Dosimetry Recommended Publications

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3D SCANNER™ Studies

"A comparison between direct TMR measurements and TMRs calculated from PDDs using BJR Supplement 25 data for flattened and unflattened photon beams" B. Sutherland, N. Middlebrook, T. Kairn, B. Hill, Australas Phys Eng Sci Med (2013)

- Study used the 3D SCANNER TPR device to determine whether TPR factors could be accurately calculated for FFF beams and conventional flattened beams.

  "TPR and PDD scans were acquired using a 3D SCANNER™ water tank….This water tank allows for direct and fast TPR measurement."

- A sub-study was performed to determine the accuracy and repeatability of the scans. Results showed a maximum difference of <0.6% in repeated scans below Dmax.
- This paper and others have concluded that TPR factors should be measured for FFF beams for field sizes larger than 20 cm x 20 cm, with depths beyond 15 cm.
- Conclusion - "The conversion using the BJR Supplement 25 data was not found to be accurate for 6 FFF for fields larger than 20 cm x 20 cm at depths greater than 15 cm.... The PDD to TMR conversion for FFF beams should be done with phantom scatter ratios appropriate to FFF beams, or the TMR should be directly measured…"

Table 1 Maximum absolute difference beyond d_{max} for direct measured TMR minus TMR calculated from PDD for square field sizes 3 cm × 3 cm to 40 cm × 40 cm

Maximum difference (%)	Field size (cm^2)							
Photon beam	3 × 3	4 × 4	6 × 6	8 × 8	10 × 10	20 × 20	30 × 30	40 × 40
6 MV	0.4	−0.5	−0.7	−0.5	−0.5	0.3	−0.7	−0.7
10 MV	−0.6	−0.6	−0.5	0.4	0.4	0.5	−0.5	−0.5
6 FFF	0.4	−0.8	−0.9	−0.9	−0.7	−0.8	−1.4	−1.7

"SU-E-T-676: Reproducibility and Consistency of Two Sun Nuclear 3D Scanning Tanks" J. Hessler, D. DiCostanzo, S. Grzetic, A. Ayan, N. Gupta, J. Woollard, Med. Phys. 42, 3492 (2015)

"In conclusion the Sun Nuclear 3D SCANNER tank shows good reproducibility in measured data. Since the tank to tank variation in measured data is within the uncertainty of repeated single tank measurements the tanks also perform consistently."

- Intra-Tank Comparisons

  "…reproducibility of depth of maximum dose (Dmax) of 0.38 mm for a 10 cm x 10 cm field and 0.67 mm for 30 cm x 30 cm on a single tank."

  "PDD values at 5 cm 10 cm and 20 cm depths were reproducible within 0.26%"

- Inter-Tank Comparisons

  "Consistency of Dmax between tanks was 0.17 mm for a 10 cm x 10 cm field and 0.44 mm for 30 cm x 30 cm. PDD values at 5 cm 10 cm and 20 cm were consistent within 0.06%"

  "Profiles showed reproducibility in field width within 0.4 mm for a 10 cm x 10 cm field and 0.7 mm for a 30 cm x 30 cm field."

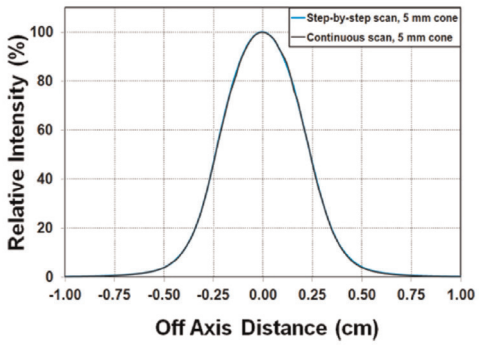
  "Profiles showed consistency in field width within 0.2 mm for 10 cm x 10 cm and 30 cm x 30 cm field sizes."

"Intra- and intervariability in beam data commissioning among water phantom scanning systems" Y. Akino, J. Gibbons, D. Neck, C. Chu, I. Das, Journal of Applied Clinical Medical Physics 15 (4), (2014)

> *"It is concluded the four major water phantom scanning systems provide adequate accuracy for beam data collection within 1% of dose difference or 1mm of DTA to each other. It should be noted that this error includes uncertainties due to the phantom setup and the difference of the protocol, such as step size, measurement time, and scanning methods."*

"Continuous versus step-by-step scanning mode of a novel 3D scanner for CyberKnife measurements"
M. Al Kafi, U. Mwidu, B. Moftah, Saudi Arabia Applied Radiation and Isotopes, Vol 105 (2015) 88-91

> *"The 3D circular scanner continuous mode is as good as step-by-step mode and can be used for CyberKnife commissioning without losing discernible amount of accuracy."*
>
> *"In addition, the scanner can save valuable time by doing faster scans and can avoid the time-consuming rotations and repeated setups of the water phantom for angled measurements."*



"Accurate Stereotactic Cone TMRs Converted from PDDs Scanned with Ray Trace" H Li et al., Med. Phys. 43, 3591 (2016)

- Study investigating the accuracy of TMRs for stereotactic cones converted from PDDs scanned with Ray Trace feature using the SNC 3D SCANNER.
  - Ray Trace and traditional methods were used to obtain PDDs for conical cones of varying sizes for different energies.
  - Continuous direct measurements of TMR were executed by filling and draining water to and from the tank
  - The authors conclude TMRs converted from Ray Trace were very close to the continuous and spot measurement, while TMRs converted from traditional PDDs had large deviation.
  - Furthermore, the Ray Trace could improve the accuracy of PDD measurements and the calculated TMRs for stereotactic cones, which was within 3% of the measured TMRs.

Detectors

"The clinical impact of detector choice for beam scanning" J. Gersh et al., JACMP 15(4), (2014)

- Study showing clinical impact caused by the choice of detector with respect to its ability to accurately measure dose in the penumbra and tail regions of a scanned profile
  - The detectors used in the study: a) SNC EDGE Detector™ scanning diode, b) PTW 60012 diode, c) IBA CC13 scanning ionization chamber
  - Concludes EDGE has equivalent accuracy to the CC13 with better penumbra results for Eclipse commissioning

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