

## Centre for the Clinical Application of Partices; activity report December 2018

This report covers the period from 16<sup>th</sup> October 2018. The Centre's annual report, which was submitted on the 1<sup>st</sup> November 2018, contained an update on the Centre's activities. Therefore this bimonthly report will focus on highlights of the activities that took place in November 2018.

### 1 Third CCAP Plenary meeting, Charing Cross Hospital, 7<sup>th</sup> November 2018

The Centre organises a six-monthly plenary meeting at which personnel active in developing the Centre's research programme present their work. Discussion at these meetings is important in defining the evolution of the Centre's programme. The third meeting in the series took place at the Charing Cross Hospital<sup>1</sup>.

#### Topics discussed:

- *Ultra-high dose rate electron-beam radiotherapy (FLASH-RT)*: The evidence for enhanced tissue sparing when radiotherapy is delivered at rates in excess of 40 Gy/sec ("ultra-high dose rate", UHDR) was presented (J. Yarnold, ICR). The potential impact of oxygenation and the differences between measurements made in-vitro and in-vivo were discussed. A possible research programme in which the response of human skin exposed to UHDR and conventional electron beams is measured was proposed. The possibility that two clinical electron linacs may become available at The Charing Cross Hospital (CXH) was presented (R. McLaughlan, C. Hardiman, CXH). Machines of the type that may become available at CXH have been modified successfully to deliver dose rates in excess of 200 Gy/s. The possible modification of one of the CXH machines to deliver electron beams for experiments was discussed. While it was not yet clear whether either of the two clinical machines would become available for research, it was agreed that a discussion should be organised to understand whether the modifications required to deliver the proposed programme were feasible.
- In addition to two presentations on the status of the R&D programme by which a proposal for the Centre's "Laser Accelerator for Radiobiological Applications" (LARA) will be brought forward (J. Pasternak, J. Pozimski, Physics), a review of the status of research into laser-driven beams for medical applications (O. Ettlinger, Physics) was presented. In Europe, the principal laboratories active in this are: are Queens University, Belfast (QUB); GSI, Darmstadt; HZDR, Dresden; LULI, Paris; LNS, Catania; and ELIMAI-ELIMED, Prague. The CCAP had begun to establish links with QUB through discussions with K. Prise (QUB) following his seminar on the 24<sup>th</sup> October 2018. The possibility of developing a collaboration with other European institutions active in this area was discussed.

The plenary meeting also included contributions on: the STFC CASE Student proposal to develop algorithms for the automation of the processing of cone-beam CT images to facility accurate adaptive radiotherapy (R. McLaughlan, CXH); the development of scintillating-fibre detectors for real-time in-situ dosimetry in radiobiological experiments; and the progress of the Centre's contribution to the carbon-ion beam commissioning at MedAustron (H.T. Lau, Physics).

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<sup>1</sup> <https://ccap.hep.ph.ic.ac.uk/trac/wiki/Communication/Plenary/2018-11-06>

**Outcomes:**

- *Ultra-high dose rate electron-beam radiotherapy (FLASH-RT)*: Action has been taken to organise a meeting to understand whether the modifications required to deliver the proposed UHDR electron irradiation programme are feasible.
- *Exploration of collaboration with GSI and HZDR*: A visit to GSI in December 2018 to discuss possible collaboration had already been planned. The review of research into laser-driven beams for clinical applications highlighted the work being carried out in Dresden as being closely aligned with the ambitions of the Centre. Therefore, through our collaborators at the Medical University of Vienna, contact has been made with the HZDR and, following an initial exploratory phone call, plans are being laid for a visit to Dresden to discuss collaboration. It is hoped that this visit will take place early in the New Year.

## 2 Collaboration with CERN

**Background:**

CERN has begun to consider the development of innovative linac- or synchrotron-based options for the next generation of proton- and ion-beam research and therapy facilities. The Balkan states have indicated their interest in establishing such a facility. CERN is therefore considering the initiation of a successor to the “Proton-Ion Medical Machine Study” (PIMMS), which was carried out at the turn of the century and led to the establishment of proton- and ion-beam centres at MedAustron and CNAO. The successor study, PIMMS2, will include consideration of various ion species, including helium and carbon.

The objectives of the study are well aligned with the goals of the CCAP. Therefore a meeting to discuss collaboration was held at CERN on the 13<sup>th</sup> November 2018<sup>2</sup>.

**Objectives:**

- Discuss areas for the development of collaboration between the Centre and CERN with a view to establishing a significant collaborative role in a future PIMMS2 project; and
- Discuss mechanisms by which to initiate the recruitment of a student into the CERN Doctoral programme as a means of making a concrete start on a collaborative R&D programme.

**Outcomes:**

- Discussion at the meeting confirmed that, at present, the most mutually beneficial area for collaboration was at the low-energy (0–15 MeV) end of the accelerator including the ion source, low-energy acceleration, low-energy beam transport and instrumentation;
- Two vehicles by which the resources to support a CERN doctoral student could be secured were identified: an application by a student recruited into the Centre’s programme for a CERN Associate Position, and, the joint application by a named student and the CCAP supervisor for a CERN Doctoral Student position.

Both avenues are being pursued in the present post-graduate recruitment exercise.

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<sup>2</sup> <https://ccap.hep.ph.ic.ac.uk/trac/wiki/Research/RT-RnD/Meetings/2018-11-13-CERN>