Charge

1) Are there unknowns in the design that need more analysis?
2) Is the planned R&D appropriate, are there additional R&D topics?
3) Specify topics that need to be addressed before the next EICAC meeting end of 2010.

Questions and things to do

Comments

1) Very good that manpower involved in EIC has been increased, that outside experts from ANL and SLAC have been attracted for consultation, and that CASA has focused on this accelerator during recent months.
2) Hardly any technical R&D topics have been shown on the first day. The RF for BNL's coherent electron cooling was the only R&D topic mentioned.
3) The figure 8 ion ring design appears very flexible and a strong feature of the JLAB EIC.
4) The amount of effort appropriate to compete in a down selection with BNL in 2013 is on the order of at least 10 FTE per year. This is already apparent from the fact that the design and R&D has to compete with significantly more than 10 FTE preparing the BNL EIC design.
5) The collaborations with BNL on the RF of a coherent electron cooler, with ANL on low energy ion acceleration, and with Novosibirsk on ion polarization are very useful. Additional collaborations for spin manipulation, e.g. with the COSY accelerator, could be quite effective, particularly if the figure 8 design could be tested experimentally in the long run. A collaboration on DC electron cooling, e.g. with FNAL, and for pulsed electron cooling, e.g. with IUCF or Novosibirsk would be helpful. A collaboration with BNL on stochastic ion cooling would also be beneficial because this cooling type is currently not part of the JLAB EIC design. Furthermore, collaborating with someone knowledgeable about HERA design and operation would is recommended because lessens learned from HERA should influence the EIC design.

Topics to be addressed before the next EICAC meeting end of 2010

1) Lay out a clear argument for why a ring/ring collider is proposed rather than an ERL/ring collider. Alternatively, do not give up the linac/ring option yet.
2) Point out that the design with 5GeV electron energy starts with equal emittances and beta functions, but that this constraint will later be freed up for further optimization.
3) Make a list of possible advantages and drawbacks for high repetition rate of 1.5GHz, but keep the option for lower RF frequencies open.

4) Specify dominant instabilities and argue that they should be no more important than at other accelerators, e.g. PEP.
5) Make an early decision on whether to start with SRF or NRF in the collider. Identify the R&D items that come with that decision.
6) Develop a clear argument that the chosen beam parameters optimize the luminosity.
7) Establish 2-D ebeam-pbeam energy plots for several parameters: x and y emittances, betax*, betay*, x-y coupling, polarization time, and luminosity. All plots are to be done for ebeam, pbeam, and ion beams.
8) Calculations from different people need to be compared, e.g. there were two different numbers for Touschek lifetime.
9) There appears to be no solution for the frequency change during ramp from 20 to 60GeV. A solution has to be found before further review.
10) The space charge tune shift for cooled ion emittances has to be computed. The space charge tune shift of the electron cooler beam should be calculated. Study possible coupled two beam instabilities. The two ebeam must be rock steady. (Should there be a feedback for the e-cooler ring?)
11) IBS calculations with different formulas should not differ as widely as presented. Collaborators at ATF (KEK) or ESRF (Nash) may help to clarify this problem.
12) Work out the lifetime of the cooler cathode, and also of the JLAB cathode.
13) Work out the luminosity lifetime due to beam-burn rate.
14) Specify self-consistent parameters where electron cooling rates equal IBS emittance growth rates, or argue clearly why other parameters are presented.
15) Develop a clear list of constraints for the accelerator design that arise from detector requirements.
16) Crabbing subjects have not been presented. Parameter specification and simulation of crab cavities will be essential. And an analysis of chromatic beta crapping will have to be done also.
17) Tracking studies for the dynamics aperture of ions and electrons.
18) Long-term stability studies for polarized ion beams, including the acceleration process.
19) The working-point search will have to include more optimization criteria: (a) width of the good-luminosity region in tune space, (b) lifetime and halo production time, (c) lattice nonlinearities and dispersion, (d) crab cavities or crabbing waist, (e) damping due to electron cooling. (e) can be a study item for the longer term.
20) The tracking analysis has to take the full optics into account, particularly the dispersion that leaks into the IP.
21) Fast kicker is R&D item. Need more study and decide what scheme to be used.
22) IR beam stay clear needs definition. Give detailed plots of SR shadows etc.

Technical R&D items

Technical R&D items will note be presentable on the time scale of less than 6 months.

Topics to be addressed before down selection anticipated 2013

1) Give up the constraint of equal electron/ion emittances to further optimize luminosity.
2) Decide which RF frequency, possibly below 1.5GHz will be chose.
3) Make a list of growth rates for dominant instabilities to specify what feedbacks are needed.
4) Give up the constraint of equal phase advance in x and y for the electron beam to reduce the Touschek-loss rate.
5) Do electron spin-polarization/depolarization calculations with spin rotators to understand, including effects for bunches with alternating polarization. If the depolarization times are too short, eliminating the dispersion in the spin rotator may be helpful.
6) Check injection with dispersion.
7) Check whether center of the arc is the best place for the RF system. Possibly it is easier to make the main straight section longer to accommodate the RF system.
8) Relying on SPEAR-scaling law will not be convincing in the long run and a detailed impedance budget has to be developed. This will be particularly important when bunch repetition rates below 1.5GHz are to be investigated.
9) Ion effects will need much more attention, e.g. the fast ion instability.
10) Tracking simulations for loss rates of ions including nonlinearities, IBS, cooling, and errors are needed.
11) Evaluate if gaps in the ion beam are needed to avoid electron trapping.
12) Perform e-cloud simulations.
13) Strip injection for the H1 beam is likely doable, but efficiency and stripper foil lifetime needs to be evaluated.
14) Background studies for the detector have to be thorough for the down selection, particularly because HERA sensitized the community to this subject.
15) Optimize the IR design by allowing a right/left asymmetric optics.
16) The beam-beam simulation code will have to be benchmarked against experimental data, e.g. HERA e-p. Make sure that the simulation contains all the necessary ingredients that are needed to reproduce existing data.
17) It is good that nonlinear transfer map terms were optimized. A technique that is more often followed is the minimization of resonance driving terms. This technique should be followed as well.
18) If collisions with ion energies below 20GeV are important, a design of the low energy collider in as much thoroughness as the main collider will be needed. Here space charge, longer bunch length, and traveling focus will be important topics.
19) A cost estimate obviously has to be produced before down selection.
20) Superbend can be considered for low energy polarized positrons.
21) Should look into other lattice designs for smaller emittances for e ring.
22) HOM damping of the CEBAF cavity
23) Recirculation 300 times in the circulator cooler. The estimate of 300 turns needs better calculation, which does not seem to be a quick calculation.
24) How to optimize the circumference of the cooler ring?

25) Detector field compensation needs to be defined for e, p, ion beams over various beam energies.
26) The limit of peak beta of 2.5 km for the proton beam IR optics should be reviewed. Comparing with existing and/or planned hadron colliders should be done. For now, the 2.5 km peak beta for e beam is useful for guidance to design, but should explore possible relaxing it for later non-baseline operations.

Technical R&D items

1) Fast kicker for electron-cooler ring.
2) Other critical items for electron cooling.
3) Broadband feedback kicker and electronics.
4) Cavities, possibly multi cell, with appropriate HOM properties.
5) Polarized ion sources of sufficient current.
6) Polarized electron sources of sufficient current.

Topics to be addressed in the long term

1) One want to chose the arc angle so that 30GeV/u deuterons leads to longitudinal polarization in both straight sections.
2) Investigate whether energy recovery with reduced beam due to a collector ring is beneficial.

Technical R&D items