Calibration of Multiple Scattering Algorithm-2

- Events were selected which had either:

  1) A muon that was unambiguously reconstructed in SFT-DC

  2) A non-muon reconstructed in SFT-DC in Station 3 or 4 and shows no sign of interaction in the modules

- Penetrating muons in each m-file are checked for systematic effects

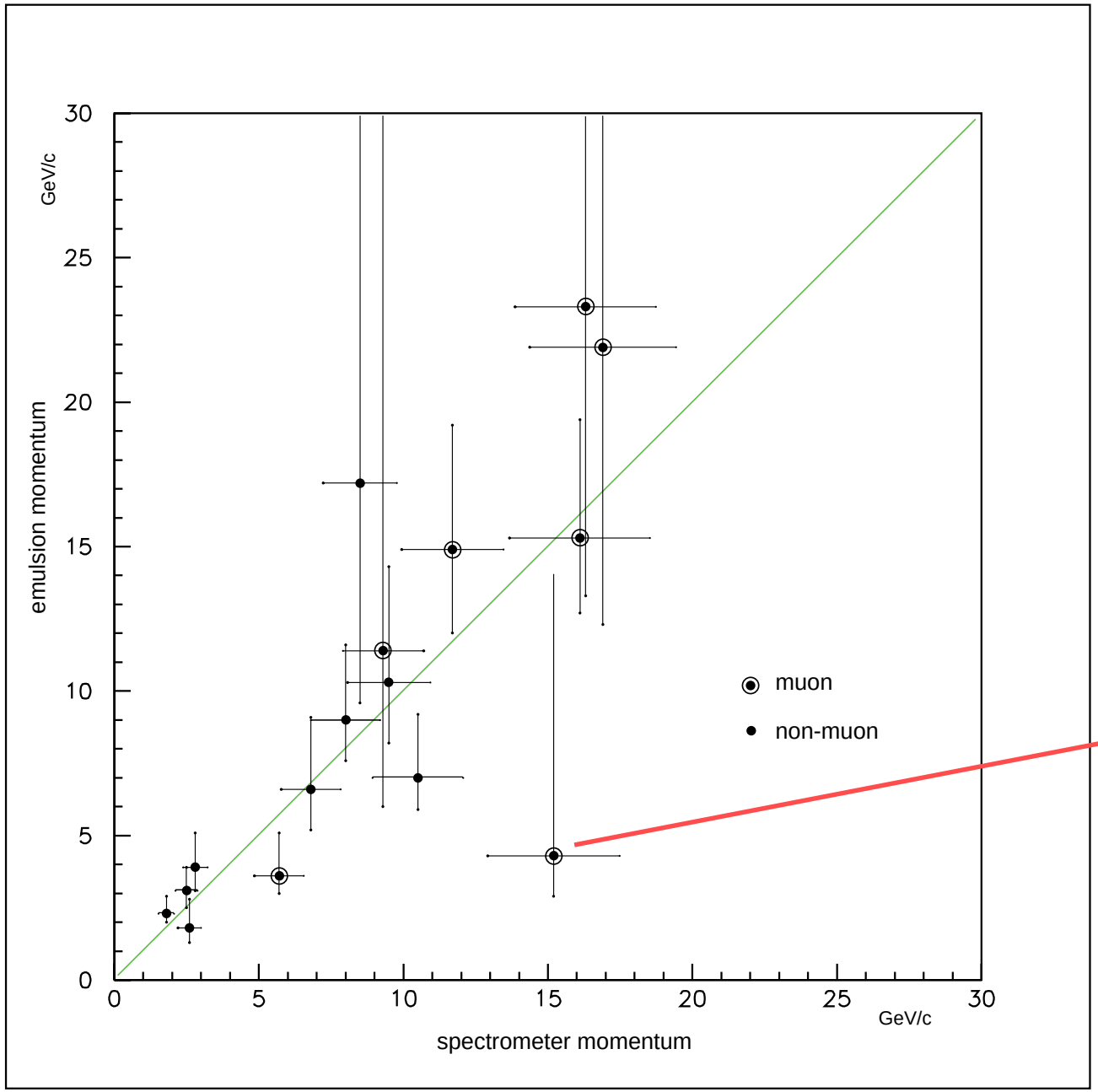
- A range of plates free of large systematics was selected and momentum found from MS is compared to spectrometer data

Part 1

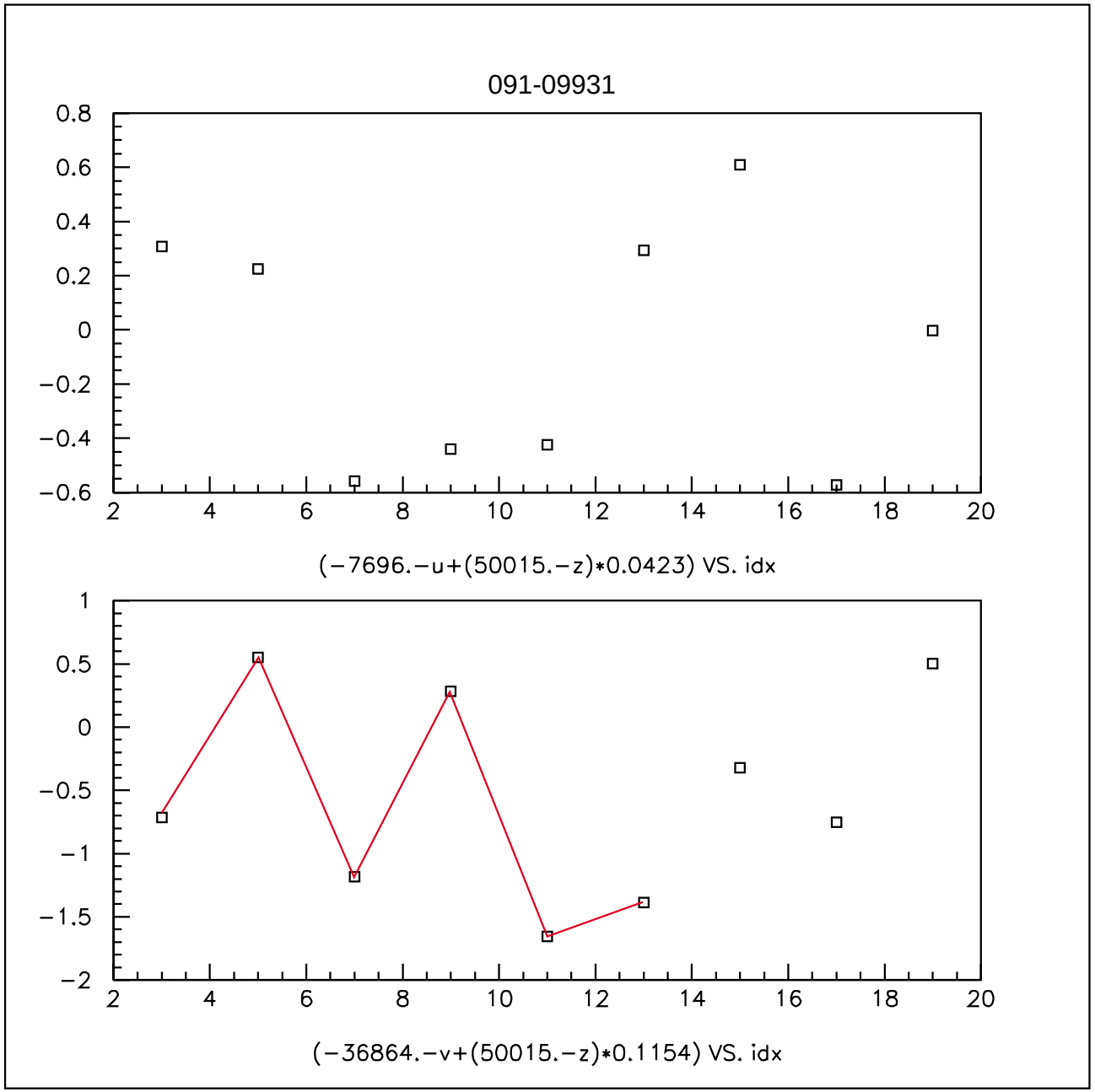
- 19 events were selected from Phase 1 data, which were also "tagged" for momentum calibration by Nagoya, last year

- the events were re-examined and refit (with very little change)

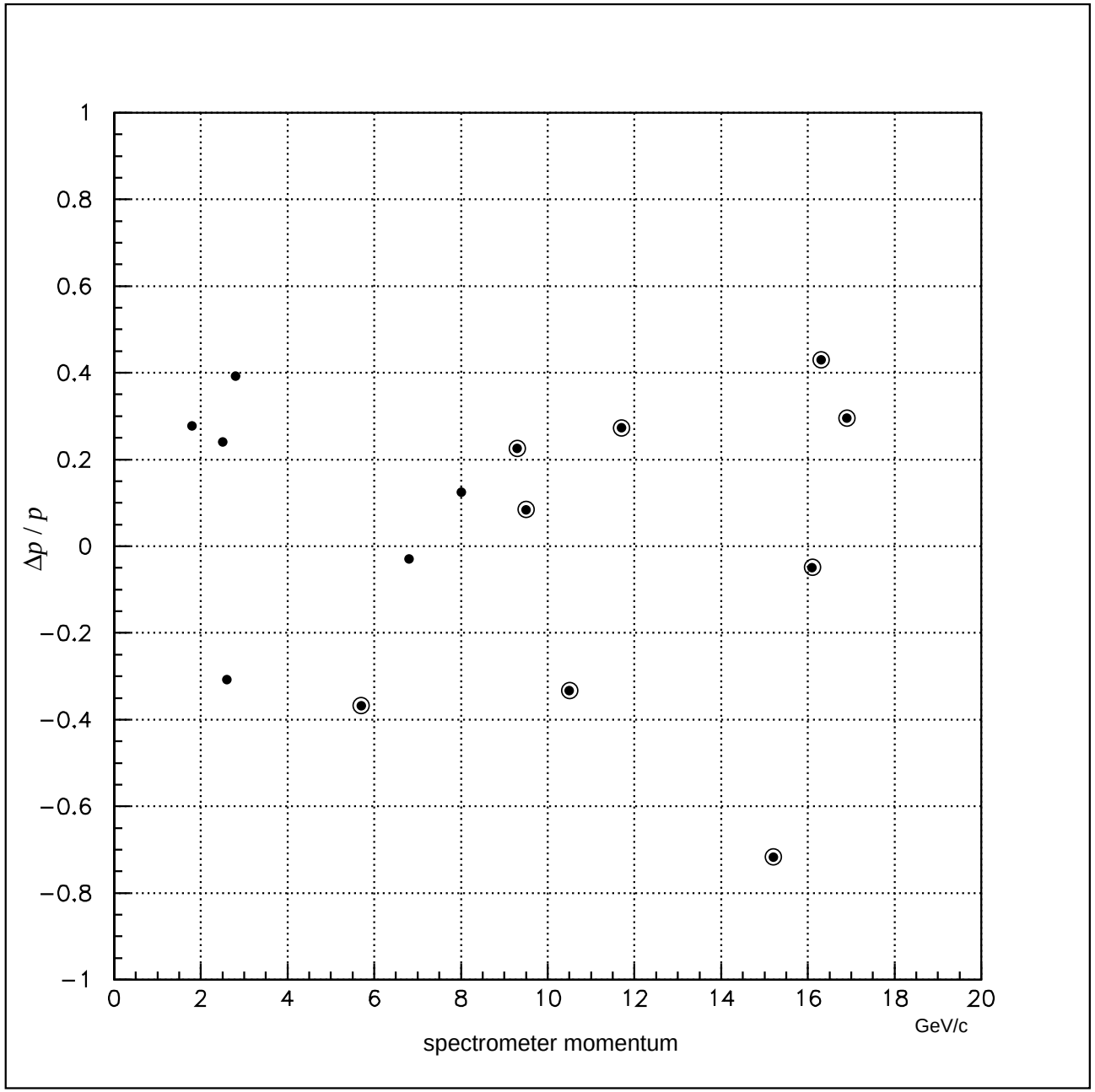
- comparison is made to refit spectrometer data and Nagoya fit



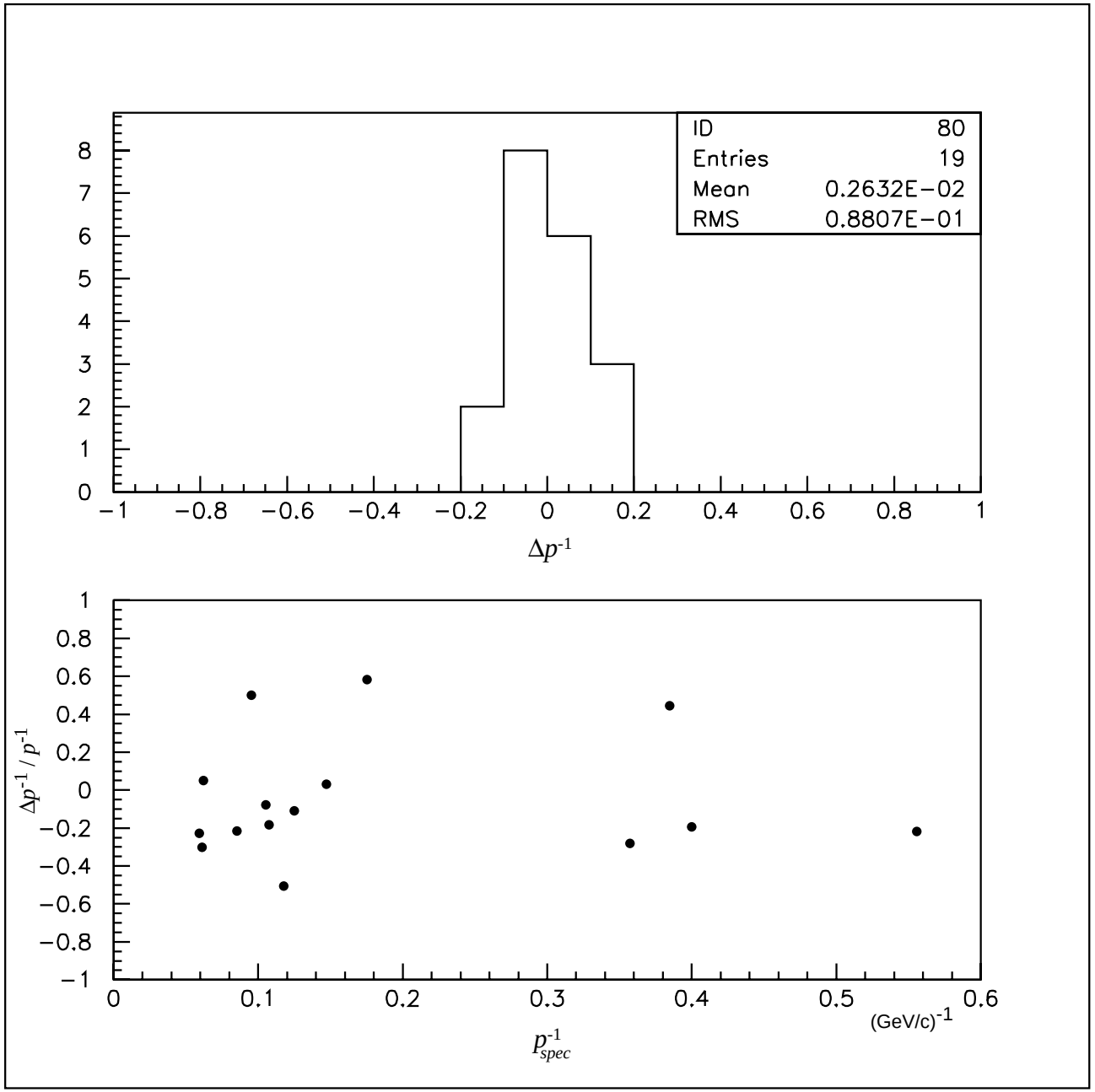
What happened here?



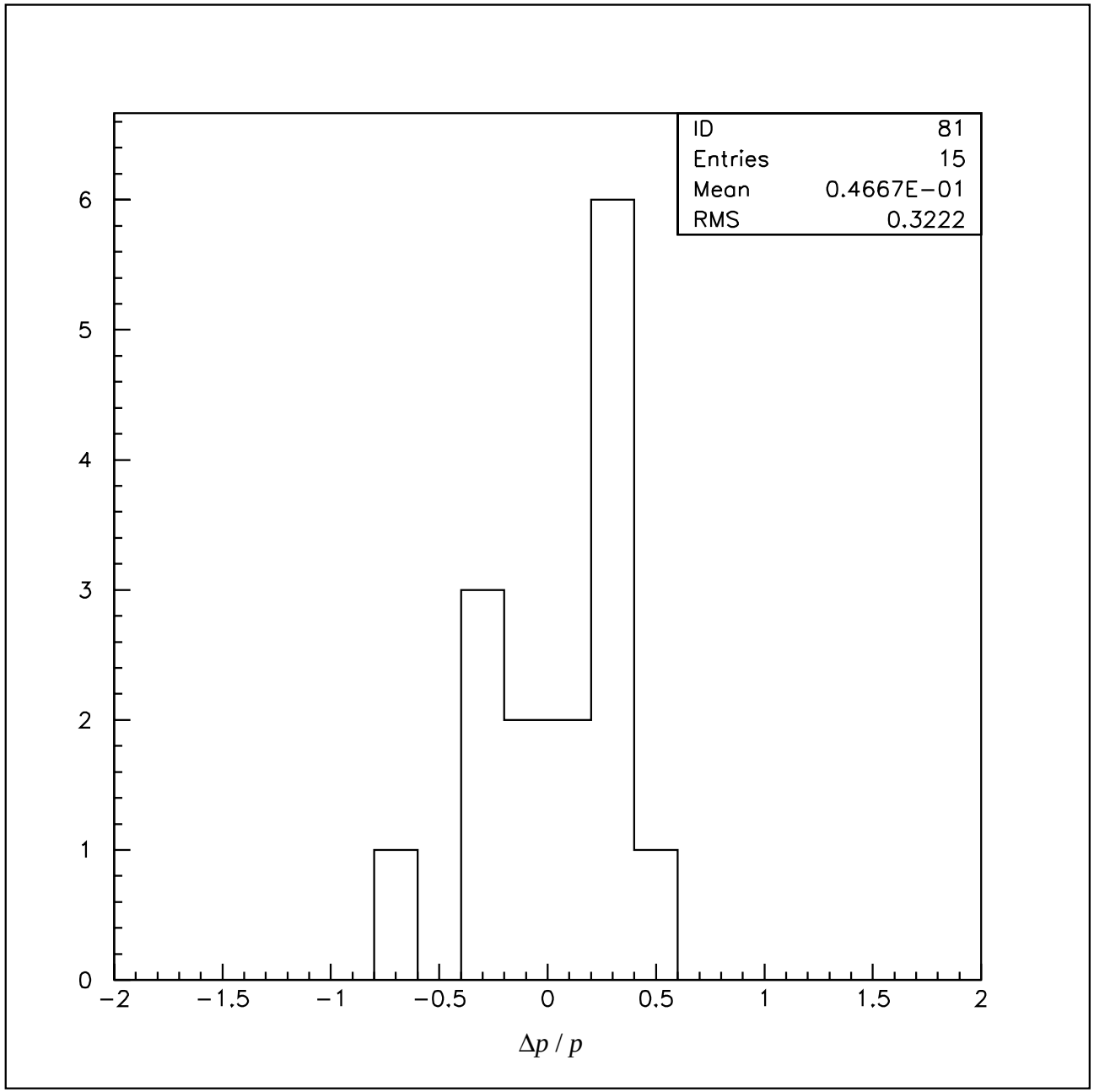
Note in the v-view that the first six points have a very unlikely distribution compared to the u-view. This causes the “skip 0” momentum measurement to be inconsistent with “skip 1” and higher.



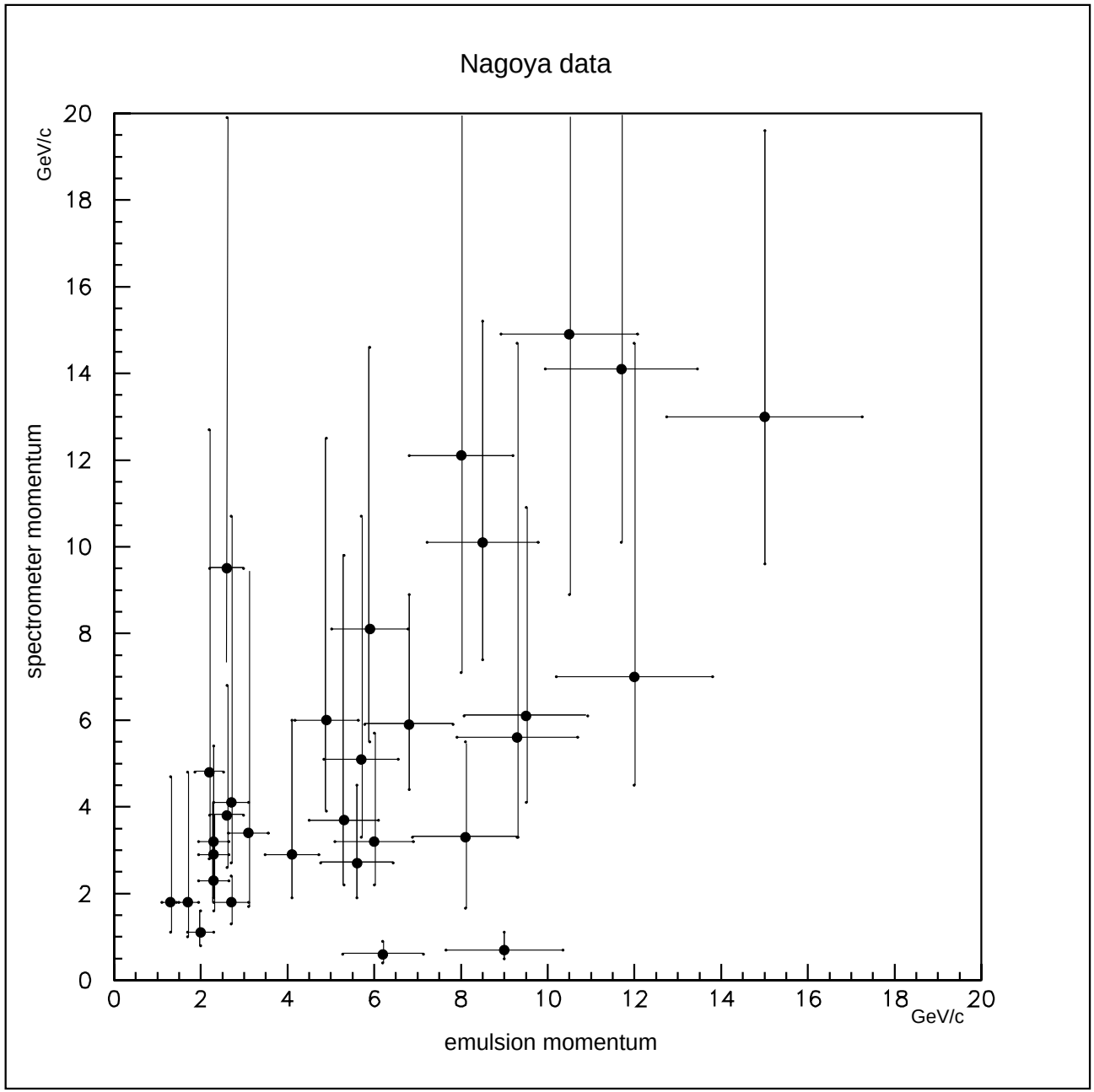
The relative error between the spectrometer and emulsion in momentum for the calibration tracks as a function of spectrometer momentum



The relative error for the inverse momentum. It has the advantages that the errors are gaussian and all momenta can be comapared, including “infinite” momenta

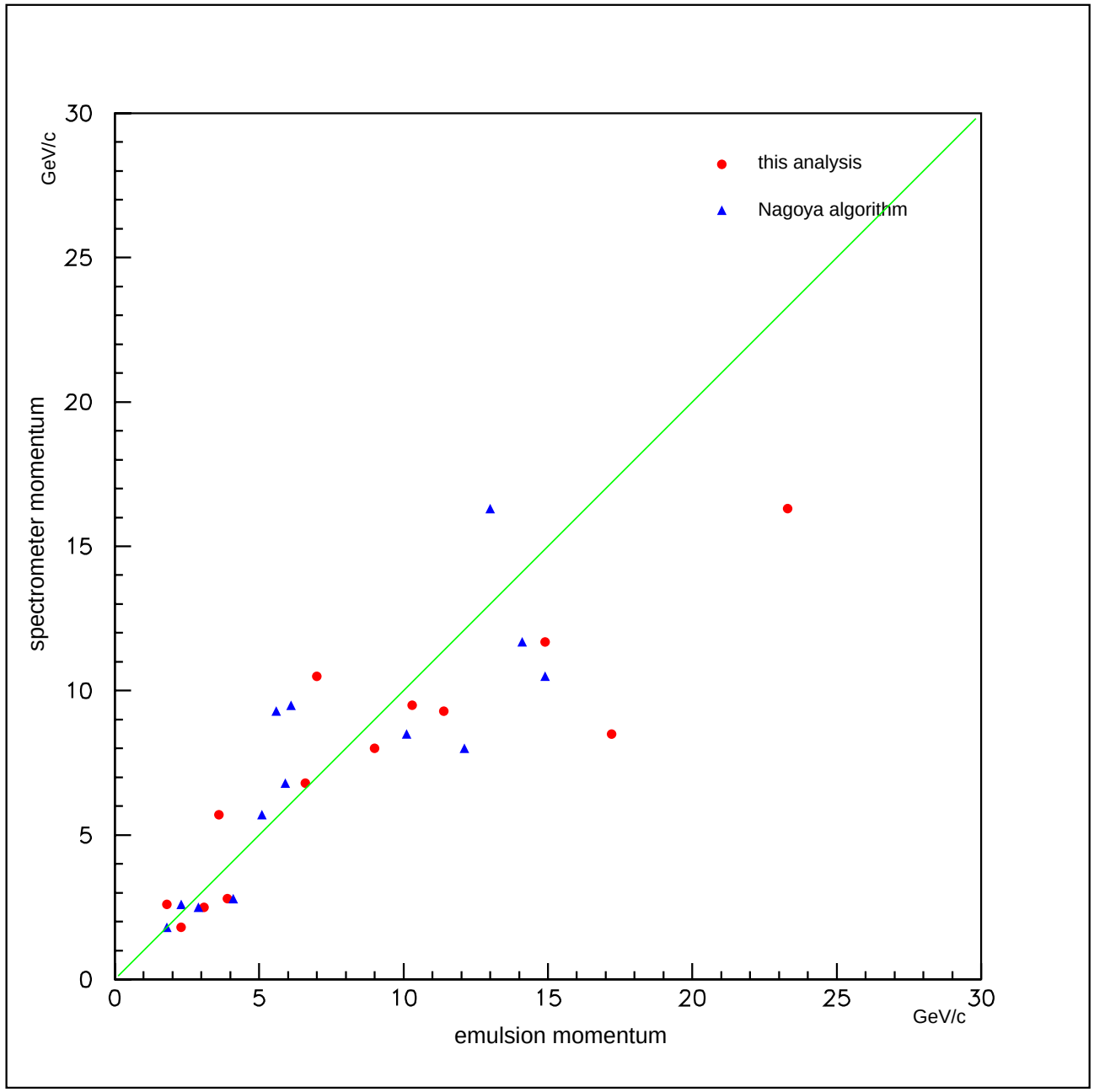


The plot of the relative error between the scattering method using emulsion data and the spectrometer (SFT / DC fit) for values of $p_{spec} < 20$ GeV/c



This is the calibration plot of the Nagoya algorithm used last year.

One of the very low points is now understood as being a secondary track from a hadronic interaction.



Momentum measurements for calibration tracks are compared

Part 2

- Tau daughter tracks were analyzed and compared with previously obtained results:

3024_30175 092-04391
3039_01910 171-04275
3263_25102 391-03610
3333_17665 562-07783

run	event	track	N_{plates}	p_{MS}(Nagoya)	p_{MS}(Fermi)
3024	30175	092-04391	13	2.9 [2.1 - 4.4]	6.4 [3.7 - 6.2]
3039	01910	171-04275	16	4.6 [3.7 - 6.1]	4.1 [3.4 - 5.2]
3263	25102	391-03610	15	1.9 [1.2 - 3.9]	1.86 [1.50-2.46]
3333	17665	562-07783	10	21.4[15.0-35.8]	10.5 [5.6 - ∞]

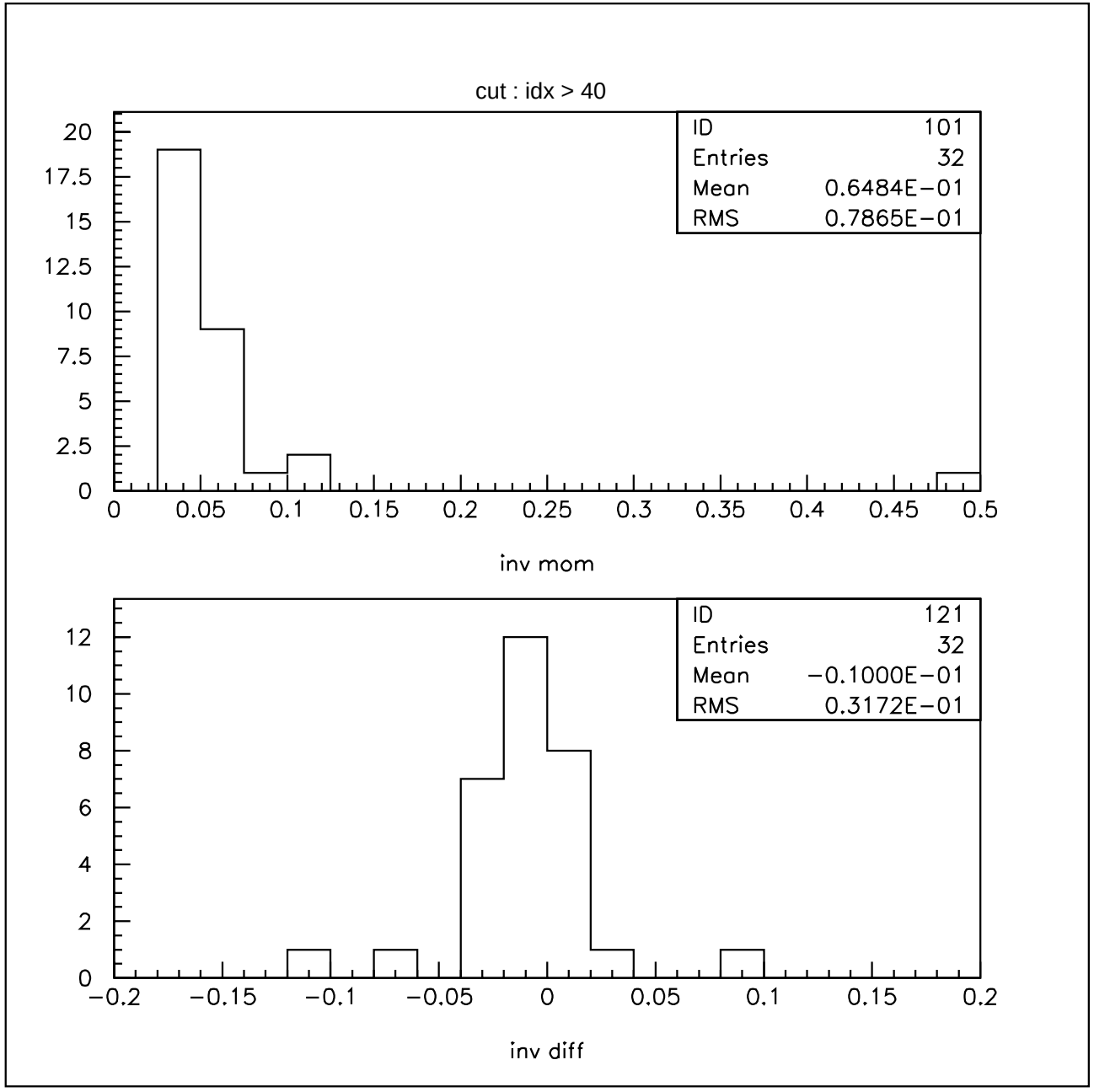
The shaded tracks are electrons. The data used is not the same for the electron tracks, but the hadron tracks appear to be using the same plates for both analyses

Conclusions

- The method is proven to be consistent with the spectrometer
- The method is also consistent with the Nagoya algorithm
- The Phase 1 tau tracks are in agreement
- The relative uncertainty is ~30% depending mainly on the number of plates used in the fit and the resolution of the plates

Additional Note

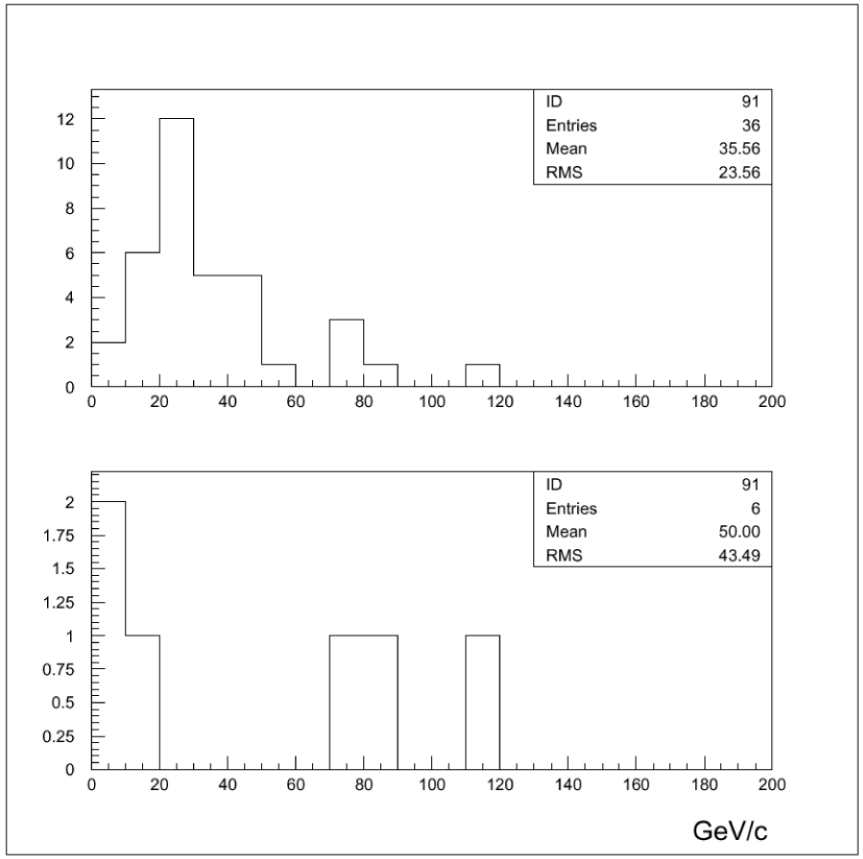
- It had been reported that momentum fitting for all primary vertex tracks appeared to be limited to low momenta
- For most data from m-files this is not the case, if the data is treated carefully
- About 60% of the files appear to be “OK” and many of the rest can be recovered
  - ☞ “OK” here means *u,v* results consistent, with an *rms* < 0.05 in p^{-1}



Results of MS momentum fitting to calibration muons in 2884_18223

The plot of p^{-1} (*top*) shows the spectrum is pushed up to the resolution limit (0.03)

The error is also shown in the plot of the difference in p^{-1} between the u and v views (*bottom*)



Spectrum of small-angle muons from physics data runs (in fact the half-density data).

It is divided into negative (*top*) and positive (*bottom*) muons

The mean momentum is 38 GeV/*c*