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Magnetic field experiment by Jupiter Icy Moons Explorer (JUICE) J-MAG and sensor alignment evaluation at the lunar-Earth flyby

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The magnetometer (J-MAG) is one of the core instruments on the JUICE spacecraft and is critical for examining prime scientific objectives of the mission. Firstly, we are expecting to gain an understanding of the interior structure of the icy moons of Jupiter, specifically those of Ganymede, Callisto and Europa. We will be able to obtain the knowledge of the depth at which the liquid oceans reside beneath their icy surfaces. We are also interested in the configuration of internal magnetic fields and the induced magnetic fields arising within these oceans. Secondary, the magnetic field drives the plasma processes within the Jupiter system. Magnetic field observations allow for a better interpretation of dynamical plasma processes, auroral phenomena and various current systems within the Jovian magnetosphere.

Defined J-MAG science targets result in a requirement to determine accurate knowledge of the sensing orientation by two fluxgate sensors, MAGIBS and MAGOB, on the spacecraft. Due to the long MAG boom it is not possible to meet J-MAG's alignment requirement by mechanical stability alone. To evaluate the alignment error of the sensing direction, the spacecraft includes two orthogonal coils mounted around its body. The coils, JACS, can be driven with a current which produces a measurable magnetic field vector at the fluxgate sensors. This signal can then be used by the fluxgates to track the variation in the sensor alignment by the method that was developed for the Kaguya mission,

After the launch of JUICE we have operated JACS several times and made preliminary analysis of the fluxgate sensor alignment. And we operated JACS before and after the lunar-Earth flyby in August 2024. It is very valuable opportunity to examine the variation of the alignment, because the alignment could be determined also by the fitting the magnetometer data to the geomagnetic model. In the presentation we show the tentative results of the alignment calibration at the lunar-Earth flyby, and discuss the perspective of the feasibility of the alignment calibration at the Jovian orbit.