

AbstractID: 8170 Title: A windowing technique for assigning gEUD optimization objectives as target constraints in IMRT inverse treatment planning

Purpose: The purpose of this work was to: (1) investigate the response of gEUD to varying levels of dose heterogeneity and (2) develop and test a method for assigning gEUD objectives for target ROIs.

Method and Materials: A total of six hypothetical target dDVHs were generated by randomly sampling (10^6 times) from Gaussian probability density functions centered at 55, 60 and 65 Gy with standard deviations of 5% and 10%. gEUD was calculated for each simulated dDVH using an α -parameter that increased (decreased) from 1 (-1) to 20 (-20). Based on the results of this exercise we developed a windowing technique for defining gEUD optimization objectives for target ROIs. The technique uses the *min* and *max* EUD objectives as defined in the Pinnacle³ treatment planning system. Two cases were used to test the new technique: (1) a treatment planning phantom that incorporated a PTV₆₆ within a PTV₅₄ and (2) a left para-pharyngeal head-and-neck case. Two plans were generated for each case; the first using only dose volume (DV) objectives and the second using the gEUD windowing technique.

Results: PTV results are presented as the percent difference in maximum (ΔD_{\max}) and mean (ΔD_{mean}) dose normalized to the prescription dose. The planning phantom PTV₅₄ results were as follows: $\Delta D_{\max} = 1.2\%$ and $\Delta D_{\text{mean}} = 0.2\%$. The planning phantom PTV₆₆ results were as follows: $\Delta D_{\max} = 0.4\%$ and $\Delta D_{\text{mean}} = 0.5\%$. The results for the left para-pharyngeal PTV₅₀ were as follows: $\Delta D_{\max} = 1.4\%$ and $\Delta D_{\text{mean}} = 0.5\%$.

Conclusion: The gEUD windowing technique was shown to produce equivalent target coverage to plans derived using only DV objectives. One benefit to using this technique is the subsequent availability of DV objectives for target ROIs. Including gEUD objectives into routine IMRT planning will provide planners with more options and should facilitate better plans.