CLAS12 Analysis and First Experiment Organization

Original "Charge" Presentation by Latifa & Jerry

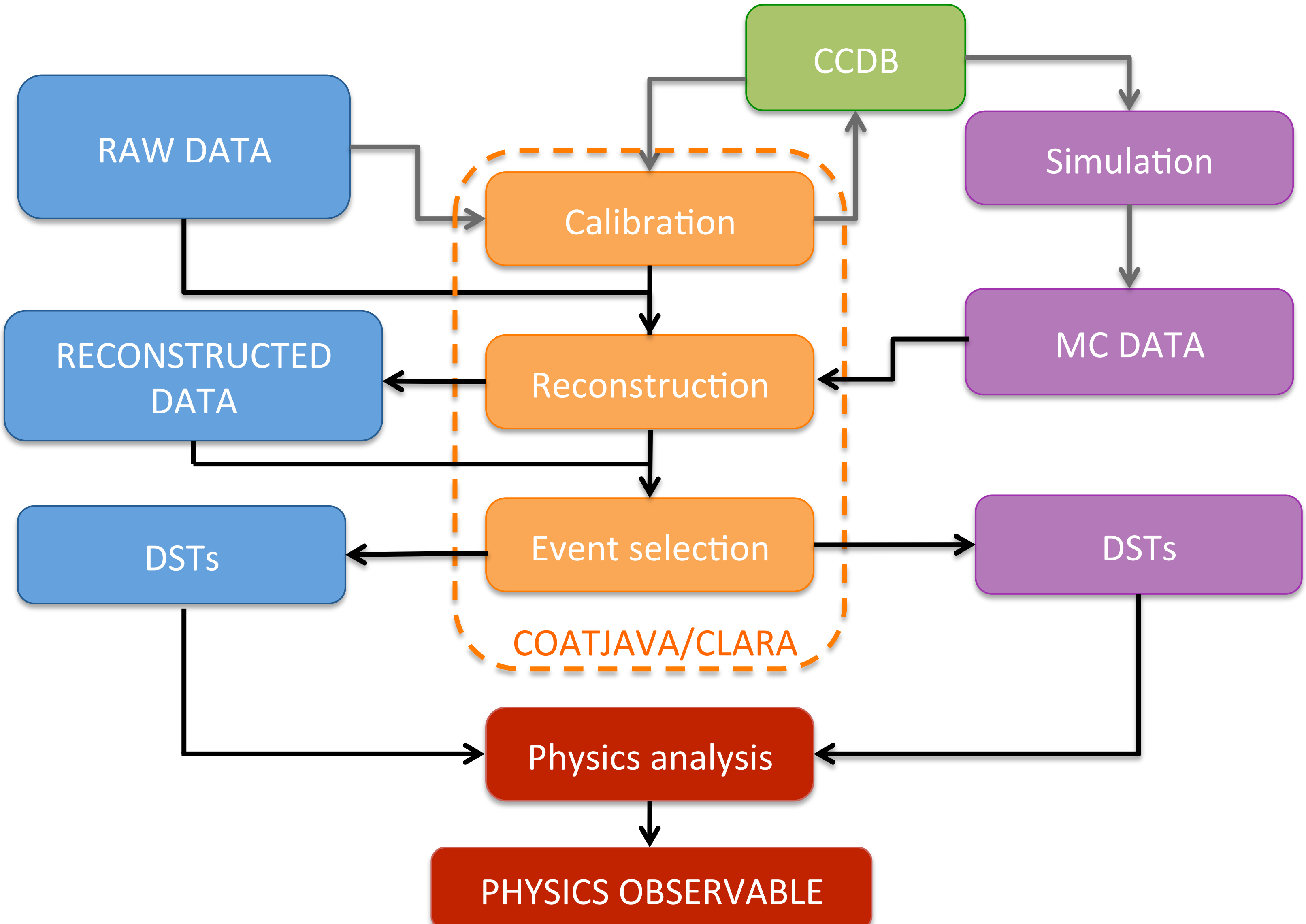
January 13, 2017

With additions from Sebastian
March 2017

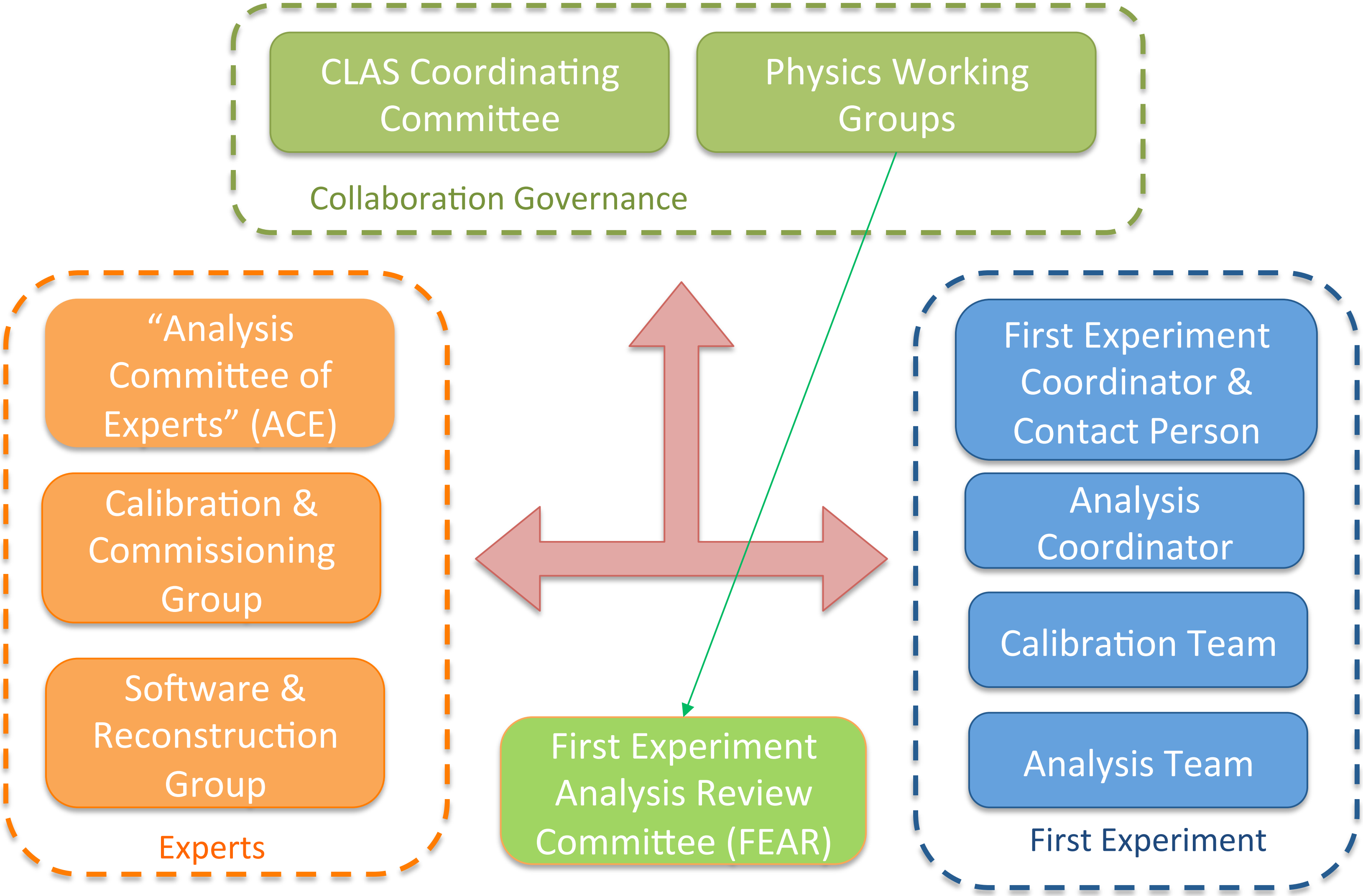
Recommendations of Common Tools Committee

- Complete COATJAVA reconstruction and calibration tools.
- Extend COATJAVA to include event selection.
- Create this group
  - Guide development of analysis algorithms
  - PID, momentum corrections, background subtraction, fiducial cuts
  - Higher level analysis – kinematic fitting, PWA
  - Standardize the algorithms and software.
- Create first experiment analysis review committee before the fall run to begin assessing the techniques used in the previous bullet.
- Get ready for the fall run: develop and run simulations for the experiments in Run Group A, define optimal running conditions, complete development of necessary tools, and define infrastructure to manage the work.
- Documentation and dissemination.

CLAS12 Data Analysis Scheme



CLAS12 First Experiment Organization



Expert Analysis Group Membership

- Ken Hicks
- Dave Ireland
- Sebastian Kuhn
- Silvia Niccolai
- Eugene Pasyuk
- Larry Weinstein
- + Kyungseon Joo

To-Do List (The Agenda)

1. Common Tools to do the following (DST generation)

- o Good run, file and event selection
- o Compile list of special runs required (calibration, in/outbending, no B, H, 2.2 GeV…)
- o Helicity sorting and matching, false asymmetries
- o Beam and target polarization, dilution, polarized background
- o Luminosity
- o PID
- o Backgrounds
- o Vertex and momentum corrections
- o Fiducial cuts and acceptance
- o Detector and reconstruction inefficiencies
- o Kinematic fitting
- o Radiative corrections
- o Simulation of all of the above (GEMC)

2. “Model” analysis notes, algorithms, checklists…

Luminosity

Integrated Charge
Trigger Efficiency

- Current measurement
  - Cannot use Faraday Cup usual way.
  - Alternate methods and how to calibrate them
- Live time
  - Periodic clock
  - Random clock
  - accepted/total triggers
  - removal of bad beam intervals
- Stability on run-by-run basis
  - Number of Reconstructed Particles per event
- Check any nonlinear rate dependence if any.
  - take data with different luminosity
- Empty target runs
- Cluster finding electron trigger.
  - Continuous monitoring of calorimeters calibration
  - If any drift is observed recalibration is needed and new calibration parameters uploaded to trigger FPGA.
- How to measure a complex trigger efficiency

Target thickness

- Precise measurement of the cell size
- Continuous monitoring of target cell pressure and temperature
- Account for thermal contraction
- Effects of windows (empty vs. full target)

PID for CLAS12

Suggestions/ideas from the ACE

January 2017

S. Niccolai, IPN Orsay

Abstract

This document describes the lessons learned on particle identification from analyses of CLAS data, and gives an overview of the typical PID procedures that are likely to be adopted for CLAS12 as well.

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1 PID: what we learned from CLAS that could be useful for CLAS12 . . . 1
1.1 PID cuts are not "absolute" . . . 1
1.2 PID cuts are linked to other cuts . . . 1
1.3 Interplay between subdetectors and sector dependence . . . 1

2 CLAS and CLAS12: what's common, what changed . . . 2

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3.3 Photons . . . 6
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Vertex and momentum corrections

Tracking Corrections For CLAS 12

Sebastian and Larry

General Philosophy

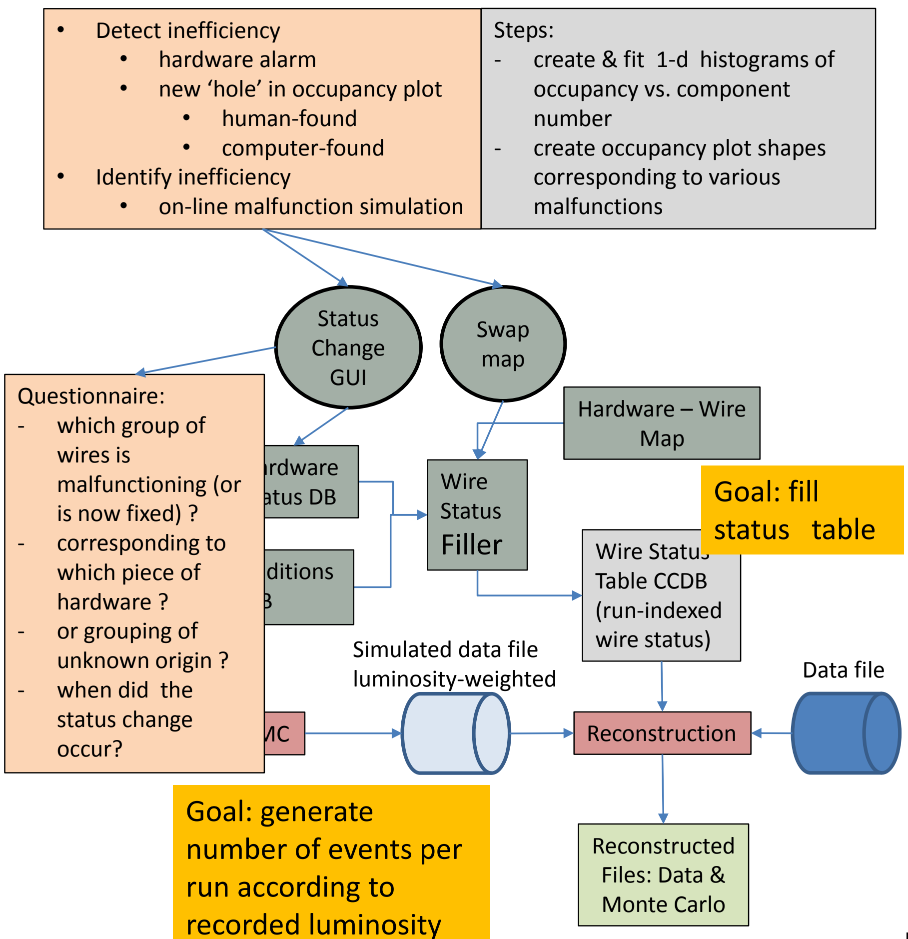
Make sure run plan contains all necessary auxiliary measurements
- Zero-field tracks for relative alignment
- Inbending and outbending field to disentangle DC displacements from magnetic field imperfections
- H runs for elastic and other exclusive channels (must also have multi-particle exclusive channels to fully cover kinematic plane, e.g. p(e,e'p pi+ pi-) or d(e,e'pp pi-)

Fix tracking **now**, not after the fact
- Optimize Kalman filter to provide best fit to measured hits (DC, SVT, μMEGAS, PreRad) including energy loss, multiple scattering and energy loss straggling as well as possible magnetic field and wire position uncertainties; incorporate actual beam position and, if appropriate, detached vertices
  - This will be improved iteratively, with data

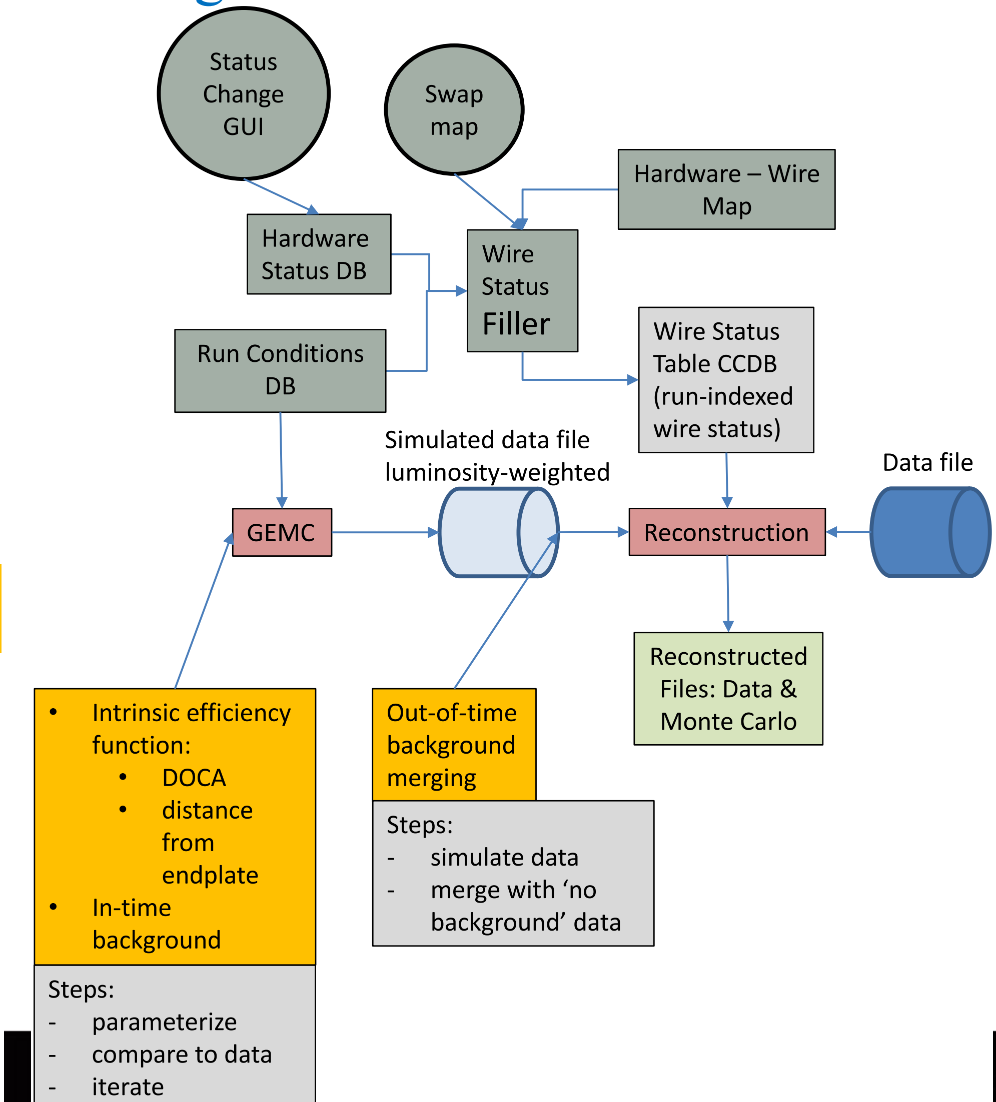
Goal: Full set of 4-momenta and vertex positions WITH correlation matrix! Allows for determination of optimum vertex (detached or on beam) including m. sc. by considering all particles in the event. Allows for kinematical fitting of momenta by considering all particles in the event.

Detector and reconstruction inefficiencies

Simulating Malfunction – Related Inefficiencies



Simulating Intrinsic and Background – Related Inefficiencies



“Model” analysis notes, algorithms, checklists

Suggested template

The run group document should serve two purposes.

1. Summarize all information needed for anyone now and will analyze in the future. This includ experiment configuration and running conditi complete list of all standard tools and procedu the analysis of this data set, how to get them ar
2. Contain description, justification and validatio procedures, corrections etc.

Summary of running conditions

Dates of the run

- Beam:
  energy,
  current,
  radiator thickness
  …
- Target:
  Material
  Dimensions
  Offset
- Start counter offset
- CLAS configuration if different from standard
- Trigger configuration(s), thresholds
- Anything else specific for the experiment

Calibration quality and PID

Present plots, which show calibration quality and dete subsystems used in the experiment. Show how defaul typical resolutions fro various detector subsystems.

Momentum and energy corrections and kine

Describe standard momentum correction, beam energy c they were obtained and demonstrate their effect. For kine distributions and confidence level distributions.

Cooking procedures

Document what software was used for cooking, its locatic

Procedure

Procedure	N/A	Yes	No
Used PART bank reconstruction for the analysis. EVNT was NOT used	☐	☐	☐
Momentum corrections as described in the g12 note	☐	☐	☐
Beam energy correction as described in the g12 note	☐	☐	☐
Inclusive Good run list as described in table 7. Individual analysis may use a subset of it	☐	☐	☐
Target density and its uncertainty as described in the g12 note	☐	☐	☐
Photon flux calculation procedure as described in the g12 note	☐	☐	☐
Lower limit for the systematic uncertainty of normalized yield is 5.7%	☐	☐	☐
Photon polarization calculation procedure as described in the g12 note	☐	☐	☐
Systematic uncertainty of the photon polarization as described in the g12 note	☐	☐	☐
gsim parameters	☐	☐	☐
gpp smearing parameters	☐	☐	☐
DC efficiency map	☐	☐	☐
EC knockout	☐	☐	☐
Minimal TOF knockout	☐	☐	☐
Lepton ID is used	☐	☐	☐

their locations. If skimming was used during
ıot bias data subset. Provide list of “good” and
ːation.

were determined and handled.

ters. Criteria for knock out.

ːiencies.

tional efficiencies
matches the data.

ocation. Systematic uncertainties of absolute
omparison of normalized yields for various
. Comparison with known cross sections.

ıcertainties

ıs and tools