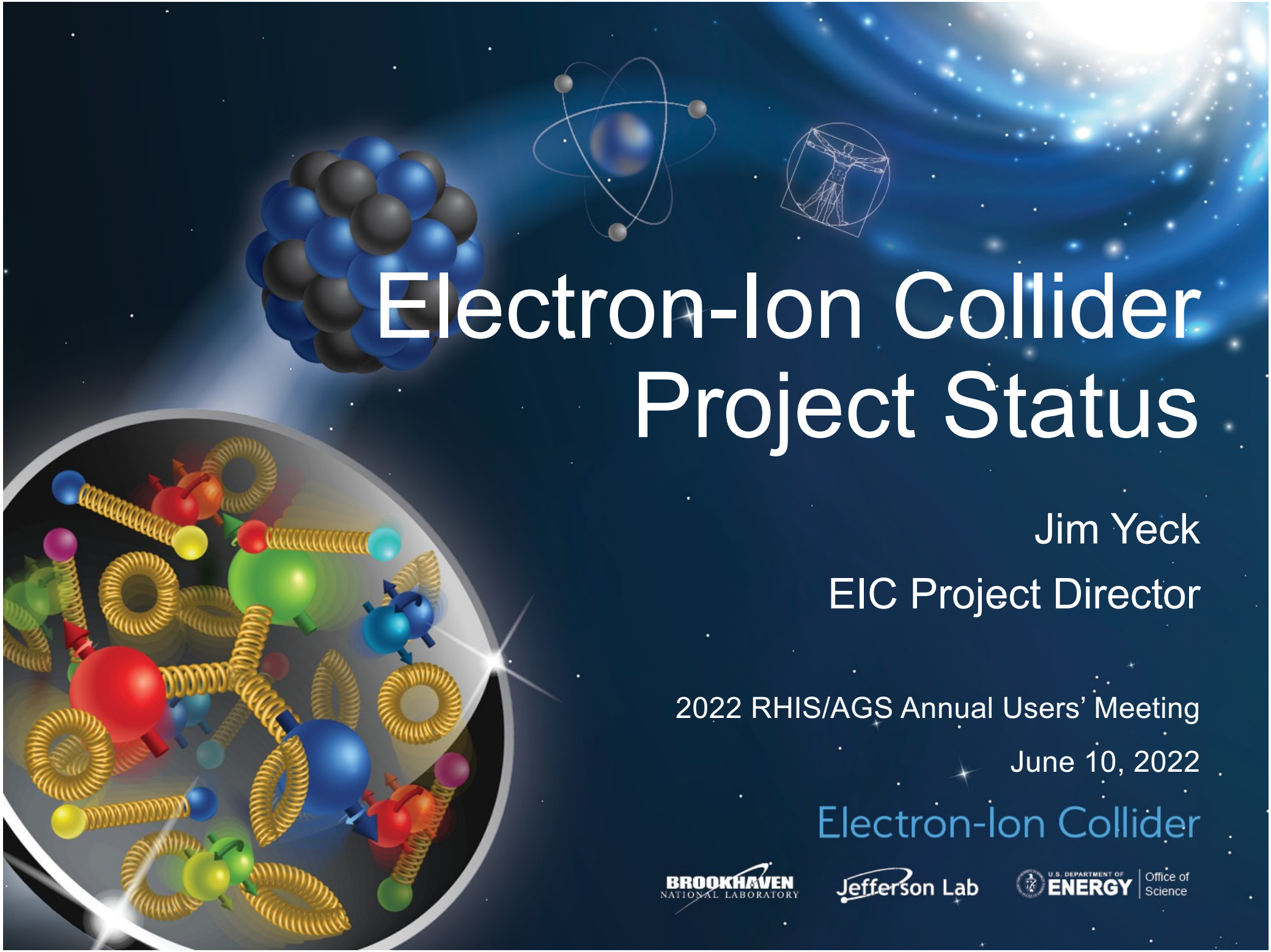


Electron-Ion Collider Project Status

Jim Yeck

EIC Project Director

2022 RHIS/AGS Annual Users' Meeting

June 10, 2022

Electron-Ion Collider

BROOKHAVEN NATIONAL LABORATORY

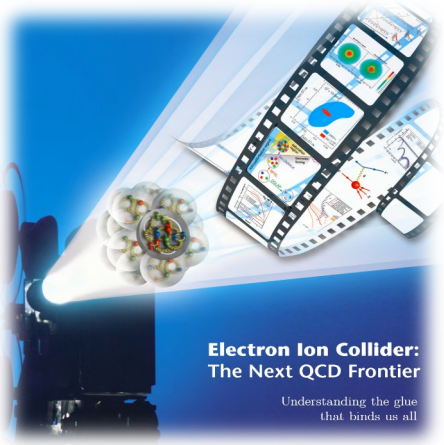
Jefferson Lab

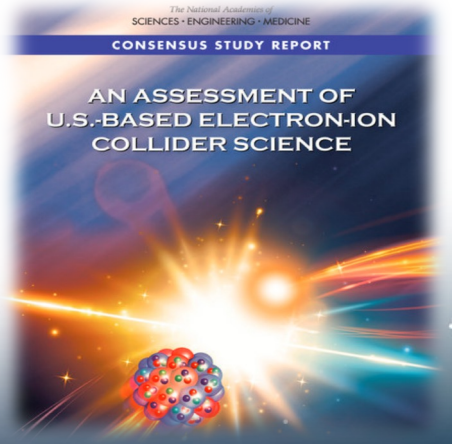
U.S. DEPARTMENT OF ENERGY | Office of Science

Project Requirements

Project Design Goals

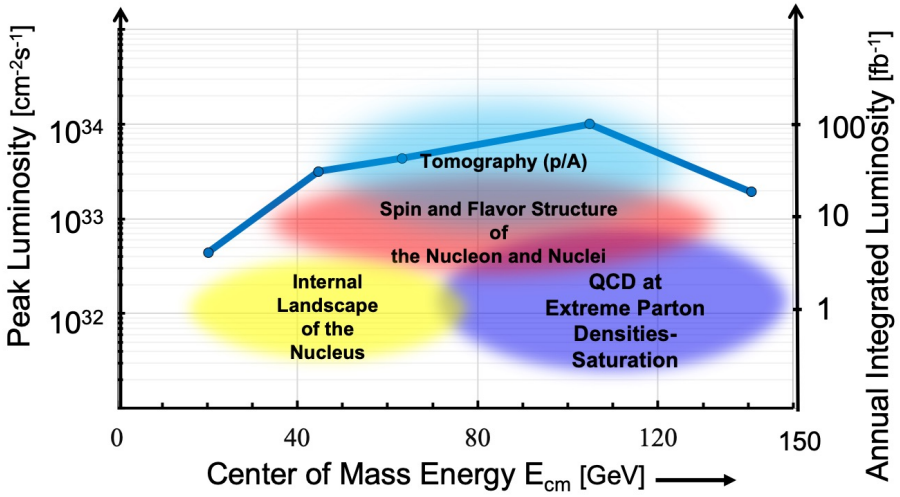
- High Luminosity: L= 10^{33} – 10^{34}cm^{-2}sec^{-1}, 10 – 100 fb^{-1}/year
- Highly Polarized Beams: 70%
- Large Center of Mass Energy Range: E_{cm} = 20 – 140 GeV
- Large Ion Species Range: protons – Uranium
- Large Detector Acceptance and
  Good Background Conditions
- Accommodate a Second Interaction Region (IR)

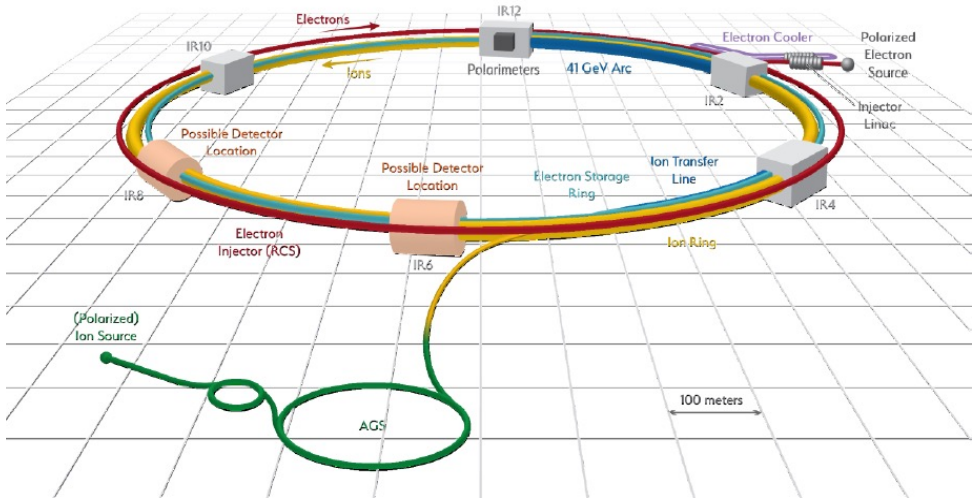




Conceptual design scope and expected performance meets or exceed NSAC Long Range Plan (2015) and the EIC White Paper requirements endorsed by NAS (2018)

EIC Machine Parameters





Double Ring Design Based on Existing RHIC Facilities	
Hadron Storage Ring: 40 - 275 GeV	**Electron Storage Ring: 2.5 - 18 GeV**
• RHIC Yellow Ring and Injector Complex	• Many Bunches, Large Beam Current - 2.5 A
• Many Bunches, 1160 @ 1A Beam Current	• 9 MW Synchrotron Radiation
• Bright Beam Emittance ε_{xp}= 9 nm	• Superconducting RF Cavities , 10MW Power
• Flat Beam, Requires Strong Cooling	
High Luminosity Interaction Region(s)	**Electron Rapid Cycling Synchrotron**
• 25 mrad Crossing Angle with Crab Cavities	• Spin Transparent Due to High Periodicity

EIC Project Recent History

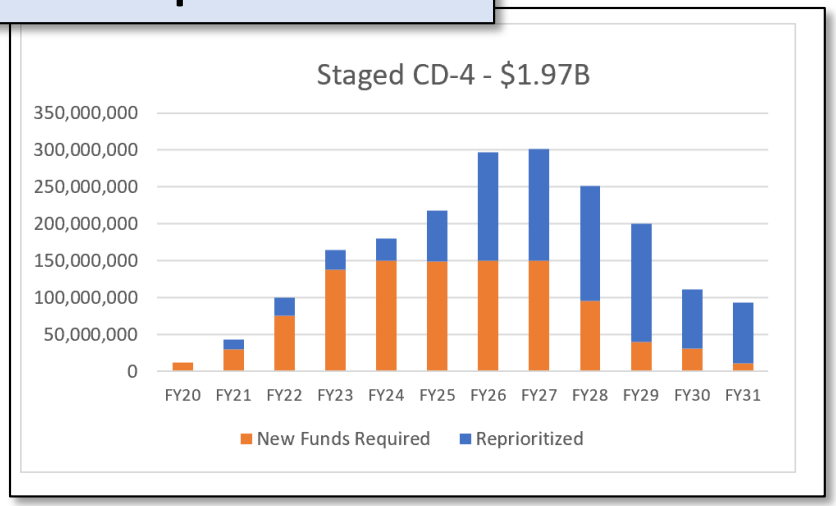
Event	Date
Mission Need Statement Approved	January 22, 2019
CD-0, Mission Need Approved	**December 19, 2019**
DOE Site Selection Announced	January 9, 2020
BNL - TJNAF Partnership Agreement Approved	May 2020
Conceptual Design Review	November 2020
DOE Independent Cost Review (ICR)	January 2021
CD-1, Alternative Selection and Cost Range, Approved	**June 29, 2021**
DOE FY2022 Budget Uncertainties, Potential DOE Infrastructure Funding…	
DOE EIC FY2022 Budget Approved at $45M	March 2022
Detector Proposal Advisory Panel Report	March 21, 2022
CD-2/3A, Baseline/Long Lead Procurement	***Likely January 2024***

FY2022 Update

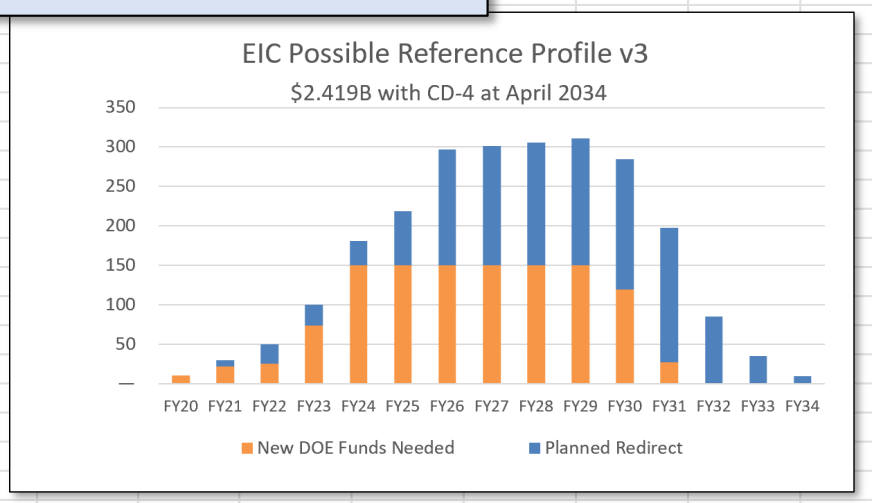
- FY2022 Plan and Funding Profile assumed $100M
- FY2022 Actual Funding – $44.8M (50% above FY2021)
  - Project continues to “lean forward”:
    - Carry out pending new hires
    - Execute MOUs
    - Start additional hiring
    - Release small procurements
    - Launch R&D procurements and seed funds to potential in-kind partners
- 9-month delay in the target dates for DOE Critical Decision milestones established at CD-1
- FY2023
  - President’s Request at $30M plus additional OPC = $45M
  - Current plans and schedules assume $90M

Project Reference Profile Evolution

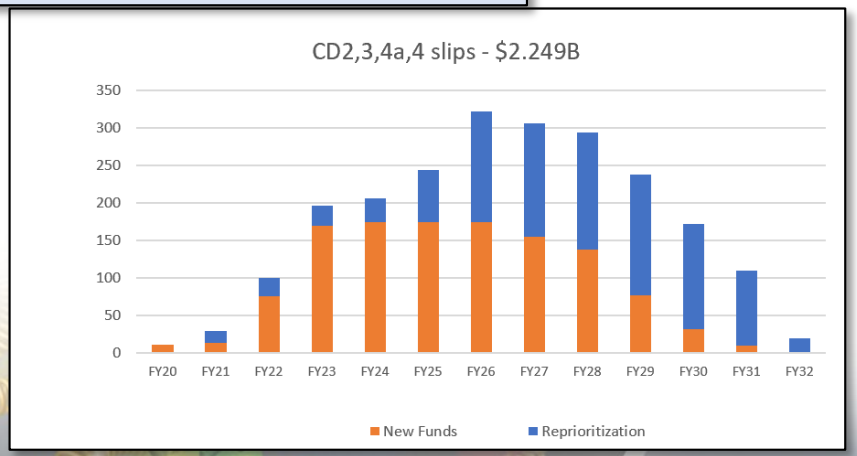
v1 – Ops Jan ‘31



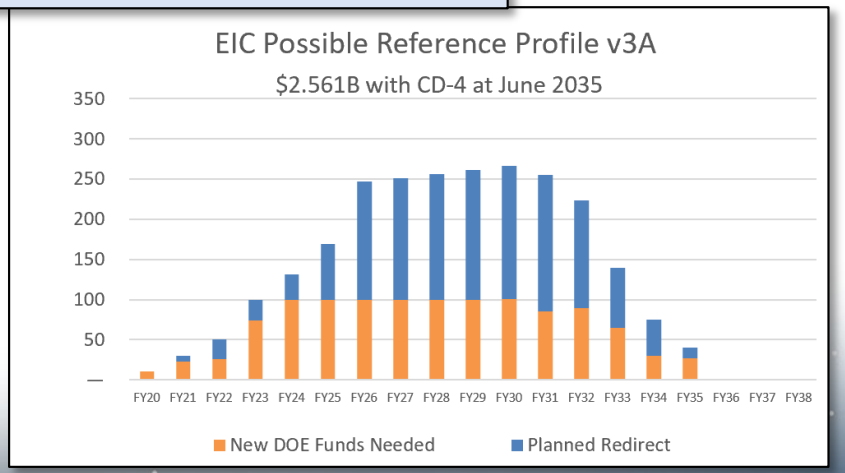
v3 – Ops Apr ‘32



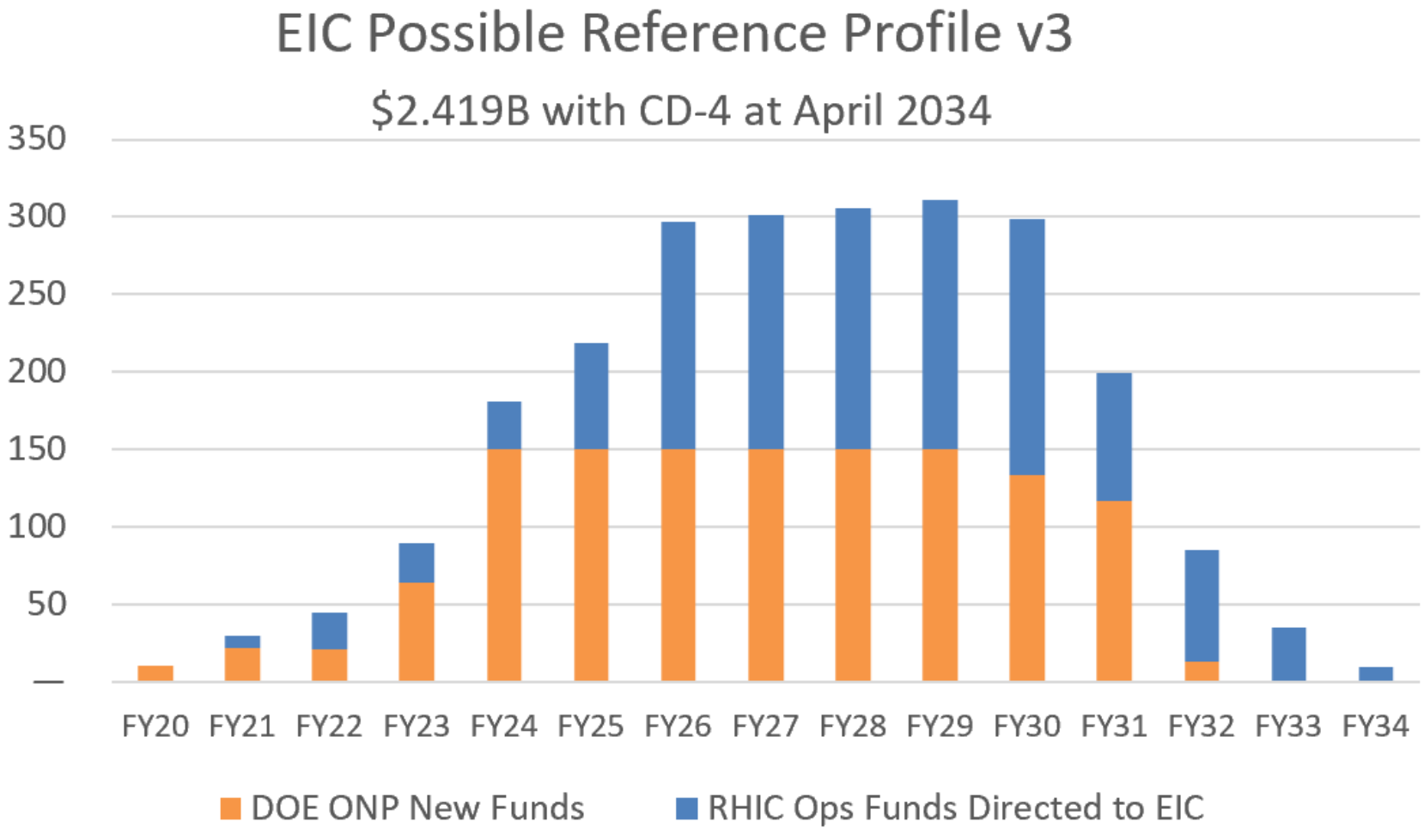
v2 – Ops Jul ‘31



v3OpB – Ops Jul ‘32



Proposed Reference Profile v3



Profile v3 Assumptions

- New funds capped at $150M/year
- 9-month slip to all CD dates
  - CD-2/3A = January 2024
  - CD-3 = April 2025
  - CD-4A EF = April 2031 (Start of Operations)
  - CD-4A = April 2032 (Start of Operations)
  - CD-4 EF = April 2032
  - CD-4 = April 2034
- Total Project Cost (TPC) ~$170M above CD-1 estimate
- Need to prioritize long lead procurements

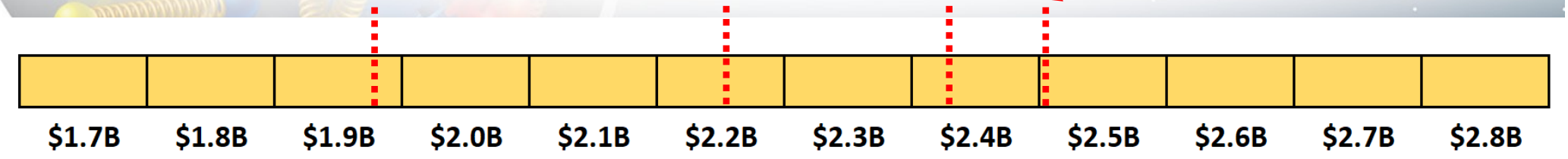
	Range	
	Low End ($M)	High End ($M)
Total Estimated Cost (TEC)		
PED	$280	$367
Construction	$1,118	$1,466
TEC Contingency	$159	$733
Subtotal TEC	$1,558	$2,566
Other Project Cost (OPC)		
OPC	$128	$167
OPC Contingency	$14	$67
Subtotal OPC	$142	$234
Total Project Cost (TPC)($M)	$1,700	$2,800

1. Pre-CD1 Profile
- Technically Driven Schedule

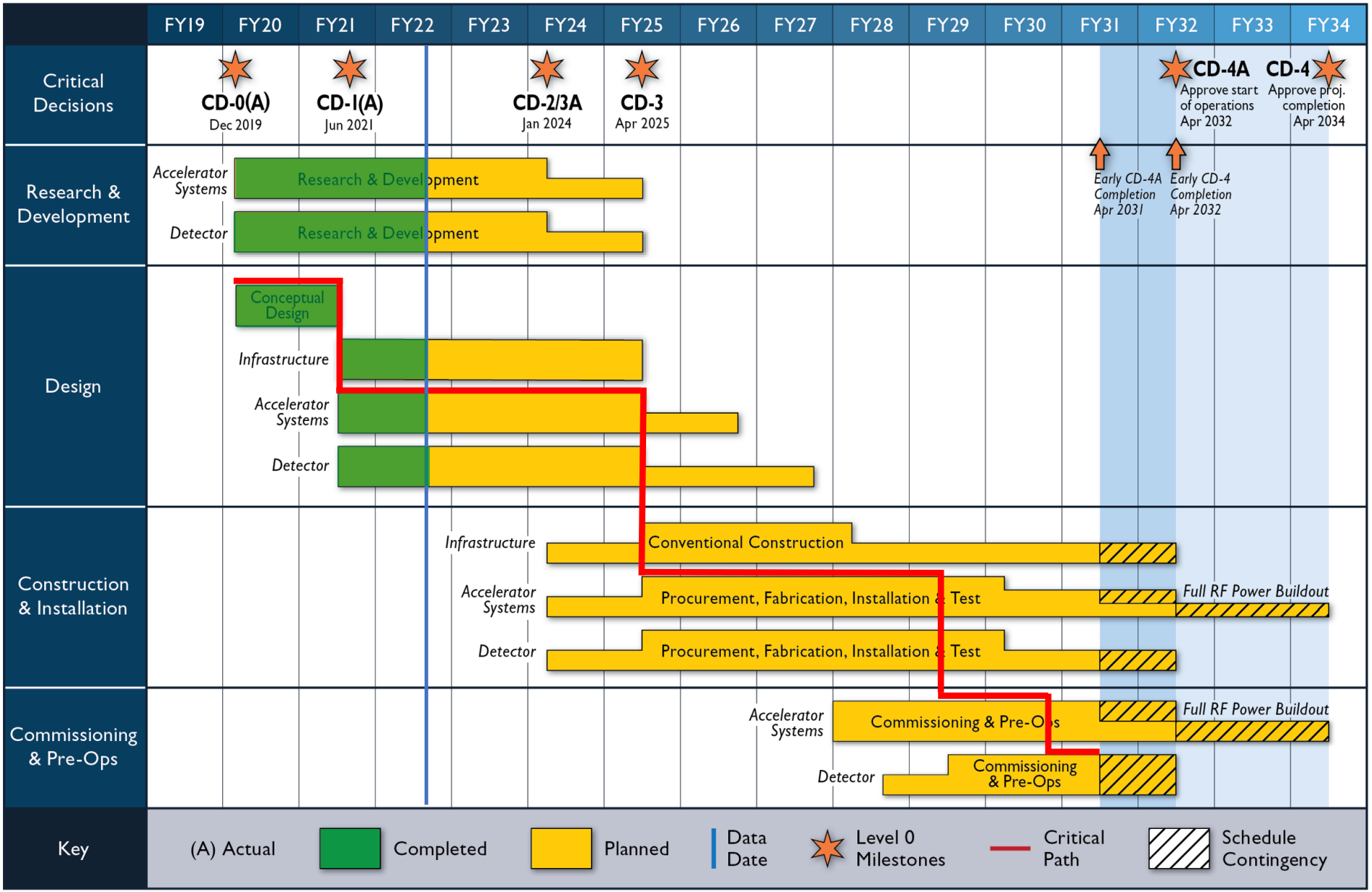
2. CD-1 Profile
- 40% Contingency
- Adjusted Funding Profile

3. Proposed Plan
- Actual FY22
- $150M/year new funds

Scenario 3A - $100M/year new funds



EIC Schedule



Perspective on DOE CD-2/3A

- Priority is to secure CD-2/3A, Project Performance Baseline/Long Lead Procurement (LLP), at the earliest achievable date
  - Typically enables a more secure funding plan
  - LLP authority improves overall schedule and supply chain risks
  - Optimum alignment with ONP redirection plans and conclusion of RHIC OPS
  - Promotes engagement of users, international partners, NSF, and DOE!
- Funding increase in FY2023 is essential for timely CD-2/3A
  - Increase pace of technical progress and restore momentum lost after CD-1
  - Increase design maturity and viability of CD-2/3A goals
  - Improve accuracy of cost and schedule uncertainty estimates, reduce risk
  - Bolster stakeholder confidence in EIC construction schedules
  - Strengthen partner engagement and secure commitments
- DOE CD-2/3A reviews will be requested when ready, following:
  - Preliminary Design Review – assessment of design maturity and technical risk
  - “Director’s Review” – comprehensive assessment of mgmt., TPC, CD-4, etc.
  - DOE Federal Project Director assessment of readiness to proceed

CD-2/3A Planning Dates

- DOE OPA Status Review (Remote) — October 19-21, 2021(A)
- Funding Discussion at DOE ONP (In-Person) — April 26, 2022 (A)
- FPD Status Update at BNL (Hybrid) — June 28, 29, 30 2022
- Cost and Schedule Scrutiny Meetings — June - August 2022
- Project Detector Meetings — Fall 2022
- DOE OPA Status Review - Confirm CD-2/3A Plans — January 2023
- Preliminary Design and Director's Reviews — May 2023
- DOE CD 2/3A OPA Review and ICR — October 2023
- DOE CD 2/3A ESAAB Approval — January 2024

Project Challenges

- Construction Funding Ramp-Up (50% vs >100% per year)
  - Funding profile and construction project affordability
  - Partner engagement and motivation of in-kind contributions
- Accelerator Science and Technology
  - Complex machine with high performance goals (luminosity, polarization, reliability, etc.) requiring a collaborative approach
  - BNL and JLab working to engage international and domestic partners in these efforts
- Infrastructure Schedule w/ NYS Support ($100M)
  - Initial pacing scope for the project with significant NYS funding
  - Requires EIC technical teams to deliver timely requirements
- Project Detector Plans
  - Excellent progress leveraging DPAP recommendations
  - Working to support an inclusive collaboration and institutional responsibilities, scope, cost & schedule for CD-2/3A

Summary

- Excellent Progress
  - Project foundation in place: organization, defined scope, conceptual design, preliminary performance parameters, cost & schedule range, and planning documentation
  - BNL/TJNAF partnership defined and actively pursuing broader collaboration and partnership in the EIC
  - Clear path forward on the project detector based on ECCE reference design located at IP6
- DOE CD-1 secured and preparing for CD-2/3A
- Strong case for substantial increase in project funding established and being pursued


Thank You!
Electron-Ion Collider
BROOKHAVEN NATIONAL LABORATORY
Jefferson Lab
U.S. DEPARTMENT OF ENERGY
Office of Science