

Slow solar wind connection SOOP

([L_SMALL_HRES_HCAD_Slow-Wind-Connection](#))

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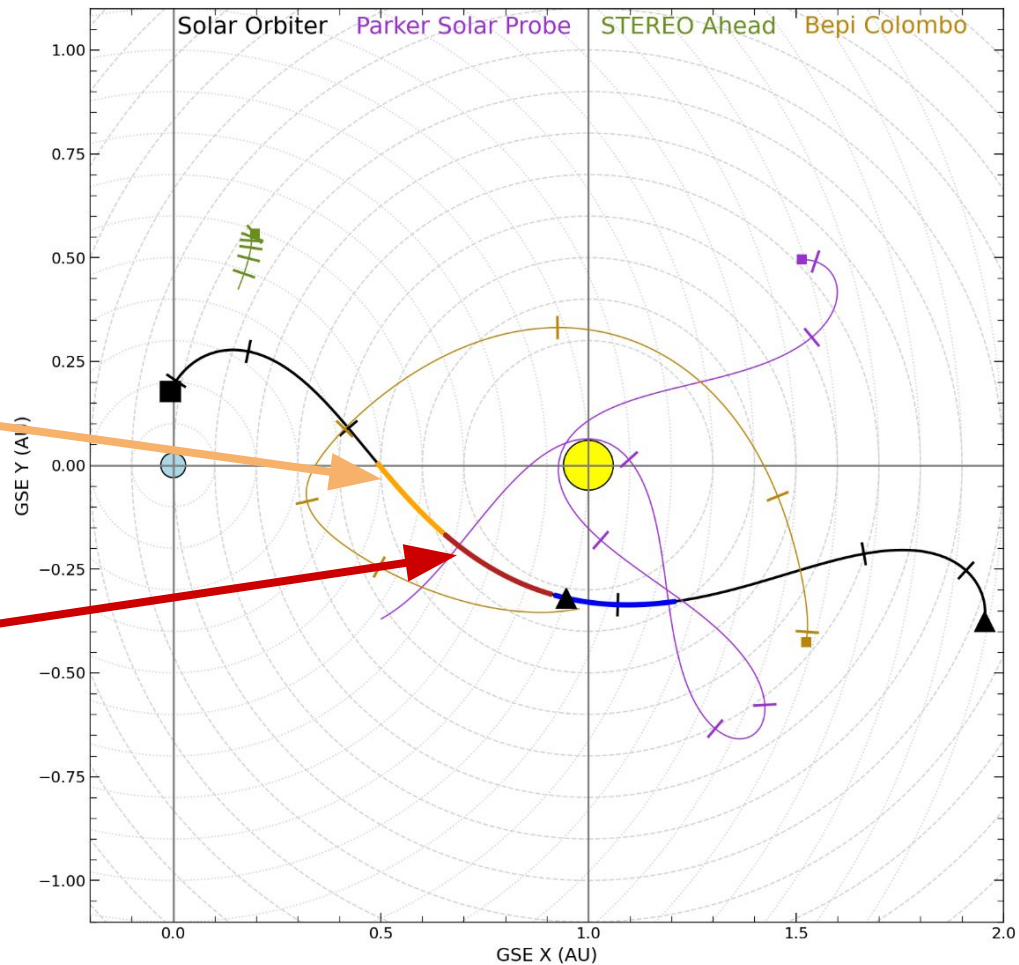
Science goals

- **What are the release mechanism of slow solar wind at an open-closed magnetic field boundary?**
- Can be at a coronal hole edge or within a large active region
- Addresses these science activity plan (SAP) goals:
 - [Does slow wind originate from the over-expanded edges of coronal holes?](#)
 - [Does slow and intermediate solar wind originate from coronal loops outside of coronal holes?](#)
 - [Disentangle the spatial and temporal variability of the slow wind](#)
 - [Study fast plasma flows from the edges of solar active regions](#)
 - [Interchange reconnection between open and closed field lines and its role in slow wind generation](#)

SOOP periods

First 3 days
(3rd - 6th March 2022)
~0.5 - 0.45 AU

First 5 days
(17th - 22nd March 2022)
~ 0.35 AU



Context data

- Position in orbit favourable for Earth-based context data (SDO)
- **Helpful (but not needed) to have low latency EUI, PHI, SoIOHI data** to evaluate coronal evolution as close as possible to SOOP
- **In-situ instruments need to continue running** for 3 days after end of window to account for solar wind travel time

Manoeuvres

- Due to small SPICE/EUI/PHI FOV, need to **track a target of opportunity** using short term pointing capabilities
- Use modelling, Earth assets (SDO), LL SoIO data, to predict source regions, starting 1 solar rotation ahead > short term pointing deadline
- Follow most likely source region throughout each SOOP window

Scientific requirements

1. Link **in-situ plasma parcels** to specific coronal **source regions**
2. Observe **magnetic field** configuration and evolution at **open-closed boundary**
3. Observe possible signatures of **interchange reconnection** at boundary

Measurement requirements

1. Identifying solar wind source regions

a. **Global coronal structure:**

full disc magnetic field, EUV, white light at ~12h cadence, ~ 4Mm resolution

b. **Solar wind magnetic connectivity:**

Magnetic polarity, electron strahl direction at ≤ 1 h cadence

c. **Coronal composition across open/closed boundary:**

Local spectroscopy at ~12h cadence, 1Mm resolution

d. **Solar wind composition:**

In-situ observations at ≤ 12 h cadence, similar ions to spectroscopy

e. **Coronal mass flux and temperatures across open/closed boundary:**

Local spectroscopy to measure density, (doppler) velocity, temperature at ~1h cadence, 1Mm resolution

f. **Solar wind mass flux and temperatures:**

Proton + electron density/speed/temperature at ≤ 1 h cadence

Measurement requirements

2. Local magnetic field configuration/evolution

a. **Coronal magnetic field structure across boundary:**

photospheric magnetograms and EUV images on sub-Mm resolutions and multiple time scales
>= 1min

3. Signatures of interchange reconnection

a. **Radio bursts/storms:**

In-situ radio spectrograms on ~1min timescale

b. **Solar wind switchbacks:**

Solar wind **B**, e- strahl, proton bulk speed on ~1s timescales

c. **Suprathermal electron enhancements:**

Solar wind e- distributions + energetic particle observations on 1min timescales

d. **Images/movies of magnetic field reconfiguration:**

photospheric magnetograms and EUV images at boundary on sub-Mm resolutions and multiple time scales >~ seconds

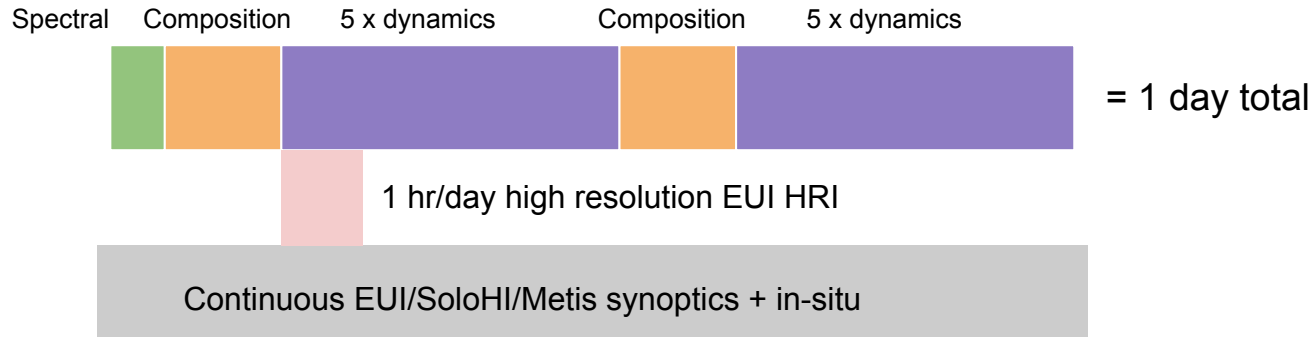
Instrument requirements

Instrument	Requirements (see previous slides for key)	Required mode(s)
MAG	1b, 3b, 3c	Normal mode
SWA	1b, 1d, 1f, 3b, 3c	EAS: 10s e- distributions PAS: 4s p+, a++ distributions HIS: 300s composition, 30s a++
EPD	3c	Normal mode
RPW	1f, 3a	Normal mode

Instrument	Requirements (see previous slides for key)	Required mode(s)
EUI	1a, 2a, 3d	FSI 15 minute cadence HRI 6s cadence
PHI	1a, 2a, 3d	<i>See next slide</i>
SPICE	1c, 1e	<i>See next slide</i>
SoloHI	1a	Synoptic near program, <= 6h cadence
Metis	1a	Long term evolution program, <= 6h cadence. <i>Closed for 2nd window</i>
STIX	n/a	None

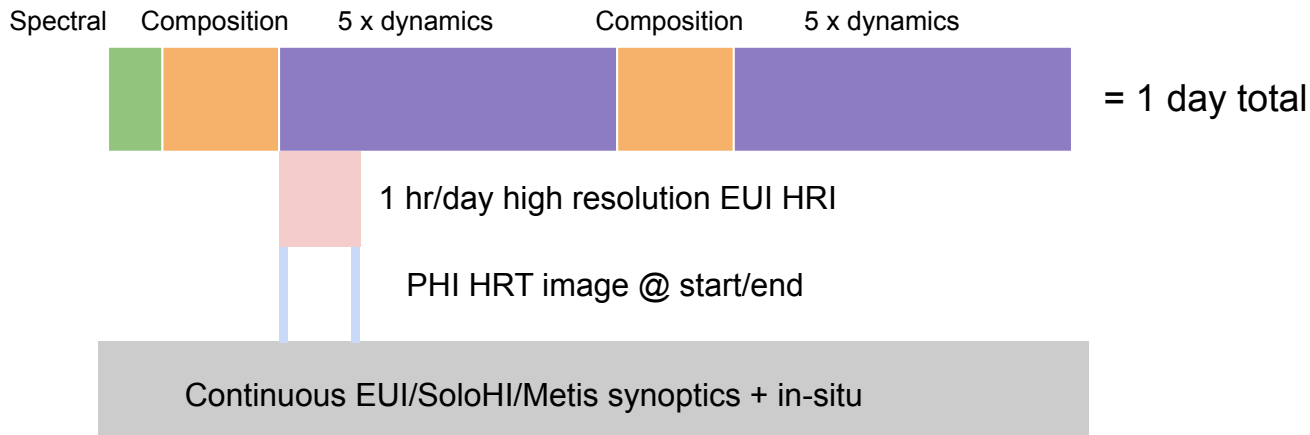
SPICE requirements

- **SPICE_SPECTRALATLAS - 1 /day (0h55)**
 - Returns all spectral lines over reduced FOV.
 - Required to check that correct windows will be selected.
 - Especially important as this will be first close perihelion for SPICE.
- **SPICE_COMPOSITION @ 60s exposure - 2/day (2h40 each)**
 - Derive FiP map across full raster
 - Track composition on ~day timescales
- **SPICE_SYNOPTIC - 10 / day (1h30 each)**
 - Derive density, velocity, temperature across full raster
 - Track evolution of solar wind source on ~ hour timescales



PHI requirements

- Earth based assets (HMI, GONG) are good enough to do connectivity for this window
 - No PHI/FDT requirement
- From HRT, require:
 - **Minimal:** 1 image at start + 1 image at end of **every** EUJ/HRI 1h window
 - **Minimal:** Continuous 1s cadence HRT images during **one** EUJ/HRI 1h window
 - Use EUJ/HRI window closest to perihelion
 - **Ideal:** 5 min cadence HRT images during every EUJ/HRI 1h window



Daily data generation (minimal plan)

Instrument	Data generation (MiB)	Mode(s)
MAG	9	MAG_EQUAL8_BURST
SWA	22	SWA_PAS_NORMAL11
	56	SWA_HIS_NORMAL
	274	SWA_EAS_HIGH
EPD	35	EPD_CLOSE_BURST
RPW	36	RPW_NORMAL_DEFAULT
Total in-situ	432	

Notes:

All 0 minutes of burst mode/day

Modes/data generation are identical for both SOOP windows

Daily data generation (minimal plan)

Instrument	Data generation (MiB)		Mode(s)
	1st SOOP window	2nd SOOP window	
EUI	17	17	FSI_SYNOPTIC_B, 15m cadence, 24h duration
	240	240	LYA_CH, 6s cadence, 1h duration
	720	720	EUV_CH, 6s cadence, 1h duration
PHI	39	416	PHI_VECTOR_HRT_1
SPICE	245	245	See "SPICE requirements slide"
SoloHI	291	291	HI_SYN_MID
Metis	60	0	METIS_LT_CONFIG, 20 minute cadence (off during 2nd window)
STIX	7	7	STIX_GENERIC
Total remote	1580	1936	
Total	2012	2368	In-situ + remote