Innovations

World's first 'live' video feed of Earth from space

The world's first high definition streaming video camera to be installed on the International Space Station (ISS) has been announced by David Willetts, Minister for Universities and Science at the UK Space Conference on 4 July. The project is a joint venture between Canada, Russia and the UK.

The high resolution camera will offer a video image with a resolution that is comparable to much of Google Earth. This will give users the unique opportunity to see man-made objects and groups of people and to search for videos of particular locations. It will be possible to zoom in and out, virtually steer the camera from side to side, rewind and fast forward as they investigate areas of interest on Earth.

The web platform also gives users the capability to constantly track the location of the ISS anticipating the exact time when it will pass over a particular geographic location. more

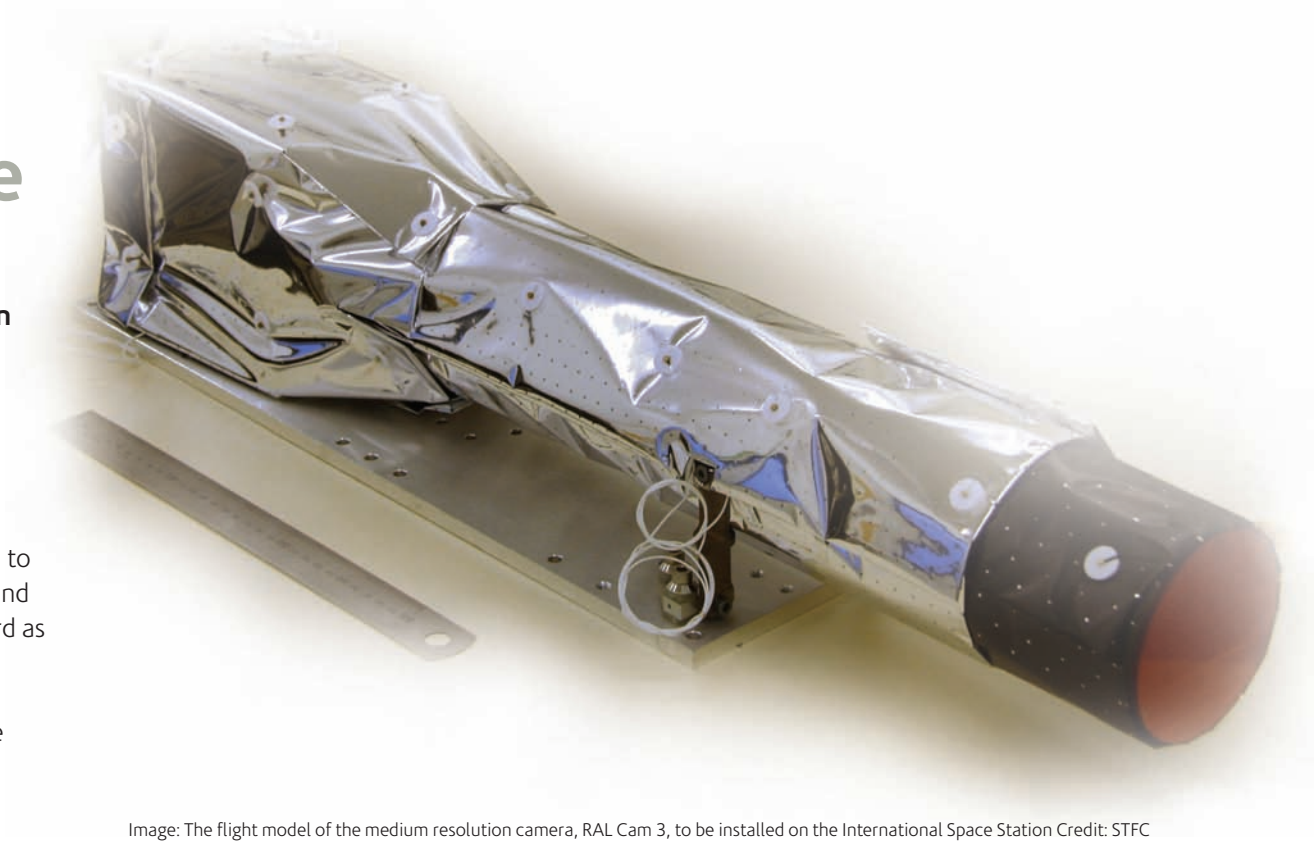


Image: The flight model of the medium resolution camera, RAL Cam 3, to be installed on the International Space Station Credit: STFC

World's first 'live' video feed of Earth from space

Canadian company UrtheCast (pronounced 'Earth cast') will supply video data and imagery of Earth, collected by two high definition cameras on the Russian module of the ISS. The two cameras, one medium resolution and one high resolution, will be designed, built and tested by STFC's RAL Space, at the Rutherford Appleton Laboratory. The data and imagery collected from the cameras will be down-linked to ground stations around the world and then displayed in near real time on the UrtheCast web platform.

President of UrtheCast, Scott Larson said "*UrtheCast is excited to be working with RAL Space on this project. We feel that the ability to show people what earth looks like from space, in a near-real time environment, will provide for a significant educational opportunity. At the same time, showing people how close we are all connected and responsible for earth, is obviously something that we continually need to be reminded about*".

Professor Richard Holdaway, Director of RAL Space said: "*Here at RAL Space we are both delighted and excited to be involved in this International project that is at the cutting edge of technology. It will provide a new and intriguing connection between space and the rest of the world*."

Commenting on the project, David Willetts, Minister for Universities and Science said: "*The UK has real strengths and expertise in space technology, as well as leading-edge research facilities. This exciting international project will give people the opportunity to see Earth from an astronaut's perspective, and I'm delighted that British scientists and the Rutherford Appleton Laboratory are playing such pivotal roles in developing this groundbreaking technology*."

Image: Backdropped against the Caspian Sea, this full view of the international space station was photographed by a crewmember onboard the Space Shuttle Discovery after the undocking of the two spacecraft. Credit: NASA

CLASP Security Call for Proposals

STFC have launched £1.5M CLASP Knowledge Exchange call for proposals to meet future challenges in security. The Challenge Led Applied Systems Programme (CLASP) aims to further increase knowledge exchange with industry and maximize the impact of the technical capabilities associated with STFC and its partners and networks.

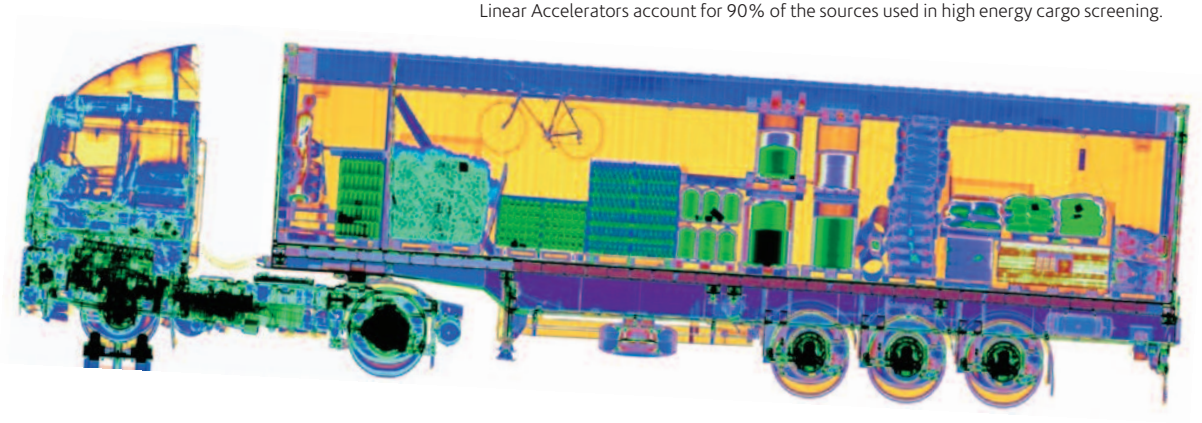
The event was held at the Royal College of Physicians in London on Tuesday 5th July 2011and was attended by 74 participants. In her introduction, Penny Woodman highlighted the aims of the CLASP call and explained the eligibility criteria for the call with a deadline for outline proposals on 23rd August 2011.

The talk was followed by a presentation from Bryan Edwards, STFC's Security Futures Programme, who stressed the need to promote and facilitate communication and collaboration between STFC, HEIs, government and the industry in identifying and exploiting novel and existing technology to address current needs in national security.

In the case studies from the previous call, Paul Sellin from the University of Surrey described the development of semiconductor detectors for gamma/neutron security imaging and Peter Mc Intosh from STFC's Cockcroft Institute described the developments in novel compact radio frequency technology for applications in cargo and global security areas.

More information about the CLASP call and the presentations from the event can be found on: http://www.stfc.ac.uk/Funding+and+Grants/35617.aspx and http://www.stfc.ac.uk/36111.aspx

Linear Accelerators account for 90% of the sources used in high energy cargo screening.



‘Cling-film’ solar cells could lead to advance in renewable energy

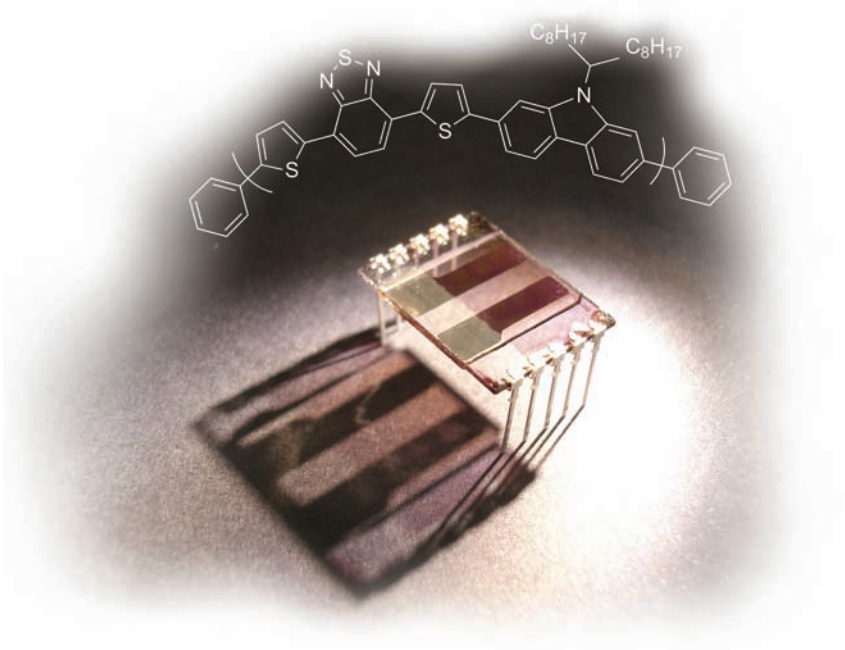
A scientific advance in renewable energy which promises a revolution in the ease and cost of using solar cells, was announced on Monday 4 July 2011. A new study shows that even when using very simple and inexpensive manufacturing methods - where flexible layers of material are deposited over large areas like cling-film - efficient solar cell structures can be made.

The study, published in the Journal Advanced Energy Materials, paves the way for new solar cell manufacturing techniques and the promise of developments in renewable solar energy. Scientists from the Universities of Sheffield and Cambridge used the ISIS Neutron Source and Diamond Light Source at STFC Rutherford Appleton Laboratory in Oxfordshire to carry out the research.

Plastic (polymer) solar cells are much cheaper to produce than conventional silicon solar cells and have the potential to be produced in large quantities. The study showed that when complex mixtures of molecules in solution are spread onto a surface, like varnishing a table-top, the different molecules separate to the top and bottom of the layer in a way that maximises the efficiency of the resulting solar cell.

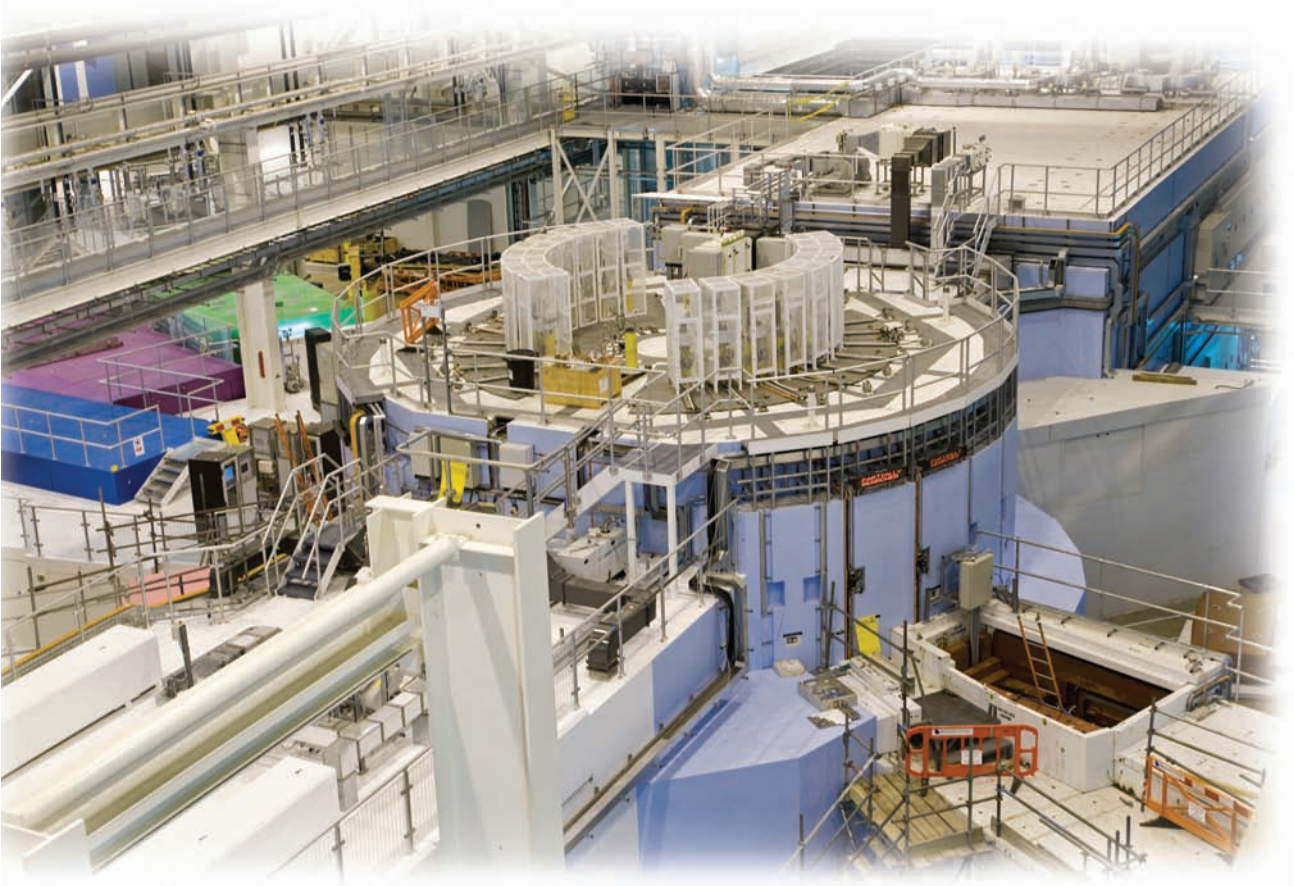
Dr Andrew Parnell of the University of Sheffield said, "*Our results give important insights into how ultra-cheap solar energy panels for domestic and industrial use can be manufactured on a large scale. Rather than using complex and expensive fabrication methods to create a specific semiconductor nanostructure, high volume printing could be used to produce nano-scale (60 nano-meters) films of solar cells that are over a thousand times thinner than the width of a human hair. These films could then be used to make cost-effective, light and easily transportable plastic solar cell devices such as solar panels.*"

A polymer solar cell ready for testing; the metal connections allow us to measure different areas of the film and measure the device efficiency amongst other parameters. Credit: Andrew Parnell

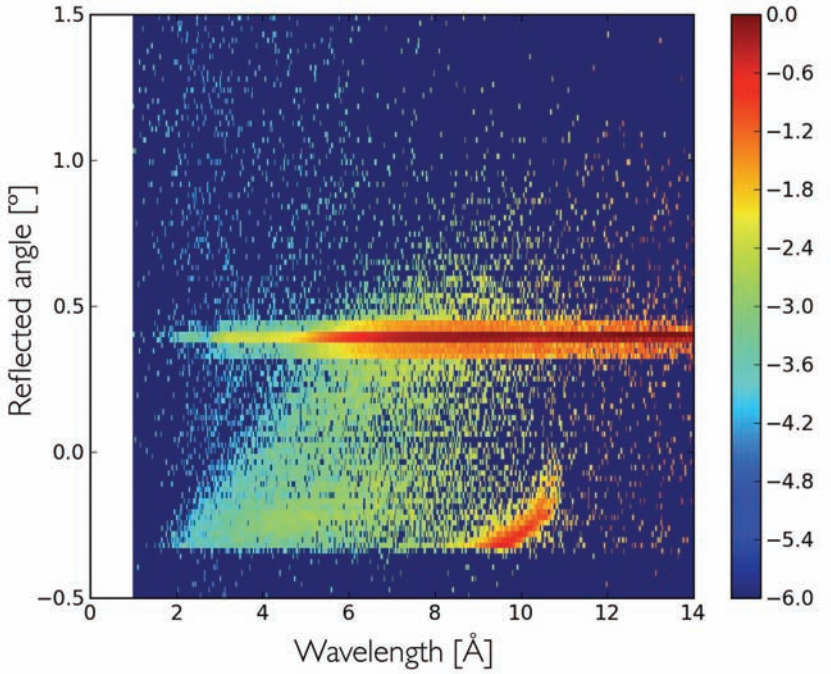


Dr Robert Dalgliesh, one of the ISIS scientists involved in the work, said, *“This work clearly illustrates the importance of the combined use of neutron and X-ray scattering sources such as ISIS and Diamond in solving modern challenges for society. Using neutron beams at ISIS and Diamond's bright X-rays, we were able to probe the internal structure and properties of the solar cell materials non-destructively. By studying the layers in the materials which convert sunlight into electricity, we are learning how different processing steps change the overall efficiency and affect the overall polymer solar cell performance.”* more

'Cling-film' solar cells could lead to advance in renewable energy



ISIS' Target Station 2 at STFC Rutherford Appleton Laboratory in Oxfordshire. Credit: STFC



This image shows how neutrons are scattered from one of the solar cell layers. Modelling this information helps us understand the composition and structure within the layer. The intense horizontal line is the mirror-like reflection (specular reflectivity) from the solar cell. The data was taken on the instrument Offspec at ISIS' Target Station 2. Credit: STFC

"Over the next fifty years society is going to need to supply the growing energy demands of the world's population without using fossil fuels, and the only renewable energy source that can do this is the Sun", said Professor Richard Jones of the University of Sheffield. *"In a couple of hours enough energy from sunlight falls on the Earth to satisfy the energy needs of the Earth for a whole year, but we need to be able to harness this on a much bigger scale than we can do now. Cheap and efficient polymer solar cells that can cover huge areas could help move us into a new age of renewable energy."*

The research was funded with a grant from the Engineering and Physical Sciences Research Council (EPSRC). The collaboration has just been allocated a new grant to carry out further studies into the structure and function of polymer solar cell materials, as well as examining new materials and innovative processes for high volume manufacture and future commercialisation.

STFC owns and operates the ISIS neutron Source and is the majority shareholder in Diamond Light Source.

STFC computational crystallography project wins Royal Society of Chemistry Award

A project established more than 30 years ago to promote collaboration between UK groups writing software for macromolecular crystallography, an X-ray technique used to study biological molecules such as proteins, viruses and nucleic acids, has been awarded the Royal Society of Chemistry's Rita and John Cornforth Award 2011. The award was made to the CCP4 project (link opens in a new window) to recognise its importance as an essential resource for macromolecular structural chemistry worldwide, and its exemplary team ethos.

Over the 32 years of its existence, CCP4 has evolved to fulfil two main roles: the production and support of an integrated suite of programs for macromolecular X-ray crystallography, and the dissemination of theory and best practice to the growing international body of researchers using the technique.

CCP4 plays a key role in the education and training of scientists in experimental structural biology by encouraging the broad dissemination of new ideas, techniques and practice. Its flagship annual study weekend attracts around 500 UK and international crystallographers who exchange experiences and ideas in computational crystallography.

The project also operates a widely used online bulletin board. With queries and contributions from crystallographers around the world, from within and beyond the CCP4 team, this resource is probably the world's most complete repository of knowledge about the theory and practice of macromolecular crystallography.

Crystal structure of Penicillin-Binding Protein 3 from the common bacterium P. aeruginosa with the antibiotic ceftazidime bound, solved using CCP4 software. Credit: S Sainsbury

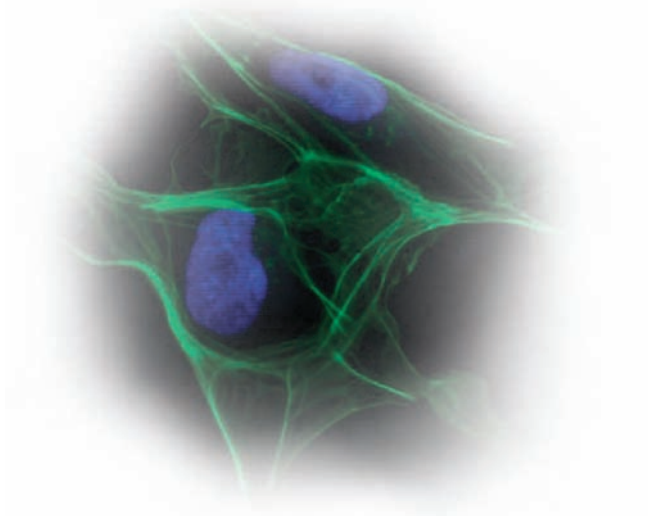
CCP4 is coordinated by STFC's Computational Science and Engineering department and is based in the Research Complex at Harwell (link opens in a new window). It is also supported by the Biotechnology and Biological Sciences Research Council (BBSRC link opens in a new window) and the Medical Research Council (MRC link opens in a new window).

You can read more about the CCP4's award on the RSC web site (link opens in a new window).

ALICE's brilliance to spark breakthrough in cell biology and cancer research at Daresbury

Unique research carried out at the Science and Technology Facilities Council's (STFC) Daresbury Laboratory in Cheshire is set to trigger a new era in research into cancer diagnosis and our understanding of how living things function.

Scientists from the University of Liverpool are linking up to Europe's most intense terahertz light source at Daresbury's ALICE accelerator, with its state-of-the-art tissue culture centre and beamline to understand the effects of terahertz (THz) rays on human cells. This improved understanding of human cells could eventually lead to significant advances in human development and the understanding of diseases, including melanomas and oesophageal cancer.



Human stem cell stained to show the nucleus (blue) and internal structure (green). Credit: Dr Rachel Williams and Professor David Edgar, University of Liverpool.

THz rays lie between microwaves and infrared light in the electromagnetic spectrum. THz light already has proven applications in both security devices and medical imaging and is already being used to detect hidden explosives, concealed weapons and drugs. Unlike traditional X-rays, terahertz radiation is considered intrinsically safe, in that it is non-destructive and non-invasive to human cells. However, scientists do not yet know what the safe upper limits for human exposure to this radiation are. A deeper understanding of THz rays' impact on living tissue will enable a new generation of medical and security imaging devices to be developed and used safely.

Professor Weightman, Principal Investigator from the University of Liverpool explained: "Like radio waves and visible light, THz rays are not expected to damage tissue like X-rays do. Our preliminary research at STFC Daresbury Laboratory has indicated that at low powers human cells appear to be unaffected by THz rays. However, the research carried out in this unique facility is the only way of establishing the safe limits of human exposure to THz radiation at high powers and what effect repeated low level exposure may or may not have on our bodies."

"The work will give us invaluable insight into the mechanisms of biological organisation and enable us to test a controversial theory of the mechanism by which biological systems organise themselves. This improved understanding of human cells could lead to significant advances in the diagnosis of diseases such as melanomas and oesophageal cancer. Low power THz instruments are already used to analyze tissue removed in surgery because cancerous and healthy tissue respond differently to THz radiation. The research on ALICE will enable us to greatly improve these procedures and eventually lead to the development of improved low cost instruments for cancer diagnosis, although it is expected to be several years before these developments are realised." more

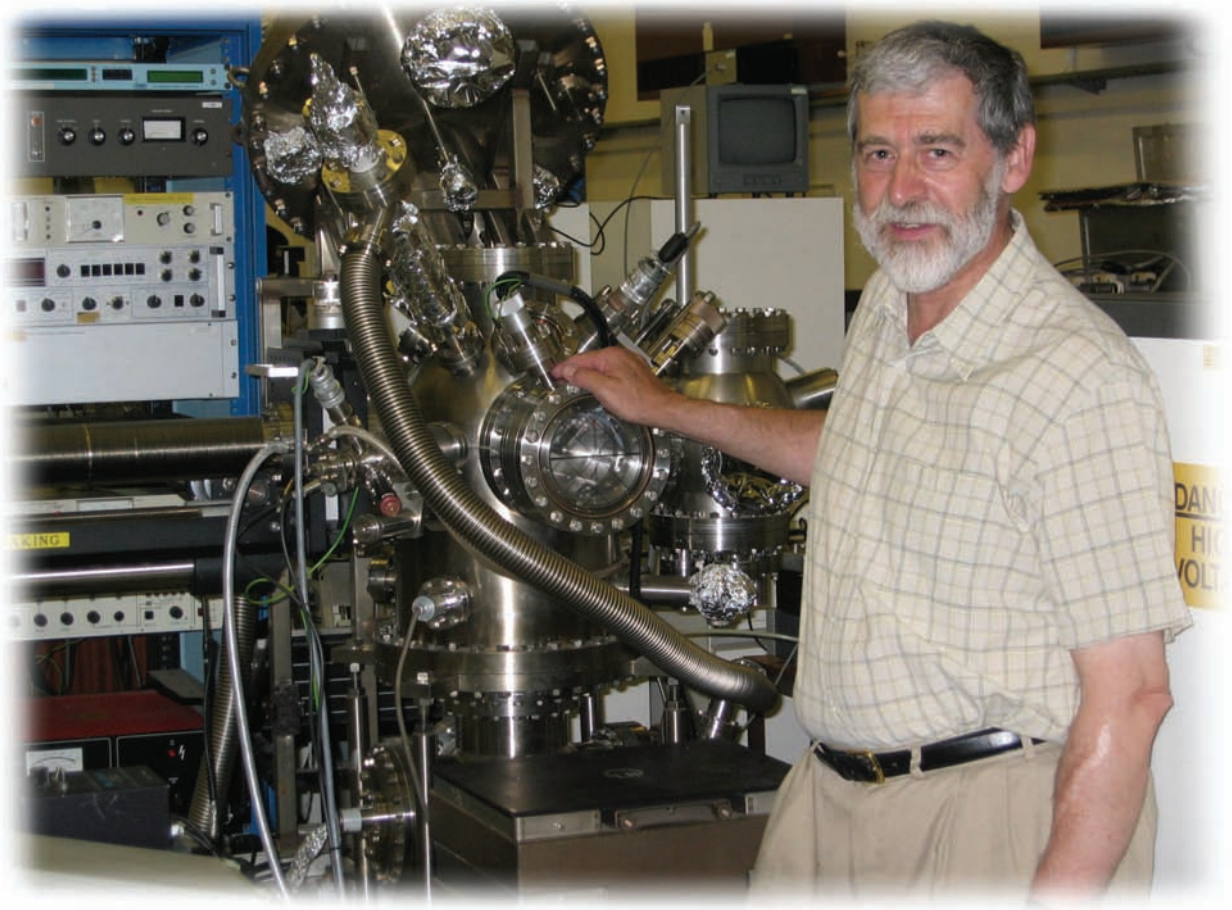
ALICE's brilliance to spark breakthrough in cell biology and cancer research at Daresbury

Dr Mark Surman, a research scientist at STFC Daresbury Laboratory added: "With ALICE we have an opportunity to irradiate living cells in a way that has never been done before, combining a high power source with a tissue culture facility. During Professor Weightman's research we expect to see about 70 kW of peak power in short pulses repeated tens of thousands of times every second. This means that the peak power will be thousands of times higher than other laboratory sources. Until now, ultra-high THz power sources have not been available to carry out this kind of research, so it is a major step forward that these trials on tiny samples of human tissue can now be carried out at ALICE."

ALICE is an R&D prototype for the next generation of accelerator-based light sources, and is based upon an unusual mode of operation for accelerators, known as energy recovery, where the energy used to create its high energy beam is captured and re-used after each circuit of the accelerator for further acceleration of fresh particles. This mode minimises the power needed to accelerate the beams, which at maximum level would otherwise require a small power station to operate. ALICE is the first accelerator in Europe to operate in this way.

ALICE accelerates to 26 million electron volts. Electrons are sent round the accelerator at 99.99% of the speed of light and 99.9% of the power at the final accelerator stage is recovered, making the power sources for the acceleration drastically smaller and cheaper and therefore economically viable.

The work is being carried out with funding from the Northwest Regional Development Agency and the Engineering and Physical Sciences Research Council (EPSRC).



Professor Peter Weightman. Credit: University of Liverpool

Business and research combine to boost UK economy - CIHE and UK~IRC announce launch of Research Taskforce

The Council for Industry and Higher Education (CIHE) and the UK-Innovation Research Centre (UK~IRC) has launched a major Task Force to answer the question: how does the UK maximise the value of publicly-funded research? The CIHE and UK~IRC believe that by uniting leading figures in industry and academia they will deliver an answer.

The Task Force's ambition is to ensure that Government policies and business and university activities are aligned to get maximum economic impact for the UK globally and to keep the country at the forefront of research. "We've set ourselves an exam question: "*How do we deepen understanding of the value of the research base in the UK and then enhance it?*" says David Eyton, Group Head of Research and Technology at BP and the Task Force's co-chair.

"*We will explore this issue through workshops, research reviews, online collaboration channels, and interviews with many of the UK's outstanding innovators. We will then present our recommendations to the Government in July 2012*."

Lord (David) Sainsbury, a member of the Steering Group, highlighted the importance of research to the UK in saying, "*Innovation is the only way we will be able to compete in today's global economy, and we should make the maximum use of our world-class research base*."

"*The UK faces increasing competition from countries where investment in research is growing. We must ensure that we maximise the impact of research that takes place in the UK and that we understand how to facilitate effective partnerships between industry and higher education*" says Professor Shirley Pearce, Vice Chancellor of Loughborough University and co-chair of the Task Force.

Professor Alan Hughes, Director of the UK~IRC, said "*The public sector is responsible for about a third of UK R&D. The central challenge is how best to enhance excellence in university research, maximise the strategic use of departmental public sector R&D and maximise complementarity with the private sector research and development effort*."

Dr David Docherty, CEO of the CIHE, concluded, "*Industry and higher education must unite effectively to tackle the challenge coming from fast growing economies, and the Task Force will make a major contribution to this unity*."