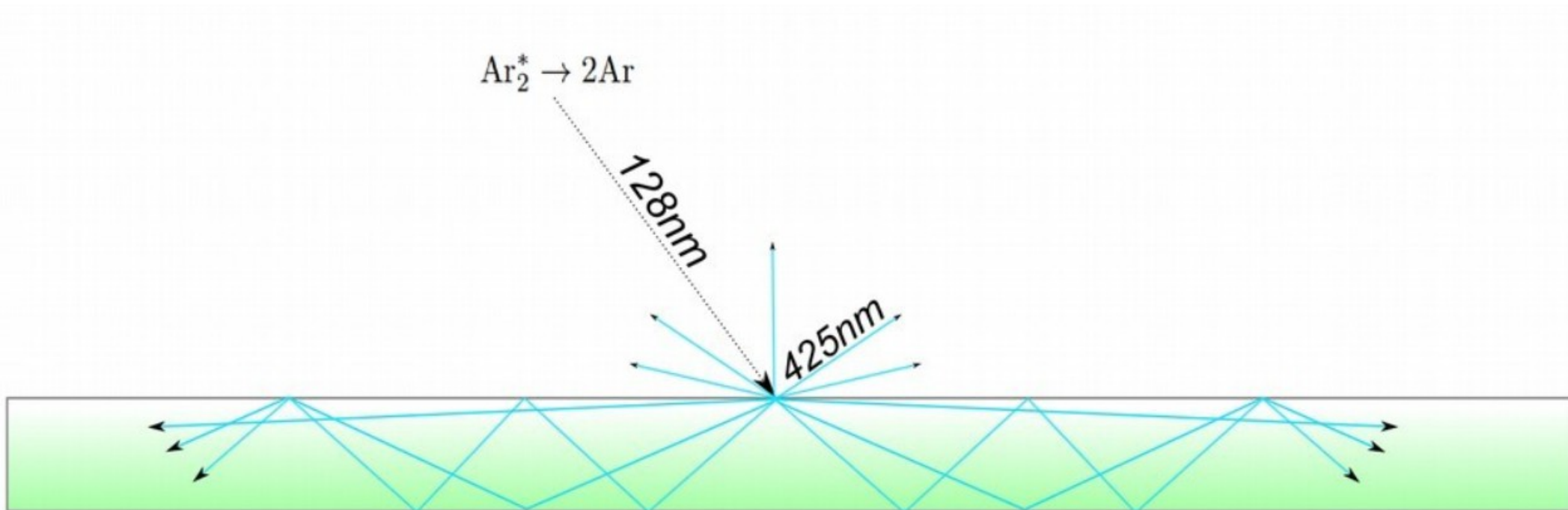


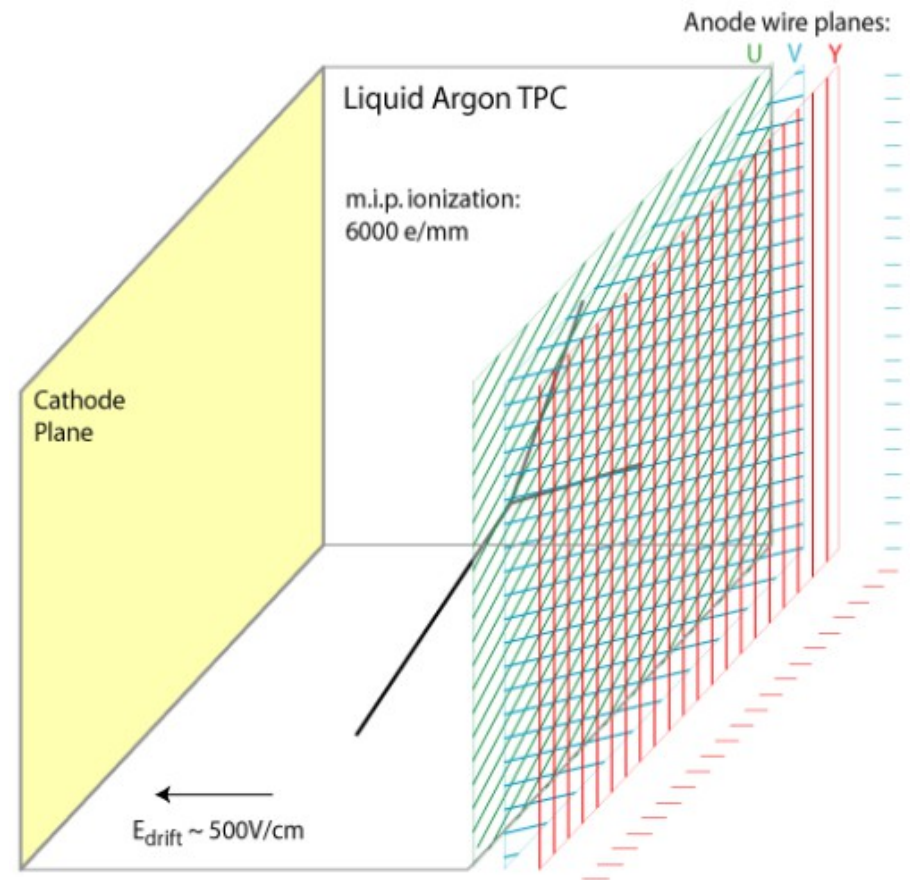
Improved TPB-coated Light Guides for Liquid Argon TPC Light Detection Systems



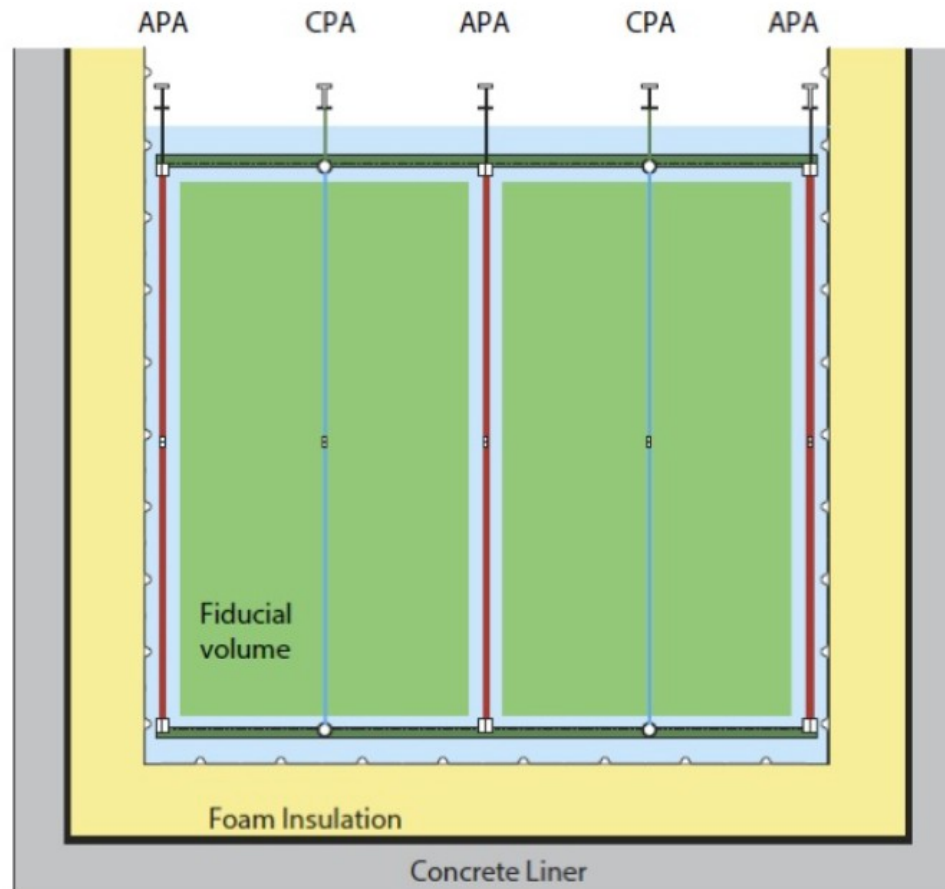
Zander Moss
MIT
June 9, 2015

Time Projection Chambers

- Scintillation light yields T0 to within $O(1)\text{ns}$.
- Drift velocities allow reconstruction along z axis.
- Cosmic ray veto by comparison to beam gate ($\sim\text{ms}$ drift time, $\sim\mu\text{s}$ gate time).

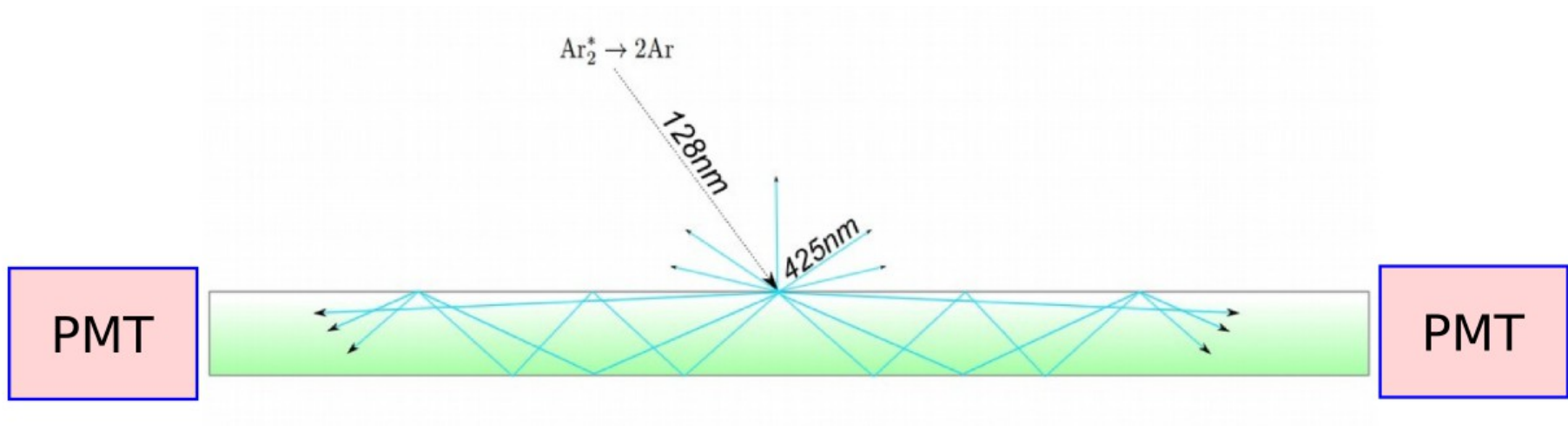


Spatial Constraints on Light Collection



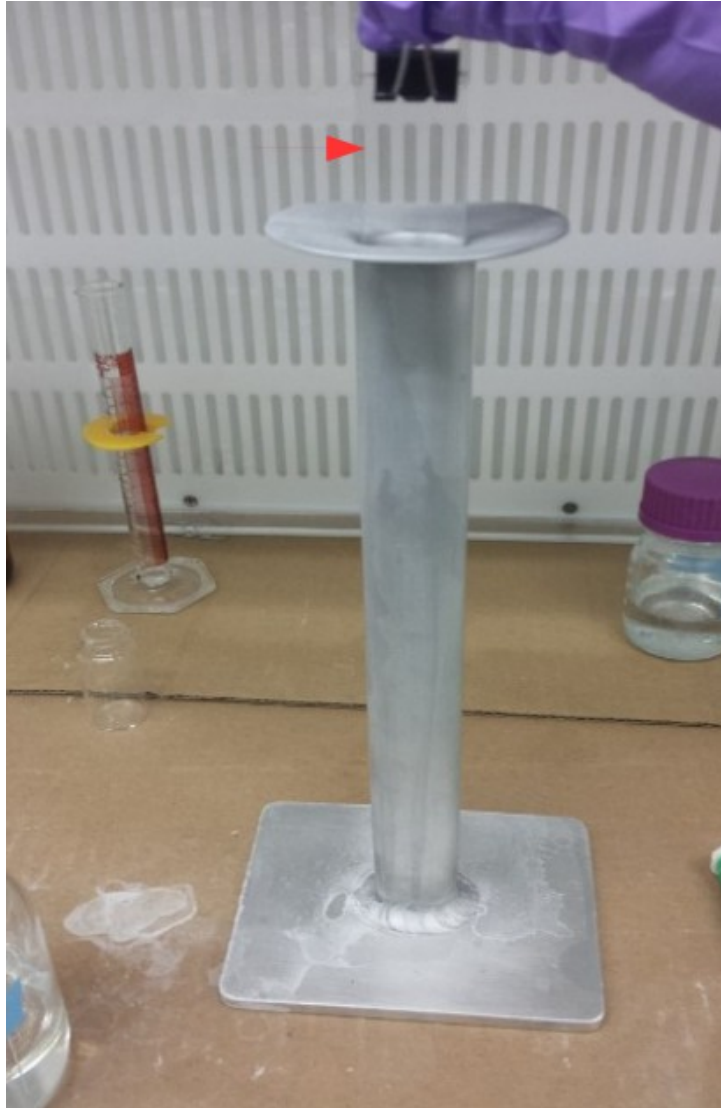
Light collection elements must fit between wire planes in the APA modules.
SiPMs + light-guide arrays fit the bill.

Wavelength-shifting Light Guides



We wish to optimize conversion efficiency and attenuation length.

Production

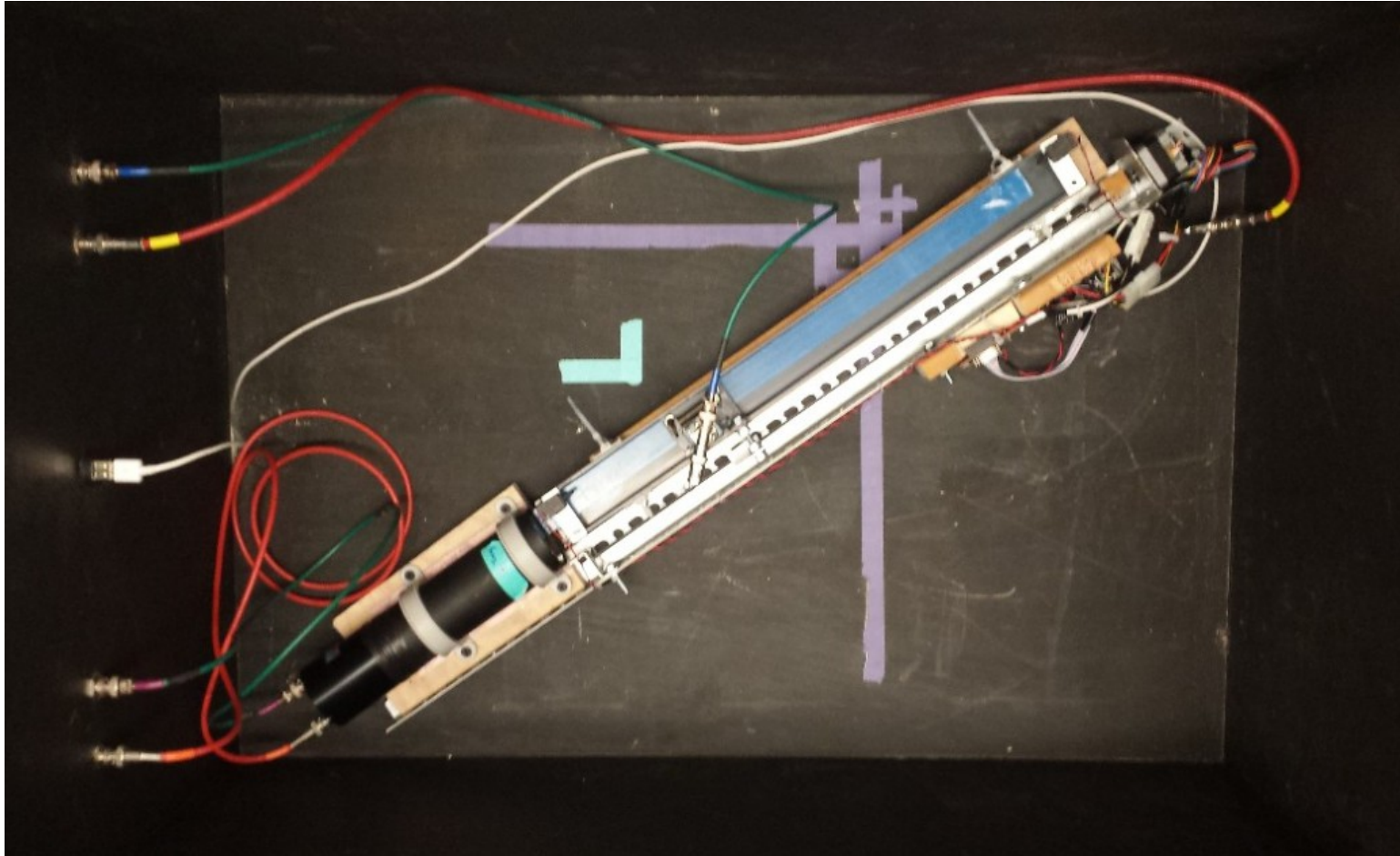


- Cut and polished cast acrylic bars.
- Annealed to avoid chemical crazing.
- Dip coated with ethanol/toluene/TPB/acrylic solution.

Experiment Summary

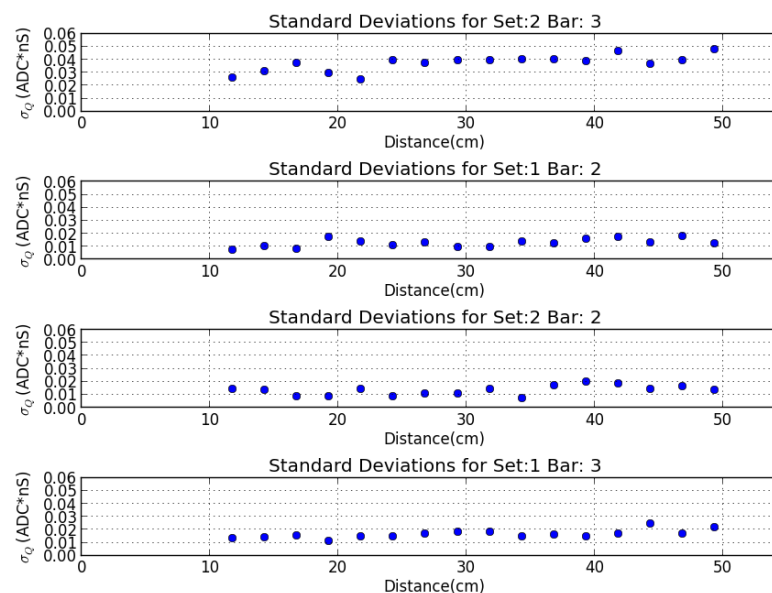
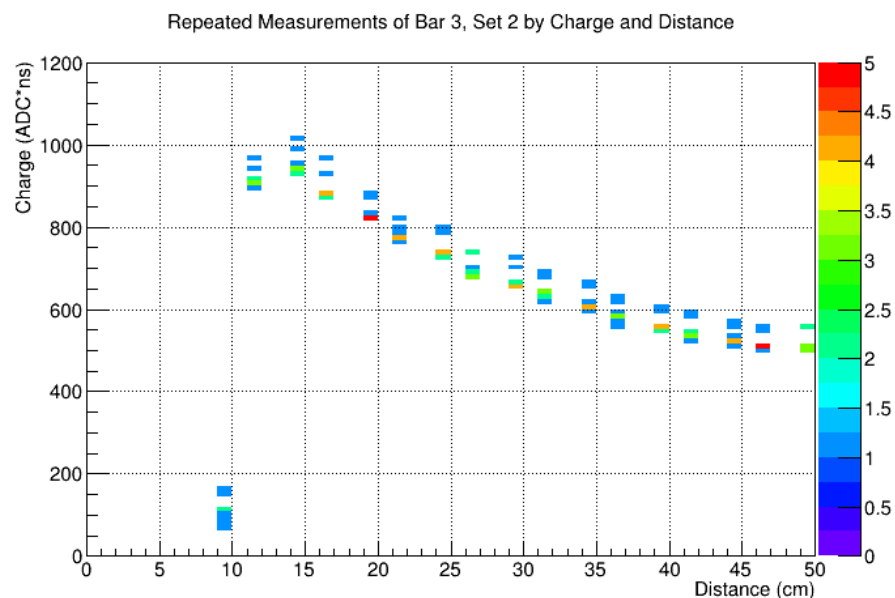
- Attenuation Length
 - Air measurements
 - Two sets of 5 bars were produced and measured.
 - Two additional bars, “A” and “B”, were measured and sent to Fermilab.
 - LAr measurements
 - At Fermilab, “A” and “B” were measured in liquid argon.
 - Ray tracing: connect air and LAr measurements.

Air Measurement Apparatus



286 nm pulsed illumination.

Error Analysis

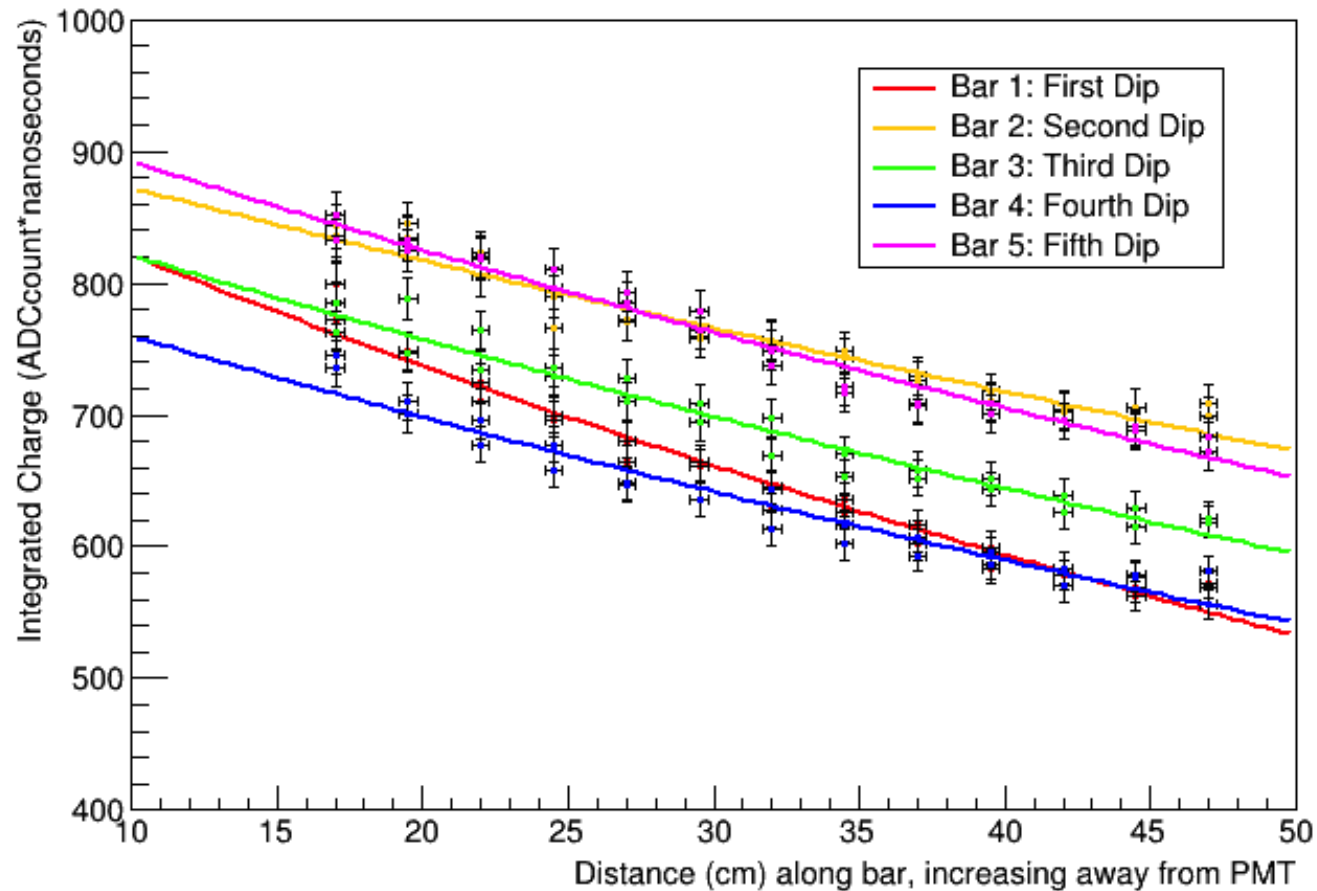


At 60k pulses/point, systematics dominate!

1.98% Sys. Err.

Air Attenuation curves

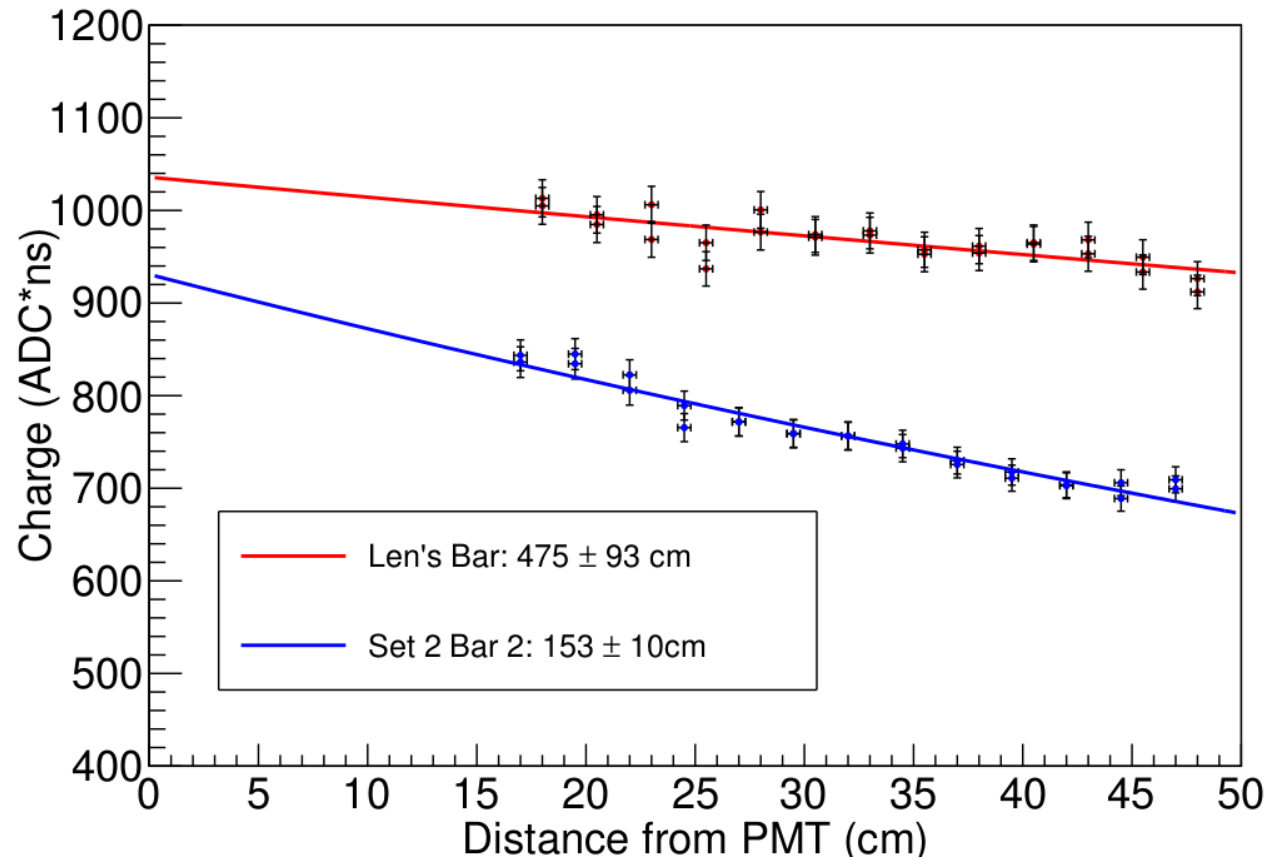
Set 1: Dark Box Measurements



$$\lambda = 110.3 \pm 17.5 \text{ cm}$$

$$\lambda_T = 112.2 \pm 16.1 \text{ cm}$$

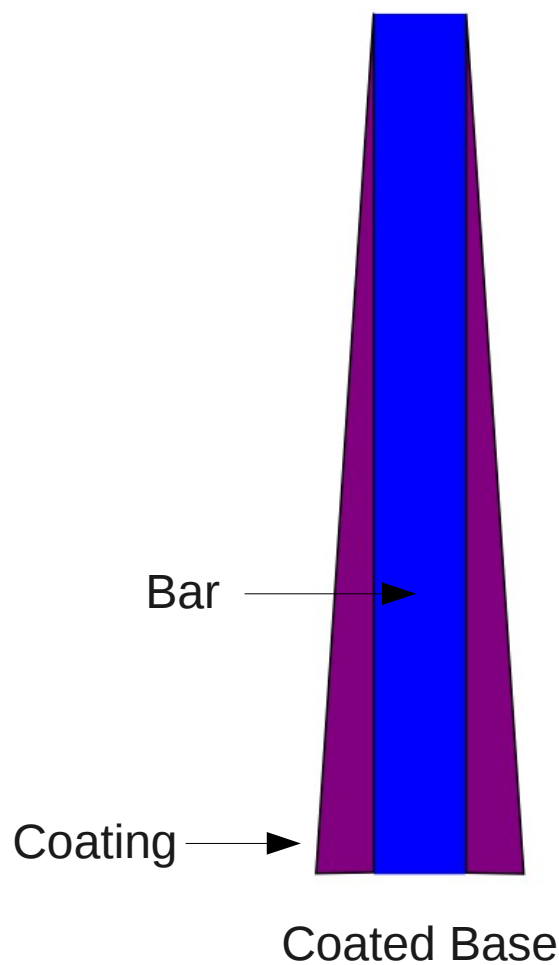
Current Lightguide Work



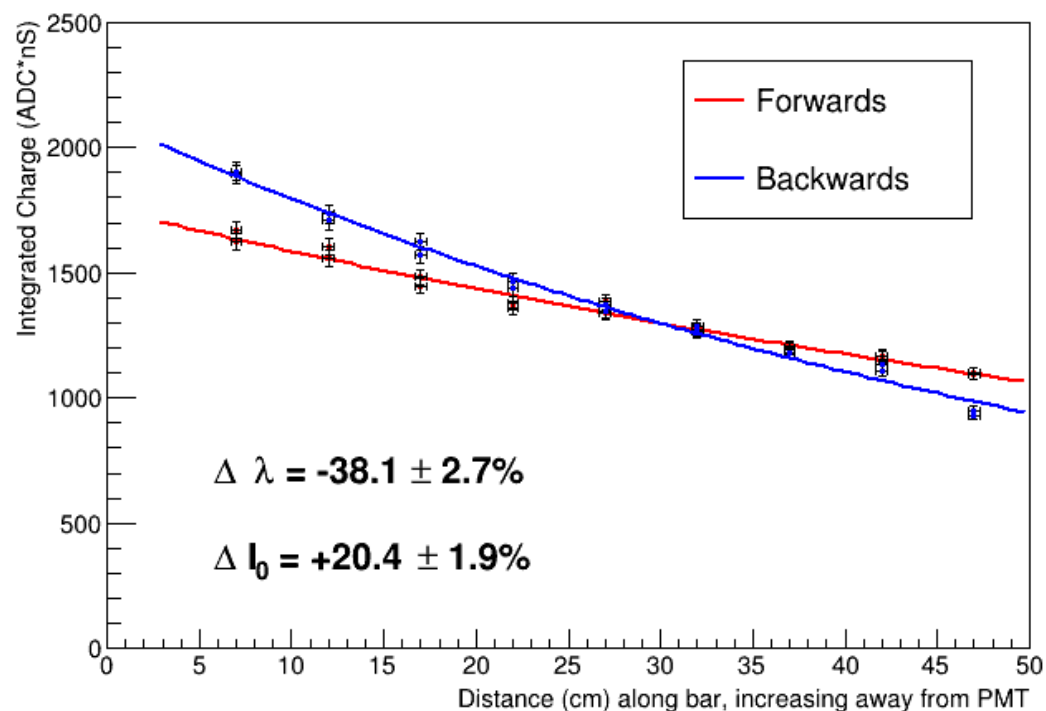
Exact solution parameters need to be tuned to optimize conversion efficiency and attenuation length.

Coating Thickness Gradient

Uncoated Top



Set 3, Bar 1: Forwards and Backwards



Special thanks to Janet Conrad, Taritree Wongjirad, Len Bugel,
and Matt Toups.

Questions?

