Monte Carlo-based Reconstruction in Water Cherenkov Detectors using *Chroma* STANLEY SEIBERT, University of Pennsylvania, ANTHONY LATORRE, University of California, Berkeley, LBNE COLLABORATION — We demonstrate the feasibility of event reconstruction—including position, direction, energy and particle identification—in water Cherenkov detectors with a purely Monte Carlo-based method. Using a fast optical Monte Carlo package we have written, called *Chroma*, in combination with several variance reduction techniques, we can estimate the value of a likelihood function for an arbitrary event hypothesis. The likelihood can then be maximized over the parameter space of interest using a form of gradient descent designed for stochastic functions. Although slower than more traditional reconstruction algorithms, this completely Monte Carlo-based technique is universal and can be applied to a detector of any size or shape, which is a major advantage during the design phase of an experiment. As a specific example, we focus on reconstruction results from a simulation of the 200 kiloton water Cherenkov far detector option for LBNE.

Stanley Seibert
University of Pennsylvania

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