

Project name

Development and Testing LC Forward Tracking

Classification (accelerator/detector:subsystem)

Detector: Tracking

Institution(s) and personnel

University of Oklahoma, Department of Physics:

Michael G. Strauss (Associate Professor), Post-doctoral researcher (To Be Named)

Contact person

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Project Overview

Traditional e^+e^- tracking detectors have provided excellent track finding and track resolution in the central region, but diminished capability in the forward direction. However, the LC detector will require excellent forward tracking to attain the maximum physics potential. For instance, certain production and decay modes of supersymmetric particles are peaked in the forward direction. This tracking must be performed with minimal material in order to preserve momentum resolution of the order $1/p_t = 10^{-5}$ GeV⁻¹. At present, studies have been done to choose tracking hardware options or software algorithms to assure quality track finding and resolution in the forward direction.

We propose a systematic software effort to understand tracking capabilities in the forward direction, to about 110 mrad from the beamline. A realistic simulation will include beam related backgrounds, accurate simulations of charge deposition, applying reasonable hit finding and merging algorithms, and developing and testing track finding algorithms. Such an effort will allow an informed choice for forward tracking technologies and design parameters. The software tools we develop should facilitate future physics studies.

At the end of this project, which may extend for more than one year, we hope to answer questions such as:

- 1) Is a barrel design suitable for forward tracking?
- 2) What detector design maximizes the forward tracking potential?
- 3) Are three-dimensional technologies necessary for tracking in the forward direction?
- 4) Can reasonable resolution and pattern recognition be performed to 110 mrad?
- 5) Does beam-related background interfere with tracking capabilities in the forward region?

Description of first year project activities

During the first year, we would like to hire a post-doctoral researcher who will develop and adapt tools for LC forward track finding.

There are a number of tools that have been developed within the high-energy community, or are being developed within the LC community that can be adapted for the purpose of understanding tracking in the forward region. For instance, reasonable forward tracking has been attained by the DØ collaboration using tracking code named TRF++. Tools and algorithms developed for TRF++ can be used as a first test of forward tracking in the LC environment. Other tools being developed for LC Monte Carlo studies, such as a complete simulation of the beam line, will be incorporated into a realistic simulation of the forward tracking.

If these tools and simulations are inadequate to answer all of the questions listed above, then we will develop new ones. The tools and algorithms developed can be distributed to the LC community for further study. After one year we expect to have implemented existing tools into a unified package that and to have preliminary conclusions regarding technology and algorithms to use for forward tracking. Further work will probably need to be done to develop and optimize future algorithms.

Qualifications of Personnel and Budget Justification

The contact person for this EOI, Michael Strauss, has significant experience developing and testing tracking software. He co-authored the track finding and fitting algorithms used in the original TPC detector at the PEP collider. He also developed and wrote the tracking software for the SLD CCD-based vertex detector. This software linked Central Drift Chamber tracks to CCD hits, and also found “stand-alone” tracks in VXD-3. He has also been involved with the DØ tracking group and has some knowledge of the TRF++ tools and algorithms available. In order to actually implement and test tracking algorithms, a post-doctoral researcher will be necessary.

Budget

Institution	Item	Cost
Oklahoma	One-half FTE Post-Doctoral Researcher Salary plus Fringe Benefits	\$28,665
Oklahoma	Oklahoma Indirect Costs	\$13,043
	Grand total	\$41,708