Construction of X-ray communication system for data transmission

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1. Introduction

X-ray communications are creating new challenges and opportunities in the fields of defense, space, and communications. Recently, NASA in the United States confirmed the potential of X-ray communications by developing technology to detect X-ray pulses generated by neutron stars.[1] X-ray communications could establish inter-satellite GPS between Earth satellites or interstellar satellites in space, enabling communication with robots and spacecraft beyond the solar system.[2] Furthermore, the high electromagnetic frequency of X-rays allows for high penetration of conductive plasma, making them potentially useful for communication with hypersonic spacecraft re-entering the atmosphere, where RF communication is impossible.[3]

2. Methods and Results

X-rays are generated by applying high voltages of tens of kilovolts (kV) to accelerate electrons and irradiating them onto metal. By controlling the electron flow at high speeds and injecting digital data (0s and 1s), digital X-rays can be generated. Digital X-rays have traditionally been used as imaging sources for examining the interior of objects in the medical field by applying a fixed frequency. However, applying a data frequency allows data transmission. Data frequencies can convert text, voice, or images into digital signals, and the X-ray generator transmits the corresponding X-ray data. The transmitted X-rays can be detected by a ray source or semiconductor. The detected X-ray signal is then amplified and filtered to be restored to a transmission signal.

The Korea Atomic Energy Research Institute (KAERI), in collaboration with the Pohang Accelerator Laboratory, has established a ground-based testbed to develop X-ray communication technology and is conducting research on data transmission via X-rays. A 40 kV high-voltage generator accelerates electrons and a high-frequency data control device is developed to control the electron flow. The data has a transmission speed of several kbps to several Mbps, and X-ray data is transmitted by converting the alphabet into a digital signal through ASCII character encoding.

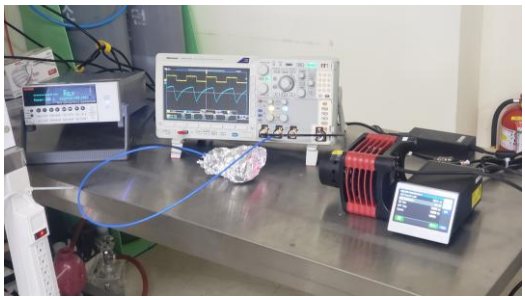

Fig. 1. Output current of the SiC detector for three particles that have been simulated as interacting

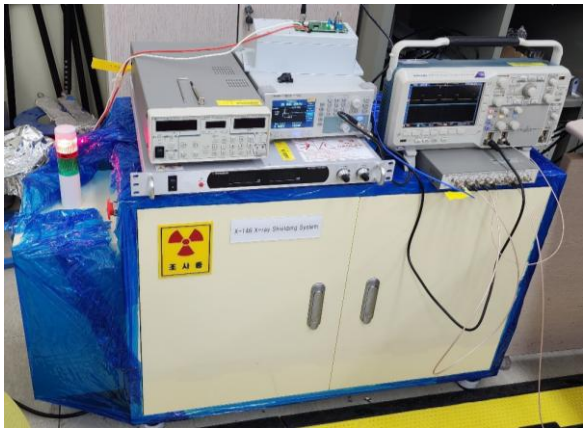

Fig. 2. Output current of the SiC detector for three particles that have been simulated as interacting

3. Conclusions

This paper studies a technique for transmitting and receiving digital information using X-rays. Digital information is transmitted by controlling X-ray pulses, and X-ray signals are acquired and restored using a photoelectric sensor.

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