Editorial

Recently the Large Hadron Collider (LHC) delivered its first collisions since late 2012. The LHC had been offline for just over two years to allow consolidation of the accelerator complex in preparation for higher proton beam energies of up to around 6.5 TeV. Proton collisions at a new world-record energy were duly established a few weeks ago, and the LHC experiments can now look forward to many more years of high-energy (and higher luminosity) data-taking, currently scheduled to continue into the mid-2030s. After many thousands of technical fixes and improvements made during the long shutdown, involving hundreds of people, this tremendously sophisticated accelerator complex was brought successfully back into life essentially on schedule (notwithstanding delays of a few weeks due to technical hitches). This is a testament to the skill and dedication of the CERN and collaborating institutes’ technical staffs, who worked hard to achieve this outcome.

The LHC is certainly the largest and highest-energy particle accelerator built to date, and, due to its scale (and cost) it is one of relatively few subatomic-particle ‘smashers’ currently in use for investigating the fundamental structure of matter and the forces of nature. Yet the number of accelerators in use as light sources and neutron sources, for providing medical diagnosis and treatment, and for broad applications in industry, energy and security continues to increase. The latest estimates indicate that perhaps more than 30,000 accelerators are in use around the world. Every day hundreds of thousands of people are diagnosed and/or treated using accelerators in hospitals, and the annual value of products manufactured, processed and/or treated with accelerated-particle beams is estimated to be in excess of US$500B!

Whether from a scientific, medical or industrial perspective, the impact of accelerator science and technology on society is truly monumental. Accelerators such as LHC are flagships of our achievements and rightly capture the public’s attention and imagination. However it can certainly be debated whether the broader societal impacts of our field are widely understood (or appreciated). So whatever kind of accelerator we work on, each of us can help get the message out, via family, friends, neighbours and colleagues, about the contributions that we are making towards the general good.

Phil Burrows

Group Chair
News from the Laboratories — Daresbury

First UK In-kind Contribution to ESS

A team from Daresbury Laboratory recently visited the European Spallation Source (ESS) for a final design review of the first UK in-kind contribution to ESS.

The programme, led by the ASTeC Vacuum Science Group, is on schedule for delivery in July 2015 to meet ESS programme requirements. The £1 million pound UK in-kind contribution will deliver state-of-the-art world class vacuum facilities to allow the ESS vacuum group to conduct a programme of innovative research that will help make key design choices for the ESS. The four work packages to be delivered are:

- Outgassing Facility – Key requirement for ESS material choices
- Calibration Facility – Important for ESS to make key vacuum diagnostic choices
- Vacuum Integration Facility – Critical for ESS to test components offline prior to installation
- Particle Test Facility – Critical requirement as ESS is a ‘particle free’ accelerator

The ASTeC vacuum science group has an excellent reputation internationally and this led ESS to approach the group two years ago for advice and assistance with the ESS vacuum design. As a result of the UK’s commitment to ESS this relationship has since developed further and allowed identification of a number of vacuum/mechanical engineering projects that STFC can deliver for ESS.

ESS are delighted with the progress made so far with the first UK in-kind contribution. Peter Ladd (ESS Vacuum Section Leader) has described the relationship as ‘fantastic’ and recognises the capabilities STFC Daresbury Laboratory can deliver.
CLARA Receives a Major Boost from SwissFEL

ASTeC has recently taken delivery of three linear accelerators and a number of focusing magnets for the CLARA project. All of this equipment has been supplied by the SwissFEL project at Paul Scherrer Institute under an official agreement with STFC.

The agreement states that ‘PSI & STFC have agreed to work on a Joint Experimental Programme on the CLARA FEL Test Facility once it is operational. The programme will test new ideas and concepts aimed at improving the performance of short wavelength FELs in general and which will be directly applicable to the SwissFEL facility in particular’. The accelerating modules are essential to enable CLARA to reach its design energy of 250 MeV. The first phase of CLARA will be installed in 2015 with first electron beams being generated in early 2016.

Happy Christmas SwissFEL!

A milestone in the fruitful collaboration between STFC and the Paul Scherrer Institute (PSI) in Switzerland was achieved with the delivery to PSI, just in time for Christmas, of the undulator for the SwissFEL laser heater system. This is a system to prepare the electron beam before it enters the hard X-ray Free-Electron Laser (FEL) to ensure optimum FEL performance. The undulator was designed and constructed by ASTeC and the Technology Department. The magnetic and mechanical measurements, which demonstrated that the undulator performance comfortably met the specification, were done in the Magnet Measurement Laboratory within the Engineering Technology Centre. The undulator now waits at SwissFEL ready for installation in the New Year.
Prof Susan Smith Re-opens the Medium Energy Ion Scattering Facility at Huddersfield University

On March 3rd the International Institute for Accelerator Applications at the University of Huddersfield held its 4th Annual Symposium on Accelerator Applications, hosted by Professor Roger Barlow. The meeting was attended by Prof Susan Smith, Dr Tim Noakes and Dr Katharine Robertson from ASTeC.

The morning session covered talks on the medical uses of accelerators, with the first talk by Professor Rob Edgecock, focusing on the development of Non-scaling Fixed Field Alternating Gradient accelerators, and in particular the EMMA accelerator designed, built and commissioned by ASTeC and Technology Department staff at Daresbury Laboratory. The second talk by Professor Olivier Heid from Siemens plc concerned a joint project with colleagues at the Rutherford Appleton Laboratory to develop the ONIAC, a compact tandem accelerator for producing ions for a wide variety of industrial applications, including those in the area of medical physics. In the third talk Professor Karen Kirkby described the new proton therapy centre being set up in collaboration between the Christie hospital and the University of Manchester.

After lunch a presentation was given by Professor Jaap van den Berg of Huddersfield University describing the many challenges involved in moving the Medium Energy Ion Scattering (MEIS) Facility from its original home at Daresbury to the International Institute for Accelerator Applications. Professor van den Berg particularly praised the staff at Daresbury for the assistance given both during the move and in setting up the instrument at Huddersfield. This talk was followed by a short ceremony with Professor Bob Cryan CBE (vice-chancellor of Huddersfield) and Professor Susan Smith (Head of Daresbury Laboratory and director of ASTeC) to re-open the facility. Professor Smith ‘pressed the button’ to initiate collection of data, demonstrating that the instrument is once more fully operational.

The opening ceremony was followed by a presentation from Dr Tim Noakes (ASTeC) on the MEIS technique and its many applications in the field of materials science, semiconductor device fabrication and nanotechnology. Professor Roger Webb (University of Surrey) and Professor Stephen Donnelly (University of Huddersfield) then gave presentations on the Surrey Ion Beam Centre and the MIAMI instrument at Huddersfield, which are other complementary facilities that also exploit ion beams for materials science based research.
News from the Laboratories — RAL

ISIS Long Shutdown Success

Over the past ten years significant investment and effort has been put into the replacement and upgrade of key ISIS accelerator equipment to underpin sustainable operations at a 90% availability level. Most of this activity has been focused around long shutdowns, which are scheduled approximately every four years. The most recent of these took place between August 2014 and February 2015.

The largest accelerator task undertaken was replacement of the quadrupole focusing magnets (EQ41 – 46) on the Target Station 1 Extracted Proton Beamline (EPB1) around the intermediate muon production target. This replaced old, radiation-damaged magnets, some of which came from ISIS’s predecessor NIMROD, with new magnets similar to those more recently used for the beamline to Target Station 2. Some repair work to the water loop on the first two collimators after the intermediate target and upgrade of the shielding for the third collimator was also carried out.

Other major accelerator work included reconfiguration of the pre-injector area (which finally removed the last remnants of the old EHT pre-injector and paves the way for the installation of a new MEBT that will significantly improve the performance of the injector), rebuilding two of the linac modulators and opening up linac tank 2 to replace a drift tube and repair the tank tuner.

Beyond the proton accelerator an important project was upgrading the front-end muon beamline using new radiation hard magnets. These magnets use an innovative design which replaces the usual resin potting around the magnet coils with concrete, and are designed to last for the lifetime of the beamline.

One area long overdue for attention has been the ISIS Main Control Room (MCR). Whilst state-of-the-art when ISIS started running in 1984, and despite incremental improvements over the years, by 2014 the MCR was beginning to show its age.
A project team including ISIS operational crew members, machine physicists, controls engineers and diagnostics staff was set up to produce an optimal new design which could be realised during the long shutdown. The new MCR installation was completed in January 2015, and was fully functional in time for machine operation in March 2015.

Overall, including work done on both target stations and on some of the suite of neutron instruments, over 500 individual tasks were successfully completed during the long shutdown. That these were done on time, on budget and with extremely tight control of radiation doses is testament to the skill and commitment of all those involved. And the planning has already started for the next long shutdown in ~2018!

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On Friday June 5th 2015, graduate students from the John Adams Institute for Accelerator Science travelled to Geneva to present a study they carried out on the design of the Future Circular Collider (FCC), one of the proposed next generation of accelerators beyond the LHC. In attendance were the team currently working on the FCC designs at CERN. This design project formed part of the students’ first year academic training in accelerator physics, and incorporated detailed studies of the proposed 100 km-circumference hadron-hadron machine, which it is hoped could achieve a centre of mass energy of up to 100 TeV.

The physics reach of such a machine was explored, as were potential lattice, magnet and RF designs, along with the impact of synchrotron radiation and various instabilities. The main focus of the project was to look at existing design ideas for the FCC and assess the possibility of varying the aperture size and dipole magnet materials in the hope of reducing costs. Physicists including Michael Benedikt, Daniel Schulte and Bernhard Holzer were present to hear the design proposals and offer the students expert feedback on their work.

Student Hannah Harrison said: “It was a great end to our introductory course to accelerator physics and a fantastic opportunity to see some of the work being carried out at CERN. We were all a little apprehensive presenting our project to the leading academics in the field, but they were all very enthusiastic about the work we had done. It was a real confidence boost to get such good feedback!”

Whilst on site the group also had the opportunity to visit the LHC Control Room, the SM18 magnet testing hall, the ATLAS exhibition and CLIC showroom. The students were guided in their study by accelerator experts Ted Wilson, Emmanuel Tsesmelis, Suzie Sheehy, Ciprian Plostinar and Neil Marks, many of whom were able to accompany the students on their trip to CERN. The graduate students included Christopher Arran, Mehpare Atay, Talitha Bromwich, Hannah Harrison, Rob Shalloo, Robert Williamson and Huibo Zhang from the University of Oxford, and Alberto Arteche from Royal Holloway University of London.
STFC and Particle Accelerators and Beams Group Workshop on Particle Accelerators for Medicine

On Tuesday February 17th 2015, STFC hosted a Workshop in conjunction with the Institute of Physics Particle Accelerators and Beams Group, looking at the potential for developing the area of accelerators for medicine. The workshop provided a high level overview of the work currently being undertaken and provided many of the key players in the area the opportunity to highlight any other relevant activities and events that are scheduled to take place. Over 80 members of the community requested tickets for the event. Amongst the attendees were representatives from MRC, EPSRC and Innovate UK.

The aim of the workshop was to gather the views of the community and discuss the relevant areas in which the STFC and the community can play a leading role. The event included talks from both domestic and international accelerator experts, who summarised their work. These talks helped to stimulate a discussion on how the UK could develop its strategy and optimise its impact in the context of the global programme.

Mr Phillip Webster of the Alliance Medical Group provided a wide general overview on the medical aspects, especially on the technetium-99m options. This led into the two following talks on the work being undertaken at two UK accelerator proton therapy centres. These were provided by Dr Simon Jolly (UCL) and Dr Hywel Owen (Manchester).

Professor Phil Burrows (Oxford/IoP) chaired the contributions from various UK institutions. The speakers listed below each gave a ten minute outline on their current work and future plans. This section of the meeting received positive feedback from several attendees who though it was informative and paced correctly.

- Professor Dino Jaroszynski - Strathclyde
- Professor Karen Kirkby - Manchester
- Professor Andrei Seryi - JAI - Oxford and Imperial
- Dr Rob Edgecock - STFC
- Dr Piero Posocco - Imperial
- Dr Claire Timlin - Oxford
- Dr Peter McIntosh - Cockcroft

Dr Vlad Skarda provided an overview of relevant current activities and opportunities provided by the STFC Innovations and Industry group (such as CLASP) as well the plans for the future. Dr Barbara Camanzi from STFC provided an overview on the work relating to the Futures Health and Cancer Care theme.

Two 30 minute talks were given by guest speakers looking at the work being undertaken at CERN and in North America. Dr Steve Myers of CERN provided an overview of relevant current activities in this area at CERN as well as any plans for the future and how the UK can engage in these areas of work. Professor Swapan Chattopadhyay talked about how the field has developed in the US, the importance of the field and how it is engaging with the wider community. He also covered the relevant current activities in this area as well as any plans for the future, outlining any future events or relevant engagement opportunities.

Professor Dan Tovey (Sheffield/STFC Science Board) chaired a discussion based on the earlier talks and the possible ways forward for the community. The open discussion focused on the lack of financial opportunities in the area and the importance of delivering the work promised when funding is obtained to enable credibility to be maintained with in the field of research.
Professor Grahame Blair reviewed the day, stating that the event had been both beneficial and informative. It was noted that whilst there were clear areas where particle physics can help hospital work in the short term (especially with regard to areas such as imaging and data), it was not clear at present that any large flagship project could be undertaken to advance work in this area significantly. It was concluded that there was a significant need to develop networking within the community, to help ensure that any potential interdisciplinary opportunities are embraced.

The presentations from the meeting can be found at http://www.stfc.ac.uk/asbworkshop

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AGTAX 2015 Workshop

The fifth AGTAX 2015 international workshop took place at the University of Oxford on March 18th and 19th. The workshop was dedicated to generation (using electron beams) and detection of coherent THz and X-ray radiation. Its aim was to bring together different communities working on the theoretical studies and experimental investigations of generation and properties of high-brightness THz and Compton X-ray beams. The main points discussed during the meeting were:

- General properties of radiation from ultrashort bunches of relativistic electron beams
- Generation and characterisation of ultrashort single/train fs bunches of relativistic charged particles
- Generation of intense, high-brightness coherent THz beams
- Compton scattering - theoretical and experimental studies
- THz and X-ray beam characterization
- Interaction of charged particle beams with artificial structures
- Application of THz and X-ray radiation beams

The workshop was well attended by representatives from the research and industry community from around the world. The number of registered attendees was 39. Eleven of the attendees were from other countries including Russia (MEPhi), the US (SLAC, RadiaBeam), Japan (KEK) and Germany (KIT). The community from two main research centres RAL and CI/Daresbury Lab was also strongly represented at the meeting. The workshop consisted of 6 sessions and 19 presentations were made including 3 invited talks by Prof. A. Seryi (JAI), Prof J. Urakawa (KEK), and Prof. A. S. Fisher (SLAC). The meeting was supported by JAI (UK), Anritsu (UK) and IoP PAB Group and the support was acknowledged during the workshop.

At the end of the workshop it was agreed that the next meeting will take place in September 2015 in Saint Petersburg.

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EuCARD-2 and the Space-Charge 2015 Workshop

Most of the UK’s accelerator physicists are familiar with the EuCARD-2 network scheme and for those working on high intensity, high brightness hadron machines there is one work package that is of particular interest. This is work package 5, known as XBeams, with the mnemonic “X” standing appositely for “extreme”. Through the XBeams network, groups are being brought together across Europe to study the challenges before us in upgrading existing accelerators and in designing future new accelerators for high intensity hadron beams. Participation was prompted initially by the need to upgrade the injector chain at CERN to provide enhanced beam to the LHC, but has broadened to include researchers from Japan, China and the US. The spectrum of study has now widened to cover hadron colliders, different types of circular accelerators - cyclotrons, synchrotrons and FFAGs - and superconducting hadron and electron linacs.

Several workshops have been organised along the lines of “A meets B” to promote interchange of ideas between different areas of study. October 2014 saw “Universities meet Laboratories”, which looked at synergies between the research programmes in the two types of institutions, the ways in which young people are attracted to accelerator physics and are trained, and the different approaches to, and obstacles faced in developing career paths. Later in December, we had “Beam Dynamics meets Magnets” aimed at bringing home to theoreticians the technological challenges of magnet design, and clarifying common requirements in theoretical, experimental and design aspects of magnets.

Most recently, in March 2015, about 60 physicists met in Oxford to focus attention on the issue of space charge in high brightness machines. This creates challenges that need to be faced to varying degrees in all stages of a proton or ion accelerator complex, whether in existing machines like the ISIS facility at the Rutherford Appleton Laboratory (RAL) or any new design of a high power accelerator to drive a muon collider or an ADS nuclear reactor.
The venue for the Space-Charge 2015 workshop was Trinity College, and the site and the period chosen (March 23-27) mirrored exactly a similar workshop held twelve years previously. Personnel had of course changed, though a few managed to return to re-live old memories. The advantage of an Oxford College is that everything is provided - meals, accommodation, entertainment - which in this case encouraged full exchange of ideas and discussion well into the evenings. It also enabled the students and young post-docs entering the field to meet experts of long-standing as well as find out about projects going on far outside their normal working environment. There was a welcome drinks reception, Trinity put on a candlelit banquet one evening and there was a tour of the RAL accelerator facilities at the end of the week.

Many of the talks at the workshop focused on upgrading the CERN injector complex, principally the PS and PS-Booster, in order to provide more intense beams in the LHC. The first stage in the process is the construction of a new H⁻ linac, known as Linac4. Because of the non-Liouvillean nature of the charge exchange process that converts H⁻ to H⁺, Linac4 will be able to inject more beam into each of the four PSB rings, and this will mean far higher intensity in the PS synchrotron. The injection process has to address the effects of space charge in order to create a suitable distribution for transport and minimise beam loss. In the PS non-linear space charge can push particles onto resonances, resulting in further loss. Recognising these challenges, CERN has strengthened its beam dynamics group and taken on a number of students and post-docs to work via simulation and experiment to identify and control space-charge driven phenomena. We heard a number of talks taking us through different aspects of the linac-Booster-PS chain, highlighting the most serious effects and outlining possible mitigation schemes. In addition there were talks devoted to more general underlying theory - for example the idea of “fixed lines” in phase-space - and how this could be used to explain the effects being seen.

Much of this is relevant to work going on at laboratories in other countries. Thus we heard about related space-charge studies in the SNS accumulator ring at Oak Ridge, where the theory of the so-called Montague resonance is being explored in a combination of simulation and experiment. At ISIS, the beam dynamics group is carrying out a detailed study of half-integer resonances: the mechanism behind them, the damage they can cause and how to mitigate against them. Such work is vital for the design of any future high power proton machine, and though such studies have been performed before, this is probably the most systematic effort for some time. Presentations
were also given on beam dynamics experiments of space-charge issues in the rings at the J-PARC complex in Japan, and of ambitious plans for ADSR and ion accelerator facilities in China, all of which face space-charge related problems.

Simulation techniques and tracking codes are at the heart of space-charge studies and several of the talks at Space-Charge 2015 were devoted to modelling effects such as halo formation and emittance growth and trying to understand the underlying driving mechanisms. Simulating a full cycle in a synchrotron can take many months, even with modern fast parallel processing computing systems. Simplified techniques are therefore necessary but then the questions arise as to how trustworthy the results are; will numerical noise propagate; can we accurately predict beam loss at the $10^{-5} - 10^{-6}$ level; are the experimental measurements accurate enough to benchmark codes, etc? A special afternoon was set aside for the discussion. A crucial question relates to the need for symplecticity (i.e. whether the equations are governed by a Hamiltonian). Are the methods used for space-charge modelling symplectic? The answer - probably not - was sufficiently vague as to leave the door open for the issue to be thrashed out at the next meeting.

An important feature of the workshop was the number of students present. A few years ago we were worried about a progressive loss of knowledge and loss of experience in dealing with beams under high levels of space-charge, so it is encouraging to see initiatives in laboratories like CERN that are ensuring the understanding survives and develops.

Thanks to sponsorship from the Cockcroft Institute and the UK’s Accelerator Science and Technology Centre (ASTeC), the organisers were able to offer financial support to 10 students, who were all registered for Ph.D. degrees. We are also grateful for financial support from the Institute of Physics Particle Accelerators and Beams Group.

Christopher R. Prior,
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Particle accelerators have been used for medicine since the earliest days after their invention, and already in 1896 Herbert Jackson realised that the greater energies and superior directionality afforded by accelerated particles could be advantageous over decay radiation for the treatment of cancer. Since then the field of accelerator-based radiotherapy has blossomed, and today the majority of radiotherapy is carried out using X-rays derived from small (c.10s of MeV) electron linacs; the UK for example has over 180 of them.

Protons and heavier ion species benefit from the finite range afforded by the Bragg peak that occurs when they slow in matter, and although this idea was first tried at Berkeley in 1952, it was only in 1989 that the first hospital-based centre in the world at Clatterbridge in the UK started treating patients with protons. Whilst Clatterbridge led other hospitals in providing protons, it is limited to rather shallow treatments of the eye by its 62 MeV proton energy.

In the intervening years there has been a growing case for the treatment in the UK of other cancer types with protons, including early exploratory case studies for laboratory-based therapy at both the Daresbury and Rutherford national laboratories. Following a Department of Health programme to develop proton therapy treatments within the UK, all this work has recently culminated in the selection of Varian Medical Systems to install two, 3-room proton therapy systems at the Christie Hospital in Manchester and at UCL Hospital in London. Technical advice on the required specification of these systems was provided by members of the Cockcroft Institute and UCL, as well as by overseas physics laboratories such as the Paul Scherrer Institute. These centres will eventually each treat 750 patients per year after treatment commences some time in 2018 - augmenting the existing referral of patients to centres overseas - and is likely that construction will commence in the next couple of months. At one centre (Christie) there is planned to be a research beamline providing protons at energies up to nearly 250 MeV, which may be used for such research purposes as accelerator component development, diagnostic instrumentation and radiobiology.

It is therefore an exciting time for the use of accelerators in medicine in the UK, and the research opportunities afforded to accelerator scientists in this area have led to a resurgence of interest in helping improve such technology at national labs, institutes and universities. One notable example in the UK was the recent culmination of the EMMA and PAMELA programmes. As probably most PAB Group members know, the EMMA project successfully demonstrated the non-scaling FFAG principle in a test accelerator; as well as guiding technology choices for future neutrino and muon facilities (for example in recent work on nuSTORM), EMMA also gave confidence that FFAGs might be used for particle therapy. The PAMELA design study showed an innovative design for both proton and carbon therapy that might improve treatment by delivering dose at different energies more rapidly; moreover, it was truly a UK-wide and world-wide accelerator collaboration involving researchers at many centres, supported by the excellent engineering implementation at Daresbury Laboratory. The NORMA FFAG design has followed on from this activity to pursue a proton-only facility but at higher energy.

Today there are many UK groups interested in developing future accelerators to be used in medicine, not only for particle therapy but also for the other key application - the production of radioisotopes for medicine. Several approaches have been proposed for both applications, and in the UK three main areas of interest are currently apparent: the use of high-gradient or high-current conventional RFQs and/or linacs, the use of FFAGs and the use of laser-based methods to accelerate protons. One important motivation has been the burgeoning crisis in the supply of technetium-99m - the isotope used in 85% of global nuclear medicine procedures - and a number of accelerator projects have sought to address it. The most likely method that could be
commercially viable is to use high-current proton cyclotrons to irradiate enriched molybdenum targets, as recently well demonstrated at TRIUMF and the University of Alberta; a recent UK review of technetium provision by the NHS and British Nuclear Medicine Society has endorsed this view ([http://arxiv.org/abs/1501.03071](http://arxiv.org/abs/1501.03071)). However, alternative methods using electron linacs or laser-based acceleration are also in development as are plans to produce technetium with FFAGs, and for example test irradiations of targets were carried out in 2013 at RAL’s Vulcan laser to produce technetium using proton bombardment. The IAEA has also recently completed a research programme of work on accelerator-based methods for technetium production.

STFC has recognised the research potential of medical accelerators in several recent calls to their Futures and other programmes. In particular there is a planned UK-wide network on advanced radiotherapy (led by Karen Kirkby) to bring together clinicians and technologies to improve radiotherapy; organised under the auspices of the national CTRad radiotherapy research working group, this network has followed several of their meetings to define clinical needs for future UK developments in this area. In the coming months the network will also bring together the UK groups working on accelerator technology to help define the research programme in these topics. Funding will be available through this network to train researchers, provide seed funding, and exchange research knowledge.

Another important activity the UK is involved with is the EUCARD2 programme ([http://eucard2.web.cern.ch/](http://eucard2.web.cern.ch/)), and in particular Work Package 4 (led by Rob Edgecock) which addresses accelerator applications through networking activities ([http://eucardapplications.hud.ac.uk/](http://eucardapplications.hud.ac.uk/)). Several high-profile workshops have already been held, and the UK has hosted (at Cockcroft Institute) workshops both on particle therapy gantries in 2014 ([https://indico.hep.manchester.ac.uk/conferenceDisplay.py?confId=4226](https://indico.hep.manchester.ac.uk/conferenceDisplay.py?confId=4226)) and on compact accelerators for medical isotopes in 2015 ([https://indico.cern.ch/event/366464/](https://indico.cern.ch/event/366464/)). Both workshops had very good attendance not only from European research groups and those further afield, but also commercial companies were well-represented. Other workshops have included ones on neutron production and for boron neutron capture therapy for which there is also UK clinical interest. These workshops have already spurred greater collaboration amongst European researchers, and it is planned to augment this networking activity in the follow-up to EUCARD2.

EUCARD2 WP4 has also recently launched the development of a European-wide report on the applications of particle accelerators in Europe - APAE. Planned to be published in early 2017 and
to be endorsed by European research labs, this report will form a consensus of the future priority directions for research to improve the use of accelerators in several key areas: energy, health, industry, security, photonics, and neutrons. Chaired by Angeles Faus-Golfes, the contributions to two chapters (health and security) will be coordinated by UK accelerator researchers, and this report is an opportunity for groups to help define the research that could be funded in future national and European programmes. The kick-off meeting was held on June 18th and 19th at the prestigious Royal Academy of Engineering in London (http://indico.cern.ch/event/377384/) with about a hundred people attending. The next step is to solicit contributions to the report chapters; interested researchers in the UK are encouraged to get involved.

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PAB Group Annual Meeting

This year’s PAB Group Annual Meeting was hosted by the Department of Physics at the University of Strathclyde in Glasgow. Despite being the most northerly meeting held so far, attendance was very healthy with around 60 participants. The speakers kindly agreed to have their talks on the web and these are available here.

The morning sessions addressed aspects of the bigger picture and ended with a Town Meeting to allow questions and discussions. The session was kicked off with a talk by Charlotte Jamieson, the CERN Liaison and Accelerator Programme Manager for STFC. Charlotte gave us a comprehensive update of what is happening within STFC’s remit - the new senior appointments, programme developments, reviews, new commitments to EU facilities, research grants update and much more was covered. Dan Tovey of the University of Sheffield then presented a very useful overview of STFC’s Accelerator Review Panel Report of December 2014, which he chaired. Dan summarised the main points from the report noting that over the past decade, the community has developed an internationally leading programme and that we should congratulate ourselves for that! He outlined a broad programme with different portfolios across different groups. It was felt that going forward, collaborations should be further encouraged and more prominence should be given to the broad range of applications which the community generates.

A wide range of topics followed throughout the day, with presentations ranging from an update of the LHC, via ELI to local UK experimental activities such as those at the AWE, RAL (ONIAC), VELA and SCAPA. The span of topics covered certainly went a long way to promoting the broad range of applications that members of the PAB Group are involved with and the talks are certainly well worth a look!

The Group AGM was held successfully following a splendid lunch and Poster Session. Peter Williams of ASTeC retired as Group Secretary (but remains as an Ordinary Member of the Committee) and was sincerely thanked for his great work over his tenure, during which Group membership has increased to nearly 400. He passes the baton to Aled Jones of AWE who was thanked for taking on this onerous position. A new member of the Committee was also elected: Graeme Burt of Lancaster University and the CI.

During lunch, the posters were displayed and student contributions judged. So, congratulations to the winners of the Poster Prize competition: Aimee Hopper of the University of Huddersfield
for her poster ‘Effects of High Power on Microwave Metamaterials’ and Alexander Dick of the University of Strathclyde for his contribution ‘The Status of the RF System for the MICE Experiment’.

The final formal event of the day was the ‘Prize Talk’, presented by Chris Prior of ASTeC, RAL and Trinity College, Oxford, the 2014 recipient of the PAB Group Prize for Outstanding Professional Contribution. The videoed talk, entitled ‘A Life in Simulation’, tells the tale of how Chris started as an unexpected contributor to the NASA moon-landings through to modelling inertial confinement fusion and of the many great scientists he met along the way.

So, with the formalities over, and with a general consensus of having had a ‘good meeting’, members then relaxed with a glass of wine (or two) and studied the posters afresh. Some members even got to discussing topics outside of their normal remit (I recall there were some diverse views on dark matter/energy) and we moved on into the evening...

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PAB GROUP & UK EVENTS

POSIPOL 2015
Daresbury Laboratory
2nd - 4th September 2105

Accelerator Engineering Network Meeting
Daresbury Laboratory
9th October 2015

Postgraduate Open Day
Daresbury Laboratory
25th November 2015

XXVII International Conference on Neutrino Physics and Astrophysics
Royal Geographical Society, London
3rd - 9th July 2016
INTERNATIONAL CALENDAR

Free Electron Laser Conference (FEL’15)
Daejeon, Korea, 23rd - 28th August 2015
http://10times.com/fel-daejeon

13th International Conference on Heavy Ion Accelerator Technology (HIAT 2015)
Yokohama, Japan, 7th - 11th September 2015
www.nishina.riken.jp/hiat2015

4th International Beam Instrumentation Conference (IBIC’15)
Melbourne, Australia 13th -17th September 2015
http://ibic2015.org/

15th International Conference on Accelerator and Large Experimental Physics Control Systems (ICALEPCS 2015)
Melbourne, Australia 17th -23rd October 2015
http://www.icalepcs2015.org/

Upcoming schools

CERN Accelerator School — Advanced Accelerator Physics
Warsaw, Poland
27th September - 9th October 2015

CERN Accelerator School — Intensity Limitations in Particle Accelerators
CERN, Switzerland
2nd - 11th November 2015

Useful Links

http://www.scitech.ac.uk/
http://www.cockcroft.ac.uk/
http://www.adams-institute.ac.uk/
www.diamond.ac.uk
http://www.desy.de/index_eng.html
http://www.linearcollider.org/newsline/
http://home.web.cern.ch/
IoP Particle Accelerators and Beams Group

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Deadline for submissions to the next newsletter is 18 December 2015

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