

Low latency improvement

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DOCUMENT

Solar Orbiter Low-Latency Data:
Concept and Implementation

Prepared by Anik De Groof, with input from Solar Orbiter instrument teams
Reference SOL-SOS-TN-0003
Issue 1
Revision 2
Date of Issue 19 Sep 2017
Status Draft
Document Type Technical Note
Distribution SOWG mailing list

European Space Agency
Agence spatiale européenne

Instrument	Type of data product [use case(s)]	Cadence	Total data vol./day
MAG	Magnetic field vector primary (outboard) sensor [1,2]	8s	75 kB ²
EPD	SIS science data, all species, low cadence [1,2] Subset of HET, EPT, STEP science data [1,2]	30 min 1s to 1h	4200 kB ³ average max 4371 kB
RPW	TNR Radio flux at frequency close to 1 MHz [1,2]	1s to 15s	Varying: max 400 kB ⁴
SWA	PAS moments (counts, density, velocity, pressure) [1-3] HIS charge state ratios & rate spectra [1,3] EAS single energy distribution [1,3]	4s 300s 100s (or 400s)	450 kB 43 kB ⁵ 470 kB (or 117 kB)
Total			max 5.8 MB (TBC)

Instr.	Type of data product [use case(s)]	Cadence	Total data vol./day
EUI	Beacon data: low-resolution FSI images (174/304Å) [2,3] Synoptic data: low-cadence, high-quality FSI images [1] If applicable: Sample HRI data (EUV+Ly-a) [1,3]	30 min 1 set/day 1 set/day	~1.5 MB/day ⁶
PHI	<i>LL data only when change in mode (or pointing)</i> QL: full-disk continuum & magnetogram thumbnail [all*] Precursor: continuum & magnetogram 1Kx1Kx8bit [1,3] Calibration: snapshot of calibration products [1]	Not daily Few per RSW 1 before RSW start/end RSW	Max 1MB/day 34 kB / QL set ⁷ 220 kB/precursor
SPICE	Each science study is preceded by LL version with same scientific performance. [1]	Varying	Varying: ≤0.1 MB/LL study Max 1 MB/day
SoloHI	Regular set of horizontal strips to build “J-maps” [3] Compressed sample of detectors or regions of interest [1]	TBD	Max 1 MB/day
Metis	2 VL image for tB + 1 UV image (all rebinned) [1] 8 light curves for each VL sector	1 set/day 4*DIT ⁸	~900 kB/day
STIX	Light curves per energy band [all*] Flare information data [all*] Energy calibration spectra [1]	4s 8s	800 kB/day
Total			~ 6.2 MB (TBC)

The LL dataset fulfils three functions:

1. It allows crude checks of instrument performance and science data quality (i.e. avoids up to 6 month delay in “seeing” what the instrument did).
2. It allows making the selective decision for some instruments that use selective data.
3. It allows improvement of pointing profile and/or re-targeting when tracking solar features.



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Currently in LTP10,
SPICE has ‘given’ its
1 MB/day to EUI

The LL dataset fulfils three functions:

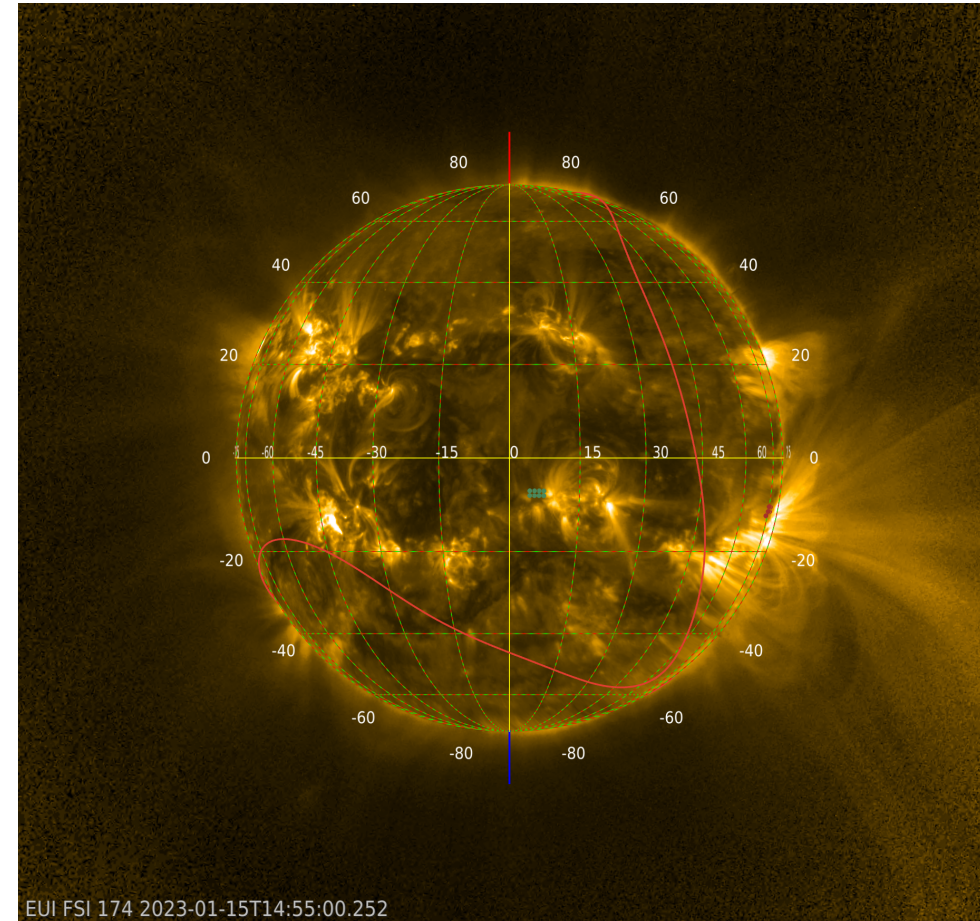
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3. It allows improvement of pointing profile and/or re-targeting when tracking solar features.

3. Pointing

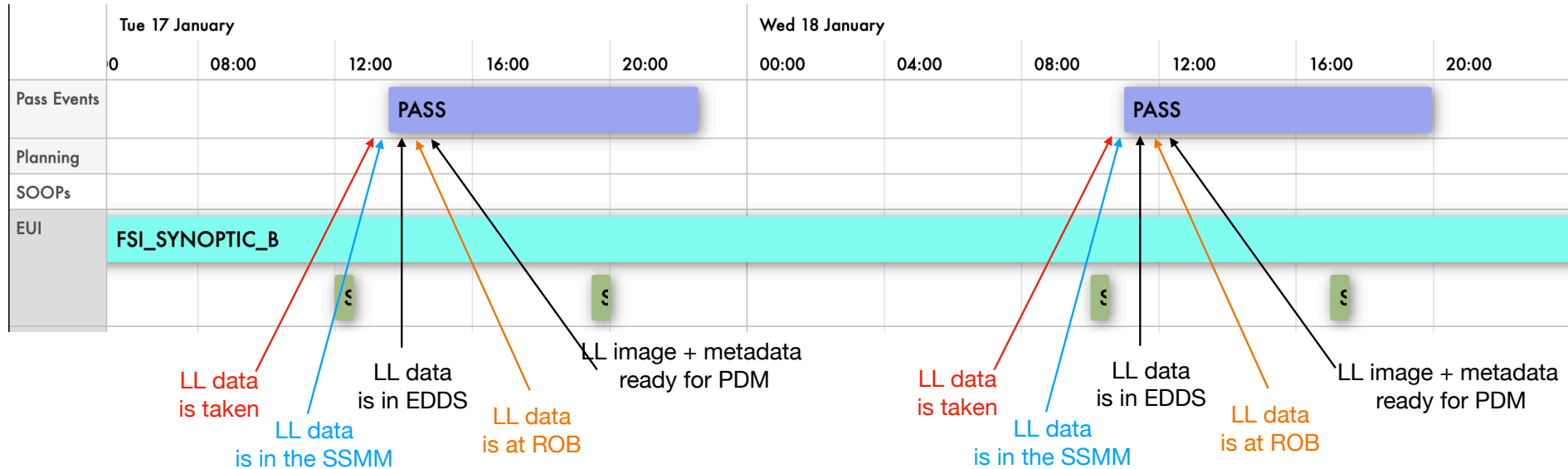
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- The “last day of FSI datas” are available at <https://www.sidc.be/EUI/data/lastDayFSI/>
This is typically 1 FSI174/304 image pair of ‘yesterday’ that was brought down per LL.
- At the Pointing Decision Meetings (PDM), these data are loaded in jHelioviewer and combined with MADAWG.
- EUI/FSI is the only source that provides the on-disc configuration in near real time, as seen from Solar Orbiter. This is particular important in the autumn perihelia and in the later phase of the spring perihelia.

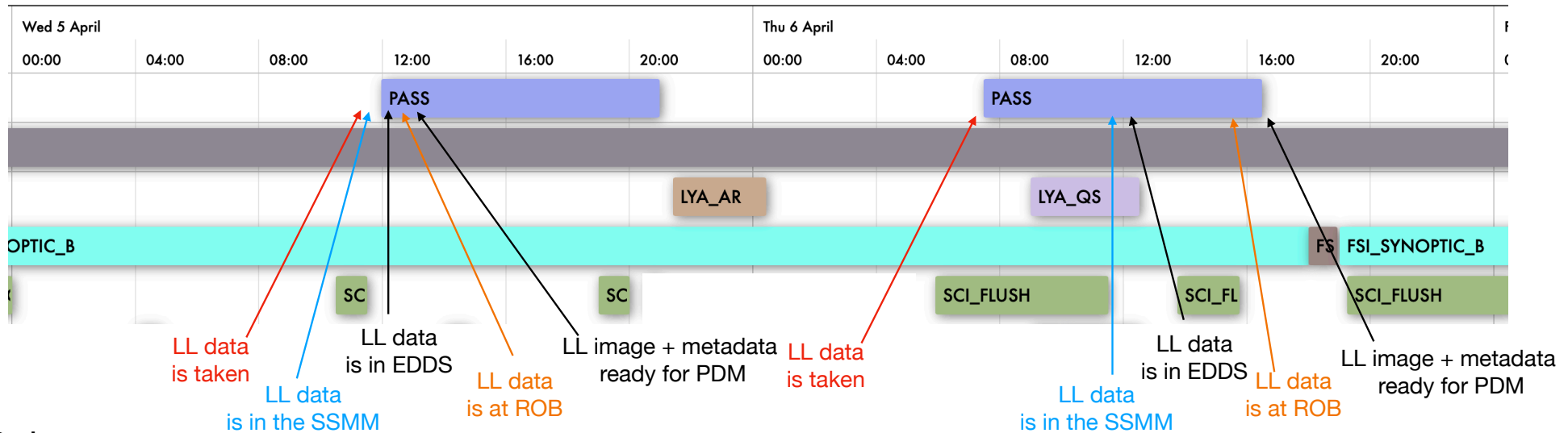


Ideal/hypothetical situation



- 1 FSI image pair per day is systematically send into Low Latency just before the pass before the PDM, which are typically in the afternoon.
- in principle, the PDM could have a LL data that is ~ 2 -3 hours old.
In practice it is nearly always >24 hours old

More realistically



Delays:

1. The LL data have to queue when an EUI data flush is ongoing. This can take many hours.
2. The EDDS data connection to ROB is not entirely stable. Sometimes FSI data are available at ESAC that are not available yet at ROB.
3. The as-flown SPICE kernels are not available until after the end of the pass, making the data pointing metadata initially inaccurate.

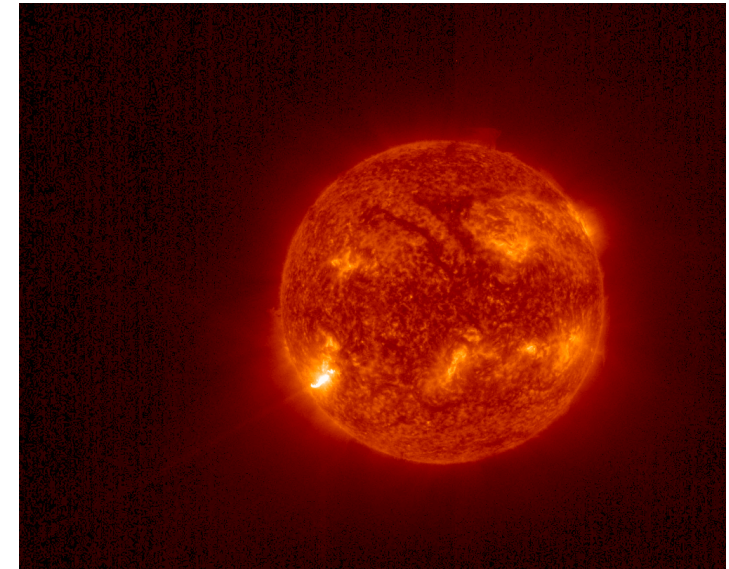
EUI PDM support would be more consistent/timely if a second LL pair could be taken at the end of the (previous) pass.

2. Selective downlink

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- EUI can, in its internal memory, disregard uninteresting data. This functionality allows to e.g. prioritise flare data.
- To be able to do that we have to get quickly to the ground an inventory of what is currently in memory. These “filesystem list reports” can be 0.3 MiB, often much smaller.
- These reports are currently already generated but not send through Low Latency.



Conclusion/ EUI wish list

The LL dataset fulfils three functions:

1. It allows crude checks of instrument performance and science data quality (i.e. avoids up to 6 month delay in “seeing” what the instrument did).
2. It allows making the selective decision for some instruments that use selective data.
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LL function	out RSW	in RSW
1. crude check instrument performance	1 image pair/day: ~1.2 MiB	covered already
2. selective decision data	1 filesystem list per day: 0.3 MiB	1 filesystem list per day: 0.3 MiB
3. pointing decision support	NA	2 image pairs/day: ~2.4 MiB
Total	1.5 MiB (current allocation)	2.7 MiB