Bialkali/Multialkali Photocathode at ANL

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General Overview of ANL Bialkali/Multialkali Photocathode Effort

Comprises of two broad efforts that run in parallel, but related to each other

8”x8” photocathode in tile assembly

Physics of photocathodes

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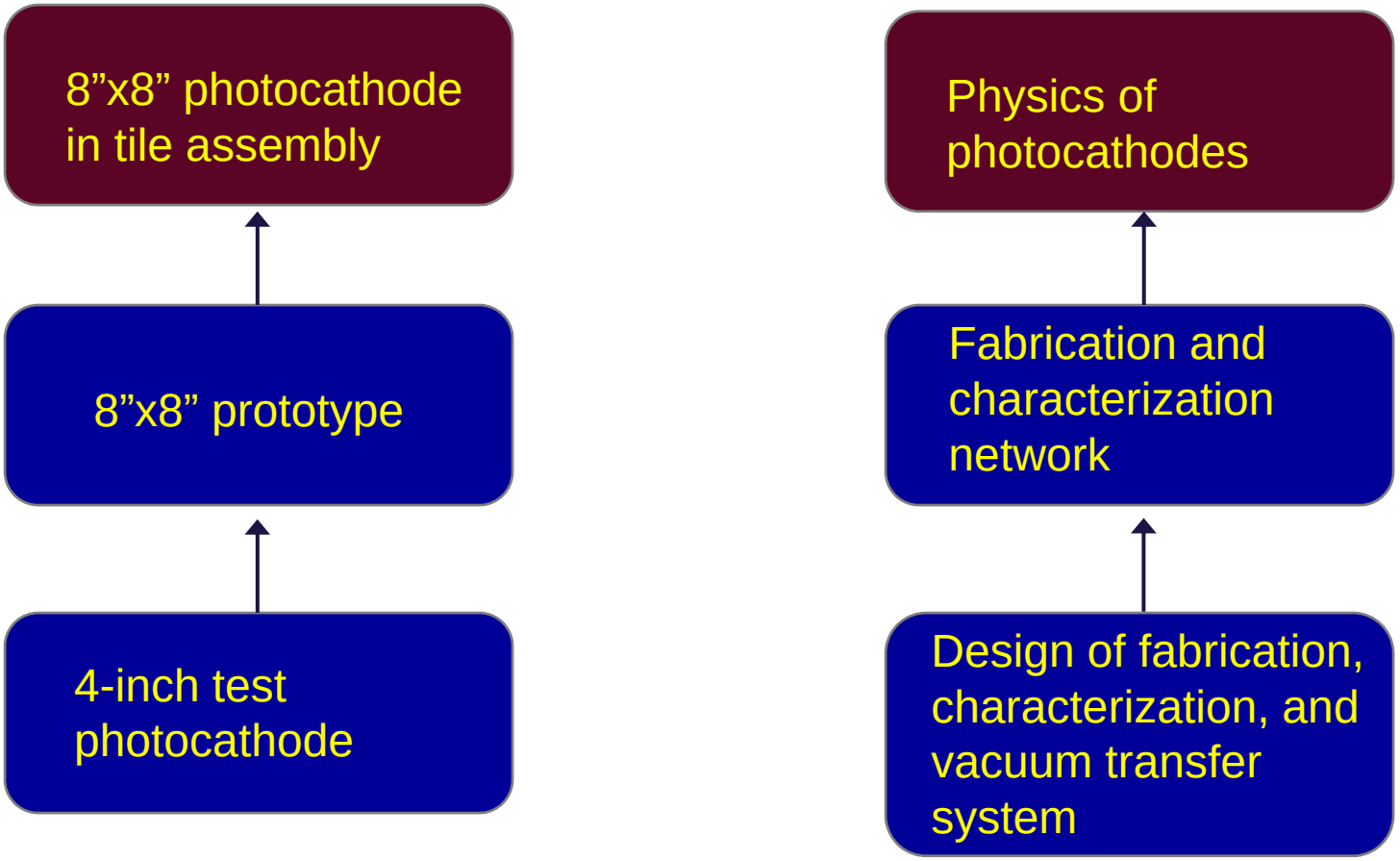
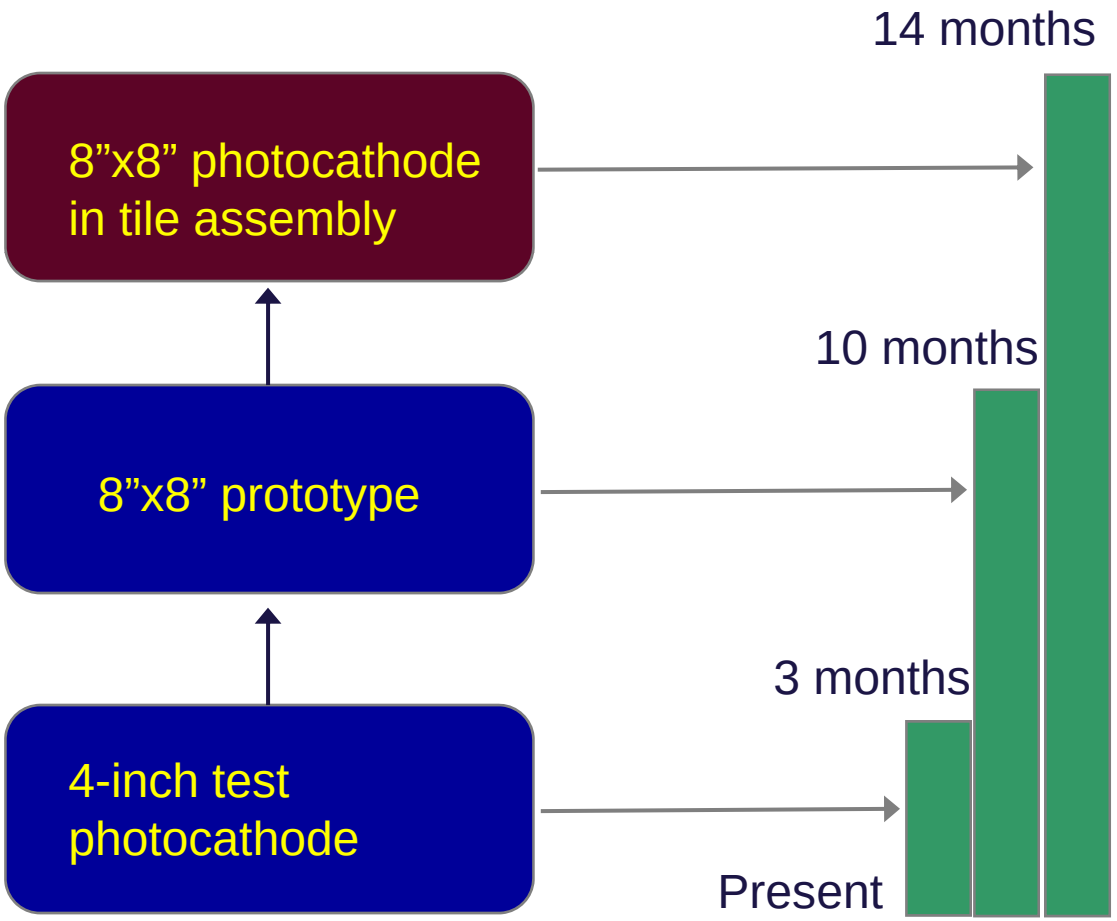


Timeline*



*Progress will certainly depend on Argonne’s Facility division in finishing modification to the laboratory space

The 4” Test Photocathode

Major lessons learned from studying bialkali photocathode fabrication for PMT at Burle Industries:

- Cleaning process for glass substrate is rudimentary;
- O_2 discharge in situ without taking surface out of vacuum;
- O_2 discharge on thin Sb surface can extend absorption spectrum into longer wavelength.

We believe that we can extract the essence from these and adopt it to our fabrication process. The question is, how to incorporate these, and are they reasonable to do for “mass production”?

The testing ground for this is the 4”x4” test photocathode.

The 4” Test Photocathode

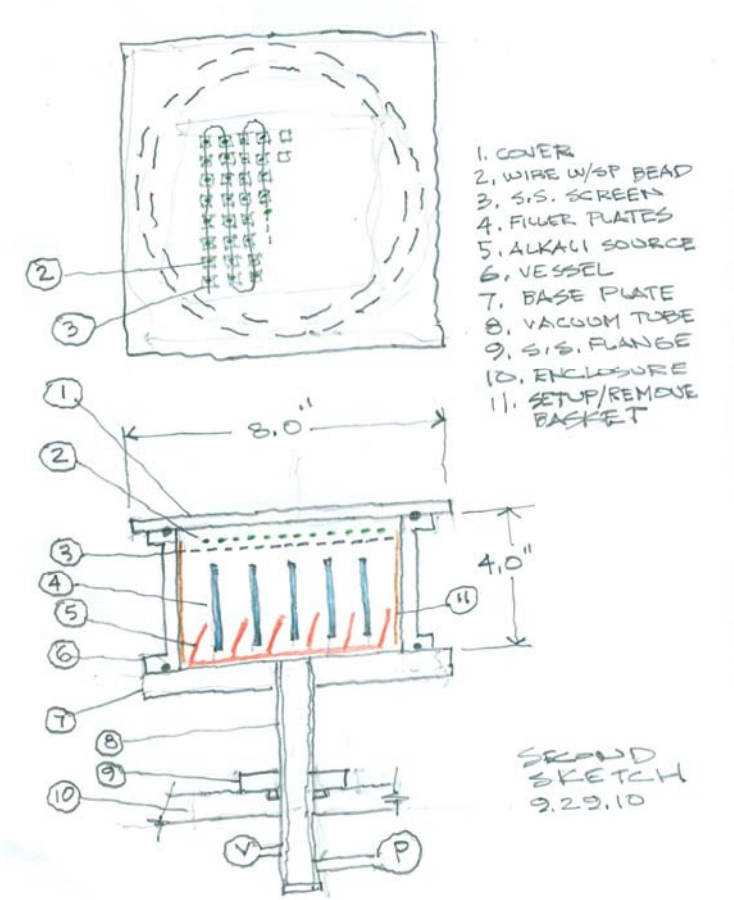
A complete fabrication system from Burle Industries that was used in bialkali photocathode fabrication for PMTs will be arriving soon.

Oven and gas/vacuum control system

Inside oven: vacuum manifold for PMTs

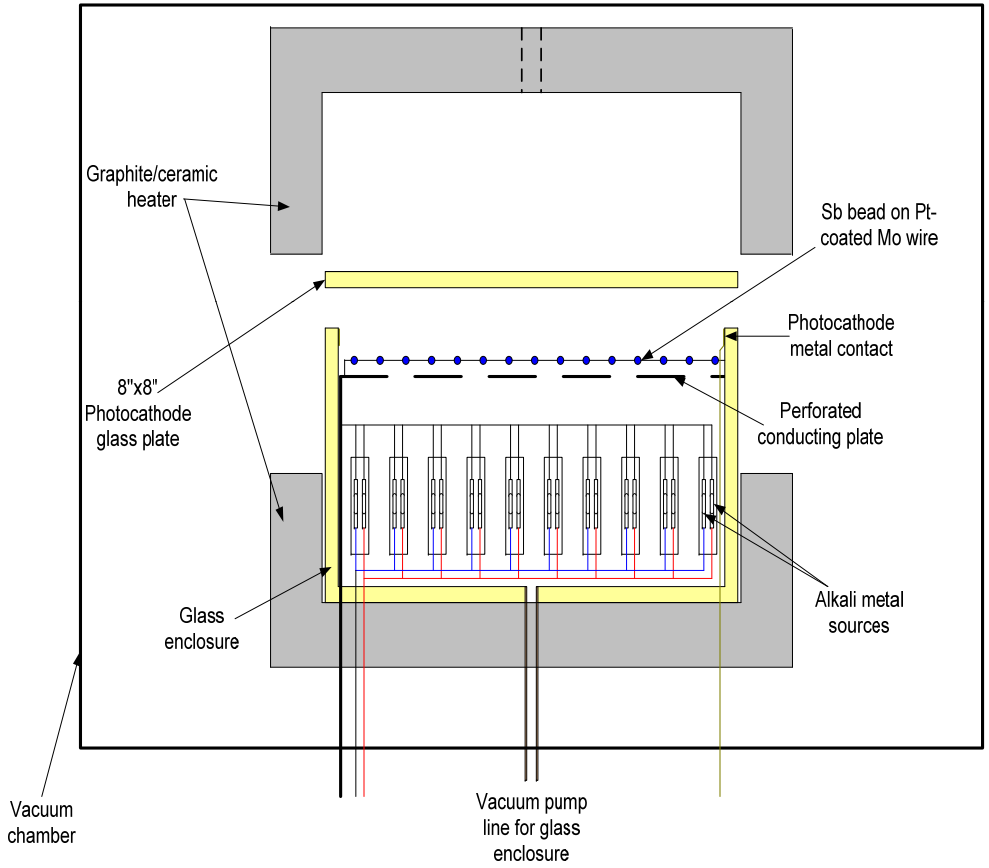
The 4” Test Photocathode

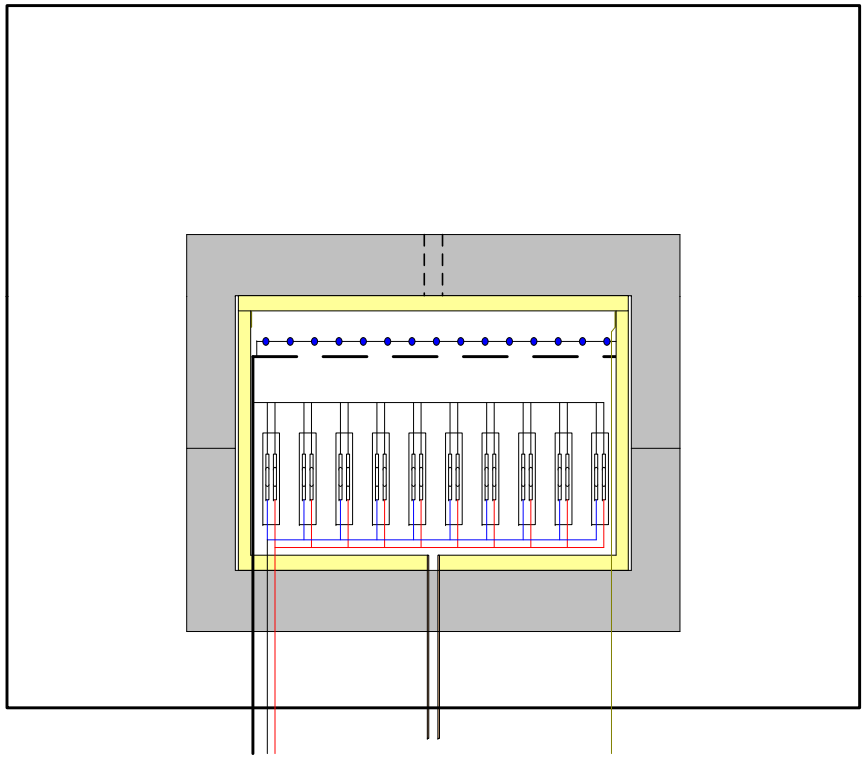
Initial plan is to make use of the Burle system to fabricate photocathode inside a 4” glass cube. The glass cube will be mounted onto the vacuum manifold via a glass stem.



Initial sketch by Richard Northrop of glass container. This will allow us to test a number of items: Sb beads production and arrangements, alkali metal dispensers locations, etc.

8” x 8” Prototype – Initial Idea (exact dimensions still being worked on – could also be done in multiple chambers)

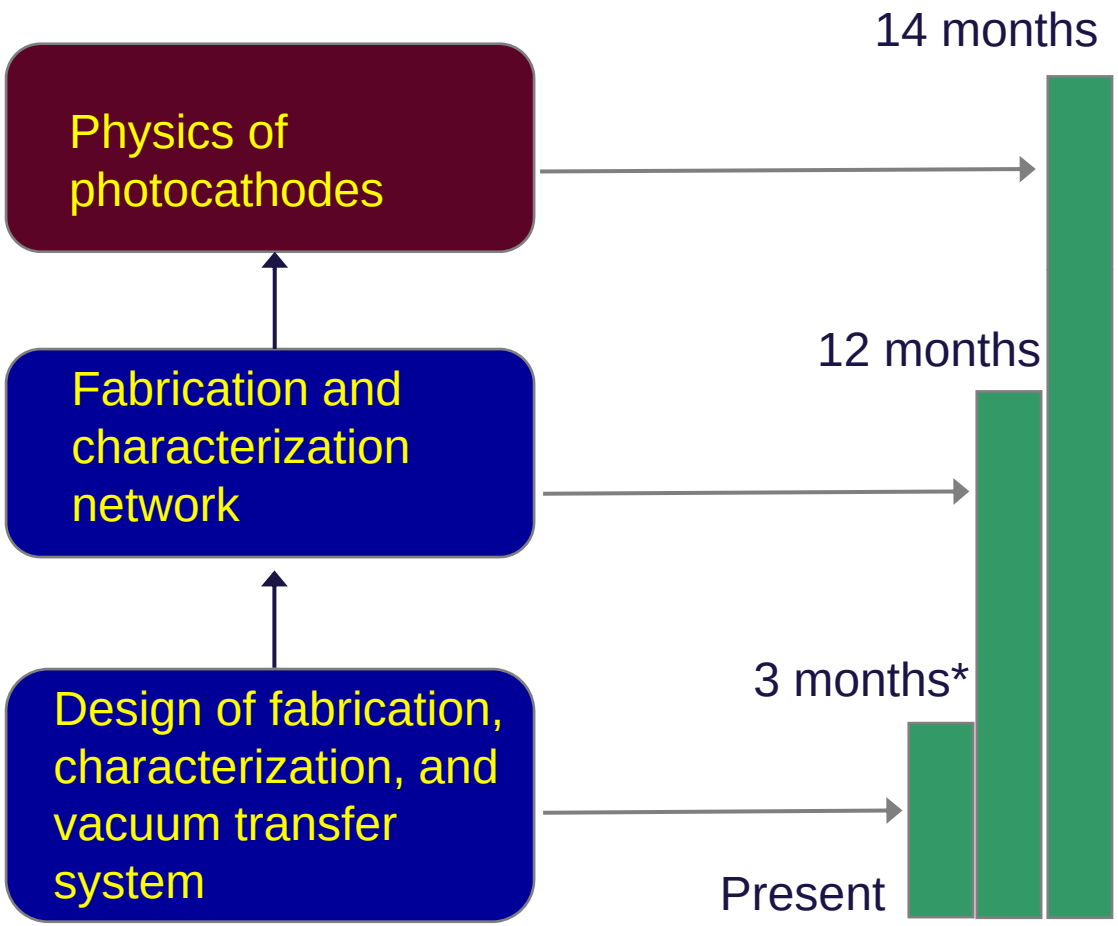




Configuration when closed for photocathode deposition

8”x8” glass plate undergoes bakeout in another chamber. It is then transported under vacuum to the deposition chamber and placed over the glass enclosure. O_2 discharge and photocathode deposition then begin. After deposition, photocathode glass plate is transported into the tile assembly chamber under vacuum.

Timeline For Bialkali/Multialkali Fabrication/Characterization System



* Substantial amount of design of the system has been completed (ref: last GP Review). The vacuum transfer system is currently being designed and will be tested on an operational Cs_2Te photocathode fabrication chamber.

Desired characterizations: XRD, optical spectroscopy, AFM, XAFS, XPS, UPS, SIMS (see Igor's and Klaus's presentations).

Resources

- Personnel: 2 staff (Klaus-50%, Zikri-50%), 2 full-time postdocs (Junqi-100%, Seon->50%), 1 mechanical engineer (Alan);
- Possible need of Rich Northrop and Joe Gregar for glass assembly design and construction;
- We expect a greater need for engineering support in the next year not only during the construction phase, but also the design phase;
- We should have a cost estimate for the 8”x8” fabrication facility within 3 months after a more detailed design work is completed.