



Comparison between predicted and measured performance of the MIDAS instrument on the Rosetta spacecraft after completion of the post-launch commissioning phase

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After the launch of the Rosetta spacecraft on 2nd of March 2004 the scientific payload went through a complex commissioning program that lasted more than six months. The three main activity blocks consisted of (a) a single instrument commissioning (b) interference measurements between all scientific payloads and (c) a pointing campaign with selected astronomical objects.

The MIDAS (Micro-Imaging Dust Analysis System) instrument on the Rosetta spacecraft will collect cometary dust particles while in orbit around comet 67P/Churyumov-Gerasimenko. The core instrument is based on an atomic force microscope and provides image data of collected dust particles. The image area is between $0.8 \times 0.8 \mu\text{m}$ and $100 \times 100 \mu\text{m}$ with a vertical resolution of 0.4 nm and a lateral resolution of 3 nm. The goal is to distinguish the mayor building blocks and the smallest components of cometary solid matter. Possible idiomorphic grown crystals can be identified and their crystal faces inspected for traces of interaction between surface and environment (liquids, gases). The dust flux and grain size distribution can be measured with temporal resolution down to several hours.

The instrument has four defined different working modes which are used to image the collected particles and in one case to describe the mechanical noise on the spacecraft

which may have negative influence on the performance of this instrument as well as on other payload elements.

The nominal working mode is the 'dynamic mode' in which the sensor detects the surface topography hardly touching the surface itself. The 'contact mode' implies a higher stress on the redundant sensor but overcomes possible disturbing electrostatic forces, thus still enables the sensor to analyze the surface topography. The 'magnetic mode' may identify magnetic properties of specific minerals grains. The 'single point scan mode' is a non-imaging mode and describes the micro vibrational background with a sub-nanometer resolution.

The commissioning phase of Rosetta consisted of three different stages relevant for payload (i.e. single instrument commissioning, interference campaign, pointing campaign,). MIDAS participated all three stages.

In the first phase the instrument was brought into a functional mode. After the initial switch-on and electronics checkout the launch-locked mechanisms were released. The integrated test specimens were measured in order to provide new, in-situ calibration data. During phase 2 and 3 the instrument was used to observe potentially disturbing mechanical noise sources e.g. momentum wheels, gyroscopes, movement of the high gain antenna, deployable mechanisms of other payloads.

It can be concluded:

1. The MIDAS instrument is fully operational and will achieve its predicted scientific performance.
2. The obtained image data show a high level of reproducibility.
3. The instrument has enhanced capabilities due to additional working modes and data channel compared to the original proposal.
4. The observed mechanical noise level on the spacecraft is lower as anticipated.