

Hall B Update

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Jefferson Lab

HPS collaboration meeting 3 - 5 May, 2017, JLab

Goals for 2016/17

HALL B

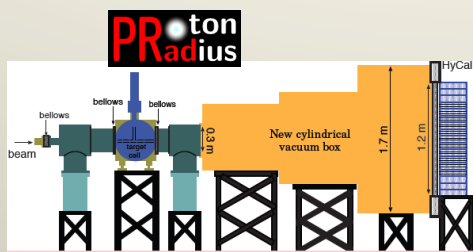
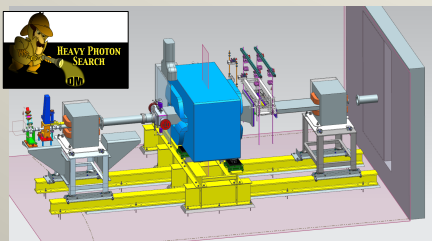
- **Complete the 12 GeV upgrade project**
 - Construct, install, and commission the CLAS12 detector
 - including a new large superconducting Torus magnet
 - a high field superconducting Solenoid magnet
 - a large number of detectors for charged particle tracking, particle identifications and calorimeters with > 110,000 readout channels
- Carry out a search for a new gauge boson connecting visible and dark matter (HPS)
- Perform a precision measurement of the proton charge radius (PRAD)
- **Demonstrate the DOE Key Performance Parameter (KPP)**
- **Prepare the engineering & physics run in the fall 2017**

Achievements 2016/17

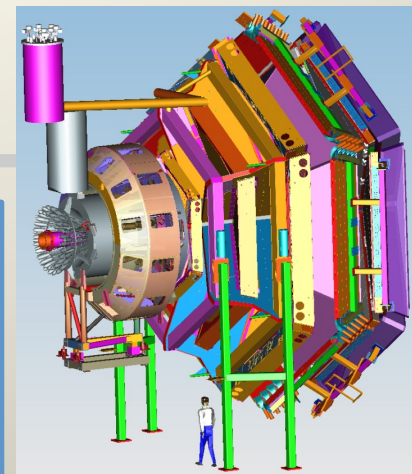
HALL B

- The **HPS** collaboration carried out a search for the hypothetical A' gauge boson at 2.3 GeV beam energy.
- The **PRAD** collaboration completed the first experiment in the 12 GeV era, collecting record statistics data at 2 beam energies.
- Conducted a highly successful beam run Feb 3-5, 2017 with CLAS12 demonstrating the DOE Key Performance Parameter (KPP), receiving DOE approval Feb 7, 2017 as a major project milestone.
- CLAS collaboration is preparing the CLAS12 engineering run & 1st physics run scheduled for October – December 2017
- Collaborations continued to analyze and published data from experiments of the 6 GeV era contributing to
 - Over 185 refereed journal publications
 - More than 2100 conference talks
 - About 200 PhD theses that are completed or are in progress

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

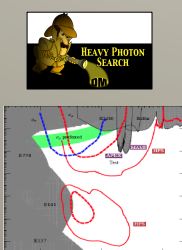


Construction & Installation

Commissioning & early 11 GeV Experiments

< 6 GeV beam

CLAS12 Installation



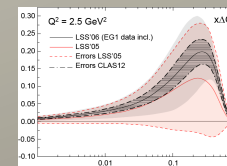
KPP run

CLAS12 ready

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

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

nDVCS & GPDs
nSIDIS & TMDs
 F_2^n



CY 2015

CY 2016

CY 2017

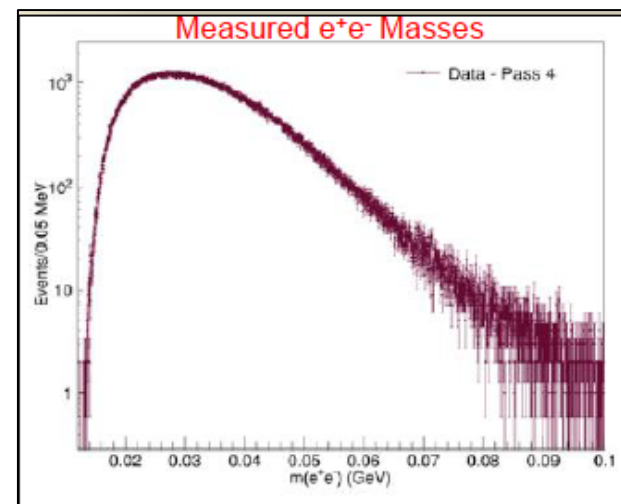
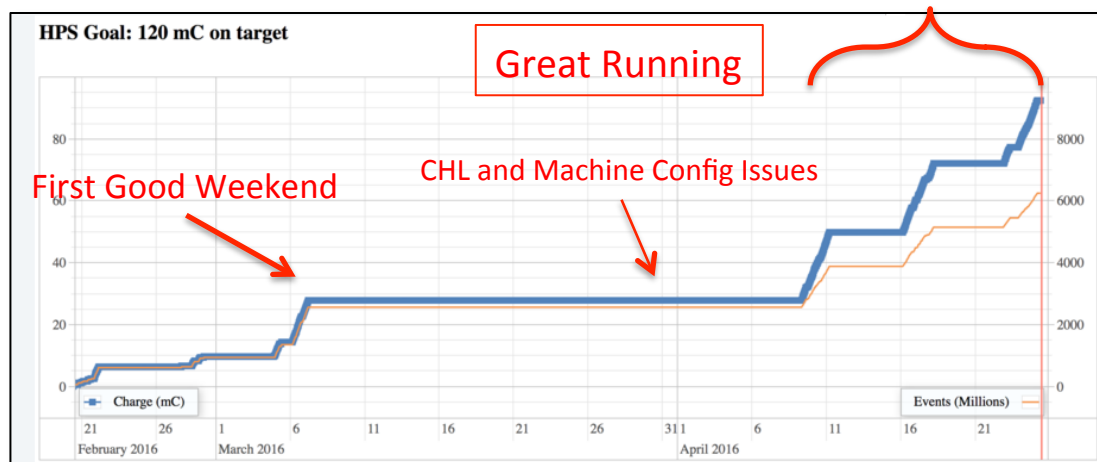
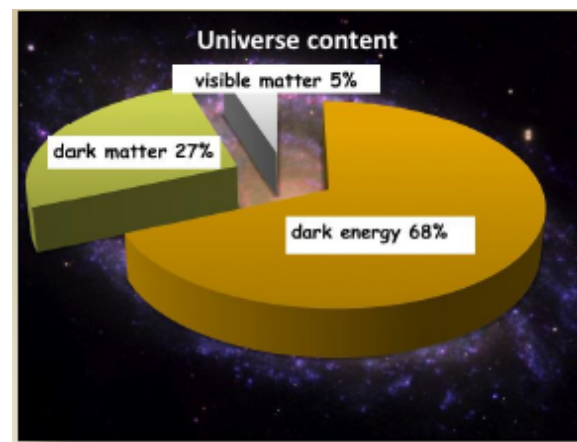
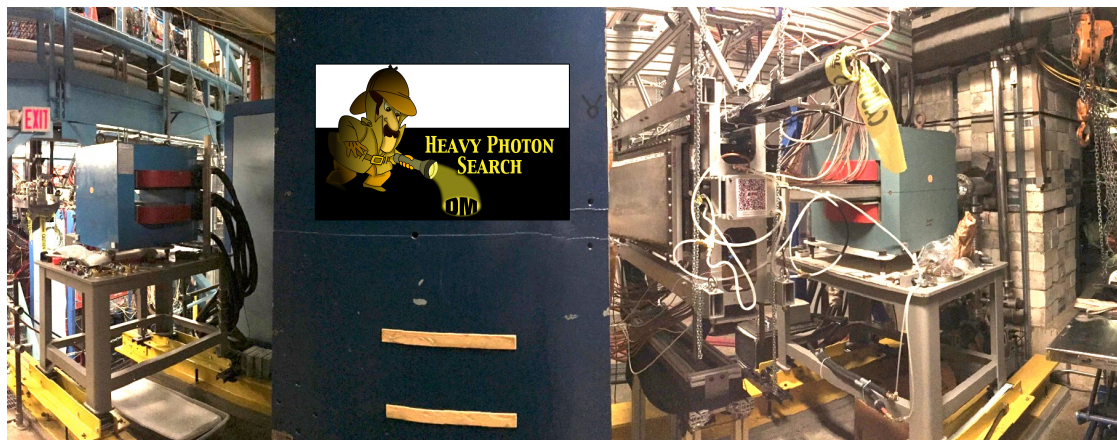
CY 2018

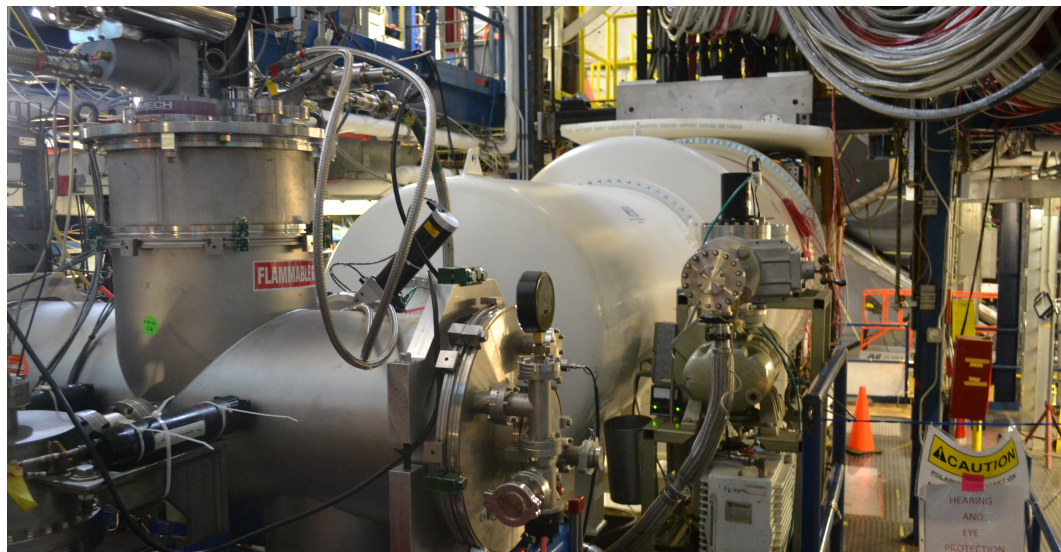
CY 2019



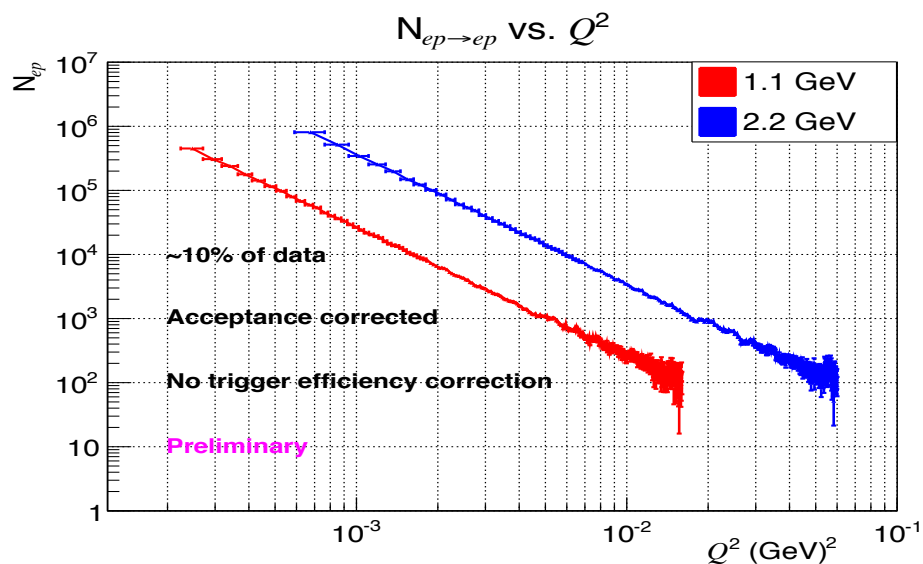
HPS Experiment

HALL B





Solving a 7σ experimental puzzle



Forward Detector (FD)

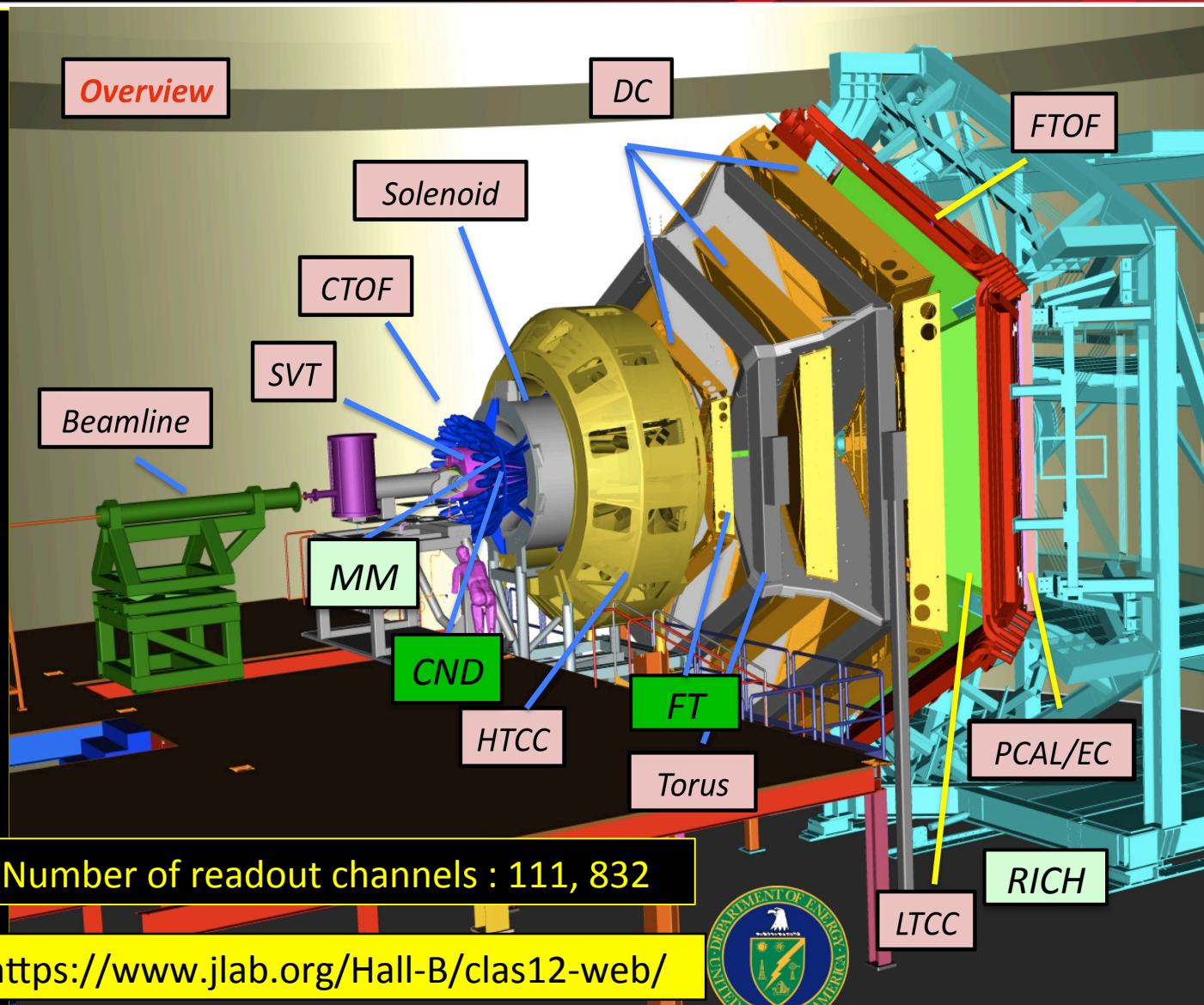
- TORUS magnet
- HT Cherenkov Counter
- Drift chamber system
- LT Cherenkov Counter
- Forward ToF System
- Pre-shower calorimeter
- E.M. calorimeter
- **Forward Tagger**
- RICH detector

Central Detector (CD)

- Solenoid magnet (1)
- Silicon Vertex Tracker
- Central Time-of-Flight
- **Central Neutron Detector**
- MicroMegas Trackers

Beamline

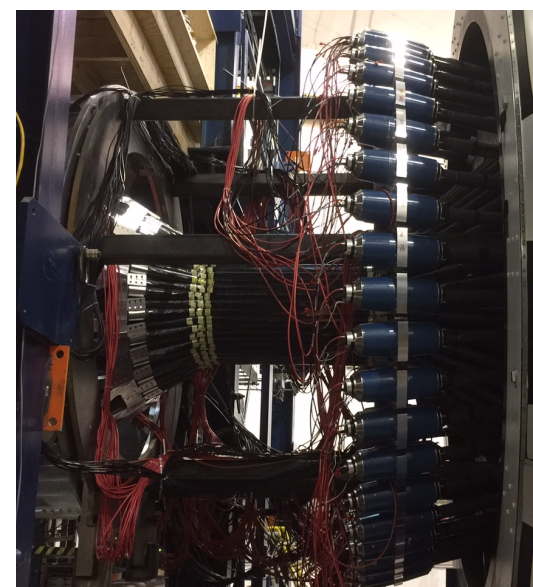
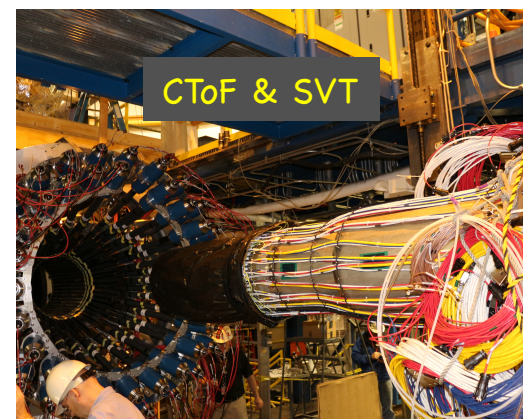
- Photon Tagger
- Shielding
- Cryo Target
- Moller polarimeter
- Polarized Targets



Number of readout channels : 111, 832

<https://www.jlab.org/Hall-B/clas12-web/>





HALL B

CTOF

SVT



5/2/17

HPS collaboration meeting - May 3-5, 2017

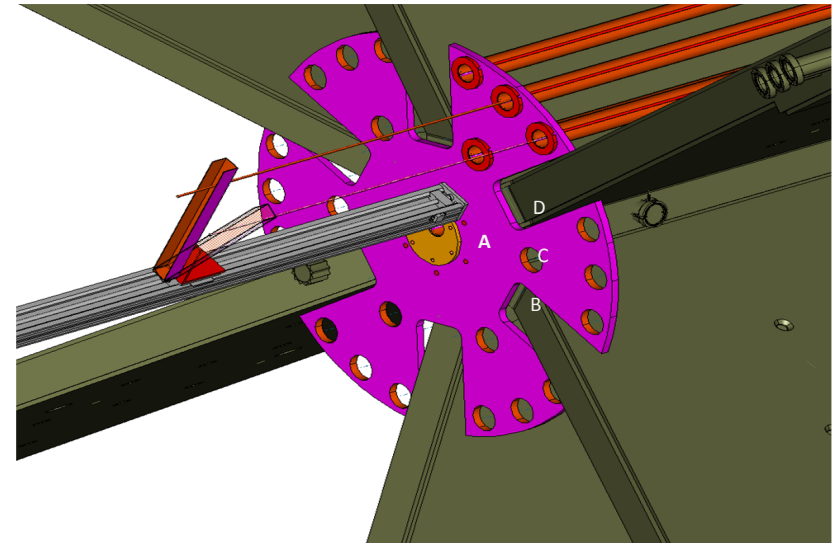
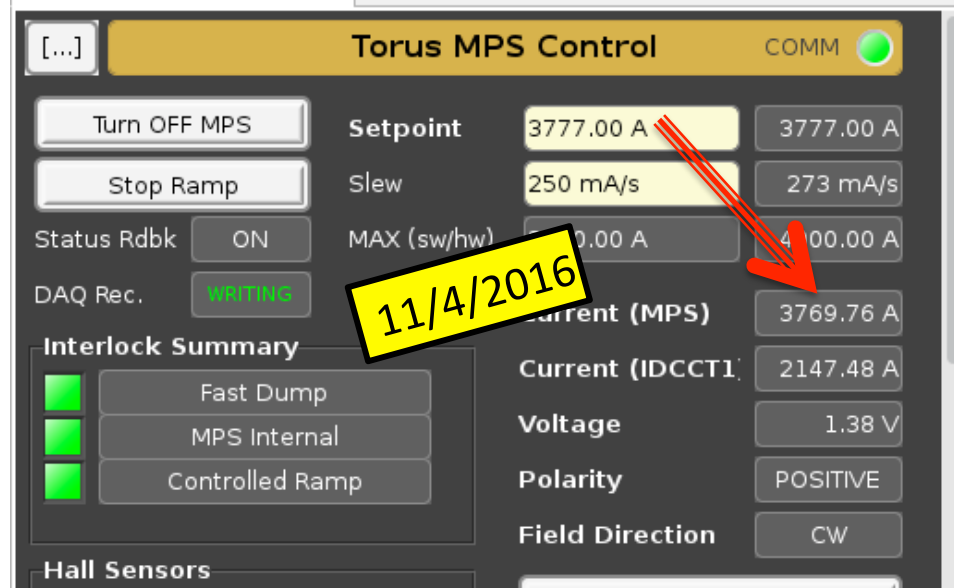
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Jefferson Lab

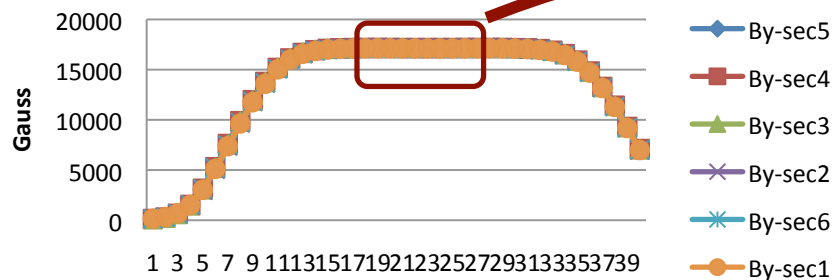
CLAS12 Torus magnet operational

HALL B

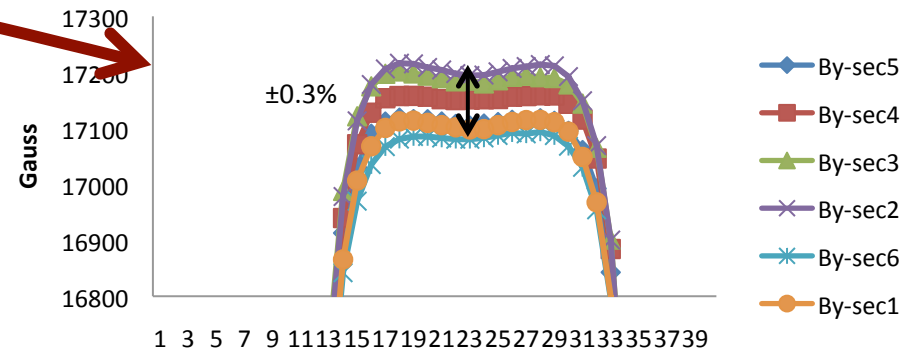
Torus magnet at design current without quench



By (+ 15 deg) - all sectors



By (+ 15 deg) - all sectors



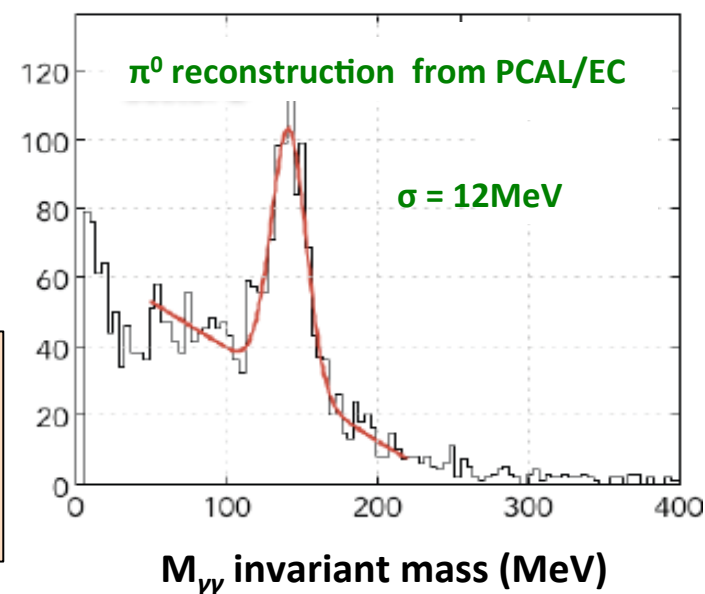
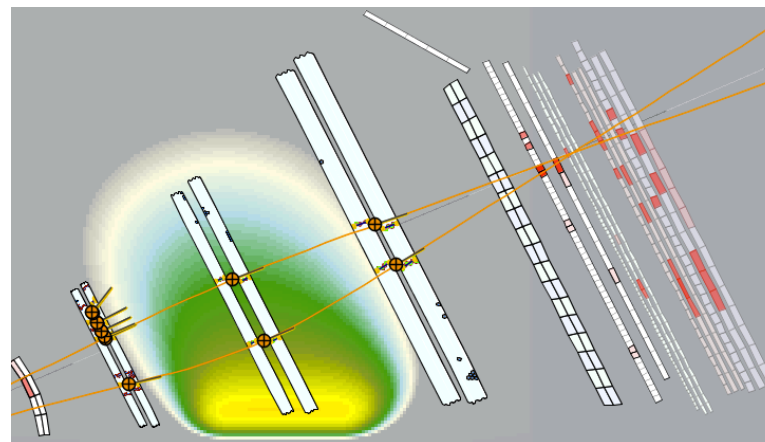
CLAS12 KPP Run Feb 3-5, 2017



- Torus magnet operational
- All base detectors installed and operational in Forward Detector or positioned along the beam line: HTCC, Drift Chambers, FTOF, PCAL, EC SVT, CTOF
- Beam energy 6.4 GeV
- Target: Carbon wire ($\varnothing = 0.5\text{mm}$)
- Luminosity: $2.1 \times 10^{33} \text{cm}^{-2}\text{s}^{-1}$ (no magnetic shield)
- DAQ rate: 5KHz, 200MB/s, 93% L.T.

Results of KPP run were obtained in two days and approved by DOE, which completed a major project milestone

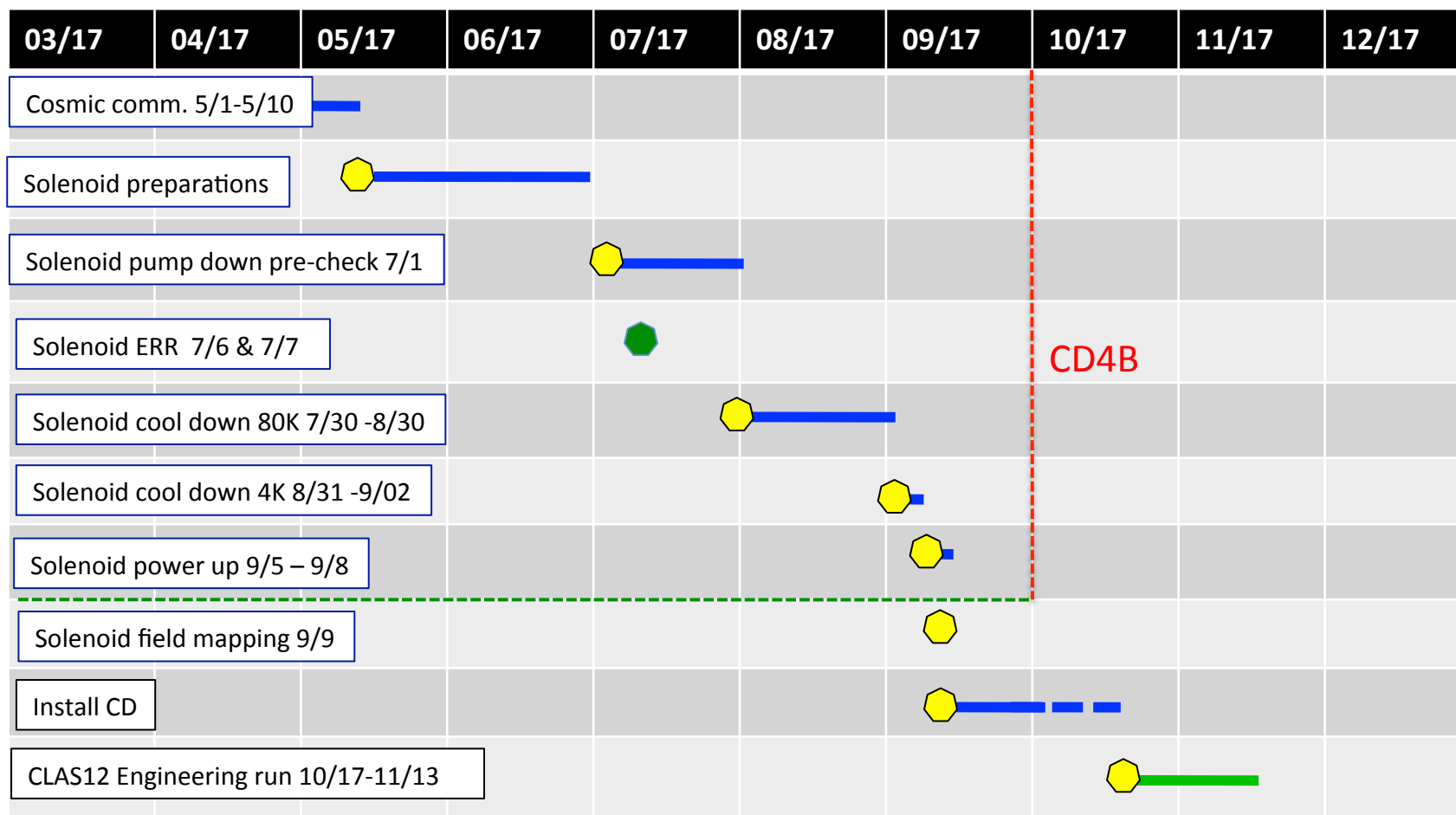
Quasi online event display (one sector)

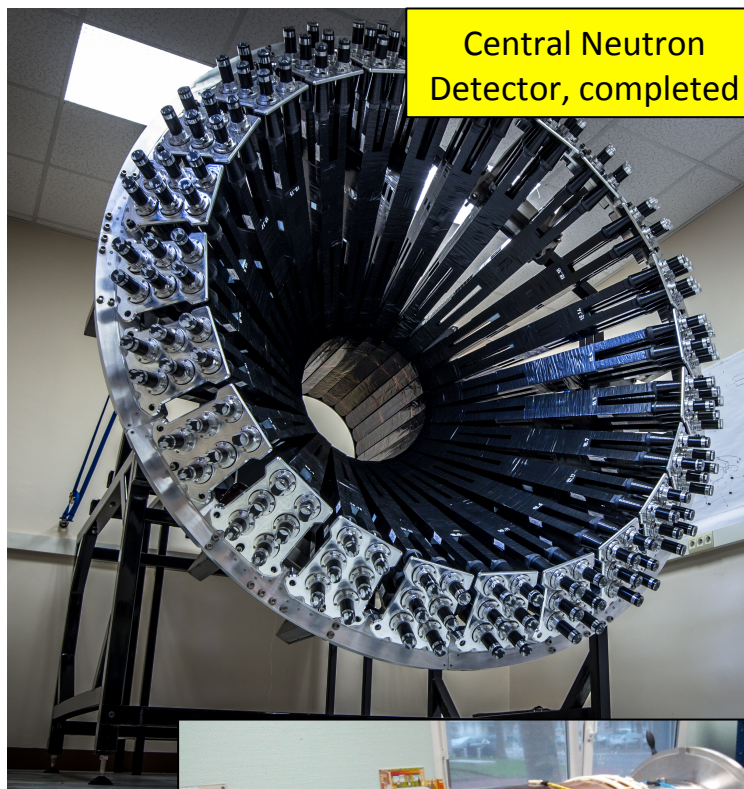


Solenoid – before closing the cryostat

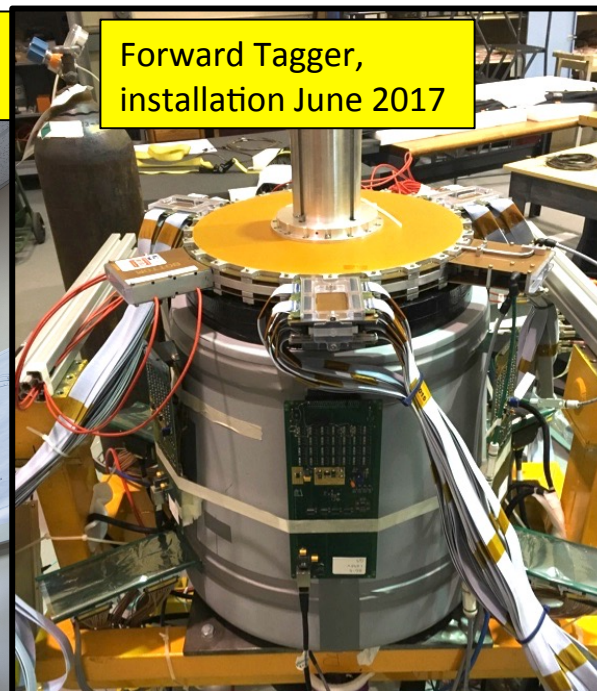


2017 Timeline Installation & commissioning





Central Neutron Detector, completed



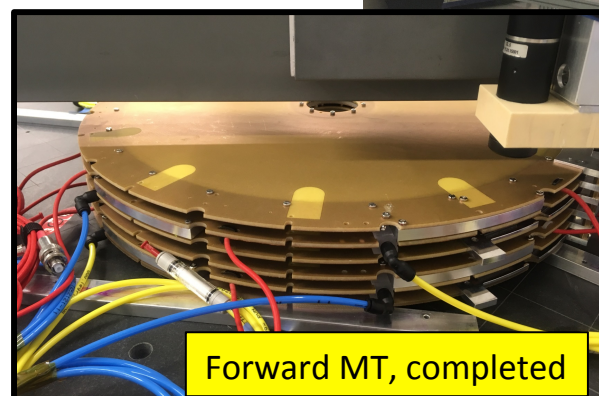
Forward Tagger, installation June 2017



RICH detector, under construction



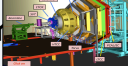


Barrel MT, shipment to JLab, May 2017



Forward MT, completed

Possible RG Schedule (straw man)

Run Group	Days	2016	2017	2018	2019	2020	2021	2022	Remain
All Run Groups	1036#)	30	15	95	105	105	105	105	456
HPS 	180*	15		35	10	10	10	10	90
PRad 	15*	15							0
CLAS12 Comm 			3 15						0
RG-A + RG-K (proton)	239*		10	20/15 25		35	20		114*
RG-B (deuteron)	90*				40				50*
RG-F (BoNuS)	42*				21				21
RG-C (NH ₃)	120				35 25				60
RG-C-b (ND ₃)	65					35			30
RG-E (Hadr.)	60						35		25
RG-H (Transv. Target)	110*						40 20		50
RG-D (CT)	60							40	20
RG-G (LiD)	55							35	20



#) incl. RG-H

Summary

- During Hall B physics operation in 2016 both PRAD and HPS collected sufficient data to have significant scientific impact.
- CLAS12 construction & installation is nearly complete, with the remaining Solenoid magnet expected to be operational in September 2017.
- Successful run in February 2017 lead to DOE approval of Key Performance Parameters for Hall B 12 GeV upgrade.
- Hall B is scheduled to enter into regular operation in the Fall of 2017 after the CLAS12 engineering run, to provide excellent opportunities for science in 2018 and beyond.