Silicon on Insulator Pixel Detector for X-ray Imaging

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1. Objective

X-ray Imaging by means of One Photon Detection to Study Impurity Transport.

2. Appratus

2.1. Silicon on Insulator Pixel Detector (SOIPIX)

- is a kind of LSI chip. [2]
- is being developed by using CAD system for circuit, layout diaphragms, and simulation.
- is processed on a semiconductor wafer of silicon on insulator.
- is both thick high-resistive radiation sensor and CMOS readout circuit. [See Fig. 1]
- consists of 264×264 pixels in size of 14 μm square.
- measures an x-ray photon of 20 keV with a quantum efficiency of 40 %.
- measures the x-ray photon in a range more than 3 keV.
- reads out signal in a fast time of 1 μs/pixel.

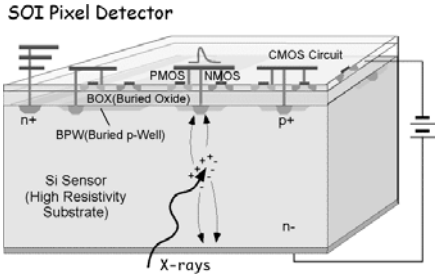

Fig. 1. Schematic view of SOIPIX [3].

2.2. Optics

- is a typical pinhole camera.

- consists of a position adjustable 100-μm-diameter pinhole and a vacuum-tight-250-μm-thick beryllium filter.

3. Performance

3.1. Data Acquisition and Control Signals

- are transferred through ethernet I/F consisting of an on-board FPGA.

3.2. Energy Resolution

- is estimated from the experimental results in LHD.

- is approximately 70 % in compared with a pulse height analyzer (PHA) operated in a counting rate of 64 kcps.

3.3. Counting Rate

- is estimated from the experimental results in LHD.

- is approximately 70 % in compared with the PHA.

3.4. Improvement of Performance

- is in progress to obtain second times larger counting rate.

4. Available data by “Retrieve”

4.1. LABCOM

- is compatible.

5. Remarks

The SOIPIX and the on-board FPGA are vacuum compatible.

The SOIPIX is cooled to less than -50 °C by a refrigerator.

The assembly of the SOIPIX will be installed at a port in LHD.

Detailed manual will be also submitted.

The performance has been carried out at 7-O port.

The distance has been approximately 16 m far from the LHD plasma.

References

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