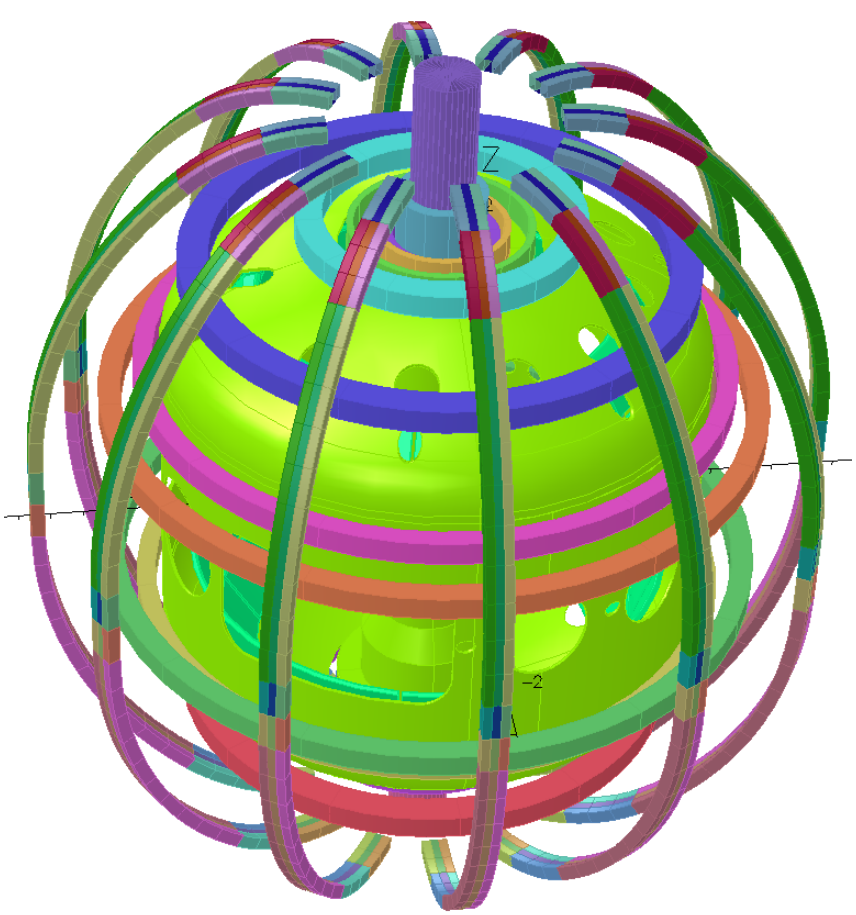
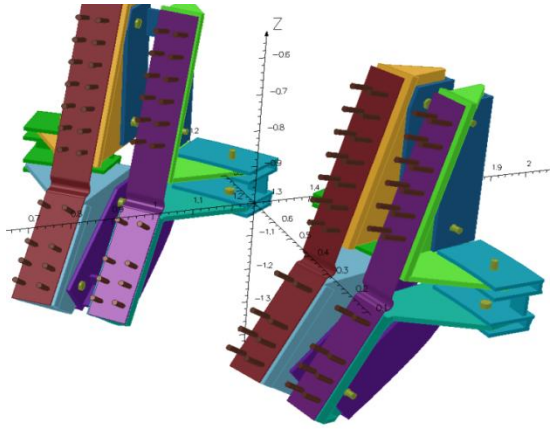
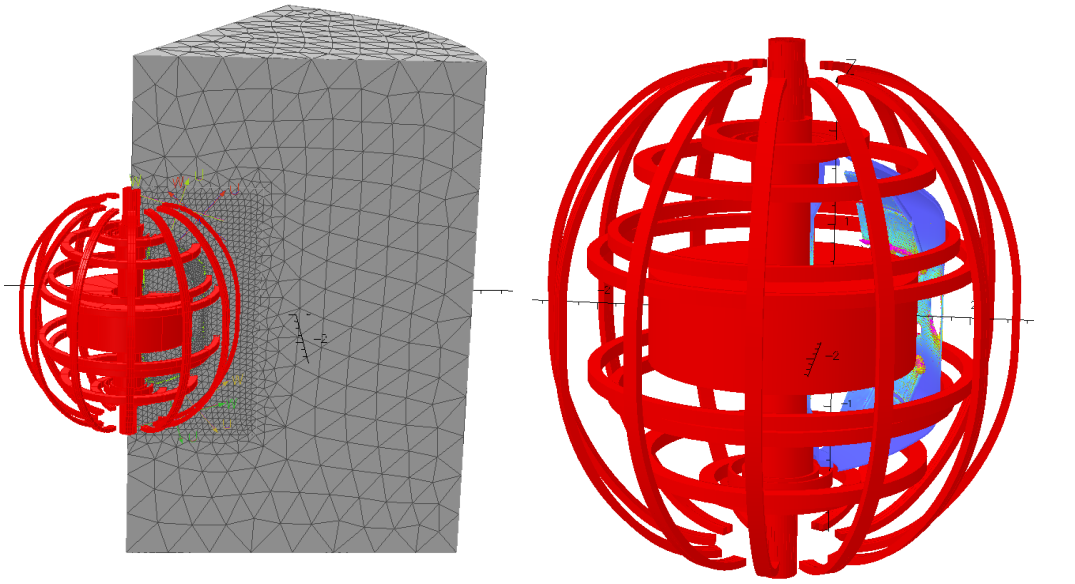
Disruption Analysis of PP, VV, and Components



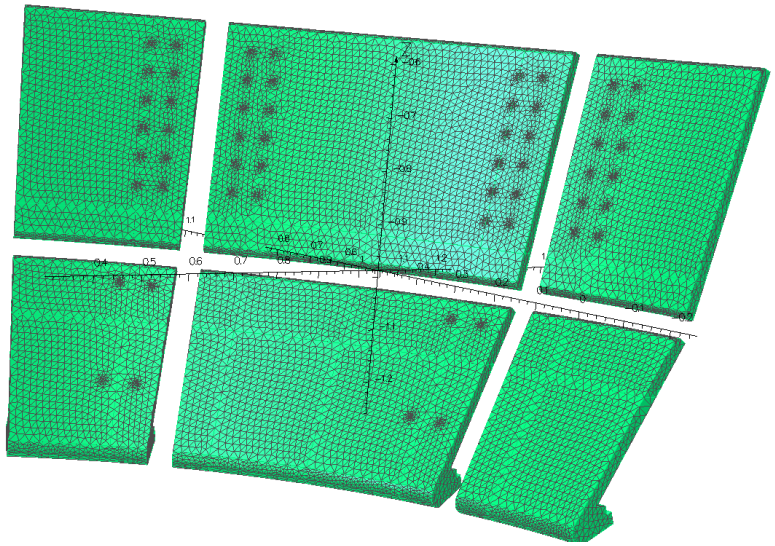


Model includes bracket conducting path on back of PPs

Opera 3D Model – Transient ELEKTRA Solver



Square shape plasma (same cross section area as circular shape)



FE Mesh

Fast mid-plane centered disruption 2 MA/ms
Back ground field OH, TF and PF coils (#79)

Plasma current (CC)
PF5 current (CW)

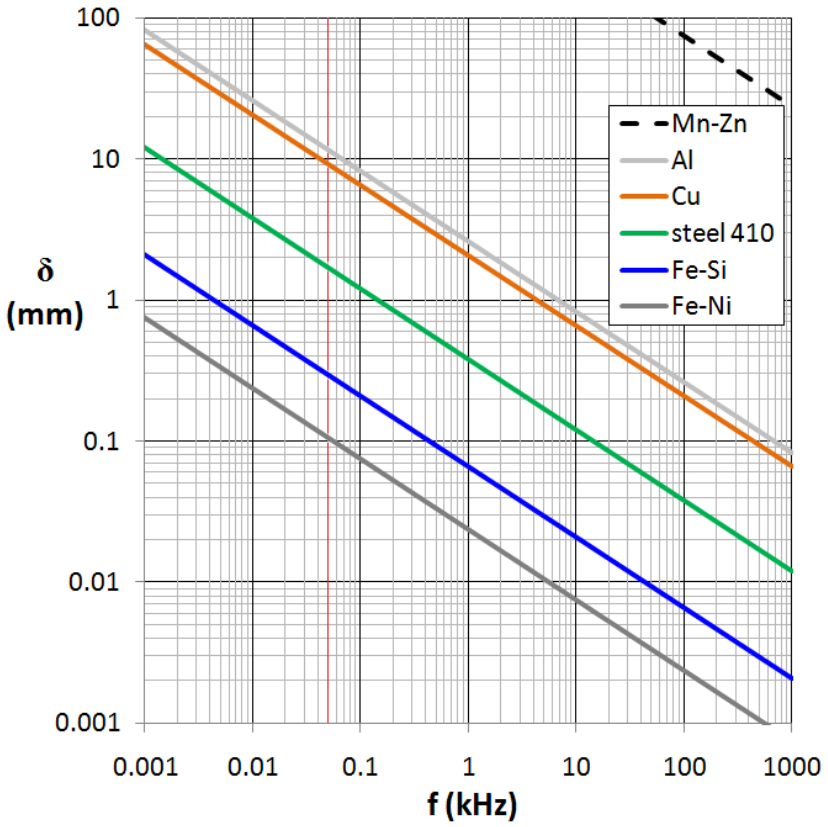
Background fields at center of lower PPPs (1.2, 0.72, -0.8) m

	Br (T)	Bz (T)
Without plasma	0.152	-0.465
With plasma t=0	-0.0265	-0.439
End of disruption	0.038	-0.264

Eddy Current Distribution – Skin Depth

Electrical conductivity and skin depth (1ms disruption)

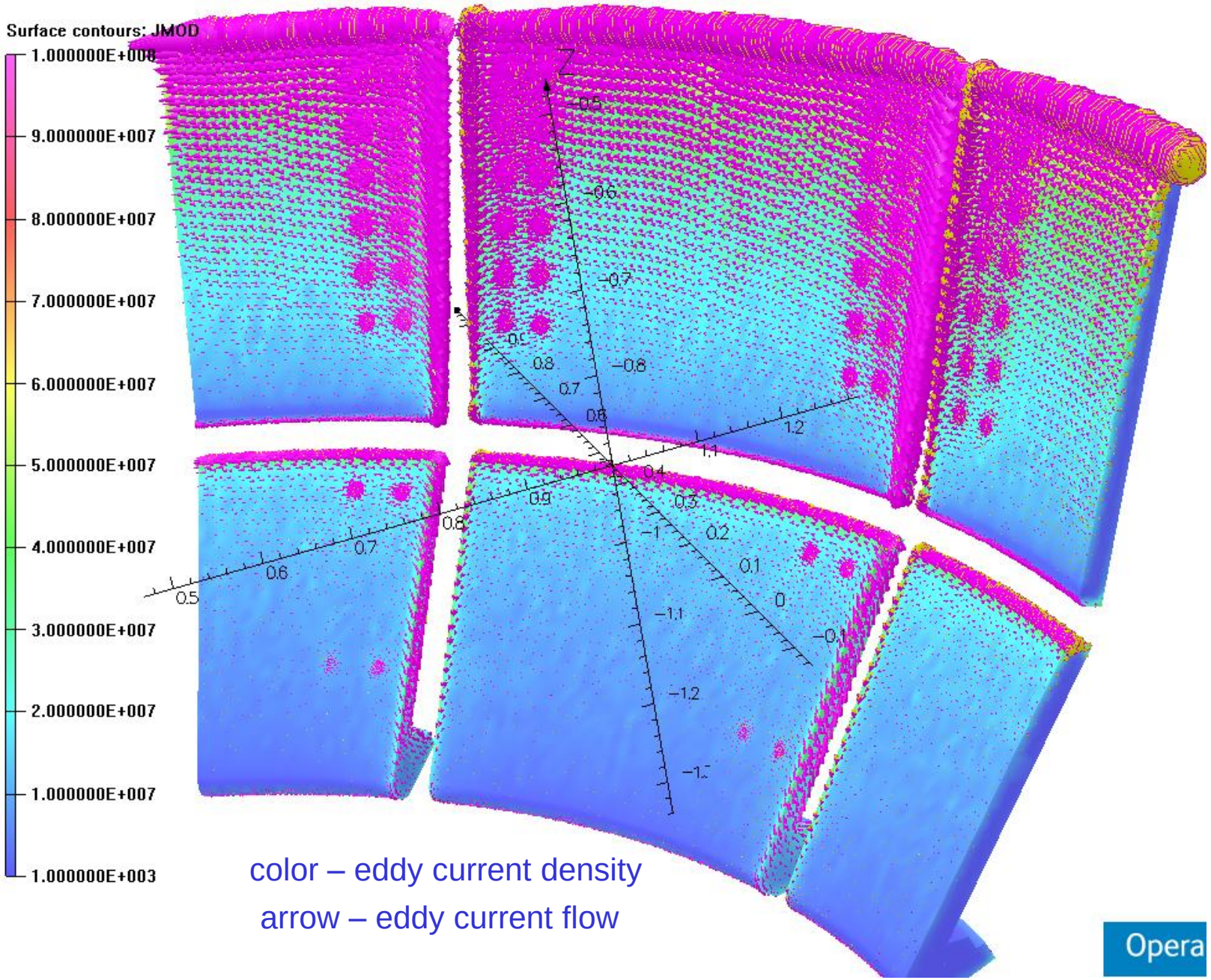
	Conductivity (S/m)	Skin depth
Passive Plate	5.07×10^{7} (85% Cu)	2.25 mm
Bracket	1.35×10^{6} (SS)	13.7 mm
VV	1.35×10^{6} (SS)	13.7 mm
CS Casing	1.35×10^{6} (SS)	13.7 mm



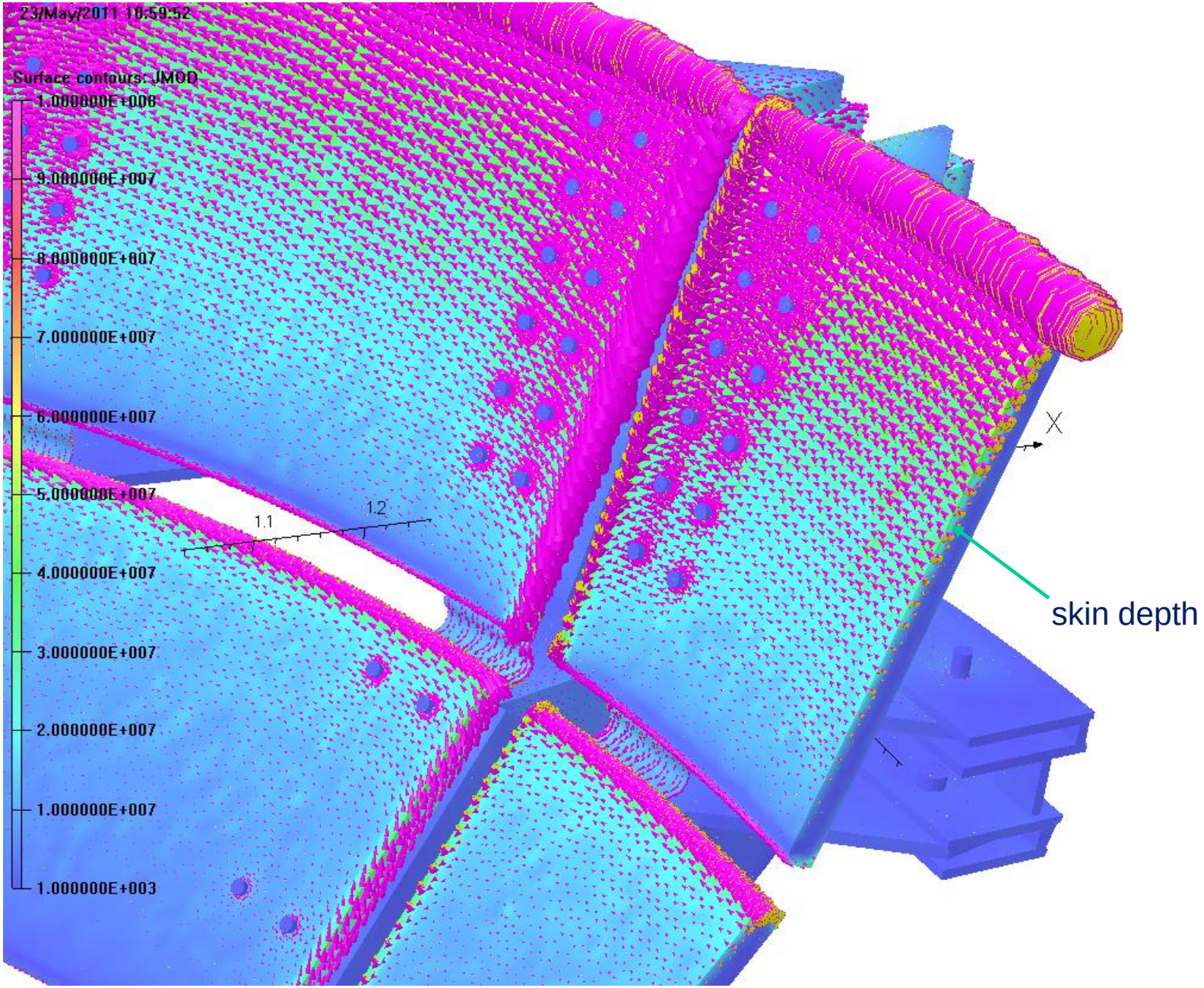
The skin depth of copper passive plates is only ~2-2.5 mm during 1 ms plasma disruption

$$\delta = \sqrt{\frac{2\rho}{\omega\mu}} = \sqrt{\frac{1}{\pi f\sigma\mu}} = \frac{1}{\sqrt{3.14\times10^{3}\times4\times3.14\times10^{-7}\times5.066\times10^{7}}} = 2.25\times10^{-3}$$

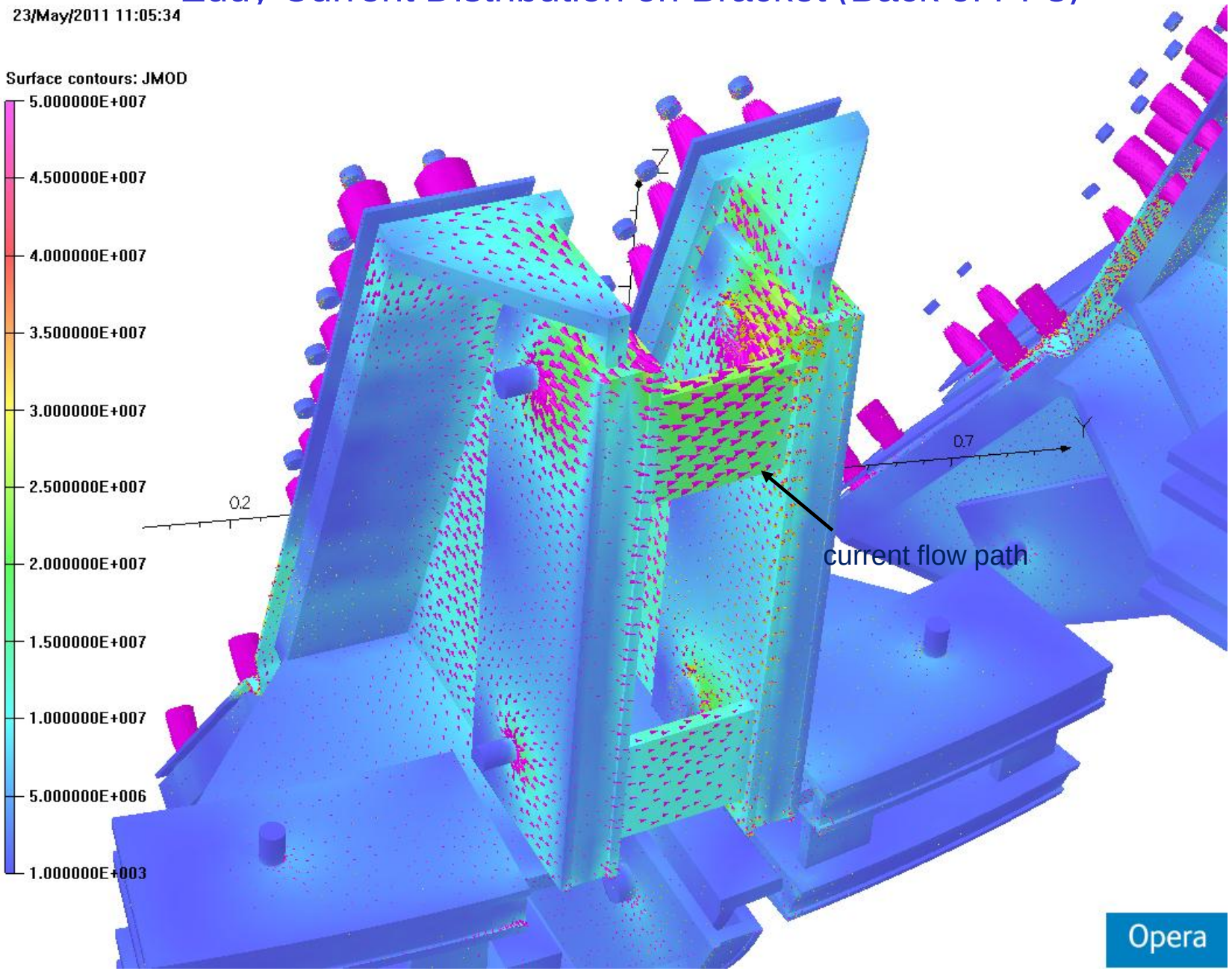
Eddy Current Centered Disruption – 60 Degree Model



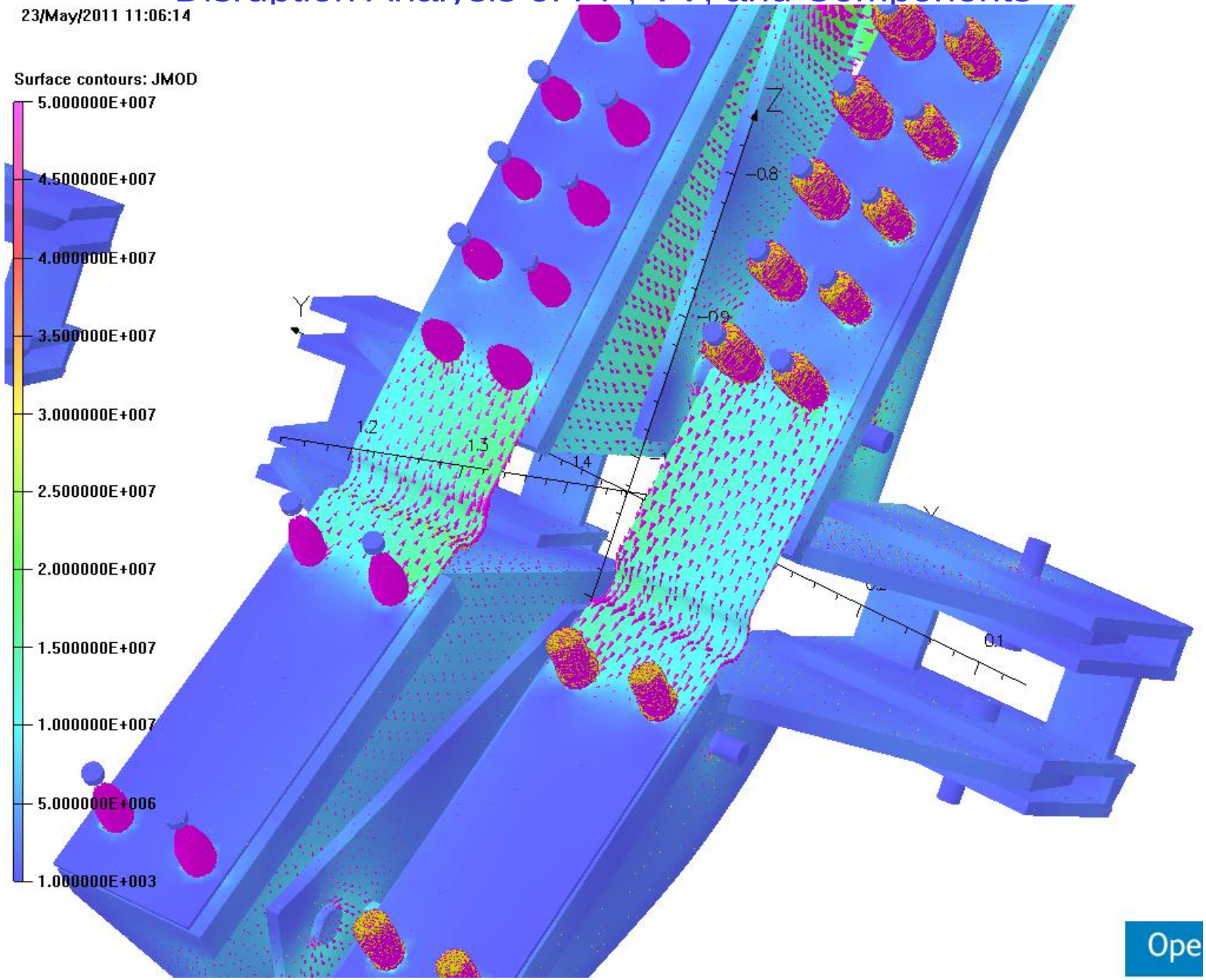
Eddy Current Centered Disruption – 60 Degree Model



Eddy Current Distribution on Bracket (Back of PPs)

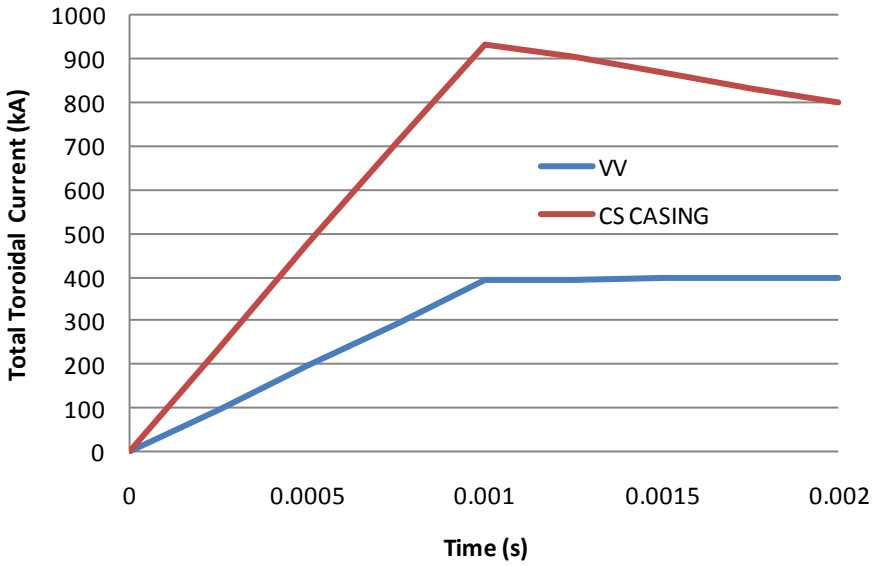


Disruption Analysis of PP, VV, and Components

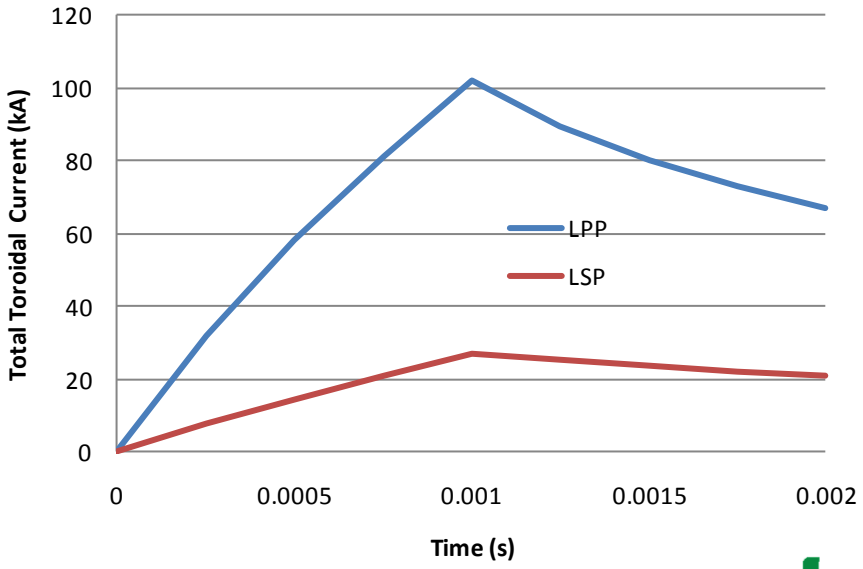


Total Toroidal Current Induced during Disruption

Eddy Current on VV and CS Casing



Eddy Current on Lower Passive Plate

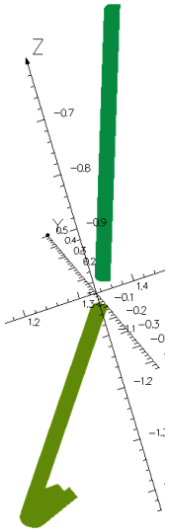


Background fields at center of lower PPPs (1.2, 0.72, -0.8) m

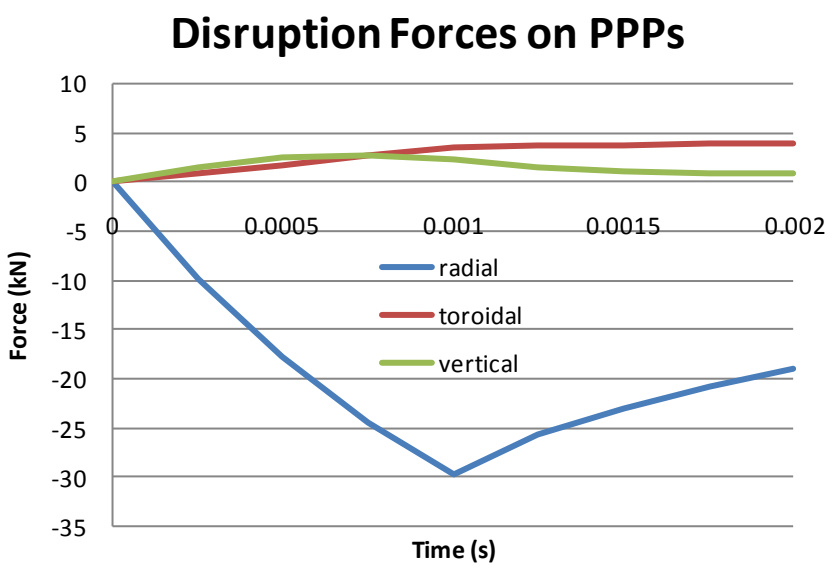
Lower PPP center	Br (T)	Bz (T)
coil background field (#79)	0.152	-0.465
with plasma at =0	-0.0265	-0.439
with plasma at 1ms	0.038	-0.264

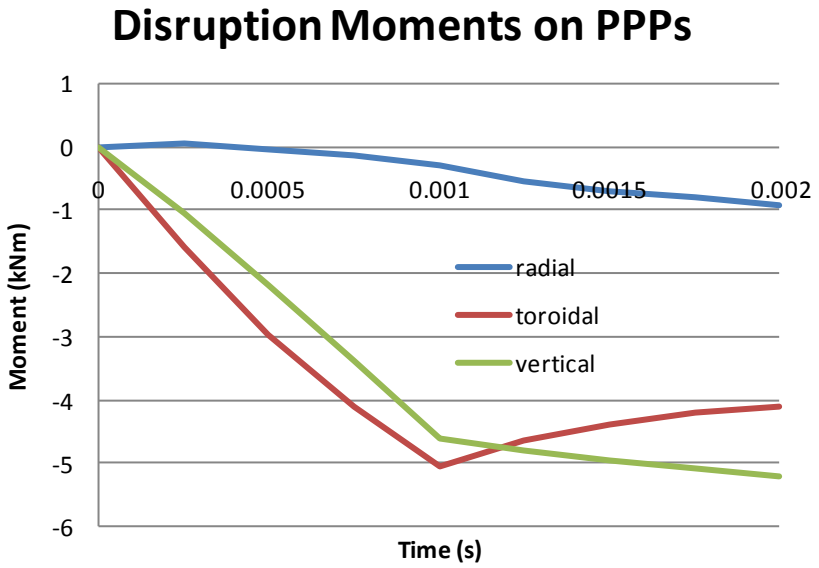
Center of lower PPPs

X (m)	Y (m)	Z (m)
1.2	0.72	-0.8



Disruption Loads on PPPs

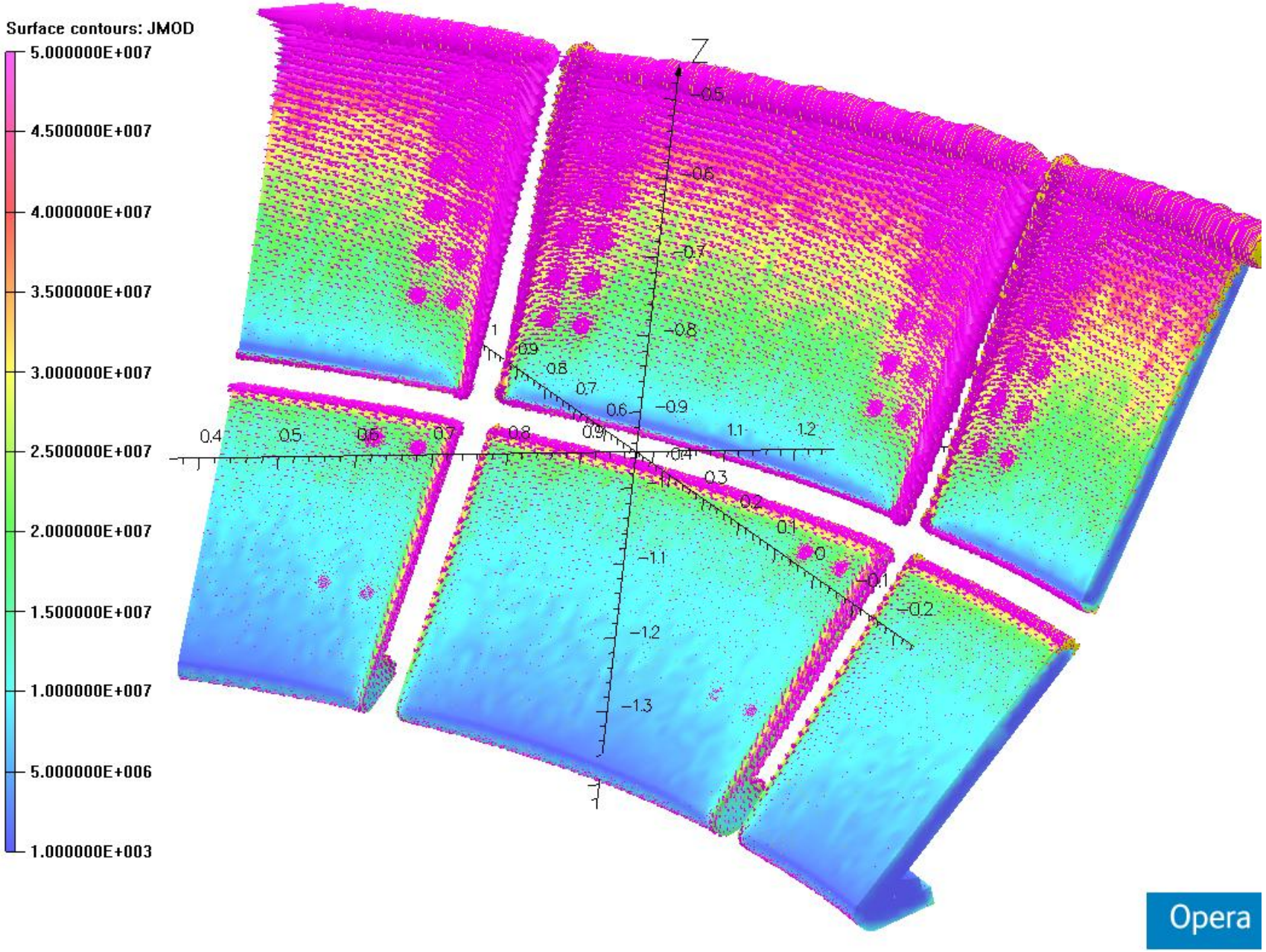




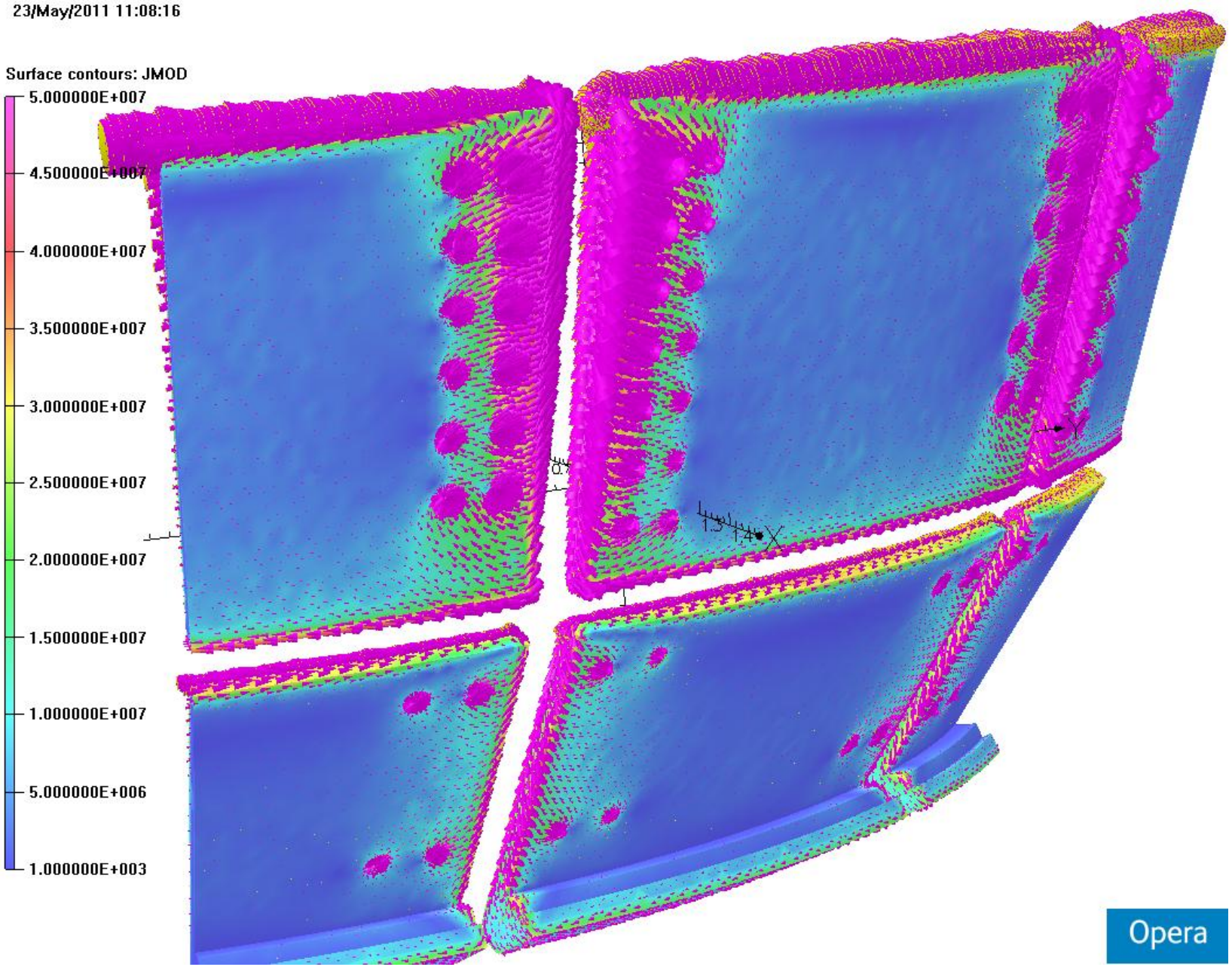
Moment center of lower PPPs

X (m)	Y (m)	Z (m)
1.2	0.72	-0.8

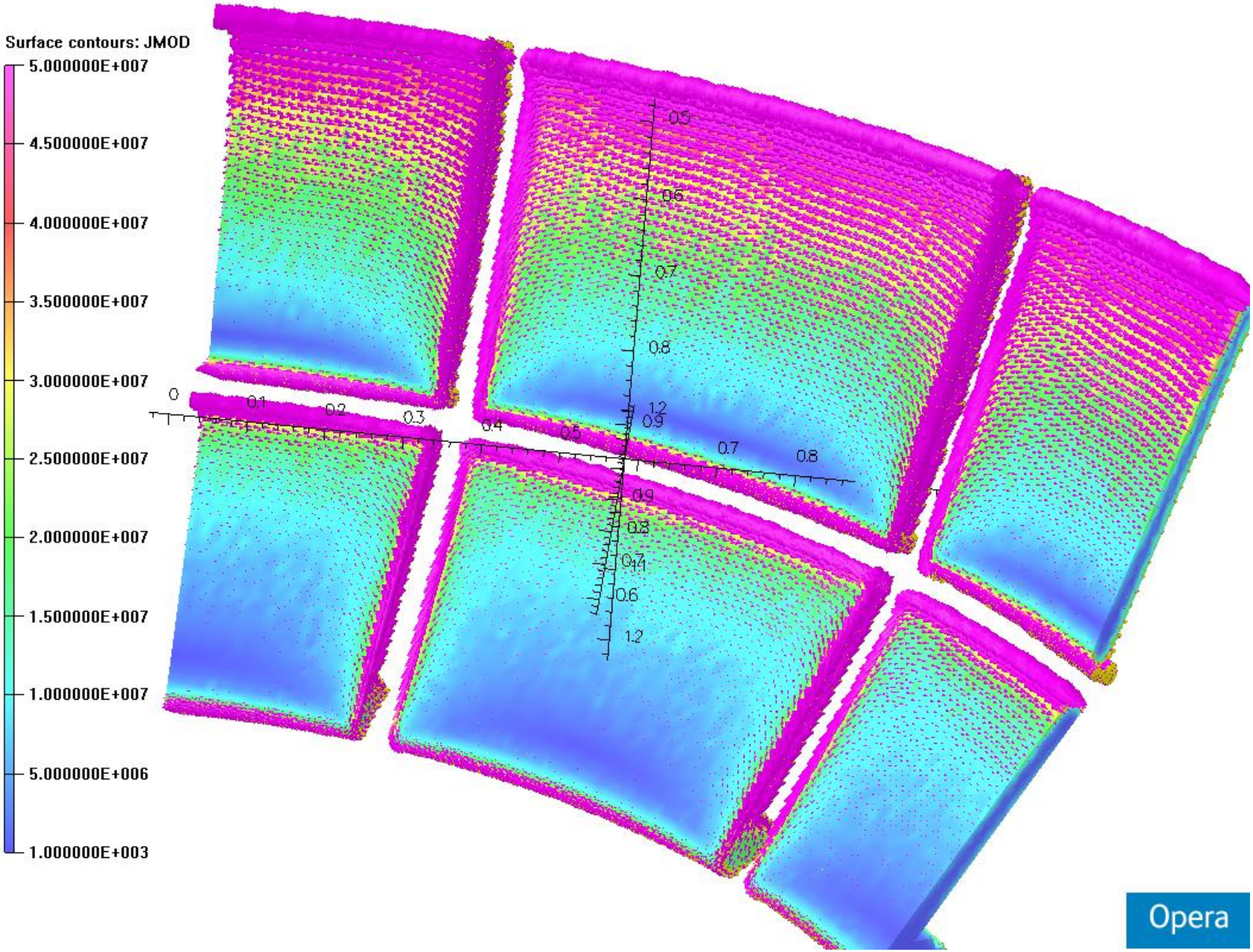
Disruption Analysis of Lower PPs



Disruption Analysis of Lower PPs



Mid Disruption Analysis of Upper PPs



Disruption Analysis of Upper PPs