Validation of a Temperature Compensation Method for MiniPIX Timepix3 Detectors Equipped with a SiC Sensor

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Abstract. Previous investigation of MiniPIX Timepix3 detectors equipped with a 4H-SiC sensor demonstrated a significant temperature dependence of the measured energy response and led to the development of a mathematical compensation method for correction of temperature-induced spectrometric distortion in the energy range from 8 keV to 58 keV and temperatures from 10 °C to 60 °C. This work presents the experimental validation of the proposed compensation method. Two MiniPIX Timepix3 detectors equipped with 4H-SiC sensors were recalibrated at 50 °C, representing a 30 °C difference from the original calibration temperature. Additional measurements were subsequently performed at 50 °C using characteristic X-rays in the energy range from 8 keV to 58 keV. The compensated energies obtained from measurements performed with the original 20 °C calibration were compared with the energies measured after recalibration at 50 °C. The results confirm the validity of the proposed compensation method, as the compensated energies closely match the experimentally measured energies obtained using the dedicated 50 °C calibration. The developed method therefore represents a practical approach for reducing temperature-induced spectrometric distortion in MiniPIX Timepix3 detectors equipped with 4H-SiC sensors without the need for repeated recalibration at different operating temperatures.