

Jet and MET measurements in 2009/2010 data

Argonne Jamboree January 2010

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Outline

- **Physics motivation goals**
- **Jet triggers:**
 - Commissioning
 - Initial beam
- **Jet and MET calibration:**
 - Performance studies
 - Jet Energy Scale (JES) determination
 - Data format for performance studies
- **Steps for jet physics measurements**
- **Current status: ETMISS**
- **Current status: JETS**
- **Summary**




Physics motivation goals (from Walkthrough)

- <http://indico.cern.ch/conferenceDisplay.py?confId=71239>
- **with earliest data ($\sqrt{s} = 900 \text{ GeV}$, $\mathcal{O}(1) \text{ nb}^{-1}$)**
 - show that ATLAS observes jet production
 - > 20000 jets with $ET > 15 \text{ GeV}$ ($|\eta| < 2.5$) per nb^{-1}
 - > 40 jets with $ET > 50 \text{ GeV}$ ($|\eta| < 2.5$) per nb^{-1}
- **with initial data ($\sqrt{s} = 7 \text{ TeV}$, $1\text{-}10 \text{ pb}^{-1}$)**
 - observe jet production in new kinematic regime
 - first credible understanding of jet energy scale
 - initial measurements on EM scale?
- **with full 2010 data set ($\sqrt{s} \geq 7 \text{ TeV}$, $10\text{-}100 \text{ pb}^{-1}$)**
 - good understanding of jet energy scale
 - more (and refined) measurements on jet production and jet properties in new kinematic regime



Jet triggers in early data

- **Early analysis will rely primarily on level 1 triggers**
 - HLT selections will be activated, after commissioning, as required by rate
 - These analyses are mainly concerned with inclusive jet triggers (di-jet triggers being evaluated)

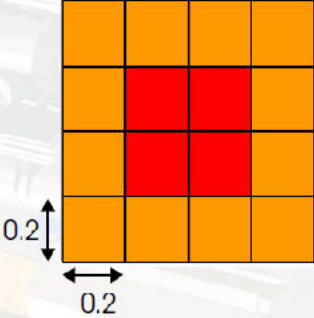
 **Level-1 Jet Triggers**

Central Jets ($|\eta| < 3.2$):

- Sliding window algorithm
- $\Delta\eta \times \Delta\phi \approx 0.8 \times 0.8$
 - Smaller clusters available for specialist applications
- Central cluster = E_T maximum
 - Prevents double counting
- 8 ET thresholds
 - Global multiplicities (0-7) passing each threshold
 - Rol information to guide HLT

Forward Jets ($|\eta| > 3.2$):

- Similar concept, but single, large η bin
- 4 ET thresholds, counted separately at $\pm\eta$.



Alan Watson Jet Analysis Walkthrough, 02/11/09 3

Jet trigger commissioning steps

- **Cosmics/Early Beam**
 - Understand noise, locating & handling dead/hot channels
 - First timing-in of towers, outputs, readout
 - Approximate tower ET against cell readout
 - Start exercising HLT algorithms
- **900 GeV/Initial 7 TeV**
 - Establish & correct L1 timing for collision data
 - Check tower calibration against cell readout
 - Begin study of jet turn-on, efficiency
- **Up to ~10 pb-1 7 TeV**
 - Precise measurement of inclusive jet trigger efficiencies
 - Commissioning of HLT algorithms (introduce when needed)
 - Studies of jet calibration (L1 and HLT). Assess refinements to L1 calibration

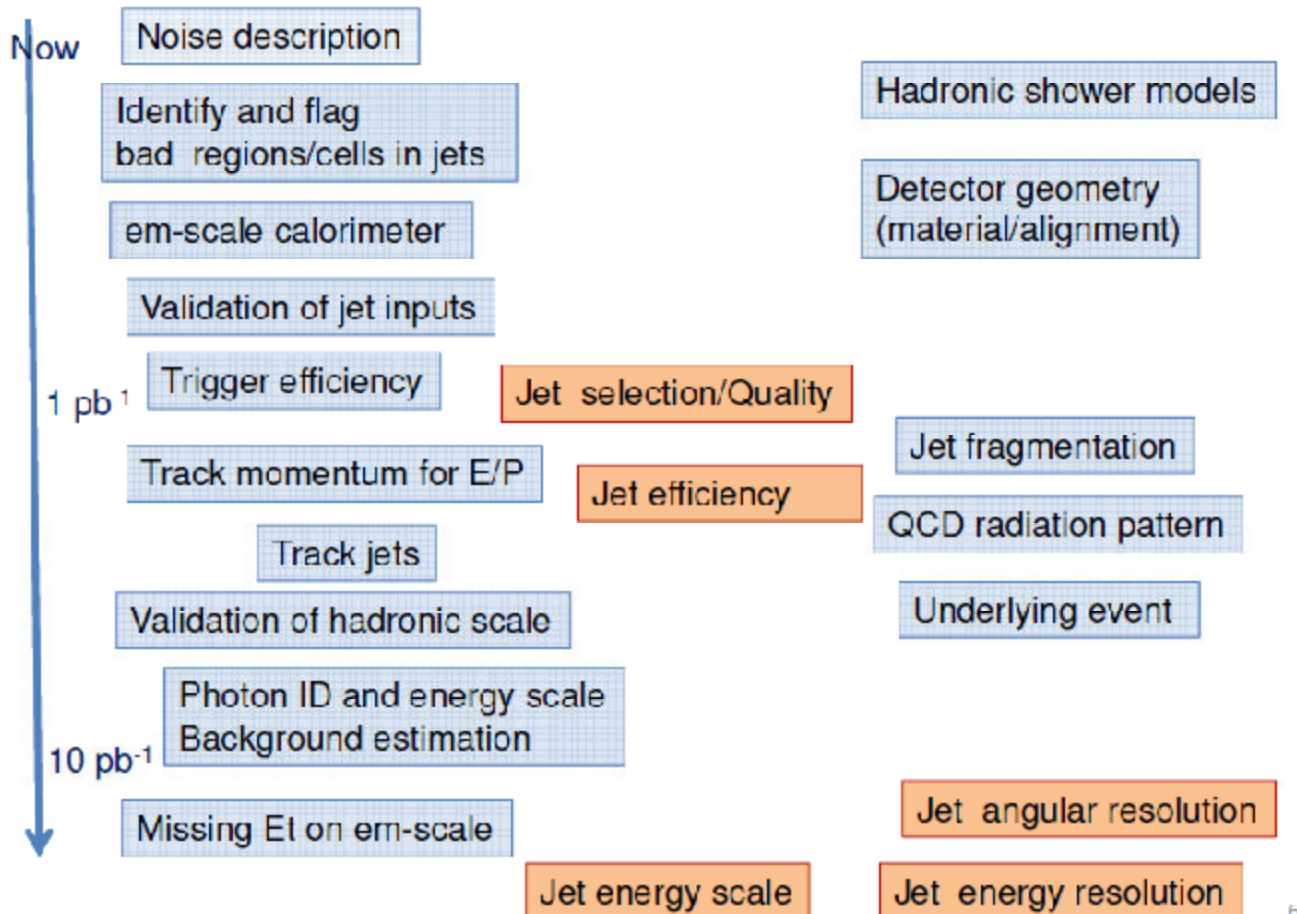


Initial beam trigger remarks

- **Minimum Bias**
 - L1_MBTS_2 as main trigger for 900 GeV collisions.
 - Use orthogonal minimum bias triggers to check efficiency (RD0, LUCID)
 - Efficiency for non-diffractive QCD = 100% / pre-scale
- **Jet**
 - L1_J5, L1_J10, L1_J10_win6, L1_J15, L1_J30, L1_J55, L1_J75
 - Commissioning oriented: low thresholds, some only for validation.
 - Pre-scales adjusted in response to rates.
 - No HLT selections
 - HLT items run for commissioning but in pass-through mode
- **General remarks**
 - Physics triggers will be ANDed with BPTX (replaced by BG once commissioned)
 - Not just a 900 GeV menu.



Jet ETmiss performance studies



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Roadmap to the determination of jet energy scale

1. Start with JES from MC

- Establish jet quality: bad calorimeter regions, background rejection, good runs...
- Compare Data to MC: single particle, calorimeter energy flow, jets...
- Produce preliminary distributions at EM-scale (Data/MC)
- If MC is reasonable, derive JES uncertainty from data/MC comparisons:
 - single particles
 - jet distributions and internal jet structure

2. Establish JES using in-situ techniques (from EM or hadronic scale)

- Aim is to provide solid uncertainty for physics analysis
- Main tool is data/MC comparisons gamma-jet and di-jets
- Work on MC improvements e.g. :
 - detector geometry: DM, cracks, time dependent detector defects, z-vtx etc.
 - QCD: radiation, underlying event

3. Establish JES using MC

- use in-situ techniques to get JES uncertainty if agreement of MC with data is achieved and uncertainty can be reduced

1 pb⁻¹

10 pb⁻¹

Data formats for performance studies in early data

- Performance Studies
 - dESD (performance DPD) is the primary format
 - Common D3PD across Performance DPDs under discussion

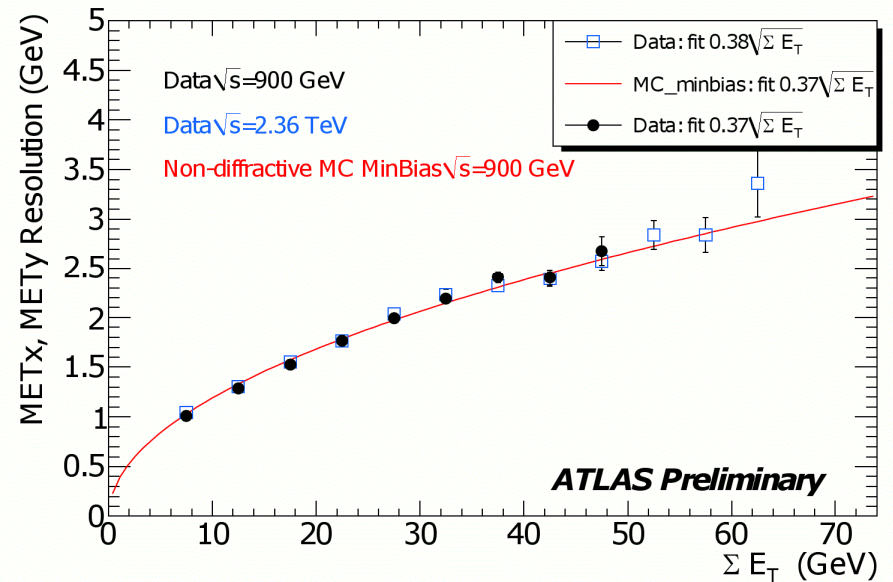
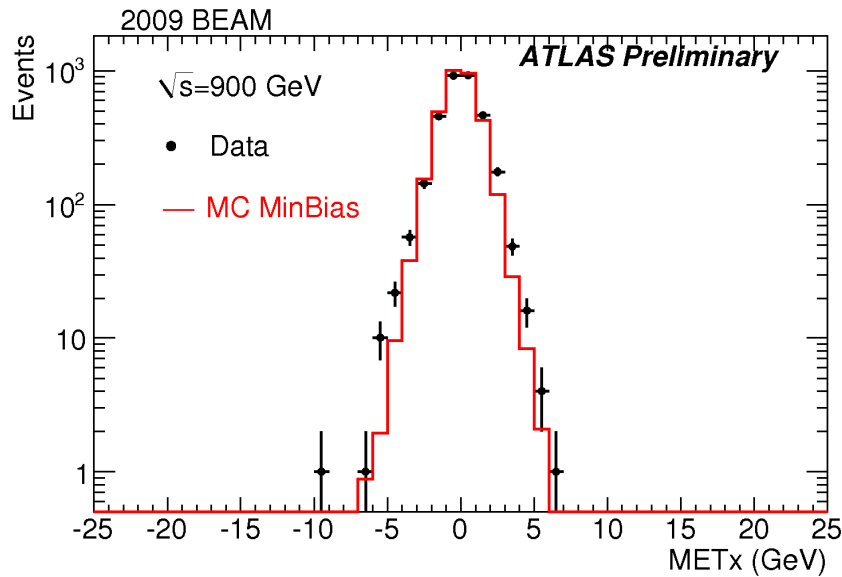
dESD_CALJET	Jet calibration/performance	Full ESD (PrepRawData removed)
dESD_PHOJET	Jet calibration with γ +jet	Full ESD
dESD_MBIAS	Jet reconstruction, noise, calorimeter E/p study	Full ESD

Steps for a jet physics measurement

- **Trigger efficiency**
- **Data Quality and Luminosity**
- **Cosmic events veto**
- **Detector effects**
- **Unfolding**
 - Jet resolution measurement
- **Uncertainties**
 - Jet energy scale
 - Jet resolution
 - Luminosity

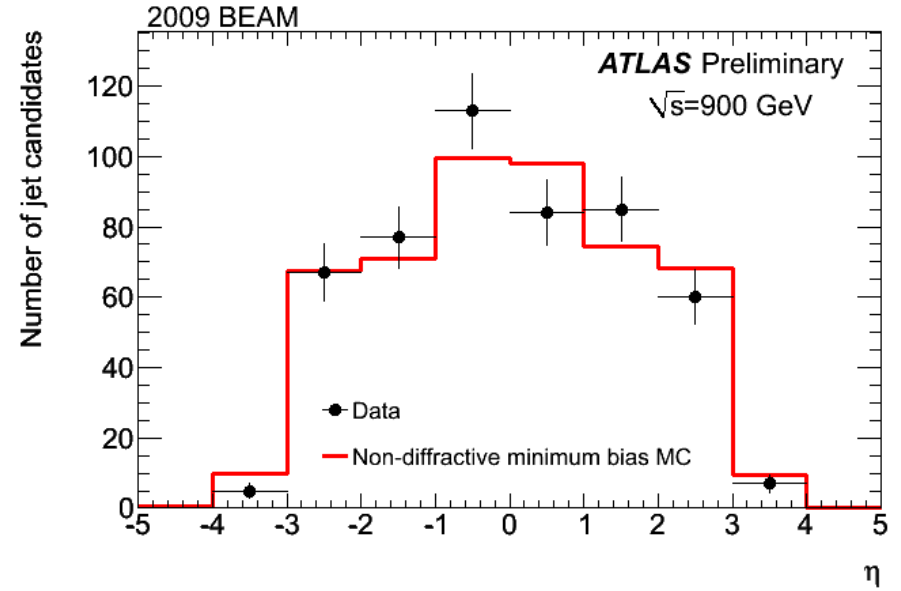
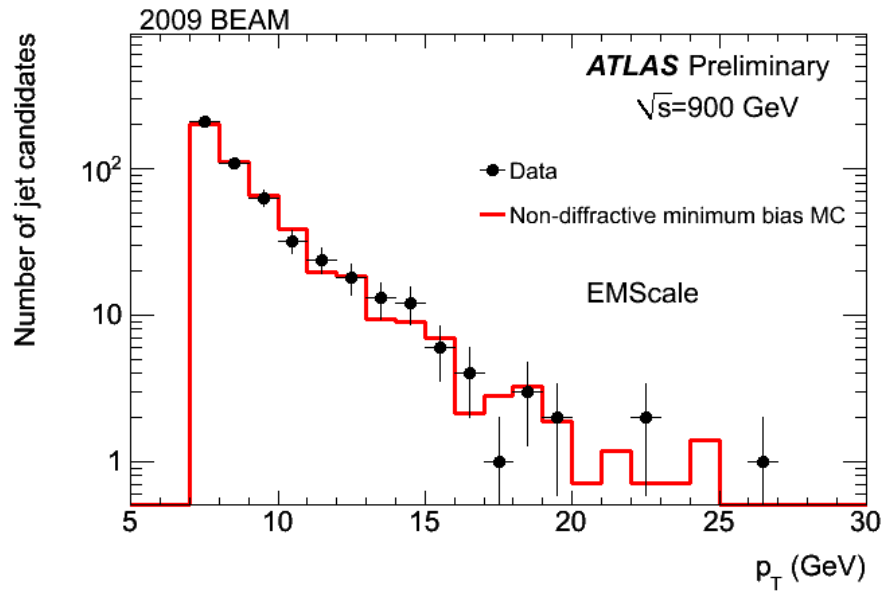


Current status: ETMISS



- Only cells in topological clusters are used (noise suppression)
- No calibration is applied

Current status: JETS



- Jet collection used \rightarrow AntiKt 0.4 Topo-Jets at EM-scale

Summary



“This is not the end. It is not even the beginning of the end. But it is, perhaps, the end of the beginning.”