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MARS ADVANCED RADAR FOR SUBSURFACE AND IONOSPHERE SOUNDING (MARSIS)

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According to the Mars Express mission, the MARSIS primary scientific objective is to map the distribution of water, both liquid and solid, in the upper portions of the crust of Mars. Detection of such reservoirs of water will address key issue s in the hydrologic, geologic, climatic and possible biologic evolution of Mars, including the current and past global inventory of water, mechanisms of transport and storage of water. Three secondary objectives are defined for the MARSIS experiment: subsurface geologic probing, surface characterization, and ionosphere sounding. The detection performance in the sounding radar are limited by the surface clutter echoes: therefore in order to maximize the sounding depth against rough surfaces, three different methods will be implemented in MARSIS: Doppler Beam Sharpening, Secondary Monopole Antenna, and Dual Frequency Processing. Moreover the requirements for fine range resolution and high compression ratios call for a high transmitted bandwidth (1 MHz) so that MARSIS will operate with a very high fractional bandwidth and very close to the expected Martian Ionosphere peak plasma frequency. This will result in a generally large phase distortion across the spectrum of the received pulses which will cause severe d egradation of the matched filter performance in term of SNR, pulse spreading and sidelobe control. The present technical paper in particular deals with the discussion of two adaptive range compression algorithm for the matched filtering of Radar sounder echoes in presence of phase distortion across the signal bandwidth. Also the unique capability of sounding the Martian environment with coherent trains of long wavelength wide band pulses, together with the extensive on -board processing will allow to collect a large amount of significant data about the Mars subsurface, surface and atmosphere will be discussed too along with the Marsis frequency-agile design which permits to tune the sounding parameters in response to changes sun illumination condition, latitude etc., allowing global coverage to be achieved within the currently accepted Mars Express baseline orbit and mission duration.