Publication list for the IBA Dosimetry Stealth Chamber

Overview

Evaluation of a novel reference chamber "stealth chamber" through Monte Carlo simulations and experimental data

Vazquez-Quino, L.A., et al.

International Journal of Cancer Therapy and Oncology, 3(2).

Abstract

Purpose: To evaluate a novel reference chamber (Stealth Chamber by IBA) through experimental data and Monte Carlo simulations for 6 and 15 MV photon energies. Methods: Monte Carlo simulations in a water phantom for field sizes ranging from 3×3 and 25×25 cm2 were performed for both energies with and without the Monte Carlo model of the Stealth Chamber in the beam path and compared to commissioning beam data. Percent depth doses (PDDs), profiles, and gamma analysis of the simulations were performed along with an energy spectrum analysis of the phase-space files generated during the simulation. Experimental data were acquired in water with IBA three-dimensional (3D) blue phantom in a set-up identical to the one used in the Monte Carlo simulations. PDD comparisons for fields ranging from 1×1 to 25×25 cm2 were performed for photon energies. Profile comparison for fields ranging from 1×1 to 25×25 cm2 were executed for the depths of dmax, 5, 10 and 20 cm. Criteria of 1%, 1 mm to compare PDDs and profiles were used. Transmission measurements with the Stealth Chamber and a MatriXX detector from IBA were investigated. Measurements for 6 and 15 MV with fields ranging from 3×3 to 25×25 cm2 dimensions were acquired in an open field with and without the Stealth Chamber in the path of the beam. Profiles and gamma analysis with a 1%, 1 mm gamma analysis criterion were performed. Results: Monte Carlo simulations of the PDDs and profiles demonstrate the agreement between both simulations. Furthermore, the gamma analysis (1%, 1 mm) result of the comparison of both planes has 100% of the points passing the criteria. The spectral distribution analysis of the phase spaces for an open field with and without the chamber reveals the agreement between both simulations. Experimental measurements of PDDs and profiles have been conducted and reveal the comparability of relative dosimetric data acquired with the Stealth Chamber and our gold standard the CC13 chamber. Transmission data measured with an ion chamber array (MatriXX) showed the small attenuation caused by the use of the Stealth Chamber. Conclusion: Simulations and experimental results from this investigation indicate the benefits associated with chamber positioning and time expended during the acquisition of the relative measurements of PDDs and profiles for the beam commissioning of photon beams when the Stealth Chamber is used as a reference chamber to perform these tasks. The results demonstrate that relative profiles and PDDs scanned with the Stealth Chamber in place are consistent with those made using a CC13 chamber within a 1% and 1 mm criterion.

Read more **HERE**.

Small Field Dosimetry in Radiosurgery Collimators with a Stealth Chamber
Azcona, J. and Barbes, B., 2016.
AAPM 2016 Poster.

Small field dosimetry in radiosurgery collimators with a Stealth chamber

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AAPM 2016 JUL 31–AUG 4

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Objective

The extraction of a reference signal for measuring small fields in scanning mode can be problematic and is a challenge for the medical physicist. We describe the use of a transmission chamber in small field dosimetry for radiosurgery collimators and compare tissue-maximum ratio (TMR) curves obtained with stereotactic diode and microionization chamber, as well as measured and calculated TMR from percentage depth dose curves (PDD).

Materials and Methods

(a) Small field-size radiosurgery cones:

- Four between 5 mm and 15 mm diameter
- Manufacturated by Elekta Medical

(b) Problem:

1. No place for positioning a regular reference diode without perturbing significantly the beam.
2. No way to extract a reference signal directly from the linac that could be interpreted by the electrometer of our scanning system (Scanditronix RFA 300plus).

(c) Stealth transmission chamber:

- Two plastic plates filled with air.
- Do not perturb significantly the beam's fluence.
- Attached to the lower part of the collimator

(d) Field detectors:

- Stereotactic unshielded diode (IBA Dosimetry)
- PinPoint 0.016 cm^3 microionization chamber (PTW Freiburg)

(e) Measuring media:

- Water with scanning water tank (IBA Dosimetry RFA 300)
- Polystyrene (PTW Freiburg solid water phantom 29672)

(f) Measurements: **(Required beam characteristics for BrainLab iPlan TPS)**

- PDD curves in water with diode (scanning mode)
- TMR curves in water with diode (integrating signal)
- TMR in polystyrene with microionization chamber (integrating signal)
- Profiles with stereotactic diode (scanning mode)
- Output factors with stereotactic diode and microionization chamber (integrating signal)

Results

1. The use of a transmission chamber allowed the measurement of the small field dosimetric properties with a simple setup.
2. Measured TMR with diode and microionization chamber agreed very well with differences larger than 1% only for depths above 20 cm, except for the smaller collimator, for which differences were always smaller than 2%.
3. Calculated TMR were significantly different (up to 7%) from measured TMR.
4. OF measured with diode and chamber showed a difference of 3.5%.

Depth (mm)	5 mm	10 mm	12.5 mm	15 mm
5	7.2	1.8	3.1	0.7
8	2.1	-0.2	0.5	5.8
12	1.0	0.1	-0.1	0.7
14	0.3	0.1	0.0	0.3
15	0.0	0.0	0.0	0.0
18	-0.1	0.1	0.1	0.1
19	0.2	0.2	0.0	0.2
20	0.2	0.3	0.0	0.0
25	0.4	0.5	0.2	0.3
30	0.4	0.0	0.2	0.2
40	-0.1	-0.4	-0.8	-0.3
50	0.4	-0.7	-0.5	0.0
75	0.8	0.1	-0.1	0.3
100	1.8	0.5	0.3	0.0
125	1.4	0.5	0.3	0.8
150	1.7	0.8	0.7	0.6
175	1.4	0.9	0.8	0.9
200	1.8	1.1	1.2	0.8
225	1.5	0.1	1.2	0.7
250	1.3	0.4	1.1	0.7

Table I. Differences between measured TMR with stereotactic diode and PinPoint chamber.

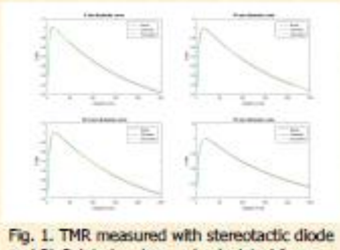

Fig. 1. TMR measured with stereotactic diode and PinPoint chamber and calculated from PDD measurements.

Depth (mm)	5 mm	10 mm	12.5 mm	15 mm
0	-8.2	0.2	10.0	6.5
5	-1.1	-6.8	-5.3	-7.7
8	-0.4	-0.7	-2.8	1.2
12	-0.1	-0.6	-0.7	-0.2
14	0.0	-0.2	-0.2	-0.1
15	0.0	0.0	0.0	0.0
18	0.0	0.3	0.4	0.2
19	0.2	0.8	0.5	0.9
20	0.4	0.8	0.9	0.9
25	0.7	1.1	1.1	1.5
30	0.4	0.7	1.0	1.3
[illegible]	0.3	0.7	0.3	1.2
[illegible]	1.0	0.8	0.9	1.2
[illegible]	1.4	2.2	1.9	2.3
[illegible]	2.8	3.3	2.7	2.2
125	3.0	3.3	2.8	3.4
150	4.3	4.0	3.8	3.8
175	4.4	4.9	4.8	4.7
200	5.0	5.9	5.0	4.3
225	5.6	6.0	5.9	5.5
250	7.3	8.3	8.4	5.5

Table II. Differences between calculated and measured TMR (stereotactic diode).

Conclusion

The Stealth transmission chamber overcomes the problem of getting a strong reference signal when measuring very small size radiation fields. Measured TMR are superior to calculated ones so measuring them is strongly recommended instead of calculating them from PDD.

Acknowledgements: José Luis Roldán and Salih Arican, from IBA Dosimetry, are gratefully acknowledged for providing with the Stealth chamber and its technical data. IBA Dosimetry and BIOTERRA S. L. (IBA's representative in Spain) provided financial support for attending to AAPM 2016 to present these data.

American Association of Physicists in Medicine

Washington, July 31st – Aug 4th, 2016

Read more **HERE**.

Stereotactic Beam Characterization using the IBA Stealth Reference Detector
Gersh, J.A., 2014.

Whitepaper.

Abstract

The technique proposed in this study uses a transmission detector, similar in function to the monitor chambers of a linac, as the scanning reference chamber. Evaluated in this study is the Stealth Detector (IBA Dosimetry), a transmission detector which perturbs the primary beam minimally, evenly, and consistently. The use of this detector would give rise to a time savings associated the user not having to perform a readjustment of the reference detector prior to each field-size change. The purpose of this study is threefold. First, it is important to determining the extent by which the beam is perturbed along the central axis by the inclusion of this transmission detector. Next, is the determination of the effect on the energy spectra of the field by evaluating percent depth dose scans using the transmission detector and comparing those to scans using standard reference detectors. Finally, profile scans using both types of reference detectors are compared.

Find the full white paper on the IBA Dosimetry webpage HERE.

For more information about the Stealth Chamber please contact your IBA Dosimetry experts HERE.