D'Andrea, Matteo – INAF/IAPS
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The Cryogenic AntiCoincidence detector for ATHENA X-IFU: preliminary test of the Demonstration Model.

The Advanced Telescope for High ENergy Astrophysics (ATHENA) is the second large-class mission selected in ESA Cosmic Vision 2015-2025, with a launch foreseen in 2030 towards an L2 orbit. One of the two focal-plane instruments is the X-ray Integral Field Unit (X-IFU), a cryogenic spectrometer able to simultaneously perform high-resolution spectroscopy ($\Delta E < 2.5$ eV at 6 keV) and detailed imaging (5" angular resolution with a 5' diameter FoV) over the 0.2-12 keV energy band. It is based on a large array (about 4000 pixels) of Transition Edge Sensor (TES) microcalorimeters, working at a bath temperature of 50 mK. To reduce the particle-induced background, thus enabling the mission science goals, the instrument includes a Cryogenic Anticoincidence detector (CryoAC). It is a 4-pixels TES-based detector, placed less than 1 mm below the TES array. The X-IFU development program foresees to build and characterize an instrument Demonstration Model (DM) before the mission adoption. In this respect, we are now developing the CryoAC DM, to be delivered on 2018 to the Focal Plane Assembly (FPA) development team at SRON for the integration with the TES array. This will be the frst compatibility test for the two detectors, representing a milestone on the path towards the X-IFU development. The CryoAC DM is a single pixel prototype able to probe the detector critical technologies, in particular the operation with the 50 mK thermal bath and the threshold energy at 20 keV. It is based on a wide area silicon absorber (1 cm2, 500 μm thick) sensed by a network of 96 iridium/gold TES. To obtain a well defined and reproducible thermal conductance towards the thermal bath, the absorber is connected to a silicon rim (in strong thermal contact with the bath) through four narrow silicon bridges (100 x 1000 μm2), achieving a suspended free-standing structure. The TES network is designed to ensure a uniform absorber surface coverage for an efcient athermal phonons collection, while constraining down the heat capacity contribution of the metal flm thanks to the quite small TES size (50x500 μm2). All these design solutions are necessary to speed up the detector thus enabling the high rejection efficiency of particle background imposed by mission requirements. Here we report the CryoAC DM preliminary testing activities, focusing on the study of the pulse dynamics and the determination of the detector low energy threshold.