DBD physics benchmarks - update and discussion

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Introduction

At ALCPG 09, Michael Peskin presented a new set of benchmarks, to re-make the physics case for the ILC in the TDR

In view of what LHC might have seen by 2012

See http://ilcagenda.linearcollider.org/materialDisplay.py?contribId=14&sessionId=3&materialId=slides&confId=3461

and my summary of this in the Oct 14 2009 phone meeting.

Introduction

The LOI groups found that the load from this proposal was dis-proportionally large, and a re-worked list was presented by Keisuke Fujii at the ILD SW/Integration workshop in July, see

`See http://ilcagenda.linearcollider.org/contributionDisplay.py?contribId=4`

`&sessionId=5&confId=4574`

and the pdf document attached to sept 22 phone meeting.

Benchmark Task-force

The RD has formed a Task-force to arrive at a conclusion. Members:

- Mikael Berggren (ILD)
- Tim Barklow (SiD)
- Akiya Miyamoto (Software)
- Norman Graf (Software)
- Michael Peskin (Physics, Chair)
- Keisuke Fujii (Physics)
- Georg Weiglein (Physics)
- Francois Richard (management)

M. Peskin initiated the discussions a few weeks ago, with an update, and five points to discuss.

Discussion points

Discussion points:

1. What reactions for full sim ?
2. (How to generate signal and background ?)
3. Should machine background be included, and if so, how ?
4. Should physics analyses be done in common ?
5. What other reactions ?

These points were discussed, in ILD (phone meeting Sept 22), in the group by mail. We met (everybody except Georg and Norman) Tuesday evening, to decide on recommendations.

What reactions for full sim ?

The only change wrt. what Keisuke presented is that $e^+e^- \rightarrow Zh$ at 350 GeV was removed from the full sim list $\rightarrow$

Only 1 TeV full-sim requested : $\nu\nu H$,$H \rightarrow \mu\mu, b\bar{b}, c\bar{c}, gg$, WW^* and ttH, $H \rightarrow b\bar{b}$!

From Tuesday's discussion: Add

- W^+W^- for polarisation : forward region, jets up to 250 GeV: un-charted country.
- Repeat one LOI analysis (not necessarily the same for us am SiD): address the RD's request for better simulation. For us: $t\bar{t}$ FB asymmetry.

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Should machine background be includes, and if so, how ?

M. Peskin suggest that machine-background, as well as $\gamma\gamma$ background should systematically be overlayed.
On Tuesday, we agreed to do this on all physics channels.
How should we do it ?

- For the mini-jet/$\gamma\gamma$ we should overlay on an event-by-event basis. We expect 0.7 such event per BX.
- For beam-strahlung:
- Produce a pool of BX:s.
- Overlay on input either to:
  - A Mokka-type simulation
  - Or a parametrized simulation
  - Or a physics analysis and
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  - DST-producer $\rightarrow$ possible, but reconstruction done independently for physics and background !

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Good idea, in principle, from the lessons learned by the LOI : differences was in analysis techniques, not detector performance !

... But realistically we doubted it could be done ...

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What other reactions ?

A different question is whether the fastsim studies of other channels need to all be done by both concepts ?

From Tuesday's discussion: NO.

The DBD should be accompanied by a document that updates the physics case for the ILC.

- Collect work that has been done for each topic in LOI and DBD.
- Possibly include new fast simulation estimates of the ILC. Avoid double work between us and SiD.

First draft needed in autumn of 2011, in time for the ECFA study in early 2012.

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Michael has set up a list of topics to be treated

- W, Z pairs
- 2-fermion processes
- Extra dimensions
- top quark
- SM Higgs
- Extended Higgs
- SUSY (SPS1a', Point 5)

ie. basically everything.
Michael will try to find two editors per section (one experimentalist, one theorist).
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What other reactions ?

In the Higgs topic, *ZHH* is not on the list (on Tuesday, maybe it is now ...)

What should we do about it ?

Many issues:

- Jet finding
- Flavour tagging
- Kinematic fits
- Backgrounds
- ...

If we will do this, we will need to form a task-force of experts on these topics, to have a coherent approach.

Summary

- Benchmarks proper, all at 1 TeV:
  - $\nu\nu H$,$H \to \mu\mu, b\bar{b}, c\bar{c}, gg, WW^*$
  - ttH, $H \to b\bar{b}$
  - W^+W^- for polarisation
  - ILD and SiD should co-operate at the analysis level.
- Redo LOI $t\bar{t}$ FB asymmetry at 500 GeV.
- A ILD - SiD coordination on other studies, aiming at the Physics Volume:
  - Different levels of ambition: literature$\to$ FullSim
- What should we do with ZHH ?

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