## **CLAS12 First Experiment Workshop Report**

## Latifa Elouadrhiri Jefferson Lab

For more details about the workshop https://www.jlab.org/indico/event/201/

CLAS Collaboration Jefferson Lab March 28-31, 2017



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## Outline

- CLAS12 Technical Specifications
- Engineering/Physics Configuration
- Status and Plans
  - Detector & Target
  - DAQ, Electronics and Trigger
  - Online & Monitoring
  - Slow Control
  - Offline: Simulation, Event Reconstruction & Calibration
- Path Forward to Physics



## **CLAS12 Technical Specifications**



CLAS12: CEBAF Large Acceptance Spectrometer 12 GeV

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	Forward Detector	<b>Central Detector</b>					
Angular Range							
Tracks	5° → 35°	35° → 125°					
Photons	3° → 35°						
Resolution							
δp/p	1% @ 5 GeV	< 5%					
δθ	1 mrad	10 – 20 mrad					
δφ	3 mrad	5 mrad					
Photon Detection							
Energy	> 150 MeV	n.a.					
δθ	4 mrad @ 1 GeV	n.a.					
Neutron Detection							
N <sub>eff</sub>	< 70% (EC+PCAL)	10%					
Particle ID							
e/π	Full range	n.a.					
π/p	< 6 GeV	< 1.5 GeV					
π/Κ	< 3 GeV	< 0.7 GeV					
K/p	< 5 GeV	< 1.0 GeV					
<i>π</i> ⁰, η → γγ	Full range	n.a.					





## **CLAS12 Channel Counts**

Sub-System	Channel Count					
Silicon Vertex Tracker	33792					
Central TOF	48					
High Threshold Cerenkov Counter	48					
Forward Drift Chamber Anodes	24192					
Low Threshold Cerenkov Counter	216					
Forward Time of Flight(1a, 1b, 2)	1080					
PreShower Calorimeter	1152					
EM Calorimeter	1296					
CND	144					
Forward Tagger Calorimeter	332					
Forward Tagger Hodoscope	116					
Forward Tagger MM	3392					
Micromegas	15000 +6000					
RICH	25024					

#### Total # of channels: 111832

(During KPP: 41664 channels)



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# **CLAS12 Engineering Run**

#### Engineering configuration same as the first experiment

The entire CLAS12 is operational including the CLAS12 upgrade detectors: CND, MVT (3MM +3 SVT), FMM, FT and RICH

### Engineering October/November 2017, followed by Physics data taking

- 1. Run at 2.2 GeV (1 pass) and 11 GeV (5 passes) with LH2 target
- 2. Commission at low luminosity using loose trigger configuration
- 3. Study detector performance as a function of luminosity, define luminosity limits the goal is L=10<sup>35</sup> cm<sup>-2</sup> sec<sup>-1</sup> (75 nA beam on 5 cm long LH<sub>2</sub> target)
- 4. Record data for physics analysis
- **5.** Perform special runs (e.g. alignment ...)
- 6. Complete quasi-online reconstruction and calibration
- 7. Determine the running condition for the physics run





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# Ready for physics



## **KPP Run Configuration**

KPP – Run Period Feb. 3 – Feb. 6, 2017. Data taking with the full detector readout: SVT, CTOF, 1 sector DC, 6 sectors FTOF & ECAL

-Beam current: 5 nA electron beam - Target: 0.5 mm carbon wire - Torus: 50% B-field -Trigger:

- 1. Hit-based trigger, ORed from 6 sectors
- 2. FADC-based trigger, ECAL INNER cluster finding with different thresholds



March 28, 2017

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Run conditions:

- Two polarities of the TORUS
- Torus Field = 0
- DC (HV and Threshold scans)
- Random trigger2
- Different trigger threshold
- 2 type of trigger
- 2 target positions
- Low luminosity run

KPP data processing (https://clasweb.jlab.org/wiki/index.php/CLAS12\_KPP)





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## **Detector System & Target**

- All baseline equipment commissioned with beam, repairs of the PCAL/EC scheduled this spring/summer once the solenoid is installed
- DC gas system will be completed in April, this will allow testing and commissioning all six sectors including trigger
- Upgrade to CLAS12: CND ready for installation, Micromegas and SVT integration and commissioning is planned for June and July. RICH being assembled at JLab and installation planned in September
- Target: currently working on controls, pressure system and the drawings of target cell. Expect to order the parts next week, and have the cell built by June and tested by July



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## **Moller Polarimeter**

## 1) Reassemble target Includes:

- a) Build new target-foil clamps
- b) Install center pick-up coils for foil polarization measurement
- c) Hook up all connections

## 2) Measure target polarization:

a) Requires filter box to be designed by Chris Cuevas.

b) Analyze polarization data

## 3) Prepare target for beam:

- a) Remove center pick-up coils
- b) Hook up and test quad power supplies (done?)
- c) Finish writing code for quad power supply (I vs energy)
- d) Reconnect electronics for detector readout
- e) DAQ for readout electronics

## Target redesign expected to be completed by beginning of May







## **CLAS12 DAQ/Trigger**

- Electronics installed (and was used for KPP): ECAL, PCAL, FTOF, LTCC, DC, HTCC, CTOF, SVT
- Online computer cluster is 100% complete and operational
- Networking is 100% complete and operational
- DAQ software is operational
- Need to add scalers for Faraday Cup, helicity etc
- Trigger simulations and algorithm developed, cluster finding for PCAL, improved energy correction for both ECAL and PCAL, HTCC, DC segment finder, DC road finder ready for implementation.
- Trigger simulation studies for both CLAS12 and FT triggers are underway.

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## Online

- Computing hardware is available for most online tasks (runtime databases, messaging system, communication with EPICS etc)
- There is no designated 'online farm' for data processing in real time, two hot-swap DAQ servers can be used as temporary solution
- Some work still needed for process monitoring and control, CLAS event display, data collection from different sources (DAQ, EPICS, scalers etc)
- Work needed: runtime database (transformation to RCDB), data monitoring (some components available)
- Slow control excellent progress on track for the engineering run





# **Slow Control**



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## Offline

- Event reconstruction, simulations calibration/commissioning effort making excellent progress using data from simulations, KPP and cosmic rays for detector calibration
- Next steps:
  - Complete simulation and reconstruction including MM
  - Complete CLAS12 timing calibration
  - Data base variations
  - Complete Field map measurement analysis and implementation
  - Complete detector alignment
  - Develop method for Background merging with physics event
  - PID and kinematical fitting
  - Event selection
  - Documentation and tutorials

Ready for quasi-online both calibration and reconstruction



## **Path Forward to Physics**

#### • Full Chain Complete from simulation to cosmic data taking to documentation

- Update commissioning document or the engineering run
- CLAS12 first experiment final configuration simulation complete
- SC Torus and Solenoid ready and field maps produced
- All detectors and corresponding electronics ready
- DAQ/Trigger firmware and hardware ready
- Beam polarization
- Experiment normalization
- Online monitoring for shift taker and for experts
- Online reconstruction, fully tested ready
- Data base complete with detector calibration
- Detector alignment
- Offline data processing and offline shift training
- Offline data calibration ready and exercised on calibration challenge
- Event selection framework completed and tested on KPP and simulations
- Final data processing to general DST
- Skimming to produce DST for the first specific experiments
- Draft analysis note based on KPP data Ready





# Analysis Committee of Experts (ACE)

- ACE members: K. Hicks (chair), D. Ireland, K. Joo, S.Kuhn, S. Niccolai, E. Pasyuk, L. Weinstein
- Goals of the committee as defined by CLAS chair, (Formed on the recommendation of the common tools committee)
  - Guide the development of analysis algorithms (after calibrations)
  - PID, momentum corrections, backgrounds, fiducial cuts, etc.
  - Higher level analysis: kinematic fitting, PWA (if applicable)
  - Standardize the algorithms and software
  - Etc.

# This should be highly collaborative effort with Software Clacom groups and first experiment analysis team





## Timeline

TASK		2017													
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar	Apr.	May	June	July	Aug.	Sept	Oct.	Nov.	Dec.
						•									
SIMULATION			1		-		-								
		New release with full central detector (MM)													
RECONSTRUCTION															
	New release with full central detector														
CALIBRATION	$\geq$		>												
	Ready for KPP														
EXP. SCHEDULE					$\left \right\rangle$										$\sum$
					KPP Rı	in							Engir	neering	Run



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## Timeline





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## Timeline



# Looking forward to successful engineering run and the start of physics with CLAS12!

Mailing list clas12\_first\_exp & biweekly meeting, Wednesdays at 8:30





