Purpose:
Our previous work suggested the potential of gEUD-based inverse optimization tool for HDR prostate brachytherapy (Giantsoudi et al AAPM 2010). In this study we attempt to define a default set of parameters for this optimization system that will maximize the conformal index (COIN – Baltas et al 1998) while leading to clinically acceptable dosimetric results.

Methods:
For given patient geometry, multiple gEUD-based optimized plans were produced by varying the penalty factors n of the objectives in the range of 0-20 for the prostate-PTV (target), prostate-OAR (used as dose constraint structure) and normal tissue (ring surrounding the prostate) structures, for various clinical cases. Calculated COIN values for all the resulting plans were plotted against the penalty factor values. The combination of factors maximizing COIN was then selected and applied in 12 clinical cases. Their dosimetric results were evaluated following the Offenbach clinical protocol. Our method’s sensitivity was then examined by varying the n-parameter values to +/-10% and the gEUD0 values to +/-2% of the default settings.

Results:
The set of penalty factor values maximizing COIN [n(prostate-PTV)=18, n(prostate-OAR)=2, n(NT)=2] led to clinically accepted plans for all 12 clinical cases and is suggested as the default optimization protocol for this method. Introducing deviations to the gEUD0 or n-parameter values, most of the dosimetric evaluators showed less than 1.6% difference compared to the default optimized solutions. Exception to this rule was the V150 parameter that showed up to 6.08% deviation for 10% change of the n(prostate-PTV) factor and 6.53% deviation for 2% change of the gEUD0(prostate-PTV).

Conclusions:
A default set of penalty factor values is suggested for our gEUD-based optimization system that leads to maximized COIN and clinically acceptable solutions for a wide range of clinical cases, facilitating HDR prostate brachytherapy inverse optimization. The stability and robustness of our method was also shown.