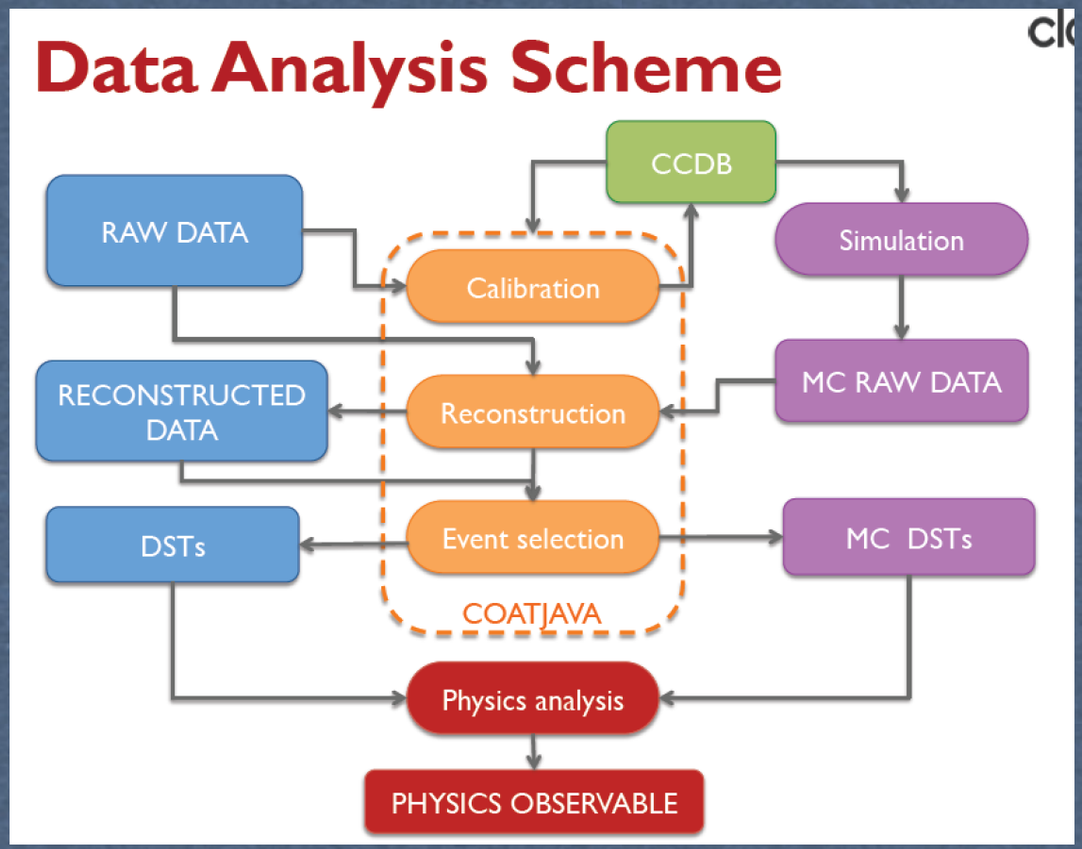
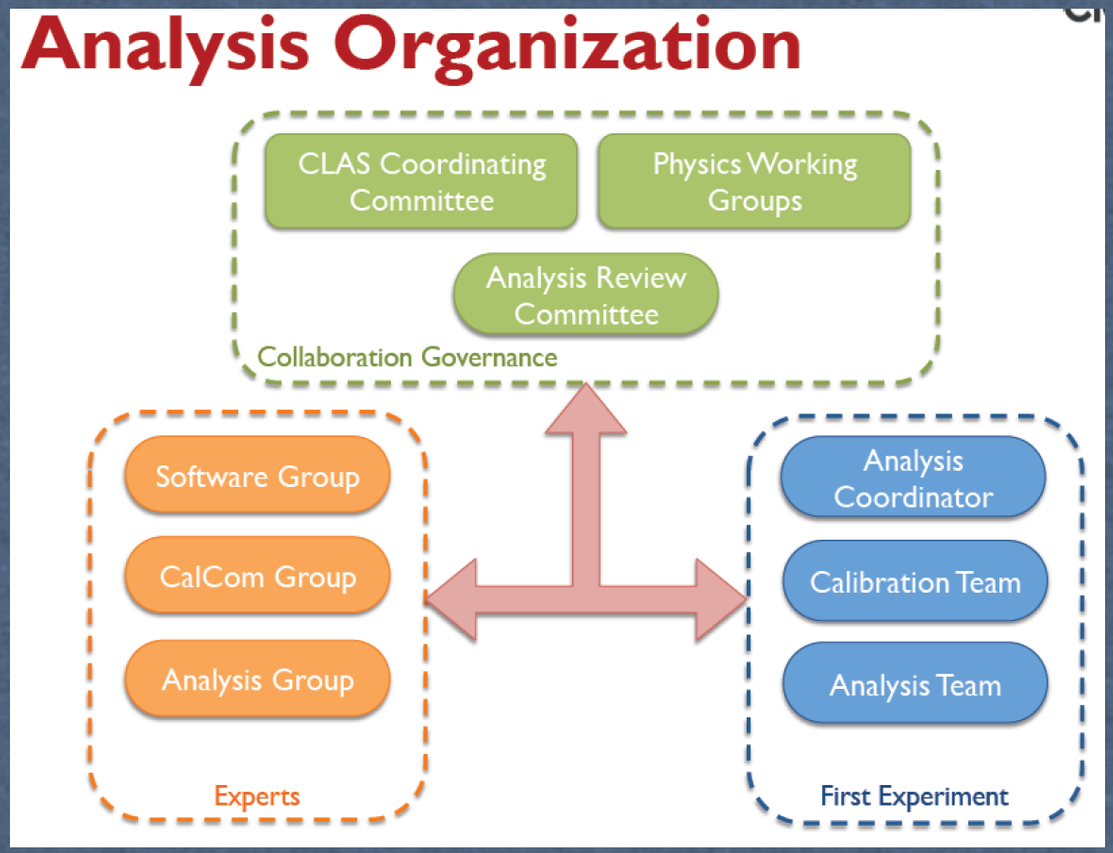
The HSWG in the CLAS12 era (HSWG 2.0)

Why?

- ✳ Feb/March 2017 CLAS12 Commissioning run (KPP)
- ✳ Fall 2017 CLAS12 engineering run
- ✳ RG-A (12 GeV on H2 target) will be the major player of CLAS12 First Experiment

- ✳ Outcome of the Common Tools Committee includes suggestions to reorganise the PWG in CLAS12 era





The HSWG in the CLAS12 era (HSWG 2.0)

How?

- Significant impact on HSWG_2.0 duties
  - Nominate representatives in the Analysis Review Committee: permanent/temporary?
  - contribute to the Analysis/Calibration team: define 'experts' and 'workers'
  - Identify specific procedures relevant for the HSWG only: PWA, Kinematic-fit?

- Significant impact in the Analysis review Process
  - Define standard procedures and extra (to be specifically review)
  - run-group review from the very beginning (e.g. g11/g12)

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When?

★ **Consider the first experiment a Collaboration and HSWG priority**

✳ HSWG members should contribute :

- to the CLAS12 Common Analysis framework
- to the CLAS12 Detector Calibration
- to the CLAS12 Detector reconstruction

✳ HSWG member should specifically:

- Focus on a specific reaction easy to analyse to get results quickly
- Define known/measured benchmark reference to compare to
- Identify critical issues in detector calibration
- Contribute to the calibration and taking care of specific HSWG procedures
- Identify procedures to insure high quality data
- Run simulation in advance
- Develop and test the full analysis chain (test on simulation)
- Test the new procedure for an efficient and timely analysis review

★ **If this scheme will be successful we should extend to all HSWG_2.0 analyses**

The HSWG in the CLAS12 era (HSWG 2.0)

★ **If we agree, we need to define a workplan and coordinate the effort from different groups**

★ **HSWG should play a major role in CLAS12 data analysis**

Collaboration - wise

- ✳ Identify Institution interested in contributing
- ✳ Identify an Analysis coordinator per each institution
- ✳ choose areas where you want to contribute

Common tools analysis framework

Common tools calibration framework

HSWG Tools

- evgen
- helicity info
- sg/bg separation
- kin fitter
- normalization
- efficiency/acceptance

HSWG Analysis

- angular distributions
- asymmetries
- DME
- trigger efficiency
- xsec
- (PWA)

Meson spectroscopy with photons in CLAS12

Exp-11-005 "MesonEx"

Study the meson spectrum in the 1-3 GeV mass range to identify gluonic excitation of mesons (hybrids) and other quark configuration beyond the CQM

✳ Hybrid mesons and Exotics

- Search for hybrids looking at many different final states
- Charged and neutral-rich decay modes
- $\gamma p \rightarrow p\, 3\pi$, $\gamma p \rightarrow p\, \eta\, \pi$, ...

✳ Hybrids with hidden strangeness and strangeonia

- Intermediate mass of s quarks links long to short distance QCD potential
- Good resolution and kaon Id required
- $\gamma p \rightarrow p\, \phi\, \pi$, $\gamma p \rightarrow p\, \phi\, \eta$, $\gamma p \rightarrow p\, 2K\, \pi$, ...

✳ Scalar mesons

- Poorly know f_0 and a_0 mesons in the mass range 1-2 GeV
- Theoretical indications of unconventional configurations (qqqq or gg)
- $\gamma p \rightarrow p\, 2\pi$, $\gamma p \rightarrow p\, 2K$, ...

- Decay and production of exclusive reactions, different final states (charged/neutral)
- Detector requirements: good acceptance, energy resolution, particle Id
- Identification of exotic configuration via PWA

Requirements

1) High intensity 6-10 GeV photon beam
   → low Q^2 electroproduction
2) 4π detector
   → CLAS12 + Forward Tagger (FT)

1st physics out of CLAS12

Data Analysis

★ easy PIds (pions)
★ not perfect resolution, limited statistics
★ narrow states, few particles involved
★ useful for calibration purposes

Physics output

★ Simple Moments analysis - extended kinematics
★ Exploiting linear polarization (asymmetries)
★ Spin Density Matrix Elements (SDME)
★ longitudinal plots
★ Testing Dalitz with new amplitudes (Veneziano)
★ [Xsection in the extended kinematics (Eg=6-11 GeV) ?]
★ Mesons never observed in photoproduction (narrow peaks)

Day 1st analysis

$\gamma p \rightarrow n \pi^+$	Used to build any theory	Angular, xsec	Requires a dedicated (prescaled) trigger
$\gamma p \rightarrow p \pi^0$	Less interesting but valuable	Angular, xsec	Easier to detect (2 clusters+ 1chrg track)
$\gamma p \rightarrow p \pi^+ (X)$	Inclusive measurement	Xsec, longitudinal plot	2 charged tracks, standard trigger
$\gamma p \rightarrow N \pi (\pi)$	Benchmark reaction	Angular, SDME, xsec	2 charged tracks, standard trigger
$\gamma p \rightarrow N \omega, \eta, ..$	Calibration reaction	Angular, SDME, xsec	2 charged tracks, standard trigger
$\gamma p \rightarrow N \pi \pi (\pi)$	Calibration reaction	Xsec, longitudinal plot	2 charged tracks, standard trigger
$\gamma p \rightarrow p \varphi$	benchmark reaction	Angular, SDME, xsec	($K^0 \rightarrow \pi\pi$)
$\gamma p \rightarrow N M$	M = any meson not observed yet in photo production, e.g. radial excitations/new states above 2 GeV		

Day 2 analysis

$\gamma p \rightarrow N K K$	2π extension	Moments analysis	Requires good Pid but could
$\gamma p \rightarrow N K \pi$	K^* spectrum	Dalitz plot	alternatively accessed by
$\gamma p \rightarrow N K \pi\pi$	$K^*\pi$ spectrum	Dalitz plot	considering neutral kaons

How to get there?

Day *minus*-1 analysis

- ★ Proceed in systematic and coherent fashion
- ★ Define and test a common analysis framework (HASPECT Working Group)
- ★ Get theoretical support from JPAC to be ready on Day 1 (xsec, angular, asymmetry estimates)
- ★ Generate massive simulations with a realistic physics implementation well in advance
- ★ Use GEMC and CLAS12 reconstruction software to study reactions
- ★ Use CLAS6 data to have a better understanding of background and concurrent reactions
- ★ Trigger condition and final state detection definition

Day 0 analysis

- ★ Use known reactions for calibration and data quality assurance
- ★ Compare results from CLAS6 in the overlapping kinematics
- ★ First measurement polarised vector meson photoprodution
- ★ Demonstrate quasi-real photoproduction is well understood
- ★ Demonstrate effect of linear polarisation on production mechanisms
- ★ Compare to GlueEx or existing data

Day 1 analysis

- ★ Extract ‘easy’ observables: SDME, Xsec, Dalitz plots, Moments and, eventually, Partial Wave Analysis