ELECTRON-ION COLLIDER DETECTOR ADVISORY COMMITTEE

Report of the 7th Meeting held on Monday and Tuesday, 21 – 22 July, 2014

BNL, in association with Jefferson Lab and the DOE Office of Nuclear Physics, has established a generic detector R&D program to address the scientific requirements for measurements at a future Electron Ion Collider (EIC). The primary goals of this program are to develop detector concepts and technologies that are suited to experiments in an EIC environment, and to help ensure that the techniques and resources for implementing these technologies are well established within the EIC user community. The initiator of the program was Tom Ludlam, who has also been the driver and coordinator since its inception. Tom Ludlam has stepped down and the committee wishes to express its sincere gratitude for initiating this important program and his able management. Thomas Ullrich has taken over from Tom Ludlam to lead the program.

The EIC Detector Advisory Committee met at BNL on July 21 – 22, 2014, to review four new proposals, seven progress reports with requests for continued funding and three progress reports without request for funding. The Committee members are: M. Demarteau (ANL/Chair), C. Haber (LBNL), R. Klanner (Hamburg), I. Shipsey (Purdue/Oxford), R. Van Berg (U. Pennsylvania), J. Va'vra (SLAC), G. Young (JLab). I. Shipsey was unable to attend the meeting due to a conflict that arose at the last minute with the annual meeting of particle physics PIs in the UK. At the previous meeting the committee made a request to learn more about designs for polarimeters and luminosity monitors, and how they could be integrated into the machine lattices proposed. The committee notes that the community has responded to this request and one of the new proposals was for the design of a Compton polarimeter.

Thomas Ullrich, the new program manager, reiterated in his opening remarks that the NSAC subcommittee on Scientific Facilities ranks an EIC as absolutely central to its ability to contribute to world-leading science in the next decade. In April, 2014 the NSAC, chaired by Don Geesaman from ANL, was charged to produce a new Long-Range Plan with a "Resolution Meeting" in the March – April, 2015 timeframe. The EIC will play a major role in the planning process. He also noted that the current detector R&D program was very well received by the community and the Office of Science and that there are many outstanding R&D issues that remain to be addressed in order to achieve the physics performance metrics.

General Remarks

The proponents are to be congratulated on the generally good quality of the talks, the focus of the work reported on key problems, and in particular on the extensive efforts to obtain the many results reported. The reports demonstrated in most cases responsiveness to prior charges and comments as well as ongoing dialog among proponents of similar technical solutions. To increase the reviewability of the proposals and in an effort to make the program more effective, the committee would like to repeat a few statements from previous reports:

Proposals need to include a well-articulated motivation for the research, which should include a description of the technologies currently being used, what the technical limitations are, and how the proposed research will advance the current state-of-the-art and what physics program it will enable. Tables of performance requirements with a discussion of how the resulting detector specifications will produce a detector that meets the physics goals would be most helpful.

Proposals should note whether the concept can work at eRHIC and/or MEIC, since the crossing rates are markedly different, and should also note whether the IR designs proposed are presenting any particular challenges for proposed physics measurements.

Proposals should be as definitive as possible. When resources are requested proposals should state where the resources would be located and the specific responsibilities of the personnel. When graduate students and postdocs are required, the proposal should state who would supervise them.

Proponents are encouraged to form research consortia with a well-defined, targeted scope of research.

The Committee notes that the timescale for CD-0 approval of an EIC is several years out, and establishment of a formal reference design for the chosen accelerator complex would be expected to occur 1-2 years beyond that. The opportunity and time horizon exist now to attempt R&D projects, which carry a higher degree of risk, yet hold the promise to advance the state of the art significantly. Proponents are encouraged to explore more innovative ideas.

The committee also notes that the intent of this R&D program is to provide seed funding for promising research proposals that after a couple of years can be sustained on independent external funding. Proponents are encouraged to explore opportunities for external funding once their research program has been established.

This review was particularly challenging because the funding request exceeded the available funding by factor of 2.5, worsened by the fact that part of the allocated money is not available due to prior hiring commitments. The charge to the committee was to provide a prioritized ranking of proposals and, for the larger proposals, provide a prioritized ranking of subtasks within a proposal. Table 1 lists the funding requests and the budgetary obligations due to prior commitments. In the next section the committee's evaluation of each proposal and progress report will be given. Recommendations are in the form of a ranking in the range from 1 to 4. A ranking of 1 means full funding recommended; a ranking of 4 means no funding recommended. For the remaining projects a ranking was assigned to subtasks within a project with a ranking of 2 or 3. Tasks recommended receiving funding have a rank of 2; tasks recommended to be deferred until funding is available have a rank of 3. An overall summary is provided in Table 3 at the end of the report.

Project	Request ($)	Prior Commitment ($)
A proposal for Compton Electron Detector R&D	125,000	0
EIC Proposal for R&D of Micromegas Detectors	201,700	0
EIC Proposal for a Scalable, Deadtime-free, Trigger-less Readout Scheme	256,100	0
Zero-degree high-precision hadronic calorimetry	32,000	0
RICH detector for the EIC'S forward region particle id.	264,000	0
R&D Proposal for (Sub) 10 Picosecond Timing Detectors at the EIC	269,000	120,000
DIRC based PID for the EIC Central Detector	115,000	68,975
Design and assembly of fast and lightweight barrel and forward tracking prototype systems for an EIC	349,000	0
A Compact Magnetic Field Cloaking Device	39,500	65,000
Status Report and Proposal for EIC Calorimeter Development	213,900	135,000
RD6 Tracking/PID Consortium: Progress Report & Funding Request	244,000	0
Development of a Spin-Light Polarimeter for the EIC: an Update	0	
R&D for an endcap TOF and TRD for identifying electrons at EIC	0	
Progress report and Proposal for an electron polarimeter a luminosity monitor and a low Q2 tagger	135,000	135,000
Total	**2,244,200**	**523,975**

Table 1: Funding request and prior commitments

RD2013-5 R&D Proposal for (Sub) 10 Picosecond Timing Detectors at the EIC
(M. Chiu reporting)

Work on pico-second timing is well motivated in the context of EIC and a clear and informative presentation was made in support of this proposal. After the January 2014 review the Committee made a number of suggestions to this collaboration. In particular the Committee advised to limit work on front-end electronics as premature, and to focus on general detector optimization studies. The expectation at that time was that physical samples, sought for testing, might not be available on a short timescale.

Six months later the situation looks somewhat different.

- As advised, work on the front-end electronics has been stopped and an existing component set has been identified and budgeted for.
- Technical attention focuses now on both LAPPDs and RPCs as two alternative approaches.
- Smaller (6 cm) LAPPDs appear to be available from Argonne on the few month (from now) timescale. But the chance to substantively modify them, to explore other options, remains remote, due to multiple requests to the facility.
- A post-doc at UIUC has been hired, apparently now to work on hardware studies of RPCs.
- An FTE student is proposed to work on theoretical studies of RPCs with the aim of optimizing them for <10ps performance.

Furthermore, it seems that some convergence has been reached with the parallel efforts on LAPPDs in the context of the RICH proposal (Yi et al.).

Generally the Committee would support efforts, which maximize breadth and avoid redundancy. It would be best to see as much learned on as many areas as practical within the constraints of funding and available samples/resources.

So what seems like a doable and well-targeted program given the constraints?

- General detector and optimization studies should be done.
- Collaborate with RICH/JLab group on basic LAPPD characterization studies.
- Post-doc efforts towards the eventual application of new photocathode materials.
- At a somewhat lower priority look into the pad readout options for LAPPDs – because the technical modifications needed are likely to lag behind the photocathode work.
- Theoretical studies of RPCs – which will apparently be well supervised – are viewed very favorably but you are encouraged, as you indicated, to seek additional funding for this.
- Make best use of your post-doc already in place at UIUC to balance the proposed work on mRPCs and efforts towards the LAPPD aspect.

In 6 months we will be happy to hear about progress on all these fronts but hope also that the groups interested in PID will find a way to configure themselves as a broader consortium, as the tracking and calorimetry groups already have done.

A Proposal for Compton Electron Detector R&D
(D. Gaskell reporting)

A written proposal has been submitted, and an oral presentation given by D. Gaskell

It is noted that quite some effort is required to understand the content of the written proposal. The oral presentation was clear and gave information on polarimetry beyond what was written in the proposal.

The aim of the proposal is to participate in the JLAB Hall A Compton polarization measurements for electron energies between 2.2 and 11 GeV, demonstrate the feasibility of a ~1% accuracy measurement, develop detectors which can stand the high rates and radiation dose required for the EIC, and compare the integral with the event-by-event methods.

Funding for three years with a total of 465 k$ is requested to support a graduate student, travel, detector procurements and the construction of a vacuum chamber and Roman pots.

In the proposal a clear presentation of the requirements in terms of bunch-to-bunch accuracy, time in which this accuracy has to be achieved, radiation dose in the sensor, and last but not least the rate required to achieve these goals are missing. The committee notes that colliders are repetitive machines and the fate of different bunches is not obviously guaranteed to be the same, due to bunch interactions with the machine structure and dependencies of emittance growth and instabilities on bunch charge. Some study is warranted here, even if the bunch crossing pattern allows all combinations as in MEIC.

The background, as shown in Fig.1, which does not yet include synchrotron radiation, is alarming, and demands a detailed study and efforts to find ways how to reduce it.

The requirements for bunch-to-bunch accuracy of the polarization measurement are essential, but have not been specified. An evaluation of rates and the development of a scheme, which satisfies the requirements for bunch-to-bunch accuracy of the polarization measurement, are essential. A further study of the backgrounds and efforts to find ways how to reduce it, have a high priority.

For 2015 the study of different sensor types (diamond, quartz and micromegas) is proposed. For all these detectors plenty of information is available in the community, beyond the one given in the proposal. Once the detailed requirements are known, and additional information on the different sensor types is acquired, the proponents should decide which one to pursue if any.

The committee considers a high-quality polarization-measurement program essential for EIC and supports the idea of a "Compton polarimeter test bed". It recommends that the detailed requirements on polarization knowledge be worked out and the resulting detector specifications evaluated, for both EIC machine designs. A close contact between the other groups working on EIC polarization and the machine experts from both EIC machine designs is strongly encouraged.

At the present state the committee does not see the need to study different sensor types, but sees an urgency to come back with a significantly improved proposal at the next EIC-R&D meeting. The committee does not recommend financing of the proposal at the present time.

EIC Proposal for R&D of MicroMegas Detectors
(D. Hasell reporting)

This new proposal requests support to develop the technology and expertise to produce MicroMegas detectors at the MIT-Bates research and engineering facility. The proposal as presented was substantially modified from the submitted proposal through the elimination of the plan to develop a lithography facility at MIT-Bates, as described in an addendum to the proposal. The proponents instead decided to work with and rely on the company Tech-Etch to make the detectors and rather focus on alternative approaches to assembly and readout and concentrate on optimizing micromegas design and performance.

The proponents have a long history in the development of wire chambers and GEM detectors and have broad expertise in other detector technologies. The group also has access to excellent mechanical and electrical engineering and facilities such as machine shops and clean rooms. Interesting ideas to improve on the current MicroMegas designs were presented.

The Committee was impressed by the expertise and knowledge of the proponents. Providing a domestic facility for the production of large-area detectors can be very beneficial for the whole community. At the same time it is noted that this is a long-term investment, to be sustained over a long period. The value added over existing R&D efforts was not well defined. Moreover, MicroMegas are already a relatively well established technology and given the timescales of the EIC detectors, more forward looking developments, though inherently more risky, could lead to higher returns.

The Committee greatly appreciates the efforts of the proponents and recommends that more input is obtained from the physics community for the need for such a facility and specifically see the EIC physics needs articulated for the construction of such an R&D facility for MicroMegas detectors. Decision is deferred until the broader needs of the community and the long-term sustainability of such a facility are confirmed.

RD 2013-4 Forward RICH Detector (New proposal)
(Y. Qiang presenting)

The committee expects to see a realistic and detailed MC simulation of the Cherenkov angle resolution as a function of various forward RICH detector options. This simulation should focus on a few examples, which are closest to a likely geometry choice in the EIC detector, which should be coordinated among other participants in the EIC development. The MC simulation of the Cherenkov angle resolution should include modeling of the state of the art of various technologies, including several Aerogel options, the DIRC-like option à la forward Panda RICH, various gaseous radiator choices, as well as various detector options. The MCP-PMT simulation should be coordinated with the ps-TOF group's simulation efforts and Argonne lab MCP builders, so it is as realistic as possible both in terms of likely performance and limitations. The people involved in the MC simulation should contact corresponding experts in other experiments doing similar work in Belle-II, Panda, and other experiments. The experimental evaluation of the MCP-PMT is very important and it should start when the LAPPD MCP tube is available. This effort, after agreement with Mickey Chiu, we understand will be centralized at JLAB. The work on the photosensitive photocathodes at the Univ. of New Mexico is very interesting, potentially very significant for the future of RICH detectors and should be supported. The Aerogel experimental evaluation is also very important to do in the future, but should wait until the funding is clearer.

The committee fully supports the simulation studies and encourages the proponents to consult with other scientists working in this area to make the simulations as realistic as possible. The development of different photocathodes and the experimental testing of LAPPD tubes is supported when funding is available.

Zero-degree high-precision hadronic calorimetry
(C. Hyde and J. Hauptman reporting)

The authors lay out the physics case for including a calorimeter at zero degrees at an EIC and enumerate several physics programs that would benefit from detection in particular of neutrons going very forward. Such a device can be located indeed at zero degrees with respect to the collision axis and some 10-40 meters distant in both lattices under consideration, both the MEIC and eRHIC. There is adequate transverse space between the separating beams to locate a calorimeter that is both large enough in the transverse direction as well as deep enough to ensure good hadronic shower containment and thus potentially good energy resolution up to 100 GeV or more. The authors advocate in particular using a so-called "compensating" calorimeter to ensure uniform response between electrons and hadrons as well as good linearity and Gaussian resolution.

The authors note that the DREAM calorimeter has upcoming beam tests with one goal in particular being to improve transverse shower containment. The DREAM device uses both quartz fibers to collect only Cerenkov light from electrons/positrons and relativistic hadrons, and scintillating fibers to collect light from all charged particles. First tests of the DREAM device showed an encouraging ratio of electron to hadron response and good linearity but only modest energy resolution, attributed in particular to incomplete transverse shower containment. The upcoming beam tests will add significant mass around the central module and include high-speed digitizers to separate various light components. The Iowa State group is constructing part of the added mass in the form of copper-fiber matrices with well-controlled mechanical tolerances. The authors request only travel funds at this time to enable their participation in the beam tests.

The Committee asks the authors to work out the required calorimeter specifications with respect to energy and position resolution, photon, pi-zero and hadron separation to reach the EIC physics goals and to investigate the needed radiation tolerance of a Zero Degree Calorimeter at an EIC and the dose, which can be tolerated in particular by the scintillating fibers. The Committee also asks about factors affecting the constant term in the energy resolution, particularly calibration accuracy. The Committee recommends the earlier papers on compensating calorimeters, particularly the R807 copper-uranium calorimeters noted in Fabjan and Ludlam's Annual Review article and references therein, and the devices deployed at HERA and the uranium-scintillator zero-degree calorimeter used in WA80, which also addressed shower containment, as well as the ZDCs employed at RHIC to tag spectator neutrons.
The Committee also encourages the authors to approach the other groups working on EIC detectors and physics proposals and explore with them the inclusion of a ZDC in their overall concept.

The Committee does not recommend funding at this time but encourages the authors to work out the required specifications for EIC physics, join with larger groups as noted above and to develop a design tailored for use at an EIC.

EIC Proposal for a Scalable, Deadtime-free, Trigger-less Readout Scheme
J. Bernauer and J. Stevens reporting

The proposal covers the full range of DAQ features from generalized front ends through data collection and event building into trigger filtering calculations. The architecture presented was generic and likely to be applicable to many possible classes of EIC detectors. Nevertheless, the proposal already includes some assumptions that might not be compatible with all classes of plausible detector (for instance that one time scale is appropriate for all sub-detectors). While it is true that for a full detector design it is very valuable to co-develop the DAQ and Front End systems, at this stage of uncertainty in a final detector design, data rates, control needs, trigger data selection algorithms and so forth the effort seems premature. In any event, the initial requirements for a successful DAQ system should be driven from the FEE and physics sides and from there the co-development can proceed. The digitization rates, time-extent and number of samples, and probability of event overlap vary by up to two orders of magnitude among technologies being discussed, and thus require some consideration whether one architecture can be adapted to accommodate all.

In addition, one might reasonably expect that advancements in FPGAs, processors and other digital functions in the next few years may well change the details of any reasonable DAQ implementation even if the high level blocks look similar to the ones presented in this proposal.

The committee does not recommend funding this effort.

RD 2011-3 DIRC-Based PID for EIC
(P. Nadel-Turonski reporting)

The committee agrees that it is important to concentrate on the MC simulation of the optics at this point in the research program. Indeed, the lens solution, originally proposed by the Panda group, is a very elegant technique to create a very good DIRC. Specifically, one should calculate the Cherenkov angle resolution as a function of various design parameters to develop a good judgment for the design. However, the lens uses complex glasses at present to achieve a higher refraction index compared to the fused silica. This brings a very real danger that it will be easy to damage such a glass by a radiation. Therefore we encourage the group to take a few samples of these glasses and subject them to 5-10krad of ^{60}Co radiation in order to weed out wrong paths as early as possible (for example, the early DIRC studies had one sample of fused silica, which turned completely black after only 10 krad of ^{60}Co radiation). This would be a very important contribution to the DIRC field. The experimental evaluation of the MCP-PMT is very important and it should start when the LAPPD MCP tube is available. The effort, after agreement with Mickey Chiu, will be centralized at JLAB. It is, however, more important to set the correct roadmap at this stage, which can only be done using the simulation. We encourage the group to continue collaboration with the Panda group.

The committee recommends funding this proposal at the requested level.

RD 2011-6 Tracking and PID for an EIC Detector
(T. Hemmick reporting)

The presentation covered a long list of significant accomplishments over the past year – notably the test beam work at FNAL including the 1m RICH detector and large area GEM detectors of a realistic trapezoidal shape in several different readout configurations. The tests seemed thorough and gave very good results in most cases and hinted at possible improvements in others. Several of the large area designs were novel in one or more ways and the collected data, after correction and calibration show promising resolution numbers and good pattern recognition power in the more complex designs. The collaboration has also looked at reducing ion feedback in GEMs combined with MicroMegas and a mini-drift chamber GEM which gives vector information and which allows for good resolution at high incidence angle.
The collaboration proposed improvements to the present large GEM designs for readout at inner radii. The collaboration is to be commended for joining with other EIC GEM efforts to use a domestic supplier of a common foil design to reduce NRE costs.
The collaboration presented a novel layered gating grid design for a large TPC to reduce ion backflow. The idea is interesting, but it was not shown via simulation or calculation that ion backflow would be a significant problem at an EIC detector. New members of the collaboration also propose looking into the SAMPA chip being developed by a Brazilian group for ALICE.
The committee strongly supports the ongoing efforts to understand and optimize forward GEM detector designs for a generic EIC detector. However, it is not obvious that the very clever gating grid concept is actually necessary for an EIC TPC and it is not clear from the time scale presented in the written proposal that the prototype full SAMPA chip will be available for test in FY15. As a side note, the collaboration also plans to test the VMM2 chip from BNL as a possible chamber readout solution. However, the time scale for the VMM2 is clearly outside of the FY15 budget window.

The committee recommends partial funding for the BNL, UVA and FIT groups and delay the funding decisions on LLNL and Weizmann funding until a clear case can be made for the gated grid in an EIC context and until availability of workable readout chips is demonstrated and a detailed test plan is presented.

Status Report and Proposal for EIC Calorimeter Development
O. Tsai reporting

A detailed written status report has been submitted, and an oral presentation was given by O. Tsai.

The report highlighted first results from the beam test at FNAL from test modules for the EIC-Barrel-EMCal, the STAR-Forward-Upgrade-EMCal, and the EIC-HCal. These results are encouraging and also point to the need of some improvements.

First results from a prototype fiber-tungsten-plate prototype were presented but additional test beam measurements are required. Promising results with the SPACAL were obtained and future effort will be consolidated to develop the SPACAL calorimeter.

Recently, two BSO-crystal from SICCAS were delivered and first results on the light yield were shown. A beam test, possibly of a 3x3 array with new BSO crystals, is planned for Nov. 2014 at CERN.

The Committee appreciates the good progress. It also notes, however, that hardly any progress has been reported on the Monte Carlo simulations for both detector design and physics to develop detector requirement specifications and physics capabilities for a comprehensive detector at an EIC. Given the manpower and resource situation, a prioritization is required. It notes that the accordion plate design has been abandoned; the committee concurs with this decision

***New proposal*:**

Within the Calorimeter Consortium a new proposal on calorimetry using $PbWO_4$ was submitted. Its goal is to evaluate by simulation and prototyping the performance that could be reached with a $PbWO_4$ calorimeter at an EIC, and, together with PANDA@FAIR and NPS@JLAB, collaborate with Crytur towards the production of high-quality $PbWO_4$ crystals.

In spite of the fact that only a first-order background estimation for the EIC machine designs is available, the committee is of the opinion that a more quantitative and complete set of specifications with respect to radiation hardness, light yield, required optical transmission, uniformity of response and stability, etc., is required for the crystal optimization. Given the large experience with crystal calorimeters, this should not be too difficult.

The Committee strongly supports the development of $PbWO_4$ calorimetry in collaboration with PANDA and NPS, and recommends the funding as requested. It suggests that the radiation damage studies of $PbWO_4$ crystals should be made as soon as crystals from Crytur, even if they are of small dimensions. The proponents are asked to present at the next meeting an updated list of crystal specifications and their impact on calorimetric performance at an EIC detector. In addition, alternatives to $PbWO_4$ should be considered as fallback solution. Given the expected

interaction rate of 200 kHz, there are a number of options, for which there are no supply problems.

Status Report on A Compact Magnetic Field Cloaking Device
N. Feege

A status report has been submitted and an excellent oral presentation given by N. Feege.

Highlights of the recent work are:

- Measurement of the properties of the superconducting (sc) tape, and the observation of flux diffusion with logarithmic time dependence.
- Optimization of the sc cylinder fabrication.
- Establishing a method to measure the permeability of ferromagnetic test samples, and to tune the permeability by mixing Al and Fe powders followed by rolling.
- Measurement of the field in and around the sc cylinder.
- Construction of a 1.3 m long cylinder, and preparations for tests in a low energy proton beam at Stony Brook.
- Demonstration of near to complete cloaking at a field of 10 mT.

The progress has been excellent. The committee reminds the authors, that some of the questions from the time of the first proposal are still open:

- Thermal effects due to accidental beam dumps in view of structural damage.
- Radiation hardness of the ferromagnetic and superconducting materials.
- Effect of a possible cryostat and its flanges on the detector acceptance and performance at small angles.
- Quantitative study of the physics benefit for a conceptual forward dipole spectrometer.

The proponents request $39,500, mainly for sc tape.

The committee is impressed by the rapid progress of this exciting project, and also appreciates the strong involvement of students. It is looking forward to answers to the remaining questions posed at previous meetings, the results of the prototype measurements, the design of a realistic cloak prototype for tests in a beam line at BNL, and the exploration of possible other applications of the magnetic cloak.

The committee fully supports the funding request.

Progress report and Proposal for the Design and assembly of fast and lightweight barrel and forward tracking prototype systems for an EIC
(B. Surrow and M. Posik reporting)

The committee was impressed by the progress made on both Micro-Megas and GEM detectors for possible barrel and forward tracking systems. The detailed optical characterization of single mask GEM foils is clearly of great benefit to improving quality control by the manufacturer. The development of a close relationship with a commercial vendor is likely to be of service to the community at large. The identification of a second polyimide vendor with material (Apical) superior to Kapton is also an important contribution to the performance potential of commercialized GEMs. Both the small (10 cm) and large (50 cm) foils produced by the vendor exhibit superior uniformity and very low leakage. The work on large area GEM foils is very promising and the joint work with FIT and UVA on defining an EIC plausible design is commendable.

The barrel MicroMegas work at SACLAY is very impressive and good progress has been made in a number of challenging areas. The work to date and plan forward on readout is sensible as is the simulation work – the material distribution studies are quite tantalizing.

The committee strongly supports the GEM work but given the present funding outlook gives the MicroMegas work a lower priority.

Progress report for Proposal for an electron polarimeter a luminosity monitor and a low Q^2 tagger
(E. Aschenauer reporting)

A status report has been submitted and an excellent oral presentation given by E. Aschenauer.

The presentation started with an overview of observed bunch-to-bunch variations of the polarization of electrons at HERA and of protons at RHIC, and their impact on the accuracy of physics measurements. The conclusion is that a precise measurement of the time dependence of both electron and hadron polarization, possibly on a bunch-to-bunch level, is essential for the EIC program.

The main part of the report presented the progress on the simulation of polarized Bremsstrahlung, on the interaction region design including the positioning of the luminometer, the polarimeters and the small angle taggers, and on the IR integration into the eRHIC simulation framework.

The committee takes note of the excellent progress.

The committee is also of the opinion that a note should be made available, in which the influence of bunch-to-bunch differences in polarization, emittance and bunch charge on selected physics measurements is discussed.

RD 2012-11 Spin Light Polarimetry
(D. Dutta reporting)

Dipangkar Dutta gave an update of the work on spin light polarimetry by phone. The heat load from synchrotron radation (SR) was identified as a significant challenge. Furthermore, the position of the collimators would interfere with accelerator operations. A new scheme has been developed to use the bending magnets that are part of the current lattice and an implementation for the MEIC was presented. The large distance between the magnets and the 20 mrad bend angle allows for a set of collimators that can separate the SR fan from each dipole. With this new design, the photon energy peaks in the range of 10 keV range, which opens allows the use of standard position-sensitive X-ray position detectors employed at X-ray sources, e.g. an x-ray CCD with 1 μm resolution. The expected asymmetry, however, is at least one order of magnitude smaller than the previous experimental configuration. Options for eRICH are being studied.

The Committee was pleased with the progress. The options that the new design enables, however, prove to make the measurement even more challenging. The proponents are encouraged to keep exploring the parameter space and thoroughly and convincingly address the various questions raised on systematics, precision and accuracy by this extremely challenging measurement.

No request for funding was made.

RD 2012-15 GEM-based TRD for Identifying Electrons in eSTAR
(M. Shao reporting)

The committee heard a report on the good progress of the GEM-based TRD work being carried out at BNL and USTC by M. Shao. The GEM chambers to monitor the TPC Tracking have been installed in the STAR detector and are performing well. The purpose of these GMT detectors is to monitor the TPC calibration, provide GEM based tracking and enable TPC and GEM tracking studies. Full analysis of the data is under way. Large-size GEMs have been constructed at USTC with a new self-stretching method. These chambers are under test at USTC. The group is preparing a first technical paper intended for submission to NIM A. The plan is to put similar GMTs in the STAR endcap and use the data to study tracking performance and impact of material budget. Simulations of the eSTAR options are continuing.

The group is to be congratulated on the excellent performance and the committee is looking forward to an update at the next meeting.

No request for funding was made.

Overall Funding Recommendation

Given the limited amount of funding available, the committee was charged to provide a prioritized list of projects to be funded. A ranking from 0 to 4 was used with the explanation of the rank given in Table 2. Proposals with a rank of 0 or 1 are self-evident. The remaining proposals were separated into subtasks and a ranking was provided for each subtask. Please note that all the rankings are provided without prejudice. The ranking is based on a balance between the success of the ongoing elements of a research proposal and the limited funding available. It is no judgment on the merit of the research.

Rank	Explanation
0	Funding not recommended
1	Full funding recommended, adjusted to overall funding level
2	First priority if funding is available
3	Second priority if funding is available
4	If funding available, reevaluate relative priority

Table 2: Rank explanation.

The two proposals "RICH detector for the EIC's forward region particle identification", PIs Hubert van Hecke and Yi Qiang, and "R&D Proposal for (Sub) 10 Picosecond Timing Detectors at the EIC", PI Mickey Chiu, show a lot of synergy and were discussed by the committee in tandem. For the forward RICH particle identification project, the simulation studies are fully endorsed by the committee to understand the potential performance of various detector options. The testing of the small form-factor LAPPDs was also given a rank of one, but funding should only be made available once prototype detectors are available. The committee also requests that the LAPPD testing which is common between the proposals by Yi Qiang and Mickey Chiu be centralized at JLab. The GEM photocathode work should be funded if resources are available and received a ranking of two. In view of many competing requests for funding, the aerogel was given a rank of four and the decision is deferred until the funding situation is better understood. The situation with the "R&D Proposal for (Sub) 10 Picosecond Timing Detectors at the EIC" is a bit more complicated since two postdocs, each at the 0.5 FTE level, are already working on the project. The committee supports the proponent's plans for LAPPD studies, but expects the work to be coordinated with the Forward RICH detector proposal. The committee also supports the addition of another 0.5 FTE of a postdoc and supports the multi-gap RPC hardware work. It is expected that some of the current effort will be redirected to the new high priority tasks. Given the limited possibility to change the design of the small form-factor LAPPDs, the efforts on the windowless UV-sensitive photo-detector work and the pad readout of the LAPPDs was given a rank of four.

The GEM work in the proposal "Design and assembly of fast and lightweight barrel and forward tracking prototype systems for an EIC", with Bernd Surrow as PI, is strongly supported by the committee and full funding is recommended. The MicroMegas work is given a rank of four without prejudice. The ranking is purely based on the current success in the area of GEM detector development and the limited availability of funding. It is not a judgment on the necessity or capability of the group to engage in the development of a central MicroMegas tracking system for an EIC detector.

The proposal by the tracking consortium was divided into three separate subtasks. The work on the Hadron Blind Detector is very promising and is recommended for full funding. The work on a layered gating grid for a large TPC to reduce ion backflow is very interesting. Given that it has not been shown that ion backflow would be a significant problem at an EIC detector it received a ranking of three. It is also not clear from the time scale presented that the prototype full SAMPA chip will be available for test during the funding period and thus, given the funding outlook, received a ranking of four. An overall summary of the recommendations is provided in Table 3.

Project	Contact Person	Request ($)	Rank
A proposal for Compton Electron Detector R&D	Alexandre Camsonne	125,000	0
EIC Proposal for R&D of Micromegas Detectors	Douglas Hasell	201,700	0
EIC Proposal for a Scalable, Deadtime-free, Trigger-less Readout Scheme	Douglas Hasell	256,100	0
Zero-degree high-precision hadronic calorimetry	Charles Hyde	32,000	0
RICH detector for the EIC'S forward region particle id.	Yi Qiang	264,000	
Simulation		55,000	1
LAPPD		50,000	1
GEM Photocathode (UNM)		84,000	2
Aerogel		75,000	4
R&D Proposal for (Sub) 10 Picosecond Timing Detectors at the EIC	Mickey Chiu	269,000	
mRPC (simulation)		34,000	4
mRPC (hardware)		84,000	2
UV sensitive MCP		66,000	4
LAPPD Pad readout		85,000	4
DIRC based PID for the EIC Central Detector	Pavel Nadel-Turonski	115,000	1
Design and assembly of fast and lightweight barrel and forward tracking prototype systems for an EIC	Bernd Surrow	349,000	
GEM		269,000	1
MicroMegas		80,000	4
A Compact Magnetic Field Cloaking Device	Abhay Deshpande	39,500	1
Status Report and Proposal for EIC Calorimeter Development	Huan Huang / Craig Woody	213,900	1
RD6 Tracking/PID Consortium: Progress Report & Funding Request	Klaus Dehmelt	244,000	
SAMPA		43,000	0
TPC/Cherenkov		126,000	1
Layered gating		75,000	3
Development of a Spin-Light Polarimeter for the EIC: an Update	Dipangkar Dutta	0	N/A
R&D for an endcap TOF and TRD for identifying electrons at EIC	Zhangbu Xu	0	N/A
Progress report and Proposal for an electron polarimeter a luminosity monitor and a low Q2 tagger	Elke Aschenauer	135,000	1
Total Request		**2,244,200**	

Table 3: Summary of the funding recommendations.