



THE WISDOM UHF GPR ON THE EXOMARS ROVER

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The WISDOM UHF Ground Penetrating Radar has been selected on the PASTEUR payload of the ESA EXOMARS rover. In accordance with the main objective of this mission it will provide observations of the geological context of the rover environment by exploring the upper layers of the sub-surface beneath the rover. These observations will give access to the geological structure and nature of the shallow subsurface by retrieving the layering and constitution of the soil material, the distribution and properties of reflectors and the electromagnetic properties of the soil. This will address a number of questions that are of major importance to appraise the conditions in the shallow subsurface and help in selecting optimal sites to drill. In addition the radar will provide data on the presence of boulders and obstacles in the underground that will improve the safety of the delicate drilling operations.

The WISDOM GPR will operate in the UHF range with a central frequency of 1.75 GHz and a frequency bandwidth of 2.5 GHz providing a resolution of a few centimetres along the vertical. The horizontal resolution will depend on the rover motion between soundings but it is expected that it should be about 10 cm. In order to minimize the power consumption and avoid the complexity of high speed electronics and its possible sensitivity to EMI, we have selected the gated step frequency technique. The phase and amplitude of the reflected signal is measured at a number of frequencies effectively measuring the transfer function between the transmitter and receiver antenna from which the impulse response can be obtained by taking an inverse Fourier transform of the frequency samples. Different window functions can be used to reduce side lobes. To avoid the direct signal between the transmitter and the receiver or strong shallow reflections the radar will be gated. Polarimetric measurements of the returning echoes will be performed to provide the radar with enhanced performances to retrieve the geometrical and physical properties of the rocks buried in the soil and the geom-

etry and roughness of the underground layer interfaces. To this aim, four orthogonal antennas have to be used to measure cross-polarization. Bow-tie or Vivaldi antennas are anticipated.

A laboratory mock-up is being built and the first test campaign is scheduled in early spring 2006.