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Innovations

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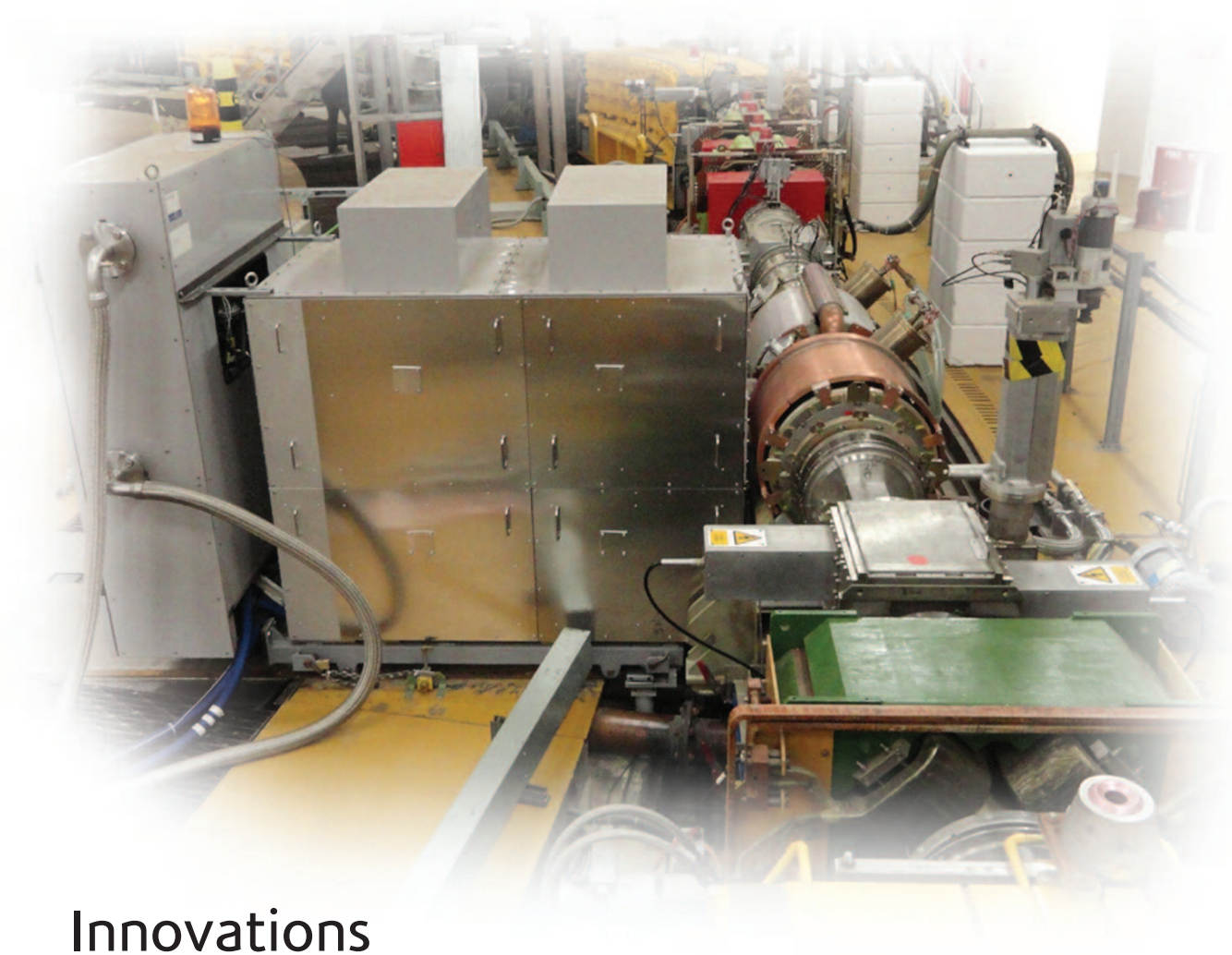


Successful beam test on ISIS for new acceleration system after a 15 year wait

Future accelerator projects will require higher beam power and beam current than is available at the moment. It has always been assumed that beam current will be limited because a fraction of the available acceleration potential is used to overcome the voltage that the beam current develops in the acceleration system – this is called "beam loading". As current – and hence beam loading – increases, eventually there will no longer be enough potential left to accelerate the beam. Dr Irie's new system, however, overcomes this problem by decreasing the amount of beam loading a given beam current produces, and perhaps opens the door for a new generation of particle accelerators. more

Successful beam test on ISIS for new acceleration system after a 15 year wait

This collaborative work started back in 1996 with an informal agreement between the KEK High Energy Research Organization in Japan, Argonne National Laboratory (ANL) in the USA and ISIS here at the Rutherford Appleton Laboratory. Over the next seven years a prototype amplifier was designed and built at KEK, and was then shipped over to ISIS for further testing and optimisation. Dedicated experimental time has been severely limited by having to fit visits from KEK and ANL scientists around the busy ISIS operational schedule, but in January 2011 the LOI system was finally ready for tests in the ISIS synchrotron and was installed in place of one of the existing acceleration systems. This involved a large amount of work from the ISIS water plant section, as the cooling requirements of the LOI system are roughly double those of the existing systems.

On April 17 2011 Dr Irie attended the machine physics session at which the LOI system was first run with beam. Initial tests show that the beam loading in the new system is about 40 times lower than that in the existing acceleration systems, and that in addition, the new system may help to stabilise the beam elsewhere in the synchrotron. This suggests that an LOI system could possibly be used to accelerate up to 40 times more beam current than any acceleration system presently in operation.

There is still much more work to do to make this system – or something like it – an operational part of ISIS, but the initial results are very promising. This approach may help ISIS accelerate much higher beam current in the future, and points the way towards acceleration systems for future ISIS upgrades and high power proton drivers for projects such as the Neutrino Factory.

For further information, see the LOI website:
http://www-accps.kek.jp/Low-Impedance_Cavity/

Zapping deadly bacteria using space technology

Technology developed with ESA funding and drawing on long-running research aboard the International Space Station is opening up a new way to keep hospital patients safe from infections.

Using plasma – superheated, electrically charged gas – Max Planck Institute for Extraterrestrial Physics director Gregor Morfill is developing ways to kill bacteria and viruses that can cause infections in hospitals.

"*What we have with plasma is the possibility to supplement our own immune system*," says Dr Morfill.

The research began on the International Space Station (ISS), where his physics experiments have been running since 2001.

The first was 'Plasmakristall Experiment Nefedov' in cooperation with Russian partners. Later, the PK-3 Plus experiment flew in 2006 as part of ESA's Astrolab mission.

"*It's the longest-running space experiment in the history of human spaceflight*," notes Dr Morfill. More than two dozen astronauts and cosmonauts have operated the equipment aboard the ISS.

The work in space led to the realisation that plasma might have very practical terrestrial applications – and Dr Morfill turned to ESA's Technology Transfer Programme to make it a reality.

Plasma dispensers can tackle a serious problem: in recent years, health experts have seen a dramatic rise in super-strains of bacteria that can survive the strongest antibiotics in medicine's arsenal.

International Space Station

One, the multiple drug-resistant *Staphylococcus aureus* – perhaps better known as MRSA – kills 37 000 people each year in the EU alone. It affects more than 150 000 patients, resulting in extra in-hospital costs of €380 million for EU healthcare systems.

With help from ESA, Dr Morfill's team is now focusing on developing a system for hospitals, but cold plasma technology might one day also make it into our homes. Plasma could be used to disinfect toothbrushes and razors instead of UV light, which only sanitises the surfaces it shines on. Plasma-charged gas would clean in hidden cracks and crevices, too. more

Tomas Reiter with PK-3 Plus

Zapping deadly bacteria using space technology

Plasma at work

At the other end of the spectrum, he says that plasma could be used as a 'planetary protection system' to clean satellites and planetary probes so they don't carry terrestrial bacteria to distant planets.

The technology looks likely to do a lot of good. Bacteria are constantly evolving, developing resistance to the most commonly used antibiotics. Today, the best way to prevent the spread of bacterial infections is sanitation: regular hand washing between patients, for example, and systematic sanitising of floors, door handles, hospital curtains and anything else that might harbour infectious material.

Instead, Dr Morfill is designing a system that makes use of plasma's innate antibacterial properties to make disinfection easy and quick.

"It has many practical applications, from hand hygiene to food hygiene, disinfection of medical instruments, personal hygiene, even dentistry – this could be used in many, many fields."

Dr Morfill adds that the research on the ISS and support from ESA has played an important role in turning physics experiments into life-saving technology here on Earth, both directly through ESA funding of a technology demonstrator project and through classic 'trickle down' of the specific technology transfer.

"ESA has been tremendously helpful – we're 90% funded by ESA," Dr Morfill concludes. *"Funding for doing experimental work in the laboratory and in space has made it possible to spin off and start other research."*

More on ESA's Technology Transfer Programme and its Technology Transfer Demonstrator projects on ESA TTP website.

Plasma device for sanitising hands

'Octopus' provides cancer breakthrough

A breakthrough in understanding a biological process that causes many common cancers including lung and breast cancer opens up a whole new realm of possibilities for the development of improved cancer drugs. The results are featured on the front cover of the journal Molecular and Cellular Biology published on12 May 2011.

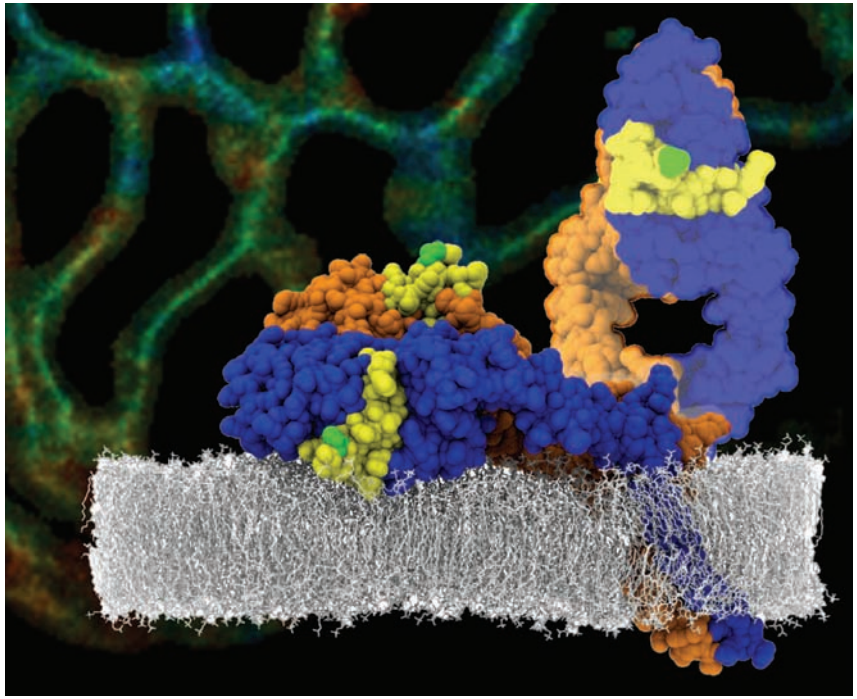
Experts from STFC's Central Laser Facility (CLF) and Computational Science and Engineering Department (CSED) have solved a puzzle that has confounded scientists for more than 30 years.

The researchers have discovered a previously unknown molecular shape which is partly responsible for transmitting the signals that instruct cells within the body when to grow and divide. It is the uncontrolled growth of cells that causes cancer to spread through the body. Until now, not enough was known about how these molecules, known as epidermal growth factor receptors (EGFRs), transmit messages in the development of cancer. This means drugs designed to stop them transmitting these cancer-inducing signals have also been limited in their effectiveness.

Project leader Dr Marisa Martin-Fernandez, a CLF scientist based at the Research Complex at Harwell (RCaH), says: "*A number of drugs aim to limit EGFRs' role in spreading cancer but because human EGFRs haven't been well understood, the drugs are designed simply to block every signal they transmit. But the human body is good at compensating for losses of function so it finds ways of bypassing blocked receptors to allow cancerous cells to grow again. Unfortunately the current drugs therefore all too often only provide temporary remission.*"

"*Our breakthrough will provide a better platform of knowledge on structure variation of EGFRs in vivo. Potentially this enables the pharmaceutical industry to develop drugs that target EGFRs' cancer-related functions more specifically but also allow the receptors to go on performing other tasks. This makes it less likely that the body will try to compensate for total loss of function.*"

Peter Parker is the Principal Investigator at King's College London on this work. Dr George Santis, also from King's College London, is a consultant in respiratory medicine and will help take this work forward. more



Background: Image of human epithelial cells from the set from which the variation in the shape of EGFR was derived. Foreground: Model of human EGFR showing the new conformation lying flat on the membrane and the previously known upright conformation

'Octopus' provides cancer breakthrough

Dr Santis "*Translating knowledge derived from scientific research into successful clinical therapies is exemplified by EGFR and its dysregulation in cancer. The use of new biologicals that inhibit EGFR has proved transformational in managing solid tumours particularly lung cancer where conventional anti-cancer treatment reached a plateau. There is however still much we don't understand regarding EGFR and its role in malignancy; this breakthrough provides the foundation for novel ways to assess EGFR in cells and tissues that may lead to new insights on how to target EGFR to treat human cancers*."

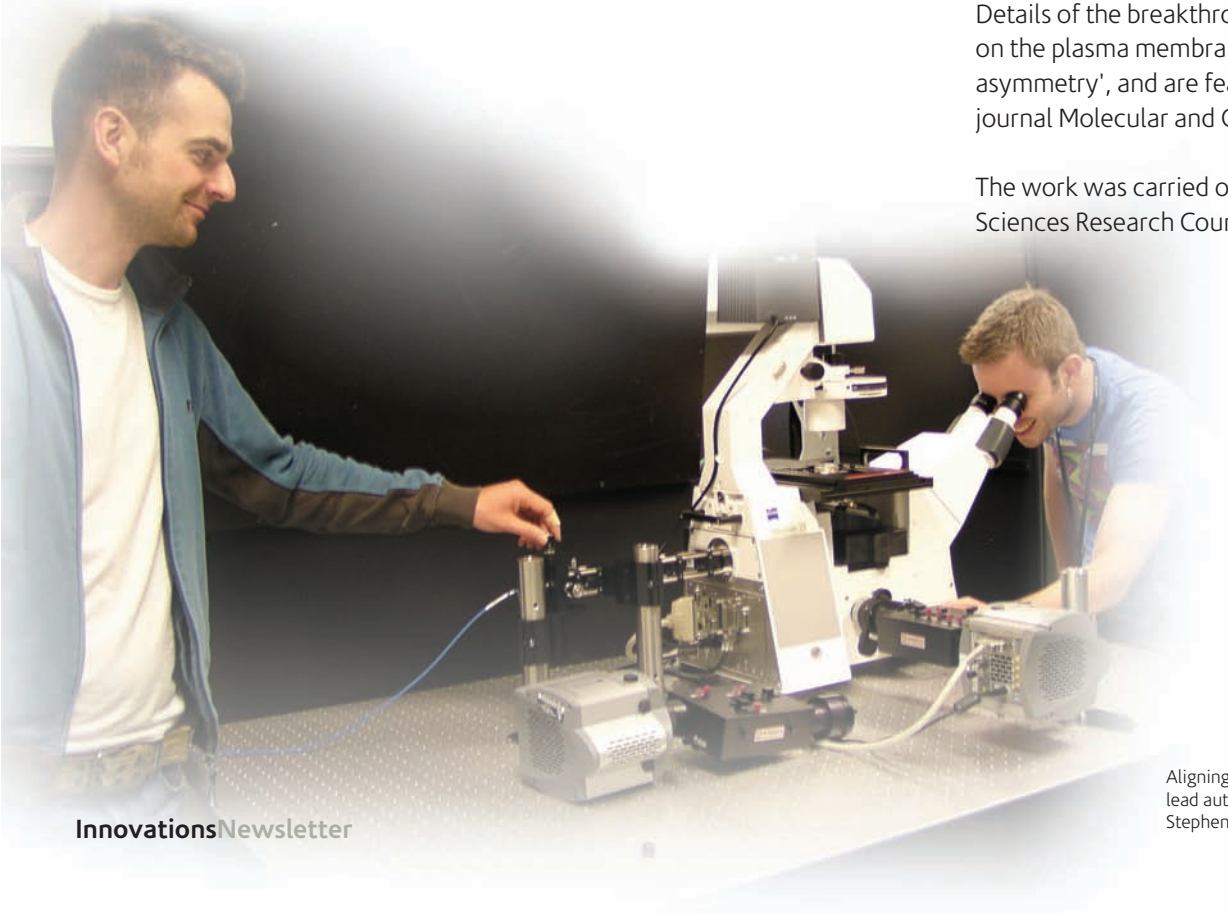
The team has also shown that this shape shares key features with the better understood EGFR molecules in fruit flies, providing clues on how EGFRs have changed during evolution.

Dr Martyn Winn of the CSED at STFC's Daresbury Laboratory says "*The key has been close collaboration between the experimental and computational teams involved. The CLF used its OCTOPUS facility to take nanoscale measurements of EGFRs in cells. We took the measurements and used high performance computing (HPC) to calculate the receptors' high-resolution structure, allowing us to determine their similarities with the fruit fly EGFRs*."

Professor John Collier, Director of the CLF, said, "*Breakthroughs like this have the potential to really pay dividends in terms of saving lives and maximising the value of healthcare expenditure. By constantly pushing forward the boundaries of what laser technology can do, we can deliver real-world benefits that tangibly improve people's lives*."

Details of the breakthrough are presented in the paper 'Human EGFR aligned on the plasma membrane adopts key features of Drosophila* EGFR asymmetry', and are featured on the front cover of the current edition of the journal Molecular and Cellular Biology published on 12 May 2011.

The work was carried out with funding from the Biotechnology and Biological Sciences Research Council (BBSRC).



Aligning a microscope prior to experiments. On the right is Chris Tynan, one of the two lead authors of the paper published in Molecular and Cellular Biology; on the left is Stephen Webb, who is in charge of the single-molecule instrumentation in OCTOPUS

CLASP Security Event

Tuesday 5th July 2011

STFC Innovations Club is please to invite you to a 'Security ' themed event on 5th July 2011 at which we will be announcing a new CLASP Security funding call.

The event is being held at the Royal College of Physicians London NW1 4LE

Security is one of four key themes under the STFC Futures Programme and there are many technologies arising from across the STFC research base that have exciting potential to solve technical challenges needed by the security community.

Registrations are now open on the web link below:

http://www.stfc.ac.uk/stfcforms/claspsecurityevent.aspx

The main purpose of the day is to allow plenty of networking opportunities for potential applicants to meet and share ideas with colleagues from the MoD , Home office and Dstl . Please see the draft programme attached.

Further information on the CLASP Knowledge Exchange Scheme and the Futures Programme
http://www.stfc.ac.uk/Business+and+Innovation/19222.aspx
http://www.stfc.ac.uk/Business+and+Innovation/34617.aspx

Programme for CLASP Security Event, Tuesday 5th July 2011

Dorchester Library, Royal College of Physicians
11 St Andrews Place, Regent's Park, London NW1 4LE

Chair: Bryan Edwards STFC Futures Security Champion

Time	Programme Item	Speaker
10:00 - 10:30	Registration and Coffee	
10:30 - 10:45	Introduction to CLASP Funding Scheme	Penny Woodman, STFC
10:45 - 11:00	Overview of STFC Futures Security	Bryan Edwards, STFC
11:00 - 11:30	Current Challenges in Security	Home Office/DSTL
11:30 - 12:00	Focus for New CLASP Call	Home Office/DSTL
12:00 - 12:20	Security Case Study 1	tbc
12:20 - 12:40	Security Case Study 2	tbc
12:40 - 13:00	Open Discussion	
12:40 - 13:00	Open DiscussionLunch and Networking	

Call for nominations to the STFC Futures Advisory Panel

STFC is seeking nominations for members to its Futures Advisory Panel, to provide independent advice to STFC on the overall programme priorities and balance of funding across the global challenge themes of energy, the environment, healthcare and security.

The Panel will comprise up to eight members, including a Chair and Vice-Chair. Nominees should have a strong track record in one of the Futures themes coupled with the ability to take a broad strategic overview of a diverse portfolio of global challenge projects. The final membership of the panel will be selected to ensure a balance of experience and expertise in academic research, knowledge exchange and innovation; members will be drawn from industry and government as well as academia. Appointments will be made initially for one year, with the possibility of reappointment.

The panel will provide advice and recommendations to the Science Board and the STFC Executive, based on a thorough understanding of the programme context plus an awareness of existing commitments and strategy.

In appointing its advisory panels, STFC considers it important to ensure broad representation from its community. We would particularly welcome nominations from groups traditionally underrepresented on such bodies.

If you wish to nominate yourself or a colleague please send the nominee's full name, institution, a brief summary of their expertise and their contact details to: sharmila.banerjee@stfc.ac.uk

Please ensure that nominees are aware of and agree to their nomination.

The closing date for nominations is Friday 29th July 2011 and the first meeting of the Panel is likely to take place in October 2011.

For further information on the STFC committee/panel nominations process, please visit the Advisory Committee Selection Process page at: http://www.stfc.ac.uk/our+research/4617.aspx

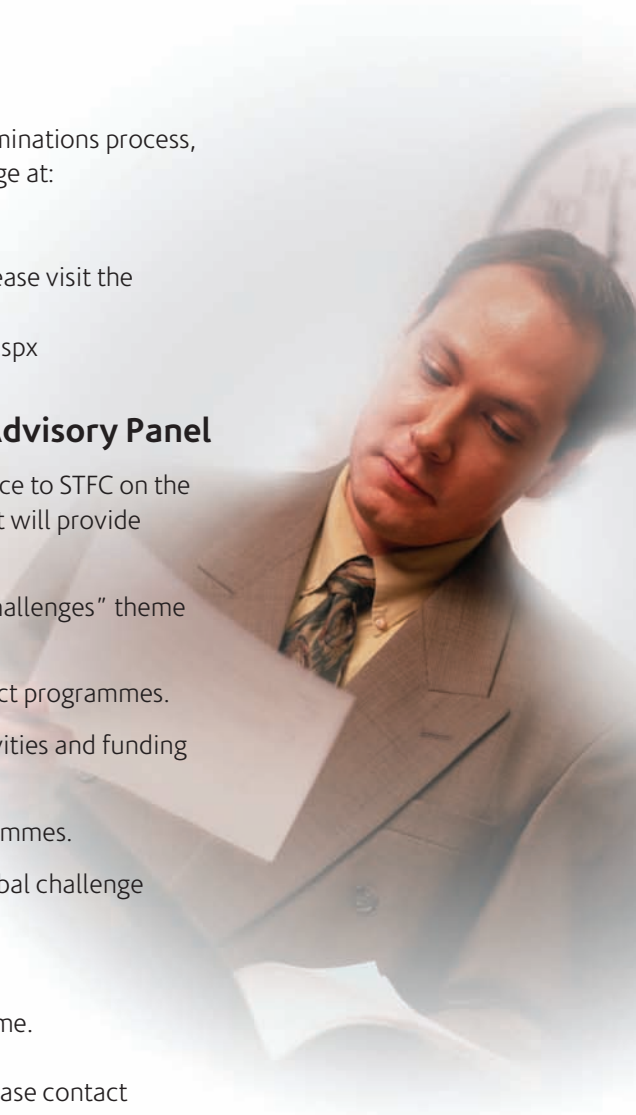
For further information about the Futures Programme, please visit the Futures Programme pages at: http://www.stfc.ac.uk/Business+and+Innovation/19415.aspx

Draft terms of reference for the Futures Advisory Panel

The Futures Advisory Panel will provide independent advice to STFC on the overall priorities of the Futures Programme. Specifically, it will provide advice on the following areas:

- Actions for implementing the "Solutions to Global Challenges" theme of the STFC Corporate Strategy.
- Actions for achieving synergy with STFC's other impact programmes.
- The optimum balance of funding across themes, activities and funding initiatives.
- STFC's contribution to the RCUK cross-council programmes.
- Specific engagement with campus partners in the global challenge themes.
- Achieving maximum visibility for the programme.
- Evaluating and measuring the impact of the programme.

If anyone wishes to discuss the role of panel members please contact catherine.ewart@stfc. ac.uk



Keep up to date on what's happening at STFC

Follow STFC on Twitter

STFC currently has two Twitter feeds STFC_Matters and STFC_B2B (business to business)

It aims to promote:

- STFC's latest news and events
- corporate updates on policy and process changes at STFC
- a way for scientists, the media and partner organisations on Twitter to interact with STFC

STFC_B2B is aimed at partners and industry and focuses industrial interactions. It aims to raise awareness of opportunities to collaborate and engage with STFC and its partners by promoting:

- how you can access our facilities, knowledge and expertise
- how you can bid for contracts with research organisations such as CERN and ESRF
- STFC organised or relevant industry sector events