

A brain-tumour treatment-planning study has been performed involving the application of advanced optimisation techniques to improve on the dose distribution of the 'standard plan'. The standard plan, created according to conventional protocol at the Royal Marsden Trust, consisted of a 3 field (two wedged) non-coplanar arrangement, with field shaping in the beam's-eye-view. Three optimised treatment-plans were created corresponding to (i) the optimisation of the beam-weights and wedge-angles of the standard plan, (ii) the optimisation of the beam-orientations, beam-weights and wedge-angles of the standard plan, and (iii) a full-fluence tomotherapy optimisation. (i and ii) were created on the VOXELPLAN planning system, and (iii) was created on the PEACOCK planning system. The downhill-simplex optimisation algorithm was used. The 'beam-cost-plot' is presented as a visual aid to the selection of beam directions. Each optimisation approach was evaluated on the basis of DVH and dose statistics in the PTV and organs-at-risk (OAR). All three optimisation approaches improved on the dose-distribution of the standard plan. The magnitude of the improvement was greater for the optimised beam-orientation and tomotherapy plans (up to 15% and 30% for the max and mean OAR doses). For the medium sized convex tumour studied, the tomotherapy dose-distribution showed a significant improvement on the standard plan, but no significant improvement over a conventional 3-field plan where the beam-orientations, beam-weights and wedge-angles had been optimised. We acknowledge NOMOS for the loan of PEACOCK and DKFZ for the loan of VOXELPLAN.