Nuclear physics promises earlier detection of brain tumours with just one scan

Time taken to detect brain tumours could soon be significantly reduced thanks to an ongoing pioneering project led by the University of Liverpool with the Nuclear Physics Group and Technology departments at the Science and Technology Facilities Council (STFC) at Daresbury Laboratory. Project ProSPECTus is developing the technology for next generation SPECT (single photon emission computed tomography) imaging that is set to revolutionise the medical imaging process, improving future diagnosis of cancer and the probability of successful cancer therapy whilst enabling a higher throughput of patients in hospitals.

Project ProSPECTus is based on a form of imaging known as SPECT which detects gamma rays emitted by a tiny amount of a radioactive pharmaceutical which is injected into the body. SPECT is a widely used method of imaging in many areas of medicine providing 3D functional information about the body, which is typically presented as cross-sectional slices through the patient. It is most commonly used to test the functioning of the heart or for the detection of tumours. Conventionally, SPECT imaging uses what is known as an ‘Anger Camera’ which relies on a collimator, a filtering device with many small holes, which lets just some gamma rays through and relies on geometry to identify exactly where they are coming from in order to build a picture of a biological process happening inside the patient.

However, ProSPECTus has taken a fundamentally different approach and has developed its technology based on what is known as the...
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‘Compton Camera’. This identifies the origin of the gamma rays without the use of a collimator, meaning that much less of the radiation used in the process is wasted, so the radiation is used more efficiently. It has not been possible to do this successfully before. However, using brand new, cutting edge detector systems, ProSPECTus is now building a prototype SPECT imaging system, using the Compton Camera principle, that is one hundred times more sensitive than existing clinical SPECT systems. This increased sensitivity offers two benefits—either the dose of radiation administered to the patient could be reduced or alternatively more patients could be scanned by one machine in a day if the current dose is used.

These new cutting edge detector systems, designed by the University of Liverpool’s Nuclear Physics research group alongside the Nuclear Physics Group at STFC Daresbury Laboratory, are a direct spin out of AGATA (Advanced Gamma Tracking Array), a nuclear physics research and development project with the aim of building the next generation gamma-ray spectrometer. ProSPECTus is funded from STFC’s Particle and Nuclear Physics Applied Systems (PNPAS) programme, a scheme aimed at exploiting techniques developed in blue-skies basic research projects like AGATA so as to generate knowledge exchange into the areas of health, security and energy applications.

Not only is ProSPECTus’ technology a hundred times more sensitive than that of the traditional Compton camera, it is unique in that it will also be possible to operate it simultaneously with MRI (Magnetic resonance Imaging), which has never been an option due to the MRI’s strong magnetic field. In fact, it will be possible to fit this SPECT system retrospectively to the 350 or so existing MRI scanners across the UK. For patients this means fewer appointments, earlier and more effective diagnosis of tumours, which means higher probability of effective treatment.

The higher sensitivity camera also offers the scope for shorter imaging time and lower doses of radiation, which is highly beneficial for patients who require frequent scanning. For clinicians, this means that more patients can be seen in a day. This is a truly collaborative effort between the Nuclear Physics Groups both at the University of Liverpool and STFC Daresbury Laboratory, working with STFC’s Technology teams who will design and build the detector cryostat and with the essential support from Liverpool’s Magnetic Resonance & Image Analysis Research Centre (MARIARC) who provide the MRI expertise.

Dr Andy Boston, the project spokesperson, at the University of Liverpool said:

“Not only is ProSPECTus’ technology a hundred times more sensitive than that of the traditional Compton camera, it is unique in that it will also be possible to operate it simultaneously with MRI (Magnetic resonance Imaging), which has never been an option due to the MRI’s strong magnetic field. In fact, it will be possible to fit this SPECT system retrospectively to the 350 or so existing MRI scanners across the UK. For patients this means fewer appointments, earlier and more effective diagnosis of tumours, which means higher probability of effective treatment.”

Ian Lazarus of STFC’s Nuclear Physics team at Daresbury Laboratory said:

“ProSPECTus has taken the abilities of the Compton imager to a new level. This is a particularly exciting example of how technology emerging from one nuclear physics project, in this case, AGATA, can have a direct and positive impact on the future wellbeing of our society.”
CLASP Challenge Led Knowledge Exchange call to meet Challenges in the Medical Sector

STFC is building on Challenge-led activities to maximize Knowledge Exchange (KE) and Impact.

The concept of developing technology demonstrators and industry-ready prototype systems is at the heart of this scheme and is aimed at de-risking the R&D process for industry. It is intended that industry representatives will be involved in all aspects of the scheme from proposal selection to product decision making.

Outline proposals are invited through Je-S, from within STFC research community which can provide a solution to one of the many challenges associated with the Medical Sector and for which there would be a demonstrable potential market. It would be expected that any IP generated would reside with the host institution.

The closing date for Outline proposals is 16:00 on 27th April 2010:

This should be two pages maximum and contain:

- Technical outline - explain the technical background to the proposal and its link with STFC funded research.
- Impact to Medical Sector - describe the ultimate goal of the project and detail the way in which development of this technology will address the sectorial challenge identified as relevant to your proposal.
- Timescale and outline work plan - Use this section to describe briefly the steps that will be taken to develop the technology in the course of the project. Include in this the justification for any collaborations (with experts external to the main proposers) that you will develop in the course of the project to support the work.
CLASP Challenge Led Knowledge Exchange call to meet Challenges in the Medical Sector

Proposals should aim to take advantage of the existing effort and skills within the STFC research community, but may include collaborations with other research groups, industry or end users. They will be assessed, in confidence, by a Steering Group with representatives from industry, academia and other stakeholder organizations for relevance to the sectors identified, technological feasibility and the potential for Knowledge Exchange.

Following the assessment of Outline proposals, shortlisted applicants will be invited to develop full proposals with assistance and advice from STFC Innovations staff and panel members. The closing date for full applications will be 16:00 on 8th July 2010. Applicants will be invited to present their final proposals to the Steering Group for consideration in early September. The anticipated start date for successful proposals will be October 2010.

The total funds available for this call will be approximately £1.5M. It is expected that this will fund a small number of projects ranging from short feasibility studies to larger developmental projects against key milestones, in the case of the latter this may lead to funding being awarded against initial stages only in the first instance.

Membership
All CLASP Panel members have signed standard STFC Non-Disclosure Agreements (NDAs). If applicants require a higher level of confidentiality then please clearly indicate this when you submit your Outline Application.

Chair
* Prof Jenny Thomas - STFC Science Board

Panel
* Dr Tim Bestwick - STFC Director of Innovations
* Dr Trevor Cross - e2v
* Mr. Chris Dorn - QinetiQ
* Dr Bryan Edwards – STFC Futures
* Dr Catherine Ewart - STFC Head of Futures Programme
* Dr Dick Lacey - Home Office
* Prof Dewi Lewis - GE Healthcare
* Dr Val O'Shea - University of Glasgow

Secretary
* Mrs Penny Woodman - Head of External Programmes, STFC
Closing date for
*RSE/STFC Enterprise Fellowships 2010 – 4th May

This scheme is funded by the Science and Technology Facilities Council (STFC) as part of the Council’s Industry Programme and delivered by the Royal Society of Edinburgh (RSE).

Please see the www.stfc.ac.uk for more information.

Enterprise Fellowships are designed to encourage exploitation of the STFC research programme. Applications may be submitted on any subject provided that the original research or technological developments have their origin as part of a programme largely funded by STFC (formerly PPARC and CCLRC), or in the case of nuclear physics programme previously funded by EPSRC (Engineering and Physical Sciences Research Council).

Please contact afraser@royalsoced.org.uk for further details on the scheme and Sue.fuller@stfc.ac.uk on questions of eligibility.

*The Royal Society of Edinburgh, Scotland’s National Academy, is Scottish Charity No. SC000470

Changes to the IPS applications closing date

The IPS closing date scheduled for July 2010 has been cancelled. This is due to the migration of the STFC grant processing system to one run by the Shared Services Centre (SSC) in Swindon.

The October closing date will go ahead and the exact date will be shown on the appropriate funding scheme pages of the STFC website, as soon as it has been confirmed.

The April deadline is unaffected and will close at 16:00 on the 13th April.

Innovations Newsletter
This meeting will be of interest to all professions working in radiotherapy and will cover clinical, technological and practical issues which relate to respiratory and other sources of motion in radiotherapy.

With support from major manufacturers they have been able to bring together an excellent programme of speakers from the UK and overseas, for a meeting which should leave attendees in a strong position to return to their department and implement a programme of clinical development.

Please go to forthcoming events
SpaceTech 2010
- UK space scientists reveal the many benefits of cutting edge space technology

The SpaceTech 2010 event, hosted by the STFC Innovations Club and the European Space Agency (ESA), gave industry, military, academic and government representatives looking for high technological solutions the chance to discover how space technology can benefit them.

Chris Bee of STFC Innovations Ltd, said, “SpaceTech 2010 has been a great success, providing a unique opportunity for the UK’s space technology groups to share their experience and knowledge with non-space industry and other organisations. By encouraging collaboration, we have seen the development of some amazing new technologies, products and services that have benefited both the economy and society. Improved car brakes, an instrument to diagnose TB, dirty bomb detectors and a special fire protective hydrojacket are all examples of where space technology has been successfully transferred to terrestrial applications.”

“By encouraging collaboration, we have seen the development of some amazing new technologies, products and services that have benefited both the economy and society.”

Chris Bee
STFC Innovations Ltd

The UK space community is at the forefront of development for advanced instrumentation and sensors and there is an enormous range of terrestrial applications for this cutting edge technology. As such, organisations have established special programmes to facilitate such technology transfer and commercialisations. In the case of ESA, technologies originally developed for space activities are transferred or spun-off to terrestrial applications through its Technology Transfer Programme.

STFC’s technology exploitation is managed by STFC Innovations Ltd. The STFC Innovations Ltd team progresses individual projects through various business models to the point of implementation as commercial licenses or spin-out companies.
There is growing interest in defence activities that draw upon human behaviour and attitudes and how they are revealed. Whilst capabilities to analyse and understand human behaviours and attitudes do exist, these have focused on people in the physical world; there has been relatively little emphasis on how behaviours and attitudes are shown, and can be shaped by, online activity within the ‘new media’ of cyberspace.

Cyberspace thus represents a new and challenging area of research and a domain within which Influence can be exerted.

The MOD’s Centre for Defence Enterprise (CDE) is seeking applications that explore human and social behavior in the virtual worlds of cyberspace.

The CDE will host a seminar on 22nd April 2010 to further describe this area of investigation. The competition will open on this date and applications are to be made through the CDE portal. A competition brief will be produced for the seminar and will be available on the website from this date.

Companies are strongly advised to attend the seminar to hear firsthand the challenge.

More detail on this competition are listed on the Technology Strategy Board website

http://www.innovateuk.org/content/competition/influence-through-cyberspace.ashx
Technology Could Revolutionise Optical and Laser Systems

A new optical circuit board technology developed as part of a project funded by the Centre for Earth Observation Instrumentation (CEOI) has the potential to significantly improve the performance of optical circuits. It can also make them more rugged, more compact and much cheaper to manufacture.

The hollow waveguide (HWG) based optical circuit board technology was originally invented by QinetiQ. In collaboration with the University of Leicester, University College London and the Centre for Terrestrial Carbon Dynamics, the technology was further developed to demonstrate a miniaturised laser spectrometer system for the measurement of atmospheric carbon dioxide - a critical greenhouse gas pollutant associated with global warming. In addition to the successful development of the technology, the project also highlighted its potential for a very wide range of laser and optics based space instruments both for Earth Science and Planetary Exploration.

Manufacturing advantage
The approach represents the optical equivalent of the electronic printed circuit board. An innovative manufacturing approach, in conjunction with automatic pick-and-place equipment, could lead to high volume low cost mass production of a very wide range of integrated optic sensors.

The HWG circuit board also has a number of advantages compared with conventional solid core integrated circuits. The hollow core has very broad waveband, high power, transmission characteristics and the fact that there is no refractive index step to bridge means discrete components can be easily integrated. The hollow core can also provide the basis of flow cells for the analysis of gases and liquids using absorption, spectroscopic and interferometric techniques.

Disruptive technology
Current optical circuit manufacturing techniques lead to instruments which are bulky, sensitive to misalignment, and are expensive to manufacture. The advantages of the HWG optical circuit board technology, are that they can lead to optical and laser systems which are more compact, more rugged and much cheaper to manufacture.

HWG optical PCBs also provide an integration platform for a very wide range of discrete optical and micro-optical components of both an active and passive nature. These include, beam splitters, lenses, waveplates, polarisers, absorption cells, lasers, amplifiers, detectors, modulators etc. These will enable the realisation of integrated systems for a diverse range of applications in the fields of space, environment, health, security and defence, including:

- Spectrometers, interferometers and radiometers for earth science and planetary exploration
- Laser radars, including lidar-on-a-chip based on hollow silicon technology for space and defence applications
- Biochemical sensors, including lab-on-a-chip for DNA analysis, for health, defence and pharmaceutical development
- Gas sensors and fluid sensors for environmental and industrial monitoring and health care
- Telecomms modules based on micro-optical components integrated on fibre pig-tailed hollow waveguide optical circuit boards
- Generic optical test and measurement instrumentation

Further information about this technology and others funded by the CEOI can be found at www.ceoi.ac.uk. You can also contact the Project Lead - Professor R Mike Jenkins tel: +44 (0) 1684-895084, email: rmjenkins@qinetiq.com, Dr Brian J Perrett, tel: +44 (0) 1684-895788, email: bjperrett@qinetiq.com or the CEOI Director, Professor Mick Johnson: Tel: +44(0)1438 774421, email: mick.johnson@astrium.eads.net.
On 23 February 2010 NERC hosted a community engagement event to launch a new £5m research programme: Networks of Sensors - Demonstration High Resolution Networks. The event, held in London, was managed by the Technology Strategy Board’s Sensors & Instrumentation Knowledge Transfer Network (SIKTN).

The meeting included a range of presentations given by a panel which was comprised of NERC and SIKTN staff, as well as representatives from the Science & Technology Facilities Council (STFC) and the Defence Science & Technology Laboratory (DSTL), both of which are supporting the programme with additional in-kind support. Following on from this, the panel answered questions during a structured plenary session. Information on a wireless environmental traffic monitoring system was also presented as a case study.

During the event, time was set aside for informal networking to provide delegates with the opportunity to discuss ideas for potential projects and develop working relationships. Over one hundred delegates from the academic community, as well as public and private sector organisations, attended the launch event. The overwhelming response, assessed through formal and informal feedback from participants, was that the event had been very successful.