The ATLAS jet trigger

This poster presents the improvements made to the ATLAS jet trigger in 2011 & a summary of its performance.
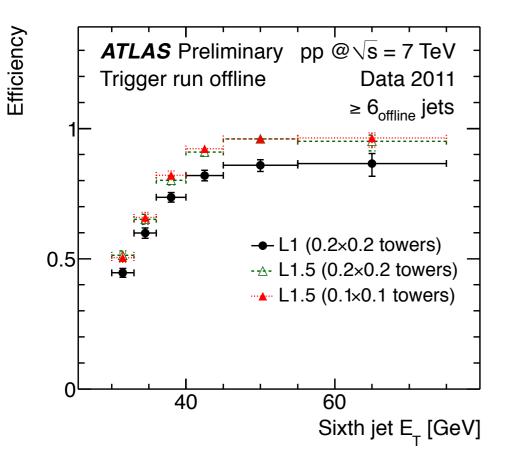

Level-1 (L1)

Full-scan sliding window jets from **L1-calorimeter towers**

In: 40 MHz (1.5 MB/25 ns)
Out: 75 kHz (120 GB/s)

< 2.5 µs

L1 jets

L1 Calorimeter Readout System towers

Calorimeter Readout System cells

Level-2 (L2)

Full-scan anti-k_T jets from **L1-calorimeter towers**

L2FS jets

~ 40 ms

Cone & anti-k_T jets from calorimeter cells *seeded* by L1 or L2FS jets   L2 jets

~3.5 kHz (5 GB/s)

Event Filter (EF)

Topological clusters & towers from calorimeter cells   clusters

Full-scan anti-k_T jets from **clusters or towers**

~ 4 s

~200 Hz (300 MB/s)

EF jets

- The primary means of selecting events with high transverse energy (E_T) jets.

- Fundamental to achieving the physics goals of ATLAS (QCD, top, new particles).

- A three level system. The first, L1, is hardware based, and the following two (HLT) are software based.

- Designed in an Region of Interest based approach

  - HLT only has access to the regions of the calorimeter nearby a L1 jet.

- Recent improvements have allow full calorimeter unpacking at EF, and a full-scan (FS) at L2.

- Now possible to run a variety of jet algorithms, both at L2 and at EF using FastJet.
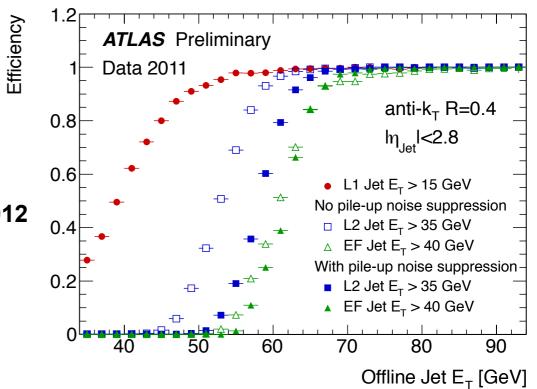
The ATLAS jet trigger

ATLAS Preliminary   pp @ $\sqrt{s}$ = 7 TeV
Trigger run offline   Data 2011
$\geq 6_{\text{offline}}$ jets

- L1 (0.2×0.2 towers)
- L1.5 (0.2×0.2 towers)
- L1.5 (0.1×0.1 towers)

Sixth jet E_T [GeV]

- **L2 full-scan** (L2FS or L1.5) is a new L2 algorithm which uses L1 calorimeter towers to reconstruct jets across the **entire detector**.

- Studying the L1 data with the L2 software provides key enhancements to the jet trigger functionality, including:

  - The ability to study the entire detector at L2 & run the same jet algorithms as used in offline analysis such as anti-k_T.

  - Enhanced L2 input rate.

  - Increased flexibility of the trigger system.

  - Ability to apply jet specific calibrations to L1 calorimeter based jets.

- The jet trigger functioned exceptionally well in **2011**

  - Noise suppression, EF only inclusive triggers, HI triggers.

  - ~5 fb^{-1} of p-p and ~160 µb^{-1} of Pb-Pb data.

- A very complete and versatile set of triggers is now available for **2012** physics analysis, including:

  - Anti-k_T at L2 & EF, jet cleaning.

  - Multi-jet, H_T and boosted object triggers.

ATLAS Preliminary
Data 2011

anti-k_T R=0.4
$|\eta_{\text{Jet}}|$<2.8

- L1 Jet E_T > 15 GeV
No pile-up noise suppression
- L2 Jet E_T > 35 GeV
- EF Jet E_T > 40 GeV
With pile-up noise suppression
- L2 Jet E_T > 35 GeV
- EF Jet E_T > 40 GeV

Offline Jet E_T [GeV]