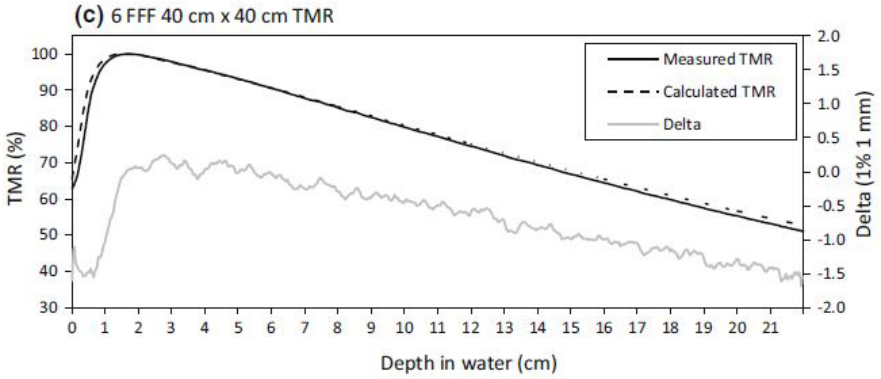
3D SCANNER™ Studies

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…"



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."

All data used is best available at time of publication. Data is subject to change without notice.
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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)

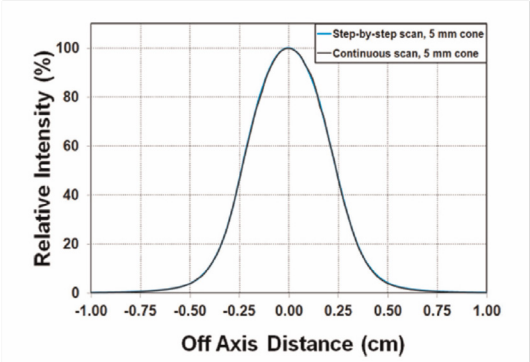
"It is concluded the four major water phantom scanning systems provide adequate accuracy for beam data collection within 1% of dose difference or 1mm of DTA to each other. It should be noted that this error includes uncertainties due to the phantom setup and the difference of the protocol, such as step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

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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Correction factor measurements for multiple detectors used in small field dosimetry on the Varian Edge radiosurgery system

S Tanny, University of Toledo Medical Center, Medical Physics, Vol. 42, No. 9, September 2015

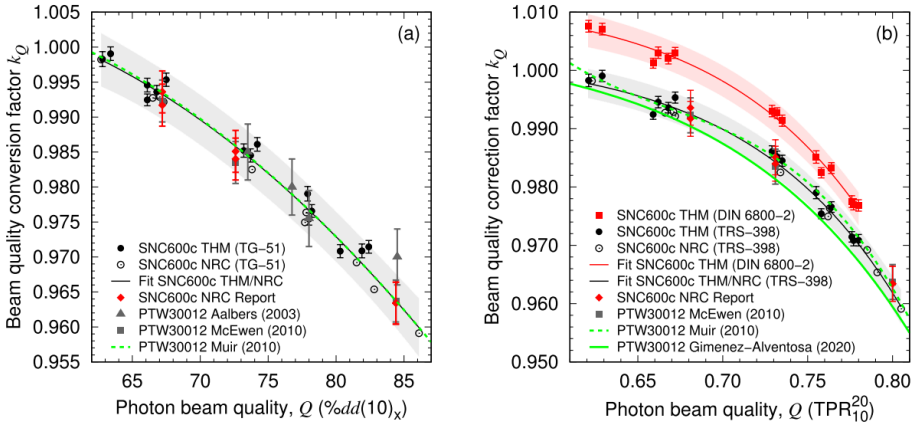
- This paper agrees best with SNC internal data on Edge, and because it is measured (versus aggregate data) it does not show large measurement uncertainty.
- TRS 483 is aggregate data; no original measurements were taken. It assumes 6MV corrections apply to 6FFF, 10MV, and 10FFF.
- This publication has factors measured for 6MV, 6FFF, and 10FFF.
- TRS 483 stops at 8mm; this publication goes down to 6mm
- This publication does not show the large uncertainties in TRS 483 - nor does SNC internal data.

SNC600c™ Farmer Chamber & SNC125c™ Reference Class Chamber

Monte Carlo calculated beam quality correction factors for two cylindrical ionization chambers in photon beams

M. Alissa, et al, Institute of Medical Physics and Radiation Protection, University of Applied Sciences Giessen (THM), Giessen, Germany, 2022

- Collaboration between the National Research Council, Institute of Medical Physics and Radiation Protection, University Medical Center Giessen and Marburg, and Marburg Ionbeam Therapy center
- Provides updated kQ values for SNC600C and SNC125C



Report IRS-2066; Monte Carlo calculation of the kQ quality conversion factor for the SNC600cionization chamber for photon beam reference dosimetry

Frédéric Tessier, National Research Council Canada, 2015

- Provides kQ factors for SNC600C

Report IRS-2065; Monte Carlo calculation of the kQ quality conversion factor for the SNC600c ionization chamber for electron beam reference dosimetry

Frédéric Tessier, National Research Council Canada, 2015

- Provides kecal factors for SNC600C

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MRgRT QA

Lateral dose response of an ionization chamber in an external magnetite field

M. Alissa, et al., Institute for Medical Physics and Radiation Protection, University of Applied Sciences Mittelhessen, Giessen, Germany, ESTRO 2022

- Monte Carlo study using SNC125c in a 1.5 Tesla field. Shows Lorentz effect to a magnetic field in the X, +Y, and -Y directions.

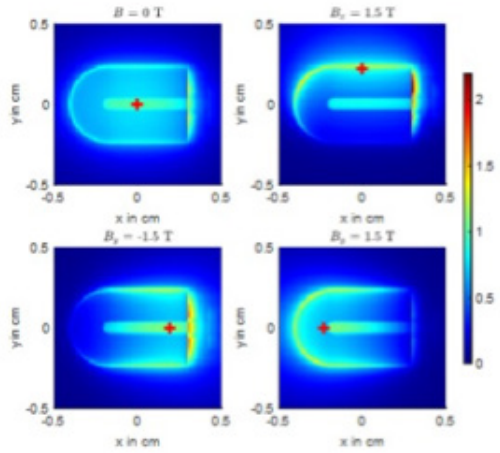


Figure 1: Spatial resolved relative dose within the sensitive volume of the SNC125c ionization chamber as a function of the pencil beam position.

Monte Carlo calculation of magnetic field correction factors for two ionization chambers

M. Alissa, et al., University of Applied Sciences Mittelhessen, Institute for Medical Physics and Radiation Protection, Giessen, Germany, ESTRO 2022

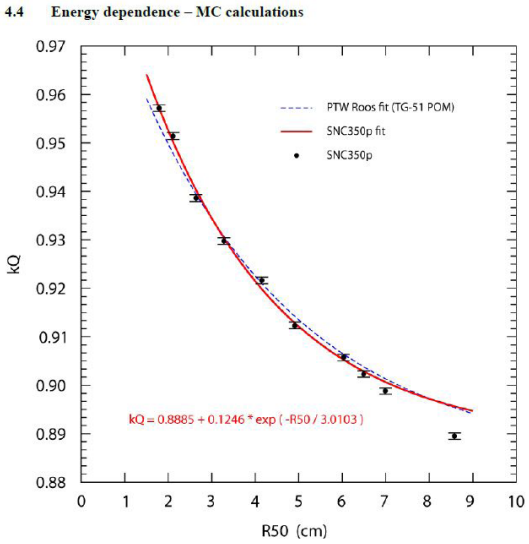
- Study applying Monte Carlo to determine the dosimetric impact of the Lorentz effect on the SNC600c and SNC125c
- *"Results: In case, where the magnetic field is parallel to the chamber axis (Bx), kB of the SNC 600c and the SNC 125c changes in dependence of the magnetic field strength Bx up to 1% and 0.5% respectively. In this case the Lorentz force directs the secondary electrons perpendicular to the chamber axis, as a result the correction factor kB is symmetrical around Bx = 0 T."*

SNC350p™ Roos-type Chamber

Characterization of a SNC350p parallel-plate ionization chamber for electron beam reference dosimetry

National Research Council Canada, Measurement Science and Standards; NRC Report Number: IRS-1860r; 11-March-2014

- The measured energy dependence of the SNC350p ionization chamber is found to be the same as that of a PTW Roos chamber within the estimated standard uncertainty of 0.13 %.



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