DSG Ansys R&D Meeting Minutes

Date: September 7, 2023
Time: 2:00 PM – 3:30 PM

Attendees: Aaron Brown, Pablo Campero, Brian Eng, and Marc McMullen

1. NPS thermal analysis with Ansys Mechanical

Aaron Brown, Pablo Campero, and Brian Eng

1. Made plots with exponential fit using data from Ansys transient simulation when the ambient temperature increases and decreases 1°C and 5 °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
   - Checked temperature profile for a crystal located next to the copper cooling plate and noted the dividers might be overlapping with cooling plate; will use SpaceClaim overlapping and interferences tools to inspect the model geometry
2. Ran Ansys transient simulation (5°C ambient increase) and plotted maximum and minimum temperature for entire crystal array and three individual crystals
   - Will run simulation controlling the time step option manually so we can take more data points prior to reaching steady state

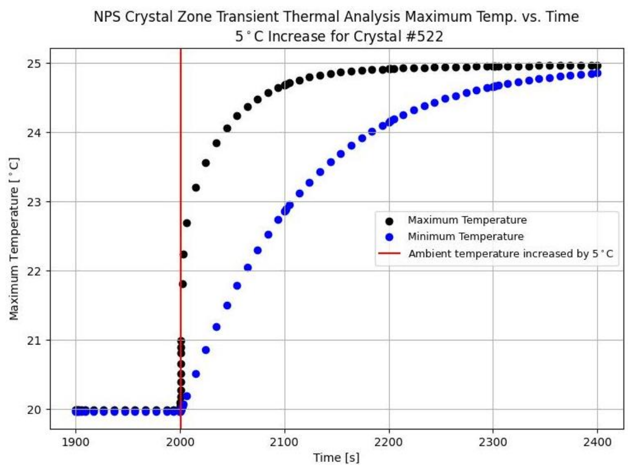

Fig. 1. Maximum and minimum temperature for crystal 522 (located in the center section of the crystal array)

2. NPS thermal analysis with Ansys Fluent

Pablo Campero

1. Installed eight 64 GB RAM on EXPCAMPERO computer; performance test in progress
2. Assigned the material for each component of the model; thermal properties include density, specific heat, and thermal conductivity
   - Fluid: Air
   - Solids: PVC, lead tungstate, copper, aluminum, carbon fiber, and mu-metal
   - Used same values for the thermal properties as those used in the Ansys Mechanical simulations
   - Generated a spreadsheet with all thermal properties to be used as reference for all simulations

3. Generated Report Definitions to calculate and implement thermal conditions for the heat exchangers and crystals
    - Internal temperature difference, performance capability, and inertial resistance
    - Total heat generated per crystal
4. Completed setting up the cell zone conditions for fluid and solid domains
    - Configured porous conditions for the heat exchanger fin
    - Set up frame motion options, rotation axis origins, and rotational speed (1650 RMP) for four heat exchanger fans
5. Set up heat source at rear wall of each crystal
    - Calculation based on 0.3 W of power (from HV and LV channel data) per crystal (same value used in Ansys Mechanical thermal analysis) over its area
    - The heat flux set for each crystal is 750 W/m2

3. EIC beampipe thermal analysis with Ansys Fluent

Pablo Campero, Brian Eng, and Marc McMullen

1. Brian Eng provided information that can be used to estimate material and thickness for each layer of the multilayer insulator
2. Modifying beampipe test stand model to simulate Kapton insulation
    - Since insulation layers are very thin (~0.16 mm) will use Shell Conduction options to simulate each insulation layer