Highlights

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Optimisation of Medical Accelerators

Although public knowledge of accelerator physics has increased in recent years with the work at CERN on the Large Hadron Collider, many people would not know that they benefit from accelerators in every aspect of their lives.

In fact, tens of millions of patients receive accelerator-based medical diagnoses and therapy every year. The most widely known products of medical accelerators are X-rays, which are used for imaging and cancer treatment, and radioactive isotopes, which are used for diagnosis. More recently the use of proton beam therapy has caught the media's attention as it offers a more targeted treatment for some cancer types, especially for children. However, despite its value to health and industry, accelerator science is still an emerging area of science and this creates exciting opportunities for research.

OMA is a new pan-European training programme that targets the 'Optimisation of Medical Accelerators'.

A cohort of 15 Fellows who were recruited from all over the world have started the projects this month and will push the frontiers for the use of accelerators in advanced cancer treatment.

OMA is positioned at the interface between life sciences, physics and engineering to present an interdisciplinary approach. We have brought together leading partners from universities, research centres, industry and clinical centres to help define and develop a cutting edge research programme. Our Fellows will get the opportunity to work with leading research institutes but also to have contact with potential end-users of the technology.

OMA will also offer a number of international events, such as Schools, Topical Workshops and Conferences which will also be open to participants from outside of the network. The OMA Express will be published quarterly and present highlights from the network and our Fellows.

Enjoy !

Prof. Carsten P. Welsch
OMA Coordinator

Who is who in OMA

OMA Consortium

OMA is a Marie Skłodowska-Curie European Training Network coordinated by the University of Liverpool. The network is comprised of 14 beneficiary partners, 11 associated partners and a growing number of adjunct partners.

Each beneficiary hosts one or two early stage researchers (ESR), each dedicated to a specific research project. Associated and adjunct partners play an important role in the network-wide training and provide secondment places for the trainees in relevant scientific areas. Partners come from academia, research centres, clinical facilities and industry, thus providing an ideal cross-sector research and training environment.

Beneficiaries

Partner Organizations

Adjunct Partners

Steering Committee

The Steering Committee is responsible for the overall network strategy and takes all the decisions concerning the network. It consists of the following elected members:

Prof Dr Joaquín Gómez Camacho, Director of Centro Nacional de Aceleradores in Seville, Spain, which provides infrastructure for particle accelerator - based fundamental and applied research. His research focus is on the scattering of exotic nuclei on heavy targets.

Dr Christian Graeff, leader of the Medical Physics group of the GSI Biophysics department in Darmstadt, Germany. His main research interests are the treatment of moving targets with scanned ion beams, including treatment planning strategies and their experimental validation.

Dr Monica Necchi, Research Grants Manager at Fondazione CNAO in Pavia, Italy. Her main research interests deal with application of physics into the biomedical field and interactions of radiation with matter.

Dr Julien Smeets, Research Project Manager at Ion Beam Applications SA in Louvain-La-Neuve, Belgium. His research focuses on prompt gamma imaging and its development for proton therapy.

Prof Dr Carsten P. Welsch, Head of the Physics Department of the University of Liverpool and scientific coordinator of the OMA network. His research covers frontier accelerators, novel acceleration schemes, as well as accelerator applications.

A **Fellows' representative** will join the Steering Committee in due time.

EU T.E.A.M.

Day to day project management is carried out by the EU Project T.E.A.M. from the University of Liverpool based at the Cockcroft Institute in Daresbury, UK. The T.E.A.M. supports Prof Carsten Welsch in coordinating the EU – funded projects and is responsible for project management, monitoring, communication, and organisation of events.

Magda Klimontowska is the project manager for OMA, Samina Faisal provides financial project administration and Alexandra Welsch is responsible for developing and managing the websites and social media profiles.

Magda Klimontowska   **Samina Faisal**   **Alexandra Welsch**

This short video presents activities of the EU Project T.E.A.M.:

https://www.youtube.com/watch?v=UUs_M5WOAu8

Network News

OMA welcomes first Fellows

Thirteen Fellows have already been recruited to the OMA project. Below we present the ones that have recently started work in their host institutions, with other Fellows to be introduced in the next issue.

Welcome to OMA!

Navrit Bal

In July 2016, Navrit Bal received a Physics MPhys degree from the University of Kent with a study abroad year at the University of California, Berkeley.

At Kent, his undergraduate Masters thesis was based on a series of computational material simulations entitled: Simulating the density of states, band structure, Fermi surface of cobalt and copper at 0-200 GPa. His final year modules included rocketry and human spaceflight, particle and quantum physics, magnetism and superconductivity and finally topics in functional materials. He also co-founded the Physics Society (PhySoc) and was Treasurer for 2 years.

At Berkeley, mostly Physics and Nuclear Engineering classes were taken which led into a summer job within the RadWatch group at Lawrence Berkeley National Laboratory (LBNL). This is where he was the primary developer for the DoseNet project, a network of custom-made dosimeter devices, primarily remotely installed in schools in the San Francisco Bay Area and now at a number of sites around the world.

In September 2016 Navrit joined the OMA project at ASI (Amsterdam Scientific Instruments) working on Medipix3 detectors.

Project:
A versatile high-speed radiation detection platform

Laurent Kelleter

Laurent Kelleter obtained his Bachelor degree in physics in 2013 from RWTH Aachen University. He graduated with a work on the set-up of a SiPM-based muon detector prototype which is now in use in the Master's laboratory class of astroparticle physics to measure atmospheric air showers. After spending a year abroad at the university of Montpellier, France, he obtained his Master's degree in experimental particle physics in March 2016. For his Master's thesis he worked on future online beam monitoring in ion therapy using prompt gamma radiation.

After completing his studies he drew up a publication on the team's results in collaboration with Jagiellonian University in Kraków, Poland.

Laurent joined the OMA network to work at UCL. His project will focus on the integration of a SuperNEMO calorimeter in a radiography/QA system for proton therapy.

Project:
Calorimeter for proton therapy and radiography

Ewa Oponowicz

Ewa studied biomedical engineering and physics at the Warsaw University of Technology, Poland. She obtained her Bachelor's degree in 2013 in cooperation with National Centre for Nuclear Research in Poland where she worked on the beam forming systems in medical electron accelerators.

She graduated in 2015 from the National School of Engineering in Nantes, France. Her Master's degree was done at CERN, where she was a Technical Student in the Beam Instrumentation group. Her work focused on the software development for the beam position and intensity measurement systems in the Antiproton Decelerator.

In 2016 Ewa joined the OMA project at University of Manchester to work on a gantry design for Linac-boosted protons.

Project:
Gantry Design for Linac-boosted Protons

Johannes Petzoldt

Johannes Petzoldt studied Physics at the Technische Universität Dresden, Germany. He obtained his Diploma in March 2013, with a project on neutron and proton activation of natural neodymium for the SNO+ experiment. Until September 2016, he worked as an assistant researcher on the topic "range verification for proton therapy" at OncoRay in Dresden, Germany. Johannes investigated scintillation materials as well as the beam characteristics at the proton therapy facility with respect to the novel Prompt Gamma Timing (PGT) method. Furthermore, he tested and characterized a PGT prototype system for the application in clinical practice.

Johannes joined the OMA project to work at Ion Beam Applications (IBA) in Louvain-La-Neuve, Belgium. There, he will continue his research on range verification based on prompt gamma rays. The focus is set on the further clinical implementation of the prototype of the knife-edge slit camera. The aim is to improve the clinical workflow and to develop routines for determining the causes of range shifts during the treatment based on measurements by the slit camera.

Project:
Imaging solutions for a novel prompt gamma camera

Liheng Tian

Liheng Tian received his Bachelor's degree in Particle Physics and Nuclear Physics at the University of Science and Technology of China in 2013. From 2013 to 2016, he studied medical physics at Institute of Modern Physics, Chinese Academy of Sciences. His paper focused on the use of radioactive ^{9}C in radiotherapy. He has experience with Monte Carlo simulation for radiotherapy.

Tian joined the OMA network in 2016 at LMU. His project is committed to combining the Monte Carlo and imaging method for radiotherapy.

Project:
Advanced Monte Carlo and imaging methods
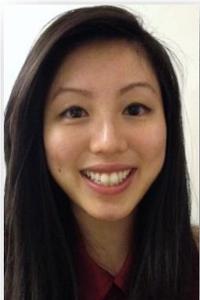
Jacinta Yap

Jacinta graduated with a Bachelor of Science majoring in Mechanical Engineering from the University of Western Australia in 2014. Thereafter, she pursued a Masters in Medical Radiation Physics with the Centre for Medical Radiation Physics (CMRP) at the University of Wollongong. Her thesis was a study of the Relative Biological Effectiveness (RBE) in proton beam therapy by application of a novel silicon microdosimeter. RBE was derived given a microdosimetric approach where experimental data was evaluated alongside Monte Carlo simulations generated using Geant4. Throughout her study she engaged in short summer internships in the Medical Physics Research Department, Sir Charles Gairdner Hospital in Perth, Australia and at the National Cancer Centre, Singapore General Hospital in Singapore.

Jacinta was awarded her MSc with Distinction in July 2016 and following this, joined the OMA project where she will be working in parallel towards a PhD with the University of Liverpool.

Project:
Halo-Dose correlation in a medical accelerator

Hanen Ziri

Hanen Ziri obtained her bachelor's degree in biomedical engineering, biomedical instrumentation specialty, in 2011 and her first master's degree in biomedical engineering, medical imaging specialty, in 2013, both from the Higher Institute of Medical Technologies of Tunis. During her studies she worked on medical image and signal processing using MATLAB. Hanen obtained her second master's degree in medical physics in 2016 from the University of Grenoble-Alpes. Her studies in France involved work in an interdisciplinary laboratory of physics in Grenoble to develop a software in MATLAB to interface a novel CMOS camera, designed for functional imaging at high resolution, with electrophysiology instrumentation. Her master research was conducted in the department of radiation physics at the university of Texas MD Anderson cancer center. It was related to particle therapy and scintillator detectors use for proton beam quality assurance.

In October 2016 Hanen joined the OMA project as a fellow at the CNAO in Pavia. She will work on refinement of the interfacing between the optical tracking system and the dose delivery system in active beam scanning particle therapy.

Project:
Tumour tracking in particle therapy

Last open positions in the OMA project!

There are two ESR positions available in the OMA Project: at Paul-Scherrer Institute in Switzerland and at Vialux, a private company in Germany.

The project at PSI **RF-based Measurement of Ultra Low charges** will focus on improvements or development of new diagnostic systems that play an important role to optimize medical treatment schemes. Currently, ionization chambers are the most commonly used detector type for beam intensity measurement. However, they use thin foils which are crossed by the beam and decrease the beam's quality by scattering. To mitigate this problem a Fellow shall develop a sensitive RF-based current monitor for fully non-interceptive beam current measurement and shall study the possibilities to measure the beam position. The system improvements will target measurement of beam currents at a very low beam intensity. The design will be based on previous developments at PSI and will also take into account developments at other OMA institutions.

Within the project at Vialux a Fellow will work on development of **New encoding methodologies for ultra-fast 3D surface scanning**. They will combine a time sequence of binary patterns with partial dithering in each of these bit plane patterns in the sequence. Furthermore, a Fellow will design and analyze methodologies of fringe pattern generation that work with a minimum of bit planes and provide the maximum precision for 3D-scanning to achieve ultra-high scanning speeds, maintaining the typical quality of phase shifting measurements. Both, theoretical and experimental work will be performed, starting from the basic pattern generator up to the full evaluation of 3D scan result in a corresponding laboratory setup and comparison with alternative techniques studied within OMA.

Details on how to apply can be found here

New partners on board

OMA consortium is pleased to announce accession of two new adjunct partners to the network.

C-RAD Positioning, a company based in Sweden, is a market leader in the development of optical systems for the purpose of fast and accurate patient positioning and treatment in the field of radiation therapy. Its Sentinel and Catalyst products are installed all over the world, in linear accelerators as well as proton facilities.

DTBS (Healthcare department) of CEA-LETI in Grenoble, France, works on integration of technologies in systems using X-ray or gamma-ray for medical imaging, security, NDT and environment for industrial partners. The Detector Laboratory of DTBS exploits the detector performances using dedicated electronic and original methods of information processing. With the help of detector and system simulation, it enables to propose new system architectures.

Welcome to the OMA network!

OMA Steering Committee meets at GSI

The second meeting of the OMA SC took place on August 1st, 2016 at GSI in Darmstadt, Germany. It gathered representatives of CNAO, IBA, GSI and University of Liverpool. Chaired by the Project Coordinator Prof Carsten Welsch the meeting aimed at reviewing activities since last meeting and plan next project actions and events. Project Manager Magda Klimontowska gave a brief overview of recruitment results and presented information on the fellows recruited. The communication activities from the last six months were also summarised and discussed. Later in the day a brainstorming discussion on next year activities and events took place, resulting in detailed plans for two OMA schools that will be hosted next year at the University of Liverpool (OMA Complementary Skills School) and at CNAO (OMA School on Medical Accelerators) and initial ideas for the OMA School on Monte Carlo Simulations, to be organized later in 2017. Opportunities for collaborations with other ITNs were also discussed and received positive feedback from all the SC members who see this as an important added value for the project. At the end of the meeting next steps for communication were agreed, with strong emphasis of all partners contributing to this aspect of the project.

Many thanks to Christian Graeff and the team at GSI for kindly hosting the meeting!

Steering Committee Members at GSI

Upcoming OMA Events

OMA Complementary Skills School
3 - 7 April 2017, University of Liverpool, UK

Why do you need complementary skills?
A good set of complementary skills will help you gain the greatest impact from any technical or scientific knowledge you may have. Complementary skills will help you manage your research project and present your results to different audiences, and in longer term also make you more attractive to employers in the competitive jobs arena. These skills are transferable and so make you more robust and flexible. They could help you take advantage of cross-sector opportunities between industry and academia or to work better at an interdisciplinary level. This is the reason why EU-funded Marie Skłodowska-Curie Actions incorporate mandatory complementary skills training in their projects.

This training is implemented in OMA through an established quality programme of complementary skills training developed and tested during the delivery of three other European networks coordinated from the University of Liverpool. This programme has been recognised as best practice by several institutions including European Commission. The training will be organized around the following topics:

- Project management
- Presentation skills
- Scientific writing
- Peer review
- Team work
- Time management

The school will be organized in the vibrant city of Liverpool which will provide an exceptional atmosphere for the first gathering of OMA Fellows.

Note that the UK is not within the Schengen area and so non-EU nationals working outside of the UK will need to apply for a UK visa in addition to their work permits. Please submit your visa application well in advance. If an invitation letter is required for visa application please ask OMA Project Manager Magda Klimontowska to provide you with it.

Note: Participation in OMA Schools is obligatory for all OMA Fellows.

1st OMA School - Medical Accelerators
5 -9 June 2017, Fondazione CNAO, Pavia, Italy

The first OMA technical school will focus on the principles of medical accelerators. This will include beam generation, transport and delivery to the patient, as well as treatment schemes, beam extraction and clinical assessment of effectiveness. Current challenges related to beam diagnostics, imaging and patient issues will also be covered.

The lectures will be complemented by study sessions and a poster session where the participants will be given the opportunity to present their own research activities in a form of a poster. There will also be a dedicated industry session.

Within the school the OMA Scientific Board annual meeting and the OMA Steering Committee meeting will take place.

The week following the OMA school there will be an opportunity for OMA Fellows to attend a school of another European training network 'Medicis - Promed', which will cover medical aspects of hadron therapy.

Partner News

Multimillion euros project on antimatter research announced

AVA (Accelerators Validating Antimatter physics) is a new European research and training network between universities, research centres and industry. Within the project a cohort of 15 Fellows will be employed to carry out cutting edge research and follow a highly innovative training program. The project was selected for funding in one of the European Union's most competitive funding schemes and will benefit from almost 4 M€ of funding over its 4-year duration. AVA targets new scientific and technical developments in antimatter research and aims at boosting the career prospects of its Fellows.

The project will be coordinated by OMA Coordinator Prof Carsten P. Welsch and will directly build up on experience and expertise gained within earlier European networks including OMA and train the next generation of researchers.

Within AVA, the project partners will pursue a closely connected R&D program across three scientific work packages. The first one focuses on facility design and optimization, addressing beam life time and stability issues in lowest energy storage rings, as well as beam cooling, deceleration and extraction processes. Work package 2 addresses the design, development and testing of novel beam diagnostics and in particular the establishment of a dedicated instrumentation and detector test stand, to fully determine the characteristics of an antiproton beam. Finally, novel low energy antimatter experiments will be carried out through involving beyond state-of-the-art beam handling, storing and analysis techniques.

A structured combination of local and network-wide trainings will also be offered within AVA. This will follow the example of the OMA project and include courses at the different host institutions, alongside network-wide trainings which will be made available to the wider scientific community. There will also be opportunities to organize joint events and training for both OMA and AVA fellows.

Currently AVA is offering 15 Fellowships to talented, energetic, highly motivated early career researchers that will be employed by the different project partners across Europe. The application deadline is 31st January 2017.

More information about the project can be found on the project home page: http://www.ava-project.eu

OMA partners lead session at the Europe's largest higher education conference

More than 5,000 higher education professionals from all corners of the world have participated in the 28th European Association for International Education's (EAIE) annual conference held in Liverpool, 13th – 16th September.

OMA project manager Magda Klimontowska and Michael Holroyd, managing director of Inventya Limited (OMA partner institution) led the 'Accelerator Researcher Career' session at Europe's largest higher education conference. They were joined by James Hunt, PhD student from the University of Liverpool, to explore the conflict between the standard training received by postgraduate students and the demands of the technology industry for highly qualified researchers.

In the session chaired by James Hunt, Michael Holroyd presented the specific industry needs and expectations in terms of highly qualified graduates and Magda Klimontowska responded to this with an overview of the postgraduate training model developed within several international training networks that have been initiated and coordinated by Prof Carsten P. Welsch from the University of Liverpool. These presentations were followed by a set of questions from the audience.

Since 2008, Prof Welsch with support from his EU T.E.A.M., has coordinated four EU-funded Innovative Training Networks in the field of particle accelerators, with a fifth one to start in 2017. OMA – Optimization of Medical Accelerators is one of them. The successful model developed over the years includes international training events, cross-sector secondments, and complementary skills training, as well as various outreach activities. As a result, a steady supply of highly qualified researchers has been provided to the international community of particle accelerator experts. The projects have also helped raise public awareness of the importance of accelerators for science in society.

OMA Events

| April 3rd – 7th 2017 | OMA Complementary Skills School, Liverpool, UK |
| June 5th – 9th 2017 | 1st OMA School – Medical Accelerators |

Other Events

Oct 24th – 25th 2016	LA^{3}NET Topical Workshop on Laser Ion Sources, Paris, France
Oct 24th – 26th 2016	LA^{3}NET Topical Workshop on Novel Accelerators, Paris, France
Oct 25th – 28th 2016	PCaPAC 2016, Campinas, Brazil
May 14th – 19th 2017	IPAC'17, Copenhagen, Denmark
Aug 12st – 25th 2017	IBIC'17, Grand Rapids, MI, USA

NOTICE BOARD

There are now only two Fellowships available within OMA. Please encourage suitable candidates to apply.

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

DEADLINE FOR THE NEXT NEWSLETTER CONTRIBUTIONS 10th January 2017

www.oma-project.eu

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