AbstractID: 1927 Title: A Monte Carlo approach to the validation of a pencil beam algorithm used in treatment planning for static conformal beam radiosurgery

Stereotactic radiosurgery with several static conformal beams shaped by a micro multileaf collimator (μMLC) is used for treating small irregularly shaped brain lesions. Specific requirements for this technique are a precise localization and positioning of the target (1mm) and a precise (1 mm) and numerically accurate (± 5 %) dose delivery. In this work, a pencil beam algorithm based treatment planning software BrainSCAN5.1 (Brainlab, Germany) is validated against measurements (diode, radiographic films) and Monte Carlo simulations (BEAMnrc, XVMC codes). The latter is required because of difficulties in obtaining precise and accurate dose measurements for small fields. A dedicated μMLC component module for the BEAMnrc code was developed as part of this project. Results show that Monte Carlo calculations agree with measured dose distributions to within 2 % and/or 1 mm except for field sizes smaller than 1.2 cm diameter where agreement is within 5% due to uncertainties in measured output factors. Comparisons with the pencil beam algorithm calculations were performed for square and irregularly shaped fields at different incidence angles on rectangular and humanoid phantoms. Results show that the pencil beam algorithm is suitable for radiosurgery although some differences were found in the comparison of interleaf leakage and beam profiles. A description of the development and validation of the Monte Carlo μMLC module will be presented followed by the comparison results.