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TEMPLE UNIVERSITY

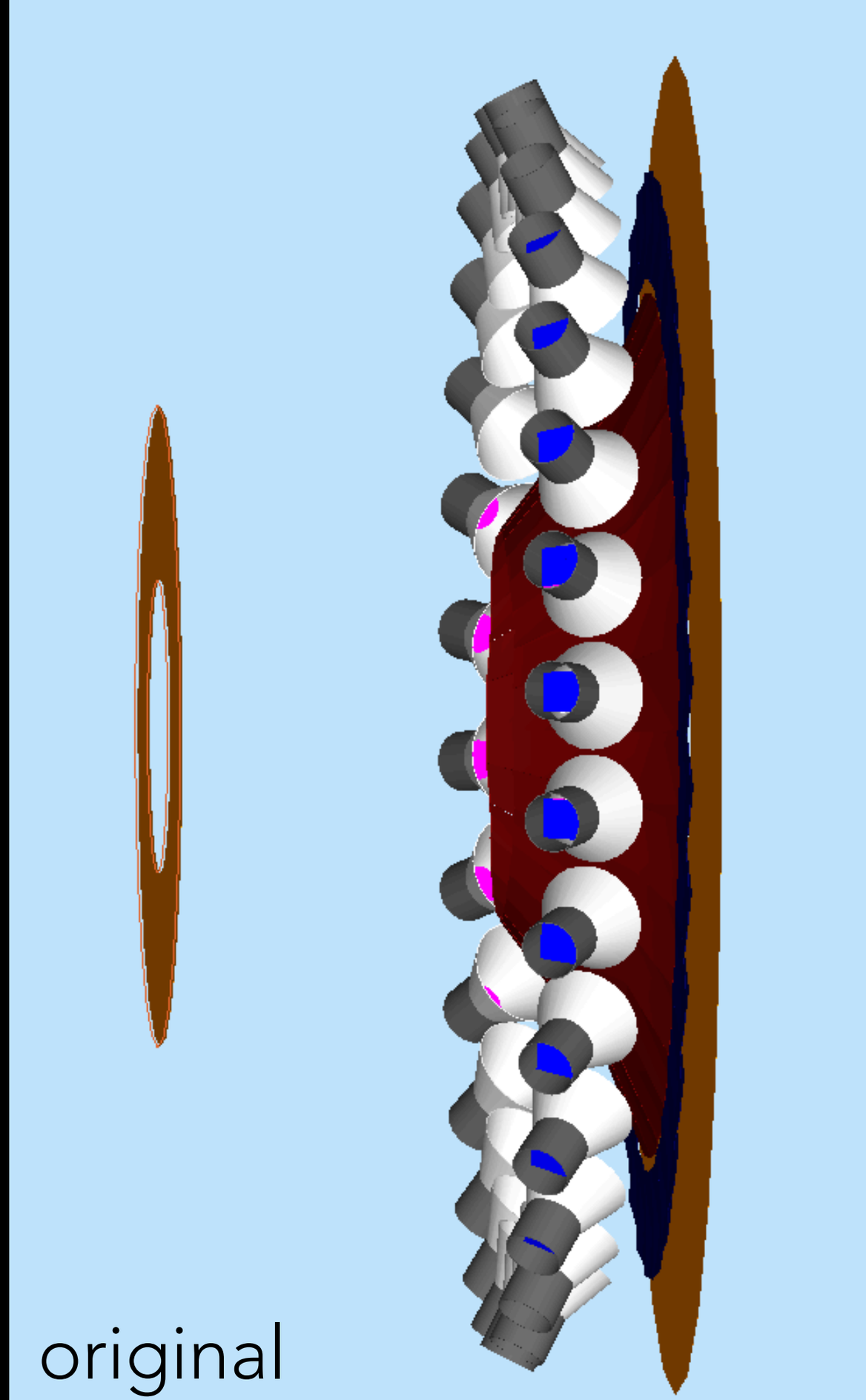
UPDATE ON SOLID LGC

SOLID COLLAB. MEETING
WEDNESDAY, JUNE 23, 2017
NEWPORT NEWS, VA

10CM DOWNSTREAM EXTENSION

- Leaving the front-line in place, all components were shifted downstream by 10 cm.

- Mirror focal points were recalculated for slightly different ray trajectories from target.



original

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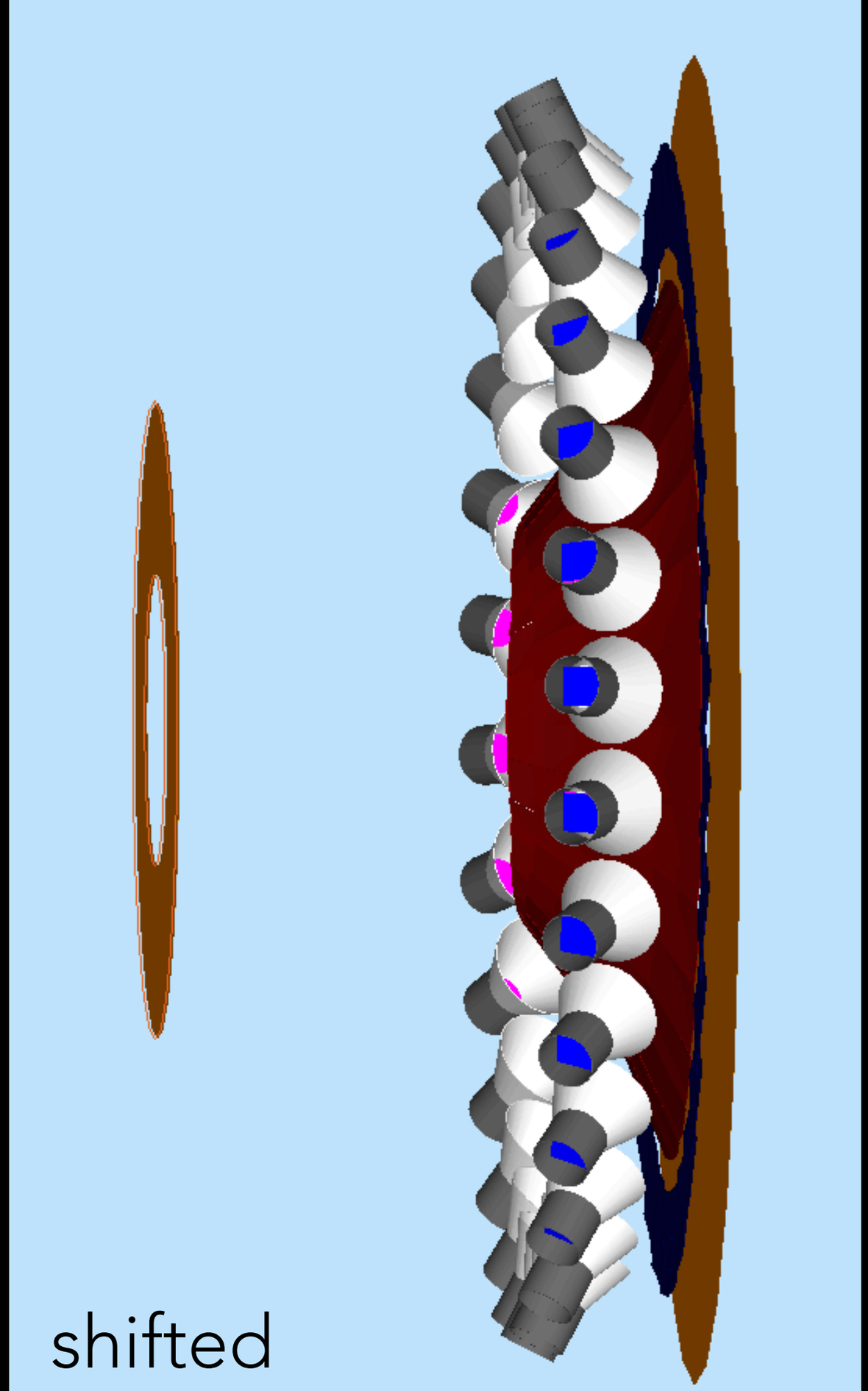

shifted

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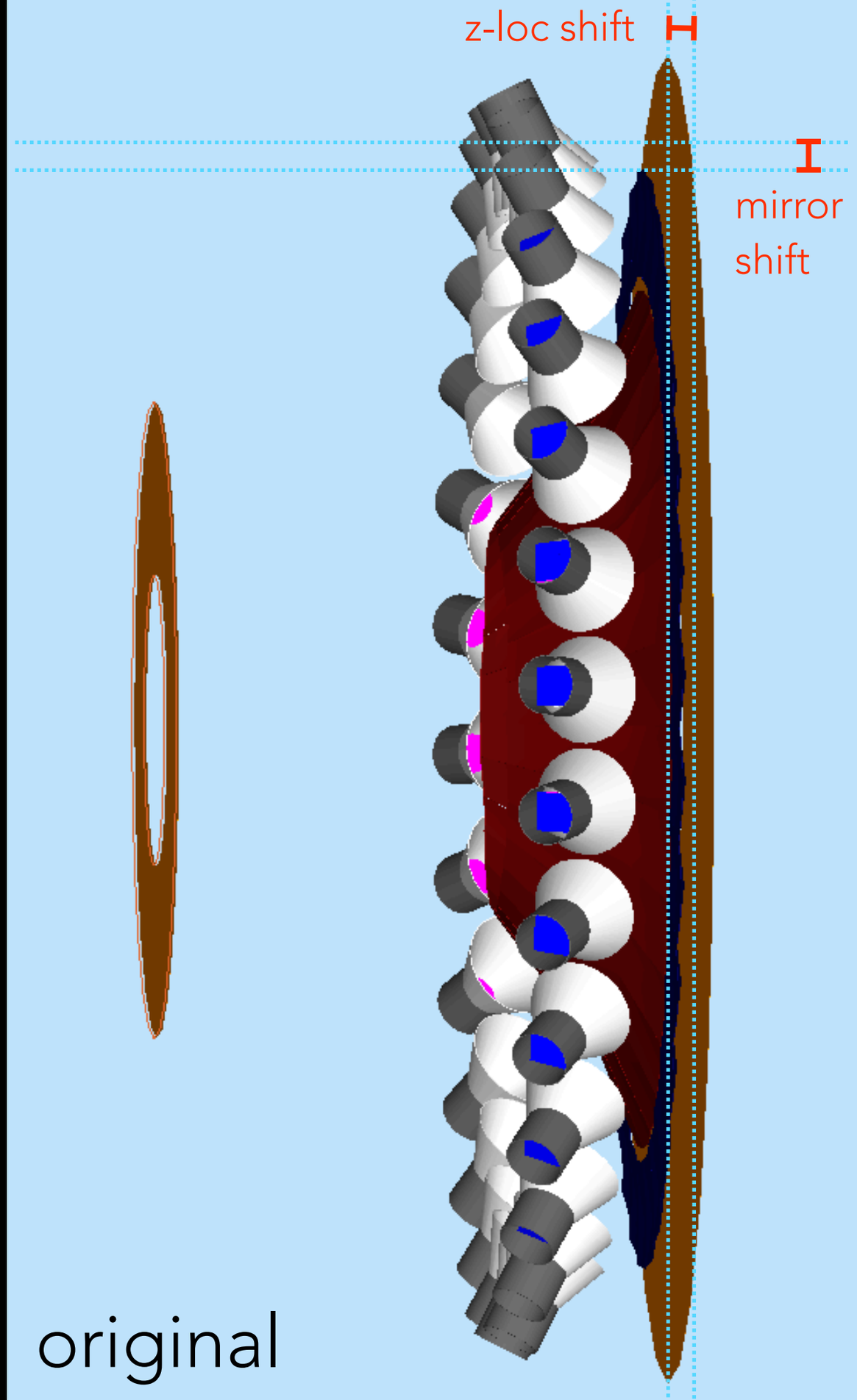
  - Changes overal mirror geometries.



original

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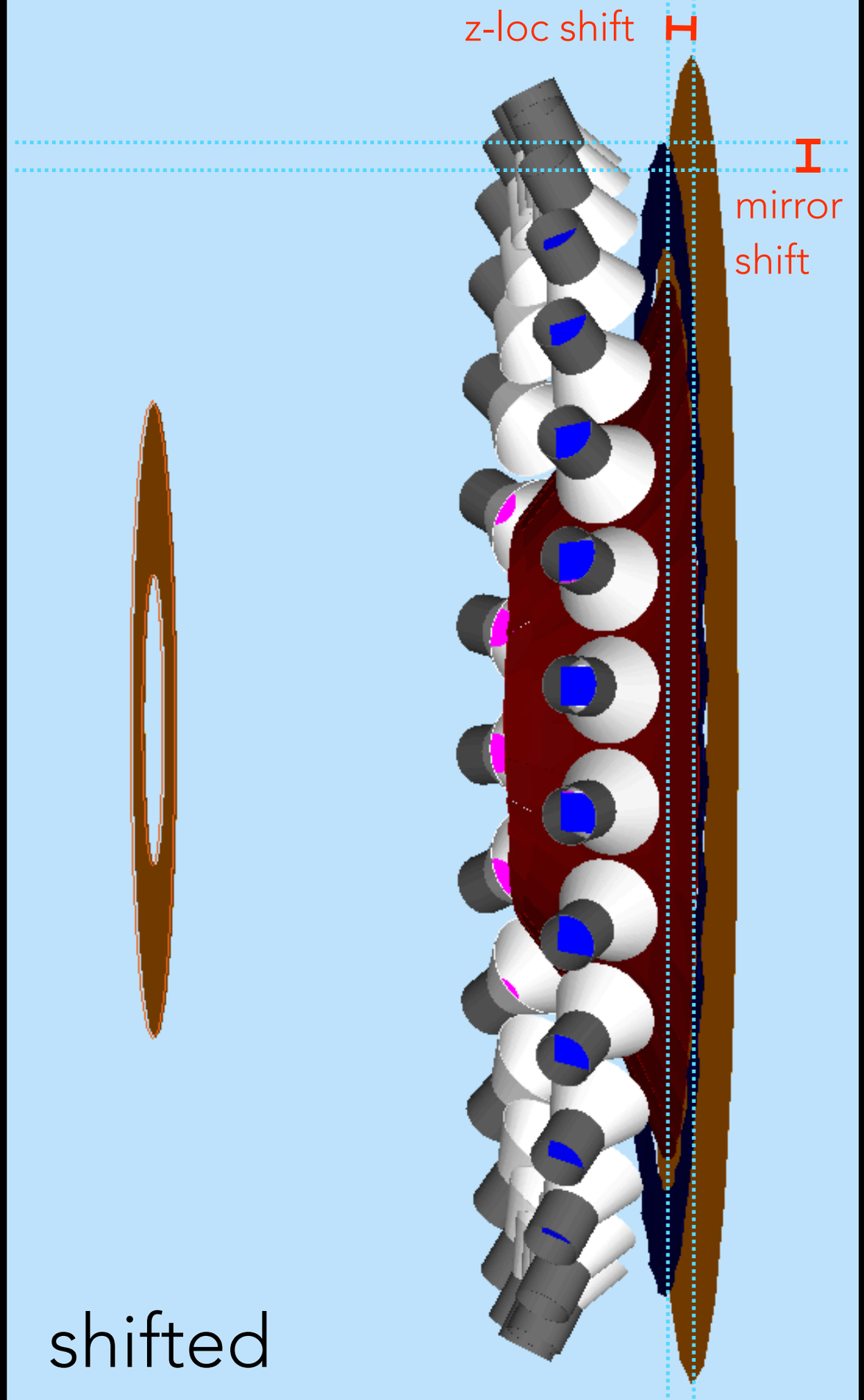
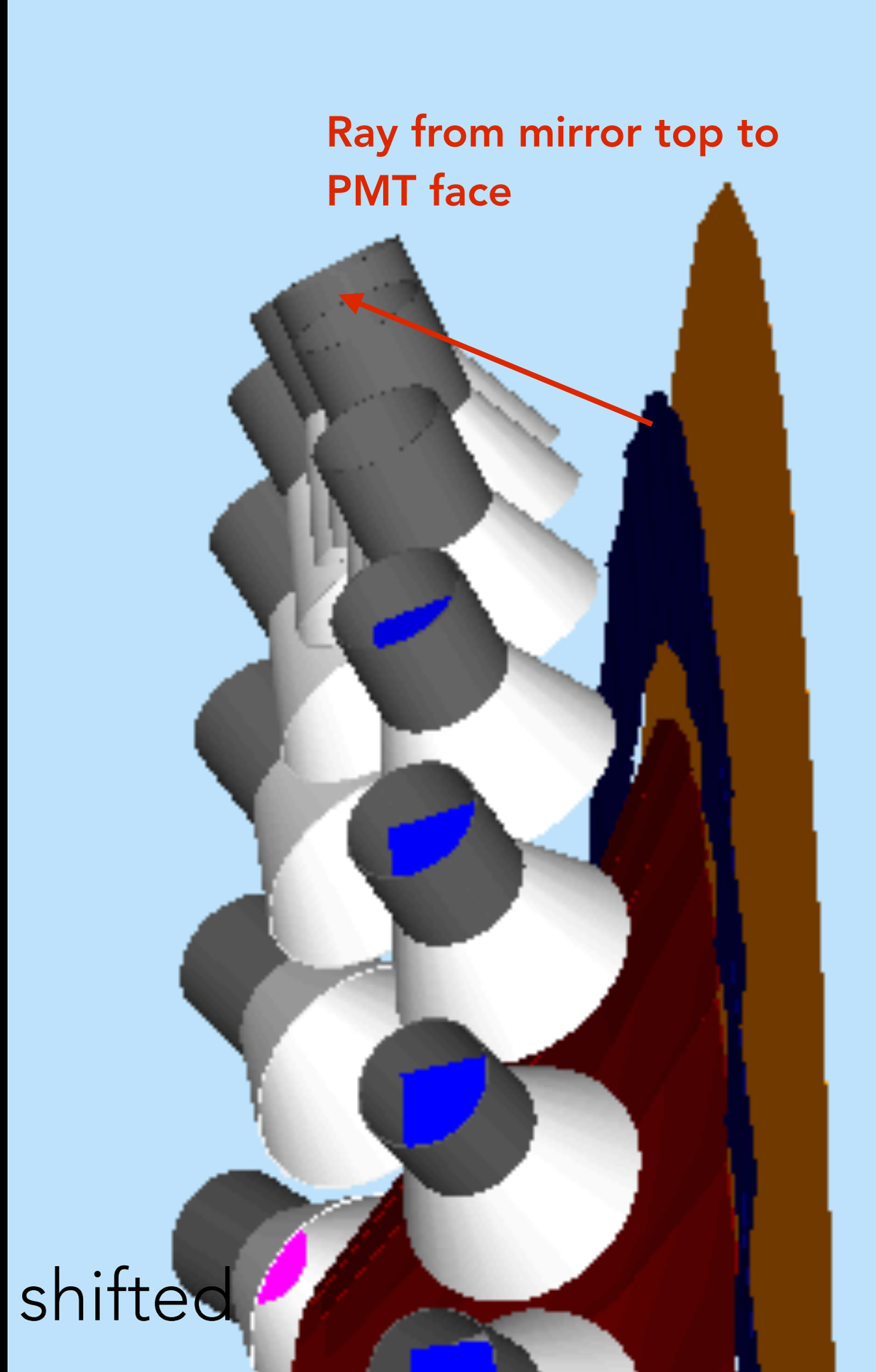


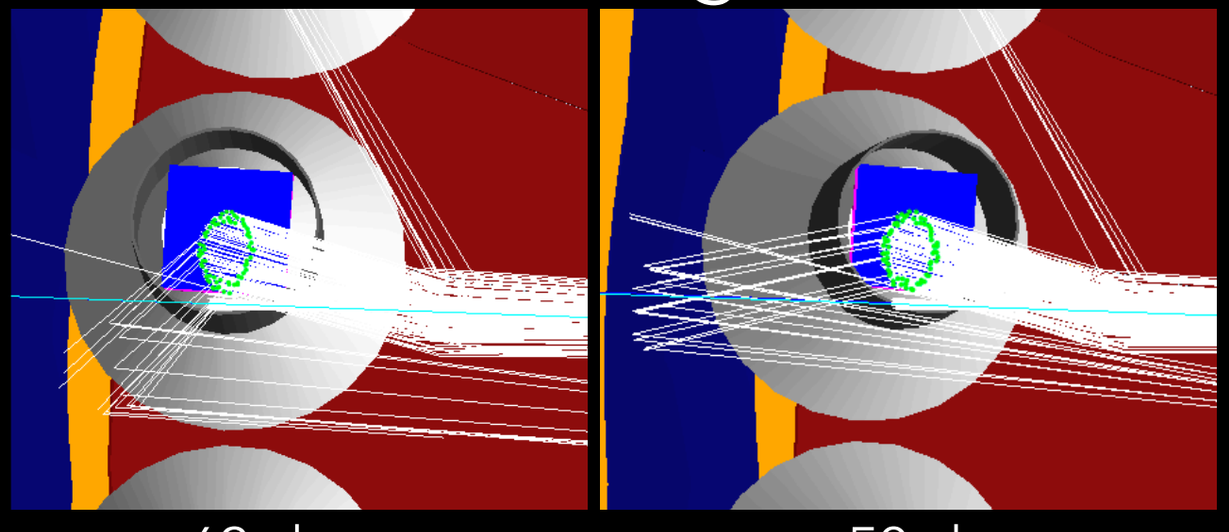
CONE ROTATION

- Typically, the PMT face and cones are rotated to allow light collection for all angles in both the SIDIS and PVDIS case.
  - For original z-pos, a 63 deg rotation was ideal.
- With downstream shift, finding a good compromise of PMT orientation becomes more tricky.



CONE ROTATION

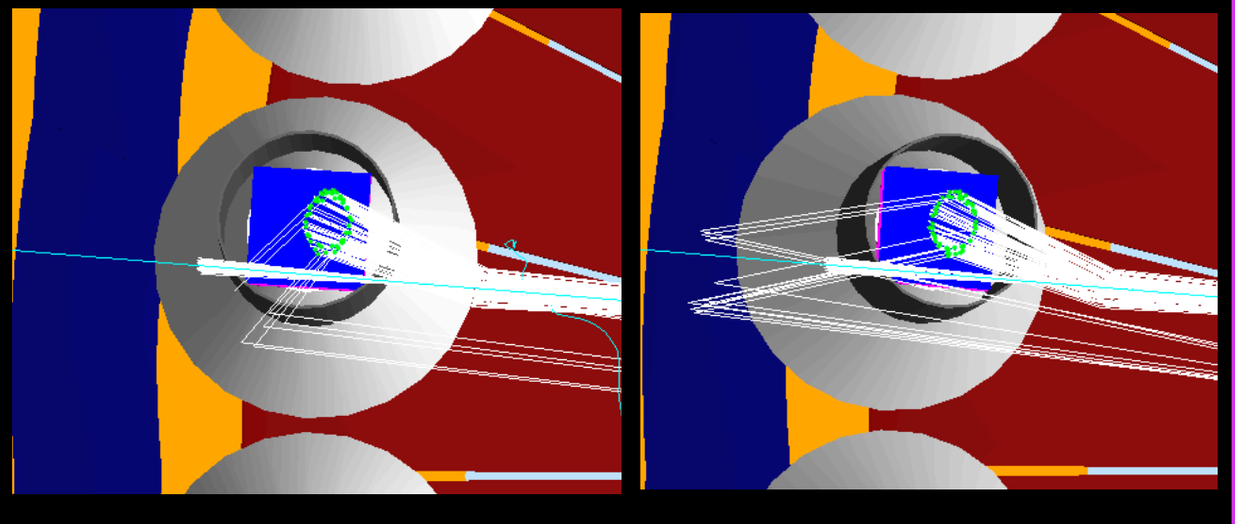
SIDIS: 11.5 deg electron



63 deg 50 deg

-cone rotation-

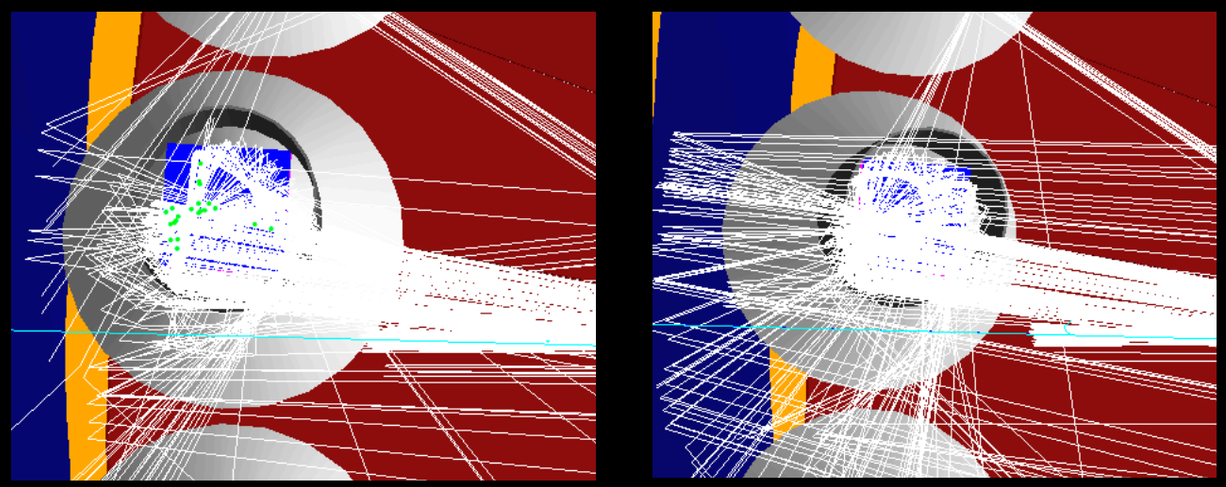
PVDIS: 28 deg electron



63 deg 50 deg

-cone rotation-

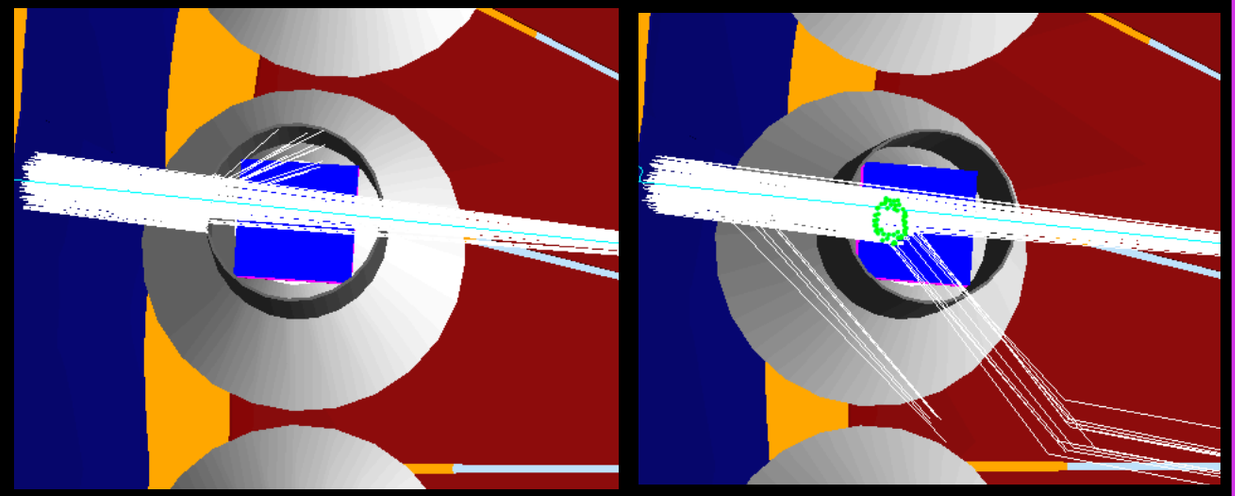
SIDIS: 8 deg electron



63 deg 50 deg

-cone rotation-

PVDIS: 37 deg electron

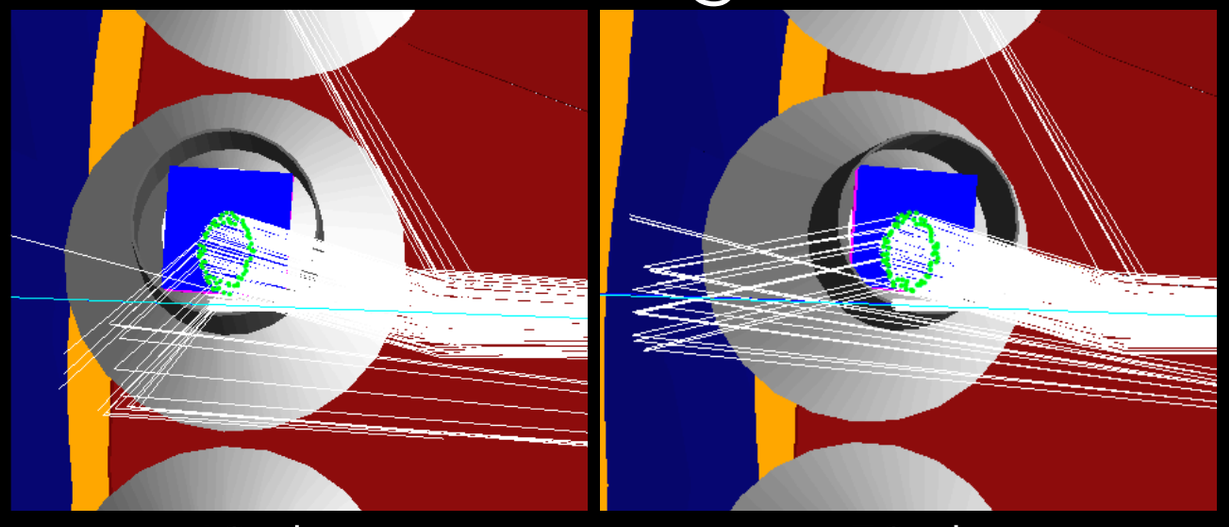


63 deg 50 deg

-cone rotation-

CONE ROTATION

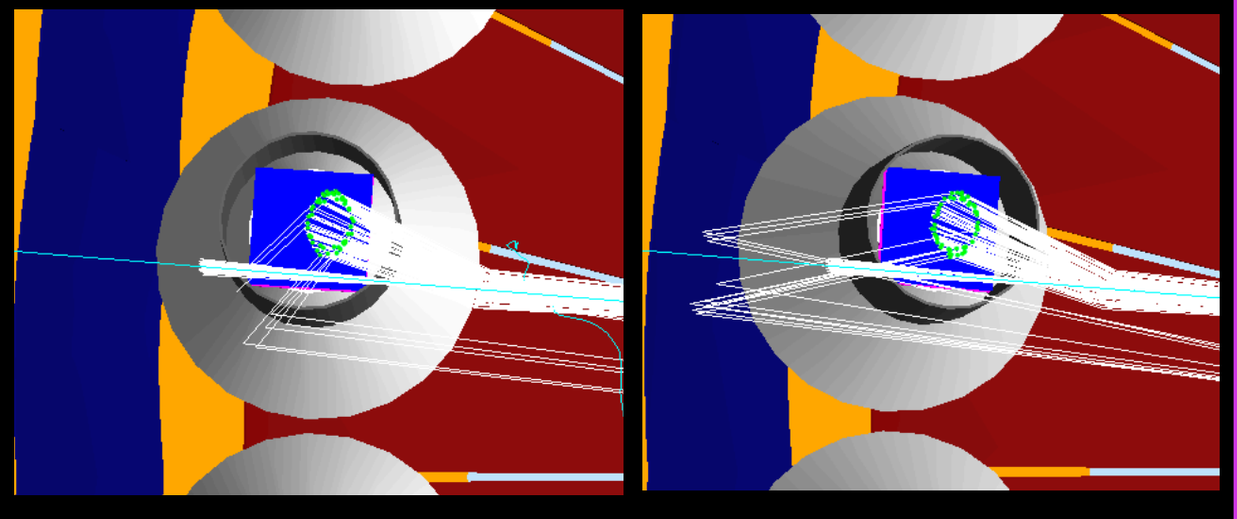
SIDIS: 11.5 deg electron



63 deg 50 deg

-cone rotation-

PVDIS: 28 deg electron



63 deg 50 deg

-cone rotation-

Center of acceptance case:

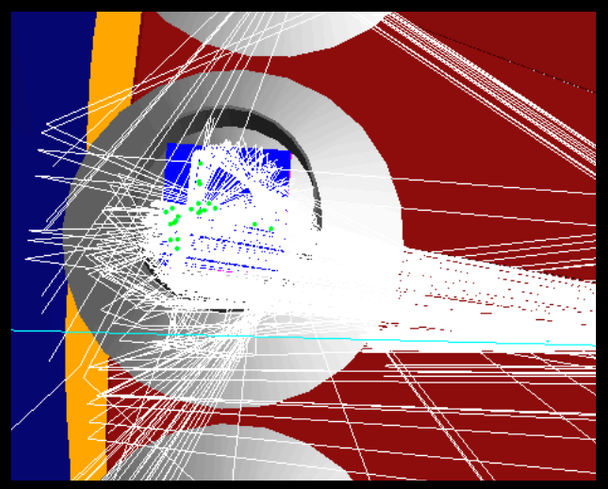
Great light collection regardless of orientation of PMTs and cone.

CONE ROTATION

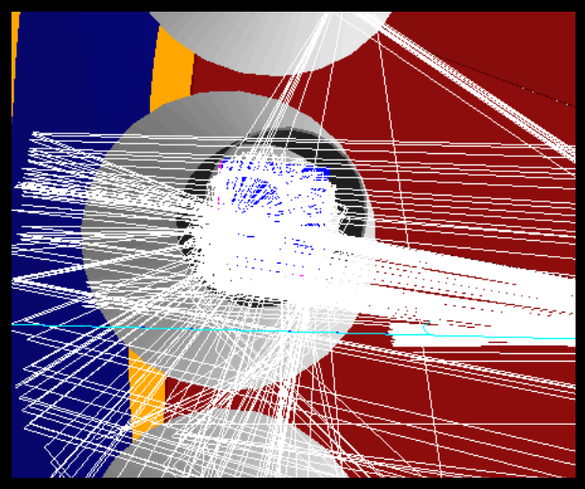
Edge of acceptance case:

PMTs and cone orientation results in cuts on acceptance.

SIDIS: 8 deg electron



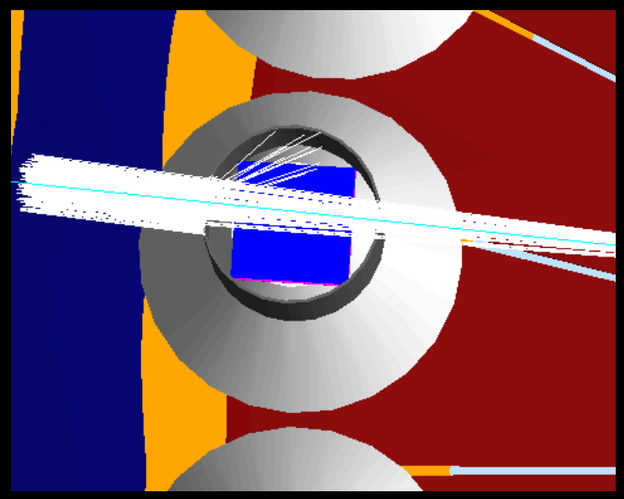
63 deg



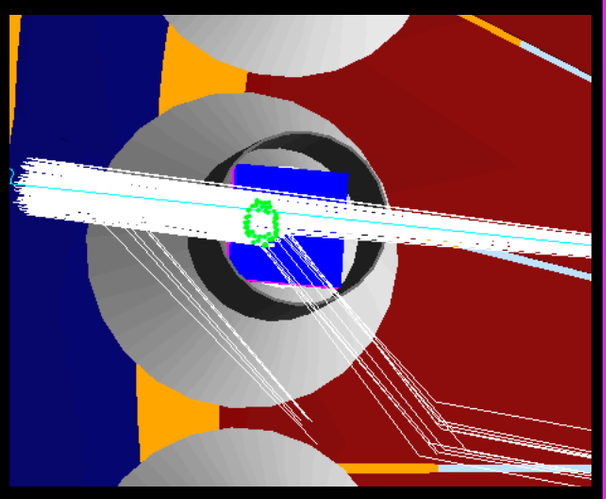
50 deg

-cone rotation-

PVDIS: 37 deg electron

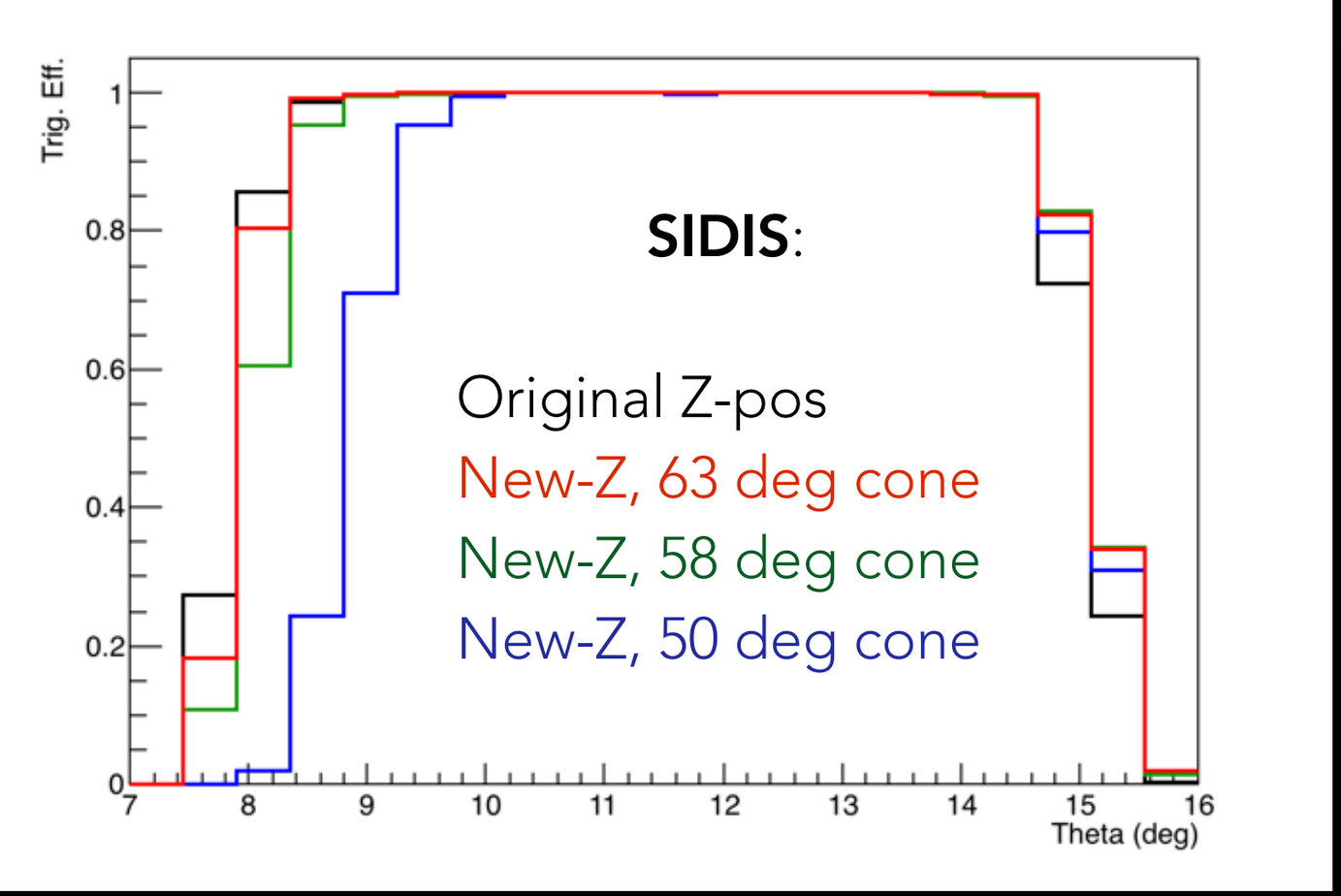


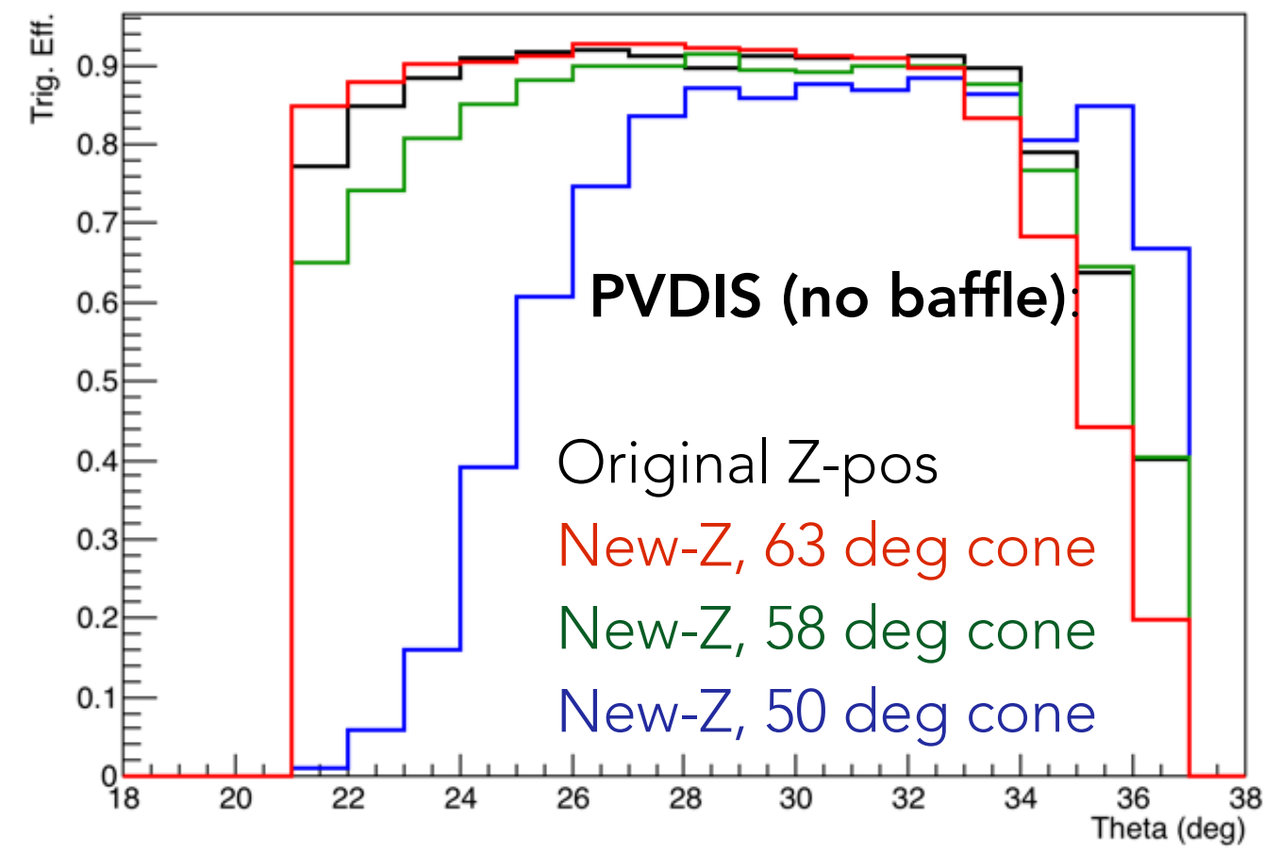
63 deg



50 deg

-cone rotation-



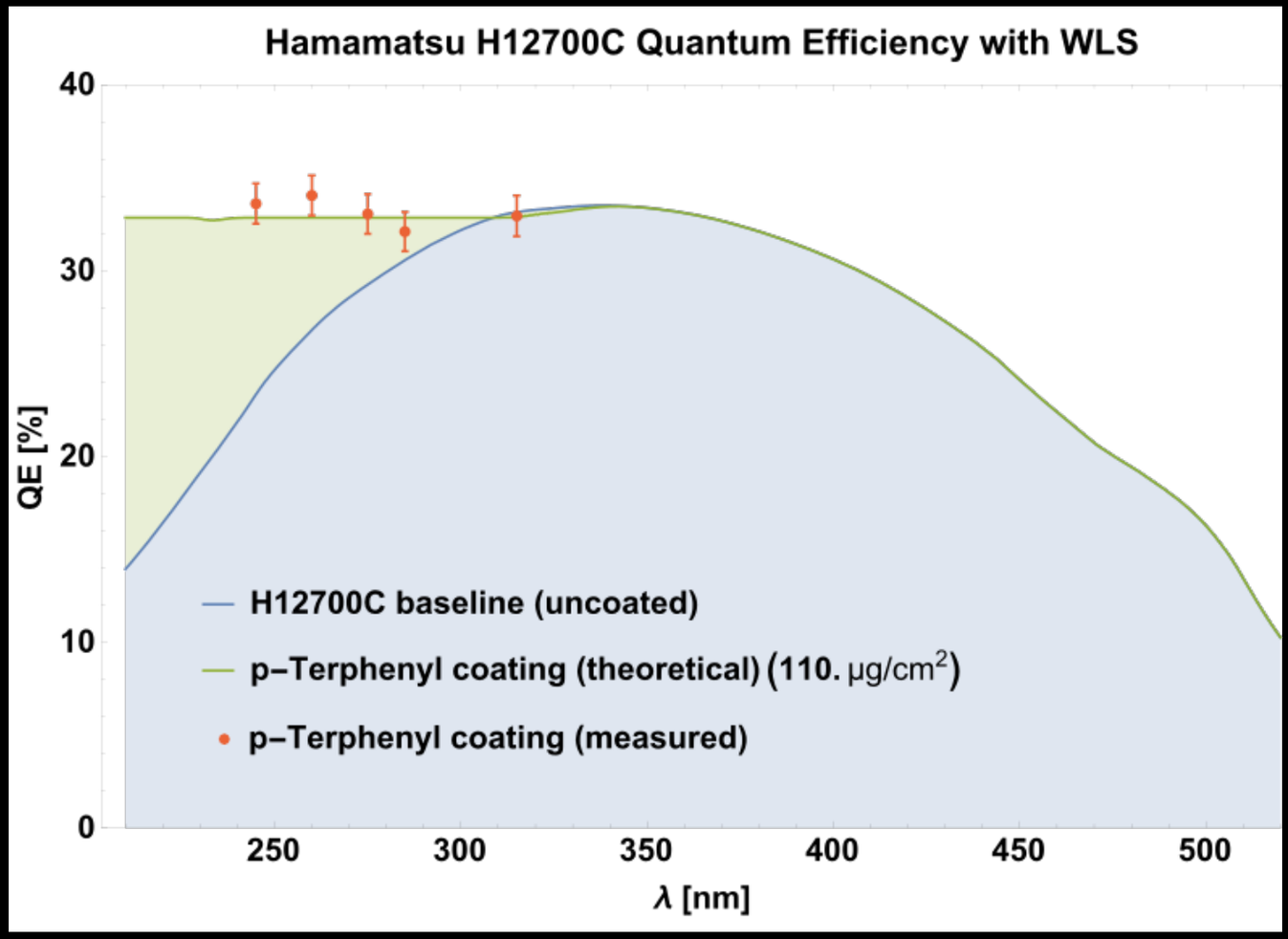


- **What can be done?**
  - "Middle ground" rotation?
    - 50 deg may be too extreme. A rotation closer to 58 deg may be good enough. Needs more simulation.
  - Mirror central angle can be tweaked.
    - This leads to a SIDIS mirror that preforms better at small angle with some efficiency loss at large angle.
    - Also tends to lengthen the primary mirror.
  - Cones could be removed or rotated for PVDIS running.
    - Leaves very little breathing room for PMT / mirror mis-alignment.
    - Could help with pi0 backgrounds.
    - Impact needs to be simulated.

EXTRAPOLATION OF WAVELENGTH SHIFTING GAINS TO PHOTONS < 200 NM

- Theoretical gains on total QE stays flat down to 180 nm.
- Measurements down to 250 nm follow this trend.
- Can we extrapolate flat QE down to 180 nm?

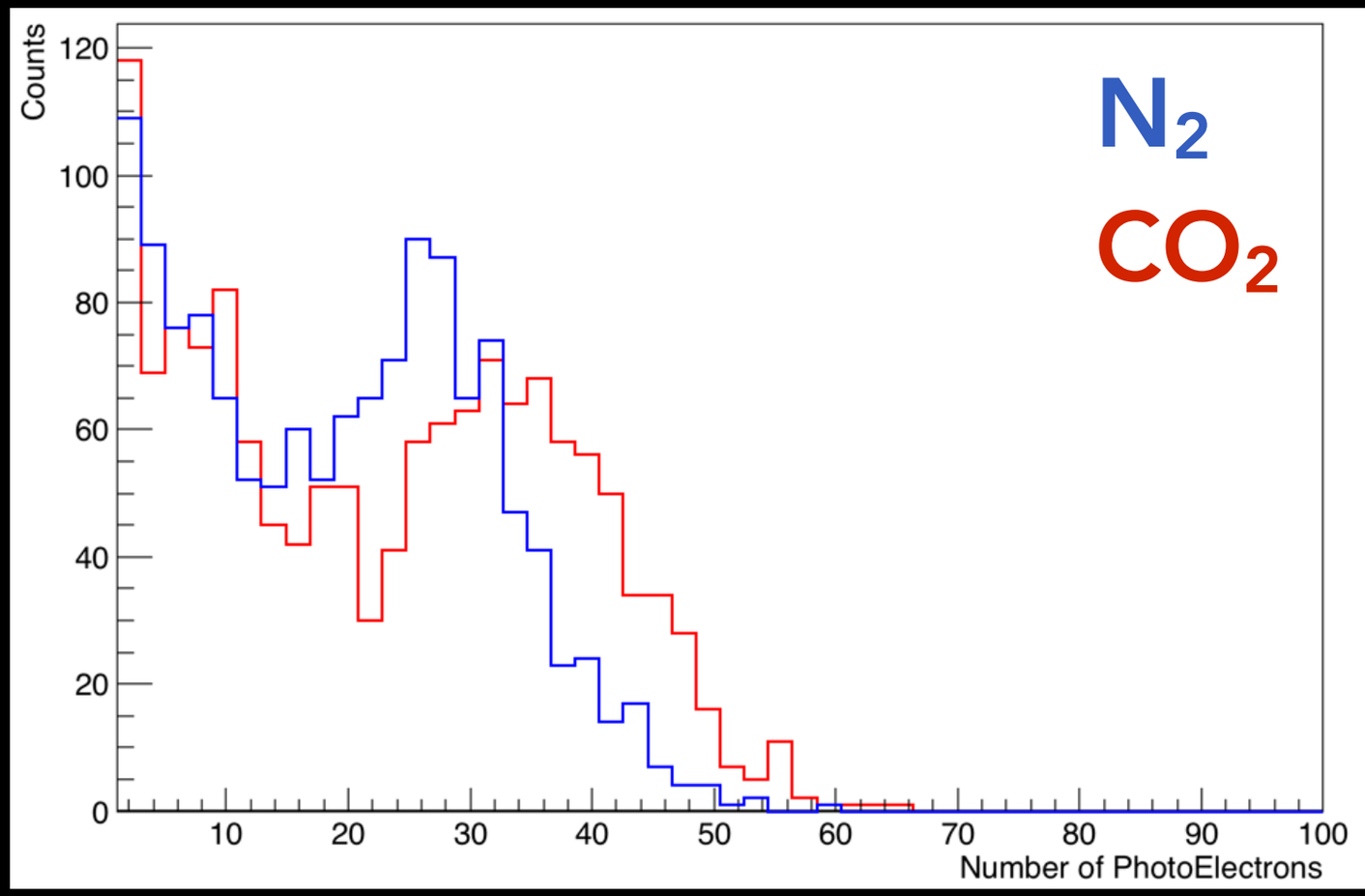
- CO2 becomes opaque at 180 nm, but N2 remains fairly transparent.
  - N2 is less efficient a radiator in general, and has some scintillation compared to CO2.



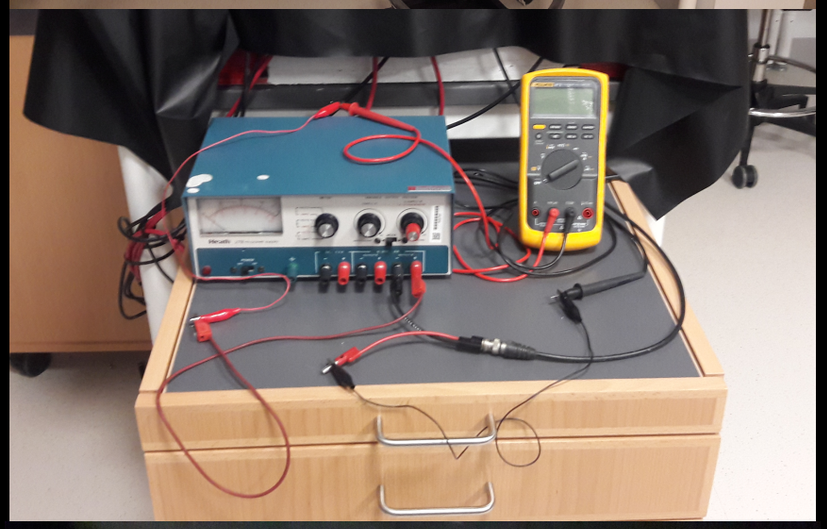
EXTRAPOLATION OF WAVELENGTH SHIFTING GAINS TO PHOTONS < 200 NM

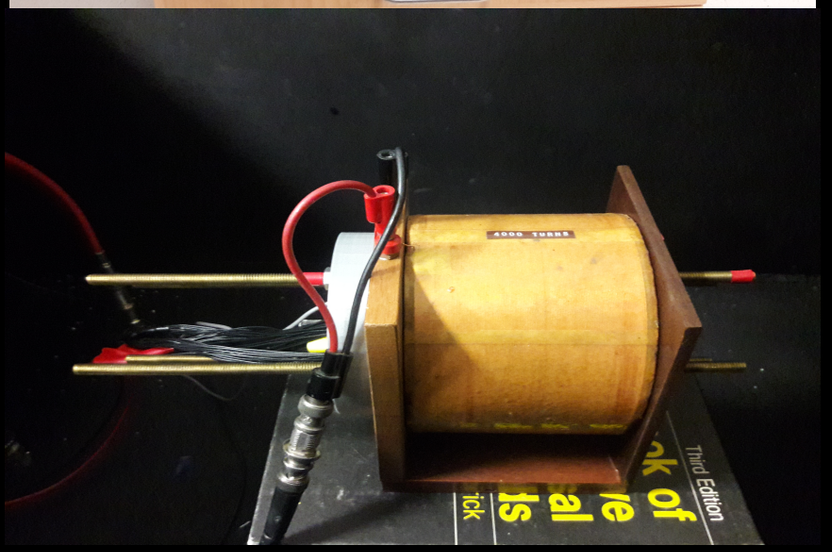
- Simulation was run on PVDIS setting, without baffles.
- electrons were simulated with:
  - p: 2 - 5 GeV
  - theta: 21 - 37 deg
  - phi: 0 - 360 deg
  - vertex is evenly distributed along target.
- 50k events, same random seed.

- Conclusion: Similar integrated number of photoelectrons.



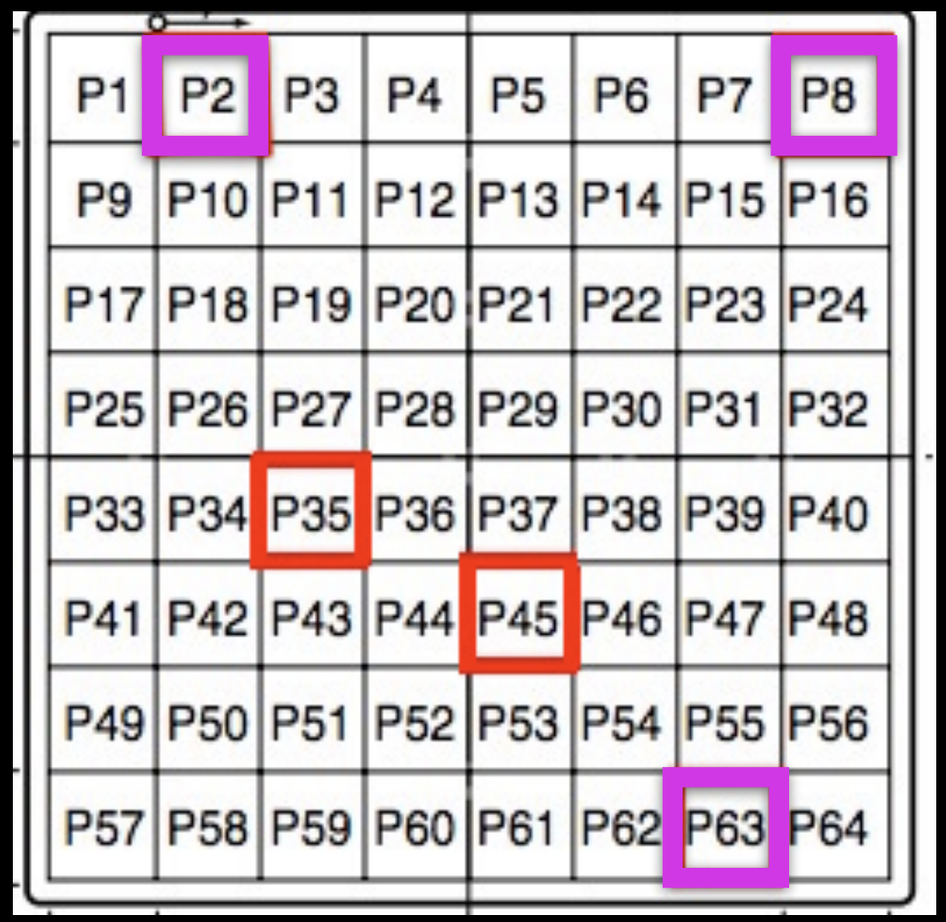
MAGNETIC FIELD TESTING OF H12700 MAPMT





- All testing done by **Melanie Drehfuss**
- Studied single photoelectron spectra of serial # HA0103 with 315 nm LED under longitudinal magnetic field produced by a solenoid, unshielded

- Tested:
  - **Edge Pixels**: 2, 8, 63
  - **Central Pixels**: 35, 45
  - Sum of all pixels



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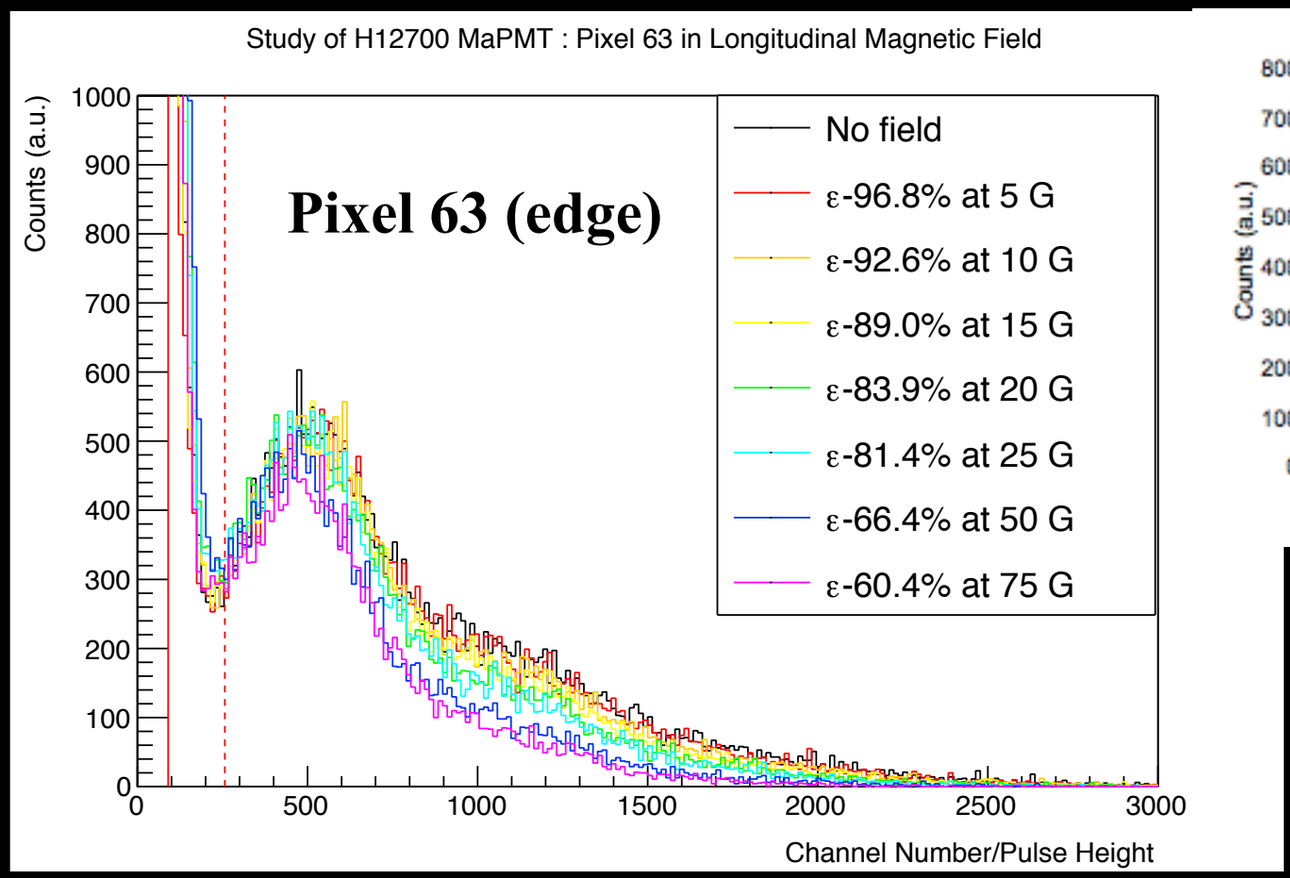
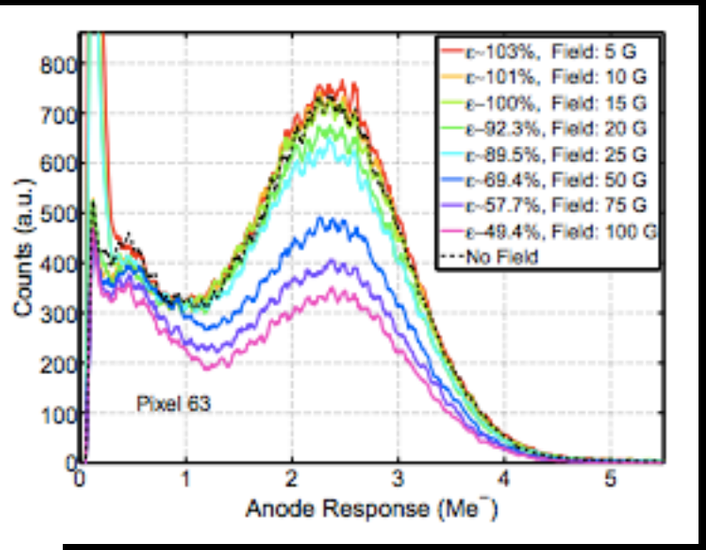
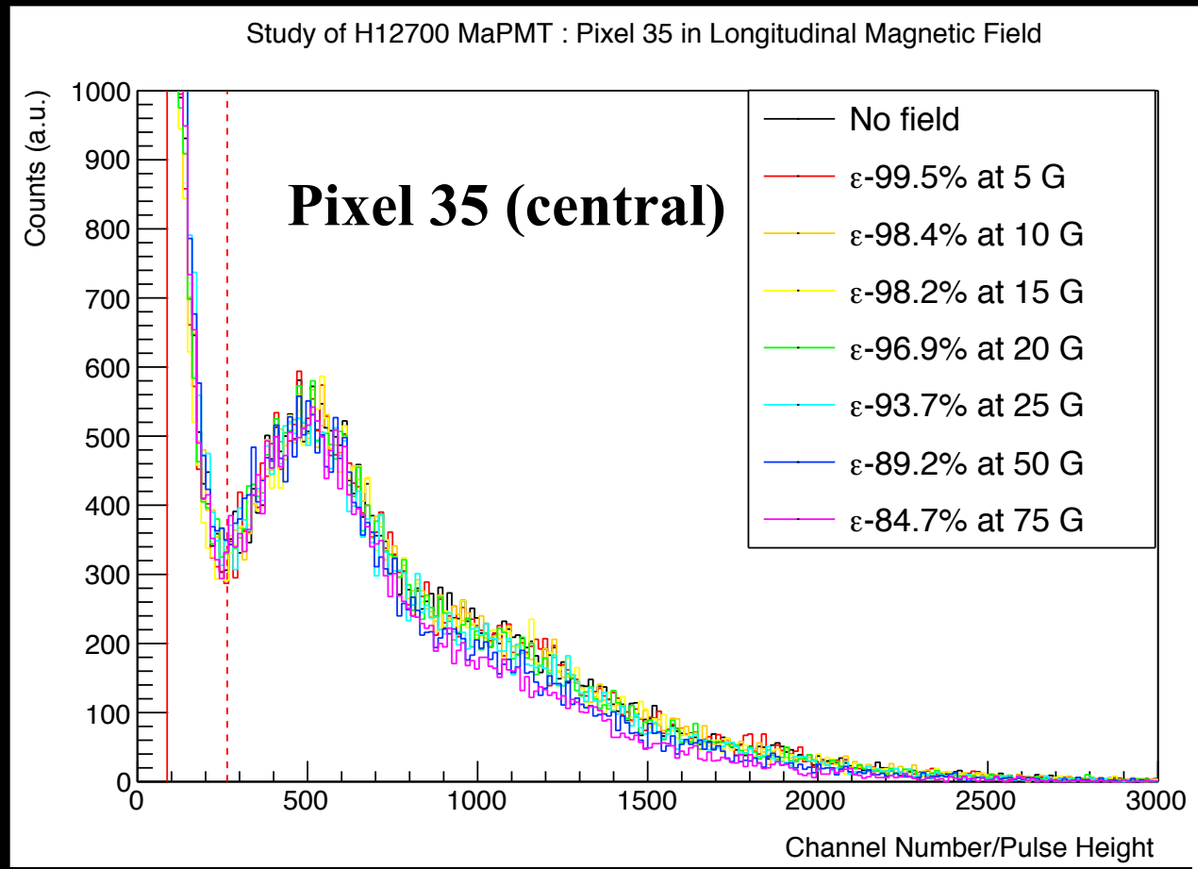
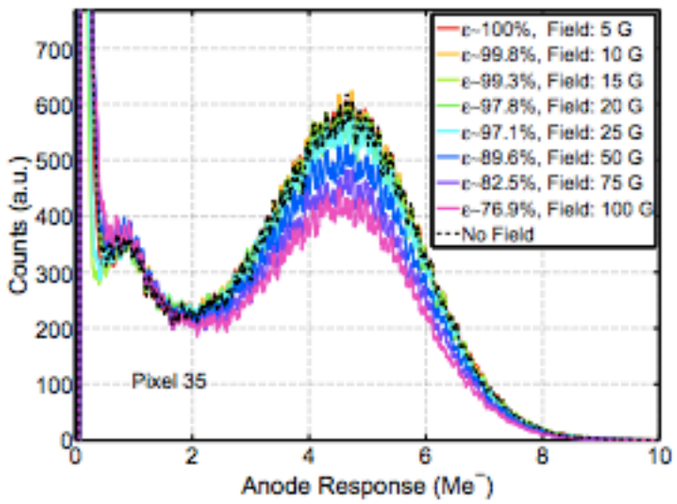




- Efficiency **ε** = (# of events for a given field /# of events for zero field)
- A cut is made 4**σ** away from the pedestal peak to separate pedestal events from PMT events





Compare to: "Characterization of the Hamamatsu H12700A-03 and R12699-03 multi-anode photomultiplier tubes," M. Calvi, et al.

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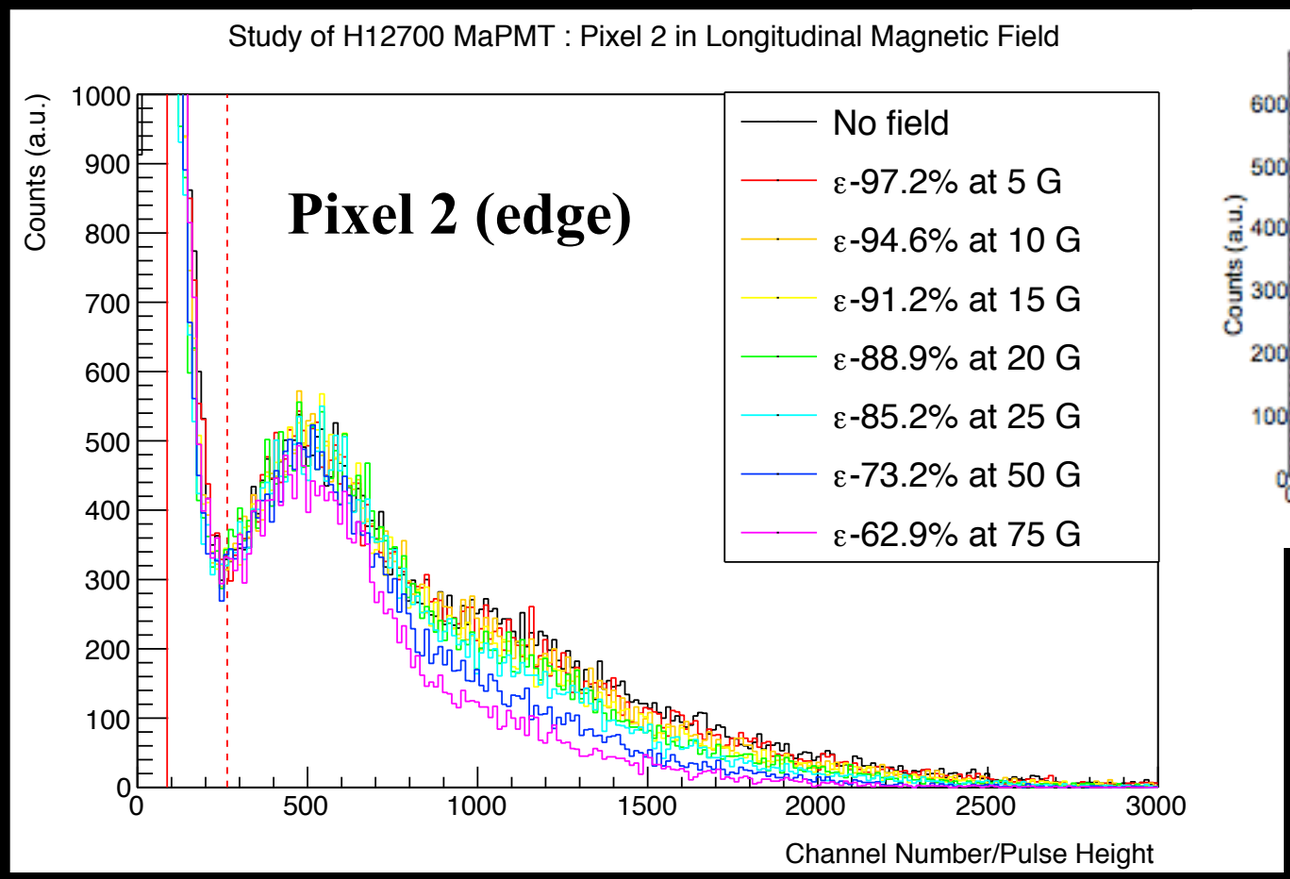

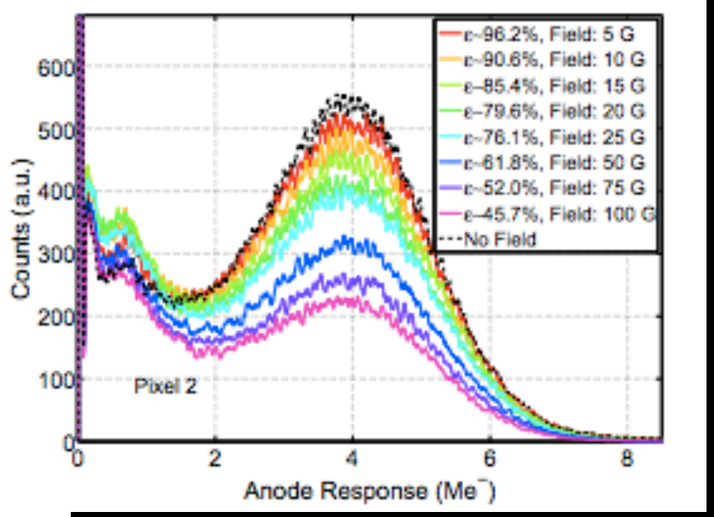

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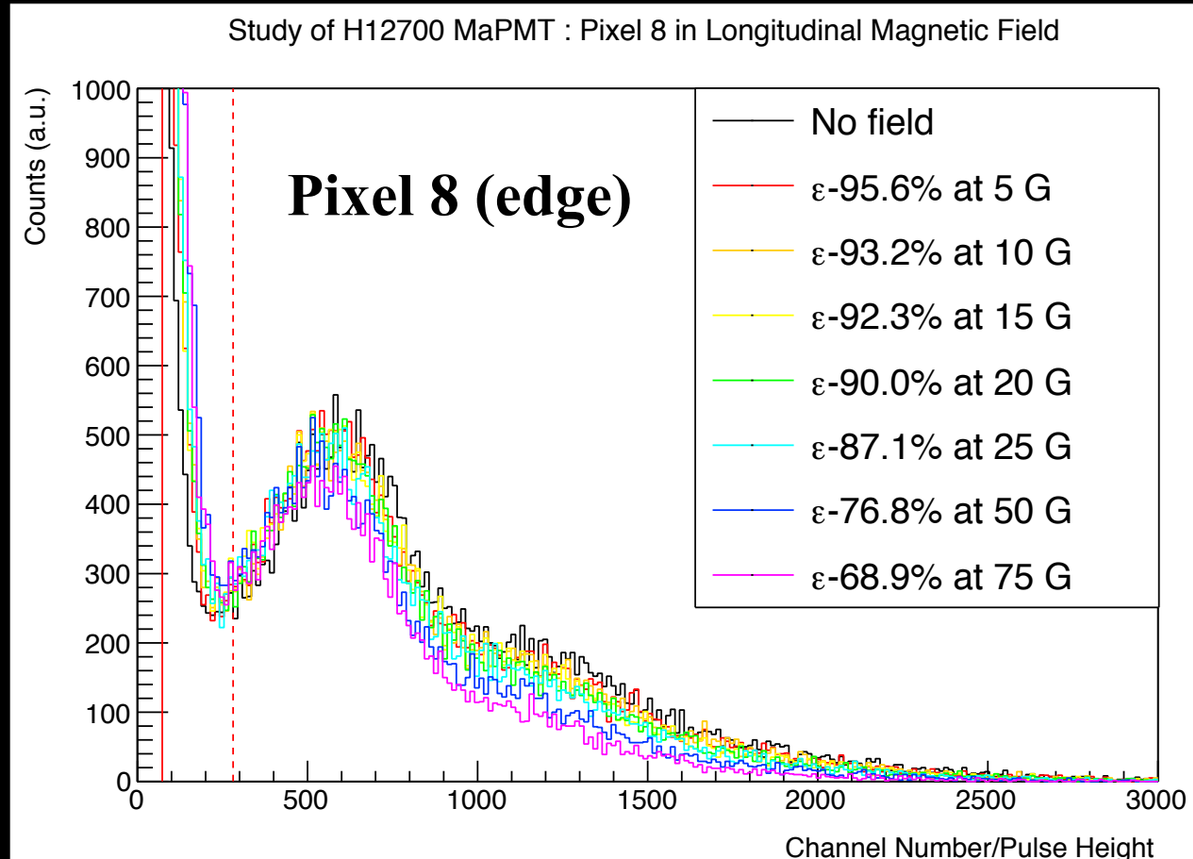

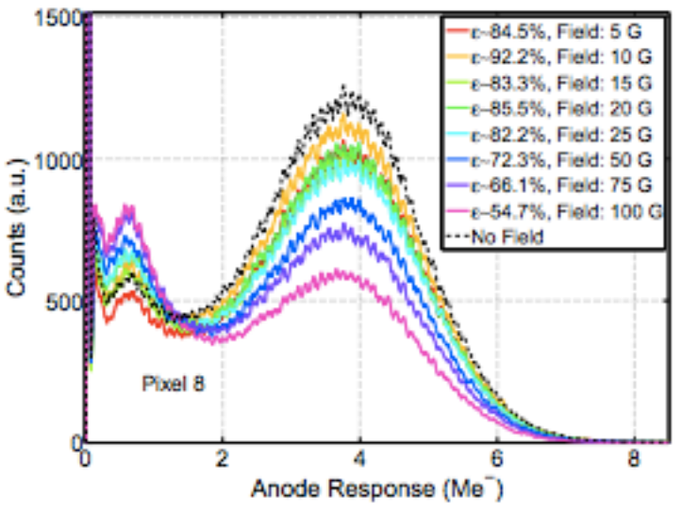

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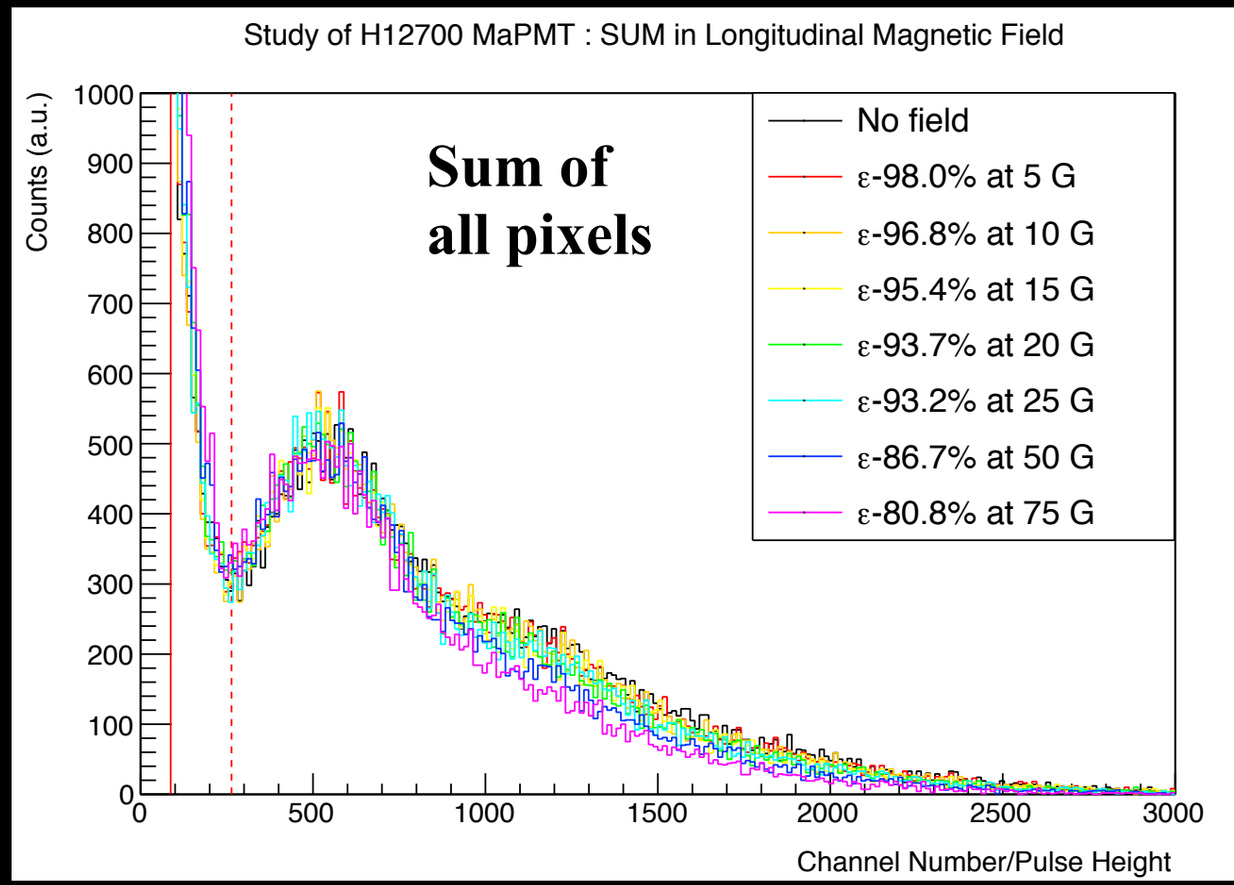
MAGNETIC FIELD TESTING OF H12700 MAPMT

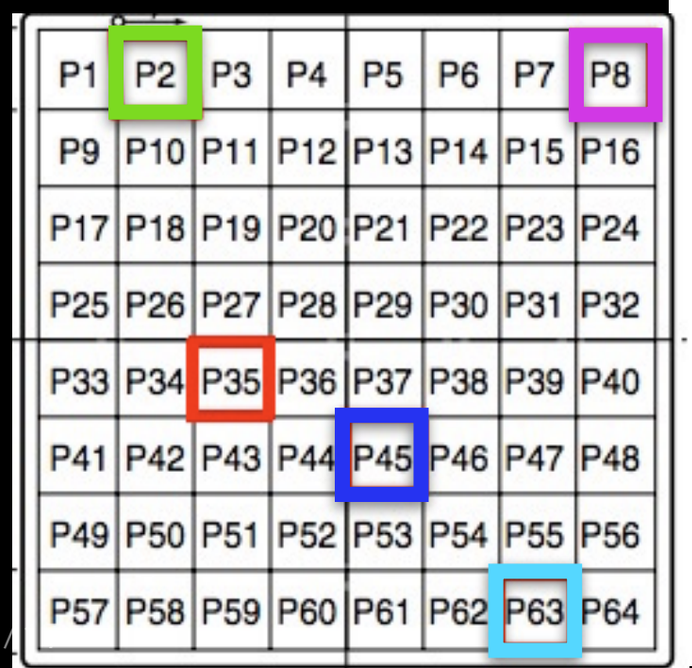
Results for edge pixels 2 and 8 more optimistic, but consistent with central pixel and edge pixel 63

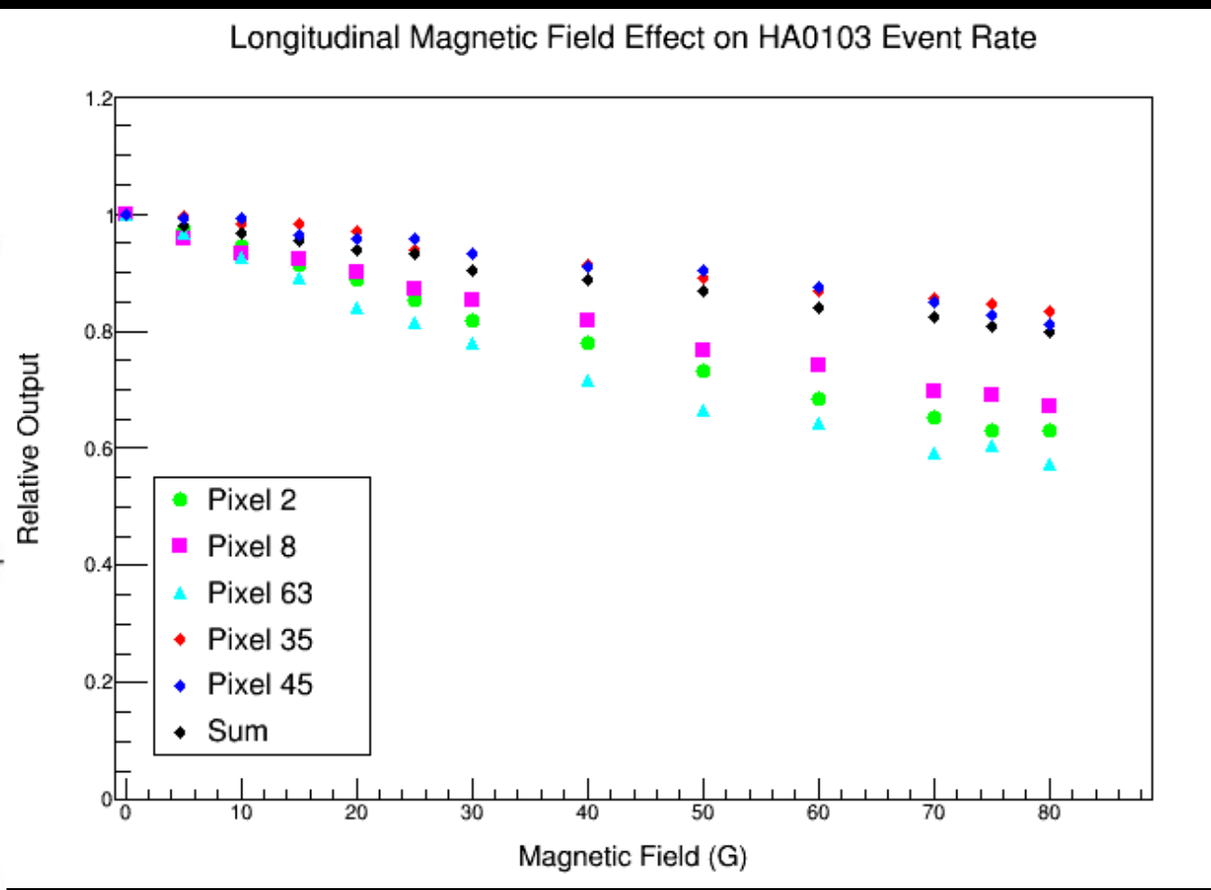
Sum of all pixels show ~14% reduction in efficiency at 50 G and ~20% reduction at 80 G

Will test different PMTs under longitudinal and transverse fields next and compare to H8500 series

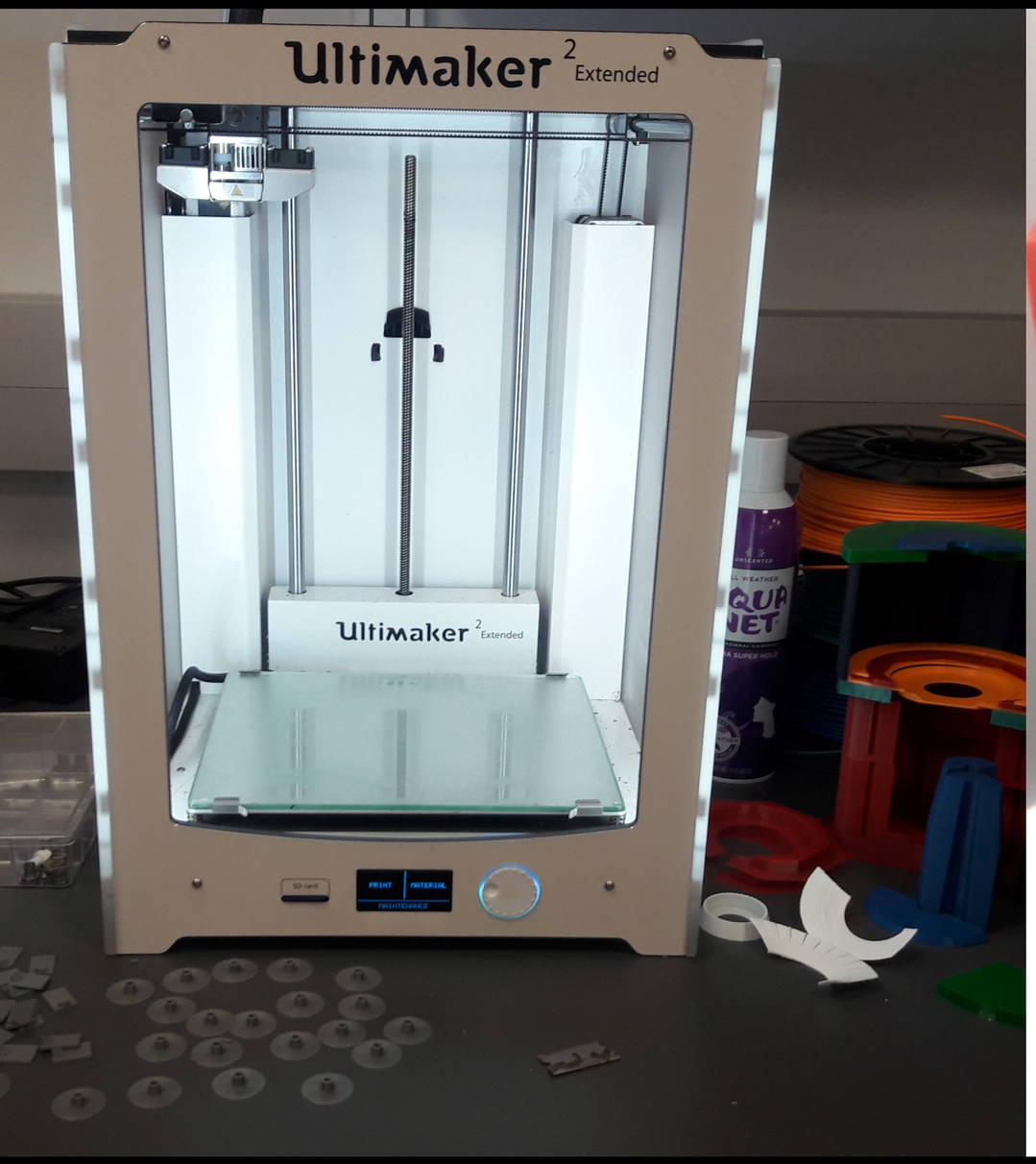
3 PMTs have been coated with p-Terphenyl and will be tested soon.

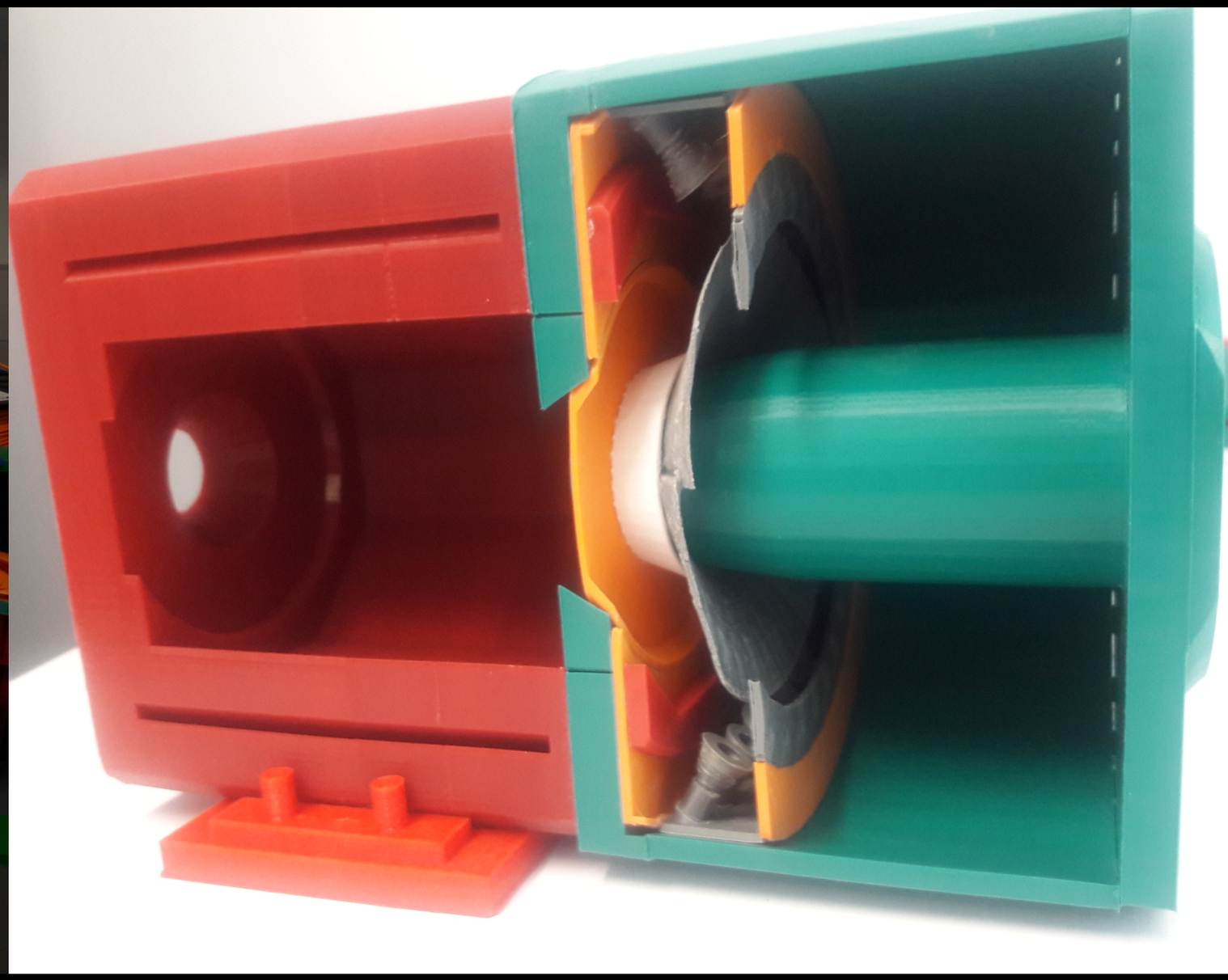






3D PRINTING OF THE SOLID DETECTOR





More nuanced prints to come!
Currently working on model to show endcap splitting/separation.

Melanie has the printed model at the meeting. Ask her to see it!

QUESTIONS?

This work is supported in part by the U.S. Department of Energy Grant Award DE-FG02-94ER4084.