# AbstractID: 8141 Title: Dose-volume histogram modeling using the Gaussian error function in radiotherapy

**Purpose:** A mathematical method, containing pair of error and complimentary error functions, is proposed to characterize cumulative dose-volume histogram (cDVH). The model was illustrated by 5-beam prostate IMRT plans with shifted clinical target volumes (CTVs) representing the interfraction organ motion. **Methods and Materials:** A phantom including prostate, seminal vesicle, rectum and bladder was created with planning target volume (PTV) 0.5 cm margin from the prostate (CTV). The CTV was shifted 1 cm to the anterior, posterior, left, right, superior and inferior directions. Pinnacle[3] TPS was used for IMRT plans with each shifted CTV. The calculated cDVHs for the plans were exported to MATLAB for modeling using the mathematical formula: $DVH(V)=a_1\ erf\ [-b_1\times(D-c_1)] + a_2\ erfc\ [-b_2\times(D-c_2)]$, where ($a_1$, $b_1$ and $c_1$) and ($a_2$, $b_2$ and $c_2$) are parameters for the error and complimentary error function, respectively. *D* and *V* are the dose and volume of the cDVH, respectively. **Results:** It is found that parameters $a_{1,2}$, vary with the relative volume of the cDVH. The slope of the cDVH after the curve drop-off can be adjusted by $b_{1,2}$, while a variation of $c_{1,2}$ can change where the cDVH drops off from the normalized volume close to 1. Corresponding cDVHs calculated using the model agree well with those calculated from Pinnacle[3]. Parameters $a_1$ and $b_1$ are almost constant with variations of $a_2$ and $b_2$. However, parameter $c_1$ is only constant when the CTV displacement is within the PTV, but changes with $c_2$ when the CTV is shifted outside the PTV. It shows that cDVH variation due to parameter c would happen when the margin between the CTV and PTV is underestimated. **Conclusions:** This error function model for the cDVH provides a new view to study the dose-volume relationship of a region of interest in radiotherapy.