DSG Ansys R&D Minutes

Date: August 17, 2023
Time: 2:00 PM – 3:00 PM

Attendees: Aaron Brown, Pablo Campero, Brian Eng, and Tyler Lemon

1. **NPS thermal analysis with Ansys Mechanical**
   Aaron Brown, Brian Eng, and Tyler Lemon
   1. Redoing plots of Ansys transient thermal simulation results
      - Adding best fit curves for the data results
      - Plots in process are focused on the period where the temperature changes and becomes steady
   2. Discussed plots generated in Python with different functions
      - Issues with plots when trying to fit exponential function for the data
        – After plotting the current exponential function, only straight lines were displayed
        – Recommended finding the right coefficients of the exponential function using function generator option and plot curve within the needed range
      - Evaluated the cubic spline function and determined that this function has limitations and will not explain the behavior of the temperature change
        – Only works for defining the behavior between two points and not for the whole curve with all needed points
      - Arctangent function seems to provide the best fit for the required range, but this function is not commonly used
      - Plot of difference between NPS Ansys data arctangent fit and exponential fit shows the distance between the curves at each data point
        – Difference is given by: Exponential fit – Arctangent fit
        – As noted in figure below, the difference is < ±0.16°C

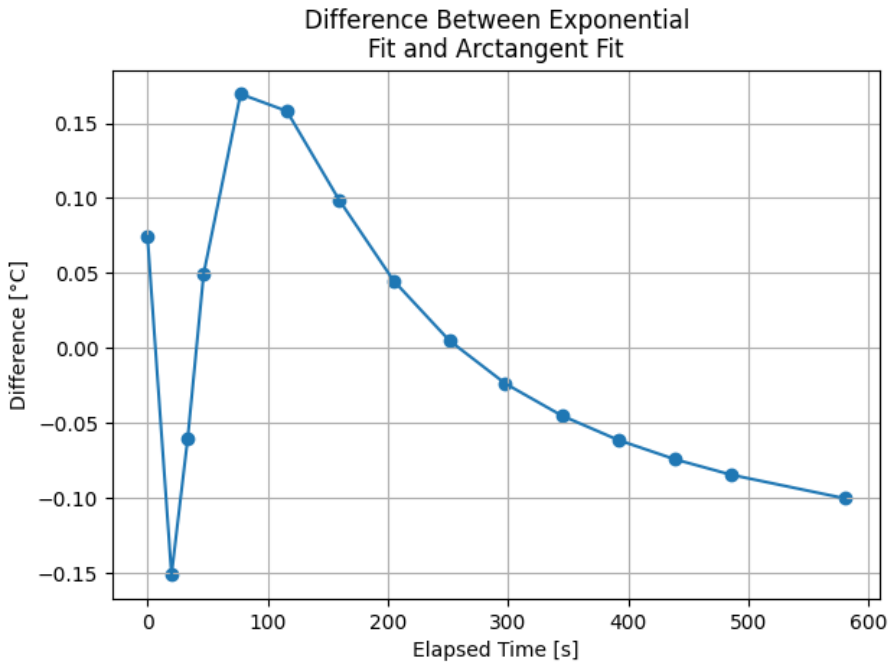

Fig.1. Difference between exponential fit and arctangent fit

2. NPS thermal analysis with Ansys Fluent

Pablo Campero

1. Researched RAM options for EXPCAMPERO computer
   - Current memory: 64 GB distributed in 4 slots
   - Maximum installable memory: 512 GB distributed in 8 slots
2. Submitted PR for eight 64 GB RAM (total 512 GB)
   - PR was signed; keeping track of order
3. Installed Ansys 2023R1 on PHYCOMP2 and EXPCAMPERO (upgrade)
4. Working on reducing the number of cells for the mesh without affecting quality of simulation
   - Opened mesh file sent by Ansys support using PHYCOMP2 computer
     - Monitored computer memory and core usage while opening mesh file
     - First attempt, tried to open mesh file with the double precision option and memory used was ~90% (230GB)
     - Second attempt, disabled double precision and memory used was ~44.5% (114GB)
   - Reduced the mesh of the model to 100 M cells; opening the system is still slow and setting up the simulation is difficult
   - Looking into techniques that can be used in Ansys Meshing to reduce number of cells

3. EIC beampipe thermal analysis with Ansys Fluent

Pablo Campero and Brian Eng

1. Discussed conditions and details of simulation
   - Beampipe material and dimensions: beryllium, ID = 62 mm, OD = 63.52, L = 9 m
   - Insulator material and thickness: polyimide (Kapton), 0.39 mm (three layers)
   - Boundary conditions for air flowing inside the beampipe: inlet with air at 100°C with a velocity of 5 m/s
   - Ambient temperature: 20°C
   - Heat transfer modes for the model: forced and natural convection
2. The goal of the thermal simulation is to generate a temperature profile for evaluating changes in temperature along the beryllium pipe length
3. For initial simulations, the beryllium pipe will be modelled as straight, without the actual conical deformation on its length