

## Assessment of the readiness of the facility for construction

It would be very expensive to build an EIC on a green-field site. However, the Subcommittee heard two presentations related to realization of an EIC in the US, building on existing investments: one from Brookhaven National Laboratory (BNL) and a second from Jefferson Laboratory (JLab). The labs are working together and have made progress in exploring pre-conceptual design options and in defining the technical challenges. They have refined their designs and have identified the performance of the designs with respect to EIC expectations of luminosity and energy, as articulated in the EIC white paper [ref], referred to as Stage I performance. Both laboratories have also considered pathways to deliver Stage II performance. Cost projections are being made by both teams with increasing maturity and thoroughness.

The BNL proposal utilizes the infrastructure of RHIC for tunnels, cryosystems, and the hadron portion of the collider. The added capability needed for electron-ion collisions is an electron accelerator, and BNL addresses this by proposing an energy recovery linac (ERL) which means that electrons are only used for collisions in one pass; their energy is then recovered and transferred to fresh electrons. Present R&D is directed at the development of the Gatling polarized electron gun, which would allow full population of buckets for collision, and at the commissioning of the demonstration ERL. ~~In order to achieve  $10^{34} \text{ cm}^{-2} \text{ s}^{-1}$  luminosity,~~ Cooling of the hadron beam is needed and BNL has chosen to pursue the technique of Coherent Electron Cooling (CeC). R&D is proceeding on this as well with the intent to do a proof-of-principle experiment, using RHIC, in 2016.

The JLab proposal utilizes electrons from the CEBAF facility at energies up to 12 GeV. They will be injected into a ring where they circulate and are topped up from CEBAF to maintain a constant current. The hadron source and ring(s) are new construction. New conventional construction is needed for both the ion accelerator systems and the detector/interaction region. The design takes advantage of a figure-8 configuration for polarization. ~~The collision repetition rate in the JLab design is 748.5 MHz, based on the available high repetition rate of the CEBAF beam.~~ The hadron source is being designed to match this. Several R&D issues are under study: interaction region design addressing chromatic compensation and dynamic aperture; polarization; low energy ion beam dynamics; and electron cooling of the hadron beam. Here, as in the BNL case, a demonstration of cooling is expected by 2016.

Subsequent comments apply to the state of the designs in general and are not laboratory specific. Both designs are in very early stages relative to the Office of Science project review process. There are outstanding R&D issues that remain to be addressed in order to achieve the white paper Stage I performance metrics. Because of this, additional phasing has been proposed that would provide a relatively early start to EIC physics while the necessary R&D is completed to enable the ultimate performance of the facility. Both facilities are actively addressing R&D issues and are making good progress. Project costs have been estimated by the laboratories, but they have not been externally reviewed. ~~We suspect that at this time the costing methodologies and basis of estimate used by the two labs are somewhat different. Neither contains the costs of detectors. Thus we believe that further work and consistent reviews of costing need to be done before concluding being able to concur that construction costs are fully understood. Operating costs were presented. These are probably best understood using the similarity of operation of an EIC to the present RHIC. We also note that operational costs would likely be independent of site.~~

Concerning readiness of the facility for construction, we rank this facility in the category **(b) significant scientific/engineering challenges to resolve before initiating construction.**