

CUTE

Cryogenic Underground TEst Facility

Silvia Scorza on behalf of the CUTE team







The Facility



Features:

- Operational temperature as low as 15 mK
- Low overall radioactive background
- Minimal mechanical vibrations
- Low level of electromagnetic interference
- Availability of calibration sources (gamma, neutron)
- Low-radon cleanroom space to change payload

SNOLAB User Facility maintained and continuously improved

Near term use: SuperCDMS detector testing, DM searches with SuperCDMS detectors

Future use: proposalbased; expect to start this process in 2022



The 'Fridge'



Base temperature:

~10 mK(empty)/~12 mK(present payload)

Cooldown time to 14 mK:

~3.5 days with present payload (cooling of internal Pb to <1K)

Stable operation for *o*(weeks) with no action (LN-trap refill ~once per two weeks)





The Shielding





1.5 m water shield
~10 cm of low activity lead
20 cm of polyethylene lid
MuMetal and copper shields
15 cm of internal lead plug + copper box







Component/material: bill of material of the facility

Radioactive emission: gamma bulk (assay), cosmogenic activation, cavern backgrounds Normalization: Geant4 simulations



validated in a 600g Ge iZIP Detector from Soudan

https://github.com/bloer/bgexplorer

M.Baiocchi- SNOLAB



The Balancing







The Calibration



A ¹³³Ba gamma source can be deployed into the shielding with a stepper motor An internal ⁵⁵Fe source has been used to provide a low energy calibration point for low threshold detectors A ²⁵²Cf neutron source will

soon be installed in the water

tank





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Slow Control

FACILITY



R.Germond - TRIUMF





Near Term Plans: SuperCDMS SNALAB

SuperCDMS Detector Testing:

First measurement of SuperCDMS Ge HV detector (1.4 kg) at low background and with HV (imminent) SuperCDMS Si HV detector (~600 g) test later this fall First "tower" (6 detectors) of Ge iZIP detectors (spring 2022)

SuperCDMSDark Matter Search options in CUTE

Single Si HV detector

Full tower with HV detectors (Si/Ge)

CPD -small low-threshold detector (11 g, Si)



CUTE Update – SNOLAB User Meeting, August 202







CUTE is a cryogenic (~10 mK) low-background (few evts/keV/kg/d) low-noise facility operational at SNOLAB Payload up to ~20 kg possible; large volume sample chamber Thermal cycle: 4 days cool-down, [Acquisition], 3 days warm-up, 1-2 days to open/close + payload work Operational since 2019

Possible future uses

- Detector testing for future dark matter and other rare event searches (may include upgrades to SuperCDMS or singlephoton IR sensors)
- Small scale rare event search experiments (payloads with a total mass of about 20 kg are possible; may e.g. include low-mass DM searches or searches for rare nuclear decays such as ⁵⁰V)
- Possible non-particle physics application: superconducting qbits (testing effect of background on coherence time)

Would your interesting project require a low-background cryogenic facility?

Get in touch!