

AbstractID: 6859 Title: A study of homogeneity parameters in low dose rate interstitial brachytherapy

**Purpose:** In this work we investigate four homogeneity parameters to determine a suitable parameter for dose homogeneity optimization.

**Method and Materials:** A new version of the Adjoint-based Greedy Heuristic (GH) 3D optimization algorithm is used to generate treatment plans for low dose rate prostate brachytherapy. Treatment plans are generated for seed-strengths varying from range 0.2mCi to 1mCi for I-125 BEST 2301 seed model. Each plan is designed for 98% target coverage. Four main homogeneity parameters -Conformation number (CN), Dose non-uniformity ratio (DNR), Uniformity index (UI) and Homogeneity index (HI) are quantified and analyzed against varying seed strengths. The local homogeneity parameter is defined as the value of a homogeneity parameter at any instant as the seeds are added during the treatment plan optimization process.

**Results:** An analysis of the final values of the homogeneity parameters using varying seed strengths reveal a strong relation between the CN and the seed strength used in an implant. The HI, UI and DNR parameters fluctuate greatly. Using a fixed source strength, a study of the local CN reveals that, as seeds are added, the CN increases to a maximum value and then decreases as more seeds are added.

**Conclusion:** Based on our study, homogeneity parameters such as HI, UI or DNR can be useful in a dose homogeneity-optimization routine using a pre-decided source-activity. An optimization routine can also aim at searching for optimum activity of the seeds to be used in an implant. For such an optimization routine CN based parameter (viz. CN/DNR) can be useful.