

Electron Ion Collider: The next QCD frontier

Understanding the Glue that Binds Us All

Why EIC? → “Imaging the glue”

*To understand the role of gluons in binding quarks & gluons into
Nucleons and Nuclei*

Hard Probes 2018
Aix Les Bains, France, October 2018

The Electron Ion Collider

Two options of realization!

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

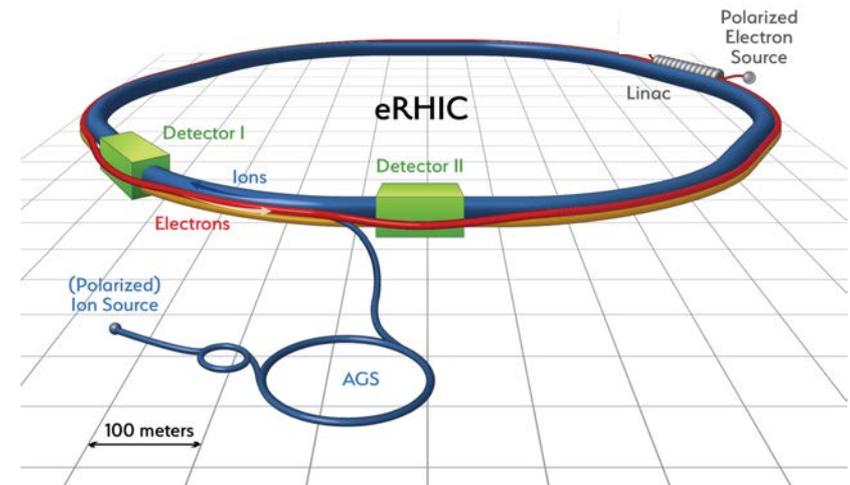
For e-A collisions at the EIC:

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

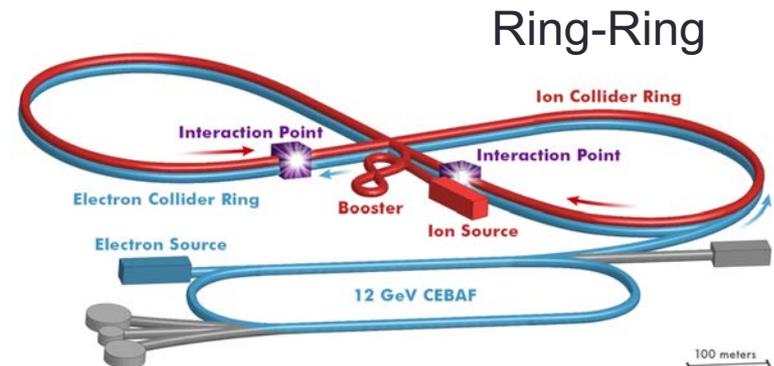
World's first

Polarized electron-proton/light ion
and electron-Nucleus collider

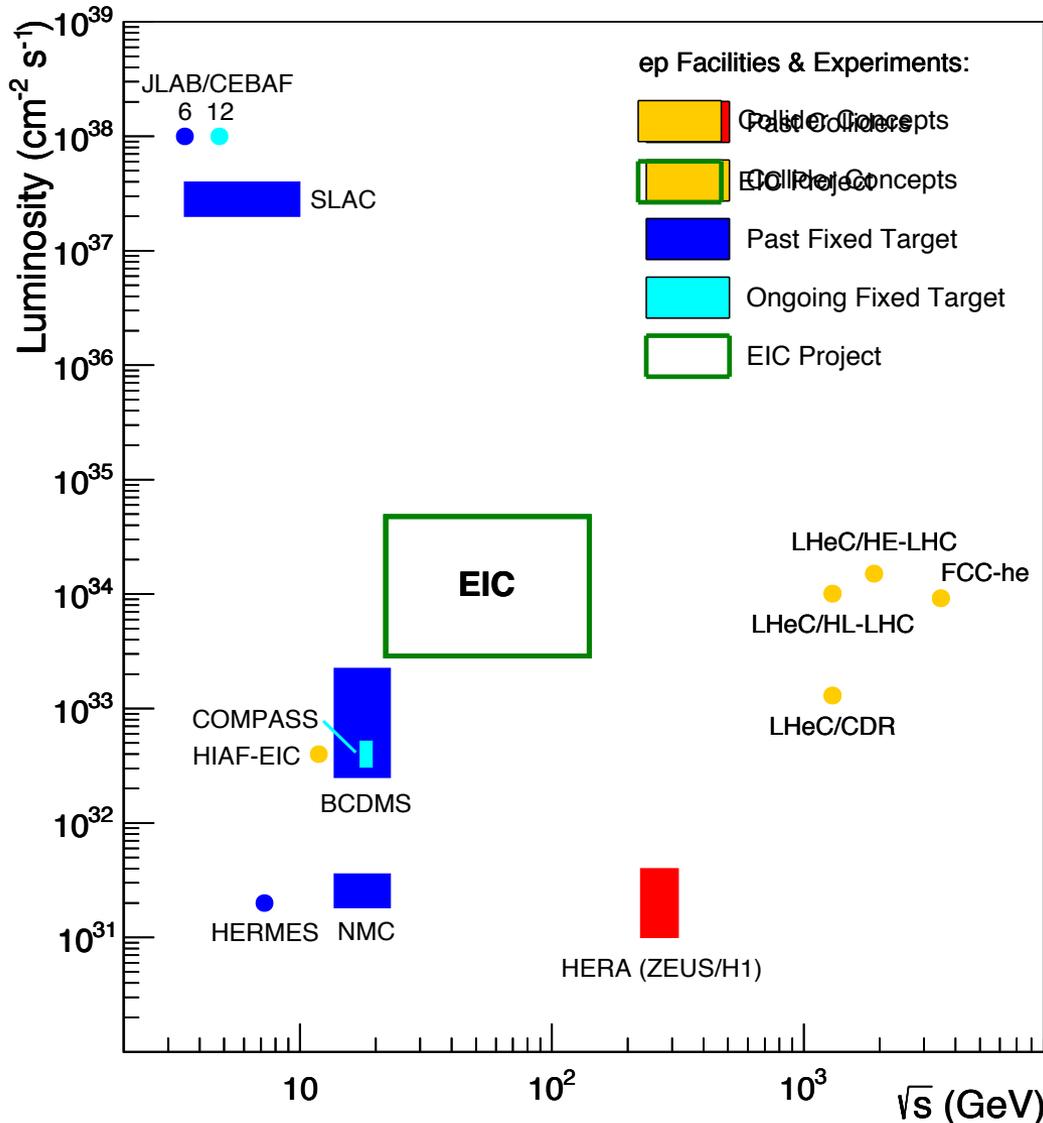
Both designs use DOE's significant investments in infrastructure



Not to scale



Uniqueness of EIC among all DIS Facilities



All DIS facilities in the world.

However,
if we ask for:

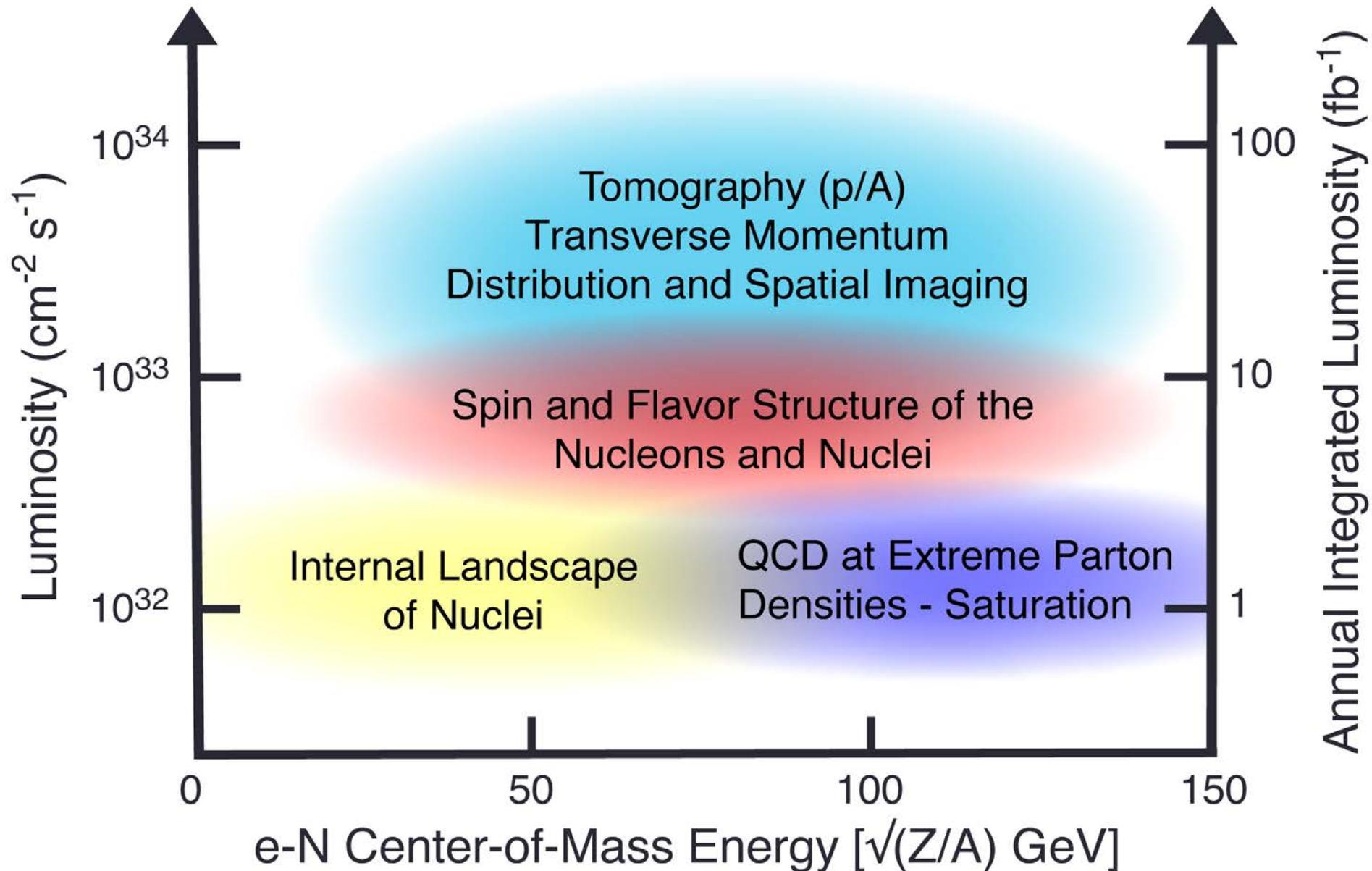
- high luminosity & wide reach in \sqrt{s}
- polarized lepton & hadron beams
- nuclear beams

EIC stands out as unique facility ...

(Rik Yoshida, earlier this afternoon)

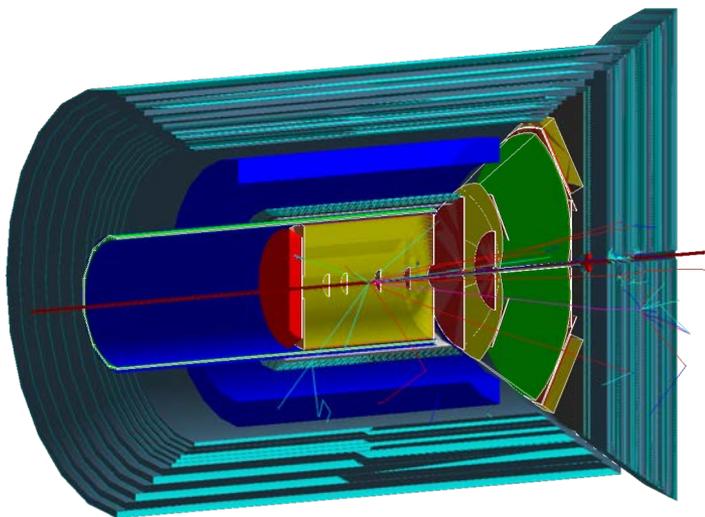
Summary: EIC Physics:

CM vs. Luminosity vs. Integrated luminosity

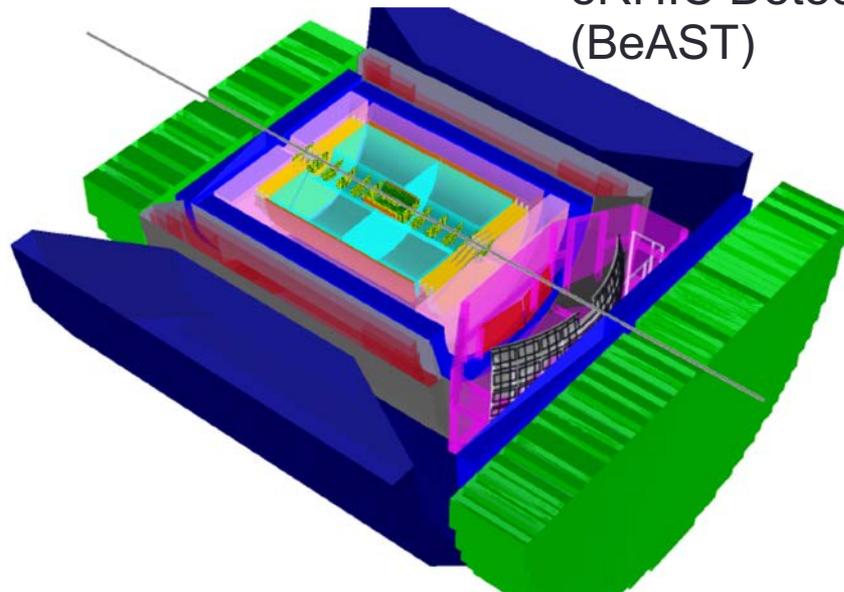


EIC Detector Concepts

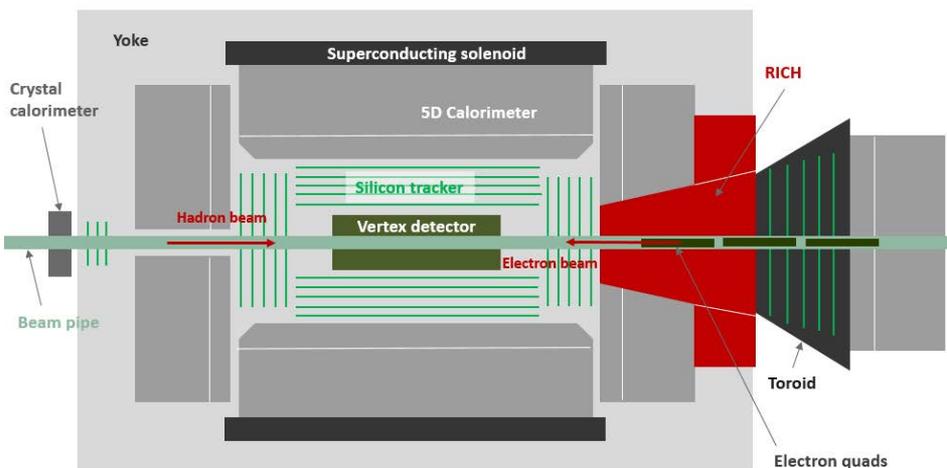
“EIC Day 1 Detector”



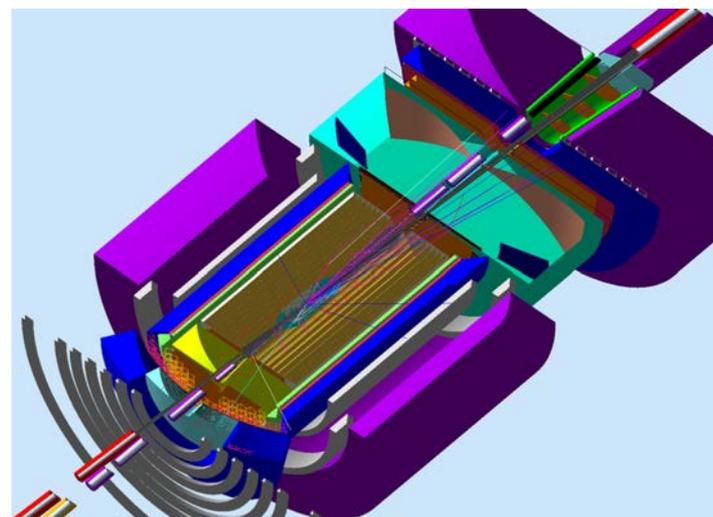
eRHIC Detector (BeAST)



TOPSiDE by ANL



JLEIC Detector

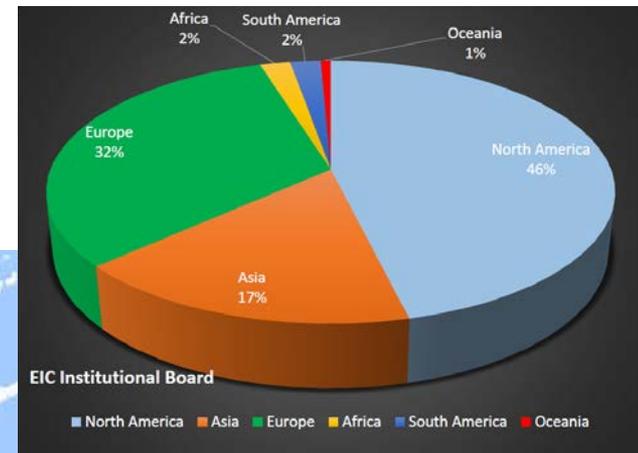


The EIC Users Group: EICUG.ORG

(no students included as of yet)

822 collaborators, 30 countries, 173 institutions... (October 2018)

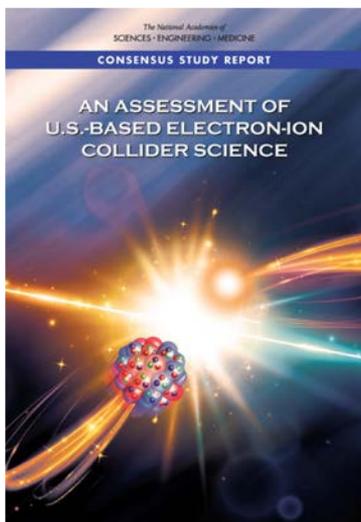
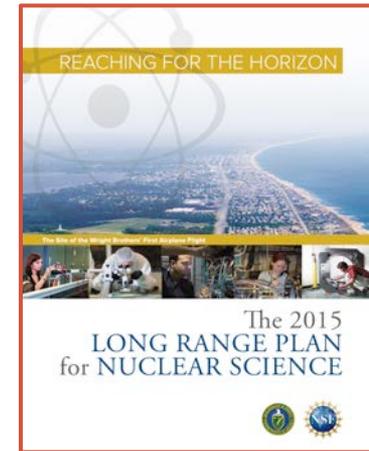
Map of institution's locations



EIC Formal Status

2015 NSAC Long range plan:

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



National Academy of Sciences,
Engineering & Medicine

The committee finds that the science that can be addressed by an EIC is compelling, fundamental and timely

What Next and When?

A strong recommendation of the EIC by the NSAC and now by the NAS, gives the DOE to move forward to a formal critical decision process (CD).

- CD0, "acceptance of science need" expected in the next few months
- Sight selection & technical & cost evaluation CD1, CD2
- CD3 Star construction (earliest by 2023), after ramping down of FRIB
- CD4 engineering collisions and physics begins: 2025+ possibly closer/around to 2030.

