Operations of the NOvA Near Detector on the Surface (NDOS)

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The NOvA NDOS

The NDOS is exposed to both NuMI and BNB beams.

- 210 ton prototype detector.
- ~16,000 highly reflective 4 cm x 6 cm x 4(3) m PVC cells filled with liquid scintillator.
- Muon catcher at end designed to capture muons from beam neutrino interactions.
- Partially instrumented during the 2011-12 run.
The NOνA NDOS

- **Goals:**
  - Full test of assembly and integration of all detector components
  - Light yield studies
  - Improvements of DAQ and DCS functionality and stability

- **Physics opportunities:**
  - Development of calibration and alignment techniques
  - Improvements to MC detector response simulations
  - Determination of cosmic-ray backgrounds
  - Measurement of CC and NC rates
  - Measurement of off-axis beam composition
Active Channels vs. Time

- Issues found while cooling APDs
- Remaining APDs Redistributed
- Tests of Coated APDs, new mounting hardware

Latest Run = 4948 (31.11%)
The NDOS APD Saga (or, this is why we build prototypes)

- APDs need to be cooled to -15°C to reach sufficient noise levels (at FD)
- Cooling done by active water system and thermo-electric cooler
- Photosensitive face of APD sits in desiccated, air-tight volume.
- Failure of seals led to air entering volume.
- Cooling led to formation of condensation on photosensitive surface of APD, which caused electrical shorts and scorching of surface.
- In order to guarantee more robust system, two-pronged approach now being tested:
  - Protective coating on surface of APDs (Silicone or parylene; both show ~5% drop in light)
  - active dry-air purge system of APD volume
**DAQ Stability**

**Uptime vs. Time**

- **Average Uptime = 75.54 %**
- **Uptime for 24 hour periods**
  - OverNight Uptime Fraction: 96.9%

Since January 1, 2012

- Average Uptime = 72.15 %
- OverNight Uptime Fraction: 100%
NuMI POT vs. Time (for runs with > 1 subrun)
InTime NuMI Events = 203 in last month

Dedicated reconstruction and cuts optimized to find NuMI and BNB candidate events.

InTime BNB Events since 12/8/2011

547 candidate events
397 background events
NDOS Commissioning – What Have We Learned?

- All sorts of construction and installation issues (what kept many of us up late at night): block construction and installation, manifold cracks, APD mounting + cooling challenges, APD, FEB and DCM checkout, scintillator filling, etc.

- Performance of both DAQ + DCS hardware and software, and how these scale from NDOS to FD.

- How to make DAQ and DCS systems work together (still some work to do, but huge progress). DCS uses the readout line as the DAQ system. Readout for these two systems had to be coordinated, not a trivial task!

- Much much more...
NDOS Commissioning – What Have We Accomplished?

- Created a very stable DAQ system!
- Developed file transfer, nearline, online-monitoring systems.
- Offline calibration and analysis of “difficult” data.
- Migration to new electronic logbook and shift scheduler: ECL (FNAL CD product)
- Active dry-air APD purge system designed and tested on NDOS; 12 APDs have been operating “cooled” for ~1 week.
NDOS Commissioning – What’s Next?

- During shutdown (and beyond), NDOS will continue to run and collect cosmic data until NDOS is longer “needed”.
- New DCMs to be installed this week; NDOS will then have a full complement of new (FD) hardware
- New APDs + mounting hardware to be installed on NDOS in this week
- Continued DAQ development, eg partitioning and automatic error recovery.
- Continued DCS development.
- **ALL** of this work is absolutely **CRITICAL** to being ready to take data in partial FD on day 1 of beam turn-on next year; active analysis of commissioning data from this summer will continue.