Study of Physics and Detectors

for

Future Linear e^+e^- Colliders

1. **Where have we come from**
2. **Where should we go from here**

C. Baltay

Chicago Meeting

January 9, 2002

PHYSICS WITH HIGH ENERGY e^+e^- COLLIDERS

A series of Workshops to study the physics potential of High Energy e^+e^- Colliders, held in preparation for the 1996 SNOWMASS Study.

- Organizational Meeting at Yale Feb 11, 1995
- Set up Physics Working groups
- Series of Workshops
  1. Estes Park, Colorado June 23-25, 1995
  2. Fermilab Nov 16-18, 1995
  3. SLAC Feb 29-March 2, 1996
  4. Brookhaven Natl Lab May 6-8, 1996

★ SNOWMASS Study June 24-July 12, 96

VANCOUVER, July 29, 1998

Organizing Committee

Of the

Worldwide Study of Physics and Detectors

For Future Linear e^+e^- Colliders

Co-chairs:

Charles Baltay	Sachio Komamiya	Dave Miller
Yale University	University of Tokyo	UC London

~~Alan Astbury~~ Bob Carmgie	TRIUMF (Canada)
Jonathan Bagger	Johns Hopkins (USA)
Paul Grannis	SUNY, Stonybrook (USA)
Steve Olsen	U. of Hawaii (USA)
Charles Prescott	SLAC (USA)
Shinhong Kim	Tsukuba U. (Japan)
Sun Kee Kim	U. of Seoul (Korea)
Takayuki Matsui	KEK (Japan)
G.P. Yeh	Taiwan
Tao Huang	U. of Beijing (China)
Michael Danilov	ITEP (Russia)
Rolf Heuer	CERN/DESY (Germany)
Marcello Piccolo	Frascati (Italy)
Francois Richard	Orsay (France)
Ron Settles	Munich (Germany)

Goals of the Worldwide Physics and Detector Study

Valid regardless of the eventual geographic location of the e^+e^- LC

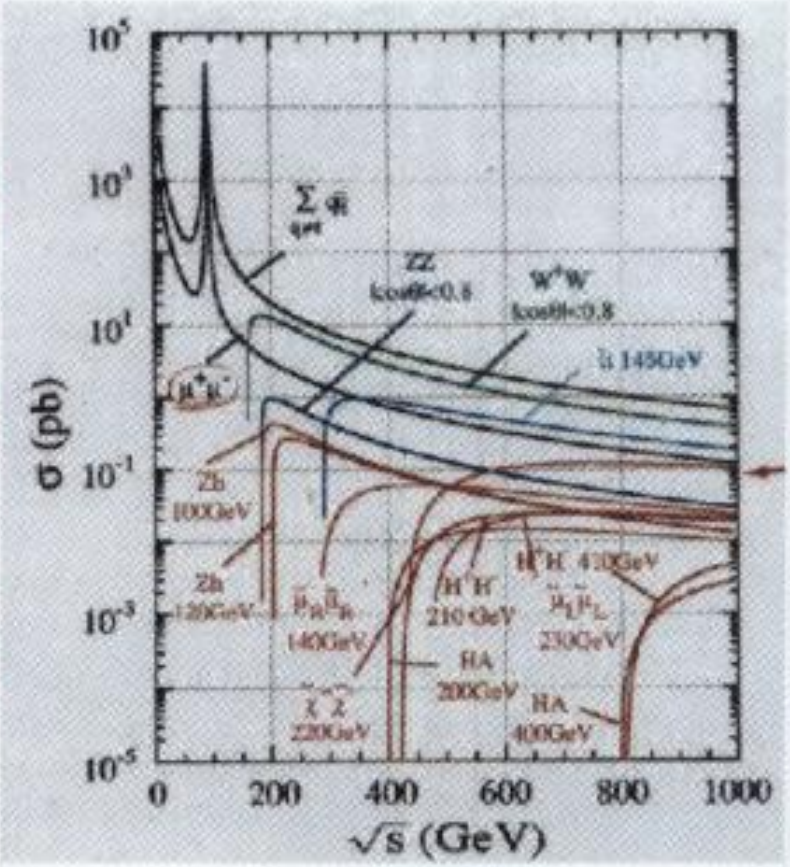
1. Further study of relevant physics processes with a focus on providing guidance on the parameters required for both the collider and the detectors.

2. Start building an international user community.

3. Start thinking about detectors with the goal of having some detector design and rough costing by the time of the design report for the linear collider.

Worldwide Study of the Physics and Detectors for Future Linear $e^+ e^-$ Colliders

A worldwide study of the Physics and Detectors for Future Linear e+e- Colliders is now underway. It has been initiated by an International Organizing Committee at their first meeting in Vancouver, Canada on July 29, 1998. This committee has agreed to meet annually for the next few years as an International Steering Committee to guide and monitor the progress of the study.



- International Organizing Committee
- Working Groups
- Working Group Contact Persons
- Inter-Regional Meetings
- European Activities
- Asian Activities
- American Activities
- Reference Reactions for Detector Simulation Studies

For comments on this web site, please contact the L C Webmaster at Yale University Physics Department.

http://lcwws.physics.yale.edu/lc

Worldwide Study

Of

Physics and Detectors

For

Future Linear e^+e^- Colliders

C. Baltay, D. Miller, S. Komamiya

ICFA Meeting

August 10, 1999

Stanford University

ICFA MEETINGS

August 10, 1999 at SLAC

Oct , 1999 at Fermilab

- Strong concensus that High Energy e^+e^- Collider is the next machine for the Worldwide Particle Physics program

- Emphacized importance of International Collaboration on such a collider

- Endorsed importance of the Worldwide Study on the Physics and Detectors for high energy e^+e^- Colliders

Working Group International Contact Persons

1.	Detector & Physics Simulations		
	M. Pohl	Mike Peskin	Keisuke Fujii
2.	Vertex Detector		
	C. Damerell	Jim Brau	Y. Sugimoto
3.	Tracking		
	R. Settles	Keith Riles	D-H Zhang
4.	Particle I.D. and other specialized detectors		
	T. Behnke	Hitoshi Yamamoto	Z-G Zhao (IHEP)
5.	Calorimetry		
	S. Bertolucci	Frank Porter	G. W-S Hou
6.	Muon Detector		
	M. Piccolo	Dave Koltick	Y-S Zhu
7.	Data Acquisition and Trigger		
	P. LeDu	Tony Barker	I. H. Park
8.	Higgs		
	E. Gross	Rick Van Kooten	Satoru Yamashita
9.	SUSY		
	U. Martyn	Teruki Kamon	C-S Li (Beijing)
10.	Other New Particles and Alternative Theories		
	G. Wilson	Slawek Tkaczyk	C. S. Kim
11.	Top Physics		
	M. Martinez	David Gerdes	Xin-Min Zhang
12.	QCD, Two Photon		
	P. Burrows	Bruce Schumm	Yuan-Han Chang
13.	Electroweak, Strong Gauge Interactions		
	K. Moenig	Tim Barklow	A. Miyamoto
14.	e-e-, $e\gamma$, $\gamma\gamma$ Options		
	V. Telnov	Karl Van Bibber	T. Takahashi
15.	Interaction Regions, Backgrounds		
	O. Napoly	Tom Markiewicz	Toshiaki Tauchi

Recent Studies

1. NLC Study in the US.
2. JLC Studies in Japan.
3. TESLA Studies in Europe.

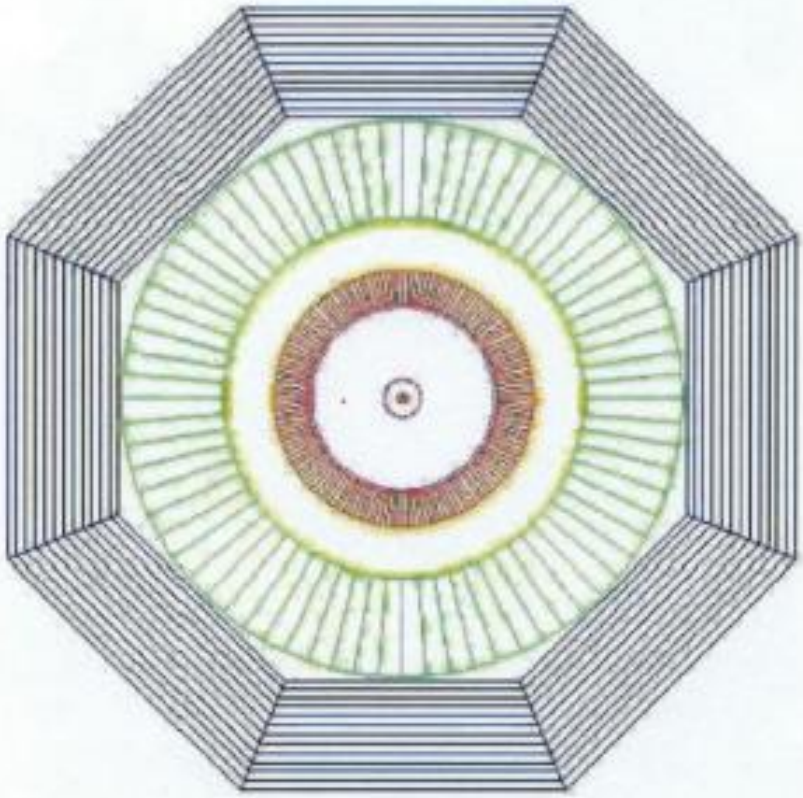
Series of International e^+e^- Workshops

- Finland 1991
- Hawaii 1993
- Japan 1995
- Barcelona Apr. 28 – May 4, 1999
  (Sitges)
- Fermilab October 2000

A STUDY OF THE PHYSICS AND DETECTORS FOR FUTURE LINEAR e+e- COLLIDERS

American Activities

A series of meetings was held in 1995 - 96 in various parts of the US to study the physics potential of future high energy e+e- colliders, culminating in the 1996 Snowmass Summer Study. The American part of the present round of the Worldwide Study of Physics and Detectors for Future Linear e+e- Colliders was initiated in a meeting at Boulder in June of



- Working Groups an their Leaders to Snowma 1996
- American Working Groups an their Organiz for the Pres Worldwid Study
- Regional Meetings i America
- Detector Simulatio Studies
- Detector Graphics
- The Detect R&D Progra
- Announceme for Future Meetings
- Announcem for Linea Collider Detector Simulation

American Working Group Interim Organizers

Paul Grannis & Charles Baltay, Coordinators

1. Detector & Physics Simulations
   Mike Peskin, Tim Barklow, Richard Dubois
2. Vertex Detector
   Jim Brau
3. Tracking
   Keith Riles, Dean Karlen, Chris Hearty
4. Particle I.D.
   Hitoshi Yamamoto, Richard Stroynowsky
5. Calorimetry
   Frank Porter, Ray Frey
6. Muon Detector
   Dave Koltick
7. Data Acquisition/Electronics
   Tony Barker, Bob Jacobsen
8. Higgs
   Rick Van Kooten, Bill Marciano
9. SUSY
   Teruki Kamon, Bob Hollebeek, H. Murayama, U. Nauenberg
10. Other New Particles
    Slawek Tkaczyk, Joanne Hewett
11. Top Physics
    David Cinabro, Dave Gerdes, Andreas Kronfeld
12. QCD, Two Photon
    Bruce Schumm, Lance Dixon
13. Electroweak, Strong Gauge Interactions
    Tim Barklow, Mike Peskin
14. e-e-, $e\gamma$, $\gamma\gamma$ Options
    Karl Van Bibber, Clem Heusch, Les Rosenberg
15. Interaction Regions, Backgrounds
    Tom Markiewicz, Stan Hertzbach

First name on each line agreed to serve as the International Contact person.

July 5, 2000

The Case for a 500 GeV e^+e^- Linear Collider

AMERICAN LINEAR COLLIDER WORKING GROUP

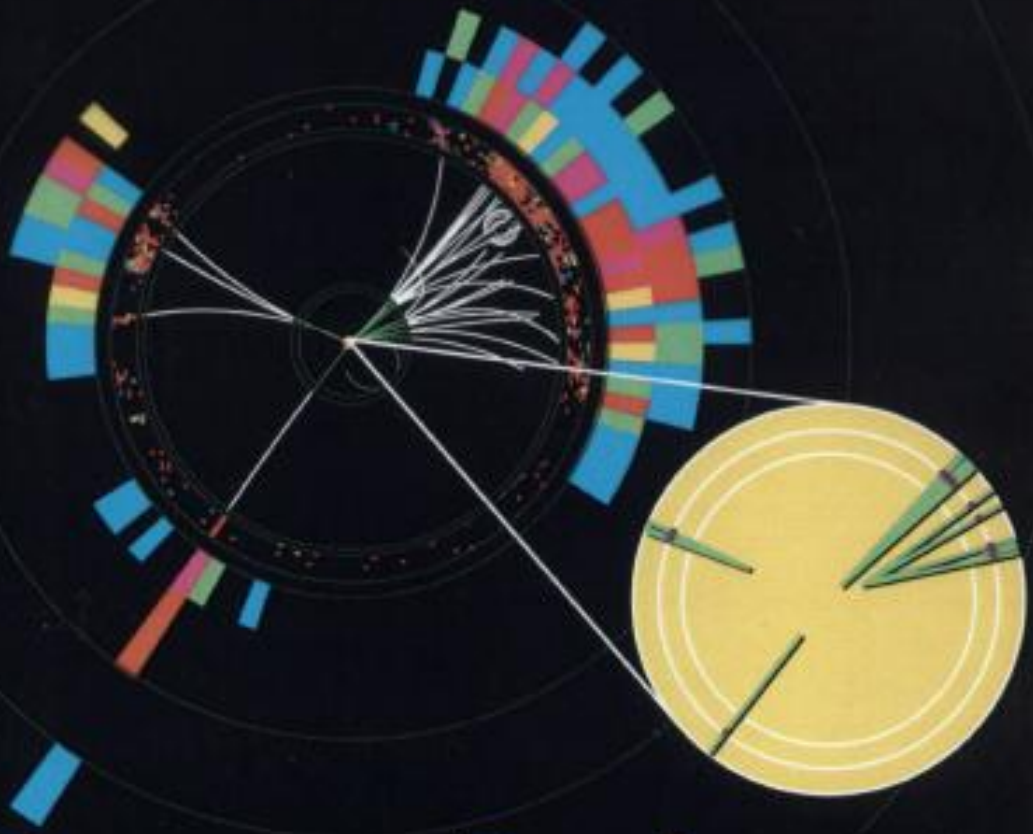
J. Bagger[11*], C. Baltay[28*], T. Barker[7], T. Barklow[26], U. Baur[18], T. Bolton[12], J. Brau[20], M. Breidenbach[26], D. Burke[26], P. Burrows[21], L. Dixon[26], H. E. Fisk[8], R. Frey[20], D. Gerdes[17], N. Graf[26], P. D. Grannis[19*], H. E. Haber[4], C. Hearty[1], S. Hertzbach[15], C. Heusch[4], J. Hewett[26], R. Hollebeek[22], R. Jacobsen[13], J. Jaros[26], T. Kamon[27], D. Karlen[6], D. Koltick[23], A. Kronfeld[8], W. Marciano[2], T. Markiewicz[26], H. Murayama[13], U. Nauenberg[7], L. Orr[24], F. Paige[2], A. Para[8], M. E. Peskin[26*], F. Porter[5], K. Riles[17], M. Ronan[13], L. Rosenberg[16], B. Schumm[4], R. Stroynowski[25], S. Tkaczyk[8], A. S. Turcot[2], K. van Bibber[14], R. van Kooten[10], J. D. Wells[3], H. Yamamoto[9]

ABSTRACT

Several proposal are being developed around the world for an e^+e^- linear collider with an initial center of mass energy of 500 GeV. In this paper, we will discuss why a project of this type deserves priority as the next major initiative in high energy physics.

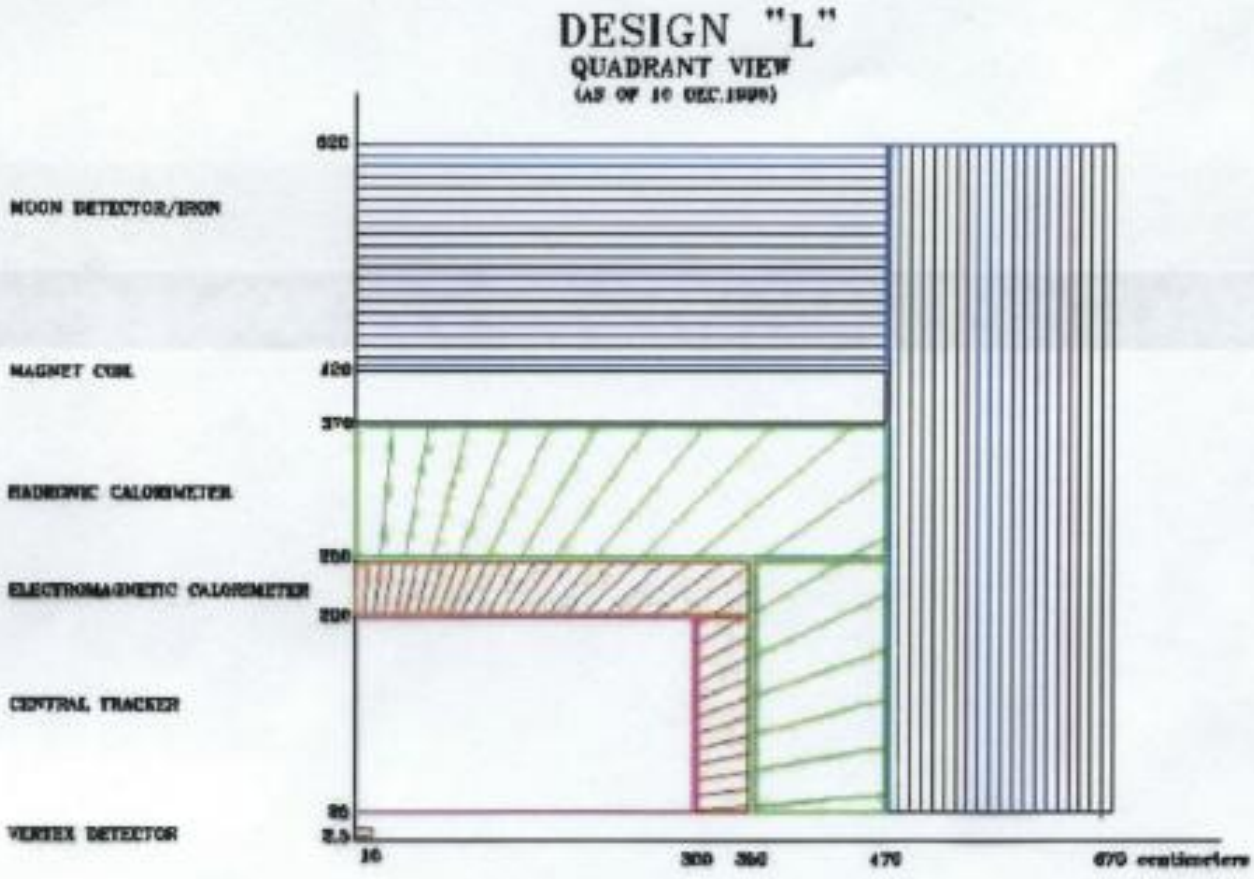
CLNS 01/1729
FERMILAB-Pub-01/058-E
LBNL-47813
SLAC-R-570
UCRL-ID-143810-DR
May 2001

Linear Collider Physics



Resource Book for Snowmass 2001

American Linear Collider Working Group



Design L - Quadrant View

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For a postscript version, please click here.

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Detector	L	SD	P
1.1 Vertex	4.0	4.0	4.0
1.2 Tracking	34.6	19.7	23.4
1.3 Calorimeter	48.9	60.2	40.7
1.3.1 EM	(28.9)	(50.9)	(23.8)
1.3.2 Had	(19.6)	(8.9)	(16.5)
1.3.3 Lum	(0.4)	(0.4)	(0.4)
1.4 Muon	16.0	16.0	8.8
1.5 DAQ	27.4	52.2	28.4
1.6 Magnet & support	110.8	75.6	30.5
1.7 Installation	7.3	7.4	6.8
1.8 Management	7.4	7.7	7.4
SUBTOTAL	256.4	242.8	150.0
1.9 Contingency	102.6	83.4	60.0
Total	359.0	326.2	210.0

Table 15.2: e^+e^- linear collider detector budgets (WBS to subsystem level) in M$ FY01.

Announcement for Linear Collider Detector Simulation and Physics Studies

We have initiated a program to provide financial support for the study of the physics and detectors for future high energy e+e- colliders.

The goals of the study are:

1. To study relevant physics processes with a focus on providing guidance on the parameters required for both the collider and the detectors.
2. To start detector simulation studies and to investigate strategic issues and trade-offs in a detector design with respect to the physics requirements and the machine environment.
3. To provide the channels of communication to, and the forum for discussions with, the international user community interested in carrying out experiments on such a collider, wherever its eventual geographic location is.

The duration of these studies is anticipated to be three to four years, to correspond to the period during which the machine designers develop a Conceptual Design Report (CDR).

It is expected that these studies will move through phases as time goes along. Initially the studies will be on detector simulation in the context of anticipated physics processes. Performance studies of a wide range of detector designs will be expected. Eventually, the outcome of the studies will guide detector component R&D and some prototyping of concepts.

To provide financial support for these studies, DOE through SLAC and Fermilab, and NSF are making funds available for this program.

Year 1 of this Program

(July 1999 - July 2000)

The first round of proposals were due by March 15, 1999. There were funding requests from 20 groups, of which we were able to fund 11 groups. Total funding approximated:

SLAC/DOE $200K
Fermilab/DOE $100K
NSF $40K

Almost all of the allocated funds were for half-time support of Post Docs for Physics and Detector Simulation Studies. There was a promise that productive grants would be continued to provide a second year of support for these Post Docs.

Year 2 of the Program

(July 2000 - July 2001)

We have received promises from the labs to support the second year of this program at the level of

SLAC/DOE $300K
Fermilab/DOE $150K

The NSF promised to try to double their level of support over the first year, depending, of course, on the quality of the proposals.

The procedures for proposals worked well las year, so we will use the same procedures again this year (see Procedures for Proposals and Content of Proposals). The due date for the second round of proposals will be

May 1, 2000 - proposals due

Year 3 of this Program

(July 20001- July 2002)

We have received promises from both DOE and NSF to fund this program for the third year at approximately the same level as last year. The DOE supported groups will get funding directly from the DOE (not the labs, as was the case last year). The procedure for proposal has worked well for the last two years so we will use the same procedures again this year (see Procedures for Proposals and Content of Proposals below). The due date for the third round of proposals will be:

May 1, 2001 - proposals due

Proposals should be sent to Professor Charles Prescott who has agreed to chair the selection committee again for the third year.
Proposals from New Groups who did not submit a proposal last year are not only welcome but encouraged.
Proposals funded last year, these groups are encouraged to submit proposals again for the second year of the program. In addition to the items listed under Content of Proposals, a discussion should be included describing the progress achieved in the first year and the rationale for continued funding.
Proposals we were not able to fund last year, these groups may wish to submit the same proposal as last year or change them in whatever way they feel is appropriate for the second year of the program.

Recent American Regional e^+e^- Meetings

Boulder	June 1998
Keystone	Sept. 1998
Berkeley	March 2000
Johns Hopkins	March 2001
★ SNOWMASS	July 2001
Chicago	Jan 7-9, 2002
2nd Meeting	June 2002 ?
(Santa Cruz	mid to late June 2002)

Physics and Detector Studies

for

Future Linear e^+e^- Colliders

Where should we go from here ?

World Wide e^+e^- Study

- Steering Committee met in Rome July 26, 2001
- Agreed that there is a need for this group to continue more or less as is for a few more years.
- We further agreed on three activities for the near future:

1. Comissioned an international R&D group to write an R&D report.

   Rolf Heuer, Chris Dammerell, Ron Settles, Jim Brau, Gene Fisk, Keith Riles, and 3 Asian members to be named.

   - First meeting at Krakow (almost)
   - Purpose of Report
     - Summarize R&D going on at the present on Linear Collider Detectors world-wide
     - Outline R&D needed in the near future
   - Report by early 2002

2. Agreed to write an international volume on Physics and Detectors for Future Linear e^+e^- Colliders

The WORLD BOOK

- Regional Documents Exist:
  - TESLA Document March 2001
  - The ORANGE Book June 2001
  - The Asian Document August 2001
- Purpose of the WORLD BOOK
  - Summarize the best of the Regional Documents
  - Include new developments between the Regional Documents and the Korean meeting August 2002
  - Show international concensus for the physics of e^+e^- colliders
  - Increase interregional cooperation
- Time scale - have 1st draft to focus discussion at the Korean Meeting August 2002
- Choose Editorial Committee at Reginal Krakow, Beijing, and U. of Chicago meetings

3. Organizing the next International Linear Collider Workshop

Cheju Island, Korea August 26-30, 2002

International Workshop on Linear Colliders

August 26 - 30, 2002 Jeju Island, Korea

International Workshop on Linear Colliders (LCWS 2002) will be held in Jeju Island (formerly spelled as Cheju Island), Korea, during August 26 - 30, 2002. This workshop will be the sixth in a series of International Workshops devoted to the physics and detectors related to the next generation large scale electron-positron linear colliders. Previous workshops took place in Finland, Hawaii, Japan, Spain, and U.S.A.

Registration | Program Information | Registered Participants | Transportation

Proceedings | Companion Program | Organizers Information | Links

Local Organizing Committee

Future of the e^+e^- Physics & Detector Studies

1. The World Wide Study at the Rome meeting (July 26, 2001) agreed to continue for a few more years

2. Suggestion - it is time to reexamine and re-organize the American Regional effort

   - The present leadership and "interim organizers" should declare their job done and step down by the summer of 2002
   - First discussion of new organization at the January U of Chicago Mtg
   - Try to decide on new organization at the May-June Meeting

Rotation of the Working Group Organizers

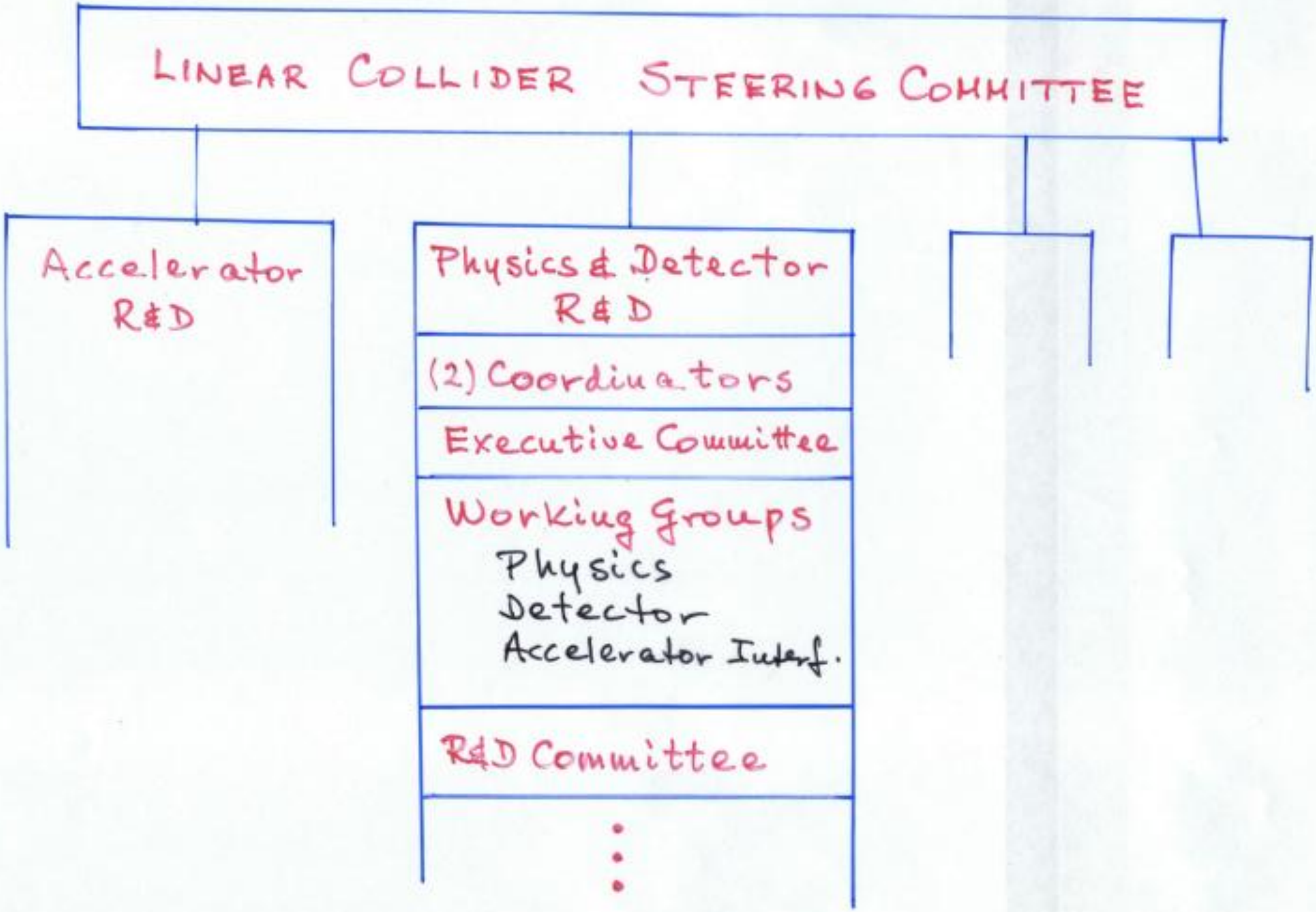
- As most of you will recall, we set up the working groups and their leadership at the Boulder meeting in June 1998. We decided to call the working group leaders "Interm Organizers".

- The word "interim" was used to emphasize that this first group should get the ball rolling, but as a broader segment of our community gets involved in these studies, we would rotate the organizers to allow room for new faces to get involved in the leadership.

- We believe that there are now new people getting involved in these studies, and the time has come to start this process.

Possibilities for Future Organization

- Structure and Purpose
  - Study of Physics and Detectors for Future Linear e^+e^- Colliders
  - Users Organization
  - Experimental/Detector Collaboration
- Overall Coordinators to be selected/endorsed by Lab Directors or New e^+e^- Steering committee
- Relook at Working Groups needed, with new/old leaders
- Seek funding for increased scope Detector R&D Program
- Try to converge by June 2002 meeting?


LINEAR COLLIDER STEERING COMMITTEE
Accelerator R&D
Physics & Detector R&D
(2) Coordinators
Executive Committee
Working Groups
Physics
Detector
Accelerator Interf.
R&D Committee

Physics & Detector R&D Program

We are in the 3rd year of an R&D Program

- Concentrated on Physics Studies and Detector Simulation
- Supported Post Docs at Universities
- About 500 K$ / year
- Charlie Prescott chaired Selection Committee

Where do we go from here?

- Continue Physics & Detector Simulations
- Start some Hardware R&D
- Will talk to Lab Directors and DOE to substantially increase funding