

CLAS12 Software Overview

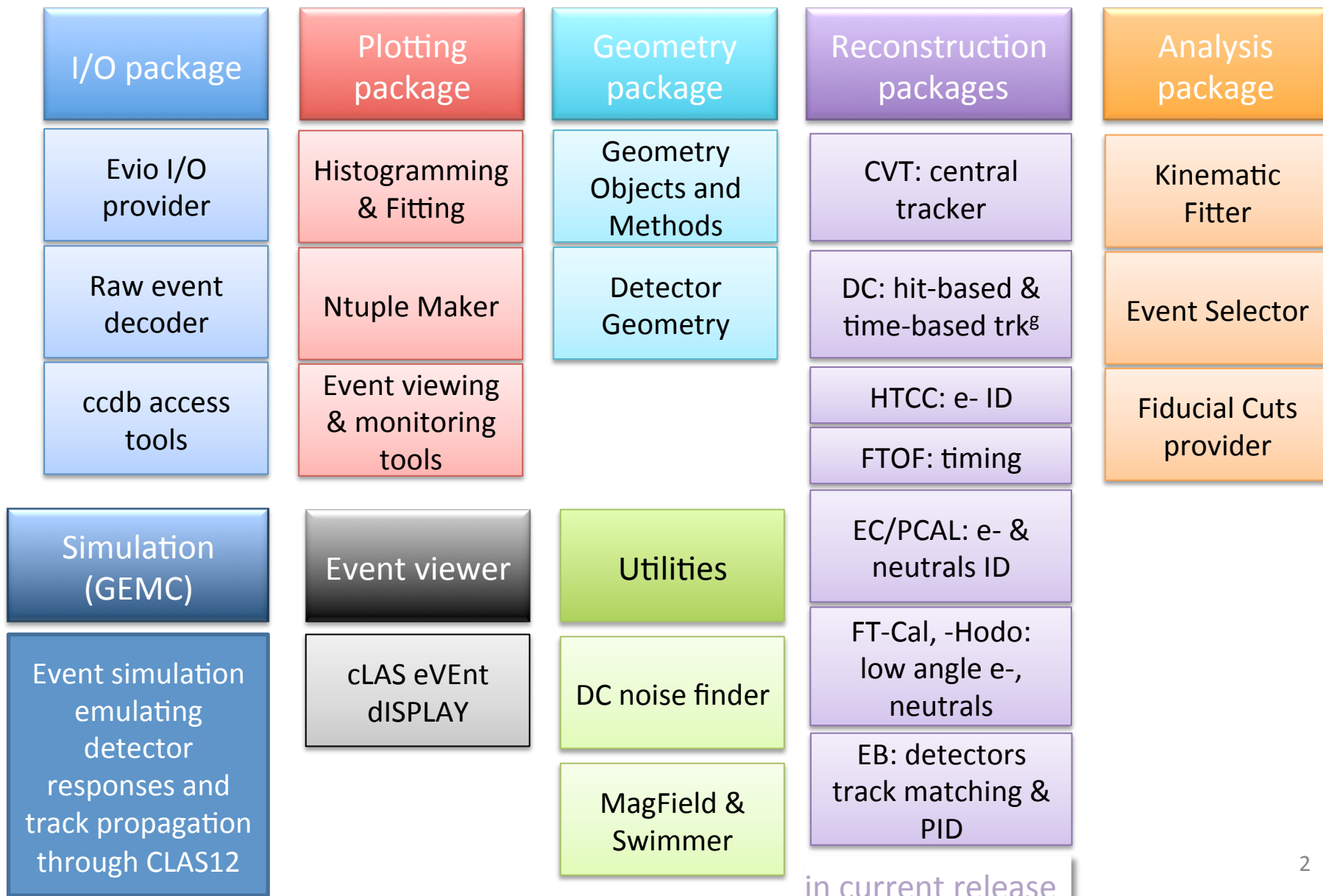
Veronique Ziegler

CLAS12 Software Workshop

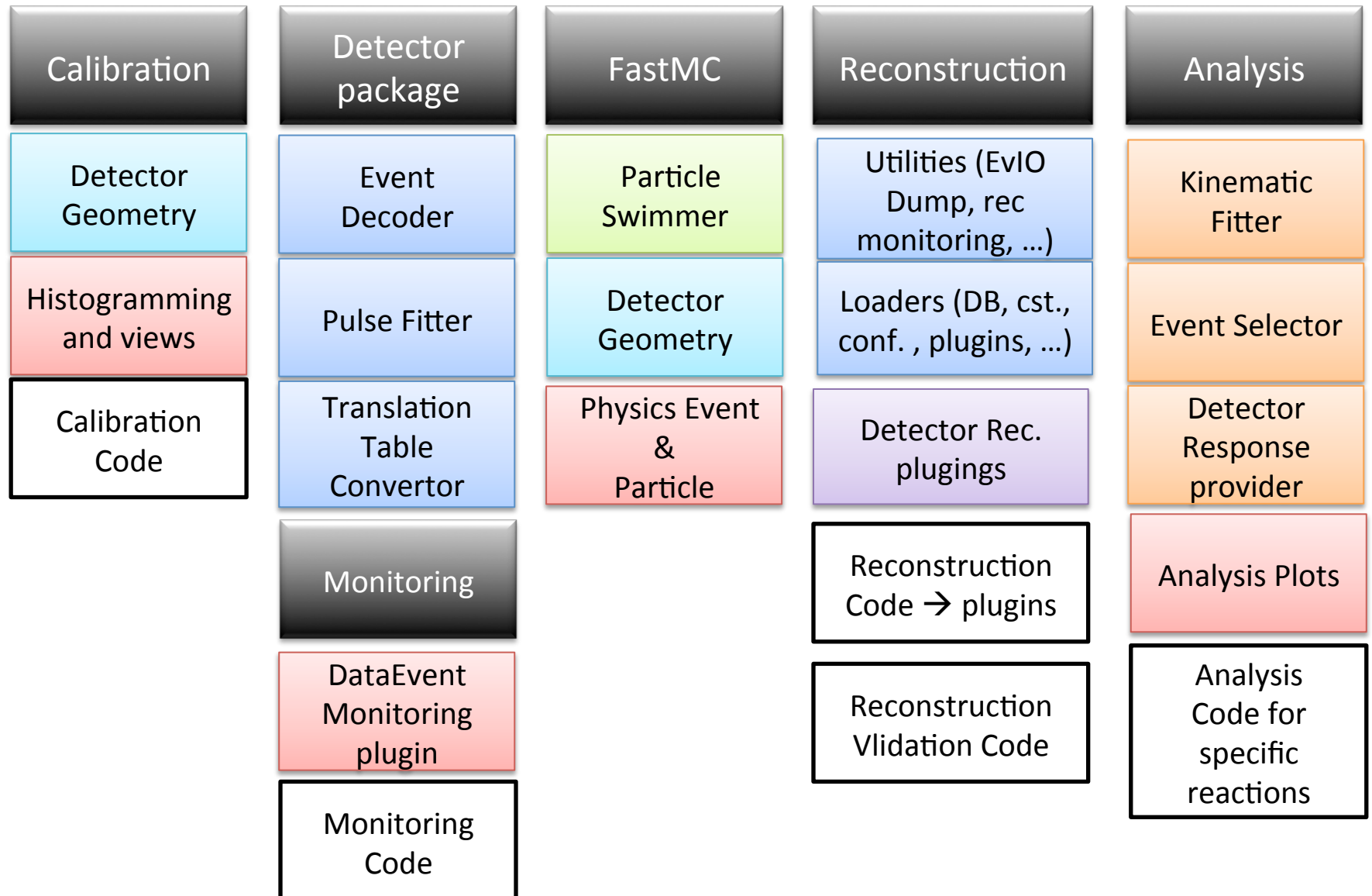
J-Lab Feb 23, 2016



CLAS12 Software at a Glance



CLAS12 Distribution (COAT-JAVA)



CLAS12 Simulation

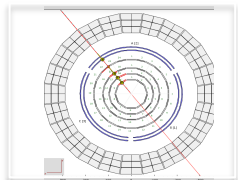
gemc devel-version 2.3

What's new:

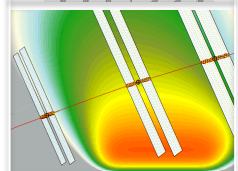
M. Ungaro

- parameters from CCDB
 - added production cut for all system
 - added cosmic ray model
 - added sampling of voltage every <bunch> ns (FADC mode 1)
 - added “trigger window” display and output
 - digitization of EC, FTOF (time resolution & attenuation) using calib. constants from DB → proper neutral reconstruction
 - 1 region barrel micromegas included in Central Detector
 - code fixes (HTCC, DC)
-
- Needs realistic time-to-distance DC fcn
 - CTOF geometry & digit. needed
 - Geometry to be obtained from geometry package for all detectors

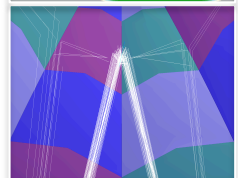
CLAS12 Event Reconstruction Status At a Glance



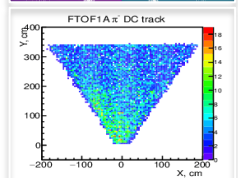
Central Tracking: code developed to analyze large angle tracks for 4 double-layers SVT + 1 double-layer BMT. Reconstructs cosmes and helical tracks. CND reconstruction under development.



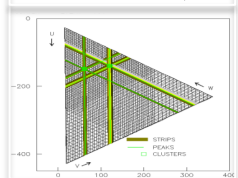
Forward Tracking : code optimization of existing clasrec-dc package. Code runs Hit-based tracking and Time-based tracking. Development of Time-to-Distance function. Realistic inefficiencies in MC. Gets geometry constants from DB.



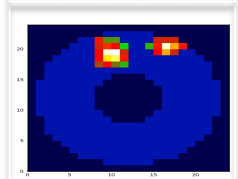
PID: HTCC: Plugin now in full reconstruction chain (e- ID). Clustering and timing validated on MC.



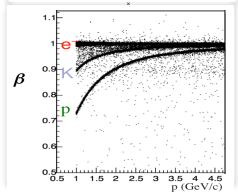
PID: FTOF: Matching of DC track to TOF panels. TDC values from ccdb database. Ongoing validation tests.



PID: EC/PCAL: Implementation of attenuation correction. Calibration constants from database. Code optimization for iterations and calibration.



FW Trkg & PID: FT: FT-Calorimeter & FT-Hodoscope services available. Improved hodoscope clustering algorithm.



Event Builder: ~ realistic forward carriage detectors digitization allows for improved PID assignment and photon reconstruction.

✓ SVT:DC:HTCC:FTOF:ECRec:FT:EB chain of services in the next release (2.3)

Forward Tracking Validation Studies

N. Harrison

Validation

- Validation of GEMC, reconstruction software and coatjava analysis tools
- fastMC development (include resolutions)
- Documentation, tutorials, and user support

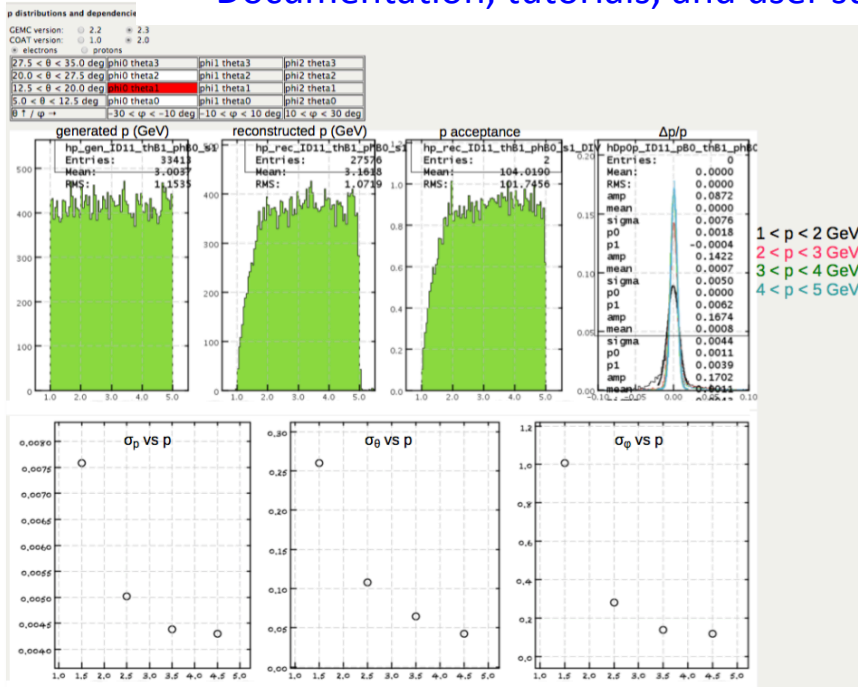
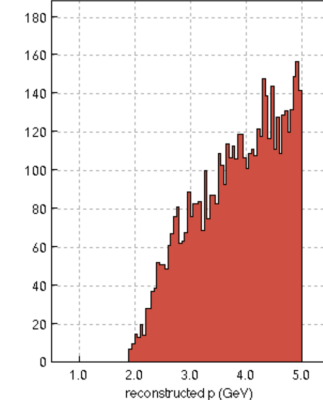
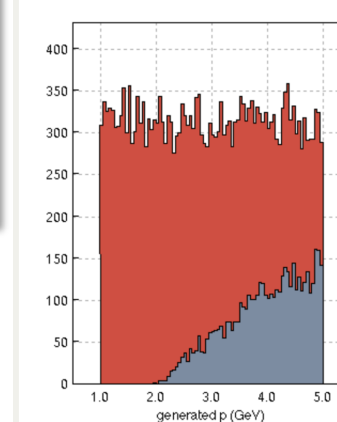
- Comparisons between different releases

- Resolution and efficiency studies for different particles as a function of p , θ , and ϕ

- Use FastMC to obtain acceptance and tracking efficiency as a function of p , θ , ϕ

● electrons ○ protons

27.5 < θ < 35.0 deg	phi0 theta3	phi1 theta3	phi2 theta3
20.0 < θ < 27.5 deg	phi0 theta2	phi1 theta2	phi2 theta2
12.5 < θ < 20.0 deg	phi0 theta1	phi1 theta1	phi2 theta1
5.0 < θ < 12.5 deg	phi0 theta0	phi1 theta0	phi2 theta0
$\theta \uparrow / \phi \rightarrow$	-30 < ϕ < -10 deg	-10 < ϕ < 10 deg	10 < ϕ < 30 deg

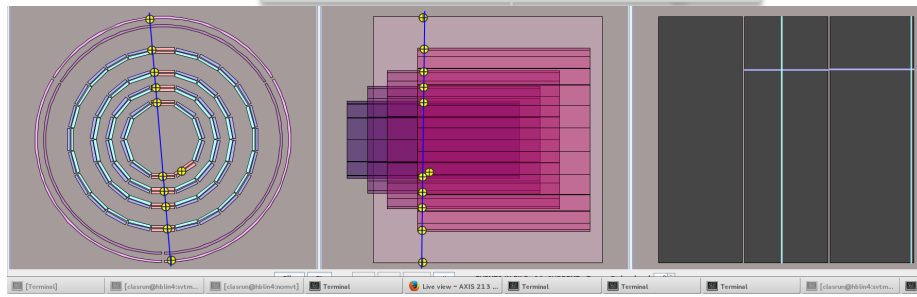


Central Tracking Validation Studies

Monitoring and Data Validation

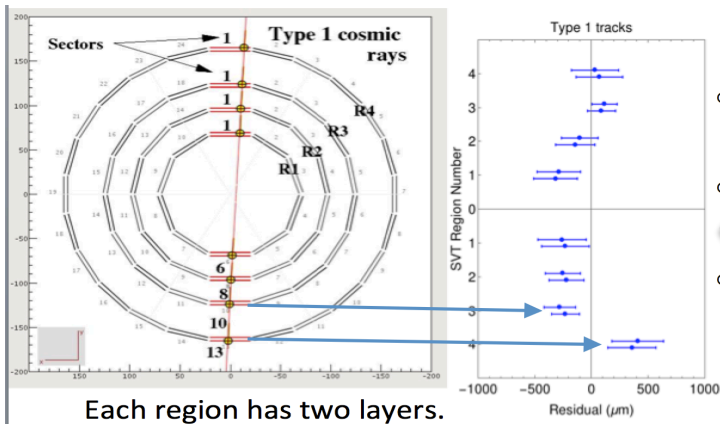
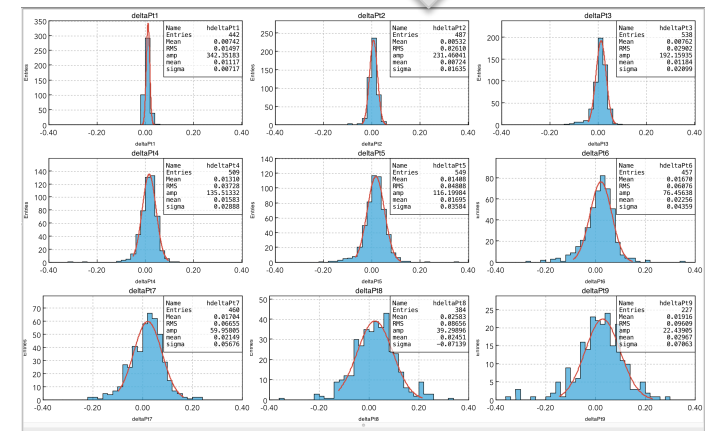
- Online cosmic track reconstruction monitoring of SVT and MVT using ET
- Validation Suite
 - Added MC truth histograms
 - Added helical tracks
 - Optimizing channel testing
 - Working on the tracker map, component and object views

Online Monitoring



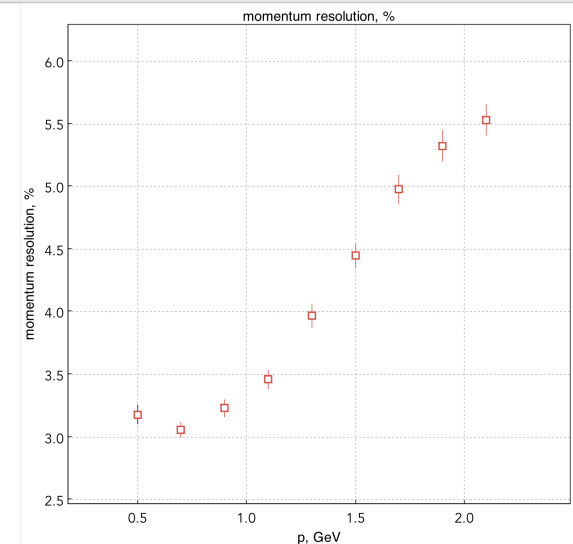
Y. Gotra

Reco. Validation (4 crosses – type 1 tracks)



J. Gilfoyle

Alignment Studies



Reco. To Do List ~ by September 2016

	Activity Name	Status
CVT Reconstruction	Reconstruction code validation	Suite in devel.
	Reco. using geometry service	Not started
	Reco. using geometry survey numbers	Not started
		* Clustering algo. using hit status in place
	Reco. using hit status	
	BMT Reconstruction code validation	To do
DC Reconstruction	Improve MM clustering algorithm	To do
	Debug KF and include BMT geometry in the projector matrix (lower priority)	Not Started
		Ongoing, validation suite needed
	Reconstruction code validation	
	Reco. using geometry survey numbers	Not started
	Reco. using hit status	Not started
FMT Reconstruction	Missing TBLA banks	Not started
	Time-to-distance function	started
FMT Reconstruction	Reco. using geometry service	Not started
	Improve clustering algorithm and DC track matching	To do
EC/PCAL Reconstruction	Methods for handling two-cluster identification with shared energy in peaks	started
	Indexing to allow identification of hit members in clusters, peaks (for iteration, calibration)	started
HTCC Reconstruction	Validation and fiducial cuts studies	started
TOF Reconstruction	Validation	Ongoing
	Develop algorithms and write code to combine the timing signals from FTOF panels 1a and 1b to extract an improved resolution *	* Timewalk & atten. len. corr. in gemc
	Match hits/clusters in the 2 FTOF panels that are part of the same track *	To do
	Validation	ongoing
Event Reconstruction	Prob. PID calculation	started
Alignment	Develop alignment code for central and forward detectors	started

Critical Tasks

- Translation tables
- I/O Decoding
- Status Tables (malfunctions...)
- Calib & Cst Tables definition and creation
- Completing missing digitization in simulation (TOFs, Micromegas, DC[Time-to-dist])
- Completing the geometry package (gemc volumes, missing detectors)
- Alignment
- Monitoring

Contributing to Reconstruction Code Development (1)

- get the distribution (Clas Offline reconstruction and analysis toolkit) to run the reconstruction and do data analysis:
<https://userweb.jlab.org/~gavalian/software/coatjava/>
 - The bank definitions are in etc/bankdefs/clas12
 - the reconstruction plugins are lib/plugins

Contributing to Reconstruction Code Development (2)

- fork the source code for a given project
- develop a component of the reconstruction using an IDE (e.g. eclipse)
- create a new plugin for a particular component of the reconstruction chain (e.g. CVT)
- run the reconstruction
`/bin/clas12-reconstruction -s SVT -i input`

Concluding Remarks

- Critical areas to contribute to make sure we are ready for KPP
- Next release (coatjava-2.3) to include
 - Improved de-digitization of TOF and CAL systems, HTCC reconstruction
 - PID using more realistic detector responses
 - new Central Tracking code (under validation)
 - ✧ Target release timescale: end of March
 - ✧ gemc-2.3 to be released by that time → consistency between simulation and reconstruction
- Reconstruction rate on 4-tracks events was 6.3 ms/event on 32 cores Haswell machines in multithreaded mode with ClaRA-4.2. Benchmarks to be performed with ClaRA-4.3