

# RPC-LAP OPERATIONS REPORT ESCORT PHASE 1

November 19, 2014 - March 10, 2015

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## Document history

Revision	Date	Comment
0.1	2015-07-21	Initial revision (AIE)
1.0	2015-12-01	First release (AIE)

## 1 Introduction

This is the report from the operations of RPC-LAP in the 1st part of the escort phase (ESC1) at the target comet 67P/Churyumov-Gerasimenko.

## 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 instrument glitches (see below, a few days at worst).

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. During the period of interest here, this was done 15 hours every second day in November and December, and then 24 hours every 2nd day, i.e. half of the time. Until Dec 18, the main macro used for these operations was macro 803, with the LAP science data being limited to current measurements at fix bias voltage on probe 1 (P1), though macro 807, in which LAP also has sweeps, was used a few times. From Dec 18, a new macro 805 also including LAP sweeps was available and became the main LDL macro.

For operations where LAP could use both probes, macro 515 was the dominant operational mode in November, except some periods with higher telemetry rate (burst mode, BM) available which then used macro 604. From Dec 6, a new macro 525 with better sweep range and probe 2 ant negative fix bias voltage replaced 515 to improve performance at the high electron temperatures ( $\sim 5$  eV) typically encountered. This then stayed as the main science mode at normal telemetry rate (NM) during all the period. In the scarce BM periods, macro 624 similarly replaced macro 604.

A special caveat must be issued for the use of data obtained at positive values of the fixed bias voltage. In principle, this 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 effect is worst at low bias voltage (+10 or +20 V), but sometimes remains strong also at +30 V. As plasma densities increased with comet activity, it was possible to use at least one probe instead at negative bias voltage, sampling ion current, with some sensitivity, which is what is done in macros 525 and 624.

Both LAP probes were occasionally run in bias current mode, measuring probe voltage, using macro 503 in NM or macro 504 in BM. While the imminent scientific usefulness of these data was not obvious, as quite significant perturbations from the s/c can be expected, it was considered necessary to gain some database also of this kind of measurements. Such data are therefore available in December 5 and 18; January 6, 10, 14, and 28; February 7, 17, and 27; and March 1 and 7. The main useful quantity here is the spacecraft potential. Deriving electric field from the probe voltage difference in this mode is in principle possible but must be done with extreme caution, being very prone to effects of spacecraft-plasma interaction. In particular, only intervals when both probes are sunlit and at negative bias current should be considered.

RPC and LAP has in principle operated continuously during the period. The exception is a period around Christmas, when LAP operational anomalies led to several consecutive days of data loss. This primarily affects Dec 19-22, Dec 25-29, and Jan 4-7. From January 7, LAP operations have again been nominal.

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 are defined to break at midnight even if the instrument operation is continuous over this artificial border. If there are instrument blocks running the same macros on both sides of midnight, this is 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.

2014-11-19T00:00:02.575	2014-11-19T23:59:30.604	515
2014-11-20T00:00:02.604	2014-11-20T07:58:26.614	515
2014-11-20T09:02:58.615	2014-11-20T23:58:26.633	803
2014-11-21T00:08:34.633	2014-11-21T23:59:30.661	515
2014-11-22T00:00:02.661	2014-11-22T08:58:42.672	515
2014-11-22T09:02:58.672	2014-11-22T23:59:30.690	807
2014-11-23T00:00:00.006	2014-11-23T00:00:00.006	807
2014-11-23T00:03:14.690	2014-11-23T23:59:30.718	515
2014-11-24T00:00:02.718	2014-11-24T08:58:42.729	515
2014-11-24T09:02:58.729	2014-11-24T23:59:30.747	807
2014-11-25T00:00:00.013	2014-11-25T00:00:00.013	807
2014-11-25T00:03:14.747	2014-11-25T04:58:42.753	515
2014-11-25T05:02:58.753	2014-11-25T14:00:02.763	604
2014-11-25T14:03:14.763	2014-11-25T23:59:30.775	515
2014-11-26T00:00:02.775	2014-11-26T08:00:02.785	515
2014-11-26T09:02:58.786	2014-11-26T23:58:26.804	803
2014-11-27T00:08:34.804	2014-11-27T23:59:30.832	515

2014-11-28T00:00:02.832	2014-11-28T08:58:42.843	515
2014-11-28T09:02:58.843	2014-11-28T23:59:30.861	803
2014-11-29T00:00:02.861	2014-11-29T00:00:02.861	803
2014-11-29T00:03:14.861	2014-11-29T20:00:02.885	515
2014-11-29T20:03:14.885	2014-11-29T23:59:30.889	204
2014-11-30T00:00:02.889	2014-11-30T07:59:30.899	204
2014-11-30T08:03:14.899	2014-11-30T08:58:42.900	515
2014-11-30T09:02:58.900	2014-11-30T23:59:30.918	803
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2014-12-04T00:00:03.004	2014-12-04T08:58:43.014	515
2014-12-04T09:02:59.014	2014-12-04T23:58:27.032	803
2014-12-05T00:08:35.032	2014-12-05T21:44:03.058	515
2014-12-05T21:48:51.058	2014-12-05T23:56:19.061	503
2014-12-06T00:01:07.061	2014-12-06T00:53:55.062	515
2014-12-06T01:12:35.062	2014-12-06T01:36:35.063	805
2014-12-06T01:48:19.063	2014-12-06T08:59:47.071	525
2014-12-06T09:02:59.071	2014-12-06T23:59:31.089	803
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2014-12-08T09:02:59.128	2014-12-08T23:59:31.146	803
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2014-12-10T00:00:03.175	2014-12-10T09:00:19.186	204
2014-12-10T09:02:59.186	2014-12-10T23:59:31.203	803
2014-12-11T00:00:00.003	2014-12-11T00:00:03.203	803
2014-12-11T00:03:15.203	2014-12-11T23:59:31.232	525
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2014-12-12T09:02:59.243	2014-12-12T23:59:31.260	803
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2014-12-13T00:03:15.260	2014-12-13T23:59:31.289	525
2014-12-14T00:00:03.289	2014-12-14T08:58:43.300	525
2014-12-14T09:02:59.300	2014-12-14T23:59:31.317	803
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2014-12-15T00:03:15.318	2014-12-15T02:00:03.320	525
2014-12-15T02:03:15.320	2014-12-15T18:04:19.339	204
2014-12-15T18:08:03.339	2014-12-15T23:59:31.346	525
2014-12-16T00:00:03.346	2014-12-16T13:24:51.362	525

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2014-12-16T17:03:31.366	2014-12-16T23:59:31.375	803
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2014-12-17T08:03:15.384	2014-12-17T14:00:03.391	204
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2014-12-23T00:32:35.546	2014-12-23T00:57:07.547	904
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2015-01-21T00:00:00.007	2015-01-21T07:57:24.383	624

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2015-01-24T11:03:00.472	2015-01-24T23:59:32.488	624
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2015-01-25T09:03:00.498	2015-01-25T23:56:20.516	805
2015-01-26T00:08:36.516	2015-01-26T23:59:32.539	525
2015-01-27T00:00:04.539	2015-01-27T08:29:24.549	525
2015-01-27T09:03:00.550	2015-01-27T23:23:48.566	805
2015-01-27T23:28:04.566	2015-01-27T23:54:12.567	525
2015-01-28T00:04:20.567	2015-01-28T13:02:28.582	503
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2015-01-31T00:02:12.651	2015-01-31T23:59:00.679	805
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2015-02-02T00:02:12.706	2015-02-02T23:59:00.734	805
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2015-02-03T00:33:40.735	2015-02-03T05:58:28.741	624
2015-02-03T06:03:48.741	2015-02-03T23:57:56.762	525
2015-02-04T00:02:12.762	2015-02-04T23:59:00.790	805
2015-02-05T00:03:48.790	2015-02-05T00:21:56.790	525
2015-02-05T00:32:36.791	2015-02-05T05:28:04.796	624
2015-02-05T05:31:48.796	2015-02-05T23:57:56.818	525
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2015-02-07T00:28:52.846	2015-02-07T00:52:20.847	525
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2015-02-13T16:02:13.044	2015-02-13T23:59:33.053	805
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2015-02-18T00:02:13.168	2015-02-18T23:59:01.196	805
2015-02-19T00:02:13.196	2015-02-19T00:12:21.196	525
2015-02-19T00:22:29.197	2015-02-19T18:16:37.218	624
2015-02-19T18:21:57.218	2015-02-19T23:57:25.225	525
2015-02-20T00:02:13.225	2015-02-20T23:56:21.253	805
2015-02-21T00:46:29.254	2015-02-21T23:55:49.277	525
2015-02-22T00:02:13.277	2015-02-22T23:59:01.305	805
2015-02-23T00:03:49.306	2015-02-23T23:57:25.334	525
2015-02-24T00:02:13.334	2015-02-24T23:59:01.362	805
2015-02-25T00:43:49.363	2015-02-25T14:46:29.380	525
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2015-02-26T00:02:13.391	2015-02-26T23:56:53.419	805
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2015-02-27T14:02:13.431	2015-02-27T23:56:21.442	525
2015-02-28T00:02:13.442	2015-02-28T23:59:01.469	805
2015-03-01T00:03:49.470	2015-03-01T11:53:09.483	503
2015-03-01T11:56:53.483	2015-03-01T23:56:21.497	525
2015-03-02T00:02:13.497	2015-03-02T23:59:01.524	805
2015-03-03T00:42:45.525	2015-03-03T00:52:21.525	525
2015-03-03T01:02:29.526	2015-03-03T12:56:37.539	624
2015-03-03T13:01:57.539	2015-03-03T23:57:25.552	525
2015-03-04T00:02:45.552	2015-03-04T23:59:33.579	805
2015-03-05T00:00:00.246	2015-03-05T00:00:00.246	805
2015-03-05T00:02:45.579	2015-03-05T00:12:53.580	525
2015-03-05T00:23:33.580	2015-03-05T23:59:01.607	624
2015-03-06T00:02:45.607	2015-03-06T23:59:33.634	805
2015-03-07T00:00:00.301	2015-03-07T00:00:00.301	805
2015-03-07T00:02:45.634	2015-03-07T00:12:53.635	525
2015-03-07T00:23:33.635	2015-03-07T12:58:45.649	504
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2015-03-08T00:02:45.662	2015-03-08T23:59:33.689	805
2015-03-09T00:00:00.356	2015-03-09T00:00:00.356	805
2015-03-09T00:02:45.689	2015-03-09T00:12:53.689	525
2015-03-09T00:23:33.690	2015-03-09T09:59:01.701	624
2015-03-09T10:03:49.701	2015-03-09T23:31:49.716	525
2015-03-10T00:02:13.717	2015-03-10T23:56:21.744	805