Report on MEIC Review
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This report contains two parts: organizational issues and technical issues.

Organizational issues

MEIC is a facility involving several advanced accelerator concepts and technologies. The workload is heavy to bring it to construction. The progress made in the past 3 years is significant, but by a linear extrapolation is not sufficient to reach CD1 by 2016. In terms of manpower, I see three types of needs:

1. High level experts: The team is strong in advanced accelerator physics. For a sophisticated facility like the MEIC, no labs in the US can cover all the needed expertise, and JLab is doing fine in this respect. For what expertise still missing, active recruiting and active soliciting of collaboration with outside experts plus outsourcing will be necessary. This seems to me to be within the norm at this stage of the project.

2. Work force: However, the heavy workload also contains detailed accelerator physics and engineering efforts that are of the more routine type. The total integral of this type of work is very large. The management will need to find enough FTEs to cover this need. At present, the team has 6 FTEs. This is not sufficient. A careful evaluation of manpower is needed and that need is to be provided. My own guess (?) is perhaps 10 FTEs for the next 2 years would be minimum.

3. Technical leadership: At present, the team seems not coordinated very well in terms of technical leadership. Good progresses made in the past 3 years tend to be made by individual efforts, and not by coordinated directed efforts. These progresses, as good as they are, do not form a coherent overall design. Some of the design features show an unforgiveable lack of

coordination. This issue will be dealt with before reaching a credible design for CD0 and CD1 but time is very short. I am not sure if there are also personnel issues involved in the managerial structure in the past 3 years but I am suspecting so. Close attention including technical and managerial ones from higher level of management might be necessary.

There is an EICAC meeting planned on 2/28. There is little prospect to make much progress by that time. My suggestion is to concentrate on the following issues: (a) a manpower planning and time profile towards CD0 and CD1, (b) a comprehensive and complete list of the envisioned issues yet to be resolved, thus showing awareness of these issues and confidence that they will be addressed in time, and (c) resolve the RF scenario issue (see later). I single out the RF issue among the several technical issues here because I consider it more basic than the others and it particularly reflects a lack of project coordination.

Technical issues

Compliments must be paid to the several clever accelerator physics ideas: figure-8, the new crab cavity design, the universal spin rotator concept, the idea of circular electron cooler, etc. All of these are first rate ideas. On the other hand, to realize each of these concepts, several technical issues will need a deeper level of accelerator physics and engineering studies/tests. At present, the basic design is piecewise in nature, and not yet self-consistent and coherent as a whole.

There are many technical items that need attention. The JLab team is of course very much aware of them. I will mention only some that come to mind bellow.

- The circular cooler is one subsystem that contains several critical path items: the magnetized gun, the proof-of-principle test, the CSR and microwave instabilities, trustworthy Touschek simulations, fast kickers, etc. A well-directed planning of the cooler system will be critical, and it is not clear all

are consistent with the goal of CD1 by 2016. On the other hand, the cooler's success or failure can become a show stopper issue.

- Synchronization is another critical - although not a show stopper - issue. Its successful resolution requires a large amount of detailed studies, such as magnet movers versus detailed beam dynamics with displaced beam orbits. These issues can only be addressed by a large amount of detailed studies.

- Lattice designs so far are quite preliminary because no systematic study has been made to address nonlinear dynamics issues. IR layout, chromatic corrections, and schemes for matching the electron and the ion beams at the IP have not been designed.

- The idea of a universal spin rotator is clever, but it depolarizes strongly. Continuous injection is the solution being proposed to provide polarization >70%. I wonder if a better way might be to invoke spin transparency in the lattice design to make the rotators spin transparent. However, this will require more efforts.

- Injection process and the corresponding RF scenario is a critical issue (as Sergei Nagaitsev rightfully pointed out in the meeting). This needs to be reviewed, hopefully in time for the 2/28 EICAC meeting. Issues to be addressed include: (a) What is the beam gap requirements due to beam aborts, ions, eclouds, and electron-ion synchronization, (b) How are these gaps produced, (c) what are the various RF systems needed to produce those gaps.

- An effort should be made to reduce the 44 MV needed in ion collider ring. This can for example be reduced by lowering the momentum compaction, and can be a minor effort, although the saving on the RF voltage can be significant.

- A wideband feedback system has been assumed. It should be checked if the assumed feedback does not exceed the levels of the B factories. Also, B-factory experience should be sought to see if the total beam current can be maintained at 3 A even when the bunch gap is reduced by a factor of 2 compared with the B-factories.

- The crab cavity design is clever. It still is an R&D item, however, as it needs a couple of years development time.