

### Hyperscout-H: cruise phase planning

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# Planning

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Nr. <u>Crt</u>	Туре	Objective	Geometrical conditions/Observing constraints	Trigger	Obs Mode/ Attitude	Observing sequence	Frequency	Total number of images	Ima ge ROI	Data per set (MegaByte)	Observations combined with	Mission phase
11	Calibration	Bias	Lowest exposure allowed by camera, no bright object in the Foy		Off-asteroid, any attitude, even during slews	3 x 0.0001 s exposures	every 6 months (one session must be scheduled just before Mars swing by)	11	1	35.2	AFC	Cruise
<del>12</del>	Calibration	Dark	No bright objects in the <u>FoV</u>		Off asteroid, any attitude, even during slews	1 x 0.1s exposure; 1 x 1s exposure; 3 x 5: exposure	every 6 months (one session must be scheduled just before Mars swing by)	45	1	144	AFC	Cruise
13	Calibration	Standard star (radiometric calibration)	Vega in the <u>FoV</u> RA: 18h 37m DEC: 38d 47m		Boresight to star in a minimum of 3 different posititons of FoV (to be agreed with AFC)	3 exposures, repeat with +- 3° off- pointing in X and Y	every 6 months (one session must be scheduled just before Mars swing by)	27	0.25	21.6	AFC	Cruise
14	Calibration	Standard star (radiometric <u>calib</u> , joint observation with AFC)	16 <u>Cygni</u> (G2V) RA: 19h 42m DEC: 50d 31m		Boresight to star in a minimum of 3 different posititons of FoV (to be agreed with AFC)	3 exposures, repeat with +- 3° off- pointing in X and Y	every 6 months (one session must be scheduled just before Mars swing by)	27	0.25	21.6	AFC	Cruise
15	Calibration	Star field (distortion measurement, geometric and radiometric calibration)	RA: 07h 21m; DEC:-25d 34m RA: 04h 25m; DEC:+15d 10m RA: 04h 21m; DEC:-60d 54m	As soon as possible after launch	Boresight to starfield.	53long exposure for each field; Repeat with +- 3° off pointing in RA and DEC for each field	Every <del>12</del> <b>6 months</b> (one session must be scheduled just before Mars swing by)	45	1	144	AFC	Cruise
18	Calibration	Mars ( <u>cross-calib</u> with AFC)	Mars in <u>FoV</u> (idealy, full coverage)	When the distance to Mars is smaller than 2e5 km (Mars covers at lest 50 macro-pixels ), and phase angle is smaller than 90 deg	<u>Boresight</u> to Mars	<u>Continous</u> imaging	-	40	1	128	AFC	Mars swing-by
19	Science	Phobos, Deimos, Mars, astrometry	Mars in <u>FoV</u> covering, 1, 2, 5, 10, 20 macropixels (distances to Hera 10e3 km, 5e6 km, 2e6 km, 1e6 km, 5e5 km). Both Phobos and Deimos in the <u>FoV</u>	When the distance conditions are met	Boresight to Mars	5 exposures	-	5	0.25	4	AFC	Mars swing-by
20	Science	Phobos far side	Phobos in FoV, closest distance allowed by trajectory		Boresight to target	Several images at dosest approach (TBD)	-	11	0.25	8.8	AFC	Mars swing-by
21	Science	Deimos far side	Deimos closest distance allowed by trajectory		Boresight to target	Several images at dosest approach (TBD)	-	11	0.25	8.8	AFC	Mars swing-by

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## Calibration images: 100 µs dark (bias) frames



- The minimum exposure time of the instrument is 100 µs. These dark frames characterize the bias level (bias exposures).
- Eight bias exposures were acquired during two sessions, 3 + 5 images.
- The instrument works at low temperatures.
- Slight variations of the median level between the two sessions.

200

400

600

800

1000

0

250

500

750

1000

Filo	TempC	TempEPA	Median	Mean	Std
	°Ç	°Ç	ADU	ADU	ADU
HS-L0-FE-0179-01-01.fits	-21	-11.0	144	143.4	12.7
HS-L0-FE-017A-01-01.fits	-21	-11.4	148	147.3	12.7
HS-L0-FE-017B-01-01.fits	-21	-11.6	145	144.8	12.6
HS-L0-FE-0198-01-01.fits	-22	-13.5	149	148.2	12.8
HS-L0-FE-0199-01-01.fits	-21	-13.0	151	149.9	12.7
HS-L0-FE-019A-01-01.fits	-21	-12.7	149	148.4	12.7
HS-L0-FE-019B-01-01.fits	-21	-12.7	148	147.5	12.7
HS-L0-FE-019C-01-01.fits	-21	-12.5	150	149.8	12.7



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### **Calibrations using Vega**



- Saturation test: 0.1, 0.3, 0.5, 1, 2 sec exposure;
- 27 images acquired in 3 x 3 pattern of pointings with 3° offset (dithering) after every three exposures.
- Radiometric calibration must consider that each channel has a specific gain and corresponds to a distinct segment of the spectrum.
- The position is a key factor for determining the number of ADU's and the radiometric calibration constant.

All channels were equalized by dividing them by their respective relative gains and the Vega spectrum.



0.3 sec exposure



0.5 sec exposure





2 sec exposure

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### **Calibrations using 16 Cyg**



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934	881	817	754	688	934	881	817	754	688	934	881	817	754	688	934	881	817	754	688				934	881	817	754	688	9
924	867	806	741	670	924	867	806	741	670	924	867	806	741	670	924	867	806	741	670				924	867	806	741	670	:
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952	901	844	782	713	952	901	844	782	713	952	901	844	782	713	952	901	844	782	713				952	901	844	782	713	
.5 - 944	893	830	769	702	944	893	830	769	702	944	893	830	769	702	944	893	830	769	702		20	12.5 -	944	893	830	769	702	
934	881	817	754	688	934	881	817	754	688	934	881	817	754	688	934	881	817	754	688				934	881	817	754	688	
924	867	806	741	670	924	867	806	741	670	924	867	806	741	670	924	867	806	741	670				924	867	806	741	670	
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	934	881	817	754	688	934	881	817	754	688	934	881	817	754	688	934	881	817	754	688
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	924	867	806	741	670	924	867	806	741	670	924	867			670	924	867	806	741	670
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	944	893	830	769	702	944	893	830	769	702	944	893	830	769	702	944	893	830	769	702
	952	901	844	782	713	952	901	844	782	713	952	901	844	782	713	952	901	844	782	713
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	924	867	806	741	670	924	867	806	741	670	924	867	806	741	670	924	867	806	741	670
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7.5	944	893	830	769	702	944	893	830	769	702	944	893	830	769	702	944	893	830	769	702
	952	901	844	782	713	952	901	844	782	713	952	901	844	782	713	952	901	844	782	713
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### **Star Fields**





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### HS-H Cruise Phase:Hera Mars Swing-by (MSB)



### Simulated with the current SPICE kernels

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Calibration	Mars ( <u>cross-calib</u> with AFC)	Mars in <u>FoV</u> (i <u>dealy</u> , full coverage)	When the distance to Mars is smaller than 2e5 km (Mars covers at lest 50 macro-pixels ), and phase angle is smaller than 90 deg	<u>Boresight</u> to Mars	<u>Continous</u> imaging	-	40	1	128	AFC	Mars swing-by	1057.6
Science	Phobos, Deimos, Mars, astrometry	Mars in <u>FoV</u> covering, 1, 2, 5, 10, 20 <u>macropixels</u> (distances to Hera 10e3 km, 5e6 km, 2e6 km, 1e6 km, 5e5 km). Both Phobos and Deimos in the <u>FoV</u>	When the distance conditions are met	Boresight to Mars	5 exposures	-	5	0.25	4	AFC	Mars swing-by	1061.6
Science	Phobos far side	Phobos in <u>FoV</u> , closest distance allowed by trajectory		Boresight to target	Several images at closest approach (TBD)	-	11	0.25	8.8	AFC	Mars swing-by	1070.4
Science	Deimos far side	Deimos closest distance allowed by trajectory		Boresight to target	Several images at closest approach (TBD)	-	11	0.25	8.8	AFC	Mars swing-by	1079.2

### HS-H Cruise Phase:Hera Mars Fly-by (MSB)





### **HS-H Cruise Phase: Deimos**





