IRT management

IRT CM5

05 November 2025, Paris

Frédéric Pinsard

On behalf of the IRT team

1. Development plan and Schedule

DDVP THS-CEA-IRT-PL-0004

Schedule THS-CEA-IRT-PL-0003

MSR Schedule

THESEUS M7 I-PRR/MSR [Mark]	**65 days**	**Thu 15/01/26**	**Thu 16/04/26**
MSR Review Readiness Check	0 mons	Thu 15/01/26	Thu 15/01/26
MSR (ESA Documents Delivery)	0 days	Thu 29/01/26	Thu 29/01/26
I-PRR - Instrument Datapack Delivery [boundary condition]	0 mons	Fri 30/01/26	Fri 30/01/26
MSR ESA Global KO [Mission design & requirements baseline]	0 days	Mon 02/02/26	Mon 02/02/26
THESEUS M7 I-PRR	**31 days**	**Tue 03/02/26**	**Wed 18/03/26**
I-PRR KO IRT (@ ESTEC)	0 days	Tue 03/02/26	Tue 03/02/26
I-PRR KO SXI.XGIS (@ ESTEC)	0 days	Wed 04/02/26	Wed 04/02/26
Review period	21 days	Thu 05/02/26	Thu 05/03/26
Spring Holidays 2026 South Holland	7 days	Sat 14/02/26	Sun 22/02/26
Panel Meeting #1	0 days	Wed 11/02/26	Wed 11/02/26
Panel Meeting #2	0 days	Wed 18/02/26	Wed 18/02/26
Panel Meeting #3	0 days	Thu 26/02/26	Thu 26/02/26
RID coordination	0 days	Thu 05/03/26	Thu 05/03/26
RID release	0 days	Fri 06/03/26	Fri 06/03/26
RID response period	5 days	Mon 09/03/26	Fri 13/03/26
co-location IRT (@ ESTEC)	0 days	Tue 17/03/26	Tue 17/03/26
co-location SXI.XGIS (@ ESTEC)	0 days	Wed 18/03/26	Wed 18/03/26
THESEUS M7 MSR	**28 days**	**Sat 14/02/26**	**Wed 25/03/26**
MSR - Prime Datapack Delivery [boundary condition]	0 mons	Mon 16/02/26	Mon 16/02/26
Report to Board	0 days	Wed 08/04/26	Wed 08/04/26
MSR - Board Meeting [boundary condition]	0 days	Thu 16/04/26	Thu 16/04/26

IRT DDVP main dates

- The IRT will be developed with a Proto Flight Model approach to be able to cope with the main delivery date at spacecraft level:
  - A IRT Proto Flight Model (PFM) delivery Q1 2034
  - A IRT Electrical Functional Model (EFM) delivery Q3 2032
  - A IRT Thermal Demonstration Model (TDM) delivery in Q2 2031
- The IRT development shall also cope with the main instrument review date:
  - IRT-SSR in Q2 2028
  - IRT-PDR in Q2 2029
  - IRT-CDR in Q2 2031

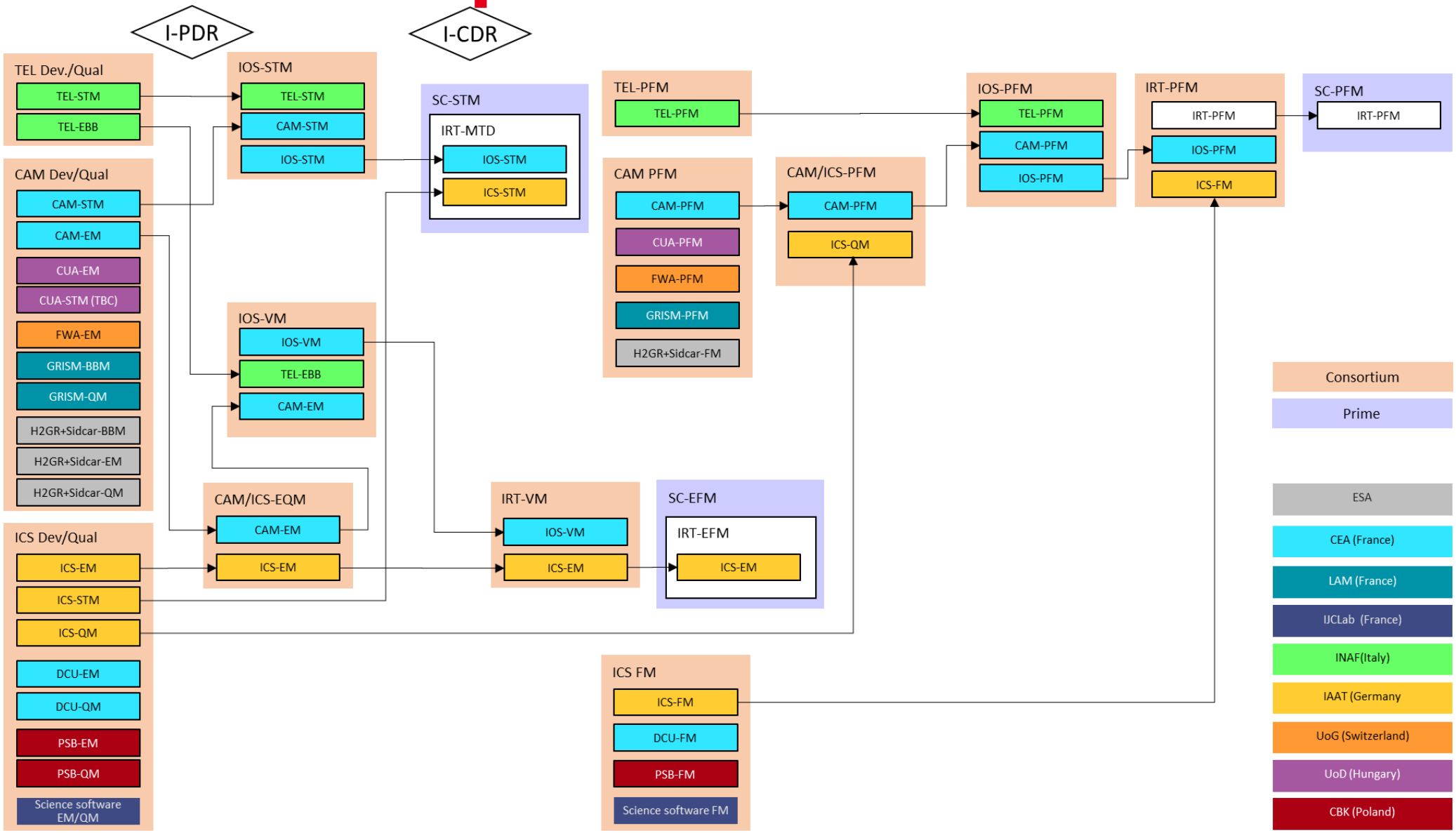
IRT models

- **Breadboards models (BBM):** Development testing to retire major risks, first Validation of all functional chains and evaluation of their performances Development testing at subsystem level (From KO Phase B1 to IRT-PDR) 2.5 years
  - BBM of the detection chain will be developed with the two following subsystem:
    - The detector control electronic BBM realized with standard electronics parts.
    - FPA BBM realized with a functional detector and Front end electronic but maybe not in the IRT final configuration.
  - BBM of the calibration functional chain will be developed with the two following subsystem:
    - Calibration Unit control electronic BBM realized with standard electronics parts.
    - Calibration Unit BBM realized with as representative elements as possible of the flight one.
  - BBM of the wheel functional chain will be developed with the two following subsystem:
    - Filter wheel control electronic BBM realized with standard electronics parts.
    - Filter wheel position sensor.
  - BBM of Data Processing board developed in order to start early the IRT software development
    - DPB BBM realized with standard electronics parts.(or processor development kit)
  - Telescope BBM activities
    - On optic mounting and Refocusing system

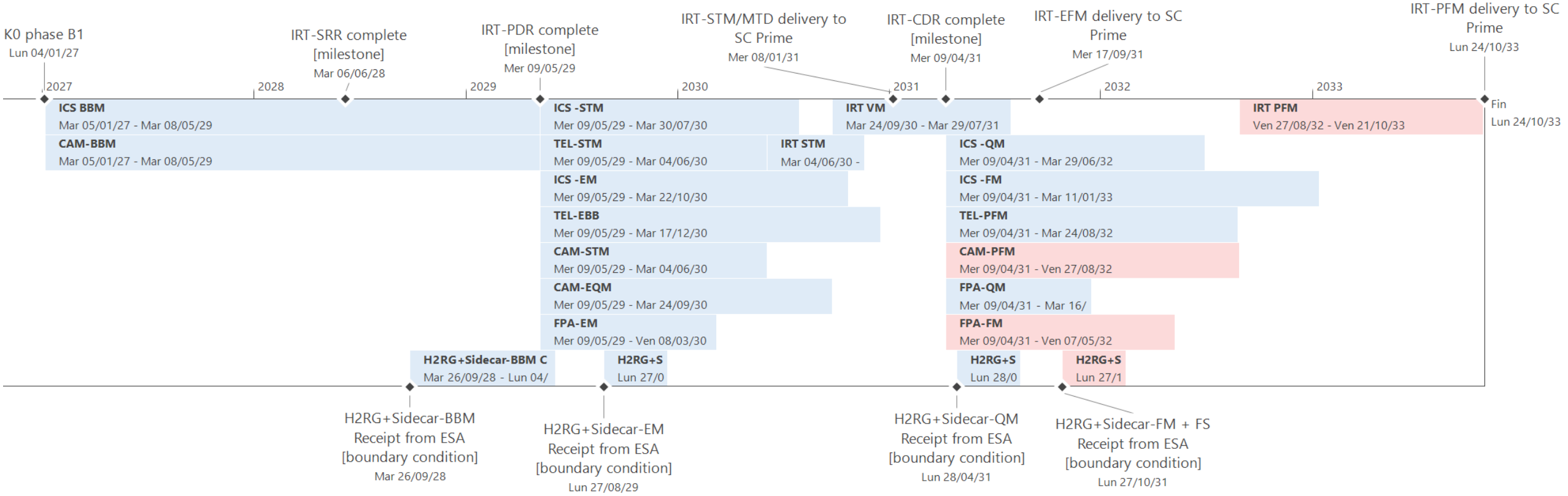
IRT models

- **Structural thermal model (STM) or Thermal Demonstration Model (TDM) deliverable at S/C level**: Verification of the mechanical and thermal behavior at Instrument level and PLM level, and optical alignment of telescope. (From IRT SRR to IRT CDR) 3 years
- **Engineering model (EM):** Verification of the design concepts and functionality as well as the electrical I/Fs at subsystem and instrument level. This model is as representative as possible compared to the flight Model as far as its electrical properties and its functionalities are concerned. (From IRT SRR to IRT CDR) 3 years
- **Verification model (VM):** performance verification and test procedure validation at IRT level. (Starting with the coupling tests between the camera and instrument control system, followed by the telescope EBB and Camera EM integration before IRT CDR, then the end-to-end tests for the IRT VM shall be done before PFM integration.)
- **Electrical Functional Model (EFM) deliverable at S/C level**: Verification of the communications and electrical behavior and instigate ground test sequences and flight operations. This model is built with the DHU electronic box EM with loads
- **Qualification Model (QM):** no qualification model will be developed at instrument level, but only at subsystem level (i.e. focal plan, Filter wheel, calibration unite and warm electronic box. Use to qualify the subsystem design. (From IRT CDR to Subsystem Qualification Review) 1 year
- **Proto Flight Model (PFM) deliverable at S/C level:** Full AIV sequence including IRT instrument performance verification and calibration. (From IRT CDR to PFM delivery) 2.5 years
- **Fight Spare (FS) deliverable at S/C level if needed:** Spare Parts of the IRT instrument for replacement at the satellite integration facility. (From Subsytem Qualification Review to PFM delivery)

IRT Verification plan overview



Schedule overview



IRT Verification plan overview

Verification test	TEL In Italy	CAM @CEA	ICS @IAAT	CAM+ICS @CEA	IOS @CEA	IRT @LAM
Performance ambient	EBB	PFM&EQM	FM,QM,EM	PFM&EM		PFM,VM
TVAC (Functional)	PFM	PFM&EQM	FM,QM	PFM&EM		PFM,VM
TVAC (Performance)	PFM	PFM&EQM	FM,QM	PFM&EM		PFM,VM
Physical properties	PFM,STM	PFM&STM	FM,STM		PFM,STM	
Static load	PFM,STM	PFM&STM	FM,STM		PFM,STM	
Sine	PFM,STM	PFM&STM	FM,STM		PFM,STM	
Random	PFM,STM	PFM&STM	FM,STM		PFM,STM	
Acoustic	PFM,STM	PFM&STM	FM,STM		PFM,STM	
Shock	EBB	EQM&STM	QM,STM			
Microvibration		PFM&STM				
EMC		PFM&EQM	QM,FM			
ESD		EQM	QM			
Magnetic		PFM&EQM				

Schedule Criticalities and the Critical Path

- The current schedule leaves some margin for delivery at the SC level:
  - 5 months margin for the PFM delivery to S/C
  - 3 months margin for the STM delivery to S/C
  - A year margin for the EFM delivery to S/C
- Currently the IRT-instrument PFM critical path goes through:
  - Detector FM characterization
  - Focal plan FM integration and test
  - Camera PFM integration and tests
  - Instrument PFM integration and tests

2. IRT Risk assessment and mitigation

Risk_Register THS-CEA-IRT-LI-0002_M7.2.0_

Risk instrument update

Risk Id	Sub-system	**Risk scenario**	Classification	**Control actions / Current status**
IRT-RISK-01	IRT	ITAR/Licensing issues	MINOR	minimize the ITAR component as far as possible
IRT-RISK-02	IRT	chain detection not redondant (detector + ASICS + DCU)	MEDIUM	FMECA on design Quality of EEE components
IRT-RISK-03	IRT-CAM	Find infrared LEDs (NISP experience using Russian infrared LEDs)	MINOR	R&T (development program ongoing with CNES) Several sources has been idemtified
IRT-RISK-04	IRT-TEL	Mirrors manufacturing tolerance are not met	MEDIUM	Anticipate manufacturing technology verification in phase A
IRT-RISK-05	IRT-TEL	Interface bipods stiffness not compatibile with S/C TE displacement	MINOR	Validate the bipods design with S/C TE data
IRT-RISK-06	IRT-TEL	Optical bench TE effects not compatible with LoS stability	MINOR	Addition of optical bench thermal control
IRT-RISK-07	IRT-CAM	Management microvibration at cryo interface	MEDIUM	Study of mechanical decoupling
IRT-RISK-08	IRT	The efficiency of earth baffle can not be tested at intrument level	MEDIUM	simulation should be done
IRT-RISK-09	IRT-CAM	Aluminium camera design performance not compliant with requirements.	MINOR	The mechanical and thermal modelling of the camera has been completed and appears to meet the IRT performance requirements. These results shall be confirmed through camera mock-up testing.

A new risk may need to be added regarding the cryocooler if its management is handled by the IRT consortium ?

Risk substem to be updated ?

Risk Id	Sub-system	**Risk scenario**	Classification	**Control actions / Current status**
IRT-ICS-RISK-01	IRT-ICS	Hardware malfunction	MINOR	Cold redundant backups of all boards except DCU
IRT-ICS-RISK-02	IRT-ICS	Single event effects on digital components	MINOR	All critical baseline components must be radiation hardened.
IRT-ICS-RISK-03	IRT-ICS	TM/TC transmission error	MINOR	Acknowledgement of data packet receipt. EDAC.
IRT-ICS-RISK-04	IRT-ICS	Software bug	MINOR	Thorough testing of all software before deployment. Fully functional 'basic' software stored in PROM as backup.
IRT-ICS-RISK-05	IRT-ICS	Failure of 'master' I-DHU	MEDIUM	Any of the I-DHUs can assume 'master' authority.
IRT-ICS-RISK-06	IRT-ICS	Lack of personnel	MINOR	Hire sufficient personnel for phase B activities.
IRT-ICS-RISK-07	IRT-ICS	Damage of I-DHU due to critical temperatures	MINOR	I-DHU temperatures will be continuously monitored during operation. Thermal design and analysis will ensure that the DHUs will not achieve critical temperatures through standard use, Cold-redundant backups of all boards can replace the nominal boards in case of thermal damage.
IRT-ICS-RISK-08	IRT-ICS	Critical mechanical design	MINOR	All units will be designed to meet requirements with appropriate margins. This is verfied through mechanical and thermal FEA.
IRT-ICS-RISK-09	IRT-ICS	Critical DPB design	MEDIUM	All units will be designed to meet requirements with appropriate margins. Alternate components will be identified as backups for each electronic components in case the baseline component does not meet requirements.
IRT-ICS-RISK-10	IRT-ICS	Critical PSB design	MEDIUM	All units will be designed to meet requirements with appropriate margins. Alternate components will be identified as backups for each electronic components in case the baseline component does not meet requirements.
IRT-ICS-RISK-11	IRT-ICS	Equipment delay	MEDIUM	All development activities will have margins to allow for delays.
IRT-ICS-RISK-12	IRT-ICS	Loss of critical skills	MEDIUM	Sufficient personnel will be hired.
IRT-TEL-RISK-01	IRT-TEL	Truss designed CTE is not achieved	MINOR	BB manufactured and tested in phase A
IRT-TEL-RISK-02	IRT-TEL	Refocusing mecanism does not achieve the requirements	MINOR	Developing a backup configuation without refocusing system
IRT-TEL-RISK-03	IRT-TEL	M2 mounting not compatible with low temperature range	MINOR	Addition of M2 thermal control

3. IRT Critical technology status and plan

Critical technology THS-CEA-IRT-RP-0004_M7.2.0

IRT Critical technology status

Parts	Technology foreseen	anteriority	Status of verification/qualification	specific qualification foreseen	back-up foreseen
Detectors	Teledyne Hawaii-2RG 2048x240 pix, 18µm, RON 7 e- EUCLID customized (TRL9)	Used on NISP/EUCLID	Qualified (TRL9)	TRL6 for mission adoption	-
Camera Structure	Material: Aluminium 6061 T6	Used on JWST/MIRI	Standard	No specific qualification is foreseen. A material trade-off is ongoing with a camera manufacturing and testing activities.	SIC utilized in NISP/EUCLID and in the M5 design study
(Cold) Front-end electronic	Asics Teledyne	Used on NISP/EUCLID	Qualified (TRL9)	To be qualified at cold temperature	-
Warm electronic	Standard	All project	Standard	No specific qualification	-
Filter wheel assembly	Standard	HITOMI & XRISM filter wheels, Euclid/RSU	Standard	To be qualified at cold temperature to verify especially the torque margins, the repeatability and positional accuracy, the holding of the position during shock/vibration tests	-
Driving motor	SAGEM Phytron stepper motor	Euclid/NISP	TRL 9 will be achieved likely at the time of the THESEUS adoption	To be qualified while mounted on the IRT WA but operations at cold for many more actuations than needed for IRT already achieved within the context of the Euclid/NISP qualification in a similar temperature range	-

IRT Critical technology status

Parts	Technology foreseen	anteriority	Status of verification/qualification	specific qualification foreseen	back-up foreseen
Filters	Material SILICA Thickness : 7mm Clear aperture CA=35 mm approx	Many projects	Standard	To be qualified at cold temperature during the lifetime test of the unit. Resistance to shock and vibrations to be demonstrated during the corresponding campaigns but no issue foreseen given heritage from many previous missions.	-
Grism	Material N-F2 / Silica Thickness: 7mm Clear aperture CA=35mm approx Grating: 27 lines/mm	Galex, NISP	Standard	Tests to be performed after gluing into the mounts: - cryogenic tests - vib tests	N/A
Mirrors	Zerodur	Many projects	Standard	Cryogenic test	N/A
IR LED (calibration unit)	LED		several provider as been idemtified	Qualification foreseen	-

Thank You

Frederic.pinsard@cea.fr