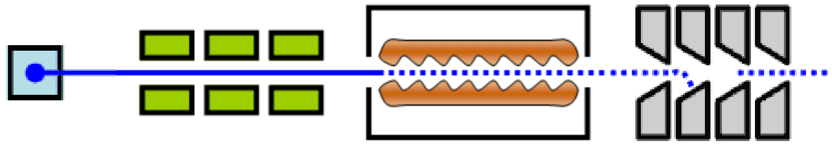
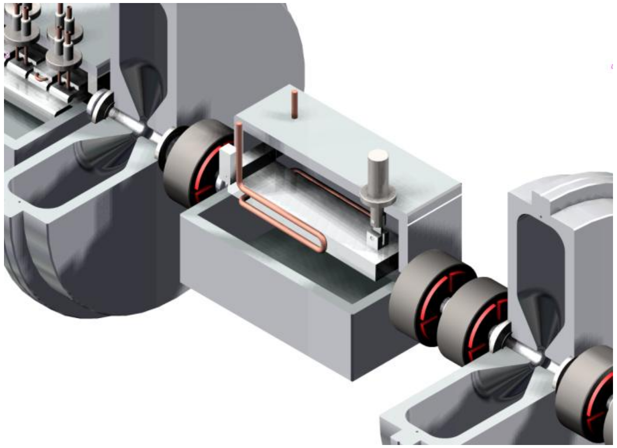


The Front End Test Stand Collaboration – FETS –

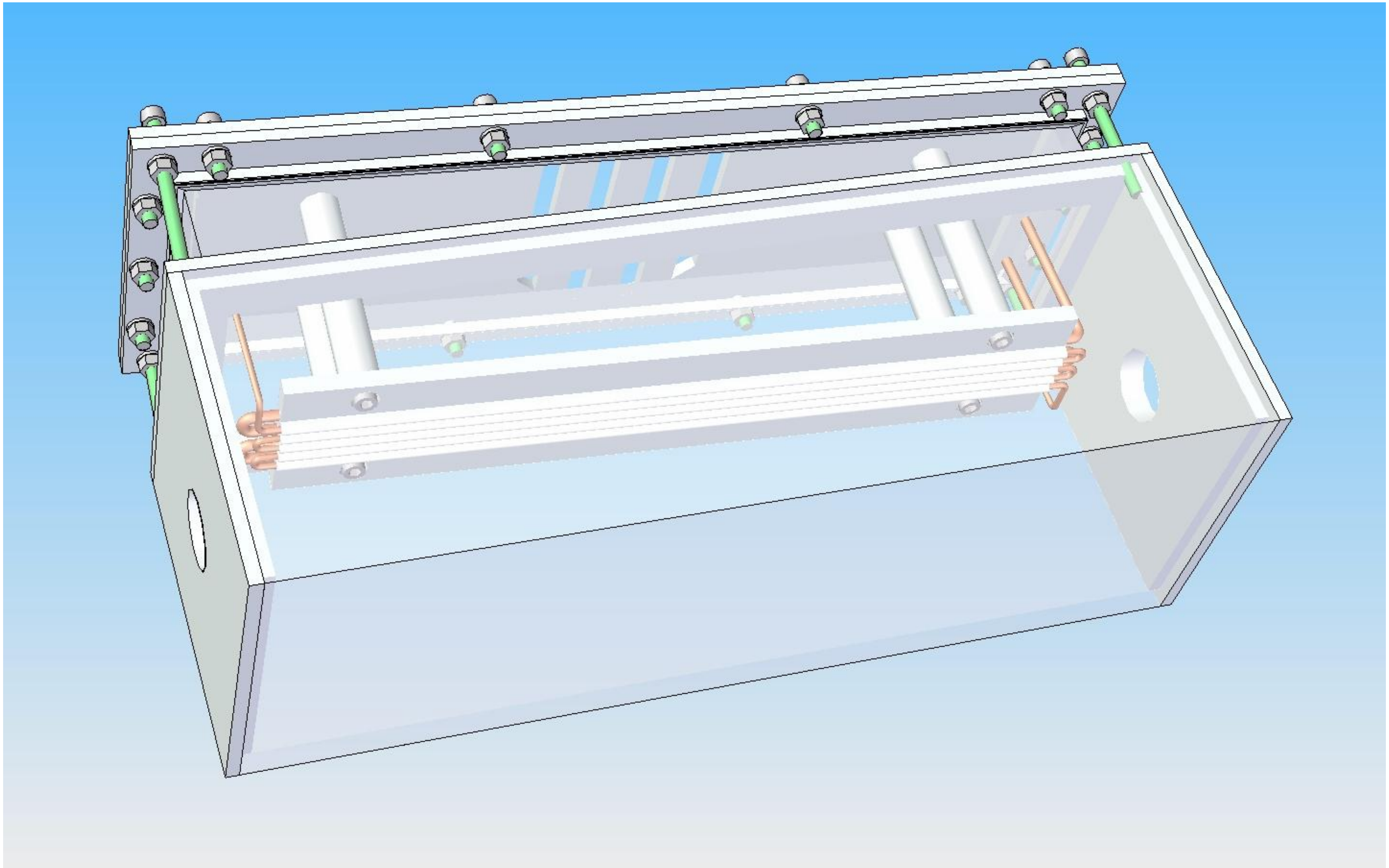
SLOW CHOPPER BEAM DUMP (Dump2)_#2

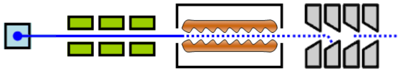
27th June 2012

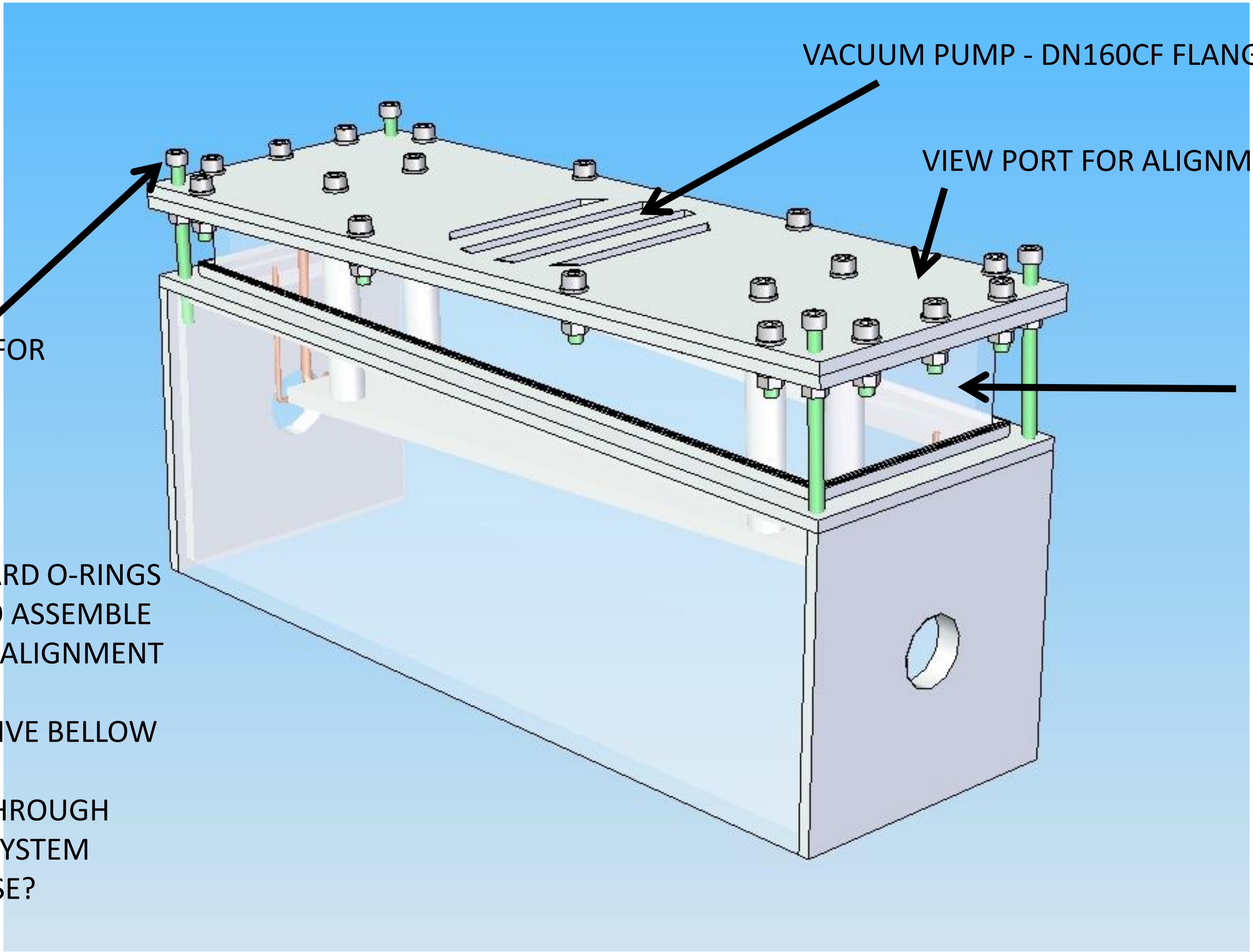


A.Garbayo at AVS – Added Value Solutions

CONCEPT DESIGN



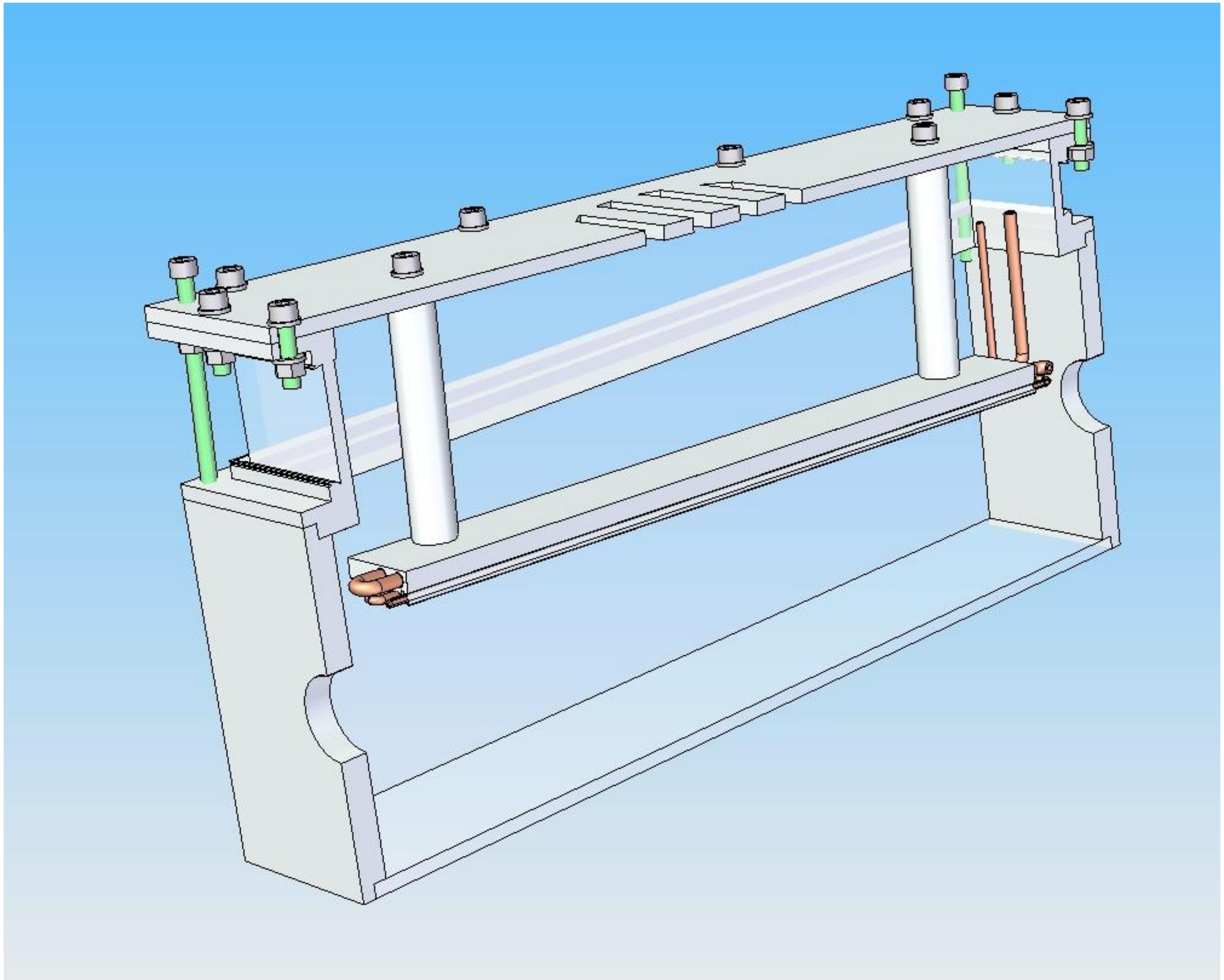


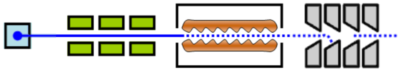


- STANDARD O-RINGS
- EASY TO ASSEMBLE
- SIMPLE ALIGNMENT

- EXPENSIVE BELLOW

- FEED-THROUGH MOTION SYSTEM OTHERWISE?

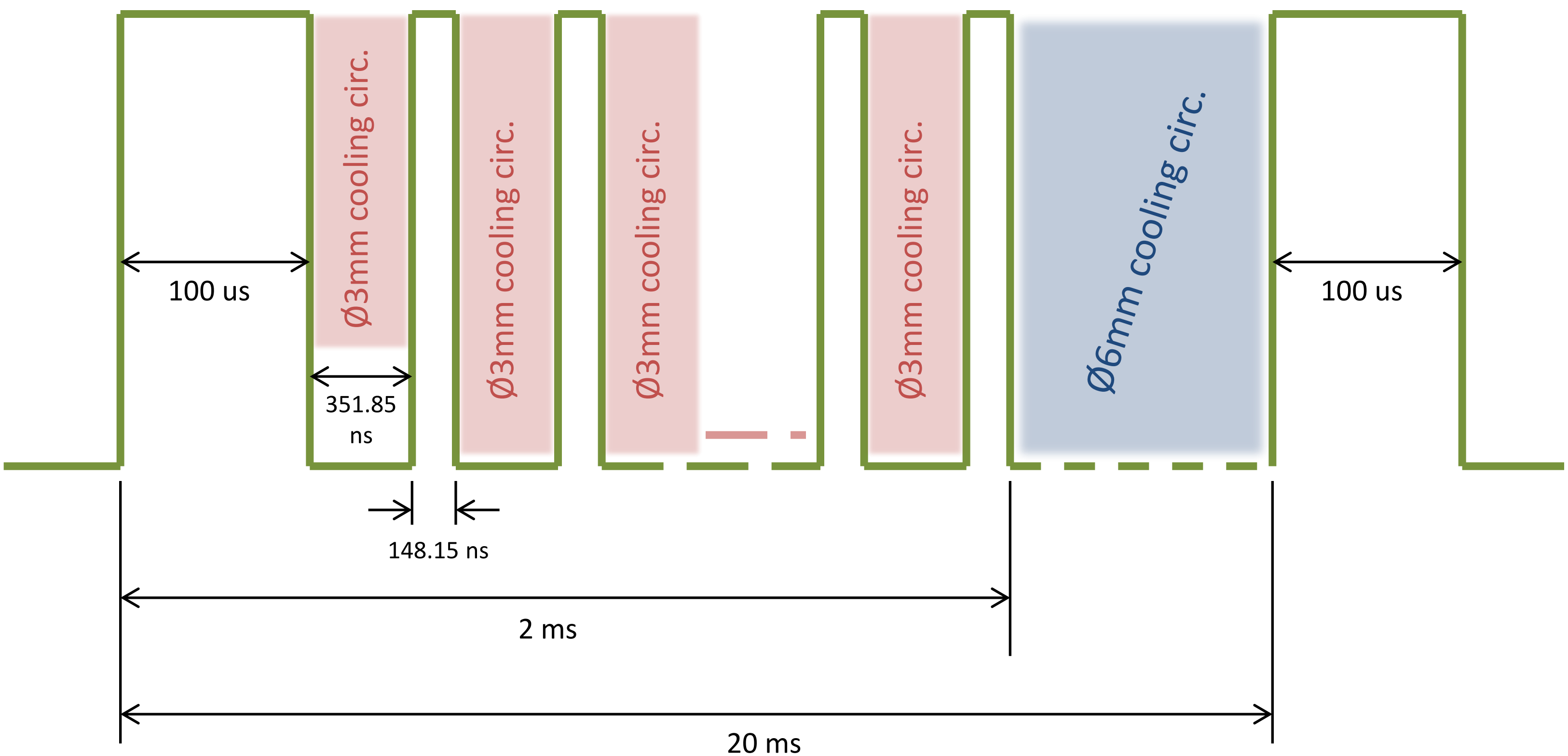




FETS CHOPPING TIME

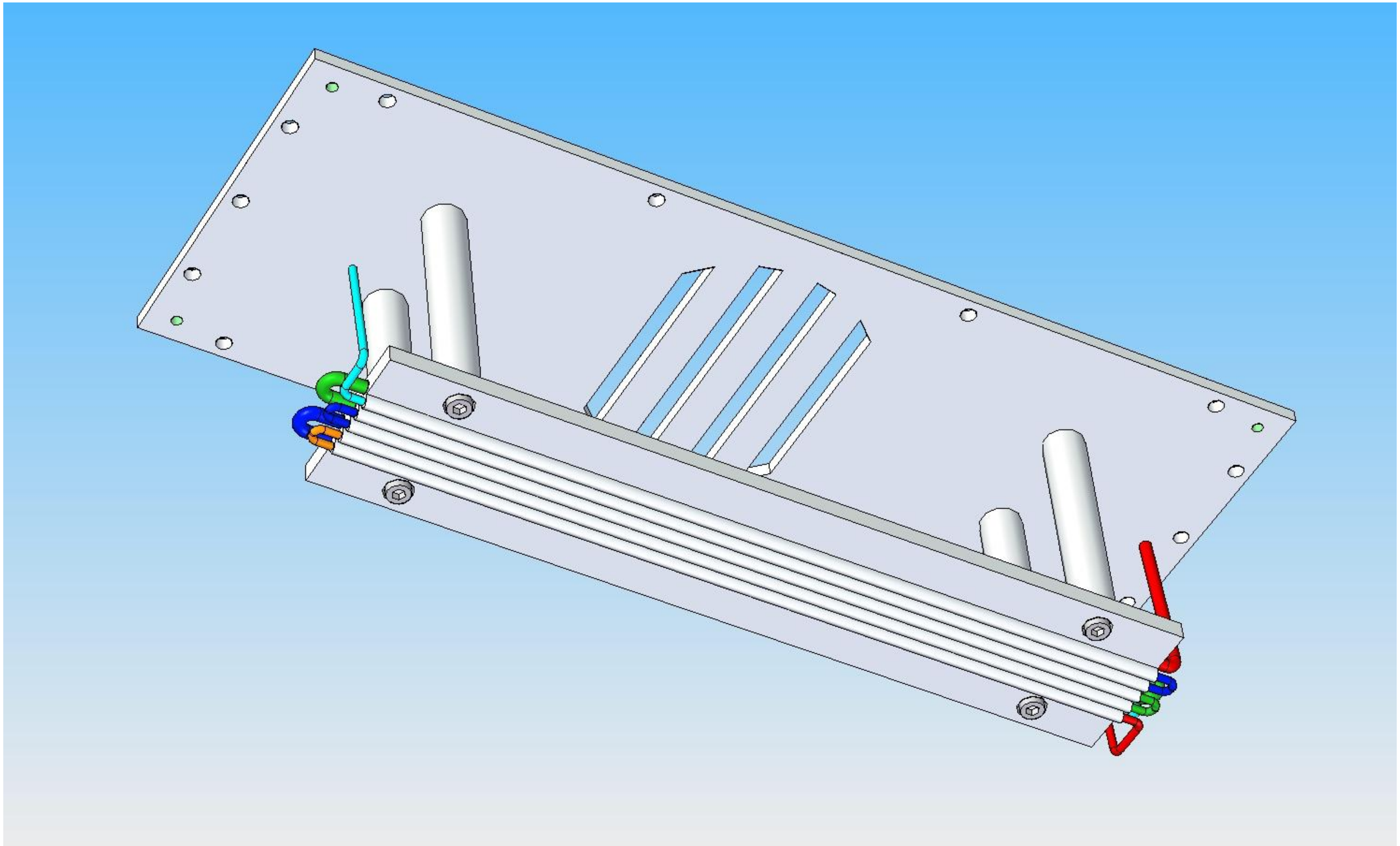
Beam seen by chopper beam dump

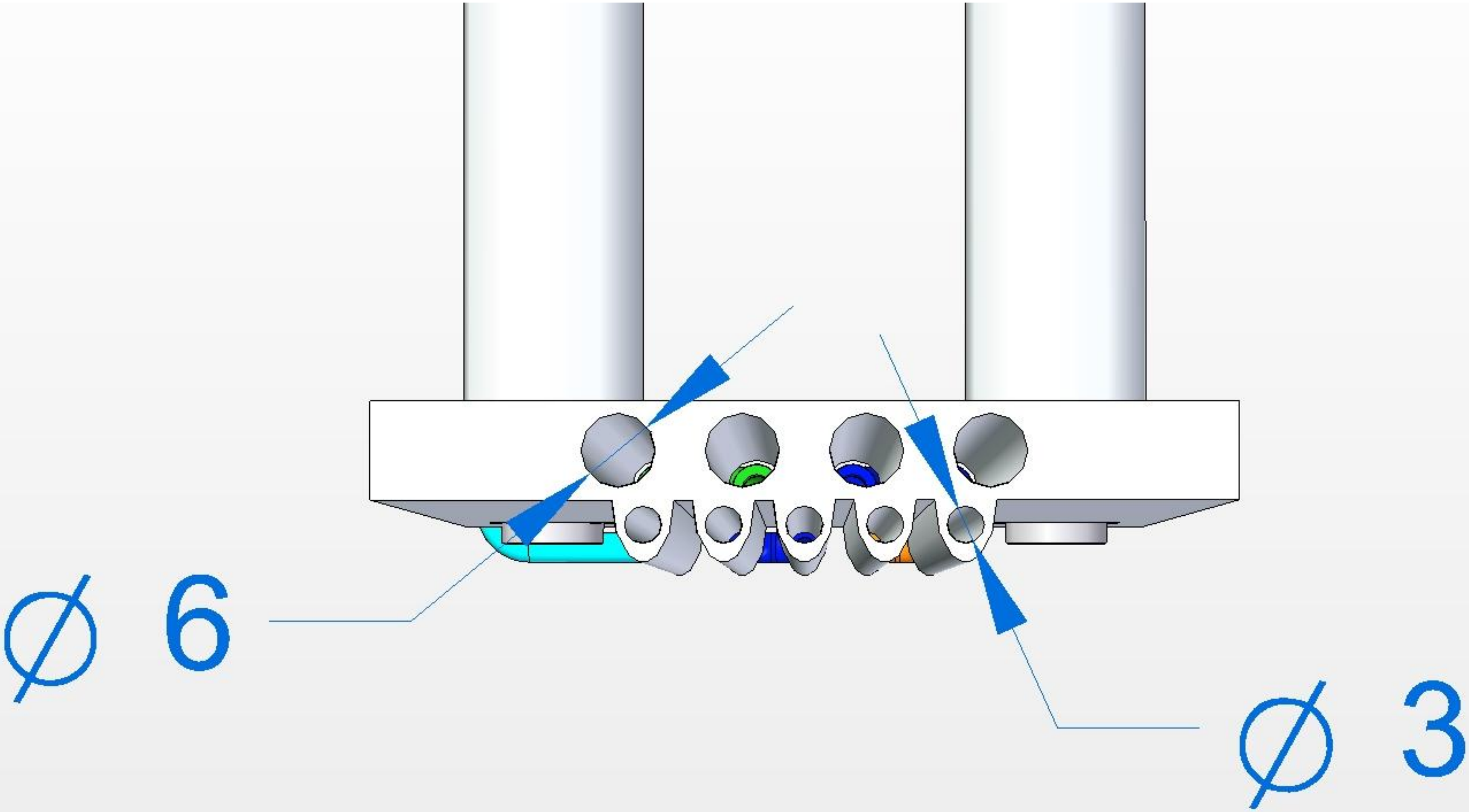
Peak beam power = 180 kW	
Duty factor during 2 ms beam pulse = 33.15%	Average power = 59.7 kW
Overall duty factor = 3.315%	Average power = 5.97 kW



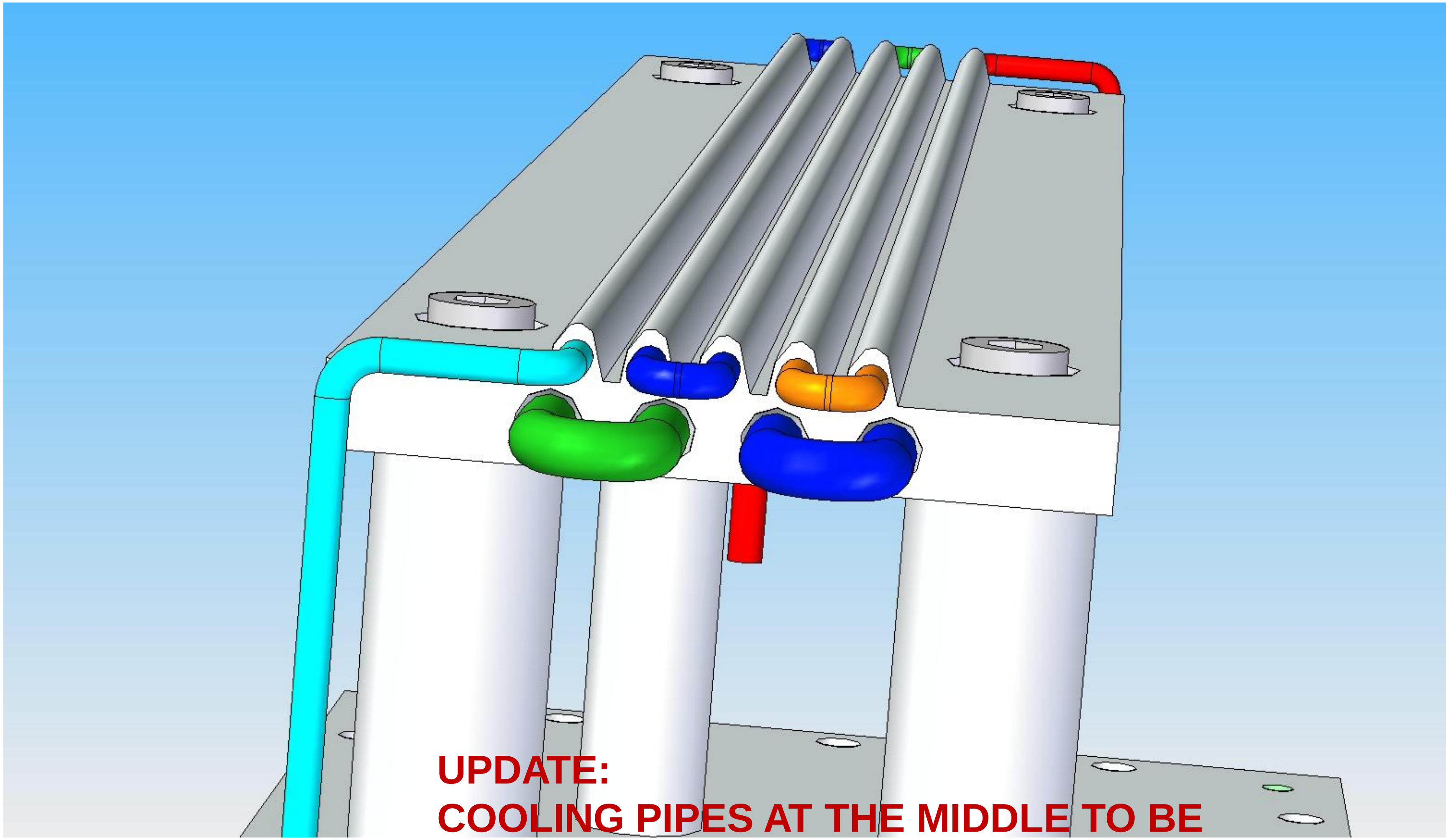
BEAM DUMP PLATE

2 cooling circuits



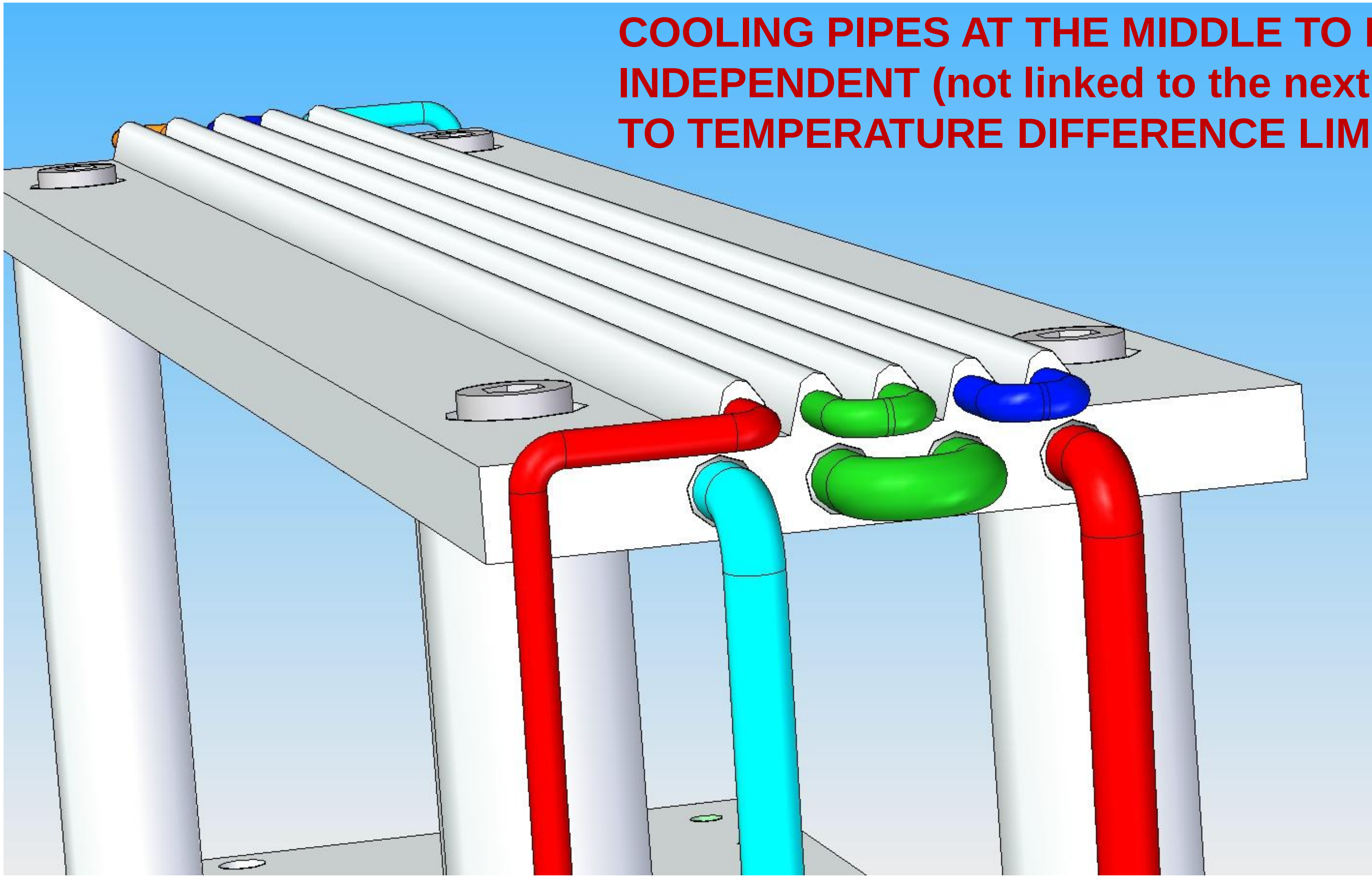


Ø 6
Ø 3



UPDATE:
COOLING PIPES AT THE MIDDLE TO BE INDEPENDENT (not linked to the next one) DUE TO TEMPERATURE DIFFERENCE LIMITATIONS.

UPDATE:
COOLING PIPES AT THE MIDDLE TO BE INDEPENDENT (not linked to the next one) DU TO TEMPERATURE DIFFERENCE LIMITATIONS



BEAM DUMP PLATE v2

THERMAL CALCULATIONS - ANSYS

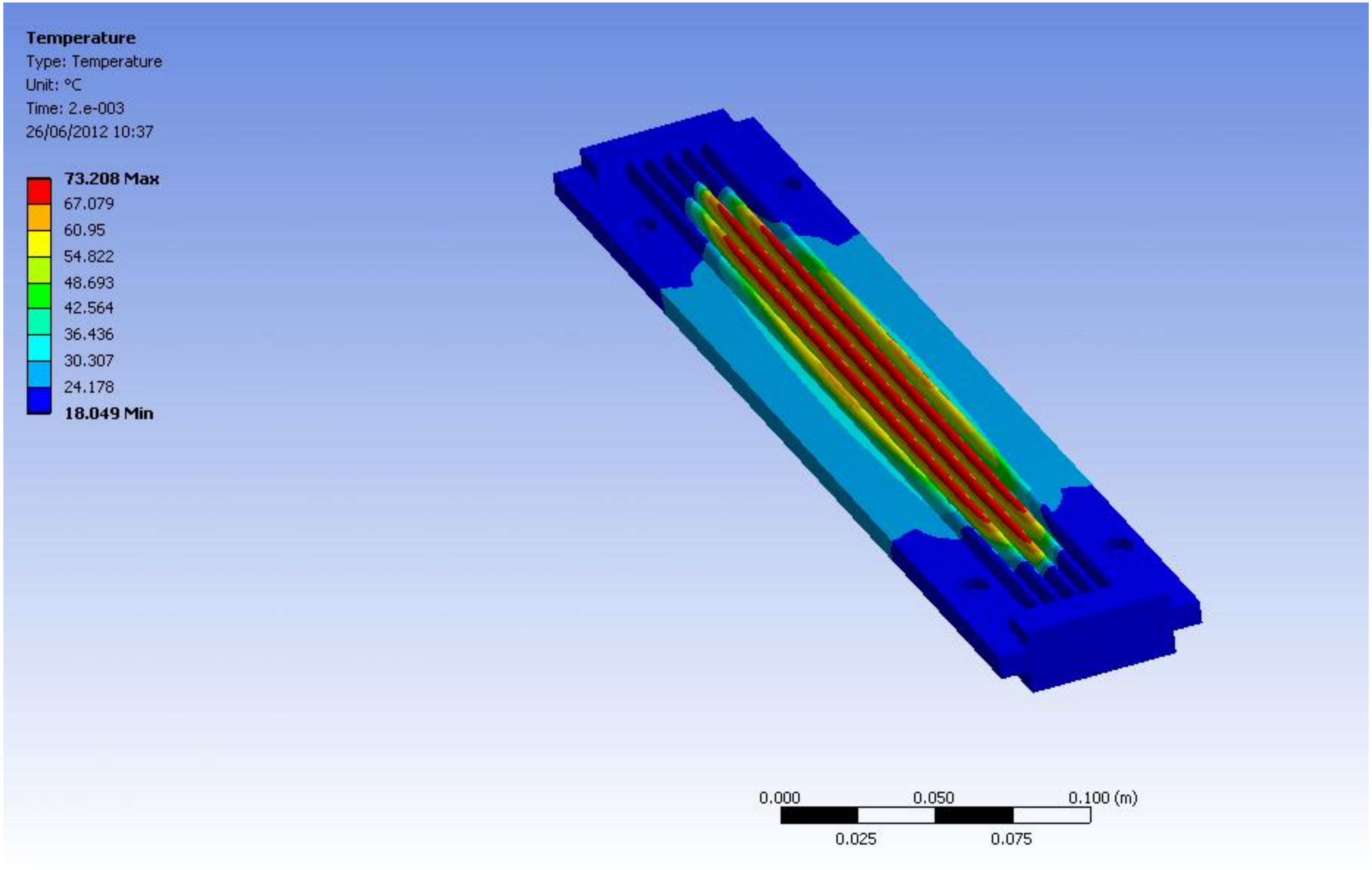
COOLING CALCS

5 m/s; L=0.36m; P=5.97kW

5 m/s over 20ms = **100mm**

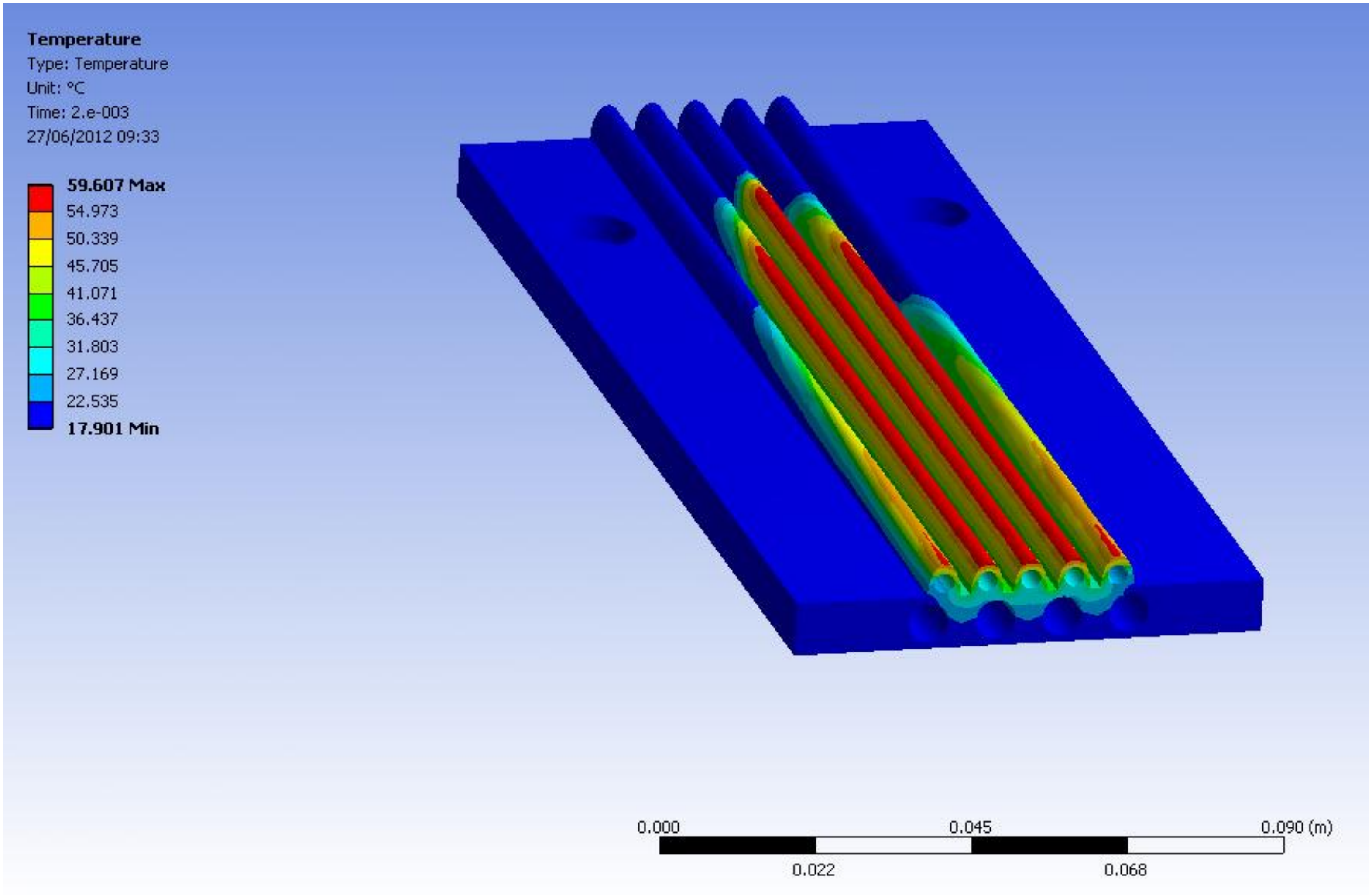
Ø3mm:
Re = 16667
HTC = 22907 W/m2 k
Ap = 0.4524 bar
AT = **39 K**
P abs = 1231 W

Ø6mm:
Re = 33333
HTC = 19942 W/m2 k
Ap = 0.19 bar
AT = 9.75 K
P abs = 2143 W

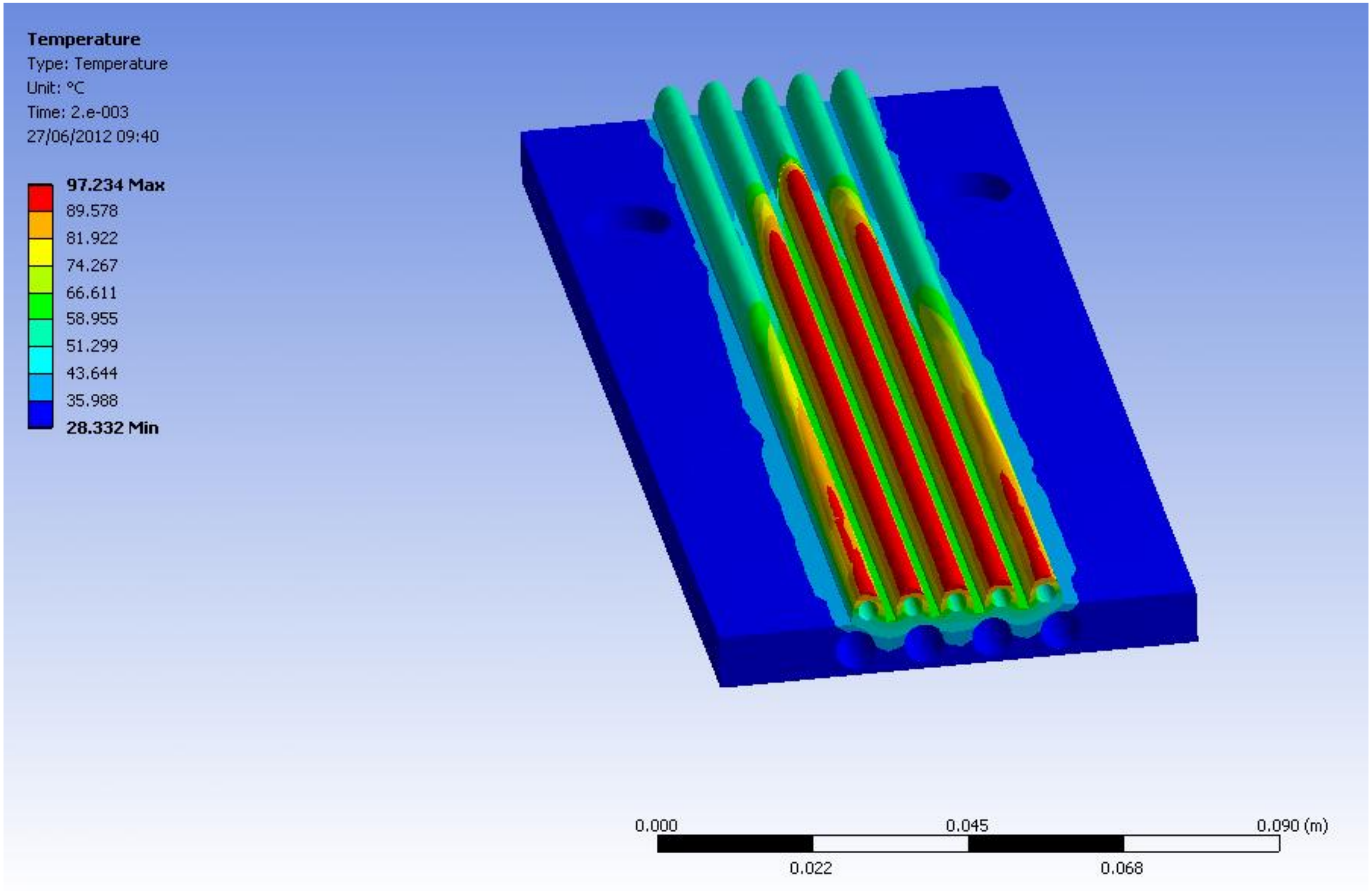


TEMPERATURE – STEADY STATE

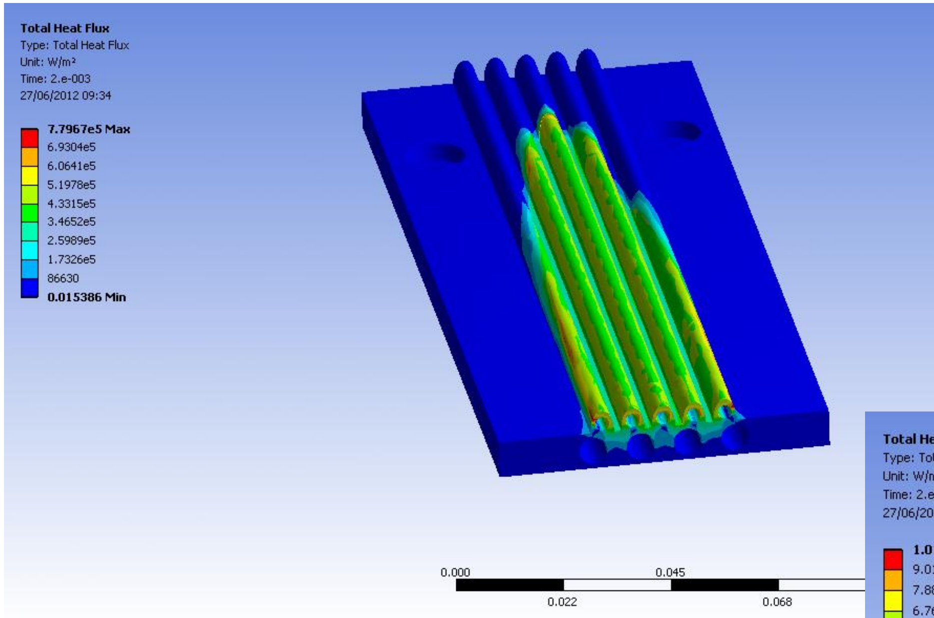
Random HTC = 8000 W / m2 k

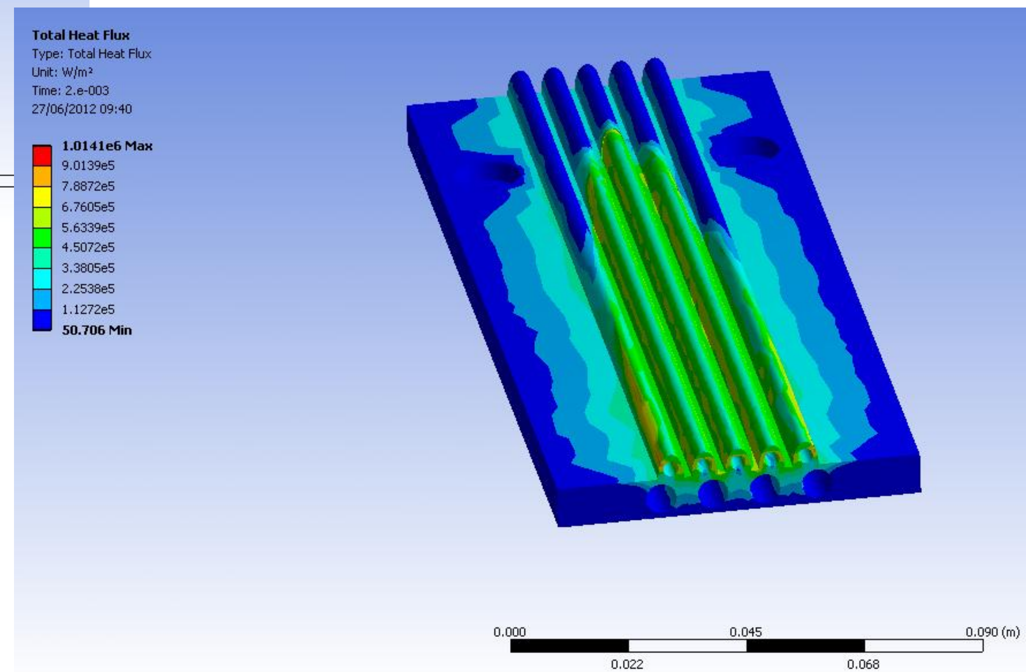


TEMPERATURE – NEW HTC AT 18oC

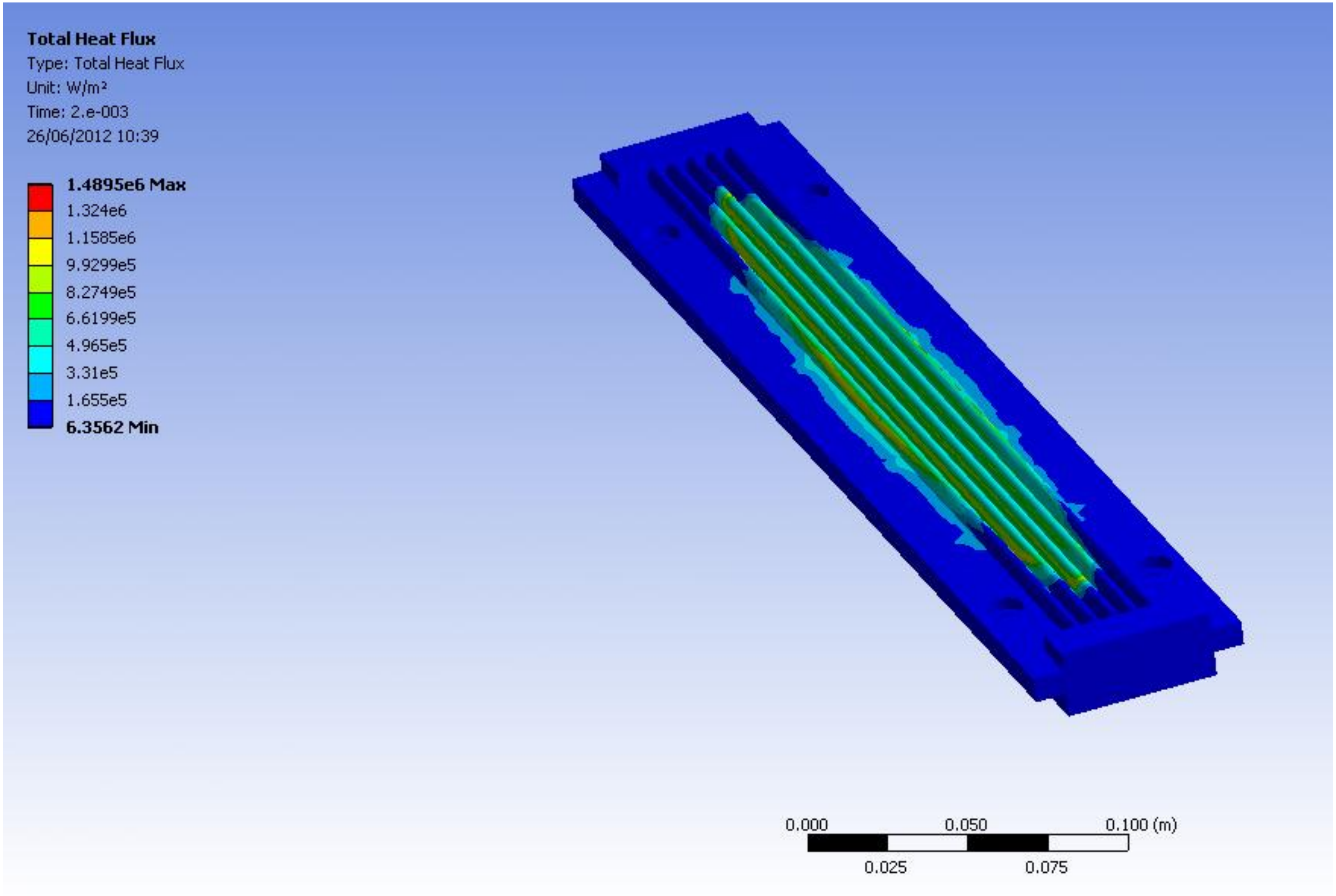


TEMPERATURE – NEW HTC RAMPED

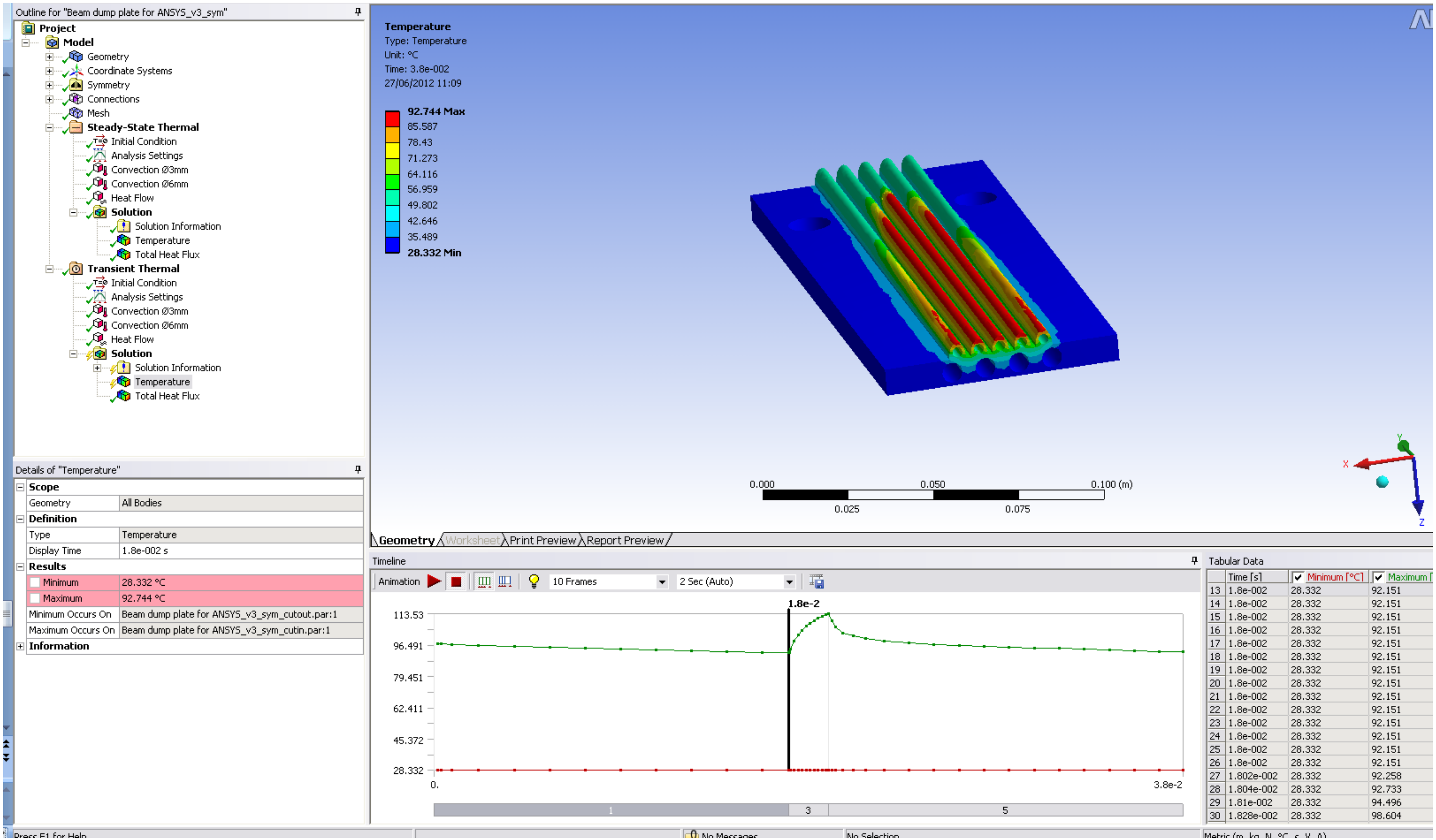




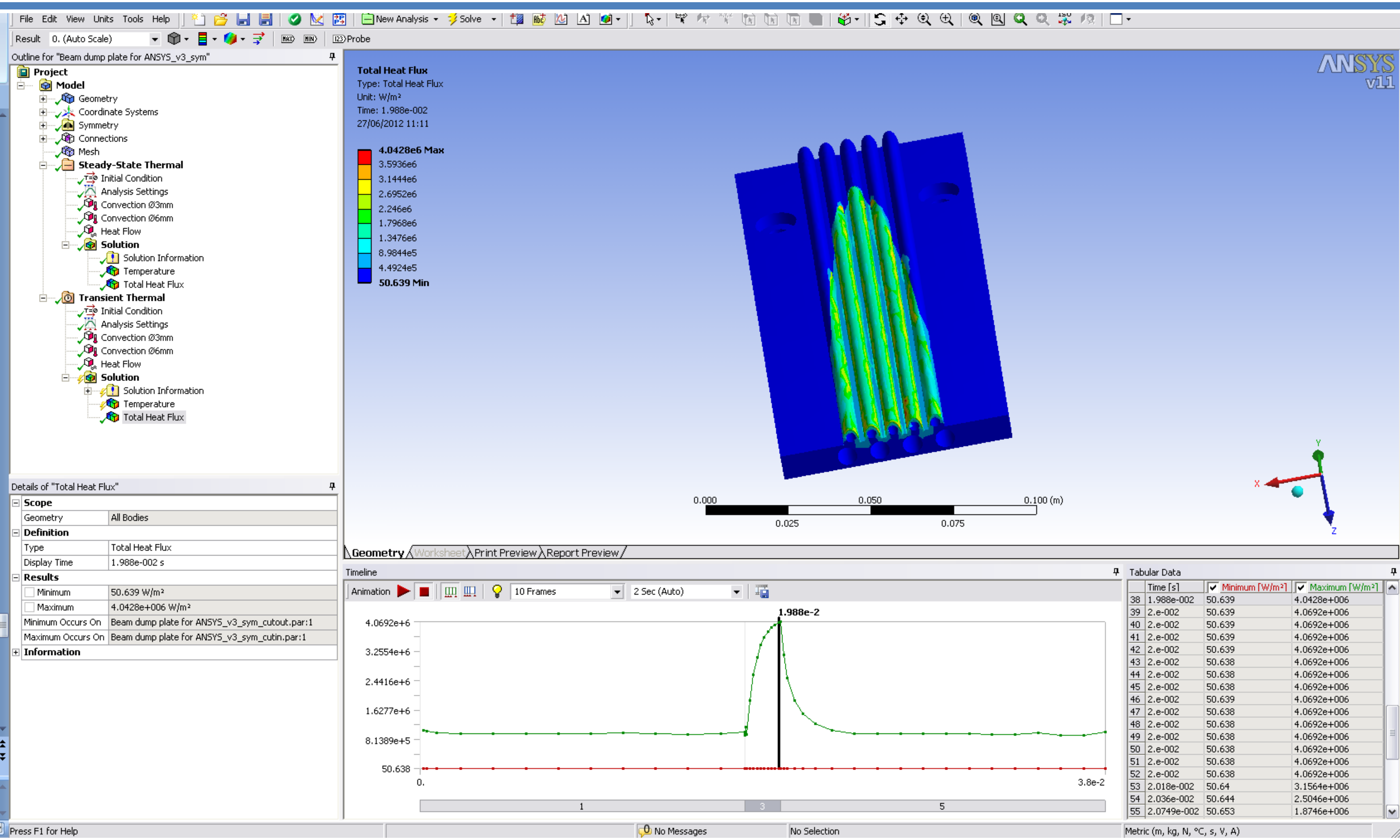
TOTAL HEAT FLUX – HTC 18oC vs. RAMPED



TOTAL HEAT FLUX – FULL MODEL



TRANSIENT - TEMP - steady state initial condition

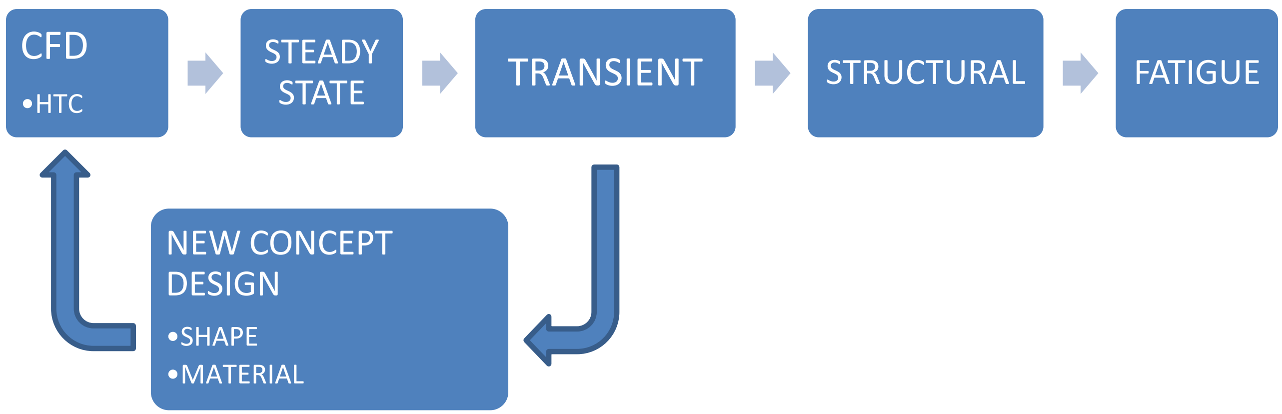


TRANSIENT – HEAT FLUX - steady state initial condition

The Front End Test Stand Collaboration

A.Garbayo at AVS – Added Value Solutions

ANSYS MAP ANALYSIS



UPCOMING

Calculate the maximum permissible temperature difference taking into account 4 to 5 m/s over 20ms = 100mm travel
= same volume of water might be hit 4 times by beam – temp diff x 4

Once CFD is done :: Transient thermal analysis with 150ns "micro" pulses over the 2ms pulse to study the effect of the Ø3mm cooling circuit

Greater SURFACE – by double "corrugation", **cylinder shape**, cylinder + corrugation...
Manufacturing techniques are to take into account in this step

Greater cooling area to manage to cool down the plate over the 18ms gap.

Late procedure:
CHOOSE MATERIAL
2D BEAM POWER DISTRIBUTION DATA AT BEAM DUMP.
VOLUMETRIC POWER DISTRIBUTION DATA AND BRAGG PEAK INFORMATION – to export to ANSYS.
FINAL THERMAL CALCULATIONS

CONCLUSIONS

WE NEED A CFD CALCULATION TO STUDY TRANSIENT EFFECT (ANSYS License...)

DOUBLE CHECK SYMMETRY MODELS AND FULL MODELS

THE PIPES WHERE THE MAXIMUM HEAT (mid ones) WILL BE APPLIED SHOULD HAVE WATER INLET AND OUTLET AT THE ENDS (not linked to the next pipe).

IMPROVE CONCEPT DESIGN WITH RECTANGULAR BELLOWS

NEW CONCEPT DESIGN WITH STANDARD BELLOWS AND SIMPLE ALIGNMENT

NEW CONCEPT DESIGN WITH FEED-THROUGH DRIVING SYSTEM:
- XY (fixed angle) adjustment
- Phi (only angle) adjustment
- Both XY + Phi adjustment

My preference:
TO SET UP A MEETING EVERY 2 WEEKS (Video conference) WITH PS, AL, JP, MA, MCG & SL.