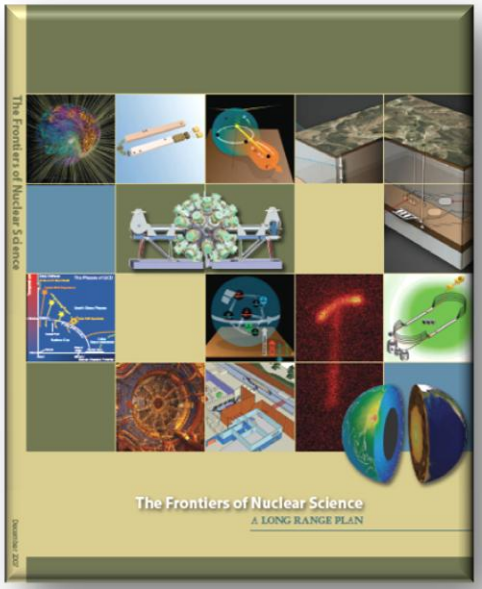
12 GeV Project Overview

Glenn R. Young
Associate Project Manager - Physics

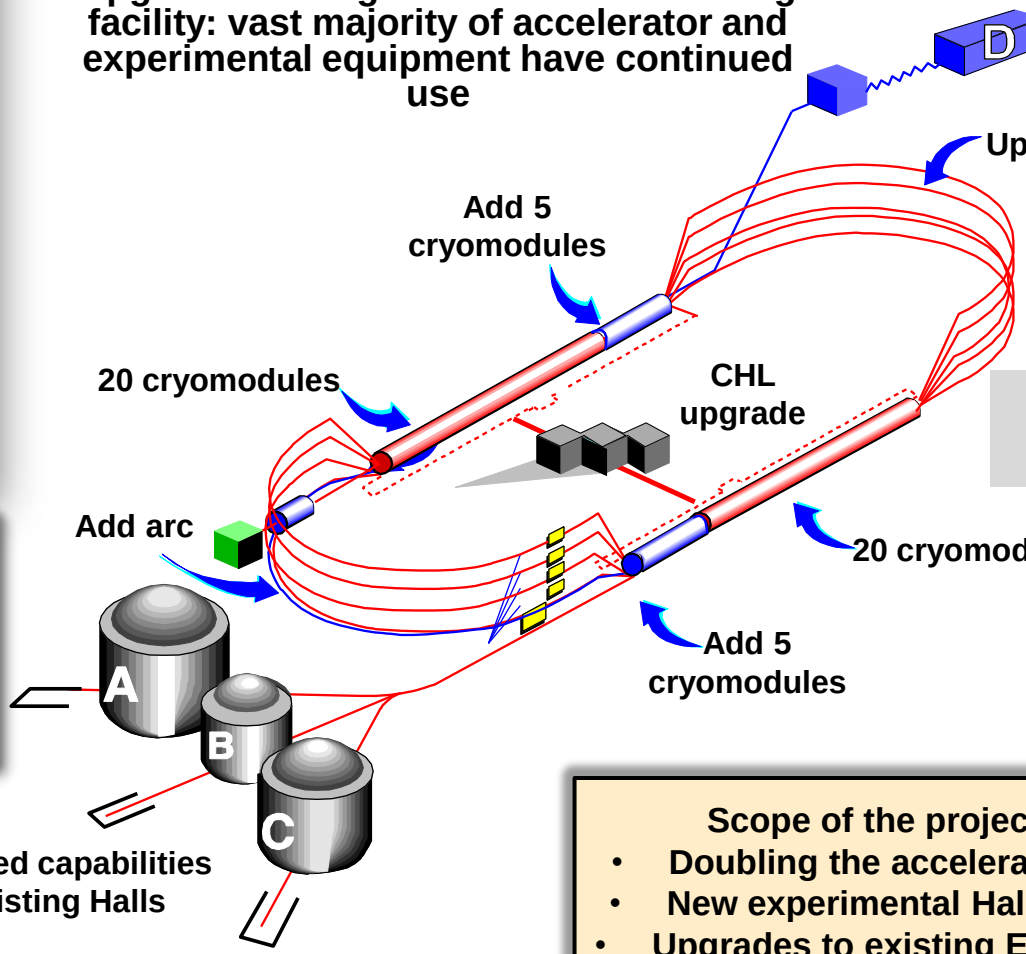
Hall C Summer Workshop
Jefferson Lab
June 22, 2012

12 GeV Upgrade Project



The completion of the 12 GeV Upgrade of CEBAF was ranked the highest priority in the 2007 NSAC Long Range Plan.

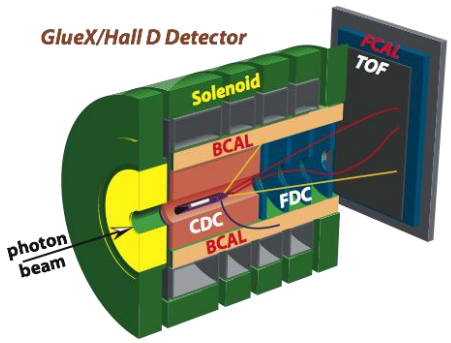
Upgrade is designed to build on existing facility: vast majority of accelerator and experimental equipment have continued use

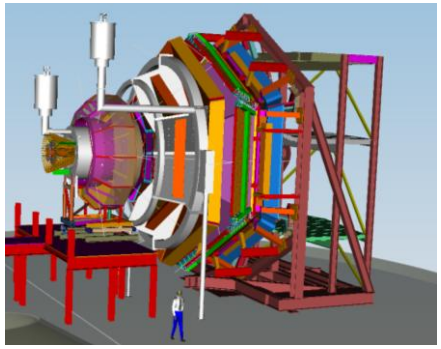


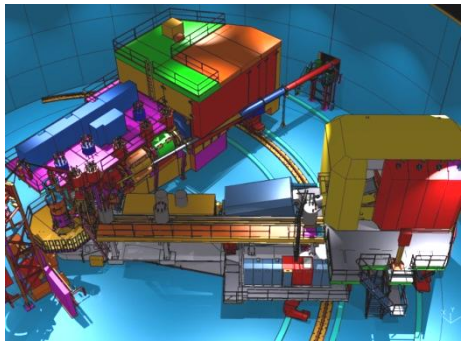
Maintain capability to deliver lower pass beam energies: 2.2, 4.4, 6.6….

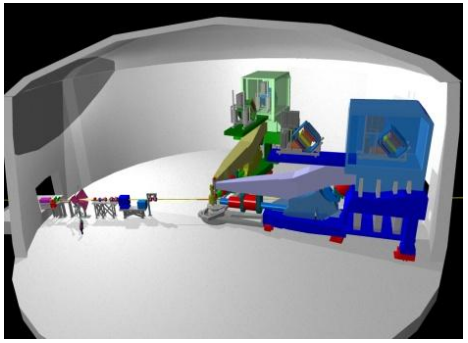
Scope of the project includes:
- **Doubling the accelerator beam energy**
- **New experimental Hall D and beamline**
- **Upgrades to existing Experimental Halls**

Detector Performance Requirements



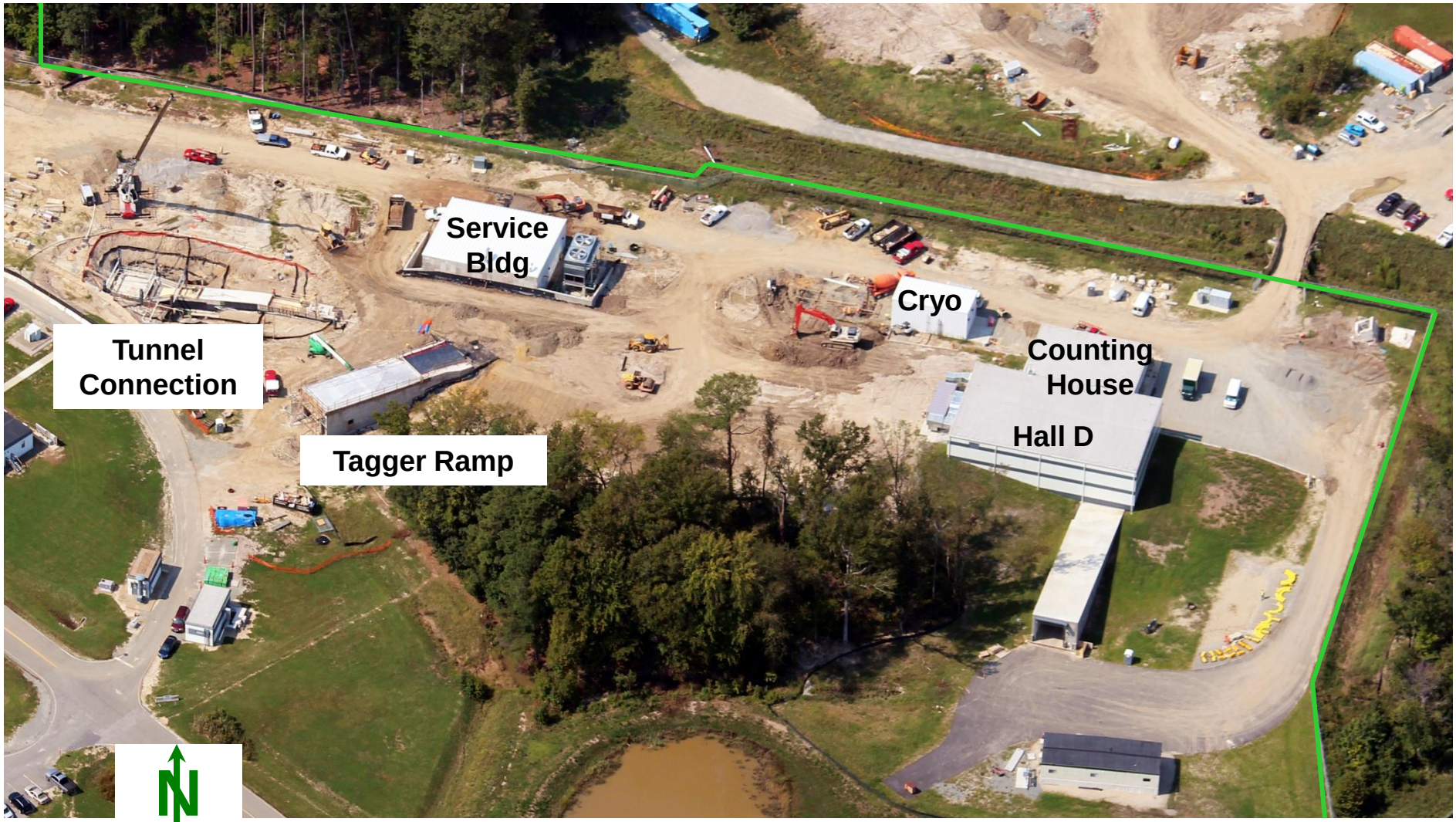






Hall D	Hall B	Hall C	Hall A
excellent hermeticity	luminosity 10^{35}	energy reach	installation space
polarized photons	hermeticity	precision	
E_γ~8.5-9 GeV	11 GeV beamline		
10^8 photons/s	target flexibility		
good momentum/angle resolution		excellent momentum resolution	
high multiplicity reconstruction		luminosity up to 10^{38}	
particle ID			

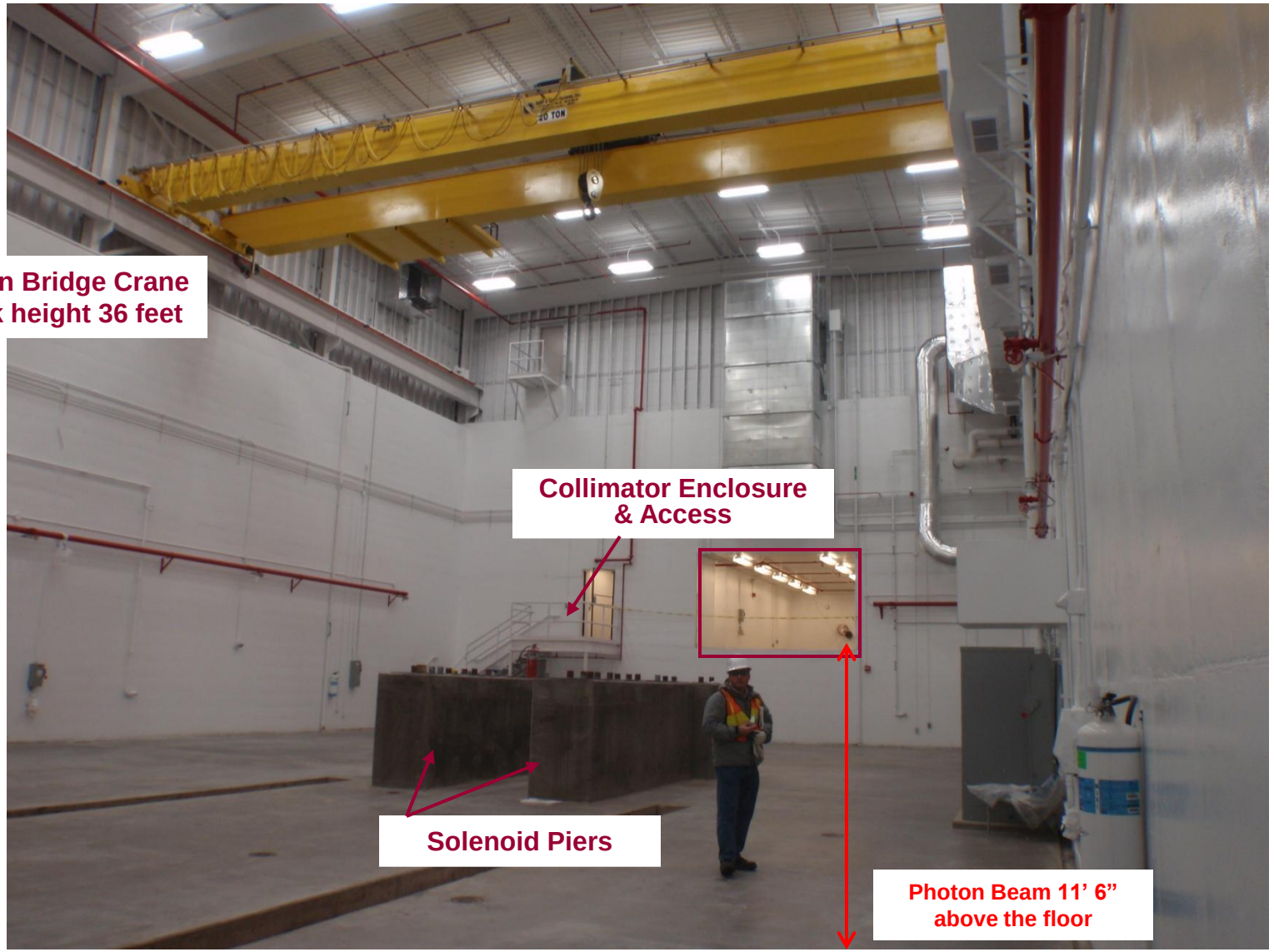
Hall D Aerial, September 2011



Civil Construction: Hall D Complex 2009-2010

Hall D Target Hall Complete

Hall D: Ready for Equipment 28 Dec 2010



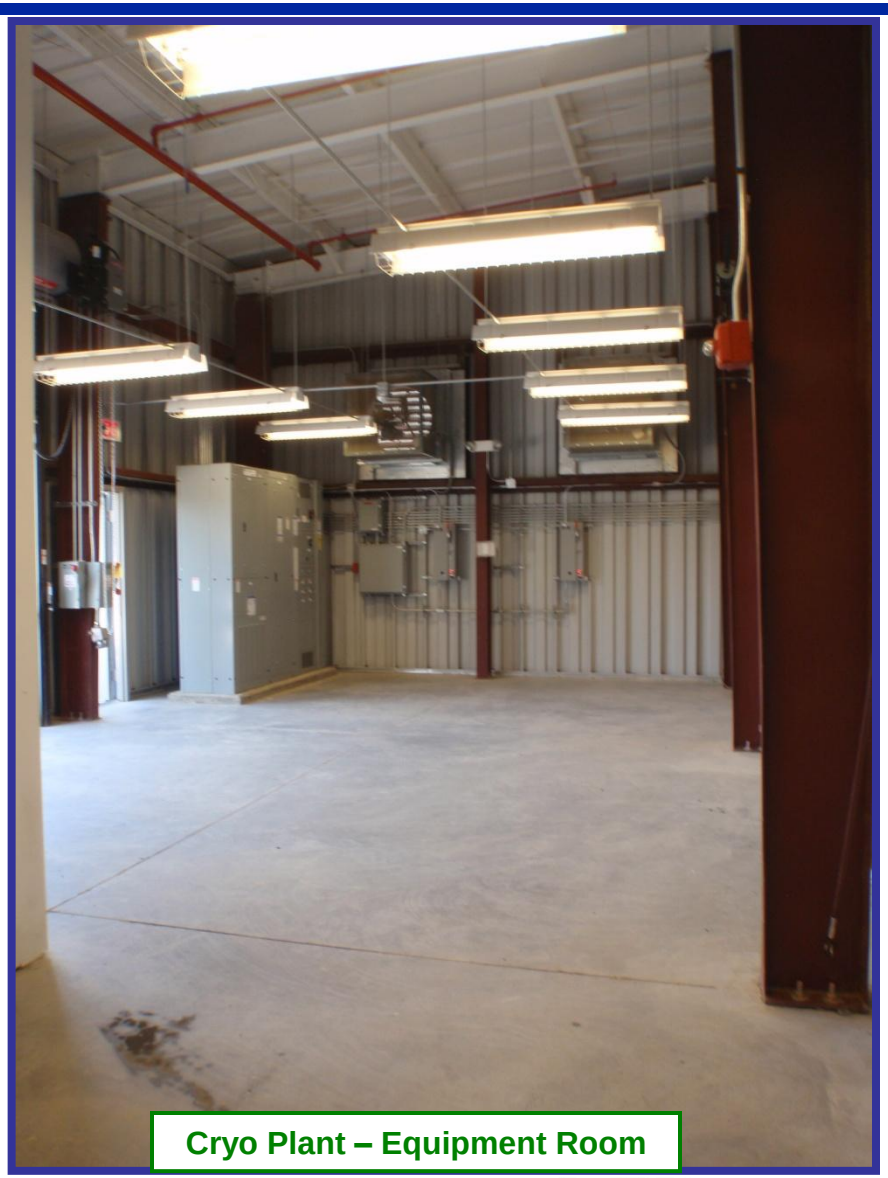
Hall D: Tagger Building

Hall D: Counting House

Main Entrance

Hall D: Cryo Plant Building

Cryo Plant – RFE 30 Sep 2011



Cryo Plant – Equipment Room

Hall D: Service Building

Service Bldg – Mechanical Room

Service Bldg – Electrical

Hall D: Tunnel Connection

Cryomodules: View of the Test Lab May 31, 2012

Moving equipment from Test Lab

C100-08 – staged for assembly

C100-09 & -10 temporarily stored 'out-of-the-way' in the (decommissioned) clean room.

Cryomodule Installation: Coming down the tunnel

Two Cryomodules Installed

2010

Oct, 2011

Cryogenics – CHL Doubling

Connection to linacs in late Spring '13

Upper coldbox being erected

CHL2 Coldbox Deliveries (100+ tons)

Lower coldbox in CHL2 building

Hall D refrigerator is being installed.
On track for cool-down of solenoid in November 2012

Arc Dipole Rework (summer 2011)

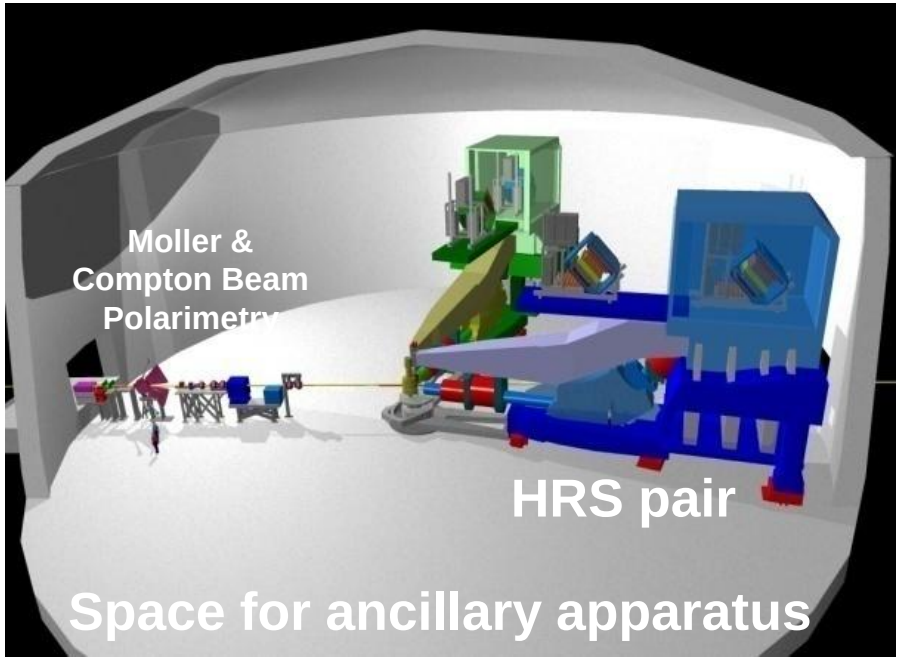
Arc Dipole Refurbishment

West Arc Refurbished Dipoles & Arc 10 Installation

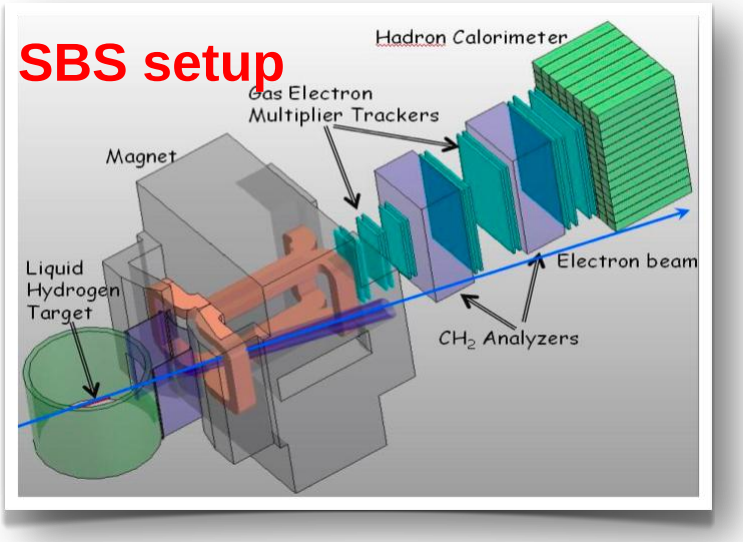
West Spreader: May 18, 2012

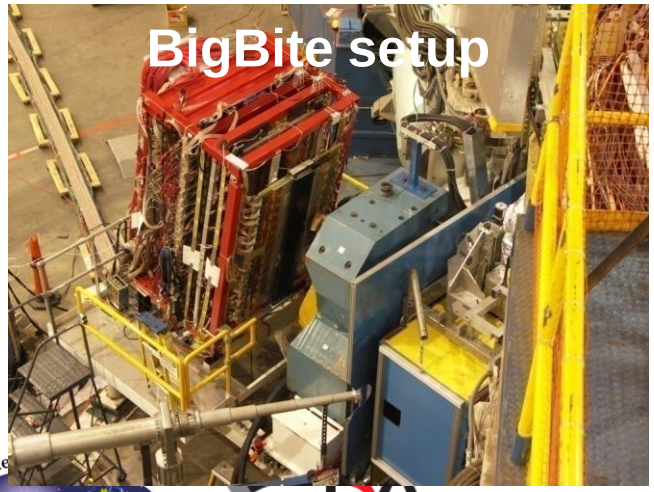
West Spreader: June 13, 2012

Hall A Equipment



Maintain HRS spectrometer pair
Physics adds SBS spectrometer
(similar to BigBite spectrometer)





Future Large Installations

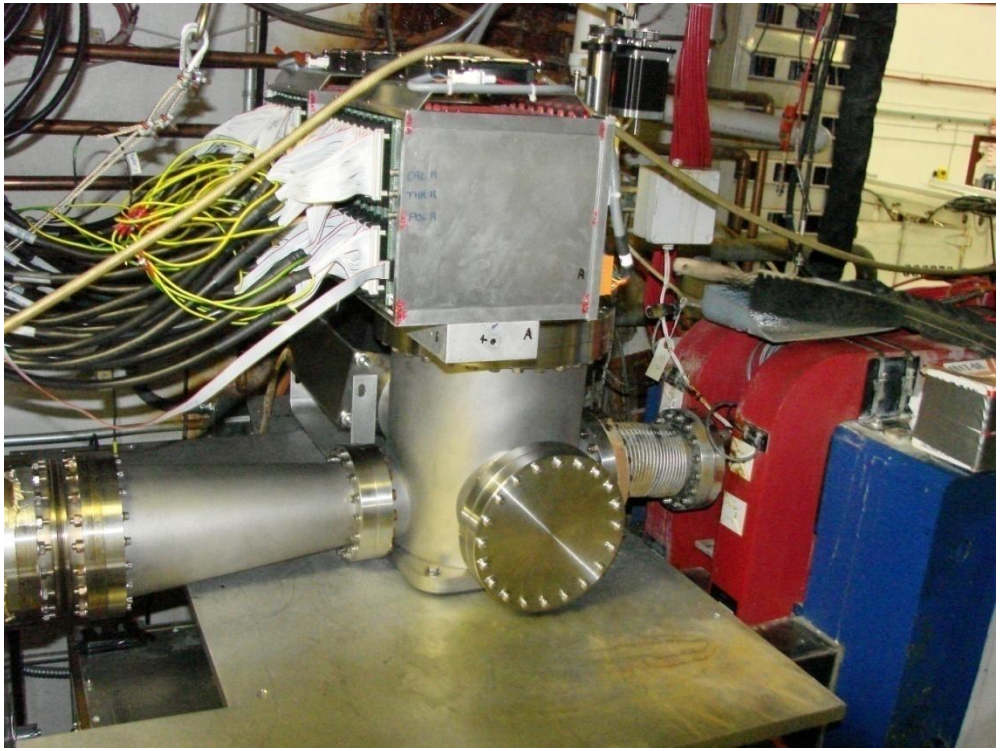
Moller

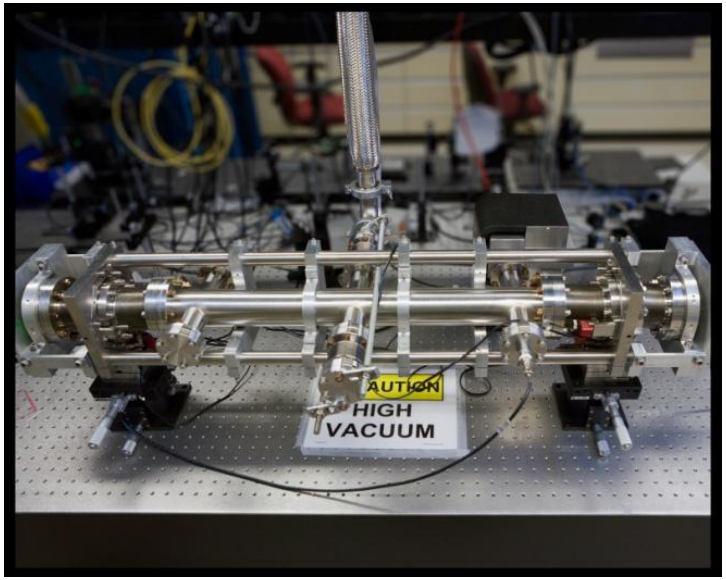
Parity Violating e-e scattering
Precise standard model test

SOLID

Parity Violating e-quark scattering
High precision TMD studies

Hall A Compton Polarimeter Electron Detector: Installed, Commissioning underway





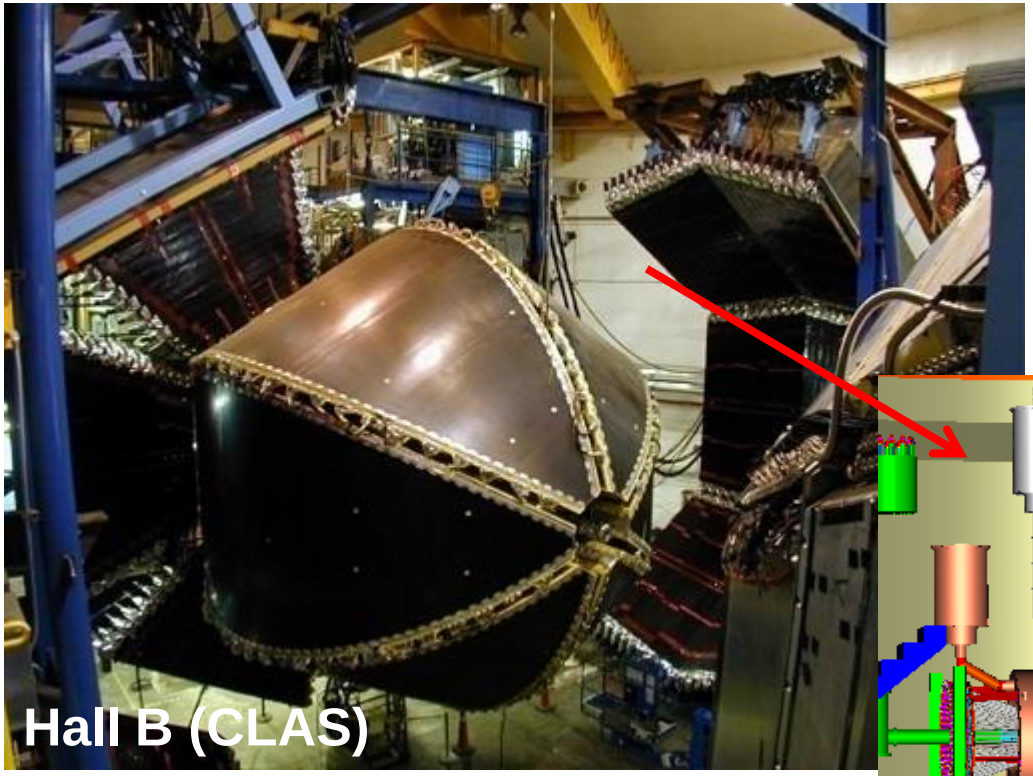
Optical Cavity with green laser developed

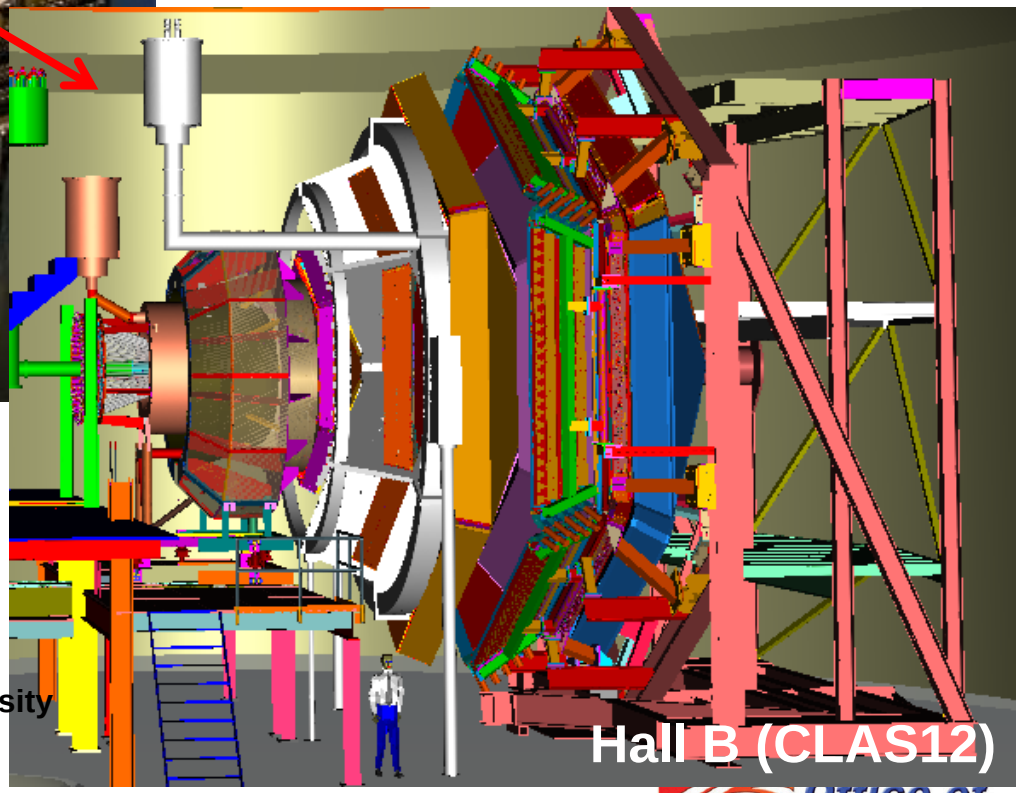
Hall A Beamline Change

Add another Møller Quadrupole

Adjust Compton and Møller polarimeters for 11 GeV operation

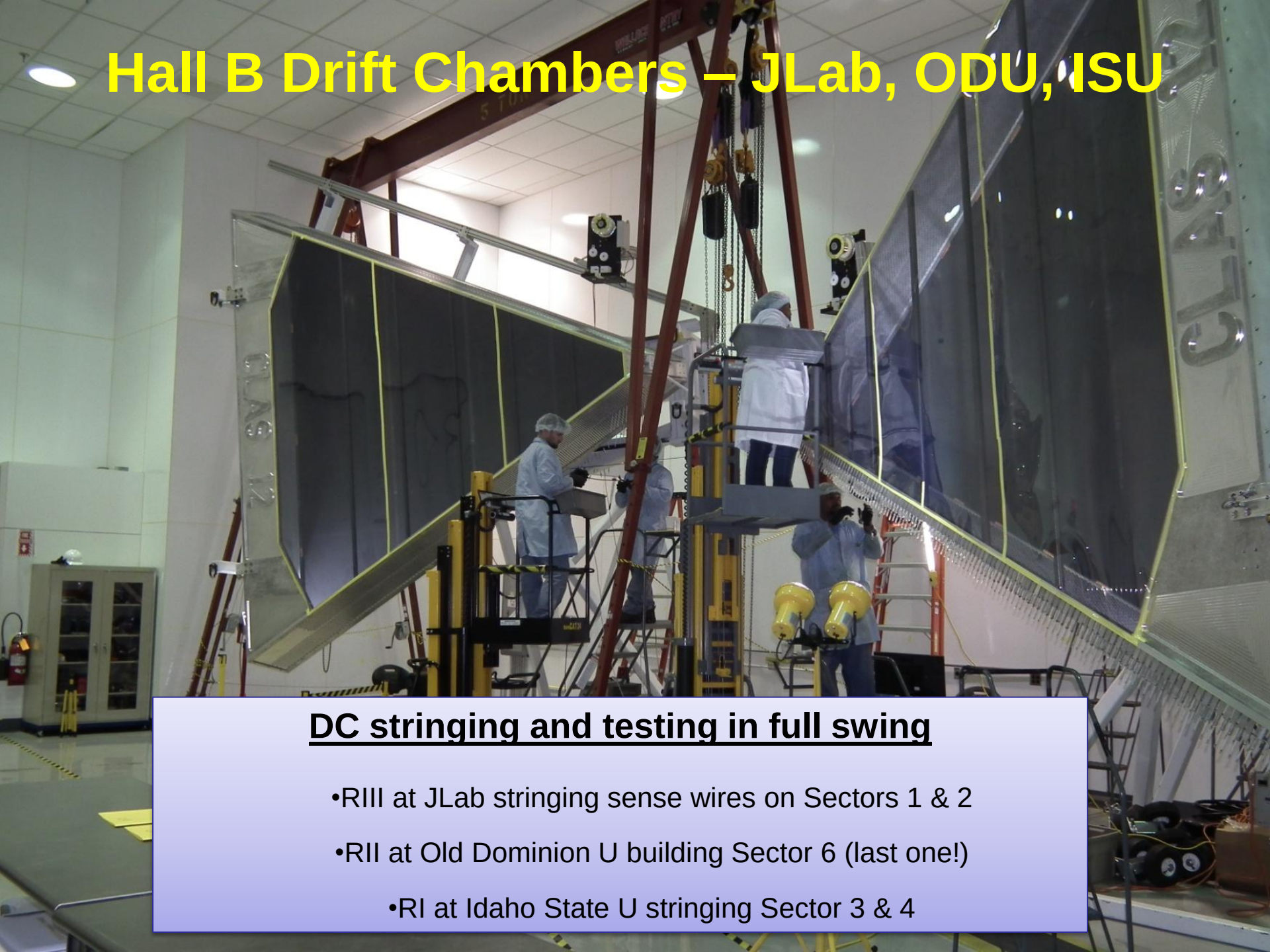
Hall B Equipment





- **Key Features:**
  - 1 torus & 1 solenoid magnet
  - new detectors: Cerenkovs, calorimeters, drift chambers, silicon vertex tracker
  - -- re-use some existing detectors
  - hermetic device, low beam current, high luminosity

Hall B Drift Chambers – JLab, ODU, ISU

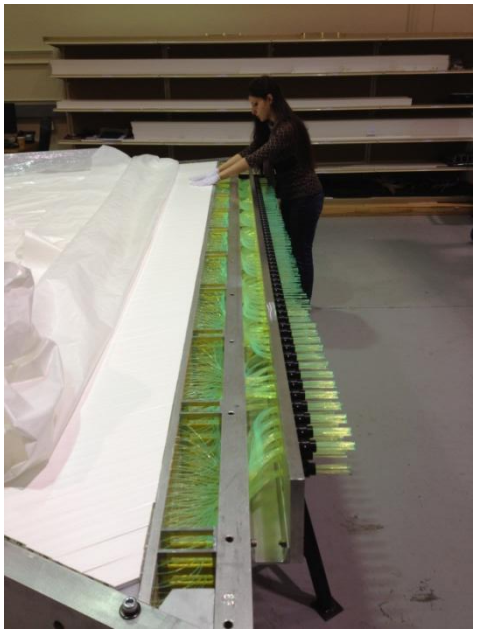


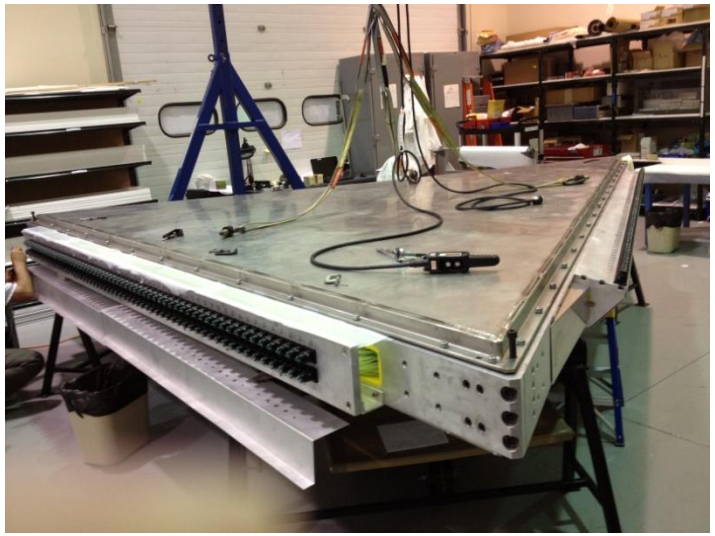
DC stringing and testing in full swing

- RIII at JLab stringing sense wires on Sectors 1 & 2
- RII at Old Dominion U building Sector 6 (last one!)
- RI at Idaho State U stringing Sector 3 & 4

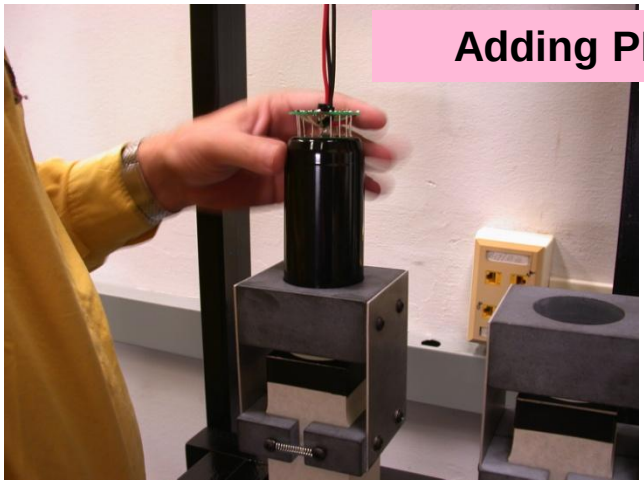
Hall B Preshower Calorimeter

- Lead, scintillator bar & wavelength-shifting fiber complete for Sector 3
  - PMTs being added
  - Sector 4 is underway



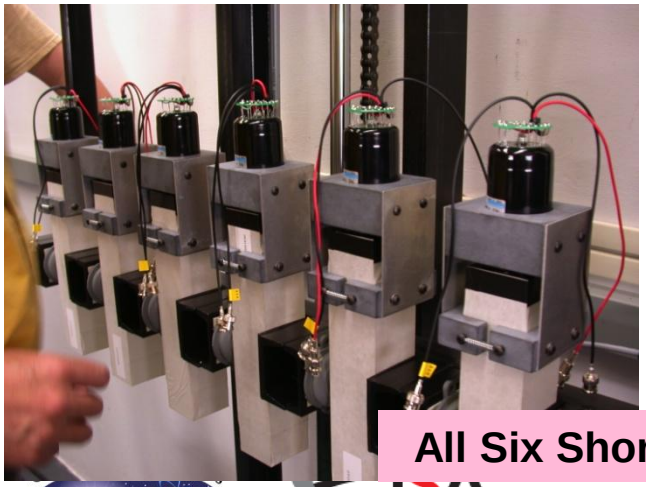


Hall B FTOF-1b Assembly at U South Carolina



Adding PMTs

Mounting on “Windmill”

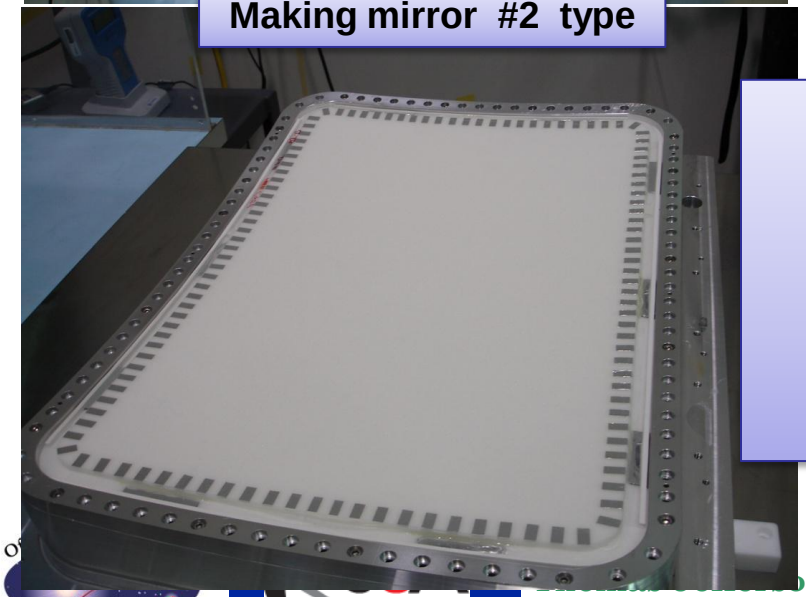


All Six Short Bars

Scintillator Wrapping

Hall B High Threshold Cerenkov Counter

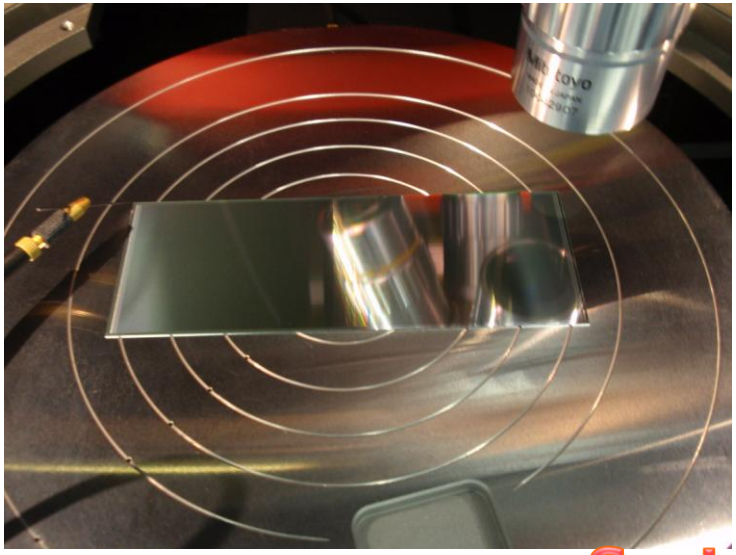
Making mirror #2 type



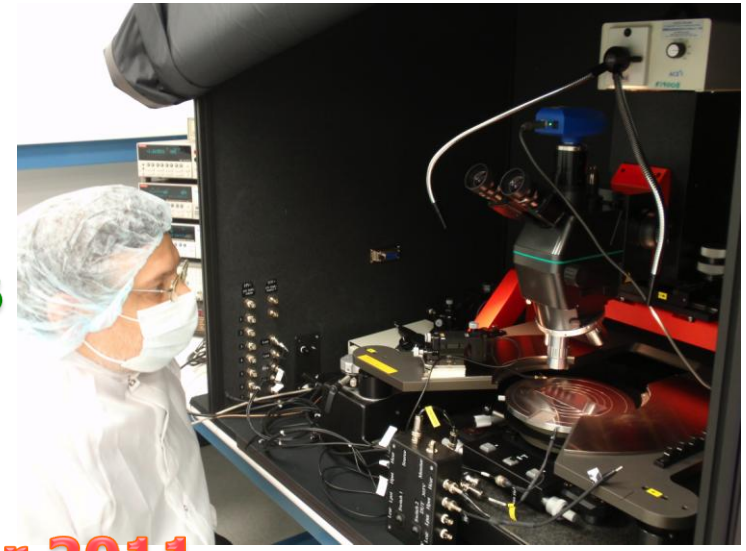
Making mirror #4 type

1. All 12 mirror #3 substrates complete
2. All 12 mirror #4 substrates complete
3. All 12 mirror # 2 substrates complete
4. Tooling for mirror # 1 complete
5. All mirrors to be completed by Sept 2012
6. Coated sample mirrors end of June 2012

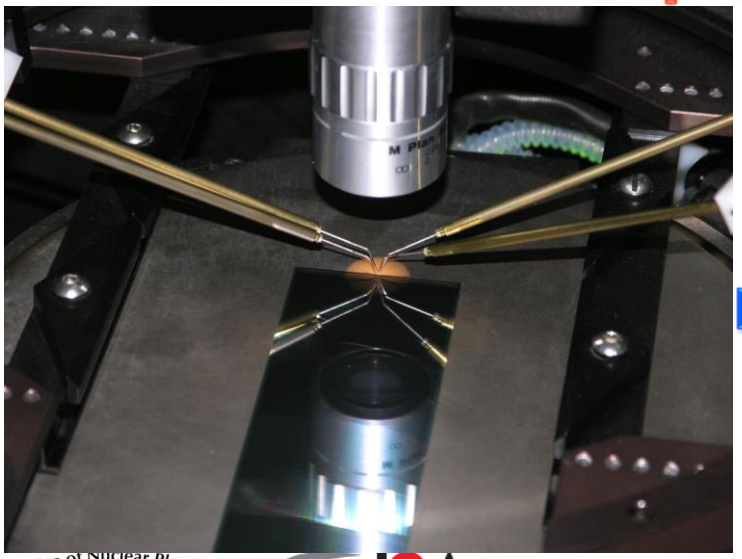
Hall B Silicon Vertex Tracker: Sensor testing



JLAB



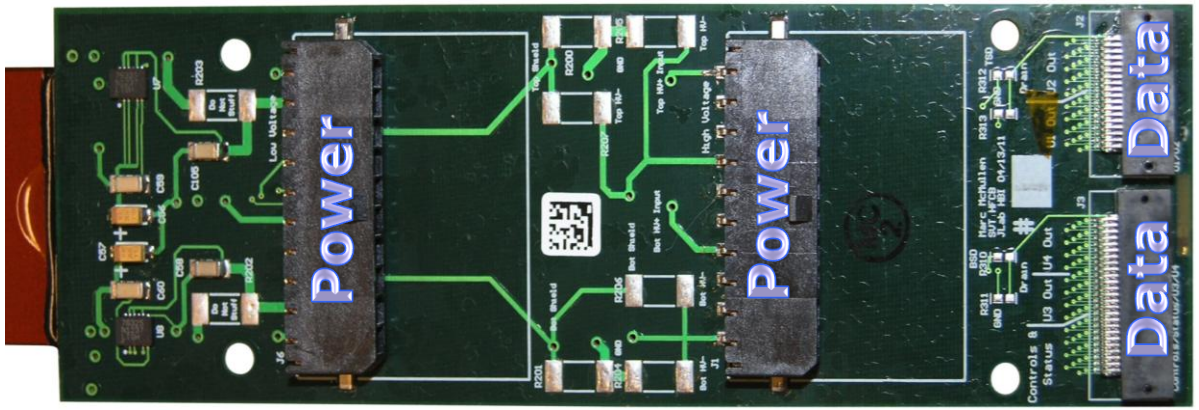
September 2011

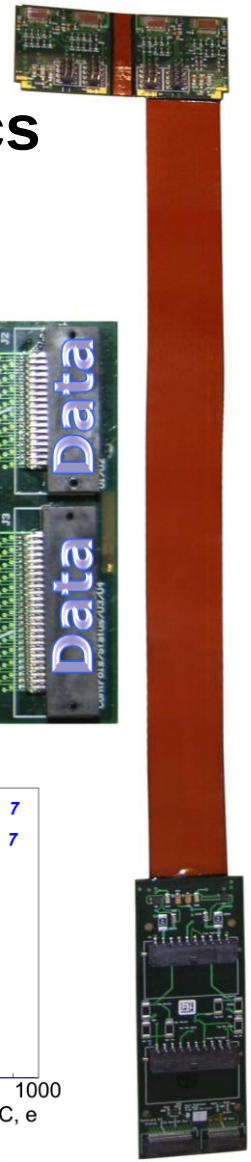


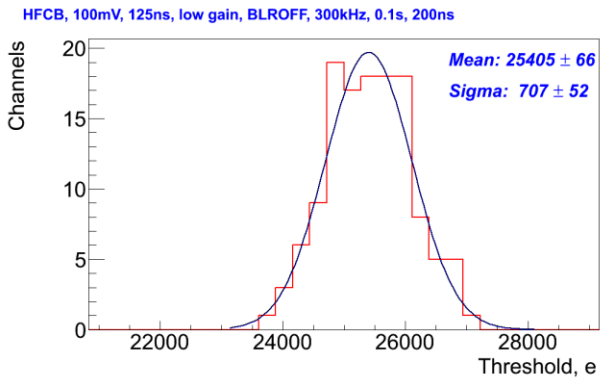
FNAL

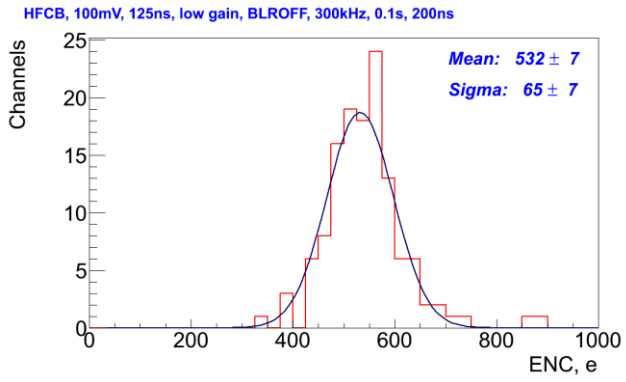
Hall B SVT : Flex Cable

- **Hybrid Flex Circuit Board (HFCB)**
  - **Test versions meeting noise and data-rate specs**

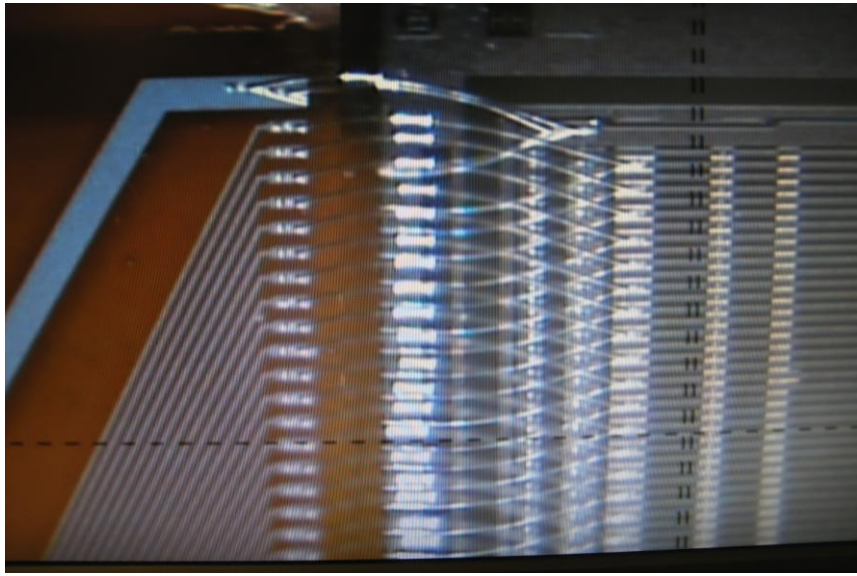


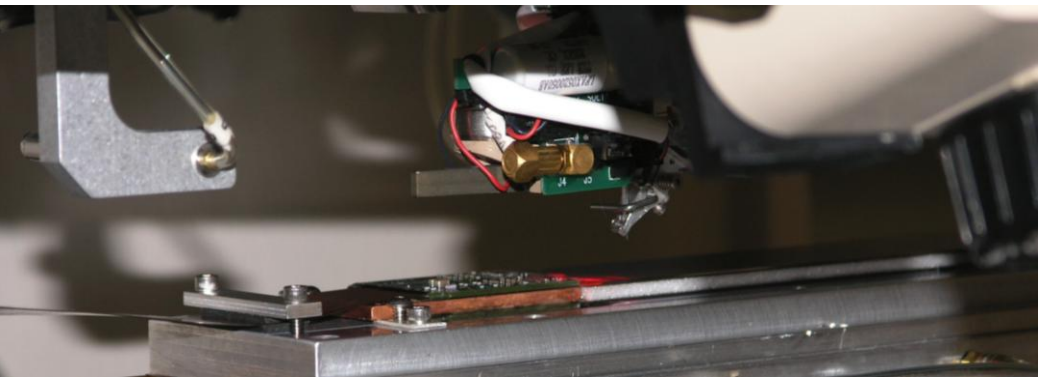


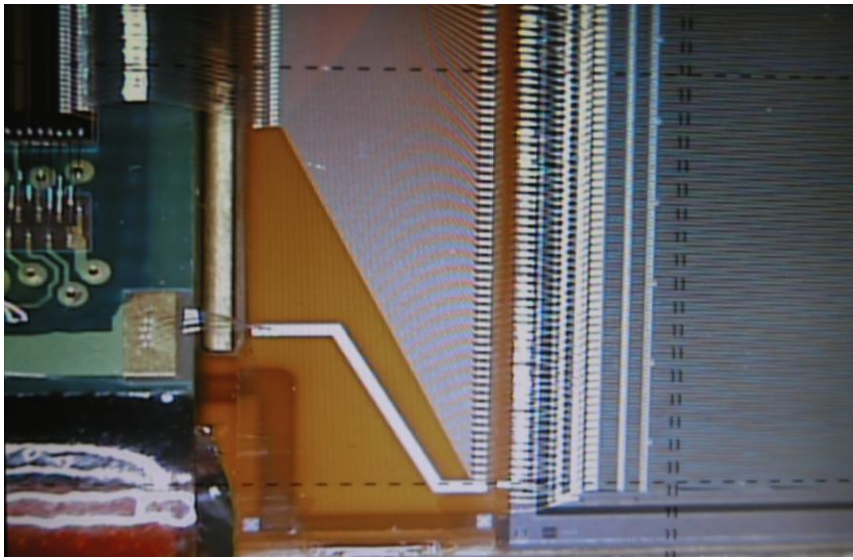




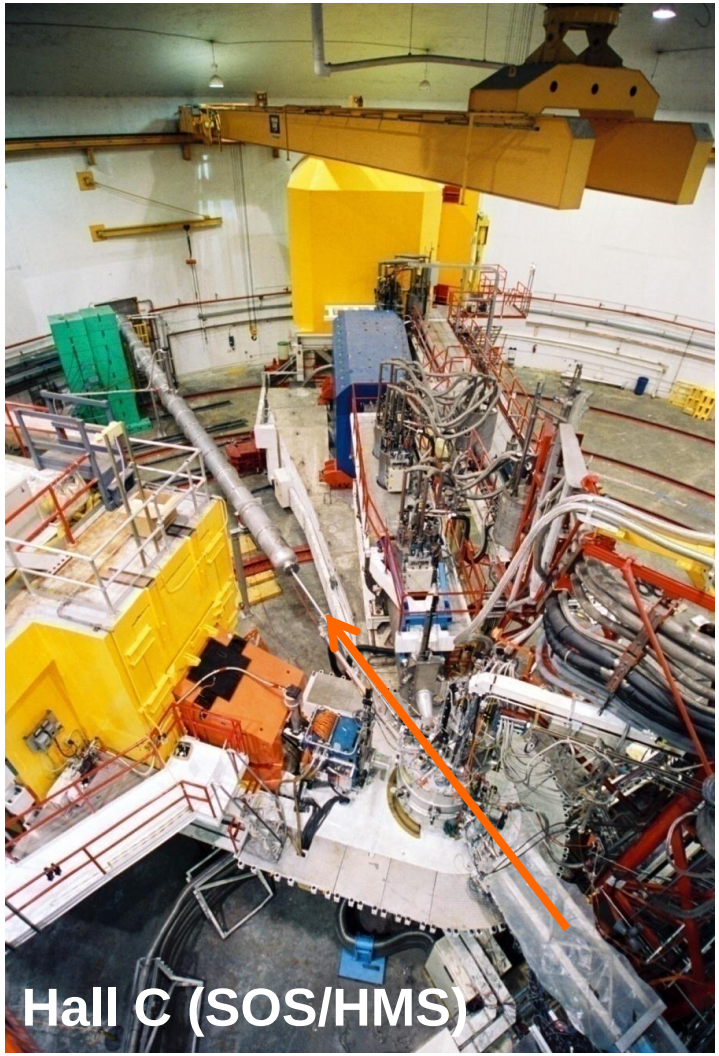
Hall B SVT: Wire-bonding at FNAL SiDet Lab



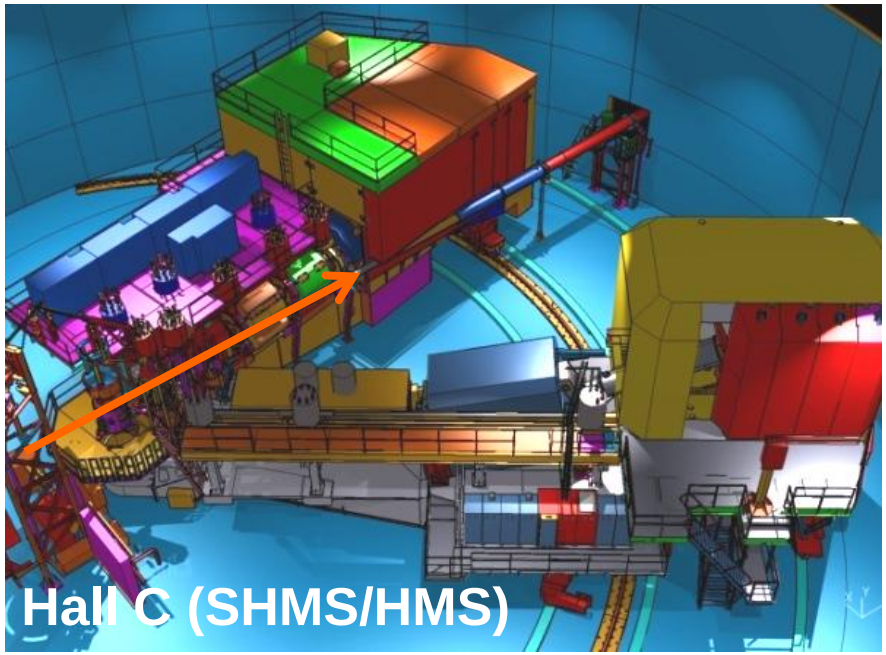




Hall C Equipment

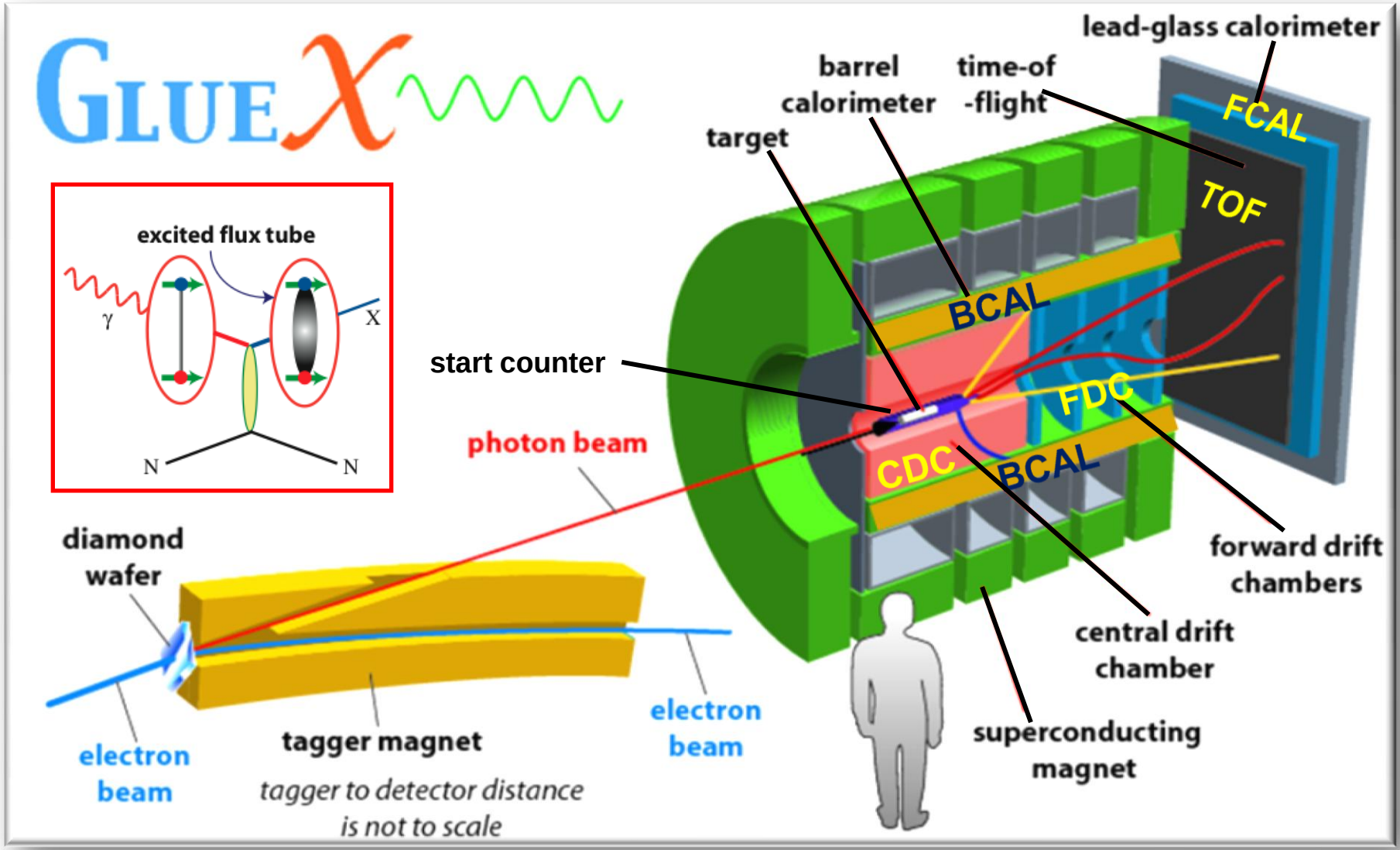


Maintain HMS spectrometer
Remove SOS spectrometer
Add SHMS spectrometer



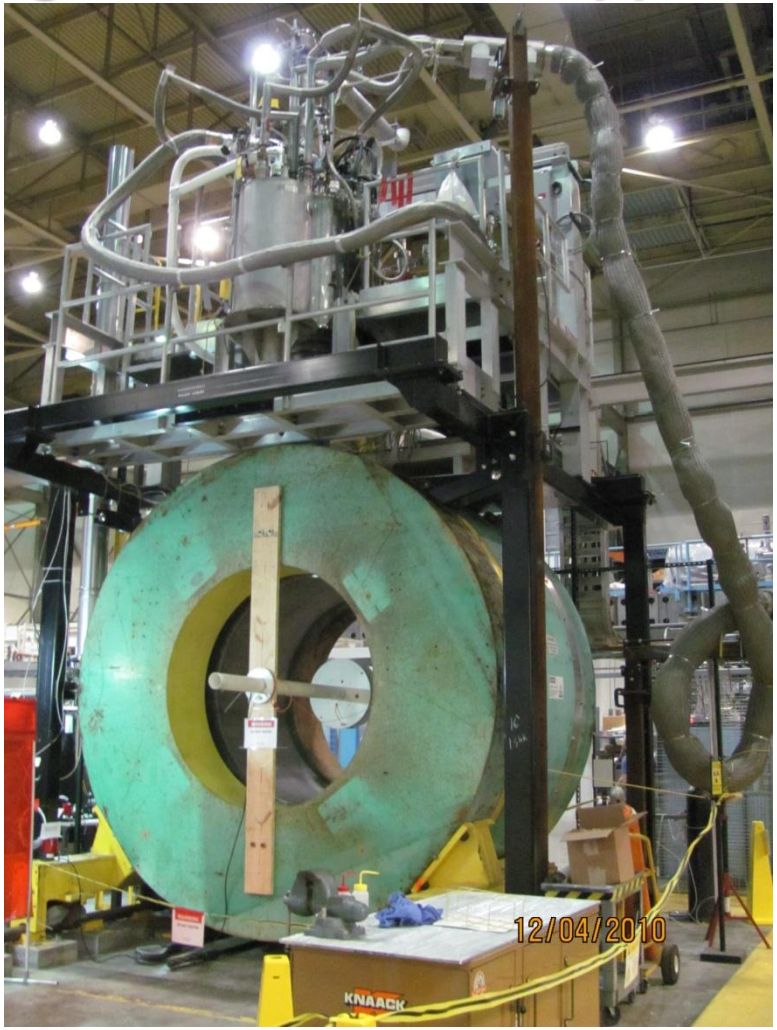
- **Key Features:**
  - 3 quadrupole & 1 dipole & 1 horizontal bend magnet
  - new 6 element detector package
  - complementary to existing spectrometer (HMS)
  - rigid support structure
  - well-shielded detector enclosure

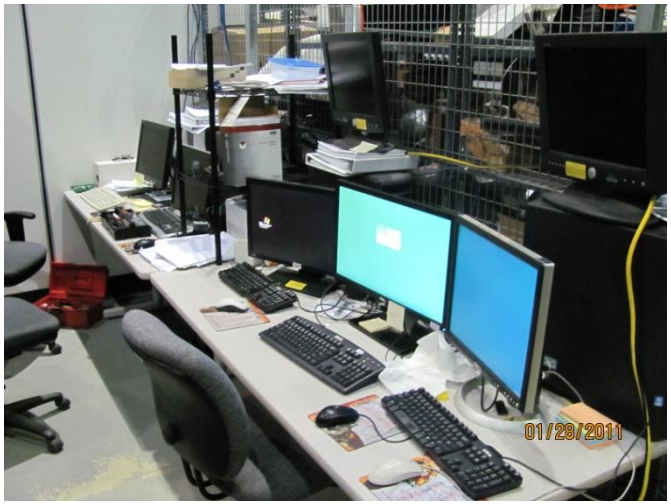
New Hall D – Photon Beam



Hall D Solenoid Test – Success!

Magnet test stand, support equipment, and control consoles



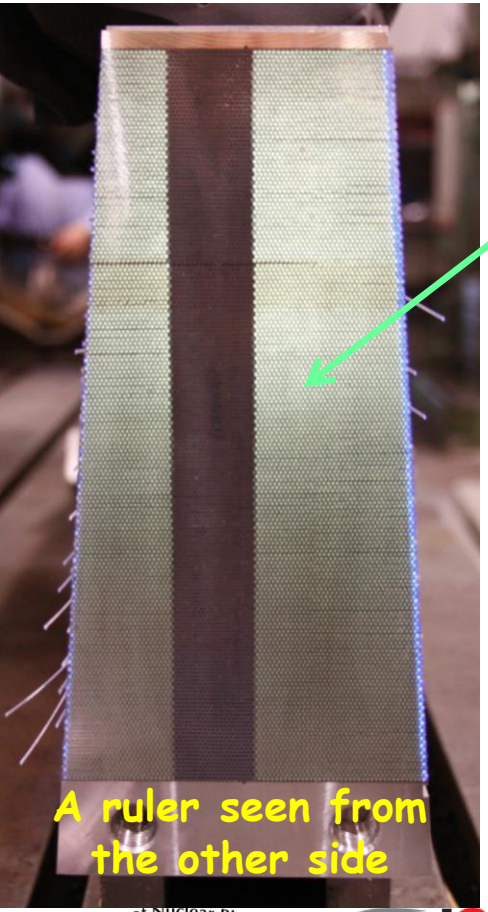


Solenoid Move to Hall D

Coils and yokes moving into Hall D

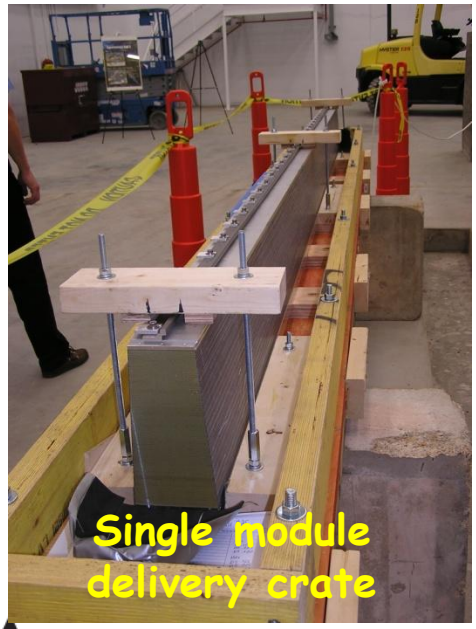
Hall D BCAL Modules: University of Regina

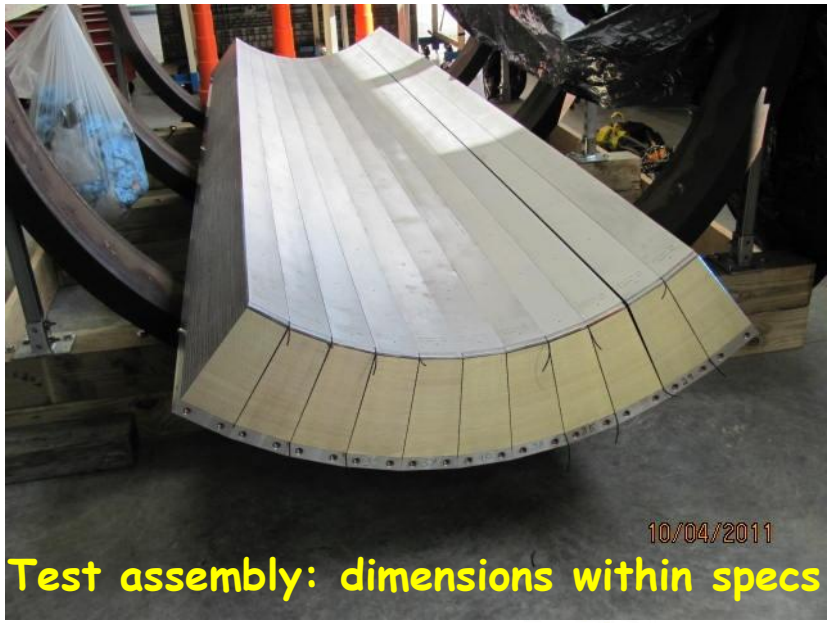
- All 48 modules delivered to JLab



QA at Regina

- Scintillating fibers characterization
- Module dimensions
- Visual quality of the matrix

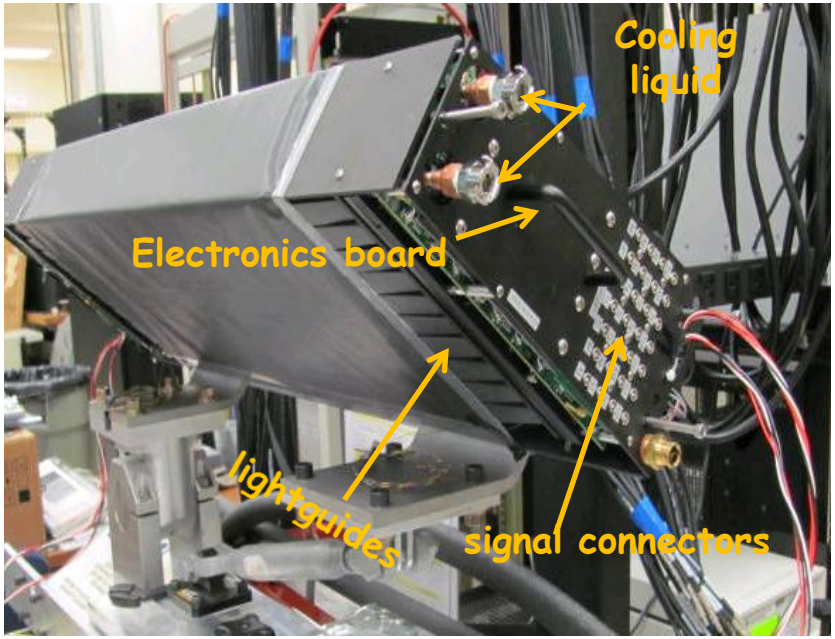




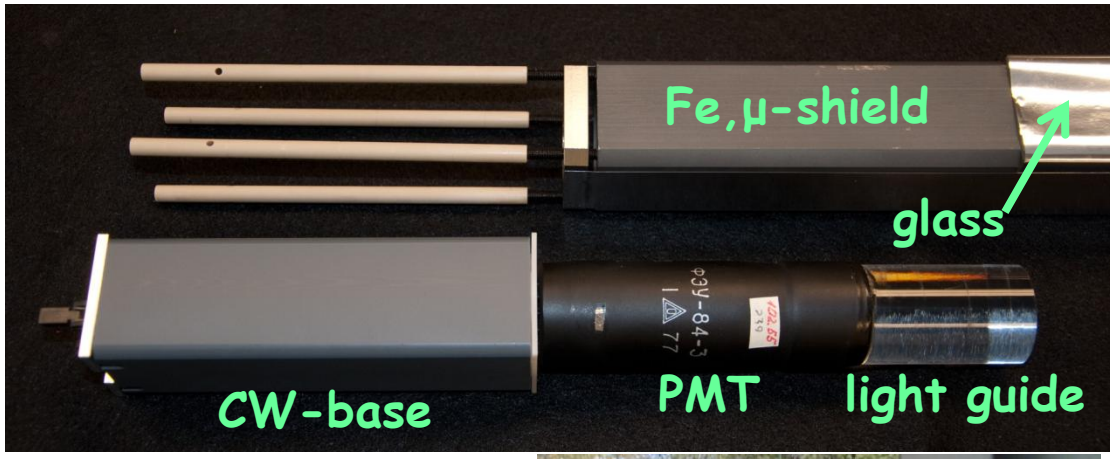
“mini”BCAL – successful test!

- mini-BCAL tests in Hall B were successful

- Light guides delivery: July-October, gluing in parallel
  - SiPM production testing started at Jlab and USM:
    >half-way at Jlab; first 400 shipped from USM 5/24



Hall D FCAL Leadglass Calorimeter



IU: loading crates with LG modules

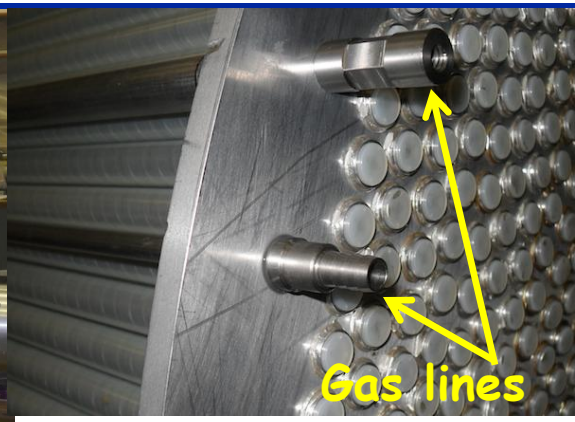
FCAL Progress

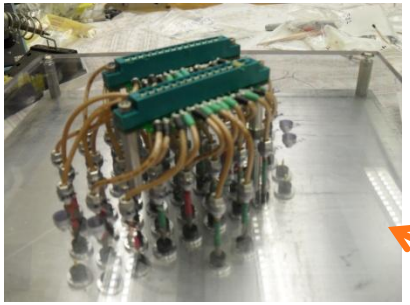
- All glass & mechanical parts delivered to JLab
- Lightguides glued to the PMTs
- Stacking of 2800 modules 8/2012-7/2013

Central Drift Chamber at Carnegie Mellon U

- Class-10000 cleanroom
- 3500 straws
- One aluminum, one carbon fiber endplate

Hall D CDC Construction at CMU



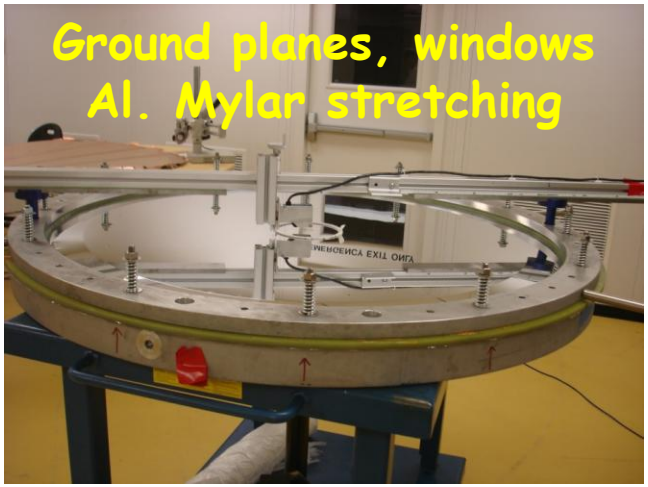


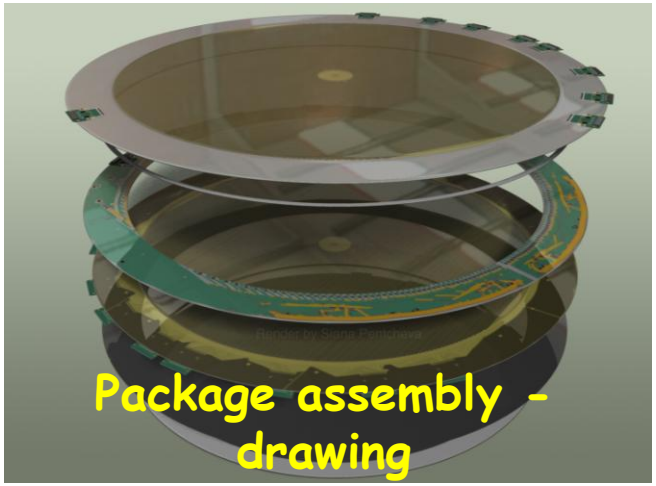
HV and signal connection prototype

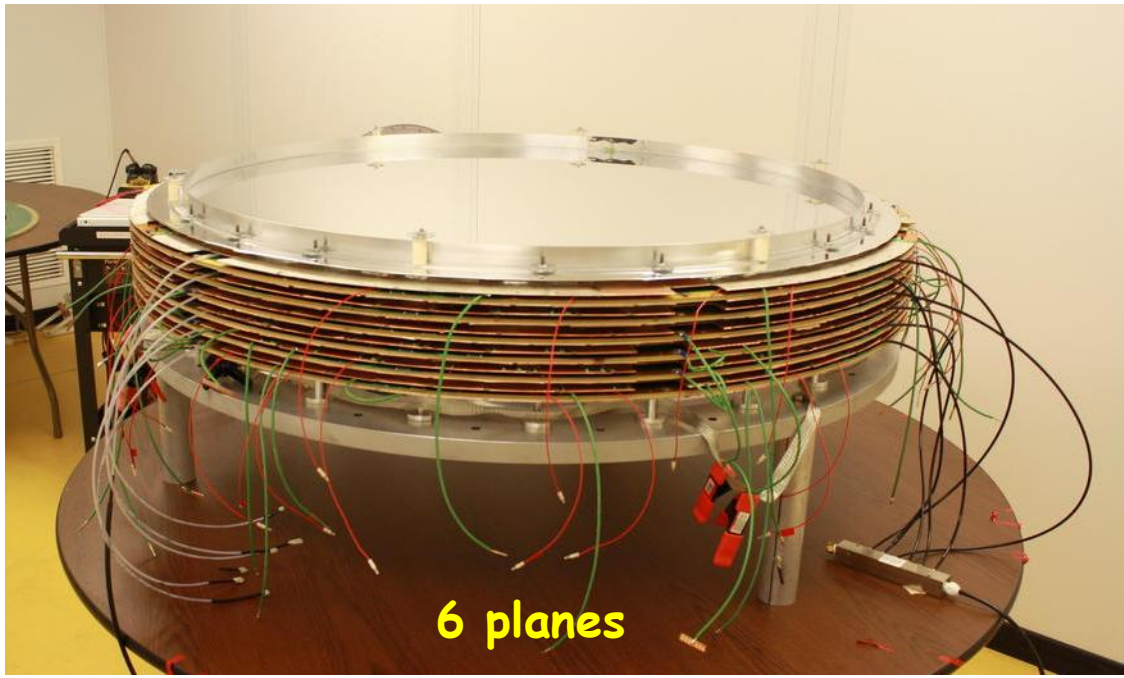
Phase 4 – wire and gas connections

- preparations of parts
- wiring underway

Hall D Forward Drift Chamber

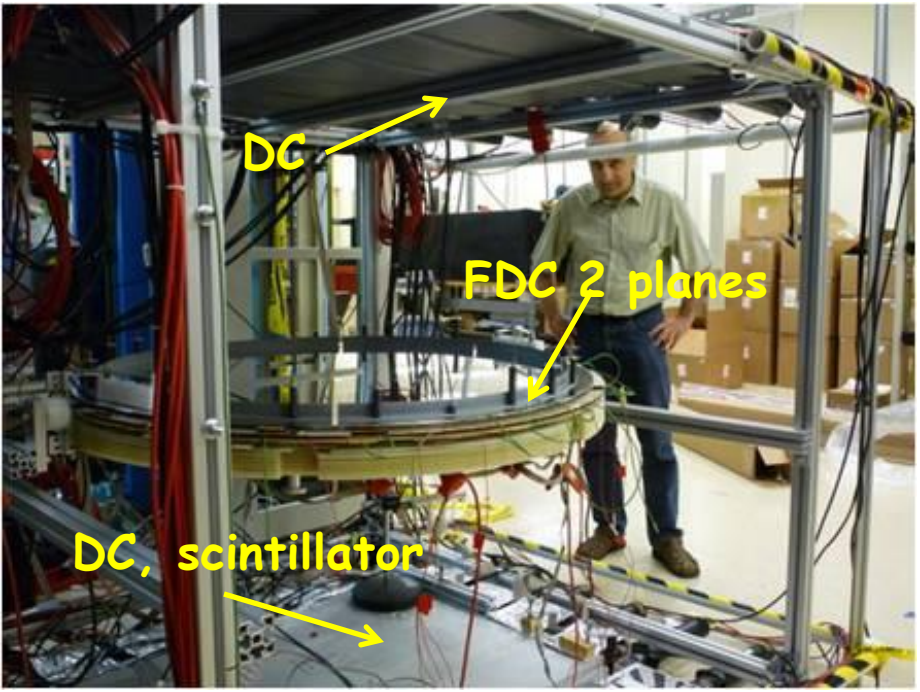


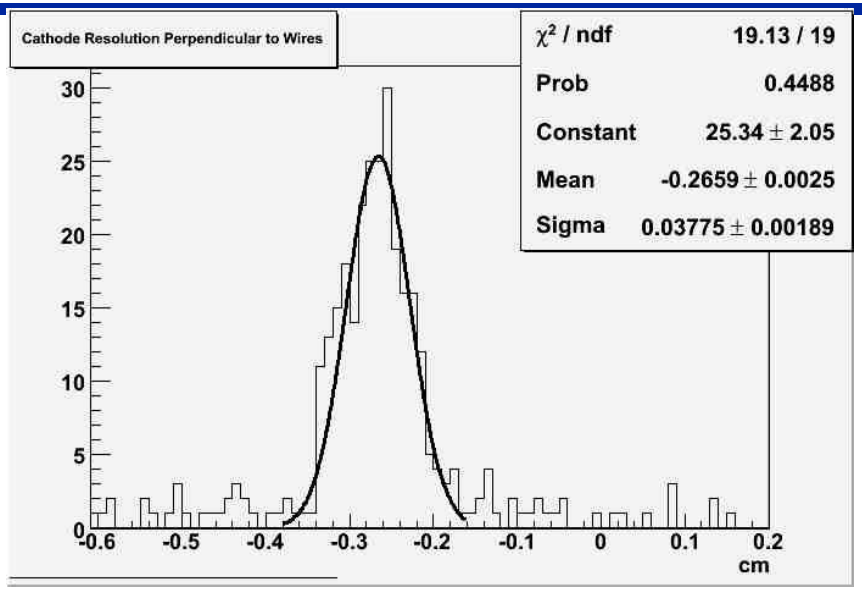




2300 anode wires
10000 u, v cathode strips
24 planes in 4 (x, u, v, x', u', v') packages

Hall D FDC Testing





Cathode resolution – wire positioning
400 μm perpendicular to wires
140 μm – one cathode plane

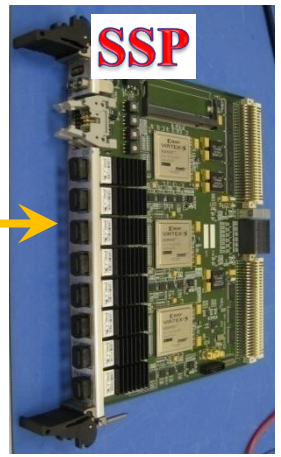
Setup:

- DC, scintillators above and below
- Cosmics, Sr source
- Electronics: 72 channels of *ASICs*, 72 ch *FADC-125*, *700 F1-TDC*

Getting ready for the 3rd package test

All Halls : 12GeV Electronics & Trigger Modules In Production

L1 Trigger 'Data'
MTP Ribbon Fiber



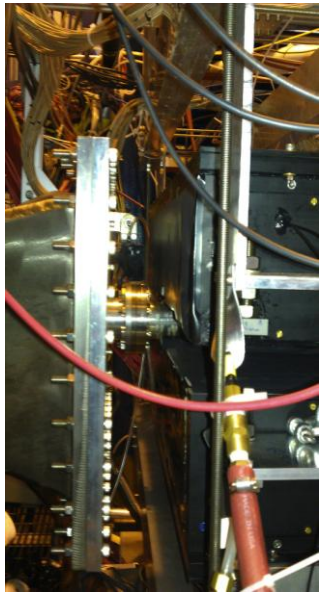
Global Trigger Crate
- Sub-System Processor
- Global Trigger Processor

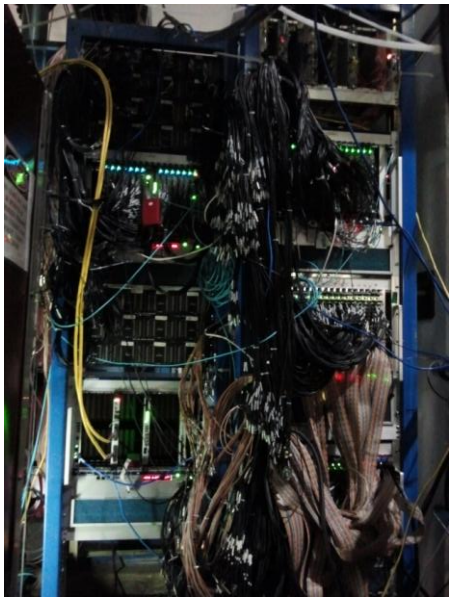
Trigger 'Link" Control
Clock, Sync
MTP Ribbon Fiber

Front End Crate
- FADC250, (FADC125), (F1TDC)
- Crate Trigger Processor
- Signal Distribution
- Trigger Interface

Trigger Control/Synchronization
- Trigger Supervisor
- Trigger Distribution

CLAS12 SVT & CLAS12 DAQ Beam Test





– Most of new electronic boards were tested in real run conditions**:** **FADC250**, **TI, SD**, **CTP, SSP**; only 2 boards (GTP and TS) still to be tested when available

– Boards supporting software (drivers, readout lists etc.) were tested.

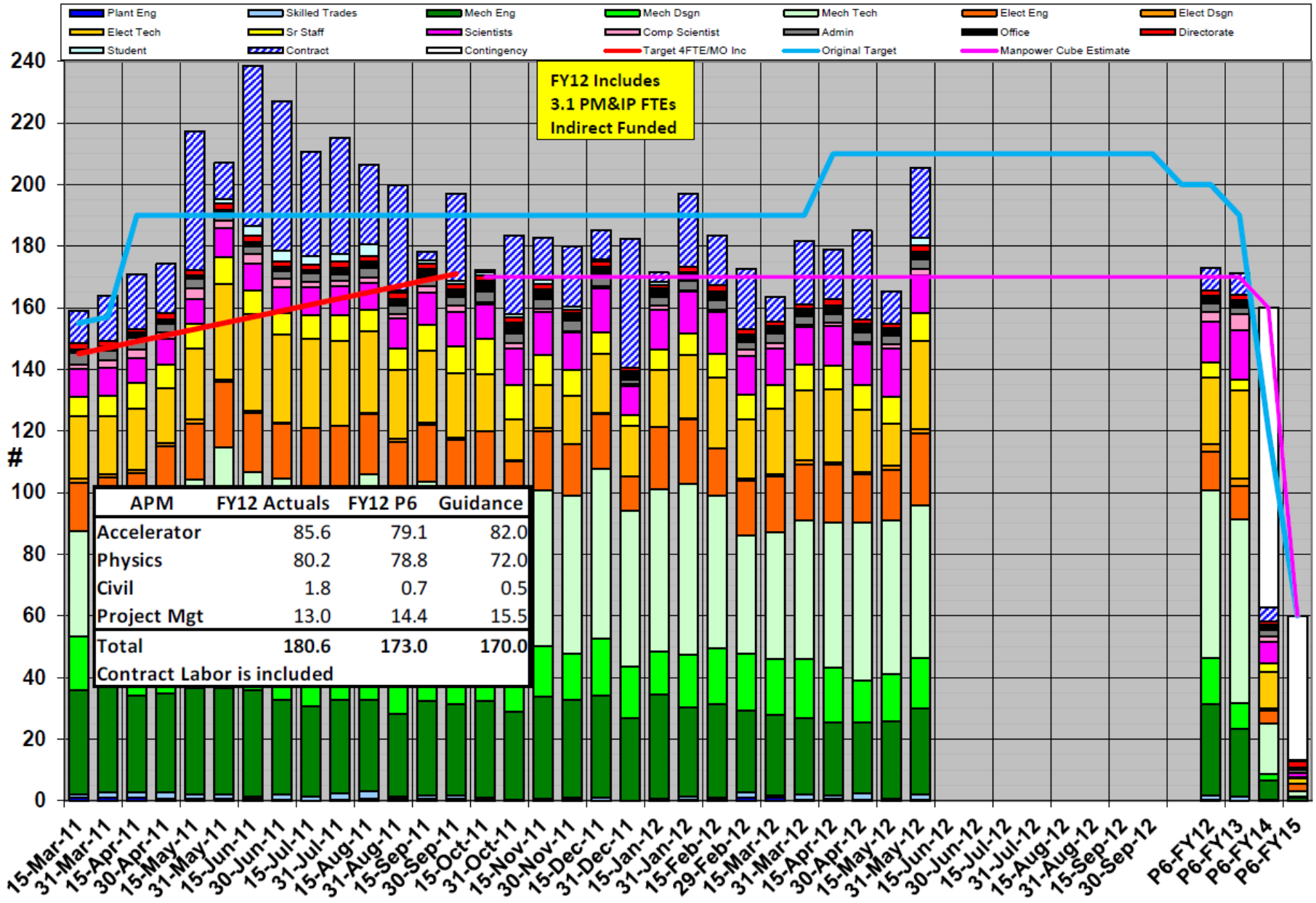
–DAQ was able to achieve planned performance

– Trigger system firmware and supporting software were developed worked as planned

– Most of trigger solutions and tools will be used in CLAS12

– Some data monitoring tools were started using EVIO4 data format

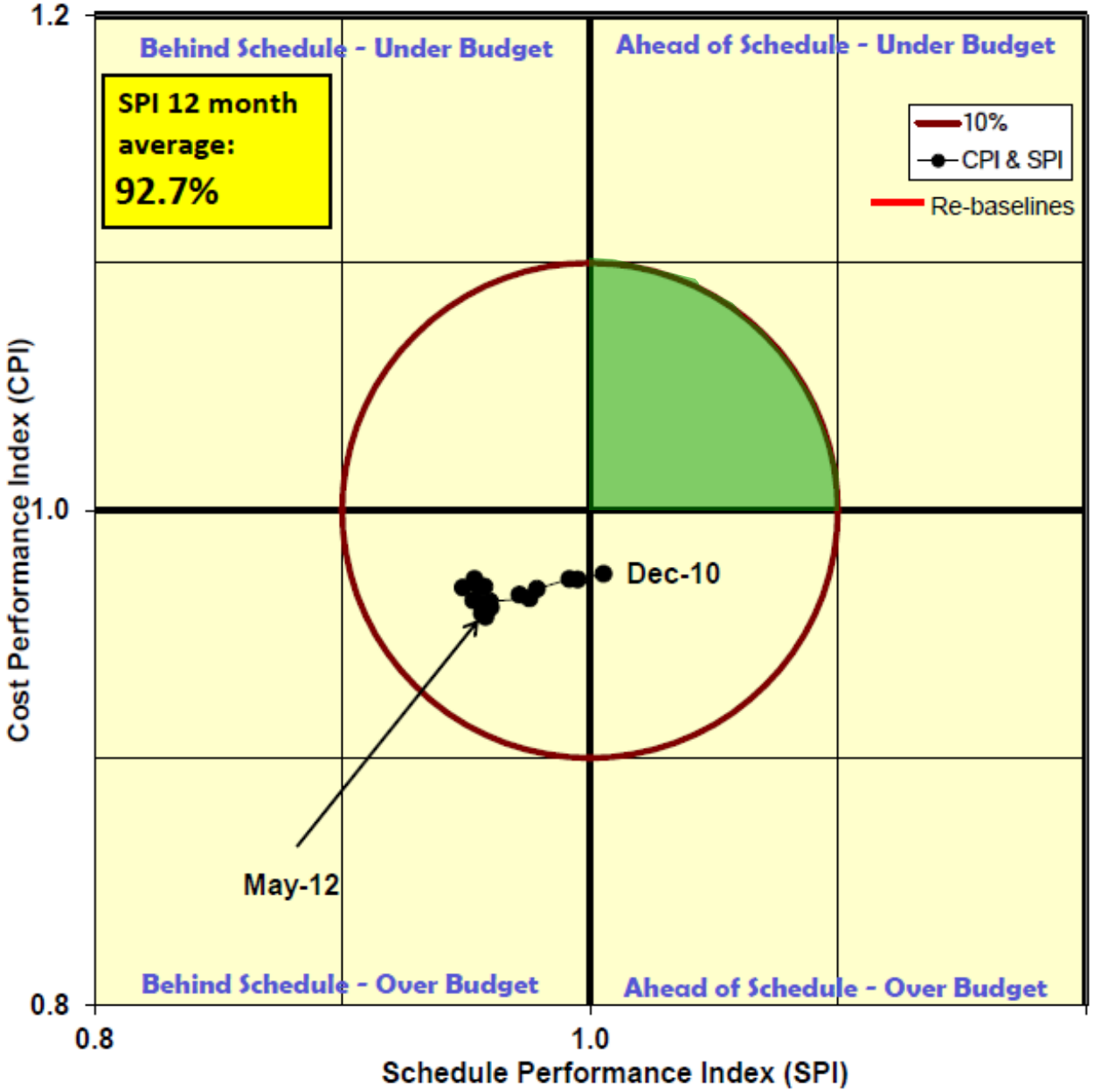
12 GeV FY12 FTEs bySKILL



APM	FY12 Actuals	FY12 P6	Guidance
Accelerator	85.6	79.1	82.0
Physics	80.2	78.8	72.0
Civil	1.8	0.7	0.5
Project Mgt	13.0	14.4	15.5
Total	180.6	173.0	170.0

Contract Labor is included

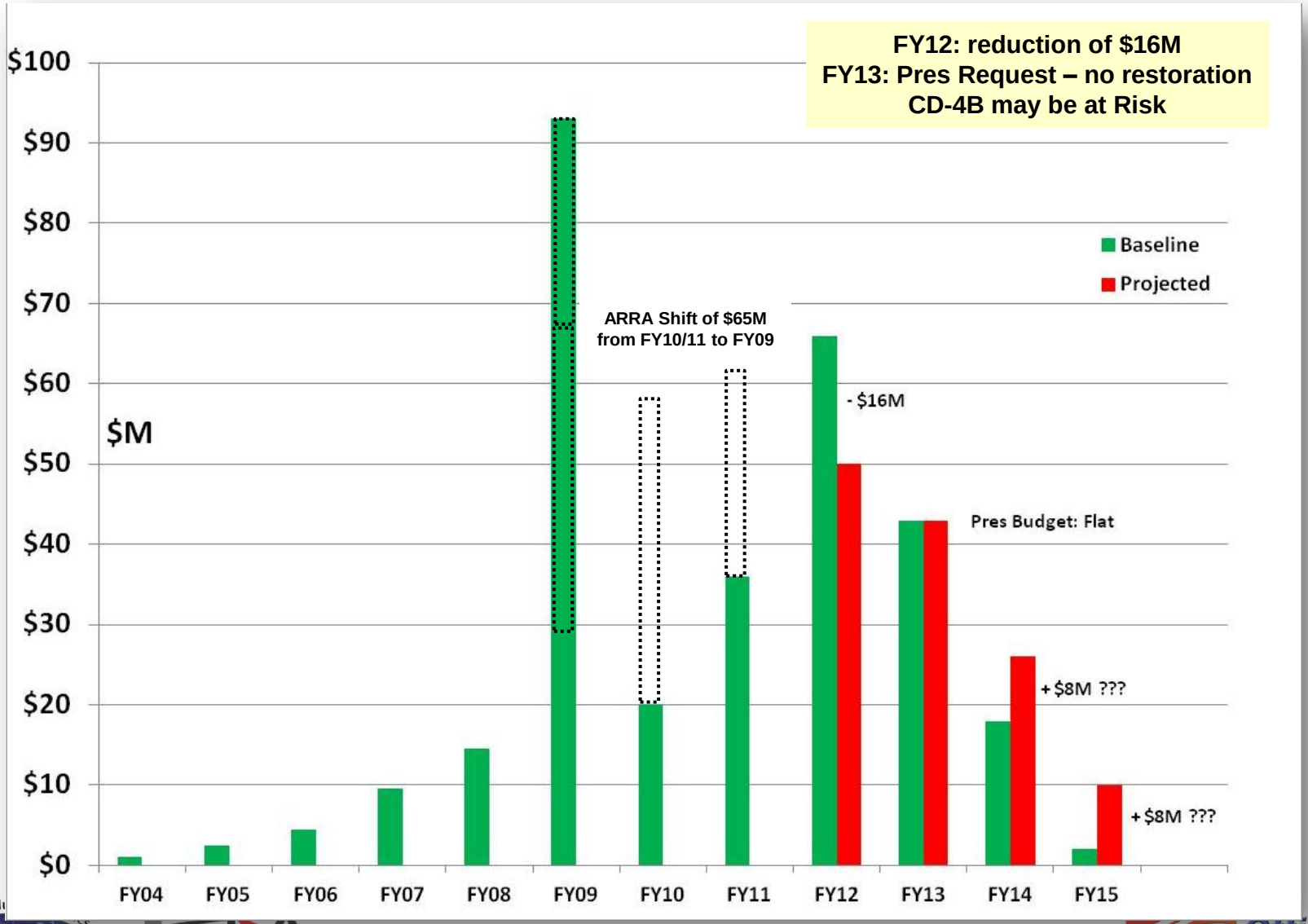
12 GeV Upgrade Project Total



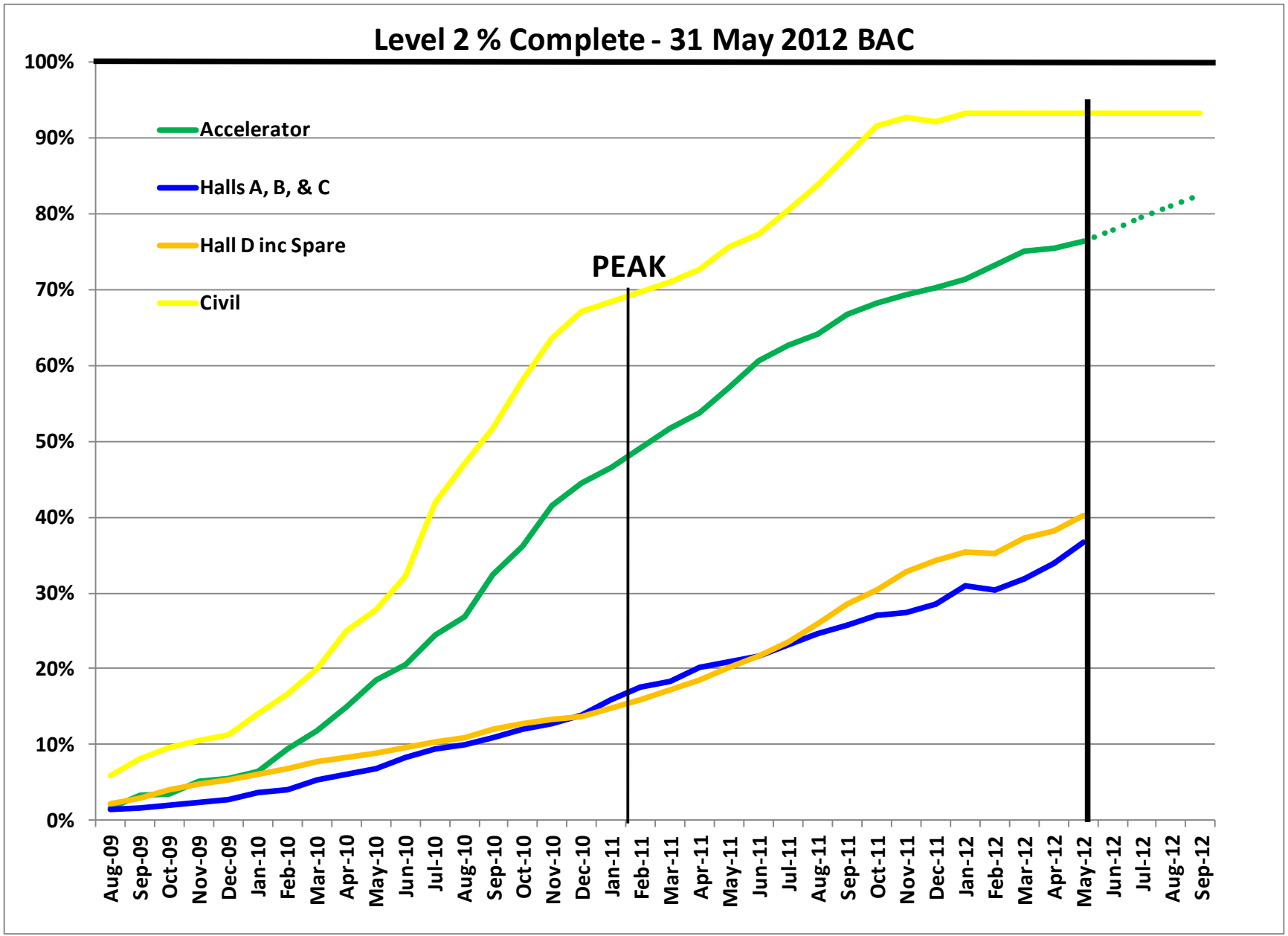
	CUM $K	Monthly $K
BCWS	188,357	4,833
BCWP	180,139	4,349
ACWP	187,947	4,267
Sv	(8,218)	(484)
Cv	(7,808)	82
SPI	0.956	0.900
CPI	0.958	1.019

Percent Obligated
74.3%
Percent Complete
63.0%

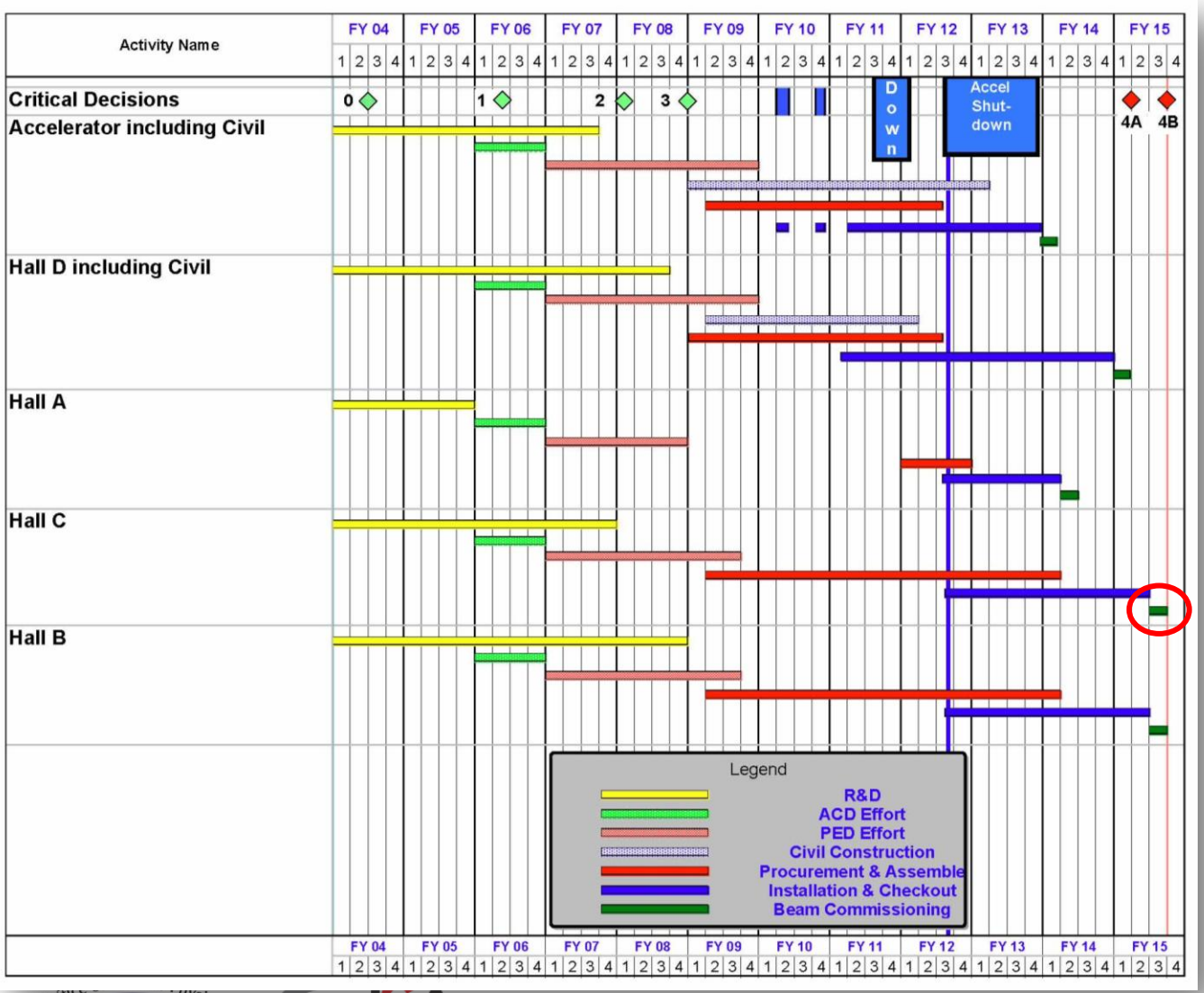
12 GeV - $310M Total Project Cost



12 GeV Project % Complete by Major Area



12 GeV Upgrade Project Schedule



May 18: Completed 6 GeV program

FY12: reduction of $16M
→ extended 12 month shutdown

~~12~~ **16-month installation**
May 2012 - ~~May~~ Sept 2013

Hall A commissioning start
~~Oct 2013~~ Feb 2014

Hall D commissioning start
~~April 2014~~ Oct 2014

Halls B & C commissioning start ~~Oct 2014~~ Apr 2015

Project Completion June 2015

Next DOE Project Review
June 21, 2012