NEWS letter

MIRROR

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Highlights

Dear friends of low energy antimatter and ion physics,

The year 2021 has started and across Europe, most of the COVID-related regulations and travel restrictions remain in place. This continues to make international collaboration challenging, but it is good to see how everywhere students and staff find creative ways to stay in touch, have regular discussions and plan measurements for as soon as these will be possible again. This is the right spirit to tackle this global crisis. This MIRROR features a number of seminars and large scientific events that will no doubt stimulate discussions and I hope that many of you will engage with these.

Researchers in the UK were delighted that a deal was struck between the United Kingdom and the EU at the end of 2020. In particular about the announcement that the UK will remain associated to the European Framework programmes and Horizon Europe. This will allow UK institutions to continue the very successful collaborations they established over the years and paves the way to follow-on activities to AVA.

Spotlight on our AVA Fellows – a look back and into the future. Now that many of our AVA projects are coming to an end, we thought it would be the perfect time to ask our Fellows about their time in the network, as well as about their future plans. In this issue of the MIRROR you will find the first round of interviews that shine a light on their personal experience. I am sure you will enjoy reading these as much as I did.

Prof. Carsten P. Welsch,
Coordinator

Research News

Towards Particle Acceleration in Carbon Nanotube Arrays

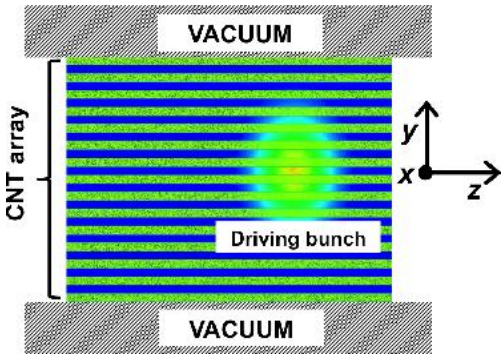
University of Liverpool based AVA Fellow Volodymyr Rodin is analyzing 3D beam transport using different simulation approaches and has applied the techniques that he developed to help model physics of carbon nanotubes-particle-beam interactions more accurately. On this he worked together with University of Liverpool PhD students Aravinda Perera and Christian Bontoiu who are conducting large-scale CPU and GPU-accelerated simulations to explore the possibility of using arrays of carbon nanotubes (CNTs) to shape, direct and accelerate particle beams.

Novel acceleration techniques such as plasma wakefield acceleration (PWFA) have in recent decades made much progress in producing particle accelerators that are, pound-for-pound, up to a thousand times stronger than conventional radio-frequency accelerators. Extrapolating such techniques to solid-state media could have the potential to produce even more intense and compact “ultra-high” accelerating fields.

A new peer-reviewed article published in a special IOP journal issue on work presented at the 4th European Advanced Accelerator Concepts workshop (EAAC2019), details preliminary work undertaken towards establishing working models of laser and particle-beam interaction with CNTs and CNT arrays.

In collaboration with Guoxing Xia and Alexandre Bonatto from the Novel Accelerators group at the University of Manchester, the team led by Javier Resta-Lopez from the University of Liverpool use the GPU-accelerated particle-in-cell code *PIConGPU* to examine laser-CNT interaction. Further, preliminary modifications to an existing code routinely employed to model PWFA, *EPOCH,* are also presented as a means of more accurately modelling physics of CNT-particle-beam interactions, supported by Monte-Carlo simulations by Volodymyr on structural damage to the CNTs by relativistic beams.

Work on detailed characterization of geometric properties, ionization thresholds, and robustness of the CNT media, as well as accuracy of the physics models used, is ongoing.



Schematic 2D plane geometry of a carbon nanotubes (CNT) array simulation model: alternating hollow channels and plasma walls inside a vacuum chamber [1]

[1] J. Resta-Lopez et al, *“Study of Ultra-High Gradient Acceleration in Carbon Nanotube Arrays”*, Proceedings of IPAC 2018

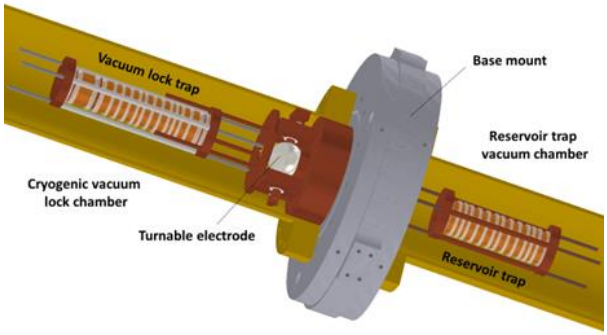
Further information:
A. Perera, …, V. Rodin et al, *“Towards ultra-high gradient particle acceleration in carbon nanotubes”*, J. Phys.: Conf. Ser. 1596 012016, 2020, https://iopscience.iop.org/article/10.1088/1742-6596/1596/1/012028

BASE is developing a transportable antiproton trap for higher-precision antimatter measurements

AVA Supervisor Stefan Ulmer at the Max Planck Institute for Nuclear Physics is founder and spokesperson of the BASE collaboration at the European particle physics laboratory CERN. The collaboration aims at precise comparisons of the fundamental properties of antiprotons and protons. Such comparisons provide stringent tests of charge-parity-time reversal invariance which is the most fundamental symmetry in the Standard Model of particle physics. This Model predicts a certain difference between matter and antimatter, but this difference is insufficient to explain the imbalance. The teams behind BASE and other experiments located at CERN's Antimatter Decelerator (AD) hall are searching for other differences between the two forms of matter.

The BASE team is now developing a transportable antiproton trap, to carry antimatter produced at CERN's AD to another facility at CERN or elsewhere, for higher-precision measurements of the properties of antimatter. The challenge for these precision measurements is limited by external disturbances to the set-up's magnetic field. Currently antiprotons produced at the AD are stored in a device called a Penning trap, which holds the particles in place with a combination of electric and magnetic fields. As the AD hall is not the calmest of the magnetic environments, this is not ideal for higher-precision measurements.

Therefore, in order to be able to perform measurements at a laboratory with a calmer magnetic environment, the collaboration proposed to make a transportable antiproton trap to take antiprotons produced at the AD elsewhere. This device, called BASE-STEP, will consists of a Penning-trap system inside the bore of a superconducting magnet that can withstand transport-related forces. In addition, it will have a liquid-helium cooling system, which allows it to be transported for several hours without the need of electrical power to keep it cool. The Penning-trap system will feature a first trap to receive and release the antiprotons produced at the AD, and a second trap to store the antiprotons.



The cryogenic inlay of the BASE-STEP transportable trap in the magnet bore. Two separate vacuum chambers contain the two electrode stacks, one forming the vacuum lock trap, the other one the reservoir trap, where antiprotons are long-term stored and protected from residual gas by a turnable electrode, which blocks the direct path from the injection port to the reservoir trap. (image credit Christian Smorra/CERN)

The overall device will be 1.9 meters long, 0.8 metres wide, 1.6 metres high and at most 1000kg in weight so that in principle the trap can be transported with a small truck or van. The research is led by BASE deputy spokesperson Christian Smorra, who received a European Research Council Starting Grant to conduct the project. BASE-STEP is expected to be completed in 2021, pending decisions and approvals. Further information can be found here.

AVA Fellow Markus Wiesinger is a member of the BASE collaboration and his project with the AVA Network is called *Sympathetic Cooling of Antiprotons*. His work focuses on advanced cooling techniques for protons and antiprotons in penning traps with the aim of improved measurements of the proton and antiproton magnetic moment.

Network News

AVA reviews project successes

Participants at the final Supervisory Board meeting.

In January 2017 the 4M€ EU-funded Accelerators Validating Antimatter (AVA) network was launched with a Kick-off Meeting in Liverpool where representatives of all partner institutions were present. They had put together a very ambitious and interdisciplinary training programme for 16 research Fellows to allow them to work at the forefront of science, participate in numerous training events and benefit from networking and various collaboration opportunities within the AVA network.

Nearly four years on, with the project coming to a close in early 2021, the Fellows were given an opportunity to showcase their research results and achievements during the final Supervisory Board (SB) meeting which took place in an online setting on 14th October 2020.

AVA Coordinator Professor Carsten P Welsch started the meeting by giving a presentation about the overall project achievements. He mentioned how the new storage ring ELENA at CERN had opened fascinating opportunities for AVA and the low energy antimatter physics community in general. He summarized the many events that the network had organized over the last four years, including workshops, schools and a large scale Symposium as an international showcase event. He also talked about the many outreach activities that the project has produced, including the AVA film and events such as Marie Curie Day and the very successful Physics of Star Wars events. The network also had the pleasure to welcome a number of new partner organisations since the project start and this was as a good indicator that there is strong interest from a much wider community. All research projects within the network have produced good results and these have been disseminated in a large number of journal and conference publications.

Following his talk, each Fellow presented a summary of their respective project to international experts from across the entire consortium. Their presentations included project results, highlighting research outcomes, interdisciplinary training and outreach activities. The latter presented AVA -

related research to the wider public in Europe and other parts of the world. This showed a number of exciting ways how the Fellows managed to inspire the next generation of scientists.

The meeting was a perfect opportunity for the Fellows to reflect on their own development and overall progression during their time in the network. The SB commended the Fellows for their research results, large number of scientific publications and invited talks, as well as their broad and interdisciplinary training. It also highlighted the excellent spirit of collaboration in the network. Given the magnitude of the COVID crisis, the SB pointed out that it was a testament to the good risk management and excellent mitigation strategies put in place by partners that only minor changes to project objectives were required and that congratulated to Fellows that the project would fully meet its objectives.

Professor Welsch said: *"I am very grateful to our fantastic project partners for their support throughout the project lifetime, in particular the AVA Steering Committee for their excellent work, and our Fellows for their commitment to excellence in research and training. A special thank you goes to my Project T.E.A.M. for their help in delivering the project to highest standards."*

The AVA project has had a global impact and is now as an established brand. All partners agreed that AVA shall now continue to serve as a platform for future joint research activities and possibly also R&D projects. The collaboration will continue its communication activities, including the website and quarterly newsletter and also has plans to organize additional workshops and events for the scientific community.

Fellows engage in AVA Careers Workshop

On 27th October 2020, the Accelerators Validating Antimatter (AVA) network held a Careers Workshop for the network's Fellows. With their training coming to an end after three years in the project, they are looking for their next career move. This event supports them in this important transition and took place online in light of current travel restrictions.

Within the AVA network more than 40 organizations from academia and industry contribute to the interdisciplinary training of 16 Fellows who are based at institutions across Europe. Given the comprehensive nature of their training, the AVA Fellows are looking at opportunities around the world and in many different sectors. To give them a better insight into the options that are now available to them, invited speakers presented career opportunities on the example of their own careers during this online workshop.

Amongst the career pathways that speakers covered, were

- the academic sector, highlighting the various challenges that have to be met by any researcher wishing to pursue a university career;
- particle therapy and the roles physicists can play in the healthcare sector;
- technology and management consultancy;
- globally operating small and medium enterprises;
- R&D in the biomedical sector.

A personal perspective of a Marie Skłodowska-Curie Actions Fellow completed the programme. The workshop was organized by AVA Coordinator Professor Carsten P Welsch with strong support of present and past members of the QUASAR Group at the University of Liverpool.

Professor Welsch said: *"The workshop showed us the diverse opportunities available to researchers on the international job market. I would like to thank our speakers for giving us a very personal insight into their own careers and the challenges they faced. This day also provided an excellent opportunity for the AVA Fellows to discuss aspects of career planning in various sectors. I am sure that this will help them decide in the future career planning."*

All workshop contributions can be found on the event webpage.

Fellows Activity

Virtual SPARC Workshop

Based at GSI, AVA Fellow Jeffrey Klimes is working on the ARTEMIS experiment where his project focuses on developing, building and testing a 'reservoir trap' which can store and deliver a well-defined number of antiprotons into precision traps for periodic measurement cycles over extended periods of time. This reservoir trap will make experiments such as ARTEMIS independent of accelerator beamtimes and shut-down periods and will provide beams at different energies.

Last Autumn, Jeffrey participated in a workshop organized by the Stored Particles Atomic Physics Research Collaboration (SPARC). The SPARC collaboration has been formed to organize atomic physics experiments at the Facility for Antiproton and Ion Research (FAIR) in Darmstadt, Germany, and aims to join expertise on atomic physics.
The SPARC held its annual workshop virtually in September 2020. This year the workshop attracted over 144 participants from more than 40 institutions around the world. There were three days of presentations, reporting on the progress of FAIR facility and phase-0 research as well as research progress within the collaboration. Research topics included experimental and theoretical atomic physics, quantum electrodynamics, and studies in ultra-high electromagnetic fields among others.

Poster presentation (Copyright Jeffrey Klimes / Pixabay)

In two separate poster sessions 62 researchers, including AVA fellow Jeffrey Klimes, presented more details about their work. The poster session was also held virtually via Zoom. Jeffrey presented an overview of the current status of the ARTEMIS experiment, including the status of its creation trap as a potential reservoir for heavy, highly charged ions from the HITRAP facility at GSI.

The workshop showcased the discovery potential of the facilities and groups that form SPARC, whether through experimentation with highly charged ions or advancement of their theoretical descriptions.

AVA Fellow co-organises Webinar on Student Opportunities at CERN

AVA Fellow Milena Vujanovic has teamed up with Lauren Yeomans, both PhD candidates at the University of Liverpool, to organise a free online webinar about Student Opportunities at CERN. This Webinar took place on Wednesday 25 November 2020 and was aimed at students at different levels in their study from undergraduates to Master and PhD students.

Milena is very familiar with student opportunities at CERN as she has held several positions at CERN. She has spent time there as a summer student, technical student, short-term intern and corporate associate. Milena also has a blog to inform and help students with their applications at CERN. So far she has supported over 500 students in this process. Her research project within AVA targets novel diagnostics that will benefit the antimatter decelerator facility at CERN. Lauren joined CERN through the University of Liverpool during her PhD and her research involved the LHCb experiment at CERN.

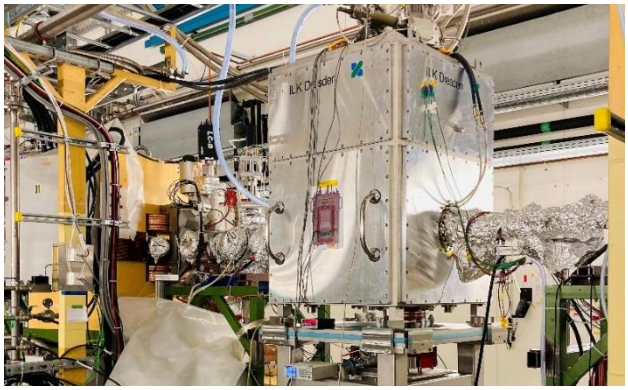
During this webinar Milena and Lauren talked about positions at CERN that are available to students. Examples of these opportunities are the Doctoral Student Programme, the Technical Student Programme and Short-Term Internships to name a few. During this webinar not only details on the various programmes were presented, areas such as the conditions and eligibility in order to participate in these programmes were also covered. This was then combined with useful information about the application process and on how to prepare a good motivation letter and Curriculum Vitae.

With institutions and universities from many countries active at CERN there are a range of options for student get involved. This webinar also provided information about different routes students can take to work at CERN. The webinar closed with a Q&A session where participants were given the chance to ask Milena and Lauren questions. The event was attended by 3,585 participants with a further 292 students who watched the recording, which was available online for a limited period, afterwards.

First beam for the Cryogenic Current Comparator at CRYRING

AVA Fellow David Haider is based at the Beam Instrumentation group at GSI carrying out *Ultra-sensitive Beam Intensity Measurements*. Within this project a Cryogenic Current Monitor is being developed to allow versatile non-destructive intensity monitoring in storage rings and transfer lines with great precision, which benefits a wide range of areas from an improved control during antimatter production to a new level of online dose monitoring in radiation therapy.

As part of this work David introduced an absolute DC beam current measurement for beam intensities below 100 nA that are stored at the low energy storage ring CRYRING.



CCC system including helium cryostat and liquefier unit was installed at CRYRING

In November 2020, he helped to install the Cryogenic Current Comparator (CCC) system, which included a helium cryostat and a liquefier unit, at the CRYRING.

The next month, the FAIR CCC monitored weak beams of Ne3+ with stored beam intensities of a few nA throughout the whole accelerator cycle. The signal is calibrated with a standardized electric current to obtain absolute intensity values. Thus, at low beam intensities the signal of the CCC can be used to calibrate other instruments like Beam Position Monitors (BPMs) or Ionisation Profile Monitors (IPMs) that typically require elaborate studies to obtain absolute intensities. In addition to this, the CCC can operate with coasting beam where other devices become insensitive.

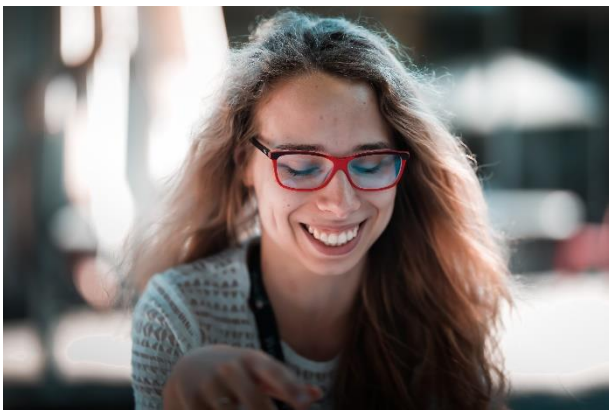
David then went on to collect first data during the beam time in December in which beams of D+, Ne3+ and Ne4+ were characterized and the lifetime of the stored neon ions will be estimated.

"After all the struggles to bring the CCC system to CRYRING in time, the recent beam time turned out to be a great success", adds David before he started his Christmas vacation. The machine operators, but especially the experiments, will profit from the low intensity data that is now available at CRYRING@FAIR.

AVA Fellow Interviews – A look back and into the future

Now the formal period of the project has come to an end, this is a good moment to look back at the Fellows' time with AVA. We have asked the Fellows a few questions as part of the AVA Spotlight Interview series; this will give you a more personal insight into their motivation, achievements and outlook.

Spotlight on Dominika Alfs



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For this interview we have spoken with Dominika Alfs who joined the AVA Network at Forschungszentrum Jülich (FZJ), Germany, in September 2017. She worked on the development of liquid target-based detectors in view of design studies of a detector system for hadron physics experiments induced by the annihilation of stopped antiprotons, which includes also the investigation of beam monitoring systems.

What did attract you to the AVA network? Has it fulfilled your expectations?

"Towards the end of my studies I already knew that I would like to focus on research, at least for a few more years. The AVA project clearly stood out from other possibilities. It gave the opportunity to work in cooperation with well known institutions on the projects that touched the most up-to-date problems in the field of low energy antiproton physics. But what really made AVA unique was the fact that it was a network with several cooperating institutions,

a well defined program of scientific and soft skills training and, most importantly, other fellows that started to work on their project more or less at the same time. Already at the beginning it looked promising and now I can clearly see how important it was. Has the fellowship fulfilled my expectations? It exceeded them by far!"

Why did you choose to go to FZJ?

"It was the project that was offered by FZJ (Liquid Target-based Antiproton Detectors). I really wanted to broaden my knowledge about detector systems and their design. The project seemed to be a perfect combination of experimental work, experimental data analysis and simulations, where results from one area directly influence the others. Furthermore, FZJ is a large research centre conducting research in various disciplines. Joining that institution was an exciting perspective!"

Can you explain in a few words what your project was about and what have you achieved?

"My project was centred around antiproton detectors. I worked on the design of a setup for studies of the strong interaction between protons and Ξ hyperons. This region of baryon-baryon interaction is relatively poorly investigated due to the short lifetime of hyperons. However, it turns out that low energy antiprotons can be used to start a reaction chain that can be used for this type of studies. A special feature of this process is an increase of the number of charged particles at some distance from the target due to several delayed decays of the produced particles. This directly influences the detector design. I investigated possible solutions for the setup elements and their impact on the detector performance. I had a chance to develop Monte Carlo simulations as well as work on results of real measurements with considered elements. This work resulted in a proposal of detector geometry."

What has AVA provided you professionally?

"Of course, I broadened my knowledge about antiproton physics, detectors, experimental methods and many more. I had a chance to work with great supervisors and scientists and I learned a lot from them. But what is equally important are also all other skills that I acquired. I worked in an international environment, prepared countless presentations, talks and reports, learned about 'the science behind soft skills'. This gives me a lot of confidence now, when the project is formally over."

Can you say something about your next career move?

"At the moment of answering this question I am just before my PhD defence and preparations still keep me busy. I am thinking about different options but right now COVID-19 has made planning a bit more difficult. Therefore, I would like to wait to reveal my next career move until it is certain to happen."

What will be your most cherished memory from AVA?

"I have many great memories! But I think that the most cherished one is the first meeting of AVA in January 2018. I still remember a mixture of curiosity and excitement before. We spend about two weeks in Liverpool and Manchester participating in our first researcher skills training and working on the AVA video. We all learned a lot, but we also had a chance to get to know each other. Now, three years later, even though the AVA project is formally over, the friendships still last and I hope that the situation will allow us to meet again soon."

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Spotlight on David Haider

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David Haider joined the AVA Network at GSI, Darmstadt, Germany in November 2017. Within GSI's Beam Instrumentation group, David has been carrying out ultra-sensitive beam intensity measurements.

What did attract you to the AVA network? Has it fulfilled your expectations?

"To me, the promise of AVA always has been the wealth of knowledge within the research partners it brings together and the active support to take advantage of this treasure in order to develop ones expertise and research skills. For a young graduate this seemed to be the perfect environment to start a career and AVA certainly has met these expectations. Moreover, the diversity of the partner institutions in both the public and the private sector offered insights in many different aspects of the ongoing research. The high degree of financial independence and the tailored training courses further helped to make the most out of the fellowship. In my opinion, AVA is a great European example of how young scientist can be supported and encouraged in their career to become an active part in the scientific community."

Why did you choose to go to GSI?

"When I read for the first time about the AVA project at GSI, I found many links to my previous research projects and saw the chance to apply my experience in the exciting environment that an accelerator facility has to offer. Moreover, the upcoming FAIR accelerator complex that now takes shape at GSI promised a future full of good and exciting research possibilities. Taking into account the knowledgeable and welcoming colleagues that I met at the job interview, it was an easy choice."

Can you explain in a few words what your project was about and what have you achieved?

"The goal of my project was an ambitious one, to design, build and to take into operation a system that surpasses all the existing beam instrumentation at GSI when the low beam intensities of fascinating but rare ions are concerned. Now, at the end of the project, extremely low ion currents smaller than 100 nA were measured at the storage ring CRYRING with a new system based on a highly sensitive superconducting magnetometer. This cryogenic sensor detects the faint magnetic field of the particle beam, which is about a billion times smaller than the magnetic field of the Earth. With this system developed during my AVA project, all future experiments at the ring can profit from the improved current measurement and the setup can serve as a prototype for several additional installations planned throughout the FAIR accelerator complex."

What has AVA provided you professionally?

"After graduating from university, I had a vague understanding of what working in science means. It only was during my project at GSI when I learned how to navigate through the endless possibilities in the lab and through the criticism of colleagues, in short, to pick up the craft of being a scientist. Beyond scientific struggles, it was AVA that offered a platform to go one step further, to lift the debate to a European level and to be recognized in the international community. Moreover, in AVA it has

always been a priority to help us develop a vision of our future career and to provide us with the toolkit to realize it. I am sure, this dedication to shape our professional profile, will always be useful in my career. Finally, on a personal level, the efforts of AVA to engage the public in science, lead me to appreciate the social responsibility of researchers in the intimate relation between the public and science."

Can you say something about your next career move?

"These days I focus on writing my PhD thesis, which leaves me with a little bit of time to consider my career possibilities. With the experience gained during the AVA project, I am looking forward to an interesting and ambitious challenge ahead."

What will be your most cherished memory from AVA?

"What I value most, is definitely the great time that I had with the AVA fellows, filled with engaging debates and cheerful moments. I wish them all the best in their career and I am looking forward to the next time I meet any of them."

Spotlight on Bruno Galante

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For this interview we have spoken with Bruno Galante who joined the AVA Network as a Fellow at CERN, in October 2017. There he has been part of a project involved in the generation of cold electrons for the cooling of an antiproton beam due to reduce or eliminate the emittance blow-up caused by the deceleration process.

What did attract you to the AVA network? Has it fulfilled your expectations?

"I was attracted by several aspects of this network. First of all, I was attracted by the project itself in terms of my personal interest, but also AVA in general. My own subject on "Generation of Cold Electrons for an eV Electron Cooler" was extremely interesting and challenging, but by being member of the network I also had the chance to receive periodical news about all the other projects which proved to be extremely fascinating. Within the AVA framework we could gain expertise, or at least basic knowledge, about most of these topics and this would have been impossible otherwise. Secondly, the possibility to work at CERN while at the same time being connected with many more institutions and people working all around Europe on related subjects are of great interest to my personal background. This, as expected and hoped for, gave me the possibility to build a strong and big network that would have been impossible otherwise to build in such a small timeframe."

Why did you choose to go to CERN?

"Because as a physicist it was a dream to work in such an important research centre as CERN. Moreover, I was lucky enough to apply for a project that was also the best match for my previous background. I would say that it was a bit of a lucky strike from this point of view. I am very happy that things worked out this way."

Can you explain in a few words what your project was about and what have you achieved?

"The aim of my project was to study and design an electron gun for the ELENA (Extra-Low ENergy Antiproton facility) complex, in particular for the electron cooler of ELENA. In ELENA's electron cooler a thermionic cathode is used and my goal was to try and study the feasibility of using field emission for the electron beam production instead. The former uses temperature to excite and extract the electrons and an electric field is then used to guide them, while the latter is only based on the application of a strong electric field, thus removing the temperature from the equation. The reason for this is to reduce the transverse energy spread of the electron beam, while at the same time making the gun layout as simple as possible. Especially since currently a few workarounds have been used in order to keep the transverse energy spread value as low as possible. During my time with AVA I have studied a material called carbon nanotubes, to be used as a field emitter for the purpose mentioned above. Carbon nanotubes are an extremely new material, therefore needed an extensive characterization for what concerns emission performance and stability. We proved that stable emission is possible for hundreds of hours and established a best practise in order to make them perform at their best. The design of the gun, despite being still ongoing, reached its final phase during the AVA timeframe thanks to numerous simulations regarding all its components."

What has AVA provided you professionally?

"I think AVA gave me a lot from a professional point of view. First of all, it gave me the possibility to do a PhD that I am now still working on and hope to finish in the next year or so. This is of course a big step ahead for my professional career. At the same time, I was also a fellow at CERN which meant that I had the possibility to almost have two different careers progressing along.
Moreover, through AVA resources I had the possibility to attend a number of courses spanning from language courses to technical courses regarding simulation tools, physics notions or even soft skills. This has been extremely useful during the project as well as for the future. Lastly, but not least, I was able to take part in various secondments. These enriched my knowledge by gaining expertise on processes and techniques that could not be performed in my host institution."

Can you say something about your next career move?

"First, I need to finish my PhD, and this alone will surely prove to be extremely challenging! Afterwards there are a few options that I am considering. I am still undecided on whether trying and continue in the academia sector or moving to the private sector, but for what I could see both of them would be suitable choices for me."

What will be your most cherished memory from AVA?

"Surely all the schools and events with the other AVA fellows. I think we had a great time together and we all became friends other than colleagues during these past three years."

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Partner News

CERN launches new and multidisciplinary science innovation forum 'Sparks!'

A new and multidisciplinary science innovation forum and public event called *Sparks! Serendipity forum at CERN* was launched via a virtual conference.

Copyright: Claudia Marcelloni (CERN)

Via this forum, CERN will bring together renowned scientists from diverse fields around the world, along with decision makers, representatives of industry, philanthropists, ethicists and the public to bring a novel, multi-faceted approach to addressing some of the big questions of our time. The goal is to foster a new community and develop a platform to spark innovation in issues related to science, technology, engineering and mathematics that are relevant to society, necessary for CERN, and that further CERN's mission of science for peace.

At the launch event, scientists talked about the current status of the field of AI research and how CERN and other big science can benefit of AI, setting the scene for the discussion about the future of this field during the event in 2021. Sparks! will begin with a cycle of three pilot events between 2021-2023, each focusing on a single theme.

The first edition is focussed on **Future Intelligence** and kicks-off with a podcast series in January 2021 with the Forum to take place at CERN, Meyrin (CH), on 17-18 September 2021. On the last day of this Forum, a public event at HEAD, Geneva (CH) closes the 2021 Edition.

CERN is the world's largest particle physics laboratory which acts as a focal point for European physics and technology collaborations. It has a very strong track record as a European training centre and it has great experience in tutoring and mentoring of early stage researchers as well as in the transmission of complementary kills. CERN has been an AVA Partner since the launch of the AVA Network in 2017.

Research physicist at CERN and AVA Steering Committee member Dr Michael Doser, who also sits on Advisory Board for Sparks!, said: *"Machine learning, neural networks, but also other forms of artificial intelligence are playing an increasing role both in extracting subtle results from experiments in fundamental research as in detecting anomalies and dealing with them. The first Sparks forum will take a step from these present applications and will focus on future challenges: recognizing (and learning to ignore) repetitive situations, implementing artificial curiosity and perhaps even creativity, and exploring how future AI technologies and approaches can help science address ever more complex questions"*

Further details, including information about the first edition and its podcast series, can be found here: https://sparks.cern. This website also provides the possibility to re-watch the virtual launch event that took place on 26 November 2020.

Video update on the FAIR construction at GSI

Future ring accelerator SIS100 (Copyright D. Fehrenz/GSI/FAIR)

At GSI - Helmholtz Centre for Heavy Ion Research, AVA Fellows David Haider and Jeffrey Klimes conducting their research. The research centre has been involved with the AVA Network since the beginning of the project and has also been a host for many Fellows during their secondments.

GSI, based in Darmstadt, is the German national centre for heavy ion research and hosts a large accelerator facility where high beam intensities for heavy ions are accelerated up to several GeV/u. Next to the GSI-complex, a worldwide unique accelerator facility is currently being constructed for heavy ions and antiprotons, the Facility for Antiproton and Ion Research (FAIR). The facility is designed for first class research in the field of atomic, nuclear and plasma physics, material sciences and biophysics and will be used to create and study matter in the laboratory that otherwise only occurs in the universe.

The construction work started in 2017 and on a site of approximately 20 hectares, 25 buildings are being constructed. Some of the unique building structures reach from 17 meters below ground level to 20 meters above the earth's surface. The key component of FAIR is a ring accelerator (SIS100) with a circumference of 1,100 meters. Connected to this is a complex system of storage rings and experimental stations. The existing GSI accelerators will serve as the first acceleration stage.

In November 2020, GSI published a new 3-minute video of the construction site at FAIR. Here you can find a number of videos such as a time lapse of the site and an overview of the entire construction cycle. Regular photo updates are also published, going back to the excavation of the SIS100 tunnel in April 2018. There is a separate page with interactive picture sliders that provide new insights and makes the progress on the large particle accelerator facility clearly visible. Viewers can compare several important stages in the construction process in 2018 and 2020.

Further information and updates about the FAIR mega-construction project can be found here.

Upcoming Seminars and Events

Online Colloquium and Seminar Series on charged particle accelerators

Physicists active in accelerator science from across the world have teamed together in organizing the One World charged particLe accElerator (OWLE) Colloquium and Seminar Series. It was established during the COVID-19 crisis as an inter-institutional global online series which can be joined by anyone via video conferencing tool Zoom.

The OWLE-Colloquiums are aimed at giving researchers a platform to share research and development results of very broad interests with the talks held every first Tuesday of the month at 19:30 (CET). The OWLE-ML Seminars have a topical focus on machine learning (ML) and experimental demonstrations of AI-ML and are held every second and last Tuesday of the month at 20:30 (CET).

A dedicated OWLE website provides abstracts for all talks, Zoom connection details for all future talks and video recordings of past presentations as a useful resource to (re)view at a convenient time.

The first colloquium and seminar took place in September 2020 with future talks currently scheduled until February 2021. These talks could be of interest to scientists working in accelerator science and related research areas at any stage of their career.

AAC Seminar Series

When the 2020 Advanced Accelerator Concepts (AAC) Workshop had to be cancelled due to the pandemic, the online AAC Seminar Series was developed. It provides an opportunity to present and discuss the latest advanced particle accelerator research and development until the accelerator community can safely re-convene for an in-person AAC Workshop.

The AAC Seminar Series is organized into working groups covering topical areas such as:

- Laser-Plasma Acceleration
- Computation for Accelerator Physics
- Beam-Driven Acceleration
- Radiation Generation and Advanced Concepts
- Advanced Laser and Beam Technology and Facilities

Each week's session is dedicated to a Working Group topic and consists of two plenary talks, followed by invited talks by junior researchers, and discussion.

The Seminar Series convene each Wednesday morning at 8:30 (Pacific time, GMT/UTC -8). The talks are presented live, using Zoom, with all sessions being recorded and made available to invitees.

The Seminar Series is free of charge and accessible by invitation after registration.

If you have any questions about the Seminar Series, the Workshop, or would like to join the mailing list, please write to aac2020@lbl.gov

National Particle Accelerator Open Day

The Cockcroft Institute will organise a virtual national particle accelerator open day on Wednesday, 3rd February 2021 for undergraduates studying engineering or physics at UK universities. The national particle accelerator open day has been an annual feature where one of the UK facilities opens their doors to UK students, alongside talks on career opportunities and a recruitment event.

This year the tours will be done in a virtual environment with two tours planned, one of the Diamond light source, the UK's flagship synchrotron light source, and one of the Elekta factory, a world-leading producer of radiotherapy machines.

The open day will have an exciting programme of events including talks and virtual lab tours, as well as the opportunity to talk to UK universities, laboratories and industry to learn how you can find studentship and employment opportunities in this exciting field.

More information, including registration to access the event, via: https://acceleratoropenday.co.uk/

12th International Particle Accelerator Conference - IPAC'21

The 12th International Particle Accelerator Conference - IPAC'21 will be held in virtual format from 24th - 28th May 2021, organized by the Brazilian Center for Research in Energy and Materials (CNPEM), located in Campinas, Brazil.

IPAC is the main international event to discuss the latest achievements in the science and technology of Particle Accelerators, promoting collaboration among scientists, engineers, technicians, students and industrial partners across the globe. This is a most exciting time in the field, with many new projects and challenges leading to innovation into the near future.

For registration and more information visit:
https://www.ipac21.org/

International Conference on Radio Frequency Superconductivity - SRF'21

The virtual conference will take place from Monday 28th June to Friday 2nd July 2021, and will be hosted by Michigan State University (MSU).

The conference will include invited oral talks by video-conference, and several virtual reality poster sessions. With the need to accommodate different time zones, the sessions will be limited to 4 hours per day. A session for "virtual lab tours" is considered at the end of the conference, with the possibility for participants to learn about their choice of several labs around the world. Best student poster prize and best young researcher presentation prize are also planned. In addition, a tutorial program by video-conference is planned in the week preceding the conference.

More information:
https://indico.frib.msu.edu/event/38/

Position Vacancies

Open positions at CERN:

Theoretical Physicist (TH-SP-2020-75-LD): The CERN Theoretical Physics Department (CERN-TH) has launched a talent pool recruitment exercise for Limited Duration (LD) research staff positions. This pool aims at defining a list of pre-assessed and endorsed candidates that can be hired for present and future opportunities, determined by the needs of the Organization. We are looking for outstanding researchers in any of the areas of theoretical particle physics traditionally covered at CERN.

Full details via https://careers.cern/alljobs

Electrical Technician for HL-LHC2kA-10V project: TTPE Programme - Are you an enthusiastic electrical technician looking for a challenging professional experience to further your career? If so, joining CERN's TTE programme may very well give you that challenge. In the framework of the HL-LHC, 36 new power converters units of [±2 kA: ±10 V] will be required to operate the new particle accelerator. The power converters will be created through a standard process of design, develop, test and production. You will join the Systems Department and the EPC group in charge (design, commissioning and operation) of the electrical power converters for all CERN accelerator complexes and more precisely the LPC section responsible of the Low Power Converter.

Full details via https://careers.cern/alljobs

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

PhD Project: A novel optical fibre analysis system for particle accelerators
The QUASAR Group, in collaboration with the beam instrumentation company D-Beam, has developed a novel beam monitor based on optical fibres. This PhD project will be based on this successful collaboration and target the development of a more comprehensive diagnostic system.

Further details: https://www.findaphd.com/phds/project/an-novel-optical-fibre-analysis-system-for-particle-accelerators/?p128957

PhD position: Supersonic Gas Jet for High Luminosity LHC
The Cockcroft Institute has pioneered the development of a supersonic gas jet as a non-invasive beam profile monitor. This is a unique monitor that allows the characterization of highest energy beams. A particular challenges arises in the High Luminosity LHC where the profile of the primary proton beam needs to be measured in parallel of the profile of the electron beam in the hollow electron lens.
In the frame of this PhD project, you will design, construct and commission a gas jet monitor for the High Luminosity LHC (HLLHC).

Further information: https://www.findaphd.com/phds/project/supersonic-gas-jet-for-high-luminosity-lhc/?p128958

Events

ongoing	Online Colloquium and Seminar Series on charged particle accelerators
ongoing	AAC Seminar Series, via Zoom
3rd February 2021	National Particle Accelerator Open Day, virtual event
24th - 28th May 2021	12th International Particle Accelerator Conference (IPAC'21), virtual conference
28th June – 2nd July 2021	International Conference on Radio Frequency Superconductivity (SRF 2021), virtual conference

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 CONTRIBUTIONS: 15th April 2021

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