# Hall A ECAL Supermodule Heating Simulation

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2022-08

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I simulated and analyzed the heating of one Hall A ECAL supermodule in Ansys.

The goal of the analysis is to simulate the heating of the ECAL assembly to see whether using a heater on a supermodule's face plate allows the lead glass blocks in the supermodule to reach up to ~250° C. This heating of the supermodules is necessary to prevent yellowing from use in experiments.

For the simulation, an NX12 model of a supermodule was used. In Ansys, the first step was to assign proper materials to objects based off of supermodule documentation. For stainless steel, aluminum, titanium, and copper parts, thermal models included with Ansys were used. For the lead glass used for the supermodule blocks and light guides, a custom thermal model was created using information on lead glass found online.

When setting up the simulation, problems arose when generating the mesh for the aluminum that is wrapped around the lead glass blocks and light guide. It is suspected that the extreme thinness (0.025 mm and 0.005 mm, respectively) of these parts was the cause of the meshing error. As a work around to get preliminary results from the simulation, the thin aluminum parts were suppressed in the model. With this, meshing was able to be successfully completed.

After meshing the model, convection to stagnant air was applied to all surfaces and 100 W of heat was applied to the aluminum face plate.

- **Heating will be applied to Hall A ECAL supermodules to help prevent yellowing over their lifetime**
- **Heating of one supermodule simulated in Ansys with 100 W applied to face plate**
- **Face plate reached ~156° C, but the majority of the supermodule remained close to ambient temperature due to low contact between hot area and other parts**

# Hall A ECAL Supermodule Heating Simulation

As part of the simulation, a temperature map of the supermodule is generated, Fig. 1. From this temperature map, it is clear that the hottest part is indeed the face plate where the 100 W of heat was applied. This part reached a temperature of ~156° C and radiated mostly into the titanium side panels that are in direct contact with the face plate. Due to the low contact between the hot end plate and other parts of the super module, the majority of other parts remained at or close to ambient temperature, 22° C.

The next step in the analysis is to improve the meshing so the aluminum wrapping of the lead glass blocks and light guides can be take n into consideration. After that, several supermodules will be put together in a more accurate representation of how the supermodules will be installed in the ECAL.

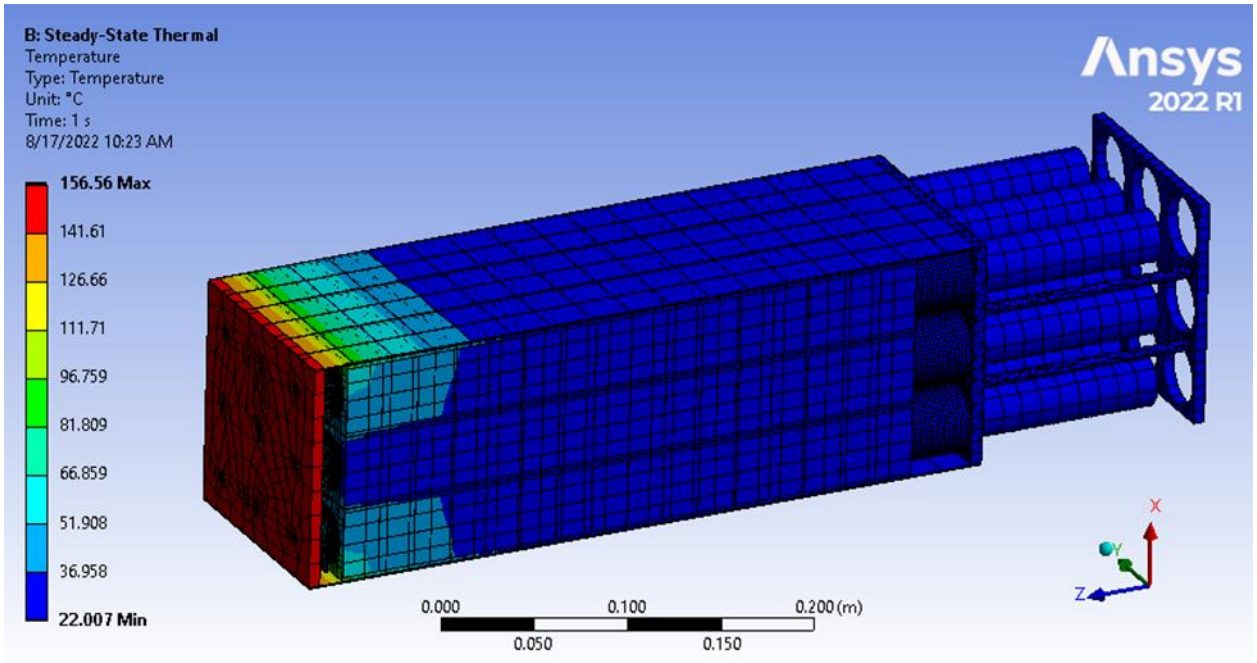


Fig. 1: Resulting temperature map from an Ansys simulation where 100 W of heat is applied to face plate of supermodule.