Performance of the T-REF Chamber

- with regard to Perturbation, Backscatter and Transmission

Table of Contents

1 Introduction

In response to the message CA-2017-004 of the Federal Institute for Drugs and Medical Devices (BfArM) about the Stealth chamber of IBA Dosimetry (IBA Dosimetry GmbH, Schwarzenbruck, Germany), our comparable application, the T-REF chamber type 34091, was examined for its worst case conditions. Worst case here means minimal distance to water surface, maximum field size and maximum high energy. Percentage depth dose curves (PDDs) and profiles have been measured.

In addition, it was investigated whether at 20 cm (and more) distance from the water surface (detector surface distance - DSD) disturbance of the reference signal by backscattering from the water surface on the chamber occurs. Conclusively this technical note shows how large the transmission through the material of the T-REF chamber is.

2 Materials

- Water phantom: MP3
- Two-channel electrometer: TANDEM T10011
- Linac: Varian Clinac (Varian Medical Systems, Inc., Palo Alto, CA), 6 MV, 18 MV
- Reference Detector: T-REF chamber TM34091; field detector: microDiamond T60019; transmission measurements: PTW Rigid Stem Chamber TM23332
- The measurement of percentage depth dose curves (PDD) and profiles (TBA scans) were implemented with the BEAMSCAN software version 4.1.

3 PDDs

In the following two compared scans have been performed. For evaluation whether the T-REF chamber shows an effect, Figure 1 demonstrates a comparison between a percentage depth dose curve with and without a T-REF chamber. The maximum field size of 5 cm x 5 cm and the minimum DSD of 20 cm have been taken into account to get the worst case scenario. Figure 2 shows a comparison between two PDDs, each without T-REF chamber. The reason for that second scan is to show that the slight instability originates from the quantum noise of the field detector.

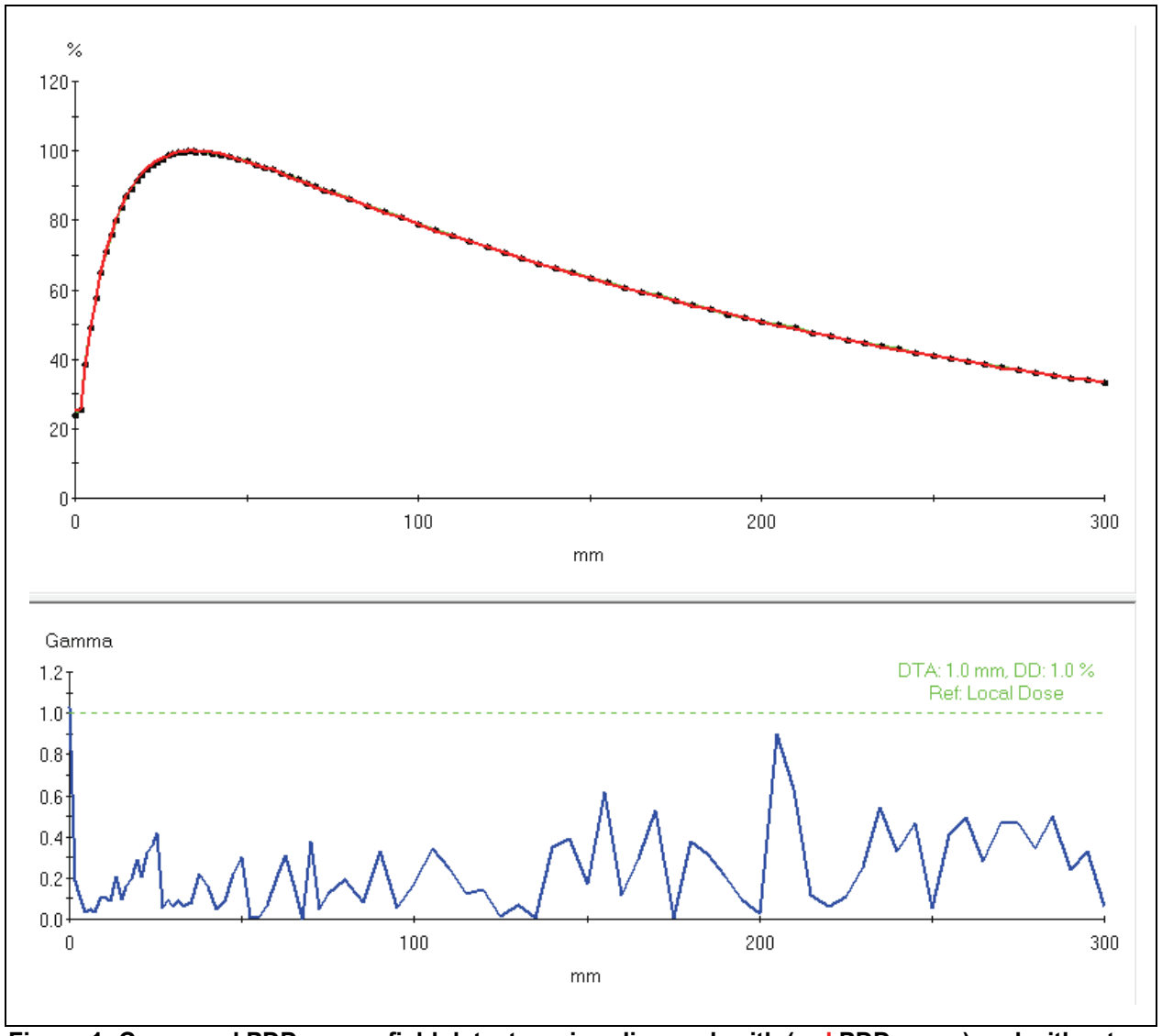

Figure 1: Compared PDD scans, field detector microdiamond, with (red PDD curve) and without (green PDD curve) T-REF chamber, 18 MV Varian Clinac, 5 cm x 5 cm, T-REF chamber DSD 20 cm

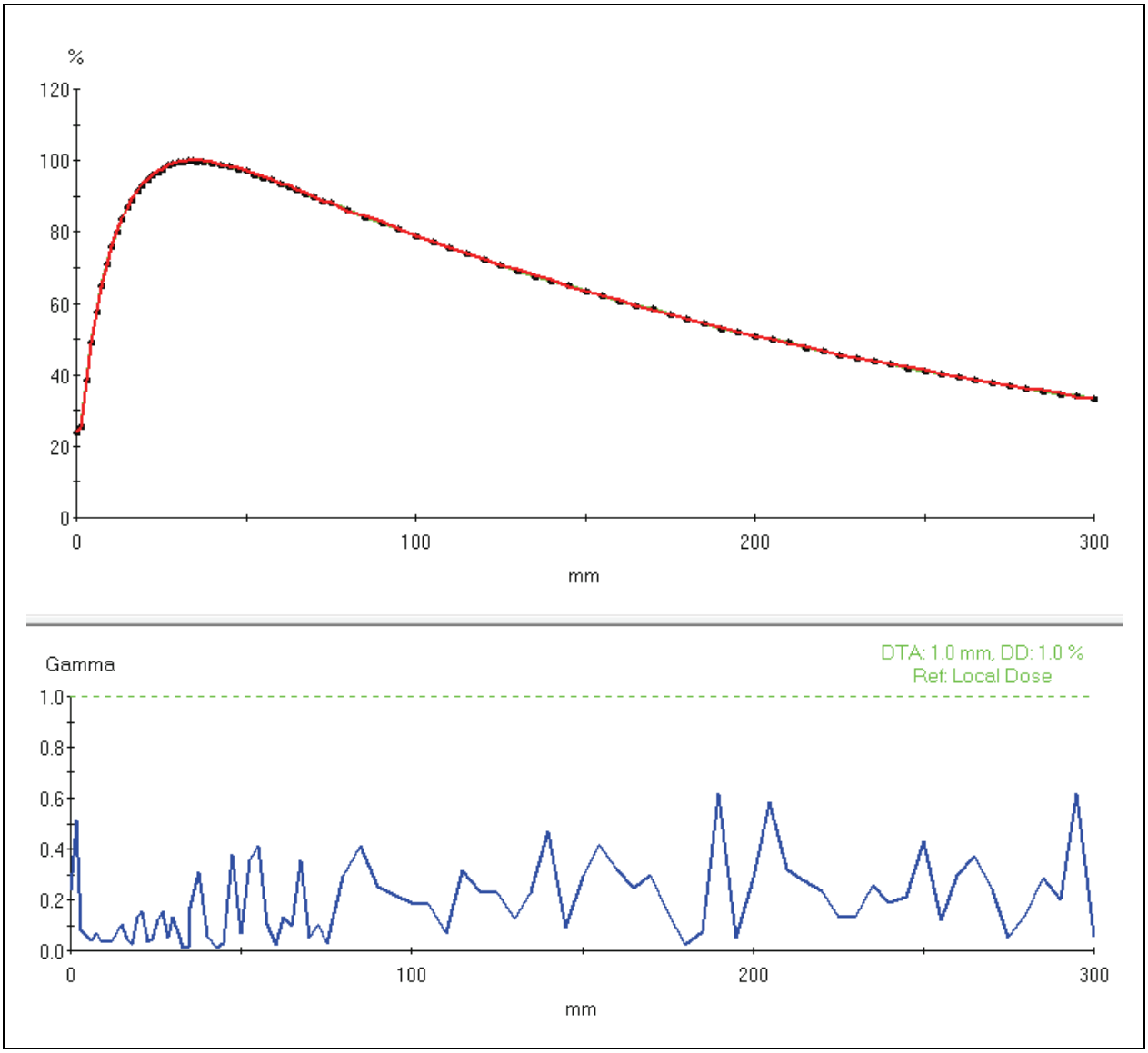

Figure 2: Compared PDD scans, field detector microdiamond, red and green PDDs each without T-REF chamber, 18 MV Varian Clinac, 5 cm x 5 cm

As a result of the PDD compared scans it makes no difference whether measuring *with and without* or *two times without* T-REF chamber. Thus, the T-REF chamber does not show a measurable effect.

4 Profiles

Figure 3 shows profiles with (green profile) and without (red profile) T-REF chamber in 33 mm depth, (which is d_max for this linac at 18 MV). The total gamma value is on the same order of magnitude as the noise alone.

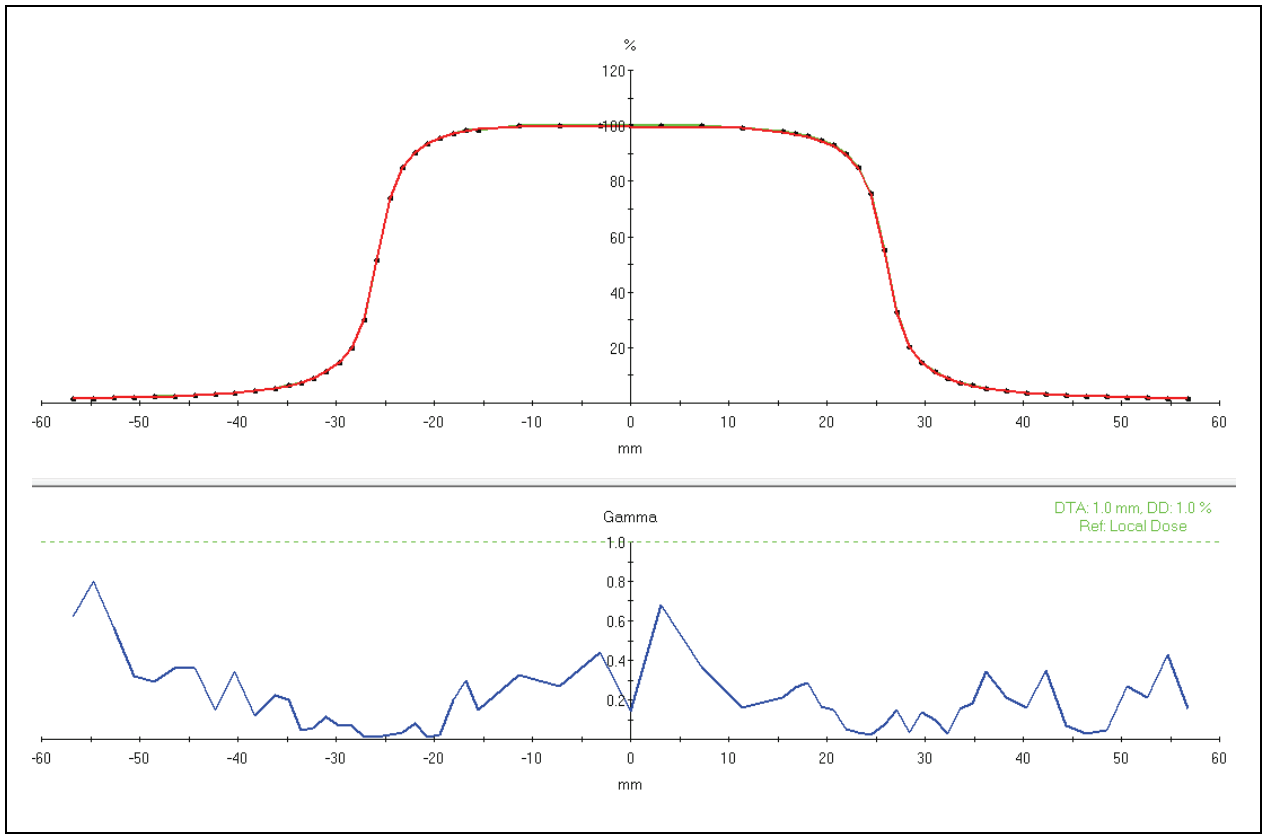

Figure 3: Compared profile scans, field detector microdiamond, with (green profile) and without (red profile) T-REF chamber, 18 MV Varian Clinac, 5 cm x 5 cm, T-REF chamber DSD 20 cm

5 Transmission

The attenuation has been measured at minimum and maximum standard photon energies (6 MV and 18 MV). To receive the attenuation value, measurements were performed with and without T-REF chamber at these two energies.

Table 1: Results of transmission measurements, 6 MV and 18 MV, measurement depth 5 cm, SSD 100 cm

6 MV			18 MV		
chamber	transmission	average	chamber	transmission	average
1	99.16	**99.08**	1	99.44	**99.43**
2	99.06		2	99.44	
3	99.03		3	99.41	
4	99.03		4	99.44	
5	99.12		5	99.41	

As a result the total transmission of photons is > 99% or rather the attenuation is < 1%.

6 Results

As a summary this investigation shows that the T-REF chamber T34091 can be used in small field relative dosimetry e.g. for profiles and PDDs. No perturbation that would influence the relative measurement results can be measured within the PTW specifications.

PTW-Freiburg
Lörracher Straße 7 • 79115 Freiburg • Germany
Phone +49 761 49055-0 • Fax +49 761 49055-70
info@ptw.de • www.ptw.de