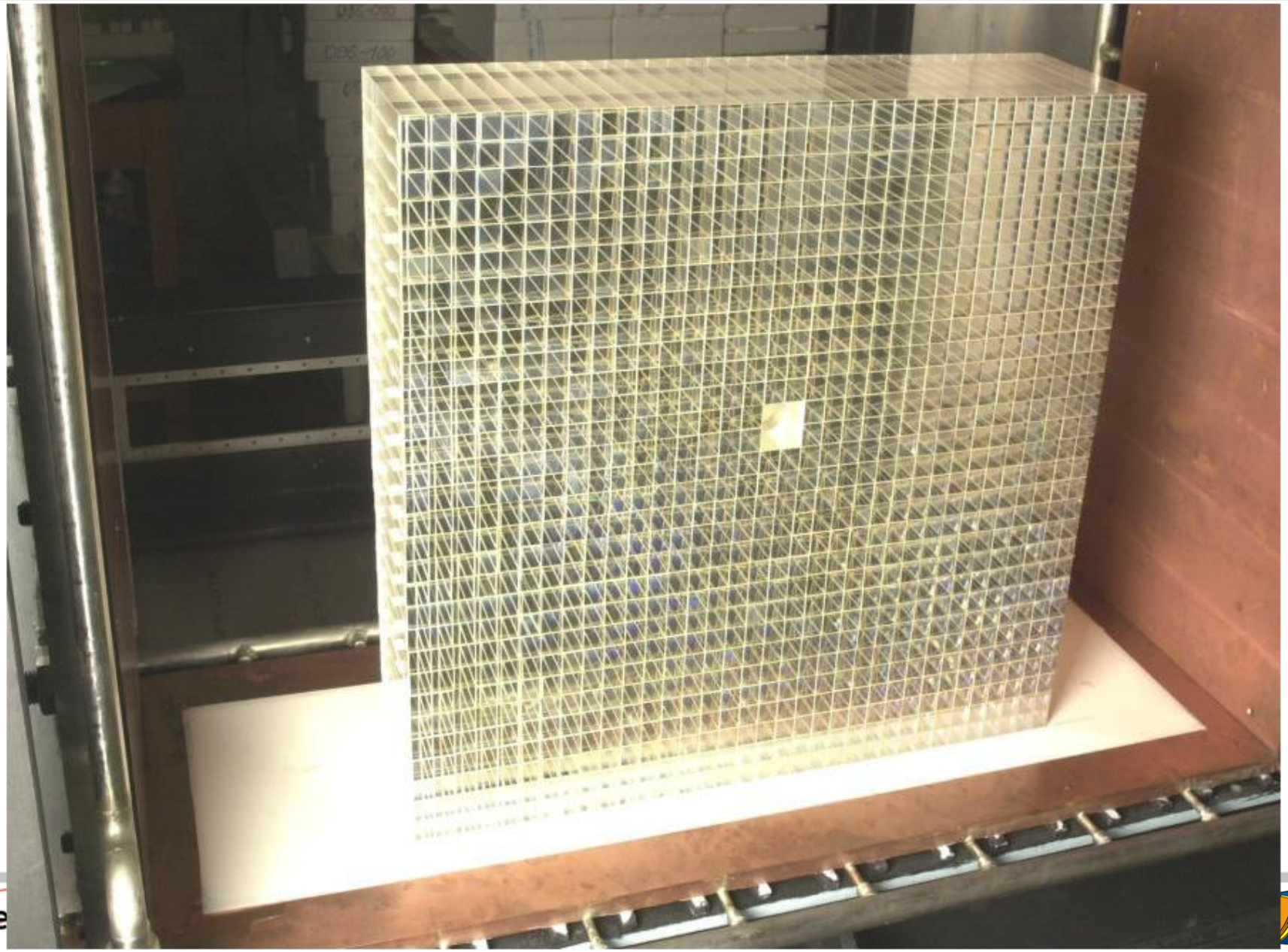
PbWO4 Neutral particle detector

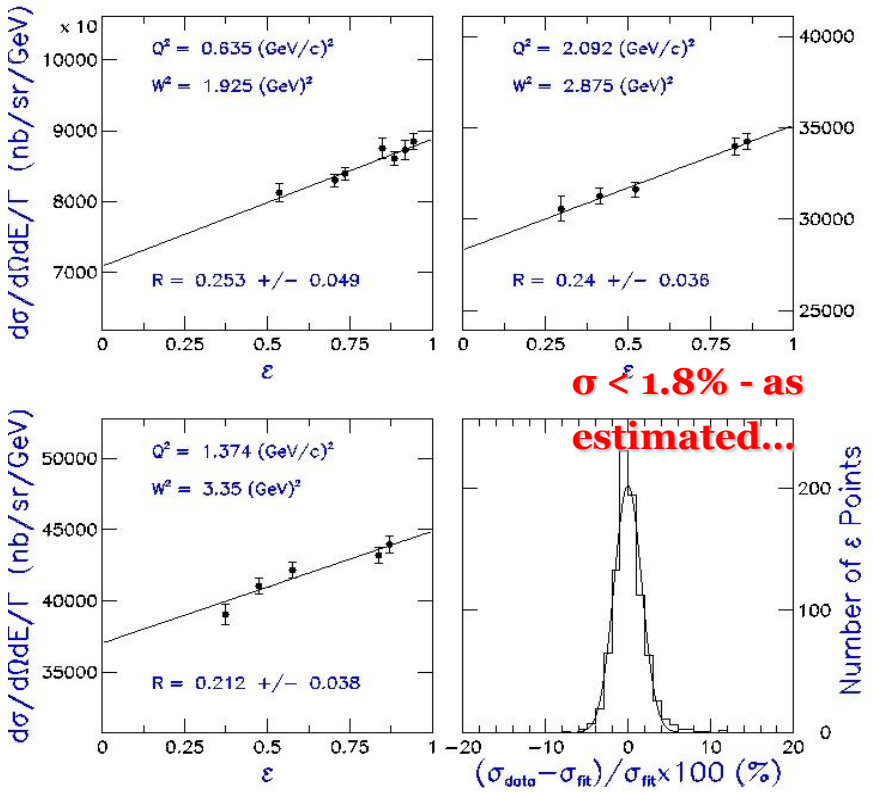


Hall C L/T Separations

- Typical and unique Hall C use: σ_L - σ_T separation
  - Measure σ at several ε with fixed Q^2
  - Control point to point errors to < 2%
  - $\rightarrow$ Control tracking/PID uncertainty to < 1% over wide range of rates

$$\frac{d^2\sigma}{d\Omega dE'} = \Gamma(\sigma_T + \varepsilon\sigma_L)$$

Quantity	Uncertainty	$\delta_\sigma(\%)$
Beam energy	$\sim 5 \times 10^{-4}$	0.30
Scattered e^- energy	$\sim 5 \times 10^{-4}$	0.25
Scattering e^- angle	~ 0.2 mrad	0.26
Target density (relative)	0.05%	0.05
Beam charge (relative)	0.1%	0.1
Dead Time Correction	0.2%	0.2
Detector Efficiency	0.55%	0.55
$e+/e-$ background	0.2%	0.2
Acceptance	0.7%	0.7
Model Dependence	0.6%	0.6
Radiative Correction (ε)	1.05%	1.05
Total point-to-point		1.6



σ < 1.8% - as estimated...

12 GeV L/T separation

Experiments with L/T Separation

E12-06-101 – Pion Form Factor

E12-06-104 – R in semi-inclusive DIS

E12-07-105 – Scaling in exclusive (charged) Pion production

E12-09-011 – Scaling in exclusive Kaon production

E12-10-002 – Nucleon structure functions

~1/3 of approved beam time

Unique capability in the 12 GeV Era

Natural to augment L/T capability with neutral pion/gamma detector.

Low cost facility adds flexibility and helps insure healthy program to 2030

π^0/γ detector timeline

August 2011 - P12-11-102, “Measurement of the Ratio R= σ_L/σ_T in Exclusive and Semi-Inclusive π^0 Production

Conditionally approved @ PAC38

2012

MRI proposal submitted

Simultaneous DVCS use discussed

June 2012 - Conditions addressed at PAC39

PAC39 Deferred experiment

MRI not approved

November 2012

Meeting at Orsay to discuss broader uses of detector

π^0, DVCS (“LT-like” separations), WACS

PAC strategy

Proposed neutrals (e.g. π^0/γ) detector facility in Hall C

- Desire to augment spectrometers with capability for precision measurements with neutral final states. (L/T separations)

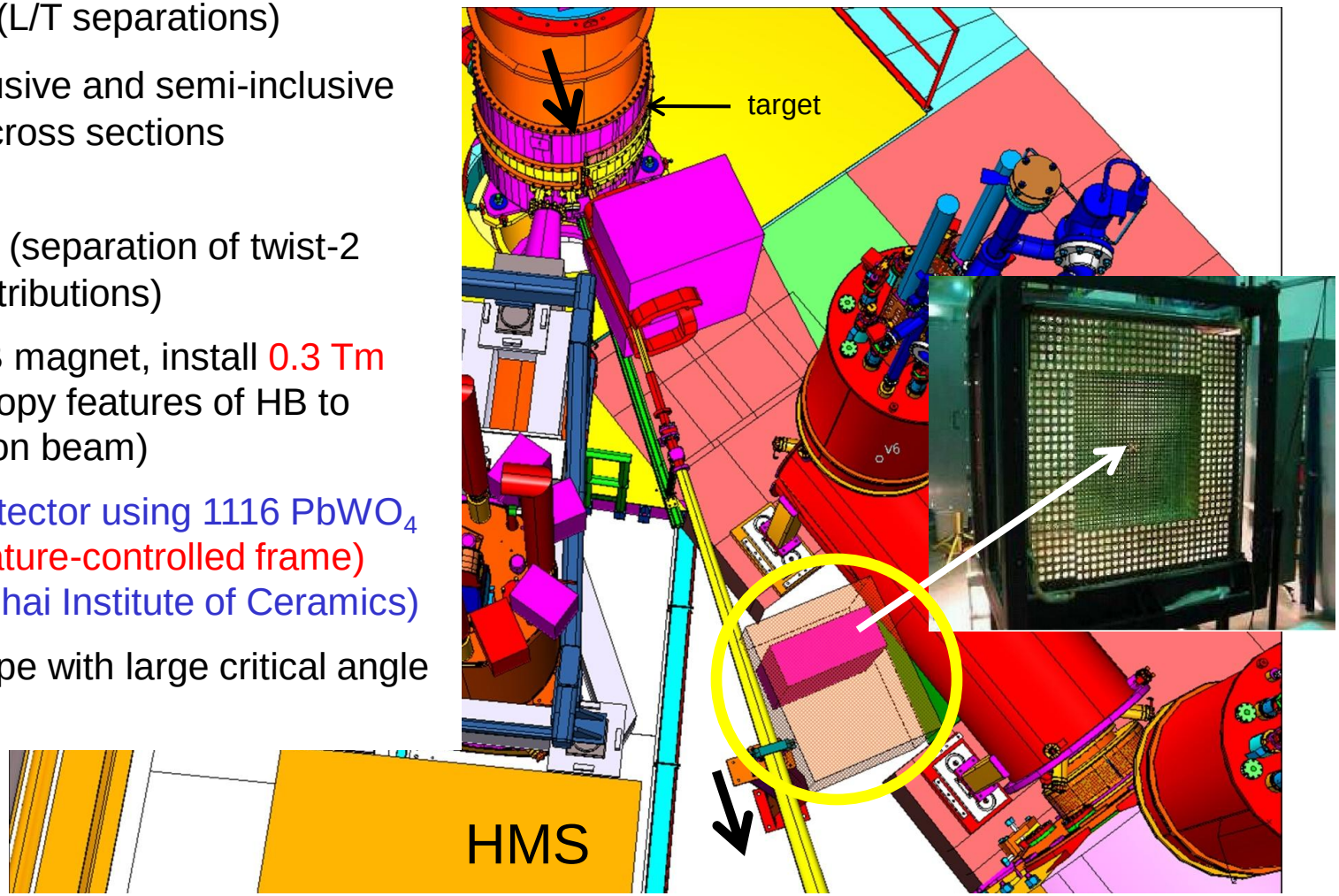
  p(e,e′π^0) exclusive and semi-inclusive L/T separated cross sections (PR12-11-111)

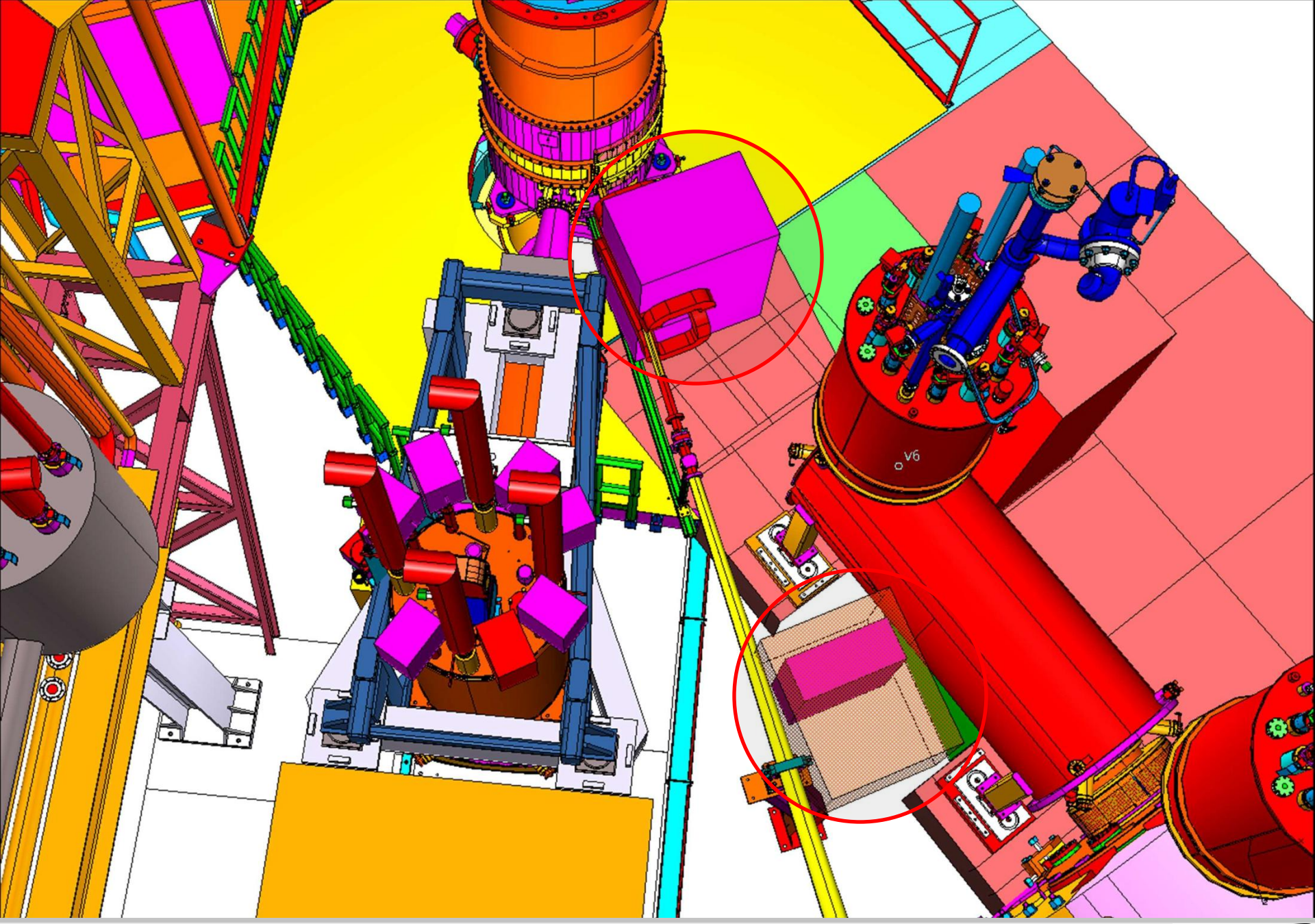
  p(e,e′γ) DVCS (separation of twist-2 and twist-3 contributions)

- Remove SHMS HB magnet, install 0.3 Tm sweeping magnet (copy features of HB to minimize stray field on beam)

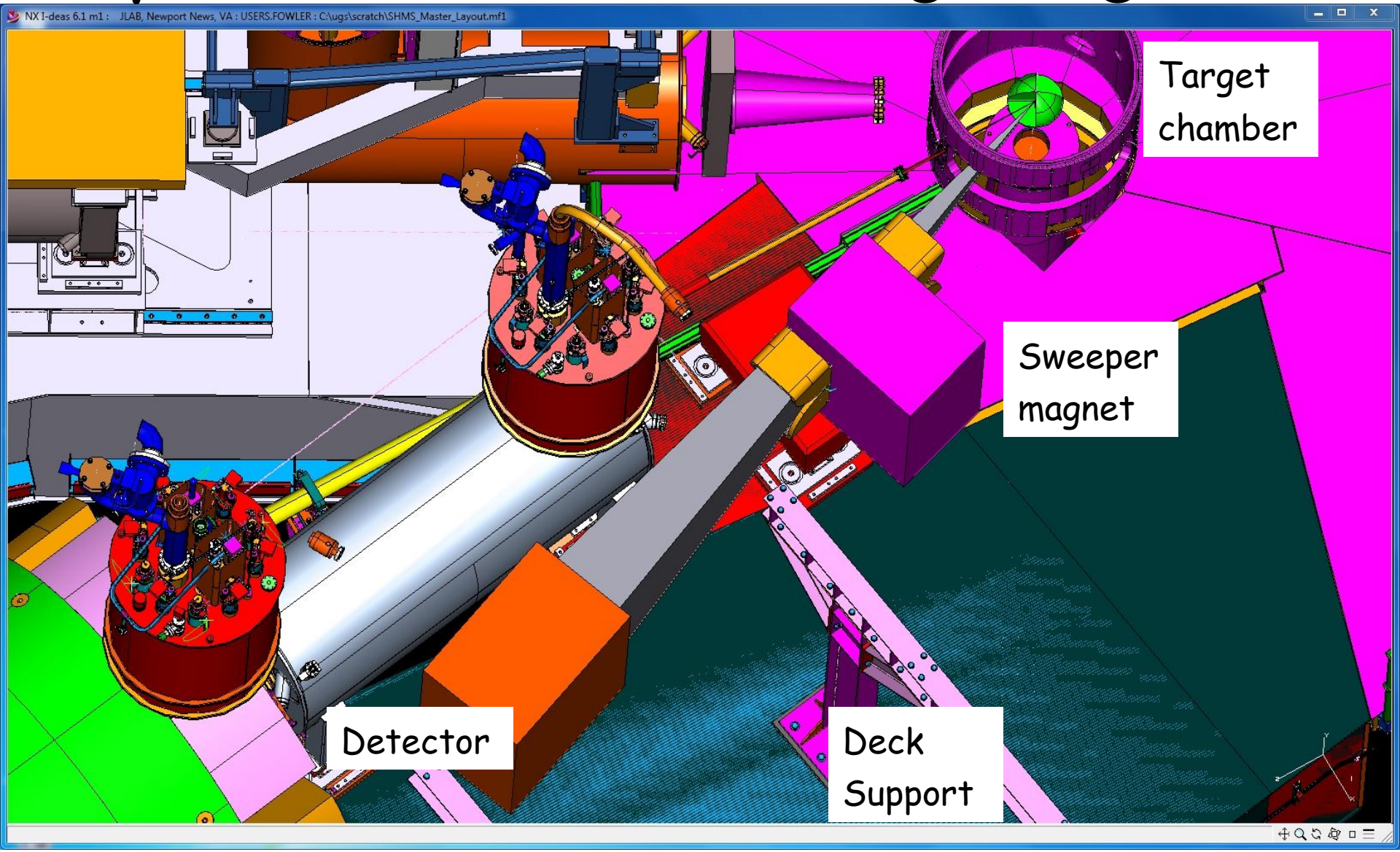
- Add 25 msr π^0/γ detector using 1116 $PbWO_4$ blocks (with temperature-controlled frame) ($PbWO_4$ from Shanghai Institute of Ceramics)

- Dedicated beam pipe with large critical angle + shielding




V6

π^0/γ detector on SHMS Large Angle side



Hall C 12 GeV Era Summary

- Hall C will have two well shielded magnetic spectrometers able to exploit full beam energy, measure low cross sections with precision, L/T separations
- Approved program of structure functions, SIDIS, exclusive reactions and nuclear effects (EMC, X>1, Transparency) $\rightarrow$ ~2020
- Additions to base equipment:
  - Neutron and proton polarimeters
  - Backward nucleon detector
- π^0/γ detector a low cost natural addition to base equipment
  - Use “could” start 2019/2020
  - Would help assure healthy physics program to 2030
  - Hall C can support modest development/design/fabrication efforts. Parasite beam testing possible.