

Status of common event samples

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Outline

- 1 Introduction
- 2 The task
- 3 The selected scheme
- 4 Current status of the Common Samples
- 5 Conclusions

Common Task Group for Generators

A cross-region and cross-concept working group was created to look into the generator side

Members

- Tim Barklow, SiD/Americas
- Akiya Miyamoto.ILD/Asia
- M.B., ILD/Europe

Since, CLIC has also joined

- Stephane Poss

What is needed for the DBD

- The DBD bench-marks are:
 - $e^+e^- \rightarrow \nu\bar{\nu}h^0$
 - $e^+e^- \rightarrow W^+W^-$
 - $e^+e^- \rightarrow t\bar{t}h^0$
- All at $E_{CMS}=1\text{TeV}$
- Also: Redo on LOI analysis with the new software. For both ILD and SiD: $t\bar{t}$ at $E_{CMS}=500\text{ GeV}$.
- Machine backgrounds and same-bunch crossing $\gamma\gamma$ events should be overlaid (in some way...)

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- Work needs to be shared.
- There are a number of short-comings with the version of Whizard used:
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 - No tau polarisation in decays
 - Hadronisation tune in PYTHIA
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2-6 fermions are done with Whizard

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 - CKM correct
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Improvement wrt. LOI

- Extension of information in the event record:
 - Colour singlet system information and particle spin.
 - Beam-particles before and after beam-strahlung.
 - Process ID in each event record.
- Coding of FSR: Mokka modified to be insensitive (as SLiC already was).
- Coding of displaced vertices: Mokka modified so that the generator decides (B. Vormwald).
- Crossing-angle: generate head-on, Mokka takes care of boosting to the side. NB: Numbers in MCParticle NOT identical to input stdhep-numbers !
- In Whizard, Flavour-summed channels are used. Will reduce the 2348 channels to a few tens. Two options:
 - Sum in phase-space evaluation: Higher gain in simplicity and CPU-time, but less flexible.
 - Channel mixing in generation: Any set of channels can be merged.Both options are used, as well as mixes of them.

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Tools for productions of generator samples

- T. Barklow's scripts to run Whizard jobs at the SLAC batch server migrated and adapted to the KEK environment, and to DESY.
- An SVN project holding Whizard source-code, installation scripts and process-description files has been set up at CERN by S. Poss.
- As generation production will now be distributed → An meta-data file with file-locations, generator settings, etc. is updated by each generation job.
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Note:

The final official 1 TeV beam-parameters from the GDE were final released only on Dec. 23.

Also at other energies the parameters have changed: waist-shift rather than travelling focus.

GuineaPig simulation and beam-spectra were ready by mid-January.

Status of generator samples : $\nu\nu h$

Assigned to T Barklow (SLAC).

- $\nu\nu h$: Includes $h \rightarrow gg$ and WW^* , so need **6-fermion background**.
 - Large advantage with aliasing, esp. when Cabibbo suppressed decays included.
 - However: Integration gets very time-consuming with aliasing.
 - Full signal sample is **Done**.
 - Background sample is **Done**. Includes all 6-fermion final-states, ie. it contains all $t\bar{t}$ channels.
 - A few technicalities remains to be addressed (file-naming, meta-data).
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Status of generator samples : ttH

Assigned to A. Miyamoto (KEK).

- ttH : 8 fermions background, **Very** difficult for Whizard.
- Use Physim
 - ttH (ie. 6fH), $ttff$ (ie. 8f) by Helas (helicity amplitude approach).
 - Same beam-strahlung function as Whizard.
 - Same PYTHIA tune.
 - Same TAUOLA.
 - Same output STDHEP format.
- Several checks done to make sure that there are no important differences wrt. Whizard.

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Status of generator samples : $t\bar{t}H$

- $e^+e^- \rightarrow t\bar{t}H, t\bar{t}b\bar{b}, t\bar{t}Z$ **all fully generated.**
- Classified by beam-polarisation, $t\bar{t}$ decay-mode ($6q, 1\nu 4q, 2l 2\nu b\bar{b}$) and Higgs.
- Always at least 50 kevents, even if 1 ab^{-1} is less.
- Log-files etc. on http://www-jlc-in.kek.jp/miyamoto/mc-dbd.log/generated/1000-B1b_ws/tth

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Status of generator samples : *WW*

Assigned to MB.

- 4 fermions: All setup at DESY.
 - Integration of all 4 fermion final-states: over-night job, with sub-per mil uncertainty on cross-section. **DONE**.
 - Generation of 1 ab^{-1} also over-night job for non-electron final states, about a week for single bosons
 - All **DONE**.
- 2 fermions:
 - At 1 TeV: Similar cross-sections as 4-fermion \rightarrow also do these.
 - ... except that $e^+e^- \rightarrow e^+e^-$ are strongly restricted.
 - Technical difficulties due to very low generation efficiency - 1 event per 1000 generated accepted: Solved.
 - Status: **DONE**
- STDHEP:s on grid, log-files, steerings, diagram-plots, etc. on the web (http://ilcsoft.desy.de/dbd/generated/4f_production/)
- NB: Cross-sections are in the **10 pb** range \rightarrow we are asked to fully simulate **tens of millions of events !!!**

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Status of generator samples : WW simulation need

- All polarisation configurations needed for the benchmark.
- Assume 80 % of $\int \mathcal{L}$ at (+-) and (-+), 20 % at (++) and (--).
- $\mathcal{P}_{e^-} = \pm 0.8$ and $\mathcal{P}_{e^+} = \pm 0.2$.
- Then: need 27.4/22.6/22.6/27.4 % of $\int \mathcal{L}$ at +/-/-++/-+ to get independent samples with unit event weight (or to make pre-mixed samples as SiD will do)
- $\int \mathcal{L} \times \sigma$ then yields 20 Mevents for 1 ab^{-1}
- However, only $e^+e^- \rightarrow WW \rightarrow q\bar{q}l\nu$ is "signal"= 4.3 Mevents.
- Remaining 16 Mevents are dominated by single Z. Only simulate $\mathcal{O}(1 \text{ Mevent})$: See A. Rosca's talk for details.

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- $\int \mathcal{L} \times \sigma$ then yields 20 Mevents for 1 ab^{-1}
- However, only $e^+e^- \rightarrow WW \rightarrow q\bar{q}l\nu$ is “signal”= 4.3 Mevents.
- Remaining 16 Mevents are dominated by single Z. Only simulate $\mathcal{O}(1 \text{ Mevent})$: See A. Rosca’s talk for details.

Status of generator samples : Backgrounds and 500 GeV

- Pairs background:
 - 2650 bunch-crossings = one bunch train produced with GuineaPig, by A. Hartin.
 - Pairs-files copied to grid, with names following the conventions.
 - Also: One bunch-train at 500 GeV (=1325 BX:es) available. Latest TDR beam-parameters from GDE used.
 - Status: **DONE**
- Low p_T , high cross-section, $\gamma\gamma$ background :
 - Uses PYTHIA-inside-Whizard.
 - **Done**, but not yet on the grid.
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 - Uses **PYTHIA**.
 - Need optimisation of **generator-level cuts**.
 - Produced at SLAC **this week**. On grid soon after.
- $t\bar{t}$ at 500 GeV (\Leftrightarrow 6 fermions).:
 - Done at 1 TeV (as background to $\nu\nu h$).
 - At 500: Need new beam-spectrum, with waist-shift rather than travelling focus.
 - As GuineaPig simulation is done (T. Hartin), only need processing to produce spectrum-input for whizard (T. Barklow)
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 - $t\bar{t}h$ is done.
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File locations:

Sub-directories of:

`lfn:/grid/ilc/prod/ilc/mc-dbd/generated/1000-B1b_ws/`

`lfn:/grid/ilc/prod/ilc/mc-dbd/generated/xxx-TDR_ws/`

(xxx=250, 350, 500)

- $t\bar{t}h$ jets will be produced at CEAC **by the end of the week**, and

Information on samples:

<http://ilcsoft.desy.de/dbd/generated/>

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