

Low Energy High Angular Resolution Neutral Atom Detection by Means of Micro-Shuttering Techniques

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The neutral sensor ELENA (Emitted Low-Energy Neutral Atoms) is going to be built for the ESA cornerstone BepiColombo mission within the SERENA instrument. The sensor will be devoted to detect the sputtering emission ($E_{\min} < 50\text{eV}$; $E_{\max} > 1\text{keV}$) within 1-D ($2\text{deg} \times 76\text{deg}$) 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 particles 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.