P2SC-ROB-WR-024-20100823 Weekly report #024	**P2SC Weekly report**	
Period covered: Date: Written by: Released by:	Mon Aug 23 to Sun Aug 29 2010 Tue Aug 31 2010 Joe Zender Marie Dominique	Royal Observatory of Belgium PROBA2 Science Center
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1. Science

Solar & Space weather events
The week started very quietly. Monday through Wednesday not a single flare activity was observed. Active Region 11100 is decaying and moves towards the west limb mid of the week and on Thursday, AR 11101 appears on the east limb. 3 small B-class flares were observed on Thursday, 14 events on Friday, 17 on Saturday followed by no activity on Sunday.
The events on Thursday and Friday were all quite small, but observable either in the Zi-Al channels of LYRA or the movies of SWAP.

Scientific campaigns
No scientific campaigns were planned.

Outreach, papers, presentations, etc.
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To be explored
The activities on Thursday and Friday can not all be observed in SWAP and LYRA. Some events might be too small to be caught by SWAP due to the 120+sec cadence. Some more analysis and comparison is needed here.

2. LYRA instrument status

Calibration

On Tuesday, the weekly LED calibration campaign was commanded, executed and verified. On Wednesday, the paving campaign was commanded and executed. During the campaign verification, several lessons-learned arose (see later discussion on this campaign).

IOS & operations

IOS0082 and IOS0083 were prepared and uploaded. The Paving Campaign required the co-running of SWAP IOS00160, that commanded the pointing.

On 20100825T02:51:10.000, the housekeeping variable LYRA VIS LED was set to "1". In this period no LED was commanded.

To be explored

 - The operator shall verify the completeness of the quaternions after a Paving Campaign.
 - The preparation of the SWAP IOS and the LYRA IOS for the Paving Campaign is complex, due to the consideration of the South Atlantic Anomaly, the Large Angle Rotations, the LYRA delays due to warm-up, etc for the planning. Can the planning activity be simplified?
- Unclear why the LYRA VIS LED housekeeping value was erroneous.

3. SWAP instrument status

MCPM recoverable errors

increased from 197 to 198 on August 24 at 23:22 (no SAA crossing).
The number of MCPM unrecoverable errors is still 0.

IOS & operations

Weekly LED calibration campaign commanded through an improved sequence, sent as IOS00159. Downlinked images verified and images are complete.
In support of the ESP testing, no SWAP image was taken during 20100825T00:26 and 20100825T00:55 (the time between two LARs). The corresponding commands were prepared and send in IOS00160, together with the off-pointing commands to support the LYRA Paving Campaign.

SWAP detector and IIU temperature

Temperatures were constant and nominal during the whole week.

To be explored

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4. PROBA2 Science Center Status

Joe Zender was operator during this week.

SWAP daily movies were created manually.
The eclipse data of LYRA from 20100115 were reprocessed on sol020 and copied over to the archive!

The following tools were updated on the operational server:

Software name	Update	Date	Comment
TLE	times updated	Aug 23	TLEs are updated around 6 and 18UT, instead of 0 and 12UT to be in phase with NORAD updates.

5. Data reception & discussions with MOC

Passes
There were no missed passes observed during the period.

Data coverage HK
LYRA_AD_2152 was received twice.

Data coverage SWAP
20100822: BINSWAP_2152 was received twice
20100826: corrupted first packet in BINSWAP_2197_RED3_2010.08.26T06.05.56.tar
20100828: corrupted first packet in BINSWAP_2215_RED3_2010.08.28T05.43.02.tar

Some statistics:
Total number of images between 20100823 0UT and 20100830 0UT: **4253**
Highest cadence in this period: 30 seconds (campaign)
Commanded cadence outside campaigns: 120 seconds
Average cadence in this period: **142.16** seconds
Number of image gaps larger than 300 seconds: 36
Number of image gaps larger than 200 seconds: 731
Largest data gap: 63.50 minutes

The 3 largest data gaps are discussed below, the other gaps last for 360s or shorter:
- Gap of 3426 seconds (=57mins), just before image
BINSWAP20100825012320000135707PROCESSED in BINSWAP_2187
-> due to ESP test, a cadence of 1700s was commanded. Due to a mistake in the IOS, there were 2 gaps of this period between the images. Unfortunately, the image in between was never downloaded, leaving a gap of 3400 seconds.
Comment: why is there an image taken starting at 20100825 00:26:00 (transferring time 00:26:13) while SWAP was commanded IDLE at 00:26:00?

- Gap of 510 seconds, just before image
BINSWAP20100826025819000136456PROCESSED in BINSWAP_2197
-> due to 2 missing images and a corrupt image in BINSWAP 2197

- Gap of 3810 seconds (=63,5 mins), just before image
BINSWAP20100826092418000136781PROCESSED in BINSWAP_2203
-> due to images being overwritten onboard on August 26. As the SWAP images taken during
the LYRA paving campaign had higher PN, they were saved onboard while the regular ones
between 8:20 and 9:24 got overwritten

Data coverage LYRA
Complete and as expected.

7. Discussion on Lyra Paving Campaign.

The pointing changes during the campaign were commanded through SWAP IOS00160. Below,
we copy the commands related to the first 30 minutes (00:29-01:00) which are discussed below.

```
2010.08.26T00:28:00.000 idle
2010.08.26T00:29:00.000 data_management on 10 off fixed 10 3600 jpeg 0 on float 128 8 off off 0 off
2010.08.26T00:29:10.000 acquisition_configuration correlated_double_sampling 10 0 0 1023 1023 59 1 led_off 120 30 12bits 0.0 0.0
2010.08.26T00:30:00.000 specific_acquisition
2010.08.26T00:33:00.000 acquisition_configuration correlated_double_sampling 10 0 0 1023 1023 59 1 led_off 120 30 12bits 0.0 -0.0043633
2010.08.26T00:36:00.000 acquisition_configuration correlated_double_sampling 10 0 0 1023 1023 59 1 led_off 120 30 12bits 0.0 -0.008726
2010.08.26T00:39:00.000 acquisition_configuration correlated_double_sampling 10 0 0 1023 1023 59 1 led_off 120 30 12bits 0.0 -0.0130895
2010.08.26T00:43:00.000 acquisition_configuration correlated_double_sampling 10 0 0 1023 1023 59 1 led_off 60 30 12bits 0.0 -0.0174524
2010.08.26T00:46:00.000 acquisition_configuration correlated_double_sampling 10 0 0 1023 1023 59 1 led_off 120 30 12bits 0.0 -0.0218148
2010.08.26T00:49:00.000 acquisition_configuration correlated_double_sampling 10 0 0 1023 1023 59 1 led_off 120 30 12bits 0.0 -0.0261769
2010.08.26T00:51:30.000 acquisition_configuration correlated_double_sampling 10 0 0 1023 1023 59 1 led_off 120 30 12bits 0.0 0.0
2010.08.26T00:52:30.000 idle
```

The following image gives more details on the situation during the campaign. The upper plot
shows the Lyman-Alpha channel during the first 30 minutes of the campaign. The lower plot
shows the yaw (left-right pointing difference from sun centre), pitch (up-down pointing difference
from sun centre) and the roll angles obtained during the first 30 minutes.
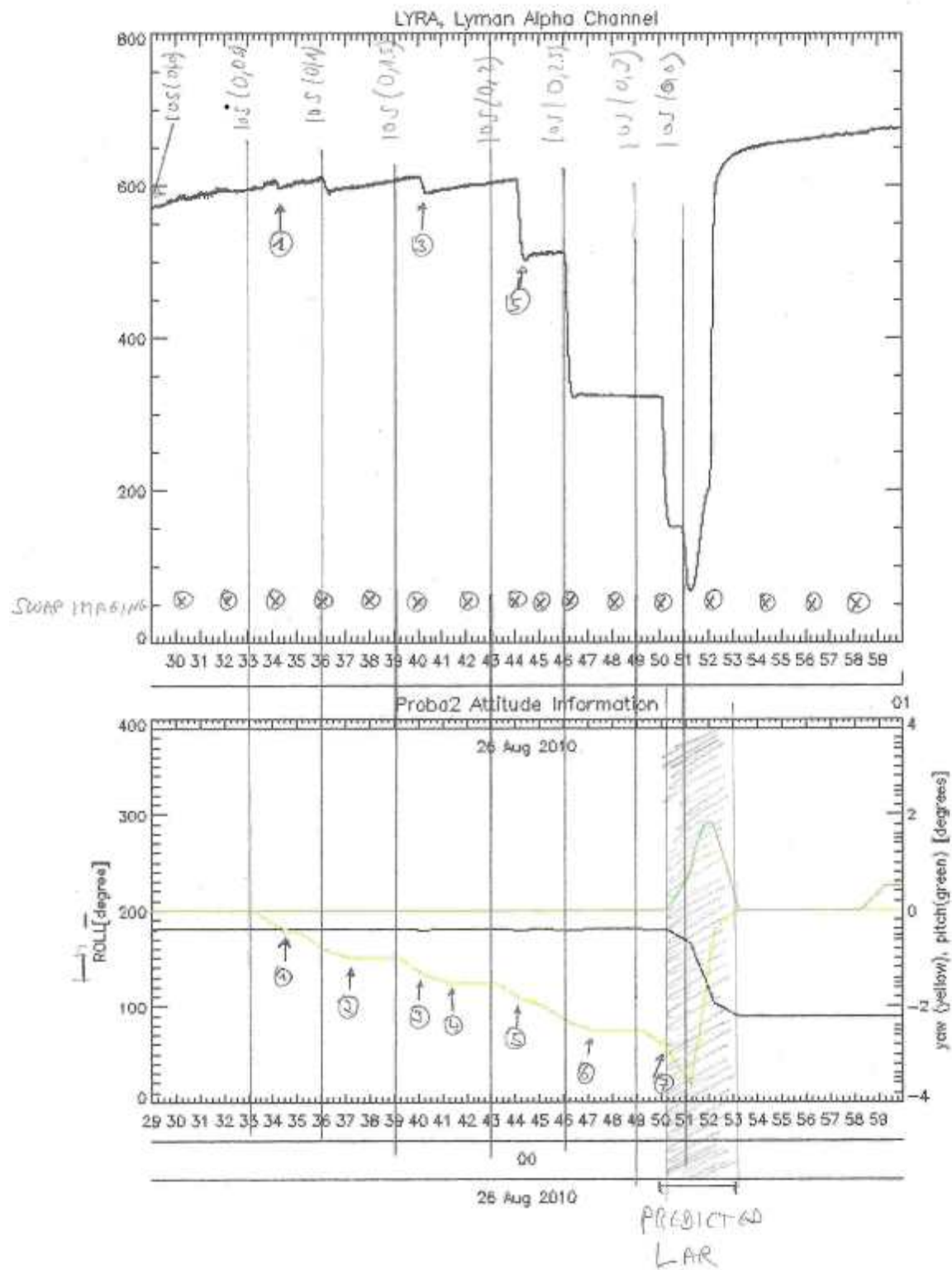
Observations:
1. From the yaw/pitch plot lines it looks as if the attitude information is updated only every minute and not every 30 seconds (tbc).

2. The time periods between the individual pointings are difficult to verify, due to
      the quaternion sampling available for P2SC is 1 minute (tbc)
      the IOS commanding was not fully synchronized with the cadence programmed
      as a consequence of the last item, the sequence used at P2SC should be
      updated properly

3. The last pointing was too near to a LAR and the signal can just stabilize

4. The image priorities is high with the consequence that a lot of images are lost after the campaign (when the table acquisition is used) - see 3 biggest gaps in SWAP data above.

5. From the campaign on 15 July 2010 not all attitude data are available. The operator shall check the completeness of the Spice C-kernel after the end of the day using the script check_attitude_completeness.sh, available on the OPSWEB directory.

The vertical lines indicate the time of the IOS given SWAP acquisition commands
 - the (x) shown in the lower part of the channel plot, gives the time instances of the SWAP image acquisition (start) time.
 - the (N) (numbers within the circles) gives the times when the yaw angle change was sampled (again sampling every minute does not really help here)
 - the shaded area in the attitude plot, shows the predicated time period of the LAR

The following interpretation of the plot is given and subject to discussion and clarification:
 - at the time of the second IOS command (00:33, commanded directional change from 0 to 0.5 degree), the spacecraft is changing attitude.
 - at 00:34, the next image is taken and the spacecraft points correctly 0.5 degree aside
 - to be prepared for the next IOS command scheduled for 00:36, the s/c continues to change attitude
     - the behaviour of changing attitude <u>before</u> the commands is under discussion and needs confirmation
 - the next IOS command at 00:36, the attitude is correctly 1.0 degrees aside, but the attitude is continues to change (and the resulting image is blurred)
 - the time between 00:43 and 00:46: it shows that there is an image done at 00:44, 00:45 and 00:46
 - the yaw is continuously changed during these 3 seconds and even until 00:47
 - how can this be explained? Within this period, none of the Lyman-alpha samples can be trusted, as the attitude is indeed unkown!

8. APPENDIX Frequently used acronyms

ADP	Ancillary Data Processor
ADPMS	Advanced Data and Power Management
AOCS	System
APS	Attitude and Orbit Control System
ASIC	Active Pixel image Sensor

BBE	Application Specific Integrated Circuit
CME	Base Band Equipment
COGEX	Coronal Mass Ejection
CRC	Cool Gas Generator Experiment
DR	Cyclic Redundancy Check
DSLP	Destructive Readout
EIT	Dual Segmented Langmuir Probe
FITS	Extreme ultraviolet Imaging Telescope
FOV	Flexible Image Transport System
FPGA	Field Of View FPA Focal Plane Assembly
GPS	Field Programmable Gate Arrays
HAS	Global Positioning System
HK	High Accuracy Star tracker
ICD	Housekeeping
IIU	Interface Control Document
IOS	Instrument Interface Unit
LED	Instrument Operations Sheet
LEO	Light Emitting Diode
LYRA	Low Earth Orbit
LYTMR	LYman alpha RAdiometer
LYEDG	LYRA Telemetry Reformatter (software module of P2SC)
MCPM	
MOC	LYRA Engineering Data Generator (software module of P2SC)
NDR	
OBET	Mass Memory, Compression and Packetisation Module
OBSW	
PE	Mission Operation Center
PGA	Non Destructive Readout
PI	On board Elapsed Time
P2SC	On board Software
PPT	Proximity Electronics
ROB	Programmable Gain Amplifier
SAA	Principal Investigator
SCOS	PROBA2 Science Center
SEU	Pointing, Positioning and Time (software module of P2SC)
SOHO	
SWAP	Royal Observatory of Belgium
SWBSDG	South Atlantic Anomaly
SWEDG	Spacecraft Operation System
SWTMR	Single Event Upset
TBC	Solar and Heliospheric Observatory
TBD	Sun Watcher using APS detector and image Processing
TBW	
TPMU	SWAP Base Science Data Generator
UTC	SWAP Engineering Data Generator (software module of P2SC)
UV	

	SWAP Telemetry Reformatter (software module of P2SC) To Be Confirmed To Be Defined To Be Written TC Telecommand Thermal Plasma Measurement Unit Coordinated Universal Time Ultraviolet