

The "Comparator"

Atfast vs. Full Reco Automated Comparison



UNIVERSITY
of
GLASGOW

Chris Collins-Tooth

19th February 2006



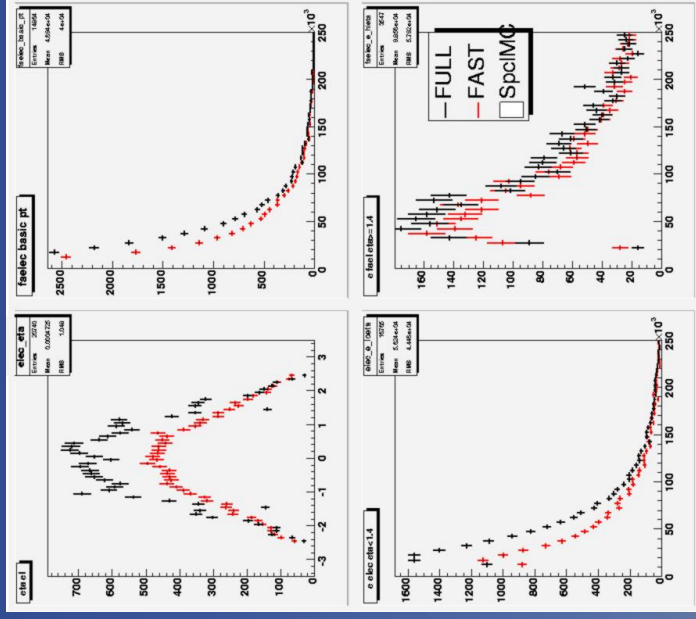
Comparator “Flow”

The Comparator- A utility to allow ATLFAS^T to be **compared and tuned** to the full simulation **using the same generated events**.

- User sets up area for running a release as normal.
- User downloads, compiles Comparator.
- Comparator uses AOD as input.
 - **Comparator makes “cleaning cuts” on full and fast collections.**
 - **Runs Atlfast many times with different smearing values.**
- Atlfast needs TRUTH information as input.
 - **Until 11.2.0, this was missing (SpclMC was not complete).**
 - **User had to make their own AOD from ESD with “TruthEvent” .**
- Comparator performs Chi-squared test on full and fast smeared distributions.
- Uses MINUIT to find optimal tuned smearing parameters.

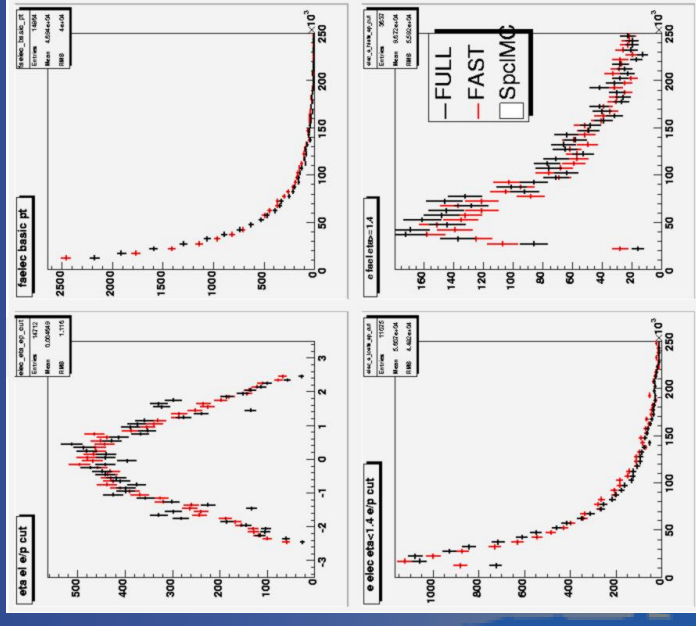
Comparator Electron Cuts

- Before any tuning of Atlfast, we make simple comparisons.
- Some “cleaning cuts” needed to be applied to get Atlfast and Full Reconstruction to agree at all...
- These cuts are applied as standard, though they can be modified via jobOptions if needed.



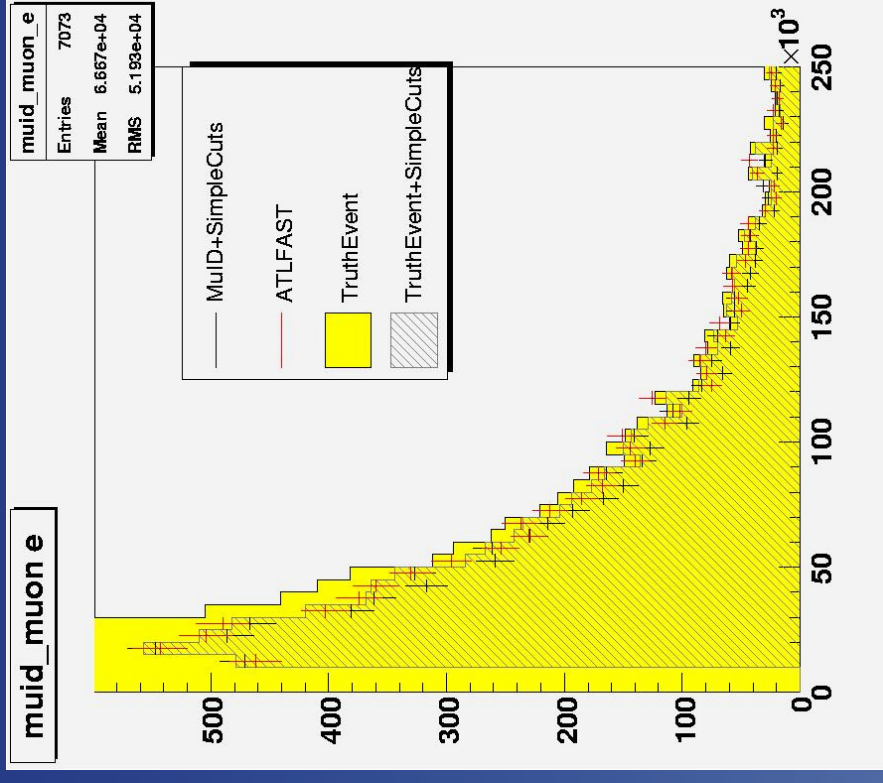
- Pt > 10 GeV,
- $|\eta| < 2.5$,
- hasTrack(),
- isEM() % 16 == 0,
- E/p in range 0.9..1.7 ($|\eta| < 1.4$)
- E/p in range 0.5..2.9 ($|\eta| > 1.4$)

↑
electron cleaning cuts



Comparator Muon Cuts

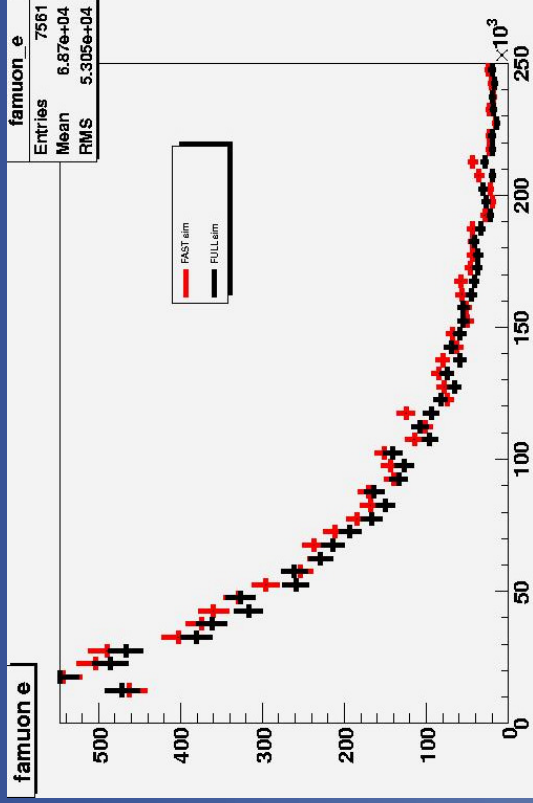
- Yellow plot shows Truth with no cuts.
- Hatched histogram shows Truth with
 - **Pt >10 GeV,**
 - **$|\eta| < 2.5.$**
- These cuts are also applied to Atfast (red) and MuID (black).
- Good agreement – now it makes more sense to tune these distributions.



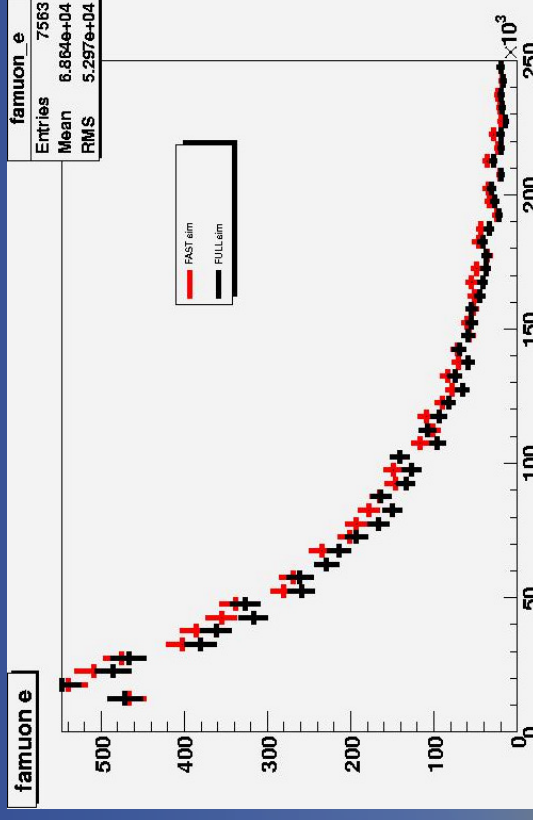
Once “cleaning cuts” applied, **engage tuning** of Atfast to drive it towards Full Reco distribution.

Tuning Atfast

- Atfast parameterisations for smearing electrons, muons and photons are not fixed any more.
- ‘Standard’ parameters are held in Atfast jobOptions.
- One can tune these parameters, or (advanced!) make up new smearing formulae...
- Example tuning below shows muon energies for same events using untuned and tuned Atfast parameters



Atfast
↑
Tuning



AMI database output

- The tuning results are stored in an AMI database.



↑

The **smearing formula** (schema) used
The **Atlfast module** (e.g. ElectronMaker) being tuned
The **input AOD** used in the tuning
The full **Athena jobOptions** used as input for the run
The **contact details** of the person performing the run
The **histogram names** used for the full/fast comparison
The **optimised output** values of the smearing **parameters**
The name and location of the **output root files**

- Users can retrieve results (i.e. tuned parameter sets),
- paste them into the Atlfast jobOptions,
- then run Athena/Atlfast as normal (i.e. no Comparator needed!).

Where might this be useful...

- Consider the Comparator if you are in need of an extremely large sample of events (e.g a background).
- You could use the Comparator on a small sample of full/fast events to gain confidence in Atlfast.
- Atlfast can be tuned if results not satisfactory.
- Atlfast can then be run on Generator files (not AOD!).
- Very rapidly produce a large sample....

Intended comparator 'core' output

- Tracks
 - multiplicities, matching efficiency etc.
- Particle distributions (e, μ , γ etc.)
 - P_t , E, η , ϕ
- Jet distributions
 - P_t , E, η , flatness in ϕ
- b-tagging quantities
 - impact parameter resolution
 - tagging efficiency/purity
- Allow more specialised parameterisations to be developed/used
 - e.g. parameterise electrons and track matching efficiency as a function of η

Finally..

- All this and further information about the Comparator is available on the TWiki: <https://uimon.cern.ch/twiki/bin/view/Atlas/AtlasComparator>
- Soon, AOD with TruthEvent should not be needed (v11.2.0+).
 - **I am performing tests on this to ensure it is useable**
- Next to come will be jets, though this presents a challenge due to missing low energy particles in new 'truth' record.