Preliminary Results for Energy Resolution For The August Testbeam

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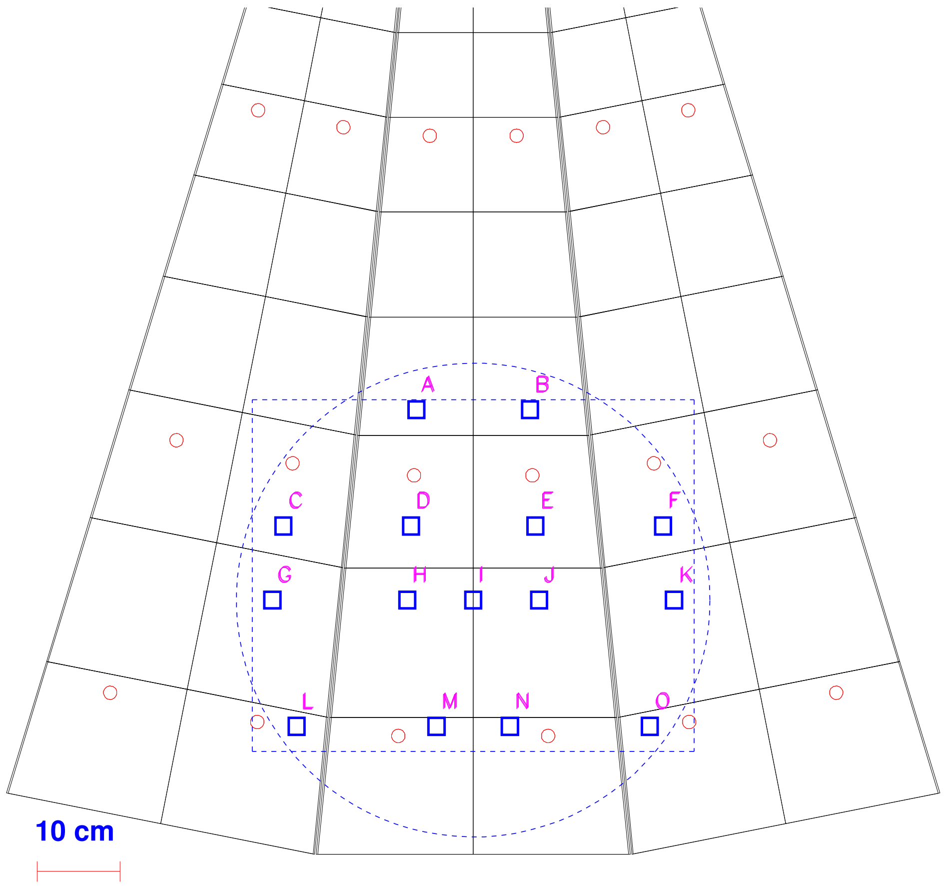
The study of the energy resolution will involve:

- **Fitting the energy scan data points for targets J and K to the function**

$$\frac{\sigma}{\mu} = \frac{A}{\sqrt{E}} \oplus B \oplus \frac{C}{E}$$

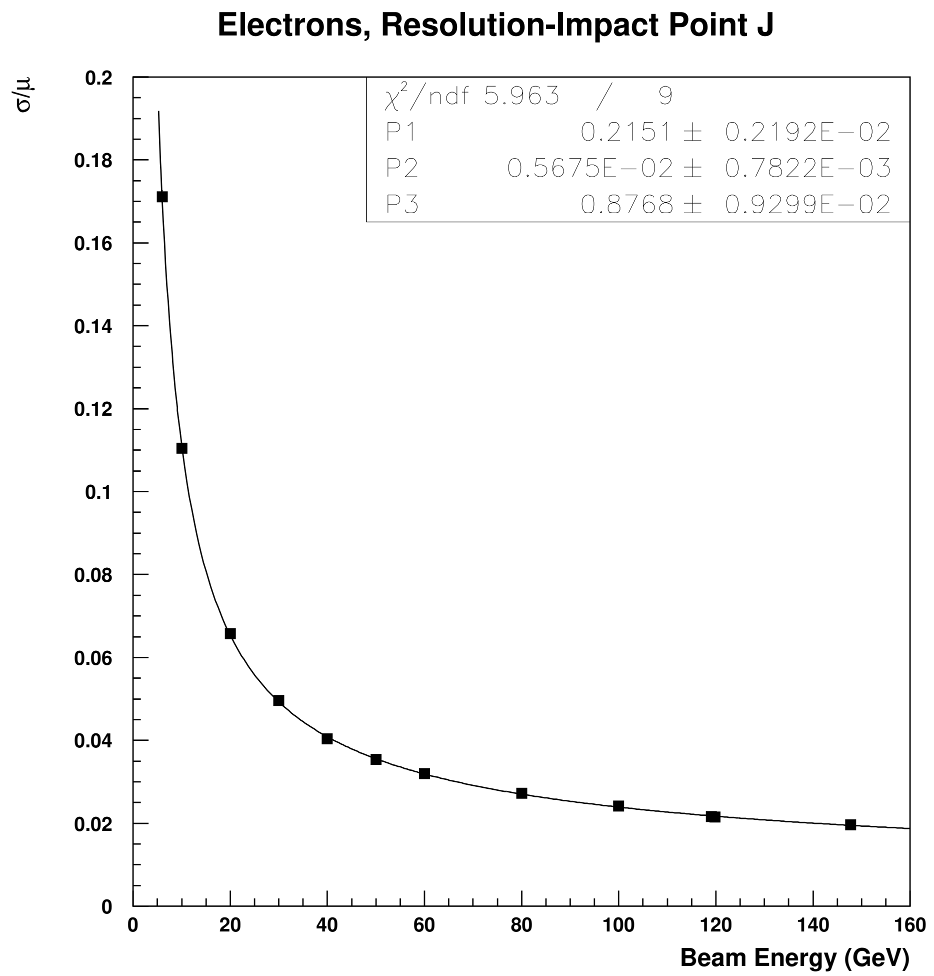
- **Comparing to results of the June testbeam**
- **Remarks about the pion testbeam results**

Please Note: **The following results are preliminary. Some analysis, such as background subtraction, has yet to be performed. Also, the signals were calibrated using a cubic fit.**

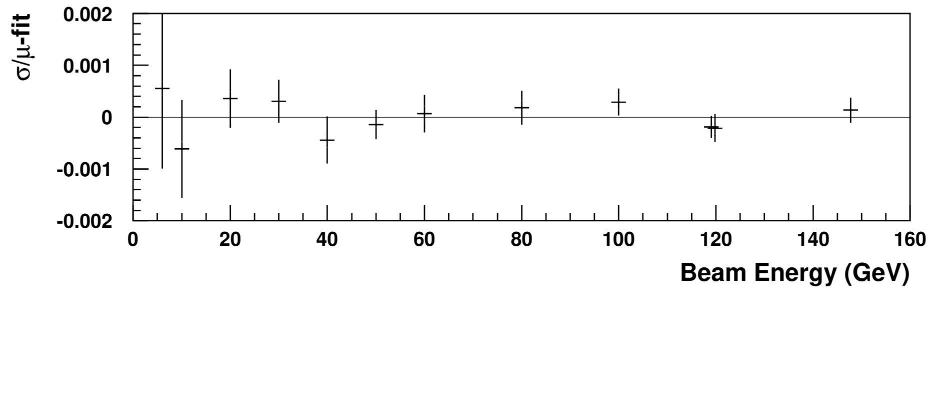


Projection on the front face of the HEC module

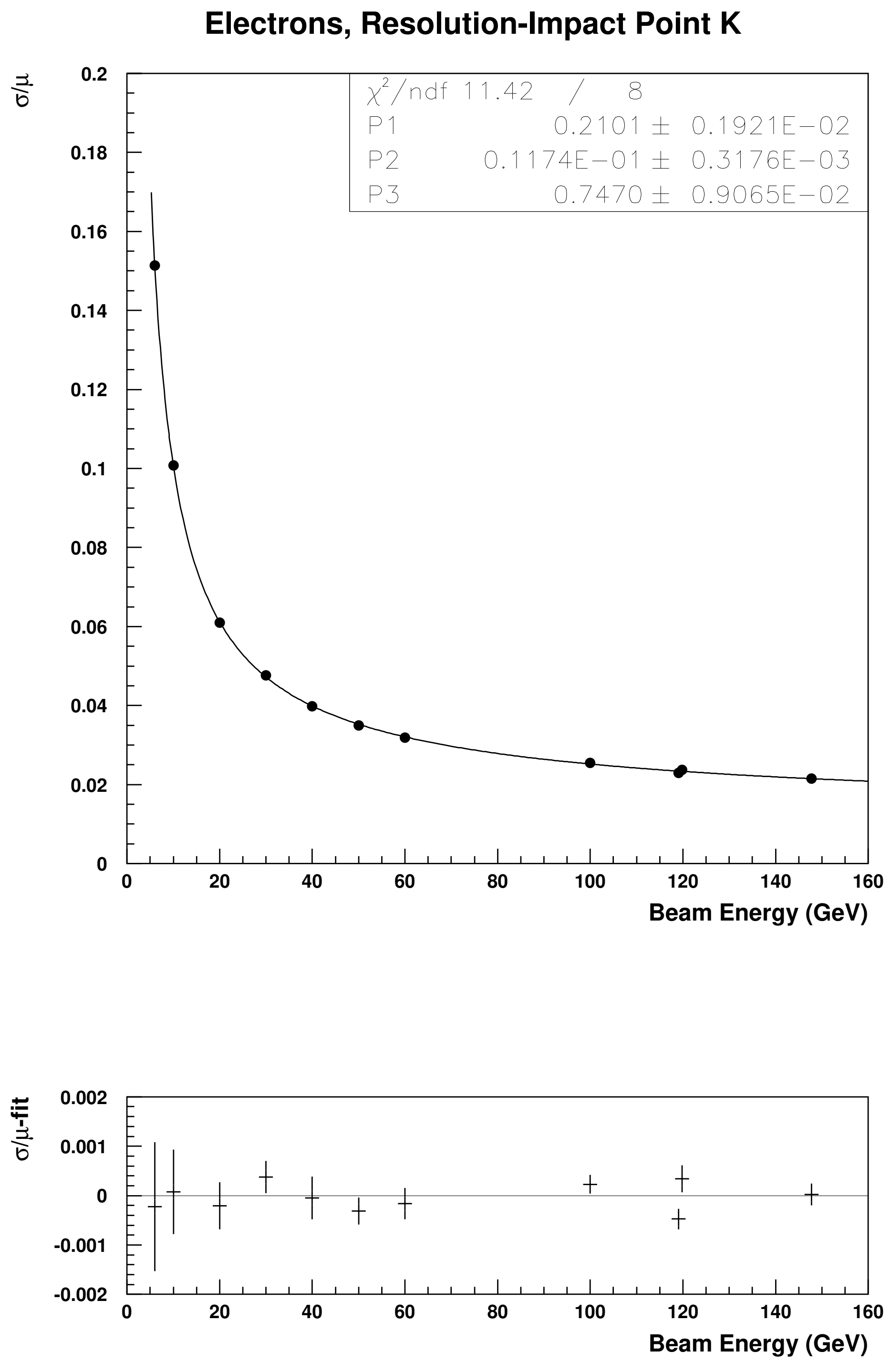
Plot obtained from
`http://wwwatlas.mppmu.mpg.de/hec.html`.



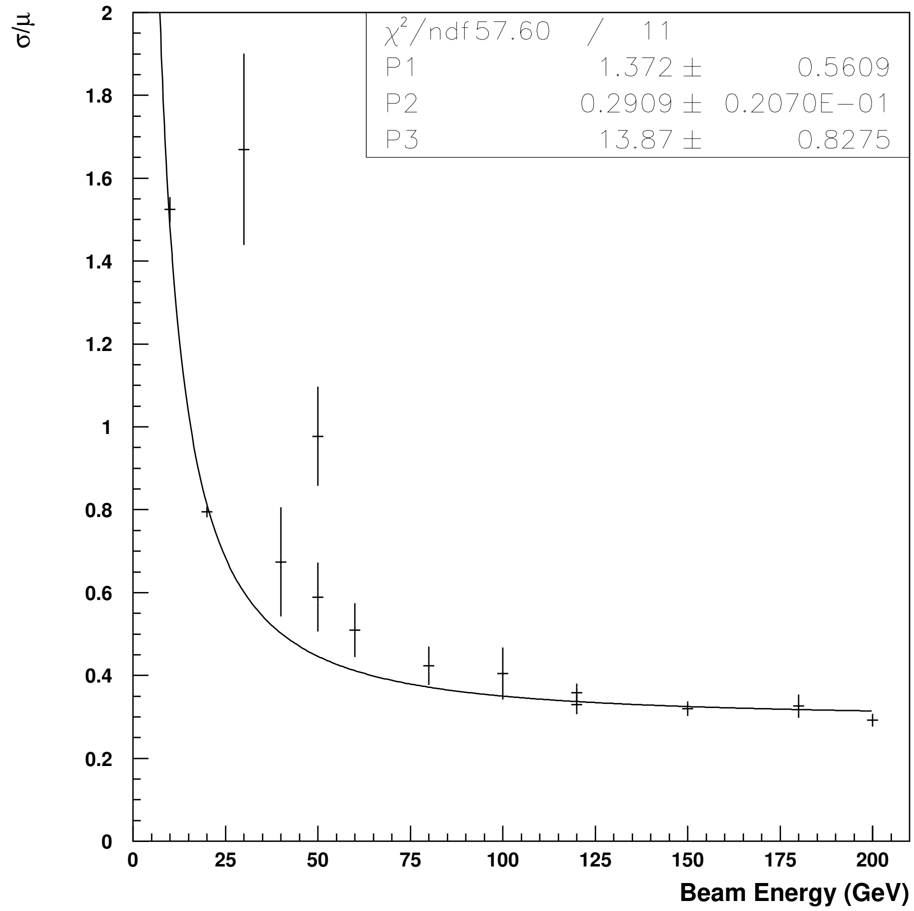
Electrons, Resolution-Impact Point J
σ/μ
χ²/ndf 5.963 / 9
P1 0.2151 ± 0.2192E-02
P2 0.5675E-02 ± 0.7822E-03
P3 0.8768 ± 0.9299E-02
0.2
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
0 20 40 60 80 100 120 140 160
Beam Energy (GeV)



σ/μ-fit
0.002
0.001
0
-0.001
-0.002
0 20 40 60 80 100 120 140 160
Beam Energy (GeV)

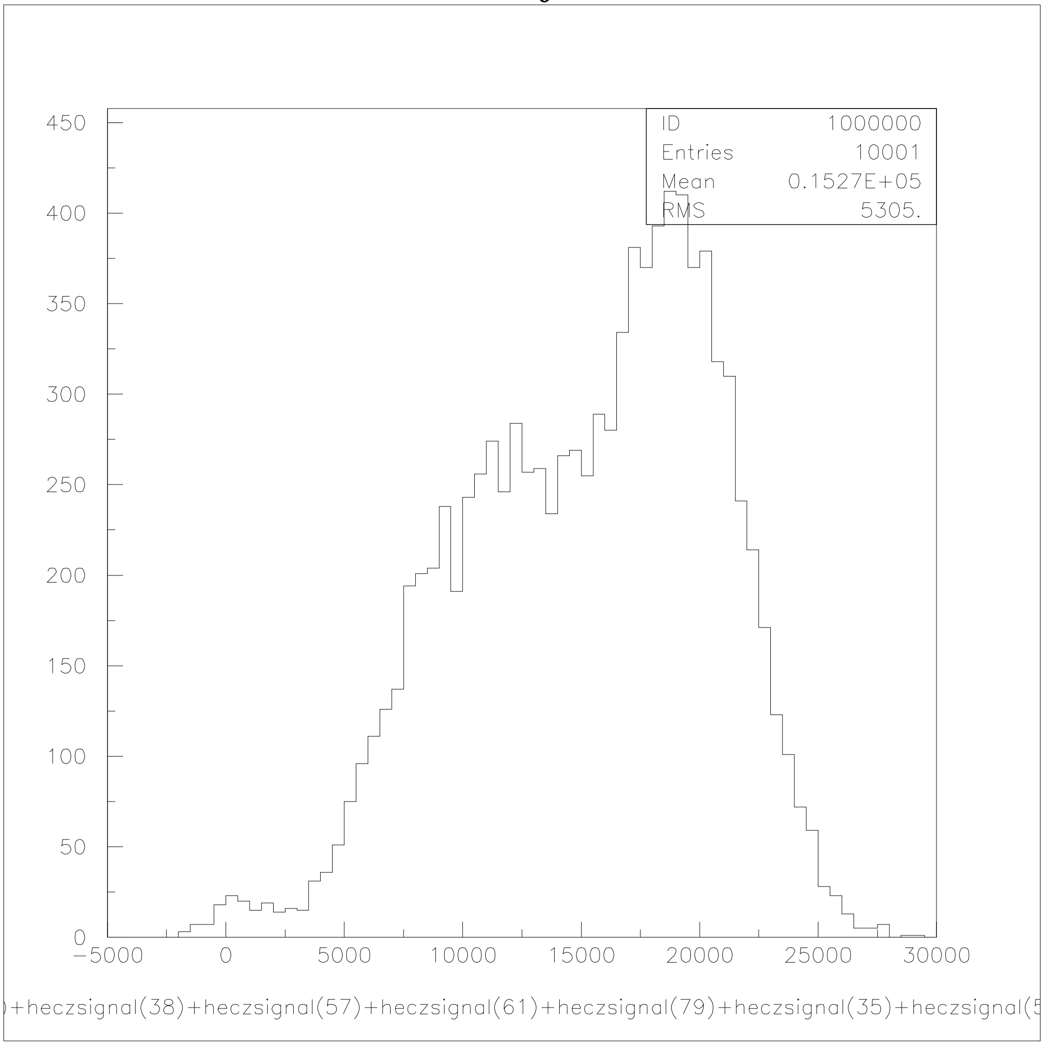

Electrons, Resolution-Impact Point K
σ/μ
χ²/ndf 11.42 / 8
P1 0.2101 ± 0.1921E−02
P2 0.1174E−01 ± 0.3176E−03
P3 0.7470 ± 0.9065E−02
Beam Energy (GeV)
σ/μ-fit
Beam Energy (GeV)

Pions, Resolution-Impact Point J



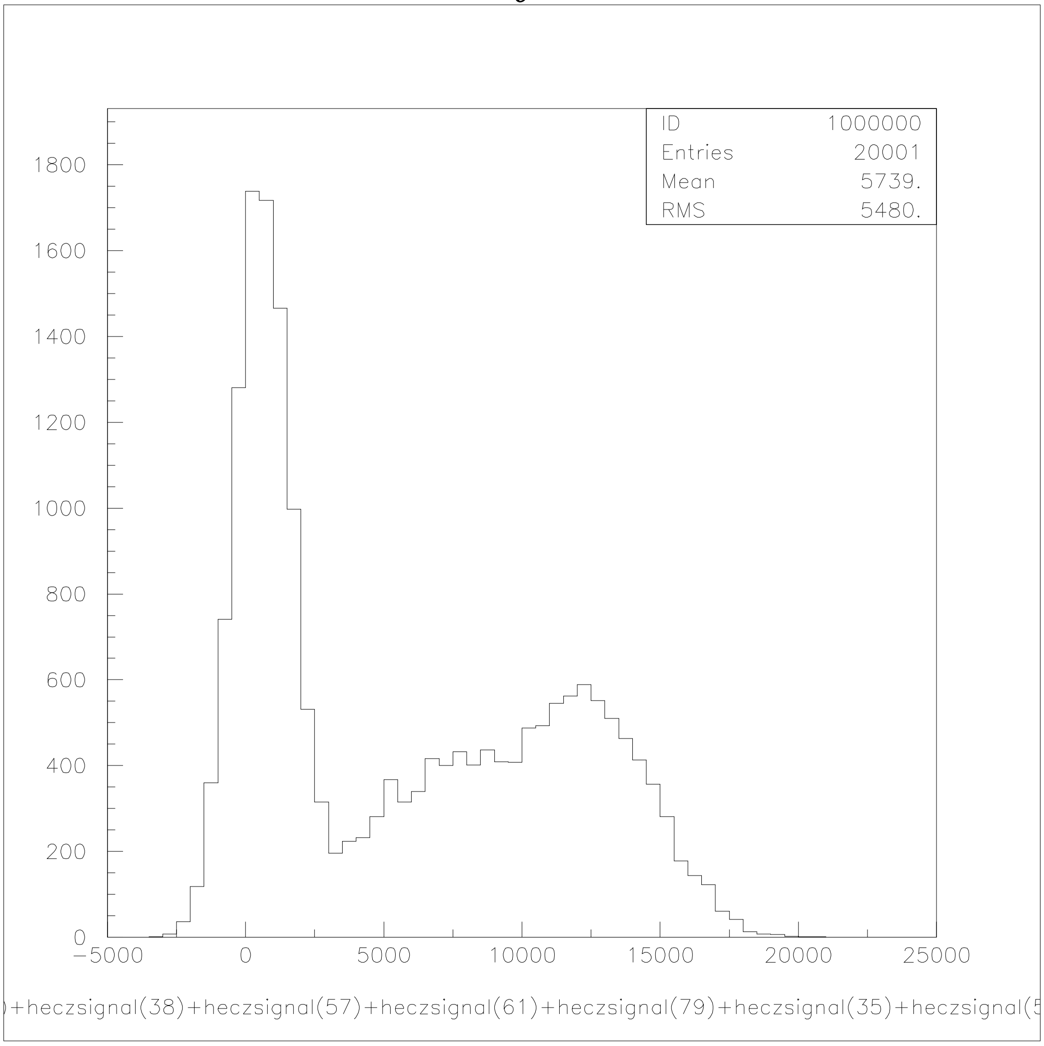
The data collected between 30 GeV and 100 GeV was taken with the tertiary beam source. Some data at 120 GeV also came from this source.

Run 10036: Pions at 150 GeV, Secondary Beam



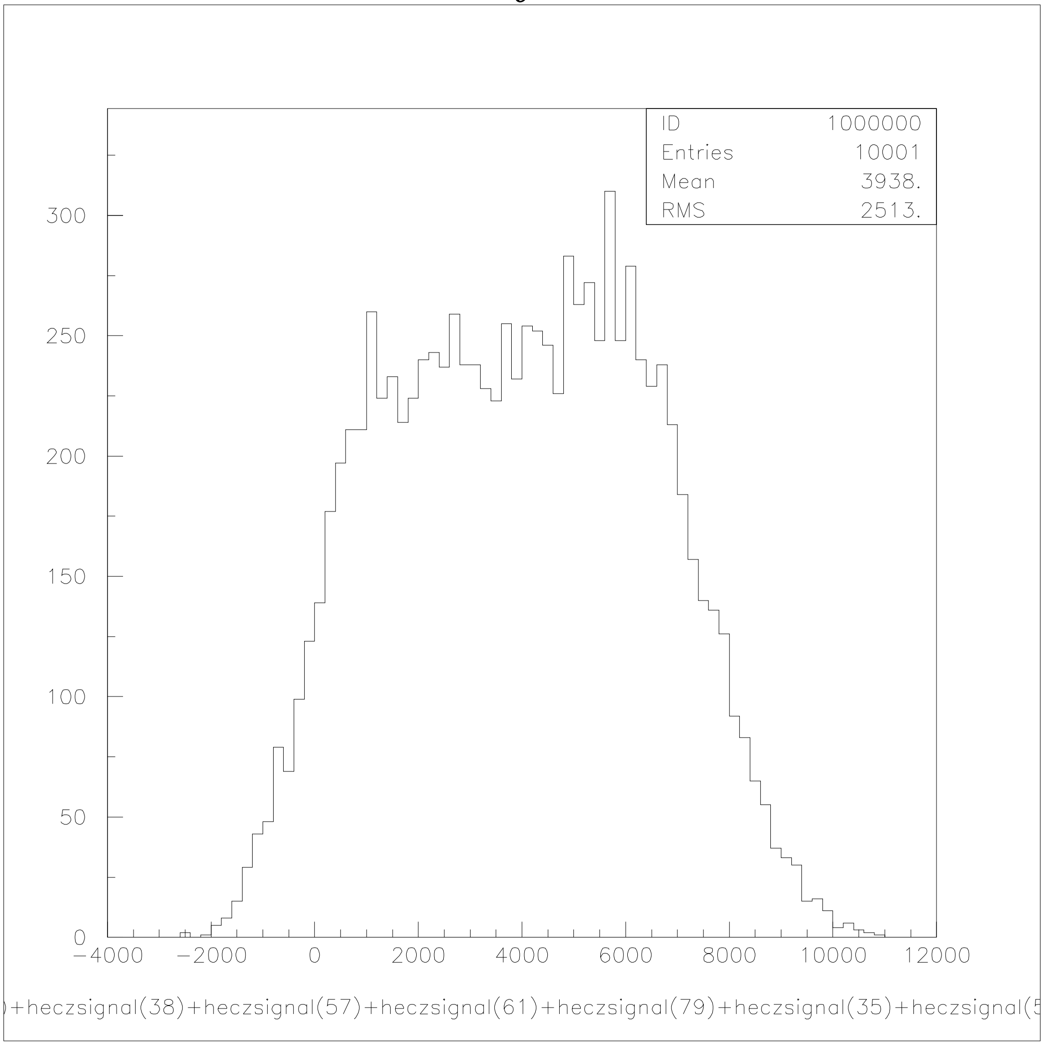
Two gaussian structures, corresponding to pions and electrons, are readily visible, and can be separated computationally.

Run 10437: Pions at 100 GeV, Tertiary Beam



Three gaussian structures are present in runs from the tertiary beam source. While the gaussian with the lowest mean is not yet understood, the other two are believed to correspond to pions and electrons, respectively.

Run 10656: Pions at 50 GeV, Tertiary Beam



As beam energy decreases, the three gaussians become more difficult to distinguish, until they are virtually indiscernible.

Comparing The June and August Results

June Runs with 07.06 Digital Weight Calibration			
Target	π **Point J**	e **Point J**	e **Point K**
A	0.7294 ± 0.0507	0.2376 ± 0.0017	0.2361 ± 0.0001
B	7.46 ± 0.21 %	0.00 ± 0.36 %	0.25 ± 0.18 %
C	7.471 ± 0.299	1.132 ± 0.009	0.9508 ± 0.0008
$\frac{\chi^2}{ndf}$	**3.047 / 10**	**43.05 / 8**	**29.50 / 7**

June Runs with 08.06 Digital Weight Calibration			
Target	π **Point J**	e **Point J**	e **Point K**
A	0.8055 ± 0.0608	0.2403 ± 0.0017	0.2378 ± 0.0031
B	7.11 ± 0.32 %	0.00 ± 0.70 %	0.78 ± 0.09 %
C	7.276 ± 0.314	1.115 ± 0.010	0.8542 ± 0.0172
$\frac{\chi^2}{ndf}$	**7.215 / 10**	**35.63 / 8**	**55.67 / 7**

August Runs with Cubic Fit Calibration			
Target	π **Point J**	e **Point J**	e **Point K**
A	1.372 ± 0.561	0.2151 ± 0.0022	0.2101 ± 0.0019
B	29.09 ± 2.07 %	0.57 ± 0.08 %	1.17 ± 0.03 %
C	13.87 ± 0.83	0.8768 ± 0.0093	0.7470 ± 0.0091
$\frac{\chi^2}{ndf}$	**57.60 / 11**	**5.963 / 9**	**11.42 / 8**

Summary

With a fit function of the form

$$\frac{\sigma}{\mu} = \frac{A}{\sqrt{E}} \oplus B \oplus \frac{C}{E}$$

we obtain the following results:

- **For electrons, the fit parameters are approximately** $A = 0.21\ \sqrt{GeV}$**,** $B = 0.75\%$**, and** $C = 0.8\ GeV$**. Recall that the fit was unconstrained, such that these results are correlated. When compared with the June results, we find that** A **has decreased slightly, while** B **and** C **have increased slightly. However, the values of** χ^2/NDF **have greatly improved.**

- **For pion runs taken with the secondary beam, it seems to be possible to separate the pions from the electron noise, albeit with greater uncertainties.**

- **For pion runs taken with the tertiary beam, a third, as yet unexplained gaussian appears near the zero signal level. As the beam energy decreases, separating the pions from the electrons and this third entity becomes increasingly difficult.**