RPC-LAP
OPERATIONS REPORT
ROSETTA EXTENSION PHASE 3

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Contents

Document history

Revision	Date	Comment
0.1	2017-03-08	Initial revision (AIE)
1.0	2017-03-09	First release (AIE/EJ)

1   Introduction

This is the report from the operations of RPC-LAP in the 3rd part of the extension phase (EXT3) at the target comet 67P/Churyumov-Gerasimenko, which also is the last part of Rosetta operations. During this period, heliocentric distance increased from 3.3 to 3.83 AU on the final day of operations. LAP was operational to the very end, with last data acquired a few minutes before impact.

2   Operations overview

LAP was operational during the full period of this archive. Shorter data gaps exist, due to macro switches (few minutes), calibration and maintenance activities (typically less than an hour), and some minor operational glitches.

The main operational mode of the instrument during this period was using one or both probes in bias voltage mode, measuring current at fixed bias voltage in between bias voltage sweeps occurring every few minutes. LAP can hand over probe 2 (P2) to RPC-MIP for use in its long-Debye length mode (LDL), to enable MIP density measurements at low densities. This operational mode again saw increased use as densities decreased with time. Four LAP macros were used for LDL operations, all in normal telemetry mode (NM): macros 814 and 816 put the remaining probe P1 in bias voltage mode (+30 and -30 V, respectively), while 715 and 716 instead used LAP1 in floating mode to sample s/c potential variations at high time resolution.

Most of the time LAP used both probes. At high densities, putting both probes at -30 V enabled two-point measurements of ion current, by the BM macro 914 (burst mode, which saw less use due to low data volume as distance to Earth increased), 517 (NM) and 612 (NM). As plasma density decreased with increasing heliocentric distance, P1 was often put to +30 V to collect electrons, by macros 926 (BM), 525 (NM) and 516 (NM). In all these modes, sweeps every 160 s are connected by quasi-continuous sampling of the current to the two probes. Electric field mode was used in macro 802 (BM) and a few times in macro 801 (NM), with both LAP probes floating. To give similar measurement conditions at the two probes, both probes should be sunlit when measuring E-fields, restricting the possibilities for use. Macros 410 (BM), 412 (BM) and 416 (NM) with P1 in floating mode and P2 at -30 V, allowing comparison of s/c potential and probe current, were often used. The latter saw much use in the last part of the mission.

A special caveat must be issued for the use of data obtained at positive values of the fixed bias voltage (P1 in macros 516, 525, 617, 624 and 926, P1 and P2 in 901). In principle, the probe current is proportional to plasma density. However, for the densities and electron temperatures encountered, the effect of varying density on the spacecraft potential, driving it more negatively and hence decreasing the current to the probe (whose positive bias is applied wrt to s/c ground), often outweighs the proportionality of current to density. As an effect, the probe current can decrease at a density increase. This issue is most severe for highly negative s/c potential, i.e. when the plasma density is high, and is minor when the spacecraft is positive. At negative bias potential, the probe current always increases with density, and the problem disappears.

For the final descent, two NM macros 710 and 910 were uploaded. Both were NM macros to maximize data volume available to critical instruments like OSIRIS and ROSINA, and in both the main mode of operation was with both probes floating, sampling E-field, with one of the

probes (P1 in 910, P2 in 710) were doing a sweep every 192 s. In this way, s/c potential could be sampled at high cadence while still maintaining probe sweeps. When probe illumination conditions at descent were finally known, macro 710 was selected, and Rosetta operations ended with this LAP macro running.

The LAP data acquired are mainly good and scientifically useful, though any user must take great care of the limitations set by the varying pointing, the tenuous plasmas, and the spacecraft-plasma interaction. In addition, for the period of this archive at least P2 data show features not yet well studied and tentatively ascribed to probe surface contamination during all this period. This affects P2 data in bias voltage mode and during the first minutes after put in E-field mode (floating probe), and data must be used with care.

3   Science operations list

Below is a list of all LAP operations blocks during this mission phase. A LAP operations block is defined as a continuous run of an instrument macro, though as the archive is organized by calendar days, blocks break at midnight even if the instrument operation is continuous over this artificial border. Instrument blocks running the same macros on both sides of midnight are thus likely to actually be a continuous operation.

The macro concept is described in the EAICD, and the macros definitions tabulated in the macro table, both available in the documents directory of the LAP archives in the ESA Planetary Science Archive (PSA). A LAP macro defines all aspects of the instrument operations, though when a probe is in electric field mode (bias current), the probe bias current may often be tuned by manual commands because of changes in pointing.

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2016-09-23T14:28:04.582	2016-09-23T14:46:44.582	926
2016-09-23T14:52:04.582	2016-09-23T23:59:48.593	412
2016-09-24T00:00:00.012	2016-09-24T00:57:56.594	412

2016-09-24T01:02:12.594	2016-09-24T01:57:40.595	416
2016-09-24T02:01:56.596	2016-09-24T03:00:36.597	715
2016-09-24T03:03:48.597	2016-09-24T09:56:36.605	416
2016-09-24T10:01:56.605	2016-09-24T11:00:36.606	716
2016-09-24T11:03:48.606	2016-09-24T23:59:48.621	416
2016-09-25T00:00:01.908	2016-09-25T23:59:48.649	416
2016-09-26T00:00:01.937	2016-09-26T23:59:48.678	416
2016-09-27T00:00:01.965	2016-09-27T09:56:36.689	416
2016-09-27T10:01:56.689	2016-09-27T10:57:24.691	612
2016-09-27T11:02:12.691	2016-09-27T14:56:20.695	914
2016-09-27T15:02:12.695	2016-09-27T18:57:56.700	412
2016-09-27T19:02:12.700	2016-09-27T22:28:36.704	802
2016-09-27T22:31:48.704	2016-09-27T23:59:48.706	710
2016-09-28T00:00:52.706	2016-09-28T10:59:00.719	710
2016-09-28T11:02:12.719	2016-09-28T23:57:40.734	612
2016-09-29T00:32:20.735	2016-09-29T12:58:28.749	416
2016-09-29T13:02:12.749	2016-09-29T23:59:48.762	710
2016-09-30T00:00:52.762	2016-09-30T10:36:36.775	710