R&D Perspectives

Jim Brau
Univ. of Oregon

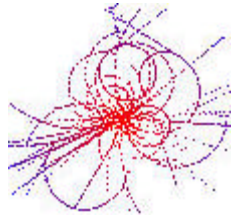
Santa Cruz Linear Collider Retreat
June 28, 2002

- R&D needed to prepare for LC program
- Regional meetings have helped move us closer to a strong R&D effort
  - April 5 - Fermilab
  - April 19 - Cornell
  - May 31 - SLAC

Detector Requirements

There is perception that Linear Collider Detectors are trivial

Not true!



The detector R&D devoted to the challenges of the LHC are helpful but not sufficient

The LC requirements differ from hadron collider requirements

hadron collider: large cross sections and large backgrounds

linear collider: smaller event rates and smaller (though not negligible) backgrounds

The LC requires a different optimization

Detector Requirements

Unburdened by high radiation and high event rate,
the LC can use

⇓

vxd 3-6 times closer to IP
35 times smaller pixels and 30 times thinner vxd layers
6 times less material in tracker
10 times better track momentum resolution
> 200 times higher ECAL granularity (if it's affordable)

But to capitalize on this opportunity,
we must do the R&D now

see Linear Collider Detector R&D (by Int'l committee)
blueox.uoregon.edu/~jimbrau/LC/LCrandd.ps

Prominent Detector R&D Goals

Develop advanced CCD vertex detector
Simulate and prototype superb energy flow calorimeter
Understand limitations of tracking options and develop them
Develop beamline instrumentation (E, pol, lum spectrum, …)
Refine and certify background estimates
Develop high-field solenoid
Develop cost reduction strategies
eg. integrated cal readout
digital cal

We don't have these capabilities now

and we can help with the accelerator developments
(there is a lot of interest in our community)

Past American Detector Simulation R&D

Linear Collider Detector Simulation and Physics Studies (1999-2002) - Prescott Committee

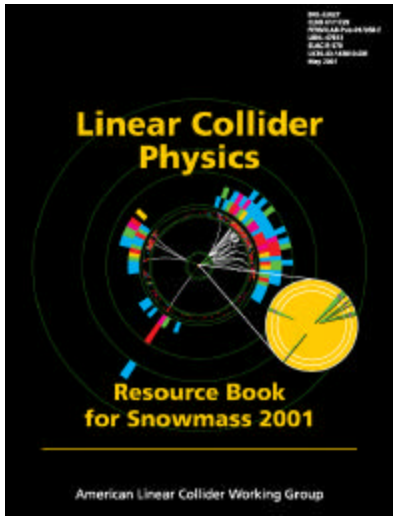
–	1999-00	SLAC/DOE	200k$
–		Fermilab/DOE	100k$
–		NSF	40k$
–	2000-01	SLAC/DOE	300k$
–		Fermilab/DOE	150k$
–		NSF	40k$
–	2001-02	DOE	about 400k$
–		NSF	40k$

~ 1/2 M$/YR

R&D in N. America

These studies culminated in the Linear Collider Resource Book (www.slac.stanford.edu/grp/th/LCbook)

Sourcebook for Linear Collider Physics
Pathways Beyond the Standard Model
Experimental Program Issues
Detectors for the Linear Collider



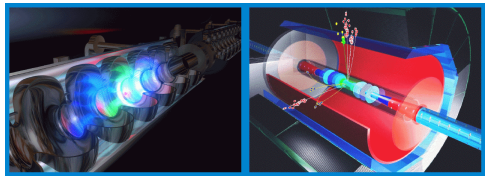
- a valuable resource for Snowmass, and gives us guidance now
- we need to take the next step

ECFA DESY Linear Collider Workshop

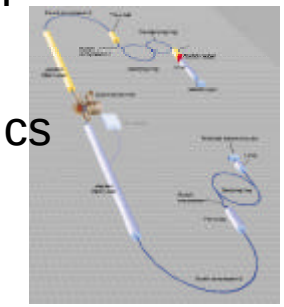
ACFA Joint Linear Collider Physics and Detector Working Group

R&D in Europe and Asia

- beg. April 1998 - 2nd Joint ECFA/DESY Study on Physics and Detectors for a Linear Electron-Positron Collider.
- March 2001 - Presentation of a costed technical proposal for the TESLA Linear Collider (TDR)



- beg. Sept 2001 - Extended Joint ECFA/DESY Study on Physics and Detectors for a Linear Electron-Positron Collider
- Nov. 1998 - 1st ACFA Workshop on Physics/Detector at the Linear Collider
- 2001 - Particle Physics Experiments at JLC (KEK Report 2001-11)



- July, 2002 - 5th ACFA Workshop on Physics/Detector at the Linear Collider

The Detector R&D Program

- There is much work to do - let's get going
- We have identified many of the issues
  - no doubt, our list is incomplete, but strategies are beginning to be formulated to address them,
  - within the ALCPG working groups and the "consortia"
- The report from the International Detector R&D committee reviews the R&D activities
    - http://blueox.uoregon.edu/~jimbrau/LC/LCrandd.ps
  - Please review this draft report (it is a first attempt)
  - send comments to the committee
  - the report is being updated
  - Suggestion - Let's mold it into our "whitepaper" on detectors?

The ALCPG Working Groups

- The Working Groups are formed to help us with our R&D
  - identify the critical needs
  - help us develop and coordinate our R&D plans
  - review and criticize the R&D proposals
  - provide forum for presenting, discussing and considering the R&D results

American Linear Collider Physics Group

Working Groups

Detector and Physics Simulations:
Norman Graf/Mike Peskin

Vertex Detector:
Jim Brau /Natalie Roe

Tracking:
Bruce Schumm/Dean Karlen/Keith Riles

Particle I.D.:
Bob Wilson

Calorimetry:
R. Frey/A. Turcot/D. Chakraborty

Muon Detector:
Gene Fisk

DAcq, Magnet, and Infrastructure:
(inactive)

Interaction Regions, Backgrounds:
Tom Markiewicz/Stan Hertzbach

IP Beam Instrumentation:
M. Woods /E. Torrence/D. Cinabro

LHC/LC Study Group
- chaired by H. Schellman and F. Paige

Higgs:
R. Van Kooten/M. Carena/H. Haber

SUSY:
U. Nauenberg/J. Feng /F. Paige

New Physics at the TeV Scale and Beyond:
J. Hewett/D. Strom/S. Tkaczyk

Radiative Corrections (Loopverein):
U. Baur/S. Dawson/D. Wackeroth

Top Physics, QCD, and Two Photon:
Lynne Orr/Dave Gerdes

Precision Electroweak:
Graham Wilson/Bill Marciano

gamma-gamma, e-gamma Options:
Jeff Gronberg/Mayda Velasco

e-e-:
Clem Heusch

Liaison to accelerator R&D
T. Himel, D. Finley, J. Rogers

http:blueox.uoregon.edu/~jimbrau/LC/ALCPG

The Reviews

- The Linear Collider Steering Group is developing a recommendation for the R&D proposal process
- Independent review committees will review the proposals and recommend funding to the agencies
  - the Int'l Detector R&D document will be used as guidance on detectors
  - http://blueox.uoregon.edu/~jimbrau/LC/LCrandd.ps
- Within the ALCPG we must conduct preliminary internal review to
  - coordinate independent efforts
  - criticize planned programs
  - focus R&D goals
  - raise quality of final proposals

Sunday's Proposal Preparation Meetings

- The UCLC is planning LCCOM2, to discuss preliminary R&D plans for a proposal to NSF
  - full agenda at www.lns.cornell.edu/public/LCCOM2/sciprog2.html
- Fermilab and SLAC community meets in parallel with UCLC to discuss the DOE R&D proposal
- Leading up to this we will hear from the agencies tomorrow
  - 2:50 Michael Procario (DOE)
  - 3:05 Marvin Goldberg (NSF)

Timetable

- The NSF proposal is constrained by the NSF deadline late in September
- The DOE proposal has no firm deadline. Should aim for October-ish submission.
- In order to keep the efforts coordinated, the DOE effort should follow closely behind the NSF proposal schedule
  - ALCPG working group oversight
  - R&D Review Panel

Conclusions

- We are on an excellent path to significantly increasing the R&D progress within North American

- With hard work, and the help of the funding agencies, we will be successful