A 3D CZT hard x-ray polarimeter for a balloon-borne payload

Today it is widely recognised that a measurement of the polarization status of cosmic sources high energy emission is a key observational parameter to understand the active production mechanism and its geometry. Therefore new instrumentation operating in the hard X/soft γ rays energy range should be optimized also for this type of measurement. In this framework, we present the concept of a small high-performance spectrometer designed for polarimetry between 100 and 1000 keV suitable as a stratospheric balloon-borne payload dedicated to perform an accurate and reliable measurement of the polarization status of the Crab pulsar, i.e. the polarization level and direction. The detector with 3D spatial resolution is based on a CZT spectrometer in a highly segmented configuration designed to operate as a high performance scattering polarimeter. We discuss different configurations based on recent development results and possible improvements currently under study. Furthermore we describe a possible baseline design of the payload, which can be also seen as a pathfinder for a high performance focal plane detector in new hard X and soft gamma ray focussing telescopes and/or advanced Compton instruments. Finally we present preliminary data from Montecarlo undergoing studies to determine the best trade-off between polarimetric performance and detector design complexity.

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