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Quantifying the effect of cosmic ray showers on the X-IFU energy resolution

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The X-ray Integral Field Unit (X-IFU) will operate an array of more than 3000 Transition-Edge Sensor pixels at 90 mK with an unprecedented energy resolution of 2.5 eV at 7 keV. In space, primary cosmic rays and secondary particles produced in the instrument structure will continuously deposit energy in the detector wafer and induce fluctuations of the pixels' thermal bath. In this contribution, we investigate by simulation of the X-IFU readout chain how these fluctuations eventually influence the energy measurement of the science photons.
Realistic timelines of thermal bath fluctuations at different positions in the array are generated from the result of a thermal model and the expected distribution of the deposited energy of the charged particles. We then model the TES response to these thermal perturbations and compute their influence on the on-board energy reconstruction process. Overall, we show that with a proper heatsinking design, the main energy resolution degradation effect remains minimal and within the associated resolution allocation of 0.2 eV. We further study how a dedicated triggering algorithm could be put in place to flag out the rarer large thermal events.

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

Y

Student (Ph.D., M.Sc. or B.Sc.)

N

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