Homework Questions Day 2

1. If the 8" MCP photodetector technology were (for whatever reason) not to materialize, but developments continue on smaller size MCPs using the same technology, what would be the likely impact on future HEP experiments? On other fields?

Answer to Question 1:

It really boils down to cost per unit area. Experiments in HEP tend to be large, and the cost of MCP's has precluded their use except in specialized low-area applications, or in applications where there is sufficient funding to pay a large premium over PMT's (such as Belle, which is paying ~8K$ per square inch to Hamamatsu). The least-expensive MCP-PMT's currently available are the 2" Photonis Planacons, which cost about 11K$ each. While the hollow core/ALD technique will lower the cost of the MCP's themselves, the main costs are still in assembly, testing, QC, and the yield of the cathode/seal, and so the price is unlikely to come down by a big factor per unit.

The way to drive down the cost, we believe, is to make the area per MCP-PMT unit as large as one can subject to mechanical and vacuum-system issues, as many of the fixed costs are per unit. The 8"-square LAPPD tubes are equivalent in area to 64 of the Hamamatsu 8K$ tubes, and 16 of the 11K$, and in quantity should cost less on a per unit basis. A smaller unit costing close to the same will have less advantage, and hence fewer adopting applications.

The collider and fixed target systems we have been considering require 10-30 square meters of coverage; an Optical TPC for a near neutrino detector, for example, would require more. Many HEP applications would be prohibitively expensive.

Lastly, to get the cost down will require adoption by other fields, possibly including neutron-detection and medical imaging. In both these cases the companies with whom we have had contact are excited by the disruptive aspects of the large area. As one moves the devices close to what is presently available generating interest, and investment, in the effort becomes more difficult.

2. Provide a plan for reduced scope and/or extended schedule for the R&D program in particular alternative funding scenarios. For each case indicate the impact on deliverables/milestones relative to what was presented in the review, and provide a brief rationale for your prioritization.
    a. Funding at 80% of request
    b. Funding at 50% of request.

Closeout

- Performance over the previous 3 yrs of the R&D period has been excellent.
    - Progress has been impressive
    - Potentially revolutionary technology (ALD+MCP)
    - Most milestone have been met
    - Significant infrastructure and expertise has been developed to prepare for next stage
- Collaboration should do more work to develop partnerships with end users for specific early applications
    - Develop science drivers which flow down to specs for performance requirements
    - Prioritize delivery of first articles to these early adopters
- Outreach to industry has been exemplary
    - Keep up the good work
    - Having more partners would be helpful
- Engagement of younger scientists in the project very encouraging
- Committee was impressed with the success of a truly interdisciplinary collaboration – setting a good example for others to emulate
- Prioritization will be critical for the next stage, without losing completely the long-range R&D
    - Previous management approach is too lightweight for next stage
    - ANL should take a larger and more proactive role
    - Near-term priority should be production, testing and implementation of first devices
- Assuming success of the first devices, further development of infrastructure to produce devices is recommended
    - Management should develop a staged strategy that can adapt to funding reality
- Continue to perform due diligence on legal and patent issues.