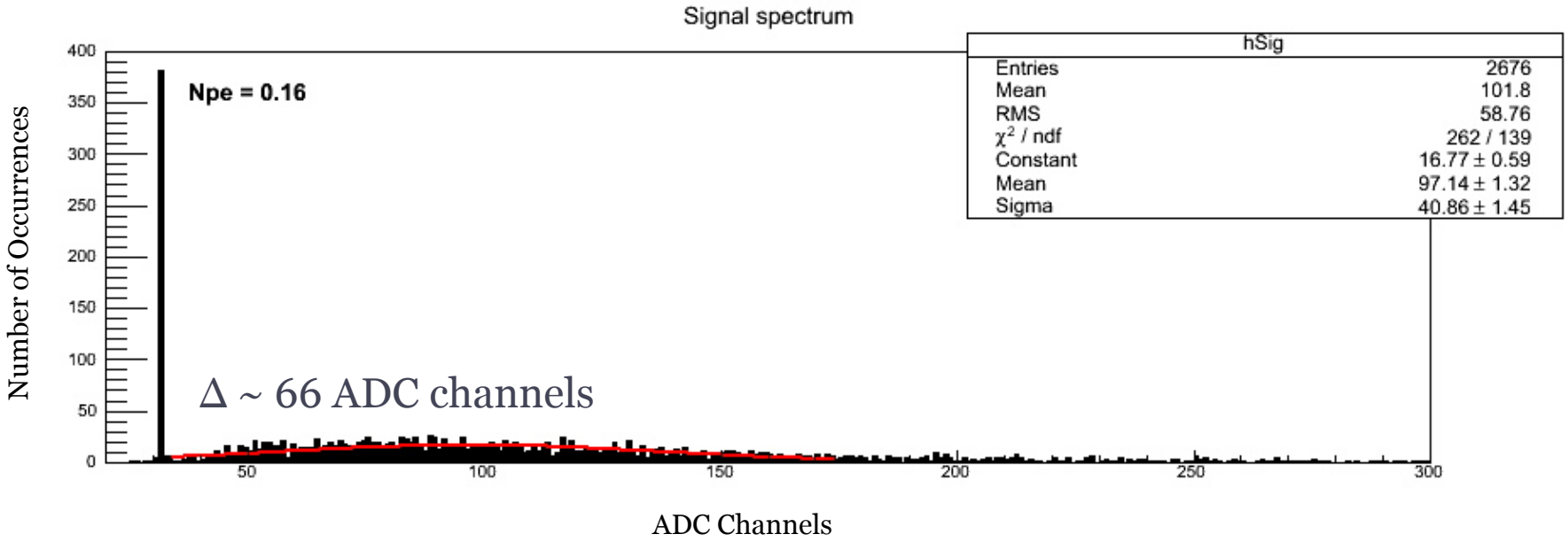
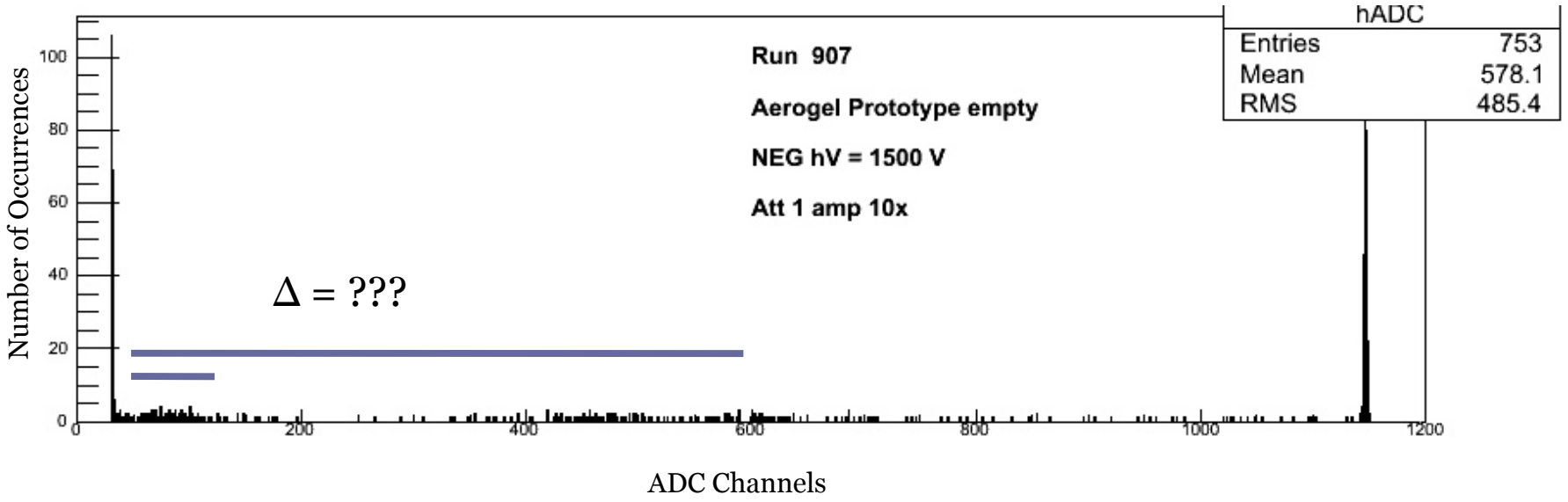
Results

- 8 centimeters of Aerogel (1800V)
  - 5 Photoelectrons → same as 5 cm
    - Reasons under investigation
  - Expected to see between 9 and 12



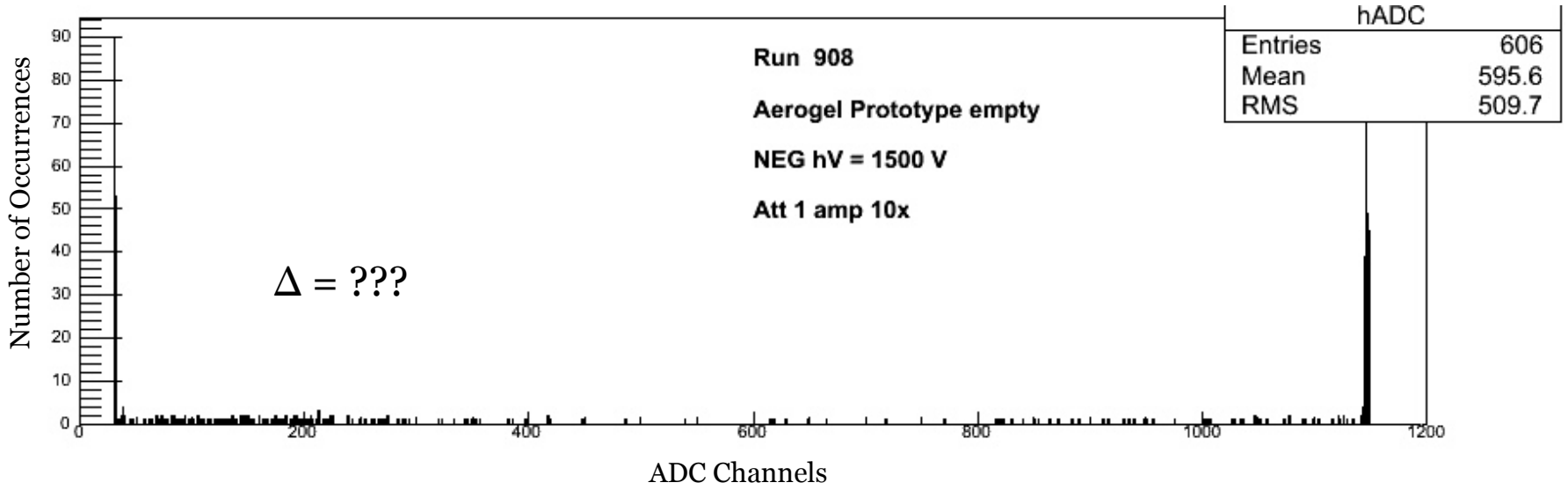
Results

- 10 centimeters of Aerogel (1800V)
  - Strange flat, double peak behavior
  - Peak at ADC overload channel
  - Unable to calculate signal mean delta



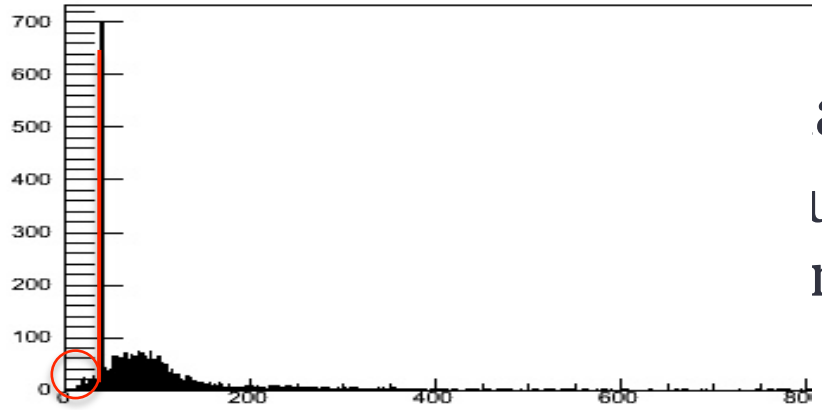
Results

- 10 centimeters of aerogel with isolated High Voltage sources
  - Testing whether signal production drains HV from other PMTs
  - Test inconclusive



Puzzles under study

- Low number of photoelectrons
  - Observation of half as many as Yerevan prototype and CUA JLab tests could be due to difference in reflective material (diffusive Millipore vs. Mylar)

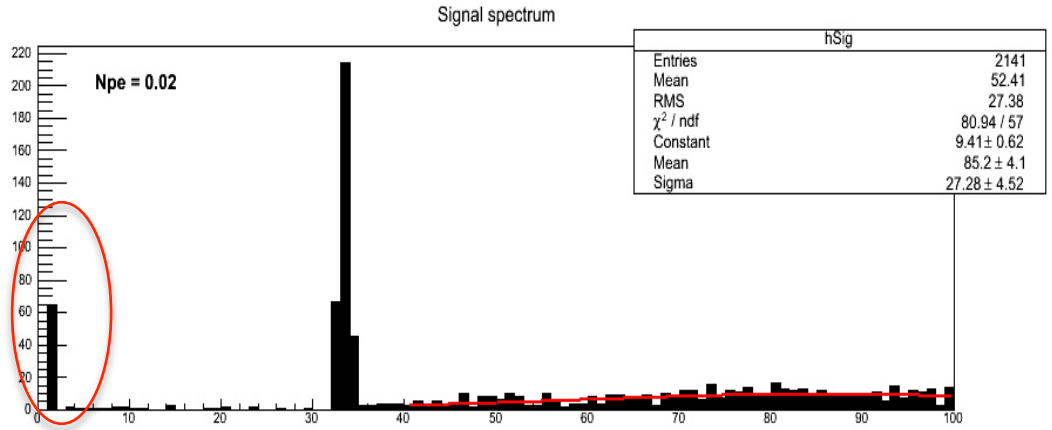


als below the Pedestal

uld be due to electronics (e.g.,
nal overshoot, gate shifting size)

Puzzles under study

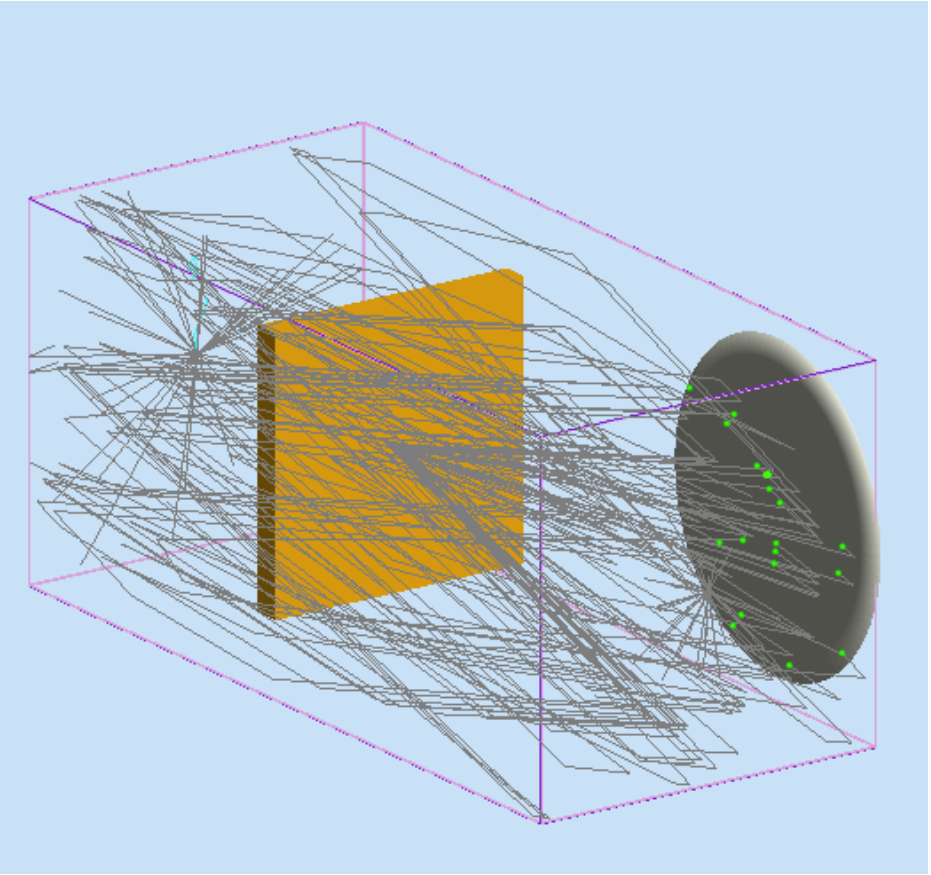
- Double peak
  - Also seen at JLab and with Yerevan group prototype
  - Similar cause as the other below pedestal events?



- Overload Channel Peak, Double Flat Peak
  - Signal from 5” PMT too large for ADC?
  - Registering signal echo?

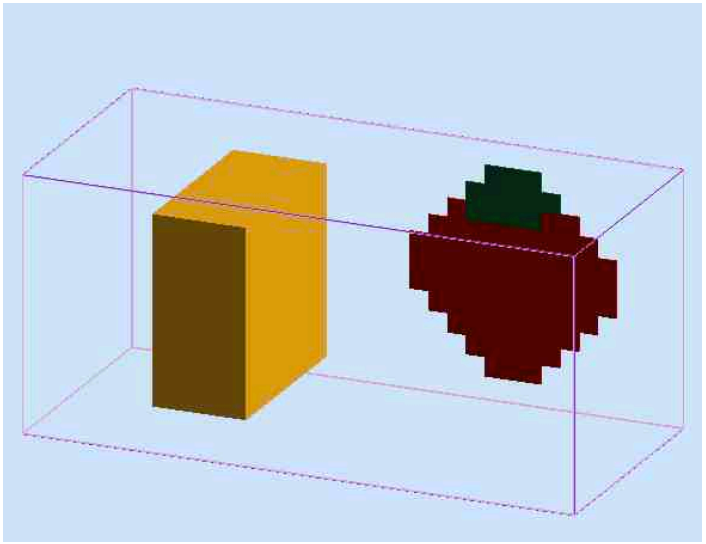
Simulations

- General idea: study detector performance in experiment environment
  - use prototype to calibrate the simulation
- Uses GEANT4 platform GEMC
- First version models the geometry of the prototype, and assumes 100% efficiency
  - Separate calculation to account for 13% quantum efficiency



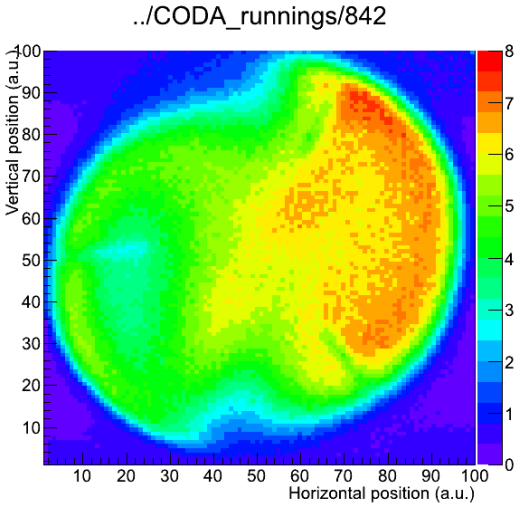
"Normal" window, 1 cm aerogel

Simulations



"Grid" window, 5 cm aerogel (GEMC), 13% efficient

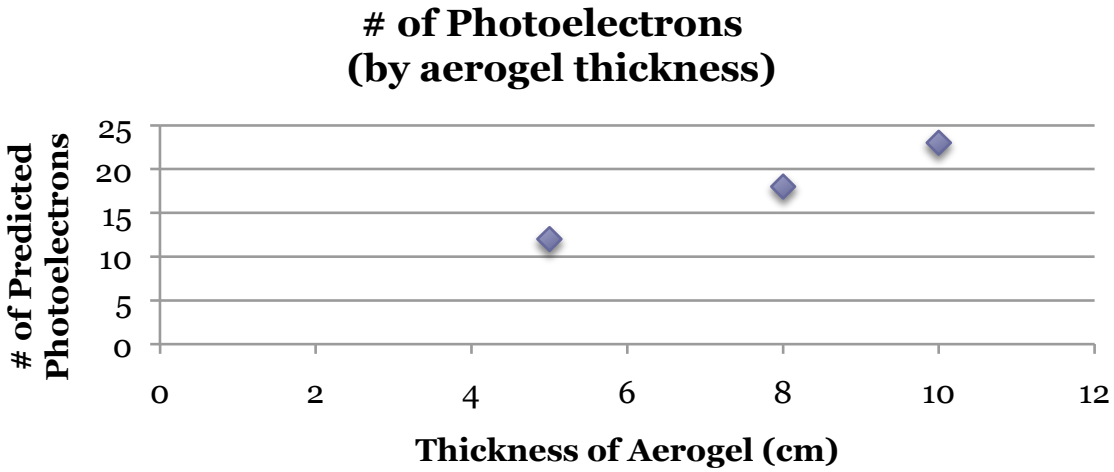
Example of PMT window scanning



- Second version implements a grid pattern PMT window
  - Each pane is a separately adjustable photocathode surface
  - Allows the pattern of inefficiency to be manipulated to match the PMT photocathode uniformity as measured in an X-Y scan across the PMT window

Simulations: Predictions and Results

- Both the “normal” and “grid” window simulations predict far more photoelectrons than seen in empirical data
  - Inconsistencies with experimental results are still being investigated



The Future

- Diffusive material (Millipore) as the detector box lining
  - Corresponding change will be made in simulation
- Low gain, high quantum efficiency PMT from previous HMS aerogel detector to be tested in prototype
  - If results similar, then performance of our PMTs may be acceptable for experiment
  - Also check for different indices of refraction (densities)
- Continue to investigate causes of low photoelectron production, signals below pedestal and double peak phenomena

Acknowledgements

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Questions?