A Comparison between the T-tracker and L-tracker(s)

Hits in the straws provide ***2d constraints*** used to fit for the track parameters.

This is a study of the tracking acceptance, using hit counting

	2d-constraints	
L-tracker	(x,z) (y,z)	(straw + 2 cathode planes)
Vertical L-tracker	(x,z) (y,z)	(straw + 2 cathode planes)
T-tracker	(x′,z) (y′,z)	

$$x' = x\cos(\Theta_i) + y\sin(\Theta_i)$$
$$y' = -x\sin(\Theta_i) + y\cos(\Theta_i)$$

where i= 1,54 Θ_i = 0, 60, 120, 180 degrees, …

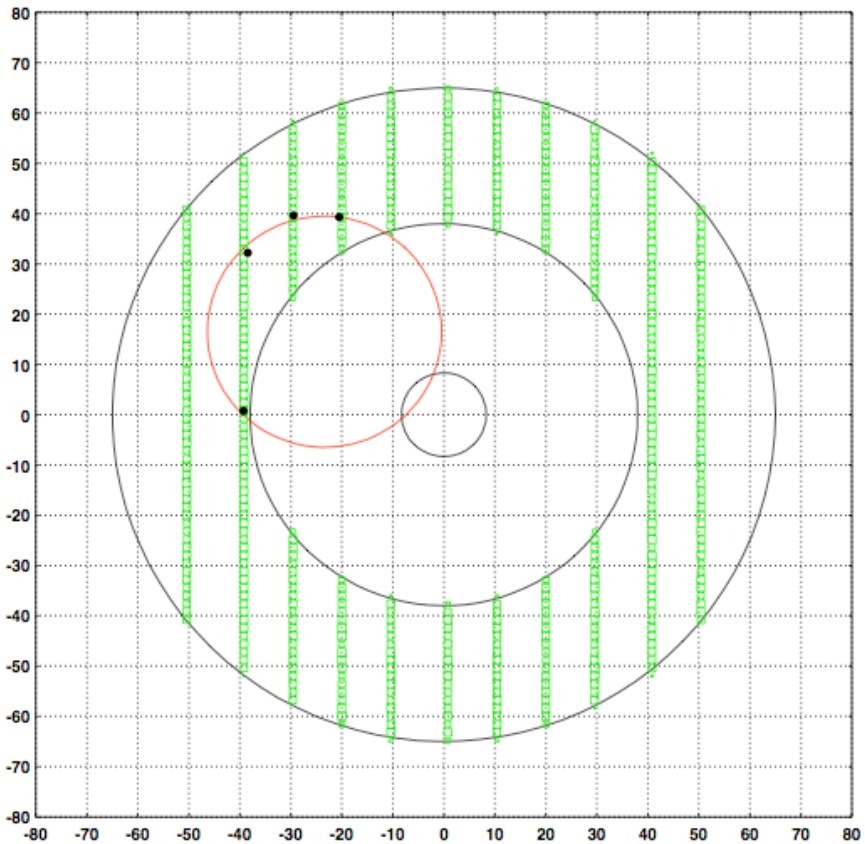
We will make the following assumptions:

- **hit errors contribute equally to tracking chi2**
  (ie. all hits have equal pull)
- **Pattern recognition equally difficult for all three configurations**
- ignore multiple scattering
- ignore energy loss
- ….

Hogan Nguyen
Aug 5th 2009

Vertical L-tracker

A single hit provides two 2d constraints:
(x,z)
(y,z)

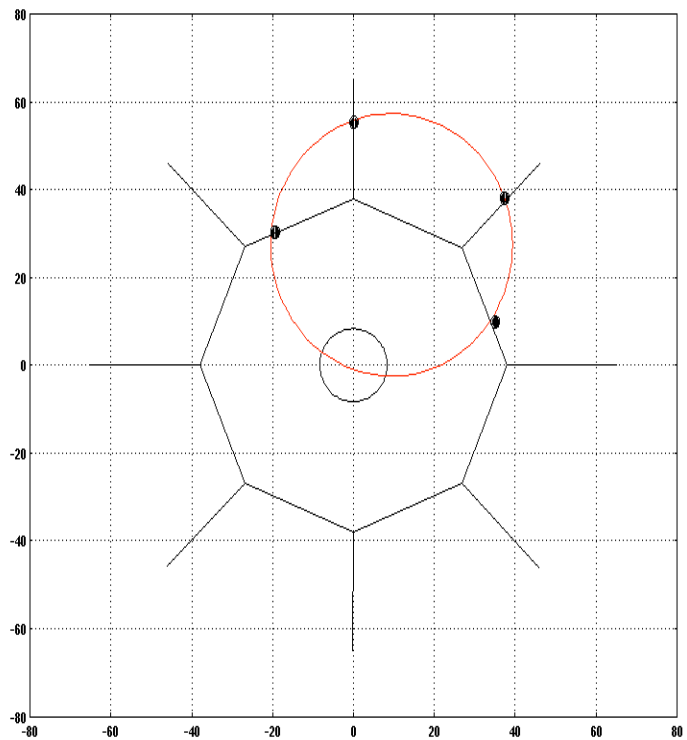


L-tracker

A single hit also provides 2
2d constraints:

(x,z) and (y,z)

Pattern recognition and stereo
cathode strips used determine z

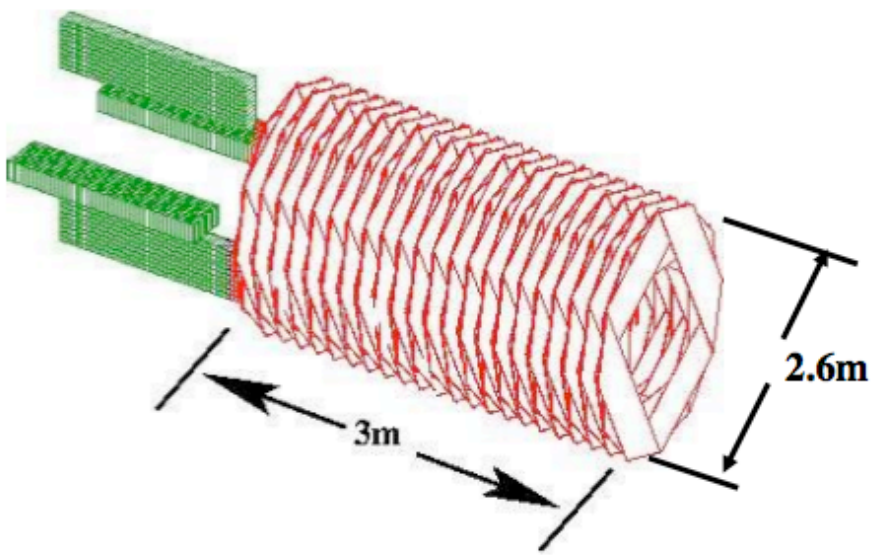


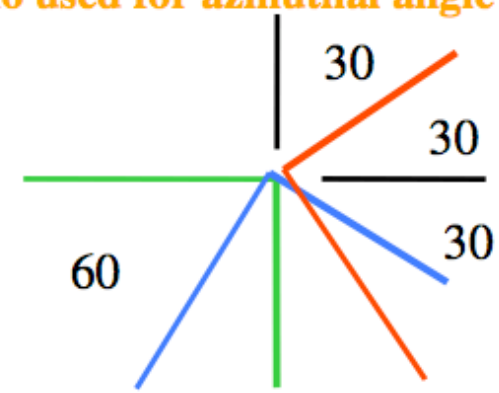
TRANSVERSE TRACKER

- 12,960 Straw Active elements
- 54 planes each rotated by 60°
- TDC and ADC on each channel

No information of position along straw axis, sterio used for azmuthal angle

Pattern recognition based on Kalman filter





- 12 Local x Views
- 4 will have show a helix projection

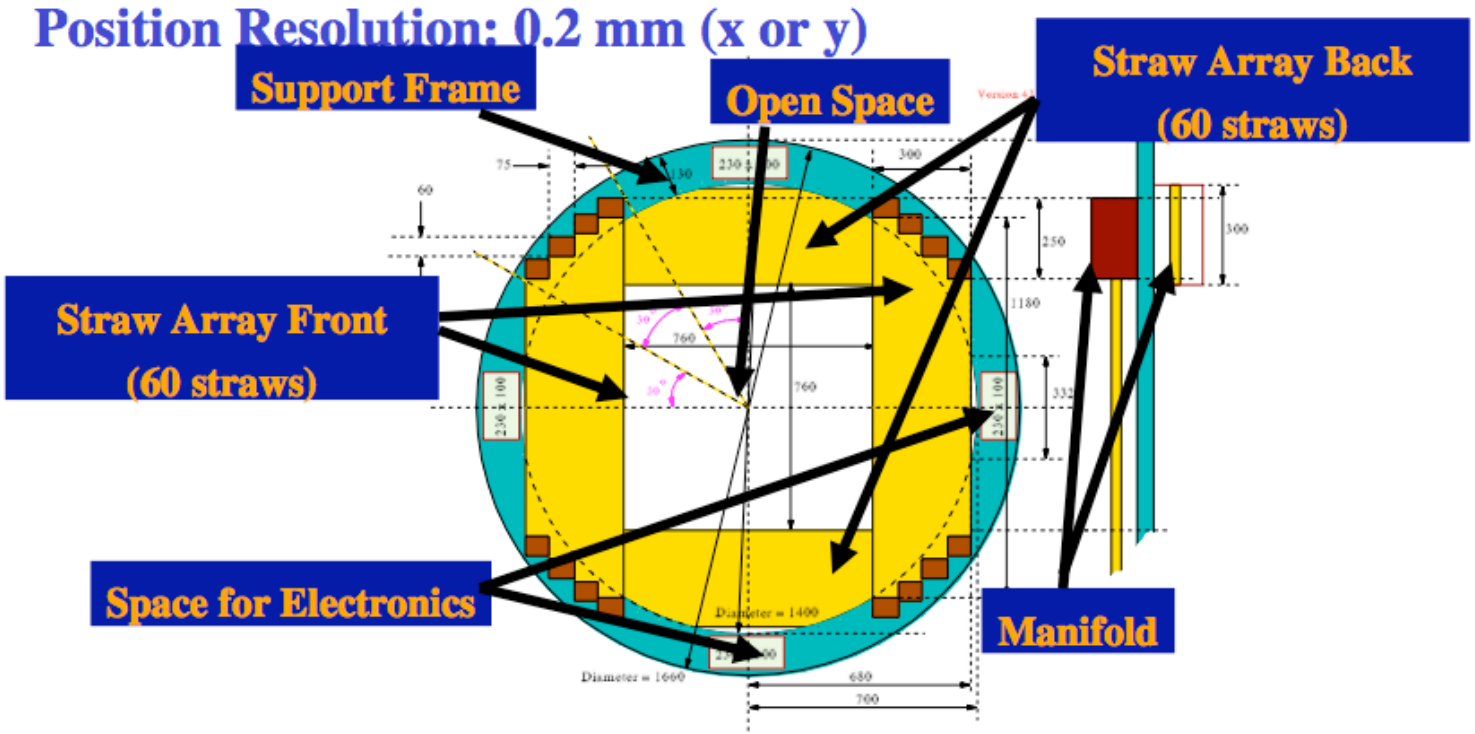
Transverse Tracker

Geometry: 54 planes; 60° rotation with respect to neighbors; 13,000 channels; TDC and ADC; 3 spare planes constructed

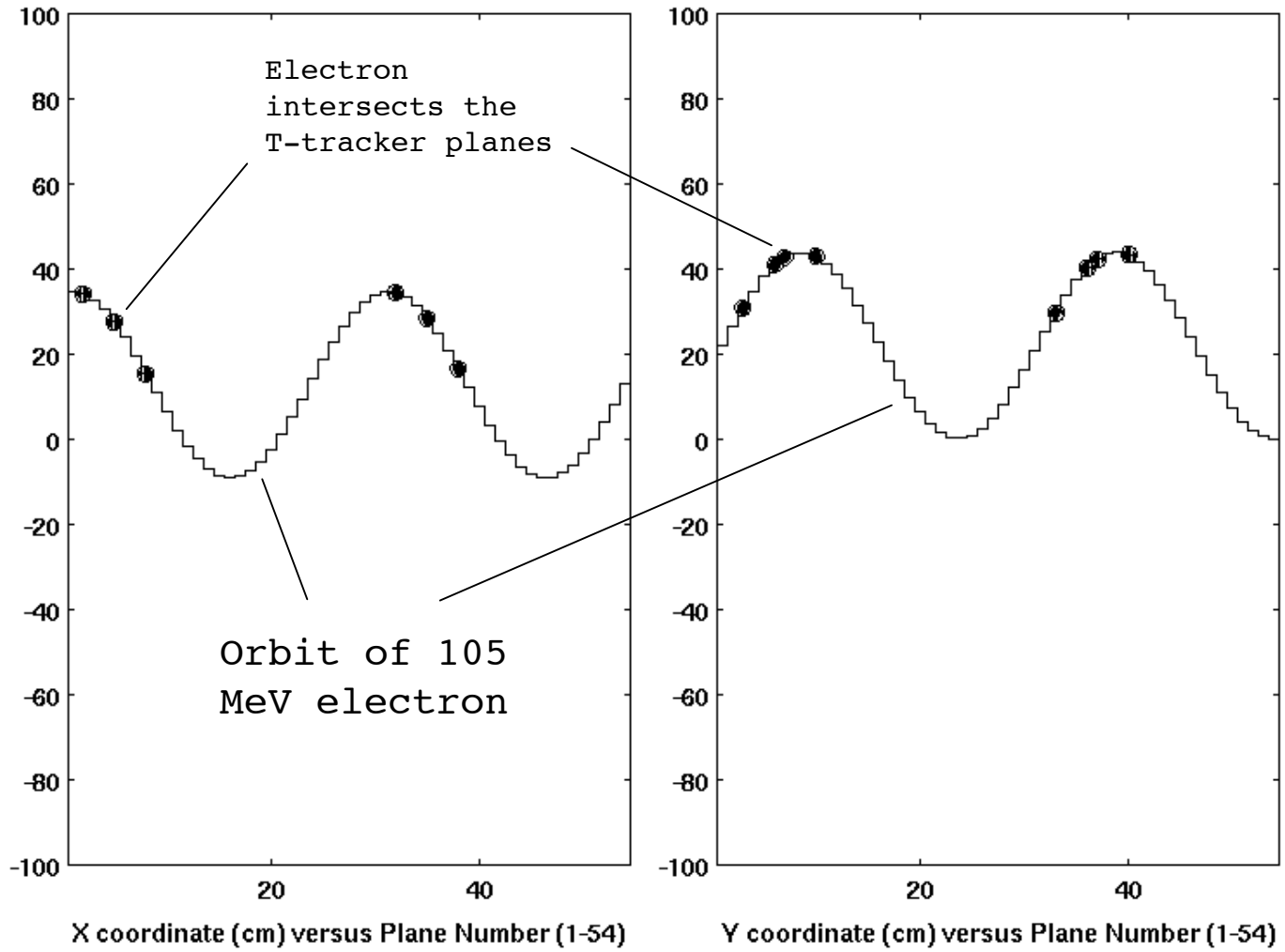
Straws: 70 -130 cm length × 5mm diameter; 15 (25)μm thickness

12,960 total; One (x,y) layer per plane; all straws are conducting

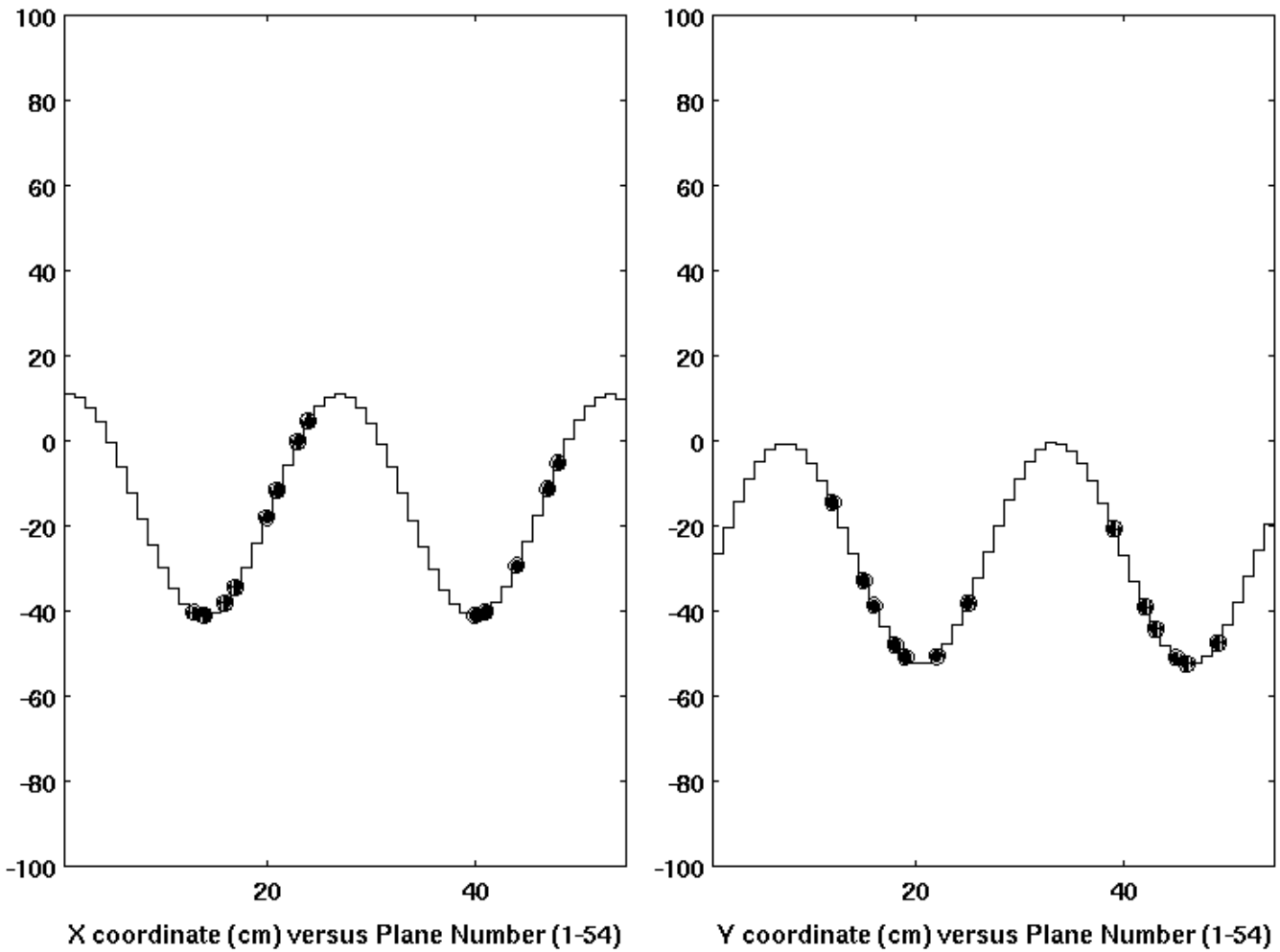
Position Resolution: 0.2 mm (x or y)



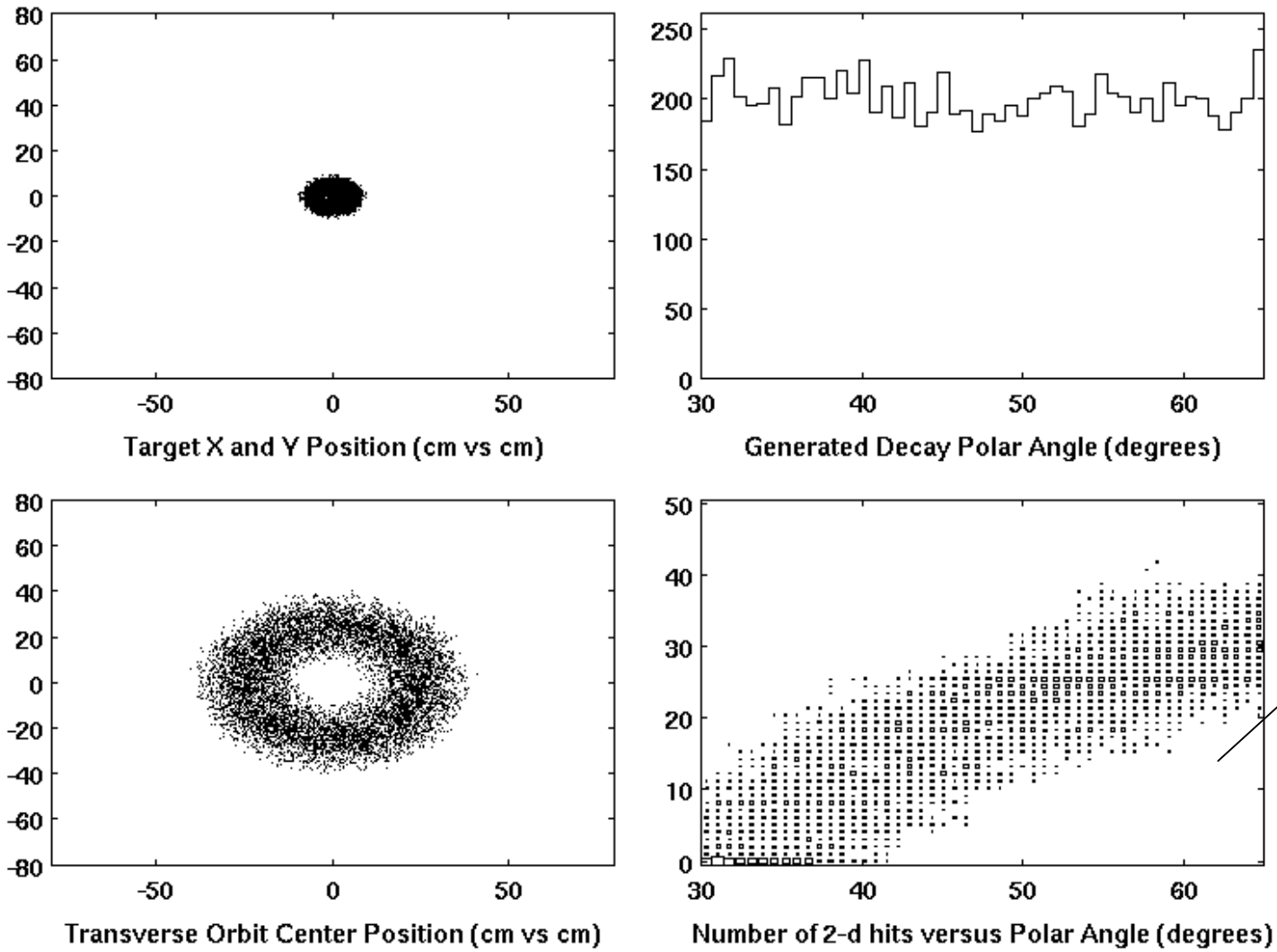
A 14-hit event in the T-tracker



A 26-hit event in the T-tracker



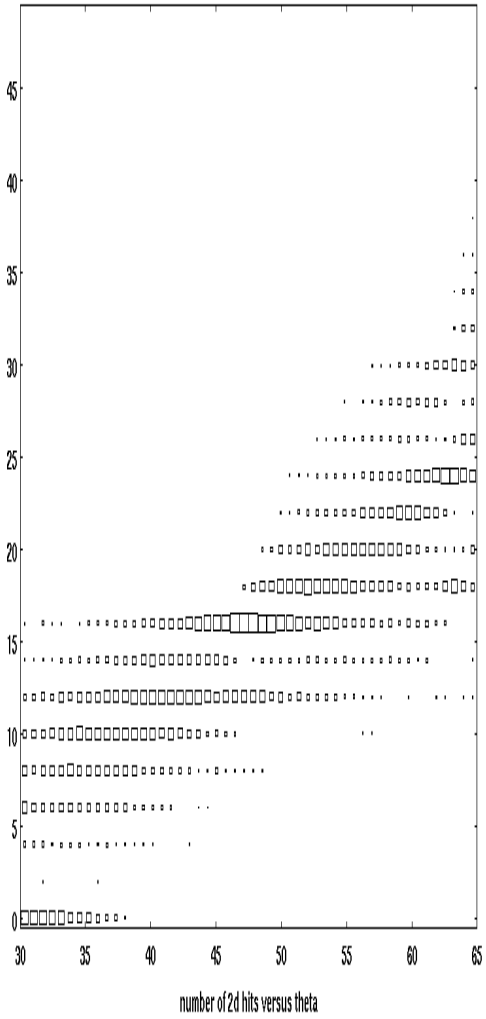
Toy Simulation of 105 MeV electrons into the T-tracker



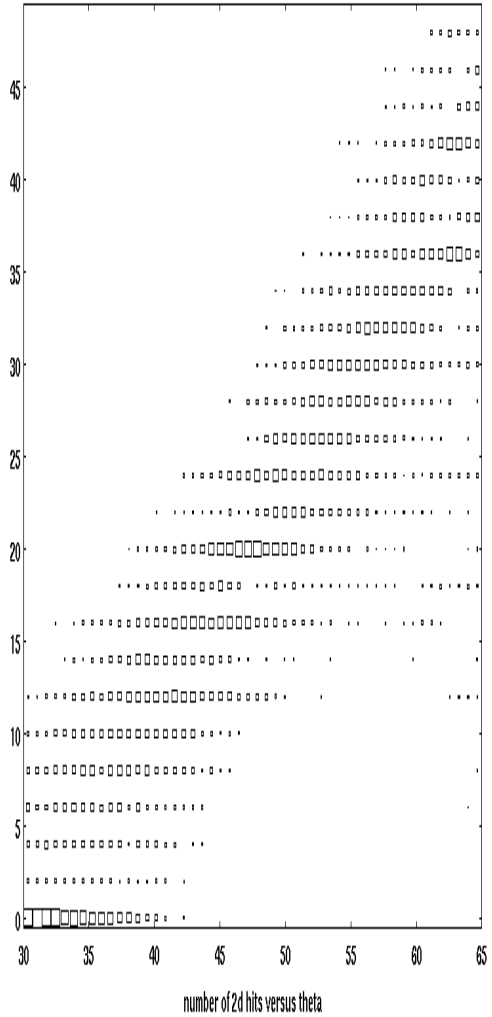
Important Plot

Number of 2d Constraints (Hits) Versus Pitch Angle

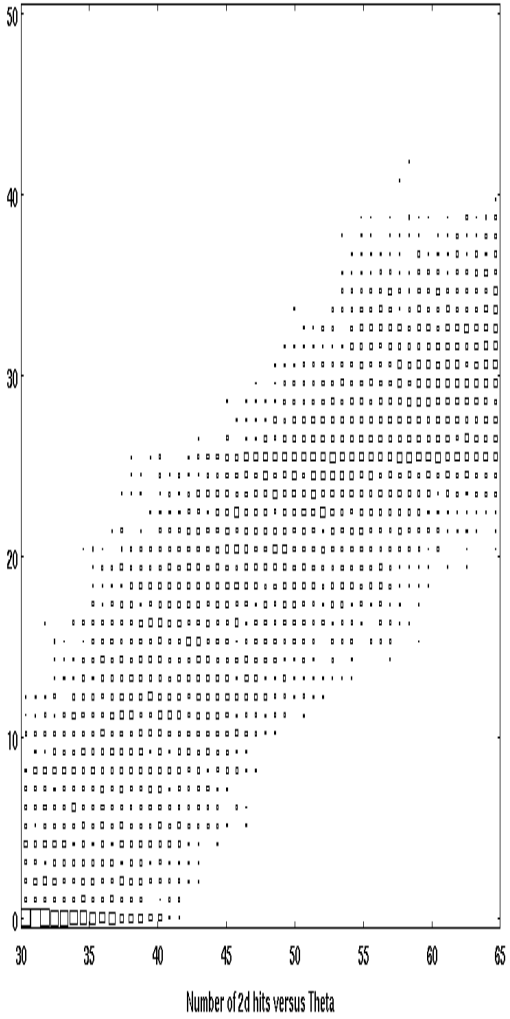
L-tracker



Vertical L-tracker



T-tracker



Track Fitting to a Helix, with Arbitrary Electron Momentum

$X(z) = X_0 + R_t\cos(2\pi(z-z_0)/R_l)$
$Y(z) = Y_0 + R_t\sin(2\pi(z-z_0)/R_l)$

where fit parameters are:

x_0, y_0, z_0 (related to track origin)
$R_t = R_t(p,\theta)$ orbit radius (cm)
$R_l = R_l(p,\theta)$ longitudinal period (cm)

At least 6 hits are needed to resolve 5 parameters

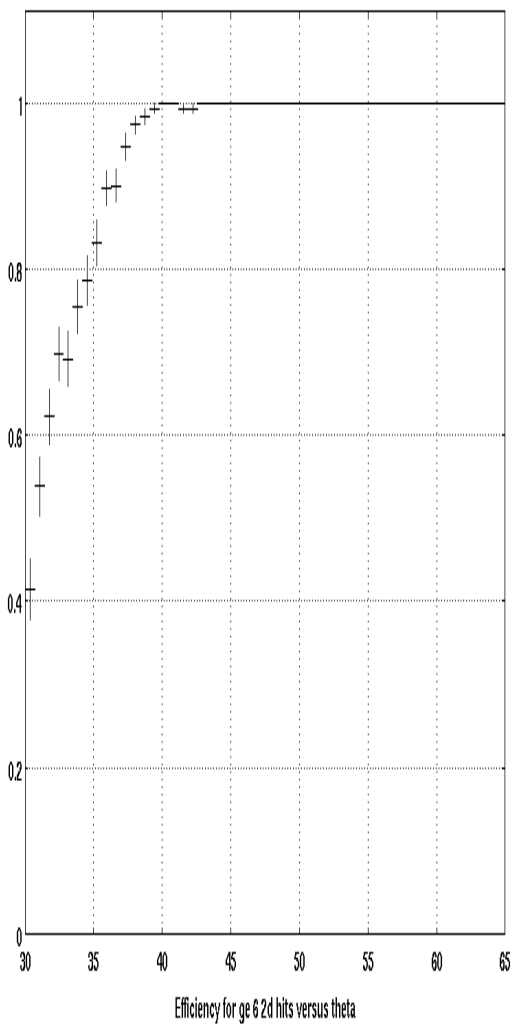
Track Fitting to a Helix, with the Signal Hypothesis (p=105 MeV)

x_0, y_0, z_0 (related to track origin)
$R_t = R_t(105,\theta)$ orbit radius (cm)
$R_l = R_l(105,\theta)$ longitudinal period (cm)

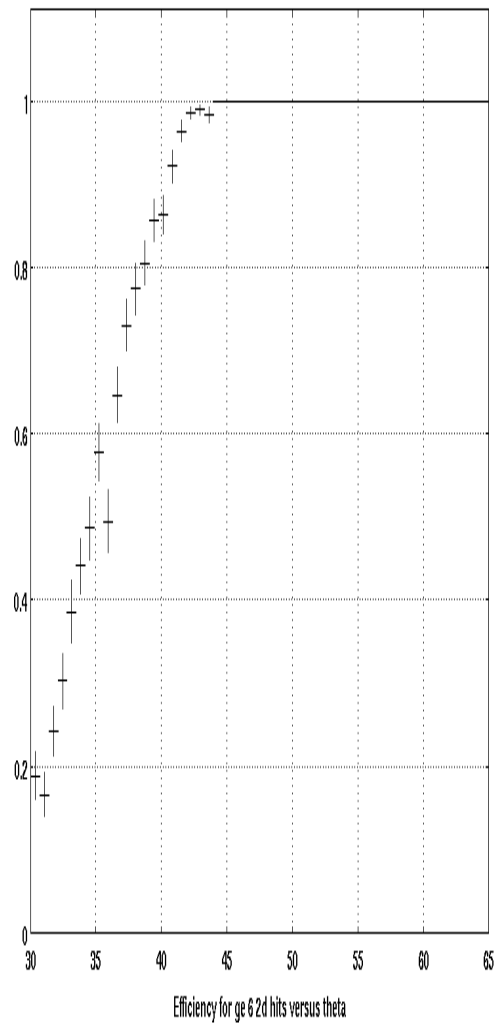
At least 5 hits are needed to resolve 4 parameters

Efficiency for having at least 6 2d hits

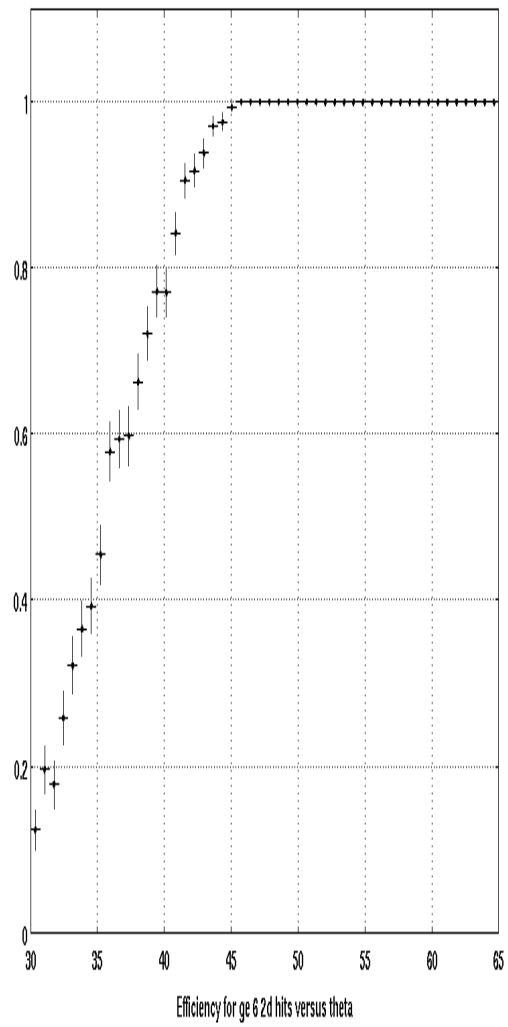
L-tracker
94.1% efficient



Vertical L-tracker
85.7% efficient



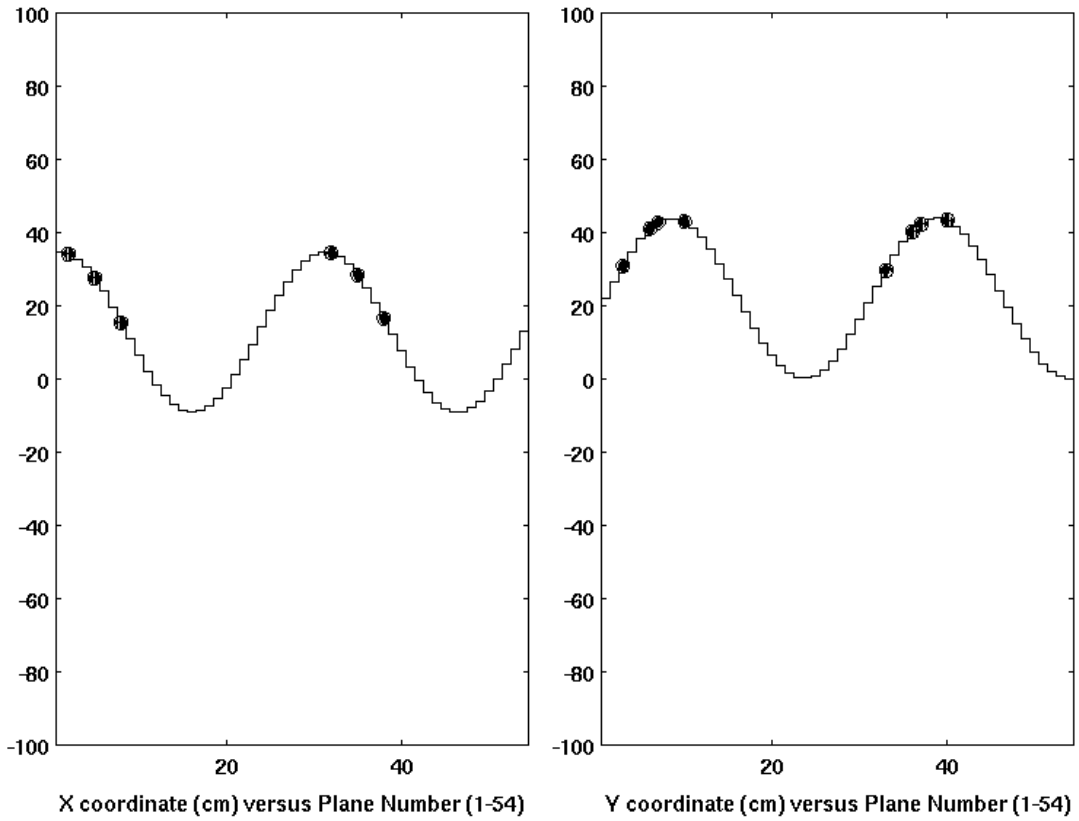
T-tracker
83.4% efficient



The trackers are all comparable in efficiency for pitch angle greater than 40 degrees.

Below 40 degree pitch angle, the L-tracker is best.

The L-tracker tangential vanes adds acceptance for low angle tracks.

Track fitting to be studied next:

(there maybe hit configurations where the fit does not converge)