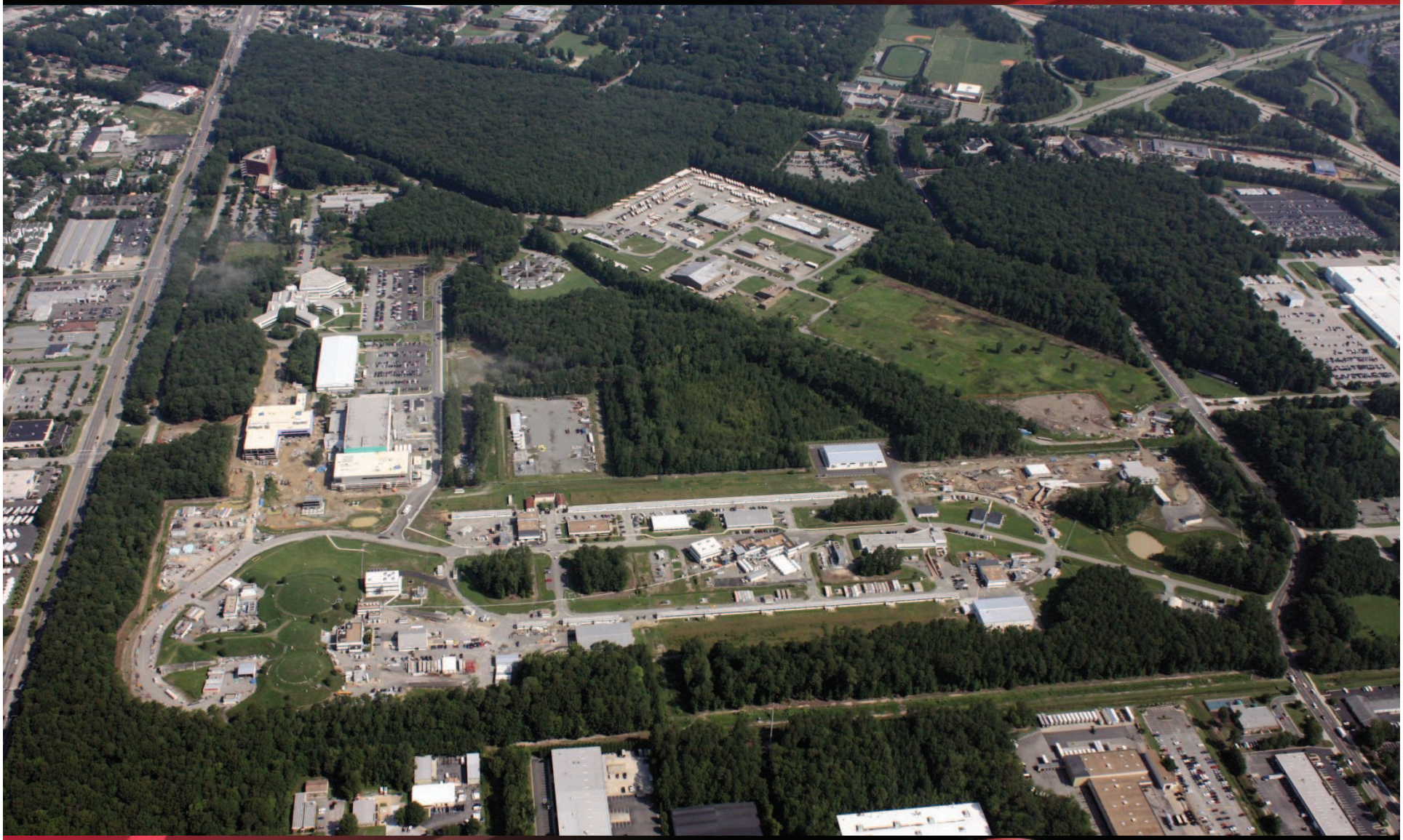
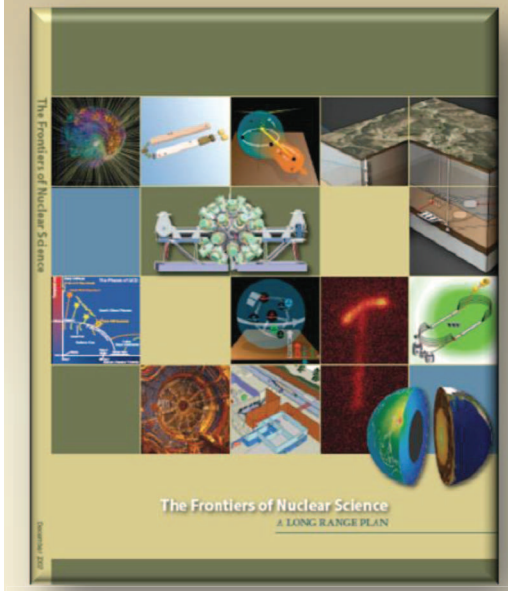
# 12 GeV Upgrade Project - Status



**Allison Lung**
**DNP – JLab Satellite User's Meeting**
**October 24, 2013**

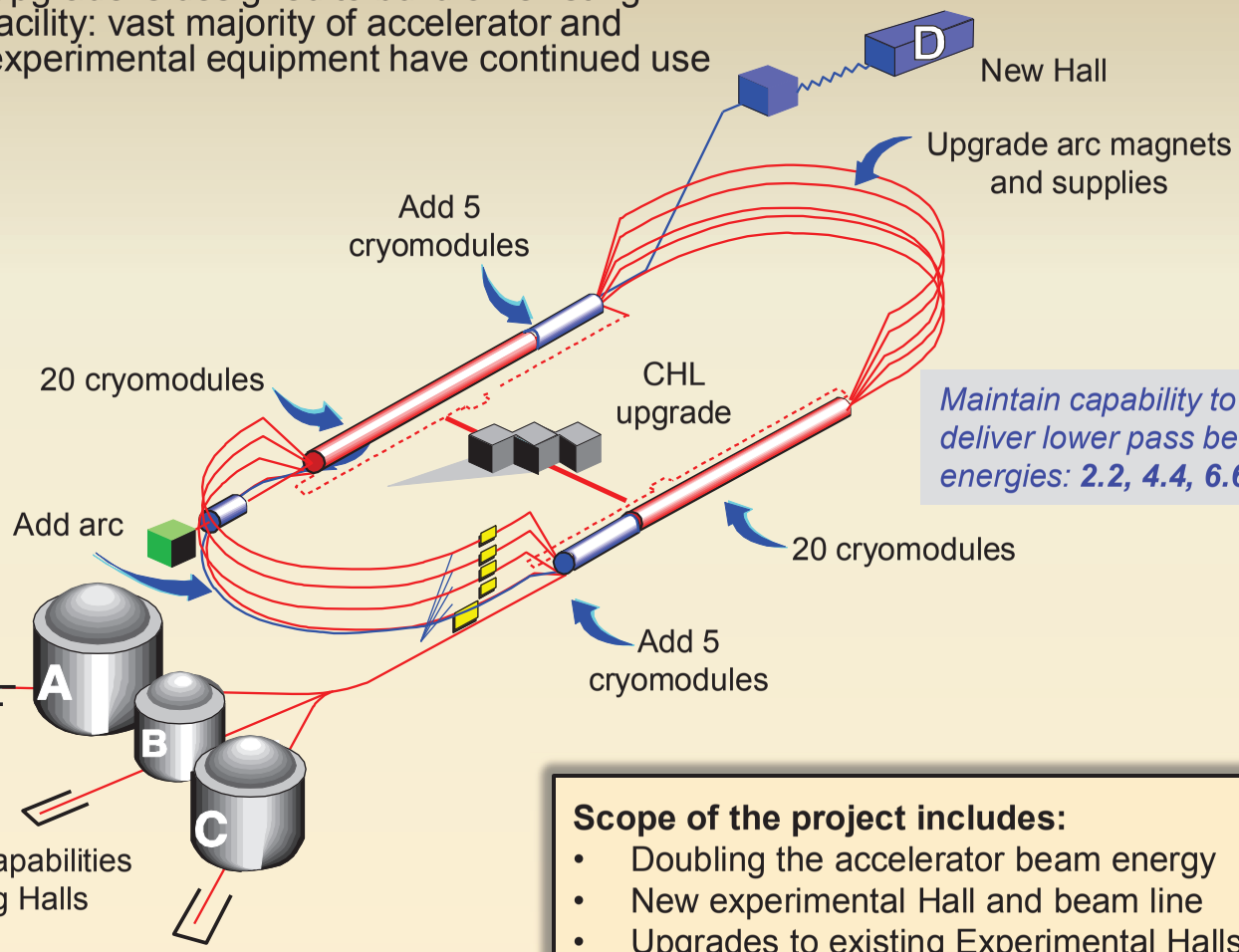
Jefferson Lab
Thomas Jefferson National Accelerator Facility

# 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



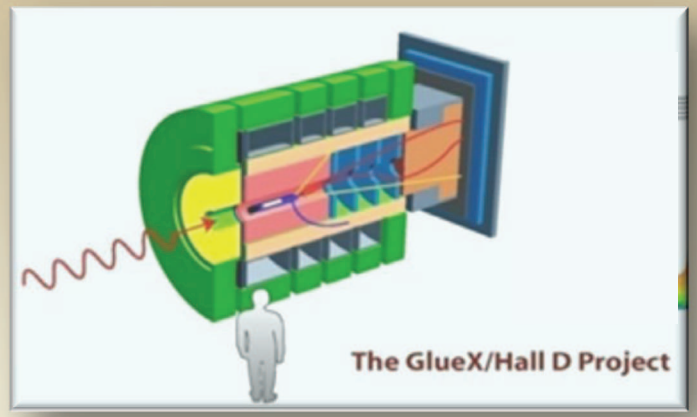

*Maintain capability to deliver lower pass beam energies:* ***2.2, 4.4, 6.6….***

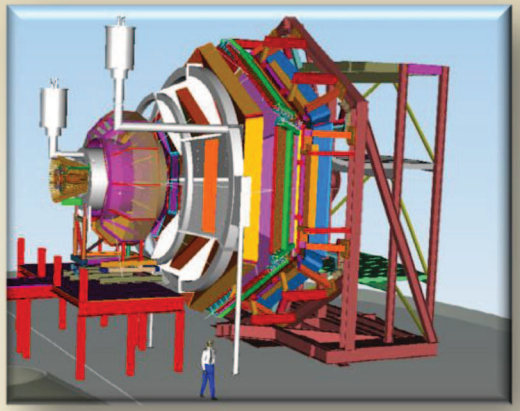
**Scope of the project includes:**

- Doubling the accelerator beam energy
- New experimental Hall and beam line
- Upgrades to existing Experimental Halls

# 12 GeV Scientific Capabilities

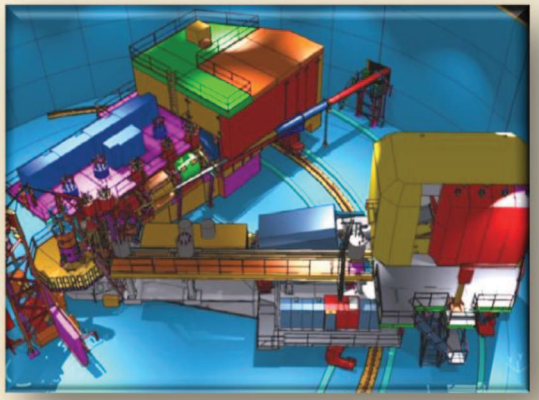
*Hall D* – exploring origin of confinement by studying exotic mesons

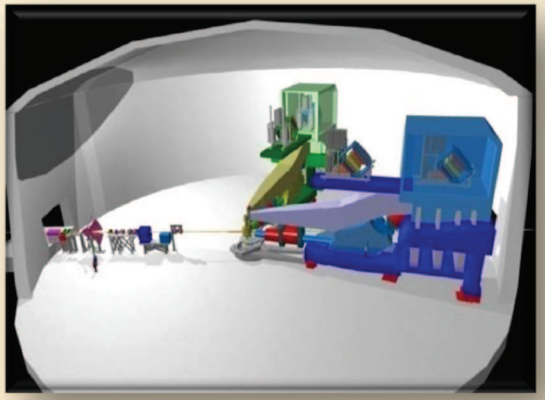


*Hall B* – understanding nucleon structure via generalized parton distributions

*Hall C* – precision determination of valence quark properties in nucleons and nuclei





*Hall A* – form factors, future new experiments (e.g., SoLID and MOLLER)

# 12 GeV Approved Experiments by PAC Days

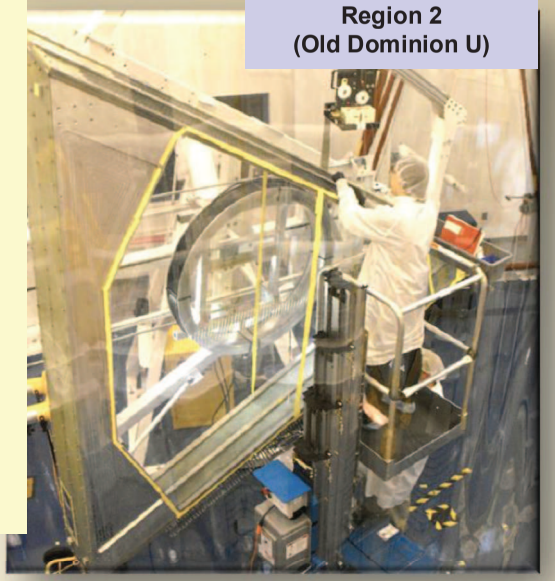
| Topic | Hall A | Hall B | Hall C | Hall D | Total |
|---|---|---|---|---|---|
| The Hadron spectra as probes of QCD (GlueX and heavy baryon and meson spectroscopy) | | 119 | | 120 | 239 |
| The transverse structure of the hadrons (Elastic and transition Form Factors) | 144 | 85 | 102 | | 331 |
| The longitudinal structure of the hadrons (Unpolarized and polarized parton distribution functions) | 65 | 120 | 140 | | 325 |
| The 3D structure of the hadrons (Generalized Parton Distributions and Transverse Momentum Distributions) | 409 | 982 | 108 | | 1499 |
| Hadrons and cold nuclear matter (Medium modification of the nucleons, quark hadronization, N-N correlations, hypernuclear spectroscopy, few-body experiments) | 114 | 120 | 179 | | 413 |
| Low-energy tests of the Standard Model and Fundamental Symmetries | 513 | | | 79 | 592 |
| **Total** ***(as of PAC39)*** | **1245** | **1426** | **529** | **199** | **3399** |

**More than 7 years of approved experiments**

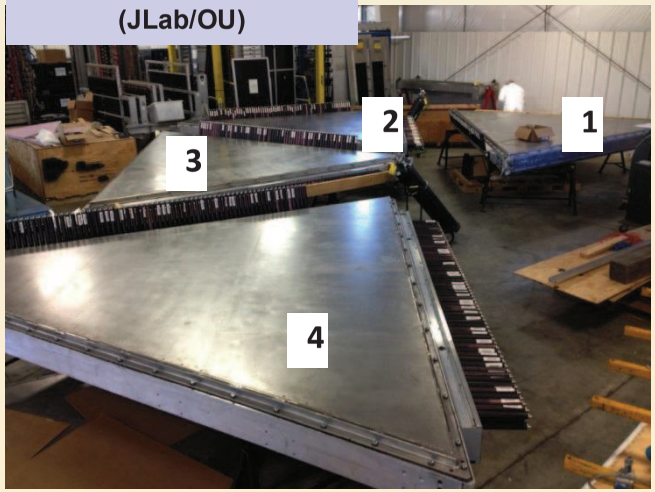
# Hall B – Detector Highlights

***All major detector systems under construction:***

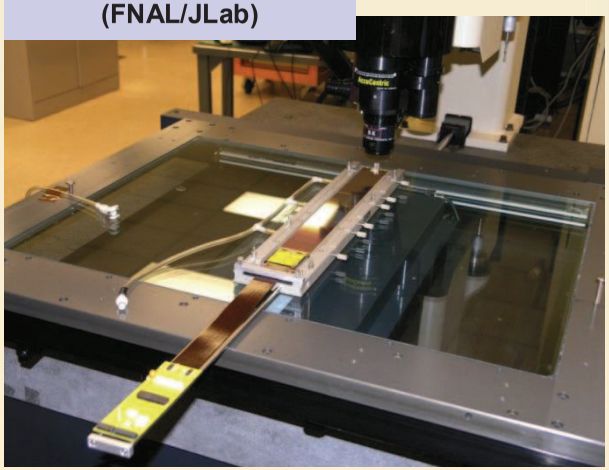
- ***SVT two modules complete; production delay at FNAL due to vendor cable issue***
- ***HTCC & LTCC in progress***
- ***CTOF in progress***
- ***DC RI and RIII on schedule (Idaho State / JLab)***
- ***DC RII complete (Old Dominion U.)***
- ***FTOF ready for installation (U. South Carolina)***
- ***PCAL ready for installation (Ohio U.)***



Hall B Drift Chamber Region 2 (Old Dominion U)



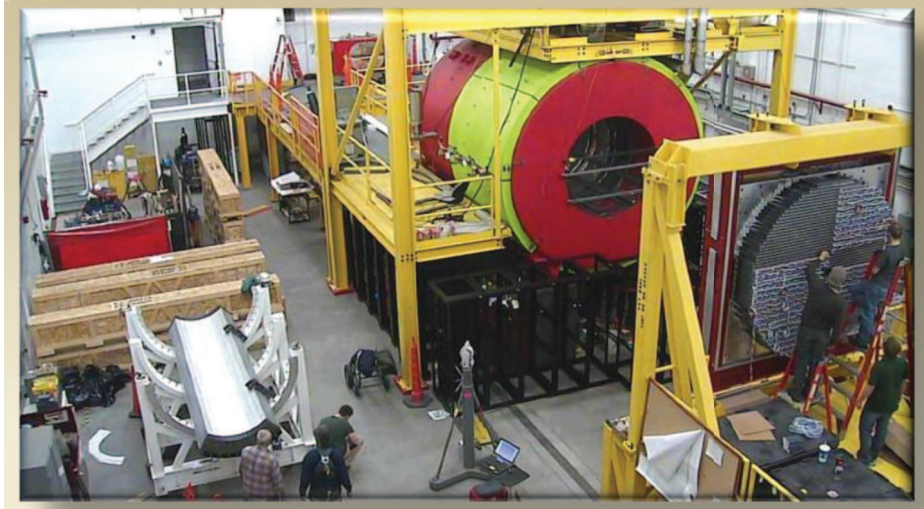

Hall B PCAL (JLab/OU)



Hall B SVT (FNAL/JLab)

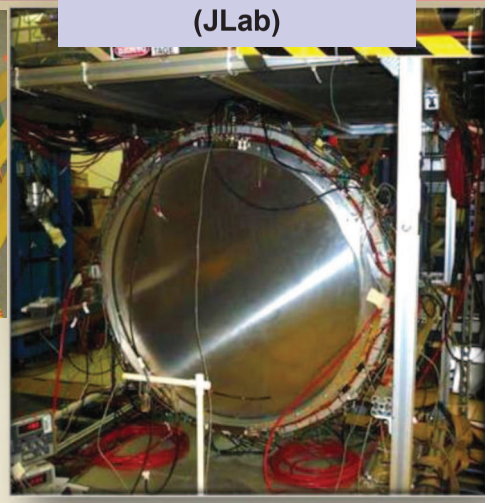
Hall B Drift Chamber Region 1 (Idaho State U)

# Hall D – Detector Highlights

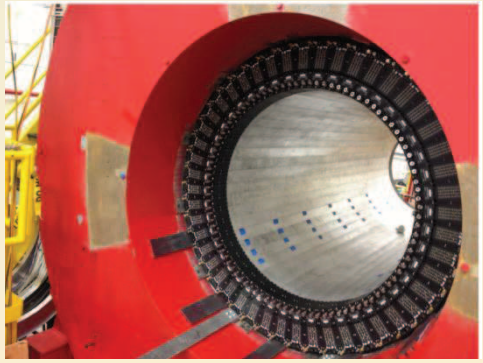


FCAL
(Indiana Univ)

Forward Drift Chamber
(JLab)



BCAL
(Univ of Regina)



BCAL (URegina) – Installed, cabling

FCAL (IU) – Installed, cabled

FDC (JLab) – Assembled, cabling test

CDC (CMU) – Assembled, ship to JLab 10/28

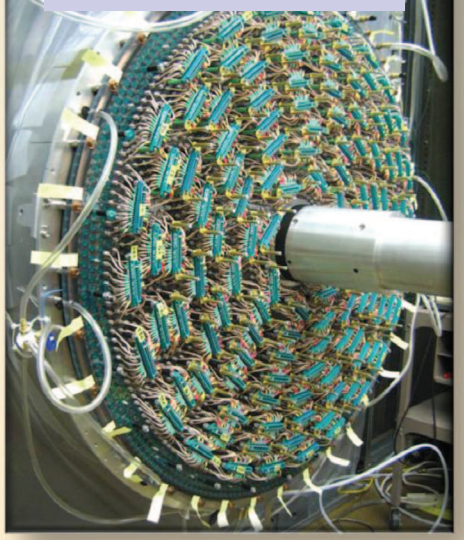
TOF (FSU) - 90% complete, ship to JLab Nov

Tagger hodoscope (CUA) – In progress

Tagger microscope (UConn) – In progress

F1TDC testing (UMass) – In progress

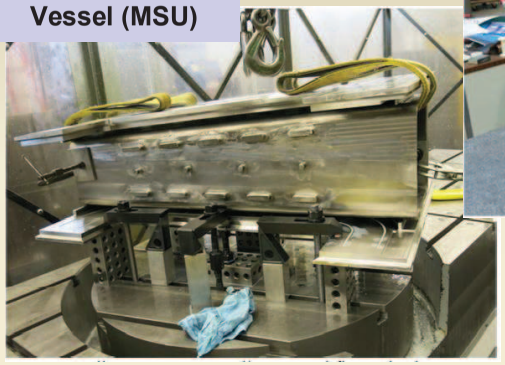
Central Drift Chamber
(Carnegie Mellon)



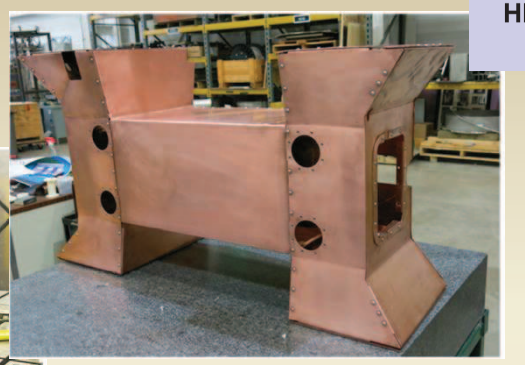
# Hall C – Highlights

***All major systems under construction***

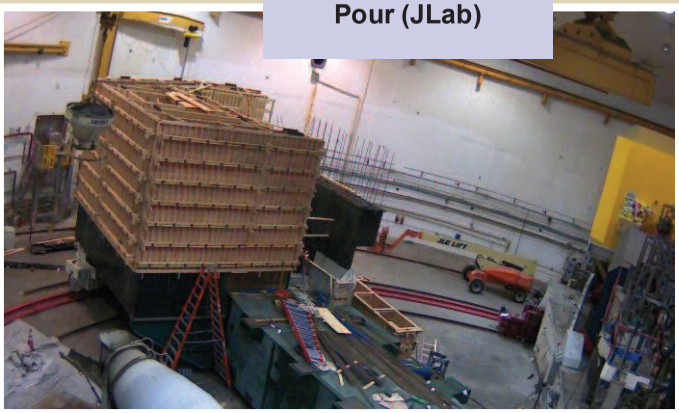
HB Helium Vessel (MSU)



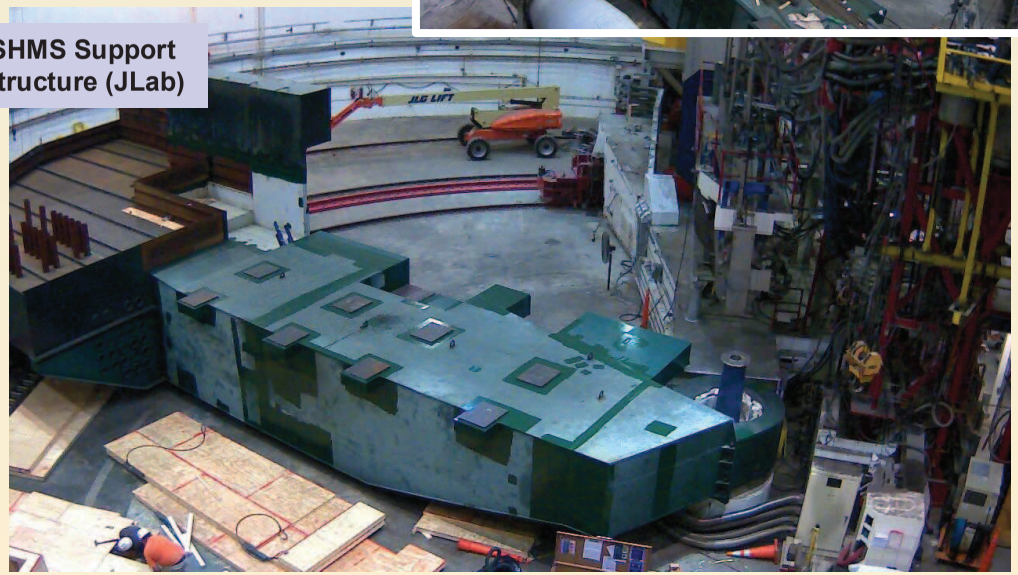
HB LN2 Shield (MSU)

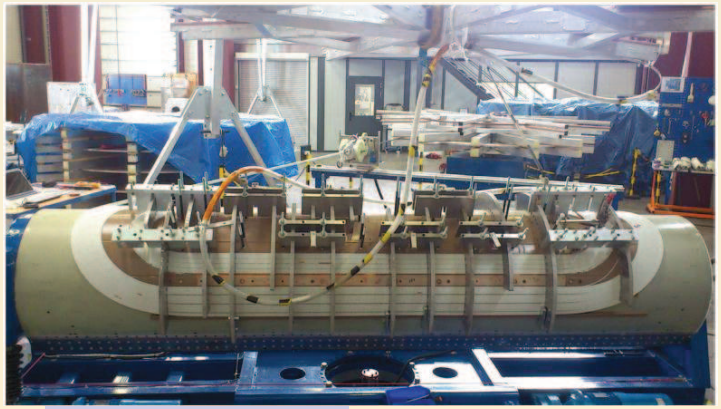


Shield House Wall Pour (JLab)



SHMS Support Structure (JLab)





Dipole prototype coil (Sigma Phi, France)

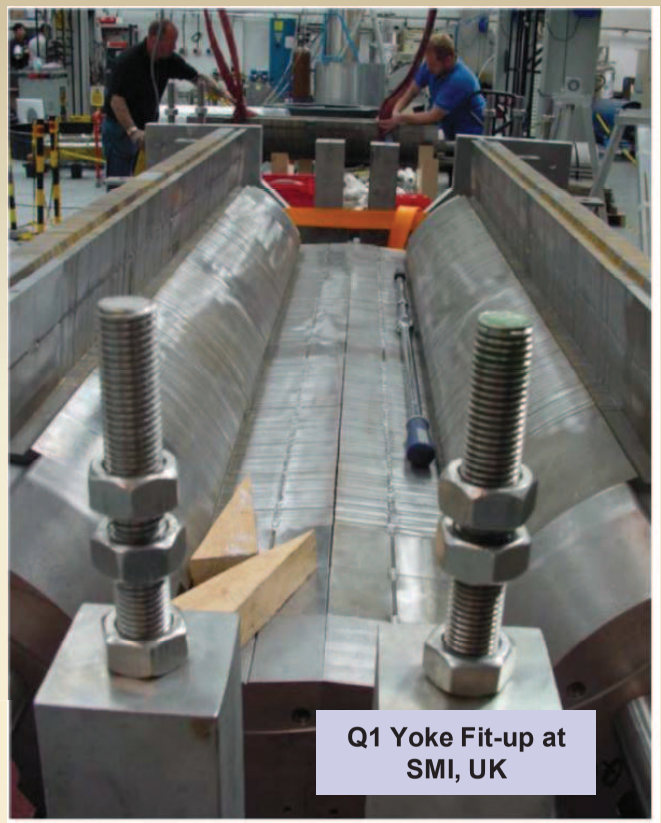
# Hall C – Highlights

**DETECTORS (NSF-MRI funded):**

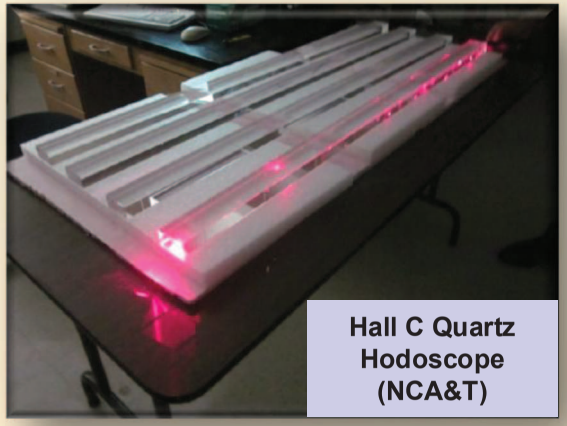
**Hampton University** – wire chamber assembly completed, testing underway.

**Univ of Virginia** - manufacturing design detailing for the noble gas Cerenkov continues, PMTs delivered, and mirrors in fabrication.

**Univ of Regina** - heavy gas Cerenkov counter assembled, mirrors aligned, awaiting installation.



Q1 Yoke Fit-up at SMI, UK



Hall C Quartz Hodoscope (NCA&T)

# 12 GeV Spectrometer SC Magnets

**Hall C SHMS:**

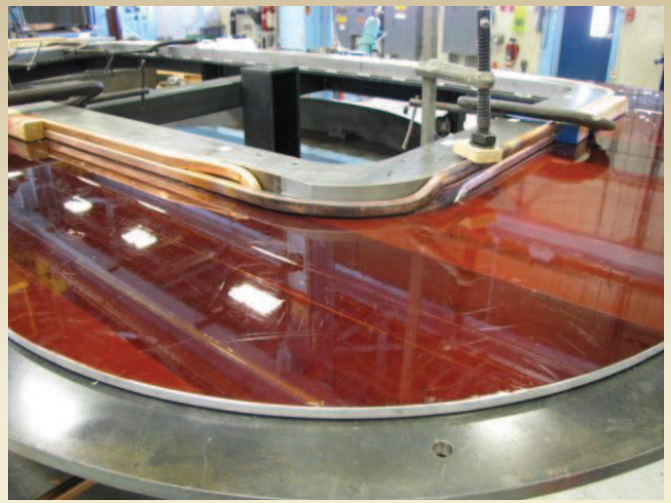
- HB – Michigan State Univ making progress
- Q1 – Scientific Magnetics, UK all 4 coils built, assembly underway
- D/Q2/Q3 – Sigma Phi, France prototype coil winding underway (1st layer of 2 done)

**Hall B CLAS12:**

- Torus – FNAL practice coil winding nearly complete; JLab design effort & cryogenics & cryostat factory making solid progress
- Solenoid – Everson Tesla, PA, behind schedule; Final Design Review ~mid-November 2013.

**Hall D:**

- Solenoid – successfully operated at 1500A, later quench required re-assessment of procedures, successfully operated and mapped at ~1300A in August 2013



CLAS12 Torus coil winding table at FNAL

# 12 GeV Upgrade - Accelerator Highlights

## *Commissioning started – September 2013*


12 GeV Cryomodules & RF Zones


CHL Upper Coldbox


East Recombiner

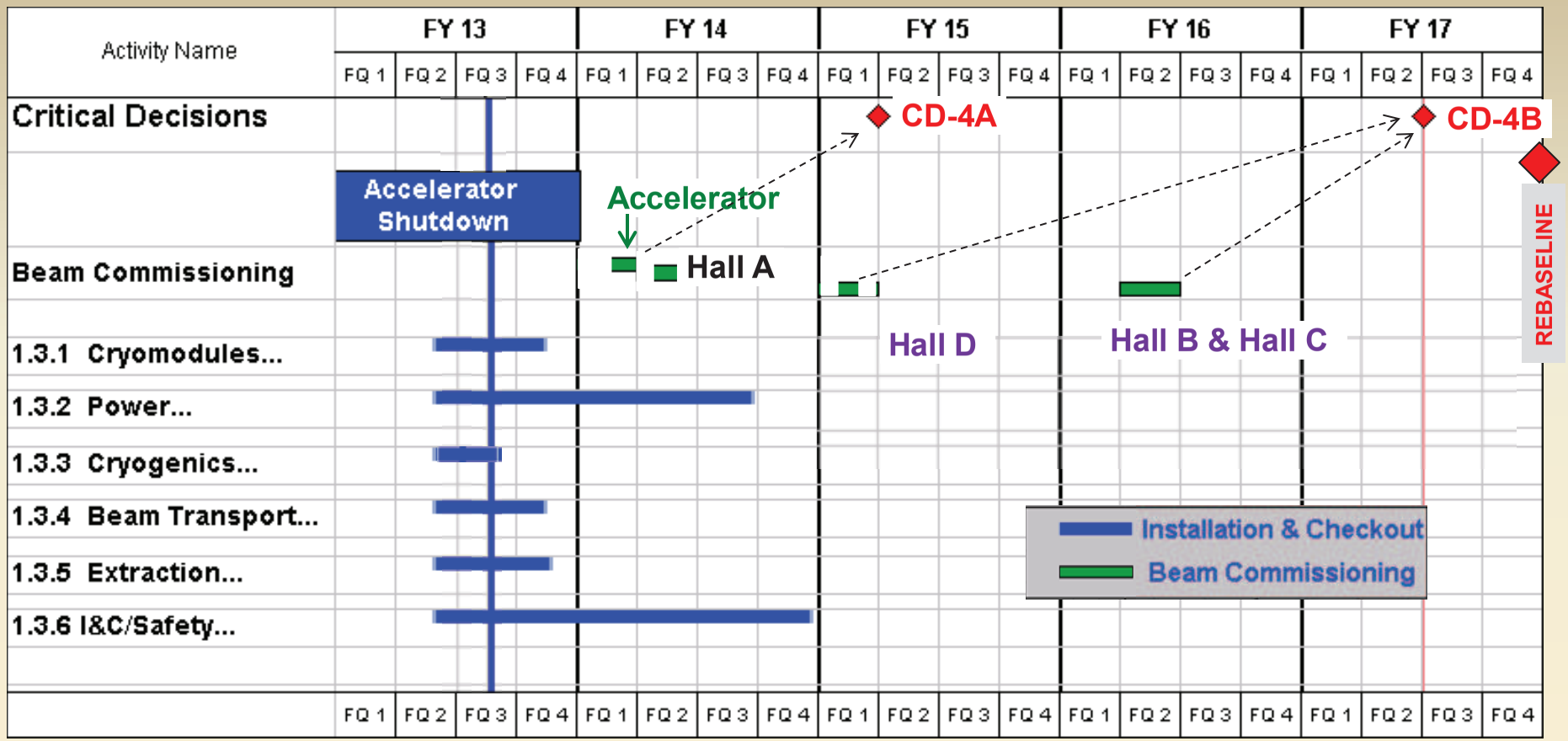

East Arc


CHL Lower Coldbox

# Accelerator Status

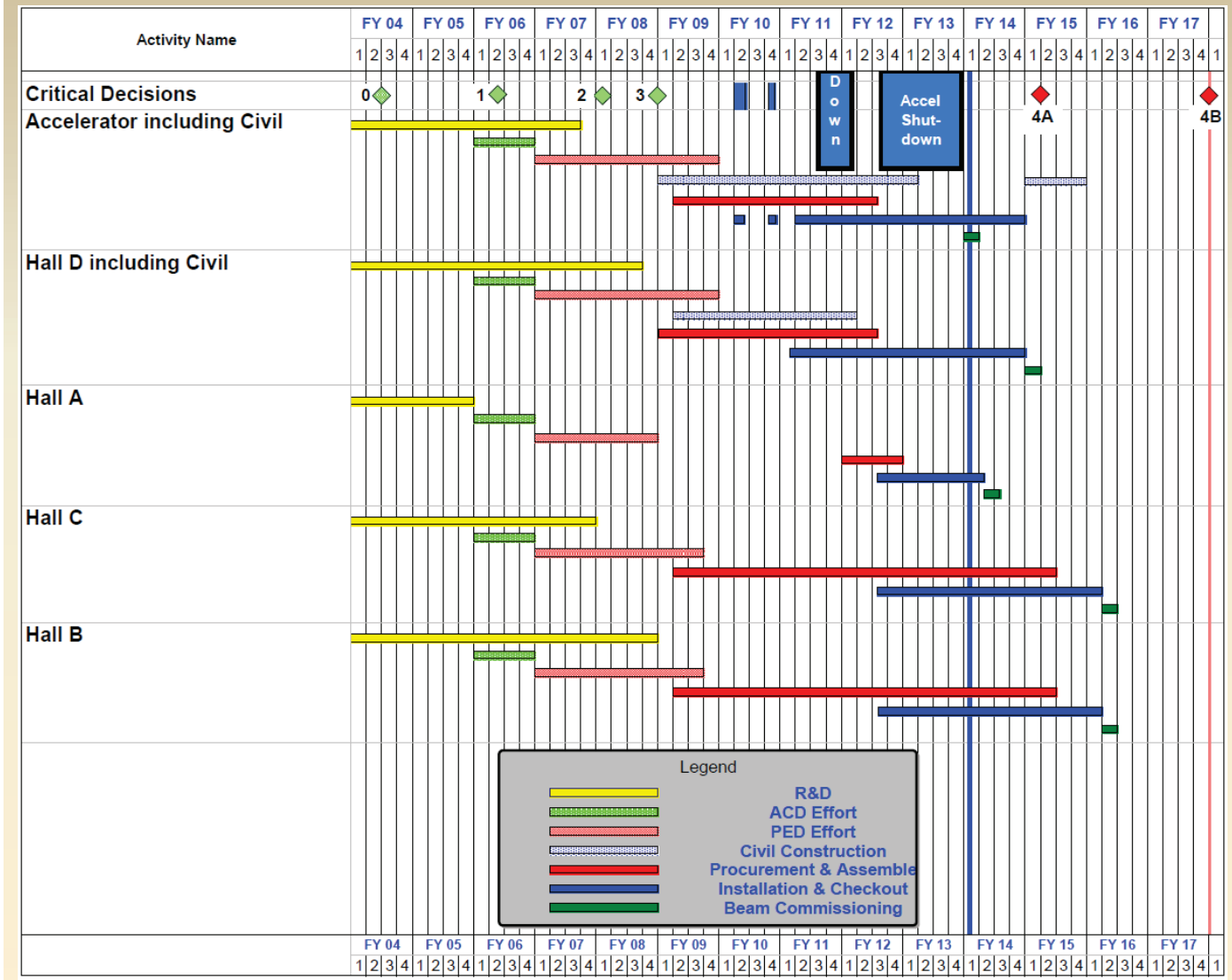
- Cryomodules: ten C100s built, installed, and nine are commissioned
- RF Power: zones #1 - #10 complete, commissioning complete except #10
- Magnet Power: all hardware required for Accelerator Run I is on site
- Cryogenics: CHL2 met the commissioning performance goals
- Beam Transport:
  - Accelerator Ring: Installation complete, only punch list left
  - Hall A/Hall B/Hall C: Hall A line reinstalled; B & C underway
  - Hall D: dipoles in, LCW and air headers installed on ramp
- Extraction: Complete
- I&C: Controls software complete; Safety systems ready for beam

# 12 GeV Project - Accelerator Schedule




- Cryomodules, Cryogenics, Beam Transport, and Extraction will be complete in CY13
- Power and I&C deliveries extend into CY14 but will not affect commissioning schedule

# 12 GeV Upgrade Project Schedule




**Rebaseline complete Sept 2013**

**16-month installation**
**May 2012 - Sept 2013 DONE**

**Accelerator commissioning start**
**Oct 2013 IN PROGRESS**

**Hall A commissioning start**
**Feb 2014**

**Hall D commissioning start**
**Oct 2014**

**Halls B & C commissioning start**
**Jan/Feb 2016**

**Project Completion**
**September 2017**

# 12 GeV Upgrade Project - Summary

Hall D & Counting House

12 GeV Cryomodules & RF Zones

**Project 82% Complete, 96% Obligated**

- Civil (92%) ; Accelerator (95%) ; Physics Equip (~69%)

**Challenges with spectrometer superconducting magnets**

- All 7 new magnets under contract
- Refurbished Hall D Solenoid successfully tested

**Rebaseline complete and implemented**

- TPC = $338M ; CD-4B September 2017

Hall D Interior

***Start of beam commissioning November 2013***