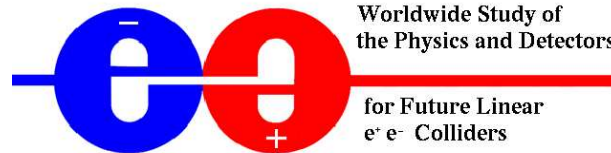

Workshop on LHC /ILC Synergies

Introduction

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SLAC 03/2005



www.ippp.dur.ac.uk/~georg/lhclc

Introduction

- Physics case is well established both for LHC and ILC, based on what each machine can do **individually**
- **LHC:** \gtrsim 2007, expected to run for about 15 years
- **ILC:** \gtrsim 2015?

Expeditious realisation of the ILC \Rightarrow period of concurrent running

What is the added value of having both machines run in parallel?

LHC / ILC interplay

LHC: good prospects for producing new heavy states

ILC: direct production \oplus high sensitivity to effects of new physics via precision measurements (cf.: WMAP vs. COBE)

ILC will have a lot to add to whatever the LHC will find out

\Rightarrow Need this information as soon as possible to identify the nature of new physics

Concurrent running: **LHC** \otimes **ILC**

\Rightarrow Information obtained at the ILC can be used to improve analyses at the LHC and vice versa

\Rightarrow Enable improved strategies, dedicated searches

LHC / ILC Study Group

hep-ph/0410364

LHC / ILC Study Group:

⇒ explore LHC / ILC
synergy

World-wide working group,
started in spring 2002

Collaborative effort of
Hadron Collider and Linear
Collider experimental com-
munities and theorists

First report:
hep-ph/0410364

Physics Interplay of the LHC and the ILC

The LHC / LC Study Group

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How far are we?

In order to assess the physics gain of LHC / ILC concurrent running need to know from both colliders for different scenarios of new physics:

- (1) can a signal be detected?
- (2) which properties can be measured; how precisely?
- (3) how well are we able to tell what it is?

⇒ Summary given in the report

Main focus of LHC studies so far was on (1), less results available on (2) and (3)

How far are we?

- Many possibilities of LHC / ILC synergy have been highlighted
 - ⇒ LHC / ILC interplay is a very rich field
 - ⇒ great potential for important physics gain
 - ⇒ Needs to be worked out and confirmed in detailed case studies, experimental simulations
- Many of the analyses so far were mainly LHC analyses where at the very end some ILC input was injected (or the other way round)
 - ⇒ Aim should be LHC / ILC analyses that make use of the interplay from the start

How far are we?

- ATLAS and CMS are actively preparing for the start of data taking: CMS writes physics TDR, many new studies in ATLAS (full simulations, new scenarios)
 - + ongoing ILC studies
 - ⇒ Many new results, ideal input for LHC ⊗ ILC studies
 - There is a strong demand from our colleagues (within and outside our field), funding agencies, . . . to justify why we want to start constructing the ILC so soon after the start-up of the LHC
 - ⇒ A strong case for concurrent running will help
- ⇒ We cannot afford to slow down in our efforts for exploring LHC / ILC interplay

Example from the U.S.

Presentation from M. Turner (NSF) to HEPAP, Sep. 23, 2004:

Complementarity

Inevitably, the question will arise of why we need a second, *less* powerful accelerator to explore the energy frontier. To educate us and to clarify this issue more generally, we would like HEPAP to form a subpanel to address complementarity, paying particular attention to the following aspects of LC/LHC complementarity:

- In the context of physics discoveries (e.g., low-energy supersymmetry) made at the Tevatron or early at the LHC, what is the role of a subTeV Collider?
- In the context of physics discoveries made an LC, what is the role of the LHC
 - In the context of “known physics” (e.g., electroweak physics), what are the synergies and complementarities of these two machines?

You should assume that the LC and LHC (with possible upgrades) will have a significant period of overlapping operation.

We are looking for a short document (20 pages), accessible to knowledgeable non-experts (e.g., members of the EPP2010 Study, OSTP Staff and ourselves). We ask that the report be completed by April 2005.

Finally, to further educate us as well as giving us an opportunity to refine and discuss the charge with you in more detail, we suggest a half-day session at the next HEPAP meeting devoted to Complementarity.

Further LHC / ILC activities in the near future:

- Les Houches Workshop: Physics at TeV Colliders

Meeting: **May 2–20, 2005**

- Snowmass Workshop: **August 14–27, 2005**

Aspen Workshop: **August 14 – September 11, 2005**