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Large Area Photodetector Development:

Mechanical Assembly and Sealing

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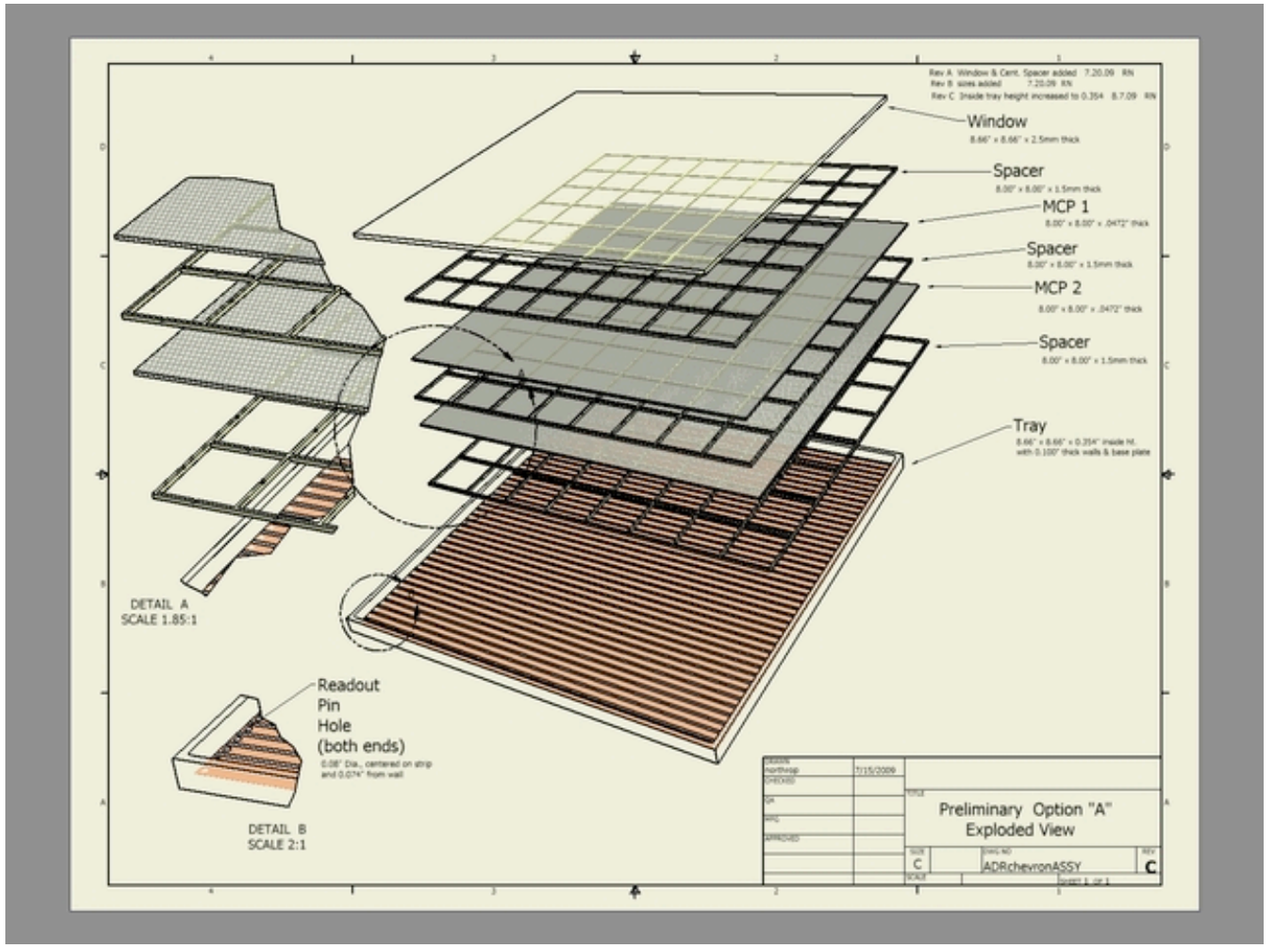
LAPD Mechanical Assembly & Sealing: Requirements

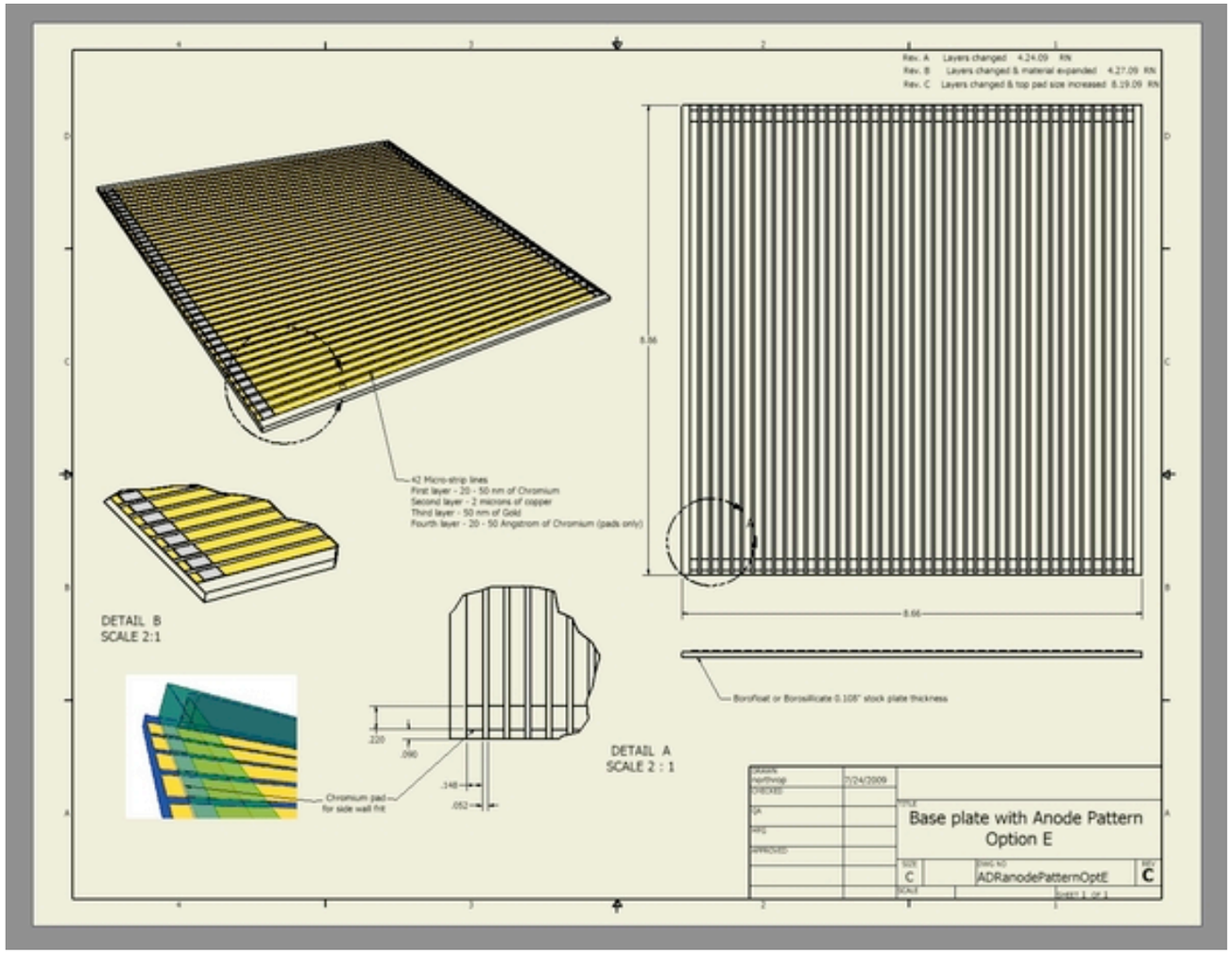
- Maintain 50Ω impedance of readout strip line for precision timing (few picoseconds)
- Avoid damage to photocathode throughout assembly process
  - load-lock transfers
  - thermal processing
  - chemicals and outgassing
- Maintain integrity of microchannel plate, strip line, and spacers during transfers and assembly
- Vacuum tight sealing of outer “envelope” across uneven surfaces of varying composition



Concept of components & assembly: one of several alternatives

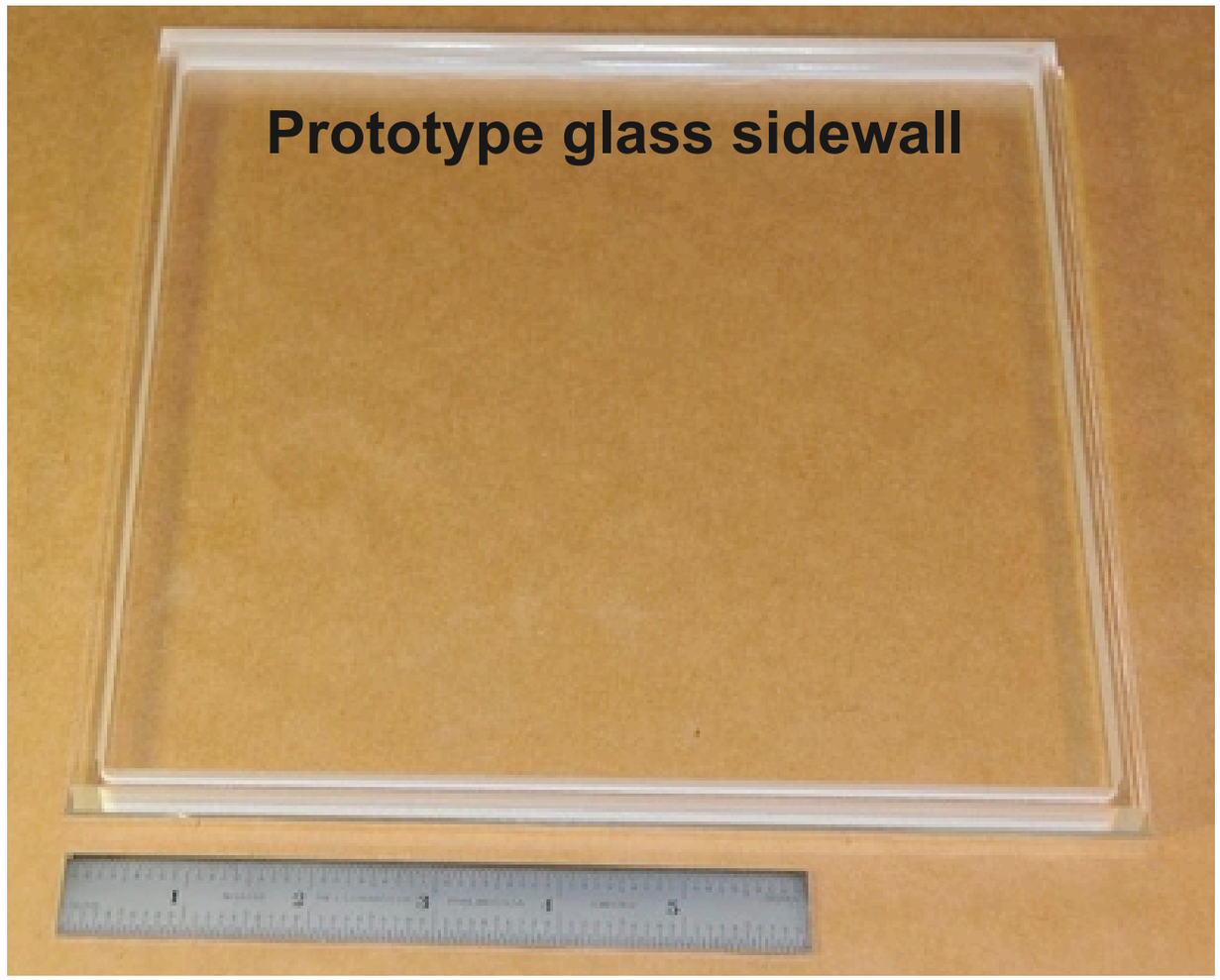
Strip Line Fabrication

- Adherence to glass or ceramic
- Compatible with photocathode material?
  - Copper -Argonne
  - Silver - Argonne, local vendors
  - Silver/Palladium - SSL
  - Gold
  - Chromium overlays for glass bonding - Argonne
- Application technique
  - Sputtering - Argonne
  - Evaporation - outside vendor
  - Photochemical machining
  - Silk-screening - contact with vendors
- External connection
  - Strips extended through outer body
  - Strips connected to penetrating pins
  - Metal plating through vias - SSL



Vacuum Container Options

- Top glass plate with photocathode is separate assembly in all options
- Two concepts for bottom and sidewall:
  - Bottom and sidewall fabricated as single piece (ceramic, glass, kovar)
    - *Probably requires through pins or plated through vias*
    - *Advantage: only top plate seal*
  - Bottom plate with strip lines extended for external connection; separate sidewall (glass or ceramic)
    - *Requires bonding sidewall frame to bottom plate over strip line*
    - *Advantage: straightforward method to getting signals out*
- Studying frits and intermediate glass for bottom to sidewall seals in second option: Univ. of Chicago, Minotech, SSL, Argonne



Photocathode and Top Plate

- Have an existing solution -- Berkeley Space Science Laboratory (Ossy Siegmund)
  - Fabrication of bialkali photocathode in vacuum as part of bakeout cooldown process
  - Indium seal of glass to ceramic sidewall
- Top plate seal plan is to use indium for any of the overall assembly options
- Beginning discussions/study to handle photocathode and assembly in pure (inert) gas environment
  - Demonstration would provide means for batch assembly for volume production
  - Less expensive solution for assembly -- glove box vs. vacuum chamber
  - Potential Challenges:
    - *Transfer handling -- movement from vacuum to controlled atmosphere; vacuum "suitcase"*
    - *Is baking required after sealing and evacuation of photomultiplier? Could bialkali pc survive?*
- Alternative photocathode materials that might be more robust -- GaN family, GaAs family, ...

Mechanical Assembly & Sealing Summary

- Actively studying several options for MCP-PMT assembly and sealing
- Concentrating on option with separate sidewall and bottom plate; strip line extended through vacuum seal. Will pursue as long as it continues viable.
- Continuing with researching and costing one piece tray options.
- Experimenting with several techniques for fabricating strip lines on glass.
- Working on ideas for spacer pieces: grid, “1-d” rods, “0-d” dots
- Discussion of photocathode handling in pure gas atmosphere is at an early stage. Emphasis is on logistics of producing test samples and equipment to transport them.
- Physical models being constructed to help identify problems, inspire better techniques