

The AIRS logo features the text "AIRS" in a bold, white, sans-serif font. Below the text is a horizontal line with a rainbow color gradient. To the right of the text is a stylized graphic of a crescent moon with a red ring at its base, set against a background of white stars on a dark blue field.

AIRS

Ariel InfraRed Spectrometer (AIRS) DR: Performance Summary

09 June 2026

J. Amiaux on behalf the AIRS team

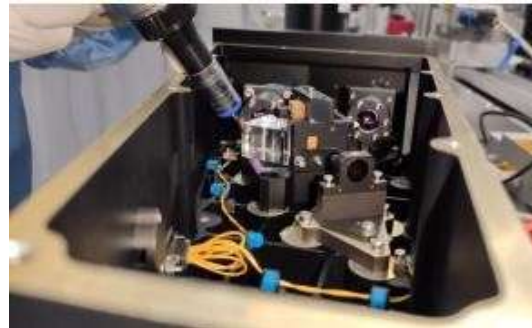




2026: a Millésime year for AIRS

2 huge events from instrument perspective:

- Critical Design Review: a major step in instrument lifecycle
 - Several months of preparation
 - 159 documents covering: Design, Interface and Verification of >500 applicable requirements
 - Successful (pending closure of actions of course)
- Engineering Model: the first fully representative AIRS model under tests (*see presentation by Jean Michel Reess for nice results*)
 - Full chain: Optical Chain + Detector + Cold and Warm electronics + Harness





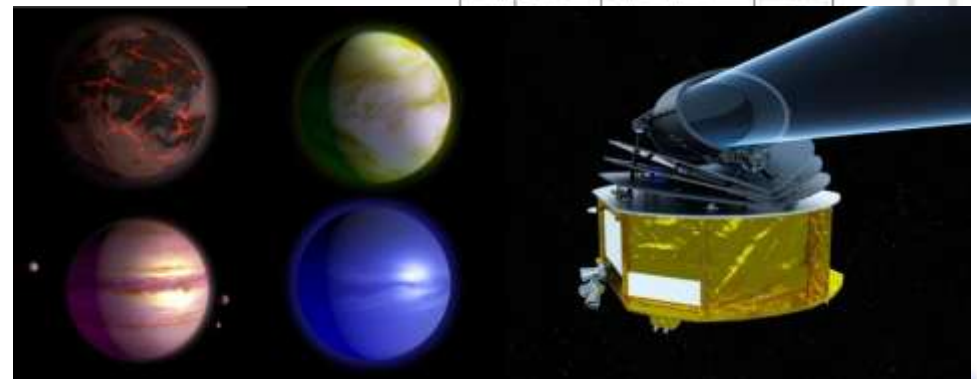
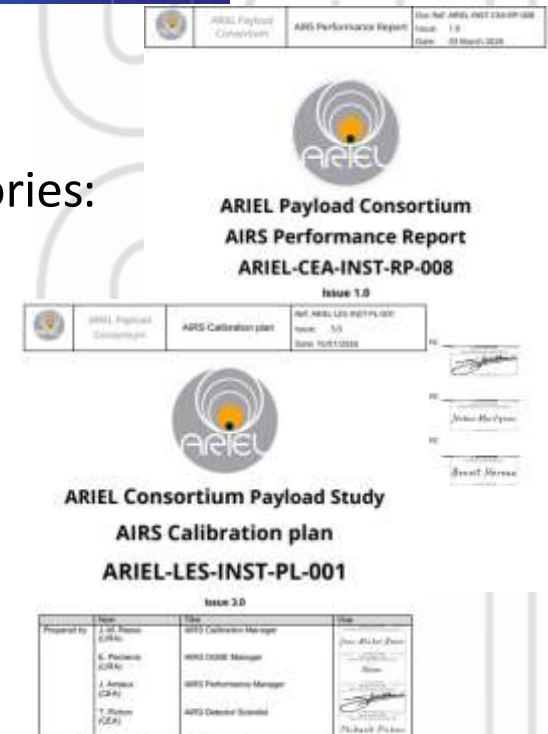
Performance and Calibration Requirements

If interested by Science out of the ~500 requirements:

- **36 performance requirements** distributed in 7 categories:

1. General Conditions
2. Observing Sequence
3. Figure of Merit
4. Structural Thermal Optical
5. Detection chain
6. Stability
7. Calibration

- **16 calibration requirements**



ID	Title	Compliance
R- AIRS- 0390	AIRS Channels Nominal Wavelength Range	C[DT]
R- AIRS- 0400	Extended Spectral Channels Range	C[DT]
R- AIRS- 0620	AIRS input beam	C[DT]
New R- AIRS- xxx	AIRS Performance Field	C[DT]
R- AIRS- 0605	Applicable Temperature	C[DT]
R- AIRS- 0311	AIRS Observing efficiency	C[A]
R- AIRS- 0325	AIRS Observation Time (extension)	C[A]
R- AIRS- 0330	AIRS observation time	C[D] (T)

R- AIRS- 0370	Bright Targets	C[D]
R- AIRS- 0372	AIRS Input Signals	C[A] (T)
R- AIRS- 0510	Temporal Resolution	C[A]
R- AIRS- 0460	Instruments' Minimum out-of-channel Performance	C[AT]
R- AIRS- 100590	AIRS Figure of Merit	C[AT]
R- AIRS- 100591	AIRS Detector Quantum Efficiency	C[DT]

R-
AIRS-
0421

AIRS Spectral Resolving Power

ND[AT]

R- AIRS- 0430	AIRS and NIRSPEC Spectral Sampling	ND[AT]
R- AIRS- 108827	Best Area selection	C[D] (T)
R- AIRS- 8390	AIRS minimum CH0 FoV	C[DT]
R- AIRS- 8400	AIRS minimum CH1 FoV	C[CT]
R- AIRS- 8402	AIRS Unvignetting	ND[AT]
R- AIRS- 0730	AIRS Optical Reference Cube	C[D]
R- AIRS- 0780	Total Integrated Scatter	C[A]
R- AIRS- 0782	Ghost Reflections	C[A]
R- AIRS- 8790	Relative Pupil Sizes	ND[A]
R- AIRS- 8290	Optical Mathematical Model	C[D]
R- AIRS- 8310	Straylight Analysis	C[D]

R- AIRS- 110591	AIRS QE EOL degradation	C[AT]
R- AIRS- 118812	BOL to EOL RON degradation	C[AT]
R- AIRS- 108812	Detector Read Noise	C[AT]
R- AIRS- 8813	AIRS Detector Dark Current : Median	NC[AT]
R- AIRS- 8813	AIRS Detector Dark Current : 95%	C[AT]
R- AIRS- 8814	AIRS Detection Chain Non-linearity	C[AT]
R- AIRS- 8827	Detector Operability	C[AT]
R- AIRS- 8818	Instrument Gain Variations	C[A]
R- AIRS- 8823	Instruments Additive Noise Variations	C[DT]
R- AIRS- 0520	Payload Calibration	C[D]





Performance: 1 slide summary at CDR



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Performance: 1 slide summary today

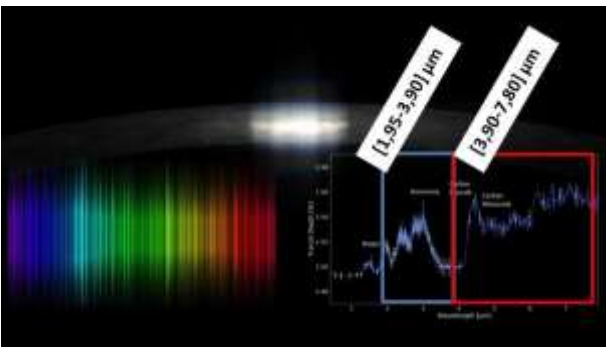
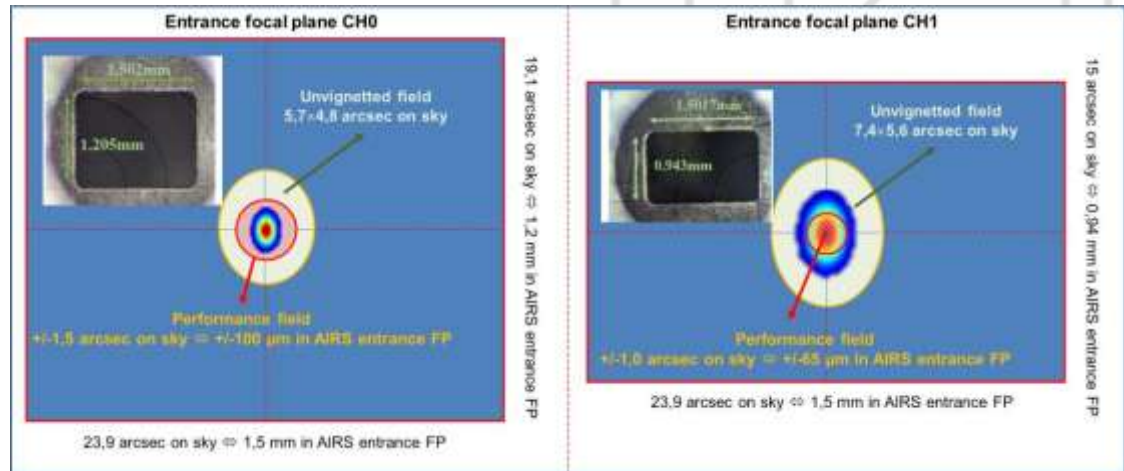
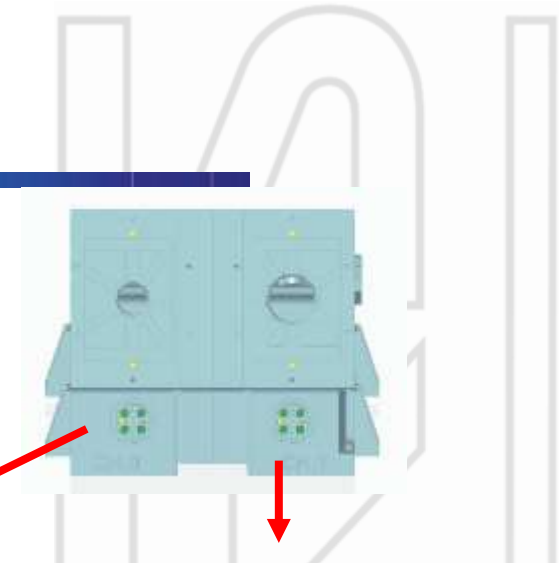




General Conditions

Mainly defines conditions at interface that drives the design:

- Wavelength (nominal and extended bands): 1750 nm – 7800 nm
- Telescope input beam / Field of performance
- Temperature: 60 K



Important note:

The full payload is aligned to put the target on CHANNEL 1 boresight (within APE)
CHANNEL 0 is aligned to +/- 0,5 arcsec with respect to CHANNEL 1 using Common optics M7
AIRS co-aligne and reference CH0 and CH1 to be within range of alignment of M7

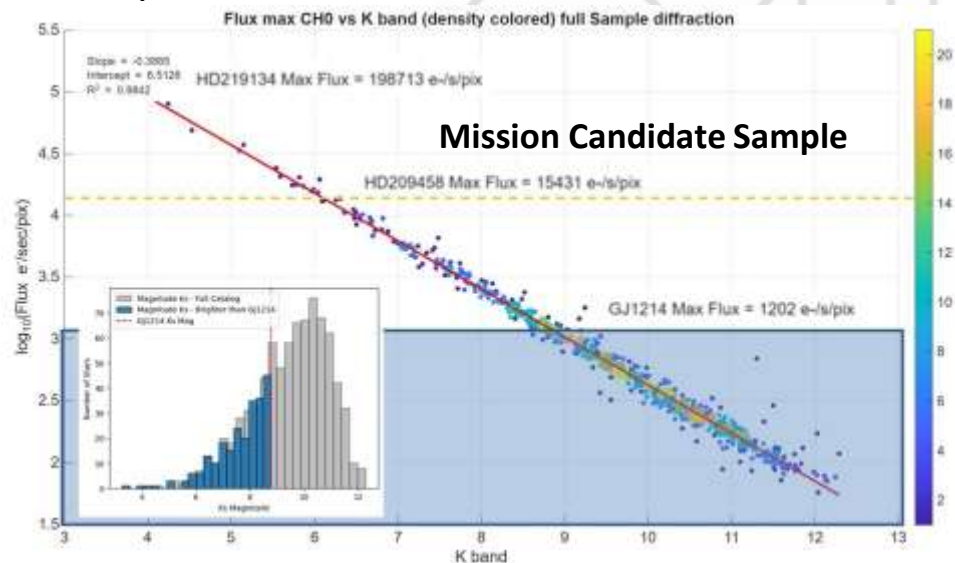
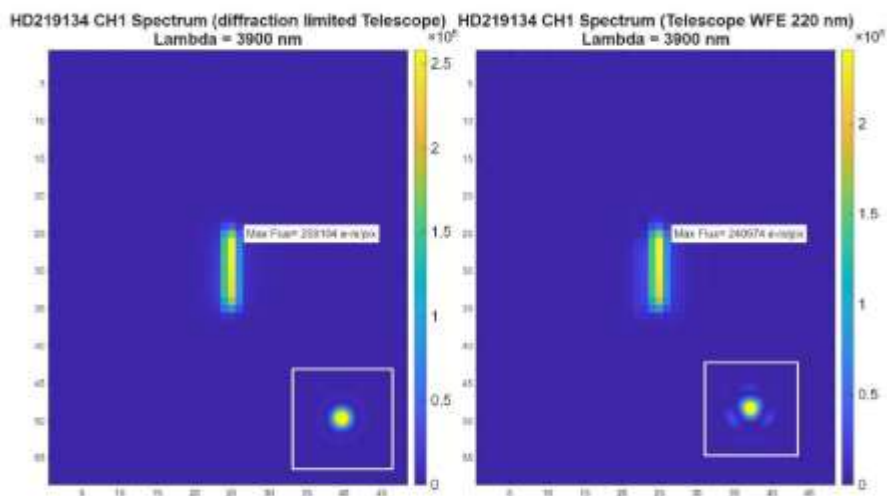


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Observing Sequence

- Defines what is the range of flux [min-max] over target range and the dynamics [min-max for a given target]. Analysis based on requirement and EXOSIM simulations.



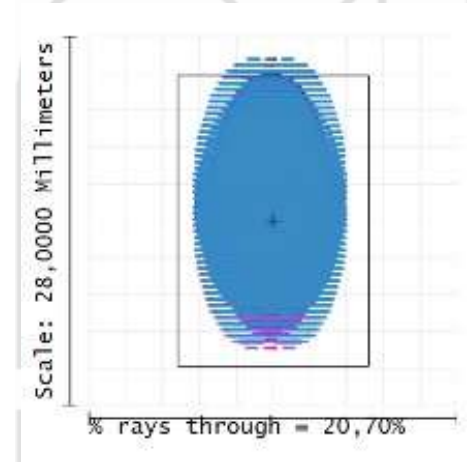
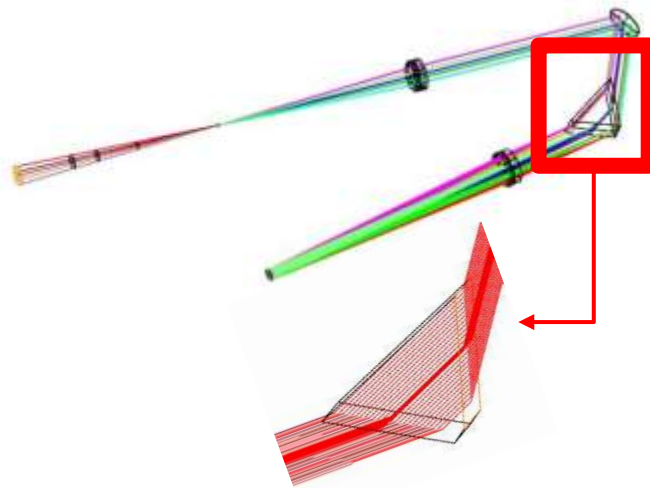
- Verification that our science operation concept is allowing observations of the full range of targets flux
- **Compliant:** In particular verification that the size of window and read out scheme are compatible with flux and efficient in science photons collection

See presentation by Pierre Vigneron for detailed analysis



Structural Thermal Optical: Vignetting

- But in worst case of tolerancing and telescope mis-alignment risk of vignetting on CH0



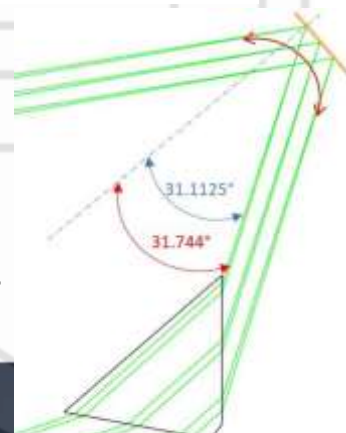
Non Compliant: risk of vignetting on the input surface of the prism of CH0:
~3% flux vignetting

Investigation of corrective actions:

By shifting the source position in AIRS CH0 (CH1 is not vignettted after source shift)

1)

By tilting the fold mirror (but displacement of the spectrum on detector)



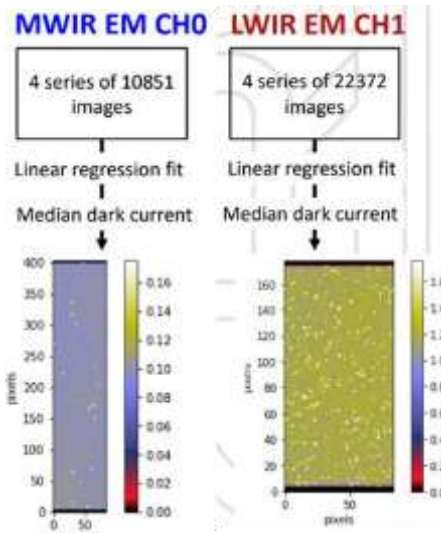
2)





Detection chain

Detection Chain performance (including detector, CFEE and DCU): Tbits of data taken:



CEA	CH0		CH1	
Dark	Median <0,08 e-/s/pix	95% (<5)	Median <0,8 e-/s/pix	95% (<10)
EM	0,13	0,15	2,15	2,2

	EM CH0	EM CH1
Wavelength range	[0.4-4.75] μm	[0.4-8.09] μm
Glow per frame	0.038 e-/frame	0.131 e-/frame

Non-Compliant: Dark current median value higher than reported by Teledyne due to extra glow dark current when using window mode. First discussion on impact ²¹ of



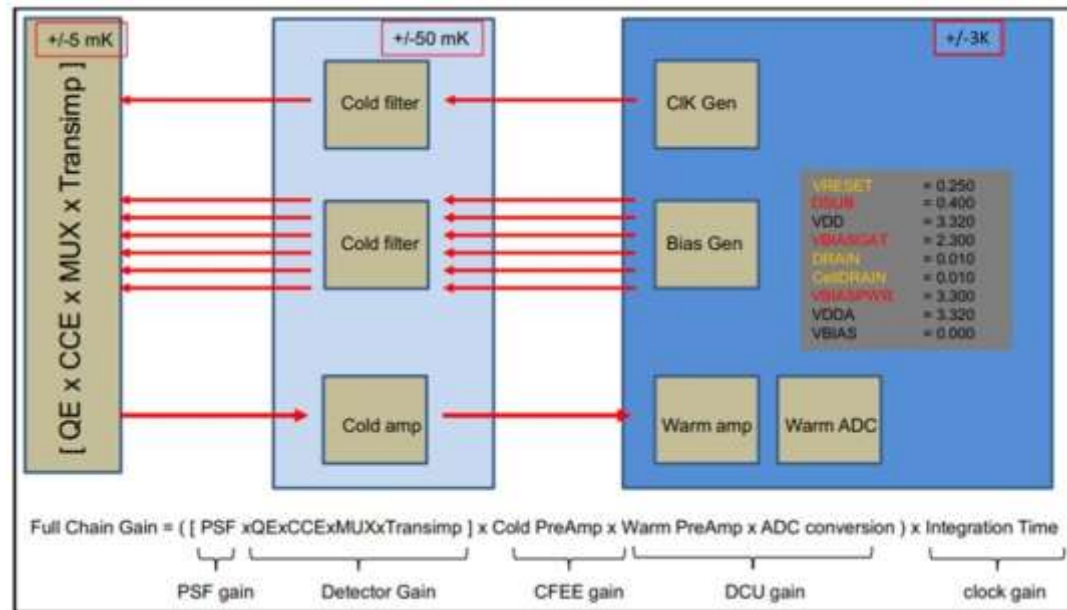
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Stability

AIRS full gain chain stability verification by analysis based on full chain thermal



Compliant: estimates of the thermal stability (acquisition chain), bias sensitivity (linked to thermal sensitivity at DCU level where the bias are generated).



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Summary

- Successful CDR (open gate to Flight Model)
- CDR performance verification mainly rely on design analysis and a large amount of component and subsystem level testing
- Verification by test on the EM is on-going (3 months of campaign with lots of data: *see presentation by Jean Michel Reess for nice results*)
- Remaining point of vigilance:
- Independant verification of detector performance (in particular QE)
- Dark current (extra dark glow)

- 
- Optical vignetting correction
 - Analysis of large amount of data on EM (in particular for fine effects for validation of stability analysis or persistence correction) will keep us busy through 2026



AIRS is a joint development by :

