



Science & Technology
Facilities Council

Accelerator R&D in the United Kingdom

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History

- Starting in 2002, the UK research councils made a targeted effort to re-establish and develop a UK-based accelerator science and technology capability
- Proposals were solicited and two new Institutes established:
 - John Adams Institute
 - Cockcroft Institute
- We have succeeded in attracting internationally recognised accelerator experts (back) to the UK
- We are training a new generation of postdocs and students
 - Example: the number of PhD students in the field has gone from < 5 to 50 in the past decade



Geography

Cockcroft Institute

Lancaster, Liverpool,
Manchester, and STFC

John Adams Institute

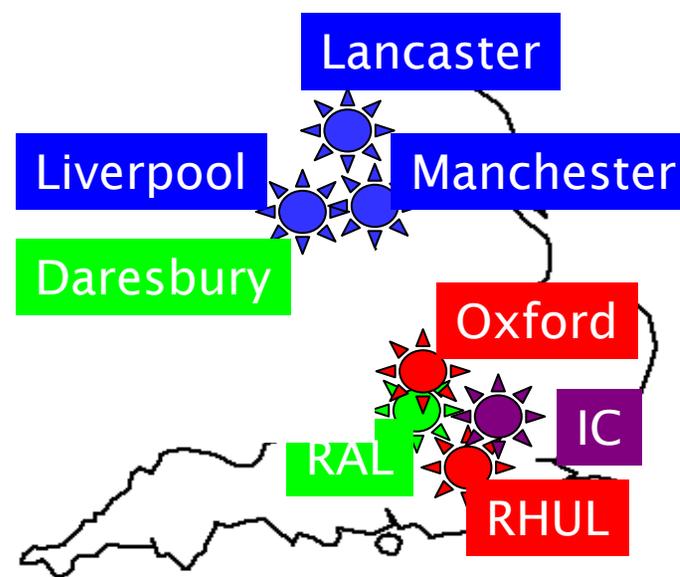
Oxford, Royal Holloway

National Laboratories

Daresbury, RAL

University Groups

notably Imperial College





Funding

- The accelerator R&D programme funded through STFC Science Programmes Office is about £10M per year
- This is complemented by resources within our national laboratories
- The programme leverages additional resources from
 - Universities
 - Other research councils
 - Regional development agencies
 - European Commission programmes
 - ...



Cockcroft Institute Building at Daresbury



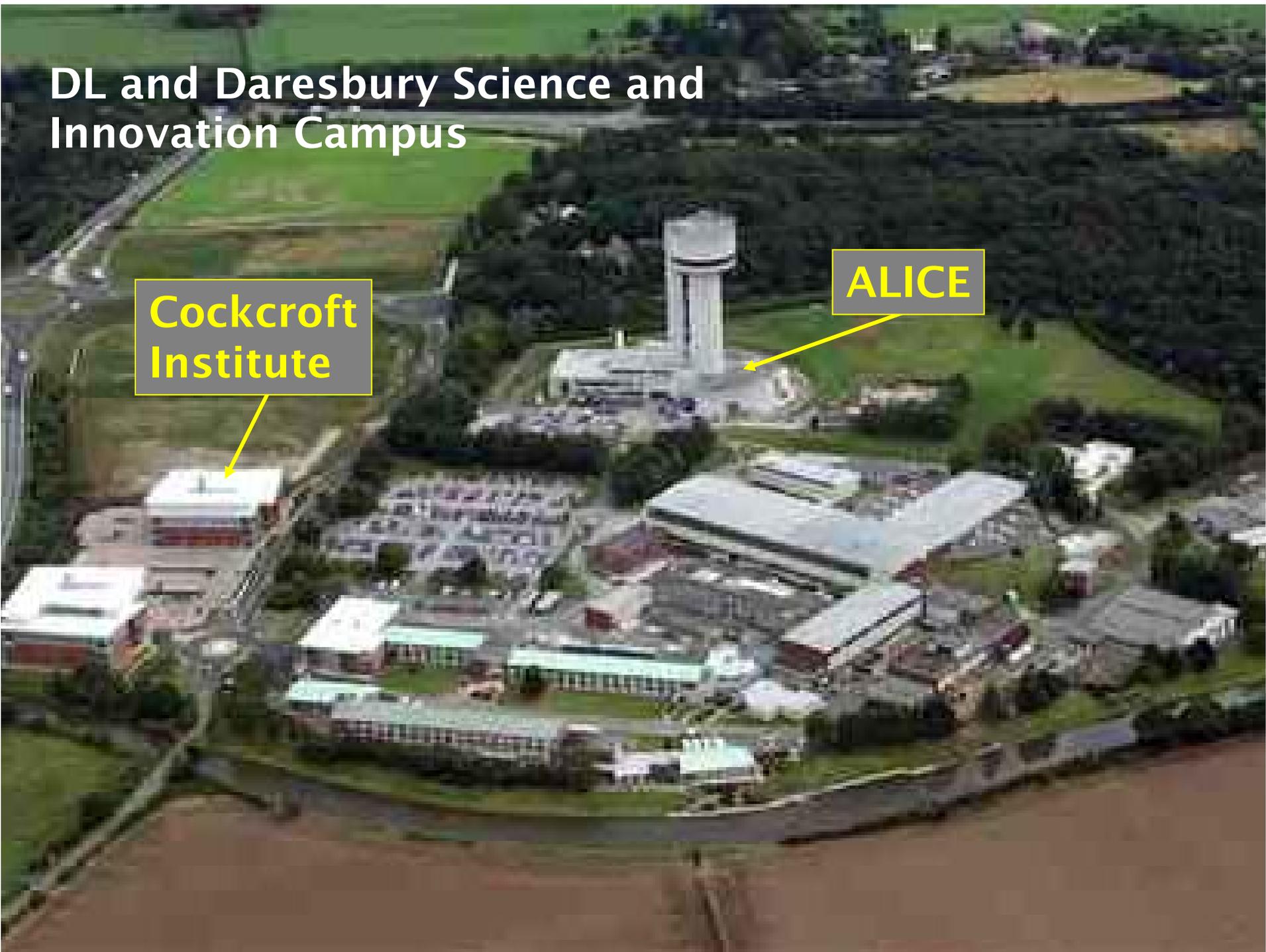
The programme

- The ALICE energy recovery linac prototype at DL
- The MICE experiment at RAL
- Design studies for New Light Source project
- Design studies for Neutrino Factory
- High Power Proton Accelerators – front end test stand for MW ISIS upgrade
- Novel accelerator techniques (FFAG...)
- Medical applications (EMMA and PAMELA)
- Underlying technologies (SCRF...)
- Future lepton colliders (retention and redirection of ILC effort)
- Support for the Cockcroft and Adams Institutes, university rolling grant effort, accelerator groups at RAL and DL

DL and Daresbury Science and Innovation Campus

Cockcroft Institute

ALICE





ALICE

- Energy Recovery Linac prototype at Daresbury Laboratory



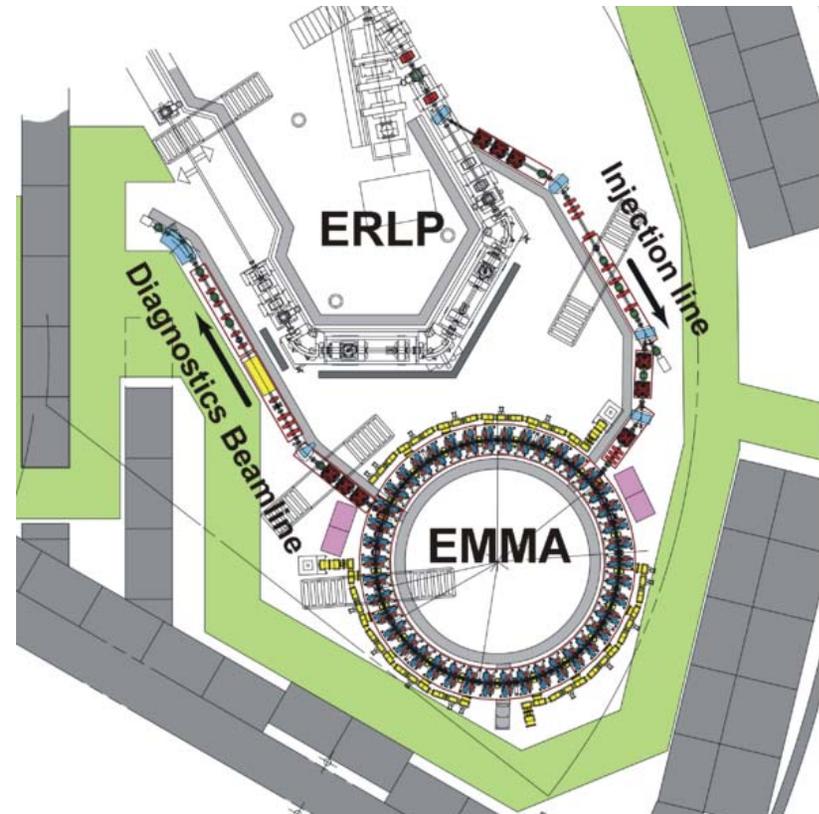
First electron
acceleration achieved
this month



Non scaling FFAG's

EMMA:

- An experimental 20MeV electron non-scaling FFAG
- Used to learn how to design NS-FFAGs for a variety of applications, including hadron therapy
- Uses ALICE as injector
- Under construction at DL





Medical applications

PAMELA

- A 70-100MeV proton NS-FFAG
- A prototype to demonstrate that the potential of NS-FFAGs can be realised in practice for hadron therapy.
- Planned to construct it in a new building for the Department of Radiation Oncology and Biology at the Churchill Hospital site in Oxford
 - Design study is underway

Hadron therapy facility

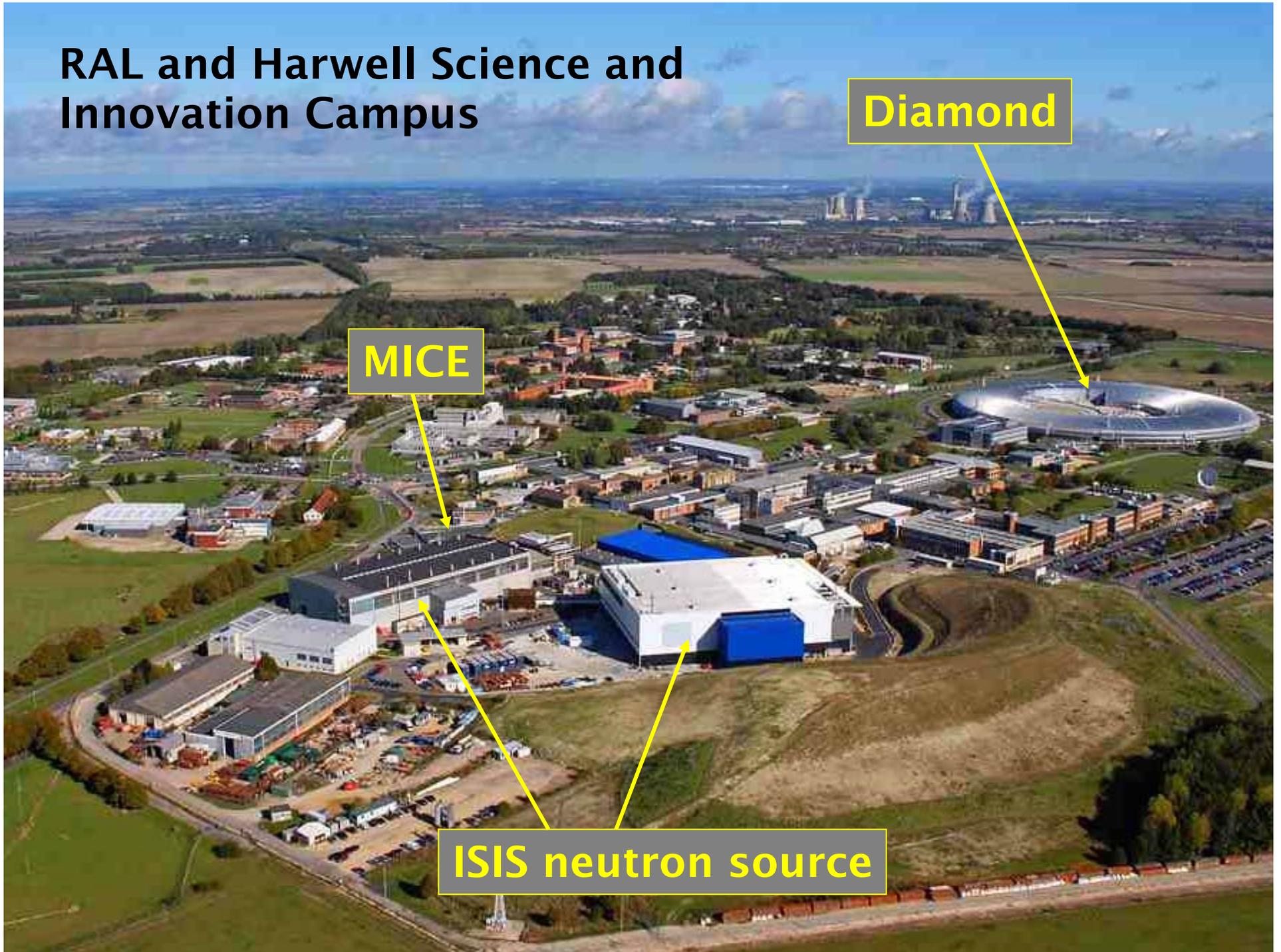
- If PAMELA is a success it will be followed by a facility for the treatment of patients using hadron beams

RAL and Harwell Science and Innovation Campus

Diamond

MICE

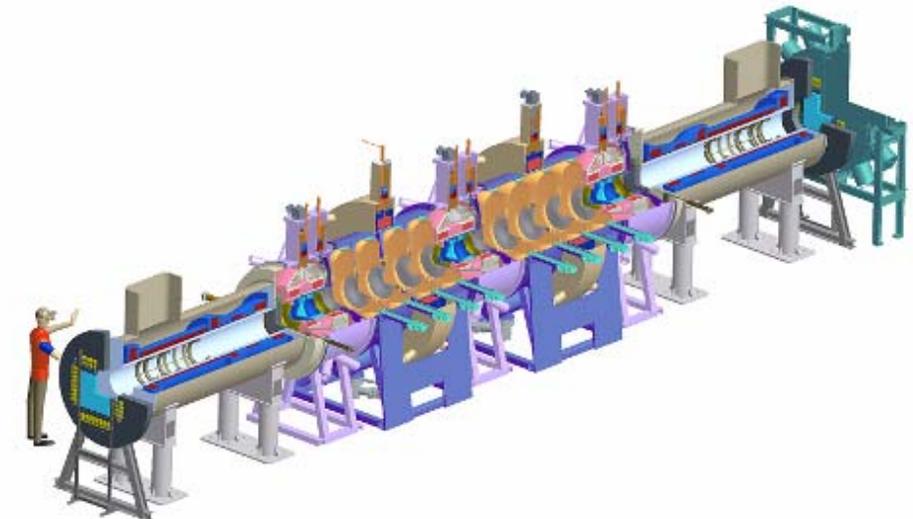
ISIS neutron source





MICE at RAL

- Systems test for ionisation cooling of muons using liquid hydrogen
- Key technology for a future neutrino factory or muon collider
- First phase (muon beam) substantially complete
- Second phase (cooling channel) under construction





Neutrino Factory

International Design Study for the Neutrino Factory

- Involves scientists and engineers from Asia, Europe, and the Americas
 - European contributions to the IDS-NF are coordinated through the EU-funded EUROnu Design Study
- In line with the recommendations of the CERN Council Strategy Group, aim to deliver the Reference Design Report for the Neutrino Factory by 2012

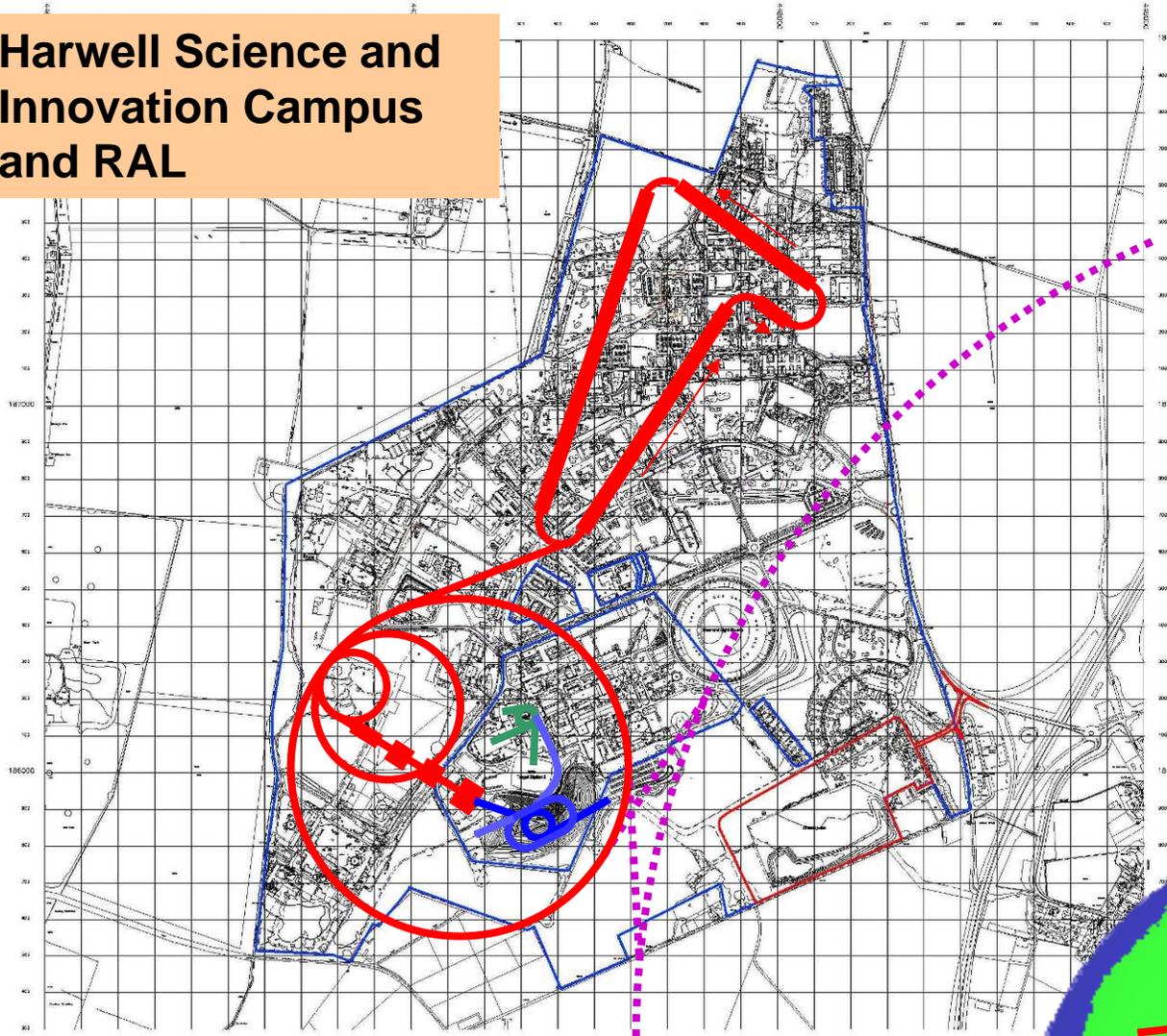
In parallel with efforts to

- Demonstrate of key technologies – MICE, MERIT
- Measure the θ_{13} mixing angle - T2K

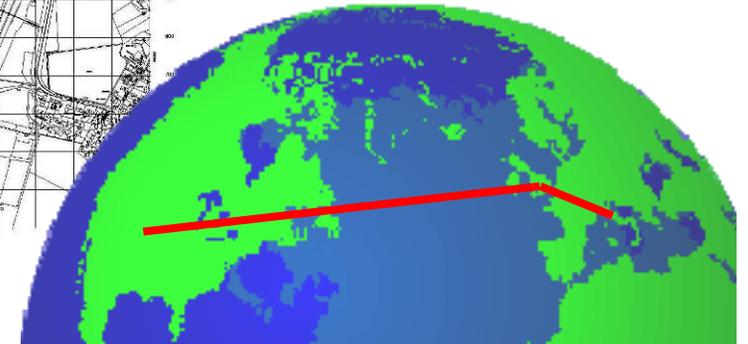


Make no little plans...

Harwell Science and Innovation Campus and RAL



- ISIS
- ISIS 1 MW upgrade
- New 5MW spallation source
- Neutrino factory
- Future multi-TeV muon collider





New Light Source Project

- Following the cancellation of the 4GLS project in fall 2007 we instituted a project to deliver a science case and conceptual design for a New Light Source
- Started by identifying the key science drivers together with the community at a series of workshops during 2008
- Science case now available:
 - www.newlightsource.org
- Reviewed by STFC's Physical and Life Sciences committee
- NLS offers internationally leading, potentially transformative research in
 - Imaging Nanoscale Structures and systems
 - States of high density plasma
 - THz-visible pump – X-ray probe of condensed phase systems
 - Short Pulse High Intensity X-ray Interaction Physics



Next steps

- The NLS team will now be invited to proceed to a conceptual design of the accelerator facility
 - A decision on the desired repetition rate should be made as soon as possible – critical issue for technology, cost and the high-energy limit for the machine
- The team will also be asked to engage with the other UK research councils and to seek potential overseas partners



Cockcroft and Adams Institutes

- Established 2004; mid-term review now in progress
- STFC invited proposals to continue support until 2017
- Core funding £2.2M per year (~ 1/5 of total accelerator programme)
- Opportunity to bid for additional funding associated with particular projects
- Cover the whole of STFC's remit
 - Generic accelerator technologies
 - Accelerator projects for HEP, NP, light sources, neutron sources, medical applications...
- Each institute has a director and advisory and oversight boards
- Cockcroft ~ 100 FTE; Adams significantly smaller



Some of the Challenges

- Breadth vs. depth
 - Critical mass in a few areas?
 - Or strength through diversity?
- What technologies are sufficiently central that we need to become good at them even if we are currently behind?
- Budgets are constrained, and hardware (especially) is expensive...



Conclusions

- The goal of recreating a vibrant accelerator community has been met
- We're committed to provide long term core funding to the institutes
- The Cockcroft model has proved particularly interesting because of the way in which it brings together laboratory and university investments with mutual benefit
 - Ironically, this was not one of the original aims 😊
- We are now developing three new “Technology Gateway Centres” at our laboratories based on this approach, in Detector Systems, Computational Science and in Imaging

A model for accelerator R&D in other laboratories and countries?