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Radiation reduction for a spacecraft in low-altitude orbit around Ganymede

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Future missions to the Jupiter System are currently being defined in more detail in collaboration between various space agencies. Radiation will be a major constraint on the available choice of mission profiles. The ESA-led Jupiter Ganymede Orbiter, as part of an international Europa Jupiter System Mission, will focus on the two icy outer Galilean satellites, Ganymede and Callisto, and will avoid the most intense radiation belts of Jupiter, where the doses are maximal. However, it will spend a considerable amount of time within 16 Rj where the dose accumulates most rapidly, since it will be ultimately injected first into an elliptical orbit and then into a polar circular low-altitude orbit around Ganymede. Current radiation models indicate that the spacecraft will accumulate the highest radiation dose during the phase when it will orbit Ganymede for months. However, these models are not appropriate to estimate the dose in orbit around any of the Jovian moons (and, hence, Ganymede) since they do not take into account the local radiation environment of the moons, which differs significantly from the Jovian radiation environment. Jovian moons themselves are indeed shielding a spacecraft from charged particles and, therefore, a significant reduction of the dose should be expected. In this paper we re-analyze available Galileo energetic particle data and provide quantitative estimates for the radiation reduction in a low-altitude orbit around Ganymede.