DSG Ansys R&D Meeting Minutes

Date: August 31, 2023
Time: 2:00 PM – 3:30 PM

Attendees: Aaron Brown, Pablo Campero, Brian Eng, George Jacobs, Tyler Lemon, and Marc McMullen

1. NPS thermal analysis with Ansys Mechanical

Aaron Brown, Brian Eng, and Tyler Lemon

1. Redoing plots of Ansys transient thermal simulation results
   - Made plots with exponential fit using the data from Ansys transient simulation results when the ambient temperature increases and decreases 1°C
     - Temperature takes ~200 s to reach steady state while heating and ~ 600 s while cooling
     - Inverse to what is stated by Newton's cooling law
2. Will make sure that dividers are making contact with crystals
3. Will review theory and equations applied by Ansys for each boundary condition

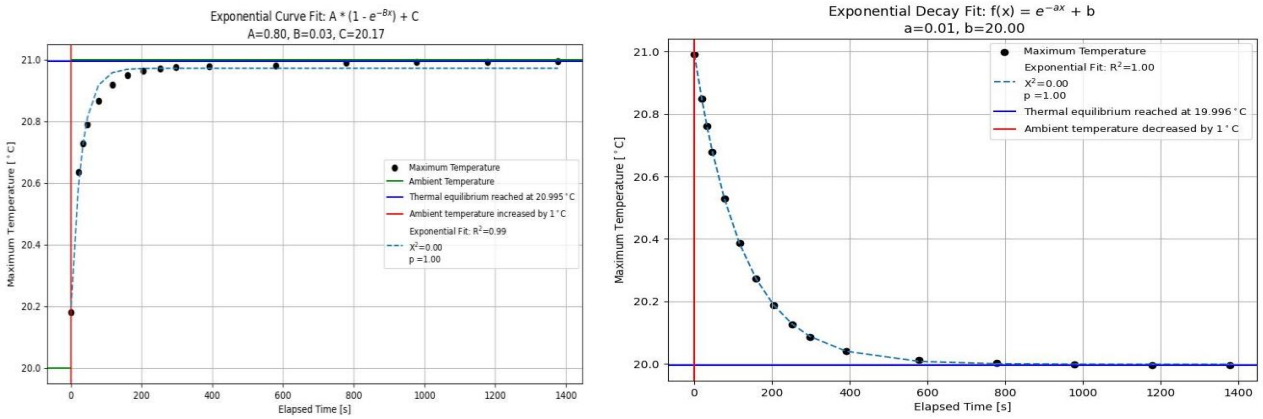

Fig. 1. Left: Exponential fit for 1°C increment in ambient temperature. Right: Exponential fit for 1°C decrement in ambient temperature

2. NPS thermal analysis with Ansys Fluent

Pablo Campero

1. Received eight 64 GB RAM to be used in EXPCAMPERO computer
2. Worked with Ansys Support to reduce the number of cells
   - Completed surface and volume mesh; improved mesh with 17 M cells working. Process speed is acceptable during operations
3. Completed with face/wall separation of 1080 crystals
   - Separation of outer face required to apply the *Shell Conduction* options in the carbon fiber and mu-metal dividers' regions
   - Used *Separate Face Zones* tools and created local regions in Ansys Fluent Meshing software to separate each crystal into five regions
   - Created regions for each crystal of front, carbon fiber, air, mu-metal, and back
4. Started setup of material and cell condition in Ansys Fluent

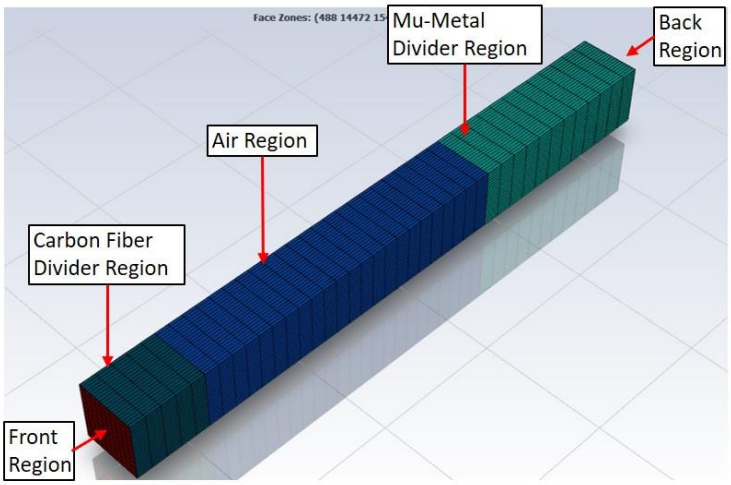

Fig.2. Isometric view of crystal-1 meshed and sectioned into five regions

3. EIC beampipe thermal analysis with Ansys Fluent

Pablo Campero, Brian Eng, George Jacobs, and Marc McMullen

1. Performed thermal simulations at different air inlet flow velocities for 9-m beampipe model
   - Model has beryllium pipe inner volume and uses *Conduction Shell* option for the beryllium pipe and Kapton insulator parts (material and thickness)
   - Ran simulations with inlet air at 100°C with a velocity of 1 m/s, 5 m/s, and 10 m/s
2. Generated temperature contour plots and placed probes at the inlet, middle and outlet sections
3. Generated table with the acquired data from Ansys Fluent results
4. Generated plot that shows the temperature at the inlet, middle, and outlet sections when air flows through its entire length at different inlet flow velocities

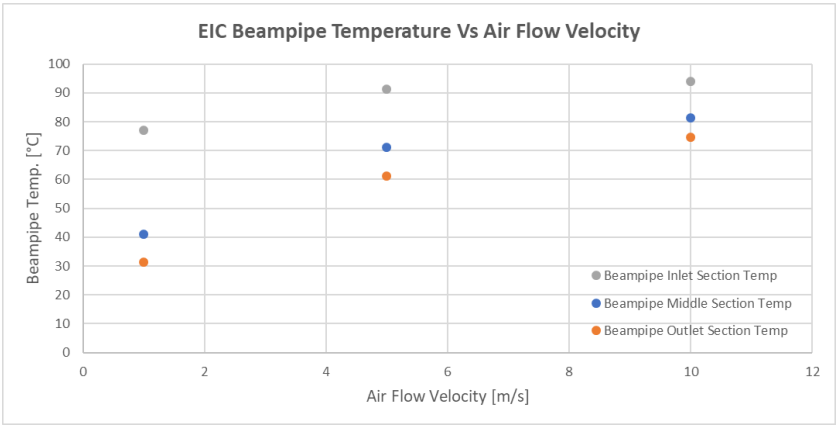

Fig.3. EIC beampipe temperature vs velocity at three regions along the length (z-direction)

5. Discussed the insulator used in the beampipe test stand so can use Fluent to replicate the thermal behavior during simulation
   - Reviewed specifications available from vendor; did not findd required technical data for simulation

     Estimated material and thickness for each layer of the multilayer insulator