SuperCDMS Update

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(for the SuperCDMS Collaboration)

SEF Meeting

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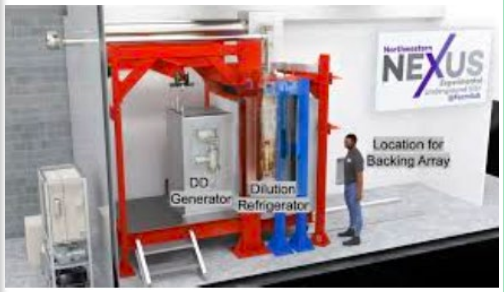
Toronto, ON

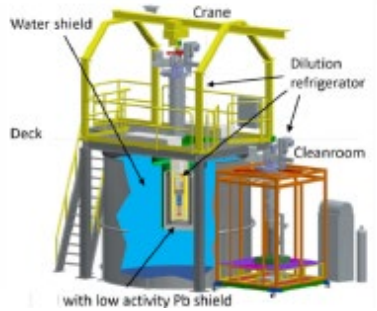
Multiple test facilities, channels, and R&D programs provide science leading to SuperCDMS SNOLAB

Lower Backgrounds, Larger Exposure

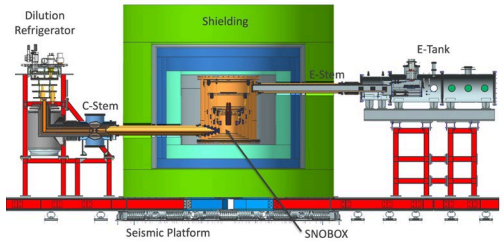
Surface R&D Facilities



NEXUS @FNAL



CUTE @SNOLAB



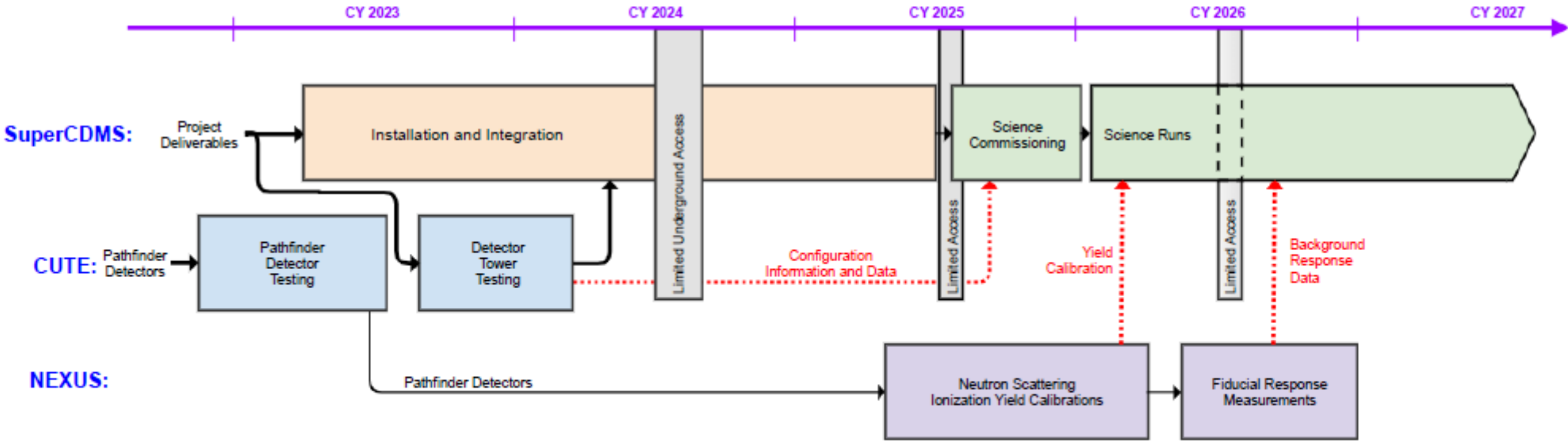
SuperCDMS SNOLAB

Operational, various results published

Operational

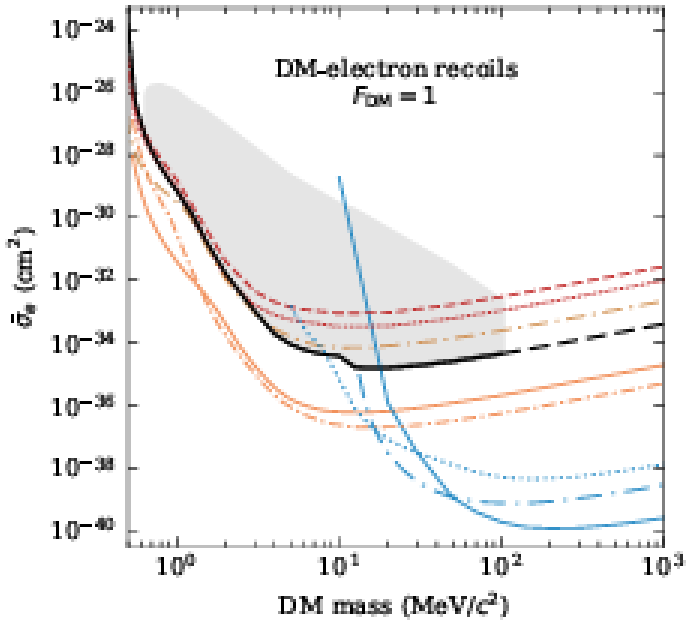
Under construction

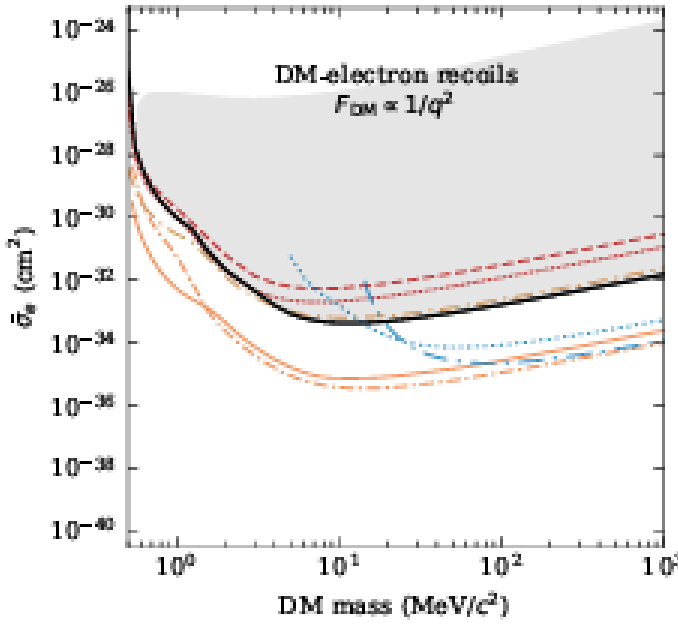
Multi-pronged approach: Test facility data, SNOLAB readiness

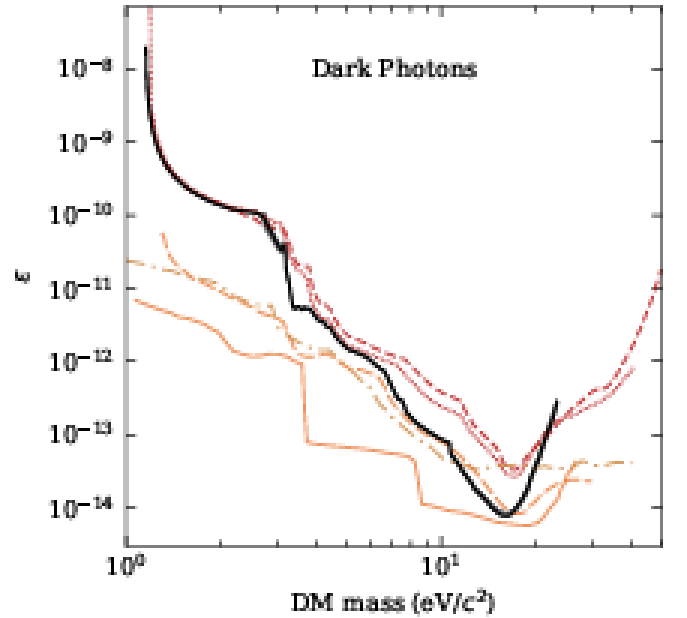


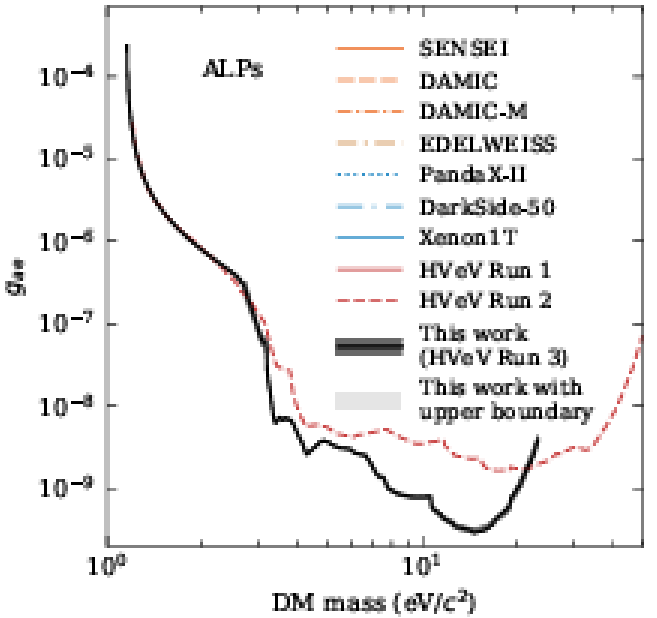
Recent & upcoming SuperCDMS publications

- HVeV Run 3 @NEXUS: arxiv:2407.08085
  - Multiple HVeVs operated underground in same housing, with anticoincidence event selection
  - ERDM, dark photon, ALP limits
- HVeV Run 4 @NEXUS: in final stages of collaboration review
  - Re-designed detector holder eliminated luminescence background from PCBs
- HVeV Si detector calibration using Compton steps: in final stages of collaboration review
  - Energy signatures at ~100eV E_{ee} (L shell steps), ~2keV E_{ee} (K shell step)



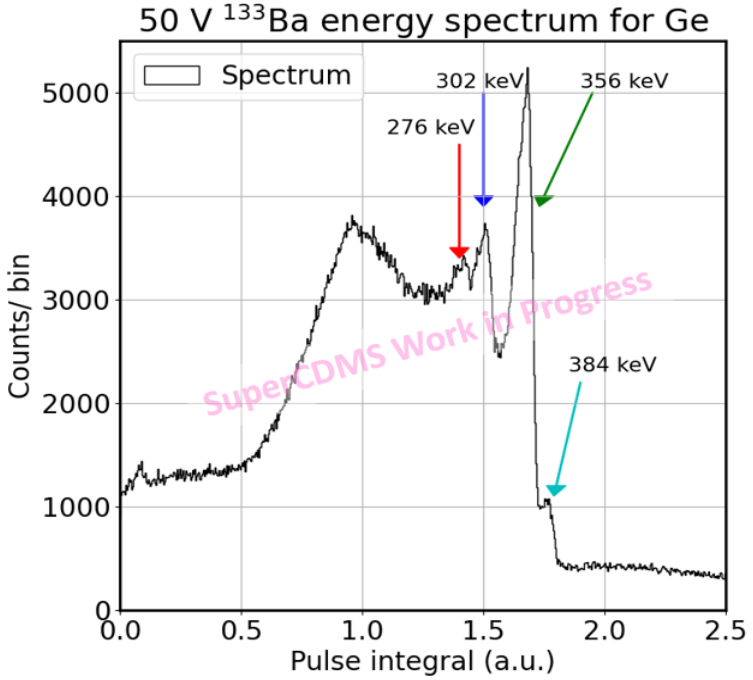


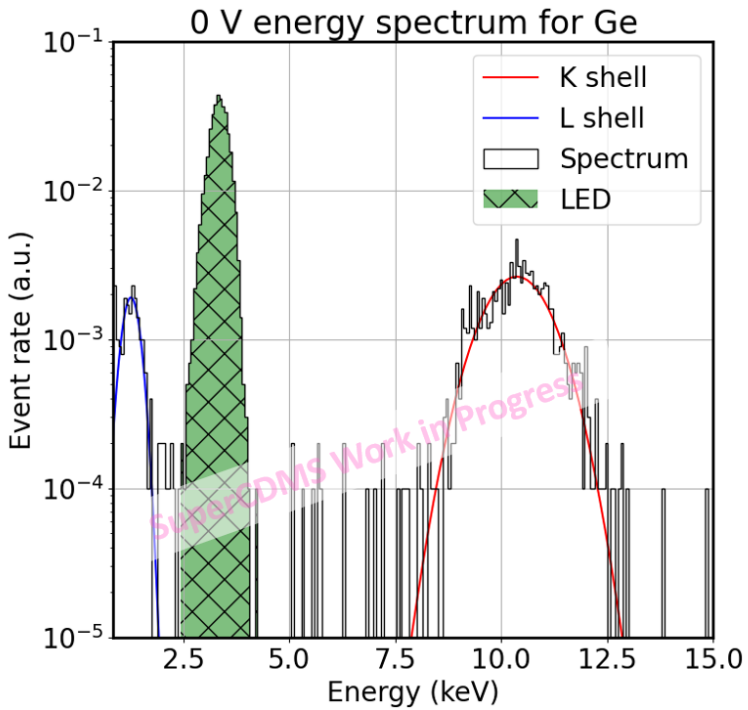


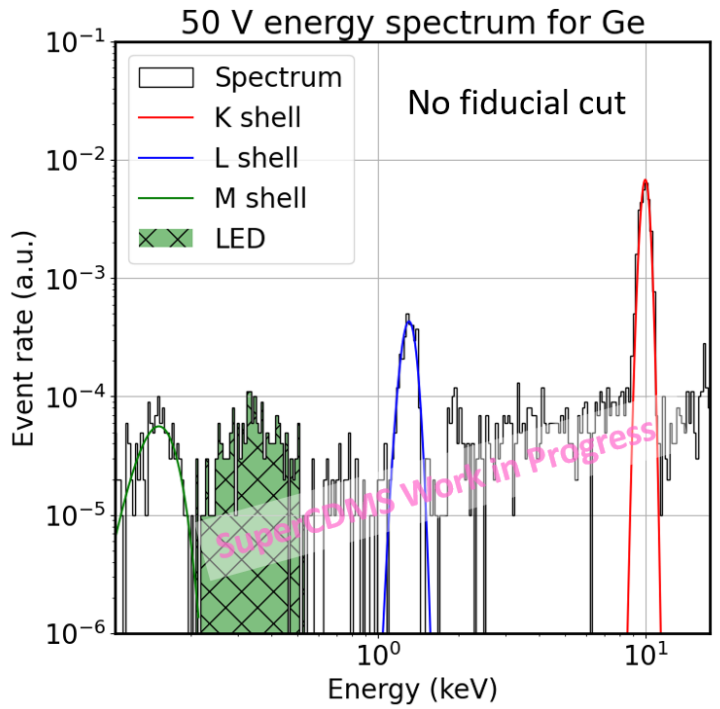


CUTE: Performed first tests of a Tower in very low-background environment

- HV Tower payload: 4 Ge, 2 Si detectors
- Winter 2023/24
- Analyses underway:
  - Noise modelling & background rates
  - Phonon signal amplification
  - Detector calibration
  - Sensitivity estimation
  - Potential DM search

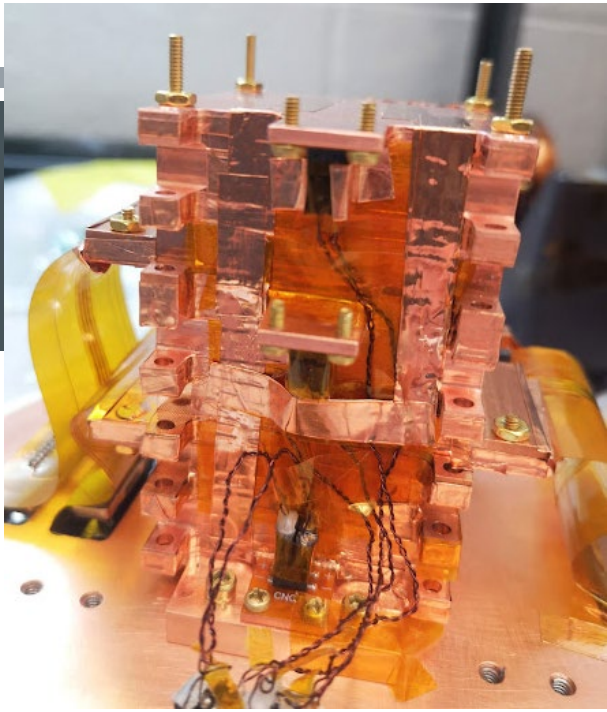


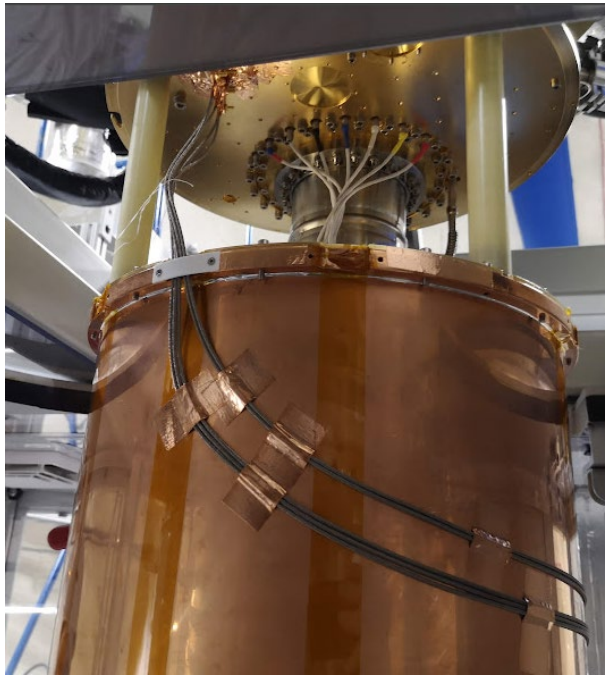


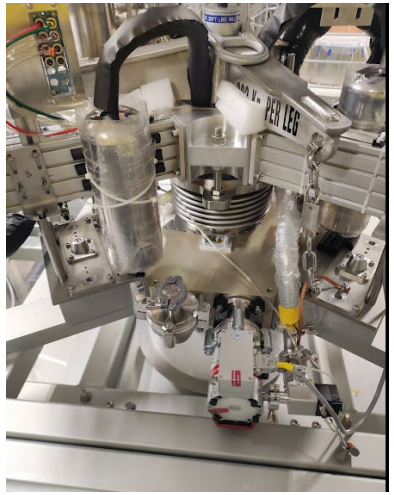


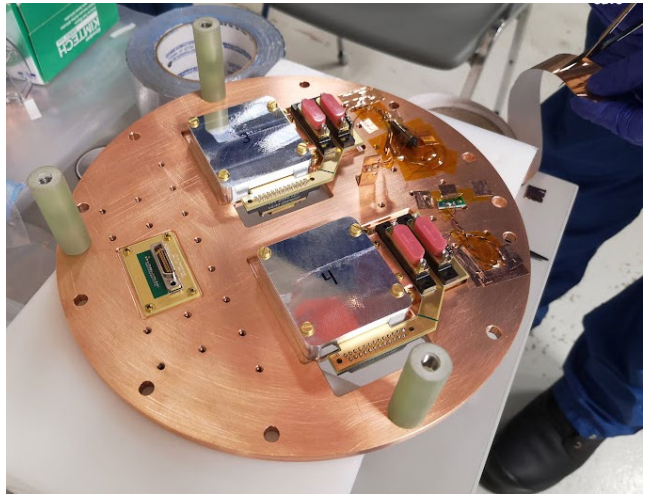
CUTE: Performed HVeV Run 5, to investigate low-energy excess in low-background environment

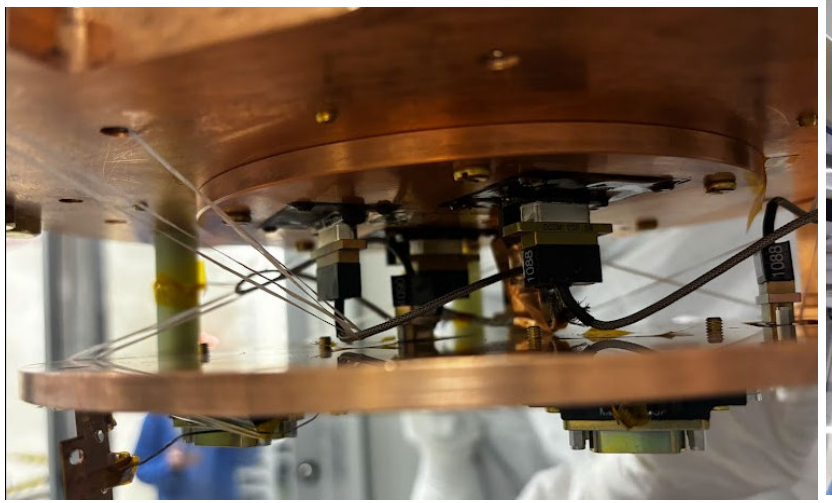
- Spring/summer 2024
- Take advantage of excellent resolution of Si HVeV to investigate:
  - Ionization yield, using data at various voltage biases
  - Rate and spectrum shape change with time and temperature, for different detector masks
  - Detector response to Ba source events











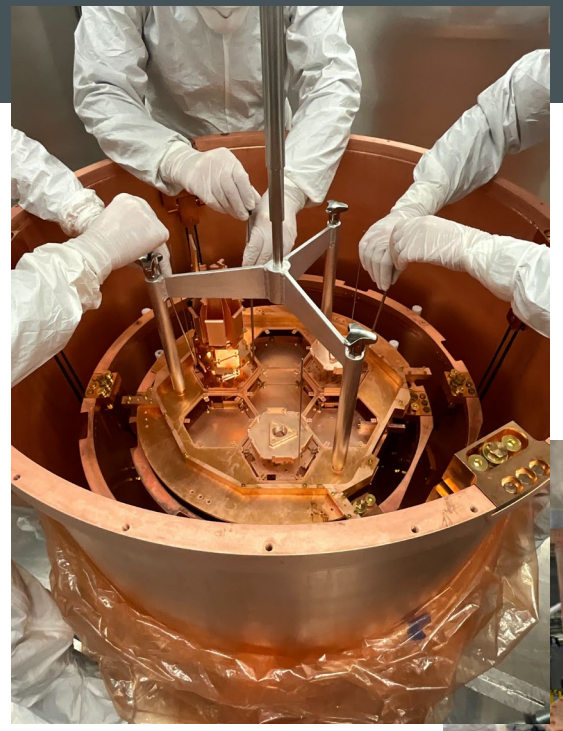
SuperCDMS SNOLAB "Installation & Integration" progress over the past year has been impressive

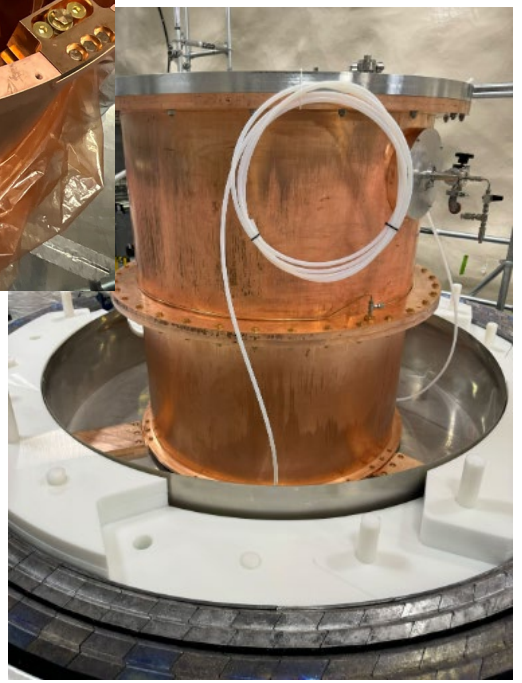
- Pre-assembly of cans performed at SLAC (Feb 2024)
- All towers shipped to SNOLAB, acceptance testing performed (Feb 2024)
- Mu-metal shield base installed (Apr 2024)
- All chambers & stems received at SNOLAB, OVC & C-stem installed (Jan 2025)
- Inner chambers assembled and ready for tower integration (Jan 2025)




SuperCDMS SNOLAB "Installation & Integration" forecast for Aug completion, to be followed by Commissioning

- Next few months:
  - Completion of etching & passivation
  - Completion of dilution fridge system test
  - Installation of towers & lids in inner cans
  - Completion of E-tank & long readout cables installation
  - Completion of shield wall & purge
  - Installation & alignment of cryostat C-stems & E-stems
  - Installation of 50K cooler
  - Finalization of readout electronics readiness
- Final steps: installation & testing of calibration system, installation of water tanks, completion of shield
- Start of cooldown for science running: projected for June





Commissioning includes plans to configure, characterize, tune, and calibrate detector payloads

- Pre-commissioning (in parallel with I&I):
  - Update of DAQ, data-quality, monitoring, and alarm/alert systems
  - Installation of warm sensors & noise filter boards
  - Planning of installation of ice-tank chilled water backup
  - Analysis readiness (processing workflow, data validation & cleaning, blinding strategy, stats tools, etc.)
- Commissioning will begin after I&I initiates cooldown