

# b-jet trigger optimization for new particle searches

The LHC will produce collisions at a rate of 40MHz. The purpose of the trigger system is to reduce the output event storage rate to about 300MB/s or approximately 200Hz. Since most of the collisions at the LHC center of mass energy will result in non-interesting physics events, such as QCD multi-jet production, the main task of the trigger system is to reject QCD events while maintaining high efficiency for low cross section processes like Supersymmetry, Higgs, etc.

The selection of b-jets at the trigger level can expand the physics discovery reach of ATLAS in topologies containing multiple b-jets in the final state. This is achieved by increasing the acceptance for signal events using lower jet ET thresholds while reducing non-b backgrounds. An efficient b-tagging trigger might be the crucial ingredient for discovering new physics in hadronic final states with b-jets.

The ATLAS trigger consists of three levels: Level 1, is hardware based. The high level trigger (HLT) consists of the Level 2 and the Event Filter. The HLT is based on software algorithms that analyze regions of interest (RoI) previously identified by the level 1 trigger.

The SLAC group has implemented and is responsible for one of the two ATLAS b-tagging algorithms at Level 2: the Impact Parameter Chi2 Probability tagger. The main advantage of this technique is that it relies on the distribution of transverse impact parameter of tracks in multi-jet events, which can be measured directly from data and does not require the use of Monte Carlo templates.

There are several research opportunities in this area, including:

- Study the b-tag trigger performance in high luminosity events, with multiple interactions.
- Implementation of a secondary vertex based b-tagging algorithm.
- Development and optimization of b-jet and missing ET trigger signatures for new particle searches.
- on-line and off-line validation: study of the inputs to the algorithm, and its performance.