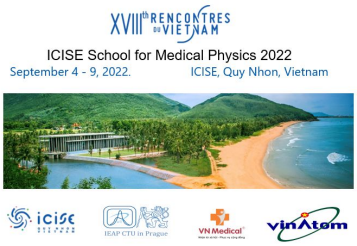

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Robustness evaluation of Intensity Modulated Proton Therapy plans using Dose Volume Population Histogram

Wednesday 7 September 2022 11:30 (15 minutes)

Purpose: Under geometrical uncertainties, different plan evaluation methods have been suggested but the dose distribution at a specified confidence level being highly desirable is lacking. In this work, we used the DVPH (Dose Volume Population Histogram) tool to evaluate the dose distribution of CTVs and OARs (Organs at Risk) and validate the PTV concept at a certain confidence level.

Methods: The plans were evaluated using PTV DVH and the DVPH approach. The DVPH approach is based on statistical analyzing of multiple CTV DVHs under geometrical errors with corresponding occurring probabilities. The random and systematic geometrical errors, assumed to follow a Gaussian distribution, are simulated by shifting the CT images.

Results: For target doses, the results showed that the minimum dose to PTV does not represent the minimum dose to the CTV. For two prostate cases, the minimum doses reduced from 98% and 95% of prescribed dose from PTV DVH to 89% and 92% of prescribed dose from CTV 90% CL-DVPH (90% Confidence Level-DVPH). This reduction was also seen in head and neck cases, from 95% to 68% and 74% of
rescribed dose. For OAR doses, OAR DVHs underestimated the OAR dose receiving.
Conclusions: With the DVPH tool, the results showed that the minimum dose to the PTV is not a representative of the minimum dose to the CTV in IMPT at the 90% confidence level. The OAR DVH does not match any OAR CL-DVPHs.

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