

Diodes vs. Mosfets

Informed Decisions for Patient Dose Monitoring

Although diodes and mosfets are both very small detectors, they exhibit very different dosimetric properties. Awareness of these differences will aid in making an informed decision when choosing a patient dose monitoring system. The following information has been compiled based on information from Sun Nuclear and the primary commercial mosfet detector manufacturer.

Reproducibility

Poor reproducibility creates uncertainty and additional time requirements when verifying dose to a patient. Reproducibility is defined as the percentage difference between consecutive measurements for the same radiation dose under the same conditions. The data in the following table is at 1 σ (32% of the readings will have lower reproducibility). If the reproducibility is calculated at 3 σ (only 1% of the readings will have less reproducibility), mosfet reproducibility worsens, however Sun Nuclear diode detectors remain relatively stable.

Buildup & Setup

For mosfets, buildup must be added in different amounts depending on energy to provide a reading at d_{max} ; diodes do not require this. Once buildup is added to a mosfet, many mosfet advantages, such as low attenuation, low energy dependence, and “one” detector for multiple energies are no longer applicable.

Sun Nuclear QED and ISORAD detectors are available without buildup. Also, the ISORAD is isotropic, so it can be irradiated from any angle along the x-axis with less than a 1% variation in response. Unlike diodes, mosfets also suffer from a very short lifetime, creep-up effect, and signal fading, which can make mosfet reading problematic and further complicate their reproducibility.

	ISORAD & QED Diodes		MOSFET Detectors				Advantage
Sensitivity¹	0.3 nC/cGy		1 mV/cGy (.0000014nC/cGy)		2.7 mV/cGy (.0000038nC/cGy)		Diodes
Reproducibility¹	>1 cGy	< 0.5%	20 cGy	< 8%	20 cGy	< 3%	Diodes
			100 cGy	< 3%	100 cGy	< 1.2%	
			200 cGy	< 2%	200 cGy	< 0.8%	
Lifetime²	>10,000 Gy		200 Gy		70 Gy		Diodes
Creep-up effect²	N/A		Up to 4 mV 4% for 100 cGy, 20% for 20 cGy				Diodes
Signal fading²	N/A		Up to 2% for 200cGy at 15 minutes, possibly greater for lower doses.				Diodes
Detector size (mm²)¹	0.8 x 0.8mm		0.2 X 0.2mm				MOSFET
Measurement at d_{max}¹	Inherent buildup included. Diodes without buildup are available.		Must manually add different buildup depending on energy.				Diodes

1. Thomson Nielson mosfet models TN-RD-50,60,70-W

2. Thomson Nielson mosfet models TN-RD-50,60; 70-W data not available at time of publication

* All data used is best available at time of publication. Data is subject to change without notice.