CLAS12 Software Meeting  
March 17, 2010 F113

Agenda

15:00-15:30 Update on ced12, Dave Heddle
15:30-16:30 CLARA – Service Oriented Architecture – Vardan Gurjyan.
16:30-16:50 gemc Demonstration – Maurizio Ungaro
16:50-17:20 Implementing the EC Simulation in gemc – Jerry Gilfoyle
CLAS12 Reconstruction and Analysis Framework

Vardan Gyurjyan

- Service-Oriented Architecture for Physics Data Processing.
  - Beyond object oriented.
  - Well-defined, reusable components.
  - OS platform and language independent (Java VM).
  - Components are loosely coupled – data are exchanged by value (not reference) and users don’t see service details.
- Enforces modularity (ease of maintenance, more agile)
- Takes advantage of distributed computing.
- Used in industry and government (Amazon, DoD...).
CLARA Status

- Infrastructure now being put in place and tested.
- Geometry service being developed at CNU.
  - Yelena Prok
  - Two new machines configured at CNU (2/10).
- Java/C++ templates for services in hand.
- Physics services need to be programmed.

Clara data throughput
Recent Progress on Simulation and Reconstruction

Maurizio Ungaro

Changes to gemc since last meeting:

- FLUX type: every track has its own hit. Good for counting purposes (i.e. how many protons pass through a detector, etc). Compare with standard ADC and TDC simulations.
  - Standard Time Window ADC: all hits in the same time window are added to give a ADC.
  - Time Window TDC: the first hit within the detector time window will give the TDC.
- Particles generators: Primary particle, electron luminosity, proton luminosity (can already read files in LUND format).
- New identifiers for EC for stacks (inner/outer).
- New solenoid field.
Introducing Scrat

Software for CLAS12 Reconstruction And Tracking

- Original Socrat code from S.Procureur migrated to C++ objects and factories.
- EVIO input/output.
- Bank list Filtering.
- JANA Multi-Threading, benchmarking.
- New Banks: DC_CLUSTER, DC_SEGM, DC_RSEGM, DC_TCANDIDATE.
- New banks can be read by CED12.

JANA reconstruction using factory methods allows change of modules.

http://www.jlab.org/~ungaro/maureepage/proj/scrat/doxy
CLAS12 Event Display
Dave Heddle

Based on Java graphics library (bCNU).
- used in ced12 and Hall D event displays.
- jevio (reads data, analogous to fdump, bosdump in CLAS6).

CED12 has many of the views used in the CLAS6 ced, but adds:
- Table of Monte Carlo events
- Easy access to printout of banks.
- Special tools for studying noise detection.
- Heads-up display.
- Auto rotate to better see how hits and tracks align.
- No build procedure to obtain an executable.

Development Plans:
- Web services.
- More geometries.
- Image service.
- 3D views.
- Interprocess communication.
Noise Analysis

More Snapshots
And More
Implementing the EC simulation in gemc

Jerry Gilfoyle

EC Geometry stored in mysql database.

Data bank definitions also stored in database.

Deposited energy spectrum for mono-energetic electrons at $\theta_e=25^\circ$, $\phi_e=0^\circ$. 

<table>
<thead>
<tr>
<th>Etot</th>
<th>Deposited energy</th>
<th>$&lt;x&gt;,&lt;y&gt;,&lt;z&gt;$</th>
<th>global position</th>
</tr>
</thead>
<tbody>
<tr>
<td>$&lt;t&gt;$</td>
<td>Time</td>
<td>$&lt;lx&gt;,&lt;ly&gt;,&lt;lz&gt;$</td>
<td>local position</td>
</tr>
<tr>
<td>pid</td>
<td>Particle ID</td>
<td>$vx,vy,vz$</td>
<td>vertex position</td>
</tr>
<tr>
<td>E</td>
<td>Track energy</td>
<td>mpid</td>
<td>mother ID</td>
</tr>
<tr>
<td>sector</td>
<td>Sector</td>
<td>mvx,mvy,mvz</td>
<td>mother vertex</td>
</tr>
<tr>
<td>stack</td>
<td>Inner, outer</td>
<td>view</td>
<td>U, V, W</td>
</tr>
<tr>
<td>EC_ADC</td>
<td>ADC</td>
<td>EC_TDC</td>
<td>TDC</td>
</tr>
</tbody>
</table>
Testing and Results

Sampling fraction extracted from deposited energy. Used mono-energetic electrons at $\theta=25^\circ$, $\phi=0^\circ$, no field.

Shower size taken from RMS of total deposited energy spectrum.

gemc consistent with GSIM within 10-15%.
Joint Software Development Effort

Eliot Wolin

- Main players: DAQ group, Hall B and Hall D
- Effort focused now on offline projects.
- Great potential for online collaboration.
- Some of the software used outside Jlab.
- Software resides in SVN repositories.
  - 12GeV (read/write for all)
  - DAQ repository (read-only except to DAQ group)
Current Joint Software Projects

- **JANA** (Dave Armstrong)
  - C++ event reconstruction/analysis framework.
  - Being used in Hall D (a lot) and Hall B (started).

- **Event Display** (Dave Heddle)
  - Java-based, experiment independent framework with 3-D!
  - Hall dependent implementations (CED and DED).

- **EVIO** (DAQ group, Dave Heddle)
  - Object-oriented representation with binary I/O.
  - Used in Hall B (CLAS12 Geant4 simulation and input format, Hall D simulation and reconstruction results).

- **cMsg** (DAQ group)
  - Publish/subscribe interprocess communication.
  - Used in CODA3 runcontrol, CLARA Service Oriented Architecture, ROOTSPY, codelite.
CLAS12 Software Workshop*

- **Goals:**
  - Broad view of the state-of-the-art in offline analysis.
  - Status of the CLAS12 software program.
  - Opportunities for users to join that program.
  - Tutorials on CLAS12 software; free DVD for participants.
  - To be held at the University of Richmond, May 25-26, 2010.
  - Travel funding available for students and post-docs.

*Supported by the JSA/SURA Initiatives Fund.

Website: [http://conferences.jlab.org/CLAS12Software/index.html](http://conferences.jlab.org/CLAS12Software/index.html)