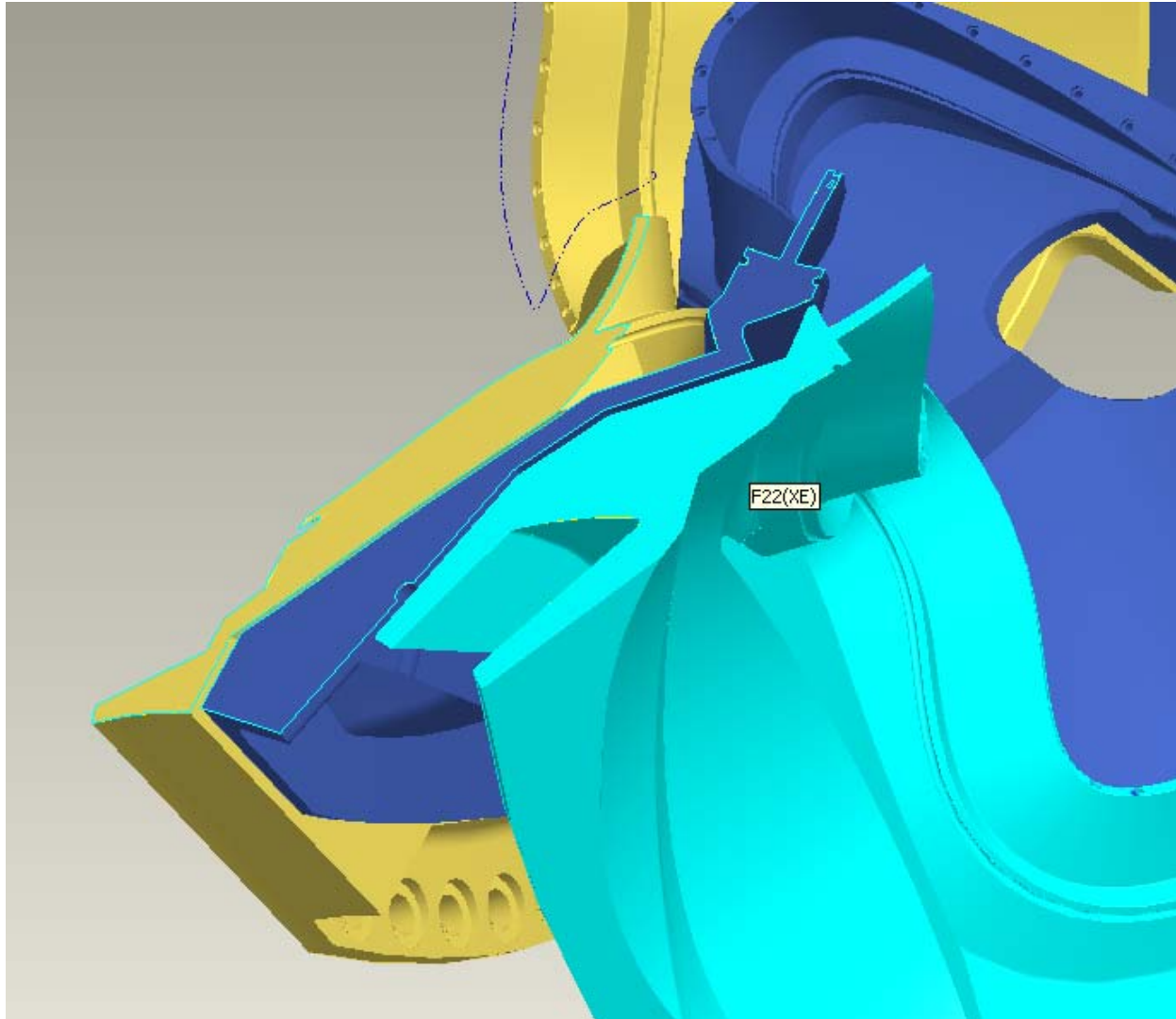


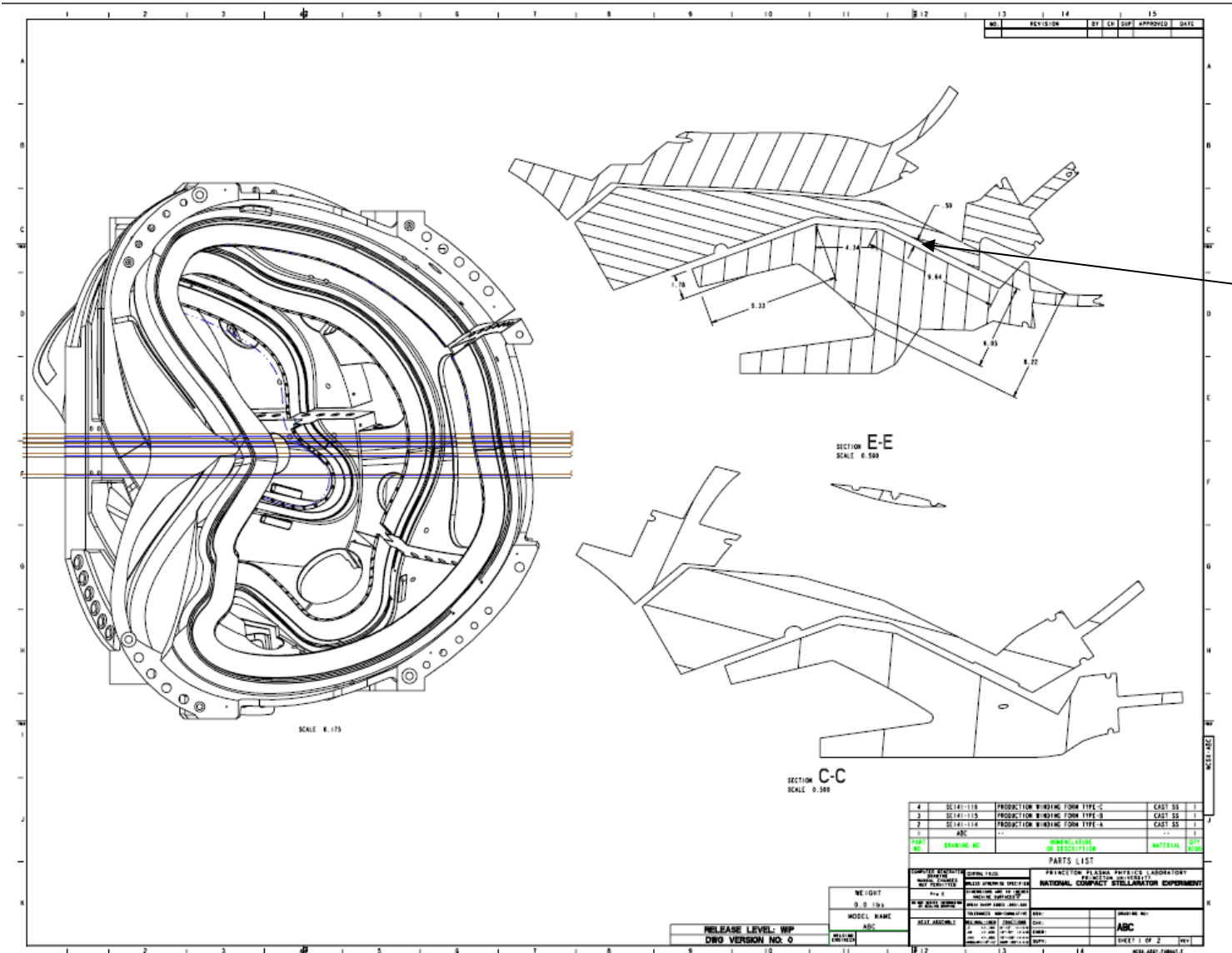
Adding material to Tee for thermal modeling

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.

REV	REV'S	BY	CHK	APP'D	DATE
4	SEI41-119	PRODUCTION WINDING FORM TYPE C		CAS	SS
3	SEI41-119	PRODUCTION WINDING FORM TYPE B		CAS	SS
2	SEI41-119	PRODUCTION WINDING FORM TYPE A		CAS	SS
1	ABC				

PART NO.	DRAWING NO.	MANUFACTURE OR SECTION	MATERIAL	CITY

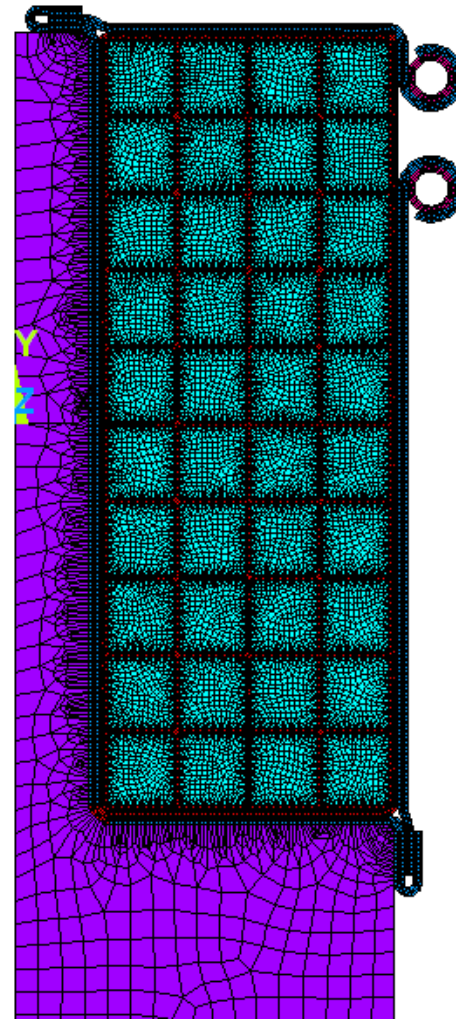
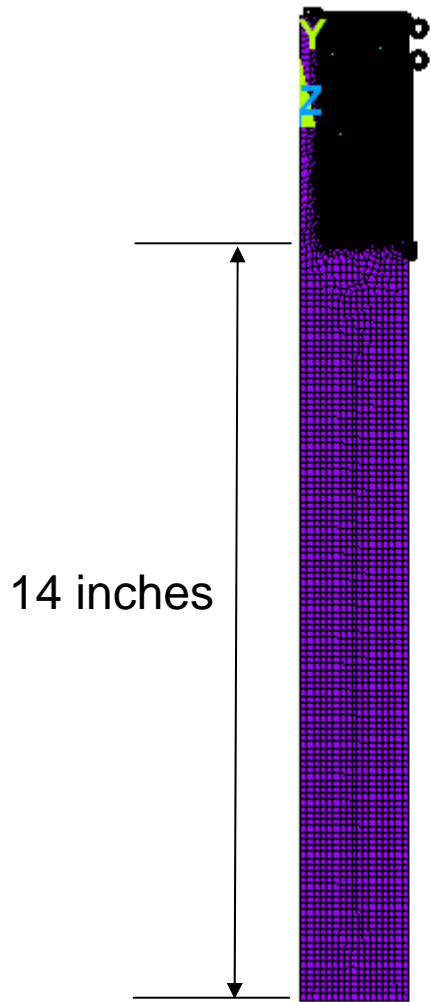
COMPANY IDENTIFICATION	PROJECT	PRINCIPAL INVESTIGATOR
PRINCETON PLASMA PHYSICS LABORATORY		

WEIGHT	MODEL NAME	RELEASE LEVEL
0.0 100	ABC	WIP

DATE	BY	CHK	APP'D

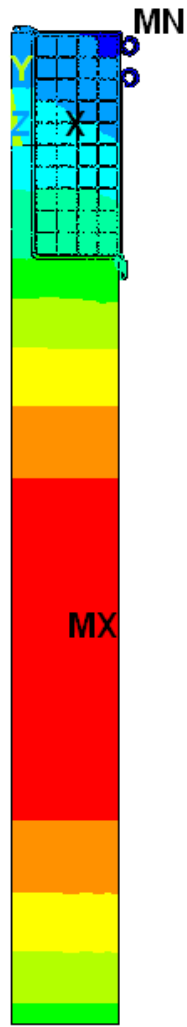
RELEASE LEVEL: WIP
DWO VERSION NO. 0

Updated FEA Model

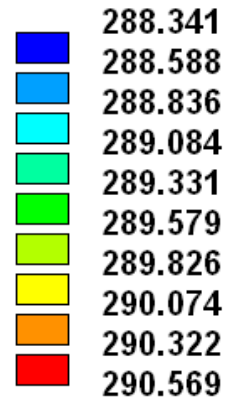


Detail of mesh near Winding
(same as before)

Case 3: Added length after 2 hours



ANSYS 11.0
NODAL SOLUTK
STEP=1
SUB =100
TIME=7320
TEMP (AVG)
RSYS=0
PowerGraphics
EFACET=1
AVRES=Mat
SMN =288.341
SMX =290.569



2 hours Cooling from room temperature to 288 K.

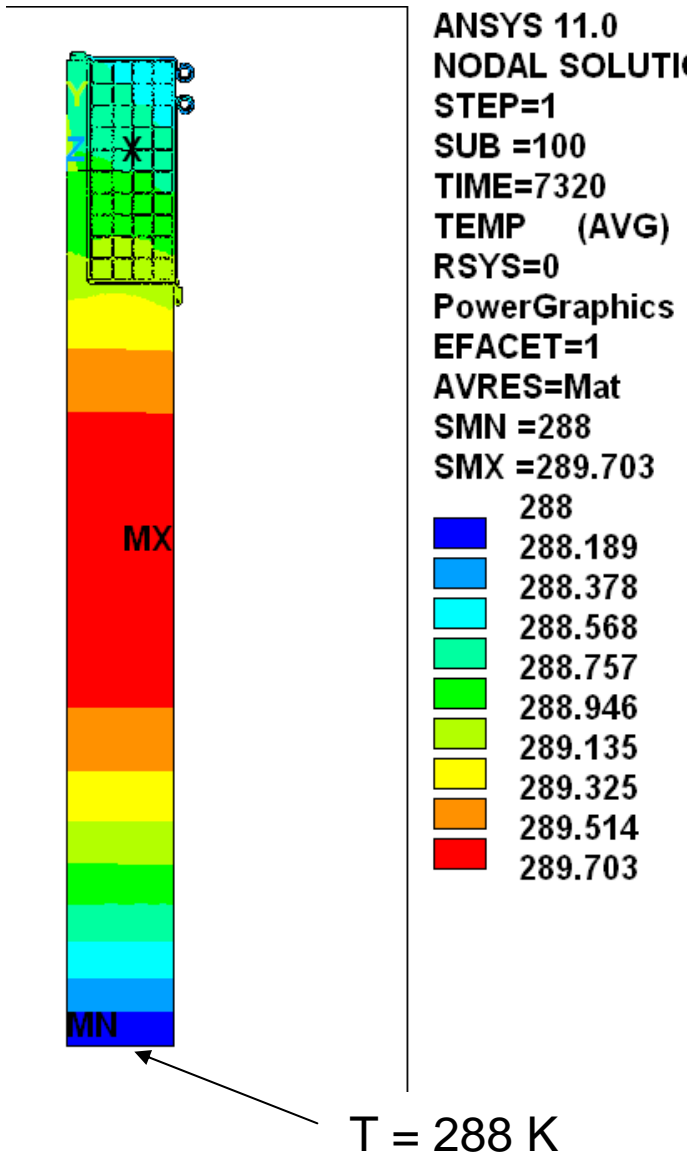
Lower Edge of model has convective cooling from cryostat of $100 \text{ W/m}^2\text{K}$

Cooling tubes : 0.08 W/cm^2 , $T = 288 \text{ K}$ (initial temperature).

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

$H = 100 \text{ W/m}^2$ at 288 K

Case 3: Added length after 2 hours



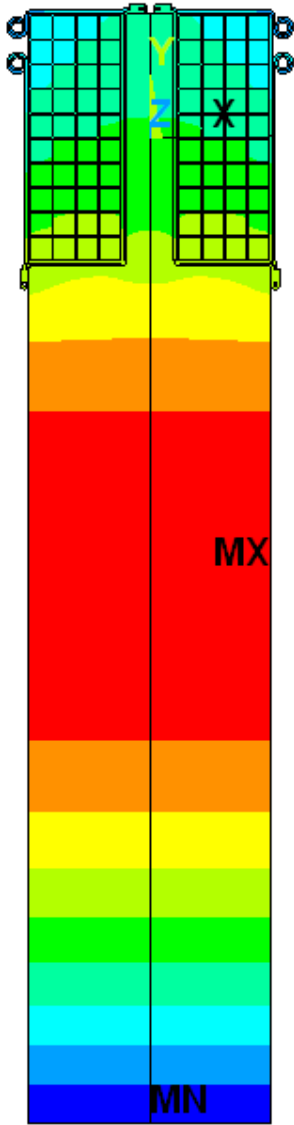
2 hours Cooling from room temperature to 288 K.

Lower Edge of model has Temperature set to 288 K.

Cooling tubes : 0.08 W/cm^2 , $T = 288 \text{ K}$ (initial temperature).

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

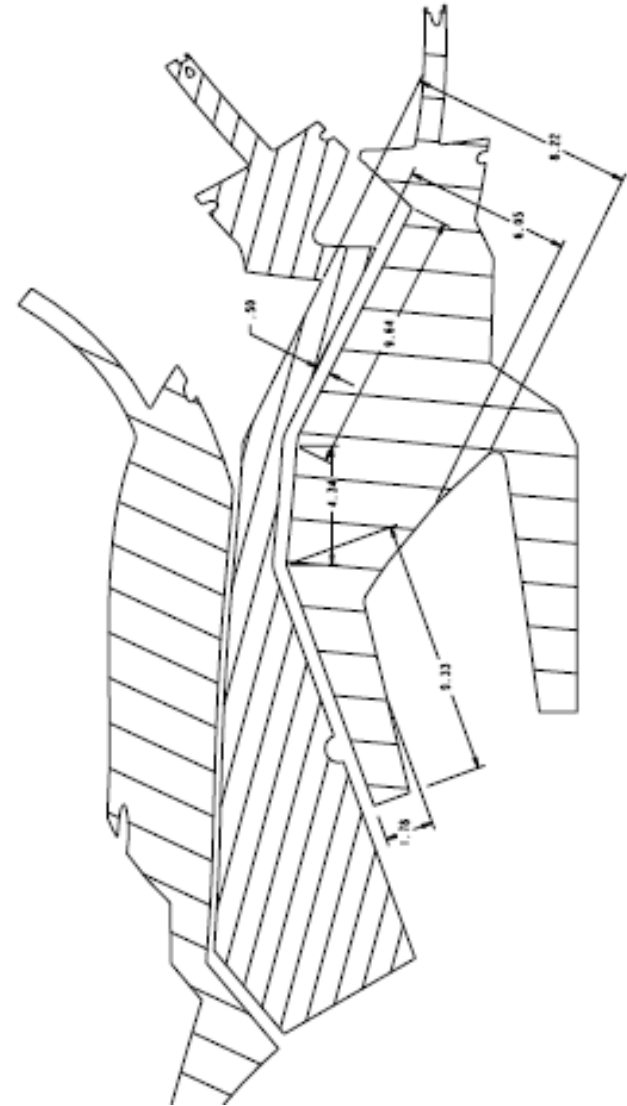
Accurate representation?



Symmetry expanded model

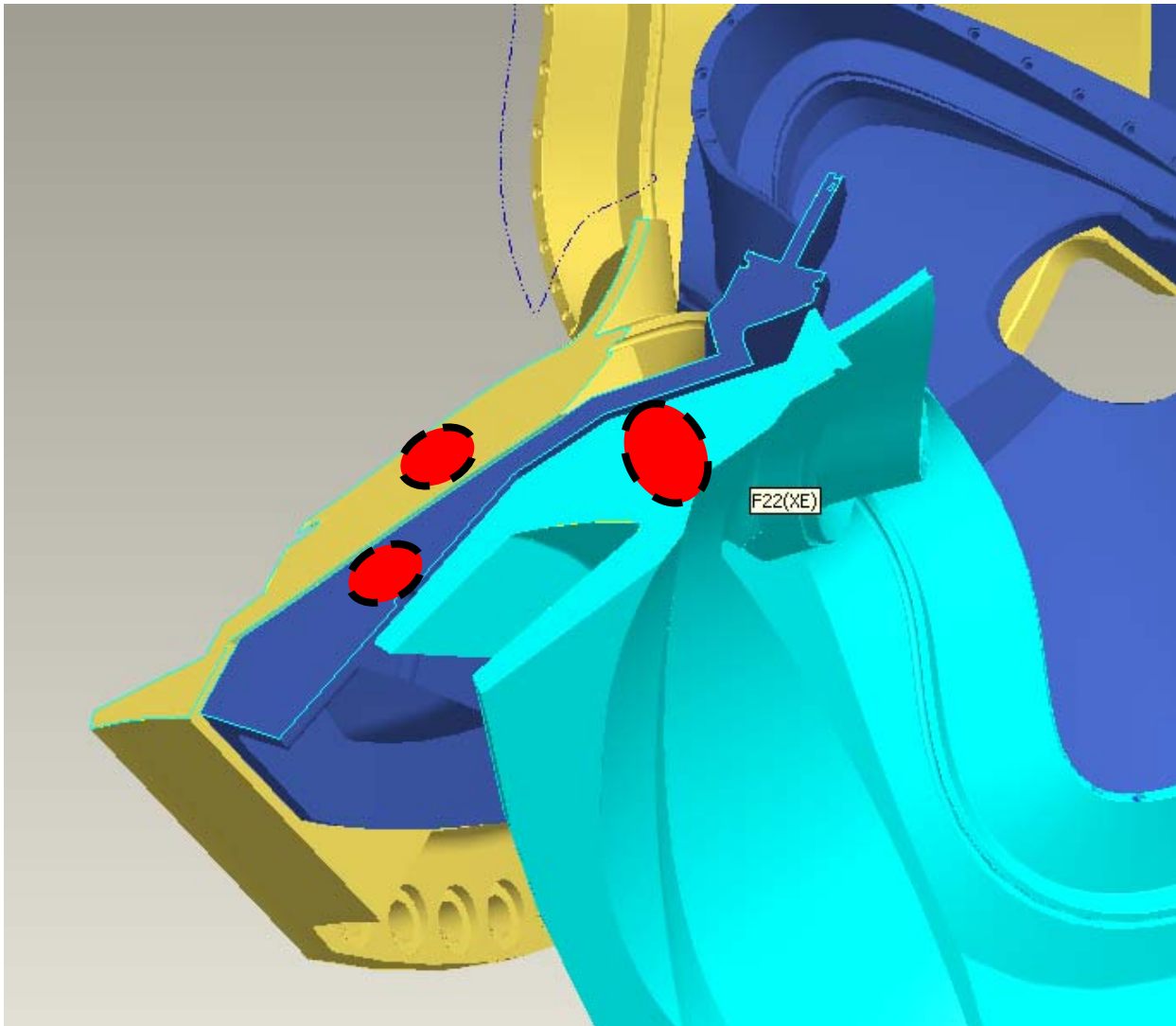
ANSYS 11.0
NODAL SOLUTION
STEP=1
SUB =100
TIME=7320
/EXPANDED
TEMP (AVG)
RSYS=0
PowerGraphics
EFACET=1
AVRES=Mat
SMN =288
SMX =289.703

Blue	288
Light Blue	288.189
Cyan	288.378
Green	288.568
Light Green	288.757
Yellow-Green	288.946
Yellow	289.135
Orange	289.325
Red-Orange	289.514
Red	289.703



Lengthwise cooling is also ignored here.

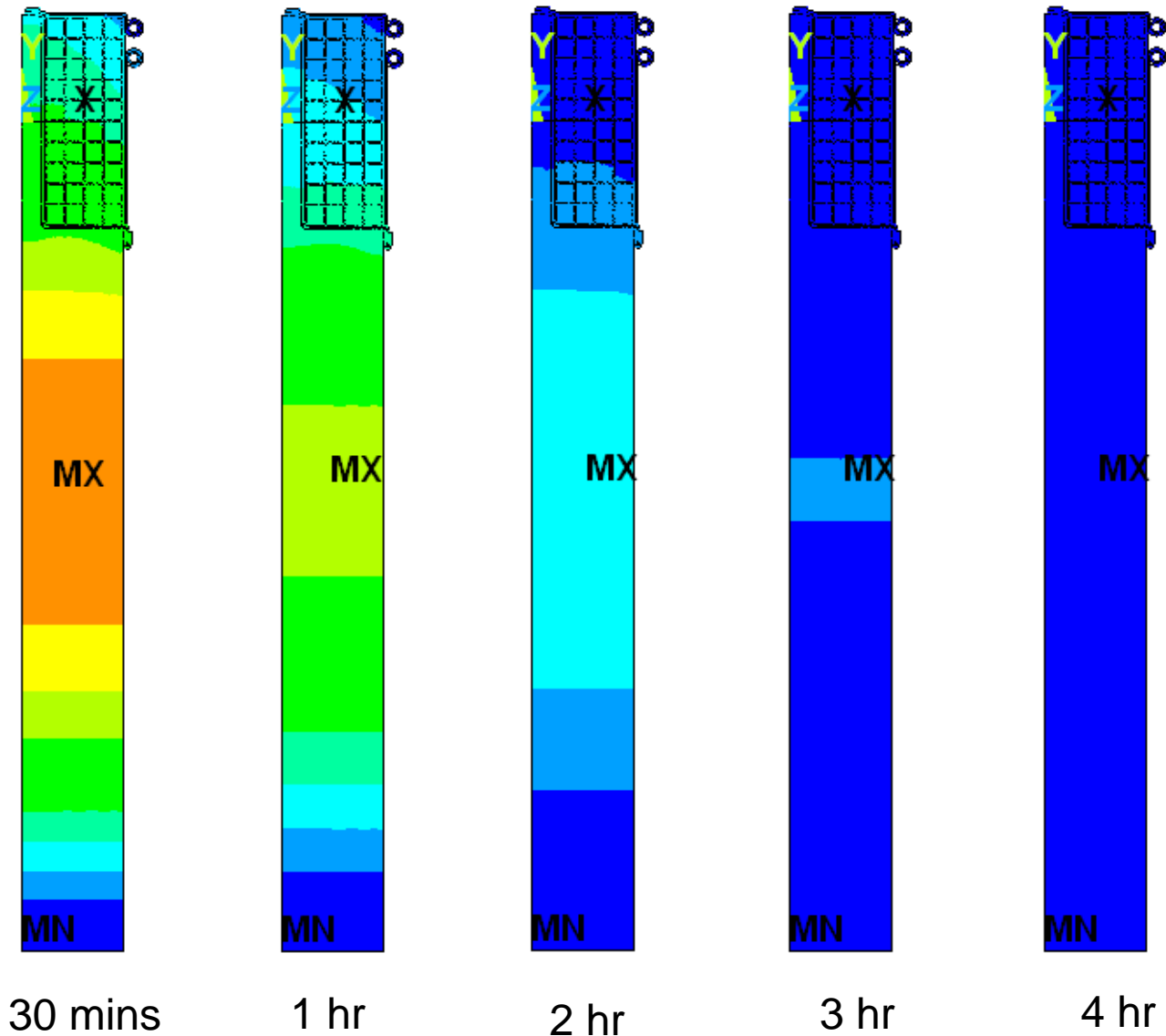
Implications



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.

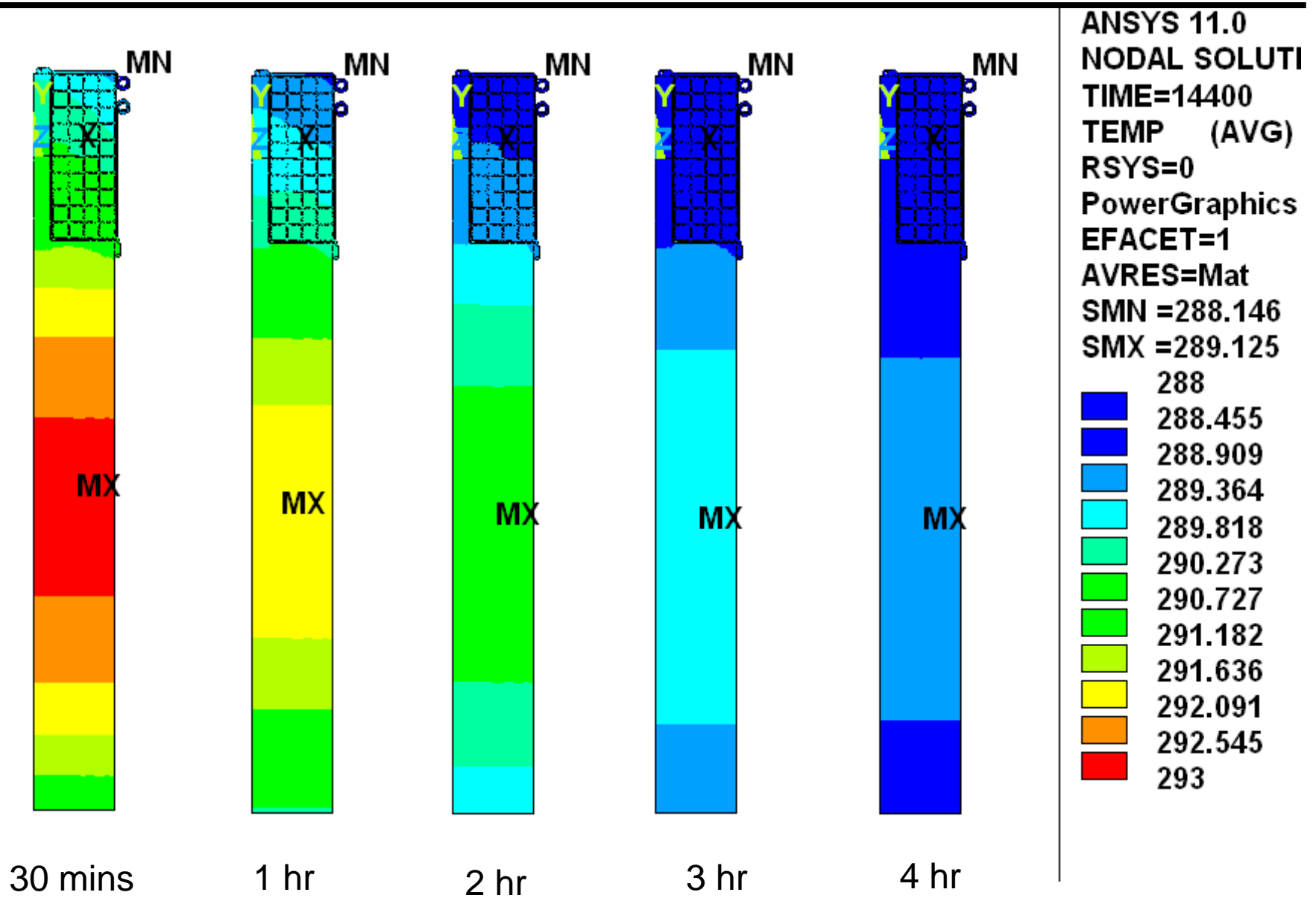
Time history profile with constant temperature on bottom



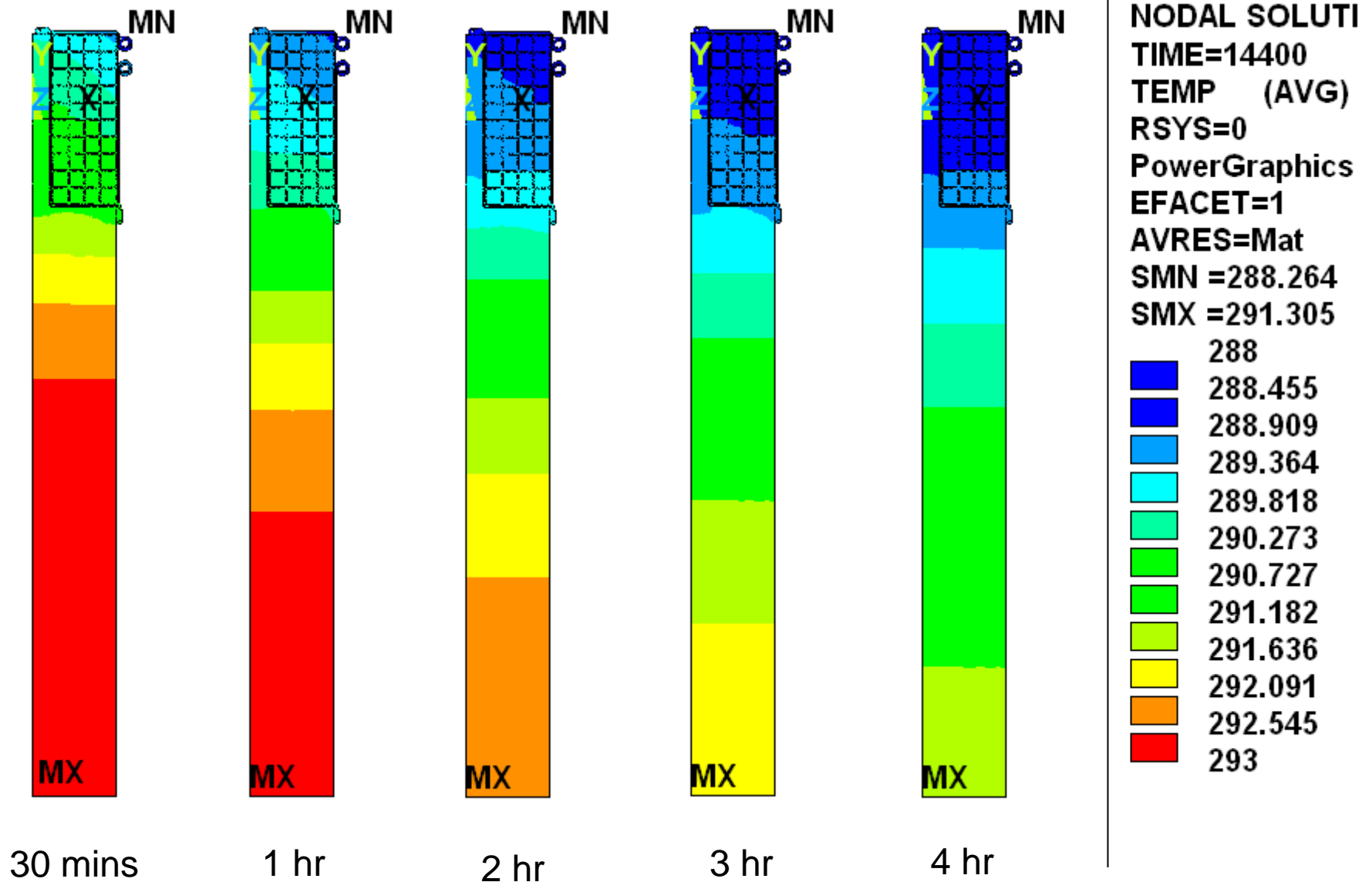
ANSYS 11.0
NODAL SOLUTI
TIME=14400
TEMP (AVG)
RSYS=0
PowerGraphics
EFACET=1
AVRES=Mat
SMN =288
SMX =288.479

288
288.455
288.909
289.364
289.818
290.273
290.727
291.182
291.636
292.091
292.545
293

Time history profile with convection on bottom



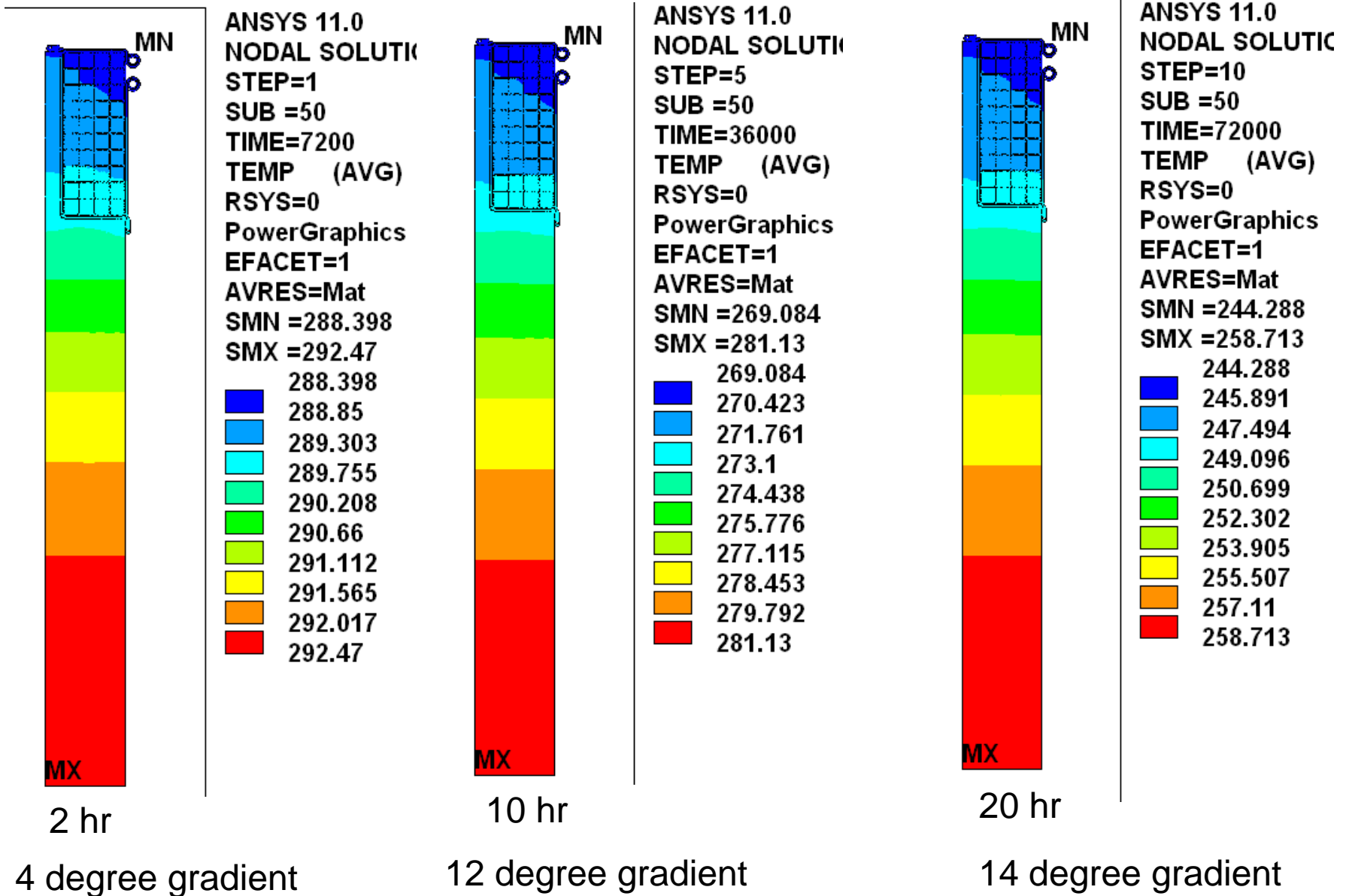
Time history profile with No convection or temperature on bottom



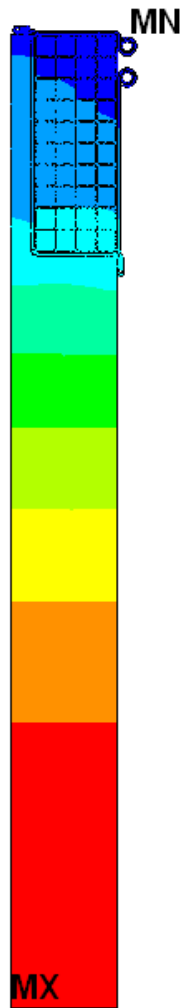
Multiple Step Modeling

- New model cools for 2 hours at 5 degrees below set / initial value. ie) first step runs with gas at $293 - 5 \text{ K} = 288 \text{ K}$ 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



Time history of gas cooling through tubes

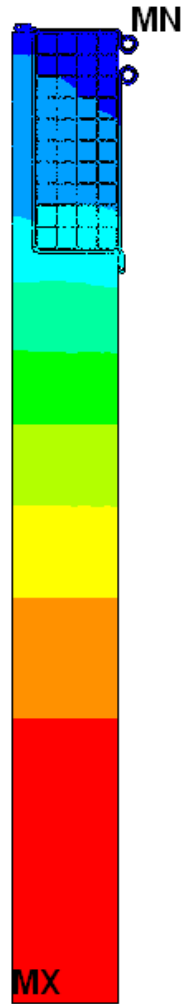


30 hr

ANSYS 11.0
 NODAL SOLUTION
 STEP=15
 SUB =50
 TIME=108000
 TEMP (AVG)
 RSYS=0
 PowerGraphics
 EFACET=1
 AVRES=Mat
 SMN =219.328
 SMX =234.215

Blue	219.328
Light Blue	220.982
Cyan	222.636
Green	224.29
Light Green	225.945
Yellow-Green	227.599
Yellow	229.253
Orange	230.907
Red-Orange	232.561
Red	234.215

14.9 degree gradient



40 hr

ANSYS 11.0
 NODAL SOLUTION
 STEP=20
 SUB =50
 TIME=144000
 TEMP (AVG)
 RSYS=0
 PowerGraphics
 EFACET=1
 AVRES=Mat
 SMN =194.336
 SMX =209.312

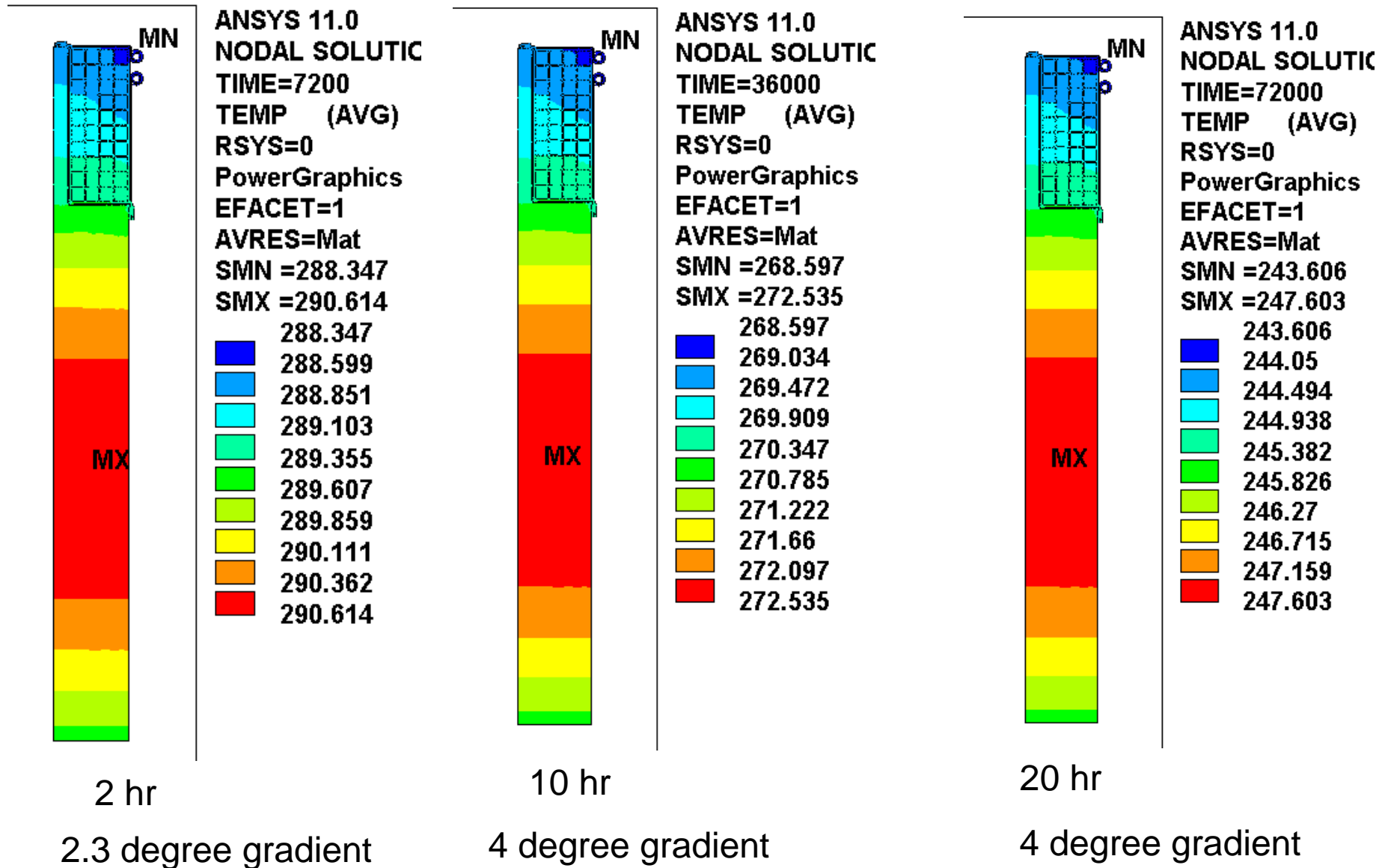
Blue	194.336
Light Blue	196
Cyan	197.664
Green	199.328
Light Green	200.992
Yellow-Green	202.656
Yellow	204.32
Orange	205.984
Red-Orange	207.648
Red	209.312

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.



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

