

Proton cancer therapy among areas threatened by skills shortage

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oPAC fellow at CERN installing radiation detectors

Improving proton therapy for cancer treatment is one of the many advances in accelerator science that have been fast-tracked by a unique approach to academia-industry training, led by the Cockcroft Institute.

The two programmes, which have produced 42 highly valued research fellows, are drawing to a conclusion and industry partners are warning of a skills chasm in the very near future unless further training is prioritised.

Prof Dr Carsten Welsch is Head of the Liverpool Accelerator Physics Group at the Cockcroft Institute in Daresbury, an internationally renowned centre for accelerator science and technology. He says: "Europe is investing heavily in world-class research facilities that will offer unprecedented insights into medical and material sciences, nuclear physics and the processes of life itself but we are not investing in the people we need to exploit these opportunities and already there is a skills shortage."

Prof Welsch has been leading two pan-European programmes which are creating fellows with vital skills in particle physics, beam technologies and laser science. These programmes are set to end this year. Of particular concern is the potential impact on medical therapies, in particular the use of charged particle beams for cancer treatment.

Prof Welsch says: "In proton beam cancer therapy, for example, our research fellows have improved ways to provide particle beams, developed advanced detector technologies to monitor the beam and dose during patient treatment and designed simulation tools to improve the understanding of these treatments.

"Pioneering work by our academic and industry project partners show [proton therapy](#) has numerous advantages over conventional treatment methods. Indeed dedicated clinical facilities are currently being built across the EU – including two proton therapy units in the UK – so that 1000s more patients will be able to benefit from the unique advantages of these technologies."

He explains that particle accelerators underpin many of the large scientific infrastructures that are vital for Europe's international competitiveness. These include the X-ray Free Electron Laser (XFEL) in Hamburg, which enables the study of biological and chemical processes at the shortest time scales and with extraordinary resolution; and the European Spallation Source (ESS) in Lund, Sweden, which will be the highest power neutron facility in the world and push the limits in material sciences, lifesciences, and nuclear physics.

The training programmes led by the Cockcroft Institute – oPAC for accelerator optimization, and LA3NET lasers for applications at accelerator facilities – are designed with the input of partners from research institutes and industry and have provided unrivalled skills development for over 40 research fellows from all over the world who offer significant commercial benefit to their employers.

In an emerging technology area, collaboration between the key players is essential to build skills and knowledge and the programmes have been successful in creating a community of highly networked accelerator scientists and engineers.

The Cockcroft Institute is warning that this community will lose momentum if the pan-European training programme is not adequately supported; developing skilled accelerator scientists and engineers with sufficient industry experience is beyond the resources of a single organisation or nation.

Industry insights

Howard Smith is Engineering Director of UK company TMD Technologies, one of the world's foremost suppliers of high power microwave amplifiers. He says his organisation has the potential to double next year with the pipeline of prospects he is currently bidding

for: "Accelerator science encompasses a large part of the RF power market and oPAC has provided a method of keeping in contact with this market, meeting the next generation of scientists and engineers and understanding future requirements.

"Accelerator equipment is mainly manufactured by industry funded through profit, and design is by research institutes funded by governments .oPAC fills the gap by bringing the key players together so that research is directed to industry need. In our opinion the fellows have been of a very high standard and have made a significant contribution to our understanding of the requirements of accelerator science."

Erich Griesmayer is CEO of Austrian company CIVIDEC, developers of cutting-edge beam diagnostics; he comments that concerns about a skills shortage are well founded: "Accelerator science is – beside advances in microelectronics – the driving force for innovation and economic prosperity of the future. Synchrotron light sources are the fundamental basis for any advance in material science and biological science, and accelerator-driven nuclear power generators offer potential candidates for future energy sources.

"Accelerator science requires a high degree of engineering skills and it is extremely difficult to recruit people with the right skills.

"The mutual stimulation of research and industry that has been achieved within oPAC is the best basis for innovation. The accelerator systems being developed are highly optimized to customer needs and provide high quality beams for a wide range of applications.

"The benefits of such a programme to my organisation are huge; we have trained a young fellow through oPAC who will get a permanent staff position in our company. He has been taught experimental physics and scientific computing and has become an expert in the field of particle

detectors and their applications to charged particles, photons and neutrons. In my experience, this combination of width and depth is exceptional for a fellow of his young age."

The Cockcroft Institute on behalf of its industry and academic partners is calling for a continuation of these programmes developed to train world-class accelerator scientists.

The outcomes from LA3NET and oPAC will be showcased at a symposium in the Liverpool Convention Centre on 26 June 2015 with world-renowned speakers. It will emphasize the fantastic results already achieved by accelerator-based research.

Prof Welsch says: "It is brilliant to see the level of expertise our Fellows have now reached and their excellent research results. This symposium will provide an insight into the economic, scientific and societal benefits of this work.

"Our academic and industry partners say that this training has been unparalleled. I hope that we will be able to give similar opportunities to future generations of researchers. Otherwise advances such as those in cancer proton therapy cannot be sustained."

Provided by Cockcroft Institute

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