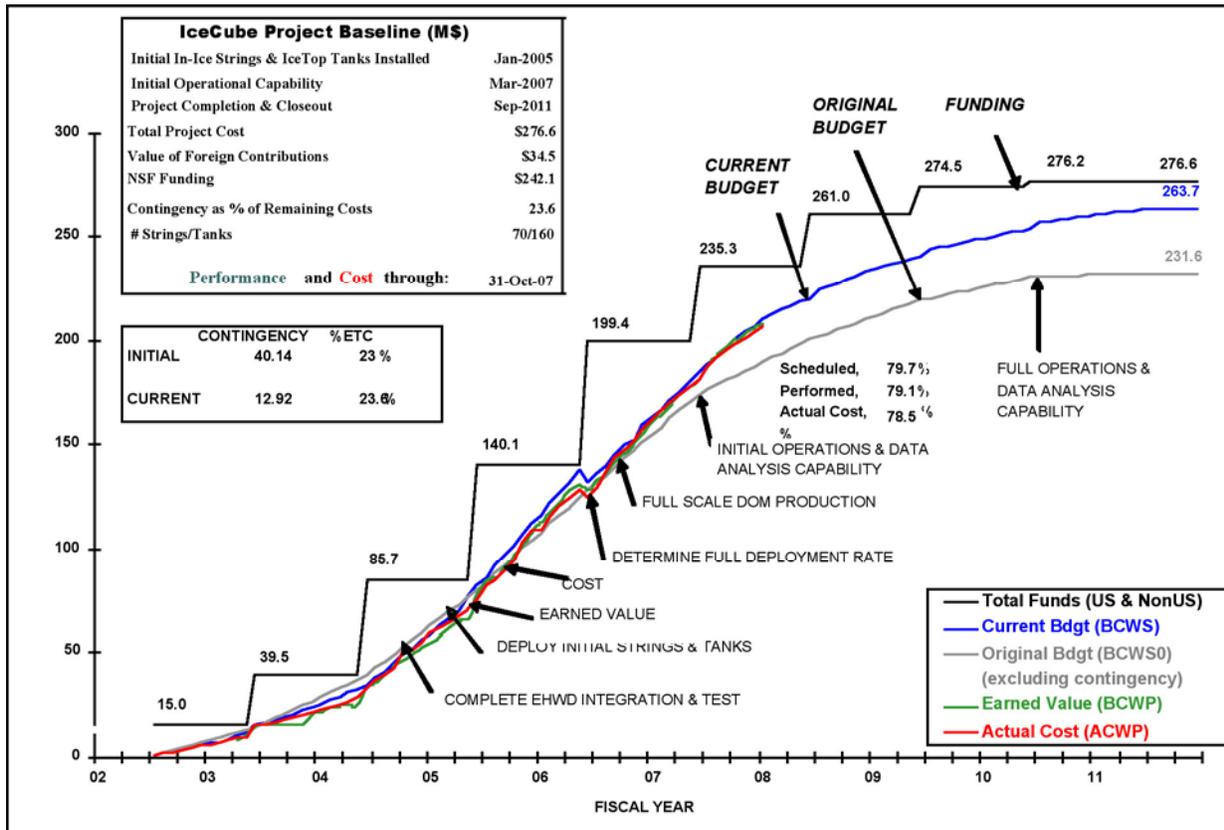


## IceCube Project Monthly Report November 2007

### Accomplishments

- Completed the commissioning of the IceCube Seasonal Equipment Site in preparations for drilling. Started deep ice drilling on December 5 following a drill readiness review.
- Successfully deployed the first IceCube string of the 2007/2008 installation season on December 8. This is a week earlier than previous years.
- Installed all of the IceTop tanks (28) for this season. A total of 40 stations and 80 tanks (160 DOMs) are now in place. All IceTop stations are connected to the surface junction boxes. The surface cables that run from the surface junction boxes to the IceCube Laboratory (ICL) are all pulled into the ICL, 14 cables this year and a total of 40 overall.
- Conducted a mock Mass Casualty Drill with Raytheon and NSF to practice the steps to be taken in response to an actual emergency within IceCube at the South Pole.
- Continued operations of the 22-string IceCube array with a detector uptime of 97%, above the internal monthly goal of 95%.



**Cost and Schedule Performance** – The project is 79.7% complete versus the plan of 79.1% 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: 10/31/2007 <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> Work		Actual Cost of Work Performed	Variance		Contingency		Budgeted AY \$s	Latest Revised Estimate	Variance	Sched	Perf	Actl Cost
	Scheduled	Performed		Schedule	Cost	Assigned	% ETC						
Project Support	21,976.9	21,976.9	21,731.0	0.0	245.9	232.1	5.0%	27,312.0	26,357.0	954.9	80.5%	80.5%	79.6%
Implementation	31,467.3	31,398.0	31,574.3	-69.3	-176.3	2,995.1	20.2%	44,447.1	46,401.5	-1,954.4	70.8%	70.6%	71.0%
Instrumentation	63,130.6	62,532.3	60,956.1	-598.3	1,576.1	629.9	5.6%	72,267.8	72,267.8	0.0	87.4%	86.5%	84.3%
Data Acquisition	32,655.6	32,082.7	32,327.1	-572.9	-244.4	174.7	11.8%	33,803.7	33,803.7	0.0	96.6%	94.9%	95.6%
Data Systems	21,793.2	21,752.4	21,754.2	-40.8	-1.8	124.0	2.5%	26,723.2	26,723.2	0.0	81.6%	81.4%	81.4%
Detector Comm. & Verification	16,918.1	16,942.4	17,242.4	24.4	-299.9	445.7	9.3%	22,017.3	22,017.3	0.0	76.8%	77.0%	78.3%
Pre Operations	272.4	272.4	151.7	0.0	120.7	0.0	0.0%	533.8	533.8	0.0	51.0%	51.0%	28.4%
Subtotal	188,214.1	186,957.1	185,736.8	-1,257.0	1,220.3	4,601.4	10.9%	227,104.9	228,104.3	-999.4	82.9%	82.3%	81.8%
RPSC SUPPORT	21,200.4	21,247.1	20,624.1	46.7	622.9	1,550.7	10.8%	35,339.9	35,024.4	315.5	60.0%	60.1%	58.4%
NSF	769.3	769.3	769.3	0.0	0.0	29.6	6.0%	1,263.0	1,263.0	0.0	60.9%	60.9%	60.9%
Total	210,183.8	208,973.5	207,130.2	-1,210.3	1,843.2	6,181.8	10.8%	263,707.8	264,391.7	-683.9	79.7%	79.2%	78.5%
CONTINGENCY <sup>Notes 3,4</sup>								12,919.7	12,235.8	683.9			
IceCube Total <sup>Note 2</sup>	210,183.8	208,973.5	207,130.2	-1,210.3	1,843.2	6,181.8	10.8%	276,627.5	276,627.5	0.0	79.7%	79.2%	78.5%

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: 23.6% of the Budgeted cost of work remaining.  
4 Budgeted contingency is: 23.3% 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 October 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.

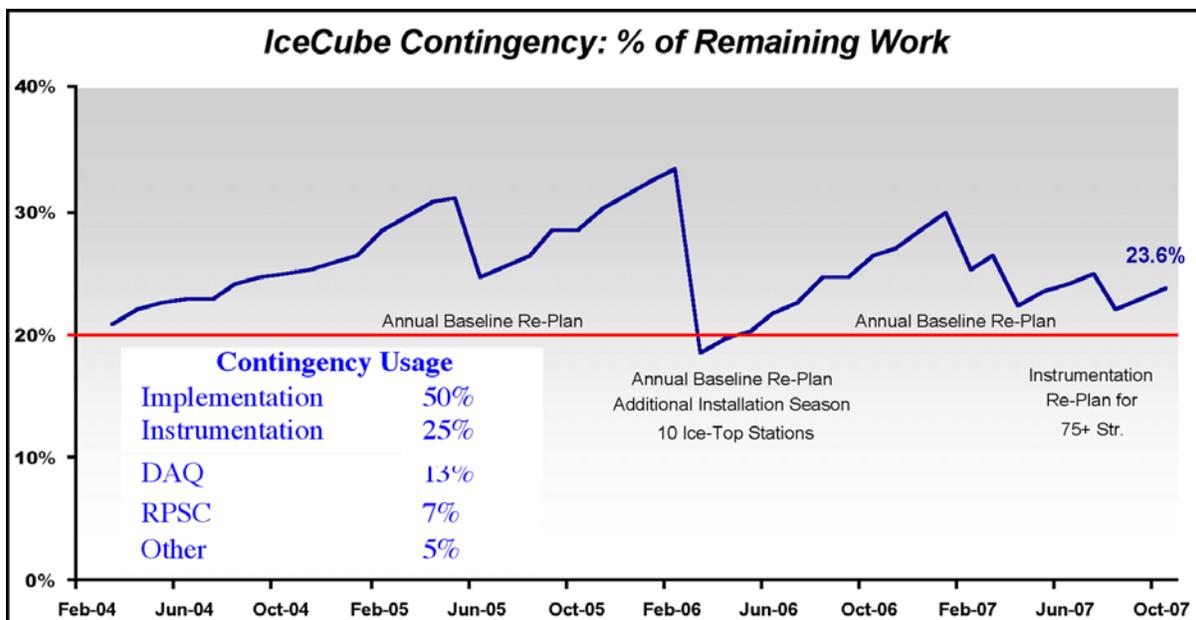
**Change Log - IceCube Total Project Budget Baseline (\$K)**

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 September 2007		276,628	263,708	0	12,920	56,962	56,819	22.7%
NA	Status as of October 2007		276,628	263,708	0	12,920	55,418	54,734	23.6%

There were no baseline changes during the month of October.

## 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.	\$6,182K
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 to restore the array to the 80-string configuration described in the original IceCube proposal.	\$3,294K



The project continues to carefully manage contingency to ensure that remaining risks are covered and the possibility of restoring strings to the 80 string configuration in the original proposal remains possible.

**Drill Operation and Installation** – Following completion of final preparations and safety readiness review activities the start of drilling for the first hole of 2007/2008 commenced on Wednesday, December 5, 2007. This was six days ahead of last year’s start date and is impressive in light of the delays getting people and equipment into South Pole at the start of the season. The IceCube baseline plan for this season is 14 holes with a stretch goal of 18. The chart below outlines the dates for drilling and deployment for the holes and strings deployed thus far and those where the drill towers are in place.

	Hole #	Start Deep Drilling	End Drilling	Finish Deployment
1	63	Dec. 05	Dec. 07	Dec. 08
2	64	Dec. 10	Dec. 12	Dec. 13
3	55	Dec. 14	Dec. 15	Dec. 16
4	71	Dec. 17	<i>Dec. 19 Estimate</i>	<i>Dec. 19 Estimate</i>
5	70	<i>Dec. 19 Estimate</i>	<i>Dec. 21 Estimate</i>	<i>Dec. 22 Estimate</i>

As in past years, the annual commissioning of the drill involves considerable trouble shooting. The first few holes and cycle times between holes are longer than expected later on in the season when all the commissioning obstacles are resolved. The problems encountered this year, although numerous, were each relatively minor. There is good news in that the drill hose is in good shape after the winter storage and so far only one section of new hose was added to provide additional length, not to replace any damaged hose.

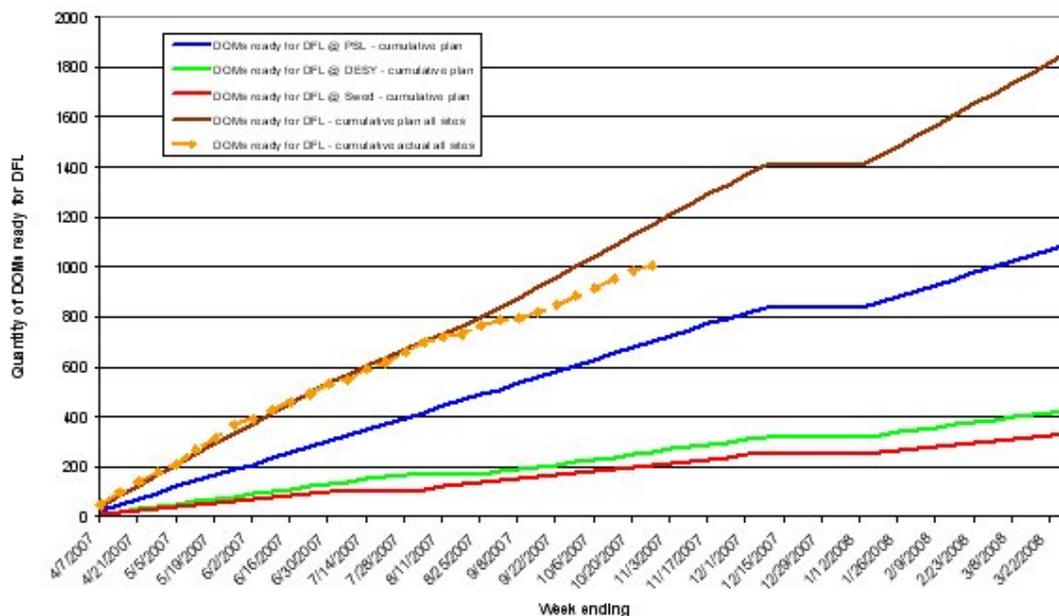
The independent firm drill is working very well and was used to start the rod well and to complete eleven firm holes. The fact that the firm holes are already in place should reduce cycle times over previous seasons. There was one firm hole, #55, where debris was encountered and the decision was made to use the shower head firm drill on the main drill hose to improve the quality and size of the hole before the start of deep drilling. This procedure was effective.

By mid December the 14 IceTop stations consisting of 28 tanks were completely installed giving IceCube a total of 40 IceTop stations enclosing 0.37 square kilometers. All the tanks are filled with water and are under freeze control to eliminate gas and bubbles in the ice. All tanks have stable temperatures and are working properly.

All 14 of the surface cables planned for this year are now installed from the surface junction boxes to the IceCube Laboratory (ICL). A total of 40 surface cables are now pulled into the ICL.

**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. Although the cumulative actual number of DOMs ready for the DFL is almost 200 less than planned, the needs at Pole will be exceeded by a wide margin (> 700 DOMs). The plan for Project Year 6 (April 2007 – March 2008) has built-in flexibility, which allows each site to reprogram as production goals are met. This chart is identical to the one included last month and will be updated after the instrumentation manager returns from the South Pole.

IceCube DOM Integration PY6 (April, 2007 to March, 2008) - Plan vs. Actual



**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. Initial database tables have been defined and a first version of the query tool is implemented. Details of the implementation are being finalized with the offline software and reconstruction group leads.

The ad hoc committee formed to decide the proper set of criteria to use when deciding whether runs are good or not met for the second time on November 28 and are currently finalizing the criteria.

Flasher control by pDAQ was tested. A few technical details are being worked out before flasher tests are performed at Pole, but most aspects of flasher control are working.

Verification is still being run separately from the online processing at Pole. We are discussing the best way of integrating verification with the online processing system. A proposal for integration and 2008 resource usage will be submitted to the Trigger and Filtering board in January.

Calibration data with the AMANDA laser will be taken soon to verify that the TWR jitter correction is working properly,

**Data Acquisition System Hardware** - The remaining primary deliverables for the DAQ hardware group at LBNL for the remainder of the project year are the DOM Main Board Assemblies. LBNL received 467 new, fully qualified, DOM Main Boards from Sanmina in November 2007, and shipped 348 to the DOM Integration facility at PSL in Wisconsin. Sanmina will deliver all remaining Main Boards by the end of December, and LBNL expects to complete shipments to the collaboration by the end of January. To date, LBNL has delivered

5560 fully qualified DOM Main Boards to the IceCube Collaboration for deployment in detector modules.

The new batch of DOMHubs arrived at Pole, were uncrated, and then installed into racks in the ICL in preparation for connection to newly-deployed strings this season. The first new hub, an IceTop hub was connected in the first week of December to the newly deployed IceTop DOMs to begin communications tests.

**Data Acquisition Software** – The ‘Latimer’ release of production DAQ software continues to run at Pole. No new releases were deployed to SPS in November. DAQ developers continue to work out bugs in the flasher implementation as well as continuing work on the trigger system performance to meet the 2008 expanded detector configuration. 47 issues were resolved from November 1<sup>st</sup> through December 10<sup>th</sup> and one resolved issue was officially closed.

**Quality Assurance and Safety** – There are 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**

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)

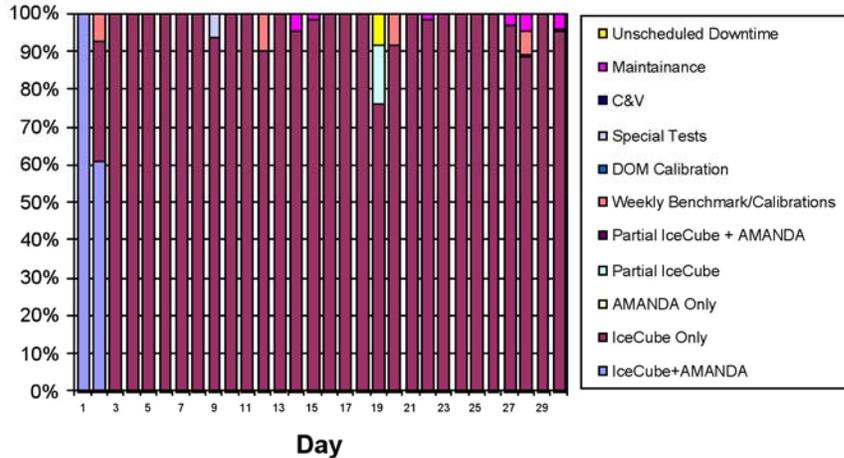


**Deployment Crew for String #63**

## IceCube Detector Operations

Detector Up Time	97.5%
IceCube Clean Run Up-Time not including AMANDA Array	91.3%
IceCube Clean Run Up-Time including AMANDA Array	3.2%
Unscheduled Downtime	0.3%
Scheduled Maintenance and Planned Downtime	2.2%
Events from DAQ	1.62 billion

### IceCube Detector Operation for November 2007



Data taking during November 2007 went very smoothly and achieved an overall 97.5% uptime. The unscheduled downtime was 0.3% and was due to the hardware failure of a DOM power supply in one of the DOMHub computers on November 19<sup>th</sup>.

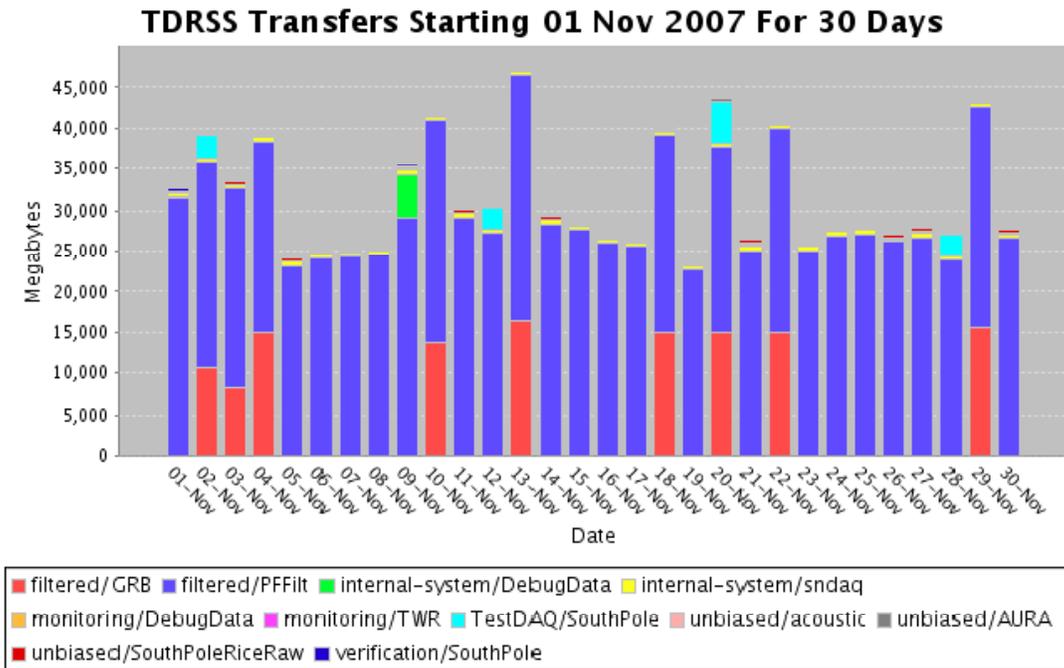
With the arrival of the first AMANDA/TWR system experts to station, the system was taken out of the normal data taking configuration on November 2<sup>nd</sup> to allow for maintenance. The maintenance work was completed by the end of November and reintegration into the standard data taking mode is planned for mid-December.

On November 5<sup>th</sup> a new configuration for the IceTop DOMs was deployed. This new configuration sets a secondary discriminator threshold to different levels for different DOMs. This provides additional shower physics information while keeping the previous functionality for IceTop detector triggering unchanged.

Two issues have been reported by Collaboration monitors. First, there are events that are tagged as having passed the DAQ multiplicity trigger that appear to have less than the required number of hits in them. This appears to be an issue in the current version of the DAQ software. However, it has been found to affect only a minute fraction of all events, therefore it is not considered critical. Investigation by the DAQ team is continuing and a solution is expected soon. Second, about one-tenth of all runs are missing monitoring stream information for one or two strings in the array. This issue is affecting only the monitoring of the data quality therefore

it is not critical to the data-quality itself. The DAQ team is actively pursuing a solution to this problem.

**Data Systems** - South Pole systems in the IceCube Laboratory (ICL) continued normal physics operation in November. The figure below shows the daily satellite data transfer rates. Continued operation, maintenance and upgrades to the UW data center and data warehouse to keep pace with incoming engineering data from IC-22. The IT personnel arrived 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. Replacement hardware for the new tape archiving system in the South Pole was done in November. Additional Hubs and Hardware for new strings are in place at the ICL.



The IC-22 online physics filtering was successfully deployed in July. The Joint-Event Builder and Processing and Filter server (JEB/PnF) streams continue sending filtered data sets of approximately 30 GB/day over the satellite as planned. Planning for online filters for the next year’s run of IC-36+ began. Monte Carlo data sets for background and neutrino signal were distributed to working groups for filter rate/efficiency studies in a coordinated way. Template filter proposals were distributed with filter requests due first week of January. The new IC-36+ run is scheduled to start with filters in place on April 1, 2008.

In offline software, the release candidate for IceTray version 2 was finalized in October. Final housekeeping cleanup of the SVN code repository and build system continues in preparation for official release of IceTray V2.0 in December. Version 2 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 and provide more efficient and speedier processing of data in the north. Development with pre-release V2.0 in all areas (simulation, reconstruction, filtering, verification) is going smoothly.

A new online near real-time event display was deployed at the ICL. This new 3D on-line event display will allow IceCube personnel and visitors at the South Pole to monitor the events visually, as the detector filters the events, for visual detector status monitoring.

Offline processing for Level 0 and Level 1 have solidified and is up to date on all data in the north. The higher level reconstructions (Level 2), which are used for reconstruction on all physics channels was in development and nearing completion. Level 2 processing of all data should begin in December.

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. Continued work on distributed production system along with better tracking and monitoring of CPU time supplied at each institution was put in place. Continued improvement on the simulation towards a new release in early 2008 for production Monte Carlo runs to be used for the IC-40 run next year.

The experiment control (EC) system is running at Pole and coordinating all subsystem configuration start/stop and status information for all IceCube subsystems (i.e. p-daq, JEB/PnF/Spade/TWR-daq). The system now coordinates and runs the flasher calibration runs from the run control console using the pDAQ system instead of the old testDAQ system.