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First dual isotope beam production for simultaneous heavy ion radiotherapy and radiography

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In the context of research on simultaneous heavy ion radiotherapy and radiography, a mixed carbon/helium ion beam has been successfully established and investigated at GSI for the first time to serve fundamental experiments on this new mode of image guidance. A beam with an adjustable ratio of $^{12}\text{C}^{3+}/^4\text{He}^{+}$ was provided by the 14.5 GHz Caprice ECR ion source for subsequent acceleration in the linear accelerator UNILAC and the synchrotron SIS18. Despite the mass difference between the $^4\text{He}^{+}$ and $^{12}\text{C}^{3+}$ ions, both could be slowly extracted simultaneously at 225 MeV/u using the transverse knock-out extraction scheme. The ion beam has been finally characterized in the biophysics cave in terms of beam composition (particularly inter- and intra-spill He fraction), depth-dose-profiles, beam size, position and other parameters, all related to combined ion beam treatment and online monitoring. Utilizing high-speed particle radiography techniques, a fast extracted mixed ion beam has also been characterized in the plasma physics cave under conditions favorable to FLASH therapy.

Footnotes

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Primary author: GALONSKA, Michael (GSI Helmholtzzentrum für Schwerionenforschung GmbH)

Co-authors: GRAEFF, Christian (GSI Helmholtzzentrum für Schwerionenforschung GmbH); ONDREKA, David (GSI Helmholtzzentrum für Schwerionenforschung GmbH); VARENTSOV, Dmitry (GSI Helmholtzzentrum für Schwerionenforschung GmbH); MAIMONE, Fabio (GSI Helmholtzzentrum für Schwerionenforschung GmbH); STADLMANN, Jens (GSI Helmholtzzentrum für Schwerionenforschung GmbH); VOLZ, Lennart (GSI Helmholtzzentrum für Schwerionenforschung GmbH); Dr SCHANZ, Martin (Los Alamos National Laboratory); SPILLER, Peter (GSI

Helmholtzzentrum für Schwerionenforschung GmbH); HOLLINGER, Ralph (GSI Helmholtzzentrum für Schwerionenforschung GmbH); REIMANN, Stephan (Goethe Universität Frankfurt); BARTH, Winfried (GSI Helmholtzzentrum für Schwerionenforschung GmbH)

Presenter: GALONSKA, Michael (GSI Helmholtzzentrum für Schwerionenforschung GmbH)

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