AbstractID: 3748 Title: Influence of ionization chamber size for Intensity Modulation treatment planning modeling

Purpose:
Intensity modulation treatment planning systems (TPS) modeling requiere beam data collection of depth dose curves and dose profiles for open fields. The internal ionization chamber diameter is related with the width of the penumbra. The purpose of this work is to model a photon beam for Intensity Modulation Radiotherapy (IMRT) using two chambers with different sizes and compare the modeling results with film measurements using standard dynamic IMRT patterns.

Method and Materials:
The TPS used was CadPlan/Helios. The treatment energy used was 6 MeV generated by a linear accelerator Clinac 21EX equipped with a 120-leaf multileaf (MLC). The ionization chambers used were Wellhofer IC-10 (0.14cc) with internal diameter of 6 mm and a PTW Pint Point 31014 (0.015cc) with an internal diameter of 2 mm. Five standards IMRT patterns were used for comparisson. Grid calculation size was 2.5x2.5 mm^2 and 1.25x1.25 mm^2. To match calculated to film-measured isodoses, external MLC generated registration points were used. Measured isodoses were done using Kodak EDR2 film. Comparisson between calculated and measured isodoses were done by gamma evaluation (3mm/3% and 2mm/2%) using RIT113 software.

Result:
Measurements of dose profiles with Pint Point detector showed narrower penumbra (20%-80% penumbra width at 5 cm depth in water were 4.0 mm for the Pint Point chamber and 6.0 mm with the IC-10). Detector noise and measuring time increased with Pint Point chamber. Single pencil beam kernels generated from profiles measurements at 5 depths were sharper with the Pint Point detector. Agreement between calculated and measured isodoses was better with the smaller detector in all the standard IMRT patterns, especially at the high dose gradient regions.

Conclusions:
For CadPlan/Helios TPS, beam modeling for IMRT improves using an ionization chamber with smaller internal diameter.