



Complete reconstruction of Philae's bounce trajectory and implications for comet 67P/Churyumov-Gerasimenko surface properties

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On 12th of November 2014, the Rosetta lander Philae bounced off the intended landing site on comet 67P/Churyumov-Gerasimenko and came to rest about two hours later after three more contacts with the surface. The final location was unambiguously identified on an image taken by the Osiris camera aboard the Rosetta orbiter on 2nd of September 2016.

Biele et al. (2015) presented two reconstructed trajectories of Philae, one by the Science Operations and Navigation Centre (SONC) of the French Centre National d'Études Spatiales and the other by the European Space Operation Centre (ESOC) of the European Space Agency. The two trajectories diverge considerably after the first bounce arc, as they used different sets of data to constrain the trajectory. None of the trajectories is compatible with all the data available now. The third arc, which was not very well constrained, was not modeled at all by ESOC. SONC assumed the properties of the third bounce to be similar to the second bounce to constrain the third arc to some extent.

Here, we present a complete reconstruction of all three arcs that is compatible with all the available data, i.e., surface contact times, deceleration direction at final impact, and imagery acquired by the orbiter. This enables the comparison of the dynamics of the three bounces and the final touchdown and hence a comparison of the surface properties at these four sites.