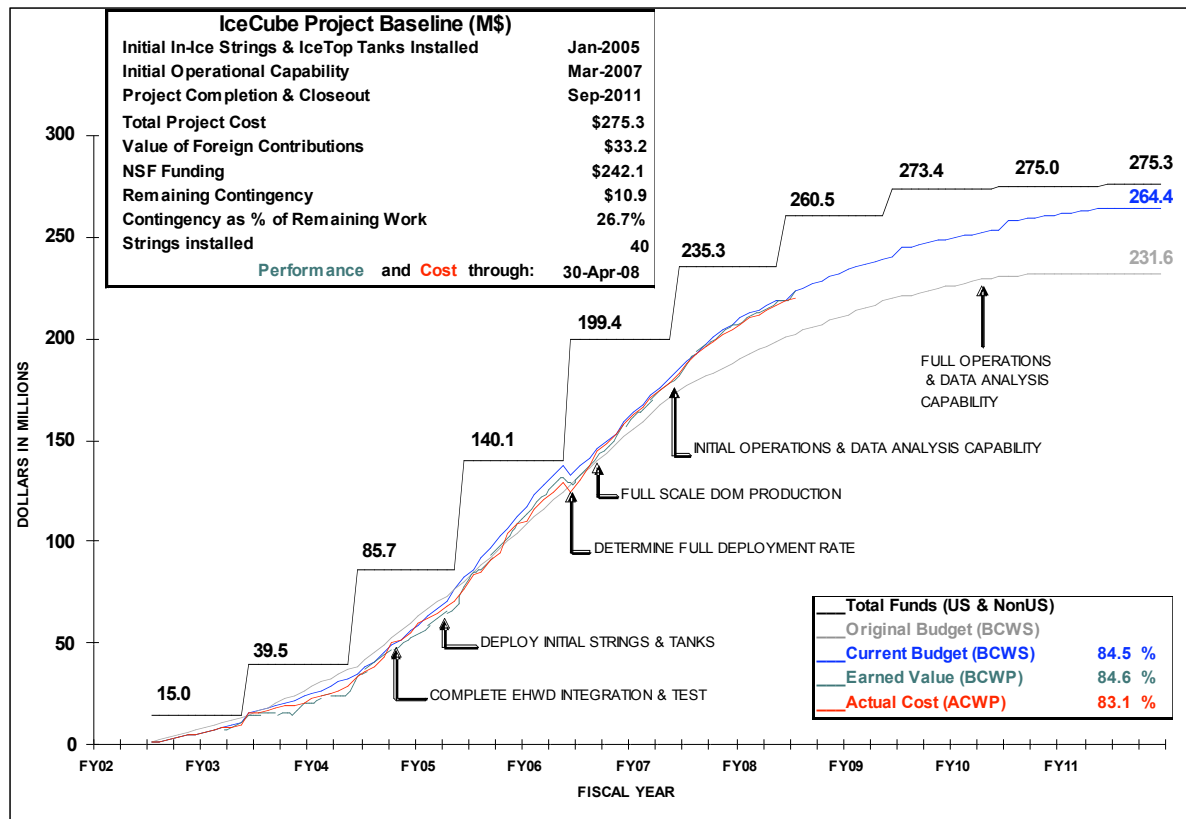


## IceCube Project Monthly Report May 2008

### Accomplishments

- The drilling and installation staffing plan for the FY2009 South Pole construction season is complete and 30 drillers were hired.
- DOM and cable production at all sites is progressing smoothly.
- Verification of IC40 (40 strings and surface stations) data taking continues without significant interruption. Studies of timing, charge, occupancy and local coincidence were performed.
- Data from the entire IC22 dataset, May 23, 2007 to April 5, 2008, was evaluated for run quality. Ninety-four percent of the In-Ice data was categorized as good for physics analysis.
- In the month of May, the IceCube data acquisition system acquired 3.6 billion events with an overall uptime fraction of 98.3%.
- The South Pole System (computing) requirements for the next season are complete and purchasing of equipment underway to enable testing prior to shipment to pole.
- Offline processing for IC22 data through Level 2 is complete.



**Cost and Schedule Performance** – The project is 84.6% complete versus the plan of 84.5% complete, as measured using earned value techniques.

IceCube Neutrino Observatory Cost Schedule Status Report Reporting Period Ending: 4/30/2008												
Cumulative (AY K\$)									At Completion (AY K\$)		Complete (%)	
OBS Structure L2	Budgeted Cost <sup>2</sup>		Actual Cost of Work Performed	Variance		Contingency <sup>6</sup>		Budgeted AY \$	Sched	Perf	Actl Cost	
	Work Scheduled	Work Performed		Schedule	Cost	Assigned	% ETC					
Project Support	22,674.5	22,674.5	22,653.4	0.0	21.1	121.6	3.2%	26,832.6	84.5%	84.5%	84.4%	
Implementation	34,287.8	34,287.8	34,208.9	0.0	78.9	1,942.6	14.2%	46,939.7	73.0%	73.0%	72.9%	
Instrumentation	65,213.8	65,489.0	65,651.8	275.2	-162.9	436.7	7.5%	71,498.0	91.2%	91.6%	91.8%	
Data Acquisition	33,206.2	33,206.2	33,165.4	0.0	40.8	90.8	14.4%	33,798.3	98.2%	98.2%	98.1%	
Data Systems	22,985.6	22,985.6	22,963.0	0.0	22.6	91.4	2.5%	26,666.6	86.2%	86.2%	86.1%	
Detector Comm. & Verification	18,508.8	18,508.8	18,492.4	0.0	16.5	226.8	10.0%	20,754.5	89.2%	89.2%	89.1%	
Pre Operations	533.4	533.4	509.2	0.0	24.2	0.0	0.0%	924.2	57.7%	57.7%	55.1%	
Subtotal	197,410.0	197,685.2	197,644.1	275.2	41.1	2,909.9	9.6%	227,414.0	86.8%	86.9%	86.9%	
RPSC SUPPORT	25,136.3	25,167.9	21,270.3	31.5	3,897.5	614.4	4.4%	35,745.8	70.3%	70.4%	59.5%	
NSF	838.1	838.1	838.1	0.0	0.0	25.5	6.0%	1,263.0	66.4%	66.4%	66.4%	
Total	223,384.5	223,691.2	219,752.5	306.7	3,938.7	3,549.9	7.9%	264,422.8	84.5%	84.6%	83.1%	
CONTINGENCY <sup>Notes 3,4</sup>								10,870.7				
IceCube Total <sup>Note 2</sup>	223,384.5	223,691.2	219,752.5	306.7	3,938.7	3,549.9	7.9%	275,293.5	84.5%	84.6%	83.1%	

Notes: 1 Incorporates approved baseline changes.  
2 Total Budget at Completion includes non-US contributions 3,522 K over the amount in the post Hartill III baseline.  
3 Budgeted contingency is: 26.7% of the Budgeted cost of work remaining.  
4 Budgeted contingency is: 26.6% of the Estimated Cost to Complete (ETC)  
5 The BAC (Budget At Completion), reflects PY7-10 detailed planning Baseline Re-Plan.  
6 Contingency is assigned based on the ETC, a bottom-up risk assessment, management judgement, and cost constraints.

A favorable total cost variance of \$3,939K at the end of April 2008 is due almost entirely to the RPSC Support cost category. There is a month delay in the Actual Cost of the Shipping, Deployment, Drilling Fuel, and Air National Guard costs. This favorable Cost Variance will be reduced once these costs are booked in May.

04/30/08

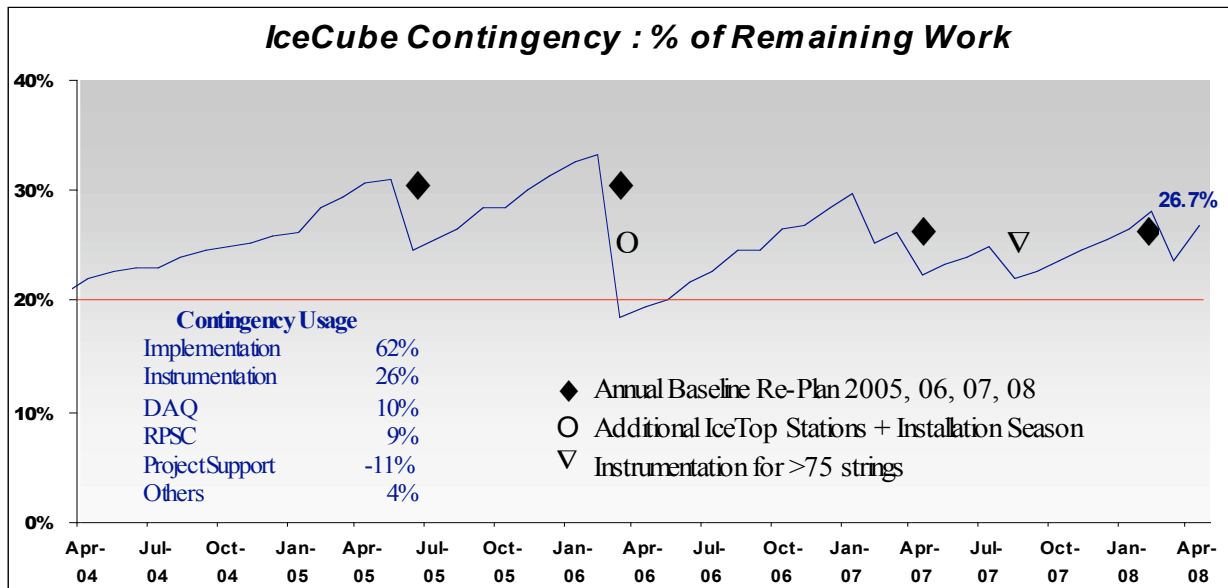
### Change Log - IceCube Total Project Budget Baseline (\$K)

No.	Description	Date Approved	Total Baseline	Allocated Budget	Allocated Budget Change	Contingency Budget	Budgeted Cost of Work Remaining	Contingency % of Remaining Work
NA	Status as of March 2008		275,382	264,869		10,513	44,513	23.6%
CR123	CR 0123 RPSC FY07-10 Baseline Re-Plan	05/16/08	275,382	265,275	406	10,107		
CR124	CR 0124 PY06 Closeout	05/16/08	275,293	264,423	-852	10,871		
NA	Status as of April 2008		275,293	264,423		10,871	40,732	26.7%

During the month of April 2008, the contingency as a percentage of the remaining work was increased from 23.6% to 26.7%. This is due in part to the closeout of Project Year 6.

<b>Risk Assessment Items &amp; Potential Cost and Contingency Requirements</b>	
Item	Potential Contingency Use
Estimated contingency that might be required to address the cost impact of technical, cost and schedule risks identified with the detailed scope of work at WBS-Level 4.	\$3,550K
Current RPSC estimate of base cost to support the 2010/11 drilling season.	\$2,260K
Current RPSC estimate for returning IceCube equipment, including the Hot Water Drill, from the South Pole. The retro work will be planned for FY2012.	\$825K
Current estimate of the cost of fuel price increases beyond those already planned.	\$500K
Pre-Operations activities may extend beyond the current budget. The most significant item is an upgrade to the Data Center/Warehouse capacity due to higher data rates than planned.	\$1,150K
Instrumentation critical path materials for up to 86 strings	\$333K
Five Surface to DOM cables for up to 86 strings	\$1,017K

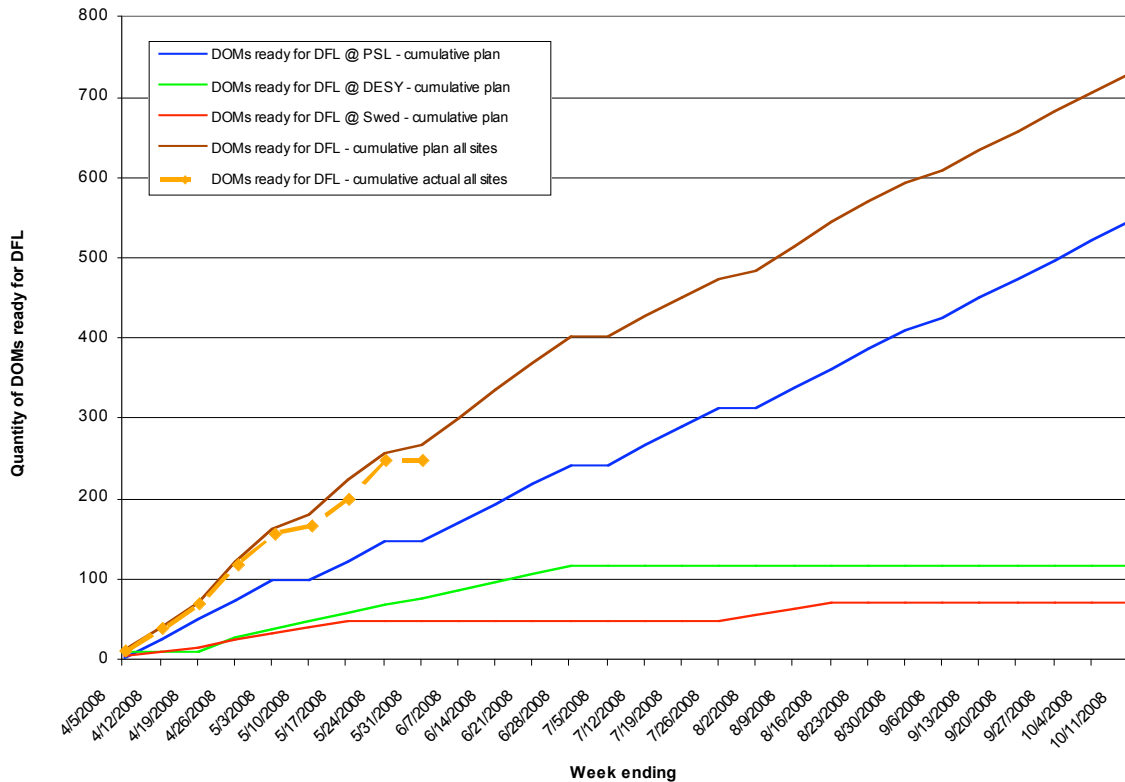
The current estimate of the fixed cost of conducting an additional drill season in FY2012 is estimated at \$3.7M. The fixed cost includes driller salaries, base fuel, and deployment costs to South Pole. The “per hole” cost is estimated at about \$200K for each additional hole.



**Drill Operation and Installation** – A staffing plan for drilling and installation is established. A total of 30 drillers were hired and a list of alternates is being developed. The 30 drillers will be divided into three shifts comprised of 10 people per shift. String installation staff will consist of eight people. Both of these groups will receive training at the University of Wisconsin-Madison Physical Sciences Laboratory (PSL) from July 28, 2008 through August 8, 2008. The training will emphasize safety, using the Safe Start program and utilize the new testing facility at PSL. Training will also incorporate the proper use of heaters, pumps, motor drives and the computer control system user interface.

**Digital Optical Module and Cable Production Status and Plans** - DOM production is in progress at all 3 sites and is progressing smoothly. Surface to DOM cable production is normal. Procurement plans have been developed for instrumentation (primarily DOM hardware and cables) to meet an overall plan of 80 IceCube strings.

**IceCube DOM Integration PY7 (April, 2008 to October, 2008) - Plan vs. Actual**  
 Plan to IC75+ with existing materials on hand with exceptions 4/18/08 (see Jonathan's email)



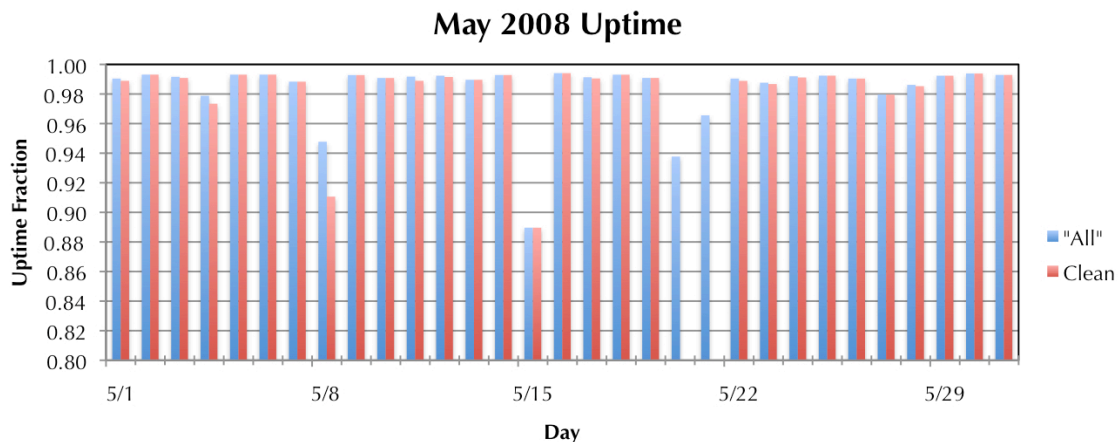
**Detector Commissioning and Verification** - Detailed studies of high-level data quantities from IC40 runs were performed, including studies of timing, charge, occupancy and local coincidence behavior. In addition to confirming the known existence of several problem DOMs, the tests revealed a very small number of additional problems. The affected DOMs are currently under investigation. A “data challenge” is underway to see how sensitive the various verification tests are to problems by taking some acquired IC40 data, introducing a fault, writing out the faulty

data to a new file, and giving that resulting file to the verification group to study. Thus far all of the problems introduced were found.

Data from the entire IC22 dataset, May 23, 2007 to April 5, 2008, was evaluated for run quality. As reported last month, using a set of simple criteria such as minimal run length, 94% of the acquired InIce data is labeled “good.” In the near future we anticipate adding a few more DOMs to the list of bad DOMs based on the results of verification tests. The small number of affected DOMs, and lack of severity of the problems, indicate that no runs will be declared bad as a result.

The calibration of the linearity and saturation response of the DOMs is underway. After-pulsing is also being studied, both as a calibration effort and as a DOM-monitoring verification task. A handful of DOMs show excessive after-pulsing behavior and are being looked at more closely. Progress continues on various efforts to calibrate the ice properties. Preliminary data still supports an effective scattering length that is roughly double that of the ice above 2000m.

**Data Acquisition Software** - During the month of May the IceCube data acquisition system acquired 3.6 billion events with an overall uptime fraction of 98.3%. The daily breakdown of the operating time expressed as fractions of a day per day of May is shown in the following figure.

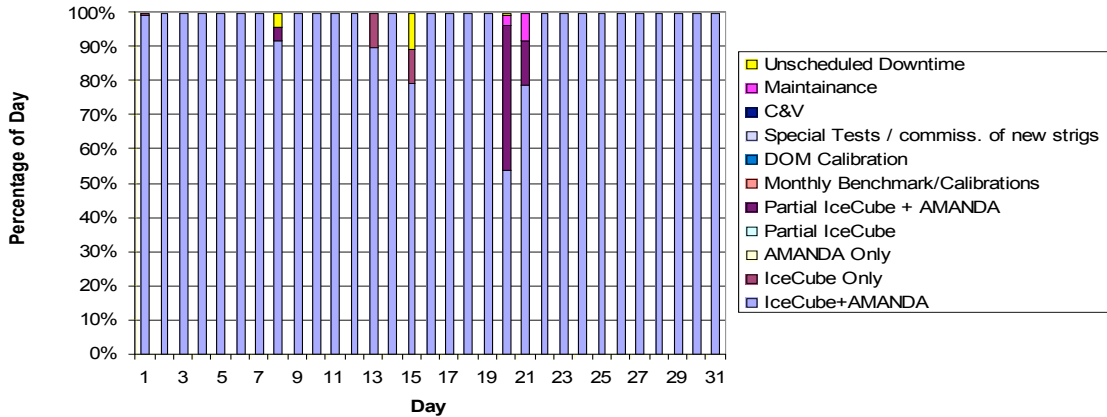


The loss of time on the 15<sup>th</sup> was due to a disk filling up without being detected, which caused a series of runs to fail. Since that time a system has been enacted which continuously monitors the DAQ computing hosts at SPS and actively alerts winter over operators and experts in the north of low disk conditions. The downtime on the 8<sup>th</sup>, 20<sup>th</sup>, and 21<sup>st</sup> was caused by a faulty DOR readout card introducing instability. It was replaced on the 21<sup>st</sup>.

## IceCube Maintenance & Operations

Detector Up Time	98.1%
IceCube Clean Run Up-Time not including AMANDA Array	96.2%
Unscheduled Downtime	0.5%
Events from DAQ	3.45 billion

### IceCube Detector Operation for May 2008



On May 8<sup>th</sup>, a communication protocol error state in string-68 caused about one-hour of unscheduled downtime. On May 13<sup>th</sup>, a power sag at the ICL caused the AMANDA trigger rate to decrease significantly. This required power cycling of AMANDA ORB crate 3 in rack #8. On May 15<sup>th</sup> another power sag required again power cycling of the before mentioned ORB crate (and the corresponding icecube-only running period). More importantly, on the same day the detector was down for about 2.5 hours. This downtime was caused by the filling of the secondary builder disk due to the wrong configuration of the Monitoring application. The temporary solution required moving aside monitoring data to free up space. Some monitoring data from the period before the DAQ was stopped was lost.

On May 20<sup>th</sup>, an attempt to deploy a new version of pDAQ, Bay Wolf, failed due to incompatibility with the AMANDA trigger source. This capability could not be tested in the North Hemisphere test system at the time. A new protocol has been established for deployments of newer versions of the DAQ code. The deployment is made, and, if apparently successful, is left running for 24-hours and then rolled back to the previous working production version. The data and logs for the new DAQ code are then vetted using the Monitoring and Verification codes. Re-deployment of the new release is then done once the qualification is completed.

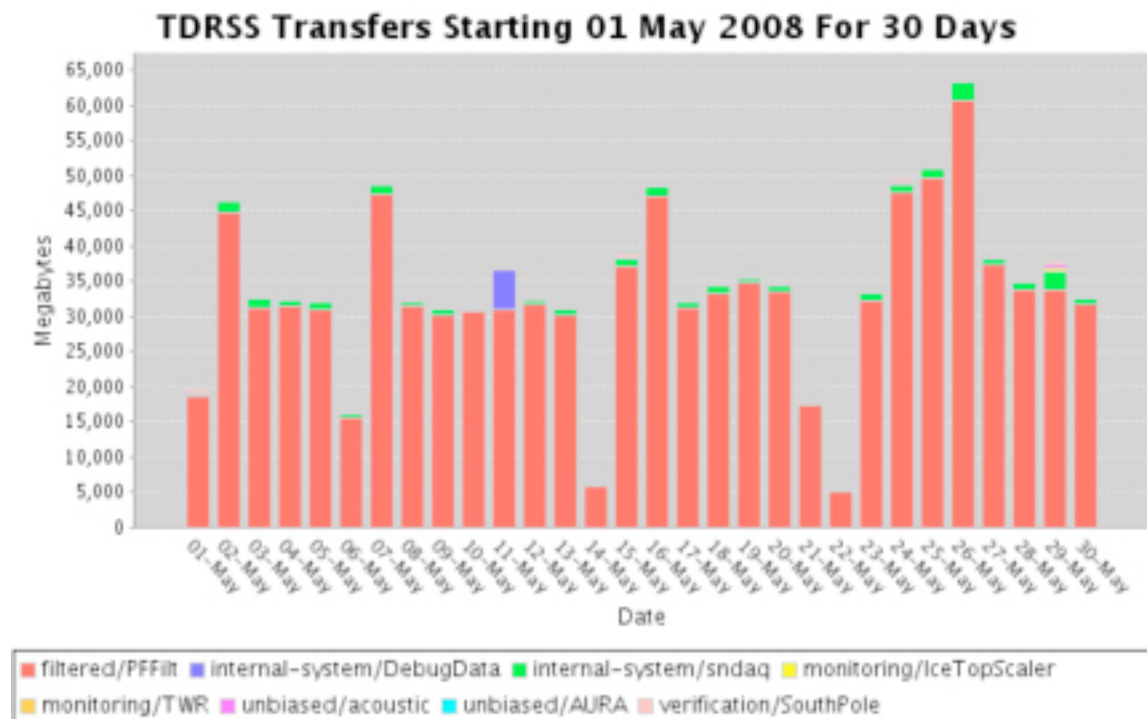
Also on May 20<sup>th</sup>, a DOR card in string-68 failed and was replaced. During the same maintenance period other cables and connectors were replaced including a swap to determine the source of TCal errors in a quad cable in string-62. On May 21<sup>st</sup> tests of the experiment control (Anvil) of flashers (in the pDAQ framework) were run.

On May 26<sup>th</sup> the AMANDA trigger rate showed a steady decrease. This was later traced to a temperature rise since the previous day in the MAPO building where it reached 79F in the server room, which was corrected by reestablishing proper air circulation. Temperature monitoring of MAPO was improved following this event. On May 27<sup>th</sup> a DOR card in IThub05 required replacement.

## Data Systems

**Data Handling** - South Pole Systems in the IceCube Laboratory began IC-40 physics operation in April. The figure below shows the daily satellite data transfer rates. Most work in this area for the MREFC is for planning requirements in the ICL for the coming deployment season to accommodate new strings.

There is also ongoing work in pre-operations for this category to enhance the Data Warehouse with a major upgrade of 200 TB of disk and an upgraded HSM tape library system.



**Filtering, Software & Database** - Filtering of IC40 data began on April 14, 2008 representing the full transition from IC-22 to IC-40 running. The Joint-Event Builder and Processing and Filter server (JEB/PnF) merging of IceCube-40 and Amanda TWR data streams continues at South Pole sending filtered data sets of about 38 GB/day over the satellite. The figure below represents a snapshot of the filter-rate monitoring page for the current IC-40 physics runs. The IC-40 trigger rate is about 1300 Hz with the filter selecting about 88 Hz of good physics events for satellite transmission to the North.

## IceCube Detector Summary

Status as of : 2008-06-16T17:12:04Z

Date	DAQ	TWR	SN	PNF	SPADE	Run	Events
2008-06-16T17:12:04Z	Started	Started		Started		111174	24552773

Current DAQ Run		Previous DAQ Run	
Number	111174	Number	111173
Start Time	2008-06-16 11:54:09.395620	Start Time	2008-06-16 03:50:43.644525
physics	24552773 events	Stop Time	2008-06-16 11:52:23.493435
monitor	73191686 events	physics	36998737 events
sn	46851687 events	monitor	110463597 events
lcal	46818050 events	sn	70762776 events
		lcal	70731469 events

Previous TWR Run		PnF Summary for Run	
Number	111173	Number	111174
physics	6507008 events	Event	24540000
		Clients	0
		Trigger Rate	1288.99
		Processing Rate	1394.04
		Summary Age	PT3S

PnF Physics Filter Rates			
Filter	Hz	Filter	Hz
CascadeFilter_08	16.25	DownGoingContained_08	13.5517
EhEFilter_08	1.28448	FilterMinBias_08	0.482759
I3DAQDecodeException	0	ICDownStarting_08	1.84483
ICLowEnergyContainedFilter_08	6.22414	ICMuonFilter_08	20.3534
IceTopSTA3_08	2.30172	IceTopSTA3_InIceSMT_08	1.93966
IceTopSTA8_08	0.577586	InIceSMT_IceTopCoincidence_08	1.74138
JAMFilter_08	3.4569	LECascadeFilter_08	7.35345
LowUpFilter_08	11.069	MoonFilter_08	13.7759
PhysicsMinBiasTrigger_08	0.448276	TWRDAQDecodeException	0
Total	88.0431		

Offline processing for IC-22 data through Level 2 was completed. This is the last offline processing step done in common for all physics topics. Higher level processing is now ongoing by individual analysis groups using the common Level 2 data sets. Preparations have begun for offline processing on the IC-40 data as it flows north over the satellite. Testing on L0 and L1 processing has gone well, and we expect to start routine processing of L0/L1 this month. Final processing of Level 2 data will be complete by early June. This schedule is nearly six months ahead of last year's IC-22 offline processing. Preparations and negotiations with the European KM3NET collaboration for use of our software framework IceTray has begun with a formal letter from the KM3NET collaboration to IceCube stating their desire to use our framework. There will be a working meeting with the two collaboration's technical personnel present in late July.



**Simulation** - Mass simulation production with IceSim Version 2.1 to produce large background and signal Monte Carlo datasets for the physics working groups to prepare for IC-22 physics analysis has been completed. Mass production for IC-40 will begin as soon as IceSim Version 2.2 is completed this month.

**Education and Outreach** – University of Wisconsin-River Falls student Matthew Blodgett’s presented his poster at the Council of Undergraduate Research meeting at the end of April 2008 on Capitol Hill. Matt was one of only 60 chosen from 255 nation-wide submissions this year. Matthew described the work he did at the University of Delaware analyzing South Pole data to calibrate IceTop tanks.

At their May collaboration meeting, IceCube staff explored the outreach potential of the digital planetarium called the Exploradome. The heart of the display is a 270 degree projection system that can show planetarium displays as well as immerse the audience in other science settings. Science experts can be present for the event through an internet connection and see the same view on their office computers as the audience sees in the dome. This technology has potential for an IceCube program that is ported to sites worldwide.

Two REU students began their summer program in Madison working with Professors Montaruli and Westerhoff.

**Quality Assurance and Safety** – No incidents to report.

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

**Meetings and Events**

Radio Workshop @ University of Maryland	July 11-12, 2008
Driller Training @ UW-Madison	July 28-August 8, 2008
International Oversight & Oversight Group Meeting	TBD, September 2008
Fall Collaboration Meeting @ Utrecht, Netherlands	September 15-19, 2008