## End-to-End tests of the new Elekta Gamma Knife ICON

A. Dorenlot, J. Champoudry

Objective:

The objective of this study is to evaluate the overall performances of the new Elekta Gamma Knife Icon via End-to-End tests.

Methods:

This study consists of three different End-to-End tests: misalignment, point dose and dose distribution discrepancies. The first study evaluates the misalignment of the dose delivery by using a phantom made of plexiglass wherein radiochromic films have been inserted. CBCT images of this phantom have been acquired and were using for the dose planning. The dose planning consisted of positioning 4 mm isocenters on specific localizations. Films were analyzed with ImageJ software. The second study evaluates point dose discrepancies. We used the anthropomorphic CIRS STEEV phantom and a PTW PinPoint ionization chamber. A dose planning, consisting of a single 4 mm isocenter centered on the sensitive volume of the ionization chamber, were performed on the CT of the phantom and the whole workflow including mask and pillow personalization and CBCT repositioning were followed step-by-step. Deviation of ten dose measurements was analyzed. The third study evaluates dose distribution discrepancies. We used the anthropomorphic CIRS STEEV phantom and a film stack insert filled with seven radiochromic films. A realistic dose planning (25 isocenters (4 and 8 mm collimators, some plugged), prescription dose of 4.8Gy at the 50% isodose) was performed on the CT of the phantom using the Convolution algorithm then the whole workflow including mask and pillow personalization and CBCT acquisitions were followed. Film distribution doses were compared with theoretical distribution using 3%/1mm gamma index analysis via FilmQA Pro software (Ashland).

Results:

Misalignment errors found were 0.25 mm and 0.27 mm in x and z directions. Point dose discrepancy found was 0.18% when the phantom has been moved and when the re-alignment procedure with CBCT acquisition was performed. Average number of pixels passing the 3%/1mm gamma index criteria is 97.5% (min. 93.6% and max. 99.45%).

Conclusion:

The sum of these results demonstrates the overall quality of the new Elekta Gamma Knife ICON and offers the guarantee of high quality procedures for hypo fractionated and frameless treatment. Informations given by the CBCT (ie. Leksell coordinates here) are enough trustable to assure the quality of treating a patient at the right localization and with the right dose.