PERFORMANCE OF THE ATLAS JET TRIGGER AND FUTURE DEVELOPMENTS

The ATLAS experiment at the LHC uses a two-level trigger system to record interesting events maintaining good signal efficiency at lower energies where pileup dominates. A new challenge is to control the increased trigger rate due to the expected higher pileup for LHC Run 2. This poster presents the jet trigger efficiency as a function of the offline jet transverse momentum for proton-proton collision data at the centre-of-mass energy of 13 TeV. In addition, the efficiencies of global sequential calibrated (GSC) jet trigger, trimmed jet and trimmed dijet triggers are shown.

**The ATLAS trigger system**
- Records the most interesting events in real time
- Reduces the event rate from up to 40 MHz to 1 kHz
- Consists of two levels
  - Level 1
  - High level trigger

**Jet trigger system**
- Level 1
  - Uses sliding window algorithm to define jets
- Events are triggered based on jet energy

**High level trigger (HLT)**
- Evaluates events using information from topological clusters
- Maximizes noise suppression
- Anti-k_t algorithm is used to reconstruct jets
- Radius parameters 0.4 and 1.0

**Trigger jet calibration**
- Jet energies are first measured at the electromagnetic (EM) or locally calibrated (LCW) scales
- In order to correct the jet kinematics, a jet energy scale (JES) calibration is then applied
- Dynamic suppression of pileup is used to correct the impact of pileup on jet energy and jet shapes

**Future developments**
- Global sequential calibration was implemented at HLT and added for commissioning during summer 2016
- GSC corrects jets based on their longitudinal shower shape and associated track characteristics without changing the overall energy scale
- Most unprescaled jet chains in 2017 will use GSC

**Grooming at HLT**
- The trimming algorithm is implemented at HLT level, which grooms jets by discarding soft jet components
- This significantly improves the pileup stability and enhances the discrimination of jets with hard substructure from standard QCD jets
- It is also possible to apply a jet mass cut at HLT level which results in a significant reduction of the trigger rate while improving the signal efficiency
- Thresholds used in the figure are chosen to achieve equal rate
- Red circles represent the standard large-R jet triggers used in 2015 and 2016
- **Trimming**: sharper turn on region
- **Mass cut**: plateau region extended to lower \( p_T \) for equivalent rate

**Conclusion**
- Despite increased levels of pileup in 2016, single-jet triggers at L1 and the HLT become fully efficient at the same point as in 2015
- Applying the GSC at the HLT increases the sharpness of turn-on region for triggers
- Applying trimming and mass cuts at the HLT significantly improves the trigger performance by making the turn on region sharper and \( p_T \) thresholds lower for equivalent rate

Nima Sherafati (Carleton University) on behalf of the ATLAS Collaboration