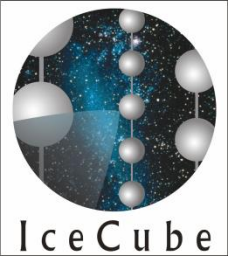
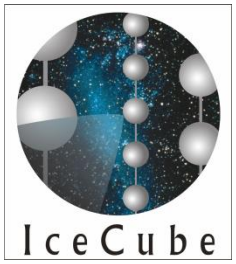


Data Quality in IceCube

Dawn Williams, University of Alabama

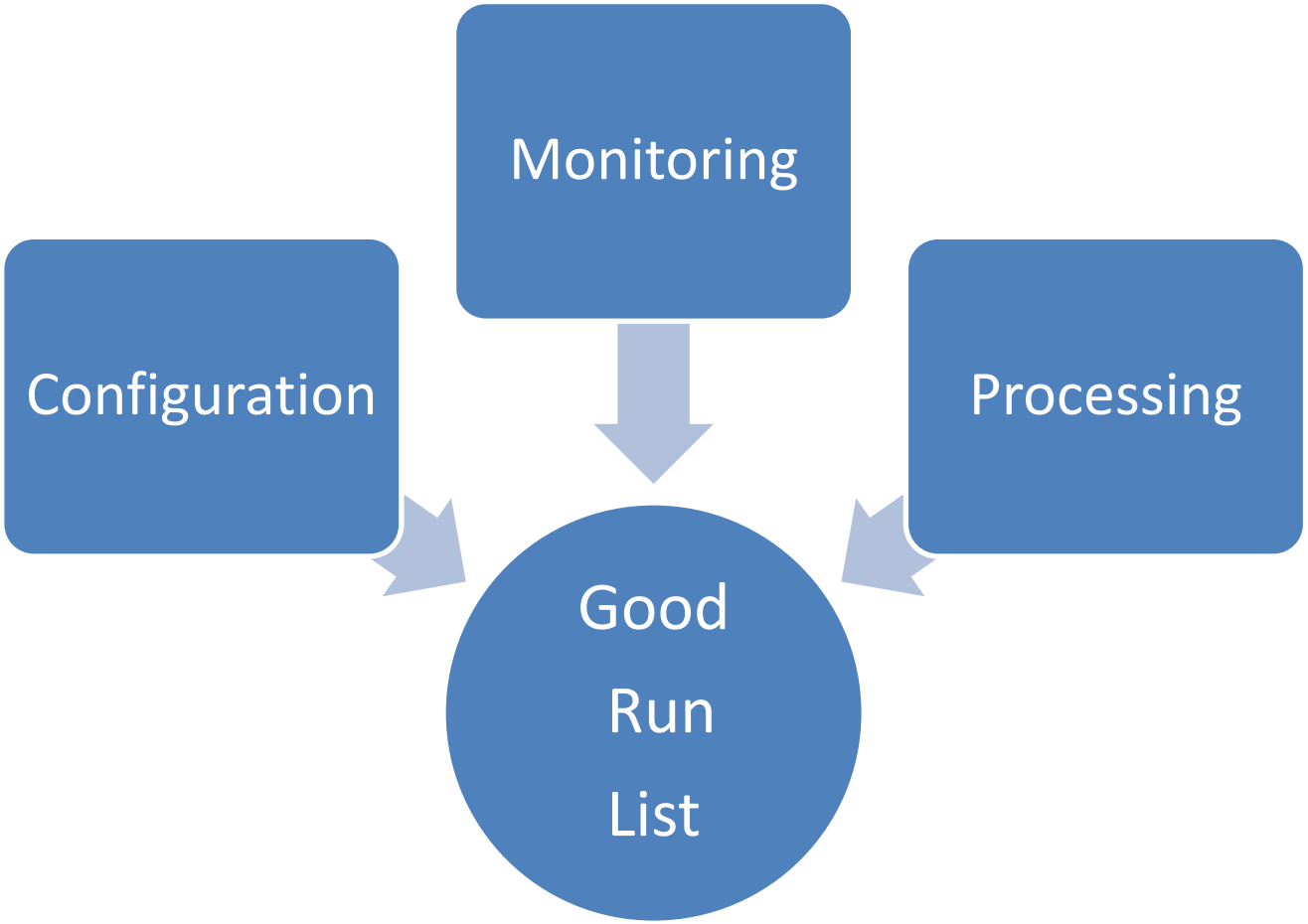
Mediterranean Antarctic Neutrino Telescope Symposium 2009
Humboldt University, Berlin
September 25, 2009



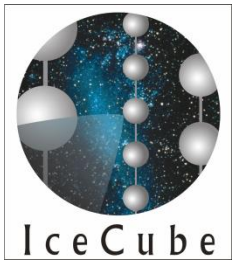
IceCube Runs

- IceCube data is divided into consecutively numbered “runs”, default 8 hours
- A run is defined by a specific detector configuration
- Types of runs
  - Physics runs – default configuration
  - Calibration runs – usually with light in detector from in-situ source
  - Test runs of newly deployed strings, new versions of data acquisition software, etc.

Data Quality



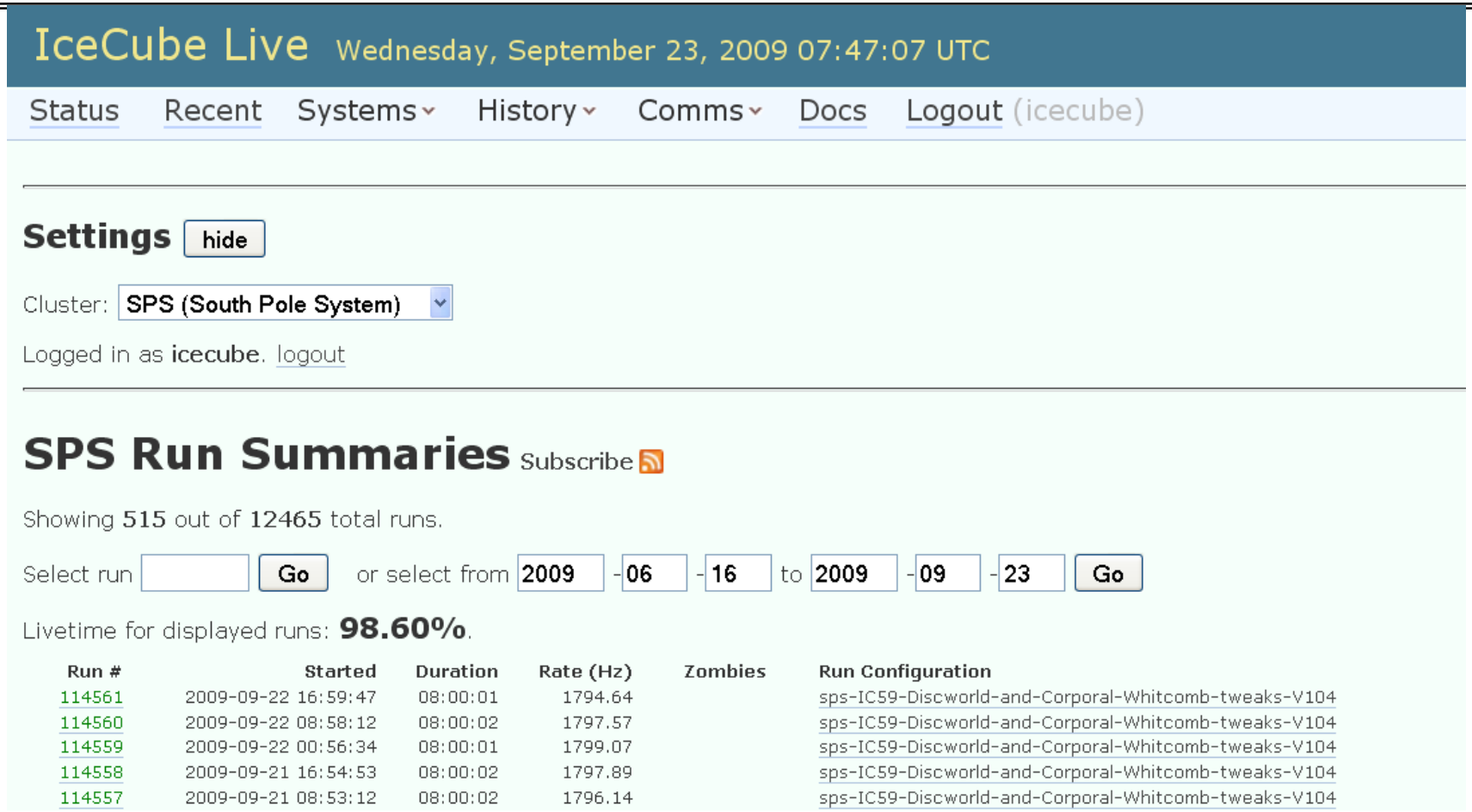
The purpose of the data quality group is to provide the IceCube collaboration with a list of runs suitable for physics analysis.



Configuration

- Runs are controlled by IceCube's experiment control system, "IceCube Live"
- IceCube Live stores configuration information in a database
  - Which strings/DOMs are operating
  - Settings (high voltage, threshold levels, etc.)
  - Trigger settings
  - "Lightmode" – LID = light in detector (calibration)

IceCube Live



Web interface to IceCube Live

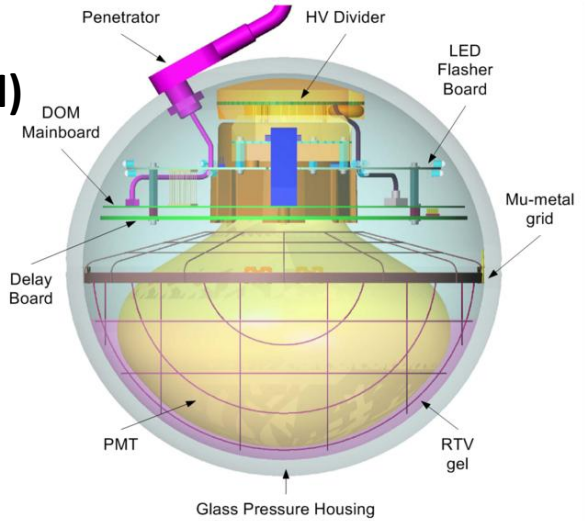
Light in the Detector

113650	2009-05-06	PhysicsTrig	domcal
113651	2009-05-06	PhysicsTrig	domcal
113652	2009-05-06	PhysicsTrig	domcal
113816	2009-05-19	TestData	flashers
113968	2009-06-13	TestData	flashers
113986	2009-06-15	PhysicsTrig	domcal
113987	2009-06-15	PhysicsTrig	domcal
114101	2009-07-08	PhysicsTrig	domcal
114102	2009-07-08	PhysicsTrig	domcal
114103	2009-07-08	PhysicsTrig	domcal
114104	2009-07-08	PhysicsTrig	Krabba
114105	2009-07-08	PhysicsTrig	Krabba
114106	2009-07-09	PhysicsTrig	Krabba
114107	2009-07-09	PhysicsTrig	Krabba
114108	2009-07-09	PhysicsTrig	Krabba
114109	2009-07-09	PhysicsTrig	Krabba
114252	2009-08-07	PhysicsTrig	domcal
114271	2009-08-09	PhysicsTrig	domcal
114272	2009-08-09	PhysicsTrig	domcal
114278	2009-08-09	PhysicsTrig	domcal
114285	2009-08-11	TestData	flashers
114285	2009-08-11	TestData	flashers
114286	2009-08-11	TestData	flashers
114287	2009-08-11	TestData	flashers

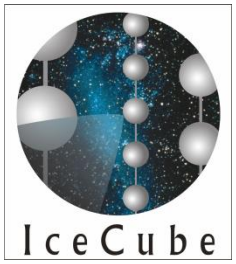
- **The database records runs with light in the detector, but not the source.**

- **The data quality group maintains a wiki with information about the source of light**
  - **flashers**
  - **standard candle**
  - **mainboard LED (domcal)**
  - **other noise sources**

Standard candle



DOM



Monitoring

- Runs are monitored for problems in the data
  - Low level monitoring
    - Monitoring information captured during data acquisition
    - Rates, temperature, high voltage setting, time calibration
  - High level “verification” monitoring
    - Basic physics analyses run on unfiltered data at Pole

Low Level Monitoring

Trigger Rate: | Instructions

Trigger type	Current Rate, Hz	Ref Rate (run 114099), Hz	Deviation, σ	Comments
ICE_TOP_CALIBRATION	26.1756 ± 0.0308	26.0562 ± 0.0659	1.64	Rate changes with atmospheric pressure
ICE_TOP_MIN_BIAS	0.2934 ± 0.0033	0.2922 ± 0.0070	0.16	Rate changes with atmospheric pressure
ICE_TOP_SIMPLE_MULTIPLICITY	27.5847 ± 0.0316	27.5868 ± 0.0678	-0.03	Rate changes with atmospheric pressure
IN_ICE_MIN_BIAS	41.1200 ± 0.0386	40.6735 ± 0.0823	4.91	--
IN_ICE_SIMPLE_MULTIPLICITY	1628.0133 ± 0.2429	1594.6898 ± 0.5155	**58.48**	--
IN_ICE_STRING	1780.9397 ± 0.2540	1743.7728 ± 0.5391	**62.37**	--

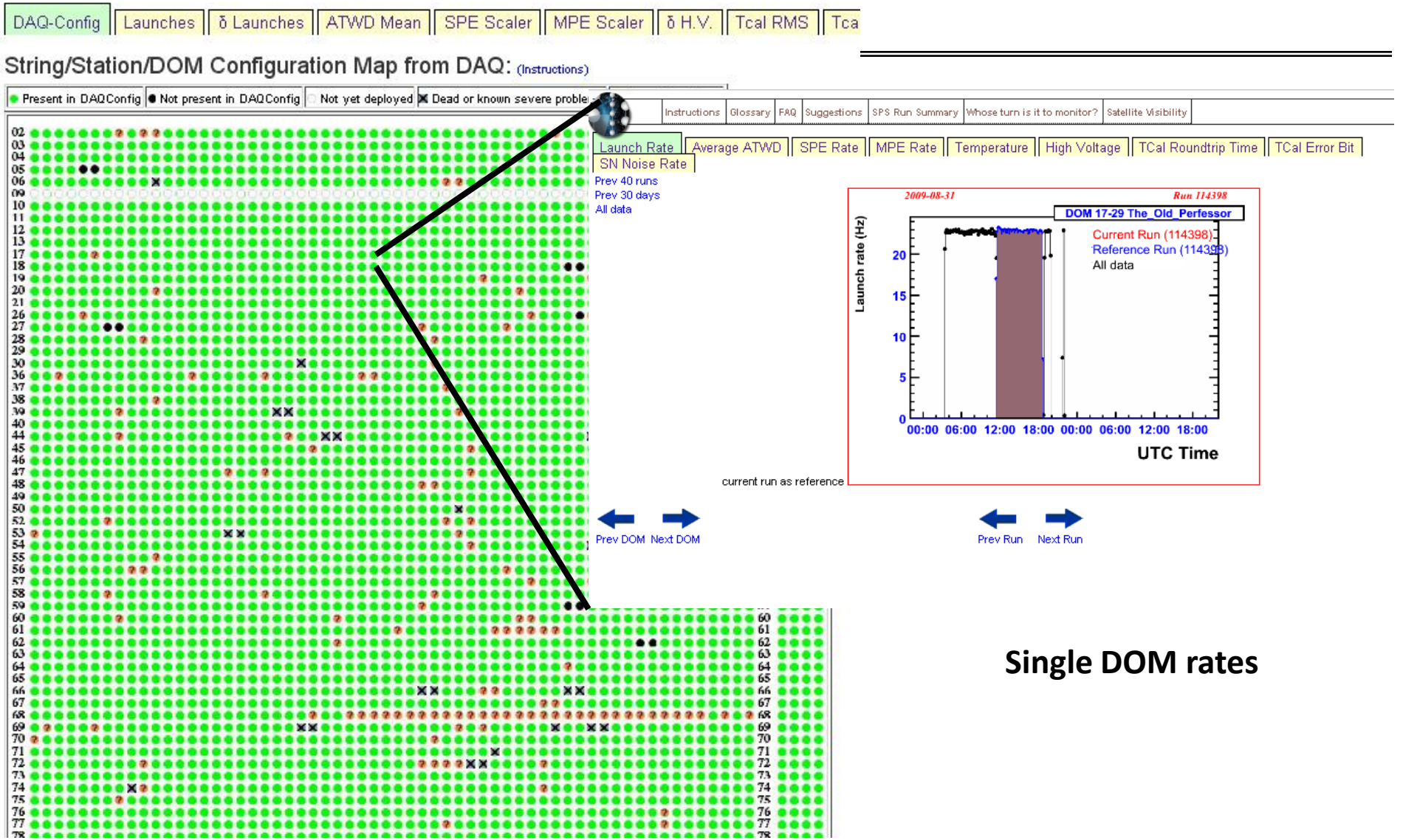
Filter Rate: | Instructions

Filter type	Current Rate, Hz	Ref Rate (run 114099), Hz	Deviation, σ	Comments
2ndLevelReco_09	10.6775 ± 0.0197	3.3847 ± 0.0238	**236.05**	--
CascadeFilter_09	30.3466 ± 0.0332	22.4178 ± 0.0611	**114.02**	--
DC4Filter_09	1.3458 ± 0.0070	1.3530 ± 0.0150	-0.43	--
DeepCoreSMTTrigger_09	3.2321 ± 0.0108	3.2118 ± 0.0231	0.80	--
DownStarting_09	4.1808 ± 0.0123	4.1878 ± 0.0264	-0.24	--
EHEFilter_09	9.5338 ± 0.0186	2.1365 ± 0.0189	**278.96**	--
FilterMinBias_09	2.8558 ± 0.0102	2.8162 ± 0.0217	1.65	--
I3DAQDecodeException	0.0000 ± 0.0000	N/A	N/A	Rate MUST be zero
IceTopMuonCalibration_09	0.0000 ± 0.0000	N/A	N/A	Rate changes with atmospheric pressure
IceTopSTA3_09	2.3347 ± 0.0092	2.3120 ± 0.0196	1.05	Rate changes with atmospheric pressure
IceTopSTA3_InIceSMT_09	1.5083 ± 0.0074	1.5077 ± 0.0159	0.03	Rate changes with atmospheric pressure
IceTopSTA8_09	1.1138 ± 0.0064	1.1080 ± 0.0136	0.39	Rate changes with atmospheric pressure
IceTopSTA8_InIceSMT_09	0.3040 ± 0.0033	0.3033 ± 0.0071	0.20	Rate changes with atmospheric pressure

Collaboration members monitor runs in shifts

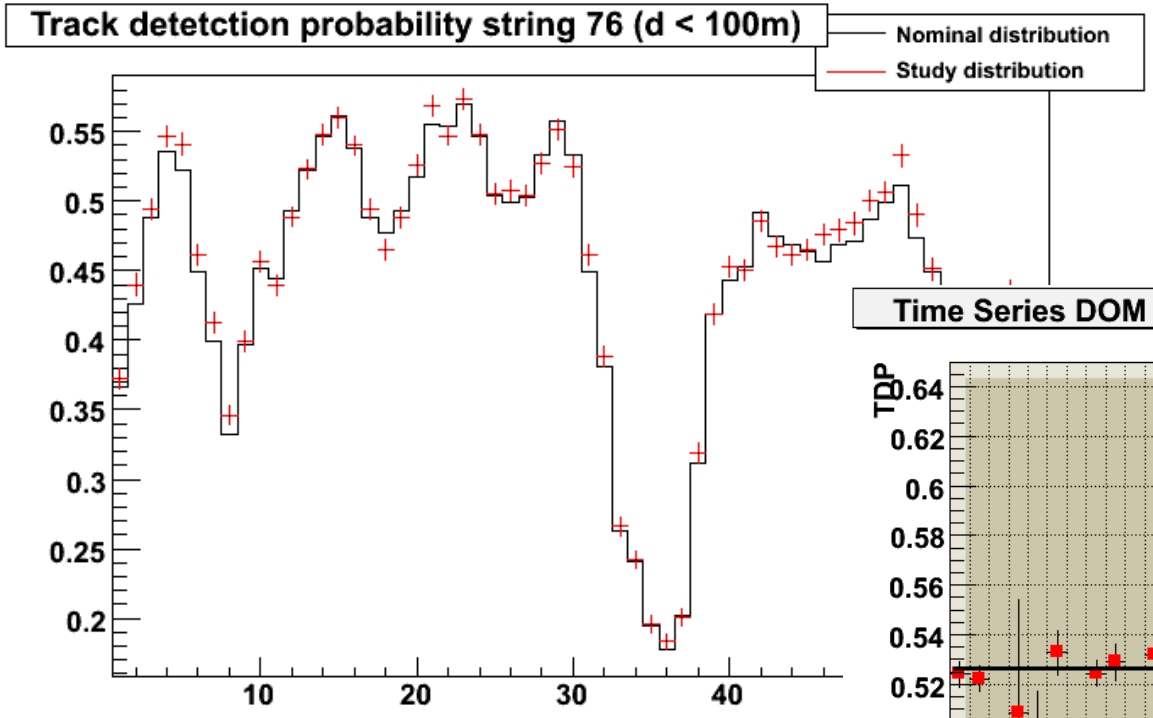
Reports are saved as xml files

Low Level Monitoring



Single DOM rates

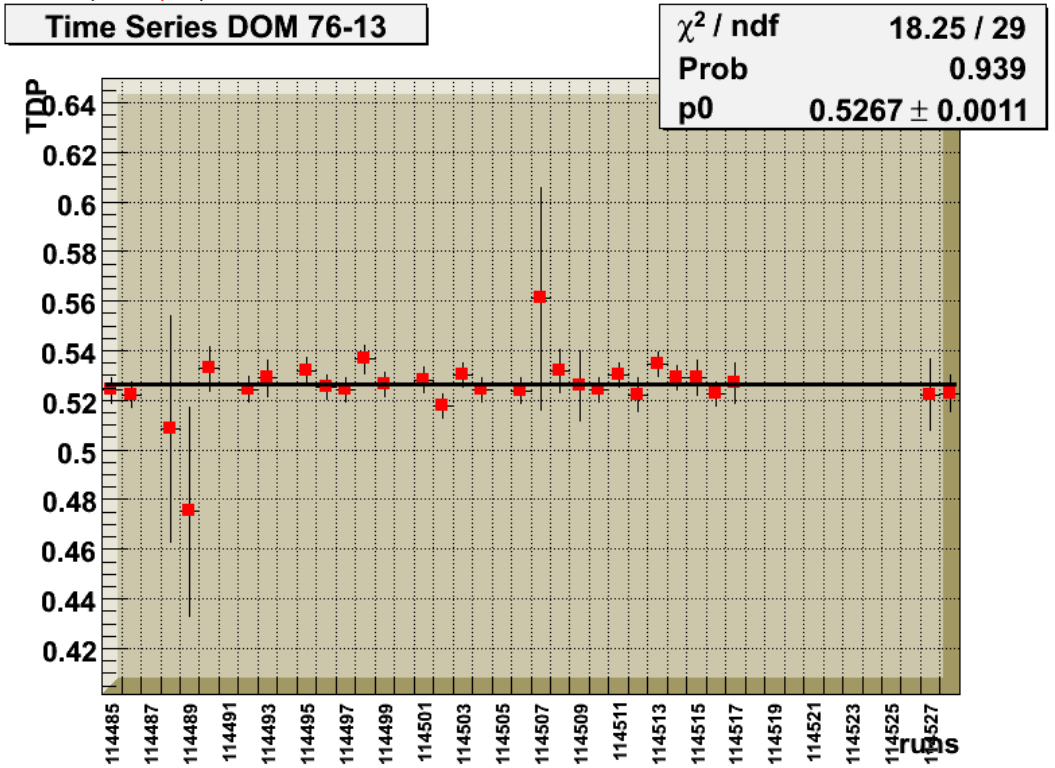
High Level Monitoring



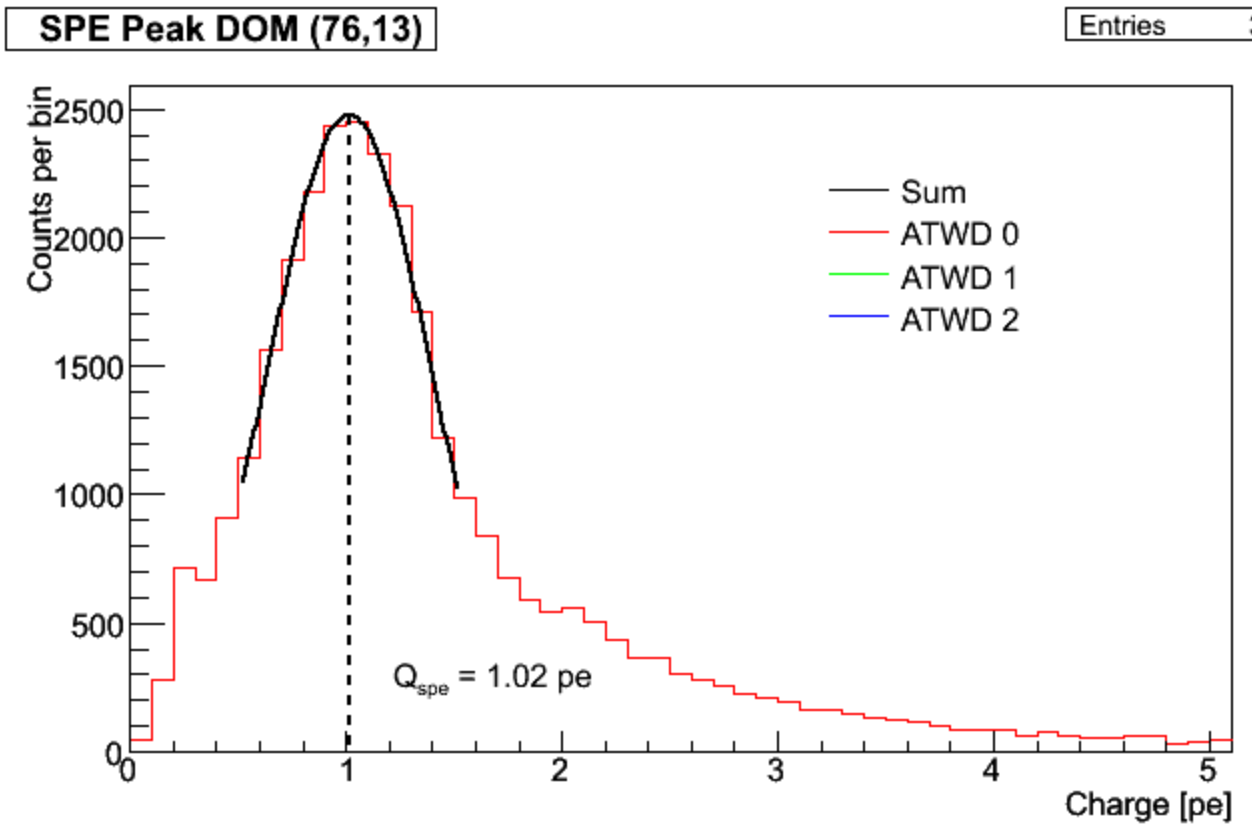
Track detection probability – analysis of high quality fitted tracks

Physics analyses run on unfiltered data at Pole

Template comparison, time series



High Level Monitoring



SPE charge (in ice)

Good run list web interface

IC40 Good Run List

Subdetector: InIce Run Number Range: 110749 TO 113916

Show: ○ Full Only ○ Partial Only ◉ Both

○ Good Only ○ Faulty Only ◉ Both

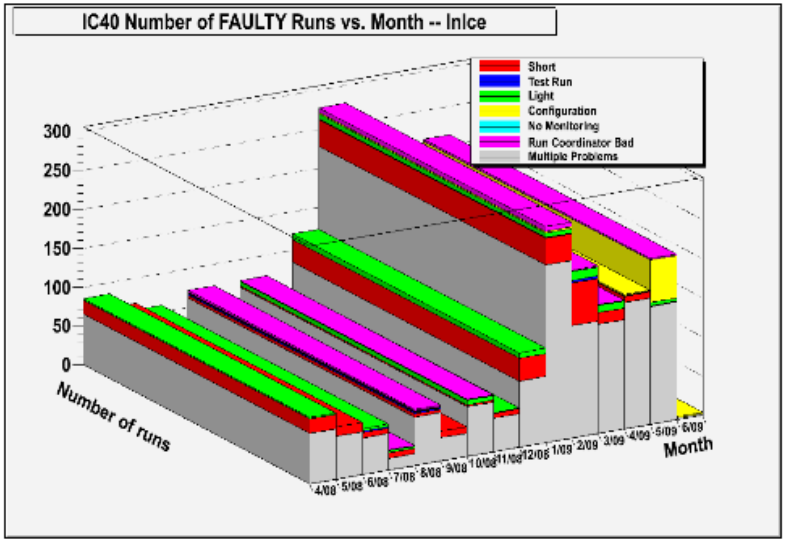
Plot Faulty Runs against: Number of runs Create List

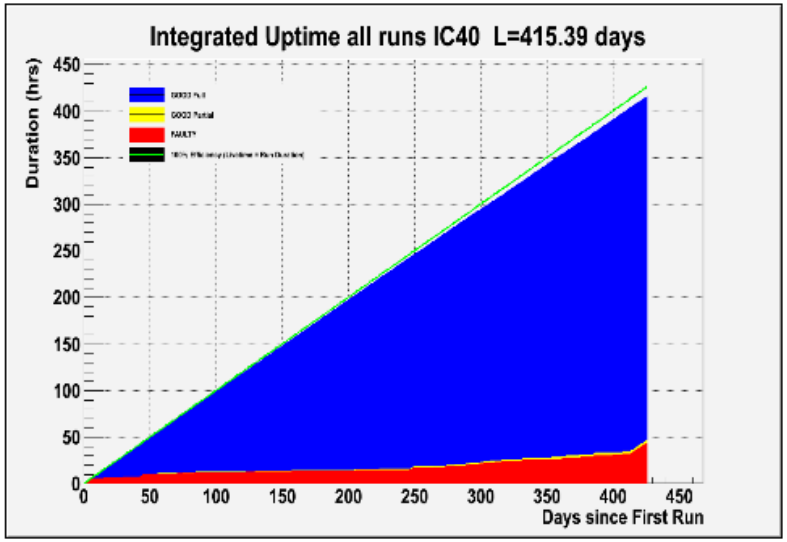
Plot FAULTY reason against month: Short Create Plot

Total Number of Runs: 3170

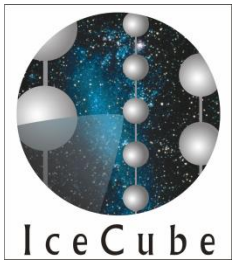
Total Integrated Uptime for All Displayed Runs: 9969.18 hrs.

Total Integrated Uptime for All GOOD Runs: 8924.66 hrs.





Run Number	Date	Duration (hrs)	Full or Partial	Decision	Comments
110749	2008-04-01	8.001389	full	FAULTY	short, no monitoring, non IC40 physics conf.
110750	2008-04-01	8.001944	full	FAULTY	short, no monitoring, non IC40 physics conf.
110751	2008-04-01	8.001667	full	FAULTY	short, no monitoring, non IC40 physics conf.
110752	2008-04-02	8.001944	full	FAULTY	short, no monitoring, non IC40 physics conf.



Future work

- Better integration of results from low and high level monitoring
- Addition of quality checks on data after additional processing in the north