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Treatment Planning for Multi-modal, Multi-port, Multi-fraction Synchrotron Radiotherapy

Treatment planning for synchrotron radiotherapy is a complex and time-consuming task, but it has been simplified with the Eclipse Treatment Planning System (TPS) (Varian Medical Systems). In this work, we present the first use of Eclipse for the planning and delivery of multi-modal, multi-fraction, and multi-port synchrotron radiotherapy treatments.

Tumour cells were implanted into the mammary fat-pad of 105 mice. The mice were evenly distributed into five groups: four receiving three daily fractions, and one un-treated control group. Each group was prescribed a treatment consisting of different combinations of microbeams (MRT) and broadbeams (BB): (1) BB-BB-BB, (2) BB-BB-MRT, (3) MRT-BB-BB and (4) MRT-MRT-MRT. Beam-qualities were chosen such that (1) each field had an equivalent spectrum, that (2) FLASH dose rates (>40 Gy/s) were achieved, and (3) the treatment was deliverable on the DynamicMRT system on IMBL at the ANSTO Australian Synchrotron. A representative treatment plan was calculated for each group. Individual treatment plans were calculated for each unique field and summed to create a finalized plan for each of the four protocols.

Two Tesla AlCu and four Tesla AlCu beam-qualities were used for the broadbeam and microbeam irradiations respectively. Microbeam fields were planned with 200 centre-to-centre spacings and 285 Gy peak and 5 Gy valley doses; broadbeam doses were prescribed 8 Gy. The summed treatment plans for each of the four protocols allowed dose-volume-histograms to be exported and assessed per treatment-regime. This is the first reported use of a TPS being used for multi-modal, multi-port, multi-fraction synchrotron radiotherapy treatments.

Level of Expertise

Student

Presenter Gender

Man

Pronouns

Do you intend to attend UM2022

In person - Melbourne

Students Only - if available would you be interested in student travel funding

Yes

Students Only –Do you wish to take part in the Student Poster Slam

Yes

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Yes

Primary authors: BARNES, Micah (University of Wollongong); ENGELS, Elette (University of Wollongong); Dr CAMERON, Matthew (ANSTO); KLEIN, Mitzi (Australian Synchrotron); Mr CROSBIE, Jeffrey (XRV); Dr FERNANDEZ-PALOMO, Cristian (Institute of Anatomy, University of Bern, Switzerland); Dr TRAPPETTI, Verdiana (Institute of Anatomy, University of Bern, Switzerland); HAUSERMANN, Daniel (Australian Synchrotron (ANSTO)); Dr DJONOV, Valentin; MARTIN, Olga (Peter MacCallum Cancer Centre); LERCH, Michael (University of Wollongong)

Presenter: BARNES, Micah (University of Wollongong)

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