

Status of CDC Stereo/Axial configuration MC Study

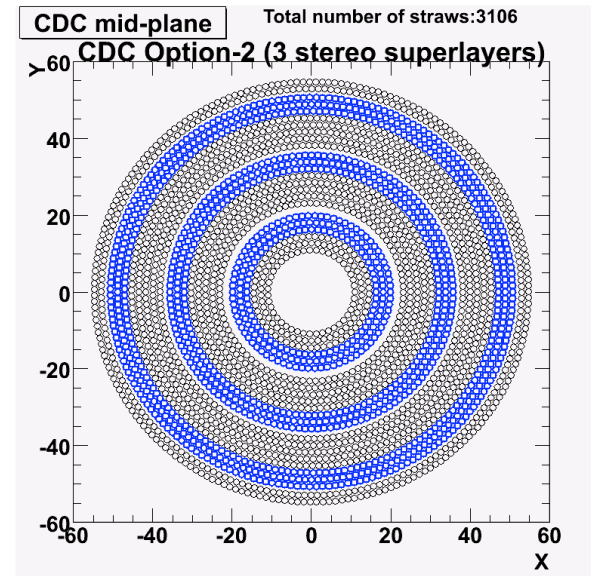
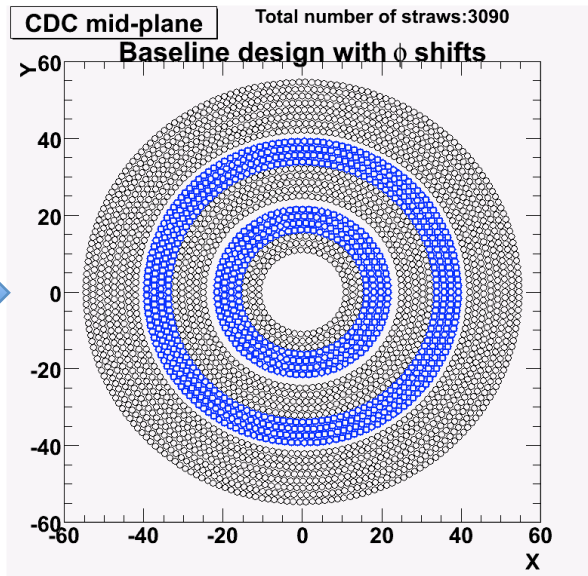
David Lawrence Jlab

August 25, 2008

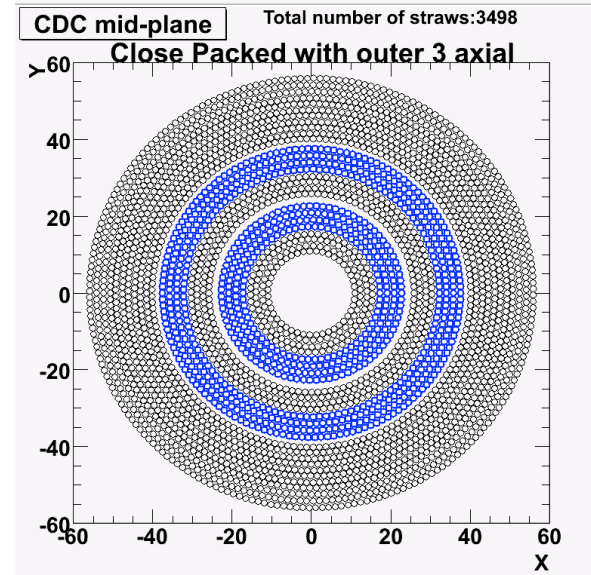
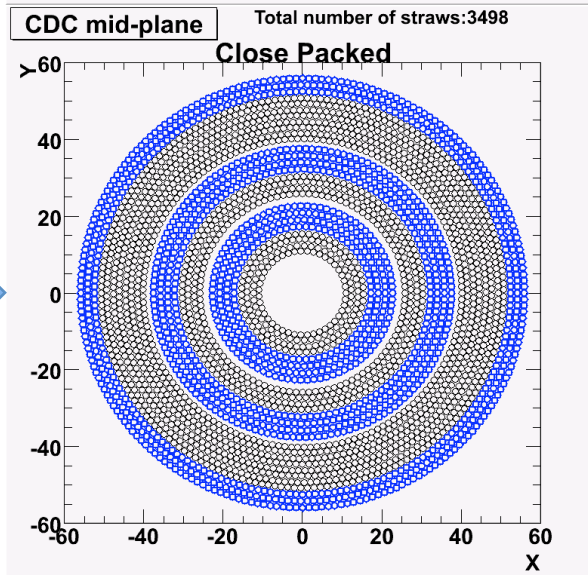
5 CDC configurations studied

(yes, only 4 are shown)

24 layers

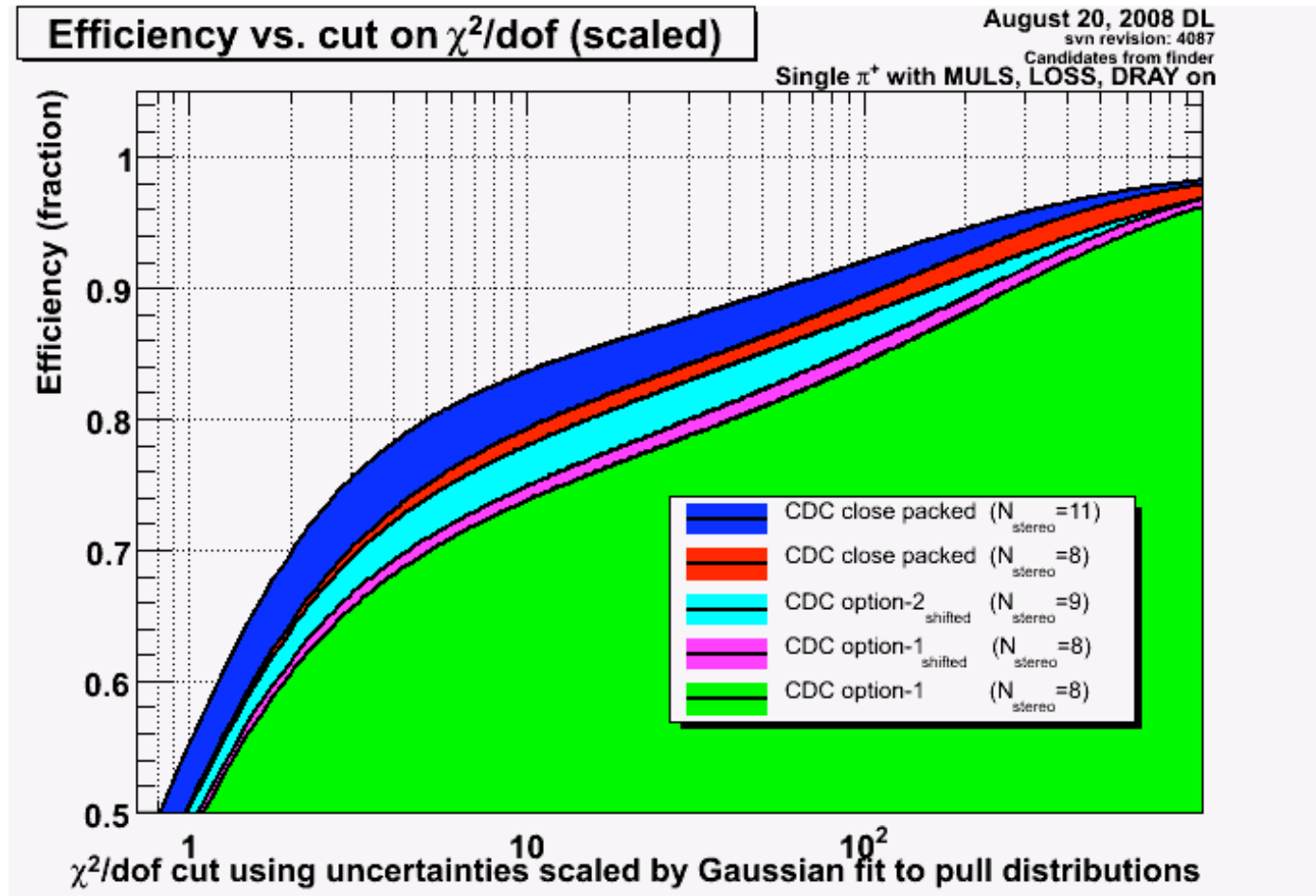


27 layers



Tracking Efficiency for Several CDC Configurations

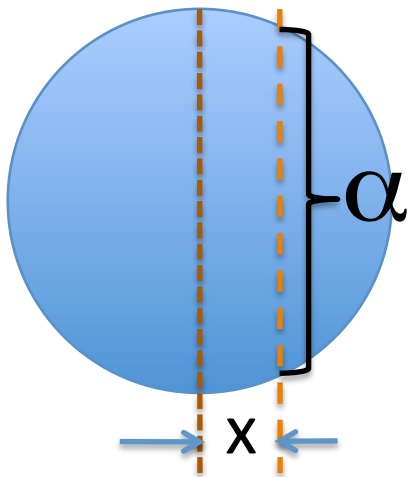
Phasespace: range



Expected energy loss in CDC gas

	dE/dx (MeV/g cm ²)	ρ (g/l)	dE/dx (keV/cm)
Ar (85%)	1.519	1.622	2.464
CO ₂ (15%)	1.819	1.842	3.351

- Total for CDC gas dE/dx = 2.597 keV/cm



$$\langle \alpha \rangle = \frac{1}{r_o} \int_0^{r_o} \alpha(x) dx$$

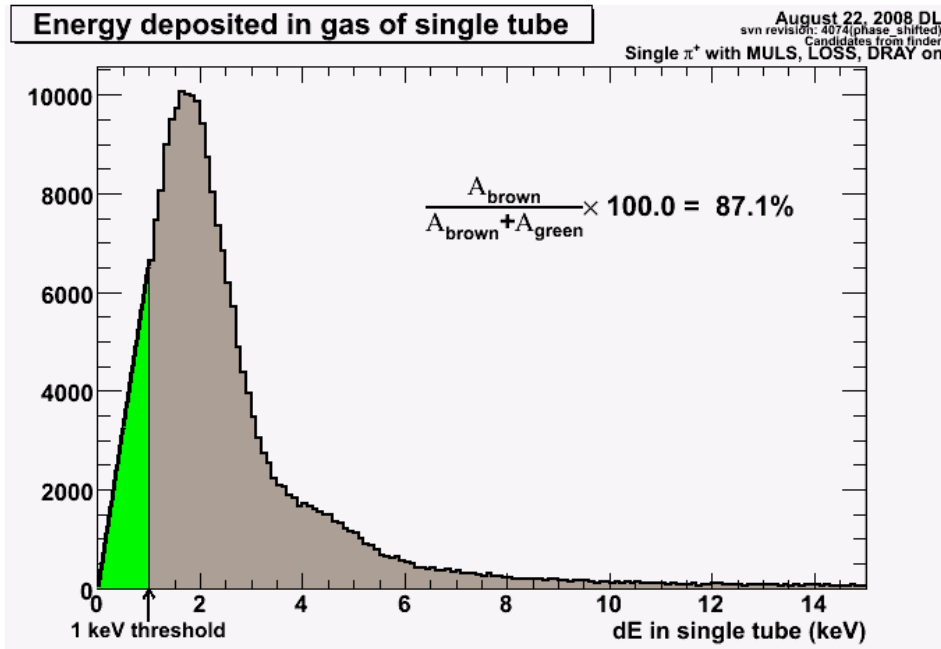
$$= 1.26 \text{ cm}$$

➔ **3.27 keV**

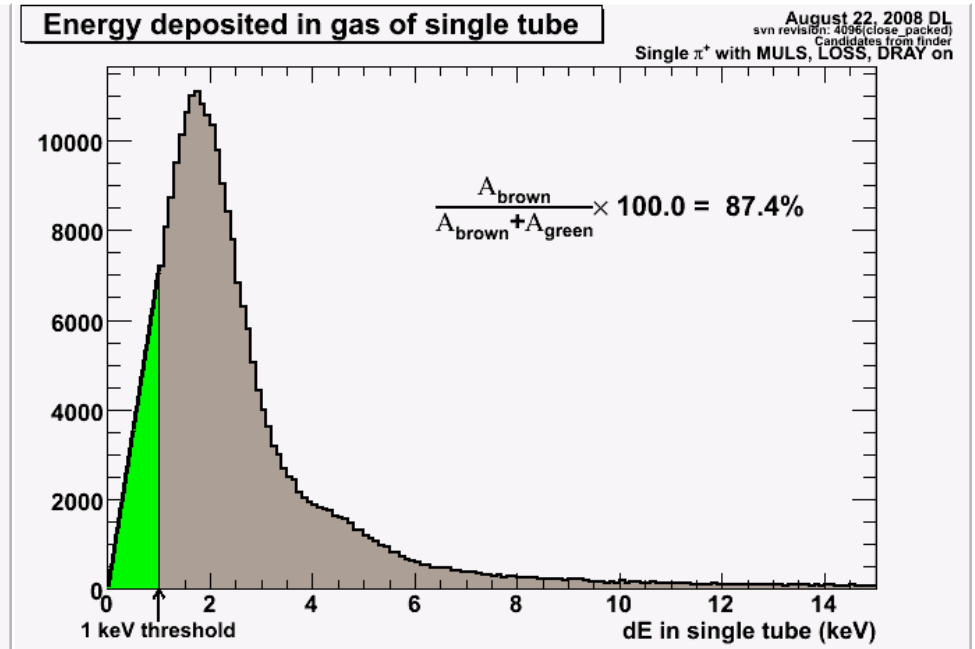
dE in single tube reported by *hdgeant*

Phasespace: 1 GeV/c ; 90°

Nominal Geometry



Close Packed

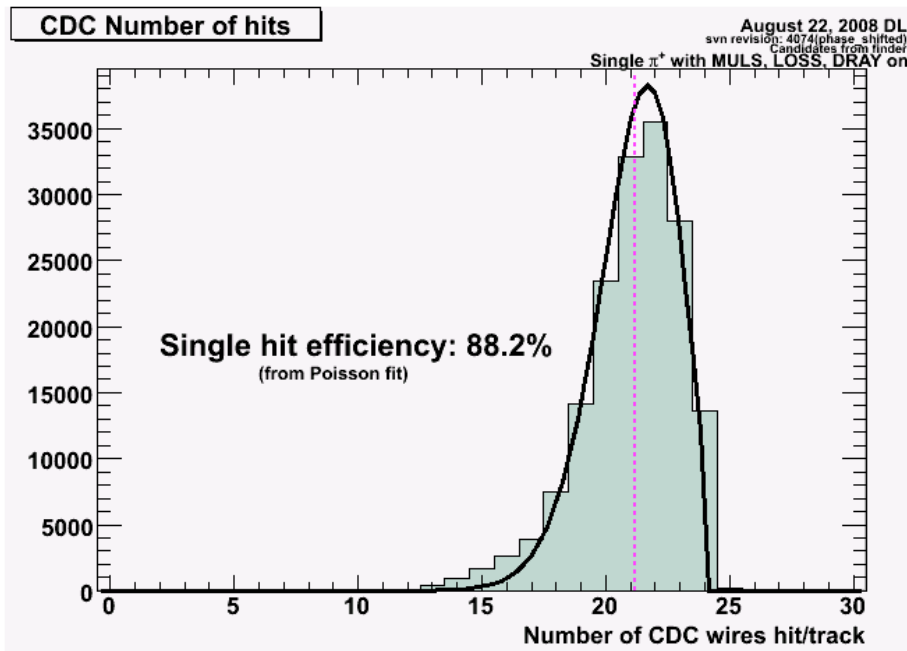


Green regions are estimates of hits discarded by dE threshold. Estimate is made by straight line from 0,0 to 1keV point. This likely overestimates the below-threshold contribution.

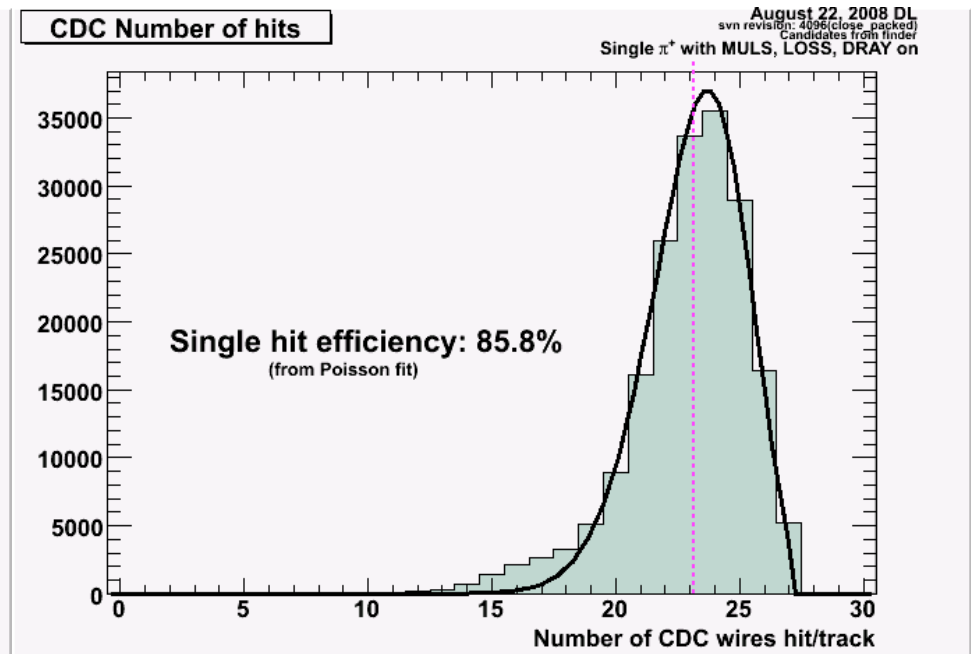
CDC hits per track

Phasespace: range

Nominal Geometry



Close Packed



The number of *missing* hits was fit to a Poisson and the mean taken as the average number of missed hits.

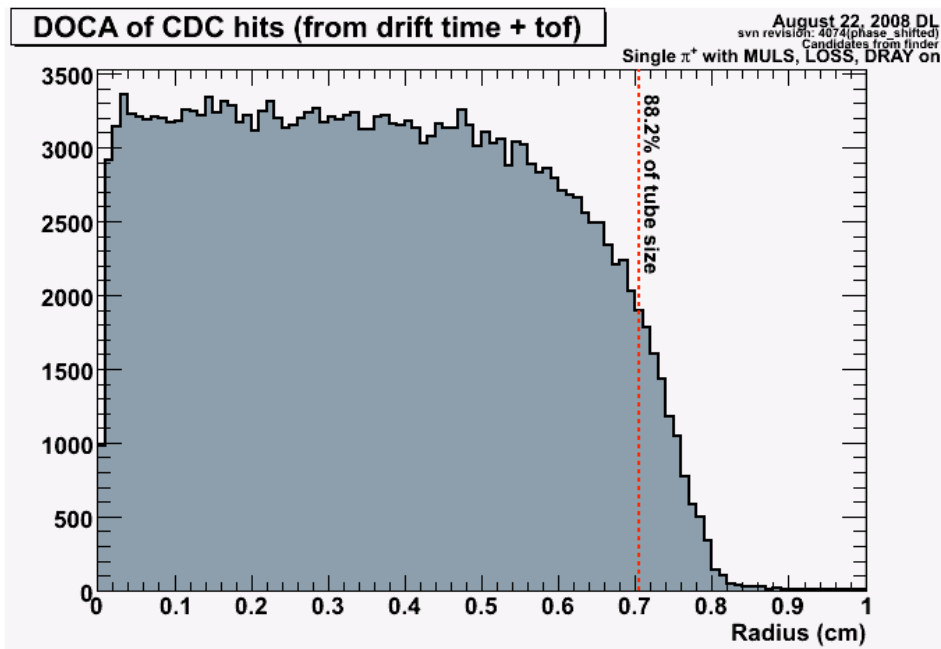
The *Nominal Geometry* is consistent with the single hit efficiency derived from the dE plots.

The *Close Packed* geometry is consistent with ~9% inefficiency on average due to gaps in the “close-packed” axial layers.

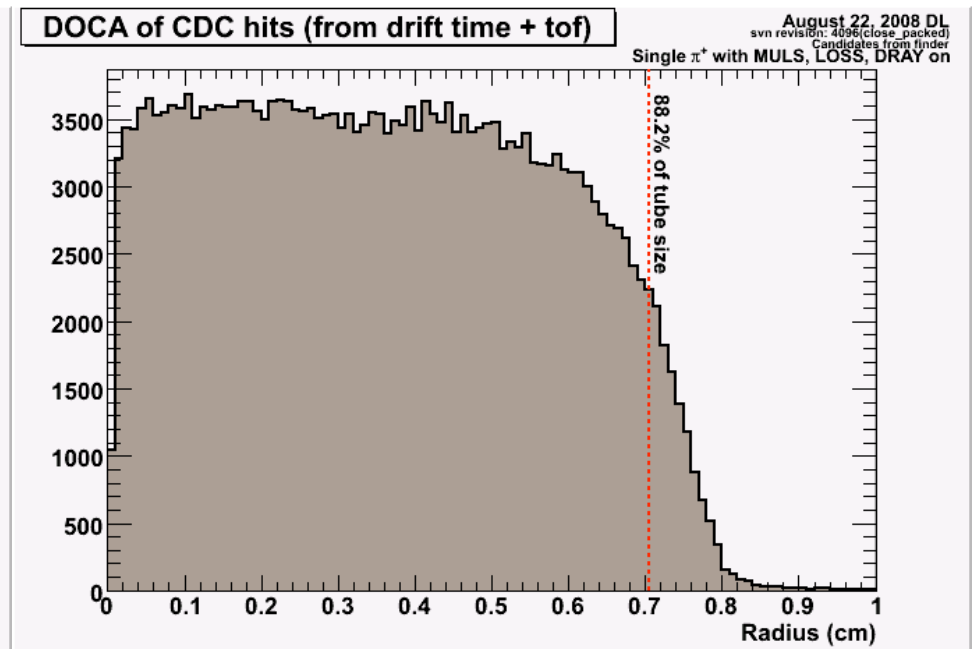
Distance of Closest Approach (DOCA) (calculated from $t_{\text{drift}} - \text{tof}$)

Phasespace: 1 GeV/c ; 90°

Nominal Geometry



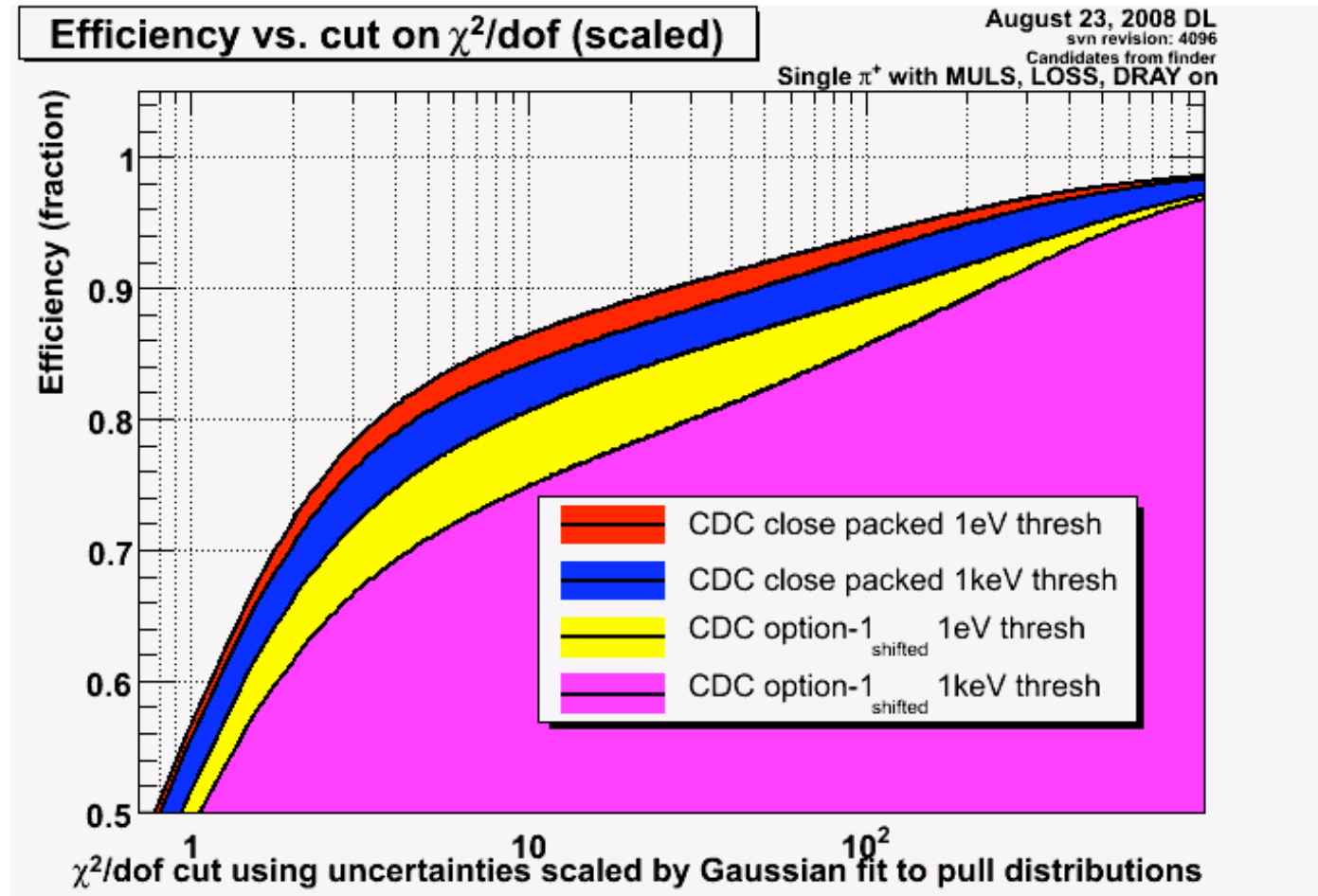
Close Packed



DOCA distributions seem consistent with the 88.2% single hit efficiency and cut on dE which corresponds to the outer part of the tube.

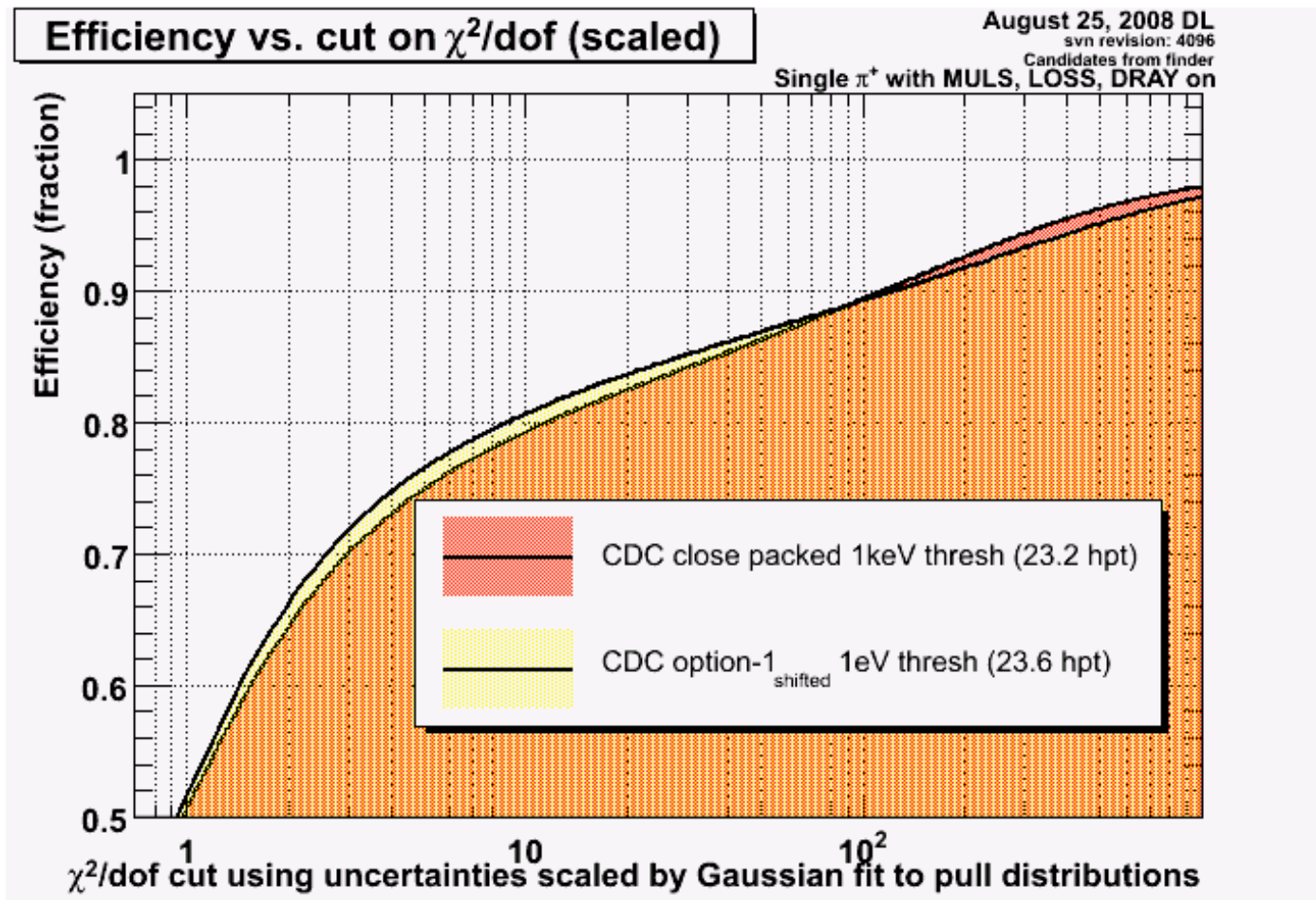
Tracking Efficiency with and without dE threshold

Phasespace: range



Close packing vs. extra layers

The low-threshold baseline design (shifted) has approximately the same number of hits per track as the close packed design with a high threshold. This gives a suggestion as to how much close packing buys vs. extra layers.



Summary

- 3 stereo superlayers improves tracking efficiency
- Additional layers improves tracking efficiency (we seem to be in a region of high sensitivity)
- Single hit efficiency due to 1keV threshold is ~88%. The energy distribution from *hdgeant* needs to be verified and then the threshold examined more closely.