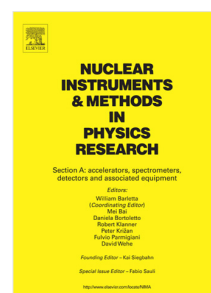


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Temporal measurement of MeV pulsed gamma-ray using a Diode Laser

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A single-shot temporal measurement of pulsed gamma ray using a diode laser has been carried out with the MeV gamma beams at “Qiangguang-I” facility. The gamma-ray temporal profile is encoded to the power of a diode laser by the carrier variation in laser cavity. We analyze the dynamic process of carriers induced by gamma rays and derive a sensitivity expression for the detector based on a diode laser. It shows that the sensitivity is determined by both the gain of resonant cavity and the efficiency of gamma-ray deposition in the diode laser. And the efficiency of depositing gamma-ray is estimated with Monte Carlo methods. The experimental results demonstrate that the detection method with diode lasers can be used for the temporal profile measurement of a MeV pulsed gamma ray source. The relative gamma-ray sensitivity of the detector is estimated at about $1.27 \times 10^{-22} \text{ C} \cdot \text{cm}^2$ from the experimental results, which agrees with the theoretical predictions.

Nuclear radiation detector, Rad-Optic, semiconductor laser, pulsed gamma ray

1 Introduction

The temporal waveform of pulsed radiation field is one of the most important fingerprints to show the dynamic characteristics of a pulsed radiation source. And MeV gamma temporal profile (intensity versus time) is an ideal object to investigate the changes in burning rate and reaction-history, because gamma rays can avoid the time-of-flight dispersion which neutrons always happen. For example, fusion gamma rays detection is designed to measure highly time-resolved bang times and deuterium-tritium (D-T) interaction rates of inertial confinement fusion (ICF) capsules^[1-5]. Conventional gamma detectors usually work by converting a gamma-ray pulse to an electric signal, and then transmitting through a coaxial cable to a digital

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