CLAS12 software status and plans

November 10, 2020

Outline

- Session agenda and software talks
- Progress since the last meeting
- Near term plans and preparation for pass2
- Documentation

Agenda

Tuesday 10:45 - 12:40

Software and Calcom Session

https://jlab.bluejeans.com/245242338

Convener: Raffaella De Vita (INFN - Genova)

10:45 **Software status and plans** *20'*
Speaker: Raffaella De Vita (INFN - Genova)

11:10 **Data processing and computing** *20'*
Speaker: Nathan Baltzell (Jefferson Lab)

11:30 **Offsite simulation resources and infrastructure** *20'*
Speaker: Maurizio Ungaro (Jefferson Lab)

11:55 **CalCom activities** *25'*
Speaker: Daniel Carman (JLab)

12:20 **DC Calibration Studies** *20'*
Speaker: Taya Chetry (Mississippi State University)

Friday 10:35 - 13:00

CLAS Collaboration Meeting - Plenary

https://jlab.bluejeans.com/245242338

Convener: Kyungseon JOO (University of Connecticut)

10:35 **Progress of Artificial Intelligence in CLAS12 reconstruction.** *30'*
Speaker: Gagik Gavalian (Jefferson Lab)

11:05 **CVT Reconstruction Status** *30'*
Speaker: Veronique Ziegler (Jefferson Lab)

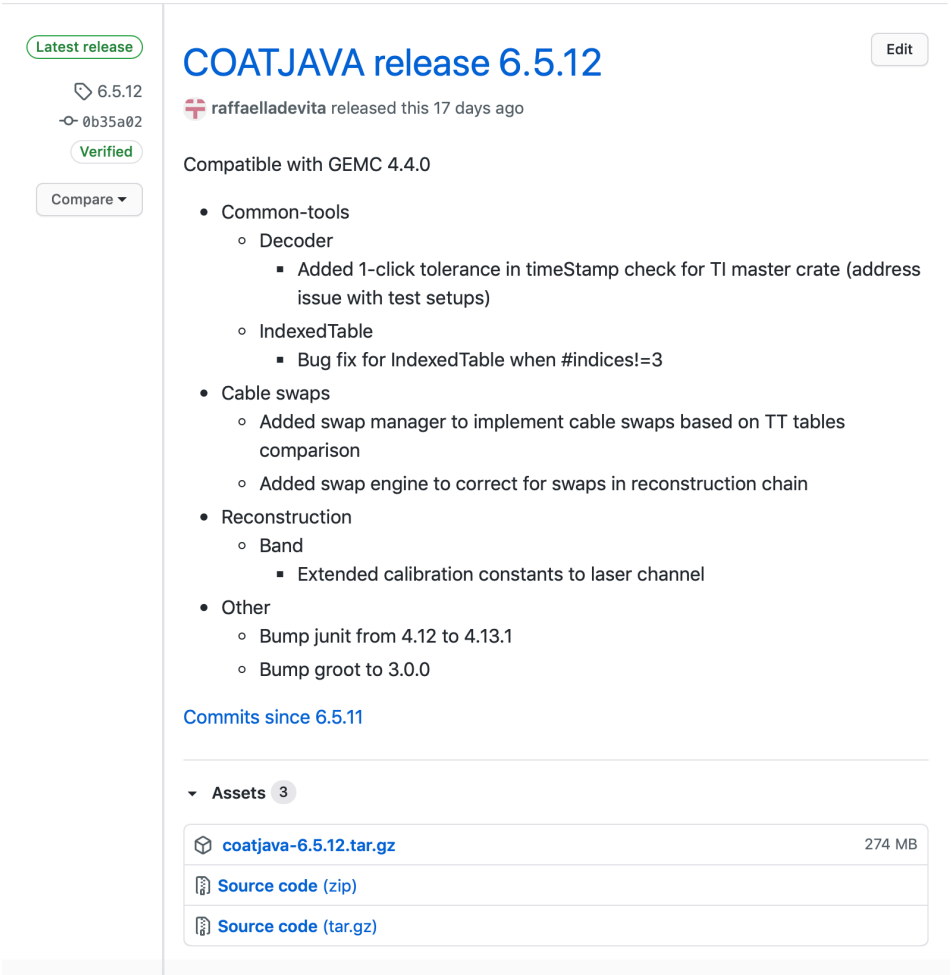
11:35 **CVT Kalman-filter based alignment** *15'*
Speaker: Sebouh Paul (U. of California Riverside)

Reconstruction progress

…since the last meeting:

- Continuous support for RG-A, B, K data processing:
  - (C)TOF clustering
  - Updated CND clustering
  - CND-CTOF veto in EB
  - Updated BAND reconstruction
  - New cable swap service
  - Updated scaler information
- RG-F support:
  - RTPC reconstruction
  - FMT reconstruction and alignment
- New run/detector: ALERT
- Ongoing developments:
  - CVT reconstruction restructuring
  - AI-assisted tracking
  - Covariance matrix tuning
  - Truth-matching
  - Geometry restructuring
  - …

https://github.com/JeffersonLab/clas12-offline-software/releases



Latest release

6.5.12

0b35a02

Verified

Compare

Edit

COATJAVA release 6.5.12

raffaelladevita released this 17 days ago

Compatible with GEMC 4.4.0

- Common-tools
  - Decoder
    - Added 1-click tolerance in timeStamp check for TI master crate (address issue with test setups)
  - IndexedTable
    - Bug fix for IndexedTable when #indices!=3
- Cable swaps
  - Added swap manager to implement cable swaps based on TT tables comparison
  - Added swap engine to correct for swaps in reconstruction chain
- Reconstruction
  - Band
    - Extended calibration constants to laser channel
- Other
  - Bump junit from 4.12 to 4.13.1
  - Bump groot to 3.0.0

Commits since 6.5.11

Assets 3

coatjava-6.5.12.tar.gz 274 MB

Source code (zip)

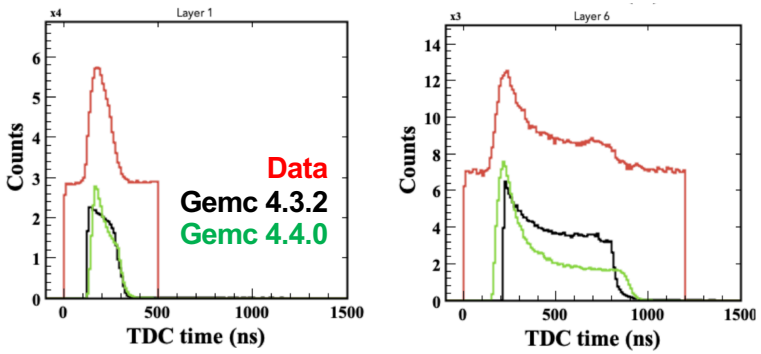
Source code (tar.gz)

Analysis support

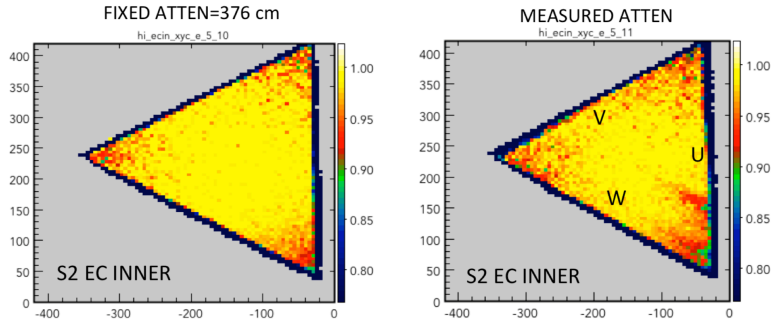
- New scaler information:
  - HEL::scaler bank
  - Includes FCup and SML reading for each helicity state
  - Useful for estimate of beam charge asymmetry
- "Trains" updates:
  - New BeamTarget wagon to facilitate standardization of custom wagons
  - New trigger-bit filtering functionality implemented for all wagons
- MC tuning:
  - Optimization of detector digitization routines to improve data-MC comparisons
  - First tuning for DC, ECAL, HTCC
  - More to come…
- BG merging:
  - Deployment of background merging software
  - Now available on OSG for RG-A and B
  - BG files for RG-K in production


```
{
    "name": "HEL::scaler",
    "group": 10000,
    "item": 16,
    "info": "Helicity-gated, analyzed scalers.",
    "entries": [
        {"name":"fcupgated",  "type":"F", "info":"Beam charge from Faraday cup, DAQ-gated (nano-Coulomb)"},
        {"name":"fcup",       "type":"F", "info":"Beam charge from Faraday cup, (nano-Coulomb)"},
        {"name":"slmgated",   "type":"F", "info":"Beam charge from SLM, DAQ-gated (nano-Coulomb)"},
        {"name":"slm",        "type":"F", "info":"Beam charge from SLM (nano-Coulomb)"},
        {"name":"clockgated", "type":"F", "info":"Clock, DAQ-gated"},
        {"name":"clock",      "type":"F", "info":"Clock"},
        {"name":"helicity",   "type":"B", "info":"Helicity state, HWP-corrected"},
        {"name":"helicityRaw","type":"B", "info":"Helicity state"}
    ]
}
```


DC TDC distributions



EC distributions

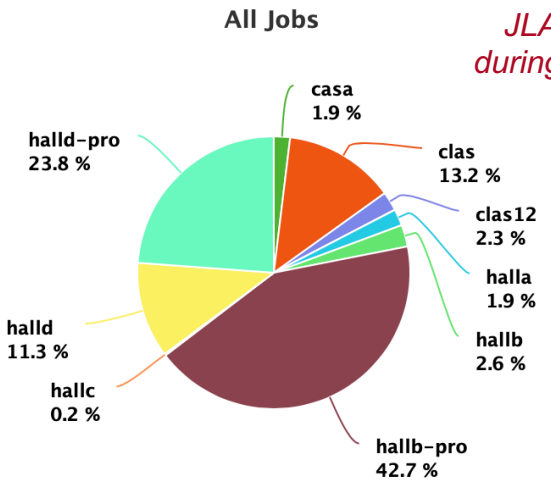


Data processing and simulations

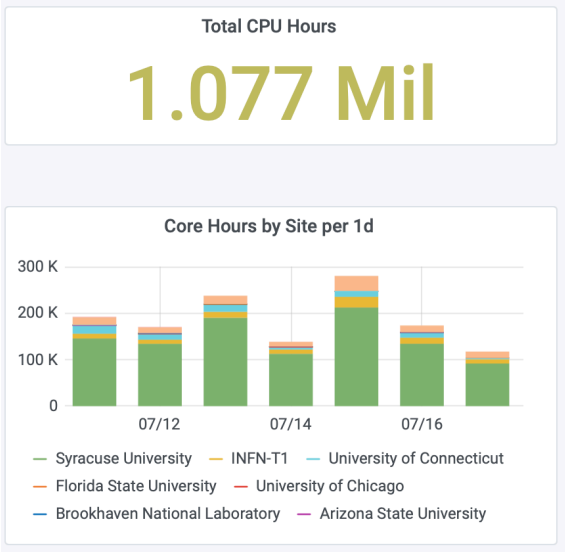
- Onsite:
  - Focus on real-data processing
  - Extensive usage for RG-A, B and K pass1 processing
  - Efficient use of Hall-B/CLAS12 fairshare with very high success rate
  - See Nathan's talk

- Offsite:
  - Focused on support for simulation via OSG
  - Extensively exercised with 4B events SIDIS production in support of first publications
  - New resources secured for 2021 and more to come
  - See Mauri's talk

JLAB farm usage during August 2020



OSG usage during the second week of July



Development plans for “pass2”

- **Goal**:
  - Build a list of work items to be completed for pass2, including software, calibration, alignment, …
  - Assign priorities
  - Estimate resources need for both core/experts and support (analysis studies, validation, …)
- **Process**:
  - Started from work list built and maintained by Software and CalCom groups
  - List expanded and updated based on input from
    - Detector experts
    - Run Groups
    - Physics Working Groups
  - First assignment of priorities and estimate of manpower
    - 4 priority levels, from 1=high to 4=low
    - Manpower estimates for core developers and supporting work (studies to finalize algorithms, validation)
  - Today: receive feedback from the Collaboration
- **Result**:
  - List available at https://jeffersonlab-my.sharepoint.com/:x:/g/personal/devita_jlab_org/EWEMPtgyNrpGizPqPvuJFNoB1M2eBG7RyEk9MIOvqsqJzQ?e=939XVQ

“Pass2” work items

- **Priority 1:**
  - **Software**:
    - **CVT**:
      - Restructuring of reconstruction package
    - **FD tracking**:
      - Tune and validate the covariance matrix
      - Resolve intra-sector z-vertex dependence
      - Save TB tracks with no beta assignment
    - **AI-assisted tracking**:
      - Complete integration, validation and assessment
    - **RICH**:
      - Finalize reconstruction and assess performance
    - **CND**:
      - Clustering and neutral veto refinement
    - **EB**:
      - Add new e/pi separation cuts
      - Use event vertex in direction calculation for FT
      - Incorporate RICH
  - **Calibration**:
    - **DC**:
      - Cable-dependent and global T0 calibration
      - Sector-dependent calibrations
    - **BMT**:
      - Update HV tables
    - **CTOF**:
      - Improve hit position correction
  - **Alignment**:
    - **RICH**:
      - Complete alignment
    - **DC**:
      - Study the effect of systematic shifts of the stereo angle
    - **CVT**:
      - Perform alignment of SVT and BMT, based on survey data and individual module adjustments with SVT-standalone tracking
  - **Other**:
    - **Field map**:
      - Complete validation of new torus field map based on modified coil geometry

“Pass2” work items

- **Priority 2:**
  - **Software**:
    - **EB**:
      - Combined usage of 1A and 1B times
      - Revisit track-hit matching cuts
      - Use energy deposition in charged-hadron PID
      - Use HTCC timing in matching
    - **ECAL**:
      - Implement cluster sharing
    - **FTT**:
      - Complete reconstruction
    - **All packages**:
      - Implement knock-out of malfunctioning elements based on status tables
  - **Calibration**:
    - **All detectors**:
      - Update calibration suites to determine component status
    - **DC**:
      - Pressure dependence of time-to-distance
    - **FT**:
      - Explore possible improvements to energy calibration
  - **Other**:
    - **Field map**:
      - Test new torus map based on full survey

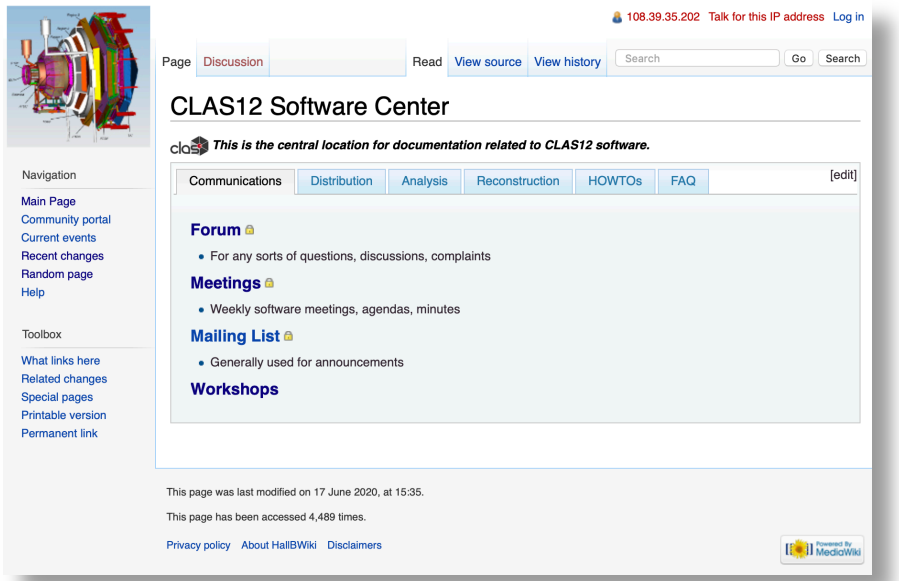
- **Priority 3:**
  - **Software**:
    - **LTCC**:
      - Implement cluster time
    - **FTOF**:
      - Use in-layer clustering
  - **Calibration**:
    - **LTCC**:
      - Timing calibrations
  - **Alignment**:
    - **CVT**:
      - Perform second stage alignment with DC-like and KF-based approach
  - **Other**:
    - **DC**:
      - Tune “effective” ministagger

- **Priority 4:**
  - **Software**:
    - **ECAL**:
      - Tune EC cluster reporting planes
    - **Other**:
      - Preserve more settings in new tag-1 banks

“Pass2” plan summary

- Work list includes tens of tasks, starting from CVT but covering most CLAS12 subsystems.
- Total estimated resources are:
  - **All tasks: 3 FTE**, 1 FTE from core/experts and 2 FTE for supporting studies and validation
  - **High priority tasks: 1.5 FTE**, 0.6 FTE from core developers and 0.8 for supporting studies and validation
- More demanding tasks are related to CVT and tracking in general
- Part of manpower for support work yet to be identified (30%)

Documentation



- New HOWTOs tab:
  - How to run the full simulation chain single-threaded
  - How to test a custom wagon
  - How to interactively probe the magnetic field
  - How to mount and use the CLAS12 software releases on CVMFS
- Others to come based on user request

Centralized software wiki: https://clasweb.jlab.org/wiki/index.php/CLAS12_Software_Center

Discourse forum for software related questions and communications