

IOP PAB GROUP NEWSLETTER

Issue 21

June 2020

Editorial

Welcome to Issue 21 of our PAB Group Newsletter. The last Editorial of the Newsletter began “As I sit here writing this on polling day, I know that everybody will know of the outcome by the time you read this. Whatever the outcome is, I hope there will be a little more stability and direction than we have seen in the recent past!” Well, there is certainly direction and that is to try to get back to living our lives without the threat of the pandemic that has since hit all of humanity.



Outgoing Committee Chair Brian McNeil (left) and incoming Committee Chair Melissa Uchida (right).

We can see how our community is responding to this threat inside these pages.

The UK's main X-ray facility Diamond, has been pulling out all the stops to find out what the Covid-19 virus looks like and how it can be disrupted. They are also contributing directly to protecting people in unexpected ways. As well as the full-on science, there is a real humanitarian desire to do everything that can be done to help. It is inspiring and definitely worth the read.

The same spirit is also being exhibited at CERN, in more ways than one! Let's make hand sanitiser! Yes, CERN, making hand sanitiser, and much more. Again, more on how our community are doing whatever it can to help inside.

And we also have longer term work in an article on “Designing new radiotherapy technologies to treat cancer in low and middle-income countries.” We not only enable the discovery of how nature works at its fundamental levels, we also carry out research to help people live better and longer lives.

We also have great news of two new PABG Committee members, Tessa Charles and Glenn Christian of the University of Liverpool and Diamond Light Source respectively. A warm welcome to them!

And details of New Directors! – our last PABG Chair, Phil Burrows is now Director of the JAI and Jim Clarke is the new ASTeC Director. Congratulations! And congratulations also to Chetan Gohil, who managed to defend his DPhil thesis despite the lockdown.

More good stuff, including research progress, and details of the effects of the disruption to events and their online alternatives are also inside.

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Editorial (continued)

Finally from me, a big thank you to my colleagues on the PABG committee and members who made my 4 years as Chair of the PABG such an informative and fun time. And another big thank you to our newly elected Chair Melissa Uchida of the University of Cambridge, who will replace me in September and would like to say 'hello' – I know that a new and exciting phase of the PABG is about to begin. *Over to you Melissa:*

Thank you Brian, and thank you to the PAB group for electing me. I have big shoes to fill.... As a committee member under Brian's leadership over the past 4 years I have experienced first hand the passion and commitment with which he has served the committee, and witnessed the growth in group numbers, events and awareness that this has created. I look forward to continuing his fine work (built similarly on the work of those who went before him) and watching the group continue to flourish.

This is a difficult time but also one of hope and excitement for things to come. The European Strategy for Particle Physics recently defined accelerator R&D as a high-priority future initiative stating: "*The European particle physics community must intensify accelerator R&D and sustain it with adequate resources.*" A welcome acknowledgement of the necessity of our work. And our community, as always, is ready to rise to the challenges ahead.

If there is anything you think we could do better or should know of, please feel free to contact us at b.w.j.mcneil@strath.ac.uk or mauchida@hep.phy.cam.ac.uk and follow us on Twitter for updates of what is happening in our community [@PartAccelBeams](https://twitter.com/PartAccelBeams)

News from the Laboratories — Daresbury

New ASTeC Director

Congratulations to Professor Jim Clarke, who has been confirmed by STFC executive board as the new director of the Accelerator Science and Technology Centre at Daresbury. Jim will take over some activities immediately and will formally take over the role from Professor Susan Smith on 07/09/2020. Peter McIntosh remains ASTeC deputy director.

Jim has over 30 years' experience in particle accelerator research and development, and is a world recognised expert on the subject of synchrotron radiation and undulator design, in which he is a published author. He is also an honorary professor at the University of Liverpool. Jim has been with Daresbury since 1989 and with ASTeC since its creation in 2002. He has held previous roles as head of the magnetics and radiation sources group and more recently head of ASTeC science division, so is well placed to lead UK accelerator development into the future.



We wish Jim the best of luck in his new role and we wish Susan a happy retirement.

Cockcroft scientists present at Virtual IPAC 2020

Every year the international particle accelerator community gathers for the International Particle Accelerator Conference (IPAC), the largest regular gathering in the field of accelerator physics. The 2020 conference was due to be held in Caen, northern France, but the physical conference was sadly cancelled due to the ongoing pandemic. The organisers instead arranged for speakers including three Cockcroft Institute scientists to give online talks and field questions from viewers.



The Cockcroft speakers were Ben Shepherd (ASTeC), Deepa Angal-Kalinin (ASTeC) and Morgan Hibberd (University of Manchester). Ben was invited to speak in the conference's opening plenary session on the global development of energy saving permanent magnet systems for accelerators around the world and the work done on these systems in Daresbury (Ben's report of his experience follows this article). Deepa was invited to give a talk on the progress of the Full Energy Beam Exploitation (FEBE) line being constructed on the CLARA accelerator at Daresbury, and Morgan was invited to give a talk on the work of the Cockcroft Institute on novel wakefield based acceleration techniques.

All three talks were very well received and generated significant online interaction between the authors and viewing scientists from around the world. The Cockcroft Institute is very proud to have been invited for three talks at this very prestigious event, and we all look forward to hopefully being able to attend the next IPAC in person!

[Alex Bainbridge](#)

Presenting Virtually For IPAC'20

ASTeC's Ben Shepherd reports on his experience presenting at Virtual IPAC 2020:

"I got the letter inviting me to give a talk at IPAC'20 towards the end of last year. I've attended IPAC for many years, and it was hugely exciting (and more than a little daunting) to be given the opportunity to speak at the opening session of this year's conference. I'd given similar talks before at smaller workshops and meetings, but this was a whole different ball game.



I started planning the talk a few months ago. I was about halfway through writing it when the COVID-19 crisis started to take hold across the world. At first it wasn't clear whether it would affect IPAC, but in March as things started to escalate with more and more countries going into lockdown, it was clear that the conference was not going to go ahead in the usual format. With a few weeks to go before the conference, all the speakers got an email asking if they'd be happy presenting a 'virtual talk'. I thought this seemed a good idea; obviously it's very different to presenting in person, but much better than doing nothing at all.

A colleague recommended an app called OBS Studio, which made it very easy to record video from my screen and my laptop camera, as well as audio from a microphone. I had some issues getting the sound right from the inbuilt mic in my laptop, and ended up using a cheap wireless headset. The sound quality seemed OK, and I cleaned it up a little bit in Audacity. We've got three children at home, but I'm lucky enough to have a separate room I've been using as a temporary office, and I could ensure there was no distracting background noise for my talk.

My usual approach to a talk would be to put the slides up and talk around the bullet points; I always felt that that was the best way to engage with a live audience. I don't normally refer to notes whilst talking as it means I'm constantly looking down at them and engaging with the audience less. But as soon as I started recording this talk, I realised the usual approach wouldn't work. Every hesitation and stumble seemed somewhat amplified, and I found that I kept stopping and re-recording because of that. So I wrote out a full script for the talk instead, printed it out and put it next to the camera. I recorded the talk in chunks of 2-3 slides at a time and joined the whole thing together using FFmpeg. Occasionally I'd decide I wasn't entirely happy with a section so it took a few takes to get it right. I thought that a 'talking head' might be distracting for the whole talk (and would make it more obvious I wasn't doing it all at once!) and anyway would get in the way of some of the slide material. So I only included my camera video for the first and last slides, which seemed to work well.

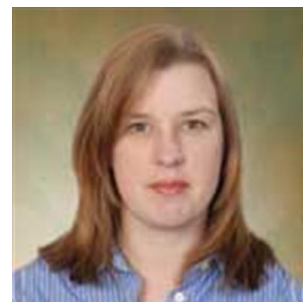
As it was an opening plenary talk, my video went up on the first day. I had a relatively clear diary that week, so I'd been able to commit to lots of time to respond to questions. I was really pleased to see so many questions coming in; it was great to get so much engagement with the audience. I thought that the format worked well too (questions submitted as threaded comments, rather than a 'live chat'), allowing me plenty of time to write a considered response to each one. And having names attached to each comment means I'll be able to get in touch with some more people working in the same field and expand my network, something that's not always possible in a face-to-face Q&A at a large conference. After the conference the speakers received an email from the organisers to say "thanks"; it was absolutely amazing to see that my talk had the most views of all the IPAC talks! The others that I watched were all really good quality, so I feel really privileged that my talk attracted so much attention.

I'd definitely consider doing a 'virtual' talk again, and I think the format has worked well. It's not a substitute for a full conference including the poster sessions and random encounters with people that tend to spark ideas. But I think it's proved that some form of remote attendance at these events is possible, and I'd like to see more of that in the future as we try to reduce CO₂ emissions produced through travel."

[Ben Shepherd](#)

New IOP Honorary Fellow

The IOP recently welcomed six new Honorary Fellows, including Rachael Buckley from ASTeC. She is one of two outstanding technical professionals that have for the first time been recognised, reflecting the crucial role played by technicians in the advancement and application of physics and highlighting the growing number of pathways into a successful and rewarding physics career.



Rachael joins the other esteemed members of the physics community who have received the highest honour IOP can bestow, and the 65 current Honorary Fellows.

There are many routes into a career in physics, and rewarding career options are open to everyone interested in the fascinating area of physical sciences, and Rachael is testament to this.

Having started her career as an apprentice, Rachael is a respected manager who leads a team of technical staff at Daresbury Laboratory. She manages all operational developments and business within ASTeC and takes a proactive lead role in the recruitment and training of a growing cohort of ASTeC apprentices.

An impassioned problem solving technician, Rachael plays an essential part in accelerator operations at Daresbury, and is key in supporting ASTeC's internationally renowned research delivery.

Moreover, through her involvement in public engagement activities, school visits and laboratory tours, she strives to inspire the next generation of technical professionals, passing on her enthusiasm for her job and dedication to her technical career.

Many congratulations to Rachael!

Further details are available at: <https://beta.iop.org/honorary-fellows-rachael-buckley>

[Reproduced with minor alterations from the IOP website](#)

News from the Laboratories — RAL

Introducing the Extreme Photonics Applications Centre (EPAC)

On 11th February, Prof. Donna Strickland, Nobel Laureate, 2018 and Chris Skidmore, the then Science Minister jointly inaugurated the Extreme Photonics Applications Centre (EPAC). Expected to be operational in 2024, EPAC will be the first open facility in the world based on a new generation of novel accelerators. Funded by the UK Research and Innovation (UKRI)'s Strategic Priority Funds, with a £10M contribution from the Ministry of Defence, this £81.2M facility will enable the first industrial, medical and security applications of laser-driven plasma accelerators.

EPAC's technology is based on plasma accelerators driven by high-power laser pulses. Plasma accelerators, with their extremely high acceleration gradient, hold the promise of realising cheaper, compact accelerators for applications cutting across a multitude of areas in society. Radiation sources produced by laser-driven accelerators are super-bright and "point-like" in space and time, offering a radically different approach that has the potential of major scale size reductions combined with unique capabilities compared to conventional accelerator technology. The UK has been a world-leader in this area, with many of the milestone research and proof-of-principle applications emerging from the Central Laser Facility (CLF)'s Gemini laser at the Science and Technology Facility Council (STFC)'s Rutherford Appleton Laboratory. EPAC builds on this expertise.



From left to right: MACE's Terry Spraggett, Executive Chair of STFC Mark Thomson, Science Minister Chris Skidmore, Nobel Laureate Donna Strickland, Director of the CLF John Collier (Credit: STFC)



Impression of the new Extreme Photonics Applications Centre at STFC's Rutherford Appleton Laboratory. (Credit: STFC)

EPAC will be driven by a 10Hz Petawatt laser enabled by STFC's proprietary DiPOLE laser technology developed by CLF. The versatile experimental areas in EPAC can drive bright, beam-like high-energy x-ray beams and beams of high-energy electrons, protons, ions, neutrons and muons by merely changing the target geometry, enabling multi-modal imaging capabilities to inspect critical industrial components. Further, these particle and radiation sources come in femtosecond bursts, just like the driving laser pulses, making them ideal for freeze-framing highly dynamic processes such as an operating turbo-engine.

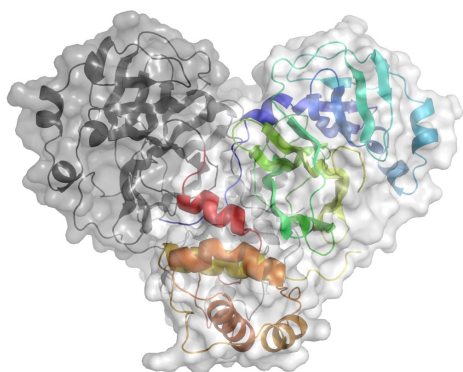
EPAC will be an exceptional science driver, providing a step-change in capabilities for laser-driven accelerator research in the UK, with multi-GeV electron beams and spatially coherent x-ray and gamma-ray beams for cutting-edge experiments in plasma physics, laboratory astrophysics and condensed matter and material science. The unique capabilities of EPAC, combining near-light speed particles and synchronised ultra-intense electromagnetic fields, would provide a world-leading platform capable of generating extreme states of matter and the tools to probe, control and manipulate them, enabling exploration of some key fundamental questions in nature including those in quantum electrodynamics. EPAC will be the test bed for other plasma accelerator-based facilities that are in the pipeline. There is also potential impact on long term fundamental science programmes, such as the future technical basis of particle physics accelerators, that will likely require this sort of disruptive approach to accelerator science.

[Rajeev Pattathil](#)

Diamond's response to COVID-19

Whilst most of the country, as indeed much of the world, has been under lockdown since mid-March, Diamond has continued beam operations as part of a global effort to combat the novel coronavirus, SARS-CoV-2. With most of its c.650 staff working remotely from home, the facility has been closed to regular beamline users and only beamlines conducting research related to COVID-19 have continued to operate.

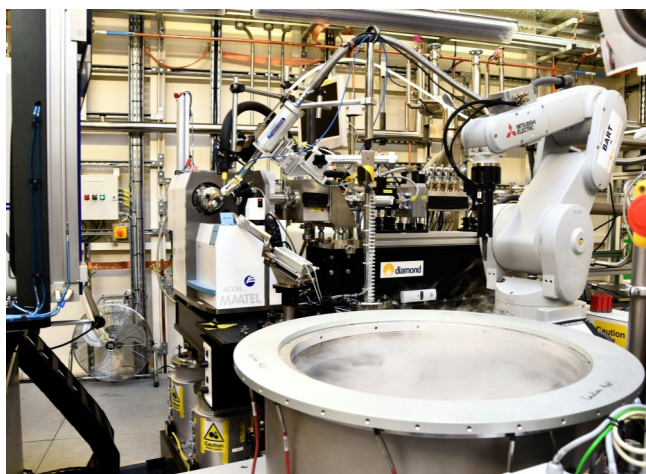
Throughout this period, with the exception of scheduled shutdowns, the accelerators have operated from Monday morning to Friday evening, rather than the usual 24/7 operation, with Monday dedicated to machine development and beam lines receiving X-rays from Tuesday to Friday. Only the minimal number of people required to safely operate the facility and prepare samples have been on-site, and to ensure staff safety, strict social distancing and cleanliness measures have been put in place. Technical staff have been on-site only when necessary for operational support, for example when called in by the operators. For the majority of staff, work has continued remotely with face-to-face meetings replaced by videoconferencing on Zoom or Teams, and instant messaging on Slack becoming the new norm for interactions with colleagues.



3D representation the SARS-Cov-2 main protease, showing how the protein chain folds.
(Credit: Diamond)

Since early February, before the UK went into lockdown, researchers at Diamond have been working with non-infectious components of the coronavirus and move towards an understanding of their structure. This information is vital in the development of novel drugs and vaccines. A call for rapid access is in place to allow research groups working on COVID-19 priority and timely access to X-ray beams.

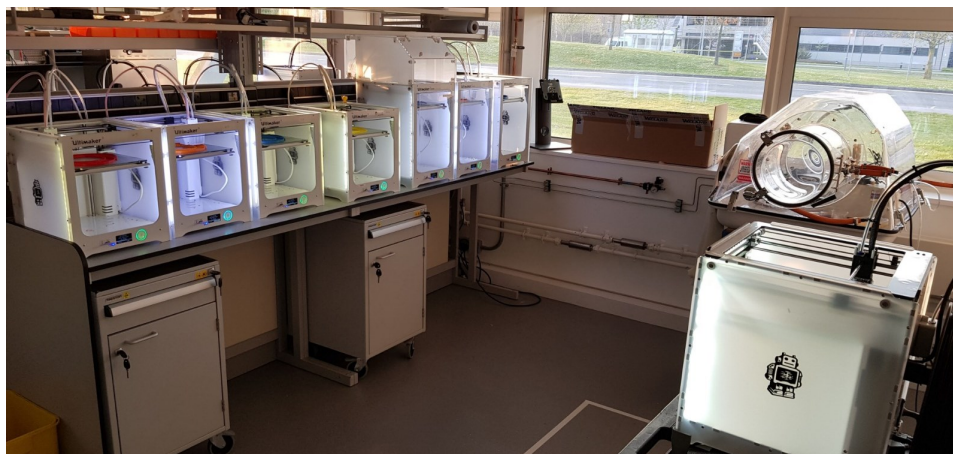
Seven of Diamond's life-science beamlines have been studying the virus. Principally, the protein crystallography beamlines I24, I03, I04, I04-I, as well as B23, B2I and B24. The crystallography beamlines solve the structures of proteins that have been coaxed into forming crystals. When illuminated by X-rays, these crystals produce a diffraction pattern containing the structural information of the constituent proteins. A primary target has been the SARS-CoV-2 main protease, an enzyme that processes viral polyproteins and is essential for viral replication; an excellent drug target. Using I04-I, a highly automated beamline, and the XChem pipeline, Diamond scientists have screened the viral protein against large libraries of drug like compounds and drug fragments, looking for molecules that will prevent the enzyme functioning.



Experimental hutch at Diamond's I04-I macromolecular crystallography beamline.
(Credit: Diamond)

Additionally, the small angle X-ray scattering beam line, B2I, has been studying virus components in solution and high powered electron microscopes in the Diamond electron Bio-Imaging Centre have provided structural data for large viral proteins, such as the spike protein found on the virus surface. These studies will play a crucial role in the design of new therapeutic drugs, or the repurposing of existing drugs, to treat the virus.

This work is of course part of a major international effort and given the global priority, Diamond, alongside other light sources and other facilities are making their data available to be shared by the scientific community, prior to peer review in order to expedite drug and vaccine development. The usual procedure would be to share data only after the results have been published. The results from these structural studies are being deposited in the Protein Data Bank as soon as they are available, and Diamond is collaborating on several initiatives with other organisations to accelerate COVID-19 antiviral treatments, such as Exscientia and PostEra who are applying machine learning algorithms to drug development.



Part of the Diamond 3D printer farm, producing visor components.
(Credit: Diamond)

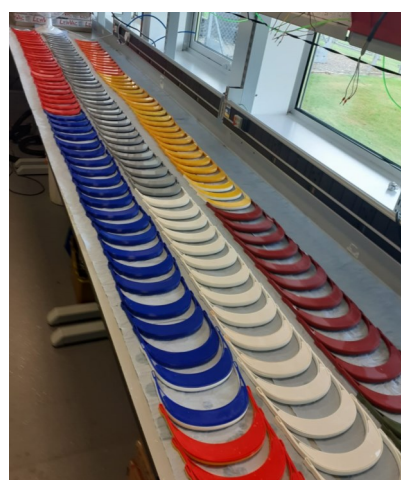
As well as scientific research into the virus Diamond has also been dedicating some of its technical capability to producing personal protective equipment for key workers during the pandemic. Working around the clock, a farm of 21 3D printers has produced more than 10,000 visors. A team of 13 volunteers at Diamond, with help from the experimental hall coordinators, worked in shifts to keep the printers running day and night. The team worked as part of the CovidPrintOxford group, a voluntary collaboration, and as well as producing visors on site, they acted as the production hub, receiving visors printed by volunteers at home. These were assembled and sent to CovidPrintOxford for distribution. They were given out to various front-line health workers, including doctors, nurses, receptionists at GP surgeries, care home workers, and COVID-19 testing centre staff. After recently achieving the impressive milestone of printing their 10,000th visor, the production at Diamond has now come to an end, as the group move to a mass produced design which staff at Diamond helped to develop.

For more information about Diamond's ongoing work around COVID-19, please visit their dedicated website:
<https://www.diamond.ac.uk/covid-19.html>

More information on COVID-19 research at light sources worldwide can be found at:

<https://lightsources.org/2020/05/28/lightsource-research-and-sars-cov-2/>

[Glenn Christian](#)



Visor components awaiting assembly.
(Credit: Diamond)

CERN against COVID-19

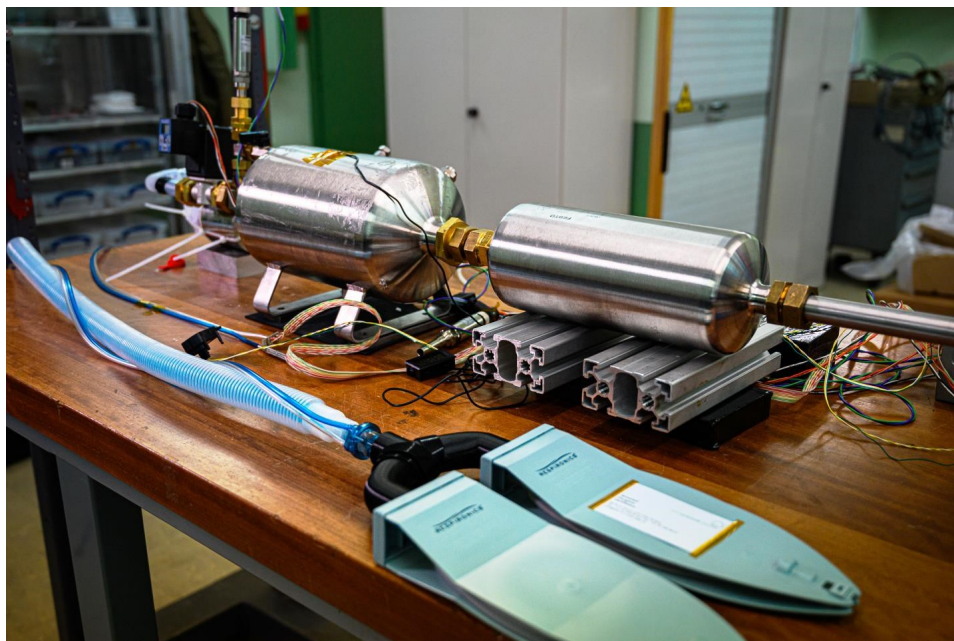
In March this year, CERN launched the 'CERN against Covid-19' task force, to offer the competencies found amongst CERN employees and collaborators to the local and international efforts to combat COVID19. The task force mandate was:

"to collect and coordinate potential ideas and contributions from CERN's scientific community of over 18,000 people worldwide to the societal fight against COVID-19. These initiatives will draw on technical and scientific expertise and facilities at CERN, in the Member State countries and beyond and will be carried out in collaboration with that community."

The task force's goal was to determine if the skills readily found at CERN (big data analysis, integrating technology, etc.) could be exploited in this emergency, under the guidance of international standards and in consultation with experts from WHO and hospitals. In late March this year, the task force put out a call for ideas and initiatives to counteract COVID-19, and received an enthusiastic response, resulting in ~100 proposals. Below are just a few examples.

The Technology Department Vacuum Surfaces Coatings (TE-VSC) group used their chemistry lab and following the WHO recommended recipe, produced more than 10,000 L of hydro-alcoholic solution as hand-sanitiser. More than enough hand-sanitiser was produced for CERN internal use and 6,000 L was donated to the local community - mainly to hospitals in France – with the help of the French military.

Three ventilator designs have been closely followed. One of the advanced ventilator designs developed completely at CERN, is called HEV (High Energy physics community Ventilator). Utilizing expertise in precise pressure regulation that is routinely called upon in experiments, members of LHCb developed the design while working in close consultation with medical experts from a number of hospitals and universities. As a first venture into medical applications, the team are proceeding with extreme prudence, and are following the recommendations and guidelines of the UK government MHRA (Medicines and Healthcare products Regulatory Agency) amongst other guidelines and regulations in order to comply with the strictest standards.



High Energy Ventilator Prototype (HEV).
(Credit: CERN)

There have been a number of computing initiatives, including massive volunteer computing to support COVID19 research. Both CMS and ATLAS were among the top donors (out of 1.5 million volunteered resources) to Folding@home – a project dedicated to understanding protein folding. In two months, the CERN and the Worldwide LHC Computing Grid (WLCG) provided 1 million computing cores running millions of jobs per day. Rapid increase in volunteer resources, saw the need to scale the distribution infrastructure. Drawing on experience from the long-running LHC@Home programme, CERN IT and EP departments teamed up with the Bowman Labs (one of the F@H consortium members), GridPP, STFC and the Hartree HPC centre in the UK, as well as FNAL and UChicago in US and others, to expand the Folding@home data handling infrastructure.



Hand sanitizer being collected by the military.
(Credit: CERN)

The Experimental Physics Detector Technologies (EP-DT) group offered contribution through manually made face-shields. In addition the Engineering Department Mechanical and Materials Engineering (EN-MME) group designed 3-D-printed and injection moulding built Face shields, which are compatible with safety helmets. These shields were designed to protect against liquid droplets and splashes only, as a protection against COVID19. The EP-DT group together with the Technology Department Magnet, Superconductors and Cryostat (TE-MS) group managed to produce 1000 per day and have been accepting requests from neighbouring institutes, companies, police stations and hospitals, via the Sous-Préfecture de Gex in France, and Service du médecin cantonal in Geneva and Direction générale de la santé in Vaud.

Some other initiatives in the area of sterilization include the development of UVC LED Boxes, as well as using ionizing radiation from Co-60 sources and CLEAR (CERN Linear Electron Accelerator for Research) for sterilizing objects with the aim of reducing PPE waste.

Finally, the CERN Fire and Rescue Service have been supporting local (Genève and Pays de Gex) emergency response, supplying personnel and ambulances for patient transport, organising information session on how to dress and undress protective overalls, and well as testing the usability of PPE design initiatives.

These are just some of the initiatives being pursued by the CERN community. More information can be found at <https://againstcovid19.cern/welcome>. The task force chair, Beniamino Di Girolamo, says the main message is that “CERN is present to help society and researchers in other fields at this difficult time.”

[Tessa Charles](#)

A committee member's experience of lockdown

"This afternoon I stepped out of the house, put my headphones on and walked into the village to get some milk and to pick up our car from the garage – the battery had run flat and we couldn't manage to jumpstart it.

After a couple of minutes I saw some people coming towards me and it gave me a jolt – the virus. For the first time in 3 or 4 months it hadn't been at the forefront of my mind when I went outside.

How things have changed. From furloughs to front line workers, flattening the curve to staying alert. Our lives have irrevocably changed course. We have all been touched by this disease. I hope you are all safe but I know that some of you have been hurt, some may not be reading this.

I started a new career last year in the private sector, providing technical customer support and expert user knowledge to a small simulation company, which is part of a much bigger global technology giant. Conversely when everyone else was stopping work we got busier. I think a lot of people who could, went home and started working on simulation ideas. For about a month we were being told to do lots of training as we weren't very busy, while simultaneously being rushed off our feet answering sophisticated customer queries.

Of course segments of society were providing even more urgently needed support whether medical, deliveries or the provision of basic necessities. How could we have coped without them all? Thursday night clapping became a thing. Something cherished. Out of the worst of post-apocalyptic visions something completely unexpected occurred: children made rainbows everywhere. In windows, on pavements. Teddy bears in ever changing outfits kept us smiling.

The disease is far from over, and the world is full of turmoil. It always has been.

And wonder."

[Ben Pine](#)



Philip Burrows appointed Director of the JAI

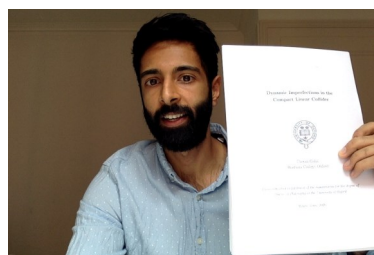


Professor Philip Burrows has been appointed Director of the John Adams Institute for Accelerator Science (JAI) for a five-year term. Professor Ian Shipsey, Head of the Department of Physics at Oxford, commented: “Philip has served ably as interim-Director of the JAI for the past two years and his appointment to Director is thoroughly deserved; he is an eminent scientist and his appointment will mark, I am sure, the beginning of an exciting new chapter for the institute. It is a privilege to have the JAI within the Department of Physics at Oxford and I look forward to a continued collaborative and productive partnership.”

Philip Burrows is Professor of Physics at Oxford University and Senior Research Fellow at Jesus College. His research is focused on the design of beam delivery systems for high-energy subatomic particle colliders and beamlines, including advanced beam instrumentation and nanosecond-timescale feedback and control systems. He has performed experiments at numerous accelerator laboratories including CERN (Switzerland), DESY (Germany), SLAC (USA) and KEK (Japan). He is Spokesperson of the worldwide Compact Linear Collider Collaboration and is a UK delegate to the European Committee for Future Accelerators. He chairs the Physics Review Committee of the Deutsches Elektronen Synchrotron (DESY) laboratory and has previously chaired the STFC Particle Physics Advisory Panel and the UK Institute of Physics Particle Accelerators and Beams Group, as well as served on CERN’s Large Hadron Collider Committee. He is a Fellow of the Institute of Physics and of the American Physical Society. Excited for his new role, Professor Burrows said that ‘It is a great honour and privilege to be appointed officially as JAI Director. The Institute’s achievements are the result of the wonderfully talented team of students, staff and faculty who bring their expertise and energy to our R&D, teaching and outreach programmes. Ever onwards!’

PhD success!

Despite the mayhem of the current lockdown, Oxford DPhil student, Chetan Gohil, has successfully submitted and defended his thesis. A member of the JAI since 2016, Chet's work of the past few years has been to characterise dynamic imperfections in the Compact Linear Collider, CLIC, a proposed TeV-scale electron-positron collider under development at CERN. In order to achieve a high luminosity the CLIC project is targeting ultra-small beam sizes at the collision point. This makes CLIC sensitive to the impact of imperfections, which degrade the quality of the beam and lower the luminosity. His thesis looks at the impact of dynamic imperfections, such as ground motion and stray magnetic fields on the beam. He characterised these imperfections through measurements at live accelerator facilities, such as inside the LHC tunnel, and developed a model that can be used in simulations. Using this model, he simulated the impact of dynamic imperfections on CLIC and was able to evaluate the effectiveness of different mitigation techniques. Following his successful defence, Chet will be working in a post doctoral position at the University of Oxford working on machine learning.



[Phil Burrows](#)

Designing new radiotherapy technologies to treat cancer in low and middle-income countries

The Cockcroft Institute and the John Adams Institute are taking part in a new project to design and develop new radiotherapy technologies in Sub-Saharan Africa, giving more cancer patients access to radiotherapy, and saving lives.

Bringing together international experts in accelerator design, medical physics and oncology, alongside IT experts and health system researchers, the project will design and develop a new type of radiotherapy machine that is affordable and robust enough to be used in more challenging environments reliably, and is specifically designed to meet the needs of African hospitals.

By 2040, there will be 27.5 million new cancer cases worldwide each year, leading to more than 13 million deaths. Up to 70% of these will occur in low and middle-income countries (LMICs).

However, for many LMICs in Africa there is an acute shortage of radiotherapy machines. In fact, in the lowest income countries only four percent of cancer patients that need radiotherapy treatment can access it. There are currently only 385 radiotherapy machines in the region, and 60 per cent of these are located in just three countries – South Africa, Egypt and Morocco. A recent report [1] published by the Lancet Oncology Commission estimated that by 2035 at least 5,000 additional radiotherapy machines would be needed to meet radiotherapy demands in low and middle-income African countries.

In the first phase of this innovative project, which is funded by STFC and led by the Universities of Lancaster and Oxford, the team will define the persistent shortfalls in basic infrastructure, equipment and specialist workforce, which remain barriers to effective radiotherapy delivery in Sub-Saharan Africa, and develop new solutions leading to a detailed specification and conceptual design. The project, known as ITAR (Innovative Technologies towards building Affordable and equitable global Radiotherapy capacity), will then progress to a prototype development phase of a medical linear accelerator for radiotherapy, at STFC's Daresbury Laboratory.

The University of Lancaster's Professor Graeme Burt, also of the Cockcroft Institute, is leading the first phase of the ITAR project. He said: "Current radiotherapy machines are optimised for use in western countries. The ITAR project aims to design specifically for use in Africa making it far more tolerant to the local environment, which will greatly increase the capacity for more lives to be saved."

STFC's Professor Deepa Angal-Kalinin, also of the Cockcroft Institute and University of Manchester, will lead the accelerator design. She said: "I am keen to apply the knowledge and expertise at Daresbury Laboratory to develop a novel medical linear accelerator design in this phase of the project which will prepare us to build a prototype to test our new ideas."

The ITAR project is a critical part of a larger international project that includes the International Cancer Expert Corps (ICEC), CERN, STFC (Daresbury Laboratory), and led by Lancaster and Oxford Universities. It brings together partners from the Cockcroft Institute, STFC's Accelerator Science and Technology Centre (ASTeC), the John Adams Institute, Swansea University, King's College London, National Hospital Abuja, Botswana-UPENN Partnership and Princess Marina Hospital alongside many other international partners.

[1] Global Task Force on Radiotherapy for Cancer Control (GTRCC) of the Union for International Cancer Control (UICC) in September 2015.



Number of people per radiotherapy machine per African country. (Credit: ICEC)

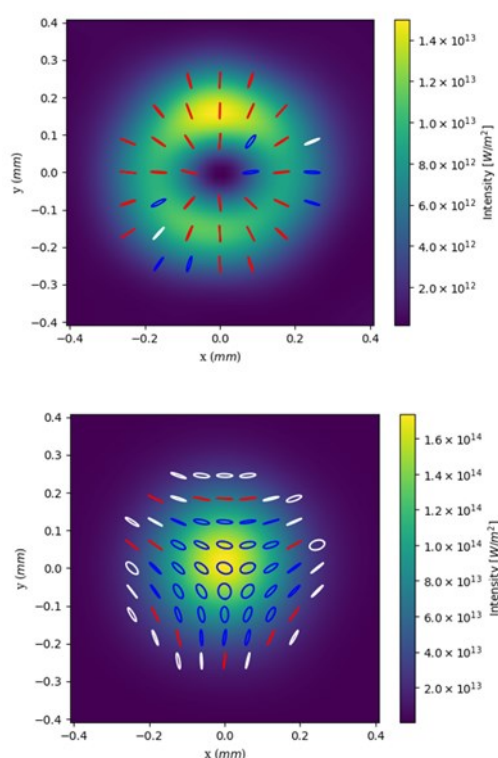
A method for generating Poincaré beams provides a new type of FEL output

The New Journal of Physics has accepted a paper titled 'Free Electron Laser Generation of X-Ray Poincaré Beams' to be published as a fast track communication. This paper is the result of a partnership between Strathclyde University in Scotland and SLAC National Accelerator Laboratory in the US.

This work proposes a method for generating Poincaré beams in a FEL. These beams have states of polarisation which vary transversely across the beam. This is not only a new type of FEL output, but the proposed method would be the first to enable generation of such structured light at X-ray wavelengths. The optics used in conventional generation methods of Poincaré beams prohibits wavelengths as short as X-rays. The proposed method is optics free and, instead, control of polarisation in the transverse plane is obtained through the overlap of different coherent transverse light distributions radiated from a bunched beam in two consecutive orthogonally polarised undulators. This then extends the wavelength range to those available through FELs opening up unexplored areas of atomic and molecular science.

Hopefully, the potential availability of this new type of FEL output will motivate users to think about applications and inspire further exploration and implementation of this method.

[Jenny Morgan](#)



Radial (top) and star (bottom) polarisation distributions from PUFFIN simulations
(Credit: Strathclyde University)

New PABG Committee Members

Welcome to Tessa Charles, who joins the committee as an ordinary member and Glenn Christian who joins as Treasurer. Tessa and Glenn's terms start on 1st October 2020.



Tessa Charles recently joined the University of Liverpool as a lecturer of accelerator physics. Prior to that, she worked for 3 years at CERN on the e⁺e⁻ Future Circular Collider (FCC-ee) project. She was awarded a PhD from Monash University, Australia in 2017, for research conducted at the Australian Synchrotron. Her research focuses on beam dynamics of Free Electron Lasers and Energy Recovery Linacs, as well as emittance tuning techniques for low-emittance circular colliders and light sources.

Glenn Christian works at the Diamond Light Source as a Senior FPGA Engineer in the accelerator controls group, where he has been since 2017. He has a background in beam-based control and stabilisation, and specialises in the application of fast digital electronics to particle accelerators. Prior to joining Diamond, he worked at the John Adams Institute in Oxford, firstly as a PDRA and subsequently Departmental Lecturer. Whilst at the JAI, Glenn worked on experiments on CTF3 at CERN and at the ATF2 at KEK in Japan. Glenn completed his DPhil in 2002, with a thesis on linear collider detector development. After this he went on to work for e2v in Chelmsford in the CCD department as a post-processing engineer for two years. Following this, he went to QMUL as an RA in the physics department, and spent two years in Hungary as a research fellow at the Institute of Nuclear Research, Atomki, before moving back to Oxford in 2009.



International Calendar

Given the present circumstances, many events have been postponed or are being replaced by virtual events. The virtual events organised so far are listed below. Updates are available at: <https://www.jacow.org/About/UpcomingEvents>

Electron-Ion Collider

2nd UK Workshop on the Electron-Ion Collider (EIC)

27 - 28 July 2020

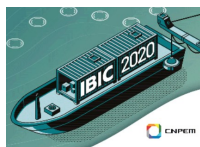
<https://indico.cern.ch/event/934314/>



30th International Linear Accelerator Conference (LINAC 2020)

31st August – 4th September 2020 (see next page for announcement)

<http://linac2020.org/>



9th International Beam Instrumentation Conference (IBIC 2020)

14 - 18 September 2020

<https://indico.jacow.org/event/34/>



24th International Workshop on Electron Cyclotron Resonance Ion Sources (ECRIS 2020)

28 September - 1 October 2020

<https://indico.frib.msu.edu/event/9/>



FEL Photon Diagnostics, Instrumentation and Beamline Design (PhotonDiag 2020)

26 - 28 October 2020

<https://indico.psi.ch/event/7531/>

Upcoming schools

CERN Accelerator School — Mechanical Materials Engineering for Particle Accelerators and Detectors

Sint-Michielsgestel, Holland, 2 - 14 November 2020



Useful Links

<http://www.scitech.ac.uk/>

<http://www.cockcroft.ac.uk/>

<http://www.adams-institute.ac.uk/>

<http://www.diamond.ac.uk>

http://www.desy.de/index_eng.html

<http://www.linearcollider.org/>

<http://home.web.cern.ch/>

<http://www.jacow.org/>

LINAC2020 Chairs' Covid-19 Announcement

On behalf of the LINAC2020 Local Organizing Committee, we unfortunately need to make you officially aware that owing to the global Covid-19 pandemic, we have been forced to postpone the physical hosting of the 30th Linear Accelerator Conference (LINAC), which was due to be held at the Arena and Convention Centre (ACC) in Liverpool, UK from 30 August - 4 September 2020. The Linac International Organising Committee (IOC) has unanimously approved this decision, whilst also deciding that postponing the conference for a single-year to 2021 would not be favourable, owing to potential complications with other large conferences which are also scheduled for late-summer and Autumn in 2021, most notably FEL'21, IBIC'21, LLRF'21 and SRF'21 and so the preference therefore would be for a 2-year postponement to 2022.

Having now re-negotiated and confirmed our contractual arrangements with the ACC venue, we are able to announce that the re-arranged physical-hosting of the next Linac Conference will take place from **Sunday 28th August to Friday 2nd September 2022** at the ACC in Liverpool, with its denotation becoming **Linac2022**. More information on its provisioning will be made available on the official conference web site in due course at: <http://www.linac2022.org/>. Subsequently, it must be noted that the original Linac2022 Conference being prepared, will now also adjust to 2024 in Chicago, with the same responsible Local Organising Committee.

Having to re-arrange hosting of the Linac2020 Conference by 2-years is obviously an incredibly difficult and disappointing decision that we have had to make under these tremendously challenging circumstances, particularly when there has been so many new and exciting developments in the field of Linear Accelerators over the past 2-years since the last Linac Conference in Beijing in 2018.

In order therefore to reduce the dramatic lack of visibility and promotion of new Linac activities and developments, we have worked in consultation with the Linac IOC and the Linac2020 Scientific Programme Committee, to identify a solution which would allow for a 'Virtual Linac Event' to be hosted, which could accommodate a significant fraction of the original Linac2020 scientific programme. Whilst details are still being developed and finalised, it is proposed to host a Zoom-based multi-day programme over the same original dates for Linac2020 i.e. Monday 31st August – Friday 4th September. The event will encompass afternoon (UK Time) sessions, in order to best capture North America and Asia participants. Information for registration, programme and logistics will be made available soon on the Linac2020 website: <http://www.linac2020.org>

We therefore look forward to seeing you 'Virtually' in September 2020 and in person in Liverpool in September 2022!

Graeme Burt (Cockcroft Institute – Lancaster University)
Scientific Programme Committee Chair

Peter McIntosh (Cockcroft Institute – STFC ASTeC)
International Organising Committee Chair

Carsten P Welsch (Cockcroft Institute – Liverpool University)
Local Organising Committee Chair

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**Particle Accelerators
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IoP Particle Accelerators and Beams Group

IoP PAB Committee

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Dr. Ben Pine (Opera Software)
Dr. Andrew Rossall (Huddersfield)
Dr. John Thomason (STFC RAL)
Dr. Melissa Uchida (Cambridge)

***Deadline for submissions to the
next newsletter is
30 November 2020***

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This newsletter is also available on the web and in larger print sizes.

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