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High energy background event identification using local group trigger in a 240-pixel X-ray TES array

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A novel triggering function developed for 240 pixel Transition-Edge Sensors is demonstrated under the high rate of particle background. The function is integrated into the standard data acquisition system in the NIST TES framework. It enables any type of combination of trigger pattern when a pixel is triggered, which is called “group trigger”. As a practical implementation, the primary trigger is distributed to the four physically nearest pixels. The group trigger function was utilized throughout the entire one-month J-PARC experiment for the measurement of the Kaonic-atom X-rays. This trigger allowed us to confirm that the increased background and degraded energy resolution we observed when operating the TES array in the presence of an ion beam are the result of thermal crosstalk from charged particles. We show that the maximum of the peak values among the four neighboring pixels is useful event selection parameter. We use cuts based on this parameter to improve the peak-to-background level in a measured x-ray energy spectrum by a factor of 2.5, while keeping 95% of measured events. This flexible group triggering technique allows us to improve the signal to noise on the very faint Kaonic Helium x-ray lines we are measuring, better understand our experiment environment, and we believe this technique may prove useful in other ground and space based TES applications.

Less than 5 years of experience since completion of Ph.D

N

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N

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