

IceCube Project Monthly Report March 2006

Accomplishments

The IceCube Data Acquisition collected more than 250 million events since mid-February 2006.

UW and RPSC conducted a detailed planning meeting in early April to prepare for the next South Pole construction season.

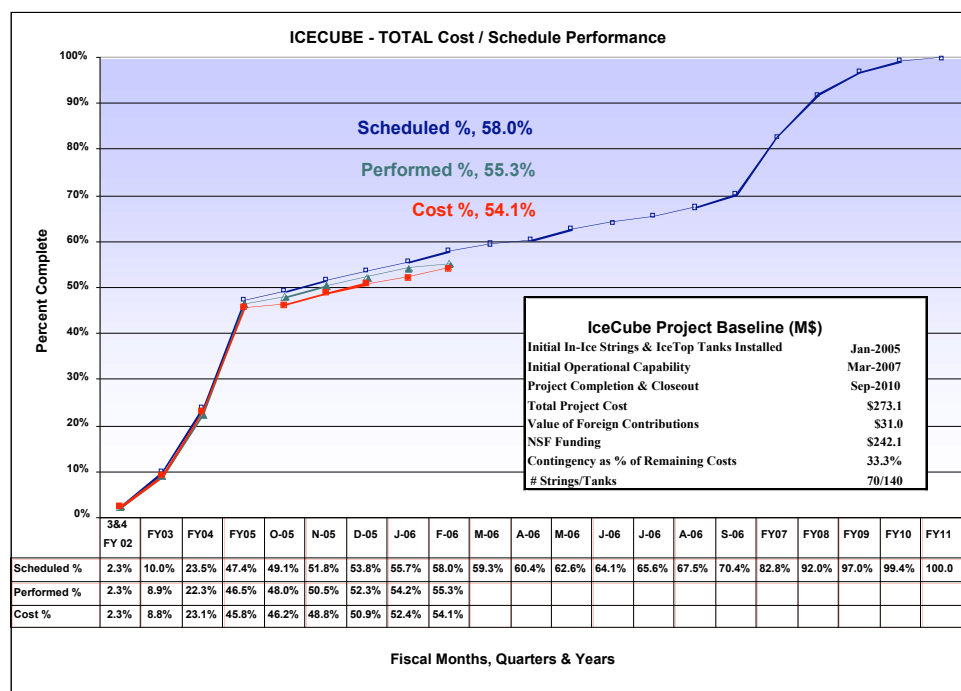
The cable Critical Design and Production Readiness Reviews were held on March 21st. A Digital Optical Module Production Readiness Review was also held on March 21st.

The Drill Advisory Panel, Project Advisory Panel, and Science Advisory Committee all met the last week of March.

The IceCube International Oversight and Finance Group (IOFG) met at the NSF on April 7, 2006.

A Collaboration meeting was held at Southern University from April 9-14, 2006. The meeting included a number of education and outreach activities.

A DAQ review will be held at LBNL from April 25th through 27th.

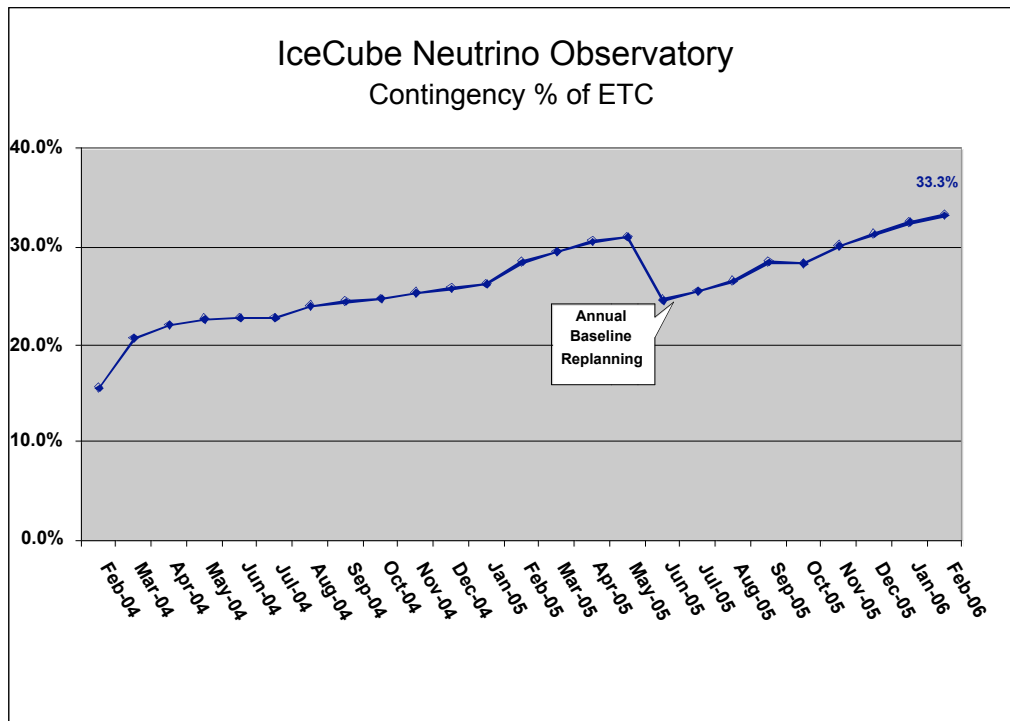


Cost and Schedule Performance – The project is 55.3% complete versus the planned performance of 58.0% complete as measured using earned value techniques. The earned value

measurement includes all tasks completed to date including design, development, procured materials, and the construction of the infrastructure that supports the seasonal installation plan, e.g., the hot water drill, cargo shipments, etc. The cost and schedule status report and total contingency percentage (contingency/cost-to-complete) as a function of time, currently roughly 33.3%, are shown in the following tables.

| IceCube Neutrino Observatory Cost Schedule Status Report Reporting Period Ending: 2/28/2006 ¹ | | | | | | | | | | | |
|--|------------------------------------|-----------|-------------------------------------|----------|---------|------------------------|-------------------------------|----------|--------------|-----------|--------|
| OBS Structure L2 | Cumulative To Date (AY K\$) | | | | | At Completion (AY K\$) | | | Complete (%) | | |
| | Budgeted Cost ² Work | | Actual Cost of Work Performed | Variance | | Budgeted AY \$s | Latest Revised Estimate | Variance | Scheduled | Performed | Actual |
| | Scheduled | Performed | | Schedule | Cost | | | | | | |
| PROJECT SUPPORT | 17169.4 | 17174.4 | 17278.8 | 5.0 | -104.4 | 29904.8 | 30009.2 | -104.4 | 57.4% | 57.4% | 57.8% |
| IMPLEMENTATION | 21312.5 | 20990.6 | 21103.1 | -321.9 | -112.6 | 32388.6 | 32501.2 | -112.6 | 65.8% | 64.8% | 65.2% |
| INSTRUMENTATION | 38185.2 | 38267.1 | 38052.2 | 81.9 | 214.9 | 65432.7 | 65217.8 | 214.9 | 58.4% | 58.5% | 58.2% |
| DATA ACQUISITION | 22299.8 | 22151.5 | 22467.6 | -148.3 | -316.1 | 32864.6 | 33180.7 | -316.1 | 67.9% | 67.4% | 68.4% |
| DATA SYSTEMS | 12483.3 | 11771.9 | 12169.9 | -711.4 | -398.0 | 25017.6 | 25415.6 | -398.0 | 49.9% | 47.1% | 48.6% |
| DETECTOR COMM. & VERIFICATION | 9605.8 | 9283.4 | 8929.6 | -322.4 | 353.8 | 18825.0 | 18471.2 | 353.8 | 51.0% | 49.3% | 47.4% |
| RPSC SUPPORT | 16189.7 | 11345.5 | 8087.3 | -4844.2 | 3258.1 | 32022.1 | 28764.0 | 3258.1 | 50.6% | 35.4% | 25.3% |
| NSF | 545.4 | 545.4 | 545.4 | 0.0 | 0.0 | 1263.0 | 1263.0 | 0.0 | 43.2% | 43.2% | 43.2% |
| Sub Total | 137791.1 | 131529.7 | 128633.9 | -6261.4 | 2895.8 | 237718.5 | 234822.8 | 2895.8 | 58.0% | 55.3% | 54.1% |
| Management Reserve | | | | | | | | | | | |
| Total Contingency Items Outside of Approved Baseline | | | | | | 35,334.8 | 38,230.6 | 2,895.8 | | | |
| IceCube Neutrino Observatory ² | 137,791.1 | 131,529.7 | 128,633.9 | -6,261.4 | 2,895.8 | 273,053.3 | 273,053.3 | 0.0 | 58.0% | 55.3% | 54.1% |

Notes: 1 Incorporates approved and currently pending baseline changes.
 2 Total Budget at Completion includes non-US contributions \$1,283K over the amount in the post Hartill III baseline.
 3 The budgeted contingency is: 33.3% of the Budgeted cost of work remaining.



Drill Operation and String Installation – The drill advisory panel met with a group of drillers to continue the process of evaluating drill operations March 27-28. The group confirmed the success of the season and the direction of efforts planned for the summer. The task list for the summer was distributed to task leaders and the work is underway. Prioritization, scheduling, and costing are ongoing. Major efforts include an independent firm drill, high pressure pump motor upgrade, water tank repair/replacement, tower operation site cabling simplification, rod well building improvements, and software upgrades. The change from two, 12-hour shifts, to three, 9-hour shifts for drilling and installation was well supported in all discussions and is now the baseline plan. This will require 30 drillers at the pole. The model for string installation is to shift the majority of the task to the driller labor pool with only a couple people dedicated just to string installation. This will help ease the overall pressure on population. The population issue is still a major challenge with the work of moving to the IceCube in addition to drilling and string installation activities. The organization and coordination of this work is a major activity now.

The detailed planning meeting with RPSC April 4-5 was routine as most of the players have been through multiple seasons now. The IceCube Lab work by RPSC and the timely approval and transfer to IceCube, efficient installation of new cables, and transfer of old cables from the Temporary IceCube Lab were identified as critical issues for this season. Rough schedules were presented and detailed scheduling has begun as an RPSC task with close support from UW.

The collaboration meeting included discussions on the sequence of drilling for both this year and the future. Optimizing the possibilities for detector calibration, science potential, and efficient construction leads to some competing constraints. A preliminary plan has been prepared and is under active evaluation.

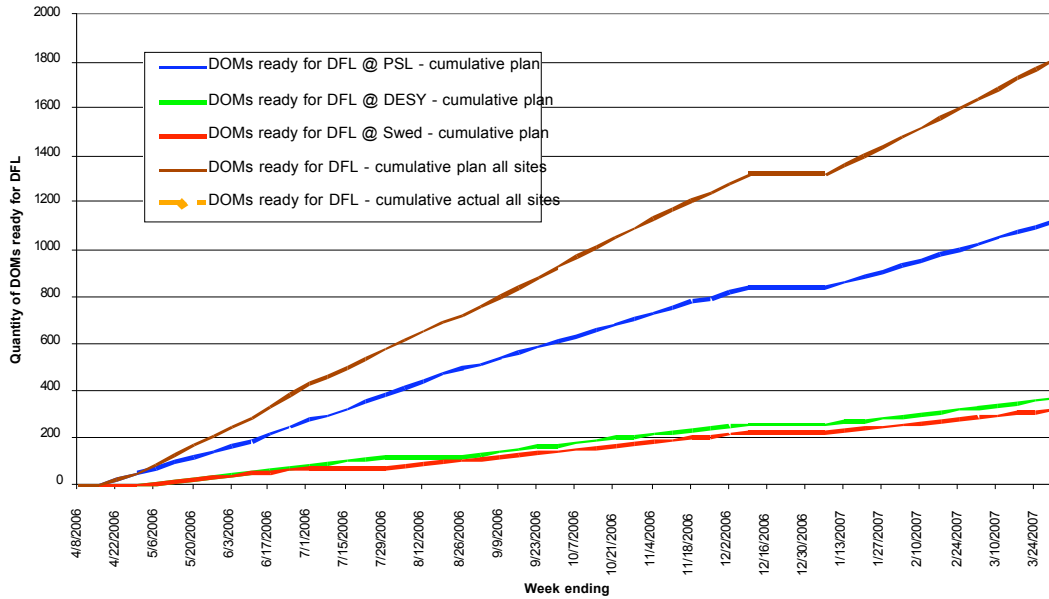
Driller interviews have been completed and we are in the process of making offers. Most of the experience crew is expected to return so we should have a very good labor force this season.

Logistics – IceCube, RPSC and the NSF met on March 16th and 17th, 2006 to discuss results and significant lessons learned from the second IceCube construction season. A more detailed season planning meeting with RPSC was held on April 4th and 5th in Madison. The Office of Polar Program's Support Information Package (SIP) is due on April 17th. A final meeting to confirm season details is scheduled to be held September 12, 2006 at RPSC in Denver.

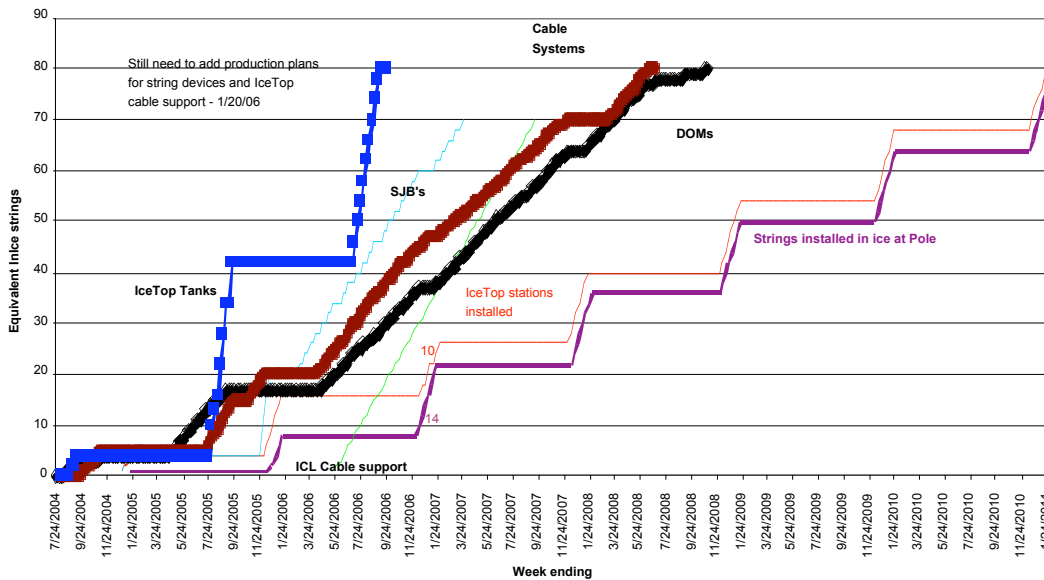
Digital Optical Module and Cable Production Status and Plans - The plan for DOM production for 2006 is provided in the chart below along with the plan for DOM, cable, and tank production plan for the entire 2004 – 2008. There are no major issues with instrumentation production. The plans provide instrumentation well in advance of the installation need dates and support the use of the least expensive shipping methods.

DOM Testing at UW-Madison – The qualification Final Acceptance Test (FAT) cycles for the three modular dark freezer laboratories (DFLs) at the Physical Science Laboratory is scheduled to be completed by the end of the month. The first FAT cycle for the new production run will be in early May. Until now, all U.S. DOM production was carried out using a single DFL. The large number of DOMs needed next season, and beyond require this expanded capability.

IceCube DOM Integration PY5 (April, 2006 to March, 2007) - Plan vs. Actual



IceCube DOM, Cable and Tank Production CY2004 - CY2008 for 76 strings installed

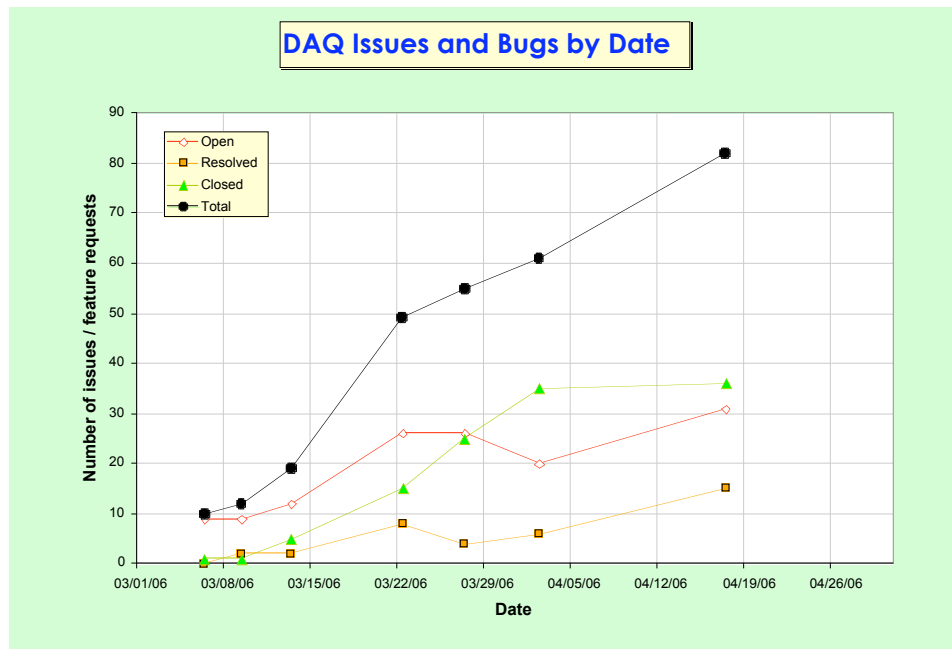


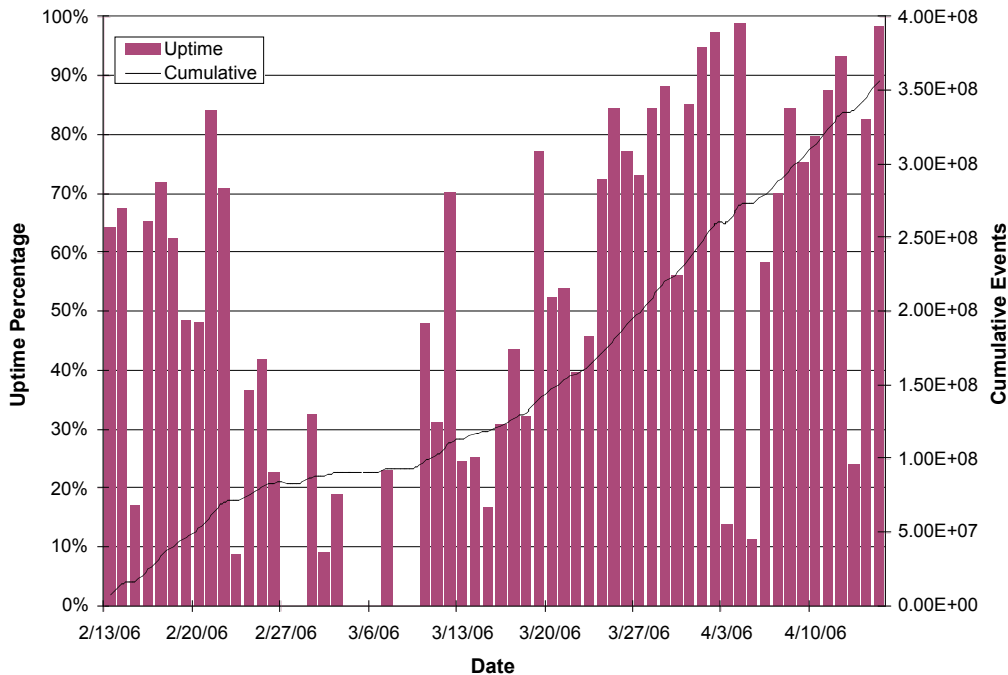
String and IceTop Commissioning – A working meeting was held March 13th through March 16th at Penn State to discuss commissioning and verification results.

Data Acquisition System – The event count for the IceCube 9 string array, with 595 DOMs currently reading out into the data stream, surpassed 250 million events on 4/4 and is upwards of 360 million events two weeks later. Improvements to both DOMHub hardware components and

DAQ S/W reflect in the detector uptime which peaked at 99% on 4/4 and holds at approx 80% averaged over week intervals – 122% increase over the same period in mid-March. The array configuration has changed slightly during this reporting period: phototube high voltages were lowered on average a few tens of volts to reflect the best knowledge of the optimum operating point as calculated by a newer version of the DOM internal calibration software. This has had the effect of reducing the overall event rate to approximately 130 Hz, down from 137 Hz previously. This will continue to fall and then increase again on the order of $\pm 10\%$ with the seasonal variations in the cosmic ray muon flux.

In the Northern Hemisphere, the DAQ application level software (not resident in the DOM itself) is being qualified for migration to 64-bit computing platforms to increasing computing density and decrease power consumption. Preliminary testing has run smoothly and there are predictions for an easy transition.





System Testing – The South Pole Test System (SPTS), a mirror site for the South Pole System is operational in Chamberlin Hall, UW-Madison Physics Department. The SPTS is the final test bed for the data acquisition and data handling software and is used to test patches and upgrades to the software operating on the South Pole System (SPS). An additional test facility is located at the UW-Madison Physical Sciences Laboratory that includes a full-length surface to DOM cable and DOMs in portable freezers to simulate actual DOM operating conditions. This additional test facility will eventually be moved to Chamberlin Hall.

Data Systems - Data Handling made good progress with no major schedule delays. Data is continuing to flow smoothly from the detector, with about 25GB/day of raw data being archived to tape at pole and 5GB/day being transmitted over satellite to the data warehouse at UW. Significant new progress includes:

- Detailed engineering specification and layout for the 17 racks to be installed in the permanent ICL next season. The system hardware has been ordered and will be built and cabled at the UW South Pole Test System (SPTS) site in Chamberlain hall. Schedule and plans for the build of the system, testing, and packing for shipments are in place.
- Decision was taken to move to 64-bit computing at Pole this season after validation by subsystem users. Orders for the South Pole computing system are in place and on schedule to meet the South Pole Build schedule.
- The first major computer hardware purchase for the Northern Hemisphere Data Center at UW was placed. The system is comprised of 64 dual processor-dual core boxes using 64-bit architecture.

The Online Filter and Software systems are on schedule with no significant delays. Particular accomplishments include:

- Successful and smooth operations of the online filter server (PnF) at South Pole with continued integration of the DAQ as it progresses.
- Implementation of first online filtering other than pre-scaling for selecting data for satellite transmission. The first filter was a simple Nhit cut and establishes the data flow and systems operation between the PnF server and filtering cluster systems.
- First online neutrino filters have been tested using pre-scale data in the north and presented to collaboration. Initial neutrino filter for testing in tagging mode at PnF being prepared for deployment within the month.
- New offline data structure and offline software tools (data classes V2.0) released for software developers. This is a significant new release of offline software with more robust and easy to use tools for data analysis.
- Preliminary version and testing for the offline Level 0 process completed. The L0 process is the first stage of the offline reconstruction on the data in the north data warehouse, which prepares (calibration, configuration etc...) the raw data from the satellite into the offline data format. The data from the 9 strings in the data warehouse for this season has been processed and is available for offline analysis using V2.0 offline software tools.

The simulation effort is slightly behind schedule with release of large production data sets of IceSim. Some accomplishments include:

- Release of IceSim (V1.2), which is the final version under offline version V1 for production testing. Limited simulation was run for testing and verification. Some problems were found, but it was good test of the system.
- Transition of IceSim into offline software version V2.0 has begun and is near completion. During this transition several known issues with V1.2 were addressed.
- A production using IceSim V2 should begin by the end of April, which will represent a significant milestone. The end of April would represent about a 6-8 week delay from the PY04 schedule.
- Significant intervention by the L2 manager occurred in simulation in response to ongoing issues with getting delivery of work from the assigned institutions. This is particularly a problem with the very distributed and fragmented manpower available from Non-US groups (i.e. small fractions of FTE's across many institutions). The L2 manager is working on building a smaller number of concentrated efforts using US resources, and hopes to get a significant concentration at a Non-US group as well.

Experiment control is making progress with some continued schedule delays. Progress in experiment control includes:

- Continued development and support for the core control infrastructure, which is particularly used by DAQ for configuration.
- Work with DAQ subsystem in working out bugs and in developing web based control and configuration of DAQ. The DAQ configuration at Pole currently uses the basic “JBOSS” and “Mbean” infrastructure by executing scripts at run start.
- Some initial systems for monitoring of the detector status have been developed and put in place.
- The top level control architecture envisioned for configuration, control, logging, and monitoring has not been fully delivered. However, there is a discussion between the developers and subsystem users on some of the issues for deciding the final implementation.

Quality Assurance & Safety – For the coming South Pole Season the three Deputy Shift Leads will also serve as Safety Officers. They will also be responsible for writing incident reports and ensuring the implementation of preventative actions. A Safety Tabletop meeting will be held at RPSC in Denver on September 13, 2006.

The monthly reports are posted at [IceCube Monthly Reports](#).

Meetings and Events

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|--|--------------------|
| DAQ/On-line Review – Lawrence Berkeley National Laboratory | April 25-27, 2006 |
| NSF Annual Review – Madison | May 23-25, 2006 |
| Summer Analysis Meeting – Penn State | June 21-25, 2006 |
| Season Confirmation Meeting – RPSC | September 12, 2006 |
| Safety Tabletop Meeting – RPSC | September 13, 2006 |