

OSC Layout Update

9/25/18

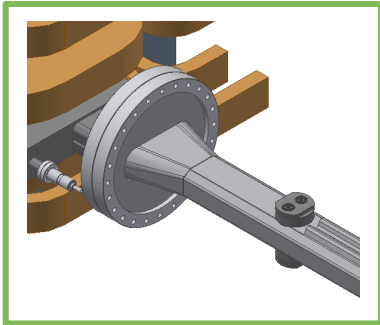


0.75m bend magnets & vacuum quality considerations

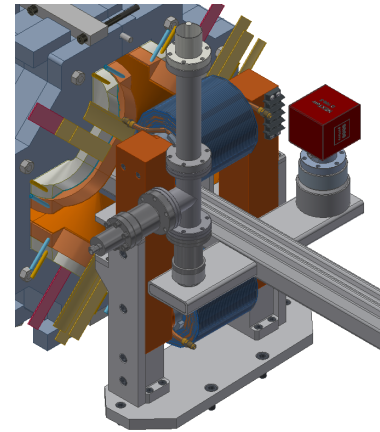
Preliminary vacuum considerations



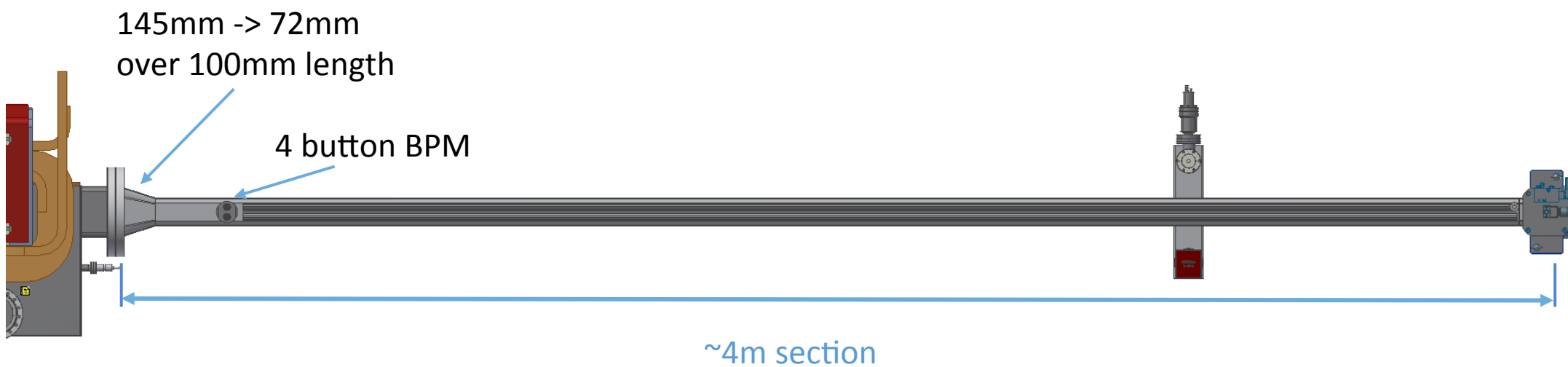
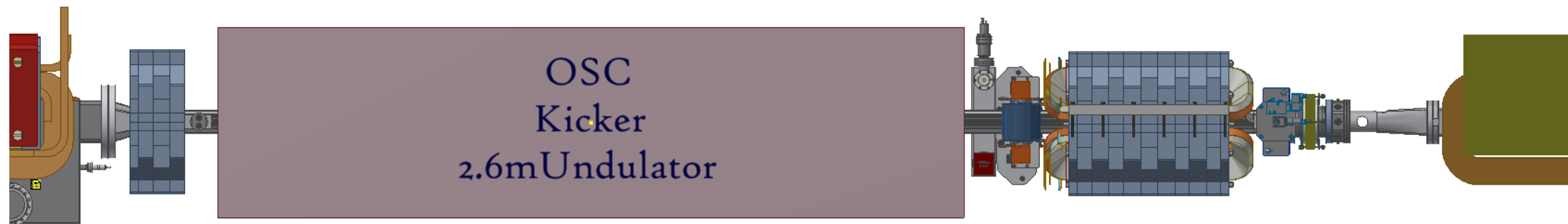
No space for vacuum connection here,
so transition is directly welded to beam pipe



Additional cooling
channels will be welded on
region inside quad



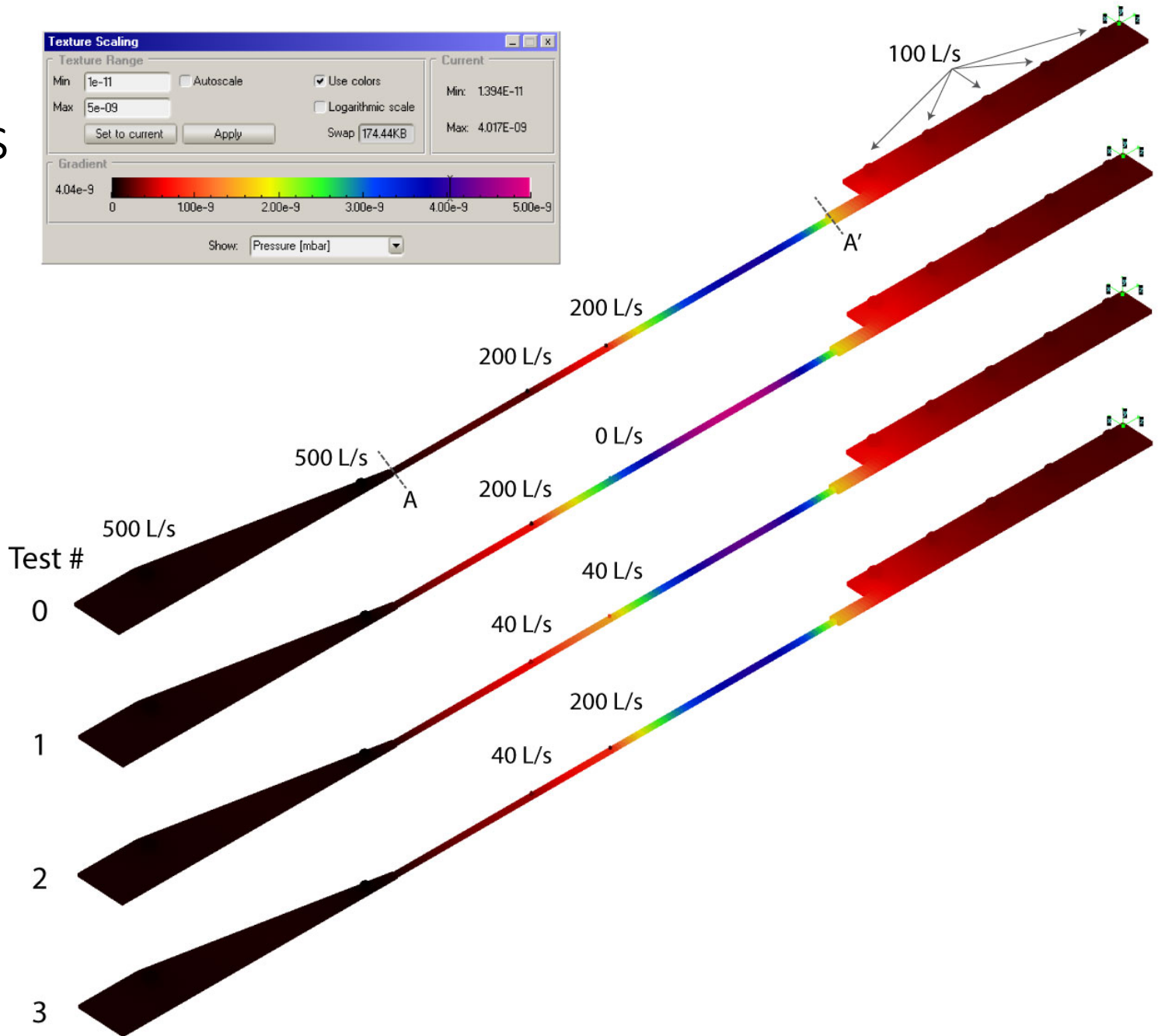
Added pump port &
CESR MK II shifted
-> 3.5cm



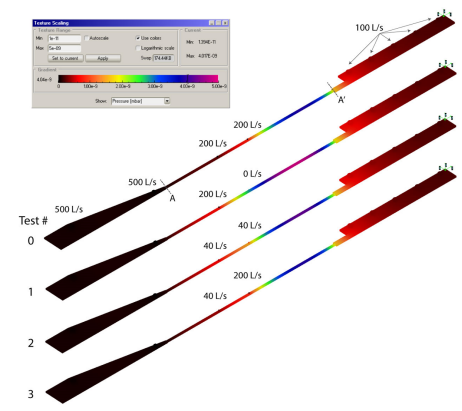
Preliminary MolFlow vacuum simulation results

- simulation results show that there is a 0.5-1 decade drop in vacuum quality in the beam pipe through the undulator
- the beam pipe through the undulator is subdivided into 10 cm segments and the gas load from synchrotron radiation is applied to it

Beampipe subdivision (m)	horiz division (deg)	theta (mrad)	total power (W)	summed flux (ph/s)
0				
0.1	0.121	2.107	110.63	5.24784E+16
0.2	0.114	1.983	104.12	4.93914E+16
0.3	0.107	1.861	97.71	4.6348E+16
0.4	0.100	1.742	91.46	4.33914E+16
0.5	0.093	1.628	85.48	4.05653E+16
0.6	0.087	1.520	79.81	3.78697E+16
0.7	0.081	1.417	74.4	3.53044E+16
0.8	0.076	1.319	69.26	3.28697E+16
0.9	0.070	1.229	64.53	3.06088E+16
1	0.066	1.143	60.01	2.84783E+16
1.1	0.061	1.065	55.91	2.65218E+16
1.2	0.057	0.991	52.03	2.46957E+16
1.3	0.053	0.923	48.46	2.30001E+16
1.4	0.049	0.860	45.15	2.14348E+16
1.5	0.046	0.801	42.06	1.99566E+16
1.6	0.043	0.749	39.32	1.86522E+16
1.7	0.040	0.700	36.75	1.74348E+16
1.8	0.038	0.654	34.34	1.63044E+16
1.9	0.035	0.613	32.18	1.52609E+16
2	0.033	0.574	30.13	1.43044E+16
2.1	0.031	0.539	28.300	1.34348E+16
2.2	0.029	0.506	26.56	1.26087E+16
2.3	0.027	0.476	24.99	1.18696E+16
2.4	0.026	0.449	23.57	1.11739E+16
2.5	0.024	0.422	22.15	1.05218E+16
2.6	0.023	0.400	21	9.95655E+15

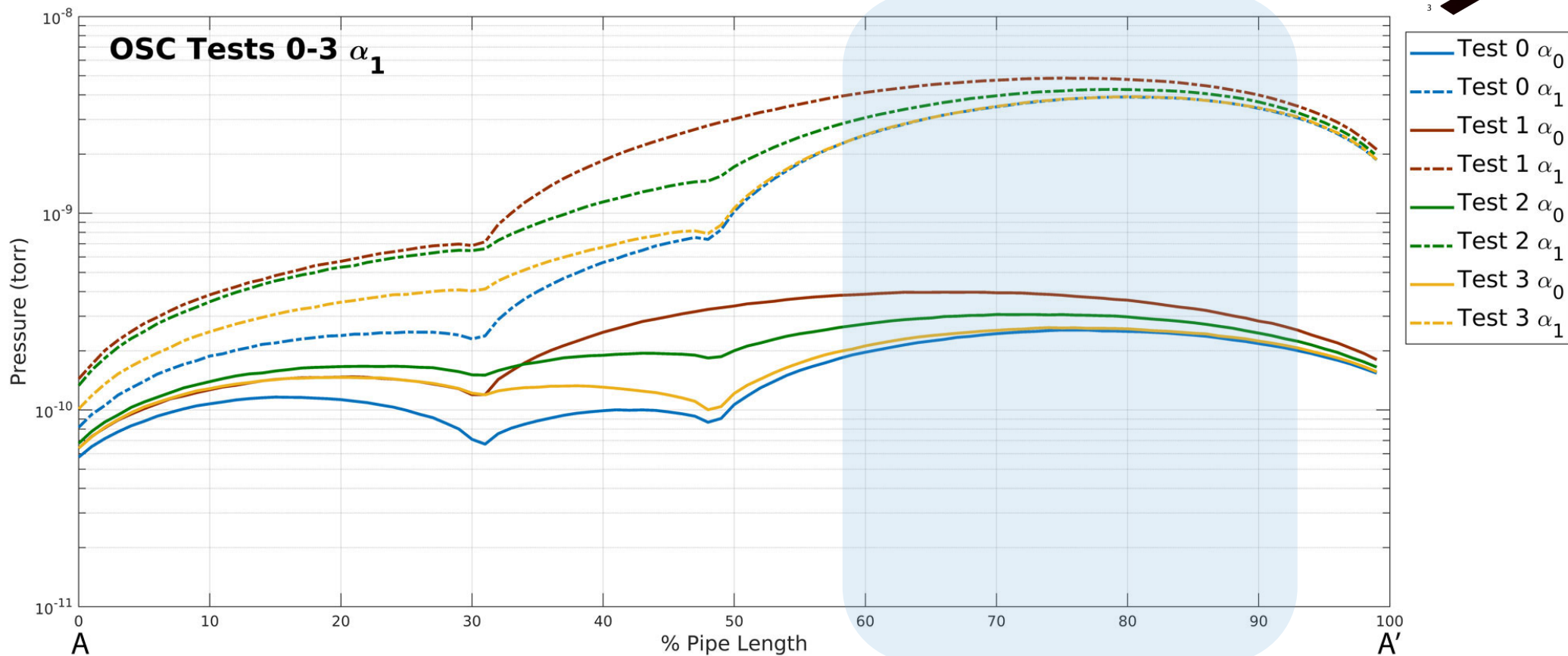


Preliminary MolFlow vacuum simulation results



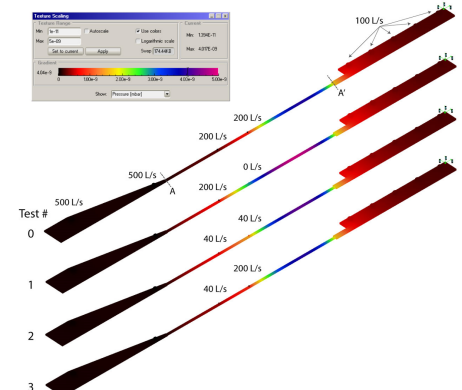
Desorption yield: $\alpha_1 = 1E-5$

Undulator Beam Pipe Region



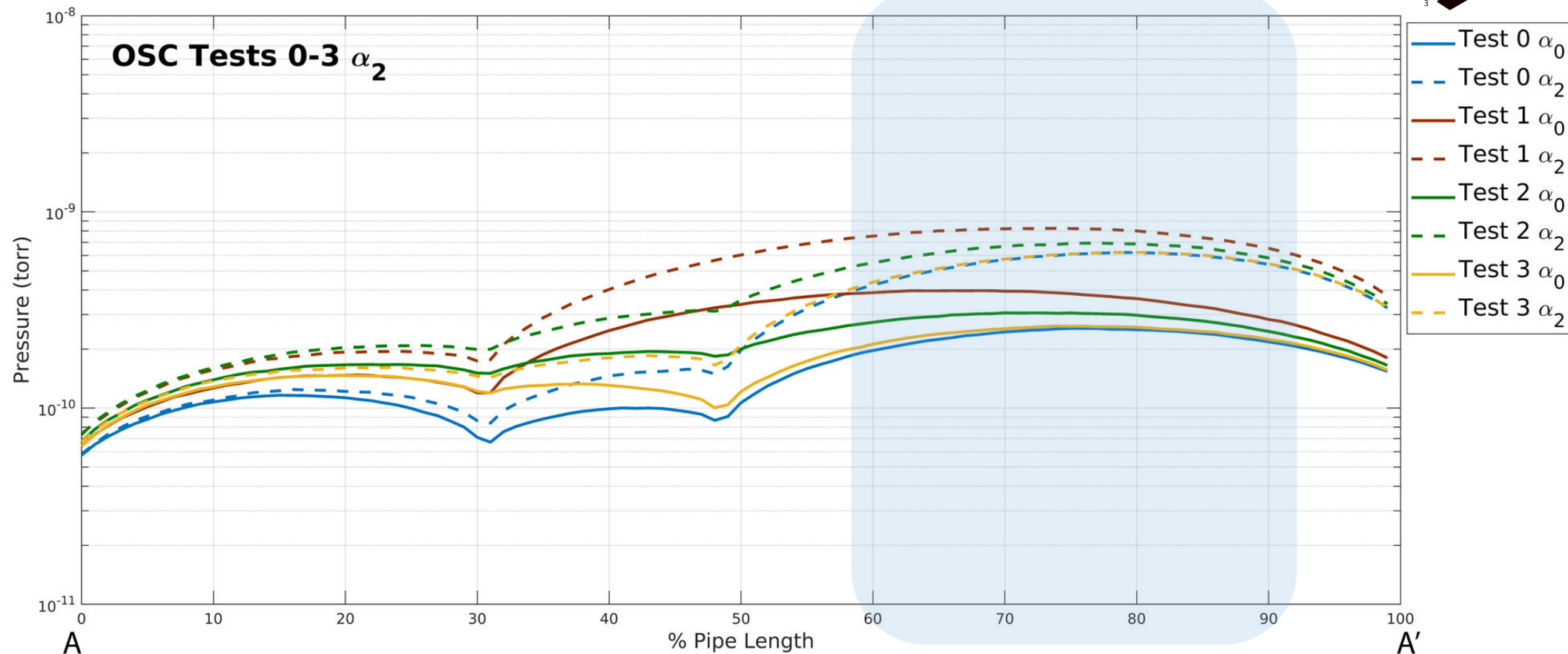
α_0 is the case without SR gas load: only thermal outgassing at $1e-12$ torr-l/s-cm²

Preliminary MolFlow vacuum simulation results



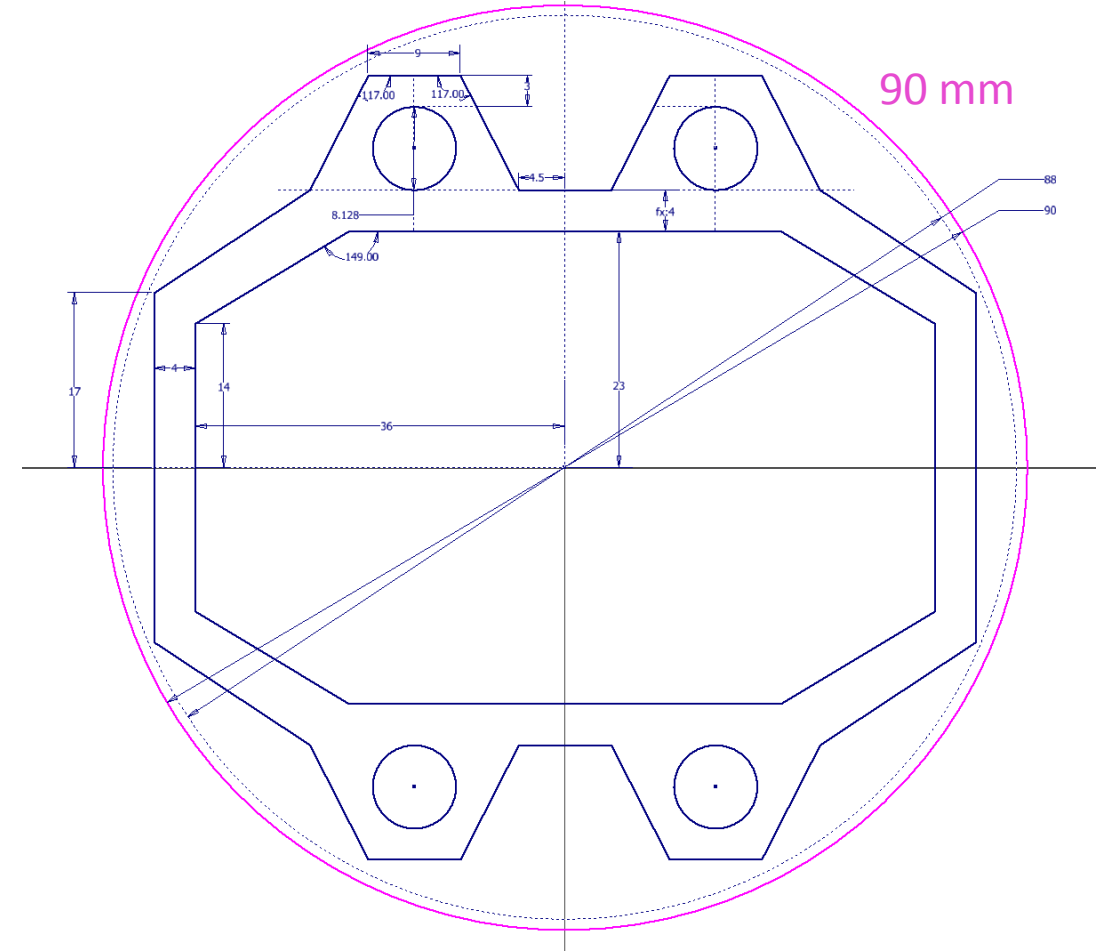
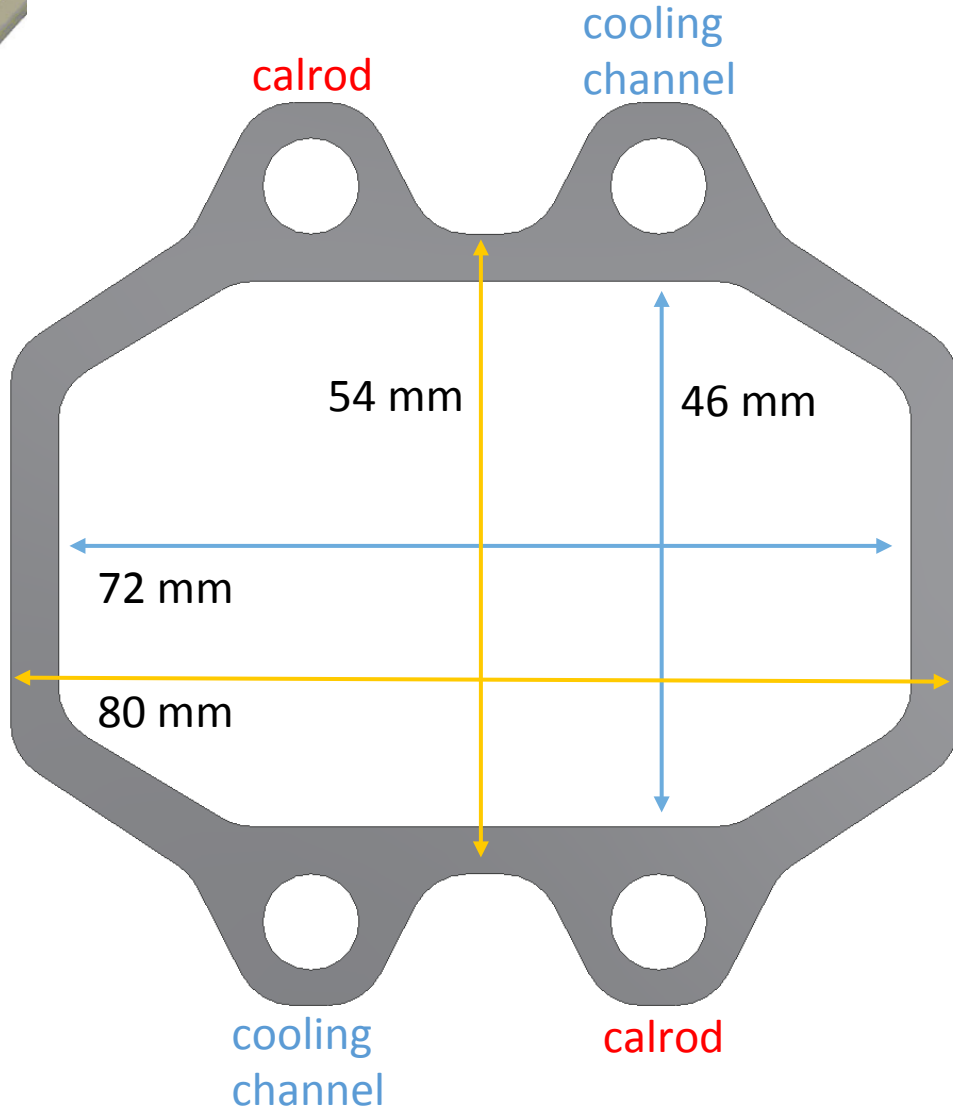
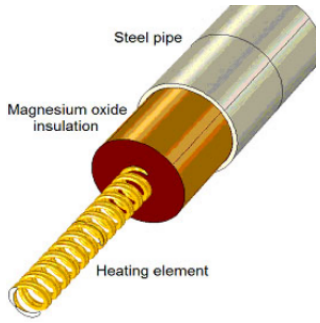
Desorption yield: $\alpha_2 = 1E-6$

Undulator Beam Pipe Region

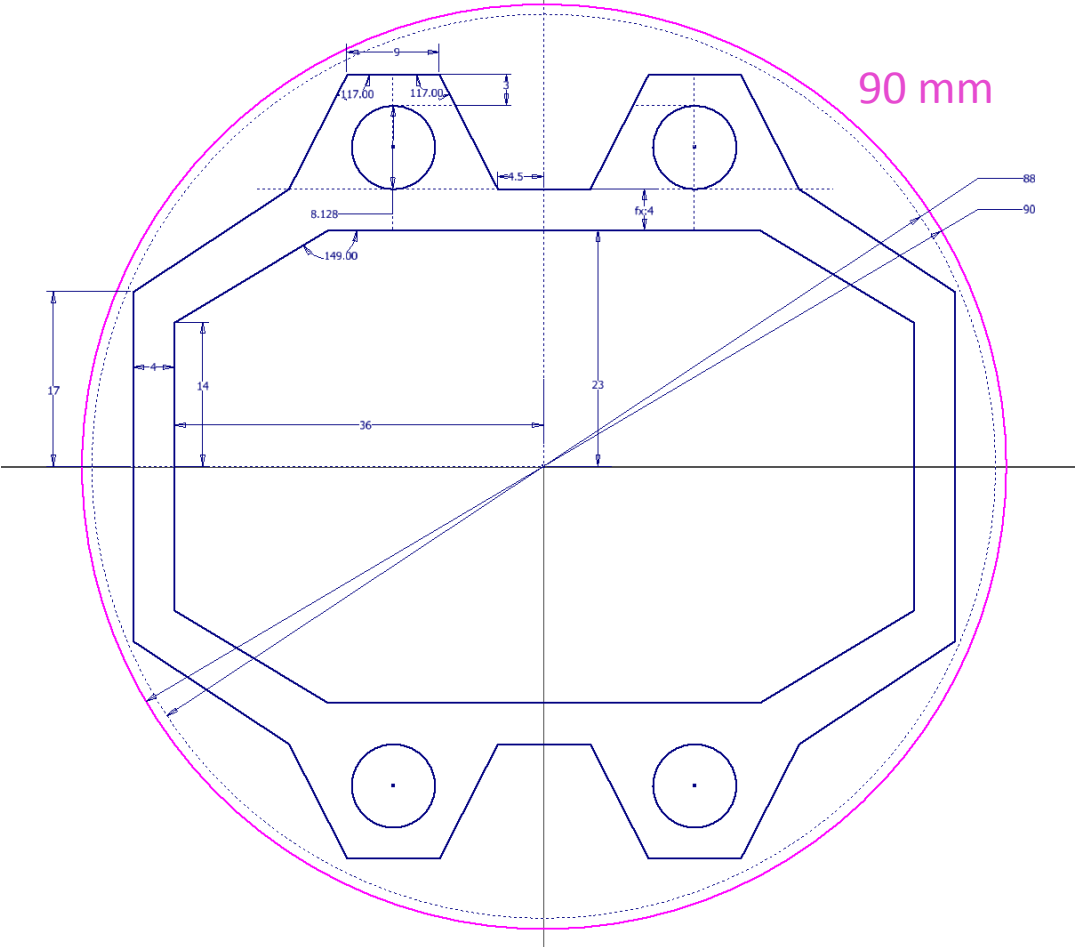
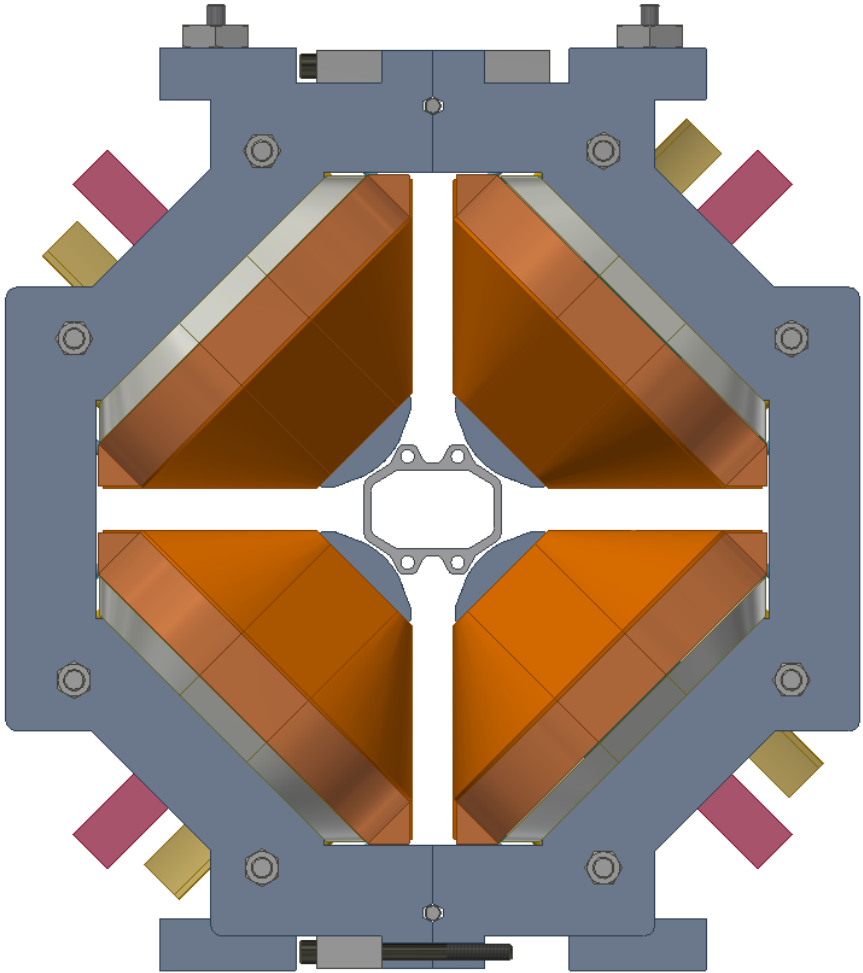


α_0 is the case without SR gas load: only thermal outgassing at $1e-12$ torr-l/s-cm²

OSC Undulator 4 Channel Extrusion Profile



Fitment inside helical undulator and CESR MK II Quad

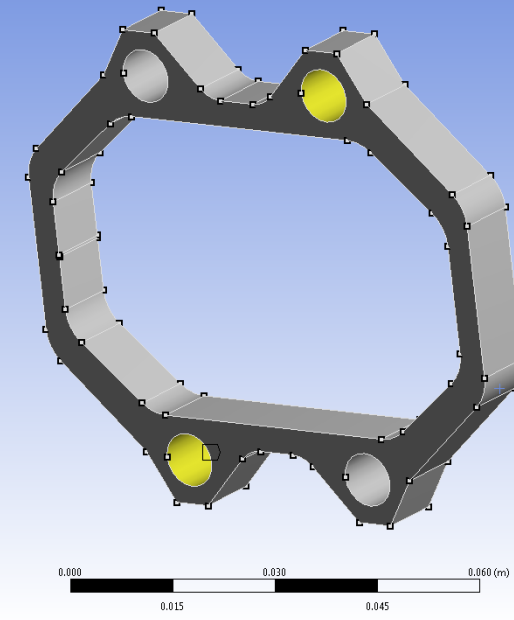


Simulation Parameters in XOP and ANSYS

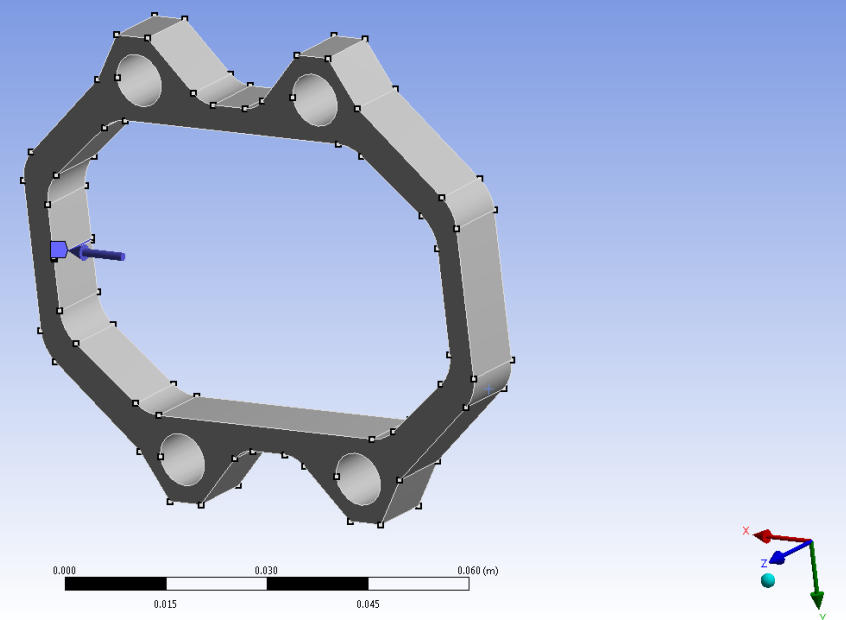
- 6 GeV, 250 mA
- 1mrad slice of bend magnet radiation
- 5000 W/m² *C film coefficient
- cooling applied to opposing corners
- 1 atm pressure to check bending stress

Machine name Bend Magnet, N	Min Photon Energy [eV] 100.00000
B from: Magnetic Radius	Max Photon Energy [eV] 100000.00
Machine Radius [m] 87.000000	Number of energy points 500
	Separation between energy points Log
Beam energy [GeV] 6.0000000	Max Psi [mrad] for angular plots 1.0000000
Beam Current [A] 0.25000000	Psi min [mrad] -1.0000000
Horizontal div Theta [mrad] 1.0000000	Psi max [mrad] 1.0000000
Psi (vertical div) for energy spectra In [PsiMin,PsiMax]	Number of Psi points 50

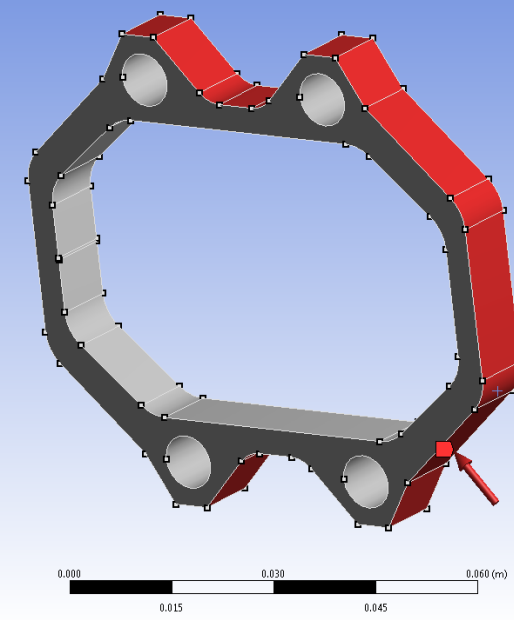
A: Steady-State Thermal
Convection
Time: 1 s
9/25/2018 8:22 AM
Convection: 22. °C, 5000. W/m²*C

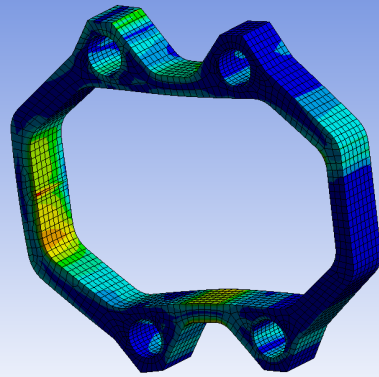


A: Steady-State Thermal
Heat Flow
Time: 1 s
9/25/2018 8:22 AM
Heat Flow: 12. W



B: Static Structural
Pressure
Time: 1 s
9/25/2018 8:23 AM
Pressure: 1.0135e+005 Pa



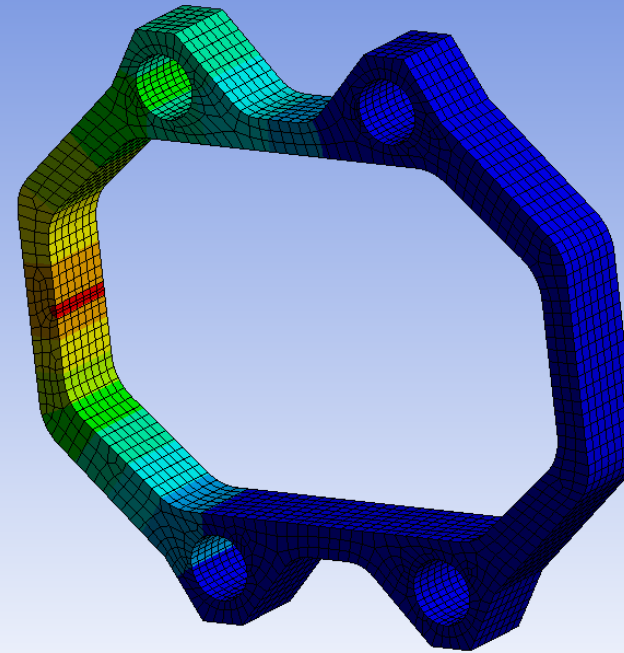
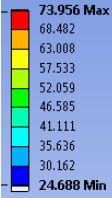


0.000 0.500 1.000 1.500 2.000 (m)

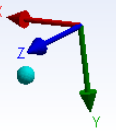


Static Stress Analysis

- Conservative estimate of 74 °C peak temperature along side wall
- Bending stresses OK



0.000 0.015 0.030 0.045 0.060 (m)



Thermal Analysis

