

INVESTIGATION OF WATER HEIGHT EFFECTS ON COSMIC RAY COUNT

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ABSTRACT

Cosmic ray rates were measured as a function of water height above a pair of stacked scintillator panels. Count rates were measured simultaneously under a tank with varying amounts of water and an open air configuration. The dependence on water height of the count rates for coincident events and for the individual events are reported.

INTRODUCTION

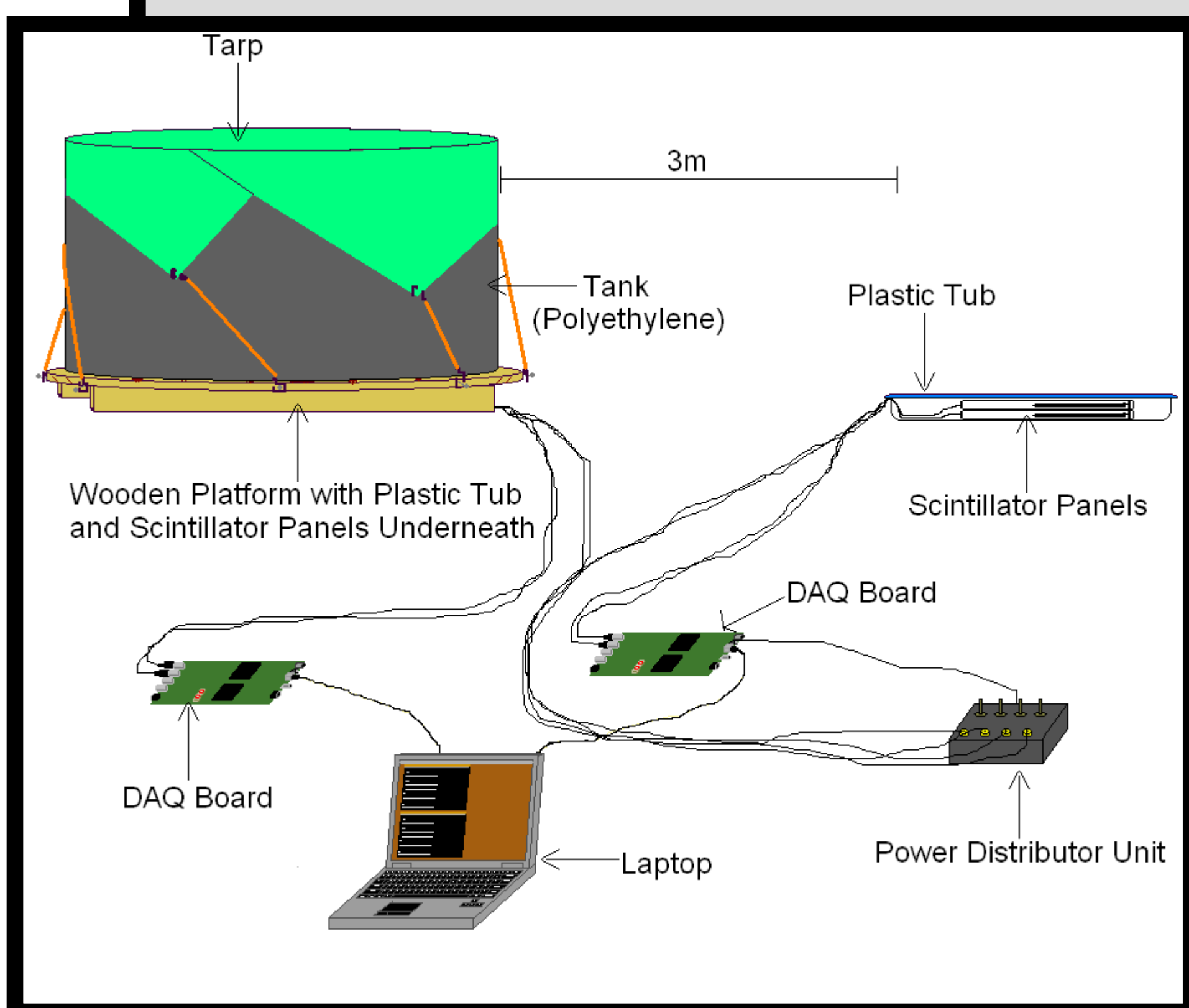
IceTop is a surface cosmic ray detector associated with IceCube, a neutrino telescope at the South Pole. IceTop uses two 1.86m diameter and 1m high tanks per station which are separated by 125m in a triangular grid covering a square kilometer.

Snow buildup on top of the tanks affects the performance of the array. This project investigated the effect of water height on the observed count rate of a scintillator/photomultiplier detector. This information may help simulate the effects of snow build up on the IceTop tanks at the South Pole.

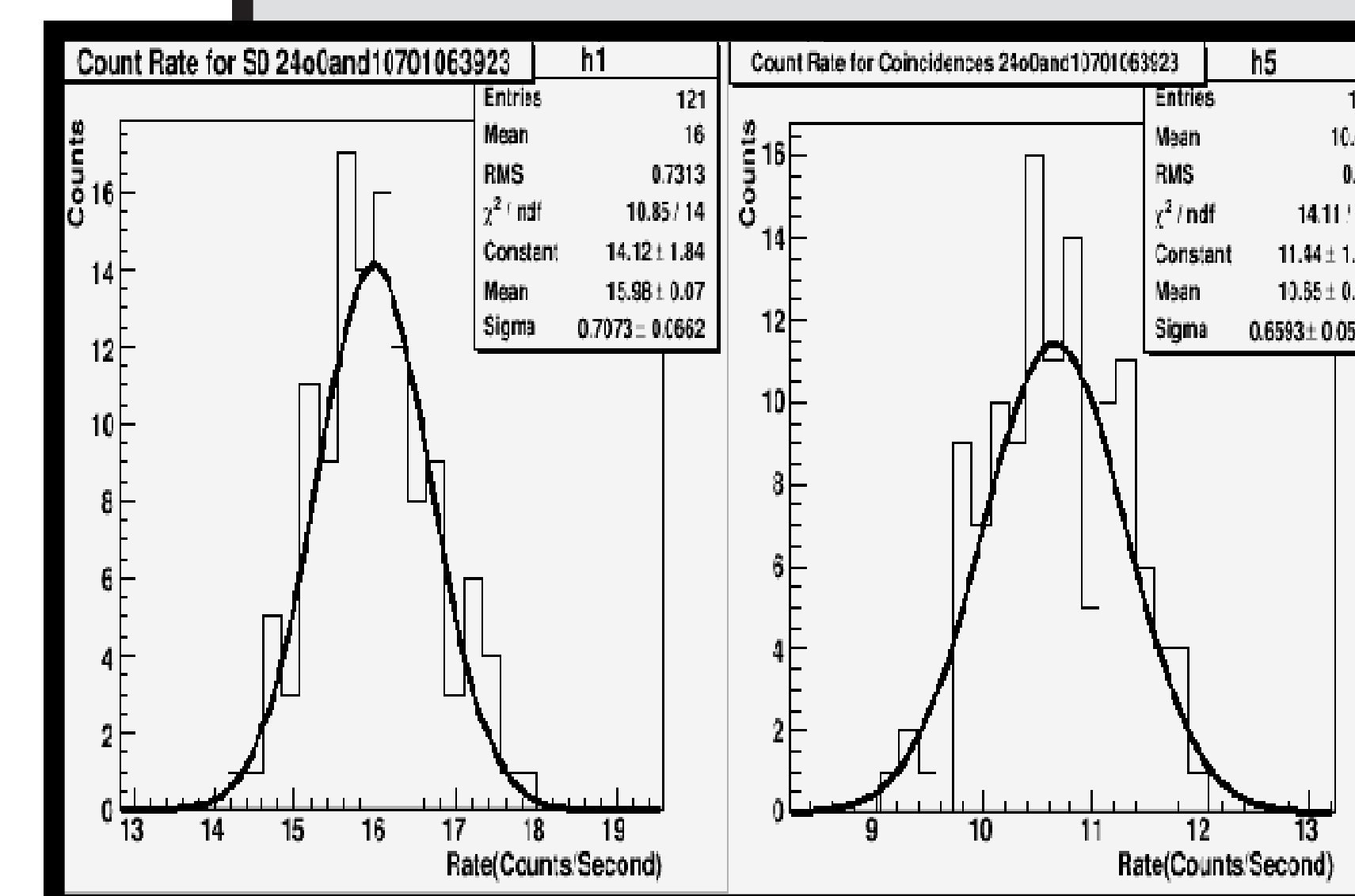
SETUP

The setup for the experiment is shown in the diagram to the left. The basic idea is to compare the count rates for the scintillators under the tank with those in the open. Water was added in 2cm increments until 1m was reached. For each water depth, the scintillator stacks were swapped and the same water depth was run again. This allowed us to check for consistent results.

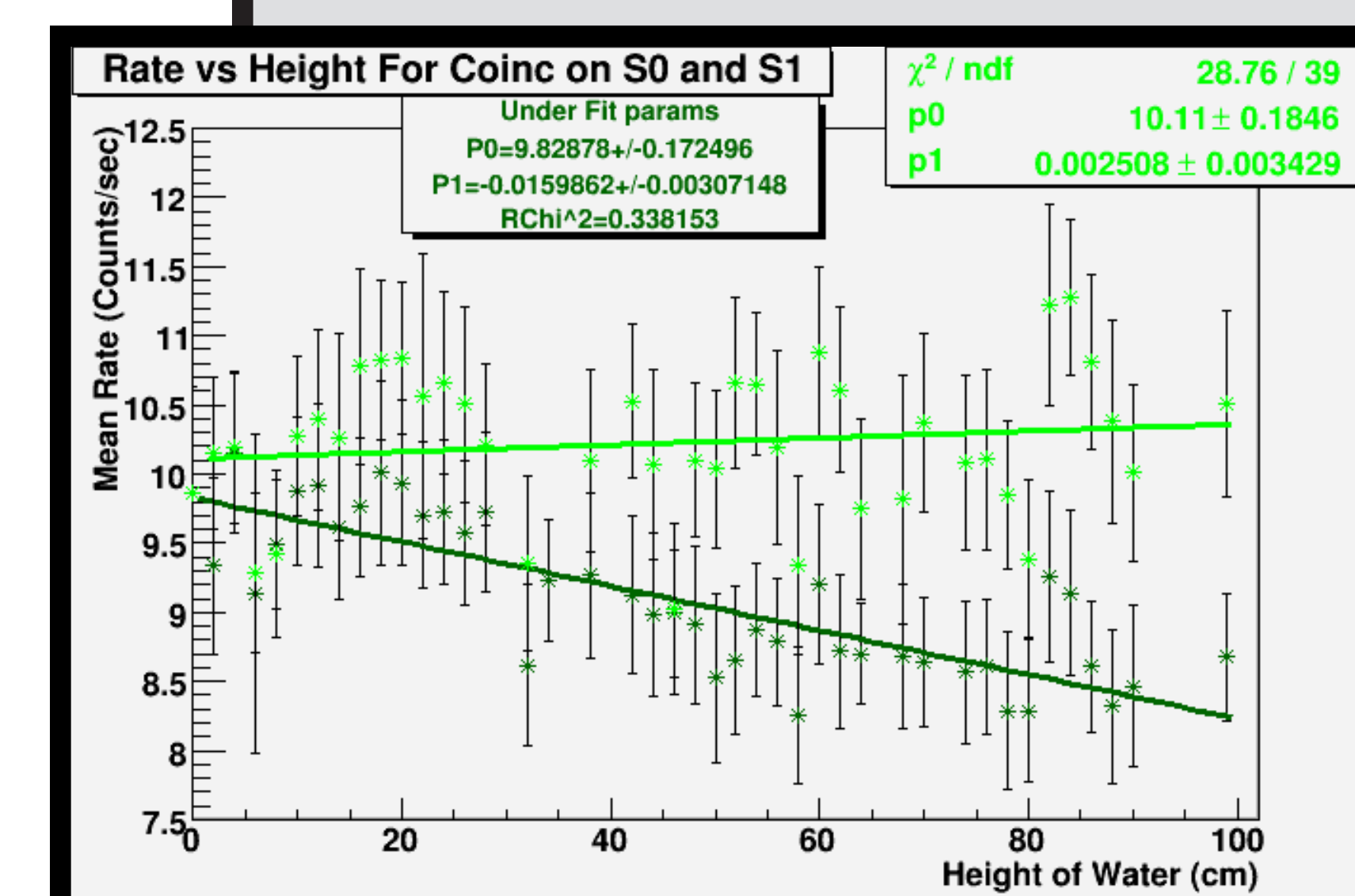
Counts were recorded every 30 seconds for one hour. Single rates and coincidence rates, which required hits on both stacked panels within 240 ns, were recorded. Data were collected with QuarkNet DAQ boards (www.phys.washington.edu/~walta/qnet_daq/), which were connected to each scintillator panel and a computer.



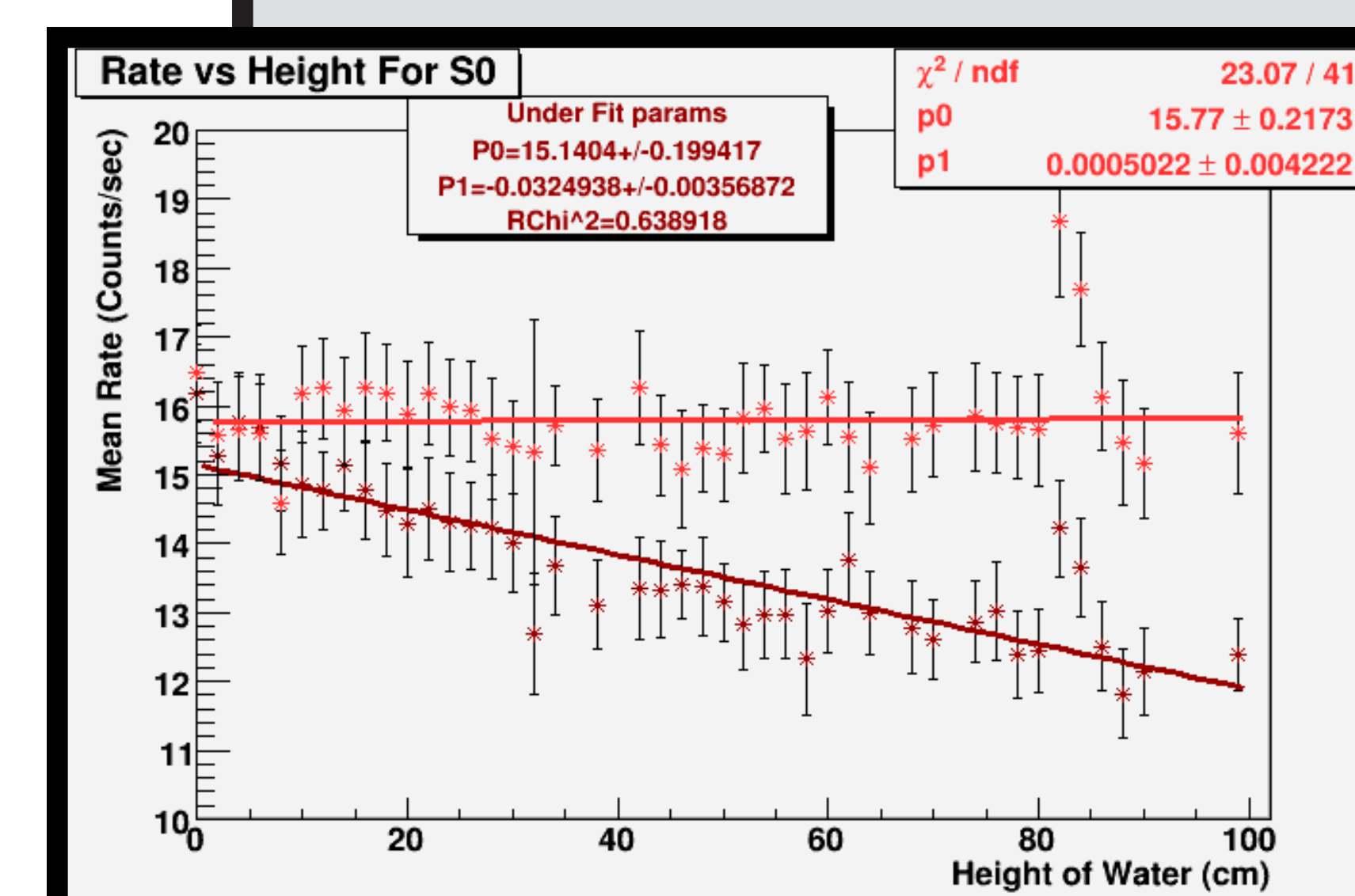
ANALYSIS



The count rate was calculated for each 30 second interval. Typical histograms for single rates and coincidence rates are shown with Gaussian fits in the diagram on the top.



The count rates for the panels outside the tank were recorded to check for intrinsic variations and are indicated by a lighter color. These show no dependence on water height as expected. Data taken underneath the tank, indicated by a darker color, show that the count rate decreases linearly with the water depth.



The middle graph shows the coincidence events which measures the dependence of muon rates on water height. The graph on the bottom depicts the single count rates which will include electrons, gamma rays, and muons. The attenuation of the single rates is much greater than for coincidence events.

RESULTS

All measurements made outside the tank showed no dependence on the water depth; the slope of count rate versus height was consistently less than a one sigma difference with steady zero values. Attenuations of 1.89 ± 0.09 Hz/meter for panels in coincidence, and 2.96 ± 0.14 Hz/meter for single panels were recorded.

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Decrease of Count Rates vs Water Height

	Under (Hz/m)	Outside (Hz/m)
S0 & S1	$1.6 \pm .3$	$.3 \pm .3$
S2 & S3	$2.5 \pm .3$	$.2 \pm .3$
S0	$3.2 \pm .4$	$.1 \pm .4$
S1	$2.1 \pm .4$	$.4 \pm .4$
S2	$3.5 \pm .4$	$2.4 \pm .4$
S3	$3.0 \pm .4$	$.1 \pm .4$