Cosmic Frontier Experiment Status

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April 6, 2015

Fermilab Center for Particle Astrophysics
## Cosmic Frontier Experiment Status
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SuperCDMS Soudan – 3 years of data taking

Deadtime due to:
- Detector Neutralization (10%),
- Calibration (10%),
- Maintenance (5%)

March 2012 to Feb 2015
SuperCDMS Soudan 2015 Operations Plan

• CDMSlite Run 3 (Feb-May, 2015)
  – 3 month run underway with lower energy thresholds
  – Substantial improvement expected in sensitivity to very low mass WIMPs

• Photo-Neutron Calibration data (June-August, 2015)
  – Mono-energetic neutrons for nuclear recoil E scale

• Systematic studies (September – December, 2015)
  – Study electrical and vibrational noise sources
  – Determine reasons for failures of detector channels
  – Measure dilution refrigerator performance

• Decommission in 2016
COUPP/PICO Operations Summary

• We continue to learn about particulates extracted from PICO-2L and COUPP/PICO60 last year
• Ongoing testing of particulate sources of events in small test chambers at Northwestern and Queens
• Goal remains to eliminate all sources of background
  – Prevent them from getting in (new run of PICO-2L)
  – Remove them in situ
COUPP/PICO Operations Summary

- PICO-2L with new jar flange, cleaning process and QA now operational for 1 month

Engineering run to test whether particulates come in from the fill or are produced in situ
COUPP/PICO Operations Summary

• PICO60 vessel to be removed and inspected this month
• Particular interest in flange seal
  – Damage to quartz flange a possible source of radioactivity
  – Galvanic rust (observed in prototype, see image) possible source of particulates

Replacement seal design (PTFE gasket) in place to be tested in parallel on prototype vessel
DarkSide-50 Status

● **TPC: MILESTONE**

● **Incident**
  - March 2\textsuperscript{nd}: Power failure → Burst disk ruptured → Lost ~8kg of Atm Ar
  - Incident was solved and actions taken to prevent future similar problems

● **Data Taking**
  - After refilling data taken to establish status of the detector: everything OK

● **Underground Ar**
  - Several tasks to establish a secure system to deploy UAr
  - Filling UAr **COMPLETED**: from March 25\textsuperscript{th} to April 1\textsuperscript{st}.
  - Data taking with UAr: running since April 1\textsuperscript{st} to establish Ar39 reduction factor
DAMIC – Dark Matter In CCDs
FNAL, UChicago, UMich, Mexico, Argentina, Paraguay, Zurich

March 2015 – April 2015

• DAMIC@Snolab: March upgrade
  • One new detector installed.
  • New inner ancient lead shield installed to produce a super-shielded CCD to test the limits of the current package design.

• Next Upgrade: April 6
  • Will replace inner lead shield with copper to measure background difference and evaluate a possible surface contamination on the ancient lead.

Status: taking data with prototype detectors. Uptime >95%. High quality data.
DES Summary

• Status: DES finished observing season 2 (out of 5+) in mid-February. We are 10% behind our originally-planned observations.

• Current DES activities: Preparing a Y3 request to NOAO, writing and submitting papers, planning the work trip for late-July to replace LN2 pump and 2 LN2 line segments. Working on primary mirror support algorithm.

Completion Map after Y2
Goal after 5 seasons is 10 tilings each field
Activities between Mar 1 - Mar 31

- SD efficiency: 97.32% efficiency in the past two weeks, on-going maintenance, upgrade R&D activity (involves SD) continuing in the field.
- Recent FD observation period: Mar 13 - 29; very smooth, rain on Mar 24, 27 - remote shift operational
- Radio array (AERA) - **deployment completed** (153 stations, 17 km²) - stable & continuous data taking

.mar 1 - 31: Number of triggers from cosmic rays (E > 10^{18} eV) per minute ~ 12000 / day
Holometer Operations Status

- Initial science results with **unprecedented** high frequency position sensitivity presented at March 27 Wine & Cheese

- Rapidly approaching holographic noise sensitivity at $10^{-20}$ m/rtHz.

- Systematics studies underway.

Single interferometer resolution $\sim$ few $10^{-18}$ m/rtHz

Single interferometer cross-spectrum resolves individual **thermally-populated(!)** phonon modes in optics substrates

Two interferometer resolution $\sim$ few $10^{-19}$ m/rtHz

Rapidly approaching holographic noise sensitivity at $10^{-20}$ m/rtHz. Systematics studies underway.