

MARSIS at Phobos: Real Data Processing Compared with Simulations Results

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Introduction

Taking advantages of the high eccentricity of the Mars Express Orbit, the multi-frequency sounding radar MARSIS has successfully observed Phobos during the latest MEX science campaign (February-March 2010). During 4 close approaches MARSIS has collected 347 frames of data, containing more than 64000 individual echoes. Ground tracks have covered new areas compared to previous flybys. Part of orbit 7915 track crossed crater Clustril in the Northern Hemisphere of Phobos. Preliminary comparison with clutter simulation models showed a good consistency of most of the secondary reflection features with the theoretical calculations. Further analysis and processing is expected to improve data SNR allowing a fine-tuning of clutter simulation models too. Timing of radar returned signals could be used to improve ephemeris of Phobos.

Phobos Data Analysis

Ground-processing of the science data, for one single frame, is shown in Fig.1. The highest peak is the surface Phobos echo signature, well above the noise level. Other features seen in the radargram can be explained by a very accurate investigation of

the environmental conditions and above all simulations.

Phobos's Simulator

The SW simulator is based on hybrid methods taking into account the Digital Elevation Model (DEM) of Phobos and the MARSIS antenna system, together with the outer structure of the spacecraft. For transmission and reception, the antenna system itself and radiation coupling effects, aboard the spacecraft, were taken into account. Spacecraft position and attitude calculated from the ephemeris were adjusted for each frame, while for the simulation of surface backscattering, the Physical Optics has been used.

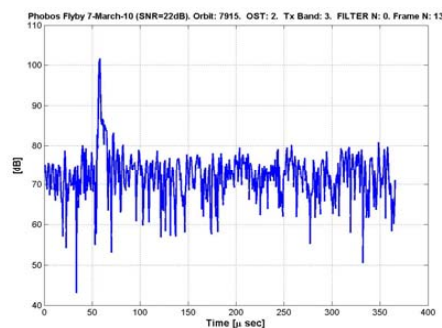


Figure 1: Phobos single frame processed data.

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References

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