

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 (40°x40°) | 5° to 45° x 40° ★ | 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. 5° to 25° x 40° (inner) + 25° to 45° x 40° (outer) at perihelion, each with different cadence. Details in table below. |
| SoloHI inner FOV subframe images (3 images of 1.88°x5°) | 5.8° to 7.68° x 5° 13.5° to 15.38° x 5° 18.5° to 20.38° x 5° | 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 (40°x5°) | 5° to 25° x 5° 25° to 45° x 5° | 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):

| Observing Region | Image Type | Field of View | | Bin Size | Downlink Pixel Count (Mpixels) | Bit Depth | Image Size (MB) | | Image Cadence | Period (hrs) | Daily Image Count | Data Volume (Gbits) | |
|---------------------------------------|--------------------------|-----------------|------------|----------|--------------------------------|-----------|-----------------|----------|---------------|--------------|-------------------|---------------------|---------|
| | | Radial | Transverse | | | | w/o DC | w/ DC | | | | 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.