ILD MC Strategies, Questions and Concerns

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Outline

Background

- Tim Barklow and Norman Graf in a great effort have produced a 2nd generation of a complete SM sample for 500fb^{-1} at $(\pm 80\,\%, \mp 30\,\%)$ polarization
- There are very good reasons to use this sample:
  - Whizard is a multi-purpose ME generator. That means:
  - Signals and backgrounds of all types (SM + MSSM) can be produced with the same settings
  - It contains all interferences, hence it is more accurate than generators like Pythia, especially for complex final states (6f and more)
  - Tuning it, on the other hand (Correct inclusion of FSR, gluon radiation, etc), is not so easy and not as well performed as for other generators which have been used at LEP
- Currently, all SM events are totally randomized in this sample
- There are a few open questions left. I'll try to summarize them.

Open Questions, under Discussion with SLAC

- Just an overview, feel free to add to the list
- What exactly are the effects of the USER defined fragmentation function, which validations have been made to test the output?
  RHUL have indicated to look into the SLAC settings, too
- Double counting in 4e and eeqq final states – has it been tested that the cuts placed on m and q^2 remove those potential problems?
- Some inbalances: Many $ee\mu\mu$, few $eeqq$, some funny effect of the abovementioned cuts?
- Has it been checked that the 0 mass approx for e, μ is sufficiently controlled by the m and q^2 cuts above?
- Some of the weights assigned to processes dominated by $\gamma\gamma$ and γe interactions are very high, with electrons going down the beam pipe at high rates in case of γe

Open Questions, under Discussion with SLAC

- Potential Showstopper: It looks like a 120 GeV SM Higgs is included in the sample?
- CKM Matrix is unity. Any experience from *WW* analysis as to how bad that is for our purpose? Probably OK for many optimization studies
- What is the exact list of all processes included in the mixed sample?
- Do we have a strategy for including the beam energy spread before beamsstrahlung? As far as we can see, this is not included in the sample
- As far as we can see, Tauola has not been used for τ decays. This is in principle easy to include in the USER defined fragmentation call. Regenerate τ final states using also Tauola?
- γ Final state radiation not included (as far as we can see), hence not very exact for 2f studies (determination of the beam energy etc.)
- One remaining wish:
  We need all final states separately, or at least ordered sensibly into several groups (see below)

Outline

Question

- Scope of the studies
- Which generator(s)?
- How to adapt the simulated events to Jupiter/Mokka
- How to produce the simulated samples?
- How to provide the (simulated) samples?

Scope of the studies

- Keep in mind: We're after optimization, not the most perfect possible LEP/ILD/... measurement
- Hence, we can accept slightly wrong tuning of the generator, as long as it is not overly optimistic
  Example: Slightly too pessimistic fragmentation would be OK, in case that the USER defined fragmentation in the SLAC Whizard sample is over-compensating

Generators

- Setting up the generator for correct treatment of initial and final conditions takes time and lots of validation.
- Hence, try to do this only once?
- Setting up and validating that different generators do this in the same way takes even more time
- ME generator is obviously more exact than Pythia, Pythia unusable for 6f and bad for 4f final states
- In a running experiment: Use data to match different generators
  We don't have data . . .

Adaption to Jupiter/Mokka

- Any news about whether Jupiter and Mokka can live with decayed K_s, Λ, etc?

Simulated Events

just a first proposal listed in the rough order of priority:

possible signals or backgrounds:	
$ee \rightarrow 4f$	50fb-1
$ee \rightarrow 2f$	20fb-1
$ee \rightarrow 6f$	$>$ 20fb-1
$ee \rightarrow hX$	50fb-1
calibration samples:	
light quark 2f at 91.2 GeV	20 000 events
tt (6f) at 350 GeV	20 000 events
backgrounds:	
$\gamma\gamma \rightarrow X$	1fb-1
$ee \rightarrow \gamma\gamma(n * \gamma)$	10fb-1
$\nu\nu(n * \gamma)$	20fb-1
$ee \rightarrow ee$	0.1fb-1
$e\gamma \rightarrow e\gamma$	0.1fb-1
rest	1fb-1

How to provide the simulated samples?

- Hopefully, we can use a coordinated method of simulating the events on the grid
- Technology for that in place at least at DESY
- Provide the output reasonably grouped into datasets (as above) on the grid?

Summary

- My recommendation would be to go for one generator for most final states
  - The work to validate several individual generators against each other by far exceeds our manpower and timescale
  - We have to make sure that our selections select final states and not generators
- My recommendation would be to to use a matrix element generator
  - 6f final states very important for optimization, useless without ME generator like Whizard
- Hence, let's try to find out about possible problems in the SLAC sample and correct it, if necessary
  - The machinery for producing hundreds of final states is in place
  - No reason to start from scratch even if included Higgs/Tauola makes re-generation of some part of the sample necessary/desireable
- Just a personal recommendation . . .