AQUARIUS/SAC-D

2010 HyspIRI Science Workshop

NIRST
Description & operation

H. Marraco

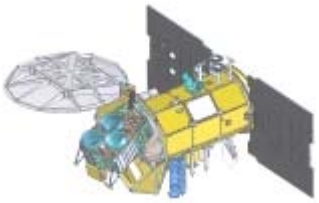
21-24 August 2010
Pasadena, California, USA

NASA

CONAE
COMISION NACIONAL DE ACTIVIDADES ESPACIALES

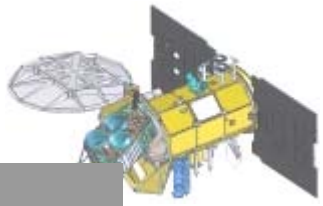
CSA ASC

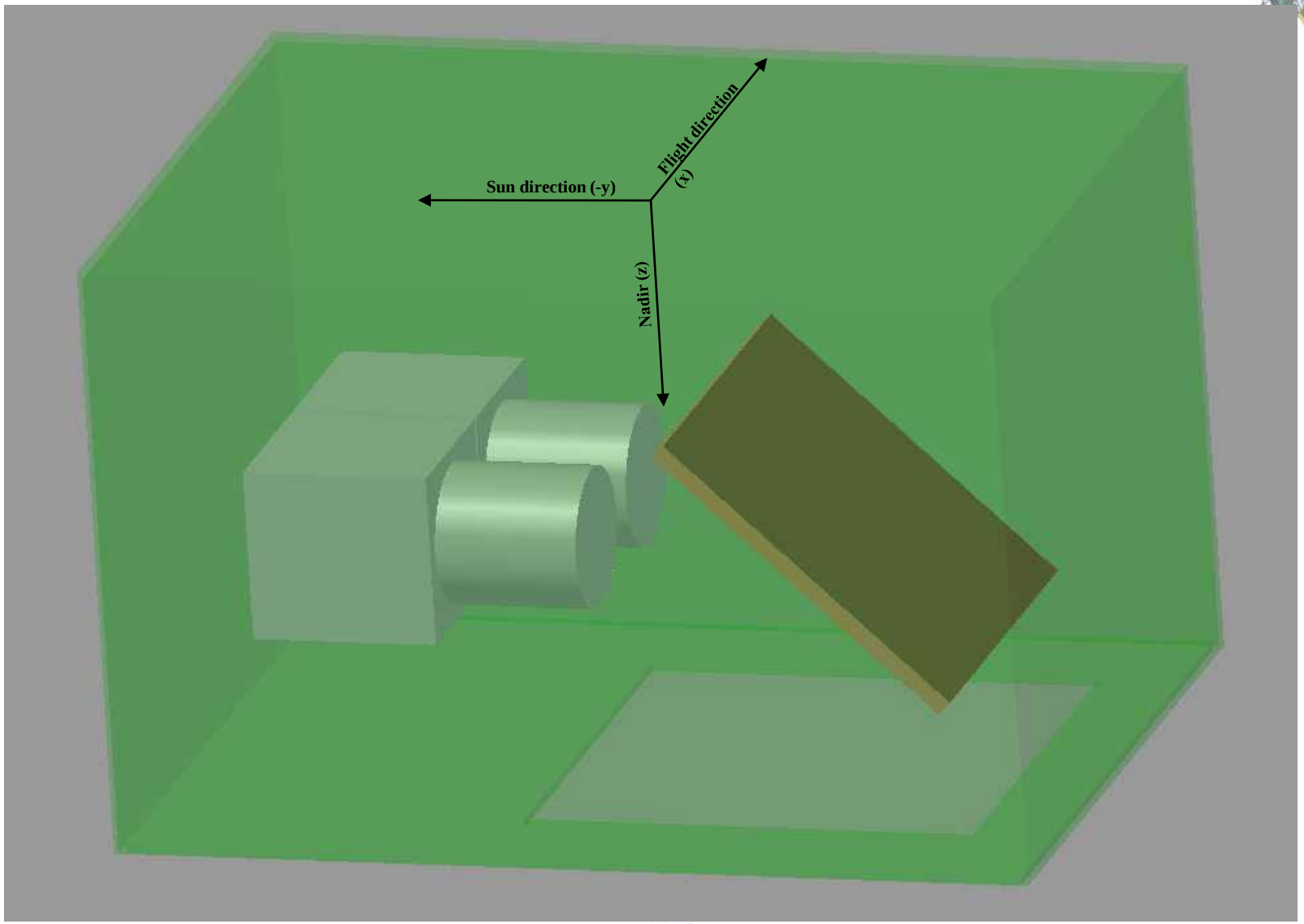
BANDS



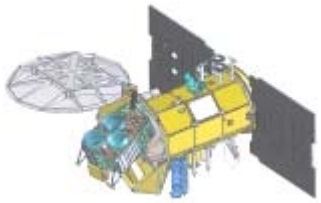
		MWIR2 (Band 1)	LWIR2 (Band 2)	LWIR3 (Band 3)
Central wavelength		3.8 µm	10.85 µm	11.85 µm
Band Limits		3.4 – 4.2 µm	10.4 – 11.3 µm	11.4 – 12.3 µm
Temperature	Min.	400K	250K	
	Max.	1000K	500K	
NE∆T		<1.5K @ 400K	<0.8K @ 300K	<0.4K @ 300K
Temp. accuracy		2.5K @ 400K	1.5K @ 300K	<2K @ 300K
Detectable size of fire event		200m^2 @ 1000K		

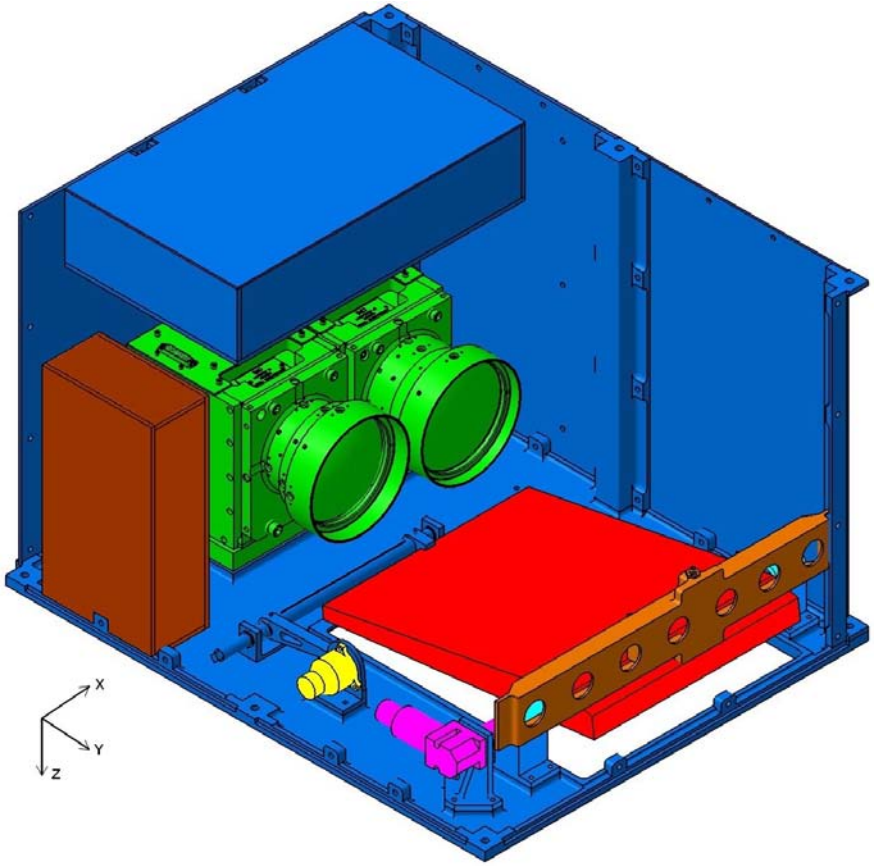
Conceptual design

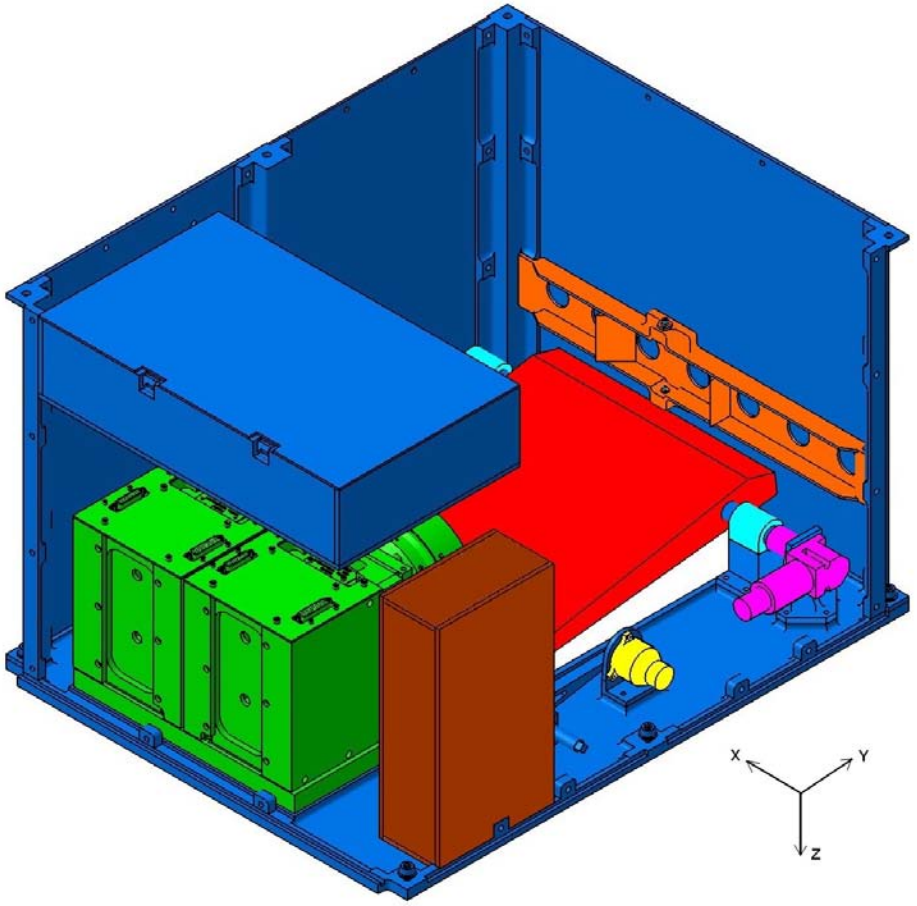




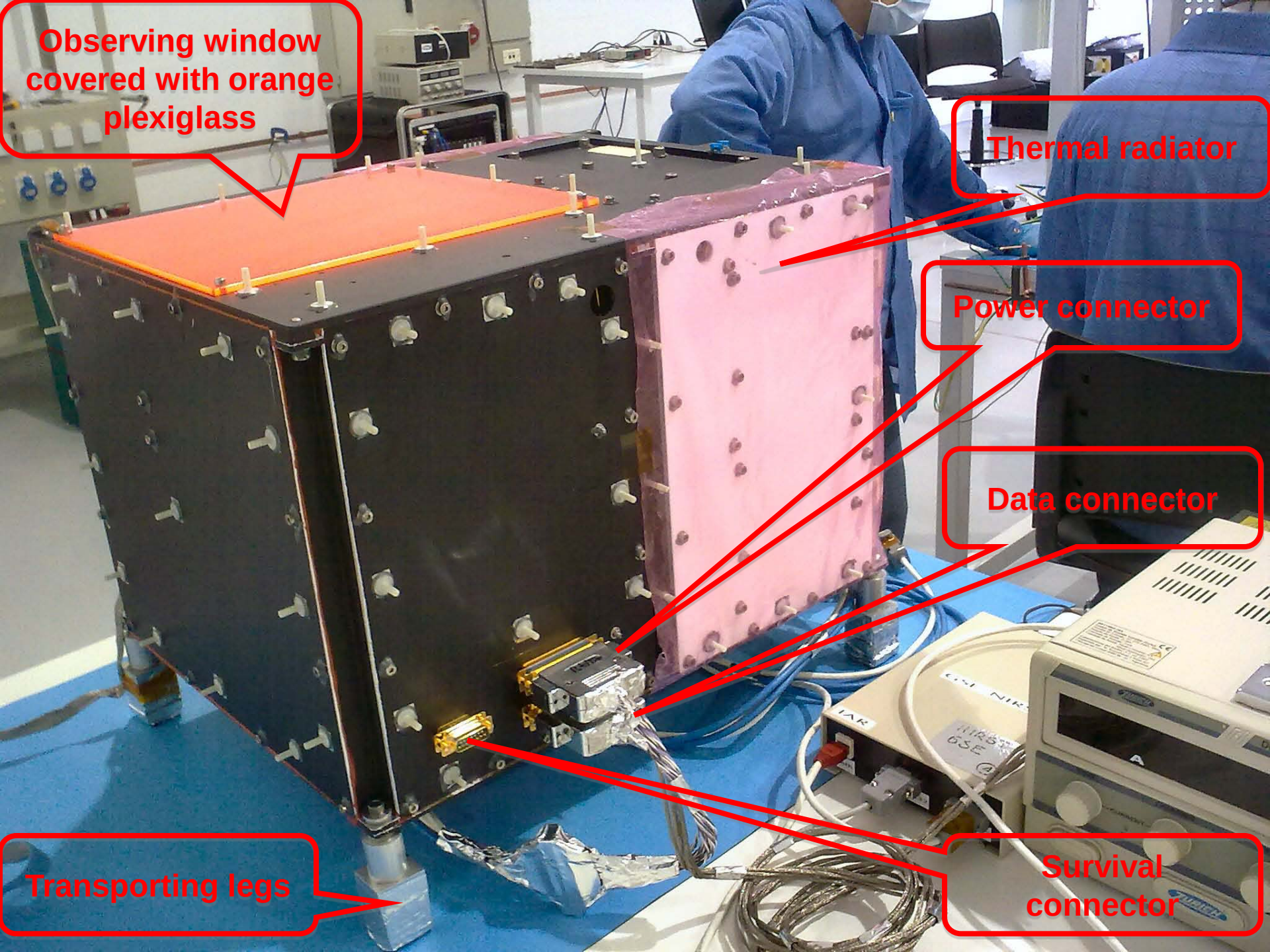
NIRST COMPONENTS

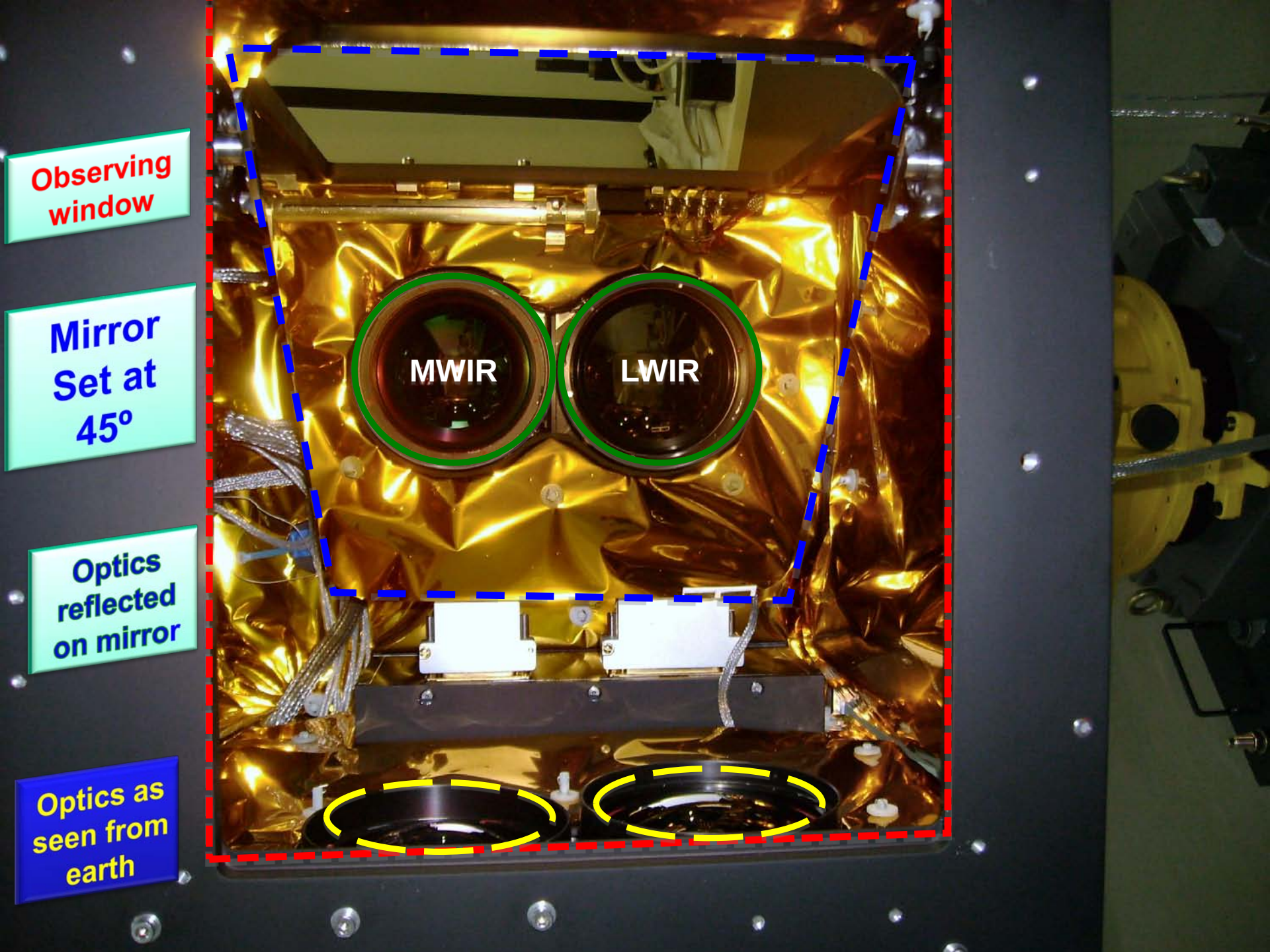




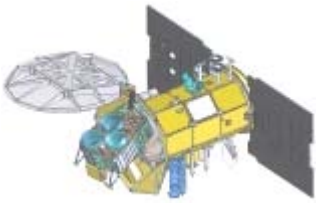


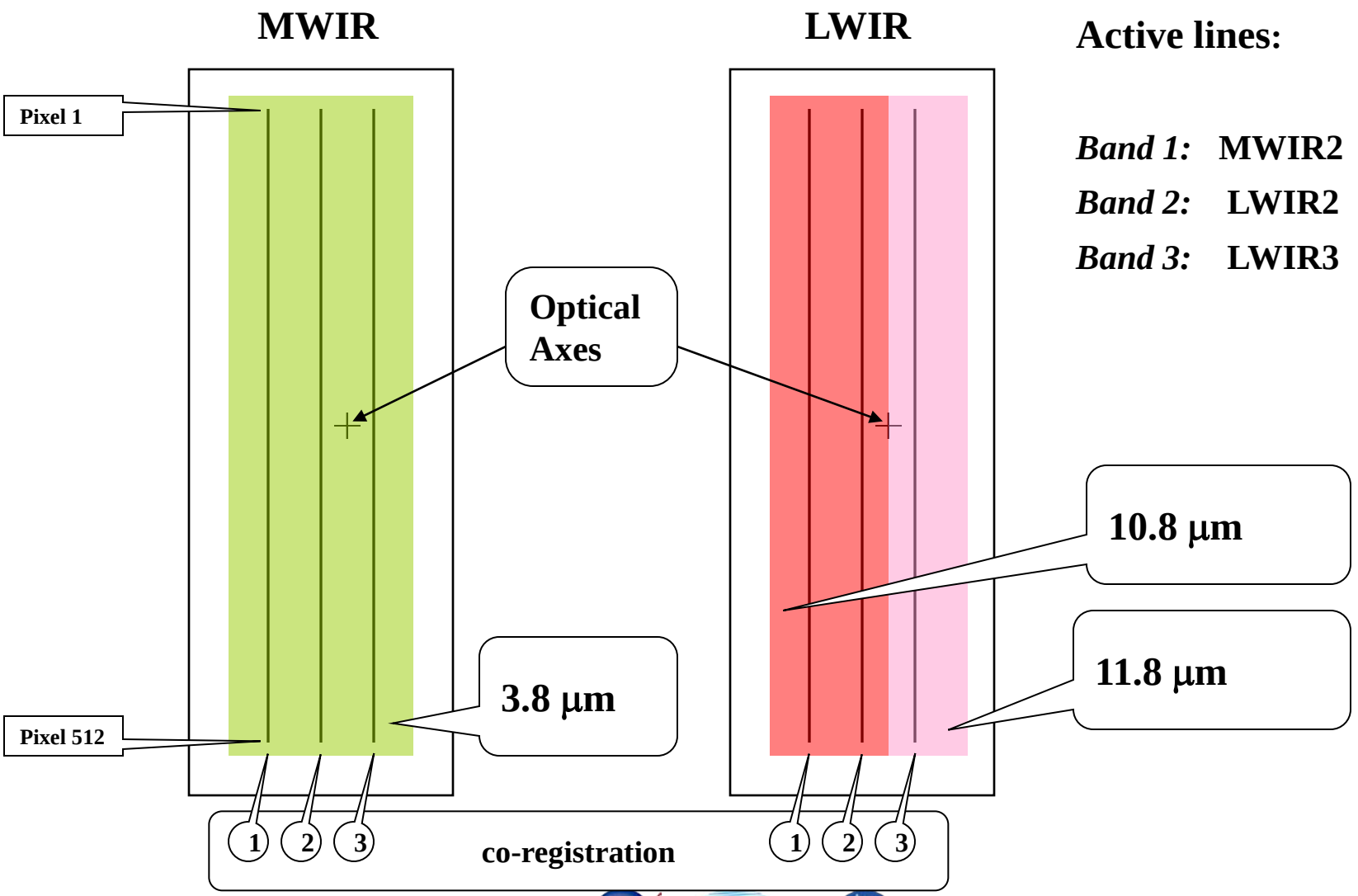
GREEN:	**INO-CSA**
BROWN:	**IAR**
YELLOW:	**TINI AEROSPACE**
BLUE:	**GEMA**
MAGENTA:	**CDA INTERCORP**
ORANGE:	**CIOP-GEMA**
LIGHT BLUE:	**SFK-AMPEP**
RED:	**AXSYS TECHNOLOGIES**


Observing window covered with orange plexiglass
Thermal radiator
Power connector
Data connector
Transporting legs
Survival connector


Observing window
Mirror Set at 45°
Optics reflected on mirror
Optics as seen from earth
MWIR
LWIR

FPA





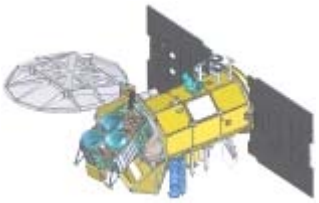
Active lines:

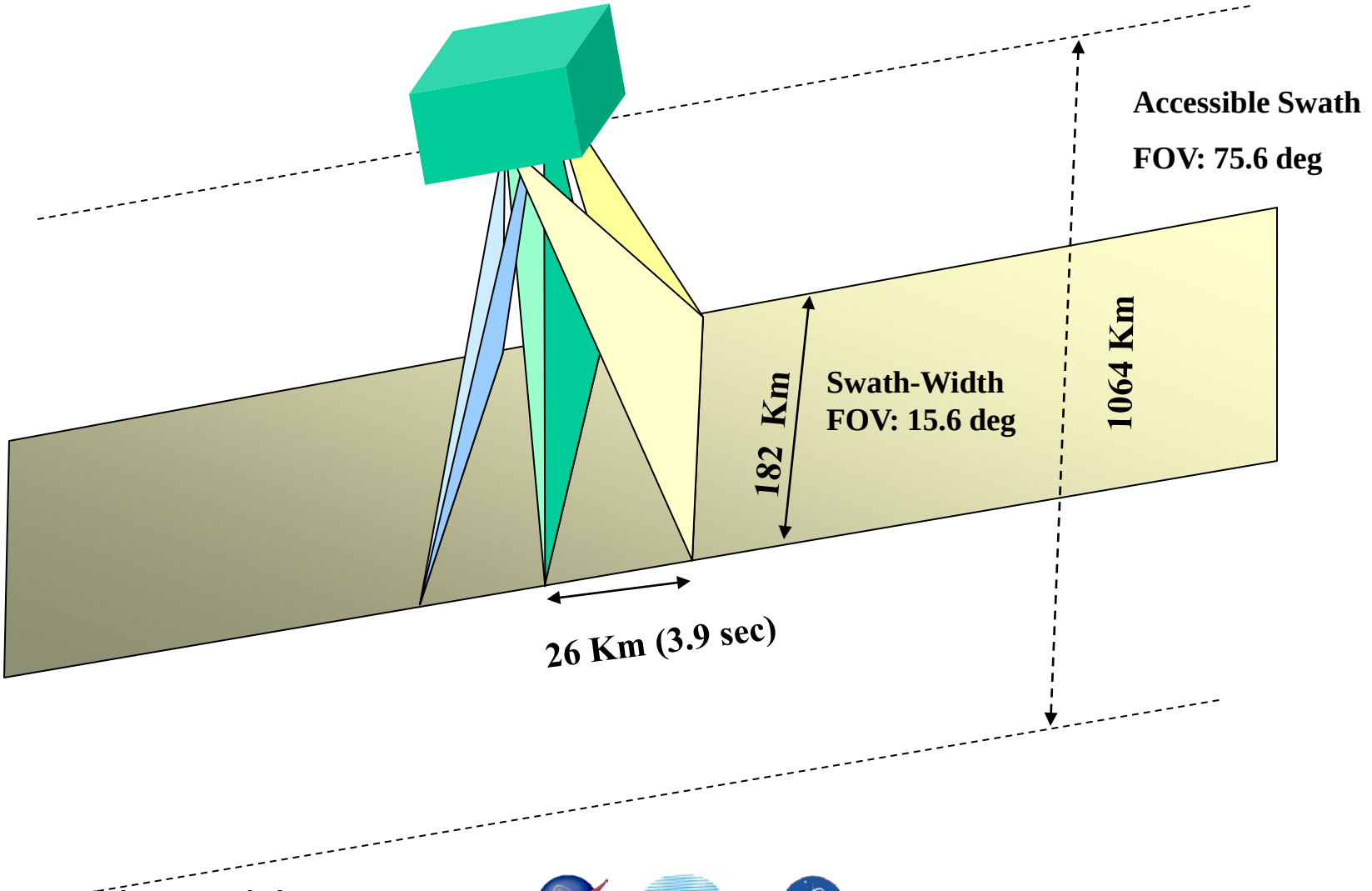
Band 1: **MWIR2**

Band 2: **LWIR2**

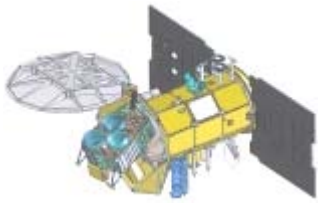
Band 3: **LWIR3**

NIRST Fields of View





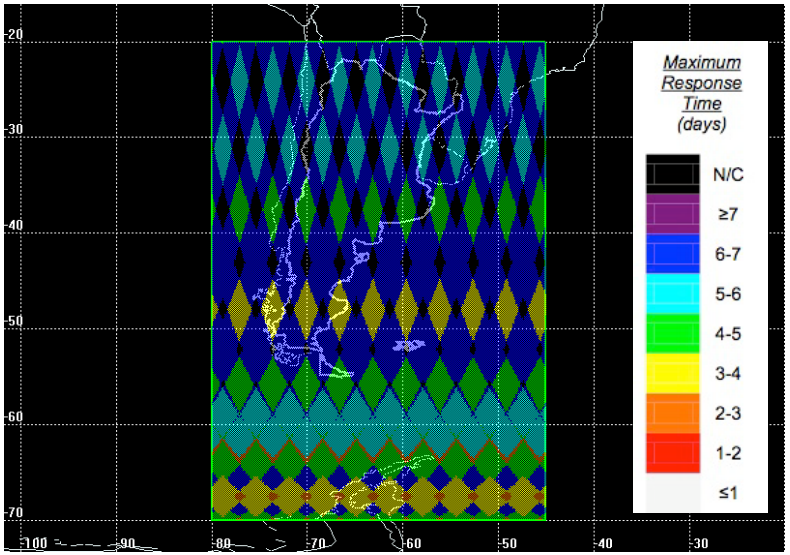
Revisit Scenario



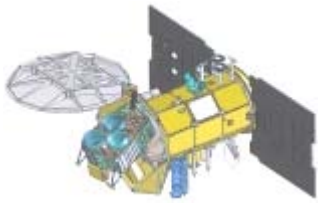
Virtual (1000 km swath)

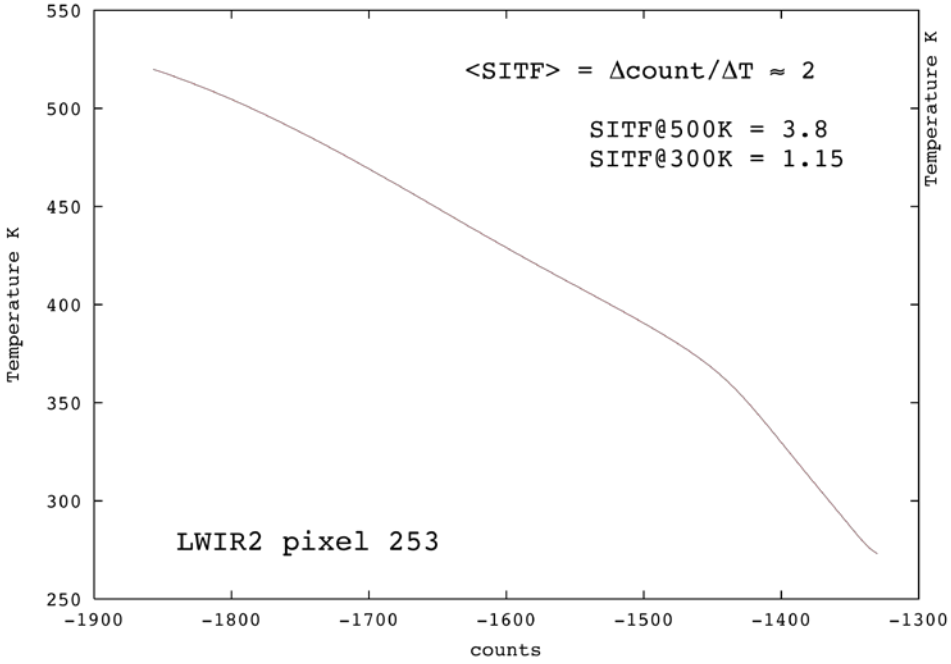
Latitude	Example location	Average revisit interval (days)	Maximum missing days
±67º	Northern Canada	0.5	0
±55º	Tierra del Fuego, mid Canada	0.7	1
±23º	Jujuy	1.2	2

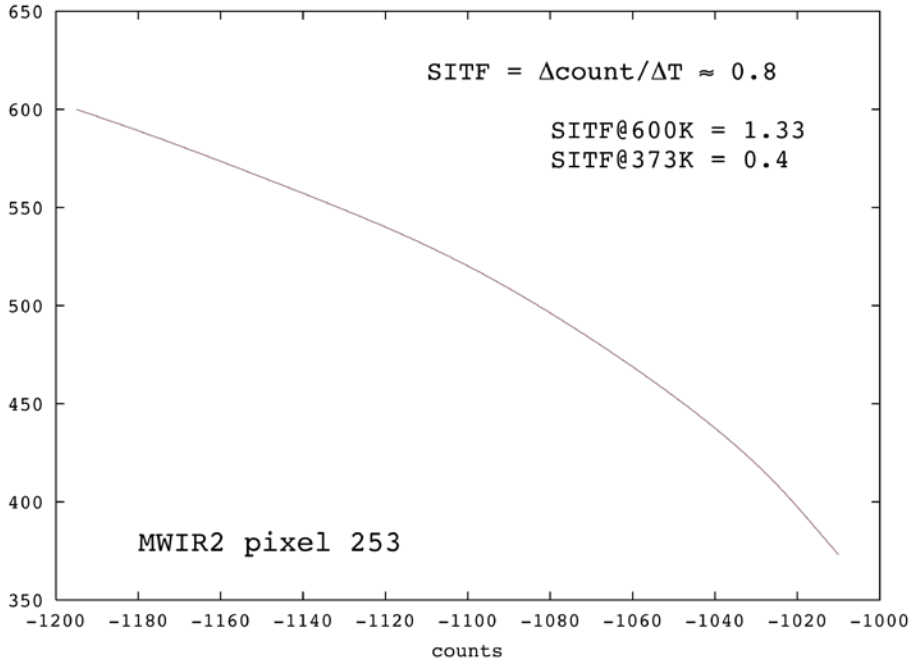
Nadir pointing (182 km swath)



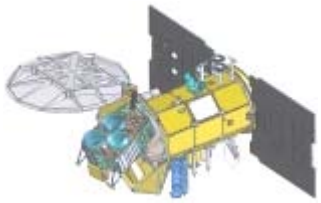
System Transfer Function

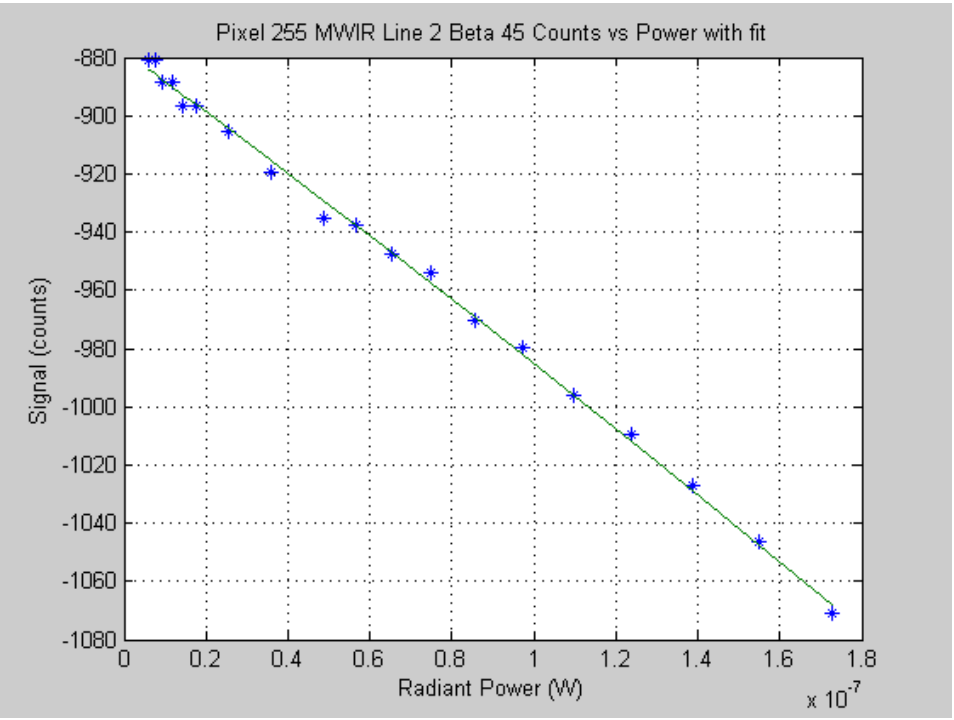


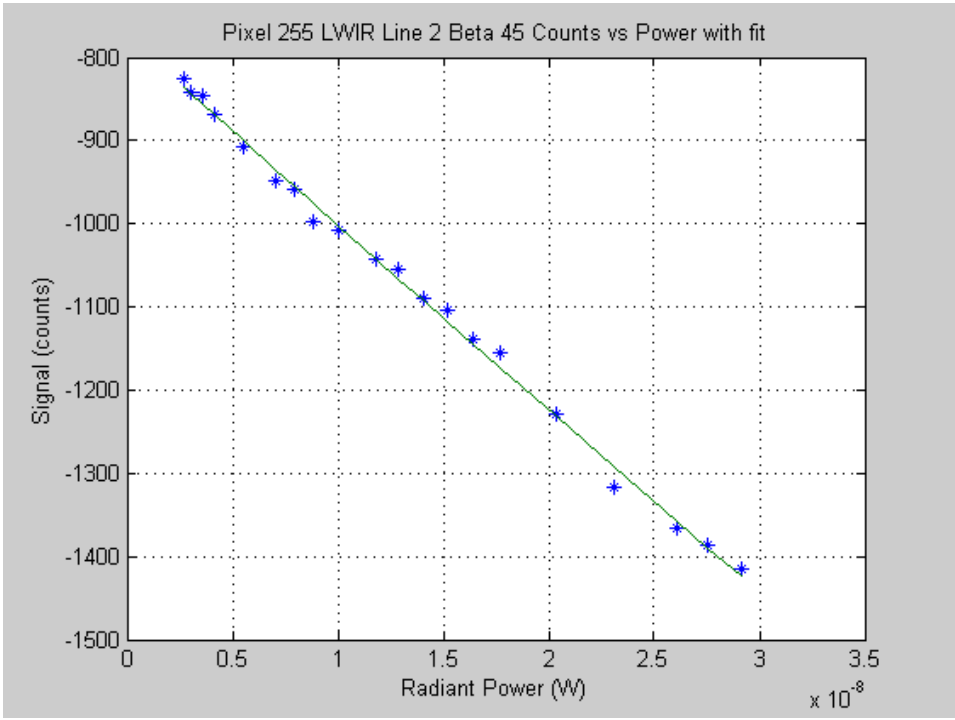




Power vs counts







Observing Canada/Italy/Argentina

Heaters off
Cameras on

TECs on
(stabilization
in less than 2^{m})

Move mirror
0^{s} to 30^{s}

Acquire data
26^{s} to XX^{s}

TECs off
Cameras off
Heaters on

Repeat as necessary

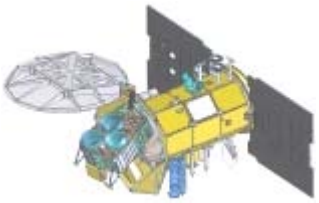
timeline

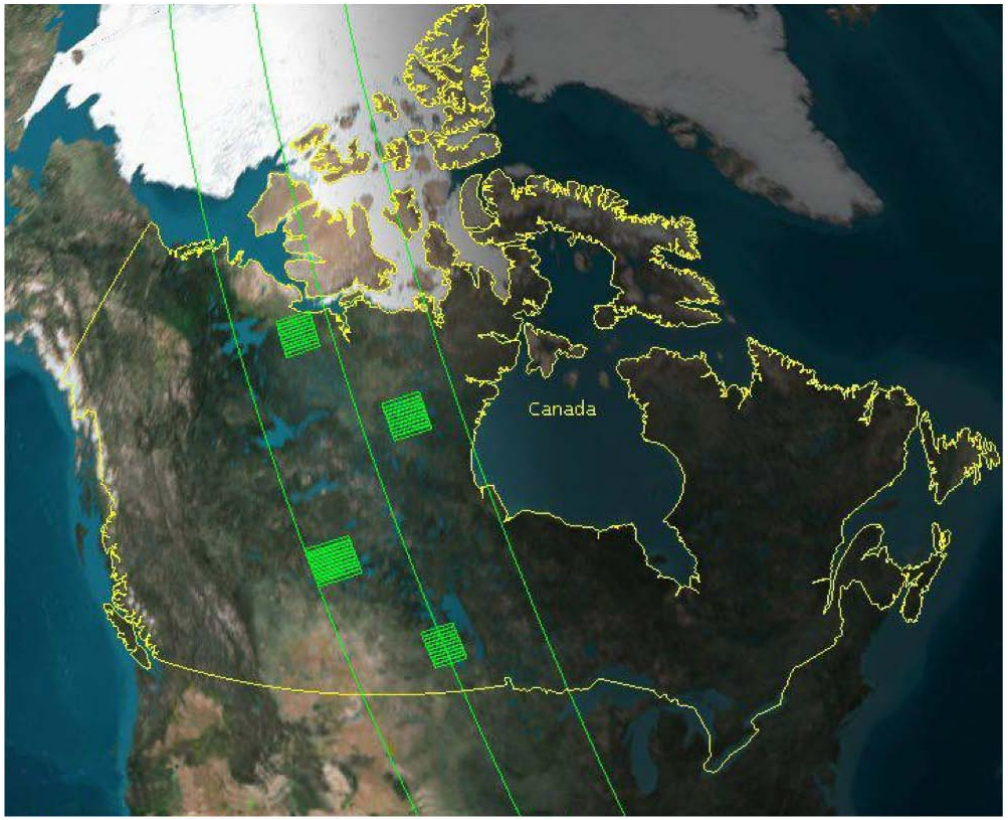
-4^{m}

0^{m}

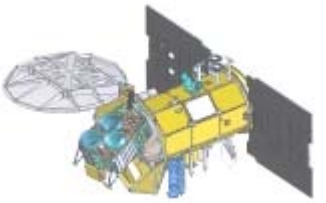
~+10^{m}

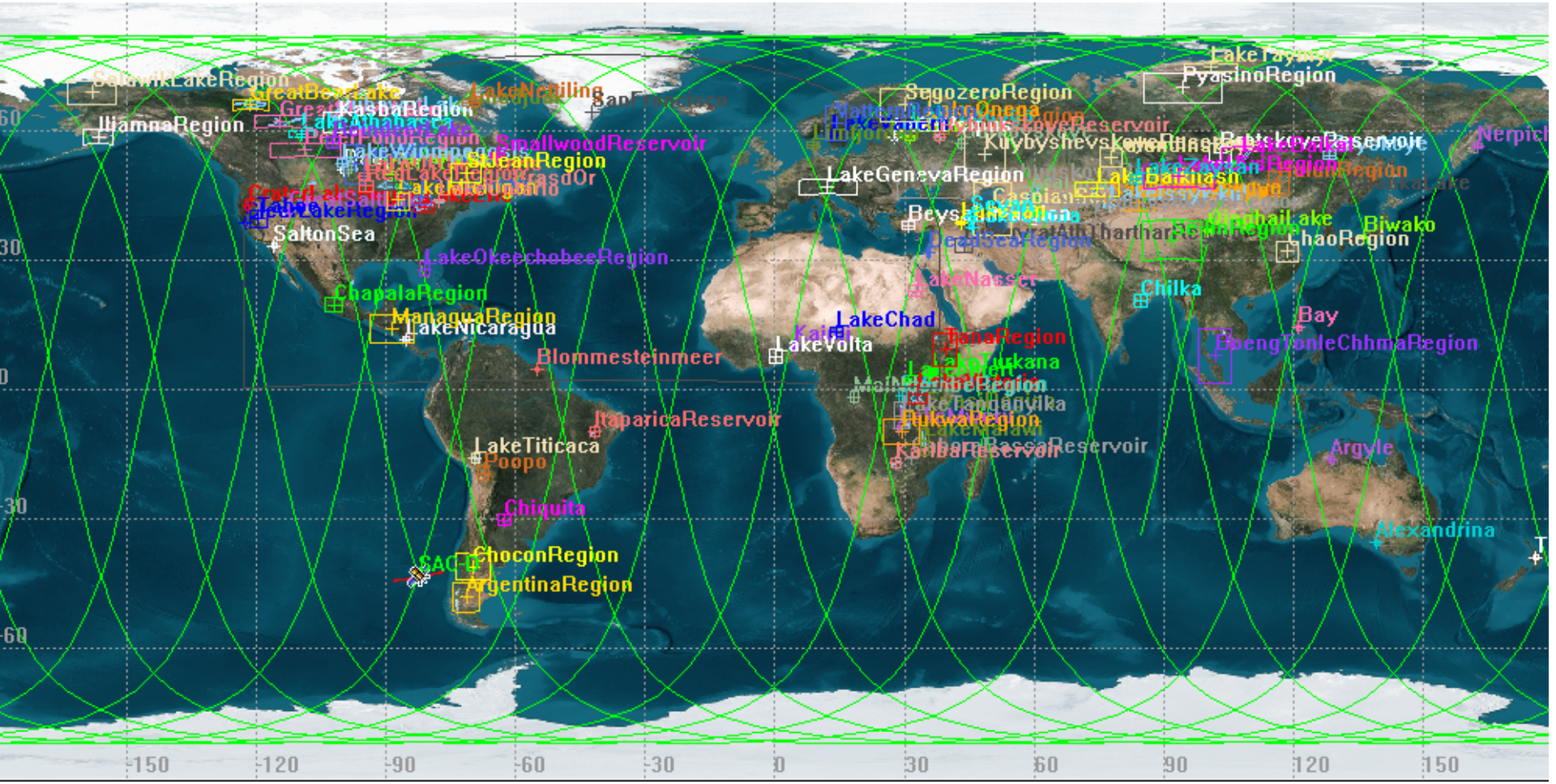
NIRST over Argentina & Canada



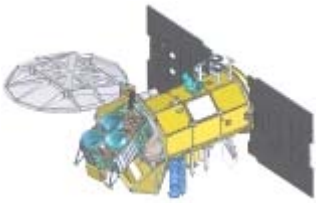


Inland waters





Weekly memory budget



Data acquisition rate: 53 kbytes/sec

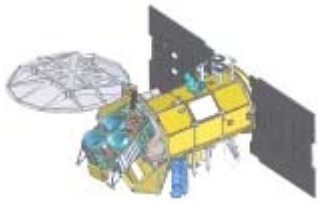
Weekly (103 rev.) statistics:

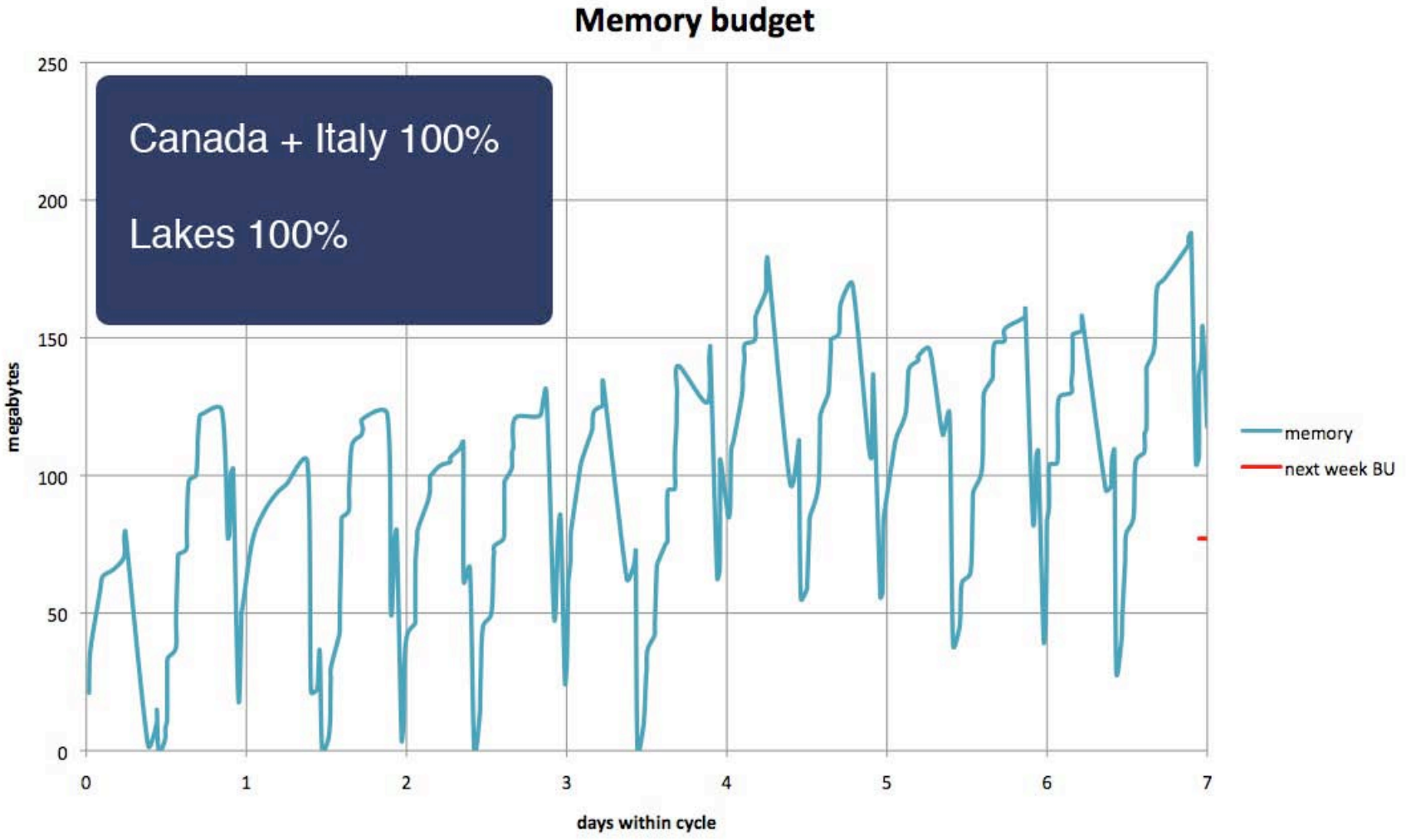
29 downloads when SAC-D is 5 over horizon at Córdoba Ground station.
92 virtual overflights of Canada and Italy.
185 possible inland waters acquisitions (only those necessary to get weekly complete data).

Assumptions:

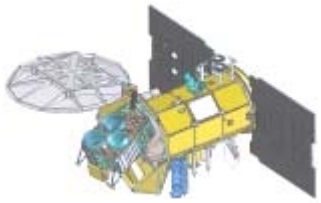
1.All acquisitions over Argentina and inland waters in neighboring countries are downloaded in real time.
2.Data stored in mass memory is downloaded at 130 kbytes/sec.
3.Canada and Italy are covered in a TBD%.
4.Inland waters are covered in a TBD%.

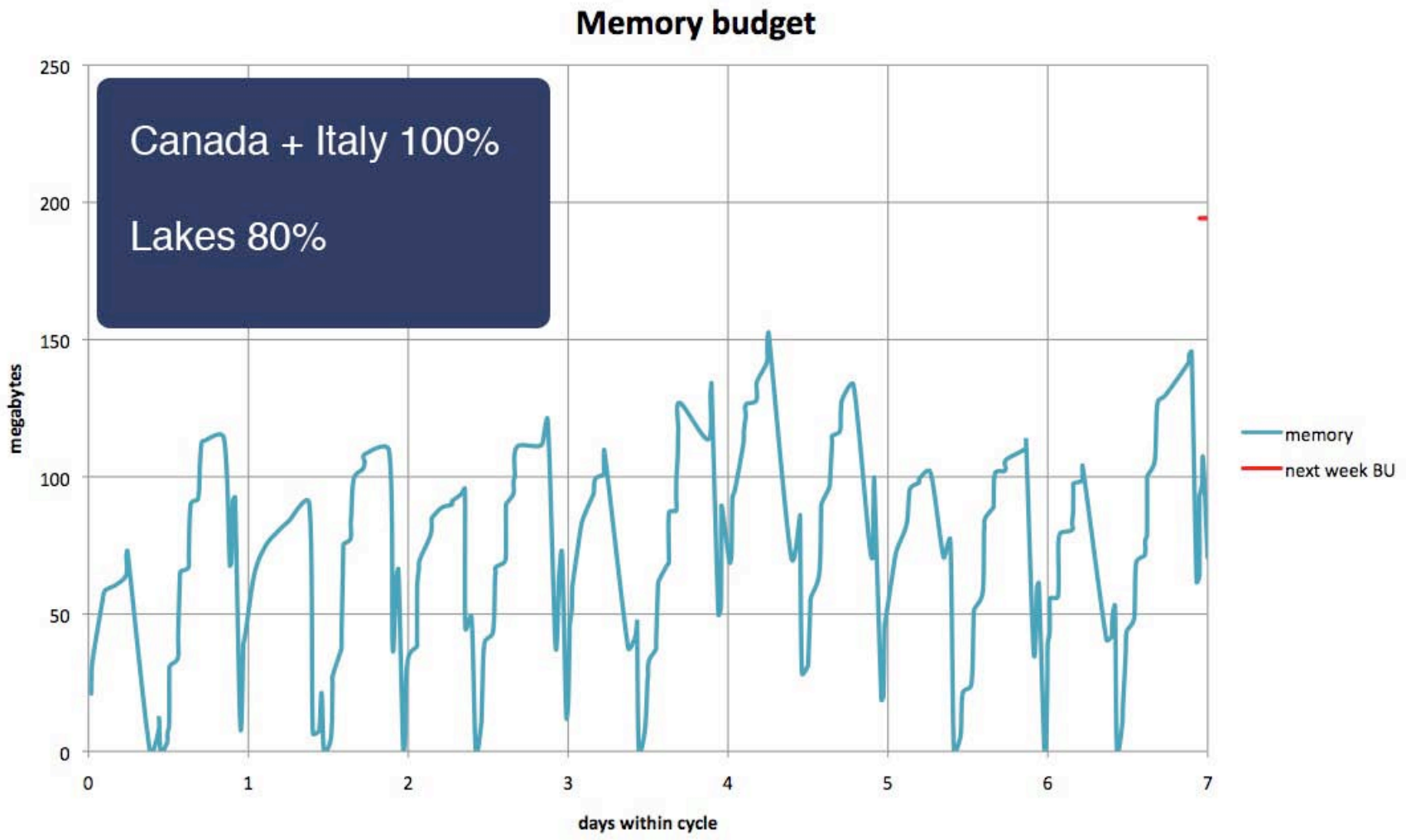
Weekly memory budget

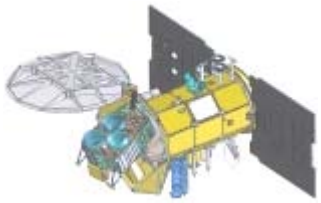




Weekly memory budget

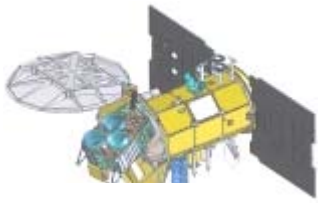


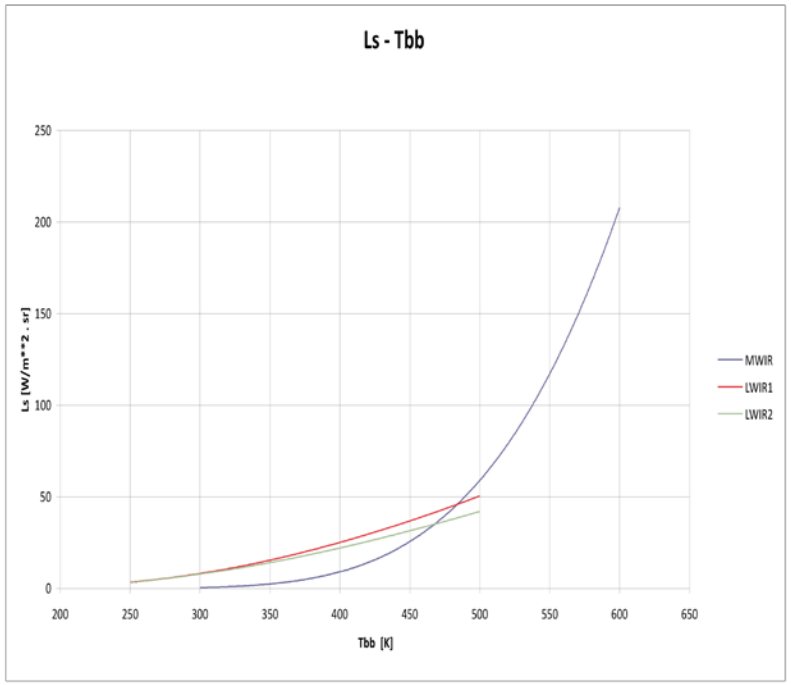




Back up slides

What we measure

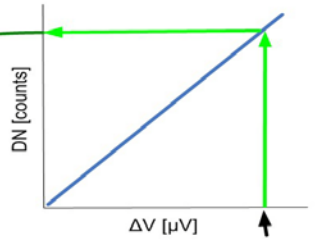




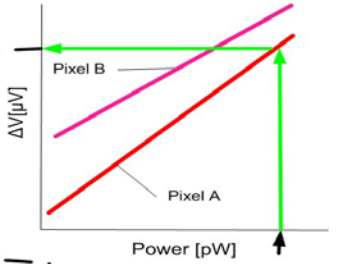
Steps in NIRST calibration

What we measure

DN is an almost linear response of voltage across μbolometer. It is affected by an offset and a gain that are fixed in the electronics but are slightly different from pixel to pixel

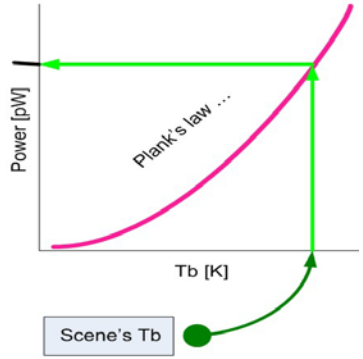


Voltage across μbolometer is an almost linear result of its temperature change which is proportional to incident power.
The whole process receives the name of responsivity and is a characteristic of each pixel.
A typical value of responsivity is 4.4×10^4 V/W



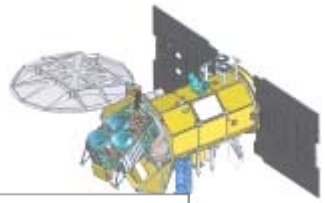
$\Phi(T) = \Omega A \int L(\lambda,T)\, \Psi(\lambda)\, d\lambda$

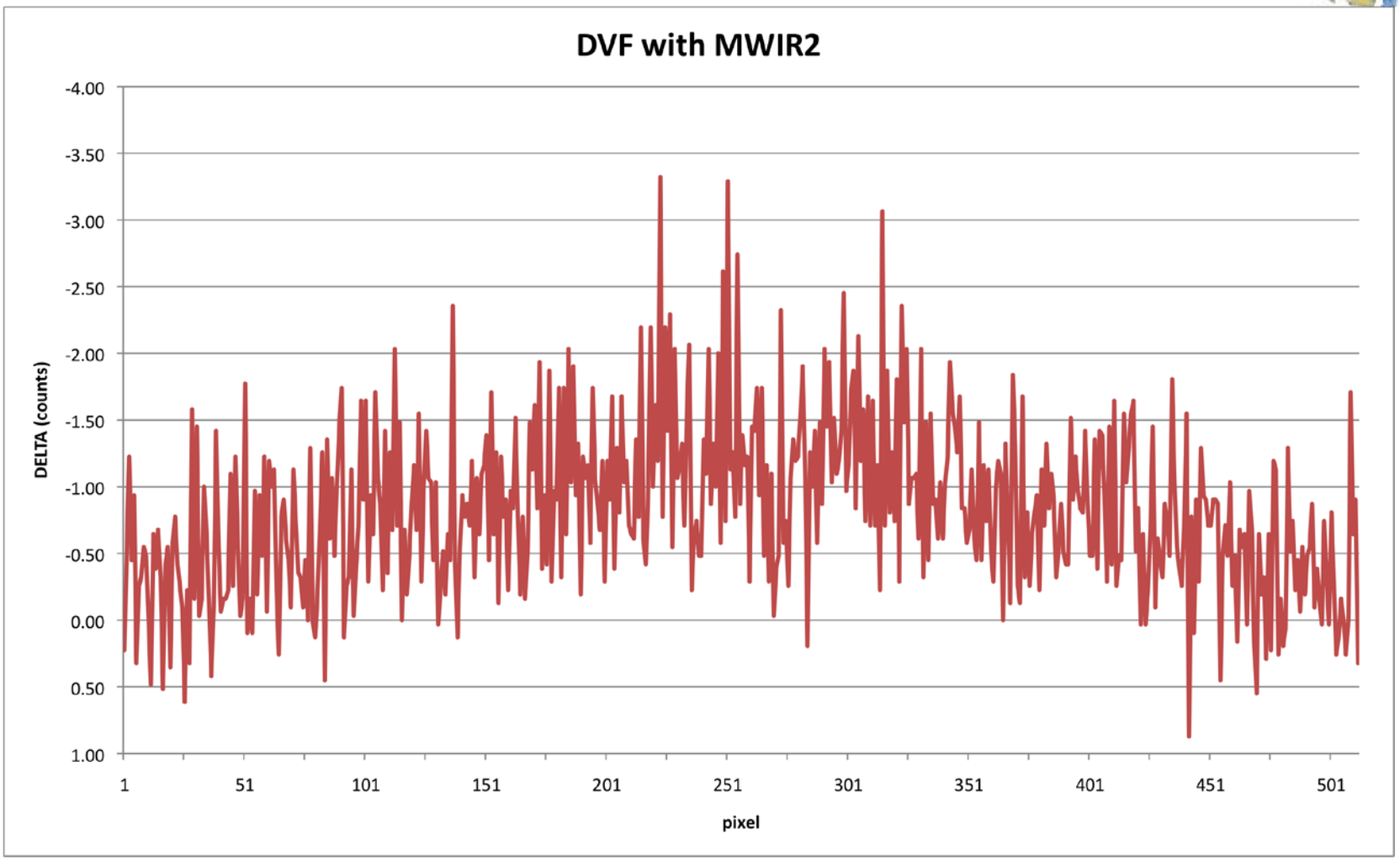
Where: Ω solid angle of optics as seen from earth
Ψ filters + optics + atmosphere trasmission
L Planck´s law
A area of pixel on earth
Φ power radiance



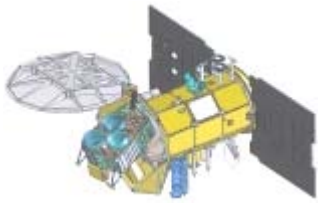
Scene's Tb

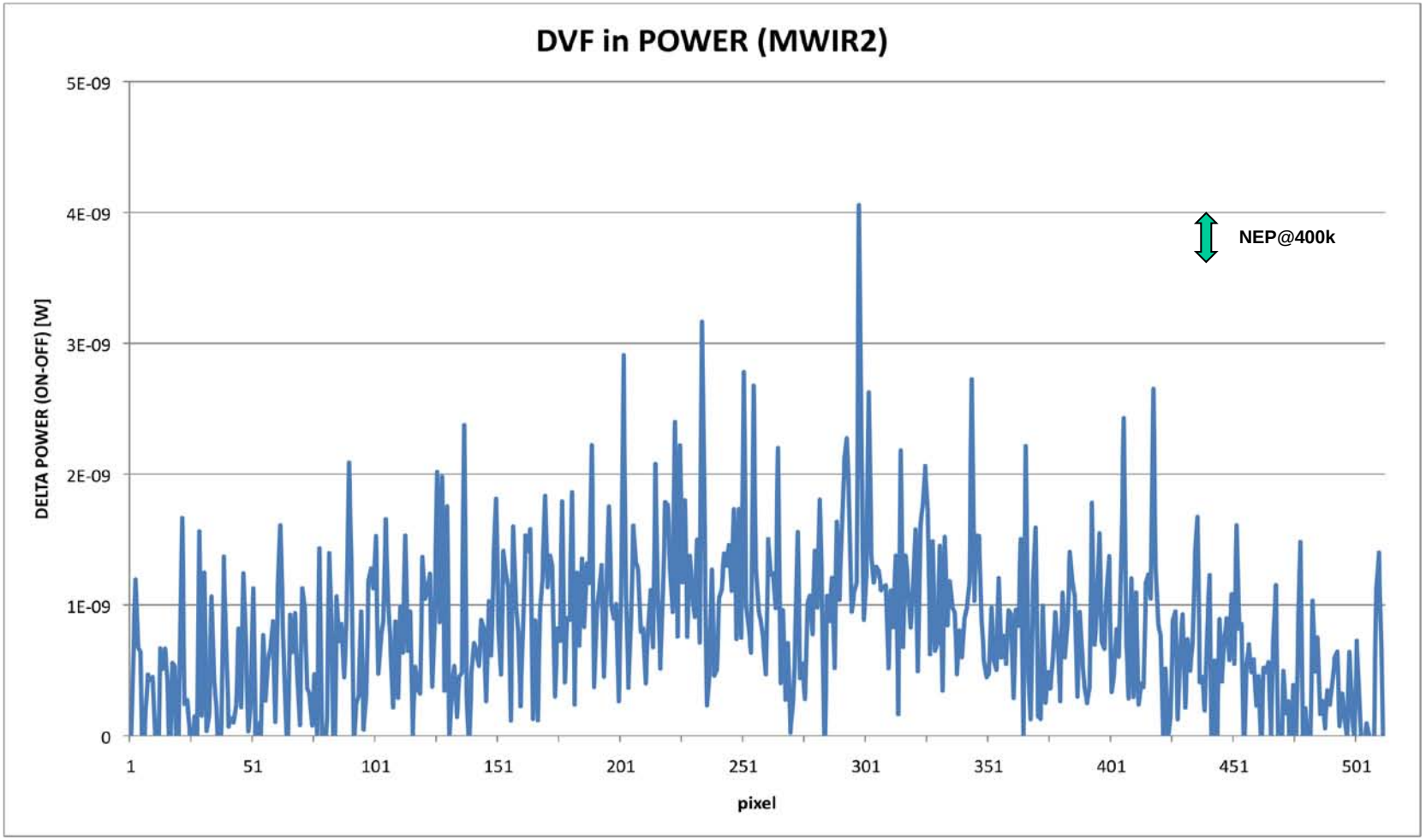
DVF (counts)



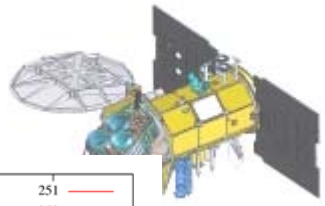

DVF with MWIR2
DELTA (counts)
-4.00
-3.50
-3.00
-2.50
-2.00
-1.50
-1.00
-0.50
0.00
0.50
1.00
1
51
101
151
201
251
301
351
401
451
501
pixel

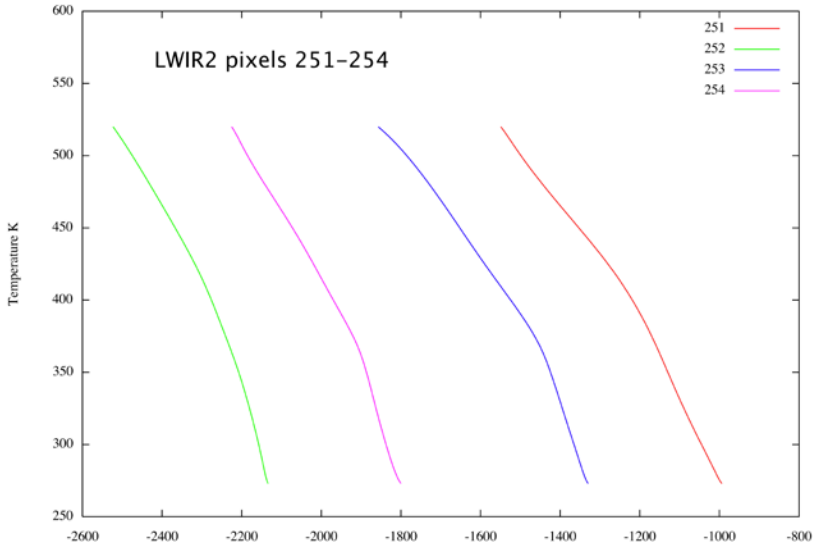
DVF (power)

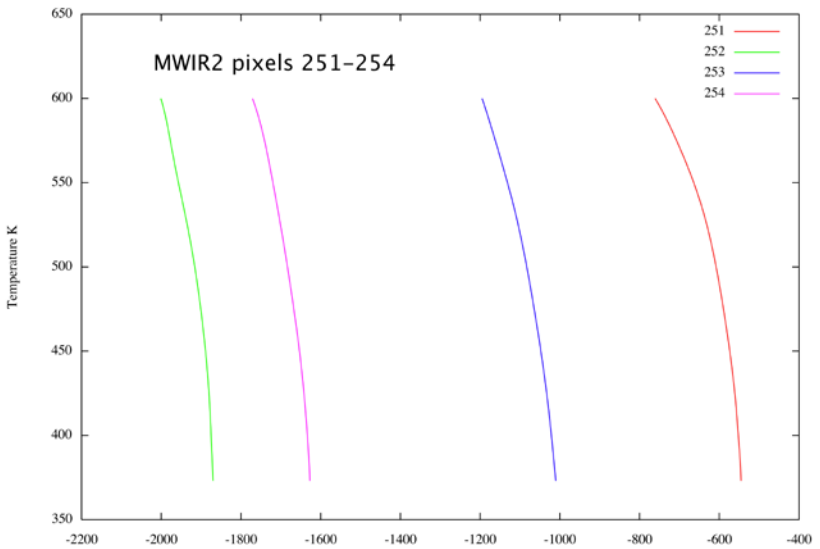


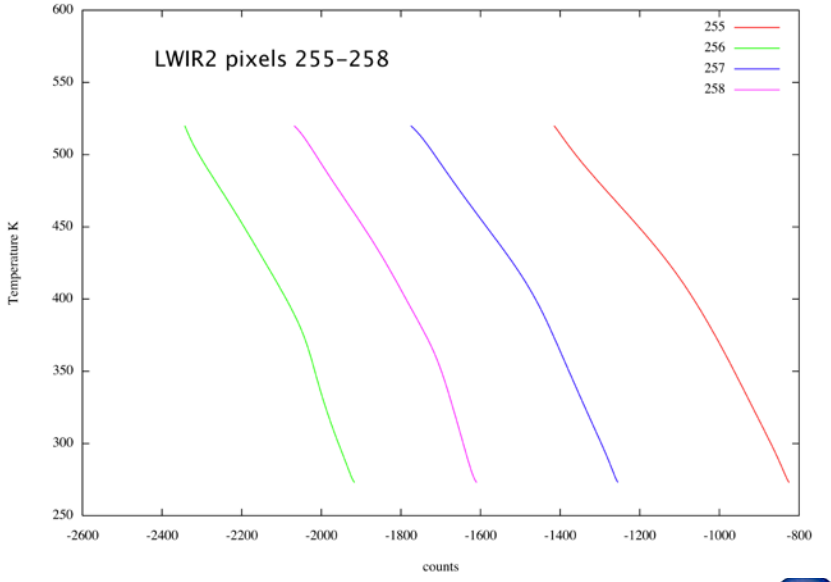

DVF in POWER (MWIR2)
DELTA POWER (ON-OFF) [W]
5E-09
4E-09
3E-09
2E-09
1E-09
0
1
51
101
151
201
251
301
351
401
451
501
pixel
NEP@400k

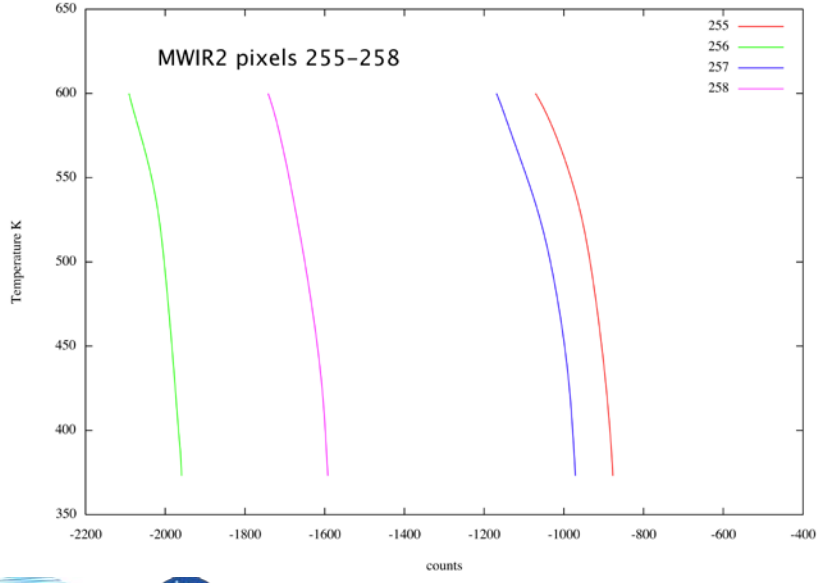
Pixel variety



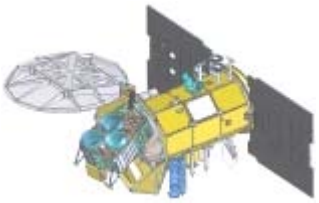


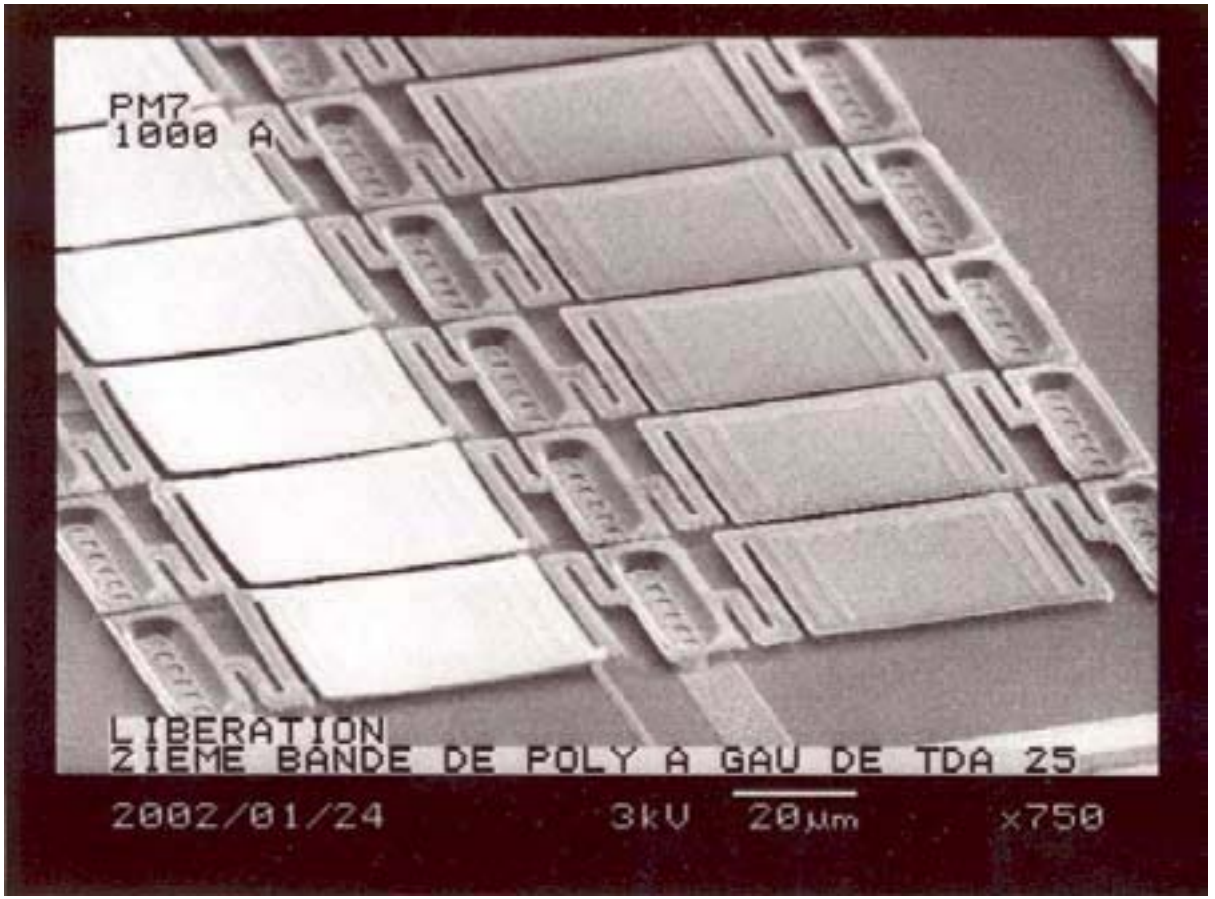




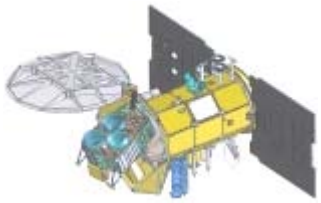


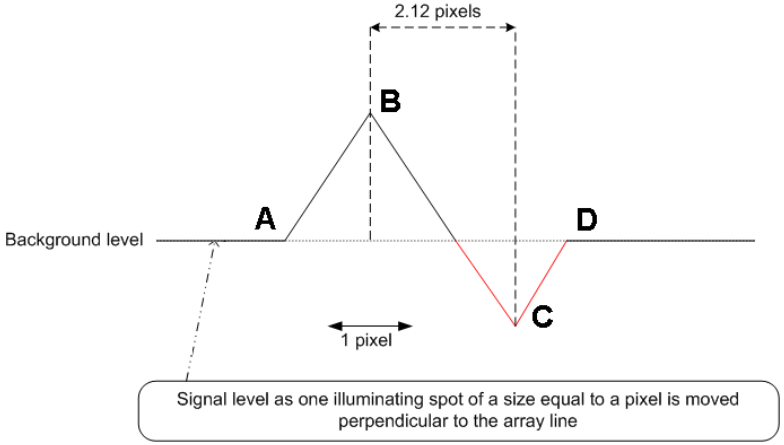
Active and reference (blind) pixels

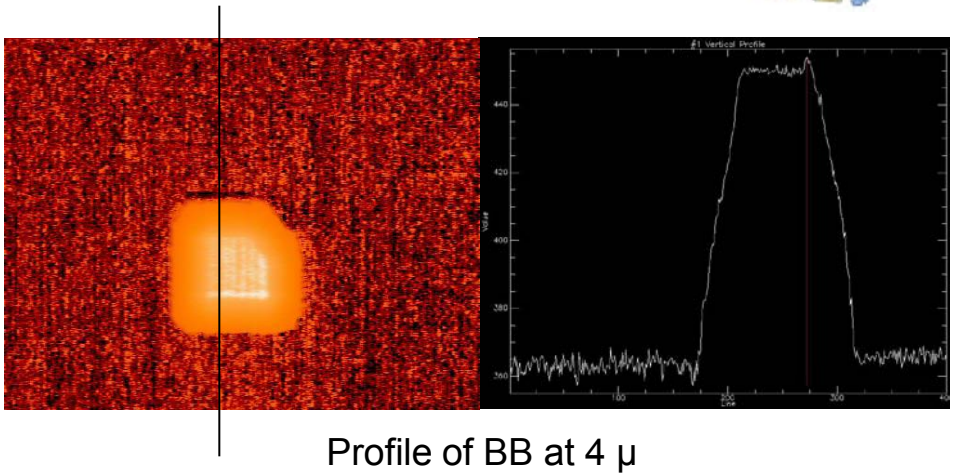




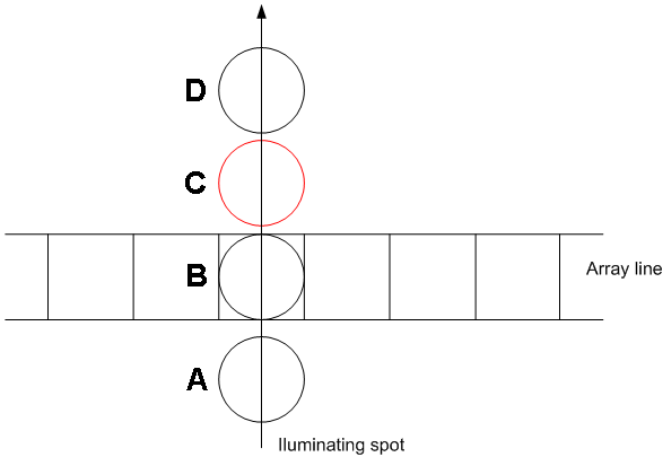
Blind pixel





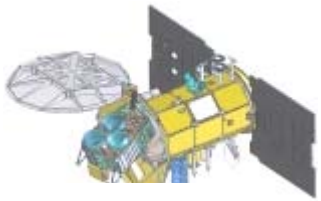


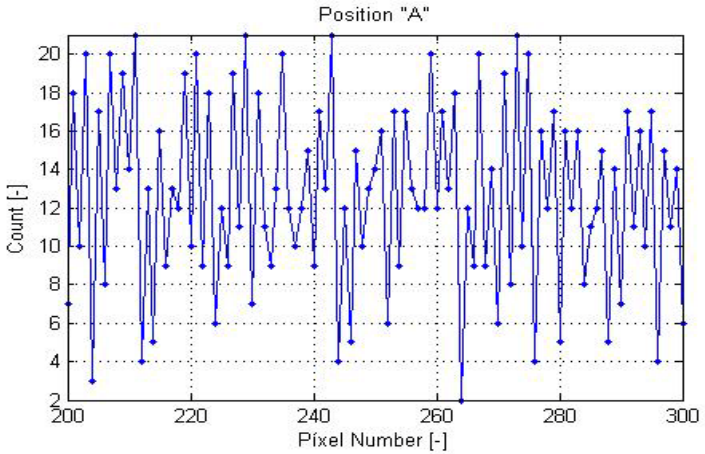
Profile of BB at 4 μ

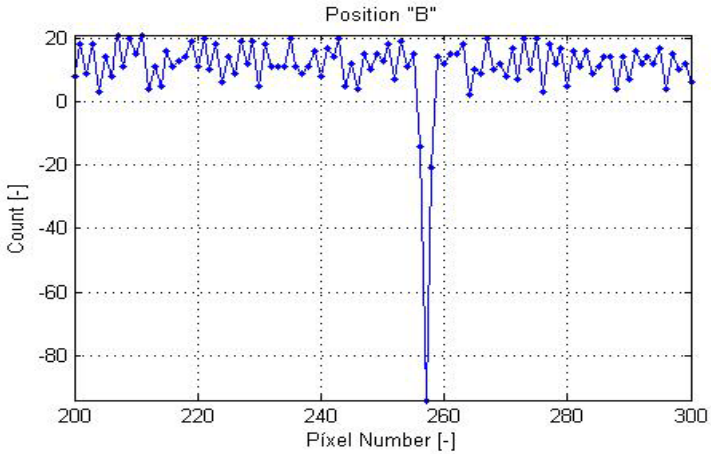


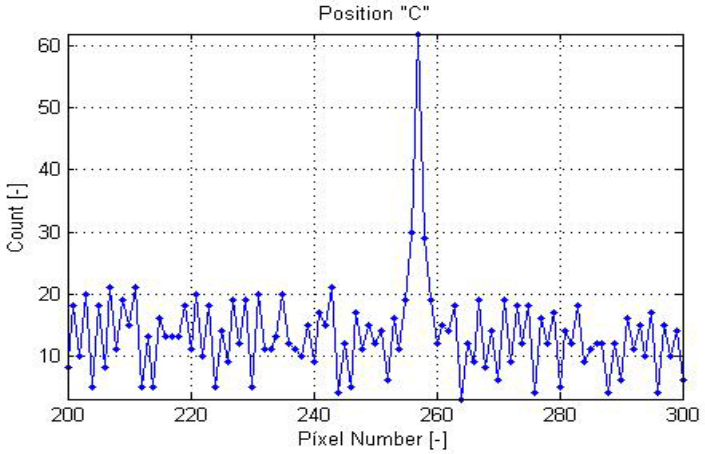
BAND	|Signal@C| / |signal@B| [%]
MWIR	51% 18%
LWIR	13% 2%

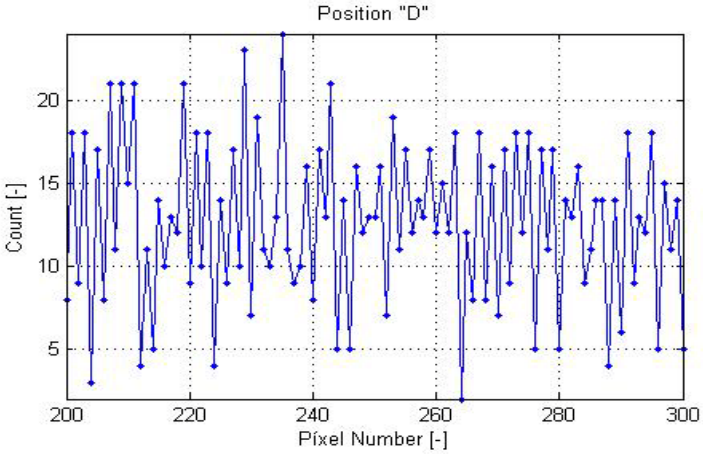
Blind pixel (MWIR)



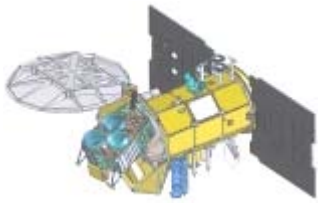






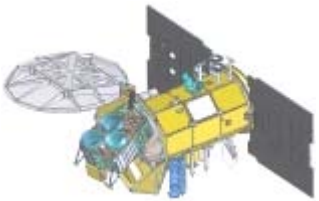


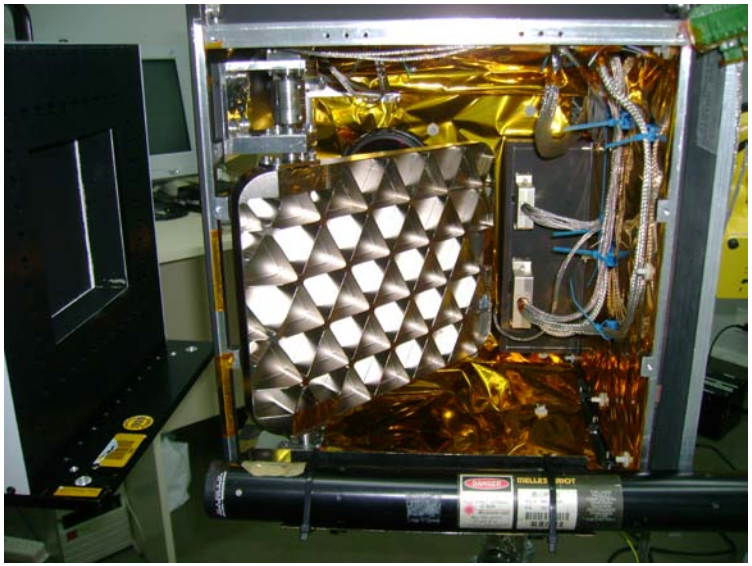
Priorities

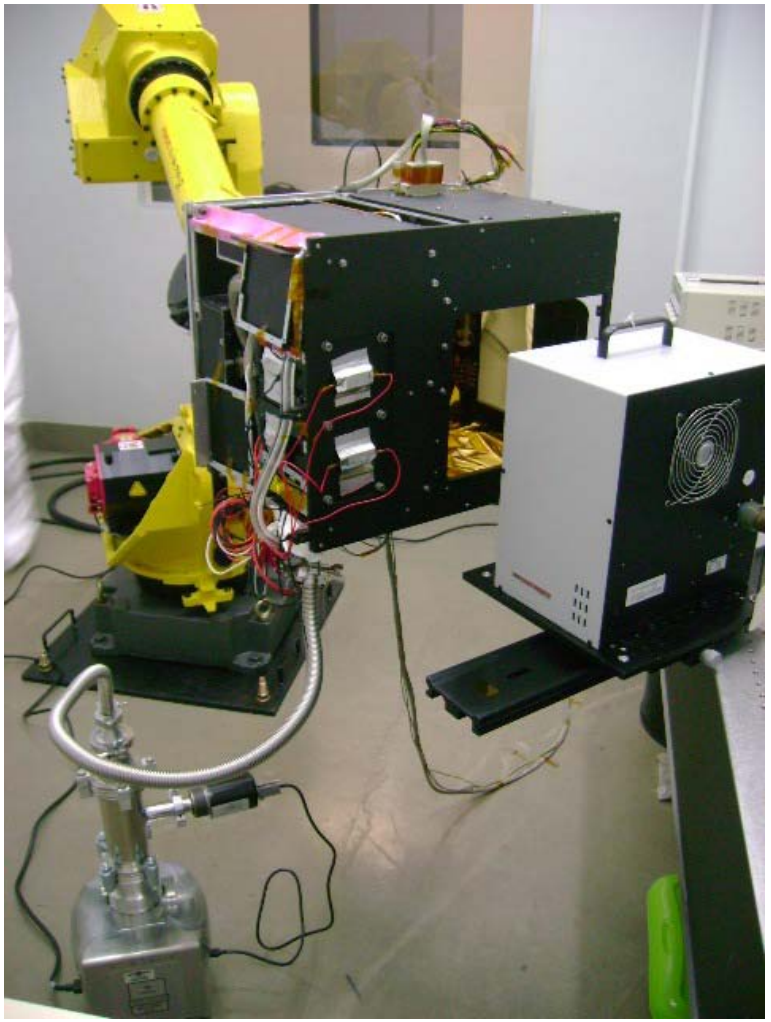


1. Emergencies
2. Instrument Health Care
3. Science Group & AOs
4. Common Users

Calibration setup

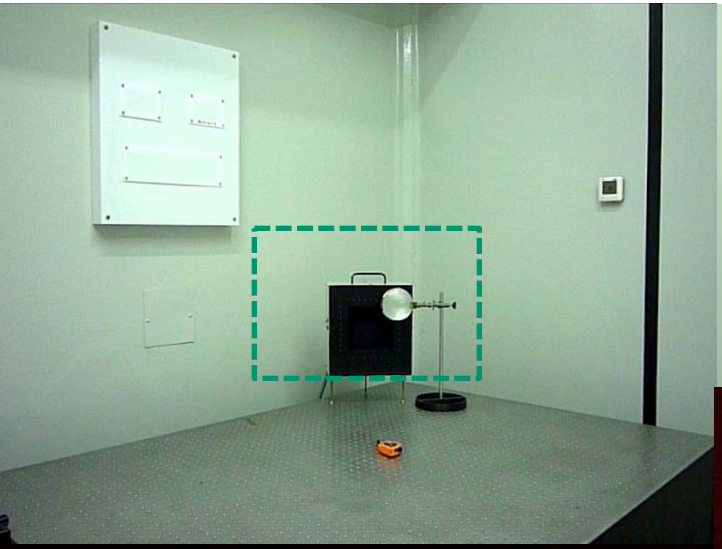


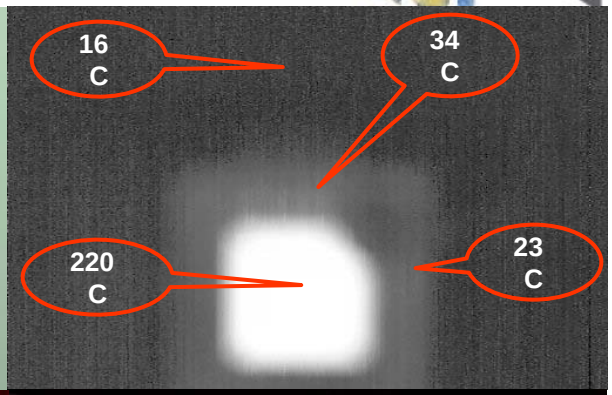


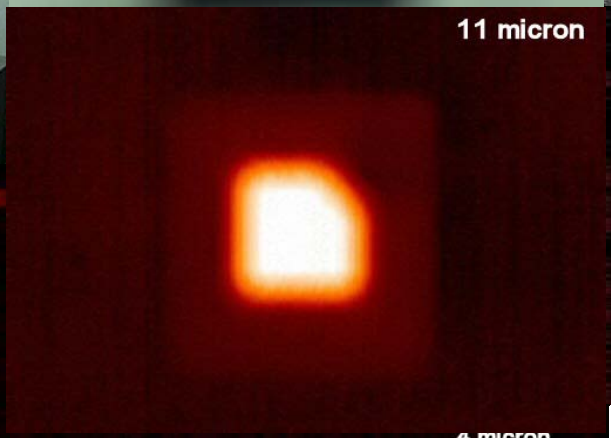


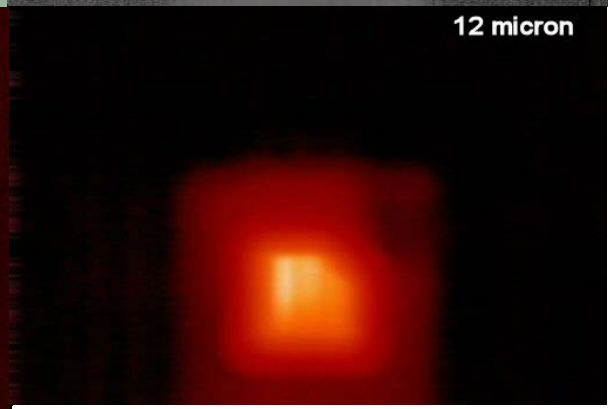
AQUARIUS/SAC-D

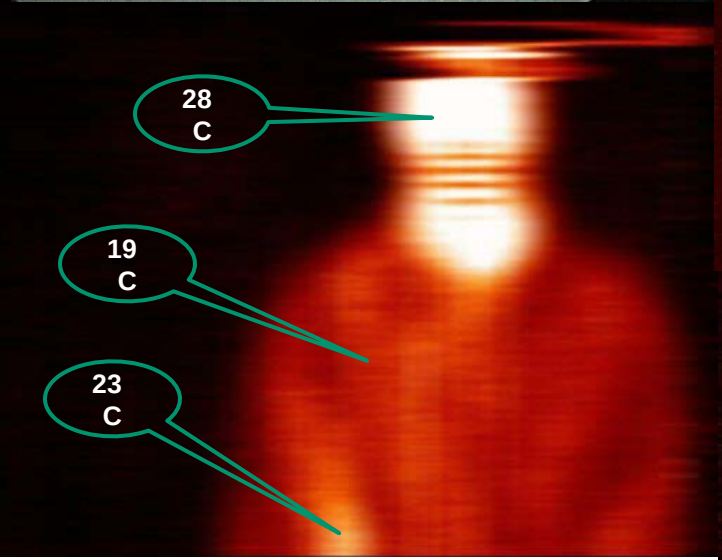
Scans at the optical lab

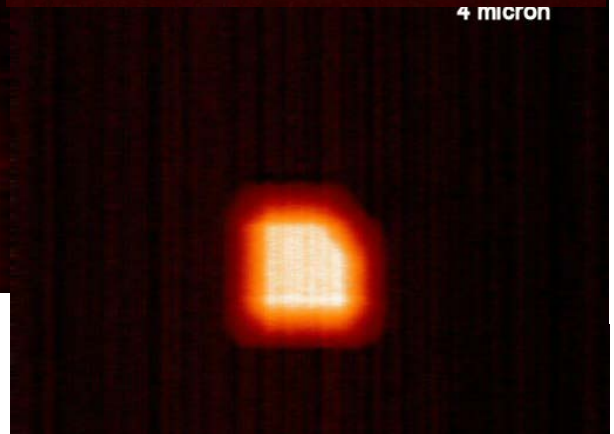


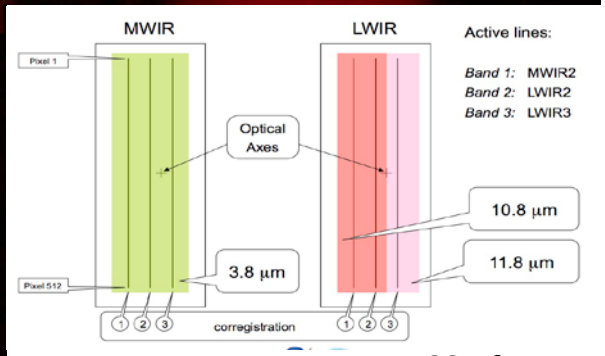




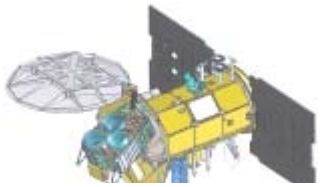


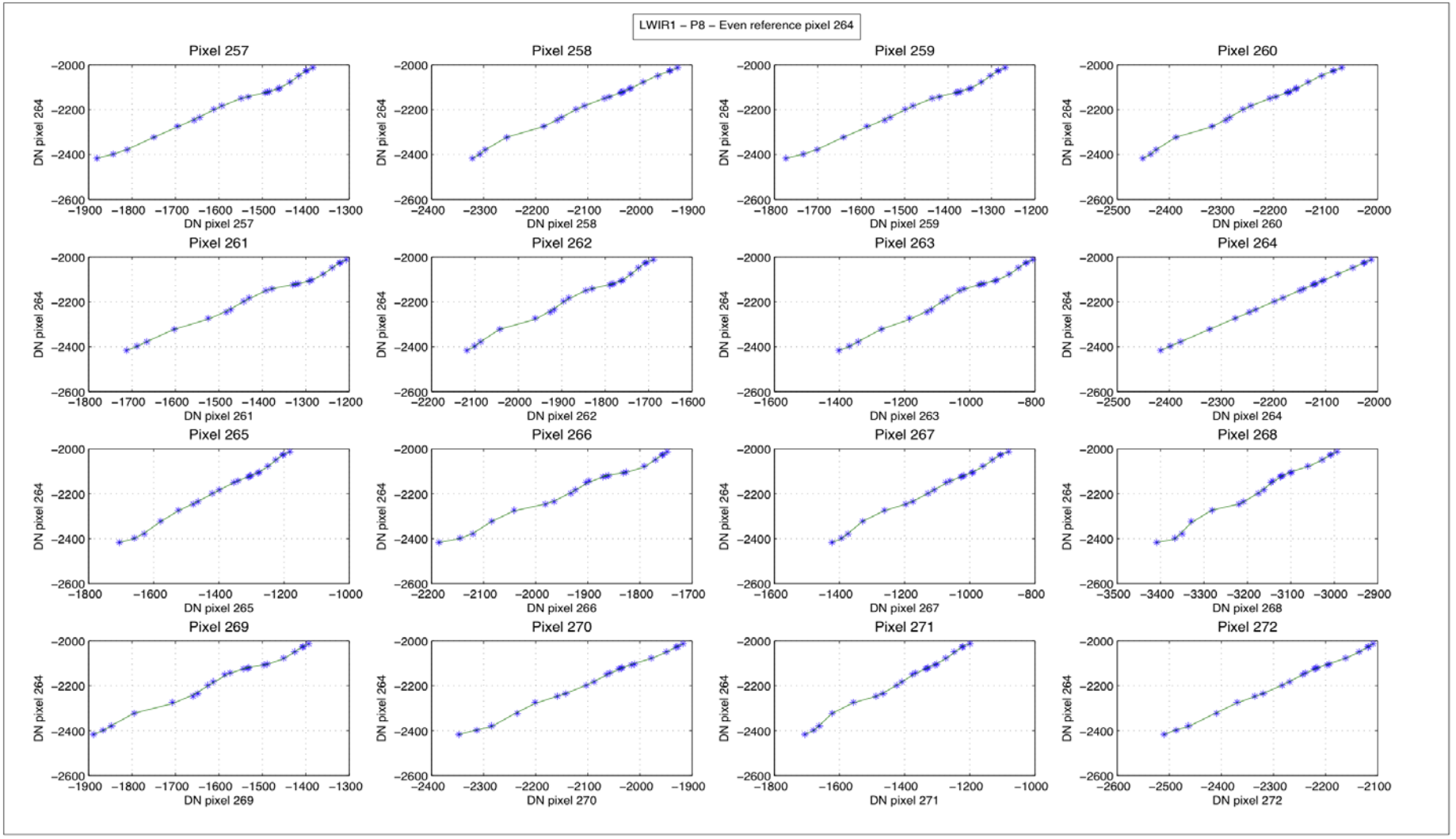


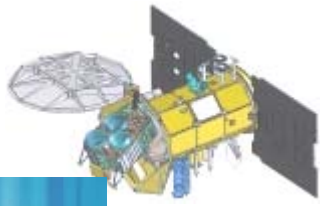




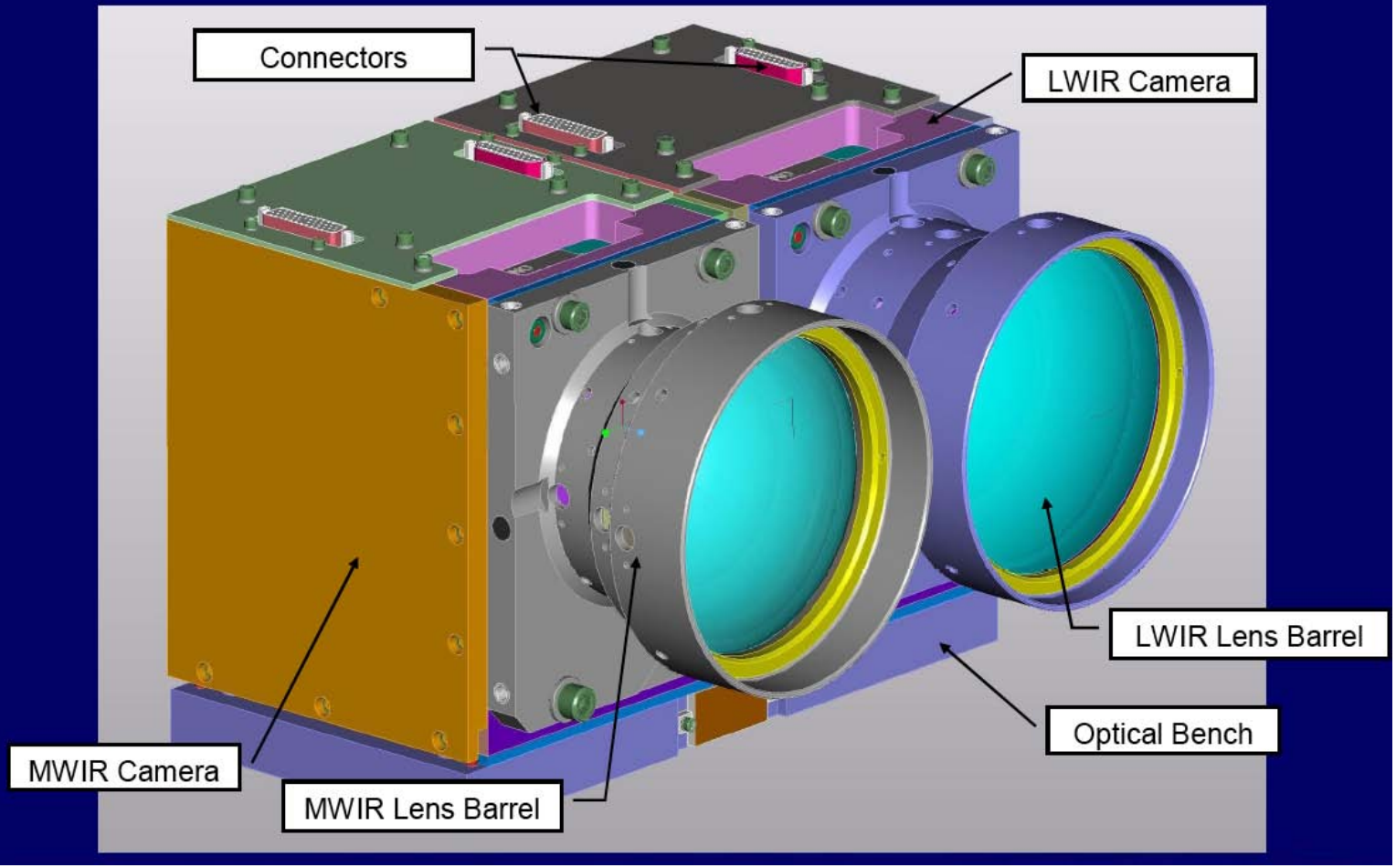
Pixel variety

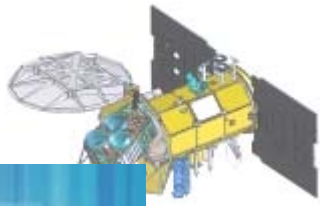




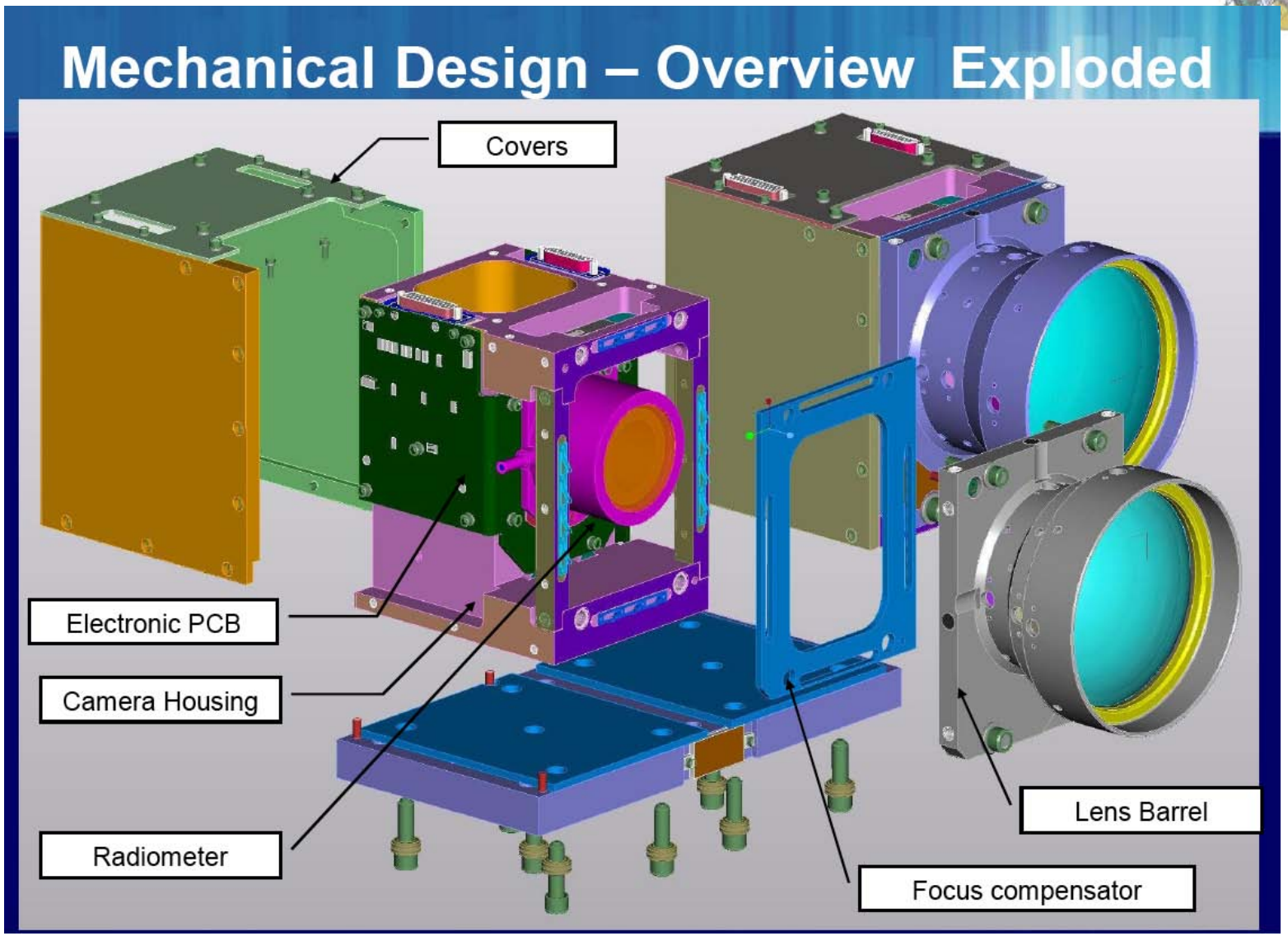


Design Overview

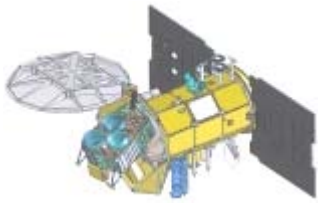


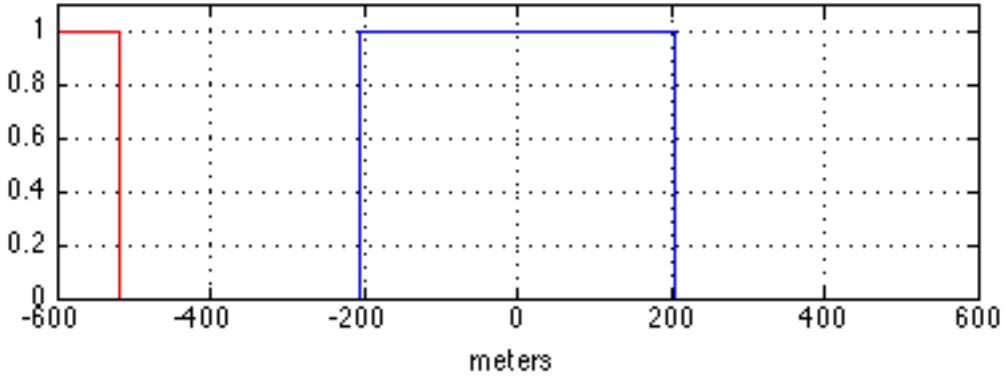


Mechanical Design – Overview Exploded

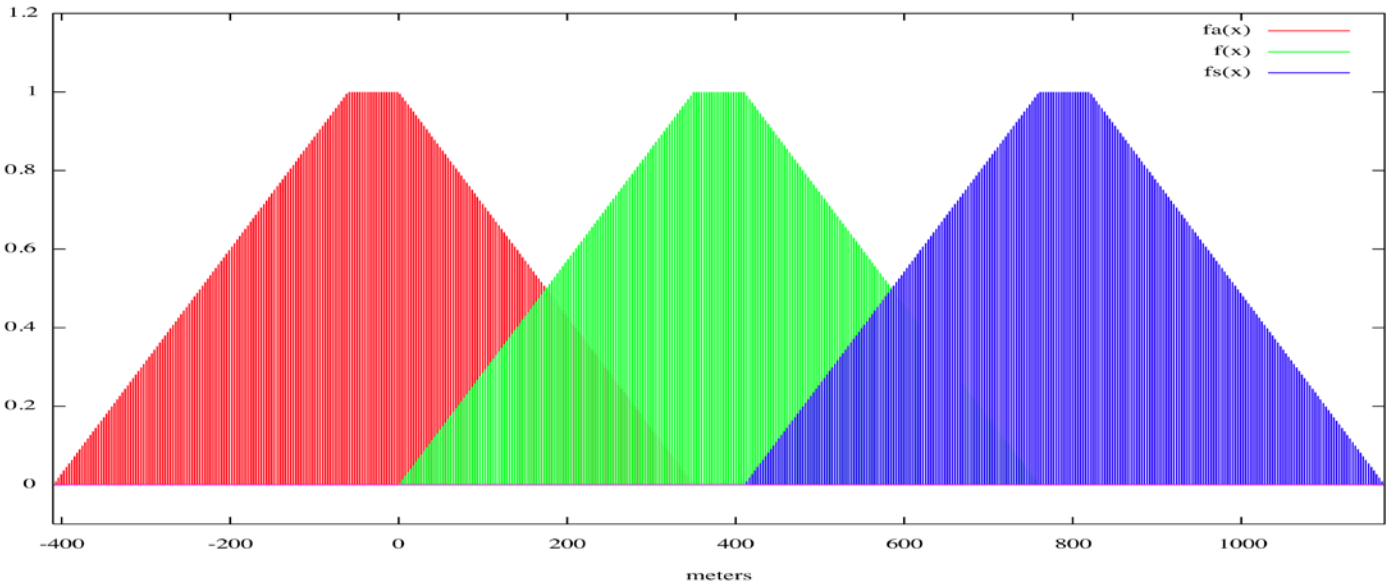


Pixels alongtrack (nadir)

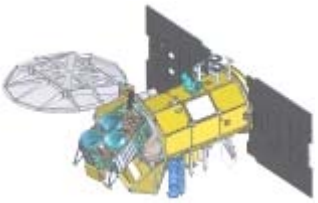




(59ms @ 6.9 km/s ≅ 410 m 0.53 mrad @ 657 km ≅ 350 m)



Integration



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