

uB Tracking in 4 slides

- Spacepoints
- Seedfinder and BezierTracking
- Track3DKalmanSPS (SPS == spacepoints)
- Track3DKalmanHit

Seeds+Bezier Tracking

1. Seed Finding Updates

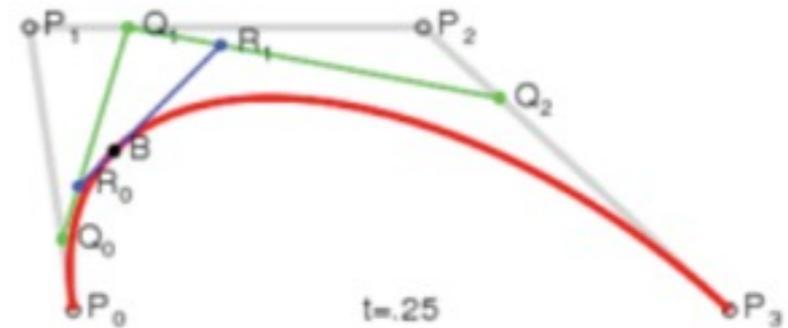
Reminder: seeds are formed by short groups of spacepoints with a strong directionality.

They seek parts of tracks where there is an unambiguous track direction in 3D

Parameters are:

- Filter, Merge** - SpacePointService parameters
- SeedMode** - 0 (find 1 seed) 1 (find many seeds)
- SeedLength** - in cm
- MinPointsInSeed** - this many points within SeedLength cm
- AngularDev** - SD of seed angular deviation from spine
- Source** - 0 (from cluster combos) 1 (from bare hits)
- HitModuleLabel, ClusterModuleLabel** - data products

Bezier Curve Segments



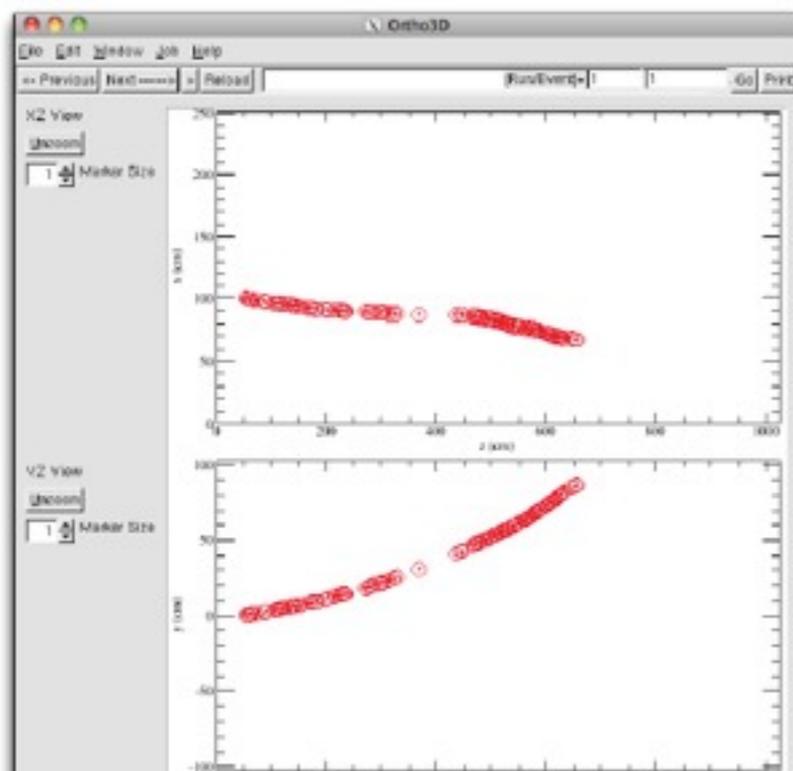
Curve matches point and direction perfectly at each seed, and varies continuously between them

$$R(s) = s^3 P_0 + (1-s)s^2 P_1 + (1-s)^2 s P_2 + (1-s)^3 P_3$$

P_0 and P_3 are the seed points

P_1 and P_2 are the seed points + seed direction *(some scaling)

The scale is set such that $|P_3 - P_2| = |P_2 - P_1| = |P_3 - P_0|/4$

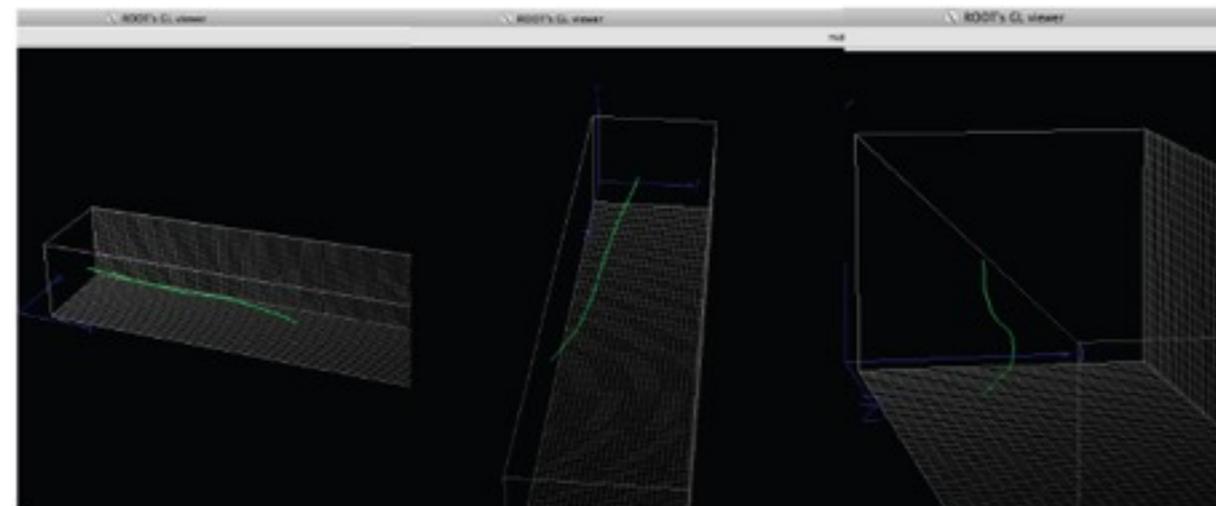


New evd views for Seeds:

This slide:
Ortho3D

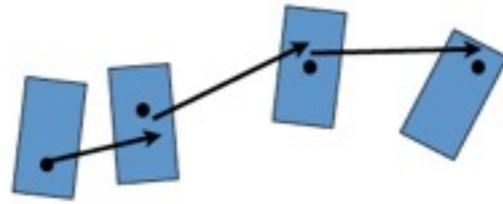
Next slide:
3D view

Bezier track in 3D



Track3DKalmanSPS

Pointing: 1 GeV/c

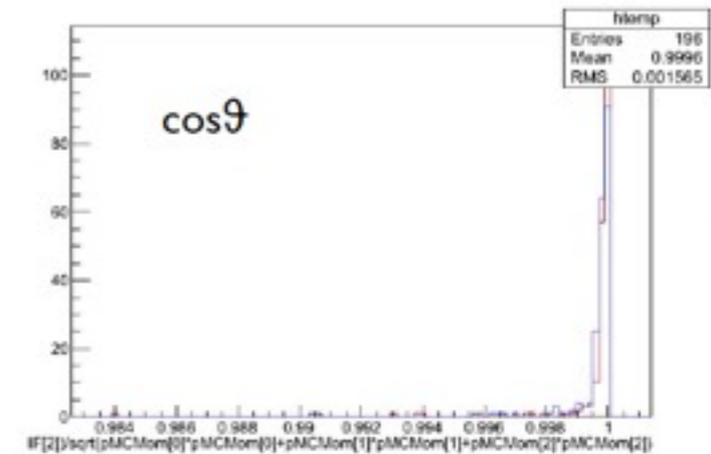


$$\vec{x} = \begin{pmatrix} q \\ p \\ \frac{dw}{du} \\ \frac{dw}{dv} \\ u \\ v \end{pmatrix}$$

$$\theta \sim 1/p$$

LArSoft's KF implements all material effects, accommodates a magnetic field.

This algo is as good as the clustering.



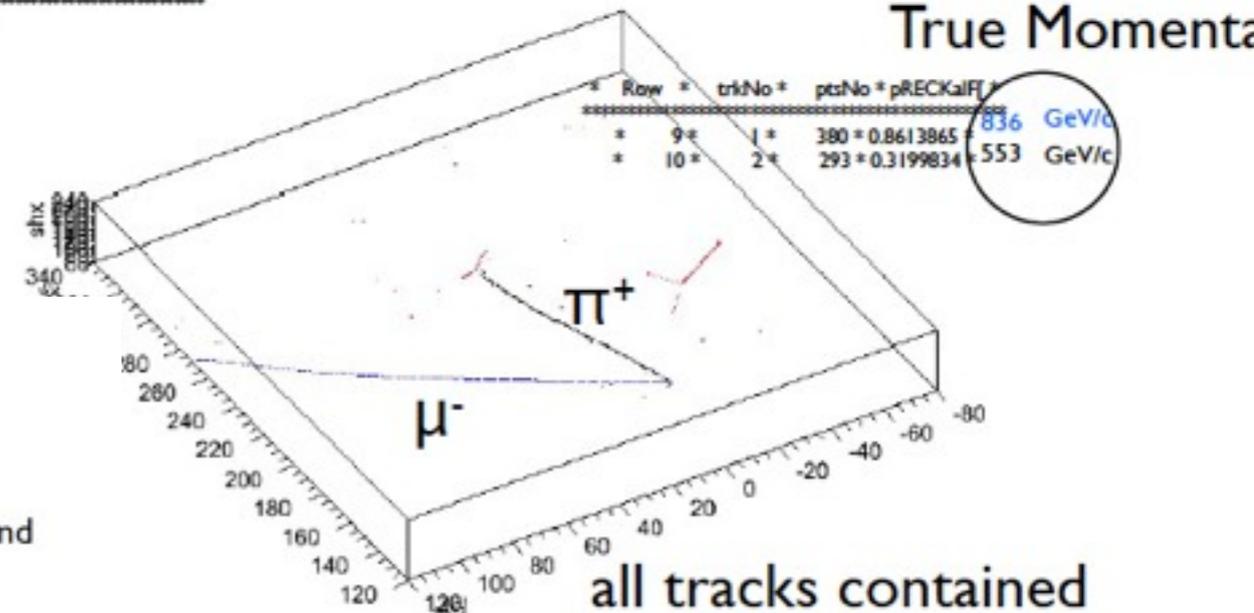
Momentum-resolution is easy for Contained trks: < 10%.
Pointing is great always w sufficient sppts.
~60-70% of BNB CC muons escape, so effort needs to continue to be on Uncontained trks:

Would still like a smarter sppt sorting algo. Currently sorting in z.

Row	MCRtg	MC Energy	MCDFProc
134	13	0.8440466	muMinusCa
135	2112	1.4427317	NeutronIn
136	211	0.5717023	PionPlus
137	2212	1.0143212	

CC numu

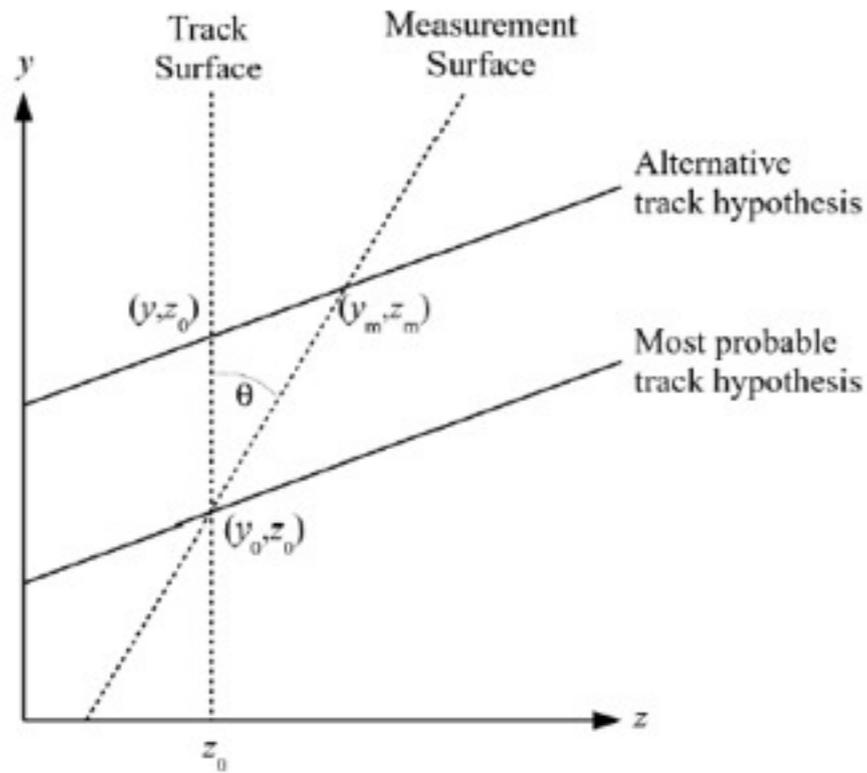
shx:shy:shz {evtNo==3}



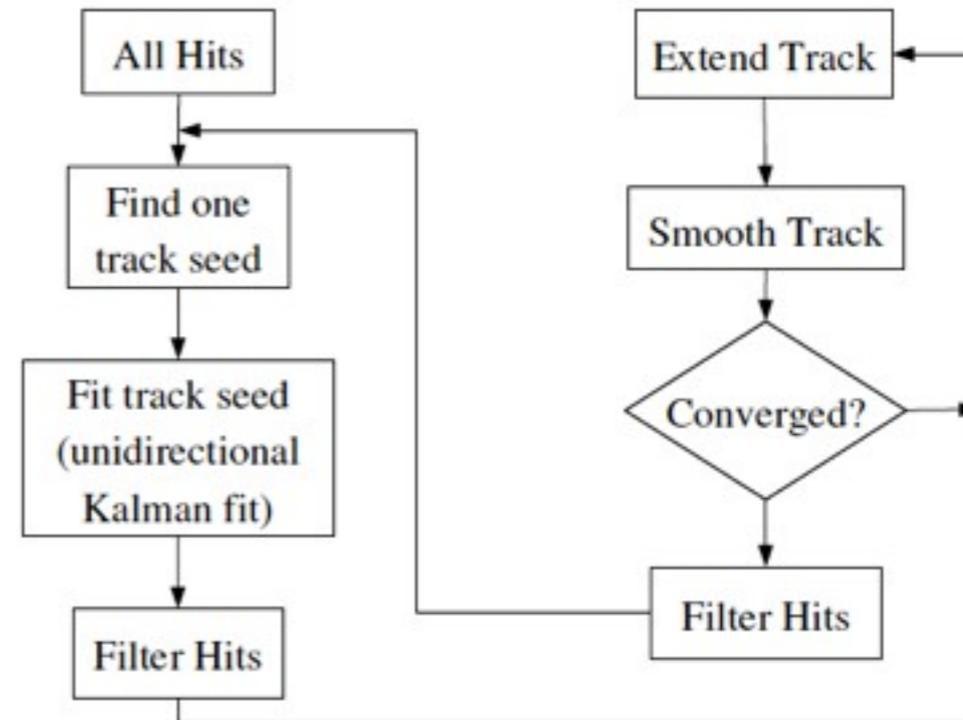
Difficulty

- $1/p * 13 \text{ MeV} * \sqrt{\text{dist}/16\text{cm}} = \theta$
- $d\theta$ depends on spacepoint errors and variation inherent in MS
- At each spacepoint I draw from a random Gaussian with expected mean θ and compare to the observed deflection over previous two measurement surfaces. **It's a weak relation, for any given point.**

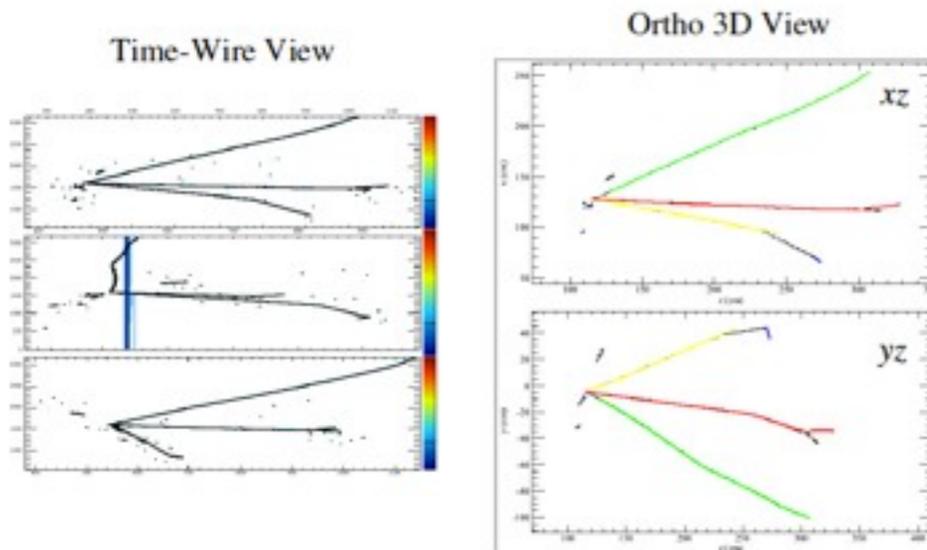
Track3DKalmanHit



Seeding Algorithm



Genie Event with Multiple Tracks



- Continuing improvements in robustness, reliability, tuning.
 - Short tracks, track stubs (perhaps an entirely different algorithm).
 - Very flat tracks.
 - Track splitting and merging (gaps in tracks).
 - Improvements in seeding.