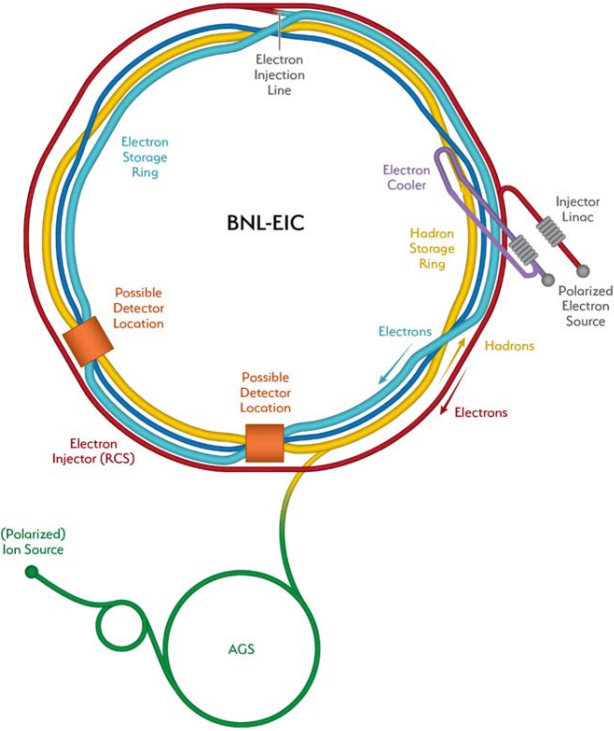


UKRI Full Infrastructure Project Bid

Peter Jones, University of Birmingham



UK Project Overview

▪UKRI Infrastructure Fund

EIC Detector R&D awarded £2.97m

Duration 2.5 years (Oct 2021 – Mar 2024)

Three detector work packages: [MAPS](#), [Timepix](#), [Polarimetry](#)

Funded institutes: [Birmingham](#), [Brunel](#), [Glasgow](#), [Lancaster](#), [Liverpool](#), [York](#), [STFC/DL](#), [STFC/RAL \(TD and PPD\)](#)

Current award is a [Preliminary Activity](#) or [Scoping Project](#)

Aims of this phase are:

- (i) Establish/maintain technical and scientific leadership
- (ii) Define the size and scope of the UK's contribution to detector construction

Intention is that construction would be a [Full Infrastructure Project](#)

▪Track Record

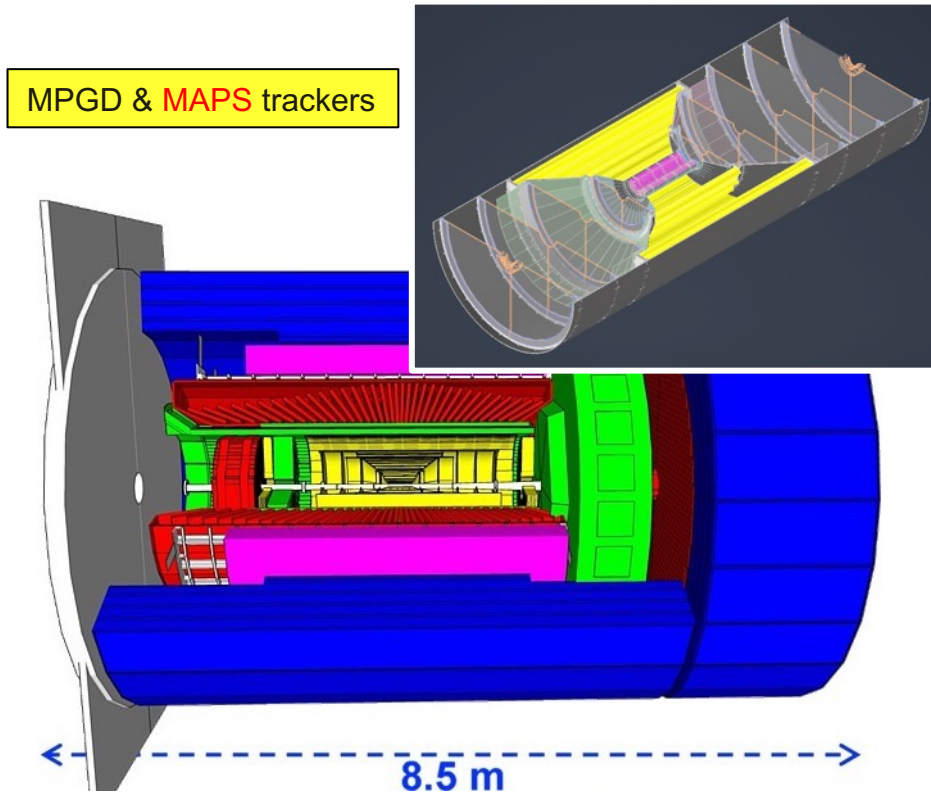
Collaboration has a strong record in developing detector technologies. Relevant examples include: [ALICE ITS2](#); [ATLAS ITk](#); [CLAS12 Forward Tagger](#); [MAMI nucleon polarimeter](#)

Leadership in [MAPS](#) at the EIC grows out of UK involvement in the US-funded, [EIC Generic R&D programme \(2016-2021\)](#)

Proposed UK in-kind contributions to the detector

- EPIC = ATHENA + ECCE: central detector and ancillary detectors

WP1: MAPS

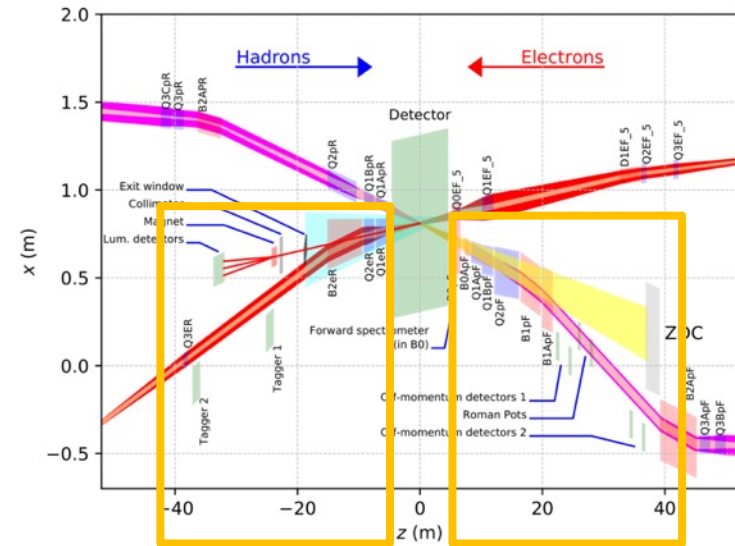


hadronic calorimeters

solenoid coils

e/m calorimeters

ToF, DIRC, RICH detectors



far backward

far forward

WP2: Timepix

WP3: Polarimetry

Future Funding Strategy

- US Project Meetings with International Funding Agencies

 - Bi-lateral Meeting between UKRI/STFC and DOE/NP – 23 August

 - Provided slides to both parties in advance of the meeting

 - Feedback from DOE/NP: [very positive meeting](#)

 - Advice from STFC: [apply for Full Infrastructure Project funding](#)

- UKRI Infrastructure Funding Cycle

 - Call for next wave of Full Projects (Wave 3) closes in [July 2023](#) with funds starting in [2025](#)

 - [Note](#): timing of following FP Wave is [not yet confirmed](#). Likely to be [2025](#) with funds starting in [2027](#). Hence, going for Full Project status now.

- Multi-lateral Pre-RRB (kick-off) Meeting – 12-13 October

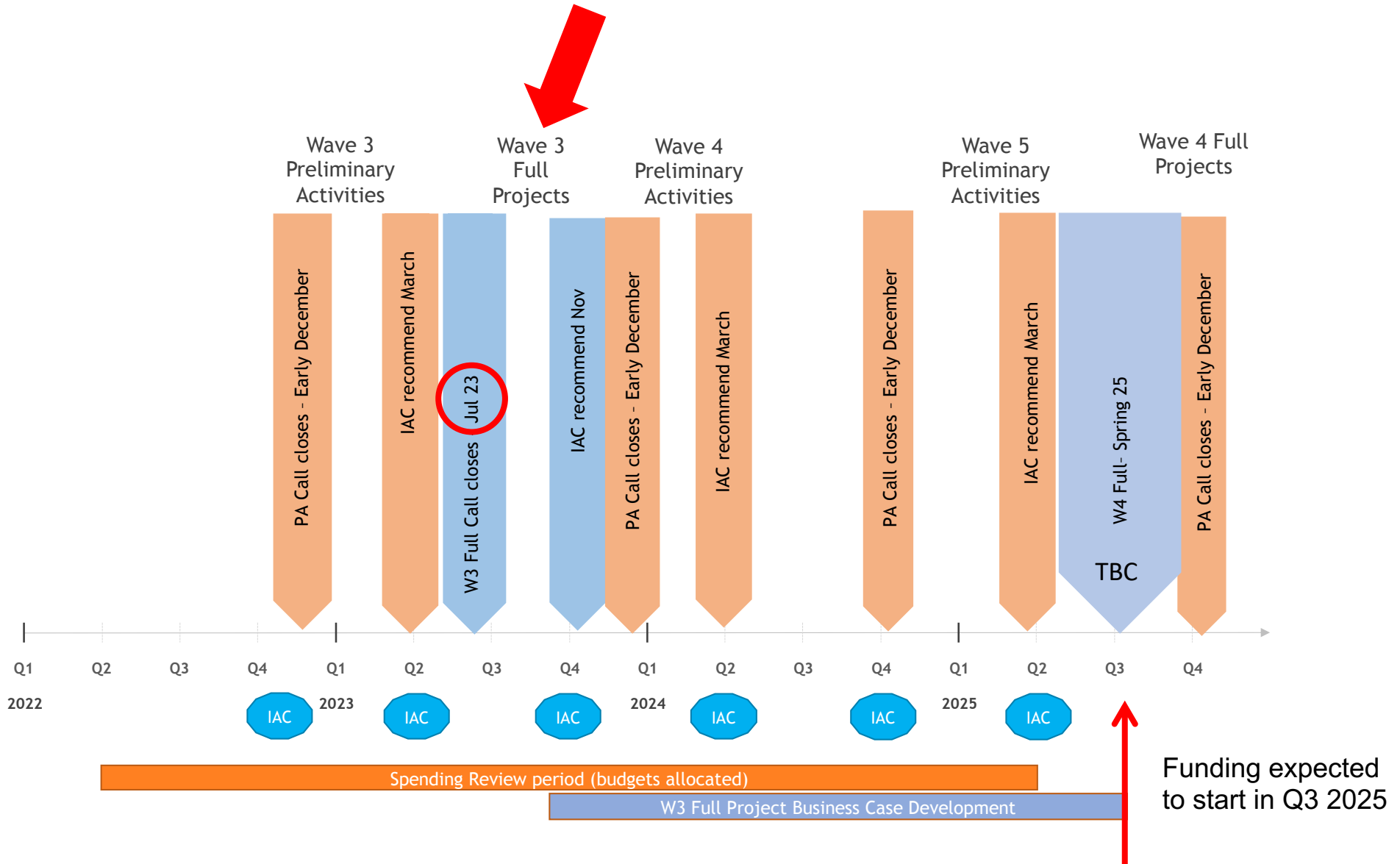
 - Attended by Grahame Blair, Justin O’Byrne, Daria Sokhan and myself

 - First regular RRB meeting 3-4 April 2023 @ BNL

 - Project is aiming for a multilateral agreement (non-binding at this stage) on international contributions to the detector by CD-2 review (October 2023)

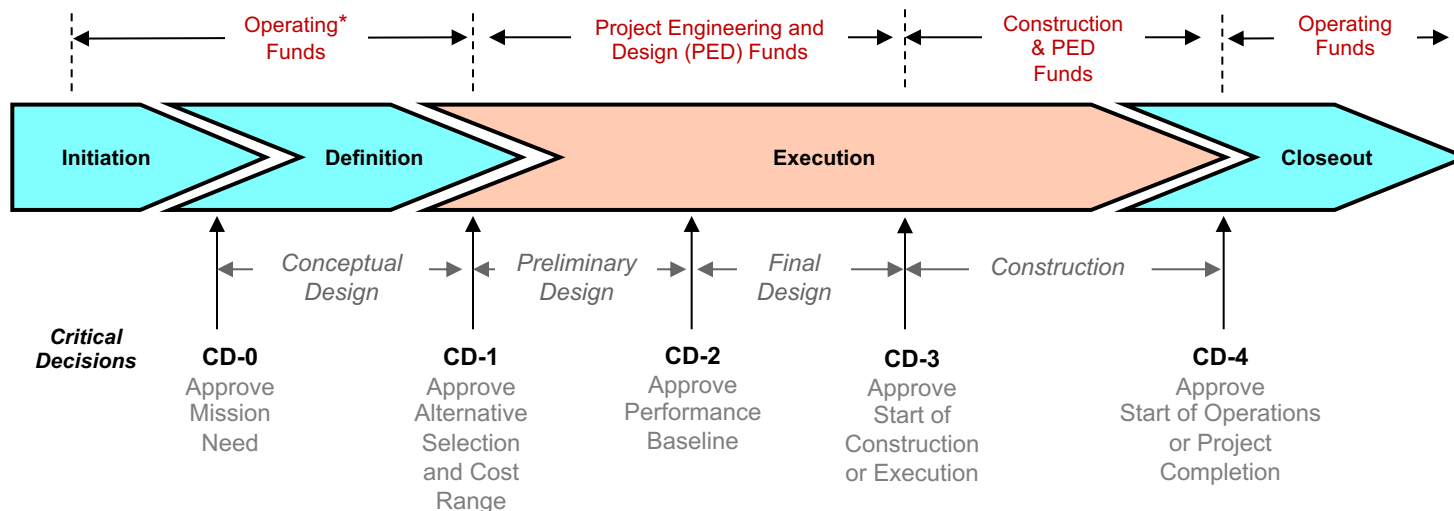
- Further meeting between DOE and international funding agencies – 16 November

UKRI Infrastructure Funding Cycles

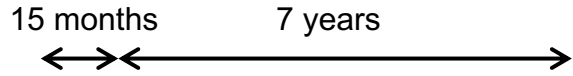


Timeline to CD-2/3A and CD-3

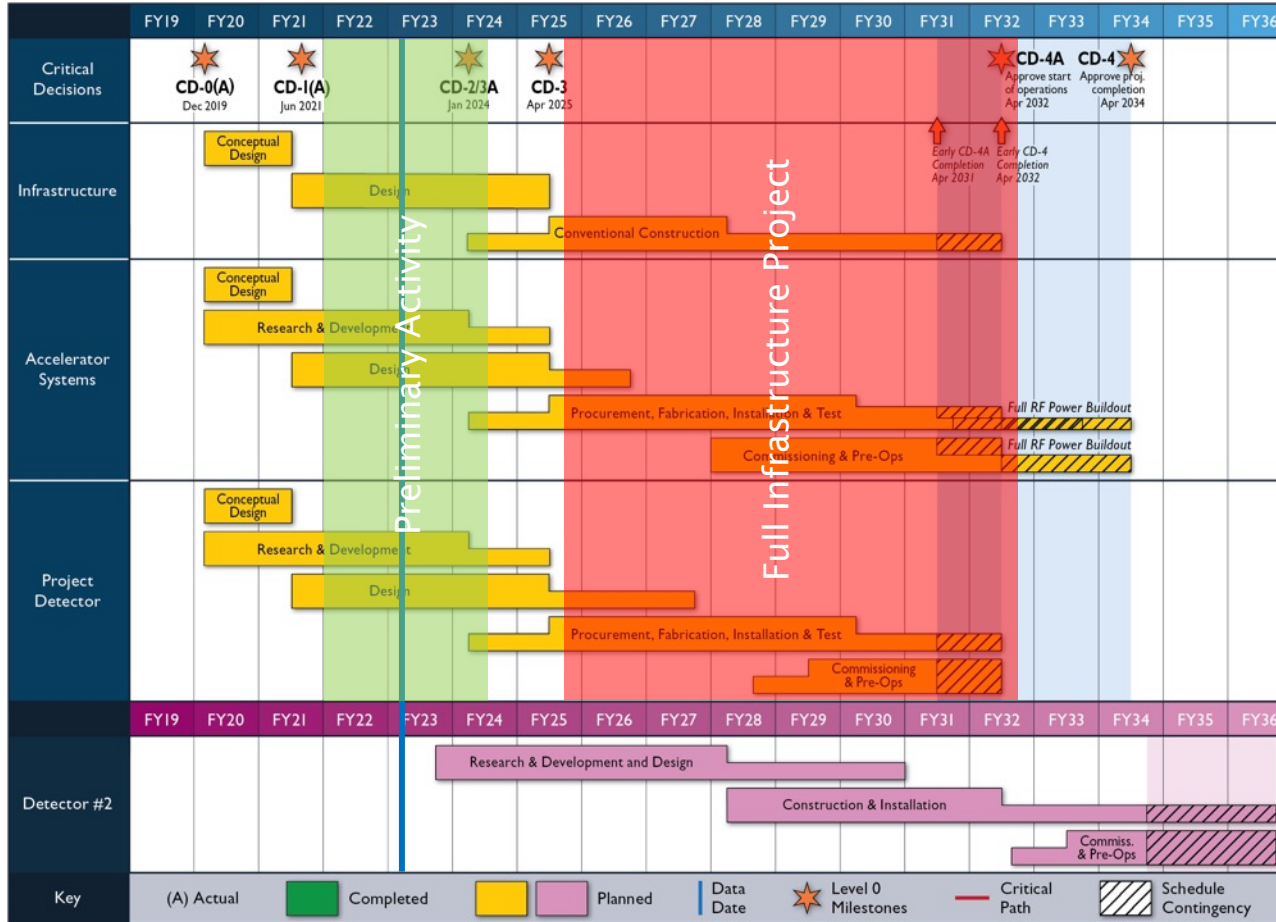
- Technical Subsystem Reviews January - December 2022
 - Tracking Review probably now in January 2023
- Office of Project Assessment (DoE) Status Review January 2023
- Preliminary Design Complete & Review May/June 2023
- Final Design/Maturity Readiness for CD-3A Items May/June 2023
- CD-2/3A Review (expectation), requires pre-TDR October 2023
- CD-2/3A (expectation) January 2024
- CD-3 Review (expectation), requires full TDR January 2025
- CD-3 (expectation) April 2025



International Project Schedule



NOTE: US Financial Years (FY) = Oct-Sep



- UK-EIC Detector R&D Project
- UK-EIC Detector Construction Project

What we know about the application process

▪ Provisional Timetable

2nd December – Initial information (timetable, initial guidance, assessment criteria)

16th December – Further details provided (further guidance, help with project development)

10th February – Submission date for Case for Support

15th February – Documents sent to Assessors

w/c 20th March – (PPRP) Panel meeting to answer questions

w/c 27th March – Feedback to Projects

April – Put information into UKRI Infrastructure Form

21st April – Submission of UKRI Form to SB/TAAB/STFC Assessment

▪ Bridging

Likely to need 15-18 months of bridging support

In discussion with STFC about a no-cost and costed extension

Also, possible to bid into the annual call for (US) Project-Directed R&D

Case for support (provisional guidance)

- Case for Support (15 pages)

1. Summary of the Infrastructure
2. Scientific and Community Need
3. Strategic Context
 - Wider Infrastructure (if international)
 - UK Contribution
4. Previous project funding
5. Infrastructure Fund Project Description
 - Objectives
 - Work Package Breakdown
6. Impact Potential
7. Gantt Chart
8. Project organisation and governance chart

- Scalability Statement

1. Reduction of 10%
2. Reduction of 20-30%

- Risk register

Utilising UKRI risk reporting scoring
Top 5 - 10

- Costings tables

How detailed should this be?

Note: Je-S submission will not be required

Top-level work packages

- **WP1 – MAPS**: 65 nm (wafer-scale) stitched sensors; developed in partnership with ALICE-ITS3. Build part of central tracker – vertex and barrel layers. Technology already adopted in baseline detector.

Institutes: [Birmingham](#), [Brunel](#), [Lancaster](#), [Liverpool](#), [STFC RAL \(PPD & TD\)](#), [STFC DL](#), [Oxford](#)

- **WP2 – Timepix**: low- Q^2 tagger using pixel sensors in vacuum. Build two tracking stations in far backward region. Detector is baseline. Timepix4 is the preferred technology.

Institutes: [Glasgow](#), [STFC DL](#)

- **WP3 – Polarimetry**: current activity is exploring use of novel polarised scattering media using chemical hyperpolarization. Also, leading design of the baseline electron beam luminosity monitor. Contribution to luminosity monitor plus option to build a polarimeter when technology is proven.

Institutes: [York](#)

- **WP4 (NEW) – Accelerator options include**: SRF modules (possibly crab cavities), ERL simulation and design; crab LLRF synchronisation; EO-BPM instrumentation.

Institutes: [CI](#), [ASTeC](#), [JAI](#) and [STFC DL \(TD\)](#)

- **Estimated total cost: £30m-£35m**

Backup – Assessment criteria

UKRI assessment criteria

Assessment Criteria	Shortlisting	Proposal Review	STFC Prioritisation	UKRI Prioritisation
Research and innovation excellence/community support		X	X*	X
High impact potential		X	X*	X
Step change in capability	X		X	X
Strategic Drivers	X		X	X
Feasibility and deliverability/risk		X	X*	X
Accessibility			X	X
Environmental Sustainability			X	X

As a UKRI Infrastructure Preliminary Activity, the EIC is already shortlisted

STFC review will focus on three areas:

1. Research and innovation excellence/community support;
2. Impact potential;
3. Feasibility and deliverability/risk

Costing

Awaiting clarification on level of detail required

Note: there will be no opportunity to go back and ask for further funding after this phase

In discussion with STFC on how to handle WA and Contingency

Backup – Assessment criteria (Part 1 of 3)

▪Community Support and Demand

Key question: Is there demonstrable demand and strong support from the community for the infrastructure?

Strong interest from both nuclear and particle physics communities. Reference NP and PP roadmaps. Evidenced by leadership in physics working groups. Membership of EICUG.

▪Research and Innovation Excellence

Key question: Does the proposal represent the highest research and innovation excellence with the potential for significant difference to be made by the infrastructure to the discipline(s) supported?

Wafer-scale stitched MAPS leading to exceptionally low mass vertex and tracking detectors. Pixelated silicon sensors in-vacuum for precision tracking at low- Q^2 . Development of novel polarised scattering media to measure polarisation of scattered nucleon. Solutions to some of the key accelerator challenges that are of strategic importance to the UK/future projects.

Backup – Assessment criteria (Part 2 of 3)

▪ High Impact Potential

Key question: Does the proposal demonstrate the impact of the infrastructure beyond the relevant research and innovation community/communities with the potential impact (e.g. social, economic, policy) evidenced?

Impact of detector technologies for future projects in NP and PP. Only new accelerator to be built in the foreseeable future. Particular challenges for the accelerator are beam cooling and crab crossings to achieve highest luminosity. Several examples of wider impact from previous work that is closely related to the technologies being developed here. Case can be made for translation into some of those existing applications.

▪ Feasibility

Key question: What is the feasibility of the project being delivered, including and evaluation of the risks associated with the project?

UK detector contributions are highly visible and well-embedded in the international project (e.g., Project directed R&D). Result of careful technology evaluation by the proponents / project (e.g., Yellow Report; Detector Proposals). Risks are understood and mitigations exist. Accelerator contributions are welcomed by the US Project recognising UK expertise to deliver key components. Careful consideration of WA and contingency.

Backup – Assessment criteria (Part 3 of 3)

▪ Appropriateness

Key question: Is there evidence that the proposal is not an unnecessary duplication and this fits within the domestic and international landscape?

The EIC facility will be the world's first polarised electron polarised proton/light-ion collider. It will also be the world's first polarised electron heavy-ion collider. Combination of highly polarised beams, wide range of collision energies and wide range of ion species make it unique. It was the highest priority new nuclear physics project in the NSAC LRP. Strong synergy with JLab and CERN-LHC, also with CERN EP in detector R&D.

▪ Justifiability

Key question: Is the magnitude of costs in balance with the project's aims?

Estimated costs appear to be in-line with the size of the user community.