AbstractID: 5252 Title: Derivation of photon energy spectra from transmission measurements using large fields

Purpose:
To reconstruct a 6 MV photon spectrum using an iterative process based on attenuation measurements performed in large fields.
Method and Materials:
The main algorithm written in Mathematica® code uses as input data Monte Carlo-predetermined pencil beam monoenergetic scatter kernels for various water phantom thicknesses, open beam fluences and beam fluences measured in air with phantoms of different thickness. The iteration starts with a flat spectrum used to calculate the polyenergetic kernels for each water thickness. The scattered radiation is calculated by convolving open beam fluences with the corresponding polyenergetic kernels. The primary fluences are determined by subtracting the scatter fluences from the fluences measured with the phantom in place. The reconstructed primary energy spectrum is derived from the transmission values using the simulated annealing technique. The spectrum determined at the end of the loop is compared to the input spectrum of the main algorithm. If the new spectrum does not meet the stopping criterion, it is fed as input for a new iteration.
Results:
72 data Monte Carlo monoenergetic scatter kernels are derived for six water thicknesses. The amplitude of the monoenergetic scatter kernels increases with energy and water phantom thickness. For thin phantoms there is a strong dependence of scatter with thickness. For large phantoms the increase is negligible after a certain phantom thickness which depends on beam energy. The average energy of the derived spectrum is 1.9MeV. There is a good agreement (2%) between measured and calculated PDD except at the first portion of the graph (electron contamination from head is not account for).
Conclusion:
The method is robust, good for portal dosimetry. It can be used to evaluate accurately the photon scatter in portal imaging since is taking into account the energy spectrum dependence of the scatter.
Conflict of Interest (only if applicable):