

SVX Upgrade Reconstruction Algorithm Proof of Concept and Event Display

Alan Dion

Motivation

Previously I had tracking efficiency of about 90%

Momentum resolution was $> 30\%$

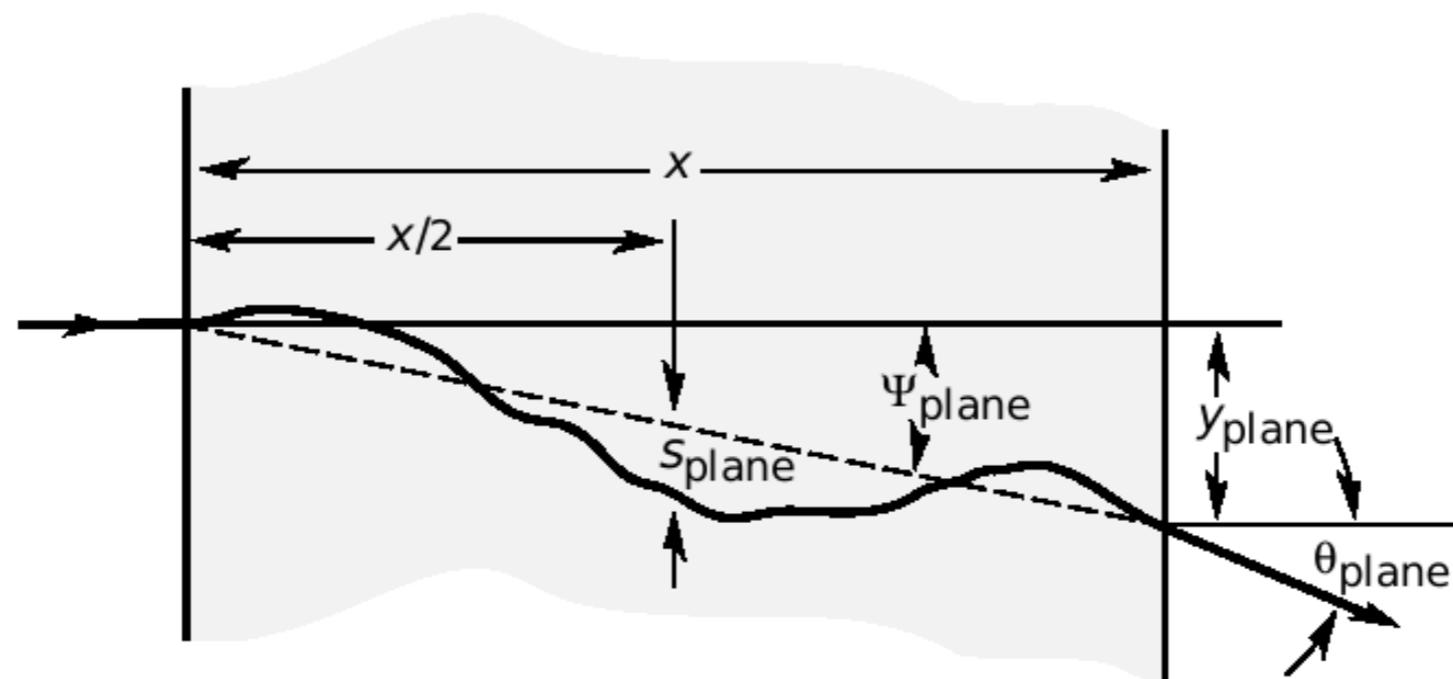
Limited by multiple scattering

Getting momentum from SVX is good for standalone-studies which utilize the high acceptance of the SVX. With some simulation, it would be nice to do a jet correlation study using the SVX.

Solution

If you can't beat 'em – join 'em. If our resolution is limited by multiple-scattering, then perhaps we should use the scattering effect to our advantage.

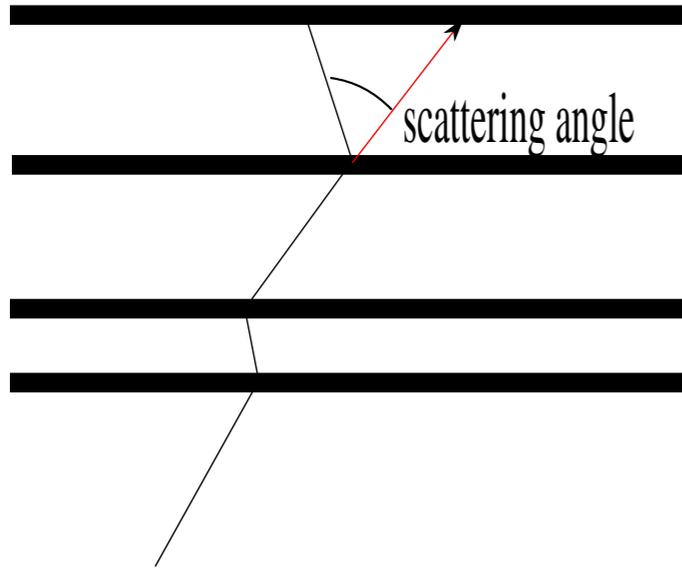
Reminder about scattering:



$$\theta_0 = \frac{13.6 \text{ MeV}}{\beta c p} z \sqrt{x/X_0} [1 + .038 \log(x/X_0)]$$

Method

Given 2 points and a momentum in a uniform magnetic field, a unique helix (up to helicity) passes through the points.



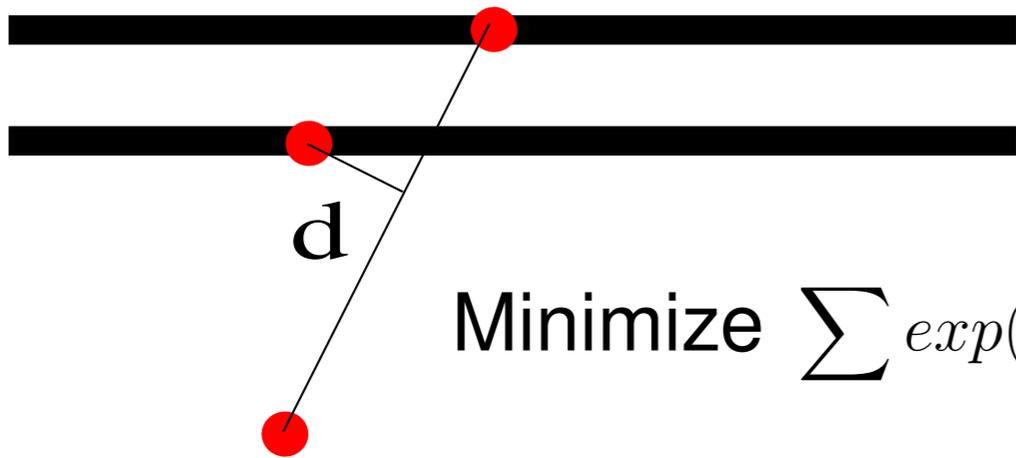
We have 3 scattering angles, each giving a probability as a function of p .

$$P(\text{is a track}) = \int P(\theta_1, p)P(\theta_2, p)P(\theta_3, p)dp$$

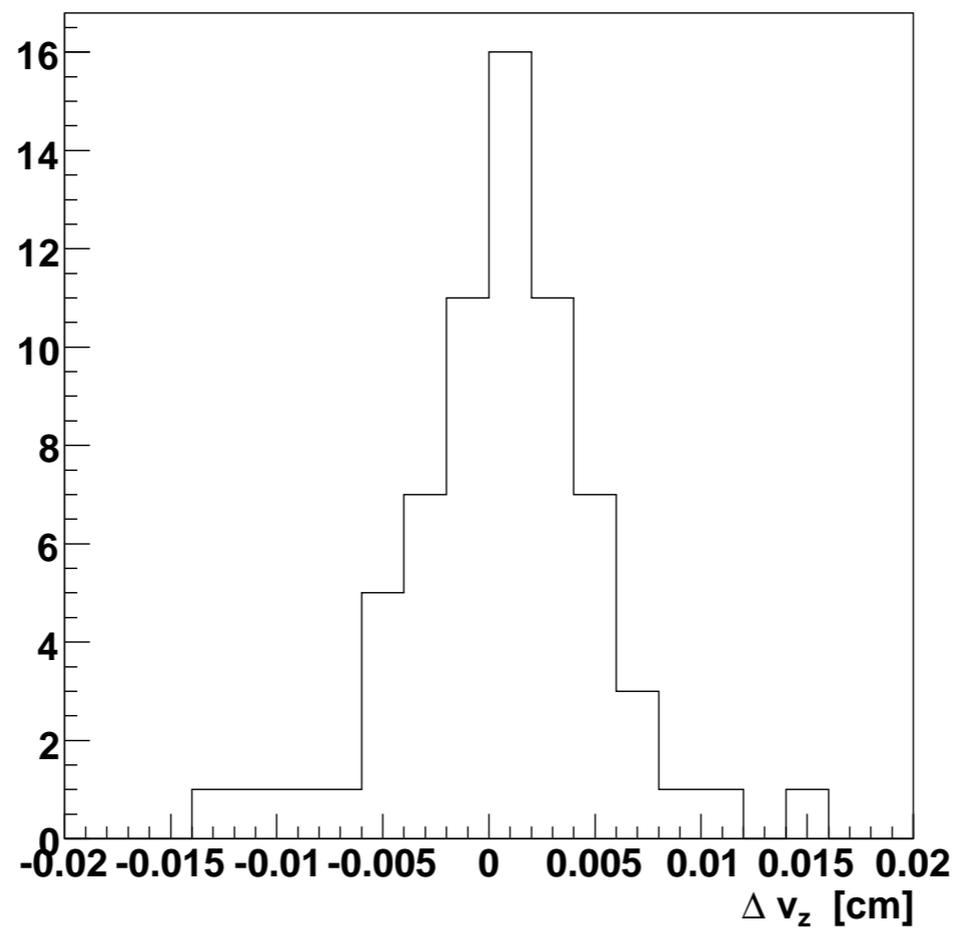
Or we can turn it around and obtain the momentum by maximizing

$$P(\theta_1, p)P(\theta_2, p)P(\theta_3, p)$$

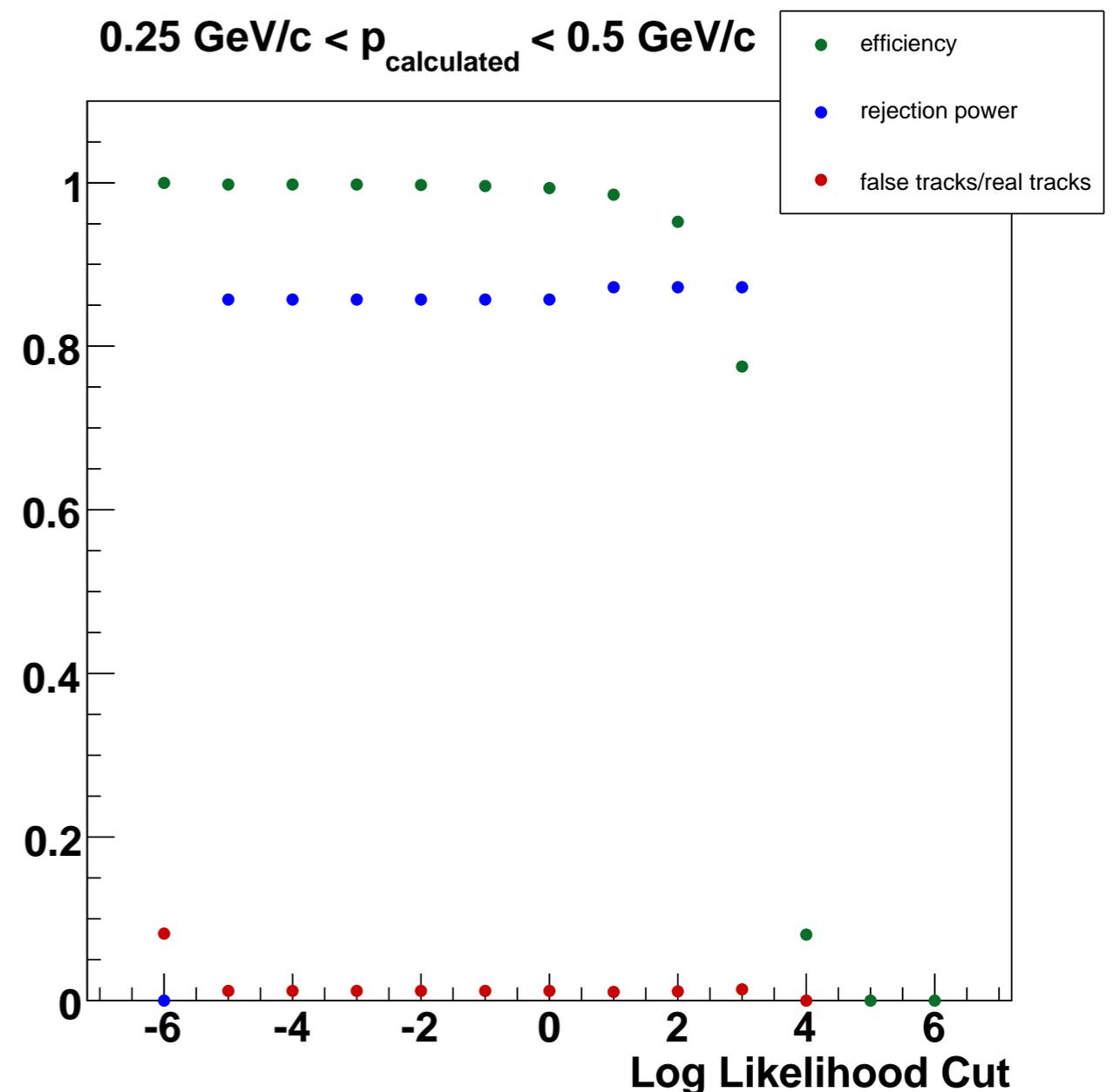
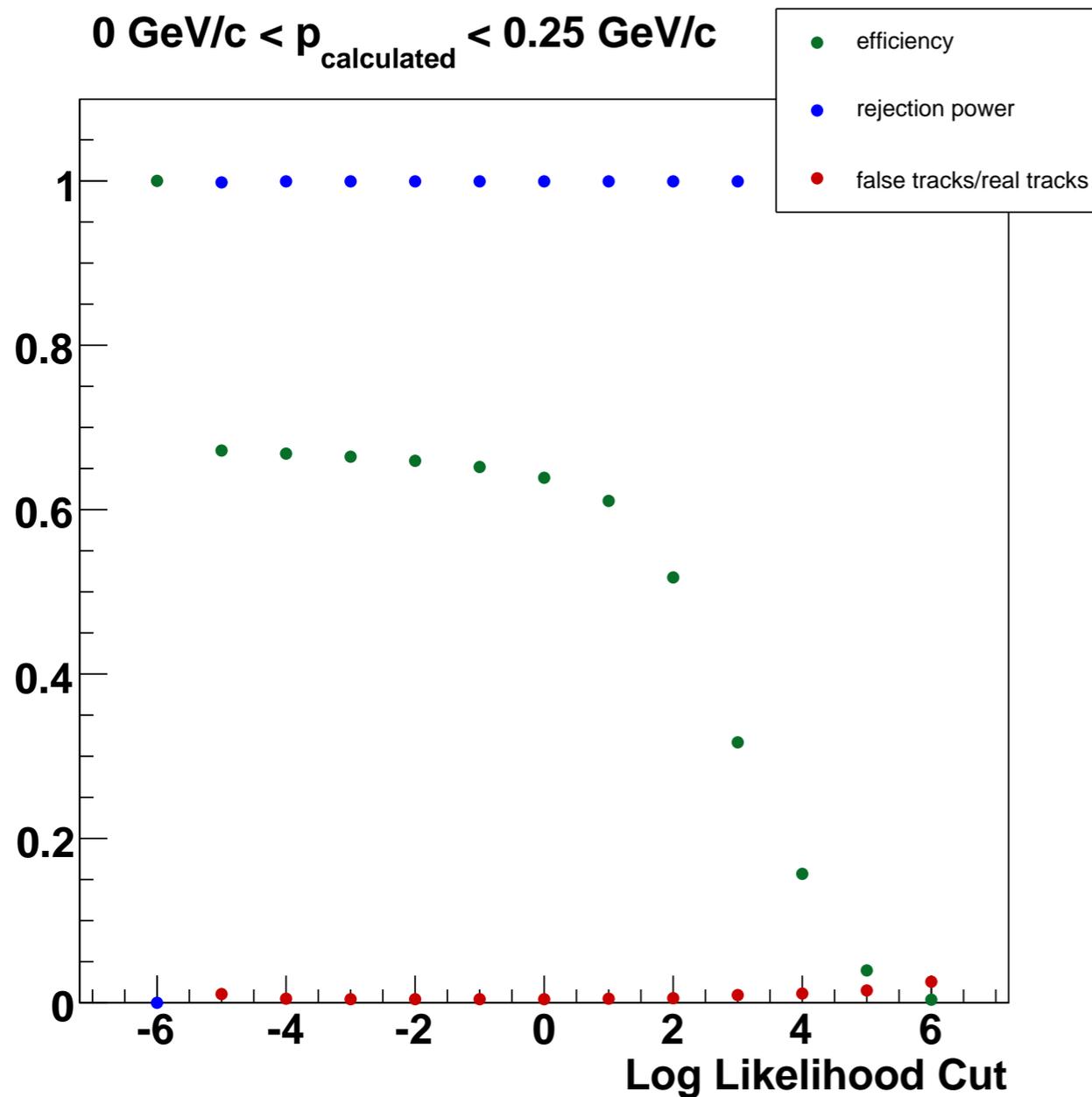
Vertex Reconstruction



Minimize $\sum \exp\left(-\frac{d^2}{2\sigma^2}\right)$ for the vertex position

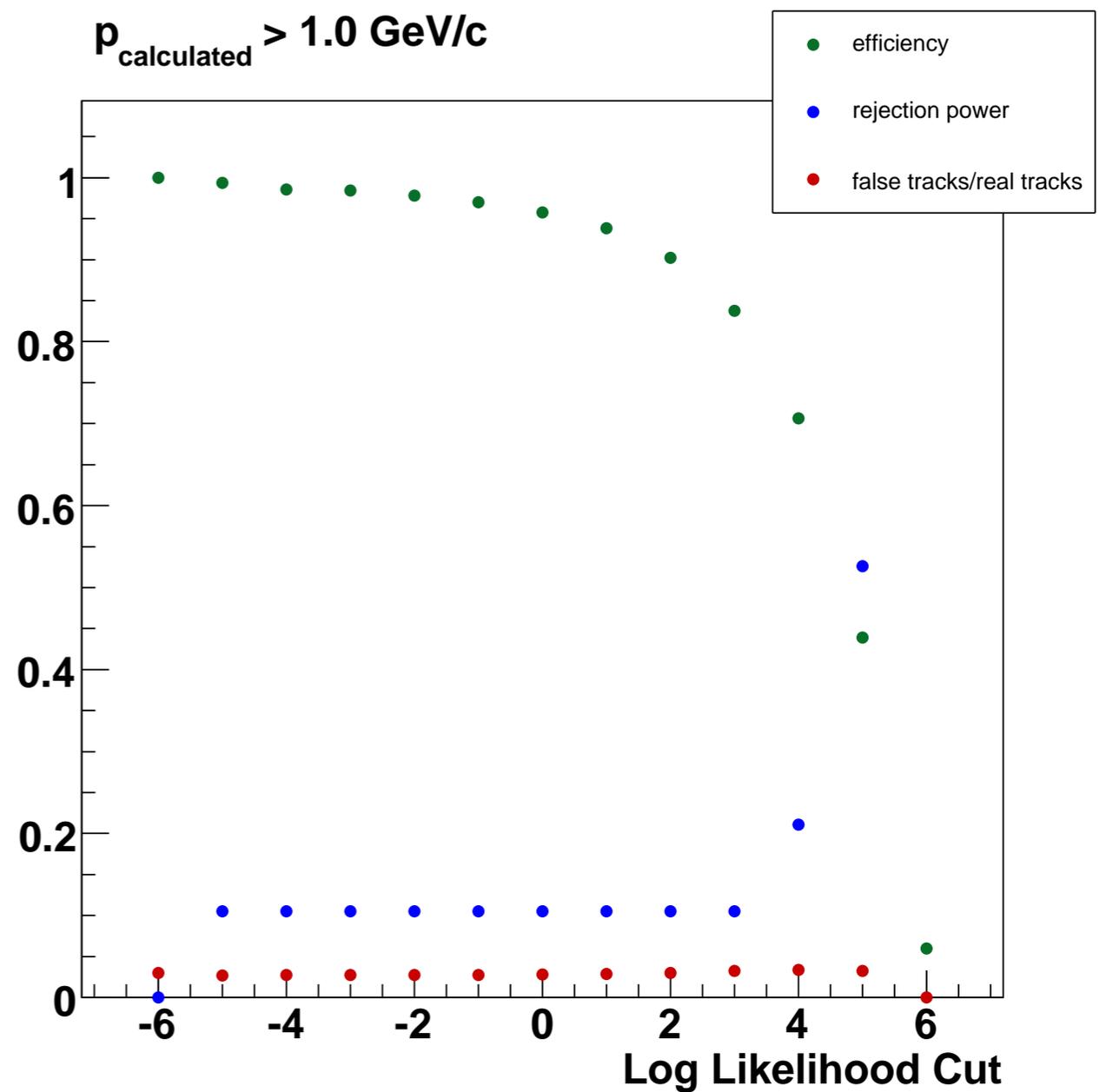
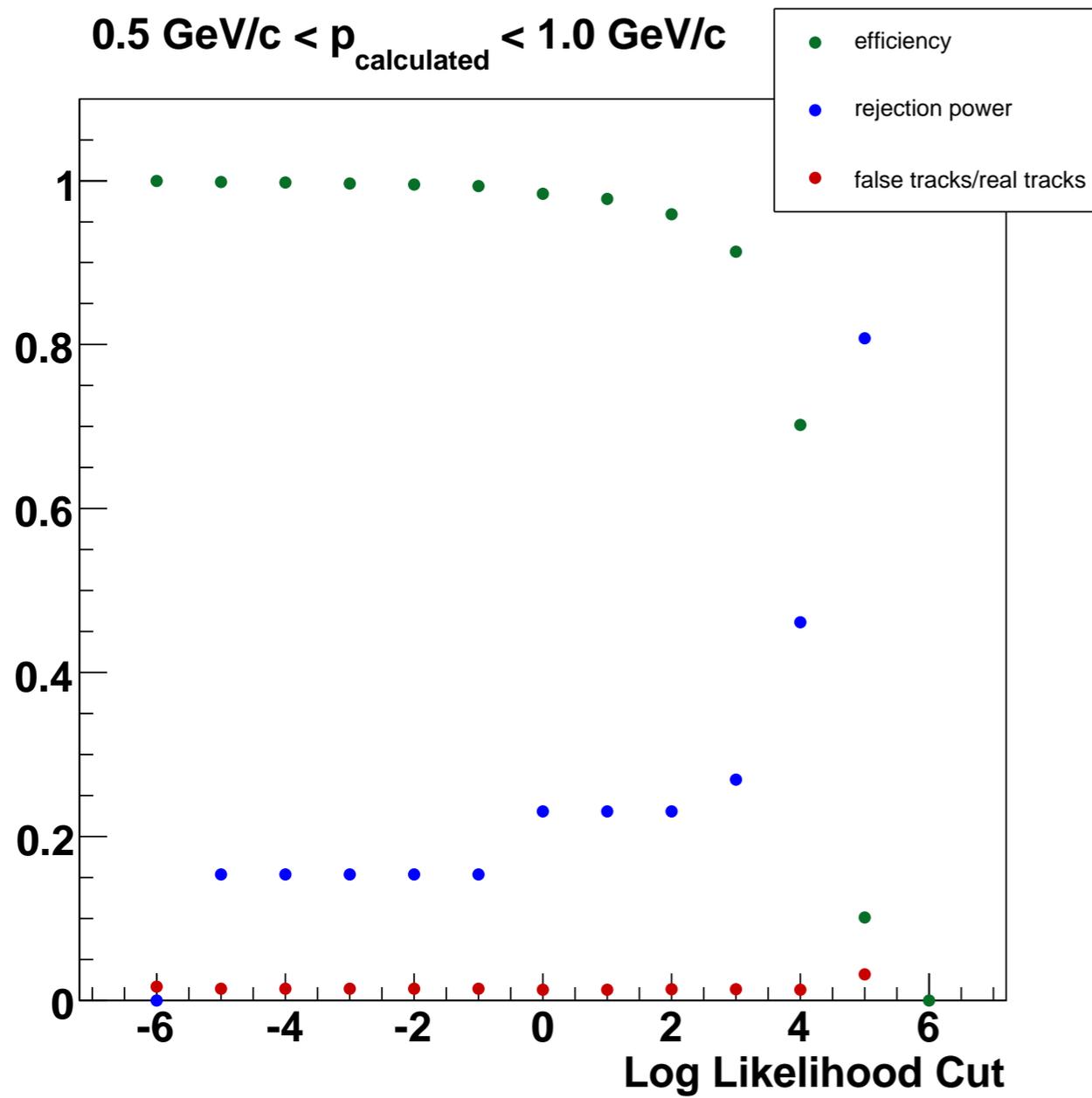


Tracking Efficiency



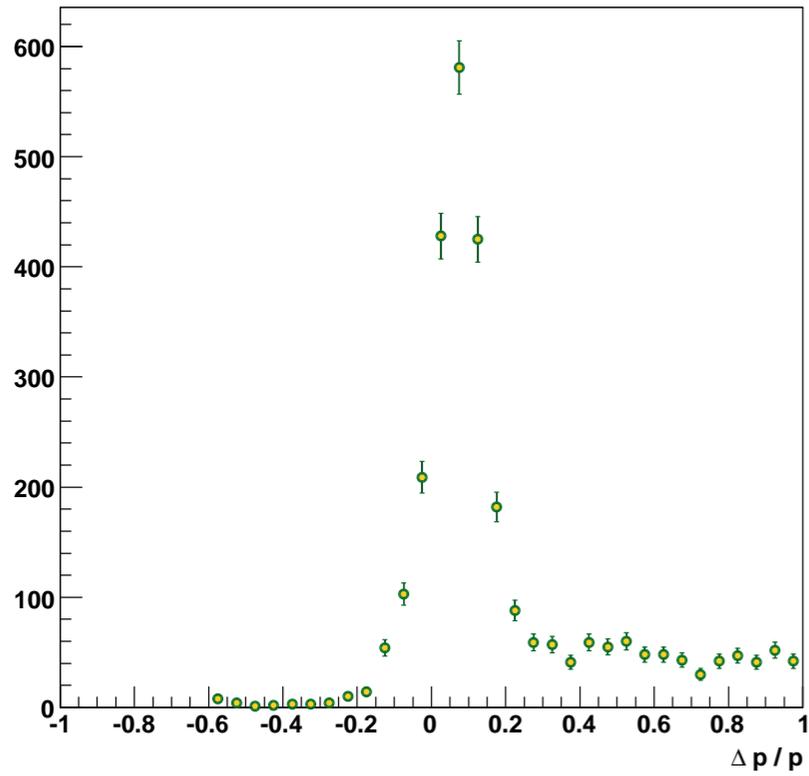
The false tracks (red points) are almost all pushed to low pt and low momentum, so there is almost no background.

Tracking Efficiency

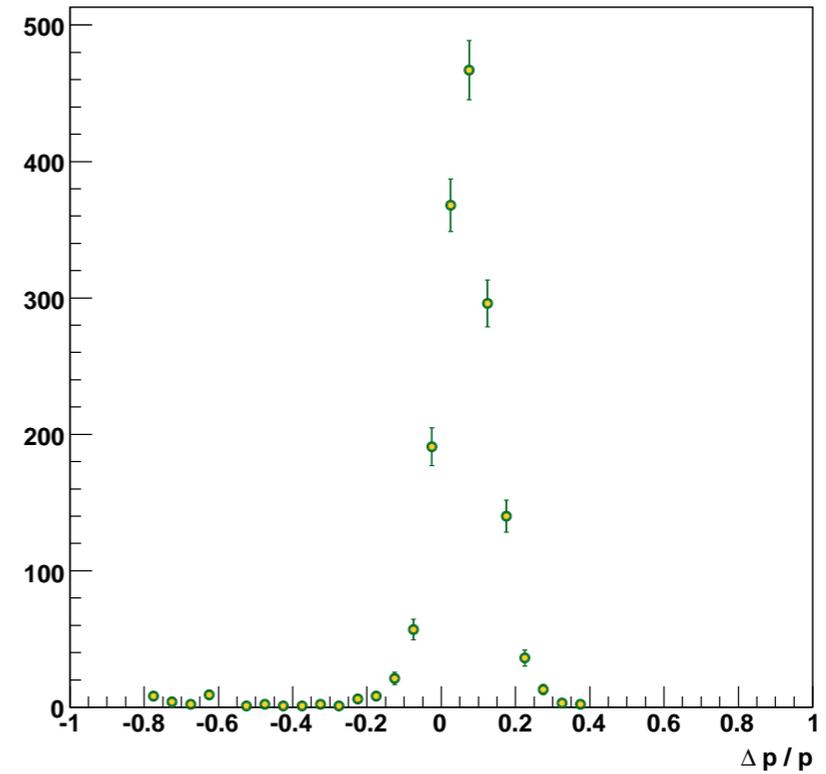


Momentum Resolution

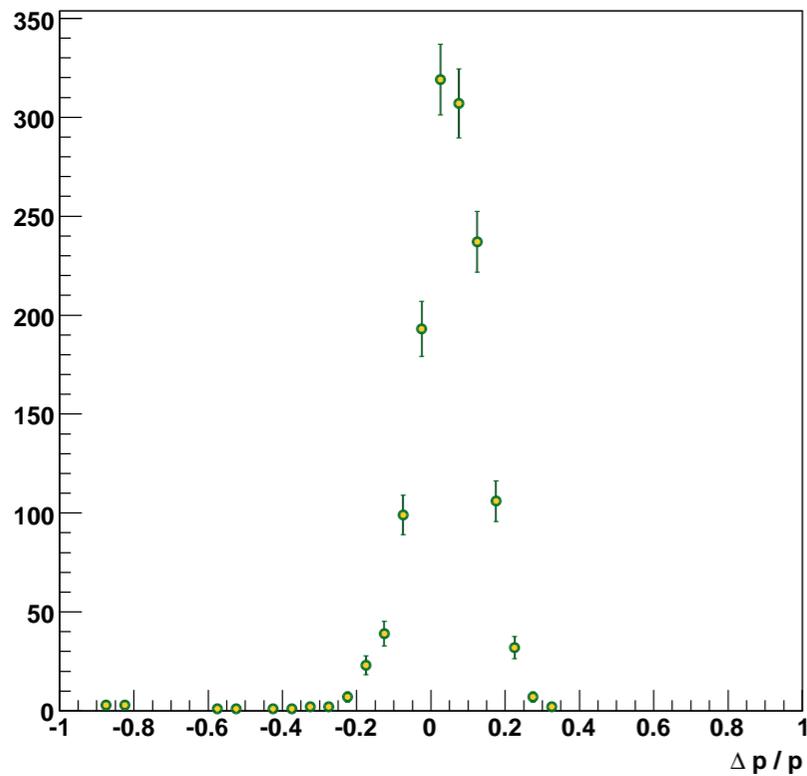
<.25 GeV/c



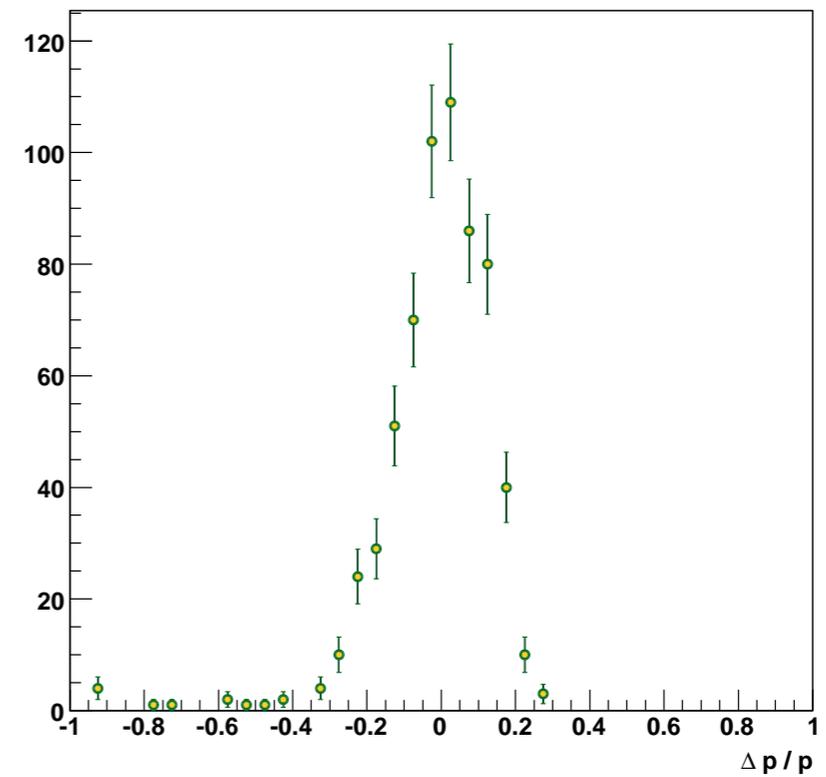
<.5 GeV/c >.25 GeV/c



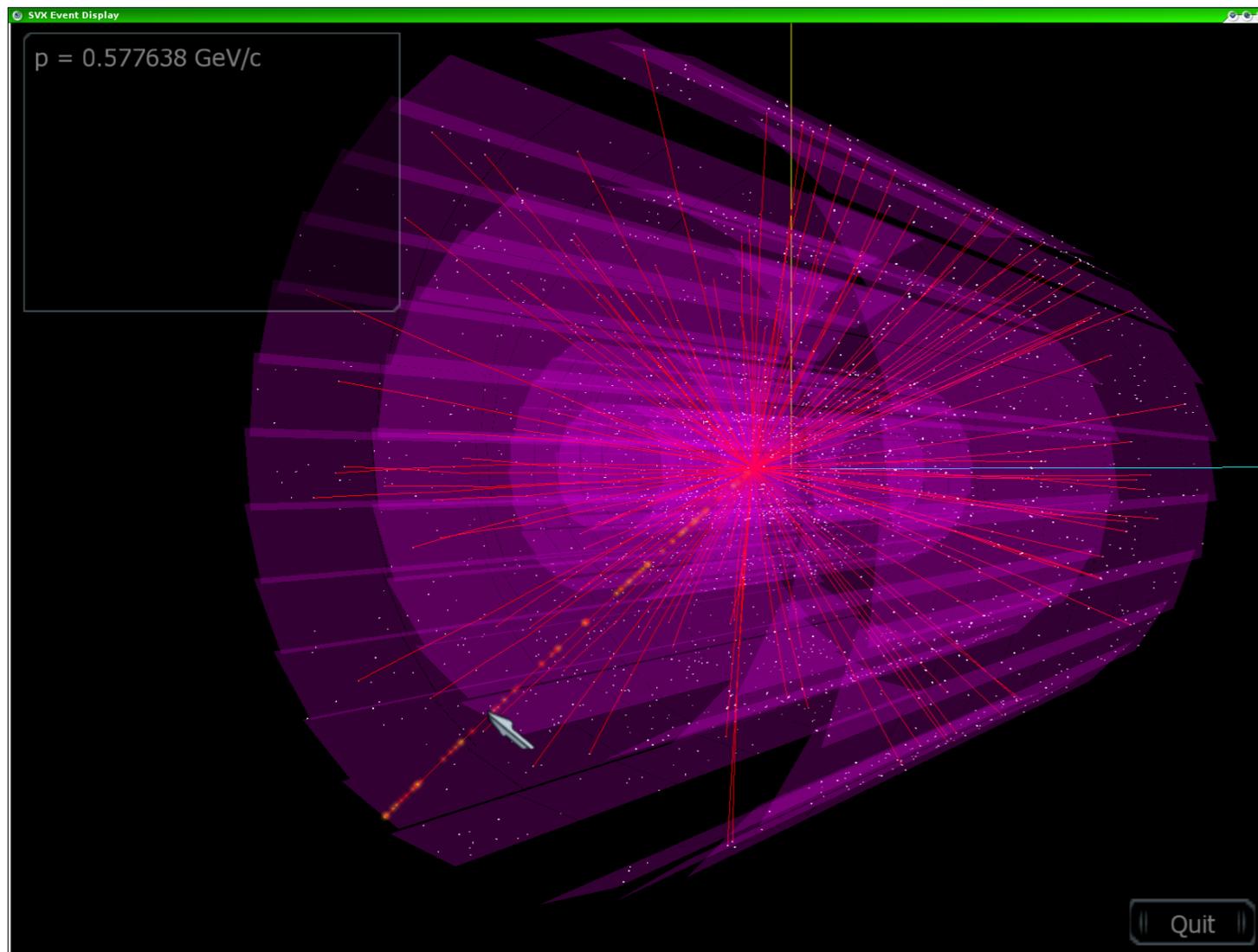
<1.0 GeV/c >.5 GeV/c



>1.0 GeV/c



Event Display



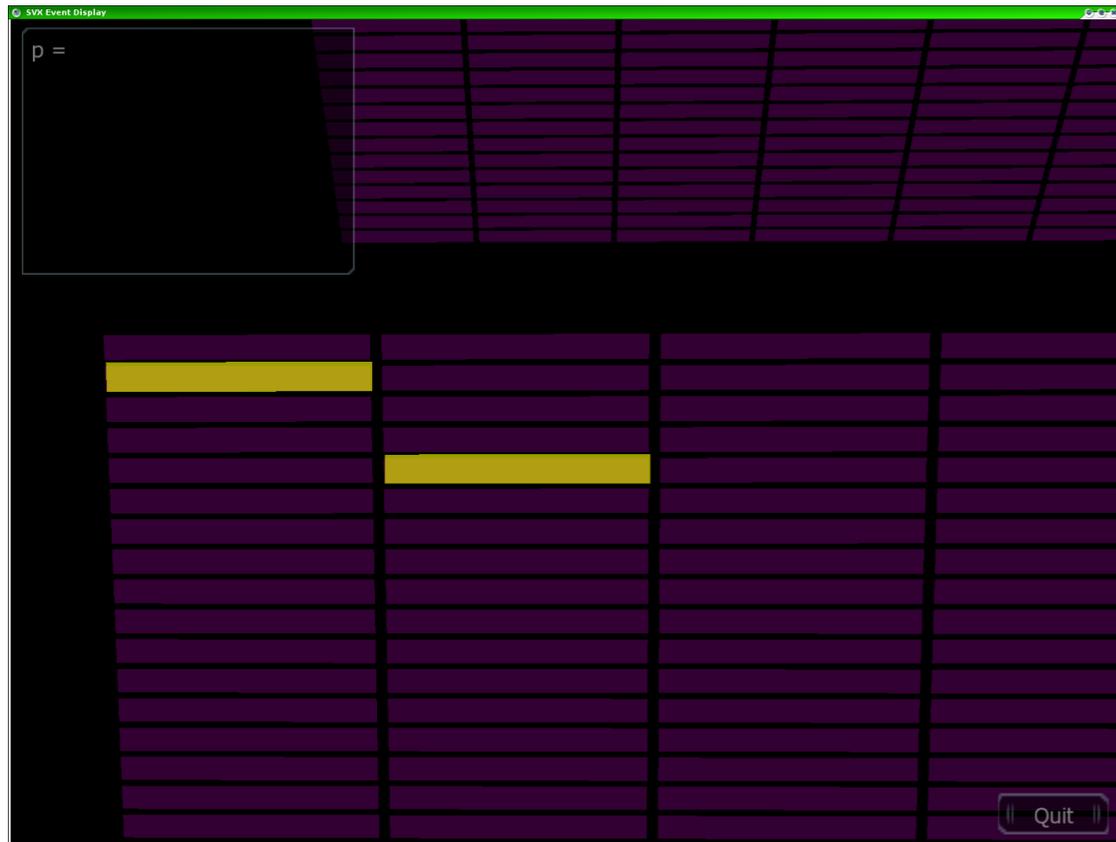
Real-time OpenGL 3D rendering.

Can view hits, tracks from any angle and display track information.

Can view all pixels in a sensor.

A variant of this event display will be used in the upcoming cosmic ray test.

Event Display



close-up view of sensor



plain of SVX

Outlook

Run more statistics

Make a second pass at vertex reconstruction

Try to find secondary tracks from D and B decays (need to run a simulation)