



ANSWERS TO HOMEWORK QUESTIONS FOR THE EIC-RICH (RD2013-4)

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Q2: Please explain how the research in the area of LAPPD detectors can be more coordinated between the various proposals and thus minimize the amount of duplication.

- The project shares common interests with two other proposals regarding the research of LAPPD detectors: RD2013-5 (TOF) and RD2011-3 (DIRC)
- **RD2013-5 (TOF)**
 - After discussion with the RD2013-5 (TOF) group, the RICH working group will focus on testing the performance of LAPPD particularly related to imaging, and leave the detailed testing of time resolution to the TOF working group. The RICH group will then only use the existing DAQ setup at JLab to carry out the tests and does not require funding for the PSEC4 readout. In addition, the LAPPD collaboration has agreed to provide small LAPPD units free of charge. The RICH group will also leave the development of the pixelated pad readout to the TOF group.
- **RD2011-3 (DIRC)**
 - While writing the proposal, the RICH group has already taken into the account the availability of the high-B testing facility set up by the RD2011-3 (DIRC) group at JLab. While we still need to provide manpower to carry out the field test of the LAPPD, no special funding for equipment is requested for this subject and the operation and maintenance of the such a facility will be provided by the DIRC group.

Q1: The proposal lists a broad spectrum of R&D areas. Please explain in more detail the timeline of the work proposed in each research area, who will do the work, where it will be carried out and how the efforts will be coordinated.

Q3: Given existing manpower on the project and limited resources available, please prioritize the funding request.

- Following pages show the detailed time line for the project, and the tasks are highlighted with different priorities using colors
 - **HIGH priority:** must have to initiate the program, required by following tasks
 - **MEDIUM priority:** like to carry out as early as possible
 - **LOW priority:** less time-critical, can be postponed to a later time

Simulation

- Coordinated by Jin Huang (BNL/10%) and Yi Qiang (JLab/10%)
- Carried out by a JLab postdoc (25%) , Liang Xue (GSU/25%) and a GSU graduate student (50%) with support from Zhiwen Zhao (ODU/10%)
- Take place at individual home institutions
- Year 1 (FY2015)
 - Implementation of optical components in MEIC-GEMC, simulation in stand alone mode to study requirement on optical qualities of aerogel and Fresnel lens
 - Evaluate response to physics events, such as phase-space and occupancies
 - Estimate background levels in a realistic EIC environment
- Year 2 (FY2016)
 - Evaluate different readout schemes: strips or pads
 - Pattern recognition
 - Conceptual design

- Coordinated by Yi Qiang (JLab/30%) and Robert Wagner (ANL/10%)
- Carried out by Carl Zorn (JLab/20%), JLab postdoc (45%) and a UTFSM graduate student (50%), Jingbo Wang (ANL/20%) with support from JLab detector group on LAPPD's R&D (0.3 FTE total for year 2)
- Tests take place at JLab using existing testing facilities. Fabrication and R&D at ANL using LAPPD R&D facility
- Year 1 (FY2015)
 - Bench top tests of the applicability of LAPPD for the RICH readout
 - Photon detection efficiency, position resolution, rate capability
 - Radiation hardness, magnetic field effect
 - Time resolution
- Year 2 (FY2016)
 - Improve LAPPD's performance in rate and readout ambiguity

Photosensitive GEM → Photocathode

- Coordinated by Hubert van Hecke (LANL/10%) and Douglas Fields (UNM/10%)
- Carried out by a UNM postdoc (50%), a UNM graduate student (100%) and Matt Durham (LANL/10%). Combined test with LAPPD with be supported by ANL.
- Take place at UNM using the CHTM facilities
- Year 1 (FY2015)
 - Development of thin layer semi-conductor photocathodes
 - Study of Bi-alkali photocathode in gas
- Year 2 (FY2016)
 - Tests of GEM and LAPPD with new photocathodes

Aerogel Tiles

- Coordinated by Marco Contalbrigo (INFN/10%) and Yi Qiang (JLab/10%)
- Carried out by a JLab postdoc (30%) and JLab summer students (20%)
- Take place at JLab
- Year 1 (FY2015)
 - Setup a test stand, acquiring aerogel samples
 - Characterization of aerogel samples
- Year 2 (FY2016)
 - Feedback to manufactures to improve aerogel performance

Items can be cut from Year 1 Budget

- Desktop computers: \$ 4k
- Travel budget related to simulation: \$6k
- Material costs for LAPPD unit: \$20k
- PSEC4 readout for LAPPD: \$5k
- GEM kit: \$10k

• Total saving: \$45k (\$309k → \$264k)