P2SC-ROB-WR-026-20100906 Weekly report #026	**P2SC Weekly report**	
Period covered: Date: Written by: Released by:	Mon Sep 6 to Sun Sep 12 2010 Tue Sep 14 2010 Anik De Groof David Berghmans	Royal Observatory of Belgium PROBA2 Science Center
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1. Science

Solar & Space weather events

No major event was detected on the Sun this week but we did see a lot of small events:
- Several B-flares and 1 C-flare were detected in LYRA data (Zr and Al channels) on Sep6 in AR1105 (N18W52). The LYRA signals of Sep 6 are shown in Sect. 2.
- The same active region produced several other B flares on Sep 7 and 8 . Towards the end of Sep 8, a C-class flare, detected both by SWAP and LYRA resulted in an interesting off-limb CME in both SWAP (see difference image below) and SOHO/LASCO (see solarsoft event gev_20100908_2305).
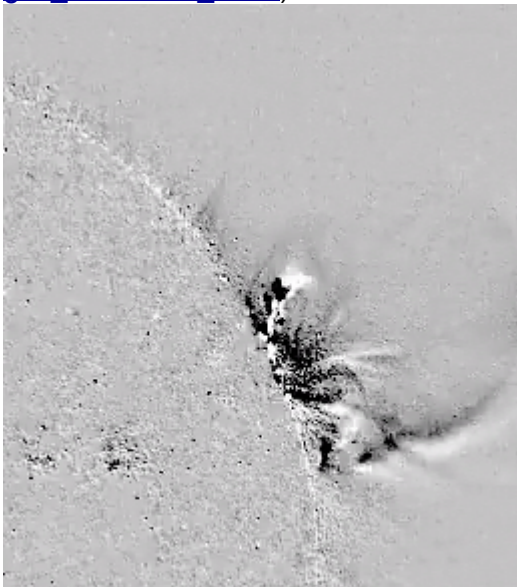

- On Sep 10, AR1106 (S21E86) took over and produced in its turn several B-class events over the weekend.

Scientific campaigns

This week, the first PROBA2 Guest Investigators visited P2SC: dr. Dipankar Banerjee and his student Krishna Prasad from Indian Institute of Astrophysics in Bangalore, India. They propose to use SWAP data for a study of "Transients and their role in heating and acceleration of the solar wind".

A first test observation campaign was scheduled for Sep 7 but failed (see Sect. 3 for details). It was repeated successfully on Sep 10.

Outreach, papers, presentations, etc.

Ingolf Dammasch gave a presentation, titled "Solar irradiance observations with LYRA on PROBA2", at the 10th Hvar Astrophysical Colloquium "The Active Sun", 10 Sep 2010, Hvar, Croatia.

In the framework of the Guest Investigator program, several presentations were given to the Guest Investigators to introduce them to SWAP and LYRA:
- General introduction to PROBA2, SWAP and LYRA - David Berghmans
- Instrumentation and early results of SWAP and LYRA - Dan Seaton
- Science topics already observed and/or studied with SWAP - Marilena Mierla
- PROBA2 Science Center - Anik De Groof

To be explored
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2. LYRA instrument status

The LYRA instrument status was highly affected by the flight mode tests that were performed this week in preparation to the RESISTOJET demonstration next week.
Below a timeline of what happened:
- <u>Sep 8, am:</u> LYIOS00085 was sent to close covers during the flight mode test (at 9:28), and reopen afterwards (at 11:10UT).
- <u>Sep 8, 9:22UT:</u> The flight mode failed (because of not responding GPS) and PROBA2 entered BDOT mode. LYRA was 'unplugged': it was switched off the instrument hardware but covers not (completely) closed and LYRA software kept in so-called 'IMAGING mode'.
- <u>Sep 8, 9:22:23UT:</u> The LYRA data manager did not receive any data anymore and switched LYRA to 'recover latchup' mode. The latch-up is not real: the software assumes that the instrument hardware is in latch-up because it is not receiving data. The software tries to recover from the latch-up by applying commands (which are not received) and switching to off mode.
- <u>Sep 8, 9:28UT:</u> The IOS command 'warm_up' fails with event 276 EVT_LYRA_NO_STATUS_REPORT_RECEIVED because LYRA is off. The same happens with all following commands onboard.
- <u>Sep 8, 12:40UT (during pass 2322):</u> a switch to imaging mode is commanded by MOC (TC) during the pass to trigger event 277 (EVT_LYRA_POWER_OFF_WITH_COVER_OPEN) which switches off LYRA, closes covers and puts it UNAVAILABLE. Then a manual TC for ENABLING is sent. After the pass, LYIOS00086 should take care of the warmup with cover 2 open and nominal parameters.
- <u>Sep 8, 12:55UT:</u> the IOS command warm_up fails again and triggers again event 277. Later we realized that the LYRA IIU was not switched back on in the warmup process because the LYRA software still had IIU flagged ON.
- This failure was only realized in the late evening of Sep 8. By then, a new flight mode test was scheduled for Sep 9 early morning:

- <u>Sep 9, 4:50-5:10UT:</u> PROBA2 was commanded by MOC into flight mode. LYIOS00087 commanded LYRA to close the covers at 4:50UT. Again the commands failed because LYRA was OFF. LYRA went into flight mode in an indefinite state.
During the same pass 2329 in which flight mode was commanded, MOC sent TCs "Set Lyra available" and "Power on IIU Lyra" (around 5:05UT).
- <u>Sep 9, 6:40UT:</u> end of flight mode, back to sun pointing. The IOS command warmup which was scheduled at the end of pass 2330 succeeded because this time both IIU and LYRA were on and available! LYRA switched back to imaging mode.
- <u>Sep 9, 10:15UT:</u> data of pass 2331 confirmed that LYRA is back and signals ok!

LYRA time series
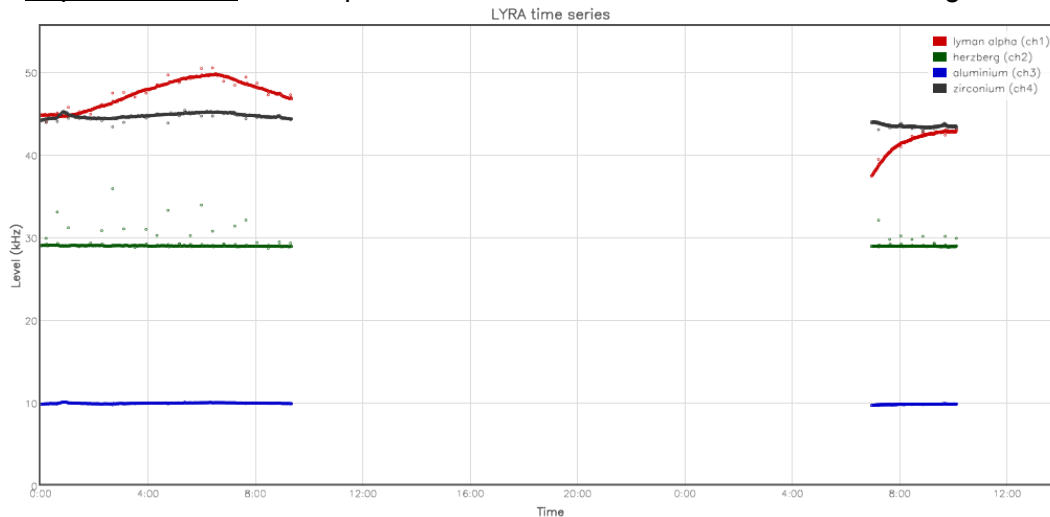
- The rest of the week, LYRA kept its nominal state.

Calibration

This week no LYRA calibration was planned due to the preparations to the RESISTOJET campaign of next week.

IOS & operations
- LYIOS00085: During the flight mode tests (preparation to RESISTOJET campaign), LYRA was commanded to close the covers and acquire dark current.
- LYIOS00086: First attempt to recover LYRA after BDOT -> Sep 8 at 12:55. This attempt failed because LYRA IIU was not switched on.
- LYIOS00087: During flight mode tests of Sep 9, LYRA was commanded to close the covers. As LYRA was still switched OFF due to failed recovery, the first warmup was not received by the instrument. The 2nd one was successfull and switched LYRA back on.

The LYRA temperatures were highly influenced by the switch to BDOT mode and later OFF mode. Due to the OFF mode, some not updated temperatures were received and processed by P2SC.
Also the techno demonstrations with the Alcatel GPS highly affected the temperatures. They resulted in a temperature rise upto 1-2 degrees on Monday Sep 6 and on Wednesday Sep 8.
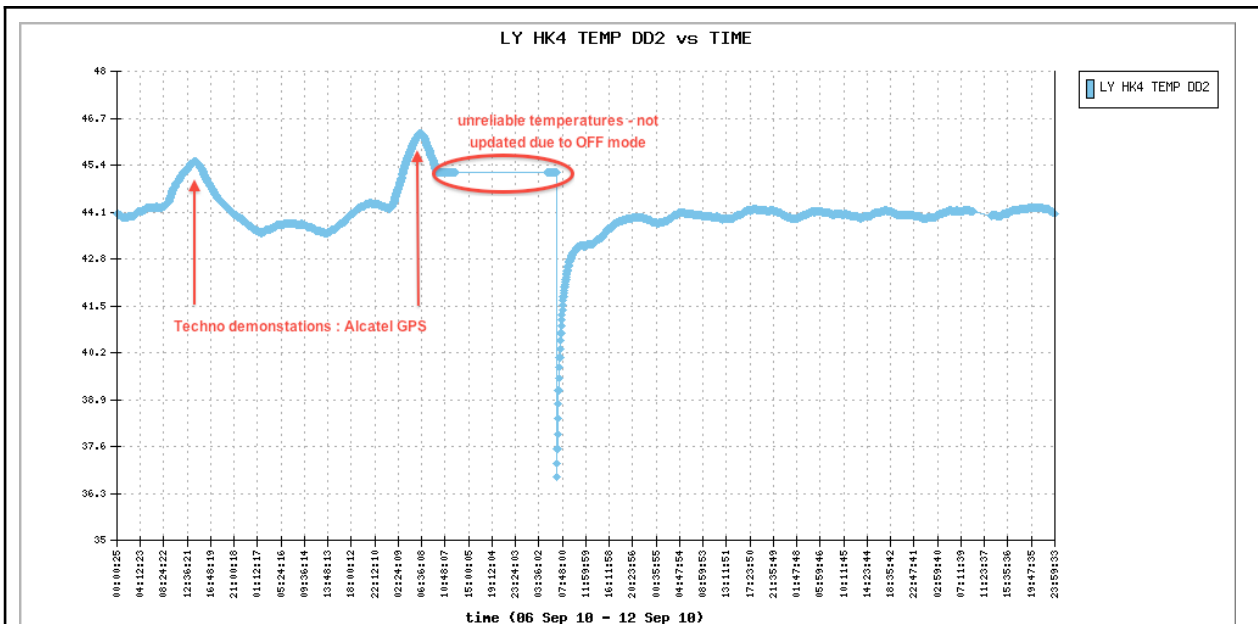
The high detector temperatures on Sep 6 and 8 also affected the Ly alpha channel, which is very sensitive to temperature variations. See plot for Sep 6:
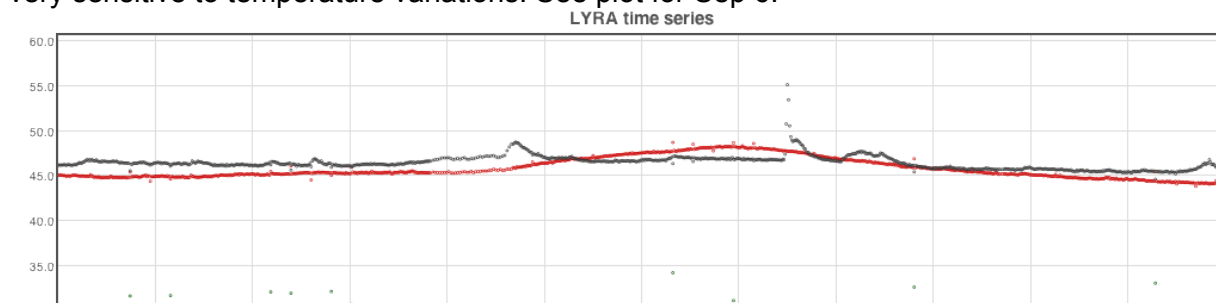
To be explored

3. SWAP instrument status

The SWAP instrument status was highly affected by the **flight mode tests** that were performed this week in preparation to the RESISTOJET demonstration next week. Apart from that SWAP was also affected by an **MCPM anomaly.**

Below a timeline of what happened:

- <u>Sep 7, pm:</u> IOS00167 was sent to switch to low cadence during flight mode scheduled for Sep 8 at 5UT.
- <u>Sep 8, 9:22UT:</u> The flight mode failed (because of not responding GPS) and PROBA2 entered BDOT mode. SWAP was "unplugged" by PROBA2. Nevertheless the SWAP software was not aware and the SWAP MODE stayed IMAGING. On August 16, a the time of the previous BDOT mode, it was automatically switching to IDLE after ~15 mins. This was because PROBA2 was not in Sun mode and there is an onboard script switching payload off/idle in this case.
Because today, we were aiming to switch to flight mode, this onboard script was disabled, and so SWAP was never properly turned IDLE. As a consequence, we received event 298 (EVT_SWAP_PROBLEM_WITH_PE_COMMUNICATION) every minute since then.
- <u>Sep 8, 12:49:30:</u> IOS00168, uploaded at pass 2322, switches SWAP to IDLE (the state it is already in but software not updated).

A following IOS command switched the instrument back to nominal imaging.

The next morning a few other problems were seen in SWAP data:

MCPM blockage:
- Sep 9, 3:24UT: at pass 2328 (3:24), only 3 SWAP images were received at P2SC: image 145888 to 145890. The last one was truncated. From SW NB PRO_IM RDY dropping from 232 (3:24:32) to 227 (3:25:02), it seems that at least 5 images were sent to the ground.
- Also at passes 2329 (4:59) and 2330 (6:39), no images were downloaded. The values in SW NB PRO_IM RDY confirm that no images were sent down.
- The MCPM seems to be in a continuous mode of downlinking images (which it does not do in the end). Although the processed buffer is full, containing 285 images, only 283 are labelled as 'ready'. The other two are probably labelled as 'being downloaded'.
- Sep 9, 13:28UT (pass 2332): MOC confirmed that the MCPM recovery was successfully performed. At first sight SWAP seemed OK, still imaging and the first data were downloaded.

SWAP HK not updated:
- During the MCPM blockage (Sep 9 3:24 - 13:30), all HK parameters coming from the PE (e.g SW HK T CF, SW HK VMIN/PLUS, SW HK IMIN/PLUS) are not anymore updated and thus unreliable. They are however still flagged as +G and thus processed by P2SC.
- Sep 9, 13:28UT (pass 2332): MOC confirmed that the MCPM recovery was successfully performed.
- At pass 2333 (~17UT), also the HK was confirmed to be updated.

In the mean time, from 4:50 to 6:40UT, PROBA2 had been in flight mode for 1 orbit, with SWAP and LYRA (see Sect.2) both in a kind of indefinite state. The flight mode in itself was successful.

MCPM recoverable errors

The MCPM errors did not increase this week. The number of recoverable errors is 198. The number of unrecoverable errors is 0.

IOS & operations

IOS00165: In the framework of the GI program Banerjee-Prasad, we test the maximal cadence we can achieve in a subfield campaign of an off-limb AR. Subfields of 300x300 pixels are taken of an AR off-limb, at 6s integration time. An unrealistically high cadence is commanded so that the maximal cadence is achieved.
-> This campaign failed. No subfield images were taken. After the campaign, SWAP went back to nominal imaging. The reason for the failure is that SWAP subfields need to consist of (multiple of 4) times (multiple of 4) pixels. This is a requirement of the detector readout.

IOS00166: Another subfield campaign that was scheduled right after the previous one. It was overwritten by IOS00167 as there were doubts on the location of the subfield as referred to the solar disk.

IOS00167: As preparation for the RESISTOJET techno demo next week, flight mode tests are performed by the MOC. This IOS commands a low cadence of 10minutes during the flight mode. After 1 orbit, we go back to nominal acquisition.

IOS00168: was sent for the SWAP switch on after BDOT mode on Sep 8.

IOS00169: lower cadence (10mins) during flight mode of Sep 9. 30mins before end of (hot!) flight mode we take 2 mins cadence to cover the hottest part.

-> as the temperature was not known (HK not updated), the dark images were not useful + LZW compression+decorrelation was not a good choice for those images.

IOS00170 was sent to lower the cadence of SWAP to 120s on Sep 9, 17:10UT.

IOS00171: Repeat subfield test campaign for GI proposal Banerjee-Prasad on Sep 10 18:00-18:20UT
It was successful this time. We imaged the AR on the SW of the solar limb with 2 subfields (120x120 and 300x300) and 3 integration times (5, 8, 10s).
The maximal cadence we achieved was independent on the size of the subfield, and equal to integration time + 5s. It was also uniform (during the periods with constant settings).

The SWAP temperatures were highly influenced by the switch to BDOT mode and later IDLE mode. Due to the IDLE mode, some not updated temperatures were processed by P2SC. Also during the MCPM blockage of Thur Sep 12, the HK data were not updated.
In addition, the techno demonstrations with the Alcatel GPS highly affected the temperatures. They resulted in a temperature rise upto 3-4 degrees on Monday Sep 6 and on Wednesday Sep 8 (0:20-5:40UT).
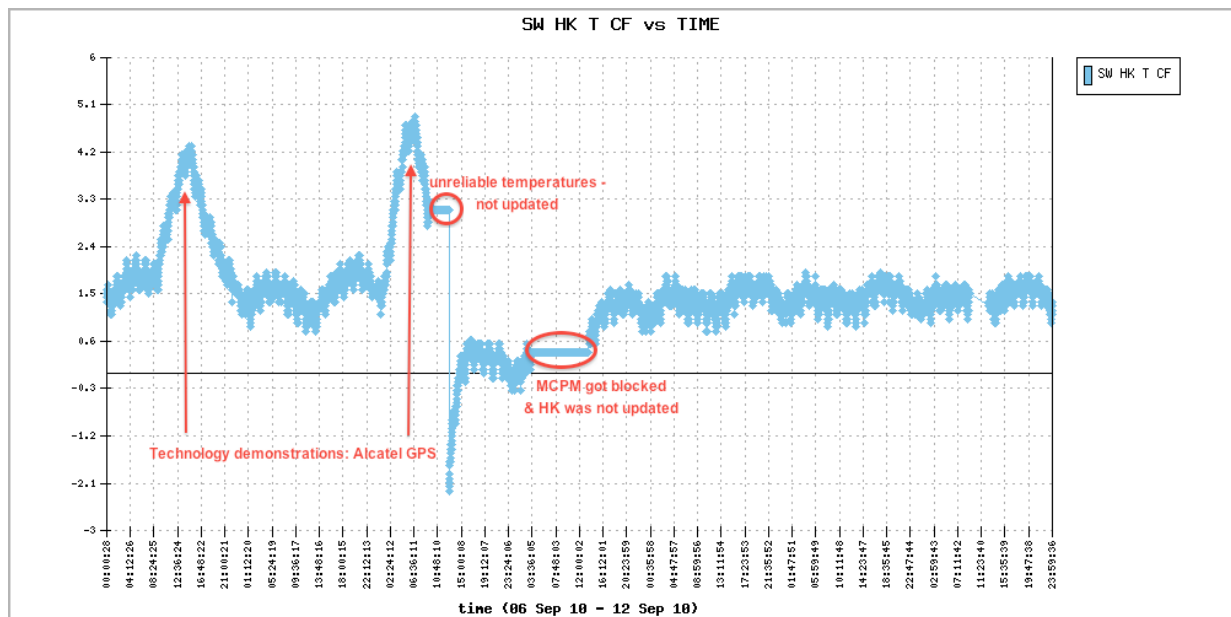
To be improved
Operators need clear guidelines on the orientation of the SWAP detector after each LAR.
A detailed understanding is crucial for subfield commanding, as the detector pixels that will image the interesting part of the Sun need to be identified.
Although the orientation of the SWAP detector with respect to the Sun over the orbit is understood, we lack a good representation for the operator's point of view, identifying the subfield pixels. The pictograms in the SW-PTI will be modified in a way it is more clear for commanding purposes.

For sure, the best starting point to command subfields is the period in which the large angle rotation = -0.7071067819. This is called ATTITUDE4 in the MOC PROBA2_Info text files (red arrow up in SW-PTI). In this position, the SWAP detector (origin (0,0) on top left) is aligned with ecliptic North.

4. PROBA2 Science Center Status

Anik De Groof was operator during this week.

SWAP daily movies were created manually.

We received quite some warnings/errors in the P2SC this week. Most of them related to the BDOT mode and payload switch-off.
There were 3 anomalies, not all related to the S/C problems, that need further investigation:
- During the days LYRA was switched off, DCVC failed unsuccessfully with error: "CASE_NOT_FOUND_EXCEPTION_MESSAGERECOVER LATCHU" -> to be investigated and debugged
- starting at pass 2310, the LYRA FITS files are NOT updated by the LYEDG. The tools reports that no data can be found for the mode BST... This also happens for passes 2311 and 2312. At the end of the day, when the LY-EDG reprocesses the full day (runid=49513), again the tool did not process the data for the passed 2310,2311 and 2312, although the data is in the Lyra_dda.db
- The backup procedure halted on august 26 due to a full disk partition. To free space on the backup partition, all swap lv -1 files (fits files in /p2sc/data/DDA/swap/) were deleted from the backup. A more permanent backup procedure is being discussed. The backup procedure was started by hand to fill the gap between august 26 and today. This left ~211 Gb of free space (~19% of the partition) to bridge the next few weeks.

The following tools were updated on the operational server:

Software name	Update	Date	Comment
PP_PROC	3647	6 Sep 2010	Also not-scheduled passes are processed - this makes the PP interface also useful to plan 3 extra non-scheduled passes per week
DCVC	new crontab	6 Sep 2010	DCVC is scheduled to run twice a day, so that the operator is informed sooner about any inconsistency
SWAPcadence	3654	6 Sep 2010	It is more clearly communicated which start and end times are used.
PTBS, PTI and LMAT-UI		6 Sep 2010	update to PHP5 (some functions deprecated)
SWAP Catalog Interface	3650	6 Sep 2010	Basic version of Catalog Search Tool has been installed on server.
LY-QLV	r3656	7 Sep 2010	Bug fix: milliseconds were not represented in the right way on the x-axis
LY-QLV	r3664	9 Sep 2010	update the selection plugin
LY-QLV	r3666	10 Sep 2010	Now zooming to millisecond level is possible in both implementations. Names of the implementations have switched: index1.php is now what used to be the default version.

5. Data reception & discussions with MOC

Passes
There were 2 missed passes observed during the period:
- pass 2301: The root cause was a power break to the system related to an installation of a new system at Svalbard. We still got HK information and 1 LYRA buffer, the other LYRA buffer and SWAP data were lost.
- pass 2359: Reason (at Svalbard): "Frozen computer (EOS FES). During support EOS FES Commander reported "Tracking: PARKED", "Mode: RUN". When the EOS FES computer was checked, it had froze. Computer was rebooted, but the support was lost."

Data from pass 2353 were sent twice (first extraction of data was incomplete)

Data coverage HK
1) There was a gap in SWAP and LYRA HK due to switch to IDLE and OFF on Sep 8-9:
- for LYRA: from Sep 8 9:22 to Sep 9 6:45UT.
- for SWAP: from Sep 8 9:22 to 13:38UT
2) The MCPM blockage caused another freeze of SWAP HK values from Sep 9 3:24UT to 13:30UT.
3) Missing pass 2359 caused a third gap in HK from Sep 12 9:20 to 12:40UT

Data coverage SWAP
There was quite some trouble with SWAP packets, missed passes or overwriting onboard (e.g. due to blocked MCPM). Nevertheless the data coverage over the week was still reasonably good.

- pass 2301 has been missed. 65 images downloaded but not received (lost in Svalbard).
- pass 2305:
    - BINSWAP20100906181120000144090PROCESSED - Truncated packet
    - BINSWAP20100906190120000144100PROCESSED - Image content shorter than expected
- pass 2323:
    - BINSWAP20100908134521000145474PROCESSED - JPEG data truncated: 327516 < 619961
    - BINSWAP20100908153701000145533PROCESSED - JPEG data truncated: 458556 < 626651
- pass 2327: BINSWAP20100909000521000145792PROCESSED - JPEG data truncated
- pass 2328: BINSWAP20100909021521000145890PROCESSED - JPEG data truncated
- pass 2332: BINSWAP20100909062400000145903PROCESSED - LZW preservation table full, probably truncated
- pass 2332: various images - LZW preservation table full, probably truncated
- pass 2358: corrupted SWAP image (first packet)
- pass 2359: no SWAP data
- pass 2362: BINSWAP20100912035820000148056PROCESSED - Truncated packet

Some statistics:
Total number of images between 2010 Sep 06 0UT and 2010 Sep 13 0UT: 4659
Highest cadence in this period: 10 seconds
Nominal cadence in this period: 110 or 120 seconds
*Average cadence in this period: **129.80** seconds*

*Number of image gaps larger than 300 seconds: **37***
Largest data gap: 210.10 minutes (at time SWAP was switched IDLE)

We switched from 100s cadence to 120s cadence on Sep 9 17:10. The average cadence achieved this week was 130s but this is highly biased by begin IDLE for 4 hours on Sep 8 and the high cadence campaign on Sep 10.

Data coverage LYRA
- LYTMR 49146 sent error "*size of packet BINLYRA201009061922290001761147RAW_0000449546201000906195559 is 1716, but the expected value given in the header is 1032* but went on with the processing. 6 packets were missing in the packet.
- Pass 2301 has been missed. But the gap has been filled later on, with 100ms cadence instead of 50ms cadence.
- Gap in LYRA data from Sep 8 9:22 to Sep 9 6:57 due to switch OFF in BDOT.
- No data from Sep 12 9:30 to 12:30 due to missed pass 2359.

6. APPENDIX Frequently used acronyms

ADP	Ancillary Data Processor
ADPMS	Advanced Data and Power Management System
AOCS	Attitude and Orbit Control System
APS	Active Pixel image Sensor
ASIC	Application Specific Integrated Circuit
BBE	Base Band Equipment
CME	Coronal Mass Ejection
COGEX	Cool Gas Generator Experiment
CRC	Cyclic Redundancy Check
DR	Destructive Readout
DSLP	Dual Segmented Langmuir Probe
EIT	Extreme ultraviolet Imaging Telescope
FITS	Flexible Image Transport System
FOV	Field Of View FPA Focal Plane Assembly
FPGA	Field Programmable Gate Arrays
GPS	Global Positioning System
HAS	High Accuracy Star tracker
HK	Housekeeping
ICD	Interface Control Document
IIU	Instrument Interface Unit
IOS	Instrument Operations Sheet
LED	Light Emitting Diode
LEO	Low Earth Orbit
LYRA	LYman alpha RAdiometer
LYTMR	LYRA Telemetry Reformatter (software module of P2SC)
LYEDG	LYRA Engineering Data Generator (software module of P2SC)
MCPM	Mass Memory, Compression and Packetisation Module
MOC	Mission Operation Center
NDR	Non Destructive Readout
OBET	On board Elapsed Time
OBSW	On board Software
PE	Proximity Electronics
PGA	Programmable Gain Amplifier

PI	Principal Investigator
P2SC	PROBA2 Science Center
PPT	Pointing, Positioning and Time (software module of P2SC)
ROB	Royal Observatory of Belgium
SAA	South Atlantic Anomaly
SCOS	Spacecraft Operation System
SEU	Single Event Upset
SOHO	Solar and Heliospheric Observatory
SWAP	Sun Watcher using APS detector and image Processing
SWBSDG	SWAP Base Science Data Generator
SWEDG	SWAP Engineering Data Generator (software module of P2SC)
SWTMR	SWAP Telemetry Reformatter (software module of P2SC)
TBC	To Be Confirmed
TBD	To Be Defined
TBW	To Be Written
TC	Telecommand
TPMU	Thermal Plasma Measurement Unit
UTC	Coordinated Universal Time
UV	Ultraviolet