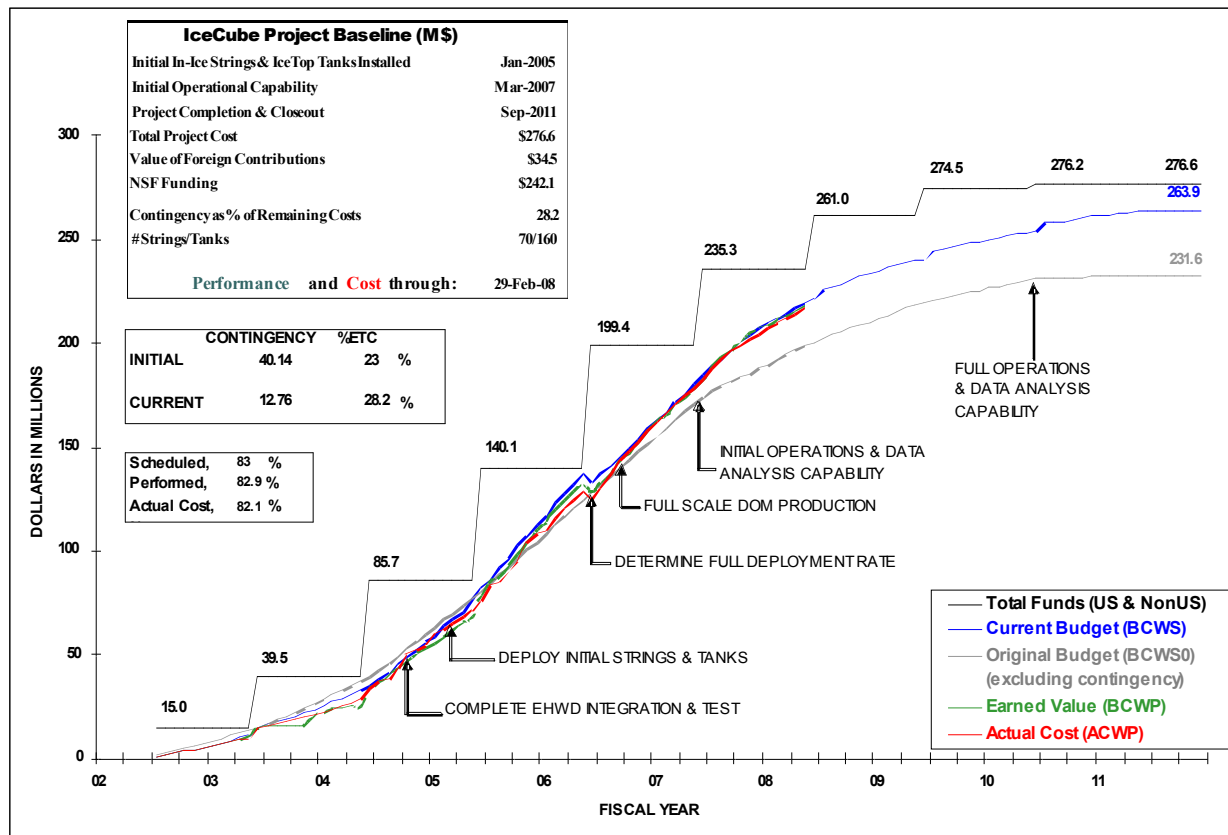


## IceCube Project Monthly Report March 2008

### Accomplishments

- 2007/2008 season review and strategic planning meetings held in Madison on March 11 – 12.
- Drilling off-ice tasking schedule developed, personnel assigned, and implementation underway.
- DOM production is in progress at the three production sites world-wide and proceeding according to plan.
- New version of the data acquisition software, Aqua, released on April 1.
- Overall detector uptime for the month of March was 97.9 percent.
- A new version of simulation code, IceSim 2.2, was released.



**Cost and Schedule Performance** – The project is 82.9% complete versus the plan of 83% complete, as measured using earned value techniques. The contingency percentage of the

remaining work is 28.2%. 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.

IceCube Neutrino Observatory Cost Schedule Status Report													
Reporting Period Ending: 2/29/08 <sup>Note 1</sup>													
OBS Structure L2	Cumulative To Date (AYK\$)							At Completion (AYK\$) <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	22,699.9	22,699.9	22,364.8	0.0	335.1	195.9	49%	27,293.4	26,334.2	959.3	83.2%	83.2%	81.9%
Implementation	33,369.8	33,369.8	33,676.1	0.0	-306.4	2,497.9	20.0%	44,477.5	46,141.9	-1,664.4	75.0%	75.0%	75.7%
Instrumentation	65,876.3	65,725.2	64,135.6	-151.1	1,589.6	479.2	58%	72,374.2	72,374.2	0.0	91.0%	90.8%	88.6%
Data Acquisition	33,198.0	33,149.1	33,069.7	-48.9	79.4	98.9	12.7%	33,846.2	33,846.2	0.0	98.1%	97.9%	97.7%
Data Systems	22,744.0	22,529.2	22,656.1	-214.8	-126.9	106.7	26%	26,781.5	26,781.5	0.0	84.9%	84.1%	84.6%
Detector Comm. & Verification	17,969.7	17,969.7	18,229.5	0.0	-259.8	342.0	9.2%	21,962.7	21,962.7	0.0	81.8%	81.8%	83.0%
Pre Operations	472.9	472.9	422.5	0.0	50.4	0.0	0.0%	533.8	533.8	0.0	88.6%	88.6%	79.2%
Subtotal	196,330.5	195,915.8	194,554.4	-414.7	1,361.4	3,720.7	11.1%	227,269.4	227,974.5	-705.1	86.4%	86.2%	85.6%
RPSC SUPPORT	21,752.3	21,961.9	21,149.2	209.6	812.7	1,539.7	11.0%	35,339.9	35,184.2	155.6	61.6%	62.1%	59.8%
NSF	814.9	814.9	814.9	0.0	0.0	26.9	6.0%	1,263.0	1,263.0	0.0	64.5%	64.5%	64.5%
Total	218,897.8	218,692.7	216,518.5	-205.1	2,174.2	5,287.2	11.0%	263,872.3	264,421.8	-549.5	83.0%	82.9%	82.1%
CONTINGENCY <sup>Notes 3,4</sup>								12,755.2	12,205.8	549.5			
IceCube Total <sup>Note 2</sup>	218,897.8	218,692.7	216,518.5	-205.1	2,174.2	5,287.2	11.0%	276,627.5	276,627.5	0.0	83.0%	82.9%	82.1%

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 baseline of: \$29,698 K  
3 Budgeted contingency is: 28.2% of the Budgeted cost of work remaining.  
4 Budgeted contingency is: 27.9% 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.

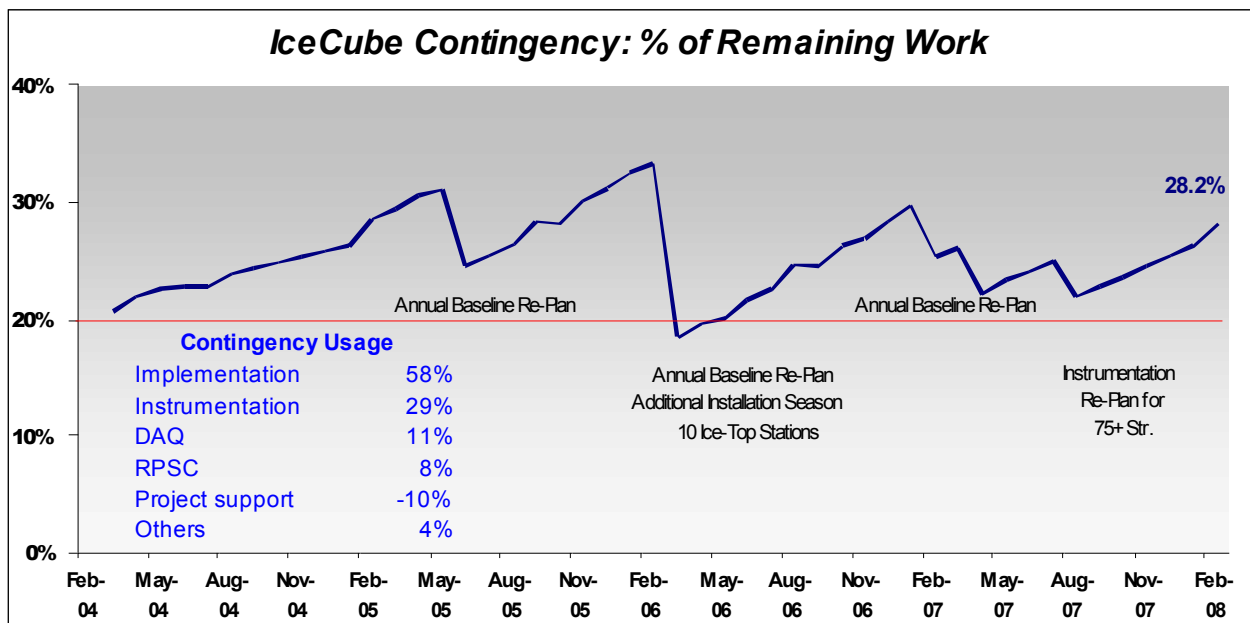
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### Change Log - IceCube Total Project Budget Baseline (\$K)

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 January 2008		276,628	263,872	0	12,755	48,790	48,418	26.3%
NA	Status as of February 2008		276,628	263,872	0	12,755	45,729	45,180	28.2%

## 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.	\$5,287K
The potential cost to retro IceCube equipment/materials from the South Pole at the end of the project in FY2012.	\$825K
PY7 Planning Review: additional budget for drill cables and PSL labor, correct fringe for seasonal drillers, better estimate of travel expenses for driller training and time in CHC, SCOARA support for 3 years, and Pre-Operations effort in PY7.	\$2,186K
Pre-Operations activities may be extended beyond the two years currently budgeted. During PY8, it may be necessary to conduct engineering runs concurrent with operations to debug software and ensure reliability of the installed equipment.	\$150K
Restore 80-string configuration. Current estimate of the cost to restore the array to the 80-string configuration described in the original IceCube proposal.	\$1,500K
RPSC FY07-FY10 Rebaseline (revision 7.0): This baseline change includes the support for the string installation stretch goals in FY09 & FY10, and addresses the fuel cost increase under ANG, and returns FY07 under-spent budget to contingency.	\$412K
Current estimate of the RPSC fixed cost for the 2010/11 drilling season.	\$2,260K

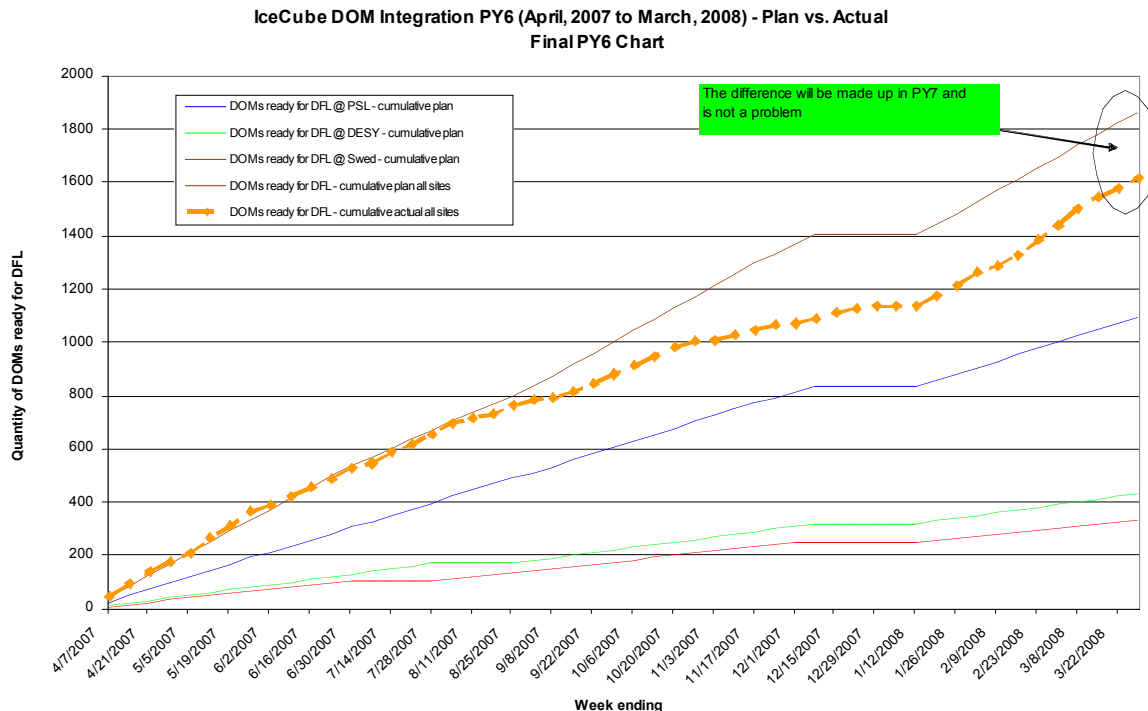


**Drill Operation and Installation** – The Season Review and Strategic Planning meetings were held on March 11<sup>th</sup> to review planned versus actual data for the PY06 season and to present strategic goals for PY07. A Detailed Planning meeting with RPSC was held on March 12<sup>th</sup> to begin development of the PY07 integrated schedule. An Implementation meeting was held on March 14<sup>th</sup> to review lessons learned and develop an off-ice plan and schedule.

The off-ice schedule was drafted to capture all required safety improvements, maintenance activities, repairs, and enhancements. A major activity is the repair and/or replacement of the main drill cable. Upon arrival back to PSL the cables will undergo a series of tests to determine nature and severity of damage and ultimate course of action. A preliminary design and cost estimate is developed for the SES replacement fuel tank. The heater strainer purge system has been designed and a prototype is being fabricated.

Preliminary plans for hole sequencing and site layout, including potential low and high energy options have been developed and is under review. Plans are also being developed to support the deployment of 19 IceTop stations (38 tanks) in PY07.

**Digital Optical Module and Cable Production Status and Plans** - DOM production is in progress at all 3 sites and is progressing smoothly. Surface cables for the 2009/2010 season have been ordered and will start production at Ericsson soon. Surface to DOM cable production is normal.



**Detector Commissioning and Verification** - Since the successful high level commissioning of the 18 new strings, the verification team has focused its efforts on performing long-term studies of IC22 data from 2007, evaluating test data taken with IC40, and preparing for IC40 data taking. The verification group is looking at the small test data samples from IC40 running and thus far

has found no and is ready for the official IC40 runs to commence at the beginning of April. The first version of the Good DOM list is working, and efforts to create a similarly-designed Good Run list has started. At the same time, additional criteria for determining whether or not a DOM is functioning properly are being studied with an eye toward eventually incorporating them in the decision. A new webpage is being designed to display the verification information and make it easier for verification experts, data analyzers and shift takers to see problems.

Progress continues on various efforts to calibrate ice properties. New hole ice data was taken using string 48, now completely frozen in, to compare it with data taken earlier when that string was completely frozen. Flasher data is being used to try to measure the properties of the deep, clear ice. Preliminary data suggests an effective scattering length that is roughly double that of the ice above 2000m. The monitoring group has also received some constructive criticism on the layout and utility of the monitoring webpage and is working to address those concerns and improve the page.

AMANDA ran smoothly during March. Discussions are still underway to determine whether or not to implement the new proposed trigger for AMANDA.

***Data Acquisition Software*** - The Aqua release of DAQ came on April 1<sup>st</sup>. This release included many new features that have been requested by the collaboration for the IC40 science run:

- new triggers for low-energy science
- improved RAPCal timing - the RAPCal engine was completely redesigned
- to be more robust in the presence of poor communication channels improved time resolution by a factor of two in general
- more efficient code - performance bottlenecks were identified in
- several components including triggers, hubs, and event builders
- special IceTop support

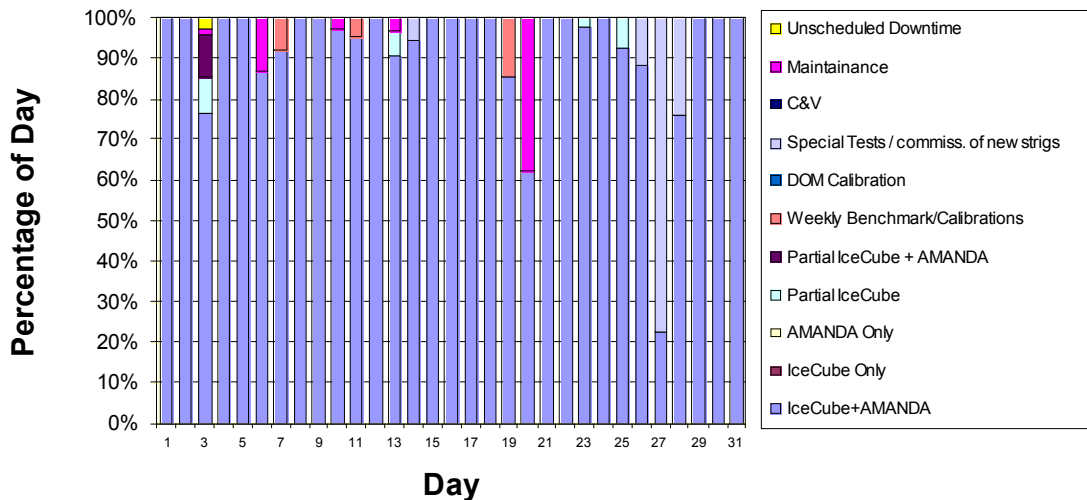
In addition, the DOM-mainboard software suite was updated to incorporate bug fixes in the FPGA image, improvements to the low-level DOM calibration software and new features in the low-level DAQ. DAQ began taking data from the IC40 configuration on April 5<sup>th</sup> and is now running stably in this mode.

We have begun work on an experimental control framework called IceCube Live, which will dramatically improve the usability and visibility of the running experiment. Some initial research and development toward a basic implementation has been underway. We are meeting in mid-April to review requirements and implementation and begin interfacing to the various experimental sub-systems.

## IceCube Detector Operations

Detector Up Time	97.9%
IceCube Clean Run Up-Time not including AMANDA Array	90.7%
IceCube Clean Run Up-Time including AMANDA Array	86.1%
Unscheduled Downtime	0.1%
Events from DAQ	1.87 billion

### IceCube Detector Operation for March 2008



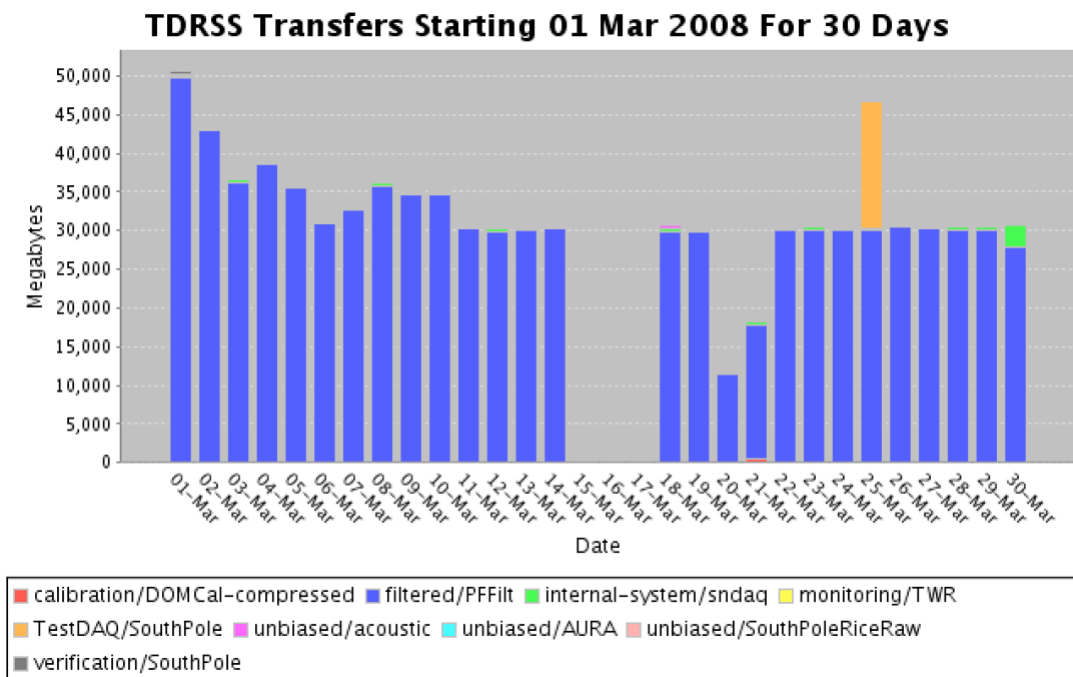
Data taking during March 2008 achieved an overall 97.9% uptime. The main focus, besides the collection of IC22 physics data, was on test runs for the IC40 data-taking season (begins in April). The IC22 clean run uptime for March (for IceCube regardless of AMANDA status) was 90.7%. The IC40 tests included tests of the pedestal subtraction in the DOMs, modified readout windows, the new string triggers and a successful 1-day long stability test starting on March 27<sup>th</sup>.

Of the 1,136 DOMs deployed this year (18 strings plus 14 IceTop stations) 1,119 are part of the IC40 configuration. Of the 17 DOMs which for now will not be part of data taking, only five are not operable, i.e. they do not power up. Of the other 12, four work but display poor communications, four exhibit high current but still work, and four are simply not yet frozen-in but otherwise work. Investigations into failed or problematic DOMs continue throughout the year as more data becomes available. Problems are formally tracked via the failure review process.

On March 19<sup>th</sup>, during the weekly benchmark/calibration (weekly runs) in which the detector takes data with the test data acquisition system (TestDAQ), the largest Gamma Ray Burst ever reported occurred. Problems during the weekly runs had extended the data-taking from the nominal one-hour to about three-hours in duration. Fortunately, the GRB occurred during a TestDAQ IC9 (nine strings) run. As a result the decision was made to move to a monthly benchmark/calibration while a partial set of the IC40 strings are run in the normal data-taking mode as backup.

## Data Systems

*Data Handling* - South Pole systems in the IceCube Laboratory continued normal IC-22 physics operation in March. The figure below shows the daily satellite data transfer rates. There was periodic testing and preparation of the South Pole computing system for the upcoming IC-40 data run. The systems were ready with no delays in IT systems at pole. Operation, maintenance and upgrades to the UW data center and data warehouse to keep pace with incoming engineering data from IC-22 continue. Continued upgrades of disk to the data warehouse to accommodate higher level processing of IC-22 data, store IC-22 simulation data and prepare for IC-40 data is starting in April 2008.



*Filtering and Software* - Progress in March primarily focused on preparations for start of the IC40 physics run. The JEB software system is being updated to the newest core software release to take advantage of several performance gains there. At the same time, an effort is underway to clean up the code-base and prepare to move it to long-term support. The filter content is also undergoing a complete update to take into account new filter requests for the IC40 physics run. Both of these updates are targeted at an April release.

Additionally, a new release of the core software package (icetray, I/O services) was prepared ahead of the IC40 physics run. New additions here include several optimizations for performance and a addressing a few issues. The database updates to the DB tables were prepared and automatic DB loading and mirroring software packages were refined following a few issues uncovered during the season at Pole.

*Simulation Code* - The latest release simulation release (IceSim 2.2) is improved in many respects. The fADC simulation has been improved and the intra-event timing was made to match data. The AMANDA simulation has been made more consistent with the database. Hit creation has been speeded up, yielding a factor of about three for the photon field and detector simulation. The handling of PE pileup in high energy events has been made more efficient, especially for AMANDA. There are several other improvements and bug fixes. All in all, IceSim 2.2 is a significant step forward.

*Simulation Production* - Presently we are still producing IC22+TWR simulation data with IceSim V2.0.14. IceSim+IceTop coincident simulation data have been produced with IceSim V2.0.15, which has a bug fix in pmt-simulator that affected IceTop simulation only. We still have trouble in producing coincident muon data for IC+TWR due to the complexity of configuration file.

Online simulation production status can be found in <http://internal.icecube.wis.edu/simulation>

Simulated events are now filtered and processed through the same L1 and L2 processing used for experimental data. This processing is going on smoothly and it is serving some current physics analysis. The processing rate has been affected by heavy usage of the UW computing resources (for simulation and experimental data re-filtering and L2 processing + various physics analyses).

Online filtering/processing status can be found in <http://internal.icecube.wisc.edu/filtering>

Currently we are running on candidate release V2.2.1 to test the new configurations and to compare simulated data with the previous release. Some fine-tuning in the production system is being working out. We also plan a series of benchmark datasets:

- test the TWR response in detail as unique conditions to produce TWR data in the future will request help from TWR group
- comparison of pmt-simulator and romeo
- comparison of hit-constructor and hit-maker (that should be faster)
- comparison of PSI-interface with PhotonicsService
- test IC+TWR coincident muon generation

We plan to stop IC22 production as soon as we are ready to run with the new release, which will most likely be after the Collaboration meeting. We plan also to run Level 1 filtering at runtime, provided the filtering software is frozen in an official release.

Tests on GridFTP are also being performed from GLOW and DESY. This protocol will be used to transfer files to UW Data Center as soon as they are produced in any site.

*Experiment Control* – Experiment Control work in the MREFC was closed out in March. The system was handed off from LBNL to the DAQ team for maintenance. Continued maintenance and development will be done by the John Jacobson, who has also proposed a framework and structure for integrating reporting from various subsystems.



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

**Education and Outreach** – The IceCube Project is the first segment of a video production of Wisconsin Public Television and the Research Channel. Several IceCube scientists and engineers participated through taped interviews. Other video from the South Pole and from previous IceCube productions was incorporated into the segment. Viewers can see a network broadcast of this show on April 23<sup>rd</sup> on a local cable or satellite network or via the web. Link to the website is as follows:

<http://www.researchchannel.org/prog/displayevent.aspx?rID=21258&fID=345>

The Research Channel was founded by a consortium of leading research and academic institutions to share the valuable work of their researchers with the public. The Research Channel is now available to more than 30 million U.S. satellite and cable television subscribers and their Web site is visited by more than 1.6 million visitors each year. The channel is also available on 70 university and school-based cable systems in the United States and in other countries.

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

**Meetings and Events**

Acoustic Neutrino Detection Working Group @ UW-Madison	April 27 – 28, 2008
GRB Workshop @ UW-Madison	April 27 – 28, 2008
Collaboration Meeting @ UW-Madison	April 29 – May 3, 2008
Science Advisory Committee Meeting @ UW-Madison	May 5 – 6, 2008
IceCube NSF Visit	May 15, 2008
Neutrino 2008 @ Christchurch, NZ	May 26-31, 2008
NSF Annual Review of IceCube @ UW-Madison	June 11-12, 2008