Abstract Submitted
for the NWS16 Meeting of
The American Physical Society

**Building a strong event discriminant using the Matrix Element Method for the $t\bar{t}H$ search with the ATLAS detector** ALEXANDER HELD, University of British Columbia, ATLAS COLLABORATION — The first run of the Large Hadron Collider at CERN has brought experimental confirmation of Higgs boson production via two out of the four main predicted mechanisms. Of major importance and so far unobserved is the $t\bar{t}H$ process, where a Higgs boson is produced in association with a pair of top quarks; it allows for a direct measurement of the top quark Yukawa coupling. This talk discusses the case where the Higgs boson decays to $b\bar{b}$ and a single lepton is present in the decay products of the top quarks. The Matrix Element Method provides a strong discriminant between $t\bar{t}H$ events and the overwhelming $t\bar{t}+b\bar{b}$ background. Its probabilistic approach relies on calculating likelihoods of observed events being consistent with $t\bar{t}H$ and $t\bar{t}+b\bar{b}$ hypotheses. Focus of the talk is a new implementation of this method, which supports calculation of the matrix elements on both GPUs and the traditionally used CPUs. Significant performance improvements are achieved, which help deal with the extreme computational demand. The current discrimination power is presented, and possible approximations in the matrix element calculations and their effects in the context of the Run II search for $t\bar{t}H$ with the ATLAS detector are discussed.

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Date submitted: 15 Apr 2016 Electronic form version 1.4