LCD simulation efforts at NIU

- lcdg4 (vs. gismo and mokka)
- simulation farm & server

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History and status

- Derived from LCDRoot,
- Made independent of Root,
- All I/O formats used by GISMO supported (plus root and text),
- problems known/found at the time of NIU workshop fixed (lack of MC info, anomalies in detector response) $\sim$3 months ago,
- only simple variants of SD and LD supported in full generality
  - all volumes must be cylindrical,
  - all segmentation projective in θ, ϕ.
  - limited ability to do non-projective, non-rectangular segmentation is hardcoded into a separate, special version - to be made more general (RTI).
  - no support structure, non-uniformity of response, noise.

- easily available - just tell us what kind of events you want or give us your own STDHEP file, and the detector of your choice, and we can process 40K-50K events/day. More about this later.
- Can now compare GISMO with Geant4, everything else being the same. Some results from single particles in following slides.
- Mokka is available too, but only for Tesla at this point. Trying to install Ties' version of Mokka with SD/LD.
- The goal is to have a single G4-based simulator that can handle SD/LD/Tesla/JLC and more realistic ones.
- Have to combine the best elements of LCDG4 and Mokka in that final product - does not matter which one we start with.
- Time is limited. Must be able to fully simulate TB modules in $<$ 2 yrs. Need coherent effort.

- Standardized code-sharing and up-to-date documentation (instructions, bug reports, results, FAQs, . . .) crucial.
- Our work is documented on `nicadd.niu.edu` → *NICADD at work* (see links under *Research Projects* and *Computing help*). These should be linked from the LC software home page.

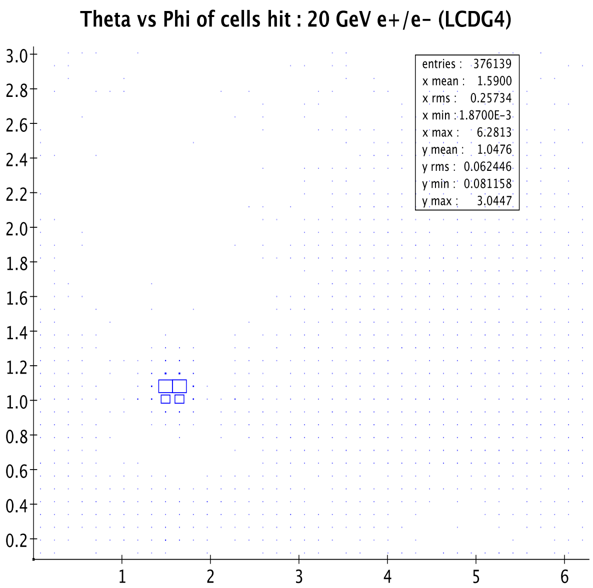
Preliminary studies

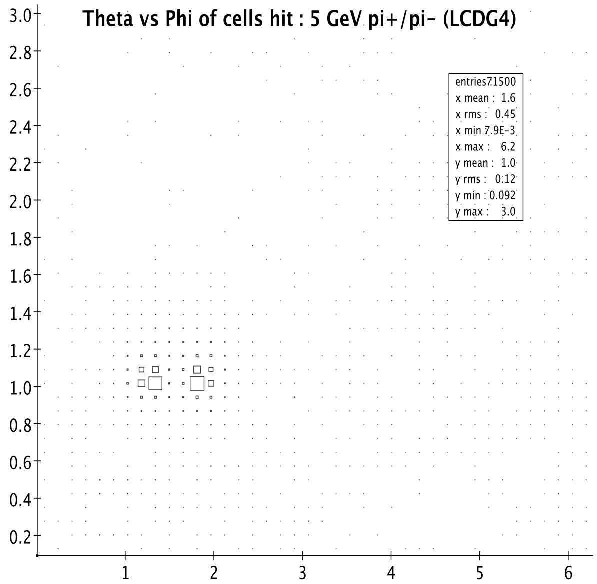
- Single $e^{\pm}$s and $\pi^{\pm}$s, 1000 events each at $E = 5$, 20, 50 GeV.
- SD geometry (Jan 2003).
- $\cos\theta = 0.5$, $\phi = \frac{\pi}{2}$
- Scale factors (from Gary, based on Gismo):
  - ECal : $\frac{1}{0.02147}$,
  - HCal : $\frac{1}{0.05538}$,
- No constant term.
- No clustering done.

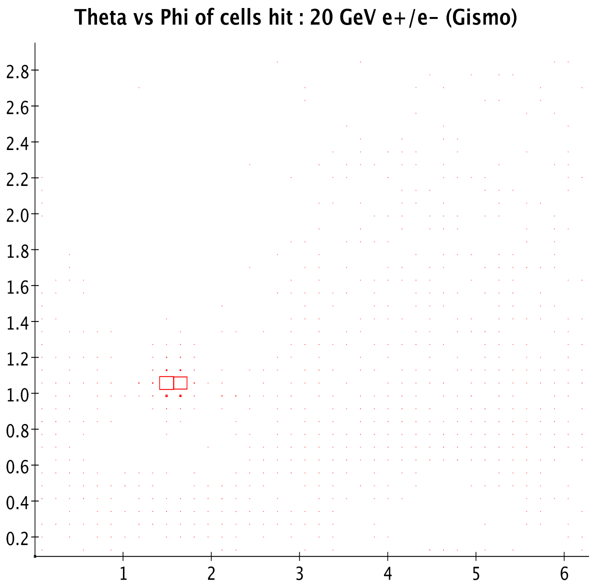
SD geometry (Jan 2003)

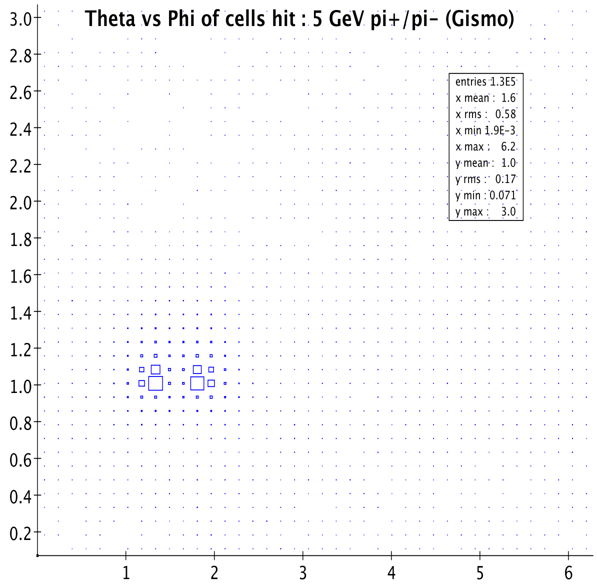
- Active layer, thickness: Si, 0.04 cm (ECal); Polystyrene, 1 cm (HCal).
- Inactive layer, thickness: W, 0.25 cm (ECal); Stainless steel, 2 cm (HCal).
- Number of layers: 30 (ECal) + 34 (HCal).
- Radiation length, interaction length: ~ 20, ~ 0.8 (ECal); ~ 40, ~ 4 (HCal).
- Sampling fraction: 0.02147 (ECal); 0.05538 (HCal) [from gismo].
- Towers: projective (ECal and HCal).
- Number of cells in $\theta \times \phi$: 840×1680 (ECal); 600×1200 (HCal).
- Inner radius: 142 cm (ECal); 153 cm (HCal).
- Max z: 210 cm (ECal); 213 cm (HCal).
- Magnetic field: 5 Tesla.
- Uniform acceptance, no crack.

A few plots with single particles



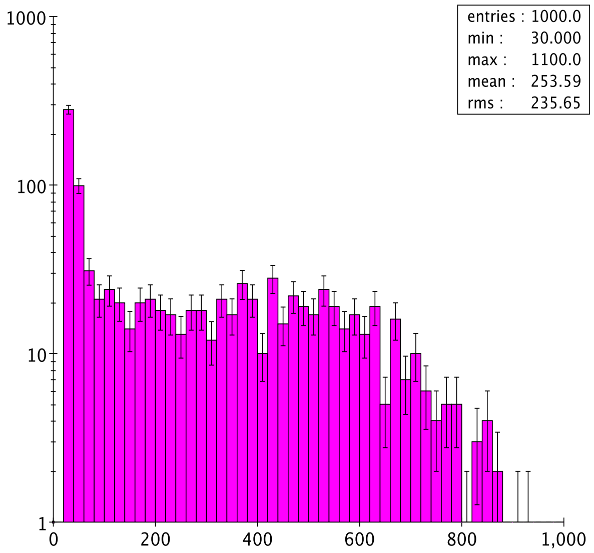




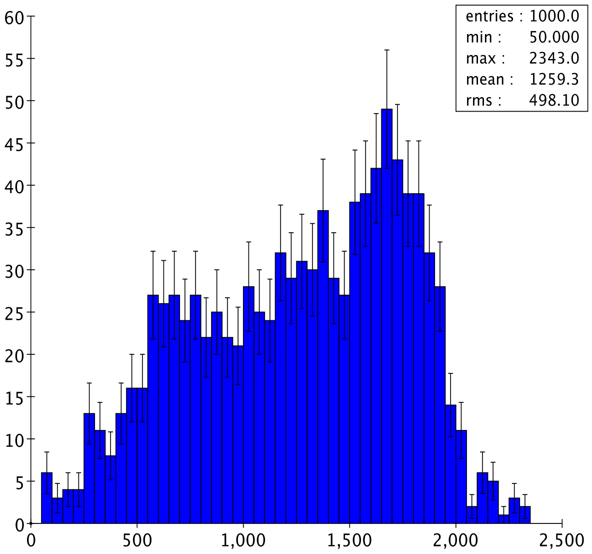


Plots with single particles (contd.)

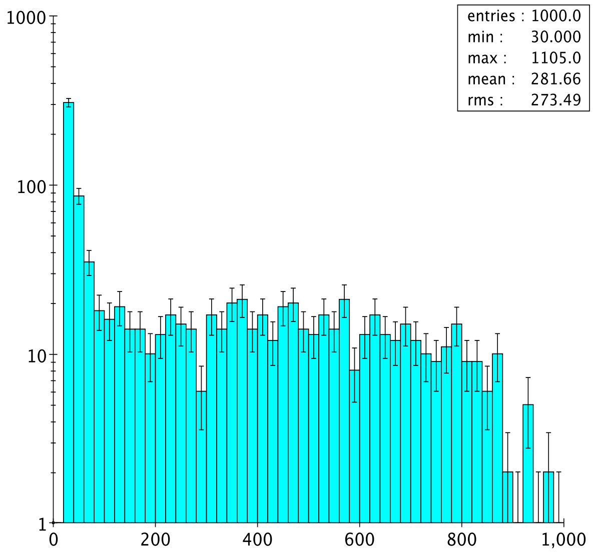
Number of ECal cells hit : 50 GeV pi+/pi- (LCDG4)



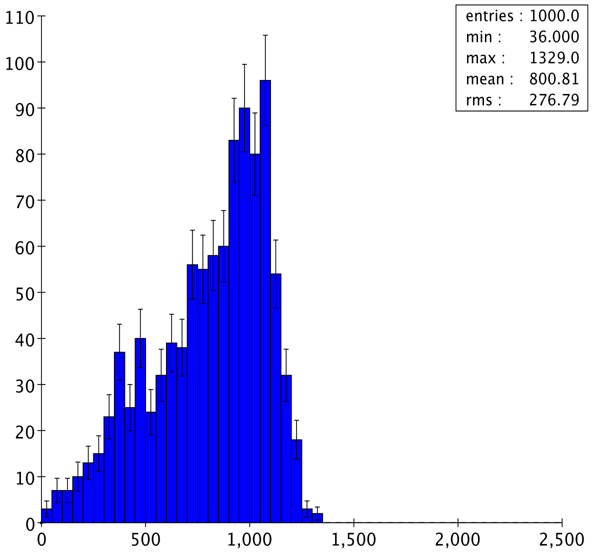
Number of HCal cells hit : 50 GeV pi+/pi- (LCDG4)



Number of ECal cells hit : 50 GeV pi+/pi- (Gismo)

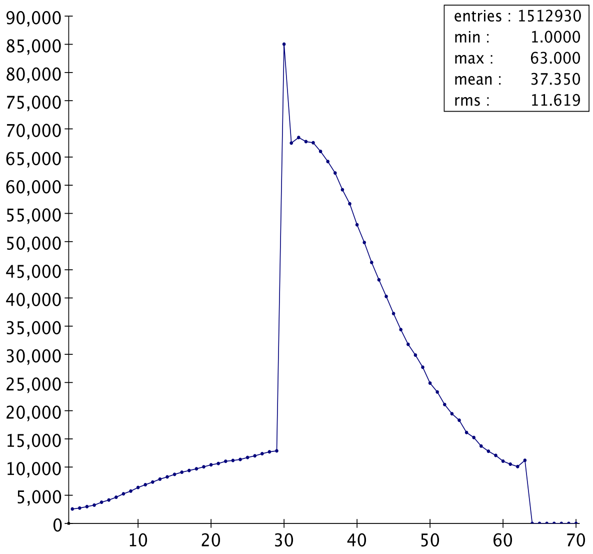


Number of HCal cells hit : 50 GeV pi+/pi- (Gismo)

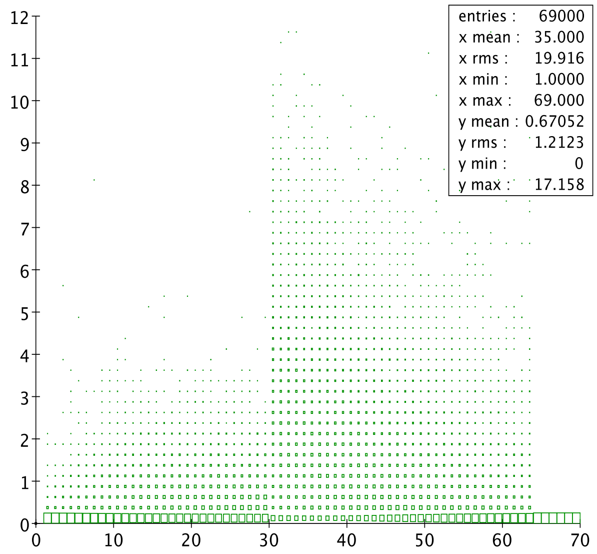


Plots with single particles (contd.)

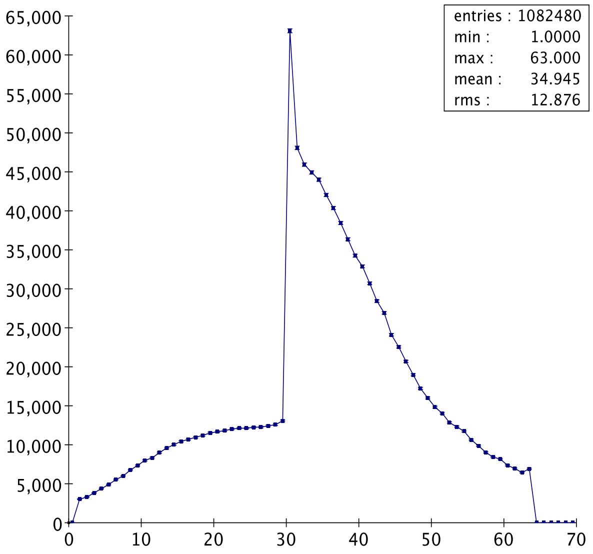
Number of cells hit vs. layer : 50 GeV pi+/pi- (LCDG4)



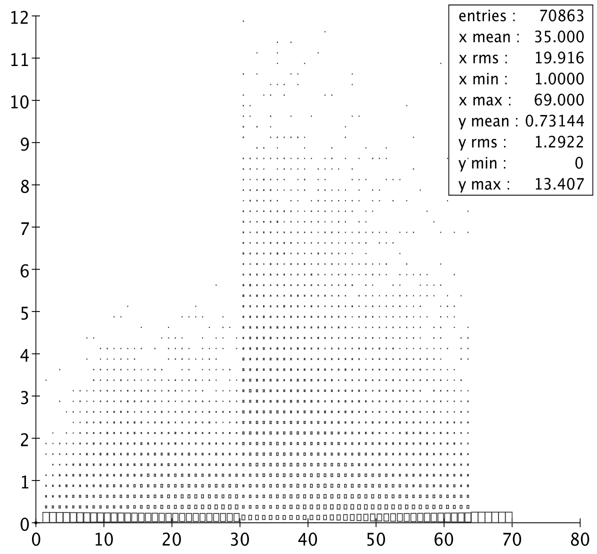
Energy vs. layer : 50 GeV pi+/pi- (LCDG4)



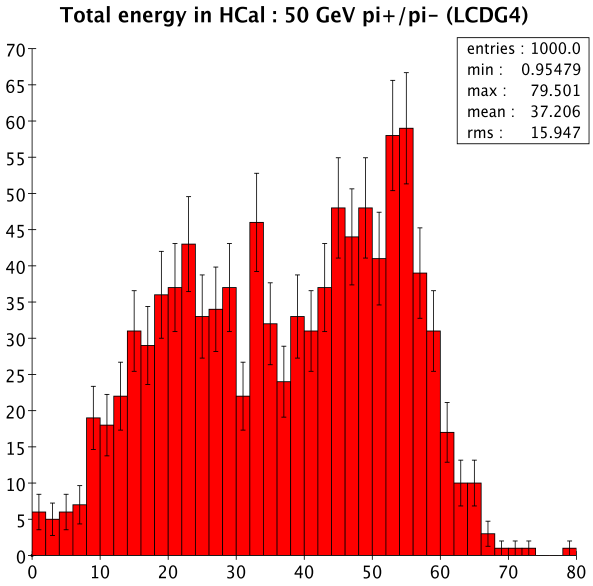
Number of cells hit vs. layer : 50 GeV pi+/pi- (Gismo)

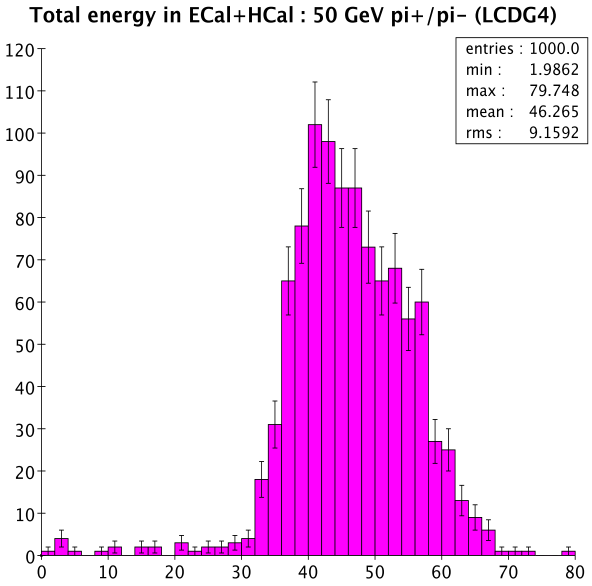


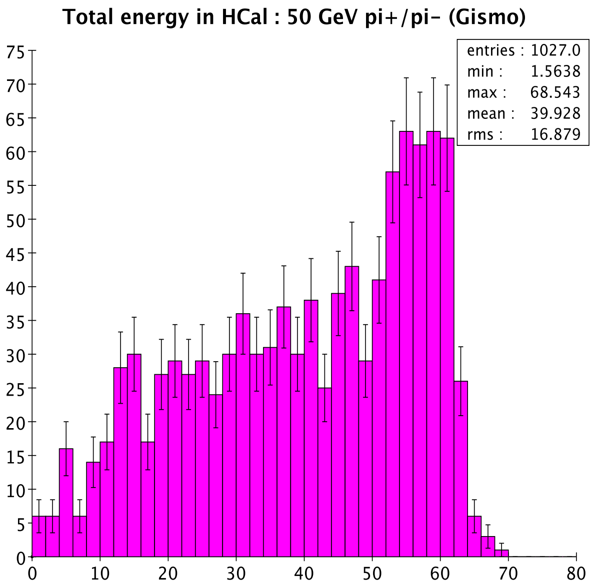
Energy vs. layer : 50 GeV pi+/pi- (Gismo)

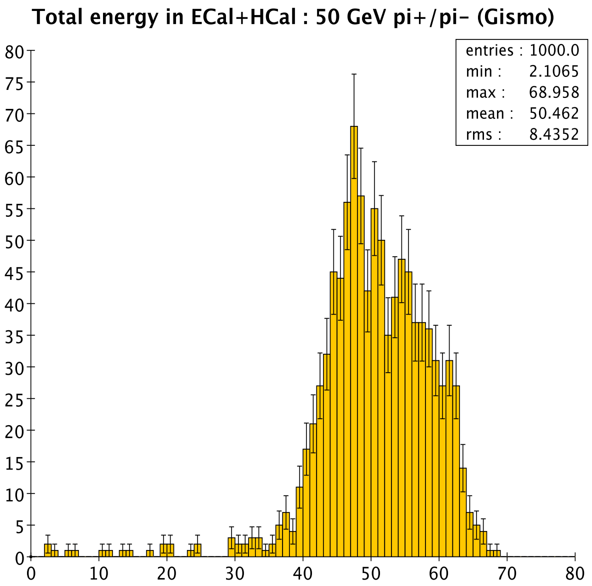


Plots with single particles (contd.)









The simulation farm and server

- Up to 40 CPUs (750 MHz, $\sim$1 GB memory per CPU) and ample storage at the FNAL fixed target Linux farm, leased to NIU for LC sim.
- Gismo running since summer, 2002, calibrated against the SLAC installation (comparison results on NICADD web page).
- Browse catalog and order events online at `nicadd.niu.edu/sio/index.html`

Attempts at Mokka

- Have installed Mokka at NIU.
- Can run it, but not much in the way of analyzing the output.
- Trying to understand the pros and cons vis-a-vis LCDG4.
- Detailed notes and documentation on `http://nicadd.niu.edu/~jeremy` and `.../~jeremy/mokka-lcdg4.html`

Work in progress

- More testing of LCDG4, including physics processes, jet reco etc.
- Improved geometry description
  - Trying to evaluate available options.
  - The goal is to be able to describe the TB modules by the end of 2004.
  - Must be able to handle general shapes and segmentation.
  - Need to model efficiencies, non-uniformities, noise.
- A thoroughly upgraded request form (hopefully in time for Cornell).