Mini-review of the RICH, October 14, 1995 (DC meeting, Oak Ridge)
November 27, 1995

Hideki Hamagaki gave an overview of the RICH status, and discussed in detail the status of photomultipliers (purchase, tests), the HV system and the front-end electronics, as well as the financial situation. The RICH had a mechanical design review September 12, 1995 in Brookhaven, and part of the material (along with some new results) was presented by Tony Frawley. Tom Hemmick discussed the cooling of the PMTs, an issue raised at and after the mechanical design review in September.

Below is a list of the topics addressed and the actions to be taken.

Gas vessel. A 1/8 scale model of the vessel has been built in cardboard.

Gas system. At least one more layer of defense has to be added to prevent human errors, namely, to prevent the vessel to be filled with methane after being exposed to air. (It should be impossible to do this without first flushing with nitrogen.)

Windows. The entrance window is 8.4 m2, the exit window is 21.6 m2, one single piece. It is agreed upon that the window material will be kapton with some additional layer to prevent UV light leakage. The permeability of a 5 mil thick aluminized kapton foil held between neoprene gaskets is low enough to keep even helium contained. The two most urgent issues to address are:
1/ welding of kapton sheets together (there is no known source of single kapton sheets big enough to cover the windows)
2/ to test if the (welded) windows can actually withstand 4 times the operating pressure (required by safety). The estimated operating pressure is .5 inches of water.

Mirror. Specification for the acceptable slope error of the mirror is less than .5 mrad. The second prototype mirror (30 mils thick) had a maximum slope error of .46 mrad and an RMS error of .26 mrad. Keep the powder dry, and let us see what happens at replication.

Alignment. Detailed specifications for the PMT, mirror and vessel alignment were presented. Alignment marks are planned to be put on the bottom corners of the vessel. The mirrors will be aimed with 0.5 mrad accuracy to the vertex. This is more stringent than the accuracy dictated by physics (which is closer to 2 mrad), but seems to be feasible. The mirrors are aligned without the PMT-s at place, on the other hand the weight of the PMTs may cause a sagging of about 1 cm, which corresponds to about 0.5 mrad disalignment.

Strongback. Tom Hemmick discussed the cooling of the photomultipliers with the current design of the "strongback". This was a follow-up of some concerns raised on the September 12 mechanical review. Using vacuum grease (no outgassing) to enhance heat conduction between the strongback and the base-plate reduces the temperature gradient to about 1 °C between the base-plate and the PMTs and in my opinion it is fully acceptable. However, a serious design effort and small modifications of the strongback are needed to show that the strongbacks can be serviced (PMT-s can be replaced replaced) safely. The biggest danger is that by any part getting loose inside the vessel the mirror at the bottom can be damaged. Stony Brook will probably produce the first design by Mid-December.

Real estate on the side of the vessel. A tentative layout of the feed-throughs, HV modules, PMT preamplifiers and cable-routing on the sidewall of the RICH vessel is needed very soon. This is important in order to check for possible integration problems.

Photomultipliers. 3000 PMTs will be delivered by the end of JFY 95. All have been tested in the factory for our specifications, rechecked by the RICH group and part of the tubes have been re-tested. The quality is good. Depeding on the VGA range some preselection (grouping) of the tubes may be necessary, as well as some "burning in".

High Voltage. The RICH group has to make a decision on the HV supply. Currently DC-DC converter manufactured in Japan is forseen (about $ 500/16 channels), but the group is interested in some generic PHENIX HV supply. This would save money and make the programming of the slow control simpler. There is at least six month time to decide, during which time a quote and at least one module of the generic HV should be obtained and tested. Also, prototype high voltage feed-throughs have to be built and tested.

Calibration, monitoring. Calibration and monitoring schemes are right now largely on a conceptual level, much more work is needed. (On the other hand we can take advantage of some of the EMCal experience, where the status of monitoring is much mroe advanced.) Monitoring of gas flow, temperature, leaks, *etc.* has to be worked out.

Trigger. The group will have to study the suggested new LVL1 trigger scheme and based on simulations pass judgement if it is acceptable or not.

Finances. Japanese funding is secure until the next JFY (starting April 96) and probable afterwards. However, fluctuations in the yen exchange rate may do us harm. The most pressing issue is that we need at least $ 1M next year, in order to stay on schedule with the vessel. Should we have financing problems, in a worst case scenario the suggestion is still to build both vessels including the entire mirror (highest priority) and defer some part of the instrumentation. In this case the first thing to go are readout channels, next are part of the phototubes.

Front-end electronics. The FEE will follow the more advanced EMCal FEE as closely as possible. The design has been discussed with ORNL the week before the DC meeting. Clearly, much more work is needed here.

PHENIX sector test. The RICH vessel is too big to be reasonably included into a PHENIX sector test. However, it would be possible to build an additional, smaller vessel that could house part of the mirror and of the phototubes. In building an additional vessel money is more of an issue than manpower. I would strongly advocate to build such a small vessel. Large parts of our physics program depend vitally on the RICH (and its cooperation with the EMCal) as electron ID and trigger. Even if LVL1 is not ready by the time of the sector test, proper analysis of the data could teach us a lot about how the trigger would work in PHENIX. There are ongoing discussions on that question and a proposal includig cost estimates will soon be presented to the PHENIX management.

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