AbstractID: 7457 Title: Comparison of fixed-beam IMRT, helical tomotherapy and IMPT for selected cases

Purpose: To identify persistent characteristics of IMRT, helical tomotherapy and IMPT across the range of potential applications.

Method and Materials: The comparison of optimized treatment plans from different planning systems is difficult because treatment objective definitions and dose algorithms differ. Here, the techniques were implemented in the same optimization algorithm and Monte Carlo dose computation was available. Each of the techniques may offer benefits for certain cases and be less suitable for others. Five cases of different classes were selected including prostate, pediatric, lung and head-and-neck. The optimization employs biologically-based objectives and enforces constraints for normal tissue doses. For each case, the same prescription and constraints were used.

Results: For the clinical dose levels of this study, no treatment modality produced significantly superior plans. IMPT spared larger parts of the OAR. However, the EUD was mostly similar to that reached by photon techniques as it is mostly determined by the extent of the high dose volume. Tomotherapy provided generally better target coverage and higher homogeneity compared to fixed-beam IMRT. However, the difference was mainly caused by the translation of the fully modulated fluence into static MLC segments. OAR irradiation was equivalent for both photon modalities, with higher mean doses for the tomo. Thus, the advantage of helical irradiation was mostly offset by the finer resolution of the MLC leaves (4 mm), once sufficiently chosen beams were used. On the other hand, non-coplanar beams did not provide a clear benefit.

Conclusion: All modalities were optimized with the same planning system, thereby eliminating differences caused by the TPS. The differences between modalities were rarely significant. The quality of the dose distribution is governed by the particle type (mean dose) and the ability to deliver the ideal dose accurately (MLC leaf width, sequencing, number of beams, scanning grid).