

An Introduction to US EIC

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The Electron Ion Collider

2003-2019

For e-N collisions at the EIC:

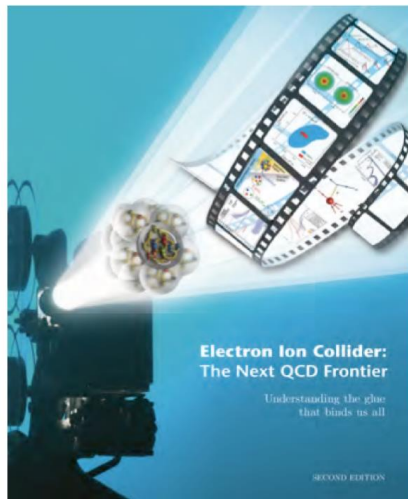
- ✓ Polarized beams: e, p, d/³He
- ✓ e beam 5-10(20) GeV
- ✓ Luminosity $L_{ep} \sim 10^{33-34} \text{ cm}^{-2}\text{sec}^{-1}$
100-1000 times HERA
- ✓ 20-100 (140) GeV Variable CoM

For e-A collisions at the EIC:

- ✓ Wide range in nuclei
- ✓ Luminosity per nucleon same as e-p
- ✓ Variable center of mass energy

World's **first**
Polarized electron-proton/light ion
and electron-Nucleus collider

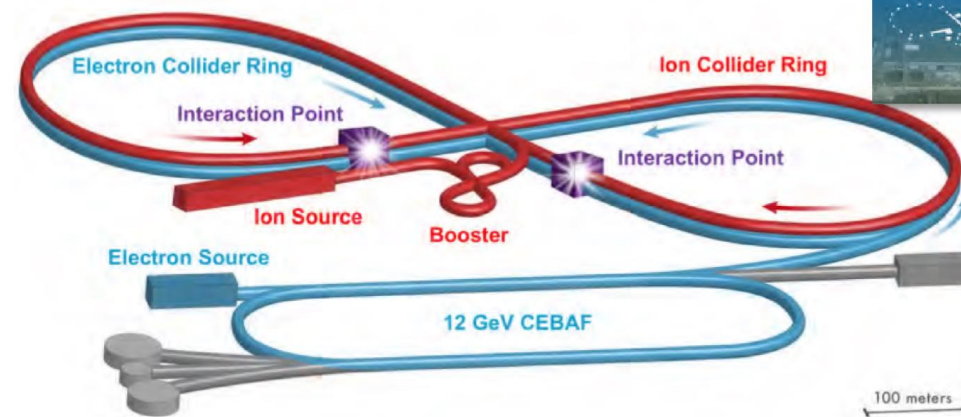
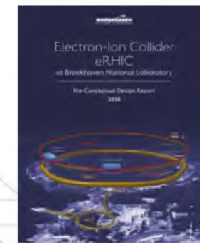
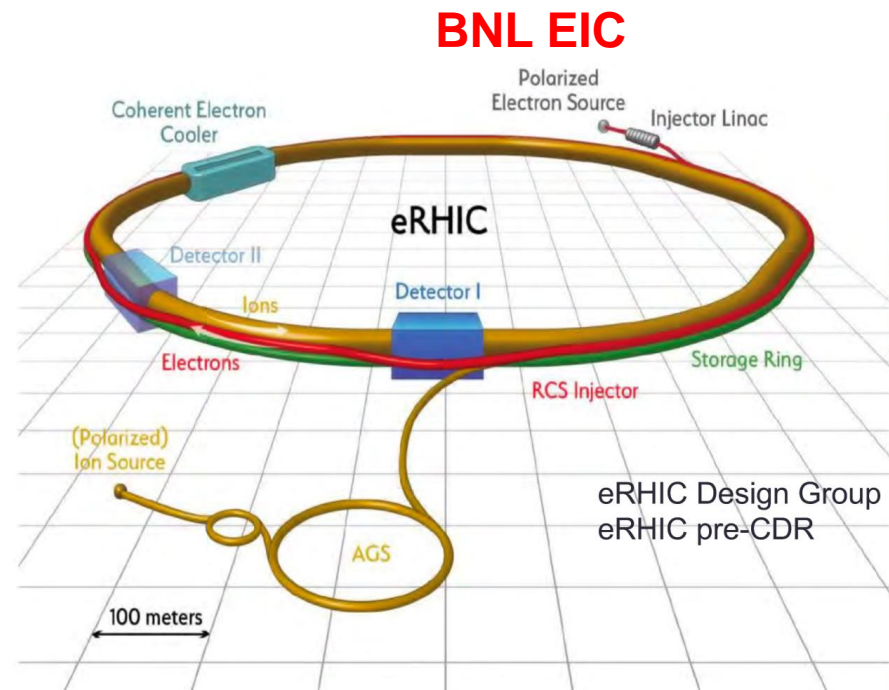
Both designs use DOE's
significant investments in
infrastructure



1212.1701.v3

A. Accardi et al

Eur. Phys. J. A, 52 9(2016)

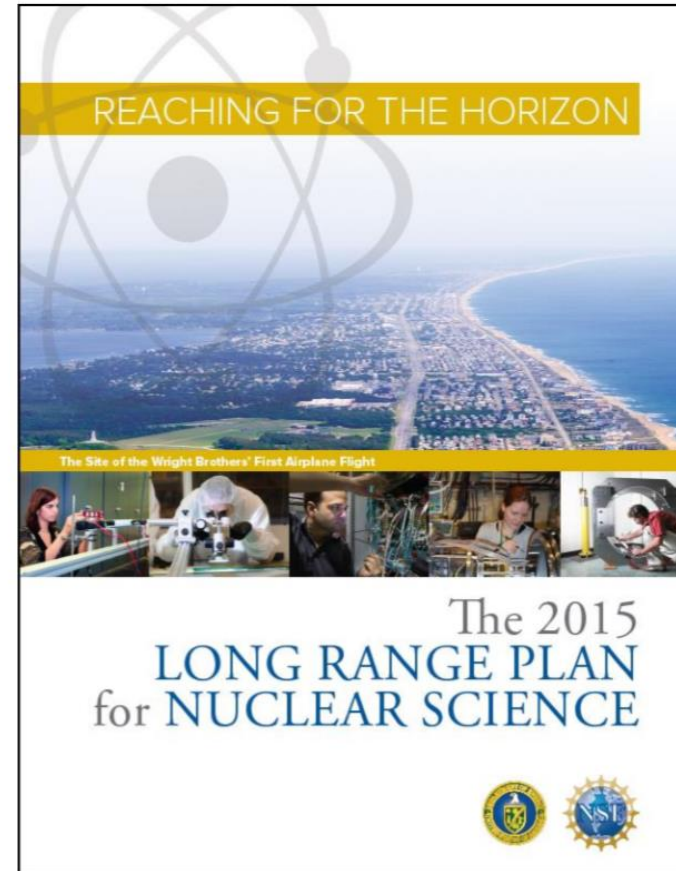


JLab EIC

The 2015 Long Range Plan for Nuclear Science

Recommendations:

1. Capitalize on investments made to maintain U.S. leadership in nuclear science.
2. Develop and deploy a U.S.-led ton-scale neutrino-less double beta decay experiment.
3. Construct a high-energy high-luminosity polarized electron-ion collider (EIC) as the highest priority for new construction following the completion of FRIB.
4. Increase investment in small-scale and mid-scale projects and initiatives that enable forefront research at universities and laboratories.



The FY 2018 Request supports progress in important aspects of the 2015 LRP Vision



Department of Energy

U.S. Department of Energy Selects Brookhaven National Laboratory to Host Major New Nuclear Physics Facility

JANUARY 9, 2020

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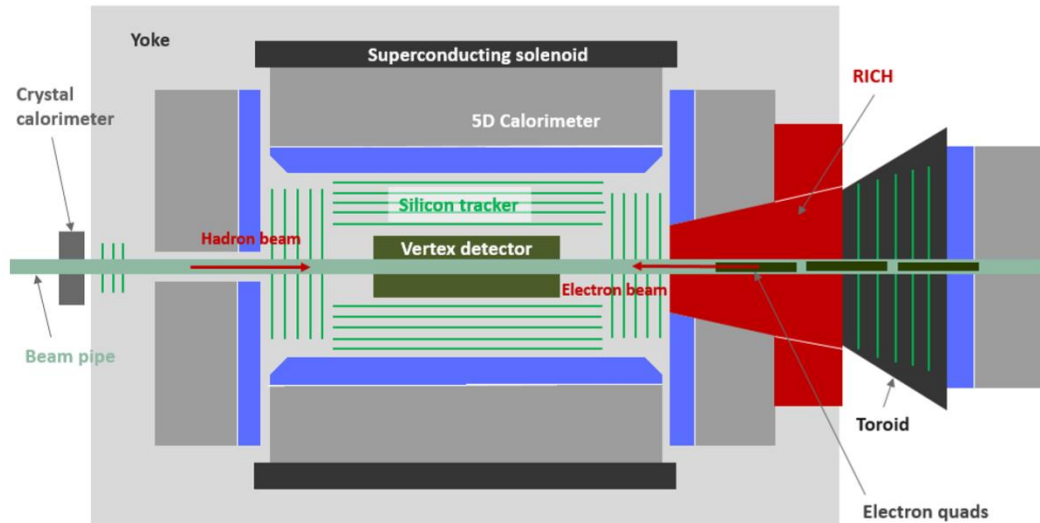
WASHINGTON, D.C. – Today, the **U.S. Department of Energy (DOE)** announced the selection of Brookhaven National Laboratory in Upton, NY, as the site for a planned major new nuclear physics research facility.

The Electron Ion Collider (EIC), to be designed and constructed over ten years at an estimated cost between \$1.6 and \$2.6 billion, will smash electrons into protons and heavier atomic nuclei in an effort to penetrate the mysteries of the “strong force” that binds the atomic nucleus together.

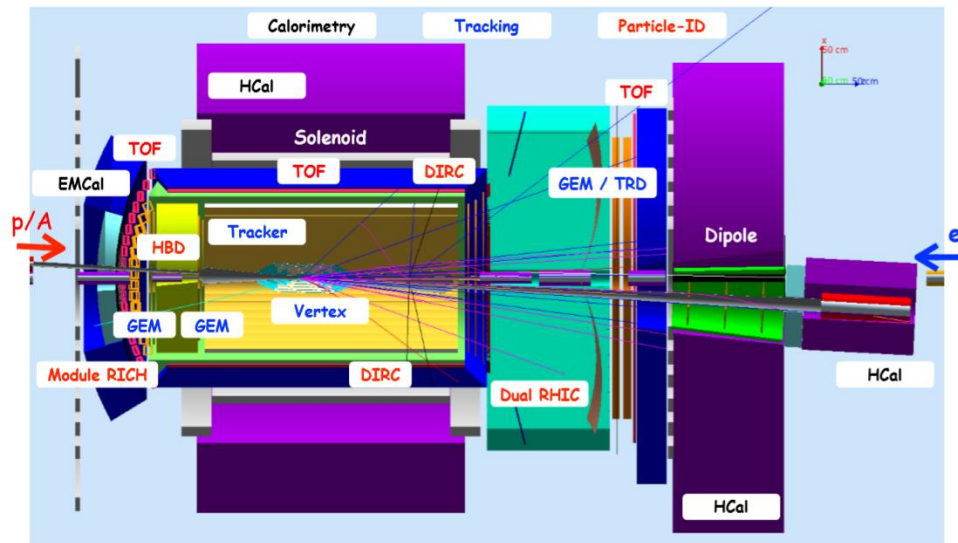
“The EIC promises to keep America in the forefront of nuclear physics research and particle accelerator technology, critical components of overall U.S. leadership in science,” said **U.S. Secretary of Energy Dan Brouillette**. “This facility will deepen our understanding of nature and is expected to be the source of insights ultimately leading to new technology and innovation.”

□ EIC detector design at JLab and BNL

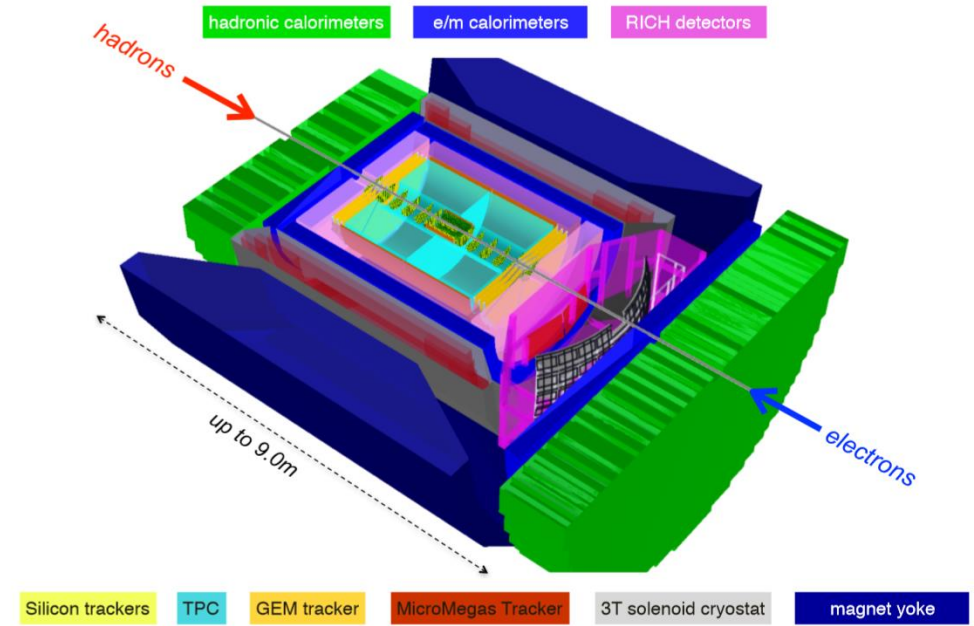
(a) TOPSIDE at JLab: Time Optimized Silicon Detector for EIC



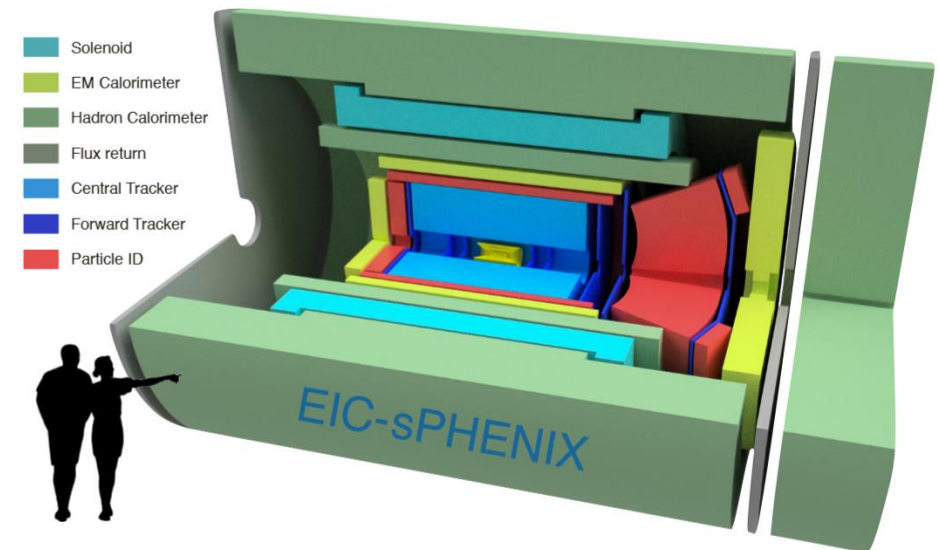
(b) JLEIC detector design at JLab:



(c) BEAST detector design at BNL:



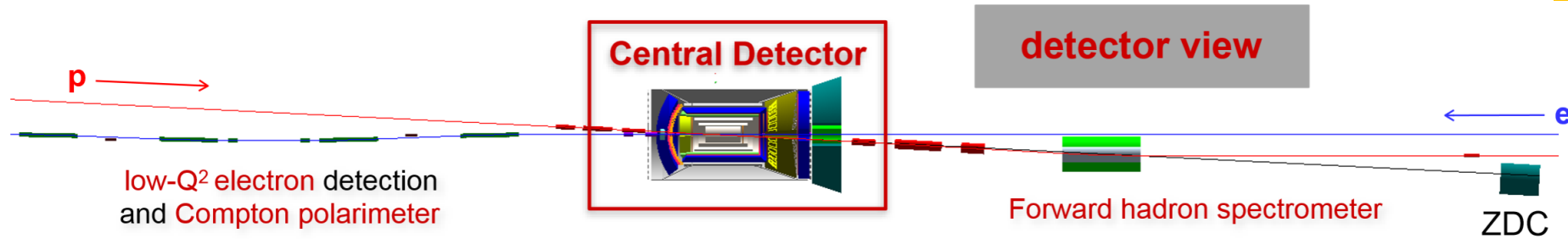
(d) sPHENIX-EIC detector design at BNL:



Far forward detectors

Jlab's proposal

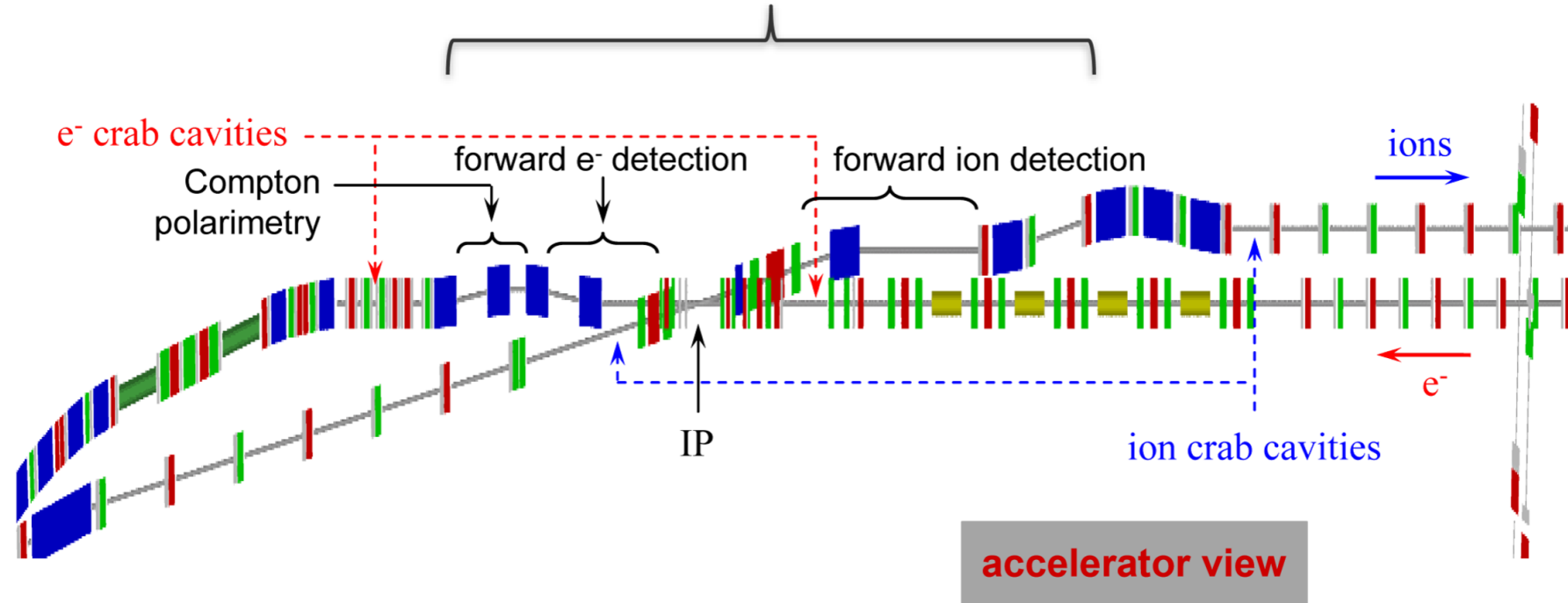
BNL follows up



Extended detector: 80m

30m for multi-purpose chicane, 10m for central detector, 40m for the forward hadron spectrometer

fully integrated with accelerator lattice



Activities after CD0

-EIC is now an official DOE project

EIC UG Yellow report strategy:










- Quantify measurements for the EIC physics (existing and new/emergent)
 - Under a **Physics Working Group** (see eicug.org for convener names etc.)
 - Address: *physics motivation → detector requirements, two vs. one detectors*
- Study detector concepts based on those physics measurements
 - Under a **Detector Working Group** (see eicug.org for convener names etc.)
 - Address: *Detector concepts → technology, complementarity, experimental systematics,*
 - Also address: folding in *polarimetry, luminosity*
 - Engage EIC detector R&D
- Study opportunities for future accelerator physics experiments
 - An **Accelerator Working Group** (see eicug.org for convener names etc.)

Timeline



Involvements of Chinese Institutes

Official involvements:

Full name of the institution ▲	Institution acronym ◇	Country ◇	Region of the World ◇
Beijing Normal University	BNU	 CHINA	ASIA
Central China Normal University	CCNU	 CHINA	ASIA
China Institute of Atomic Energy	CIAE	 CHINA	ASIA
China University of Geosciences (Wuhan)		 CHINA	ASIA
Institute of Modern Physics	IMP	 CHINA	ASIA
Institute of Physics, Academia Sinica, Taiwan	IPAS	 TAIWAN, PROVINCE OF CHINA	ASIA
Nanjing University, Institute for Nonperturbative Physics	NJU INP	 CHINA	ASIA
National Cheng Kung University	NCKU	 TAIWAN, PROVINCE OF CHINA	ASIA
Shandong University	SDU	 CHINA	ASIA

Just small individual contributions from students and postdocs associated with Chinese Universities

- Hope USTC, UCAS, THU... to join the project
- NSFC funding for both EicC and EIC efforts in 2021?

Ideas for discussion

- US EIC is on the fly, also Chinese EIC
- Combine Chinese interests/expertise/manpower to play critical role in the development of US EIC and Chinese EIC
- Both Physics and Technology of EIC could be readily applied to EicC and STCF
 - Solid tracker based on ITS3-stitching technology
 - Useful for EicC and STCF vertex/tracking detectors