

Title TGT-CALC-103-016

Description: CFD model of T2 gas with beam heating and convective cooling at walls.  
Convection model is laminar.

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# 1. TGT-CALC-103-016

Thermal analysis of T2 Gas in beam

Conditions:

- 1) Beam current 20 microA
- 2) Raster 2x2mm
- 3) 2.9W beam heat in gas
- 4) Cell walls are 40K
- 5) Cell exits are 100K
- 6) Solution is steady state only
- 7) boyancy is included
- 8) fluid is ideal gas
- 9) properties are scaled from H2
- 10) Convection model is laminar

## 2. File Report

**Table 1.** File Information for CFX

Case	CFX
File Path	C:\Users\David\Documents\Ansys models\T2 fluid\T2 fluid_files\dp0\CFX\CFX\Fluid Flow CFX_002.res
File Date	29 August 2015
File Time	05:06:23 AM
File Type	CFX5
File Version	16.0

# 3. Mesh Report

**Table 2.** Mesh Information for CFX

Domain	Nodes	Elements
Default Domain	171375	697753

## 4. Physics Report

**Table 3.** Domain Physics for CFX

Domain - Default Domain	
Type	Fluid
Location	B19, B6
Materials	
Tritium	
Fluid Definition	Material Library
Morphology	Continuous Fluid
Settings	
Buoyancy Model	Buoyant
Buoyancy Reference Density	3.0000e-01 [kg m <sup>-3</sup> ]
Gravity X Component	0.0000e+00 [m s <sup>-2</sup> ]
Gravity Y Component	-9.8000e+00 [m s <sup>-2</sup> ]
Gravity Z Component	0.0000e+00 [m s <sup>-2</sup> ]
Buoyancy Reference Location	Automatic
Domain Motion	Stationary
Reference Pressure	2.7000e+01 [psi]
Heat Transfer Model	Thermal Energy
Turbulence Model	Laminar
Domain Interface - Default Fluid Fluid Interface	
Boundary List1	Default Fluid Fluid Interface Side 1
Boundary List2	Default Fluid Fluid Interface Side 2
Interface Type	Fluid Fluid
Settings	
Interface Models	General Connection
Mass And Momentum	Conservative Interface Flux
Mesh Connection	Automatic

**Table 4.** Boundary Physics for CFX

Domain	Boundaries	
	Boundary - Default Fluid Fluid Interface Side 1	
	Type	INTERFACE
	Location	F15.6
Default Domain	Settings	
	Heat Transfer	Conservative Interface Flux
	Mass And Momentum	Conservative Interface Flux

Boundary - Default Fluid Fluid Interface Side 2

Type INTERFACE

Location F26.19

Settings

Heat Transfer Conservative Interface Flux

Mass And Momentum Conservative Interface Flux

Boundary - Cell wall

Type WALL

Location F16.6, F17.6, F18.6

Settings

Heat Transfer Fixed Temperature

Fixed Temperature 5.0000e+01 [K]

Mass And Momentum No Slip Wall

Boundary - beam entrance

Type WALL

Location F24.19, F25.19

Settings

Heat Transfer Fixed Temperature

Fixed Temperature 1.0500e+02 [K]

Mass And Momentum No Slip Wall

# 5. Solution Report

**Table 5.** Boundary Flows for CFX

Location	Type	Mass Flow	Momentum		
			X	Y	Z
Cell wall	Boundary	0.0000e+00	-8.3292e-10	9.0613e-04	-1.0501e-09
Default Fluid Fluid Interface Side 1	Boundary	0.0000e+00	0.0000e+00	0.0000e+00	0.0000e+00
Default Fluid Fluid Interface Side 2	Boundary	0.0000e+00	0.0000e+00	0.0000e+00	0.0000e+00
beam entrance	Boundary	0.0000e+00	-1.8308e-11	-5.9781e-09	-1.2613e-10

# 6. User Data

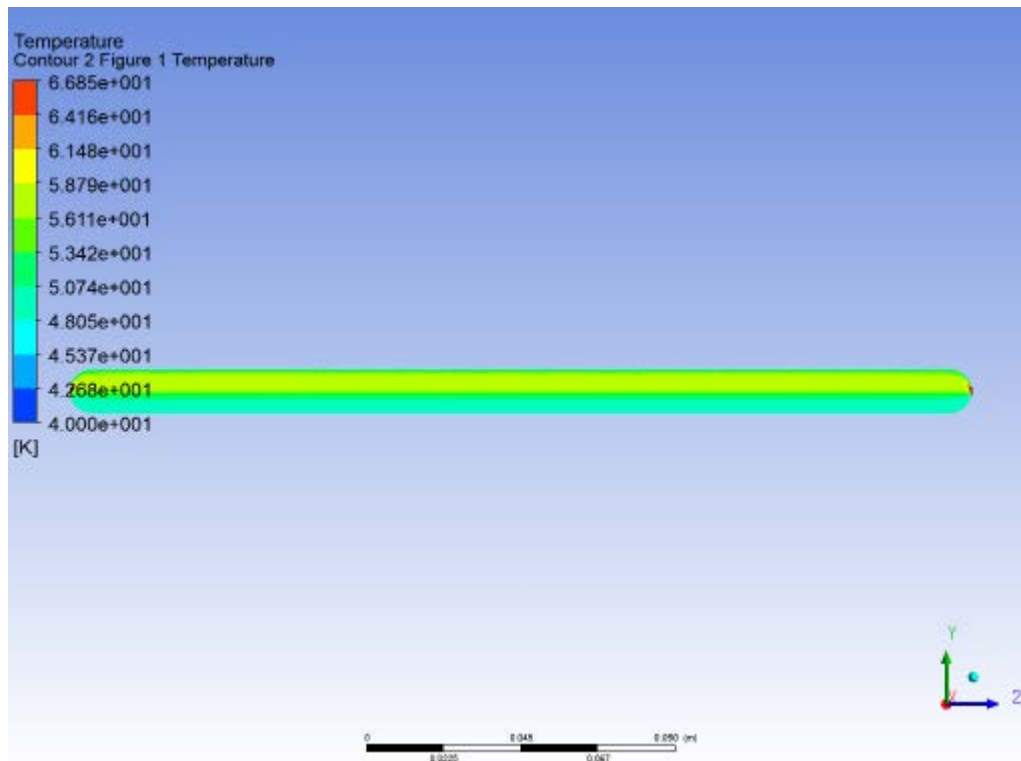
## Volume Average of Density on Beam

2.42347 [kg m<sup>-3</sup>]

Starting density is 3 kg/m<sup>3</sup>

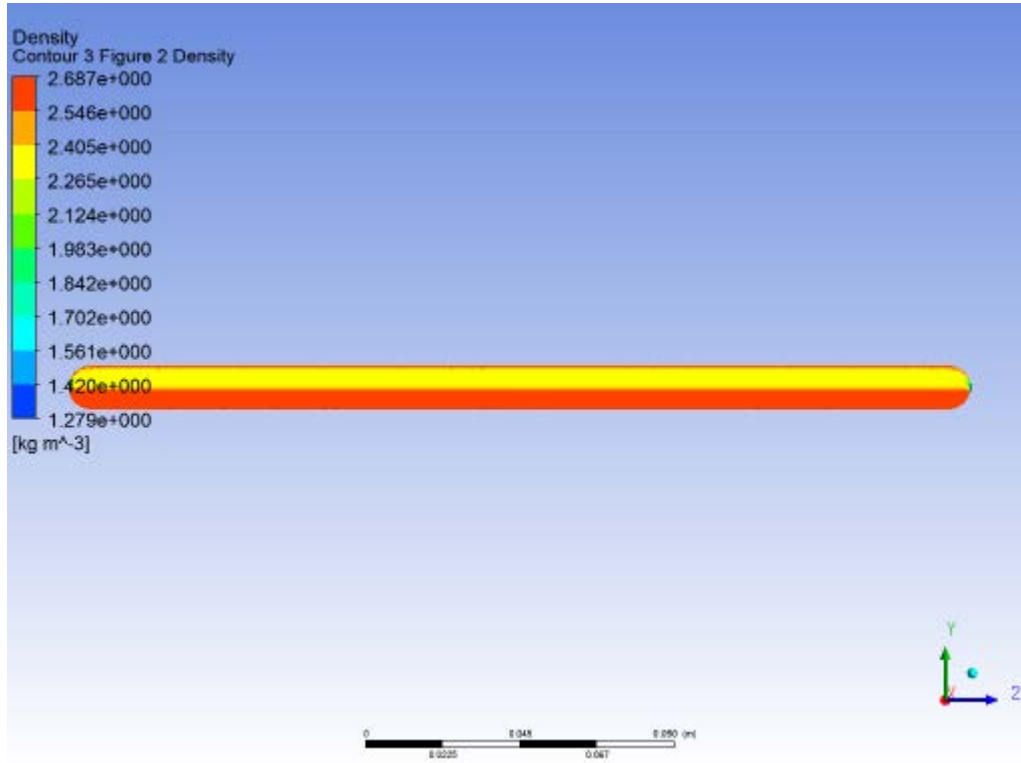
Target density with beam is 80% of density without beam

**Figure 1.**



**Temperature**





Density