Tracking Software Optimization for the Silicon Detector Option

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Overview:

Tracking is a crucial component of the Linear Collider Detector and the track detectors must be optimized for cost, efficiency, size, robustness against beam backgrounds and for minimization of fake tracks in reconstructed events. The silicon detector option has 5 vertex CCD layers and outer silicon planes. Tracking code already exists for 3D hits, but several optimization questions (described below) need to be answered with existing code or code that may have to be written.

Work to be Performed:

Software work will be done to address all the following questions and issues.

Development work underway is exploring very low-mass Si strip options for the LC central tracker (see http://scipp.ucsc.edu/~schumm/nlc/adv_det_01.ps). We want to explore whether this will work from standpoint of pattern recognition. Several questions come to mind: is it necessary to have silicon drift planes outside the vertex detector, or are silicon strip planes adequate? Can the CCDs be used to find tracks using axial-only silicon strips to confirm them and reduce fake track backgrounds? In the case of large beamsstrahlung background, can we start the tracking with outer planes, using the vertex detector only for vertex region track error reduction?

This work will be initiated and supervised by Purohit. Simulation software will play a large role in this effort and will require communication and assistance from the simulation group. Weidemann will serve as liaison with Norman Graf (to help with software troubleshooting).

For now, we will specifically focus on two issues:

1. Use of the existing 3-d pattern recognition code (i.e., code that relies on hits from intrinsically 3-d detectors) to explore capabilties of the CCD vertex detector for stand-alone tracking, as a function of background level.
2. Exploration of reconstruction algorithms for use with an axial-only silicon strip tracker. This work will be informed by what is learned with the stand-alone CCD studies.

Future Plans:

Writing pattern recognition and track reconstruction code for many detector options is a rather large task and will ultimately require the dedicated work of many people over many years. Much of this needs to be done now, in order to arrive at an optimum detector. As such, the software project is more than a year long by itself.

Time permitting, Weidemann is interested in implementation of the topological vertex reconstruction successfully used by SLD for CCD standalone tracking (if it isn't being done by anyone else - see David Jackson, SLAC-PUB-7215, A Topological Vertex Reconstruction Algorithm for Hadronic Jets, http://www.slac.stanford.edu/pubs/slacpubs/7000/slac-pub-7215.html).

Mainly though, our plan in the long term is to focus on the impact on physics studies: how would Higgs, SUSY etc. physics yields and resolutions depend on the different trackers. The silicon strip code developed should be useful to differentiate between strip, drift and TPC-based trackers.

Initial Budget:

While Purohit has tracking experience from silicon hardware and tracking software on E791, he is constrained by time spent on BaBar and teaching. Ideally, a postdoc working with him would be able to handle the burden best. Therefore, we are asking for half a postdoc's expenses (the other half to come from existing funds). We expect that the ½ post-doc salary at approximately $22,000 will be the major expense. The post-doc (and the rest of us) may need to attend approximately one meeting a year dedicated to Linear Collider work (travel to destinations other than BaBar-related meetings).

Item	Cost
½ postdoc salary	$22,000
Travel to LC-only meetings	$3,000
Indirect Costs	25%
Total	$31,250