

AbstractID: 8207 Title: An alternative design of helical tomotherapy using multiple stationary Cobalt 60 sources for treatment of intra-cranial lesions and its feasibility

**Purpose:** To propose an alternative design of helical tomotherapy using multiple stationary Cobalt 60 sources for treatment of intra-cranial lesions and study its feasibility

**Method and Materials:** Helical tomotherapy (TomoTherapy Inc., Madison, WI, USA) is able to deliver a highly conformal intensity modulated dose to target while sparing neighboring normal structures. However, its current design of rotating a gantry mounted LINAC while synchronizing couch translation is complex engineering wise, and thus could potentially suffer more system error during operation. In this work, a significantly simplified yet helical tomotherapy equivalent technique using multiple cobalt 60 sources and a non-rotating gantry is proposed. To simulate the fan beam helical delivery of tomotherapy, a series of stationary (or rotating) Co-60 sources can be arranged on a non-rotating gantry ring in a co-planar pattern. Multiple groups of jaws and binary MLCs can be used to modulate beam intensity existing from each source simultaneously. Various respects of the proposed design are discussed including issues such as the general concept, source activity estimation, optimal number of sources, source design and geometric penumbra, jaw design, binary MLC design, radiation shielding, comparison with current LINAC based tomotherapy, comparison with Gamma Knife, potential add-on onboard imaging functions, cost analysis and alternative rotating multiple sources designs.

**Results and conclusion:** The proposed design is capable of delivering a highly conformal intensity modulated dose to intra-cranial lesions, in a fashion equivalent to helical tomotherapy. The new system is significantly simplified engineering wise and conceptually a generalization of single LINAC radiation source tomotherapy optimization wise.