
White Papers, Framework Proposals, FOA's, and LCDRD

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SiD Meeting Oregon ALCPG

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All started with White Paper Strategy

Lepton Physics & Detectors; Version 6.3
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Proposal for a US strategy towards physics & detectors at future lepton colliders

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Brookhaven National Laboratory
Fermi National Accelerator Laboratory
Lawrence Berkeley National Laboratory
SLAC National Accelerator Laboratory*

1. Introduction

For several years, there has been a strong international consensus that an e^+e^- collider will be needed to study the underlying physics of the new phenomena in the mass range from 0.2 – 1.0 TeV, which are expected to be discovered at the LHC. It has also been suggested that this physics might be addressed by a muon collider, making it crucial to understand these different approaches to a lepton collider. Current accelerator technology, either available, being developed or being considered, folded with cost constraints, limits the reach of a possible energy frontier lepton-lepton collider to about $\sqrt{s} = 4$ TeV. The possible machines being considered are at different stages of feasibility: the International Linear Collider (ILC), the Compact Linear Collider (CLIC) and various warm variants, and the muon collider (MuC). ILC and CLIC are both linear electron colliders, with ILC starting at $\sqrt{s} = 0.5$ TeV, ultimately reaching 1 TeV and CLIC being able to reach $\sqrt{s} = 3$ TeV. The muon collider is currently proposed for running up to a center of mass energy of $\sqrt{s} = 4$ TeV. All of these machines have varying luminosity performance within their energy range. All of them aim to fully understand the underlying physics at the TeV scale, but they address different physics depending on their energy range, beam energy spread, luminosity characteristics, polarization, backgrounds, and lepton type. There are R&D programs around the globe at different stages of maturity to develop the necessary accelerator and detector technologies. This document outlines the creation of a single detector research program in the US with the goals to:

- Establish the physics capability of lepton colliders.
- Establish the requirements of detector systems so the physics can be extracted, taking into account the very different operating conditions at each machine.
- Provide feedback to the machine design to further optimize the physics potential.
- Propose necessary detector and other R&D to verify detector technologies.
- Compare the physics potential of these machines and carry out a cost-benefit analysis.
- Coordinate the detector and physics program.

Such a coordinated program of support for the university and national laboratory community would by its nature have a very close relationship to the corresponding machine development programs.

The physics and detector programs for the three major collider options are at different stages of development. The ILC program is far more mature than the others, but has struggled for recognition and

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http://www.dpfnewsletter.org/wp-content/uploads/2011/08/lepton_collider_framework_v6-4_final.pdf

“White Paper” Proposal → LCFP

“Outline of a US Strategy towards Physics & Detectors at Future Lepton Colliders” was presented to the DOE Electron Review in June. DOE requested that a full proposal be developed, later to be called *the Lepton Collider Framework Proposal (LCFP)*.

Goals

- Understand the machine capabilities, limitations, and timetables for each lepton collider option.
- Establish detector requirements at each collider, accounting for the very different machine environments
- Facilitate development of suitable detector concepts, exploiting the existing SLAC software framework for simulation and benchmarking
- Coordinate the necessary physics studies and detector R&D needed to establish concept viability
- Compare the physics potential of all the options on an equal footing.

DOE FOA stimulated LCPF's request for LOI's

Message to members of the American Physical Society's DPF, Authorized by Alice Bean, Secretary/Treasurer =====
Dear Colleagues, ...

Over a week ago the Department of Energy put out a request for proposals for generic detector R&D related to future energy frontier colliders. You can find the call for university proposals and for laboratory proposals at links below

<https://www.fedconnect.net/FedConnect/PublicPages/PublicSearch/PublicOpportunities.aspx>

and

<http://www.science.doe.gov/grants/pdf/SC-FOA-0000438.pdf>

This note is to those of you who are interested in/intend to submit proposals related to or motivated by detectors at future energy frontier lepton colliders.

The LCPF will list lepton collider related detector R&D proposals being submitted either by groups or individuals. We invite you to inform us of your proposal and whether you want it listed as one of the detector R&D proposals associated with the LCPF. If you do want to be listed, we encourage you to refer to the LCPF in your proposal for lepton collider related detector R&D.

LCFP Proposal Put on Hold, LCDRD starts up

- DOE's Funding Opportunity Announcement deadlines pushed us to move on the R&D Consortium, which was to be a part of LCFP, and back burner the full LCFP proposal.
- We noted that the University Detector R&D Program through SiD/Oregon would dispense its final funds at the end of FY11. Hence, it was important to start LCDRD as a continuation, but also an expansion of the SiD/Oregon program.
- LCDRD adopted many of the ideas articulated for LCFP:
 - * Support all Lepton Colliders: ILC, CLIC, MuC
 - * Support detector concept development
 - * Identify R&D critical for concepts and initiate it
 - * Finish up ILC R&D, start CLIC R&D, identify needed MuC R&D
 - * Support the lcsim simulation infrastructure for detector studies

LCDRD Consortium Proposal

- SLAC administers LCDRD
- PI's Jim Brau, Marcel Demarteau, John Jaros
- A Solicitation invited Detector R&D proposals to join the LCDRD Consortium Proposal and outlined LCDRD management plan
- 14 Proposals submitted to LCDRD
- LCDRD Review Board reviewed and prioritized proposals
- SLAC submitted Consortium proposal on March 18, 2011.
- After DOE establishes funding level for Consortium, Review Board will set funding levels consistent with DOE guidelines
- Annual reviews and solicitations of new proposals; annual reports to DOE

LCDRD Proposals

Project No.	Topic	Institutions	PI	Project Description
1.1	Simulation	SLAC-Fermilab	Graf/Lipton	CD Simulation Framework
2.1	Vertex	Yale/Oregon	Baltay	Chronopix Development
2.2	Vertex	UC Santa Cruz	Battaglia	High Resistivity Pixel Sensors
3.1	Tracking	Michigan	Riles	Precision Alignment
3.2	Tracking	UC Santa Cruz	Schumm	Si Sensor and Readout
3.3	Tracking	New Mexico	Seidel	Si Sensors and Interconnects
4.1	Calorimetry	UT Arlington	White	GEM HCal
4.2	Calorimetry	Iowa	Onel	Digital HCal with RPCs
4.3	Calorimetry	Iowa	Onel	Dual Readout Calorimetry
4.4	Calorimetry	Oregon/Davis	Frey	Si/W ECal
4.5	Calorimetry	Iowa	Mallik	Particle Flow Algorithm
4.6	Calorimetry	Princeton	McDonald	RPC Aging Study
5.1	Beamline	Notre Dame	Hildreth	BPM Energy Spectrometer
5.2	Beamline	Oregon	Torrence	Extraction Line Spectrometer

LCDRD Proposals

- Mostly continuations of SiD R&D
- Several proposals now explore applicability at CLIC or MuC
 - * Alignment
 - * Energy Spectrometers
 - * PFA
 - * Dual Readout calorimetry
- One proposal solidly directed at new lepton collider studies, important for MuC and CLIC:
 - * Collider Detector Simulation Framework (lcsim+)
- Future years will need more CLIC and MuC proposals.

LCDRD next

- Communicate with Proponents (soon)
 - * Collect some missing information for website
 - * Distribute Copy of Proposal
 - * Distribute Budget Request
- Await response from DOE
- Evolve LCDRD/LCFP to cover outstanding LCFP goals
 - * Physics simulation funds
 - * Comparison of physics capability
 - * Comparison of machines and detectors
- Additional proposals to DOE?