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## Simulation study of a pixelated CZT MIXE spectrometer for MELODY

Muon-Induced X-ray Emission (MIXE) technique has shown significant application potential in the elemental analysis of cultural heritages, extraterrestrial materials, and energy materials, owing to its non-destructive nature, depth scanning capabilities, and high sensitivity to low-Z elements. As the China 's first muon source facility, MELODY is currently under construction. A dedicated negative muon beamline and a decay muon beamline have been reserved for the application of the MIXE technique at MELODY. To improve the counting rate of MIXE experiment, we propose developing a pixelated Cadmium Zinc Telluride (CZT) detector-based MIXE spectrometer for MELODY. CZT detector can be fabricated with millimetres-scale pixel readout and operate effectively at room temperature, eliminating the need for cryogenic cooling systems. Moreover, CZT detectors offer relatively high detection efficiency ( $>95\%$  for 100 keV X-rays) and satisfactory energy resolution ( $<4\%$  for 100 keV X-rays). This report will introduce the detailed design of the negative muon beamline and decay muon beamline at MELODY, and also the application of MIXE technique. Besides, the preliminary simulation results of the pixelated CZT detector-based MIXE spectrometer will also presented.

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