Tracking Simulation Overview

- The primary goal of the tracking simulation effort is to develop robust and realistic tracking simulations that can be used to quantify SiD tracker performance and optimize the tracker design
- Simulation effort has several distinct elements:
  - MC simulation of tracker – GEANT based detector simulation
  - Detailed simulation of tracker hits – convert energy deposits to tracker hits
  - Track finding algorithms – pattern recognition to associate hits into tracks
  - Track fitting algorithms – fitting hits to determine track parameters and errors
  - Tracking performance studies

Tracking Simulation Efforts I

Focus is currently on developing simulation tools

- MC simulation of tracker
  - Cylindrical barrel and disk geometry – complete
  - Planar detector geometry (Jeremy McCormick / Tim Nelson)
- Detailed simulation of tracker hits
  - Complete simulation of charge deposition in strips / pixels, readout, and clustering of strip hits to form “tracker hits” (Tim Nelson / Nick Sinev)
  - Have also in hand a tracker hit cheater that simulates clustering and resolution effects (Tim Nelson / Rich Partridge / Nick Sinev)
  - Define extensions to existing org.lcsim framework needed for tracking (Rob Kutschke + others)
- Track finding algorithms
  - Vertex seeded tracking (Lori Stevens / Rich Partridge / Steve Wagner)
  - Conformal mapping algorithm (David Baker / Norman Graf)
  - Stand alone outer tracking (Cosmin Deaconu / Tim Nelson)
  - Calorimeter seeded tracking (Dima Onoprienko)

Tracking Simulation Efforts II

- Track fitting algorithms
  - Weight matrix (Nick Sinev)
  - Kalman filter (David Baker / Norman Graf / Steve Wagner)
  - Fast helix finder for track finding (Lori Stevens / Rich Partridge)
- Tracking performance studies
  - Multi-algorithm track finding (Tyler Rice / Bruce Schumm)
  - Segmentation of outer tracker (Lori Stevens / Bruce Schumm)
  - Forward tracking studies (Francisco Carrion Ruiz / Hans Wenzel)
  - Tracking performance metrics (Chris Meyer / Bruce Schumm)

Track Finding Algorithms

- For tracks that originate at origin, the vertex detector provides powerful 3D pattern recognition
  - ~95% of tracks are in this category
  - 5 layers of 3D pixel hits
  - Outer tracker confirms track candidates found in vertex detector, provides precise momentum measurement
  - Nick Sinev has demonstrated that this works very well in barrel
- Tracks that originate some distance from the origin are more difficult
  - K_S, Λ, some boosted heavy quark decays, etc.
  - Tools are stand-alone tracking in outer tracker and calorimeter assisted tracking
- Major focus this summer is on the track finding algorithms
  - Summer students are making major contributions
  - We will hear a few progress reports today