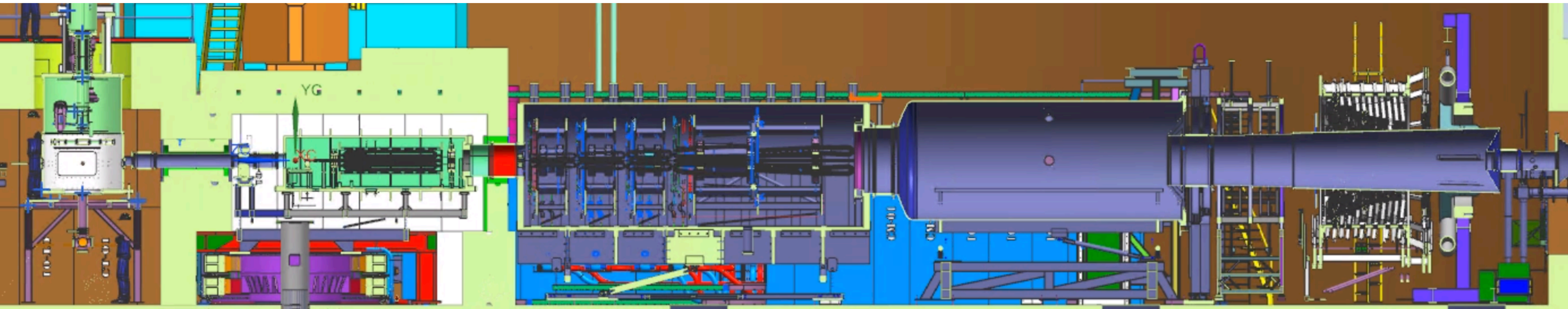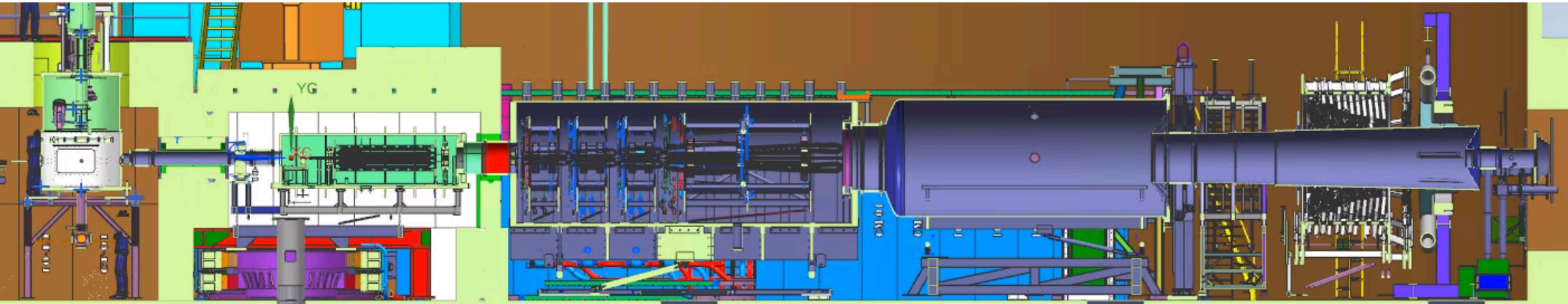# Technical Update

Kent Paschke
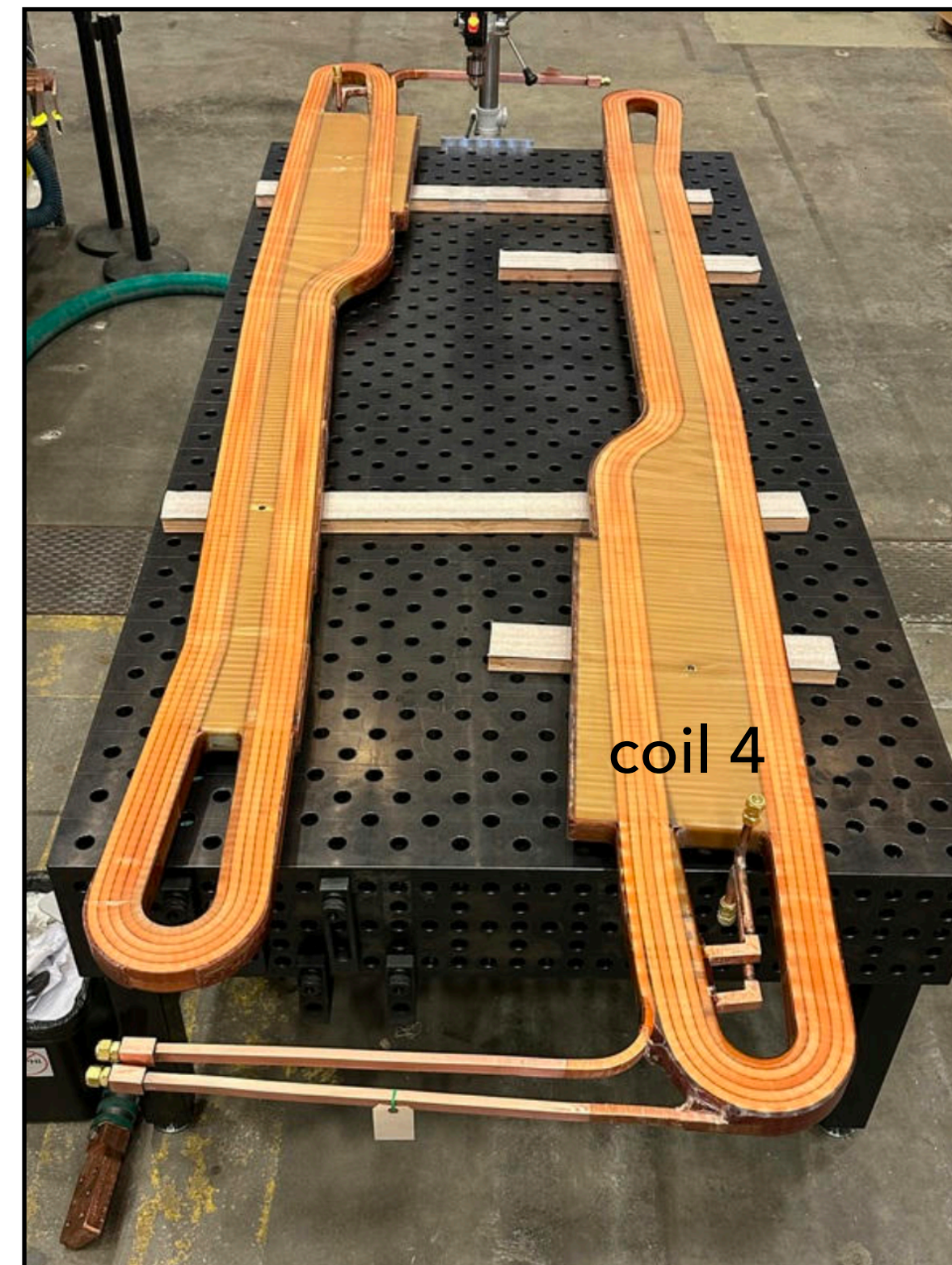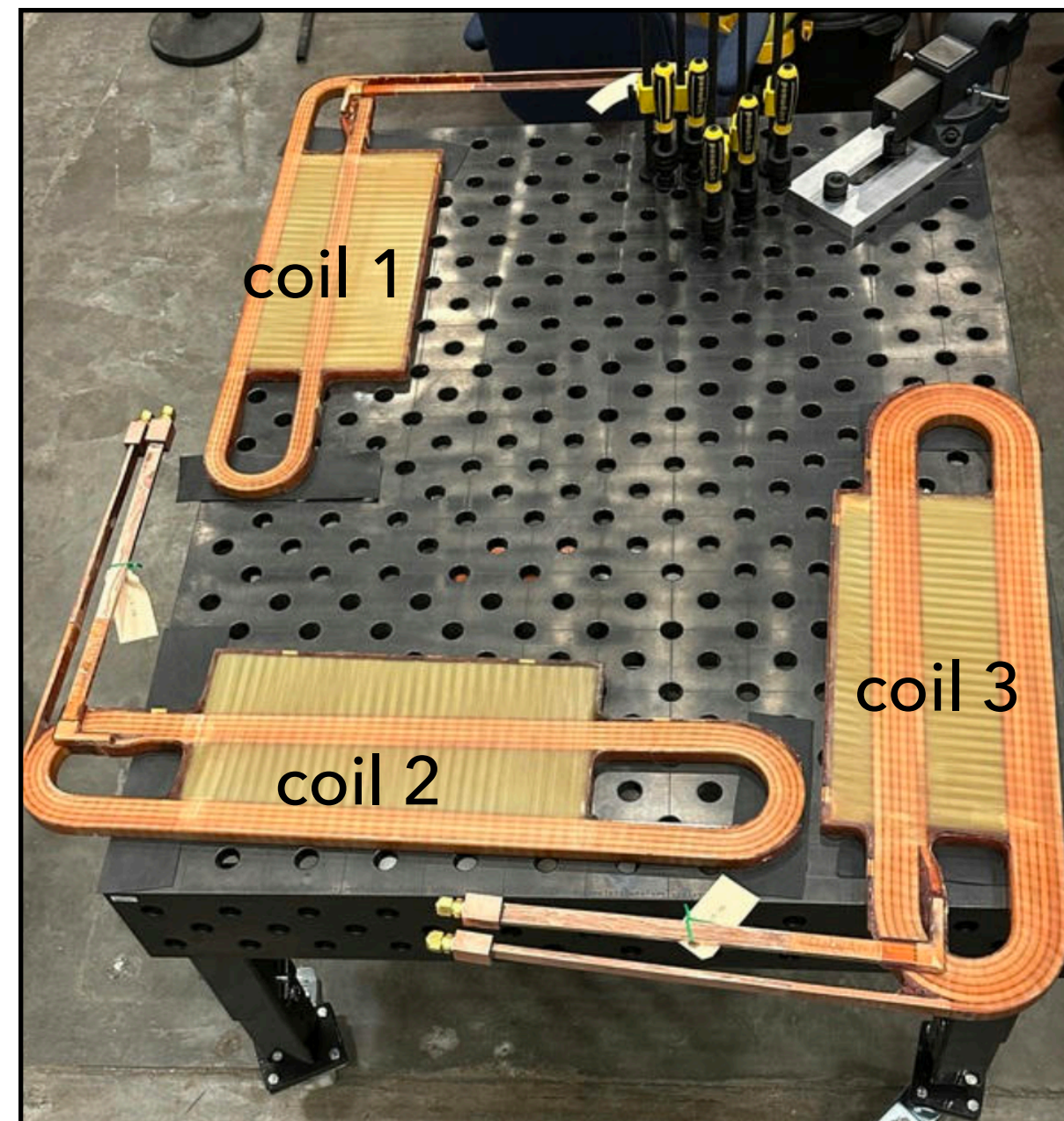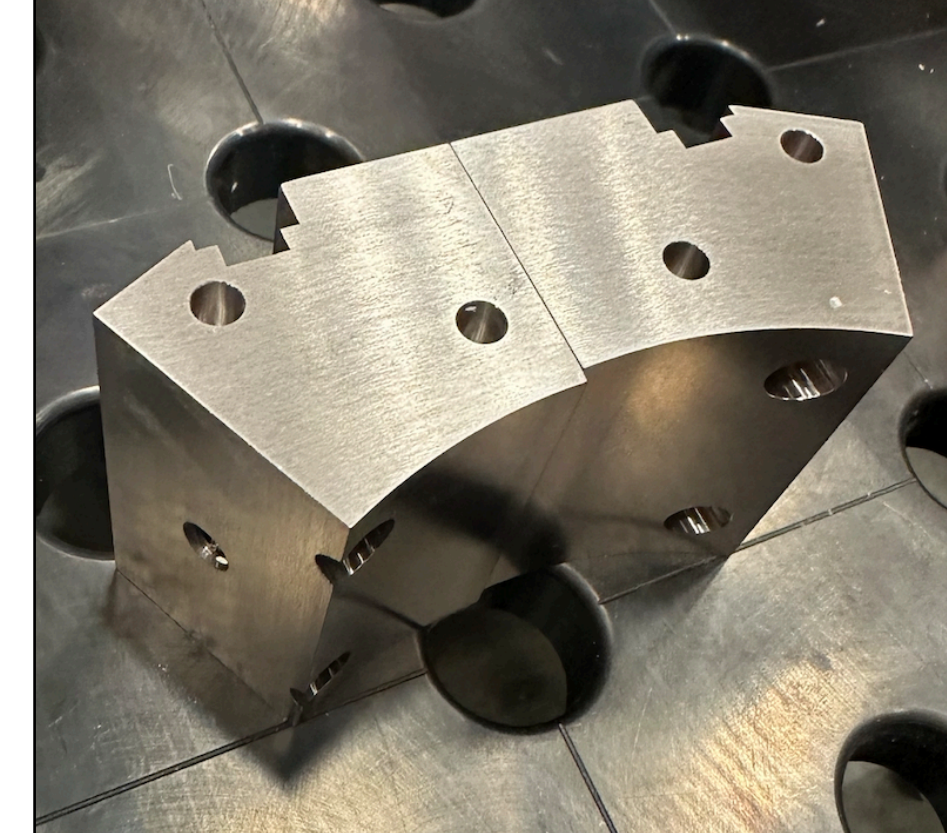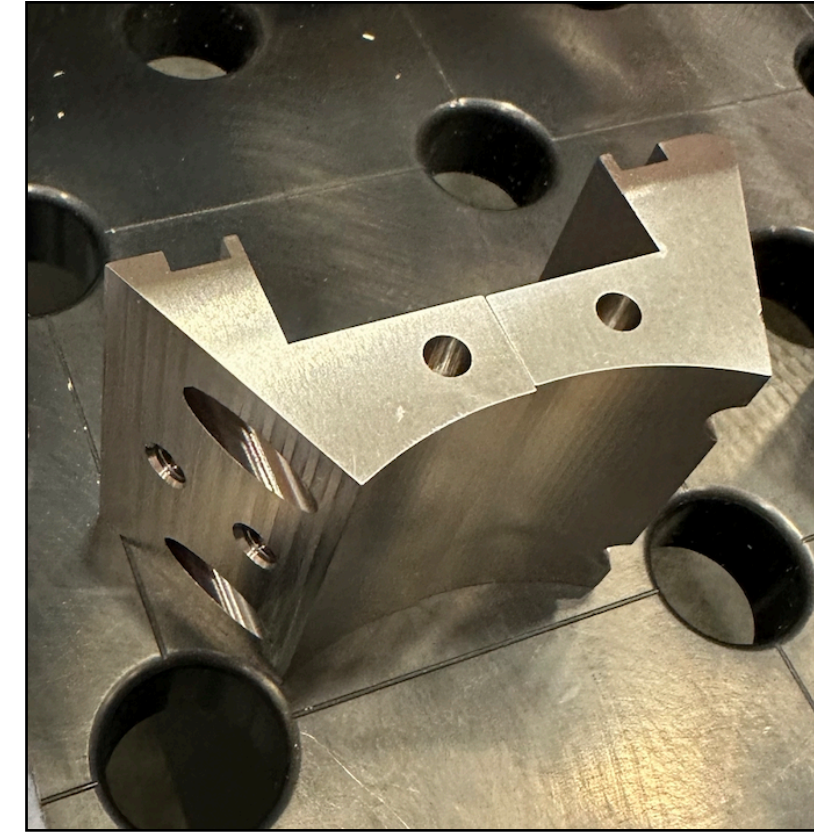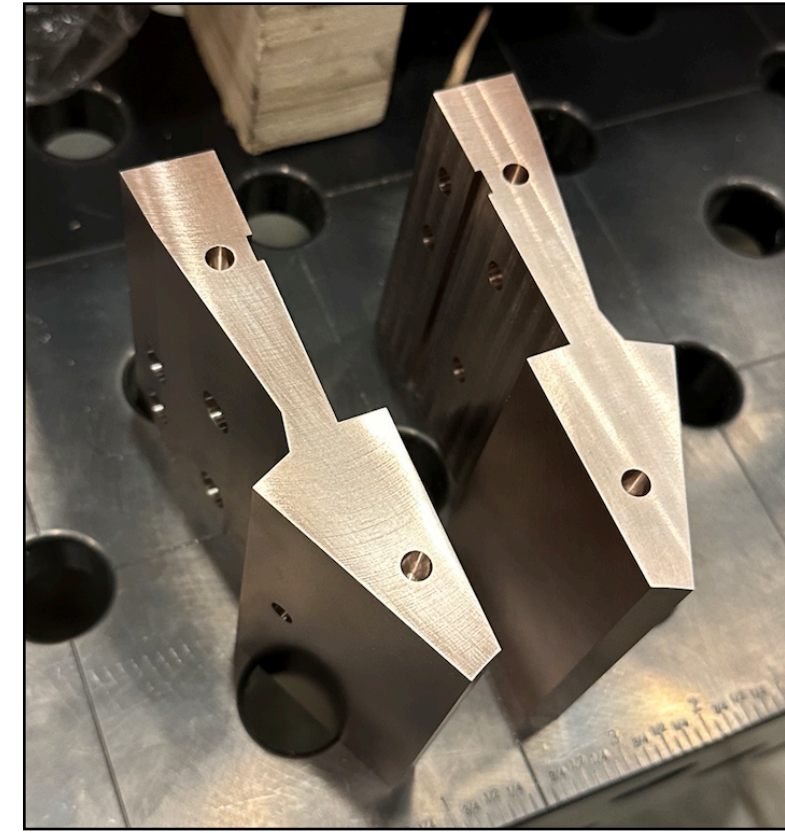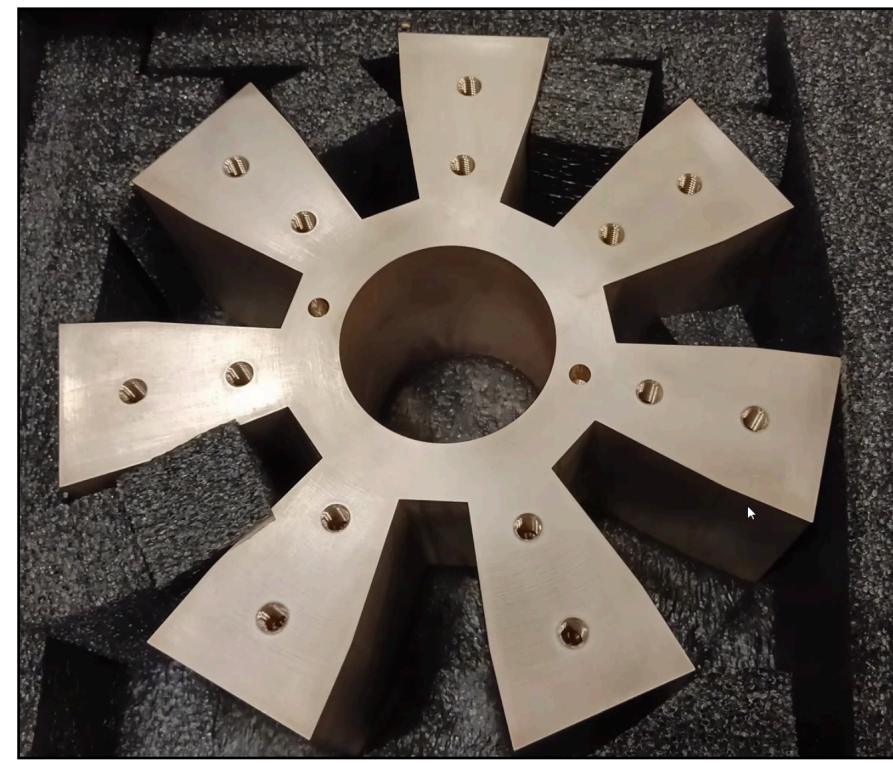
# Progress

- Fabrication!  CD2/3 imminent!
- Locating coils - design, plans, epoxy thickness, field scan
- MD tiling verified, rates, deconvolution, variation (ZD)
- Compton electron detector  HVMAP design
- Compton electron detector diamond strip readout design
- Modeling of activation dose in detector area
- Feasible target-chamber vacuum window design

- Optics calibration planning
- PQB - Beam studies, injector upgrade planning
- BCM bench and beam studies
- Injector upgrade (gun and booster)
- Halo monitor simulation and beam studies, planning
- Continued evaluation of ferrous components
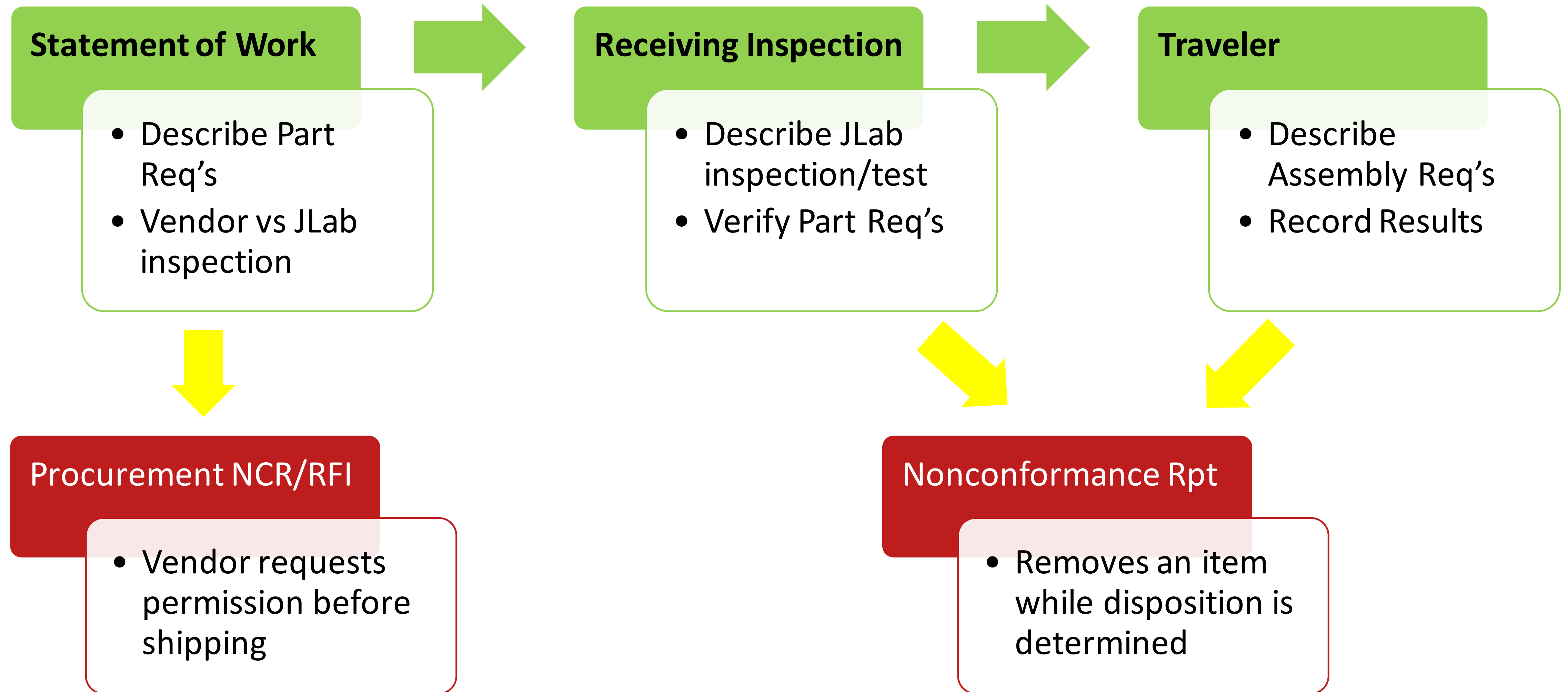- Commissioning plan draft outline

# Fabrication has started



coil 1
coil 2
coil 3

coil 4

UNIVERSITY of VIRGINIA

# Q/A process

Jacob Harris

**Statement of Work**

- Describe Part Req's
- Vendor vs JLab inspection

**Receiving Inspection**

- Describe JLab inspection/test
- Verify Part Req's

**Traveler**

- Describe Assembly Req's
- Record Results

Procurement NCR/RFI

- Vendor requests permission before shipping

Nonconformance Rpt

- Removes an item while disposition is determined

RIR index register in sharepoint:        Documents  >  Quality Assurance  >  Receiving Inspection RIRs IN-PROGRESS

# Importance of alignment along beam axis

Trajectory of high momentum tracks in acceptance relatively unaffected by small coil misalignments in the large-radius gaps

Disrupted beam (with low-momentum tracks) in narrow gap between coils very sensitive to coil misalignment



TM2 | Radial field, symmetric vs asymmetric
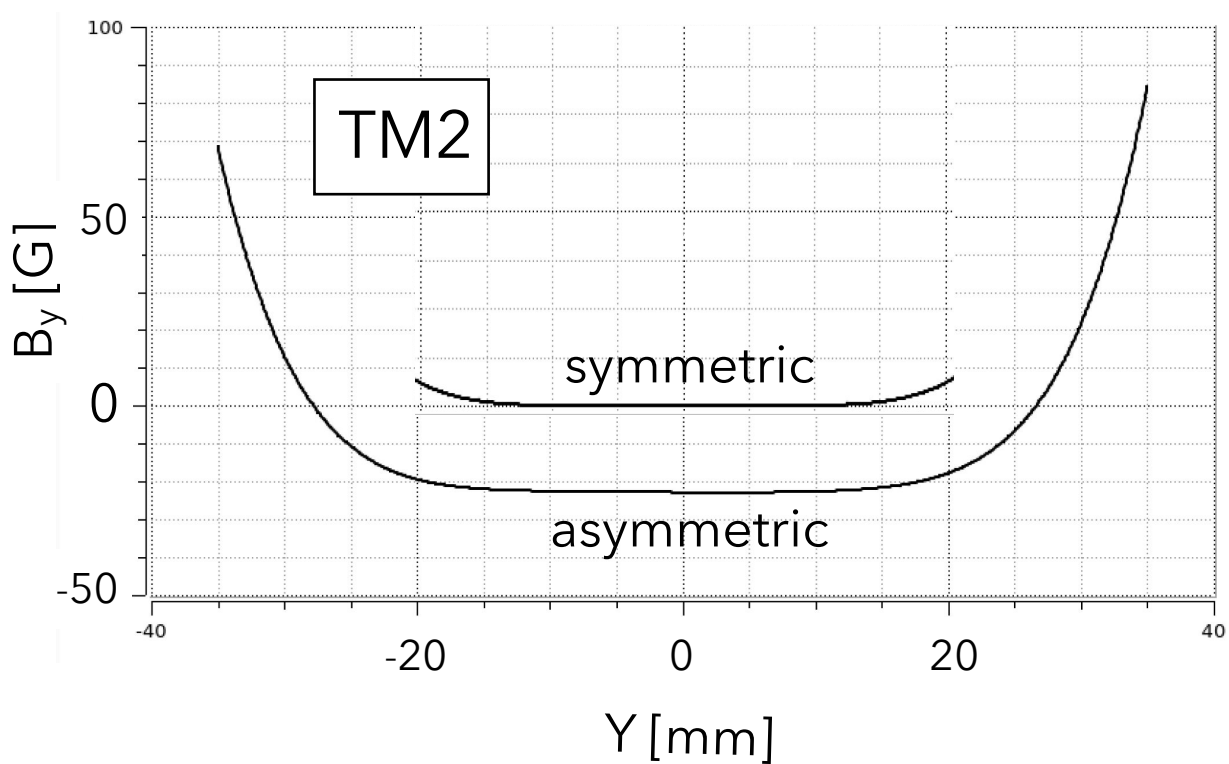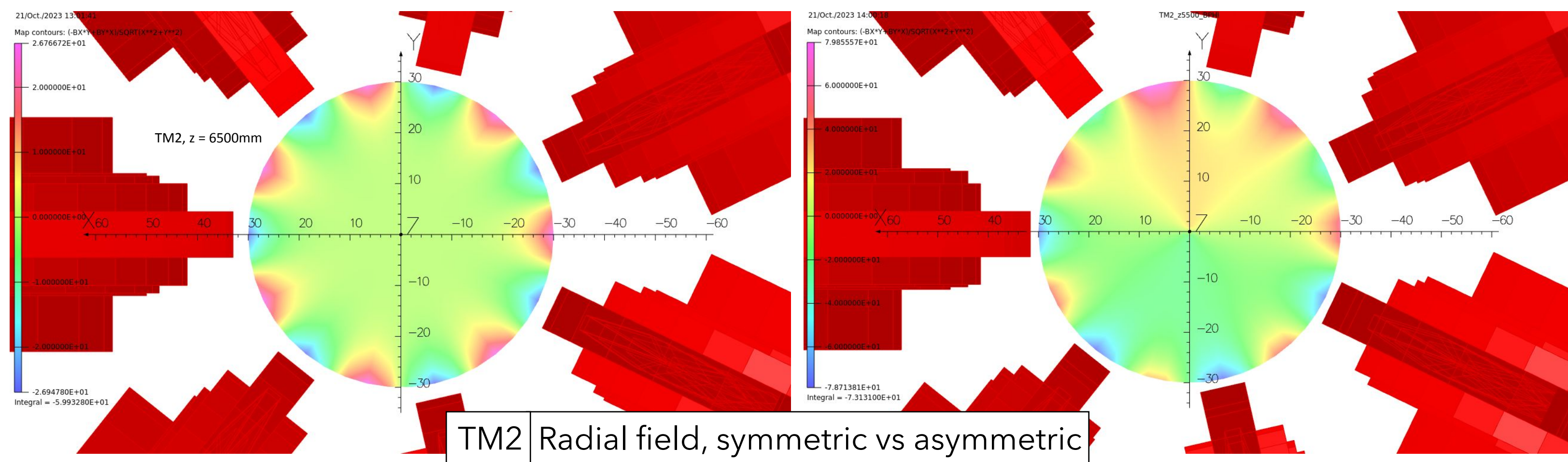


Planning for:

- magnetic measurements of assembly on/near beam axis
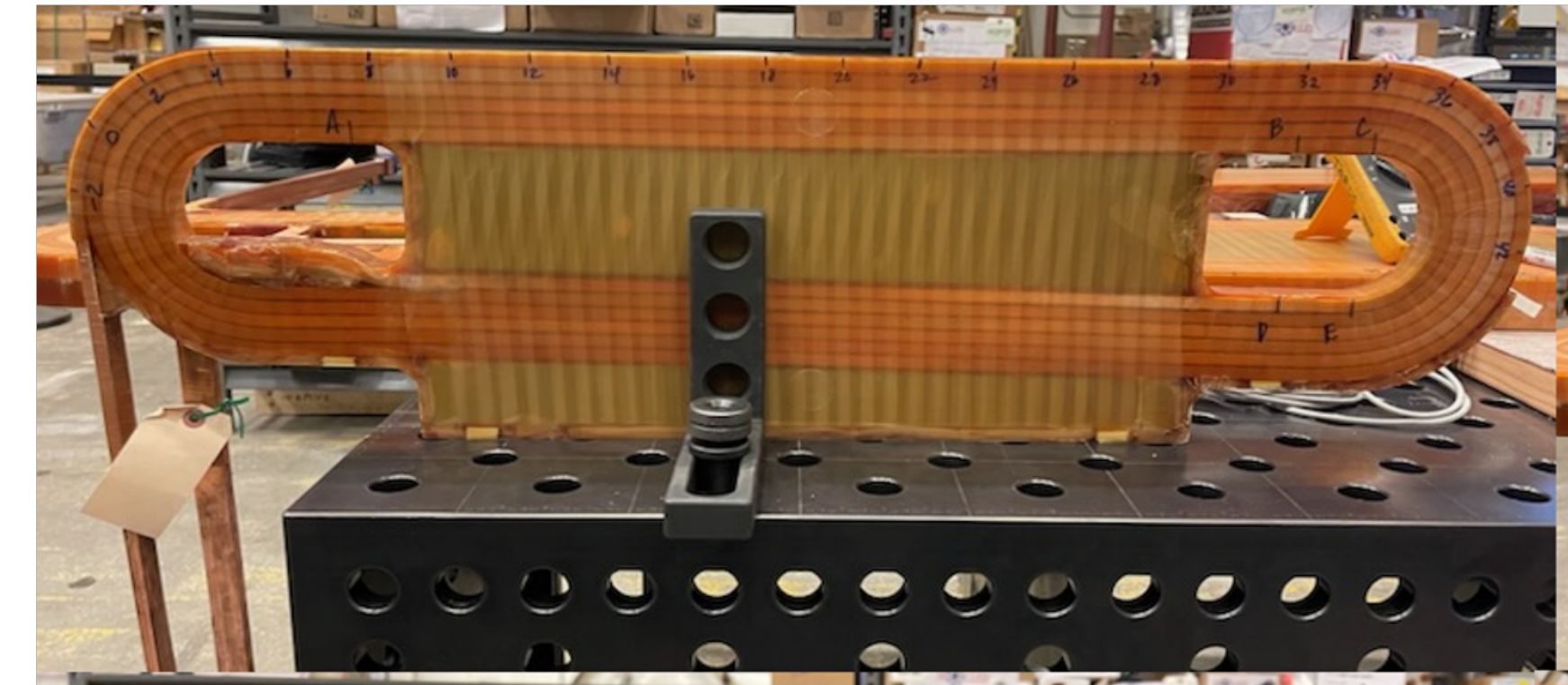- Verifying small beamline dipole during commissioning
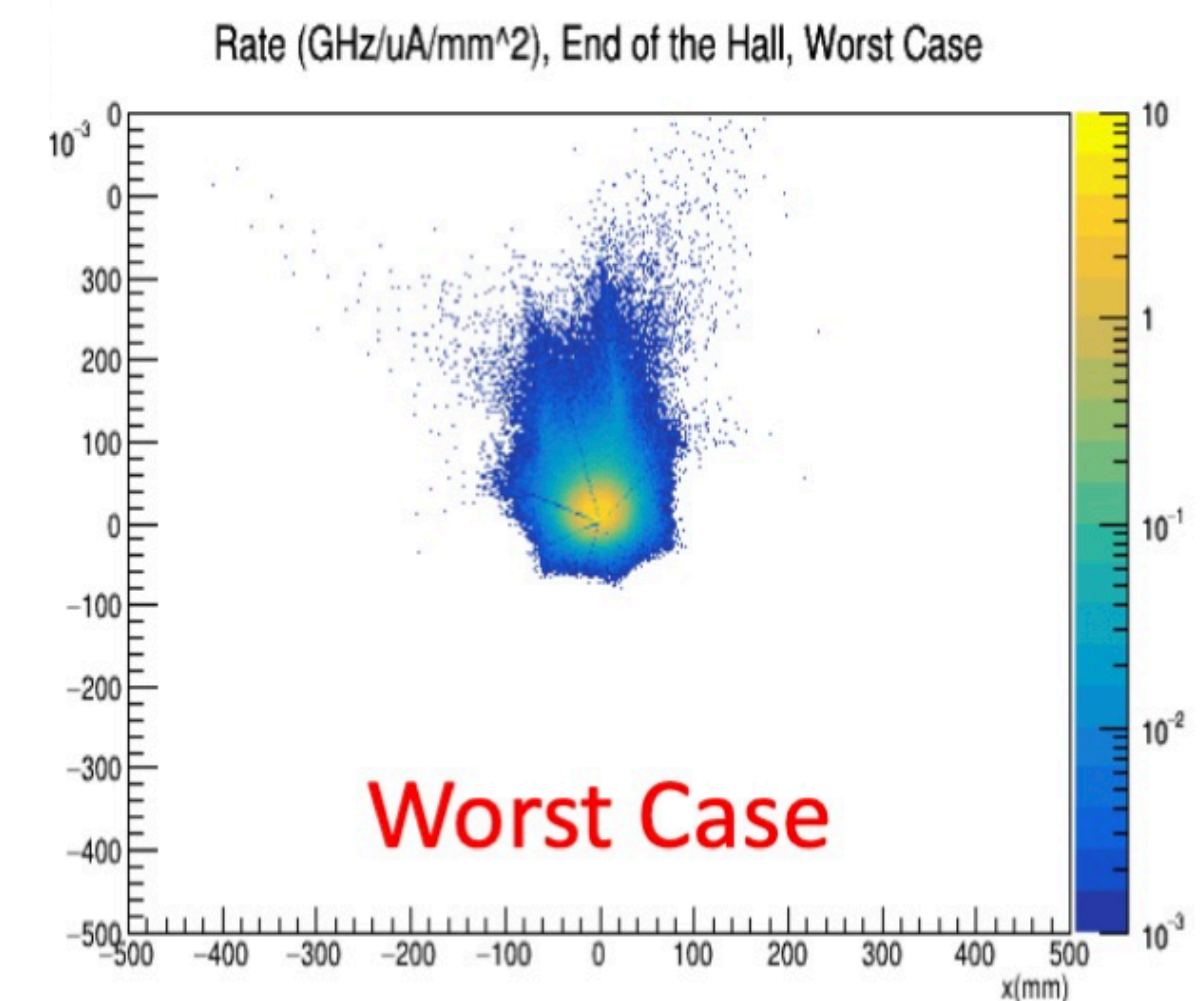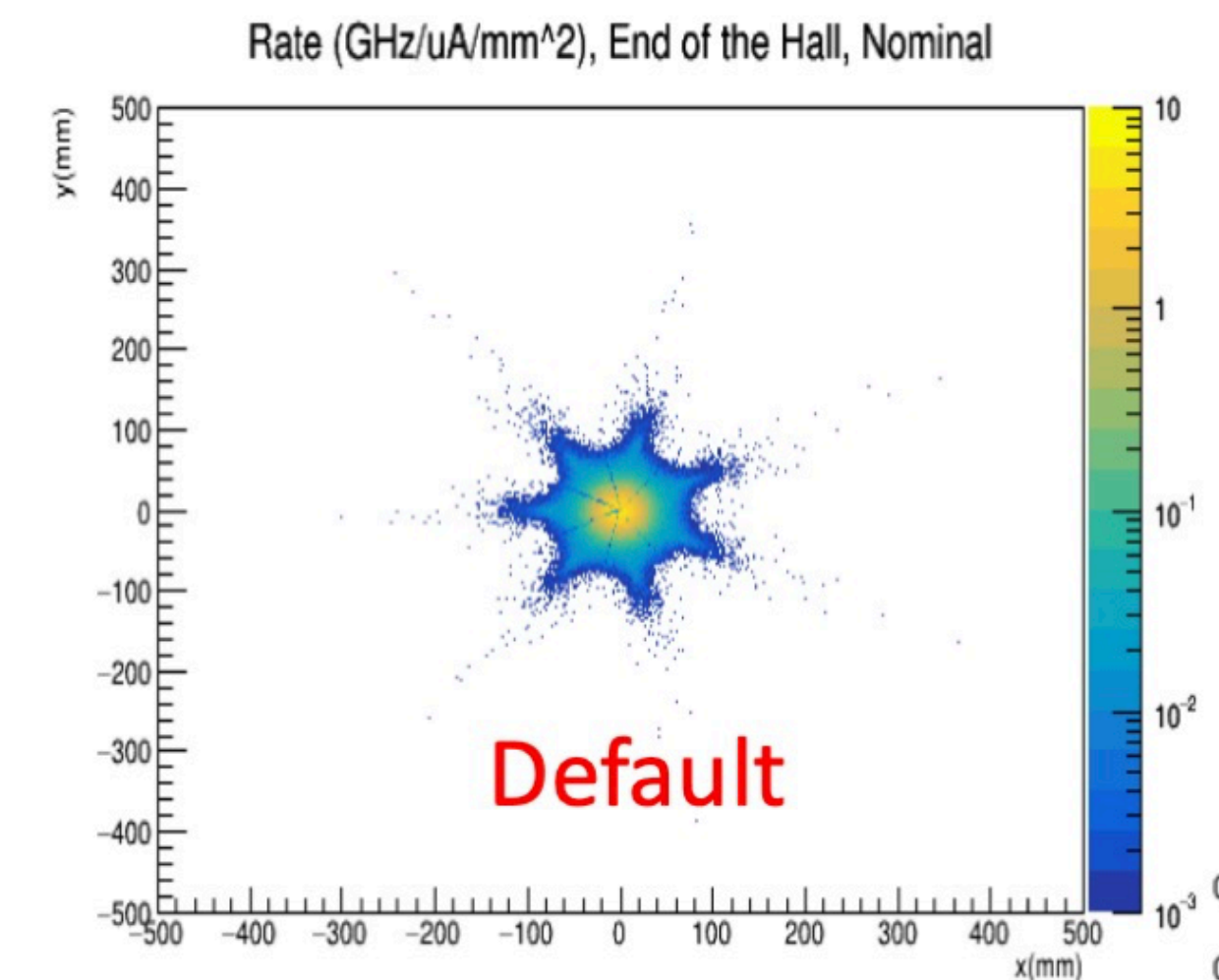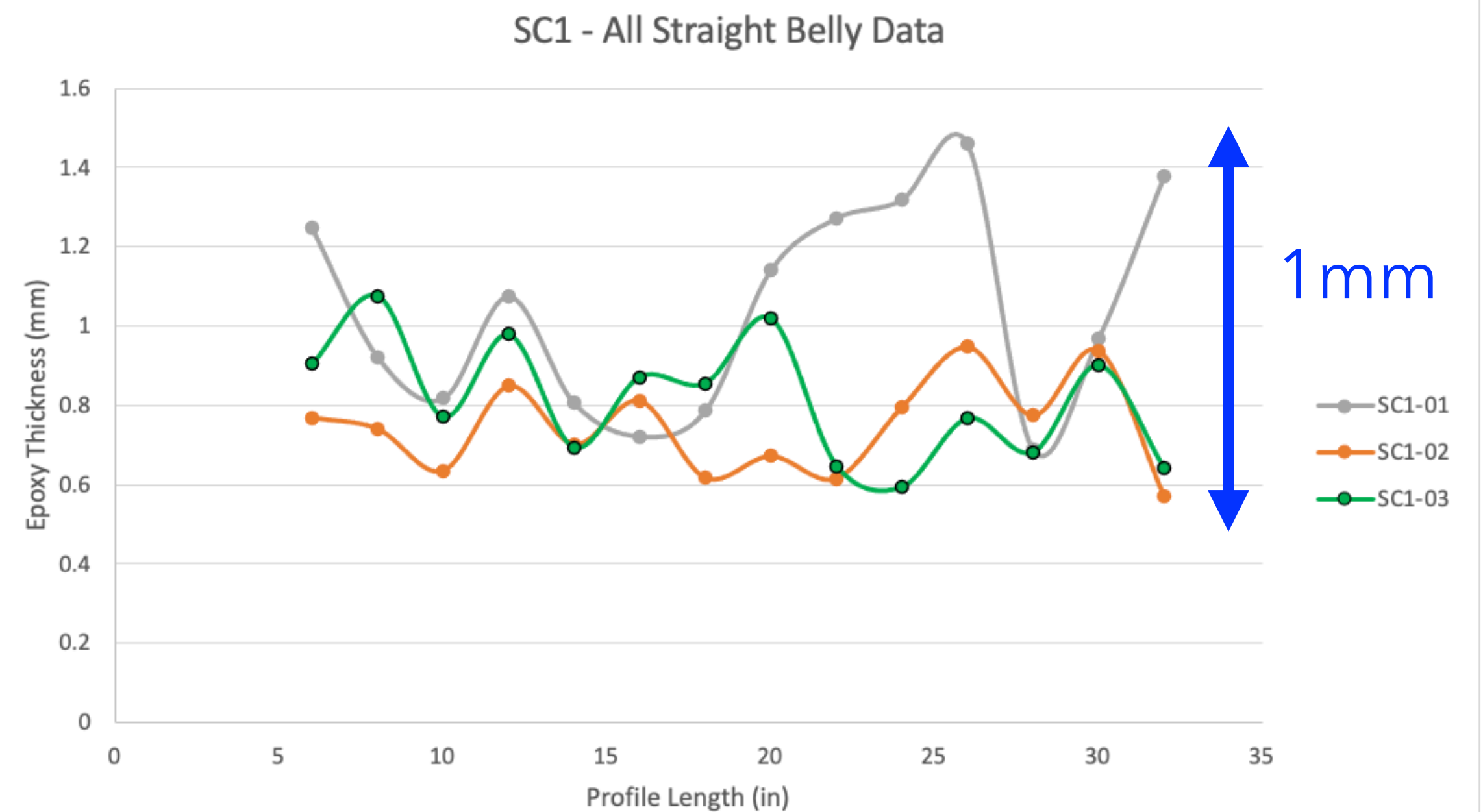
# Positioning the coils - epoxy thickness

Test fitting of magnet and collimator mounting




inductance probe

Epoxy thickness variation measurement



Clamp used to Apply Pressure

1" x 4" AL Clamp Bar

2" x 2" x ¼" Angle Bar
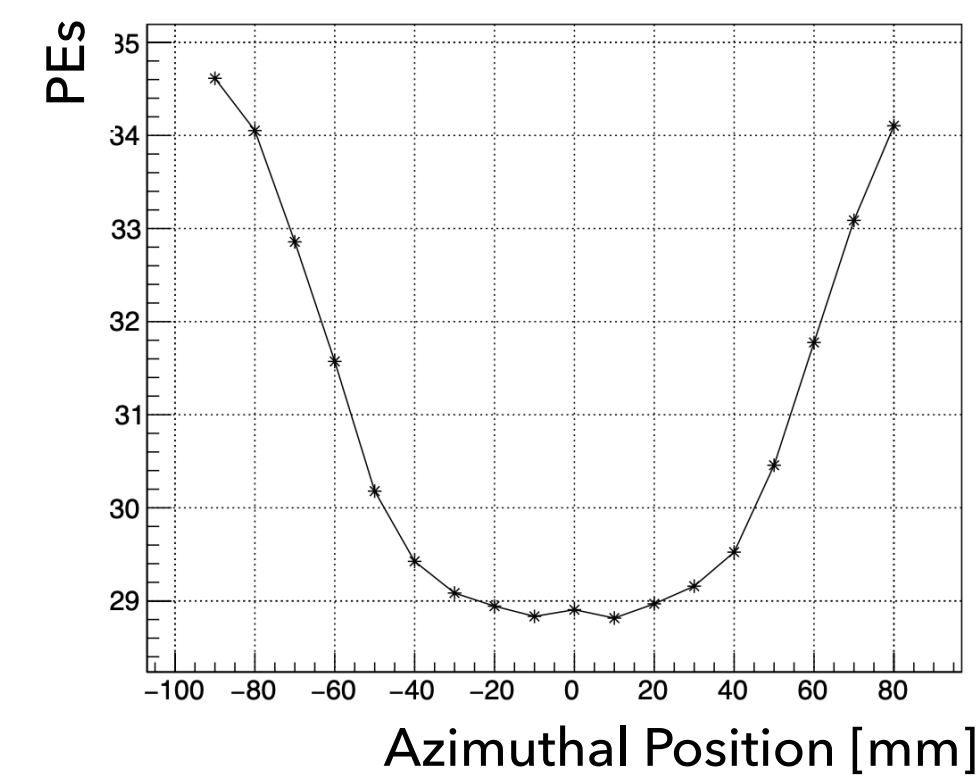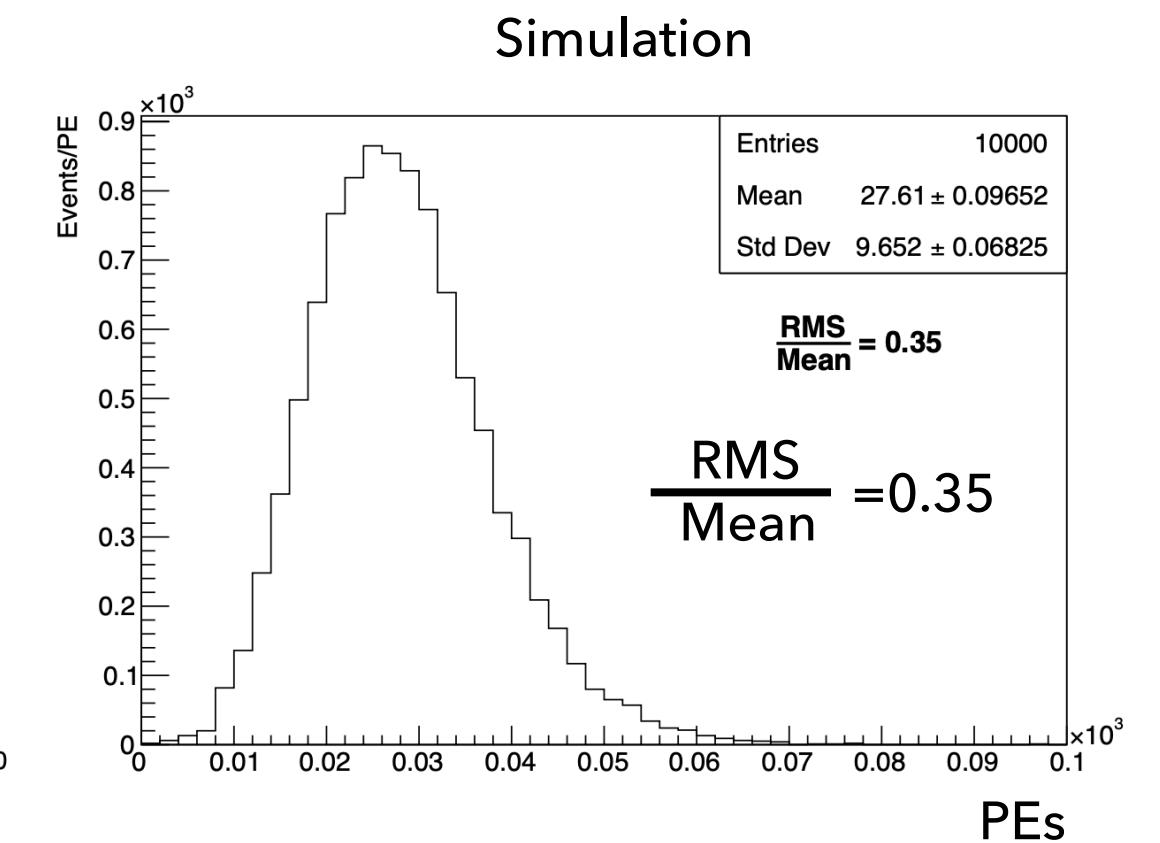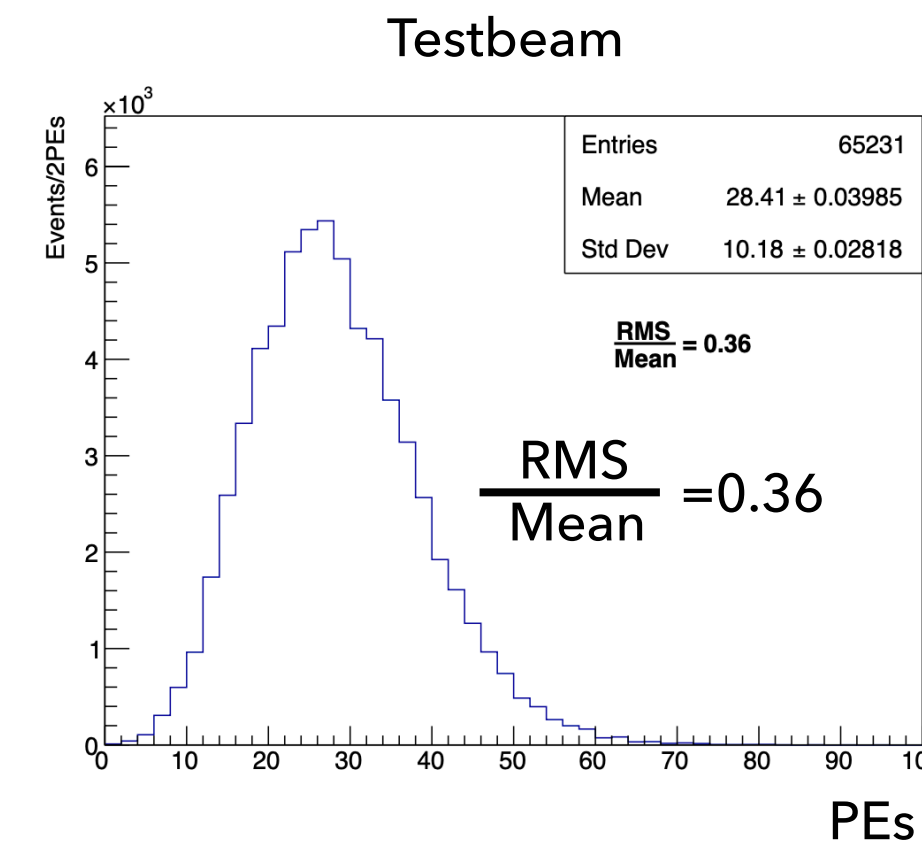
US Leads

US Coil Bracket AY

Table Clamp

1 mm tolerance on inner conductor position

# Mainz Beam Test results

Validation of main detector R3/R4 module mechanical designs, number of p.e.'s resolution, and light guide signal (results of comprehensive Mainz tests)
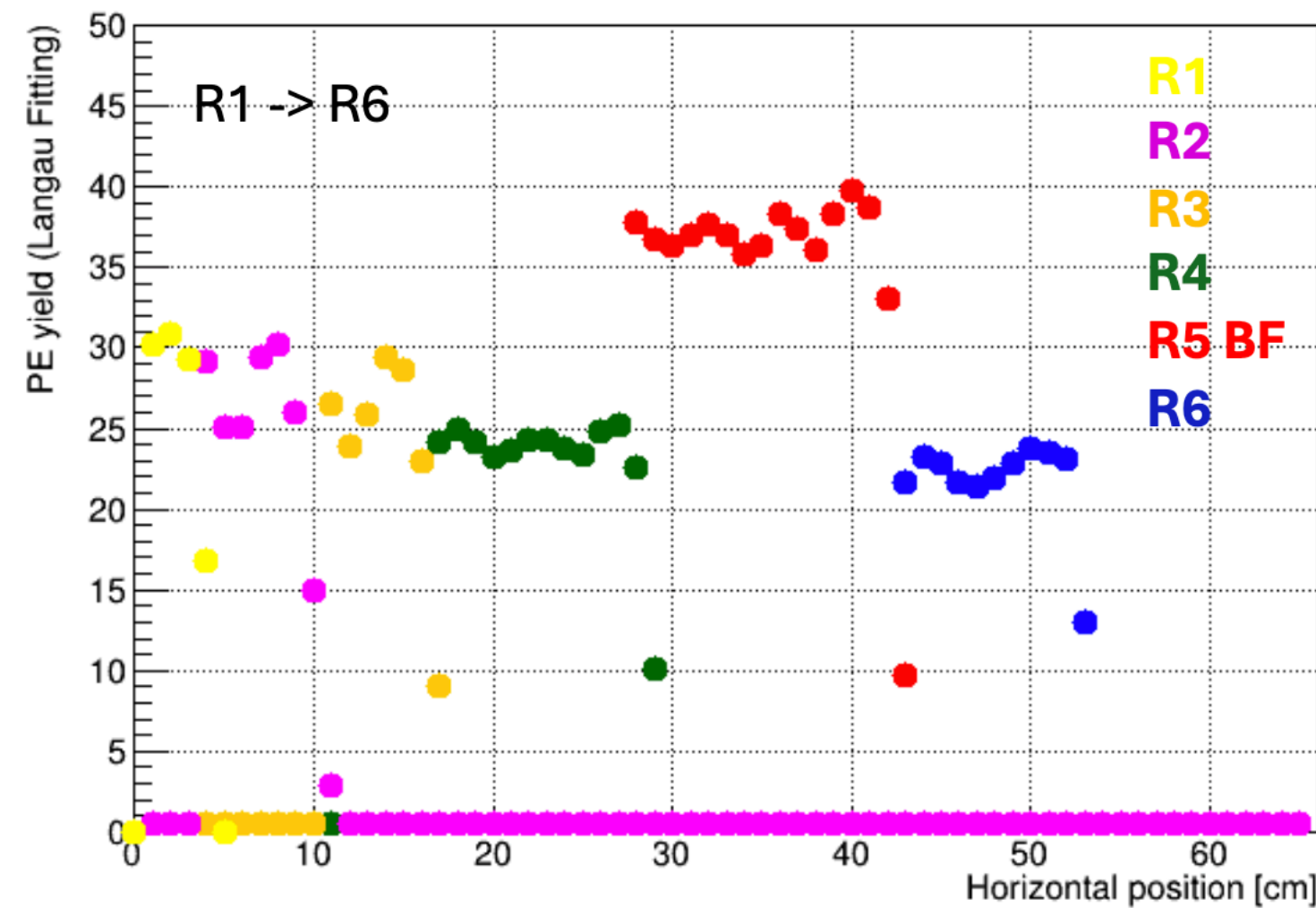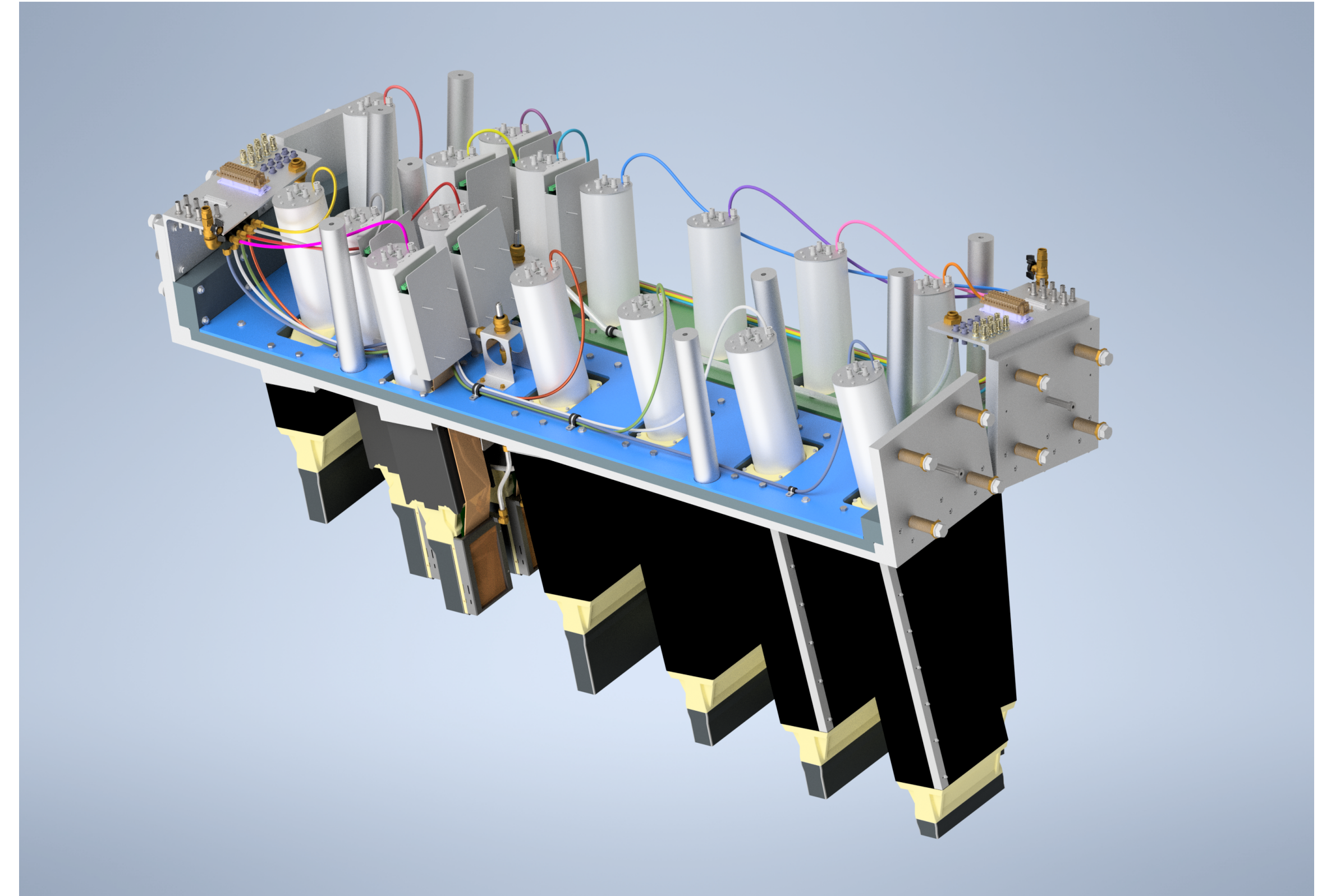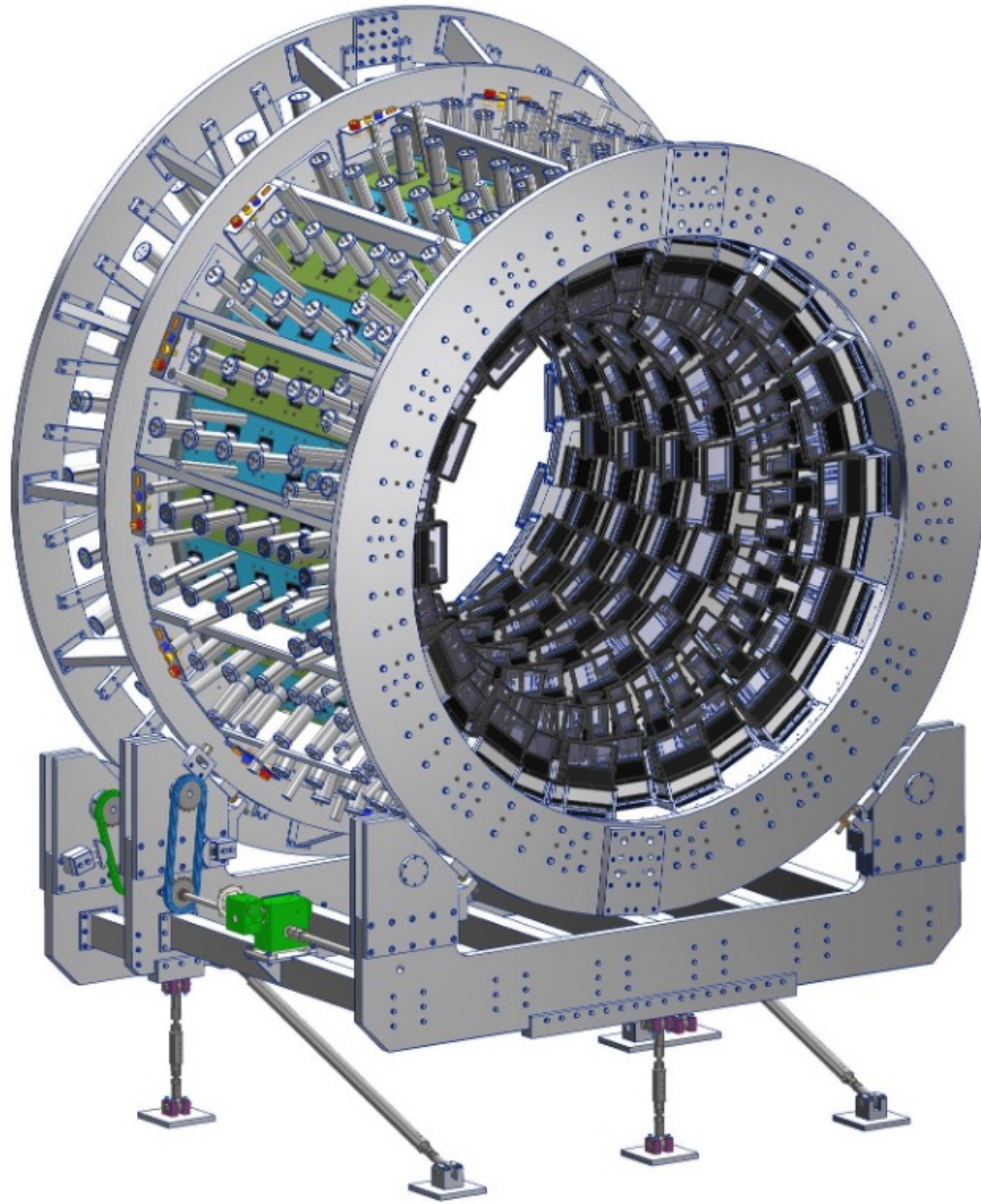


Showermax design validated with test beam
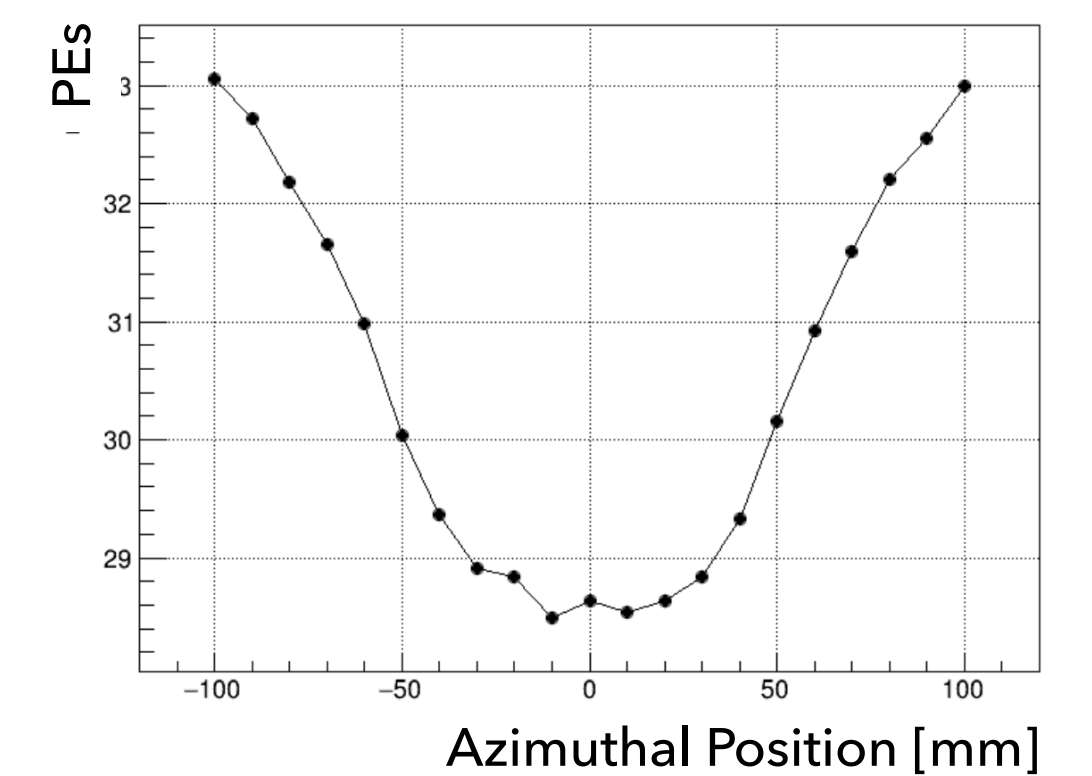


| Rings | PE yield (beam data) | PE yield (MC sims) | RMS/MEAN (beam data) | RMS/MEAN (MC sims) |
|-------|---------------------|---------------------|----------------------|--------------------|
| 1 | 26.6 + 0.1 | 30.2 ± 0.1 | ~ 30 % | 30 % |
| 2 | 25.0 + 0.1 | 26.1 ± 0.1 | ~ 28 % | 28 % |
| 3 | 22.5 + 0.8 | 25.5 ± 0.1 | ~ 28 % | 28 % |
| 4 | 23.6 + 0.2 | 24.3 ± 0.1 | ~ 30 % | 28 % |
| 5 BF | 32.0 + 0.2 (UVS) | 37.0 ± 0.1 (UVC) | ~ 25 % (UVS) | 23 % (UVC) |
| 6 | 20.7 + 0.2 | 21.5 ± 0.1 | ~ 32 % | 23 % |

# Main Detector Mechanics





- Detector holding structure mechanical design completed and components are out for fabrication
- Storyboard established for main detector module segment construction, assembly, testing, storage and installation

# Detector Progress

Readout

- All critical components radiation-tested to the level required
- Integrating ADC design validation.

Modules

- Design completed and final fabrication of main detector modules has begun
- First Heraeus quartz (6 of 21 plates) has arrived at vendor in Indiana for polishing
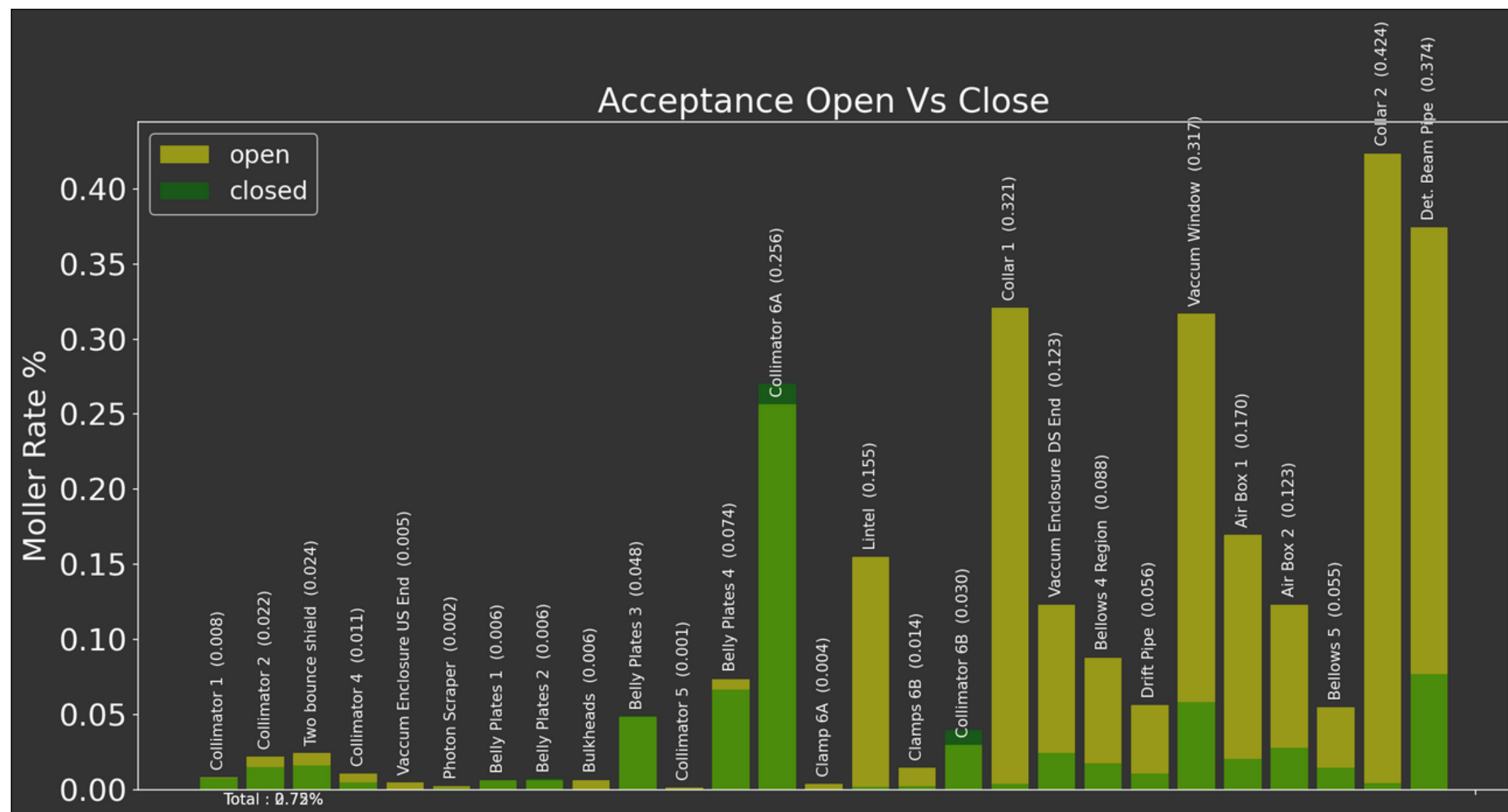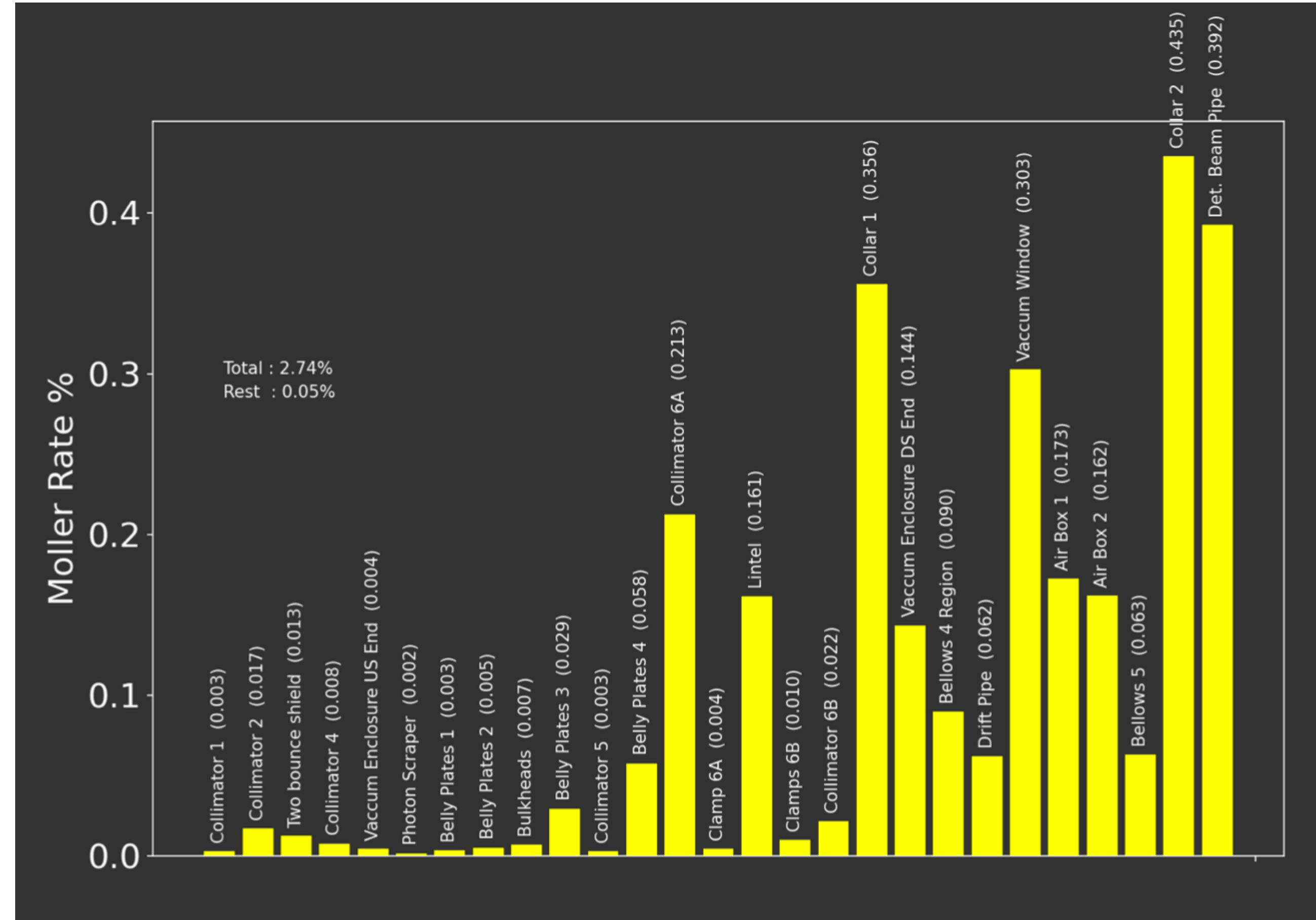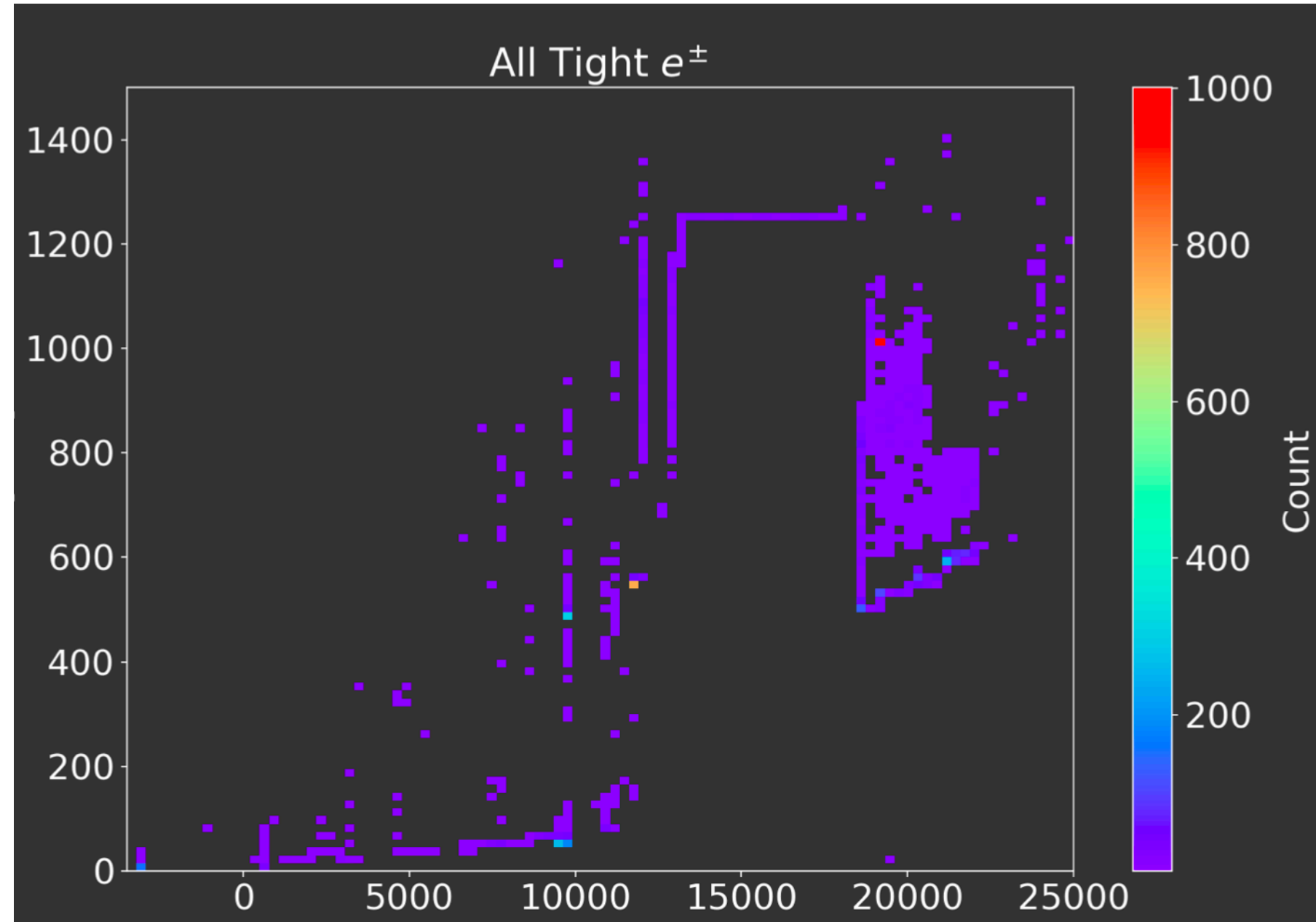
# Target chamber vacuum window design

Cyclic loading due to thermal stress (beam trips)
Window curvature reduces stress in expansion/contraction
Acceptably thin window from background and beam disruption



Core section

150 mm radius
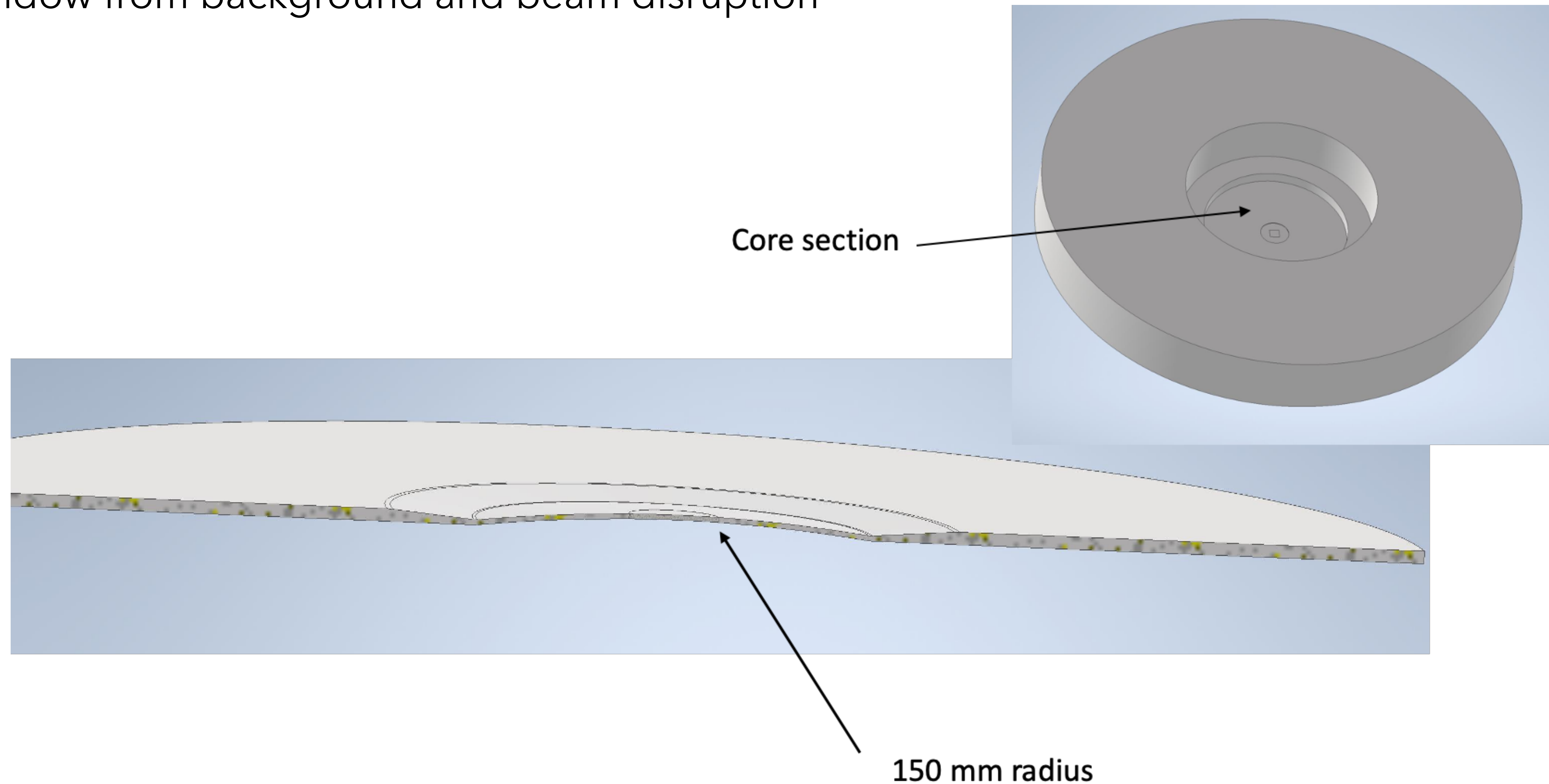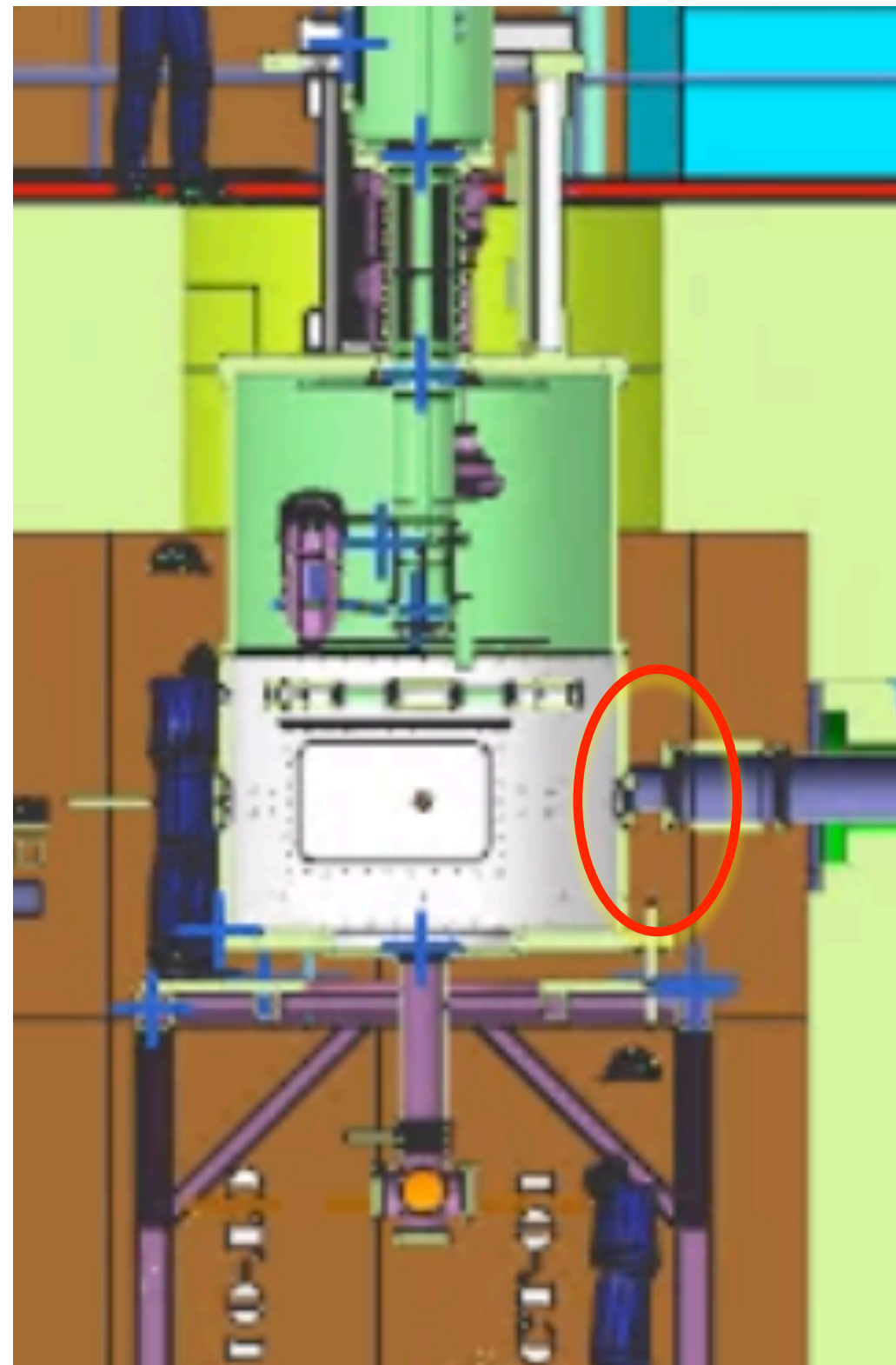
# Simulation and backgrounds



Rapid turnaround on drift pipe upstream-end redesign, collimator 4 aperture optimization, bellows 4 non-compliance evaluation
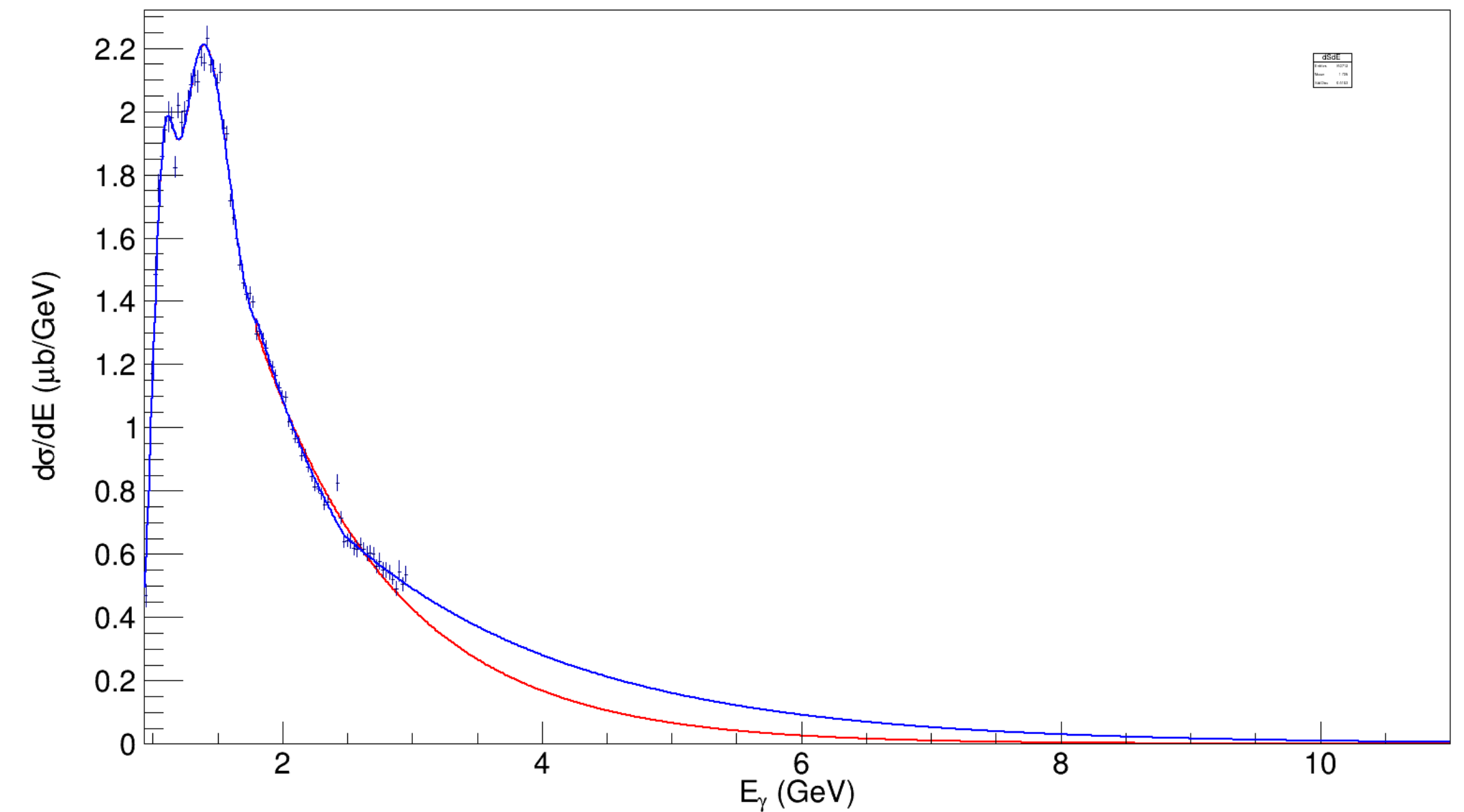
Prakash Gautum

# Hyperon background

## Photoproduction

- Simulated real photon flux in target

- Used $\dfrac{d\sigma}{dE}$ and $\dfrac{d\sigma}{d\theta}$ for $\Lambda$ and $\Sigma^0$ from CLAS,

- Fit to parameters and extrapolated to cover range up to 11 GeV

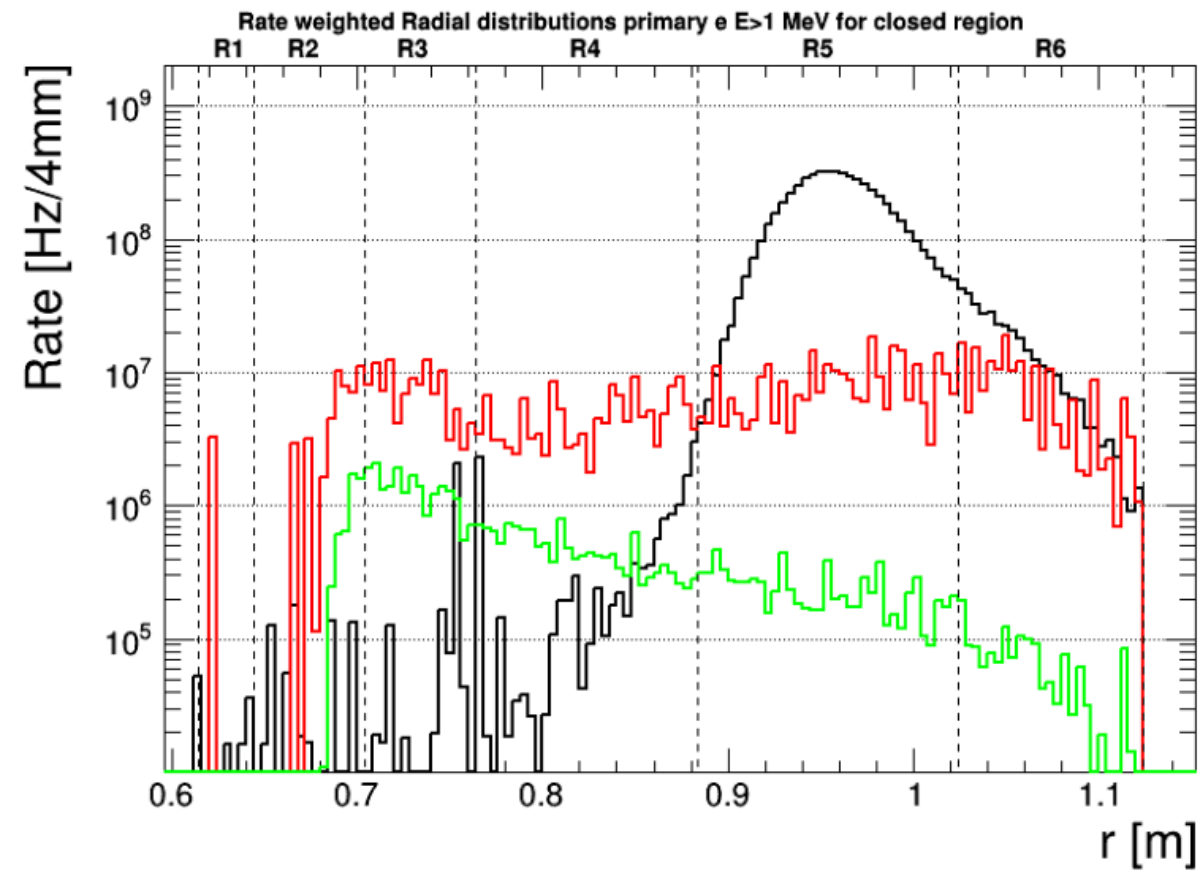- Generate strange baryons, track decay pions

## Electroproduction

- Simulated real photon flux in target
- CLAS data available
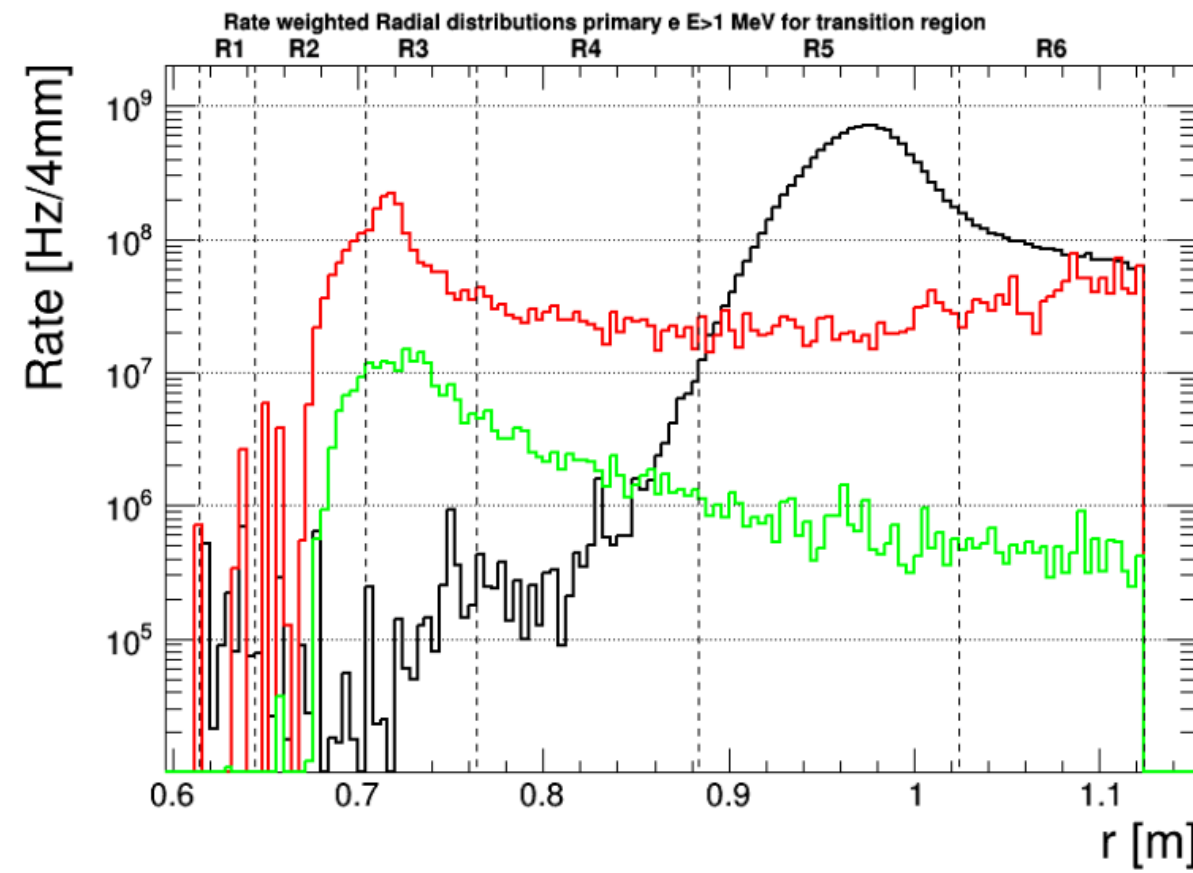- Will use available models to extrapolate over full range of $Q^2$ and $W$

Future work includes applying analyzing power, tracking into pion and showermax detectors
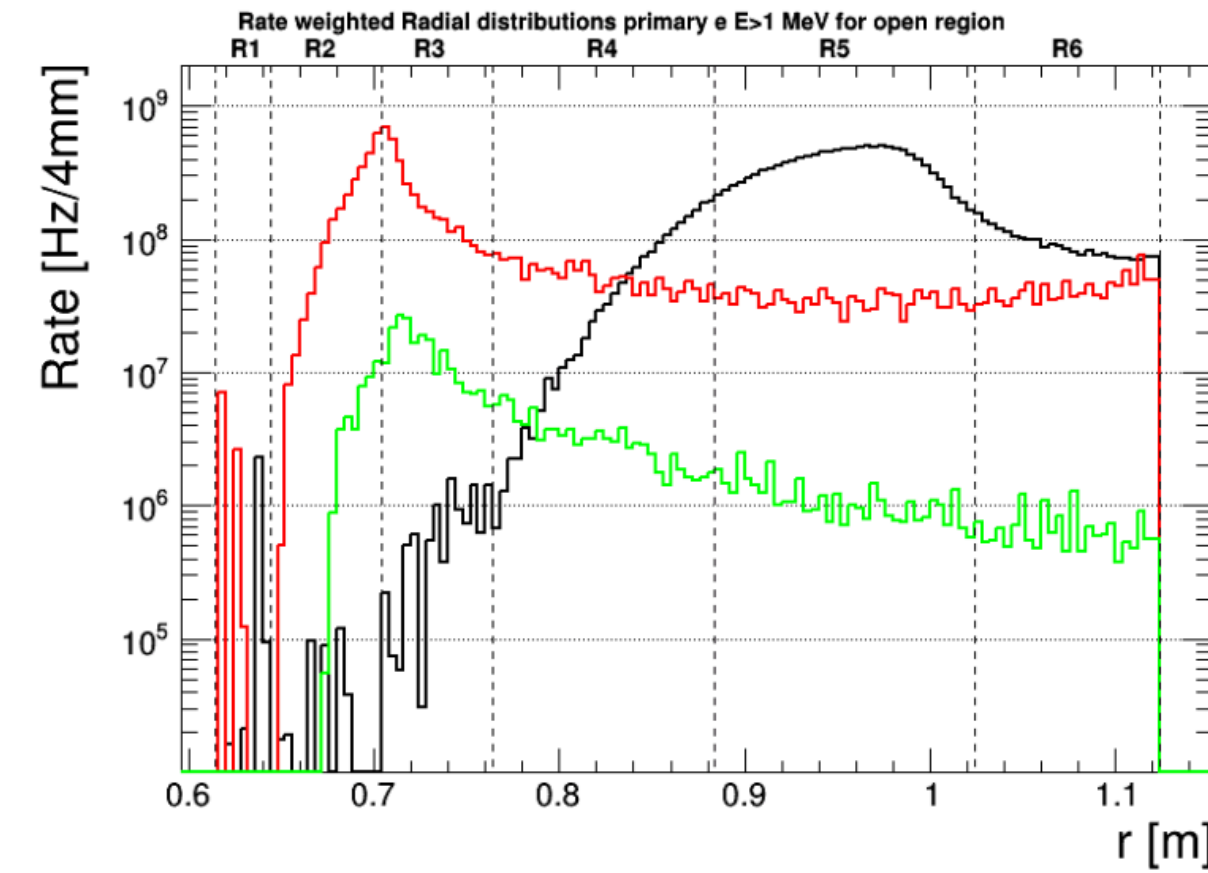
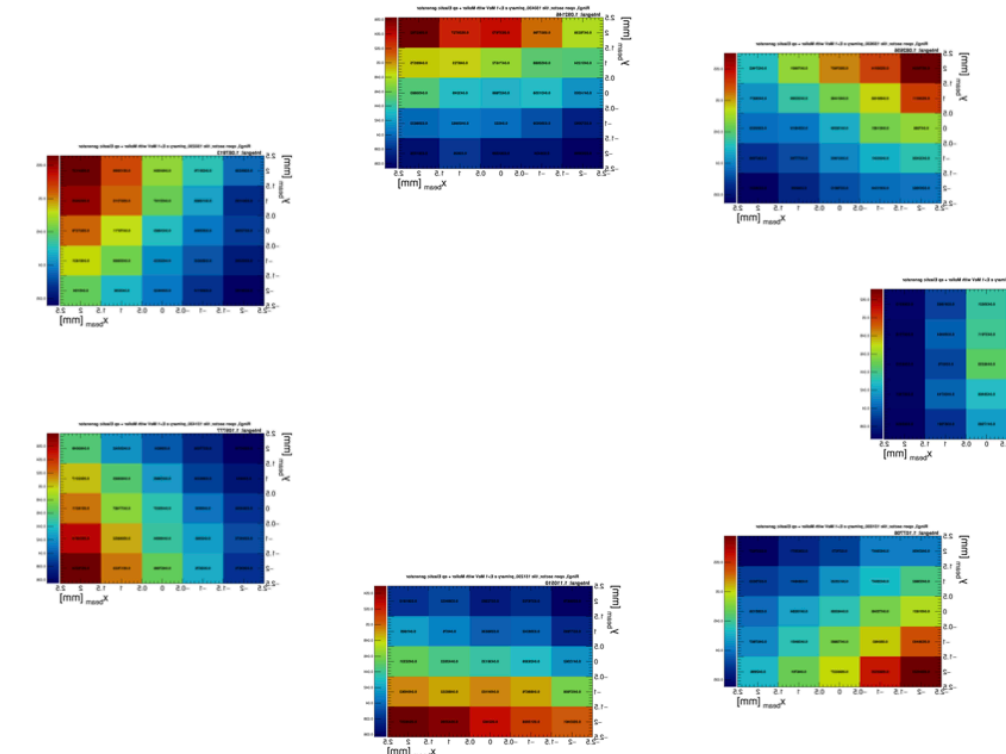Andrew Hurley

# MD tiling and rates



Closed sectors  Transition sectors  Open sectors
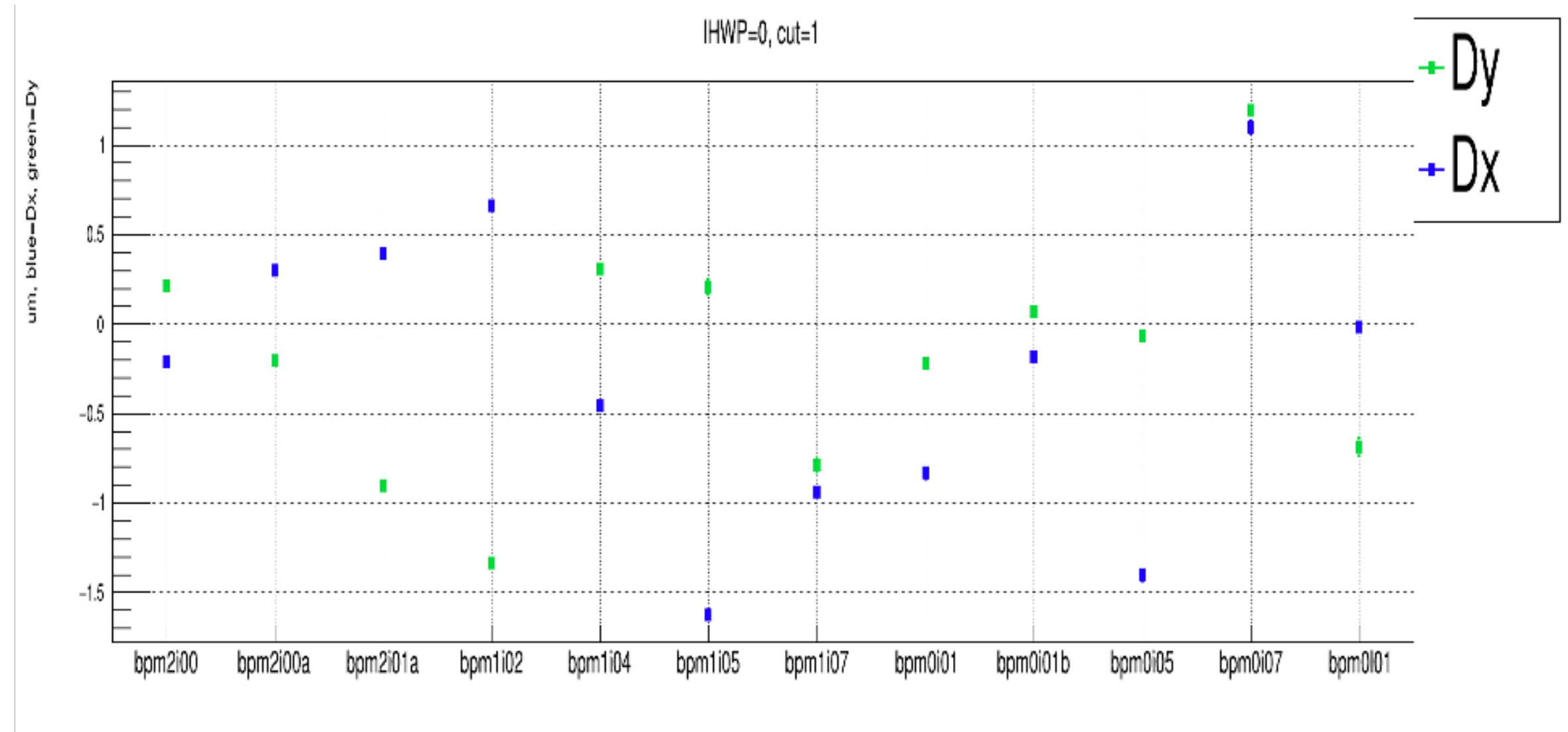


## Take-aways from continued studies

- Deconvolution stable under recent changes
- Ring 1 quartz optimization (exclude ep signal to raise sensitivity)
- Deconvolution check to evaluate range of acceptable thickness for Al vacuum window
- Rate variation over raster pattern for readout chain dynamic range
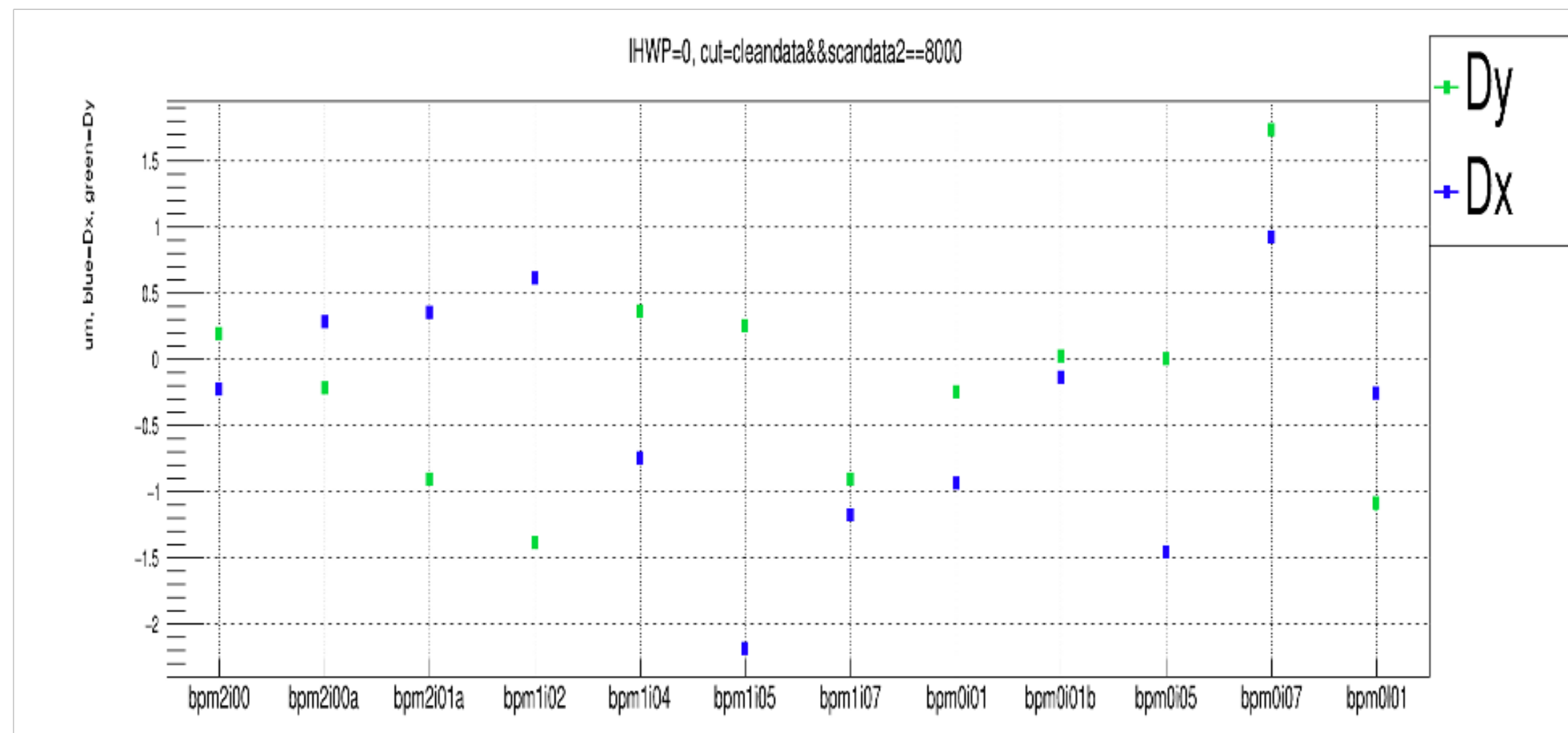
Z. Demiroglu



Average rate in Ring4 tiles
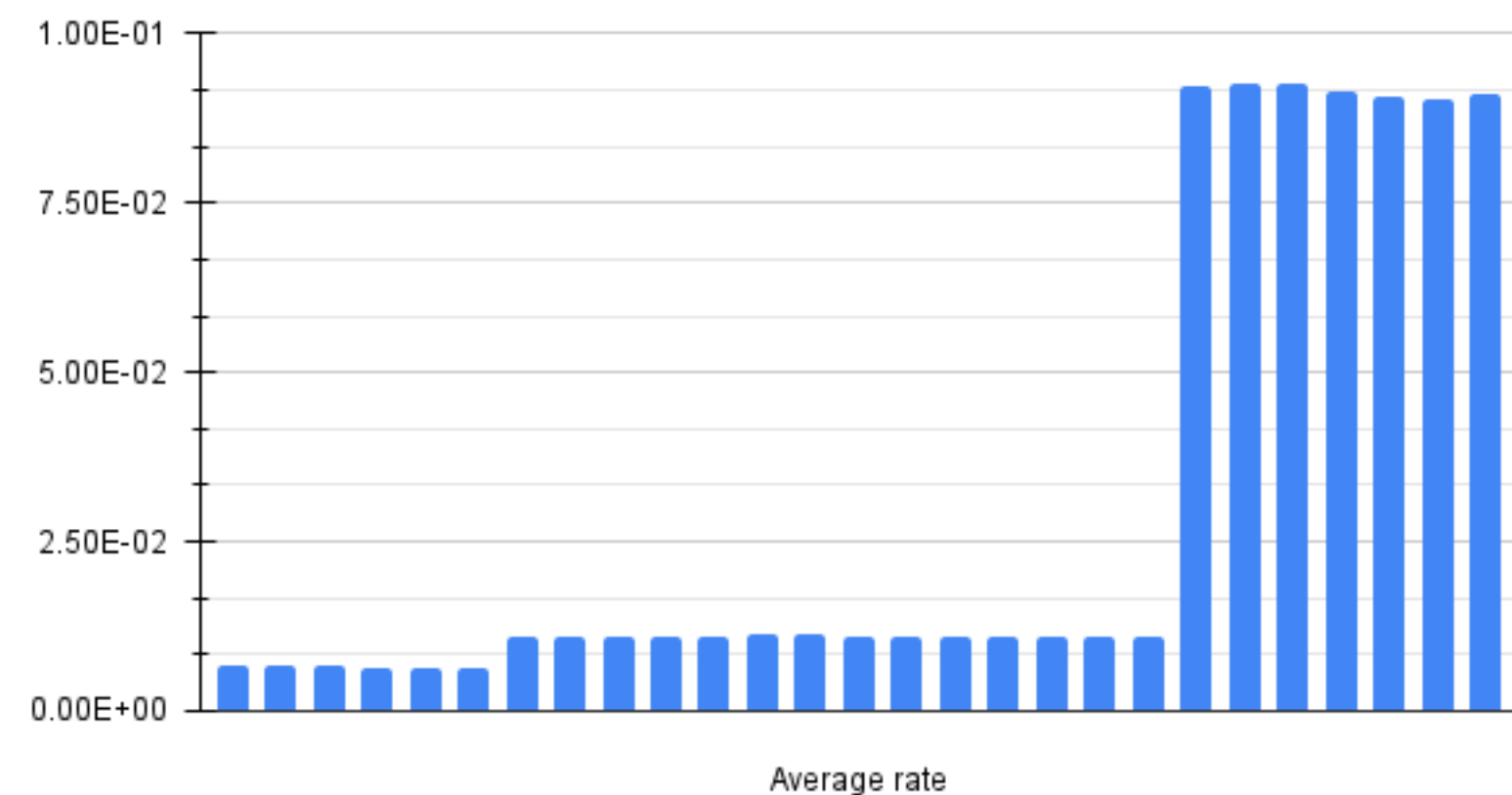
# Beam Tests



Tested polarized gun at 180kV
(not final upgraded gun)
- Chopper scans
- Wein flip
- "damping"
- integration gate vs noise
- new vacuum window

Tested Fast Feedback and FeedForward in Hall A
- Operated successfully
- Preliminary analysis suggests it is working as intended
- More careful analysis underway

# Beyond project: tasks for the next year

- Simulations: backgrounds, detector response, beam effects
  - Rate / asymmetry signatures for trajectory or energy variation or for models of halo
  - Asymmetry signature for $P_T$
  - continue to refine optics calibration and alignment plans
  - Pion electroproduction, analyzing power, sensitivity of other detectors.
  - Analyzing power in "reducible" (rescattered) backgrounds

- Polarized beam studies..
- Beam monitor bench tests and beam tests.

- Analysis chain software development, both integrating and counting
- Analysis design and planning