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by a recalibration process

Supplementary material

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A method for performing film dosimetry as part of a postal audit service by a recalibration process

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Introduction

The Nuclear Technology Centre (NuTeC) perform postal dosimetry audits using alanine/EPR and film dosimetry. The major issue using film dosimetry for postal audits is that it is very difficult to control the time window between scanning and irradiation. A system is required to compensate for the differences in the time window. Besides, the films should be possible to rescan if required even after very long times (order of years). We present our film dosimetry procedure wherein we compensate for the time delay and various scanner effects using the "one-scan" protocol [1]. We investigated for post-exposure changes, lot-to-lot variability, different dose-response functions and the required accuracy of the delivered dose that is used for rescaling.

Material and methods

The centres irradiated an anthropomorphic phantom preloaded with film/alanine detectors with an IMRT plan (as part of the audit). They also irradiated a PMMA plate containing film/alanine detectors with a uniform field with similar dose as the IMRT plan. All the films were scanned together (Figure 1). Films were rescanned many times and compared to the patient plans and the dose maps of the original scans. Dose maps were calculated using calibration curves from 4 different lots and with 2 dose-response functions. 1 lot had a different marker dye. The dose used for rescaling was deliberately altered to investigate the sensitivity of the rescaling dose.

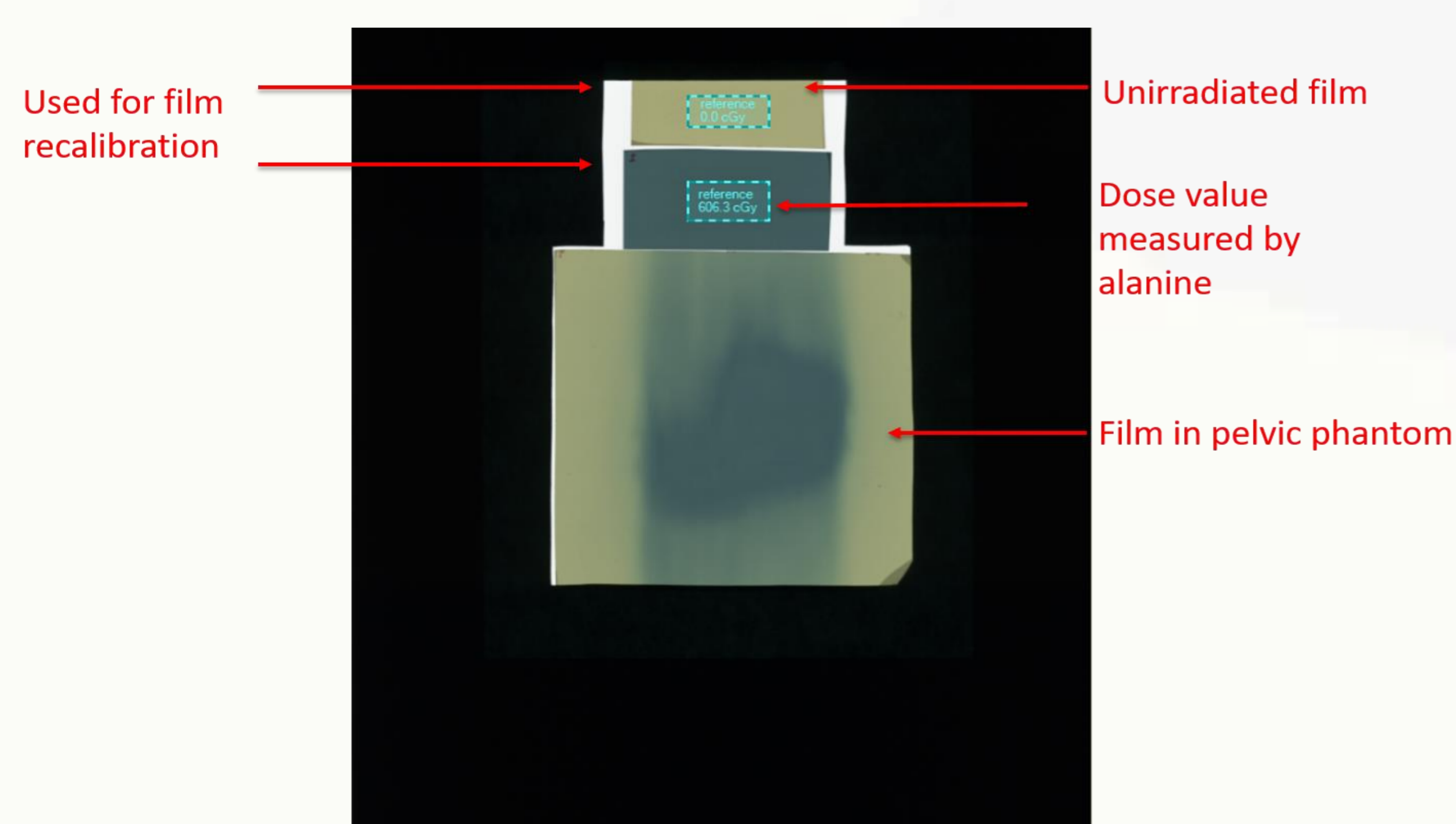


Figure 1 : Placement of the films on the scanner.

Results

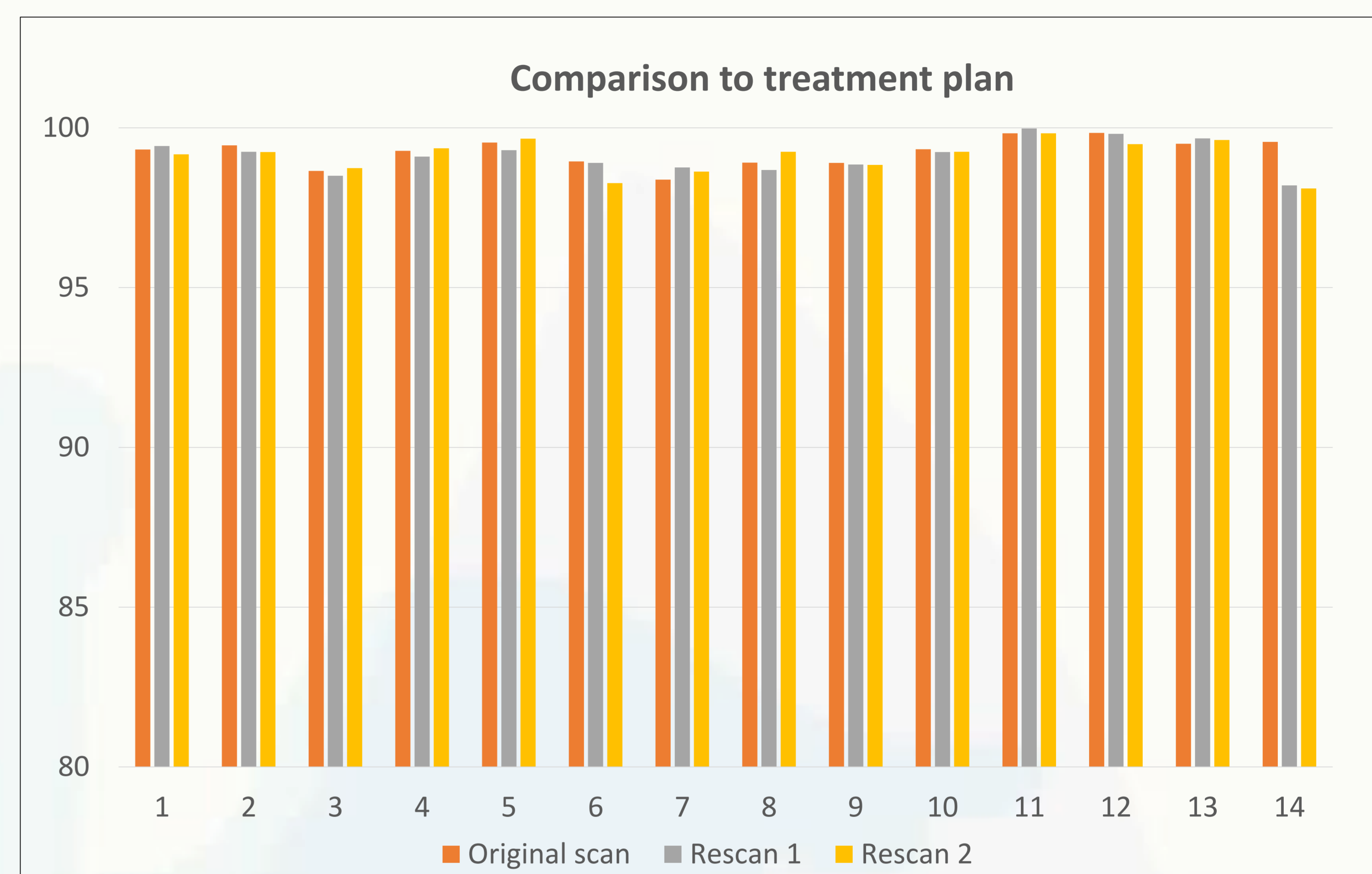


Figure 2: Gamma evaluation - 3%/3mm global 10 % TH = - 14 plans

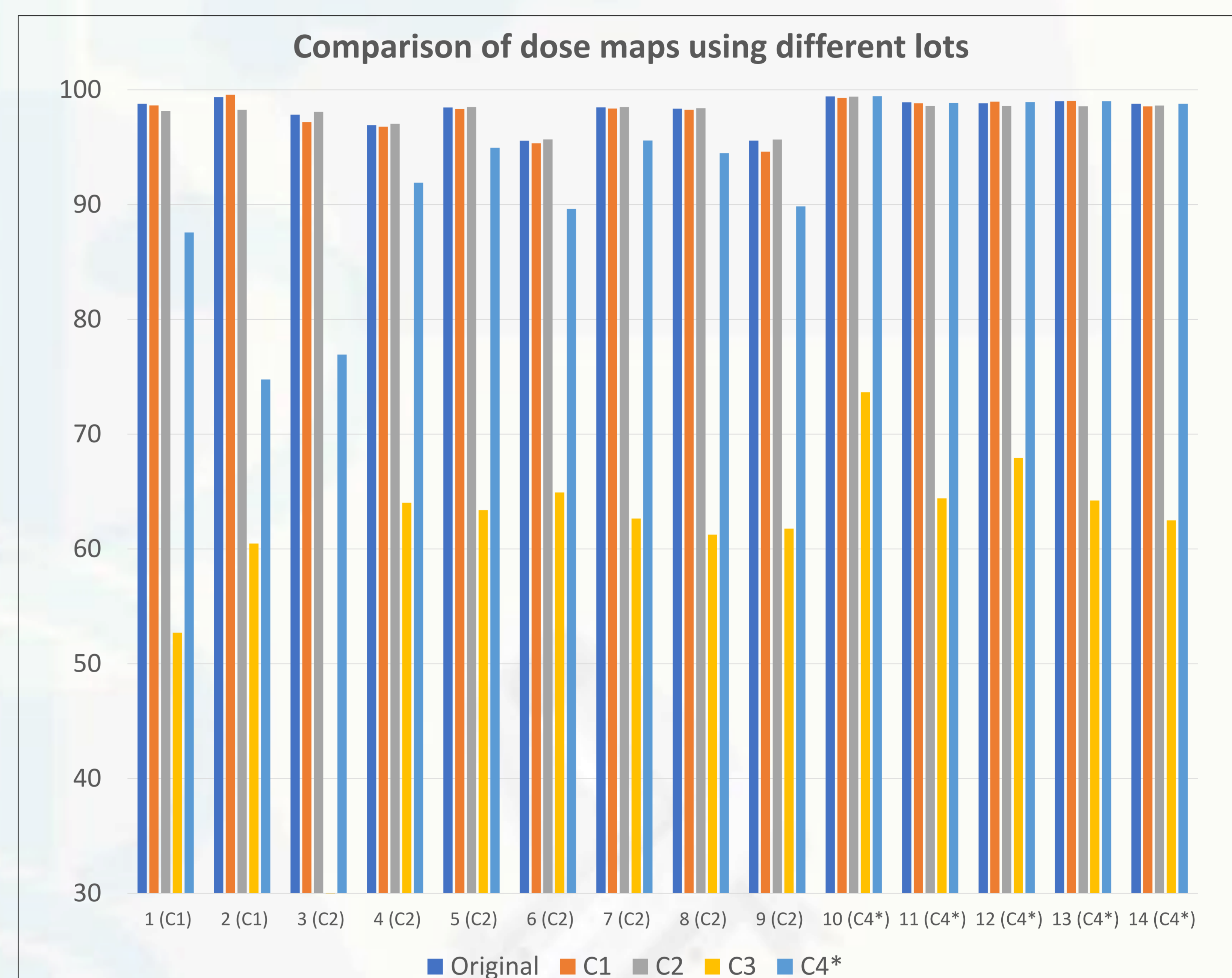


Figure 3: Comparison of dose maps using dose difference criteria of 4 % for the 14 plans. 4 different lots (C1 to C4 were used). C4 had a different marker dye than the others. C3 could only be fit using the cubic function due to differences in the active layer.

Conclusions

It is possible to use film dosimetry using a rescaling method for postal auditing services at certain conditions. It might be possible to use a generic calibration curve for EBT3 films with the rescaling method. User must be careful not to mix film lots having a different marker dye that is used for the film calibration and to analyse films with unknown dose distribution.

References

[1] D. Lewis et al., "An efficient protocol for radiochromic film dosimetry combining calibration and measurement in a single scan," Med Phys, vol. 39, no. 10, pp. 6339-50, Oct 2012, doi: 10.1118/1.4754797.