Higgs mass measurement using full simulation

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Goals

- Demonstrate the ability to conduct a physics analysis using full detector simulation and reconstruction.

- Exercises existing tools, points out missing pieces.

- Provides a point of comparison between the full simulation and reconstruction and the fast Monte Carlo.

Z Higgs

- Higgs mass determination via recoil mass determination provides a simple physics analysis which emphasizes the tracking capabilities of a detector:
  - Track-finding efficiencies in the vertex detector and outer tracker for high momentum tracks.
  - Track momentum measurement.
  - Track finding in the calorimeters and muon system.

Event Samples

- Repeat previous analyses at 350 GeV cms.
- Obtained nominal set of beam parameters for operation from Andrei Seryi.
- Takashi Maruyama has generated pair backgrounds using guineapig.
  - 4000 beam crossings to-date
- Lumi.dat file generated, provides input e^+ & e^- energy distributions for physics event generation.
- $\gamma\gamma\rightarrow$ hadrons to be generated.

Event Samples

- $e^+e^- \rightarrow Zh$, $Z \rightarrow \mu^+\mu^-$
  - Events generated with $m_{higgs} = 120\,GeV$
- $e^+e^- \rightarrow ZZ$ as major background

Detector

- sid01 defined as baseline detector.
- First round of Q/A on the detector done.
- Fast track smearing matrices generated by Bruce Schumm.
- Has not been extensively studied, may have some surprises.

Simulation

- Using latest version of Geant, v8.2.
- First round of Q/A done.
- Has not been extensively studied, may have some surprises.

Event merging

- Have ability to combine events at the hit level, and combine MC history.
- Adds tracker hits at SimTrackerHit level, so can study hit merging.
- Adds calorimeter hits at SimCalorimeterHit level, but keeps timing information.
- Can add arbitrary admixtures of signal and backgrounds.
  - Bookkeeping done by hand, so error-prone.

Reconstruction (digi)

- Pixel digitization, clustering, hitfinding available.

- Due to low multiplicity in barrel region, simple hit smearing probably OK.

- Forward region tiling design still missing.
  - punt?
  - or smear and add salt & pepper hits?

Reco (pattern recognition)

- Finding mip traces in calorimeters and muon system done.

- Track finding in vertex detector done
  - Evaluating efficiencies for high momentum.

- Linking inner and outer tracks.

- Track fitting package available
  - working on comparison to fastMC smearing

ReconstructedParticle

- Will link mip-trace clusters with found tracks and create ReconstructedParticles.
- Analysis can then proceed from lcio output.