

RPC-LAP OPERATIONS REPORT ROSETTA EXTENSION PHASE 2

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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 2nd part of the extension phase (EXT2) at the target comet 67P/Churyumov-Gerasimenko. During this period, heliocentric distance increased from 2.7 to 3.3 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. This operational mode saw less time in this period than before, but LDL operations nevertheless are present throughout. Four LAP macros were used for LDL operations: macros 617 and 827 in burst mode (BM) was used only a few times, while two new normal mode (NM) macros, 814 (with P1 at -30 V) and 816 (+30 V), complemented the old 805 (NM, -20 V) and were used most of the LDL time.

For the operations where LAP could use both probes, the BM macros 624, 926 and 914 saw less and less use as data volume decreased with time. At high densities, the most useful data were still found to be provided putting both probes at -30 V, and macro 517 was uploaded as a NM counterpart to 914 for doing this. As plasma density decreased with increasing heliocentric, P1 was often put to +30 V to collect electrons, by macros 624 (BM), 926 (BM), 525 (NM) and 516 (NM). Macro 901 (BM), with both probes at +30 V, was also used a few times. 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. Macro 410 with P1 in floating mode while P2 is at -30 V, allowing comparison of s/c potential and probe current, also saw some use.

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.

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.

Start time	End time	Macro ID
2016-04-06T00:00:00.014	2016-04-06T23:59:59.817	926
2016-04-07T00:00:00.007	2016-04-07T23:56:47.845	926
2016-04-08T00:02:07.845	2016-04-08T23:59:59.873	827
2016-04-09T00:00:00.011	2016-04-09T00:00:31.873	827
2016-04-09T00:04:15.873	2016-04-09T23:59:59.901	914
2016-04-10T00:00:00.004	2016-04-10T15:56:47.919	914
2016-04-10T16:02:07.919	2016-04-10T23:58:23.928	410
2016-04-11T00:02:07.929	2016-04-11T15:26:55.946	926
2016-04-11T15:32:15.947	2016-04-11T16:59:43.948	617
2016-04-11T17:03:59.948	2016-04-11T18:58:39.951	504
2016-04-11T19:01:51.951	2016-04-11T19:29:03.951	802
2016-04-11T19:31:43.951	2016-04-11T23:59:59.956	624
2016-04-12T00:00:00.008	2016-04-12T11:56:15.970	624
2016-04-12T12:02:07.970	2016-04-12T23:57:51.984	617
2016-04-13T00:02:07.984	2016-04-13T11:56:15.998	926
2016-04-13T12:02:07.998	2016-04-13T23:59:28.012	617
2016-04-14T00:00:00.012	2016-04-14T00:00:32.012	617
2016-04-14T00:04:16.012	2016-04-14T11:56:48.026	624
2016-04-14T12:02:08.026	2016-04-14T23:59:28.040	617
2016-04-15T00:00:00.040	2016-04-15T00:00:32.040	617
2016-04-15T00:04:16.040	2016-04-15T13:48:48.056	926
2016-04-15T13:54:08.056	2016-04-15T15:29:04.058	504
2016-04-15T15:32:16.058	2016-04-15T15:58:24.059	802
2016-04-15T16:02:08.059	2016-04-15T23:59:28.068	624

Start time	End time	Macro ID
2016-04-16T00:00:00.068	2016-04-16T09:56:16.079	624
2016-04-16T10:02:08.080	2016-04-16T22:00:32.093	617
2016-04-16T22:24:00.094	2016-04-16T23:59:28.096	926
2016-04-17T00:00:00.096	2016-04-17T11:56:48.110	926
2016-04-17T12:02:08.110	2016-04-17T23:59:28.124	617
2016-04-18T00:00:00.124	2016-04-18T00:00:32.124	617
2016-04-18T00:04:16.124	2016-04-18T11:56:48.137	926
2016-04-18T12:02:08.138	2016-04-18T23:56:16.151	914
2016-04-19T00:02:08.152	2016-04-19T11:56:16.165	926
2016-04-19T12:02:08.165	2016-04-19T23:59:28.179	914
2016-04-20T00:00:00.179	2016-04-20T05:56:16.186	914
2016-04-20T06:02:08.186	2016-04-20T14:59:44.197	827
2016-04-20T15:04:00.197	2016-04-20T23:59:28.207	914
2016-04-21T00:00:00.207	2016-04-21T13:59:28.223	914
2016-04-21T14:32:00.224	2016-04-21T14:58:08.225	516
2016-04-21T15:01:52.225	2016-04-21T15:28:00.225	517
2016-04-21T15:32:16.225	2016-04-21T15:58:24.226	814
2016-04-21T16:02:08.226	2016-04-21T16:28:16.226	816
2016-04-21T16:32:00.226	2016-04-21T16:37:20.227	510
2016-04-21T16:48:32.227	2016-04-21T23:59:28.235	914
2016-04-22T00:00:00.235	2016-04-22T23:56:16.263	914
2016-04-23T00:02:08.263	2016-04-23T03:00:16.266	827
2016-04-23T03:04:00.267	2016-04-23T23:59:28.291	914
2016-04-24T00:00:00.291	2016-04-24T23:59:28.319	914
2016-04-25T00:00:00.319	2016-04-25T23:59:28.351	914
2016-04-26T00:00:00.351	2016-04-26T23:56:48.379	914
2016-04-27T02:16:00.382	2016-04-27T23:59:28.407	914
2016-04-28T00:00:00.407	2016-04-28T04:56:32.413	914
2016-04-28T05:01:52.413	2016-04-28T06:58:40.415	805
2016-04-28T07:04:00.416	2016-04-28T16:56:32.427	624
2016-04-28T17:01:52.427	2016-04-28T18:58:40.430	805
2016-04-28T19:04:00.430	2016-04-28T23:59:28.435	525
2016-04-29T00:00:00.435	2016-04-29T04:58:08.441	525
2016-04-29T05:01:52.441	2016-04-29T06:58:40.444	805
2016-04-29T07:04:00.444	2016-04-29T16:58:08.455	525
2016-04-29T17:01:52.455	2016-04-29T18:58:40.458	805
2016-04-29T19:04:00.458	2016-04-29T23:59:28.464	525
2016-04-30T00:00:00.464	2016-04-30T10:58:08.477	525
2016-04-30T11:01:52.477	2016-04-30T12:58:40.479	805
2016-04-30T13:04:00.479	2016-04-30T13:59:28.480	525

Start time	End time	Macro ID
2016-04-30T14:03:12.480	2016-04-30T23:57:20.492	914
2016-05-01T00:00:00.492	2016-05-01T04:57:36.498	914
2016-05-01T05:08:48.498	2016-05-01T06:04:48.499	802
2016-05-01T06:08:00.499	2016-05-01T23:59:28.520	914
2016-05-02T00:00:00.520	2016-05-02T16:56:32.540	914
2016-05-02T17:01:52.540	2016-05-02T18:58:40.542	805
2016-05-02T19:01:52.542	2016-05-02T23:58:24.548	410
2016-05-03T00:02:08.548	2016-05-03T16:11:12.567	914
2016-05-03T18:19:12.570	2016-05-03T18:58:40.571	805
2016-05-03T19:04:00.571	2016-05-03T23:22:40.576	914
2016-05-03T23:52:00.576	2016-05-03T23:59:28.576	517
2016-05-04T00:00:00.576	2016-05-04T04:58:08.582	517
2016-05-04T05:01:52.582	2016-05-04T05:22:40.583	801
2016-05-04T05:28:00.583	2016-05-04T23:59:28.605	517
2016-05-05T00:00:00.605	2016-05-05T23:59:28.633	517
2016-05-06T00:00:00.633	2016-05-06T09:56:48.645	517
2016-05-06T10:02:08.645	2016-05-06T23:59:28.661	914
2016-05-07T00:00:00.661	2016-05-07T23:59:28.689	914
2016-05-08T00:00:00.689	2016-05-08T05:02:56.695	914
2016-05-08T05:07:44.695	2016-05-08T05:24:48.696	802
2016-05-08T05:28:00.696	2016-05-08T23:59:28.717	517
2016-05-09T00:00:00.717	2016-05-09T13:56:48.734	517
2016-05-09T14:02:08.734	2016-05-09T15:58:56.736	814
2016-05-09T16:03:44.736	2016-05-09T18:56:32.740	517
2016-05-09T19:01:52.740	2016-05-09T19:28:00.740	801
2016-05-09T19:31:44.740	2016-05-09T23:59:28.746	517
2016-05-10T00:00:00.746	2016-05-10T11:57:52.760	517
2016-05-10T12:02:08.760	2016-05-10T13:58:56.762	814
2016-05-10T14:03:44.762	2016-05-10T23:59:28.774	517
2016-05-11T00:00:00.774	2016-05-11T04:56:32.780	517
2016-05-11T05:01:52.780	2016-05-11T05:28:32.780	802
2016-05-11T05:31:44.780	2016-05-11T23:59:28.802	914
2016-05-12T00:00:00.802	2016-05-12T15:28:32.820	914
2016-05-12T15:31:44.820	2016-05-12T15:58:24.821	802
2016-05-12T16:02:08.821	2016-05-12T21:29:04.827	410
2016-05-12T21:31:44.827	2016-05-12T21:58:24.828	802
2016-05-12T22:02:08.828	2016-05-12T23:59:28.830	410
2016-05-13T00:00:00.830	2016-05-13T02:58:08.834	410
2016-05-13T03:01:52.834	2016-05-13T03:28:32.834	802
2016-05-13T03:31:44.834	2016-05-13T13:16:16.846	914

Start time	End time	Macro ID
2016-05-13T14:02:08.847	2016-05-13T23:57:20.858	814
2016-05-14T00:08:32.859	2016-05-14T17:57:20.880	517
2016-05-14T18:02:08.880	2016-05-14T18:28:48.880	802
2016-05-14T18:32:00.880	2016-05-14T21:56:48.884	914
2016-05-14T22:02:08.884	2016-05-14T22:28:48.885	802
2016-05-14T22:32:00.885	2016-05-14T23:59:28.887	914
2016-05-15T00:00:00.887	2016-05-15T04:56:32.893	914
2016-05-15T05:01:52.893	2016-05-15T05:28:32.893	802
2016-05-15T05:31:44.893	2016-05-15T23:59:28.915	914
2016-05-16T00:00:00.005	2016-05-16T23:59:28.943	914
2016-05-17T00:00:00.016	2016-05-17T23:59:28.966	914
2016-05-18T00:00:00.004	2016-05-18T11:28:32.980	914
2016-05-18T11:31:44.980	2016-05-18T12:58:08.981	410
2016-05-18T13:01:52.981	2016-05-18T14:26:40.983	517
2016-05-18T14:32:00.983	2016-05-18T15:58:24.985	802
2016-05-18T16:02:08.985	2016-05-18T23:59:28.994	814
2016-05-19T00:00:00.994	2016-05-19T01:58:56.997	814
2016-05-19T02:03:44.997	2016-05-19T18:56:33.016	624
2016-05-19T19:01:53.016	2016-05-19T23:59:29.022	901
2016-05-20T00:00:00.008	2016-05-20T23:28:01.049	901
2016-05-20T23:31:45.049	2016-05-20T23:58:25.050	802
2016-05-21T00:02:09.050	2016-05-21T23:58:57.078	516
2016-05-22T00:02:09.078	2016-05-22T00:58:41.079	802
2016-05-22T01:01:53.079	2016-05-22T04:26:41.083	516
2016-05-22T04:32:01.083	2016-05-22T05:58:25.085	410
2016-05-22T06:02:09.085	2016-05-22T06:57:37.086	517
2016-05-22T07:01:53.086	2016-05-22T07:58:25.087	802
2016-05-22T08:02:09.087	2016-05-22T23:59:29.106	914
2016-05-23T00:00:00.005	2016-05-23T23:59:29.134	914
2016-05-24T00:00:00.016	2016-05-24T23:59:29.162	914
2016-05-25T00:00:00.009	2016-05-25T23:56:17.189	914
2016-05-26T00:02:09.189	2016-05-26T00:58:41.191	802
2016-05-26T01:01:53.191	2016-05-26T08:00:01.199	814
2016-05-26T08:03:45.199	2016-05-26T08:58:41.200	802
2016-05-26T09:01:53.200	2016-05-26T18:00:01.210	814
2016-05-26T18:03:45.210	2016-05-26T18:58:41.211	802
2016-05-26T19:01:53.212	2016-05-26T23:59:29.217	926
2016-05-27T00:00:00.013	2016-05-27T23:59:29.245	926
2016-05-28T00:00:00.007	2016-05-28T11:56:17.259	926
2016-05-28T12:02:09.259	2016-05-28T12:58:41.260	802

Start time	End time	Macro ID
2016-05-28T13:01:53.260	2016-05-28T20:10:41.269	901
2016-05-30T18:43:29.323	2016-05-30T23:59:45.329	901
2016-05-31T00:00:00.000	2016-05-31T23:57:37.357	901
2016-06-01T00:04:01.357	2016-06-01T04:56:49.363	516
2016-06-01T05:02:09.363	2016-06-01T05:58:41.364	802
2016-06-01T06:01:53.364	2016-06-01T15:58:41.375	516
2016-06-01T16:01:53.375	2016-06-01T16:58:25.376	802
2016-06-01T17:02:09.377	2016-06-01T23:59:45.385	516
2016-06-02T00:00:00.886	2016-06-02T03:57:37.389	516
2016-06-02T04:01:53.389	2016-06-02T04:58:25.390	802
2016-06-02T05:02:09.390	2016-06-02T15:46:57.403	516
2016-06-02T15:51:45.403	2016-06-02T16:48:49.404	802
2016-06-02T16:52:01.404	2016-06-02T23:58:09.412	516
2016-06-03T00:01:53.413	2016-06-03T11:58:41.426	814
2016-06-03T12:04:01.427	2016-06-03T15:28:49.431	516
2016-06-03T15:32:01.431	2016-06-03T16:28:33.432	802
2016-06-03T16:31:45.432	2016-06-03T23:59:45.440	516
2016-06-04T00:00:00.942	2016-06-04T09:56:33.452	516
2016-06-04T10:01:53.452	2016-06-04T19:58:41.464	816
2016-06-04T20:04:01.464	2016-06-04T23:59:45.468	516
2016-06-05T00:00:00.970	2016-06-05T11:58:09.482	516
2016-06-05T12:01:53.482	2016-06-05T19:58:41.492	814
2016-06-05T20:04:01.492	2016-06-05T23:59:45.496	516
2016-06-06T00:00:00.998	2016-06-06T23:10:09.523	516
2016-06-06T23:13:53.523	2016-06-06T23:59:45.524	901
2016-06-07T00:00:00.005	2016-06-07T02:44:01.527	901
2016-06-07T02:47:45.527	2016-06-07T03:27:13.528	516
2016-06-07T03:32:01.528	2016-06-07T07:48:33.533	802
2016-06-07T07:51:45.533	2016-06-07T09:13:53.535	516
2016-06-07T09:18:09.535	2016-06-07T12:50:25.539	802
2016-06-07T12:54:09.539	2016-06-07T13:33:37.540	516
2016-06-07T13:37:53.540	2016-06-07T17:52:49.545	802
2016-06-07T17:56:01.545	2016-06-07T19:12:49.546	516
2016-06-07T19:18:09.547	2016-06-07T22:52:33.551	901
2016-06-07T22:57:53.551	2016-06-07T23:59:45.552	516
2016-06-08T00:00:01.054	2016-06-08T07:58:41.561	516
2016-06-08T10:31:45.564	2016-06-08T19:56:33.575	517
2016-06-08T20:01:53.575	2016-06-08T22:28:01.578	914
2016-06-08T22:31:45.578	2016-06-08T23:59:45.580	516
2016-06-09T00:00:01.082	2016-06-09T09:56:33.591	516

Start time	End time	Macro ID
2016-06-09T10:01:53.592	2016-06-09T11:56:33.594	624
2016-06-09T12:01:53.594	2016-06-09T17:28:49.600	802
2016-06-09T17:32:01.600	2016-06-09T17:56:33.601	624
2016-06-09T18:01:53.601	2016-06-09T19:58:41.603	816
2016-06-09T20:04:01.603	2016-06-09T23:58:41.608	802
2016-06-10T00:01:53.608	2016-06-10T11:58:09.622	410
2016-06-10T12:01:53.626	2016-06-10T15:58:41.631	517
2016-06-10T16:01:53.631	2016-06-10T17:58:41.633	814
2016-06-10T18:04:01.633	2016-06-10T23:59:45.640	516
2016-06-11T00:00:00.035	2016-06-11T19:58:09.664	516
2016-06-11T20:01:53.664	2016-06-11T21:58:41.667	816
2016-06-11T22:04:01.667	2016-06-11T23:59:45.669	517
2016-06-12T00:00:00.064	2016-06-12T21:57:37.695	517
2016-06-12T22:01:53.695	2016-06-12T23:58:41.698	814
2016-06-13T00:04:01.698	2016-06-13T11:58:09.712	516
2016-06-13T12:01:53.712	2016-06-13T16:58:25.718	802
2016-06-13T17:02:09.718	2016-06-13T18:58:57.721	516
2016-06-13T19:02:09.721	2016-06-13T23:58:41.726	802
2016-06-14T00:01:53.727	2016-06-14T01:58:41.729	814
2016-06-14T02:04:01.729	2016-06-14T15:58:09.746	516
2016-06-14T16:01:53.746	2016-06-14T23:25:05.755	410
2016-06-14T23:27:45.755	2016-06-14T23:59:45.755	525
2016-06-15T00:00:01.257	2016-06-15T12:57:53.771	525
2016-06-15T13:02:09.771	2016-06-15T23:59:45.784	516
2016-06-16T00:00:00.178	2016-06-16T05:57:37.791	516
2016-06-16T06:01:53.791	2016-06-16T11:56:33.798	926
2016-06-16T12:01:53.798	2016-06-16T12:56:17.799	914
2016-06-16T13:02:09.799	2016-06-16T13:56:33.801	926
2016-06-16T14:01:53.801	2016-06-16T17:58:41.805	802
2016-06-16T18:01:53.805	2016-06-16T18:56:17.807	901
2016-06-16T19:02:09.807	2016-06-16T22:58:25.811	802
2016-06-16T23:02:09.811	2016-06-16T23:56:33.813	914
2016-06-17T00:01:53.813	2016-06-17T02:58:25.816	802
2016-06-17T03:02:09.816	2016-06-17T03:56:33.817	901
2016-06-17T04:01:53.817	2016-06-17T06:58:25.821	802
2016-06-17T07:02:09.821	2016-06-17T07:56:33.822	926
2016-06-17T08:01:53.822	2016-06-17T11:58:41.827	802
2016-06-17T12:01:53.827	2016-06-17T23:59:45.841	516
2016-06-18T00:00:00.236	2016-06-18T11:37:21.855	516
2016-06-18T12:01:53.856	2016-06-18T21:58:41.868	816

Start time	End time	Macro ID
2016-06-18T22:04:01.868	2016-06-18T23:59:45.870	516
2016-06-19T00:00:00.264	2016-06-19T09:58:09.882	516
2016-06-19T10:01:53.882	2016-06-19T19:58:41.894	816
2016-06-19T20:04:01.894	2016-06-19T23:59:45.899	516
2016-06-20T00:00:00.293	2016-06-20T23:59:45.927	516
2016-06-21T00:00:00.322	2016-06-21T23:59:45.951	516
2016-06-22T00:00:00.345	2016-06-22T23:59:45.979	516
2016-06-23T00:00:00.373	2016-06-23T23:59:46.007	516
2016-06-24T00:00:00.402	2016-06-24T23:59:46.035	516
2016-06-25T00:00:00.430	2016-06-25T23:59:46.063	516
2016-06-26T00:00:00.458	2016-06-26T23:59:46.092	516
2016-06-27T00:00:00.486	2016-06-27T15:02:10.109	516
2016-06-27T16:02:26.110	2016-06-27T23:03:14.119	816
2016-06-27T23:08:02.119	2016-06-27T23:52:50.120	525
2016-06-27T23:58:10.120	2016-06-27T23:59:46.120	816
2016-06-28T00:00:00.514	2016-06-28T07:04:18.128	816
2016-06-28T07:08:02.128	2016-06-28T07:52:50.129	525
2016-06-28T07:58:10.129	2016-06-28T15:04:18.137	816
2016-06-28T15:08:02.137	2016-06-28T15:52:50.138	525
2016-06-28T15:58:10.138	2016-06-28T23:59:46.148	816