VLBI as a tool for planetary science missions

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The Very Long Baseline Interferometry (VLBI) technique exploits the fundamental principles of optics to achieve ultimately high angular resolution in detecting signals from remote celestial sources. Originally it was developed for studies of natural celestial sources, but has a long and successful record of precise tracking of deep space missions. Higher data rates, lower noise temperatures of radio telescopes, advanced data processing equipment and algorithms enable VLBI tracking of distant planetary missions in the outer Solar System. Recently, this potential has been demonstrated by VLBI tracking of the Huygens probe during its parachute descent in the atmosphere and after touch-down on the surface of Titan. The key element of the experiment was a specially designed software VLBI processor (correlator) able to process signals arriving from the source in the optical near field (an unusual situation for a traditional VLBI processor. A spin-off of this development includes high spectral resolution tracking of the Smart-1 spacecraft and observations aimed at detection of water vapour in the Saturnian system. Prospective applications of the VLBI technique for tracking future planetary and deep space missions using the next generation of Earth-based radio facilities will be reviewed.