Polarized ^{3}He target in Hall C

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Jefferson Lab

Organizational meeting
January 5, 2012

Talking points

1) Requirements for A_1^n and d_2^n

2) Beam polarimetry: Compton and Moller upgrades

3) Polarized 3He coils system

4) Target R&D

5) Hall C projected budget for the target

6) Accelerator projected schedule

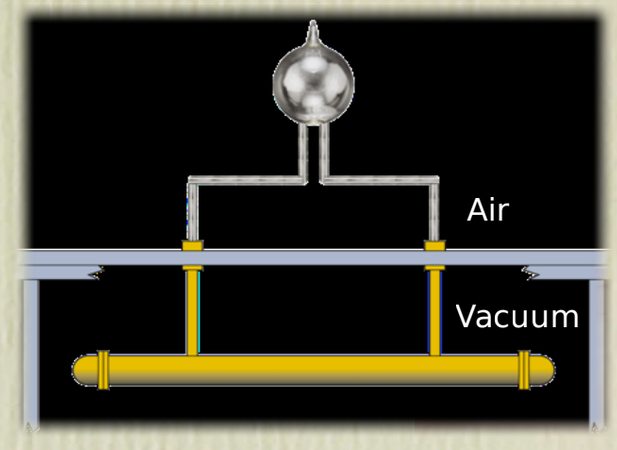
7) Manpower for Hall C running

Requirements for A_1^n and d_2^n

(from updated proposals)

GEN-II target:

- ✓ 60 cm Alkali-hybrid cell, 12 amg
- ✓ 2 transfer tubes for convection
- ✓ Gold-plated Aluminum target chamber
- ✓ Pulsed NMR



A_1^n

- Target: 60% polarization with 60μA and 3% rel. syst. on polarimetry
- Beam: 85% polarization and 1% rel. syst. on polarimetry

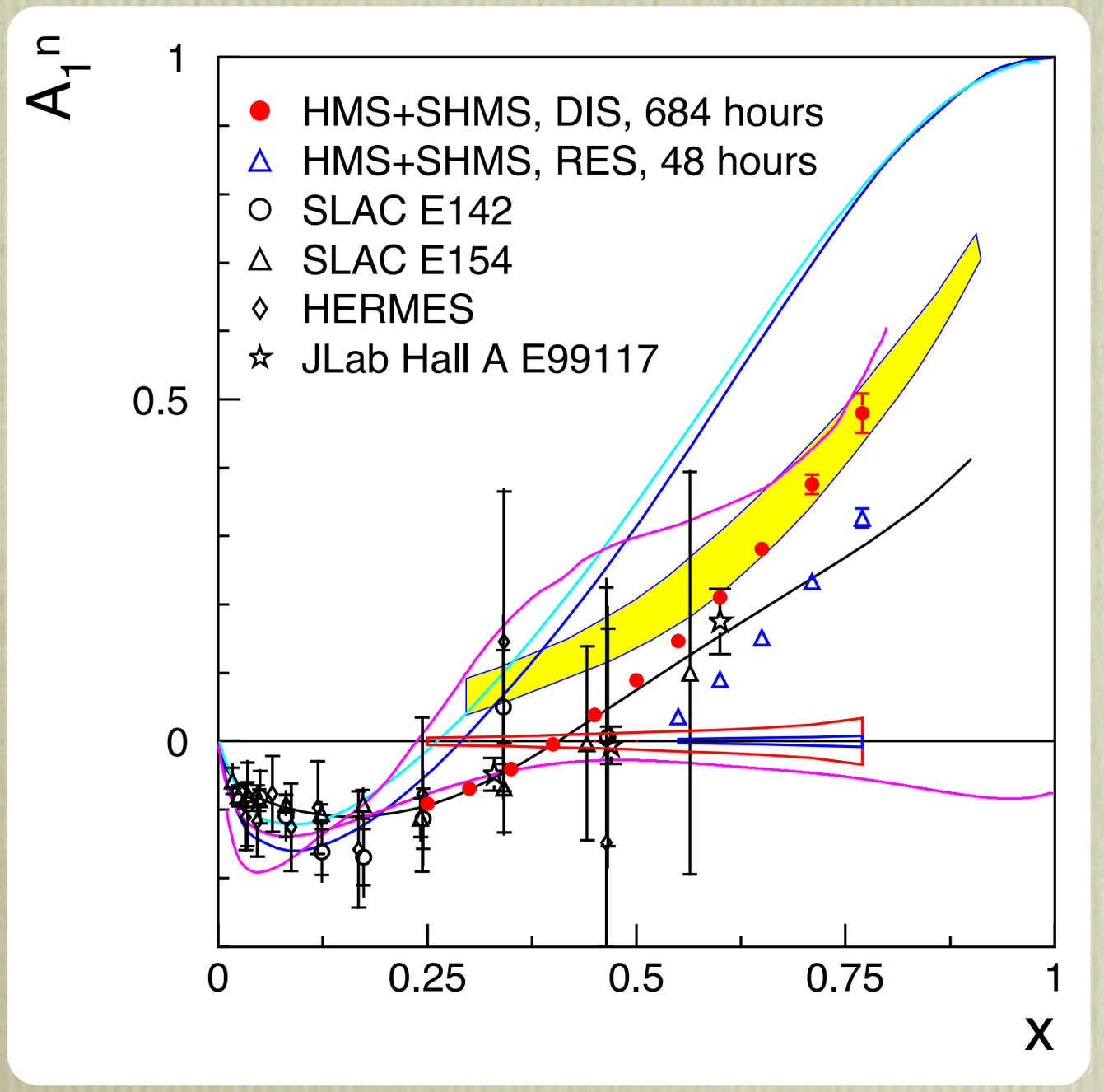
(684hrs DIS + Res) + (169 hrs calib./comm./overhead) = 853 hours (35.5 pac days) total

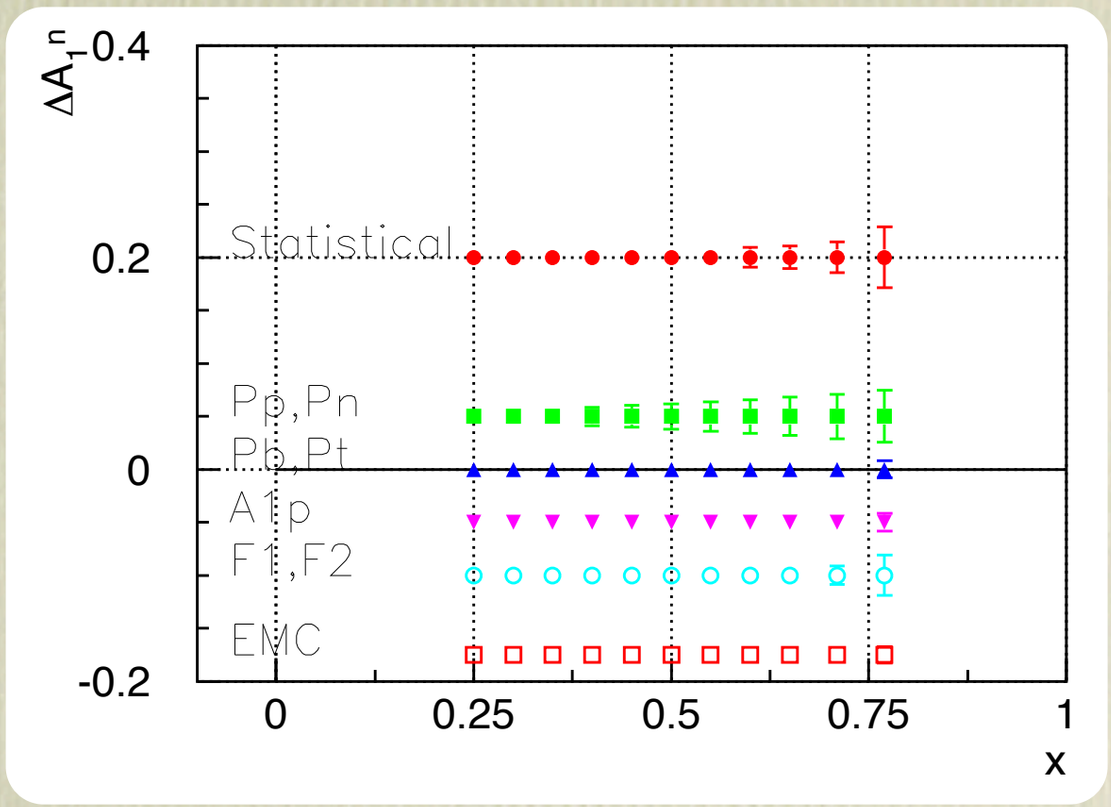
d_2^n *(update PAC36)*

- Target: 55% polarization with 30μA and 3% rel. syst. on polarimetry
- Beam: 80% polarization and 1.5% rel. syst. on polarimetry

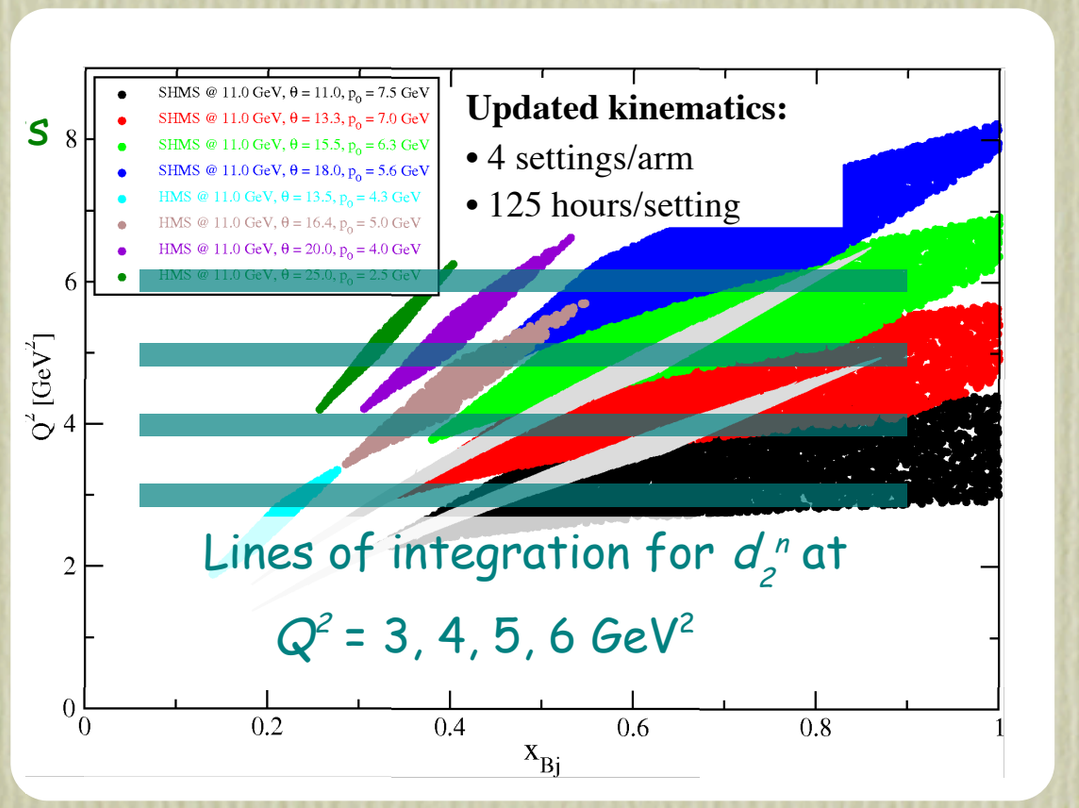
(125hrs * 4 conf.) + (200hrs calib./comm./overhead) = 700 hours (29 pac days) total

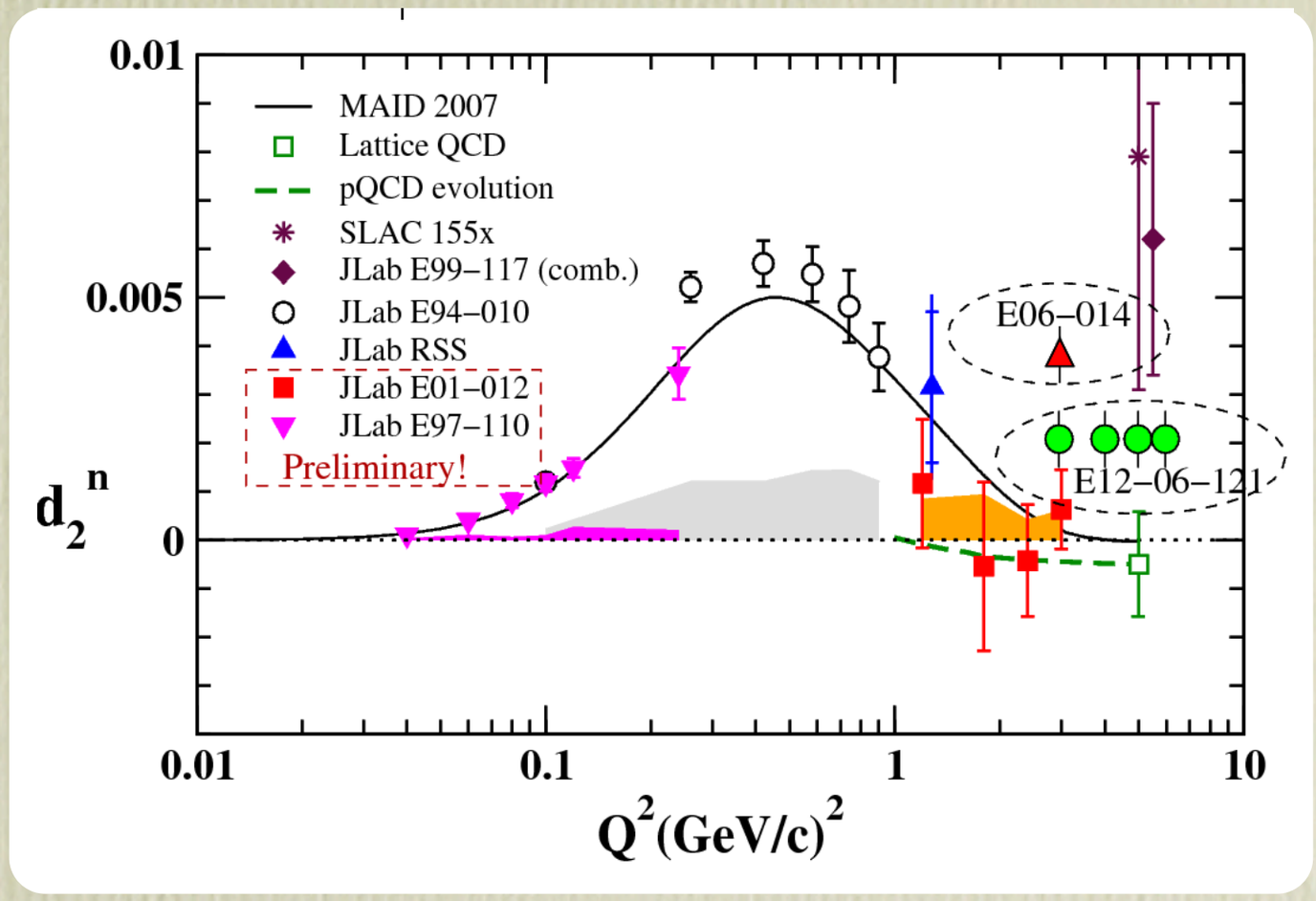
Projected precision for A_1^n





Projected precision for A_1^n





Hall C 12 GeV Polarimetry

D. Gaskell

Møller Polarimeter

→ 6 GeV operation: uses 2 quads to focus Møller events on detector plane, systematic error dP/P < 1% at low currents

→ 11 GeV operation requires additional quad, altered tune, systematic error will be slightly larger (still under evaluation)

→ Møller polarimeter will be ready from day 1 (October 2014)

Compton Polarimeter

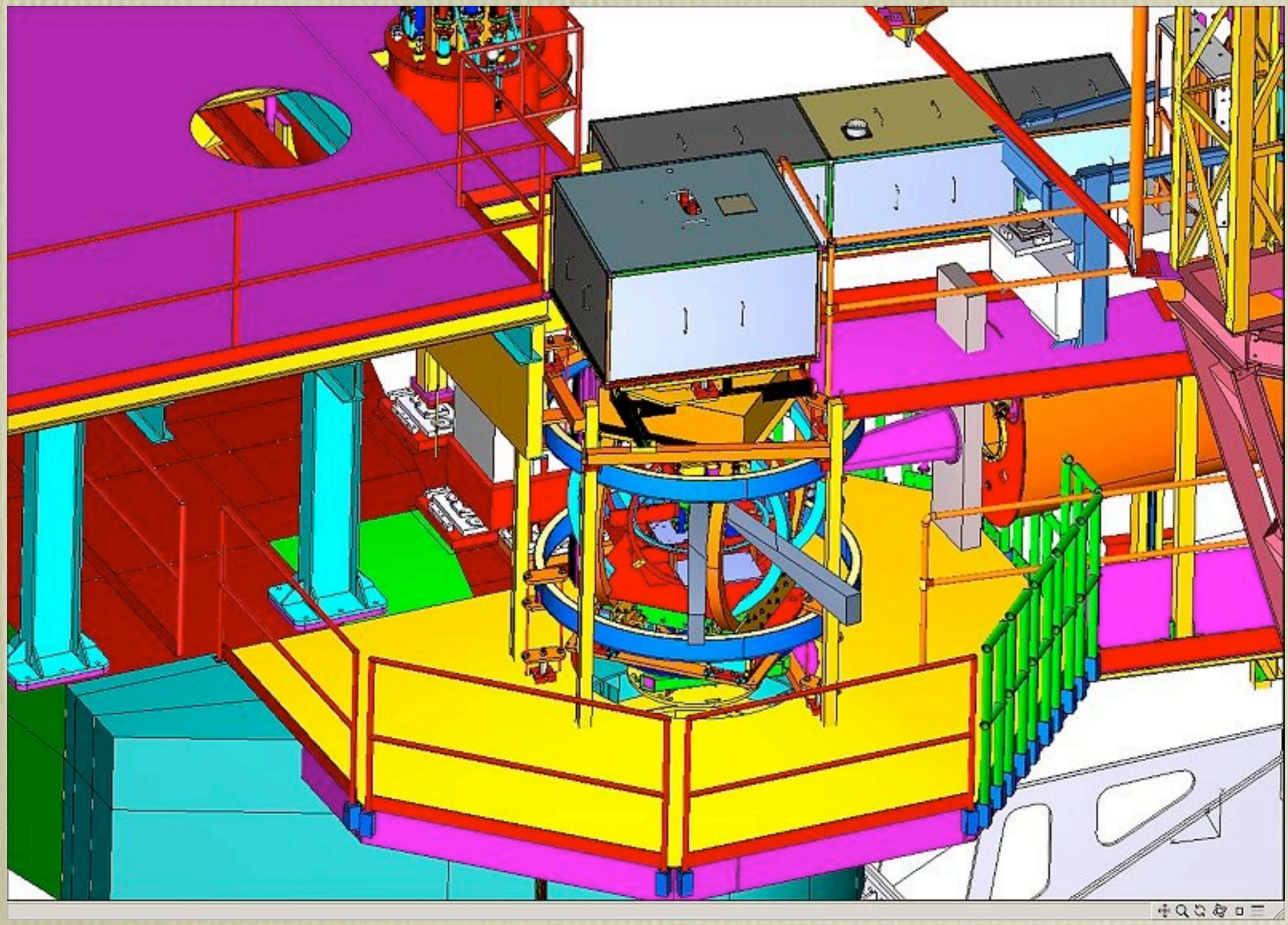
→ Newly installed for Q_{Weak} – similar to Hall A system (FP cavity, diamond strip electron detector, photon detector) – electron detector analysis should yield dP/P<1%

→ 11 GeV operation requires changes to dipole chicane (57 cm deflection → 13 cm)

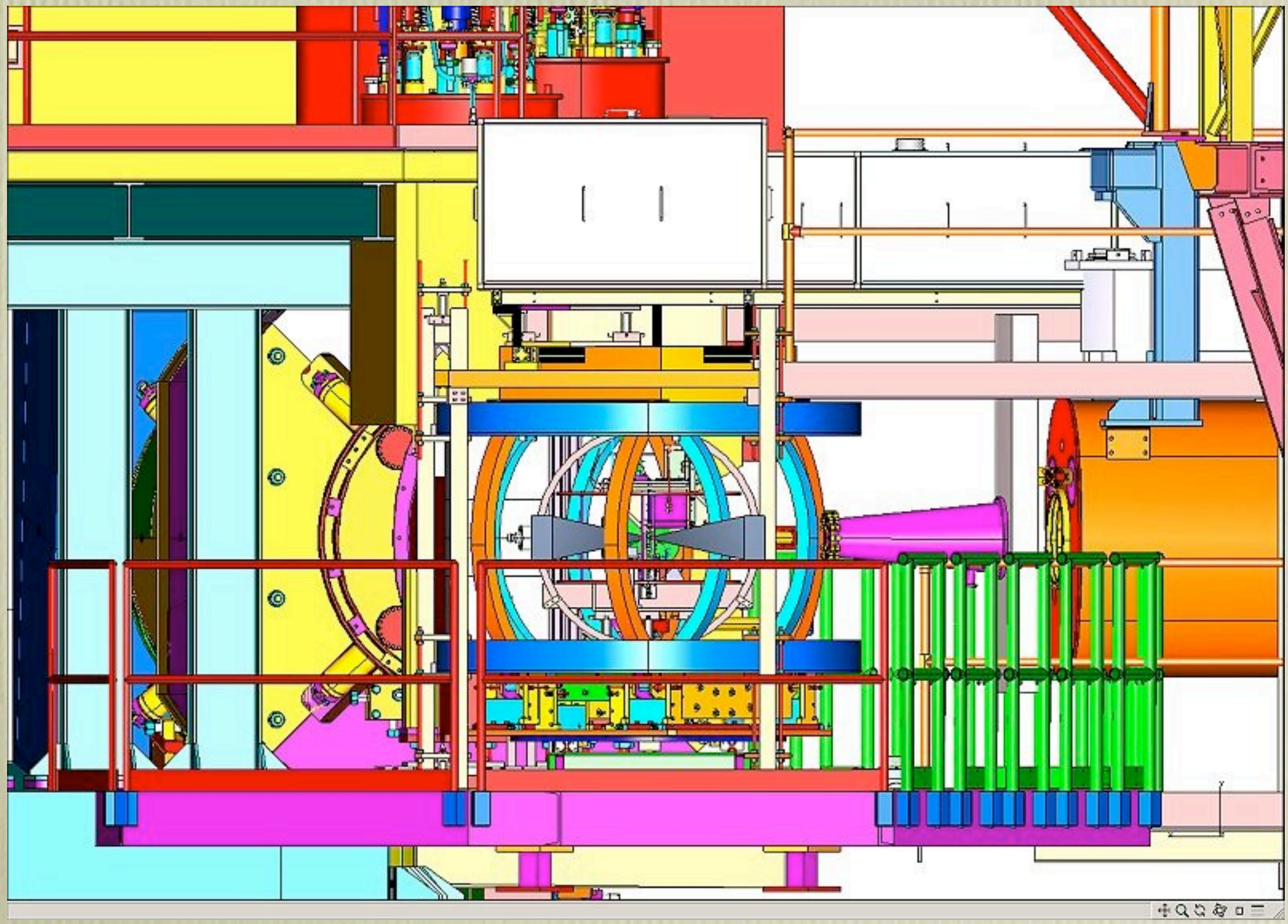
→ Assuming same laser system (1700 W green) and similar backgrounds in electron detector, 1% measurement in <30 minutes at 11 GeV (10 μA)

→ Design work just began for upgrade – Compton may not be ready for first beam – depends on scope of work, etc.

Hall A polarized ^{3}He system



Hall A polarized ^{3}He system



Polarized ^{3}He system

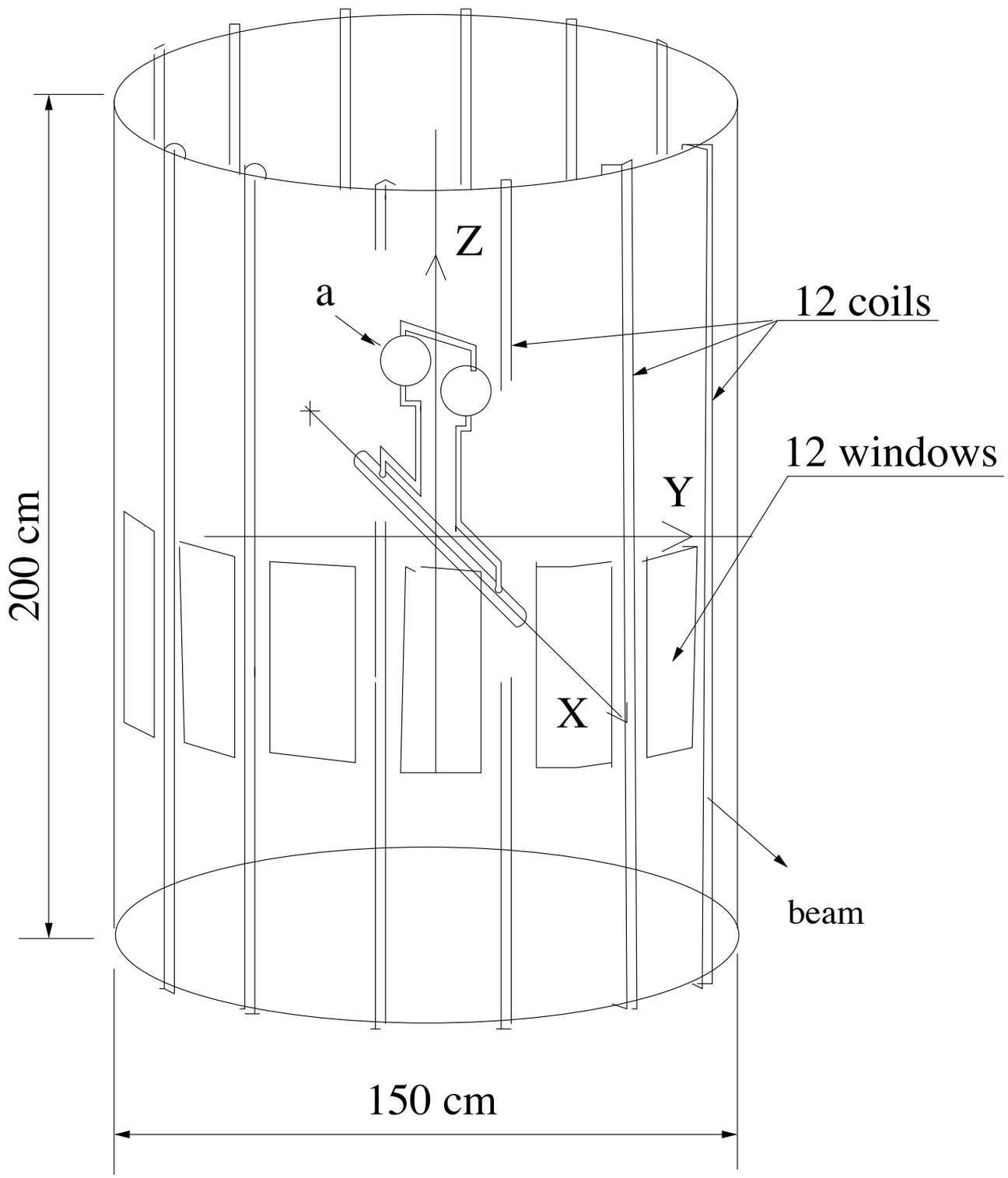
From Vladimir Nelyubin's talk at the Hall A collaboration meeting:

The barrel type magnet provides holding field for new target cell with inhomogeneities:

$$\left[|\vec{\nabla} B_y|^2 + |\vec{\nabla} B_z|^2\right]^{\frac{1}{2}} \sim 20 \frac{\mathrm{mG}}{\mathrm{cm}}$$

The angle between directions field in the target and pumping chamber is $\sim 0.7^o$.

The first consideration show that barrel type magnet is very promising. To decrease gradient we plan optimize sizes of the barrel magnet.



Current 12 GeV target R&D

@ JLab:

Zhiwen Zhao (UVa postdoc)
Jie Liu (UVa student)
Chunhua Chen (Hampton student on HKS)
Yawei Zhang (Rutgers student on E05-015)

Wiki page: https://hallaweb.jlab.org/wiki/index.php/Target_Lab_Main

- Setup and test of the standard target system and "diffusion" target cells
- Preparation of the existing target system for "convection cells": oven design, pulse NMR

@ UVa:

Al Tobias (Research scientist)
Vladimir Nelyubin (Research scientist)
...

- Production of "convection cells"
- Coils design, polarimetry improvement, ...

Hall C projected budget

Hardware:

- Glass cell

  --> 10 cells @ $4-6K per cell ---------- $60K

- 3He gas

  --> 10 liters/cell @ $600/liter ---------- $60K

- Optical fiber

  --> about 10 100m-fibers and connectors ---------- $120K

- Lasers

  --> 4 COMET 30W lasers @ $26K/laser ---------- $104K

- Electronics:

  --> computer and target electronics spares ---------- $100K

$444K

People:

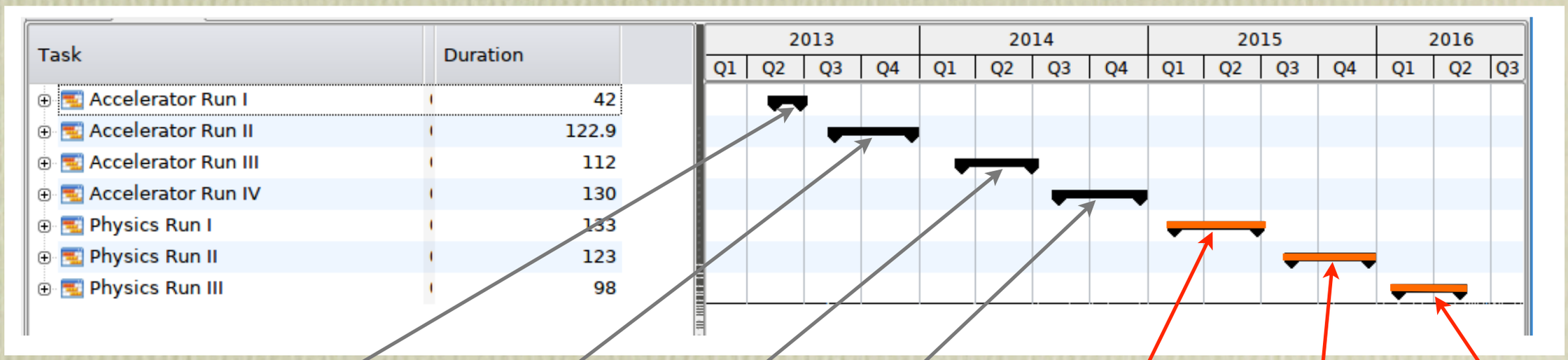
1 FTE designer/engineer for 2 years

3 FTE technicians for 3 months for installation

Physicists and students

Accelerator projected schedule

From Arne's talk at the Hall A collaboration meeting:



no physics

beam to Hall-A
(1 week for detector checkout)

beam to Hall-D
(3 weeks for transport tests)

Hall-A physics
(up to 3 pass)

Hall-A eng./physics
(up to 3 pass)

Hall-B&C
(detector tests)

Hall-D engineering run

Hall-A Physics

Hall-B&C ?

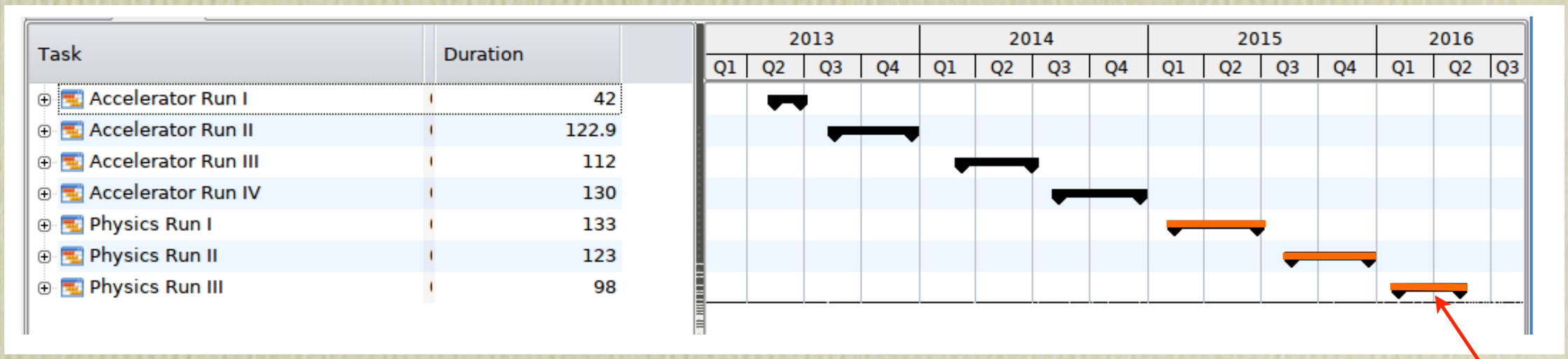
Hall-A Physics

Hall-B&C engineering runs

Physics in all Halls

Accelerator projected schedule

From Arne's talk at the Hall A collaboration meeting:



Physics in all Halls

"Optimistic" earliest run seems to be late 2016