Surplus Hits Ratio

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C&A Meeting

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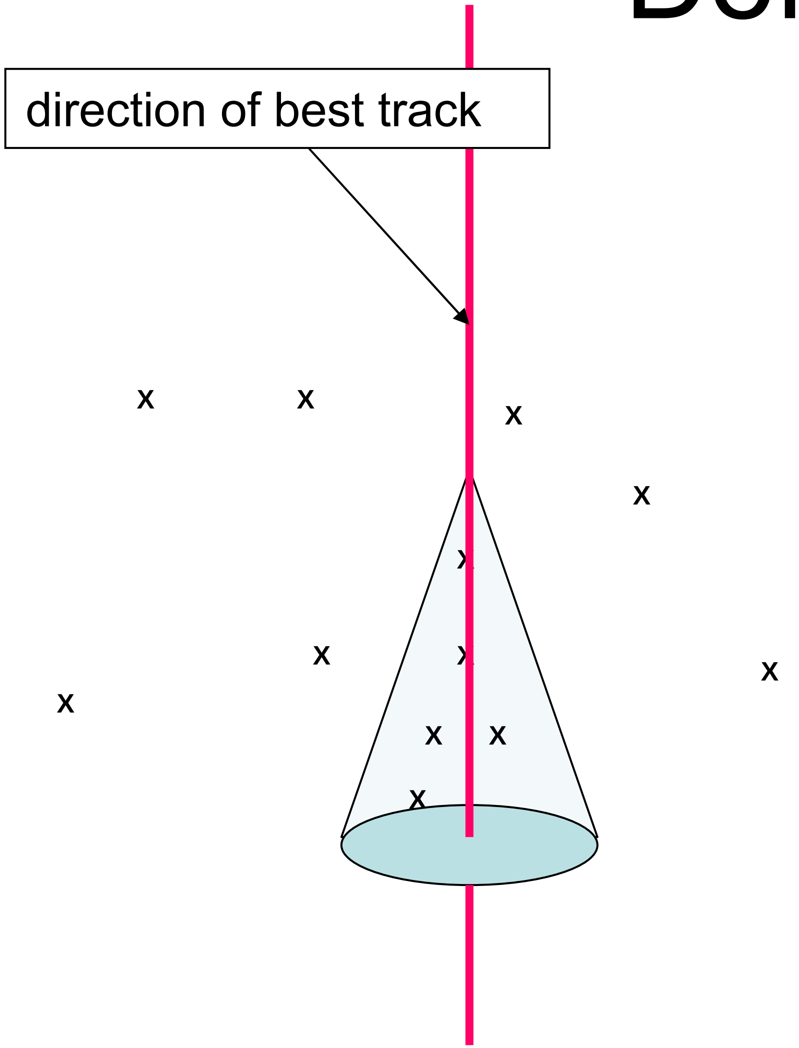
Definition



It's the ratio between the number of clusters outside the cone and the number inside

- Currently, 1-D distances are used for X and Y separately (so it's actually a square!)
- To reduce noise only clusters in layers with both x and y hits are counted

Details

How does the cone angle vary with angle and energy?

The naïve expectation is that it goes as $1/E_{gamma}$ and maybe $1/\cos\theta_{track}$.

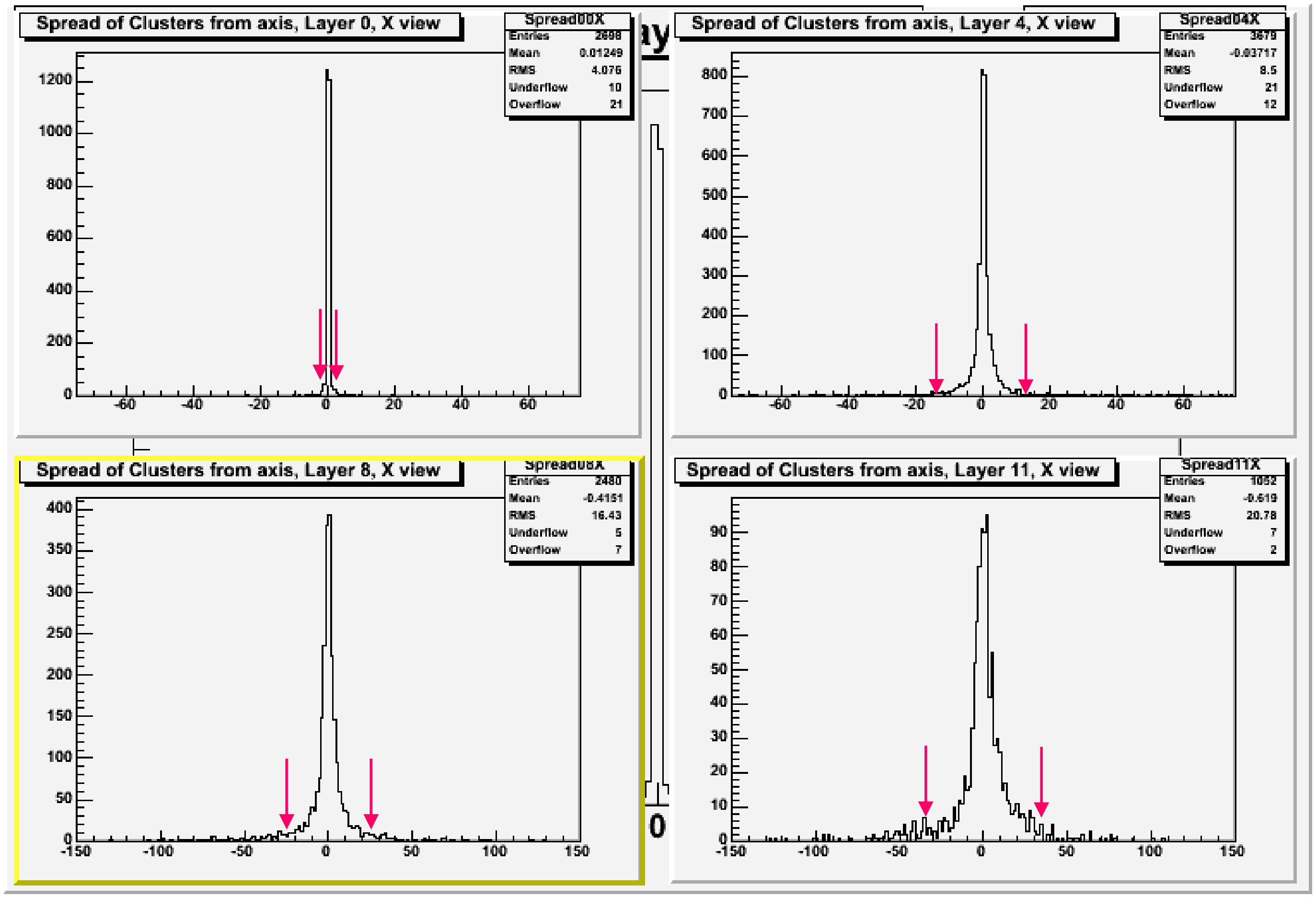
Wrong!

Study with Gleam

Gamma runs:

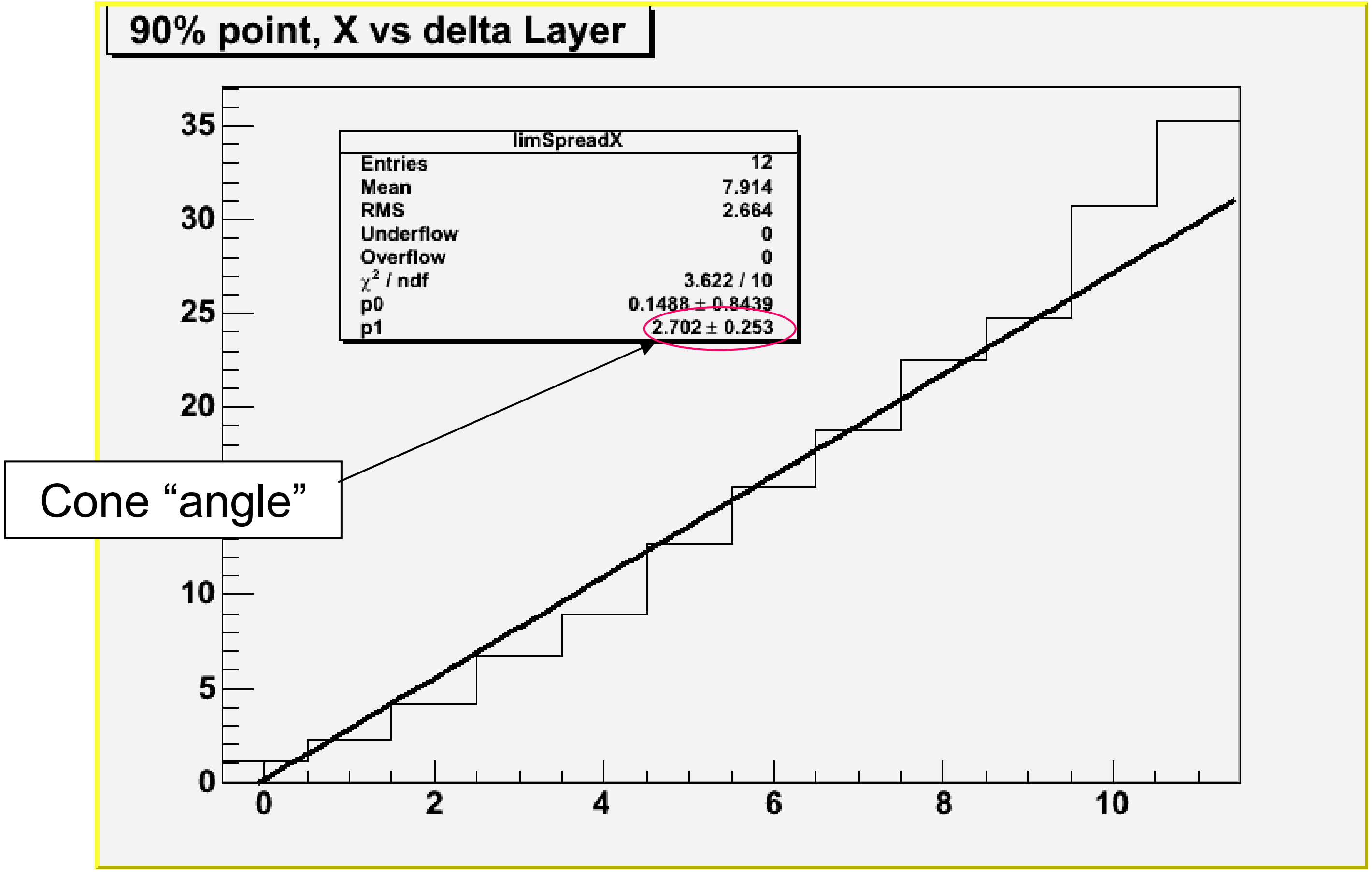
- Energies: 30, 50, 100, 200 MeV, 1, 3, 10 GeV
- Angles: Theta =0, 30, 45, 55º, Phi = 0º
- Histogram the distance between track projection and clusters in each layer
- Find the 90% lower and upper point
- Compare X and Y

Some Plots for 1GeV 0º

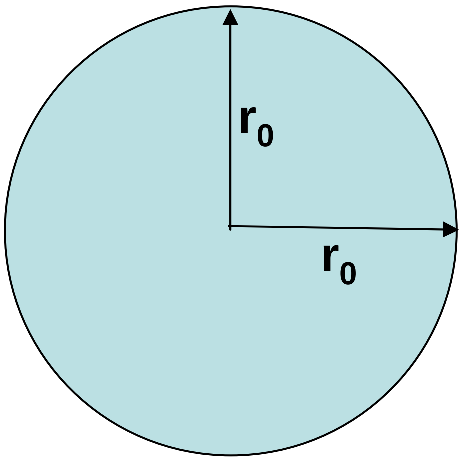


"Layer" means length of track in layers
(Only thin layers are used for plot)
Red arrows mark 90% region

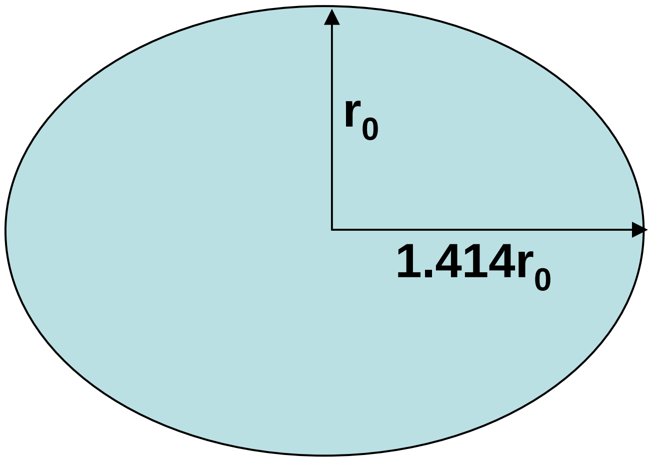
Summary Plot, 1 GeV, 0°



Footprint of Cone on Silicon, Theory



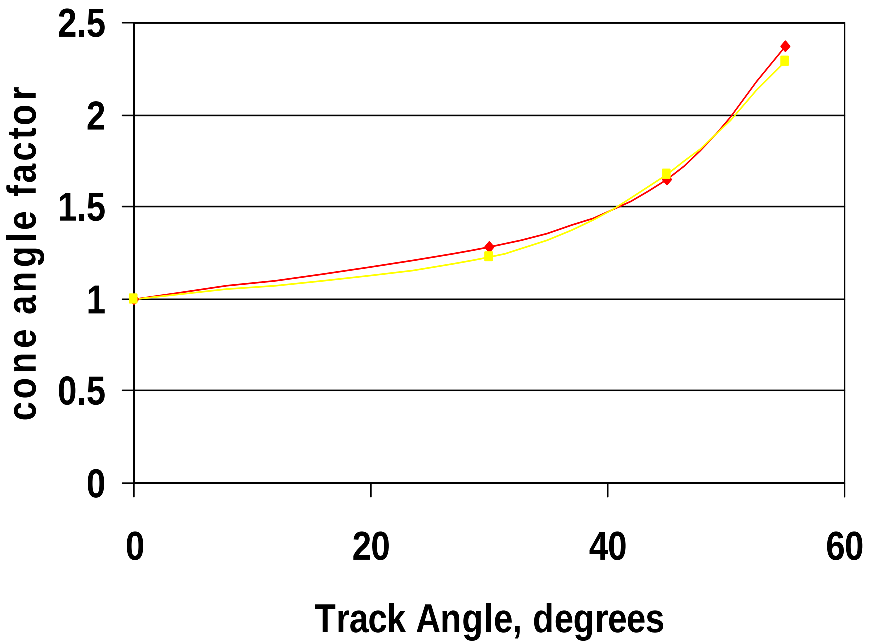
Track at 0º



Track at 45º

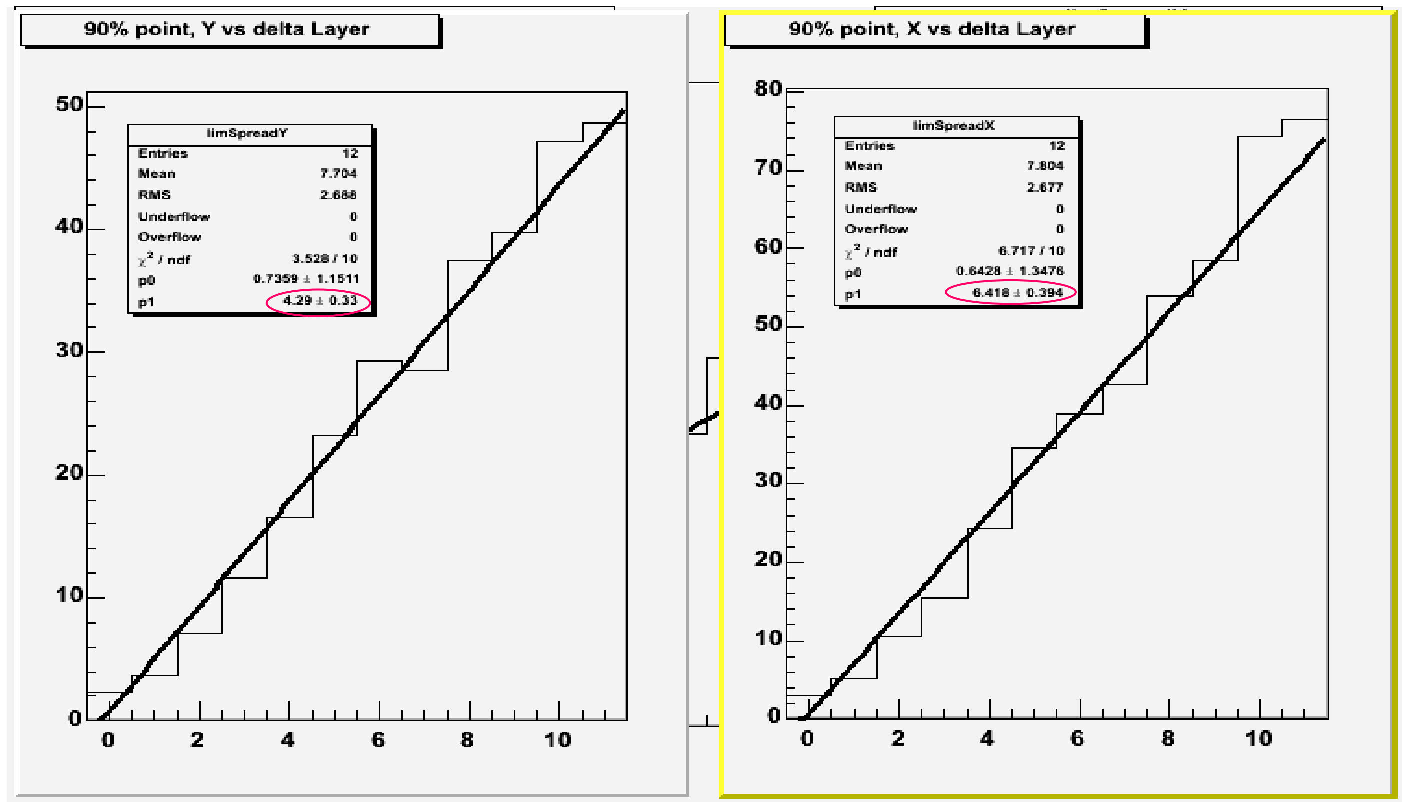
Major axis of ellipse grows as 1/cosθ
Minor axis stays constant

Angular Dependence, 1GeV (minor axis)



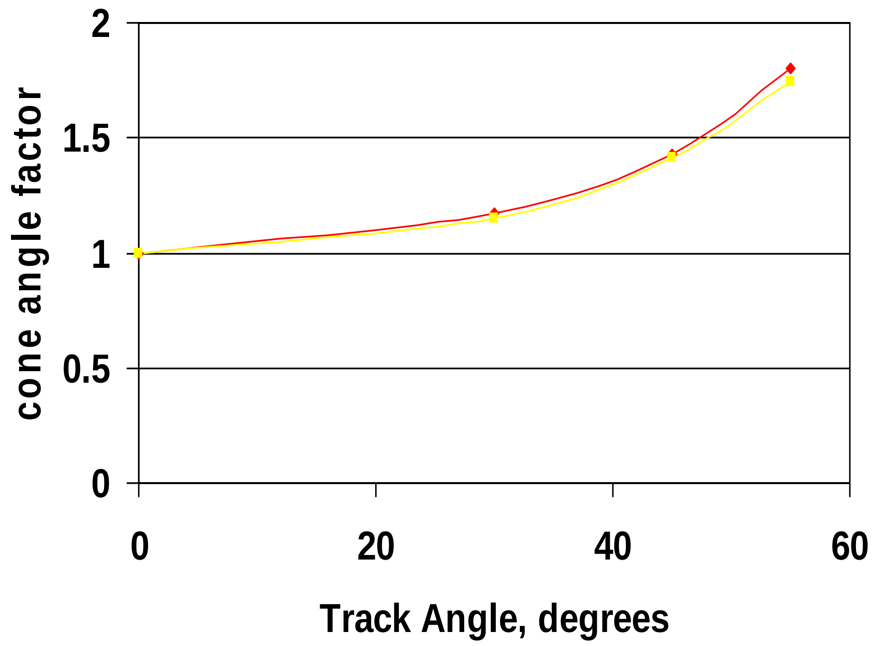
red line: data
yellow line: $(1/\cos\theta_{track})^{1.5}$

Footprint of Cone on Silicon, Experiment



By comparing X and Y, we can separate the effects of the footprint. Note that the X projection is wider, as expected.

Footprint Factor



red line: data

yellow line: $1/\cos\theta_{track}$

Angular dependence

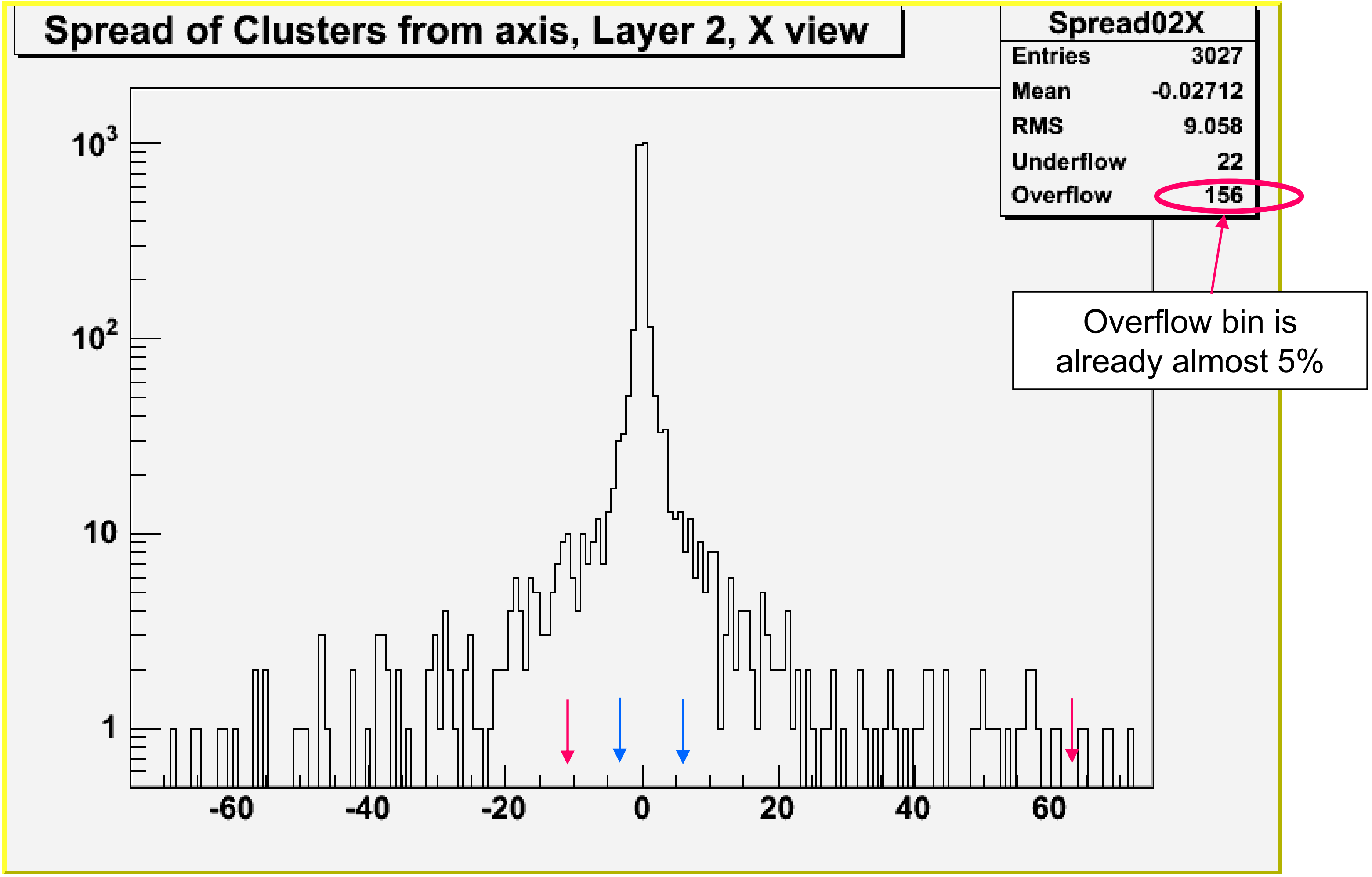
Cone angle goes like $(1/\cos\theta_{track})^{2.5}$

This is "obvious":

- 1 power from the track length
- ½ power from sqrt(rad. length)
- 1 power from the footprint of the ellipse
  - in general, a different footprint in x and y directions.

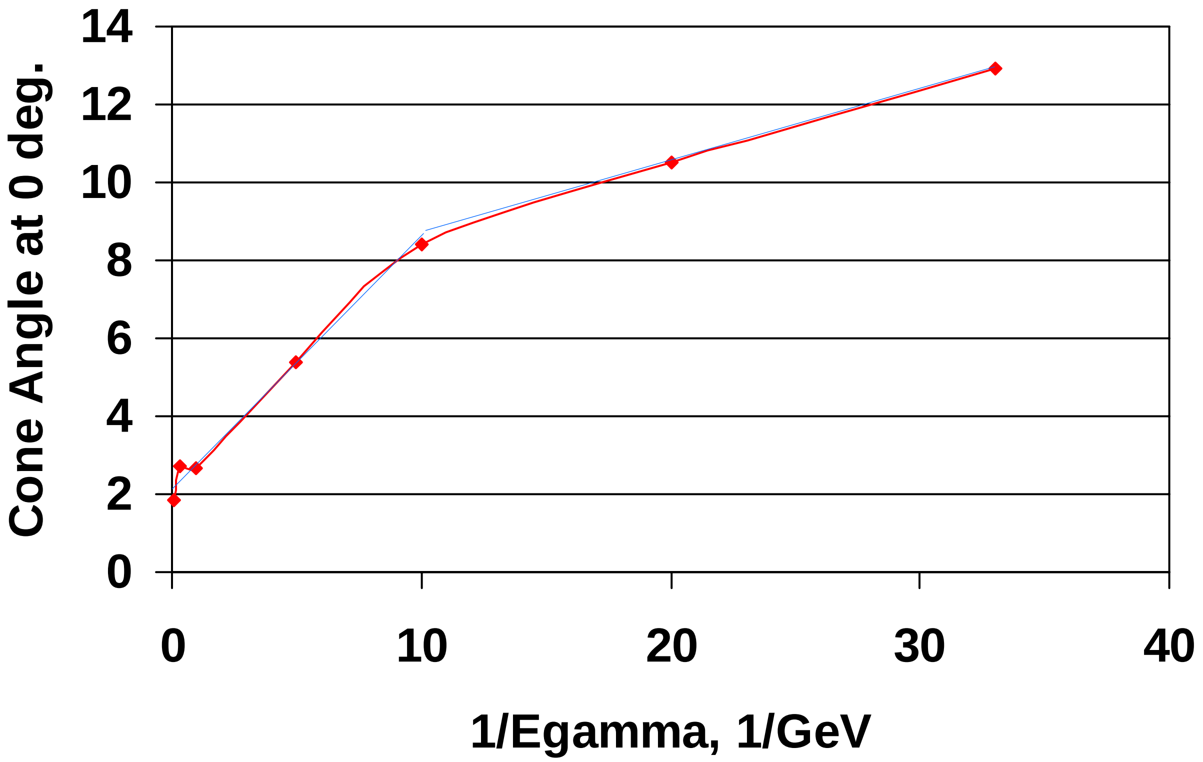
Power softens to ~2.0 at energies below 200 MeV, but there's probably no harm in using the same value everywhere, since that will only make the cone a bit larger than it needs to be at these energies.

Effect at Higher Energy, 10 GeV, 45º



At 10 GeV, 90% is too wide (too much tail), so use 80%

Normalization vs Energy



Linear in 1/E at higher energies, but with an offset.
Saturates at low energies.
Blue line is a simple model of the data