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An InGrid based Low Energy X-ray Detector for the CAST Experiment

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The CERN Axion Solar Telescope (CAST) is searching for axions and other new particles coupling to photons and emerging from the sun. Those particles are converted into soft X-ray photons in a high magnetic field. To enhance sensitivity for physics beyond the Standard Model it is necessary to cope with weak couplings and low energies, thus requiring an efficient background discrimination as well as a detection threshold below 1 keV.

A promising candidate for a future CAST detector is an InGrid based X-ray detector. This detector combines the high spatial resolution of a pixelized readout with a highly granular Micromegas gas amplification stage. Fabrication by photolithographic postprocessing techniques allows to match the amplification grid to the pixels. The thereby achieved overall high granularity facilitates detection of single electrons which allows to determine the X-ray energy by electron counting. Additionally, rejection of background events mostly originating from cosmic rays is provided by an event shape analysis exploiting the high spatial resolution. A first prototype achieved a background reduction of roughly 120 and an energy resolution of 5.2 % at 5.9 keV.

In order to demonstrate its low detection threshold an InGrid based detector was tested in the CAST Detector Lab where an X-ray generator for energies down to a few hundred eV is available. Results of these tests demonstrating the detector's ability to detect the carbon K_α line at 277 eV will be presented as well as a short report on the installation at the CAST experiment.

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