

LCD Simulations

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Event Generators

- Standard packages available within LCD environment (interfaced with CIRCE and writing out stdhep binary files)
 - PYTHIA, ISAJET, HERWIG, PANDORA
 - BHLUMI, BHWIDE (Bhabha's)
 - GUINEAPIG (beam-beam interactions)
- HADES available as PYTHIA plugin or standalone to simulate $\gamma\gamma \rightarrow$ hadrons.
- Diagnostic single-particle generation.

“Single” Particle Generation

- Incredibly useful for algorithm development and benchmarking.
- Allows carefully constructed custom events to be generated, i.e. can assure that all particles fall within some fiducial phase space.
- Currently using interface to PYTHIA to allow arbitrarily complex events to be simulated.
 - Initial state particles as well as decay channels.
 - Runtime control via ASCII file input.

Background samples

- Using PYTHIA to simulate $\gamma \rightarrow \text{hadrons}$.
 - Standalone for full simulations.
 - HADES interface for fast simulations.
- Using GUINEAPIG for beam-beam simulations.
 - T. Maruyama has detailed BDS simulation in GEANT3 plus scoring planes for LD and SD.
 - Outputs files readable by full simulation.
- Large samples of fully simulated events exist.
 - SIO output can be overlaid onto “signal” events.

Detector Simulation

- Still using GISMO for the bulk of simulation.
- Would like very much to move to GEANT4!
 - See talks by T. Abe and M. Arov.
- Currently using simplified representations of geometries (cylinders and disks) for flexibility.
- Would like very much to move to more detailed geometries!
 - Need better scheme for describing both input and reconstruction geometries.

G4Hadronic Shower simulations

- Problems identified by G. Bower and R. Cassell have been fixed in local SLAC GEANT4. Patches available, should be in next release.
- Fixes have not yet been compared to test beam data. (BTeV working on this?)
- New vector-model availability also planned for next release to replace “Gheisha model”.
- Geant4 team at SLAC very involved.
 - M. Asai extremely helpful.

Fast Simulations

- Almost all existing physics analyses conducted with parameterized smearing packages.
- Difficult to correctly simulate efficiencies and resolutions in arbitrary event topologies.
- Two different philosophical approaches:
 - SimDet: attempts to mimic capabilities of full reconstruction (existing or near-term expected).
 - Current LCD approach represents ideal case; not expected that we can actually achieve this.

Intermediate Fast Simulations

- Produce hits in detector elements which can be used by the reconstruction programs, but are faster (and more flexible) than full G4.
- Swim tracks, account for MS and dE/dx , record intersections with detector elements.
 - No secondary productions or decays in flight.
- Simulate calorimeter showers via analytic parameterizations & populate cells.
- Work ongoing (S. Pathak and W. Langeveld)

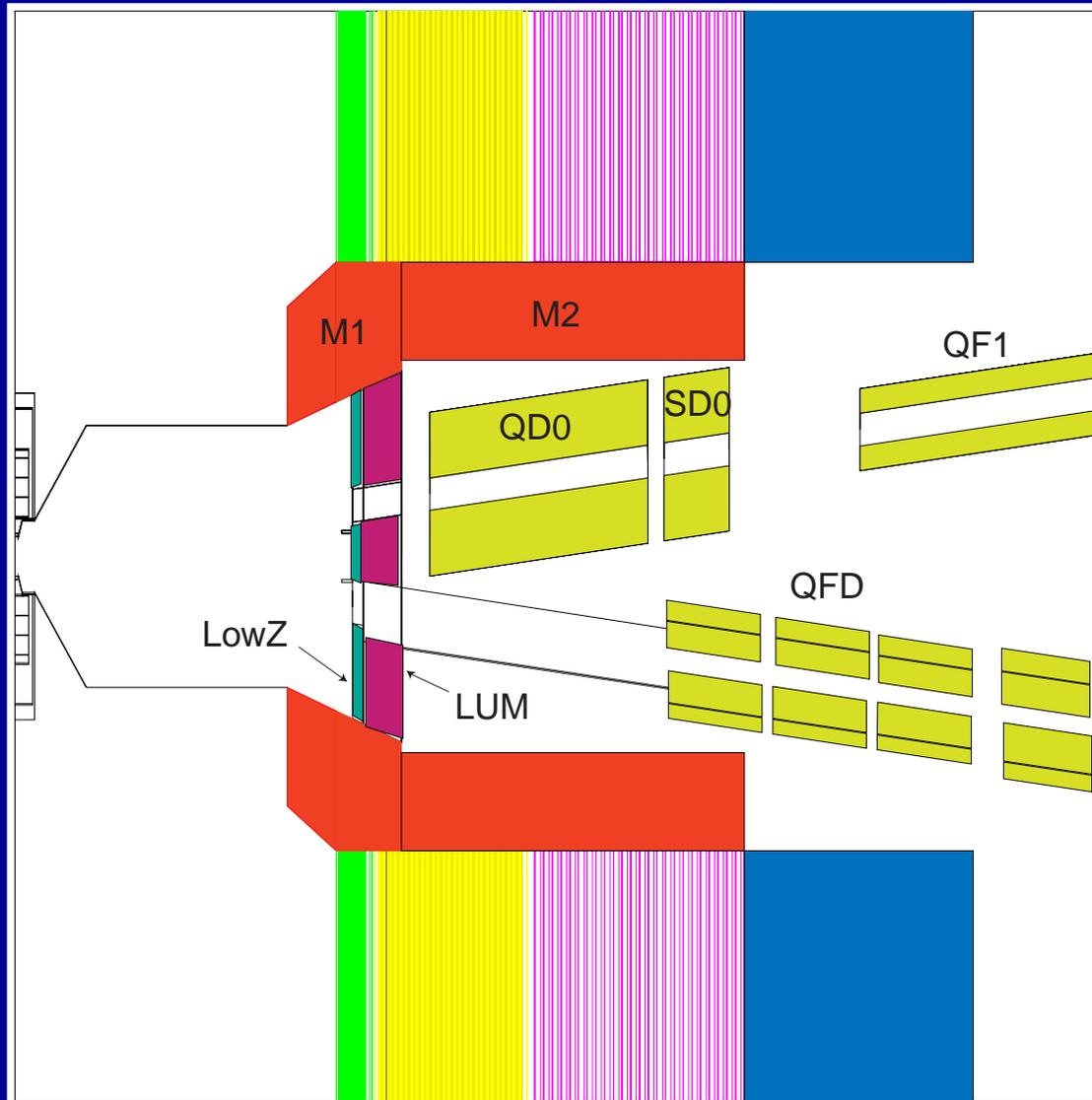
Detector Designs

- Current focus on LD and SD from March 2001.
- Need to revisit designs and review them!
 - Is material what we want?
 - Are readouts and segmentation credible?
- What upgrades do we want to consider?
 - Remove gap between EM and HAD in SD.
- Working with T. Behnke to introduce a T detector to facilitate comparisons with TESLA.
- Aim for 03 series of detectors.

Calorimetry

- We have concentrated on “central” calorimetry to date.
- Far-forward, luminosity calorimetry has been neglected. This needs work!
- Need to develop and implement the BDS final focus system.
- Very impressive work by M. Iwasaki incorporating JLC beamline into LCDGEANT4.
 - Close collaboration with G. Blair and T. Maruyama.

BDS Simulation (GEANT3)



International Collaboration

- Goal of having one Geant4 executable for worldwide LC simulations still a dream.
- Work ongoing to develop common data definitions for full simulation output.
- Work started to develop Brahms Data Interface Module for JAS/LCD analyses.
 - Could easily be extended to LCDROOT.
- Java SimDet interface developed (M. Ronan).

Reconstruction

- Supporting both JAS/Java and ROOT/C++ reconstruction and analysis frameworks.
 - See talks by T. Abe & T. Johnson.
- Need to identify elements of reconstructed objects (tracks, clusters, reconstructed particles) which will be used in physics analyses.
- Would like to see discussion at this workshop on the Event Data Model and designs for persistent reconstruction output.

Tracking

- Central tracking algorithms working fairly well.
- Pattern recognition for forward regions developed recently, working on fitting.
- Remaining issues are those of hit merging and ghosting in high track-density environments.
 - Need realistic digitization!
- Need to revisit and quantify efficiencies, fake rates and resolutions.
- Essential part of any energy flow analysis!

Calorimetry

- Subject of this workshop. Wake up!

Muon Id

- Rich Markeloff's hep.lcd package to identify muons part of latest release.
- Works well in central (barrel) region for high pT muons. Extend into endcaps!
- Needs to be augmented to find muons which range out before making it to the muon system for low pT muons.
- Need to characterize efficiencies, fakes, etc.
- Essential to recover punchthrough π energy!

Canonical Samples: Single Particle

- Test reconstruction on simple events. Study finding efficiency, fake rates and measurement resolutions (E, p, mass) using:
- Single Fundamental Particles
 - $e^{+/-}$, γ , $\pi^{+/-}$, $\mu^{+/-}$
- Simple Composite Single Particles
 - π^0 , ρ , τ , ψ
- Complex Composite Single particles
 - Z, W

Canonical Samples: Physics Signal

- $WW_{\nu\bar{\nu}}$ and $ZZ_{\nu\bar{\nu}}$ at 800GeV cms
 - Stresses jet mass resolution.
 - $VV_{\nu\bar{\nu}}$ removes temptation to include beam constraint.
 - 800GeV tests energy extensibility without excluding any one technology.
- $t\bar{t}$ at threshold, $t\bar{t}h$ at 800GeV
 - Stresses pattern recognition and flavor tagging in busy environment.

Canonical Samples: Inclusive Events

- Inclusive SM processes for backgrounds.
- A 2 ab^{-1} sample at 1 TeV cms has been generated; 0.5, 0.8, 1.25, 1.5 to follow.
- 600 GB sample disk-resident after cuts.
- Stdhep files suitable for FastMC analyses.
- Some fraction will be fully simulated.
- Developing techniques to serve up correct mix of processes to outside users.
- Terrific work by T. Barklow.

Informational Mailing Lists

■ lcd-sim

- This list is directed to those **using** the simulation, reconstruction and analysis software.

■ lcd-dev

- This list is directed to the simulation and analysis software **developers**.

- Simulation group planning to institute regular meetings to discuss “nuts and bolts” issues.