Daya Bay Antineutrino Detector: Testing and Commissioning

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Anti-neutrino Detector

- Progress of AD Assembly
- First Step in Commissioning: AD Dry Run

AD = Anti-neutrino Detector
A Busy Year

Now: Assemble 1st pair of detectors above ground

Early 2010: AD Dry Run

Spring 2010: Transport underground and fill with scintillator.

Summer 2010: Install at near site and begin taking data

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Surface Assembly Building

- Gate 1
- Gate 2
- North Bay
- 10 ton Overhead Crane Coverage
- Clean Room
- AD Pit
- PMT Test
- SSV Storage
- Wash Area
- PMT Ladder Assem
- Clean Change
- SSV Storage
- PGM
- AC
- North Bay
- 10 ton Overhead Crane Coverage

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Detector Assembly

Lower 5m stainless steel vessel into pit

Install 4m outer acrylic vessel
Detector Assembly

Install 3m inner acrylic vessel

Mount PMTs on support structure and lower into vessel
Detecter Assembly

Close lid, install calibration units, etc.

Wash, rinse, repeat: 8 detectors in total.

Before moving detector, opportunity to check that it all works...

→ AD Dry Run
AD Dry Run

System check before filling with scintillator

1. Dark Hits:
   - Verify PMT readout and system integration

2. Buffer LEDs:
   - Verify coordination of Calibration and DAQ

3. Central LED:
   - Initial Calibration
   - PMT measurements:
     - timing offsets
     - gain
     - P/V ratio
     - relative efficiency

4. Off-Center LED:
   - Reference data for optical modeling
Check instrumentation is working correctly
Integrated test of complete AD system
Much progress in recent months

Display of raw data

Electronics

DAQ Interface

FEE

Splitter

VME

Trigger

DAQ

Calibration system at Caltech

LEDs

Driver

Calibration Control

Photomultipliers

HV

PMTs

Trigger

Analysis Software

Local Computing
On the Road

Detector is moved underground for filling / installation

Lift detector out of assembly pit

Transport into mine using specialized vehicle

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Near Site Commissioning Run: Summer 2010
~10,000 $\bar{\nu}_e$ per week

Can study:
- Reactor anti-neutrino spectrum
- Backgrounds
- “Identical” detector systematics

Potential for quick results!

Detector systems must be tested and ready.

arXiv:0907.1896
$\sin^2 2\theta_{13}$ sensitivity limit (NH, 90% CL)
Summary

- Detector assembly is starting

- Testing program
  - Ensure prompt data taking and analysis

- AD Dry Run
  - Requires integrated test of all AD subsystems
  - Subsystem integration tests in progress