CDC Simulation Studies

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Oct. 30, 2008

4 CDC Geometries Studied

These represent the axial/stereo configurations that will be studied via simulation. The orientation is listed from outermost layer (top) to innermost layer (bottom).

Relative ϕ-shifts between layers is implemented in all designs for axial wires. Stereo wires are also ϕ-shifted for geometries "C" and "D".

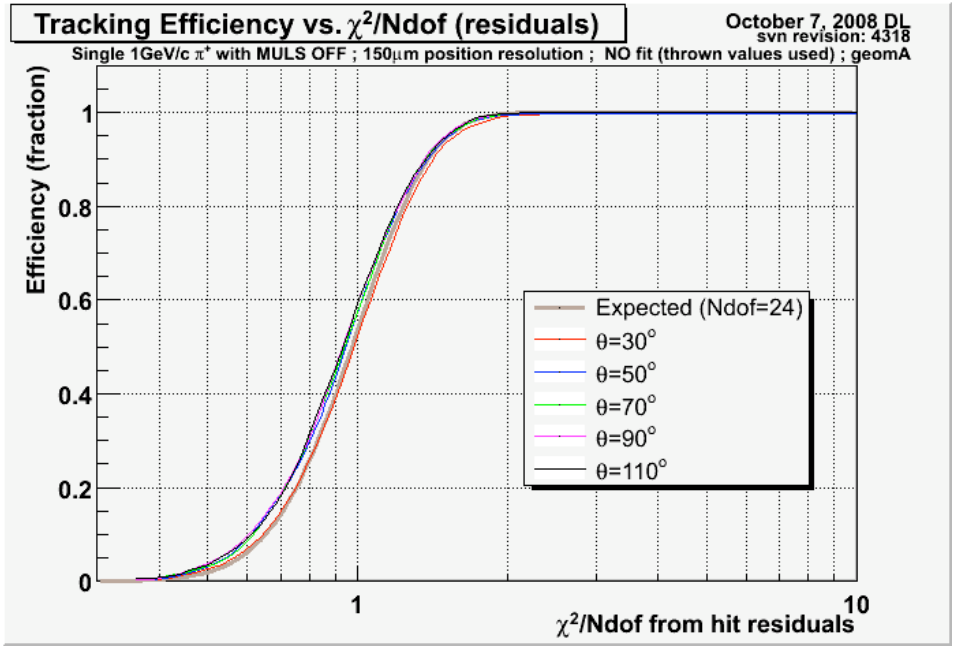
Geometry A
8 axial
2 stereo +6°
2 stereo -6°
5 axial
2 stereo +6°
2 stereo -6°
3 axial

Geometry B
8 axial
4 stereo +6°
5 axial
4 stereo -6°
3 axial

Geometry C
4 axial
4 stereo +6°
4 stereo -6°
4 axial
4 stereo +6°
4 stereo -6°
4 axial

Geometry D*
3 stereo -6°
8 axial
4 stereo +6°
4 axial
4 stereo -6°
4 axial

Consistency Checking



4k single π^+ 1GeV/c events were thrown at 5 discrete angles ranging from 30° to 110°. Multiple scattering etc. was turned OFF

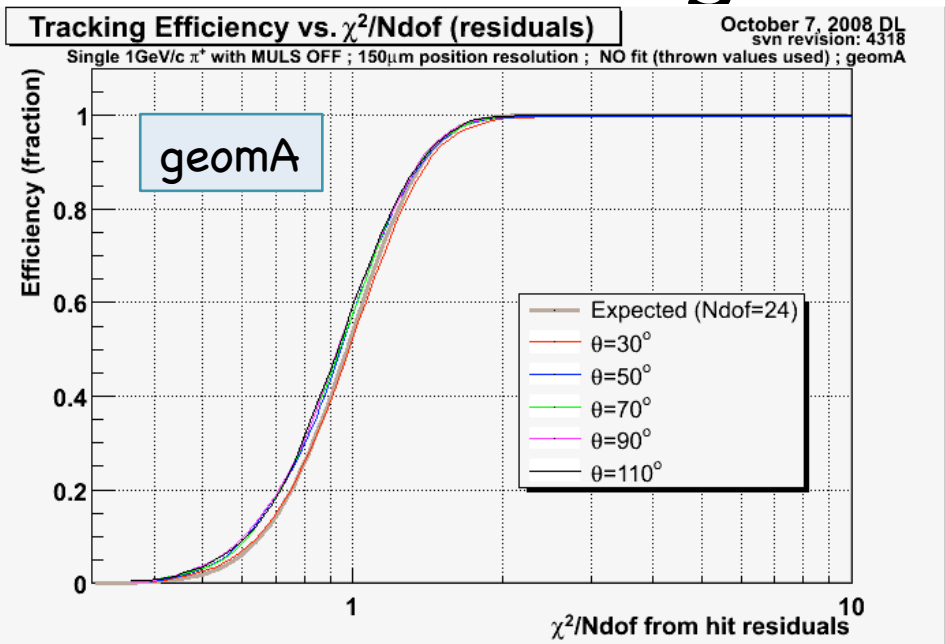
Drift times were smeared via Gaussian to give them a position resolution of 150 μm

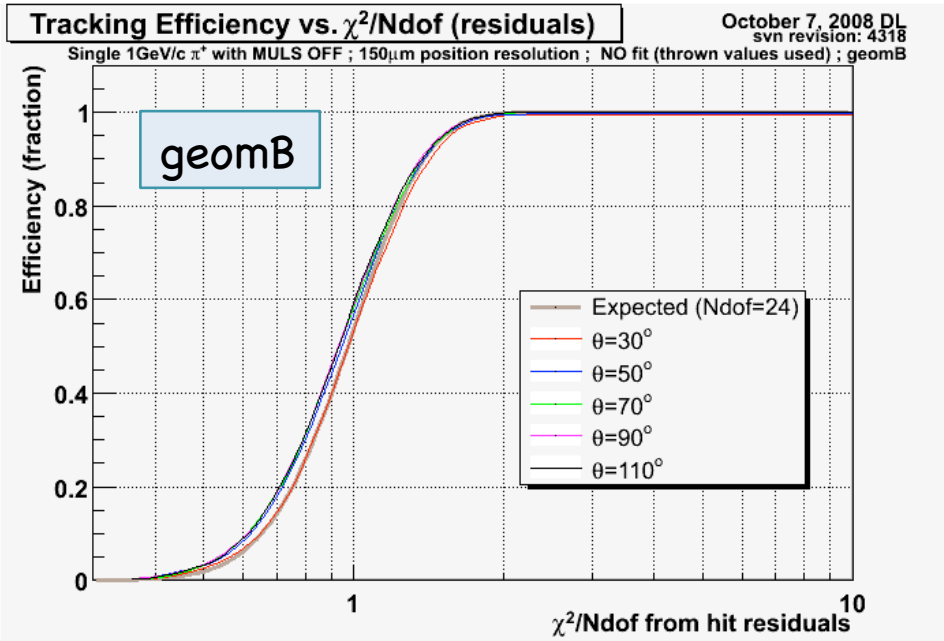
A tracking χ^2 was formed from the hit residuals using the known 150 μm resolution

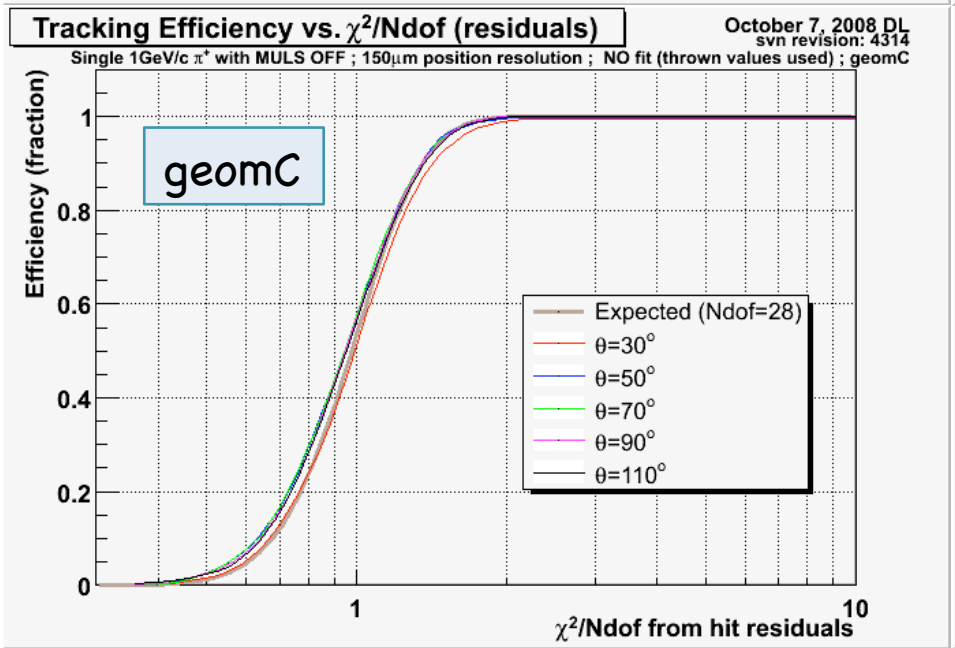
The χ^2 distribution was integrated and compared to the known cumulative χ^2 function

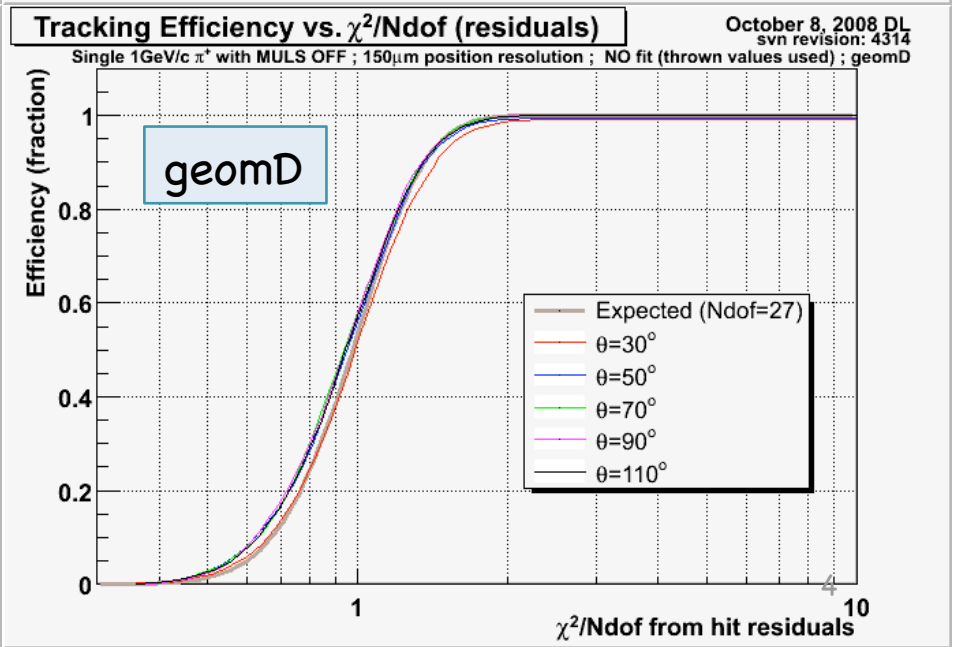
To check consistency between the simulation and reconstruction geometries as well as transport through the magnetic field etc. , thrown values were used

Checking All 4 Geometries

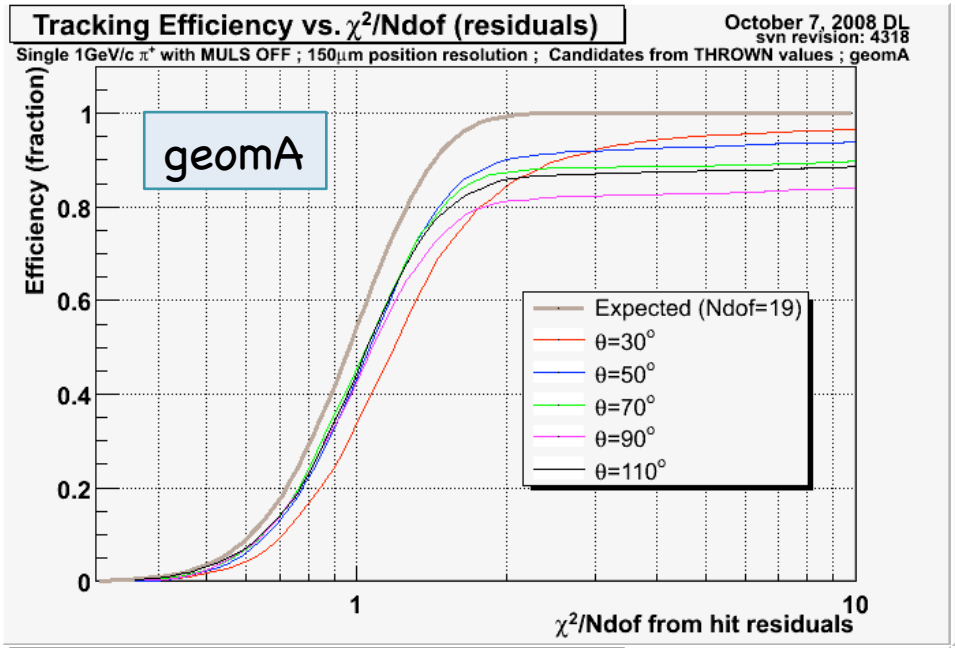


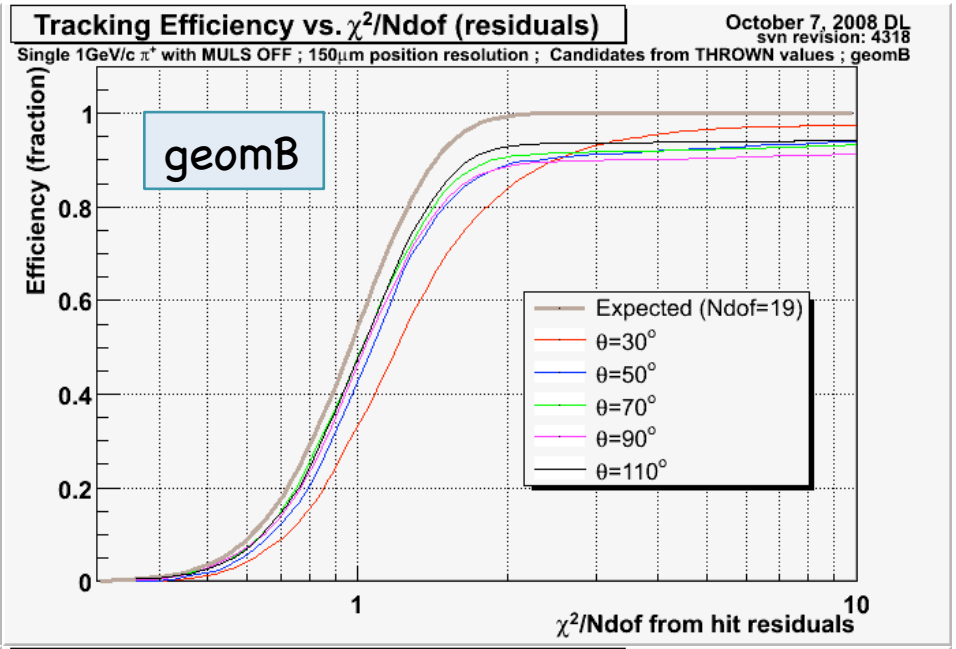


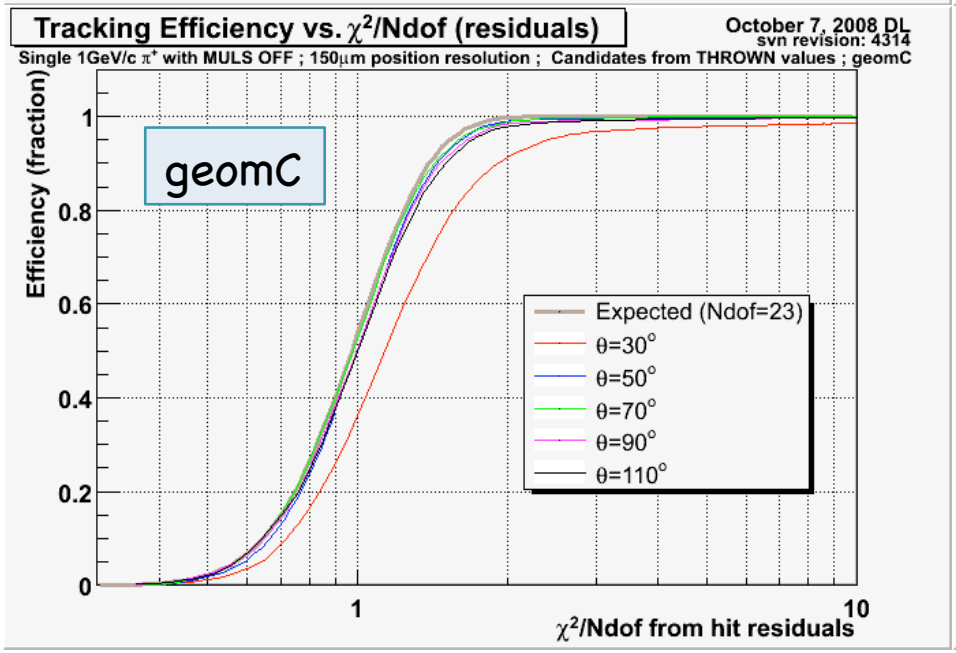


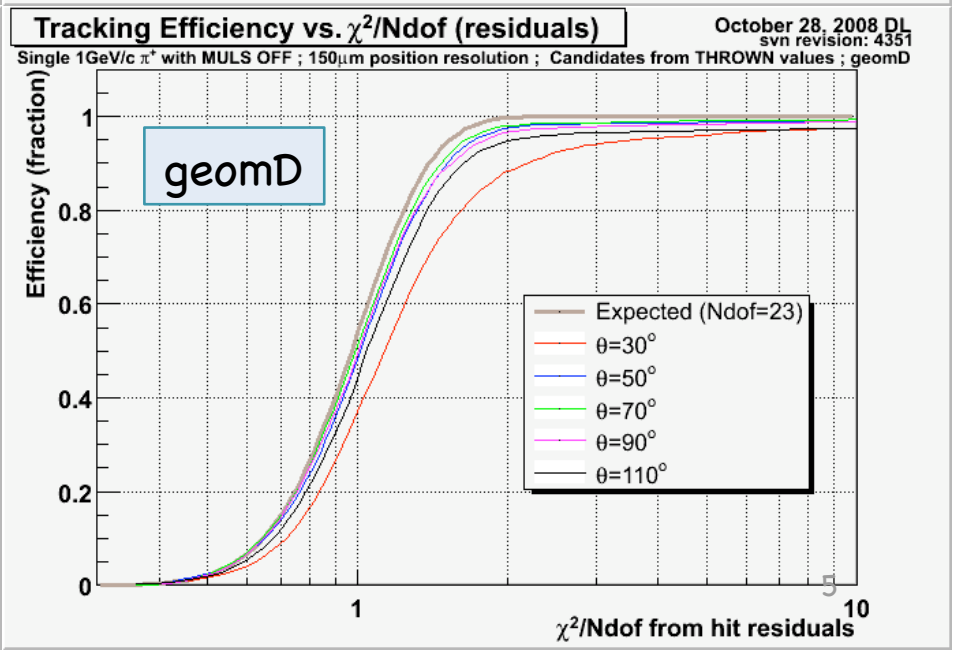


Wire and time -based fits starting from the right answer

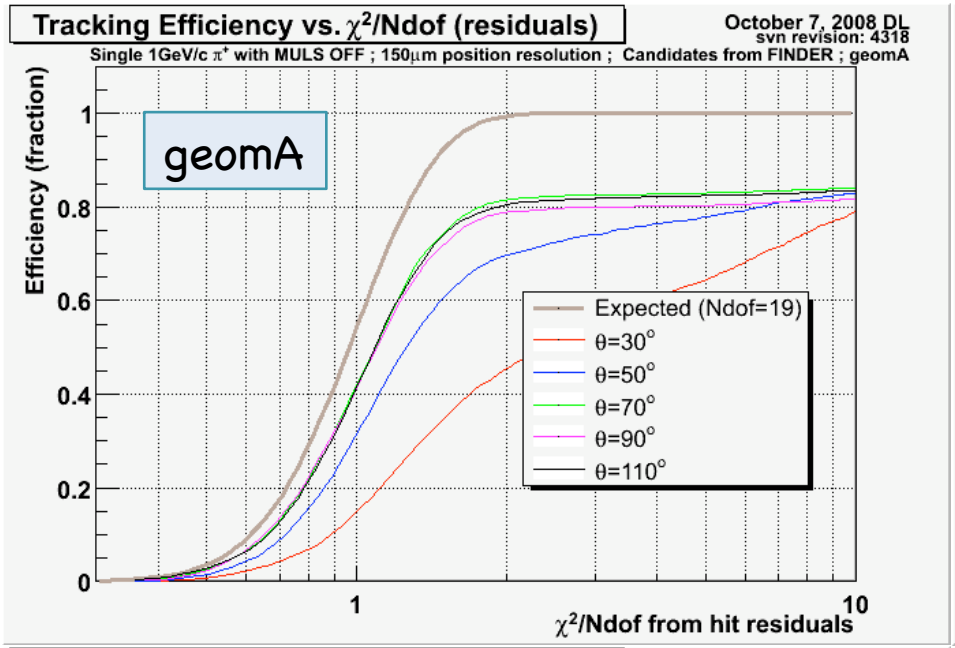


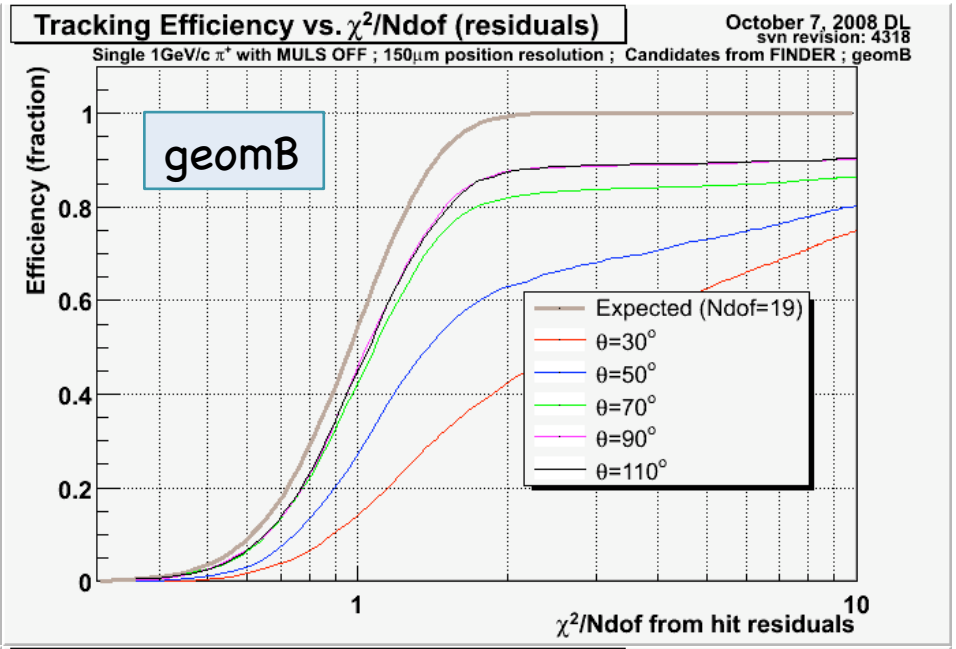


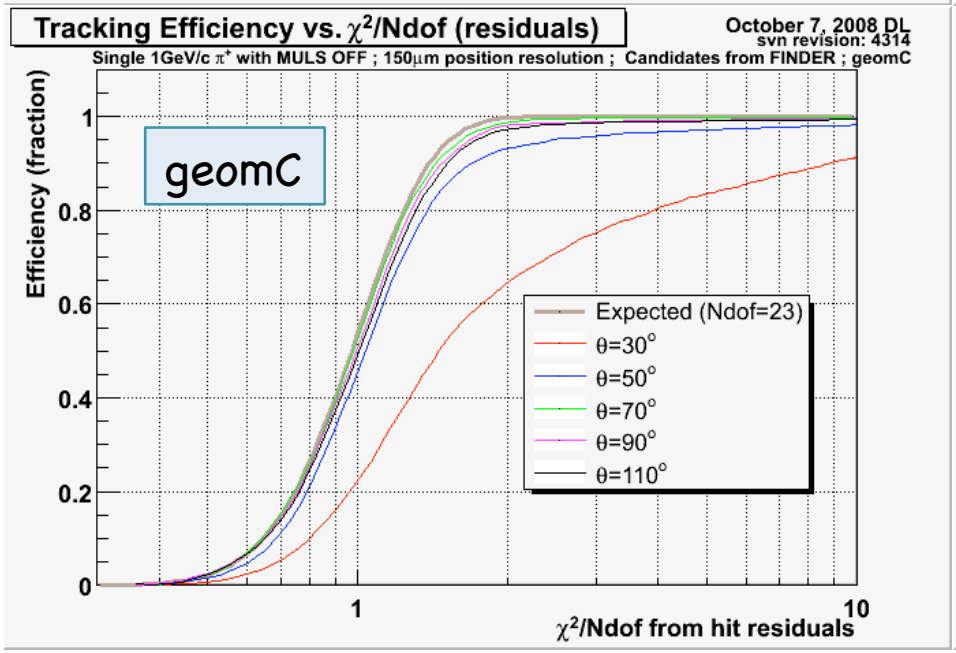


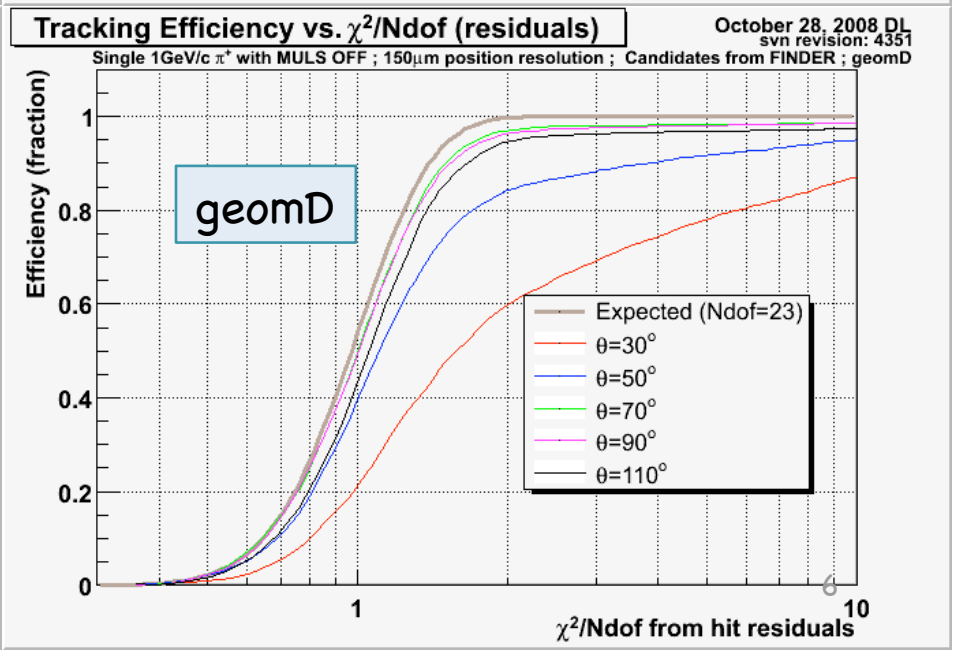


Full Reconstruction





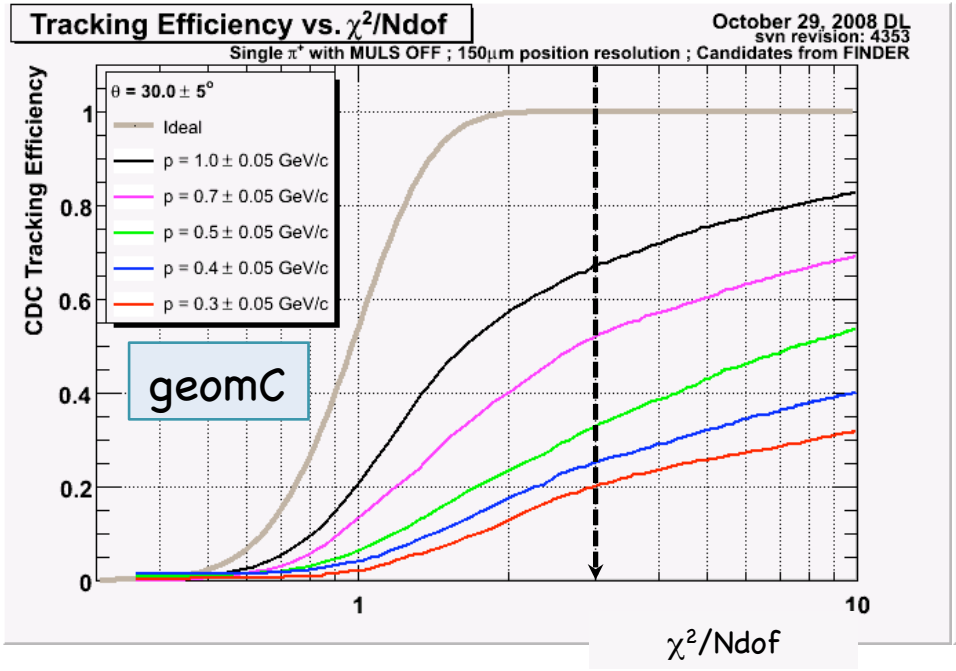




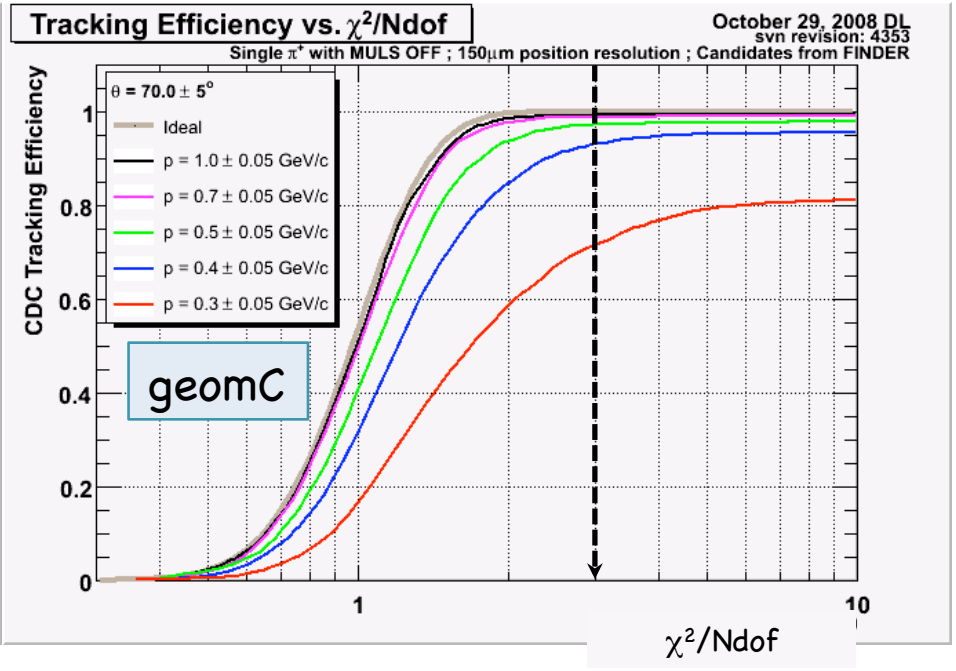
Tracking Efficiency vs. χ^2/Ndof

These two plots show that the tracking efficiency is a strong function of both polar angle and momentum. Plots like these were made for several values of θ and the efficiencies at χ^2/Ndof =3 were plotted vs. momentum (shown on next slide).

30°



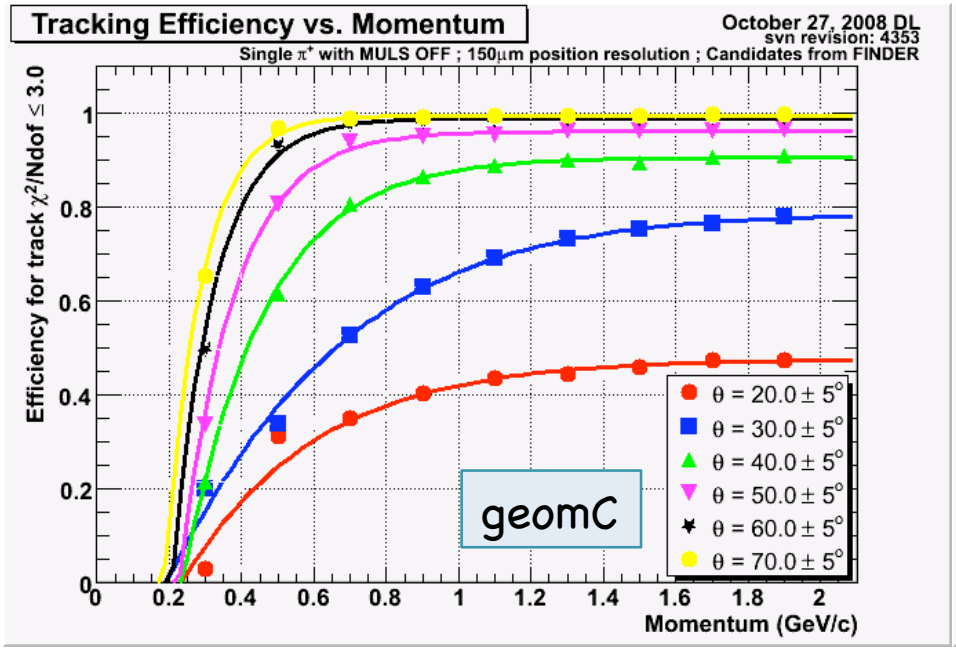
70°

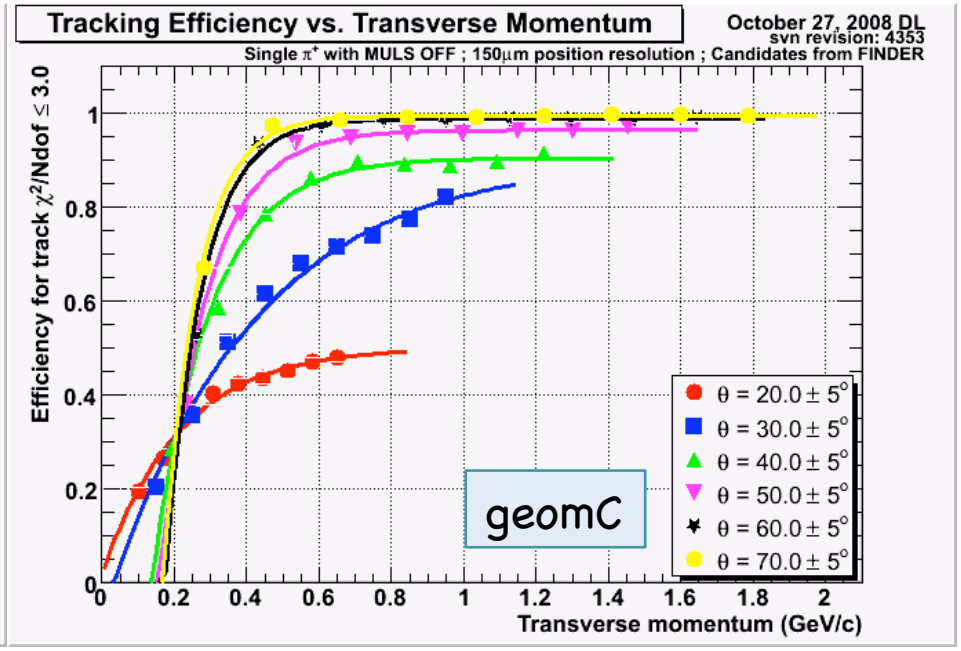


Tracking Efficiency

These plots show a more complete view of the efficiency throughout the expected phase space.

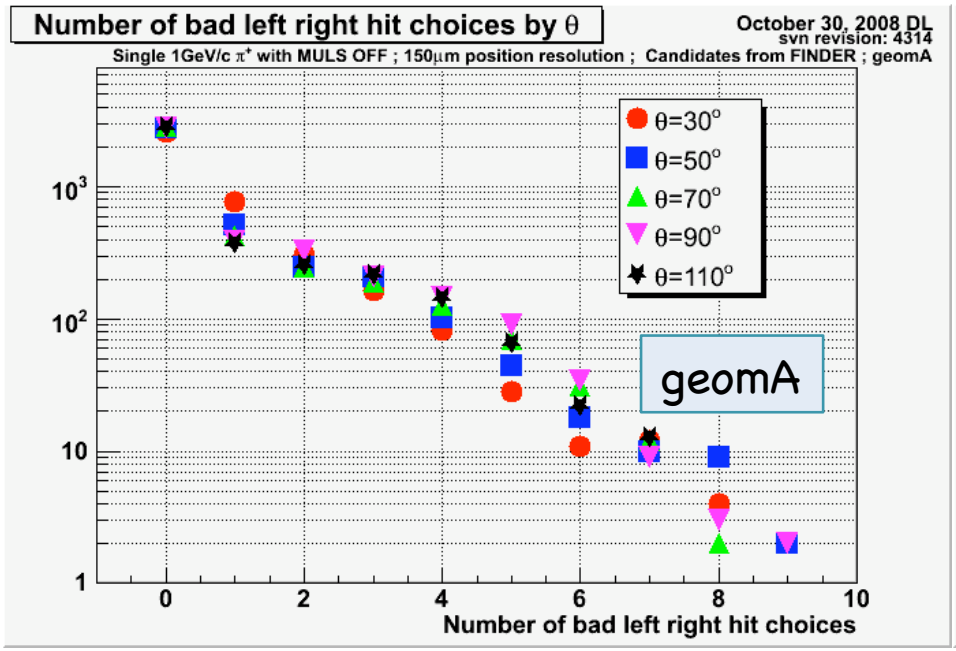
Fitting was done with the "ALT1" global fitter which included a wire-based pass and no special treatment for selecting left/right solutions.

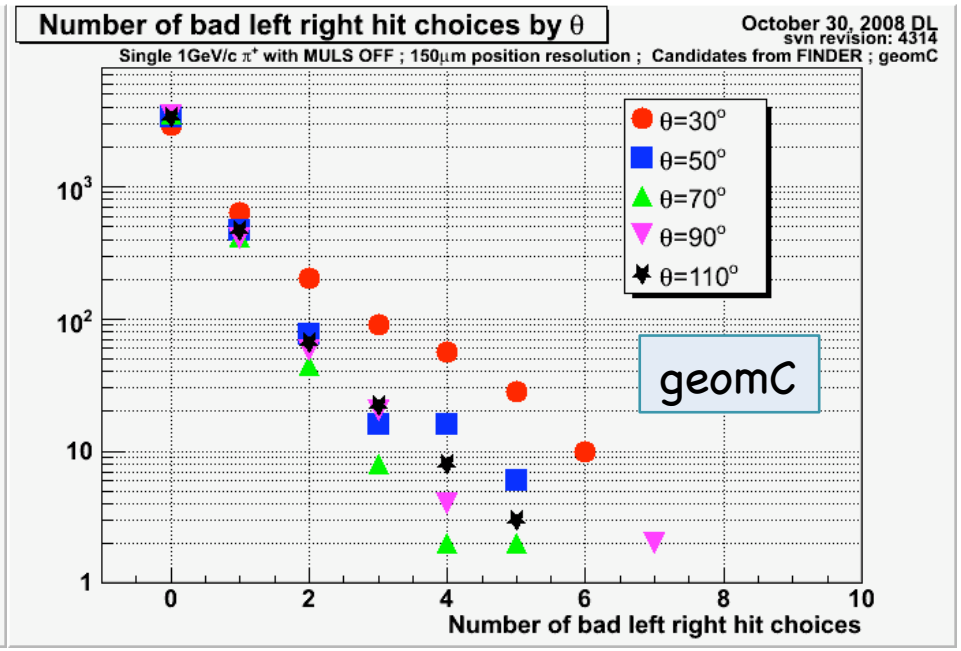




Number of bad left-right choices

These plots show that the number of incorrect left-right assignments for geomC is significantly less than for geomA, but that for 30 degrees, it is still an issue.

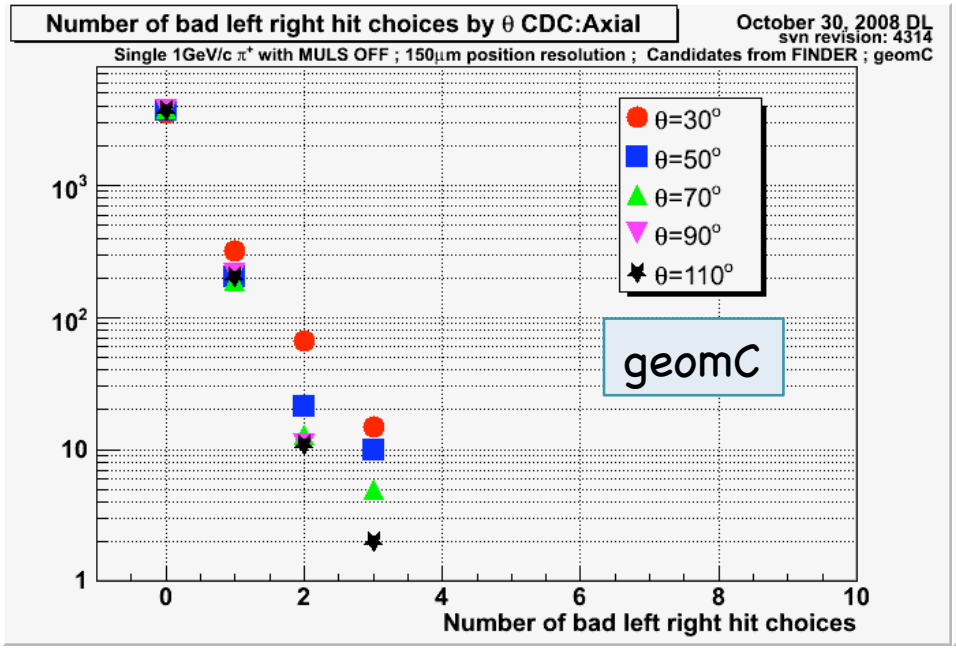




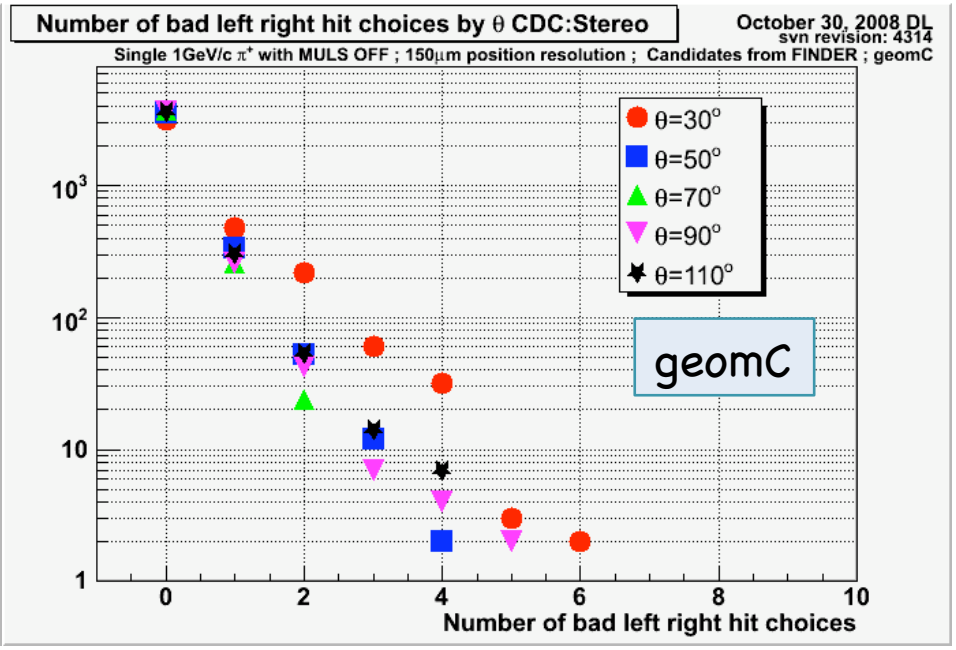
Bad L-R choices by axial and stereo

The number of incorrect left-right choices is increased at 30° for both axial and stereo layers, though slightly worse for the stereos. This, however, is just a symptom of the actual problem…

CDC Axial Wires

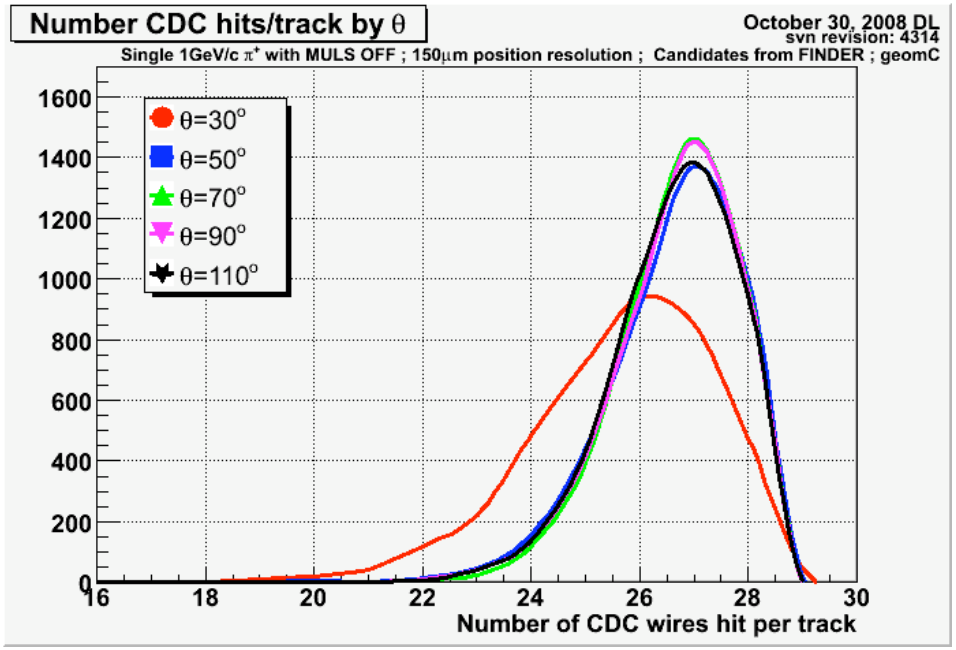


CDC Stereo Wires



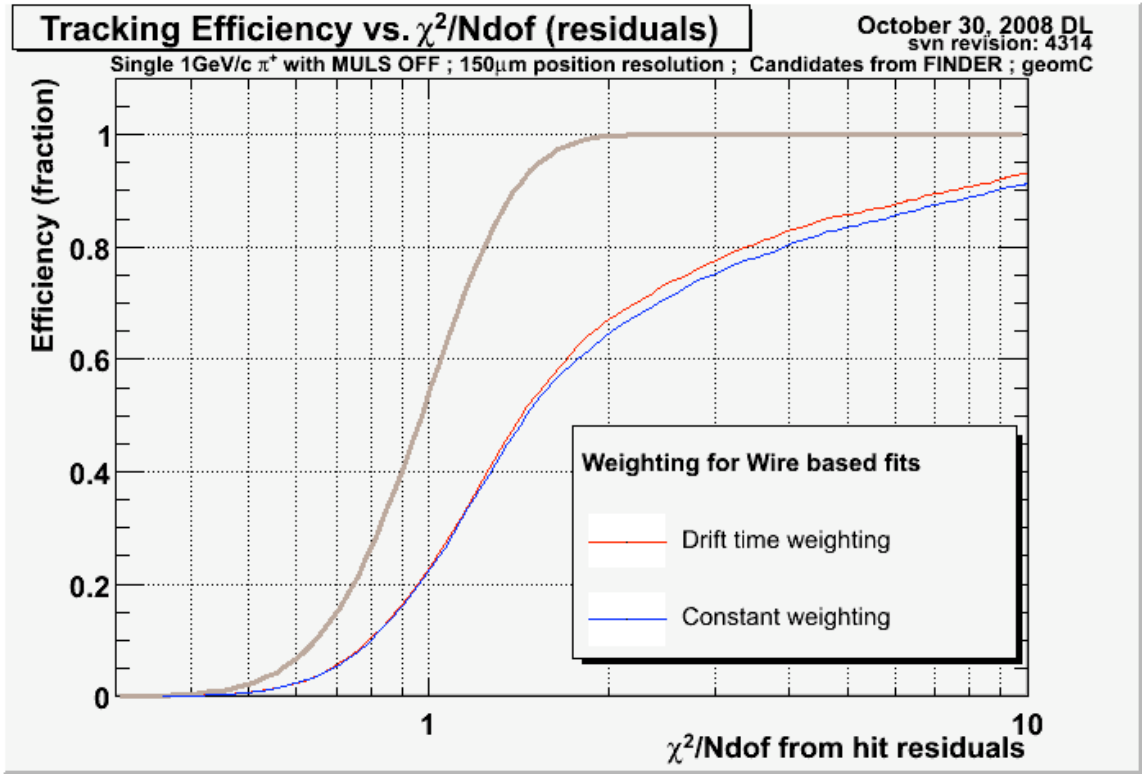
Number of CDC hits/track

The total number of CDC hits per track is less for 30^{o} on average than for higher angles. This is probably due to the fact that the stereo tubes extend further from the beamline at the ends than the center, introducing additional gaps



Weighting for Wire based Fits

The weighting of the individual hits used in the wire-based fits has been constant up to now. In this plot, it is changed to be proportional to the drift time. The change was trivial in the code, costs no more in execution time, and gains a couple of percent in efficiency for 30^{o} tracks.



Summary

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