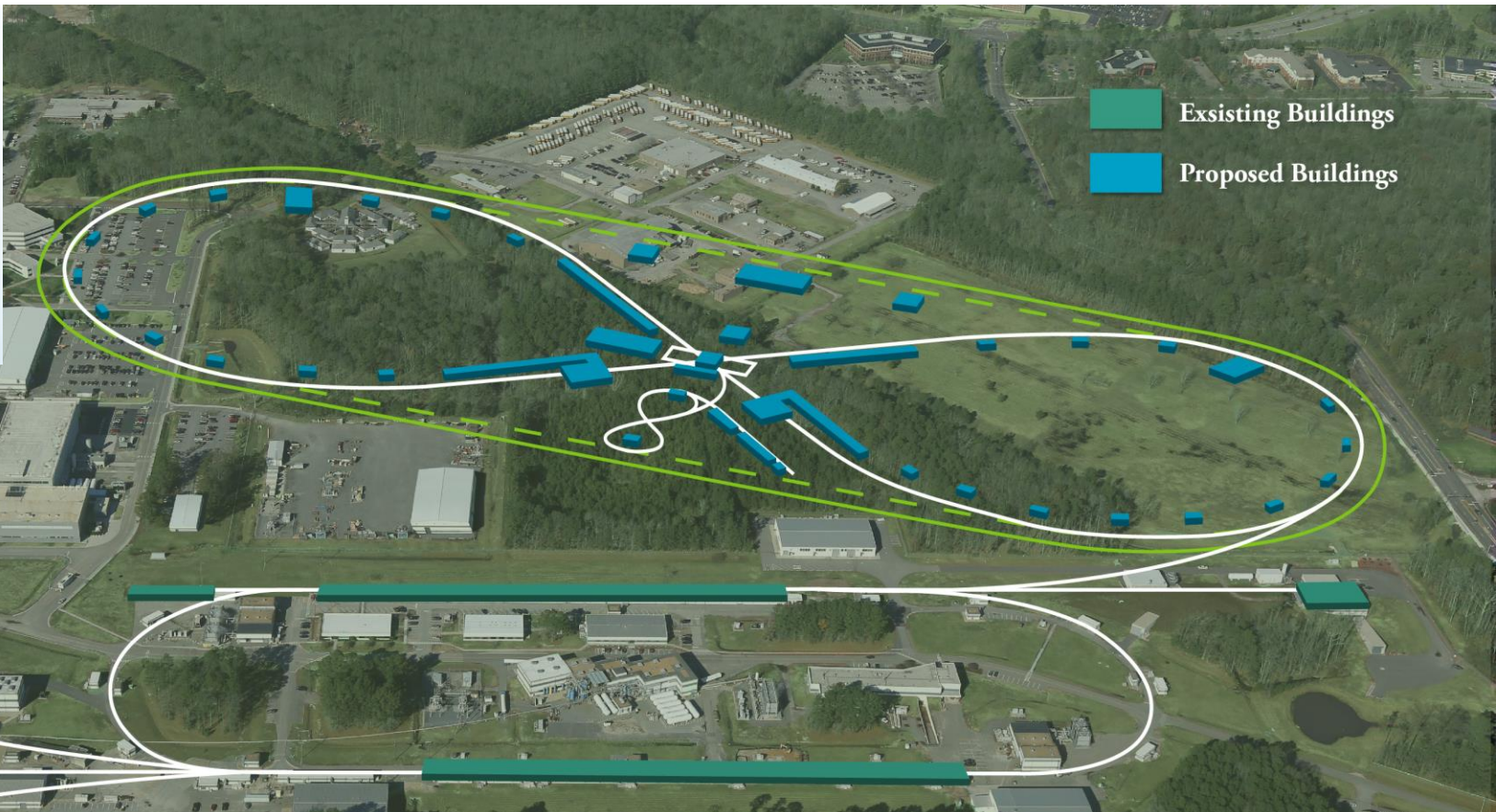


Update on the JLEIC Project

Fulvia Pilat



JLEIC 3rd Collaboration Meeting
JLAB March 29-31 2016

JLEIC 3rd Collaboration Meeting

- 1st Collaboration Meeting March 2015
- 2nd Collaboration Meeting October 2015

- 3rd Collaboration Meeting:
 1. Bunched beam electron cooling and ERL cooler
 2. Detector interface and interaction region
 3. Update on R&D program
 4. Plans for pre-CDR and project development

JLEIC Collaboration Meeting Goals

- Define and compare options with the goal of optimizing cost and performance for the:
 - electron cooling
 - IR and detectors
- Discuss and define roles, responsibilities and deliverables of collaborators for:
 - Design optimization
 - Pre-project R&D
 - Pre-CDR writing
- Engage **industrial partners** and form basis for collaboration and potential SBIR's
- Plan **future** Collaboration Meetings

outline

EIC Overall vision and plan

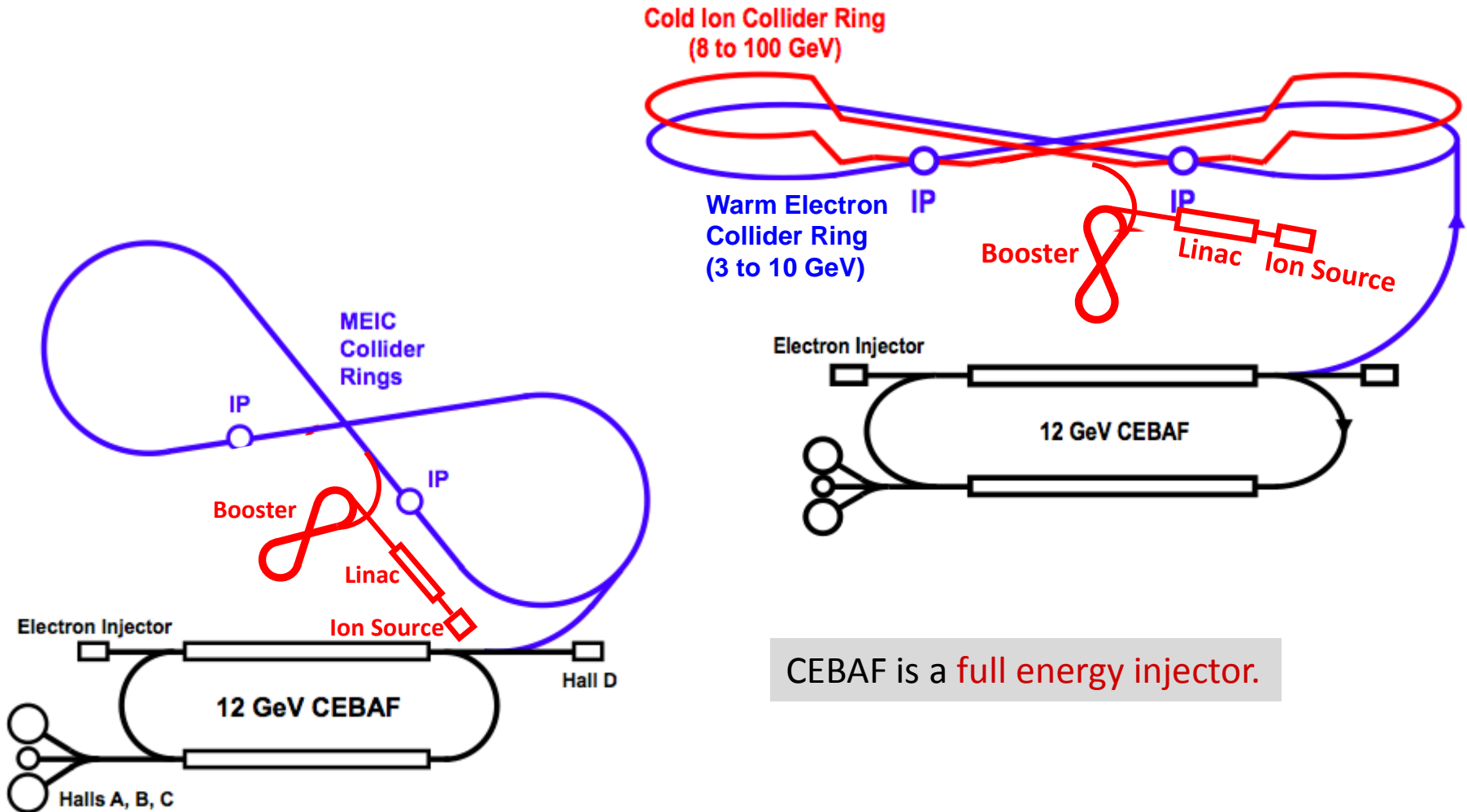
Update and progress – last 6 months

- LRP process concluded – EIC highest priority for new construction
- EIC Users Group Meeting January 2016
- 1st JLAB Accelerator Advisory Committee February 2016
- Technical progress

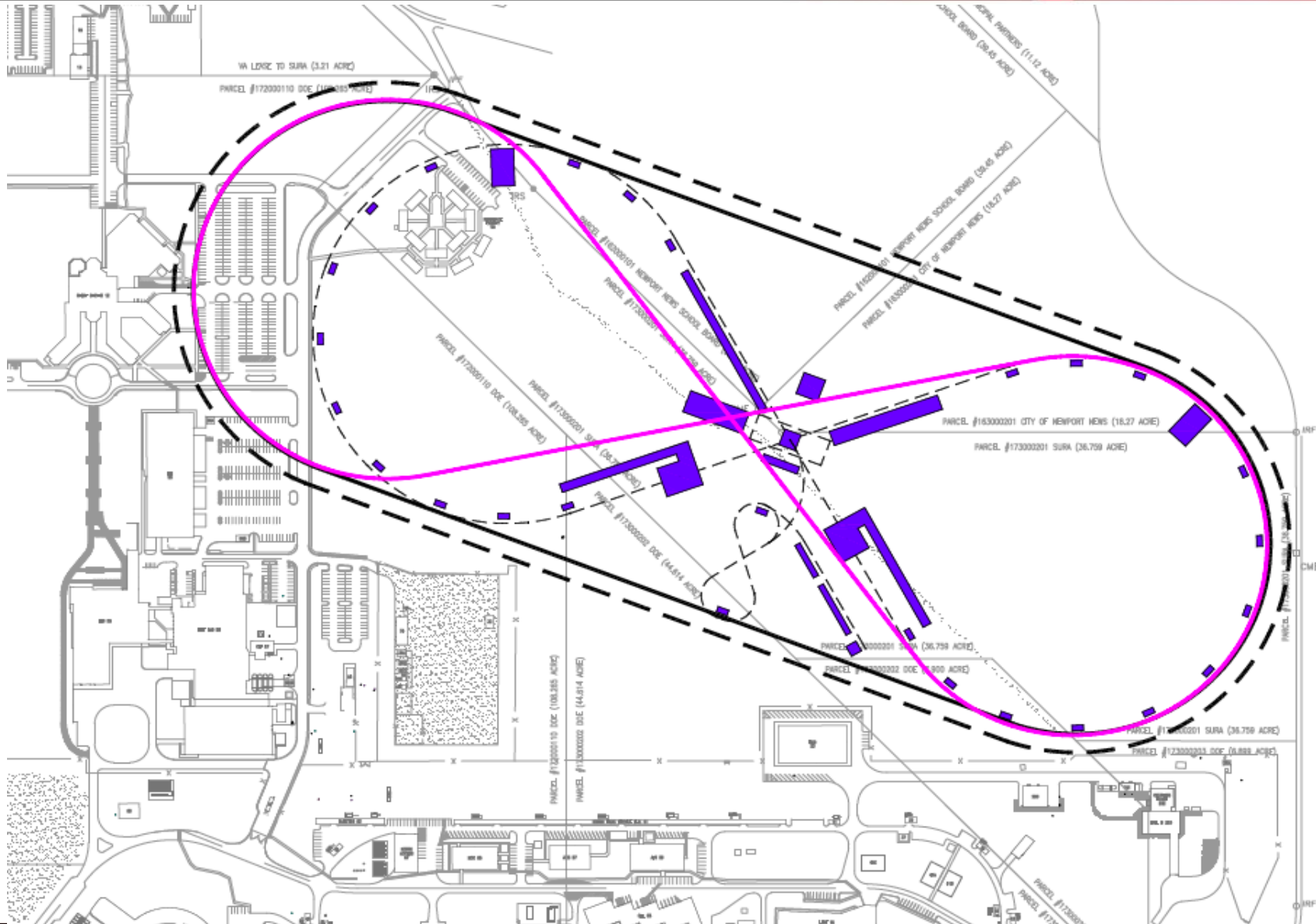
Plans and priorities for next 6 months

- Baseline review end April 2016
- Advance design and R&D
- JLEIC pre-CDR and project development → *talk on Thursday*

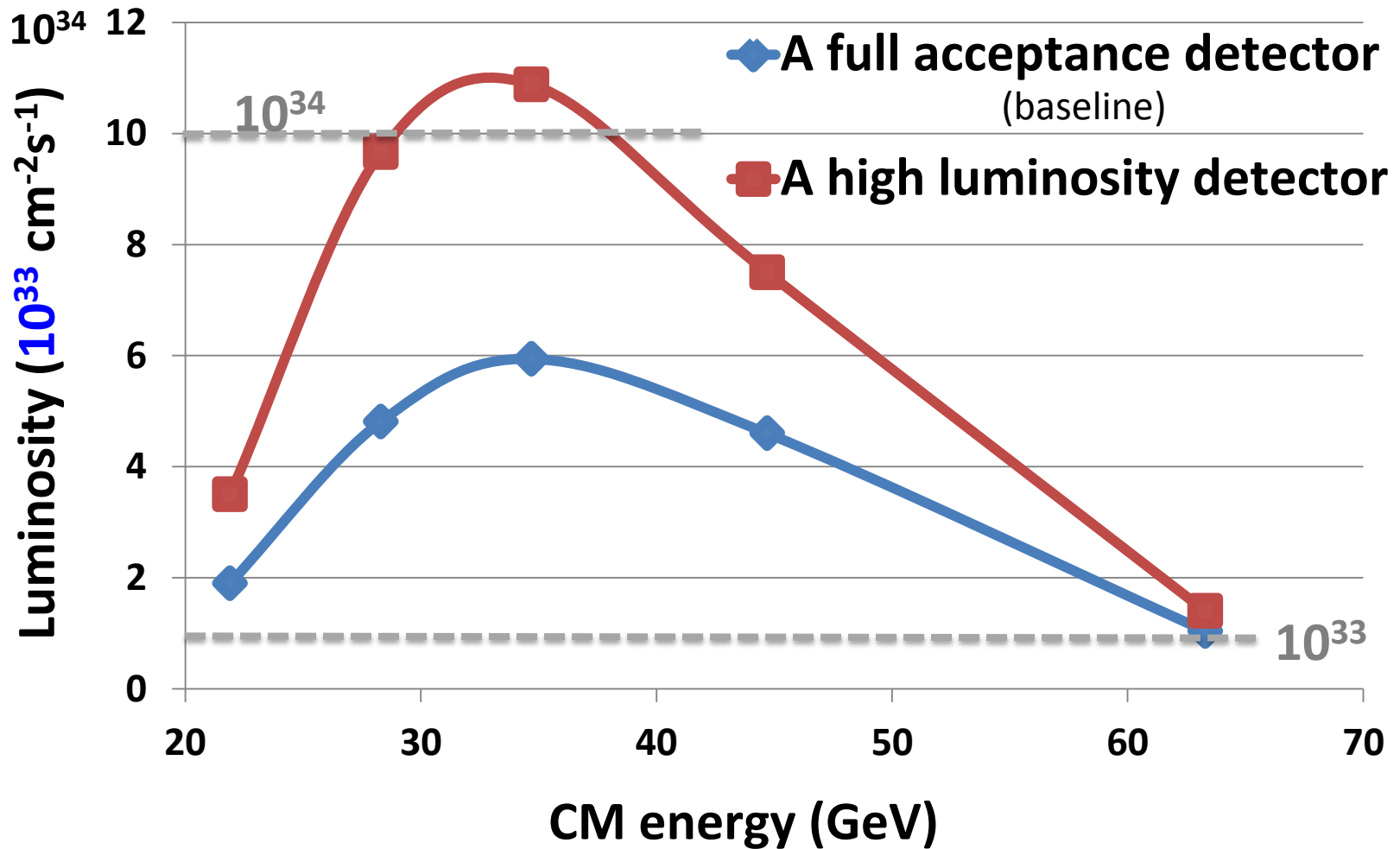
JLEIC Baseline



Campus Layout



e-p Luminosity



The baseline performance requires a **single pass ERL bunched beam cooler**
Without bunched beam cooling luminosity down only factor 2-3

JLAB EIC Timeline

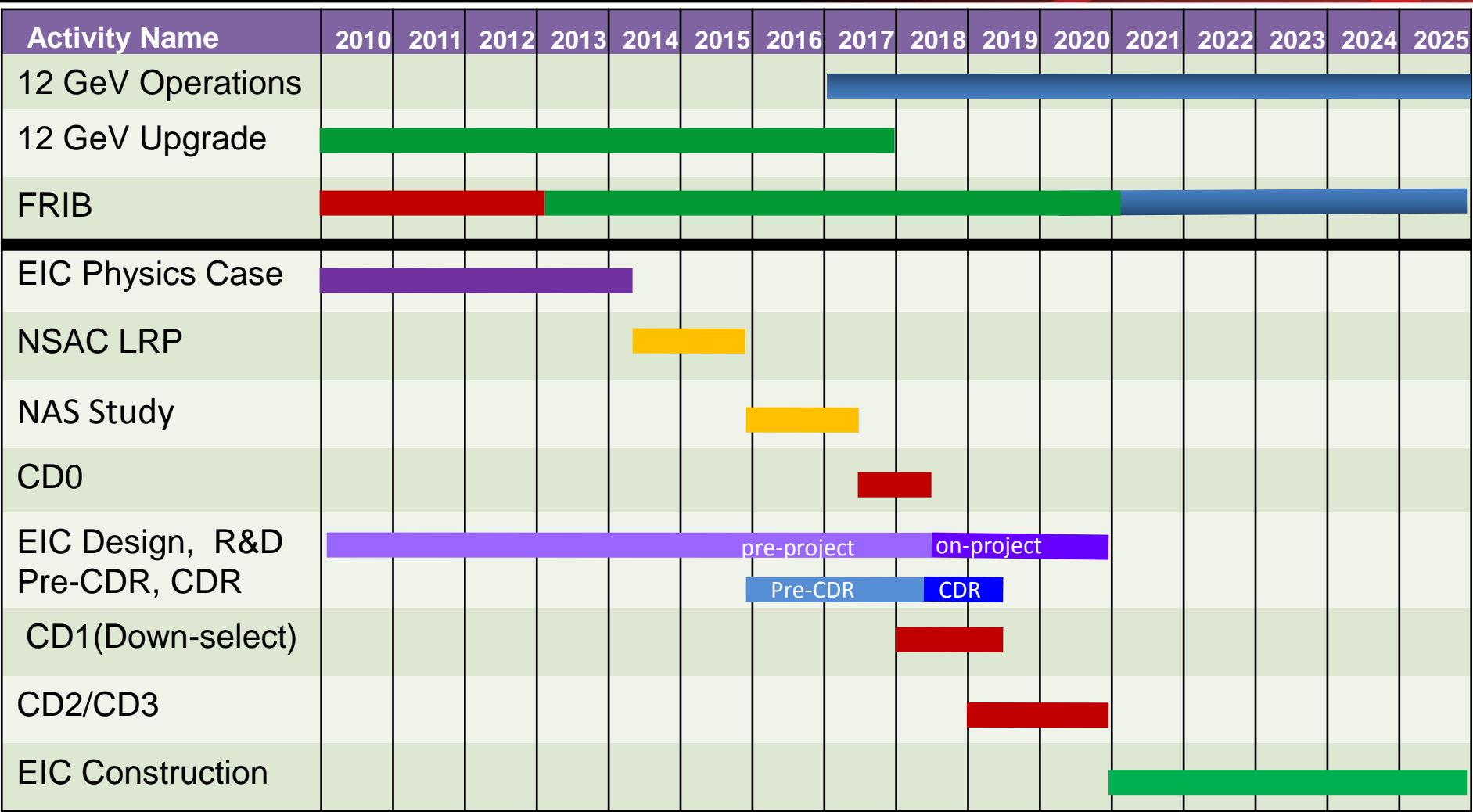
- JLAB EIC design starts early 2000
- White Paper: physics case, machine requirements 2011, refined in 2012-14
- Preliminary conceptual design report 2012
- Design optimization, EICAC reviews 2012-2014
- NSAC/LRP process starts 2014
- Internal and Director's reviews 2014-2015
- JLAB EIC Design Summary document January 2015
- NSAC/LRP Cost Review January 2015
- **1st JLAB EIC Collaboration Meeting** March 2015
- NSAC/LRP: EIC Recommendation 3 October 2015
- **2nd JLAB EIC Collaboration Meeting** October 2015
- EIC Users Group Meeting January 2016

We recommend a high-energy high-luminosity polarized EIC as the highest priority for new facility construction following the completion of FRIB.

LRP
Recommendation 3



EIC Timeline



CD0 = DOE “Mission Need” statement; **CD1** = design choice and site selection (VA/NY)
CD2/CD3 = establish project baseline cost and schedule

JLAB EIC Plan

GOALS

- deliver **pre-CDR by ~end FY17** (ready for CD0)
- deliver **CDR by FY18-19** (ready for CD1, down-select?)

Activities:

- Baseline design optimization (cost reduction)
- Pre-project R&D planning and execution
- Enhance synergy and **collaborations** with labs, universities and industry
- Completion of civil **site development**

1st JLAB Accelerator Advisory Committee

- Overall review of Operations, JLEIC and Accelerator R&D, February 17-18, 2016
- Charge JLEIC
 - Is the design team addressing the right issues?
 - Are the expectations for a conceptual design in 2018 reasonable?
 - Are the resources sufficient? If not, assuming limitations, for which aspects should extra resources be deployed?

Comments JLEIC

- The design JLEIC CM energy of 65GeV is slightly low when compared to the EIC white paper specifications.
- The stated incremental project cost, which should be validated, for [pushing the CM energy to 100GeV by the use of Cosine-Theta magnets](#) would be a small fraction of the total project cost.
- The use of electron cooling for the proton and ion beams results in challenging and beyond the state of the art parameters.
- The JLEIC study does not yet properly address all the issues related to the [vacuum system](#) (ion instabilities, experimental background, synchrotron radiation, etc)

Comments JLEIC

- [Simulation of finite-angle collision beam-beam interactions](#) should be extensively conducted, particularly for halo formation. Halo can cause large background for the detectors, while adding a collimator to eliminate the noise can significantly reduce the lifetime. Since it can be very difficult to simultaneously reduce the background at both IPs and maintain a useful lifetime, an appropriate model should be created.
- The presented [outline of the Pre CDR document](#) does not seem to be complete:
A plan on how to [satisfy the DOE requirements](#) for large construction projects (CDR, CD0, CD1, etc) was not presented.

Recommendations JLEIC

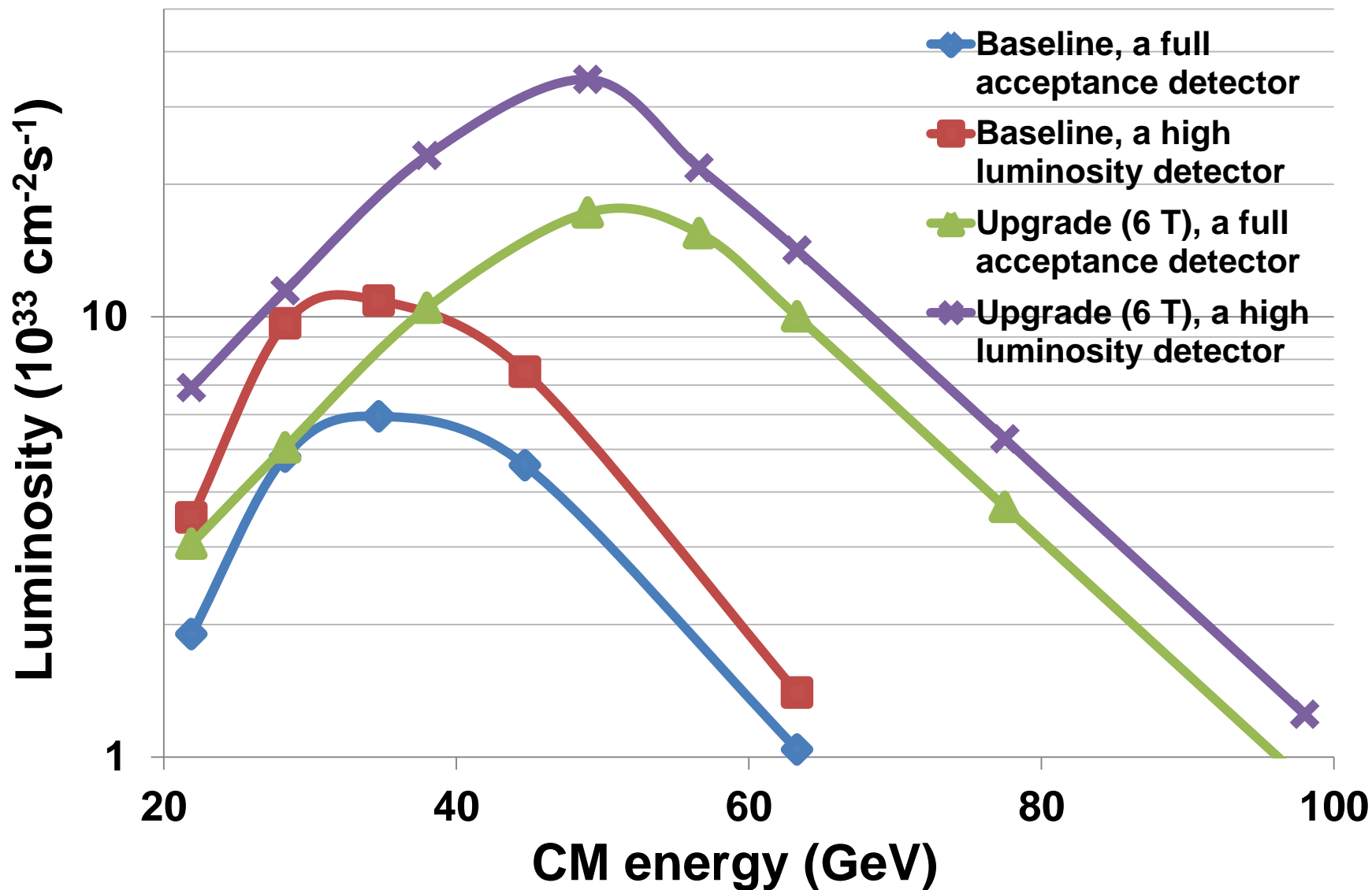
- Prepare a detailed cost comparison between the use of super-ferric and cosine-theta magnet design.

JLAB response: initiated a cost estimate for 200 GeV ion collider option (L. Harwood talk)

- Ensure that the Pre CDR document is complete.

JLAB response: detailed outline for a pre-CDR and project development (F. Pilat talk)

JLEIC lumi: Baseline and Upgrade



Baseline Design progress highlights in 2015 – to date

- Studied [lower energy SRF linac](#) and stripping scheme
- Started technology study for ion linac (warm vs cold)
- Evaluated [racetrack vs. figure-8](#) configuration for the booster, ion collider
- [Ion Polarization design](#) finalized and spin tracking in progress
- [e- Polarization design](#) finalized and spin tracking in progress (with DB)
- Cooler design group formed, [ERL cooler design](#) in progress
- [Cooling simulations](#) in progress
- Completed basic scheme of [proton and ion beam formation](#)
- [Beam synchronization](#) scheme (summary report published)
- Studied [emittance reduction options](#) in the e-ring
- [Chromaticity correction](#) scheme finalized
- [Solenoid compensation](#) studied
- [DA aperture](#) study and sensitivity analysis in progress
- [Collective effects](#) inventory
- [Beam beam](#) code development in progress

JLEIC Pre-project R&D Program

Main scope: (2015-2017)

- **Ion collider ring magnets R&D:**
super-ferric magnet prototype: design, winding mock-up, prototype and test (Texas A&M)
evaluation cos-theta designs (LBL)
- **FF quadrupoles**, design and integration (Texas A&M, LBL)
- **952 MHz SRF cavities** for cooler and ion collider: design and prototype (JLAB)
- **952 MHz crab cavity** design, integration, prototype (ODU, JLAB)
- **Magnetized source** for e- cooler (JLAB LDRD, Cornell SBIR)
- **Bunched beam cooling experiment** (INP, JLAB)
- **Ion Injector** optimization (ANL.JLAB)
- **IR optimization** (SLAC, JLAB)

JLEIC Pre-project R&D: progress in 2015 – to date

Super-ferric prototype, Texas A&M :

- ✓ Design Jun 2015
- ✓ winding down-select and winding mock-up
construction Mar 2016
cold test 2017
end 2017

952 MHz SRF cavity for cooler, JLAB:

- ✓ design down-select Dec 2015
prototype end 2016

952 MHz cavity for ion collider, JLAB:

- Design down-select Dec 2016
Prototype end 2017

952 MHz crab cavity (ODU, JLAB)

- ✓ design outline and plan Dec 2015
design, integration, prototype end 2017

FF quadrupoles, design and integration

end 2017

Magnetized source for e- cooler

- ✓ JLAB LDRD awarded and work started end 2015
- ✓ Cornell SBIR awarded and work started

Bunched beam cooling experiment (INP-JLAB)

- ✓ Planning, design (JLAB 2015 LDRD) Dec 2015
- ✓ Engineering and tests in progress
Experiment run May 2016

Next 6 months: accelerator goals

- Outline pre-CDR March 31
- Pre-CDR **tasks-list**, including **simulation** effort April 15
with names, institutions, timeline
- **Baseline review** (footprints, linac energy, e-ring, BBC staging approach) ~end of April
- **LDRD** proposals for 2017 April 29
- NP EIC Accelerator R&D **FOA** May 2
- 200 GeV **cost estimate** ~June 2016
- **Configuration management** and control August 2016
parameter tables
lattices and element database
nomenclature
document

EIC R&D: NP FOA' s

- **FY16**

Research and Development for Next Generation Nuclear Physics Accelerator Facilities

Post date: March 4 2016

Close date: May 2 2016

To labs and university: 1.8 M\$ including JLEIC, eRHIC and possibly other R&D

- **FY17**

In addition to the **R&D FY17 funds** NP will redirect and pool ~2.5% **operations funds** from JLAB and BNL to support EIC R&D

A **panel** will be convened in late summer to prioritize areas and topics

An FOA and call for proposal will follow at a later date

- **FY18 and beyond**

Budget request for EIC are being formulated (with EIC recognized by LRP as the highest priority for new construction in NP)

EIC design and R&D focus

Bunched beam electron cooling

- ERL Cooler design (JLAB)
- Magnetized source for e-cooler (JLAB LDRD, Cornell SBIR)
- Bunched beam cooling experiment (JLAB, IMP)

Magnets for the ion booster and collider

- Super-ferric magnet R&D for 3T , prototype, IR magnets (Texas A&M, JLAB) FOA
- Super-conducting magnets design for 6T, IR magnets (LBL, JLAB) FOA

SRF cavities and crab cavities

- 952 MHz crab cavity design, integration, prototype (ODU-JLAB) FOA
- 952 MHz SRF cavities for cooler and ion collider:* (JLAB)

Ion injector

- SRF linac design, stripping, simulations (ANL, JLAB) FOA

Interaction Regions and beam dynamics

- IR design, detector interface, backgrounds, collimation (SLAC, JLAB) FOA
- Non-linear dynamics, corrections, DA (SLAC, JLAB)

Beam physics and simulations

- (JLAB → collaborations) FOA

FOA proposed timeline

- March 18 Kick-off video-conference
- March 29-31 Collaboration Meeting at JLAB
- April 1 Magnet meeting at JLAB
- April 7 Deadline proposal outlines
- April 8 Proposal internal review (video-conference)
- April 22 Target date for proposal submission to NP
- May 2nd Deadline submission

Conclusions

- Good progress on JLEIC in the past 6 months
- Focus for the 6 months is on advancing design, R&D and plans for the pre-CDR
- Goal is to deliver a pre-CDR by the end of 2017

In my closing talk I will summarize relevant issues discussed at the collaboration meeting and outline the plans for the pre-CDR