



## Laser technology could shrink accelerators

Shine a powerful laser beam on a small piece of metal, plastic, or a liquid and a burst of intense high-energy ionising radiation is emitted. Thanks to a grant of £4.5m from the Basic Technology programme, researchers from CLF, Queen's, Imperial, and the universities of Birmingham, Paisley, Southampton Strathclyde and Surrey aim to exploit this property of laser-irradiated matter. They hope to develop new radiation sources with such diverse medical, industrial and security applications as the treatment of cancers, monitoring quality control in semiconductors and the rapid detection of hidden explosives.

In fundamental science, the new approach might lead to the versatile production of intense, synchronised beams from a robust and compact source. This type of source could undertake many of the

experiments that facilities like SRS and Diamond currently do, but at much lower cost and on a laboratory bench-top scale. Physical scientists could carry out 'pump-probe' experiments on an almost routine basis,

allowing them to get to the heart of matter, materials, and molecules in biology, nanotechnology, and chemistry.

STFC will lead the way, explains Project Manager, David Neely, "CLF laser and micro fabrication expertise, together with CMF know-how, will play a crucial part in the delivery and development of this exciting new technology."

Success will provide ultra-short synchronised bursts of protons, ions and gamma rays for potential use in research, engineering, and medicine. The devices should also be adaptable to delivering X-ray, electron, and neutron beams for even more diverse applications. For example, neutron beams in combination with gamma-ray tomography could be used to activate materials to considerably speed up identification of suspect materials.



→ The STFC project team, from left: Martin Tolley, Andy Ward, Bob Stevens and David Neely



# A finger in every pie!

Since moving to the Cockcroft Institute last year, ASTeC staff have been working flat out to contribute their expertise to many of the world's leading accelerator science projects. FACTS asked Naomi Wyles for a quick overview of ASTeC's role in each of the projects.

- **International Linear Collider**

We are co-ordinating two of the work packages for this project - the Beam Delivery System and the Polarised Positron Source. We're also contributing to other work packages; low emittance tuning and the vacuum design of the damping rings.

- **EuroFEL** is a European funded project to produce design studies for a Free Electron Laser (FEL). The work is split into six work packages to which ASTeC contributes. We're leading the Beam Dynamics work package.

- **4GLS** - The design study is proceeding in parallel with the commissioning of ERLP. Much progress has been made in the areas of the electron beam dynamics and modelling of the electron beam all the way around the machine. The final



layout is being finalised and the Technical Design Report is due to be published in March 2008.

- **ERLP** - The commissioning of the injection gun is due to be finished by the end of March 2007. We have been installing the remainder of the machine (the Beam Transport System) and testing the cryo system to ensure there are no heat leaks. We've also been testing the RF systems for the rest of the machine.

- **EMMA** - This project is an off-shoot of ERLP. ASTeC is currently designing a machine which will eventually lead to the design and construction of a non scaling fixed field alternating gradient synchrotron (PAMELA) to be used for medical applications. [see FACTS issue 3 for more info]

- **HIPPI** is a project to design and build a high intensity proton linac. ASTeC is contributing to the studies to better understand the beam dynamics in these linacs and the design of the normal conducting accelerating structures used in them. A prototype chopper structure is being designed to aid these studies.

*And last, but definitely not least...*

- **SRS** - We are continuing to support operation of the SRS. ASTeC provides accelerator physics and RF support when problems occur. We also run a program of beam studies shift to continually improve the performance of the machine resulting in greater efficiencies during user beam.

## New Horizons for Small Molecule X-ray Crystallography

This recent work, published in Science and highlighted in physorg.com, highlights new possibilities for small molecule single crystal X-ray diffraction (SMX). The results were produced by Station 9.8 of the SRS in collaboration with Matt Rosseinsky and Darren Bradshaw's group at Liverpool University. Their research has changed current thinking of SMX. The metal organic framework (MOF) had previously been shown to be active as a hydrogen storage medium. These new results show that it could also be a 'mini reactor'. During the process of hydrogen storage testing, MOF systems are often checked using benzene to confirm the porosity of the system. The MOF's ability to take up benzene opens up the possibility that other similar sized molecules such as aspirin could be placed in the cavities and their reaction profiles studied in situ using SMX.

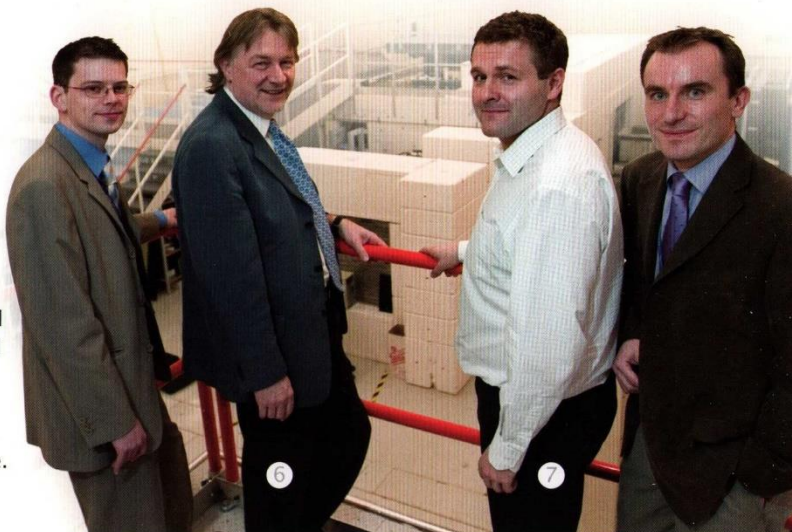


# Movers and shakers

① **Steve Bennington** and ② **Felix Fernandez-Alonso** (ISIS) have been appointed visiting professors in the Department of Physics and Astronomy at UCL. Felix will be using high-resolution neutron spectroscopy to confine molecules at the nanoscale. This work has implications for environmental issues such as waste disposal and management, as well as in the development of new technologies for gas and liquid processing and storage. Steve's research will focus around carbon, looking at graphite intercalates and nanostructured carbons for both hydrogen storage and electronics applications.

③ **Andy Kimber** (ISIS) has just achieved Chartered Engineer status. This accreditation from the Institute of Engineering and Technology (formerly the Institute of Electrical Engineers) demonstrates that Andy has met the IET's stringent list of technical competencies and recognises his professional development over the last 4½ years.

④ **Chris Benson** and ⑤ **Sean Higgins** (ISIS) have become Chartered Mechanical Engineers. This accreditation, awarded by the Institution of Mechanical Engineers, recognises Chris and Sean's continued professional development since joining ISIS as part of the Graduate Recruitment programme.



→ Left to right: Rob Clarke (CLF), Professor Keith Mason, Dr Philip Kaziewicz and Mike Dunne (CLF)

⑥ **Professor Keith Mason** visited CLF and ISIS in March, shortly before formally taking up his post as Chief Executive of the Science and Technology Facilities Council. Professor Mason met staff from the departments and was given an overview of current research projects. Professor Mason has also visited Daresbury Laboratory and DSIC (Daresbury Science and Innovation Campus). During the visit he started the DSIC Golden Mile charity walk for Comic Relief.

⑦ **Dr Philip Kaziewicz** who has been appointed to the STFC Council also visited RAL with Professor Mason.

## Published in a flash

Getting a paper accepted for publication by one of the leading journals can take up to 12 months. But **Mike Henderson** and **John Charnock** (SRD) have had a paper that they wrote with Dave Plant (Manchester Uni) accepted by the Journal of Physics: Condensed Matter in just four weeks.

The paper has been included in IoP Select - a measure of its scientific importance. The research is about spinels, crystals which occur naturally or can be fabricated. Although structurally simple at a macroscopic level, spinels have a complex composition. They have a variety of use in both science and jewellery design.





# Milestone magnet installed

The first of 23 quadrupole magnets for the ISIS Second Target Station project has been installed.

The magnet will help control the extracted proton beam as it travels from the ISIS synchrotron to the TS-2 target. Weighing in at 1.4 tonnes, the bespoke magnet was manufactured in Sweden by Scanditronix Magnet AB. The remaining magnets have been delivered and will be installed over the next few months.

You can find out more about TS-2 at brand new OPB events on 12 and 14 June. Book your place via the OPB web site.



→ Andrew Taylor and the TS-2 team

## Explosion of interest in hot paper

A paper concerning a new approach to the synthesis of porous solids has been highlighted as a 'hot paper' (as defined by Thomson ISI's Essential Science Indicators) on the American Chemical Society's Publications website. In the article, Tim Prior (SRS) and co-workers from the University of Liverpool describe the structures of a series of novel porous materials obtained using small molecule crystallography beamlines on the SRS.

Porous materials offer considerable internal surface area for separation, manipulation, and catalytic transformation of guest molecules. A good example of such a system is the aluminosilicate zeolite.

In the last fifteen years there has been an explosion of

interest in attempts to mimic zeolite chemistry. Because of their flexibility and complexity, these structures often can only be encouraged to form small crystals, so, in order to apply crystallographic methods beams of intense synchrotron radiation are generally required. Making the SRS the ideal tool.

## Notice anything different about **FACTS?**

Our new layout encapsulates the corporate style for STFC. To order your new letterheads, business cards and compliment slips please contact Media Services. The full corporate style guide is available on the web.

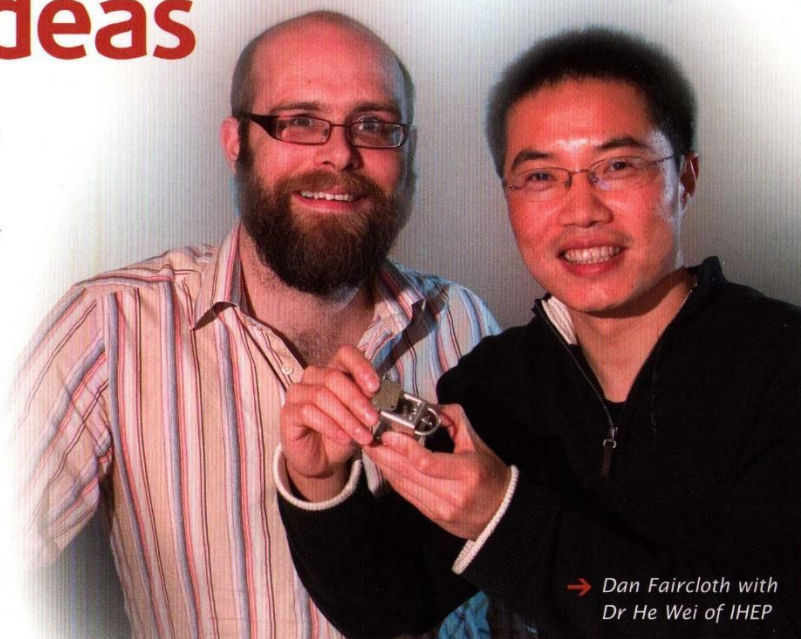


# Crouching tiger, great ideas

China is on track to become a major player in global science. Rather than designing and building their facilities from scratch, the Chinese Academy of Sciences (CAS) has been collaborating with some of the world's leading science labs to develop new ideas, and building partnerships which will enable Chinese facilities to benefit from tried and tested technology.

The Institute of High Energy Physics (IHEP), which is part of the CAS, is planning to build a spallation neutron source. Its scientists and engineers have naturally turned to ISIS for advice and expertise.

IHEP has chosen to implement designs of several parts of ISIS including the ion source, the very first stage in the production of ISIS neutrons and muons. Last



→ Dan Faircloth with Dr He Wei of IHEP

year Dr Ouyang and Prof Zhang from IHEP made an initial visit to gather information, and more recently, their colleague, Dr He Wei has been to ISIS to test ion sources that were manufactured in China to the ISIS design.

Dan Faircloth (ISIS) has been working with IHEP. "The Chinese ion sources were manufactured to an impressively high standard.

They ran very well and gave a very high output current. We're still carrying out tests to determine the lifetime of the sources but this collaboration has already provided new directions for the development of our own ion source."

You can learn more about the ISIS ion source at OPB events on 20 and 21 June. Book your place via the OPB web site.

## e-Science goes global

e-Science has been extending its strategic role beyond the UK.

Over the last few months the department has contributed to an EU workshop on the future of grid technology and been awarded an EU grant to provide expert guidance. The department has also received a grant to encourage liaison between Europe and China on the future of grid technologies.

## 20 years of muons

The first muons were produced at ISIS on 23 March 1987.

A muon is a subatomic particle, very much like an electron but heavier. Muons provide an alternative to the neutron as a probe of condensed matter and are frequently used in complementary experiments. The ISIS muon facility attracts users from 18 different countries as there are only four muon sources around the world.



→ Left to right: Adrian Hillier, Philip King, Francis Pratt, Steve Cox, James Lord

If you want to know more, sign up for one of our OPB events.



# Blisters at Blenheim



A team from FBU put their best feet forward and took part in the OX5 Run in aid of the new Children's Hospital in Oxford. The 5-mile run took place in the grounds of beautiful Blenheim Palace on 25 March.

Some of the team agreed to take part without being clear about what they were letting themselves in for; hence the team name 'We thought it was a disco...' "Katie [Hopgood, FBR] wielded her big stick so we had to join in," said one team member who asked for his anonymity to be respected, "but at least my blisters are for a good cause."

## Baby, there's a lot of it about!

Over in ISIS there has been a sudden baby boom with staff in all parts of the department becoming mums and dads, many for the first time.

Rumours are rife that there is 'something in the water', a fact categorically denied by ISIS Health and Safety Office, Jane Vickers. Andrew Taylor, Director of ISIS and Head of FBU commented that "It's good to know that ISIS staff are making the most of maintenance shutdowns." Congratulations to everyone in ISIS currently enjoying sleepless nights!

Here's just a few of the scientists of the future;

- ① Abigail Holt
- ② Benjamin Webster
- ③ Eira Hughes
- ④ Jaume Taylor
- ⑤ Lise Chapon
- ⑥ Matthew Hillier

## Facts

To ensure you get the best, we want to know what you want from FACTS.

This is your opportunity to tell us what we should cover, how frequently it should be distributed and the format you prefer.

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