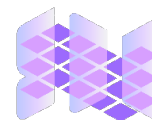


Document title

DCMIX4 DATA BLANK BOOK

Prepared by	Daniel Luque Arriero
Reference	SDC-BB-DCMIX4
Issue and revision	i2, r1
Date of issue	15/02/2021
Status	Baseline
Distribution	ESA, data producers



SIGNATURES SHEET

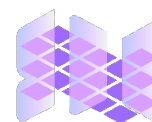
Title: Investigation Data Blank Book	Issue: i2, r1
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Prepared by: _____ Signature(s) and date

Daniel Luque Arriero

Approved by: _____ Signature(s) and date

Concurred by: _____ Signature(s) and date



CHANGE LOG

Reason for change	Issue	Date
First release	i1, r0	14/11/2019
“Experiment” term replaced by “Investigation” term throughout the whole document “Number of files” column added in 4.2 section table	i1, r1	15/04/2019
New document template	i2, r0	25/01/2021
Corrections	i2, r1	15/02/2021

CHANGE RECORD

Issue: i2, r1

Description of change	Page(s)	Paragraph(s)
Update document reference	All	All
Correct products summary table	6	4.1.1

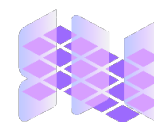
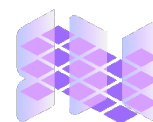


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1. Introduction

This document provides the data and specific metadata definitions for the DCMIX4 investigation necessary for the implementation of the investigation data archive by the SDC (Science Data Centre).

The document shall be filled by those entities (data producers) that will deliver data to the SDC for archival, which can include (depending on the investigation and platform):

- the operations entity, responsible for the operations execution of the investigation,
- a representative of the science team, whenever they generate data that will be archived by the SDC,
- any other entity generating data to be archived by the SDC,
- the ESA project scientist.

2. References

2.1. Applicable Documents

Document	Document title	Issue	Source
[AD1] SCI-ESA-HSO-ESR-DCMIX4	DCMIX4 Experiment Scientific Requirements	i3 r0	ESA

2.2. Reference Documents

Document	Document title	Issue	Source
[RD1] SDC-RP-PROC004	SDC Processes: Science and Operational Data to SDC	i1 r1	SDC

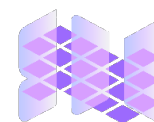
2.3. Acronyms and abbreviations

AD	Applicable Document
DCMIX	Diffusion Coefficients Measurement in ternary mIXtures
ESA	European Space Agency
ESR	Experiment Scientific Requirements
E-USOC	Spanish User Support and Operations Centre
MSG	Microgravity Science Glovebox
PoC	Point of Contact
RD	Reference Document
SDC	Science Data Centre
SODI	Selectable Optical Diagnostics Instrument

3. Investigation data producers list

The following table lists the entities that will deliver investigation data to the SDC.

Entity	PoC	Role in investigation
E-USOC	Daniel Luque	Investigation operations entity and on-board dataset producer
ESA	Marco Braibanti	Project Scientist



4. DCMIX4 data definition

4.1. Products

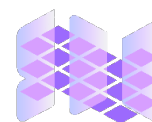
Within this section, information related to the products to be delivered is presented. A product is defined as a set of digital files with the same format (e.g. csv) and content description (e.g. description of parameters in the file).

4.1.1. Products summary

Product	Producer	Proprietary (Yes/No)	Scientific content (Yes/No)	Extension	Number of files	Average file size (MB)	Expected total size (GB)
SODI telemetry, telecommands and logs	E-USOC	Yes	Yes	mlf	4197	2	4.5
Raw images	E-USOC	Yes	Yes	raw	0	4	0
Raw image stacks	E-USOC	Yes	Yes	stk	88752	10	550
Processed images	E-USOC	No	Yes	fits	27418	25	550
Complete telemetry	E-USOC	No	Yes	csv	141	1000	60
Science telemetry	E-USOC	No	Yes	csv	58	300	15
MSG log messages	E-USOC	No	Yes	csv	139	6	≈ 0
Telecommand history	E-USOC	No	Yes	csv	75	2	≈ 0
Image quality data	E-USOC	No	Yes	csv	0	TBD	TBD
Internal table of runs	E-USOC	No	Yes	xml	1	0	≈ 0
User's table of runs	E-USOC	Yes	Yes	xlsx	1	0	≈ 0

4.1.2. Investigation specific metadata

Metadata	Definition	Type of metadata	Possible values	Comments
runName	Investigation run identifier	String	1r01, 1r02, 1r03, 1r04, 1r05, 1r06, 1r07, 1r08, 1r08d, 2r01, 2r02, 2r03, 2r04, 2r05, 2r06, 2r07, 2r08, 2r09, 2r10, 2r11, 2r12, 2r13, 2r14, 2r15, 2r16, 3r01, 3r02, 3r03, 3r04, 3r05, 3r06, 3r06r, 3r07, 3r08, 3r09, 3r10, 3r11, 3r12, 3r13, 3r14, 3r15, 3r16, 3r17, 3r18, 3r19, 4r01,	



			4r02, 4r03, 4r04, 4r05, 4r06, 4r07, 4r08, 5r01, 5r02, 5r02r, 5r03, 5r04	
phaseName	Investigation phase identifier inside a run	String	demixing, gradient, mixing, soreset, temperature, thermalisation	

4.1.3. Products details

Details for each product are provided in the following subsections.

4.1.3.1. SODI telemetry, telecommands and logs

Product	SODI telemetry, telecommands and logs
Product description	SODI payloads' telemetry, telecommand and log data information in MLF proprietary format
File format	MLF: Proprietary telemetry log file format
Processing level	0
Naming convention	<YYYYMMDD_hhmm>.mlf where <ul style="list-style-type: none"> • YYYY: Start date year • MM: Start date month • DD: Start date day • hh: Start date hour • mm: Start date minute
Content description	N/A (proprietary)
Investigation specific metadata	None
Investigation specific metadata format (only for producers other than USOCs)	N/A
Comments	None

4.1.3.2. Raw images

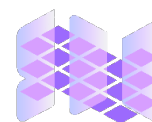
Product	Raw images
Product description	DCMIX raw images files
File format	RAW: Series of greyscale pixel values, starting from the top left corner, advancing row by row. Pixel values are 8-bit unsigned integers, linear-encoded
Processing level	0
Naming convention	<EE>_<yy>_<XXXX>@<1234>_<LS>_RAW_<YYMMDD>_<HHMMSS>_<#>.raw where: <ul style="list-style-type: none"> • EE: Investigation ID. 0...15, with 15 = no cell array present; corresponds to the cell array (assembly of five primary cells and one companion cell) hardwired ID, also downlinked in HK. • yy: Cell ID. 255= Unknown/no cell array. Up to 3 digits. • XXXX: Timeline script checksum (in hexadecimal notation). • 1234: Identifies the current command in the timeline script. • LS: Light Source <ul style="list-style-type: none"> - FR = Red laser in fixed optical Bridge



	<ul style="list-style-type: none"> - MR = Red laser in Movable Optical Bridge and red laser shutter is open - MN = NIR laser in Movable Optical Bridge and NIR laser shutter is open • YYMMDD: Acquisition date stamp <ul style="list-style-type: none"> - YY = two-digit year - MM = two-digit month - DD = two-digit day • HHMMSS: Acquisition time stamp <ul style="list-style-type: none"> - HH = two-digit hour - MM = two-digit minutes - SS = two-digit seconds • #: Sequence number. When multiple time stamps are generated within one second, a sequence number is added, incremented by 1 with each image stamp generated. Note that not all image data is recorded to disc, so these sequence numbers may or may not be continuous.
Content description	N/A (proprietary)
Investigation specific metadata	None
Investigation specific metadata format (only for producers other than USOCs)	N/A
Comments	None

4.1.3.3. Raw images stacks

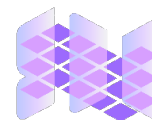
Product	Raw image stacks
Product description	DCMIX raw image stack files
File format	STK: Five raw images with small current steps in the illumination source (red or NIR laser) stored in a stack.
Processing level	0
Naming convention	<p><EE>_<yy>_<XXXX>@<1234>_<LS>_DSC_<YYMMDD>_<HHMMSS>_<#>.stk where:</p> <ul style="list-style-type: none"> • EE: Experiment ID. 0...15, with 15 = no cell array present; corresponds to the cell array (assembly of five primary cells and one companion cell) hardwired ID, also downlinked in HK. • yy: Cell ID. 255= Unknown/no cell array. Up to 3 digits. • XXXX: Timeline script checksum (in hexadecimal notation). • 1234: Identifies the current command in the timeline script. • LS: Light Source <ul style="list-style-type: none"> - FR = Red laser in fixed optical Bridge - MR = Red laser in Movable Optical Bridge and red laser shutter is open - MN = NIR laser in Movable Optical Bridge and NIR laser shutter is open • DSC = Type of Image; five raw images with small current steps in the illumination source (red or NIR laser) stored in a stack (STK image file). • YYMMDD: Acquisition date stamp. <ul style="list-style-type: none"> - YY = two-digit year - MM = two-digit month - DD = two-digit day • HHMMSS: Acquisition time stamp. <ul style="list-style-type: none"> - HH = two-digit hour



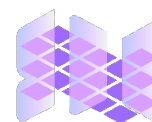
	<ul style="list-style-type: none"> - MM = two-digit minutes - SS = two-digit seconds • #: Sequence number. When multiple time stamps are generated within one second, a sequence number is added, incremented by 1 with each image stamp generated. Note that not all image data is recorded to disc, so these sequence numbers may or may not be continuous.
Content description	N/A (proprietary)
Investigation specific metadata	None
Investigation specific metadata format (only for producers other than USOCs)	N/A
Comments	Some of the stk files will be compressed in 7zip-bzip2 format, and will be provided with .zip extension.

4.1.3.4. Processed images

Product	Processed images
Product description	FITS (open standard format) image composed by two (if non-binary acquisition) or three (if binary acquisition) raw image stack (STK) files
File format	FITS: Image data file containing a metadata header and a collection of 8-bit linear grayscale, 1920 pixels wide by 1080 pixels high images
Processing level	1
Naming convention	<p><YYMMDD>_<HHMMSS>_DCMIX4_<RUN>_<PHASE>_<NUMBER>_level1.fits where:</p> <ul style="list-style-type: none"> • YYMMDD: Acquisition date stamp. <ul style="list-style-type: none"> - YY = two-digit year - MM = two-digit month - DD = two-digit day • HHMMSS: Acquisition time stamp. <ul style="list-style-type: none"> - HH = two-digit hour - MM = two-digit minutes - SS = two-digit seconds • RUN: Run identifier • PHASE: Phase identifier: <ul style="list-style-type: none"> - thermalisation: Monitored thermalisation or thermal homogenisation phase. - gradient: Temperature gradient build-up phase. - soret1: Soret 1 phase. - soret2: Soret2 phase. - soret3: Soret3 phase. - cooldown: Temperature gradient removal or monitored cool-down phase. - diffusion1: Diffusion 1 phase. - diffusion2: Diffusion 2 phase. - diffusion3: Diffusion 3 phase. - demixing: Monitored demixing (for special runs) - mixing: Monitored mixing (for special runs) - temperature: Monitored temperature build-up (for special runs) • NUMBER: Sequence number within the phase (4 digits, 0-padded).

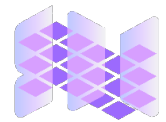


<p>Content description</p>	<p>Each FITS file has one primary HDU (Header Data Unit) with observation-related metadata and ten or fifteen image HDUs (1 per image: 5 MN images, 5 MR images and possibly 5 FR images), with the actual image contents and related metadata:</p> <ul style="list-style-type: none"> • Primary HDU Metadata: <ul style="list-style-type: none"> - MN_STK: MN STK filename. - MR_STK: MR STK filename. - FR_STK: FR STK filename (or N/A). - TIME: Acquisition time. - EXP: Investigation name. - RUN: Investigation run name. - CELL_P: Primary cell number. - COMP_1_P: Primary cell component 1 - FRAC_1_P: Primary cell component 1 mass fraction (%) - COMP_2_P: Primary cell component 2 - FRAC_2_P: Primary cell component 2 mass fraction (%) - COMP_3_P: Primary cell component 3 - FRAC_3_P: Primary cell component 3 mass fraction (%) - BINARY: Binary run (true or false). - COMP_1_C: Companion cell component 1 - FRAC_1_C: Companion cell component 1 mass fraction (%) - COMP_2_C: Companion cell component 2 - FRAC_2_C: Companion cell component 2 mass fraction (%) - T_MEAN: Target mean temperature (degC). - DT: Target temperature gradient (degC). - MN_ET: MN exposure time. - MN_BL: MN black level. - MN_G: MN gain. - MN_C0: MN current start. - MN_CS: MN current span. - MR_ET: MR exposure time. - MR_BL: MR black level. - MR_G: MR gain. - MR_C0: MR current start. - MR_CS: MR current span. - FR_ET: FR exposure time. - FR_BL: FR black level. - FR_G: FR gain. - FR_C0: FR current start. - FR_CS: FR current span. - PHASE: Phase within the run. - TP_UPPER: Actual temperature at primary cell top (degC). - TP_LOWER: Actual temperature at primary cell bottom (degC). - TC_UPPER: Actual temperature at companion cell top (degC). - TC_LOWER: Actual temperature at companion cell bottom (degC). • Image HDU metadata <ul style="list-style-type: none"> - FILENAME: Image filename. - TIME: Image acquisition time. - SEQUENCE: Image acquisition sequence number. - CELL: Cell number. - LASER: Light source (MN, MR or FR).
<p>Investigation specific metadata</p>	<ul style="list-style-type: none"> • runName: Investigation run identifier • phaseName: Investigation phase identifier inside a run
<p>Investigation specific metadata format (only for producers other than USOCs)</p>	
<p>Comments</p>	

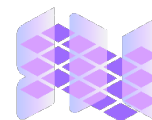


4.1.3.5. Complete telemetry

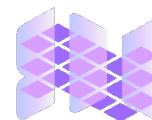
Product	Complete telemetry
Product description	<p>Tabular data files where all the DCMIX telemetry parameters from different sources are retrieved. There are two types of complete telemetry reports:</p> <ul style="list-style-type: none"> • Per-run: If data belongs to a whole run • Daily: If data corresponds to a single day
File format	CSV: Human-readable tabular data in comma-separated values format
Processing level	1
Naming convention	<p><YYMMDD>_<HHMMSS>_DCMIX4_<RUN>_complete_level1.csv where:</p> <ul style="list-style-type: none"> • YYMMDD: Reference date stamp. <ul style="list-style-type: none"> - YY = two-digit year - MM = two-digit month - DD = two-digit day • HHMMSS: Reference time stamp. <ul style="list-style-type: none"> - HH = two-digit hour - MM = two-digit minutes - SS = two-digit seconds <p>Note: Reference datetime is the stamp that has the first line within the telemetry file</p> <ul style="list-style-type: none"> • RUN: <ul style="list-style-type: none"> - If per-run complete telemetry: Run identifier (e.g. 5r01) - If daily complete telemetry: Daily identifier (“daily”)
Content description	<ul style="list-style-type: none"> • time: YYYY-MM-DD hh:mm:ss • ms: milliseconds • AI_pelt_temp1: temperature adjacent to the upper thermal device on cell 0 (degC) • AI_pelt_temp2: temperature adjacent to the lower thermal device on cell 0 (degC) • AI_pelt_temp3: temperature adjacent to the upper thermal device on cell 1 (degC) • AI_pelt_temp4: temperature adjacent to the lower thermal device on cell 1 (degC) • AI_pelt_temp5: to the upper thermal device on cell 2 (degC) • AI_pelt_temp6: temperature adjacent to the lower thermal device on cell 2 (degC) • AI_pelt_temp7: temperature adjacent to the upper thermal device on cell 3 (degC) • AI_pelt_temp8: temperature adjacent to the lower thermal device on cell 3 (degC) • AI_pelt_temp9: temperature adjacent to the upper thermal device on cell 4 (degC) • AI_pelt_temp10: temperature adjacent to the lower thermal device on cell 4 (degC) • AI_pelt_temp11: temperature adjacent to the upper thermal device on cell 5 (degC) • AI_pelt_temp12: temperature adjacent to the lower thermal device on cell 5 (degC) • therm_output1 • therm_output2 • therm_output3



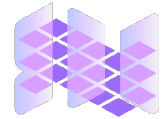
- therm_output4
- therm_output5
- therm_output6
- therm_output7
- therm_output8
- therm_output9
- therm_output10
- therm_output11
- therm_output12
- TOD_century
- TOD_year
- TOD_month
- TOD_day
- TOD_hour
- TOD_min
- TOD_sec
- DO_pelt_reset3
- DI_pelt_on3: 0=Off, 1=On
- DO_pelt_cool_heat3: 0=cooling on cell side, 1=heating on cell side
- DI_pelt_overcurr3: 0=Overcurrent situation detected; thermal element disabled
- DO_pelt_reset4
- DI_pelt_on4: 0=Off, 1=On
- DO_pelt_cool_heat4: 0=cooling on cell side, 1=heating on cell side
- DI_pelt_overcurr4: 0=Overcurrent situation detected; thermal element disabled
- DO_pelt_reset1
- DI_pelt_on1: 0=Off, 1=On
- DO_pelt_cool_heat1: 0=cooling on cell side, 1=heating on cell side
- DI_pelt_overcurr1: 0=Overcurrent situation detected; thermal element disabled
- DO_pelt_reset2
- DI_pelt_on2: 0=Off, 1=On
- DO_pelt_cool_heat2: 0=cooling on cell side, 1=heating on cell side
- DI_pelt_overcurr2: 0=Overcurrent situation detected; thermal element disabled
- DO_pelt_reset7
- DI_pelt_on7: 0=Off, 1=On
- DO_pelt_cool_heat7: 0=cooling on cell side, 1=heating on cell side
- DI_pelt_overcurr7: 0=Overcurrent situation detected; thermal element disabled
- DO_pelt_reset8
- DI_pelt_on8: 0=Off, 1=On
- DO_pelt_cool_heat8: 0=cooling on cell side, 1=heating on cell side
- DI_pelt_overcurr8: 0=Overcurrent situation detected; thermal element disabled
- DO_pelt_reset5
- DI_pelt_on5: 0=Off, 1=On
- DO_pelt_cool_heat5: 0=cooling on cell side, 1=heating on cell side
- DI_pelt_overcurr5: 0=Overcurrent situation detected; thermal element disabled
- DO_pelt_reset6
- DI_pelt_on6: 0=Off, 1=On
- DO_pelt_cool_heat6: 0=cooling on cell side, 1=heating on cell side



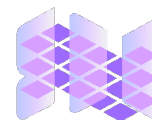
- DI_pelt_overcurr6: 0=Overcurrent situation detected; thermal element disabled
- DO_pelt_reset11
- DI_pelt_on11: 0=Off, 1=On
- DO_pelt_cool_heat11: 0=cooling on cell side, 1=heating on cell side
- DI_pelt_overcurr11: 0=Overcurrent situation detected; thermal element disabled
- DO_pelt_reset12
- DI_pelt_on12: 0=Off, 1=On
- DO_pelt_cool_heat12: 0=cooling on cell side, 1=heating on cell side
- DI_pelt_overcurr12: 0=Overcurrent situation detected; thermal element disabled
- DO_pelt_reset9
- DI_pelt_on9: 0=Off, 1=On
- DO_pelt_cool_heat9: 0=cooling on cell side, 1=heating on cell side
- DI_pelt_overcurr9: 0=Overcurrent situation detected; thermal element disabled
- DO_pelt_reset10
- DI_pelt_on10: 0=Off, 1=On
- DO_pelt_cool_heat10: 0=cooling on cell side, 1=heating on cell side
- DI_pelt_overcurr10: 0=Overcurrent situation detected; thermal element disabled
- DI_spi1_int
- DO_spi1_adc_start
- DI_spi1_adc1_ready
- DI_spi1_adc2_ready
- DO_spi1_manual_reset
- DI_spi2_int
- DO_enable_24v_conv: 1=24V enabled
- DO_enable_12v_conv: 1=12V
- DO_enable_5V_12V: 1=5/12V enabled
- DO_spi2_adc_start
- DI_spi2_adc1_ready
- DI_spi2_adc2_ready
- DO_spi2_manual_reset
- DO_transl_motor_coll_ena: Power to colloid cell array translation mechanism enabled
- DO_transl_motor_dsc_ividil_enable : Power to translation mechanism movable optics enabled
- DO_vib_motor_enable: Power to IVIDIL shaker enabled
- DO_mov_mirr2_enable: Power to movable mirror in fixed optics enabled
- DO_mov_mirr1_enable: Power to movable mirror in movable optics enabled
- DO_lin_motor_enable: Power to COLLOID lens translation enabled
- DO_high_speed2
- DO_pim2403_a
- DO_pim2403_b
- DO_ips110_b
- DO_ips110_a
- DI_vib_motor_error
- DI_transl_motor_dsc_ividil_error
- DI_transl_motor_colloid_error
- DO_decoders_enable
- DI_switch_1



- DO_stirrer_enable
- DO_shutter_1_enable: 1=RED laser in Movable optics path
- DO_shutter_2_enable: 1=NIR laser in Movable optics path
- DO_high_speed
- AI_pelt_curr1: current consumption by thermal element in (A)
- AI_pelt_curr2: current consumption by thermal element in (A)
- AI_pelt_curr3: current consumption by thermal element in (A)
- AI_pelt_curr4: current consumption by thermal element in (A)
- AI_pelt_curr5: current consumption by thermal element in (A)
- AI_pelt_curr6: current consumption by thermal element in (A)
- AI_pelt_curr7: current consumption by thermal element in (A)
- AI_pelt_curr8: current consumption by thermal element in (A)
- AI_pelt_curr9: current consumption by thermal element in (A)
- AI_pelt_curr10: current consumption by thermal element in (A)
- AI_pelt_curr11: current consumption by thermal element in (A)
- AI_pelt_curr12: current consumption by thermal element in (A)
- AI_pelt_volt1: Voltage over thermal element(V); needs to be correlated with DI_pelt_on#
- AI_pelt_volt2: Voltage over thermal element(V); needs to be correlated with DI_pelt_on#
- AI_pelt_volt3: Voltage over thermal element(V); needs to be correlated with DI_pelt_on#
- AI_pelt_volt4: Voltage over thermal element(V); needs to be correlated with DI_pelt_on#
- AI_pelt_volt5: Voltage over thermal element(V); needs to be correlated with DI_pelt_on#
- AI_pelt_volt6: Voltage over thermal element(V); needs to be correlated with DI_pelt_on#
- AI_pelt_volt7: Voltage over thermal element(V); needs to be correlated with DI_pelt_on#
- AI_pelt_volt8: Voltage over thermal element(V); needs to be correlated with DI_pelt_on#
- AI_pelt_volt9: Voltage over thermal element(V); needs to be correlated with DI_pelt_on#
- AI_pelt_volt10: Voltage over thermal element(V); needs to be correlated with DI_pelt_on#
- AI_pelt_volt11: Voltage over thermal element(V); needs to be correlated with DI_pelt_on#
- AI_pelt_volt12: Voltage over thermal element(V); needs to be correlated with DI_pelt_on#
- AI_drv_ref_inp1
- AI_drv_ref_inp2
- AI_led_temp1: temperature for laser 1 (degC)
- AI_led_temp2: temperature for laser 2 (degC)
- AI_led_temp3: temperature for laser 3 (degC)
- AI_led_curr1: current for laser 1 (A)
- AI_led_curr2: current for laser 2 (A)
- AI_led_curr3: current for laser 3 (A)
- AI_volt_test_p1
- AI_volt_test_p2
- AI_volt_test_p3
- motor_powered1: 1=software enabled the motor
- motor_powered2: 1=software enabled the motor
- motor_powered3: 1=software enabled the motor
- motor_powered4: 1=software enabled the motor



- motor_powered5: 1=software enabled the motor
- motor_powered6: 1=software enabled the motor
- motor_selected1: 1=selected/communicating
- motor_selected2: 1=selected/communicating
- motor_selected3: 1=selected/communicating
- motor_selected4: 1=selected/communicating
- motor_selected5: 1=selected/communicating
- motor_selected6: 1=selected/communicating
- motor_found1: 1=motor was successfully homed (precondition for any movement)
- motor_found2: 1=motor was successfully homed (precondition for any movement)
- motor_found3: 1=motor was successfully homed (precondition for any movement)
- motor_found4: 1=motor was successfully homed (precondition for any movement)
- motor_found5: 1=motor was successfully homed (precondition for any movement)
- motor_found6: 1=motor was successfully homed (precondition for any movement)
- motor_state1
- motor_state2
- motor_state3
- motor_state4
- motor_state5
- motor_state6
- motor_position1: Position in encoder units
- motor_position2: Position in encoder units
- motor_position3: Position in encoder units
- motor_position4: Position in encoder units
- motor_position5: Position in encoder units
- motor_position6: Position in encoder units
- motor_ls_negative1: 0=limit switch engaged
- motor_ls_negative2: 0=limit switch engaged
- motor_ls_negative3: 1=Limit Switch engaged
- motor_ls_negative4: 1=Limit Switch engaged
- motor_ls_negative5: 1=Limit Switch engaged
- motor_ls_negative6: NA
- motor_ls_positive1: 0=limit switch engaged
- motor_ls_positive2: 0=limit switch engaged
- motor_ls_positive3: 1=Limit Switch engaged
- motor_ls_positive4: 1=Limit Switch engaged
- motor_ls_positive5: 1=Limit Switch engaged
- motor_ls_positive6: NA
- motor_setpoint1: Unusable due to overlap with next par
- motor_setpoint2
- motor_setpoint3
- motor_setpoint4: Unusable due to overlap with next par
- motor_setpoint5
- motor_setpoint6
- cam1_images_to_get
- cam2_images_to_get
- cam1_free_buffers
- cam2_free_buffers
- cam1_is_grabbing: 1=image data being acquired



- cam2_is_grabbing: 1=image data being acquired
- cam1_storing: 1=storing
- cam2_storing: 1=storing
- cam1_is_displaying
- cam2_is_displaying
- cam1_on_ext_trigger: 1=on external trigger (IVIDIL shaking), 0=on internal camera clock
- cam2_on_ext_trigger: 1=on external trigger (IVIDIL shaking), 0=on internal camera clock
- disk_free_c: Free space in MB
- disk_free_e: Free space in MB
- shaker_frequency: Current shaker frequency in Hz (IVIDIL only)
- shaker_amplitude: Current shaker amplitude in Hz (IVIDIL only)
- timer_period: Value as received in WAIT_TIMER command
- GEN_cycle_cnt: 1..0xFFFF
- WV_discrete_fire: Facility Fire bit
- DI_status_5v_12v: 1=5/12V is enabled & available
- DI_status_24v: 1=24V is enabled & available
- DI_status_12v: 1=12V (from MSG120V) is enabled and available
- DO_led1_enable: laser1, 1=on
- DO_led2_enable: laser2, 1=on
- DO_led3_enable: laser3, 1=on
- cam1_connected: camera connection state, 1= connected
- cam2_connected: camera connection state, 1= connected
- instrument_state: 0=IDLE (no script active, but actuators & monitoring are) 1=RUN (script being executed) 2=SUSPEND (script execution halted on error)
- cmd_acc_cntr: incremental counter of accepted commands
- cmd_rej_cntr: incremental counter of rejected commands
- incident_counter: 0...255, does not overrun; must be manually reset using RST_INCID_CNTR
- DI_experiment_id: experiment ID, hardwired in cell array
- script_checksum: 0x0000 ... 0xFFFF, checksum calculated over script for verification & script identification
- script_curr_cmd: id of current command in the script
- AI_fcu_temp: FCU temp in Deg C
- AI_ipu_temp: IPU temp in Deg C
- cpu_core_temp: temp in Deg C
- cpu_usage: cpu usage in %
- memory_load: memory load in %
- disk_free_d: free space on removable HDD in MB
- exp_type: 0=none, 1=IVIDIL, 2=COLLOID, 3=DSC
- timeline_state 0 = Idle, 1 = processing command, 2 = waiting (for condition to be true), 3 = suspended, 4 = DSC imaging, 5 = IVIDIL imaging, 6 = COLLOID Imaging, 7 = shell cmd in progress, 8 = FTP transfer in progress, 9 = moving cell; motor_position1 changes for COLLOID, position2 for DSC or IVIDIL, 10 = A SHAKE_IVIDIL command is being processed; shaker state is being changed to requested amp/freq, 11 = Wait Timer; MSG_HK::step_time counts down to 0 before moving on to next command, **next are COLLOID only. 12 = Aggregation Detection step A, 13 = Aggregation Detection Step B, 14 = Phase Separation Detection step A, 15 = Phase Separation Detection Step B, 16 = Phase Separation Detection Step C, 17 = COLLOID Reference Cell run
- continue_on_error: 1=errors will not cause script to be suspended, debug/off-nominal ops only



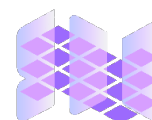
	<ul style="list-style-type: none"> • <code>step_mode</code>: 1=halt at each consecutive command in script, debug/off-nominal ops only • <code>file_trf_in_progress</code>: 1=file transfer in progress • <code>pelt_active1</code>: 1=element temperature is controlled to setpoint provided • <code>pelt_active2</code>: 1=element temperature is controlled to setpoint provided • <code>pelt_active3</code>: 1=element temperature is controlled to setpoint provided • <code>pelt_active4</code>: 1=element temperature is controlled to setpoint provided • <code>pelt_active5</code>: 1=element temperature is controlled to setpoint provided • <code>pelt_active6</code>: 1=element temperature is controlled to setpoint provided • <code>pelt_active7</code>: 1=element temperature is controlled to setpoint provided • <code>pelt_active8</code>: 1=element temperature is controlled to setpoint provided • <code>pelt_active9</code>: 1=element temperature is controlled to setpoint provided • <code>pelt_active10</code>: 1=element temperature is controlled to setpoint provided • <code>pelt_active11</code>: 1=element temperature is controlled to setpoint provided • <code>pelt_active12</code>: 1=element temperature is controlled to setpoint provided • <code>curr_cell</code>: is 1 when <code>exp_type</code>, =IVIDIL is 1...5 when <code>exp_type</code>, =DSC is 0...4 when <code>exp_type</code>, =COLLOID 255=<undefined> • <code>data_recorder_ok</code>: 1=telemetry data is being recorded • <code>DO_crew_led_power_on</code>: 1= LED on FCU is on • <code>DO_crew_led_exp_run</code>: 1= LED on FCU is on • <code>DO_crew_led_change_fdu</code>: 1= LED on FCU is on • <code>DO_crew_led_exp_finished</code>: 1= LED on FCU is on • <code>DI_led_overcurr1</code>: 0=Overcurrent; laser disabled • <code>DI_led_overcurr2</code>: 0=Overcurrent; laser disabled • <code>DI_led_overcurr3</code>: 0=Overcurrent; laser disabled • <code>init_in_progress</code>: 1=initialization in progress (after <code>INIT_INSTRUMENT</code> command) • <code>step_time</code>: Time in seconds spent on current timeline command (in script); when <code>timeline_state</code>=WaitTimer it counts down to 0 • <code>parent_checksum</code>: As <code>script_checksum</code>, but for suspended (parent) script; the parent is suspended on a <code>CMD_SCRIPT_START</code> line and will resume when the current running script (as defined in this <code>CMD_SCRIPT_START</code>) has completed • <code>parent_curr_cmd</code>: As <code>script_curr_cmd</code>, but for suspended (parent) script • <code>WV_Air_Temp</code>: Work Volumen Air Temperature in degC • <code>WV_Humidity</code>: Work Volumen Humidity in PCT • <code>Fans Work Volumen Fan On</code>. Can be 'ON' or 'OFF' • <code>AAA_Speed Avionics Air Assembly Motor Fanspeed</code> in RPM
Investigation specific metadata	If per-run telemetry: <ul style="list-style-type: none"> • <code>RunName</code>: Investigation run identifier
Investigation specific metadata format (only for producers other than USOCs)	N/A
Comments	None

4.1.3.6. Science telemetry

Product	Science telemetry
Product description	Tabular data files where all the investigation scientific telemetry parameters are retrieved. Each Science Telemetry file contains data for a single run.
File format	CSV: Human-readable tabular data in comma-separated values format



Processing level	1
Naming convention	<p><YYMMDD>_<HHMMSS>_DCMIX4_<RUN>_science_level1.csv where:</p> <ul style="list-style-type: none"> • YYMMDD: Reference date stamp. <ul style="list-style-type: none"> - YY = two-digit year - MM = two-digit month - DD = two-digit day • HHMMSS: Reference time stamp. <ul style="list-style-type: none"> - HH = two-digit hour - MM = two-digit minutes - SS = two-digit seconds <p>Note: Reference datetime is the stamp that has the first line within the telemetry file</p> <ul style="list-style-type: none"> • RUN: Run identifier (e.g. 5r01)
Content description	<ul style="list-style-type: none"> • time: YYYY-MM-DD hh:mm:ss • ms: milliseconds • AI_pelt_curr1: current consumption by thermal element in (A) • AI_pelt_curr2: current consumption by thermal element in (A) • AI_pelt_curr3: current consumption by thermal element in (A) • AI_pelt_curr4: current consumption by thermal element in (A) • AI_pelt_curr5: current consumption by thermal element in (A) • AI_pelt_curr6: current consumption by thermal element in (A) • AI_pelt_curr7: current consumption by thermal element in (A) • AI_pelt_curr8: current consumption by thermal element in (A) • AI_pelt_curr9: current consumption by thermal element in (A) • AI_pelt_curr10: current consumption by thermal element in (A) • AI_pelt_curr11: current consumption by thermal element in (A) • AI_pelt_curr12: current consumption by thermal element in (A) • AI_pelt_volt1: Voltage over thermal element(V); • AI_pelt_volt2: Voltage over thermal element(V); • AI_pelt_volt3: Voltage over thermal element(V); • AI_pelt_volt4: Voltage over thermal element(V); • AI_pelt_volt5: Voltage over thermal element(V); • AI_pelt_volt6: Voltage over thermal element(V); • AI_pelt_volt7: Voltage over thermal element(V); • AI_pelt_volt8: Voltage over thermal element(V); • AI_pelt_volt9: Voltage over thermal element(V); • AI_pelt_volt10: Voltage over thermal element(V); • AI_pelt_volt11: Voltage over thermal element(V); • AI_pelt_volt12: Voltage over thermal element(V); • AI_pelt_temp1: temperature adjacent to thermal device on cell (degC) • AI_pelt_temp2: temperature adjacent to thermal device on cell (degC) • AI_pelt_temp3: temperature adjacent to thermal device on cell (degC) • AI_pelt_temp4: temperature adjacent to thermal device on cell (degC) • AI_pelt_temp5: temperature adjacent to thermal device on cell (degC) • AI_pelt_temp6: temperature adjacent to thermal device on cell (degC) • AI_pelt_temp7: temperature adjacent to thermal device on cell (degC) • AI_pelt_temp8: temperature adjacent to thermal device on cell (degC) • AI_pelt_temp9: temperature adjacent to thermal device on cell (degC) • AI_pelt_temp10: temperature adjacent to thermal device on cell (degC) • AI_pelt_temp11: temperature adjacent to thermal device on cell (degC)



	<ul style="list-style-type: none"> • AI_pelt_temp12: temperature adjacent to thermal device on cell (degC) • AI_led_temp1: temperature for laser 1 (degC) • AI_led_temp2: temperature for laser 2 (degC) • AI_led_temp3: temperature for laser 3 (degC) • AI_led_curr1: current for laser 1 (A) • AI_led_curr2: current for laser 2 (A) • AI_led_curr3: current for laser 3 (A) • WV_Humidity: Work Volume Humidity in PCT Fans • Fans: Work Volume Fan On. Can be 1 (ON) or 0 (OFF) • AAA_Speed: Avionics Air Assembly Motor Fanspeed in RPM
Investigation specific metadata	runName: run identifier
Investigation specific metadata format (only for producers other than USOCs)	N/A
Comments	

4.1.3.7. MSG log messages

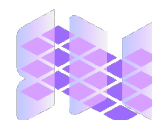
Product	MSG log messages
Product description	Tabular data file where all the investigation logs' information is retrieved.
File format	CSV: Human-readable tabular data in comma-separated values format
Processing level	1
Naming convention	<p><YYMMDD>_<HHMMSS>_DCMIX4_log_level1.csv where:</p> <ul style="list-style-type: none"> • YYMMDD: Date stamp. <ul style="list-style-type: none"> - YY = two-digit year - MM = two-digit month - DD = two-digit day • HHMMSS: Time stamp. <ul style="list-style-type: none"> - HH = two-digit hour - MM = two-digit minutes - SS = two-digit seconds
Content description	<ul style="list-style-type: none"> • time: YYYY-MM-DD hh:mm:ss • ms: milliseconds • interface: IN, OUT • packet: MSG_LOG • CRC error • GEN_Src: 152 • GEN_Dest: 0 • GEN_Class: 65 • GEN_Type: 0 • GEN_Length: 0...82 • LOG_error: none=0, invalid_command=1, invalid_parameter=2, invalid_state=19, software_error=20, buffer_overflow=21, protocol_error=22, process_failure=23, shell_output=24, limit_transgression=25, motor_comm_error=26, script_load_error=27, script_log=28, colloid_status=29 • LOG_severity: info=0, warning=1, alarm=2, error=3
Investigation specific metadata	None
Investigation specific metadata format (only for producers other than USOCs)	N/A



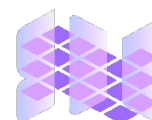
Comments	None
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4.1.3.8. Telecommand history

Product	Telecommand history
Product description	Tabular data file where all the investigation telecommands' information is retrieved.
File format	CSV: Human-readable tabular data in comma-separated values format
Processing level	1
Naming convention	<p><YYMMDD>_<HHMMSS>_DCMIX4_logs_level1.csv where:</p> <ul style="list-style-type: none"> • YYMMDD: Reference Date stamp. <ul style="list-style-type: none"> - YY = two-digit year - MM = two-digit month - DD = two-digit day • HHMMSS: Reference Time stamp. <ul style="list-style-type: none"> - HH = two-digit hour - MM = two-digit minutes - SS = two-digit seconds
Content description	<ul style="list-style-type: none"> • time: YYYY-MM-DD hh:mm:ss • ms: milliseconds • interface: IN: The command was issued by the operator on ground. OUT: The command was issued on board, most of the times it is issued by an automated script. • Packet: Packet header contains the command that was issued. • CRC error • GEN_Src • GEN_Dest: 150 • GEN_Class: 136+cntr • GEN_Type • GEN_Length • exp_type: 3=DSC • CMD_pelt_id: 1...12, valid values depend on exp_type • CMD_pelt_on : 1=enable thermal control, 0=disable • CMD_pelt_setpoint: setpoint in degC • CMD_digital_out_id • CMD_new_state: 1=enable, 0=disable • CMD_analog_out_id • CMD_new_value • motor_id: 1=COLLOID cell array translation, 2=movable optics translation, 3= COLLOID lens translation, 4=movable mirror fixed optics, 5=movable mirror movable optics, 6= IVIDIL shaker • motor_function: 1=MOTOR_ACTIVATE, 2=MOTOR_CONNECT, 3=MOTOR_STOP, 4=MOTOR_HOME, 5=MOTOR_POSITION, 6=MOTOR_DISCONNECT, 7= MOTOR_STIRRER_ON (COLLOID only)-. specify motor_value, 119=MOTOR_POSITION_LAUNCH_LOCK prelaunch only, 136=MOTOR_MOVE_SINE – DO NOT APPLY: use SHAKE_IVIDIL instead • motor_value: When motor_function=MOTOR_POSITION: command new position of motor in encoder units. When MOTOR_STIRRER_ON: encoder position for end of movement • cam_id: 0=DSC/IVIDIL Fixed or COLLOID. 1=DSC/IVIDIL Movable



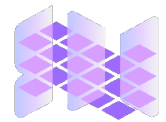
	<ul style="list-style-type: none"> • cam_cmd: 1=connect camera define, 2=configure, 3=start grabbing, 4=stop grabbing, 5=process params • cam_type: 1=DALSA (IVIDIL/DSC), 2=JAI (COLLOID) • cam_sample_frequency: if (cam_cmd=configure) In Hz, 1-30 • cam_nr_images_to_get: if (cam_cmd=start grabbing):0=continuous until stopped, otherwise stop when specified nr acquired • cam_store_data: If (cam_cmd=process params):1=store raw images to disk • cam_use_ext_trigger: If(cam_cmd=configure):1=grab on external trigger, IVIDIL only • cam_display: If(cam_cmd=configure):1=grab on external trigger, IVIDIL only • cam_exp_time: If (cam_cmd=configure): exposure time in microseconds • cam_gain: If (cam_cmd+configure): gain • cam_b_level: If (cam_cmd=configure): black level • enable: 1=enable recording of cell temp and power consumption with a rate of 5 Hz (default is 1 Hz) • continue_on_error: 1=errors will not cause script to be suspended, debug/off-nominal ops only • test_only: 1=load script only (do not start execution) • step_mode: 1+suspend after (each) command • run_verbose: 1=generate a log message for each command received/processed from timeline • load_verbosity: 0=none, 2=errors, 3=info + errors • script_file_name: 82 character 0-terminated string identifying file • move_absolute: 1=jump_step is absolute or 0=relative to script_curr_cmd • jump_step: Identify command step/ids, use negative value to move back • pvi_mzi_img_freq: Requested frequency in Hz, 0=execute once • duration: Duration in seconds • fixed_acq_freq • movable_acq_freq • colloid_img_freq: Acquisition Rate 0-?? Hz • cell_id 0-5, depending on exp_type; see also curr_cell • transfer_cmd: Identify direction (SODI<->MLC (low rate or FTP), SODI->SPLC (low rate only) 1=upload to FTP server (MLC), 2=download from FTP server (MLC), 128= low rate to MSG/SPLC=128, 131=low rate to MLC, UNUSED: 146=low rate to WV1, UNUSED: 150=low rate to WV2 • file_name: 92 character 0-terminated string identifying file • command_line: string specifying Command + any parameters • param_name: name of parameter as string; any entry first column is valid, except for t_c_str type parameters • test_operator: test operator: EQ = 0 (=), GT =1 (>), LT =2, (<), NEQ=3, (<>) • test_value: value to wait for • shaker_frequency: Current shaker frequency in Hz (IVIDIL only) • shaker_amplitude: Current shaker amplitude in Hz (IVIDIL only) • timer_period: Value as received in WAIT_TIMER command • temp_step: Temperature step in degC • coll_exp_run_sets: Time between two cycles; internal logic according to timeline
Investigation specific metadata	None



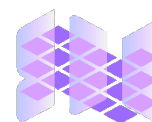
Investigation specific metadata format (only for producers other than USOCs)	N/A
Comments	

4.1.3.9. Image quality data

Product	Image quality data
Product description	Tabular data file where the images' data quality information is retrieved. One Data Quality file per-run is generated
File format	CSV: Human-readable tabular data in comma-separated values format
Processing level	1
Naming convention	<p><YYMMDD>_<HHMMSS>_DCMIX4_<RUN>_quality_level2.csv where:</p> <ul style="list-style-type: none"> • YYMMDD: Reference Date stamp. <ul style="list-style-type: none"> - YY = two-digit year - MM = two-digit month - DD = two-digit day • HHMMSS: Reference Time stamp. <ul style="list-style-type: none"> - HH = two-digit hour - MM = two-digit minutes - SS = two-digit seconds • RUN: Run identifier (e.g. 5r01)
Content description	<ul style="list-style-type: none"> • time • FITS_filename • Region_of_interest_top_left_corner_column • Region_of_interest_top_left_corner_row • Region_of_interest_width • Region_of_interest_height • Black_saturation_of_MN_picture_number_1 • Black_saturation_of_MN_picture_number_2 • Black_saturation_of_MN_picture_number_3 • Black_saturation_of_MN_picture_number_4 • Black_saturation_of_MN_picture_number_5 • Black_saturation_of_MR_picture_number_1 • Black_saturation_of_MR_picture_number_2 • Black_saturation_of_MR_picture_number_3 • Black_saturation_of_MR_picture_number_4 • Black_saturation_of_MR_picture_number_5 • Black_saturation_of_FR_picture_number_1 • Black_saturation_of_FR_picture_number_2 • Black_saturation_of_FR_picture_number_3 • Black_saturation_of_FR_picture_number_4 • Black_saturation_of_FR_picture_number_5 • White_saturation_of_MN_picture_number_1 • White_saturation_of_MN_picture_number_2 • White_saturation_of_MN_picture_number_3 • White_saturation_of_MN_picture_number_4 • White_saturation_of_MN_picture_number_5 • White_saturation_of_MR_picture_number_1 • White_saturation_of_MR_picture_number_2 • White_saturation_of_MR_picture_number_3 • White_saturation_of_MR_picture_number_4



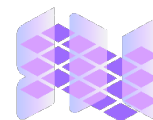
	<ul style="list-style-type: none"> • White_saturation_of_MR_picture_number_5 • White_saturation_of_FR_picture_number_1 • White_saturation_of_FR_picture_number_2 • White_saturation_of_FR_picture_number_3 • White_saturation_of_FR_picture_number_4 • White_saturation_of_FR_picture_number_5 • Michelson_contrast_of_MN_picture_number_1 • Michelson_contrast_of_MN_picture_number_2 • Michelson_contrast_of_MN_picture_number_3 • Michelson_contrast_of_MN_picture_number_4 • Michelson_contrast_of_MN_picture_number_5 • Michelson_contrast_of_MR_picture_number_1 • Michelson_contrast_of_MR_picture_number_2 • Michelson_contrast_of_MR_picture_number_3 • Michelson_contrast_of_MR_picture_number_4 • Michelson_contrast_of_MR_picture_number_5 • Michelson_contrast_of_FR_picture_number_1 • Michelson_contrast_of_FR_picture_number_2 • Michelson_contrast_of_FR_picture_number_3 • Michelson_contrast_of_FR_picture_number_4 • Michelson_contrast_of_FR_picture_number_5 • RMS_contrast_of_MN_picture_number_1 • RMS_contrast_of_MN_picture_number_2 • RMS_contrast_of_MN_picture_number_3 • RMS_contrast_of_MN_picture_number_4 • RMS_contrast_of_MN_picture_number_5 • RMS_contrast_of_MR_picture_number_1 • RMS_contrast_of_MR_picture_number_2 • RMS_contrast_of_MR_picture_number_3 • RMS_contrast_of_MR_picture_number_4 • RMS_contrast_of_MR_picture_number_5 • RMS_contrast_of_FR_picture_number_1 • RMS_contrast_of_FR_picture_number_2 • RMS_contrast_of_FR_picture_number_3 • RMS_contrast_of_FR_picture_number_4 • RMS_contrast_of_FR_picture_number_5 • Relative_phase_of_MN_picture_number_1 • Relative_phase_of_MN_picture_number_2 • Relative_phase_of_MN_picture_number_3 • Relative_phase_of_MN_picture_number_4 • Relative_phase_of_MN_picture_number_5 • Relative_phase_of_MR_picture_number_1 • Relative_phase_of_MR_picture_number_2 • Relative_phase_of_MR_picture_number_3 • Relative_phase_of_MR_picture_number_4 • Relative_phase_of_MR_picture_number_5 • Relative_phase_of_FR_picture_number_1 • Relative_phase_of_FR_picture_number_2 • Relative_phase_of_FR_picture_number_3 • Relative_phase_of_FR_picture_number_4 • Relative_phase_of_FR_picture_number_5
Investigation specific metadata	RunName: run identifier



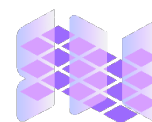
Investigation specific metadata format (only for producers other than USOCs)	N/A
Comments	None

4.1.3.10. Internal table of runs

Product	Internal table of runs
Product description	The "Internal Table of Runs" product summarizes the executed runs (together with their main parameters) within the DCMIX4 investigation in xml format in order to deliver this information to HREDA database.
File format	XML: Extensible Markup Language, a simple text-based format for representing structured information
Processing level	1
Naming convention	DCMIX4_runs_table.xml
Content description	<p>runsTable: document root; it contains a series of run elements:</p> <ul style="list-style-type: none"> • run: metadata summarizing an investigation run. <ul style="list-style-type: none"> ○ experiment: token element with the name of the experiment. ○ runName: token with the name of the run. ○ startTime: dateTime element with the start time of the run. ○ endTime: dateTime element with the end time of the run. ○ scientificParameters: these are the parameters that define the run. <ul style="list-style-type: none"> ▪ typeOfRun: parameters regarding the type of run. <ul style="list-style-type: none"> • regular: boolean element; true when the run is regular (as most runs are) or false when the run is special (an ad-hoc run that doesn't follow the same protocol as regular runs). • binary: boolean element; true when the run uses the companion cell (and thus has secondary cell pictures). • diffusion: boolean element; true when the run has a diffusion phase. ▪ primaryCell: parameters regarding the primary cell. <ul style="list-style-type: none"> • cellNumber: integer number from 1 to 5; primary cell number. • composition: composition or mixture of the primary cell's sample; a series of 3 component elements. <ul style="list-style-type: none"> ○ component: description of a component of the mixture. <ul style="list-style-type: none"> ▪ compound: token element naming this component's chemical compound. ▪ massFraction: decimal number from 0 to 100; the mass fraction percentage of this component. • meanTemperature: decimal number; primary cell gradient temperature in degrees Celsius. • gradientTemperature: decimal number; primary cell gradient temperature in degrees Celsius. ▪ companionCell: parameters regarding the secondary cell; optional element (present in binary runs only).



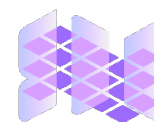
- composition: composition or mixture of the secondary cell's sample; a series of 2 component elements.
 - component: description of a component of the mixture.
 - compound: token element naming this component's chemical compound.
 - massFraction: decimal number from 0 to 100; the mass fraction percentage of this component.
- opticalParameters: these are the optical parameters used to acquire images during the run.
 - movableRedOpticalParameters: optical parameters of the movable red (MR) camera and laser.
 - exposureTime: decimal number with the camera exposure time.
 - blackLevel: decimal number with the camera black level.
 - gain: decimal number with the camera gain.
 - currentStart: decimal number with the laser lowest current.
 - currentSpan: decimal number with the laser current span.
 - movableInfraredOpticalParameters: optical parameters of the movable infrared (MN) camera and laser.
 - exposureTime: decimal number with the camera exposure time.
 - blackLevel: decimal number with the camera black level.
 - gain: decimal number with the camera gain.
 - currentStart: decimal number with the laser lowest current.
 - currentSpan: decimal number with the laser current span.
 - fixedRedOpticalParameters: optical parameters of the fixed red (FR) camera and laser (present in binary runs only).
 - exposureTime: decimal number with the camera exposure time.
 - blackLevel: decimal number with the camera black level.
 - gain: decimal number with the camera gain.
 - currentStart: decimal number with the laser lowest current.
 - currentSpan: decimal number with the laser current span.
- phases: optional element with a series of phase elements.
 - phase: description of a phase of the run.
 - name: token element with the name of this phase.
 - startTime: dateTime element with the start time of this phase.
 - duration: duration element with the duration of this phase.



	<ul style="list-style-type: none"> • hotTemperature: decimal number; hot side temperature of this phase in degrees Celsius. • coldTemperature: decimal number; cold side temperature of this phase in degrees Celsius. • imageAcquisitions: integer number; number of image acquisitions of this phase. <ul style="list-style-type: none"> ○ repetitions: optional element with the repetitions of this run (other runs with the same scientific parameters); a series of repetition elements. <ul style="list-style-type: none"> ▪ repetition: information on a particular repetition of this run (other run with the same scientific parameters). <ul style="list-style-type: none"> • experiment: token element with the name of the experiment in which the repetition took place. • runName: token element with the name of the repetition run. ○ data: data availability of this run. <ul style="list-style-type: none"> ▪ images: boolean element telling whether the images are available. ▪ telemetry: boolean element telling whether the telemetry data are available. ▪ acceleration: boolean element telling whether the acceleration data are available. ○ comments: token element with comments on the run.
Investigation specific metadata	None
Investigation specific metadata format (only for producers other than USOCs)	N/A
Comments	A schema file (XSD format) must be provided in order to check the xml file structure

4.1.3.11. User's table of runs

Product	User's table of runs
Product description	The "User's Table of Runs" product summarizes the executed runs (together with their main parameters) within the DCMIX investigation in Excel format in order to disseminate this information to potential users.
File format	XLSX: Microsoft Excel spreadsheet
Processing level	1
Naming convention	DCMIX4_runs_table.xlsx
Content description	<p>The columns in the file are the following:</p> <ul style="list-style-type: none"> • runName • startTime • endTime • cellNumber • primaryCellComposition • primaryCellMeanTemperature • primaryCellGradientTemperature • companionCellComposition • companionCellMeanTemperature • companionCellGradientTemperature • binary • diffusion



	<ul style="list-style-type: none"> • comments
Investigation specific metadata	None
N/A	
Comments	None

4.2. Documents

Document Reference	Document Title	Description	Issue	Producer	Scientific content (Yes/No)
SCI-ESA-HSO-ESR-DCMIX4	DCMIX4 Experiment Scientific Requirements	Scientific requirements definition for the DCMIX4 investigation	i3 r0	ESA	No
EUSOC-MOIC-DCMIX4	DCMIX4 Mission Operations Implementation Concept	Operations definition for the DCMIX4 investigation	i1 r1	E-USOC	No

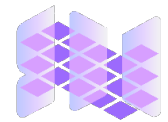
4.3. Foreseen execution summary

As defined in the investigation ESR ([AD1]), 48 runs will be executed in the DCMIX4 investigation. The duration of the run (and therefore the amount of generated files per run) will depend on the cell where each run is carried out. In the following tables the runs that will be executed are presented along with their main associated properties (Run ID, Cell, Primary cell mean temperature, Primary cell temperature difference and Priority).

Run ID	Run # (order of runs)	Cell#	Primary cell		Priority
			Mean temperature (T _{mean}) [°C]	Temperature difference (ΔT) [°C]	
1r01	1	1	20	2	High
1r02	2		25	2	High
1r03	3		30	2	High
1r04	4		20	2	Medium
1r05	5		25	2	Medium
1r06	6		30	2	Medium
1r07	7		20	2	Low
1r08	8		30	2	Low

Table 1: DCMIX4 Cell 1 Runs

Run #	Cell#	Primary cell
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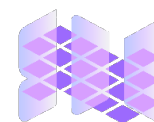


Run ID	(order of runs)		Mean temperature (Tmean) [°C]	Temperature difference (ΔT) [°C]	Priority
2r01	1	2	20	2	High
2r02	2		22.5	2	High
2r03	3		25	2	High
2r04	4		27.5	2	High
2r05	5		30	2	High
2r06	6		20	2	Medium
2r07	7		22.5	2	Medium
2r08	8		25	2	Medium
2r09	9		27.5	2	Medium
2r10	10		30	2	Medium
2r11	11		20	2	Low
2r12	12		30	2	Low

Table 2: DCMIX4 Cell 2 Runs

Run ID	Run # (order of runs)	Cell#	Primary cell		Priority
			Mean temperature (Tmean) [°C]	Temperature difference (ΔT) [°C]	
3r01	1	3	20	5	High
3r02	2		22.5	5	High
3r03	3		25	5	High
3r04	4		27.5	5	High
3r05	5		30	5	High
3r06	6		32.5	5	High
3r07	7		35	5	High
3r08	8		20	5	Medium
3r09	9		22.5	5	Medium
3r10	10		25	5	Medium
3r11	11		27.5	5	Medium
3r12	12		30	5	Medium
3r13	13		32.5	5	Medium
3r14	14		35	5	Medium
3r15	15		20	5	Low
3r16	16		30	5	Low

Table 3: DCMIX4 Cell 3 Runs



Run ID	Run # (order of runs)	Cell#	Primary cell		Priority
			Mean temperature (T _{mean}) [°C]	Temperature difference (ΔT) [°C]	
4r01	1	4	25	5	High
4r02	2		30	5	High
4r03	3		35	5	High
4r04	4		20	5	Medium
4r05	5		25	5	Medium
4r06	6		30	5	Medium
4r07	7		35	5	Medium
4r08	8		20	5	Low

Table 4: DCMIX4 Cell 4 Runs

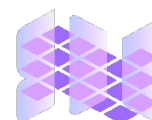
Run ID	Run # (order of runs)	Cell#	Primary cell		Priority
			Mean temperature (T _{mean}) [°C]	Temperature difference (ΔT) [°C]	
5r01	1	5 (as primary cell) and 6 (as secondary cell)	20	5	High
5r02	2		25	5	High
5r03	3		30	5	Medium
5r04	4		35	5	Low

Table 5: DCMIX4 Cell 5 Runs

4.4. As-run execution summary

Details about DCMIX4 execution can be found in the Internal and User's Tables of Runs (products defined in sections 4.1.3.10 and 4.1.3.11). However, the as-run execution summary and main differences compared to the foreseen execution (see 4.3) are listed below:

- Additional run. A non-foreseen run was executed (run 1r08d) with the following properties:
 - Cell number 1
 - Cooling to 17.5 degC (10 hours)
 - Heating to 25 degC (10 hours)
- Run 1r07 interrupted as per science team request on 2019-02-20T16:00:25
- Some runs were executed again: 3r06r (from 3r06), 5r02r (from 5r02)



- Some unavailable acquisitions due to file corruption in runs: 2r02, 3r02, 3r02, 3r03, 4r01, 5r03 and 5r02
- Some acquisitions may have erroneous pixels due to data corruption in runs: 1r08d, 2r04, 3r07 and 5r02r

4.5. User interface

1. A specific run could be selected in two different ways:

- Tabular view: From a table where run's main properties are presented:

<input type="checkbox"/> All run	Experiment	Run Name	Start Time	End Time	Type of Run	Primary Cell			Comments	
						id	Sample	Mean Temp.		Temp. Gradient
<input type="checkbox"/>	DCMIX4	3r03	2018-12-13T15:31:00	2018-12-14T15:00:00	Regular	3	T55-M25-C20	25	5	Completed
<input type="checkbox"/>	DCMIX4	5r01	2018-12-30T06:45:00	2019-01-03T06:45:00	Regular	5	P2-T55-C59	20	5	Completed
<input type="checkbox"/>	DCMIX4	3r10	2019-02-02T21:34:00	2019-02-03T09:36:00	Special	3	T55-M25-C20	25	5	Completed
<input type="checkbox"/>	DCMIX4	5r06	2018-02-05T06:45:00	2019-02-09T06:45:00	Special	5	P2-T55-C59	20	5	Completed
<input type="checkbox"/>	DCMIX3	Run_01	2016-09-02T07:45:00	2016-02-03T09:36:00	Regular	1	T55-M25-C20	25	5	Completed
<input type="checkbox"/>	DCMIX3	Run_02	2016-09-03T07:45:00	2016-02-04T09:36:00	Regular	2	T55-M25-C20	25	5	Completed
<input type="checkbox"/>	DCMIX3	Run_03	2016-09-04T07:45:00	2016-02-05T09:36:00	Special	3	T55-M25-C20	25	5	Completed
<input type="checkbox"/>	DCMIX2	Run_01	2013-11-02T21:34:00	2013-11-03T09:36:00	Regular	5	T55-M25-C20	25	5	Completed
<input type="checkbox"/>	DCMIX2	Run_02	2013-11-03T21:34:00	2013-11-04T09:36:00	Regular	2	T55-M25-C20	25	5	Completed
<input type="checkbox"/>	DCMIX2	Run_03	2013-11-04T21:34:00	2013-11-05T09:36:00	Regular	1	T55-M25-C20	25	5	Completed

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- Graphical view: From two graphics where run's main properties (mass fractions, mean temperature and gradient temperature) are selected:

