# 電荷およびチェレンコフ光の解析に基づく TlBr ガンマ線検出器の特性評価

Characterization of TlBr Gamma Detector Based on Electrical Charge and Cherenkov Light Analysis

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In this study, we developed a Thallium Bromide (TlBr) semiconductor detector, featuring a pixelated anode and a planar cathode, for room-temperature gamma-ray detection. Time resolution assessments indicated potential performance in the picosecond range, showcasing the capability of TlBr for precise energy resolution and time resolution.

**キーワード：**臭化タリウム検出器，チェレンコフ光，ガンマ線検出器

## 1. 緒言 (Introduction)

Thallium Bromide (TlBr) semiconductors are highly valued for room-temperature gamma-ray detection due to their high crystal resistivity and photon-stopping power. [1]Detecting Cherenkov photons from gamma-ray interactions significantly enhances the timing performance of TlBr detectors. [2] [3] This study focuses on characterizing TlBr by analyzing electrical charge carriers and Cherenkov light, emphasizing energy resolution, drift time, and time resolution.

## 2. 実験方法 (Method)

TlBr detector consisted of a 5 mm × 5 mm × 5 mm crystal with a planar cathode, pixelated anode, and surrounding ground electrode to minimize pulse-height loss from hole trapping. Signals from charge carriers and Cherenkov light were read concurrently. The waveform characteristics are influenced by recombination, trapping, electric field non-uniformity, and variations in charge collection efficiency. Therefore, we perform depth of interaction (DoI) analysis based on the pulse height of charge carrier signals to enhance energy resolution.

## 3. 結果(Result)

The energy resolution of TlBr improved to 1.94% FWHM at 662 keV with the filtered waveform-based depth of interaction analysis, correlating time drift (2 μs to 30 μs) with the DoI parameters. The 5 × 5 × 5 mm³ TlBr crystal achieved a time resolution of approximately 511 ps at 6 p.e.

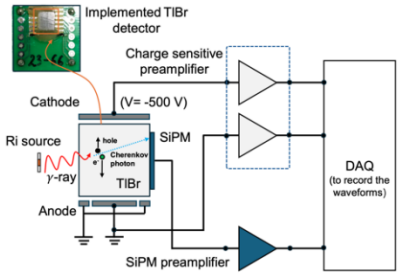


Fig.1. TlBr characterization using electrical and optical readout system

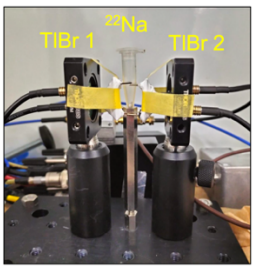


Fig.2.Experimental setup

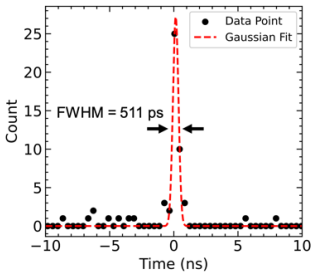


Fig.3.Time resolution distribution at 6 p.e.

## 参考文献(Reference)

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