RPC-LAP
OPERATIONS REPORT
ROSETTA EXTENSION PHASE 1

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Anders Eriksson, Erik P G Johansson
Swedish Institute of Space Physics, Uppsala

Swedish Institute of Space Physics
Uppsala

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Document history

Revision	Date	Comment
0.1	2017-02-28	Initial revision (AIE)
1.0	2017-02-28	First release (AIE/EJ)

1   Introduction

This is the report from the operations of RPC-LAP in the 1st part of the extension phase (EXT1) at the target comet 67P/Churyumov-Gerasimenko. During this period, heliocentric distance increased from 2.1 to 2.7 AU.

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. The frequency and length of LDL operations shifted during the period: often either a daily 2-hour block or a 12-hour block (nucleus spin period) every other day. Three LAP macros were used for LDL operations: macro 805 in normal telemetry mode (NM) and macro 827 in burst mode (BM), both leaving P1 to collect ion current (at -20 V and -30 V bias voltage, respectively), were used within about 100 km from the nucleus where sufficiently high ion densities were expected (and found). During the nightside excursion in March-April, macro 617 with P1 at +30 V and thus collecting electrons was also used.

For the operations where LAP could use both probes, macro 624 (BM) and its close relative 926 (also BM, with slightly different sweeps) saw constant use throughout the period, placing P1 at +30 V and P2 at -30 V between sweeps. At high densities, the most useful data were still found to be provided by macro 914 with both probes at -30 V, collecting ions, and this became the single most used macro in this period. In all these modes, sweeps every 160 s are connected by quasi-continuous sampling of the current to the two probes. Electric field mode is used in macro 802, with both LAP probes floating. To give similar measurement conditions at the two probes, both probes should be sunlit in this mode. A macro 410 with P1 in floating mode while P2 is at -30 V was uploaded in early March, to allow comparison of s/c potential and probe current, and saw some use in that month.

A special caveat must be issued for the use of data obtained at positive values of the fixed bias voltage (P1 in macros 617, 624 and 926). 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. The issue is less important when the s/c potential goes positive. At negative bias potential, the probe current always increases with density, and the problem disappears.

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.

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.

Start time	End time	Macro
2016-01-13T00:00:00.004	2016-01-13T23:10:53.470	914
2016-01-14T00:02:37.471	2016-01-14T23:59:57.499	827
2016-01-15T00:04:13.499	2016-01-15T11:26:21.512	914
2016-01-15T11:32:13.512	2016-01-15T23:28:29.526	802
2016-01-15T23:32:13.526	2016-01-15T23:59:57.526	914
2016-01-16T00:00:00.000	2016-01-16T05:56:45.533	914
2016-01-16T06:02:05.533	2016-01-16T23:59:57.554	827
2016-01-17T00:04:13.554	2016-01-17T11:58:53.568	802
2016-01-17T12:02:05.568	2016-01-17T23:56:45.582	914
2016-01-18T00:02:05.582	2016-01-18T23:59:57.610	827
2016-01-19T00:00:00.015	2016-01-19T00:00:00.015	827
2016-01-19T00:04:13.610	2016-01-19T11:58:53.624	802
2016-01-19T12:02:05.624	2016-01-19T23:59:57.642	914
2016-01-20T00:00:00.012	2016-01-20T05:56:45.649	914
2016-01-20T06:02:05.649	2016-01-20T17:59:57.663	827
2016-01-20T18:04:13.663	2016-01-20T23:59:57.670	802
2016-01-21T00:00:00.006	2016-01-21T05:58:53.677	802
2016-01-21T06:02:05.678	2016-01-21T23:59:57.699	914
2016-01-22T00:00:00.017	2016-01-22T05:56:45.706	914
2016-01-22T06:02:05.706	2016-01-22T17:59:57.720	827
2016-01-22T18:04:13.720	2016-01-22T23:59:57.728	914
2016-01-23T00:00:00.011	2016-01-23T17:30:05.748	914
2016-01-23T18:02:05.749	2016-01-23T23:59:57.756	802
2016-01-24T00:00:00.005	2016-01-24T05:58:53.763	802
2016-01-24T06:02:05.763	2016-01-24T17:59:57.778	827
2016-01-24T18:04:13.778	2016-01-24T23:59:57.785	914
2016-01-25T00:00:00.016	2016-01-25T22:57:01.812	914
2016-01-25T23:01:49.812	2016-01-25T23:59:57.813	802
2016-01-26T00:00:00.010	2016-01-26T05:58:53.820	802
2016-01-26T06:02:05.820	2016-01-26T17:59:57.835	827
2016-01-26T18:04:13.835	2016-01-26T23:59:57.842	914
2016-01-27T00:00:00.004	2016-01-27T07:56:45.851	914
2016-01-27T08:02:05.851	2016-01-27T20:58:37.860	802

Start time	End time	Macro
2016-01-27T21:01:49.860	2016-01-27T23:59:57.864	914
2016-01-28T00:00:00.009	2016-01-28T17:56:45.884	914
2016-01-28T18:02:05.885	2016-01-28T23:59:57.891	827
2016-01-29T00:00:00.002	2016-01-29T05:59:57.898	827
2016-01-29T06:04:13.898	2016-01-29T23:59:57.919	914
2016-01-30T00:00:00.013	2016-01-30T05:56:45.926	914
2016-01-30T06:02:05.926	2016-01-30T17:58:53.940	802
2016-01-30T18:02:05.940	2016-01-30T23:59:57.947	827
2016-01-31T00:00:00.006	2016-01-31T05:59:57.954	827
2016-01-31T06:04:13.954	2016-01-31T23:57:17.975	914
2016-02-01T00:00:00.016	2016-02-01T17:56:45.995	914
2016-02-01T18:02:05.995	2016-02-01T23:59:58.002	827
2016-02-02T00:00:00.009	2016-02-02T05:59:58.009	827
2016-02-02T06:34:38.010	2016-02-02T23:59:58.030	914
2016-02-03T00:00:00.002	2016-02-03T09:56:46.042	914
2016-02-03T10:02:06.042	2016-02-03T21:58:54.055	802
2016-02-03T22:02:06.055	2016-02-03T23:57:18.058	805
2016-02-04T00:04:14.058	2016-02-04T21:56:46.083	914
2016-02-04T22:02:06.083	2016-02-04T23:57:18.085	805
2016-02-05T00:04:14.086	2016-02-05T21:56:46.111	914
2016-02-05T22:02:06.111	2016-02-05T23:59:58.113	827
2016-02-06T00:04:14.113	2016-02-06T21:56:46.139	914
2016-02-06T22:02:06.139	2016-02-06T23:59:58.141	827
2016-02-07T00:04:14.141	2016-02-07T11:58:54.155	802
2016-02-07T12:02:06.155	2016-02-07T21:56:46.166	914
2016-02-07T22:02:06.166	2016-02-07T23:59:58.169	827
2016-02-08T00:04:14.169	2016-02-08T21:56:46.198	914
2016-02-08T22:02:06.198	2016-02-08T23:57:18.200	805
2016-02-09T00:04:14.200	2016-02-09T21:56:46.226	914
2016-02-09T22:02:06.226	2016-02-09T23:57:18.228	805
2016-02-10T00:04:14.228	2016-02-10T11:56:46.242	914
2016-02-10T12:02:06.242	2016-02-10T23:58:22.256	802
2016-02-11T00:02:06.256	2016-02-11T02:01:02.258	827
2016-02-11T02:04:14.258	2016-02-11T23:59:58.283	914
2016-02-12T00:00:00.013	2016-02-12T01:56:46.285	914
2016-02-12T02:02:06.286	2016-02-12T03:58:54.288	805
2016-02-12T04:04:14.288	2016-02-12T23:59:58.311	914
2016-02-13T00:00:00.006	2016-02-13T05:56:46.318	914
2016-02-13T06:02:06.318	2016-02-13T07:58:54.320	805
2016-02-13T08:04:14.320	2016-02-13T23:59:58.338	914
2016-02-14T00:00:00.017	2016-02-14T03:56:46.343	914
2016-02-14T04:02:06.343	2016-02-14T06:01:02.345	827
2016-02-14T06:04:14.345	2016-02-14T23:59:58.366	914
2016-02-15T00:00:00.010	2016-02-15T07:56:46.375	914
2016-02-15T08:02:06.375	2016-02-15T09:58:54.378	805
2016-02-15T10:04:14.378	2016-02-15T13:58:22.382	802
2016-02-15T14:02:06.382	2016-02-15T23:59:58.394	914
2016-02-16T00:00:00.003	2016-02-16T09:56:14.405	914

Start time	End time	Macro
2016-02-16T10:02:06.405	2016-02-16T11:58:54.407	805
2016-02-16T12:54:22.409	2016-02-16T23:59:58.421	914
2016-02-17T00:00:00.013	2016-02-17T05:56:14.428	914
2016-02-17T06:02:06.428	2016-02-17T17:58:22.442	802
2016-02-17T18:02:06.442	2016-02-17T18:20:14.442	827
2016-02-17T18:23:58.442	2016-02-17T23:59:58.449	914
2016-02-18T00:00:00.006	2016-02-18T15:56:46.467	914
2016-02-18T16:02:06.467	2016-02-18T16:20:14.468	827
2016-02-18T16:23:58.468	2016-02-18T23:59:58.477	914
2016-02-19T00:00:00.016	2016-02-19T01:56:46.479	914
2016-02-19T02:02:06.479	2016-02-19T13:58:22.493	802
2016-02-19T14:02:06.493	2016-02-19T14:20:14.493	827
2016-02-19T14:23:58.493	2016-02-19T23:59:58.504	914
2016-02-20T00:00:00.009	2016-02-20T11:27:26.517	914
2016-02-20T11:32:14.517	2016-02-20T23:58:22.532	802
2016-02-21T00:02:06.532	2016-02-21T11:58:54.546	805
2016-02-21T12:04:14.546	2016-02-21T23:59:58.559	914
2016-02-22T00:00:00.013	2016-02-22T23:56:46.587	914
2016-02-23T00:02:06.587	2016-02-23T11:58:54.601	805
2016-02-23T12:04:14.601	2016-02-23T23:59:58.615	914
2016-02-24T00:00:00.016	2016-02-24T05:56:46.622	914
2016-02-24T06:02:06.622	2016-02-24T17:58:54.635	805
2016-02-24T18:04:14.635	2016-02-24T23:59:58.642	914
2016-02-25T00:00:00.009	2016-02-25T23:59:58.670	914
2016-02-26T00:00:00.002	2016-02-26T11:56:46.684	914
2016-02-26T12:02:06.684	2016-02-26T23:58:54.698	805
2016-02-27T00:04:14.698	2016-02-27T23:56:46.725	914
2016-02-28T00:02:06.725	2016-02-28T11:58:54.739	805
2016-02-28T12:04:14.739	2016-02-28T23:59:58.753	914
2016-02-29T00:00:00.016	2016-02-29T23:56:46.780	914
2016-03-01T00:02:06.780	2016-03-01T11:58:54.794	805
2016-03-01T12:04:14.794	2016-03-01T23:59:58.808	914
2016-03-02T00:00:00.002	2016-03-02T11:56:46.826	914
2016-03-02T12:02:06.826	2016-03-02T13:58:54.828	805
2016-03-02T14:04:14.828	2016-03-02T23:59:58.840	914
2016-03-03T00:00:00.016	2016-03-03T13:56:46.856	914
2016-03-03T14:02:06.856	2016-03-03T15:58:54.858	805
2016-03-03T16:04:14.858	2016-03-03T23:59:58.868	914
2016-03-04T00:00:00.010	2016-03-04T15:56:46.886	914
2016-03-04T16:02:06.886	2016-03-04T17:58:54.888	805
2016-03-04T18:04:14.889	2016-03-04T23:59:58.895	914
2016-03-05T00:00:00.003	2016-03-05T02:57:02.899	914
2016-03-05T03:08:14.899	2016-03-05T03:32:46.900	926
2016-03-05T03:38:06.900	2016-03-05T05:53:34.902	410
2016-03-05T06:02:38.902	2016-03-05T17:56:46.916	914
2016-03-05T18:02:06.916	2016-03-05T19:58:54.919	805
2016-03-05T20:04:14.919	2016-03-05T23:59:58.923	914
2016-03-06T00:00:00.013	2016-03-06T11:56:46.937	914

Start time	End time	Macro
2016-03-06T12:02:06.937	2016-03-06T23:58:54.951	805
2016-03-07T00:34:38.952	2016-03-07T23:59:58.979	914
2016-03-08T00:00:00.017	2016-03-08T11:56:14.993	914
2016-03-08T12:02:06.993	2016-03-08T23:58:55.007	805
2016-03-09T00:04:15.007	2016-03-09T23:59:59.034	914
2016-03-10T00:00:00.003	2016-03-10T11:56:47.048	914
2016-03-10T12:02:07.048	2016-03-10T23:58:55.062	805
2016-03-11T00:04:15.062	2016-03-11T23:59:59.090	914
2016-03-12T00:00:00.007	2016-03-12T11:56:47.104	914
2016-03-12T12:02:07.104	2016-03-12T23:58:55.118	805
2016-03-13T00:04:15.118	2016-03-13T23:59:59.146	914
2016-03-14T00:00:00.011	2016-03-14T11:56:47.159	914
2016-03-14T12:02:07.160	2016-03-14T14:01:03.162	827
2016-03-14T14:04:15.162	2016-03-14T23:59:59.173	914
2016-03-15T00:00:00.004	2016-03-15T13:56:47.190	914
2016-03-15T14:02:07.190	2016-03-15T15:58:55.192	805
2016-03-15T16:04:15.192	2016-03-15T23:59:59.201	914
2016-03-16T00:00:00.014	2016-03-16T04:58:07.207	914
2016-03-16T05:03:59.207	2016-03-16T21:58:23.227	410
2016-03-16T22:02:07.227	2016-03-16T23:00:15.228	805
2016-03-16T23:03:59.228	2016-03-16T23:59:59.229	914
2016-03-17T00:00:00.008	2016-03-17T19:56:47.252	914
2016-03-17T20:02:07.252	2016-03-17T21:00:15.253	805
2016-03-17T21:27:59.254	2016-03-17T23:59:59.257	410
2016-03-18T00:00:00.001	2016-03-18T17:58:23.278	410
2016-03-18T18:02:07.278	2016-03-18T19:00:15.279	805
2016-03-18T19:03:59.279	2016-03-18T23:59:59.285	914
2016-03-19T00:00:00.011	2016-03-19T23:59:59.312	914
2016-03-20T00:00:00.004	2016-03-20T23:59:59.340	914
2016-03-21T00:00:00.015	2016-03-21T23:59:59.368	914
2016-03-22T00:00:00.008	2016-03-22T03:56:47.373	914
2016-03-22T04:02:07.373	2016-03-22T05:00:15.374	805
2016-03-22T05:03:59.374	2016-03-22T17:58:23.389	410
2016-03-22T18:02:07.389	2016-03-22T23:59:59.396	914
2016-03-23T00:00:00.001	2016-03-23T11:56:15.410	914
2016-03-23T12:02:07.410	2016-03-23T23:59:59.424	617
2016-03-24T00:00:00.012	2016-03-24T08:00:31.433	617
2016-03-24T08:04:15.433	2016-03-24T23:59:59.451	624
2016-03-25T00:00:00.005	2016-03-25T22:56:31.478	624
2016-03-25T23:01:51.478	2016-03-25T23:59:59.479	617
2016-03-26T00:00:00.015	2016-03-26T00:01:03.479	617
2016-03-26T00:04:15.479	2016-03-26T15:22:07.497	624
2016-03-26T15:27:59.497	2016-03-26T17:45:03.500	802
2016-03-26T17:48:15.500	2016-03-26T23:56:47.507	624
2016-03-27T00:02:07.507	2016-03-27T04:00:31.512	617
2016-03-27T04:04:15.512	2016-03-27T07:14:07.515	410
2016-03-27T07:17:51.515	2016-03-27T08:14:23.516	802
2016-03-27T08:18:07.517	2016-03-27T11:56:15.521	624

Start time	End time	Macro
2016-03-27T12:02:07.521	2016-03-27T23:59:59.535	617
2016-03-28T00:00:00.002	2016-03-28T04:00:31.539	617
2016-03-28T04:04:15.539	2016-03-28T11:56:47.549	624
2016-03-28T12:02:07.549	2016-03-28T23:59:59.563	617
2016-03-29T00:00:00.012	2016-03-29T00:00:31.563	617
2016-03-29T00:04:15.563	2016-03-29T23:59:59.590	624
2016-03-30T00:00:00.006	2016-03-30T11:22:07.604	624
2016-03-30T11:52:31.604	2016-03-30T23:59:59.618	926
2016-03-31T00:00:00.016	2016-03-31T05:52:31.625	926
2016-03-31T05:57:51.625	2016-03-31T07:14:39.627	802
2016-03-31T07:17:51.627	2016-03-31T12:56:31.633	926
2016-03-31T13:01:51.633	2016-03-31T23:58:55.646	617
2016-04-01T00:00:00.009	2016-04-01T02:01:03.648	617
2016-04-01T02:04:15.648	2016-04-01T06:52:47.654	926
2016-04-01T06:58:07.654	2016-04-01T08:25:03.656	802
2016-04-01T08:28:15.656	2016-04-01T23:59:59.674	926
2016-04-02T00:00:00.002	2016-04-02T23:59:59.702	926
2016-04-03T00:00:00.013	2016-04-03T12:26:07.716	926
2016-04-03T12:31:59.716	2016-04-03T23:59:59.729	617
2016-04-04T00:00:00.006	2016-04-04T02:29:51.732	617
2016-04-04T02:34:07.732	2016-04-04T08:56:31.744	926
2016-04-04T09:01:51.744	2016-04-04T18:01:03.754	617
2016-04-04T18:04:15.754	2016-04-04T23:56:47.761	926
2016-04-05T00:02:07.761	2016-04-05T12:59:43.776	617
2016-04-05T13:03:59.776	2016-04-05T23:59:59.789	926