



Update on the Gas Ring Imaging Cherenkov (GRINCH) Detector for A_1^n using BigBite

**SBS Meeting
January 16, 2013**

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In collaboration with:

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J. Annand, Glasgow



Wiki: http://wm-jlab.physics.wm.edu/mediawiki/index.php/Bigbite_Gas_Cherenkov

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Motivation: High Rate Running

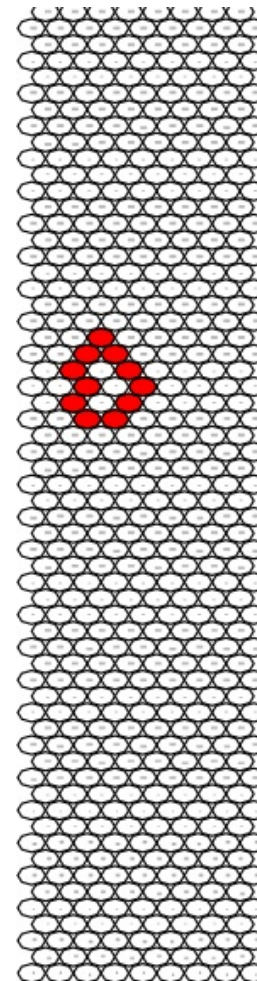
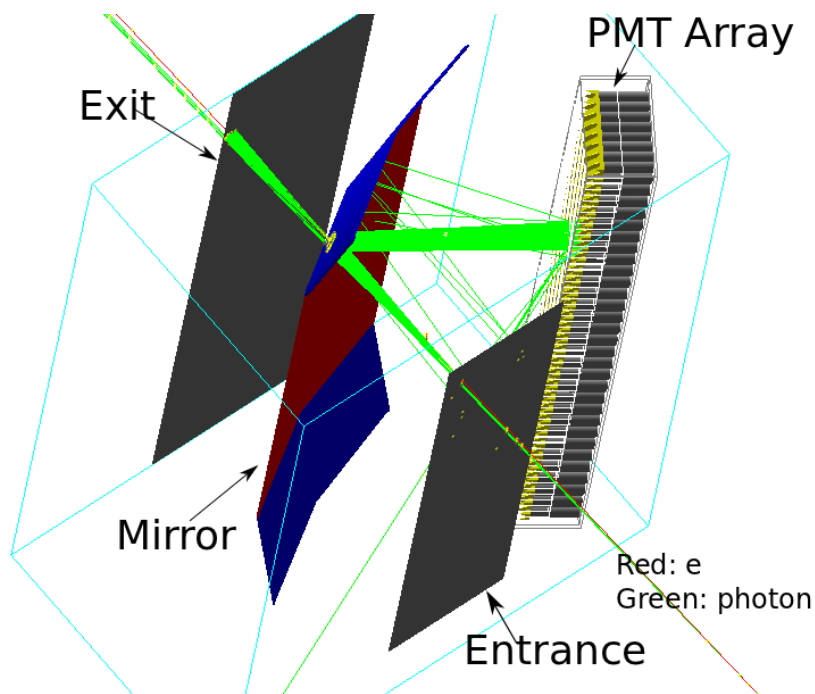
- Expect 4-5x increase in total luminosity over previous BigBite running.
- Assume 4-5x background rate.
- 30 degree scattering angle
- Segmented PMT array (29mm tubes), 9(8) x 60 tubes
- Search for timing clusters in 5-10 ns window.
- Magnetic shielding between rows.
- Locate PMT array on large angle side away from beam line. Shield beamline for EM background.
- C_4F_8O heavy gas at 1 atm



Simulation and Design



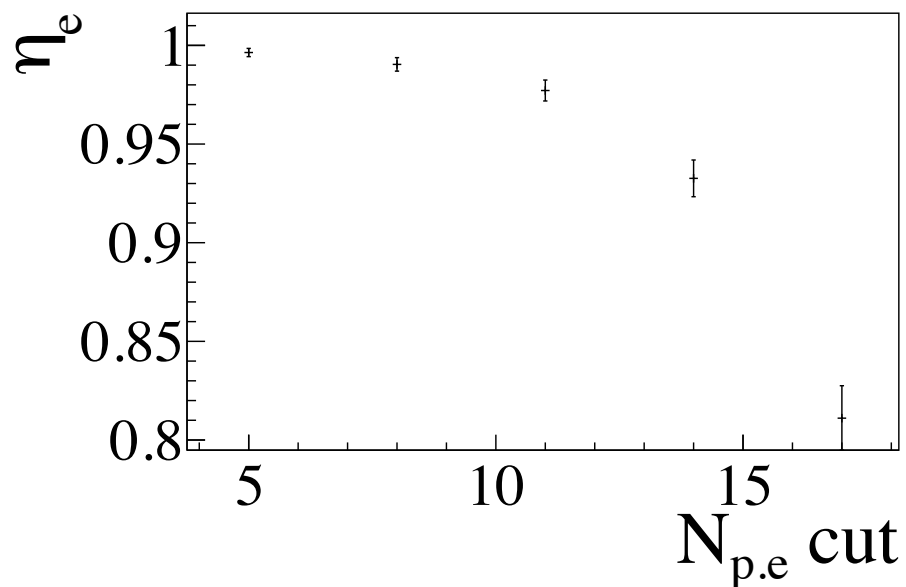
- Design based on GEANT 4 simulation and geometric constraints from BigBite detector package
- 65 cm path length, 85 cm keep out
- Single reflection from cylindrical mirrors. Not focusing on specific PMT's, not sensitive to precise mirror geometry/alignment
- Clusters with avg 10 PMT's/event and 1.7 p.e.'s/tube



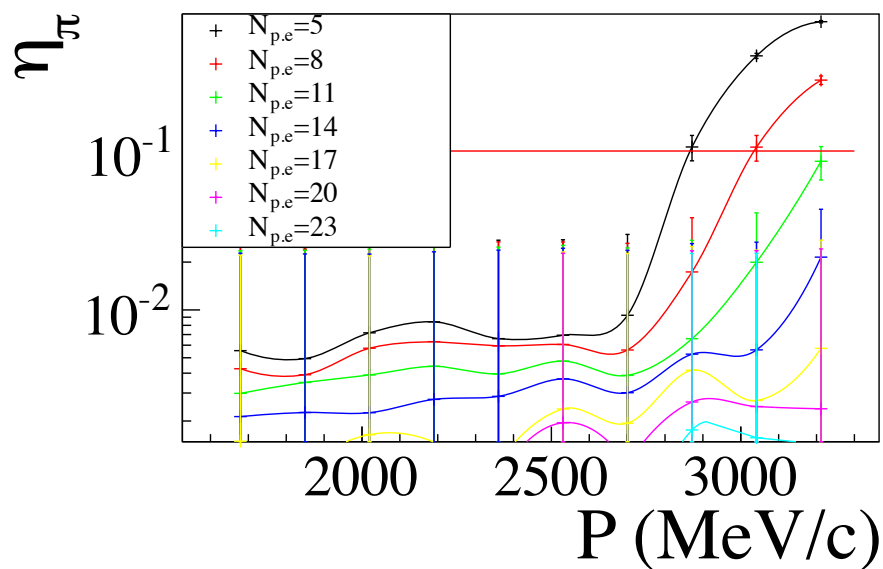


Electron and π efficiencies

e efficiency (η_e) vs $N_{p,e}$ cut (Zoom)



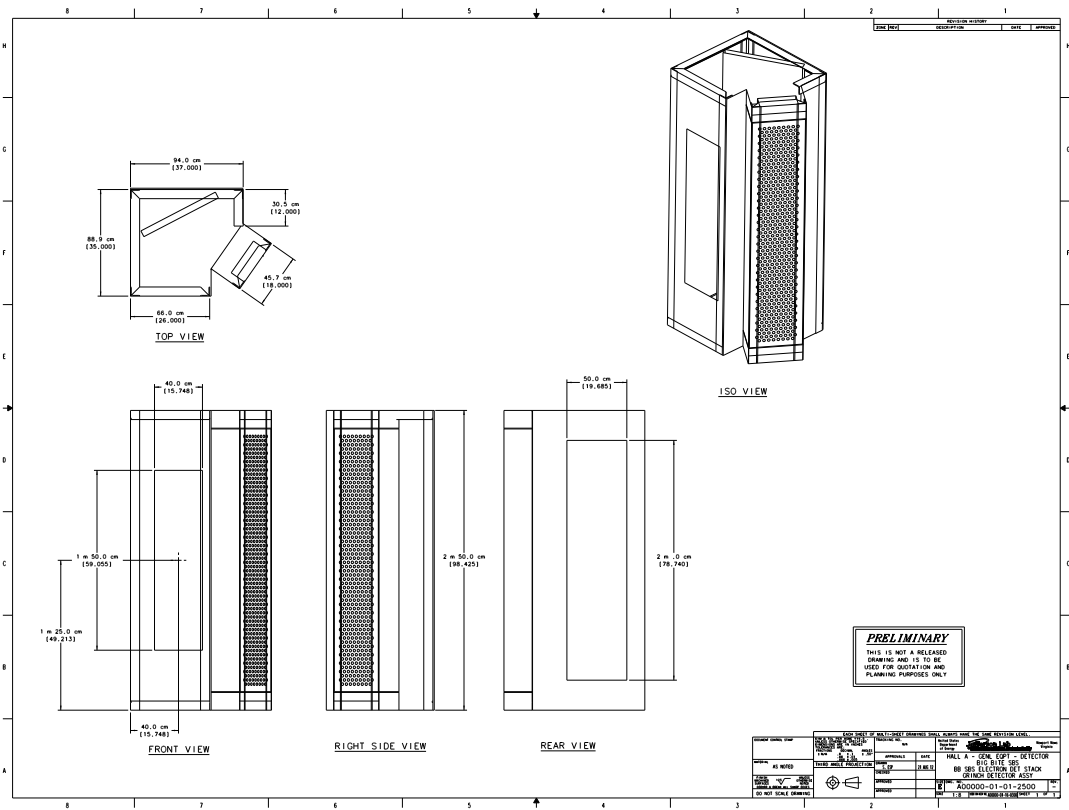
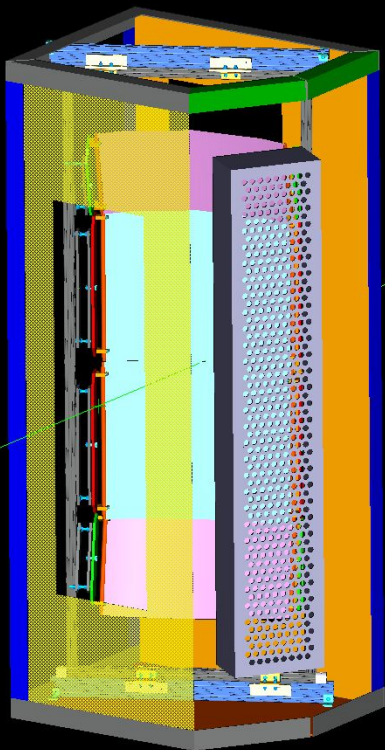
π efficiency (η_π) vs P (MeV/c) for different $N_{p,e}$ cut





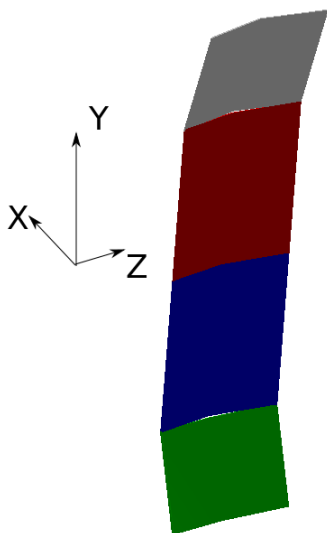
Design

- First draft of design complete. Iterating on details.
- Detector vessel made from frame of angled aluminum with sheet aluminum sides
- Small angle side removable for internal access.
- Windows glued onto box directly.
- 9 (8) x 60 array of PMT's in iron box, with mu metal and iron strips/bars between rows. Attach to vessel, removable.
- Removable mirror frame.

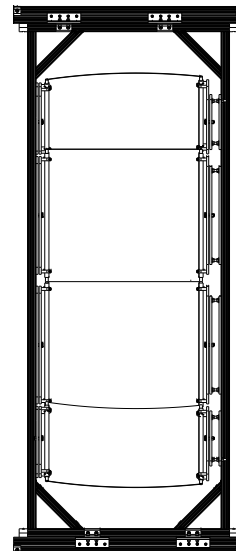
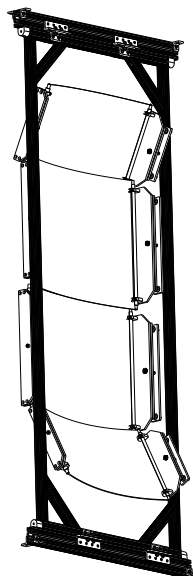




Mirror Frame



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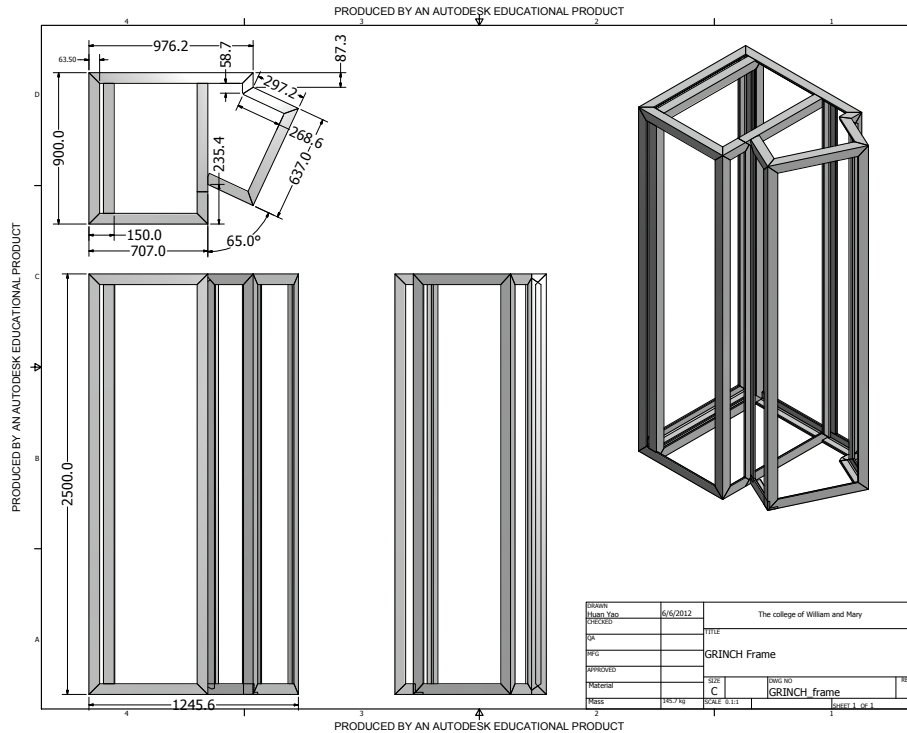
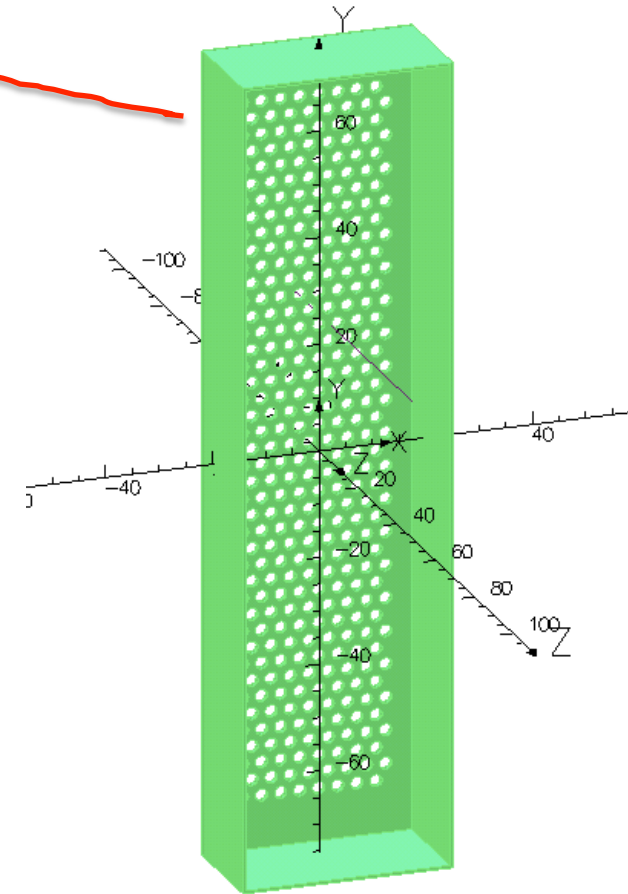
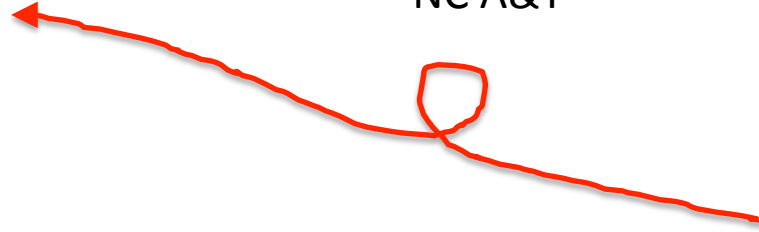
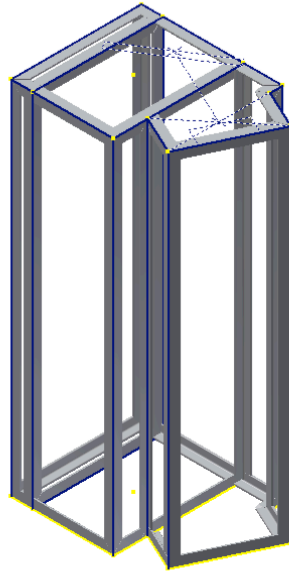




Mirror Tests

- Received sample of Al coated Lexan, flat pieces, from ECI coatings.
- H. Yao to measure reflectivity in test stand for flat and then curved mirrors.
- Assemble prototype mirror mount at W&M to test ability to shape and align mirror.
- Optimize mirror design.
- Procure mirrors—W&M.
- Quote for 6 mirrors ~\$7k

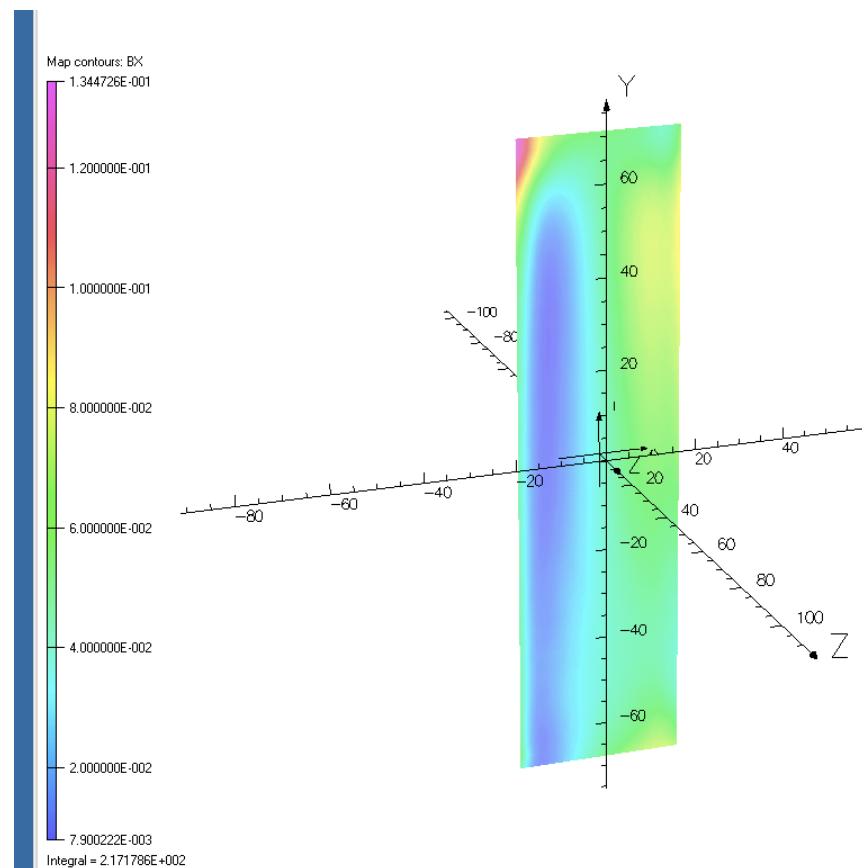
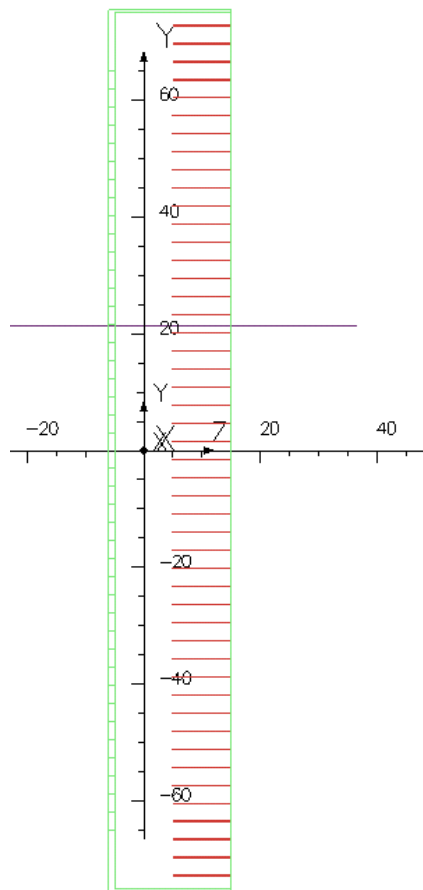
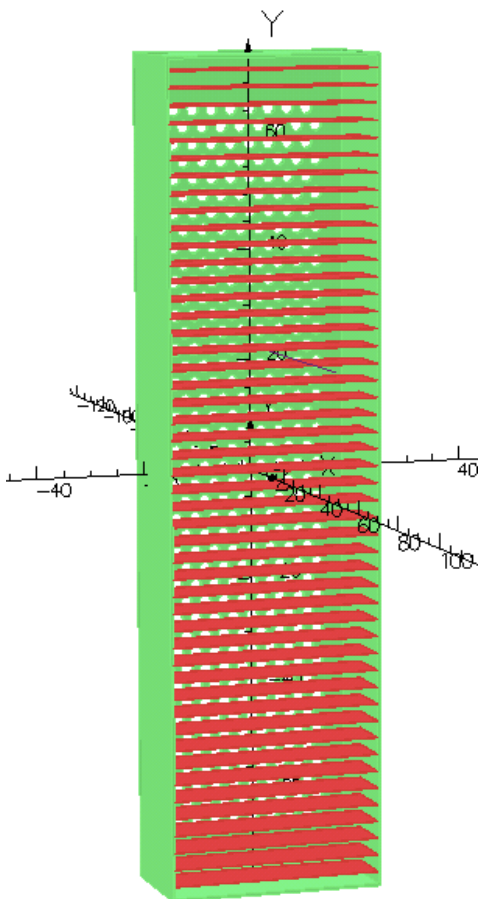
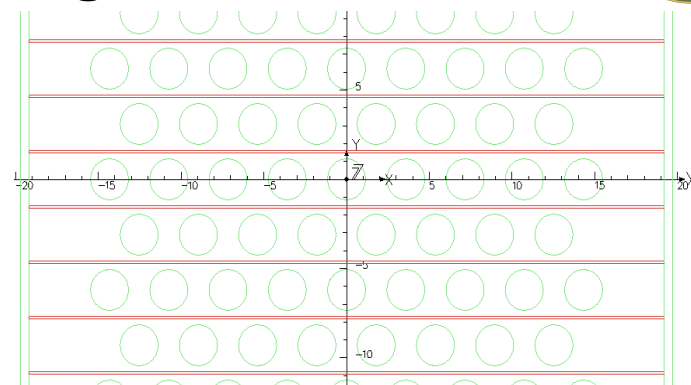
PMT Array Shielding Box NC A&T





Magnetic Shielding

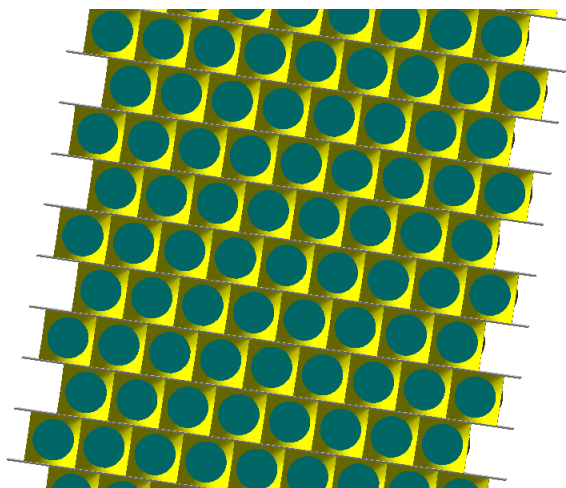
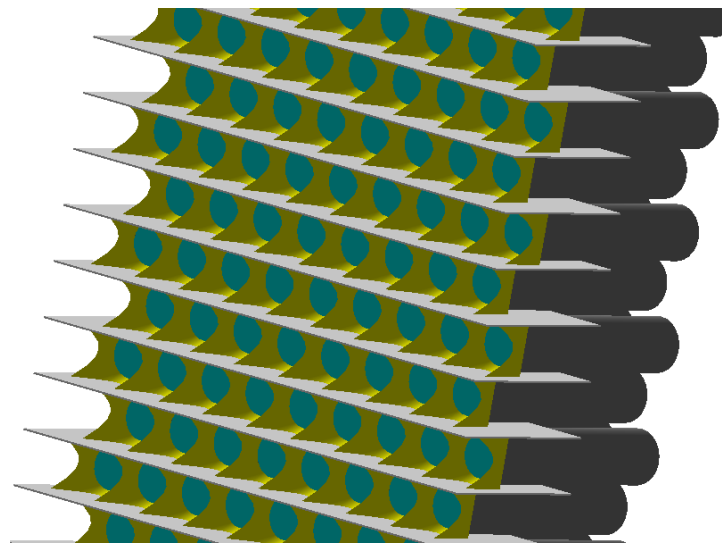
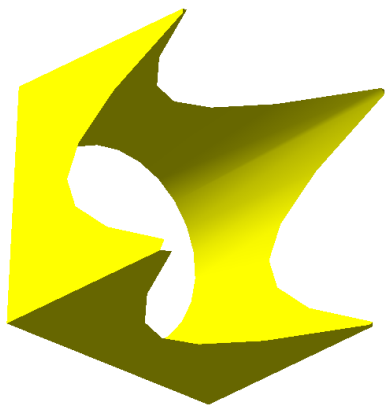
- TOSCA simulations using mu-metal and iron plates between PMT rows.





Light Cones

- Aluminized plastic cones





NC A&T Status

A. Ahmidouch, S. Danagoulian

- Responsible for PMT shielding box: prototype and full assembly
- We have all necessary quotations. We submitted POs for some of the items
- In the process of submitting the remaining POs.
- We will have a prototype with 34 PMT, fully assembled, including
 - iron shielding bars between rows
 - mu-metal shielding bars
 - light catchers
- When we receive iron bars and light catchers, then we will send them for mirror deposition.



Electronics, HV, Cables

- All 1877s FastBus TDC's and level translators (from MWDC) are ready.
- Need 64 channels of +HV. Provided by JLab
- Flat twisted ribbon cables for TDC's—Jlab, W&M.
- NINO-based amplifier, discriminator cards—Glasgow. Prototype testing underway. J. Annand visiting Monday.
- K. Anoil recently purchased cards.



Manpower and Budget

Item	Cost	Manpower
Vessel	\$45k, Jlab, not yet quoted	Jlab, W&M
PMT array and shielding box	\$30k, NC A&T	NC A&T, W&M
Mirrors	\$20k, W&M	W&M
NINO cards	\$25k, Glasgow, Cal. St. LA	Jlab, Glasgow
Gas System	\$10k, W&M	W&M
Total	\$130k	
Collaborator contributions	\$95k	



Plans

- Finish production drawings for vessel, mirror mounting, March 31st, 2013
 - Send drawings for quotes, April
 - Fabrication, Summer 2013
 - Assembly, Fall 2013
 - Testing, late 2013
- Finalize mirror design studies by March 31st
 - Order mirrors April, May