Optimization of X-ray Imaging by Timepix Based Radiation Camera with SI GaAs Sensor

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Abstract. Digital radiation imaging cameras consisting of 2D pixelated semiconductor detector structure directly bump bonded to readout chip and connected to personal computer through an interface have found their way from particle physics to medical and industrial applications. The most frequently used camera sensor material, the silicon, is being gradually substituted by other compound semiconductor materials with higher absorption of X-rays and gamma rays like CdTe or GaAs, for some applications. The detection performance of our fabricated SI (semi-insulating) GaAs pixelated sensor connected to Timepix readout chip of radiation camera was investigated. We have optimized the irradiation geometry to improve the imaging performances of camera. We have shown, that irradiation from the back side of camera with GaAs sensor which suffers incomplete depletion of detection volume will bring better imaging performances than the conventional front side irradiation of camera. The reason rests in higher penetrability of the silicon Timepix readout chip to X-rays placed at back camera side in comparison to passive GaAs sensor layer from the front side of the camera.