SYDOR TECHNOLOGIES

X-ray Beam Intensity & Position Monitor
SI-DBPM-M402 SN:017

Specifications:

- Sydor Diamond p/n: DP 130
- Dimensions: 4.5 x 4.5 mm
  - Thickness: 44 µm
- Metallization: Al
- Leakage current: <±0.3 pA at ±10 VDC
- Suggested Operation Voltage: ±10 VDC
- Overcoat: 25 nm SiO_2

Device Characteristics:

The diamond sensor was metalized with ~100 nm of aluminum on each face. The bias electrode is a 3.1 x 3.1 mm solid square, and the readout electrode pattern is a 3.1 x 3.1 mm square divided into quadrants by ~20 µm gaps. The bias electrode is mounted directly to the carrier PCB, and the quadrant electrodes are connected by wirebonds.

Testing:

This detector was tested using a 50 W, 8.04 keV (Cu-anode) polycapillary x-ray source at Sydor Technologies by Dan Slakes. The beam was incident on the readout contact face of the diamond sensor and exited through the bias electrode on the opposite face. Test results are discussed in the following sections.

Detector Bias Scan

Device x-ray response testing was performed with an applied bias range of ±20 VDC with its center aligned to the x-ray beam. Signal saturation was ~33 nA with bias at or below -2 V and ~20 nA at or above +2 V.

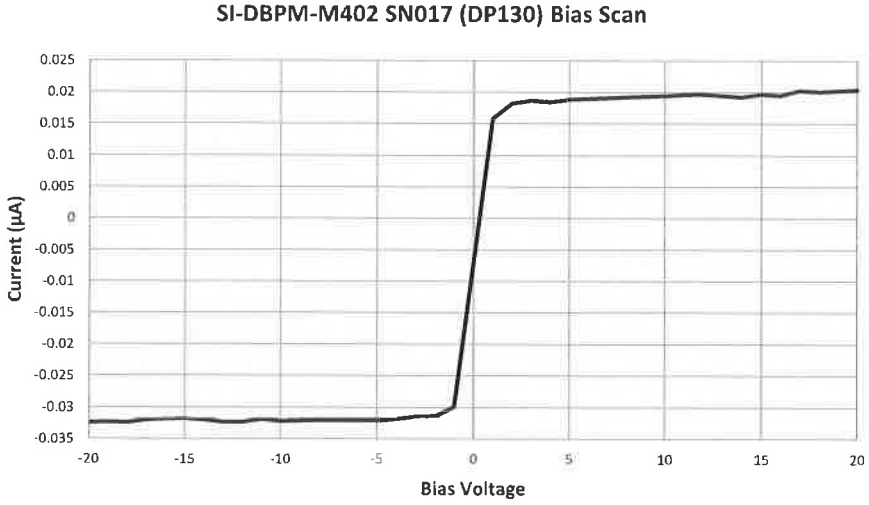

Figure 1

Detector Position Calibration

The vertical and horizontal positions are calibrated by manipulating the detector through the path of a <100 µm Ø x-ray beam using precision motorized stages. The position of the x-ray beam on the detector is determined based on current outputs from the device contacts (A-D). The (X, Y) position is calculated with the following equations:

$$X = G_x \frac{(A+D)-(B+C)}{A+B+C+D} \qquad Y = G_y \frac{(A+B)-(C+D)}{A+B+C+D}$$

Sensitivity constants, Gx and Gy, were obtained from the inverse of the slope in the active region of the detectors. The sensitivity factors are unique for specific beam shapes and intensity profiles. Linear response over the device active area is demonstrated in *Figures 2 & 3*.

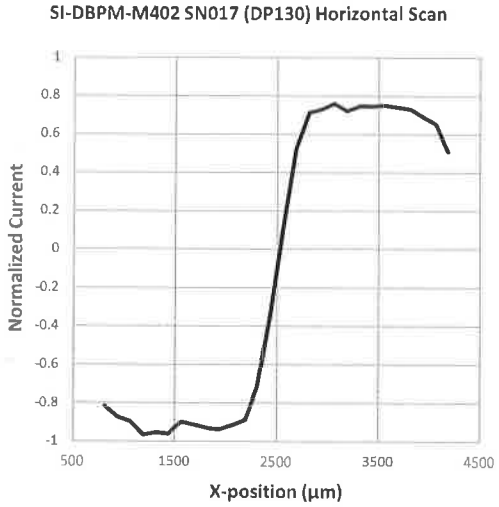

Figure 2

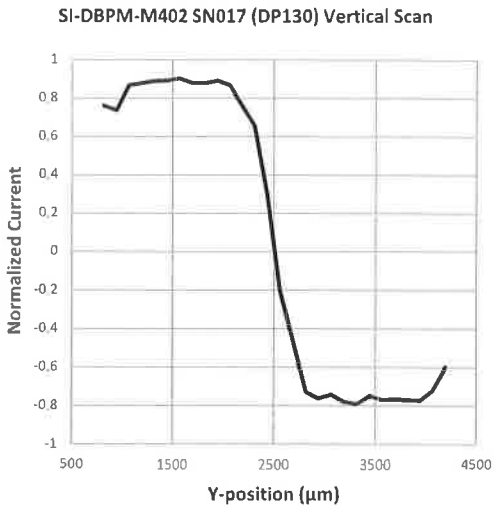

Figure 3

Detector Uniformity

Uniform response of the detector was confirmed by mapping response to the x-ray beam over its entire active area. No remarkable photoconductive gain area was observed. Results shown in *Figures 4 & 5*.

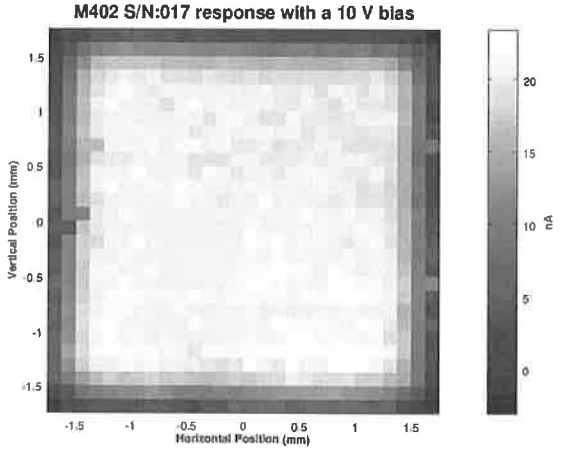

Figure 4

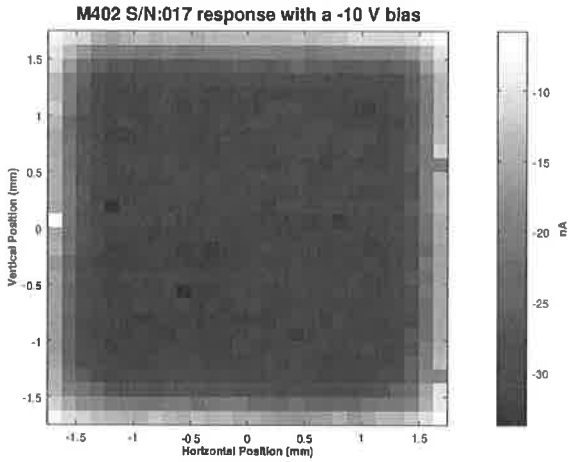

Figure 5