

# RPC-LAP OPERATIONS REPORT PRE-LANDING PHASE

January 21 - November 18, 2014

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### Document history

Revision	Date	Comment
0.1	2015-07-07	Initial revision (AIE)
0.1.1	2015-07-07	Minor corrections, incl. two bad dates. (EJ)
1.0	2016-12-16	Minor correction (bad mission phase/data set end date) (EJ)

## 1 Introduction

This is the report from the operations of RPC-LAP in the pre-landing phase (PRL) at the target comet 67P/Churyumov-Gerasimenko.

## 2 Operations overview

During PRL, LAP operated in the following slots:

- Instrument re-commissioning: March 23-27, 2014. This was a checkout of the LAP instrument, verifying the integrity of instrument and the macros stored in EEPROM following the hibernation.
- Pre-landing science phase: May 9 - November 19, 2014. The main intent here was to acquire scientifically useful data from the approach and early operational phase at the comet.

Regular science operations started on May 9, 2014. At that time, the heliocentric distance was 4.07 AU and the distance to the comet more than 1.5 million km. LAP science operations were then more or less continuous for the rest of the period of this dataset, with some exceptions due to spacecraft operational slots during the approach phase, turning off to avoid interference with CONCERT at critical stages, a few days lost due to an instrument glitch, and shorter intervals for macro uploads, onboard calibrations, and macro switches.

In the tenuous solar wind, the photoemission current from a probe or the Rosetta s/c at zero potential wrt surrounding space overcomes the current from the plasma electron flux. As a result, the s/c potential is positive, the s/c photoelectron cloud is dense as electrons are retained in the vicinity of the positive s/c, and the probe current is dominated by photoelectrons, emitted by the probe itself or collected from the s/c cloud, at all voltages. Langmuir probe bias sweeps are therefore of limited value for direct indication of solar wind plasma properties, except through the information given by the s/c potential.

Initially, in May and June, the main scientific mode of LAP was therefore its electric field mode, with the probes operated with a bias current and their voltages wrt s/c ground as the measured quantity. The prime target quantity in this phase was the s/c potential, of which the measured voltages constitute a fraction, with some contamination of space charge induced voltages from e.g. the s/c photoelectron cloud. Some hours of Langmuir probe operations, where the probes are put at a bias voltage and the resulting current is measured, were inserted with a few days interval. From early July, when the cometocentric distance was some 40,000 km and some likelihood of denser plasmas by comet outbursts was perceived to be possible, the Langmuir mode took over as the main operational mode.

LAP can hand over probe 2 (P2) to RPC-MIP for use in its long-Debye length mode. This was done initially for a few hours now and then, rising to about 6 hours per day in July, 12 hours every other day in August, and then to 15 hours every second day from late October. 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.

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 the pre-landing science phase, from May 9 to November 18. 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.

Block start	Block end	Macro	Notes
2014-03-24T08:12:59.490	2014-03-24T12:28:27.495	505	
2014-03-24T13:32:27.496	2014-03-24T14:18:19.497	803	
2014-03-24T14:22:35.497	2014-03-24T14:47:39.498	703	
2014-03-24T14:51:23.498	2014-03-24T15:18:03.498	704	
2014-03-24T15:21:15.499	2014-03-24T15:47:23.499	807	
2014-03-24T15:51:39.499	2014-03-24T16:17:15.500	604	
2014-03-24T16:21:31.500	2014-03-24T17:18:03.501	504	
2014-03-24T17:21:15.501	2014-03-24T17:47:23.502	506	
2014-03-24T17:51:39.502	2014-03-24T17:59:39.502	503	
2014-03-24T19:32:27.504	2014-03-24T23:59:39.509	506	
2014-03-25T00:00:00.843	2014-03-25T23:59:39.539	506	
2014-03-26T00:00:00.872	2014-03-26T23:59:39.569	506	
2014-03-27T00:00:00.902	2014-03-27T04:57:47.575	506	
2014-05-09T15:23:00.883	2014-05-09T20:58:28.890	506	
2014-05-09T21:32:36.890	2014-05-09T23:59:48.894	503	
2014-05-10T00:00:00.627	2014-05-10T23:59:48.924	503	
2014-05-11T00:00:00.657	2014-05-11T23:59:48.954	503	
2014-05-12T00:00:00.687	2014-05-12T06:09:24.962	503	
2014-05-12T06:12:36.962	2014-05-12T09:08:04.965	506	
2014-05-12T09:12:20.966	2014-05-12T14:29:08.972	503	
2014-05-12T14:32:20.972	2014-05-12T23:59:48.984	504	
2014-05-13T00:00:00.001	2014-05-13T02:29:08.987	504	
2014-05-13T02:32:20.987	2014-05-13T14:31:49.002	503	
2014-05-13T14:36:05.003	2014-05-13T22:01:57.012	803	
2014-05-13T22:06:13.012	2014-05-13T23:59:49.014	503	

2014-05-14T00:00:00.748	2014-05-14T19:58:45.040	503	
2014-05-14T20:02:29.040	2014-05-14T23:59:49.045	803	
2014-05-15T00:00:00.245	2014-05-15T03:58:45.050	803	
2014-05-15T04:32:21.050	2014-05-15T14:27:01.063	506	
2014-05-15T14:32:21.063	2014-05-15T23:59:49.075	504	
2014-05-16T00:00:00.008	2014-05-16T02:29:09.078	504	
2014-05-16T02:32:21.078	2014-05-16T23:59:49.105	503	
2014-05-17T00:00:00.838	2014-05-17T23:59:49.135	503	
2014-05-18T00:00:00.869	2014-05-18T05:57:09.143	503	
2014-05-18T06:02:29.143	2014-05-18T17:19:17.157	506	
2014-05-18T17:22:29.157	2014-05-18T22:43:01.164	504	
2014-05-18T22:46:13.164	2014-05-18T23:59:49.165	604	
2014-05-19T00:00:00.032	2014-05-19T11:12:53.180	604	
2014-05-19T11:17:41.180	2014-05-19T13:30:29.182	506	
2014-05-19T13:33:41.183	2014-05-19T23:59:49.196	503	
2014-05-20T00:00:00.929	2014-05-20T11:22:29.210	503	
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2014-05-26T13:32:13.394	2014-05-26T23:59:57.407	504	
2014-05-27T00:00:00.007	2014-05-27T01:54:05.410	504	
2014-05-27T01:57:17.410	2014-05-27T23:59:57.437	503	
2014-05-28T00:00:00.637	2014-05-28T23:59:57.468	503	
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2014-05-29T13:32:13.485	2014-05-29T23:59:57.498	504	
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2014-05-31T15:22:37.547	2014-05-31T16:18:05.548	506	
2014-05-31T16:22:21.549	2014-05-31T23:59:57.558	504	
2014-06-01T00:00:00.008	2014-06-01T00:59:09.559	504	
2014-06-01T01:02:21.559	2014-06-01T02:27:09.561	506	
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2014-06-02T00:00:00.788	2014-06-02T23:59:57.619	503	
2014-06-03T00:00:00.819	2014-06-03T10:21:17.632	503	
2014-06-06T03:48:53.714	2014-06-06T06:28:21.717	506	
2014-06-06T07:03:33.718	2014-06-06T23:59:33.739	504	
2014-06-07T00:00:00.006	2014-06-07T03:00:21.743	504	

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2014-06-25T10:47:18.297	2014-06-25T23:59:50.313	504	
2014-06-26T00:00:00.013	2014-06-26T02:25:58.317	504	
2014-06-26T02:29:42.317	2014-06-26T04:33:26.319	807	

2014-06-26T04:37:42.319	2014-06-26T11:34:14.328	604	
2014-06-26T11:38:30.328	2014-06-26T23:59:50.344	504	
2014-06-27T00:00:00.010	2014-06-27T04:21:10.349	504	
2014-06-27T04:24:22.349	2014-06-27T23:54:30.374	503	
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2014-06-29T00:00:00.004	2014-06-29T08:56:54.415	503	
2014-06-29T10:02:30.417	2014-06-29T10:58:30.418	506	
2014-06-29T11:02:14.418	2014-06-29T22:28:06.432	504	
2014-06-29T22:31:18.432	2014-06-29T23:59:50.434	803	
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2014-07-04T02:47:58.559	2014-07-04T04:44:14.561	803	
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2014-07-04T07:47:42.565	2014-07-04T08:43:10.566	505	
2014-07-04T08:47:58.566	2014-07-04T09:43:26.567	506	
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2014-07-05T00:00:00.002	2014-07-05T10:58:54.599	504	
2014-07-05T11:02:38.599	2014-07-05T12:58:54.602	803	
2014-07-05T13:02:38.602	2014-07-05T14:59:26.604	506	
2014-07-05T15:02:38.604	2014-07-05T23:59:42.616	503	
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2014-07-06T09:53:18.628	2014-07-06T20:18:54.641	504	
2014-07-06T20:22:06.641	2014-07-06T22:18:22.644	803	
2014-07-06T22:22:06.644	2014-07-06T23:59:42.646	504	
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2014-07-07T07:33:02.655	2014-07-07T09:29:18.658	803	
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2014-07-08T00:02:54.676	2014-07-08T01:59:10.679	803	
2014-07-08T02:02:54.679	2014-07-08T08:16:14.686	503	
2014-07-11T02:47:58.770	2014-07-11T04:44:14.773	803	
2014-07-11T04:47:26.773	2014-07-11T14:08:30.784	604	
2014-07-11T15:12:30.786	2014-07-11T16:07:58.787	503	
2014-07-18T02:47:58.982	2014-07-18T08:39:58.989	803	
2014-07-18T08:49:02.989	2014-07-18T13:42:54.995	604	
2014-07-18T13:47:42.995	2014-07-18T16:43:10.999	506	
2014-07-18T17:41:51.000	2014-07-18T23:59:59.008	604	
2014-07-19T00:00:00.008	2014-07-19T02:43:43.012	604	
2014-07-19T02:47:59.012	2014-07-19T08:44:15.019	803	

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2014-07-19T20:47:59.035	2014-07-19T23:59:59.039	803	
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2014-07-20T04:37:19.044	2014-07-20T06:33:35.047	504	
2014-07-20T06:37:19.047	2014-07-20T23:59:59.069	506	
2014-07-21T00:00:01.202	2014-07-21T02:44:47.072	506	
2014-07-21T02:47:59.072	2014-07-21T08:44:15.080	803	
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2014-07-22T00:00:00.032	2014-07-22T02:18:39.102	604	
2014-07-25T02:47:59.193	2014-07-25T08:44:15.201	803	
2014-07-25T08:47:27.201	2014-07-25T23:59:59.220	604	
2014-07-26T00:00:00.020	2014-07-26T05:42:55.227	604	
2014-07-26T05:47:43.227	2014-07-26T11:43:59.235	803	
2014-07-26T11:47:43.235	2014-07-26T23:59:59.250	506	
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2014-07-27T06:47:27.259	2014-07-27T07:43:27.260	304	
2014-07-27T07:47:43.260	2014-07-27T08:43:11.261	307	
2014-07-27T08:47:27.261	2014-07-27T14:43:43.269	803	
2014-07-27T14:47:27.269	2014-07-27T23:59:59.280	604	
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2014-07-29T12:47:27.327	2014-07-29T13:43:27.328	304	
2014-07-29T13:47:43.328	2014-07-29T14:43:11.329	307	
2014-07-29T14:47:27.329	2014-07-29T20:43:43.337	803	
2014-07-29T20:47:27.337	2014-07-29T23:59:59.341	604	
2014-07-30T00:00:00.007	2014-07-30T17:42:55.363	604	
2014-07-30T17:47:43.363	2014-07-30T23:43:59.371	803	
2014-07-30T23:47:43.371	2014-07-30T23:59:59.371	506	
2014-07-31T00:00:01.504	2014-07-31T20:43:11.397	506	
2014-07-31T20:47:27.397	2014-07-31T23:59:59.401	803	
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2014-08-03T08:02:39.472	2014-08-03T08:58:07.473	307	
2014-08-03T10:02:39.474	2014-08-03T21:58:55.489	803	
2014-08-03T22:02:39.489	2014-08-03T23:59:59.492	506	



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2014-08-06T00:00:01.685	2014-08-06T02:47:27.556	506	
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2014-08-09T22:02:39.671	2014-08-09T22:58:07.672	304	
2014-08-09T23:02:23.672	2014-08-09T23:49:51.673	307	
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