

Overview of 8" Tube Production

Bob Wagner
LAPPD Collaboration
Tuesday 18 Dec 2012

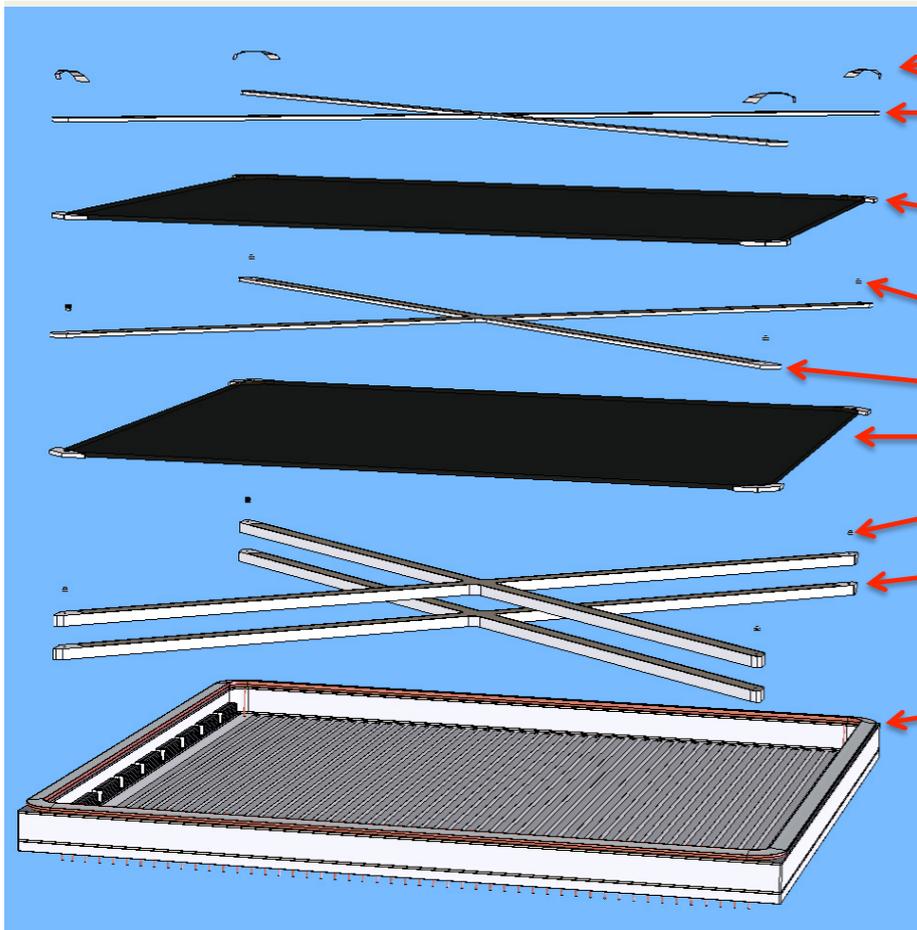
Facilities for MCP-PMT Fabrication

- ▶ Space Sciences Laboratory/Berkeley
 - **Large Process Tank ready for first 8" tube fabrication**
 - Ceramic or Glass body
 - Ceramic body process fully specified with most steps qualified
 - Glass body process is beginning to be qualified
 - Na₂KSb photocathode with QE > 20%
- ▶ Argonne
 - Design work for 8" vacuum transfer system is ongoing with complete design anticipated for late spring 2013 and construction through mid-2014
 - Initially Glass body production of 8"×8" pinless 30-anode strip line design with indium seal
 - Thermopressure seal; parallel backup is hot pre-tinned indium seal
 - Adaptable for fabrication of alternative formats, photocathodes, ALD materials
 - K₂CsSb photocathode
 - Existing 4" vacuum transfer system in process of modification to proof process steps on smaller 2.5" format
 - Parts handling and processing generally directly scales to 8" format. Photocathode process will likely require formulation changes



SSL Ceramic Tube Process

Components for SSL Ceramic Tube



- Stack hold-down straps
- Top X-Grid – .060" thick plus ~.002" X-shim to adjust stack height
- Top MCP – with anti-rotation blocks at corners
- HV contacts
- Middle X-Grid – .060" thick
- Bottom MCP (w/ AR blocks)
- HV contacts
- Anode gap X-Grids - .060" ea plus ~.020" X-shim to adjust stack height
- Prepared BBA (indium and getters)
- Internal stack height .003"–.006" shorter than walls to ensure seal



Trial detector stack-up

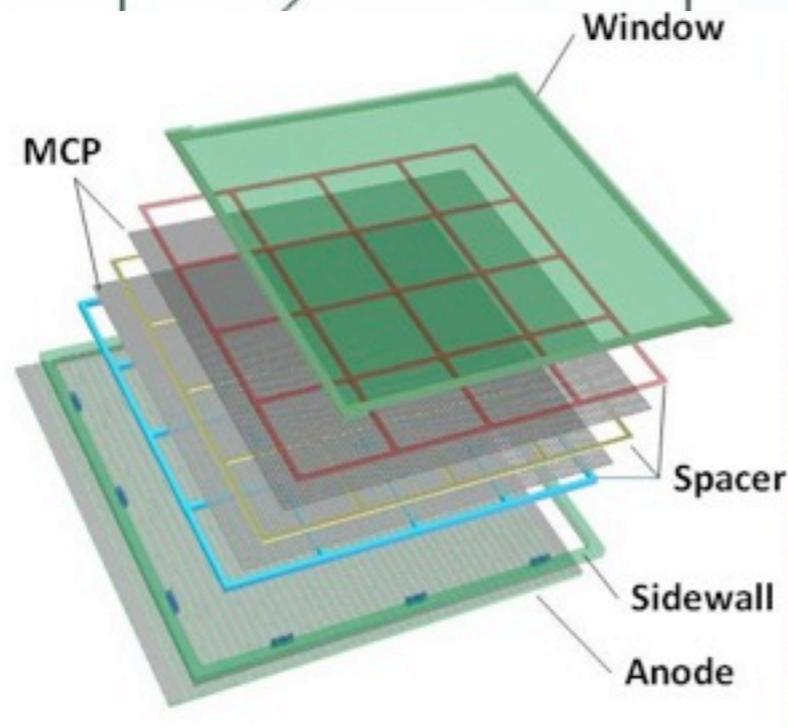
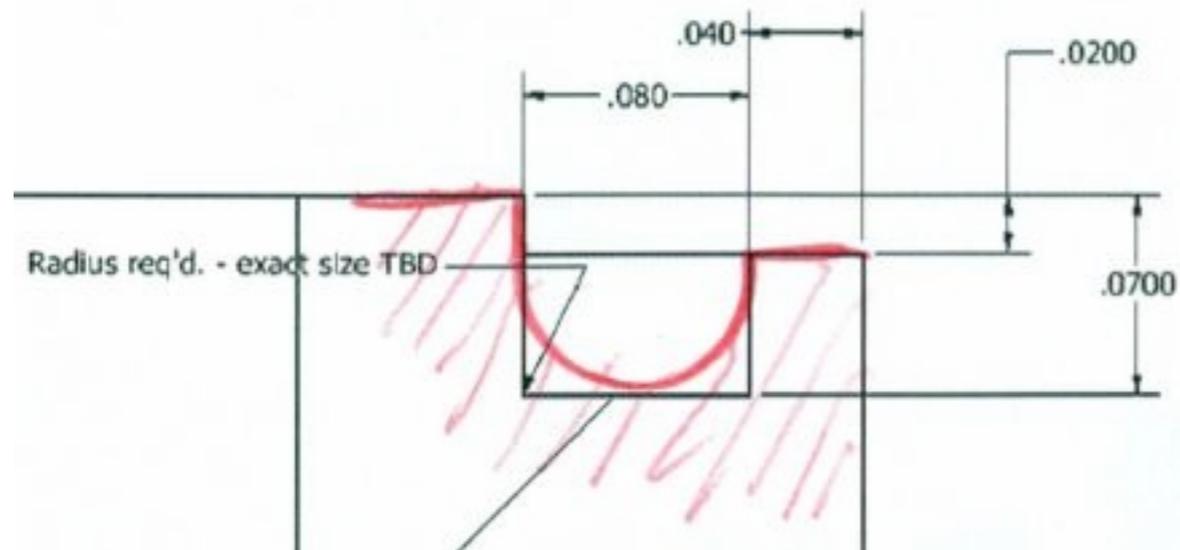


and with top window

Bob Wagner, Argonne, LAPPD2 DOE Review, 18 Dec 2012



Glass Body – Modified for SSL

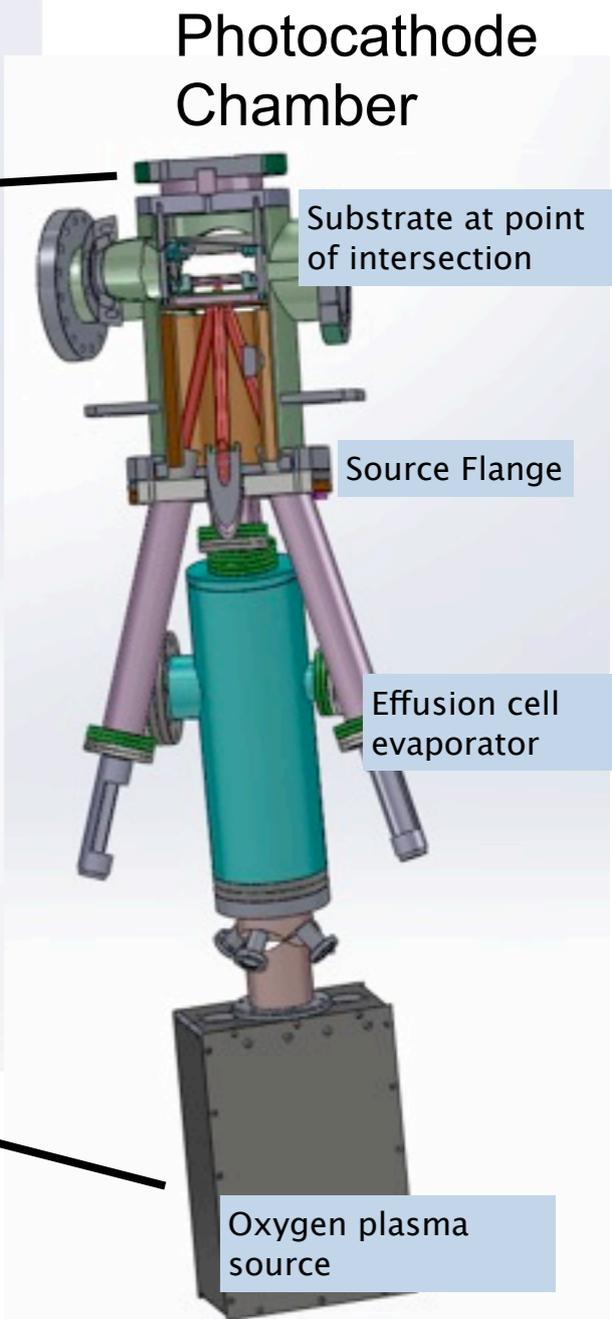
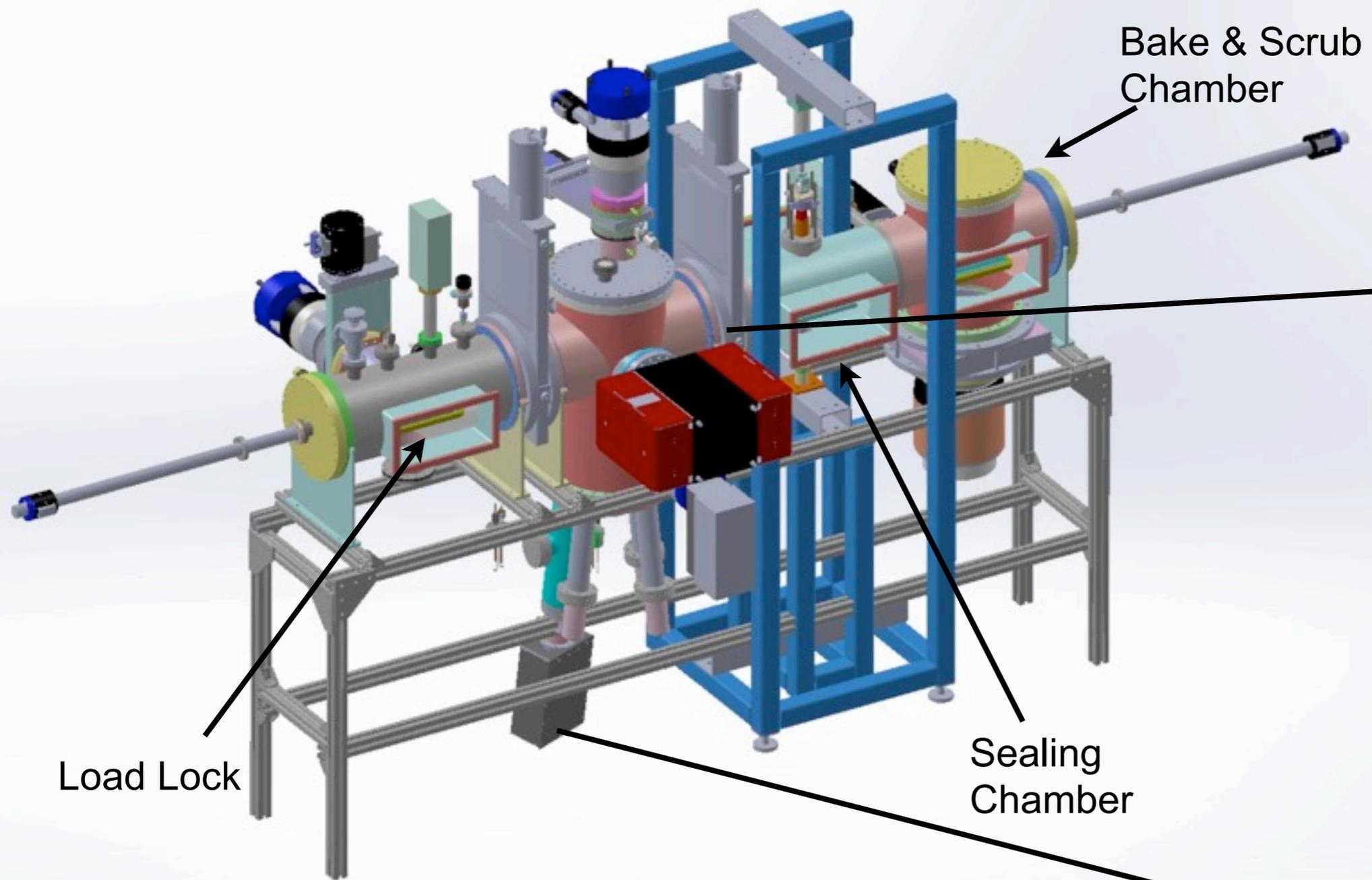


Design Drawing - September 2010



Groove modeled on SSL ceramic body design well. Bare glass indium well coated with Inconel and Cu to effect seal

8" Single Tile Processing System at Argonne



Bob Wagner, Argonne, LAPPD2 DOE Review, 18 Dec 2012



Tube Production Plan for Next 3 Years

▶ Space Science Laboratory/Berkeley

- Year 1
 - First sealed ceramic tube. Process Development. Continue with 1–2 more ceramic tubes
 - First glass body tube.
- Year 2
 - Continued ceramic tube fabrication (2–3) & improvement/optimization
 - Continued glass body tube fabrication (1–2).
- Year 3
 - Ceramic tubes and/or systems customized for early adopter; 1 per 4 week cycle
 - Glass tubes by request

▶ Argonne National Laboratory[†]

- Year 1
 - Complete 8” Single Tile Processing System design, begin procurement and assembly
- Year 2
 - Complete assembly of 8” STPS, demonstrate individual processing steps (sample handling, photocathode shoot, baking & scrubbing, tube sealing)
 - Fabricate first 8” glass body tube
- Year 3
 - Establish routine production ramping up to 1 tube/2 week cycle

[†] need sealed-tube facility manager with phototube production experience



Tile Costs

| | 30 | 1,000 | 10,000 | 100,000 |
|-------------------------------|---------------|-------------|-------------|-------------|
| Top Window | \$60 | 55 | 45 | 40 |
| Sidewall | 110 | 80 | 70 | 65 |
| Anode Base | 50 | 50 | 40 | 30 |
| top/mid Grid Spacers (2/tile) | 145 | 90 | 85 | 80 |
| bottom Grid Spacer | 90 | 55 | 50 | 50 |
| MCP Substrate (2/tile) | 1225 | 800 | 800 | 800 |
| Getter material | 60 | 40 | 40 | 40 |
| ALD of 2 MCPs | 1160 | 625 | 625 | 625 |
| Photocathode material | 350 | 250 | 230 | 200 |
| Materials Subtotal | 3250 | 2045 | 1985 | 1940 |
| Readout (60 chs) | 9900 | 2000 | 1500 | 1000 |
| TOTAL | 13,150 | 4045 | 3485 | 2940 |

Legend

Actual Cost
 Estimate
 Guess
 Totals

Compare materials subtotal plus guess at labor cost for large quantity to commercial cost of 2"×2" MCP-PMT

