Critical Questions for SiD

- Critical Questions document written by J. Brau, M. Breidenbach, J. Jaros, H. Weerts
- Posted on SiD home page (http://www-sid.slac.stanford.edu/)
- 5 critical questions for tracking
- Goal of this talk is to begin a discussion on what studies need to be performed to answer the tracking critical questions

Role of Baseline Design

- The baseline design will serve as the reference tracker design
- Highest priority is to define, simulate, and perform detailed studies of tracking performance for the baseline design
- This, in itself, will allow us to answer some of the critical questions
- Other critical questions are of a comparative nature, which requires one or more alternate geometries to be studied and compared against the baseline
- Studies of alternate geometries can, if desirable, be targeted towards answering a specific question
- Limited time and resources: focus first on the baseline design, and then consider a small number of alternatives

Critical Questions

1. Develop a baseline design for the forward direction
2. Does the baseline design find tracks well? Is the performance robust in the presence of machine and physics backgrounds?
3. Does the tracker design need to become more complicated than the baseline design?
4. Can decays in flight be detected efficiently? Is this an important capability?
5. Demonstrate (if true) the need to minimize tracker material to minimize multiple scattering.

Critical Questions 1 & 2

- These questions are focused on the baseline design

Develop a baseline design for the forward direction

- Finalizing the location and associated material for the forward direction is something we hope to do shortly
- We have some flexibility to study different strip orientations by changing the digitization code
- Can also compare strips vs pixels in the $r < 20$ cm region if that's an issue

Does the baseline design find tracks well? Is the performance robust in the presence of machine and physics backgrounds?

- This is a major goal for the baseline design studies

Critical Questions 3 - 5

- Answering these questions requires studying alternatives to the baseline design

Does the tracker design need to become more complicated than the baseline design?

Can decays in flight be detected efficiently? Is this an important capability?

Demonstrate (if true) the need to minimize tracker material to minimize multiple scattering.

A Single Alternative Geometry?

- Can we answer all of these questions with a single alternative geometry?
- For example, add a second silicon sensor to each of the barrel modules in the outer three layers
  - Strip orientation can either be axial or small angle stereo, as determined in the digitization code
  - Allows comparison of baseline with 8 axial layers
  - Allows comparison of baseline with the addition of 3 stereo layers
  - Allows comparison of K_S finding efficiency between baseline and a 3D tracker
  - Allows impact of added material to be studied
- Is this approach workable? Is three additional layers the right number?

Beyond the Critical Questions

- There may be further optimizations that are desirable beyond those needed to address the critical questions
- Example: is a uniform radial spacing of barrel layers optimal
- Example: is locating the disks at the end of each barrel optimal
- Example: add your favorite variation here
- Suggestion: postpone further optimization until after we have studied the baseline design and answered the critical questions