Results: Whereas for machines younger than 10 years agreement between measured and stated dose was 90% overall, for those over 30 years old agreement dropped to 70%. However, this pattern varied with region. Linac dosimetry was always better than 150Co and multi-machine centres generally performed better than single machine institutions. We interpret this latter observation as a reflection of a more substantial physics infrastructure in larger centres. The data suggest virtually no dependence on the time elapsed since the last dosimetry system calibration at least up to 10 years. Second or subsequent participation in audits reflected higher quality dosimetry (85% of results within the XIX’s acceptance criterion) than the first audit (77%). The use of N_{#alpha}, based dosimetry protocols resulted in more accurate dosimetry than the use of the older N_{#beta} or N_{#gamma} protocols (95%, 92% and 79% agreement respectively). Conclusions: Clearly, over the 45 years that the XX has accumulated these TLD data, practice has changed both in institutions and at the XX’s Dosimetry Laboratory. However, it is possible to draw some general conclusions from the analysis. Higher quality dosimetry is generally associated with younger machines, linacs as opposed to 150Co, centres with more than one machine, prior experience with the XX’s audit programme and the use of an N_{#alpha} based protocol.

PD-0385
Characterization of a microDiamond dosimeter in clinical scanned carbonion beams

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Purpose/Objective: To evaluate the dosimetric properties of the synthetic diamond dosimeter PTW 60019 (microDiamond) in high-energy scanned clinical carbon ion beams.

Materials and Methods: The measurements were performed at the National Center for Oncological Treatment (CNAO) synchrotron facility. The detector response was tested under actively scanned carbon ion beams ranging from 115 to 380 MeV/u. All measurements were performed in a water phantom. The detector performance was firstly evaluated in terms of response stability, dependence on beam energy and ion type (carbon ions and protons), linearity with dose, dose rate and angular dependence. The depth dose curve of a 280 MeV/u carbon ion beam, obtained by the microDiamond detector was compared to the one measured using a PTW Advanced Markus ionization chamber, and to numerical simulation from FLUKA Monte Carlo code. Dose measurements in spread-out-Bragg-peaks (SOBP) were also performed and the results were compared to the data from the treatment planning system (TPS).

Results: A response reproducibility within about 1% was found. Deviations of the calibration factor below 3.5% with respect to the reference Co-60 source were observed for the whole set of beam qualities investigated (including protons). The detector response showed a good linear behavior and its sensitivity was found to be dose rate independent, with a variation below 1.3% in the evaluated dose rate range. Very good agreement between the measured Bragg peak curves, with respect both to the ones obtained by the Advanced Markus chamber and to simulated ones were observed, demonstrating a substantial LET independence of the microDiamond response. Very good results were also obtained from SOBP measurements, with a difference below 1% between measured and TPS-calculated doses.

Conclusions: The results of the present study showed that the microDiamond detector is suitable for clinical carbon ion beams dosimetry.

PD-0386
Multi centre comparative dose accuracy of Flattening Filter Free beams for SBRT lung cancer treatment

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Purpose/Objective: Flattening filter free (FFF) beams are becoming the new gold standard modality for clinical stereotactic body radiotherapy (SBRT). Beneficial characteristics compared to conventional flattened fields (FF) include higher dose rate, reduced lateral changes in beam hardening, reduced leakage, and less out-of-field dose. These have the potential to improve treatment plans. The two main accelerator manufacturers have chosen to implement FFF with different energy definitions and are using quite different MLC designs, which might also influence the achievable plan quality, as might the use of different treatment planning systems (TPS) with different MLC segmentation algorithms. This study investigates the possibility of creating FFF plans with high dose delivery accuracy across the different vendors, energies, and TPS used for planning.

Materials and Methods: Ten lung patient cases were provided to seven different cancer treatment centres for SBRT planning using FF and FFF beams. The different centres’ linac/TPS combinations were: Varian-Eclipse, Varian-Pinnacle, Novalis-Eclipse, Elekta-Pinnacle and Elekta-Monaco. All planning followed the same protocol. The prescribed minimum dose was 48Gy/4fr for tumours located less than 1.5cm from the thorax wall, 50Gy/5fr for tumours located within 2cm of the main bronchial tree, and 54Gy/3fr for free lying tumours in the lung. Half circle VMAT arcs were used for all plans avoiding the contra lateral lung. All treatment plans were delivered and measured using the Sun Nuclear ArcCheck phantom and evaluated using a 3% and 3 mm gamma analysis between planned and measured doses. Beam on times were recorded for the treatment beams. All DWH metrics were tested for significant differences with a paired two-sided Wilcoxon-signed rank test, with a significance level of 5%.

Results: All the linac-TPS combinations show high dose accuracy across the ten patients, with a mean pass rate of 98.1% and 97.4% for FF and FFF treatment plan respectively (see table). For the Elekta-Pinnacle combination the FFF plans have lower pass rates than FF plans, which might be related to the relative calibration of the ArcCheck phantom.