recombination correction factors appear depending on the orientation of the chamber which is also consistent with other observations in the literature and with the theory of Jaffé.

PO-0833
CHO cell depth-survival distributions after different configurations of contralateral carbon beams
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Purpose/Objective: Contralateral ion beams, both with spread out Bragg peaks (SOBP), will yield a more uniform dose distribution over the target region than that from a single-port SOBP irradiation. We may achieve this either by superposing two contralateral beams, each with a ‘flat’ SOBP dose distribution (case A), or by applying two ‘ramped’ SOBP beams (case B). For these two carbon beam configurations we compared the depth distributions of dose, survival, RBE, dose-averaged energy and dose-averaged LET over the target region, against another calculation where we obtained a desired uniform level of survival over the target region directly using our other optimisation algorithm (case C).

Materials and Methods: We applied a numerical algorithm to optimise the entrance spectra of a composition of pristine carbon ion beams which delivers a desired dose-depth profile over a given range by spreading out the Bragg peak. The physical beam transport model was generated using the SHIELD-HIT10A Monte-Carlo code. A multi-dimensional interpolation algorithm was used to calculate at given beam depths the cumulative energy-fluence spectra for primary and secondary ions in the optimised beam composition, as required by the mixed-field calculation of Katz’s Track Structure Theory (TST) which then predicts the resulting depth-survival profile. The depth-dose profile is optimised over a given depth range using the L-BFGS-B algorithm, with parallel processing support. Another optimisation algorithm incorporating the formulae of Katz’s TST, is able to yield a desired survival-depth profile directly. Our 1-dimensional irradiation geometry consisted of a 4 cm slab of ‘target volume’ surrounded by 8 cm slabs of ‘healthy tissue’ both composed of water and of CHO cells represented by Katz’s TST cellular parameters (m = 2.31, d0 = 1.691 Gy, sigma0 = 5.967e-11 m\(^{-2}\), kappa = 1692.8). The desired dose over the target volume was 3 Gy and the survival level 20%.

Results: With respect to dose-depth distributions, we found that the ‘2 flat dose’ (case A) gave the best sparing of healthy tissue, compared with ‘2 ramp dose’ (case B) and ‘flat survival’ (case C). However, case A gave a highly non-uniform survival distribution over the target region (‘underkill’ in the central region and ‘overkill’ at its borders), unlike cases B and C (uniform survival distribution over the target region). The ‘2 flat dose’ (case A) gave the highest non-uniformity of dose-averaged energy and dose-averaged LET distributions over the target region.

Conclusions: Our 1-dimensional kernel of a carbon beam therapy planning system, based on a beam transport model, Katz’s Track Structure Theory with in vitro cell survival parameters, and efficient optimisation algorithms, is able to yield quantitative predictions of various beam configurations and irradiation strategies relevant to therapy planning using carbon beams.

Poster: Physics track: Dose measurements

PO-0834
Derivation of a universal dataset for commissioning of an EPID-based dosimetry system
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Purpose/Objective: Commissioning an EPID for dosimetry purposes requires a large number of measurements, which is time-consuming and cumbersome. In order to decrease the commissioning time, the use of a universal dataset would be advantageous. In this study the derivation and feasibility of such a universal dataset is described.

Materials and Methods: Measurements were performed on 22 Elekta linac/photon beam energy combinations at 10 different sites in 6 countries, all equipped with aSi iViewGT EPID systems (see table). A single set of equipment, consisting of an electrometer, two types of IC, mini-phantoms and a slab phantom, was sent to each site prior to the measurements.

IC measurements were performed using different combinations of phantom thicknesses and field sizes to obtain the dosimetric characteristics of the linac. Additionally, IC measurements in a mini-phantom were performed at EPID level. EPID images were then acquired for all thickness/field size combinations. For the full commissioning in total, 45 IC measurements and 50 EPID images were required per linac/energy combination, which takes approximately 4 hours.

From this large dataset a universal dataset has to be derived which should then be combined with as few as possible linac specific measurements to complete the modeling. The accuracy of using such a simplified procedure was tested by comparing the 2D dose distribution in a polystyrene phantom, reconstructed from the EPID measurements and the universal