

Quartz Cerenkov: Test Results and Design Update

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Overview

- Test Results:
 - JLab prototype tests
 - Summary of Simulation versus Tests

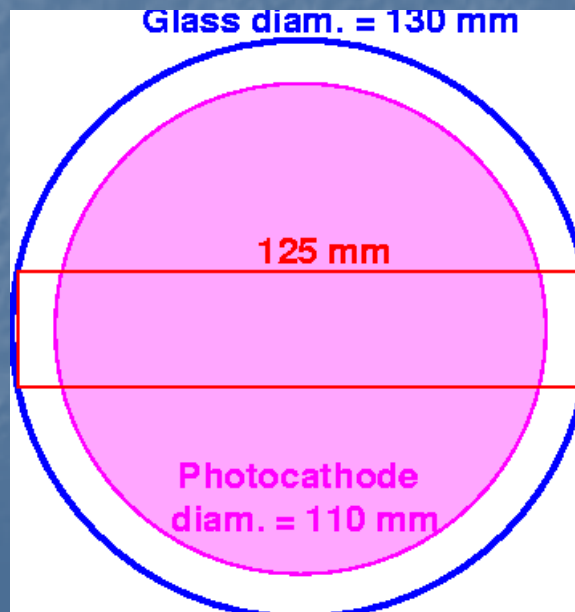
JLab Prototype Tests



- Spectrosil 2000 fused silica
- Dimensions 100cm x 2.5cm x 12.5 cm – or 20% RL
- XP4572B 5" pmt's, lime glass windows, 300 nm cutoff

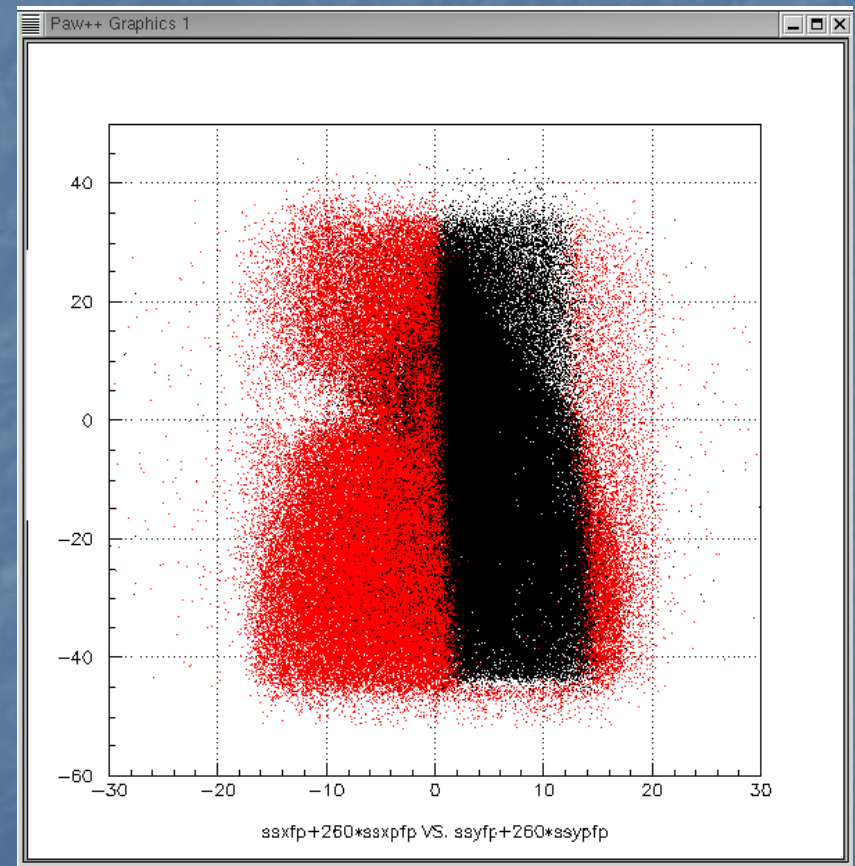
Photocathode Coverage

- The quartz bar was glued directly to the PMT.
- About 15% of the bar area is not covered by photocathode.

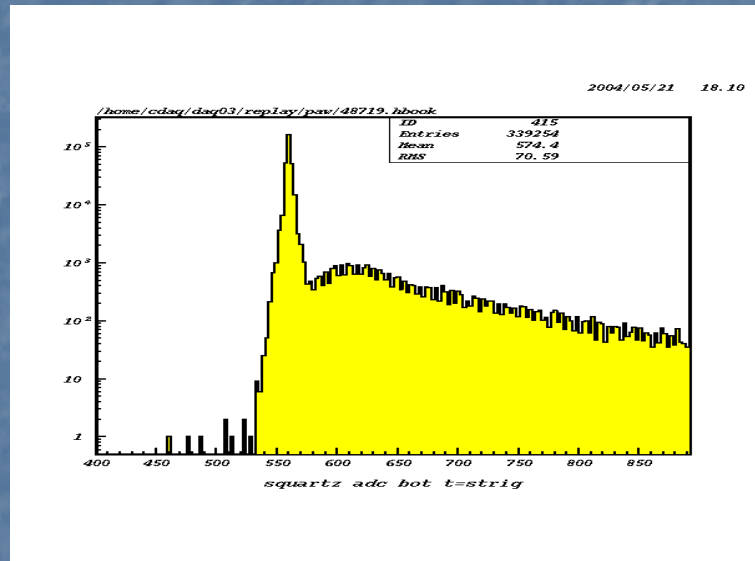


Conditions of Beam Test in SOS Detector Hut

- Inserted between S2X and S2Y hodoscopes
- Tracking by WC's
- 1 mm Carbon target
- 1 and 1.5 GeV/c P0
- pi- and e- beam
- 80 cm of 100cm length illuminated by beam
- Two tilt angles: normal and 5 degrees

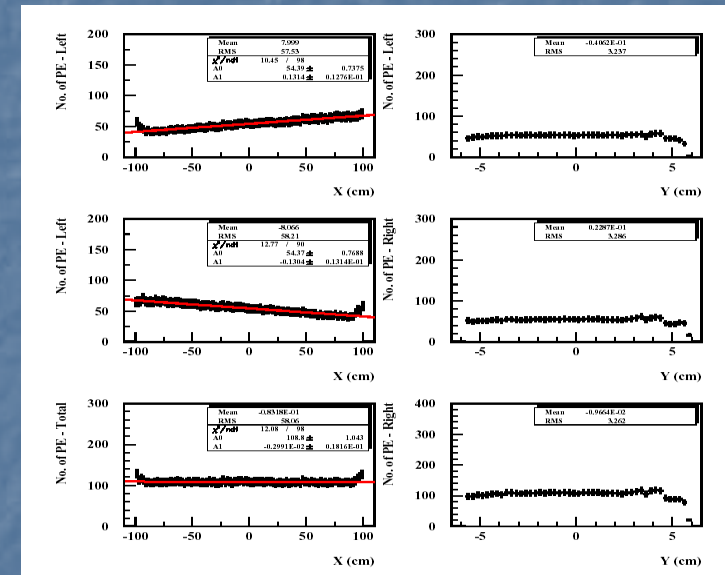
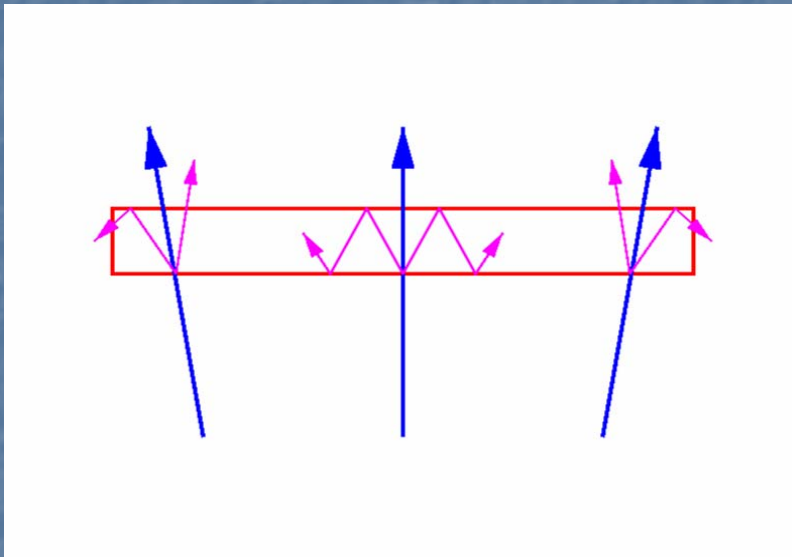


Single PE Calibration



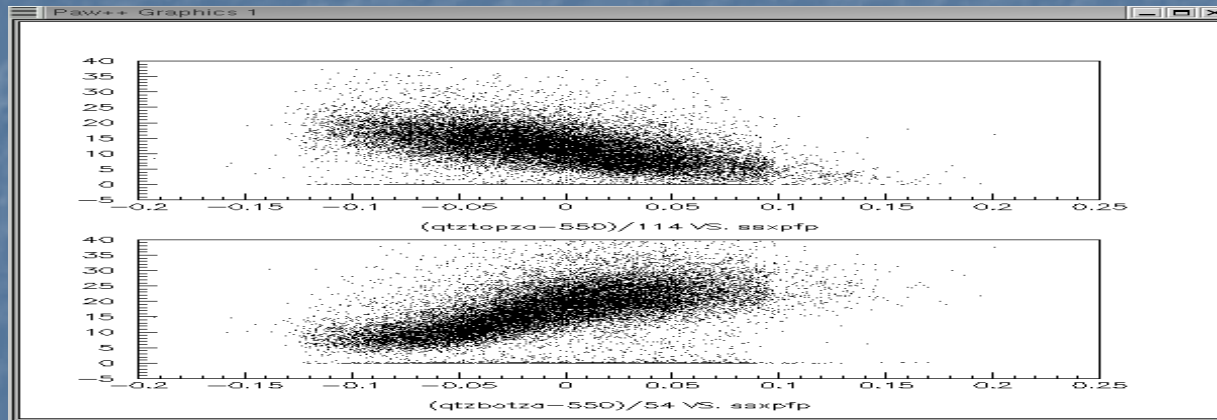
- Couldn't do calibration reliably with beam on:
 - i. single PE resolution of XP4572B is poor
 - ii. mean PE number was too high (~15)
- Used beam off, random trigger, and tube noise

Bar Rotation Angle: a problem that doesn't exist



- The naïve 2-D picture above suggested that rays tilted more than a few degrees would produce no light in the unfavored PMT.
- However, 3-D LaTech simulations clearly show ALL hits are double-ended. These simulations reproduce our prototype data.
- Bar will probably be oriented perpendicular to local electron beam.

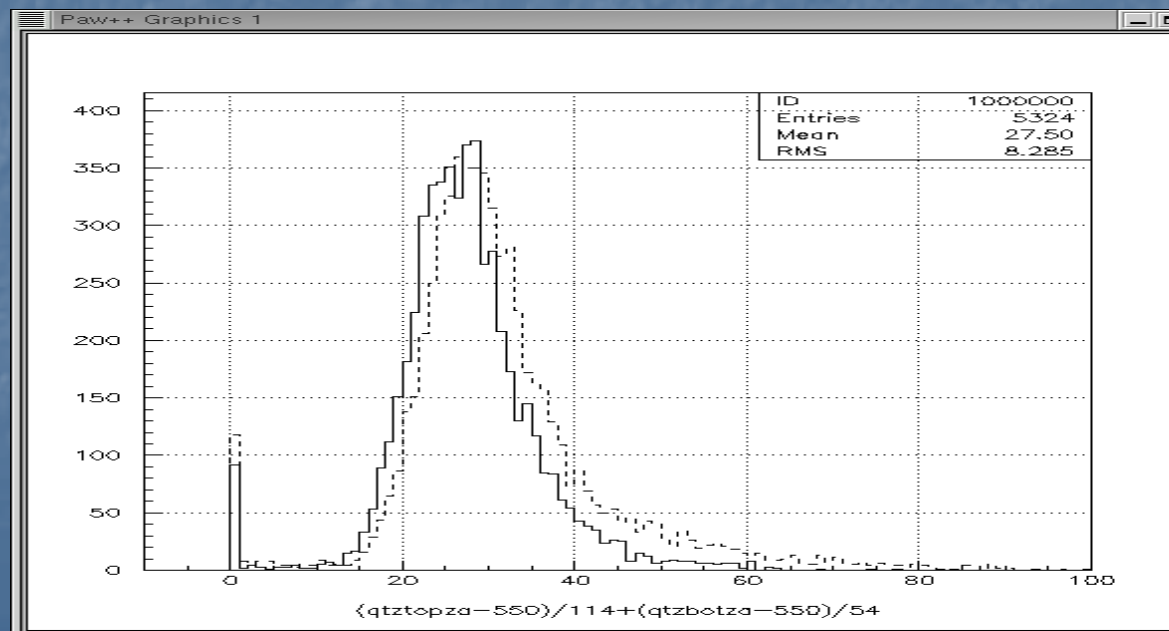
Detector Performance



- Figure: Photoelectron number versus angle.
- Alignment to a few degrees is needed to reproduce linear dependence from simulations.

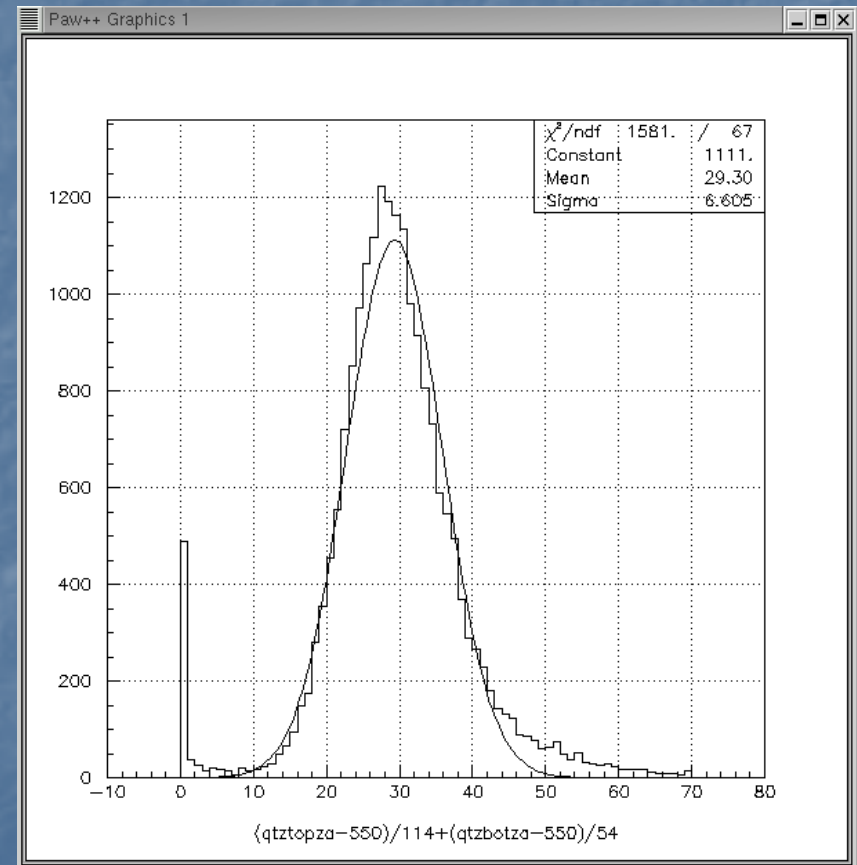
Detector Performance: Pions versus Electrons

- As expected at these momenta, pi- and e- give similar response.
- Closer examination reveals the electron response is somewhat larger and broader due to showering.



Total PE Number

- Yield is ~ 29 pe's (pi-)
- Mismatch between bar and photocathode may have cost us 20% of our pe's
- Corrected value for comparison to e-simulations ~ 38



Summary: Simulation vs Tests

Table 1: Photoelectron yields based on LaTech simulations compared to actual prototype measurements. The last column extrapolates to an S20 photocathode assuming 2/3 the integrated quantum efficiency of bi-alkali. We expect about 80 pe's for the final Qweak configuration.

Bevel Type	Lime Glass/bialkali (JLab config.)	UV Glass/bialkali (LANL config.)	Lime Glass/S20 (Qweak Config.)
no bevel	70	133	89
polished 1 mm	57	108	72
unpolished 1.5mm	40 (vs JLab 38)	76 (vs LANL 87)	51

- Assuming either no bevel or < 0.5 mm and polished, we can expect about 150 pe's with Quartz windows and this 1" thickness.

Summary

- Prototype tests:
 - Good agreement between LaTech simulations and JLab and LANL tests.
 - We have plenty of pe's and can simulate the final detector geometry with confidence.