Characteristics of Unshielded MicroSilicon Diode Detector in Photon Small Fields

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INTRODUCTION

Silicon based diode detectors are attractive compared to other detectors due to small volume and very high signal. PTW has introduced a new diode PTW-60023 called microslicon (µSi) with disk diameter of 1.5 mm and thickness of 18 mm with minimal epoxy. The characteristics of this detector have been recently characterized by Schönfeld et al[1] in photon and Akino[2] in electron beam. However some characteristics such as temporal, thermal and angular dependence are not available which is presented here. Also output factor and profiles for small fields created with jaw and MLC are investigated and compared with plastic scintillator W-2. Measurements were performed in a scanning water phantom along with various other micro-detectors with methodology as described in literature.[3-5]

METHOD

Measurements were performed on a Varian TrueBeam with scanning water phantom.

- The thermal response was carried out in a small phantom with variable temperature.
- Angular dependence was performed in air and in 5 cm water depth.
- The µSi measured output and beam profiles are compared with PSD-W2.

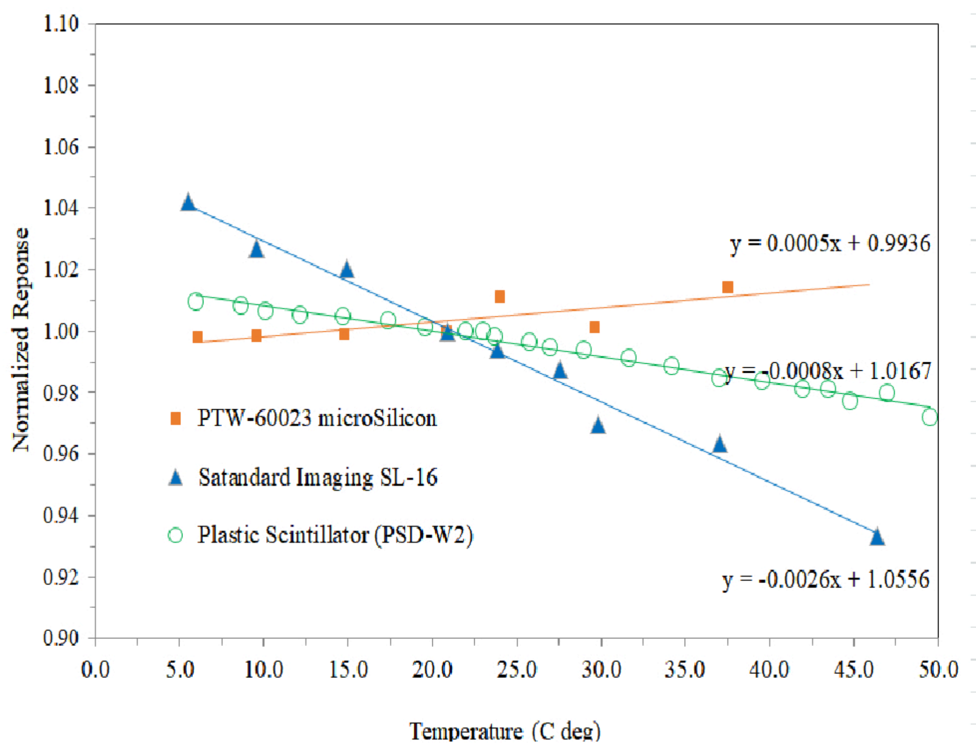

Figure 1. Thermal response of three types of detectors, mSi, Ion-chamber and Plastic scintillator.

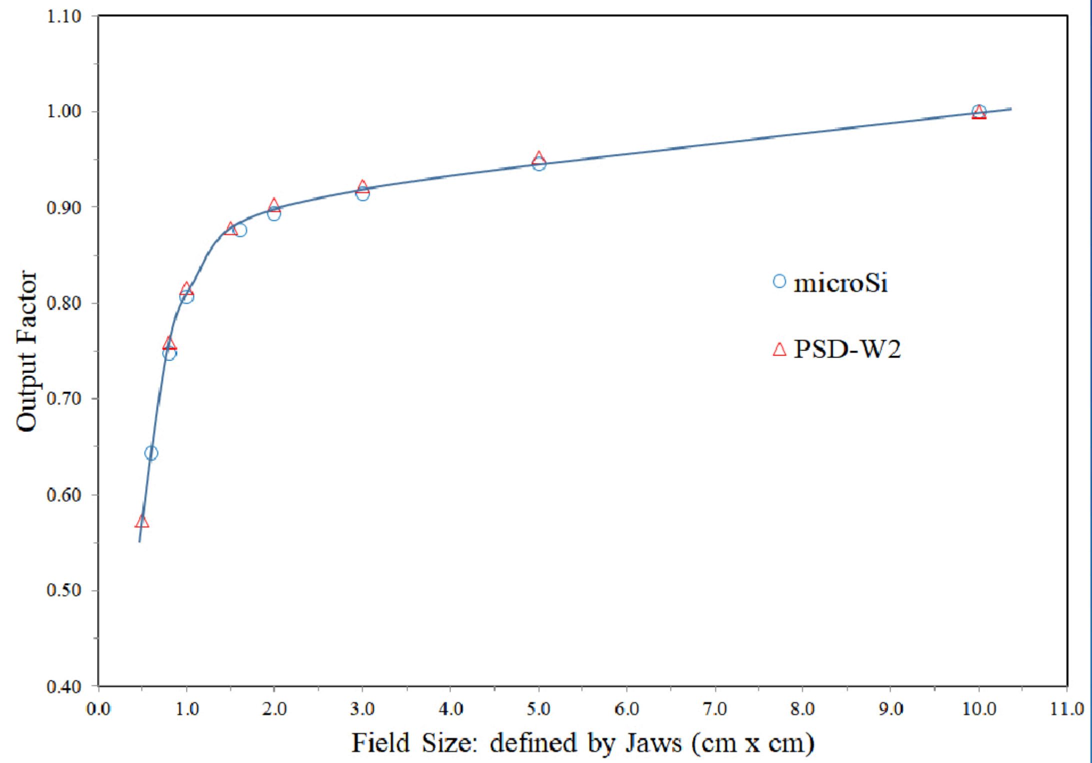

Figure 3. Output factors vs field size for µSi compared to PSD W2

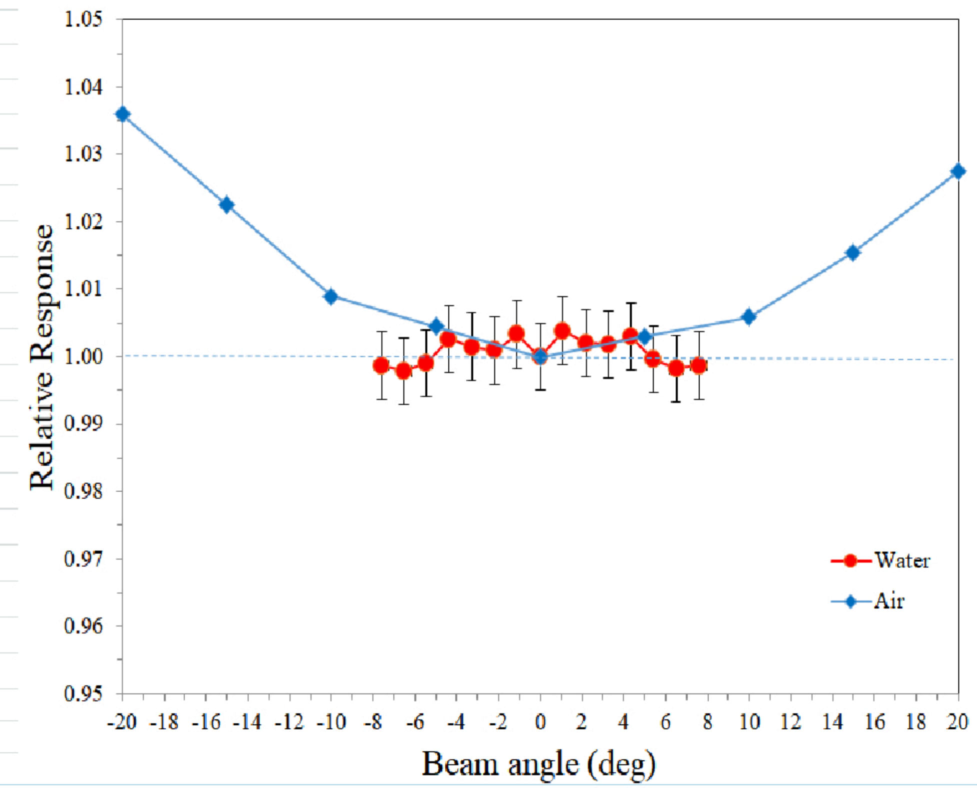

Figure 2. Angular dependence of mSi in air and water

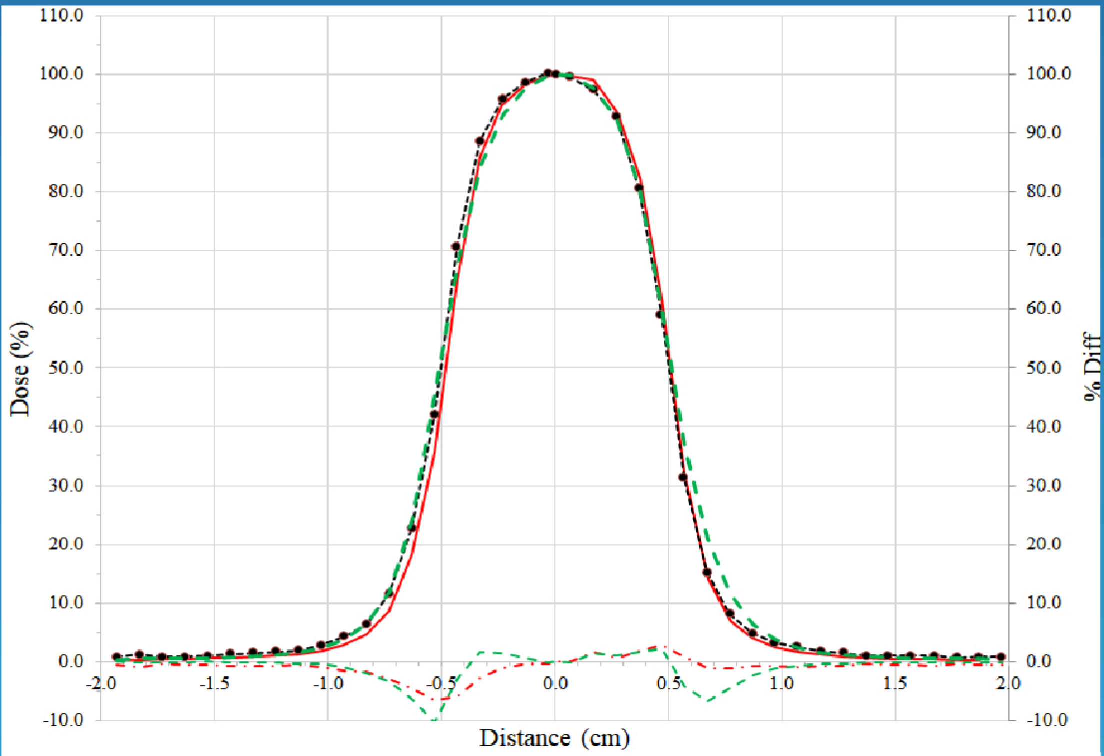

Figure 4. Profile of 1x1cm^2 field at dmax, where data point is from film, red line is µSi and green line is PSD-w2.

RESULTS

Temporal response of mSi is constant without any warm up. The thermal response is relatively constant with slight upward (+ slope) compared to PSD-W2 and SL-16 ion chambers that have negative slopes (Fig 1). Within operating range of clinical water temperature (15-25ºC), mSi is temperature independent. The angular dependence in air is strong but when used in water scanning and computing the dose with beam angle for 30x30cm2, it is within <1% (Fig 2). The effect of MLC defined small field produces consistently <1.5% lower values compared to the jaw fields and the k(clin, msr) is nearly unity except for 6x6 mm2 field where it deviates <5% (Fig 3). The small field profiles of mSi are identical to film and W2 profiles. Fig 4 shows profile at dmax for 1x1 cm2 field with film, W2 and mSi detector.

CONCLUSIONS

The µSi detector has optimum characteristics in photon beam with dose, dose rate, energy and thermal response. The temporal and angular dependence is also found to be minimum. It is concluded that µSi is one of the better detectors with k(clin, msr) values within ±1% except for very small fields. It also provides high resolution profile and accurate depth dose.

REFERENCES

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CONTACT INFORMATION

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