1.1.3.3 What is the distribution of the open magnetic flux?

Description of the objective:

- Understand what determines the amount of open flux from the Sun, how open field lines are distributed at the solar surface at any given time, and how these open field lines reconnect and change their connection across the solar surface in time.
- Origin of the open magnetic flux from:
    - Coronal holes.
    - Active regions.
    - Quiet Sun.
    - Loops of varying heights.
    - Tips and legs of the helmet streamer.
    - Polar plumes.
    - Other solar structures.

Remarks:

- We need MAG measurements for the magnetic field polarity and strength, over a wide range of distances and latitudes, combined with signatures of connectivity such as suprathermal electrons (SWA/EAS) to determine the amount of open magnetic flux in the heliosphere from solar minimum to maximum.
- METIS can provide electron density and outflow velocity maps with a 20-30 min cadence.
- EUI can support with FSI for complementing observations in the lower lying corona, at low cadence as METIS.
- PHI can provide low-resolution synoptic context.
- As for all goals of the category 1.1.3 Source regions of the heliospheric magnetic field, far side observations will be most innovative, as well as high-latitude. EMC Quiet periods are required for the MAG measurements.

Part of this objective can be addressed with the I_DEFAULT SOOP as well as during the connectivity operating plans for the fast and slow winds, e.g. L_SMALL_HRES_HCAD_Fast_Wind, L_SMALL_HRES_HCAD_SlowWindConnection, L_SMALL_MRES_MCAD_Connection_Mosaic.

However up to now, we have only included it in R_SMALL_MRES_MCAD_AR-Long-Term, but this would only partially address it.

- SPICE:
    - Target: Coronal Holes, Quiet Sun, Active Region mainly on disk
    - Observing mode: Composition mapping (Doppler maps and composition) and Dynamics
    - Slit: 30” for Composition mapping and 4” for Dynamics
    - Exposure time/cadence and number of X positions: 180 s, X=32 for Composition mapping; 10 s, X=224 for Dynamics
    - Field of View: 16’×14’ for Composition mapping; 15’×11’ for Dynamics
    - Number of repetitions of the study: 1 for Composition mapping followed by 10 for Dynamic and 1 again for Composition mapping
    - Observation time: 1.6 hours for Composition mapping; 6.3 hours (0.63 hours per study) for Dynamics
    - Key SPICE lines to be included: Ne VIII 770 Å, Ne VIII 780 Å, Mg IX 706 Å, O II 718 Å, O IV 787 Å, O V 760.4 Å, O V 761 Å, O VI 1032 Å, O VI 1037 Å, Ne VI 999 Å, Ne VI 1010 Å, Mg VIII 772 Å, Mg VIII 782 Å, C III 977 Å, Fe III 1017 Å - 2 profiles and 13 intensities or 4 profiles and 11 intensities (maximum of 15) for Composition mapping;C III 977 Å, O VI 1032 Å, O VI 1037 Å, Ne VIII 770 Å – 10 lines (4 profiles and 6 intensities) for Dynamics
    - Observing window preference: perihelion preferred
    - Other instruments: EUI, PHI, METIS, SoloHI, SWA, EPH, MAG
    - Comments: *The choice of lines, and also the number of intensities and profiles, is flexible, although the sum of the intensities and profiles is constrained to a maximum (e.g 15 for composition mapping). While varying the number of intensities and profiles, within the maximum, has no effect on the duration of the study, it will have an effect on the telemetry*.
- EPD: All detectors: sudden changes in energetic particle fluxes, EPT-HET: pitch angle distribution (during enhanced flux periods).
- PHI,

HRT medium resolution data	Requirement
FOV [pixels]	1024 x 1024
Parameters	I_c, v_{LOS}, B, ,
duration	whenever possible
cadence	~~1/(5 min)~~ 20-30 min
N orbits	4

solar distance	?
PHI operating mode	6 (synoptic)
co-ordination	comparison of global and high-resolution magnetic fields requires co-ordination with NEO data

- METIS: Measurement of the electron density through the polarised brightness in VL (580-640 nm) in the field of view 1.5-2.9 degrees to derive the magnetic field topology from the global corona configuration. **Cadence 20-30 min.**
    - Products:
        - Global maps of the electron density in corona/coronal configuration.
    - Modes:
        - MAGTOP (min. obs time 2 hr, data volume 480 Mb)
        - GLOBAL (min. obs time 2 hr, data volume 300 Mb)
        - LT-CONFIG (min. obs time 2 hr, data volume 30 Mb)
          Repeated each half a day in one observation window preferably at perihelion.
    - Other instruments: PHI, EUI, SoloHI.
- All instruments.

Duration:

- A few days.

Other constraints:

- EMC stability required for accurately calculating the magnetic flux. This is important for example for flux disconnection rates.
- Important to also look at high latitudes later in the mission.