

Evaluation of PTW microSilicon diode detector for small field dosimetry with the Elekta Versa HD linear accelerator

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INTRODUCTION

- Accurate beam data measurement for small field radiotherapy is challenging task
- The IAEA TRS-483 CoP for small field dosimetry recommends detectors should be small relative to the minimum field size, have a high signal to noise ratio(SNR) & high spatial resolution
- Diamond based detectors** is often used for small field beam measurement because of their many advantages, but they are **expensive**
- We evaluate the performance** of relatively inexpensive new detector that can **replace diamond detectors**

AIM

- The **evaluation of the new microSilicon diode detector** (PTW, Germany) for **small field dosimetry** by comparing with different detectors

METHOD

- Machine:** Elekta Versa HD
- Energies:** 6 MV, 10 MV, 6 MV FFF, 10 MV FFF
- Detectors:** PTW microSilicon, PTW60019 microdiamond, PTW31022 PinPoint 3D(IC), PTW31021 SemiFlex 3D(IC)
- PTW TRUFIX system was used for all chambers
- Measurement condition**
 - SSD: 100cm, depth:10cm
- In this work,
 - Compare output factors of each detector for various square field sizes
 - Compare field size(FWHM) from profile, and FWHM value was average value which of cross-plane and in-plane

RESULTS

Output factor Comparison

- The detector orientation is parallel to beam
- Reference field size: 10x10 cm²
- Sensitive volume of detectors (mm³)

microDiamond	microSilicon	PinPoint 3D	SemiFlex 3D
0.004	0.03	16	70

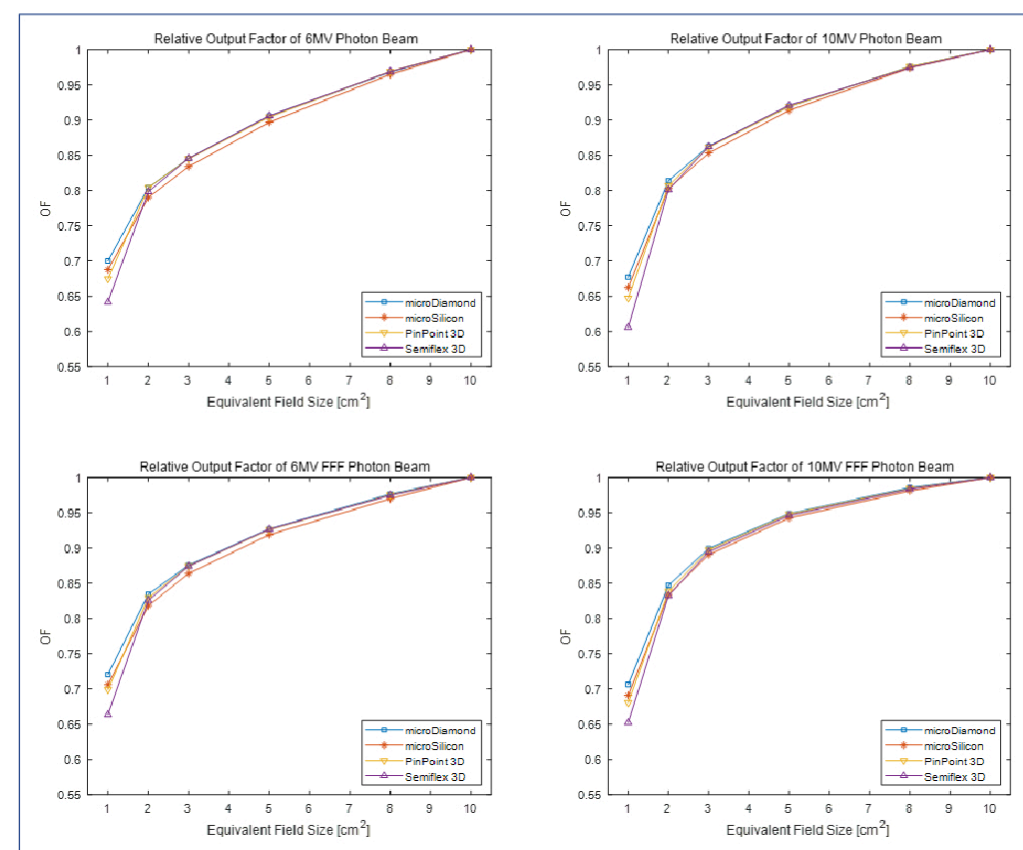


Figure 1. Relative output factor of photon beams measured by the different detectors

- The output factor for all detectors decreased with decreasing of field size
- The output factors measured by microSilicon is most similar to output factor of microDiamond
- The difference of 1x1 cm² field output factor between microDiamond and other detectors: 2.04% (microSilicon), 3.66% (PinPoint 3D), 8.60% (SemiFlex 3D)

Radiation field size (FWHM) Comparison

- As the chamber volume increases, the FWHM becomes overestimate
- The average FWHM difference between microDiamond and other detectors: 0.29% (microSilicon), 0.48% (PinPoint 3D), 0.95% (SemiFlex 3D)

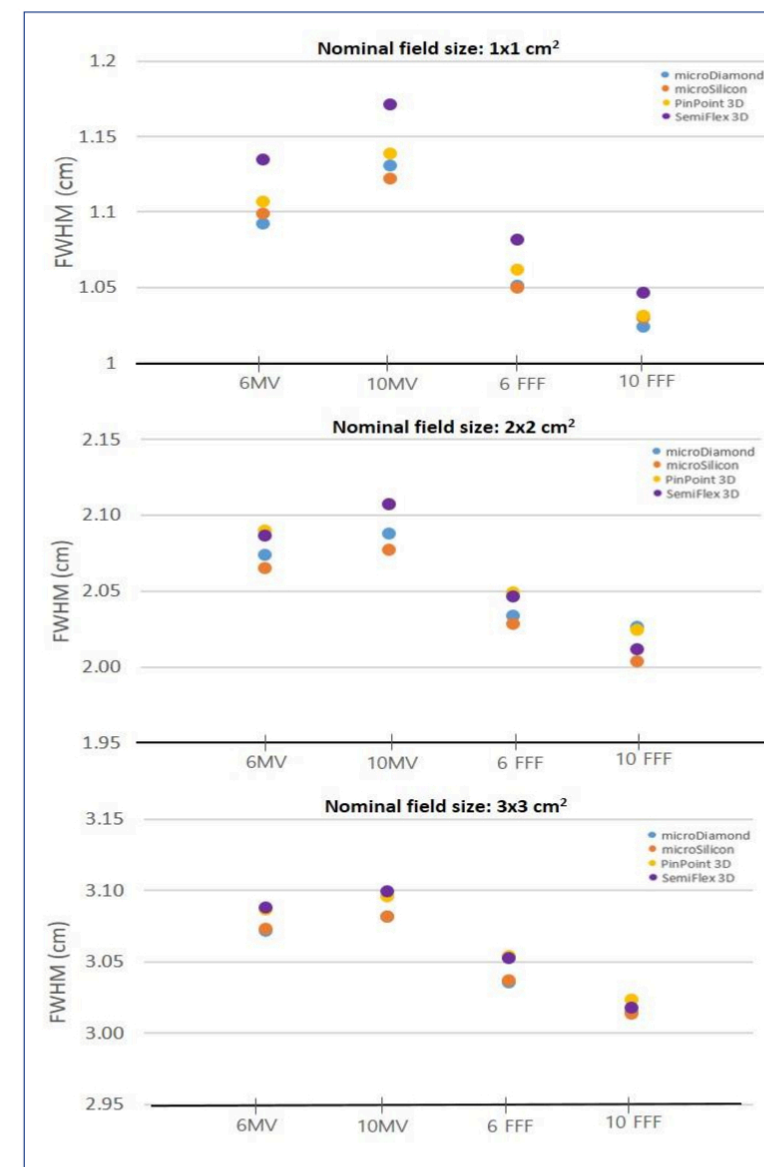


Figure 2. FWHM according to field size and energy

CONCLUSIONS

- The performance of PTW microSilicon detector is more similar to microDiamond detector than ionization chambers
- The smaller active volume of detector, the more similar to nominal field size
- In small field size(under 2x2 cm²), the difference between the output factor of microDiamond and that of microSilicon is the smallest
- However, there is a performance difference between microDiamond and microSilicon, so it is good to use with caution

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