Status of PandoraPFA

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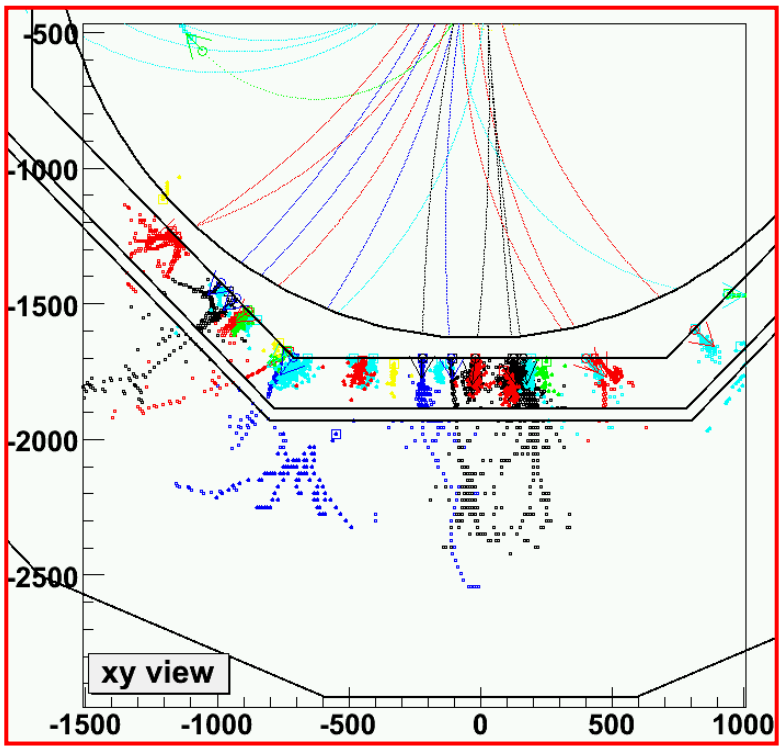


This Talk:

1. What's new
2. Current Performance
3. Limitations
4. V0.0 Release

❶ What's new…

Not all that much……

i) Optimisation

- ★ **Major effort to optimise performance**
  - **Sequentially switched off all parts of code**
  - **Re-evaluated performance at $\sqrt{s}$=91, 200, 500 GeV**
- ★ **Conclusions:**
  - **Performance at 91 GeV very robust !**
    - **All that really matters is being careful**
    - **Can switch off much of the code without significant degradation in performance.**
  - **At higher energies all aspects of the code do some good:**
    - **"Reclustering" is very important**
  - **No significant improvements found!**

ii) Calibration

In the June phone meeting I commented on an issue with the calibration for high energy photons.

- ★ **Fixed this "feature"**
  - **Single hits corresponding to > 1 GeV were being set to 1 GeV.**
  - **This (probably) makes sense for hadronic showers but not for high energy EM showers.**
  - **Threshold now only applied to calculation of hadronic energy of shower.**

iii) Code Improvements

- ★ **Effort to tidy up code (not finished)**
  - **Remove obsolete/redundant methods**
  - **Careful testing of each part of the code – some minor bugs fixed.**
  - **Strip out some monitoring of performance used in development.**
  - **Now writes out clusters and Particles**

❷ Current Performance (as of 28/7/06)

Figures of Merit:

rms_{90}

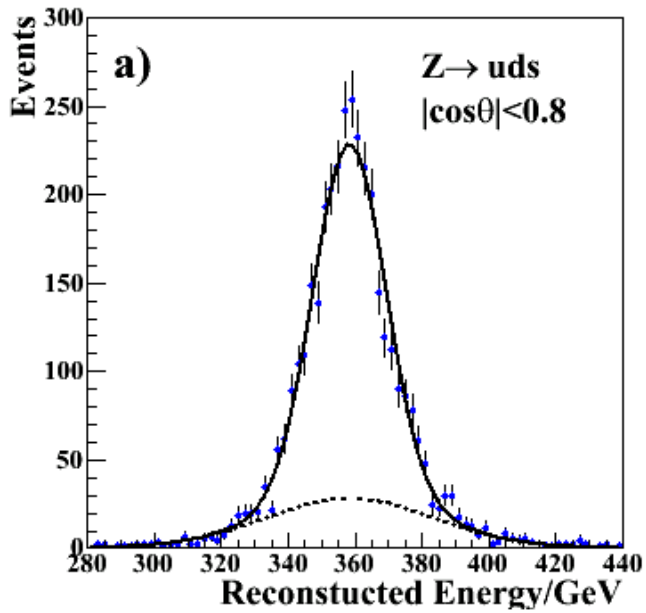
- ★Find smallest region containing 90 % of events
- ★Determine rms in this region

E_{JET}	$\sigma_E/E = \alpha\sqrt{(E/GeV)}$ $\lvert\cos\theta\rvert<0.8$
45 GeV	0.30
100 GeV	0.37
180 GeV	0.57
250 GeV	0.75

- ★Slight improvement compared with previous results mainly due to calibration issue.

σ_{75}

- ★Fit sum of two Gaussians with same mean. The narrower one is constrained to contain 75% of events
- ★Quote σ of narrow Gaussian

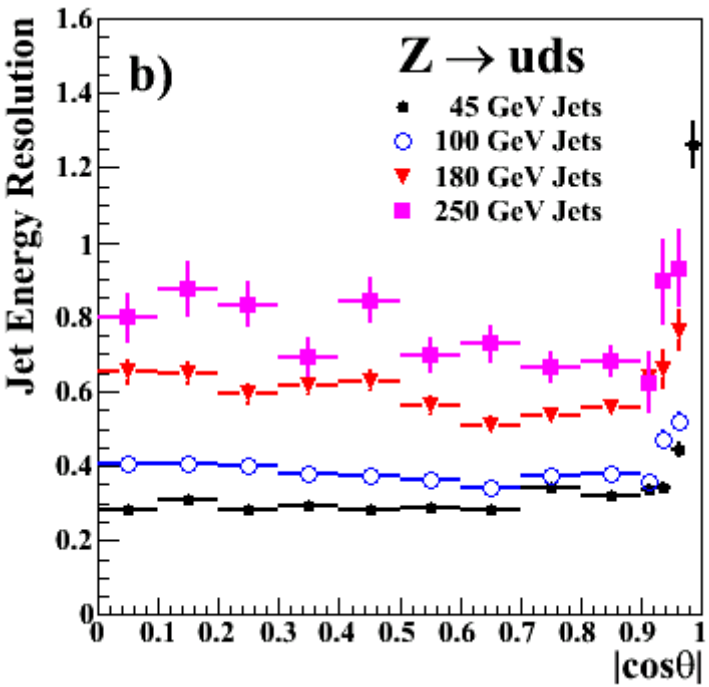


It is found that $rms_{90} \approx \sigma_{75}$

★**The current performance of the algorithm is well described by the EMPIRICAL expression:**

$$\frac{\sigma_E}{E} = \frac{0.265}{\sqrt{E(\mathrm{GeV})}} + 1.2 \times 10^{-4} E(\mathrm{GeV})$$

Angular Dependence

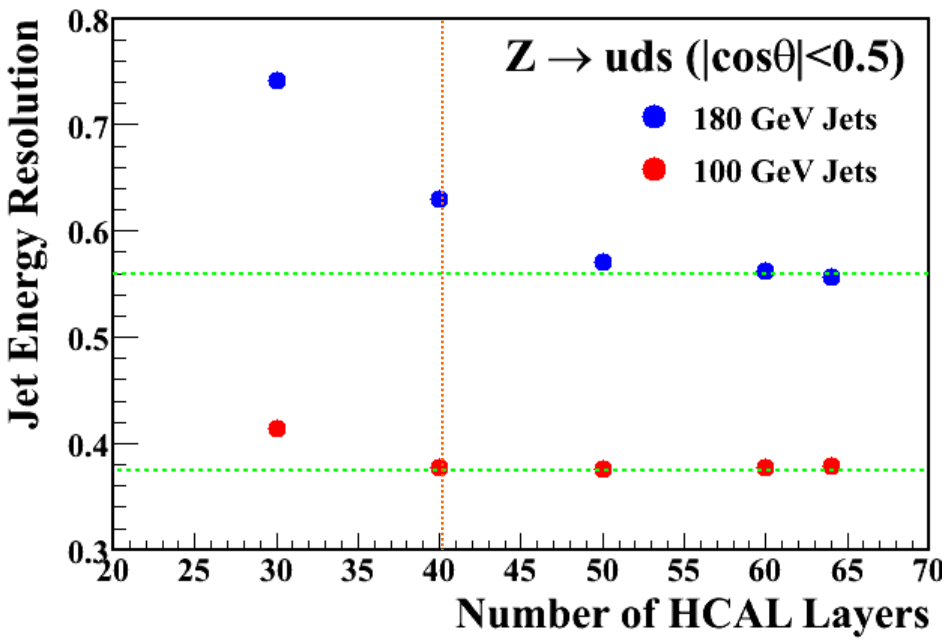


- **Jet energy resolution depends on polar angle**
- **Degradation in endcap : nuclear interactions in TPC endplate have some impact + longer track extrapolation**
- **For high energy jets performance in barrel region worse at low values of |cosθ| - at June phone meeting mentioned that I suspected that this was due to non-containment of hadronic showers…..**

HCAL Depth

★ **Recently (yesterday) investigated this hypothesis**

- **David Ward generated some Z→uds events with a large HCAL (64 layers)**
- **In PandoraPFA introduced a configuration variable to truncate the HCAL**
- **Took account of hexadecagonal geometry**



- **For 100 GeV Jets no advantage in going to larger HCAL !**

- **For 180 GeV Jets HCAL leakage degrades PFA perforamance**

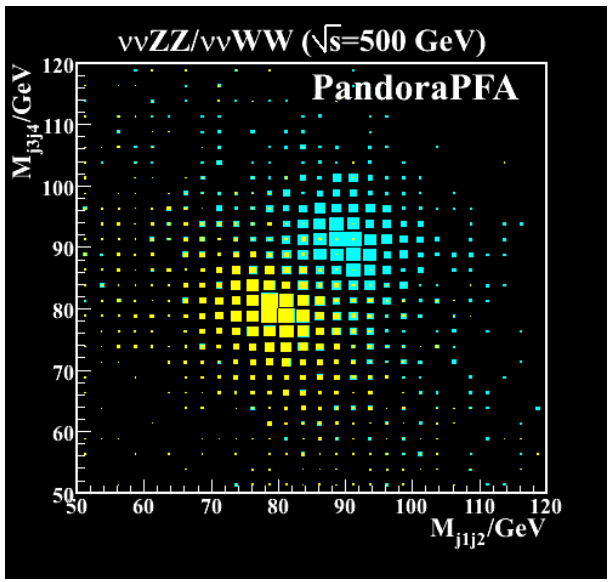
❸ Limitations of PandoraPFA

What needs to be improved:

- ★ Currently only tested/tuned for TrackCheater tracks
- ★ Track extrapolation from TPC to Calorimeters uses simple Helix fit which doesn't account for energy loss. For looping tracks this is an issue.
- ★ Still too many "fragment" clusters from hadron showers – to date no real effort to identify these. This needs to be improved.
- ★ No treatment of muon chambers as a tail catcher or attempt to correct energy of leaking hadronic showers
- ★ No treatment of energy in FCAL
- ★ Photon ID is OK – but is very simple and could be improved.
- ★ Hard-coded conversion from CellID to physical layer in calorimeters (used to get size of pixel) – keyed on detector name written out by Mokka !!!!

❹ Release of Version 0.0

- ★ At the June phone meeting I pledged to release the code before end of July…..
- ★ Still not quite there…
- ★ However code available as a .tar file from
  http://www.hep.phy.cam.ac.uk/~thomson/pandoraPFA
- ★ This code is well tested – have run over ~1 Million events
- ★ "Documentation" and current performance in LCWS06 contribution: available as **physics/060726**



Bottom Line:

- PandoraPFA is far from perfect…
- **BUT**, it can be used for detector studies (with all the normal caveats)
- **AND**, can be used for full simulation physics studies (see next talk)…

AT THIS STAGE FEEDBACK FROM PEOPLE USING THE CODE WOULD BE VERY HELPFUL

Fin.