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Introduction to EUI data and some examples of connection science with the in situ instruments

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In situ solar wind sources and connection science SolO working group
21/01/2021

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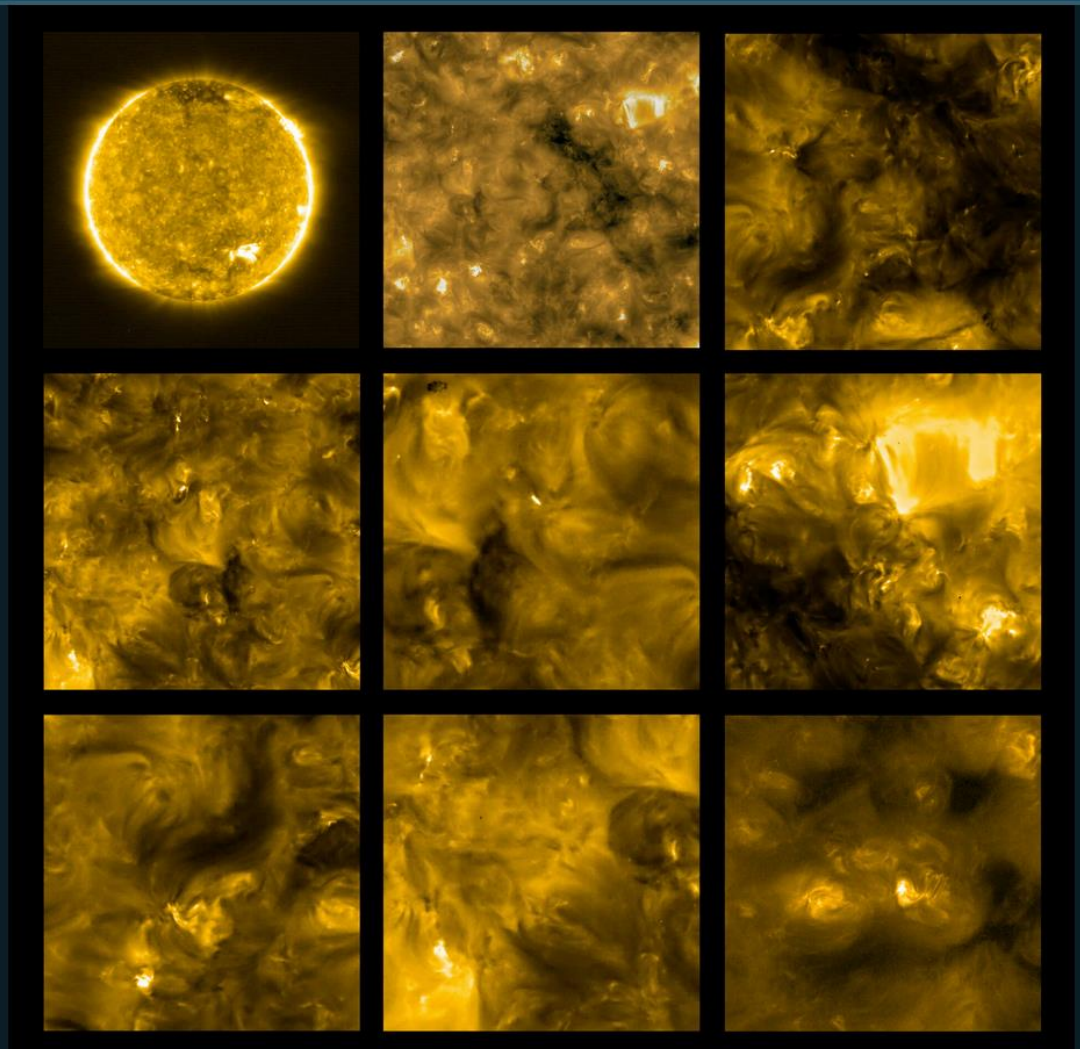
The Extreme Ultraviolet Imager (EUI)

→ THE EUROPEAN SPACE AGENCY



SCIENCE & EXPLORATION

Solar Orbiter's first view of the Sun

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DETAILS RELATED

The Extreme Ultraviolet Imager (EUI) on ESA's Solar Orbiter spacecraft took these images on 30 May 2020. They show the Sun's appearance at a wavelength of 17 nanometers, which is in the extreme ultraviolet region of the electromagnetic spectrum. Images at this wavelength reveal the upper atmosphere of the Sun, the corona, with a temperature of around 1 million degrees. EUI takes full disc images (top left) using the Full Sun Imager (FSI) telescope, as well as high

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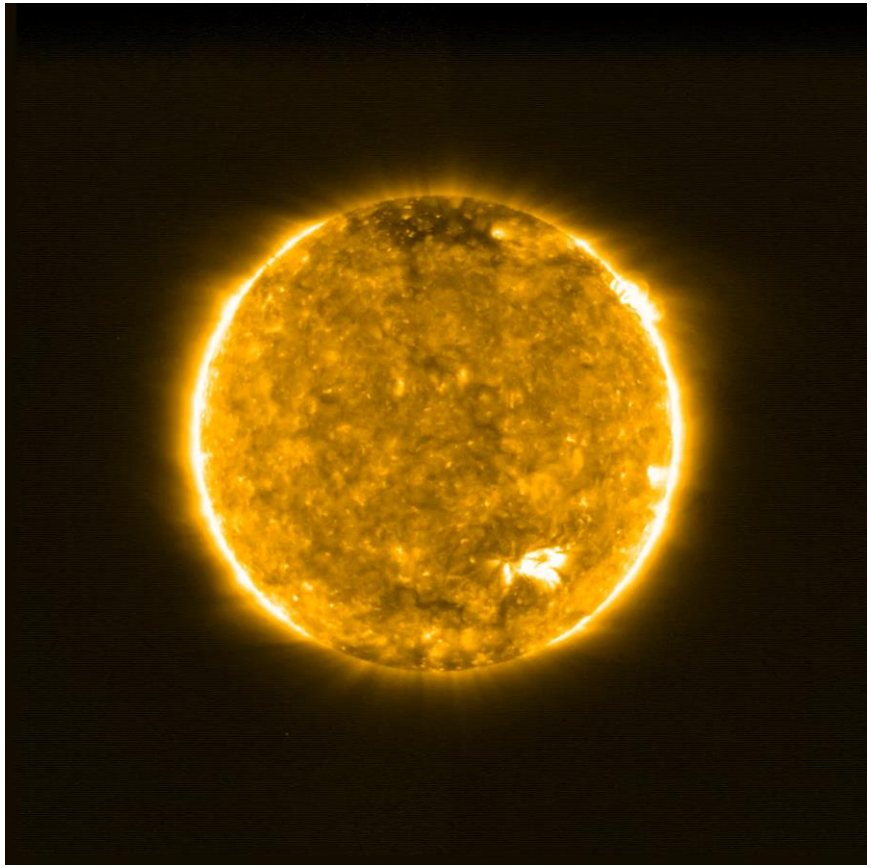
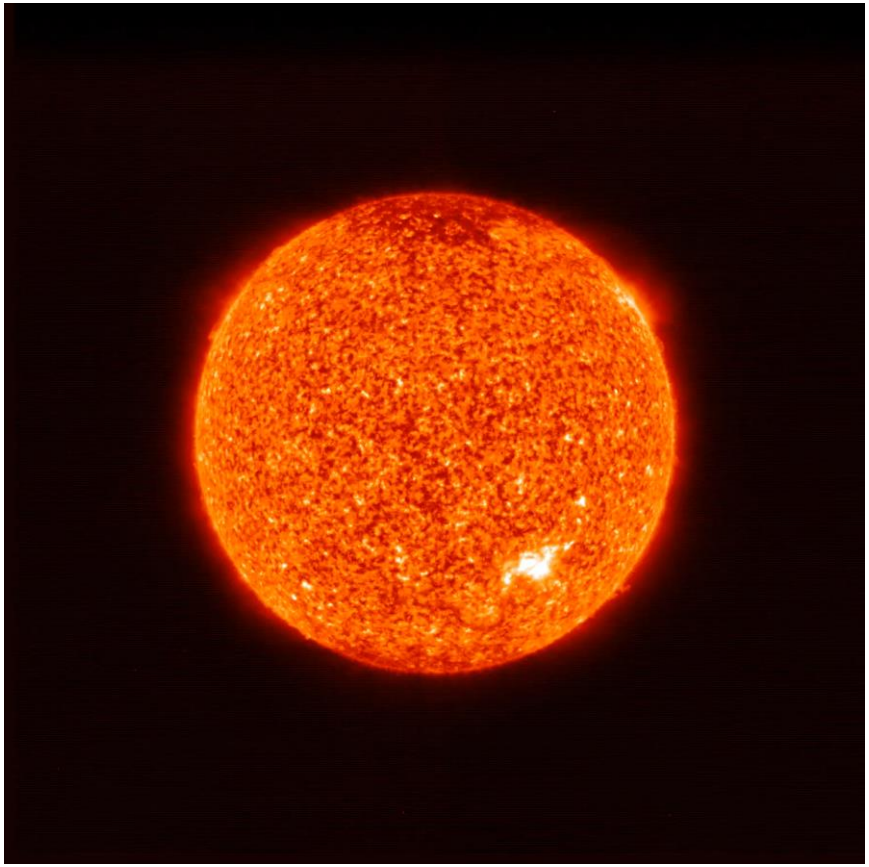
The Extreme Ultraviolet Imager (EUI)

FSI 17.4 nm



FSI 30.4 nm



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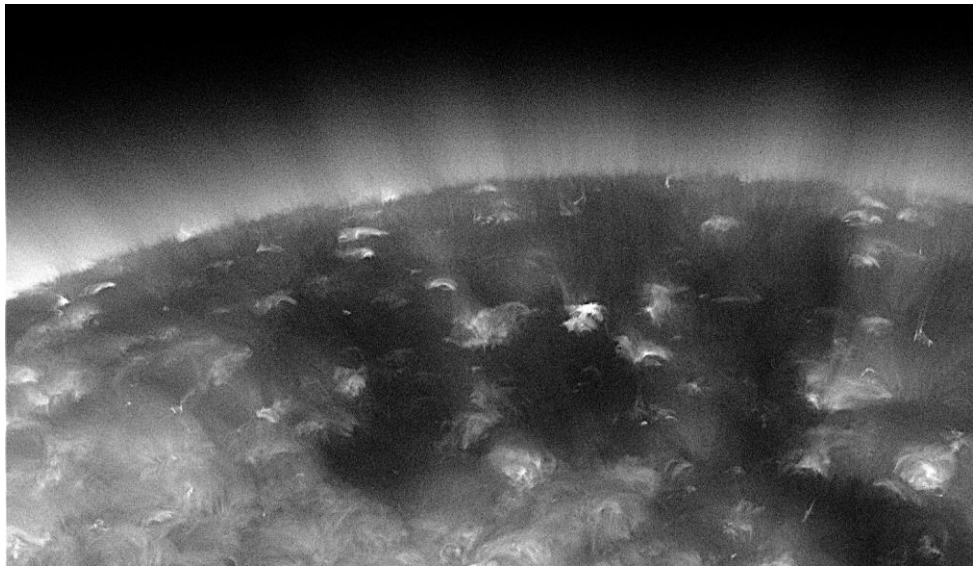
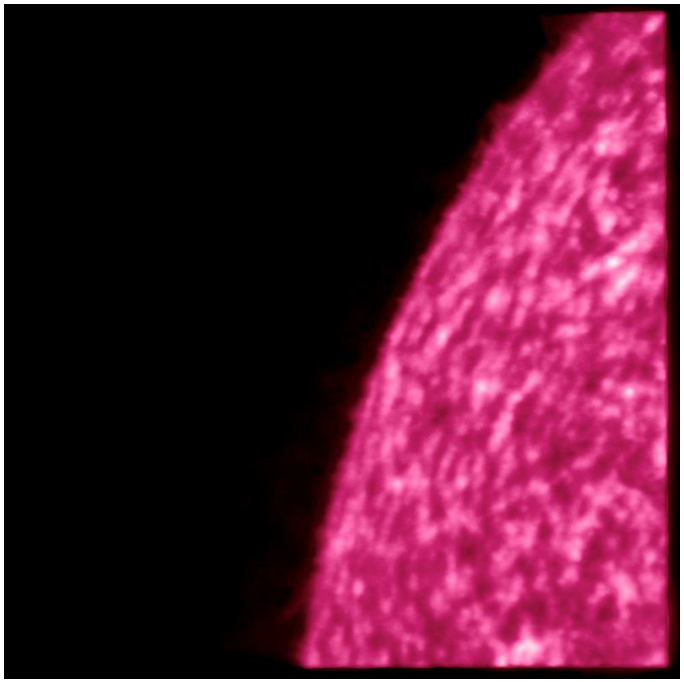
The Extreme Ultraviolet Imager (EUI)

HRIEUV 17.4 nm



HRILya 121.6 nm



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EUI observations

Availability:

- May: 12, 13, 16, 20, 21, 28-30
- June: 16-21
- August: 4-8
- October: 19, 21
- November: 17-22
- January: 14-17

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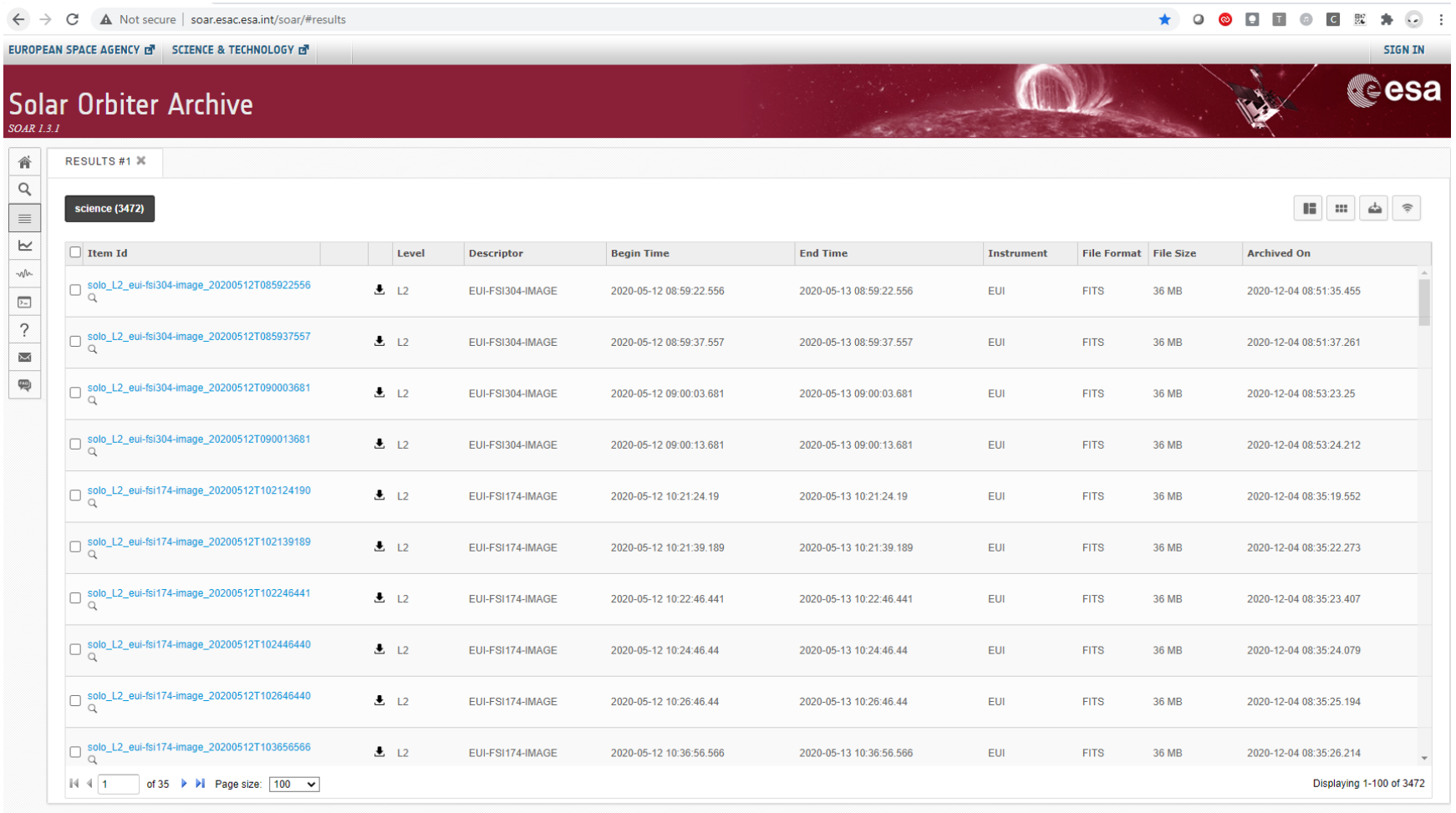
EUI data

http://soar.esac.esa.int/



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EUI data

http://sidc.be/EUI/data

EUI Data Release 1

Release date

- 2020-12-01: release 1.0 for L1 data from March, 3 2020 - October, 30 2020.
- 2020-12-04: release 1.0 for L2 data from May, 12 2020 - October, 30 2020.

Availability:

- May: 12, 13, 16, 20, 21, 28-30
- June: 16-21
- August: 4-8
- October 19, 21

Release Notes & Disclaimer

"EUI data release 1" contains the Solar Orbiter/EUI data recorded up till October 30. This period covers the Near Earth Commissioning Phase (NECP) and the first few months of Cruise Phase. This implies that most data is the result of technical tests, for which the instrument configuration was often non-nominal. Most data is therefore a-priori not suitable for scientific analysis but is instead primarily intended as a reference for the further development of analysis and visualisation software.

Data policy

The EUI data releases 1.0 is public and can be freely downloaded from the EUI website and from the Solar Orbiter Archive.

Because of the technical and uncalibrated nature of the current release, it is strongly recommended to get in contact with an EUI Consortium member who will provide technical assistance during data handling. In return, co-authorship on eventual publications is expected. If you are not sure who to contact, ask a suggestion to the EUI Principal Investigator Team.

Citation & acknowledgements

Scientific papers using EUI data are asked to cite the EUI instrument paper "Rochus et al, AA, 2020". The usage of EUI images as online web graphics or in printed materials should mention "Image Courtesy: ESA/Solar Orbiter/EUI". The full EUI team (CSL, IAS, MPS, MSSL/UCL, PMOD/WRC, ROB, LCF/IO) can optionally be mentioned in acknowledgements.

Papers using EUI data are friendly requested to send a notice to eui@sidc.be as to facilitate cross-referencing and accumulate statistics for future mission and team reviews.

Known issues

- Spacecraft pointing instabilities (thermoelastic, others) might affect the pointing metadata. It is recommended to use the pointing metadata only as a rough approximation. For FSI L2 images, the pointing metadata was updated using a solar limb-fitting procedure, and should typically be more accurate than 0.5 pixel, unless the solar limb is saturated in the image.
- CMOS sensor settings vary a lot throughout NECP. Various CMOS issues (image lag, unstable offset) are still being addressed at the time of writing. EUI images are not suitable for photometry yet.
- FITS files containing "wicom2" in the filename contain broken images. The meta-data inside these files is correct, but the image data itself could not be decompressed properly and should be considered lost.
- the calibration of the detector temperature sensor is to be improved. The temperature keywords (TEMPINT, TEMP1DET, TEMP2DET) can deviate.
- FSI images with the occulter in place have IMGTYPE="unknown image". This will change in future releases to IMGTYPE="occulted image".
- For HRILYA, LYCMCP and LYCSCR FITS keyword values are inaccurate for low values.

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EUI data

http://sidc.be/EUI/data

Index of /EUI/data/L2/2020/10/21

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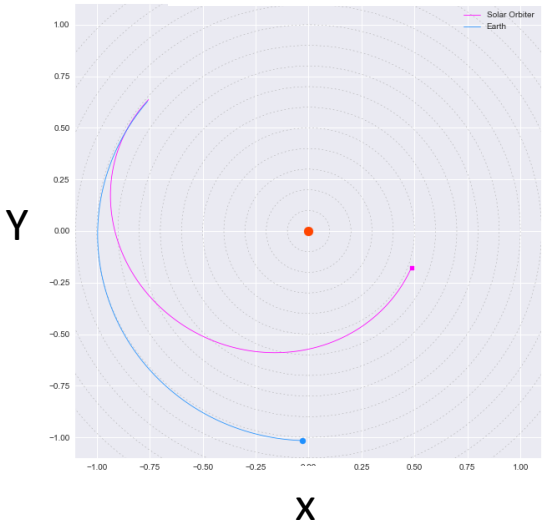
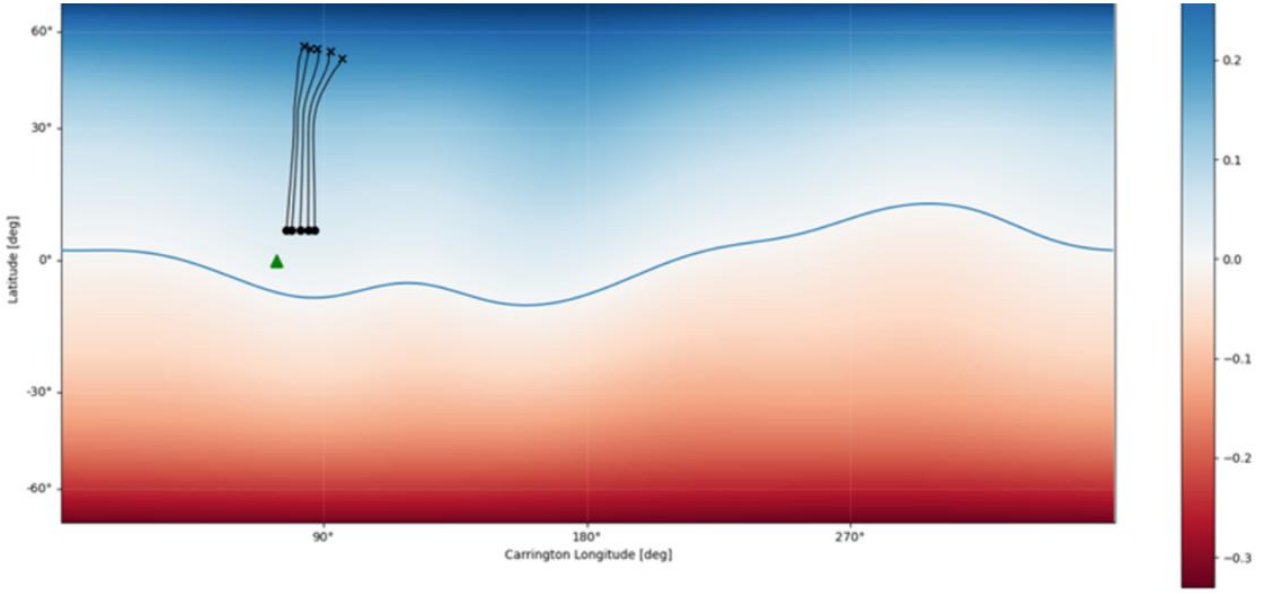
EUI-MAG June 2020

16 June 2020





The black dots are the ballistically mapped Orbiter footpoints; the crosses are the PFSS-mapped surface points (which is where we should be looking in the images).

Here are the Carrington lats and longs of those footpoints.

	Carrington Long	Carrington Lat
0	96.38759	49.88311
1	92.32847	52.35952
2	87.95915	53.38909
3	85.56766	53.53671
4	83.37838	54.30436

From Ronan Laker and Tim Horbury:

- Start from a timeseries of MAG data and the location of SOLO
- Ballistically map back to the Sun (2.5 Rs), using Vsw = 500 km/s
- Time and location of plasma release on the Sun (2.5 Rs)
- Use PFSS to go from the source surface to the solar surface

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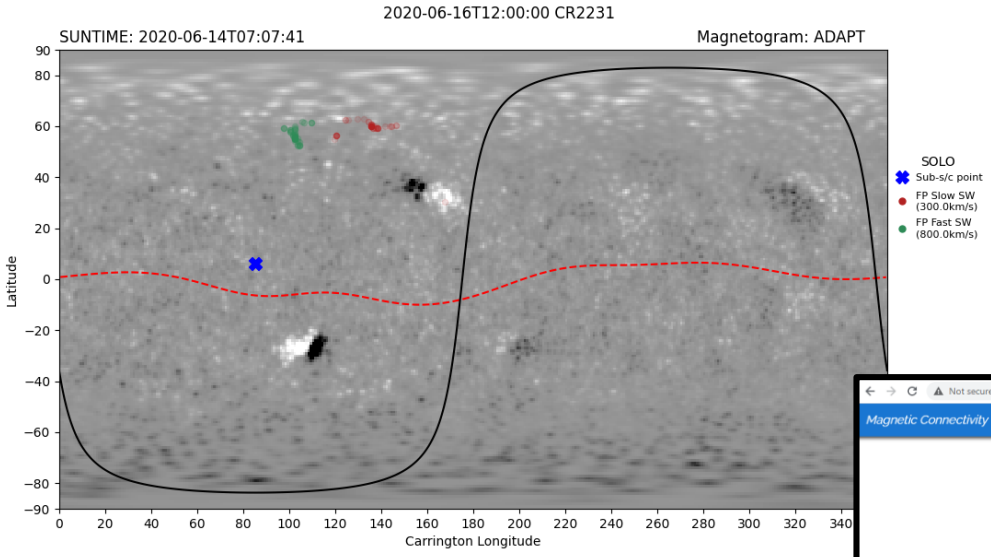
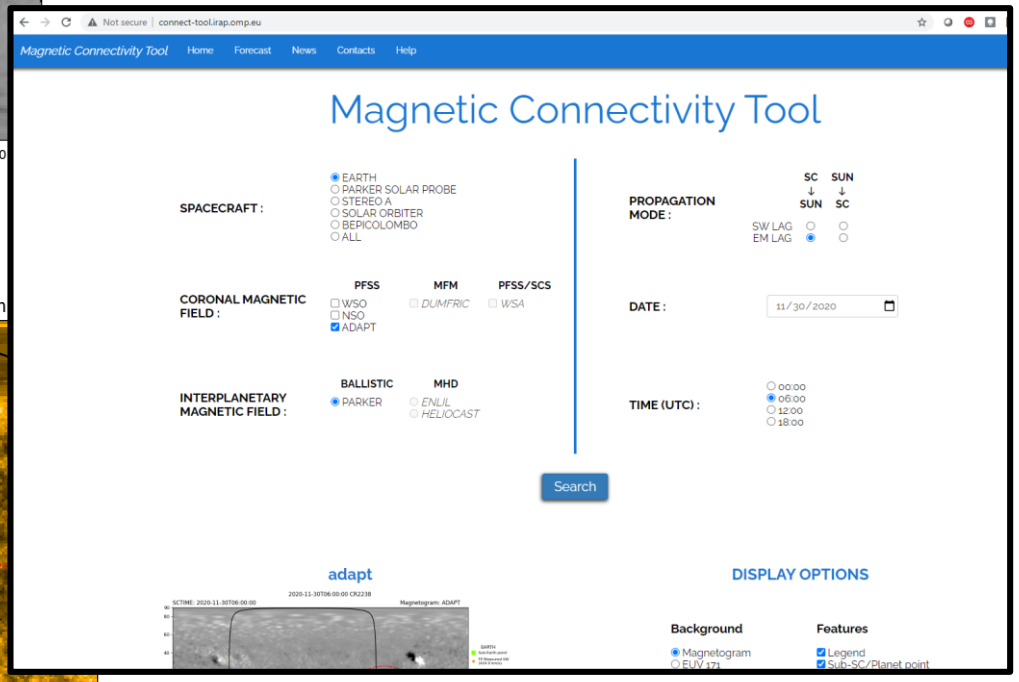
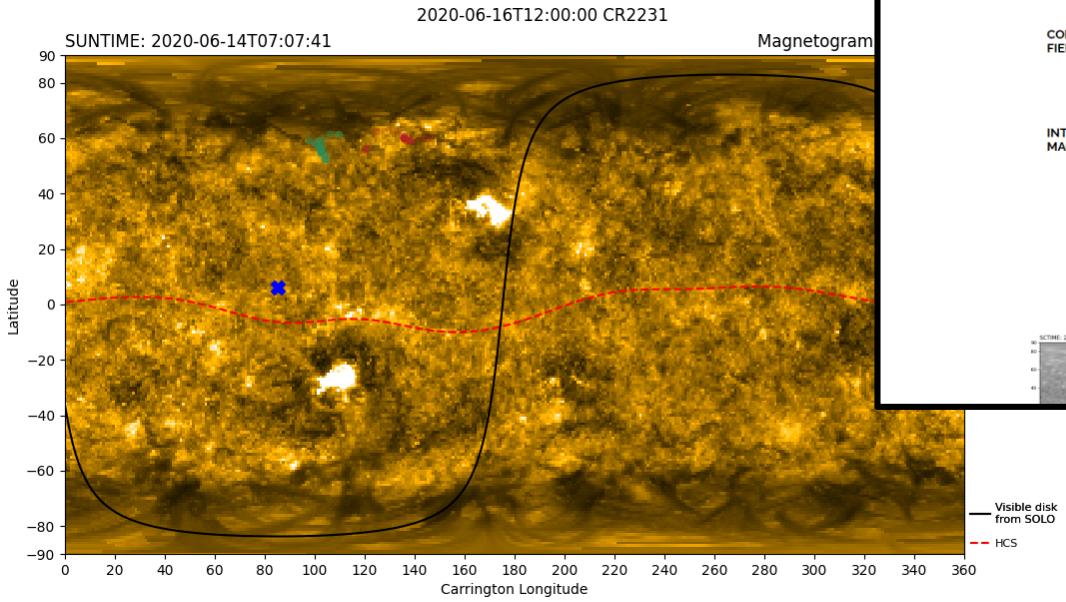
EUI-MAG June 2020



http://connect-tool.irap.omp.eu/





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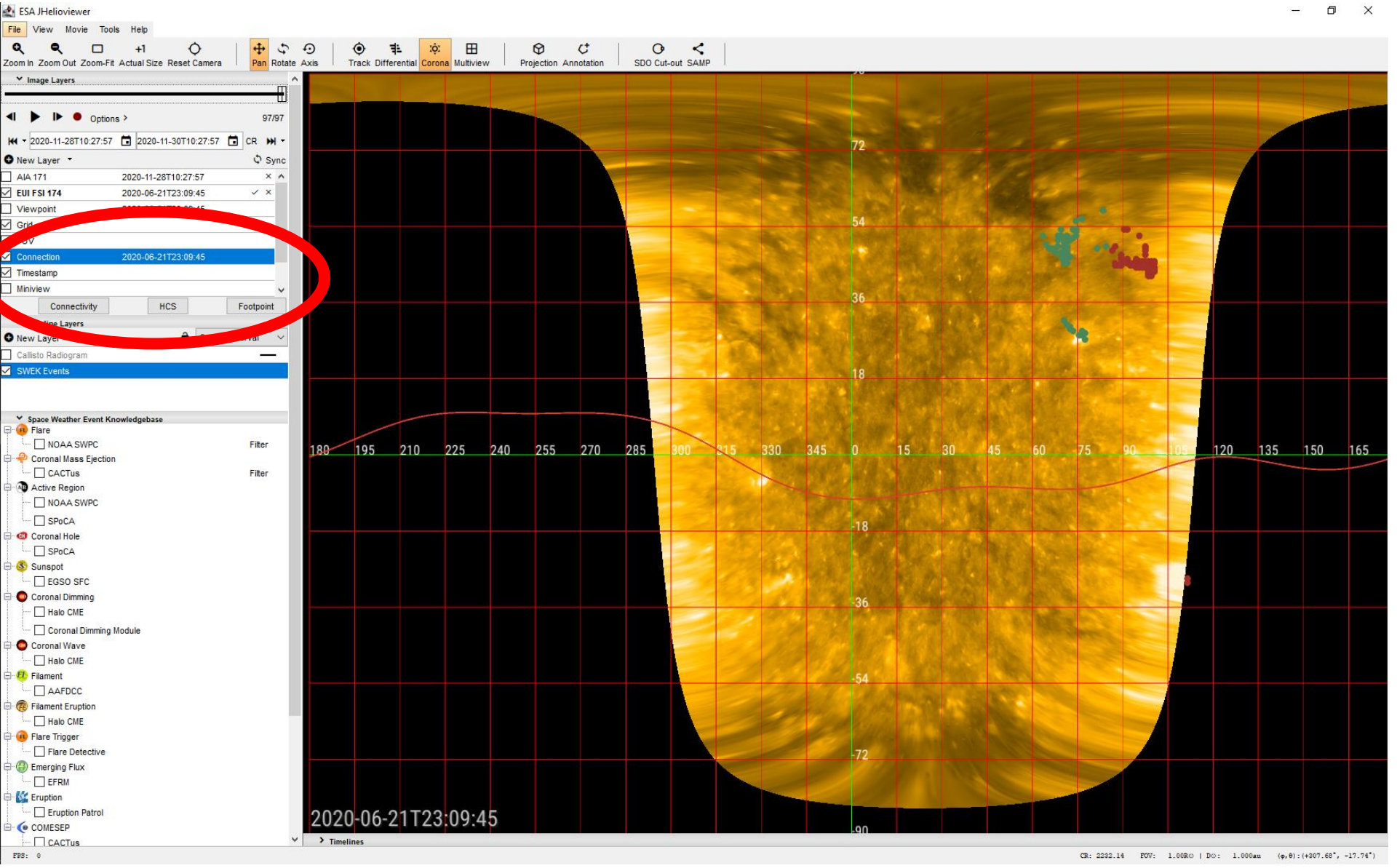

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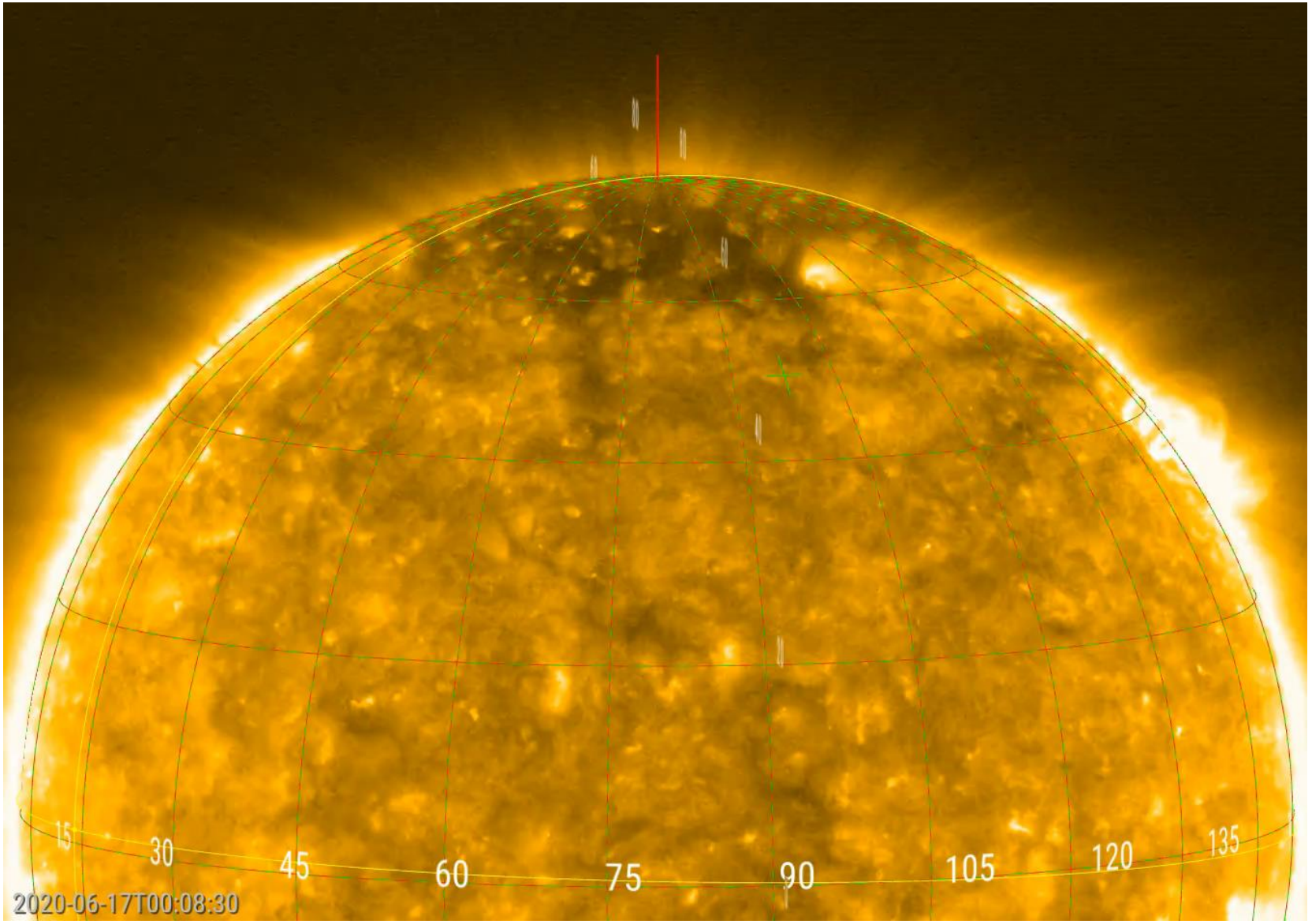

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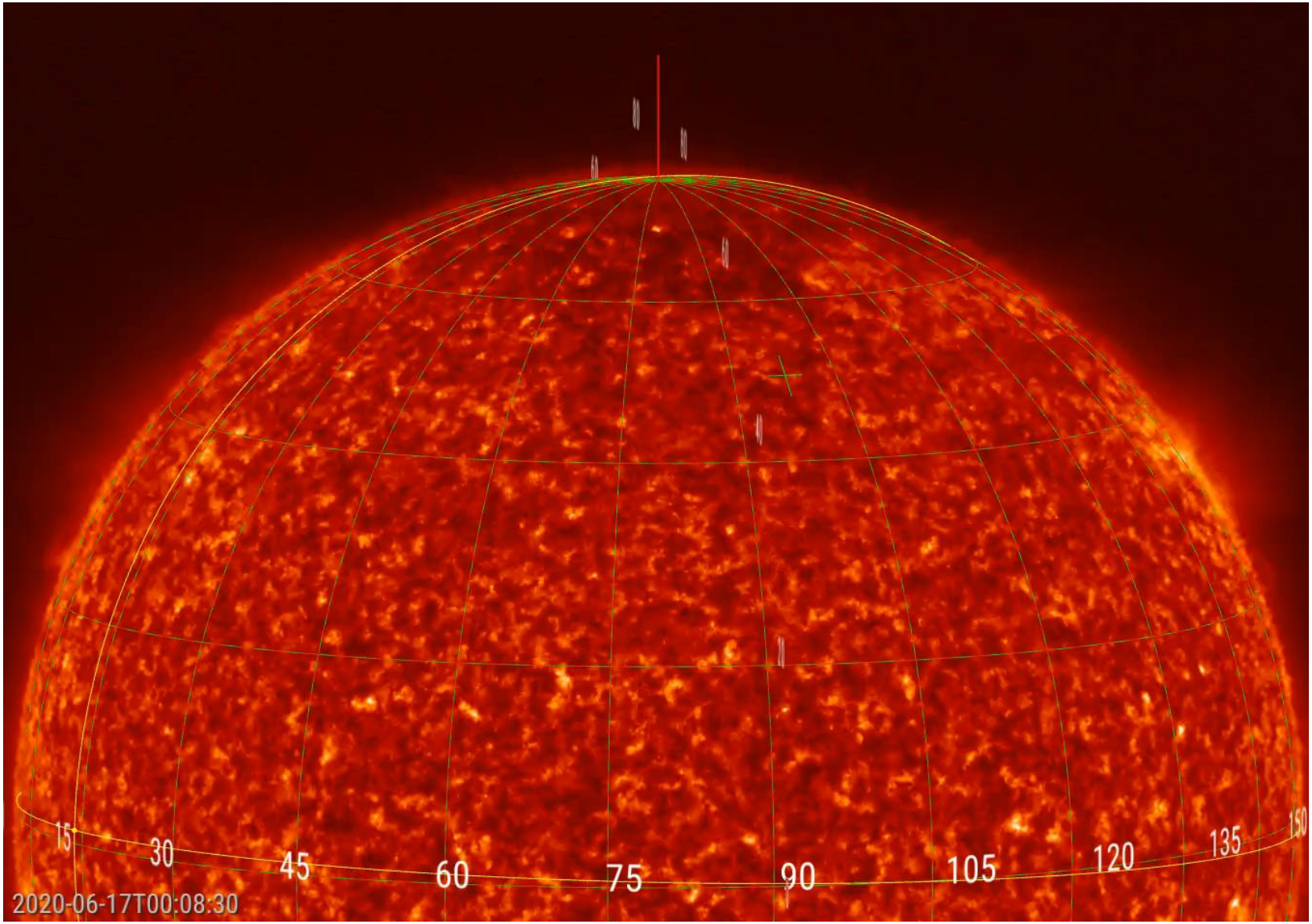

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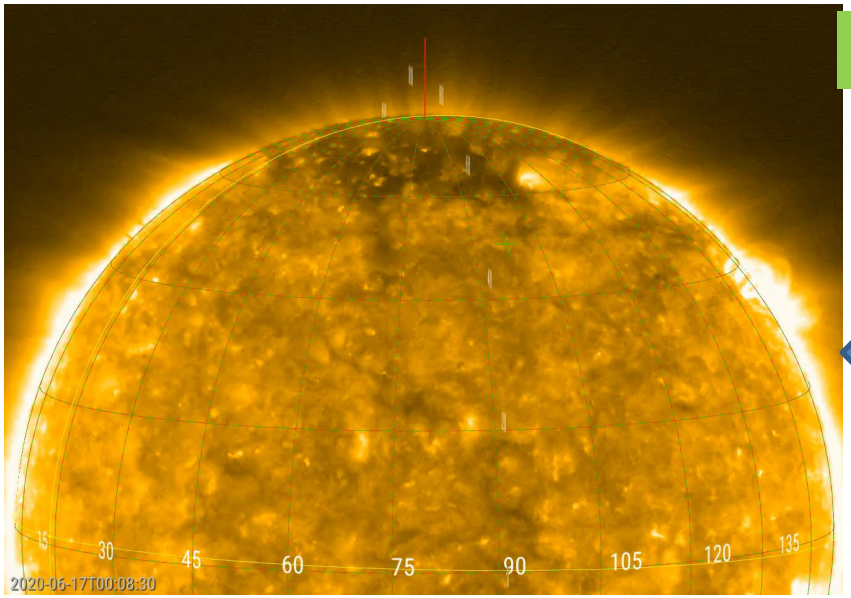
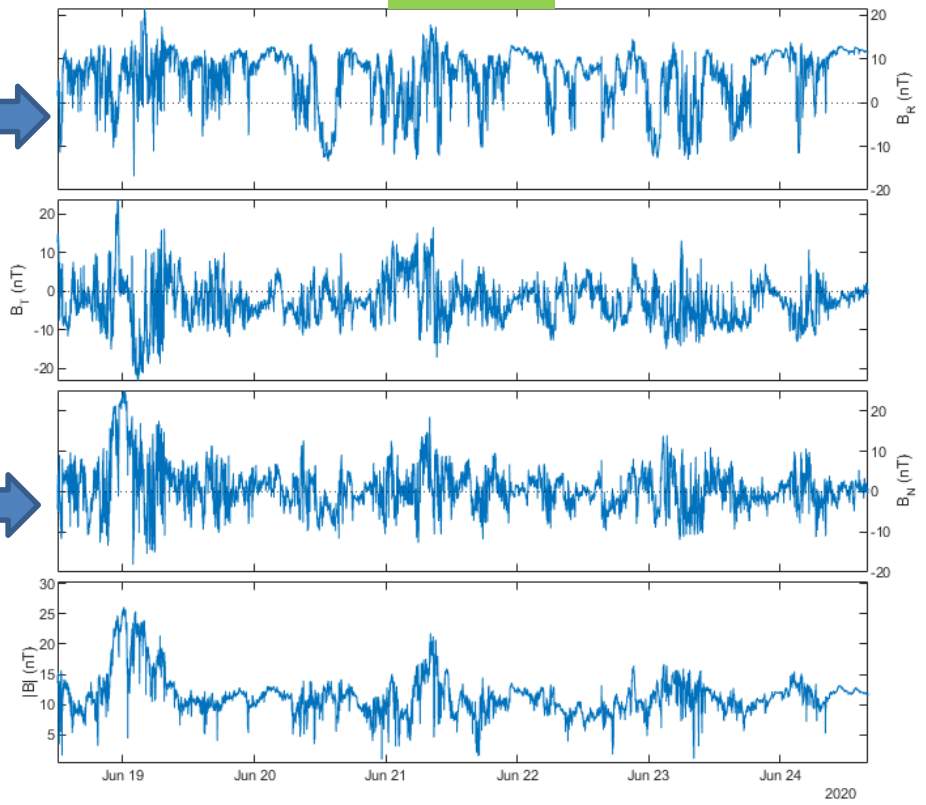
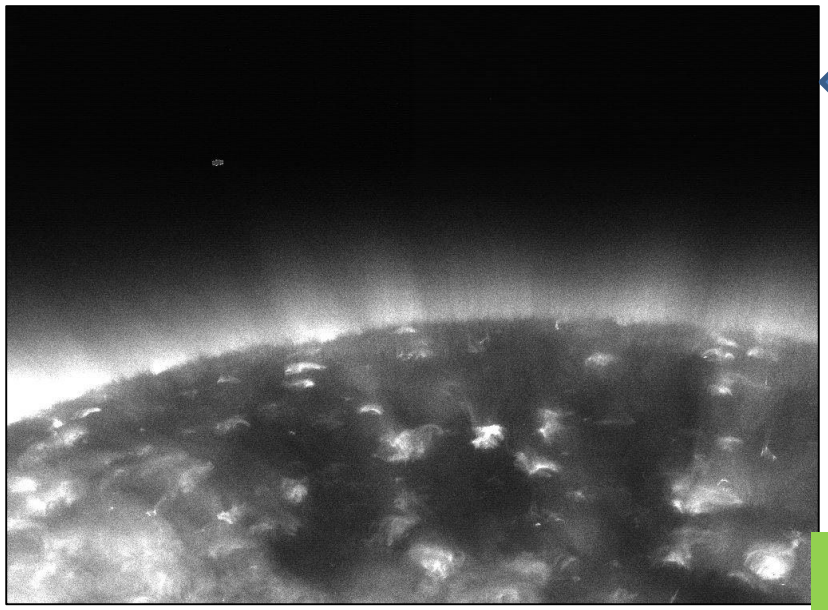


EUI FSI

MAG

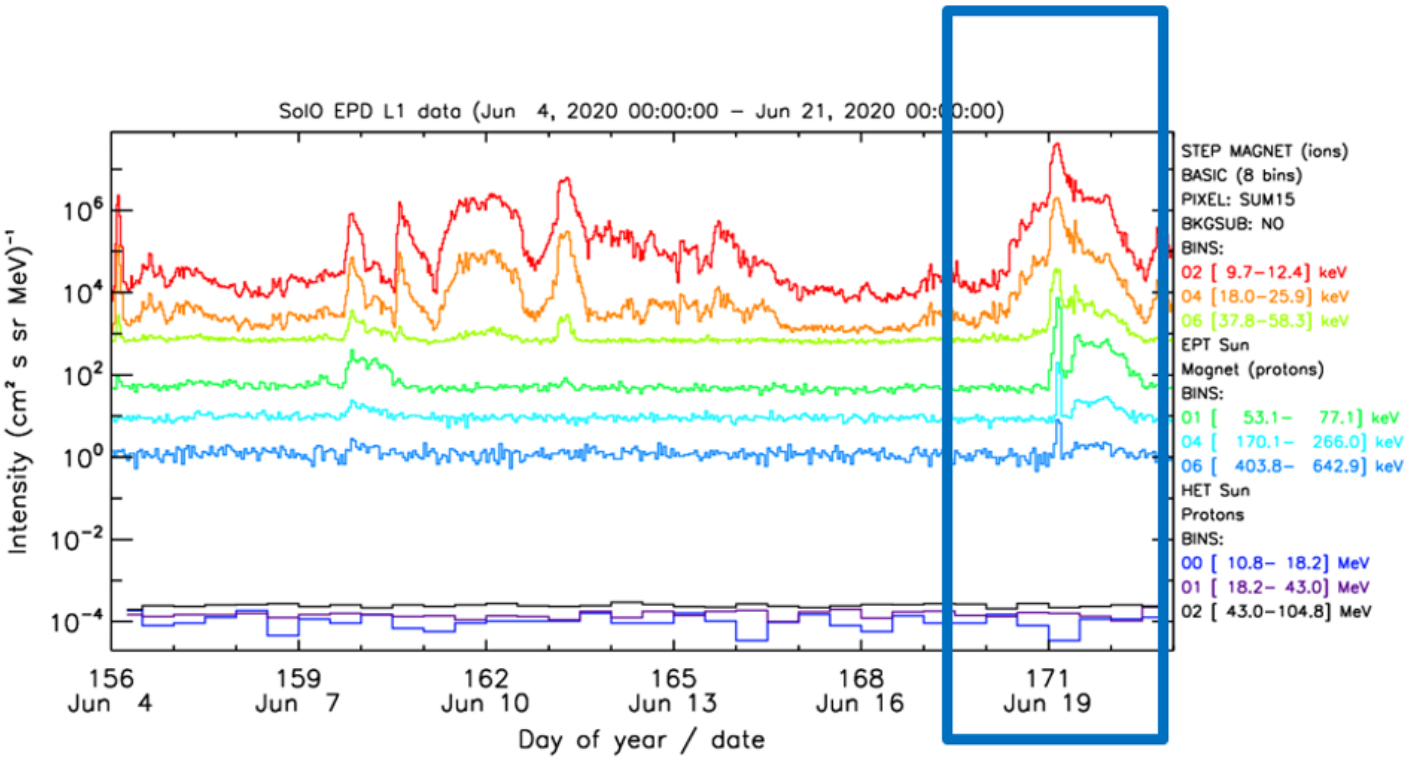




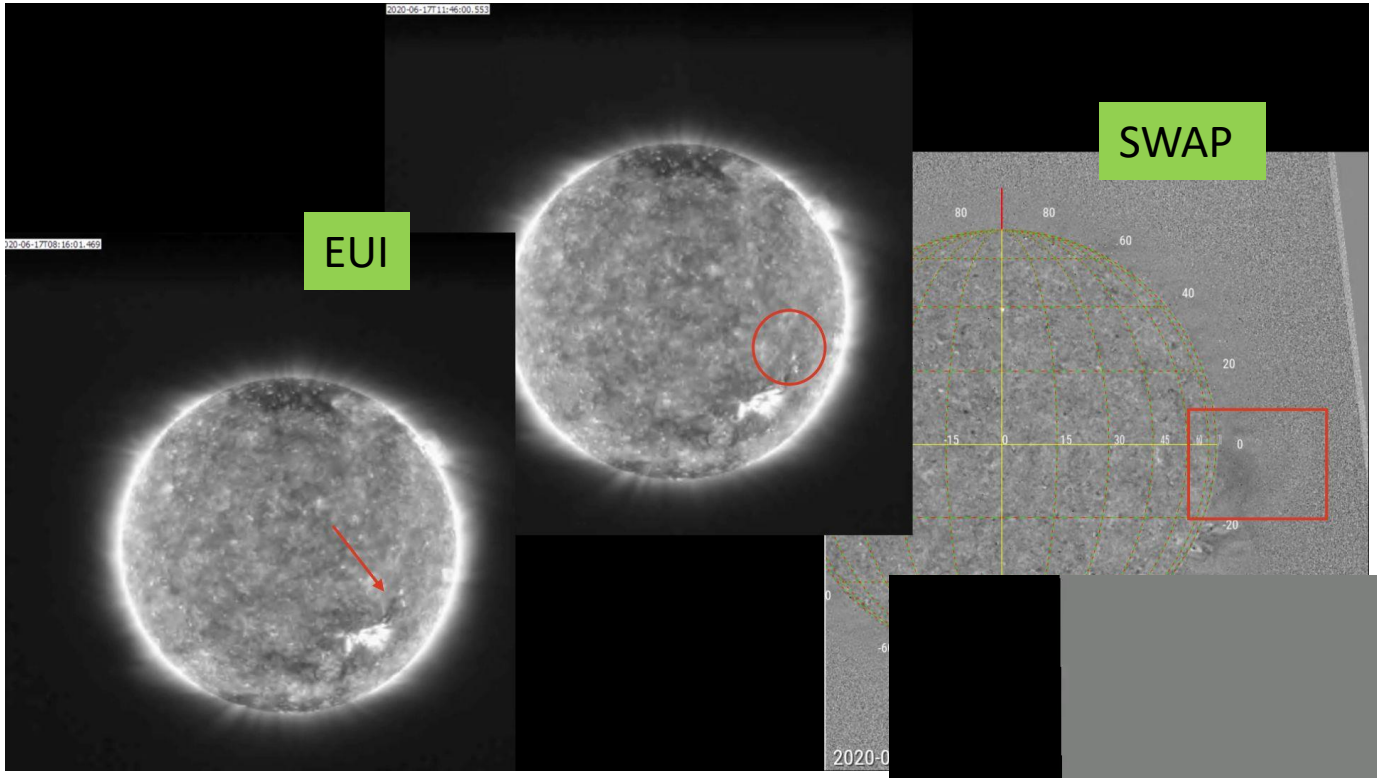
EUI HRI

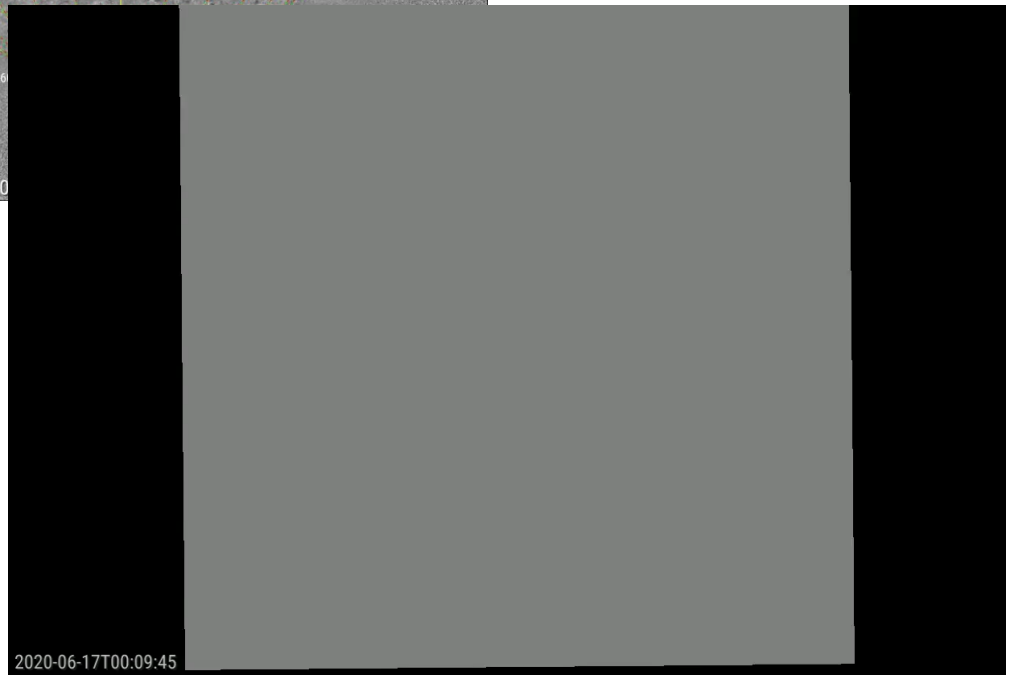
EUI - EPD June 2020

Summary of STEP, EPT and HET proton observations



EUI - EPD June 2020





- June 17: Faint eruption
- No good CME candidate on coronagraphs

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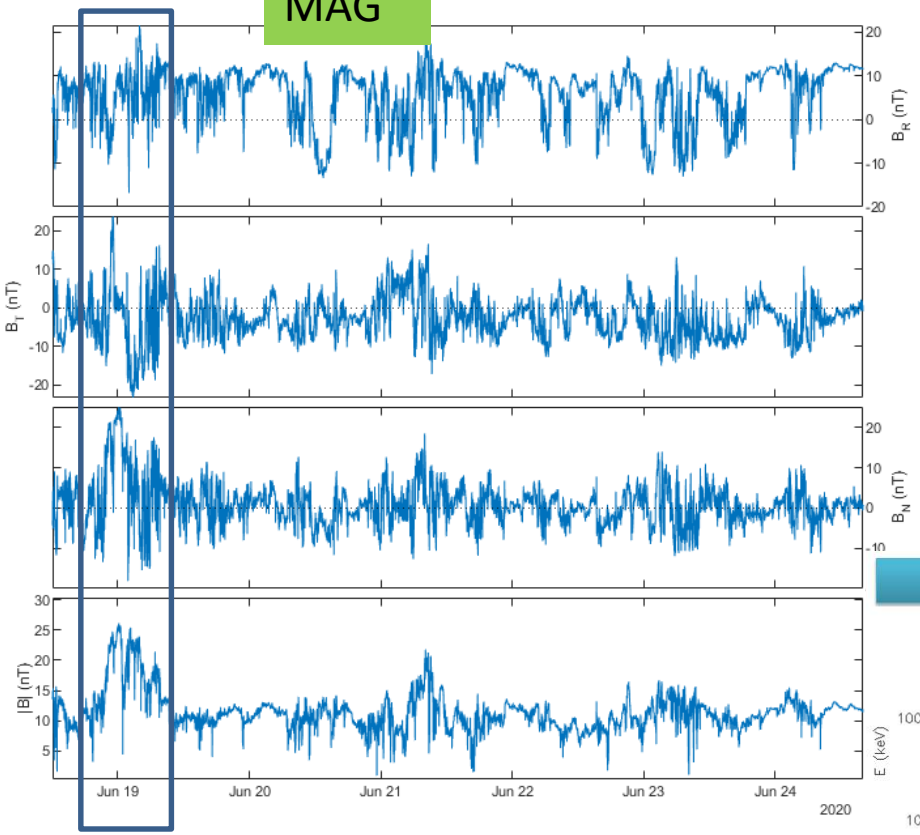
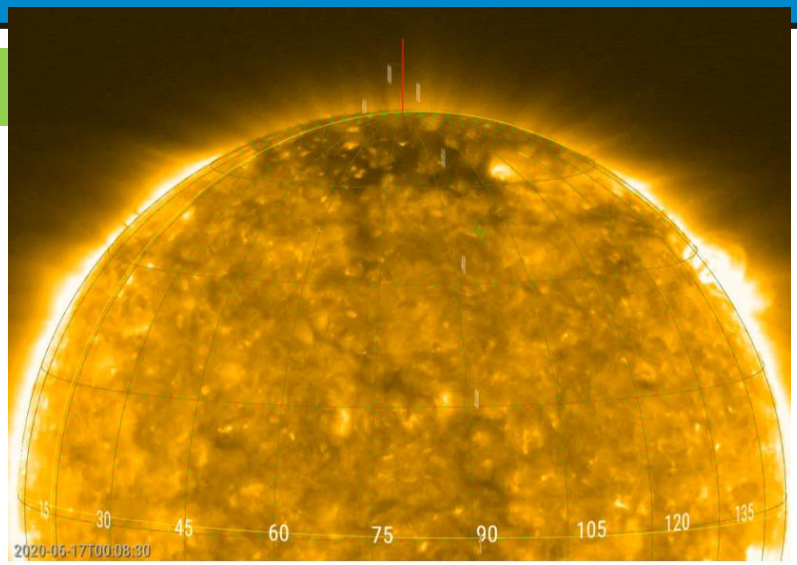
EUI - EPD June 2020

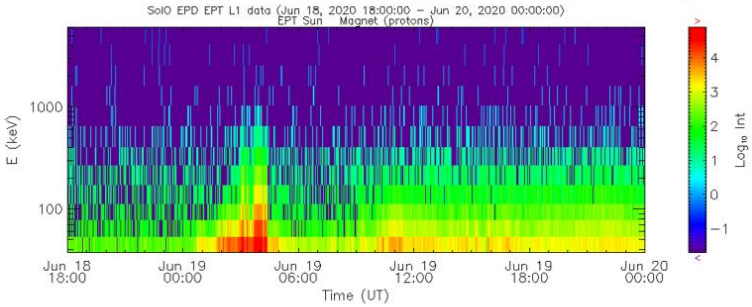
MAG



EUI



STEP+EPT-Sun proton dynamic spectrum

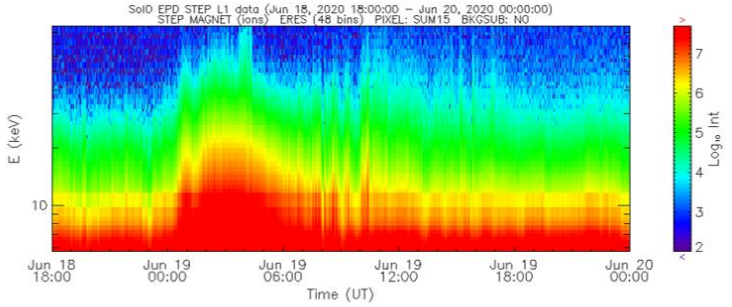


Increase up to ~1 MeV

No obvious velocity dispersion

Crossing of flux tube already filled with SEPs?

Alternatively: IP origin not far from s/c?

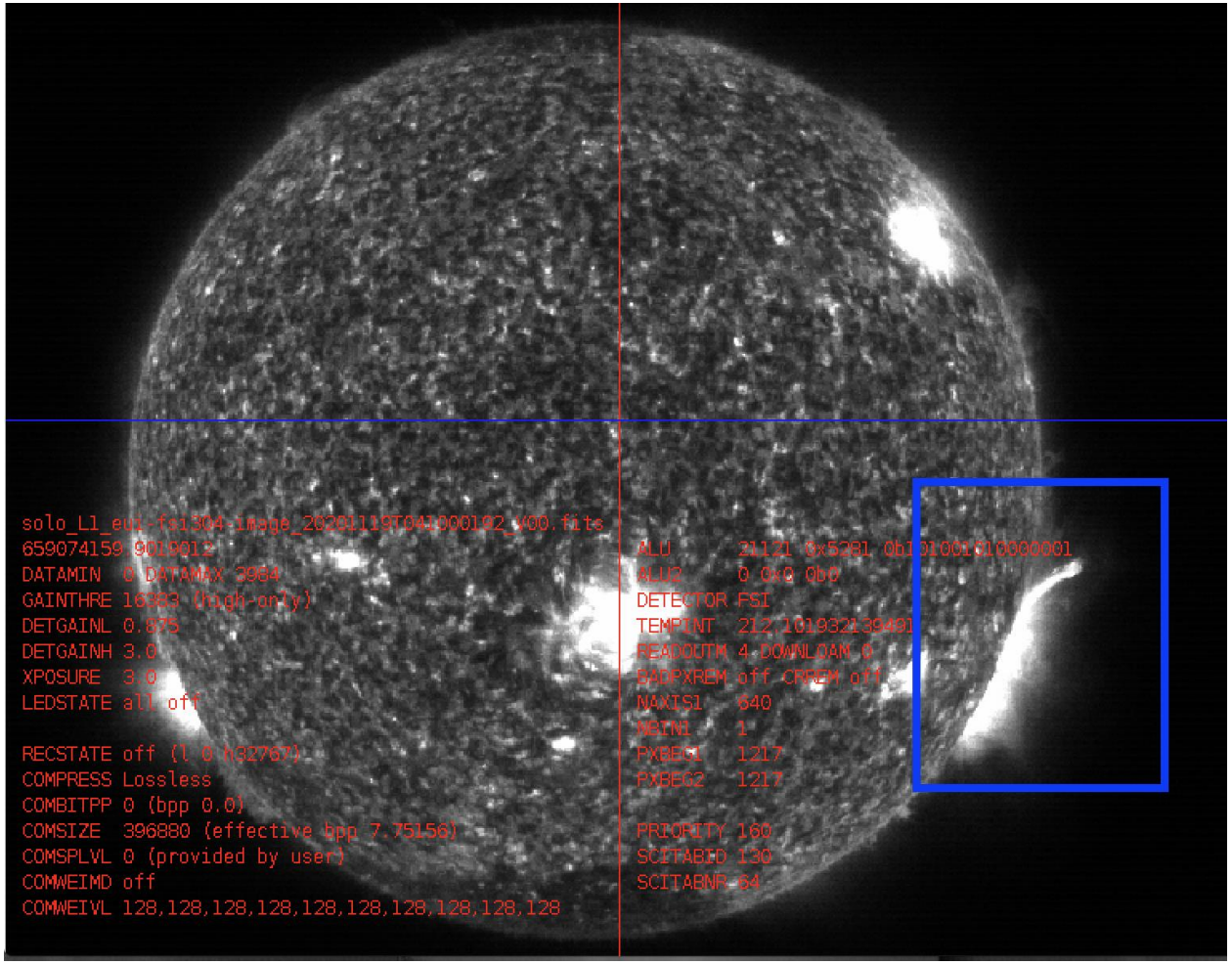


- Faint eruption/no good CME
- Probably SIR/CIR related

EPD

EUI - ?

- November 19, limb flare



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To do

- EPD
  - Small electron event around 17:00 on August 5, accompanied by a emission on 8/4, but it is probably artificial.
  - There is a good SEP event on October 22.
  - Small solar electron event on October 21 (around 20h).
- RPW
  - Faint type III burst on 10/21 around 20 UT.
  - IP shock passage on 5/12 around 08 UT.
  - Intense narrowband o bursts observed e.g. on 5/28 by Parker, STEREO-A, and Wind with direction-finding capabilities, when the RPW was turned off.
- MAG
  - Check footpoints in new data

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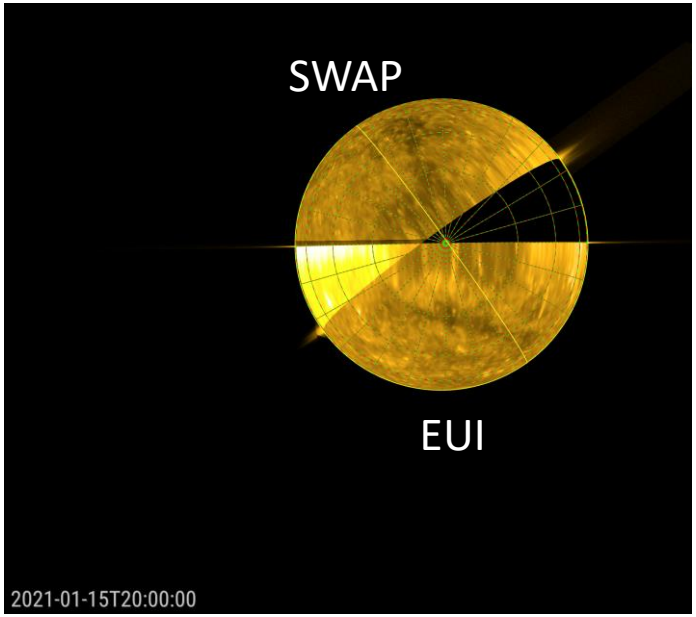
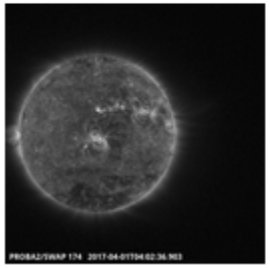
Interesting coming periods



- Now

Special observation campaign with SWAP

Fri, 01/08/2021 - 16:52 — Elke D'Huys



The PROBA2 team is planning a special observation campaign in collaboration with the Solar Orbiter and Parker Solar Probe teams next week. During this campaign the PROBA2 spacecraft will be off-pointed most of the time with its EUV imager SWAP taking solar images in which the solar disk will be shifted to the edge, as for example in the image on the left that was taken during another special campaign in 2017.

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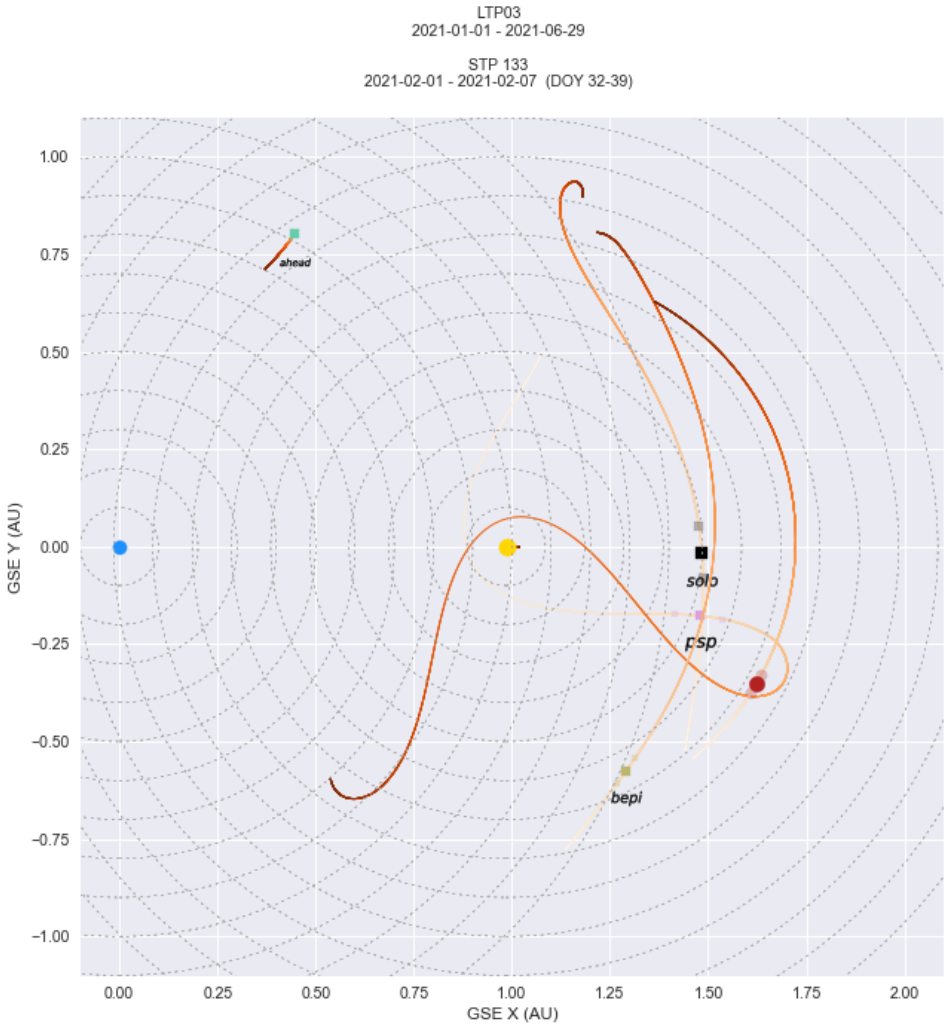
Interesting coming periods

- Perihelion 10 Feb 2021 @ 0.49 AU



Interesting coming periods

- RSCW2 Feb 20-25