

Mars ground penetrating radars

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RPIF-3D workshop
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Mars ground penetrating radars

Summary

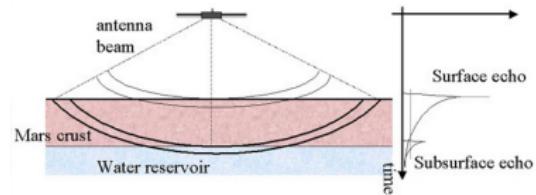
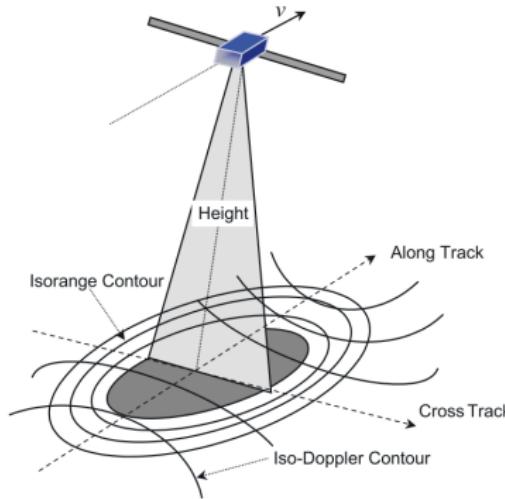
- ▶ Ground penetrating radars
- ▶ GPR on Mars
- ▶ Mars radars data access

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Ground Penetrating Radars

Overview



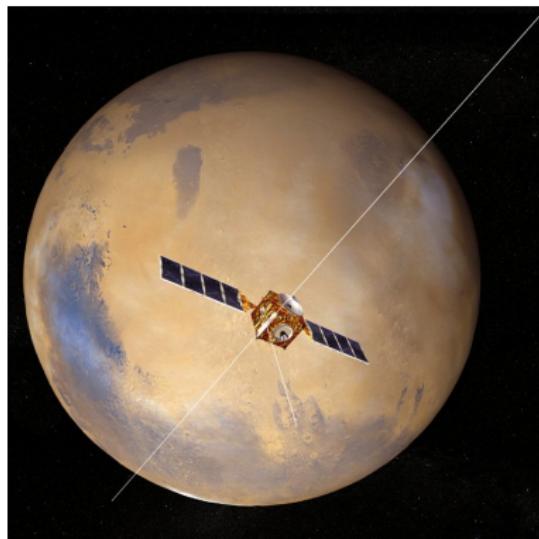
Ground Penetrating Radars

Planetary radars

- ▶ 1972: Apollo Lunar Sounding Experiment (ALSE) - Apollo 17
- ▶ 2003: Mars Advanced Radar for Ionosphere and Subsurface Sounding (MARSIS) - ESA's Mars Express
- ▶ 2005: SHAllow RADar (SHARAD) - NASA's Mars Reconnaissance Orbiter

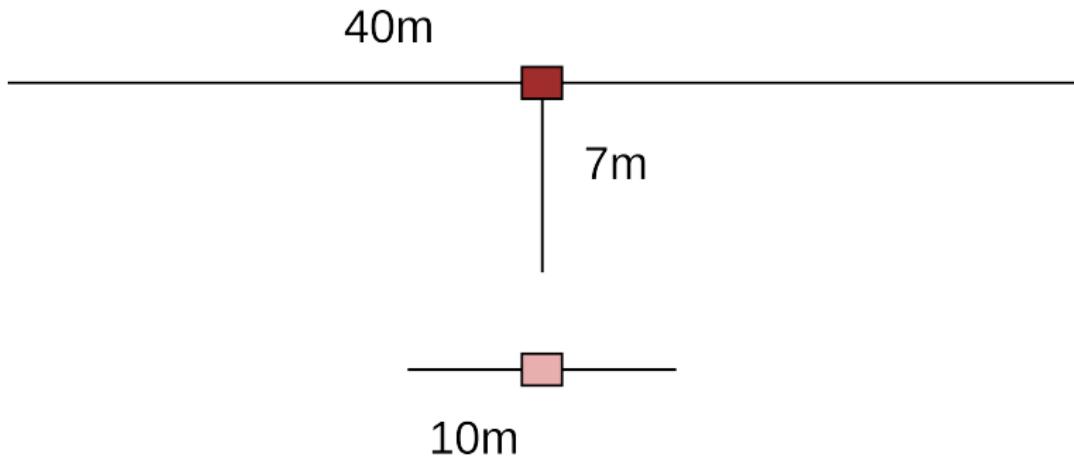
Mars Radars

MARSIS vs SHARAD



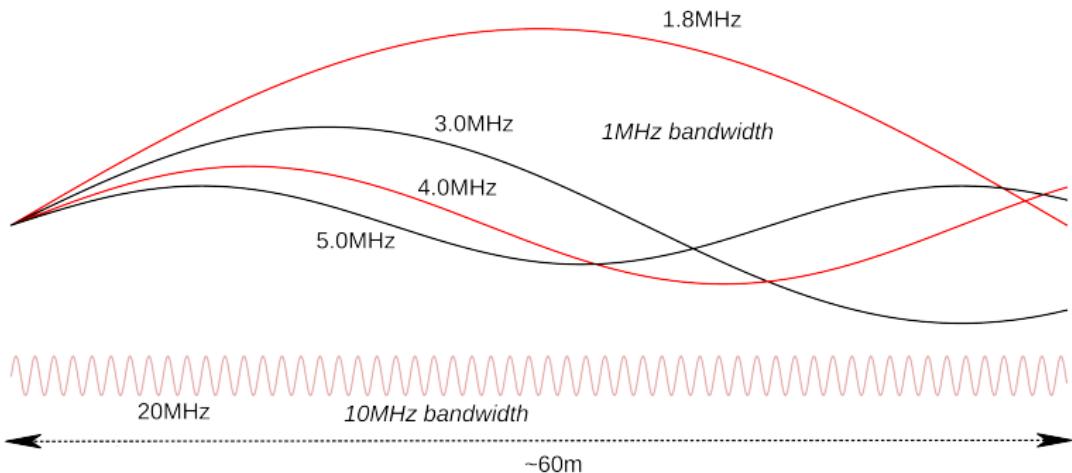
MARSIS vs SHARAD

Dimensions



MARSIS vs SHARAD

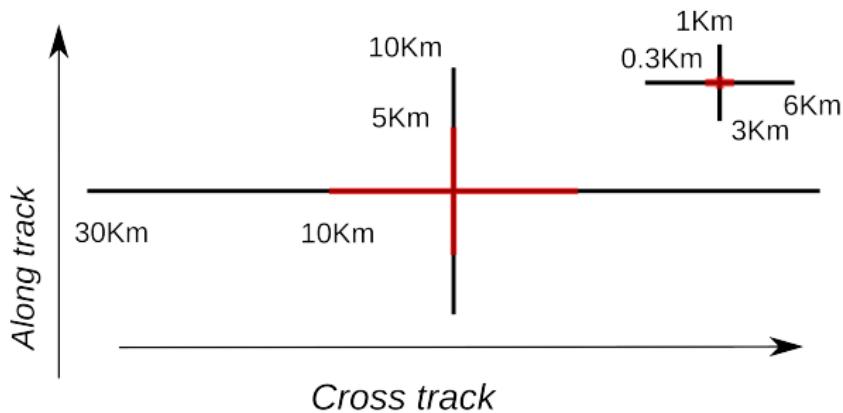
Wavelengths



Plots does not represent the radiated waveform

MARSIS vs SHARAD

Resolution

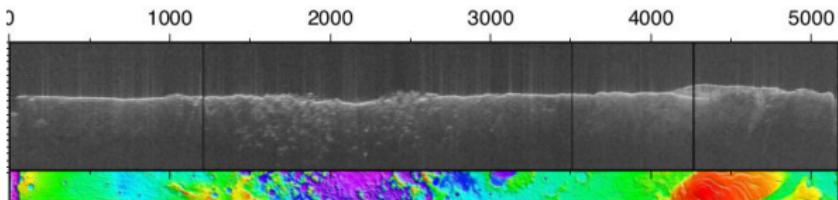


Vertical

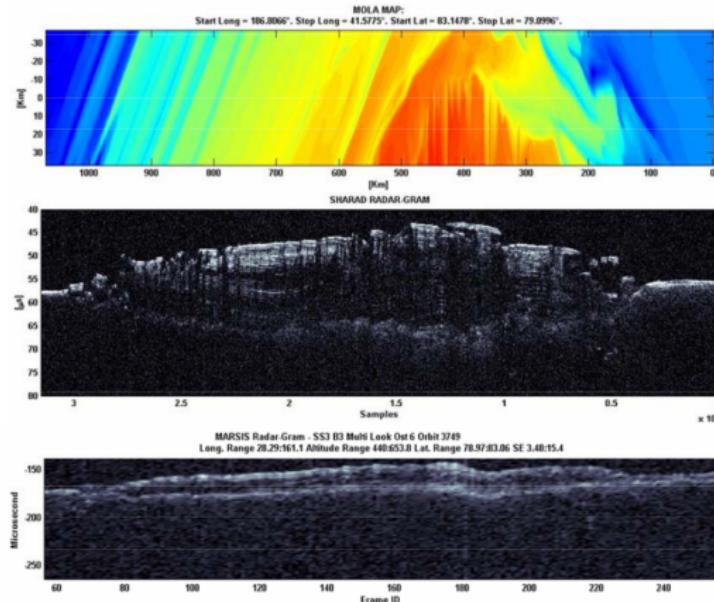
75m

7.5m

- ▶ Frame (geometric data + telemetry data + data)
- ▶ ~ 10000 orbits, ~ 1000 points per orbit
- ▶ Observing win $350\mu s$ (512 px)



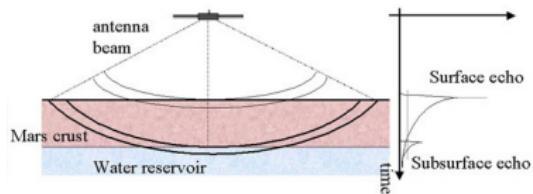
- ▶ Observing win $135\mu\text{s}$ (3600 px)



Planetary radars

Surface clutter

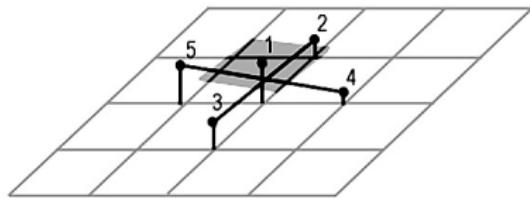
- ▶ Radar not directional
- ▶ On board mitigation not sufficient
- ▶ To simulate the surface clutter



Surface clutter mitigation

MARSIS simulations

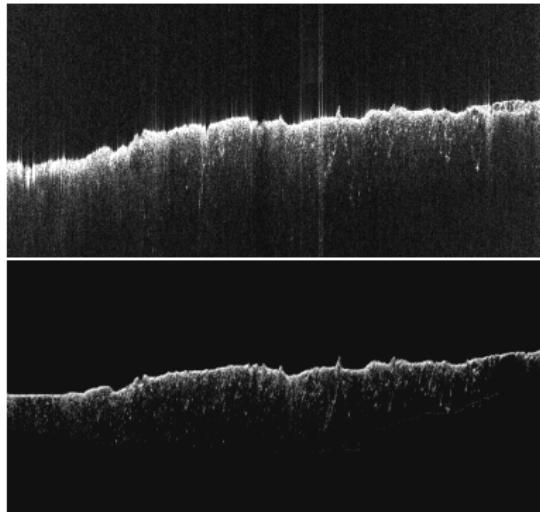
- ▶ Facet model of surface scattering (Nouvel et al. - Radio Science vol.39, 2004)
- ▶ 500m resolution elevation model of Mars (MOLA)
- ▶ Effect of on-board processing



- ▶ Full MARSIS dataset simulated (PRACE 8th call. Mar 2014 - Feb 2015)
- ▶ SHARAD simulations?

Surface clutter mitigation

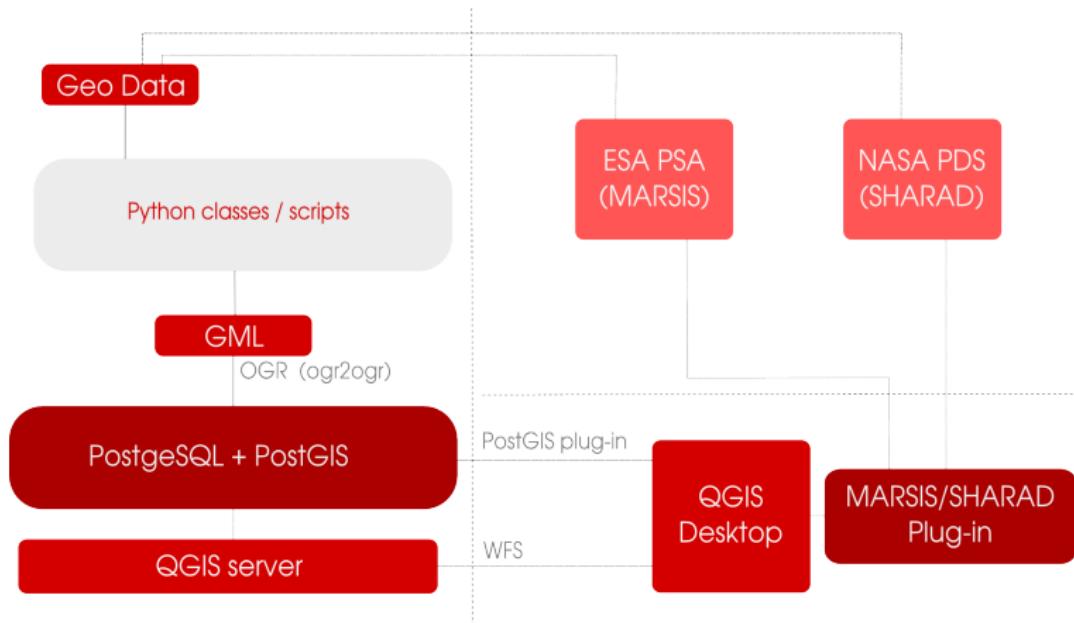
MARSIS simulations



orbit #2848

Mars radars

Data access



Mars radars

Data access

- ▶ Demo

Mars radars QGIS plug in

To do

- ▶ Make 3D viewer reliable
- ▶ Data export (Paraview, Blender, Seg-Y ?)
- ▶ Plug-in release (GitHub?)
- ▶ Bug fixing

Mars radars QGIS plug in

Keeping in touch

- ▶ <http://redmine-espace.epfl.ch/projects/imars/wiki>
- ▶ email to *federico.cantini@epfl.ch* - Subject: *Mars radars QGIS*