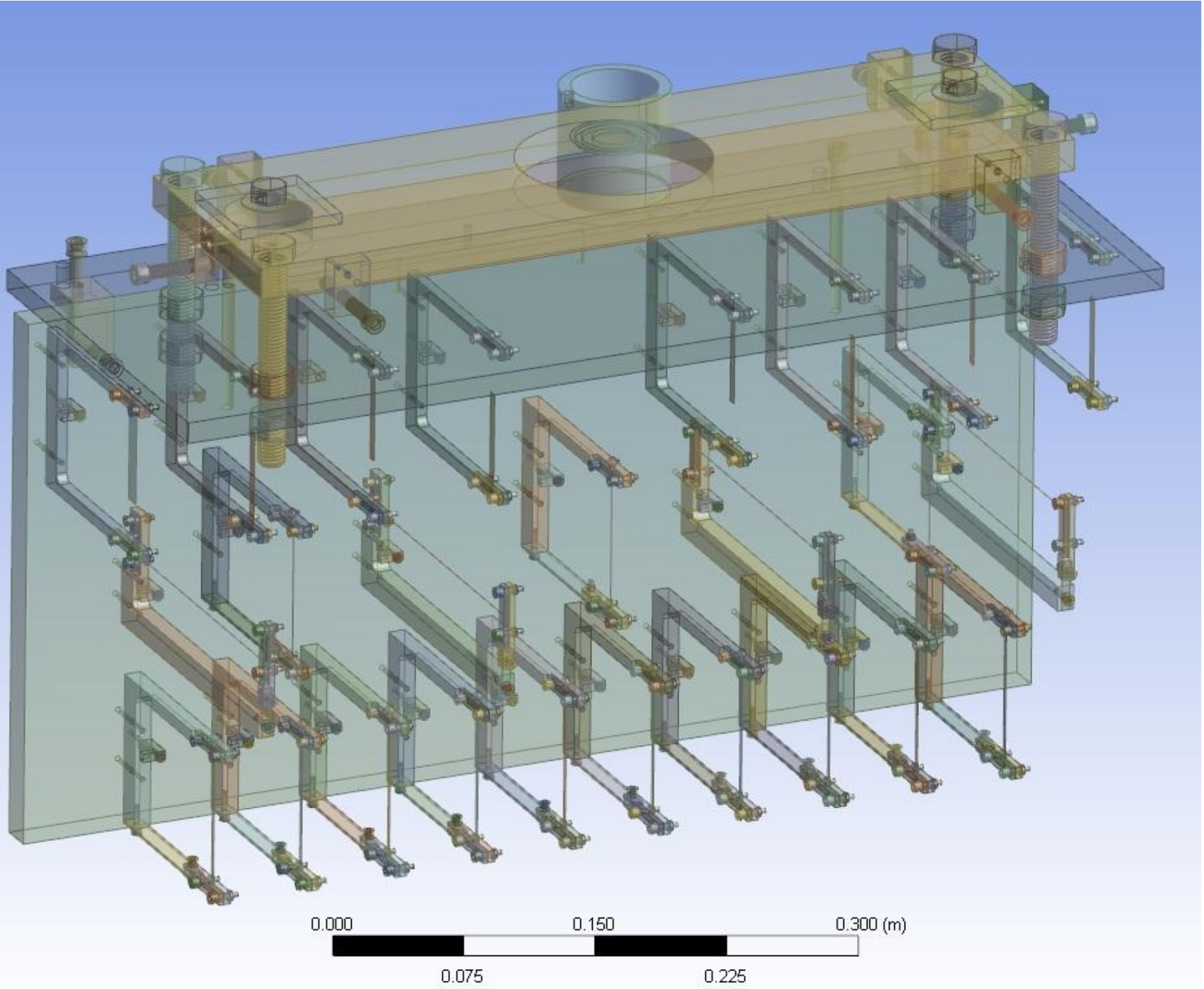
APEX Target Update

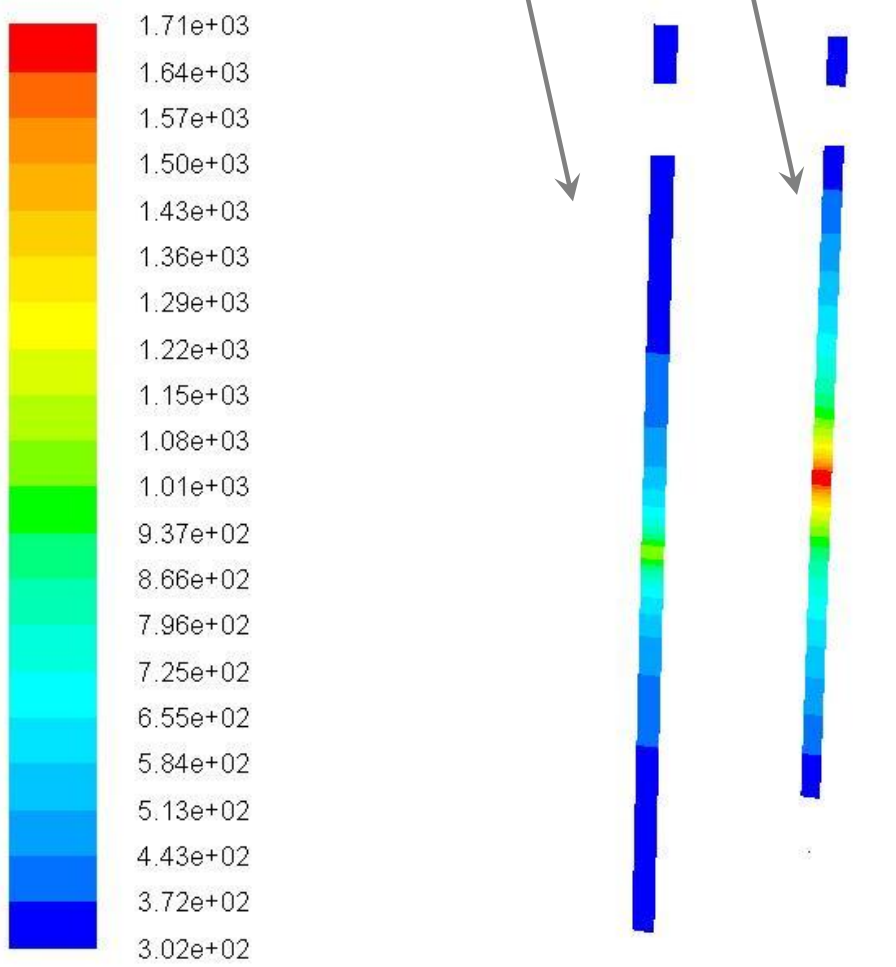
- On Jan 28 2015 there was a meeting with Robin W., Alan G., E. Folts, Bogdan W., Vladislav R. and I – we'll generate the 3D-CAD model of the inside the target chamber, Hall A eng responsible for modeling the target chamber on the beam line
- Mechanical designer, Vladislav Razmyslovich (Slava) started working on APEX target Feb 2015, integrating a 3D-CAD model of the target in its chamber.
- Slava noticed some interferences between various modeled parts, holes misaligned with bolts etc. – the model and some parts will need cleaning/remanufacturing (see next slide)
- The upper target chamber that Hall A would like to use for APEX does not have a CAD model. This chamber has other drawbacks (no cooling lines, mating flange needs working, 250 mm vertical travel etc.)
- Slava thinks we could use the Qweak target upper chamber for the APEX target (480 mm vertical travel, 90 mm horizontal travel, cooling lines), this has to be decided


0.000
0.150
0.300 (m)
0.075
0.225

APEX Target Thermal Analysis

- 3D model of W target finite element analysis with ANSYS-FLUENT 15
- From Marco O.: W is 99.9% pure, Al is 6061-T6 alloy
- Material properties vs temperature (cp, k) and constant density taken from MPDB (materials properties db)
- Electron beam at 40 μA, rastered at 2.5x2.5 mm^2 uniform heating, 2 W/tungsten ribbon
- Radiation and conduction included, radiation models used P1 and DO (discreet ordinates, no bands), outside radiation temperature assumed 300 K
- No cooling of the target assumed, all contacts assumed ideal/perfect
- W emissivity taken from MPDB, ~0.1 (ΔT max ~ 1700 K), but also considered 1 (ΔT max ~ 1100 K)
- Al absorption taken to be 0 (ΔT max ~ 5 K) or 0.2 (ΔT max ~ 35 K).
- The analysis was done in steady-state, but it could be done in transient mode (SLAC model gets T max ~ 1300 K in W at 40 μA, same raster)

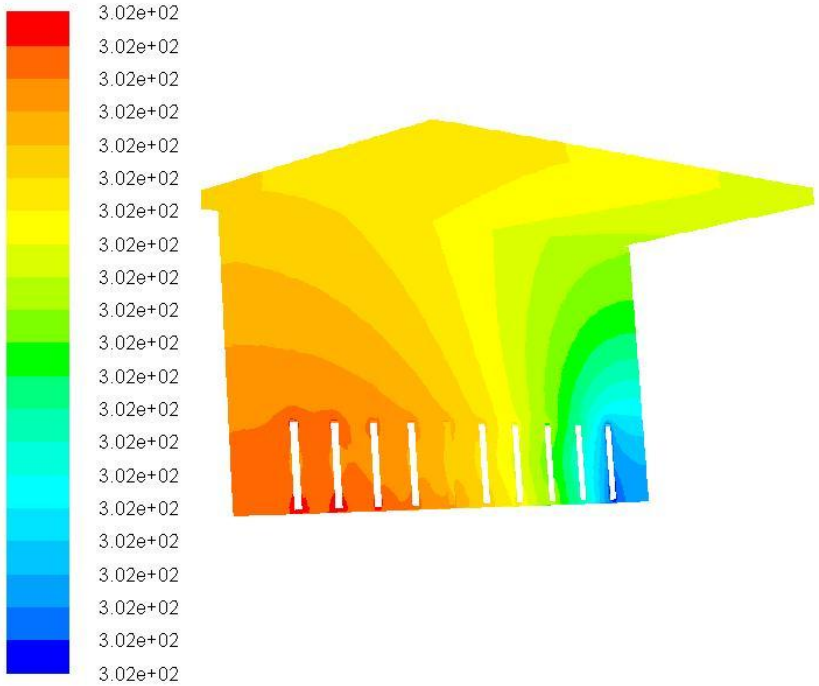
W ribbons with ε = 1 and ε = 0.1 respectively

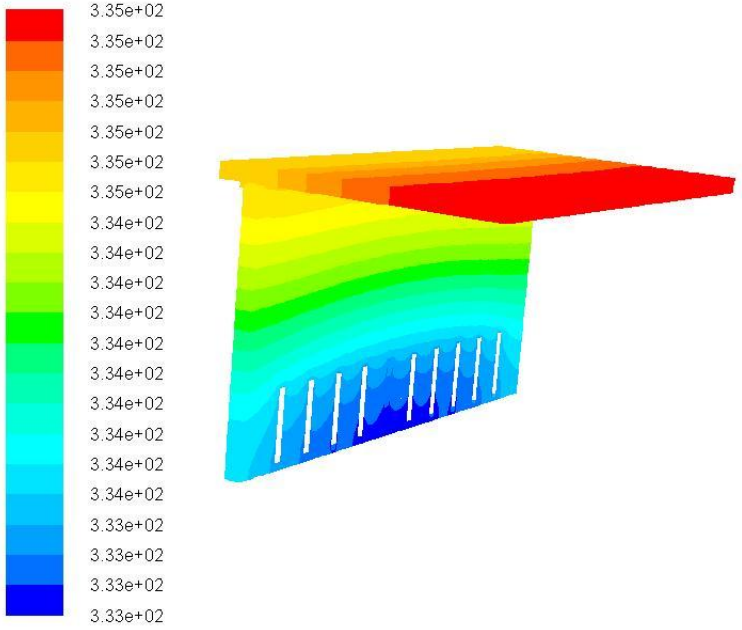


Contours of Static Temperature (k)

Feb 13, 2015
ANSYS Fluent 15.0 (3d, dp, pbns, lam)

Al-6061 target frame with 0 absorption in Al





Al-6061 target frame with 0.2 absorption in Al

Summary

- Thermal analysis: refine the radiation model, check the max beam current before cooling the target becomes mandatory
- CAD: clean up the model and see what parts have to be made and/or modified
- Test assembly the target, fiducialize, check alignment and alignment adjuster, put some temperature sensors on the target, do a thermal test/check of the assembled target
- Decide which target upper chamber to use
- JLab to decide if the target needs a readiness review or it will be folded into the experiment's readiness review

I still do not have a student to help out, this impacts progress on the target (I can fund the student)