SoloHI

TM figures

Allocated TM	20.5 kbits/s	
Download capacity per orbit	6.642 GB	= 53.136Gbits

Subtelescopes/units that can be commanded independently

SoloHI consists of 1 white-light telescope with wide FOV. The image is captured on a mosaic of four 2048x1920 APS detectors that are read out independently. This gives flexibility for image operations: independent exposures, cadences, etc.). Data can be read out either from the whole detector or from selected subfields.

Typically, SoloHI images will have one of 3 typical FOVs defined below. These are used in the observing programs/modes currently defined but could be changed in-flight if necessary.

	FOV split (radial x transverse)	**Downlinked pixels**	**Typical cadence**	**Comments**
SoloHI Full frame image (40ºx40º)	5º to 45º x 40º ⭐	1960 px * 1960 px (incl. 2x2 bin)	24-36 min (inner FOV) 30-72 min (outer FOV)	⭐ split in 2 or 3 readout frames depending on solar distance, e.g. 5º to 25º x 40º (inner) + 25º to 45º x 40º (outer) at perihelion, each with different cadence. Details in table below.
SoloHI inner FOV subframe images (3 images of 1.88ºx5º)	5.8º to 7.68º x 5º 13.5º to 15.38º x 5º 18.5º to 20.38º x 5º	192 px * 512 px (not binned) 96 px * 256 px (binned 2x2) 96 px * 256 px (binned 2x2)	18-36 sec 36-72 sec 1.5-3.0 min	Subframe images typically only used at and near perihelion (up to 0.36AU)
Radial Swath subframe image (40ºx5º)	5º to 25º x 5º 25º to 45º x 5º	1960 px * 256 px (incl. 2x2 bin)	6 min (inner FOV) 12 min (outer FOV)	Radial swath images typically only used at and near perihelion (up to 0.36AU)

Observational modes

Main science programs

source: SoloHI UM - SSD-DOC-SOLOHI-013 Rev. B draft 5

The SoloHI baseline observing program will be defined to repeat for each occurrence of the same unique orbit (i.e. each orbit of the trajectory within the same resonance with Venus). Therefore, a SoloHI baseline observing program will be defined for each orbit phase in NMP/EMP and will be executed for all orbits within that resonance.

Example of such an orbit plan is below:

Observing modes - Example plan		**Use case**	**#images / day**	**Science data volume / day**	**SoloHI data rate**	**Observing duration / orbit**
				(Gbits) estimate	**(kbits/s)**	**(days) example**
Perihelion programs:		0.28-0.29 AU				
SoloHI Solar Wind Turbulence @perih			1296	2.22	26.5	3
SoloHI Shock Formation @perih			468	2.54	30.3	3
Near-Perihelion programs:		0.29-0.36 AU				
SoloHI Near-perihelion Synoptic Program			348	1.69	20.3	5

SoloHI Solar Wind Turbulence Near-perihelion			750	1.94	23.2	2
SoloHI Shock Formation Near-perihelion			516	2.45	29.3	2
Far-Perihelion programs:		0.36-0.42 AU				
SoloHI Far-Perihelion Synoptic Program			132	1.64	19.7	7
Southern ⭐ Out-of-ecliptic programs:		0.5-0.7 AU ⭐				
SoloHI Southern Synoptic Program			104	0.84	10.3	8

⭐ *Dependent on the trajectory*

Examples of more-detailed observing program for 1 type of orbit during the mission *(source: 04_130904_SoloHI_CDR_ObsProg.ppt)*:

		Field of View					Image Size (MB)					Data Volume (Gbits)	
Observing Region	**Image Type**	**Radial**	**Trans-verse**	**Bin Size**	**Downlink Pixel Count (Mpixels)**	**Bit Depth**	**w/o DC**	**w/ DC**	**Image Cadence**	**Period (hrs)**	**Daily Image Count**	**Daily**	**Orbital**
Perihelion 4 days	Full Frame	5° to 25°	40°	2 x 2	1.92	17	7.3	2.16	24 min	96	60	1.09	4.36
		25° to 45°	40°	2 x 2	1.92	16	7.3	1.32	30 min	96	48	0.53	2.13
	Inner FOV Subframe	5.8° to 7.68°	5°	1 x 1	0.10	14	0.375	0.062	0.3 min	12*	1200	0.62	1.25
		13.5° to 15.38°	5°	2 x 2	0.025	14	0.094	0.016	0.6 min	12*	600	0.08	0.16
		18.5° to 20.38°	5°	2 x 2	0.025	14	0.094	0.016	1.50 min	12*	240	0.03	0.06
	Radial Swath Subframe	5° to 25°	5°	2 x 2	0.25	17	0.97	0.29	6.0 min	48	240	0.58	1.15
		25° to 45°	5°	2 x 2	0.25	16	0.97	0.26	12.0 min	48	120	0.27	0.53
Near Perihelion 8 days	Full Frame	5° to 25°	40°	2 x 2	1.92	18	7.3	2.33	30 min	192	48	0.94	7.5
		25° to 35°	40°	2 x 2	0.98	15	3.8	0.44	30 min	192	48	0.18	1.43
		35° to 45°	40°	2 x 2	0.94	15	3.6	0.61	30 min	192	48	0.24	1.95
	Inner FOV Subframe	5.8° to 7.68°	5°	1 x 1	0.10	15	0.375	0.176	0.6 min	24*	600	0.33	1.31
		13.5° to 15.38°	5°	2 x 2	0.025	15	0.094	0.016	1.2 min	24*	300	0.04	0.16
		18.5° to 20.38°	5°	2 x 2	0.025	15	0.094	0.016	3.0 min	24*	120	0.02	0.07
	Radial Swath Subframe	5° to 25°	5°	2 x 2	0.25	18	0.97	0.31	6.0 min	72	240	0.62	1.86
		25° to 45°	5°	2 x 2	0.25	16	0.97	0.26	12.0 min	72	120	0.27	0.80
Far Perihelion 12 days	Full Frame	5° to 25°	40°	2 x 2	1.92	19	7.3	2.43	30 min	288	48	0.98	11.72
		25° to 35°	40°	2 x 2	0.98	16	3.8	1.03	30 min	288	48	0.41	4.96
		35° to 45°	40°	2 x 2	0.94	16	3.6	0.98	60 min	288	24	0.20	2.36
Southern Out-of-Ecliptic 3 days	Full Frame	5° to 25°	40°	2 x 2	1.92	18	7.3	2.26	30 min	72	48	0.91	2.73
		25° to 33°	40°	2 x 2	0.81	16	3.1	0.85	60 min	72	24	0.17	0.51
		33° to 41°	40°	2 x 2	0.69	16	2.6	0.72	60 min	72	24	0.14	0.43
Northern Out-of-Ecliptic 3 days	Full Frame	5° to 21°	40°	2 x 2	1.52	18	5.8	1.85	36 min	72	40	0.62	1.86
		21° to 25°	40°	2 x 2	0.40	18	1.5	0.48	72 min	72	20	0.08	0.24
		25° to 32°	40°	4 x 4	0.18	17	0.68	0.20	72 min	72	20	0.03	0.11

DC= Data Compression

* 10 min image sequence every hr

Based on table above:

- a typical **perihelion** programme would produce ~25kbps (during 4 days), -> see modelled observations HI_SHOCK_PER (DATARATE=30300 [bits/sec]), HI_TURB_PER (DATARATE=26500 [bits/sec]),
- near-perihelion SoloHI would produce ~20kbps (during 8 days) , -> see modelled observation HI_SYN_PER (DATARATE=20300 [bits/sec])
- ~18.5kbps even further out (during 12 days) and -> see modelled observations HI_SYN_NEAR (DATARATE=19700 [bits/sec])
- in the far-out RSwindow, a datarate around 10 kbps would be reached. -> see modelled observations HI_SYN_FAR (DATARATE=10300 [bits/sec])

(see also SoloHI concept study report Dec 2011)

How to organize SoloHI observations in coordination with the other instruments, i.e. does SoloHI have 'observing modes' to choose from for each solar distance?, is still to be discussed in more detail. Also, while the schema above may be optimal from a science perspective, the varying downlink rate & SSMM storage limits may impose limitations on when which datarate can be used.