Evaluation of LDRD Proposal 2018-LDRD-5: Generation and Characdterization of Magnetized Bunched Electron Beam from DC Photogun for JLEIC Cooler (Riad Suleiman and Matt Poelker)

1. *Is the project innovative and does it have high scientific and/or technical excellence in one or more of the forefront areas relevant to the DOE missions?*

   It is highly innovative. Electron bunched-beam cooling of the ion beam is a requirement for the proposed electron-ion colliders. Use of a magnetized beam will improve the effectiveness of the cooling and aid in achieving high luminosity. This proposal is a well-defined start on the path to ion cooling with a magnetized beam, and a high current magnetized beam has never been produced and characterized.

   It has high scientific excellence. The results would demonstrate a technique that can improve cooling effectiveness by 1-2 order of magnitudes. An existing beam line in the FEL test lab is used to measure and characterize magnetized beam from a high-voltage 350 KV DC photogun. A solenoid is added to the gun that uses an innovative alkali-antimonide photocathode. Skew quadrupoles and instrumentation are added that will be able to test and validate round-to-flat beam transformation. High current gun R&D aligns well with forefront areas relevant to DOE missions – in particular with the DOE stewardship of accelerator science and the Nuclear Physics missions.

2. *Does the project align well with or enhance JLab's Strategic Goals?*

   Yes, magnetized bunched beam electron cooling is one of the remaining uncertainties in the JLEIC design. Theoretically, it has been shown that magnetized beams are part of the solution and demonstrating that such beams can be produced is central to the lab's strategic goals.

3. *Is there a clear, high impact deliverable by the end of the funding period?*

   Yes, the deliverable is production and characterization of high current magnetized beam. First magnetized beam is expected in October 2016, and so far the rate of progress in installation and preliminary beam tests has been impressive.

4. *Can the project's aims be completed within the timeline and budget limits (i.e. are the human, technical and financial resources adequate)?*

   All of the indicators are positive; the project has achieved excellent results in the first year while remaining on budget. It is reasonable to expect that the level of performance will continue to be high.

   Dr. Mamun Abdullah has recently graduated and he has been identified as the optimal candidate to carry out this project as a post doc and with the support and guidance of the PI. The 2-year post-doc term will start in October 2016, assuming continued funding of the LDRD. The planned procurements and installation have been executed according to the plan in 2016.

5. *Is there any aspect of the project that isn't clear from the written material provided or any aspect that has high technical risk?*

   No

6. *Is there a reasonable probability that timely "follow-on" funding will result from the project in the proposal? (e.g. incremental DOE/NP funding, a patent and tech transfer, a new work for others project, etc.?)*

   It is possible that a continuation of this R&D activity be funded in the framework of the upcoming increased NP EIC R&D Program.

Comments: The comparison of progress against the goals that were established should be tightened up. The first year is only 2/3 through so it is to be expected that not all goals would have been completed already. Beyond the LDRD period, this proposal, with extended scope, has the potential to attract NSF funding if a university collaborator joins the effort

Recommendation: The Committee judged this to be an *Outstanding* Proposal that should be funded.