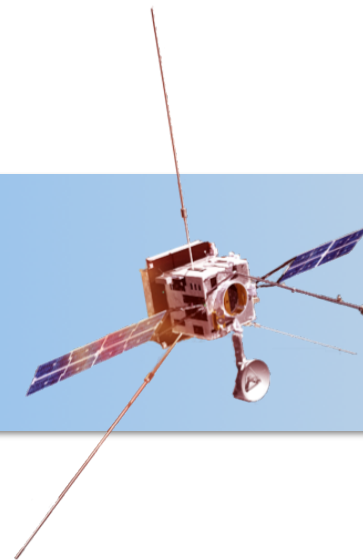


# Solar Orbiter EUI

## Extreme UV Imagers



## Status EUI development following mini-consortium meeting 2016 Sept 19

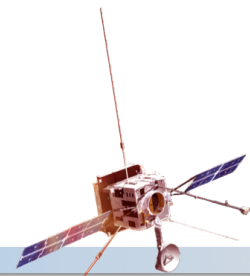
D. Berghmans for  
P. Rochus and the EUI consortium



*Solar Orbiter SWT-19, 2016 Sept 21-22, London*



# Overall schedule



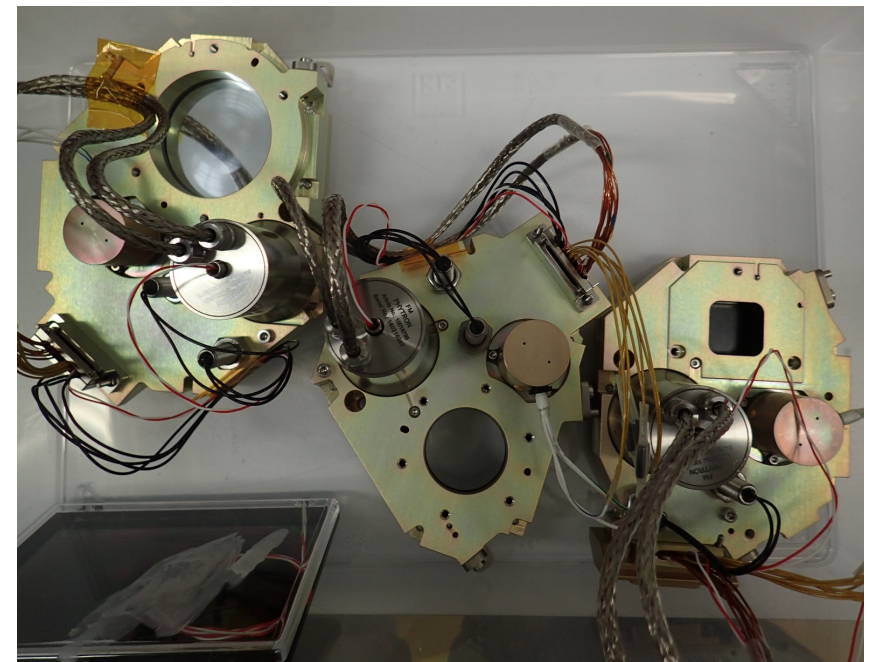
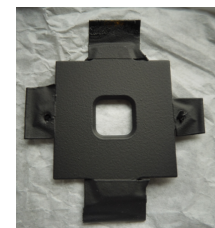
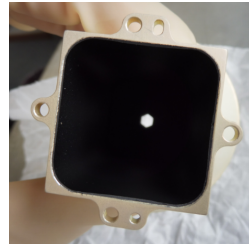
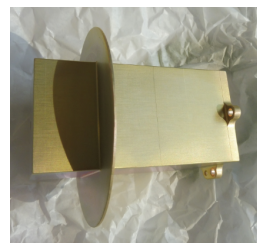
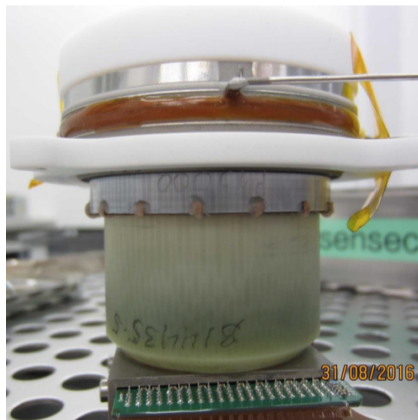
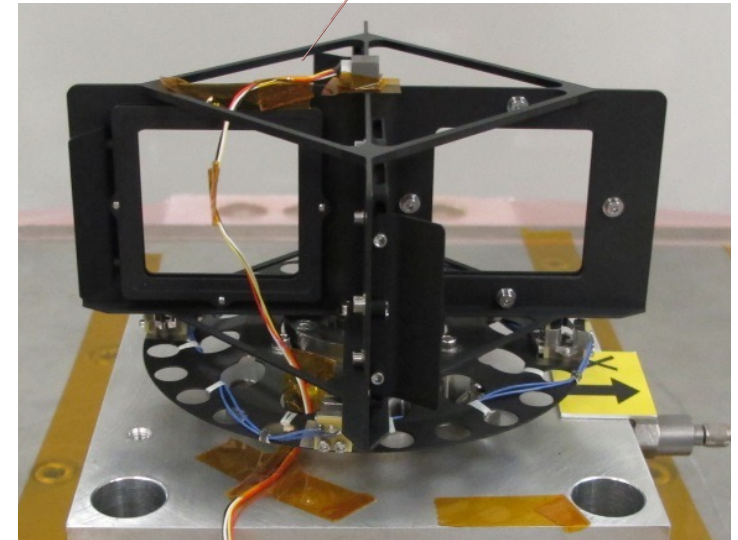
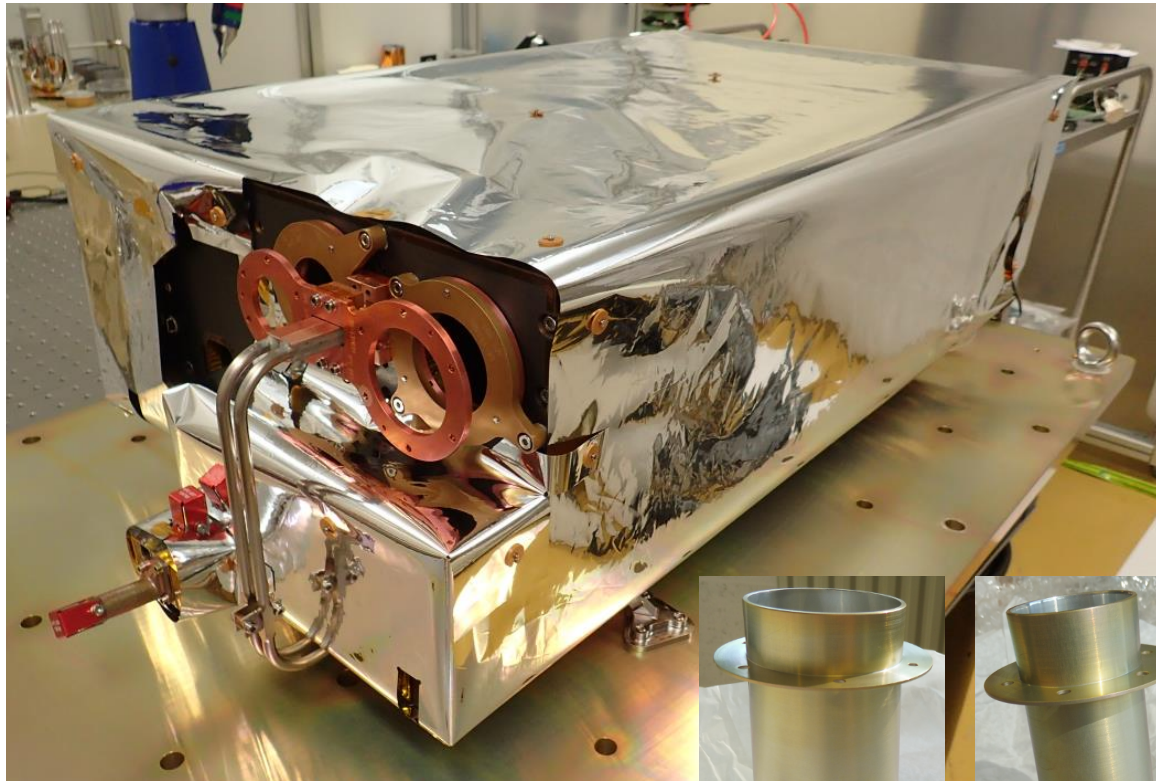
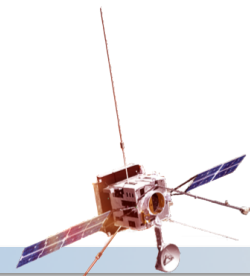
Activity ID	Activity Name	Remaining Duration	Early Start	Early Finish	J	F	I
5881	FM PHI E-Box IRR	5	02-Dec-16	08-Dec-16			
STIX FM		5	08-Dec-16	14-Dec-16			
5394	FM Handover STIX	0		08-Dec-16			
5404	FM STIX IRR	5	08-Dec-16	14-Dec-16			
EUI FM		9	23-Nov-16	05-Dec-16			
4802	FM Handover EUI	0		23-Nov-16			
4852	FM EUI IRR	5	23-Nov-16	29-Nov-16			
4862	FM Handover EUI E-Box	0	29-Nov-16				
4872	FM EUI E-Box IRR	5	29-Nov-16	05-Dec-16			
METIS FM		9	06-Jan-17	18-Jan-17			

It takes ~two months to integrate, acceptance tests, functioning tests and calibration of EUI.

Hence we have to start integrating this week.

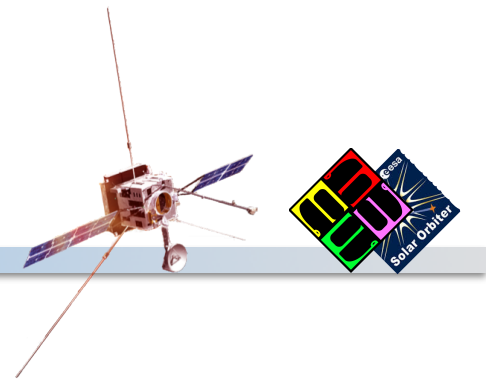
Are all the elements on the table?

# Ready (or nearly ready) for integration



# Critical elements

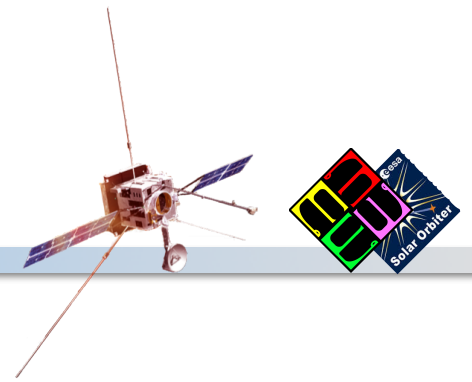
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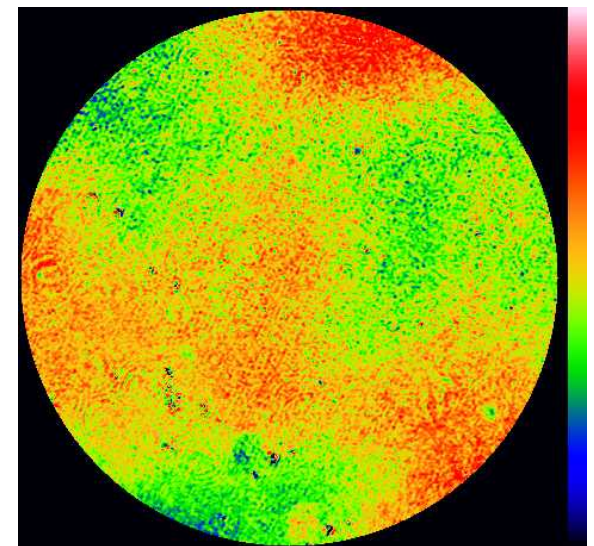
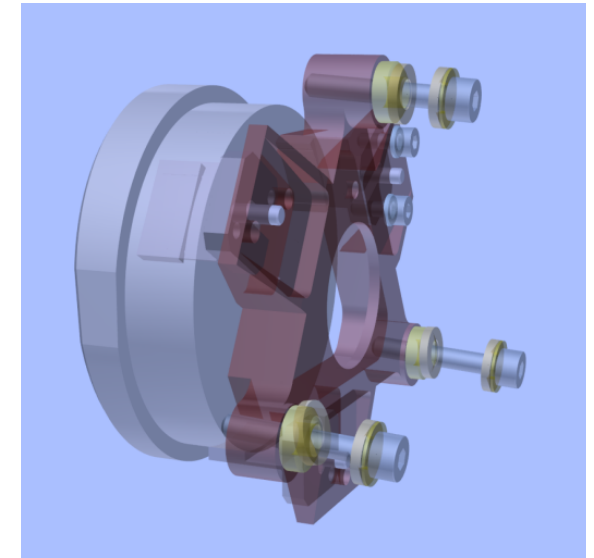
1. We do not have the FM CMOS sensors and FM cameras but we do have the QM models.
2. Since many months we have not been able to align the HRI-EUV mirrors, but we do now understand why
3. For maximal science use, we really would like to do an end-to-end absolute calibration but is there still time?



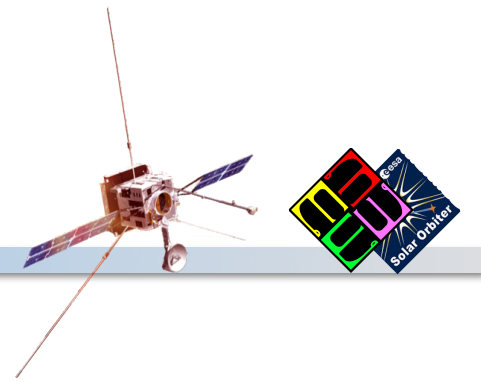
# Mirror alignment



- Since first alignment tests of HRI QM (Dec 2015) there is unexplained astigmatism present in images
- Impact: HRI: reduced spatial resolution ( $\sim x5$ ), FSI TBC
- Over past 9 months, many different causes (test set-up, mirrors, modelling) have been considered and could be disregarded.
- Past weeks, probable root cause identified: the 3 blades, that are glued to the mirrors for mounting in the base, deform the mirror when screw-tightened
- Different options to resolve this, NCR will be issued. This can be fixed, we budget min 6 weeks.

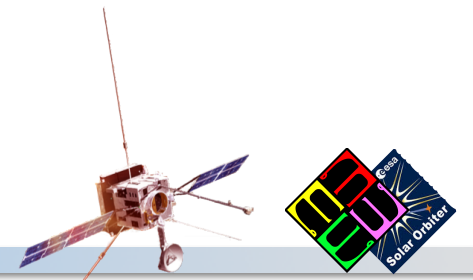


# Cameras+sensors

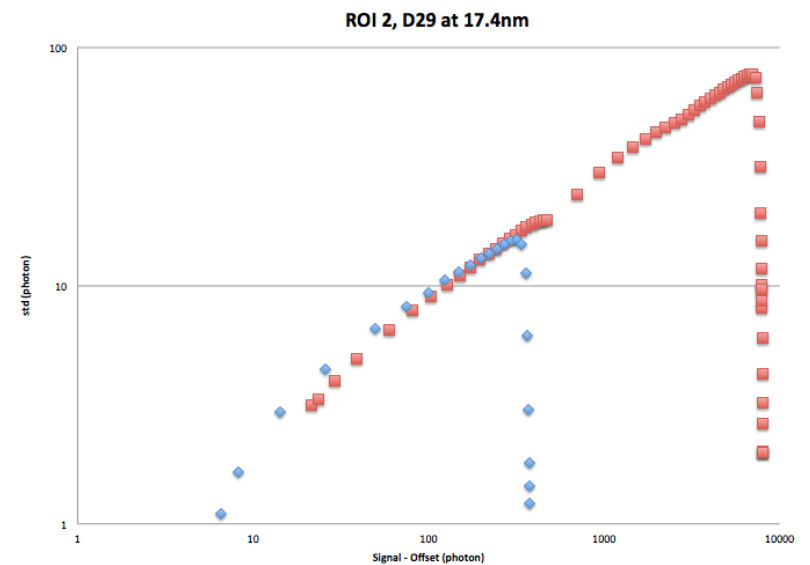
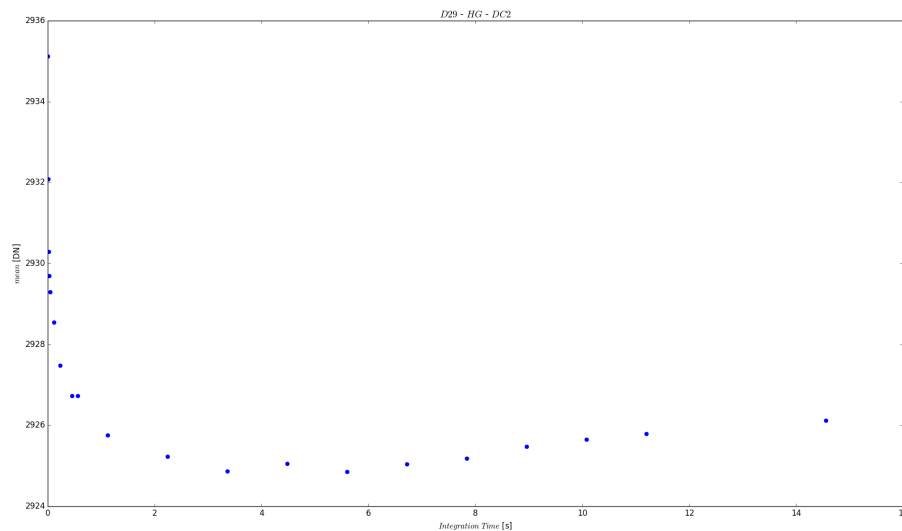
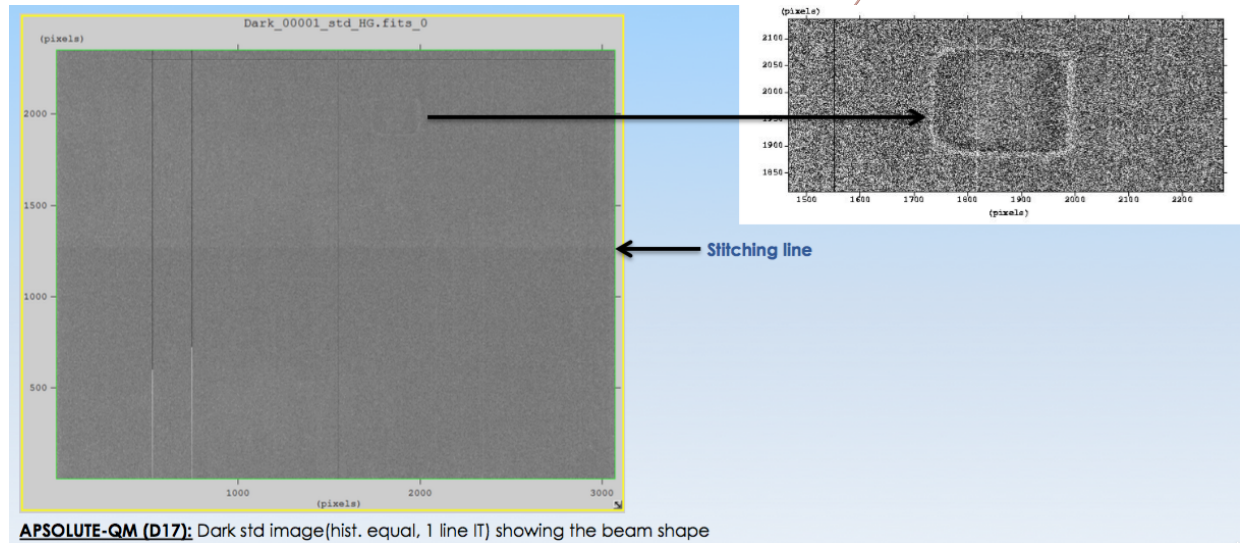


- Cameras+sensors have been since long on the critical path
- Lya-camera has a manufacturing problem: misalignment of the different PCB layers. Contractor will issue an NCR. We assume delivery in January.
- Production of FM sensors is troubled. Delivery of FM sensors now expected end December-early January
- We will use a QM sensor for Lya (no backthinning, no passivation, stronger signal)

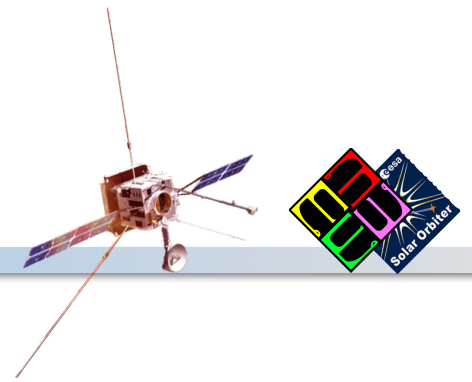
# QM sensors



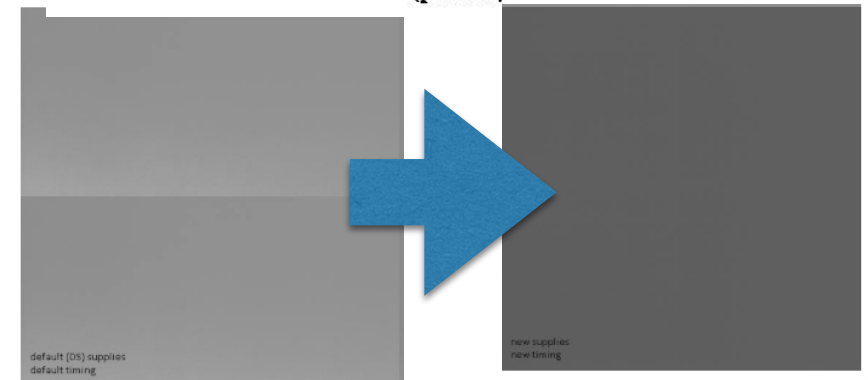
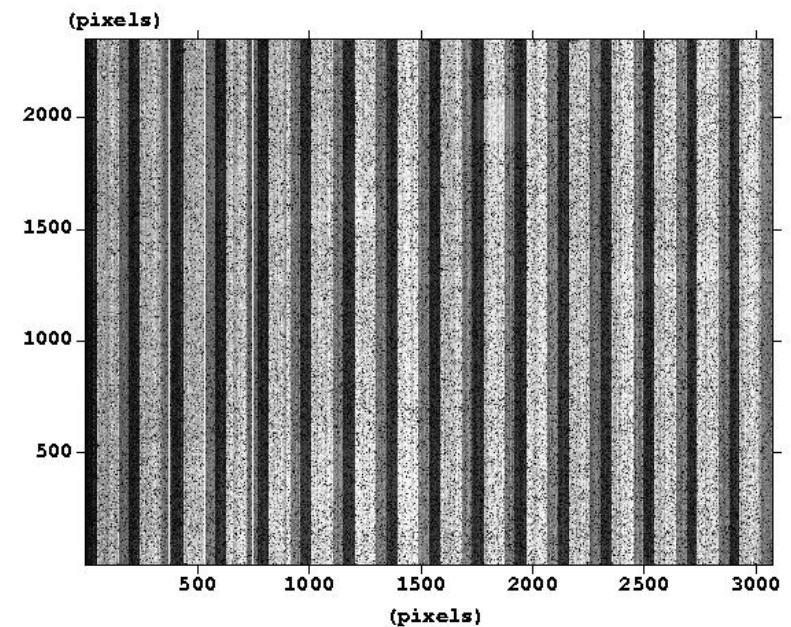
- surface damage
- no passivation
- stitching problem



# QM cameras

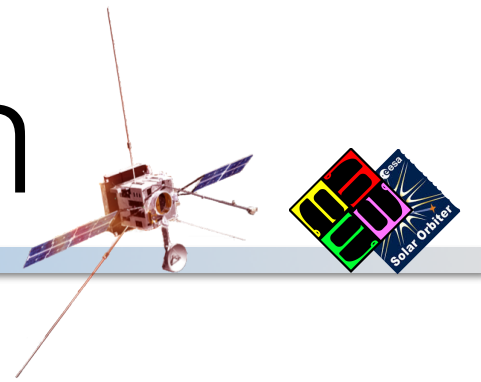


- subfield windowing only in Y-direction  
(highest cadence 0.1s->0.5s)
- interference ripples in images  
(partially addressed in QM/  
PFM refurbishment)
- non-optimal detector logic  
(voltages/timings)





# End-to-end calibration



**pro E2E  
calibration**

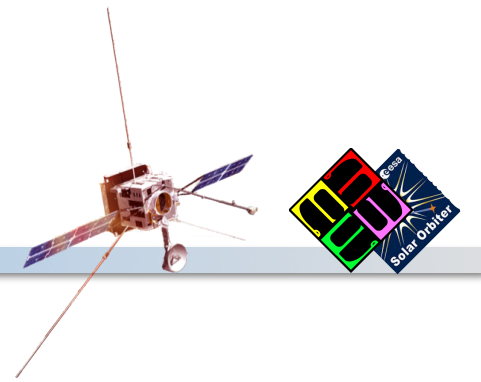
- To obtain absolute calibration DN  $\leftrightarrow$  photons
- Important for cross-comparisons with SPICE, METIS and with other EUV imagers

**E2E only  
if time  
remains**

- Reference point to monitor/correct degradation
- End-to-end calibration can be deduced from multiplying throughput from individual optical elements. This approach can be checked with the spare model after delivery
- Conversion to physical units is not the prime science topic of EUV imagers

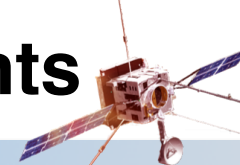
# Impacts & decisions

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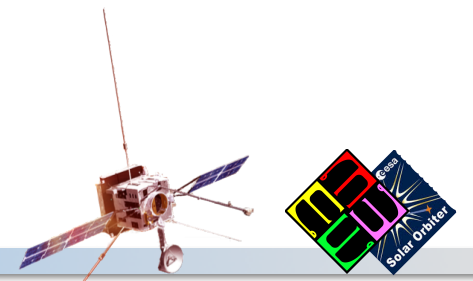
- Fixing the alignment problem, waiting for FM cameras and doing final calibration takes extra time.  
How does these decisions impact the science?
- EUI has 35 top level science requirements. Roughly half of them are not affected, half are affected.

# Affected top level science requirements



	alignment issue	QM problems	no final calibr.
FSI resolution	TBC		
FSI SNR			
FSI dynamic range			
HRI-EUV FOV		TBC	
HRI-EUV resolution			
HRI-EUV SNR			
HRI-EUV dynamic range			
HRI-EUV exposure time			
HRI-EUV cadence			
Lya FOV			
Lya resolution			
Lya SNR			
Lya dynamic range			
Lya exposure time			
Lya cadence			
Photometric accuracy			
	MAJOR SCIENCE LOSS	30% requirements affected	10% requirements affected

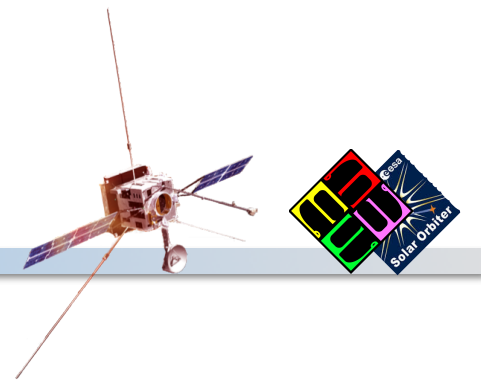
# Schedule



		Alignment	QM/FM camera	end2end calibration	% Science requirements not met	
<b>Nov 2016</b>	1a	NCR, allocated 6 weeks			N/A	not acceptable
<b>Dec 2016</b>	1b				40	very strong science reduction
<b>Mid Feb</b>	1c				30	2 months waiting for calibration?
<b>End Feb</b>	2b				10	Minimum viable
<b>Mid March</b>	2c				0	Optimal



# Conclusions



- We wait for the conclusions of the NCR board on alignment problem and for the delivery of the FM cameras (including NCR on Lya PCB).
- Hence we cannot start integration this week.  
We will not deliver on November 23 2016.
- Meanwhile we proceed as fast as we can on all critical elements such as to be on track for a February-March delivery.
- The possibility of an end-to-end calibration will be explored later