RPW Consortium Meeting #21
Instrument Paper, Science Organization and Action Items

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04-05 June 2018,
Dresden

Mission book update & deadlines

- Submission date independent of launch (PIs' telecon decision 28 Nov 2017)
- Definition of papers' sections, lead writers per section and co-authors list. Deadline: 15 September 2017 **(2 missing)**
- Submission to Holly & Yannis for internal coordination **(30 September 2018)**.
  - Then share all drafts with all first authors (any objection?).
- Papers to be submitted to A&A by 31 October 2018.

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SO/RPW

RPW

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ABSTRACT

We describe RPW

Key words. solar wind, space instrumentation, plasma and radio waves

1. The RPW science objectives and measurements requirements

1.1. The Solar wind between 0.3 and 1 AU

1.2. Turbulence-LF

1.3. QTN

1.4. Radio

1.5. Dust

1.6. The synergy with other Solar Orbiter instruments

2. Instrument design

2.1. ANT including DF and bending

2.2. SCM

2.3. MEB overview including LVPS and DPU - Moustapha

The Main Electronics Box (MEB) is a stacked assembly that gathers all the electronics boards (except ANT and SCM preamplifiers) of the RPW experiment. It includes a set of radio receivers, as well as the power supply and the data processing subsystems. The combination of analyzers – associated to the various electric and magnetic sensors – allows to cover a wide variety of functions to explore the plasma waves in the spectral and time domain from near-DC to 16.4 MHz.

The MEB consist of the following subsystems:

– The Low Voltage Power Supply and Power Distribution Unit (nominal and redundant LVPS-PDU)
– The Data Processing Unit (nominal and redundant DPU)
– The biasing unit (BIAS)
– The Low Frequency Receiver (LFR)
– The Time Domain Sampler (TDS)
– The Thermal Noise and High Frequency Receiver (TNR-HFR)

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All the subsystems are assembled into a single mechanical chassis and interconnected together using harnesses, as shown in Figure 1.

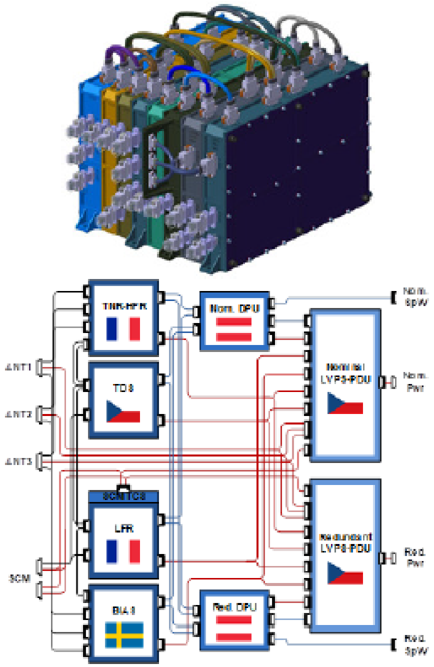

Fig. 1. Upper panel: ; Lower panel:

The signals from sensors are amplified locally, close to ANT and SCM, and then transmitted to the MEB via dedicated harnesses and connectors. The interconnection design results from a failure analysis. The three LF components of the E-Field from ANT are passed through the BIAS unit, where they are conditioned and combined prior to be distributed to both, the LFR and TDS. The three HF components of the E-Field from ANT are routed to the TNR-HFR and then redistributed to the TDS and the LFR. The three LF components of the B-Field from the SCM directly feed the LFR and TDS, while the SCM MF component feeds TDS and TNR-HFR. The interconnection scheme depicted above allow LFR to use the HF preamplifiers as a backup in case of failure of the DC/LF chain (partial redundancy). In addition, if LFR failed, TDS can be in-flight reconfigured in his proper LFR mode to process the ANT and SCM LF components. Finally, the LVPS-PDU and DPU are duplicated and connected as shown in Figures 2 and 3. Both are identical but independent units, so that it is possible to activate and operate the MEB indiscriminately from the nominal or the redundant channel. This guarantees a complete redundancy of the vital functions in case of damage in one unit. In addition, the electrical interfaces between these units and the subsystems have been designed with the utmost care, so that failures cannot propagate from one unit to another.

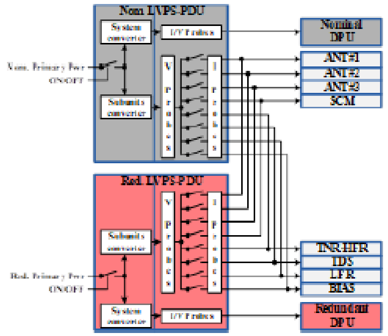

Fig. 2. ...

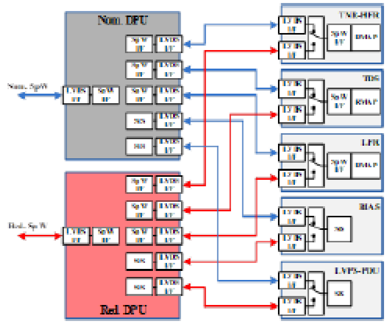

Fig. 3. ...

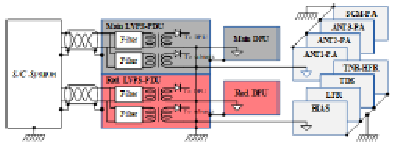

Fig. 4. ...

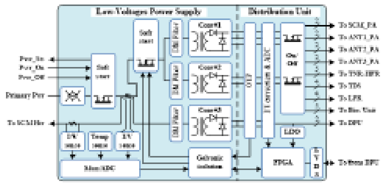

Fig. 5. ...

For EMC cleanliness, the grounding scheme follows the Distributed Single Point Grounding (DSPG) concept, illustrated in Figure 4. The loads (MEB subsystems and preamplifiers) are provided with isolated grounds. The latter are connected to the chassis ground on the LVPS-PDU side only.

2.3.1. The Power Supply

The RPW instrument includes two LVPS-PDU that operates in cold redundancy. The LVPS and the PDU are combined as a single unit as shown in Figure 5.

The spacecraft system feeds the RPW experiment with two unregulated power lines ranging from 26 V to 29 V. In order to produce a number of isolated and well regulated power outputs to the RPW subsystems, the LVPS is built using three step-down DC-DC converters: one is devoted to the powering of MEB system (PDU and DPU) and the two others to supply the science subsystems: one to the sensitive analog parts and the other to the "noisy" digital parts. The converters are based on a push-pull topology with current mode control. This topology was selected with regards to the good cross regulation between output voltages and for availability of the components with low consumption in space quality. Powering during operation is realized by output common choke in fly-back mode and its voltage follows the output voltage of converters. If short circuited or overloaded, the output voltage will drop, lowering the voltage of the control circuit. This control circuit will then turn itself off and the circuit will try to start again. If the conditions that caused this power-off are resolved, the power source will restart. The feedback circuit works in current mode, controlling the duty cycle according to actual current. This allows to ease the output filtering, simplify the compensation of the feedback loop and improve the response when load steps occur. In sensitive scientific instruments of this kind, the power supply is a central element. Therefore, in order to properly drive the Pulse Width Modulator (PWM), RPW requests a crystal-controlled switching frequency using quartz oscillator. This requirement is to avoid unstable

- **Inputs received from Moustapha, Jan, Thomas**
- **Missing : BIAS, THR, Antenna, SCM, Science, ROC**
- **New Deadline for the first inputs : Friday 22 June**
- **Preliminary list of co-authors defined. Milan will circulate it**

science organization

- specific RPW science workshops ?
- publication rules ?

ACTIONS

1. Xavier to look at what the FIELDS is doing for the « TNR » magnetic & electric data. Different variable names or no. End june ?
2. Eric to involve the teams to the upcoming EMC monthly teleconfs? 19 June ?
3. Meeting with CNES for the SPIS simulations complements. End june
4. Jan to Discuss with MAG & FIELDS on the choice of frame for the L2 data. Instrument frame ? Science frame ? Both ? End september ?
5. Matthieu & Yan to agree on the factor 2 and provide to Milan corrected data for the peformance document. End june ?
6. Thomas to provide electric waveform and spectral backround level for the perfo document. End june ?
7. Xavier to organise discussions on the data validation experience from teams. Early september ?
8. Elise to think about a performance review @ CNES. Mid-september