First Report on the International Detector R&D Panel

R.-D. Heuer

Hamburg University

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LC Detector R&D: Why

(see talks by K.Riles, R.Frey, G.Fisk, N.Graf)

High precision measurements at the LC requires much better detector performance (resolution and systematics) compared to LEP/SLC:

Some demanding examples are

- Flavour Tagging (in particular charm)
  $H \rightarrow c\bar{c}$
  multi-jet final states (e.g. top and WW final states)

- Momentum resolution
  Higgs signal from dilepton recoil mass
  Endpoint mass spectra in SUSY cascades

- Jet reconstruction (Energy-Flow)
  Higgs self-coupling HHZ
  $e^+e^- \rightarrow ZZ\nu\bar{\nu}, WW\nu\bar{\nu}$
  multi-jet final states, e.g. ttH
  effect of shower leakage (muon system as tail catcher)

- Forward angle coverage
  New t-channel processes (e.g. sparticle production)
  Differential luminosity measurement

- Beam energy determination
  Threshold scans (e.g. WW)
  GigaZ

- Polarisation measurement
  GigaZ

- Interaction Region issues
  Mask and mask instrumentation (hermeticity)
  Diagnostic detectors
  Photon Collider issues

Present simulation studies suggest the following performance figures

- for vertexing $\delta(IP_{r\phi,z}) \leq 5\,\mu\text{m} \oplus \frac{10\,\mu\text{m GeV/c}}{p\sin^{3/2}\theta}$
- for tracking $\delta(\frac{1}{p_t}) \leq 5 \times 10^{-5}(\text{GeV/c})^{-1}$ with systematics $\leq 10\,\mu\text{m}$
- for energy flow $\frac{\delta E}{E} \simeq 0.35\,\frac{1}{\sqrt{E(\text{GeV})}}$
- for hermeticity excellent forward coverage with the beam pipe as only order (10 mrad) hole in the 4π acceptance
- for background robustness fine granularity in all subdetectors and a large (> 3T) $\vec{B}$-field
- for beam energy determination an accuracy of 10^{-4} to 10^{-5}
- for polarisation an accuracy below 10^{-3}

Performance of a LEP/SLC detector not sufficient
$\Rightarrow$ need more agressive detector design, possibly new technologies and new ideas

Benefit from R&D for LHC detector? Yes, but
nature of events at LHC and LC different
$\Rightarrow$ LC experiments will require different optimisations and detector choices

Need for

LC detector R&D
$\oplus$ detector oriented simulation studies
$\oplus$ development of algorithms

Timescale: Form experiment collaboration(s) around 2005!

LC Detector R&D: Status

Detector R&D ongoing in Asia, Europe, North America
- different level of activities
- different emphases
- mostly individual groups or regional projects

→ talks by J.Brau, G.Fisk, K.Riles

-Detector designs to first order (except for bunch spacing) independent of machine designs under consideration
-Funding and human resources tight (avoid unnecessary duplication)
-testbeams scattered around the world
⇒ We can and should work together

Existing interregional projects:
- TPC studies (Europe, North America)
- Calorimeter studies (Europe, US)
- IR: development of diagnostic detectors (Europe, North America)
- Laser system for $\gamma\gamma$ - IR (Europe, US)

International LC Detector R&D: Plans

LC World Wide Study Organising Committee suggested

to organise the R&D efforts more globally and
to facilitate and foster interregional co-operation and collaborations

Set up a panel with the following members:

Asia: Yoshiaki Fujii, Hwanbae Park, Hitoshi Yamamoto
Europe: Chris Damerell, Ron Settles, Rolf Heuer
North America: Jim Brau, Gene Fisk, Keith Riles

Group met with varying composition in Krakow, Beijing, Chicago

Aim: Produce a first report by mid February

This report should

- describe required detector performance and challenges, and the need for R&D
- list the R&D efforts presently going on
- point out areas where effort is missing or areas which are not adequately covered

This report is not meant to be prescriptive:

There will be areas of R&D not mentioned in the report

There will be hopefully novel ideas

The report is structered according to subdetectors or R&D items NOT according to regions:

Within individual R&D topics, (inter)regional projects will be listed with short descriptions also pointing out their similarities and complementarities, links to Web pages (encouraged!) will be given.

Status of the report as of today

Items 1 and 2:
Sufficiently advanced to have that part available mid February in a prel. version
⇒ should help to improve contacts and information exchange between groups in different regions
⇒ allows interested groups/individuals to join ongoing projects or initiate new projects

Item 3:
For a meaningful overview of missing efforts, possibly prioritised, more information about ongoing projects needed, aim for end of March(?)
⇒ trigger interest from new groups, useful for raising funds

Problem: Such a report is 'static', need more 'dynamical' tool

Proposal:

Create (and maintain) Web pages, structured in the same way as the report:

	Maintenance responsibility:
• Overview page linked from the World Study Web page containing general detector R&D information and links to	Panel members
• Subdetector or topic related pages (structure and content still to be defined) with links to	Regional contact persons
• Individual project pages	Project leaders

⇒ Up to date information about ongoing and missing R&D efforts

Crucial: Maintenance of these pages

International LC Detector R&D: Summary

- International LC Detector R&D Panel set up
- Status report in preparation
- Structure for Web based R&D information proposed

Comments and suggestions welcome

Aim and Hope:

Achieve more information exchange between individual projects, encourage closer interregional co-operation and even collaboration on individual subdetector or R&D items

Time is ripe: Let's make detector R&D more global