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## GPU Accelerated Event-by-event Reweighting for a T2K Neutrino Oscillation Analysis

*Monday, April 13, 2015 5:00 PM (15 minutes)*

The Tokai-to-Kamioka (T2K) experiment is a second generation long baseline neutrino experiment, which uses a near detector to constrain systematic uncertainties for oscillation measurements with its far detector. Event-by-event reweighting of Monte Carlo (MC) events is applied to model systematic effects and construct PDFs describing predicted event distributions. However when analysing simultaneously several data samples from both near and far detectors, the computational overhead can become a limiting factor in an oscillation analysis. Because reweighting each MC event is an independent process, it can be parallelized using graphics processing units (GPUs). For a recent T2K analysis, several bottlenecking calculations were offloaded onto NVIDIA GPUs using CUDA: the calculation of oscillation probabilities with matter effects and the evaluation of non-linear parameter responses with cubic splines. Individually, these methods achieved 40-180x speed-ups in standalone benchmarks. When implemented into the analysis software suite, an improvement of ~20x was seen to the overall analysis. This talk will discuss the motivation and implementation of GPU reweighting into the T2K oscillation analysis, and prospects for further improvements using GPUs.

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**Track Classification:** Track8: Performance increase and optimization exploiting hardware features