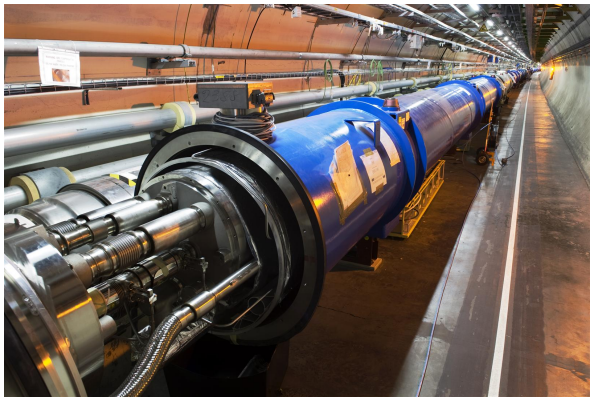
August 2015
Public version

The Strategy of the Cockcroft Institute

2015-2020

Scientific frontier facilities



Addressing global challenges

Novel acceleration techniques

Executive summary

The strategy of the Cockcroft Institute (CI) is to be a fully sustainable organisation able to deliver world-class research and development in particle accelerator science & technology, which is well aligned to the strategic requirements of the partner universities and STFC, and world leading in one or two areas.

The CI will focus on a carefully selected suite of activities, chosen for their scientific and technical importance and for their potential to excel against key performance indicator targets, including 4*/3* publications in HIF refereed journals, impact case studies of similar quality & research income generation.

Delivery of strategically important facilities for UK science and industry, exploiting the opportunities presented by the "northern powerhouse" agenda, is absolutely central to the strategy, with an advanced X-ray Free Electron Laser (FEL) facility programme at the forefront of our long-term ambitions.

We will educate the next generation of accelerator experts, inspire school students and the general public and address global challenges in health, security, energy, manufacturing & the environment.

The principal research activities of the Institute will be

- **Scientific frontier facilities & underpinning technologies**
- **Applications of accelerators in addressing global challenges**
- **Novel acceleration techniques**

Each has the potential to handsomely deliver on one or more of our KPI targets, although a further investment in academic posts will be critical to achieving the proposed rebalancing of the research programme. The **scientific frontier facilities** on which we will focus for the next 5 years are

- **High/medium energy proton machines** & **secondary beams** derived from them
    - The Large Hadron Collider at CERN
    - Fermilab's ultra intense proton driven neutrino and muon beam complex
    - The Future Circular Collider (FCC) design study (80-100km, 100 TeV proton collider)
    - The European Spallation Source (ESS) for neutrons
    - The ELENA antiproton ring at CERN
- **Low energy electron machines** at DL for intense short pulse light sources & electron diffraction
    - ALICE operated as an EPSRC mid-range facility, or alternative superior IR/THz source
    - VELA operation, exploitation including development of electron diffraction capability
    - CLARA construction & commissioning

The **application of accelerators** to address global challenges in health, security, energy, manufacturing & the environment over the next 5 years will cover a range of activities/projects including but not limited to

- Developments in particle therapy, including future upgrades of the proton beam therapy facility at Christie Hospital & exploitation of its research beam line; high energy electron radiotherapy R&D
- Accelerator technology for efficient production of radio-isotopes for medical imaging and therapy
- Medical FFAG accelerator development for proton imaging
- Development of compact accelerators for cargo and other security scanning
- Water purification using electron beam irradiation

A broad range of **novel acceleration techniques** will be studied over the next 5 years including plasma wake field, dielectrics, photonics & meta-materials. Plasma wake field acceleration will play the most prominent part with emphasis on three diverse projects/activities

- The AWAKE experiment at CERN (proton driven)
- A dedicated Cockcroft beam line at the University of Strathclyde's SCAPA facility (laser driven)
- The Plasma Acceleration Research Station (PARS) at CLARA (electron driven)