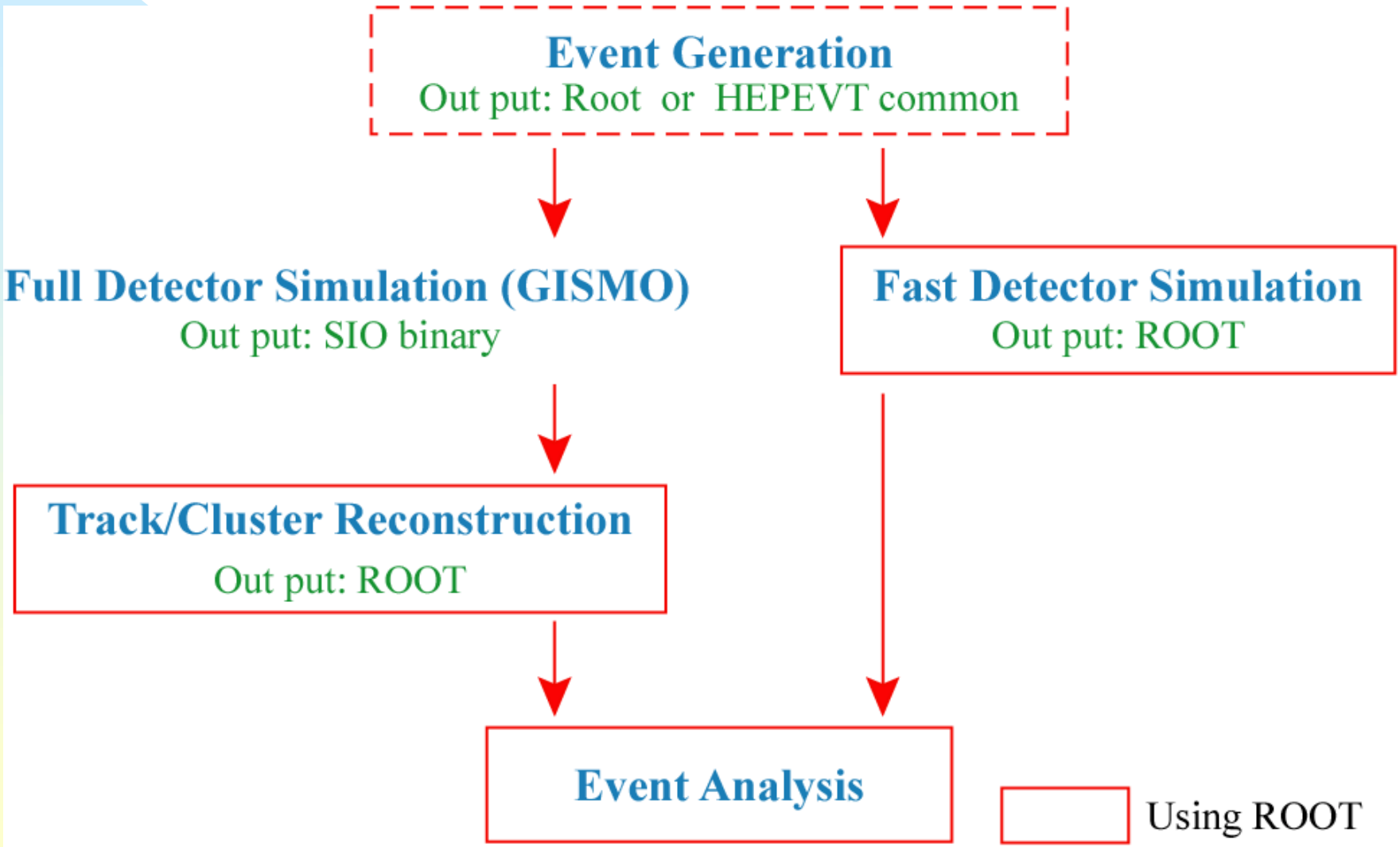
Root at the LCD

6/13/2001

M. Iwasaki Univ. of Oregon

North American Linear Collider Detector Group (LCD) has constructed a simulation facility based on Root

→ LCD Root



So far we only support Linux and SunOS (developing Windows)

Event generation at LCD Root

- PANDORA-PYTHIA (C++) by M.Peskin

  → our main generator

  include beam polarization, beamstrahlung

  CINT implementation

  directly use in C++ interpreter

- PYTHIA (TPYTHIA: supported by ROOT)

Output : ROOT or stdHEP (HEPEVT common)

ROOT can go through FastMC

stdHEP can go through FullMC (GISMO) & FastMC

Or can be directly linked to FastMC

Detector Simulation at LCD Root

We use 2 kinds of detector simulations

- Fast simulation For physics studies
- Full simulation For detector studies

Fast simulation

Smear particle position/energy and IP position

Output Root or is directly linked to Event Analysis

Full simulation (GISMO)

make digitized detector outputs (SIO binary)

Full recon

make tracks and clusters

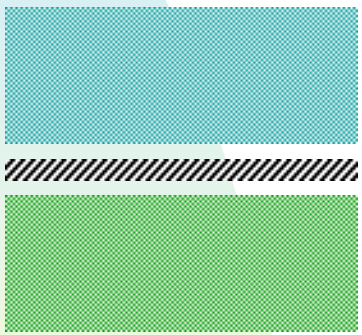
Output Root or is directly linked to Event Analysis

Detector Simulation at LCD Root

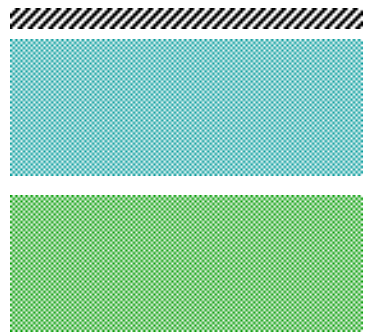
LCD Group considering 3 kinds of Detector designs

Silicon, Large, and Precise

→ Different Detector sizes, materials, and Calorimeter Configurations....



OR



... We prepare 3 kinds of

Detector geometry files

Detector resolution files (for smearing)

Some/all of these parameters can also be changed at user analysis level

Event Analysis at LCD Root

We have several useful analysis tools for Linear Collider experiments

- Jet Finder … 3 kinds of algorithms
- Thrust Finder
- Particle extrapolator
- Topological Vertexing

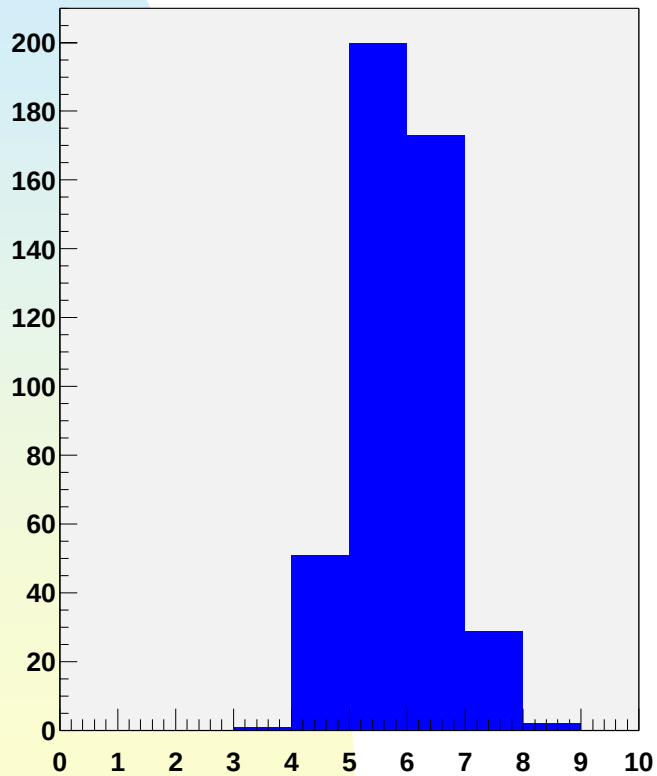
… translated from SLD ZVTOP

Jet Finder

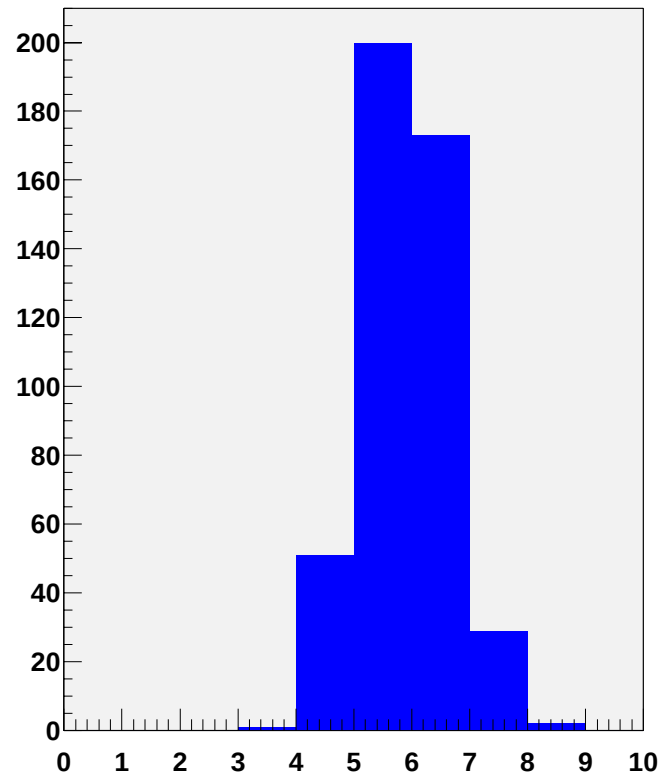
3 kinds of algorithms .. Jade, Jade E, and Durham

Comparison of original Fortran Jet Finder and ours

Fortran



LCD Root (C++)

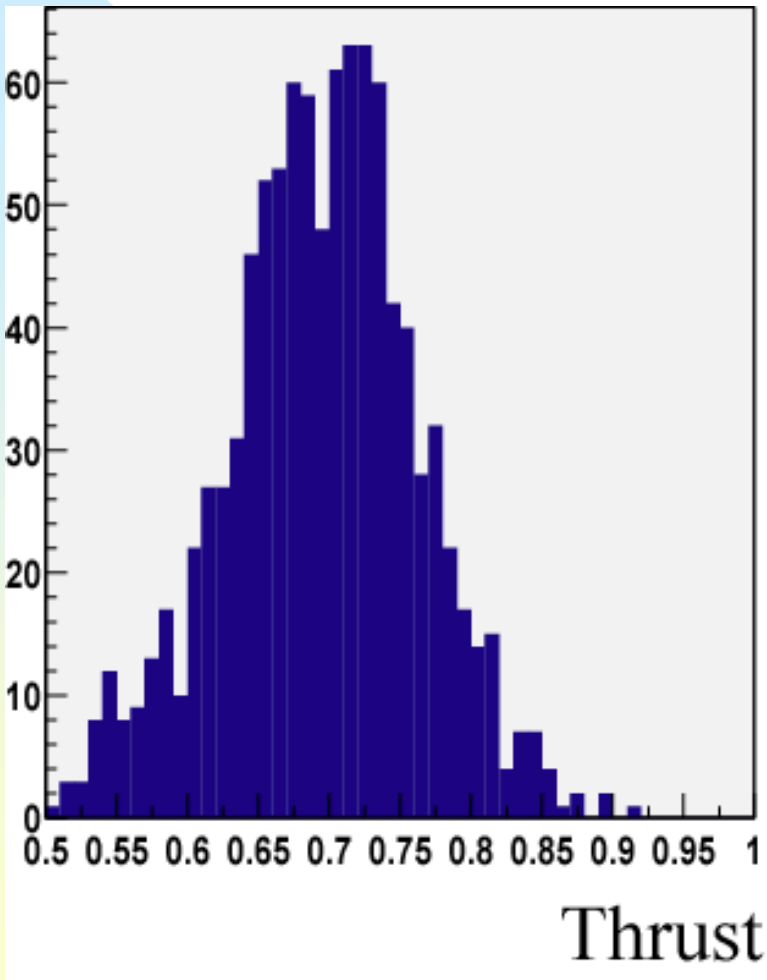


($t\bar{t} \rightarrow$ 6jets event)

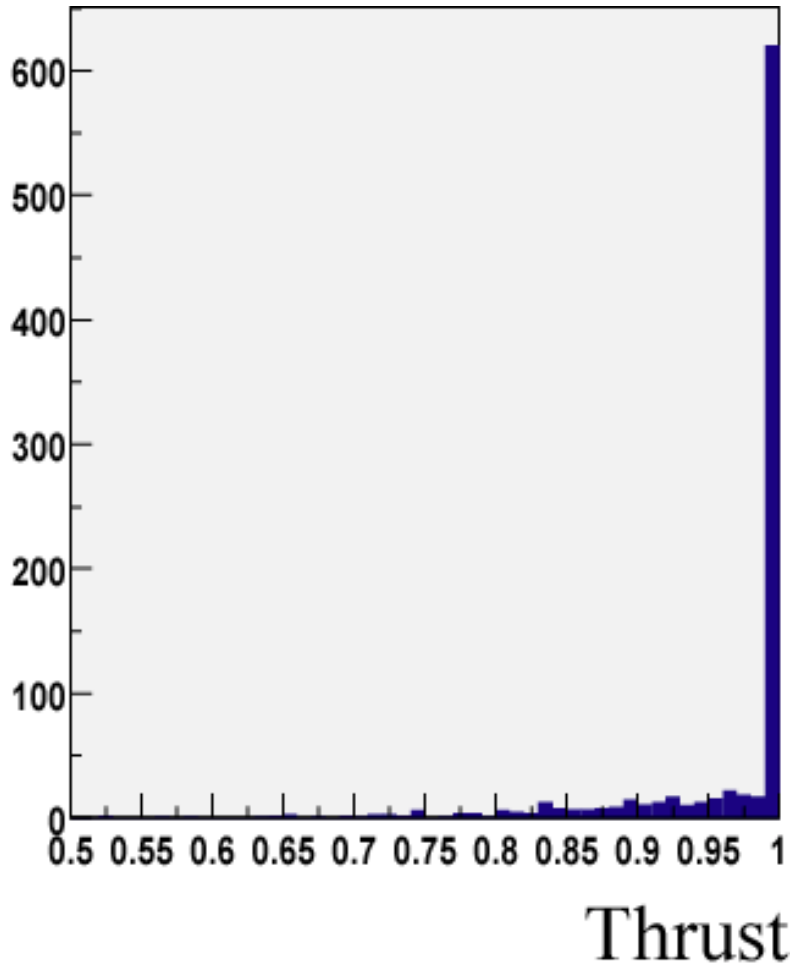
Works well!

Thrust Finder

$t\bar{t}$ events



$\tau\tau$ events



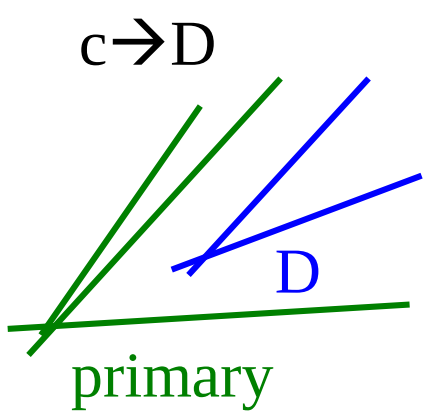
Works well!

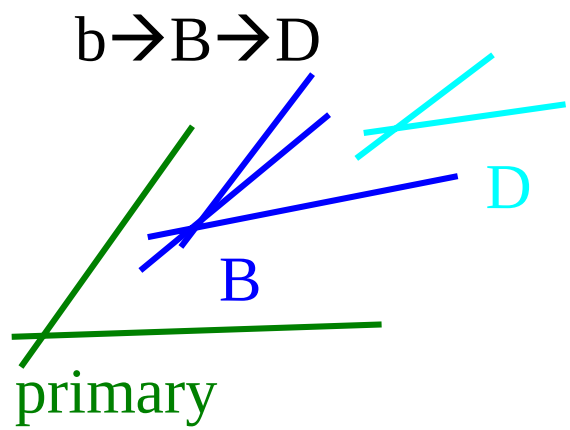
Topological vertex finder

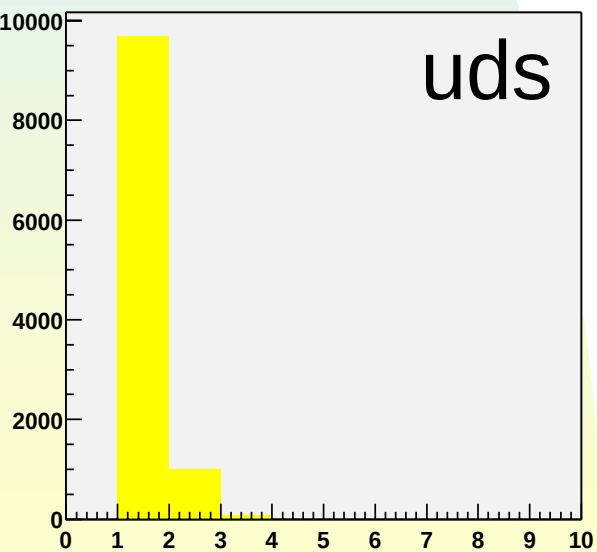
Translated from SLD ZVTOP

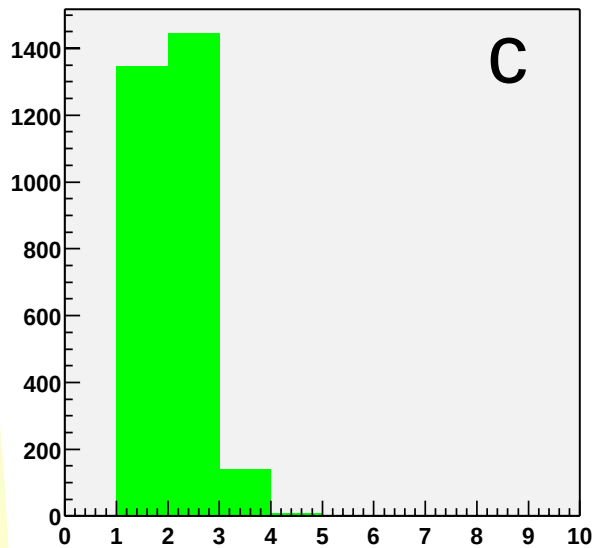
Reconstruct secondary vertices in a jet

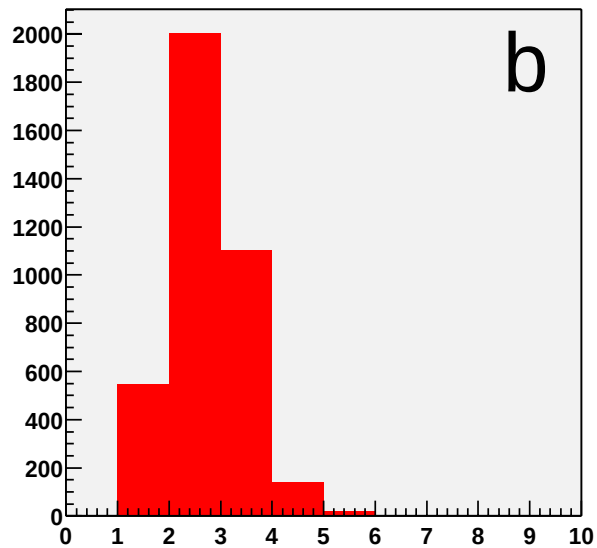
.. Find points of high overlap tracks







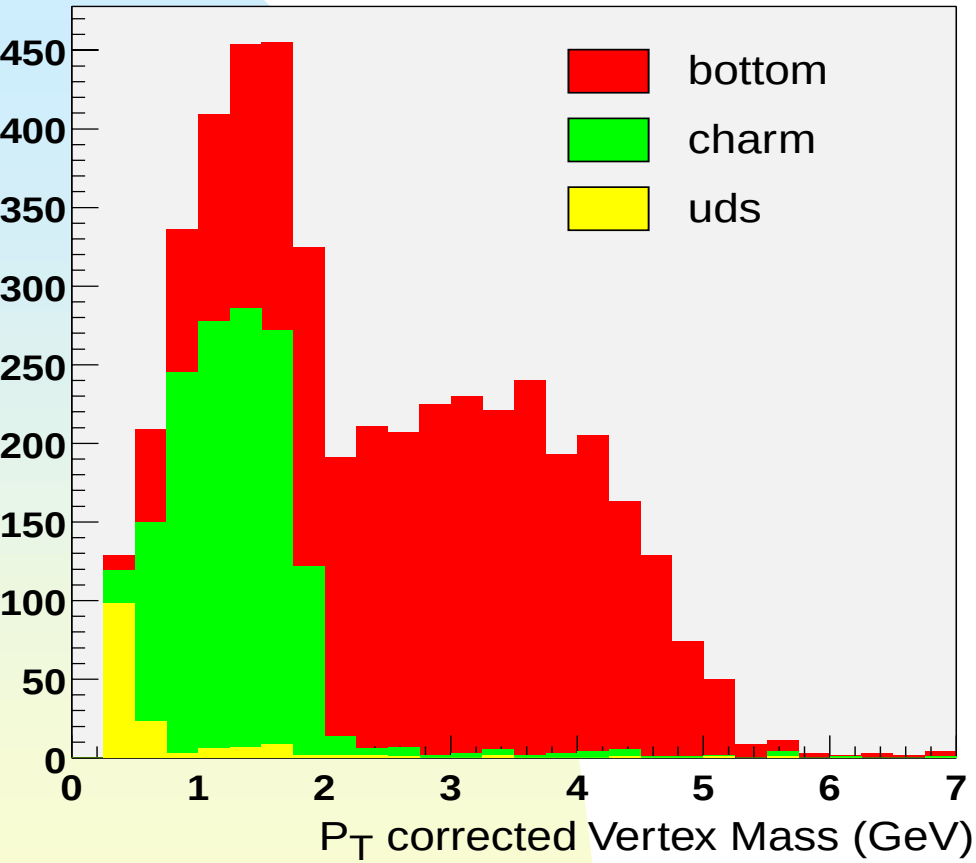




#Vertices reconstructed

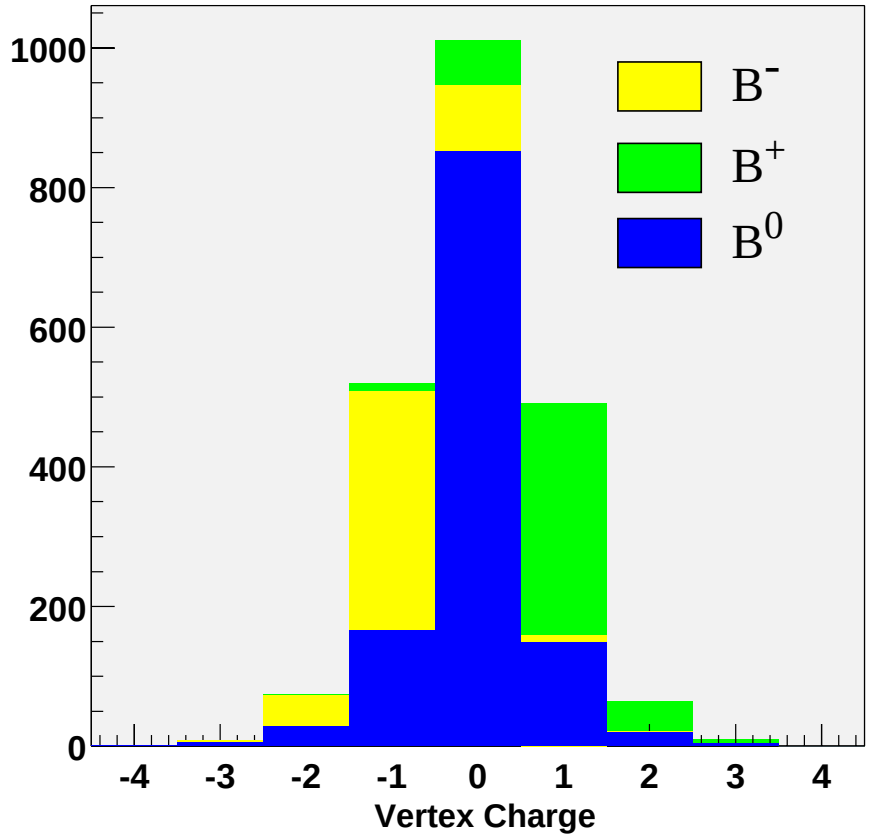
Using the reconstructed vertices, we can do

1) Heavy-flavor tagging



Vertex Mass

2) Charge separation



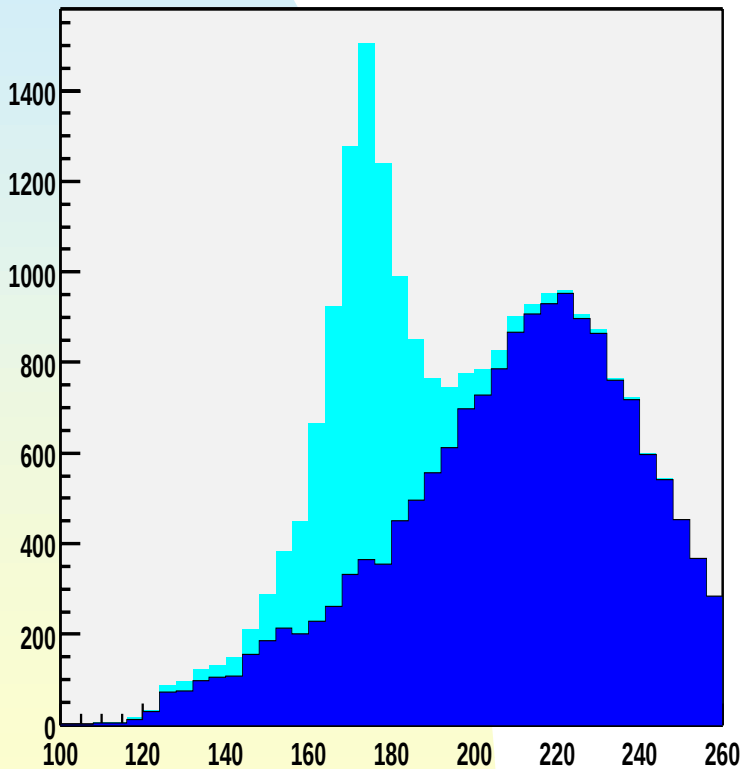
Vertex Charge

For example..

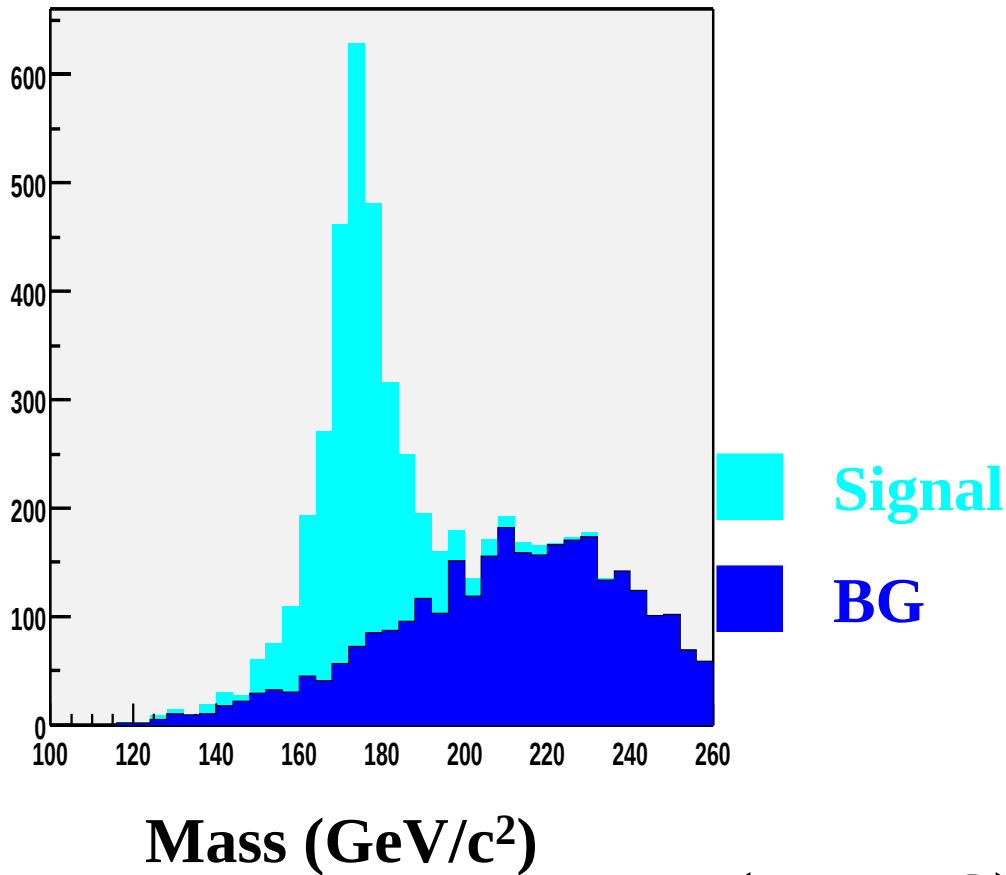
Analysis example with b-tag:

Reconstruction of t-quark mass in $t\bar{t} \rightarrow$ 6jets event

Without b-tag

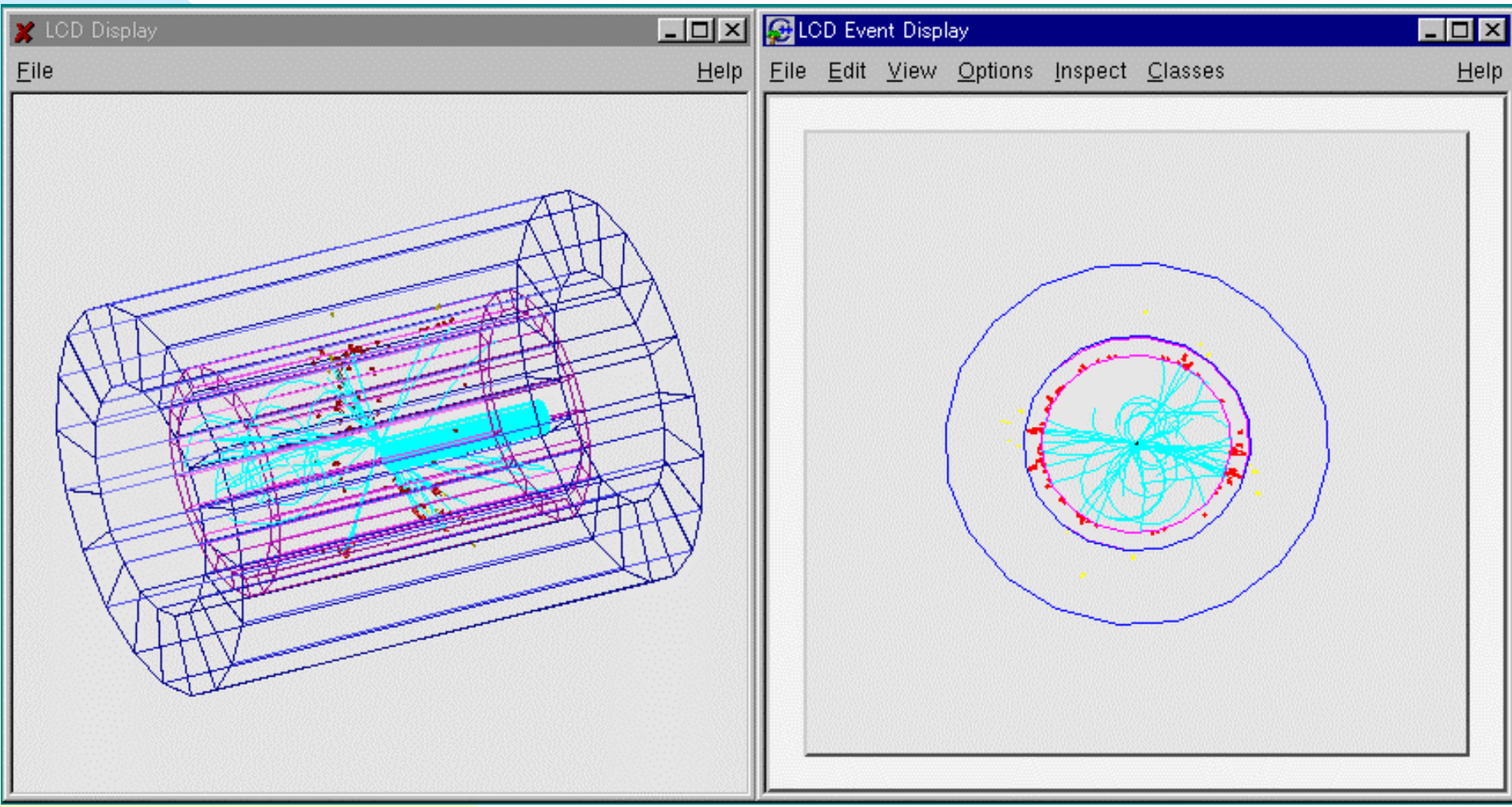


With b-tag



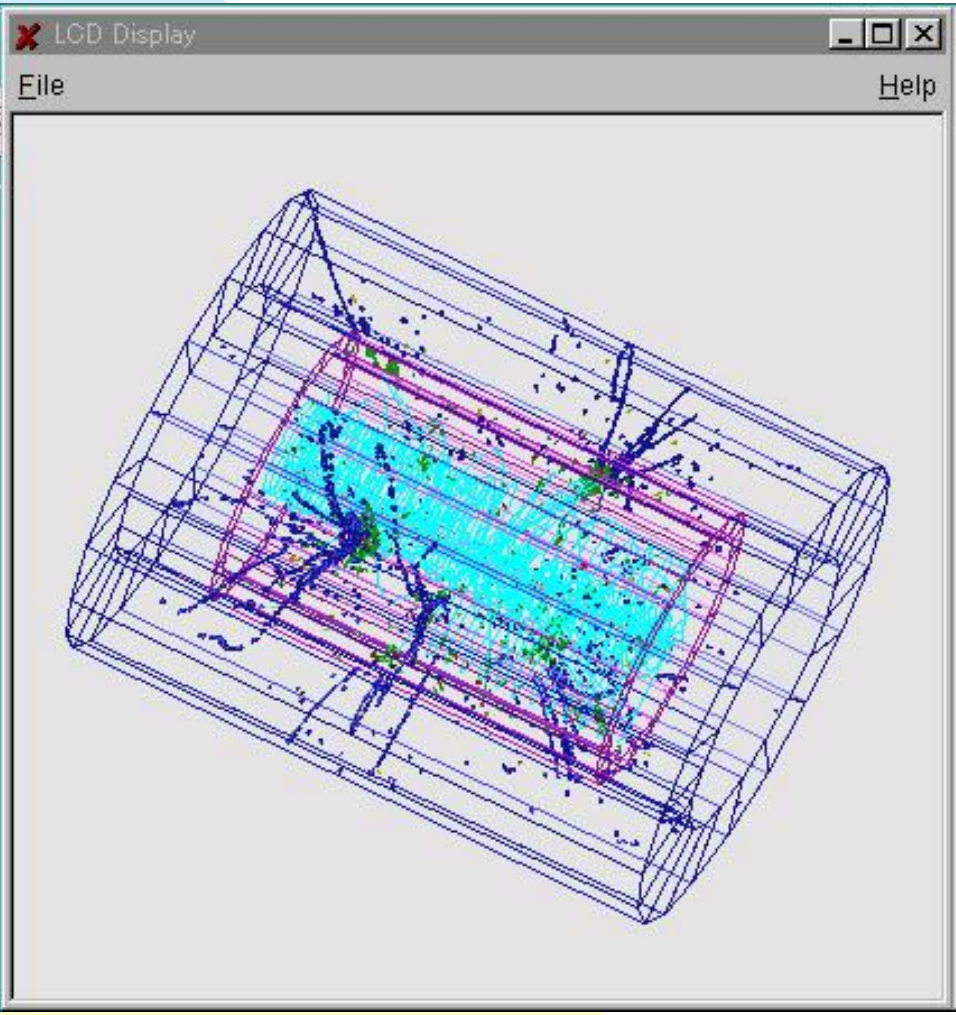
(FastMC)

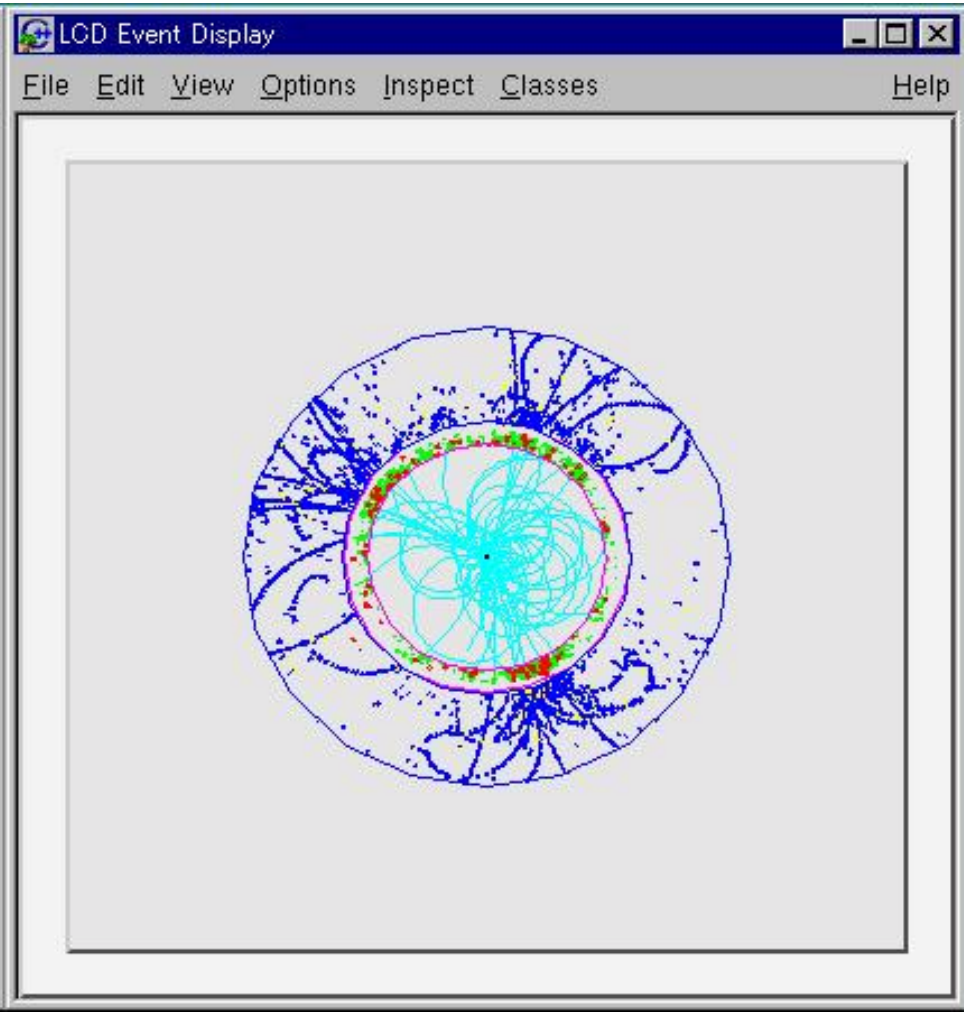
LCD Root Event Display



FastMC (e^+e^- → ZH)

LCD Root Event Display





FullMC ($e^+e^- \rightarrow t\,t$)

Event structure at LCD Root

Event

- Event Header — event number …
- Beam parameters — polarization, IP position …
- Generator level particle information — McParticles
- Raw data (Full) — VXDHits TrackerHits CalHits
- Reconstructed Data — Tracks Clusters

Based on TClonesArray

Summary

LCD group has constructed simulation/analysis tools for the future Linear Collider experiments

- The simulation/analysis tools based on ROOT

  → work well!

- LCD Root handles several I/O

  … Some of them require STL

  (can be worked ROOT V3.00 or later)

- There is a LCD Root tutorial page! (Under construction)

URL:

http://www-sldnt.slac.stanford.edu/nld/New/Docs/LCD_Root/root.htm

Future Plan

- GEANT4
- GUI
- Support Windows

We are happy to collaborate with

other exp. groups to develop analysis tools!!

(Currently LCD Root is maintained by 2 people …)