Jet Slice – use of TopoClusters

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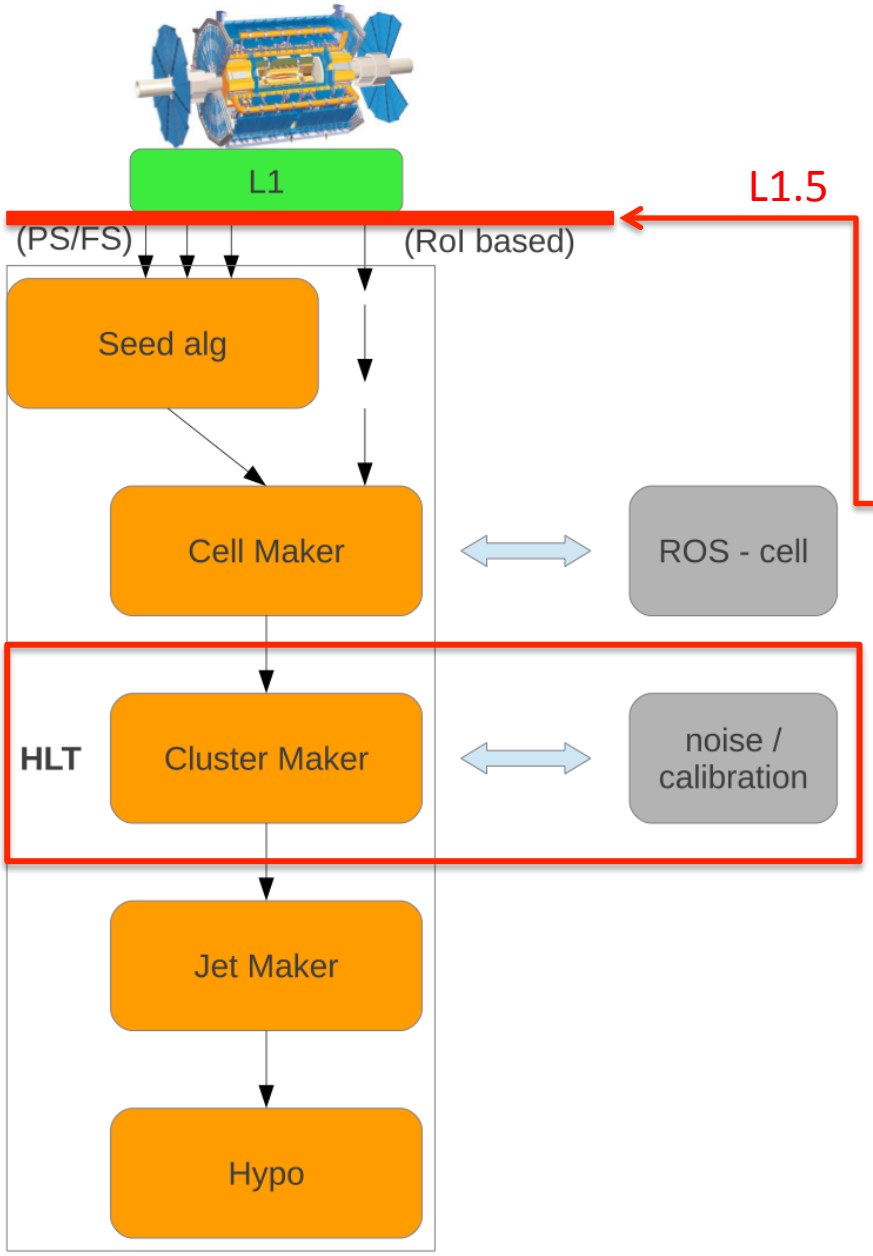
For the Jet Trigger Group
Trigger General Meeting – 20 August 2014

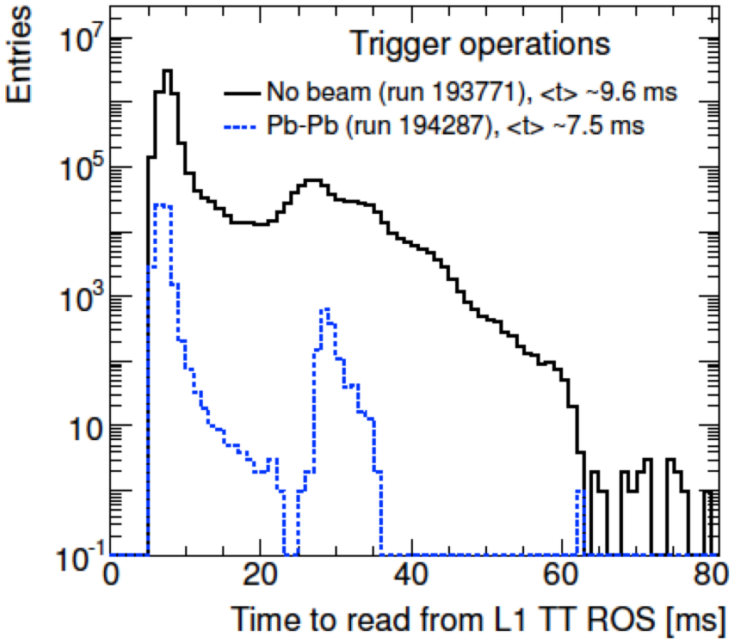
Use of TopoClusters

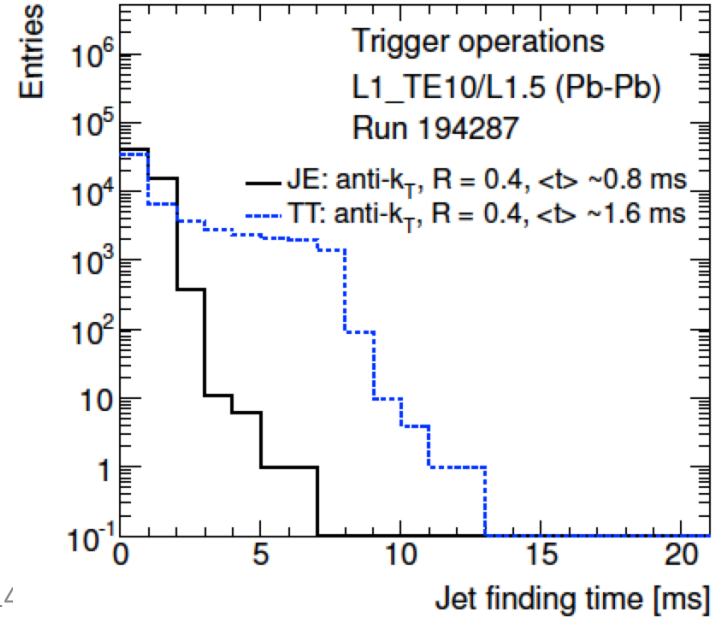


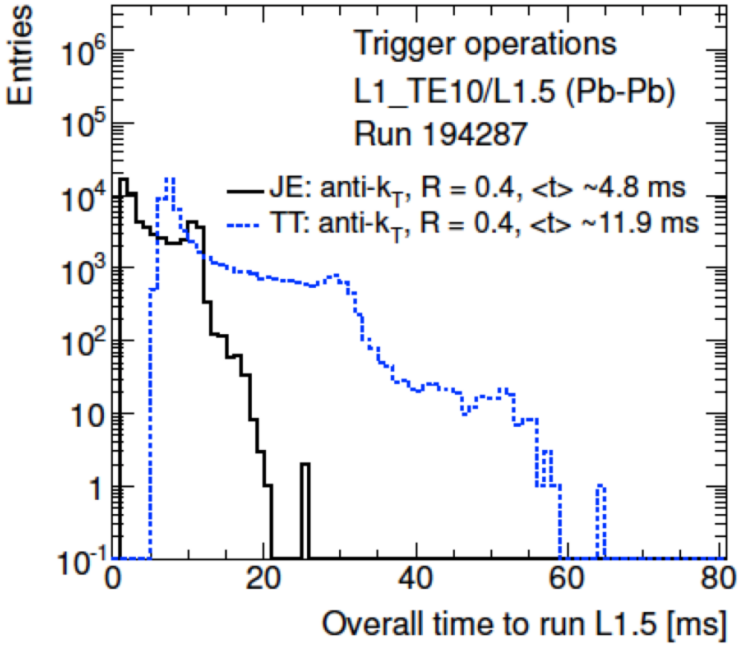
- TopoClusters:
  - **Essential** to have performance close to offline
  - Good resolution wrt offline paramount to control rates
- Additionally:
  - TriggerTower full scan (L1.5)
  - Runs Anti-kT jet reco on 0.1x0.1 TriggerTowers
  - **Avoids bias from close-by jets**
  - Current plan is to run L1.5 to seed HLT reconstruction
- Could not test with L1.5 yet
  - But see Run I cost and performance in next slide

L1.5 cost

- From **Run I tests** (see ATL-COM-DAQ-2012-015):
  - L1Calo ROSes (3 for TT, 1 for JE) read out at up to 7kHz
  - Expect up to 15kHz with upgraded ROSes
- Total time around 12ms
  - Readout time around 9ms
  - Jet finding (anti-kT 0.4) around 1-2ms

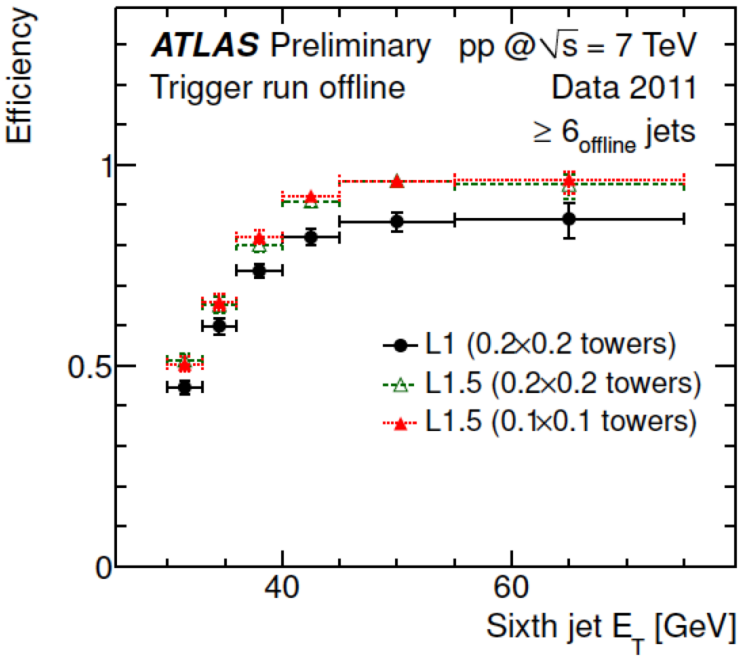


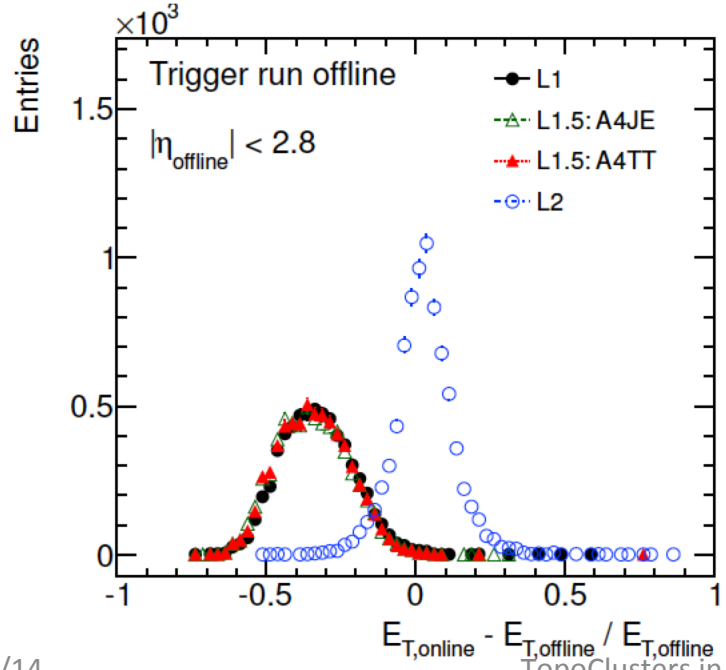


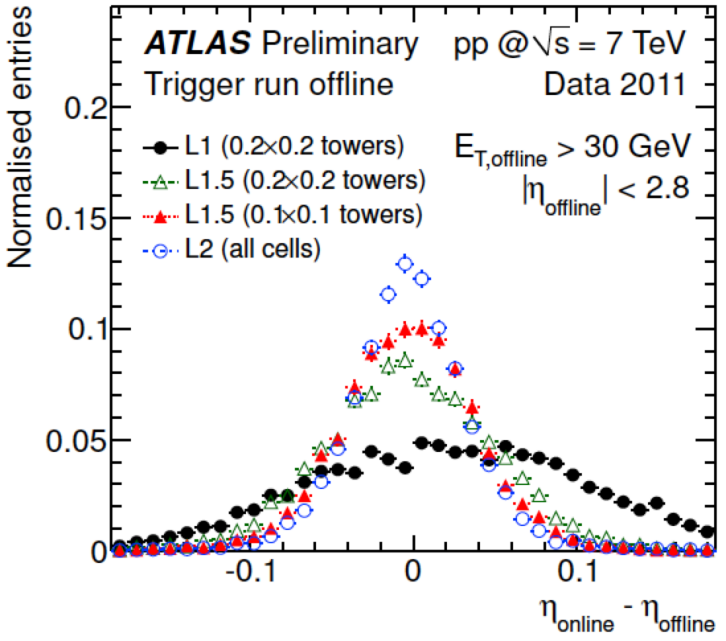


L1.5 performance

- The TriggerTower full scan recovers L1 inefficiency for close-by jets
  - See ATL-COM-DAQ-2012-009
- Reasonable spacial resolution
- Energy resolution same as L1
  - See ATL-COM-DAQ-2012-009







TopoCluster making and Partial vs Full Scan

- L1.5 code not working at present: partial results only
  - Partial scan seeded directly by L1 for now

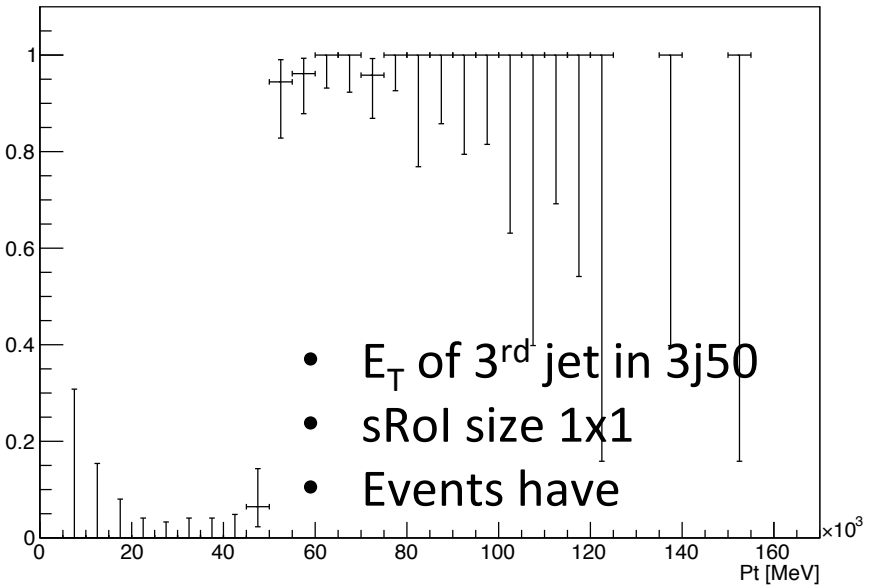
- Latest numbers comparing partial scan vs full-scan of calorimeter cells, both using TopoClusters
  - Full-scan should have **performance close to offline**
  - Again, this is essential – cannot show direct comparisons now, but studies are ongoing

- Details:
  - MC sample: mc12 14TeV JZ2W: akT0.6 (truth); E_T=80-200 GeV; <μ>= 80
  - L1_J20 seed shown here L1_J50 also studied
  - Opening sRoI's of 1x1 or 1.5x1.5 around L1 RoIs, 0.8x0.8 also studied

TopoCluster performance

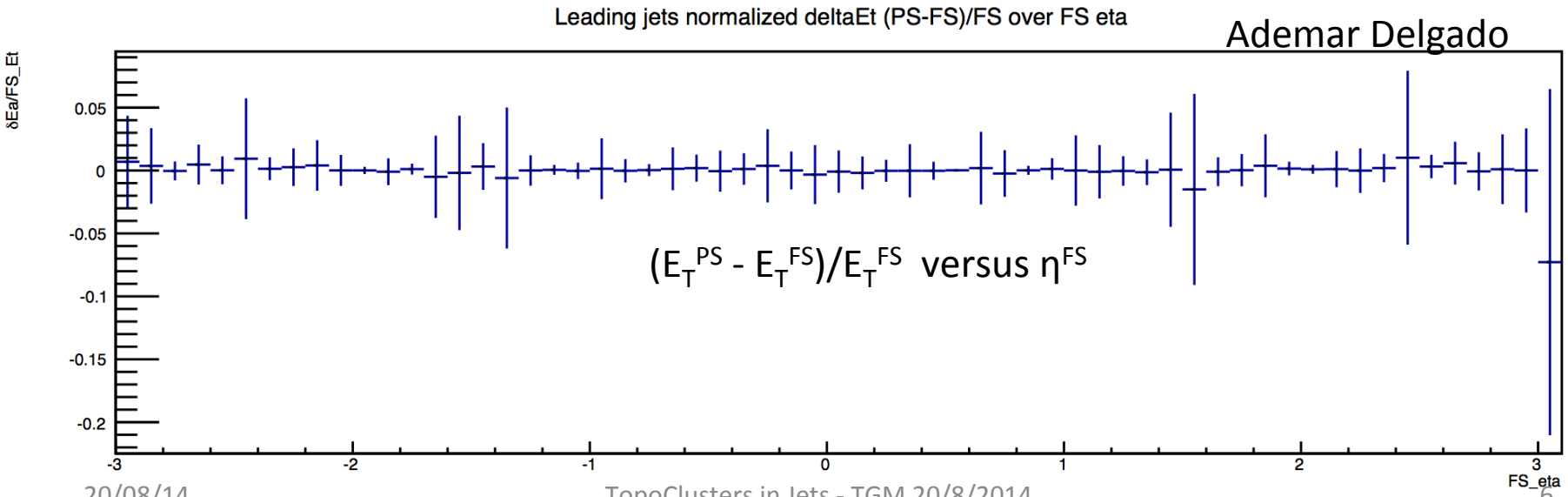
- Comparing PS to FS
- Assumes FS performance is closer to offline

David Freeborn

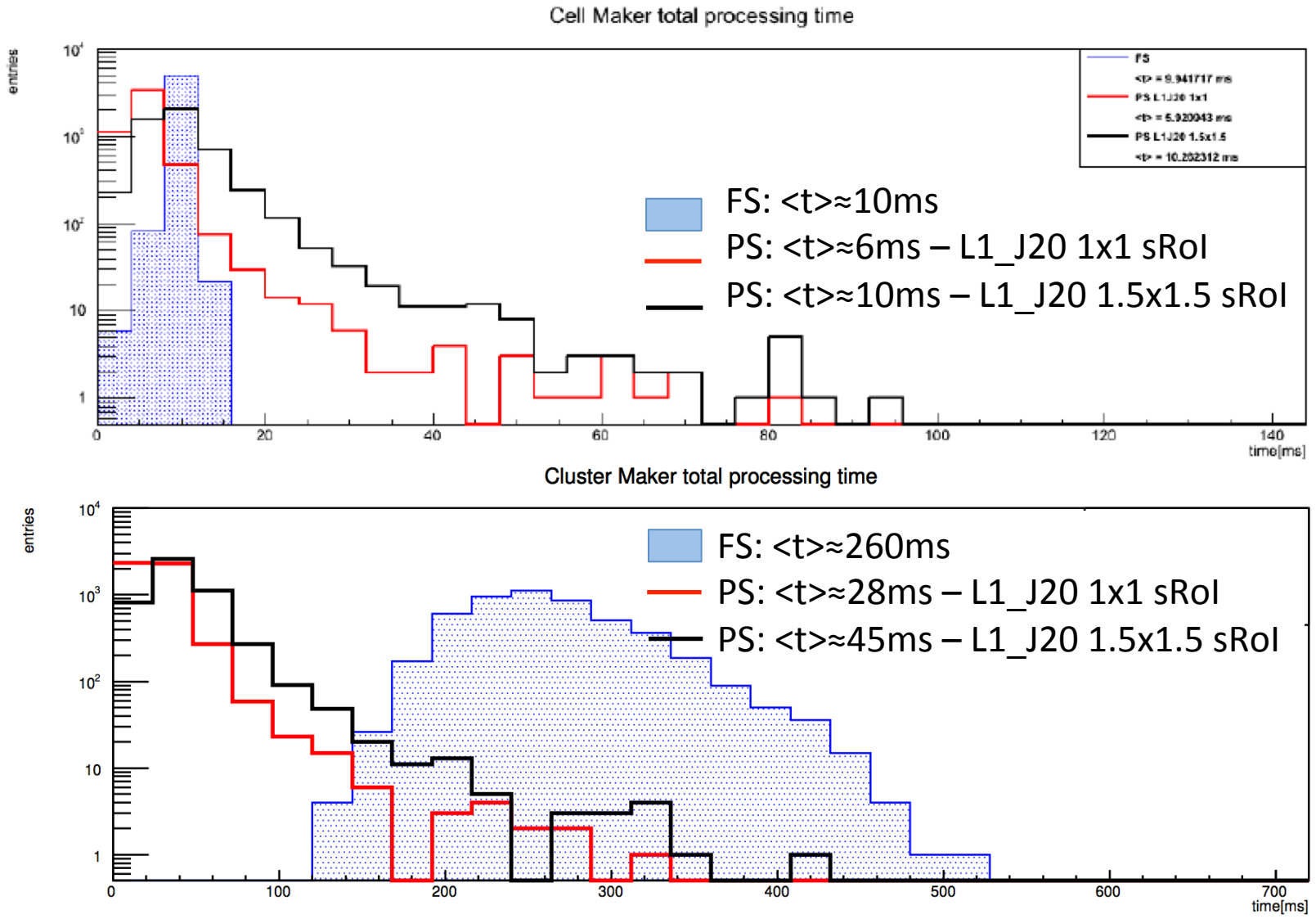


- E_T of 3rd jet in 3j50
- sRoI size 1x1
- Events have

Ademar Delgado



TopoCluster making cost



Conclusions… so far

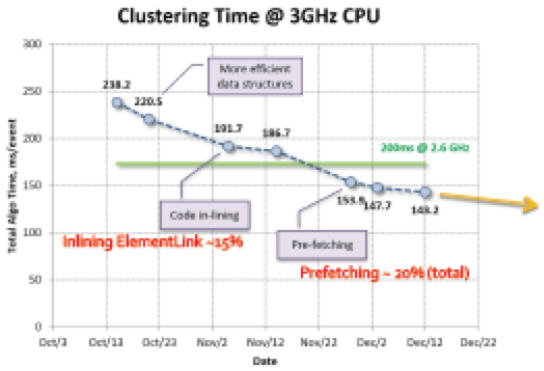
- **TopoClusters essential for the jet trigger**
  - The cost is high, but we believe the gains will be measured in physics
  - PS, L1.5, and the menu provide tunable parameters to minimize impact of processing time

- **To-do (many things…):**
  - Direct comparison with offline jets
  - Study performance of different calibration methods – both time and energy/position important
  - Using L1.5 to seed TopoCluster and jet finding
  - Optimisation of PS parameters: sRoI size, L1 seed – although reasonable values are now clear
  - Establishing menu after/in parallel with reconstruction options
  - Development: fixing some geometrical effects coming from RegionSelector, etc

Backup

Additional costs: Jet Calibration

Topo-clustering costs and benefits

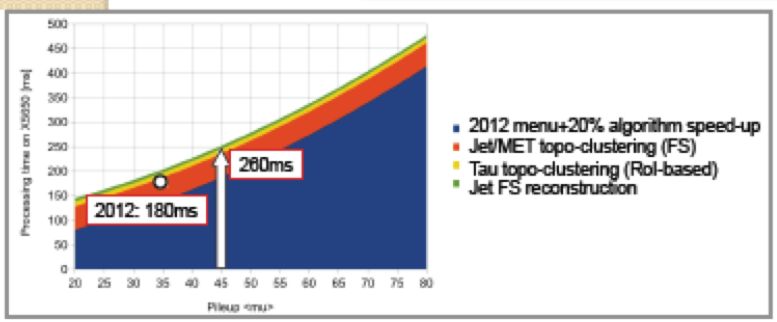


	ROI base	FS mode
Data preparation	1.5 -> 1.7 [ms]	77 -> 12 [ms]
TopoClustering	12.5 -> 7.7 [ms]	311 -> 170 [ms]
TowerMaker	17 -> 0.9 [ms]	----------

❖ Close to the limitation achieved by c++ optimization

COMMON ASPECTS

- Full-Scan topoclustering is our preferred option! For which objects does it matter? Fat jets, multi-jets, MET, taus, … What would be the effect of not having full-scan topoclustering at L1 rate is still to be quantified.



- Impact on required processing power
  - Processing time: 180ms (2012, μ=35) → 260ms(μ=45)
    44% up in conservative estimate

Signatures who want to use FS topo intensively (Jet/MET/tau) should provide some numbers concerning the benefit of topo-clustering in terms of rates/ thresholds within ~1 month
→ Propose 16 April TGM to report

Jet energy scale

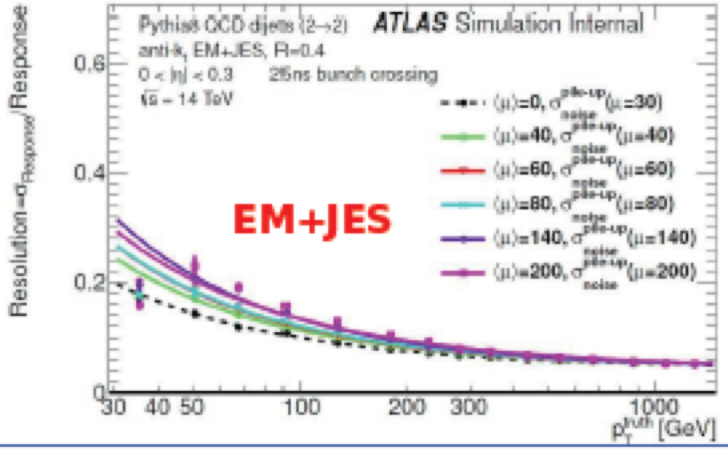
		rel_o
1. Clustering	Clustering	39 ms
	Splitting	42 ms
	Moment computation	34 ms
2. Calibration	Apply calibration	44 ms
TOTAL		159 ms

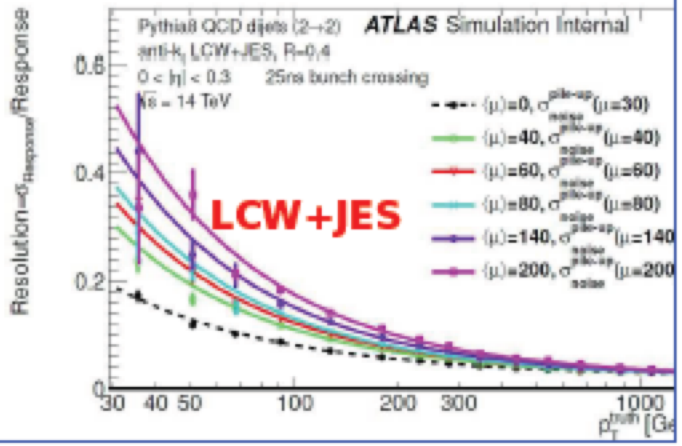
Calibrate trigger jets as EM+JES or LC+JES?

- both used in Run 1 analyses
  - perfectly fine to use EM+JES jets with LC-based E_T^{miss}
- both calibrations will be available in 2015

Choose one calibration or double number of jet chains?

- EM+JES currently yields better resolution at high μ for low p_T jets
- local calibration (and topoclusters) under investigation
  ⇒ *expect improvements for 2015 including increased forward jet rate*
- dropping LC reduces topocluster time by 50% but affects Tau and E_T^{miss} trigger performance ⇒ *needs further study*
- not much extra unique rate if we keep both; but maybe too many chains?





- Also, does L1calo calibration need to change from EM for jets?