

Purpose/Objective To analyze results of IROC Houston QA center's (RPC) H&N and prostate IMRT phantoms to determine the effect that tightening criteria would have on the phantom pass rate.

Material/Methods : IROC Houston's anthropomorphic H&N and prostate phantoms (Figs 1 and 2) are used to credential institution's to participate in NCI clinical trials that allow the use of IMRT. The phantoms are shipped to institutions where they are filled with water and undergo imaging, treatment planning, and irradiation as a patient would. Each phantom houses targets and organs at risk. They also hold film and TLD. Dosimeter results are compared to the institution's treatment plan using the criteria of 7% for PTV TLD doses and $\geq 85\%$ pixels must pass 7%/4 mm global gamma analyses. Pass rates for the H&N and prostate phantoms were recalculated using the following tighter criteria options:

- 1) 5% TLD and 85% pixels 7%/4 gamma
- 2) 5% TLD and 90% pixels 7%/4 gamma
- 3) 5% TLD and 85% pixels 5%/4 gamma

Gamma analysis was repeated for the 30 most recent irradiations of each phantom to estimate results for criteria 3.

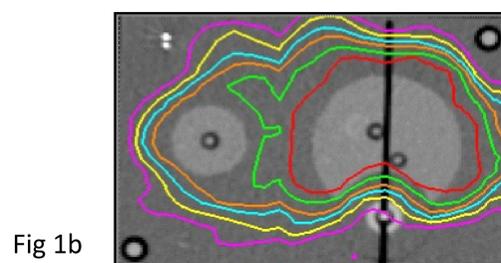
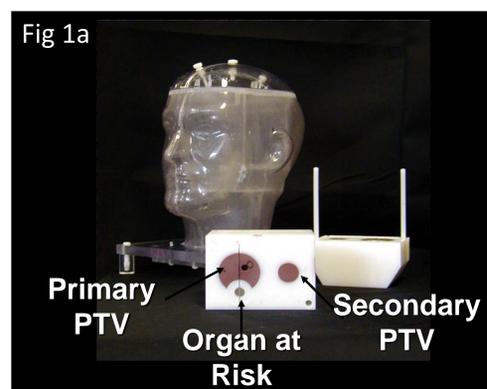


Figure 1 a) head and neck phantom b) treatment plan for head and neck phantom

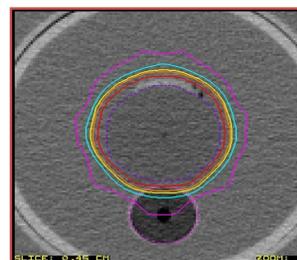
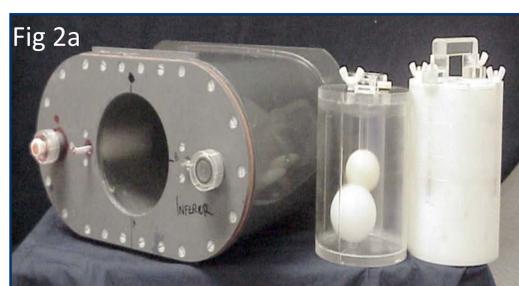


Fig 2b

Figure 2 a) prostate phantom b) treatment plan for prostate phantom

Results Pass rates using current criteria for the H&N and prostate phantoms are 84% and 85% respectively. Pass rates since gamma criteria were introduced in 2012 are 90% and 87%. The criteria applied to irradiations since 2012 can be seen in Table 1. Decreasing the TLD criteria from $\pm 7\%$ to $\pm 5\%$ give H&N and prostate pass rates of 62% and 82% respectively. Criteria 1 applied to all irradiations that have gamma results drops pass rates to 76% and 82%. Applying criteria 2 to drops pass rates to 80% and 84% and they fall to 83% and 67% respectively using criteria 3. The tighter gamma criteria applied to 30 recent irradiations can be seen in Table 2. Figures 3 and 4 show examples of gamma analysis for H&N and prostate phantoms

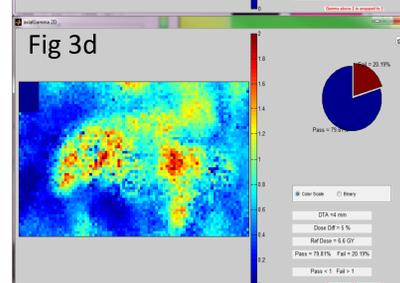
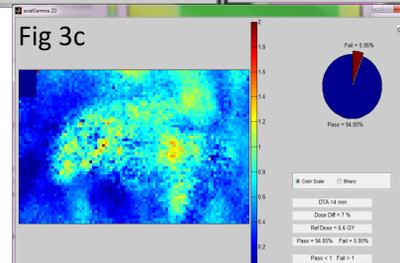
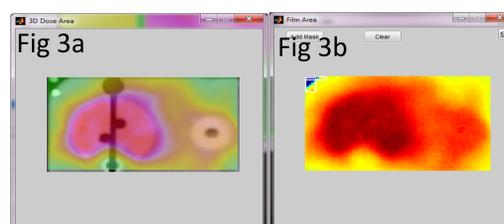


Figure 3 a) H&N plan region of gamma analysis b) film region of gamma analysis c) gamma results with current metrics d) gamma results with tighter metrics

Table 1 Pass rates for phantoms since 2012.

criteria	HN	prostate
7%; 85% of 7%/4mm	90%	87%
5%; 85% of 7%/4mm	76%	84%
7%; 90% of 7%/4mm	81%	79%
5%; 90% of 7%/4mm	69%	77%

Table 2 Pass rates for 30 recent irradiations each of H&N and prostate phantoms.

criteria	HN	prostate
7%; 85% of 7%/4mm	87%	87%
7%; 85% of 5%/4mm	83%	70%
5%; 85% of 5%/4mm	80%	83%
7%; 90% of 5%/4mm	67%	50%
5%; 90% of 5%/4mm	63%	50%

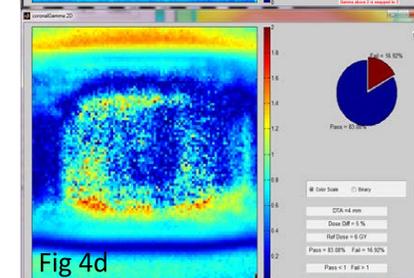
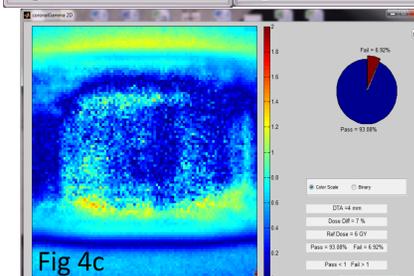
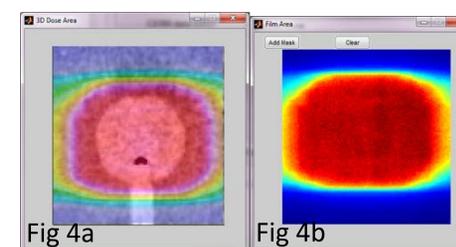


Figure 4 a) prostate plan region of gamma analysis b) film region of gamma analysis c) gamma results with current metrics d) gamma results with tighter metrics

Conclusion Applying tighter criteria to phantom results has potential to increase quality in clinical trials. The results of the 30 most recent irradiations indicate that there may be room to tighten H&N phantom criteria in the future.