Cosmic Frontier Experiment Status

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June 2, 2014

Schramm Experimental Fellow
DES Collaboration
# Cosmic Frontier Experiment Status

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<td>Dark Matter</td>
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SuperCDMS Soudan

Contributions to the dead-time include:

- 10% due to calibration with gamma and neutron sources
- 10% to maintain detector charge collection
- 5-8% for maintenance and special data sets

Continuing normal data-taking
Extended neutron calibration taken at beginning of May
SuperCDMS Soudan

Integrated live time (days) since beginning of operations
Detector mass is approximately 9 kg Ge, so WIMP exposure = 12.8 kg-years
COUPP/PICO Operations Summary

Ended both COUPP-60 and PICO-2L in the last two weeks
  – Both runs ended without incident
  – Target fluids safely drained and detectors are now idle and un-pressurized
  – Collected large calibration data sample in COUPP-60 over last several weeks, PICO-2L ran in dark matter search mode until the end
• Currently making a temperature measurement in PICO-2L to confirm our understanding of the thermodynamic conditions
• Plan for June is to begin a careful sampling of the remaining fluids, looking primarily for particulate contamination
• To be followed by a refill of PICO-2L with a new buffer fluid (LAB liquid scintillator)
• COUPP60 plan will be determined once sampling results are in hand
Final Exposure vs Time
2013-2014 Run

COUPP-60

PICO-2L

Hydraulic leak

22–May–2014
07:03:05, End
of Run

19–May–2014 07:05:15,
End of Run
DarkSide-50 Status

• During May all detectors operated

• TPC
  • Running with Atmospheric Ar
  • Collecting high statistics to prove 39Ar rejection for DS-G2.
  • Several fixes to the DAQ are making data acquisition smooth and >95% live.
  • Acquiring at 40 kg- day/day

• Neutron Veto (TMB and PC mixture)
  • Observed a high 14C rate due to TMB
  • TMB removal and replacement with new PC.
    • Distillation plant:
      • Purification of new PC batch. DONE
      • Separation of old PC from the TMB: ONGOING
    • Scheduled to be finished by end of July.
April-May 2014

• DAMIC-100 detectors fabrication completed
  • First batch already at Fermilab
  • Flex circuit in production at Cordoba, will be delivered next week.
  • Will start packaging the CCDs in June.

• Current setup dominated by 210Pb background
  • Ancient lead pieces machined at Uchicago, shipping to Snolab next week.
  • Low radioactivity lead pieces from Zurich ready, being shipped to Snolab.
  • Installation at Snolab during June.

Status: taking data with prototype detectors. Uptime >95%. High quality data.
Activities between April 20 - May 31

- SD efficiency: 98.5% efficiency in the past five weeks, on-going maintenance, upgrade R&D activity (involves SD) continuing in the field.
- Recent FD observation period: - April 20 - May 9; no error, smooth running
  - current shift (May 19 - June 7); high wind warning for May 29, all smooth so far.
  - remote shift now enabled (@ Wuppertal, Germany)
- Radio array (AERA) is running, only few maintenance trips required - getting more stable.

April 20 - May 31: Number of triggers from cosmic rays ($E > 10^{18}$ eV) per minute ~ 12000 / day
Holometer (E-990) Commissioning Status:

- Control system now engages a stable 1 kW beam lock with a single mouse-click.
  - Implements transitions through multiple intermediate cavity power configurations, adjusting gains and signal filtering at each stage
- **Interferometer power pushed to 4 kW for short periods.**
  - Previous best was 2.1 kW
  - Required signal integration time improves as $1/\text{Power}^2$
- **Wind noise is the dominant source of instability in locking the interferometers.**
  - Wind disturbances are somehow coupled into the ground around our external building enclosure. On windy days, interferometer control is erratic.
  - Currently implementing angular alignment control loops with the hypothesis that the wind noise couples mainly to angular misalignments
  - Additional mechanical isolation systems will be fabricated/installed in June.
- **High current photoreceivers are exhibiting RF saturation effects at >100 mA.**
  - Replacing 1mm photodiodes with 2mm photodiodes to reduce space-charge
Dark Energy Survey

- Season 1: August 30, 2013 — February 10, 2014
- DECam currently being used by other experiments/projects.
- Season 2 schedule submitted to CTIO: Mid-August start (more half-nights)
- Early May: DOE/NSF agency review (went well)
- DES Collaboration meeting in May 24-28 @ UIUC hosted by NCSA
- DESDM and collaboration working hard towards Year 1 annual data release
- ~1000 deg^2 scheduled for late August
LN2 System Maintenance

- DECam cooled by dual-phase, closed-loop LN2 system
- Vacuum jacket of LN2 transfer lines compromised during Y1
- FNAL team traveled to Chile to purge vacuum lines (train CTIO staff).
- Replace LN2 pump after 7 months of routine operation (install accelerometers to monitor pump performance).
- Vacuum re-established and LN2 pump running nominally

Trip By: T. Diehl, A. Lathrop, R. Flores, O. Alvarez, and ADW
Mass and galaxy distributions of four massive galaxy clusters from Dark Energy Survey Science Verification data

ABSTRACT

We measure the weak-lensing masses and galaxy distributions of four massive galaxy clusters observed during the Science Verification phase of the Dark Energy Survey with the purpose of 1) validating the DECam imager for the task of measuring weak-lensing shapes, and 2) utilizing DECam’s large field of view to map out the clusters and their environments over 90 arcmin. We conduct a series of rigorous tests on astrometry, photometry, image quality, PSF modeling, and shear measurement accuracy to single out flaws in the data and also to identify the optimal data processing steps and parameters. We find Science Verification data from DECam to be suitable for lensing analyses. The PSF is generally well-behaved, but the modeling is rendered difficult by a flux-dependent PSF width. We employ photometric redshifts to distinguish between foreground and background galaxies, and a red-sequence cluster finder to provide cluster richness estimates and cluster-galaxy distributions. By fitting NFW profiles to the clusters in this study, we determine weak-lensing masses that are in agreement with previous work. For Abell 3261, we provide the first estimates of redshift, weak-lensing mass, and richness. In addition, the cluster-galaxy distributions indicate the existence of filaments attached to 1E 0657-56 and RXC J2248.7-4431, stretching out as far as 1 degree (approximately 20 Mpc), showcasing the potential of DECam and DES for detailed studies of degree-scale features on the sky.