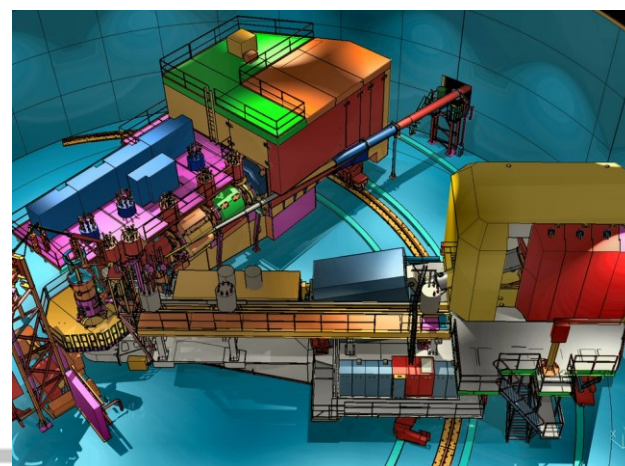




PAC43
July 7, 2015



Thomas Jefferson National Accelerator Facility

Publications and Students

Separated Response Functions in Exclusive, Forward π^\pm Electroproduction on Deuterium
[Phys. Rev. C **91**, 015202 \(2015\)](#) (from Fpi data)

The HKS Experiments at JLab Hall C and the New Spectroscopy of $^{12}_\Lambda\text{B}$ Hypernuclei
[Phys. Rev. C **90**, 034320 \(2014\)](#) (from E01-011 and E05-115)

The Q_weak Experimental Apparatus [NIM A781, 105 \(2015\)](#)

Polarization Transfer in Wide-Angle Compton Scattering and Single-Pion Photoproduction from the Proton [arXiv:1506.04045 \(submitted to PRL\)](#)

In the pipeline: Qweak+ancilliary measurements, more hypernuclear, inclusive electron scattering, super-rosenbluth

Recent Ph.D.:

HKS: Chunhua Chen, Toshiyuki Gogami

Qweak: Adesh Subedi, Josh Hoskins, Nuruzzaman, Amrendra Narayan

SANE: Hoyoung Kang, Whitney Armstrong, Luwani Ndukum

SHMS

SHMS Structure complete
Services (Power, LCW, AC, signal/HV
cables) installed
Detector install in progress
HB and Q1 cooled and powered
Steel for Q2, Q3, Dipole installed



Q1 "accepted" and
contract closed

HB undergoing
acceptance testing



Q2, Q3, Dipole

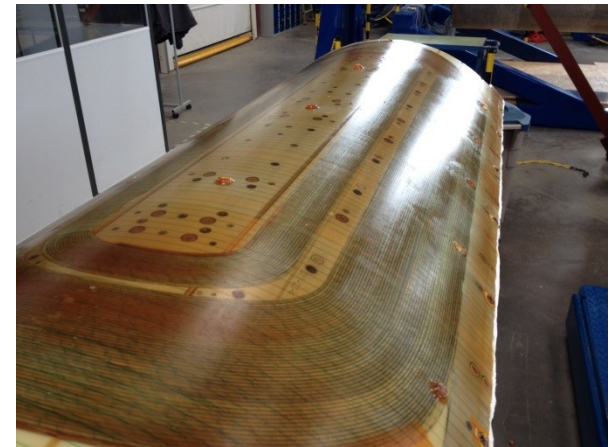


SigmaPhi, France

All coils wound and potted

Dipole "collared"

Q2/3 splicing of layers, preparing for collaring



Q2, Q3, Dipole



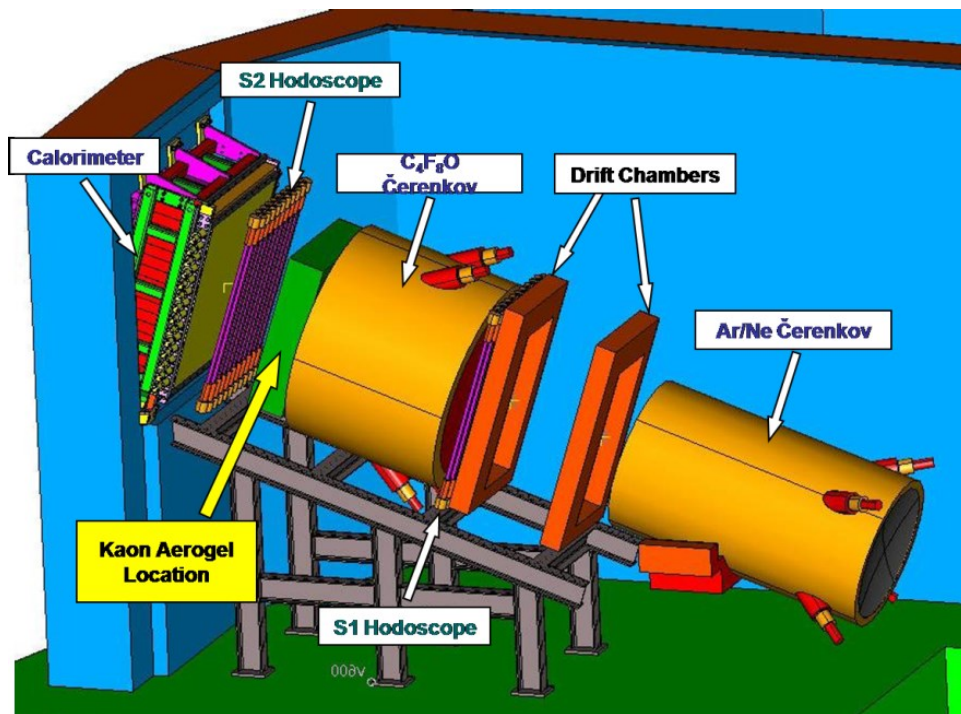
Dipole now being installed in cryostat

Delivery: January-April, 2016

Installed and cold: Summer 2016



SHMS Detectors – Old Slide



Drift Chambers

Hampton – MRI

Hodoscopes

James Madison – MRI

Quartz Hodoscope

North Carolina A&T – MRI

Detector Frames

W&M – MRI

Heavy Gas Cerenkov

Regina – NSERC

Noble Gas Cerenkov

UVA – 12 GeV Project

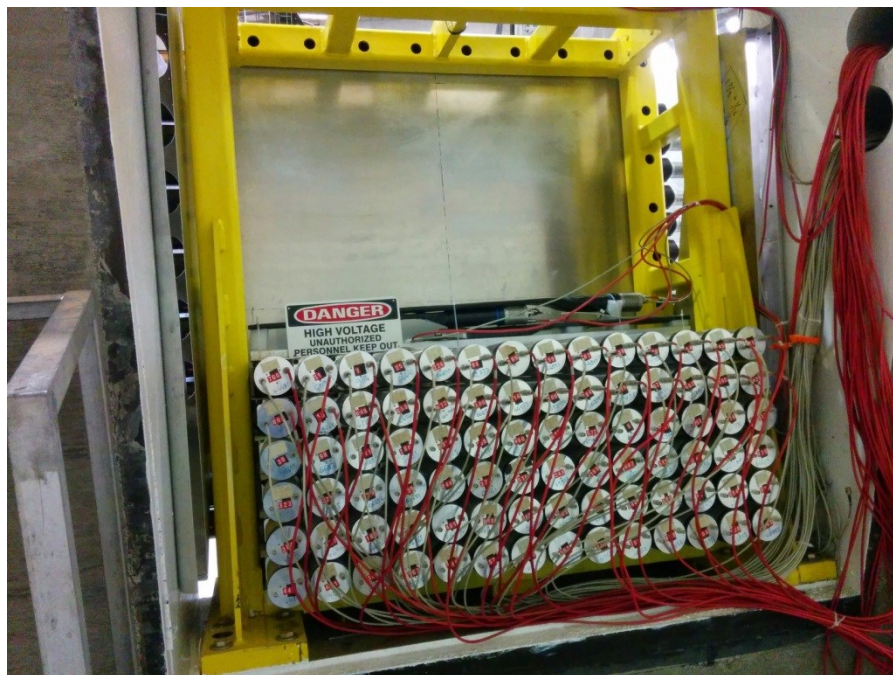
Aerogel

CUA Led – New MRI

Shower Counter

Yerevan – 12 GeV Project

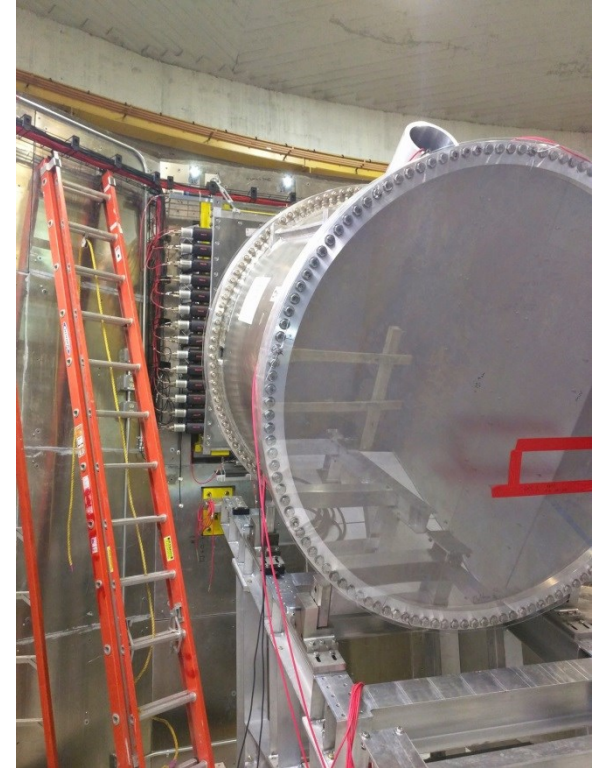
SHMS Detectors – 2015



SHMS Preshower and Shower Counter installed

14x2 + 16x14 channels

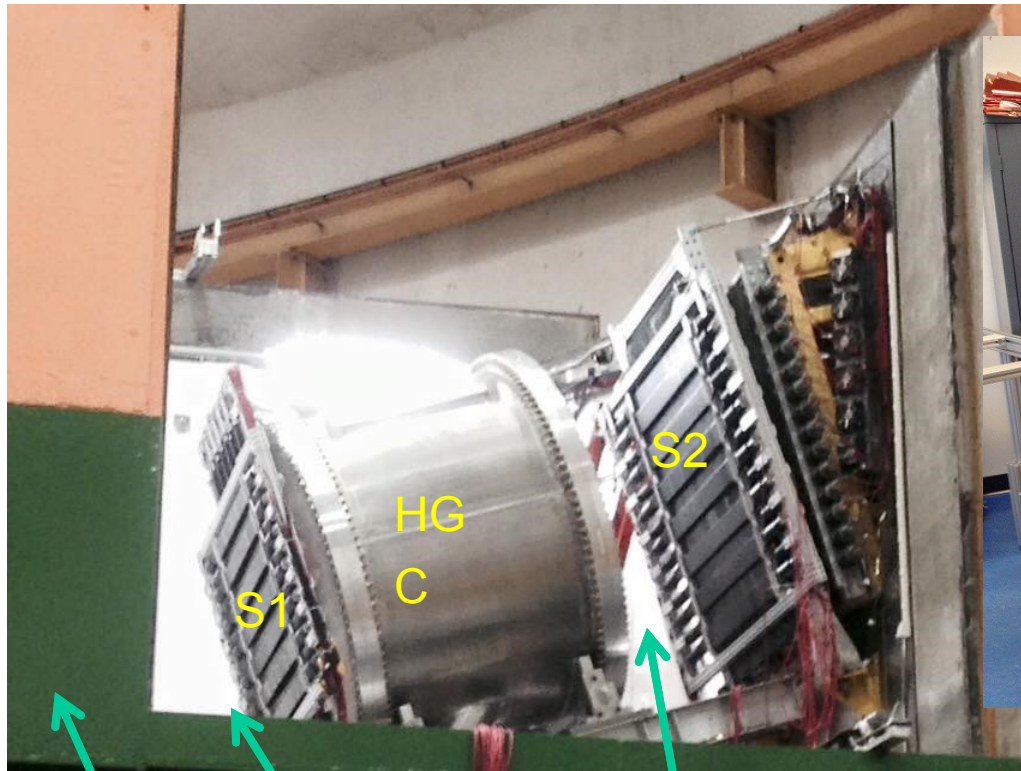
SHMS Detectors



S1X, S1Y, S2X, S2Y (Quartz) hodoscope planes assembled and installed.

Heavy Gas Cerenkov installed

SHMS Detectors



Noble Gas
Cerenkov

Aerogel Cerenkov

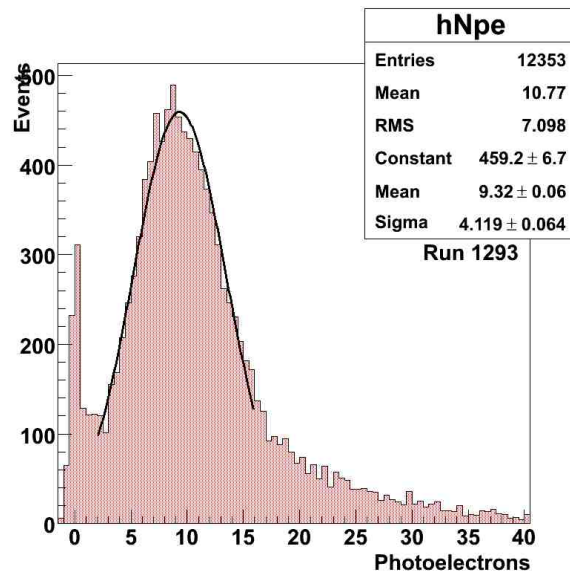
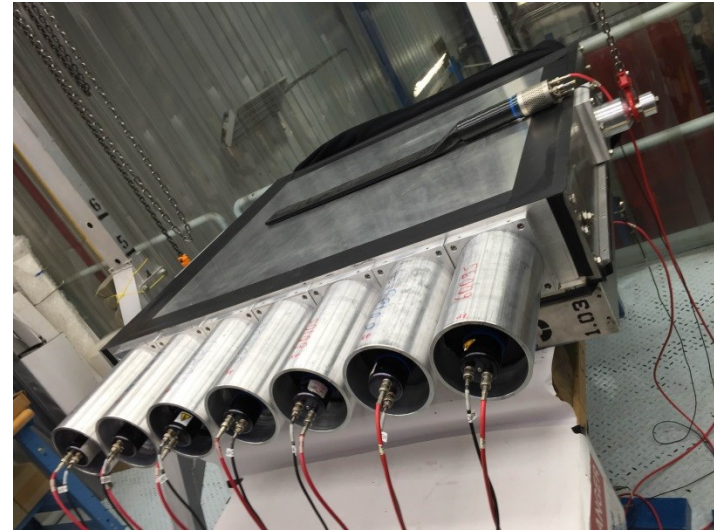
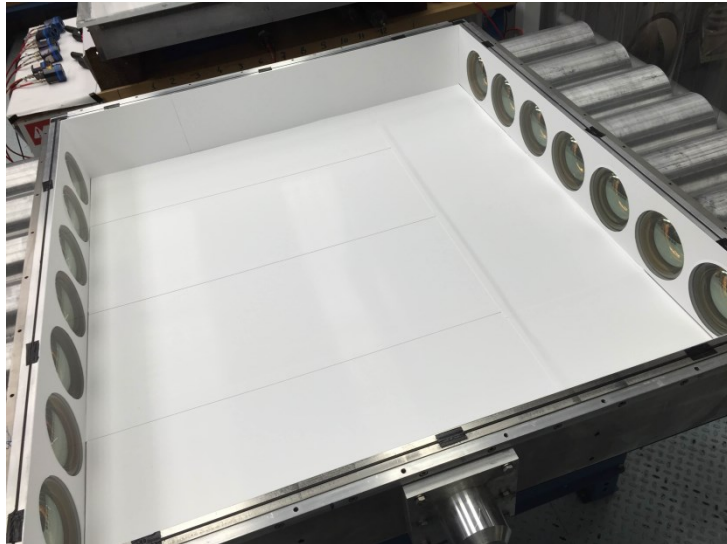
Drift Chambers



One wire chamber on site

Noble gas Cerenkov delivery this month

SHMS Detectors - Aerogel



Good performance with cosmic ray tests with tray of $n=1.03$ Aerogel with “wrong way” muons.

(In spectrometer, particles will pass through Aerogel before the diffusion box. In cosmic tests, Aerogel on bottom.)

Installation in August

LAD – Large Acceptance Detector

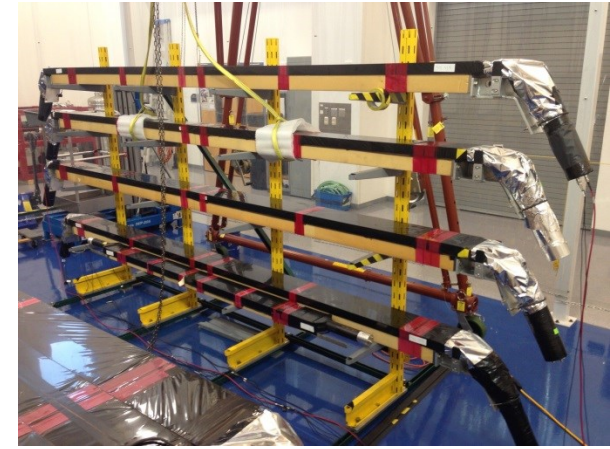
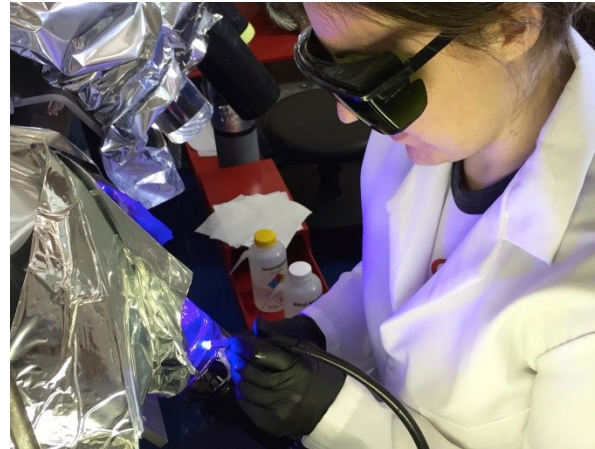
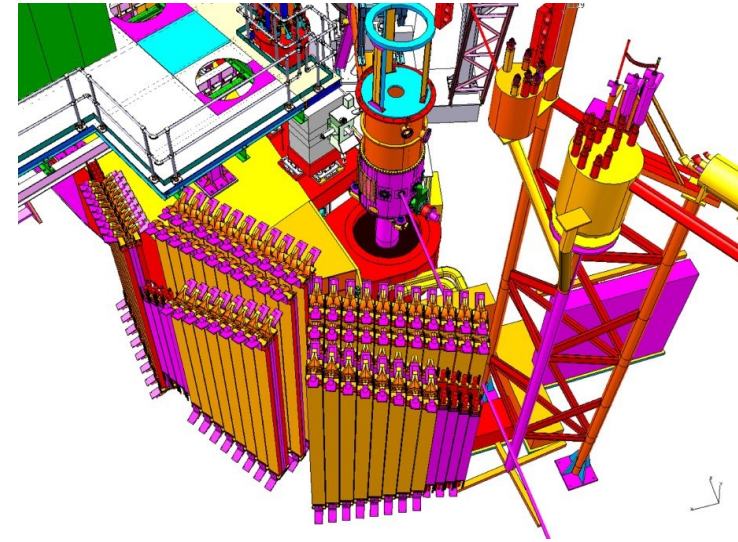
E12-11-007: Deuteron EMC – d(e,e' backward p)

Very large solid angle for $L = 10^{36} \text{ cm}^{-2} \text{ s}^{-1}$ and $\theta > 90^\circ$

Optimized for medium momentum nucleons

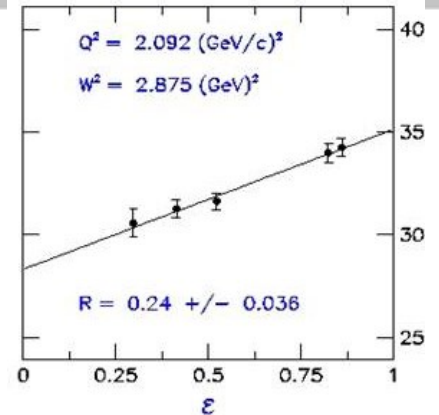
$$0.3 \leq p_N \leq 0.7 \text{ GeV}/c$$

Built from old CLAS-6 TOF scintillators. Two planes refurbished @ODU by ODU, KSU, TAU, MIT, GWU. Third plane starting soon.

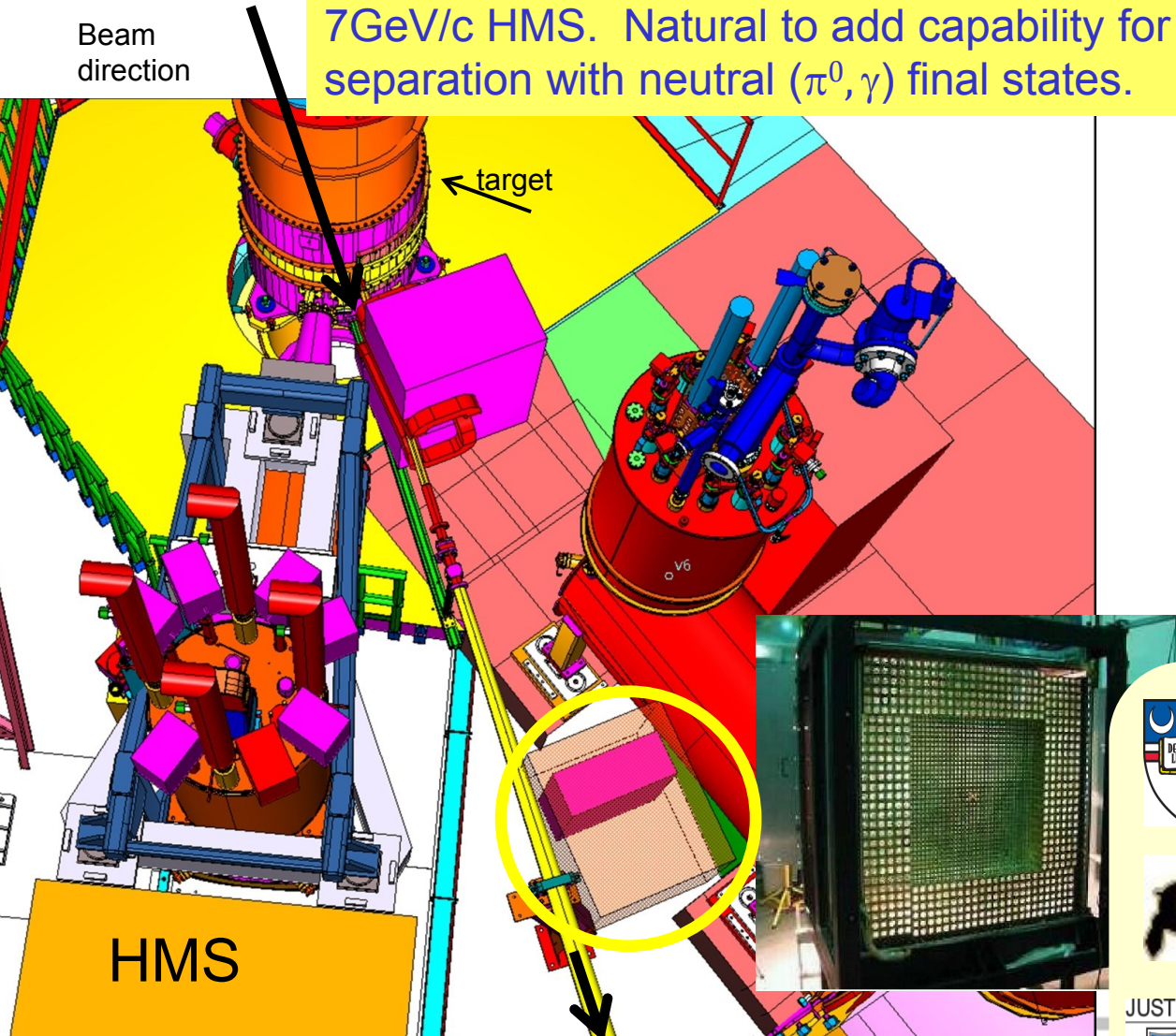


Neutral Particle Spectrometer (π^0/γ)

Hall C has unique L/T separation capability with 7GeV/c HMS. Natural to add capability for L/T separation with neutral (π^0, γ) final states.



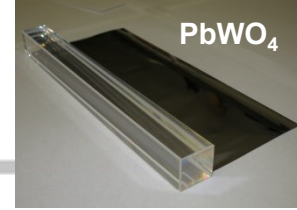
Concept: Place ~1000 block PbWO_4 detector on SHMS carriage with conventional sweeping magnet replacing SHMS horizontal bend.



HMS



NPS Status



- ❑ Global design of a neutral-particle spectrometer between 5.5 and 60 degrees consists of a highly segmented EM calorimeter preceded by a sweeping magnet
- ❑ **2015 NSF/MRI** funding proposal was **selected for an award**
 - Award will provide for NPS infrastructure, including the magnet, assuming existing crystals
 - In the ideal case the NPS would use new crystals
 - Application for UK grant with emphasis on additional equipment aimed at WACS requirements submitted
- ❑ **Significant efforts** of the NPS collaboration have recently been **related to PbWO₄ crystals**
 - 10+5 PbWO₄ crystals produced by SICCAS have been tested for optical properties and radiation hardness; 30 more crystals on order
 - Infrastructure for crystal testing being developed at IPN-Orsay and CUA
 - Close collaboration with Giessen University on crystal evaluation, as well as Caltech and BNL

5 Experiments approved

E12-13-007: π^0 SIDIS

E12-13-010: DVCS and π^0 cross sections

E12-14-003: WACS at 8 and 10GeV

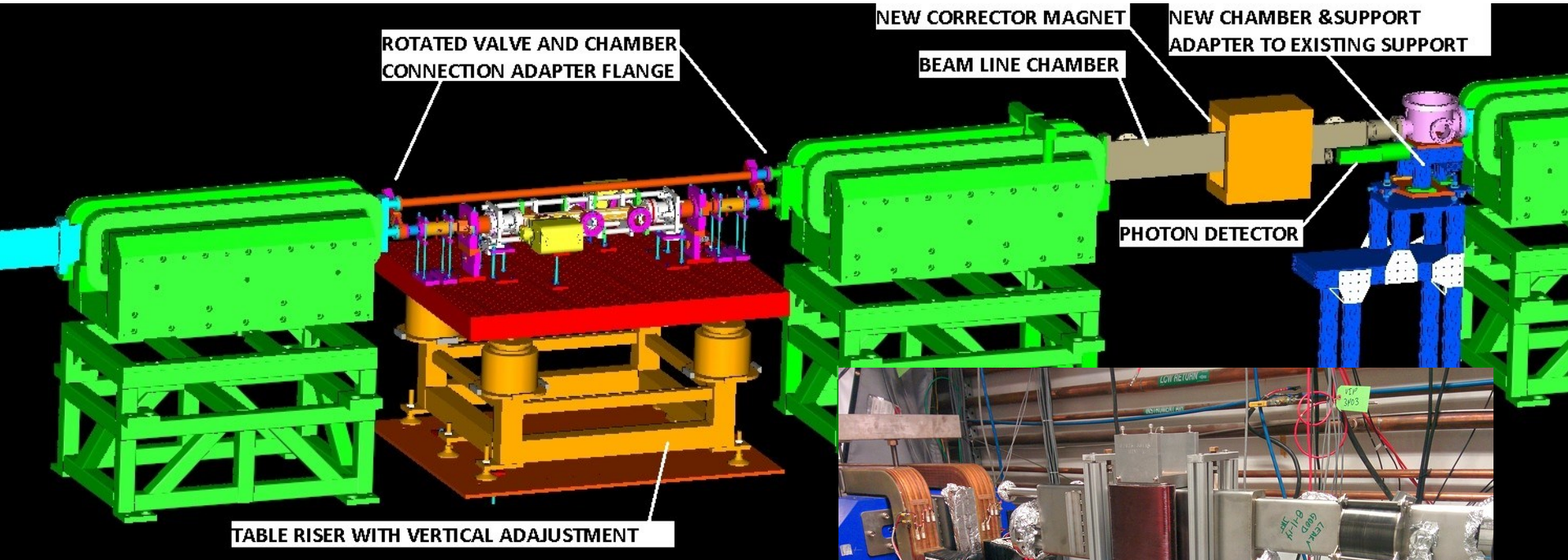
E12-14-005: Wide angle exclusive π^0

E12-14-006: Initial state helicity correlation in WACS

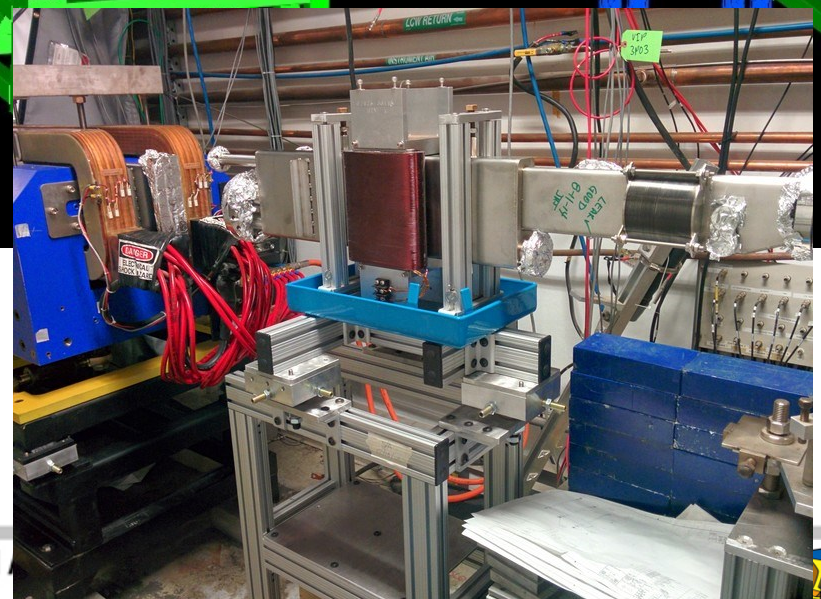
One proposal, one LOI at PAC43

Compton Polarimeter Upgrade

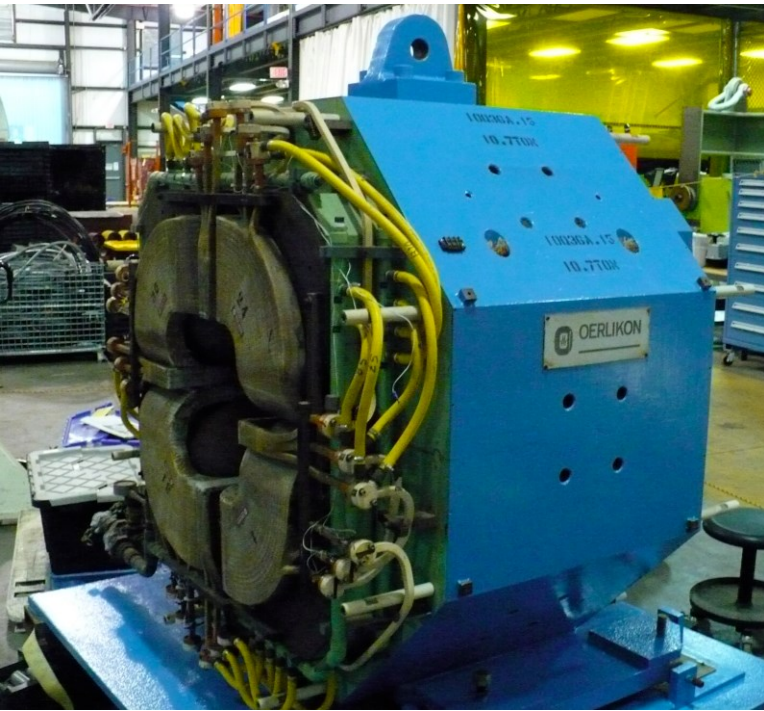
Modify Compton chicane, laser table and interaction region to account for stiffer 11 GeV beam.



Magnets re-installed on new supports
New Laser table support
New custom correctors and stands



Møller Polarimeter Upgrade



Upgrading Moller polarimeter for 11 GeV. (Adding second large quadrupole)

Replaced coils and fully refurbished both large quadrupoles (sand off rust, paint, new water hoses, etc.)

Compton, Moller and beamline upgrades on track for possible spring 2016 test beam

Early running plans – Year 1

Fall 2016:

Precommissioning – detector checkout

~25 PAC days – Commissioning “Experiment”

9 days of E12-06-107 [search for color transparency](#)

$A(e,e'p)$ only – “easy” coincidence measurement

E12-10-002 [F₂^{p,d} structure functions at large x](#)

Momentum scans help understand acceptance

2 days E12-10-108 [EMC Effect](#)

Integrate light nuclei with F₂ run,

Point target helps acceptance studies.

3 days of E12-10-003 [d\(e,e'p\)](#)

If time available

Push to lower cross sections

Early running plan – Years 2-3

2017:

E12-09-017 P_t dependence of basic SIDIS cross sections

Push particle ID capabilities of SHMS

E12-09-002 Precise $\pi^+\pi^-$ ratios in SIDIS – Charge Symmetry
Detector efficiencies

E12-09-011 L/T separated $p(e,e'K^+)$ factorization test
Easiest L/T separation

2018:

Choose a “High Impact Experiment”?

E12-06-110 A_1^n (needs high Luminosity polarized ^3He)

E12-06-101 Pion Form Factor (needs well understood SHMS)

E12-06-105 $x > 1$

Evaluate status of SHMS systematic control and ^3He target

Hall C after 12 GeV Upgrade

- Beam Energy: 2 – 11 GeV/c
- Super High Momentum Spectrometer (SHMS)
 - Horizontal Bender, 3 Quads, Dipole
 - $P \rightarrow 11$ GeV/c
 - dP/P $0.5 - 1.0 \times 10^{-3}$
 - Acceptance: 4msr, 30%
 - $5.5^\circ < \theta < 40^\circ$
 - Good e^-/π^- $e^+/\pi^+/K^+/p$ PID
- High Momentum Spectrometer (HMS)
 - $P \rightarrow 7.5$ GeV/c
 - dP/P $0.5 - 1.0 \times 10^{-3}$
 - Acceptance: 6.5msr, 18%
 - $10.5^\circ < \theta < 90^\circ$
 - Good e^-/π^- $e^+/\pi^+/K^+/p$ PID
- Minimum opening angle: $\sim 17^\circ$
- Well shielded detector huts
- 2 beamline polarimeters
- Ideal facility for:
 - Rosenbluth (L/T) separations
 - Exclusive reactions
 - Low cross sections (neutrino level)

