Purpose: This work aims to investigate the feasibility of scattering foil free beams for use in energy modulated electron therapy. The main significance of this investigation is the potential reduction in photon contamination within the Bremsstrahlung tail region and its corresponding reduction in dose to healthy tissue.
Materials and methods: A Varian (Varian Medical, Inc., Palo Alto, CA) 21EX linear accelerator was used in conjunction with an existing, custom-built electron collimator to produce 8x8 cm2 and 2x2 cm2 fields at isocenter. The scattering foil was removed from the beamline by removing the port plug from one of the extra ports and manually rotating the empty port into the beamline. PDDs and profiles were acquired with and without the scattering foil. Measurement data was used to commission a Monte Carlo model of the accelerator and the model was incorporated into an in-house designed inverse treatment planning system. Plans for each beamline were generated on a solid water test phantom consisting of a target and two organs at risk. DVH's were then compared for each plan.
Results: PDD curves showed a dose reduction factor between 7.4 and 12.2 within the Bremsstrahlung tail region with the scattering foil removed. For quasi-identical target coverage, removal of the scattering foil was able to produce superior organ at risk sparing in the optimized plans in the test phantom.
Conclusion: This work has shown that by removing the scattering foil from the beamline in energy modulated electron therapy the component of Bremsstrahlung photons produced in the accelerator head is significantly reduced allowing superior plans that spare healthy tissue. The practical aspects of the dosimetry of these beams using the internal transmission ion chamber in the accelerator is a topic of further study.