INCOM

Bright Ideas in Fiberoptics

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Dear Andrew,

It was a pleasure speaking with you on Tuesday evening, and discussing our mutual interest in life testing Incom supplied LAPPD in your facilities at University of Texas, Arlington, as initially proposed by Dr. Helmut Marsiske.

As I explained during our conversation, we are still at an early stage in commissioning our pilot production facility. I am pleased to report however, that since our Tuesday evening conversation, we have now confirmed that the tile fabricated on September 14th, was in fact our first successful fabrication of an LAPPD, albeit, one with an Aluminum photocathode! Tile #9 was designed as a test to confirm whether bialkali photocathode over coating onto the critical indium sealing surfaces was contributing to prior sealing problems. The tile was completed Tuesday late afternoon, and testing continued into the evening until about 7PM. When we spoke, I reported test results that were encouraging but somewhat mixed. A fresh start Wednesday morning, and redoing some of the electrical connections to the detector tile, convincingly demonstrated that the tile is functional, at a level consistent with our expectations for the Aluminum photocathode. The immediate course of action is to set-up to do more comprehensive testing of that tile, confirming, among other things, the sustainability of tile vacuum over time. Meanwhile, preparations are already underway for LAPPD #10, which will incorporate a bialkali photocathode. While this result is extremely encouraging, and one that represents a considerable milestone for our team, we are mindful that we still have a ways to go before we will be making tiles on a routine basis, and have them available for life testing. My intent with this letter is to put that accomplishment in context and provide you with some guidance on when we might realistically be ready to call upon you for long life testing support.

Our progress on infrastructure and process development has been steady. In the 2½ years since beginning construction in April 2014, a first-rate pilot production infrastructure has been created, starting with nothing. A talented, experienced team of scientists, engineers, and technicians was assembled enabling MCP and LAPPD process development commissioning trials to begin in December 2015.

No technical roadblocks or insurmountable barriers have been encountered since commissioning trials began in December 2015. Development trials progressed as follows: a) Routine operation of Incom integration & sealing tool operating at 10^{-10} Torr, b) demonstration of a repeatable 203mm X 203mm ALD-GCA-MCP fabrication process, c) sidewall to top window sealing trials, d) photocathode deposition trials, e) mock LAPPD assembly and sealing trials, followed by f) nine fully integrated LAPPD fabrication trials. Eight leak tight indium top window seals were made achieving a major program goal. Seven K_2NaSb PCs were deposited on 8”X8” widows with QEs that varied from 1% to 12% @ 365 nm and 190C (equivalent of 20-22 QE at room temperature). Evolutionary optimization, as practiced in pilot operations, has proven to be an effective strategy for identifying & resolving technical issues, including the following: MCP functionality, photocathode QE, HV stability, HV connectivity, optimized stack height, improved leak integrity, and use of fused silica windows.

Advanced LAPPD Development, funded by the Department of Energy (DOE), targeting application specific needs relevant to anticipated high energy physics (HEP) needs, and reduced cost, is progressing at the same time:

- ALD-GCA-MCPs with Enhanced Life Durability
  - Development of Incom’s C14 glass
  - Virtually no alkali elements
  - Dark counts 10-25 X Lower vs. conventional MCPs
  - Improved signal to noise (S/N)

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- Curved ALD-GCA-MCPs for Terrestrial & Space Compact Instrumentation Applications (NASA Funding)
- GEN II Ceramic Package LAPPD™
  - Ceramic Body - enables fabrication of a generic detector tile
  - Capacitive coupling of detector signals – gives end users the option of specifying the design of the signal output
  - Option for strips or pads on the outside
- ALD-GCA-MCPs with reduced, near-zero TCR
  - Allowing their use over very wide temperature ranges

A transition from "commissioning stage" to "exploitation" and routine pilot production is expected shortly after identified component and hardware improvements are implemented and process experience is gained! Improvements currently being implemented include: improved UHV window transfer hardware, enabling down pressure application during sealing, and improved window cleanliness & masking for optimal PC QE and preservation of seal surfaces. ALD-GCA-MCPs (203mm X 203mm) are being fabricated routinely and are available for LAPPD use or for purchase. Incom remains on-plan to deliver prototype "all glass" LAPPDs to early adopters in QIV of 2016.

Taking all this together, and your own inputs regarding your schedule plans, my sense is that sometime in the second half of 2017, we anticipate producing a standard LAPPD suitable for life testing. I look forward to working more closely with you to work out a specific plan for accomplishing this, including how our own measurement team could benefit by learning some of the methods you employ.

Sincerely,

Michael J. Minot
Director, R&D

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