# Goal Status & Plans for Large Area MCP Photodetectors

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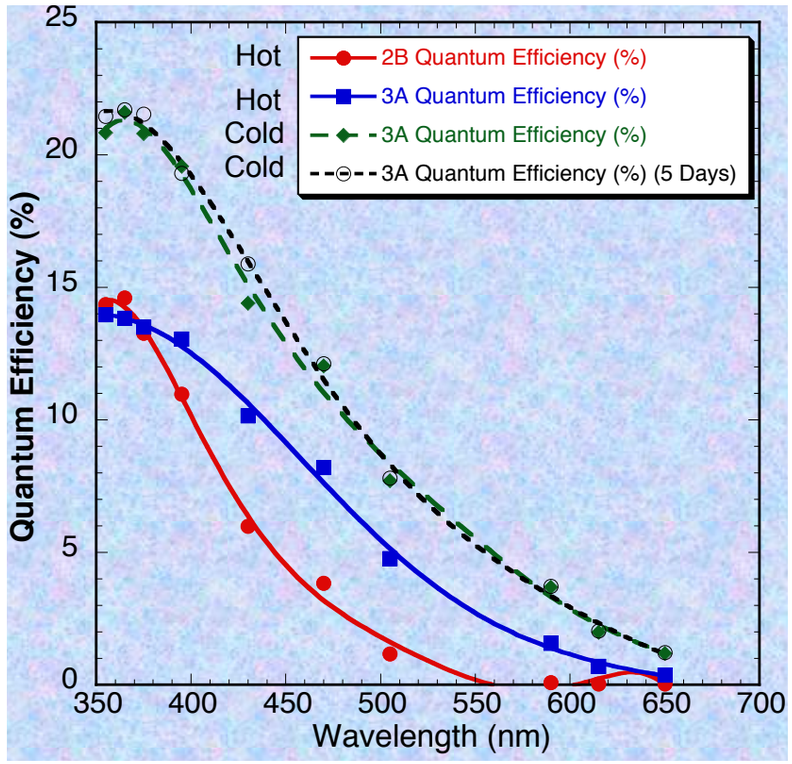
for LAPPD Collaboration
DOE Visit, Thursday 24 May 2012

# Reminder of LAPPD FY2012 Goals

- Proof-of-Principle Sealed 8" Ceramic Tile — SSL & Univ. of Hawaii
- Continued Development of ALD & Substrates — Argonne & Incom, Inc.
- Operational Pumped 8" Glass Tile with Al Photocathode and O-Ring Seal — Argonne & Univ. of Chicago
- Vertical Slice of 0.5m$^2$ Tray/Tile Supermodule Read-Out to PC with Data Reconstruction — Univ. of Chicago

# # 1) 8” Ceramic Tile Status

- Braze Ceramic Assembly
  - Design modified to eliminate potential warping
  - Presently determining braze parameters
  - Time scale: later June
- Photocathode
  - Produced 8” photocathode w/QE > 20%
- Indium Seal
  - Initial tests
  - Recovering from 2 day site power outage
- Process Tank
  - Bake-out delayed by two oven relay failures
  - Time scale: 1 month; depends on H outgassing
- MCPs
  - Pair testing ongoing at SSL
  - Argonne ALD group improving uniformity & cleanliness
- Electronics
  - Pre-amps, ASICs available, Integration Board in progress at Univ. of Hawaii
  - On schedule for integration with 8” Ceramic Tube



# Ceramic Tile Status (cont.)

- Brazing modifications have extended finish time for ceramic body
- 8” MCPs have been functionalized and tested
  - Working to improve gain uniformity to produce best possible tubes
- Process tank bake-out has been delayed ~ 1 month due to relay troubles
  - Not a critical path item
- Electronics on schedule
- On-track for attempting first tube assembly July/August

Shortfall for SSL/Berkeley: $173k

Shortfall for Univ. of Hawaii:  $121k

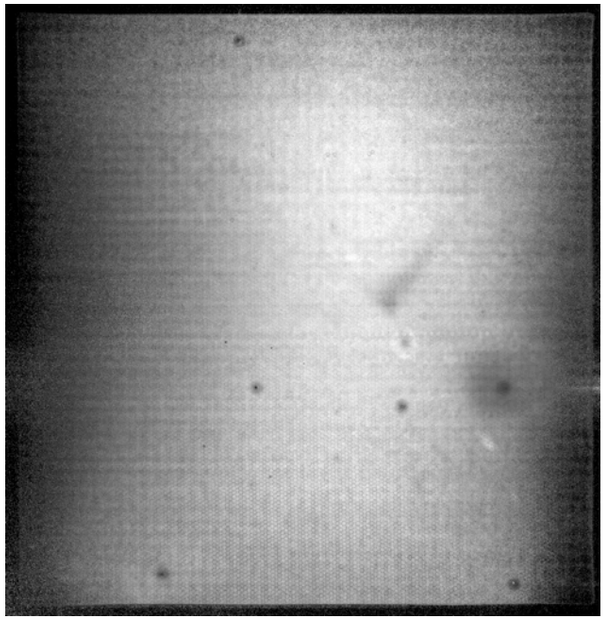
# #2) ALD and Glass Substrate Development

Portable clean room installed April, 2012 has improved MCP cleanliness

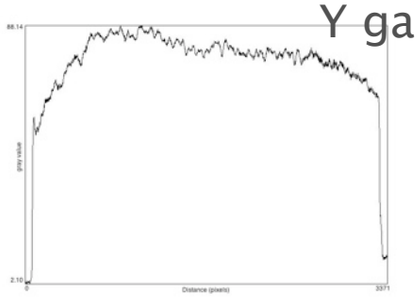
Top MCP Bias direction

Bottom MCP Bias direction

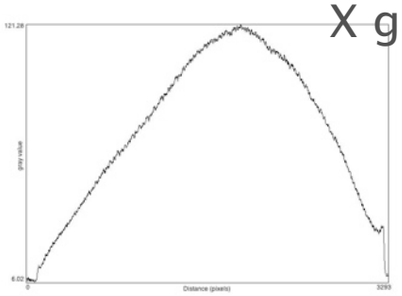
MCP 13600 – 045, 10.5 MΩ – top
MCP 13600 – 010, 8MΩ – Bottom



Y gain slice

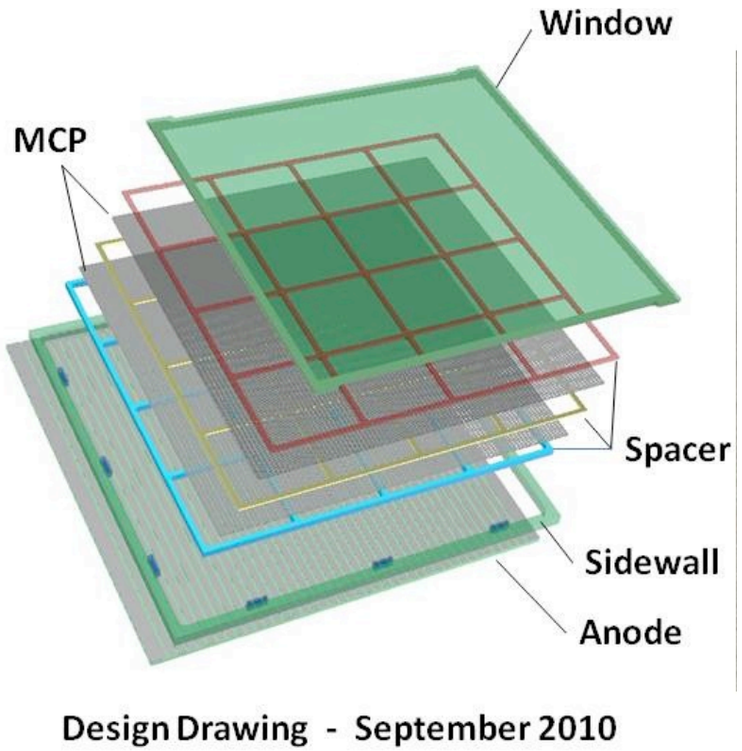


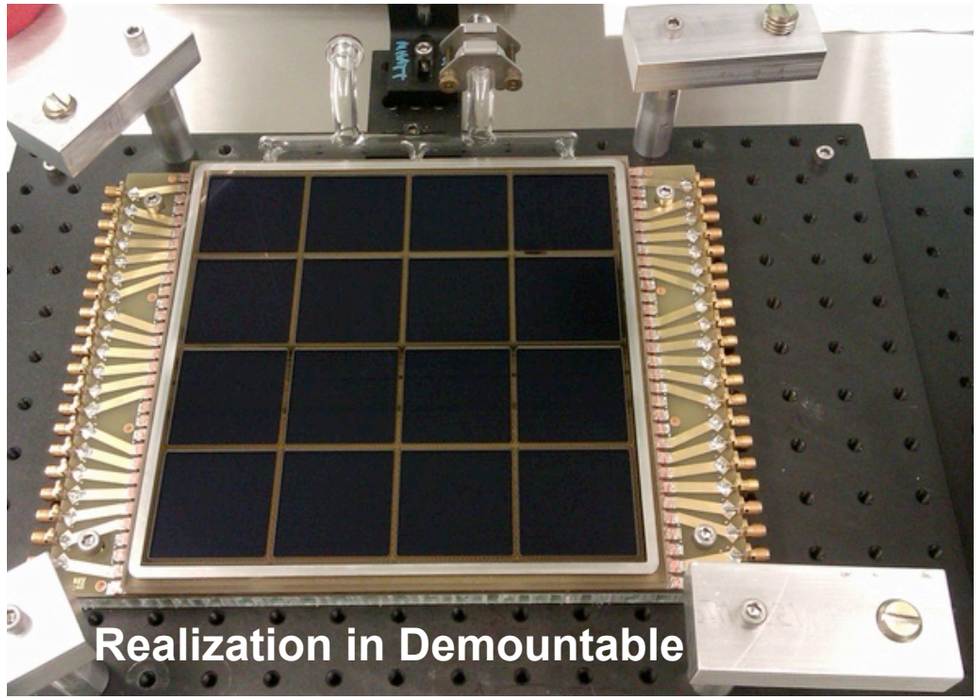
X gain slice



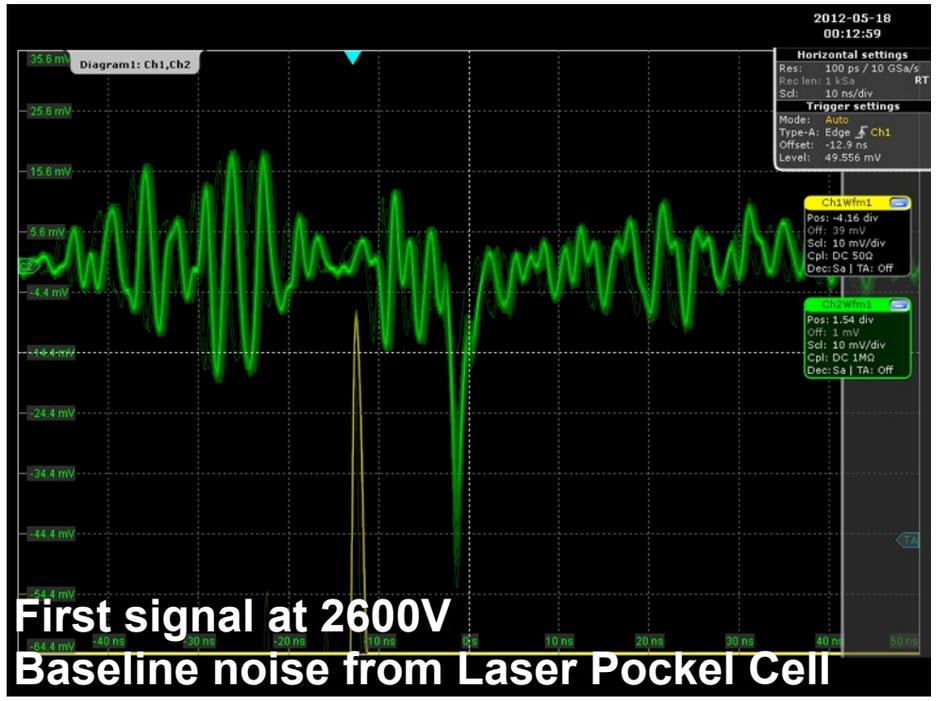
1. Routinely producing targeted resistance
2. Working to improve Secondary Electron Emission layer gain uniformity

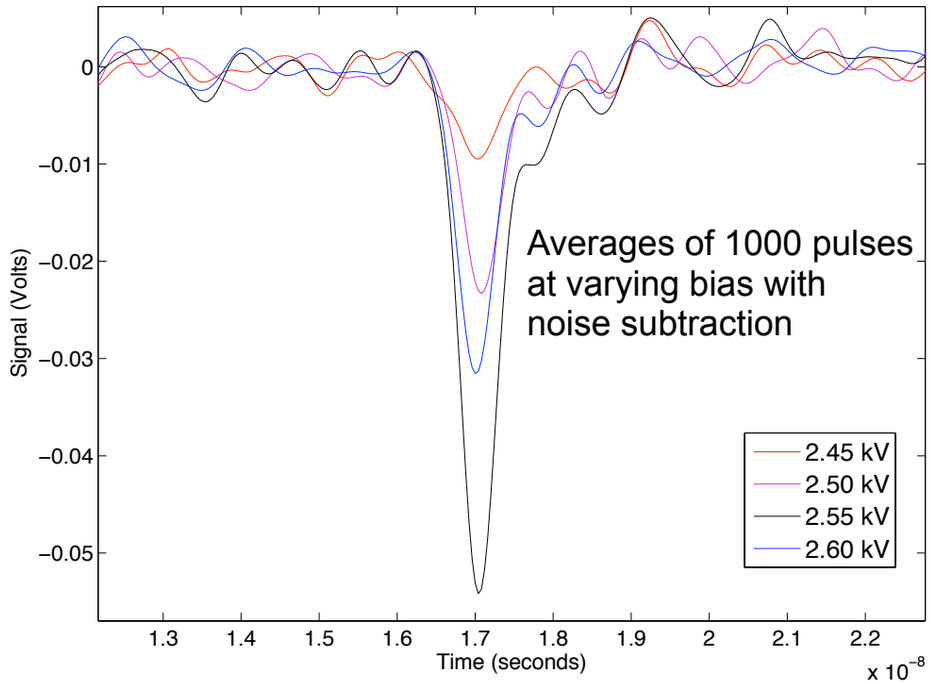
# #3) Operational Pumped 8” Glass Tile — Demountable



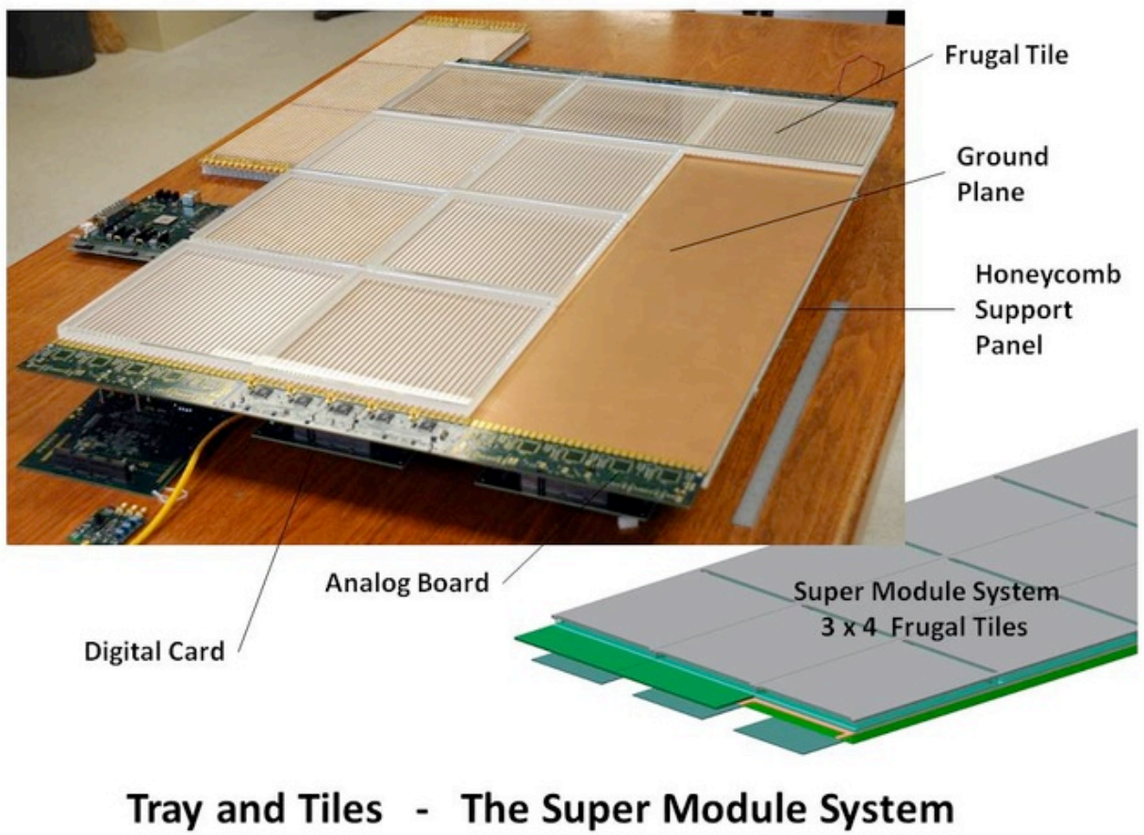

Demountable assembled in ALD clean room and transported to APS UV Laser Lab for test operation

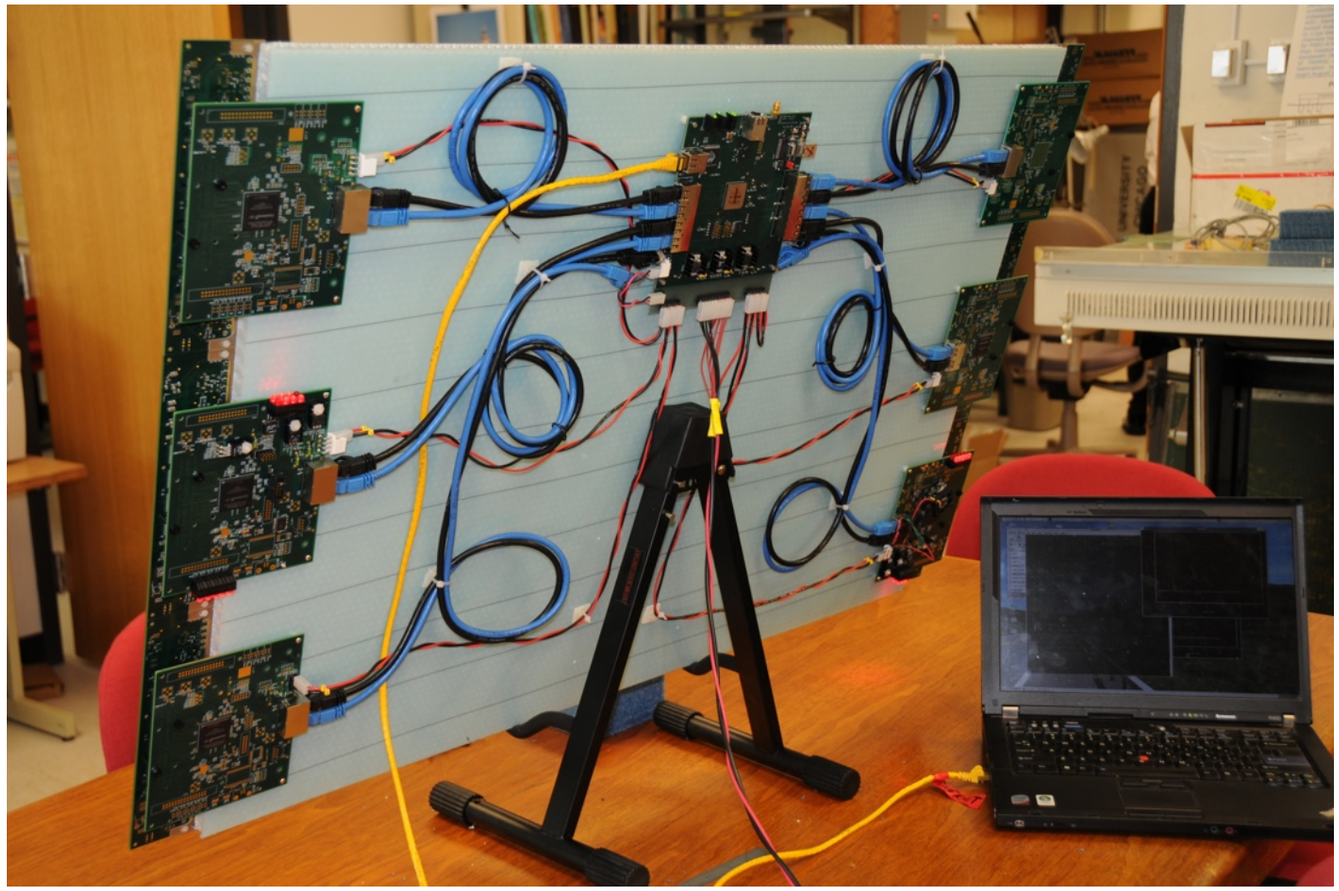



First Demountable Signals from UV laser excitation demonstrating whole of All-Glass Concept

# #4) Vertical Slice of 0.5m$^2$ Supermodule

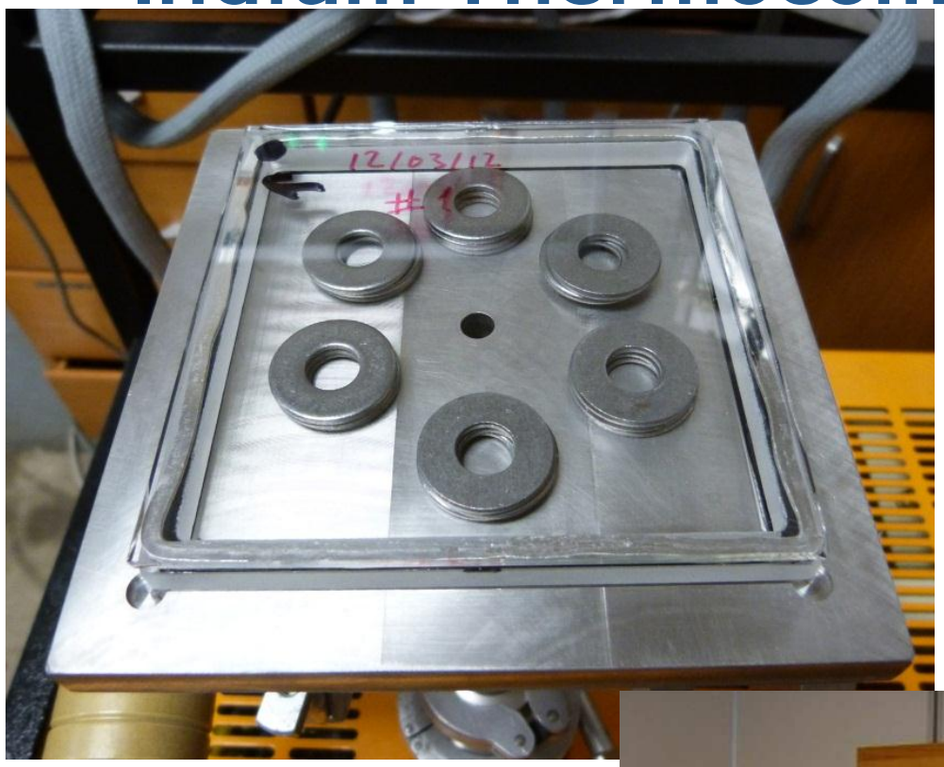


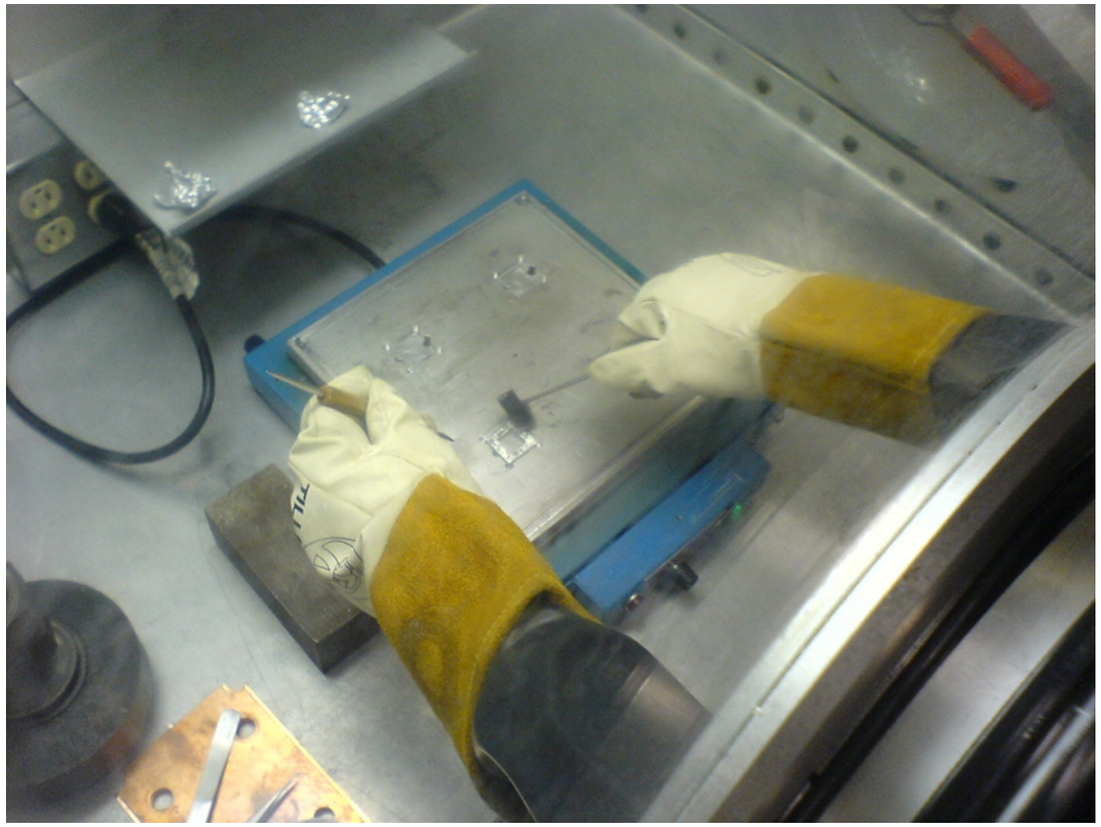
Complete readout chain completed from frontend waveform sampling ASIC through digital and central control cards to graphics processor PC

Planning for integration of readout chain into Demountable Tile

# Essential Tasks for Future All-Glass Development — Indium Thermocompression & Hot Seal Alternatives




4” window compression seal under vacuum test

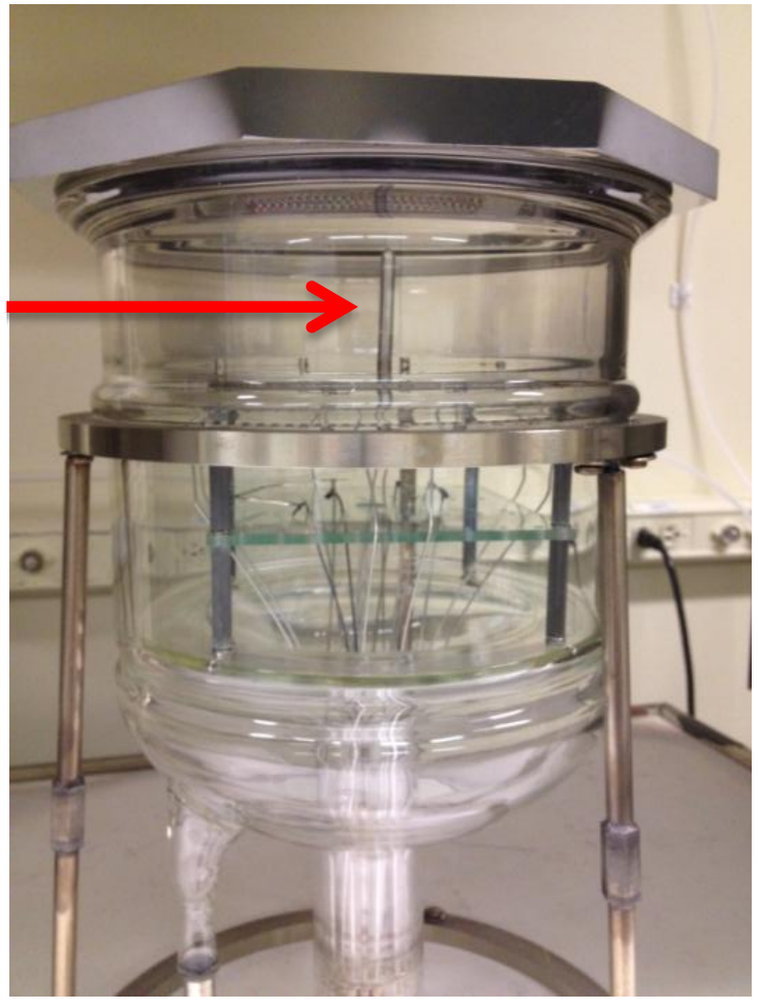


Hot seal indium “tinning” in nitrogen glove box

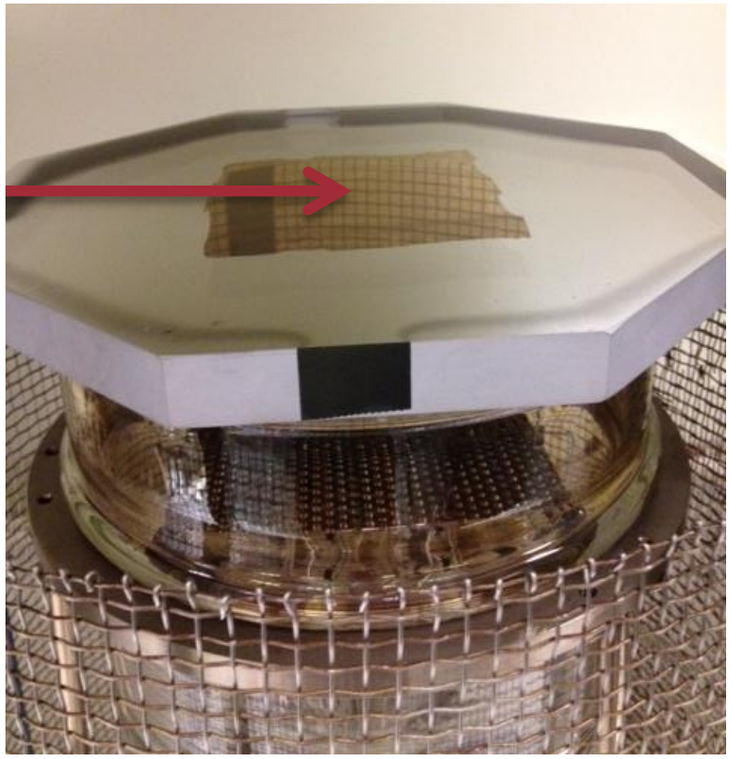
Vacuum test chamber for thermocompression seal development

**Reproducibly hermetic sealing achieved by both methods**

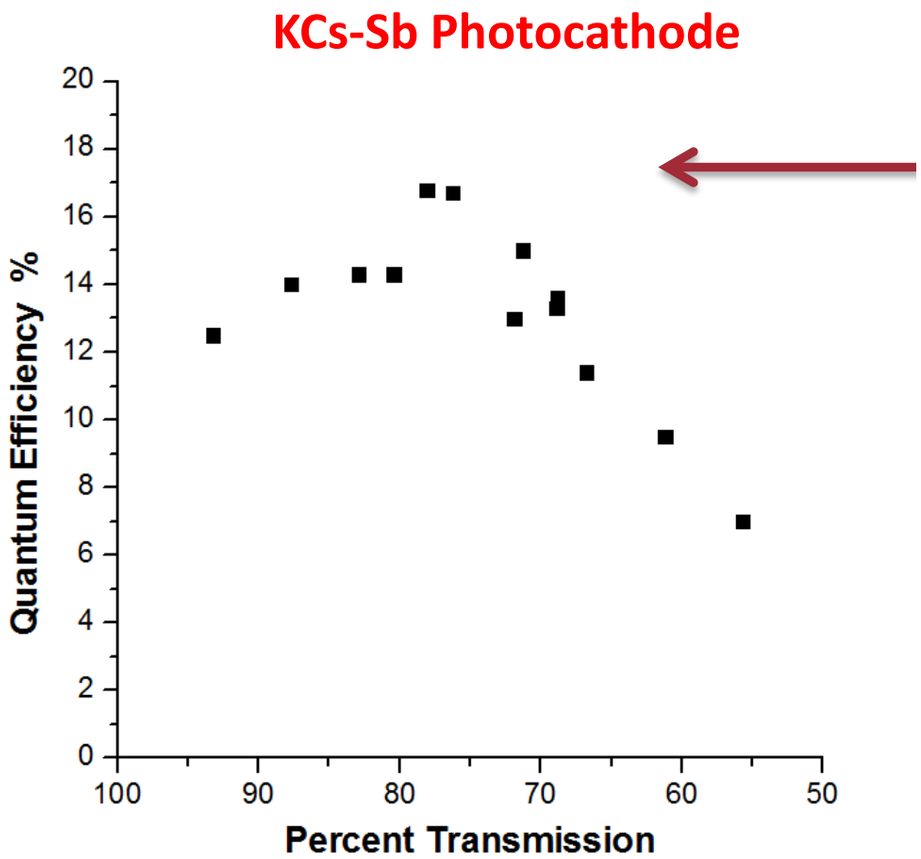
# Essential Tasks for Future All-Glass Development — Photocathode Development at Argonne



"Chalice" Photocathode Deposition Chamber



4" Photocathode area on test window



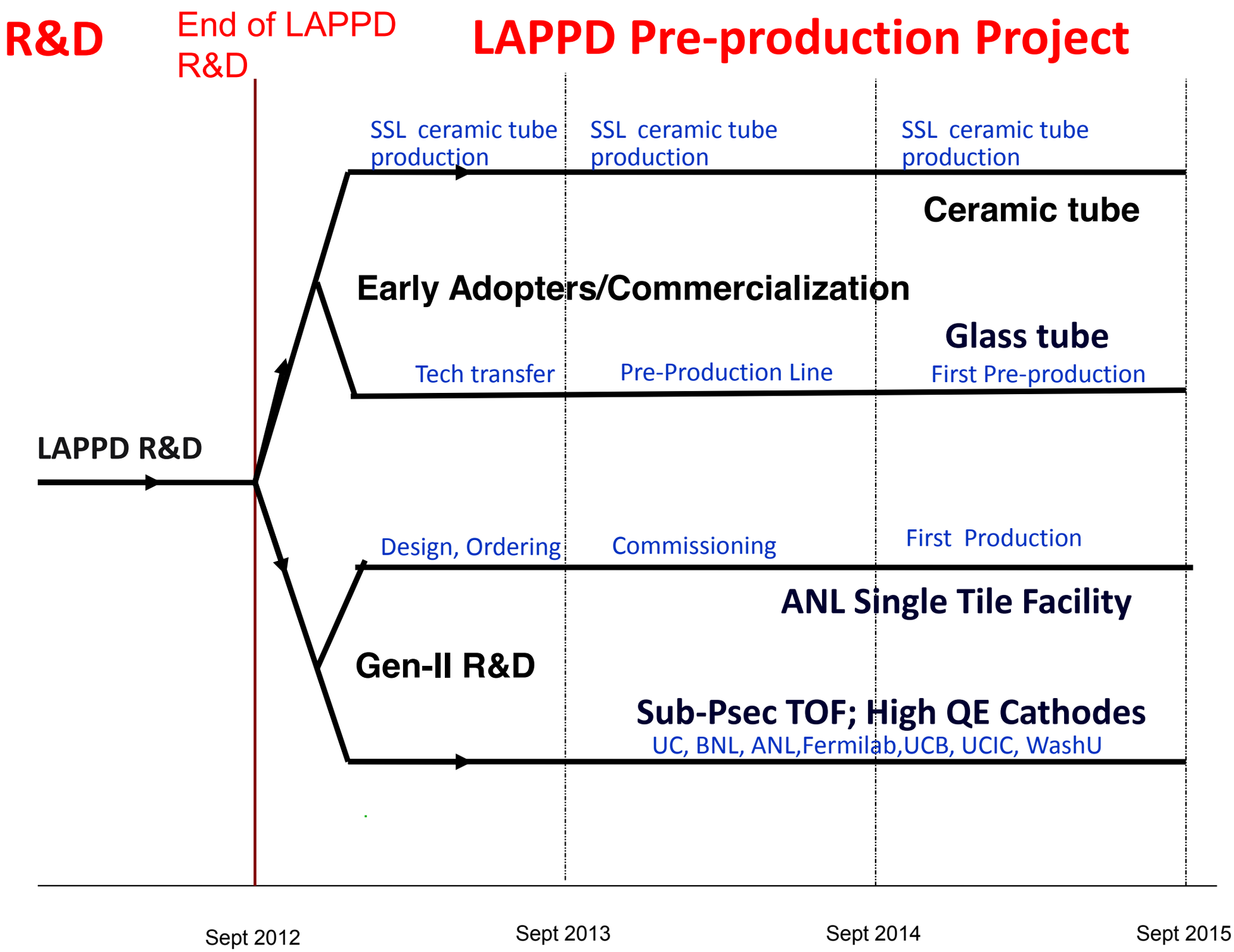

Relate the QE of the KCs-Sb cathodes with the Sb film transmission at 400 nm.

# Essential Work Remaining for FY2012

- Tasks for sealed ceramic tile and development of all-glass Demountable
  - Continue acquisition of 8" glass capillary plates for MCP production
  - ALD functionalization of 8" MCPs with uniform gain
  - Continue study of successful Demountable Tile and characterization of MCPs in Demountable and 8" vacuum test chamber at Argonne APS Laser Facility
- Essential Tasks for Development of All-Glass sealed tiles at Argonne
  - Improvement of QE for Argonne photocathode fabrication (17% → ~25%)
  - Thermopressure indium seal development for Argonne Tile Facility
  - Continued design of Single Tile Processing System for production of all-glass photodetectors at Argonne and completion of much of the lab infrastructure for facility
- Support for collaboration with University of Chicago
  - Mechanical design for tile, supermodule, indium hot seal
  - Electronics for readout
  - Blog, web site, database management
- Support for collaboration University of Illinois-Chicago
  - Graduate engineering student support for thermocompression indium seal

Shortfall: $440,000

# Funding Shortfall Summary

| | |
|---|---|
| Support for SSL-Berkeley for Ceramic Tile Delivery | $173k |
| Support for Univ. of Hawaii Ceramic Tile Readout | $121k |
| Argonne, UC, UIC funding for MCPs, ALD, and All-Glass Tile Tasks | $440k |
| Total Shortfall | $734k |

# Future Work for Large Area Photodetector