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GIADA: preparatory activities before the comet encounter

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The whole 2014 will be a pivotal year for the Rosetta mission. In fact, on the 20th January it will be switched on after more than 18 months of hibernation. Then, Rosetta will begin the rendezvous maneuvers to reach and follow the short period comet 67P/Churyumov-Gerasimenko.
Among the payloads on-board Rosetta, GIADA (Grain Impact Analyzer and Dust Accumulator) is an in-situ instrument devoted to measure the dynamical properties of the dust grains emitted by the comet.
In preparation of the actual scientific phase of the mission (i.e. the comet phase), the GIADA science team has carried out three major activities to prepare the science operations and the data interpretation:
1)Analysis of the Cruise Phase: a careful analysis of the data collected by GIADA during the seven-year cruise shows that all the GIADA functional and performance parameters maintained nominal behavior during the seven year trek across the Solar System [1].
2)Extended Calibration using the GIADA Flight Spare Model: taking into account the knowledge gained through the analyses of Interplanetary Dust Particles and cometary samples returned from comet 81P/Wild 2 (Stardust mission), we selected some terrestrial materials as cometary dust analogues and we produced grains with sizes ranging from 20 – 500 μm in diameter. These grains were characterized by FE-SEM/EDS and micro-IR spectroscopy. Single grains are then manipulated and shot into the GIADA Flight Spare Model (housed in our laboratory) with velocities in the range of 1 – 100 m/s to obtain calibration curves as a function of chemical-physical grain properties. By means of the on ground calibration data collected during the instrument qualification campaign (performed on Flight and Spare Models), we can rescale the Extended Calibration data to GIADA mounted on board the Rosetta S/C. The calibration curves coupled with the GIADA telemetries collected during the Rosetta Cruise phase constitute a large database of sensors responses that will support the scientific data interpretation.
3)Development of the simulation tool to evaluate GIADA performances (GIPSI): we developed a SW capable of predicting the scientific and technical performances of GIADA vs. a simulated cometary dust environment was developed. GIPSI (GIADA Performance Simulator) describes the instrument performances, in terms of scientific (grains detected) and technical (power, data volume, etc.) response having as inputs the orbit proposed by the Rosetta Scientific Ground Segment and the output of an evolutionary coma dust model. Moreover, GIPSI can evaluate GIADA performances starting from different coma dust model: ab-initio physical models and models obtained from cometary astronomical observations .
The present work focus on the three aforesaid activities performed by the GIADA team and that will be critical for the future interpretation of scientific data. Moreover, we can display the earliest data collected by GIADA just after the hibernation of Rosetta.