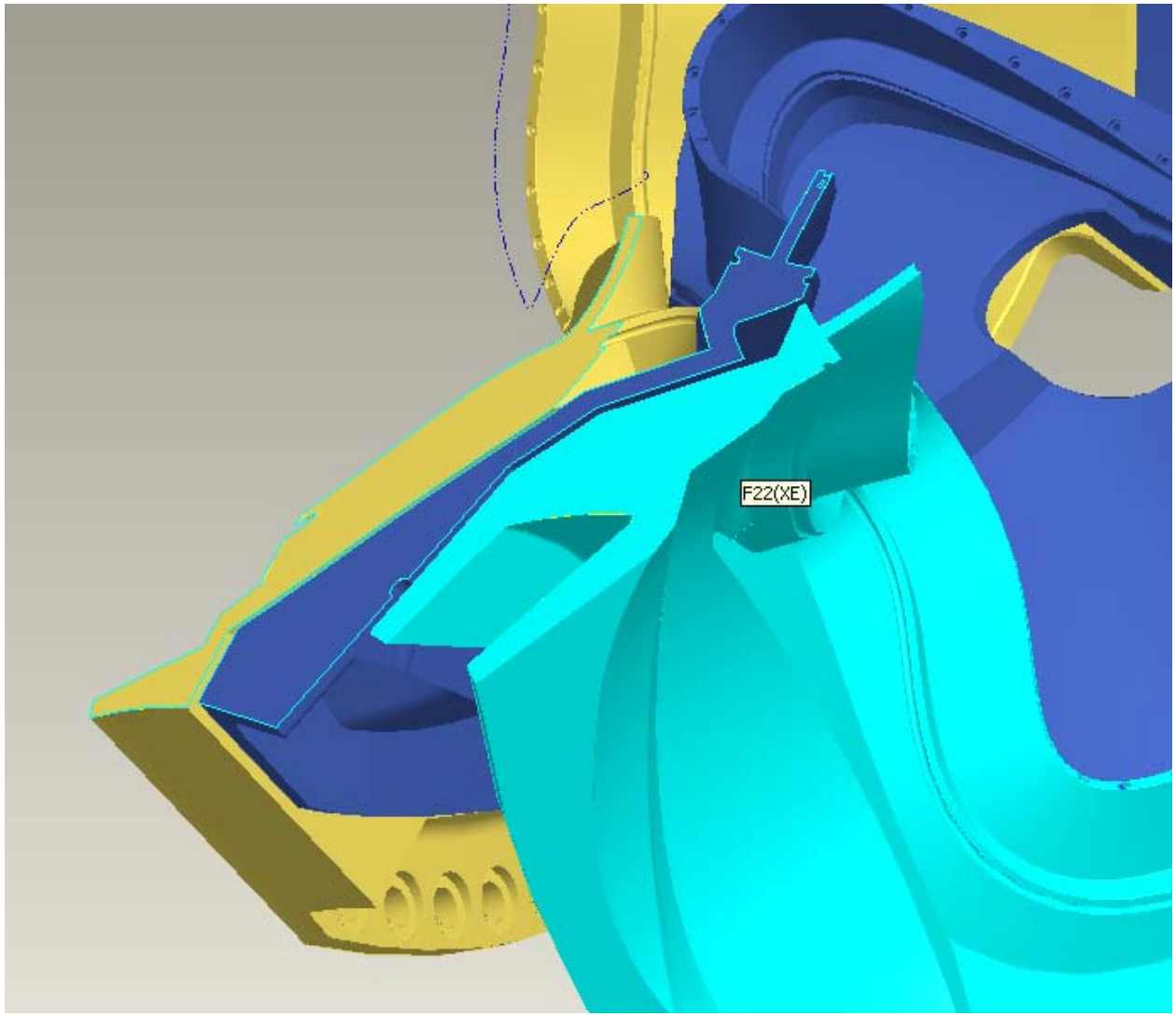
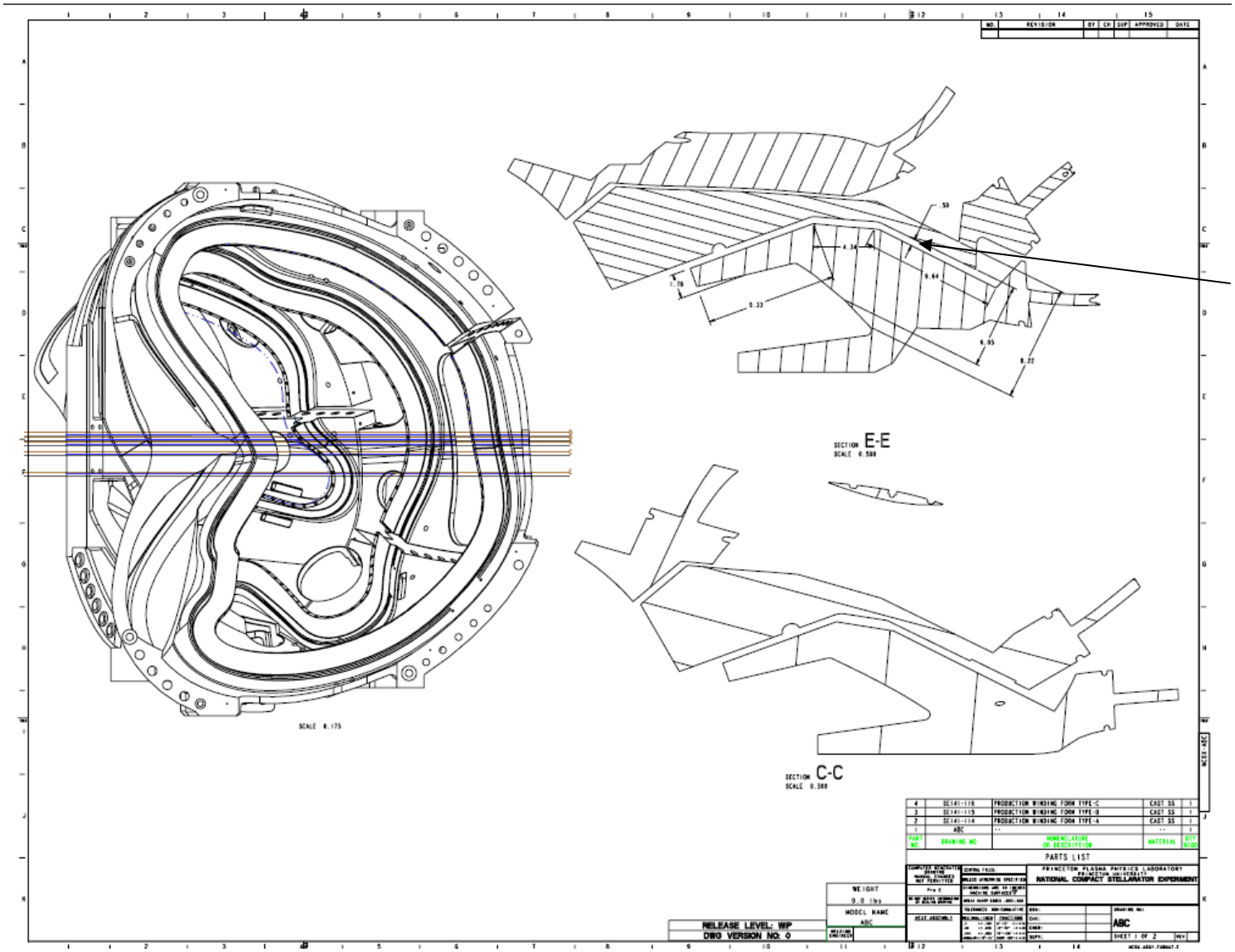
Adding material to Tee for thermal modeling

5-20-08

Determining a worst case cross section

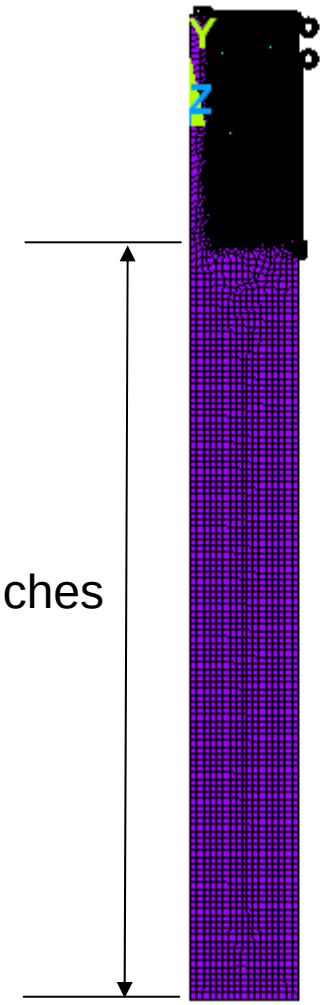


Determining a worst case cross section

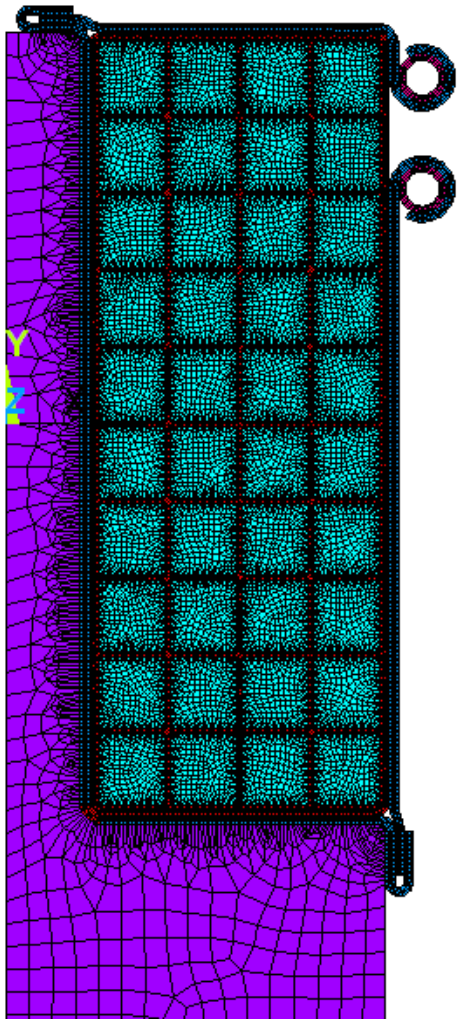


Approx 14 inches of length from the tee section to the edge of the back surface.

Updated FEA Model

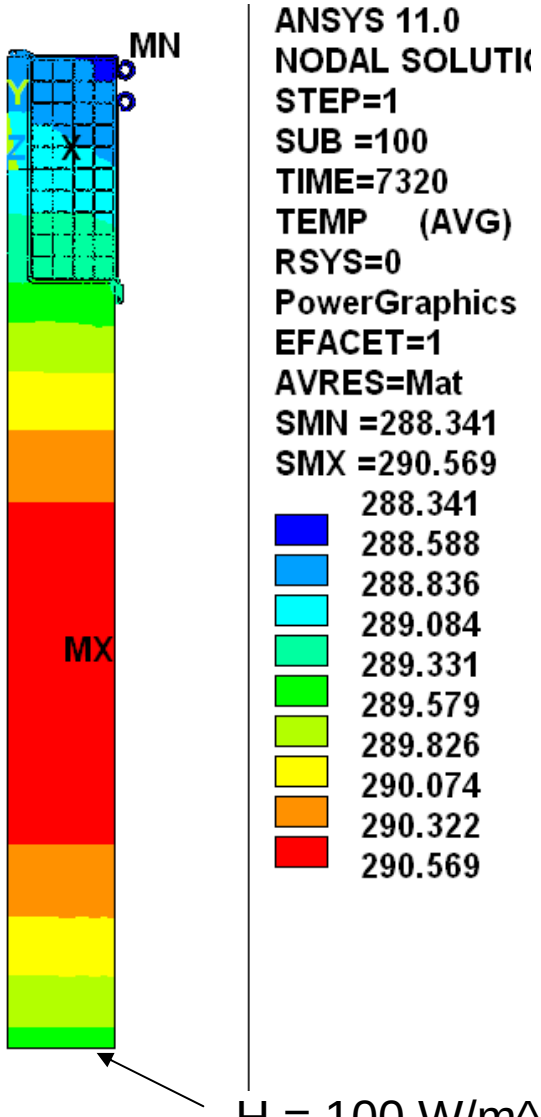


14 inches



Detail of mesh near Winding
(same as before)

Case 3: Added length after 2 hours



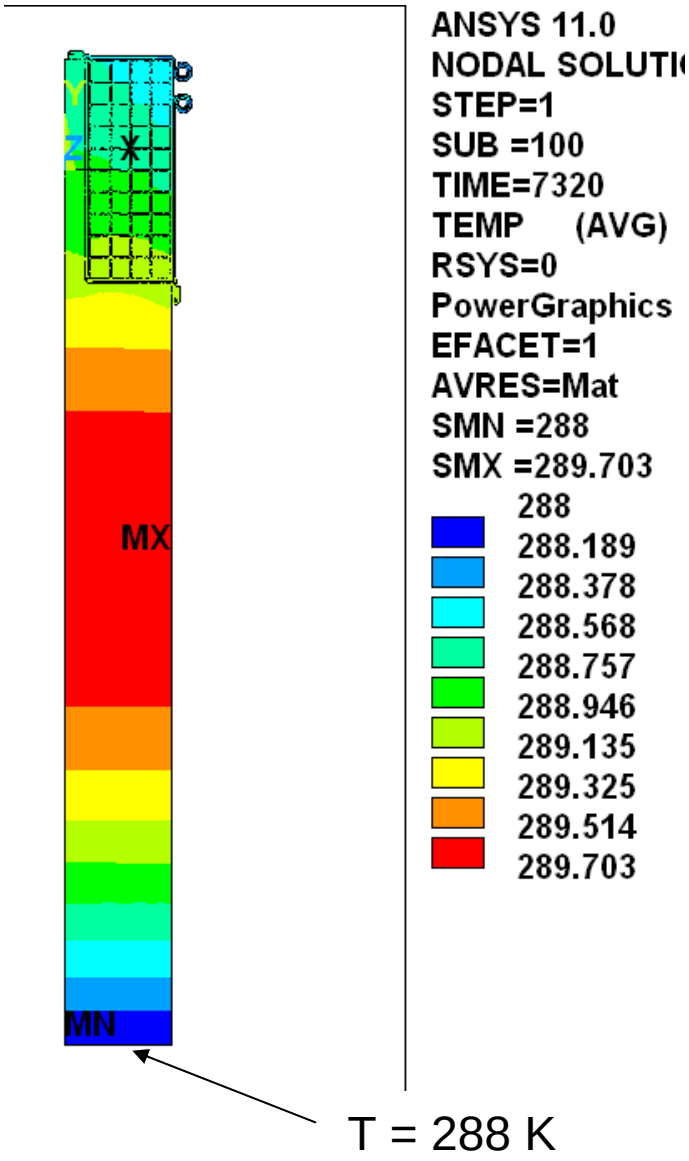
2 hours Cooling from room temperature to 288 K.

Lower Edge of model has convective cooling from cryostat of 100 W/m^2K

Cooling tubes : 0.08 W/cm^2, T = 288 K (initial temperature).

This Model Does not cool even with convection on the bottom.

Case 3: Added length after 2 hours



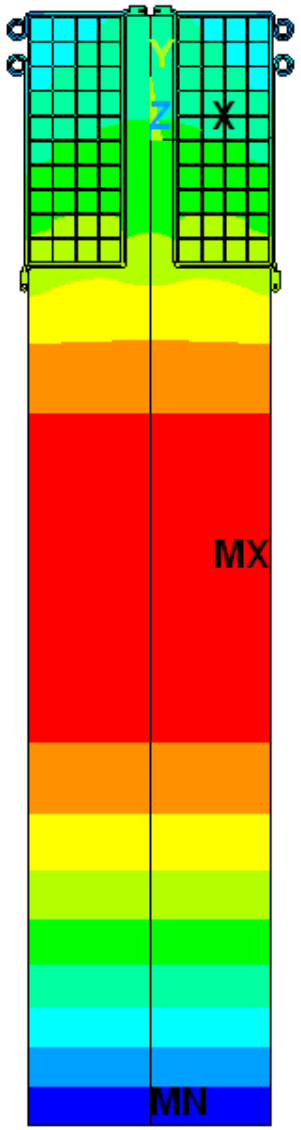
2 hours Cooling from room temperature to 288 K.

Lower Edge of model has Temperature set to 288 K.

Cooling tubes : 0.08 W/cm^2, T = 288 K (initial temperature).

This Model Does not cool even with a constant temperature set at the lower boundary.

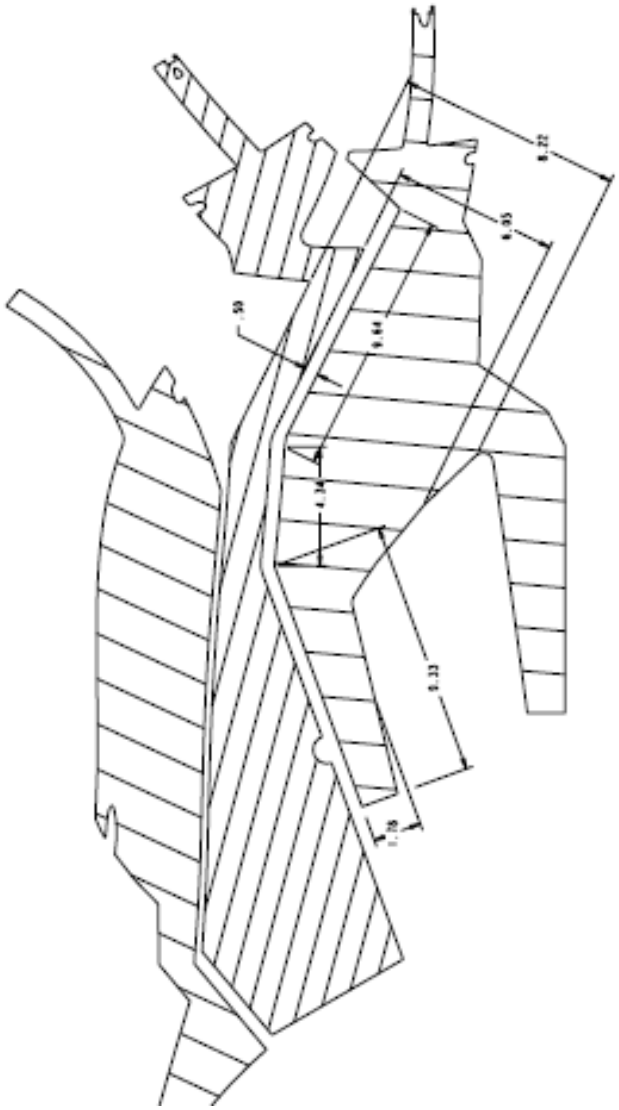
Accurate representation?



Symmetry expanded model

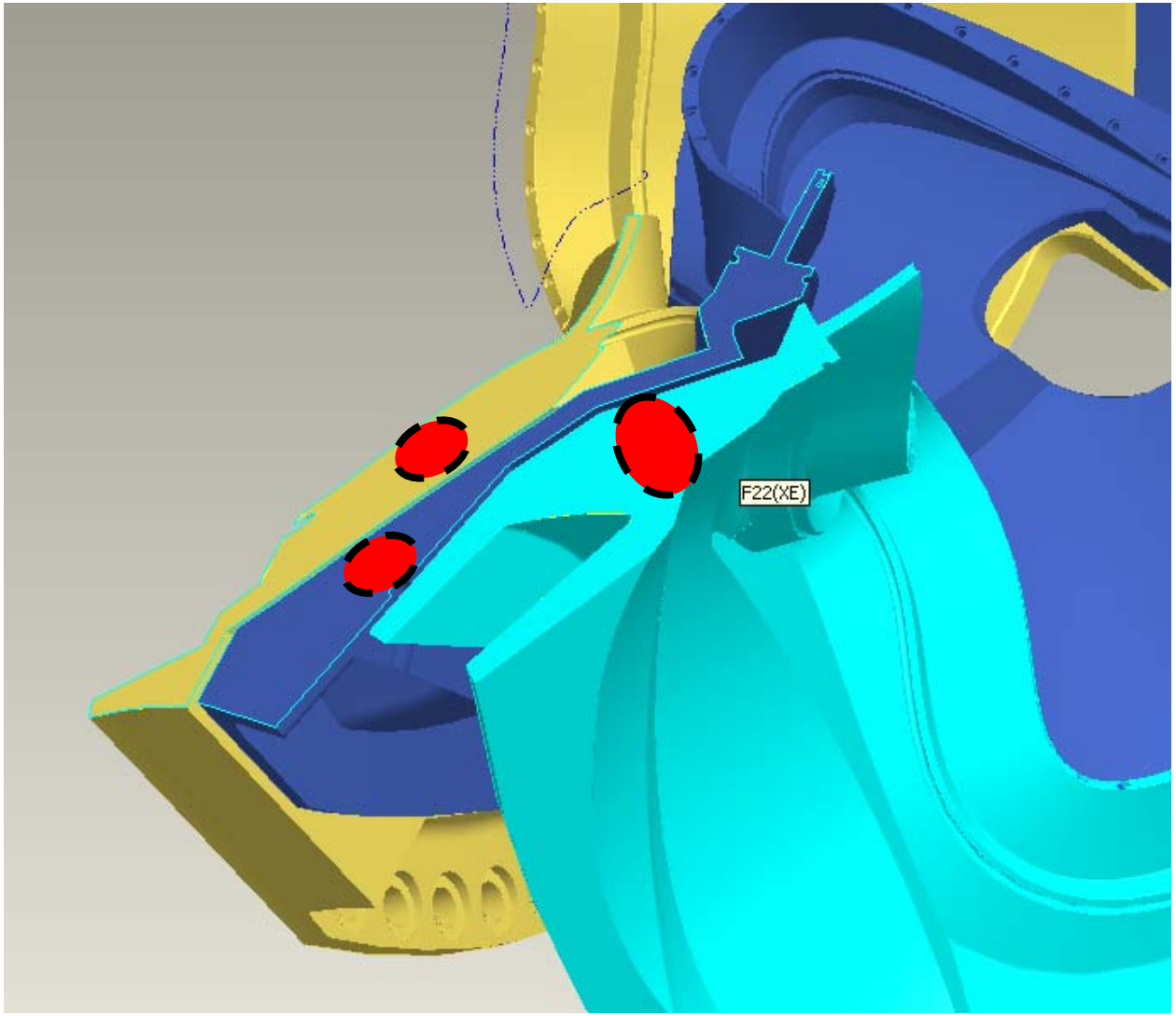
ANSYS 11.0
NODAL SOLUTION
STEP=1
SUB =100
TIME=7320
/EXPANDED
TEMP (AVG)
RSYS=0
PowerGraphics
EFACET=1
AVRES=Mat
SMN =288
SMX =289.703

288
288.189
288.378
288.568
288.757
288.946
289.135
289.325
289.514
289.703



Lengthwise cooling is also ignored here.

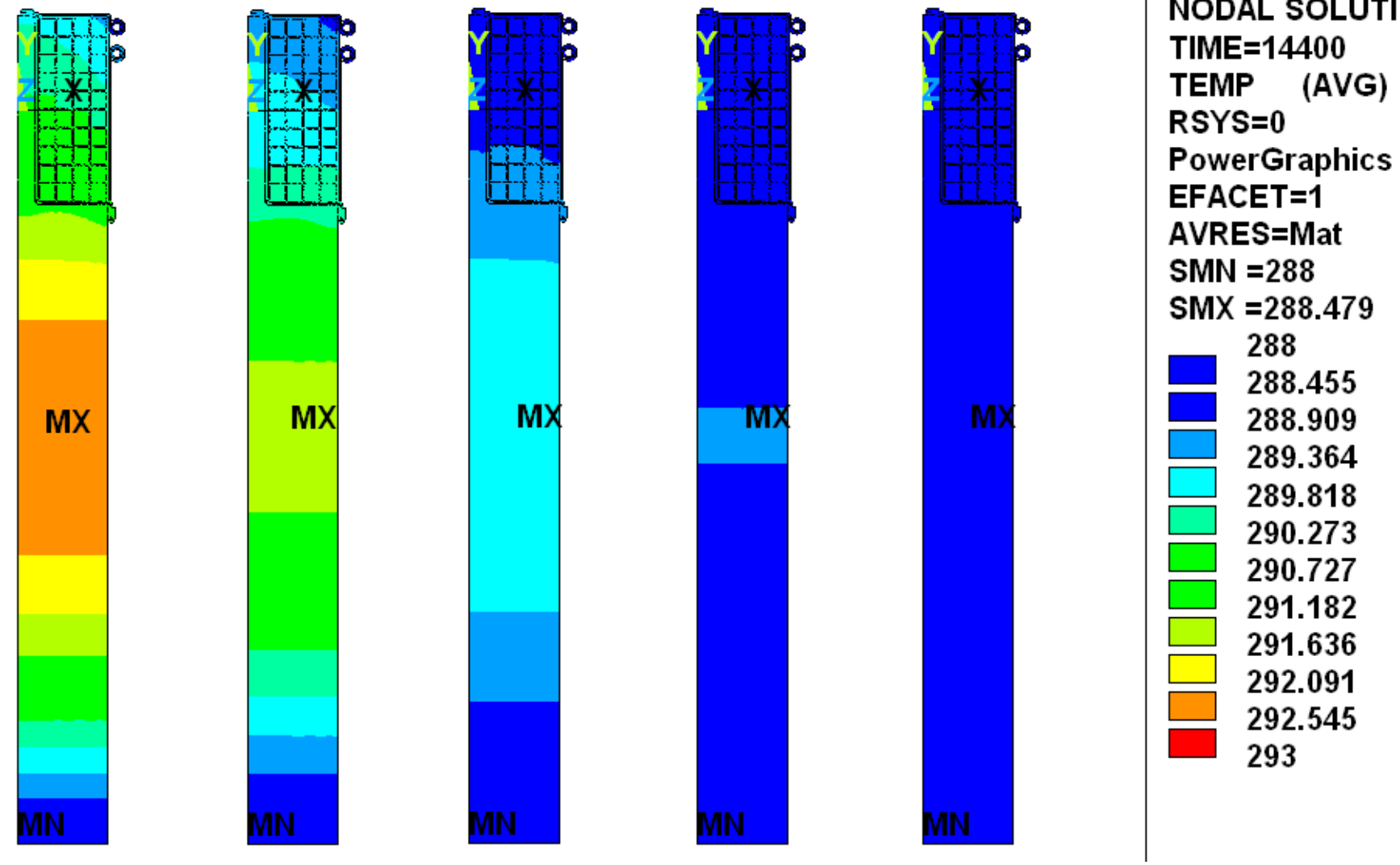
Implications



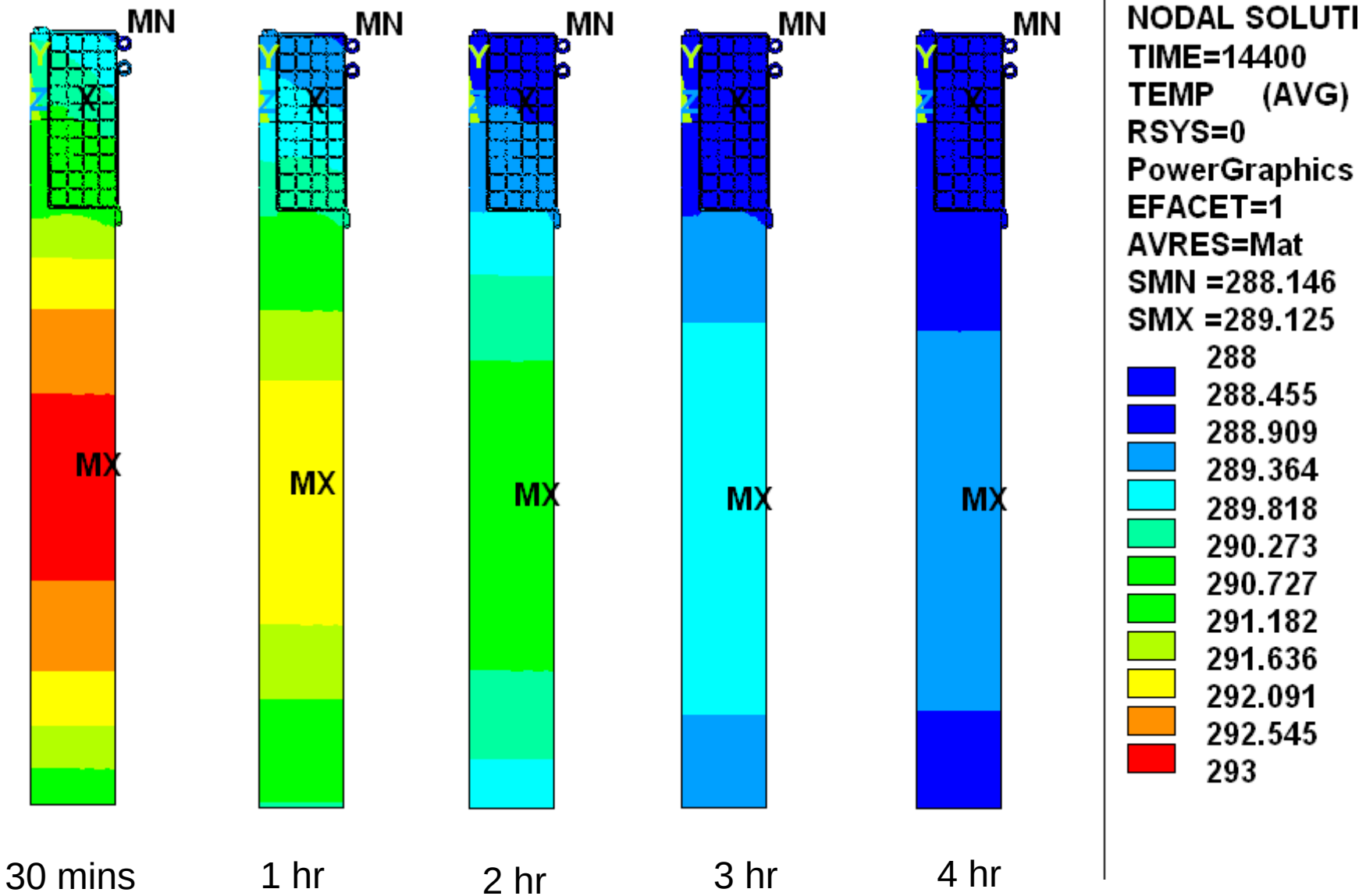
The vast majority of the coil has cross sections similar to those analyses in the last memo.

The wing regions are the outliers where hot zones may appear.

Time history profile with constant temperature on bottom

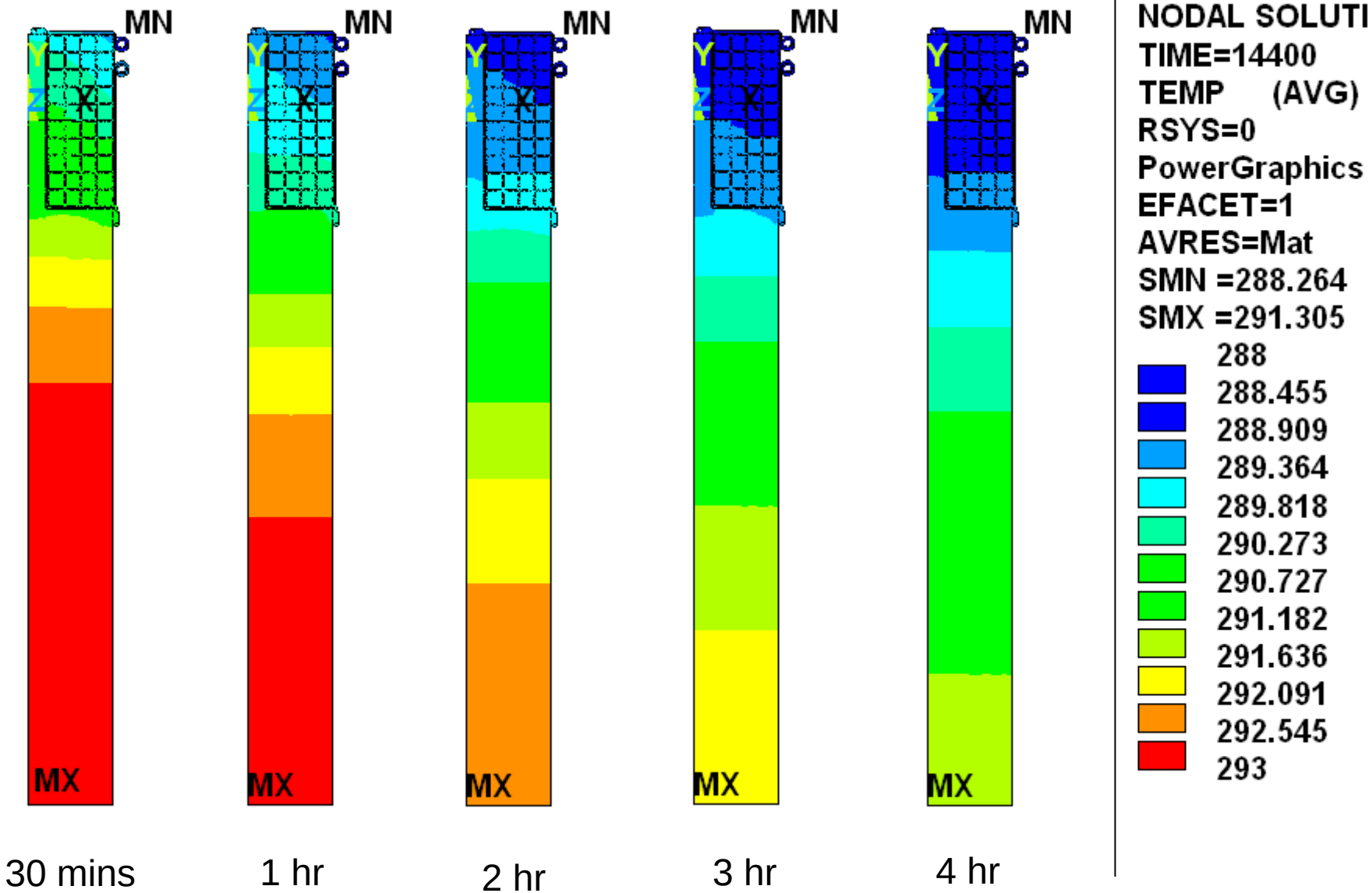


Time history profile with convection on bottom



30 mins 1 hr 2 hr 3 hr 4 hr

Time history profile with No convection or temperature on bottom

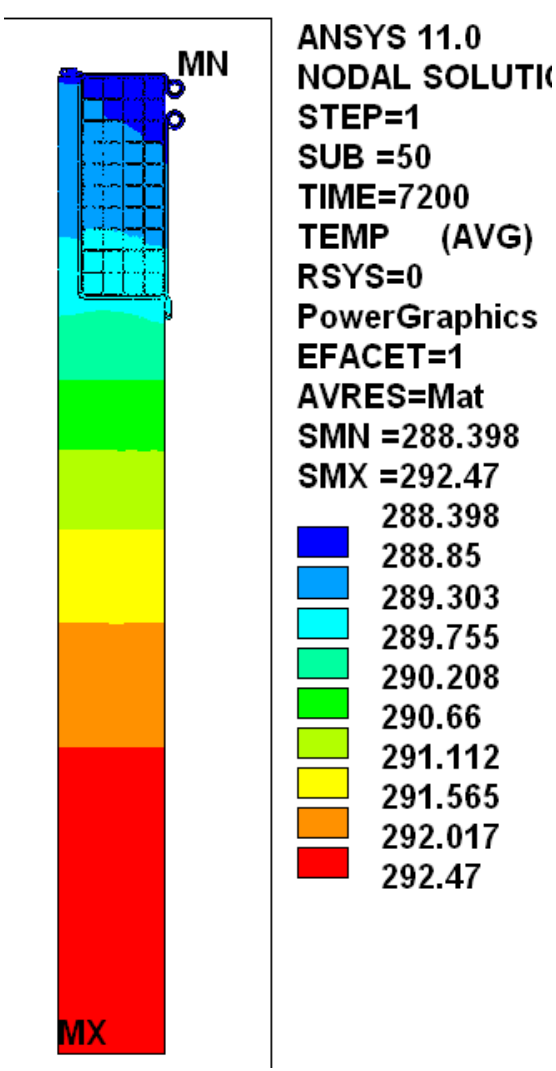


30 mins 1 hr 2 hr 3 hr 4 hr

Multiple Step Modeling

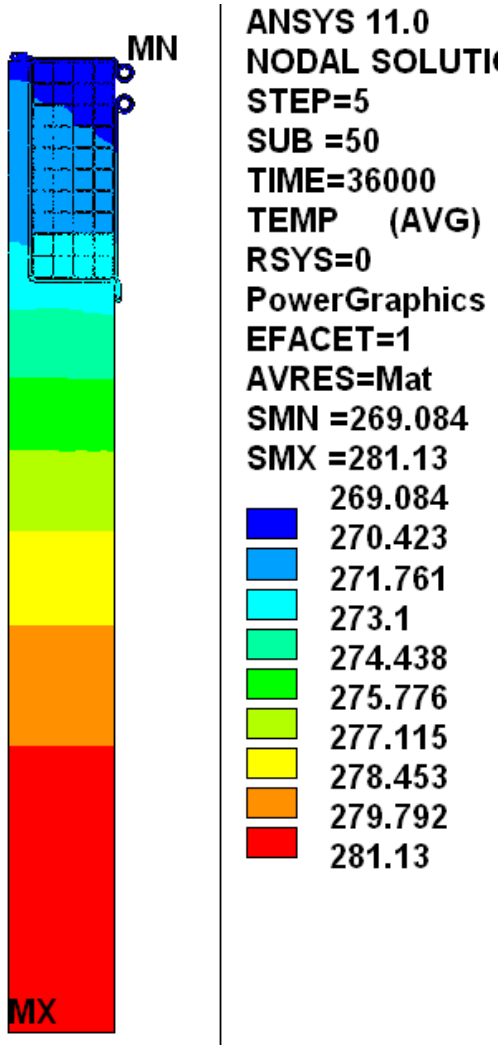
- New model cools for 2 hours at 5 degrees below set / initial value. ie) first step runs with gas at 293 – 5 K = 288 K second step runs with the gas at 283 K and so on.
- There is NO convective cooling or constant temperature on the bottom of this model

Time history of gas cooling through tubes



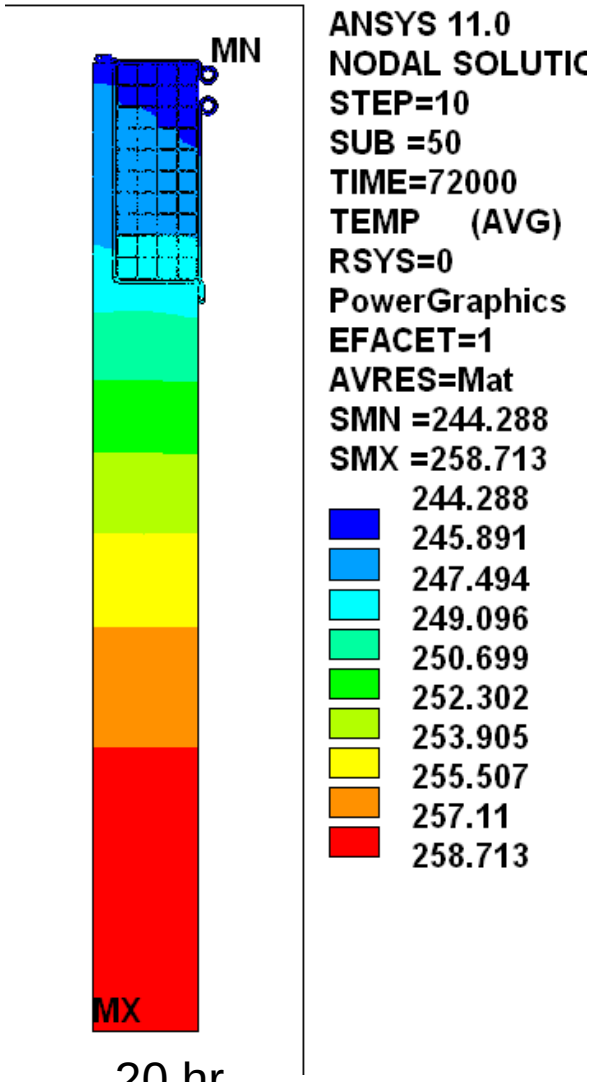
2 hr

4 degree gradient



10 hr

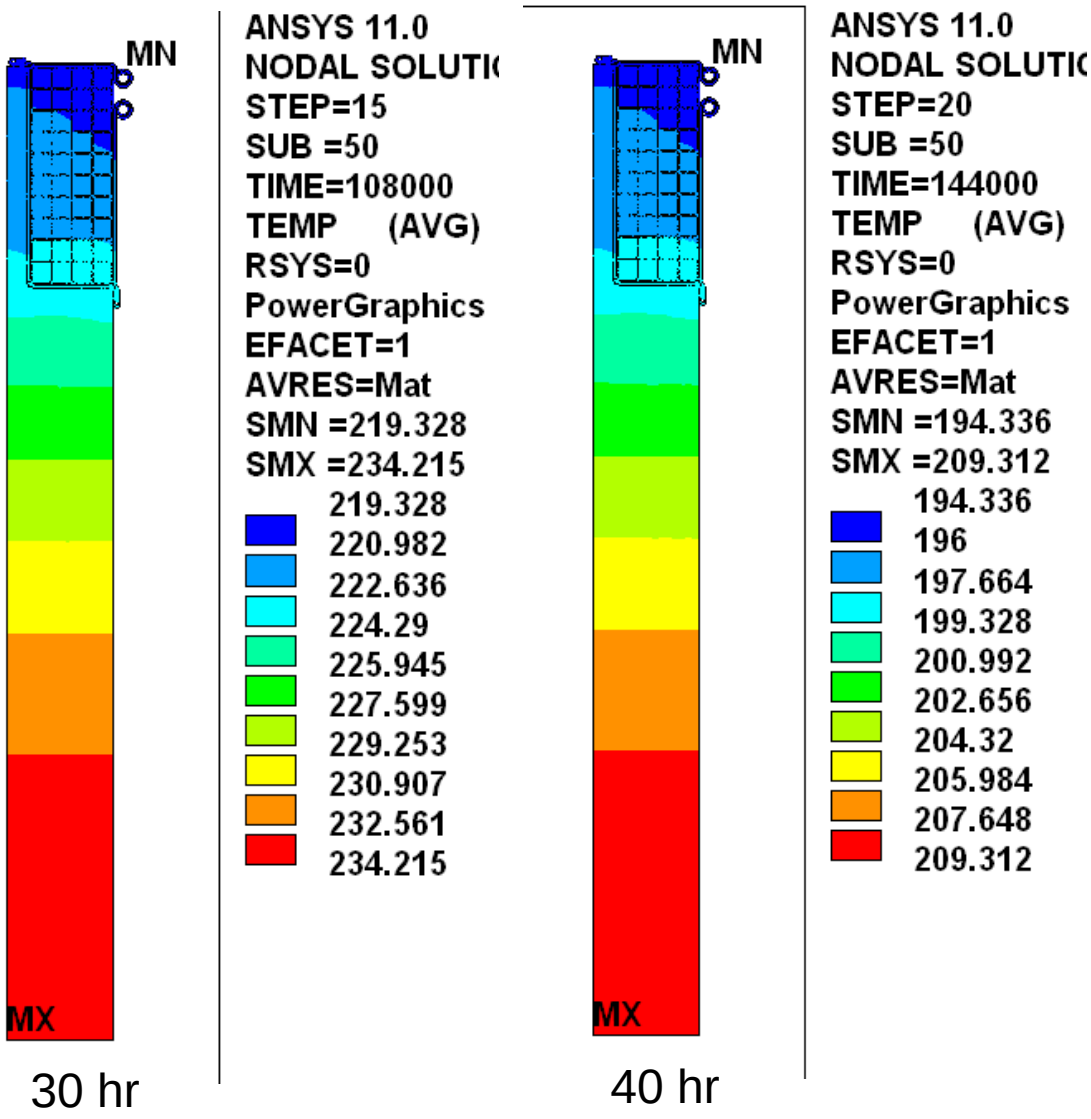
12 degree gradient



20 hr

14 degree gradient

Time history of gas cooling through tubes



30 hr

40 hr

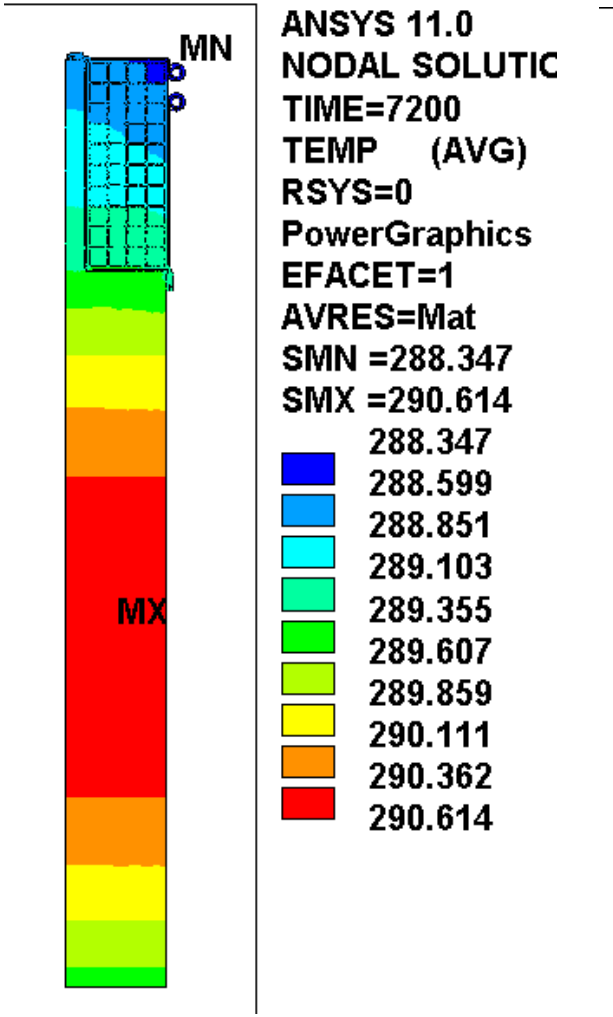
14.9 degree gradient

15 degree gradient

Cool-down with convection on bottom

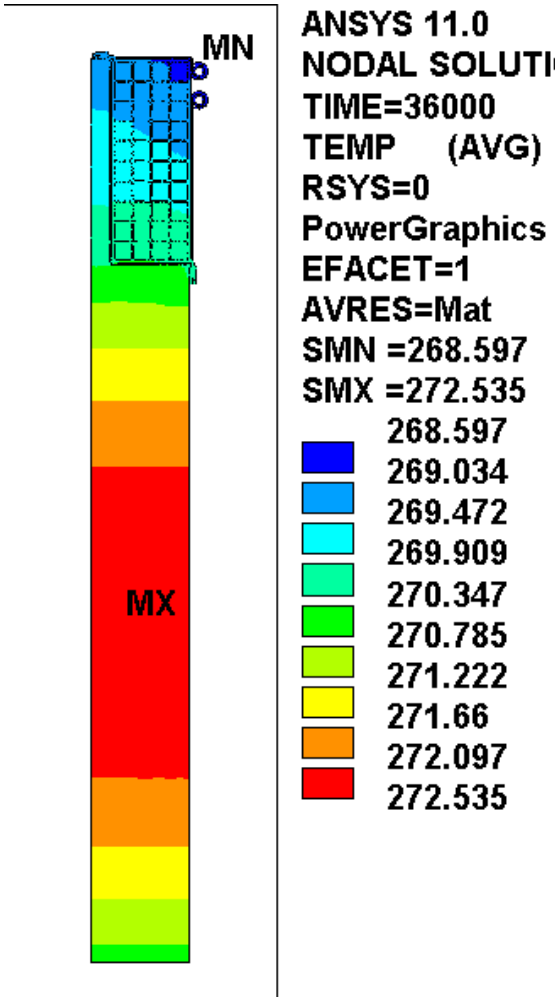
- Complete cool-down history of cross section of wing.

The entire cool-down with convective cooling on the lower edge.



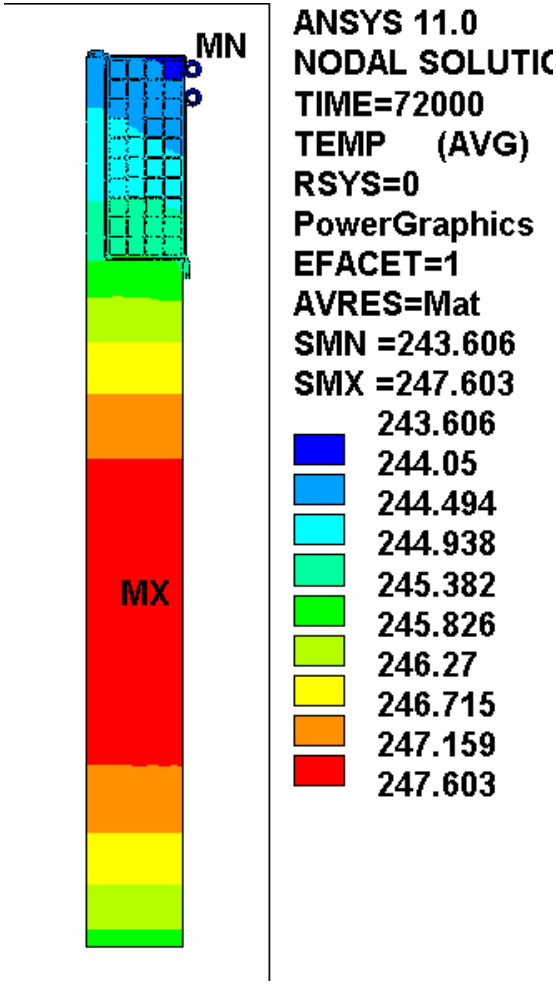
2 hr

2.3 degree gradient



10 hr

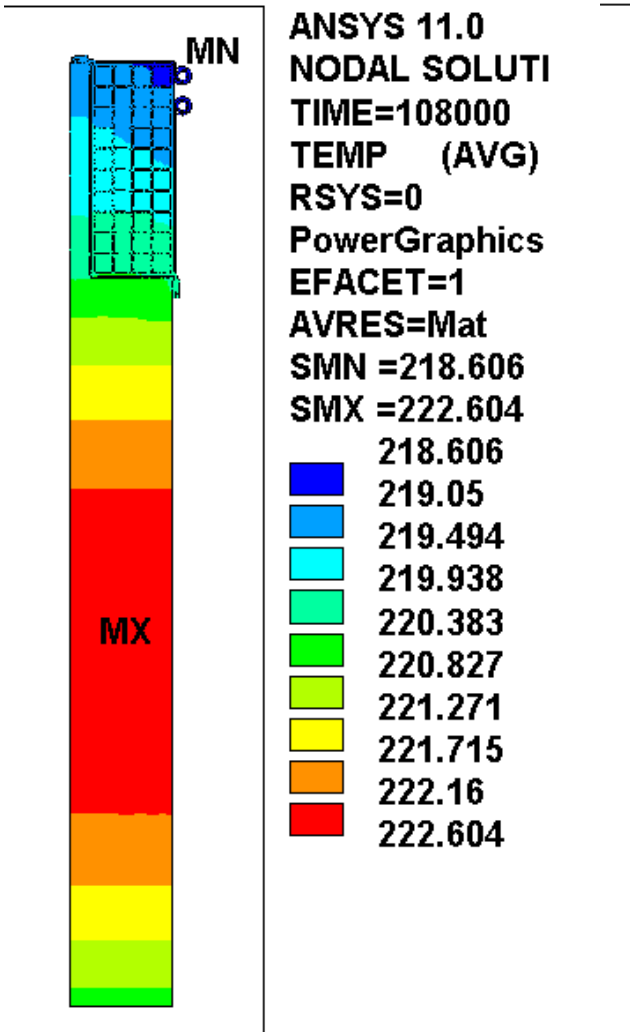
4 degree gradient



20 hr

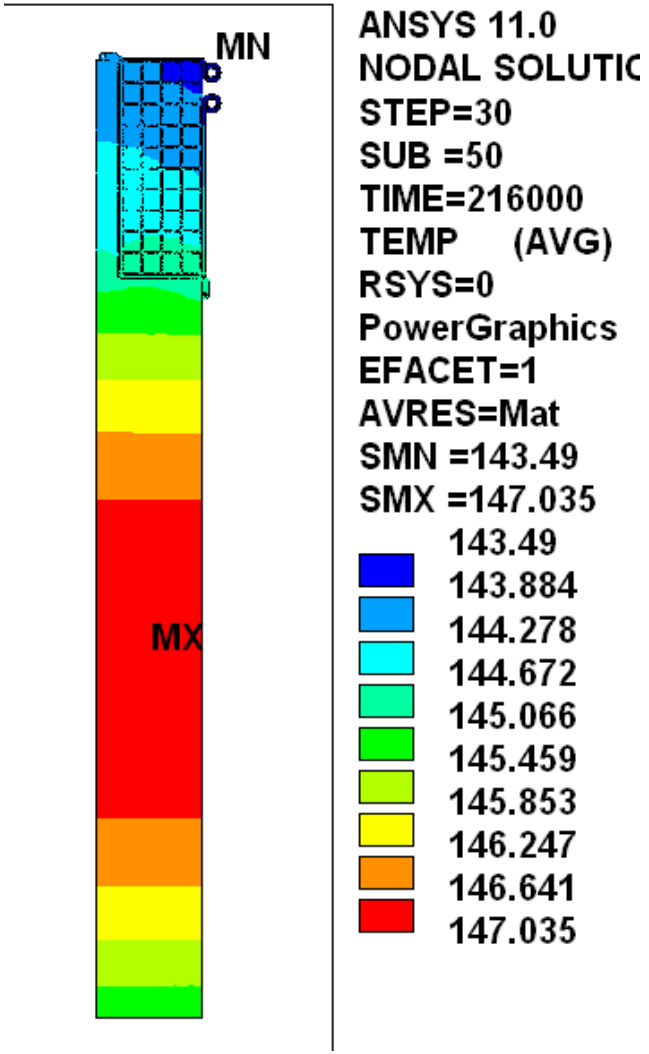
4 degree gradient

The entire cool-down with convective cooling on the lower edge.



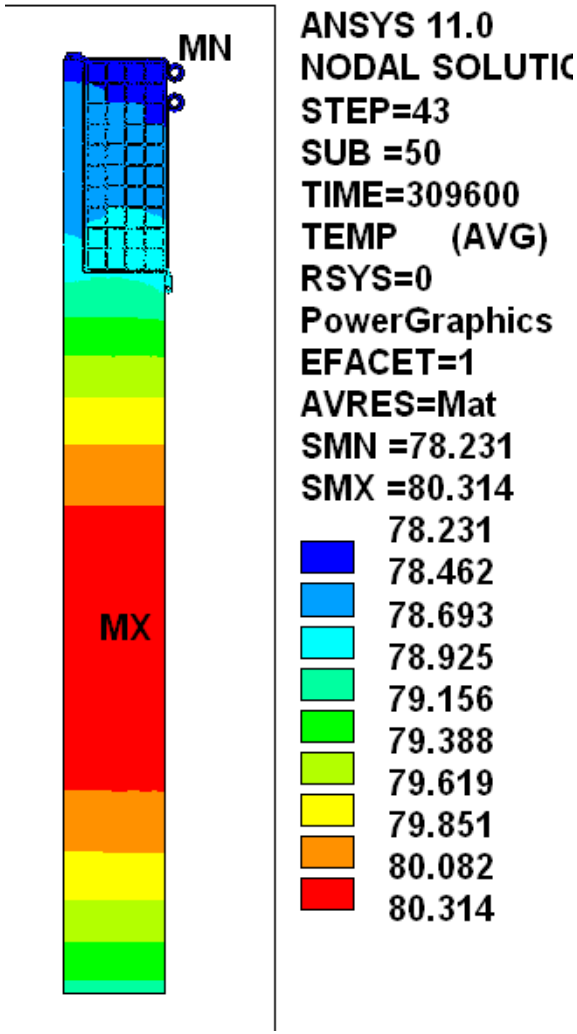
30 hr

4 degree gradient



60 hr

3.5 degree gradient



86 hr

2 degree gradient