# Hall B: Software Utilization

**Gerard Gilfoyle**
**University of Richmond**

**12 GeV Upgrade Software Review**
**Jefferson Lab**
**November 25-26, 2013**

# CLAS12 Software User Environment

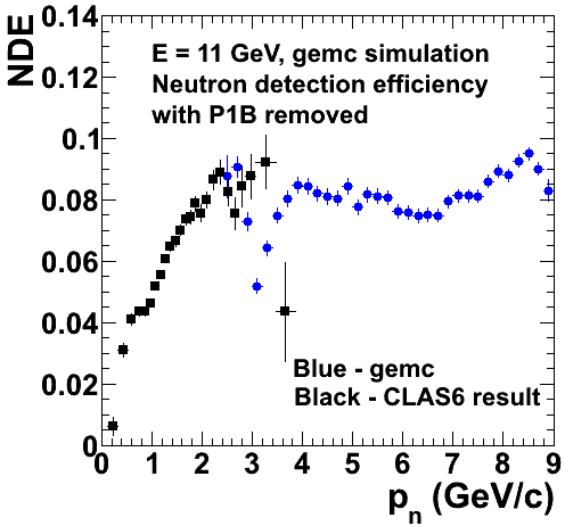
- Introduction: Software tasks, users, projects.
- Tools.
- Simulation.
- Reconstruction.
- Visualization
- Physics Analysis.
- Summary.

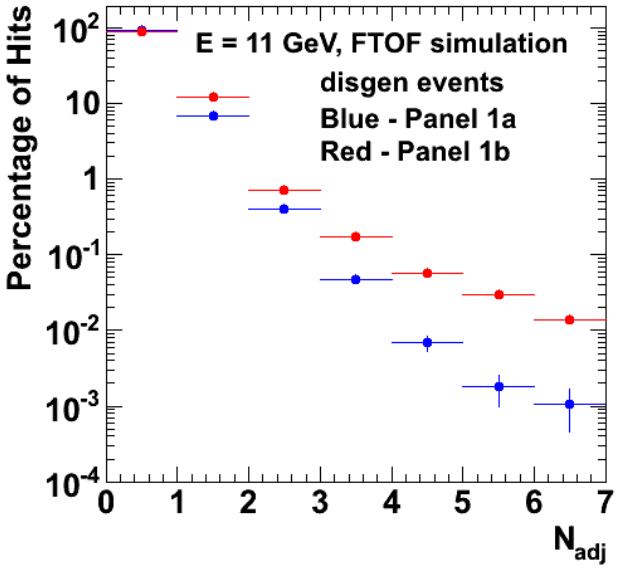
# Introduction - Tasks and Users

- Software Categories:
  - Calibration (not discussed here)
  - Simulation
  - Reconstruction
  - Visualization
  - Physics analysis
- User Categories
  - A - environment developers.
  - B - service developers.
  - C - physics users.
- Focus on off-site physics users.
- Access, ease-of-use, extent of use, support.

# Introduction - Physics Projects

- Experience with Richmond cluster, offsite users.
- Simulations for CLAS12 neutron magnetic form factor $G_M^n$ experiment (E12-07-104).
  - **Quasielastic neutron detection from $^2H$** with forward Time-of-Flight (TOF) (*CN 2011-015*).
  - **Calorimeter (EC) simulation** (*CN 2011-019*).
  - **EC geometry simulation** (*BAPS, DNP, 2012*).
  - **$G_M^n$ target simulation** (*BAPS, DNP, 2011*).
- CLAS12 TOF Subsystems Reconstruction Software
  - Forward and central TOFs.
  - Tested with *gemc.*
  - Deep-inelastic scattering event generator.



# Software Tools

General

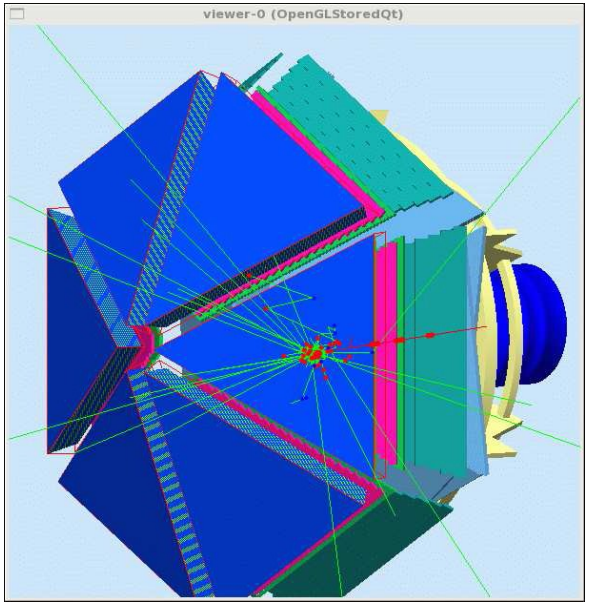
| Tool | Description | | Tool | Description |
|---|---|---|---|---|
| subversion | Version control utility | | scons | software construction tool |
| mysql | Open source database | | qt4 | widget toolkit |
| clhep | C++ library of utility classes for HEP | | geant4 | simulation of particles passing through matter |

Locally Developed

| Tool | Description | | Tool | Description |
|---|---|---|---|---|
| Clara | CLAS12 analysis environment | | clasJLib | CLAS12 utilities - JMath, ced, cMsg |
| JToolbox | evio, bank handling classes, property lists | | ccdb | mysql geometry and calibration database |

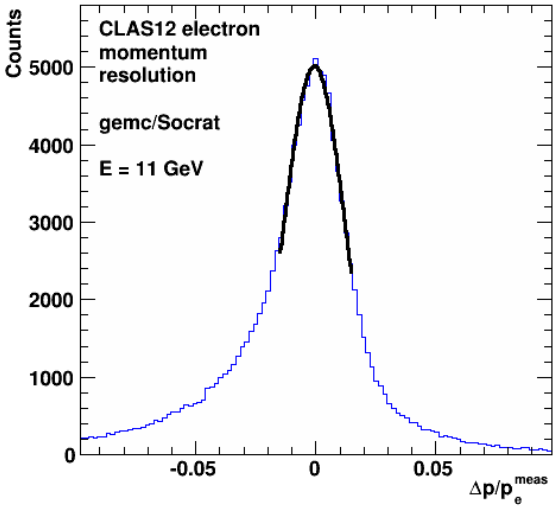
# Simulation

- Event Generators
  - pythia
  - local programs: disgen, ppgen, genev, ...
  - Use - Pythia is a mature, widely-used program. Other codes vary in ease of use.
  - Support - Pythia well supported by Lund and CERN. Varied support for others.
  - Point-of-contact JLab staff (H.Avakian).
- CLAS12 Simulation - *gemc*
  - JLab program for CLAS12 and others.
  - Uses evio data format common among the halls.
  - Use - Scripts for offsite installation: time-consuming, but reliable: being improved.
  - Support - Complete web-page, bug reporting.
  - JLab staff member (M. Ungaro).
  - See Veronique Ziegler's talk.



# Reconstruction

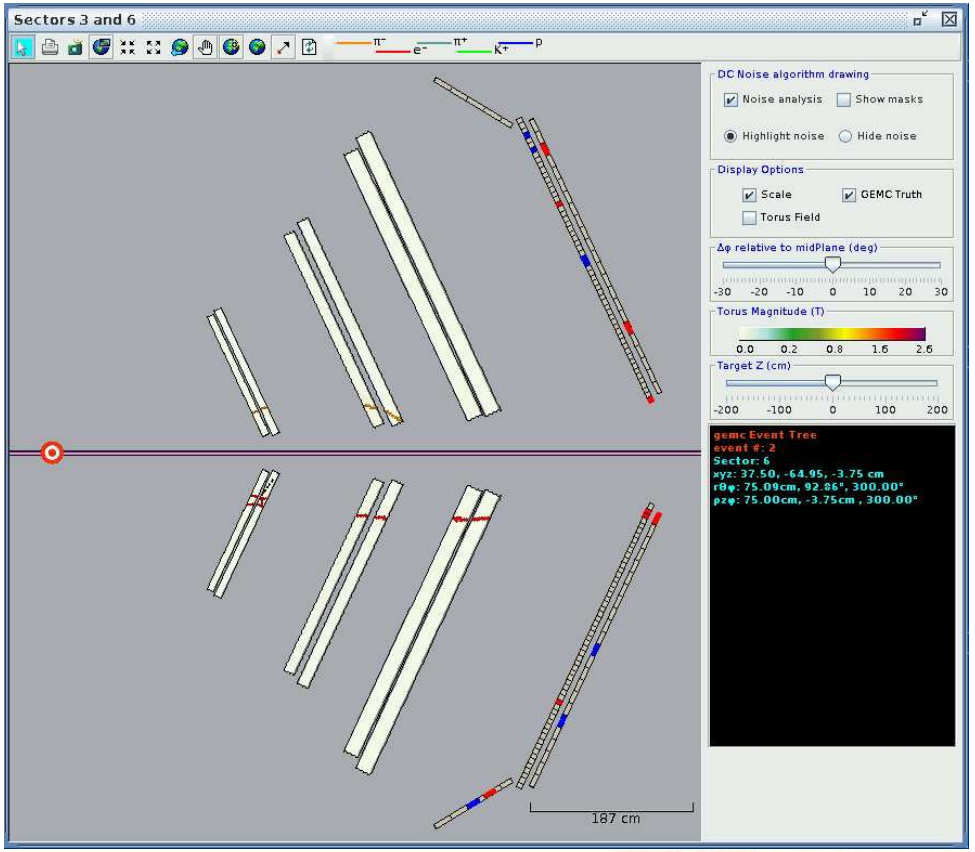
- Socrat (SOftware for Clas12 Reconstruction And Tracking)
  - Local, generation one, C++ code for electrons in forward detector (S. Procureur author).
  - Use - Compiled with Root libraries (ACLiC), complex code.
  - Support - CLAS-NOTE 2008-015, limited Collaboration support.




- TRAC (Track Reconstruction Application for CLAS12)
  - Current focus of main development effort on full CLAS12 reconstruction.
  - See Veronique Ziegler's talk.
  - Use - Applied to other reconstruction projects - Forward tagger (offsite) - R. De Vita, Barrel Silicon Tracker - Y. Gotra.
  - Support - CLAS-NOTE in preparation.

# Visualization - ced12

- ced12 (cLAS eVENT dISPLAY) is the 12 GeV version of the 6 GeV application.
- Use - Built on top of the bCNU libraries. Easy to use.
- Support - Single Collaboration member (D.Heddle).



# Physics Analysis

- evio2root
  - Converts evio data into root ntuples.
  - Generation 2 version in development.
  - Use - Generation 1 is easy to build, but cumbersome to adapt to new banks.
  - Generation 2 being developed by one JLab staff member (M.Ungaro). Generation 1 no longer supported.

# Summary

- Event generators - pythia, ppgen, disgen, and other locally developed ones.
- Simulation - *gemc* is complete, mature and in wide use.
- Reconstruction - generation 3 development far along.
- Visualization - ced12 event display well developed and widely used.
- Physics analysis – evio2root gives access to root; improved, generation two version being developed.
- Ease-of-Use - Many packages accessible to offsite users. TRAC just starting to spread offsite.
- Support - Faculty or JLab staff contacts for each major software subsystem (often the original author).