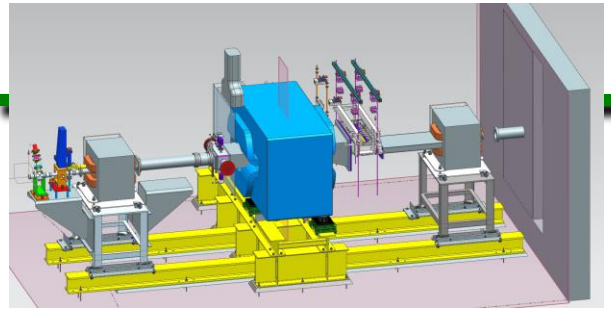
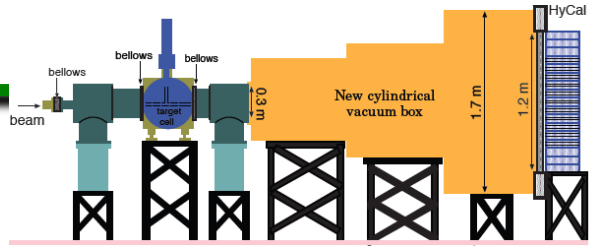
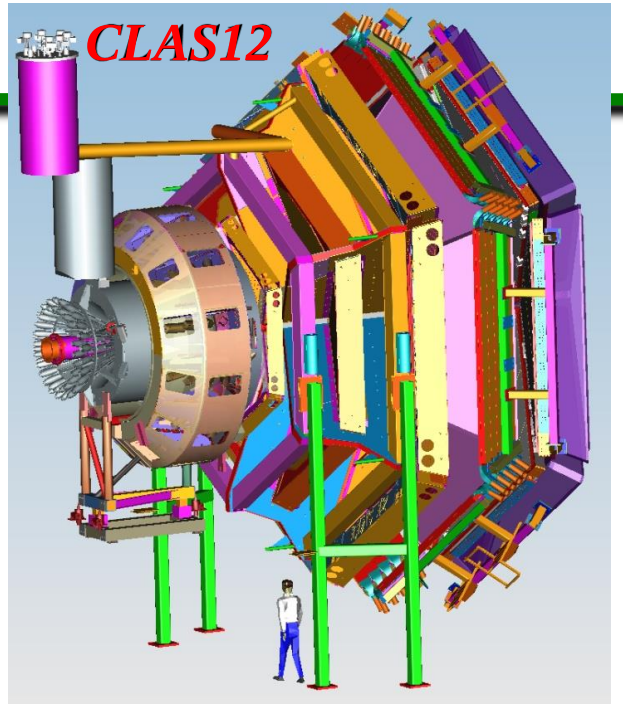






Status of Hall B

Volker D. Burkert

CLAS Collaboration Meeting
February 23-26, 2016

Jefferson Lab
Exploring the Nature of Matter

clas
CEBAF Large Acceptance Spectrometer

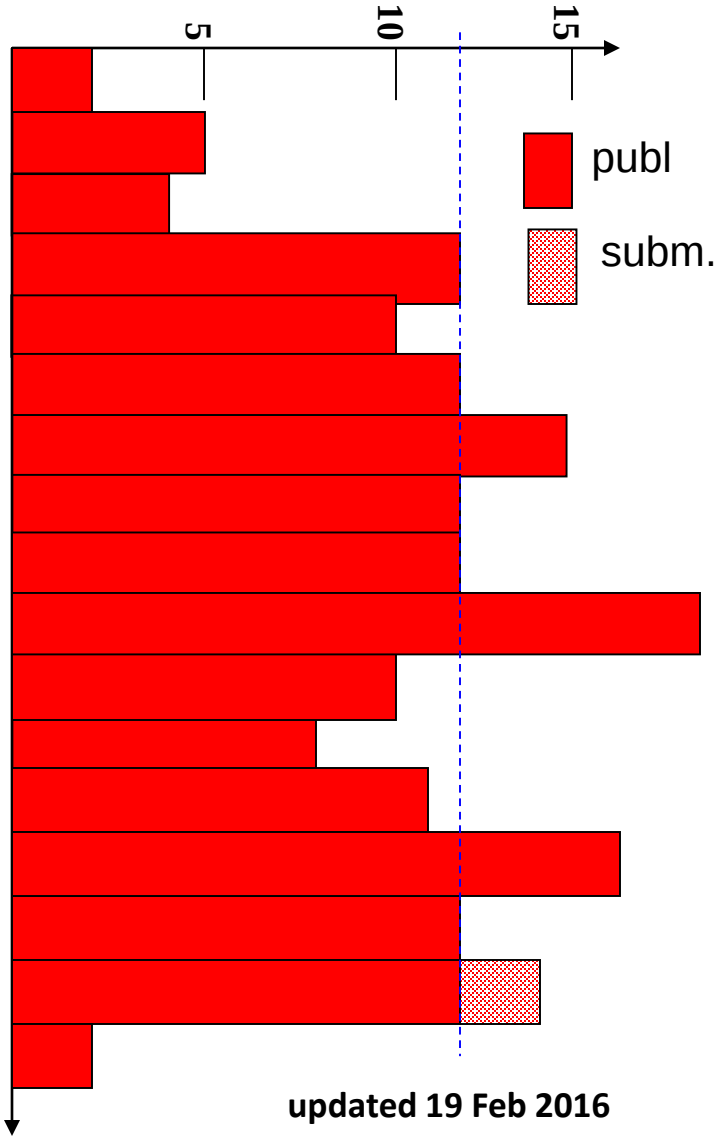
Hall B Overview

- **Personnel: Nathan Harrison, new Postdoctoral Research Associate 1/19/2016**
- **Solid flow of PhD theses, publications in refereed journals and conference talks**
  - **156** PhD theses completed on CLAS results (**32** in progress)
  - **174** physics papers published/accepted in refereed journals (incl. higher level analysis papers based on CLAS data)
  - **38** technical papers published in NIM (**25** CLAS, **12** CLAS12, **1** HPS)
  - **> 1,875** talks at conferences (**11** talks for every published physics paper)
- **Non-CLAS experiments**
  - **HPS** – Spring/2016 run started 2/5/2016
  - **PRad** – Preparations ongoing – March/April setup and tests, run scheduled for May 2016.
- **12 GeV upgrade project**
  - All **base detector** construction completed, **CTOF** undergoing final testing. **Slow controls** efforts strengthened.
  - **Torus** assembly nearly complete – survey & alignment ongoing, cryogenics next, plan for (limited) field mapping
  - **Solenoid** coil #5 (shielding) winding started
- **CLAS12 upgrades with collaboration driven equipment**
  - **CND on site,** to be tested this spring**, FT** assembly in EEL**, MM -** First barrel layers integrated with SVT

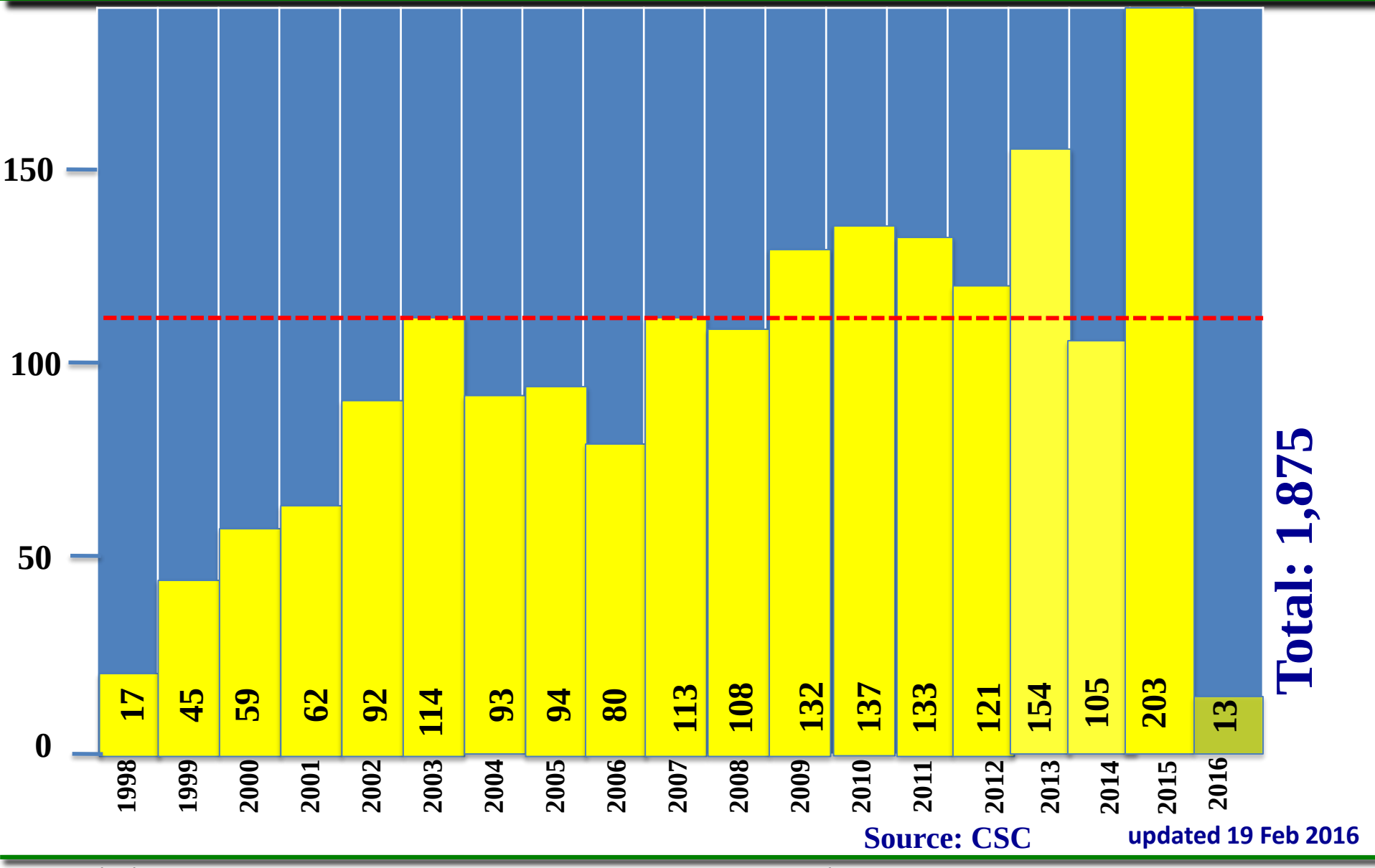
    RICH detector on track for 2017 completion (1 sector)
  - **Event reconstruction, calibration/commissioning** effort making immense progress using cosmic rays for validation and detector calibration.

Hall B Physics Publications in refereed Journals

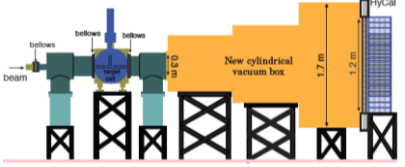
	HSWG	DPWG	NPWG	ALL
2000	-	1	1	2
2001	2	3	-	5
2002	3	-	1	4
2003	7	4	1	12
2004	3	3	4	10
2005	7	3	2	12
2006	8	4	3	15
2007	7	2	3	12
2008	4	6	2	12
2009	8	7	4	19
2010	4	2	4	10
2011	3	1	4	8
2012	6	3	2	11
2013	8	6	2	16
2014	5	6	1	12
2015	4	5	3	12 (2)
2016	2			2
SUM	81	56	37	174



Conference Presentations



PRad Status

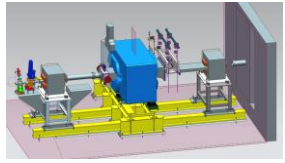


- Mechanical design work is complete. Main installation to begin in March.
- The collimator box and windowless gas target installed on the beam line. (HPS beam passes through)
- Two GEM chambers have been built at UVA and delivered to JLAB. Readout is integrated into CODA.
- HyCal ready to run.

Vacuum Tank

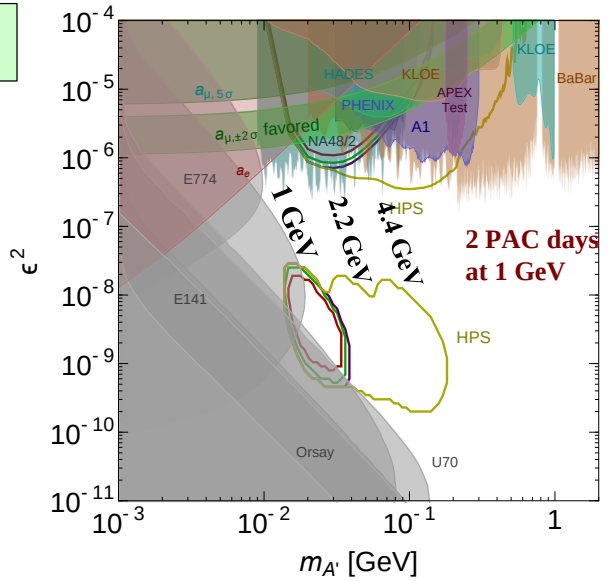
- Focus is development of software tools
- The final ERR is scheduled for 3/25
- The first commissioning beam scheduled for 4/8-10 followed by accelerator configuration change
- Physics run scheduled for May 1-28, contingent on non-interference with CLAS12

HPS Progress Report

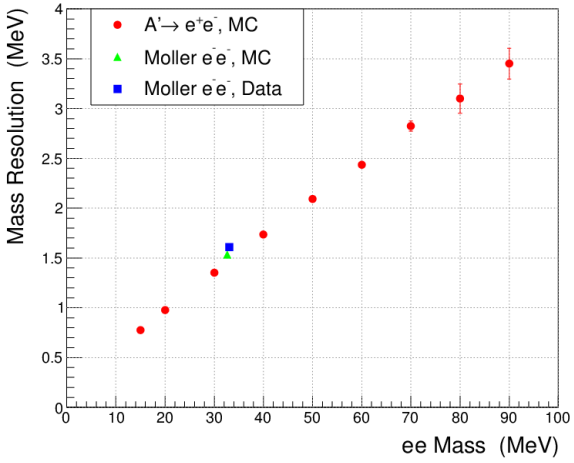


Physics run May 4 - 18, 2015 with 1.05 GeV beam energy

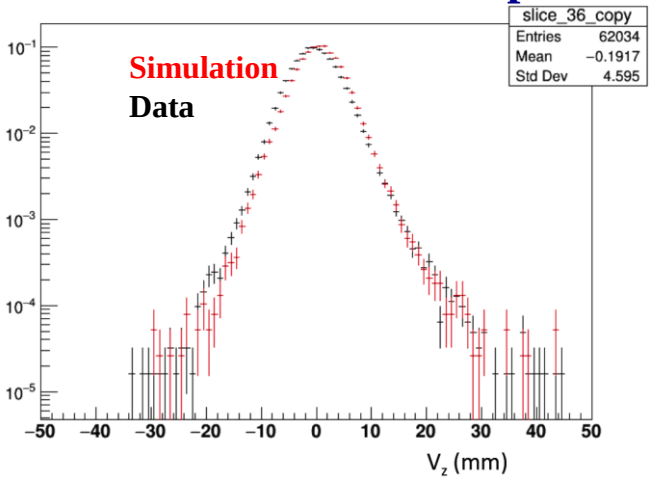
- Collected 2 PAC-days of physics data with SVT Layer-I at 0.5 mm from the beam plane (θ_{min} = 15 mrad) at proposed run conditions - 50 nA beam current and 0.125 r.l W-target
- Pass4 processing of 10% of unblinded data for calibration and analysis is complete
- Analysis of benchmark reactions (e^-e^-, $e^-\gamma$, e^-e^+, e^-A) shows remarkable agreement with expected performance from simulations
- Ready for final processing of 100% of data.



Mass Resolution

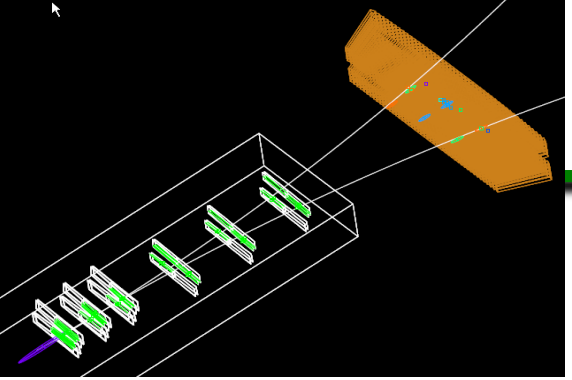


Vertex distribution of pairs

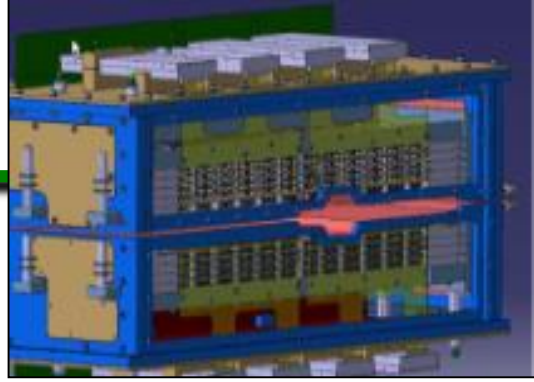


Parameter	Proposal value	Measured value
Beam current	50 nA	50 nA
SVT occupancy	< 1%	1%
Ecal rates	0.5 MHz	1.2 MHz
DAQ/trigg. rate	18 kHz	19 kHz
Pair mass res.*	1.5 MeV	1.6 MeV
Pair vertex res.♯	4.4 mm	4.6 mm

* At 34 MeV ♯ At 40 MeV

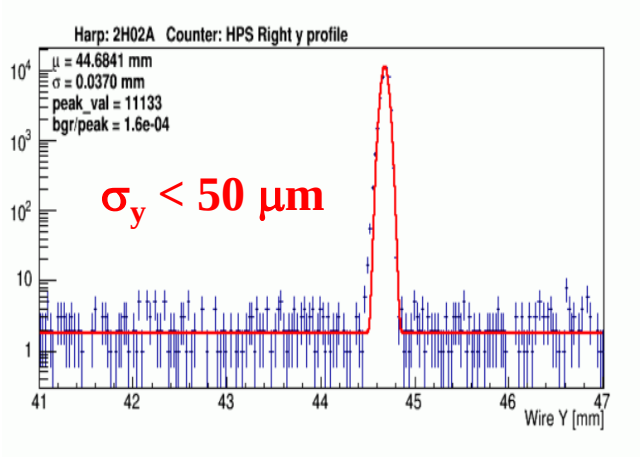


2016 Running

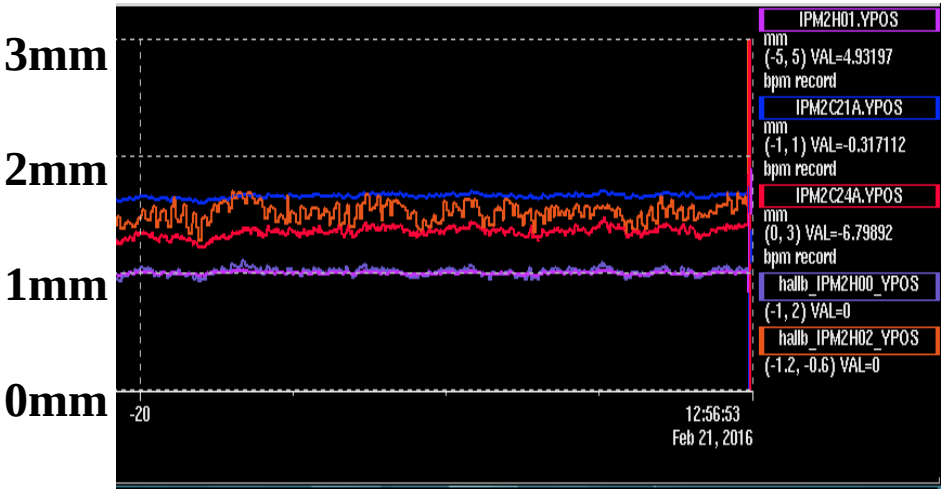


Physics Run on Weekends at 2.3 GeV
February 4 - March 14, 2016

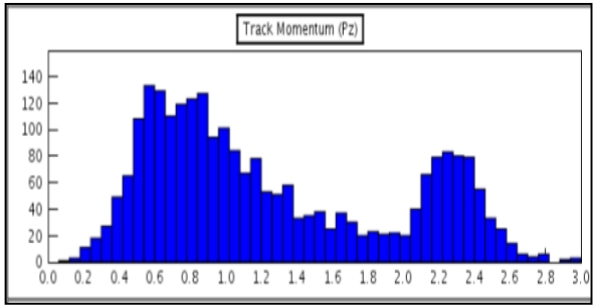
- **HPS Detector and Beamline are Fully Commissioned**
  * Beam spot σ_x ~ 200 μm, σ_y < 50 μm
  * Ecal calibrated on Coulomb scattered electrons
  * Trigger/DAQ at 250 nA: 25 kHz, 85% Live Time
  * SVT commissioned and positioned 500 μm from beams



- **CEBAF delivers good beam stability**



Online Track Momentum (GeV/c)



- **Physics Production Running has begun February 21, 2016.**
- **Goal: 7 PAC Days at 2.3 GeV**

CLAS12 Hall B Equipment

Forward Detector (FD)

- TORUS magnet
- HT Cherenkov Counter
- Drift chamber system
- LT Cherenkov Counter
- Forward ToF System
- Pre-shower calorimeter
- E.M. calorimeter

Central Detector (CD)

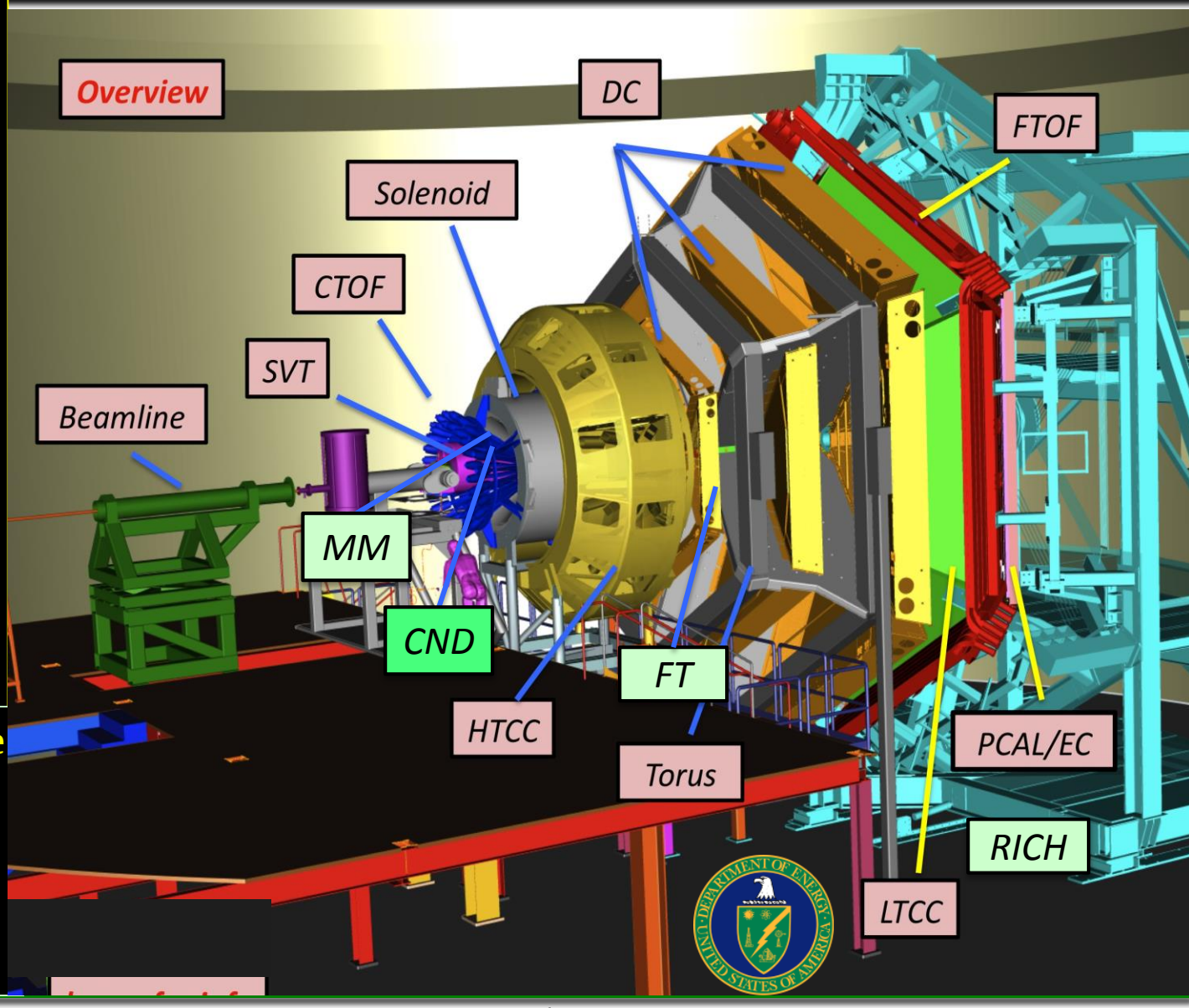
- SOLENOID magnet
- Silicon Vertex Tracker
- Central Time-of-Flight

Beamline

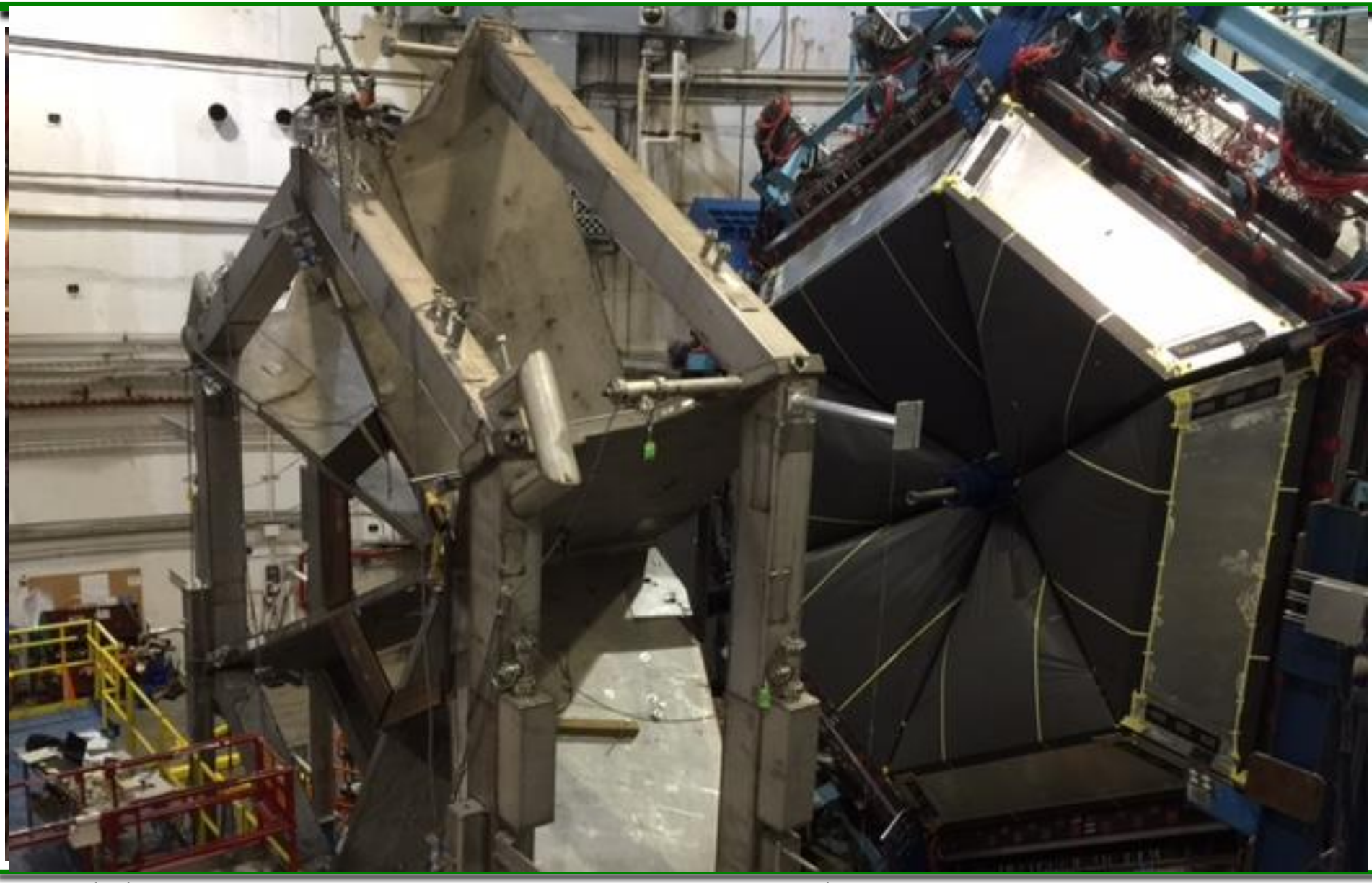
- Cryo Target
- Moller polarimeter
- Shielding
- Photon Tagger

Upgrade to the baseline

- Central Neutron Detector
- MicroMegas
- Forward Tagger
- RICH detector
- Polarized target



Hall B in February 2016



Status of Hall B

TORUS Magnet Installation

All coils and connections installed in Hall B

Pump down	Mar 2016
Cool down (after ERR)	April 2016
Magnet ramp up	May 2016
Field mapping	June 2016
Drift Camber installation start	Aug 2016

SOLENOID Magnet

4 **of 5 coils** winding/potting complete**,**

Shielding coil being wound

Delivery of Magnet to JLab	09/2016
Expected to be operational	12/2016
Detector (CND, CTOF, SVT, MM)	12/2016

Beam Line Instrumentation

Commissioned during HPS run up to Faraday cup, BPMs, harps, halo counters**.**

Moeller quad moved in position for 12GeV operation

Beamline shielding in final design stage

Forward Carriage

FTOF1a, FTOF1b, PCAL and EC operational

LTCC installation completed 2/23/2016

FTOF Panel 2 installation is next

HT Cerenkov Counter

High Threshold Cherenkov Counter

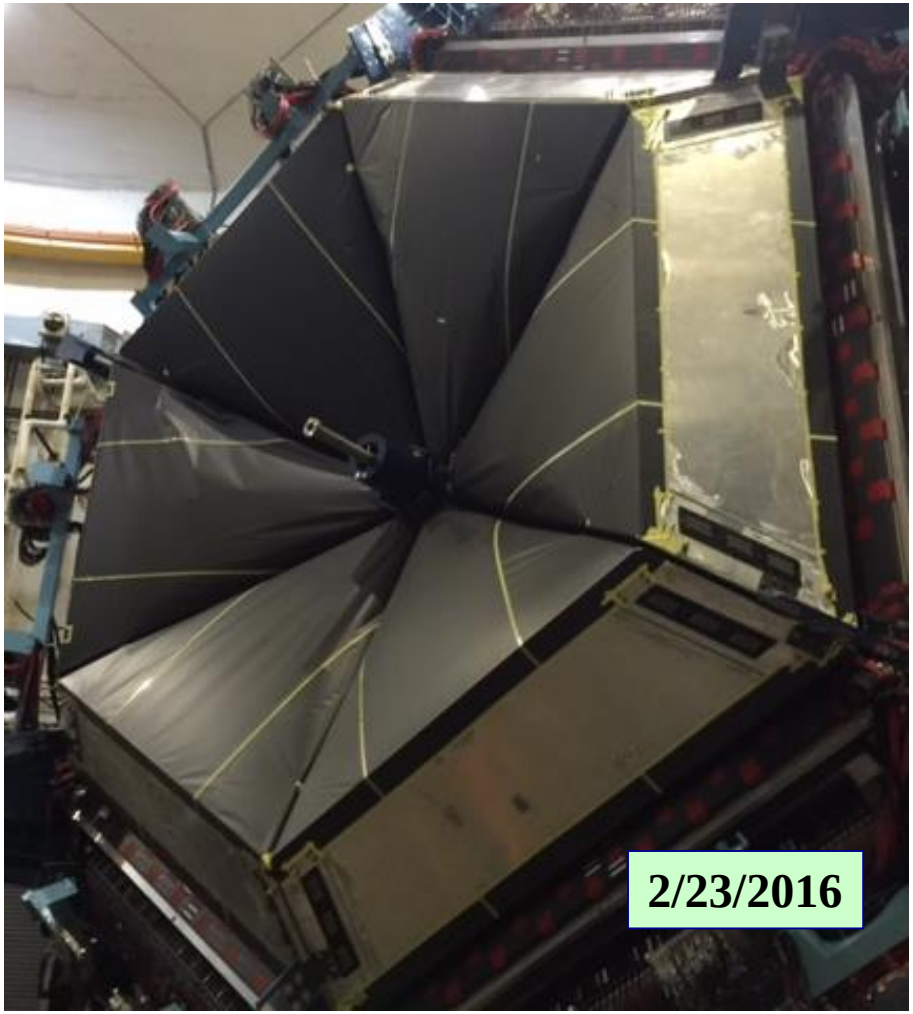
Purpose:	e/π sep.
Radiator Gas (18.8m^3):	CO_2 (1atm)
Mirror thickness	**135mg/cm^2**
Pion threshold:	4.9 GeV/c
Number of Channels:	48
Light readout:	5”PMTs (Quartz)
Construction completed:	6/2015
Calibration w/ LMS:	s.p.e.
Coverage in θ & ϕ	**5^o – 35^o, 360^o**
Ready for installation:	**~7/2016**

CLAS12 Low Threshold CC Status

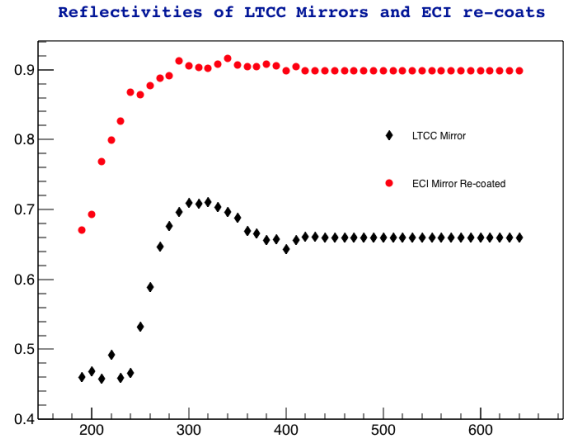
Purpose: Separate charged π's from K/p

All 6 sectors completed, installed in CLAS12

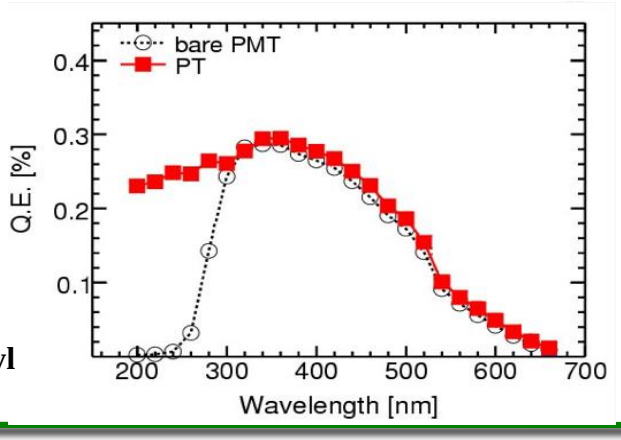
- **refurbished boxes, increase C_4F_{10} volume**
- **recoated mirrors & Winston cones**
- **PMT windows coated w/ waveshifter**



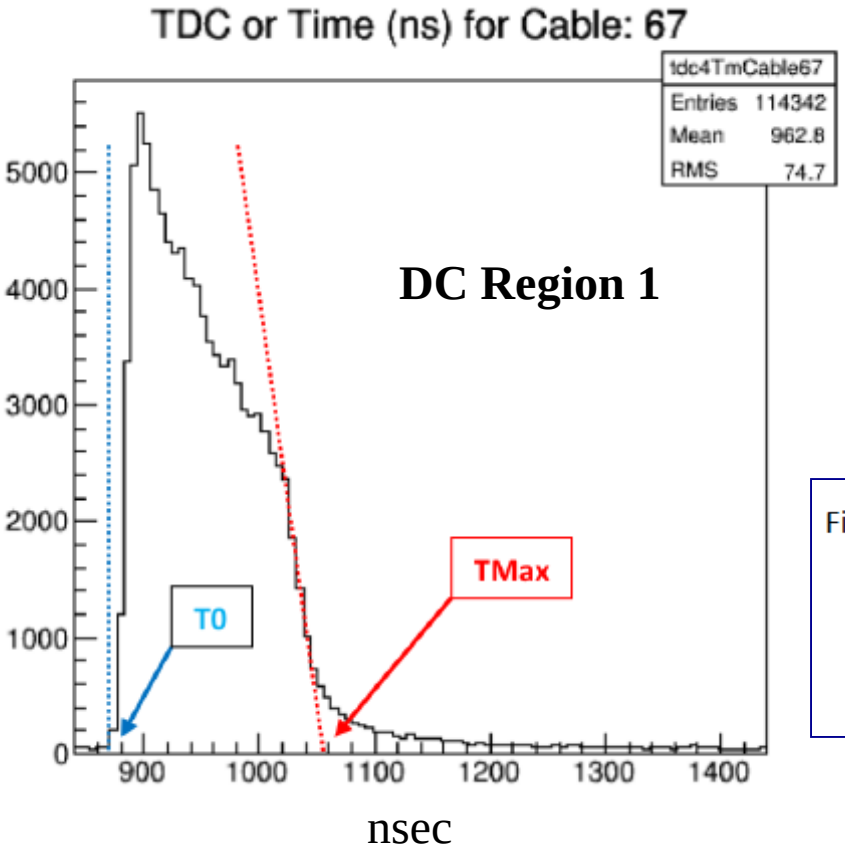
Typical before / after reflectivity of mirrors, WC



q.e. improvement with p-terphenyl



CLAS12 Drift chamber calibration



Knowledge of Tmax useful in monitoring DC conditions and performance, e.g. if gas density changes, Tmax will change.

Fit function:

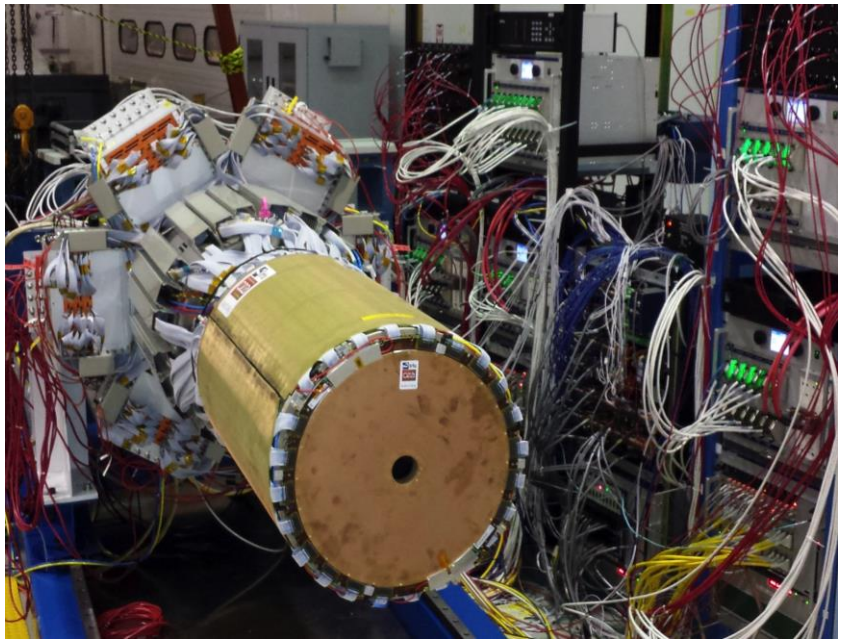
$$f(t) = (1 - sigmoid) \times exponential + constant$$

$$f(t) = (1 - \frac{1}{1 + e^{A-Bt}}) \times e^{C-Dt} + E$$

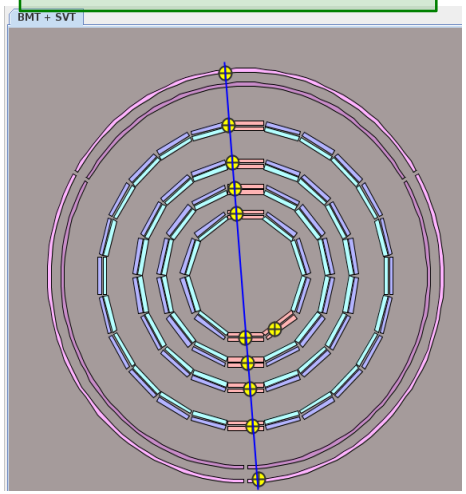
CLAS12 Silicon Vertex Tracker

- SVT is integrated with Micromegas
- Both systems calibrated, no extra noise observed integration
- Cosmic alignment sample: 100M SVT and 20M SVT/MVT tracks collected

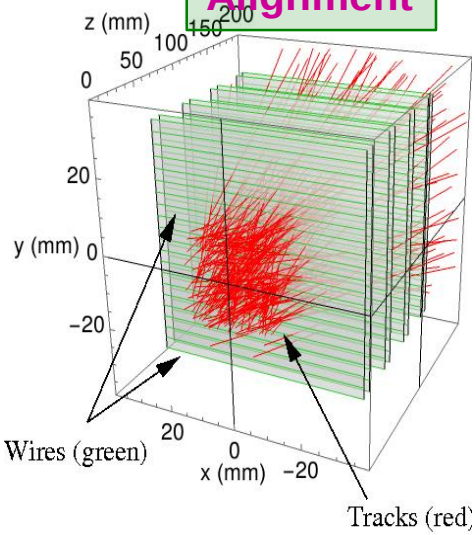
- Central tracker commissioning, taking cosmic 24/7
- Developing data validation and monitoring suite
- Validation of local and track reconstruction
- Monte Carlo tuning on the cosmic data
- SVT alignment using Monte Carlo and cosmic data

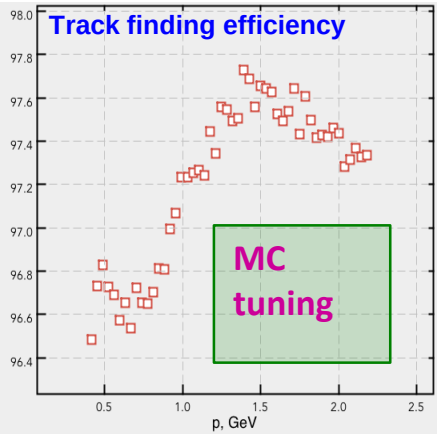


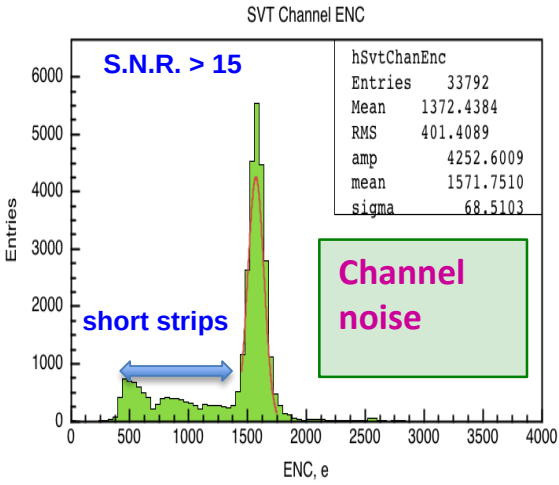
Online Monitoring



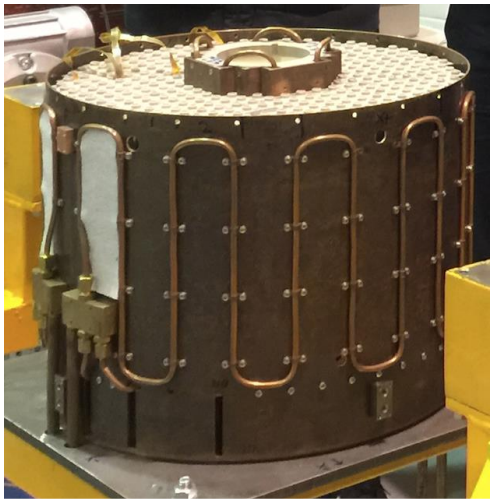
Alignment



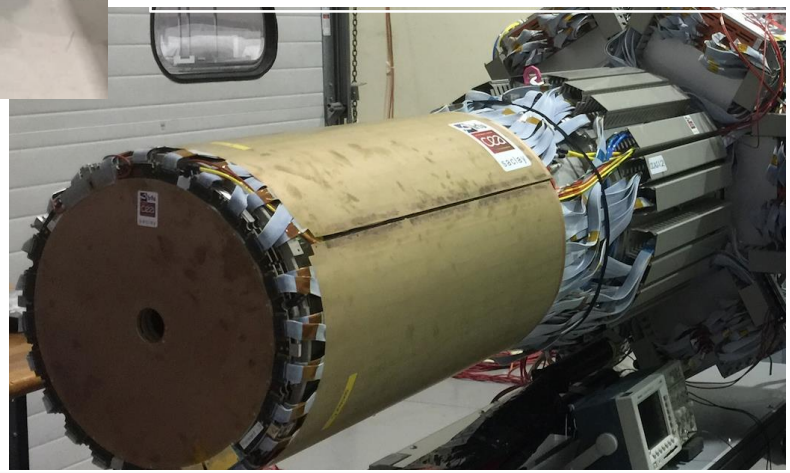




CEA & INFN teams assemble the MVT & FT



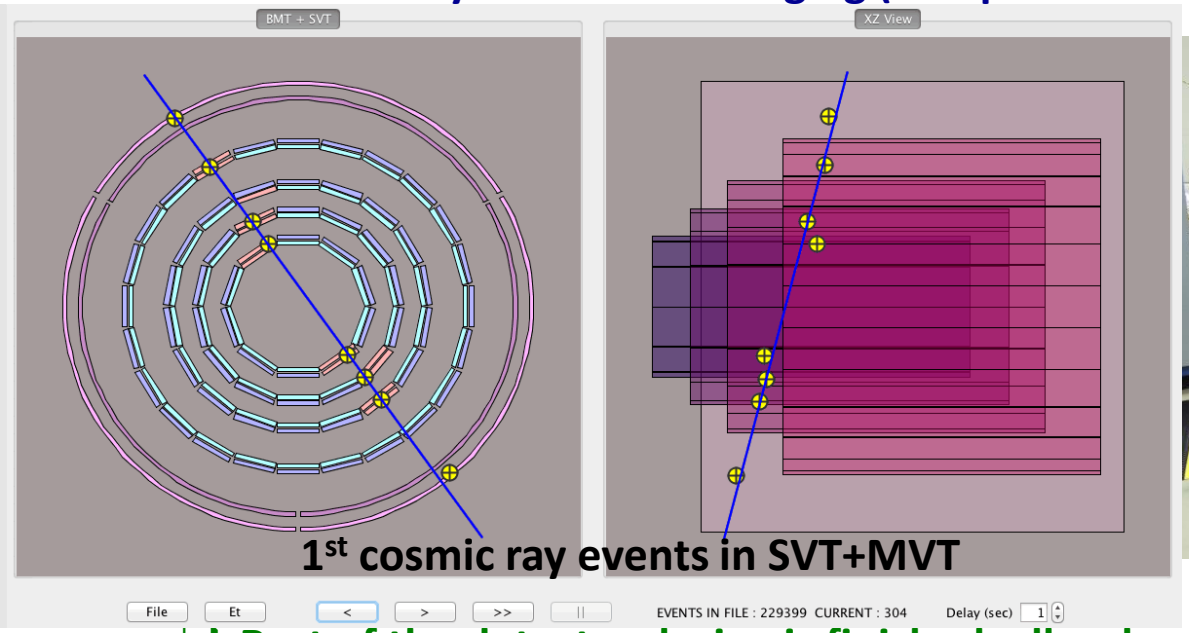
$PbWO_4$ calorimeter designed and built by the Genova/INFN team in preparation for testing.



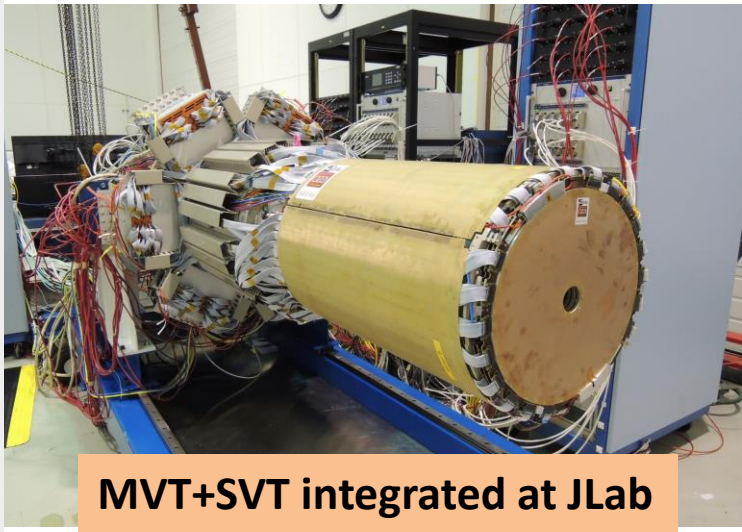
The two layers of the MicroMegas Vertex Tracker designed and built by the CEA team have been assembled at JLab for integration with the Silicon Vertex Tracker.

Micromegas Vertex Tracker

- ✓ Shipment of 2-layer barrel and 3-layer forward in 11/2015 at Jefferson Lab
- ✓ Integration with SVT (2x4 layers) went flawlessly
- ✓ Cosmic ray data taken since
- ✓ Analyzed barrel data so far
- ✓ Preliminary results encouraging (no optimization yet)



1st cosmic ray events in SVT+MVT



MVT+SVT integrated at JLab

- ❑ Rest of the detector design is finished, all ordered from CERN
- ❑ Expect all detectors integrated at Saclay by the end of summer
- ❑ Mechanical structure for 6-layers expected before summer
- ❑ Final gas system expected before summer
- ❑ All electronics/cables are here

CLAS12 Forward Tagger (FT)

Detect electrons at small angle to perform quasi-real photo-production experiments.

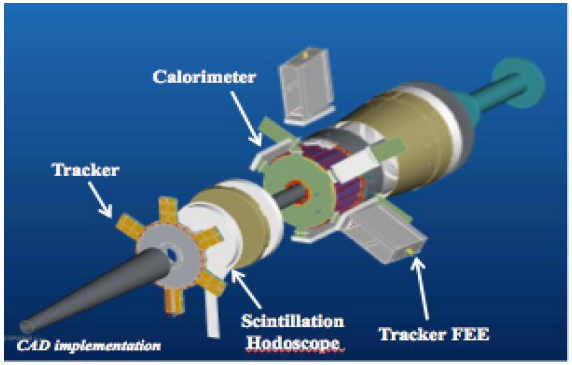
Calorimeter: electron energy/momentum

Photon energy ($\nu=E-E'$), Polarization $\varepsilon^{-1} \approx 1 + \nu^2/2EE'$

$PbWO_4$ crystals with APD/SiPM readout

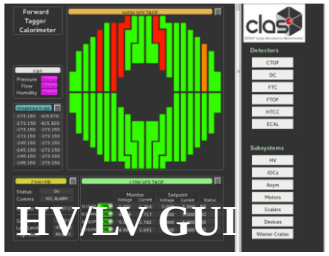
Scintillation Hodoscope: veto for photons, Scintillator tiles with WLS

Tracker: electron angles, polarization plane, MicroMegas detectors

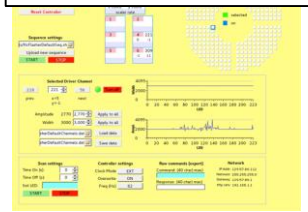


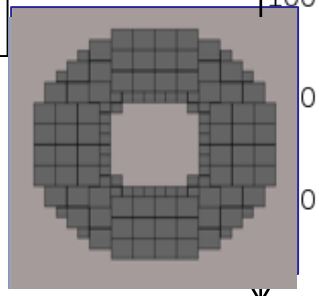
FT-Cal+FT-Hodo cosmic test at JLab

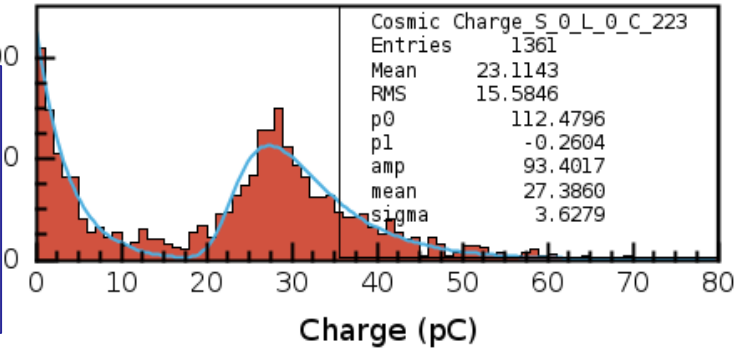
- FT-Cal and FT-Hodo assembled and under cosmic ray test at JLab
- FT-Trk tested at Jlab
- Full FT integration at JLab in spring 2016
- Developing common tools for monitoring and data analysis



LED GUI

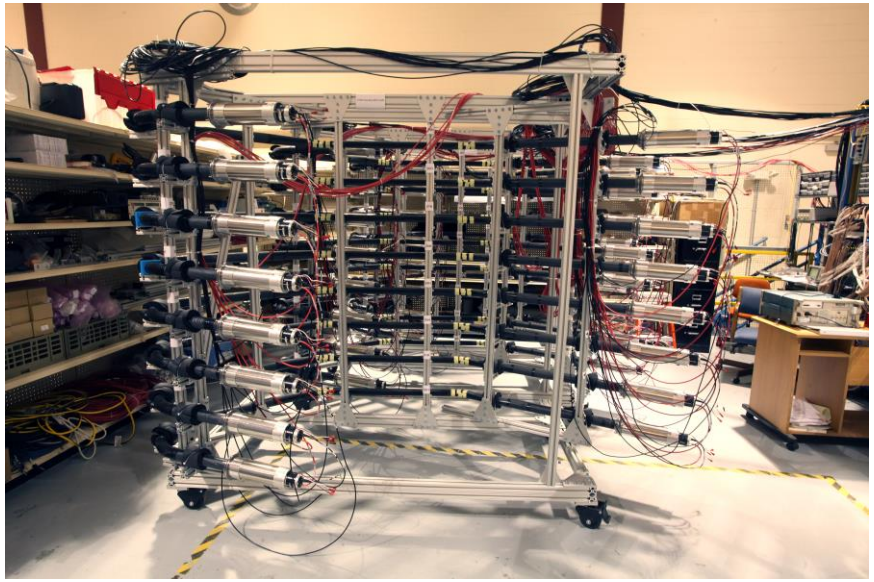






Energy distribution of cosmic muons in PbWO FT-Cal crsystal

CTOF Status



Design and Procurements:

- Upstream support structure delivered; test assembly/survey this spring
- Downstream support structure design in progress – completion by March 31
- Installation tooling/fixtures design in progress – completion by March 31
- LMS fiber bundle assembly ordered

Counter Assembly:

- All counters assembled on storage carts
- Fiber mounting blocks for Light Monitoring System (LMS) installed

Calibration and Testing Status:

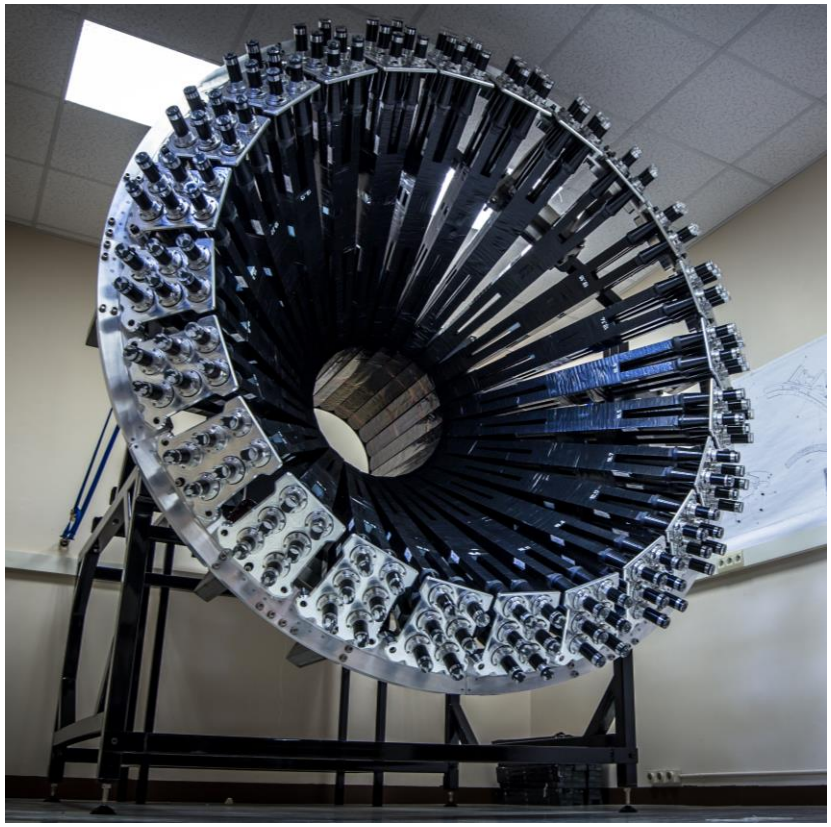
- Cosmic ray testing in progress since June 2015
  - Counter performance stable since extensive surface re-polishing last summer
- HV gain matching completed; detailed counter characterization in progress (PAW/FORTRAN)
  - Time resolutions measured (70 → 75 ps)
- Calibration suite (JAVA) under development
- Testing, optimization, controls, and calibration of the LMS to be completed this winter/spring
- Preparation of technical paper in progress

CLAS12 Central Neutron Detector

IPN ORSAY

Recent achievements:

- Construction completed
- Detector at JLab (ESB building) since 6/2015
- HV calibrations of PMTs completed
- Cosmic data analysis: σ_t ~150 ps for all blocks
- Assembly in mechanical structure done
- Development of calibration and reconstruction software ongoing

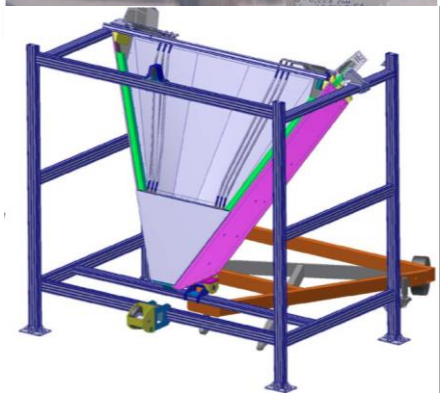


Plan for 2016:

- March-April: Cosmic rays tests at JLab to check time resolution and characterize the block using CLAS12 electronics
- June: ERR
- December: scheduled installation in the CD

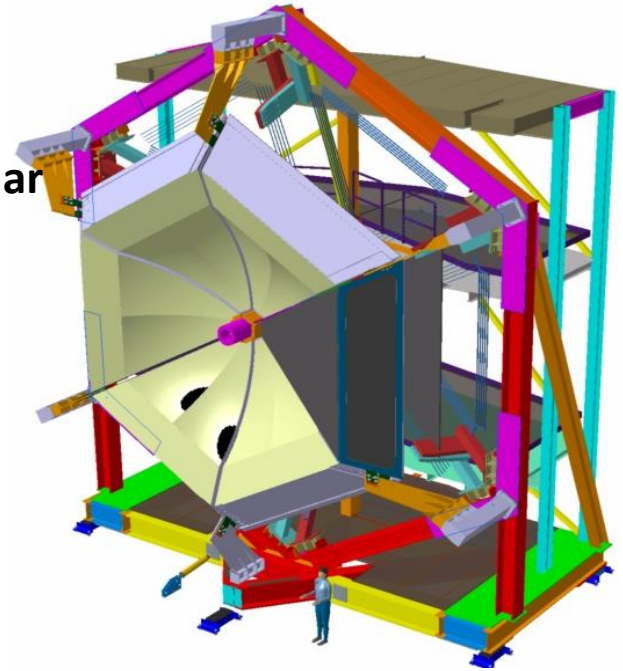
Photos of the CND:
https://www.flickr.com/x/t/0095009/photos/117533494@N07/

RICH Detector



MAPMTs and ELECTRONICS

All 430 *Hamamatsu MAPMTs* delivered and tested at JLab. Procurement of the front-end electronics started.



MIRRORS

Production of the spherical and planar mirrors started. Delivery of the first mirrors is expected in March.

AEROGEL

Production of the first layer of large angle section is in progress. Completion is expected in March. Order of the second layer started.

MECHANICS

Construction of the RICH mechanical structure and of the frontal and electronic panels started. Assembling and installation procedures established.

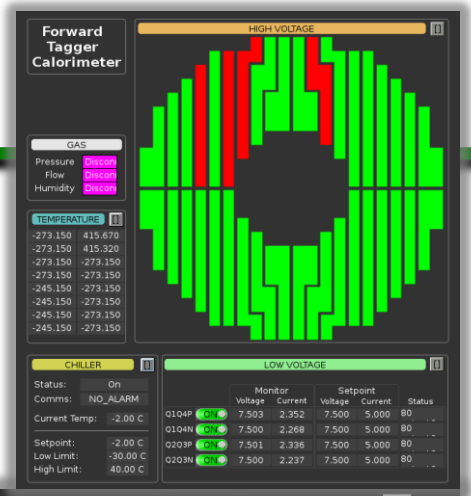
CLAS12 Slow Controls

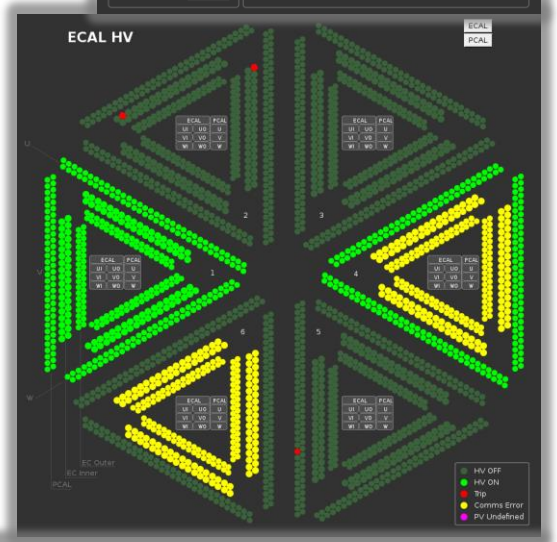
- Main Team (Glasgow & JLab): N. Baltzell, K. Livingston, B. McKinnon, W. Moore
  - Biweekly meetings (8:30 on Fridays in L210A), minutes posted on wiki
  - Wiki: https://clasweb.jlab.org/wiki/index.php/CLAS12_Slow_Controls
  - Gantt chart: https://userweb.jlab.org/~baltzell/CLAS12/SC/SlowControlsPlan.oplx
  - KPP, Full baseline support by summer's end

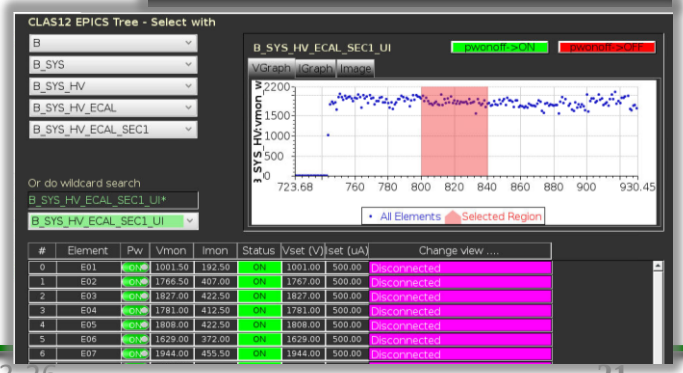
- Framework:
  - UI: java-based CS-Studio
  - OS: RHEL7
  - EPICS: R3.14.12.5
  - Lots of sharing with Hall-D
  - **JLab Mya EPICS archiver and viewer**
  - **BEAST alarm system inside CS-Studio**
  - **Porting & improving/replacing CLAS6 software**

- **Recent Highlights:**
  - **Detector specific GUIs developed and in use (CTOF/FTOF/ECAL/PCAL/FTC)**
  - **Hierarchical system, now navigable via tree view**
  - **Hardware purchases this month (e.g. MYA Server, Cameras, Weather)**
  - **Alarm system tested at end of 2015, to be deployed spring 2016**
  - **Gas/Torus/Solenoid/Cryo EPICS interfaces in progress with DSG**
  - **FTC Flasher support and GUI**

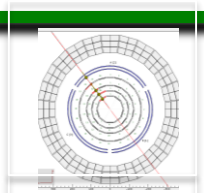
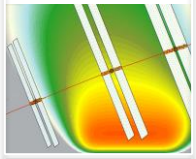
- **Upcoming:**
  - **Finish/deploy controls for next installed detectors (LTCC, DC, HTCC)**
  - **Moller system, DAQ Integration, (selected) DISC/FADC scalers**
  - **Off-site access in a web browser, etc.**
  - **En route to KPP by end of summer 2016**

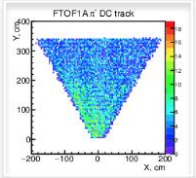


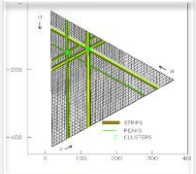
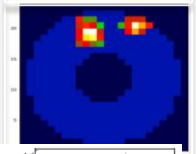
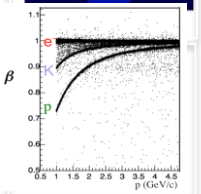




CLAS12 Event Reconstruction Status



Central Vertex Tracker: Development of central tracker package with new algorithms to employ micromegas hit information. SVT validation package to analyze cosmic and helical tracks at advanced stage.

DC: Hit-based tracking used to analyze cosmic data. Realistic inefficiencies in MC. Code optimization & ongoing validation tests using simulated physics events.

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

FTOF: Matching of DC track to TOF panels. Updating time calculation to read TDC values from the database. Ongoing validation tests.

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

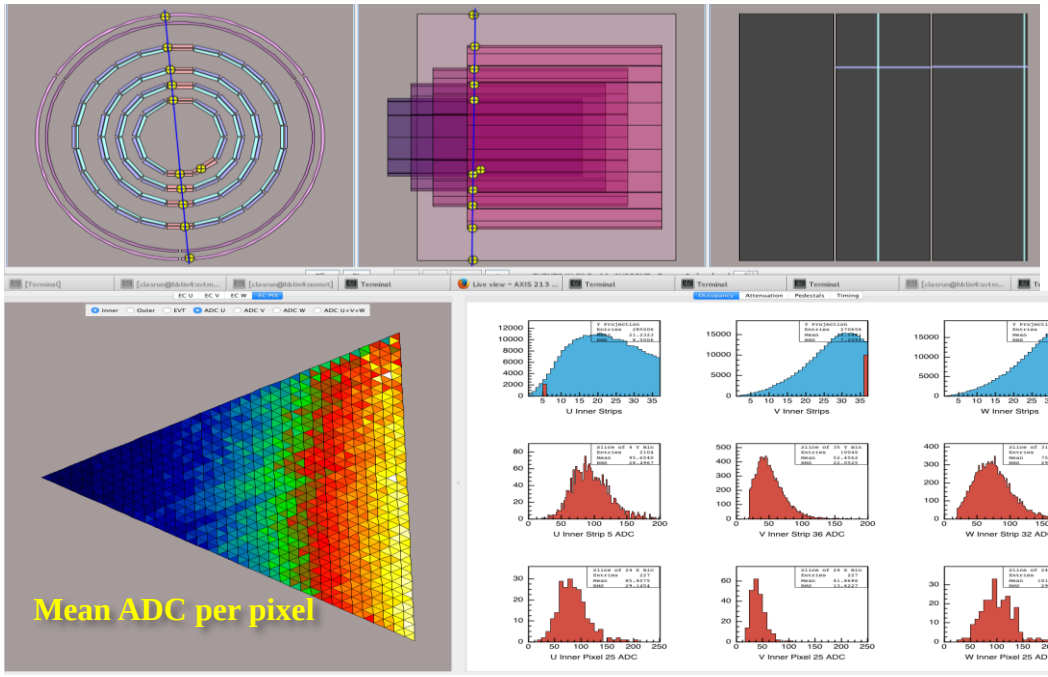
FT: FT-Calorimeter & FT-Hodoscope services available. Improved hodoscope clustering algorithm.

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)

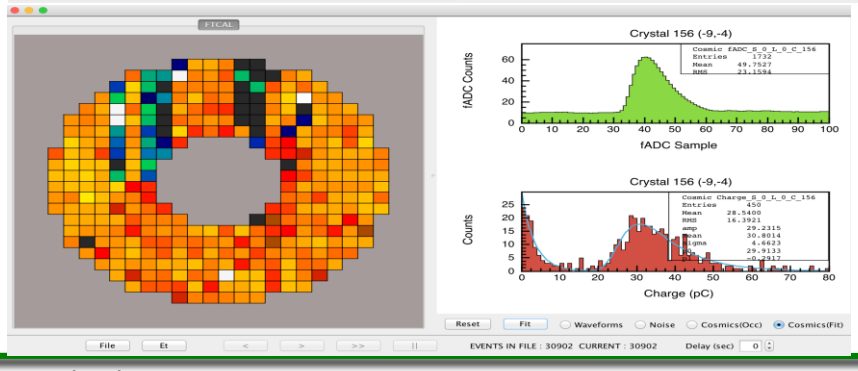
CLAS12 Monitoring & Calibration

Data R/W development: raw data decoder & pulse fitter used to analyze cosmics
Advances in calibration (tools & implementation), plotting & fitting packages



Event monitoring SVT + BMT GUI connected to ET ring & currently running in SVT cleanroom

EC calibration GUI showing ADC profiles for strips and pixels. Each strip object contains pixels relevant for the calibration of that strip

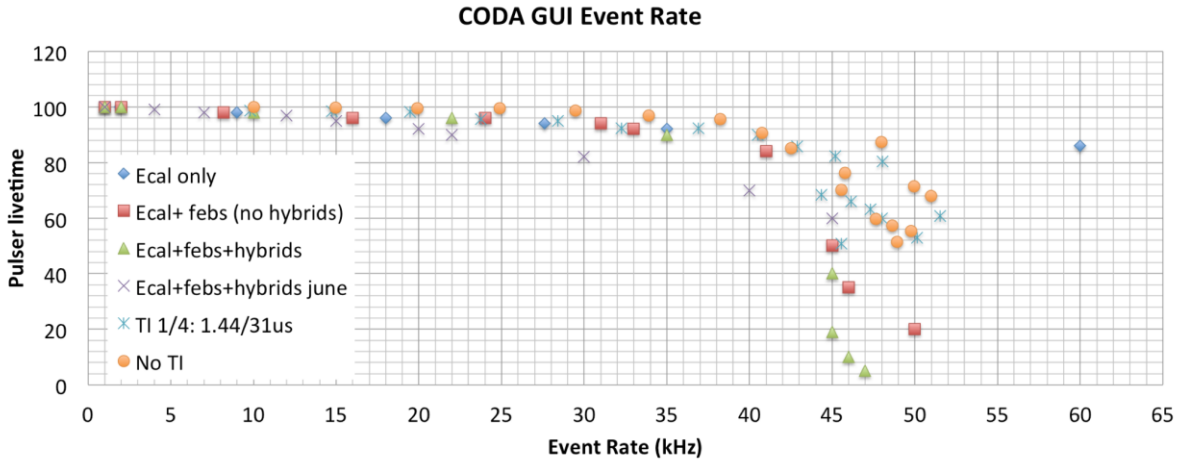


Forward Tagger Calorimeter GUI used for commissioning with cosmic rays showing problematic channels that needs preamp replacement (black squares)

DAQ

- Forward carriage DAQ electronics installation is almost complete, remaining electronics (VTPs) are ordered and will be installed within few month
- Space Frame and Subway DAQ electronics installation in progress
- Fiber Ethernet and trigger network complete
- Counting room complete
- DAQ software is operational, development continues
- ECAL, PCAL and FTOF detectors are taking data; CTOF, DCRB, SVT, etc. tests

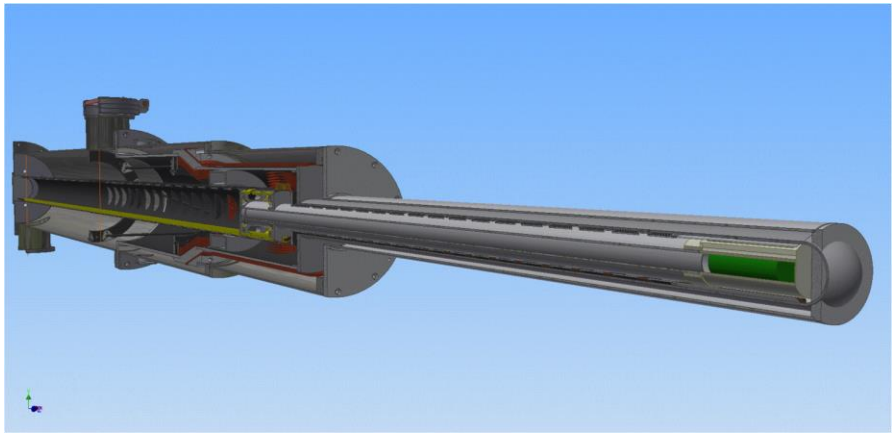
DAQ rate in current HPS run. Expect similar performance for CLAS12 > 180MBytes/sec



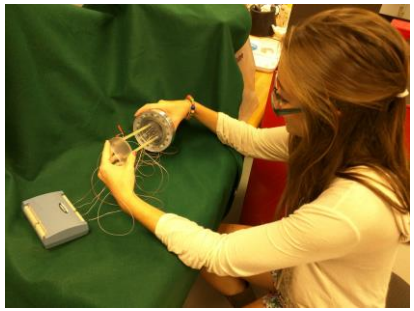
Longitudinally Polarized Target

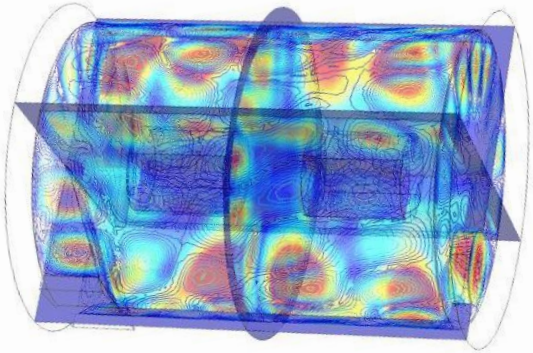
Design and engineering of the cryogenic system is ongoing by the JLab Target Group.

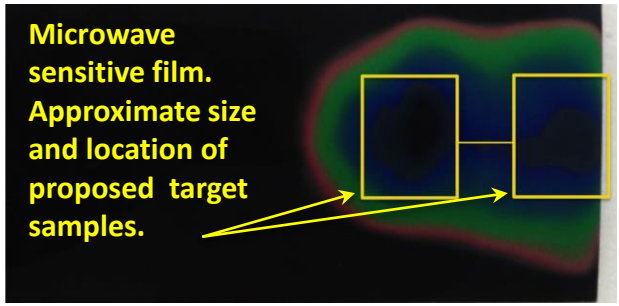
Procurement of the NMR, microwave, and pumping systems has been completed by CNU, UVa and ODU.



Optimization of the microwave cavity and waveguide for single and double cell designs is underway at JLab, CNU, and UVa.







Jefferson Lab

OLD DOMINION UNIVERSITY

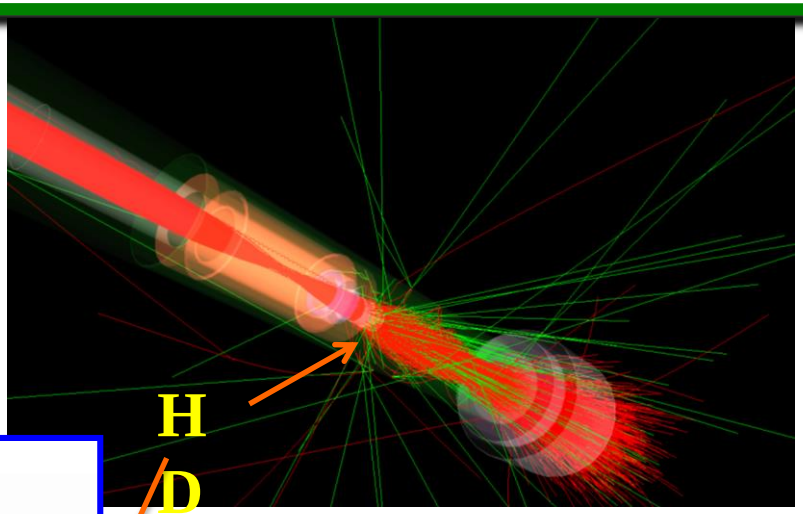
UNIVERSITY of VIRGINIA

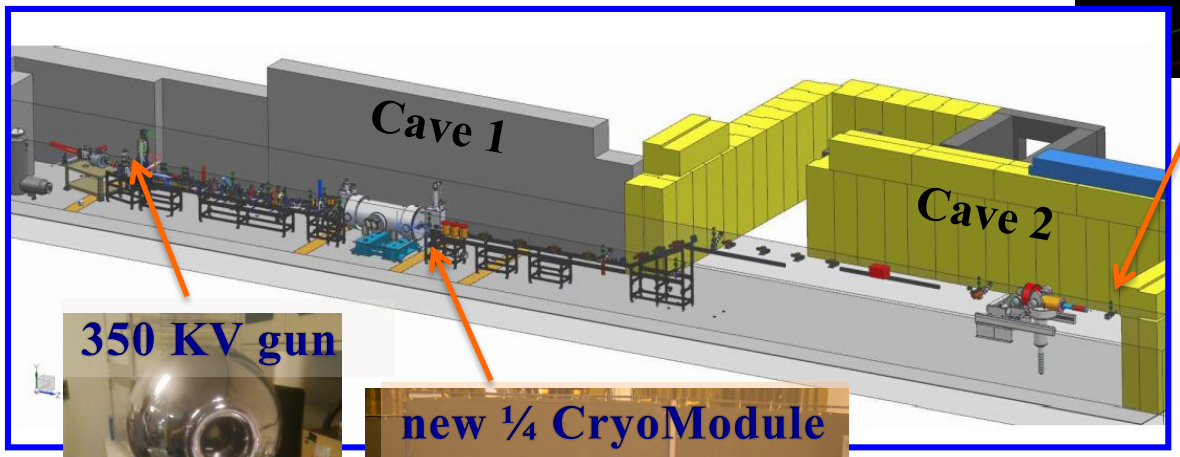
CHRISTOPHER NEWPORT UNIVERSITY

Preparations for e+HD at the Upgraded Injector Test Facility

UITF ⇔ 10 MeV accelerator in the *TestLab*

- *polarized, parity quality e⁻ beams*
- *energy deposition in HD ~ as with 10 GeV*
  ⇔ *testbed for transverse e+HD*
- *1st MeV beams to Cave 2 by Sept/16*
- *beam on polarized HD by April/17*





- e⁻ beam ionizes/unpairs *1s* electrons of HD
  - should be inert if polarized

- UITF conditions adjusted to produce the same polarization of residual unpaired electrons (0.998) as in CLAS-12

- multiple scattering, $\vartheta \sim 1/\gamma$

➔ power density not as uniform ~ 3 x higher than Hall B

Run Group Schedule – Tentative

Run Group	Days	2015	2016	2017	2018	2019	2020	2021	Remain
All Run Groups	**936**		CND	FT RICH MM			Trans. PT	525	411
HPS	180*	2-3	7 ?						
PRad	15*		10 ?						---
CLAS12 KPP				**15**					
RG-A (proton)	139*			20 **50**					69*
RG-F (BoNuS)	42*				40				2
RG-B (deut.)	90*				45				45*
RG-C (NH_3)	120				15	45			60
RG-C-b (ND_3)	65					35			30
RG-E (Hadr.)	60						20 15		25
RG-G (TT)	110*						55		55
RG-D (CT)	60							30	30
RG-K (LiD)	55							55	---

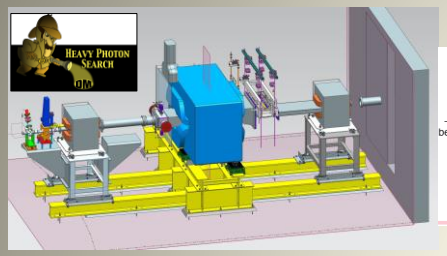
CLAS12 assembly

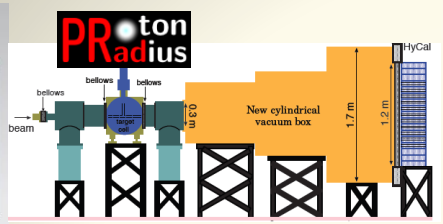
SUMMARY

- CLAS data continue to deliver important science in many areas
- Heavy Photon Search experiment is taking data on weekends. Proton Radius experiment preparing for May 2016 run.
- All CLAS12 base detectors are complete, in testing with cosmic rays. CTOF in final testing.
- Superconducting Torus magnet on track for operation in June 2016. Solenoid expected to arrive in Sept/Oct 2016 for assembly with the cryogenic service tower.
- CLAS12 upgrade led by European collaborators (Central Neutron Detector, Forward Tagger (ECAL,HODO,MM), MVT, RICH) are well on-track, several detector components being assembled and tested at JLab.
- Software development on track to be ready on “Day 1” (9/2016). Planning for engineering and first physics run in 2017 underway (CLAS12 workshop 2/23)

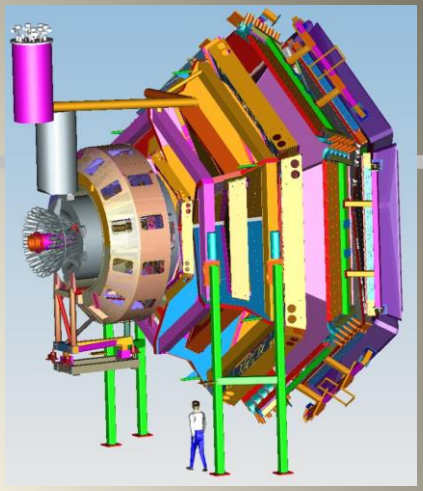
next slide

Plans for first years of Beam in Hall B





5 A-rated experiments in early running: HPS, PRad, pDVCS, nDVCS, pSIDIS, g_1^p/g_1^n



Construction & Installation — **Commissioning & early 11 GeV Experiments**

< 6 GeV beam — Installation

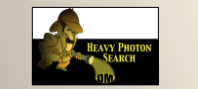
pDVCS & GPDs
pSIDIS &TMDs
N*s & $M_q(p)$

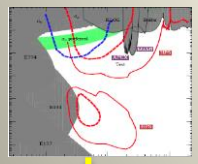
g_1^p , g_1^n - large x spin structure

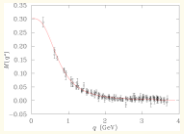
QCD in nuclei

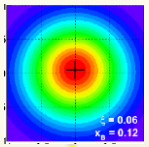
nDVCS & GPDs
nSIDIS & TMDs
F_2^n

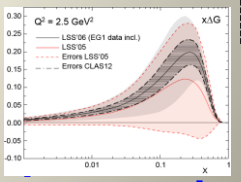
11 GeV











CY 2015 | CY 2016 | CY 2017 | CY 2018 | CY 2019

Physics Journal Publications 2015

M. McCracken et al., Search for baryon-number and lepton-number violating decays of Λ hyperons using the CLAS detector at JLab, PRD 92 (2015) 7, 072002.

D. Adikaram et al., Towards a resolution of the proton form factor problem: new electron/positron scattering data, PRL 114 (2015) 6, 062003

C. Colle et al., Mass dep. and Q.N. of SRC pairs from A(e,e'p) and A(e,e'pp), PRC 92, 024604, 2015

Or Hen, et al., Symmetry energy of nucleonic matter with tensor correlations, PRC 91, 025803, 2015

I. Senderovich et al., First measurement of the helicity asymmetry E inηphotoproduction on the proton, Phys.Letts. B755 (2016) 64

N. Guler et al., Precise determination of the deuteron spin structure at low to moderate Q2 with CLAS and extraction of the neutron contribution, PRC 92 (2015) 5, 055201.

N. Zachariou et al, Determination of the Beam-Spin Asymmetry of Deuteron Photodisintegration in the Energy Region Eγ=1.1−2.3GeV, PRC 91, 055202 (2015)

H.S. Jo et al., Cross sections for the exclusive photon electro-production on the proton and GPDs, PRL 115 (2015) 21, 212003

S. Pisano, et al., Single and double spin asymmetries for deeply virtual Compton scattering measured with CLAS and a longitudinally polarized proton target, PRD 91 (2015) 5, 052014

E. Seder et al., Longitudinal Target-Spin Asymmetries for Deeply Virtual Compton Scattering, PRL 114, 089901 (2015)

I. Niculescu et al., Direct observation of q-h duality in the F2n structure function, PRC 91, 055206 (2015).

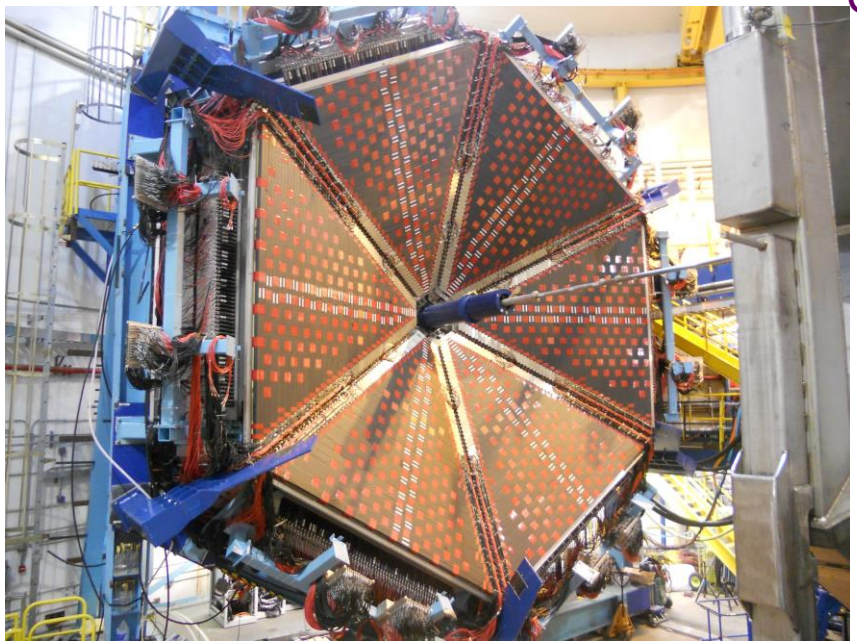
G. Aznauryan et al., Electroexcitation of the$\Delta(1232)3/2^+$ and$\Delta(1600)3/2^+$ in a light-front relativistic quark model, PRC 92 (2015) 3, 035211

S. Strauch et al., First Measurement of the Polarization Observable E in the $p(\gamma,\pi^+)n$ Reaction up to 2.25 GeV, PLB 750 (2015) 53

I.G. Aznauryan et al., Extracting meson-baryon contributions to the excitation of the $N(1675)5/2^-$ nucleon resonance, PRC 92 (2015) 1, 015203

K. Park et al., Measurements of $ep\rightarrow e'\pi^+n$ at W = 1.6 - 2.0 GeV and nucleon resonance electro-couplings at CLAS, PRC 91 (2015) 045203

CLAS12 FTOF Calibration Update



Calibration Runs: (S1 → S6)

- *Check signal connectivity*
- *Check signal inverters (panel-1b)*
- *Complete HV gain matching*
- *Check for swapped cables*
- *Check counter functionality*
- *Test DAQ and electronics*
- *Collect data for calibration suite development*

Recent/Current Work:

- *Completed final functionality checks after torus spit removal and LTCC support install*
- *Check functionality after LTCC installation*
- *Preparing for FTOF panel-2 installation in Feb. 2016*

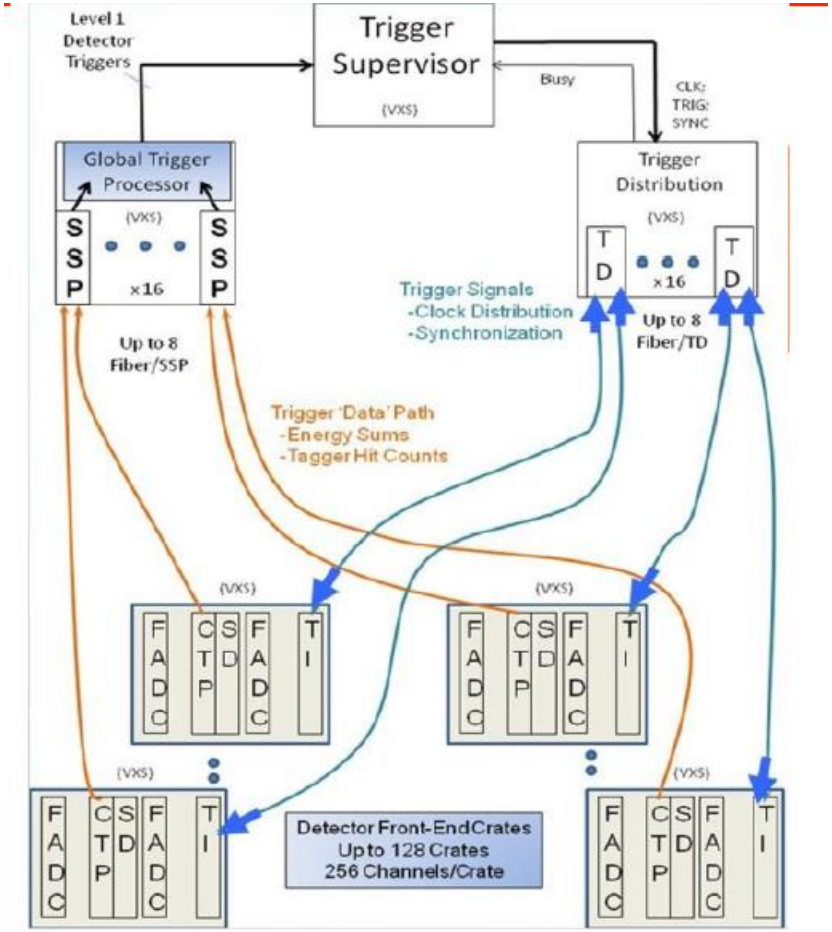
Known Problems: *(4 out of 1080 channels)*

- *S4b #7R (high PMT current)*
- *S5a #4L (bad dynode)*
- *S6a #21L (bad voltage divider)*
- *S6b #54L (high PMT current)*

Trigger

- All trigger electronics installed except first stage boards (VTPs)
- Trigger algorithms development is in progress, primary goal is to deliver electron trigger (ECAL+PCAL+HTCC) by summer, with other detectors following
- Currently available: hit-based ECAL/PCAL trigger (used in cosmic runs in the hall), drift chamber hit-based segment finder (used in drift chamber test setup)
- TO DO: new VTP board production and commissioning (Ben Raydo, Sergey Boyarinov); VTP-based ECAL/PCAL algorithms development (Ben Raydo, Cole Smith, Sergey Boyarinov); all electronics testing (with Fast Electronics Group and CODA group involvement)
- DAQ+Trigger whole system commissioning during summer

DAQ & Trigger



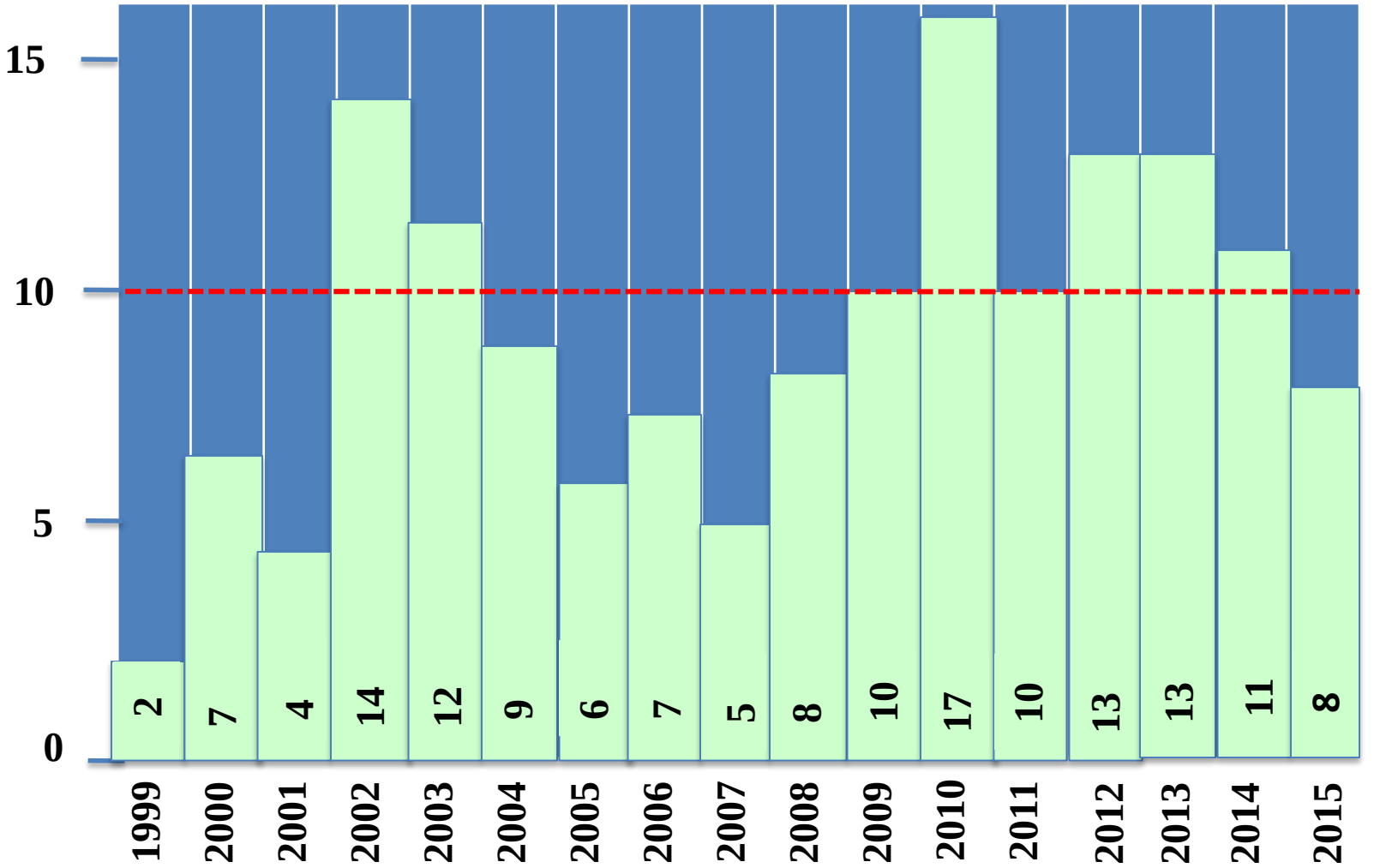
PARAMETER	DESIGN VALUE
Module Format/Bus	VITA 41 - VME64x and VXS (High Speed Serial Extensions)
Number of Readout Crates	50
Number of L1 Crates	30
Serial Interface Technology	2.5 Gbps and 5 Gbps
Serial Interface Transmission	Backplane and Multi-Fiber Optic
VME64x Data Bus Transfer	200 MB/sec
Trigger Distribution Method	High Speed Serial over Fiber Optic
Full L1 System Latency	< 3.7 μs
Trigger Rate Capability	200 kHz
Trigger Resolution	4 ns
Trigger Types	32
Front End Acquisition Clock	250 MHz
Synchronicity (All crates)	4 ns
Bit Error Rate	TBD

- Forward Carriage DQA crates installed
- CLAS12 Trigger Fiber-Optic cabling installed in FWCR and Pie Tower
- Subway rack installation for DCs completed
- All DC boards received and all boards pass acceptance testing
- 20 VXS crates received

CLAS PhD Theses

Completed: 156 In progress: 32

updated 29 Dec 2015



Hall B CLAS12 experiments – run groups

Proposal	Physics	Contact	Rating	Days	Group	New equipment	Energy	Run Group	Target
E12-06-108	Hard exclusive electro-production of π^0, η	Stoler	B	80	139	RICH (1 sector) Forward tagger	11	A F. Sabatié	liquid H_2
E12-06-112	Proton's quark dynamics in SIDIS pion production	Avakian	A	60					
E12-06-119	Deeply Virtual Compton Scattering	Sabatie	A	80					
E12-09-003	Excitation of nucleon resonances at high Q^2	Gothe	B+	40					
E12-11-005	Hadron spectroscopy with forward tagger	Battaglieri	A-	119					
E12-12-001	Timelike Compton Scatt. & J/ψ production in e+e-	Nadel-Turonski	A-	120					
E12-12-007	Exclusive φ meson electroproduction with CLAS12	Stoler, Weiss	B+	60					
E12-11-005a	Photoproduction of the very strangest baryon	Guo	NR	(120)					
E12-07-104	Neutron magnetic form factor	Gilfoyle	A-	30	90	Neutron detector RICH (1 sector) Forward tagger	11	B K. Hafidi	liquid D_2 target
PR12-11-109 (a)	Dihadron DIS production	Avakian							
E12-09-007a	Study of partonic distributions in SIDIS kaon production	Hafidi	A-	30					
E12-09-008	Boer-Mulders asymmetry in K SIDIS w/ H and D targets	Contalbrigo	A-	56					
E12-11-003	DVCS on neutron target	Niccolai	A	90					
E12-06-109	Longitudinal Spin Structure of the Nucleon	Kuhn	A	80	185	Polarized target RICH (1 sector) Forward tagger	11	C S. Kuhn	NH_3 ND_3
E12-06- 119(b)	DVCS on longitudinally polarized proton target	Sabatie	A	120					
E12-07-107	Spin-Orbit Correl. with Longitudinally polarized target	Avakian	A-	103					
PR12-11-109 (b)	Dihadron studies on long. polarized target	Avakian							
E12-09-007(b)	Study of partonic distributions using SIDIS K production	Hafidi	A-	80					
E12-09-009	Spin-Orbit correlations in K production w/ pol. targets	Avakian	B+	103					
E12-06-106	Color transparency in exclusive vector meson production	Hafidi	B+	60	60		11	D	Nuclear
E12-06-117	Quark propagation and hadron formation	Brooks	A-	60	60		11	E	Nuclear
E12-06-113	Free Neutron structure at large x	Bueltman	A	40	42	Radial TPC	11	F	Gas D_2
E12-14-001	EMC effect in spin structure functions	Brooks	B+	55	55	Pol. LiH target	11	G	LiH
TOTAL run time				1466 (1586)	631				

C1 approved proposals & non-CLAS12

Proposal	Physics	Contact	Rating	Days	Group	Equipment	Energy	Group	Target
C12-11-111	SIDIS on transverse polarized target	Contalbrigo	A	110	110	Transverse target	11	G	HD
C12-12-009	Transversity w/ di-hadron on transvere target	Avakian	A	110					
C12-12-010	DVCS with transverse polarized target in CLAS12	Elouadrhriri	A	110					
All transverse target proposals				330	110				
C12-11-006	Heavy Photon Search at Jefferson Lab (HPS)	Jaros	A	180	180	New setup in alcove	2.2, 6.6	H	Nuclear
E12-11-106	High Precision Measurement of the Proton Charge Radius	Gasparian	A	15	15	Primex	1.1, 2.2	I	H2 gas
Beam time request from CLAS12 C! experiments + non-CLAS12 experiments				**525**	**305**				
Beam time from approved CLAS12 experiments (from previous page)				**1466**	**631**				
TOTAL Beam time for all Hall B experiments				**1991**	**936**				

Optimistically, we may run 90 PAC days per year. To run all experiments as run groups with full beam time will require 936/90 ≈ 10 years.

Hall B Run Group Publications

- **published / accepted**
- **submitted**

E1 (a-g) (26):

K. Park et al.,	Measurement of p(e,e'π^+)n at 1.6<W<2.0GeV & N* coupl.	PRC 91 045203, 2015
M. Mestayer et al.,	Flavor Dep. of qq-bar Creation Observed in the Exclusive Limit	PRL 113, 152004, 2014
M. Gabrielyan et al.	Induced polarization of $\Lambda(1116)$ in kaon electroproduction,	PRC 90, 035203, 2014
W. Gohn et al.,	Beam-spin asymmetries from semi-incl. pion elecvtrproduction	PRD89 072011, 2014
H. Lu et al.,	First Observation of the $\Lambda(1405)$ Line Shape in Electroproduction	PRC 88, 045202, 2013
D. Carman et al.	Structure functions in $K^+\Lambda$ and $K^+\Sigma$ electroprod. at 5.5 GeV	PRC87, 025204, 2013
V. Mokeev et al.,	Study of P11(1440) and D13(1520) in p(e,ep$\pi^+\pi^-$)	PRC86, 035203, 2012
G. Gavalian et al.	Beam Spin Asymmetries in DVCS with CLAS at 4.8 GeV	PRC79, 015204, 2009
G. Fedotov et al.,	Electroproduction of pπ+π- at 0.2<Q2<0.6, 1.3<W<1.57Ge	PRC79, 015204, 2009
R. Nasseripour et al.,	Polarized structure function σ_{LT}' for p(e,e'K^+)Λ in N* region	PRC77, 065208, 2008
H. Denizli et al.,	Q^2-dependence of $S_{11}(1535)$ & Evidence for P-wave resonance	PRC76, 015204, 2007
P. Ambrozewicz et al.,	Separated Structure Functions for ep→eKΛ/KΣ Final States	PRC75, 045203, 2007
H. Egiyan et al.,	Electroproduction of single π^+ in ep -> eπ^+n	PRC73, 025204, 2006
K. Joo et al.,	σ_{LT}' for pion electroproduction in the Roper resonance	PRC72, 058202, 2005
C. Hadjidakis et al.,	Exclusive ρ^0 electroproduction from hydrogen	PL B 605, 256, 2005
K. Joo, et al.,	Measurement of $\sigma_{LT'}$ for p(e,e'π^+)n in Δ region	PRC70, 042201, 2004
H. Avakian et al.,	Beam spin asymmetry for p(e,e'π^+)X in DIS region	PRD69, 112004, 2004

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E1(a-g) (26) cont'd:

▪ K. Joo et al.,	Polarized structure function σ_{LT}' in $\Delta(1232)$ region	PRC68, 032201, 2003
▪ M. Osipenko et al.,	Kinematically complete measurement of F_2 in N* region	PRD67, 092001, 2003
▪ D. Carman et al.,	First measurement of transferred polarization in p(e,e'K^+)Λ	PRL90, 131804, 2003
▪ M. Ripani et al.,	Measurement of p(e,e'p$\pi^+\pi^-$) and baryon resonance analysis	PRL91, 022002, 2003
▪ K. Joo et al.,	Q^2 dependence of quadrupole strength in $\Delta(1232)$ excitation	PRL88, 122001, 2002
▪ S. Barrow et al.,	Electroproduction of the $\Lambda(1520)$ hyperon	PRC64, 044601, 2001
▪ S. Stepanyan et al.,	First observation of exclusive DVCS in beam asymmetry	PRL87, 182002, 2001
▪ K. Lukashin et al.,	Exclusive electroproduction of ⟩ mesons at 4.2 GeV	PRC63, 065205, 2001
▪ R. Thompson et al.,	The p(e,e'p)η reaction at and above the $S_{11}(1535)$	PRL86, 1702, 2001

E1-6 (12):

▪ P. Khetarpal	Near threshold π^0 production at high Q^2 and generalized ff	PRC87, 045205, 2013
▪ K. Park et al.,	Exclusive nπ+ production in the deep inelastic region	EPJA49, 16, 2013
▪ K. Park et al.,	Generalized form factors at high Q^2 in γp->nπ+ near threshold	PRC85, 035208, 2012
▪ I. Aznauryan et al.,	Electroexcitation of N* in CLAS in pion electroproduction	PRC80, 055203,2009
▪ D. Carman et al.,	B-R Polarization Transfer in N* Region for ep→e'$K^+\Lambda/\Sigma$	PRC79, 065205,2009
▪ M. Osipenko et al.,	Measurement of semi-inclusive π^+ electroproduction off protons	PRD 80, 032004,2009
▪ S.A. Morrow et al.,	Exclusive ρ0 electroproduction on the proton at CLAS	EPJ A39, 5-31, 2009
▪ J. Santoro et al.,	Electroproduction of $\phi(1020)$ Mesons at High Q^2 with CLAS	PRC78:025210,2008
▪ I. Aznauryan et al.,	Electroexitation of the Roper resonance in ep→enπ+ at Q^2<4.5	PRC78, 045209,2008
▪ K. Park et al.,	Cross section and beam asymmetries for ep→enπ+ at Q^2<4.5	PRC77, 015208,2008
▪ M. Ungaro et al.,	N$\Delta(1232)$ Transition at high Momentum Transfer	PRL97,112003,2006
▪ L. Morand et al.,	Deeply virtual and exclusive electroproduction of ω mesons	EPJ A24, 445, 2005

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E2 (8):

▪ H. Baghdasaryan et al.	Comparison forward/backward pp pair knockout in 3He(e,e'pp)n	PRC 85, 064318, 2012
▪ H. Baghdasaryan et al.	Tensor correlations measured in 3He(e,epp)n	PRL105, 222501, 2010
▪ M. Osipenko et al.	Nucleon structure function F2 in nuclear medium and moments	NPA 845, 1, 2010
▪ K. Egiyan et al.,	Measurement of 2-N and 3-N SRC Probabilities in Nuclei	PRL 96,082501,2006
▪ D. Protopopescu et al.,	A_{LT}' in electron scattering on He-4 and C-12	NPA748,357,2005
▪ A.V. Stavinsky et al.,	Proton source size measurements in A(e,e'pp)X	PRL93,192301,2004
▪ R. A. Niyazov, et al.,	Two-nucleon momentum distribution in ^{3}He(e,e'pp)n	PRL92,052303,2004
▪ K. Egiyan et al.,	Observation of nuclear scaling in A(e,e') at $x_B > 1$	PRC68,014313,2003

E1-DVCS (6):

▪ H.S. Jo et al.,	Exclusive Photon Electroproduction and GPDs	PRL 115, 212003, 2015
▪ I. Bedlintsky et al.,	Exclusive pi0 electroproduction at W>2 GeV with CLAS	PRC 90, 025205, 2014
▪ I. Bedlintsky et al.,	Exclusive pi0 electroproduction str. funct. and transversity GPDs	PRL 109, 112001, 2012
▪ M. Aghasyan et al.,	Precise measurements of beam spin asymmetries in π^0 SIDIS	PL B 704, 397, 2011
▪ F. X. Girod, et al.,	Deeply Virtual Compton Scattering Beam Asymmetries	PRL100,162002,2008
▪ R. De Masi et al.,	Beam Asymmetries in Deeply Virtual π^0 Production	PRC77, 042201,2008

E5 (1):

▪ J. Lachniet et al.	Precise measurement of the neutron magnetic form factor	PRL102,192001,2009

E6 (3):

▪ K. Egiyan et al.	Study of Exclusive d(e,e'p)n Reaction Mechanism at High Q^2,	PRL98,261502,2007
▪ A. Klimenko et al.,	Deuteron s.f. with fast backward proton	PRC73,035212,2006
▪ M. Osipenko et al,	Deuteron s.f. F2 in the resonance region & its moments	PRC73, 045205,2006

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EG1 (12):

▪ N. Guler, et al.,	Deuteron Spin Structure and the Neutron Contribution	PRC 92, 055201 (2015)
▪ H. Avakian et al.,	Spin asymmetries in SIDIS of pion prod. off long. pol. target	PRL105,262002,2010
▪ Y. Prok et al.,	Moments of spin s.f. g_1^p and g_1^d for $0.05 < Q^2 < 3.0$ GeV^2	PLB 673:12, 2009
▪ A. Biselli et al.,	First measurement of target asymmetry .. In the ep->eppi0	PRC78:045204,2008
▪ P. Bosted et al.,	N15/C12 Cross section ratios`	PRC78:015202,2008
▪ P. Bosted et al.,	Quark-Hadron Duality in Spin structure functions g1p and g1d	PRC75,035203,2007
▪ V. Dharmawardane	Measurement of x-and Q^2 dependence of Asymmetry A1	PLB641:11-17, 2006
▪ S. Chen, et al.,	Deeply Virtual Compton Scattering on Polarized Protons	PRL97,072002,2006
▪ R. Fatemi et al,	Proton spin structure function g1(x, Q^2) for Q^2=0.15-1.6 GeV^2	PRL91,222002,2003
▪ J. Yun et al.,	Measurement of inclusive spin S.F.'s of the deuteron	PRC67,055204,2003
▪ A. Biselli et al.,	Polarized beam asymmetry for p(e,ep)π^0 in Δ(1232) region	PRC68,035202,2003
▪ R. De Vita et al.,	First measurement of double spin asymmetry in p(e,e'π+)n	PRL88,082001,2002

EG1-DVCS (3):

▪ A. Kim et al.,	Target and Double Spin Asymmetries for DVπ^0P on pol. target	arXiv:1511.03338, 2015
▪ S. Pisano et al.,	Single and Double spin asymmetries for DVCS on pol. target	PRD91 5, 052014, 2015
▪ E. Seder et al.,	Longitudinal target-spin asymmetries for DVCS	PRL 114, 032001, 2015
▪ Y. Prok	Precision measurement of g1 of the proton and deuteron at 6 GeV	PRC 90, 025212, 2014

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EG2 (4):

O. Hen et al.,	Momentum sharing in imbalanced Fermi systems	Science 346, 614, 2014
O. Hen, et al.,	Transparency ratios from short-range correlated pairs	PLB 722, 63, 2013
El Fassi, et al.,	Onset of Color Transparency in ρ^0 production off nuclei	PLB 712, 326, 2012
A. Daniel, et al.	Nuclear multiplicity ratio for K^0_s hadronization at CLAS	PLB 706, 26, 2011

EG3 (1):

H. Egiyan et al.,	Upper limits for the $\phi^{--}(1860)$ production off the deuteron	PRC85,015205, 2012

EG5 (2):

K.P. Adhikari et al.,	Towards resolving the proton FF problem w/ new e^+e^- data	PRL 114 6, 062003, 2015
M. Moteabbed, et al.,	Novel Technique to measure 2-gamma effects in elastic e+p/e-p	PRC 88 025210, 2013

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E8-BoNuS (2):

▪ S. Tkachenko et al.,	Measurement of nearly free neutron structure functions from ..	PRC 89, 045206, 2014
▪ N. Baillie et al.,	Neutron F_2 structure function via spectator tagging	PRL 108, 142001, 2012

G1 (14):

▪ M. Dugger et al.,	π^+ Photoproduction on protons at energies from 0.675 – 2.875	PRC 79, 065206,2009
▪ M. Dugger et al.,	π^0 Photoproduction on protons at energies from 0.675 – 2.875	PRC 76, 025211,2007
▪ I. Hleiqawi et al,	Cross sections for $\gamma p \rightarrow K^{*0}\Sigma^+$ at E=1.7-3 GeV	PRC 75,042201,2007
▪ R. Bradford et al,	Measurement of beam-recoil polarization in $K\Lambda$, $K\Sigma$	PRC 75, 035205,2007
▪ M. Dugger et al.,	η' photoproduction on the proton	PRL 96,062001,2006
▪ R. Bradford et al.,	Diff. cross sections of $\gamma p \dashrightarrow K^+Y$ for Λ and Σ hyperons	PR C73, 035202. 2006
▪ S. Strauch et al.,	Beam helicity asymmetry in photoproduction of $p\pi^+\pi^-$	PRL 95,162003,2005
▪ S. Taylor et al.,	Radiative decays of the $\Sigma^o(1385)$ and $\Lambda(1520)$ hyperons	PRC 71 054609,2005
▪ K. McCormick et al.,	Tensor polarization of ϕ in high-t photoproductio	PRC 69,032203,2004
▪ J.W. McNabb et al.,	Hyperon photoproduction in the nucleon resonance region	PRC 69, 042201,2004
▪ M. Dugger et al.,	η photoproduction on proton for energies 0.75-1.95G	PRL 89, 222002,2002
▪ M. Battaglieri et al.,	Photoproduction of ω mesons at large momentum transfer	PRL90, 022002,2003
▪ M. Battaglieri et al.,	Photoproduction of $\rho 0$ on proton at large momentum transfer	PRL87, 172002,2001
▪ E. Anciant et al.,	Photoproduction of ϕ at large momentum transfer	PRL85, 4862 (2000)

G2 (5):

▪ X. Qian et al,	Near-threshold Photoproduction of ϕ mesons on Deuterium.	PL B696, 338, 2011
▪ Y. Ilieva, et al.,	Observation of backward peak in $\gamma D \rightarrow D\pi^0$ near η threshold	EPJA 43, 261, 2010
▪ P. Rossi et al,	Onset of asymptotic scaling in deuteron photo-distintegration	PRL94, 012301,2005
▪ M. Mirazita et al.,	Complete angular distributions in $d(\gamma,p)n$ from 0.5-3 GeV	PRC70, 014005,2004
▪ S. Stepanyan et al.,	Observation of S=+1 baryon in $D(\gamma,K^+K^-p)n$	PRL91, 252001,2003

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G3 (4):

▪ I.Pomerantz,Y. Ilieva,..	Hard 2-body photodisintegration on ^{3}He	PRL 110, 24301, 2013
▪ R. Nasseripour et al.,	Coherent Photoproduction of π^+ from ^{3}He.	PRC 83, 034001, 2011
▪ R. Nasseripour et al.,	Photodisintegration of ^{4}He into p+t,	PRC 80, 044603,2009
▪ S. Niccolai, et al.,	3-body photodisintegration of He-3 for 0.55 - 3 GeV	PRC 70 064003,2004

G6 (3):

▪ M. Nozar et al.,	Search for exotic mesons in the photoproduction of $\pi^+\pi^+\pi^-$	PRL102,102002,2009
▪ J. Price, et al.,	Photoproduction of cascades from proton targets	PRC71, 0518201,2005
▪ V. Kubarovsky et al.,	Observation of baryon with S=+1 in $p(\gamma,K^+K^-\pi^+)n$	PRL92, 032001,2004

G7 (3):

▪ M. Wood et al.	Absorption of omega and phi mesons in nuclei	PRL105:112301,2010
▪ M. Wood et al.,	Light Vector Mesons in the Nuclear Medium	PRC78:015201,2008
▪ R. Nasseripour et al.,	Search for medium modifications of the ρ^0	PRL 99, 262302,2007

G8 (1):

▪ M. Dugger et al.	Beam asymmetry Σ in pi+ and pi0 photoproduction	PRC 88, 065203, 2013

G9 (1):

▪ I. Senderovich et al.	Helicity asymmetry E in η photoproduction on the proton	PLB 755, 64, 2016
▪ S. Strauch et al.	First Measurement of E asymmetry in $p(g,\pi+)n$ up to 2.25GeV	PLB 750, 53, 2015

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G10 (7):

▪ S. Pereira et al.,	K-Σ^- photoproduction on neutrons in deuterium	PLB 688, 289, 2010
▪ X. Qian et al.,	The extraction of φ−N total cross section from d(γ,pK+K^-)n	PLB 680, 417, 2009
▪ W. Chen at al.,	Differential cross section for $\gamma n \rightarrow \pi^- p$	PRL 103:012301,2009
▪ D. Ireland et al.,	Bayesian analysis of pentaquark signals from CLAS data	PRL 100:052001,2008
▪ T. Mibe, et al.,	First measurement of coherent phi production off ^{2}H..	PRC76:052202,2007
▪ S. Niccolai et al.,	Search for Θ^+ Pentaquark in $\gamma D \rightarrow \Lambda K^+ n$	PRL97:032001,2006
▪ B. McKinnon et al.,	Search for Θ^+ Pentaquark in $\gamma D \rightarrow p K^- K^+ n$	PRL96:212001,2006

G11 (22):

▪ M. McCracken et al.	Search for baryon- and lepton-number violating decays of Λ	PR D92, 072002, 2015
▪ B. Dey et al.,	Exclusive phi photoproduction and SMDE	PRC89, 055208, 2014
▪ H. Seraydaryan et al.	phi meson photoproduction on H2 in the neutral decay mode	PRC89, 055206, 2014
▪ K. Moriya et al,	Spin and Parity measurement of the $\Lambda(1405)$ baryon	PRL112, 082004, 2014
▪ K. Moriya et al.,	Diff. photo. cross sections for $\Sigma^0(1385)$, $\Lambda(1405)$, $\Lambda(1520)$	PRC 88 045201, 2013
▪ C.S. Nepali et al.,	Transverse polarization of Σ+(1189) in photoproduction on H_2	PRC 87, 045206, 2013
▪ W. Tang et al,	Cross sections for $\gamma p \rightarrow K^{*+}\Lambda$ and $\gamma p \rightarrow K^{*+}\Sigma^0$ at CLAS	PRC 87, 065204, 2013
▪ K. Moriya et al.,	Measurement of $\Sigma\pi$ line shapes near the $\Lambda(1405)$	PRC87, 035206, 2013
▪ M. Anghinolfi et al.	Comment on 'Observation of a narrow structure in p(g,Ks)X'	PRC86, 069801, 2012
▪ D. Keller et al.,	Branching Ratio of the Electromagnetic Decay of the $\Sigma^+(1385)$	PRD 85, 052004, 2012
▪ D. Keller et al.,	Electromagnetic Decay of the $\Sigma^0(1385)$ to $\Lambda\gamma$	PRD 83, 072004,2011

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G11 (22) cont.

▪ B. Dey et al.,	Diff. crs. and recoil polarizations for $\gamma p \rightarrow K^+\Sigma^0$	PRC82, 025202,2010
▪ M. Mc Cracken et al.,	σ and P_Λ measurements for the $\gamma p \rightarrow K^+\Lambda$	PRC81, 025201,2010
▪ M. Battaglieri et al.,	Photoproduction of $\pi^+\pi^-$ meson pairs on the proton.	PRD 80, 072005,2009
▪ M. Williams et al.,	Diff. cross section for $\gamma p \rightarrow p\eta$ and $\gamma p \rightarrow p\eta'$	PRC80, 045213,2009
▪ M. Williams, et al.,	Partial wave analysis of the reaction $\gamma p \rightarrow \omega p$ and search for N*	PRC 80, 065209, 2009
▪ M. Williams, et al.,	Diff. cross section and spin density matrix for $\gamma p \rightarrow \omega p$	PRC 80, 065208, 2009
▪ M. Battaglieri et al.,	1st measurement of direct f0(980) photoproduction on protons	PRL102:102001,2009
▪ L. Guo et al.,	Cascade production from protons	PRC76:025211, 2007
▪ R. De Vita et al.,	Search for Θ^+ in $\gamma p \rightarrow K^0K^+n$, and K^0K^0p	PRD74:032001, 2006
▪ V. Koubarovsky et al.,	Search for Θ^+ pentaquarks in $\gamma p \rightarrow K^+K^-p$	PRL97:102001, 2006
▪ M. Battaglieri et al.,	Search for Θ^+ pentaquark baryon in $\gamma p \rightarrow K^0K^+n$	PRL96:042001, 2006

G13 (1):

▪ N. Zachariou et al.,	Σ for Deuteron Photodisintegration for $Eg =1.1-2.3$ GeV	PRC 91 (2015) 055202

G5 (2):

▪ C. Cetina et al.,	Photofission of Heavy Nuclei from 0.2 to 3.8 GeV	PRC65, 044622, 2002
▪ C. Cetina et al.,	Photofission of Heavy Nuclei at energies up to 4 GeV	PRL84, 5740, 2000

PrimEx (1):

▪ I. Larin et al.,	A new measurement of the π^0 radiative decay width	PRL 106, 162303, 2011

Hall B Advanced Analysis Papers

❖ **non-collaboration paper**

E1 - Physics Analysis groups (7):

❖ V. Mokeev et al.,	New results from N* studies from ep-> eppi+pi-	PRC 2016
❖ I. Aznauryan, Burkert	Extracting meson-baryon contributions to N(1675)5/2$^-$ excitation	PRC92:015203, 2015
❖ V. Mokeev, et al.,	Model analysis of ep→epπ+π- at Q^2 = 0.2 – 0.6 GeV^2	PRC80:045212,2009
❖ H. Avakian, et al.,	Effect of OAM on Valence-Quark Helicity Distributions	PRL99:082001,2007
❖ I. Aznauryan et al.,	Electroexcitation of N* at Q^2=0.65 GeV2 in Nπ and Nππ	PRC72, 045201,2005
❖ D. Carman, B. Raue	σ_L/σ_T for p(e,e'K)Λ from polarization transfer	PRC71, 065209,2005
❖ I. Aznauryan et al.;	Electroexcitation of Δ(1232), P_{11}, S_{11}, D_{13} at Q^2=0.4, 0.65 GeV^2	PRC71, 015201,2005

E2 Physics Analysis groups (1)

❖ L. Weinstein, et al.	Short range correlations and the EMC effect	PRL106, 052301, 2011

E8-BONUS - Physics Analysis groups (1):

❖ I. Niculescu et al.,	Direct observation of q-h duality in the F2n structure function	PRC 91, 055206, 2015

EG2 Physics Analysis groups (2):

❖ Or Hen, et al.,	Symmetry energy of nucleonic matter with tensor correlations	PRC 91, 025803, 2015
❖ C. Colle et al.	Mass dep. and Q.N. of SRC pairs from A(e,e'p) and A(e,e'pp)	PRC92, 024604, 2015

EG1 Physics Analysis groups (6):

❖ A. Deur et al.,	The effective strong coupling constant from CLAS spin str. Data	PLB 665:349,2008
❖ A. Deur et al.,	Experimental Study of isovector spin sum rules	PRD78:032001,2008
❖ A. Deur et al.,	Determination of an effective α_s from the Bjorken sum	PLB 650, 244,200
❖ M. Osipenko et al.,	Global Analysis of Proton Structure Function g1 and Moments	PRD71, 054007,2005
❖ M. Osipenko et al.,	Higher twist analysis of the proton g_1 structure function	PLB 609, 259,2005
❖ A. Deur et al.,	Experimental determination of the Bjorken Integral at low Q2	PRL93, 212001,2004

Hall B Advanced Analysis Papers

❖ **non-collaboration paper**

E1-DVCS Physics Analysis groups (3)

❖ I. Akushevich, et al.	Rad. effects in excl. electroproduction from polarized protons.	PRD 85 053008, 2012
❖ M. Guidal	GPDs from Deeply Virtual Compton Scattering at CLAS.	PLB 689, 2010,2010
❖ H. Moutarde	Extraction of the CFF H from JLab DVCS measurements.	PRD 79, 094021,2009

EG1-DVCS - Physics Analysis groups (1):

❖ A. Deur, Y. Prok et al.	High precision determination of the Bjorken Sum vs (Q^2)	PRD 90, 012009, 2014

G1-G11 - Physics Analysis groups (7):

❖ V. Anisovich et al.,	Existence of $\Delta(2200)$ precludes ChS restor. at high mass	arXiv: 1503.05774, 2015
❖ B. Dey	Scaling behavior in exclusive meson photoproduction	PRD 90, 014013, 2014
❖ A.V. Anisovich et al.,	Helicity amplitudes for photoexcitation of neutron resonances	EPJ A 49: 67, 2013
❖ D. Keller, K. Hicks	U-Spin predictions of transition moments for decays of $\Sigma(1385)$	EPJ A 49: 53, 2013
❖ W. Chen, et al.	Amplitude analysis of $\gamma n \rightarrow \pi^- p$ data above 1 GeV	PRC86:015206,2012
❖ R. Schumacher et al.,	Scaling and resonances in elementary $K^+\Lambda$ photoproduction	PRC83:025207,2011
❖ A. Szczepaniak et al..,	P-wave $\pi^+\pi^-$ amplitude from dispersion relations	PRD82:036006,2010
❖ A. Puente, ..,B. Raue	New fits to the process $\gamma p \rightarrow K^+\Lambda$	PRC80, 065205,2009

Hall B Other Refereed Journal Publications

❖ **non-collaboration paper**

Hall B scientists & others (23)

❖ H. Matevosyan et al.	Sivers SSA in 1 and 2 hadron e-production for CLAS12 and EIC	PRD 92 (2015) 5, 054028
❖ I. Aznauryan, V.B.	Electroexcitation of $\Delta(1232)$ and $\Delta(1600)$ in LC RQM	PR C92 (2015) 3, 035211
❖ A.V. Anisovich et al.,	Energy-independent PWA of the reaction $\gamma p \rightarrow K^+\Lambda$	EPJ A50 (2014) 129
❖ M. Guidal et al.,	GPDs in the valence quark region from DVCS	RPP 76, 066202, 2013
❖ I. Aznauryan et al,	Studies on Nucleon Structure in Exclusive Electroproduction	IJMP E22,1333, 2013
❖ I Aznauryan, Burkert	Nucleon em ff and N* in a light-front relativistic quark model	PRC 85 055202, 2012
❖ I Aznauryan, Burkert	Electroexcitation of nucleon resonances (Review)	PPNP 7:1, 2012
❖ A. Sandorfi et al	Photoproduction amplitudes from complete experiments	J.Phys.G38, 053001, 2011
❖ S. Pereira	Hyperon production and polarization w/ CLAS and CLAS12	IJMP E19, 1021, 2010
❖ S. Brodsky, A. Deur,	Non-perturbative QCD coupl. And β function in LF holography	PRD 81, 096010, 2010
❖ S. Brodsky, A. Deur	AdS/QCD holography and non-pert. strong running coupling	IJMP A25, 5009, 2010
❖ H. Avakian et al.,	The trans. mom. dependent distr. functions in the bag model.	PRD 81, 074035, 2010
❖ H. Avakian et al.	Insights on non-perturbative aspects of TMDs from models	MPLA24:2995,2009.
❖ H. Avakian et al,	Transverse momentum dependent distribution function h1	PRD78:114024,2008.
❖ H. Avakian, et al.	Are there approximate relations among TMDs?	PRD77,014023,2008.
❖ H. Avakian et al.,	Effect of OAM on Valence-Quark Helicity Distributions.	PRL99:082001,2007
❖ V. Burkert et al.,	Single Quark Transition analysis of N* in [70,1-] multiplet	PRC67, 035204,2003
❖ V. Burkert, H. Lee	Electromag. meson production in N* region	IJMP E13, 1035, 2004
❖ A. Afanasev et al.,	QED radiative corrections for exclusive pion production	PRD66, 022002,2003
❖ V. Burkert	Generalized GDH sum rule for p-n in chiral perturbation theory	PRD63,097904,2001.
❖ V. Burkert, B. Ioffe	Polarized str. funct. and GDH and Bjorken sum rules	JETP78, 619, 1994
❖ V. Burkert and Zh. Li	What do we know about the Q^2 evolution of GDH S.R.?	PRD47, 46, 1993
❖ V. Burkert, B. Ioffe	Q^2 variation of spin-dependent DIS from protons	PLB 296, 223, 1992

Hall B Technical Publications (36)

CLAS

• Torus Magnet		IEEE Mag.25 (1989) 1902
• Drift Chambers		
– construction	M. Mestayer	NIM A323 (1992) 191
– update	M. Mestayer	NIM A367 (1995) 316
– Region I	D. Carman	NIM A419 (1998) 315
– Region II	L.M. Qin	NIM A411 (1998) 265
– Summary	D. Carman	NIM A449 (2000) 81
• Cerenkov Counter	P. Stoler	NIM A465 (2001) 414
• TOF Counters	E. Smith	NIM 432 (1999) 265
• Start Counters	S. Taylor	NIM A462 (2001) 484
• Forward Cal.	C. Smith	NIM A460 (2001) 239
• Large Angle Cal.	M. Anghinolfi	NIM A447 (2000) 431
– Response	M. Anghinolfi	NIM A537 (2005) 562
• Tagging System		
– window	S.K. Mathews	NIM 421 (1999) 23
– tagger	D. Sober	NIM 440/2 (2000) 263
• Polarized target	C. Keith	NIM A501 (2003) 327
• FROST coil	O. Dzyubak	NIM A526 (2004) 132
• CLAS Overview	B. Mecking	NIM A503 (2003) 513
• Start Counter #2	Y. Sharabian	NIM A556 (2005) 246

Technical Publications, cont'd

• A bootstrap method for gain calibration	R.T. Jones	NIM A566 (2006) 366
• Performance of the RadPhi Detector	R.T. Jones	NIM A570 (2007) 384
• Calibration of the JLab Photon Tagger	S. Stepanyan	NIM A572 (2007) 654
• A Double-Target System for the CLAS-EG2 run	H. Hakobyan	NIM A592 (2008) 218
• BoNuS: Radial TPC using Cylindrical GEMs	H. Fenker	NIM A592 (2008) 273
• Nuclear Targets for PRIMEX	R. Miskimen	NIM A612 (2009) 46
• Portable cryostat for cold transfer of pol. HD target	C. Bass et al.	NIM A 737 (2013) 107

Hall B Technical Publications, cont'd

CLAS12

• Innovative Photon detectors for CLAS12 RICH	M. Contalbrigo	NIM A787 (2015) 224
• Ionising radiation effects on CLAS12 FT calorimeter	S. Fegan	NIM A789 (2015) 101
• Operation of resistive micromegas in air	S. Procureur et al.,	NIM A664 (2012) 11
• Dynamic magnetic shield for CLAS12 CTOF PMTs	V. Baturine et al.,	NIM A664 (2012) 213
• The CLAS12 large area RICH detector	M. Contalbrigo et al.	NIM A639 (2011) 302
• Discharge in Micromegas in hadron beams	G. Charles et al.	NIM A 648 (2011) 174
• Discharge in Micromegas in a magnetic field	B. Moreno et al.,	NIM A 654 (2011) 135
• Discharge in Micromegas a150GeV/c pion beam	S. Procureur et al.,	NIM A 659 (2011) 91
• Readout electronics for Silicon Tracker in CLAS12	A.G. Voronin et al.	Springer IET 53 (2010) 805
• Time resolution of fine mesh and regular PMTs	V. Kuznetsov et al.	NIM A621 (2010) 184
• The MicroMegas tracker project for CLAS12	S. Aune et al.	NIM A604 (2009) 53
• MCP Time Resolution	V. Batourine et al.	NIM A562(2006) 327

HPS

• The Heavy Photon Search Test Detector	M. Battaglieri et al.,	NIM A777 (2014) 91-101

Physics Publications by Run Groups

• e1(a – f)	26
• e1-6	12
• e2	8
• e1-dvcs	6
• e5	1
• e6	3
• e8-Bonus	2
• eg1	12
• eg1-dvcs	3
• eg2	4
• eg3	1
• eg4	
• eg5-TPE	2
• eg6	
TOTAL:	**80**

• g1	14
• g2	5
• g3	4
• g5	2
• g6	3
• g7	3
• g8	1
• g9	2
• g10	7
• g11	22
• g12	
• g13	1
• g14	
• PRIMEX	1
TOTAL:	**65**

Advanced Analysis

• E1	7
• E2	1
• EG1	6
• EG2	2
• E1-DVCS	3
• EG1-DVCS	1
• E8-BoNuS	1
• G1-G11	7
TOTAL:	**28**

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