

Evaluation of a Beo-Based Optically Stimulated Luminescent Dosimetry System for In-Vivo Applications In Radiotherapy

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PURPOSE / OBJECTIVES

- Commission the myOSL BeO OSLD system for clinical in-vivo dosimetry.
- Evaluate dose linearity, energy, dose-rate, angular, field-size, SSD dependence, signal depletion, and fading.
- Verify suitability for routine clinical radiotherapy.

MATERIAL & METHODS

myOSL chip Dosimeter

- Beryllium oxide (BeO) element with dimensions 4. 7x 4.7 x 0.5 mm
- $Z_{eff} = 7.2$, Density = 2.85 g/cc
- ABS (Acrylnitril-Butadien-Styrol-Copolymer) black sheath
- Printed code for identification

Reader

- Contains 2D code reader
- Read and erase LEDs (One each)
- Photosensor containing PMT with peak sensitivity at 400 nm

Bleacher/ Eraser

- Slots for 48 chips
- Contains 48 high power LEDs



MATERIAL & METHODS

Device Calibration

Fifteen dosimeters were irradiated to same known dose

Dosimeters with $\pm 10\%$ variation from average response were selected

$$DCF = \text{Average Response} / \text{Given Dose}$$

Individual dosimeter calibration

Establishes intrinsic sensitivity of each dosimeter

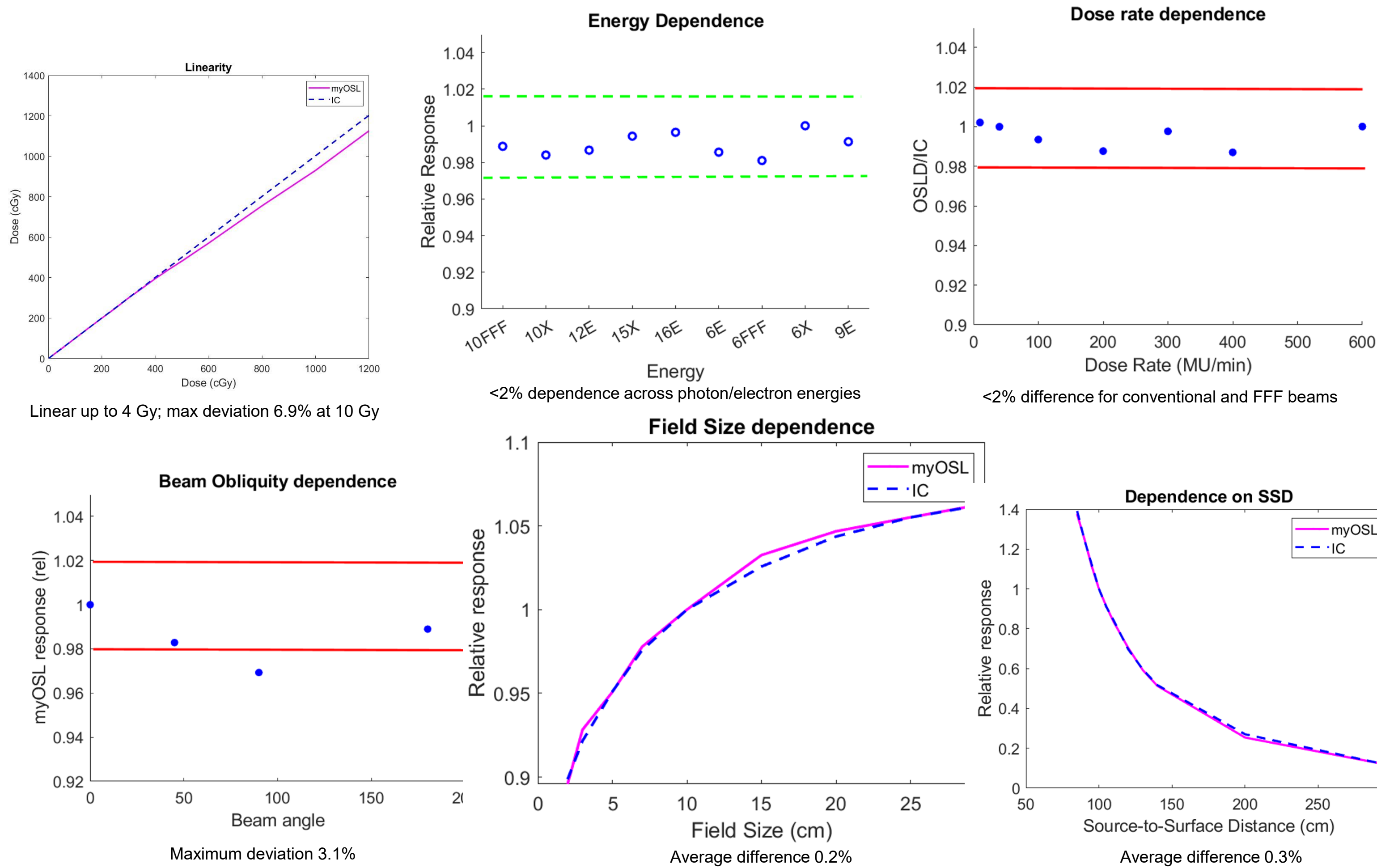
$$k(i) = (\text{Average Response from Device Calibration}) / (\text{Response from chip (i)})$$

System Calibration

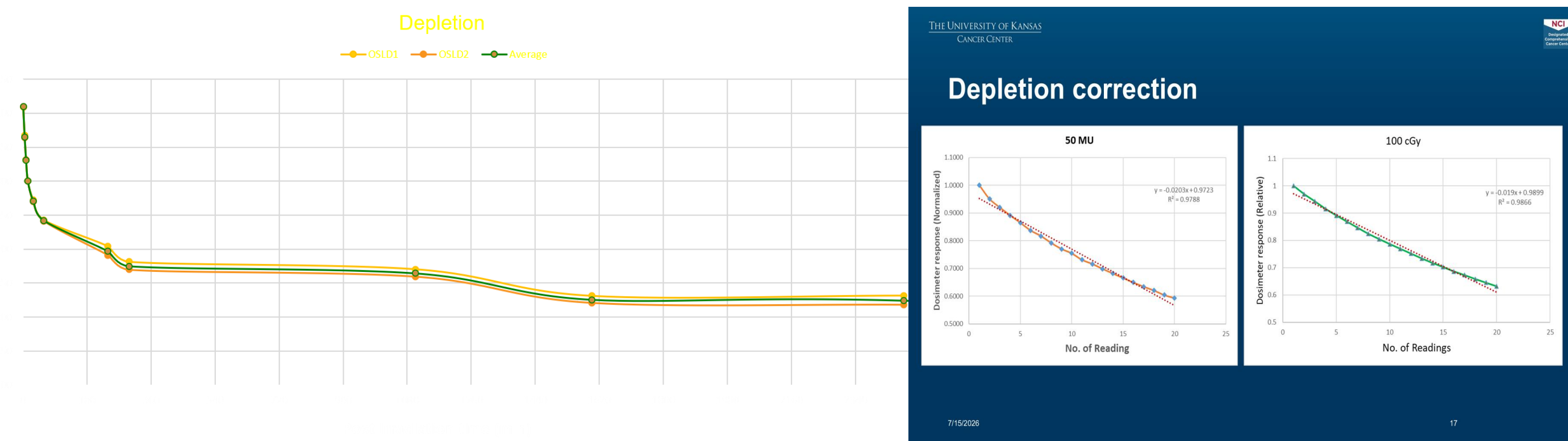
Calibration dosimeters are irradiated to known dose

Calibration factor for system correction is calculated by the average signal of the calibration dosimeters (usually $\sim 0.5\%$)

RESULTS



RESULTS



Dose (cGy)	OSLD Dose	K(L)	Corrected Dose	%Diff
50	50.04	1.00	50.04	0.08%
100	100.07	1.00	100.0745	0.07%
200	198.23	1.00	198.2273	-0.89%
300	297.03	1.00	297.3839	-0.87%
400	387.15	1.01	392.0301	-1.99%
500	481.24	1.04	499.2319	-0.15%

Agreement within ~2%

SUMMARY / CONCLUSION

- myOSL System Successfully commissioned for clinical use for invivo dosimetry and replaces recalled nanodot system.
- Near water-equivalent response.
- Minimal beam quality, dose-rate, field-size, and SSD dependence.
- Mild nonlinearity above ~ 4 Gy
- Suitable for routine in-vivo dosimetry.
- Depletion of signal of $\sim 2\%$ was observed with the successive readings
- Fading was found less than 1.5%
- Dedicated software keeps track of successive background values

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