LBNE VUV Photons

Victor M. Gehman, Richard Kadel

Liquid Argon TPC R&D Workshop

March 21, 2013

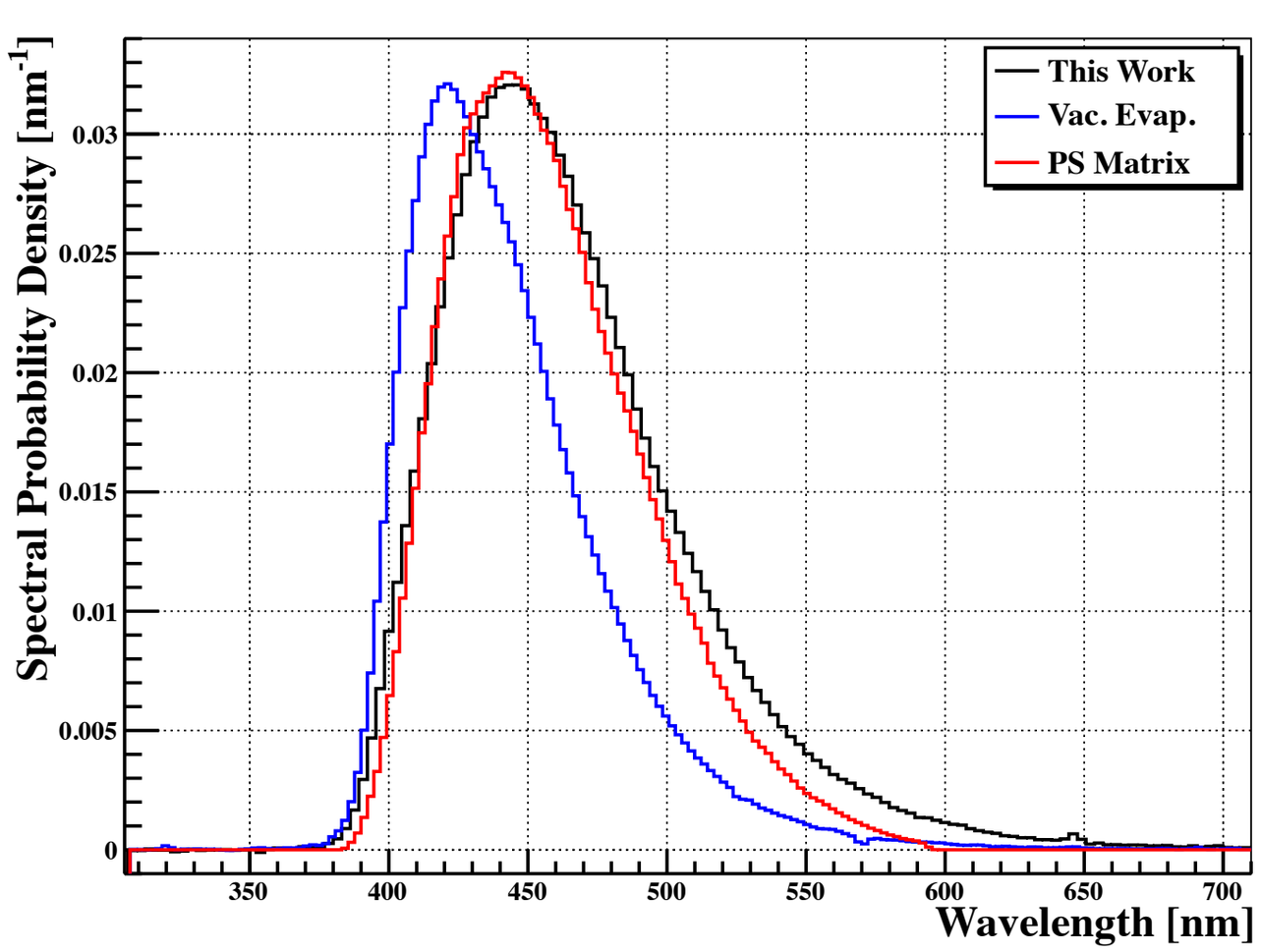
Fermilab

Outline

- Previous measurements: film preparation matters
- More recent work:
  - Deuterated TPB
  - More fluors
- Large-area paddles: LBNE and others

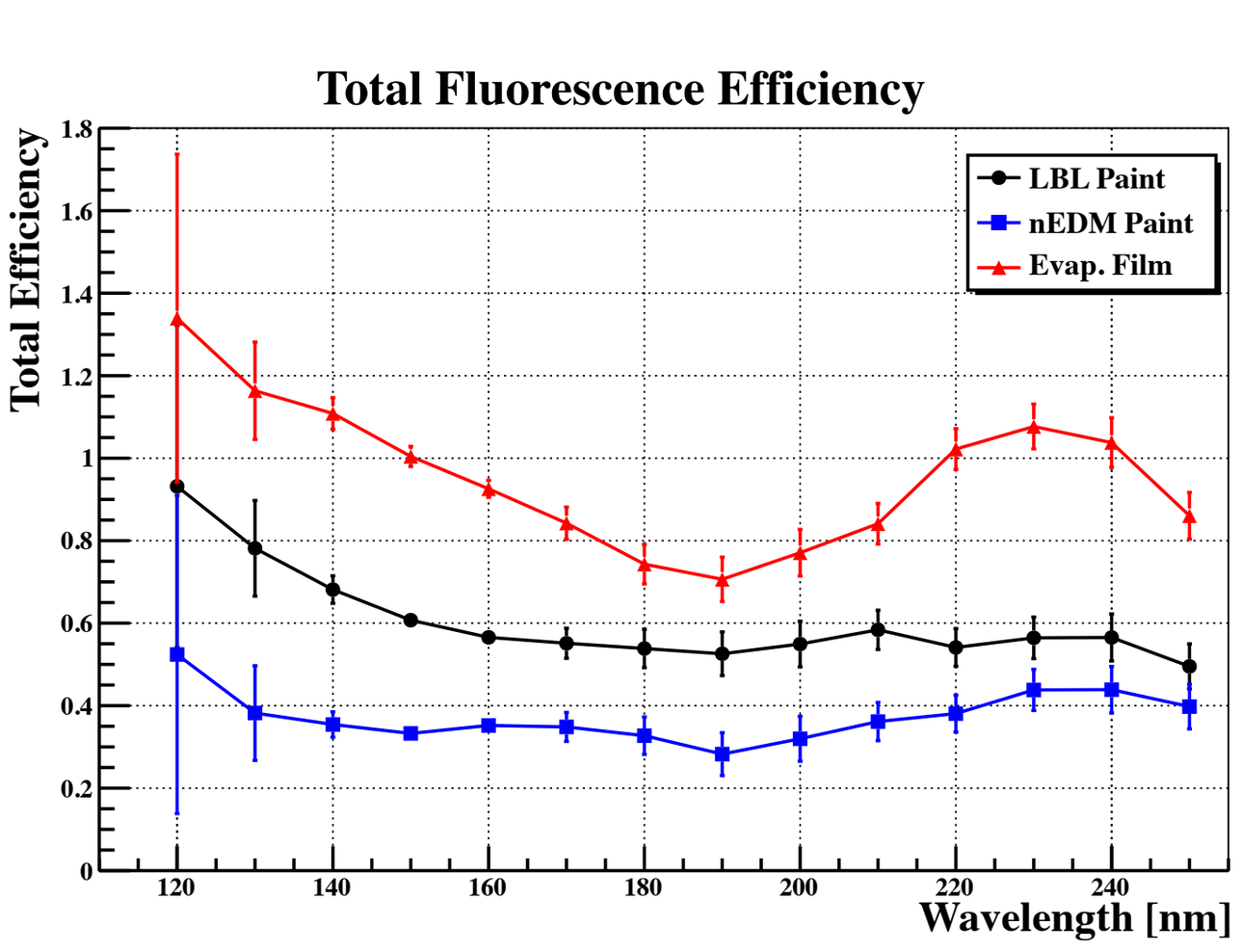
Previous measurements

- Most recent published R&D papers are on TPB (*J. Inst.* **8** (2013) 01013, *Nucl. Inst. Meth. A* **654**, (2011) 116)
- Shift fluorescence peak for different film preparation techniques
- Total fluorescence efficiency also changes for different film preparation techniques



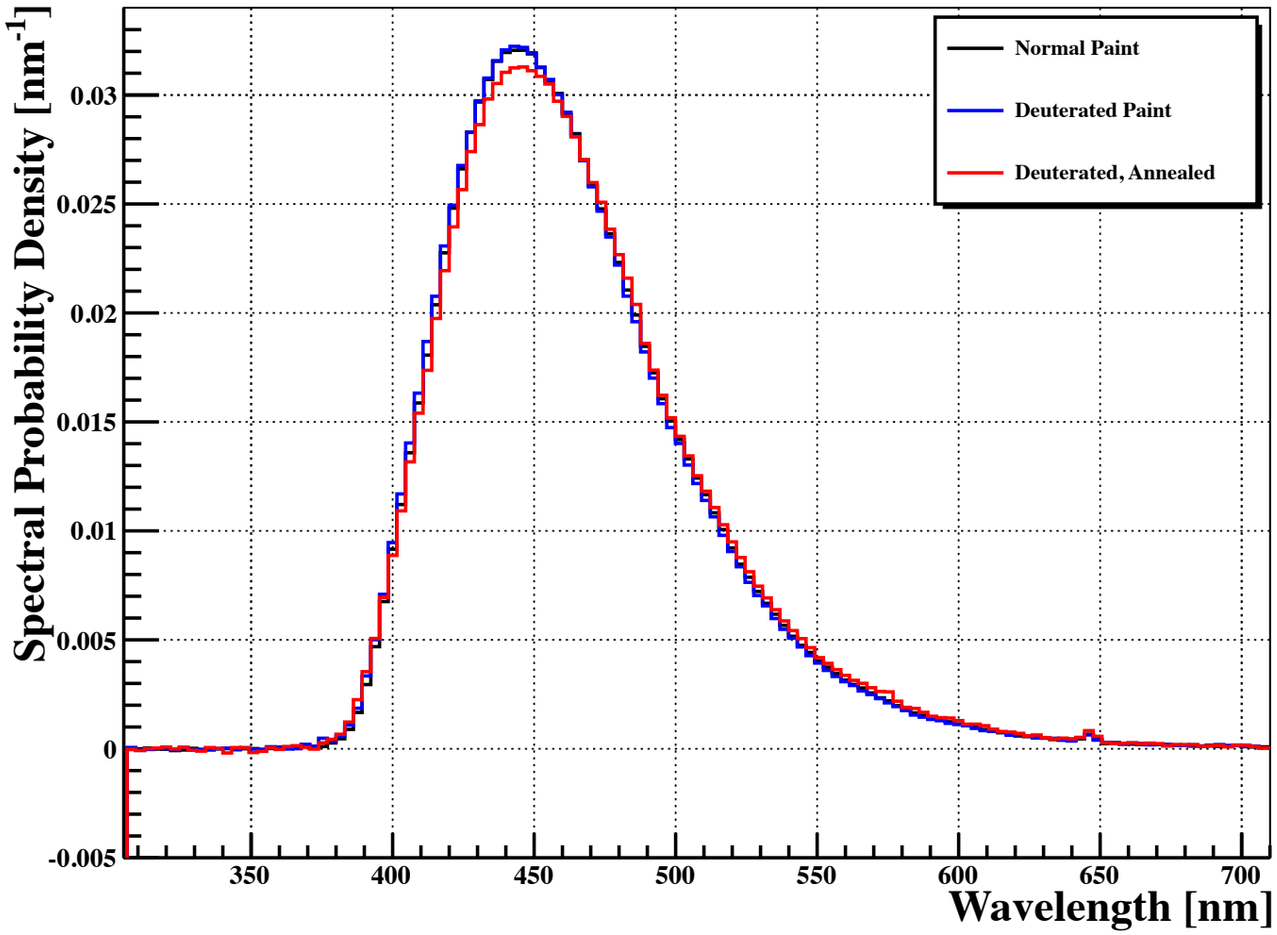
Previous measurements

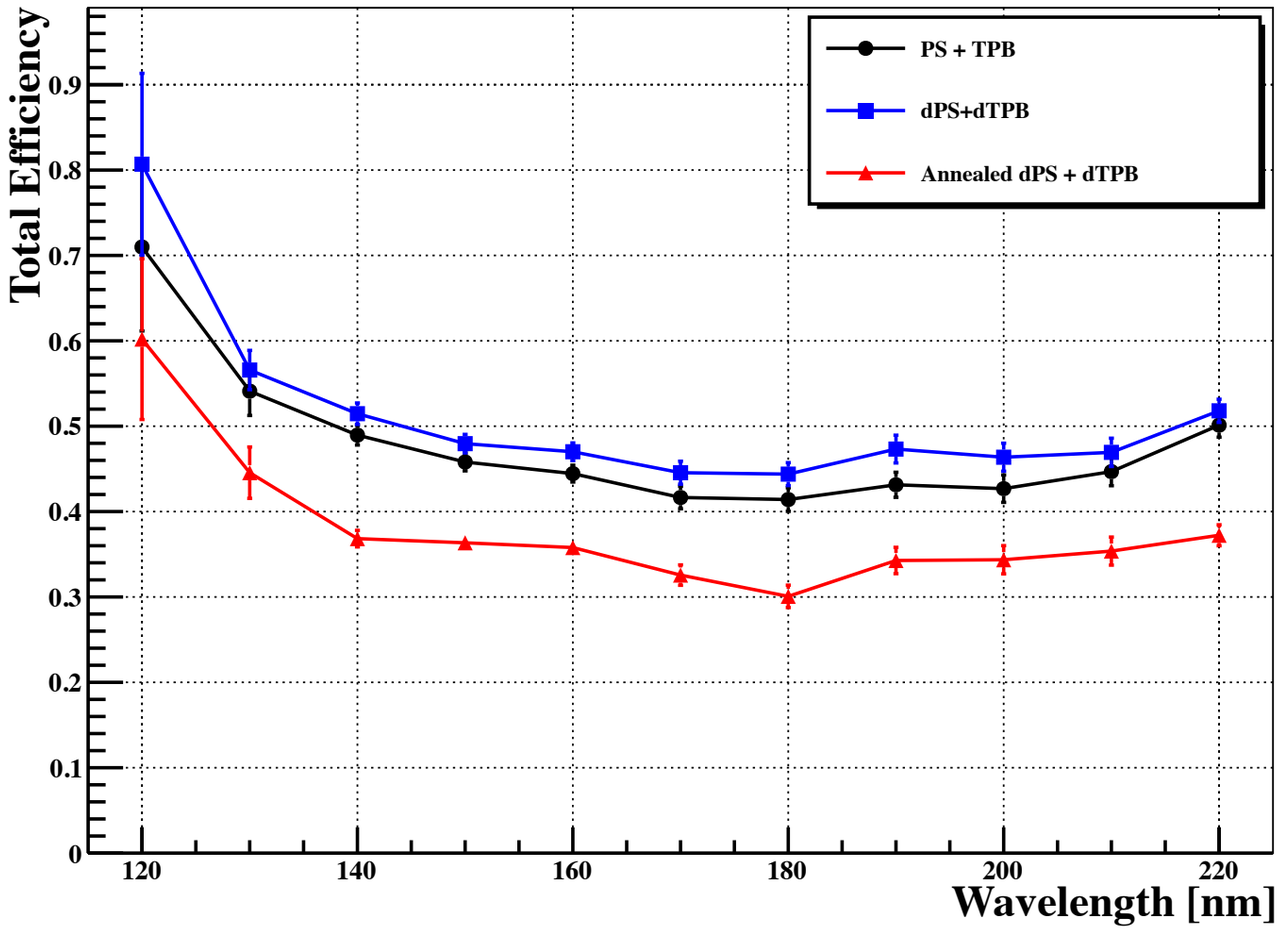
- Most recent published R&D papers are on TPB (*J. Inst.* **8** (2013) 01013, *Nucl. Inst. Meth. A* **654**, (2011) 116)
- Shift fluorescence peak for different film preparation techniques
- Total fluorescence efficiency also changes for different film preparation techniques



Deuterated TPB

- Recently submitted paper to J. Inst. on the properties of deuterated and annealed TPB films (related to neutron EDM experiment)
- Synopsis: deuterated TPB ≈ normal TPB, and annealing lowers efficiency



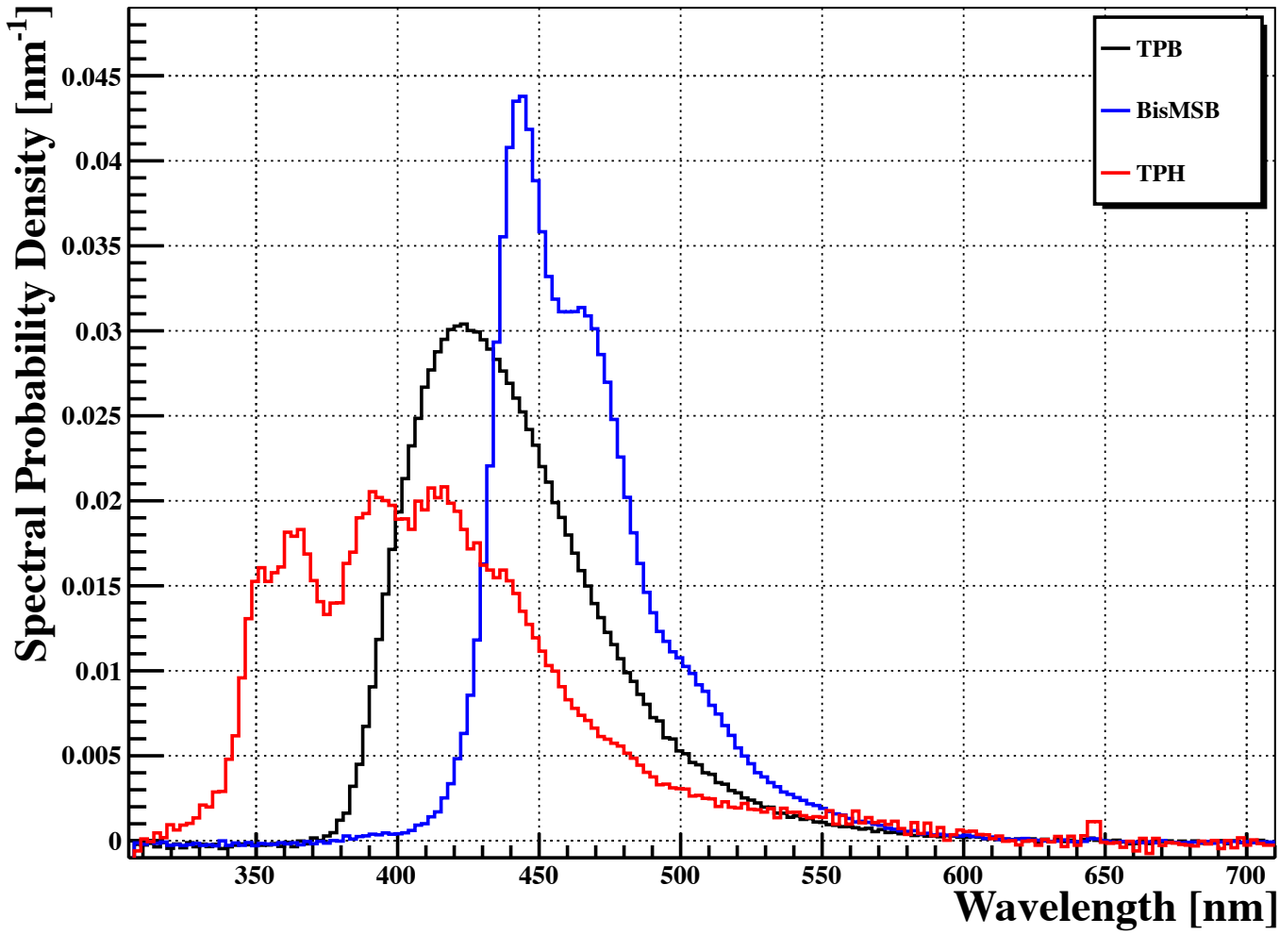


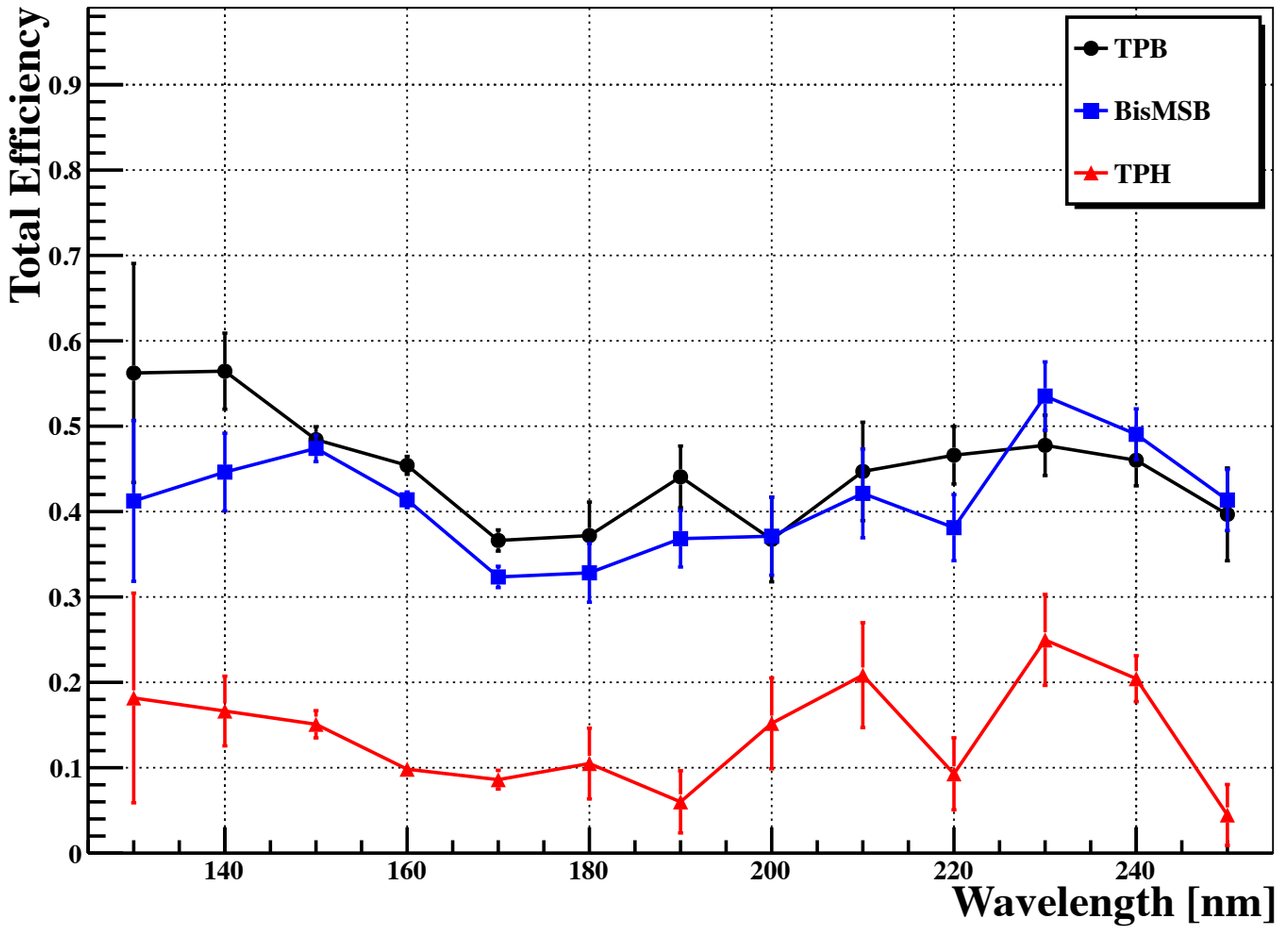
More Fluors

More Fluors

More Fluors

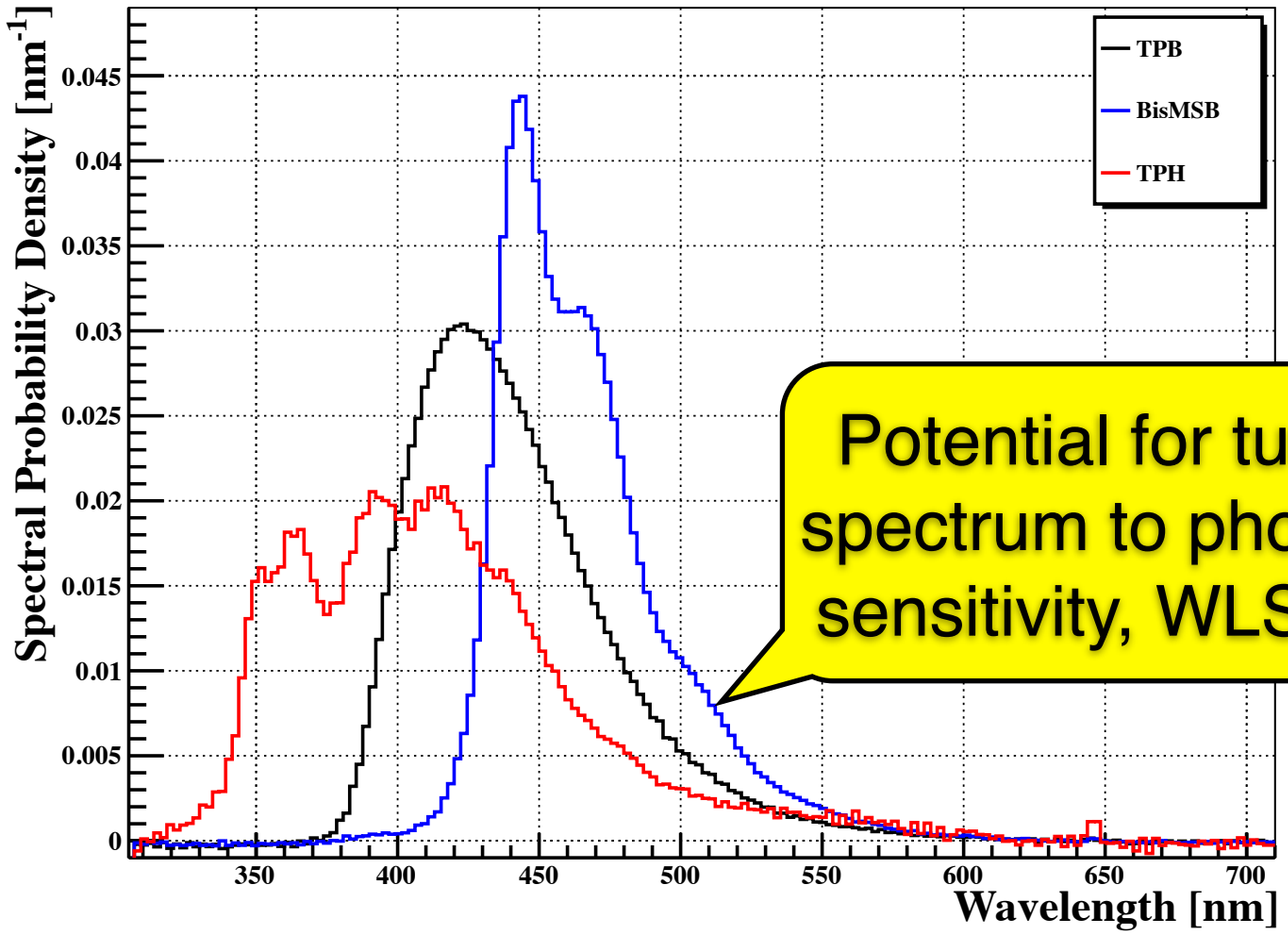
- Recently did absolute measurements for two more fluors: BisMSB (of interest for LBNE) and TPH (because I had some in my lab...)
- BisMSB is a very promising alternative to TPB, but doesn't dissolve in Toluene as well.



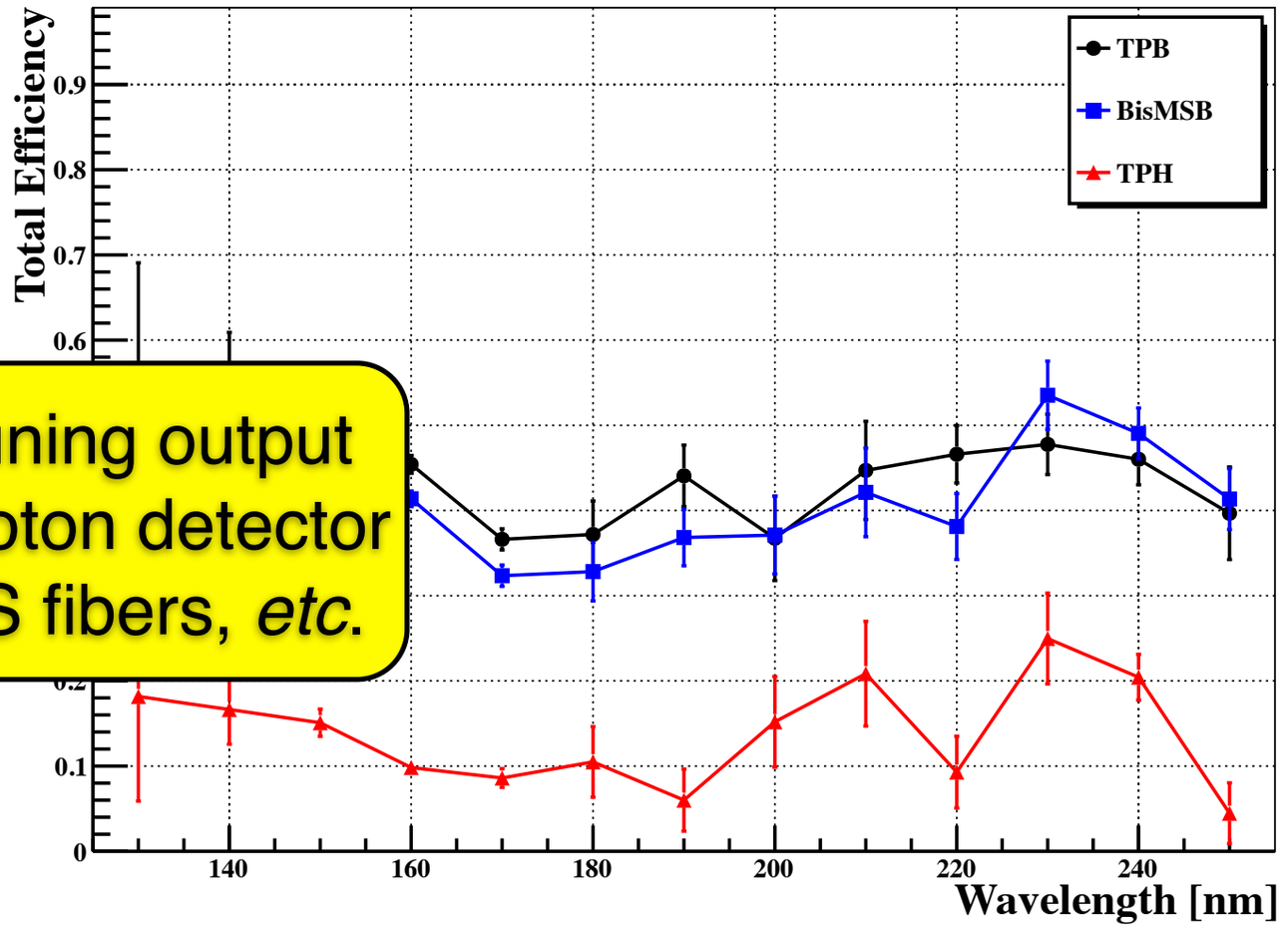


More Fluors

- Recently did absolute measurements for two more fluors: BisMSB (of interest for LBNE) and TPH (because I had some in my lab...)
- BisMSB is a very promising alternative to TPB, but doesn't dissolve in Toluene as well.



Potential for tuning output spectrum to photon detector sensitivity, WLS fibers, *etc*.

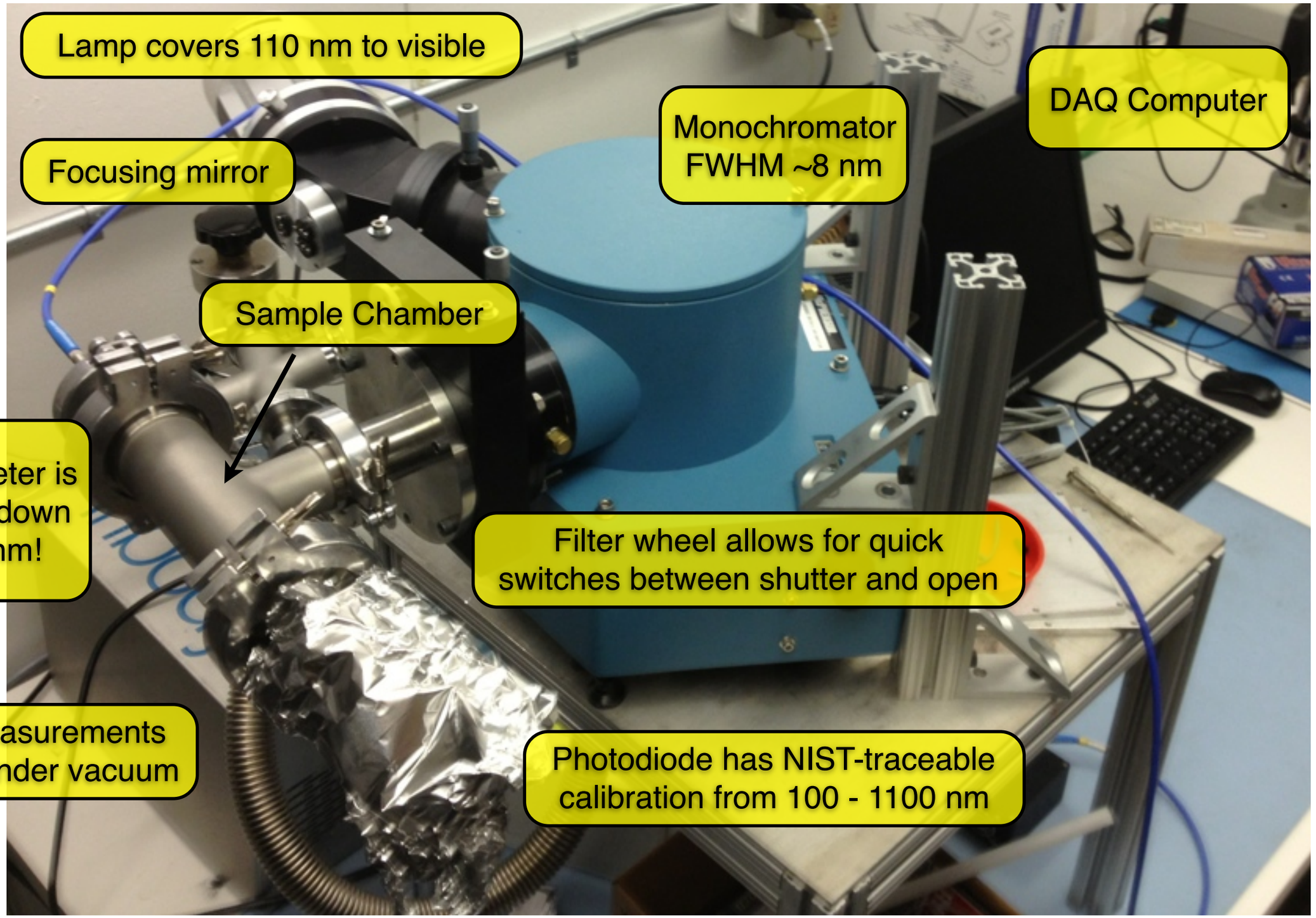


Large-area paddles

- Instead of coating light guides with WLS, cast the WLS in during manufacture.
- Opens up the possibility for “off-the-shelf” commercial option (working with Eljen right now)
- Minor repairs (surface scratches) are much simpler, allows for a final polishing before APA wire wrapping
- Three-step plan:
  - Step 1: broad range of doping for both TPB and Bis-MSB
  - Step 2: optimize in range determined from Step 1
  - Go BIG: start with drop in replacement for LBNE baseline, then look at trying to fill entire APA with WLS panels. Also investigate fiber readout.

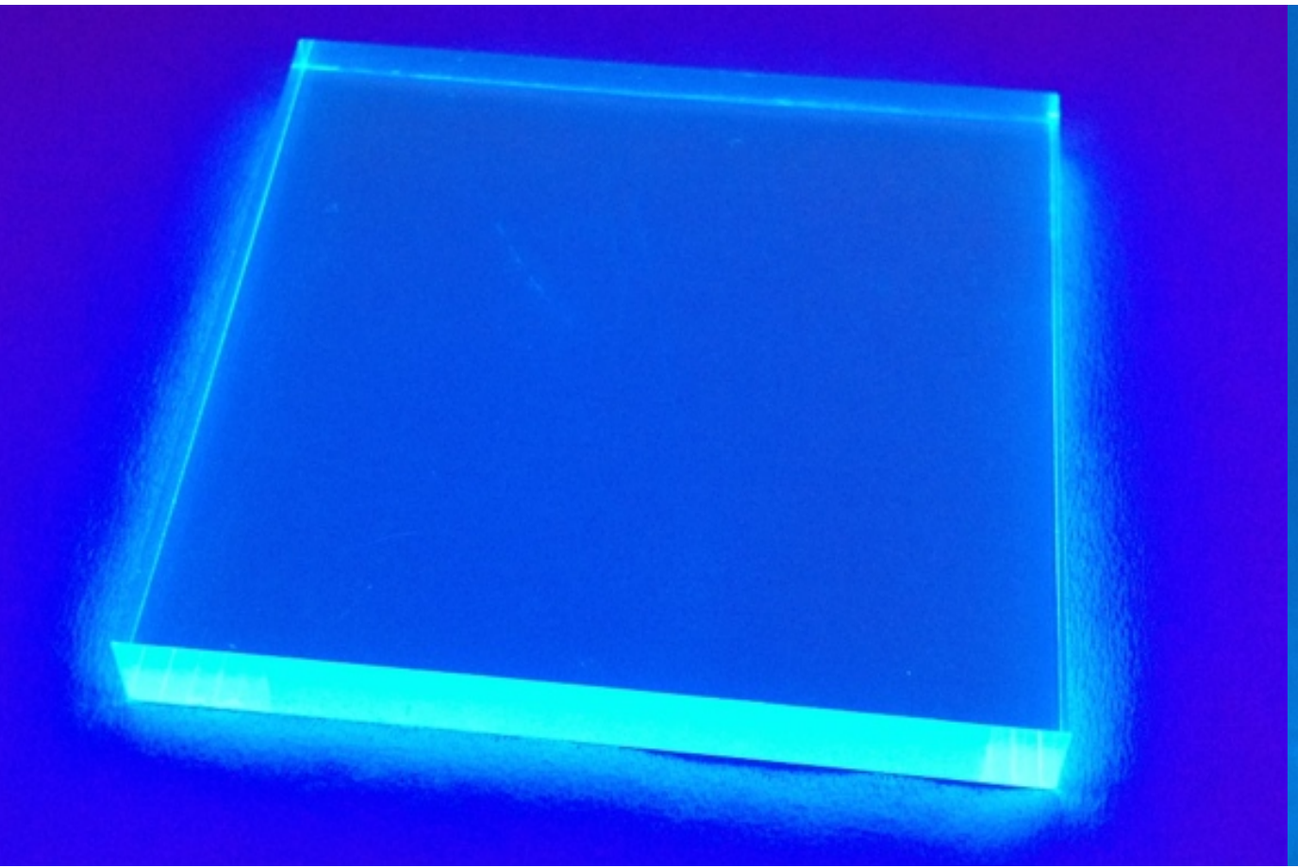
Experimental Apparatus

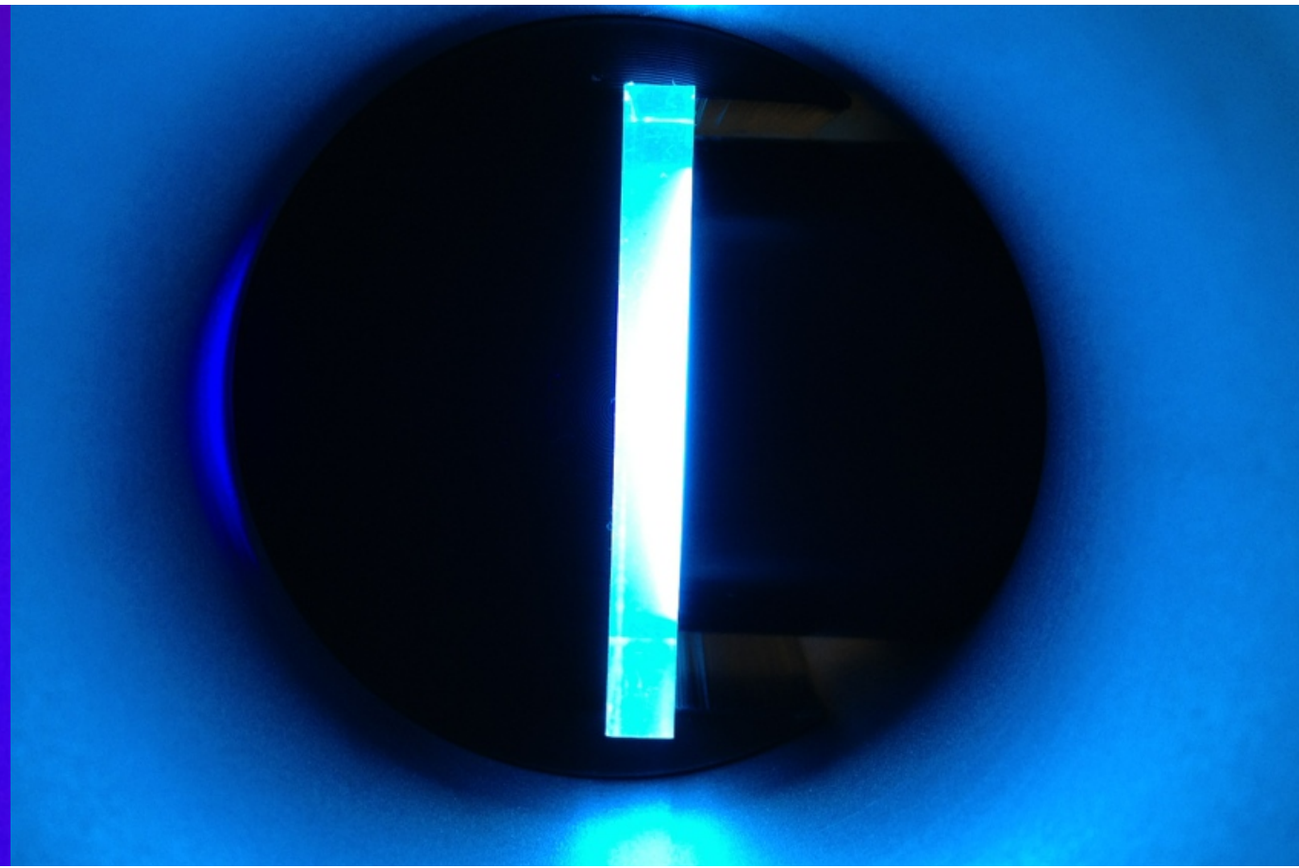
This is what our instrument looks like:



Current Status

- Have first WLS plastic coupons in hand
- Initial tests were successful! Optimizing experimental hardware for better light collection...
- Both TPB and BisMSB look good
- If this design works well, this could be a boon for any experiment needing to collect VUV scintillation photons





Thank you for your attention
Any questions?