Report of the EIC Detector Advisory Committee
5th Meeting, June 5-6 2013

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.

On June 5-6, 2013 the EIC Detector Advisory Committee met at BNL to review eight progress reports that were presented concerning work from projects funded earlier; six of the reports also included proposals for additional funding, submitted in response to the fourth solicitation. Two reports from simulation efforts, one on detector response and one on physics events, were presented; both these projects are ongoing multiyear efforts. Two new proposals were also considered. The Committee did not this time have a report on the machine designs, but notes that it would still find benefit in a pedagogic exposition of the machine layouts and performance parameters. BNL management also presented a discussion on the inclusion of an Electron-Ion Collider in the deliberations of the recent NSAC Subcommittee on Scientific Facilities, chaired by R. Redwine, and on the expectations regarding the timeline for developing a new Long Range Plan for nuclear physics, in which an EIC could be expected to have a central place. The Committee members are: M. Demarteau (ANL), C. Haber (LBNL), R. Klanner (Hamburg), I. Shipsey (Purdue), R. Van Berg (U. Pennsylvania), J. Va'vra (SLAC), G. Young (JLab, Chair). I. Shipsey was unable to attend the June meeting.

General Remarks

The proposers are 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.

A report on the detector simulation effort, given by A, Kiselev, demonstrated that this effort is off to a good start and draws upon existing frameworks familiar to the community. The detector laid out in EIC Layout Phase 2 is being fully implemented, with steps included for simulation, digitization, reconstruction, and a first "PID" stage. The tools needed for specific detector simulations are being developed, with several examples of response studies discussed. The tracking tools are rudimentary at this stage, such that resolution can be studied, but as yet no track fitter is available, limiting for example the ability to study occupancy or vertex distributions. This area is the subject of upcoming planned work. First functions to support studies of the calorimetry for several possible technology choices are available. The magnet description can support designs either using a steel yoke or employing self-shielding. Toolkits for users for various aspects of PID are under development, including lepton E/p and RICH ring fitting. An example study of (x, Q^2) bin migration was given to show how various parts of the package already work together. The status of including machine backgrounds, both in time as well as space, was discussed as were plans for further work. The issues of releases, code management, user manuals and training, and interface updates were also addressed. While many further developments are planned, the progress to date is most encouraging.

The Committee notes, as it has before, that this as well as the event generator effort reported under RD 2012-5 (presented by T. Toll, discussed further below) will be a "decadal" effort and will need sustained manpower. Those presently engaged in setting it up can be expected to move on to larger responsibilities as detectors are defined and their construction undertaken and as careers progress. A dialogue that has been started by Lab management with the funding agencies can ensure a stable source of support for this effort. This will need to include computing experts who can address robustness of code and examine the same from maintenance and continuing support points of view, more so since one can expect continued evolution of the available computing environment.

The Committee notes the broad interest expressed in GEM detector technology and reminds the reader of its comments offered in the report for the last meeting, held in December 2012, and repeated here:

> The various groups should talk to each other even more.
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> Is GEM foil stretching causing a risk that some copper holes' edges develop cracks and cause breakdowns? One group demonstrated an automated CCD-based scanner for GEMs. Could this be used after foil stretching to inspect all holes? In this sense TGEM might be a safer and more long-lived technical choice as it is not stretched.
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> One should develop and then establish a standardized way to qualify GEMs for breakdown. One possible protocol could be to search for discharges using a 2D-scanning machine equipped with an alpha source; such an automatic machine would scan over all GEM holes, with the operator carefully monitoring current spikes.
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> We encourage groups to consider the use of at least 4-GEMs for single photo-electron detection in order to handle discharges better; initial studies of this by other groups were encouraging. Using 5-GEMs might yield even better performance; one might consider 5-fold GEMs in order to reduce the gain per stage, which would mitigate problems due to highly ionizing ions entering the chamber on occasion. An effort to study these issues with the simulation tools now being developed is of interest.
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> As an alternative to GEMs, one might consider using fast micro-channel plates. Recent development by H. Frisch, though still at an early stage, addresses 20cm x 20 cm MCPs which could have low cost/unit area. The advantages are that these are thick, can be coated, and have a precise hole pattern, which is potentially much "cleaner" for UV detection applications than G-10 or Kapton. Study is required to determine whether electrons could be extracted from the upper surface were it coated by e.g. CsI, else one might have to add a window coated by CsI and extract photoelectrons from that. A dialogue is encouraged.

A quick check might be done whether occupancies permit using, instead of a pad structure, a wire chamber with resistive wire readout and charge division.

In anticipation of proposals expected for the next meeting, the Committee does repeat a few statements from the December 2012 report. Most proposals took care to state the requirements to be addressed by the proposed detector concept. Proposers need to include a discussion and tables of performance requirements and then discuss how their resulting detector specifications will produce a detector that meets them. Development of reference detector designs by the community will help this by providing an agreed-upon set of requirements and how they change for different regions, e.g. barrel, e-endcap, h-endcap, and beamline regions. 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. This is an important part of an ongoing dialogue with machine designers. This discussion should expand in the future to encompass triggering needs, because these necessarily influence the design chosen. Proposers should also discuss specific responsibilities of personnel, more so since a specific R&D effort is often not the main activity of a given group.

Estimates of neutron dose, together with new measurements from the STAR IR, were presented by the calorimetry group, with an encouraging level of agreement noted; this can serve as a first threshold to rule out technologies that are especially radiation-soft. The Committee takes note of this nice result on a problem that will need sustained study. The community needs to develop the understanding of the radiation dose and occupancy expected for each of the two machine proposals. Simulations must eventually include the full environment, including all detectors, shielding walls and the accelerator structure for up to ±100m, to fully understand the dose. It appears the needed work to include this in the detector simulation package is underway. Detector proponents need to note the radiation dose their proposed technology can withstand and discuss where further knowledge is needed; this will require further effort by most proposers to date.

A general understanding of bunch-to-bunch variations of polarization and luminosity is still needed.

The Committee expects there may be further proposals concerning silicon tracking and vertex detector development. It may be that a multi-institute consortium, such as is forming for the calorimetry, will bring forward proposals in this area. The timescale for gaining the needed expertise for this technology, and for setting up local facilities to produce a tracking device to be installed in an EIC, is significant.

A few remarks about risk-taking seem appropriate. The proposals and ongoing effort represent varying levels of innovation relative to established state of the art. It does not seem unreasonable to observe that all projects now underway should result in buildable devices on the timescale of a few years. The Committee notes however that the timescale for CD-0 approval of an EIC does seem to be 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. At such a future time, detector proposals would need to mature and the scope of the R&D program in support of them would be expected to expand well beyond that of the present program, yet such latter day R&D would have a certain urgency to result in a buildable design that can be well estimated as to cost and schedule and thus might not have much of an exploratory aspect. In contrast, the opportunity and time horizon exist now to attempt R&D projects which may not *a priori* appear to have a high probability of success, yet would advance the state of the art.

RD-1 (RD 2011-1, RD 2012-14) Calorimeter Development for EIC
(C. Woody, reporting)

An excellent presentation was given C. Woody.

The EIC Calorimeter Development Effort covers four different topics:

1. W-powder/scintillating fiber compact SPACAL EMC calorimeter

Progress has been achieved by selecting the materials and placing the orders for the construction of the prototype modules this summer. In addition the voltage regulator for the temperature compensation for the MPPC (Hamamatsu SiPMs) has been built and its impressive performance demonstrated. The plans for this summer are testing the SiPMs and constructing the prototype, in order to perform a beam test in November 2013. The schedule is tight and, given a number of open points, probably optimistic.

The Committee takes note of the progress and is looking forward to the completion and first results from the prototype.

2. The W-plate accordion-shaped EMC calorimeter

Presented were problems in achieving the planned mechanical tolerances of the accordion-shaped W-plates, detailed measurements on fiber properties, the layout of the SiPM readout at the fiber end and a scheme of the temperature compensation for the SiPM. The latter is similar to the one described in 1. above, however its actual implementation is quite different.

The plans are to complete the studies of light-collection and readout with single and multiple SiPMs, and to build and test in a beam a new W-plate prototype with 7x7 towers. In addition, Monte Carlo studies to evaluate the differences in performance of accordion, tapered and flat W-plates will be performed.

The Committee takes note of the progress achieved and the difficulties of obtaining accordion shaped W-plates with the tight mechanical tolerances. It is looking forward to the results from the new 7x7 prototype and from the Monte Carlo studies of the differences in performance of accordion, tapered and flat W-plates. The progress with respect to the light yield determination and details of the SiPM readout is very much appreciated.

3. BSO crystal calorimeter

Significant progress and detailed measurements including first radiation-damage studies on high-quality BSO crystals was reported. However the yield of high-quality crystals still appears to be low. A further understanding is needed of crystal-growing conditions required to obtain high quality crystals in this case and how the techniques employed to date could be improved.

The proposed next steps are a beam test of a 3x3 BSO-crystal calorimeter and detailed simulations in order to optimize a crystal calorimeter for an EIC experiment. In addition, an R&D program on LYSO crystals is proposed.

The Committee takes note of the good progress achieved, and considers the beam test and the further optimization as high priority items. The R&D effort on LYSO is also considered of high, general interest but is considered as a second priority.

4. Monte Carlo Simulations

This topic was covered in the talk by A. Kiselev and is noted in the Introduction above as well as under the report for RD 2012-5 below.

Neutron background

In addition first results of a measurement of the slow-neutron background in STAR has been reported and a first comparison to simulations has been shown. They appear to agree within a factor 3 which is very encouraging.

The Committee considers this study as highly relevant and encourages further efforts on this topic.

The proposal requests a new budget of $112.5K to support effort at BNL and $75K to support effort at USTC.

The Committee supports the budget request for the tungsten calorimeter work at the full level. It supports an initial $35K for the crystal work, but recommends reserving the $40K requested for LYSO crystals at a lower priority, to be awarded only pending overall consideration of the budget for all projects.

RD-3 (RD 2011-3, RD 2012-7) DIRC-Based PID for EIC
(P. Nadel-Turonski reporting)

The Committee heard a well-presented R&D program looking at various FDIRC options in the broadest possible way. This is appropriate at this stage. In particular, we are interested in the solution with small lenses. One should include various optical elements carefully, including the glues, to simulate this problem correctly. It would not hurt to have a small optical bench test with a laser and a few optical elements to verify some simulation conclusions. The DIRC group worked hard to verify the radiation hardness of quartz and the glue. In fact, the epoxy is the weaker element from this point of view. Therefore any solutions such as BK7 glass should make sure that this point is addressed well before one would conclude that one has a solution. The Committee encourages various sensor studies, especially with SiPMT arrays. The Committee also encourages the first simulation attempts with FDIRC SuperB optics.

The proposal requests a new budget of $115K to support effort at JLab on readout and optics issues.

The Committee supports the budget request.

RD-6 (RD 2011-6, RD 2012-9, RD 2012-16) Tracking and PID for an EIC Detector (T. Hemmick reporting)

The committee received an update on the hardware development of the tracking and PID consortium. The construction of the quintuple GEM stack with a CsI photocathode and novel high quality UV mirror coating was completed and the chamber was tested with an ^{55}Fe source at Stony Brook. The chamber was subsequently tested in a beam in the SLAC End Station A. The running conditions were a zero-electron trigger fraction of 70%. The committee suggests running at a zero-trigger fraction of 90%, i.e. the likelihood of an electron being present of less than 10%. The nearly on-line results shown were very encouraging. Rings were clearly observed and the photon yield seems in agreement with expectation. The committee recommends understanding the source of the spurious hits, given that this is a test beam environment with no background. We note that it would have been very useful to establish a baseline performance before the beam tests were carried out. A laser scan to establish a 2D map of the single electron-uniformity of the response should be established under various HV configurations of the GEM stack, before the next test beam studies, although the Committee notes doing this with adequately small spatial resolution may not be possible, given the 40μ spacing between holes in the GEMs. The committee is looking forward to a complete analysis of the results at the next meeting; the Committee does take note that the run was completed just prior to the meeting.

The TPC & Hadron Blind Detector (HBD) detector thrust is concentrating on solving several fundamental problems in field sensitivity and gas choices. A setup to measure the mobility of positive ions has been built and relative ion mobilities of Ne- and Ar mixtures have been measured and are being compared to Garfield predictions. The results look encouraging.

The Forward Tracker effort has made progress in foil stretching and conceptual design of very large area readout schemes and has reconstructed tracks from small GEM chambers as well as tracks from a GEM with a novel “zigzag” readout scheme, both of which were operated in a CERN test beam. The design of the readout board is being advanced.

Unfortunately the TPC plus HBD will not be ready in time for this beam test. Overall the group is making excellent progress and continued support is strongly recommended.

The proposal requests continued support at the level of the "Year 2" request shown in the May 2012 presentation, plus an additional $27K to cover unexpected costs of the SLAC test beam run. The Committee supports this effort, as well as the on-going simulation work presented by Dr. Kiselev. The Committee recognizes that the funding request for this effort is substantial, and that some of the funds previously allocated are not yet spent (in part because of the timing of post-doc hires). We recommend that BNL management meet with the RD-6 leadership to develop a funding plan that optimally uses available funds to meet the goals of the collaboration."

RD 2012-3 Fast and Lightweight Tracking Systems
(B. Surrow and M. Vandenbroucke reporting)

The Committee heard a progress report on the development of fast and lightweight tracking systems and the design of large forward Triple-GEM chambers for intermediate tracking. An overview of last year's accomplishments was presented. The laboratories with dedicated clean room facilities have been set up at the university for the testing, characterization and construction of forward GEM tracking chambers. GEM foils have been characterized in terms of leakage current and optical uniformity and small triple GEM test detectors have been built. The DAQ and HV system is currently being set up. With respect to the MicroMegas development, the group has successfully assembled two flat CLAS12 MicroMegas detectors and tested them in a cosmic ray test stand. Tests of light-weight, low capacitance flex cables were also completed.

The goals for the current year are the design and assembly of planar triple GEM detectors utilizing light-weight materials, the design and testing of a new readout chip, and the further development of a commercial fabrication process for large area GEM foils and 2D readout foils in collaboration with Tech-Etch using a single mask manufacturing technique. The design of the triple GEM detectors has made very good progress employing the novel idea of kapton rings to minimize the mass and cost.

The group also plans on the development of a large prototype of a curved MicroMegas barrel tracking detector. It is noted that this effort will be carried out fully by Saclay. The effort will indirectly contribute to growing the expertise at Temple University but the collaboration should prove very beneficial over the long term. Further emphasis on building local expertise is recommended. The MicroMegas system has been proposed as an intermediate tracker for the barrel, which is different from the baseline EIC detector concept. Motivation for the choice of this technology and its advantages in physics performance would be welcomed.

The proposal requests $295K, of which $42K is for MicroMEGAS work at CEA.
The Committee supports this request.

RD 2012-5 Physics Simulations
(T. Toll reporting)

Two excellent presentations on the progress of simulations were given:

1. Update on EIC detector by A.Kiselev
2. Physics Simulations by T. Toll

In 1. major progress on the development of a general EIC simulation network using PandaRooot was reported. Best use is made of the FairRoot development effort. First results on tracking performance, the calorimeter simulation, and the solenoid model were shown. Resolution studies using the eic-smear package were presented and encouraging results obtained with respect to accuracy of the measurement of kinematic quantities. In addition, for each topic a concise to-do list was presented.

The Committee is pleased to see the significant, well focused progress and fully supports its continuation. It stressed again the importance that information on the background and radiation dose be obtained in a timely manner. This will require also to implement beam elements well outside of the detector, eventually to of order ±100 meters.

In 2. progress on event generators for the EIC was presented: The work on Sar*t*re has been completed, the corresponding publications written, and the documentation is well under way. The work on PYTHIA/DPM-jet, on the extension of CASCADE to eA reactions and the implementation of radiative corrections were also discussed.

The Committee is impressed by the significant progress and fully supports its continuation. In addition, it appreciates the approach of verifying the results of the simulations with data from the LHC, where possible.

The Committee also notes that ideas concerning how to assure the long-term maintainability of the MC programs, the code management and the quality control of the code, have to be developed. There, an important role of the EIC host laboratories is seen.

There are continuing funds, approved in earlier meetings, to support the ongoing simulation work, in the amount of $143K.

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

The collaboration has made significant progress in putting together a simulation of the proposed polarimeter and the plan for proceeding and the explanation of operation of the device are now much clearer. Nevertheless, several previous questions remain unresolved and additional significant questions were raised during the presentation.

The proposal and report addresses some of the questions raised earlier about the expected magnitude of systematic errors that might arise with the proposed polarimeter, but the derivation of and justification for many of the numbers in Table 1 remains unclear. This lack of clarity should be eliminated in any future proposal.

Figures 8, 9 and 12 present two different schemes for building differential ionization chambers, but only the Figure 9 design seems reasonably plausible to the committee. This requires clarification, and a future proposal would benefit by only showing designs which are proposed to be built.

In response to questions raised during the formal presentation, a synchrotron radiation power estimate was presented to the committee in a supplementary discussion. The power loss for an 11 GeV 3A eRHIC beam was calculated as 5.4kW – a number that grows rapidly with beam energy. A serious study of whether SR power losses on this scale are viable for either EIC design is needed before detailed work on an ion chamber or wiggler make sense. Consultation with machine experts is therefore a must.

While the general principle of having multiple methods deployed to measure polarization is certainly compelling, any such method has to show that it can provide complementary measurements that directly benefit the physics program. The rather long averaging time of the proposed device and the relative nature of the measurement call into question the direct relevance of the measurements for the physics program at an EIC. A more careful analysis of the benefits of this technique would be very helpful in motivating the proposed R&D program.
The committee recommends that the proponents continue to refine their understanding of the effect of the proposed polarimeter on both (or either) EIC machine design and, working closely with the machine designers, provide a clear statement of compatibility with at least one of the machine designs before proceeding with any prototyping or testing. In addition, the benefits of the proposed polarization measurements to the physics program need to be spelled out in some detail to provide convincing motivation for whatever burden a machine would face from SR power loses and emittance increases.

The committee recommends approving the requested travel funds ($10K) to enable in depth discussions between the proponents and machine and detector analysis experts. The committee does not favor investing in any hardware or employing a new post doc at this time.

The proposal requests $97K to support the effort.
The Committee recommends $10K to support travel to consult in particular with machine experts.

RD 2012-13 Pre-Shower Detector for Forward EM Calorimeters
(W. Brooks reporting)

A clear report on the progress of the proposal "Pre-shower Detector for forward EM Calorimeters" has been presented by W. Brooks.

Details were presented of the design and the status of the ordering of components, in particular of the MPPCs (Hamamatsu SiPMs), and of the design of the readout of the SiPMs. In addition, the results of attenuation-length measurements using the tagged gammas from a ^{22}Na source and GEANT4 simulations of the crystal array have been shown. The 625 crystals, (4mmx4mmx4.5cm, Saint-Gobain Prelude 420 ($Lu_{1.8}Y_{0.2}SiO_5$:Ce)) are available.

The planned work is the construction of the prototype, beam tests, exploration of tiling options, in simulation and hardware, exploration of methods of achieving U, V readout, and further simulation work.

The Committee appreciates the good progress made, however also notes that its earlier comments have been addressed only partially. In particular:

- It remains unclear if the concept can be developed into a large area pre-shower detector, and the question of the ambiguities has not been addressed.
- The performance of the concept in a real physics environment with emphasis on the shower separation in the presence of ambiguities has not been addressed

The detector simulation tools discussed earlier might be useful for this study.

The Committee notes that a timeline for the R&D was presented at this meeting.

The proposal did not request any new funds at this time.

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

This proposal addresses the development of detectors for electron ID in the forward direction using transition radiation in GEM chambers coupled with TOF and upstream tracking in the TPC.

In Dec 2102 the Committee stated:
In terms of questions and comments on the present status of work, the committee makes the following points:

1) Future presentations on this work would benefit from a written text summarizing the results and referencing the prior reports and milestones.

2) The committee heard a number of proposals for forward tracking and PID some using GEMs in a number of functions. It would be good to understand a) the extent to which these various efforts are in synergy, are mutually exclusive, utilize overlapping technology, are in some sort of collaboration already.

3) To what extent is the TPC tracking sufficient for this as part of an electron ID system or would additional tracking layers which are part of a larger GEM (or other) system have some advantage. Is there room?

4) What is the optimization of TRD, number of measurements, efficiency vs rejection, and other tracking layers in the available space?

5) The ATLAS tracking uses silicon followed by a straw tube/TR system. Conceptually there is some relationship to the present proposal. Can you learn anything from the ATLAS experience to help you better understand the usefulness or design of the system proposed here?

While not entirely covered, most of these questions have been addressed. We would encourage the collaboration to review this list again and confirm that as much as they feel relevant has been covered.

We note otherwise good technical progress and documentation has continued to come. The strong international collaborative aspect is excellent. In terms of issues to address for the next review, the committee suggests the following:

1) On page 25 a new small angle "Inner TPC (or other technology?) tracker is shown. This apparently adds ~30% hits to the tracks. The Committee requests more clarification about such small angle tracking. What would be the plan for this?

2) What will be the effect of additional inner sector TPC electronics on the performance of this and other downstream devices?

3) Consider the effect of moisture and dry-out on the long term behavior of TGEMS

4) Explore in more detail the tradeoffs between the TGEM approach and using more traditional foil-based GEMS instead. As a material G-10 remains a bit of a wild card particularly in large areas.

The proposal requests $89K in new funds.
The Committee supports this request.

RD 2013-1 Sensors for Calorimeters (New proposal)
(E. Kistenev presenting)

The prospect of edgeless or fully active planar sensors is attractive. Similarly the prospect of wider availability and a larger pool of foundries and vendors is attractive as well. While this proposal offers these prospects, it also raises some questions which the committee would like to see addressed before investing resources in this development. In addition the document submitted lacks clarity in certain regards and the committee would like to see that addressed.

1) The fundamental idea of adding engineered n+ doping at the edges seems to have potential, but an understanding of prior work in this area, and the topic of active edges in general, was not apparent.

2) The budget does not add up in a clear fashion; please recheck the numbers.

3) The strongest attraction comes if you can really "butt" these devices next to each other. In reality there will need to be ~few hundred microns space anyway in case of bad devices. Potentially also, even for guard-ring free devices there will still be some dead area around the edges – what is a practical estimate of this?

4) The claim that this innovation will lead to widespread availability of science quality devices from "any foundry" remains unsubstantiated. To make such a claim requires more evidence. Can you present the results of a reasonable inquiry?

5) In the case we would still need to go to traditional major manufacturers, for example HPK or Micron, to make these devices. Would they be willing to incorporate such structures and qualify the resulting devices for sale?

6) A considerable fraction of the proposed budget supports a post-doc. Clarify the roles this person will play in the project and what sort of qualifications would be sought in this person.

In addition to addressing these questions, we suggest the group make a study of the existing work in edgeless and active edge devices, and then come back in 6 months with a report, a revised plan, and a proposal.

The proposal appears to request $167K for this year.
The Committee feels the above background research needs to be done before proceeding to funding and will be interested to see a revised proposal.

RD 2013-2 Magnet Cloaking Device (New proposal)
(Abhay Deshpande presenting)

A magnetic cloaking device, which creates a field-free region inside a magnetic field without disturbing the field, is certainly an interesting idea to investigate. It could have many applications in the accelerator field if successful. The authors are investigating this problem using the COMSOL software. A question is if this software has already been used reliably for similar problems, and if there are questions related to how to operate it correctly. One should talk to an expert who has a real experience with this code for similar magnet applications. One should also work closely with an accelerator expert to check what is the effect of the end-field on the accelerator performance.
The dependence of the permeability on magnetic field used in the simulation should be checked, and if necessary verified by measurements.

One should also investigate thermal effects due to accidental beam dumps to see if one could damage the structure. In addition the radiation hardness of the ferromagnetic and superconducting material should be checked. One also should evaluate the effect of a possible cryostat and its flanges on the detector acceptance and performance at small angles. The next report should provide some quantitative study of the physics benefit for a conceptual forward dipole spectrometer.

The proposal requests $72K for an initial trial.

The Committee supports this.