

# LTP05 Oct 2021-Dec 2021

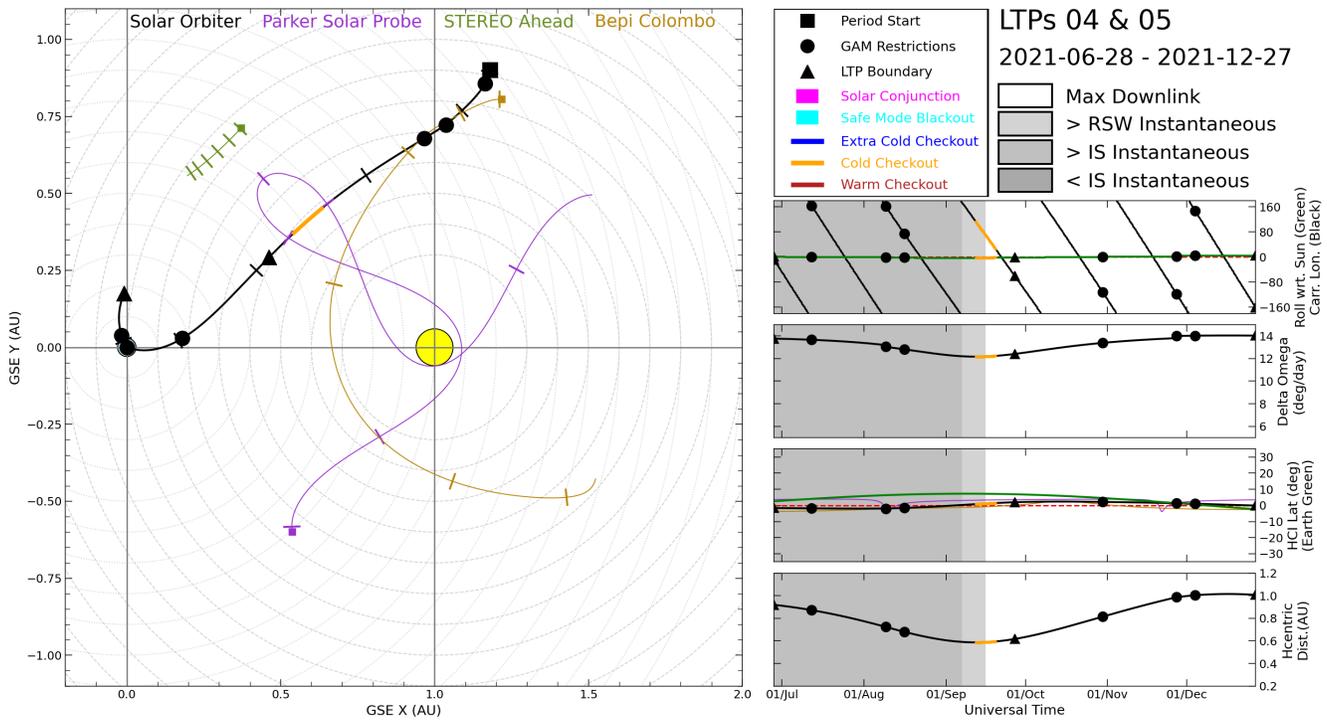
LTP05 has been confirmed to run from 2021-09-27T00:00:00Z until 2021-12-27T00:00:00Z.

**i** In March 2021, it was decided to change the typical duration of an LTP from 6 to 3 months, in order to allow Flight Dynamics to produce stable LTP input and to add flexibility by planning LTP closer to the execution dates. This page has been constructed from the original page [LTP04 July 2021-Sep 2021](#), started at MLP (Oct 2020), by copying over all information regarding the period Oct-Dec 2021.

- [Orbital context](#)
- [RS checkout window placement](#)
- [GAMs and conjunctions](#)
- [Science and calibration planning](#)
  - [IS calibrations:](#)
  - [RS calibrations:](#)
  - [IS-only science:](#)
  - [Coordinated science \(and cross-calibration\) campaigns:](#)
- [HS door operations](#)
- [Context from mission level planning during SWT27 \(Oct 2020\)](#)
- [SOOP Kitchen plan](#)
- [Reference material](#)
- [Inputs to pre-LTP05 Technical Note](#)

## Orbital context

Plots are in GSE (geocentric solar ecliptic) coordinates, so Earth is at [0,0], the Sun is at [1,0]. The plot is the projection of the orbit on the ecliptic plane.



Animated Version: [Orbit\\_GSE\\_2021H2.mp4](#)

New definition for the grey shading representing downlink rates:

- white = maximum downlink rate at which you can empty the SSMM in ~10 days
- light-grey = SSMM fill state decreases with everyone operating at EID-A rates
- mid-grey = SSMM fill state increases within RSW (10 instruments operating) and decreases outside RSW (IS-only breakeven rate < downlink rate < inside-RSW breakeven rate)
- dark-grey = SSMM fill state increases with just IS operating (downlink rate < IS-only breakeven rate)

## RS checkout window placement

No RS checkout windows in LTP5.

Note that the **first month of NMP** is covered by this LTP: NMP starts officially at the Earth GAM on 2021-11-27. Nominal IS and RS science will start after the navigation window (~4 Dec 2021).

## GAMs and conjunctions

- Earth GAM 1 on **2021-11-27**, GAM restriction period runs from 2021-11-01 to 2021-12-13, but last TCM is on 3 Dec, so we can start RS synoptics on 4 Dec as previously planned.
- Note also that SC will roll back to nominal 0 degree angle on **2021-12-04**.

## Science and calibration planning

Note the *text in red* highlights adjustments still to be made in SOOP Kitchen plan during Long Term Planning

### IS calibrations:

- **MAG calibration roll** ★ has been scheduled on **13 October 2021**
- **3 RPW calibration rolls** ★ (roughly daily) have been scheduled in the period **2021-11-30 and 2021-12-02** when SC-Earth distance is within the range (115, 1000) Earth radii, and when Solar Orbiter is between -80 and +120 deg from the minus X GSE axis as defined in RPW EIDB ★

### RS calibrations:

Context: *TN on star calibration opportunities and planetary transits*

- Some opportunities involving planetary transits or comets passing through FOVs:
  - 4 Oct: Mercury moving through FSI FOV (2.63 Rsun) on 4 Oct, i.e. during the RS coordinated synoptics mentioned below. FSI adjusted the observations to take advantage of this opportunity.
  - 24 Dec: Venus opportunity for Metis. No offpointing required.
- **Metis** star calibration opportunities :
  - 2021-12-17 - 2021-12-25, Ophiuchi (interleaved with synoptics)
- Both EUI and PHI plan to run a test annealing campaign at the end of Cruise phase, i.e. after RSCW4 (decision made by RSWG at SOWG#14).
  - EUI input: This annealing campaign is meant to assess the detector degradation and in case of strong degradation, to foresee an annealing campaign preceded and followed by an onboard calibration to assess its efficiency. Ideally, this campaign would have a TM of 1900 MiB. If this is not feasible, we can limit the TM by taking subframes.
  - Input SOWG kick off meeting: annealing campaigns to be scheduled 18 to 20 Dec. Note the actual annealing is expected to take about 24hrs but (at least for EUI) calibration campaigns are needed before and after.

### IS-only science:

- IS science modes, incl. regular and coordinated bursts
- High rate observations for the in situ instruments for the following period:
  - 2021-12-04 - 2022-01-01 (start nominal mission phase, plentiful downlink)

### Coordinated science (and cross-calibration) campaigns:

These address the opportunities identified during SWT 27 (listed in the table below)

- Remote sensing synoptic programme (based on [L\\_FULL\\_LRES\\_MCAD\\_Coronal-Synoptic](#) SOOP definition with additional SPICE observations included) during the following periods:
  - 2021-09-20 (=LTP4) - 2021-10-11 (post RSCW, support BC Mercury Flyby; 180 degree field ambiguity resolution)
  - 2021-12-04 - 2022-01-01 (start nominal mission phase, assumed default synoptic programme)
  - Note: synoptic programme has been reviewed and updated by RSWG, see [https://docs.google.com/spreadsheets/d/1W6mhOK9B6-K9CisXThdv\\_L8Rwlouk4NxMU-SypXXqoc/edit?usp=sharing](https://docs.google.com/spreadsheets/d/1W6mhOK9B6-K9CisXThdv_L8Rwlouk4NxMU-SypXXqoc/edit?usp=sharing). For LTP5, proposal is to run as a min the 1xEID-A variant (see comment below page).
- 5 Nov: Cross- and inter-calibration opportunity with Earth-based assets, aligned with crossing the Earth-Sun line (note that 5 Nov is during the NAV window, detailed timing TBC by flight dynamics).
- RS Instruments with internal memories can transfer extra TM to the SSMM after the RSCW4, to take advantage of good downlink performance close to Earth.
- **27 Nov EGAM** :
  - SoloHI and Metis are interested in imaging Earth during the EGAM. Metis decided during SOWG to not take part due to illumination risk during EGAM (incl albedo Earth). SoloHI operations planned in SOOP Kitchen **To be formally approved by MOC**
  - RPW also interested during the eclipse close to EGAM in order to get clean observations without interference from Solar Panels planned in SOOP Kitchen **To be formally approved by MOC**
  - Request from CMS team to operate through the EGAM. planned in SOOP Kitchen **To be formally approved by MOC**
- 4 Dec: Solar eclipse as seen from Earth. Also Solar Orbiter is close to Sun-Earth line (but close to EGAM). Synoptics adjusted to support.
- 17 to 21 Dec: Comet C/2021 A1 (Leonard) passing through Metis FOV on 15 Dec 2021, will be visible in SoloHI's FOV from 17 to 21 December. No rolls required. Synoptics adjusted to support.

★ Note that the coordinated off-pointing campaigns and rolls need to be requested to MOC (flight dynamics) before LTP planning and timing/details cannot be changed anymore at time of Long Term Planning.

# HS door operations

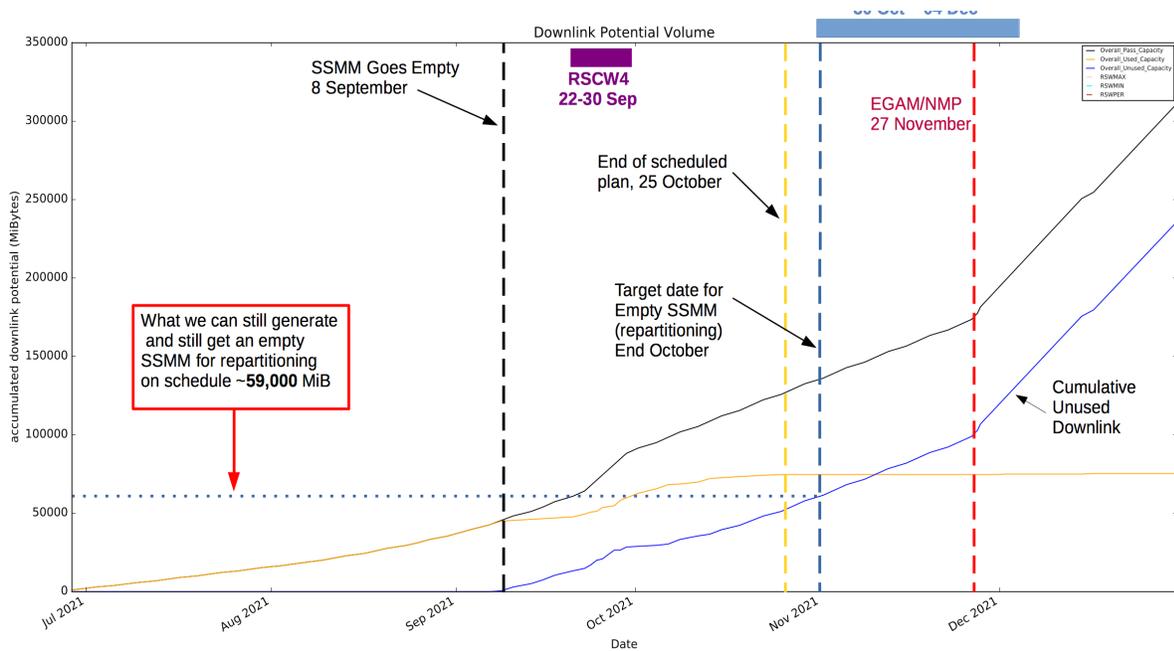
LTP5 starts with all HSDs open, except EUI/HRI closed.

Following HS door operations are proposed, refined and confirmed during SOWG (detailed timeline in SPKT):

- **Close all HSDs when trajectory manoeuvres may potentially point SC beyond disk:**
  - between 20 Nov (FAR\_SUN) & 4 Dec (TCM+1w) = around EGAM
  - on 13 Dec for MAINT+TCM >0.95AU (open afterwards) short pause in synoptics
- **EUI/HRI:** Open HRI HSD for the cross-calibration campaign (5 Nov)

## Context from mission level planning during SWT27 (Oct 2020)

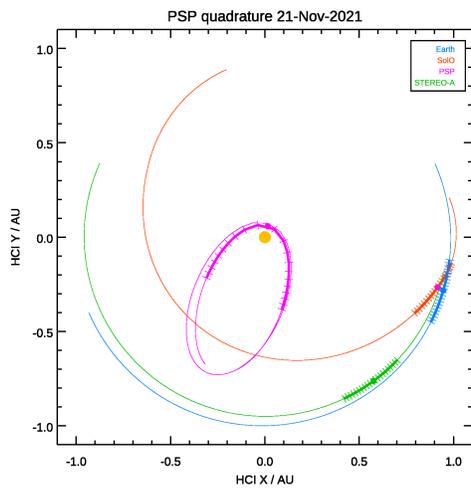
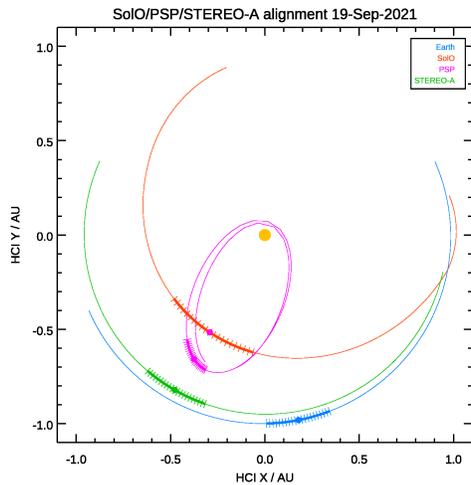
Since launch, comms performance has been found to be much better than baselined, so there is significant scope for extra activities. These were handled directly by the SOWG for LTP2 and LTP3, however for LTP4 the priorities for how to use the additional telemetry will be set by the SWT in line with the expected procedure for the nominal mission phase. The new level of available telemetry is summarised in the below plot. The decision taken by the SWT in order to use this Telemetry are reflected in the information above. This section is left here for context.



Note there will be some carry-over of data from LTP3 and 4, and the SSMM will need to be empty close to the EGAM to allow for repartitioning.

First priority will be given to completing any necessary calibration and characterisation campaigns, followed by addressing the science priorities decided by the SWT.

Context for PSP coordination:



Orbit plots courtesy of V. Andretta.

## SOOP Kitchen plan

High-level (=MLP) plan of whole cruise:

- Post-launch MLP update with more representative downlink performance (note this plan contains LTP4+5 only): <https://solarorbiter.esac.esa.int/soopkitchen/#/planning/plan/Mission%20Level%20Plan%20for%20LTP4%20Only>

Starting point for LTP05 planning in SOWG#18: [https://solarorbiter.esac.esa.int/soopkitchen/#/planning/plan/LTP05\\_Sep2021-Dec2021/215](https://solarorbiter.esac.esa.int/soopkitchen/#/planning/plan/LTP05_Sep2021-Dec2021/215)

- See also [SOWG #18 - Jul 2021](#)

Final plan LTP05: [https://solarorbiter.esac.esa.int/soopkitchen/#/planning/plan/LTP05\\_Sep2021-Dec2021](https://solarorbiter.esac.esa.int/soopkitchen/#/planning/plan/LTP05_Sep2021-Dec2021) (baseline 8 is the plan distributed on 30 July '21 as **LTP5 V01** incl. EFCS at V02)

## Reference material

- [TN on star calibration opportunities and planetary transits](#)

## Inputs to pre-LTP05 Technical Note

Slides presented at SWT #29 are now here: [LTP05 at SWT 29.pptx](#)