SuperCDMS Operations Status and Plans

Dan Bauer

All Experimenter’s Meeting
January 26, 2015
SuperCDMS Soudan – 3 years of data taking

Deadtime due to: Detector Neutralization (10%), Calibration (10%), Maintenance (5%)
Focus is on low-mass WIMPs

- **Recent Results:**
  - CDMSlite
    - arXiv:1309.3259v3; published in PRL)
  - SuperCDMS low threshold
    - arXiv:1402.7137v2; published in PRL)

- **Upcoming Results**
  - CDMSlite run 2
    - More data, background subtraction
  - SuperCDMS “high threshold”
    - Background-free results from full data set
SuperCDMS Soudan FY15 Operations Plan

• Calibration data and systematic studies
  – Extended calibration data sets
    • Neutrons (252Cf) and Gammas (133Ba, 60Co)
    • Mono-energetic neutrons (Y/Be, Sn/Be) for nuclear recoil E scale
  – Better understanding of backgrounds
    • Source studies in stems and outside shield
  – Study electrical and vibrational noise sources, and ways to reduce these
  – Determine reasons for failures of detector channels

• These studies are important for understanding the SuperCDMS Soudan data systematics, but also for risk mitigation in the design of SuperCDMS SNOLAB
CDMSlite Run 3  
(April – September 2015)

• Previous CDMSlite runs have been done with a kludge that allows relatively high charge bias (70V) at the expense of reading out only one side of the detector, and having a distorted electric field in the crystal  
  – With prototype SuperCDMS SNOLAB electronics, it appears possible to operate one of the Soudan iZIPS in CDMSlite mode with a more symmetric field and double-sided phonon readout  
  – We also have made substantial reductions in vibrational noise and can achieve lower thresholds even with single-sided readout

• 3-4 months of additional data with reduced energy thresholds will provide a significant improvement in low mass WIMP sensitivity  
  – Important both for the physics and for a demonstration that this will work for SuperCDMS SNOLAB
Improving sensitivity to very low mass WIMPs

CDMSlite run 3 (February – June, 2015)
Higher charge bias, lower noise, improved electric field geometry, better fiducial volume definition against backgrounds
Tension between SuperCDMS Soudan and SuperCDMS SNOLAB

• Continued operation at Soudan helps inform the design for SNOLAB
  – Thermal tests, understanding of radioactive background sources, calibration, electronics testing

• Continued operation at Soudan takes manpower away from SNOLAB
  – This is true for both CDMS scientists and Fermilab technical labor

• Need to finish at Soudan during FY2015
SuperCDMS Soudan Decommissioning Plan

• Terms of the DNR lease require removal of all CDMS equipment from the underground lab
  – Soudan lab staff will do most of this work during FY2016
    • Estimate 8 months to take down, crate and ship
  – Some oversight needed from Fermilab scientists and technical personnel
  – M&S mainly for packaging and shipping
  – Travel to Soudan for Fermilab personnel
Summary

SuperCDMS Soudan has operated successfully for several years and produced world-leading low-mass WIMP limits

We are taking calibration and systematic study data now and plan one more CDMSlite data set to extend our reach to even lower WIMP masses

We plan to end SuperCDMS Soudan operations in FY2015 and decommission in FY2016

Focus of the collaboration is shifting to the G2 SuperCDMS SNOLAB project
SuperCDMS SNOLAB
Recently selected as G2 experiment

- **Science:** direct detection of dark matter WIMPs with focus on light masses (< 10 GeV/c^2)
  - ‘Conventional’ WIMPs
  - ‘Dark sector’ particles (low-mass WIMPs)
  - Other exotic particles (axions, LIPs,...)

- **New experimental setup:** Larger, cleaner cryogenics and shielding system, with capacity for up to 400 kg of target mass

- **Location:** SNOLAB, Sudbury, Ontario Canada (deepest clean laboratory in North America)

- **Timescale:** Design (FY15), Fabrication (FY16-18), Operations (FY19-22)
SuperCDMS SNOLAB Reach