AbstractID: 13975 Title: Optimal treatment beam fluence generation for volumetric arc therapy using dose image backprojection with initial corona calculation

Purpose: Derive a novel solution to the initial premise that IMRT fluence can be easily calculated using dose image backprojection.

Method and Materials: Calculations were performed using MATLAB with the imaging toolbox using parallel beam geometry. A phantom matrix P was constructed with a concave target, simultaneous integrated boost, and organ at risk with respective desired percent doses of 100, 110, and 40. Let R:SP be the backprojection of sinogram S of P. Iterative reconstruction using standard Ratio Method converges on a solution by computing Si+1 = Si * (P / R:SiP). For the novel Corona Method, we compute the corona using iterative backprojection reconstruction using ratios on only the target volumes T, T' = R:S0T, and then superimpose the organ at risk , P' = T' + OAR. Iterative backprojection on P' is then performed by successive addition correction, Si+1 = Si-1 + (S0 – Si), where S0 is the sinogram of P'. Any negative intensities are set to zero during the iteration process. Target coverage is improved using the Compensated Phantom Method by computing a revised target based on the results Z of the process described thus far. We then define a new target T" = T'/Z and superimpose the OAR, such that P" = T" + OAR. The final procedure is to perform additive iteration constrained to contain only positive intensities.

Results:
Ratio Method : Target and boost areas receive their respective dose goals but the organ at risk unacceptable.
Corona Method : OAR acceptable but poor target coverage.
Compensated Phantom Method : Acceptable target coverage and the OAR goal is achieved.

Conclusion: Dose image backprojection with initial corona calculation significantly reduces the dose to the organ at risk while maintaining acceptable target coverage.