

## Science knows no borders

### Highlights

- Radiation hardness study of CMOS image sensor for 3D Scanning
- High gradient performance of Acceleration Structures
- Upcoming Events
- Fellows Activity

**International collaboration has never been more important than it is today.** As society faces a number of wide-ranging 'global challenges' including food security, climate change, energy security and disease, internationally collaborative research is essential to finding solutions.

International collaboration is also increasingly synonymous with excellence in research. It enables individual researchers and organisations to increase the impact of their research, pool talent, equipment and resources to address challenges that they could not tackle alone. Over a third of all articles published in international journals are now internationally collaborative.

Forming international links has perhaps never been simpler, but it has also never been more necessary. The rate of globalization is increasingly rapid, with unhindered communication channels and inexpensive travel. Scientists and engineers can work together across borders and

disciplines, building at the same time bridges between cultures and generations. This is one of the cornerstones of R&D and training in the OMA project.

I am delighted to announce that the FCC collaboration has just launched the video "[Science knows no Borders](#)" on YouTube that highlights why our world needs more collaboration. I believe it carries a very strong message about what science stands for, well beyond any particular project. I would like to encourage you to share it widely!

**Finally, we have two new OMA events coming up:** [Registration](#) for our *Topical Workshop on Medical Accelerator Design and Diagnostics* is now open and places are very limited. Make sure you register this month before the deadline at the end of this month! We will also host an *Advanced School and Medical Accelerators and Particle Therapy* in Vienna between 1<sup>st</sup> - 5<sup>th</sup> April 2019, so make sure you save these dates.



Prof. Carsten P. Welsch,  
Coordinator

## Research News

### Radiation hardness study of CMOS image sensor for 3D Scanning



*The ViALUX electronics and the 3D scanner device that are currently under test (image courtesy of ViALUX GmbH).*

**OMA Fellow Samuele Cotta recently spent a week at LMU University in Munich to perform tests with radioactive sources.** Samuele is undertaking research at ViALUX GmbH, a German company, and he is also enrolled in a PhD program at LMU under the supervision of Prof Katia Parodi, so this was also an opportunity for him to get in touch with the research groups and the other PhD students at LMU. In particular the tests were performed under the supervision and with the help of Dr Peter Thierolf and his group. Samuele is currently studying the radiation hardness of a CMOS image sensor that will be used in a 3D scanning device for radiotherapy. Scattered photons and photo neutrons can cause errors and/or damage in the devices used in the conventional radiotherapy treatment rooms. In particular, the dose absorbed in the CMOS sensor can contribute to its performance degradation. In order to collect data about the effects caused by the secondary photons, the CMOS sensor

was exposed to different gamma sources, each one with specific photon energies, covering the energy range of the secondary photons in the treatment rooms ( 100keV - 1MeV). The differences in the CMOS performance before and after the irradiation are now under study.

During irradiation the CMOS sensor was shielded from the visible light, in order to acquire only the signals due to the radioactive sources. These data will be then combined with Monte Carlo simulations to study if the dose absorbed by the CMOS sensor can be estimated from the data acquired by the sensor itself.

The next step in Samuele's project will be to test the effects of the thermal and fast neutrons on different electronic components and on a complete 3D scanning device. These tests will be performed at the nuclear reactor FRM II in Garching bei München, thanks to the collaboration with TUM University in Munich.

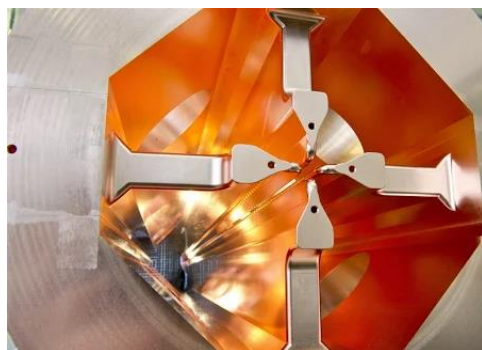
ViALUX

LMU  
LUDWIG-  
MAXIMILIANS-  
UNIVERSITÄT  
MÜNCHEN



## High gradient performance of Acceleration Structures

OMA Fellow Anna Vnuchenko presented “Proposal, procedure, and requirements for high-gradient studies of the Linac 4 RFQ” on 1st Linac 4 Spare RFQ Working Group Meeting at CERN [1].



*Internal view of section of the RFQ Linac 4*

The high-accelerating gradient performance of CLIC acceleration structure demonstrated potential for use in the future generation of compact proton-therapy facilities for cancer treatment. This progress has been accomplished through a combination of studies of the basic processes that occur at high fields, understanding of the influence of radio-frequency design, building up a testing infrastructure, development of specific fabrication technology and extensive experience operating structures and making measurements.

Following the successful tests of the CLIC Collaboration, a number of groups around the world are now considering to base their future accelerator projects on the same technology. These projects are not part of the high-energy physics community but share the need for a compact, highly efficient accelerator design. The projects include X-ray free electron lasers, Compton scattering based X-ray sources as well as medical linacs. It was decided to assess the possibility of

applying the same technology to low-speed ion accelerators such as RFQ. The design of the acceleration structure and acceleration principle of the charge particle are very different from the previous tested ones. One of the main ideas is to study the location of the breakdowns along the accelerating structure.

The main idea of this collaboration is to present possibility to redesign and potential build of a Linac 4 spare RFQ, study and advise on a maximum surface field (MV/m) achievable at CERN in a 352 MHz RFQ with a 1.5 ms RF pulse length at 1 Hz repetition rate. The implications of a higher duty cycle (5 - 10 Hz) should be also evaluated.

The Linac 4 RFQ is used to accelerate H-beam pulses of 1.2 ms duration from 45 keV from the RF source to 3 MeV, while keeping the beam both transversely and longitudinally focused, and presenting a minimum emittance growth. The nominal value of surface electric field is 34 MV/m [2]. The renovated RFQ would have beam characteristics that reliably exceed the higher requirements of LHC.

Anna, under the guidance of her supervisor, offered ideas on conditioning algorithm of the structure after fabrication and demonstrated the willingness to testing the existing RFQ Linac 4 to define the limiting parameters of high power performance.

After the submitted proposals and discussions, it was decided to grant access to Anna for data collection and perform testing without interruption operation of Linac 4. Testing and debugging of the developed data acquisition system was conducted during commissioning phase of Linac 4 after technical shutdown. Regardless of the management of LINAC 4, the signal of interest are collected there. The experiments are directed toward the understanding of the physics of rf breakdown in systems.

This approach to optimizing the RFQ is an innovation and has not been carried out before. Technology of successful upgrade of

the RFQ for Linac 4 can be used for optimization design of the RFQ for medical applications.

References:

[1] <https://indico.cern.ch/event/748634/>

[2] The Radiofrequency Quadrupole Accelerator for the LINAC4: LINAC4 Project Document No. L4-ACRFQ-ES-0001 rev.1.0, 2011.

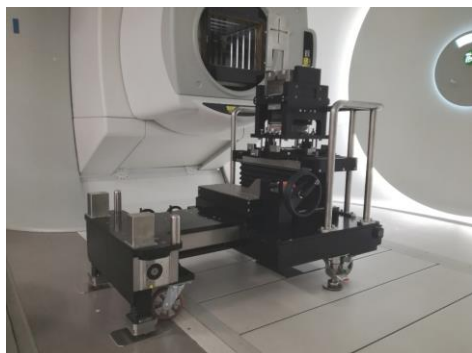
## New positioning system for the OncoRay prompt gamma camera

**Johannes Petzoldt has successfully completed work on a new positioning system for the prompt gamma camera, the focus of his OMA project.** The new system was delivered and installed this August at OncoRay in Dresden allowing for more precise verification of the proton range during patient treatments compared to the previous positioning device. The prompt gamma camera can now be also positioned under the treatment couch allowing for the imaging of prostate treatments whereas so far only brain and head & neck patients could be monitored.

the system in which the camera is mounted can then be connected to the docking points to ensure a robust and more reproducible positioning of the camera with respect to the beam isocenter. During the project phase, Johannes defined the requirements of the trolley, based on the experience made from clinical application of the previous version, and managed the design and manufacturing process in collaboration with a subcontractor in Belgium.

During the installation of the system in Dresden, Johannes received support from his IBA colleagues. After successful installation of the docking station, the position of the camera within the trolley was calibrated and validated with the collaboration partners from OncoRay. The position of the camera was adjusted in 6 degrees of freedom using the in-room stereoscopic X-ray system that is also used for patient alignment. The improved positioning accuracy significantly reduces the uncertainties of the PG measurements allowing for a more precise detection of range variations during patient treatment. The first patient treatments with the new trolley are planned for end of this year.

Johannes would also like to take the opportunity to thank everyone who contributed to this project: the colleagues from OncoRay, IBA, Karl Hugo, and Aeriene!



*Trolley developed for under bed positioning of prompt gamma camera.*

The new system is based on additional docking points that are installed in the floor of the treatment room. The moveable part of

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## Network News

### OMA welcomes new Project Manager

We are delighted to welcome Dr Samantha Colosimo to the OMA network. Samantha completed her degree in Astrophysics at Saint Mary's University, in Halifax, Nova Scotia, Canada. After which, she joined the University of Liverpool as a PhD student in 2009 and worked within the nuclear physics group on the European-wide AGATA project and subsequently became a postdoctoral research associate at the University. She has most recently developed novel radiation detectors for medical physics applications. Additionally, Samantha has worked to improve the research community and environment at the University of Liverpool for early career researchers.

Samantha joined the University of Liverpool's QUASAR Group as Research Associate in

March 2018 and took on the role as Project Manager for the European Training Network OMA in September this year.

**Welcome!**



## Upcoming OMA Events

### 3<sup>rd</sup> OMA Topical Workshop – Medical Accelerator Design and Diagnostics – Register now!

11<sup>th</sup> - 12<sup>th</sup> December 2018, GSI, Germany

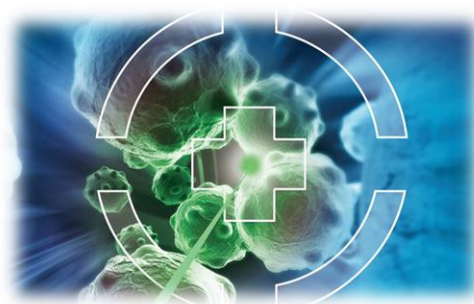
The 3<sup>rd</sup> OMA Topical Workshop on 'Medical Accelerator Design & Diagnostics' will look into the efficient integration of the devices developed in Work Package 2 (Beam imaging and diagnostics) into the facilities, beam lines and gantries from Work Package 4 (Facility design and optimization). The discussion will focus on how to improve the use beam and patient diagnostics to design and operate ion beam treatment facilities.

The workshop is mandatory for all OMA Fellows in WP2 and WP4; all other Fellows are welcome to attend.

A limited number of places will be offered to external participants.

**Registration deadline: 31<sup>st</sup> October 2018**

More information and how to register  
<https://indico.cern.ch/event/744722/>



## Advanced School on Medical Accelerators and Particle Therapy

1<sup>st</sup> - 5<sup>th</sup> April 2019, TU Vienna & MedAustron, Austria

The third scientific school of the OMA project, in partnership with MedAustron, will take place at TU Vienna from April 1<sup>st</sup> - 5<sup>th</sup>, 2019. The school will cover advanced topics in particle therapy including Radiobiology, Beam Diagnostics, 4D Imaging and treatment delivery over a 5-day school and is open to students and researchers with an interest in all aspects of Medical Physics and Accelerators. The school will also feature

an opportunity to learn from leaders in the field of Particle Therapy and a visit to the MedAustron site.

This advanced school is mandatory for all OMA Fellows.

More information and how to register will soon be available via our [webpage](#).



## Other Events

### Applications for JUAS 2019 now open!

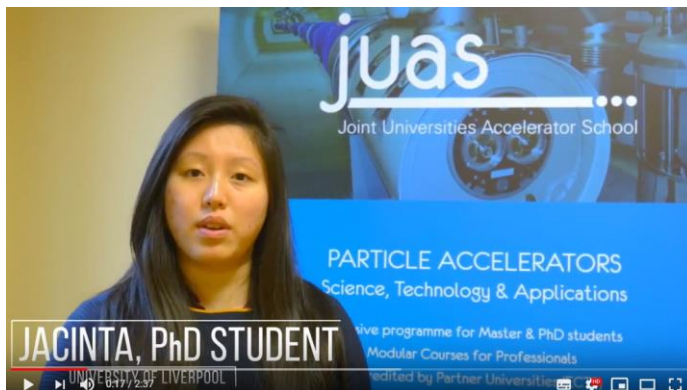
7<sup>th</sup> January – 15<sup>th</sup> March 2019, Archamps, France

Applications for the Joint Universities Accelerator School - [JUAS 2019](#) have now opened. JUAS brings together Master, PhD students and young professionals to undertake an in-depth study of current and future particle accelerators, delivering a regularly updated, academically accredited training programme in partnership with CERN and a cluster of 16 European universities. The school consists of two intensive 5-week courses delivered by a faculty comprising some 50 experts from academia, research facilities and industries active in the field.

Course 1 (mid-January to mid-February) addresses the science of particle accelerators, whereas course 2 (mid-February to mid-March) covers technology and applications.

OMA Fellow Jacinta Yap, based at the University of Liverpool, is featured in a promotion for the school - discover more about JUAS in this [video](#).

**Applications are open until 31<sup>st</sup> October 2018.**



## Symposium Particle Colliders - Accelerating Innovation

22<sup>nd</sup> March 2019, Liverpool, UK



The University of Liverpool and CERN, together with partners from the FCC/EuroCirCol projects, will host a symposium to showcase the science and technology challenges related to the Future Circular Collider (FCC). The FCC study is a global collaboration, supported by the H2020

EuroCirCol project, to investigate options for a future higher energy particle collider.

The symposium “Particle Colliders - Accelerating Innovation” will take place in the Liverpool Arena and Convention Centre on 22<sup>nd</sup> March 2019. The aim of this special event is to explore the opportunities opened by the FCC for co-innovation with a variety of industries.

The event will feature talks by keynote speakers, an industry exhibition, as well as hands-on activities for the general public.

The Symposium will be followed by an Industry Innovation Workshop in the afternoon, offering companies an ideal opportunity to get involved in one of the largest scientific and technological endeavours of the 21<sup>st</sup> century.

For more information and to register please visit <https://indico.cern.ch/event/747618>

## 10<sup>th</sup> International Particle Accelerator Conference

19<sup>th</sup> - 24<sup>th</sup> May 2019, Melbourne, Australia

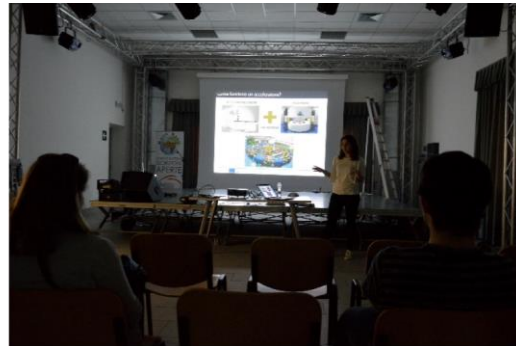
IPAC is the main international event for the worldwide accelerator community and industry. Attendees will be presented with cutting-edge accelerator research and development results and gain the latest insights into accelerator facilities across the globe. With over 1000 delegates and 70 industry exhibits this is a unique opportunity to network with, learn from and meet a wide range of decision makers, opinion leaders, buyers and new kids on the block.

Fellows and partners from OMA will be at [IPAC'19](#) presenting talks and posters and we look forward to meeting you all at **Booth D13** in the main exhibition hall.



## Fellows Activity

### Back to Italy: Anna gives an outreach talk on the medical applications of nuclear physics



Anna Baratto Roldán gave an outreach talk in Italian entitled “Non solo bombe atomiche: la fisica nucleare nella diagnosi e nella cura delle malattie – Not only atomic weapons: nuclear physics in the diagnosis and treatment of diseases”, at the “Centro Giovani Monfalcone – Innovation Young” in Monfalcone, Trieste (Italy). Anna, OMA Fellow based at the Universidad de Sevilla/Centro Nacional de Aceleradores, is originally from Italy and studied physics at the University of Trieste. She collaborated with her former University colleague Stefano Miniussi in the organization of this event. Stefano, who earned a Master’s degree in astrophysics, has been always interested in outreach activities and science dissemination and has been very active in the organization of talks, laboratories and astronomical observations in the area of Monfalcone and Trieste. Between April and June, he organized a series of conferences directed to the general public, entitled “Raccontiamo la scienza: ciclo d’incontri con giovanissimi

ricercatori e scienziati”, with the aim of making physics more accessible and familiar to the public, showing its interdisciplinary nature through the voices of young researchers.

Anna’s talk was devoted to the application of nuclear physics in diagnosis and treatment of cancer. She began by defining the word “nuclear” in physics, covering the basics and early history of nuclear physics and then discussed particle accelerators and their importance in the medical field; ending with a discussion of proton and ion therapy, showing the possibility of treating otherwise difficult to treat tumors. The public showed genuine interest in the topic and asked many questions, mostly about the advantages and disadvantages of proton and ion therapy compared to photon radiotherapy, from the point of view of secondary effects, quality of life and costs. The event was very successful and the organizers hope to organise a similar workshop in the future





## Giulia Aricò - invited speaker at the 15<sup>th</sup> Varenna Conference on Nuclear Reaction Mechanisms

From 11<sup>th</sup> - 15<sup>th</sup> of June 2018 the 15<sup>th</sup> Varenna Conference on Nuclear Reaction Mechanisms took place on the shore of Lake Como, and in particular in the fascinating Villa Monastero that every summer hosts the Enrico Fermi International School of Physics. The NMR conference is a triennial meeting that attracts physicists and researchers from all around the world, working among others in the field of medical radioisotopes, hadron therapy, fission and nuclear reactions. This year 90 participants were invited from Europe, USA, South Africa, China, Japan, etc.

OMA Fellow Giulia Aricò contributed a presentation on the developments of the nuclear reaction and fragmentation processes in FLUKA for radiotherapy. Giulia found the atmosphere at the conference highly stimulating and was impressed by the achievements, discoveries and developments reached in nuclear and medical physics over the last few years. The motivation, creativity and curiosity of the scientists at the conference amazed Giulia, who returned to CERN with even more enthusiasm into her work than before.

## Sudharsan Srinivasan visits IBA for his first secondment

Sudharsan Srinivasan, an OMA Fellow based at PSI (Paul Scherrer Institut), carried out his first secondment at IBA, Louvain La Neuve, a partner institute of the OMA network. This week long visit exposed the Fellow to an industrial setting and allowed him to gain knowledge about IBA's contribution to the field of proton therapy.

A guided tour of IBA's assembly hall for the S2C2 cyclotron presented a picture of the bottlenecks associated in building such a machine. Information about the working principle and factory quality testing procedure was presented to Sudharsan by the IBA employees and he also was given the chance to visit the Gantry assembly hall. Discussions with IBA's physicists and engineers helped him to gain information about beam optics and beam line modelling, dosimetry and also the opportunity to participate in troubleshooting factory testing procedures.

Sudharsan presented a summary of his work on the beam monitor prototype at PSI which was well received and could result in a potential chance to test his detector in one of

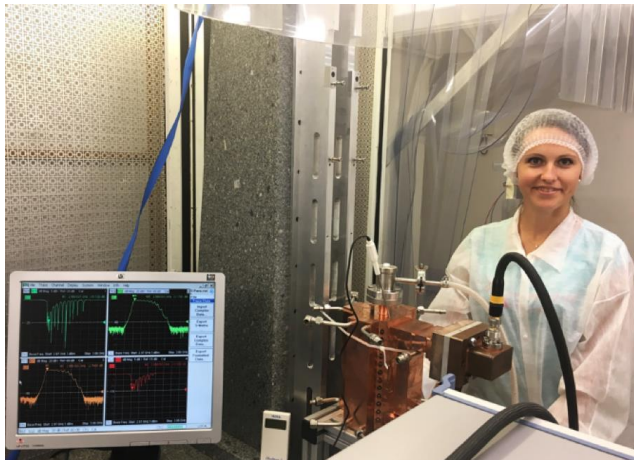
the dedicated beam lines at IBA in the future. The Fellow particularly enjoyed the friendly working environment at IBA. Special thanks to Johannes Petzoldt, an OMA Fellow based at IBA for making the experience and transition smooth.



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PAUL SCHERRER INSTITUT  
PSI

## A high power test of an S-band accelerating structure for TULIP's medical proton linac



*Anna Vnuchenko participates at the RF measurement of an acceleration structure prototype for a medical proton linac*

Several major projects worldwide are pursuing the development of compact hadron therapy linacs. A new generation of linear accelerators offers the potential for a more compact, lower-cost facility with higher treatment precision and additional flexibility as an added benefit. Part of the cost of a linac can be reduced by making it as short as possible - a reduction made possible using the high gradient technology.

To demonstrate this potential, members of the CLIC Collaboration joined efforts with the CERN KT (Knowledge Transfer) group to fund the construction of an accelerating structure based on CLIC technology, but adapted to accelerate protons in the energy range needed for cancer therapy. The high gradient backward traveling wave (BTW) structure prototype for a medical proton linac have been tested using the high-power infrastructure from the CLIC experimental program. Researchers from École Polytechnique Fédérale de Lausanne (EPFL) and the Therapy with Hadronic Radiation (TERA) foundation worked to develop the structures, and students from the University

of Valencia and the University of Lancaster were participating in the tests.

The structure operated above expectations. As it is more difficult to accelerate low-velocity protons than relativistic electrons, the predicted gradient of these structures is 50 MV/m. The test structure was able to reach 60 MV/m and behaves consistently when compared to the CLIC structures tested by the CLIC Collaboration.

Anna Vnuchenko actively participated in testing and data analysis. The results have been presented at conferences and at the OMA topical workshops. RF Measurement of the structure was performed after high power testing. As the comparative analysis data before and after high power test showed, the frequency of the regular cells did not change in general. There is a noticeable detuning of the several cells. These data are being prepared for publication. In the near future, the second BTW structure will be tested at the HG RF laboratory in Valencia, now in construction.



## Anna Baratto Roldán presents her research at events in Spain



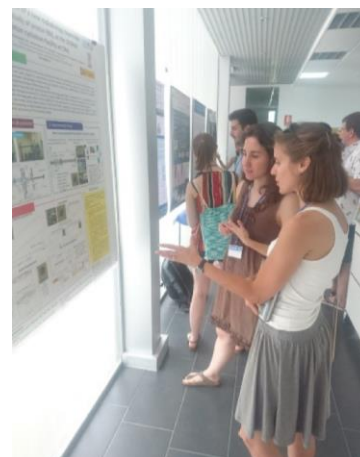
*Anna during her talk at the II Jornadas RSEF/IFIMED de Física Médica.*

During 14<sup>th</sup> – 15<sup>th</sup> June, Anna attended the “II Jornadas RSEF/IFIMED de Física Médica”, a two-day workshop organized by the Spanish Royal Society of Physics and the Institute of Medical Physics in Madrid which aims to gather the Spanish medical physics community and share achievements and results. She gave a talk entitled Proton RBE at low energies: preparation of a new radiobiology beam line at the 18 MeV proton cyclotron facility at CAN (Seville, Spain).

processing, treatment planning and PET applications” which were very interesting and gave rise to a fruitful discussion.

Anna presented a poster on the Development of a new radiobiology beam line for the study of proton RBE, at the 18 MeV proton cyclotron facility at CNA (Seville, Spain), which discussed the results of her project, and received helpful and positive feedback.

Anna also attended the “International Scientific Meeting on Nuclear Physics – La Rábida 2018”, a summer school on nuclear physics held at [La Rábida](#), Huelva (Spain) every three years. The school is intended for PhD students and young postdocs working in the field of nuclear physics, and the topics covered aspects from basic theory to technological applications. This year, from the point of view of applications, Prof. Dr. Katia Parodi, Professor of Medical Physics at the Ludwig-Maximilians-Universität München and supervisor of the OMA project Advanced Monte Carlo and imaging methods project, gave a series of lectures on “Medical image



*Anna presenting her poster at “La Rábida 2018” school.*



## Laurent Kelleter visits MedAustron for a secondment

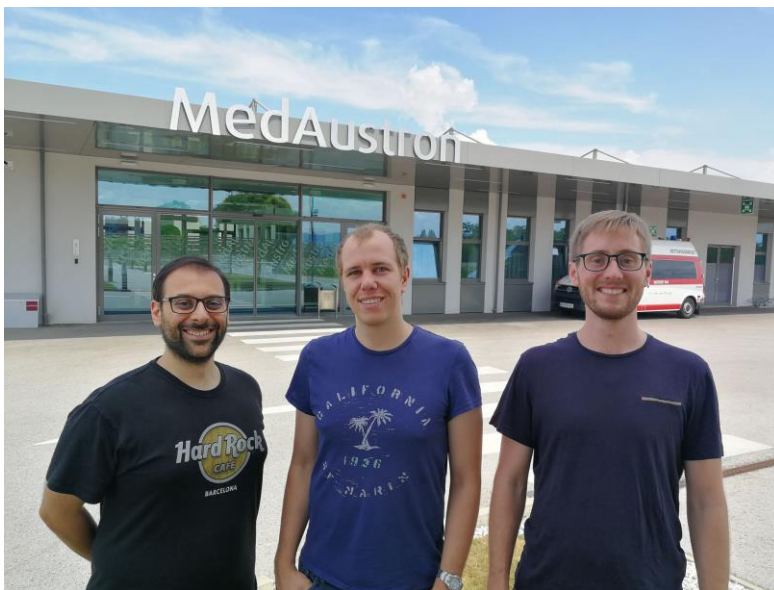
In July, OMA Fellow Laurent Kelleter from University College London (UCL) joined MedAustron for an OMA secondment. Since then, he's been working closely with OMA Fellow Andrea de Franco and his supervisor Claus Schmitzer as part of the group responsible for the MedAustron synchrotron, offering a unique opportunity to gain first-hand experience about the operation of a modern particle therapy centre. The current tasks include the commissioning of the new carbon ion beam line – one of only about a dozen worldwide – with a focus on synchrotron optics and third order slow resonant extraction optimisation. An important milestone was reached in mid-August, when the carbon beam became first available to medical physicists.

Laurent is also involved in the performance improvement of the proton beam line. The project aims at increasing the proton beam intensity available for patient treatment, thus reducing treatment time and increasing

patient throughput. In the course of this project he contributes to range/energy fluctuation measurements and verifications to assess the need of additional safety systems.

Another focus of Laurent's stay at MedAustron was the work with the group from the technical university of Vienna (TU Wien) performing non-clinical research. This project had already kick-started with a joint beam test at MedAustron earlier this year. The efforts focus on exploring a combination of the detector systems being developed in Vienna and at UCL for proton radiography.

At the same time, [AVA](#) Fellow Miha Cerv based at CIVIDEC in Vienna visited MedAustron and joined a tour in the synchrotron hall. Miha, Andrea and Laurent will stay in close contact in order to benefit from each others expertise and deepen the ties between the two partner networks OMA and AVA.



From left to right: Andrea de Franco (OMA), Miha Cerv (AVA), Laurent Kelleter (OMA)

MedAustron

UCL

CIVIDEC

## Anna Vnuchenko attends an RF measurement training course at CERN

OMA Fellow Anna Vnuchenko attended a two day course of the Fundamentals of RF Instrumentation and Measurements at CERN. The purpose of the course was to learn the essential RF work practices and accurately and safely measure RF structures and devices properly. The training included both theoretical explanations and hands-on lab exercises. The instrumentation for measuring RF power, including spectrum analyzers, network analyzers and RF power meter were overviewed and used for experimental tasks.

All the practical examples considered were taken from the current issues of RF department of CERN which is engaged in the production, testing and transfer of CERN X-band technology for normal-conducting high gradient accelerating structures to industry. This experience was very useful for Anna, as she incorporated the training into her daily work. The experience widened her understanding and knowledge base in the field of RF instrumentation.



## Science is Wonder-ful – European Researcher’s Night



Sudharsan Srinivasan participated in “[Science is Wonder-ful!](#)”, an outreach event organized by the European Commission on 25<sup>th</sup> – 26<sup>th</sup> September at Parlamentarium, Brussels, Belgium. The event is set for popular science and fun learning and brought together more than 4000 visitors comprised of school-age students, researchers from different countries, investors and politicians amongst others.

The event provided a platform for Sudharsan to showcase his project in accessible terms to trigger curiosity and interests among the visitors. Moreover, this served to break the stereotypical understanding of researchers

among the public. Thanks to a music box, an android tone generator application, an open-close end glass tube and some Styrofoam balls, they were made to dance for certain frequencies thus explaining the concept of resonance and its usage in medical accelerators. Special thanks to his supervisor Pierre-André Duperrex, as Sudharsan did not worry about the French speaking visitors and was a part-time visitor of his own stand. The attendees considered them to be “Magicians” and commented - “Wow, this is Magic” and “It’s Unbelievable”. Other attendees planned to try the experiment at home and in their schools to re-enact the magic of “Resonance”.

## Partner News

### The Force is strong in OMA

On 11<sup>th</sup> October 2018, the Star Wars universe came to Daresbury Laboratory. OMA Coordinator Professor Carsten Welsch gave a special staff seminar on the Physics of Star Wars.



*The force was strong at Daresbury Lab on 11<sup>th</sup> October 2018.*

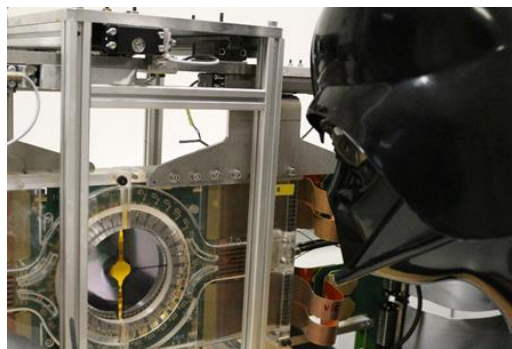
The event included hands-on demonstrations about superconducting magnets, droid races and computer games into the maximum acceleration that can be achieved using plasmas – asking questions about how fast we can accelerate macroscopic objects such as space ships with current technology. It also featured posters that linked the Star Wars universe to research currently being undertaken in his QUASAR Group. Finally, a number of Star Wars characters, including R2-D2, Darth Vader and Kylo Ren “invaded” Daresbury Lab campus and helped create a very special atmosphere. Absolutely no seat was left and a number of staff had to stand in the back of the room when Prof Welsch started his seminar and described what is science and what is fiction in the famous movie series that started more than 40 years ago, in November 1977.

Professor Welsch first covered some basic questions related to space fights, space craft flight manoeuvres and whether one can travel through hyperspace, before continuing to show how specific aspects of the films are linked to his ongoing research programme.

A particular highlight was when he discussed the iconic scene when Luke Skywalker in 1977's A New Hope, the very first Star Wars movie, uses proton torpedoes to destroy the Death Star and how this relates very closely to using ‘proton torpedoes’ in ion beam-based cancer therapy.

He linked this scene to the activities in the OMA project and how proton beams are used to target cancer cells hidden deep inside the body of a patient. The different imaging technologies developed by the OMA Fellows will help monitor these beams better than anything currently available, improving cancer care in the future.

It was a very special afternoon for Daresbury lab. One, that fascinated everyone for both, Star Wars and medical accelerators.



*Lord Vader inspecting the VELO detector that shall be used for medical imaging at the Clatterbridge Cancer Centre.*

*This was not an official Disney/Lucasfilm event, but planned, organised and run by Liverpool staff and students. It was supported by STFC through the Cockcroft Institute core grant and a Spark Award. The kind permission of Lucasfilm to use film excerpts as part of the seminar is acknowledged.*



## Science knows no borders – new video

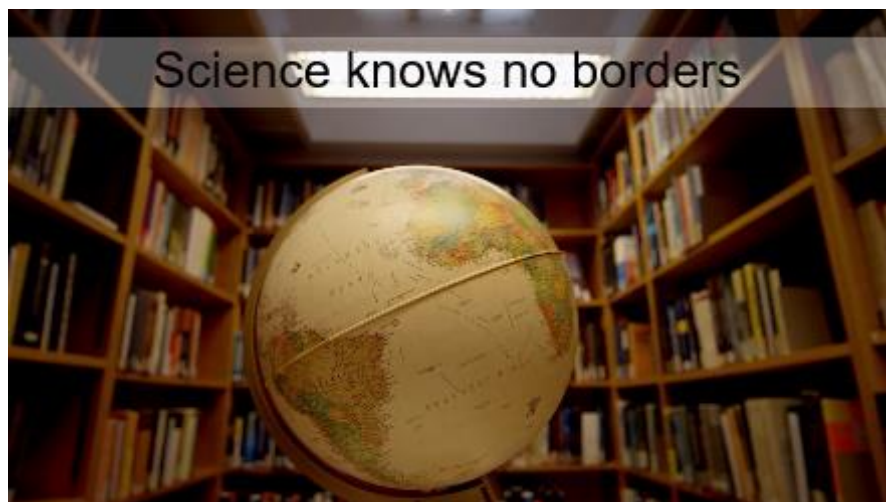
**A new video featuring former CERN DG Prof Rolf Heuer highlights the importance of international research collaboration on the example of the Future Circular Collider (FCC) project.** It was produced by the University of Liverpool in collaboration with CERN in the framework of the FCC and EuroCirCol projects.

Large scale research infrastructures require the world to work together on the design, construction, operation and subsequent optimization of these facilities to fully exploit their discovery potential. Scientists and engineers are working together across country borders, research disciplines, building bridges also between cultures, genders and generations. These are the cornerstones of the OMA project.

CERN in Geneva has been an outstanding example of the successes made possible through open collaboration and this video presents a strong message why the world needs more of this.

The video is now available on [YouTube](#) with subtitles in eight languages and has also been added to the [EU Science & Innovation](#) playlist where it stands among the top most watched videos!

**Enjoy!**



[Watch the video!](#)

## Vacancies

### PhD Position at OncoRay

Helmholtz-Zentrum Dresden-Rossendorf, Germany <https://www.hzdr.de/> is gladly welcoming applications for a new PhD position in medical physics at its Institute of Radiooncology – OncoRay <https://www.oncoray.de/>, a leading proton therapy research centre in Germany and adjunct partner of the OMA project.

Interested candidates should email the lead researcher Dr Richter [Christian.Richter@OncoRay.de](mailto:Christian.Richter@OncoRay.de)



### Job Opening: System Engineer at CIVIDEC

CIVIDEC Instrumentation is an R&D company which is located in Vienna, Austria, is opening an indefinite position for a system engineer in the field of particle accelerators, hadron therapy, and electronics. Applicants shall have a finished master degree in either Electrical Engineering or Physics.

This position will be opened by 1<sup>st</sup> of January 2019 and applicants are welcome to send their application, including a letter of motivation and CV to: Dr. Christina Weiss, [office@cividec.at](mailto:office@cividec.at).



### Open positions at University of Liverpool/The Cockcroft Institute:

**Grade 7 Project Manager** to work on the research and training projects "Accelerators Validating Antimatter Physics" (AVA) and the Liverpool Centre for Doctoral Training on Big Data Science (LIVDAT). You will be responsible for the day-to-day management of the projects, including ensuring efficient implementation of the project, building strong links with project partners, event organisation and international communication of all project outcomes. Further information can be found [here](#)



**Grade 8 Commercial Development Manager** that helps maximise the commercial impact of research in the University of Liverpool physics department. This includes ideas generated by the Accelerator Science, Nuclear Physics and Particle Physics Groups. You will develop opportunities for commercial exploitation and partnerships with industry; advise on future technological growth directions and perform market research.

**Grade 7/8 Research Fellows** based at the Cockcroft Institute in the UK or at CERN specialised in either beam diagnostics R&D for charged particle beams, or beam dynamics studies ranging all the way from low energy storage rings and beam lines to the TeV energy range in the LHC and linear colliders. You will contribute to/lead activities in either of these areas and collaborate closely with the staff and students in the QUASAR Group. An internationally excellent track record, demonstrated for example through publications or leadership roles, will be expected.

**Grade 7/8 Research and Impact Marketing and Communications Manager.** You will support our institutional and departmental strategies by communicating our research outcomes and events internationally, and also contribute to our communication-related impact case studies. You will have excellent media links and a demonstrated track record in science communication.

*Grade points will be determined on the basis of experience. For more details please contact [c.p.welsch@liverpool.ac.uk](mailto:c.p.welsch@liverpool.ac.uk)*



## OMA Events

December 11 <sup>th</sup> - 12 <sup>th</sup> 2018	3rd OMA Topical Workshop - Accelerator Design and Diagnostics, GSI, Germany
April 1 <sup>st</sup> – 5 <sup>th</sup> 2019	Advanced School on Medical Accelerators and Particle Therapy, MedAustron, Vienna, Austria
June 24 <sup>th</sup> – 25 <sup>th</sup> 2019	Advanced Researcher Skills and Technology Transfer Workshops, Liverpool, UK
June 28 <sup>th</sup> 2019	Symposium: Accelerators for Science and Society, ACC Liverpool, UK

## Other Events

March 22 <sup>nd</sup> 2019	Symposium: Particle Colliders – Accelerating Innovation, ACC Liverpool, UK
May 19 <sup>th</sup> – 24 <sup>th</sup> 2019	IPAC'19, Melbourne Convention & Exhibition Centre, Australia
June 10 <sup>th</sup> - 15 <sup>th</sup> 2019	PTCOG58, Manchester, UK
July 1 <sup>st</sup> - 3 <sup>rd</sup> 2019	ENLIGHT Annual Meeting and Training, Caen, France

## NOTICE BOARD

This newsletter is published on a quarterly basis. Help us keep it interesting by providing your news and updates.

DEADLINE FOR THE NEXT NEWSLETTER **15<sup>th</sup> December 2018**



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