ITER FW and SB Design Status

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PFC Meeting at ORNL

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Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company, for the United States Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.

Overview of ITER Status

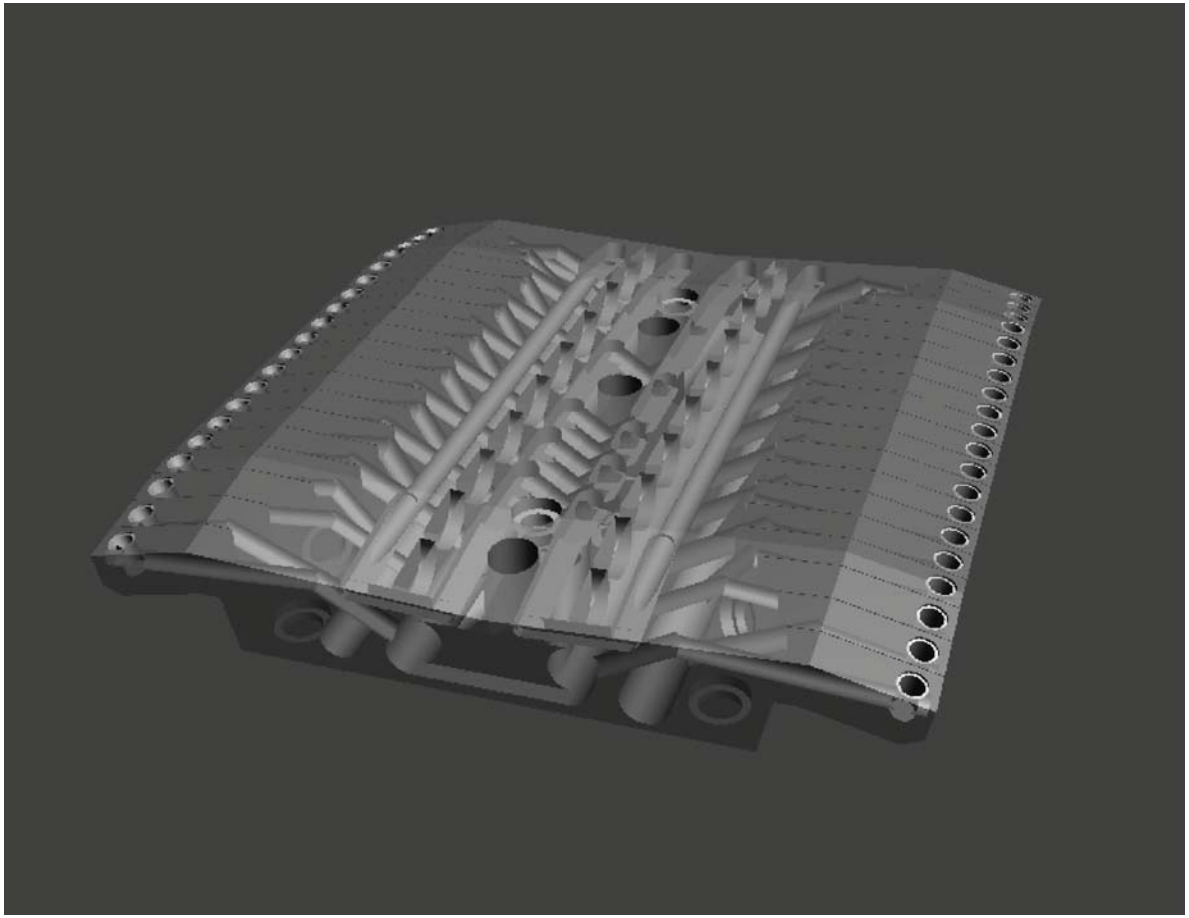
- Japanese Earthquake has impacted manufacturing and testing of ITER components
- As a result some fabrication may be shared among other parties
- The official date for first plasma has been delayed from November 2019 to November 2020
- However, the schedule for the First Wall and Shield Block component design and fabrication is not delayed
- The FW and SB design teams will have a Preliminary Design Review in November 2011

Design Features

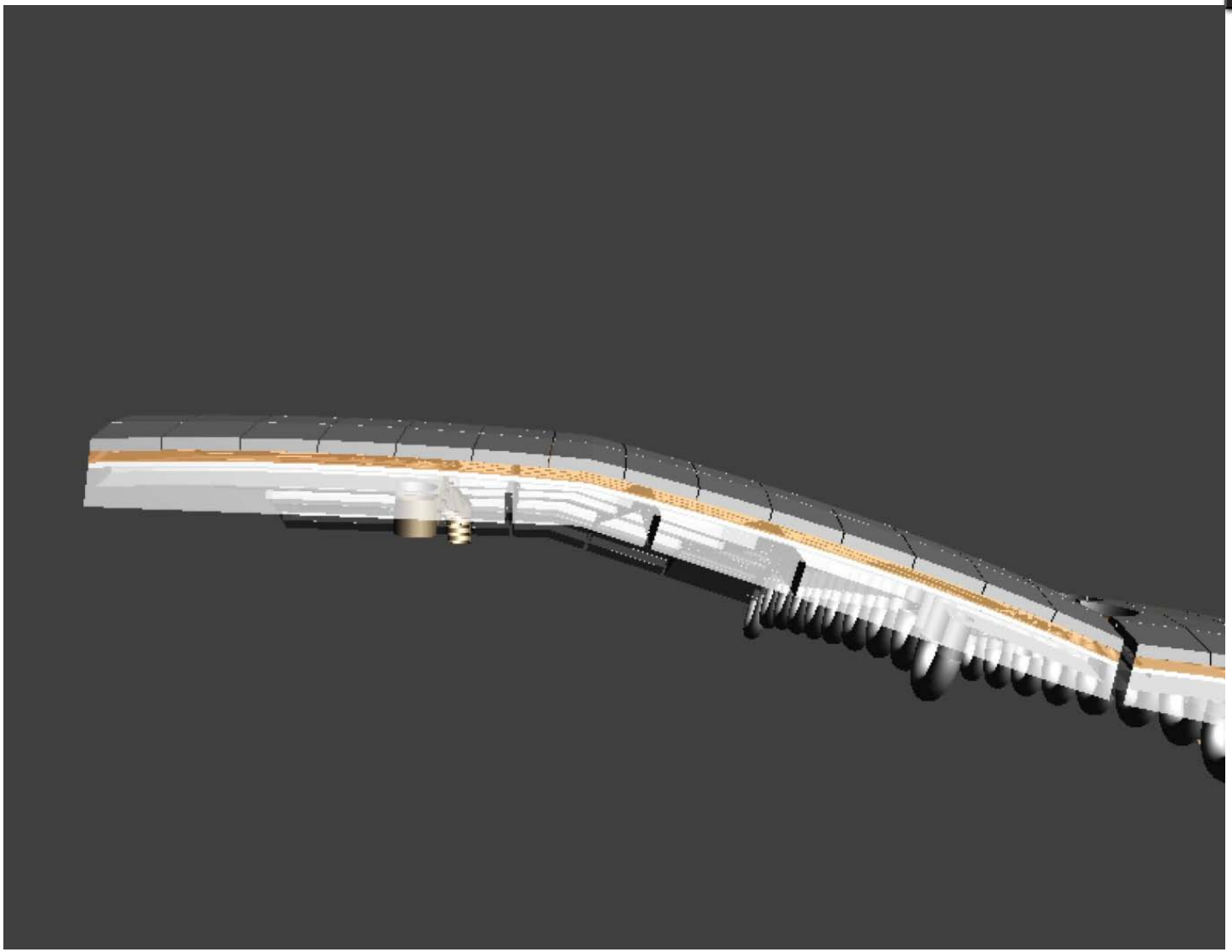
- The features of this design have been developed through collaboration among the EHF design team.
- The main features are present in the EHF panels that have been studied thus far but in many cases the features must be modified to fit in the unique geometry of a given panel.
- The main features of the design are:
  - The beam has arms that support the high heat flux fingers
  - The beam is drilled to distribute coolant to each pair of fingers and cool the beam body
  - The fingers have a hypervapotron cooling scheme
  - Pairs of fingers are connected with a “U” shaped tube
  - The coolant connection to the beam is via a welded tubular manifold

SB Side of Beam

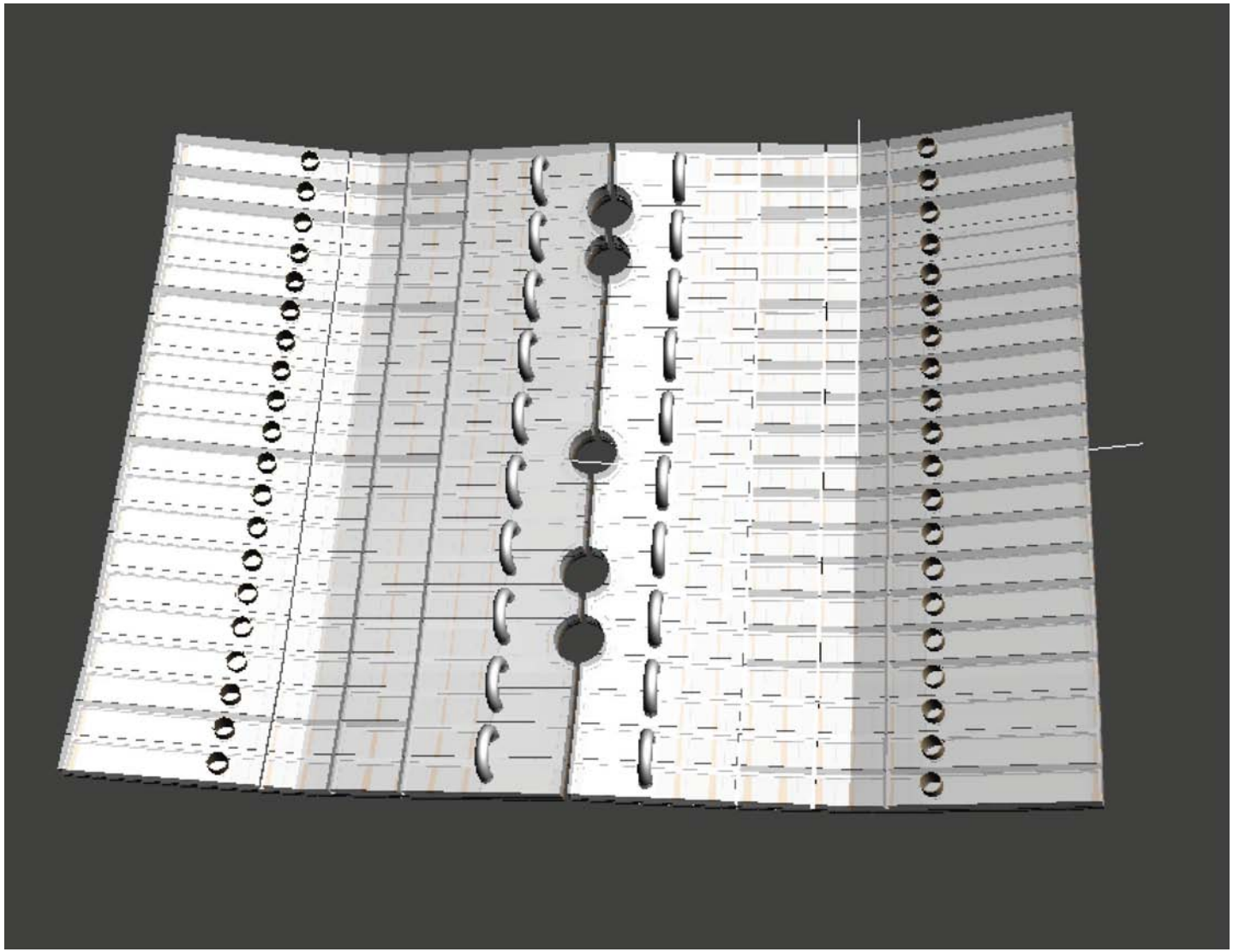
FW Beam Showing Internal Passages



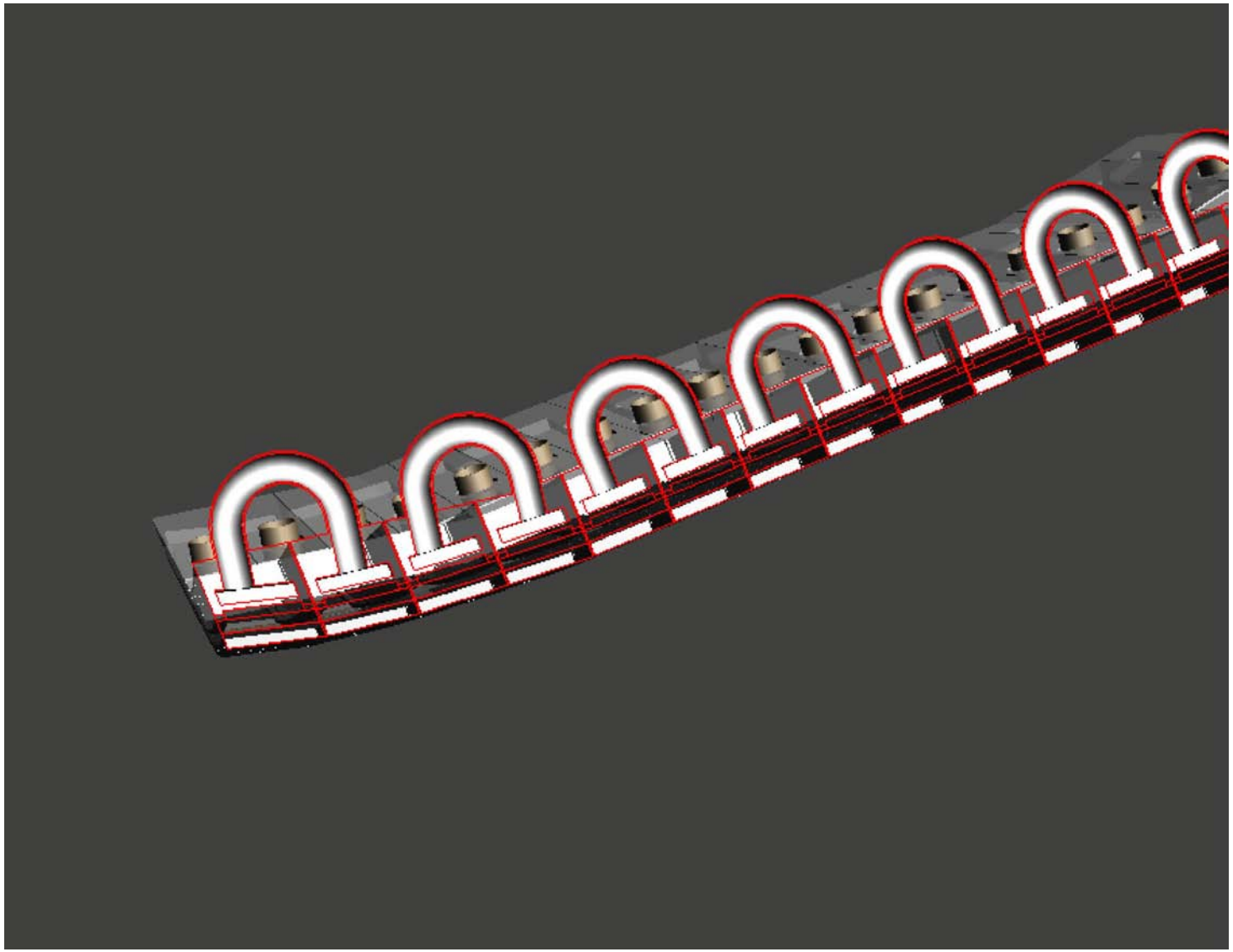
Poloidal Edge View



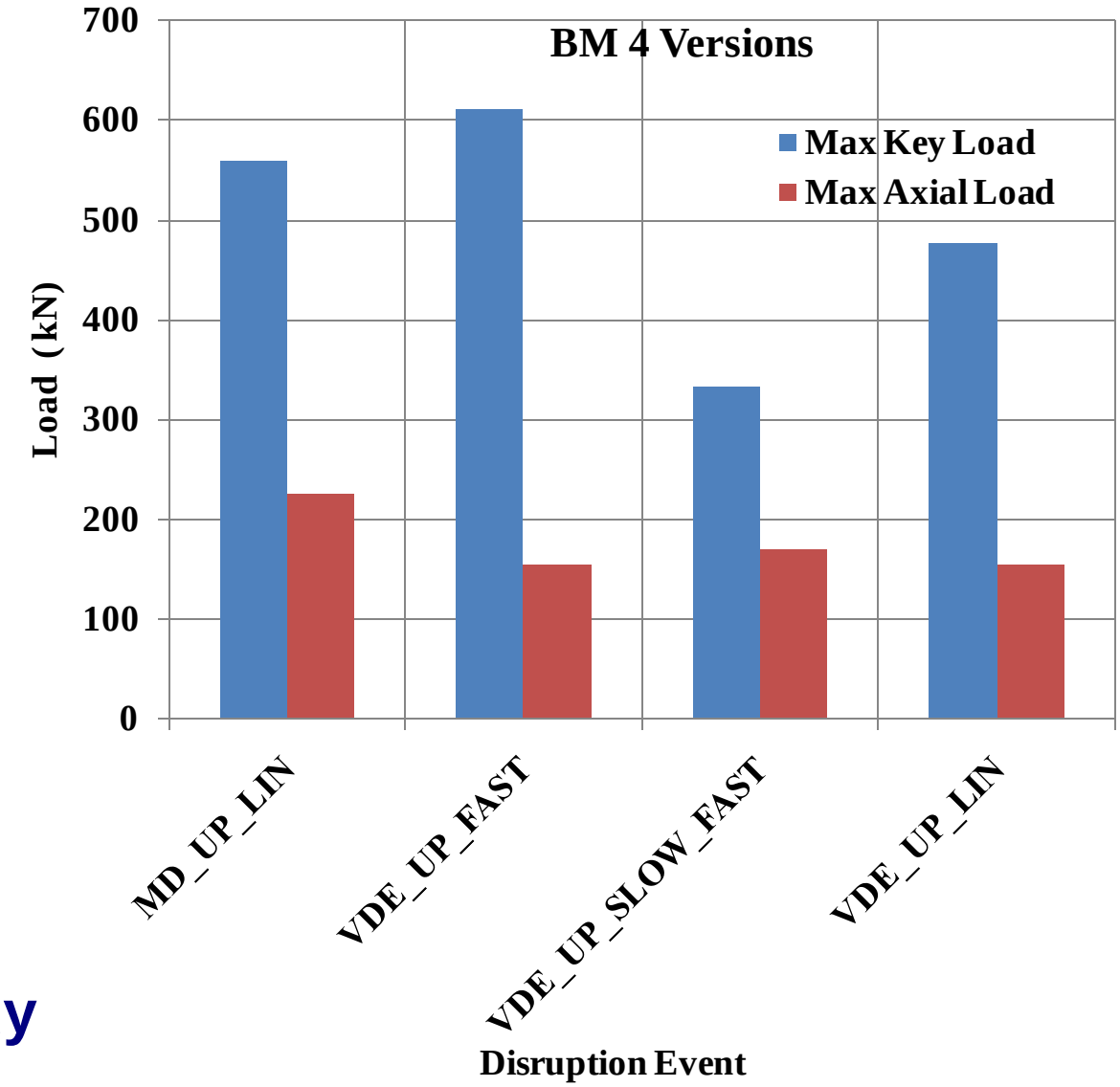
SB side of FW Fingers



Section Through “U” Tubes

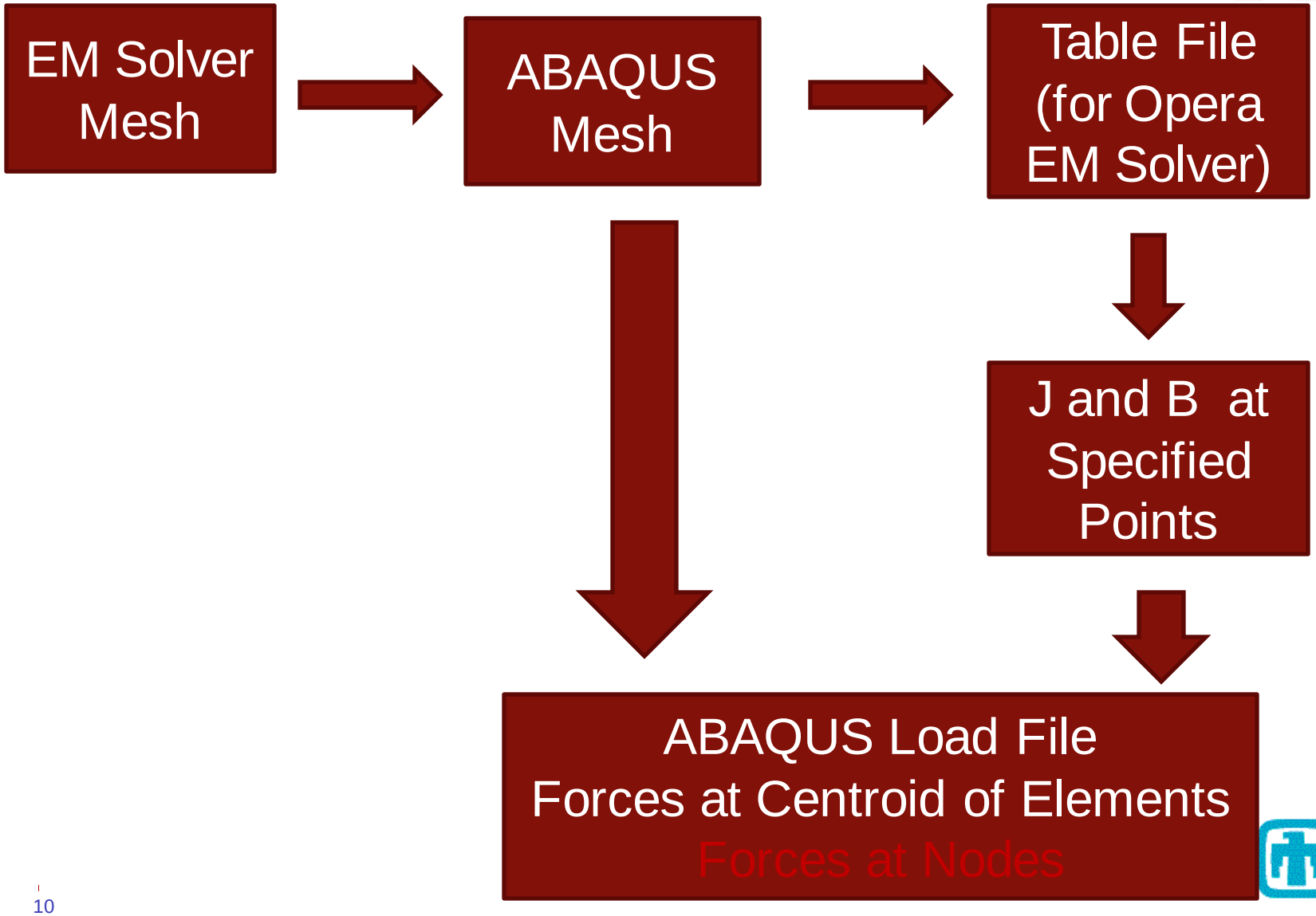


Maximum Loads

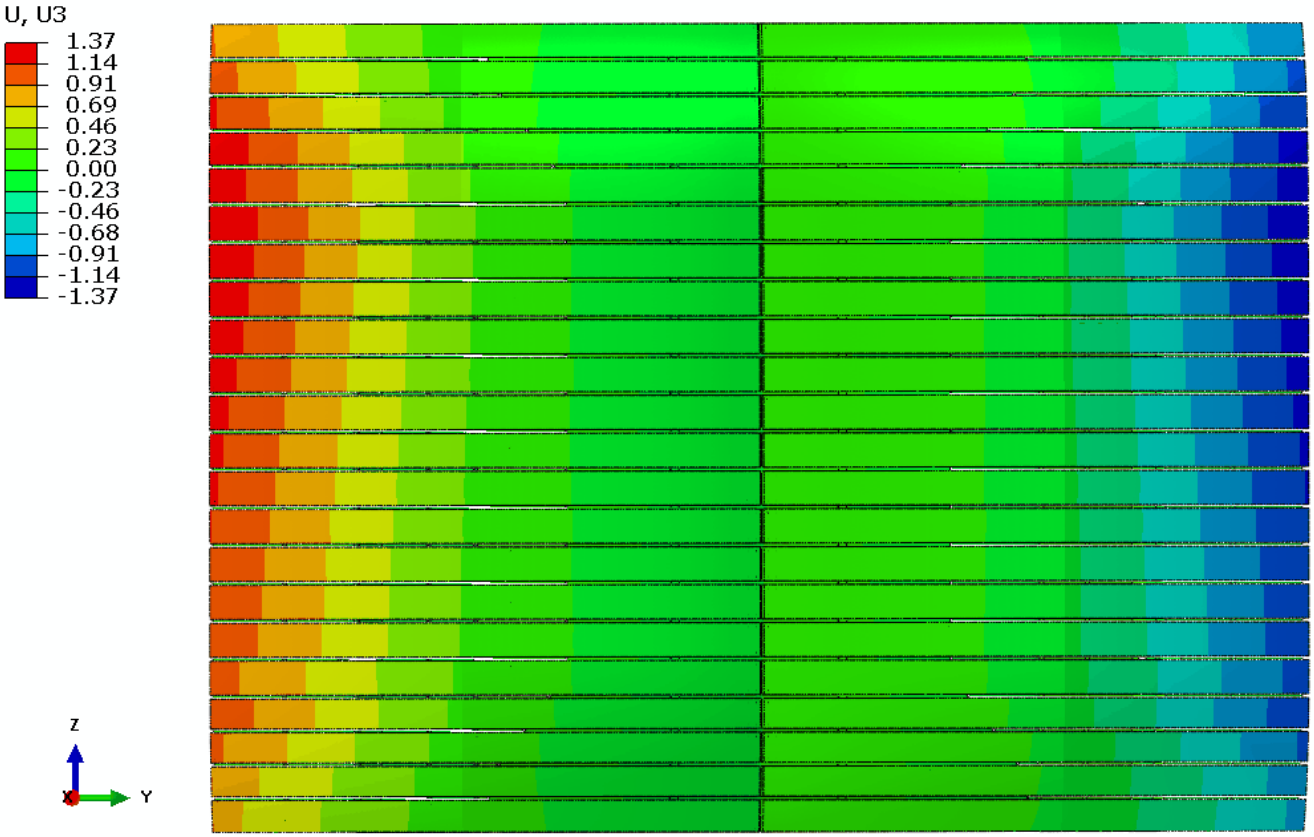


Due to eddy currents

Stress Analysis Procedure

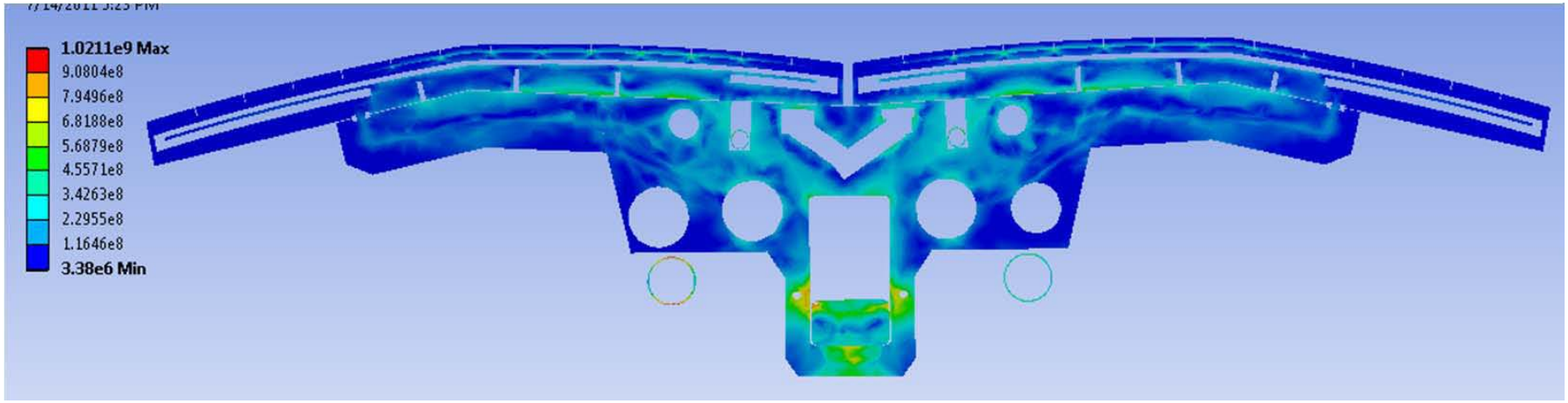


Finger Deflection

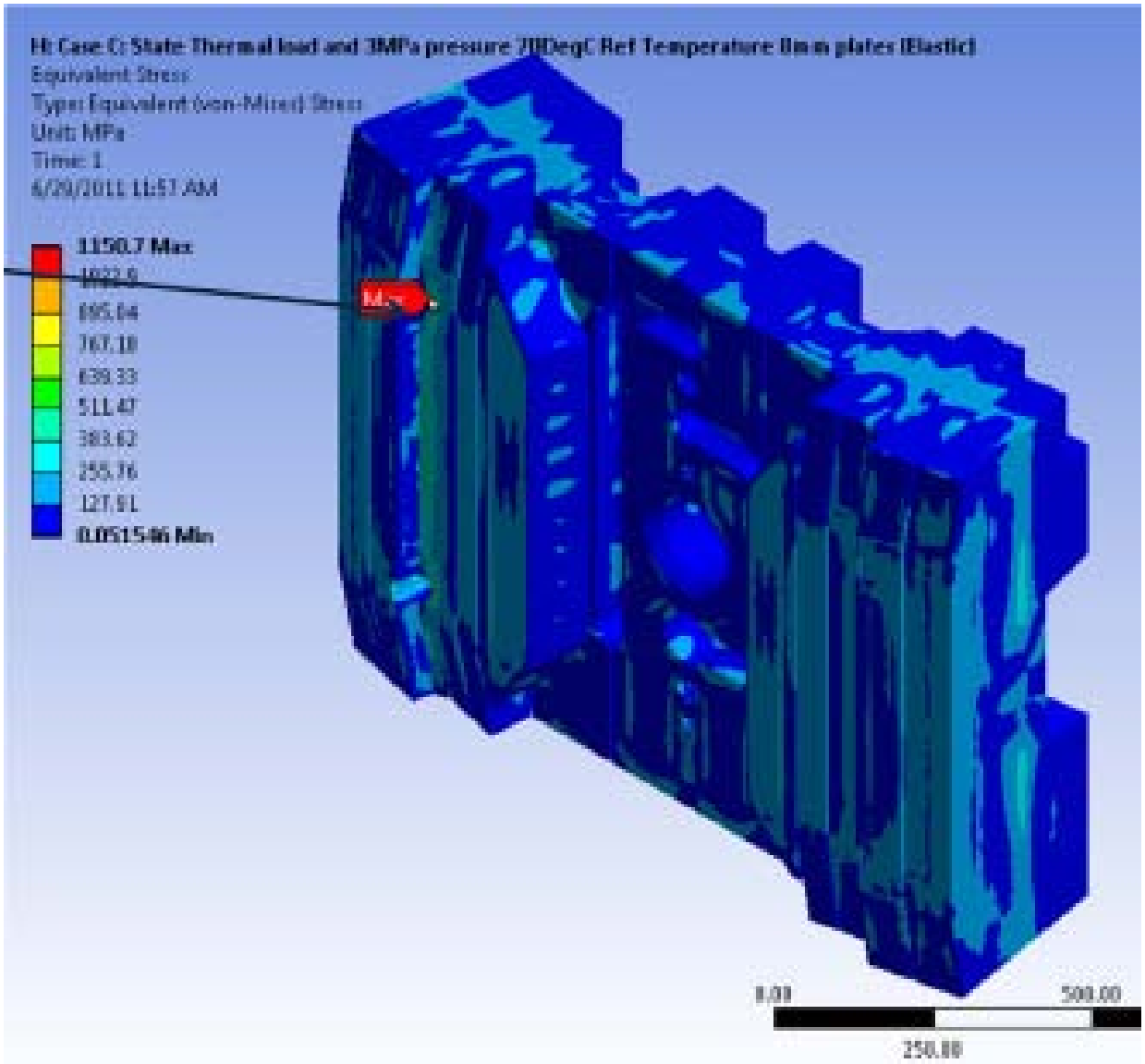


VDE-UP-FAST_II
Fingers do not collide

Thermal Stress in FW04

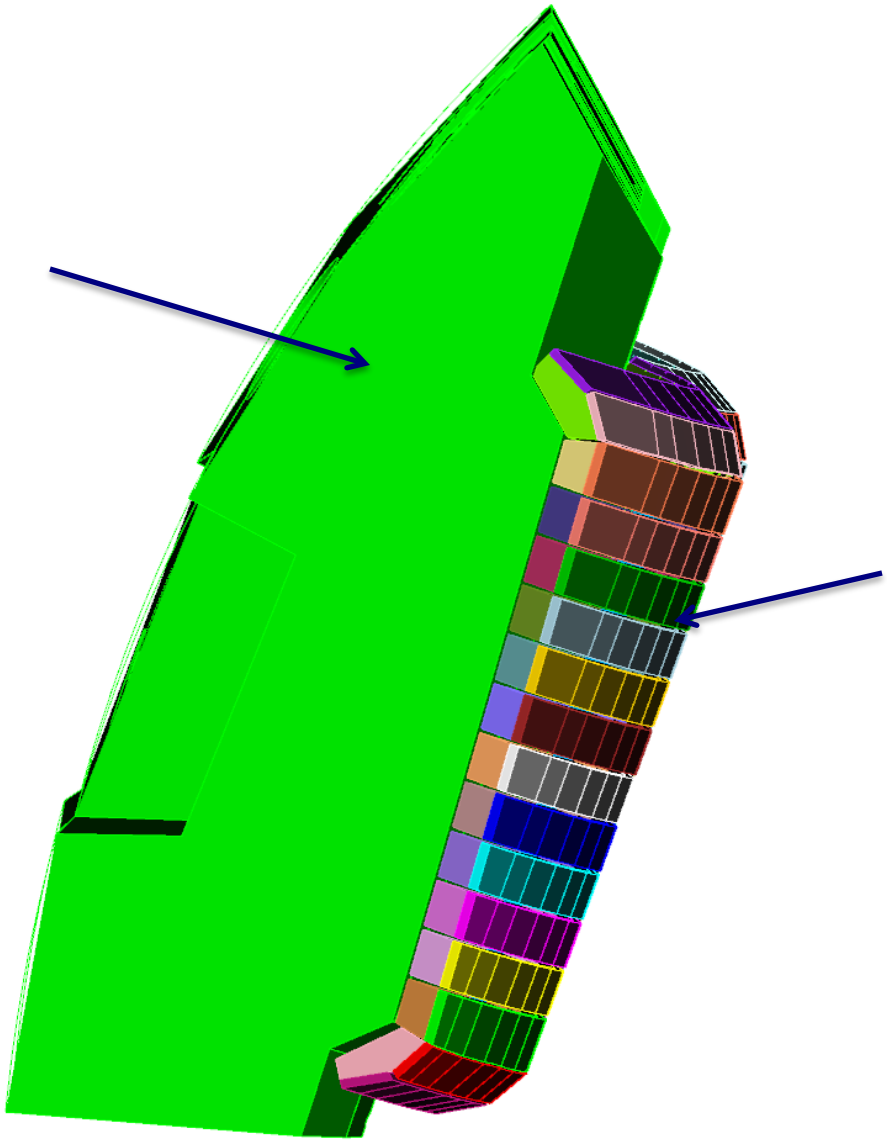


Thermal Stress in SB04



Model for Blanket Module 8

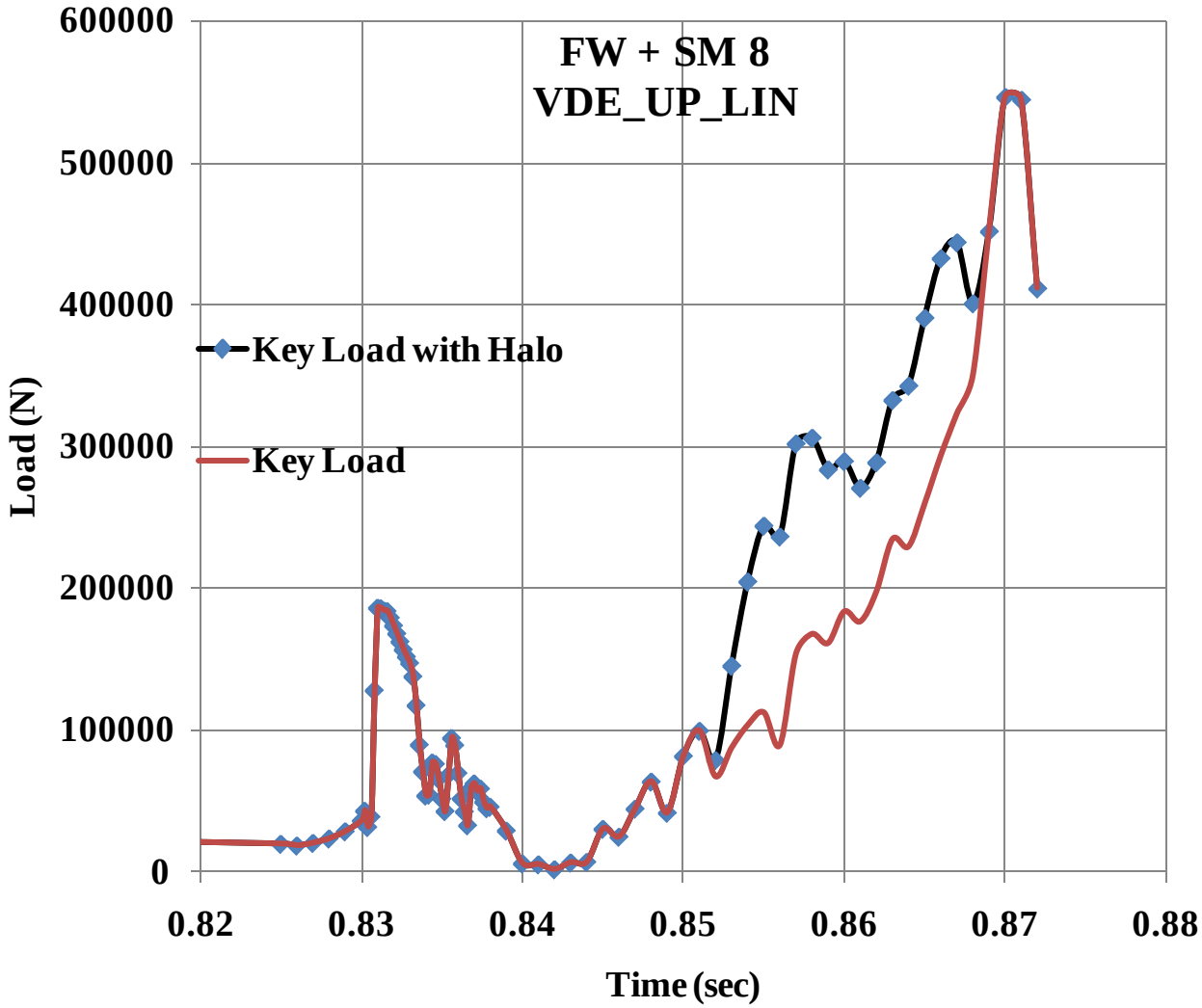
Shield
Module 8



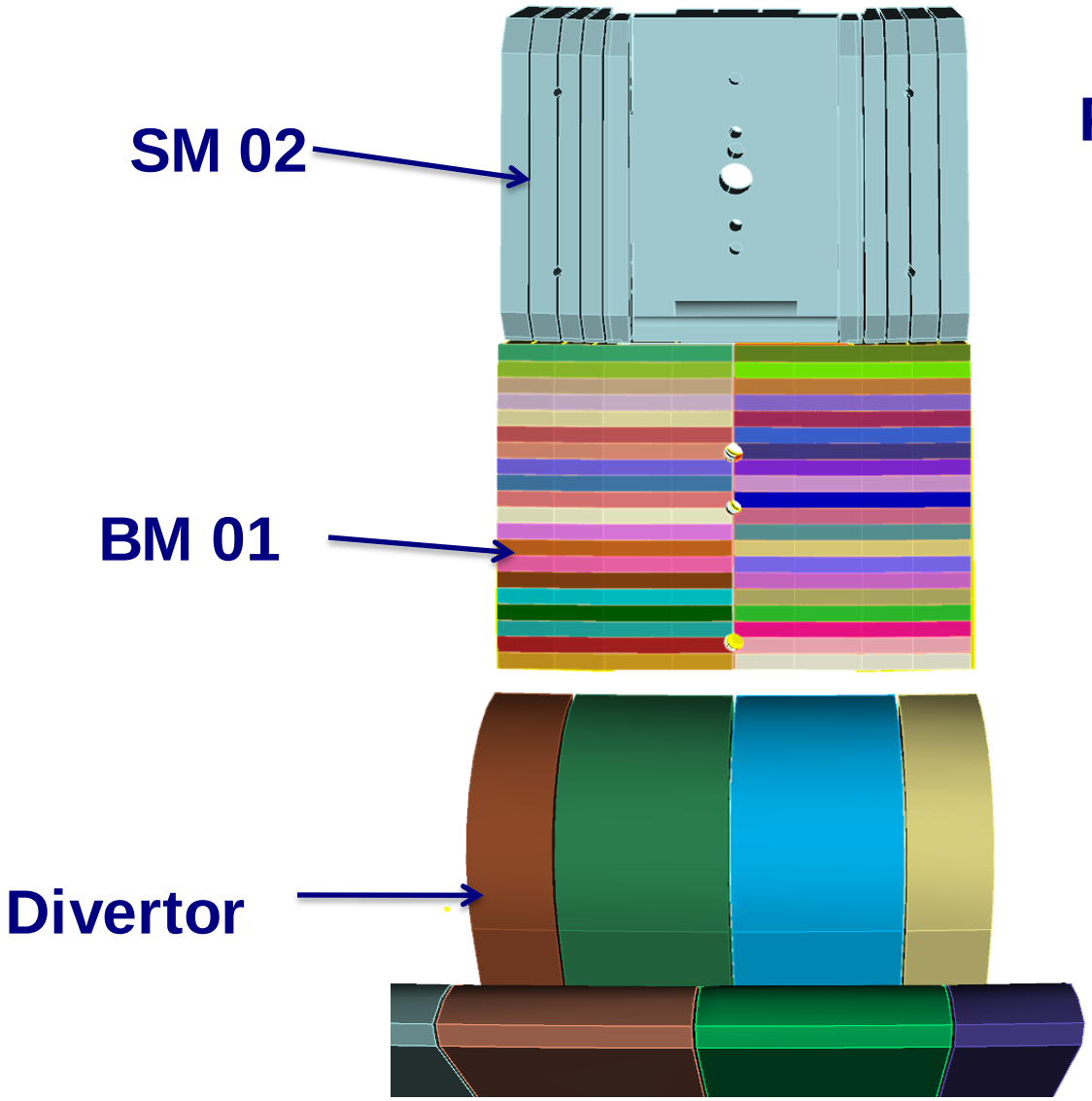
FW Assembly

Side view

Results Comparison

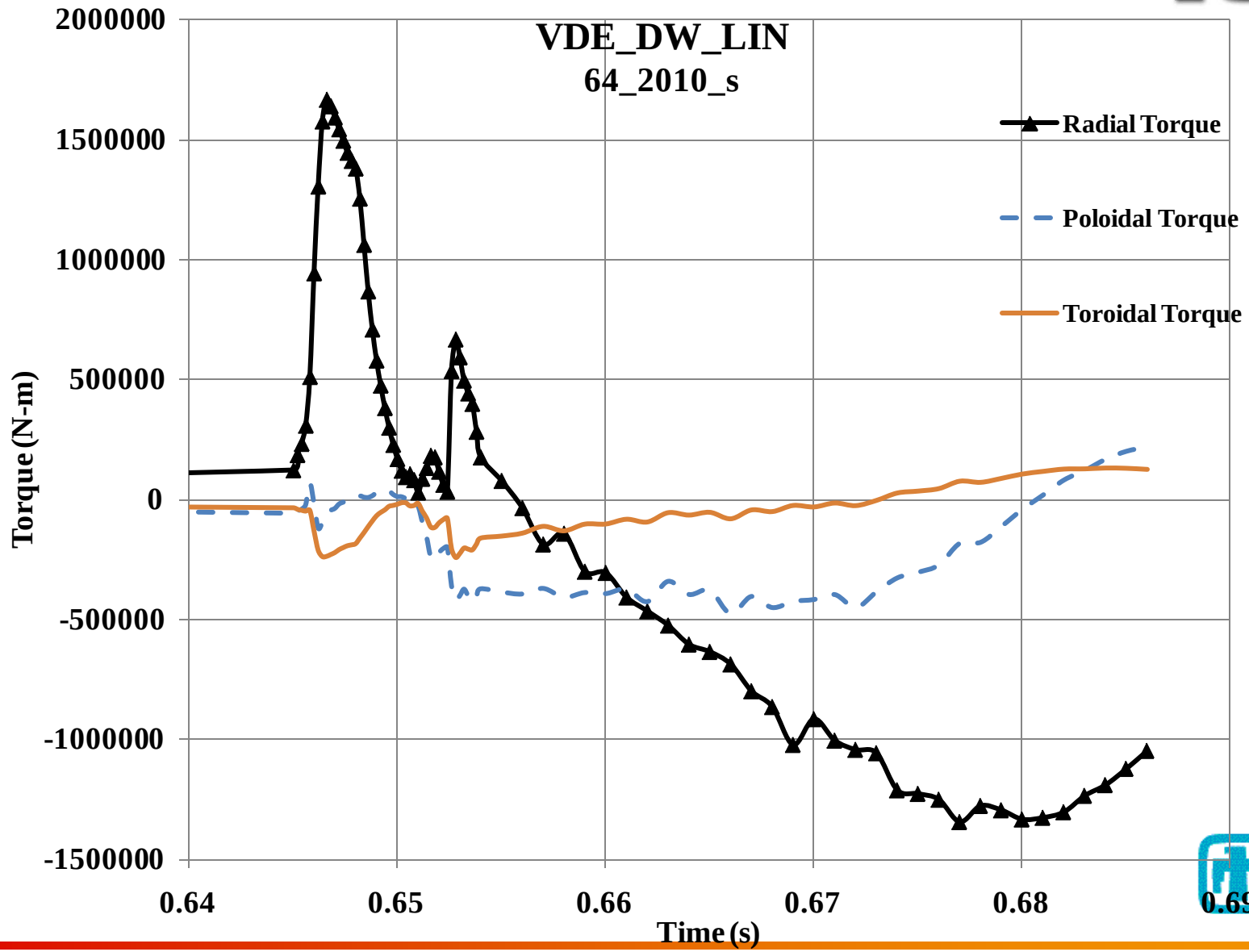


Solid Model

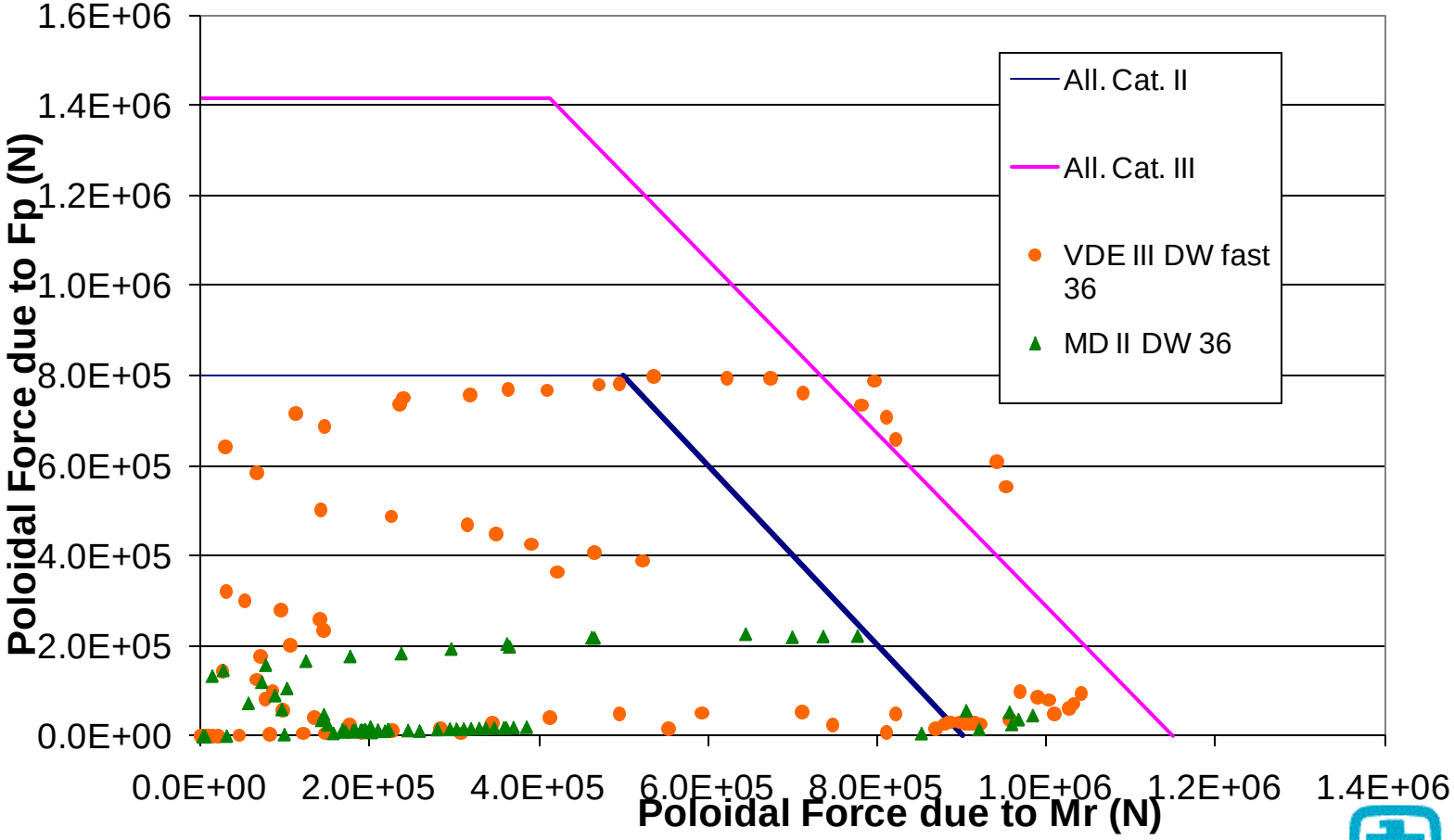


Plasma Facing View

Results


VDE_DW_LIN
64_2010_s
Radial Torque
Poloidal Torque
Toroidal Torque
Torque (N-m)
2000000
1500000
1000000
500000
0
-500000
-1000000
-1500000
0.64
0.65
0.66
0.67
0.68
0.69
Time (s)

Loads vs. Intermodular Key Allowable on BSM #1



Summary

- Flow through the return side of the FW is slightly (<10%) different from flow on the supply side of the beam.
- The average flow rate through the fingers is about 10% less than the desired 2 m/s
- There are high stress regions in the copper layer due to EM loads that may coincide with thermal stress.
- Combined load analysis should be performed for the most heavily loaded finger.
- There does not appear to be a stress problem for combined EM and preload application.
- At some locations the combination of moments and forces slightly exceeds the allowable for the vessel.