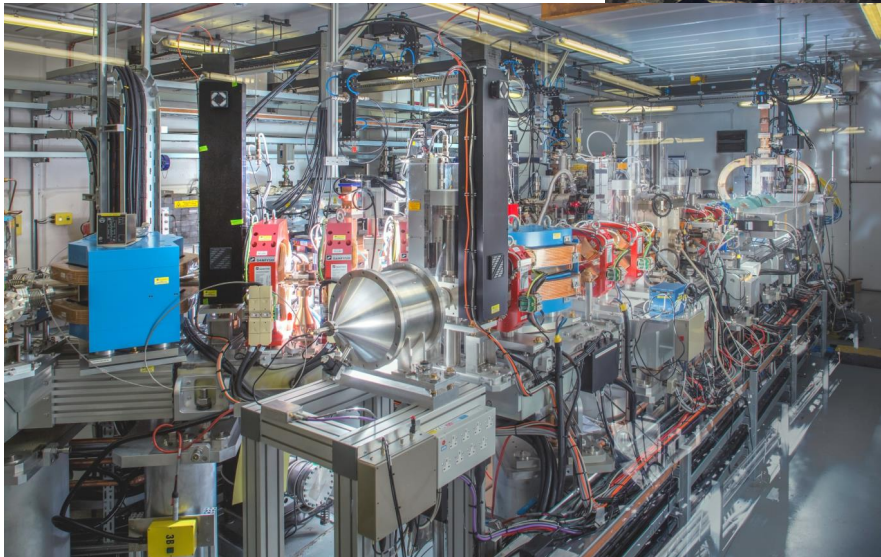
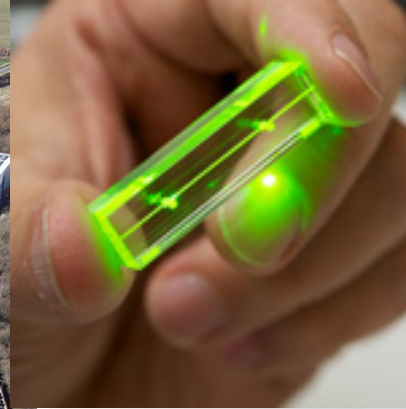


EIC Collaboration Workshop:

Promoting Collaboration on the EIC

7th – 9th October 2020

Welcome
from the UK



Peter Ratoff
Director
Cockcroft Institute



EIC WORKSHOP

Promoting Collaboration on the Electron-Ion Collider

Organizing Committee:

Jim Clarke (Cockcroft Institute and ASTeC, UK)

Peter McIntosh (Cockcroft Institute, UK)

Peter Williams (Cockcroft Institute, UK)

Graeme Burt (Cockcroft Institute, UK)

Peter Ratoff (Cockcroft Institute, UK) (Co-Chair)

Andrei Seryi (JLab) (Co-Chair)

Ferdinand Willeke (BNL)

Bernd Surrow (EIC User Group)

EIC WORKSHOP

Promoting Collaboration on the Electron-Ion Collider

A truly global event
Over 320 registered participants
from 23 countries
in 6 continents
Only Antarctica is missing!

EIC WORKSHOP

Promoting Collaboration on the Electron-Ion Collider

The **Electron-Ion Collider** will be a powerful new facility in the United States, hosted at the Brookhaven National Lab, constructed with the aim of studying the particles, gluons, which bind all the observable matter in the world around us. The **EIC machine** will consist of two intersecting accelerators, one producing an intense beam of electrons, the other a high-energy beam of protons or heavier atomic nuclei, which are steered into head-on collisions.

Brookhaven National Laboratory (BNL), together with Thomas Jefferson National Accelerator Facility (TJNAF), are developing the EIC project plans, including coordination of domestic and international partners to deliver the EIC construction project.

EIC WORKSHOP

Promoting Collaboration on the Electron-Ion Collider

Cockcroft Institute of Accelerator Science and Technology, UK, working with the EIC project team, will be hosting a virtual meeting on October 7-9, 2020 which will focus on potential partnership in the EIC Project. The meeting will span over three days and will include sessions spread over multiple time zones, making it easier for participants from the entire world to participate.

The workshop will include an overview of the project status, overview of the accelerator and its subsystems, as well as presentations from the labs and institutes interested in collaboration on EIC accelerator, together with discussion of the relevant accelerator science and technology topics, representing a necessary step on the path to form the multi-lab collaboration that will deliver the EIC project.

EIC Workshop – Promoting Collaboration on the Electron-Ion Collider

7 Oct 2020, 00:00 → 9 Oct 2020, 21:00 Europe/London

Description Please visit workshop web-site: <https://www.cockcroft.ac.uk/events/eic20/> for details. The workshop is by invitation only. Please pre-register following the link below to request the invitation for participation. Agenda below is work-in progress and is subject for adjustments. Please use the menu in the upper right corner to view the agenda in your time zone.

Registration Please pre-register in order to request invitation for participation. [Register](#)

Participants Abhay Deshpande, Ady Hershcovitch, Akira Miyazaki, Akira Yamamoto, Alessandro Drago, Alessandro Gallo

Select your local time zone on Indico

<https://indico.cern.ch/event/949203/>

WEDNESDAY, 7 OCTOBER

14:00 → 16:00	Opening Conveners: Andrei Seryi (Jefferson Lab), Peter McIntosh (UKRI STFC), Peter Neil Ratoff (Lancaster University (GB))	
14:00	Welcome from the UK Speaker: Peter Neil Ratoff (Lancaster University (GB))	25m
14:30	Welcome from the DoE Speaker: Timothy Hallman (U.S. Department of Energy)	25m
15:00	EIC Project Overview Speaker: Jim Yeck (Brookhaven National Laboratory))	25m
15:30	EIC Accelerator Overview Speakers: Andrei Seryi (Jefferson Lab), Ferdinand Willeke (Brookhaven National Laboratory)	25m
16:00 → 18:00	Break	2h
18:00 → 20:00	Domestic/Americas Focus: Session 1.1 Conveners: Todd Satogata (Jefferson Lab), Vadim Ptitsyn (Brookhaven National Laboratory)	
18:00	Session Chair Introduction Speaker: John Byrd (Argonne National Laboratory)	5m

18:00	Session Chair Introduction Speaker: John Byrd (Argonne National Laboratory)	⌚ 5m	✎
18:10	EIC Electron Ring Speaker: Christoph Montag (Brookhaven National Laboratory) ESR-Montag-Oct20... ESR-Montag-Oct20...	⌚ 25m	✎
18:35	Potential ANL Contribution to the EIC Speaker: Brahim Mustapha (Argonne National Lab)	⌚ 20m	✎
18:55	FNAL accelerator technology and EIC Speaker: Sergey Belomestnykh (FNAL)	⌚ 20m	✎
19:15	Potential application of APS-U simulation tools to the EIC Speakers: Dr Michael Borland (Argonne National Laboratory), Xiaobiao Huang (Argonne National Laboratory)	⌚ 20m	✎
19:35	Berkeley Center for Magnet Technology and EIC Collaboration Speaker: GianLuca Sabbi (LBNL)	⌚ 20m	✎

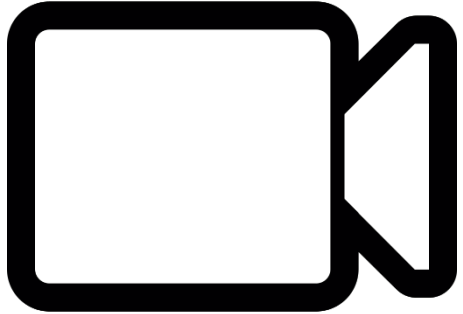
20:00 → 22:00	Domestic/Americas Focus: Session 1.2 Conveners: Todd Satogata (Jefferson Lab), Vadim Ptitsyn (Brookhaven National Laboratory)		
20:00	Session Chair Introduction Speaker: Robert Laxdal (TRIUMF)	⌚ 5m	✎
20:05	EIC Ion Source, Hadron Ring Polarisation Speaker: Vadim Ptitsyn (Brookhaven National Laboratory)	⌚ 25m	✎
20:30	SRF Developments and Facilities at Argonne Speaker: Michael Kelly (ANL)	⌚ 20m	✎
20:50	Modeling beam-beam effects in the EIC Speaker: Ji Qiang (Lawrence Berkeley National Laboratory)	⌚ 20m	✎
21:10	Status of R&D for the EIC Speaker: Qiong Wu (Brookhaven National Lab)	⌚ 20m	✎
21:30	ORNL and EIC Speaker: Sarah Cousineau (ORNL)	⌚ 20m	✎

22:00 → 00:00	Domestic/Americas Focus: Session 1.3 Conveners: Todd Satogata (Jefferson Lab), Vadim Ptitsyn (Brookhaven National Laboratory)		
22:00	Session Chair Introduction Speaker: Sergei Nagaitsev (Fermi National Accelerator Laboratory)	⌚ 5m	✎
22:05	EIC Electron Ring Polarisation Speaker: Fanglei Lin (Thomas Jefferson National Accelerator Facility)	⌚ 25m	✎
22:30	TRIUMF and EIC Speaker: Robert Laxdal (TRIUMF)	⌚ 20m	✎
22:50	Berkeley Accelerator Controls and Instrumentation (BACI) Center and EIC collaboration Speaker: Derun Li (LBNL)	⌚ 20m	✎
23:10	Sirius accelerators overview Speaker: Lin Liu (LNL/CNPEM)	⌚ 20m	✎
23:30	USPAS and EIC Speaker: Steve Lund (MSU)	⌚ 20m	✎



00:00 → 02:00	Break	⌚ 2h	
02:00 → 05:10	Asia/Oceania Focus: Session 2.1 Conveners: Christoph Montag (BNL), Haipeng Wang (Thomas Jefferson Lab), Jiquan Guo (Jefferson Lab), Zachary Conway (Brookhaven National Laboratory)	✎	
02:00	Session Chair Introduction Speaker: Yoshihiro Shobuda (J-PARC)	⌚ 5m	✎
02:05	EIC RHIC Upgrades (chamber etc) Speaker: Silvia Verdú Andrés (Brookhaven National Laboratory)	⌚ 25m	✎
02:30	Beam-beam studies updates Speaker: Kazuhiro Ohmi (KEK)	⌚ 30m	✎
03:00	PAL accelerator / vacuum technology and EIC Speaker: Taekyun Ha (Pohang Accelerator Laboratory)	⌚ 25m	✎
03:25	SPS-II: A 4th Generation Light Source in Southeast Asia Speaker: Prapong Klysubun (Synchrotron Light Research Institute, Thailand)	⌚ 25m	✎
03:50	Open microphone	⌚ 20m	✎
04:10	Accelerator Graduate education in Japan and EIC Speaker: Masao Kuriki (Hiroshima University)	⌚ 20m	✎
04:30 → 07:00	Asia/Oceania Focus: Session 2.2 Conveners: Christoph Montag (BNL), Haipeng Wang (Thomas Jefferson Lab), Jiquan Guo (Jefferson Lab), Zachary Conway (Brookhaven National Laboratory)	✎	
04:30	Session Chair Introduction Speaker: Chang-ki Min (Pohang Accelerator Laboratory)	⌚ 5m	✎
04:35	EIC Polarised E-Injector Chain Speaker: Vahid Ranjbar (Brookhaven National Laboratory)	⌚ 25m	✎
05:00	Reverse phase mode operation of the RF Speaker: Yoshiyuki Morita (KEK)	⌚ 25m	✎
05:25	Reducing impedances of J-PARC kickers Speaker: Yoshihiro Shobuda (J-PARC)	⌚ 25m	✎
05:50	SACLA's thermionic low-emittance gun and the future perspective Speaker: Kazuaki Togawa (Spring-8)	⌚ 25m	✎
06:15	Spin Polarized Cathode Development for EIC at Euclid Speaker: Eric Montgomery (Euclid Techlabs LLC)	⌚ 25m	✎
06:40	Open microphone	⌚ 20m	✎
07:00 → 12:00	Break	⌚ 5h	

EIC WORKSHOP



In a meeting, its nice to see you but no pressure to show yourself

zoom

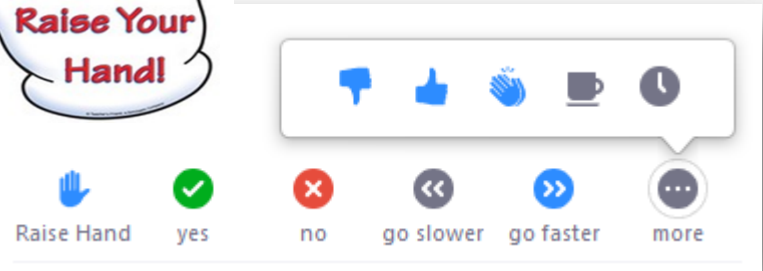
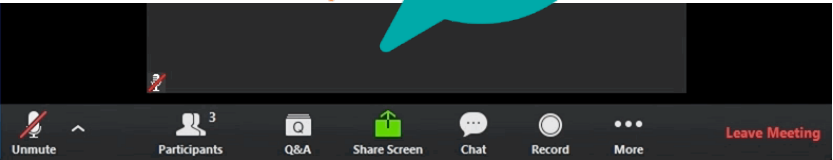
RULES OF ENGAGEMENT



If you are not speaking please be muted



If you have a question, you can either write it in the Chat window or under the Participants tab, raise your hand and you will be allowed to talk



EIC WORKSHOP



We will do our best to keep to time



We have NOT scheduled coffee breaks (sorry!)
... but there are gaps between the sessions



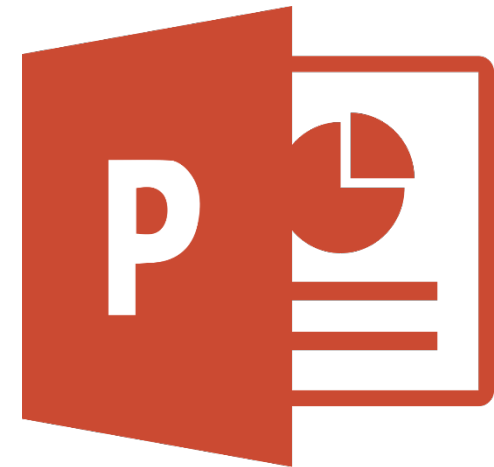
But if you need to go...



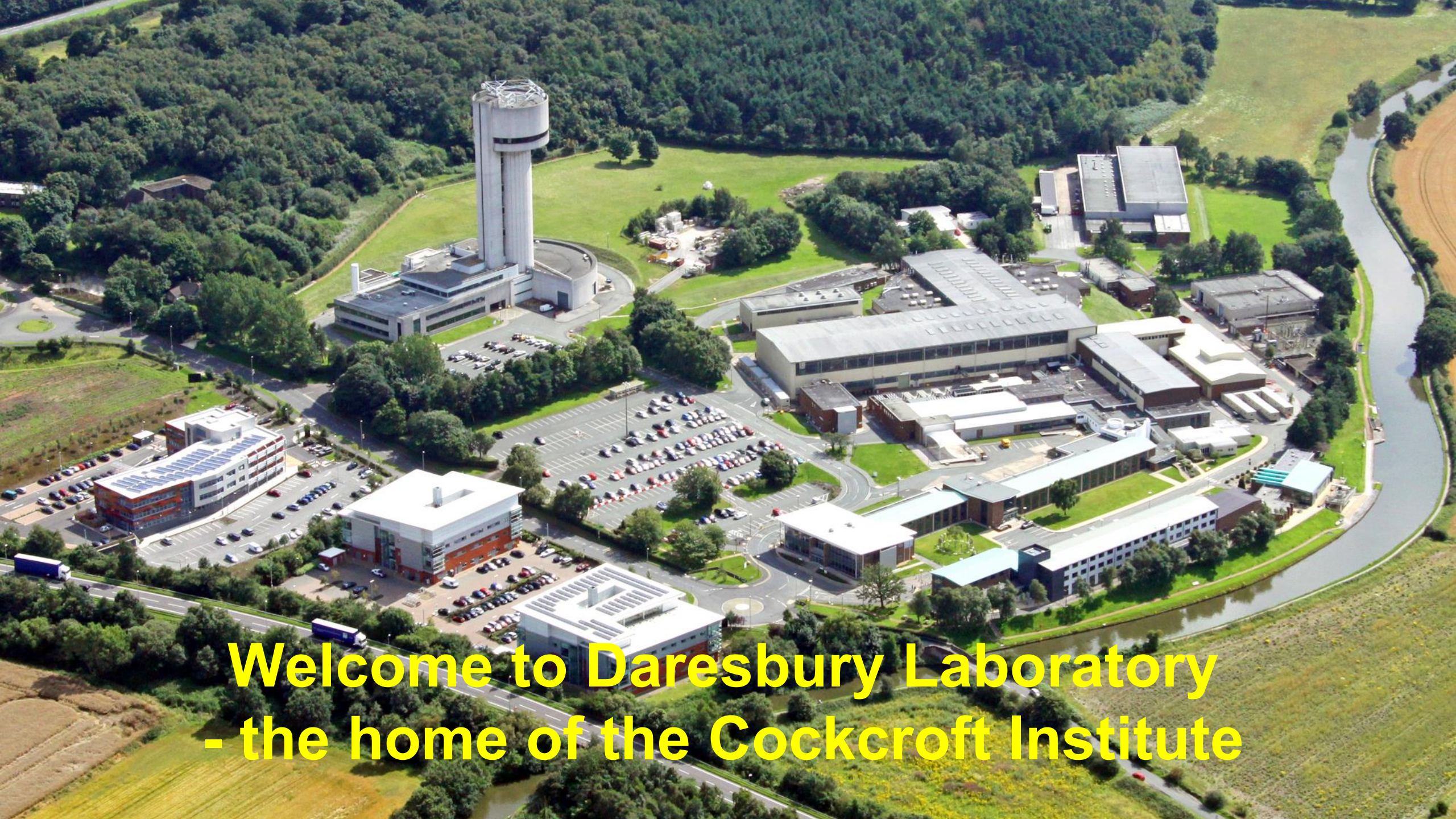
We understand if there are distractions



Feel free to take notes



PPT &/or PDF slides on Indico site

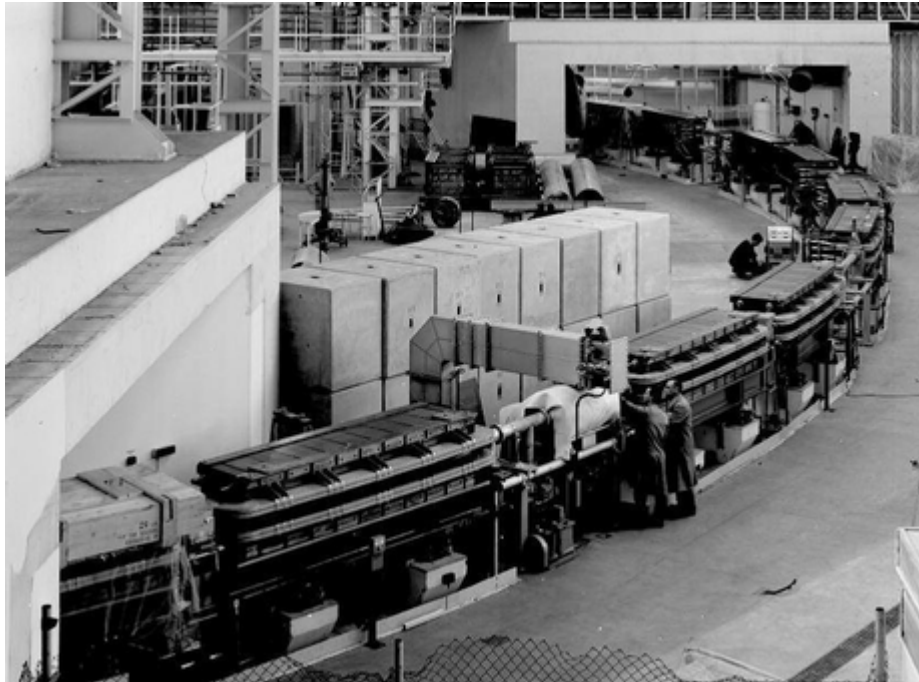


**Welcome to Daresbury Laboratory
- the home of the Cockcroft Institute**

Birthplace of Lewis Carroll (Alice in Wonderland)

A Brief History of Daresbury Laboratory

The Lab was established in 1962 as an accelerator lab to host NINA - a 5 GeV electron synchrotron for particle physics

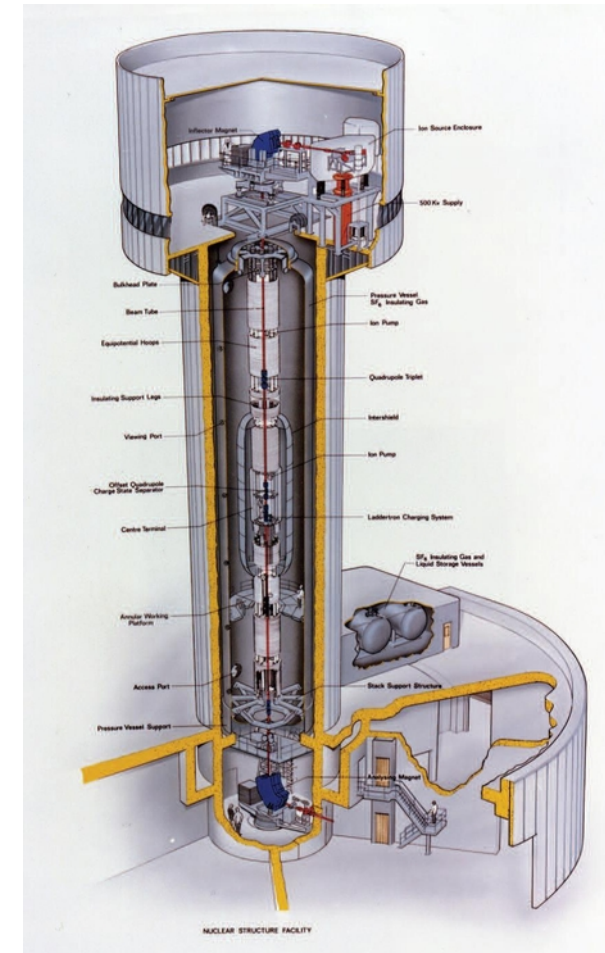


Bridgewater Canal, 1761

A Brief History of Daresbury Laboratory

The Tower was built in the late 1970s to host a Van der Graaff accelerator for nuclear physics

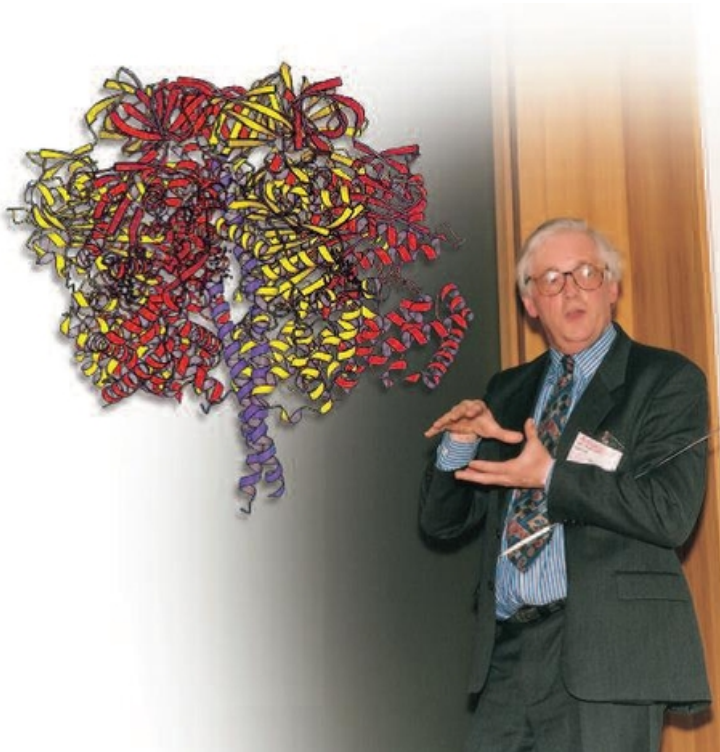
Meanwhile NINA closed down and was replaced by the 2GeV SRS – an X-ray source for chemistry, physics, materials, life sciences, etc



A Brief History of Daresbury Laboratory

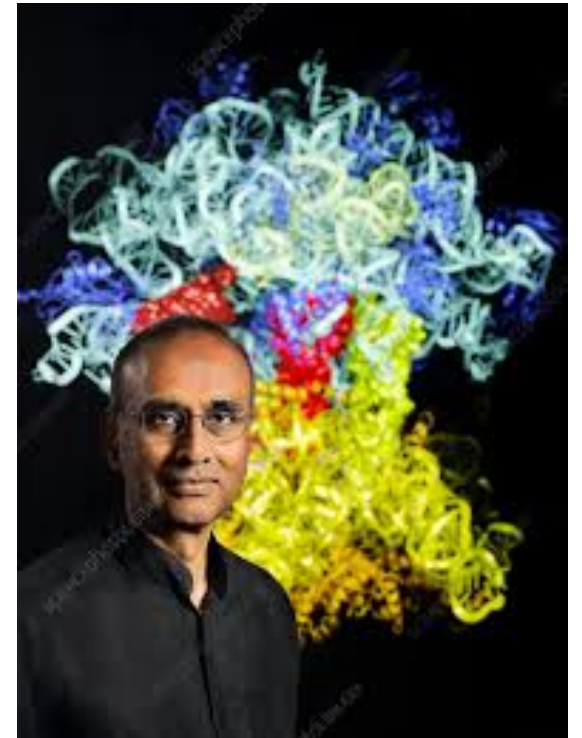
The Van der Graaff was closed in 1993 and the building repurposed

The SRS was upgraded and enhanced many times and eventually closed in 2008 once Diamond was up and running



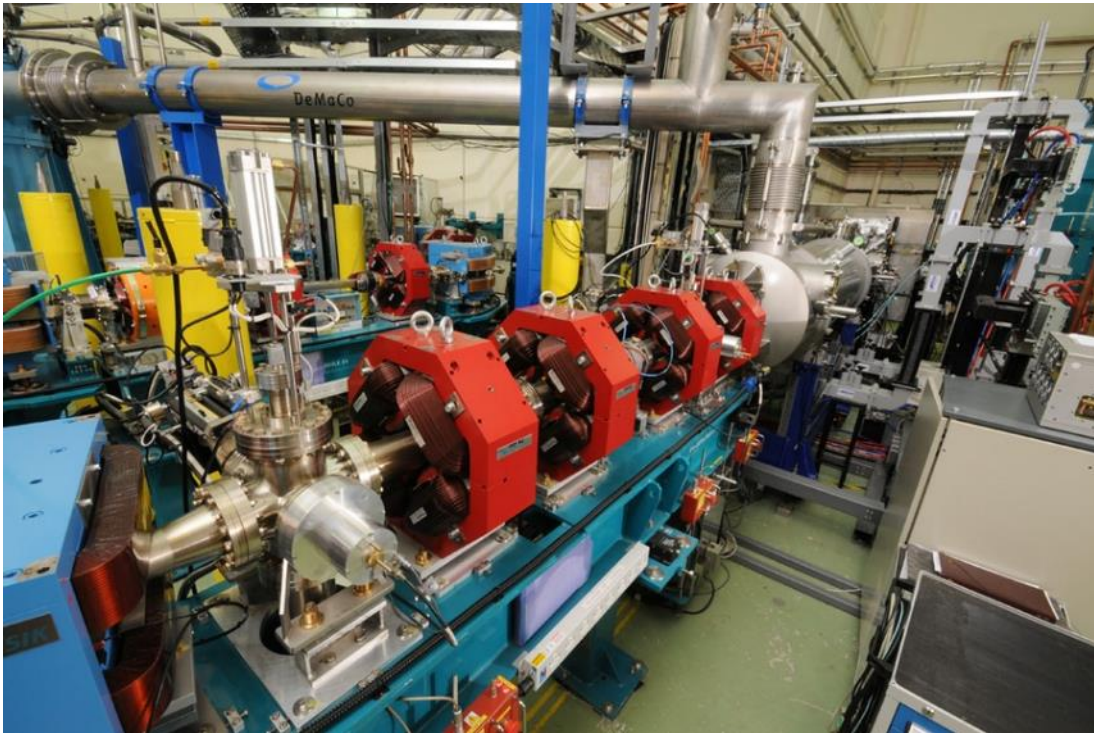
Sir John Walker won the Nobel Prize in Chemistry in 1997 for solving the structure of the F1 ATPase enzyme using the SRS

Sir Venki Ramakrishnan won the Nobel Prize in Chemistry in 2009 for his work on the structure and function of the Ribosome, also making use of the SRS

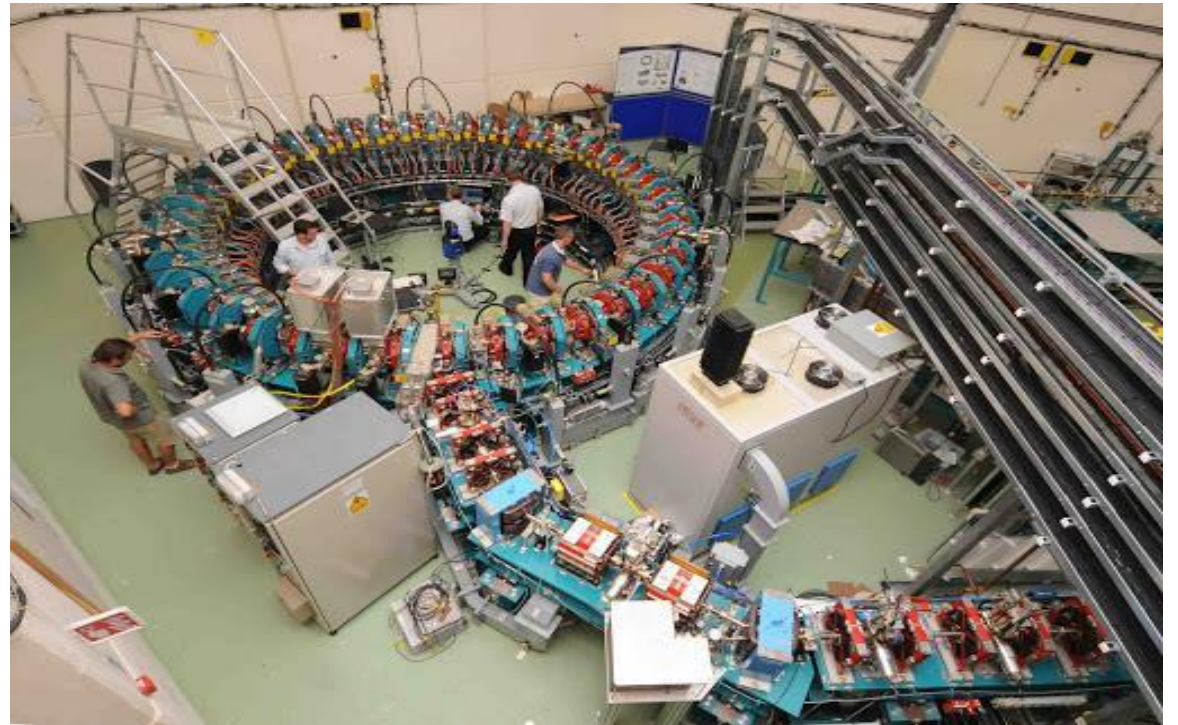


A Brief History of Daresbury Laboratory

The accelerators on site then shifted from user facilities to test facilities or prototypes for accelerator R&D



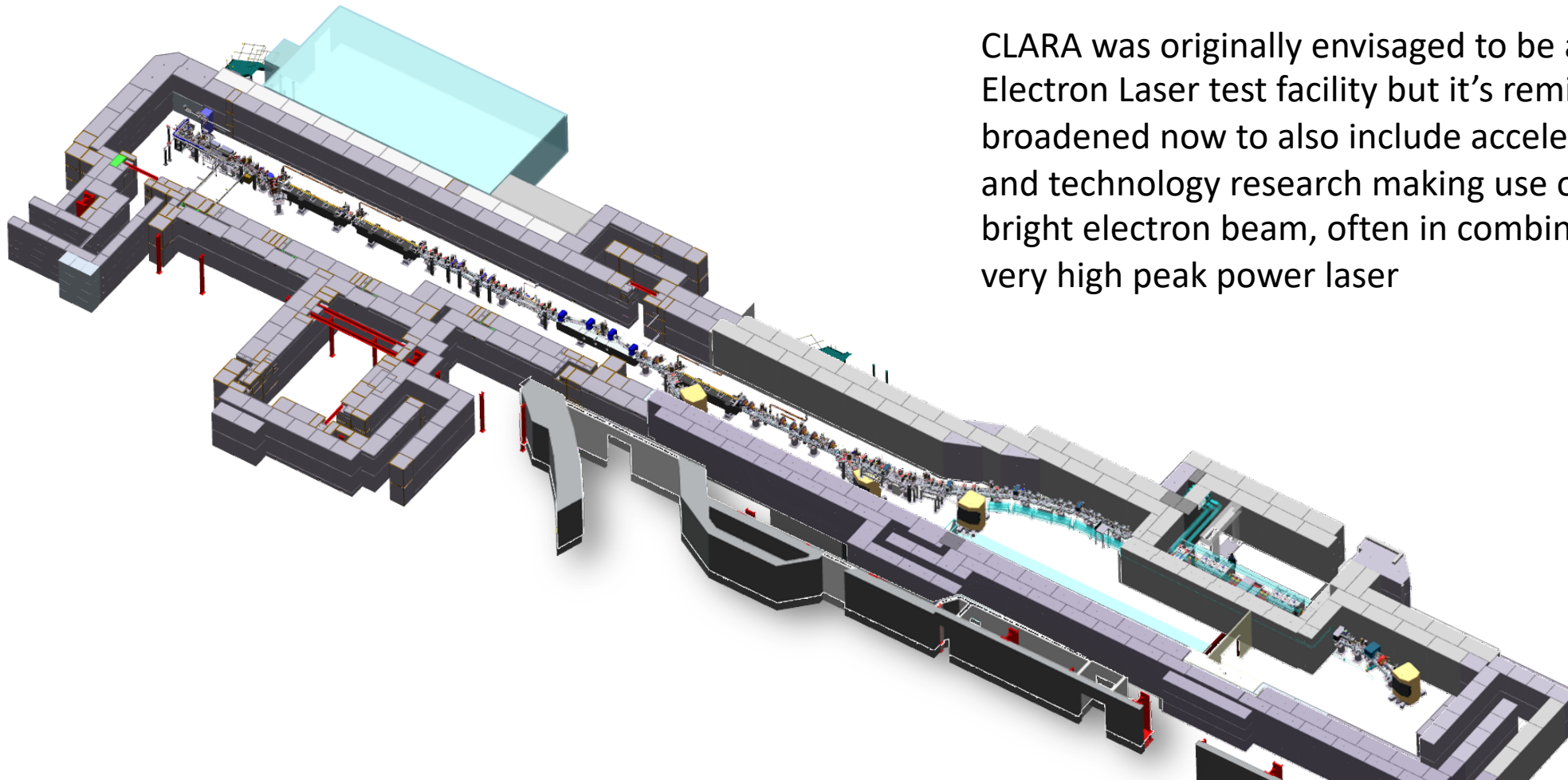
ALICE – an Energy Recovery Linac – the first in Europe



EMMA – A Fixed Field Accelerator – the first of its kind

Daresbury Laboratory Today

Our primary test facility now is CLARA – a 50MeV electron linear accelerator, soon to be upgraded to 250MeV



CLARA was originally envisaged to be an X-ray Free Electron Laser test facility but it's remit has broadened now to also include accelerator science and technology research making use of the very bright electron beam, often in combination with a very high peak power laser

Accelerator Science & Technology in the UK

The Government Sector

UKRI/STFC

National Laboratories

Daresbury/Rutherford Appleton

CLARA
CLF
Diamond plc
ISIS

The University Sector

Accelerator
Institutes

Cockcroft/John Adams

Other
Universities

The Business & Industry Sector

Accelerator components
Radiotherapy
Security

AVO, Elekta, Rapiscan, T-e2V, etc.

Accelerator Science & Technology in the UK

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UK Research and Innovation (UKRI)

The primary government body which carries out and funds academic research for the UK.

Operating across the whole of the UK with a combined budget of more than £8 billion, UKRI brings together the seven research councils, Innovate UK and Research England.

Note: UKRI is responsible for the vast majority of the UK funded research on COVID-19



Science and
Technology
Facilities Council



Arts and
Humanities
Research Council



Engineering and
Physical Sciences
Research Council



Biotechnology and
Biological Sciences
Research Council



Economic
and Social
Research Council



Research
England



Natural
Environment
Research Council



Innovate
UK



Medical
Research
Council

Science and Technology Facilities Council

STFC funds and carries out research in particle physics, astronomy, nuclear physics, and space science, most of which is undertaken as part of international collaborations.

They also plan, design, construct and operate world-class multidisciplinary facilities used by academic and industrial researchers across all areas of science and engineering – they operate a number of sites (‘National Laboratories’).

STFC is also the UK partner for overseas organisations, such as CERN, ESA, and ESO.

STFC National Laboratories & Accelerator Institutes

Astronomy Technology Centre



Boulby Underground Laboratory



Daresbury Laboratory / Cockcroft Institute



You are here

Rutherford Appleton Laboratory



Chilbolton Observatory



John Adams Institute (London/Oxford)



STFC User Facilities



In the UK we have **Diamond Light Source**, **ISIS Neutron and Muon Source**, and the **Central Laser Facility**. These are all based at **Rutherford Appleton Laboratory** in **Oxfordshire**

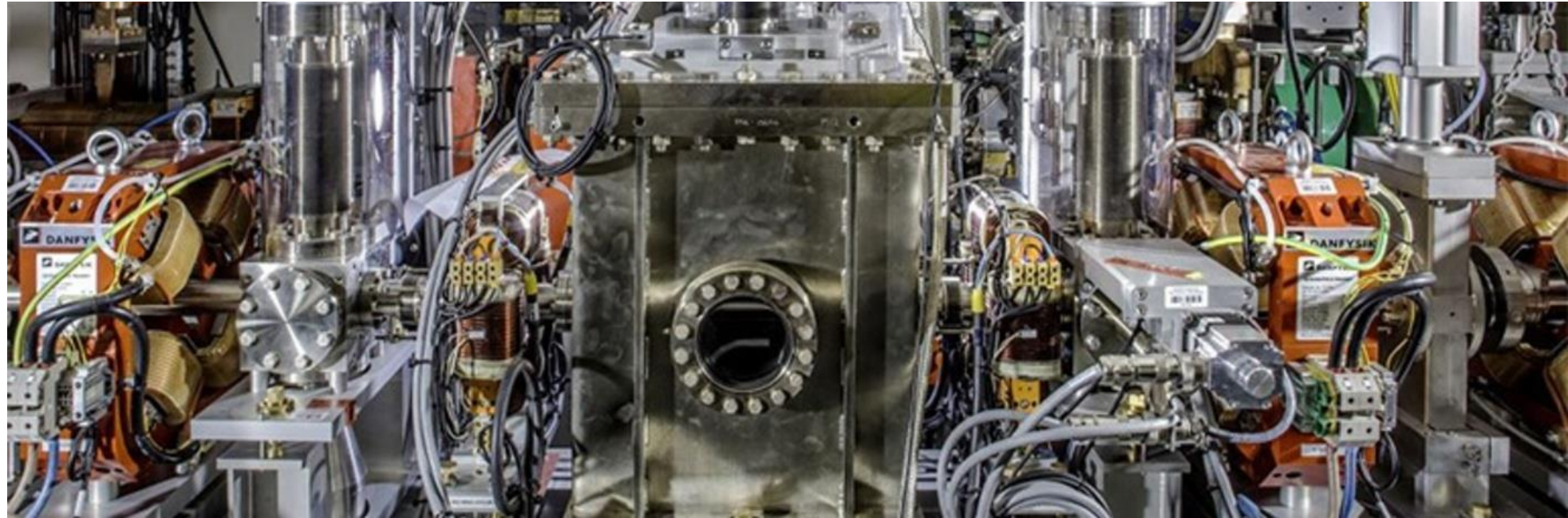
Daresbury Laboratory



Daresbury Laboratory has leadership in **Accelerator Science, Scientific and High Performance Computing, and Nuclear Physics**

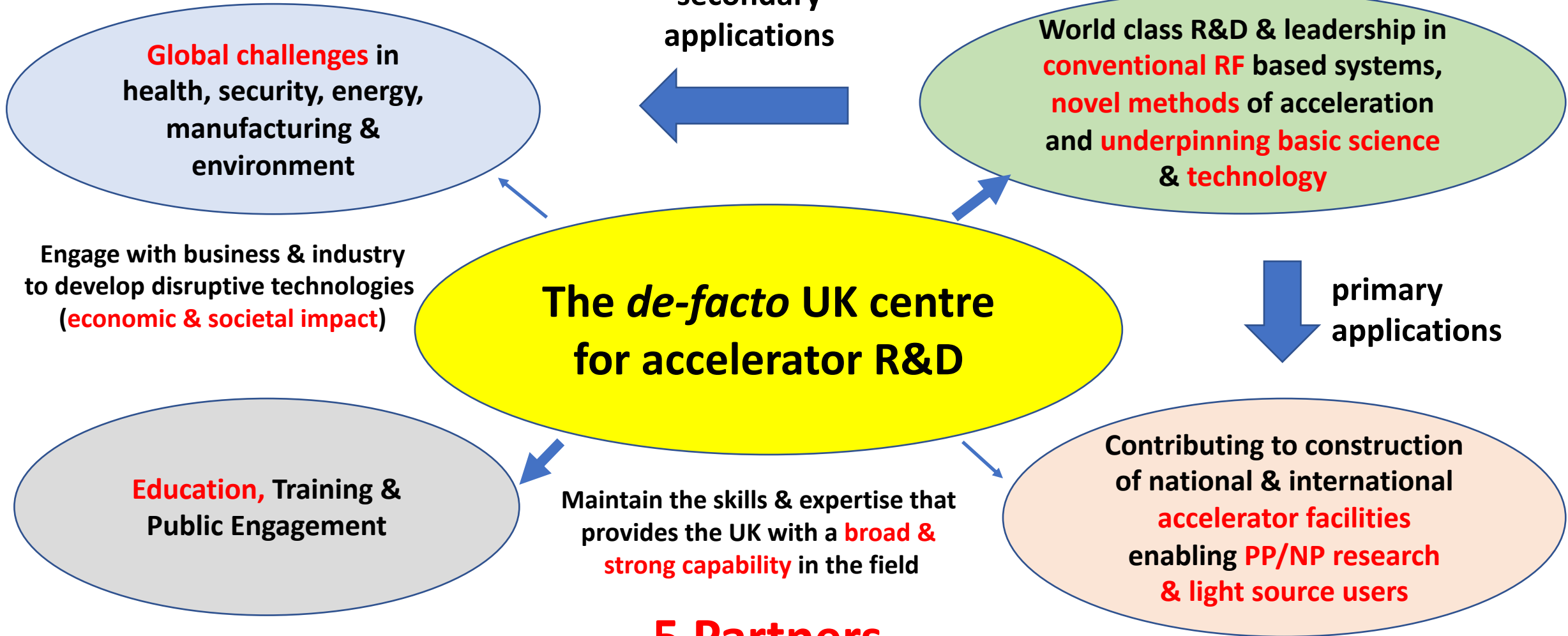
Accelerator Science and Technology Centre

- **ASTeC** is a department of **STFC** and a partner within the Cockcroft Institute
- All of their staff are based at **Daresbury Laboratory** and they share the same building as other members of the CI
- They are **employees of UKRI** and funded directly by the government
- They are STFC's (and so the government's) **centre of excellence** in particle accelerator research and development



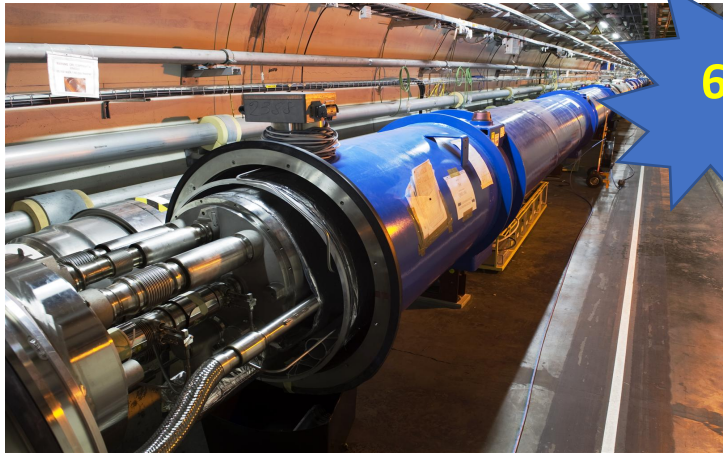
The Cockcroft Institute (2004-)

Align with **STFC accelerator strategy**
& **ESPP** (future colliders & nu beams)



5 Partners

1 Scientific Frontier Facilities



60%

The Strategy of the Cockcroft Institute 2020-2025



2 Novel Acceleration Techniques



30%

Highest level Strategic Areas (with % of resources)

Includes basic underpinning science & technology

Includes ASTeC

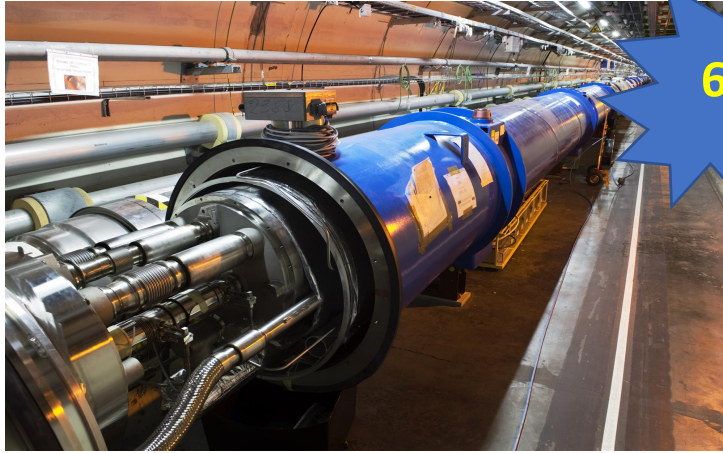
3 Addressing Global Challenges



10%



1 Scientific Frontier Facilities



60%

The Strategy of the Cockcroft Institute 2020-2025



2 Novel Acceleration Techniques



30%

Light sources

- CLARA R&D/ops
- X-FEL R&D (UK-XFEL)
- Diamond-II upgrade

High energy colliders

- HL-LHC upgrade (PIP-II)
- CLIC/FCC etc.

Low energy rings

- ERLs (CBETA/PERLE/EIC?)
- Muon g-2
- ELENA

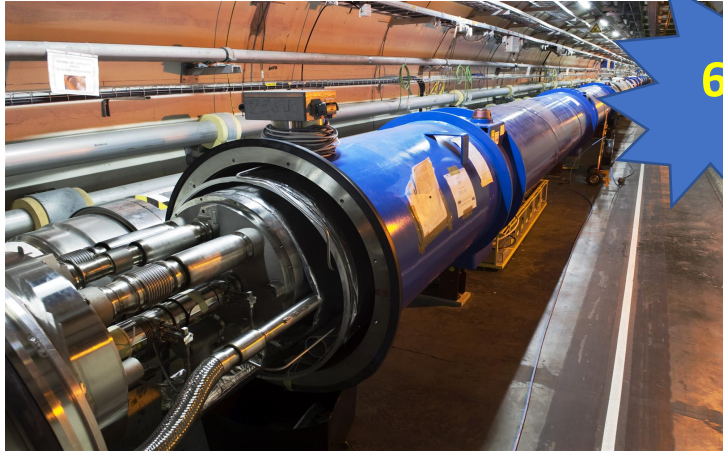
3 Addressing Global Challenges



10%



1 Scientific Frontier Facilities



60%

The Strategy of the Cockcroft Institute 2020-2025



2 Novel Acceleration Techniques



30%

Novel structures

- THz/dielectric
- DWA
- Other structures

Plasma accelerators

- LWFA & laser-solid
- p-PWFA (AWAKE)
- e-PWFA (PPC)
- Hybrid LWFA-PWFA

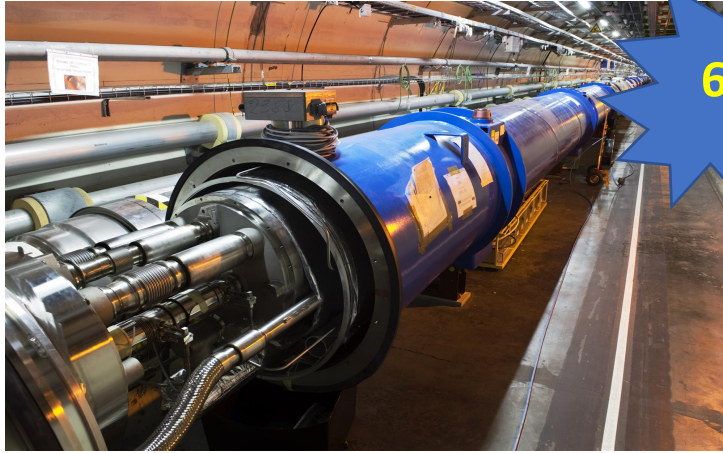
3 Addressing Global Challenges



10%



1 Scientific Frontier Facilities



60%

The Strategy of the Cockcroft Institute 2020-2025



2 Novel Acceleration Techniques

3 Addressing Global Challenges



10%



30%

Disruptive technologies

- Radiotherapy
- Cargo Security
- Effluent Treatment
- Space Radiation
- Diagnostics (spin-out)
- Mass Spectrometry



Cockcroft Institute Staff & Students (~250)

PhD Students

Faculty/Academics

Admin.

30-35

75-85

33%

PEOPLE

- Faculty
- ASTeC
- Postdocs
- Students
- Admin

STFC Daresbury Lab
Accelerator Staff

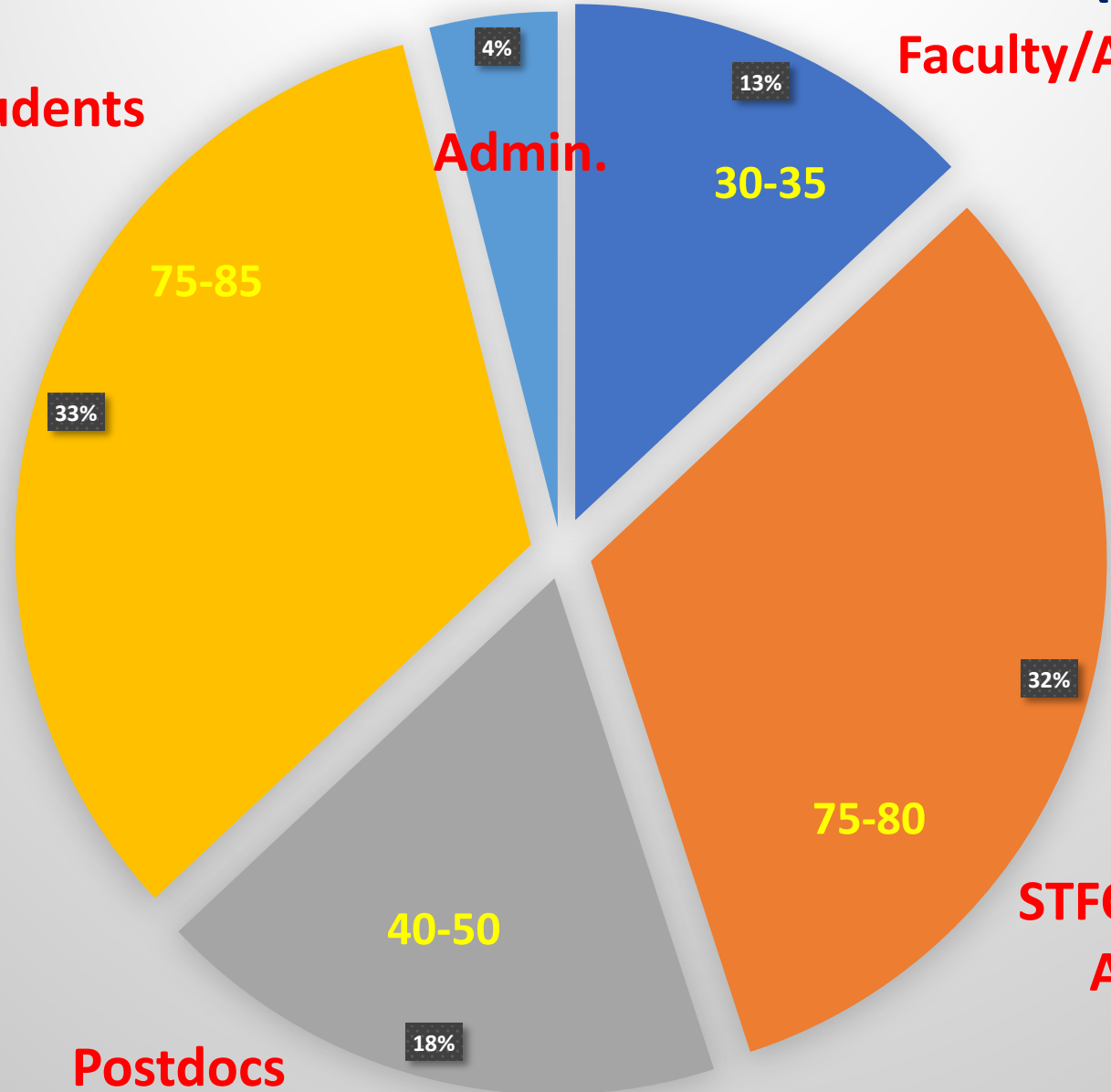
75-80

32%

40-50

18%

Postdocs

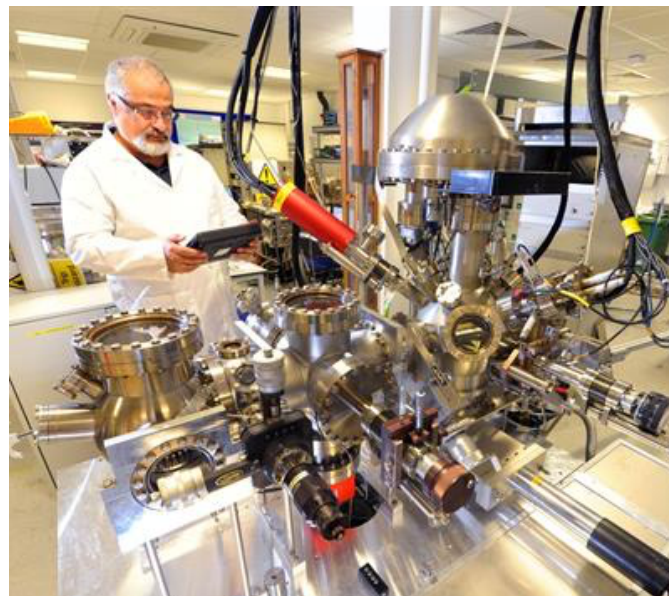


Daresbury Laboratory

RF, Cryo, Diagnostics, Laser & Vacuum labs

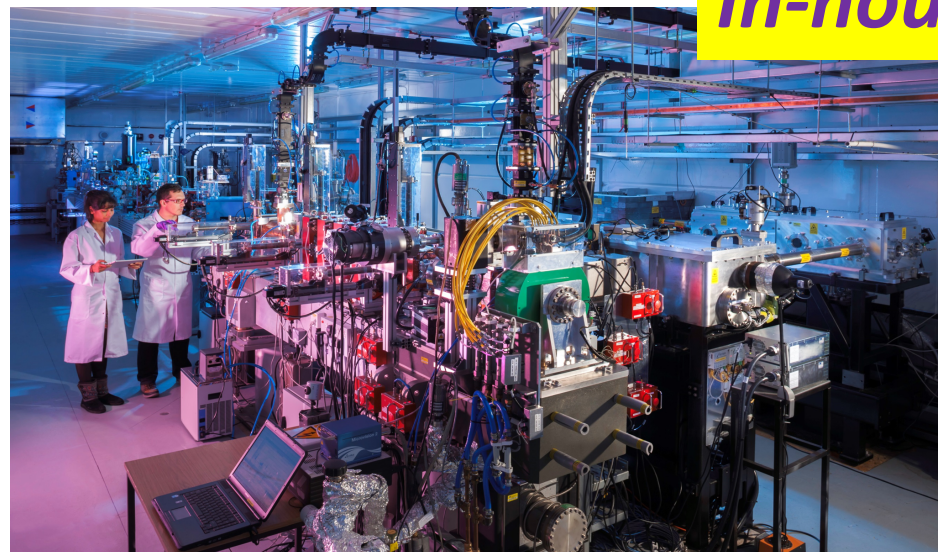
University of Strathclyde

RESOURCES

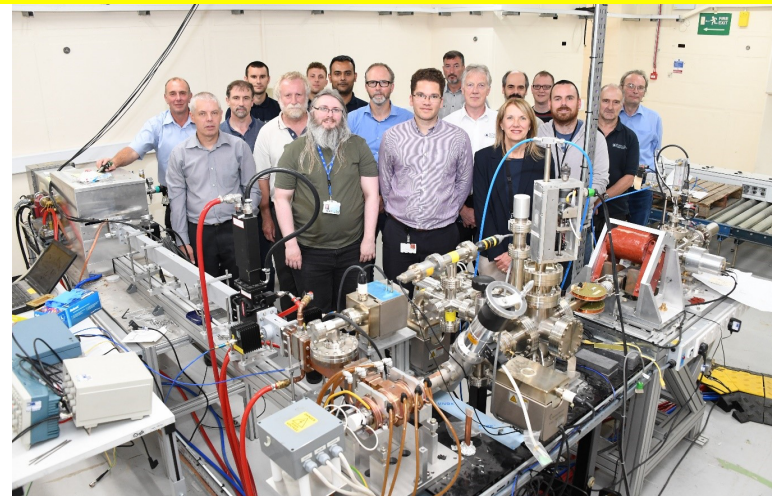


**SCAPA
7 beamlines**

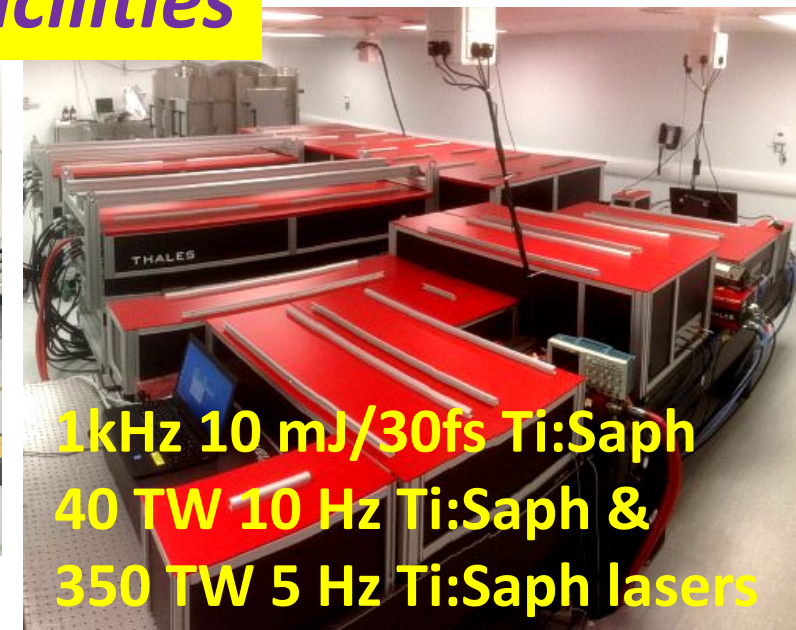
In-house developed labs & facilities



CLARA/VELA (4-250 MeV)



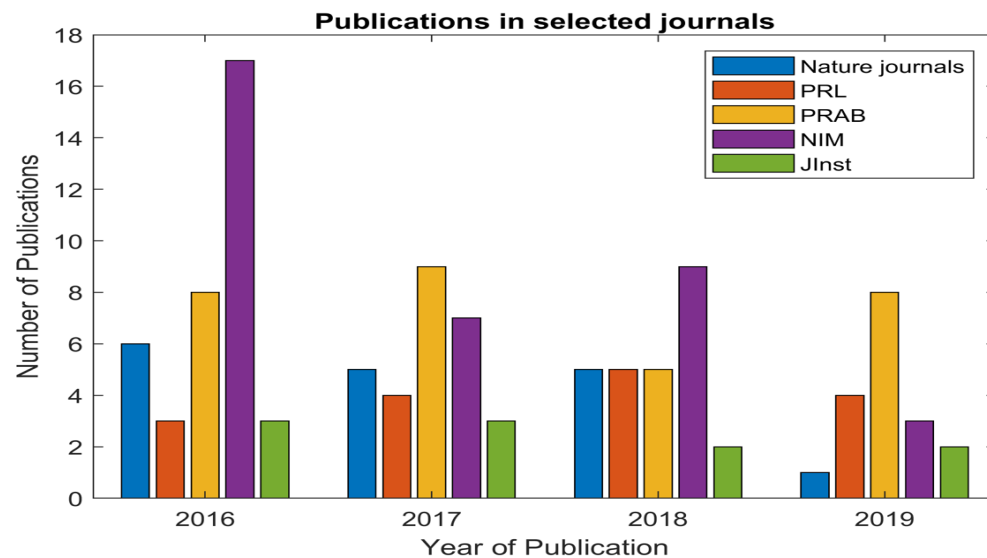
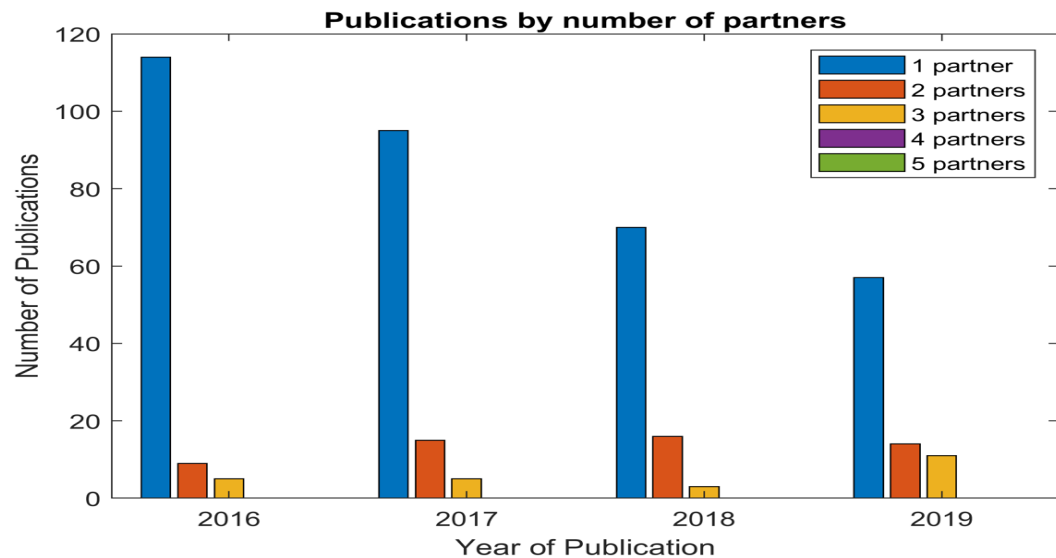
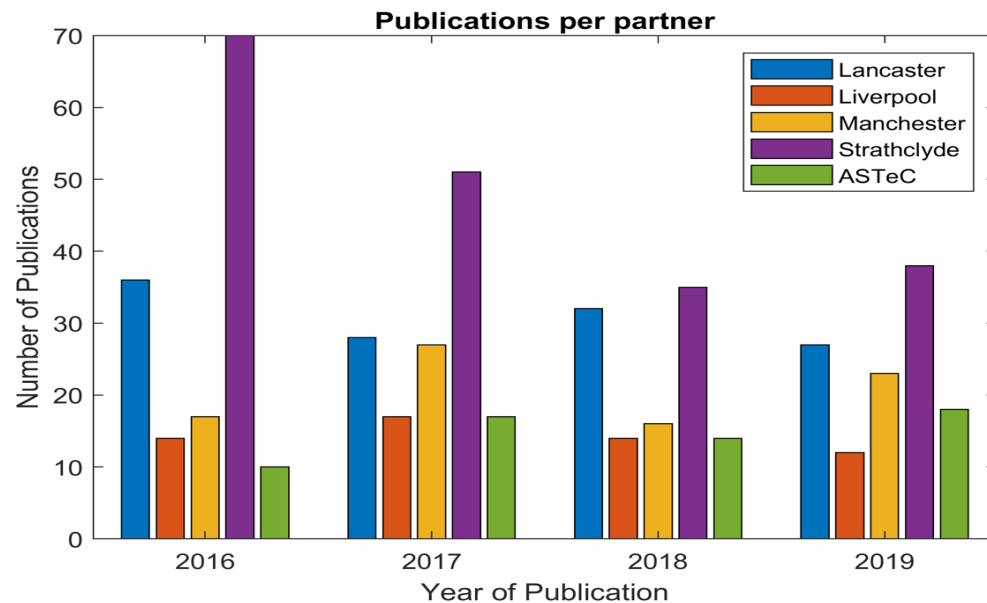
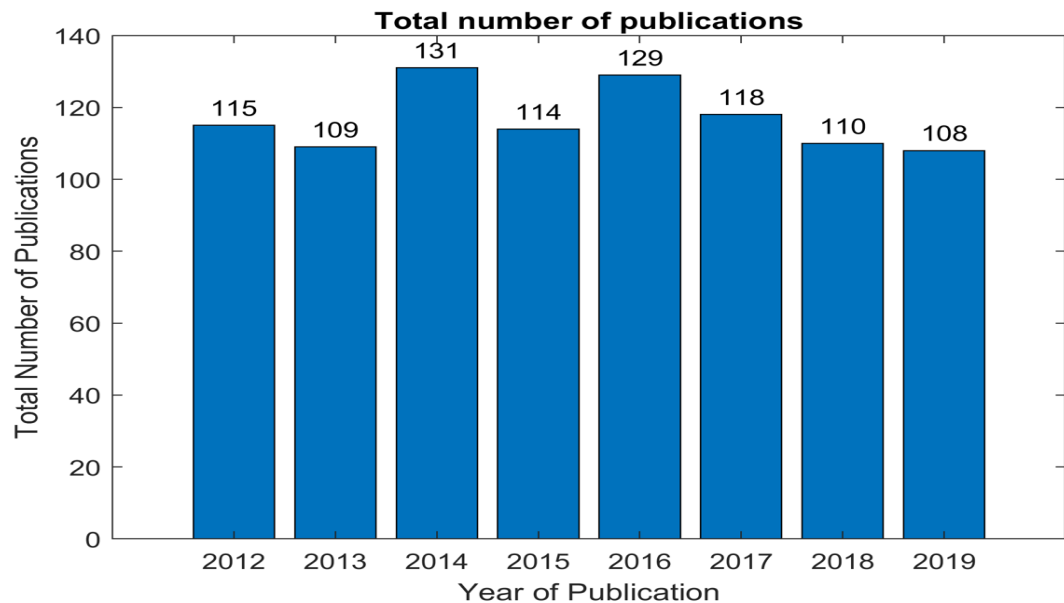
3.5 MeV Compact Linac



**1kHz 10 mJ/30fs Ti:Saph
40 TW 10 Hz Ti:Saph &
350 TW 5 Hz Ti:Saph lasers**

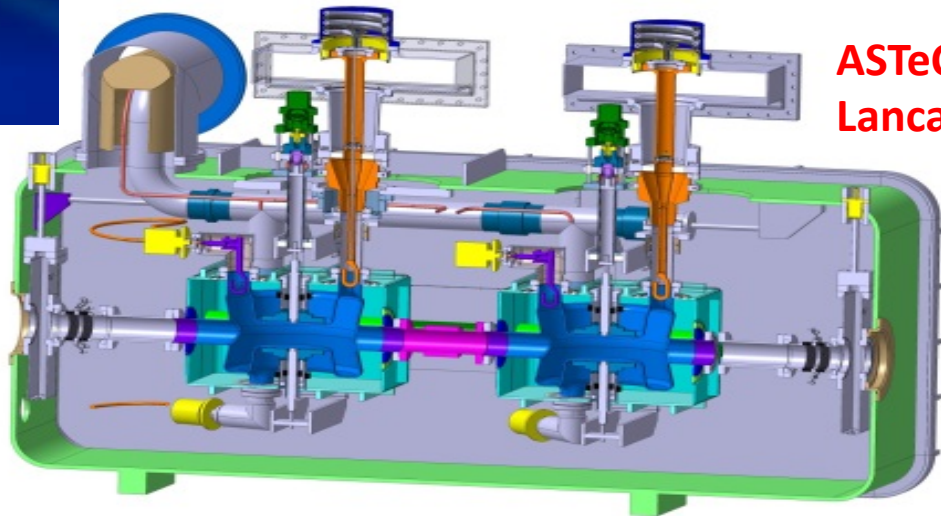
OUTPUTS

~ 120 papers per year in refereed journals



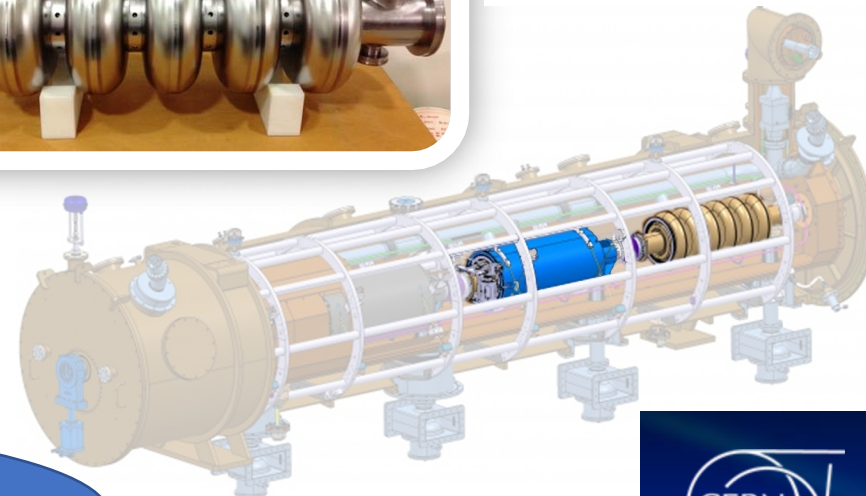


HL-LHC Pre-Series Crab Cryomodule



ASTeC
Lancaster

High Beta (0.86) Cavities



ASTeC

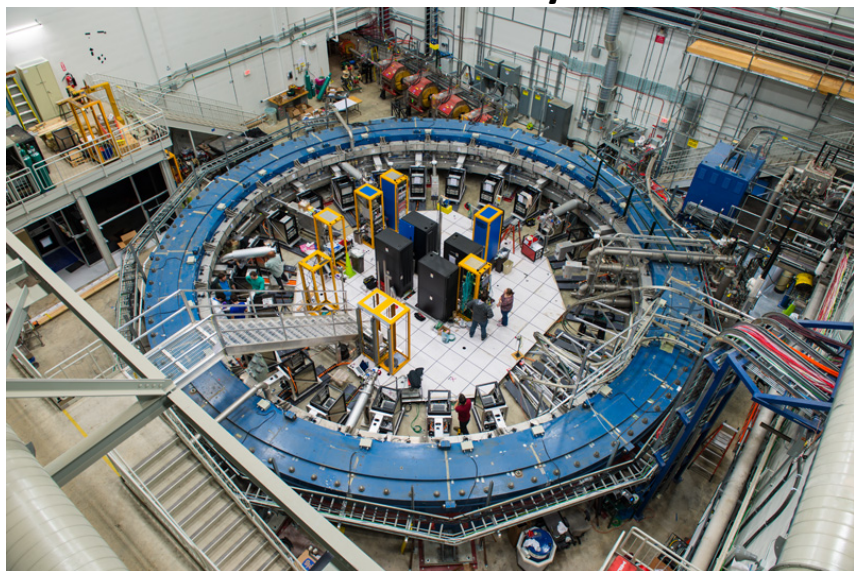


Contributions to International Facilities



Muon g-2
Beam Dynamics

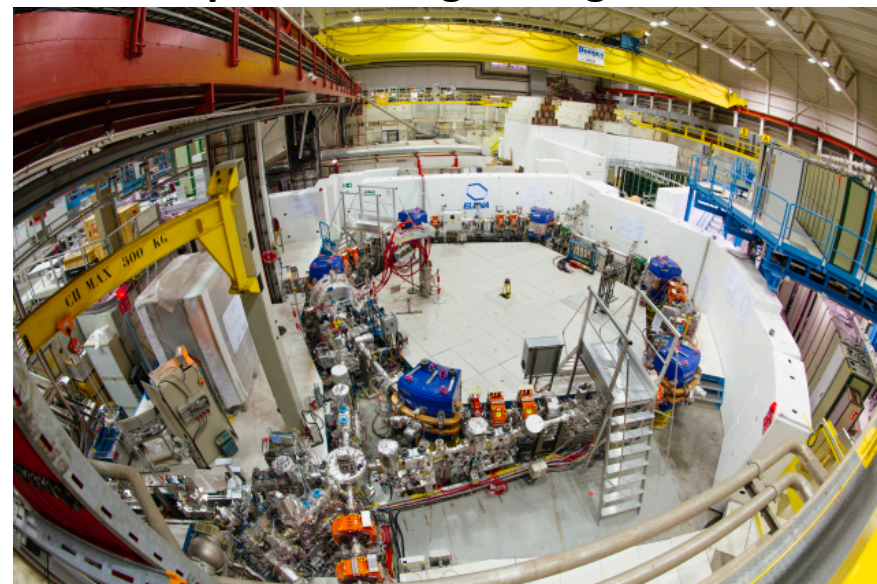
ELENA Antiproton Beam
Transport, Cooling & Diagnostics

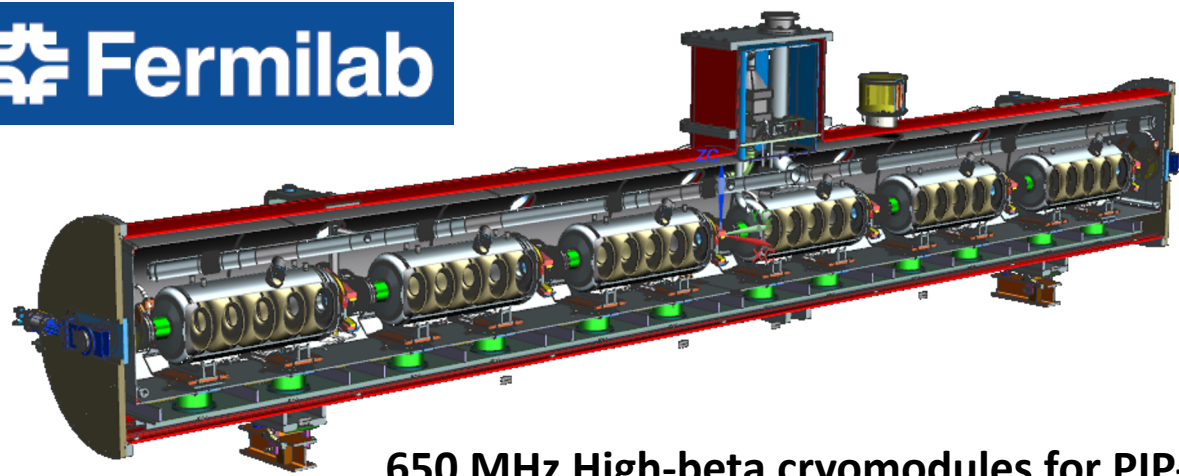


Lancaster
Liverpool

OUTPUTS

Liverpool
Manchester





650 MHz High-beta cryomodules for PIP-II

ASTeC



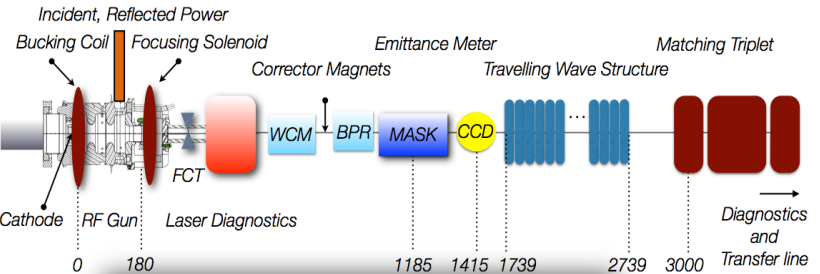
ASTeC, Strathclyde



Electron Linac
Booster for AWAKE
Lancaster

Contributions to International Facilities

CLIC Zero-Power Adjustable Dipoles

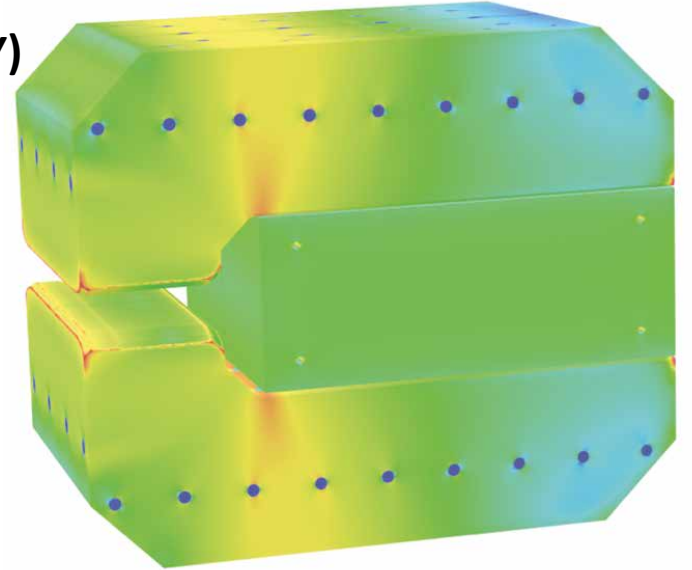
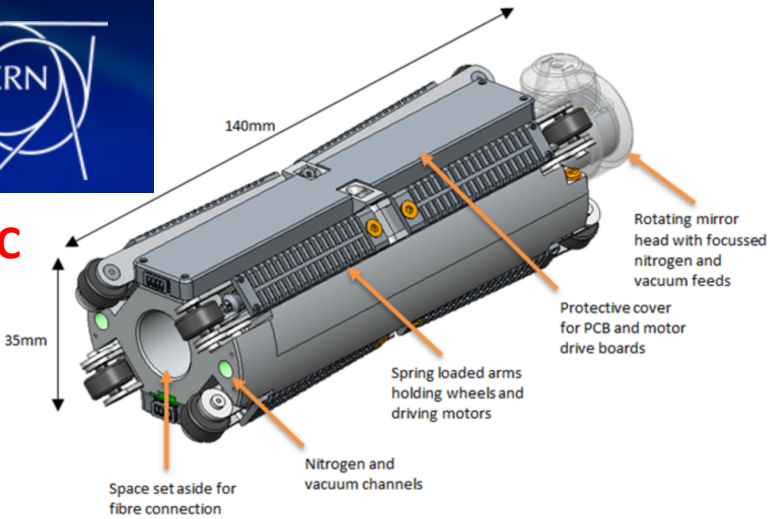


Parameter	Baseline	Range of interest
Beam energy (MeV)	16	10-20
Energy spread (σ , %)	0.5	-
Bunch length, (σ , ps)	4	0.3-10
Beam focus size, (σ , μm)	250	250-1000
Norm. emittance (rms, mm-mrad)	2	0.5-5
Bunch charge, (nC)	0.2	0.1-1

LESS – Laser Engineered Surface Structures (SEY)



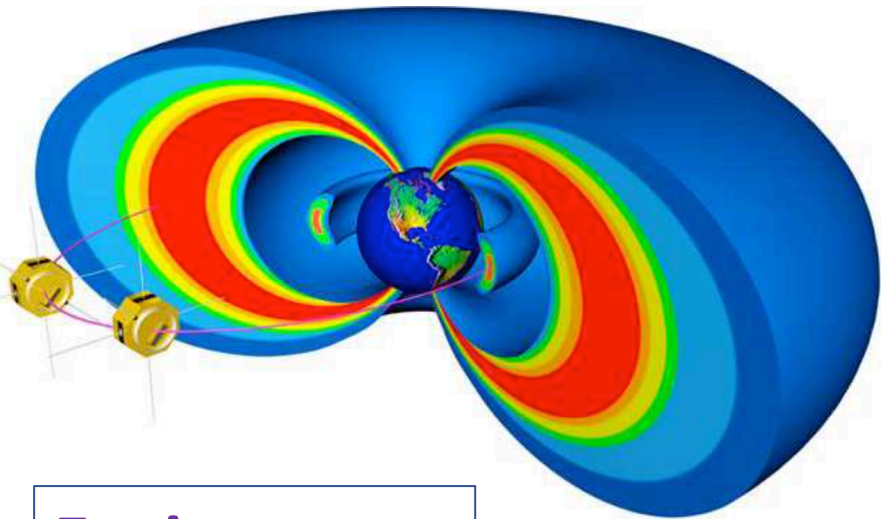
ASTeC



ASTeC

OUTPUTS

Space Radiation Simulation with LWFA



Environment

Strathclyde



Healthcare



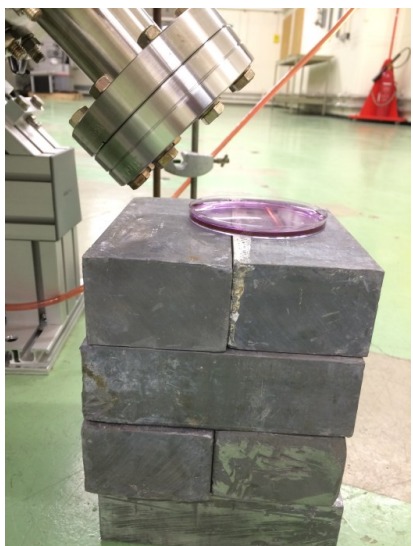
**The Christie
NHS Foundation Trust**

Proton Beam Therapy R&D

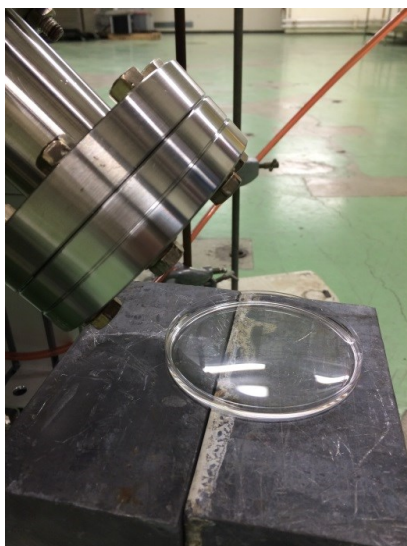
**Manchester
Lancaster**



**Healthcare, Security, Energy,
Manufacturing & Environment**



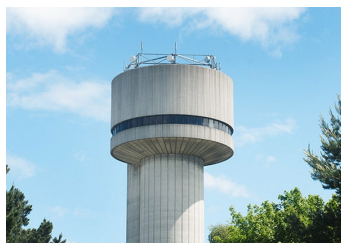
Before



After

Water Purification

**ASTeC
Lancaster**



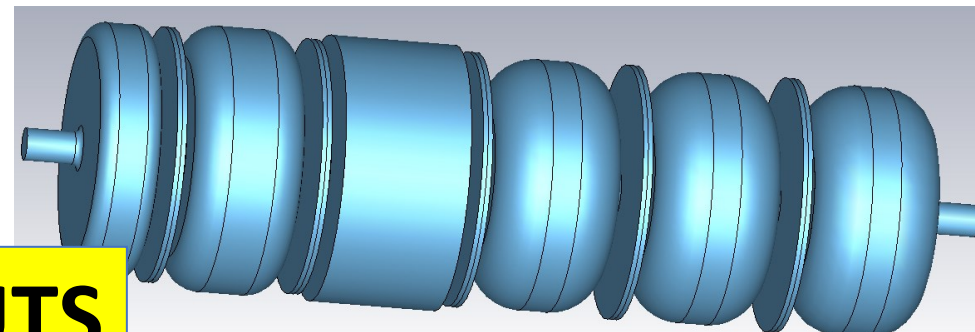
Security

**ASTeC
Lancaster
Teledyne e2V**

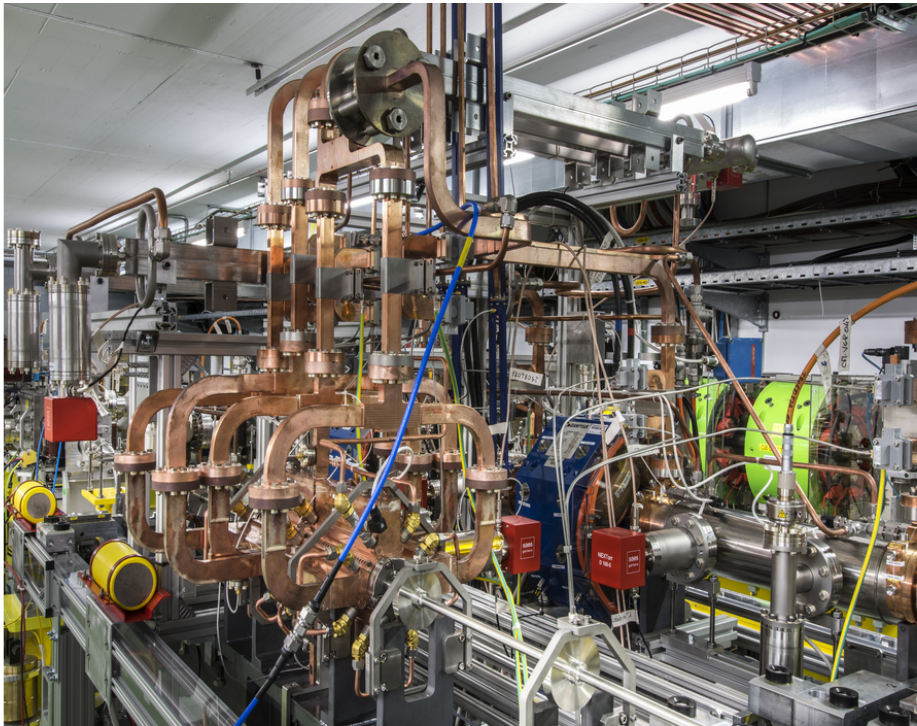


3 MeV S-Band Compact Linac

OUTPUTS



John Adams Institute



- **A centre of excellence for advanced and novel accelerator technology, providing expertise, research, development and training in accelerator techniques, and promoting advanced accelerator applications in science and society**

JAI: overview



- **Oxford University, Royal Holloway, Imperial College**
-
- **One of two UK national academic centres of excellence in accelerator science, set up 2004**
-
- **20 faculty**
- **29 staff**
- **39 PhD students**

- **Research projects at: CERN, DESY, KEK, Diamond, ISIS ...**
-
- **Comprehensive PhD training programme**
-

JAI research activities



- **Electron beams:** **Linear + circular e+e- colliders**
 - **Diamond Light Source**

- **Proton beams:** **High-Luminosity LHC**
 - **Future Circular Collider**
 - **Intense hadron beams**

- **Particle-beam therapy:** **Smart linacs for challenging environments**
 - **FLASH therapy**

- **Plasma-based advanced acceleration techniques**

- **Beam dynamics, instrumentation, feedback + control, metrology/alignment, RF systems**

EIC Workshop – Promoting Collaboration on the Electron-Ion Collider

7 Oct 2020, 00:00 → 9 Oct 2020, 21:00 Europe/London

Description Please visit workshop web-site: <https://www.cockcroft.ac.uk/events/eic20/> for details. The workshop is by invitation only. Please pre-register following the link below to request the invitation for participation. Agenda below is work-in progress and is subject for adjustments. Please use the menu in the upper right corner to view the agenda in your time zone.

Registration Please pre-register in order to request invitation for participation. [Register](#)

Participants Abhay Deshpande, Ady Hershcovitch, Akira Miyazaki, Akira Yamamoto, Alessandro Drago, Alessandro Gallo

WEDNESDAY, 7 OCTOBER

14:00 → 16:00

Opening

Conveners: Andrei Seryi (Jefferson Lab), Peter McIntosh (UKRI STFC), Peter Neil Ratoff (Lancaster University (GB))

14:00

Welcome from the UK

Speaker: Peter Neil Ratoff (Lancaster University (GB))

14:30

Welcome from the DoE

Speaker: Timothy Hallman (U.S. Department of Energy)

15:00

EIC Project Overview

Speaker: Jim Yeck (Brookhaven National Laboratory)

15:30

EIC Accelerator Overview

Speakers: Andrei Seryi (Jefferson Lab), Ferdinand Willeke (Brookhaven National Laboratory)

16:00 → 18:00

Break

2h

18:00 → 20:00

Domestic/Americas Focus: Session 1.1

Conveners: Todd Satogata (Jefferson Lab), Vadim Ptitsyn (Brookhaven National Laboratory)