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A CMOS Active Pixel Sensor for high resolution imaging of the Jovian system

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The Jovian system is the subject of study for the Jupiter Icy Moon Explorer (JUICE), an ESA mission which is planned to launch in 2022. The scientific payload is designed for both characterisation of the magnetosphere and radiation environment local to the spacecraft, as well as remote characterisation of Jupiter and its satellites. A key instrument on JUICE is the high resolution and wide angle camera, JANUS, whose main science goals include detailed characterisation and study phases of three of the Galilean satellites, Ganymede, Callisto and Europa, as well as studies of other moons, the ring system, and irregular satellites.

The CIS115 is a CMOS Active Pixel Sensor from e2v technologies selected for the JANUS camera. It is fabricated using 0.18 μm CMOS imaging sensor process, with an imaging area of 2000 x 1504 pixels, each 7 μm square. A 4T pixel architecture allows for efficient correlated double sampling, improving the readout noise to better than 8 electrons rms, whilst the sensor is operated in a rolling shutter mode, sampling at up to 10 Mpixel/second at each of the four parallel outputs.

JANUS will face an extremely hostile radiation environment and it is essential to understand how this will impact the performance of the CIS115. During the interplanetary travel phase of the mission it will be exposed to solar protons and cosmic rays and once it arrives in the Jovian system it will face continual bombardment by protons and high energy electrons trapped within Jupiter's magnetic field. To ensure that the CIS115 will meet the mission's science data collection requirements a detailed radiation damage study is planned which will include gamma, proton, heavy ion and electron irradiations. In addition to the long-term degradation of the CIS115's performance, the effect of the trapped environment around Jupiter on the sensor must be studied to confirm that background radiation during observation will not significantly degrade the image quality. The latest results of this analysis and the CIS115's radiation campaign will be presented.

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