# Revised E&M Disruption Calculations

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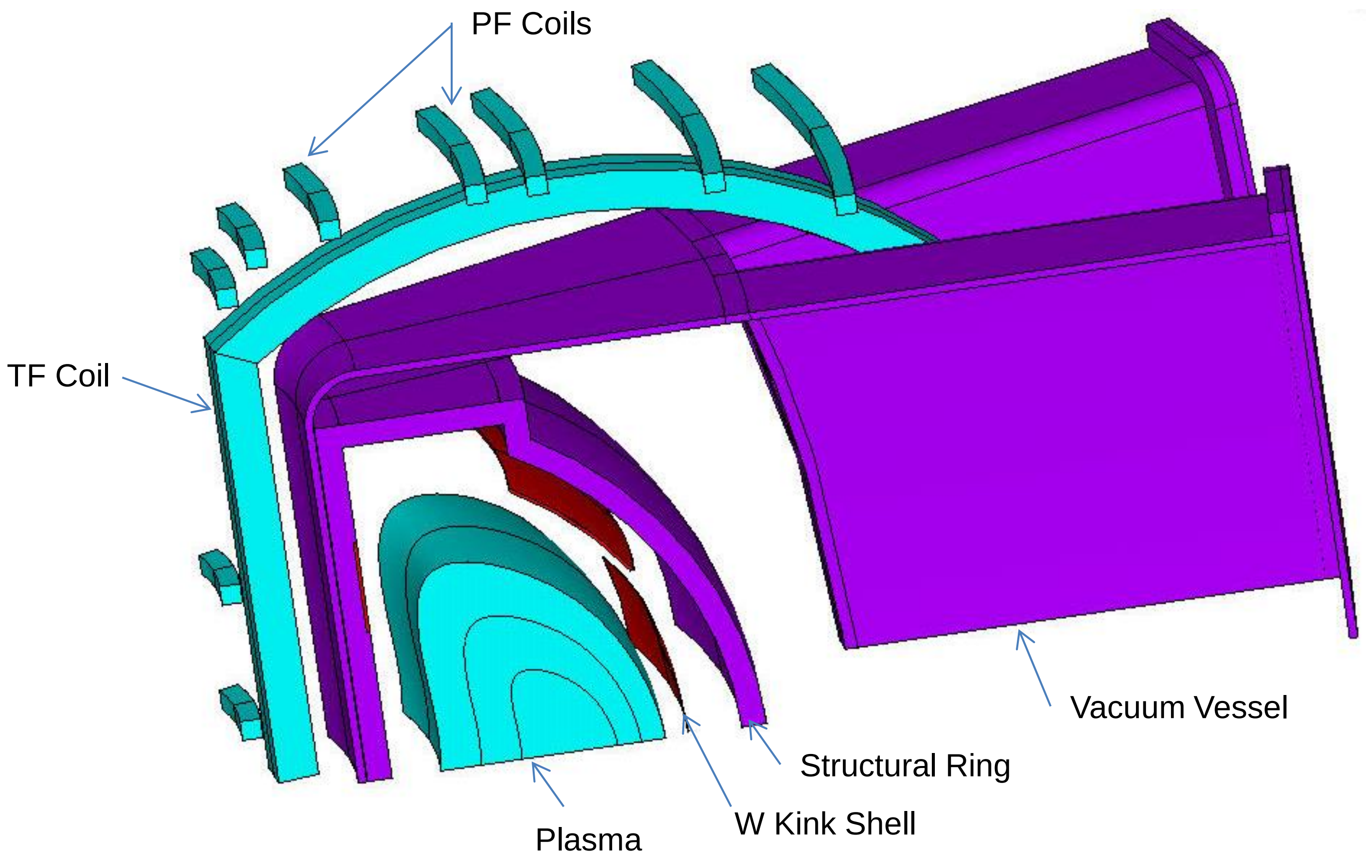
# Recent Modeling Enhancements

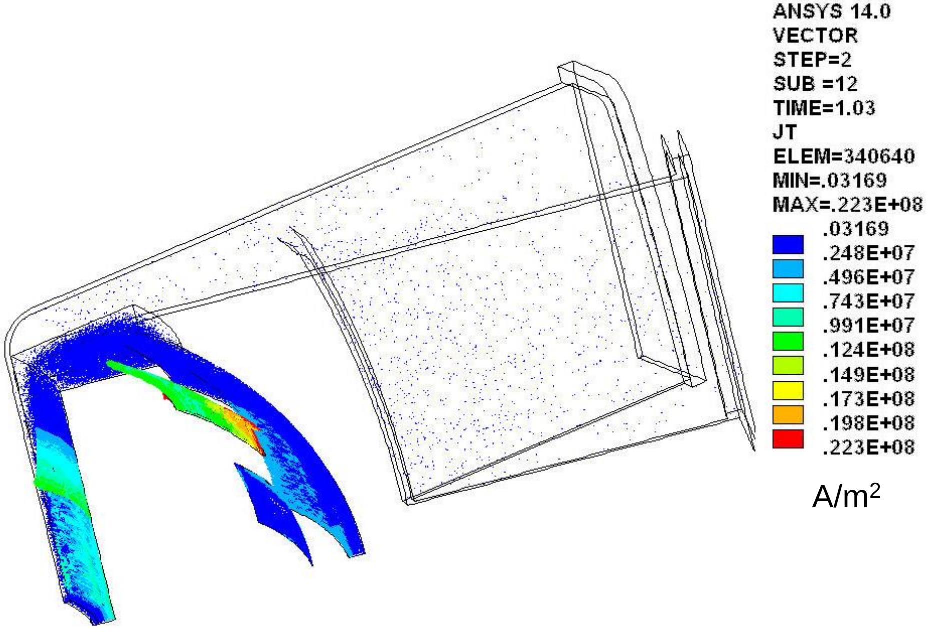
- Realistic plasma shape and current distribution incorporated
- Toroidal field effects included in structural analysis
- Inclusion of tungsten stabilizing and kink shells



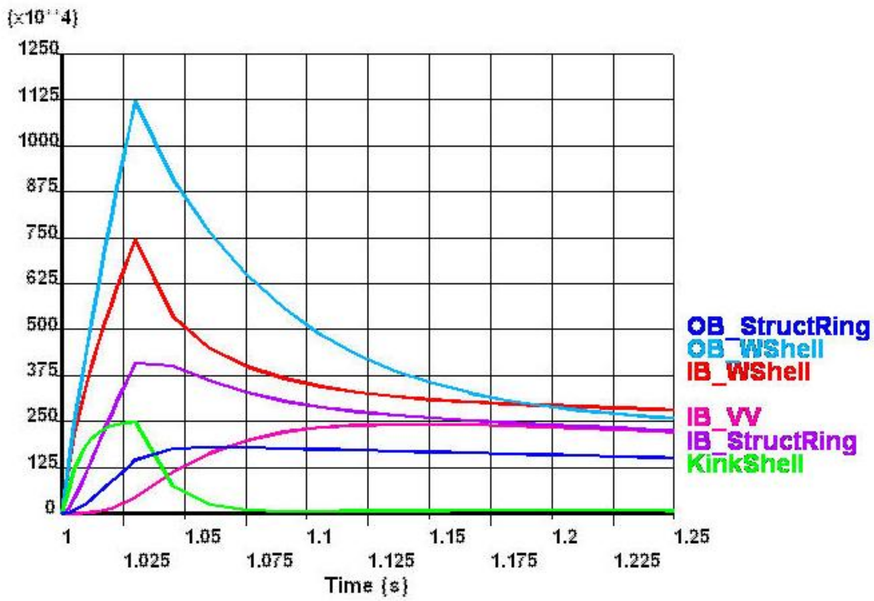
# Current Densities at End of Plasma Ramp-down

- Plasma assumed to ramp down in 0.03 sec.

**At End of Plasma Ramp-down**



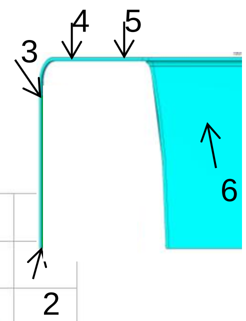

**Time history in Various Components**

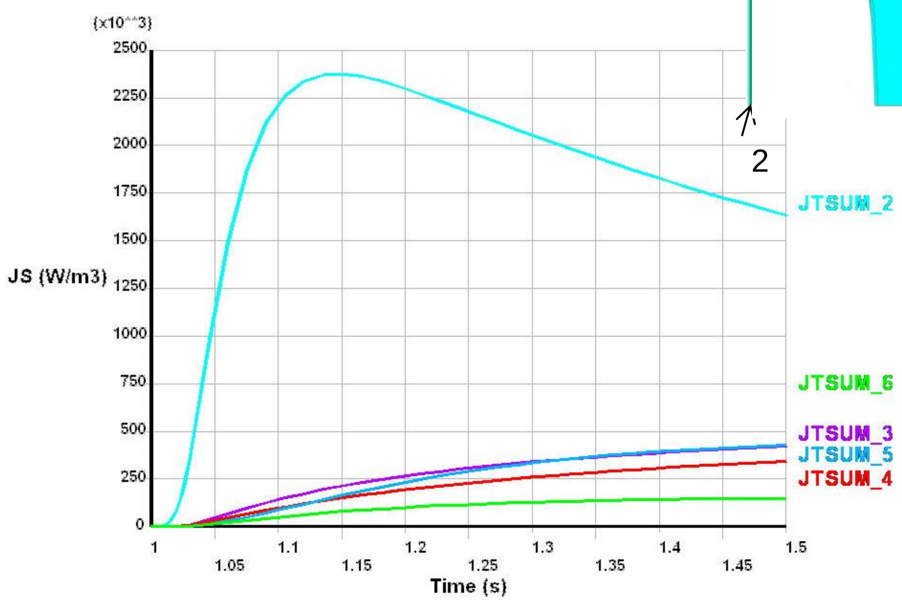


# Comparison of VV Current Densities for Old and New Models

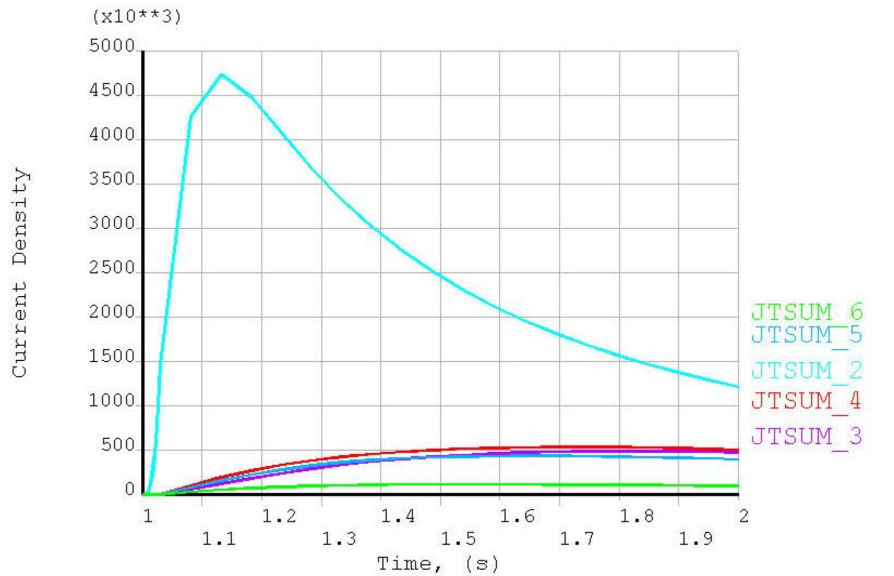
- Current density at IB centerline cut in half, but similar at other points.
- Largest effect is change in plasma current shape

**New Model**




**Old Model**

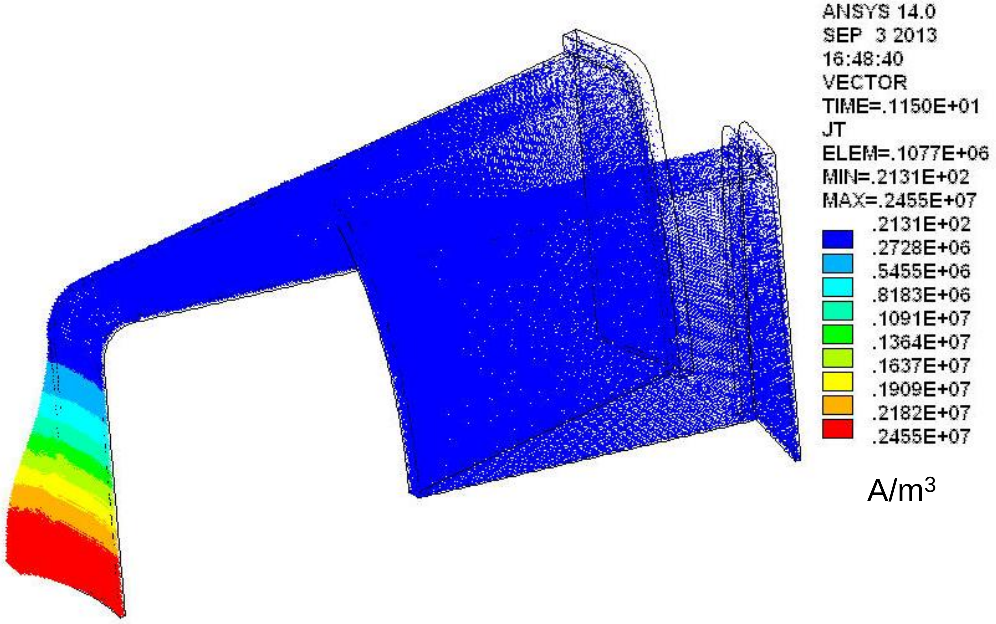


# Maximum Current Density and Polloidal Field Magnetic Forces

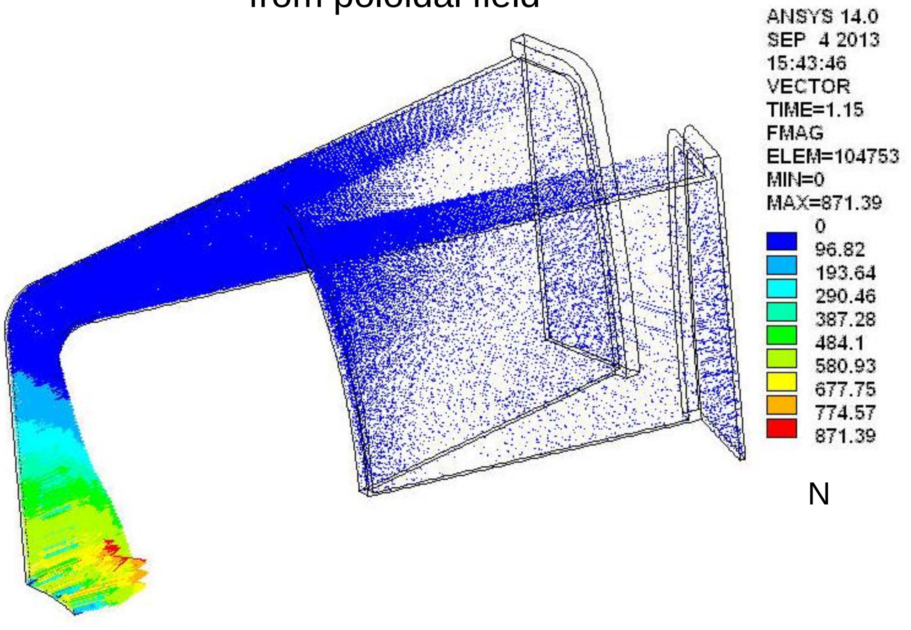
- Maximum currents occur ~0.15 s after start of plasma ramp down.

- Maximum currents and magnetic forces occur at inboard region near mid-plane.

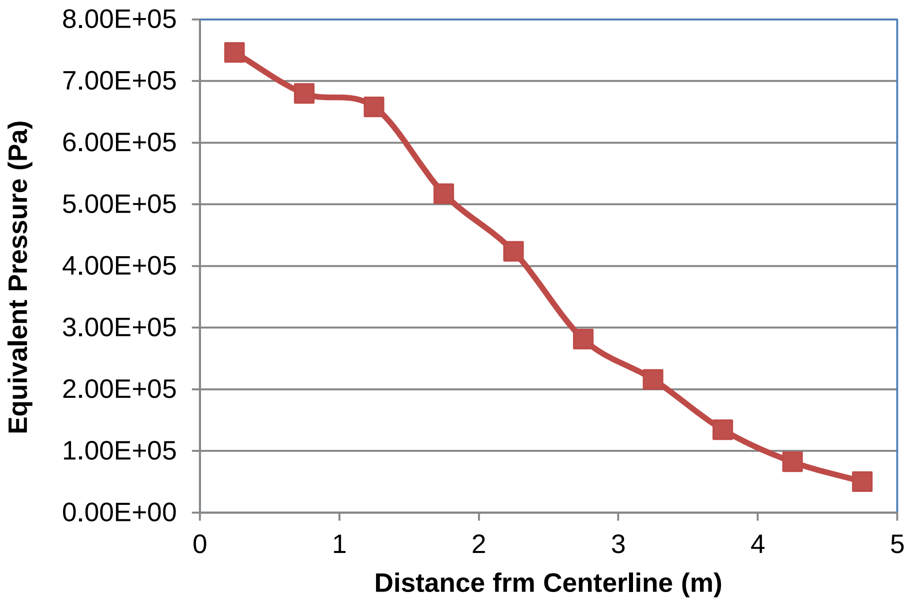
Current Density

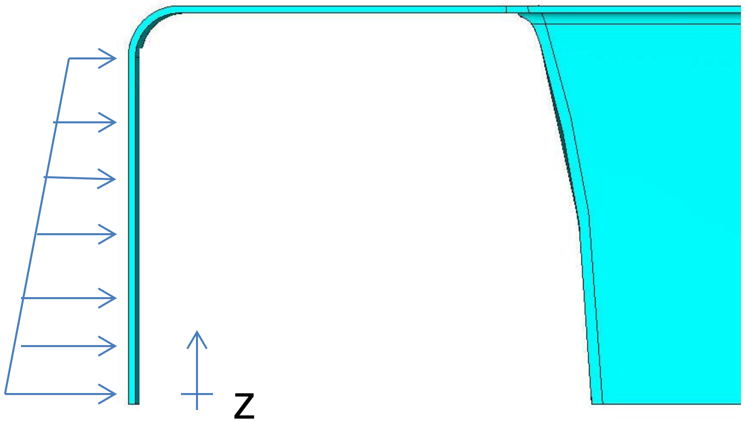



Magnetic Forces
from poloidal field



# Magnetic Forces Approximated as Equivalent Pressure on Inner Wall of the Vacuum Vessel



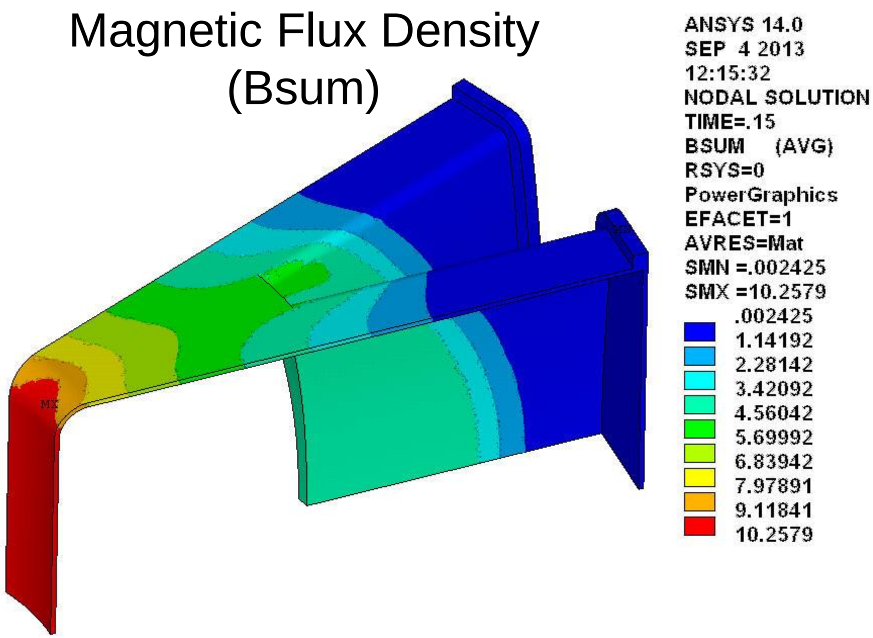

“old” pressure peaked at 5 MPa

# Magnetic Flux Density in VV from Toroidal Field Coils

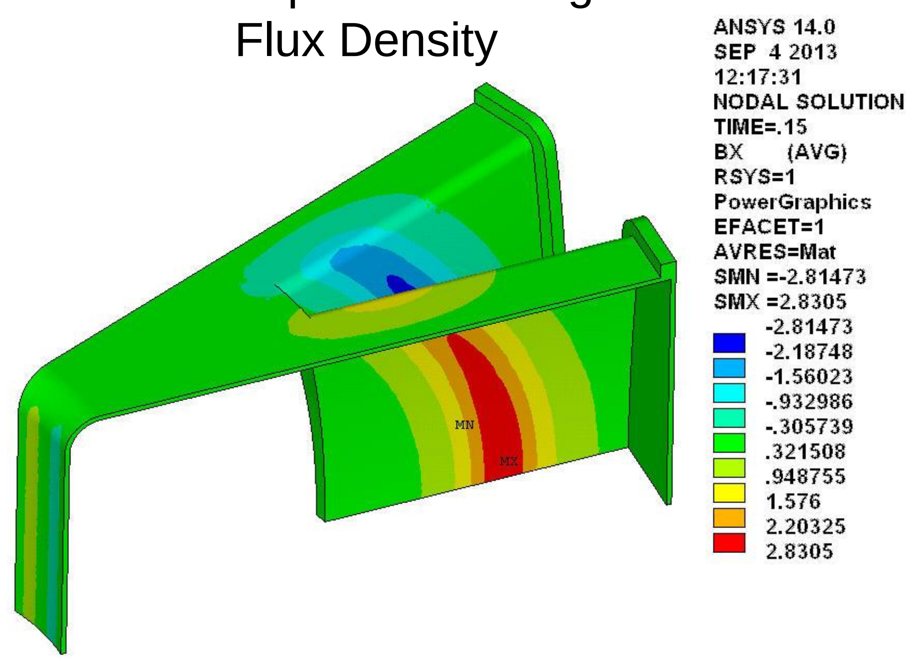
- Magnetic fields from poloidal and toroidal coils cannot be modeled simultaneously with a sector model (incompatible b.c.’s)

- Hence, we calculated them separately and manually calculated resulting forces

Magnetic Flux Density (Bsum)



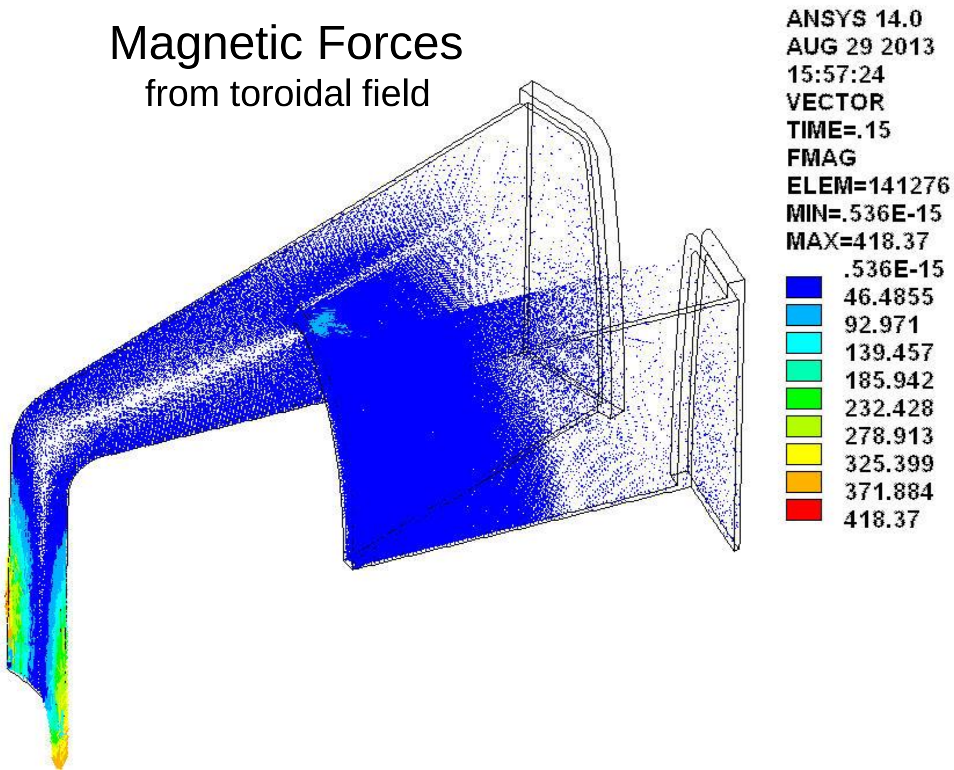

Radial Component of Magnetic Flux Density



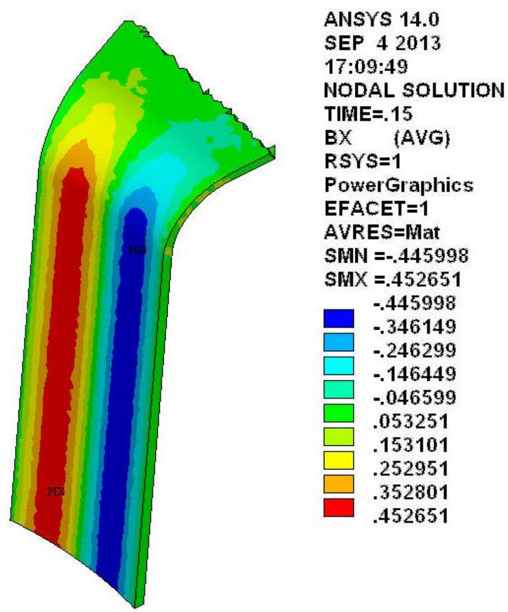
# Magnetic Forces From Toroidal Field

- Maximum forces result from radial variation in field around inboard toroidal coil.
- Forces are perpendicular to forces from poloidal field.

Magnetic Forces
from toroidal field



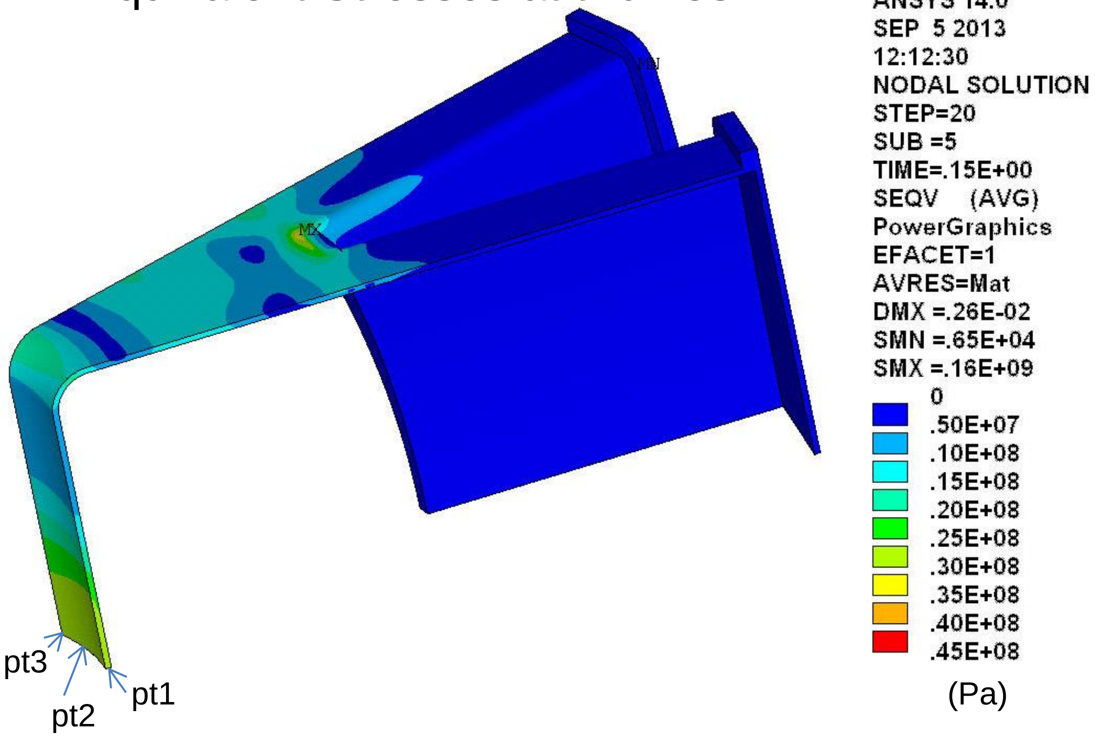

Radial Component of Magnetic Flux Density



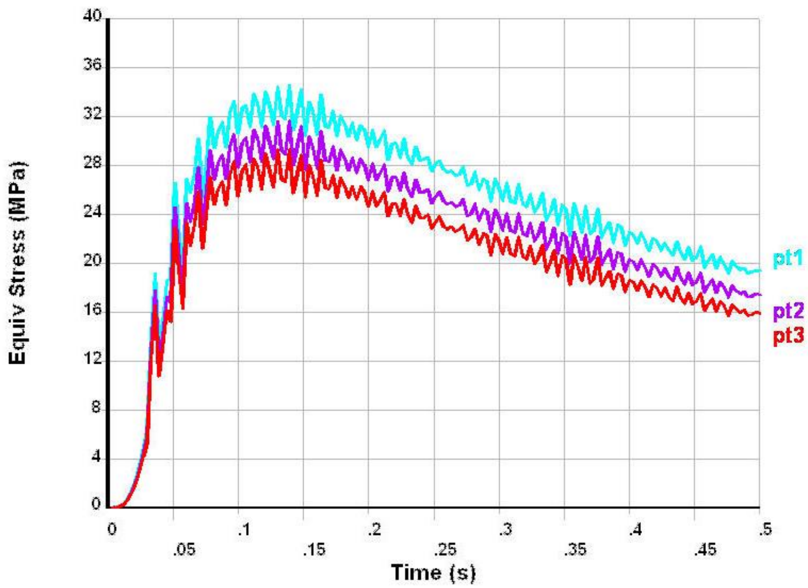
# Transient Structural Analysis Results

- Poloidal and toroidal force results linearly combined.
- Inclusion of toroidal field forces produces some asymmetry in stress results.
- Ignore inertial effects.

Equivalent Stresses at t=0.15s

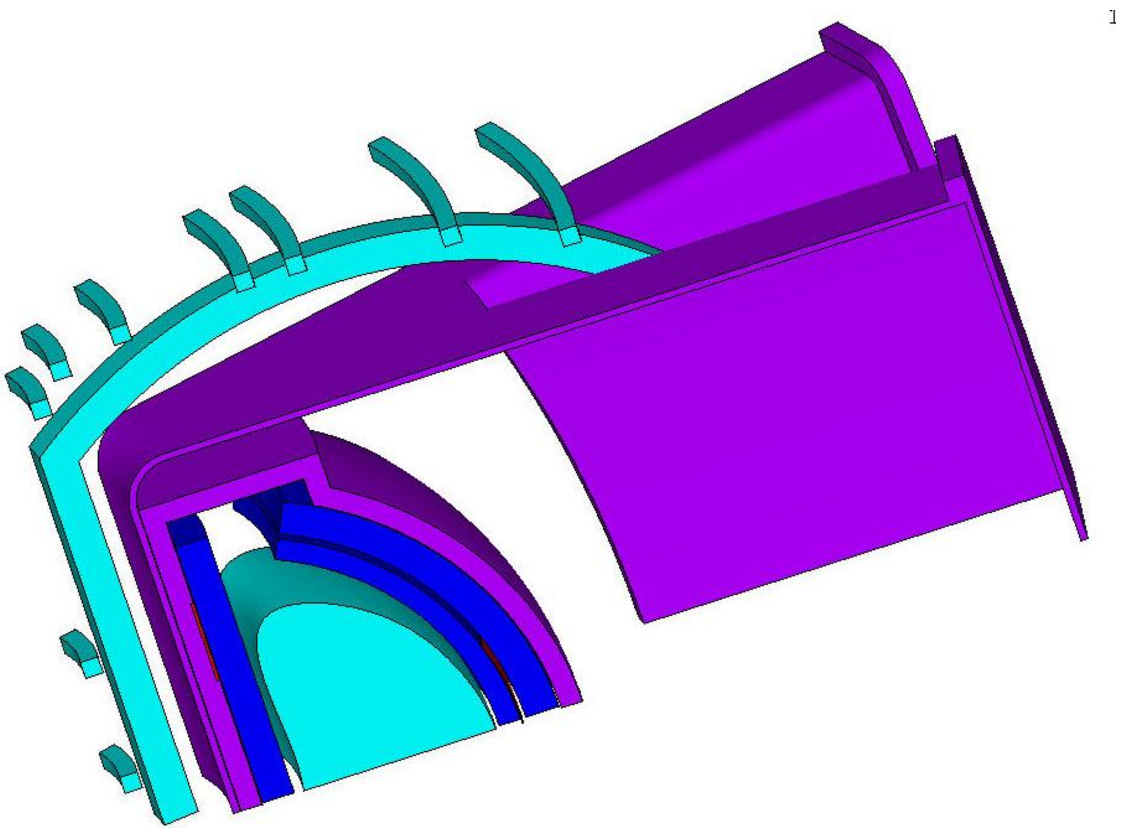



Transient Stresses at Midplane



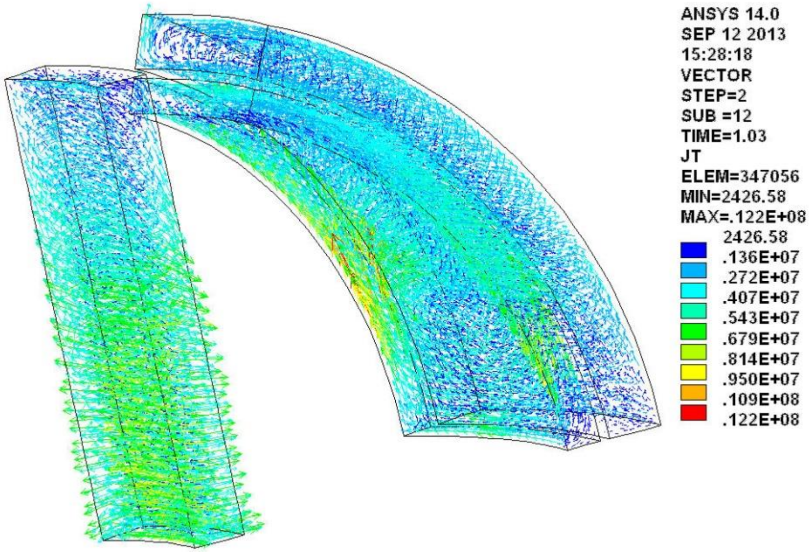
# Approximation of Blanket Structure Added to Model

- Solid blocks of appropriate thickness used to investigate potential effects of blankets on VV currents and forces.
- Blanket modules are not electrically continuous.
- Initial models use effective electrical conductivity of steel for blankets.

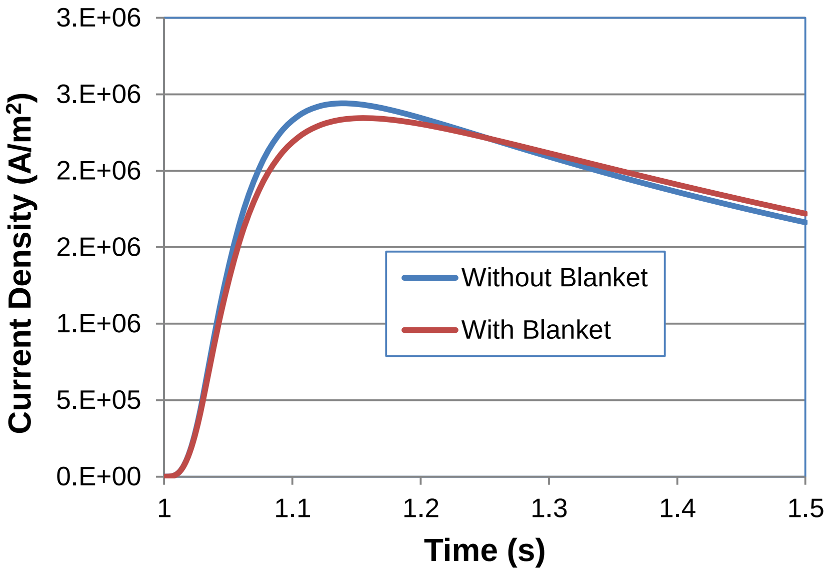


# Vacuum Vessel Currents are not Greatly Affected by Blankets

Current Density in Blankets at End of Plasma Ramp down



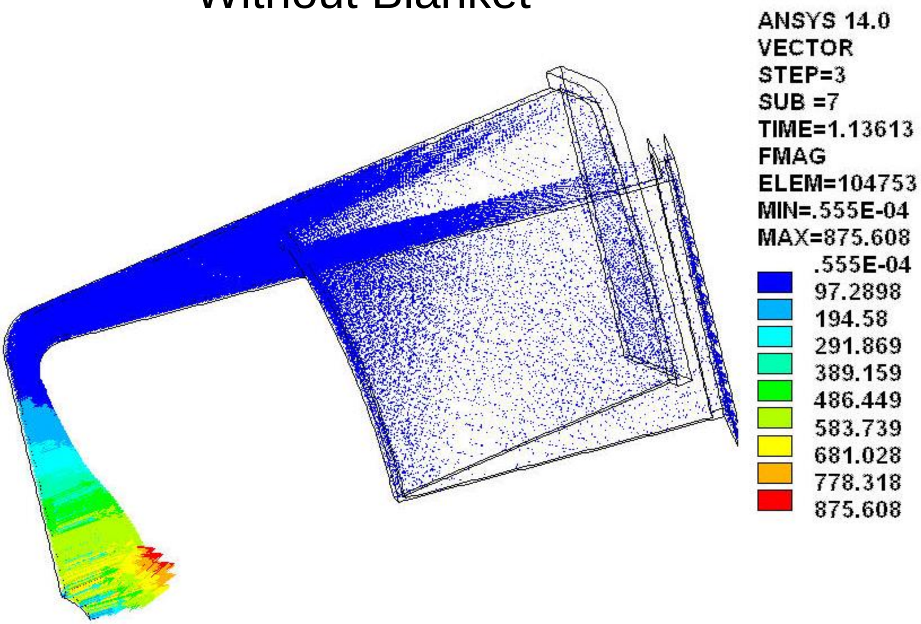

Current Density at VV Inboard Midplane With and Without Blanket



# Vacuum Vessel Magnetic Forces are Only Slightly Reduced with Inclusion of Blanket

**Magnetic Forces in VV 0.15 sec After Start of Ramp Down**

Without Blanket




With Blanket