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P1.005 CHIPS R&D: water attenuation measurements

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on behalf of CHIPS collaboration

CHIPS (CHerenkov detectors In mine PitS) is an R&D project aiming to develop novel cost-effective neutrino detectors, focused on measuring the CP-violating neutrino mixing phase (δ_{CP}). A single detector module would contain an enclosed volume of purified water submerged in an existing lake, located in a neutrino beam. A staged approach is proposed with first detectors deployed in a flooded mine pit in Northern Minnesota, 7 mrad off-axis from the existing NuMI beam. A small proof-of-principle model (CHIPS-M) has already been deployed and the first stage of a fully functional 10 kton module (CHIPS-10) is planned for 2018. Innovation is needed in every area to reduce the costs to the target \$300k/kt.

The proposed CHIPS water Cherenkov detector faces some unique design challenges that arise from the aim to reduce the cost by two orders of magnitude compared to previous water Cherenkov detectors. The water purification system used for the CHIPS-M detector has proved to be adequate for attaining an attenuation length of longer than 30m, the value used in the simulations. A 3m high column was used together with a 405nm laser and a PIN diode to measure the attenuation of the light for different water heights. The pit water was continuously filtered and diverted into the measurement column periodically. Furthermore, comparison with a simple simulation allowed the measurement of some scattering properties of the water to be measured separately from the bulk attenuation. The whole system was controlled, and data was taken with a Beaglebone Black.