ARIES-CS LOCA Thermal Analysis

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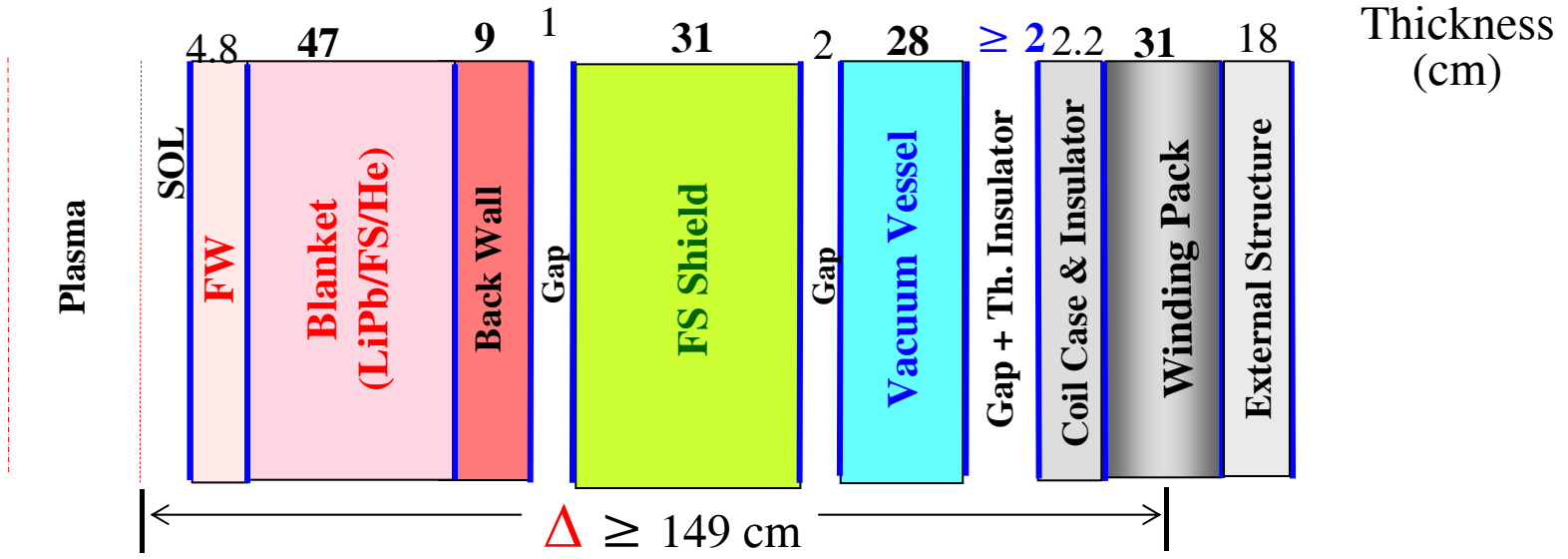
LiPb/FS/He Radial Build
(Water Cooled Internal VV)



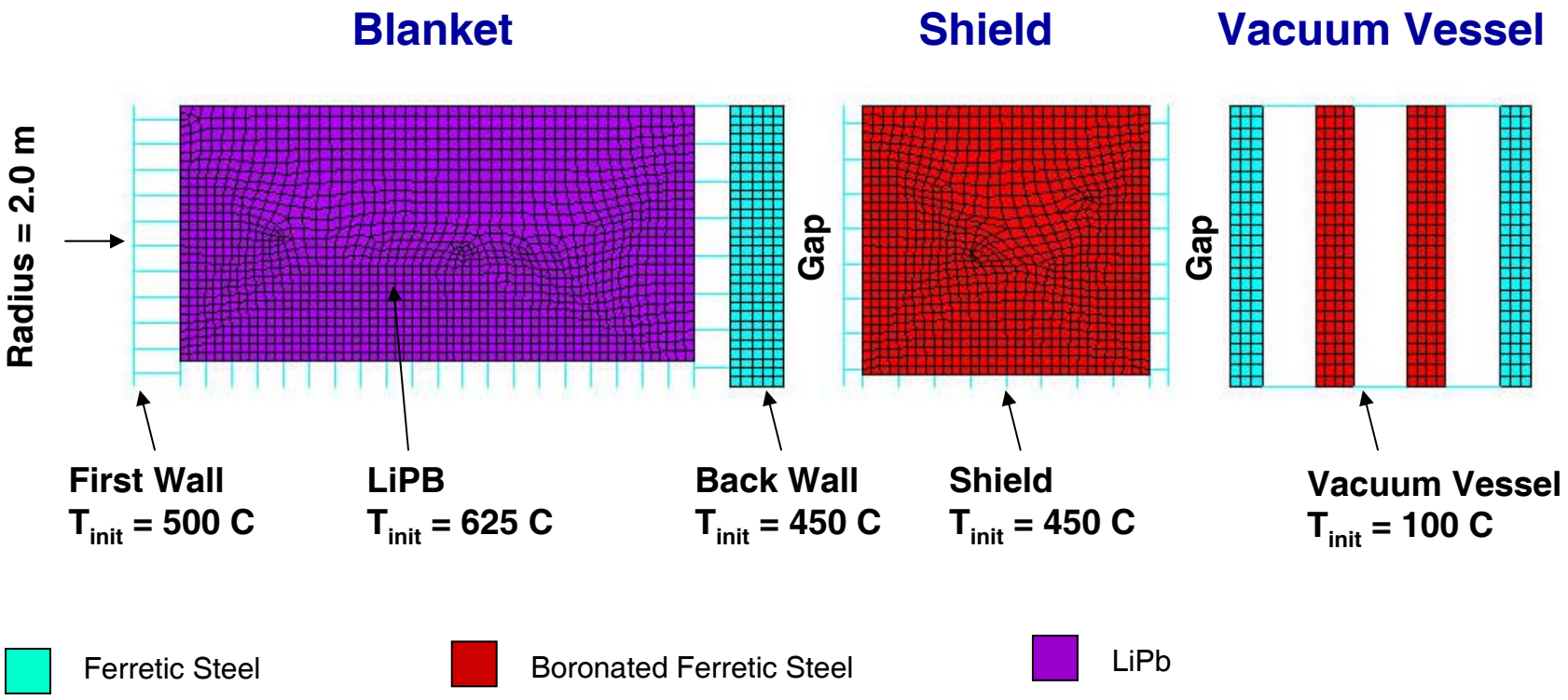
Permutations

- Questions:
  - Which coolants are lost?
  - Which are present, but static?
  - Which are flowing naturally?
  - Which still have forced flow?

  - Does plasma stay on?

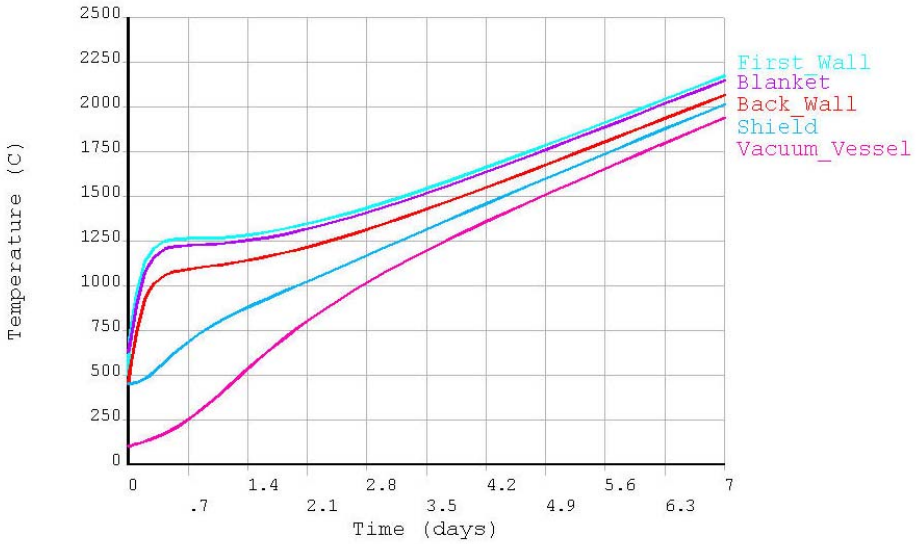
FE Model and Boundary Conditions for Thermal Analysis

- Adiabatic boundary at back of vacuum vessel
- Model is axisymmetric about plasma centerline and symmetric on sides
- Assumed there is no helium or water in channels

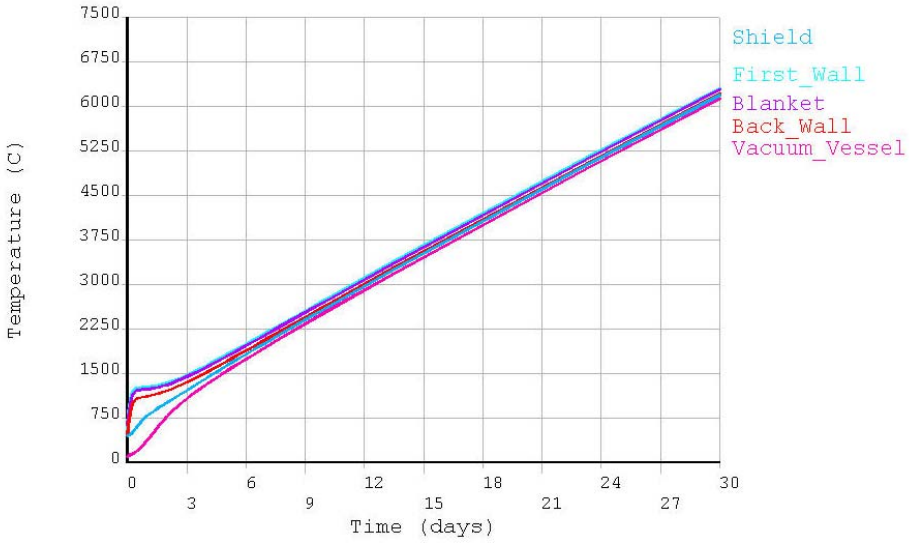


Transient Temperature Response Without Heat Removal

Seven Day Response



Thirty Day Response



Note that LiPb afterheat is underestimated!

Transient Temperatures Without Heat Removal

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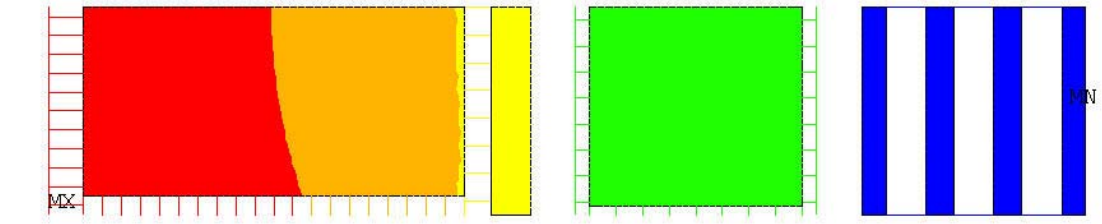
After 1 Hour



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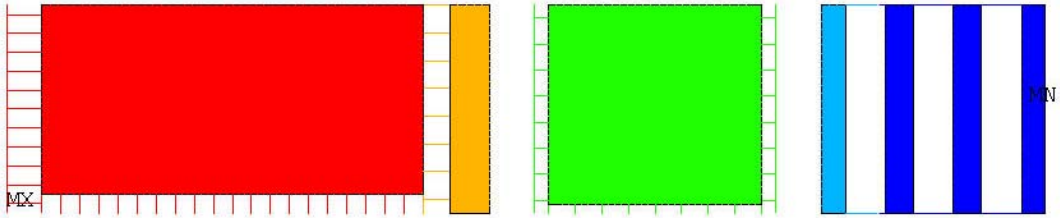
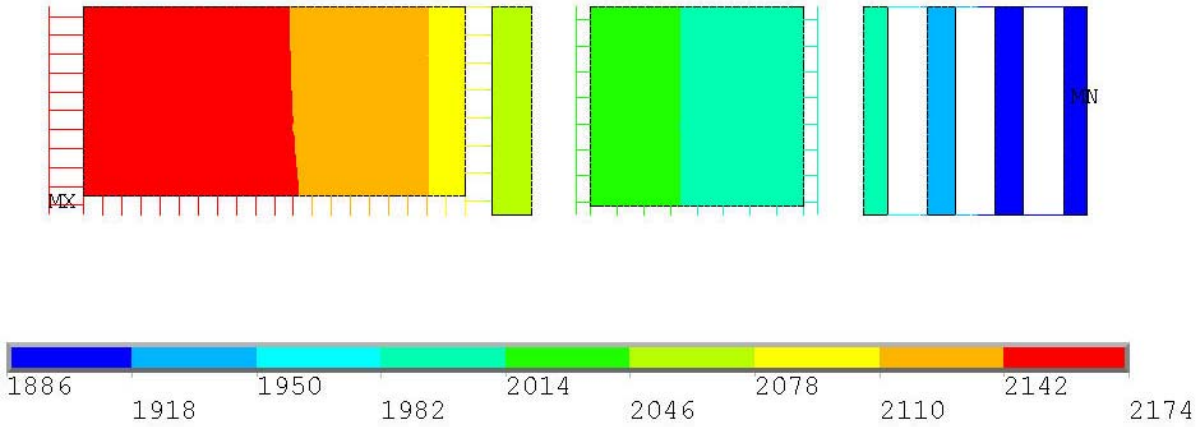
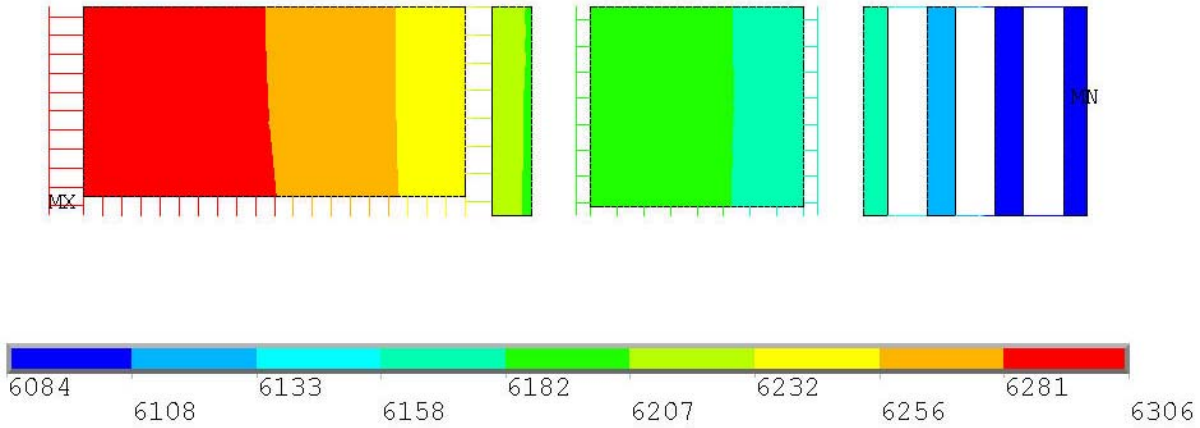


Transient Temperatures Without Heat Removal

After 1 Week

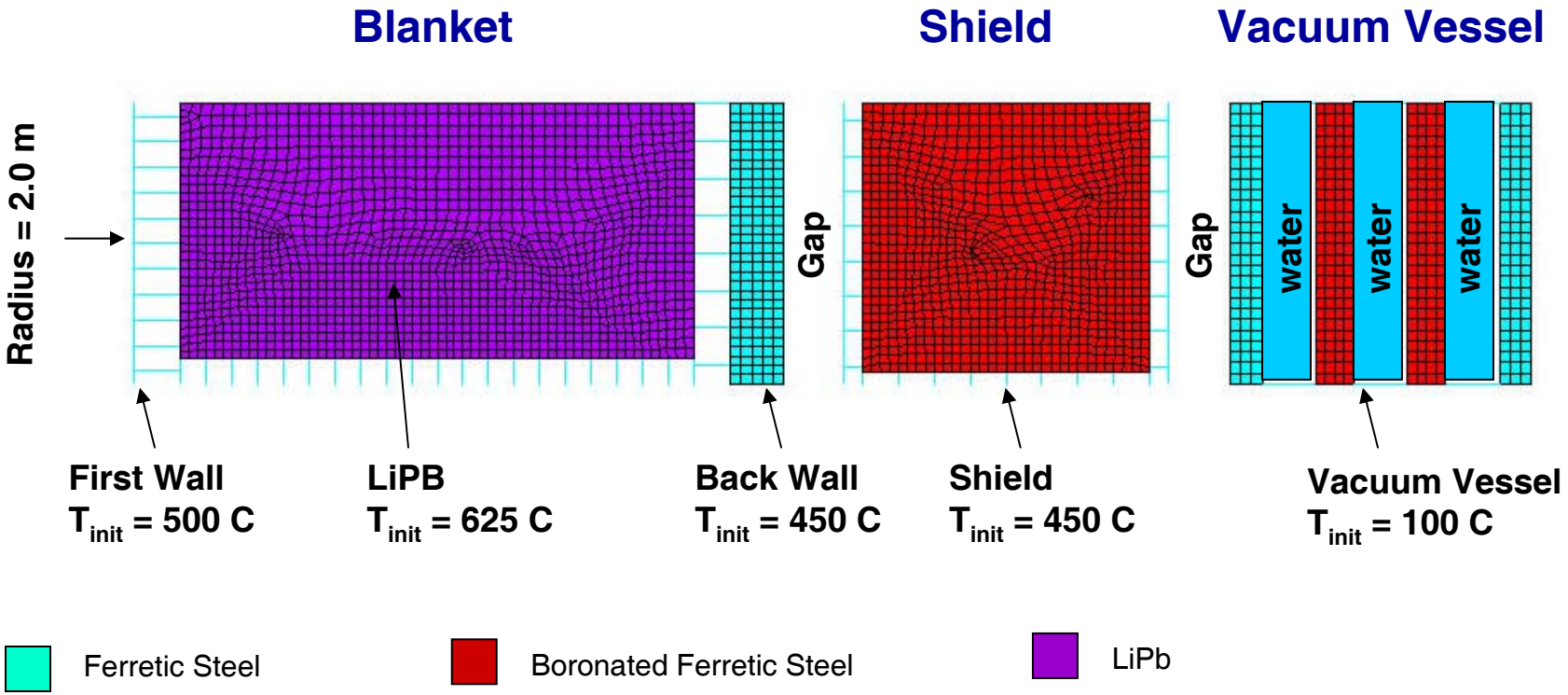


After 1 Month



Analysis with Natural Convection to Water in Vacuum Vessel

- Natural convection to water in vacuum vessel included in model
- Heat transfer coefficient of 500 W/m^2-C to 100 C water assumed
- Emissivity of 0.1 assumed in vacuum gaps



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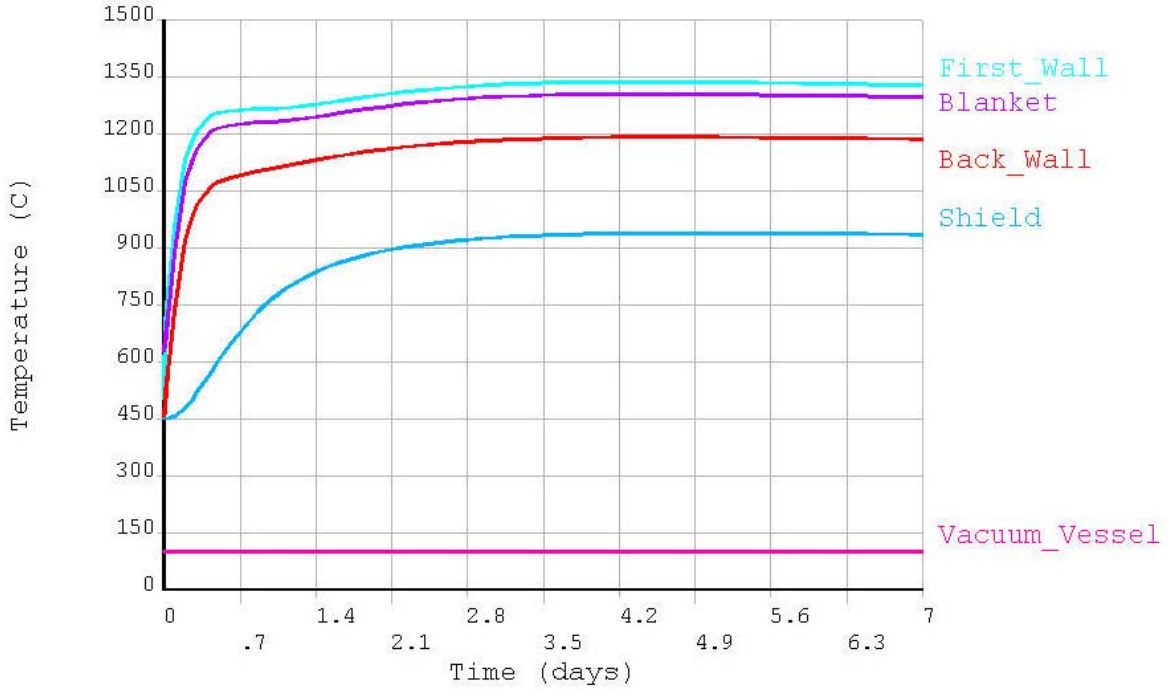

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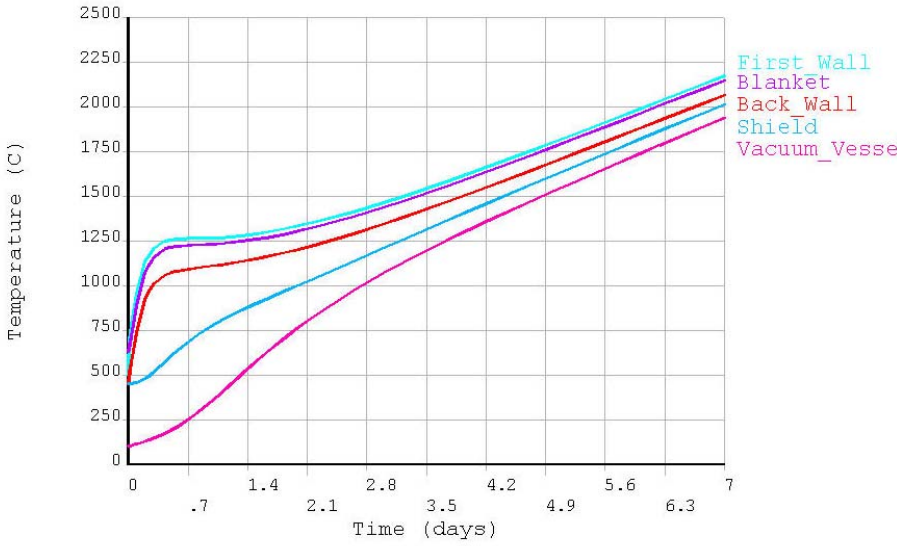
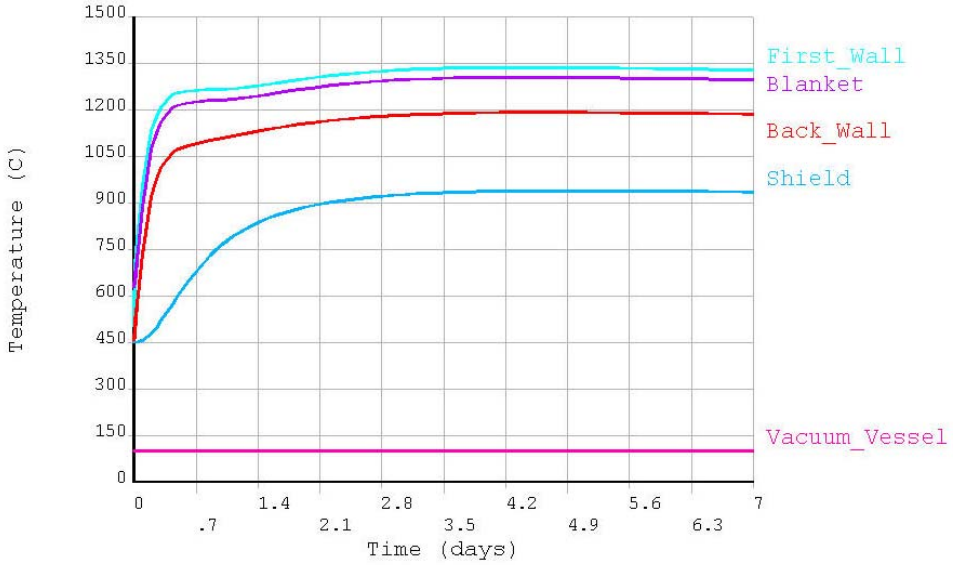
Side By Side Comparison

Without VV Cooling



With VV Cooling



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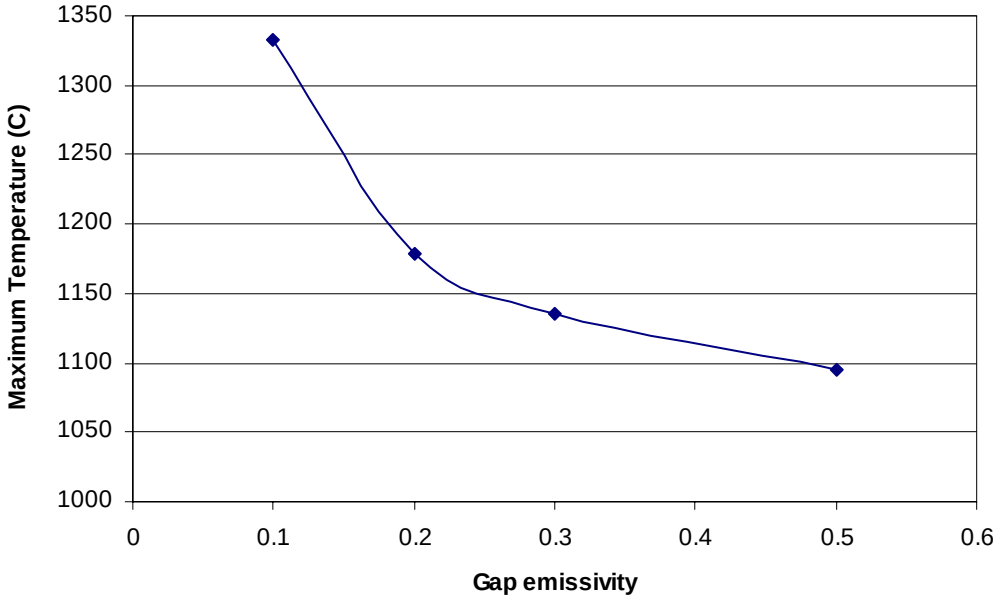
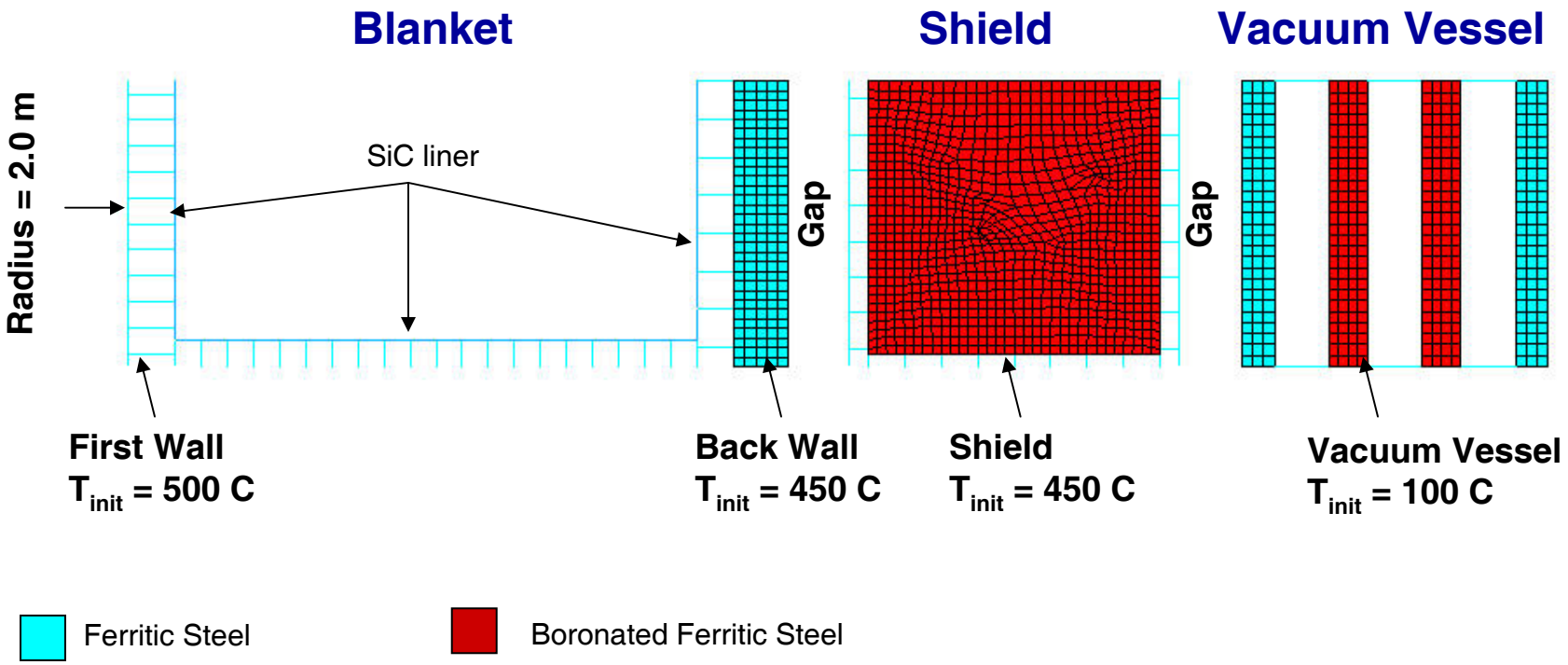
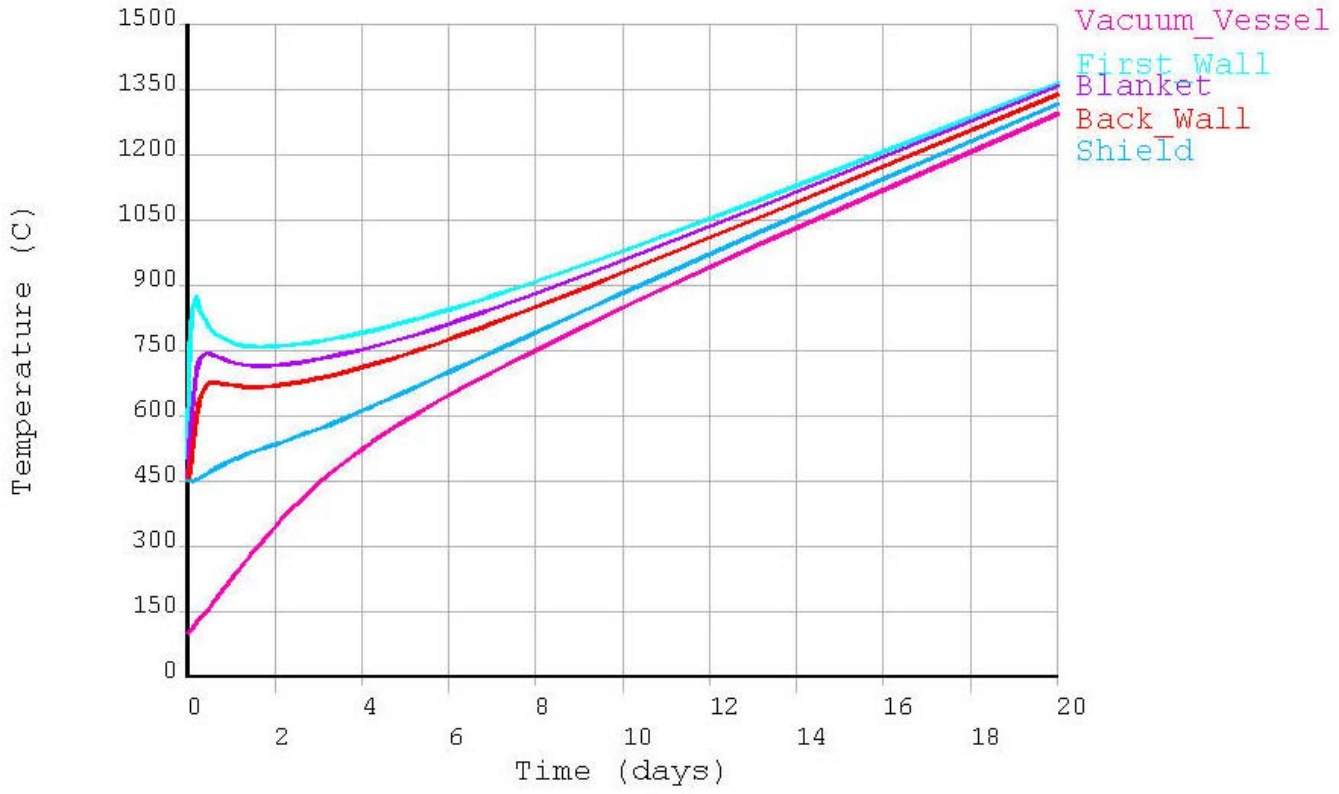
Sensitivity of Maximum Temperature to Gap Surface Emissivity



Repeat without LiPB in Channels



Transient Temperature Response Without Heat Removal



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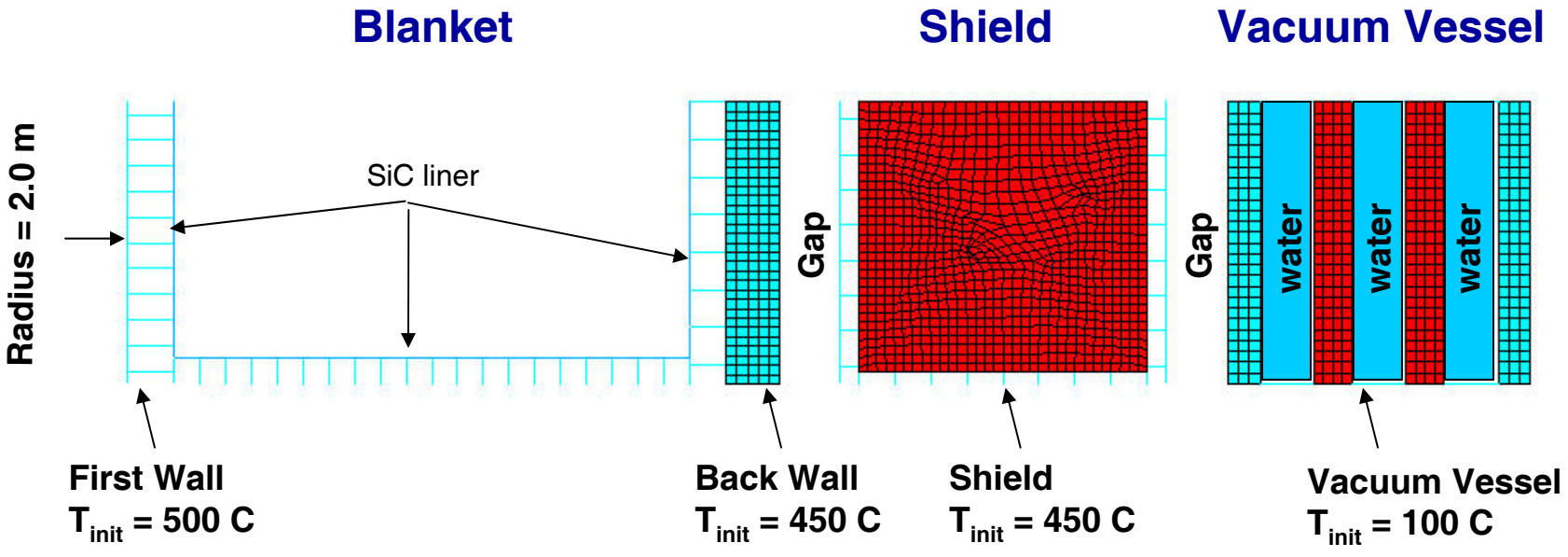
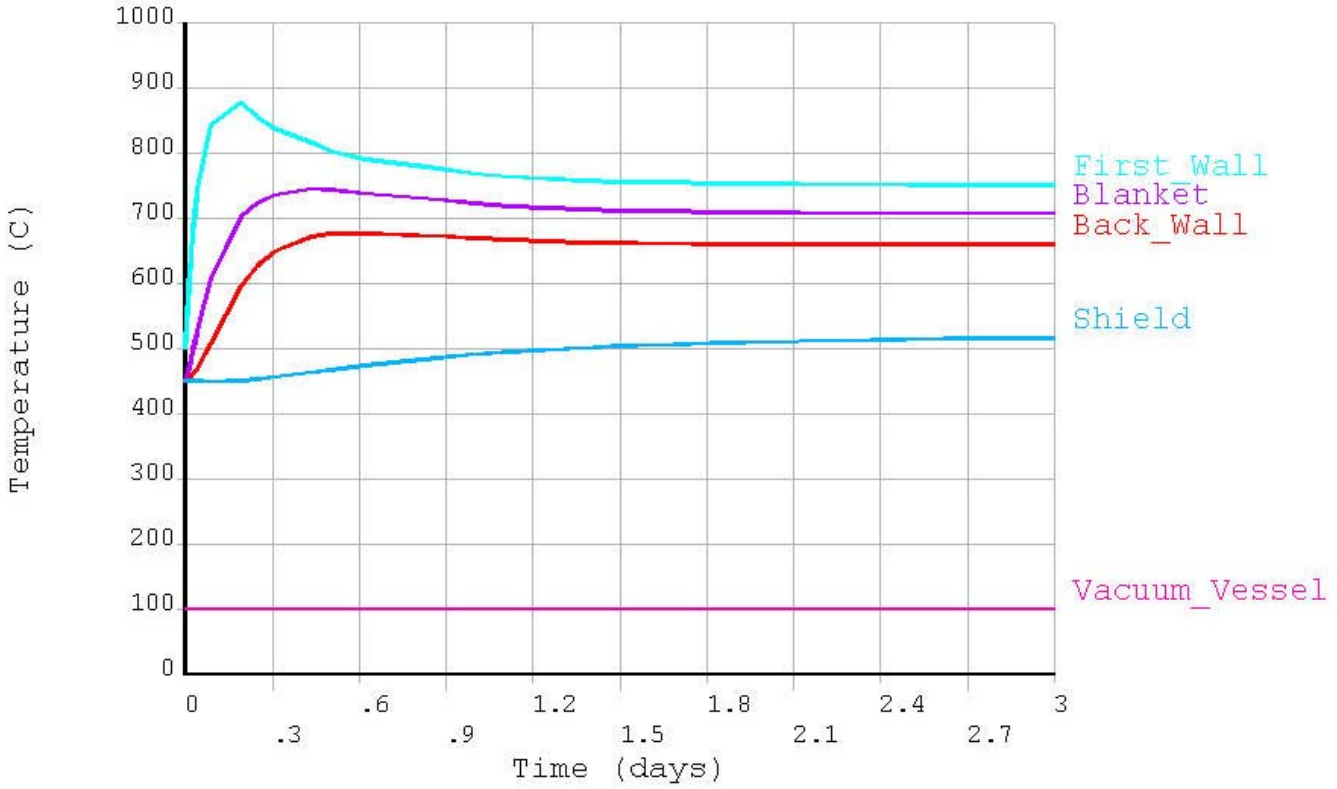


Transient Temperature Response with Natural Convection in Vacuum Vessel



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