Aerogel Cherenkov Prototype Experiments

Laura Rothgeb

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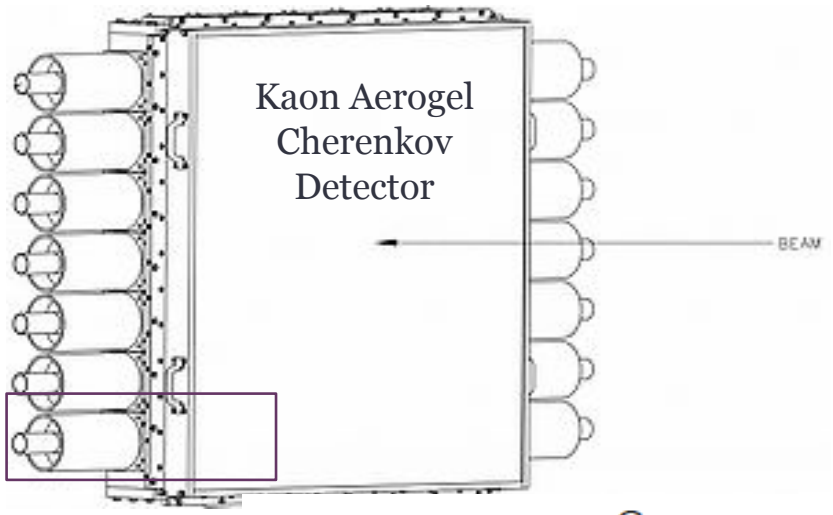
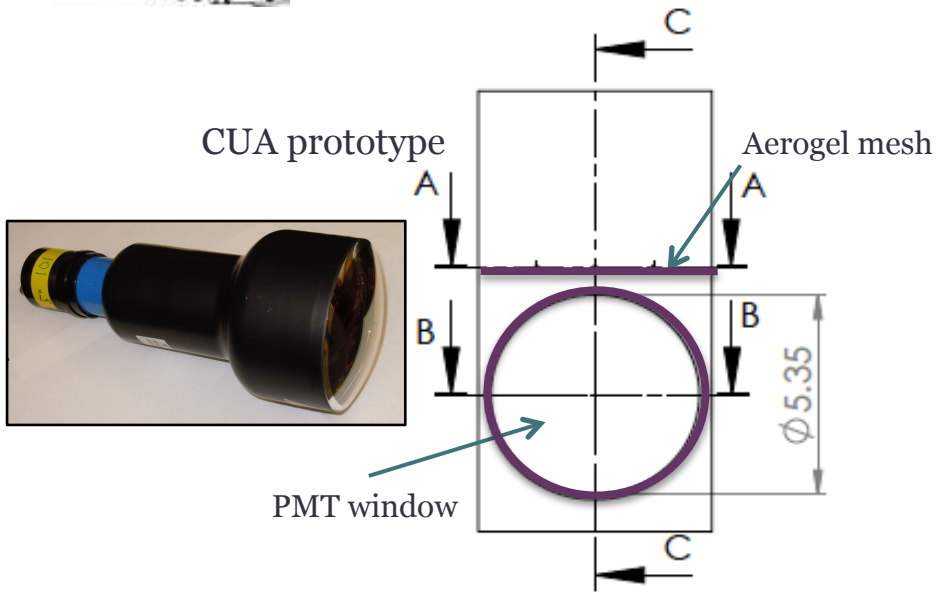
Introduction

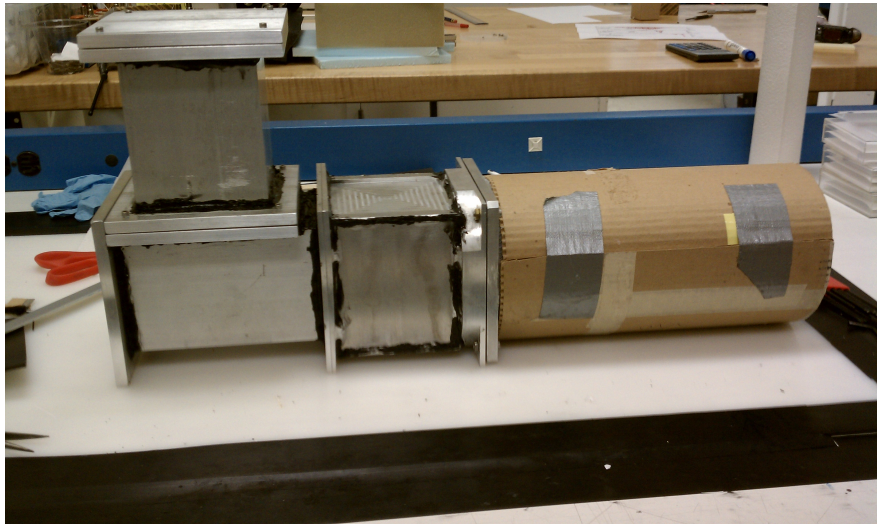




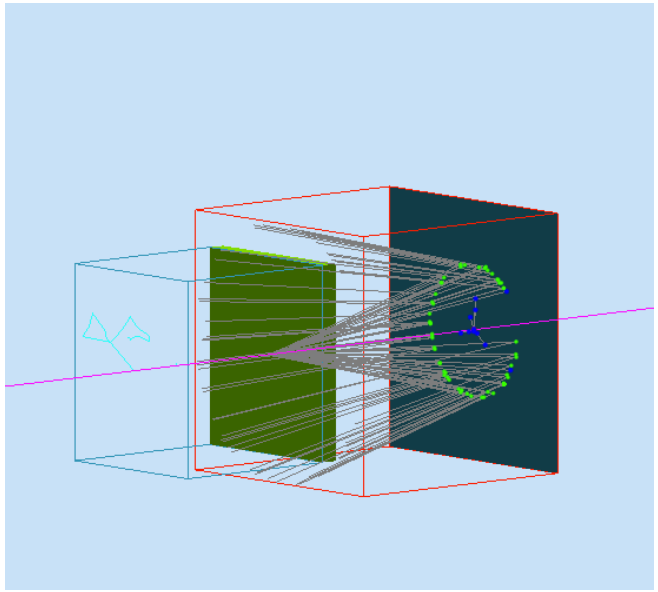
- Testing performance of components important before assembling large detector
  - All custom-built, nothing "off-the shelf"
- Key component in aerogel detector are the 5" PMTs
  - Large radius!
  - How effective is the light collection of the PMT?
  - How effective are these PMTs in combination with other detector components?
- Prototype of the detector allows one to address these questions
  - Prototype custom-built

Background

- Summer 2011: first version prototype built, simulated and tested
  - Extension volume
- Fall 2011: second version built and simulated
  - No extension volume
- Our collaborators from the Yerevan Physics Institute in Armenia built a second prototype

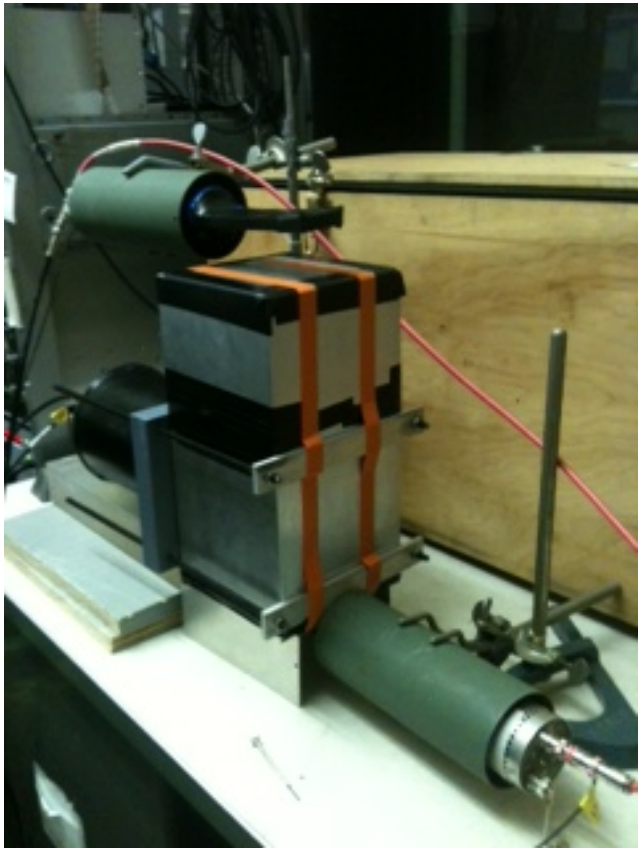


Summer 2011, Kevin Wood (USC, Yerevan Group)



Fall 2011, First GEMC simulation

The CUA Prototype



CUA Prototype, with gate PMTs

- Spring 2012: final CUA prototype designed and constructed
  - Uses one 5” diameter photomultiplier tube previously used at Bates Laboratory at MIT
    - High gain, low quantum efficiency
  - Gated by two cosmic muon detectors
  - DATA gathered using CODA and analyzed using ROOT curve-fitting software

Initial Testing

- First prototype testing performed at JLab
  - 5 cm aerogel: 5 photoelectrons
  - 8cm aerogel: 9 photoelectrons
- Puzzle: Tests with the same prototype at CUA resulted in far fewer photoelectrons
  - Component optimization: constructed new scintillators for gate PMTs
  - Experimental setup changed to maximize calculation accuracy

Results

- 5 centimeters of Aerogel (1800V)
  - Approximately 5 photoelectrons
  - Expected to see between 5 and 9 photoelectrons
    - Agrees with initial JLab tests of CUA prototype