One version of the SD barrel outer tracker (preferred by Marty Breidenbach) has 5 single-sided layers of Si.

I refer to this as the SOD, mostly to keep people from confusing it with other versions of the SD outer tracker which have some z information, ranging from almost as good as the \( r\phi \) measurement (Si drift, z strips) to good-but-not-great (small-angle stereo).

But Marty prefers to put his money into a finely segmented inner tracker and calorimeter; the SOD is just a “momenter”.

To many people this seems like too minimal an outer tracker.

Rather than just saying it won’t work, or option X is far superior, I’m willing to spend the time to try to prove it won’t work.

If I fail, ergo, it will work.
Compared to What?

• Someone else should probably set the criteria as to whether or not I’ve failed/succeeded

• It’s also better to have someone else test the final product (and that for the other, superior tracking options also)

• But that’s a ways off; I’m just starting

• I’m also not willing to sink a huge amount of time into writing pat rec for a detector that may never be built (steal or reuse as much as possible)

• Made harder by the fact the stuff I have to steal from is in $c++$; no trivial (like f2c) port to java (just as well; too many BaBar tentacles)

• Not a great fan of the tools currently out there; they weren’t designed, just accreted (or not there yet)

• I’m not trying to sell my stuff, just trying to explain why I seem to be insisting on “rolling my own”
What Been Done So Far?

- All the other studies I know of have been done for 3D outer detectors
- Vladimir Rykov at the Santa Cruz workshop (outer tracker similar to a 5-layer Si drift detector)
- Norman Graf at September 26, 2002 SLAC LC meeting (inner CCD detector and tracks projected out to outer, 3D endcap detector)
- I’ve been working for \(~ 3\) months (part time), from my first lines in \texttt{java} to projecting fit trks from inner trker out to the SOD
- Report to the SLAC 2PM Friday LC Tracking meeting about once a month
- All trivial first steps, mistakes can be found at \url{http://www.slac.stanford.edu/~stevew/nlc.html}
  Will not repeat most of that here
- Working in JAS using SDJan03 MC data (and just ignoring the \(z\) info that’s there for the SOD hits)
- Wrote *simple* TrackFinder to work in SOD
- > 96% for finding both tracks from a 10 GeV/c $p_T K^0_s \to \pi^+ \pi^-$ decay with $r_{DEC} < 20 \, cm \, (R_{L1})$ with no other trks in evt
- Not really what people wanted, but was useful for finding trks in VXD *only* when given VXD hits
- Also ported simple helix (circle) fitter $\rightarrow$ will Kalmanize any day now
Adding SOD Hits to Projected VXD Tracks

- Take trks found and (helix) fit in VXD and project out to SOD
- Add (closest) hit and refit trk at each SOD layer
- 50 GeV/c tracks (shown) gobble up SOD hits, get better as they go out ($\sigma_{resid} = 490 \ \mu m$ at L1 to $\sigma_{resid} = 74 \ \mu m$ at L5)
- Will only get a little better with full Kalman fits
- Run it on clean tracks (1 and 50 GeV/c pT) projected out and projected back; picks up all hits and fits correctly
- But no one really cares about tracking in trivial evts
Project VXD Tracks into Jet Core

- Write out SOD hits from 500 GeV $q\bar{q}$ evts ($\langle \text{hit/layer} \rangle \sim 45$) and thrust direction (if $t_z < 0.7$)

- Find and fit VXD trk with no hits overlayed (not a study of VXD tracking problems)

- Rotate $q\bar{q}$ SOD hits to angle wrt VXD trk and mix with single trk SOD hits

- NOT EVEN A PRELIMINARY RESULT ON TRKING EFF - JUST FIRST BRANCH IN WHAT WILL BE A MULTI-BRANCH ALGO.

- Only possible to write one algorithm that’s worse than this without specifically trying to make bad decisions
Conclusions/To Do

- Next step requires $\chi^2$ evaluation of different branches (growing and pruning) - for this need to add hits with material properly taken into account (Kalman hit adding).

- Then questions like: how many branches do I need to consider (time!)?

- How does it fail (time, eff) with increased noise (BGs)?

- How does it fail with detector ineff (dead ladders)?

- Should have something realistic in next few months (by Paris meeting)

- Right now SOD hit adding looks like it will be easy, even in realistic evts. Any other requirements?