RPW Operations Centre

ROC User Requirements

ROC-GEN-SYS-URD-00064-LES
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Prepared by:	**Function:**	**Signature:**	**Date**
RPW Team			DD/MM/YYYY
Verified by:	**Function:**	**Signature:**	**Date**
Desi Raulin	RPW ground segment CNES support engineer		Dd/mm/yyyy
Approved by:	**Function:**	**Signature:**	**Date**
Milan Maksimovic	RPW Principal Investigator		Dd/mm/yyyy
For application:	**Function:**	**Signature:**	**Date**
Xavier Bonnin	RPW ground segment project manager		Dd/mm/yyyy

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l'Observatoire de Paris LESIA
Laboratoire d'Études Spatiales et d'Instrumentation en Astrophysique

CNRS-Observatoire de PARIS
Section de MEUDON – LESIA
5, place Jules Janssen
92195 Meudon Cedex – France

Change Record

Issue	Rev.	Date	Authors	Modifications
1	0	DD/MM/YYYY	ROC Team	First issue

Acronym List

Acronym	Definition
AIT	Assembly Integration Test
AIV	Assembly Integration Validation
ANT	(Electrical) antennas
APID	Application Process ID
CDPP	Centre de Données de Physique des Plasmas
CIRD	Concept and Implementation Requirements Document
CNES	Centre National d'Etudes Spatiales
CoI	Co Investigator
CP	Cruise Phase
DDS	Data Dissemination System
DPU	Digital Processing Unit
EDDS	EGOS Data Dissemination System
EID-A	Experiment Inteface Document - Part A
EMP	Extended Mission Phase
EPD	Energetic Particles Detector
ESA	European Space Agency
ESAC	European Space Astronomy Centre
ESOC	European Space Operation Centre
FDIR	Failure Detection Isolation and Recovery
FOP	Flight Operation Plan
GFTS	Generic File Transfer System
HFR	High Frequency Receiver
HK	Housekeeping parameters
IAP	Institute of Atmospheric Physics
ID	Identifier
IOR	Instrument Operation Request
IT	Instrument Team
ISM	Instrument State Model
IOP	Instrument Operation Planner
IOR	Instrument Operation Request
LEOP	Launch & Early Operations Phase
LESIA	Laboratoire d'Etudes Spatiales et d'Instrumentations en Astrophysiques
LFR	Low Frequence Receiver
LLVM	Low Latency Virtual Machine
LPC2E	Laboratoire de Physique et Chime de l'Environnement et de l'Espace
LPP	Laboratoire de Physique des Plasma
LVPS-PDU	Low Voltage Power Supply - Power Distribution Unit
MDOR	Memory Direct Operation Request
MOC	Solar Orbiter Mission Operation Centre

MUSIC	Monitoring and control subsystem user interface
NECP	Near Earth Commissioning Phase
NMP	Nominal Mission Phase
OGS	Operations Ground Segment
OS	Operating System
PDOR	Payload Direct Operation Request
PI	Principal Investigator
PM	Ground Segment Project Manager
POR	Payload Operations Request
ROC	RPW Operation Centre
RODP	RPW Operations and Data Pipeline
RPW	Radio and Plasma Waves
RSS	ROC Software System
RSW	Remote-sensing Window
SDP	Software Development Plan
S/C	Spacecraft
SBM	Selective Burst Mode
SCM	Search Coil Magnetometer
SGS	Science Ground Segment
SGSE	Software Ground Support Equipment
SOC	Solar Obriter Science Operation Centre
SOOP	Solar Orbiter Observing Plan
SOV	System Operation Validation
SOWG	Science Operations Working Group
SSL	Space Science Laboratory
SSMM	Solid State Mass Memory
SVT	System Validation Tests
SWT	Science Working Team
TC	Telecommand
TDS	Time Domain Sampler
TM	Telemetry
TNR	Thermal Noise Receiver
URD	User Requirements Document
VM	Virtual Machine

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1 GENERAL

1.1 Scope of the Document

This is the Users Requirements Document (URD) for the RPW Operations Centre (ROC).

It specifies the user needs for the exploitation of the ROC Software System (RSS) in support of:

- Instrument operations requests preparation, submission and verification
- Instrument operations planning visualization at mission and instrument levels
- Instrument monitoring
- Instrument data visualization
- RSS monitoring

The URD covers the RSS deployed and run at the Laboratoire d'Etudes Spatiales et d'Instrumentation en Astrophysique (LESIA) in Meudon (France), during the RPW instrument exploitation starting at the Cruise Phase (CP). The user specific needs for the RPW instrument commissioning phase are defined in a separated document [RD1].

1.2 Applicable Documents

This document responds to the requirements of the documents listed in the following table:

Mark	Reference/Iss/Rev	Title of the document	Authors	Date
AD1	ROC-GEN-SYS-PLN-00002-LES/1/4	ROC Concept and Implementation Requirements Document (CIRD)	Y. de Conchy X. Bonnin	17/11/2017
AD2	ROC-GEN-OTH-REQ-00081-LES/1/0	ROC Requirements	M. Maksimovic	11/01/2019
AD3				
AD4				

1.3 Reference Documents

This document is based on the documents listed in the following table:

Mark	Reference/Iss/Rev	Title of the document	Authors	Date
RD1	TBD	RPW Commissioning requirements	E. Lorfevre	TBD
RD2	ROC-GEN-SYS-PLN-00015-LES/02/03	ROC Software Development Plan (SDP)	X. Bonnin	17/11/2017
RD3	ROC-GEN-OTH-NTT-00044-LES/1/1	ROC Glossary of terms (RGT)	X. Bonnin	08/11/2018
RD4	ROC-GEN-SYS-SPC-00026-LES/1/2	ROC Software System Specification (RSSS)	X. Bonnin	
RD5	SOL-ESC-PL-10001/1/2	Solar Orbiter FOP Preparation Plan (FOPPP)	I.Tanco	18/01/2017
RD6	SOL-SGS-ICD-0003/1/0	Solar Orbiter Instrument Operation Request Interface Control Document (IOR ICD)	C. Watson	13/03/2017
RD7	SOL-SGS-ICD-0009/1/0	Solar Orbiter File-Transfer	E Salazar, C.Watson	24/03/2017

		SOC<-> Instrument Teams ICD		
RD8	ROC-GEN-SCI-PLN-00077-LES/1/0 (draft)	RPW science Data Validation and Verification Plan (DVVP)	X.Bonnin, S.Lion	11/01/2019
RD9	SOL-ESC-IF-05011/1/0	Solar Orbiter Data Delivery Interface Control Document	L. Michienzi	10/09/2013
RD10	SOL-SGS-TN-0017/0/2	SOC-Provided Ancillary Data for Solar Orbiter	A.Walsh	18/09/2017
RD11	SOL-SGS-TN-0006/1/2	SOC Engineering Guidelines for External Users (SEGU)	Richard Carr	03/08/2017
RD12	SOL-ESC-TN-12000/1/2	Solar Orbiter – Mission Planning Concept (MPC)	SOL FCT	27/06/2014
RD13	SOL-SGS-ICD-0006/1/2	Solar Orbiter Enhanced-Flight Events Communications Skeletons Interface Control Document	C. Watson	31/10/2017
RD14	SOL-SGS-ICD-0007/1/0	Solar Orbiter Telemetry Corridor Interface Control Document	C. Watson	14/03/2017
RD15	ROC-PRO-DAT-NTT-00006-LES/1/2 (draft)	ROC Data Products (RDP)	X.Bonnin	DD/MM/YYYY
RD16	RPW-SYS-MEB-GSE-NTT-000792-LES/1/0	C-SGSE User Manual	A.Gaget	22/05/2014
RD17	SOL-ESC-IF-05010/1/2	Planning Interface Control Document (PLID)	L. Michienzi	07/2015
RD18	ROC-TST-GSE-SWU-00003-LES/1/2	RPW Calibration Data Visualization User Requirements	X.Bonnin	12/02/2016

1.4 About this document

1.4.1 Access policy

This document is accessible without any restriction.

Any modification of the URD requires formal approval of the RPW Ground Segment Project Manager before publication.

1.4.2 Requirement identification

The structure of requirement is a following:

Req. reference	Req. title	**Req. verif.**
Req. description		
Req. target	**Implements:**	
Req. comment		

Where:

- "Req. reference" is the reference identifier of the requirement. It must "REQ-ROC-URD-XXXX", where "XXXX" is an unique 4-digits integer over the document. This field must be defined.
- "Req. title" is the title of the requirement. This field must be defined.

- "Req. description" gives the description of the requirement. This field must be defined.
- The way the requirement is verified must be reported into the "Req. verif." cell. The possible value are: "Test", "Demo", "Code inspection", "Review". This field must be defined.
- "Req. target" indicates for which system or entity the requirement must be applied. This field is optional.
- The reference of the parent requirement(s) (i.e., the higher-level requirements covered by the requirement) must be listed in the "Implements:" cell. This field is mandatory if any parent requirement is identified.
- "Req. comment" cell can be used to add any comment or justification relative to the requirement. This field is optional.

2 INTRODUCTION

2.1 Context and purpose

The ROC has the overall responsibility of the RPW ground segment. In support to its activities, dedicated infrastructure shall be implemented at LESIA, allowing the ROC to cover the required functions as defined in the ROC Concept and Implementation Requirements Document (CIRD) [AD1].

The technical specification of the RSS are listed in the ROC Software System Specification (RSSS) [RD4].

2.2 Software covered by the ROC User Requirements Document (URD)

The RSS is presented in the ROC Software Development Plan (SDP) [RD2].

The RSS software units covered by the URD are:

- RPW Operation and Data processing Pipeline (RODP), to retrieve, process and distribute RPW telemetry (TM) and operational data related to the Solar Orbiter mission.
- Monitoring and control subsystem User Interface (MUSIC), to visualize RPW data and support operations activities.
- ROC Ground Support Equipement (GSE), to support ground activities (process and visualize RPW data generated by instrument models on-ground, simulate SBM algorithm detections).

2.3 Definitions

The ROC-related terms definitions can be found in the ROC glossary of terms [RD3].

3 ROC USE CASES

3.1 RPW data processing-related use cases

3.1.1 General use case

The RPW data processing will be performed by the RODP hosted at LESIA. The processing gathers all the tasks from the RPW TM raw data retrieval to the fully calibrated science data archiving at the European Space Astronomy Centre (ESAC) located near Madrid (Spain). The main steps are:

1. Retrieving newest RPW TM raw data from the Solar Orbiter Mission Operations Centre (MOC) Data Dissemination System (DDS) [RD9], as well as ancillary data, required for the data verification and higher-level science data production. In the nominal case, the data retrieval will have to be performed at least every 24 hours. Especially, the RODP shall ensure that all TM packets for a given pass have been retrieved.
2. Analyzing, checking and preparing the retrieved data for the processing phase. This step is hereafter named as the pre-processing step. It will mainly consist of identify the TM packets received, verify the integrity and save TM binary data into the database. The end of the process should lead to save the RPW TM binary data into daily files, also called LZ level data files.
3. Generating the L0 and L1 science data files, as listed in [AD2]. In the same time, the RODP will produce HK "digest" files.
4. From L1 data files, producing the L2 full-calibrated science data files, as listed in [AD2], using the RPW calibration software (RCS) [AD2].
5. Generating summary plots as expected in [AD2].
6. Running the verification of the RPW data, as defined in [RD8].
7. Delivering the L0/L1/L2 science data files to the Solar Orbiter data archive at ESAC. In the same time the data should be archived at the CDPP and make publicly available from the RPW Web site at LESIA.

Note that:

- Most of these tasks will have to be run without human intervention, but with enough traceability and notification mechanisms to help the ROC administrators to rapidly identify and isolate any failure in the system.
- The steps 3 to 5 could require several iterations in order to fill possible data gap in the TM packets from a pass to another, to refine the calibration step, to improve the science data quality during validation process. Moreover, the data received for the current day may be incomplete and will have to be re-processed within few hours after the end of the day.
- It is not plan that the production of RPW L3/L4 data is done at LESIA. Nevertheless, the ROC should at least collect, archive and distribute the L3 data.
- The production of the RPW Low Latency LL01 data is performed by the SOC using the LLVM delivered by the ROC. However, the ROC will also deploy its own instance at LESIA, as a backup and to check the consistency of the RPW LL01 data generated by the SOC.

More detailed use cases are presented for each of this step in the next sections.

3.1.2 Retrieving RPW-related data with the MOC/SOC interfaces

Figure 1 shows the nominal use case to retrieve RPW-related data, instrument TM/TC raw/report data and mission ancillary data [RD10], through the MOC DDS and the SOC Generic File Transfer System (GFTS) [RD7] Web interfaces respectively.

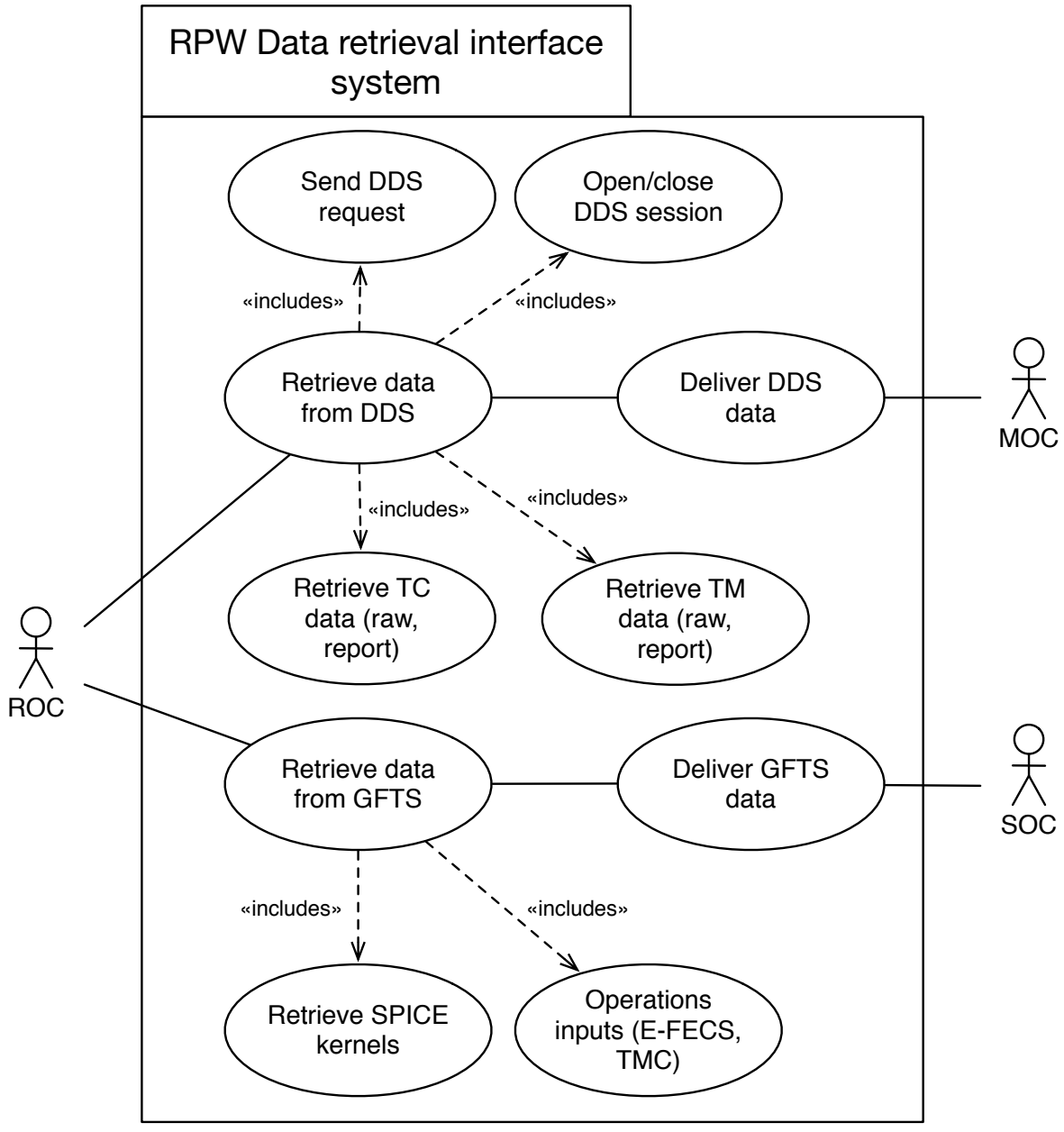

Figure 1. RPW data retrieval interface nominal use case.

Especially, the RSS shall be able to:

1. Check in the GFTS node on the ROC side for new data from the SOC, namely: ancillary SPICE kernels and operations inputs (i.e., E-FECS, TMC files)
2. If new data are found, import them into the ROC mission database and file system.

3. Open a DDS session and send a request to get RPW related-data: TC catalogue, TM raw data for a given time range (e.g., typically the last 24 hours or the data downlinked from the latest pass or time range(s) for missing packet data)
4. If new data are found, import them into the RSS to be processed.

This task will be autonomously performed by the RODP using dedicated DDS client and GFTS file manager.

3.1.3 Producing and delivering RPW calibrated science data

Figure 2 displays the nominal use case to produce and deliver to the ESAC data archive centre (Madrid, Spain), the RPW calibrated science data. It is also expected to deliver science data to the CDPP data archive in Toulouse (France).

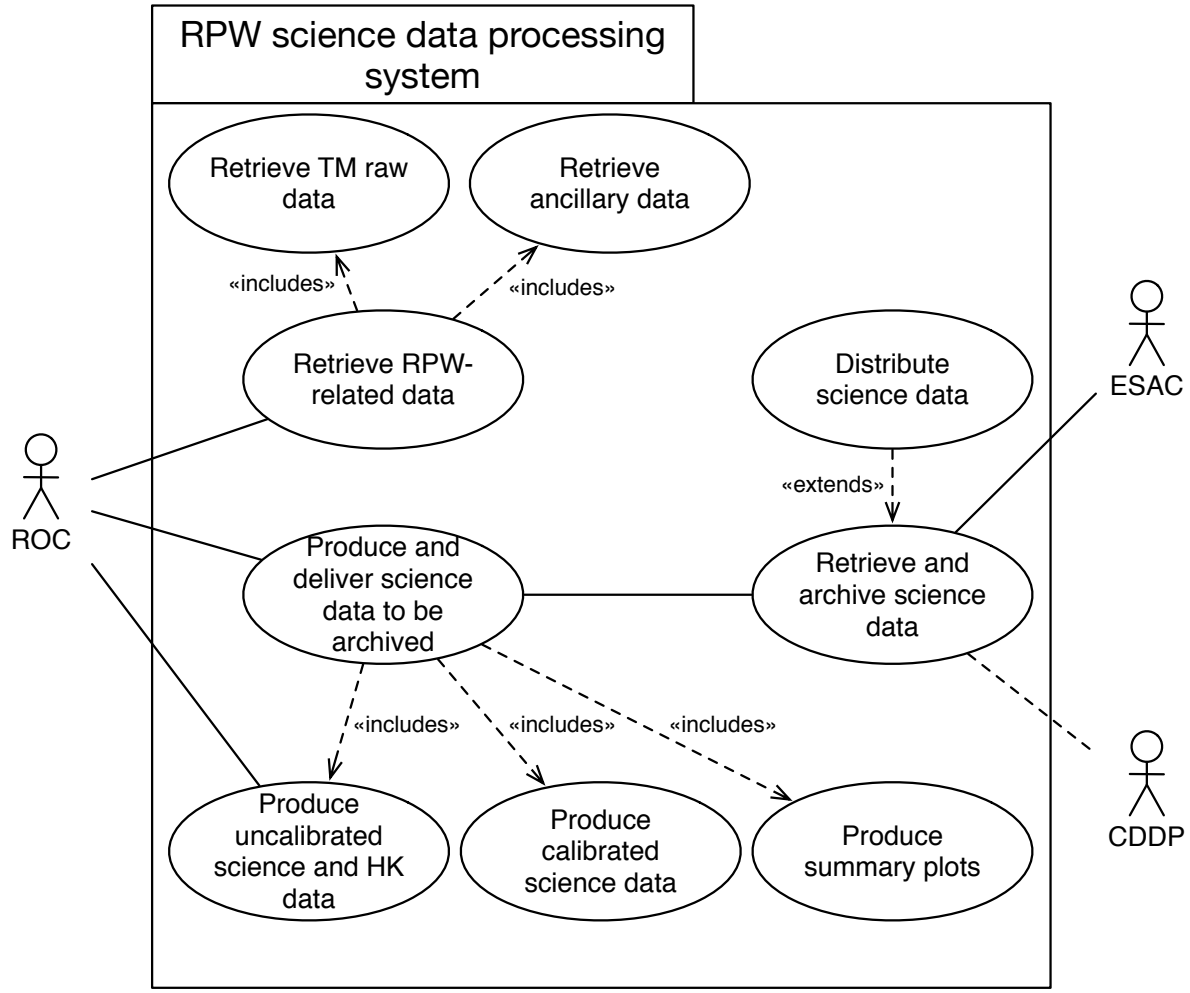

Figure 2. RPW science data processing nominal use case.

From the data retrieved via the DDS and GFTS interfaces (see previous section), the ROC shall be able to:

1. Generate LZ data files from the TM raw packet data
2. Produce the L0, L1 and HK data files from the LZ data files, and corresponding summary plots

3. Produce the L2 data files from the L1, HK and ancillary data files, and corresponding summary plots
4. Perform the verification of the L1 and L2 data files before archiving
5. Submit within 3-months the L1 and L2 data files – and associated calibration products (i.e., calibration tables) - to the ESAC data archive centre, via the GFTS.

This task will be autonomously done by the RODP, using the RCS for the L2 data production.

The generation of the (LZ, L0, L1, L2, HK) files set may require several iterations due to missing data (i.e., TM packets delivered with latency) or calibration refining. Hence, several versions of files may be generated until the distribution to archive centre, and a distinction between *preliminary* (i.e., not archived yet; proprietary period) and *definitive* (i.e., archived) data should be made here.

It must be noticed that the *preliminary* data shall be accessible as soon as possible to the RPW Lead CoI teams and Solar Orbiter consortium in a private way. *Definitive* data will have to be publicly available.

3.1.4 RPW Low Latency data retrieving and processing

Figure 3 gives the nominal use case concerning the LLD processing for RPW. This use case can be divided into two main activities:

- Preparing (i.e., developing, testing, validating) and submitting to the SOC, a ready-to-be deployed instance of the RPW LLVM. Especially, the ROC will have to ensure the maintenance of its LLVM and to be capable of delivering to the SOC a new instance within a reasonable time (i.e., a week)
- Deploying and running its own instance of the RPW LLVM at the LESIA site. This instance will have to be as much as possible run in a system environment similar to the SOC one, in order to support LL01 data comparison generated from the two sites.

It must be noticed that from the LL01 data produced by the dedicated RODP installed in the LLVM, the SOC will produce post-processed data at LL02 level. These LL02, which will serve as a basis for IT and SOC to prepare the instrument operations and monitor on-board payload activities, e.g. SBM1/SBM2 events data stored on the Solid State Mass Memory (SSMM) of the S/C. These data will be visible from the dedicated SOC LL Web page. The IT will also be able to retrieve LL01 and LL02 data files generated by the SOC for analysis.

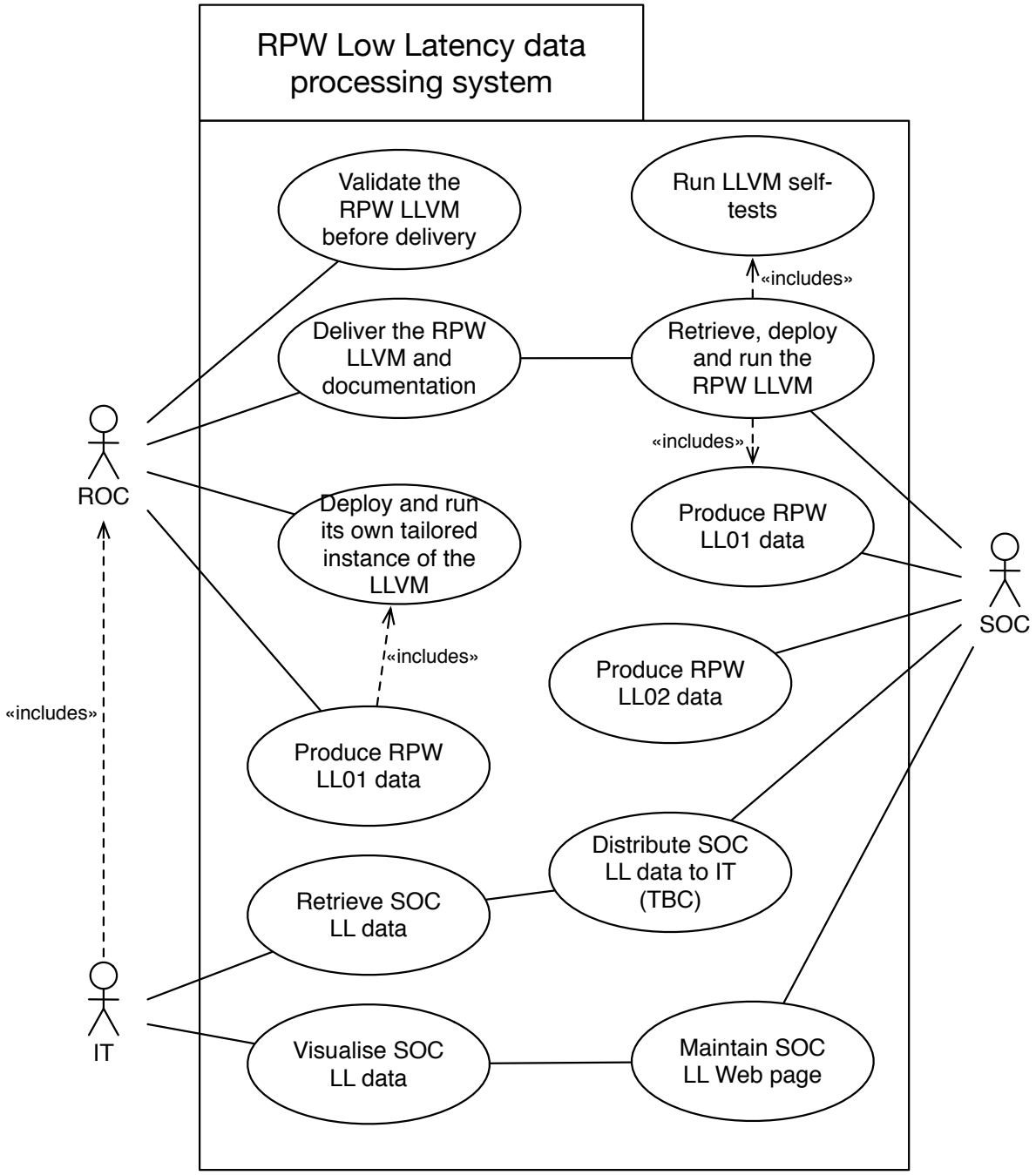

Figure 3. RPW Low Latency data processing nominal use case.

The RPW LLVM delivery shall follow the steps:

1. After any development or upgrade, testing and validating the LLVM and expected data products to ensure the compliance with the specification in [RD11]. The testing phase will have to be performed in a dedicated environment close to the "real" conditions at the SOC site.
2. Delivering the RPW LLVM and up-to-date documentation using the mechanism defined in [RD11]

The LLD retrieving and processing workflow at the LESIA site shall respect the following main steps:

1. Identifying the LL data from the RPW TM raw packets, retrieved via the DDS.
2. Submitting these LL data to the RPW LLVM instance installed at the LESIA site
3. Controlling the expected LL01 data products, and moving them to the dedicated directory
4. Performing comparison with the LL01 data generated at the SOC site.

The SOC team should be notified if incompatibilities have been found.

3.2 RPW monitoring and commanding-related use cases

3.2.1 Instrument event, HK and science data monitoring

Figure 4 shows the nominal use case concerning the monitoring of RPW data. Especially the ROC shall be able to promptly process and visualize science and HK data as a first investigation. The RSS shall also include automated processes to check the data integrity and validity, as well as to control the data executed and returned by the on-board instrument (including the TC acknowledge, TM production rate, instrument HK and event reports, etc.). The RSS should support the automated publication of reports via different media (e.g., email, log files, JIRA issue, Web page notification, etc.) and at different emission frequencies (e.g., as soon as possible, every day, every week, etc.), depending of the severity of data analyse results.

Some of these reports will have to be distributed to the RPW teams involved in the ground segment activities. The RPW teams can use them in complement to the processed RPW data, to analyse their sub-system state and to supply expertise in case of anomalies.

In some specific cases (e.g., instrument failures, special operations), the ROC may also need support from the SOC and/or MOC; the MOC that stays in all cases the primary entity in charge of monitoring the instrument behaviour, from the information supplied in the instrument user manual.

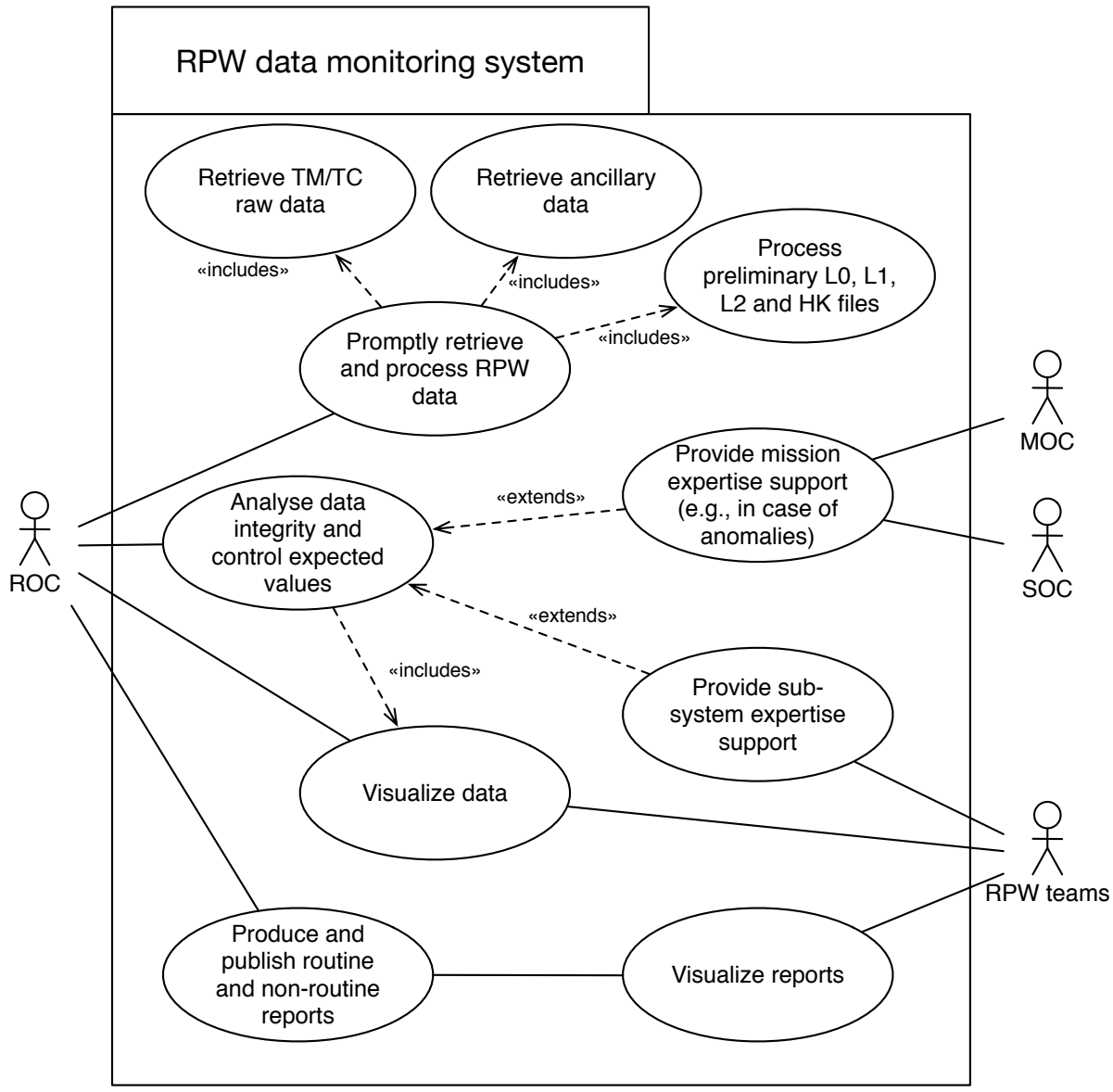

Figure 4. RPW data monitoring nominal use case.

In order to support the ROC team in the analysis of instrument data, the RODP shall implement the following workflows to perform primary automated survey of the incoming data flow:

- An event monitoring workflow to filter and report information by the on-board instrument via the "event reporting" TM packets.
- An HK/science data monitoring workflow, to report instrument status and science performance.

3.2.2 RPW Instrument Operation Request (IOR) creation, validation and submission

Figure 5 presents the use case to prepare and submit RPW IOR to the SOC, for science operations.

The Solar Orbiter operations planning concept is detailed in the "Mission Planning Concept" (MPC) [RD12].

Main inputs required to prepare the science operations shall be provided by the SOC via its GFTS interface. It concerns namely: Ancillary files [RD10] , Enhanced-Flight Events and Communication Skeleton (E-FECS) [RD13], Telemetry Corridor (TMC) [RD14], power allocation corridor (TBC) and Soopkitchen export files [RD?].

These SOC-provided operations inputs will be delivered for each Medium Term Planning (MTP) corresponding to an orbit (~6 months). The payload teams will then prepare their IOR, in agreement with the science objectives and mission constraints (i.e., orbits/attitude, S/C rolls, EMC and resource allocations, etc.) defined at the Long Term Planning (MTP) level.

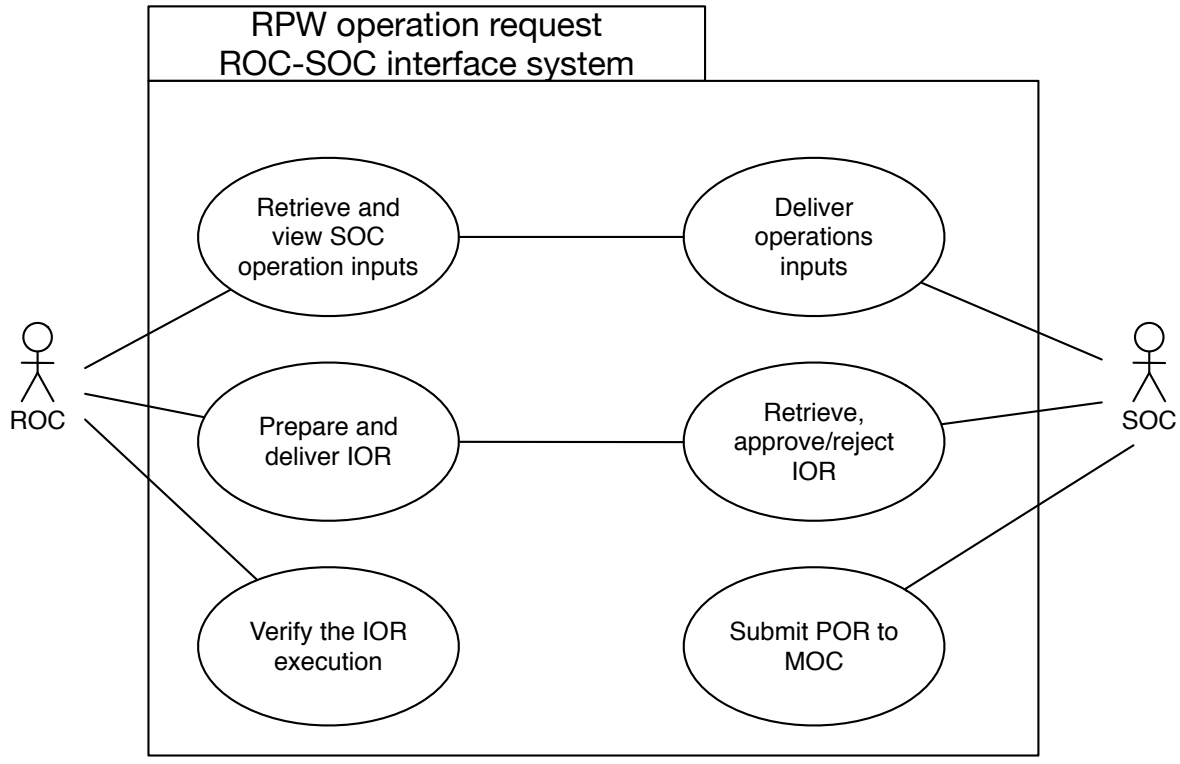

Figure 5. RPW operation requests ROC-SOC interface nominal use case.

The use case will have the following steps:

1. The SOC delivers to the ROC via the GFTS the operations inputs relative to a given MTP cycle, covering ~6-month orbit. The delivery will be done 6 months prior to the MTP-cycle start, in agreement with LTP.
2. The ROC retrieves and makes visible the operations inputs.
3. The ROC prepares and generates a first set of STP IORs for the MTP cycle
4. The RPW MTP IORs are delivered to the SOC via the GFTS mechanism.
5. The SOC will then perform a first validation of the IORs and check that they are consistent with the mission operations timeline and constraints. The SOC can reject the IORs if the requirements are not met.

6. From this first set of MTP IORs, the ROC will then refine and submit every week final IORs for each STP cycle[1]. In the same time, the ROC will check that the sequences of TC have been correctly executed on-board.
7. IORs will be converted by the SOC into Payload Operation Requests (POR) and send with the expected additional inputs (e.g., orbit/attitude data request) to the MOC.

3.2.3 RPW flight procedures and Payload/Memory Direct Operation Request (PDOR/MDOR) creation, validation and submission

The interface between ROC and MOC concerning the operations concerns two activities:

- Producing and delivering the RPW flight procedures to the MOC. Furthermore, the procedures are reported into the Flight Operations Plan (FOP) [RD5], after validation and acceptation by the MOC. Besides, the MOC will extract sequences written inside the procedures and insert them into its Mission information Base (MiB). A copy of the operational MiB is delivered to the ROC. This copy shall be used to generate the IOR.
- In the case of special operations, the ROC shall directly deliver the operation requests to the MOC, via its GFTS interface and in the expected MDOR/PDOR format. This interface shall be only used for these special operation requests.

N.B.:

- The MDOR shall be built by ROC from memory patch commands provided by the RPW flight software team.
- In both flight procedures and MDOR/PDOR submission processes, the ROC shall support the capability of performing verification tests prior to delivery, by running the sequences of TCs with a representative enough instrument model available on-ground. In this specific case, resulting RPW TM data will have to be analysed using the ROC-SGSE facilities.

[1] During the NMP, a STP covers approx. a week of operations. The duration may be longer during the cruise phase.

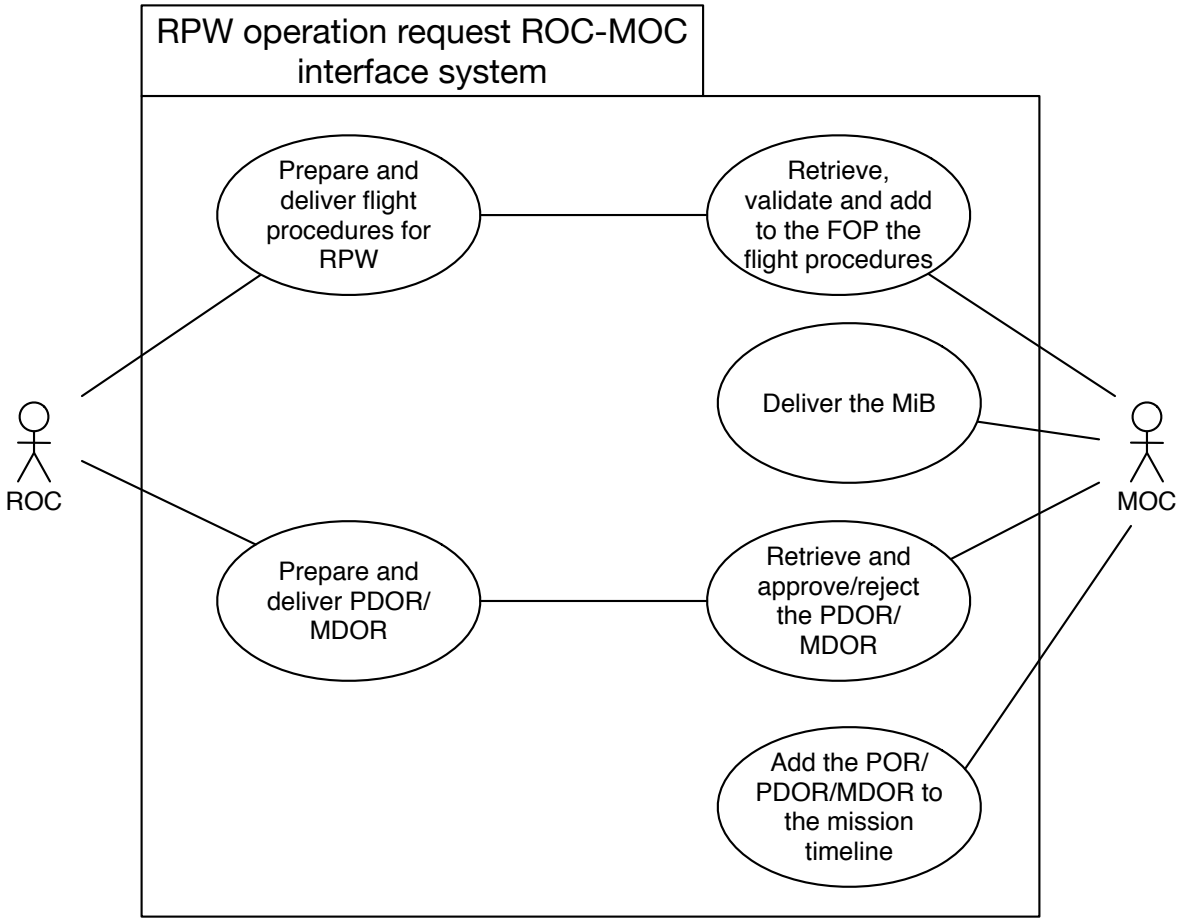

Figure 6. RPW operation request ROC-MOC interface system.

Note the both IOR and MDOR/PDOR shall be generated using the sequences stored in the operational MiB provided by the MOC.

3.2.4 Selected Burst Modes (SBM) event data selection

Figure 7 shows the nominal use case about the SBM event data selection for RPW. The ROC shall support the capability of view and select SBM events data to downlink every STP.

The main steps for the SBM selective downlink life-cycle is:

1. As soon as they are available via the MOC DDS, the LLD packets for each instrument are processed at SOC to produce LL01, LL02 and LL03 data. Especially, the RPW LLD contains, among other, the list of SBM1/SBM2 events detected on-board
2. The SOC will make available via its dedicated LL Web page, the LLD. Especially, summary plots at LL03 will be generated to support, among others, the ROC and in-situ teams in the selection of the SBM event to downlink.
3. In the same time, the ROC will publish the list of detected SBM events on-board in its dedicated MUSIC interface. In practice, the complete list of events, including downlinked, will have to be accessible from this interface.
4. From the SOC LL Web page, MUSIC interface and any extra value-added data, the RPW Operations Board (ROB) will select the SBM1/SBM2 events data to downlink.
5. The request of SBM events data to downlink will be sent to the SOC by the ROC. The request will have to be validated by the RPW ground segment project manager before

submission (TBC). The interface to be implemented by the ROC to request for SBM data is not known in details yet. Nevertheless, after validation, the system shall permit to accelerate the selection-to-request process, by automatically generating and submitting to the SOC the list of selected SBM event data in the expected format.

6. The SOC will then convert in the appropriate format and submit to the MOC, the request.
7. When available, the ROC will retrieve, process and distribute the selected SBM event data. Note that the data may require several passes to be fully downlinked.

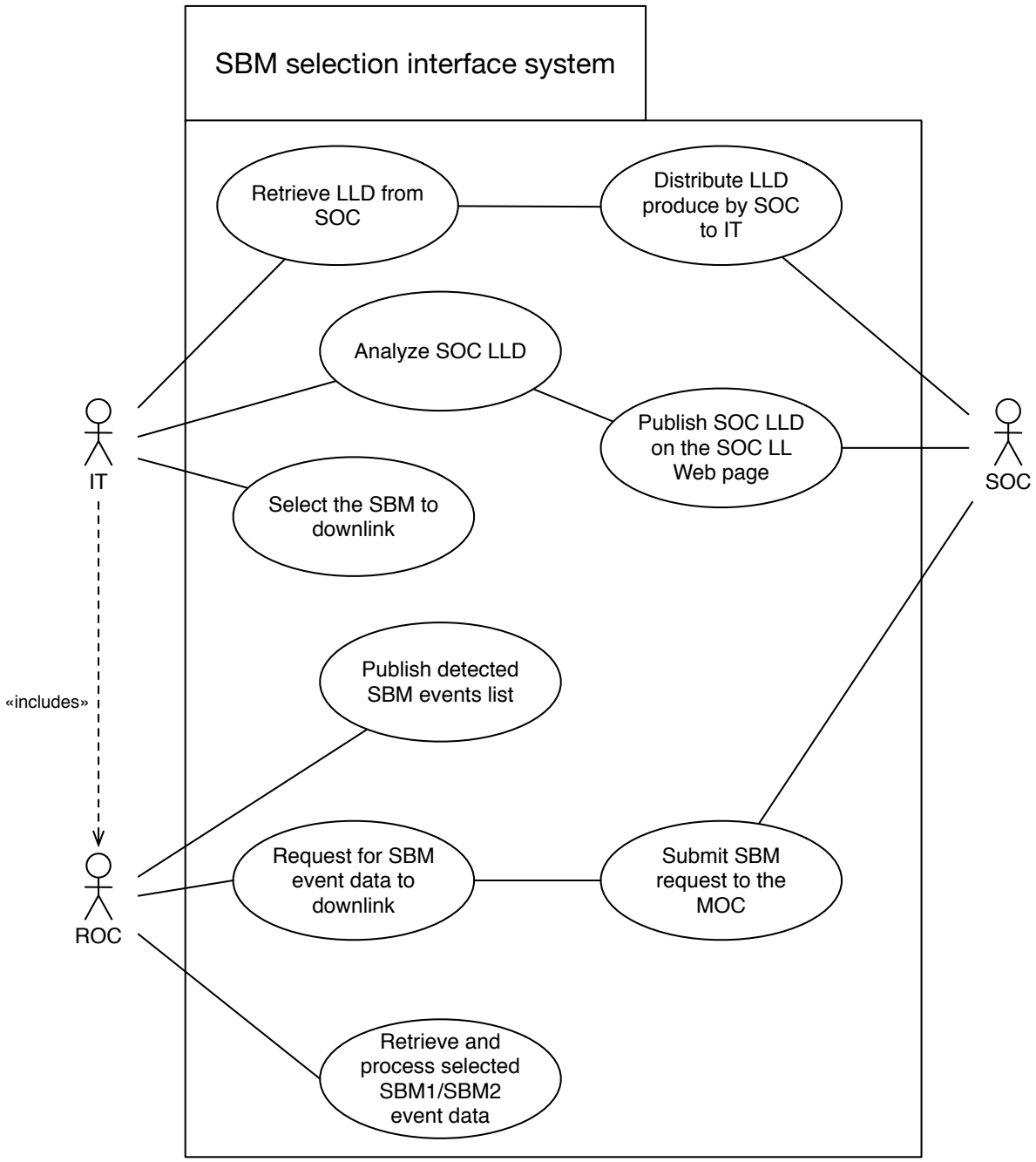

Figure 7. SBM event data selection nominal use case.

3.2.5 Instrument sequence execution test use cases

The following steps shall be followed to test the execution of one or more RPW TC sequence calls using the MUSIC and MEB GSE facilities. It is assumed here that the MEB GSE is up-and-running to run C-SGSE scripts on the instrument "spare" or "engineering" model on-ground.

1. Using MUSIC export the set of sequence to test as MEB GSE C-SGSE XML script file.
2. Import the C-SGSE script file into the MEB C-SGSE tool
3. Run the C-SGSE script
4. Validate the sequence calls by comparing with resulting TM/TC data flow

It must be noticed:

- The validation of the sequence calls can be done by comparing the results of the run (i.e., TC/TM output data flow) with the expected TC/TM defined in the sequence. The comparison should be realized in an automated way (e.g., MEB GSE assert checker tool).

4 MONITORING AND CONTROL SUBSYSTEM USER INTERFACE (MUSIC) USER REQUIREMENTS

4.1 Overview

The MUSIC application gathers graphical user interfaces (GUI) and command line interfaces (CLI) used by the ROC to:

- Visualize RPW data, via the MUSIC GUI component
- Prepare and submit instrument operation requests (IOR),
- Generate instrument command (TC) sequences inside flight procedures
- View the mission and instrument levels operation planning
- Select the SBM event data to downlink

The next sections list the user requirements related to the MUSIC components.

4.2 General user requirements

REQ-ROC-URD-0010	MUSIC GUI design	**Test**
The MUSIC GUI shall be a Web-based interface.		
MUSIC	**Implements:**	REQ-ROC-CIRD-0470 REQ-ROC-CIRD-0870

The MUSIC GUI should be at least accessible with the Firefox and Google Chrome Web browsers.

REQ-ROC-URD-0020	MUSIC accessibility	**Test**
MUSIC shall only reachable from the RPW PI-ship laboratory intranet.		
MUSIC	**Implements:**	REQ-ROC-CIRD-0470 REQ-ROC-CIRD-0870
It means that users must first login to the PI-ship laboratory intranet before view the MUSIC interface.		

REQ-ROC-URD-0030	MUSIC GUI user registration	**Test**
A user shall be registred in the MUSIC database in order to access to its GUI components. The registration form shall contain at least the following fields related to the user: - First name - Last name - Email address - Type of permission requested by the user for each MUSIC component tool: “observer”, “operator” or “no access” (default).		
MUSIC	**Implements:**	REQ-ROC-CIRD-0870
This mechanism should permit to identify the users as well as control their access and permissions to the MUSIC GUI components.		

REQ-ROC-URD-0040	MUSIC GUI user registration validation	**Test**
Any MUSIC GUI user registration request shall be validated by a ROC administrator before being effective.		
MUSIC	**Implements:**	REQ-ROC-CIRD-0870

REQ-ROC-URD-0050	Change the MUSIC GUI user permissions	**Test**
A ROC administrator shall be able to restrict users' access to all or part of the MUSIC application functionalities. Other users (observer/operator) shall not be able to change their access permissions.		
MUSIC	**Implements:**	REQ-ROC-CIRD-0870

REQ-ROC-URD-0060	MUSIC GUI main page	**Demo**
The MUSIC GUI shall have a main Web page where the users, registered or not, can: - Sign up (i.e., access to the registration form) - Sign in - Access to the MUSIC GUI functionalities - Contact the ROC support (i.e., webmaster) - Access to the ROC MUSIC GUI user manual - Check the version of MUSIC and the change log - Provide the status of MUSIC application (i.e., application is up-and-running, application is stopped for upgrades/bugs fixing) - Go to the RPW Web portail at LESIA and SOC Web interfaces (SOOPKitchen and LL Web page)		
MUSIC	**Implements:** ROC-REQ-CIRD-0420	
Additionaly, it could be useful to view news related to the application (i.e. upgrade will be performed in 2 days).		

4.3 RPW data visualisation user requirements

4.3.1 Context

MUSIC shall offer GUI to view the RPW data retrieved and processed by the ROC.

This GUI is not designed to perform fine analysis of RPW data, but to have a quick overview of instrument data and related events in support to the flight operations.

This component is dedicated to be used by the ROC team at LESIA first. Nevertheless an access should be also allowed to external people involved in the RPW ground segment activities, and more particularly the RPW instrument and science teams from other laboratories.

N.B. The SOC team will make available to the Solar Orbiter payload teams a Web page dedicated to the Low Latency data visualization.

4.3.2 Expected functionalities

4.3.2.1 General features

REQ-ROC-URD-0070	Select RPW data time range	**Test**
The MUSIC GUI shall allow users to select the RPW data to plot by filtering the start/end time.		
MUSIC	**Implements:** REQ-ROC-CIRD-0200	
It should be possible for users to set the start, end or duration of the time range.		

By default the MUSIC GUI should display the last 24 hours of RPW data downlinked on-ground, however a user should be able to modify the length of the time range.

An option should allow users to refresh in an automous way, the RPW data plots as soon as new data are available.

REQ-ROC-URD-0080	Flag RPW time synchronization	Test
The MUSIC GUI shall allow users to know when the RPW on-board time is not synchronized for a given measurement.		
MUSIC	**Implements:**	REQ-ROC-CIRD-0200

Additionaly, the MUSIC GUI should allow users to export a RPW data plot in the following formats:

- JPG

4.3.2.2 RPW science survey data visualization

4.3.2.2.1 General features

REQ-ROC-URD-0090	Plot RPW data by science survey submode	Test
The MUSIC GUI shall allow users to plot the science survey data for the following RPW science submodes: - SURVEY_NORMAL - SURVEY_BURST - SBM_DETECTION - SURVEY_BACKUP		
MUSIC	**Implements:**	REQ-ROC-CIRD-0200

REQ-ROC-URD-0100	Plot RPW calibration data	Test
The MUSIC GUI shall allow users to plot RPW data flagged as calibration.		
MUSIC	**Implements:**	REQ-ROC-CIRD-0200

REQ-ROC-URD-0110	Plot RPW science uncalibrated/calibrated survey data	Test
The MUSIC GUI shall allow users to plot the RPW uncalibrated (L1) or calibrated (L2) science data.		

MUSIC	**Implements:**	REQ-ROC-CIRD-0200

4.3.2.2.2 Plot RPW TDS science survey data

REQ-ROC-URD-0120	Plot RPW TDS science survey data	**Test**
The MUSIC GUI shall allow users to plot the following specific TDS science survey data for a given time range: - Regular Waveform Snapshots (E+B) - Triggered Waveform Snapshots (E+B) - 1D histograms - 2D histograms - Low rate information - Dust statistics - LFR redundancy mode data (when available)		
MUSIC	**Implements:**	REQ-ROC-CIRD-0200

4.3.2.2.3 Plot RPW LFR science survey data

REQ-ROC-URD-0130	Plot LFR science survey data	**Test**
The MUSIC GUI shall allow users to plot the following LFR data for a given time range: - Snapshots waveforms: - V, E1, E2, B1, B2, B3 of a given frequency f0, f1 or f2 at the same time or separately. - Snapshots waveforms should be displayed for a given time range and in TM units - Continuous waveforms: - V, E1, E2, B1, B2, B3 of a given frequency f1, f2 or f3 at the same time or separately. - Continuous waveforms should be displayed for a given time range and in TM units. - Average spectral matrices (ASM): - Values in TM and physical units - Possibility to plot frequency spectra (up to 9 elements of the matrix amongst 25 on the same window to be chosen by user). - Possibility to plot color dynamical spectra: all frequencies (from f0, f1 and f2) for a given time range and for up to 9 elements of the matrices. - Basic parameters (BP): - For BP2, same as ASM - For BP1, same as ASM applied to the de-commuted BP1 parameters (11 max.): PE, PB,		

NVEC_V0/V1/V2, ELLIP, DOP, SX, SX_Arg, VPHI, VPHI_Arg. - LFR waveforms versus TDS waveforms: - TDS "Low frequency mode" parameters (TC_TDS_LOAD_LFM_PAR) - It shall be able to combine LFR and TDS "low frequency mode" waveforms, cross and power spectrum plots (TM_TDS_SCIENCE_LFM_*) for a given time range overlayed on same graph/window.
MUSIC — **Implements:** REQ-ROC-CIRD-0200
It could be useful to be able to overlay snapshots and continuous waveforms of the different frequencies (f0, f1, f2 and f3).

4.3.2.2.4 Plot RPW TNR-HFR science survey data

REQ-ROC-URD-0140	Plot TNR science survey data	**Test**
The MUSIC GUI shall allow users to plot the following TNR data for a given time range: - AGC values as a function of time. - Auto-correlation and cross-correlation values as a function of time for a given frequency range. - - If more than one time series are found in the frequency range, it shall be able to plot the individual data curves, an integrated curve or the maximal values. - Auto-correlation and cross-correlation values as a function of frequency for a given time range. If more than one spectrum are in the time range, it shall be able to plot individual data curves, an integrated curve, or max. - Auto-correlation and cross-correlation values as functions of time and frequency (i.e., dynamical spectrum). - Phase in degrees as a function of frequency. - Moreover, it shall be able to display AGC, auto and cross–correlation values in TM units (i.e., L1) or calibrated values (i.e., L2) if possible. Time shall be given in count since the beginning of the test or in seconds and frequency in kHz. - It shall be possible to plot TNR data for one or both channels (1 and 2) on the same plot and for each receiver band (A, B, C and D).		
MUSIC — **Implements:** REQ-ROC-CIRD-0200		

REQ-ROC-URD-0150	Plot HFR science survey data	**Test**
The MUSIC GUI shall allow user to plot the following HFR data for a given time range: - AGC values as a function of time for a given frequency range. If more than one time series are found in the frequency range, it shall be able to plot individual data curves or an integrated curve. - AGC values as a function of frequency for a given time range. If more than one spectrum are found in the time range, it shall be able to plot individual data curves or an integrated curve. - AGC values as functions of time and frequency (i.e., dynamical spectrum). It shall be able to display AGC values in TM units or calibrated values (i.e., dB(V^2/Hz)) if possible. Time shall be given in count since the beginning of the test or in seconds and frequency in kHz. It shall be possible to plot HFR data for one or both channels (1 and 2) on the same plot and for each		

receiver band (HF1 and HF2).	
MUSIC	**Implements:** REQ-ROC-CIRD-0200

4.3.2.3 RPW specific data visualization user requirements

4.3.2.3.1 RPW snapshot data visualization user requirements

REQ-ROC-URD-0160	Plot RPW snapshot data	**Test**
The MUSIC GUI shall allow users to plot RPW data for a given snapshot only.		
MUSIC	**Implements:** REQ-ROC-CIRD-0200	

4.3.2.3.2 RPW BIAS data visualization user requirements

REQ-ROC-URD-0170	Plot Bias sweeping data	**Test**
The MUSIC GUI shall allow users to plot RPW data for a given Bias sweeping only.		
MUSIC	**Implements:** REQ-ROC-CIRD-0200	

REQ-ROC-URD-0180	Plot Bias current data	**Test**
The MUSIC GUI shall allow users to plot RPW Bias unit current intensity data for a given time range.		
MUSIC	**Implements:** REQ-ROC-CIRD-0200	

4.3.2.3.3 RPW SBM data visualization user requirements

REQ-ROC-URD-0190	Plot RPW SBM1 event data	**Test**
The MUSIC GUI shall allow user to plot RPW data for a given SBM1 event only.		
MUSIC	**Implements:** REQ-ROC-CIRD-0200	

REQ-ROC-URD-0200	Plot RPW SBM2 event data	**Test**
The MUSIC GUI shall allow users to plot RPW data for a given SBM2 event only.		
MUSIC	**Implements:** REQ-ROC-CIRD-0200	

4.3.2.4 RPW engineering data visualization

4.3.2.4.1 Plot RPW HK parameters

REQ-ROC-URD-0210	Plot HK parameter	Test
The MUSIC GUI shall allow users to plot RPW HK parameters for a given time range.		
MUSIC	**Implements:**	REQ-ROC-CIRD-0200 REQ-ROC-CIRD-0340

It should be possible to display HK parameters using graphical or tabular views.

4.3.2.4.2 Display RPW telemetry (TM) packet data

REQ-ROC-URD-0220	Display RPW TM downlinked packets list	Test
The MUSIC GUI shall allow users to display the list of RPW TM downlinked packets, as a table, with the following columns: - Packet count, sequence number of the packet, related to the DAS packet counter. - Packet index. First 7 characters of the packet ROC ID in the MDB. - Packet reception time – It must be the reception local time of the TM. (The format is "YYYY-MM-DD HH:MM:SS.FFF".) - Packet creation time – It must be the on-board TM packet creation time (The format is "YYYY-MM-DD HH:MM:SS.FFF".) - Packet time synchronization flag - Packet APID – Apid of the packet - Packet name – human-readable name of the packet - Packet processing status – One of the following TM statuses: "Received" (received by the ROC), "Validated" (packet integrity and identification validated), "Corrupted" (packet content is partially or fully corrupted), "Processed" (packet data has been processed correctly)		
MUSIC	**Implements:**	REQ-ROC-CIRD-0200 REQ-ROC-CIRD-0340

By default, the TMs sould be sorted by decreasing packet creation time (i.e., most recent TM at the top of the list).

In the case where a packet has been identified but the content is corrupted (i.e., partially corrupted), all columns should be provided, but the status should be set to "Corrupted".

In the case where a packet cannot be identified (i.e., fully corrupted), only the packet count, index, reception time and status - with "Corrupted" value - columns should be provided.

REQ-ROC-URD-0230	Display RPW TM packet content	Test
The MUSIC GUI shall allow a user to view the content of a given TM packet, including the binary/human-readable values of scalar parameters. It is not needed to view the content of the block parameters.		
MUSIC	**Implements:**	REQ-ROC-CIRD-0200
It should be possible to view raw or engineering values.		

4.3.2.4.3 Display RPW command (TC) packet data

REQ-ROC-URD-0240	Display RPW TC uplinked packets list	Test
The MUSIC GUI shall allow an user to display the list of uplinked RPW TC packets, as a table with the following columns: - Packet count, sequence number of the packet. - Packet index. First 7 characters of the packet ROC ID in the MDB. - Packet submission time – It must be the submission local time of the TC. (The format is "YYYY-MM-DD HH:MM:SS.FFF".) The submission local time corresponds to the time when the corresponding operation request file has been sent to the SOC/MOC. - Packet execution time – It must be the on-board TC packet execution time in UTC. (The format is "YYYY-MM-DD HH:MM:SS.FFF".) - Packet APID – Apid of the packet - Packet name – human-readable name of the packet - Packet processing status – Status from the corresponding Service 1 (S1) TM (accepted/executed)		
MUSIC	**Implements:**	REQ-ROC-CIRD-0200 REQ-ROC-CIRD-0340

By default, the TCs shall be sorted by decreasing packet execution time (i.e., last executed packets at the top of the list).

REQ-ROC-URD-0250	Display TC packet content	Test
The MUSIC GUI shall allow a user to view the content of a given TC packet, including the binary/human-readable values for scalar parameters. It is not needed to view the content of the block parameters.		
MUSIC	**Implements:**	REQ-ROC-CIRD-0200
It should be possible to view raw or engineering values.		

It should be also helpful for users to have link the TC with the related operation request and planning (e.g., IOR, STP/MTP) using the unique ID mechanism.

4.3.2.4.4 Display instrument general and sub-systems status

REQ-ROC-URD-0260	Display instrument status	Test
The MUSIC GUI shall allow an user to display the instrument general and sub-systems status for a given time range. It concerns the parameters listed in the Table 1.		
MUSIC	**Implements:** REQ-ROC-CIRD-0200 REQ-ROC-CIRD-0340	
The MUSIC GUI should allow users to overplot more than one instrument general and sub-system status parameter on the same figure.		

Parameter name	Possible values
DPU Status	
Active DPU	Nominal, Redundant
Active SW	DBS, DAS
DBS SW Version	
DAS SW Version	
FPGA Version	
Current Mode	
Compr.	ON, OFF
Reset cause	
DAS Sw Addr	Unknown, RAM, EEPROM1, EEPROM2
Boot Addr. LFR	Not booted, RAM, EEPROM1, EEPROM2
Boot Addr TDS	Not booted, RAM, EEPROM1, EEPROM2
Boot Addr THR	Not booted, RAM, EEPROM1, EEPROM2
DAS Config in EEPROM	Missing, OK, Corrupted
BIAS Calib	
DPU Recovery	ON, OFF
DPU Anomalies statistics	
Anomalies count - Low	
Anomalies count - Medium	
Anomalies count - High	
Last error - Code	
Last error - RID	
Last error - Time	
Sub-Systems State	
THR – Hear beat	ON, OFF
THR – Link Err.	ON, OFF
THR – Transp. Mode	ON, OFF
LFR – Hear beat	ON, OFF
LFR – Link Err.	ON, OFF
LFR – Transp. Mode	ON, OFF
TDS – Hear beat	ON, OFF

TDS – Link Err.	ON, OFF
TDS – Transp. Mode	ON, OFF
BIAS – Hear beat	ON, OFF
BIAS – Link Err.	ON, OFF
PDU – Hear beat	ON, OFF
PDU – Link Err.	ON, OFF
TM Statistics	
DPU - SSMM	
DPU - OBC	
LFR – w/o SBM	
LFR - SBM	
TDS – w/o SBM	
TDS - SBM	
THR – w/o SBM	
Link Status	
LVDS Status – THR/LFR	
LVDS Status – TDS/BIAS	
SiS Status - PDU	
SiS Status - BIAS	
SpW Links – Link S/C - Enable	
SpW Links – Link S/C - State	
SpW Links – Link S/C – Rx Max	
SpW Links – Link S/C – Tx Max	
SpW Links – Link THR - Enable	
SpW Links – Link THR - State	
SpW Links – Link THR – Rx Max	
SpW Links – Link THR – Tx Max	
SpW Links – Link TDS - Enable	
SpW Links – Link TDS - State	
SpW Links – Link TDS – Rx Max	
SpW Links – Link TDS – Tx Max	
SpW Links – Link LFR - Enable	
SpW Links – Link LFR - State	
SpW Links – Link LFR – Rx Max	
SpW Links – Link LFR – Tx Max	
DPU Statistics	
CPU load – Max.	
CPU Load Ave.	
S/C TX FIFO Rate Ave	
DPU Elapsed Time	
Maximal FIFO Size - TC	
Maximal FIFO Size - COMP	
Maximal FIFO Size – HK TM	

Maximal FIFO Size – SVY TM	
Maximal FIFO Size – OBC TM	
Maximal FIFO Size – SBM TM	
PDU Cmd/TM Counters	
Cmd (Write)	
Cmd (Failed)	
Telem. (Read)	
PDU Primary Power	
Voltage - Primary	
Voltage - Heater	
Current - Primary	
Current - Heater	
PDU Temperature	
Temp1	
Temp2	
PDU Power / Overcurrent	
CONV – Power On/Off	ON, OFF
SCM – Power On/Off	ON, OFF
ANT1 – Power On/Off	ON, OFF
ANT2 – Power On/Off	ON, OFF
ANT3 – Power On/Off	ON, OFF
BIAS – Power On/Off	ON, OFF
TNR/HFR – Power On/Off	ON, OFF
LFR – Power On/Off	ON, OFF
TDS – Power On/Off	ON, OFF
SCM – Over Current	ON, OFF
ANT1 – Over Current	ON, OFF
ANT2 – Over Current	ON, OFF
ANT3 – Over Current	ON, OFF
BIAS – Over Current	ON, OFF
TNR/HFR – Over Current	ON, OFF
LFR – Over Current	ON, OFF
TDS – Over Current	ON, OFF
BIAS Mode	
Version	
ActiveLink	
HV	
BIAS 1	
BIAS 2	
BIAS 3	
Diff. Probe 1	
Diff. Probe 2	
Diff. Probe 3	

Byp. Probe 1	
Byp. Probe 2	
Byp. Probe 3	
Multiplexer Set - Mode	
Multiplexer Set – BIAS_1	
Multiplexer Set – BIAS_2	
Multiplexer Set – BIAS_3	
Multiplexer Set – BIAS_4	
Multiplexer Set – BIAS_5	
Multiplexer Set – Operation	
BIAS Status	
Cmd Count	
Cur. Select. PAge	
Dummy	
AC Diff. gain	

BIAS Temperature	
ANT1	
ANT2	
ANT3	
PCB	
BIAS Saturation	
Probe 1	
Probe 2	
Probe 3	
BIAS Setting	
Probe 1	
Probe 2	
Probe 3	
BIAS Voltage	
Reference - Ground	
Reference - +1.5V	
Reference - +2.5V	
High Voltage - -100V	
High Voltage - + 100V	
LFR Status	
Current Mode	
Reset Cause	
Watchdog	ON, OFF
Calibration	ON, OFF
Sw Version	
FPGA Version	
Gain	
LFR Configuration	
V	
E1_F0	
E1_F1	
E1_F2	
E1_F3	
E2_F0	
E2_F1	
E2_F2	
E2_F3	
LFR Temperature	
PCB	
SCM	
FPGA	
LFR SpW Links	
Enable	ON, OFF

State	ON, OFF
LFR TC Statistics	
TC Count – Update Info	
TC Count – Update Time	
TC Count – Exe Tc	
TC Count – Rejected TC	
Last Executed TC - ID	
Last Executed TC - Type	
Last Executed TC - SubType	
Last Executed TC - Time	
Last Rejected TC - ID	
Last Rejected TC - Type	
Last Rejected TC - SubType	
Last Rejected TC - Time	
LFR Anomalies statistics	
Anomalies Count - Low	
Anomalies Count - Medium	
Anomalies Count - High	
Last Error - Code	
Last Error -RID	
Last Error - Time	
TDS Status	
Current Mode	
Reset Cause	
Watchdog	ON, OFF
Calibration	ON, OFF
Sw Version	
FPGA Version	
TDS SpW Links	
SpW Links - Enable	ON, OFF
SpW Links - State	ON, OFF
TDS Configuration Status	
Common	ON, OFF
Normal	ON, OFF
Burst	ON, OFF
SBM1	ON, OFF
SBM2	ON, OFF
LFM	ON, OFF
TDS Snapshot Statistics	
Processed since last dump	
Q Factor - Min	
Q Factor - Max	
Valid snapshot in queue - Normal	

Valid snapshot in queue – SBM2	
TDS Temperature	
PCB	
FPGA	
SRAM	
TDS TC Statistics	
TC Count – Update Info	
TC Count – Update Time	
TC Count – Exe Tc	
TC Count – Rejected TC	
Last Executed TC - ID	
Last Executed TC - Type	
Last Executed TC - SubType	
Last Executed TC - Time	
Last Rejected TC - ID	
Last Rejected TC - Type	
Last Rejected TC - SubType	
Last Rejected TC - Time	
TDS Anomalies statistics	
Anomalies Count - Low	
Anomalies Count - Medium	
Anomalies Count - High	
Last Error - Code	
Last Error -RID	
Last Error - Time	
THR Status	
Current Mode	
Reset Cause	
Watchdog	ON, OFF
Calibration	ON, OFF
Sw Version	
FPGA Version	
THR Anomalies statistics	
Anomalies Count – Low	
Anomalies Count – Medium	
Anomalies Count – High	
Last Error - Code	
Last Error - RID	
Last Error - Time	
THR Temperature	
PCB	
FPGA	
ANT1	

ANT2	
ANT3	
THR TC Statistics	
TC Count – Update Info	
TC Count – Update Time	
TC Count – Exe Tc	
TC Count – Rejected TC	
Last Executed TC - ID	
Last Executed TC - Type	
Last Executed TC - SubType	
Last Executed TC - Time	
Last Rejected TC - ID	
Last Rejected TC - Type	
Last Rejected TC - SubType	
Last Rejected TC - Time	
THR SpW Links	
Enable	ON, OFF
State	ON, OFF
THR Voltage	
Power supply voltage 1	
Power supply voltage 2	
Power supply voltage 3	

Table 1. Instrument status parameters.

Additionaly, it should be possible to export the instrument status parameters in XML format files.

4.3.2.4.5 Display instrument packet statistics

REQ-ROC-URD-0270	Display statistics data	**Test**
The MUSIC GUI shall allow an user to view the following statistics parameters: - TM total count number - TM count number since last counter reset on-board - Received/validated/corrupted/processed TM total count number - Received/validated/corrupted/processed TM count number since last counter reset on-board - TC total count number - TC failed (acceptance)/failed (execution) total count number - These parameters can be viewed over all the TM/TC, but it shall also be possible to see statistics for a given TM/TC or by category (e.g., Low/medium/high event reporting TM).		
MUSIC	**Implements:**	REQ-ROC-CIRD-0200 REQ-ROC-CIRD-0340

It should be possible for a user to display the statistics data in a table or using histograms.

The MUSIC GUI should allow users to export statistics data in one of the following file formats:

- CSV

4.3.2.4.6 Display RPW DAS events

REQ-ROC-URD-0280	Display RPW DAS event log	Test
The MUSIC GUI shall allow an user to view the log of RPW DAS events (CAT = 7, Type = 5) generated on-board since the first in-flight switch-on. The following information shall be provided for each event: - PUS date - RPW TM event packet name and SRDB ID - Event code - RPW TM event Packet description		
MUSIC	**Implements:**	REQ-ROC-CIRD-0200 REQ-ROC-CIRD-0340

REQ-ROC-URD-0290	Filter RPW DAS event log	Test
The MUSIC GUI shall allow an user to filter the log of RPW DAS events by: - PUS sub-type (progress / low failure / medium failure / high failure) - Event code - Start/end date - Day, week, month, trimester, semester		
MUSIC	**Implements:**	REQ-ROC-CIRD-0200 REQ-ROC-CIRD-0340

The MUSIC GUI should allow an user to export the RPW DPU software event log as:

- XML format files
- CSV format files

4.4 Flight procedure edition user requirements

4.4.1 Context

The MUSIC shall have a GUI dedicated to the edition of RPW flight procedures. Especially, the granularity of the editor shall allow an operator to generate one or more TC sequences for a given procedure.

Any TC sequence generated by the ROC team has to be submitted for validation to the MOC. After the validation process, a TC sequence is inserted into the MIB and used by the ROC team for the RPW instrument flight operations.

The validation and the insertion into the MIB of a new RPW TC sequence are performed by the MOC team, with the support of the ROC team. Each of these two steps can require several iterations between the teams. In consequence, the full process can take a long time before a new operational MIB, including the new RPW TC sequence, is released by the MOC.

4.4.2 Expected functionalities

4.4.2.1 General features

REQ-ROC-URD-0300	RPW TC sequence name uniqueness	**Test**
A given TC sequence shall be uniquely named in the MUSIC GUI.		
MUSIC	**Implements:** REQ-ROC-CIRD-0031	

A TC sequence in the MUSIC GUI should be associated with the following metadata:

- TC sequence name (used as an unique ID). Especially, the sequences delivered to the MOC shall be named with the expected convention [RD5].
- Procedure name (used as a sequence "folder" by the GUI). The name of the procedure shall be consistent with the associated TC sequences name [RD?].
- Short description – short description of the sequence
- Author (set automically to the login name by default)
- Creation local date/time (set automatically by the GUI at the sequence creation)
- Mode at start (can be left blank) – expected RPW software mode(s)/submode(s) at the sequence execution start
- Mode at end (can be left blank) -- expected RPW software mode(s)/submode(s) at the sequence execution end
- Config at start (can be left blank) – expected RPW configuration(s) at the sequence execution start
- Config at end (can be left blank) – expected RPW configuration(s) at the sequence execution end
- Comment (can be left blank) – Any additional comment. Especially, this field can be used by an operator to indicate the delivery status of the sequence (e.g., "tested on GSE", "sent to MOC, waiting for feedback", "validated by MOC", etc.)

4.4.2.2 Handle RPW TC sequences

REQ-ROC-URD-0310	Create RPW TC sequence	Test
The MUSIC GUI shall allow an operator to create a new TC sequence.		
MUSIC	**Implements:**	

REQ-ROC-URD-0320	Import TC sequences	Test
An operator shall be able of importing a MOIS importer Excel format file [AD6] containing a RPW TC sequence via the MUSIC GUI.		
MUSIC	**Implements:**	
As decided with the MOC, the MOIS importer Excel format is now used to deliver sequence files instead of procedures.		

It should be also possible for an operator to import a MEB C-SGSE "TC script" XML file via the MUSIC GUI.

REQ-ROC-URD-0330	Select TC sequence IDB version	Test
The MUSIC GUI shall allow an operator to select the RPW IDB source/version to be applied when the sequence is created or imported for the first time.		
MUSIC	**Implements:**	
In operations, MUSIC should always propose the MIB version working at MOC as the default version.		

REQ-ROC-URD-0340	Save TC sequence	Test
The MUSIC GUI shall allow an operator to save a TC sequence into the MUSIC database.		
MUSIC	**Implements:**	

REQ-ROC-URD-0350	View TC sequence content	Test
The MUSIC GUI shall allow users to view the content of a TC sequence already saved in the MUSIC database.		
MUSIC	**Implements:**	

REQ-ROC-URD-0360	Delete TC sequences	Test

The MUSIC GUI shall allow an operator to delete a TC sequence saved in the database.	
MUSIC	**Implements:**
MUSIC should ask to the operator to confirm before doing the sequence deletion.	

REQ-ROC-URD-0370	Export TC sequences in MOC format	**Test**
The MUSIC GUI shall allow a user to export as a MOIS importer Excel format file [AD6], a TC sequence saved in the MUSIC database.		
MUSIC	**Implements:** REQ-ROC-CIRD-0310	

REQ-ROC-URD-0371	Export TC sequences for MEB GSE format	**Test**
The MUSIC GUI shall allow a user to export as a MEB C-SGSE "TC script" format file [RD16], a TC sequence saved in the MUSIC database.		
MUSIC	**Implements:** REQ-ROC-CIRD-0320	

Additionaly, it shall be possible to export TC sequence in the following formats:

- CSV format files
- C-SGSE "TC script" XML files

REQ-ROC-URD-0380	Duplicate TC sequence	**Test**
The MUSIC GUI shall allow an operator to duplicate of an existing TC sequence. The copy shall be considered as a new TC sequence with its own name.		
MUSIC	**Implements:**	

REQ-ROC-URD-0390	Lock/unlock TC sequences	**Test**
The MUSIC GUI shall allow an operator to lock/unlock the sequences she/he has created. When a sequence is locked, other operators shall not be able to modify or delete it. (Nevertheless it shall be still possible to duplicate it, in order to create a new sequence). A ROC administrator can unlock/lock a TC sequence if required.		
MUSIC	**Implements:**	

TC sequences which have been delivered to the MOC shall be systematically locked.

REQ-ROC-URD-400	View RPW TC sequences list	**Test**
The MUSIC GUI shall allow users to view the list of RPW TC sequences already saved in te database.		
MUSIC	**Implements:** REQ-ROC-CIRD-0031	

4.4.2.3 Edit RPW TC sequences

REQ-ROC-URD-410	Edit TC sequence	**Test**
The MUSIC GUI shall allow an operator to edit a TC sequence that is not locked. The edition consists of adding/removing/editing TC sequence statements.		
MUSIC	**Implements:**	

REQ-ROC-URD-420	Edit TC sequence metadata	**Test**
The MUSIC GUI shall allow an operator to edit the metadata of unlocked TC sequences.		
MUSIC	**Implements:**	

REQ-ROC-URD-430	Change TC sequence IDB version	**Test**
The MUSIC GUI shall allow an operator to change the RPW IDB source/version of a given TC sequence.		
MUSIC	**Implements:**	
MUSIC should ask to the operator to confirm before doing the IDB version change.		

A alert message with confirmation should be displayed to alert the user when changing the IDB.

4.4.2.4 Check RPW TC sequences

REQ-ROC-URD-440	Check TC sequences	**Test**
The MUSIC GUI shall allow an operator to check if a given TC sequence is compliant with the expected specification.		

The check process shall at least include: - sequence and associated procedure names compliance with the MOC convention [RD5]. - sequence TC parameters values consistency w.r.t. to the associated IDB source/version: value range and format	
MUSIC	**Implements:**

4.5 Operation request edition user requirements

4.5.1 Context

The MUSIC GUI shall support the ROC operator when creating and submitting the RPW IOR [RD6] to the SOC during the mission.

A IOR basically consists of a timeline populated with TC sequences. In the MUSIC GUI framework, this timeline is labelled as a scenario.

A scenario is associated at least with the following metadata:

- A validity time range
- A scenario ID, unique in the system

And possibly:

- A date of creation
- An author
- A version
- List of TC sequence calls (empty at the sequence creation)
- Scenario status (“created”, “submitted”, “rejected”, “accepted” (TBC), “executed” (TBC)).
- locked/unlocked status
- Associated mission-level planning cycles (MTP/STP)
- Tag (e.g., IOR, PDOR, C-SGSE)
- Comment (can be left blank)

Additionally, MUSIC shall also permit to export scenarios as:

- PDOR for special operations with the MOC.
- RPW TC script files, which can be imported into and run with the MEB GSE C-SGSE tool.

Concerning flight software updates, expected memory patch commands shall be provided by the RPW flight software team to the ROC, which will then convert these commands into MDOR.

4.5.2 Expected functionalities

4.5.2.1 General features

REQ-ROC-URD-0450	Scenario uniqueness	Test
A scenario shall be uniquely named in the MUSIC GUI.		
MUSIC	**Implements:**	

4.5.2.2 Handle RPW scenarios

In practice the operation request timeline is populated with TC sequence calls. The way the TC sequences are inserted and the operations are requested depends of the mission planning and the related point of contact. In the nominal case, the operation requests are delivered to the SOC as IOR files at the MTP and STP cycle planing levels. In case of special operations, operations requests shall be sent to MOC as PDOR files. In both cases, building the RPW operations timeline is not straightforward and the MUSIC GUI shall let the possibility to define several scenarios of operations planning before delivering a single resulting scenario.

REQ-ROC-URD-0460	Create new scenario	Test
The MUSIC GUI shall allow an operator to create a new scenario.		
MUSIC	**Implements:**	

REQ-ROC-URD-0470	Lock/unlock scenario	Test
The MUSIC GUI shall allow an operator to lock/unlock a scenario she/he has created. (An operator cannot lock/unlock a scenario created by another person.)		
MUSIC	**Implements:**	

REQ-ROC-URD-0480	Save scenario	Test
The MUSIC GUI shall allow an operator to save a scenario into the MUSIC database.		
MUSIC	**Implements:**	

REQ-ROC-URD-0490	Delete scenario	Test

The MUSIC GUI shall allow an operator to delete an existing scenario, only if it is not locked.	
MUSIC	**Implements:**

REQ-ROC-URD-0500	Duplicate scenario	**Test**
The MUSIC GUI shall allow an operator to copy an existing scenario. In this case the duplicated scenario shall be seen as a new one with its own name.		
MUSIC	**Implements:**	

This feature is helpful to generate multiple scenarios for a given planning. But also, if an operator wants to create a new scenario from a scenario already played in a previous planning cycle.

Additionaly, the MUSIC GUI should allow an operator to:

- Split a scenario into two scenarios
- Insert a scenario into another one. The GUI shall stop the insertion and notify the operator if a conflict is found (i.e., incompatible scenarios).
- Merge scenarios. The GUI shall stop the insertion and notify the operator if a conflict is found (i.e., incompatible scenarios).

REQ-ROC-URD-0510	View scenarios	**Test**
The MUSIC GUI shall allow users to view the list of saved scenarios.		
MUSIC	**Implements:**	

REQ-ROC-URD-0520	Search scenario	**Test**
The MUSIC GUI shall allow an user to search saved scenarios by: - scenario name - validity time range (start and/or end time)		
MUSIC	**Implements:**	

Additionally, it should be possible to filter scenarios by:

- creation date
- mission planning cycle number (STP/MTP)

- author
- scenario tag
- scenario status

Especially, the scenario status and tag search filters should help the user to easily retrieve the list of already submitted scenarios as IOR or PDOR to the SOC or MOC.

REQ-ROC-URD-0530	View scenario content	**Test**
The MUSIC GUI shall allow users to view the content of a saved scenario, i.e., the scenario timeline and related metadata.		
MUSIC	**Implements:**	

4.5.2.3 Edit RPW scenarios

REQ-ROC-URD-0540	Edit scenario timeline	**Test**
The MUSIC GUI shall allow an operator to edit a scenario that has not been locked. The edition of a scenario shall consist of building its timeline with instrument TC sequence calls. The values of the formal parameters shall be set at this stage. A given sequence calls in the timeline shall always be associated to a scenario.		
MUSIC	**Implements:**	

In the case of PDOR and C-SGSE TC scripts, it shall be also possible to insert TC in the scenario timeline.

REQ-ROC-URD-0550	Edit scenario metadata	**Test**
The MUSIC GUI shall allow an operator to edit the metadata of an unlocked scenario.		
MUSIC	**Implements:**	

The MUSIC GUI should allow an operator to filtering TC sequences to insert into a scenario timeline by:

- Sequence name
- Sequence origin (e.g., working MIB)

It should be possible for an operator to view only working MIB TC sequences.

Moreover, the following filters should be also available:

- Parent procedure name
- Sequence category
- Sequence tags

REQ-ROC-URD-0560	Check scenario	**Test**
The MUSIC GUI shall allow an operator to check the compliance of a scenario related to IOR, MDOR or PDOR specification.		
MUSIC	**Implements:**	
It should be an option that can be deactivated by the operator if required.		

4.5.2.4 Create RPW IOR

REQ-ROC-URD-0570	Export IOR	**Test**
It shall be possible for an operator to export a scenario as IOR files from the MUSIC GUI.		
MUSIC	**Implements:**	REQ-ROC-CIRD-0220 REQ-ROC-CIRD-0260

REQ-ROC-URD-0580	Import IOR	**Test**
It shall be possible for an operator to import IOR files as a new scenario from the MUSIC GUI.		
MUSIC	**Implements:**	

4.5.2.5 Create RPW PDOR

REQ-ROC-URD-0590	Export PDOR	**Test**
It shall be possible for an operator to export a scenario as PDOR files from the MUSIC GUI.		
MUSIC	**Implements:**	REQ-ROC-CIRD-0290

REQ-ROC-URD-0600	Import PDOR	Test
It shall be possible for an operator to import PDOR files as a new scenario from the MUSIC GUI.		
MUSIC	**Implements:**	

4.5.2.6 Create RPW MDOR

REQ-ROC-URD-0610	Create RPW MDOR	Test
MUSIC shall allow an operator to create MDOR files for RPW.		
MUSIC	**Implements:**	REQ-ROC-CIRD-0300 REQ-ROC-CIRD-0640
The MDOR should be generated from the inputs (memory patch commands) provided by the RPW flight software team.		

4.6 Resource monitoring user requirements

4.6.1 Monitor RPW telemetry

REQ-ROC-URD-620	Compute predictive RPW telemetry volume	Test
MUSIC shall allow an operator to compute a predictive RPW telemetry volume for a given time range, based on the RPW instrument state model (ISM) bit rate estimation.		
MUSIC	**Implements:**	REQ-ROC-CIRD-0250

REQ-ROC-URD-630	Compute real RPW telemetry volume	Test
MUSIC shall allow an operator to compute a posteriori the real RPW telemetry volume for a given time range.		
MUSIC	**Implements:**	REQ-ROC-CIRD-0250

REQ-ROC-URD-640	Plot RPW telemetry volume	Test
MUSIC shall allow an operator to plot the predictive and/or real RPW telemetry volume for a given time range.		

MUSIC	**Implements:**	REQ-ROC-CIRD-0250

REQ-ROC-URD-650	Check Telemetry corridor	**Test**
MUSIC shall allow an operator to check the RPW accumulated telemetry data volume is inside the telemetry corridor (TMC) for a given time range.		
MUSIC	**Implements:**	REQ-ROC-CIRD-0250

REQ-ROC-URD-660	Check Telemetry corridor versus IOR	**Test**
MUSIC shall allow an operator to check the RPW accumulated telemetry data volume is inside the telemetry corridor (TMC) for a given set of IORs.		
MUSIC	**Implements:**	REQ-ROC-CIRD-0240

4.6.2 Monitor RPW power consumption

REQ-ROC-URD-670	Compute predictive RPW power consumption	**Test**
MUSIC shall allow an operator to compute a predictive RPW power consumption for a given time range, based on the RPW instrument state model (ISM) estimation.		
MUSIC	**Implements:**	REQ-ROC-CIRD-0250

REQ-ROC-URD-680	Compute real RPW power consumption	**Test**
MUSIC shall allow an operator to compute a posteriori the real RPW power consumption for a given time range.		
MUSIC	**Implements:**	REQ-ROC-CIRD-0250

REQ-ROC-URD-690	Plot RPW power consumption	**Test**
MUSIC shall allow an operator to plot the predictive and/or real RPW power consumption for a given time range.		
MUSIC	**Implements:**	REQ-ROC-CIRD-0250

REQ-ROC-URD-700	Compute RPW power consumption in IOR	Test
MUSIC shall allow an operator to compute the RPW power consumption for a given set of IORs.		
MUSIC	**Implements:** REQ-ROC-CIRD-0240	

4.7 Operation planning data visualization user requirements

4.7.1 Context

The MUSIC GUI shall allow users to view all the necessary data to establish the instrument operation planning. It concerns the operations input data provided by the SOC to prepare the mission planning, but also RPW-related data in support to the operations.

N.B. The SOOPKitchen tool [RD?] recently implemented by the SOC can potentially cover a part of the expected functionalities related to the RPW operation planning visualization. Especially, this tool tends to become the main interface for the Science Operations Working Group (SOWG) to discuss about the operations at mission level. Nevertheless the SOOPKitchen tool specification is not delivered yet by the SOC, hence, the user requirements related to the MUSIC GUI are not formaly listed at this stage.

4.7.1.1 SOC-provided operations input data

The SOC-provided operations input data gathers:

- Enhanced Flight Event Communication Skeleton (E-FECS) [RD?] -- the E-FECS files contain the mission planning cycles as well as events that impact the payload operations.
- Observation timeline at both RPW and payload levels, as provided by SOC via the SOOPKitchen tool export data [RD?].

Additionaly, the GUI shall support the visualization of the following resource allocation data:

- Telemetry corridor (TMC) [RD?] -- The telemetry corridor is a maximum and minimum curve of allocated cumulative telemetry downlink through the ~six month planning period. Providing an instrument team maintains their data-production between the maximum and the minimum curves then their data-return can be considered guaranteed.

4.7.1.2 RPW-related operations input data

It concerns the following data:

- Real telemetry bit rate
- Real power consumption (TBC)
- SBM1/SBM2 selected/downlinked event list (TBC)

4.7.2 Expected functionalities

4.7.2.1 Display RPW-related operations data

The MUSIC GUI shall allow users to browse inside the operation planning as a calendar or a timeline.

It shall be possible to select a given day to see related operation planning.

It shall be possible to filter data to display (i.e., E-FECS, SOOPKitchen and RPW SBM1/SBM2 events)

It shall be possible to display data as a table or on a timeline for a given time range.

4.8 SBM event data selection user requirements

4.8.1 Context

The MUSIC GUI shall allow pre-defined users to view and select the SBM1/SBM2 event data to downlink.

4.8.2 Expected functionalities

4.8.2.1 Display SBM1/SBM2 event detected on-board

REQ-ROC-URD-0710	Display SBM events list	**Test**
The MUSIC GUI shall allow a user to view the list of detected SBM events in a table with at least the following columns: - Sequence counter of the SBM event (shall be two different counters for SBM1 and SBM2 events) - Type of event (SBM1 or SBM2) - Date/time of detection on-board (in UTC by default, but switching to on-board time should be possible) - Quality factor value - Approximate duration before deletion (computed from the rank of the event in the SSMM buffer and the size of the buffer) (TBC) - Status (“available”, “downlinked”, “selected”, “deleted”, “partially downlinked”, “lost”) (TBC)		
MUSIC	**Implements:**	REQ-ROC-CIRD-0620

REQ-ROC-URD-0720	Display SBM1/SBM2 event summary information	**Test**
The MUSIC GUI shall allow a user to view following information for a given SBM event detected on-board: - Information displayed in the SBM events list - SBM event-related source_data parameters from the corresponding TM_DPU_EVENT_PR_DPU_SBM1 {YIW00304} packet for a SBM1 event and from TM_DPU_EVENT_PR_DPU_SBM2 {YIW00305} packet for a SBM2 event.		

MUSIC	**Implements:**	REQ-ROC-CIRD-0620

N.B. The plots of the Low Latency data used to support the selection of SBM1/SBM2 events will be available from the SOC LL Web page.

4.8.2.2 Select SBM1/SBM2 event data to downlink

REQ-ROC-URD-0730	Selecting SBM events	**Test**
The MUSIC GUI shall allow an operator to select the SBM event(s) to be downlinked.		
MUSIC	**Implements:**	REQ-ROC-CIRD-0280 REQ-ROC-CIRD-0620

The SBM event selection process should be only possible for a very restricted number of operators. Two operator should be a good number, in order to ensure the continuity in case of vacancy. In practice, these operators should be representative enough and choosen between the following people: ROC project manager, RPW PI, instrument scientist or the RPW Operations Board (ROB) leader.

5 RPW OPERATIONS AND DATA PIPELINE (RODP) USER REQUIREMENTS

5.1 Context

The RODP is the main data processing pipeline run by the ROC in order to produce RPW science/HK data files.

In principle, the ROPD is designed to work in an autonomous way, without human intervention, expect for maintenance.

Nevertheless, functionnalities can be implemented in support to the ROC activities.

5.2 Expected functionalities

5.2.1 Monitor RPW

5.2.1.1 Report RPW command execution status

REQ-ROC-URD-0740	Report RPW command execution status	**TBD**
The RODP shall provide every day to the RPW consortium a human-readable file reporting the status of RPW commands uplinked on-board. The file shall contain at least the following parameters: - The TC name and SRDB ID - The UTC date/time of execution - The Service 1 status (accepted/rejected/executed/failed)		
RODP	**Implements:**	REQ-ROC-CIRD-0350

	REQ-ROC-CIRD-0360 ROC-REQ-CIRD-0500 REQ-ROC-CIRD-0820

The RPW commands status report files shall be available through the restricted area of the ROC Web site, as soon as they have been produced by the RODP.

The RPW commands status report file format is described in [RD15].

N.B. The RPW commands status will be also available from the MUSIC GUI.

5.2.1.2 Report RPW equipment status

REQ-ROC-URD-0750	Report RPW system status	**TBD**
The RODP shall provide every day to the RPW consortium a human-readable file reporting the on-board status of the instrument equipment over time, including the software mode(s), equipment status and the loaded configuration(s). The file shall contain the parameters listed in the Table 1. The file shall updated as soon as a new RPW systems state has been confirmed.		
RODP	**Implements:**	REQ-ROC-CIRD-0340 REQ-ROC-CIRD-0360 REQ-ROC-CIRD-0820

The RPW state report file format is described in [RD15].

N.B. The RPW equipment status parameters will be also available from the MUSIC GUI.

5.2.1.3 Report RPW DPU status

REQ-ROC-URD-0760	Report RPW DAS events log	**Test**
The RODP shall provide every day to the RPW consortium a human-readable log file providing the list of RPW DAS events (CAT = 7, Type = 5) generated on-board since the first in-flight switch-on. The following information shall be provided for each event: - PUS date - RPW TM event packet name and SRDB ID - Event code - RPW TM event Packet description There shall be a single file for the whole mission. The file shall be updated as soon as new events have been retrieved.		
RODP	**Implements:**	REQ-ROC-CIRD-0340 ROC-REQ-CIRD-0500 REQ-ROC-CIRD-0640 REQ-ROC-CIRD-0820

The RPW DAS events log file format is described in [RD15].

REQ-ROC-URD-0770	Report RPW DPU update status	**Test**
The RODP shall provide to the RPW flight software teams inputs required to verify that a memory patch have been correctly performed on-board. Inputs shall include the CRF Response Files (CRR) [RD17] and TM/TC history report [RD9] from MOC.		
RODP	**Implements:**	REQ-ROC-CIRD-0370

5.2.1.4 Report RPW SBM1/SBM2 events

REQ-ROC-URD-0780	Report RPW SBM1/SBM2 events	**Test**
The RODP shall provide every week to the RPW consortium a human-readable file containing the list of the SBM1/SBM2 events: - Detected on-board - Selected by the ROB - Downlinked on-ground		
RODP	**Implements:**	REQ-ROC-CIRD-0340 REQ-ROC-CIRD-0620

5.2.2 Monitor RODP

5.2.2.1 Report RODP activity log

REQ-ROC-URD-0790	Report RODP activity log	**Test**
The RODP shall report its processing activity into “log” files, in near real-time and in a format readable by human (e.g., text file).		
RODP	**Implements:**	ROC-REQ-CIRD-0420 ROC-REQ-CIRD-0500
The information provided in the RODP log files will have to be flagged by severity (debug, info, warning, error) and time-stamped (local date and time).		

The RODP log file(s) should be accessible through the restricted area of the ROC Web site.

5.2.2.2 Report RODP data production status

REQ-ROC-URD-0800	Report RODP data production status	Test
The RODP shall report the status of the data production (i.e., succeeded, failed) and availability.		
RODP	**Implements:** REQ-ROC-CIRD-0210 ROC-REQ-CIRD-0500	
The data availability shall be displayed from the RPW Web portal at LESIA.		

5.2.3 Produce data

Additionaly to the RPW science data products, the ROC shall make available the RPW TM/TC packet data retrieved and processed at LESIA, in a format and through an interface that are compatible with the MEB GSE tools. These tools are more particularly used by the RPW instrument teams, i.e., DPU flight software, MEB, for testing and anomaly investigations activities on-ground.

REQ-ROC-URD-0810	Produce MEB GSE test log file	TBD
The RODP shall be able of exporting RPW TM/TC data for a given time range as a MEB GSE “test log” file.		
RODP	**Implements:**	

The MEB GSE “test log” files should be available through the restricted area of the ROC Web site, as soon as they have been produced by the RODP.

5.2.4 Execute RODP

REQ-ROC-URD-0820	Execute RODP	TBD
It shall be possible to execute the RODP using a command line interface (CLI).		
RODP	**Implements:**	
It allows automated executions as batch jobs using dedicated tools (e.g., cron).		

REQ-ROC-URD-0830	RODP usage permission	TBD
Only ROC administrators shall be authorized to use and maintain the RODP.		
RODP	**Implements:**	

Especially, the production instance of the RODP shall be hosted on a dedicated server with a user authentication access.

The list of people allowed to connect this server shall be approved by the RPW Ground Segment Project Manager.

5.2.5 Handling RPW Instrument Database (IDB)

REQ-ROC-URD-0840	Import RPW IDB	TBD
It shall be possible to import the RPW IDB into the ROC database using the RODP command line interface.		
RODP	**Implements:**	

REQ-ROC-URD-0850	Select working RPW IDB	TBD
It shall be possible to select the working version of the RPW IDB using the RODP command line interface.		
RODP	**Implements:**	

6 ROC GROUND SUPPORT EQUIPEMENT (GSE) USER REQUIREMENTS

6.1 Context

The ROC GSE gathers software in support to the activities performed on-ground with GSE, mainly:

- Visualize RPW data generated with instrument models on-ground during calibration campaigns, command testing or anomaly investigations
- Simulate the behaviour of the SBM1/SBM2 algorithms to optimize the detection rate on-board.

6.2 Expected functionalities

6.2.1 Visualize RPW data from instrument models on-ground

REQ-ROC-URD-0860	Visualize RPW data from GSE	Demo
A ROC operator shall be able of viewing RPW data by an instrument model using GSE, as expected in [RD18].		
RODP	**Implements:**	REQ-ROC-CIRD-380

6.2.2 Simulate SBM1/SBM2 detection algorithms

REQ-ROC-URD-0870	Assess SBM1 detection rate	**Test**
It shall be possible to assess the SBM1 algorithm detection rate from a given set of input parameters.		
RODP	**Implements:** REQ-ROC-CIRD-410	

REQ-ROC-URD-0880	Assess SBM2 detection rate	**Test**
It shall be possible to assess the SBM2 algorithm detection rate from a given set of input parameters.		
RODP	**Implements:** REQ-ROC-CIRD-410	

7 LIST OF TBC/TBD/TBWS

TBC/TBD/TBW			
Reference/Page/Location	Description	Type	Status

8 DISTRIBUTION LIST

LISTS See Contents lists in "Baghera Web": Project's informations / Project's actors / RPW_actors.xls and tab with the name of the list or NAMES below		
		Tech_LESIA
		Tech_MEB
		Tech_RPW
		[Lead-]CoIs
		Science-CoIs

INTERNAL

LESIA CNRS		

LESIA CNRS		

EXTERNAL (To modify if necessary)

CNES		C. FIACHETTI
		C. LAFFAYE
		R.LLORCA-CEJUDO
		E.LOURME
		M-O. MARCHE
		E.GUILHEM
		J.PANH
		B.PONTET
IRFU		L. BYLANDER
		C.CULLY
		A.ERIKSSON
		SE.JANSSON
		A.VAIVADS
LPC2E		P. FERGEAU
		G. JANNET
		T.DUDOK de WIT
		M. KRETZSCHMAR
		V. KRASNOSSELSKIKH
SSL		S.BALE

AsI/CSRC		J.BRINEK
		P.HELLINGER
		D.HERCIK
		P.TRAVNICEK
IAP		J.BASE
		J. CHUM
		I. KOLMASOVA
		O.SANTOLIK
		J. SOUCEK
		L.UHLIR
IWF		G.LAKY
		T.OSWALD
		H. OTTACHER
		H. RUCKER
		M.SAMPL
		M. STELLER
LPP		T.CHUST
		A. JEANDET
		P.LEROY
		M.MORLOT