Optimization of Preliminary Data Analysis for PINGU DARIA
PANKOVA, Pennsylvania State Univ, ICECUBE-PINGU COLLABORATION —
The IceCube Neutrino Observatory (INO), a 1 km^3-sized detector at the South
Pole, collects Cherenkov light from neutrino interactions in the ice. The light is
detected by Photomultiplier tubes (PMT), which are contained inside the Digital
Optical Modules (DOM) along with an FPGA board with an ARM CPU meant
to process and analyze the incoming signal. The analysis includes the Wavedeform
routine, which uses a Non-Negative Least Squares algorithm to unfold the signal
into a series of separate pulses. The Precision IceCube Next Generation Upgrade
(PINGU) is a proposed low energy infill extension to the INO, which will require
the deployment of many additional DOMs. The new DOMs can be optimized by
running a routine like Wavedefom on the FPGA fabric or CPU. Because the output
of Wavedeform is much more compact than the original waveforms, the amount of
data transmitted from the DOM would be greatly reduced. As it is, Wavedeform
is a complicated procedure that depends on several libraries and requires a lot of
processor power to run. It needs to be optimized or substituted by a faster algorithm.
The performance of other algorithms for identification of single photoelectron pulses
(SPE) is evaluated and the received parameters of SPE pulses are compared to those
by Wavedeform.

Daria Pankova
Pennsylvania State Univ

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