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Estimation of Comet 67P Surface Properties from CONSERT Data Obtained during Descent of Philae

Dirk Plettemeier (1), Christoph Statz (1), Sebastian Hegler (1), Ronny Hahnel (1), Alain Herique (2), and Wlodek Kofman (2)

(1) Technische Universität Dresden, Germany, (2) Institut de Planétologie et d'Astrophysique de Grenoble, France

The Comet Nucleus Sounding Experiment by Radiowave Transmission (CONSERT) is an experiment aboard the ESA spacecraft "Rosetta". After a detailed observation of the comet 67P/Churyumov–Gerasimenko, the landing unit "Philae" will descend to the cometary nucleus in November 2014. The CONSERT instrument will then perform a sounding of 67P's core using radiowaves. From these data an estimation of several properties of the comet 67P shall be derived. These include the mean permittivity, the mean absorption and volume scattering of the comet nucleus, the size of irregularities and/or small structures inside the comet, the size of potential cometesimals forming the nucleus as well as the re?ection coef?cient at internal interfaces.

In addition to the nominal operation, i.e. the bi-static sounding through the cometary nucleus, the CONSERT instrument will operate during the descent of lander "Philae" where the direct path between orbiter and lander as well as reflections from the surface of the comet will be measured. From this data, scientific as well as operational information can be derived. The direct path is determined by lander and orbiter positions and attitudes.

In addition to theses properties the reflected path is influenced by the comet's surface permittivity distribution and roughness as well as by the stratigraphy close to the surface. The data obtained during the descent will provide initial values for CONSERT's main objective.

In this presentation we will introduce a methodology to obtain the surface permittivity distribution using a regularized least-squares approach and gradient based optimization as well as performance estimates for the proposed algorithm depending on instrument constraints, orbitography and surface roughness.