

WP-PWIE SP-D Kick-Off-Meeting 2021

K. Schmid

A thick red diagonal line is drawn across the Helmholtz logo from the bottom-left to the top-right.

HELMHOLTZ
SPITZENFORSCHUNG FÜR
GROSSE HERAUSFORDERUNGEN

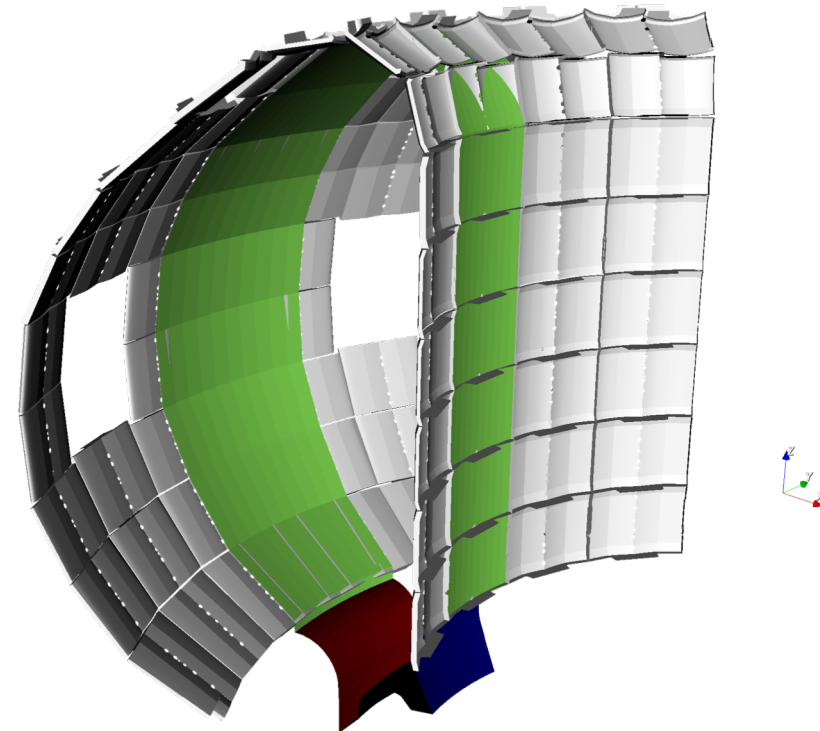
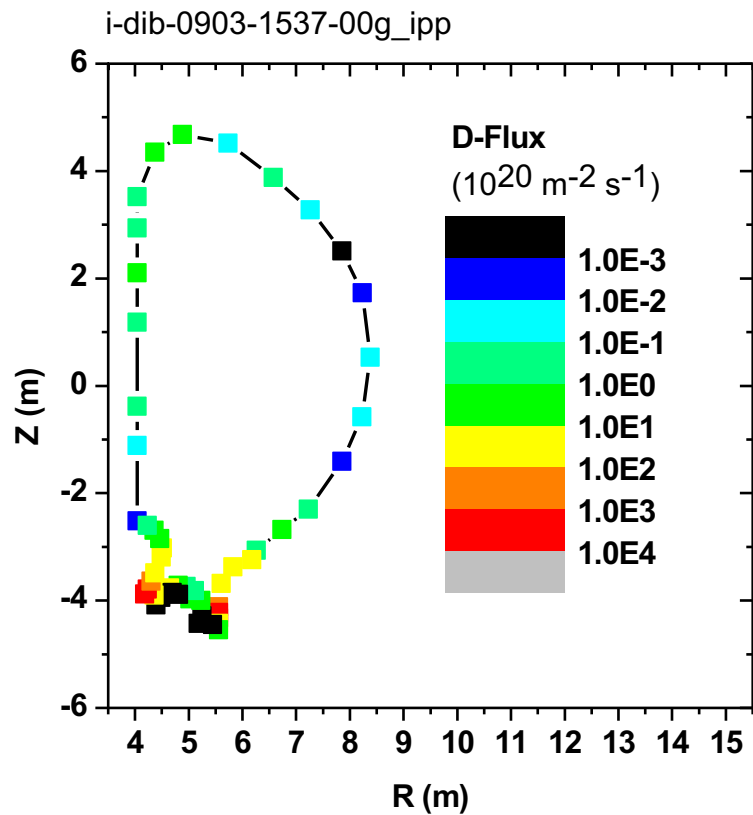


WalldYN3D modeling of the ITER “realistic” 3D first wall

❖ Original WalIDYN(2D) calculations based on toroidally symmetric first wall

→ Probably ok for divertor

→ No so ok for main chamber Be wall (see ERO results by J. Romazanov)



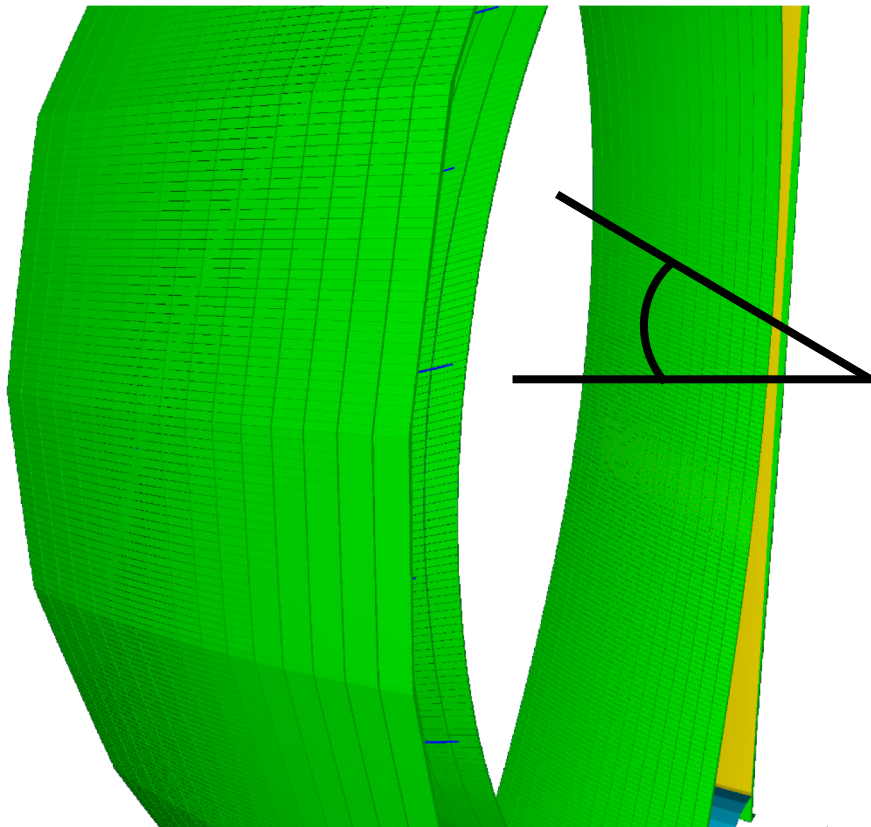
WaIDYN3D modeling of the ITER “

❖ Use EMC3-Eirene background plasma / grid from Wei Zhang [1]

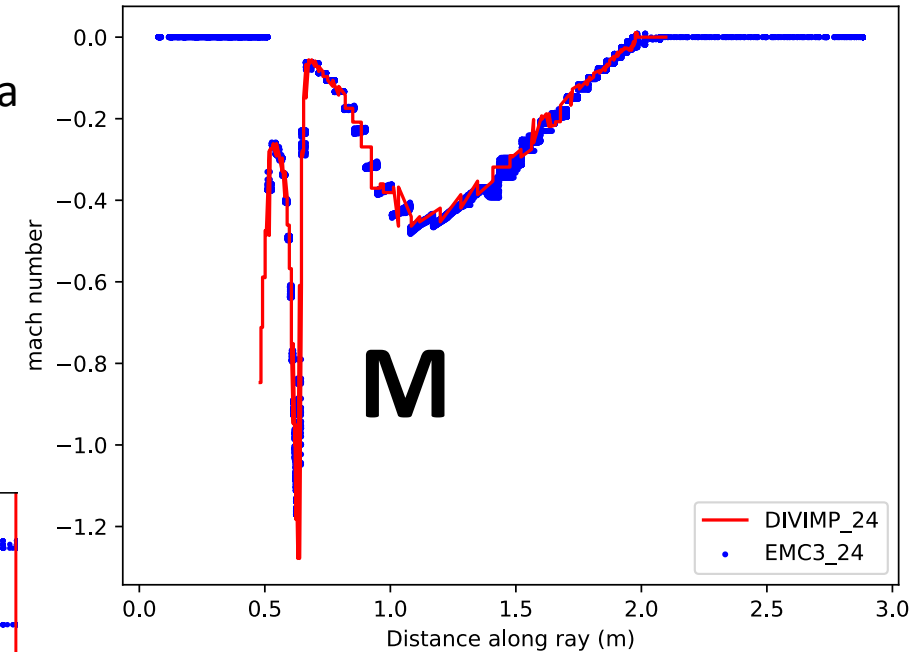
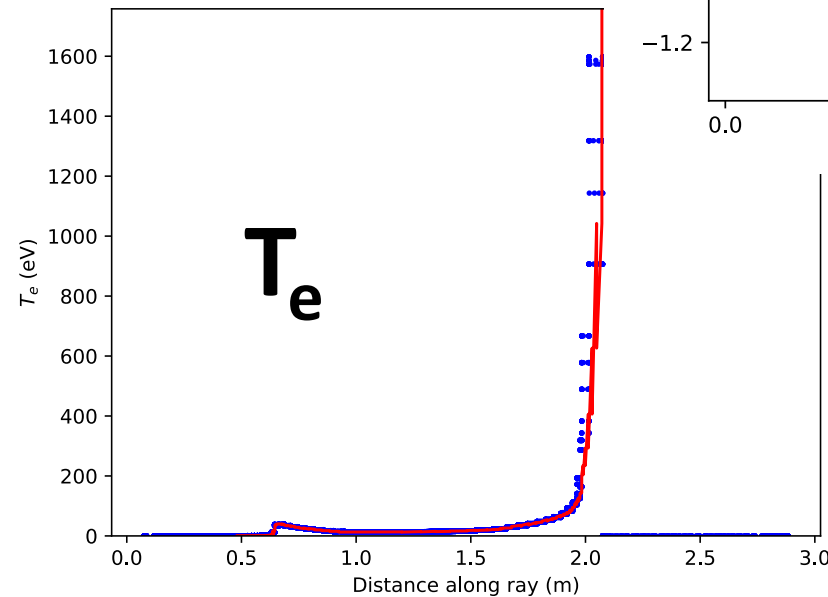
→ Problem: good main chamber plasma BUT unrealistic divertor plasma

→ Map SOLPS solution from same equilibrium onto EMC3-Eirene grid

i-ref-0003-1514-00g



➤ Bilinear interpolation at cell centres (scipy)

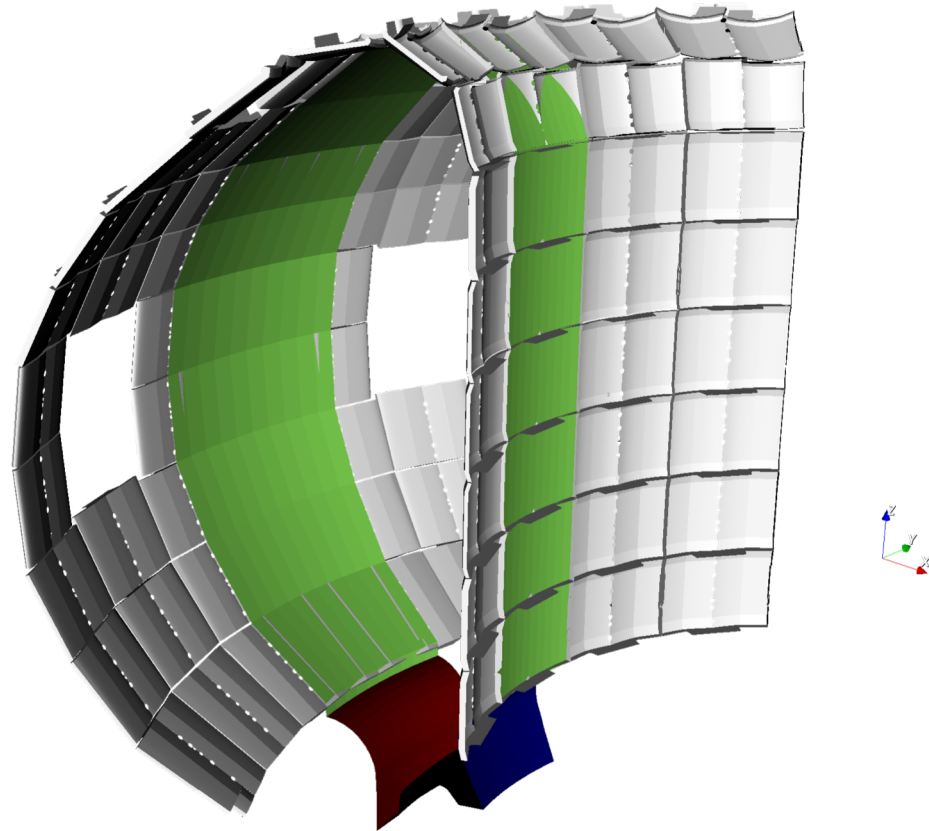


➤ Perfect match of background plasma after mapping

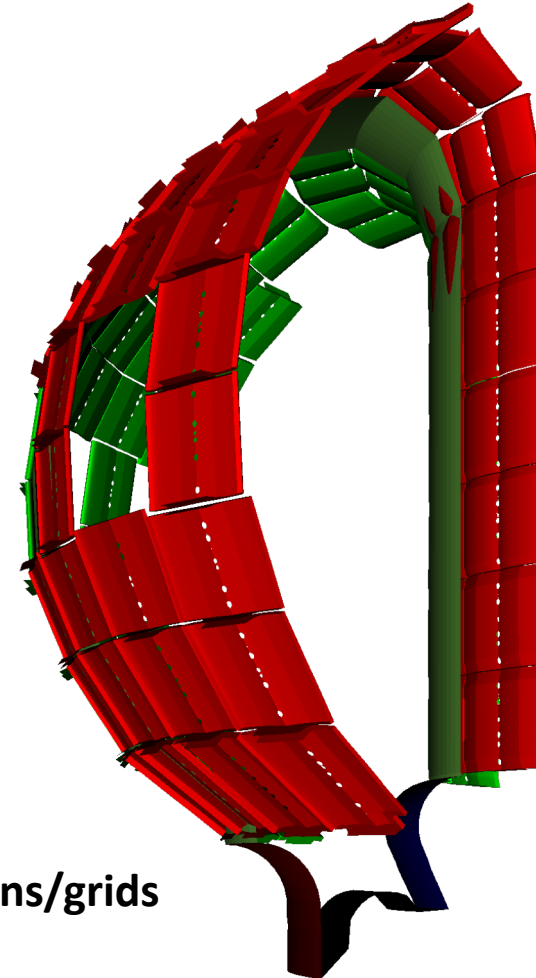
[1] Zhang W, et al, Nucl. Mat. and Energy 19 (2019) p. 364

WaIDYN3D modeling of the ITER “

❖ Generate a more accurate wall for EMC3



➤ In R, Z, Phi-space scaled wall elements with $R < 4.92$ m to move wall inward



→ Apex of 3D wall limiting elements now matches 2D DIVIMP wall

➤ HF-side wall is different than it was for DIVIMP cases

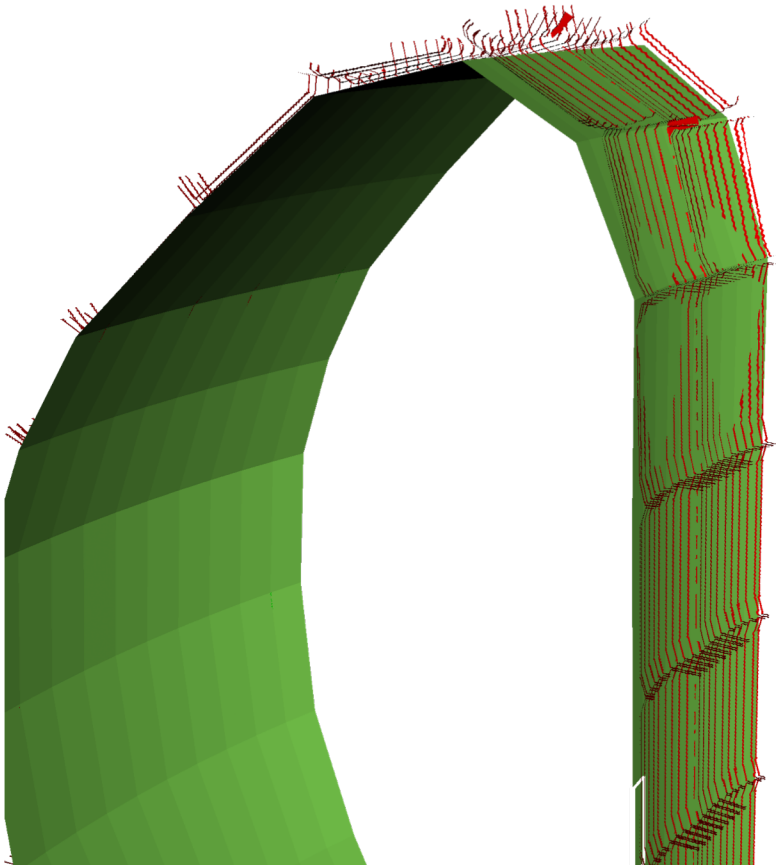
→ This wall is incompatible with existing plasma solutions/grids

❖ Generate an EMC3 wall representing the 3D wall

1.) Intersect 3D wall with poloidal planes in R,Z Space

2.) Clean up contours

3.) Generate EMC3 wall definition files

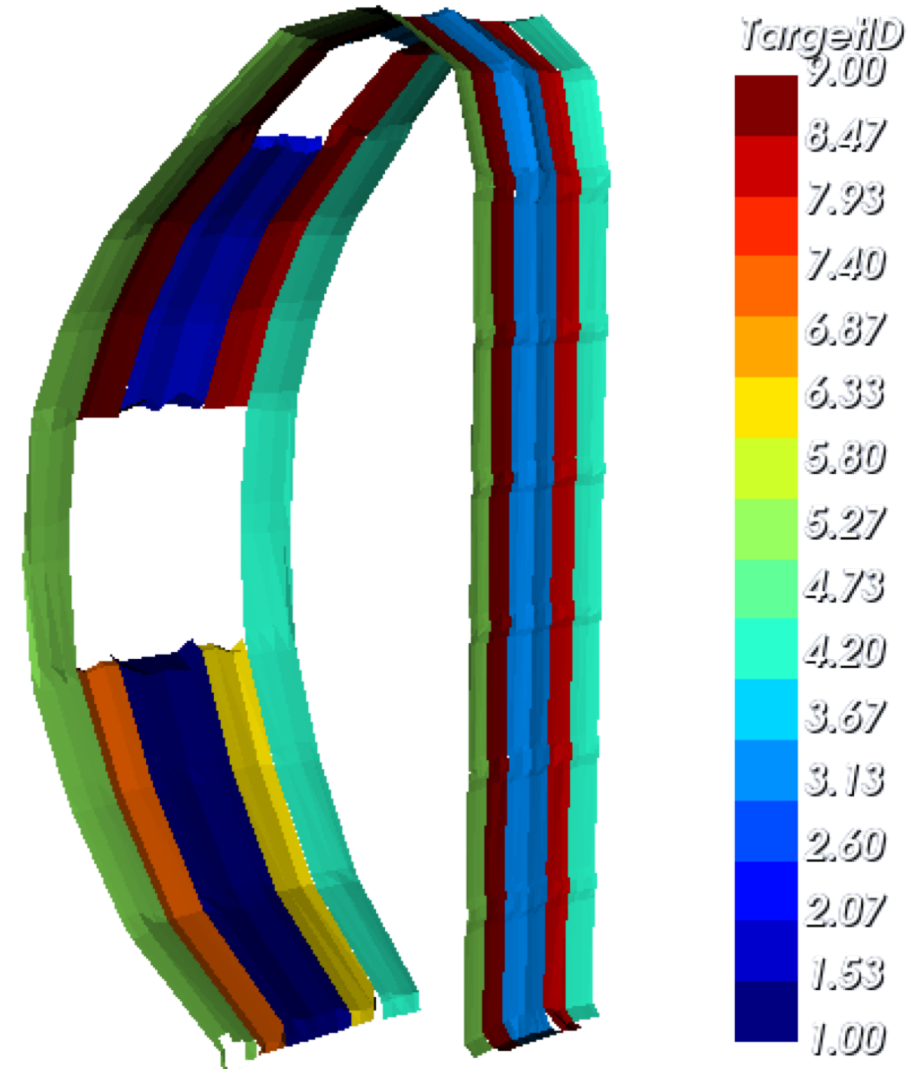


❖ New 3D wall for Wei Zhang’s ITER case

- WalIDYN can’t handle arbitrary number of wall elements so only a coarse approximation is achieved

❖ Next steps:

- “Clean up” wall geometry...
- Update the Wall/Grid intersection data
- Re-run EMC3?
 - Lack of volume recombination results in unrealistic divertor conditions
- Map SOLPS/OSM solution onto 3D grid?
 - Only run post processing for wall plasma



WaIDYN3D modeling for tungsten W7-X

❖ I have a W7X EMC3-Eirene based plasma

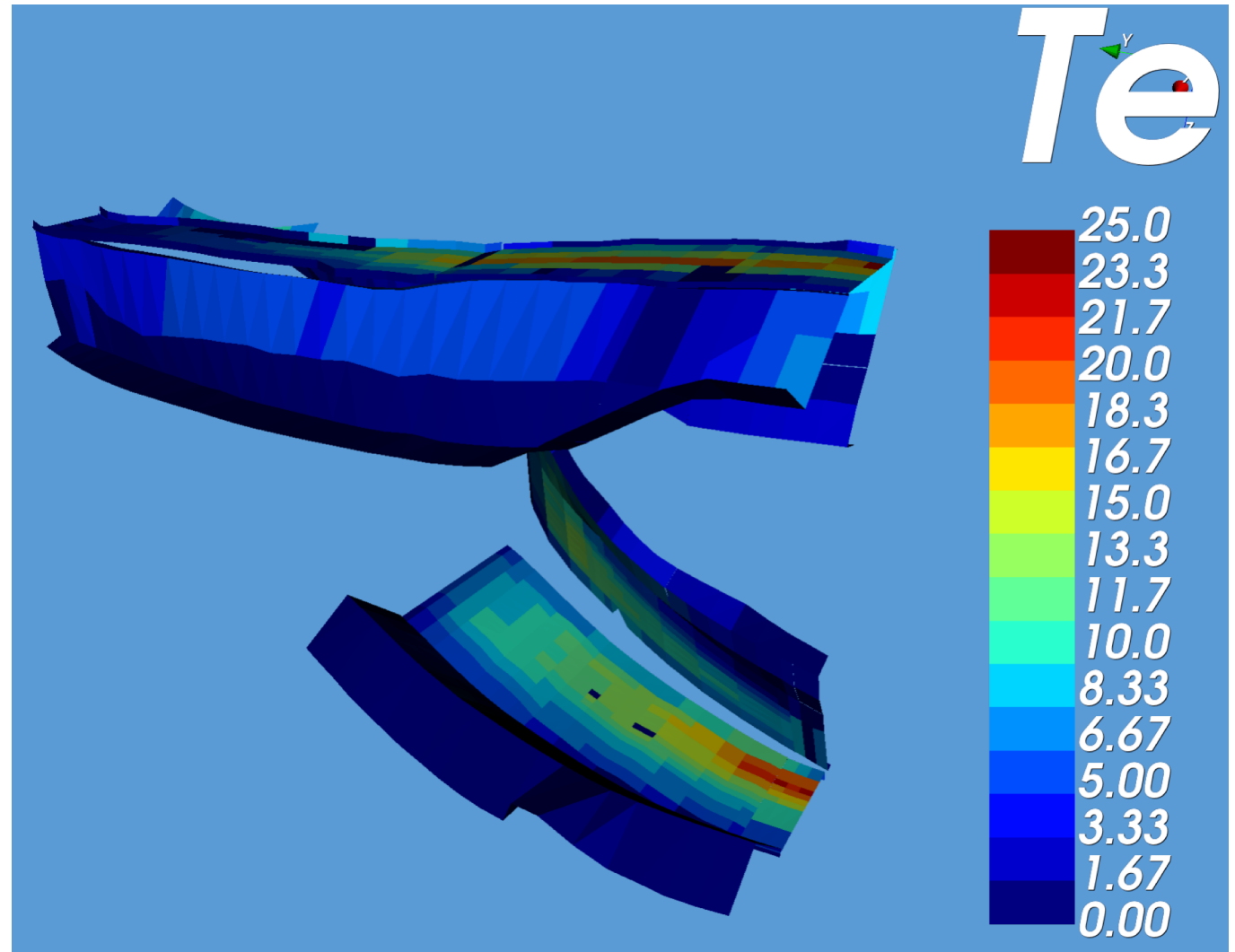
→ Change sputter yield database

→ Run WalIDYN3D



❖ Rather pointless operation

➤ Attached plasma with $T_e = 25\text{eV}$ is incompatible with W



- ❖ Need to adopt plasma solution/re-run EMC3-Eirene using:
 1. Change wall material in EIRENE to W
→ Different particle & energy reflection coefficient
 2. Increase D puff
→ Increase density and drop target T_e

- ❖ Either I do this or I use a background plasma already designed for W use by the W7X SOL modeling group

WallDYN(3D) is ready
As always the background plasma solutions are the bottle neck