Planning Eye Treatments in a Spot Scanning Gantry with Monte Carlo Calculated Beamlets

At Mayo Clinic in Rochester, MN, we'll soon begin treating ocular targets in a spot scanning gantry with apertures and eye-tracking equipment designed and built in-house. Our treatment planning system, Eclipse, does not adequately model treatments through an aperture, and so the applicator system was modeled in TOPAS Monte Carlo for pristine energy levels ranging from 76.8 to 123.5 MeV. Given the desired range and modulation, a MATLAB script calculates the energy level weighting to produce a flat SOBP. Each layer consists of either a single spot for small apertures, or an arrangement of 5 spots to cover larger apertures. Variables for the five spot calculation include distance from central axis to the four corner spots and weighting of the central axis spot relative to the corners. MATLAB will generate a spot pattern which is imported to an Eclipse plan where the aperture is designed. Finally, the Eclipse plan with the aperture and spot pattern is exported to our in-house Monte Carlo dose calculation to generate the final dose distribution. Eclipse also generates the reference DRRs for pre-treatment IGRT.