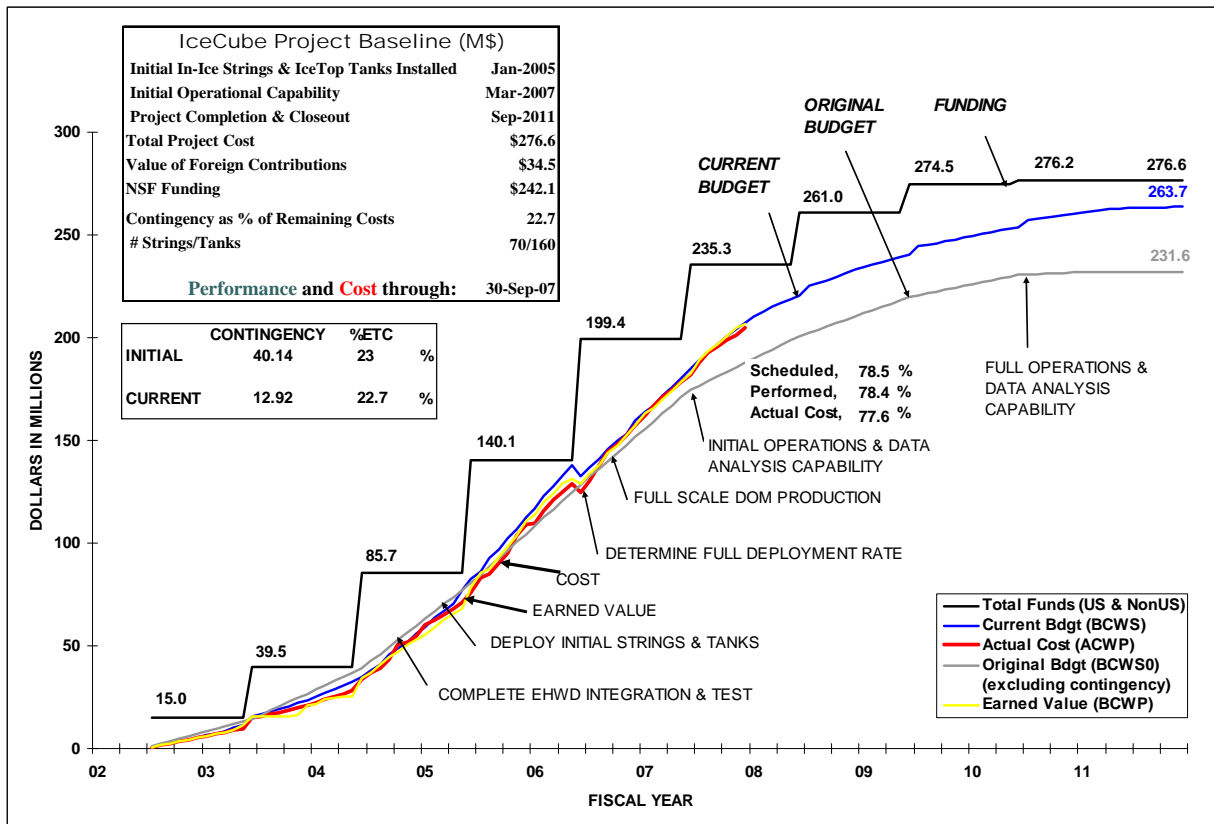


## IceCube Project Monthly Report October 2007

### Accomplishments

- The 07-08 South Pole season is underway. There was a slow start to this season due to weather conditions in McMurdo Station and at the South Pole that forced a reduced number of passenger/cargo flights relative to the original plan.
- Data taking during October 2007 was very smooth and an overall uptime of 96.2% was achieved. The unscheduled downtime was 3 hours (0.5%) due to two separate power outages that brought down AMANDA and one of the IceCube surface computers.
- DOM Flasher control using the production Data Acquisition System (p-DAQ) was installed and successfully tested. The p-DAQ is now used to control flasher runs for calibration and verification.
- A new online Gamma Ray Burst (GRB) filter that sets a secondary discriminator threshold for different DOMs was deployed and successfully tested. The filter provides additional physics information while keeping the previous IceTop trigger functionality unchanged.
- Mass simulation production continues in support of the 22-string (IC-22) physics analysis. In addition a large production run of 80 string simulation events was completed.



**Cost and Schedule Performance** – The project is 78.4% complete versus the plan of 78.5% 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 Enhanced Hot Water Drill, cargo shipments, etc.

IceCube Neutrino Observatory Cost Schedule Status Report Reporting Period Ending: 9/30/2007 <sup>Note 1</sup>													
OBS Structure L2	Cumulative To Date (AY K\$)						At Completion (AY K\$) <sup>Note 5</sup>			Complete (%)			
	Budgeted Cost <sup>2</sup>		Actual Cost of Work Performed	Variance		Contingency		Budgeted AY \$s	Latest Revised Estimate	Variance	Sched	Perf	Actl Cost
	Work Scheduled	Work Performed		Schedule	Cost	Assigned	% ETC						
Project Support	21,780.4	21,780.4	21,554.5	0.0	225.9	246.4	5.2%	27,312.0	26,336.4	975.6	79.7%	79.7%	78.9%
Implementation	31,230.9	31,161.2	31,095.6	-69.7	65.6	2,926.6	19.8%	44,447.1	45,881.6	-1,434.4	70.3%	70.1%	70.0%
Instrumentation	61,503.0	62,089.3	59,866.5	586.3	2,222.9	651.7	5.3%	72,267.8	72,267.8	0.0	85.1%	85.9%	82.8%
Data Acquisition	32,490.9	31,861.4	32,289.6	-629.5	-428.2	199.2	13.2%	33,803.7	33,803.7	0.0	96.1%	94.3%	95.5%
Data Systems	21,423.4	21,173.9	21,431.9	-249.5	-258.0	145.8	2.8%	26,723.2	26,723.2	0.0	80.2%	79.2%	80.2%
Detector Comm. & Verification	16,605.5	16,633.4	16,934.3	27.9	-300.8	475.1	9.3%	22,017.3	22,017.3	0.0	75.4%	75.5%	76.9%
Pre Operations	233.0	233.0	117.8	0.0	115.2	0.0	0.0%	533.8	533.8	0.0	43.6%	43.6%	22.1%
Subtotal	185,267.0	184,932.6	183,290.1	-334.4	1,642.5	4,644.8	10.5%	227,104.9	227,563.8	-458.9	81.6%	81.4%	80.7%
RPSC SUPPORT	21,101.7	21,198.8	20,605.0	97.2	593.9	1,530.1	10.8%	35,339.9	34,823.8	516.0	59.7%	60.0%	58.3%
NSF	757.8	757.8	757.8	0.0	0.0	30.3	6.0%	1,263.0	1,263.0	0.0	60.0%	60.0%	60.0%
Total	207,126.5	206,889.3	204,652.9	-237.2	2,236.4	6,205.2	10.5%	263,707.8	263,650.6	57.2	78.5%	78.5%	77.6%
CONTINGENCY <sup>Notes 3,4</sup>								12,919.7	12,976.9	-57.2			
IceCube Total <sup>Note 2</sup>	207,126.5	206,889.3	204,652.9	-237.2	2,236.4	6,205.2	10.5%	276,627.5	276,627.5	0.0	78.5%	78.5%	77.6%

Notes: 1 Incorporates approved baseline changes.  
2 Total Budget at Completion includes non-US contributions 4,857 K over the amount in the post Hartill III baseline of: \$29,698 K  
3 Budgeted contingency is: 22.7% of the Budgeted cost of work remaining.  
4 Budgeted contingency is: 22.8% of the Estimated Cost to Complete (ETC)  
5 All latest revised estimates detailed planning for PY6-10  
6 Contingency is assigned to each L-2 element based on the ETC, a bottom-up risk assessment model, management judgement, and cost constraints.

The cost status report for the period ending September 30, 2007, includes contingency assignment in dollars and as a percentage of the Estimate-to-Complete (ETC). The Latest Revised Estimates for all Level 2 elements reflect the current budgets or the budgets modified by the cost performance index.

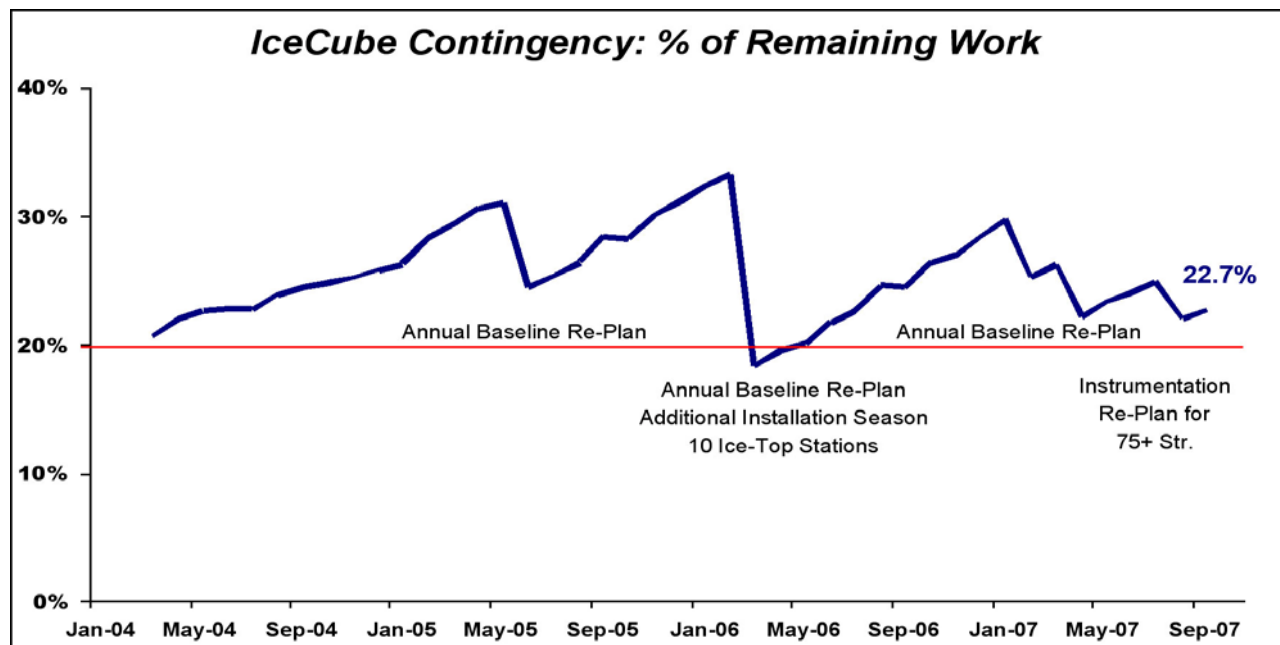
### Change Log - IceCube Total Project Budget Baseline (\$K)

No.	Description	Date Approved	Total Baseline	Allocated Budget	Allocated Budget Change	Contingency Budget	Estimate To Complete (ETC)	Budgeted Cost of Work Remaining	Contingency % of Remaining Work
NA	Status as of August 2007	276,628	263,708	0	0	12,920	58,625	58,684	22.0%
NA	Status as of September 2007	276,628	263,708	0	0	12,920	56,761	56,819	22.7%

There were no baseline changes during the month of September. The contingency as a percentage of remaining work increased from 22.0% to 22.7%.

### Risk Assessment & Potential Contingency Allocations

Item Description	Potential Contingency Allocation
Assign contingency to mitigate technical, cost and schedule risks associated with the defined scope of work. Risk model applied at WBS-Level 4 to assess appropriate contingency as a percent of the cost of work remaining.	\$6,205K
The cost to retro IceCube equipment/materials from the South Pole at the end of the project was not included in the baseline budget. This number represents a worst-case scenario if all drill equipment is returned after the 2010/11 drilling season. A more likely scenario would cost less than one half of this amount.	\$1,500K
The remaining budget for spare hose segments does not fully satisfy the likely demand. The increased hose service life gained by increasing the storage temperature is not yet quantified.	\$500K
Pre-Operations activities may be extended beyond the one year currently budgeted. During the first three years of initial operations it may be necessary to conduct engineering runs concurrent with operations to debug software and ensure reliability of the installed equipment.	\$667K
Restore 80-string configuration. This is the current estimate of the cost remaining to restore the array to the 80-string configuration.	\$3,294K



**Drill Operation and String Installation** – The road to the drill Seasonal Equipment Site (SES) was graded and a 5000-gallon fuel tank was hauled across the Ski-way and located near the generators. Generator 3 was moved into position and plumbed directly to the 5000-gallon fuel tank to provide early power to the SES.

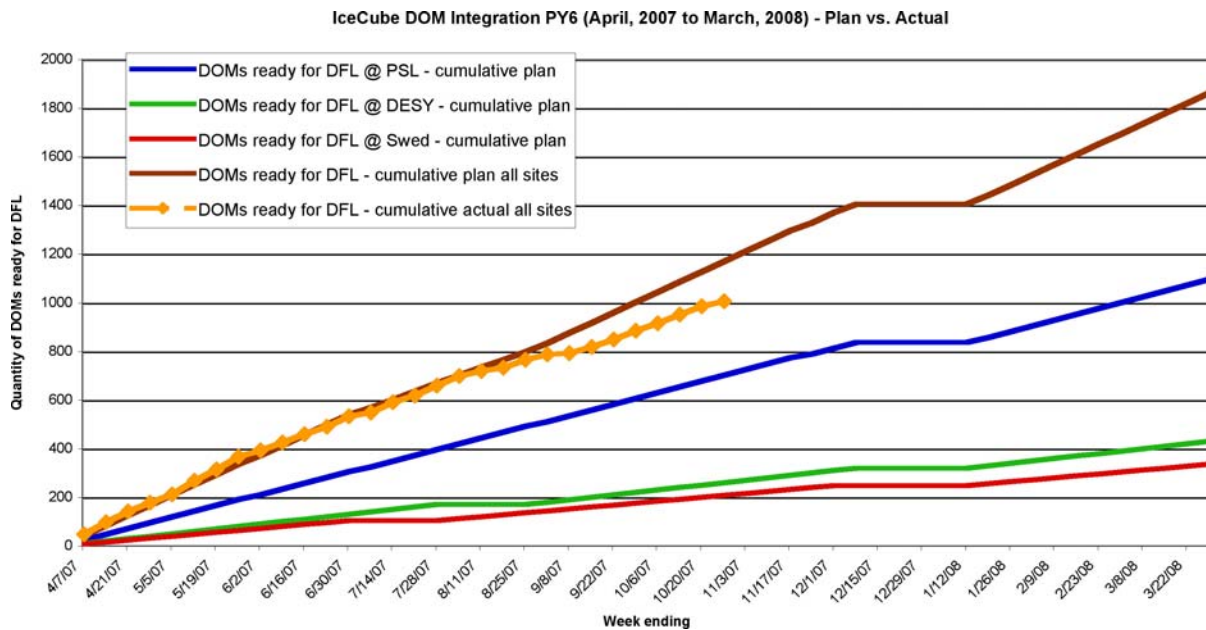
The camp was cleared of snow to the point that fuel and power lines can be run to each of the Modular Drilling Structure (MDS) units. The snow ramp to Water Tank 1 is in place. Pump and motor modifications are being completed in the High Pressure Pump MDS. The Drill Control Center is in place. The MECC (expandable shelter) was opened and outfitted as a central location for safety equipment and will be used as a break area and meeting room for drill crews.

Work on the Independent Firm Drill (IFD) continues. The IFD was moved to the site for the new Rod Well.

Weather conditions in McMurdo and at the South Pole Station remain the primary factor for the reduced number of passenger and cargo flights to Pole.

As of November 9<sup>th</sup>, the Station was 30-35 flights behind schedule. Drilling shifts began on Monday, November 12<sup>th</sup> and run as follows: First Shift runs from 6:30 a.m. to 3:30 p.m., Second Shift runs 2:30 p.m. to 11:30 p.m., and Third Shift is 10:30 p.m. to 7:30 a.m.

**Digital Optical Module and Cable Production Status and Plans** - There are no major issues with instrumentation production. The plans provide instrumentation well in advance of the installation dates and support the use of the least expensive shipping methods. The actual status of DOM integration is provided in the following chart. Note that although the cumulative actual DOMs ready for the DFL is about 100 less than planned, the needs at Pole will be exceeded by a wide margin (> 700 DOMs). The plan for PY6 has built-in flexibility, which allows each site to reprogram as production goals are met



***Detector Commissioning and Verification*** - Progress has been made on version 2 of the “Good Run” list generation system, incorporating an interface to the official database. This new version will be deployed near the end of November. The first draft “Good Run” list was presented at the Ghent Collaboration Meeting held in early October. An *ad hoc* committee was formed to decide the proper set of criteria to use when deciding whether runs are good or not. This committee has already met once on November 9<sup>th</sup>.

A technical review of the Verification software system is scheduled to take place on November 19<sup>th</sup> at Penn State.

Flasher control with p-DAQ was installed and the resulting data tested by the verification group. The test was successful and the project is now planning to use p-DAQ to control flasher runs at Pole for Calibration and Verification.

The current system for generating the verification plots is still being run separately from the PnF. Discussions to develop a system to verify short timescale detector stability have begun. It is anticipated that groups in Berlin, Germany interested in “Neutrino Target of Opportunity” measurements will play the lead role in implementing this system.

Simulations of the AMANDA TWR jitter may provide a means to verify that the jitter correction code is working properly. Down-going vertical muon data may also be helpful, and is being studied. A large sample of simulated IceCube+TWR data was produced, but appears to have a fundamental flaw: there are virtually no TWR hits. The problem does not appear to be in the TWR simulation, but rather in the way the production scripts were run.

***Data Acquisition System Hardware*** - The remaining primary PY6 deliverables for the DAQ hardware group at LBNL are DOM Main Board Assemblies. LBNL did not receive any new DOM Main Boards from Sanmina in October, but a delivery is planned for the first week of November. On delivery of fully qualified DOM Main Boards, LBNL plans to deliver a minimum of 200 DOM Main Boards per month to the DOM Integration sites until the final delivery goal is met or exceeded.

Repair and test of DOM Main Boards from previous production runs continues to progress well, with a current yield of approximately 20 to 30 units repaired and qualified for deployment per month. To date, we have recovered over 60 DOM Main Boards for use in the deployed detector.

*Data Acquisition Software* – The DAQ software releases in October are itemized below.

- DOM Mainboard Release 431: The FPGA image was rewound to release 472, a previous version, after extensive testing revealed that the return of the phenomenon of dropping channels was related to the FPGA. The rest of the MB application-level software is new, including a new data acquisition CPU application which includes enhancements to support requested features for IceTop and overall reduction in run start-up times.
- Grange: The Grange DAQ release was deployed at Pole on October 19<sup>th</sup>, but the initial test runs at Pole failed the test criteria. As a result the release was pulled and the old version of the software was restored.
- Heritage/Latimer: On October 31<sup>st</sup>, DAQ developers deployed the release called Heritage at the Pole. Similar to the experience with the failed Grange deployment, there were some issues with the AMANDA subsystem, which only showed up when running on the real system. DAQ developers were able to make some modifications, test them out, and deploy the Latimer release later that day with the fixes rolled into the release. This release has been successfully taking data since October 31<sup>st</sup>.

The IceTop group has requested some modifications to the FPGA and CPU applications running on the DOMs to allow more effective waveform compression of high-charge PMT pulses, which are commonplace in the IceTop DOMs. These improvements to the FPGA, CPU firmware and CPU software were completed by the end of October.

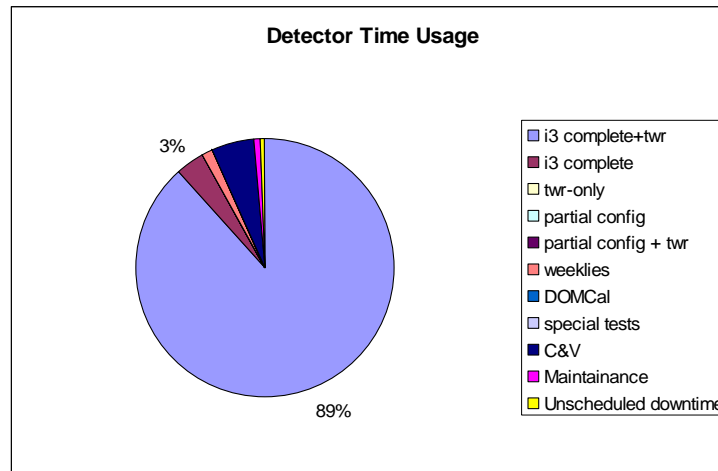
A full end-to-end test of the recently added flasherboard calibration functionality was completed successfully on the SPTS 64-bit test system with all stakeholders present. We are now at the point where actual South Pole runs can commence with this new functionality.

The IceCube DAQ Wiki pages (IceCube DAQ Wiki Page) were overhauled to remove some older documentation links and make way for a new set of active DAQ documentation pages for collaboration reference. The 2007-2008 DAQ deployment plans, which describe planned activity at the South Pole to bring newly installed strings online, have also been completed.

## IceCube Detector Operations

Detector Up Time	96.2%
IceCube & AMANDA Combined Mode	88.4%
Unscheduled Downtime	0.5%
Events from DAQ	1.76 billion

Data taking during October 2007 was very smooth and achieved an overall uptime of 96.2%. The unscheduled downtime was 0.5% (3 hours), due to two power outages that affected the AMANDA hardware and a separate incident in which a DOMHub computer crashed.



The detector ran 88.4% of its uptime in its default mode: combining data from the IceCube and AMANDA-TWR DAQ. The IceCube-only mode was due to one of the power outages that affected TWR operation, and required a TWR hardware module replacement. In addition, about 1 day of combined-mode data was taken with only 3 of the 19 AMANDA strings because an ORB did not automatically come back online after the power outages (optical signal amplifiers). Post-power outage procedures have been modified to address the latter instance.

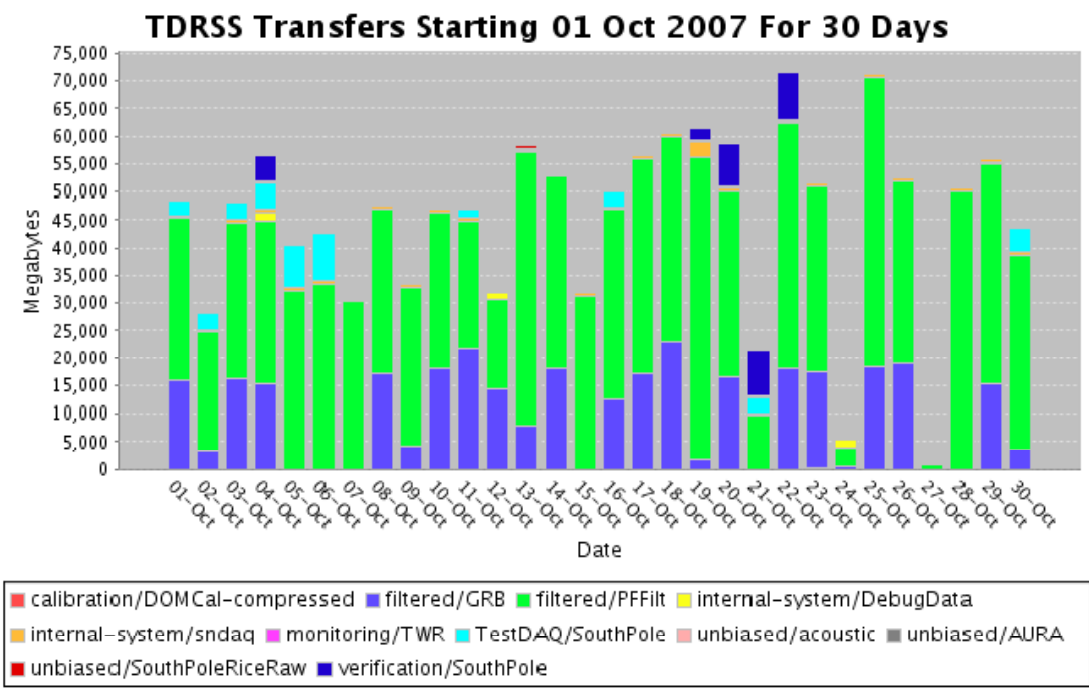
Two special long calibration runs were successfully taken for a total of 38 hours. One run was used to measure the optical properties of the refrozen IceCube holes using light from sources in AMANDA strings. This light was detected in the closest IceCube string, #48. The other run, a continuation of a pilot measurement in September, was performed to measure the amount of shear at the bottom of the long AMANDA string caused by glacial motion.

Most of the maintenance time was used for various deployments of newer and older versions of the DAQ software and its corresponding DOM software/firmware package. As a result of this maintenance time, the DOM drop-out issue from the data runs was resolved on October 31<sup>st</sup>. The temporary solution required rolling back to an older version of the DOM mainboard firmware, which resulted in minimal loss of functionality.

Finally, a newer version of the online GRB filter was deployed without incident, and a test run of a new configuration for the IceTop DOMs discriminators was successfully tested. This new

configuration sets a secondary discriminator threshold to different levels for different DOMs and this provides additional shower physics information while keeping the previous functionality for IceTop detector triggering unchanged.

**Data Systems** - South Pole systems in the IceCube Laboratory (ICL) continued normal physics operation in October. The figure below shows the daily satellite data transfer rates. Continued operation, maintenance, and upgrades to the UW data center and data warehouse are keeping pace with incoming engineering data from IC-22. Purchase and installation of the tape archiving upgrade continues on schedule. Replacement hardware for the new tape archiving system in the South Pole ICL was shipped this month. IT personnel are scheduled to arrive at Pole in early November to begin the yearly system maintenance and install additional IT hardware and software to support the new strings deployed this season.



The Joint-Event Builder and Processing and Filter server (JEB/PnF) merging of IceCube-22 and AMANDA-TWR data streams continues at the South Pole, sending filtered data sets of approximately 30 GB/day over the satellite as planned. The following figure shows the IceCube Detector Run Status Summary web page. The detector trigger rate is nominal at 628 Hz, with the total physics filtered satellite rate shown at 79 Hz. Note, TWR (AMANDA DAQ) is not running due to down time for maintenance and upgrade installation scheduled during this period.

# IceCube Detector Summary

Status as of : 2007-11-12T15:22:45Z

Date	DAQ	TWR	SN	PNF	SPADE	Run	Events
2007-11-12T15:22:45Z	Started			Started		109686	14303673

Current DAQ Run		Previous DAQ Run	
Number	109686	Number	109685
Start Time	2007-11-12 09:08:04.160220	Start Time	2007-11-12 05:09:02.937731
physics	14303673 events	Stop Time	2007-11-12 09:07:05.548868
monitor	35523465 events	physics	9045281 events
sn	30534034 events	monitor	22637721 events
tcal	30607425 events	sn	19350966 events
		tcal	9236257 events

Previous TWR information is not available.

#### PnF Summary for Run

Number	109686
Event	14300000
Clients	0
Trigger Rate	628.204
Processing Rate	647.207
Summary Age	PT5S

PnF Physics Filter Rates			
Filter	Hz	Filter	Hz
CascadeFilter	20.828	ContainedFilter	3.89172
DowngoingContainedFilter	2.94268	EHEFilter	1.6051
FilterMinBias	3.25478	I3DAQDecodeException	0
IceCubeMuonFilter	23.3631	IceTopSMT	3.10191
IceTopSMT_InIceCoincidence	2.87261	IceTopSMT_Large	1.06369
InIceSMT_IceTopCoincidence	3.87898	JAMSMuonFilter	0
LowEnergyContainedFilter	4.64968	MoonFilter	18.879
MuonFilter	23.3631	NoClientFilteredIt	0
PhysicsMinBiasTrigger	2.1465	TWRDAQDecodeException	0
Total	78.8599		

In offline software, the release candidate for IceTray version 2.0 was finalized. Final housekeeping cleanup of the SVN code repository and build system was performed in preparation for official release of IceTray V2.0 in November. Version 2.0 supplies several key improvements to the IceTray framework, including improved I/O performance and flexibility to allow higher data rates from DAQ as the detector grows, while also providing faster and more efficient data processing in the north. A new online near real-time event display for deployment at South Pole ICL was developed, and will be installed in November. This new 3D on-line event display will allow IceCube personnel and visitors at South Pole to monitor the events visually, as the detector filters the events, for visual detector status monitoring.

Mass simulation production continues with IceSim Version 2 to produce large background and signal Monte Carlo datasets for the physics working groups to prepare for IC-22 physics analysis. There was also a large production run of 80-string simulation events to use for filter development and rate planning for the IC-40 physics run scheduled to begin April 1, 2008. The Trigger-Filter-Transmission (TFT) board, which is responsible for setting the configuration and filters for all physics runs, distributed the 80-string datasets to the physics working groups. Work continued on the software and procedures for the production system to enable distributed production across the collaboration computing resources.

The Experiment Control (EC) system is running at Pole, and is coordinating all subsystem configuration start/stop and status information for all IceCube subsystems (i.e. p-DAQ, JEB, PnF, Spade, and TWR-DAQ). Work on the final feature set and improved ease-of-use for operators is continuing. The major new development was that the first test runs using the IceCube Experiment Control system and regular p-DAQ system for taking LED flasher calibration data was completed in October.

Formal work at LBNL for Experiment Control in the MREFC is scheduled to be completed at the end of the project year, with the system transitioning to M&O on April 1, 2008. A closeout review has been scheduled for December 3<sup>rd</sup> at UW-Madison. This review will help make final preparations for the hand-off and documentation of the Experiment Control system.

***Quality Assurance and Safety*** – No significant issues to report.

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

The On-Ice Weekly Construction reports are posted at [On-Ice Weekly Construction Report](#).

### **Meetings and Events**

Review of IceCube Verification Software @ Penn State	November 19, 2007
NSF Business Systems Review @ UW-Madison	November 26 – 30, 2007
Experiment Control System Closeout Review @ UW-Madison	December 3, 2007
Collaboration Meeting @ UW-Madison	April 29 – May 3, 2008
Science Advisory Committee Meeting @ UW-Madison	May 5 – 6, 2008
Neutrino 2008 @ ChristChurch, NZ	May 26-31, 2008
International Oversight and Finance Group @ UW-Madison	TBD (Spring 2008)



**IceCube Drill Seasonal Equipment Site (November 10, 2007)**



**IceCube Laboratory Facing West- Northwest**

