AbstractID: 7060 Title: Comparison of tomotherapy dose distributions for 6MV X-rays and different Cobalt-60 source designs using Monte Carlo methods.

**Purpose:**
To investigate intensity modulated dose distributions for Co-60 based tomotherapy with cylindrical and rectangular shaped source geometries for a typical head and neck case using Monte Carlo (MC) methods.

**Method and Materials:**
EGSnrc/BEAMnrc MC code has been used to model three Co-60 tomotherapy units and a 6 MV (Varian 2100EX) unit. Two of the Co-60 units, consisting of modified collimator systems with customized binary multi-leaf collimator (BMLC) were modeled for 3 and 5 cm long rectangular sources and SADs of 70 and 80 cm, respectively. The other units were a conventional Co-60 unit (T780c) with 2 cm diameter cylindrical source (MDS Nordion, Canada) and a 6 MV Linac with an add-on MIMiC BMLC (NOMOS, USA). All the Co-60 sources had identical active volumes.

EGSnrc/DOSXYZnrc MC code was used to calculate the intensity modulated beamlets and fan beam dose profiles in a water phantom. The intensity modulated energy fluence profiles from a 6 MV Linac and two Co-60 units using the same beam segments will be compared. Tomotherapy treatment plans for a typical H&N case were calculated. All plans were optimized for PTV, two neck nodes and the spinal cord using the same optimization parameters. The treatment planning was provided by an in-house inverse planning system based on a multi-objective gradient-search approach using MC calculated dose data.

**Results:**
Comparisons of optimized dose distributions, dose difference maps and dose area histogram will be presented. Despite significant differences in fluence profiles for Co-60 and 6 MV beams, optimized dose distribution for all plans met the dose-volume and tolerance criteria. However, the integral doses are potentially higher for Co-60 plans particularly with longer source size and shorter SAD.

**Conclusions:**
Co-60 based tomotherapy with appropriate source and BMLC design is dosimetrically viable.

Research supported (in-kind) by MDS Nordion, Canada.