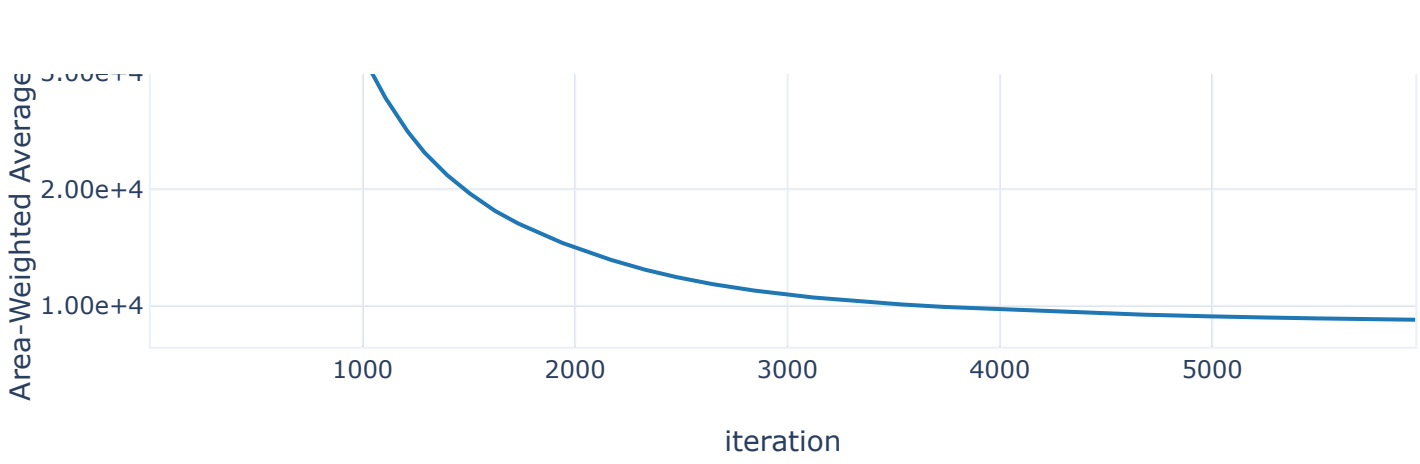


cn_moment_plot



q_plot

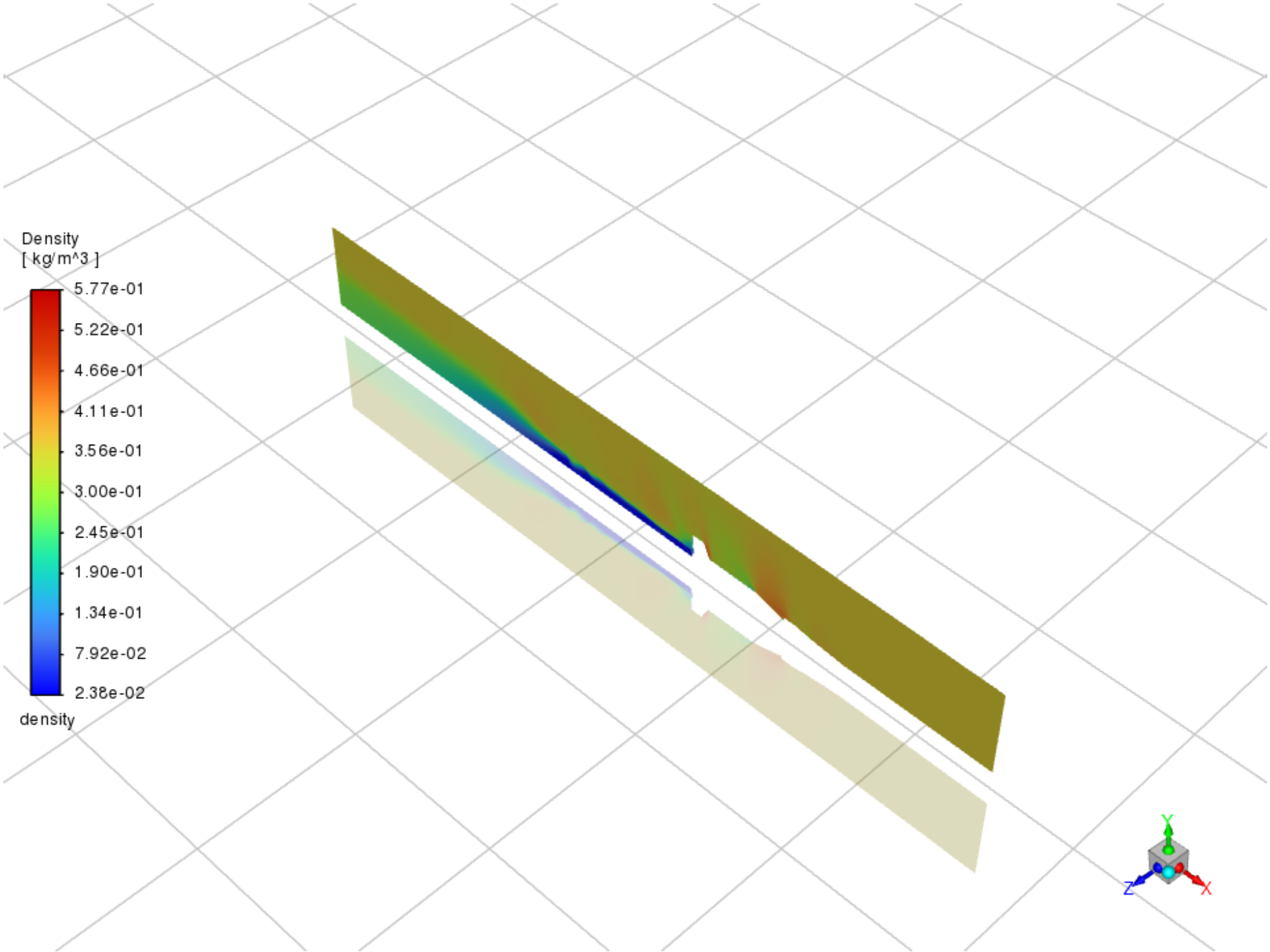




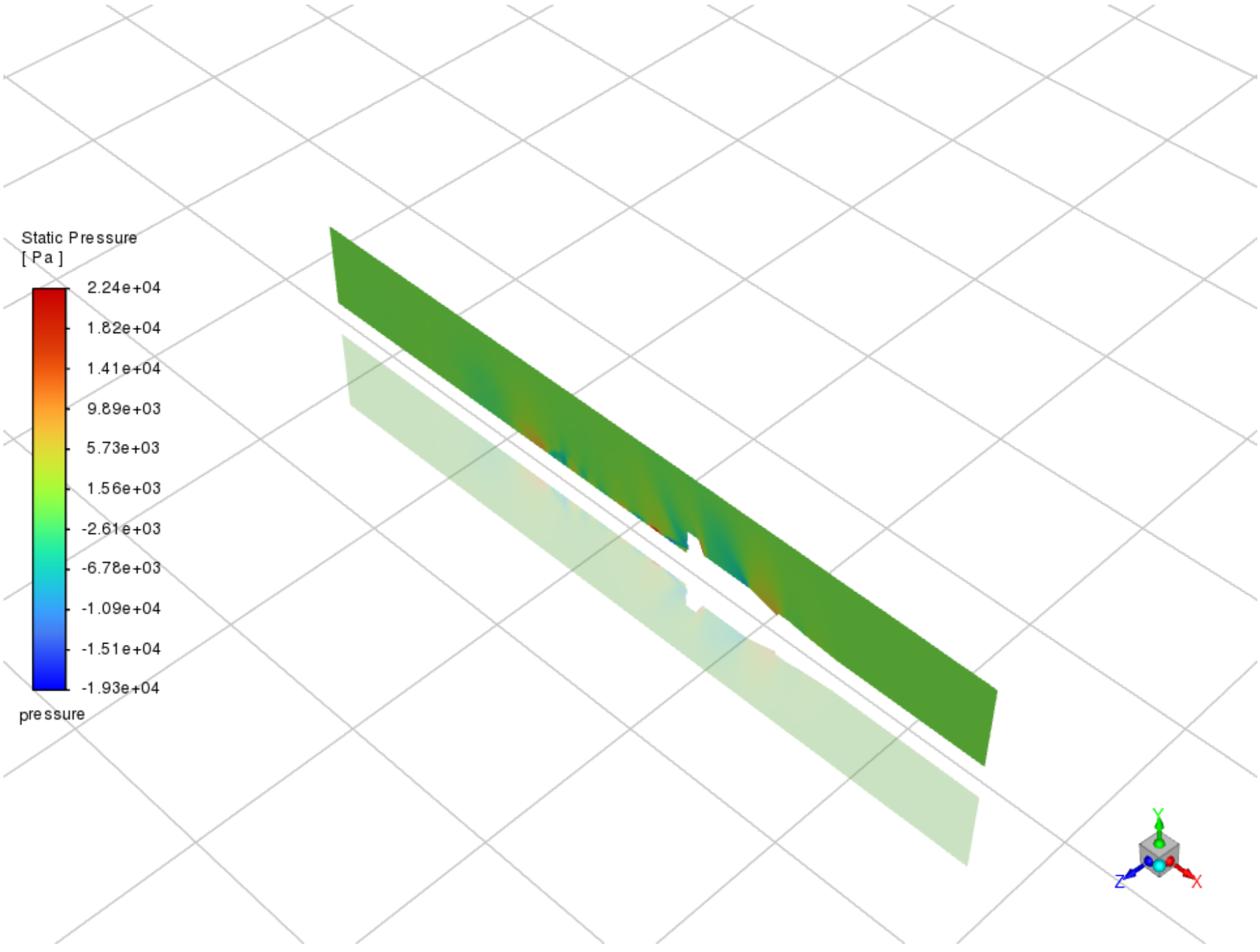
Contours

yplus

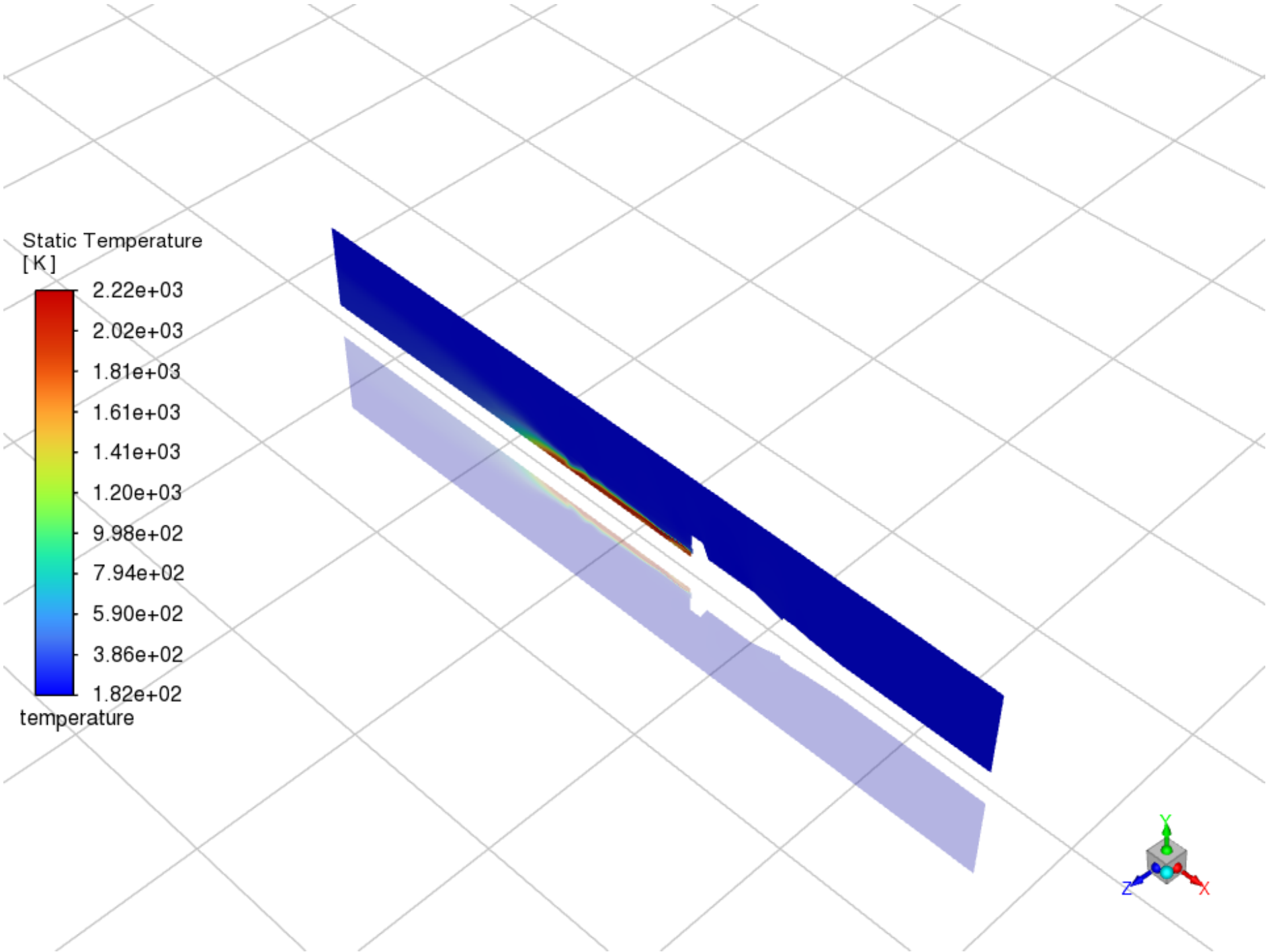
density


Density
[kg/m^3]
5.77e-01
5.22e-01
4.66e-01
4.11e-01
3.56e-01
3.00e-01
2.45e-01
1.90e-01
1.34e-01
7.92e-02
2.38e-02
density
Y
Z
X

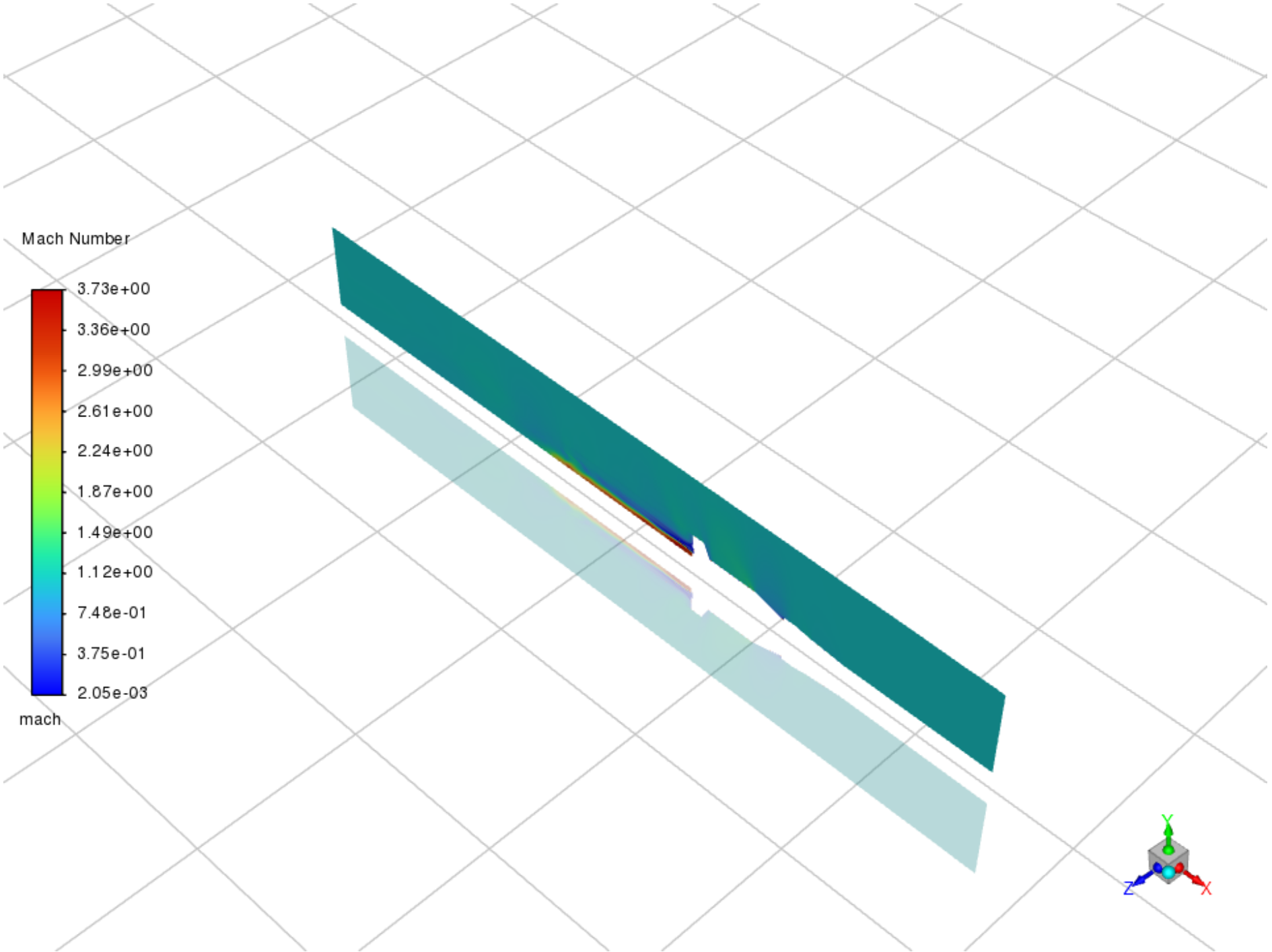
pressure


Static Pressure
[Pa]
2.24e+04
1.82e+04
1.41e+04
9.89e+03
5.73e+03
1.56e+03
-2.61e+03
-6.78e+03
-1.09e+04
-1.51e+04
-1.93e+04
pressure
Y
Z
X

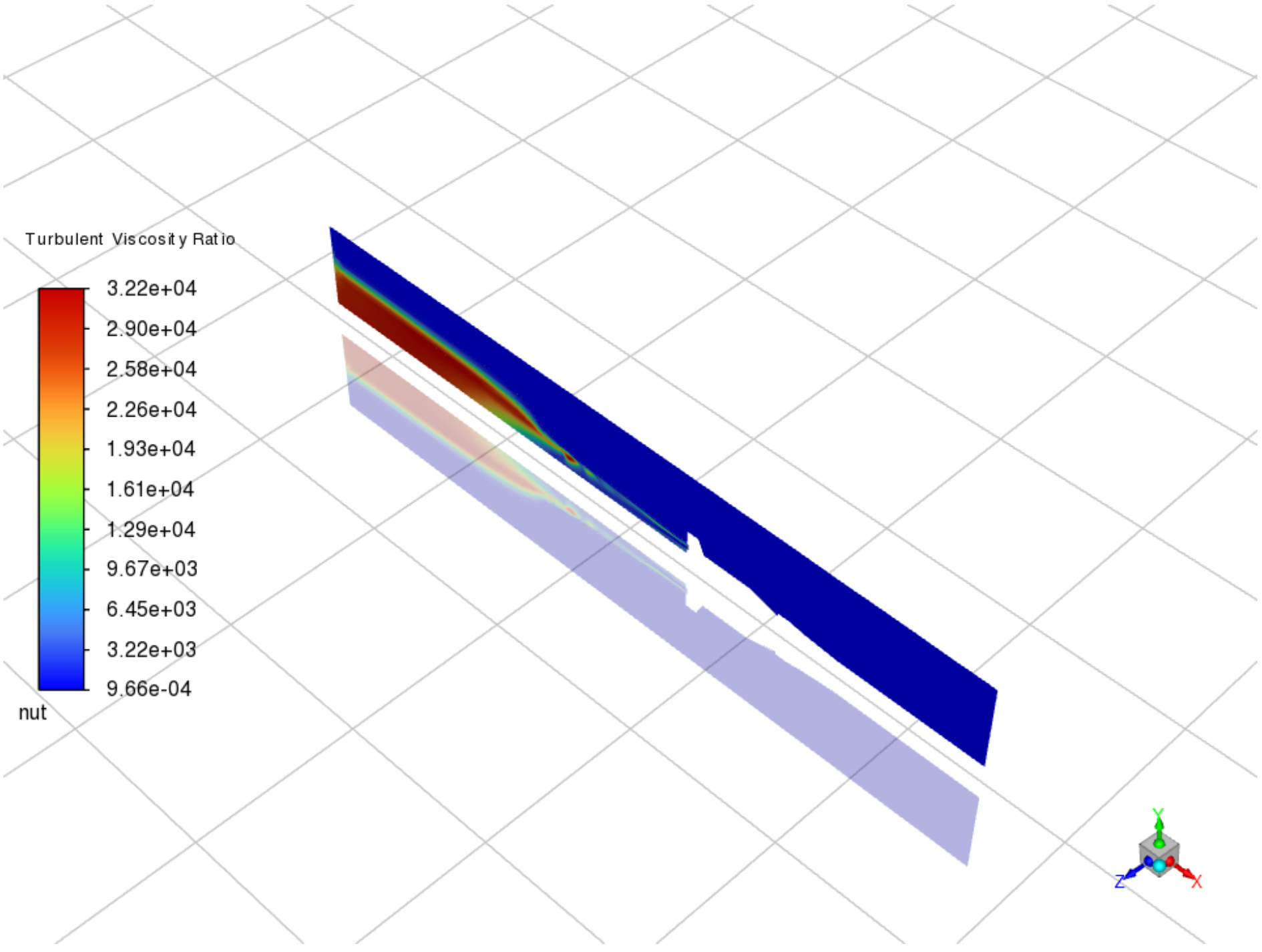
temperature



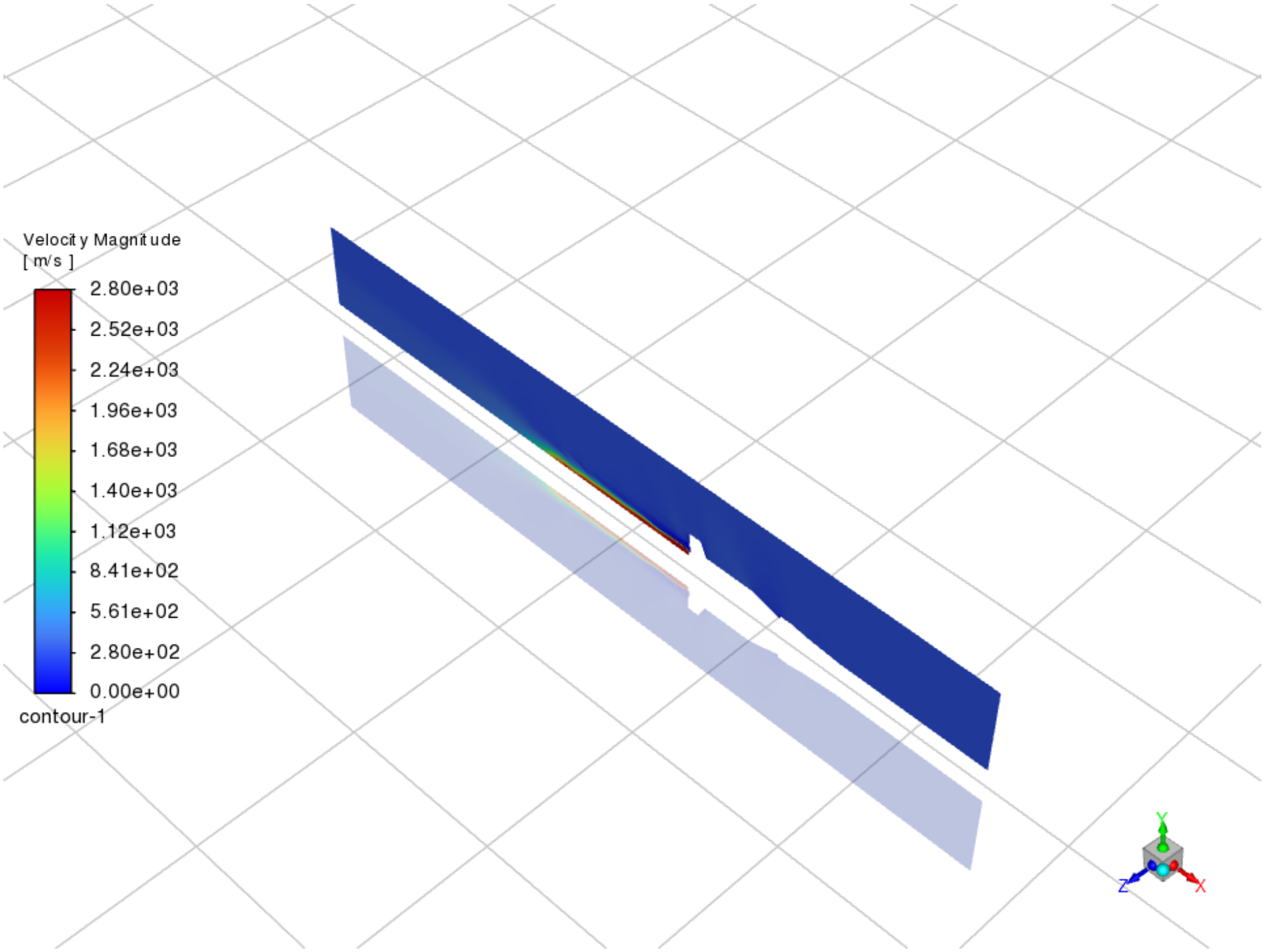
mach


Mach Number
3.73e+00
3.36e+00
2.99e+00
2.61e+00
2.24e+00
1.87e+00
1.49e+00
1.12e+00
7.48e-01
3.75e-01
2.05e-03
mach
Y
Z
X

nut

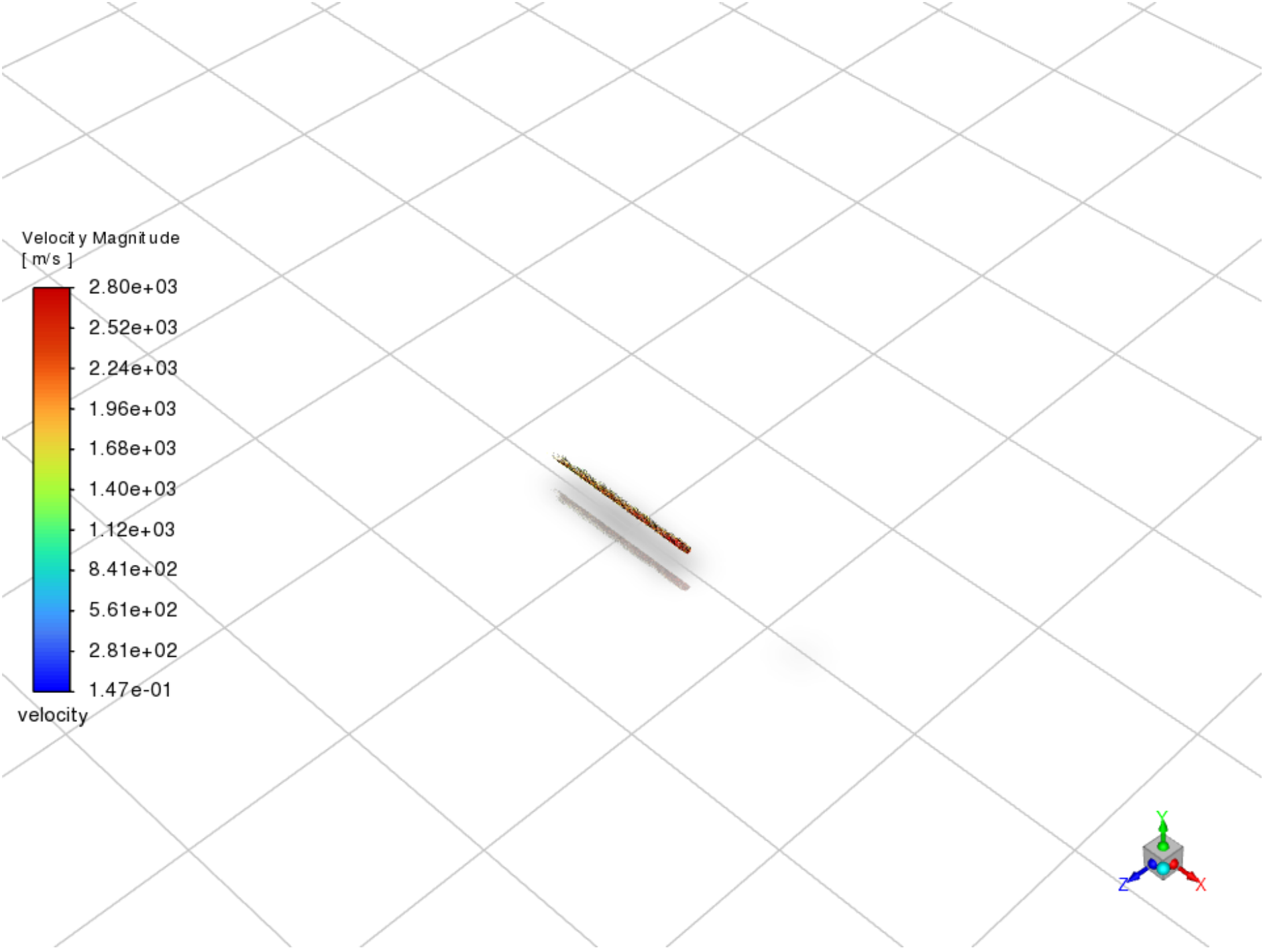

Turbulent Viscosity Ratio
3.22e+04
2.90e+04
2.58e+04
2.26e+04
1.93e+04
1.61e+04
1.29e+04
9.67e+03
6.45e+03
3.22e+03
9.66e-04
nut
Y
Z
X

contour-1



Vectors

velocity


Velocity Magnitude
[m/s]
2.80e+03
2.52e+03
2.24e+03
1.96e+03
1.68e+03
1.40e+03
1.12e+03
8.41e+02
5.61e+02
2.81e+02
1.47e-01
velocity
Y
Z
X