

CDC Simulation Studies

David Lawrence, JLab

Oct. 8, 2008

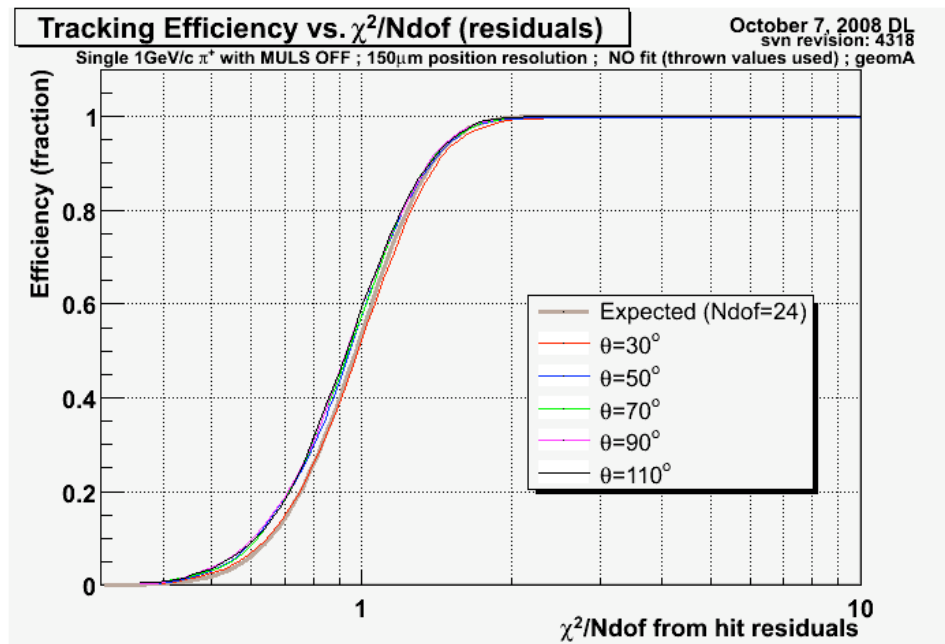
4 CDC Geometries Currently Under Study

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 | Geometry B | Geometry C | Geometry D* |
|---------------------|---------------------|---------------------|---------------------|
| 8 axial | 8 axial | 4 axial | 3 stereo -6° |
| 2 stereo $+6^\circ$ | 4 stereo $+6^\circ$ | 4 stereo $+6^\circ$ | 8 axial |
| 2 stereo -6° | 5 axial | 4 stereo -6° | 4 stereo $+6^\circ$ |
| 5 axial | 4 stereo -6° | 4 axial | 4 axial |
| 2 stereo $+6^\circ$ | 3 axial | 4 stereo $+6^\circ$ | 4 stereo -6° |
| 2 stereo -6° | | 4 stereo -6° | 4 axial |
| 3 axial | | 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

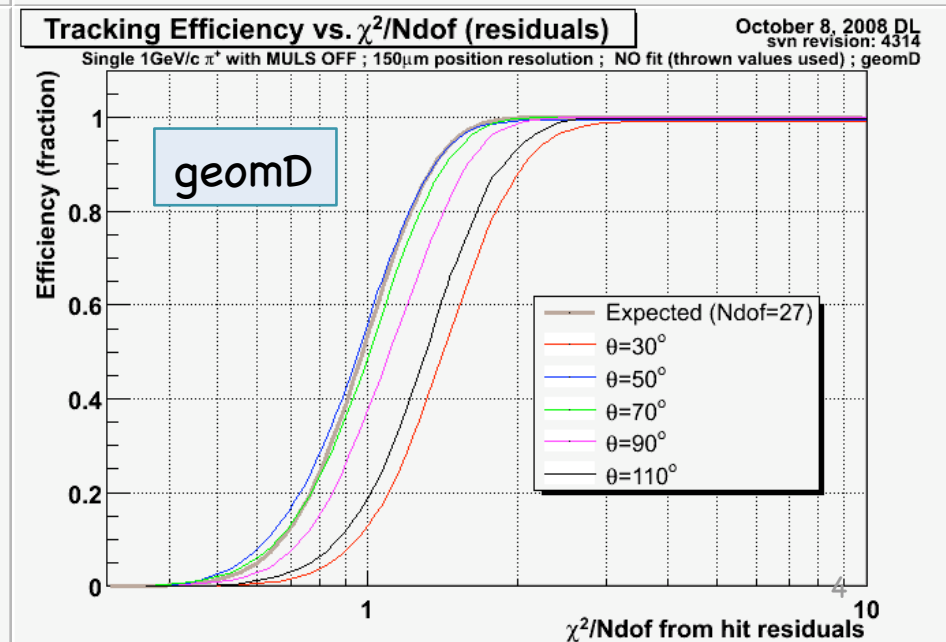
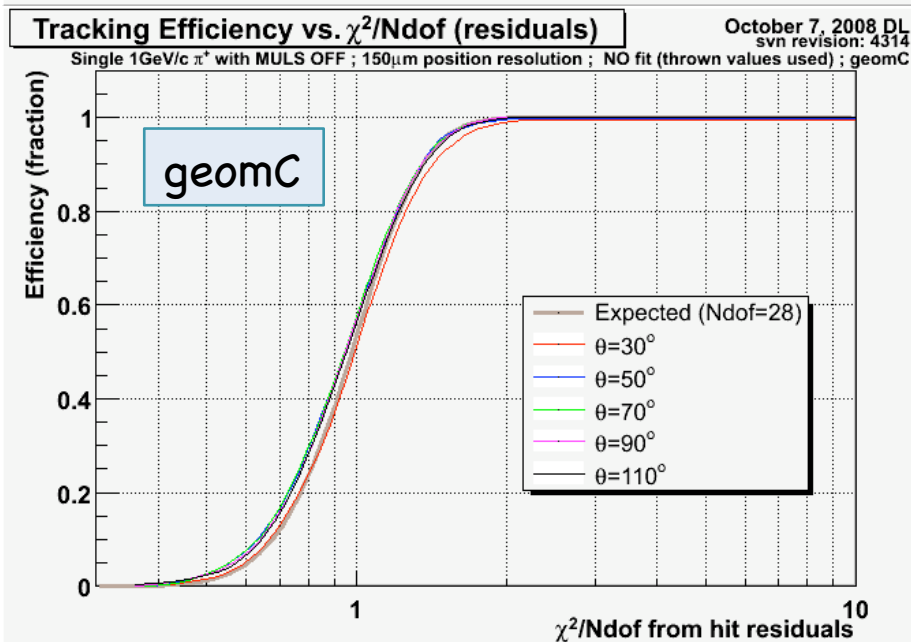
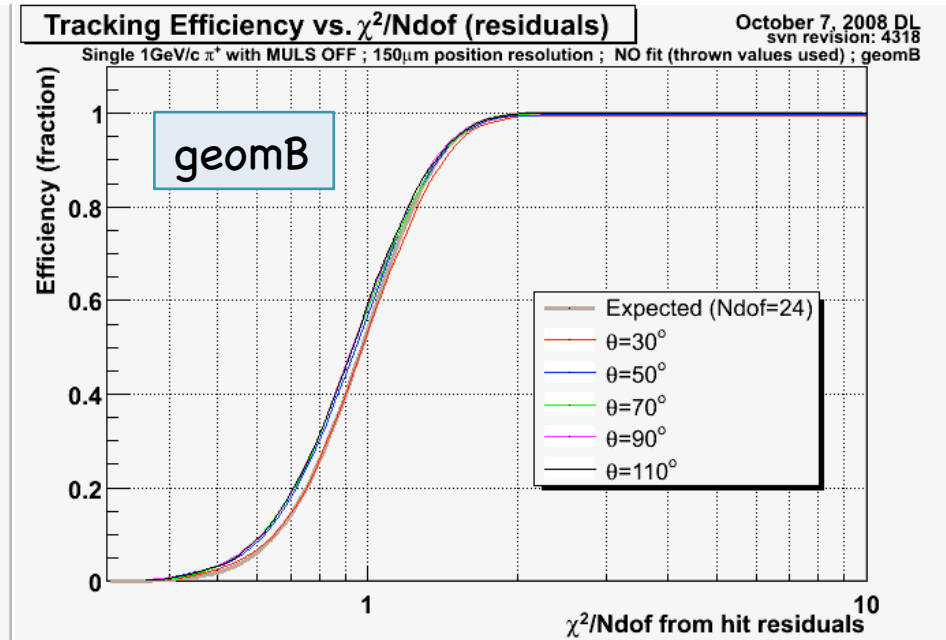
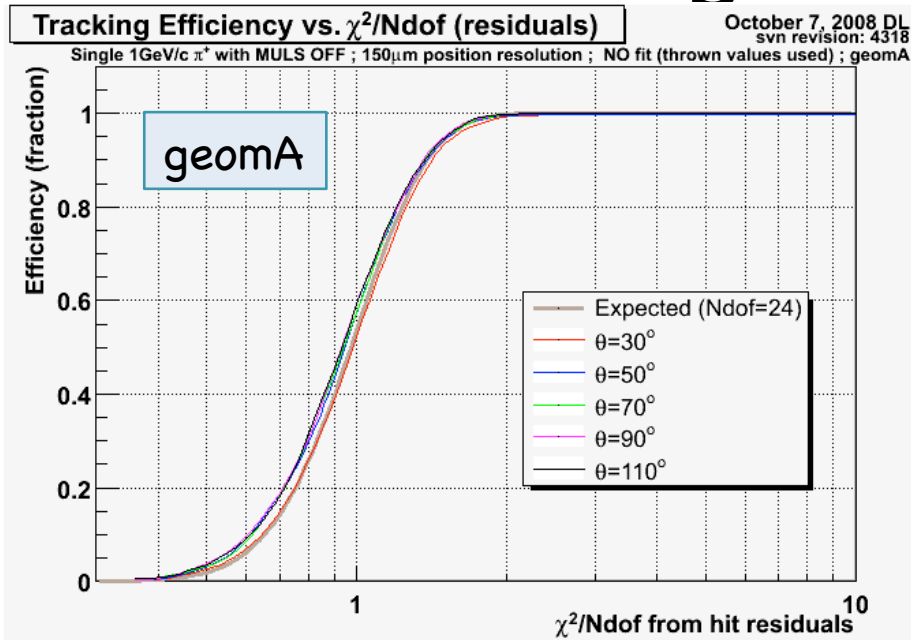
Drift times were smeared via Gaussian to give them a position resolution of 150 μm

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

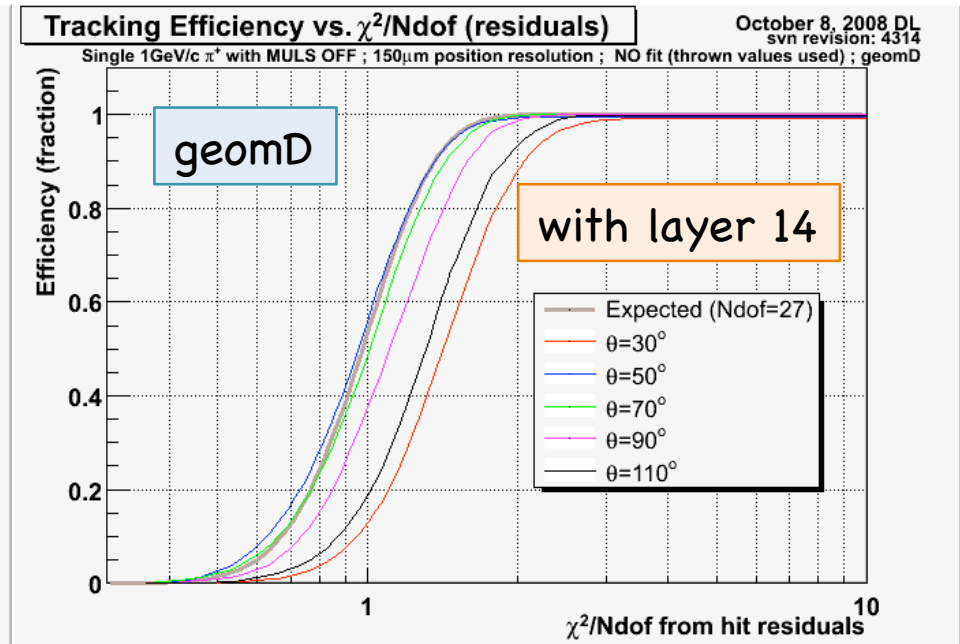
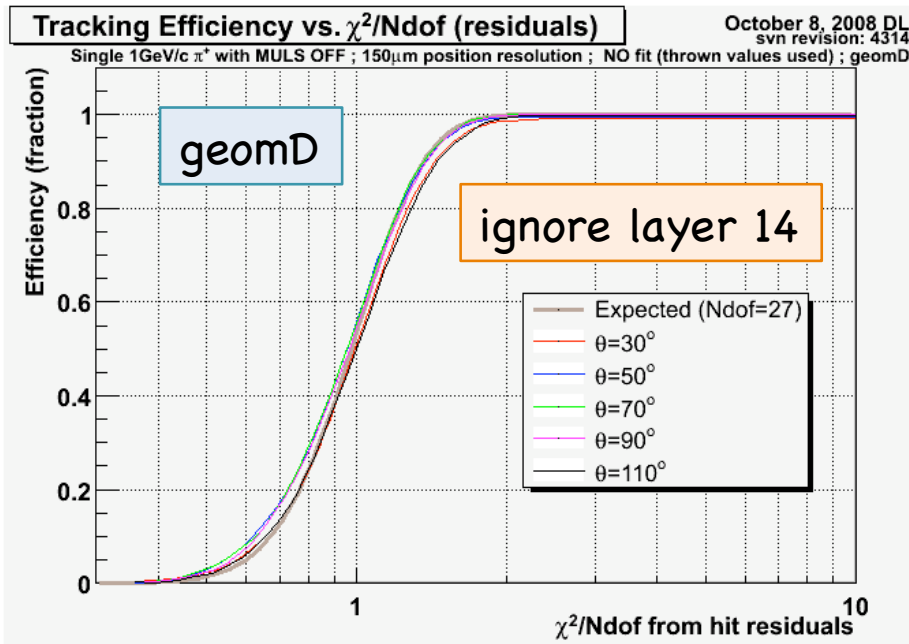
To check consistency between the simulation and reconstruction geometries as well as transport through the magnetic field etc. , thrown values were used

Checking All 4 Geometries



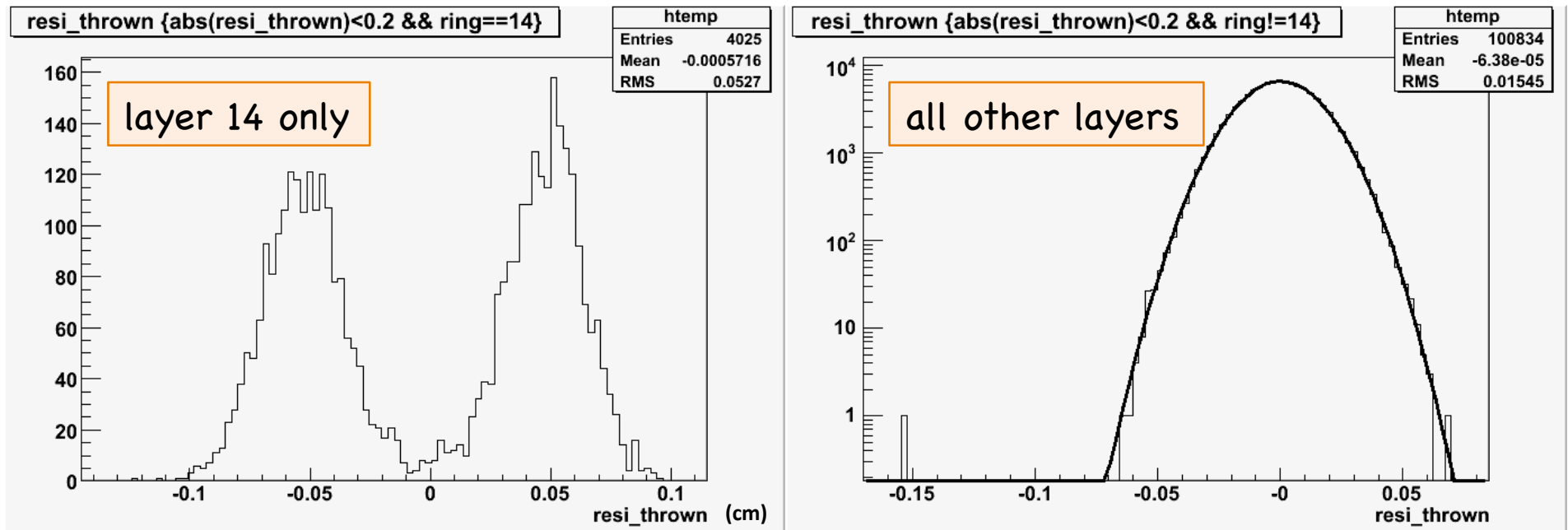
Sensitivity of Probability Function

- An inconsistency exists between simulation and reconstruction for CDC geomD, layer 14. The source of the discrepancy is still not known.
- The effect of a single layer is clearly seen in the probability distributions

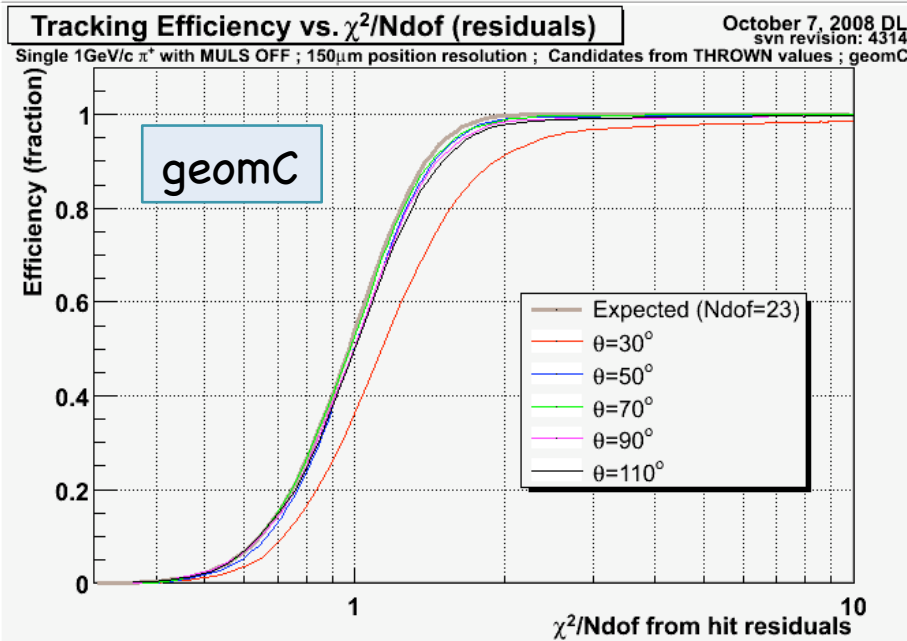
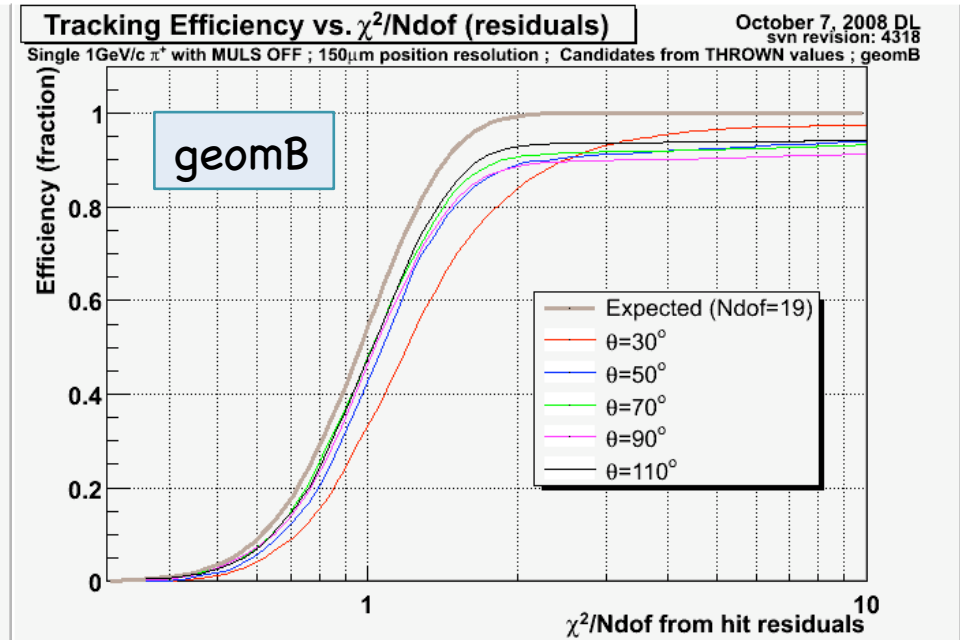
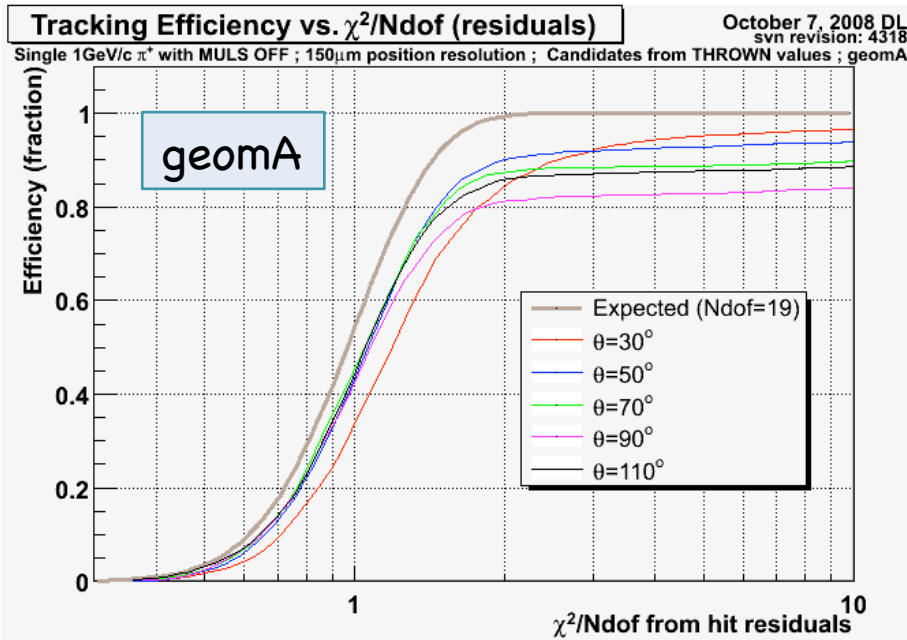


Layer 14 problem in geomD

Residuals with respect to the thrown track

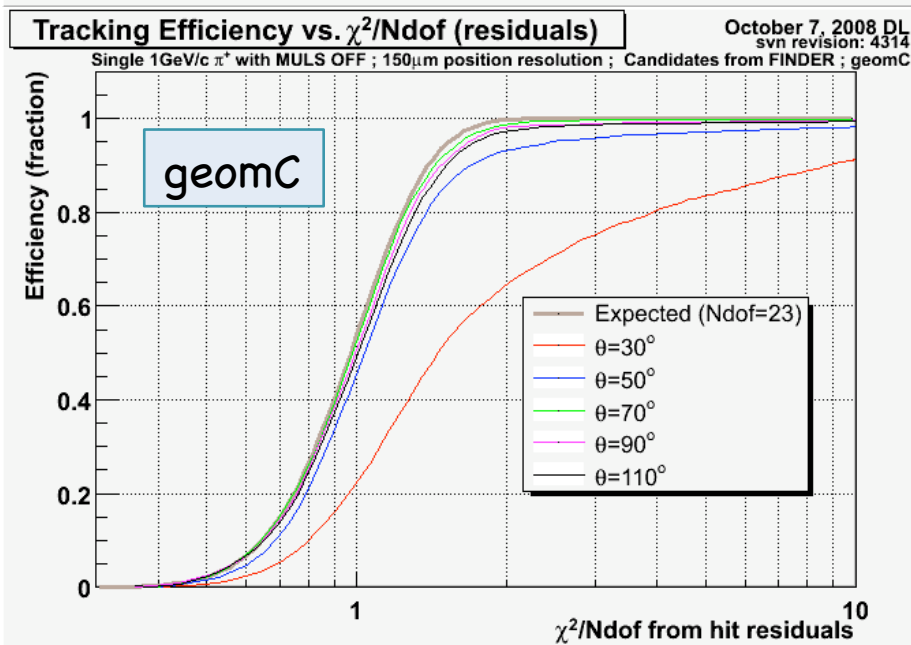
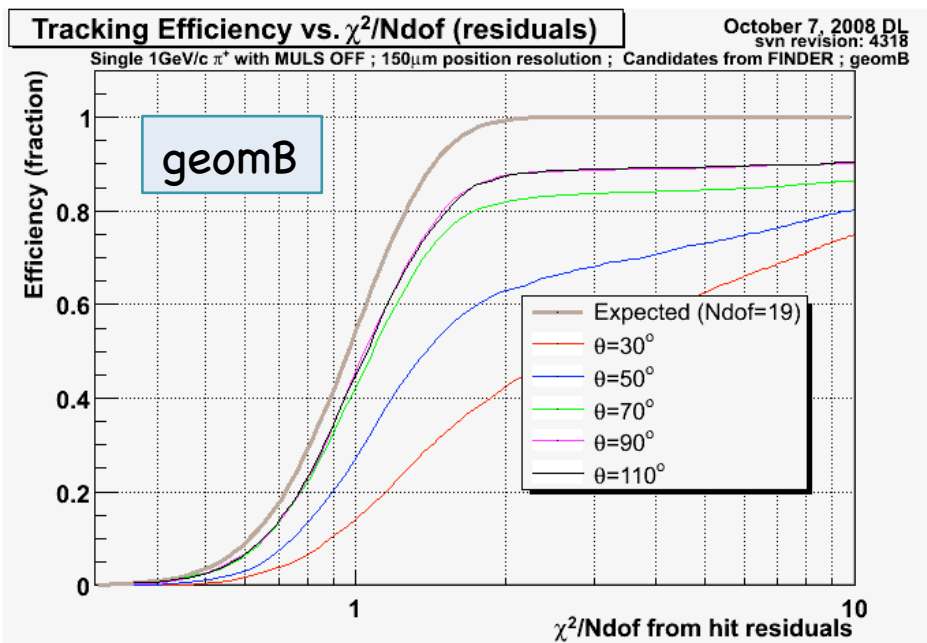
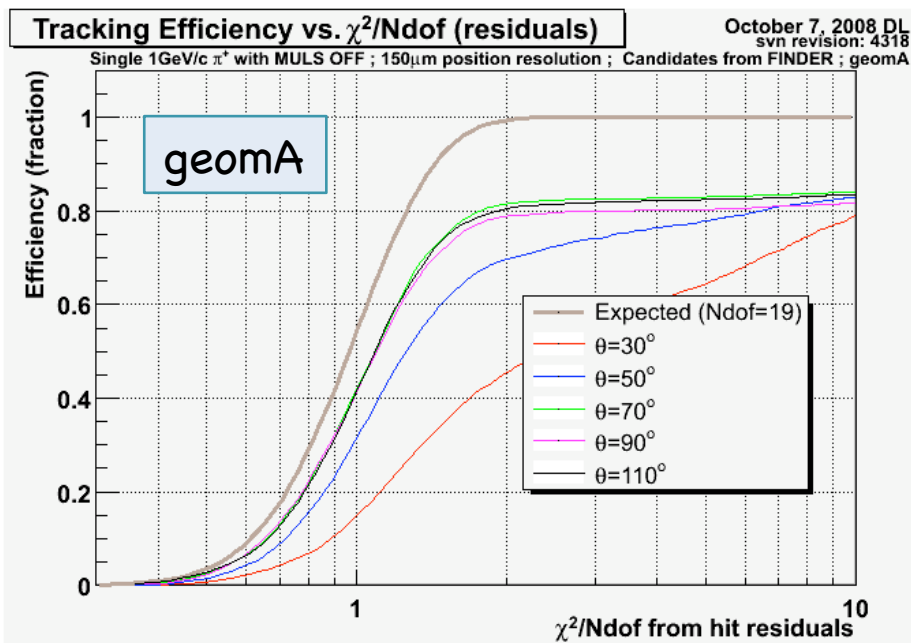


Wire and time -based fits starting from the right answer



geomC shows clear improvement over previous designs though forward angle (30°) seems to still show some room for improvement

Full Reconstruction



Full track finding+fitting
appears to be vastly improved
as well

Summary

- Residual based tracking efficiencies for single track events with no M.S. but with position smearing indicate significant improvement with geomC over the geomA and geomB designs.
- The geomB design (+4 stereo) shows a modest, but measureable improvement over geomA (+2, -2 stereo) for large angles
- An inconsistency still exists between simulation and reconstruction for geomD
- We still need to look at the impact of multiple scattering
- We still need to look at the accuracy of the reconstructed parameters