Development of an Enclosure for Cryogenic Dark Matter Detectors excluding Electromagnetic Radiation
Luke Schwaller¹, Clayton Brown¹, Mark Angelo Emiliano²
Nicholas Pohlman¹
Fermi National Laboratory
¹Mechanical Engineering, and ²Electrical Engineering

Abstract
The goal of this project was to develop a platform capable of supporting multiple families of dark matter detectors, that was capable of greatly improving the amount of photon pollution blocked by the enclosure as well as reaching cryogenic temperatures of 4 millikelvin. To accomplish this, copper was formed in such a way to thermodynamically assist in the cooling of the structure, while sealing in such a way that most of the noise would be attenuated by the enclosure.

Methods and Materials
High purity copper was found to be the best material for the enclosure, as it has the perfect blend of signal attenuation, specific heat, and thermal contraction rates. Additionally, Copper emits relatively little radiation at cryogenic temperatures, removing another source of noise. The enclosure can be seated to the optical table in Fermilab’s NEXUS fridge to cool to cryogenic temperature and has a cassette design to snugly fit the detector crystal.

Discussion and Conclusion
The successes or failings of the design will be proved once the manufacturing and testing is complete. Regardless of the completeness of the project as far as reaching all outlined goals there has been much progress made. The current iteration of the design eliminates many of the problems in previous models and improves on many of the desired features.

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