AbstractID: 6667 Title: Dosimetric evaluation of a Monte Carlo IMRT treatment planning system with the MIMiC

Purpose: To evaluate a pre-release version of a Monte Carlo planning system (PEREGRINE 1.6b, NOMOS, PA), which incorporates the modeling of serial tomotherapy IMRT treatments with the binary Multileaf Intensity Modulating Collimator (MIMiC). The intent of validation was to investigate the accuracy of doses calculated by a conventional finite size pencil beam / Effective path length (FSPB/EPL) algorithm for lung lesions treated on the stereotactic body radiation therapy dose regime via serial tomotherapy.

Method and Materials: PEREGRINE, developed by Lawrence Livermore National Laboratory and licensed to NOMOS Corporation for distribution uses the BEAMnrc MC code. Doses calculated by PEREGRINE were compared against measurements in homogenous and inhomogenenous materials carried out on a Varian 600C with a 6 MV beam. Phantom studies (CIRS lung phantom) simulating various sized unit density lesions located centrally in the lung were also carried out to explain some of the large dose discrepancies seen in the dose calculations with small lesions.

Results: PEREGRINE calculations agreed to within 2% in water and up to 3% for measurements in inhomogeneous phantom containing lung, bone and unit density tissue. Inhomogeneous phantom studies revealed that dosimetric error seen in the lesion with the FSPB/EPL increased as the lesion size decreased, up to 13.5 % in the center of a 1 cm lesion compared to a less than 1% prediction by PEREGRINE.

Conclusion: PEREGRINE 1.6b (MC) provides an accurate method of calculating dose to lung lesions. The dose differences observed between MC and FSPB/EPL is significant and should be considered when reporting and prescribing dose to lung lesions.