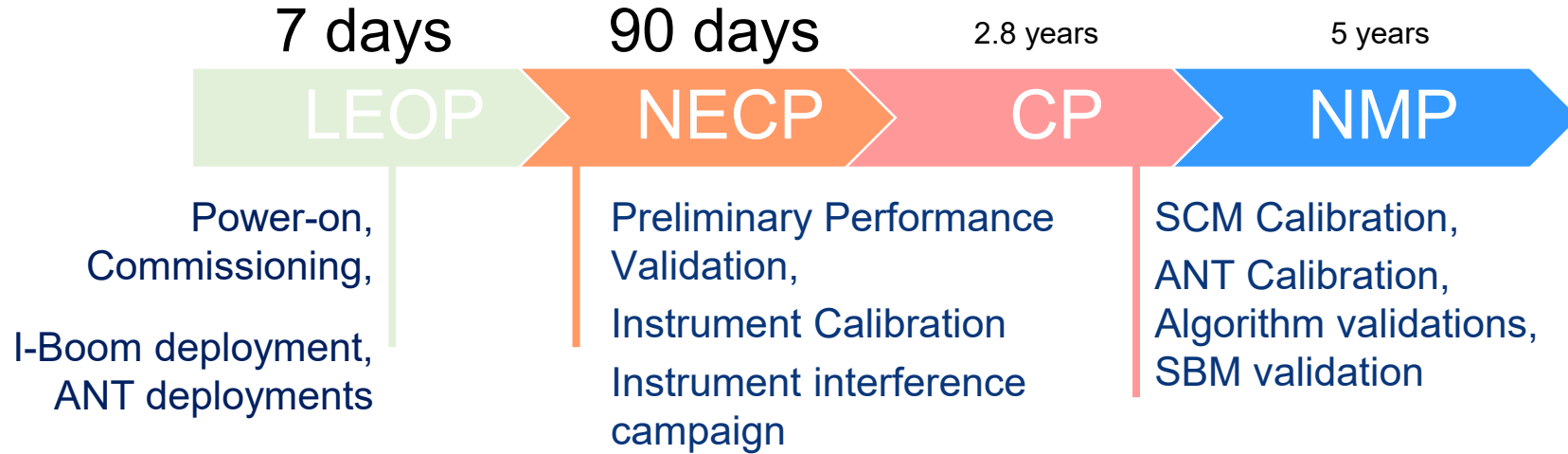




RPW Consortium Meeting – RPW Commissioning

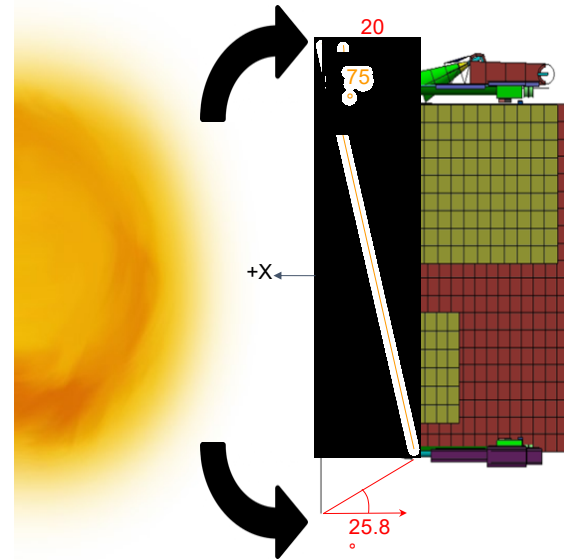
E. Lorfèvre - September 30th 2019

Instrument Operation Time line



Launch & Early Orbit Phase (LEOP)

- **RPW first power-on / CNES responsibility with LESIA support**
RPW instrument health check
 - To check startup sequence, health status
- **No RPW In-Flight SFT performed before deployments**
- **PZ ANT Deployment / CNES responsibility with LESIA support**
ANT deployment monitoring and Science Measurement
 - To check SC HK (μ switch, temperatures...)
 - To perform science measurement (see previous consortium meetings)
- **I-Boom Deployment / CNES responsibility with LESIA support**
SCM deployment monitoring and Science Measurement
 - To check SC HK (switch, temperatures...)
 - To perform science measurement (see previous consortium meetings)
- **PY & MY ANT Deployments / CNES responsibility with LESIA support**
ANT deployment monitoring and Science Measurement
 - To check SC HK (μ switch, temperatures...)
 - To perform science measurement (see previous consortium meetings)



Near Earth Commissioning Phase (NECP)

- **RPW In-Flight SFT / CNES responsibility with LESIA support**

Aim : RPW instrument functional check before any deployment

- To check TMTC, behavior, currents, secondary bias, temperatures, mech. parts (BIAS, PA relays)
- To check science TM, noise floor, sweep + low latency, internal calibrations

- **Instrument Calibration / CNES responsibility with LESIA support**

- To perform ANT aurora kilometric radiation (AKR) calibration rolls
- ~~To perform SCM calibration in earth lobes magnetosphere~~ → to be postponed during the first E-GAM (TBC).

- **Instrument interference campaign / CNES responsibility with LESIA support**

Aim : Assessment of the in-flight performances

- To check inter instrument interferences (wrt auto compatibility results)

- **Preliminary Performance Validation**

Aim : Assessment of the in-flight performances

- To check science mode & TM, noise floor, sweep, low latency, internal calibrations and algorithm validation (LFR, TDS, SBM), to check PAS filtering, wheels filtering
- To validate the Bias current setting operation routine
- To perform first galaxy measurement
- To take into account HGA interference and Spice heatshield door illumination

- **Continuous RPW electrical/magnetic characterization (New)**

Aim : RPW should be continuously ON in normal except during other activities

Activities 1/3

| Payload | Activities Originally planned in UM | Expected Duration (hrs) | Order/Timing | OBSM Planned | Pointing Requirements | Interactivity Real Time ops | Parallel Operations | Data Volume | Power (W) | Comments |
|---------|---|---|--------------|--------------|--|-----------------------------|--------------------------|-----------------|-----------|--|
| RPW-2 | I-Boom Deployment Observation 1) Nominal switch-on 2) Boot DAS in Stand-by 3) Enter Service Mode and SWON all units in right order 4) Put RPW in I-Boom deployment configuration 5) Abandon science mode and SWOFF RPW | 10min + I-Boom deployment duration + 10min | | No | Pointing needed for Boom deployment | No | Only boom deployment MAG | < 40 kpbs (TBC) | 19.1 | RPW: In the latest scenario the RPW-2 and RPW-3 activities will be planned as a single operation during LEOP: the RPW antenna +Z will be deployed first, then the i-boom, then the two other +Y/-Y RPW antennas. No interaction with the MOC team. RPW should be switched ON/OFF 10 min. before/after the whole deployment operation. |
| RPW-3 | RPW Antennae Deployment 1) RPW SWON in antennae deployment configuration and S/C TM verification (current in SMA heater, PA temperature of each antenna, micro-switches status, S/C AOCS TM) For each antenna 2) Stub boom deployment & check correct deployment 3) Stacer monopole deployment & check deployment 4) Switch OFF RPW. | 3 x (10 min + 1 antenna deployment duration + 10 min) | | No | S/C 3-axis stabilised & Sun pointing (TBC, depending on the deployment scenario) | No | No | < 40 kpbs (TBC) | 19.1 | |
| RPW-1 | In-flight Short Functional Test 1) RPW SWON and run RPW in-flight SFT 2) Switch OFF RPW. | 1.5 | | No | No | Yes (TBC) | No | < 40 kpbs (TBC) | 19.1 | RPW: SFT shall now be planned before the RPW-4 activity. |

Activities 2/3

| Payload | Activities Originally planned in UM | Expected Duration (hrs) | Order/Timing | OBSM Planned | Pointing Requirements | Interactivity Real Time ops | Parallel Operations | Data Volume | Power (W) | Comments |
|---------|--|-------------------------|--------------|--------------|--|-----------------------------|---------------------|-----------------|-----------|--|
| RPW-4 | RPW Antennae calibration rolls 1) RPW SWON in antennae calibration rolls configuration 2) SWOFF RPW | 4 x 8h | | No | S/C rolls around X-axis (TBC) | No | No | < 40 kpbs (TBC) | 19.1 | RPW: Shall be planned during the first week of the NECP, when S/C is close enough from Earth to observe AKR. 8hrs of rolls in 4 days are requested. EMC quiet. |
| RPW-5 | RPW SCM calibration 1) RPW SWON in SCM calibration configuration 2) SWOFF RPW Activity removed from NECP timeline. To be replanned during the first Earth GAM (depending on the operational constraints) | 9 (TBC) | | No | No | No | No | < 40 kpbs (TBC) | 19.1 | RPW: Shall be planned during the first week of the NECP, when S/C passes through the Earth magnetic lobes. EMC quiet. |
| RPW-6 | Inter-instruments Interference Campaign 1) Successive switch ON of instruments 2) All in-situ instruments ON (remote sensing OFF) 3) All remote sensing ON (in-situ OFF) 4) All instruments ON 5) Interference campaign with the platform | > 20 | | No | Depends on the requirements of the instruments switched on during the campaign | No | No | < 40 kpbs (TBC) | 19.1 | Towards the end of NECP when all instruments have been commissioned |

Activities 3/3

| Payload | Activities Originally planned in UM | Expected Duration (hrs) | Order/Timing | OBSM Planned | Pointing Requirements | Interactivity Real Time ops | Parallel Operations | Data Volume | Power (W) | Comments |
|---------|---|-------------------------|--------------|--------------|-----------------------|-----------------------------|---------------------|-----------------|-----------|--|
| RPW-7 | RPW-PAS filtering tune campaign 1) Determine configuration of the RPW filtering parameters | ? | | No | No | No | SWA shall be ON | < 40 kbps (TBC) | 19.1 | Activity to be better defined |
| RPW-8 | RPW electrical/magnetic characterization 1) RPW measurements during NECP when other instruments turn-on and perform commissioning (RPW in normal mode) | ~ 90 hrs | | No | No | No | Yes | ~5.5 kbps | 19,1 | RPW: This activity should start asap after the end of RPW-4 (antenna rolls). RPW should be continuously ON in normal mode, except during RPW-6 and RPW-7 activities. |

BACKUP SLIDES

RPW First Power on

Assumptions:

- After a first RPW switch-on, instrument health is checked
- I-boom and antennas are in stowed positions.

In this phase, RPW is powered on for the first time in flight.

No SFT is performed before deployments.

Instrument health is checked only with HK TM from OBC packets

Duration is some minutes.

PZ RPW Antennas Deployment Operation Specification

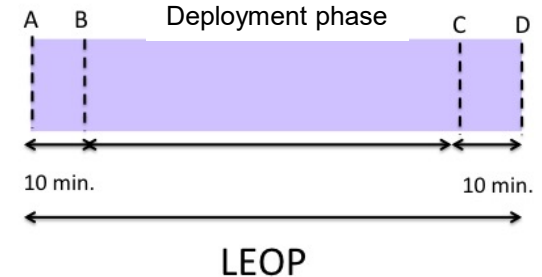
Assumptions:

- The main objective is to acquiring RPW data during the electrical antennas (ANT) deployment (x3).
- The antenna deployment will occur during the LEOP phase.
- RPW will be switched-on before and after the entire deployment phase.
- The SSMM will be available.
- MOC will control the deployment of the antennas.
- The ANT deployment will be performed the following order: starting with the PZ (ANT1), then I-Boom, PY (ANT2) and finally MY (ANT3).

In this phase, RPW measures the noise of the platform. RPW is set in the same specific configuration for all the deployment phase (excepted THR during antenna deployment). Measurements will be performed also during the first and last 10 minutes before and after the deployment phase.

RPW Measurement Configuration:

See other presentations for detailed configuration and timeline



I-Boom Deployment Operation Specification (to be discussed)

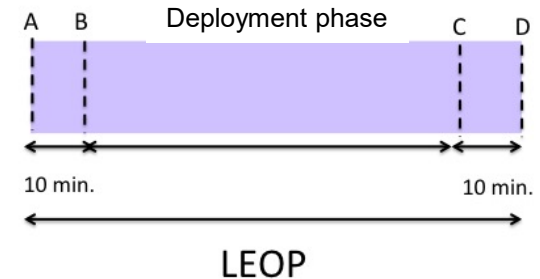
Assumptions:

- The I-Boom deployment will occur during the LEOP phase.
- RPW will be switched-on before and after the entire deployment phase.
- During the Boom deployment only the MAG instrument will be also switched-on.
- The SSMM will be available.
- MOC will control the deployment of the I-boom.

In this phase, RPW measures the noise of the platform. RPW is set in the same specific configuration for all the deployment phase. Measurements will be performed also during the first and last 10 minutes before and after the deployment phase.

RPW Measurement Configuration:

See other presentations for detailed configuration and timeline



PY RPW Antennas Deployment Operation Specification

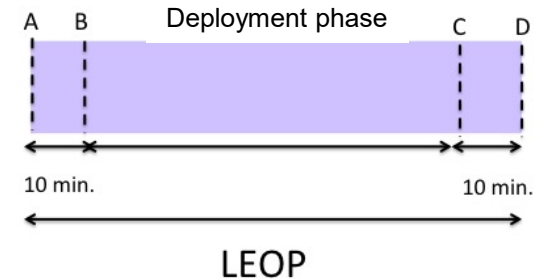
Assumptions:

- The main objective is to acquiring RPW data during the electrical antennas (ANT) deployment (x3).
- The antenna deployment will occur during the LEOP phase.
- RPW will be switched-on before and after the entire deployment phase.
- The SSMM will be available.
- MOC will control the deployment of the antennas.
- The ANT deployment will be performed the following order: starting with the PZ (ANT1), then I-Boom, PY (ANT2) and finally MY (ANT3).

In this phase, RPW measures the noise of the platform. RPW is set in a single specific configuration for the deployment phase (excepted THR during antenna deployment). Measurements will be performed also during the first and last 10 minutes before and after the deployment phase.

RPW Measurement Configuration:

See other presentations for detailed configuration and timeline



MY RPW Antennas Deployment Operation Specification

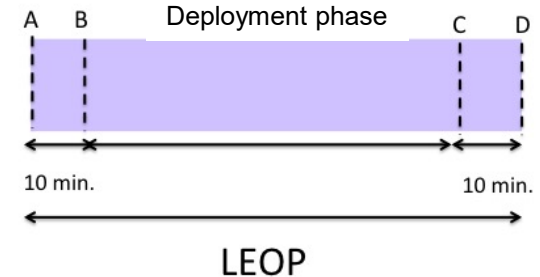
Assumptions:

- The main objective is to acquiring RPW data during the electrical antennas (ANT) deployment (x3).
- The antenna deployment will occur during the LEOP phase.
- RPW will be switched-on before and after the entire deployment phase.
- The SSMM will be available.
- MOC will control the deployment of the antennas.
- The ANT deployment will be performed the following order: starting with the PZ (ANT1), then I-Boom, PY (ANT2) and finally MY (ANT3).

In this phase, RPW measures the noise of the platform. RPW is set in a single specific configuration for the deployment phase (excepted THR during antenna deployment). Measurements will be performed also during the first and last 10 minutes before and after the deployment phase.

RPW Measurement Configuration:

See other presentations for detailed configuration and timeline



Instrument Interference Campaign

Assumptions:

- RPW will run measurements covering the full frequency range for both magnetic and in electric sensors, in normal and burst mode.
- At the beginning of the campaign all the Solar Orbiter Instruments are OFF. Then they are successively set to ON.
- Towards the end of NECP when all instruments have been commissioned.

The purpose of this campaign is to characterize the Solar Orbiter payload EMC in space. RPW will analyze the influence of each equipment/instrument, one after the other, on its measurements and on the background noise.

Switch ON sequence

- 1) Successive switch ON of instruments
- 2) All in-situ instruments ON (remote sensing OFF)
- 3) All remote sensing ON (in-situ OFF)
- 4) All instruments ON
- 5) Interference campaign with the platform

Preliminary Performance Validation

- **LFR software algorithm validation**
- **TDS software algorithm validation**
- **SBM algorithm validation**
- **PAS filtering, Wheel filtering**
- **Validation of the Bias current setting operation routine**
- **HGA interferences**
- **Spice heatshield door illumination of an antenna**
- **...**

Responsibilities

- **CNES**

- Coordination,
- Assessment of instrument health and performances,
- Commissioning report issuing,
- ...

- **ROC**

- Command/control Interface, data processing et distribution (between MOC and RPW teams),.
- Providing of data visualization tools,
- Support to commissioning activities and associated report issuing
- ...

- **RPW teams**

- Science performances assessment
- Support to commissioning activities and associated report issuing
- ...