Hi-pSi Semiconductor Detectors for Radiation Field Scanning

Semiconductor detectors offer many practical advantages for radiation field analysis. They are small, mechanically stable devices which deliver a high level signal output. Bias voltages are not required, and the response is very fast and independent of pressure variations. Their small size allows the detection area to be located very close to the surface (0.5 mm) and provides excellent spatial resolution. The sensitivity is extremely high – typically about 18,000 times that of an airfilled ionization chamber of the same volume.

The waterproof Hi-pSi semiconductor radiation field detectors are designed to meet the diverse needs of photon and electron radiation field analysis. They are delivered pre-irradiated, which stabilizes sensitivity at the expense of a slight temperature coefficient. However, for extensive water phantom measurements, detector stability with accumulated dose is a much more important consideration than variation due to temperature change.

Specifications

Model:	EFD-3G	PFD-3G	SFD-3G
Part number:	999-602	999-702	999-750
Detector type:	p-type	p-type	p-type
Active area diameter:	2.0	2.0	0.6
Active area thickness:	0.06 mm	0.06 mm	0.06 mm
Eff. measurement point:	0.5 ±0.15	0.45 ±0.15	0.5 ±0.15
Sensitivity:	0.25 nC/cGy	0.35 nC/cGy	0.06 nC/cGy
Pre-irradiation level:	8 kGy	8 kGy	8 kGy
SVWT (%/°C):	0.3	0.3	0.3
Collection time:	5 ms	5 ms	5 ms
Impedance at zero bias:	>150 MΩ	>150 MΩ	>150 MΩ
Encapsulation diameter:	7.2 mm	7.2 mm	4.1 mm
Stem diameter:	4 mm	4 mm	4 mm
Stem material:	stainless steel		
Cable/connector:	2 meters, BNC coaxial male		

RFD-3G, 999-802 Reference Field Detector:

Detector type:	p-type
Sensitivity:	30 nC/Gy, typical
Pre-irradiation level:	not irradiated
Encapsulation:	5 mm diameter
Cable/connector:	2 meters, BNC coaxial male

Options

Model 999-SET Detector Set: one each EFD, PFD, RFD

3BM-2BF: Adapter, allows connection between diode detector with coaxial BNC input to electrometer with triaxial BNC input

Model EFD-3G Electron Field Detector

The water/silicon mass collision stopping power of the 3G-pSi semiconductor detector is practically constant at energy levels above 5 MeV. This allows depth-ionization curves for electron beam measurements to be used as depth-dose curves without requiring correction factors. Electron beam measurements may be made as close as 0.5 mm to the phantom surface, and directional dependence is less than 2.5% for a 20 x 20 cm field at 2 cm depth in a 20 MeV beam.

Model PFD-3G Photon Field Detector

In photon beams, depth-dose percentages obtained from a semiconductor tend to be overestimated. This tendency increases with the depth due to increased sensitivity of the semiconductor to energies below 400 keV. To prevent this, the Hi-pSi semiconductor chip is backed with a tungsten/epoxy shield to capture low-energy backscattered photons. The result is an energy-compensated photon detector giving precise readings from 50 to 400 mm.

Model SFD-3G Small Field Detector

The very small size of the stereotactic detector, its energy independence in fields less than 10 cm, and the low impact of nonelectron equilibrium make it the obvious choice for measuring output factors and depth-dose curves in stereotactic beams.

Model RFD-3G Reference Field Detector

This is a relatively low-cost detector that should only be used to obtain a reference signal for relative field measurements. By calculating the quotient of the field and reference signals, the effect of variations in dose rate from the accelerator are nulled out. It is best not to use an ion chamber as the reference when the field detector is a diode because of signal size and the need for bias.

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