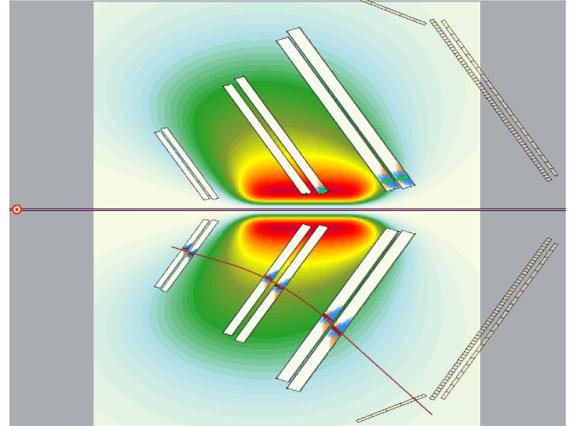


CLAS12 Offline Software

The **CLAS12 offline software** system will analyze the large amounts of experimental data acquired by the CLAS12 detector.

The system is a Service Oriented software Architecture which consists of the framework, event reconstruction, visualization, calibration, monitoring services, as well as detector and event simulation.



CLAS12 OFFLINE SOFTWARE - COMPONENTS

| COMPONENTS | DESCRIPTION |
|--|---|
| GEMC | Full-Geant4 based detector simulation |
| CED | Event-level visualization |
| CLaRA | SOA-based Physics Data Processing application development framework |
| DPE | Physics Data Processing Environment in Java, C++, and Python |
| Service Containers | Multi-threaded support |
| Application Orchestrators | Cloud/ batch-farm support |
| Online Level-3 Data Processing | CLaRA-based application deployment and operation on the online farm |
| Reconstruction Services | |
| Tracking | Charged-particle track reconstruction |
| FTOF/CTOF | Time of flight reconstruction for PID |
| EC/PCAL | Neutral particle identification |
| LTCC/HTCC | K/pi separation |
| Forward Tagger | Quasi-real photon tagger |
| PID | Particle identification |
| Calibration and Monitoring Services | Detector calibration, monitoring of data processing, histogramming |
| Auxiliary Services | Geometry, magnetic field, swimmer, noise rejection packages, fitting libraries based on jMinuit |
| Calibration and Conditions Database | Calibration and conditions database for on/offline constants |
| Data Analysis | |
| DST | Data summary tapes, data format for analysis |
| Data Mining | Distributed data access |

- **Development Strategy and Project Leadership:**
 - Core Developers Team: Gagik Gavalian, Vardan Gyurjyan, David Heddle, Andrey Kim, Nathan Harrison, Sebastian Mancilla, Maurizio Ungaro, Raffaella de Vita, Veronique Ziegler *
 - Development strategy:
 - Framework development done at JLab
 - Reconstruction and analysis software development involving detector groups from collaborating universities, validation and code management done at JLab
 - Rapid prototyping
- **Significant Dates:**
 - May 2013: Large scale testing of ClaRA reconstruction on simulated data
 - June 2013: Core components of central reconstruction completed
 - September 2013: : Core components of forward reconstruction in DC to TOF systems completed
 - Spring 2014: *Development of common tools packages*: Implementation of interfaces to access EvIO & DB constants from xml files
 - Fall 2014: Geometry package package completed for DC, SVT, FTOF, EC, PCAL, CND, FTCal, FTHodo. Histogramming and Fitting Libraries available. Event Builder in place.
 - January 2015: code version tracking and release in place (Maven)
 - February 2015: verified linearity of ClaRA scaling with number of threads
 - May 2015: first package released to beta testers for reconstruction validation studies
 - Fall 2015: Calibration suites for SVT, EC, FT, HTCC fully integrated with Coat-Java framework
 - February 2016: Successful transition to ClaRA 4.3
 - February 2017: Successful transition to Highly compressible data Output format (HIPO), successful on/offline reconstruction, monitoring and calibration (for EC/PCAL, H(L)TCC, FTOF) of KPP data
- **Project Status:**
 - GEMC:
 - Mature, contains all baseline detectors, capability to read geometry and calibration constants from database
 - Framework:
 - ClaRA framework complete
 - Mature Java DPE and set of Java services
 - Upgraded to version 4.3. Increase in reconstruction speed by a factor of 1.3
 - Linear scaling with the number of threads verified on 32 Core machines
 - C++, Python DPE completed
 - Deployments and tests on cloud-type environment, farm deployment in progress
 - Common framework and tools for CLAS12 reconstruction code
 - Reconstruction:
 - Charged track reconstruction in the Central Tracking system consisting of 4 SVT regions and 1 region of Barrel Micromegas (outer-most ring)
 - Reconstruction of events in the EC & PCAL completed
 - Reconstruction of events in the Forward Tagger ongoing
 - Reconstruction of events in the FTOF & CTOF completed.
 - Forward Tracking complete for simulated events
 - Time-to-distance function using CLAS12 data completed
 - Kalman Filter in place
 - Five-out-of-Six superlayer tracking algorithms in place.
 - Event Builder with Likelihood-based PID in place

Last Updated: March 27, 2017

 Jefferson Lab



Contact: * V. Ziegler, CLAS12 Software Project Coordinator (ziegler@jlab.org) 757-269-6003
L. Elouadrhiri, Control Account Manager (latifa@jlab.org) 757-269-7303
G. Young, Associate Project Manager for Physics (young@jlab.org) 757-269-6904
V. D. Burkert, Hall B Group Leader (burkert@jlab.org) 757-269-7540