



Design Improvements to Cables and Connectors in the MAJORANA DEMONSTRATOR

Operating underground at the 4850' Sanford Underground Research Facility

Goals: - Demonstrating backgrounds low enough to justify building a tonne scale experiment.

- Establishing feasibility to construct & field modular arrays of Ge detectors.

- Searching for additional physics beyond the standard model.

Energy resolution of 2.5 keV FWHM @ 2039 keV is the best of any $\beta\beta$ -decay experiment

Background Goal in the $0\nu\beta\beta$ peak after analysis cuts with the achieved resolution: 2.5 counts/(FWHM t yr)

- Projected backgrounds based on assay results ≤ 2.2 counts/(FWHM t yr)

44.1-kg of Ge detectors

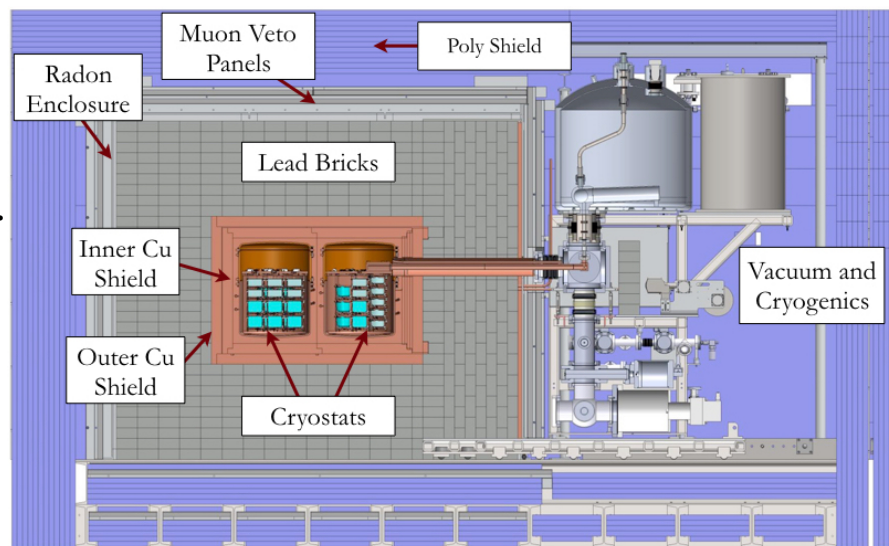
- 29.7 kg of 88% enriched ^{76}Ge crystals
- 14.4 kg of $^{\text{nat}}\text{Ge}$
- Detector Technology: P-type, point-contact.

2 independent cryostats

- Ultra-clean, electroformed Cu
- 22 kg of detectors per cryostat
- Naturally scalable

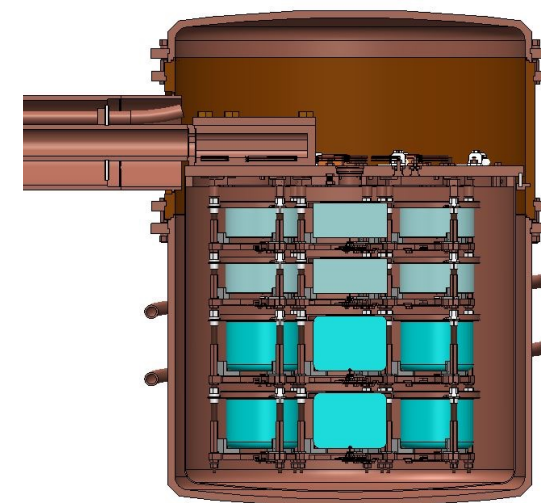
Compact Shield

- Low-background passive Cu and Pb shield with active muon veto



N. Abgrall et al. (Majorana Collaboration), Advances in High Energy Physics, 2014, 1 (2014).

C. E. Aalseth et al. Phys. Rev. Lett., 120(13):132502, 2018.



U.S. DEPARTMENT OF
ENERGY

Office of
Science



THE UNIVERSITY
of NORTH CAROLINA
at CHAPEL HILL

Funded by DOE Office of Nuclear Physics, NSF Particle Astrophysics, NSF Nuclear Physics with additional contributions from international collaborators.



Design Improvements to Cables and Connectors in the MAJORANA DEMONSTRATOR

Based on the DEMONSTRATOR's operational performance, a replacement set of cables and connectors is being developed with the aim of increasing overall reliability while maintaining low connector mass and radiopurity

High Voltage Cable Solutions:

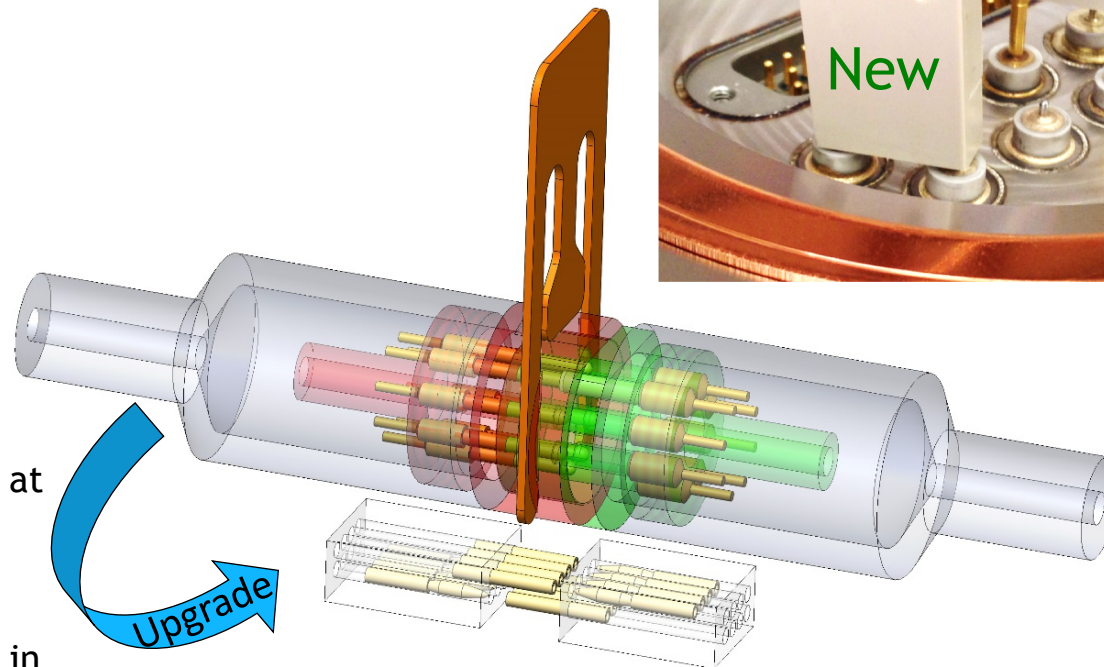
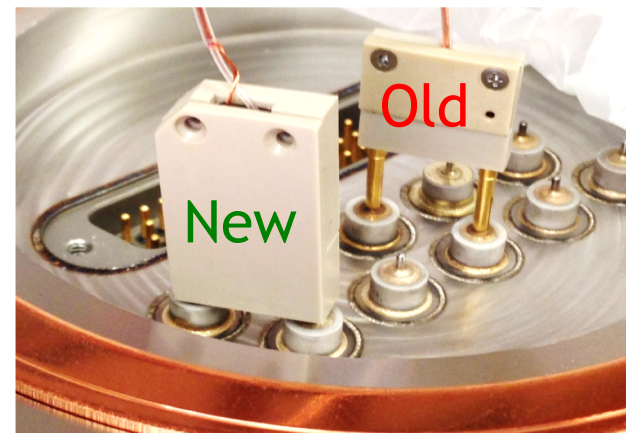
- Improved HV Cable Protection
- Change to crimped terminations

Signal Cable Solutions:

- Replace connectors with custom commercially manufactured connectors that incorporate a twist pin mechanism to improve connector reliability
- Change to crimped terminations

Current Status and Future Work:

- Progress is being made toward the cable and connector upgrade
- Construction of a re-cabled prototype detector string is underway at UNC
- Initial testing shows improved reliability in both HV and signal connections
- Reliable, low background cables and connectors will be important in designing LEGEND



U.S. DEPARTMENT OF
ENERGY

Office of
Science



THE UNIVERSITY
of NORTH CAROLINA
at CHAPEL HILL