# PVDIS Cherenkov Update

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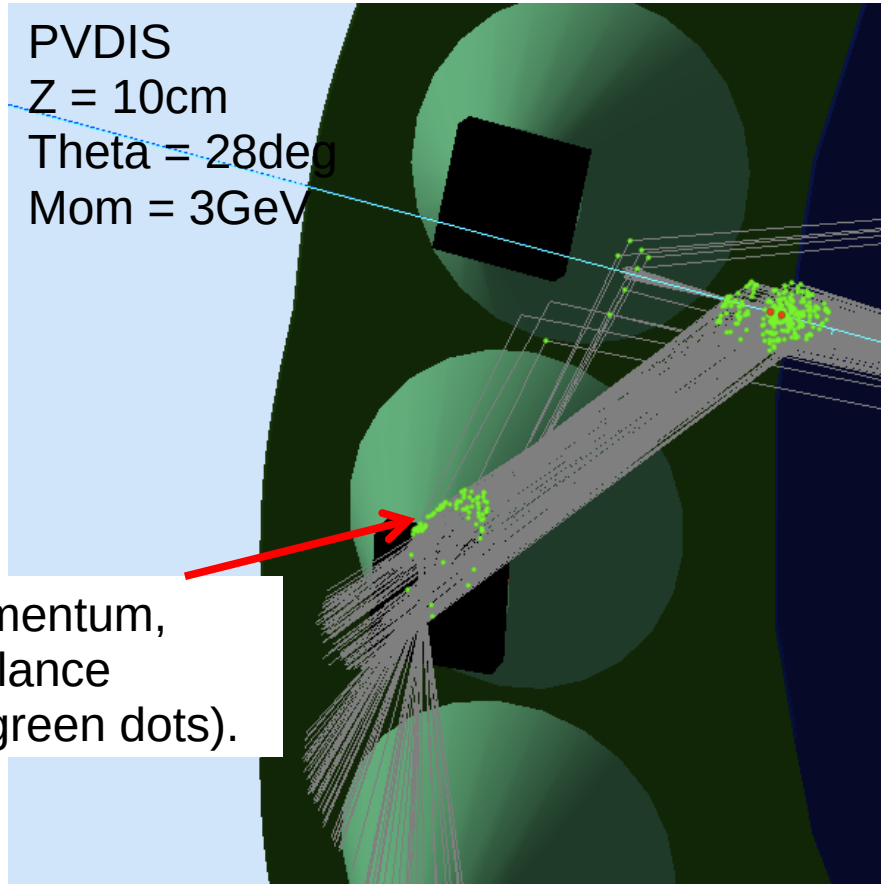
Temple

# PVDIS / SIDIS common configuration for Cherenkov

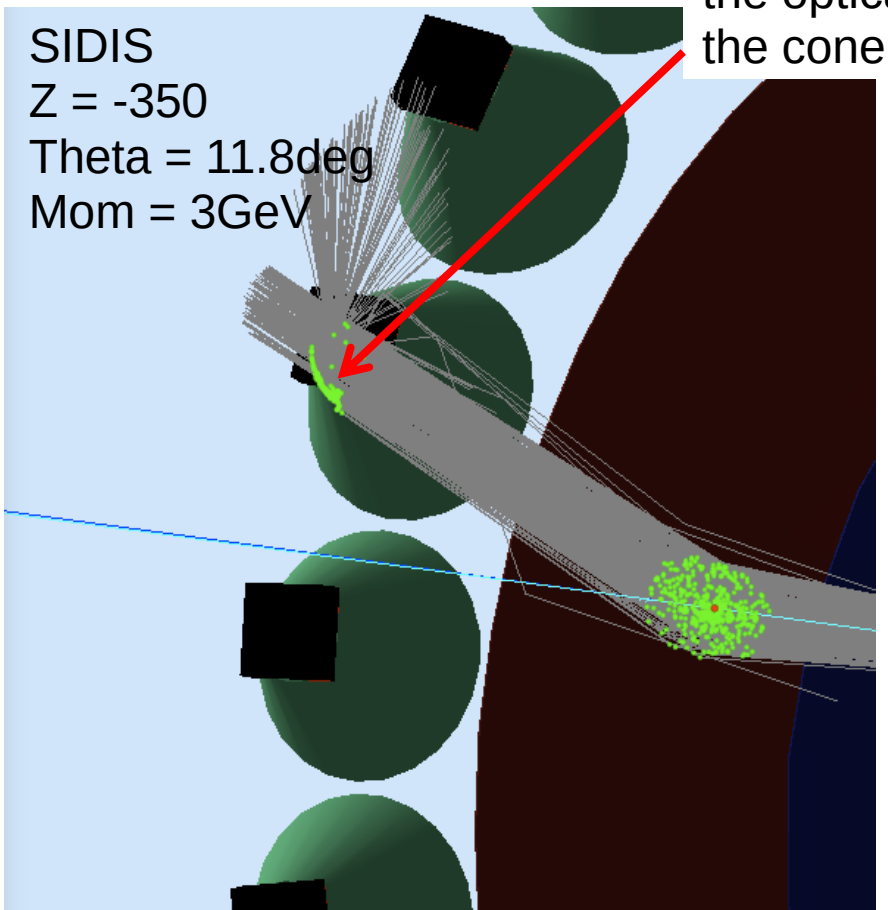
- A common (more cost effective) configuration between PVDIS and SIDIS cherenkov is being explored.
- Common items would include:
  - Main tank
  - The PMT array (3x3) and winston cone
  - Primary set of SIDIS mirrors
- PMT array location and orientation would be fixed common for both PVDIS and SIDIS.
- SIDIS mirrors will need to be rotated prior to PVDIS running to optimize collection efficiency.
- A second set of mirrors for PVDIS large angles, and the secondary SIDIS gas tank remain exclusive.

# PMT rotation and orientation

- In the independent configurations, the PVDIS and SIDIS PMT arrays used a slightly different position and rotation to optimize collection efficiency.



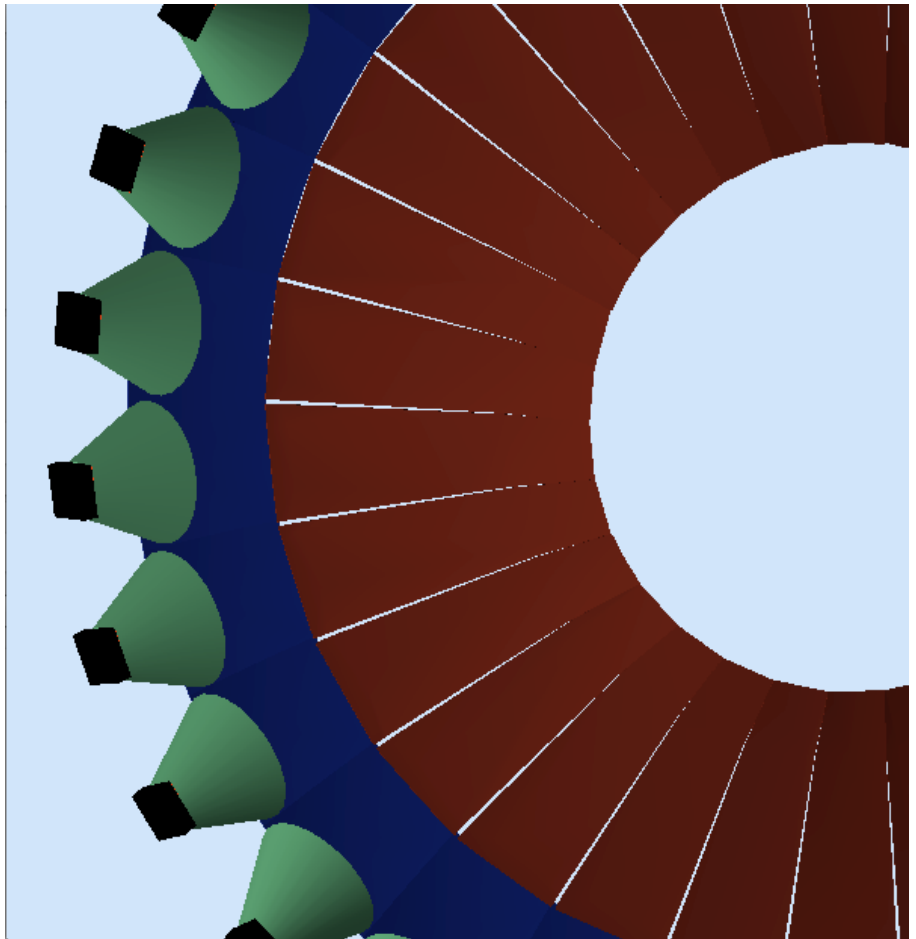

At central angle and momentum, the optical photons will glance the cone (shown by the green dots).

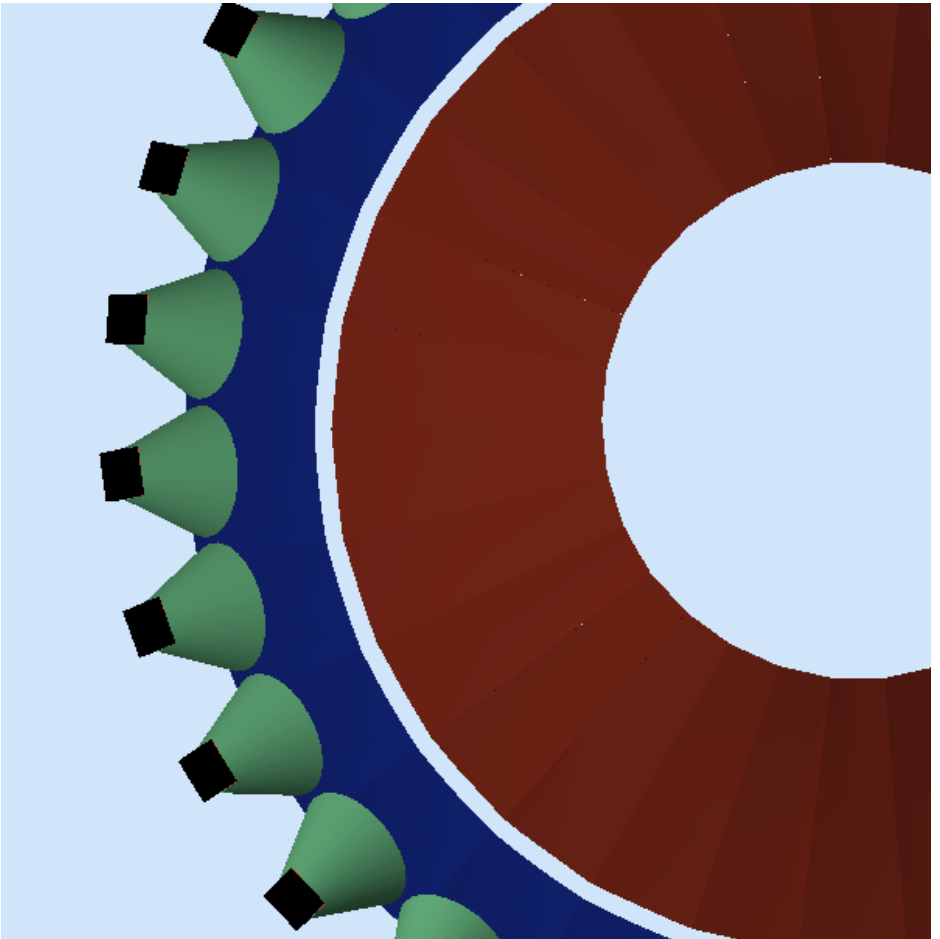



- A “hybrid” configuration is proposed here:
  - Advantages include reduced cost for cones (1 set instead of 2 sets) and the arrays are only orientated once during assembly.
  - The disadvantage is a efficiency drop (~9% over all angles/momentums).

# Mirror Rotation

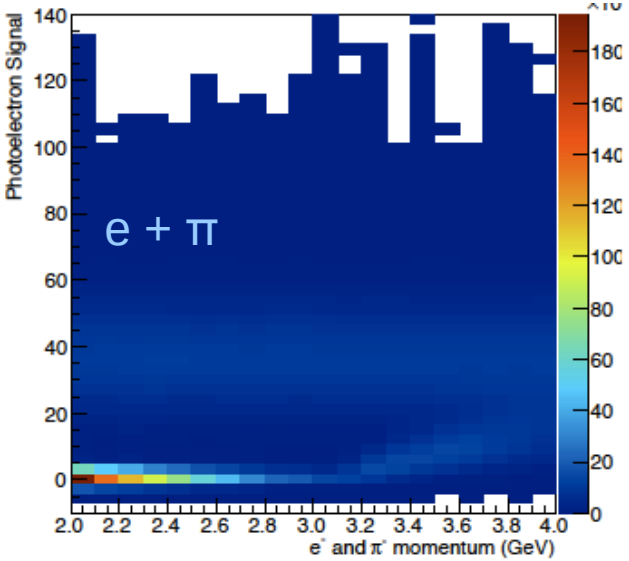
- The SIDIS configuration (right):  1 set of mirrors sit flush and cover complete kinematic range.
- PVDIS configuration (left):  Primary mirror rotated about innermost edge by ~8 deg.  Additional mirrors required for large angle electrons.

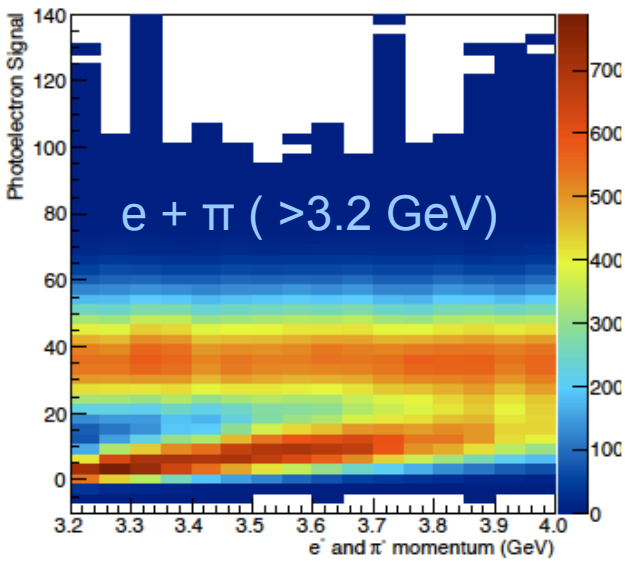




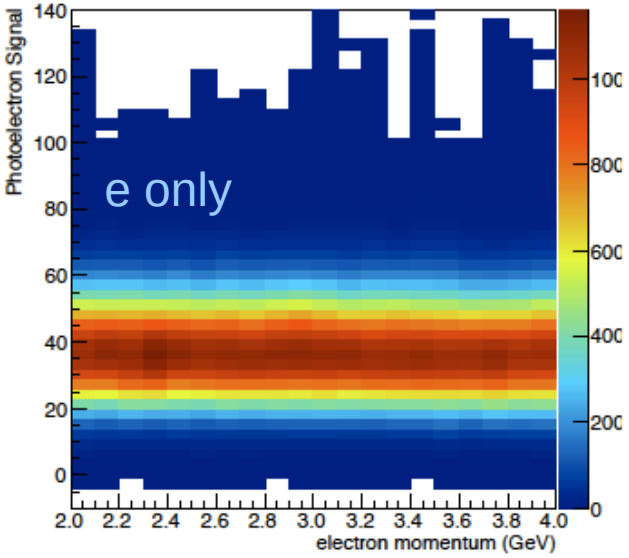
# PVDIS previous configuration (Eric's)

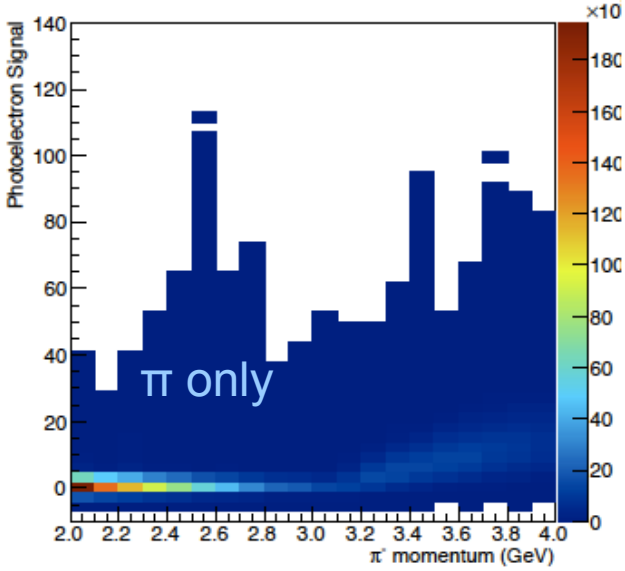
- “Photoelectron Signal” is the collected photoelectrons per-event, over all PMTs and after Q.E., represented as a Poisson distribution with a 1 p.e. Gaussian resolution.
- Pions are only pions from the target (no knock-ons, yet) and pions with no signature are artificially represented by a single p.e.



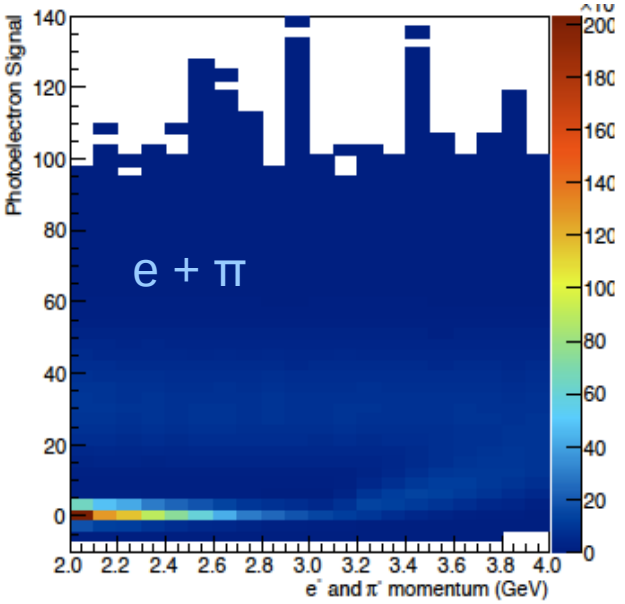

Photoelectron signal vs Momentum (All theta, all z-targ)

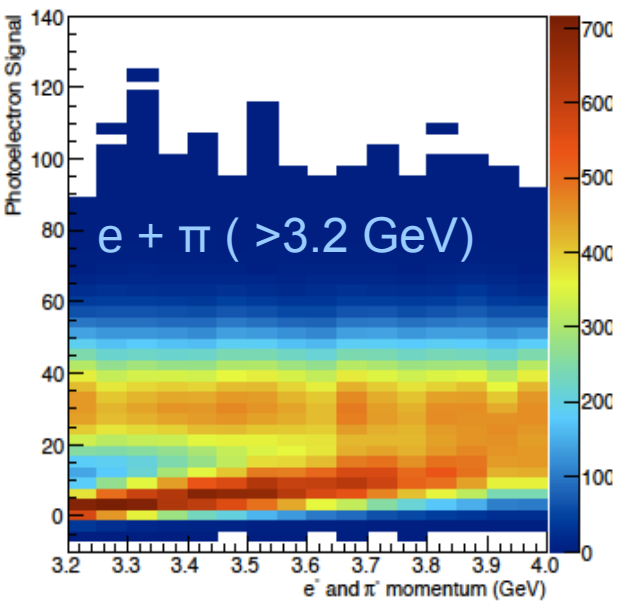


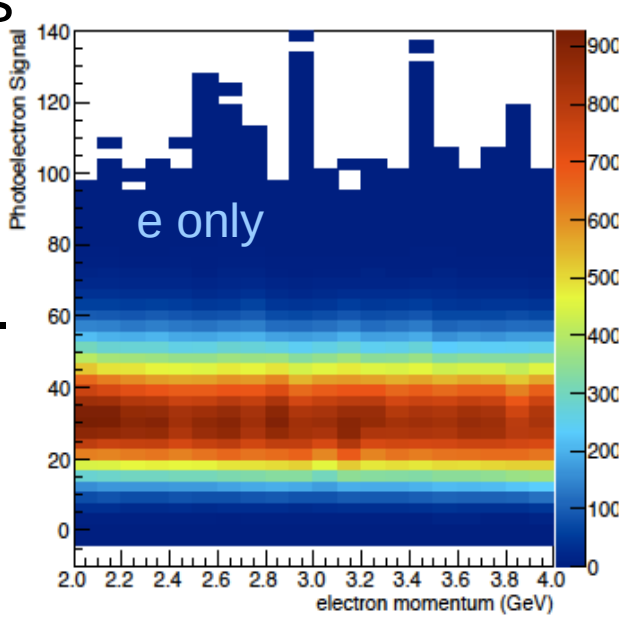



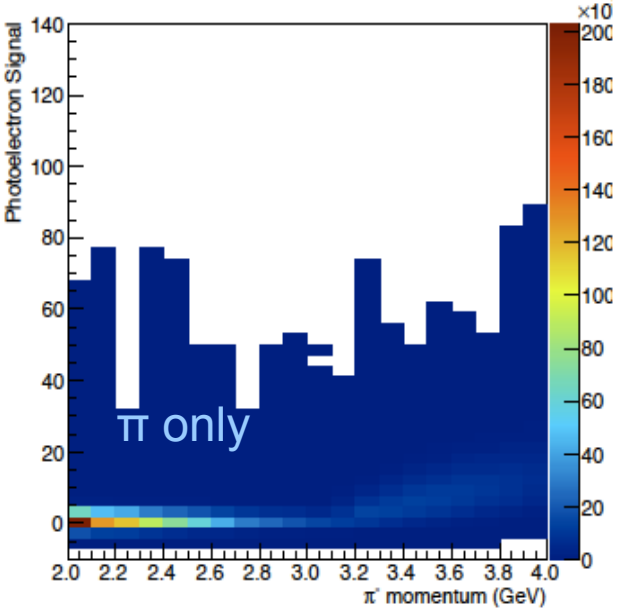
# PVDIS new configuration (rotated SIDIS mirror)

- Photoelectron yields vs momentum  similar to Eric's previous configuration.
- The mean electron p.e. peak is slightly reduced when compared to Eric's settings (from ~34 to ~30).  This is likely from a reduced track-length from tank entry to mirror.

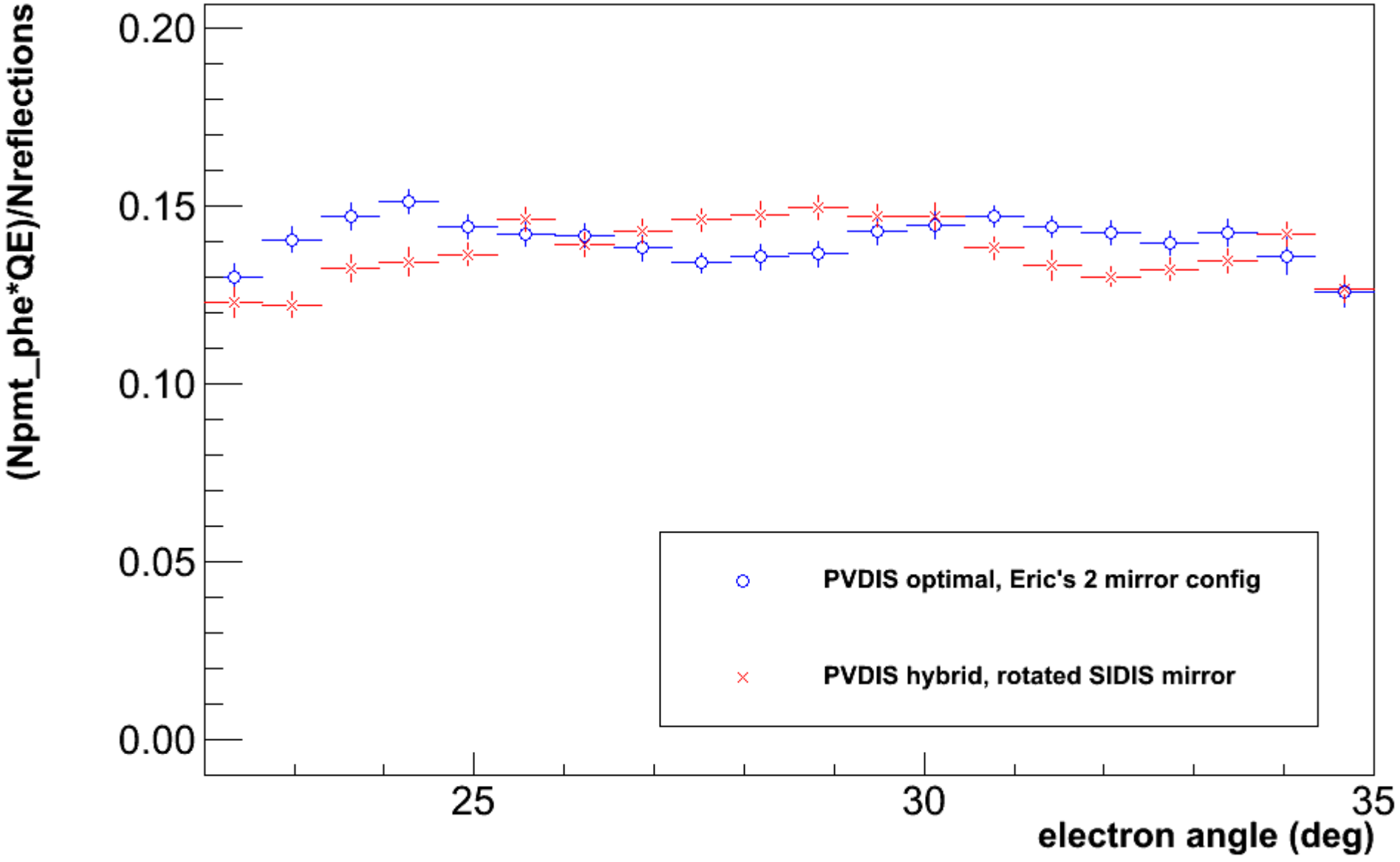


# PVDIS Efficiency Comparison: Optimal vs Hybrid



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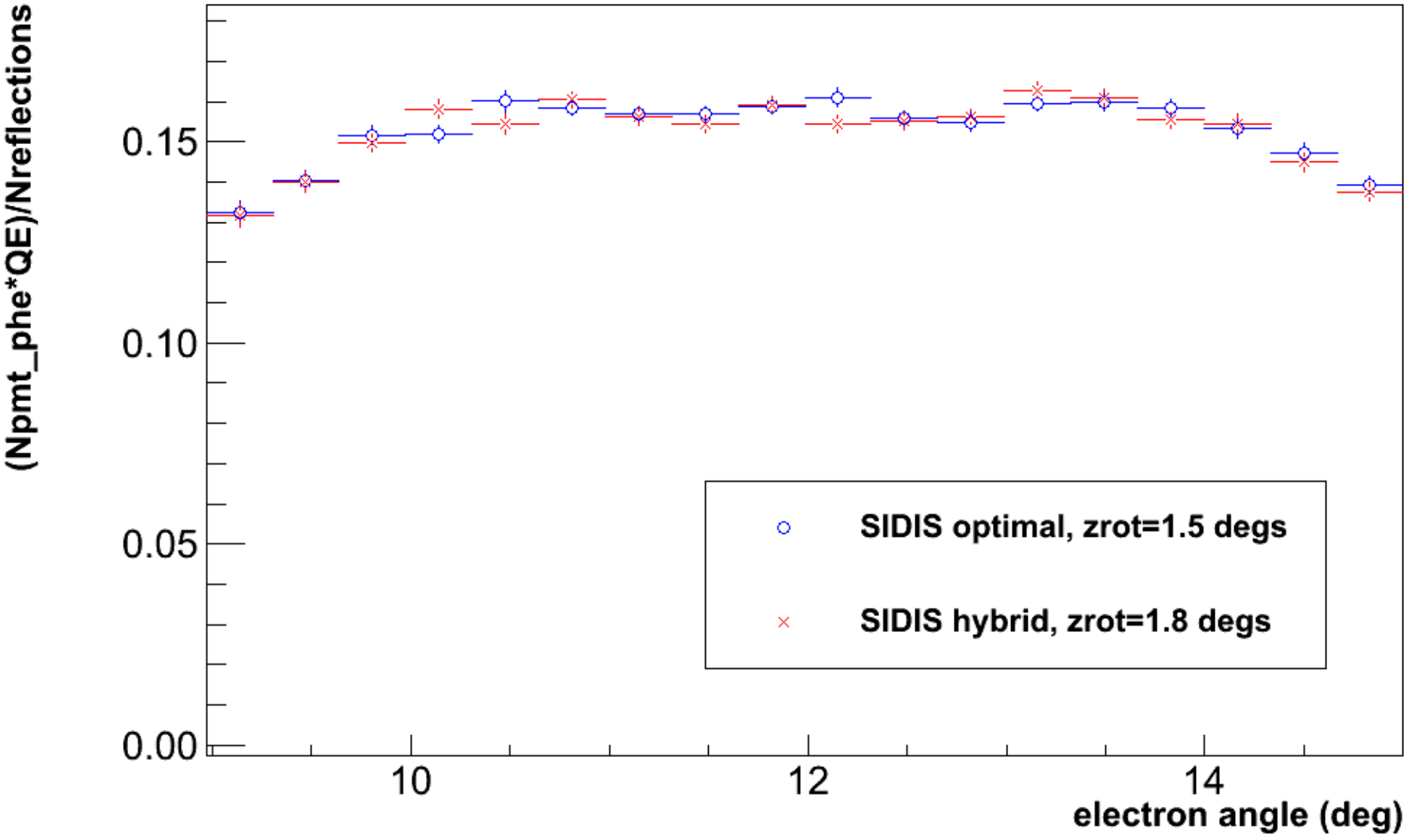
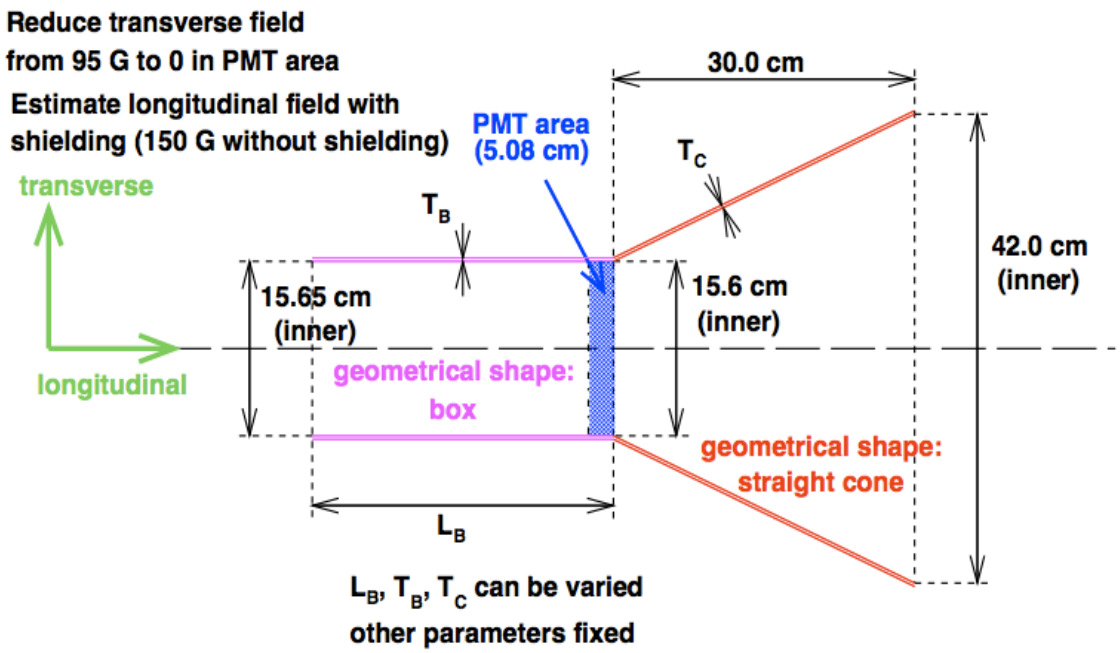


# PMT array shielding

- The cost for mu metal “box” enclosures of the PMT arrays + winston cones has been quoted from Amuneal. However we are uncertain if this quote includes the “faceplate” connection piece from the box-front to the cone.
- We will contact Amuneal again for clarification, and we will also request a quote for a cylinder enclosure design of the PMT array, which may save some costs.




Box Design Quote (total): $35,920

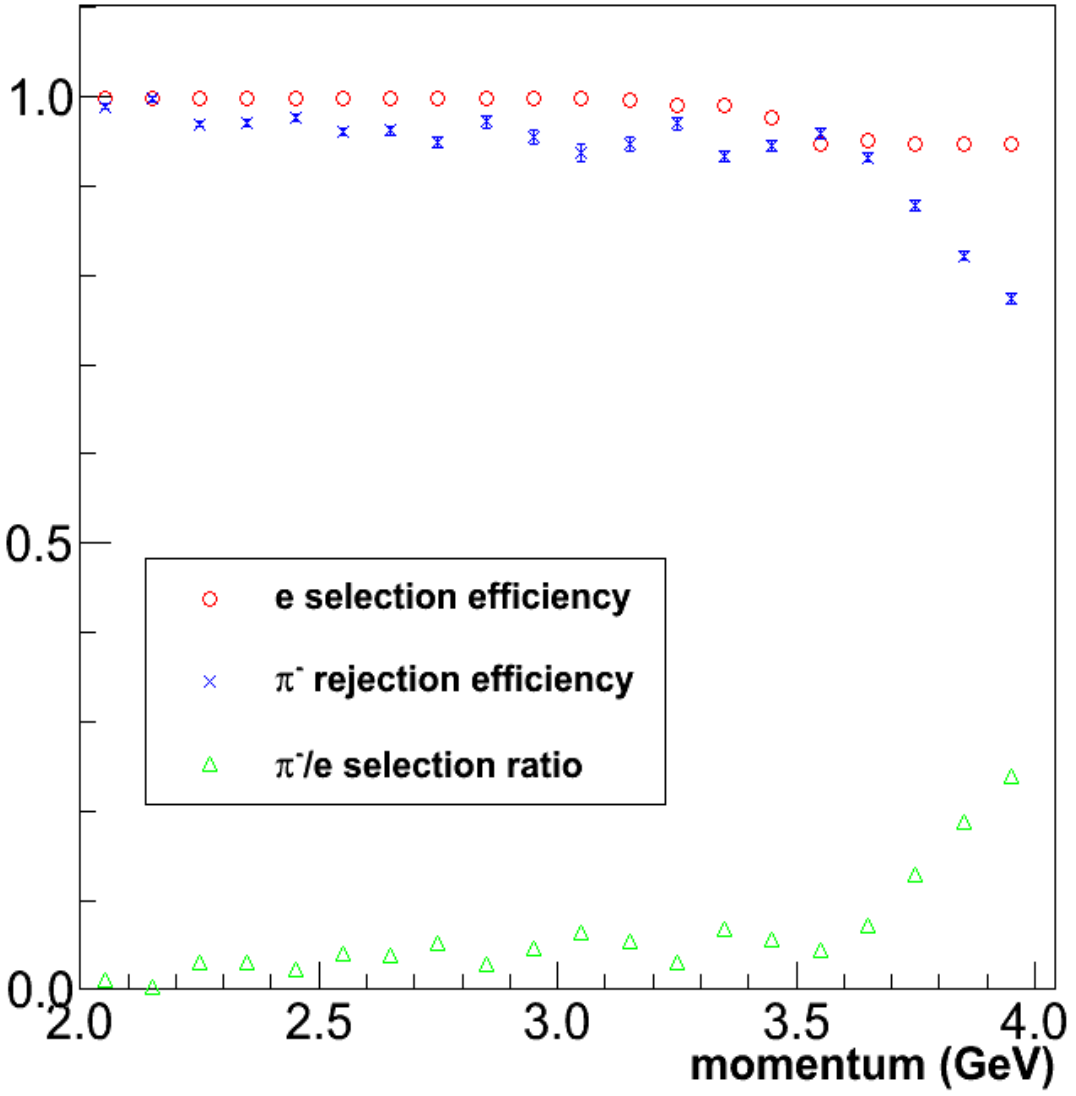
Possible alternate cylinder design

# Work still to be done:

- Getting mirror coating quote from Quantum Coating, based in Delaware (once a final mirror design is finalized).
- Integrate Mike's current gemc with the solid gemc.
- Simulate “full” background contribution to p.e. signal.
  - Includes knock-ons and pair production in PMT glass from downstream background.
- Processing and digitization (ala libgemsol code)
  - (started but not completed)
  - Estimate pile-up at the ADC level
- Prototyping of a single sector.

# PVDIS previous configuration (Eric's)

- These efficiencies are all based on a p.e. cut to best separate the pion peak from the electron peak.
- “e selection efficiency” is the number of p.e. kept after cut / all p.e.'s.
- “pi- rejection is rejected pions after cut / total”
- “pi/e selection ratio” is pion selection eff / electron selection eff



# PVDIS new configuration (rotated SIDIS mirror)

- The reduced p.e. yield results in a decreasing electron selection efficiency at large momenta, but pi/e separation remains very good through out.