



Daresbury Science
& Innovation
Campus

Accelerator Science
and Technology

Shaping the Future of Science and Innovation

Daresbury Science and Innovation Campus (Daresbury SIC) is an internationally recognised location for high-tech businesses and leading-edge science. It represents a fundamentally new approach to driving UK competitiveness in global science and innovation.

Daresbury SIC was formed by the Northwest Regional Development Agency (NWDA), the Science & Technology Facilities Council (STFC), Halton Borough Council and the research intensive universities of Lancaster, Liverpool and Manchester.

The Campus provides a unique environment for innovation and business growth with knowledge sharing, collaboration and networking, and offers

major opportunities for the application of accelerator science and technology and for knowledge exchange and the development of collaborative activities.

STFC manages a number of leading edge facilities which are of key importance to the Accelerator Science and Technology sector. It provides this capability through its large scientific facilities at Daresbury and its sister campus at Harwell in Oxfordshire (Harwell SIC).



The ATLAS Detector, developed by STFC for the Large Hadron Collider

A National Technology Pool

The design, construction and operation of large scale and advanced scientific facilities are an important core business activity of STFC. A significant fraction of these facilities is based on the exploitation of charged particle accelerators and necessitates world class expertise in this area. National examples include Diamond Light Source and ISIS neutron source, respectively based on electron and proton synchrotrons - with STFC also contributing internationally to a number of collaborative projects, especially on a European scale. Advanced R&D activity is mainly concentrated in STFC's Accelerator Science and Technology Centre (ASTeC) which takes place mostly on its Daresbury SIC site, with supplementary skills and expertise from Harwell SIC. ASTeC also maintains strong collaborative links with the higher education community.

A World Leader for Five Decades

Daresbury Laboratory was created in 1963 as a home for a high energy accelerator to be built for particle physics experiments. This was followed by the world's first high energy facility dedicated to synchrotron light exploitation (synchrotron radiation source or SRS), operational from 1980.

Synchrotron radiation is emitted when relativistic electrons follow a bent path, as in any circular accelerator, and are an astonishingly powerful source that is utilised for advanced materials and biological science research. Through the Daresbury site, the UK led the world for nearly two decades, with a stream of innovative improvements to the SRS. The Daresbury team then designed a successor, the Diamond Light Source, as a next generation solution that was eventually constructed on the Harwell SIC. More recently Daresbury has seen the emergence of the unique ALICE and EMMA facilities (p 4 and 5).



Diamond Light Source at Harwell SIC

www.daresburysic.co.uk/sectors/accelerator-technology

Technology Exchange

The facilities and services of STFC, managed by its leading research groups active in a number of accelerator science and technology related areas, can be accessed through its knowledge transfer organisation STFC Innovations Ltd, which progresses individual projects through various business models to the point of implementation as commercial licences or spin-out companies.



STFC Innovations Ltd

Industry Focus

Critical Mass

Particle accelerator based projects always have a high technology content and are ideally suited to a multi-disciplinary environment. The full range of these skills exists at Daresbury SIC, from beam dynamics expertise to specialist frontier technologies in magnetics, vacuum science and RF systems, supplemented by a more generic engineering base delivering mechanical, electrical and controls solutions. The strengths of ASTeC are supplemented by the powerful academic base provided by Campus partner, the Cockcroft Institute (the National Centre for Accelerator Science), which brings together the universities of Lancaster, Liverpool and Manchester in accelerator science focused physics and engineering research.

Real World Applications

All such advanced accelerator projects demand close collaboration with industrial suppliers in the development of novel solutions, and this spin-off is widely recognised. More direct application of the technology expertise to solving industrial problems has also occurred, including recent examples on the Daresbury Campus. A major testing programme is already underway with a commercial company investigating the application of accelerators to security scanning. Another example is a grant recently awarded jointly with an industrial partner to develop the production of niobium structures for RF exploitation. And on a smaller scale an RF scalpel for medical usage has been developed in a commercial collaboration. ASTeC's Vacuum Science team has a great many industrial links, including calibration and testing services for commercial customers.

At the Forefront

Active existing projects that sustain these strengths at Daresbury include the ALICE facility (Accelerators and Lasers In Combined Experiments) and EMMA (Electron Machine of Many Applications). ALICE is a world leading Energy Recovery Linear Accelerator that employs state-of-the-art technical solutions such as superconducting RF systems. EMMA is a revolutionary new type of particle accelerator with enormous potential, a world first technology, that is under construction and is scheduled for commissioning during 2010. These technologies have potential applications in materials and life sciences, including for example, oncology. In addition, accelerator experts on the site take part in many other collaborations, often with international partners; examples being a design study for a next generation photon source based on free electron lasers and a strong contribution to studies of a proposed successor to the Large Hadron Collider for particle physics.



The ALICE facility at Daresbury SIC

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The Future

Daresbury SIC has been identified by STFC as its preferred site for major new accelerator R&D projects, building on the previous success of the SRS and more recently the highly innovative ALICE programme.

Central to this policy is the provision of both accelerator test facilities and technology infrastructure. The plan is to utilise the large technical buildings remaining after SRS decommissioning to install such accelerator systems in the future. A major part of this strategy will also involve advanced technology component prototyping, including the leadership of UK activities on superconducting radiofrequency systems. The latter also involves installation and operation of large scale refrigeration plant for liquid helium processing.



Accelerator projects on the Campus are also able to call upon the scientific and technical expertise of the emerging Gateway Centres. The Hartree Centre will offer collaboration on solutions to the most challenging simulations,

involving modelling the complex nonlinear behaviour of particle beams in electromagnetic fields. The Detector Systems Centre will provide specialist skills in advanced diagnostics applications.

Accelerating Science – Accelerating Business

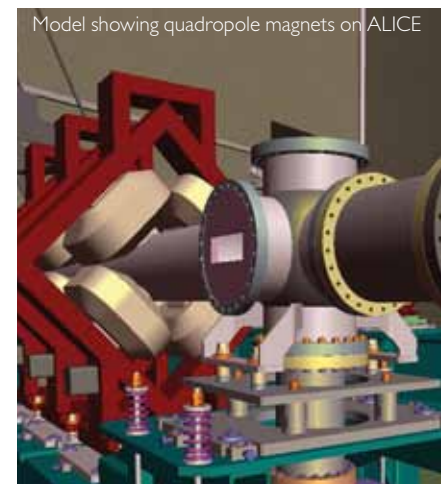
There is a long history of spin-outs from the science and technology of accelerators developed for research purposes. These include a variety of applications of which the best known will be for medical use, both for diagnostics (e.g. radio-isotope production) and oncology. Any x-ray set is an example of a mini-accelerator of electrons that impact a target, whilst the cathode ray tube television set was also an example of a mini-accelerator, with its electron gun and focusing coils. Particle accelerators employ advanced technologies in the areas of magnets, RF systems, vacuum components and high precision engineering techniques, all of which have had both direct and indirect spin-off impact.

Business at the Heart of Science

The Campus is home to around 100 high-tech businesses, ranging from small start-ups to strategic units of large multi-national corporations, and offers high quality office space alongside its multidisciplinary laboratory facilities.

Business support facilities and accommodation within the Daresbury Innovation Centre provide:

- A recognised research & development focused environment with an STFC account manager and links to a wide network of research intensive universities
- Fully equipped materials laboratory within the STFC Innovations Technology Access Centre
- Opportunities for technological and commercial collaboration, and fast access to commercial and academic contacts through a high-tech focused ecosystem
- Excellent transportation links
- Tailored business support and connections to major funding streams
- A spacious rural location in Cheshire



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