Timestamp Test of Emulsion Gamma-ray Telescope at Mt. Norikura Cosmic-ray Observatory

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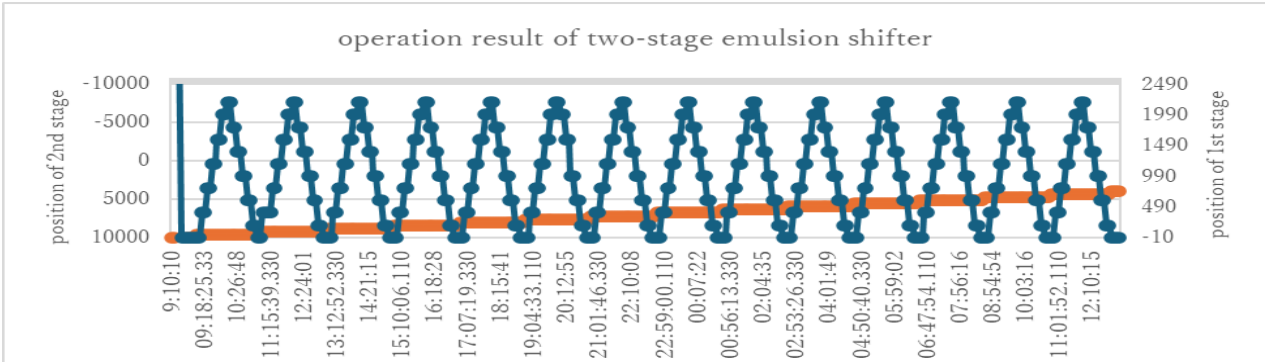
Introduction

Observations of cosmic gamma rays provide essential insights into high-energy astrophysical phenomena and the origin of cosmic rays. Emulsion gamma-ray telescopes, with their excellent angular resolution, are well suited for detailed track measurements. However, long-duration observations require a timestamping technique that can assign precise timing information to each recorded event.

Test Experiment

To address this issue, we conducted a test experiment using a hybrid detection system that combines a multi-stage emulsion shifter and a scintillating fiber tracker (SFT). The experiment was performed at the University of Tokyo Cosmic-ray Observatory on Mt. Norikura from August 18 to 21, 2025. The detector system consisted of a converter (a stack of 45 emulsion films), a two-stage shifter with periodic motion (10 min and 2 h cycles), and a SFT for timing reference. During the campaign, after setup and system checks, we carried out ~28 h of continuous observation and confirmed stable operation of the entire system.



Prospects

At present, data analysis is at an early stage, but stable performance of both the shifter and the SFT has been demonstrated. Further studies will focus on evaluating timestamping performance for individual tracks, such as low-energy (~50MeV) electrons and positrons, with the aim of applying this method to large-scale emulsion telescopes for high-precision gamma-ray astrophysical observations.