

Breaking the limits for low energy high angular resolution neutral atom detection by means of micro-shuttering techniques.

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A comprehensive suite for the particle detection in the Mercury environment, the SERENA instrument, is going to be built for the ESA cornerstone BepiColombo mission. The SERENA package consists of the sensors STROFIO and ELENA, which identify the neutral particles and measure their energies in the range from fractions of eV to a few keVs, and the sensors PICAM and MIPA for measuring and analyzing ionized particles from some eV to tens of keV.

The neutral sensor ELENA (Emitted Low-Energy Neutral Atoms) will be devoted to detect the sputtering emission (E min < 50eV; E max > 1 keV) within 1-D (2 deg x 76 deg) nadir cross track slices from the planet surface. ELENA is a Time-of-Flight (TOF) detector, based on the state-of-the art of ultra-sonic oscillating choppers (operated at frequencies up to a 100 kHz) and mechanical gratings. The sensor concept is based on micro -valve choppers, which release the incoming neutral partic les impinging on the detector entrance with a definite timing. The new development in this field allows unprecedented performances in angular resolution within the timing discrimination constraints for the expected population of the sputtered particles.

This presentation describes the new design techniques approached for the neutral particles identification, the nano-technique activities for designing and manufacturing the nano-structure shuttering core of the ELENA sensor. Report and progress on the related miniaturized data-handling unit will be also given. Such design technologies could be fruitfully exported to different applications for planetary exploration.