Improving Patient-Specific QA Effectiveness Through Multi-Point Plastic Scintillation Detectors

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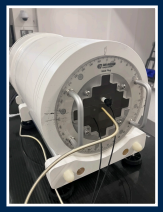
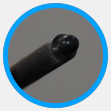


Despite widespread clinical availability of phantom-based QA detectors, their output is typically reduced to a few summary metrics (gamma pass rate, mean dose difference), yielding a binary pass/fail result.

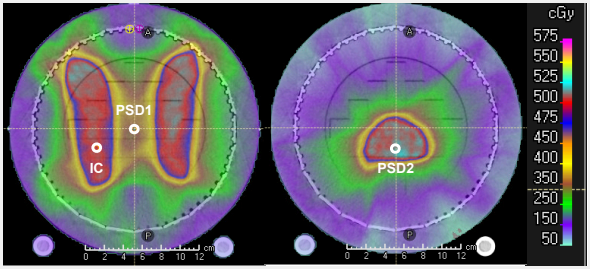
Methods: 25 clinical plans were delivered to an ArcCHECK (Sun Nuclear) with an **IC** and a **2-point PSD** inserted into the phantom.

Plastic scintillation detector (PSD)
2-point detector
Sensitive volume : 0.0008 cc
(Hyperscint Pro-Series, Medscint)

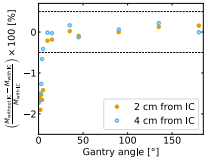
Ion chamber (IC)
Sensitive volume : 0.86 cc
(Exradin A12, Standard Imaging)



IC position: high-dose, low-gradient region according to clinical practice.
PSD position: clinically relevant locations (CTVs, OARs) regardless of gradient or dose level

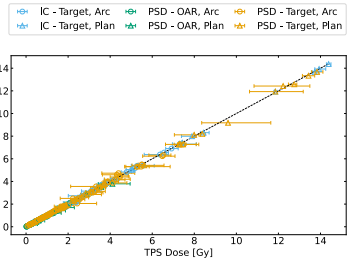


IC dose perturbation



IC introduces air cavities that prevents the use of multiple IC detectors simultaneously. PSD signal variation caused by the IC volume is shown as a function of gantry angle.

PSD vs IC dose accuracy

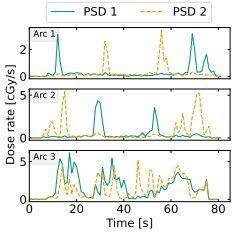


4 ± 7 cGy (0.5 ± 2%)
PSDs vs TPS

2 ± 4 cGy (0.03 ± 0.6 %)
IC vs TPS

Largest uncertainties with the PSDs stem from their placement in higher-gradient regions.

Conclusion: Multipoint PSD streamlines clinical workflow with simultaneous dose measurements at relevant clinical locations, without perturbing the dose distribution



Future work will look at possible use of temporal resolution and increase of measurements points to investigate possible sources of QA failures.