Contribution ID: **9** Type: **not specified**

GPUs 4 top quarks

Top quarks are important particles that, due to their large mass, provide a direct probe to the Higgs sector and possible extensions of the standard model of particle physics. At the LHC, the standard model predicts top quarks to be produced in pairs, alone, or in groups of four, of which the CMS experiment recently observed evidence. The production of three top quarks is another order of magnitude rarer than the production of four top quarks.

The reconstruction of multiple top quarks from events with many jets, leptons, and missing transverse energy is challenging at the LHC. In particular, disentangling the individual neutrino momenta from the measured momentum imbalance is crucial for reconstructing the mass of new, exotic particles decaying to top quarks. The method of choice to solve such problems is kinematic fitting yet the currently available tools, developed primarily for top quark pair production, are computationally inadequate for handling the increased complexity of final states with 3 or 4 top quarks.

The project consists of a novel implementation of kinematic fitting for reconstructing events with multiple top quarks by harnessing the parallelization capabilities of modern GPUs. Technically, the task will be solved by repurposing existing frameworks and minimization algorithms developed initially for training neural networks. Hence no detailed knowledge of GPU computing is required. If successful, the resulting kinematic fitting framework will open entirely new analysis channels to search for beyond the standard model physics.

Field

B1: Particle physics analysis (software-oriented)

DESY Place

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Special Qualifications:

Python

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