What is the mean time between failure (hardware/software) of the current SD units?

- Seventeen tanks which were ready and calibrated on September 18 have been left alone since then. (~680 tank-days)
  - There was one hardware failure (cold solder joint) which would have been detected by the QA planned in production.
  - There have been no software hangs; the tanks have been rebooted occasionally for operational reasons (e.g. diagnostics).

What is the muon signal in photoelectron units?

- Measurements were made on the test tank Laura, prior to the use of RTV coupling of the PMTs which doubles the observed signal.
- The photomultiplier gain was measured using the statistical method, by observing the width of the distribution of the charge collected upon repeated flashes of an LED. The results were crosschecked with laboratory calibrations using the single photoelectron peak.
- The water in the tank at the time of the tests was local spring water, inferior to that used in the EA.

PMT #	Photoelectrons	
1	32	
2	26	
3	28	
Sum	90	(spec is 50)

The value of ~30 photoelectrons per PMT without RTV was checked on this tank by two independent groups.

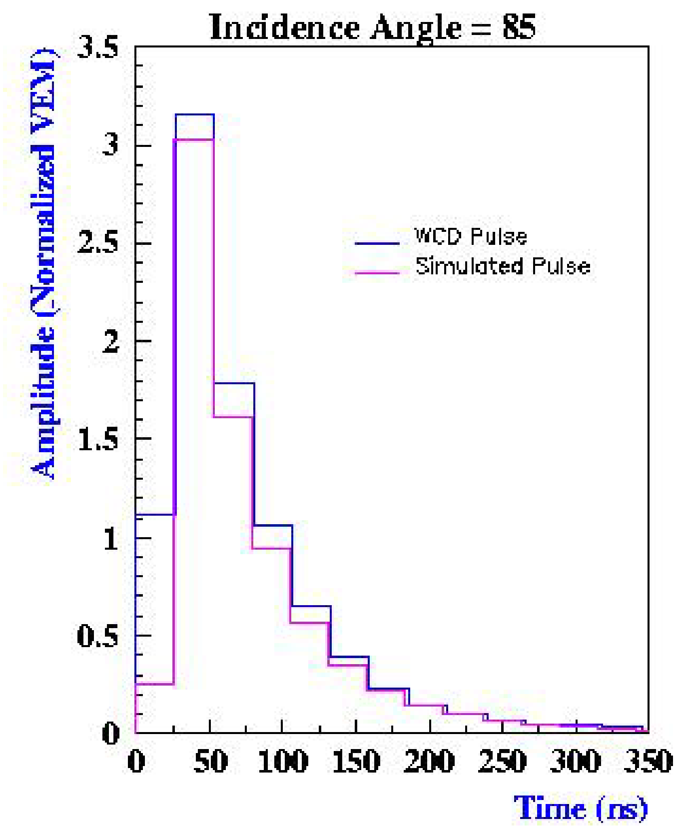
The signal approximately doubles when RTV coupling is used. Fermilab test tank results give 50 photoelectrons per tube with RTV coupling.

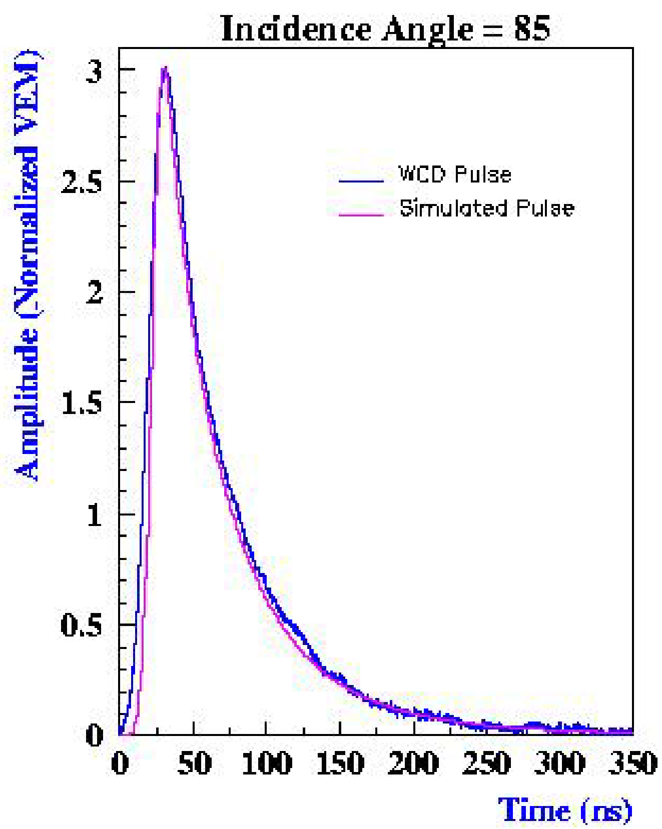
30 PE per tube is used in designing the signal chain to provide margin for deterioration over the life of the experiment. There is sufficient margin in the phototube operating high voltage range to accommodate changes in photoelectron yield.

How are photoelectrons calibrated?

- The primary means of photoelectron calibration planned for tanks in the field is the LED method.
- Both the photoelectron yield and the muon pulse shape provide a diagnostic of the water and liner health.
- The vertical equivalent muon peak is used the end-to-end physics calibration.
- The LED pulsers designed for use with the Auger SD electronics are to be provided by MEPhI. They are late and are a planned retrofit to the EA.
- All measurements thus far in the test tanks have been well in excess of our specification.
- Field measurements of the photoelectron yield on sample tanks are planned after the conclusion of the hybrid runs.

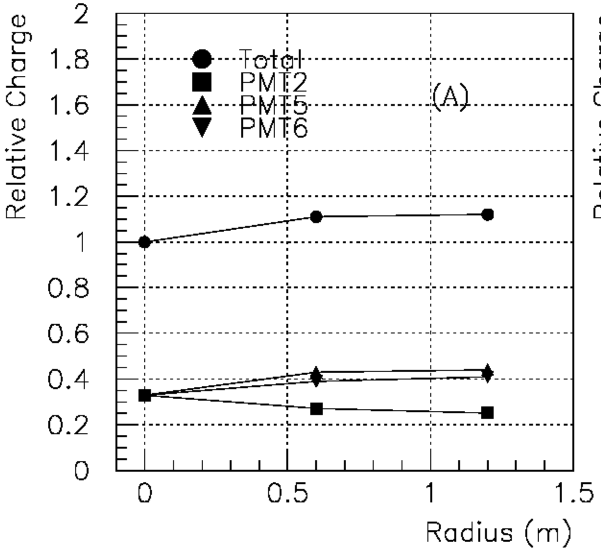
How does the single muon pulse shape compare with Monte Carlo simulations?



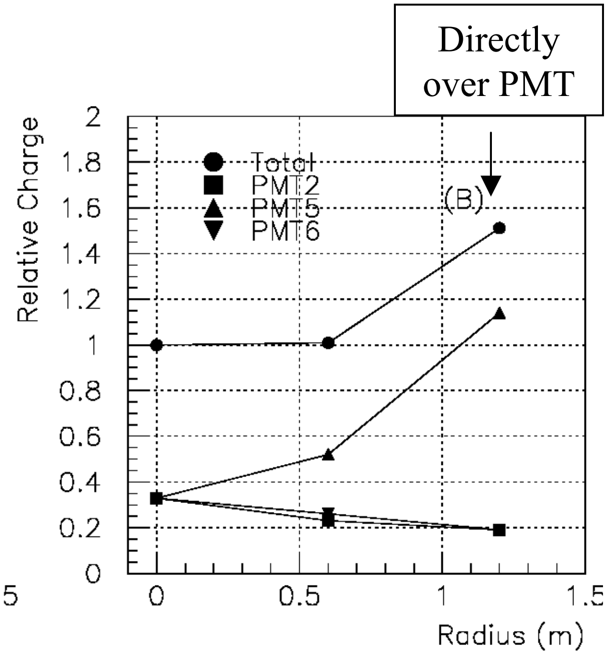


Average muon pulse shape and total charge. Comparison of experimental data taken at Buenos Aires with SDSim simulations.

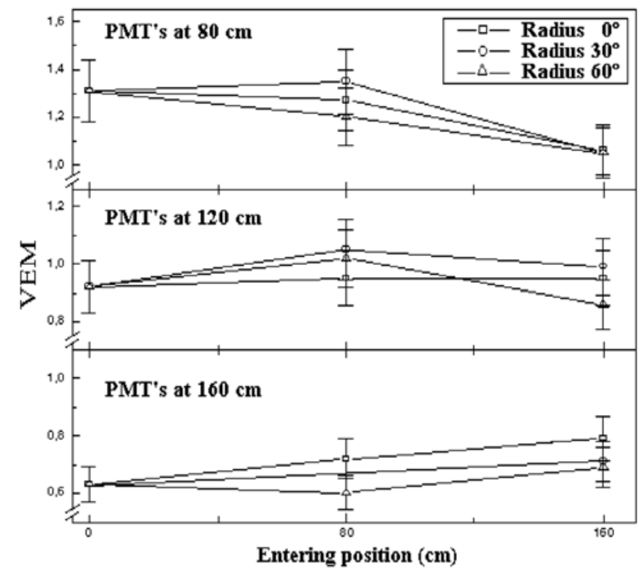
Are there uniformity scans with an external trigger telescope, or other data on uniformity?



Scan along line from center halfway between two PMTs.



Scan along line from center through PMTs.

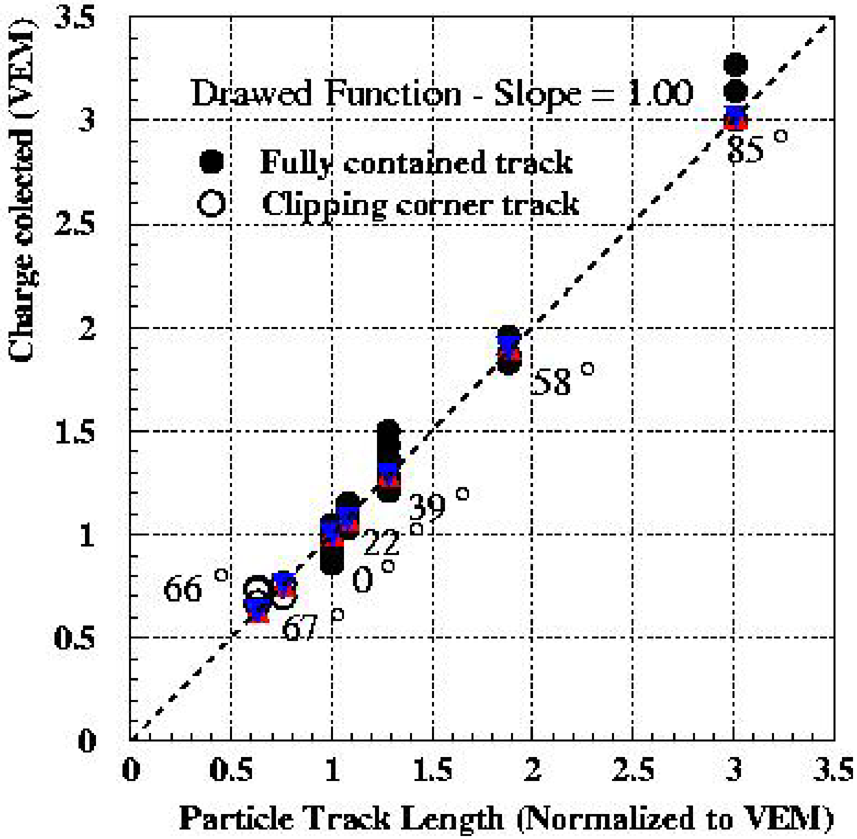


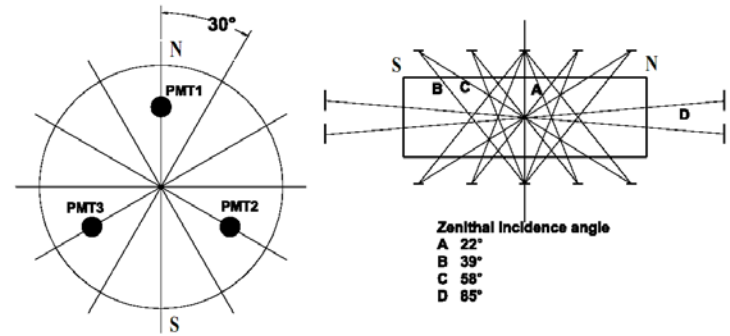
PMT placement optimization

Fermilab test tank data

Tandar test tank data

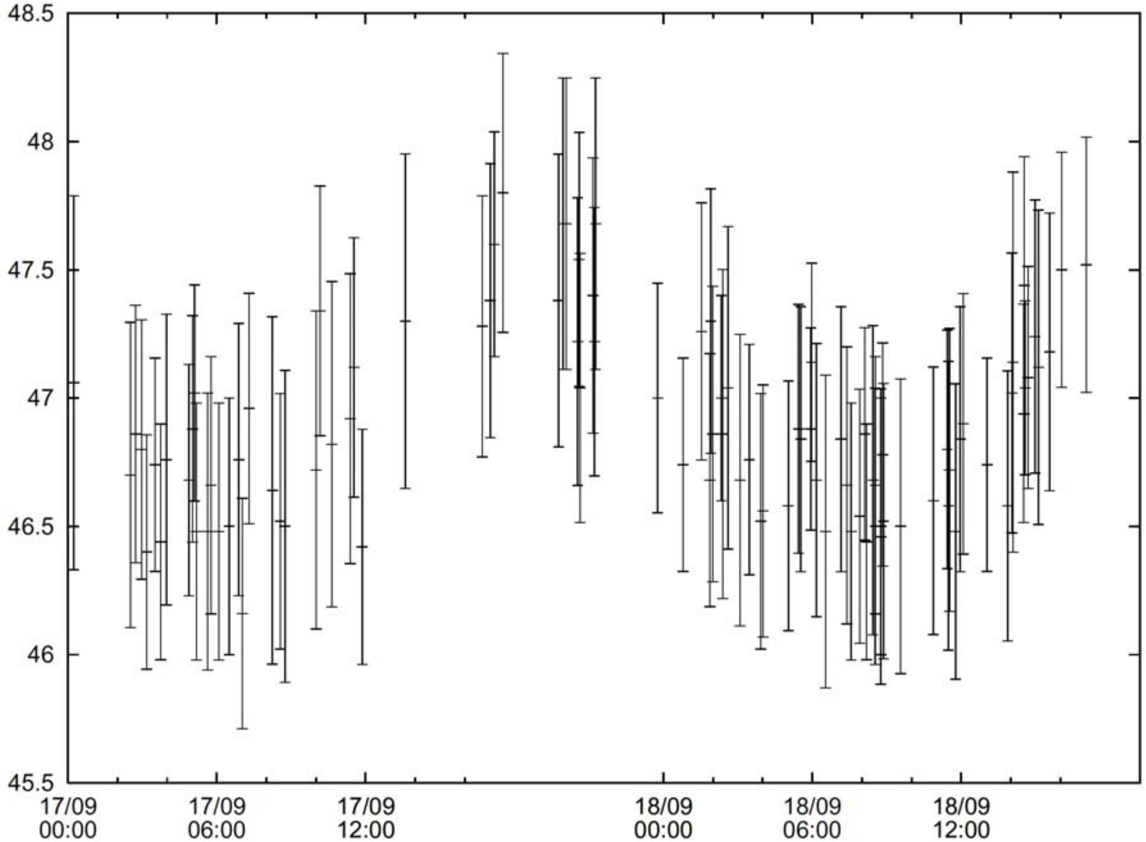
Are there uniformity scans with an external trigger telescope, or other data on uniformity?





Tandar test tank data compared with simulations for fully contained and corner clipping tracks.

What is the stability of the FADC baseline?

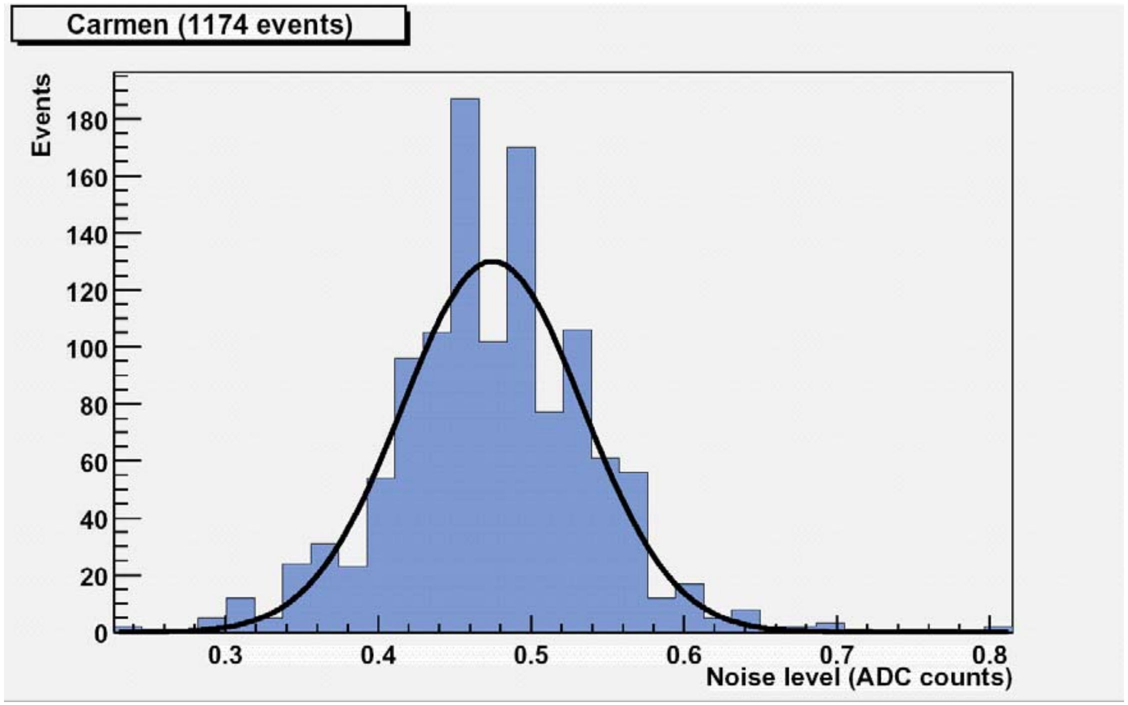


Two days of FADC baseline data from a tank in the field show a baseline variation of less than 2 ADC counts from 15° C to 45° C.

This is measured with each event, and compensation for these small drifts is planned.

The signal is AC coupled at the base (+HV) and at the input of the front end filter amplifier.

What is the noise level in the FADC?



The noise level was measured using the pretrigger portion of the FADC traces on an operating tank, with events having particles in this time span removed. The mean standard deviation of the FADC trace is 0.47 channels.

These results are consistent with bench tests using the full readout chain.

What is the noise level while the radio is transmitting data?

- This is an interesting question!
  - We have looked for and not found events with high noise levels. The radio transmits about 0.8% of the time in normal operation.
  - We have not seen evidence of RF interference in the presence of laptops, handy-talkies, etc.

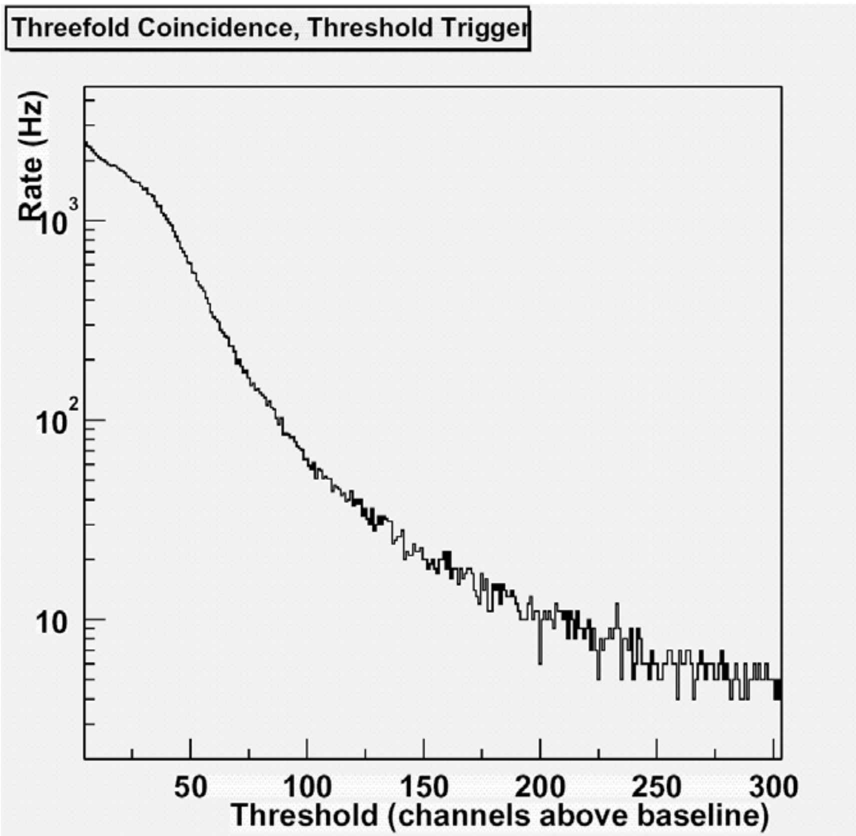
What is the linearity with the actual final base and readout chain?

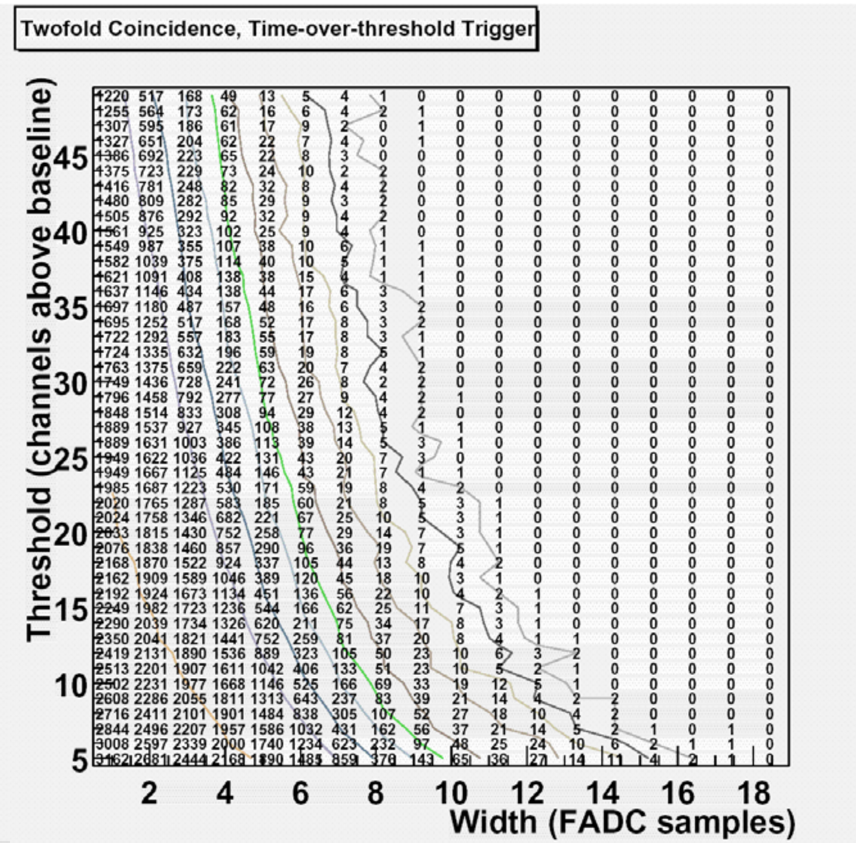
- The dominant source of nonlinearity is the PMT itself, which must meet a specification of a nonlinearity of <5% for the largest pulses.

Time constants and undershoot for AC coupled signals

- The base time constant is >1 ms (100kΩ × 10 nF)
- The anode undershoot for the maximum signal is less than 2 mV (1 LSB).
- The dynode channel recovery is more complicated and has been simulated.
  - The dynode undershoot is 65 mV (32 LSB), or ~0.1% of the peak signal, for the Auger maximum specified signal (600 m from the core at 10^{21} eV).
  - The undershoot is less than our nominal 50 channel pedestal, so it can be measured.

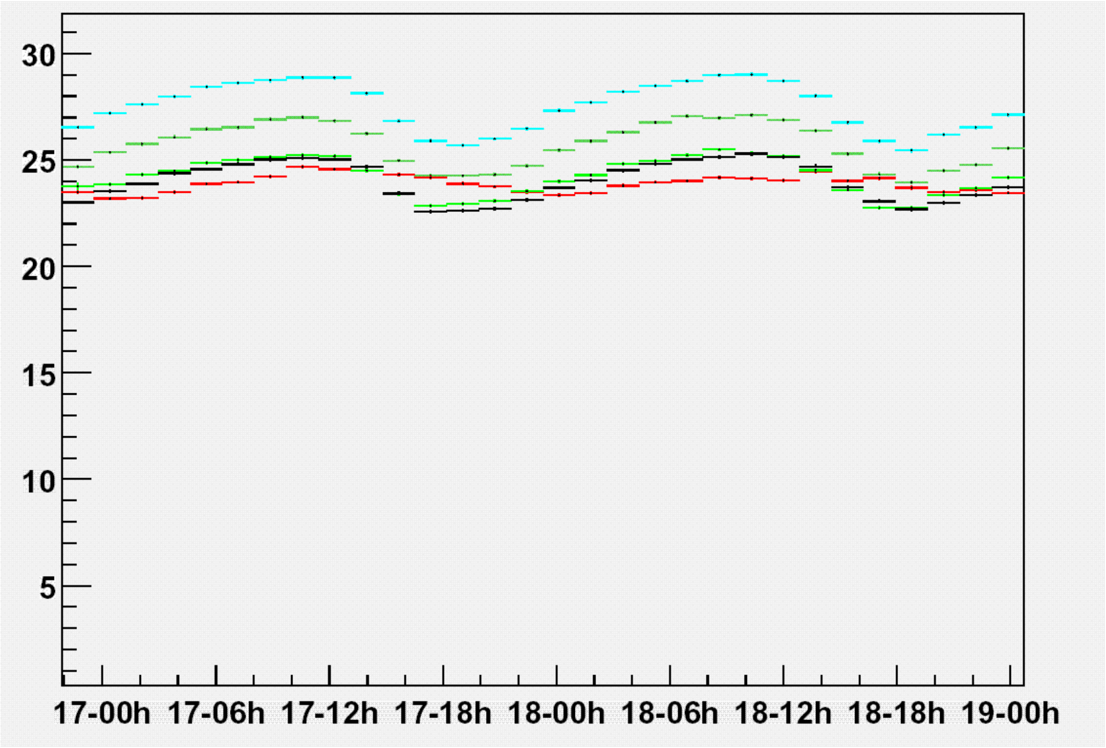
What is the T2 rate as a function of trigger conditions (threshold and time-over-threshold)?





Measured rates of components of EA T1/T2 as a function of trigger parameters in Laura.

How does the T2 rate vary over detectors, time, and temperature?



The T2 rate is shown as a function of time for six tanks. The ~10% variation shown is negatively correlated with the temperature inside the tank.

The tank software does not yet perform automated continuous monitoring of the muon peak, so we cannot unfold the origin of these changes at this time.

How does the T2 rate compare with expectations?

- The philosophy has been to simulate the signal rate, and measure the background rates from muons and small showers.
- First measurements were taken using AGASA test tank data.
- The rates in Malargue for wide time over threshold values at low thresholds are below the rates found in AGASA.
- We believe this is due to the low noise floor in the EA electronics compared to the AGASA setup.