

Final Report on Michigan Group's Linear Collider Research

The University of Michigan Linear Collider group (PI: Keith Riles) made progress in two distinct areas: 1) R&D for a linear collider detector tracker alignment system based on frequency scanned interferometry (FSI); and 2) physics and detector simulation studies relevant to the design of a high-precision linear collider tracking system.

During this grant period, the Michigan group commissioned an optical fiber prototype of an FSI channel and demonstrated spatial resolutions better than 100 nm for distance measurements of half a meter or more, a precision more than adequate for a linear collider tracking system. These measurements, however, were carried out under carefully controlled laboratory conditions. Follow-up work beyond this grant period (funded by the National Science Foundation) involved the use of a dual-laser enhancement of the optical fiber system.

The Michigan group also carried out simulation studies to provide guidance in the design of a high-precision tracking system for a linear collider tracking system. Two elementary particle physics channels were examined: 1) Higgs boson production in association with a Z boson; and 2) Supersymmetric lepton (slepton) pair production with subsequent decay to ordinary leptons and neutralinos. This work confirmed that precision on Higgs mass determination can be improved with improved resolution in track momentum. The study also determined that slepton mass resolution does not improve significantly with improved momentum resolution, in the absence of independent precise measurement of neutralino mass.

These findings were reported at Linear Collider workshops in the United States (at SLAC and Snowmass in 2005) and were published in *Applied Optics*, 44 (2005) 3937-3944.

Physicists working on this effort during the grant period:
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