SPACE OPERATIONS SYMPOSIUM (B6)
New Operations Concepts (2)

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INTEGRAL - RENAISSANCE OF OCCULTATION TECHNIQUES USING THE EARTH

Abstract

The INTernational Gamma Ray Astrophysics Laboratory (INTEGRAL) was launched on the 17th of October 2002, designed to simultaneously observe objects in gamma rays, X-rays and visible light.

In order to prevent the Earth albedo from affecting the observations performed by the instruments on board INTEGRAL, an Earth aspect angle constraint of 15 degrees about the earth disk is applied for the payload boresight nominal operations. In this context, a challenging experiment was done in 2006 performing an Earth Observation (EO) with the scientific objective to better resolve and understand the Cosmic X-Ray Background (CXB) at high energies (above 20 keV), as well as to study the Earth high energy emission during storms in auroral regions. The experiment was successful, it demonstrated the feasibility of such EOs and highlighted the scientific potential of Earth occultation observations for INTEGRAL.

Currently a second EO program is under preparation. It will focus on the Earth occultation concept to enhance the potential for detection and differentiation for three soft gamma-ray background components: the CXB, the Galactic Ridge X-ray emission and the two Earth emission components, namely the reflection of the CXB and the cosmic-ray induced radiation. Several proposals were studied regarding its implementation, some of them with different experiments and requirements compared to INTEGRAL's first EO in 2006. New scientific requirements such as observation duration or the possibility of performing the EO in a pre-selected target attitude (necessary to know EO background in celestial coordinates) were to be fulfilled. Parameters like the timing and duration of the Earth disk passage through the different instruments fields of view (FOV), the attitude during EO and the Earth angular radius as seen from INTEGRAL had to be calculated as a function of epoch, taking into account the predicted evolution of the orbit until 2014.

The scope of this paper is to present the detailed analysis performed on these different proposals, comparing it with the approach followed in 2006, and the conclusions they lead to.