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In inverse treatment planning optimization, we typically use dose-volume histograms to judge the quality of a proposed plan. Current approaches that use weighted least squares objective functions can be optimized quickly due to its convex nature and has a dual capability of maximizing tumour dose and minimizing critical organ dose. However, the objective functions and/or constraints are indirectly linked to dose-volume histograms. Furthermore choosing relative importance parameters can be difficult, especially for a large number of critical structures. Another approach uses simulated annealing to optimize the tumour dose while always respecting the critical organ dose volume constraints. But this will result in plans giving critical structures their tolerance doses. We propose an alternate formulation in which the objective is to minimize the dose to the critical structures relative to their dose-volume constraints, subject to PTV dose uniformity requirements that are strictly satisfied. These requirements can either be user defined or protocol based. The result is a minimum objective function value that directly corresponds to the resulting dose-volume histograms. This formulation gives rise to multiple local minima in which a stochastic optimization approach is necessary. Within this formulation, simulated annealing is sometimes slow in convergence and does not guarantee a global solution in finite time. Therefore, we introduce a modified Luus-Jukola global optimization method that can converge to favourable solutions in a desired time period. This solution is applied to various 2D phantoms and is compared to solutions generated using fast simulated annealing.