Proposal submitted in 2008
Launch in 71 days

EUI on Solar Orbiter

D. Berghmans
(humbly presenting the work of 149 people)

November 27, 14:30, ROB Pavilion room.

2019 Oct 19 @ IAGB (Munchen)


AIRBUS
AIRBUS
DANGER
ACOUSTIC TEST
FRONT
WARNING !
THIS ITEM IS NOT ATEX !

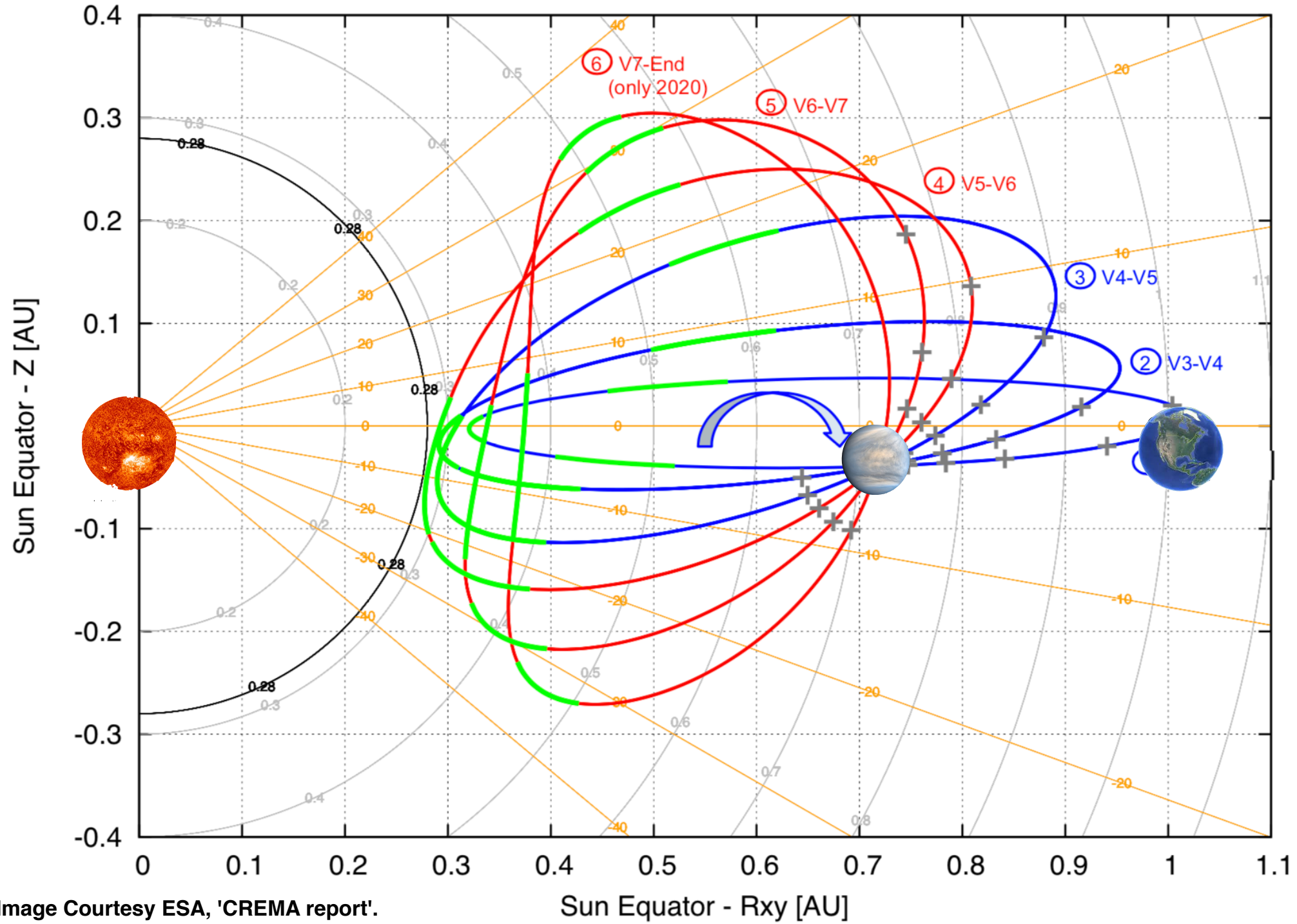
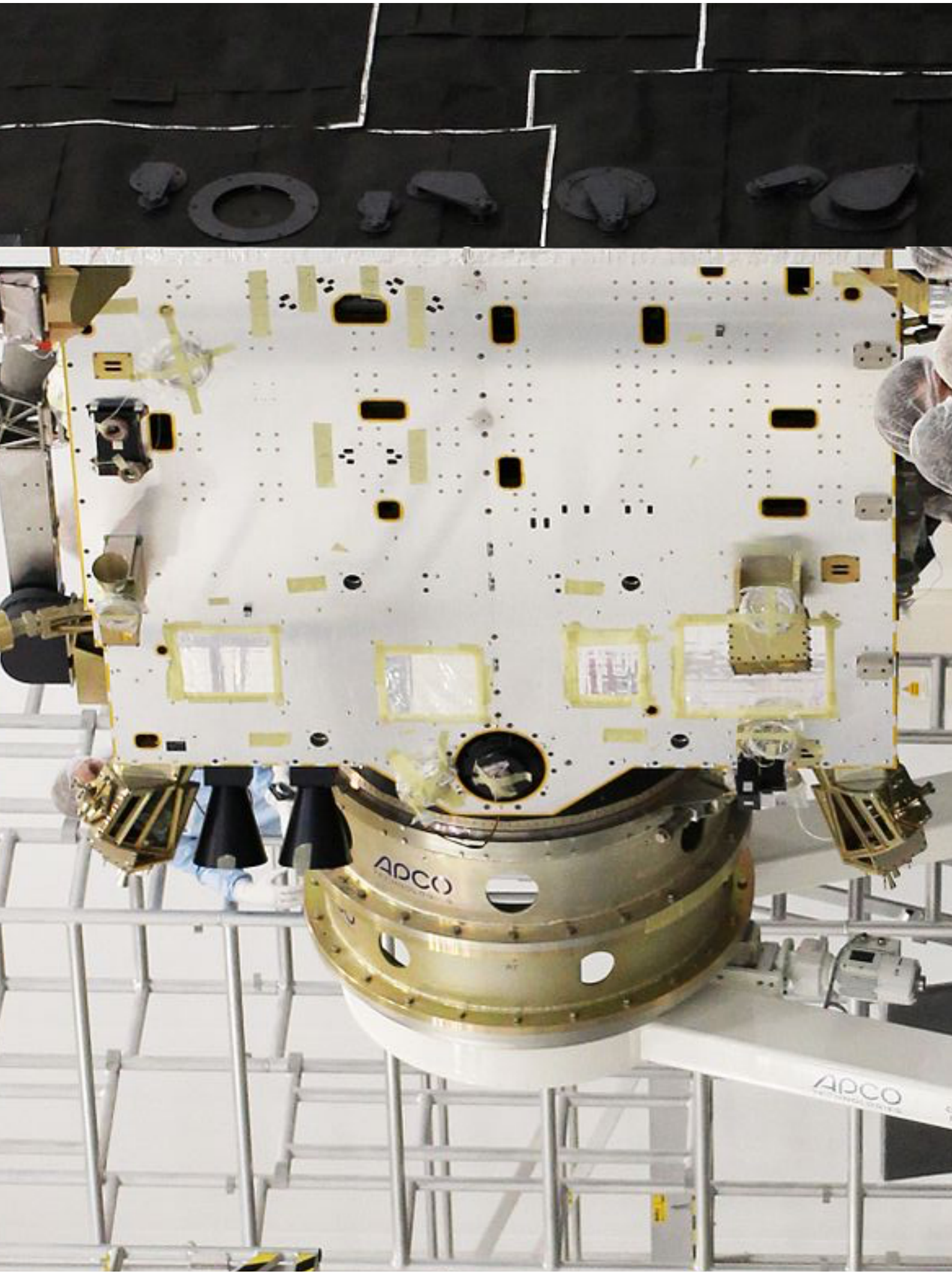
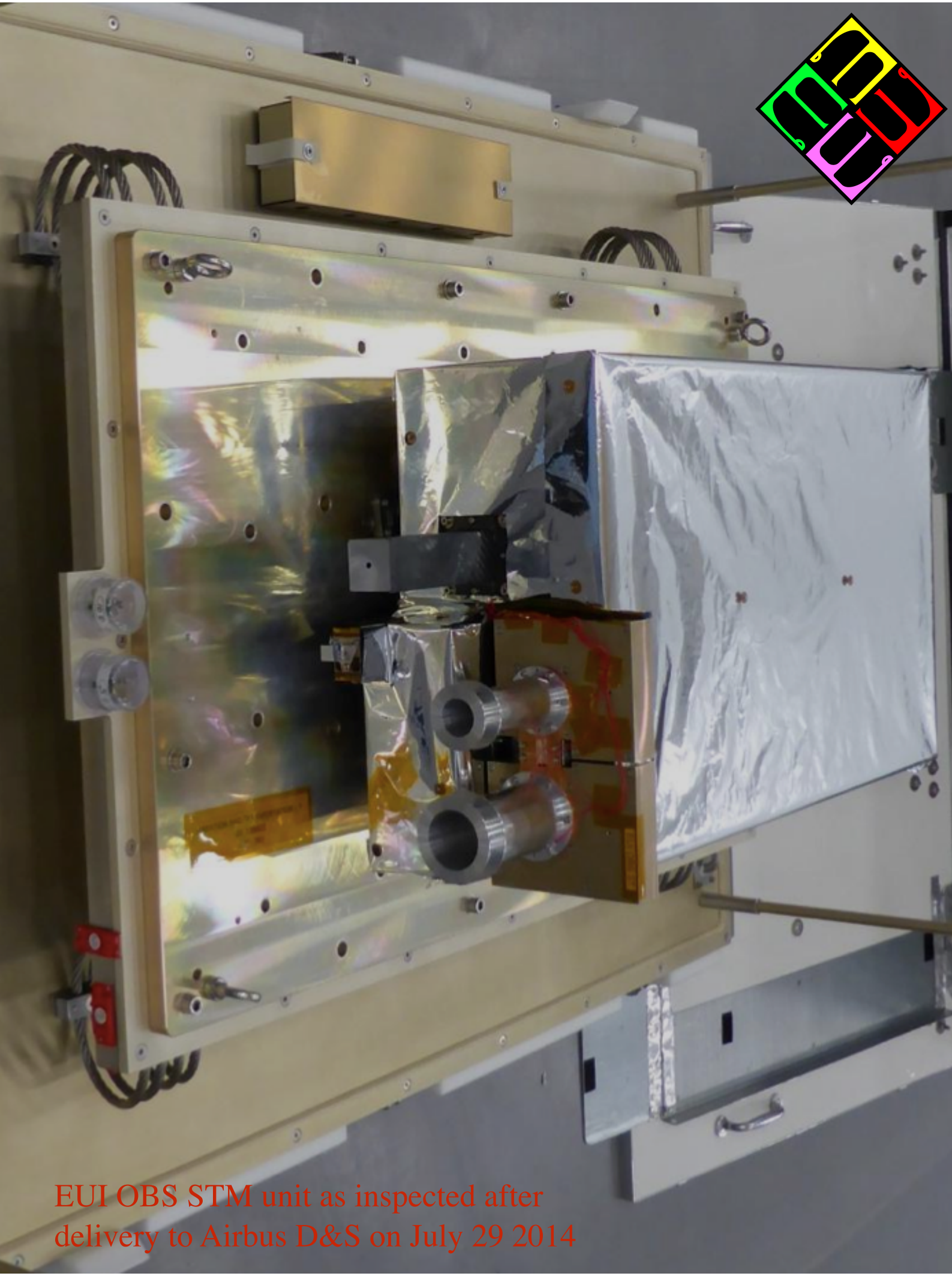


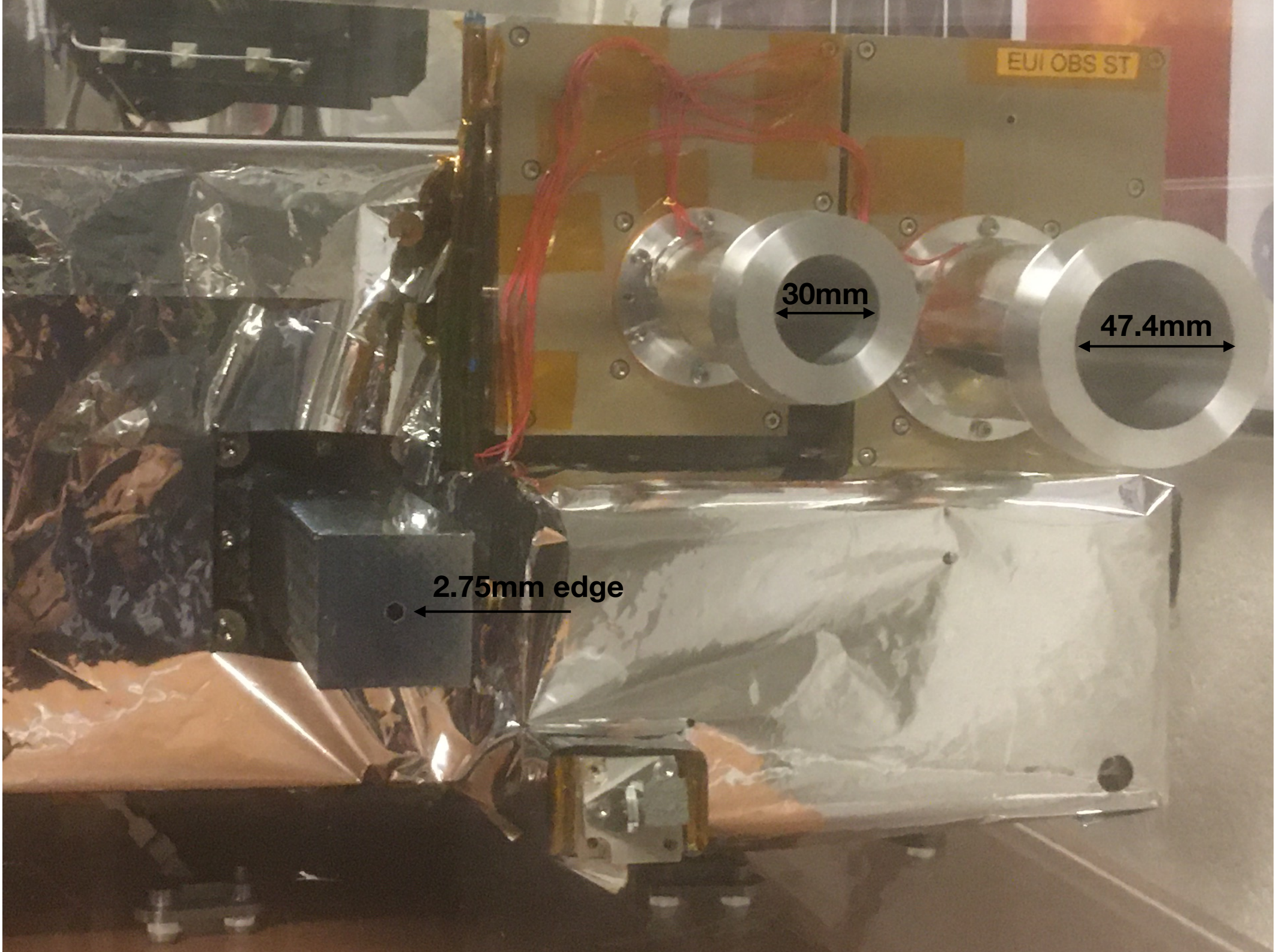
Image Courtesy ESA, 'CREMA report'.

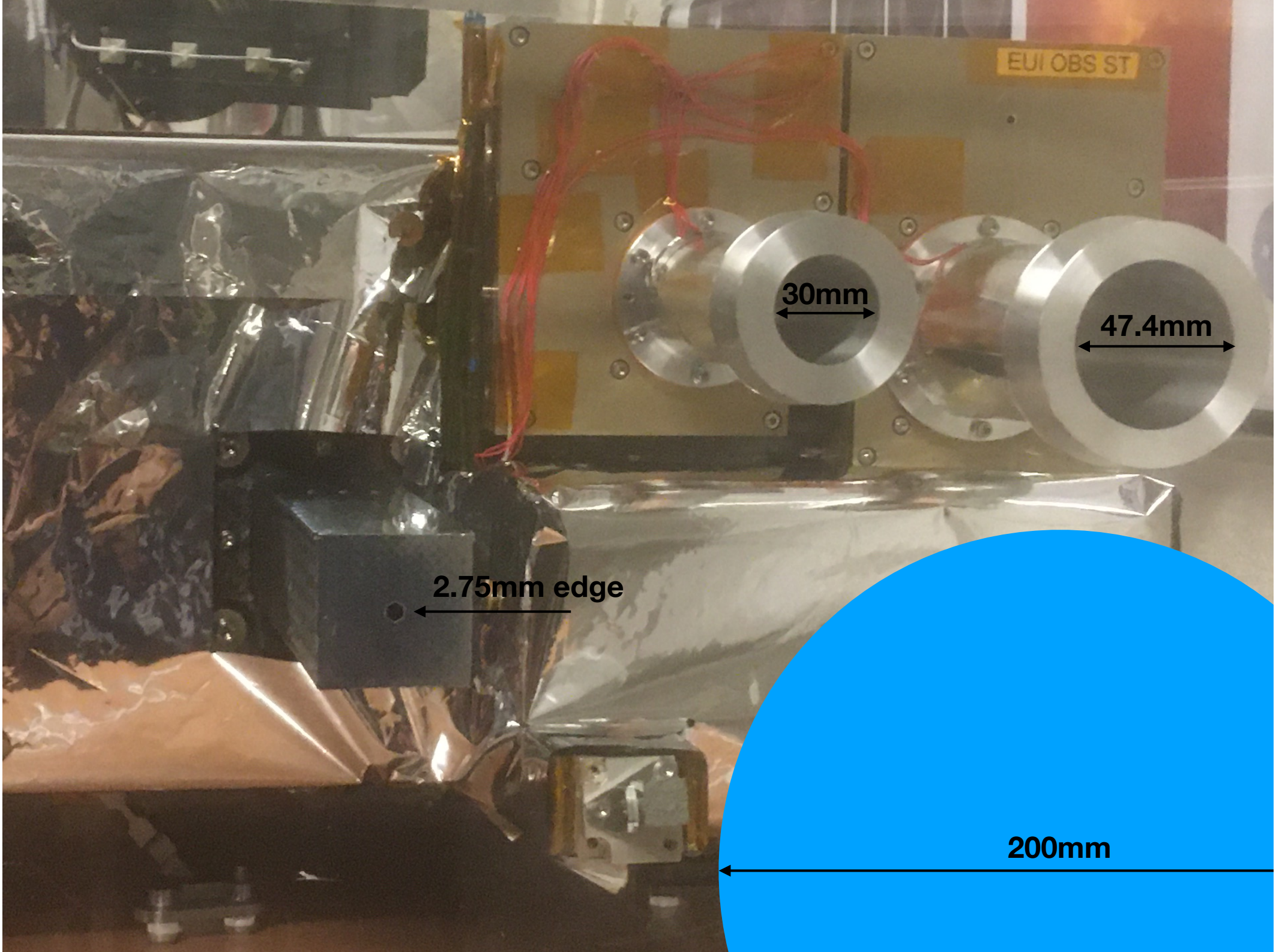
Airbus UK

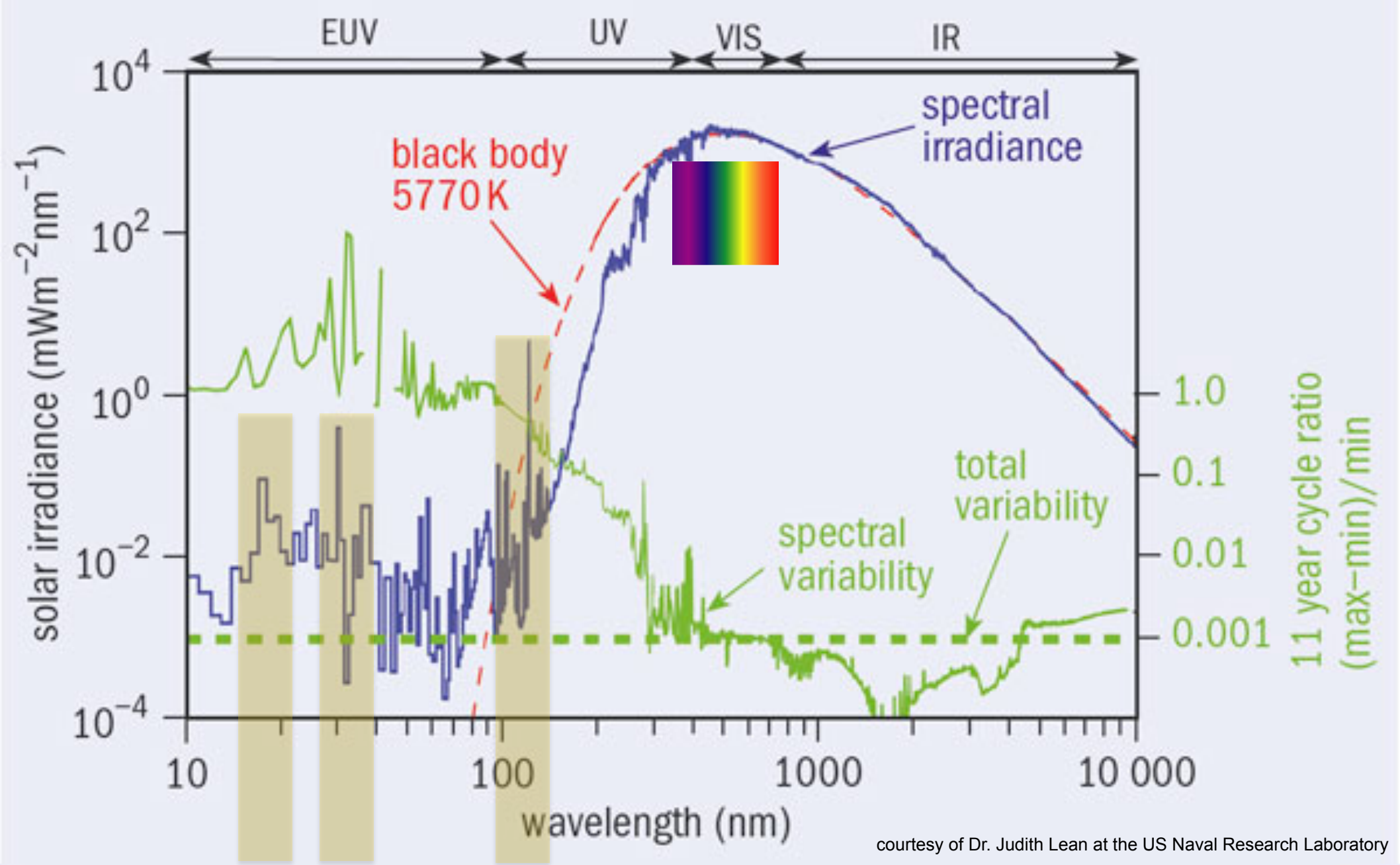

APCO
APCO



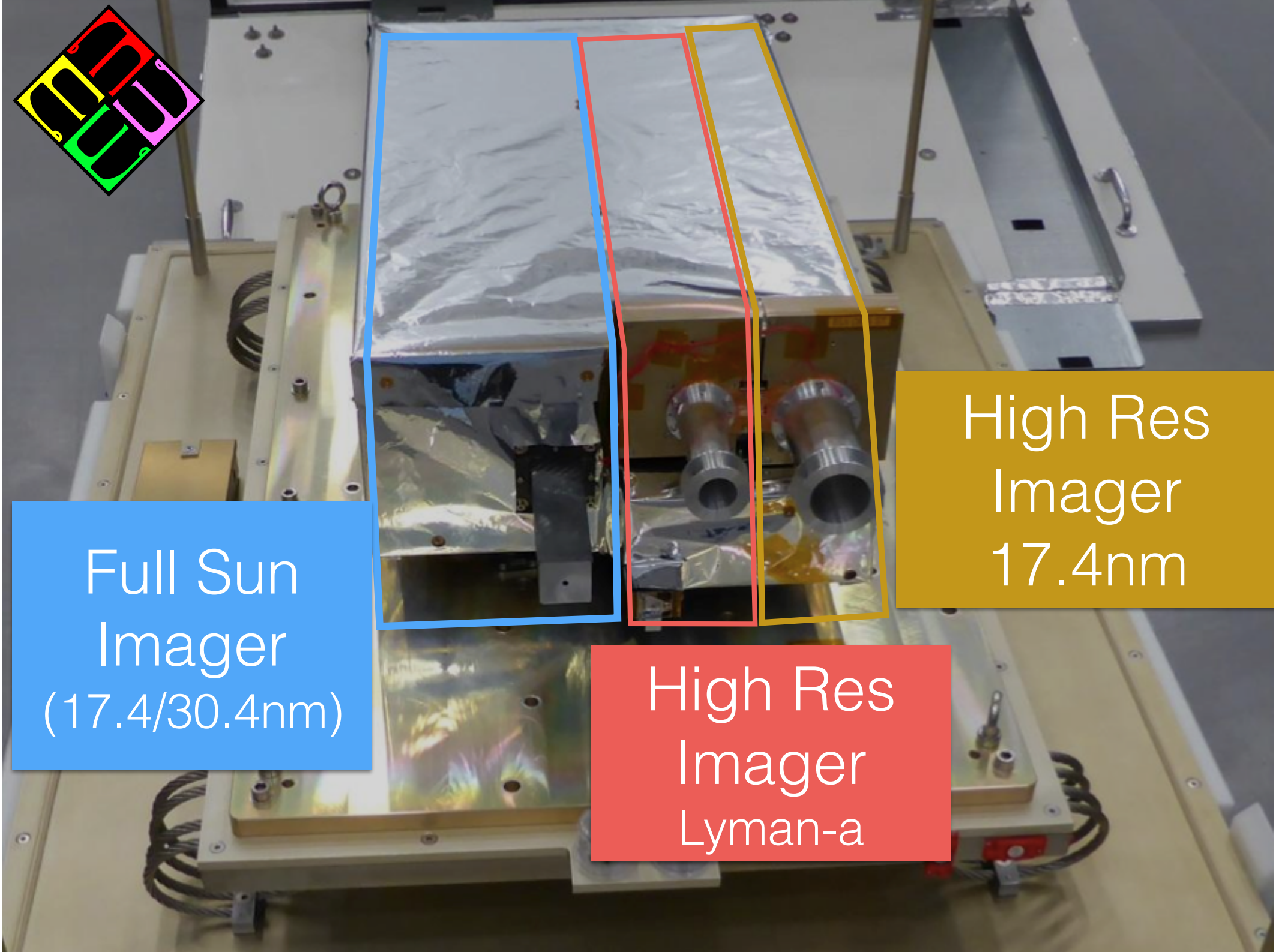
EUI OBS STM unit as inspected after delivery to Airbus D&S on July 29 2014


EUI OBS ST
30mm
47.4mm
2.75mm edge


EUI OBS ST
30mm
47.4mm
2.75mm edge
200mm



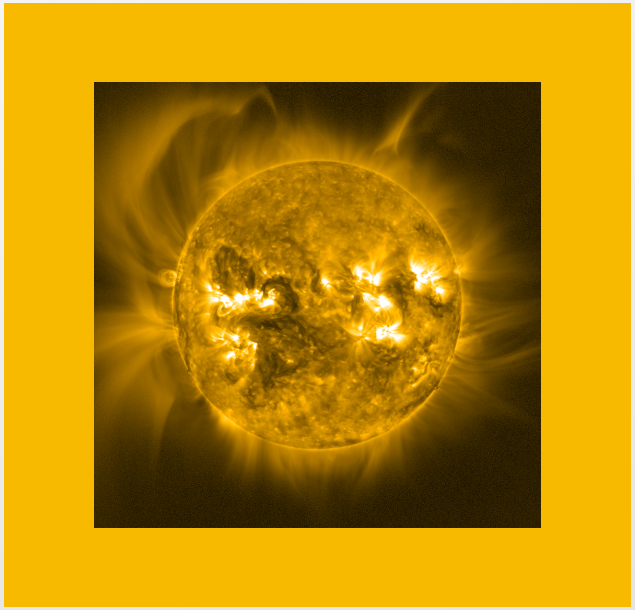
courtesy of Dr. Judith Lean at the US Naval Research Laboratory

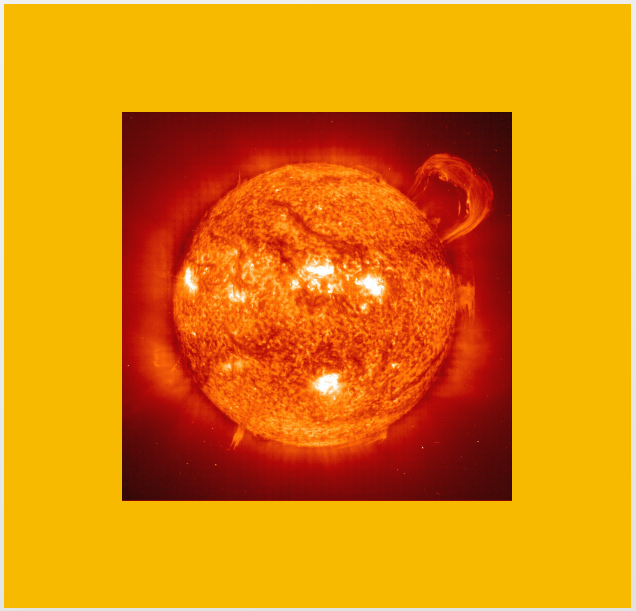

Full Sun
Imager
(17.4/30.4nm)
High Res
Imager
Lyman-a
High Res
Imager
17.4nm

FSI: Full Sun Imager

FOV: 3.8°x3.8°, @ 0.28 AU: 4 Rsun x 4 Rsun

17nm





30.4nm

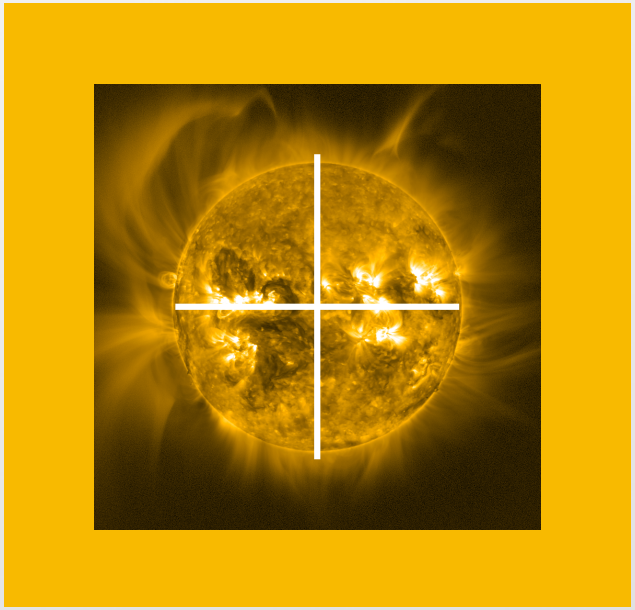
resolution: 9 arcsec on 2 pixels

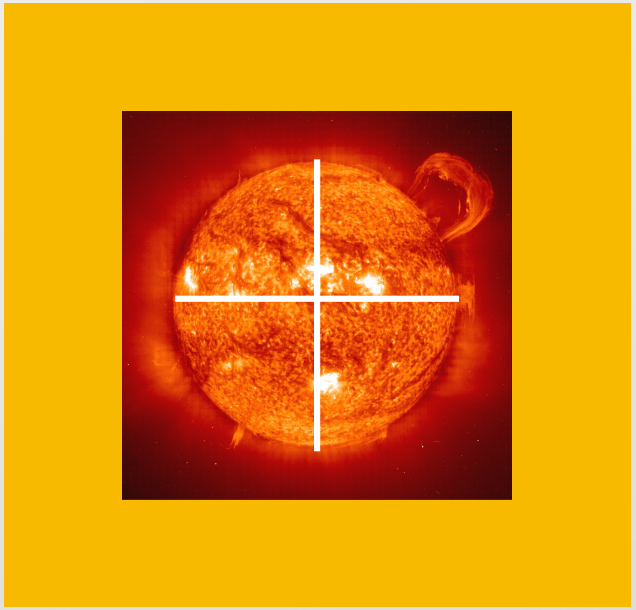
@ 0.28 AU =1830 km on 2 pixels

FSI: Full Sun Imager

FOV: 3.8°x3.8°, @ 0.28 AU: 4 Rsun x 4 Rsun

17nm





30.4nm

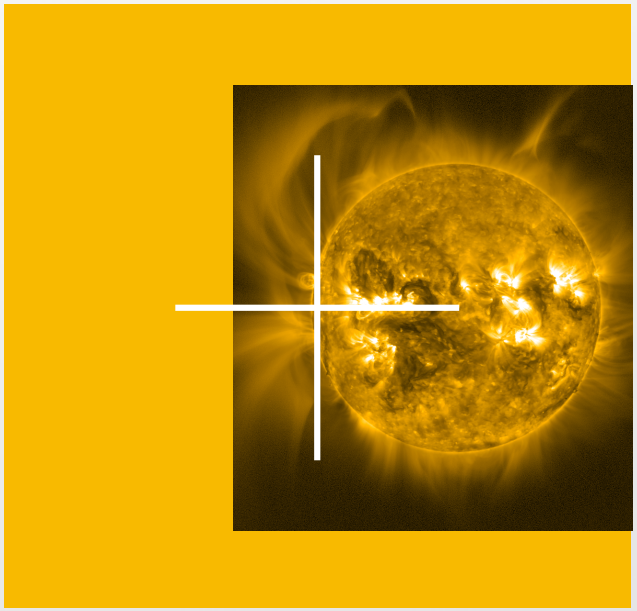
resolution: 9 arcsec on 2 pixels

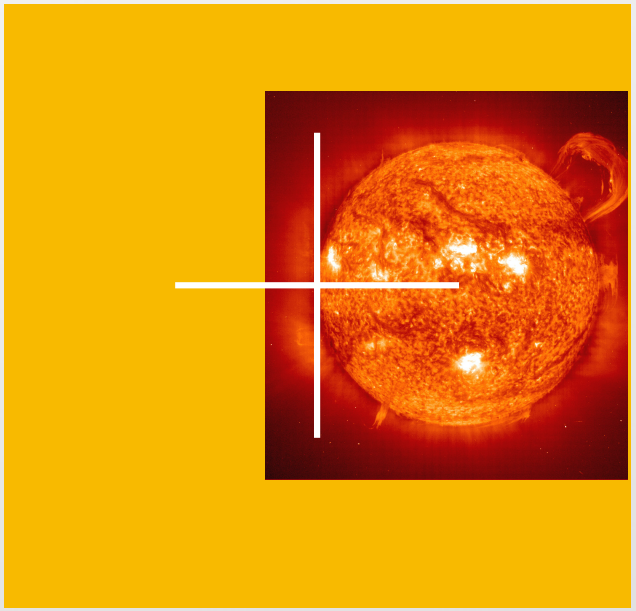
@ 0.28 AU =1830 km on 2 pixels

FSI: Full Sun Imager

FOV: 3.8°x3.8°, @ 0.28 AU: 4 Rsun x 4 Rsun

17nm





30.4nm

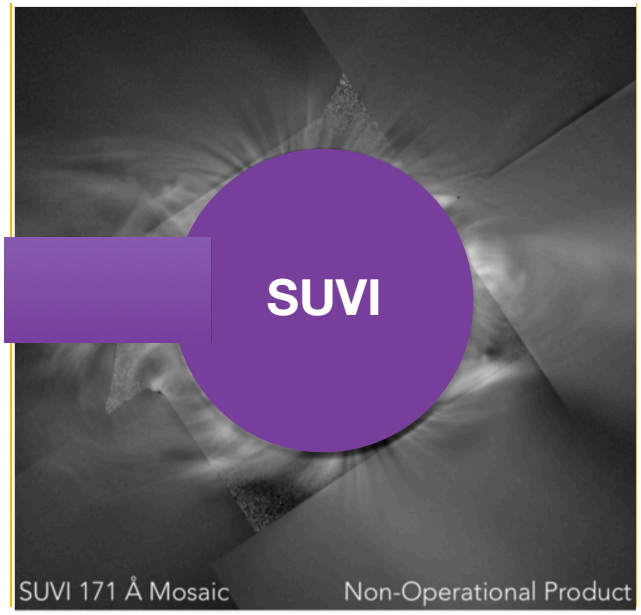
resolution: 9 arcsec on 2 pixels

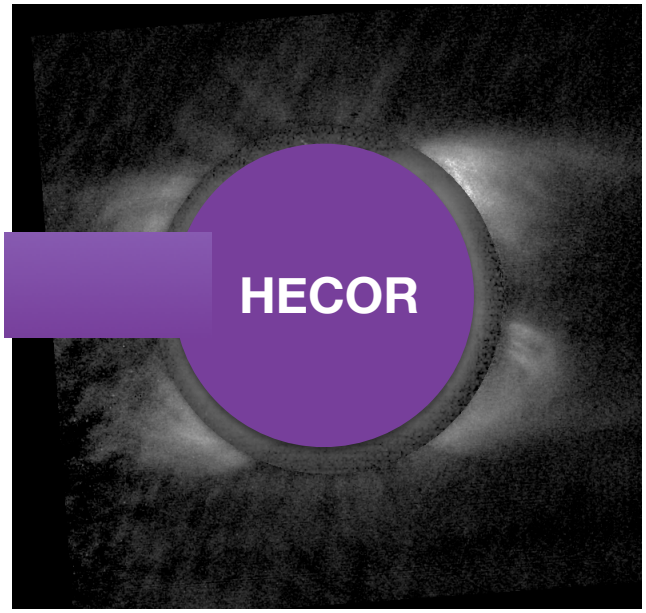
@ 0.28 AU =1830 km on 2 pixels

FSI: Full Sun Imager

FOV: 3.8°x3.8°, @ 0.28 AU: 4 Rsun x 4 Rsun

17nm





30.4nm

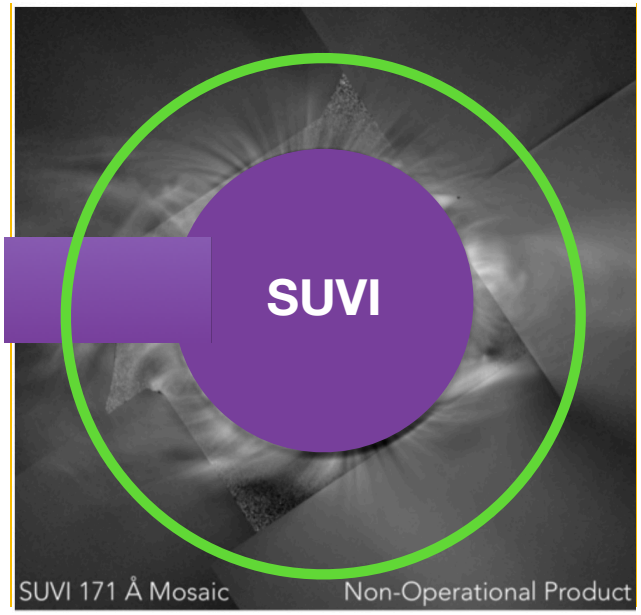
resolution: 9 arcsec on 2 pixels

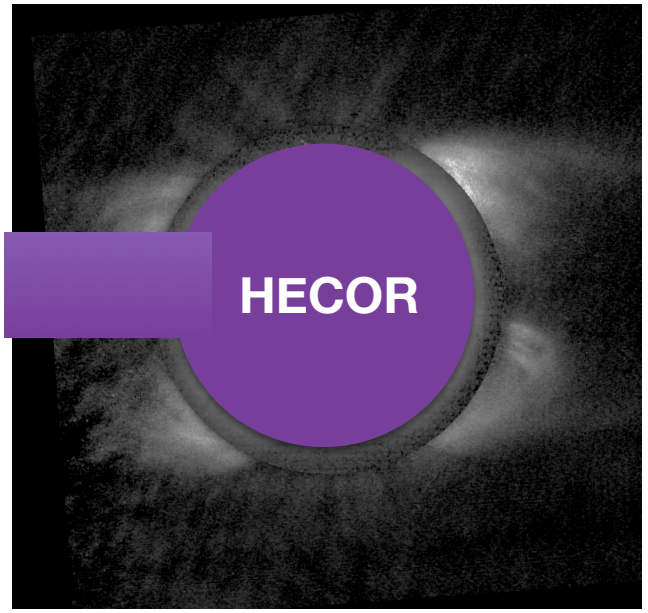
@ 0.28 AU =1830 km on 2 pixels

FSI: Full Sun Imager

FOV: 3.8°x3.8°, @ 0.28 AU: 4 Rsun x 4 Rsun

17nm



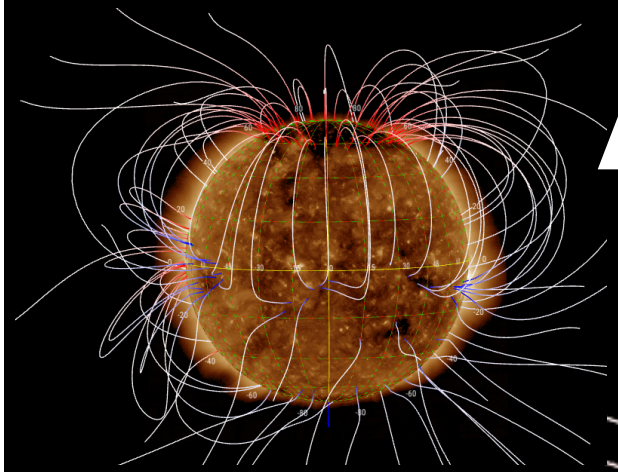


30.4nm

resolution: 9 arcsec on 2 pixels

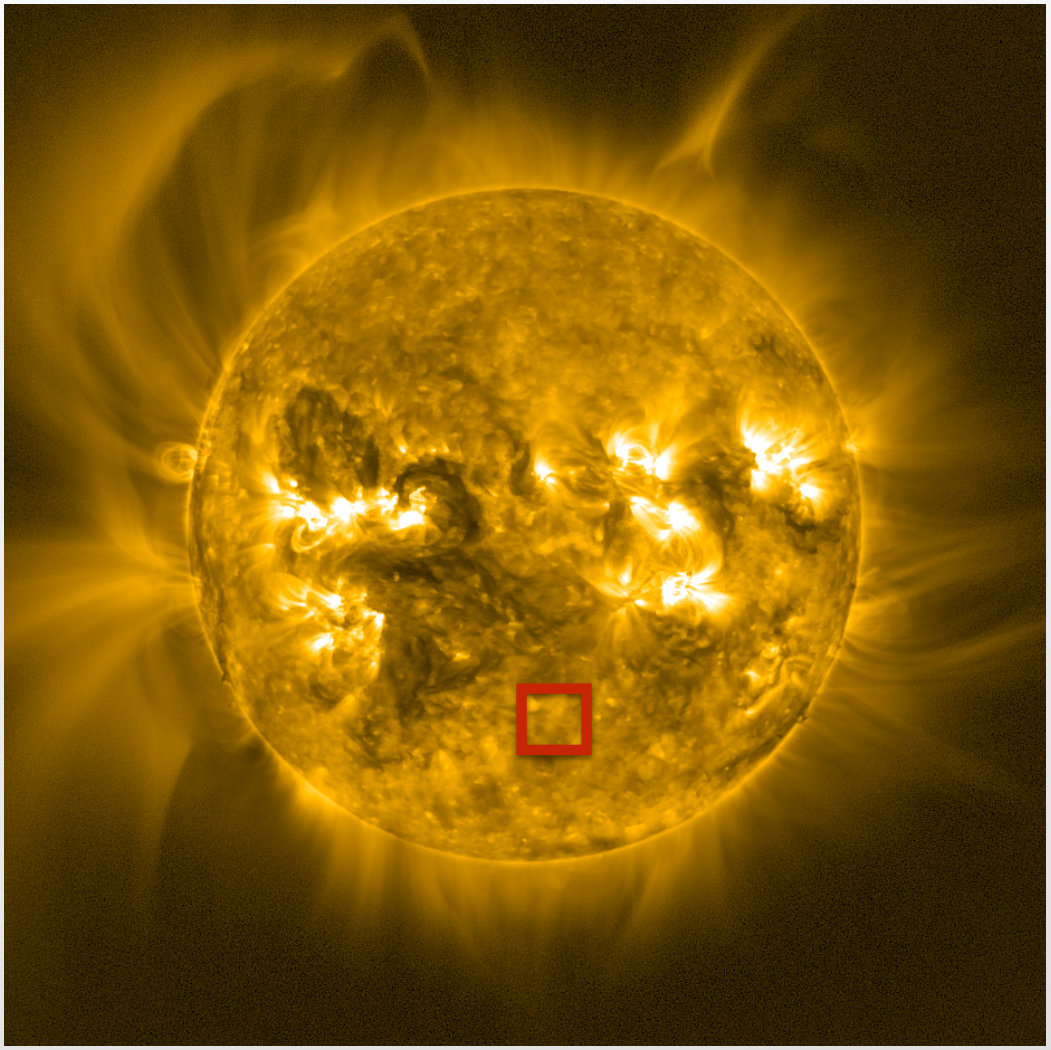
@ 0.28 AU =1830 km on 2 pixels

A view off the poles



jHelioviewer

HRI:High Resolution Imagers



FOV:

17’x17’

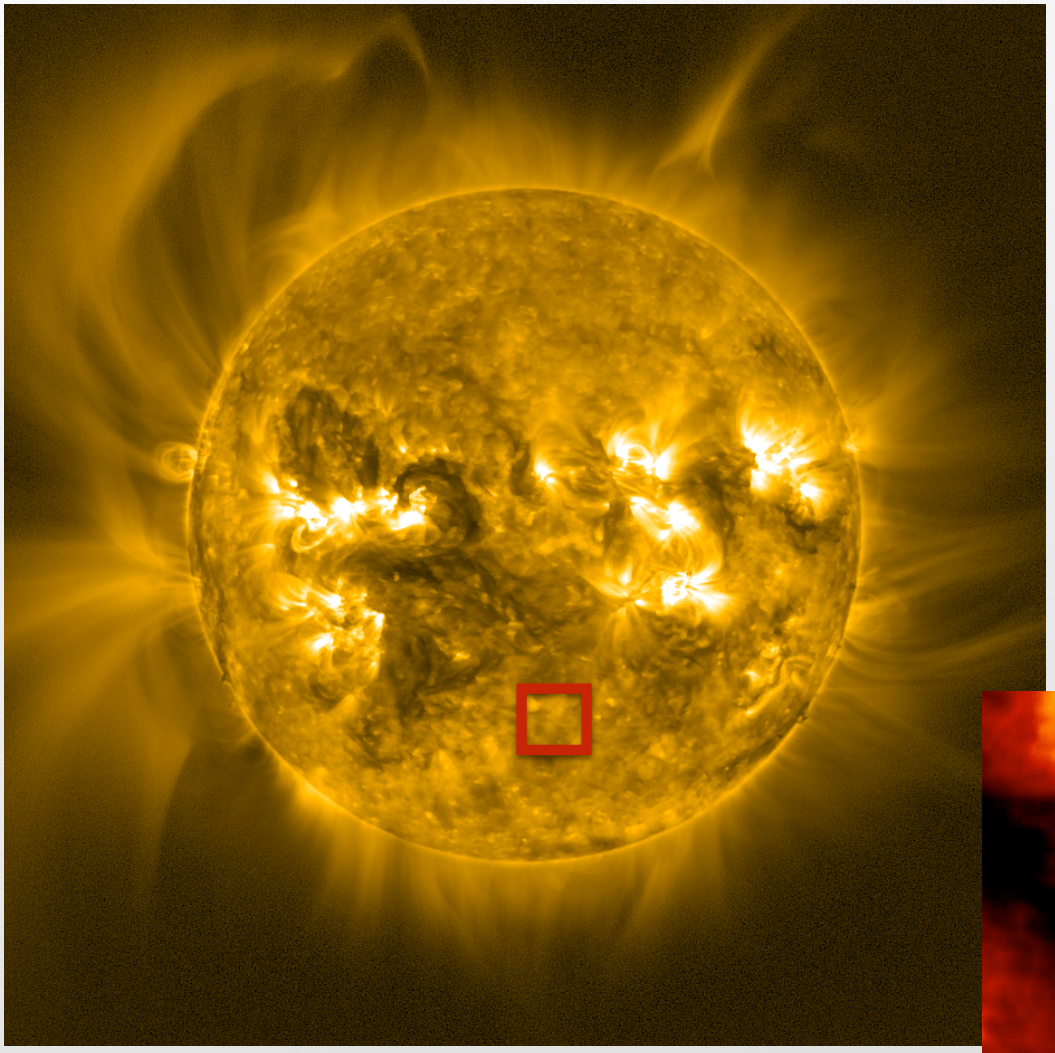
@ 0.28 AU = (0.16 R)^2

resolution:

1 arcsec on 2 pixels

@ 0.28 AU = 200km

HRI:High Resolution Imagers



FOV:

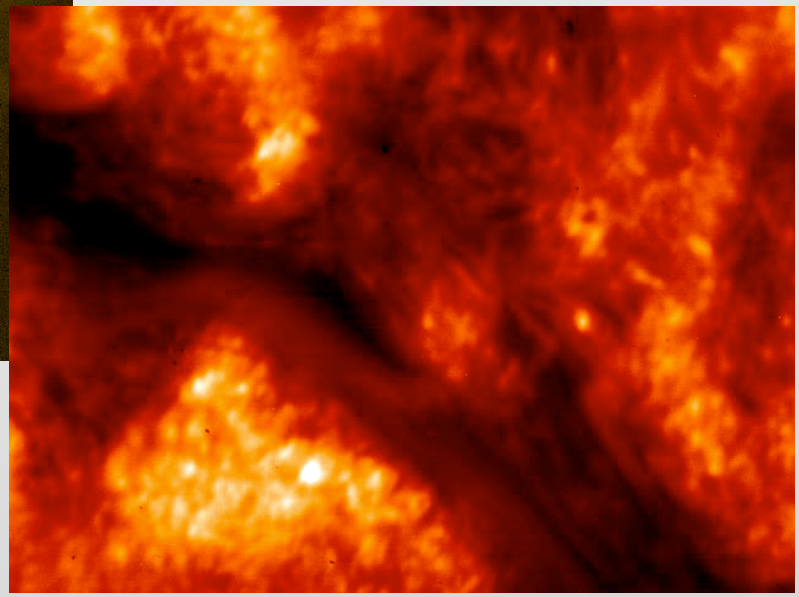
17'x17'

@ 0.28 AU = (0.16 R)^2

resolution:

1 arcsec on 2 pixels

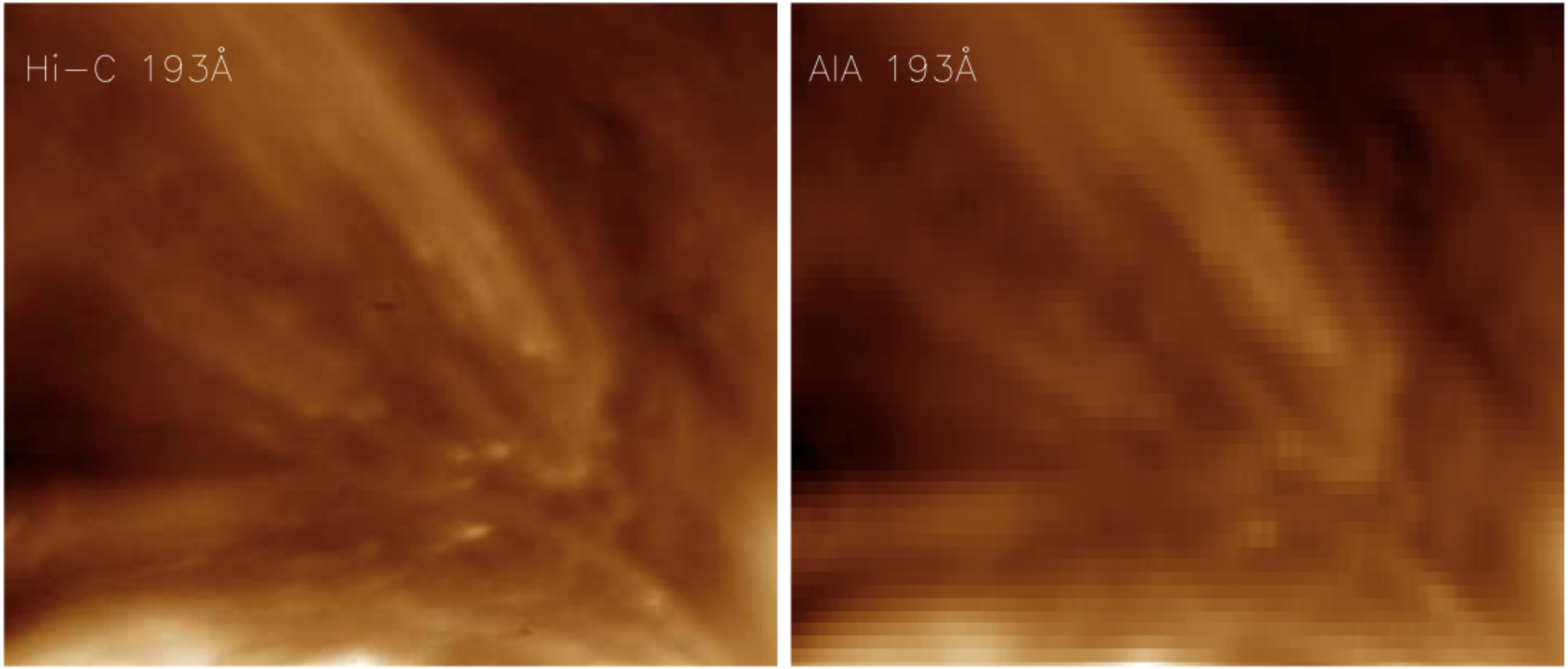
@ 0.28 AU = 200km



VAULT 2002
0.5" res = 360 km
21 images at 17s cadence

Hi-C sounding rocket

19.3nm , 0.3”= 220km res, 122 images

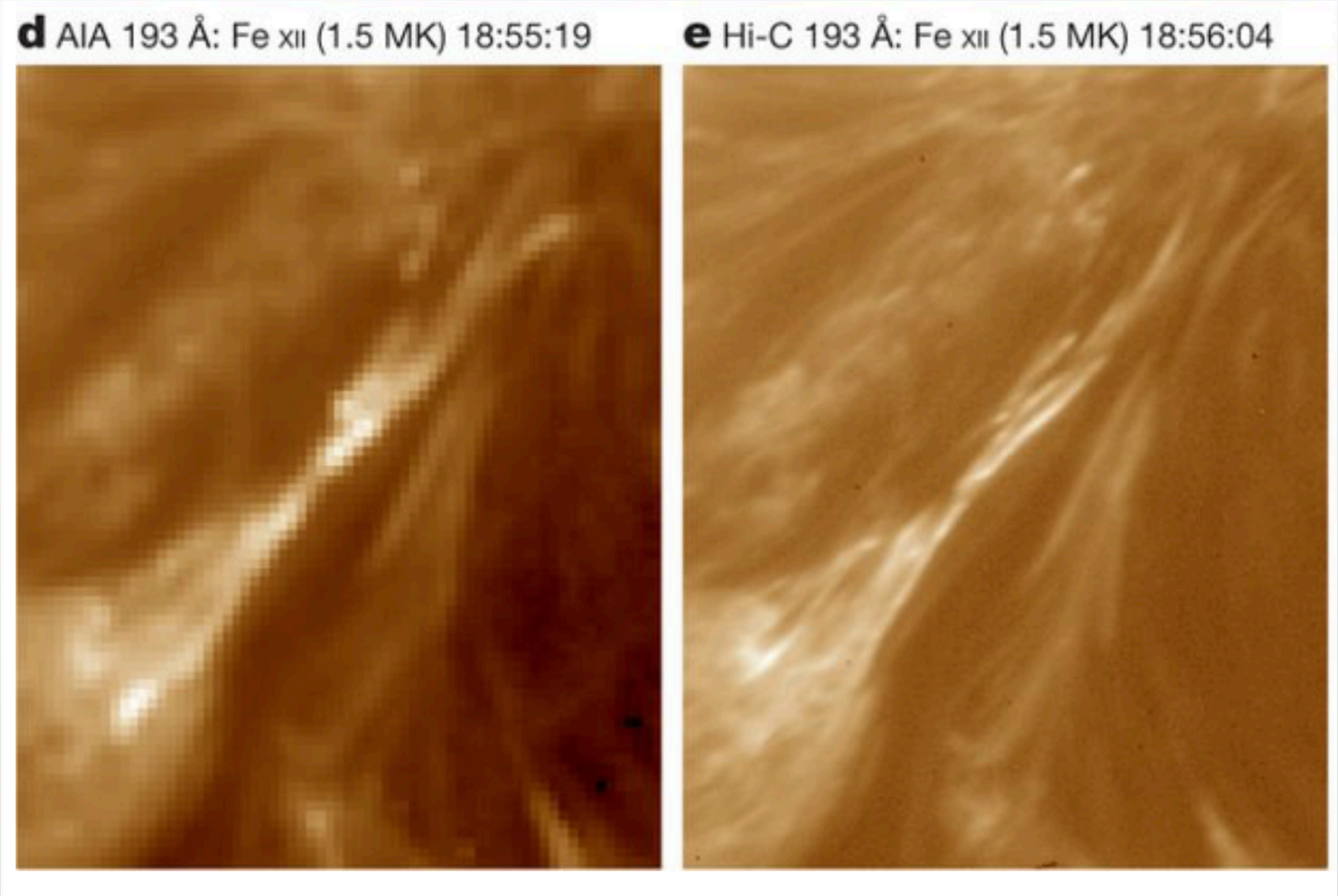


EUV Bright Dots (EBDs) at base of large loops
Lifetime ~25s, size~ 0.68 Mm

Regnier et al, ApJ, 2014

Hi-C sounding rocket

19.3nm , 0.3”= 220km res, 122 images



Cirtain et al 2013 Nature

Solid Line = 150 km/s = sound speed at 1 MK

motion blur

SOHO/EIT

SDO/AIA

PROBA2/SWAP

Exposure time!!!!!

imaging cadence (s)

1000.0
100.0
10.0
1.0
0.1

100
1000
10000

km on the Sun

Solid Line = 150 km/s = sound speed at 1 MK

motion blur

SOHO/EIT

FSI

PROBA2/SWAP

SDO/AIA

HRI

EUI resolution
at perihelion

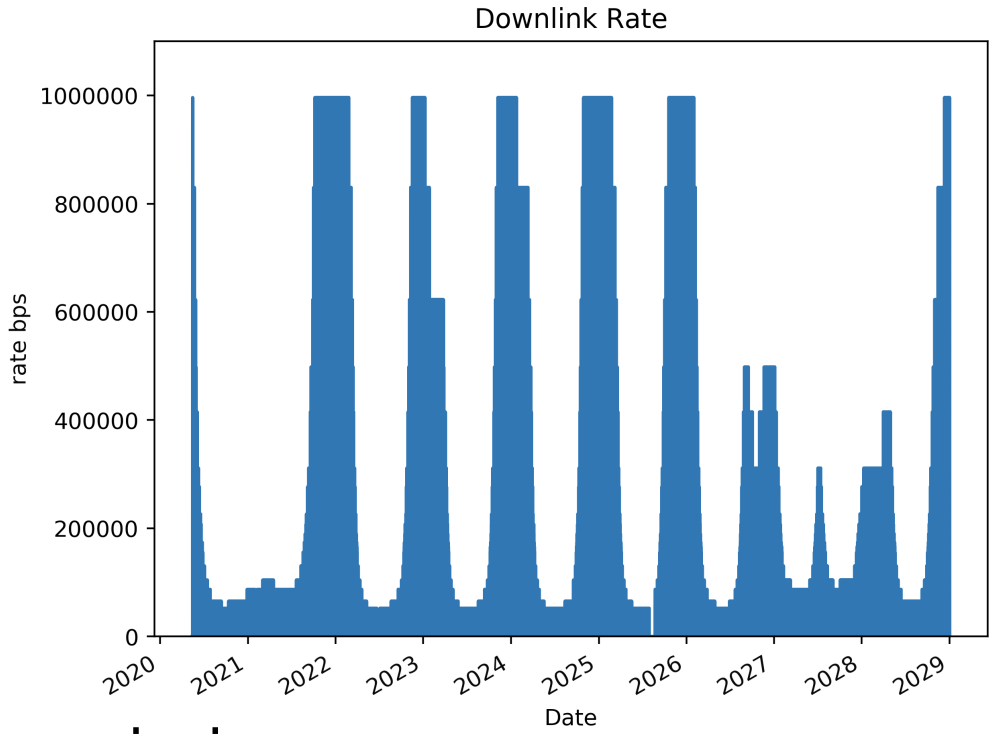
1000.0
100.0
10.0
1.0
0.1

100
1000
10000

Exposure time!!!!!
imaging cadence (s)

km on the Sun

Telemetry



- telemetry is difficult for near-Sun mission
- EUI gets 20.5 kbps during 30 days per orbit (180 days)
- Total data/year = 13 000 MB
- ~ 500 uncompressed images per telescope/year
- for HRI at 1 sec, this would be a movie of 8 min…

Planning

Nov 5 2019


AIRBUS solar orbiter esa
SOLAR ORBITER
TRANSPORT CONTAINER (SOSC)
LEFT
VOLGA DNEPR
http://www.volga-dnepr.com

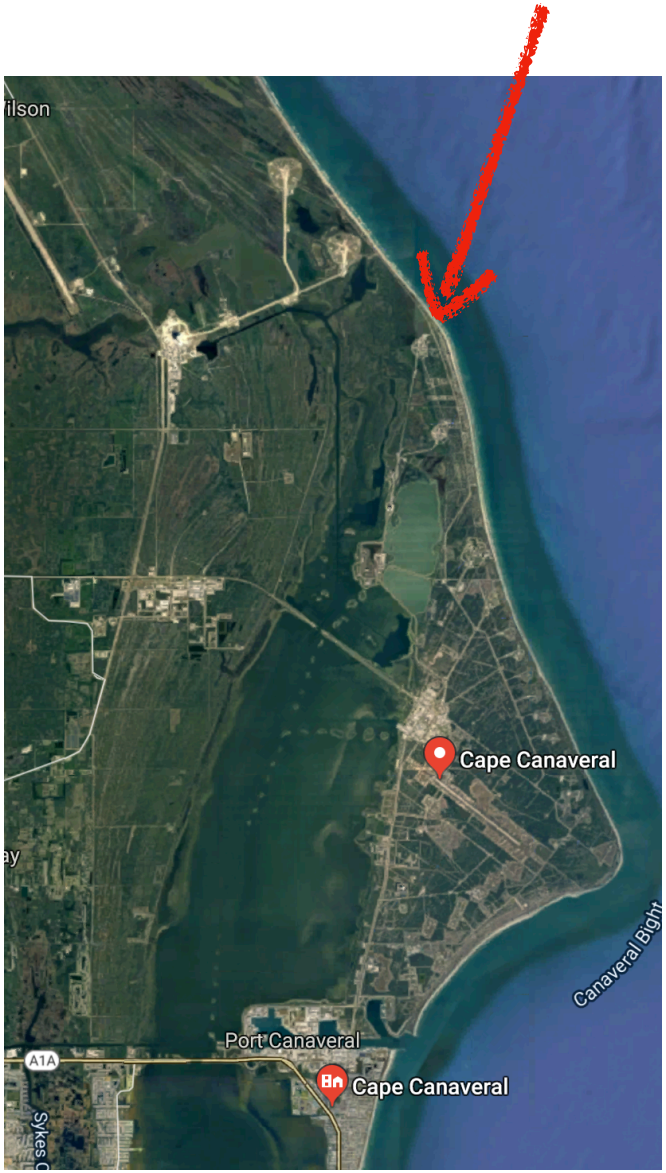
Nov 21 2019


TRANSPORTATION COVER
SERIAL NUMBER-001
UNDER COVER CANVAS
WEIGHT 20 LBS.
CCB TRANSPORTATION COVER
SERIAL NUMBER-001
UNDER COVER CANVAS
WEIGHT 20 LBS.

Nov 22 2019
Boeing CST-100 Starliner

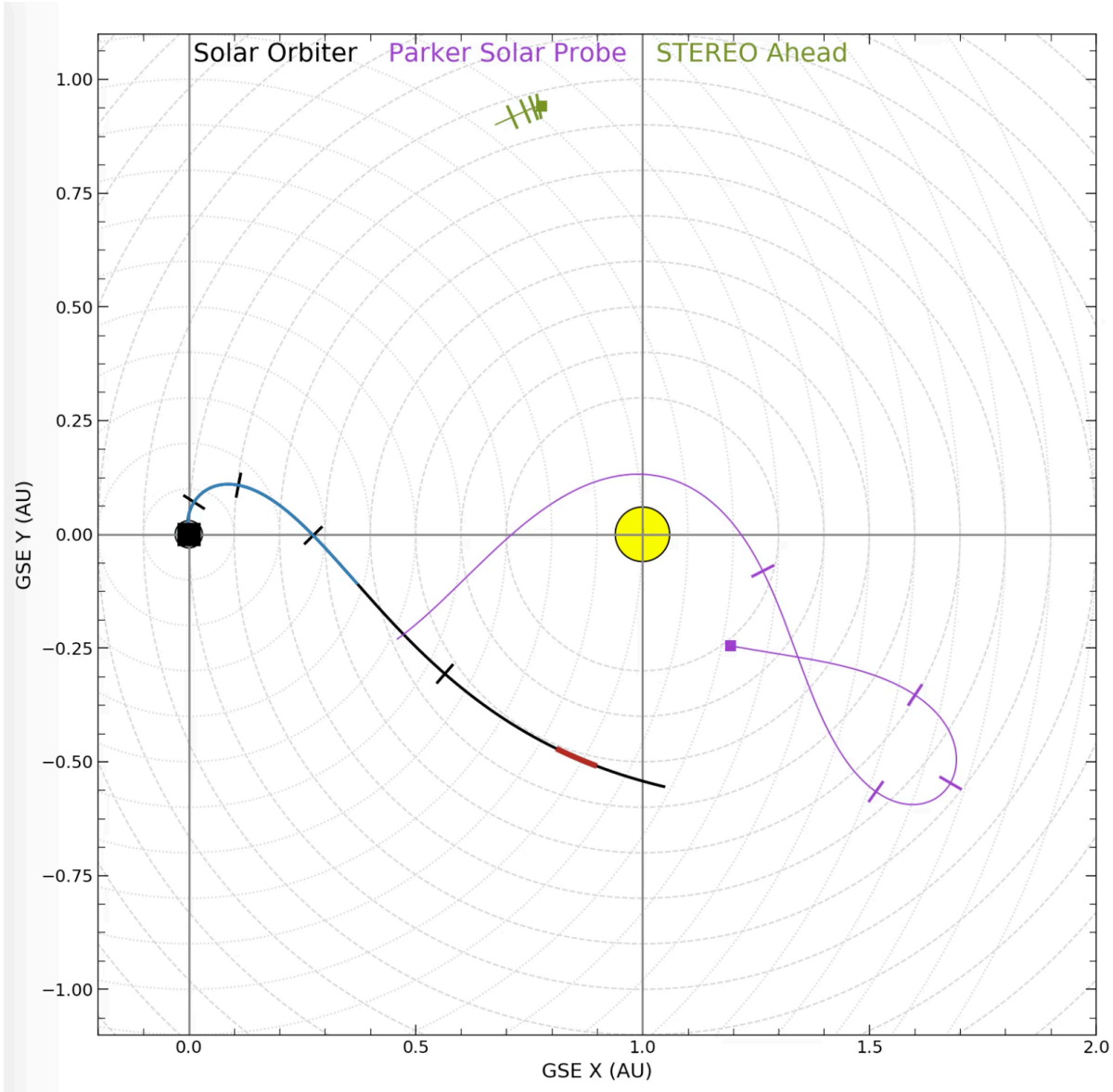
Launch Dec 17 from LC 41

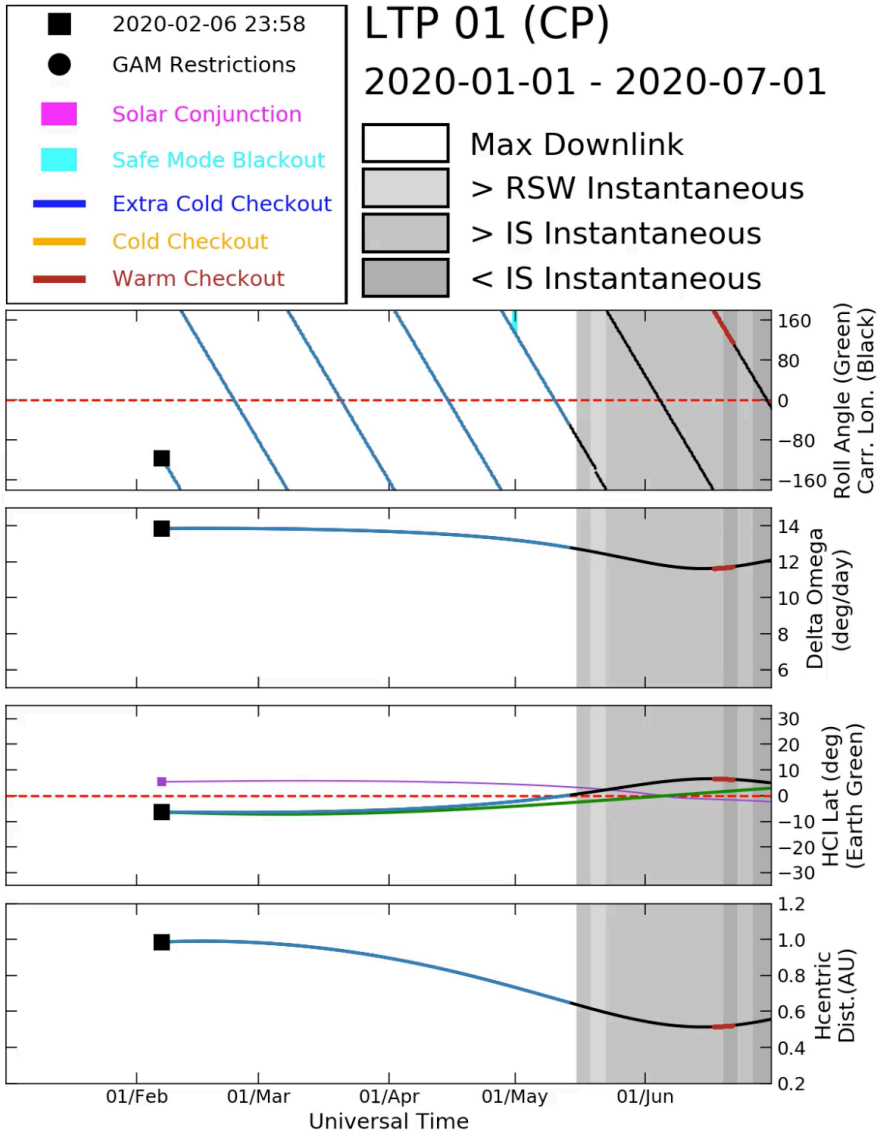
2020 Feb 6 (late Feb 5 Florida time)



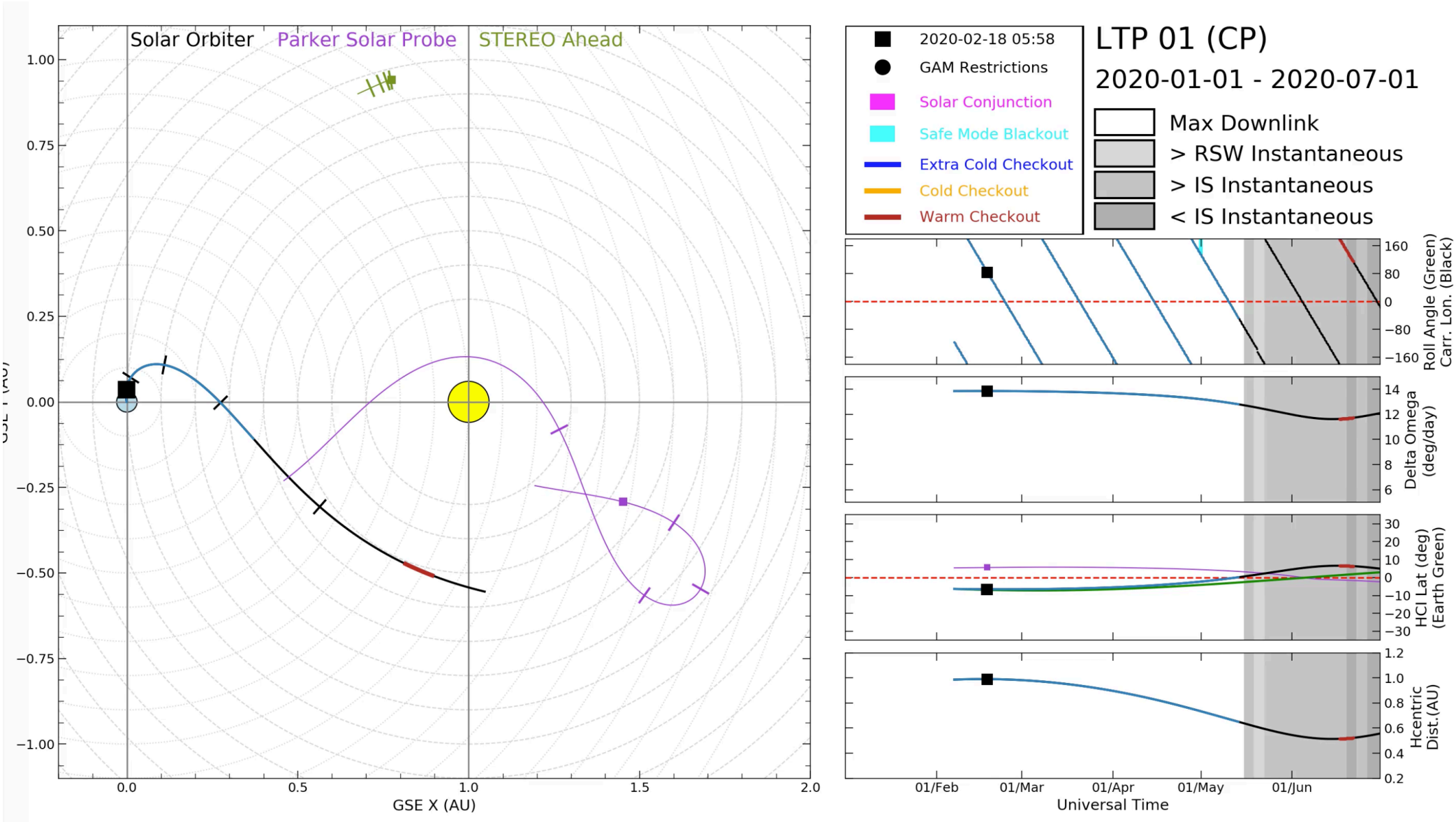
GOES-R launch with Atlas V from LC 41

Feb 6: launch

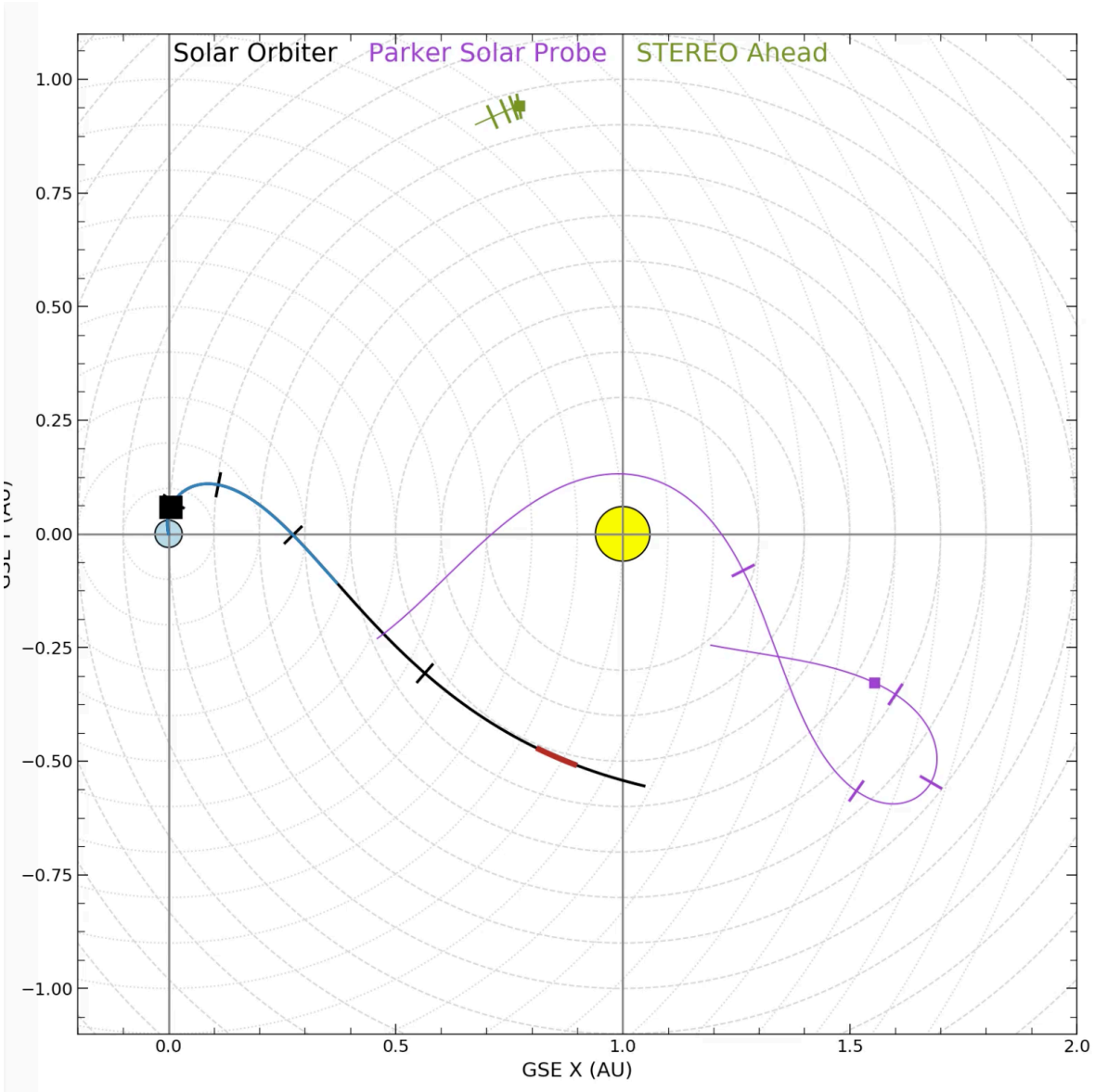

Solar Orbiter
Parker Solar Probe
STEREO Ahead
GSE Y (AU)
GSE X (AU)
1.00
0.75
0.50
0.25
0.00
−0.25
−0.50
−0.75
−1.00
0.0
0.5
1.0
1.5
2.0

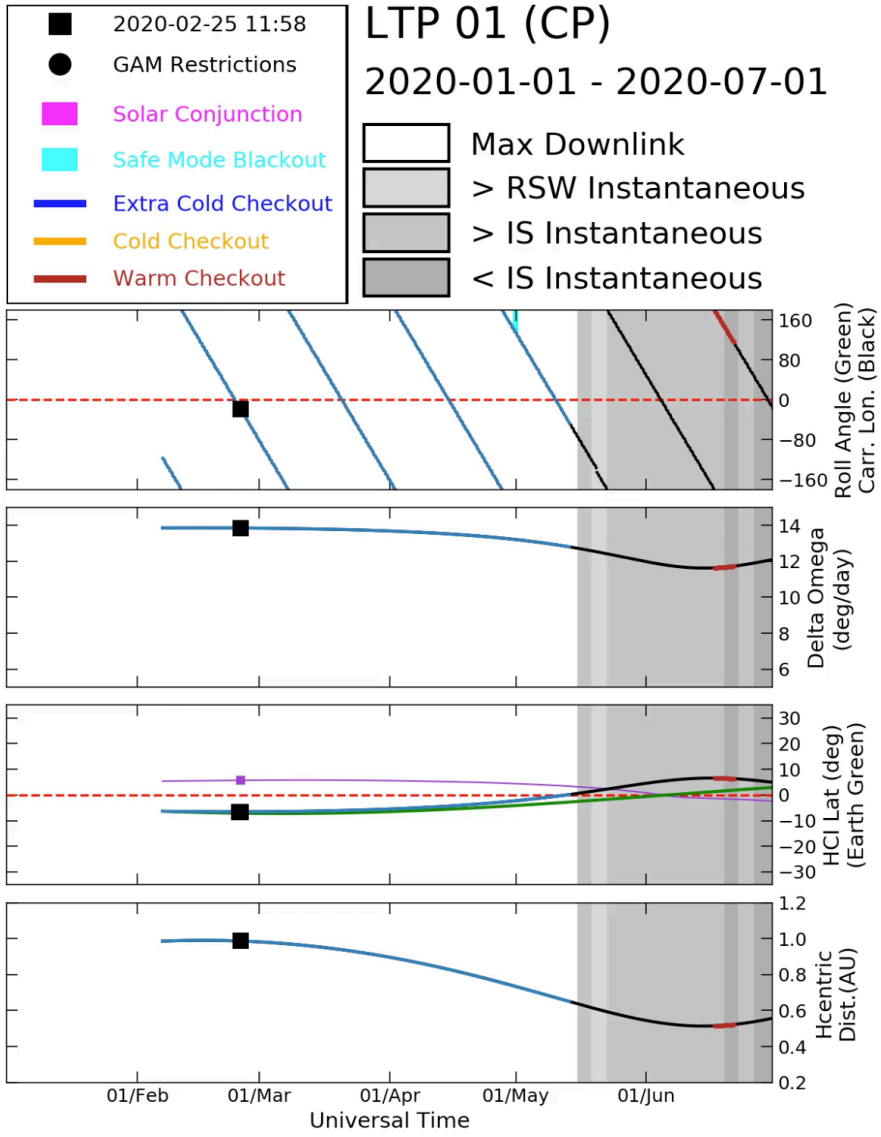

2020-02-06 23:58
GAM Restrictions
Solar Conjunction
Safe Mode Blackout
Extra Cold Checkout
Cold Checkout
Warm Checkout
LTP 01 (CP)
2020-01-01 - 2020-07-01
Max Downlink
> RSW Instantaneous
> IS Instantaneous
< IS Instantaneous
Roll Angle (Green)
Carr. Lon. (Black)
Delta Omega
(deg/day)
HCI Lat (deg)
(Earth Green)
Hcentric
Dist.(AU)
01/Feb
01/Mar
01/Apr
01/May
01/Jun
Universal Time

Feb 18 EUI 2a: CEB switch on, instrument-controlled heaters on

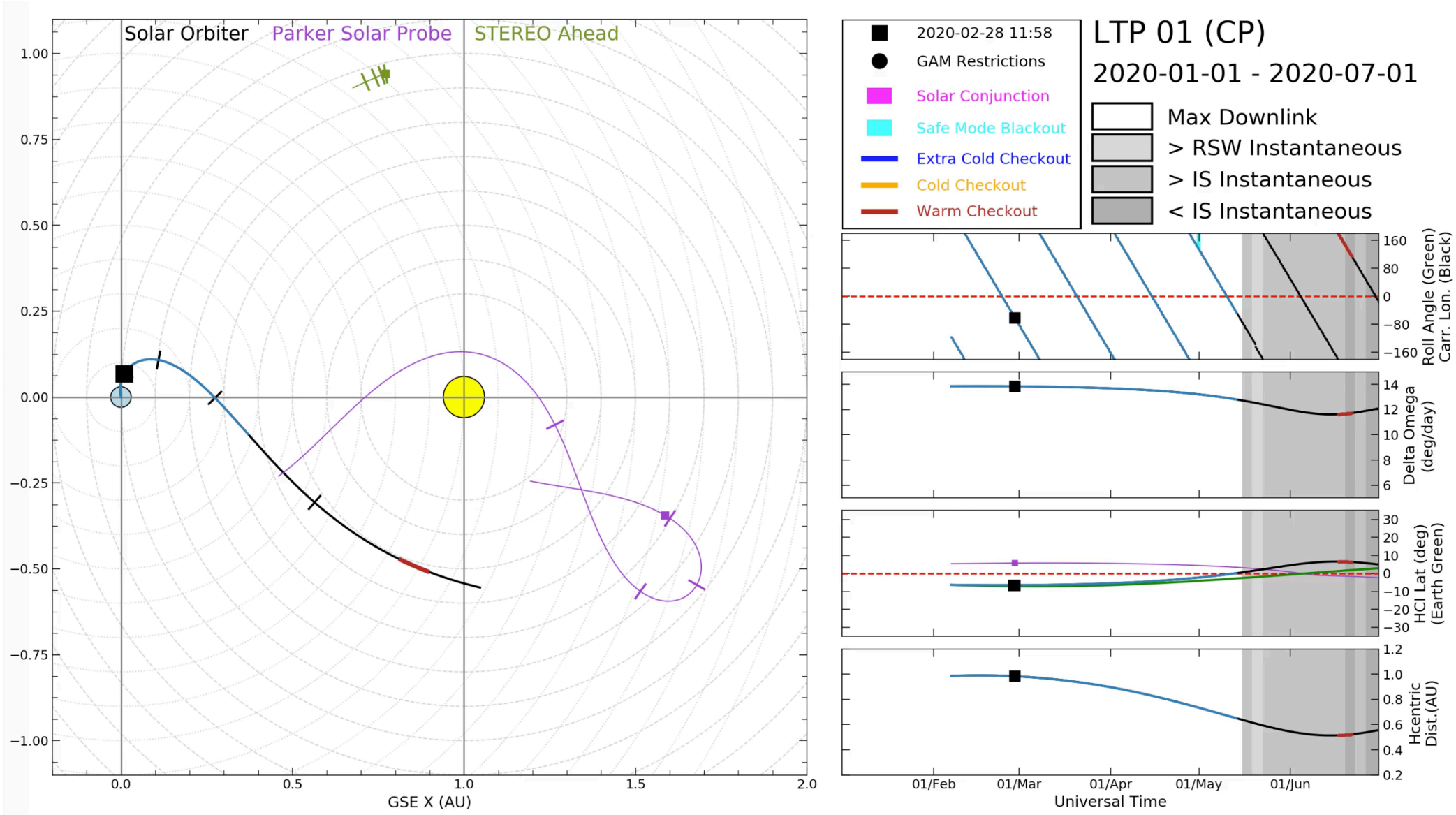


Feb 25, 26, 27 EUI 2b: CEB (including WICOM compression chip) self tests

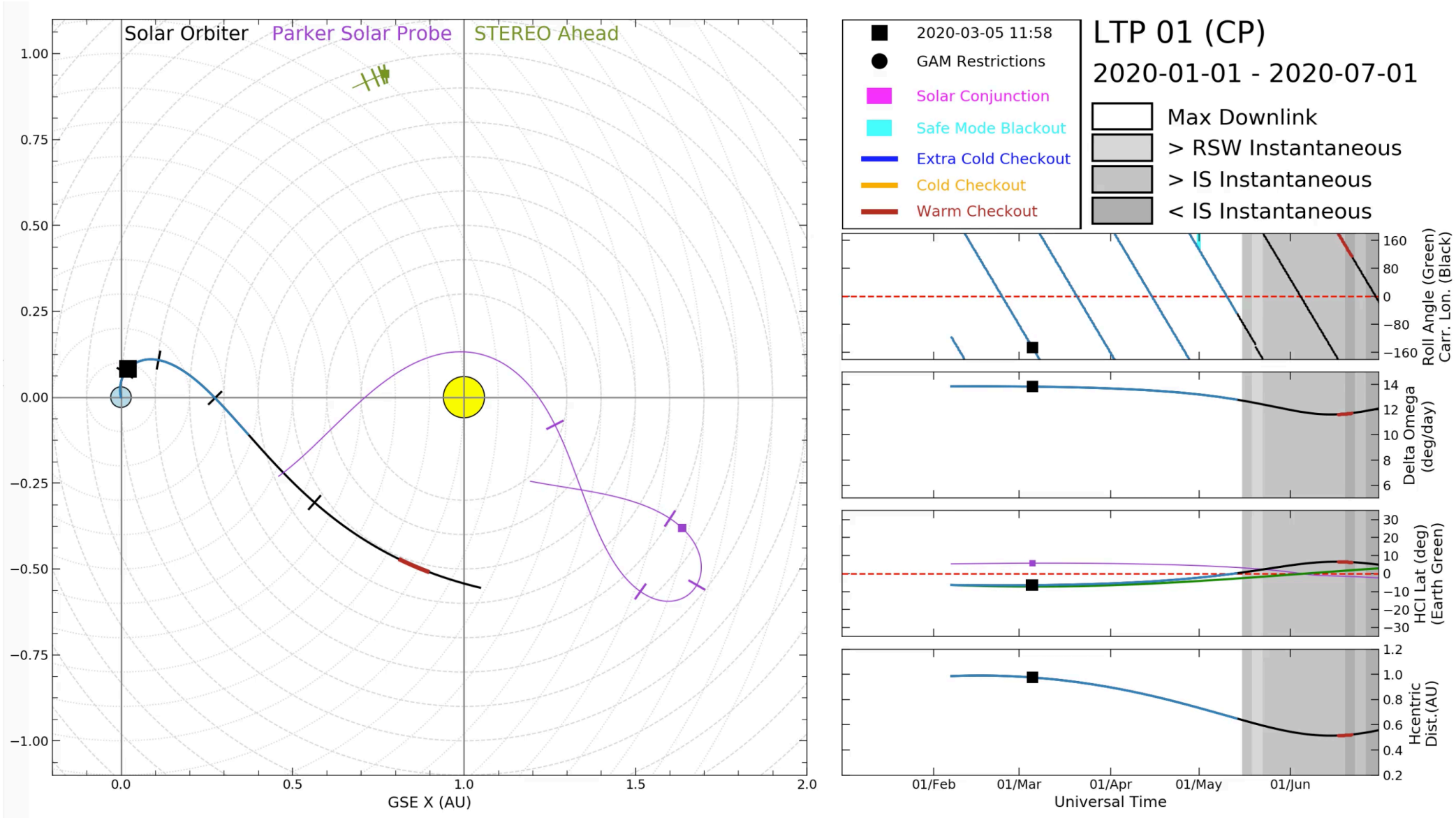




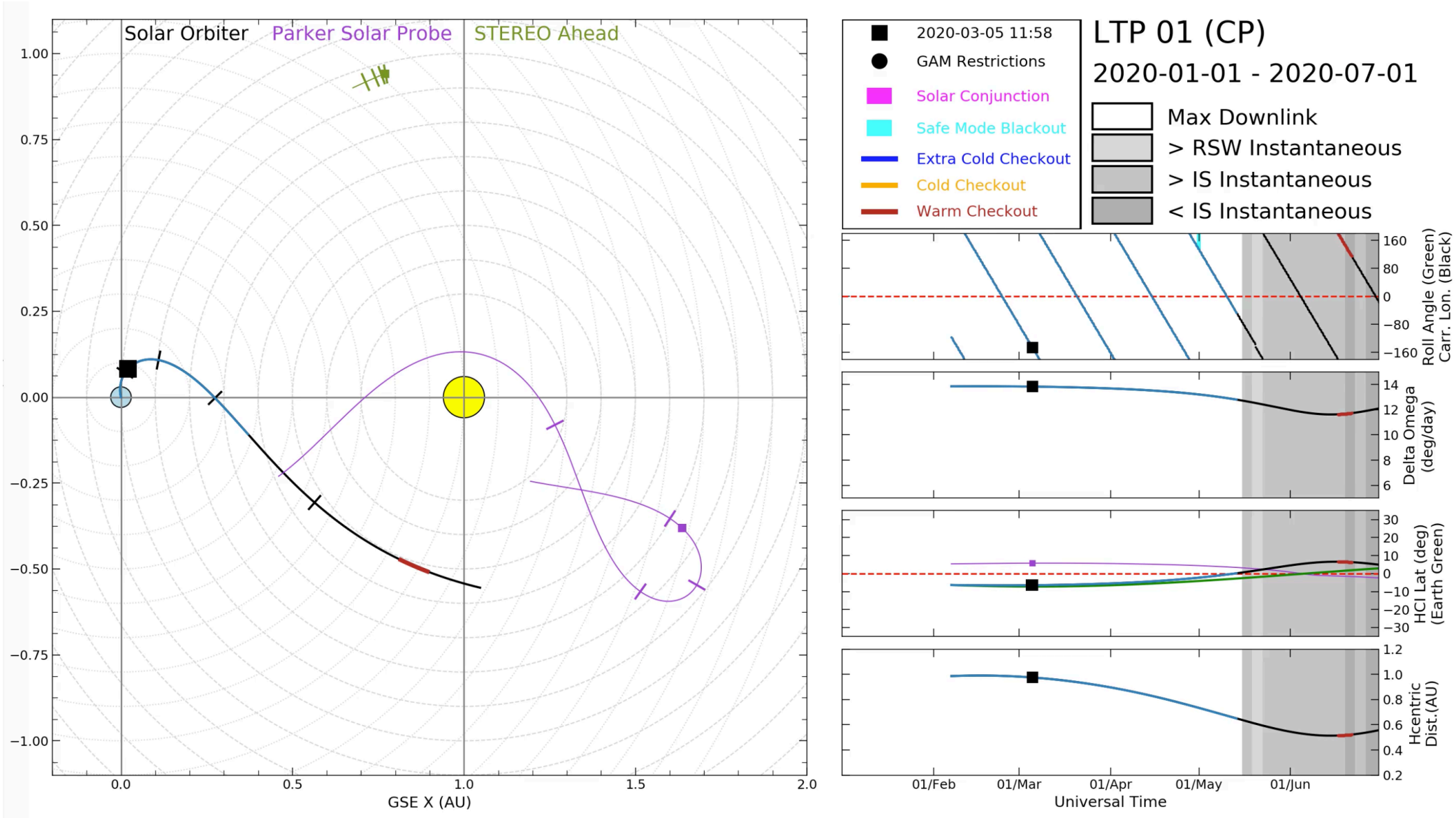
Feb 28 EUI 3: cameras switch on, single dark and LED images



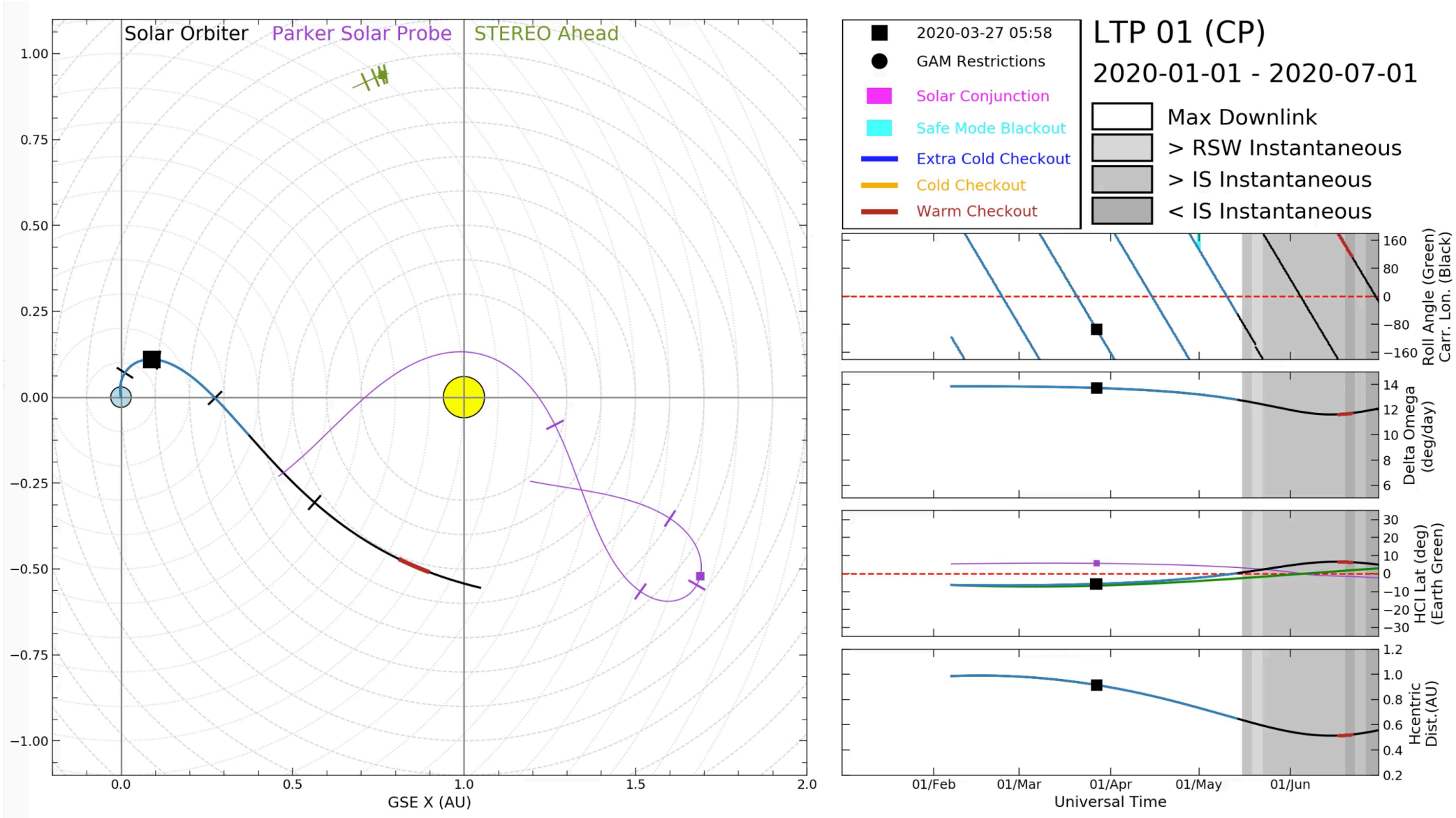
Mar 3 EUI 6.2: open heat-shield doors to enhance outgassing



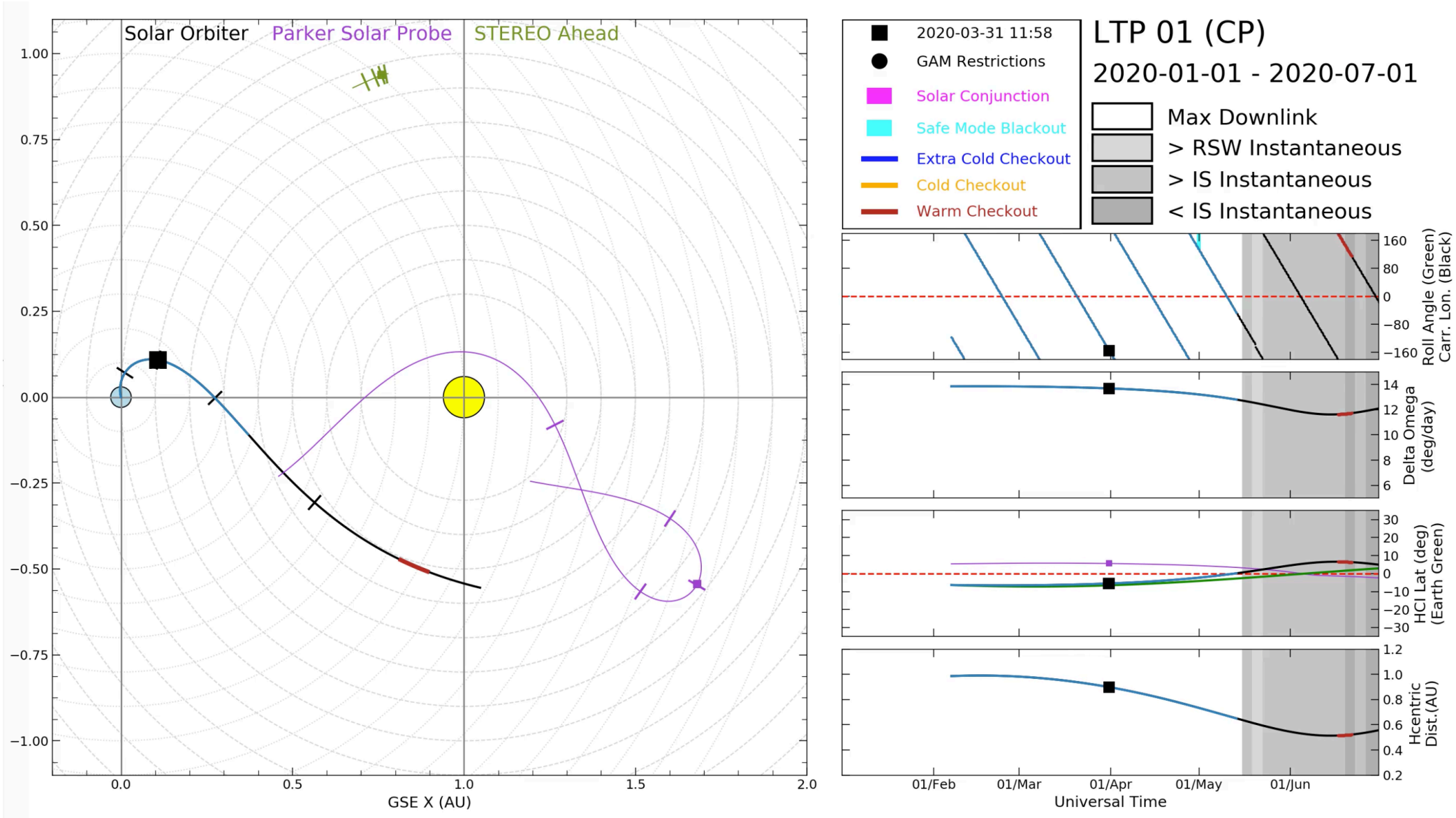
Mar 5, 14 EUI 4: compressed dark & LEDs, detector settings, Test Science Tables



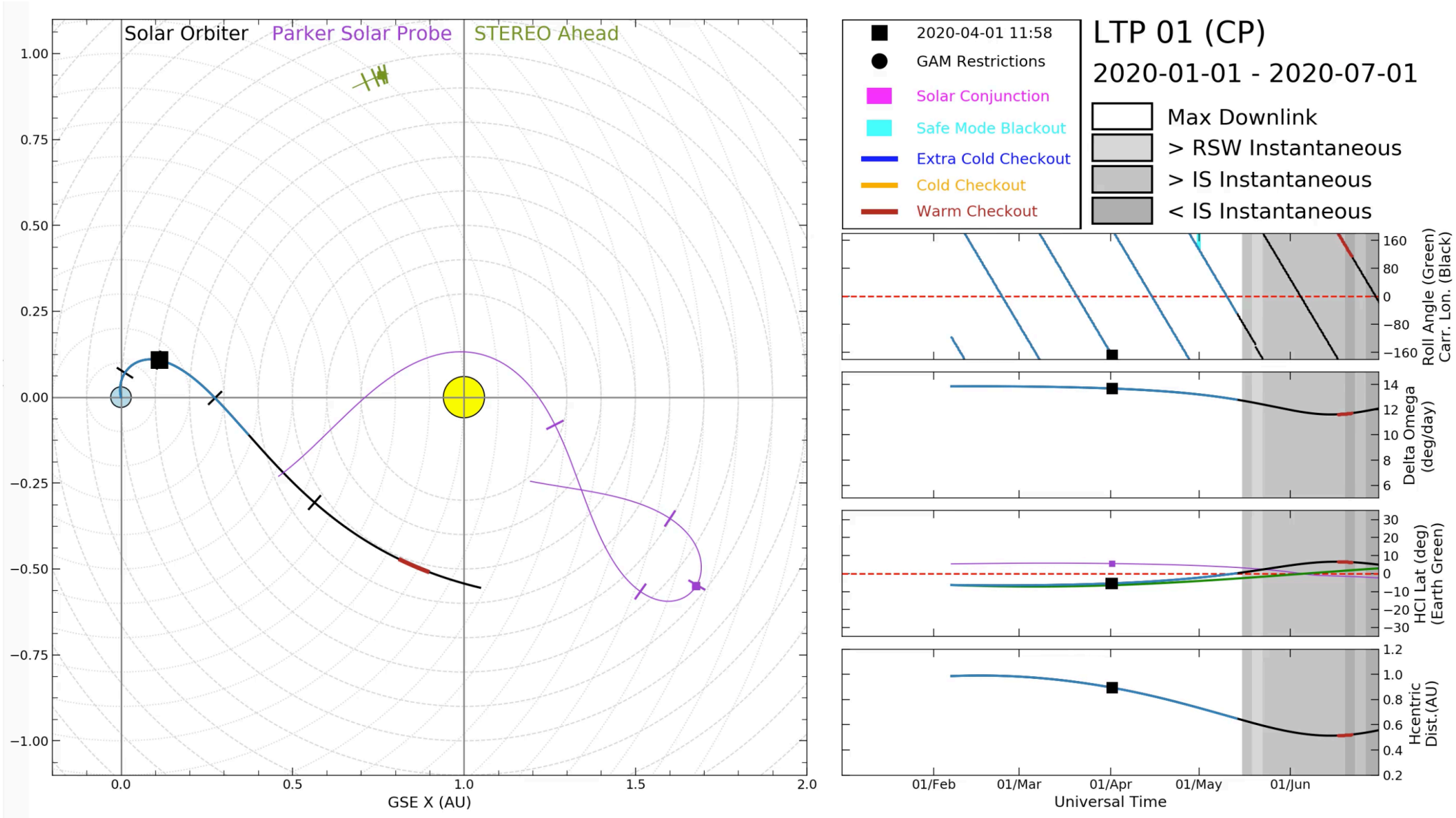
Mar 27 EUI 5: software upload and science tables



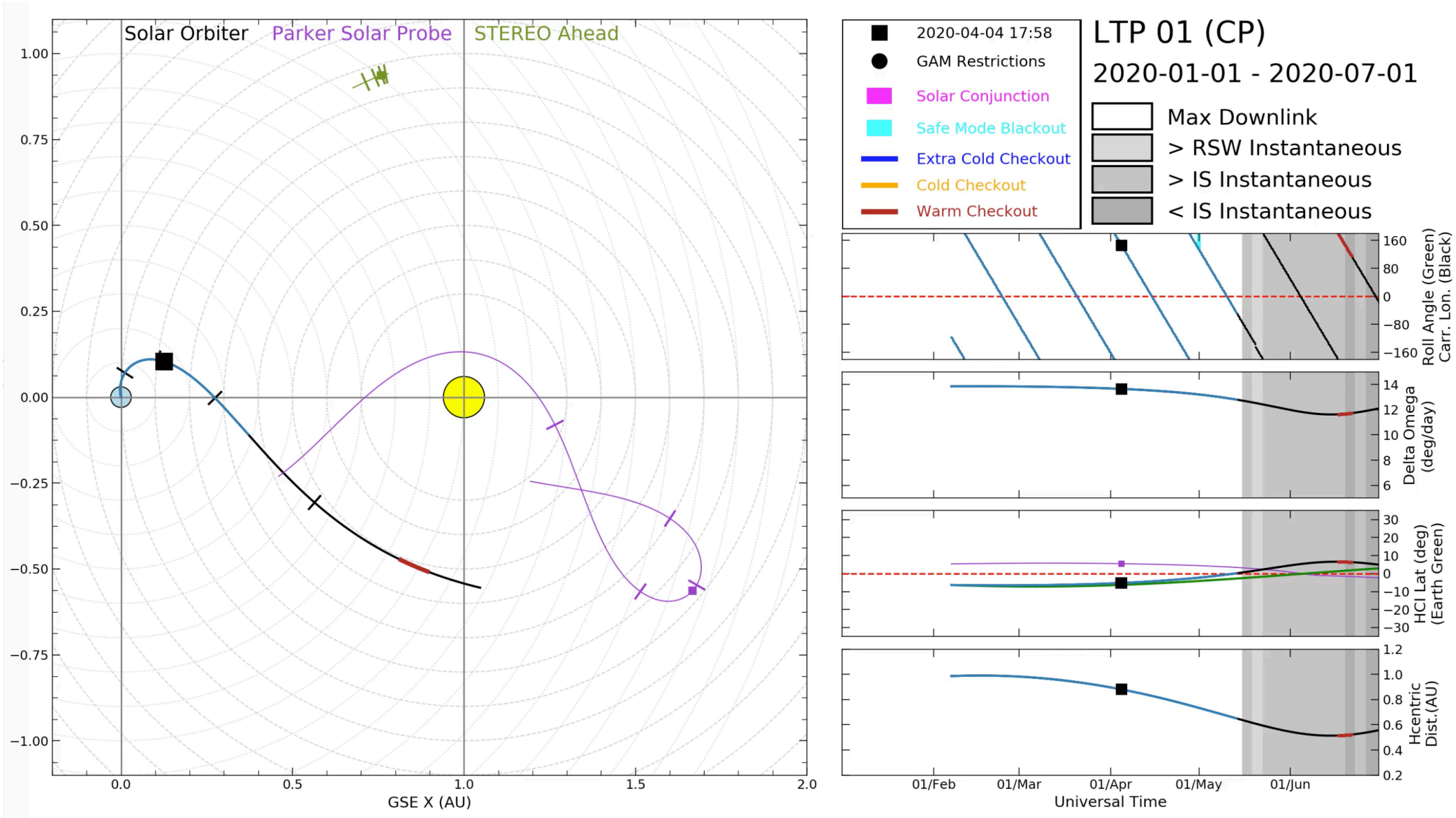
Mar 31 EUI 6.9 and 6.10: opening alternating heat shield and instrument doors for last outgassing



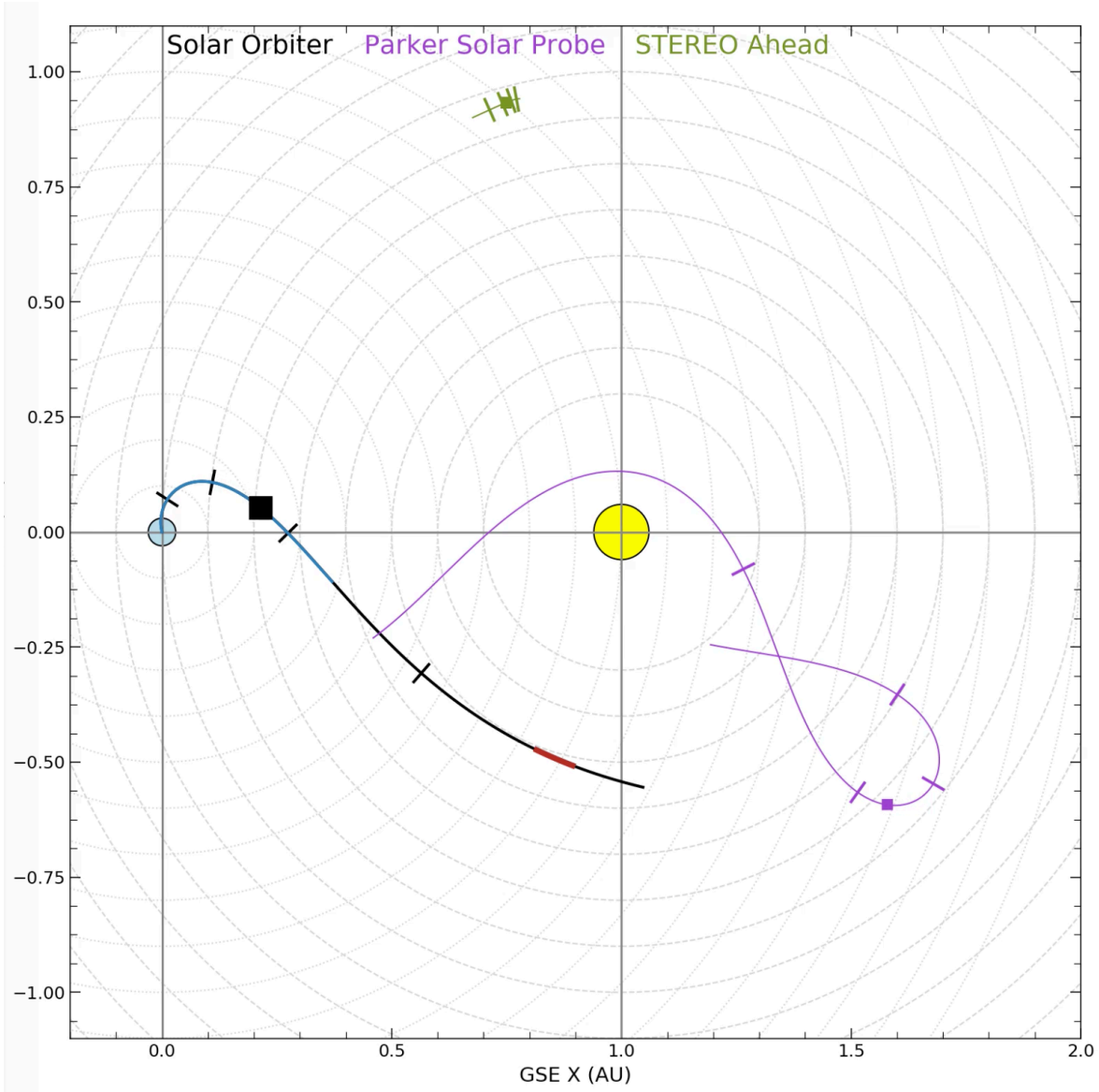
Apr 1 EUI 7: turn off heaters and monitor detector cooling

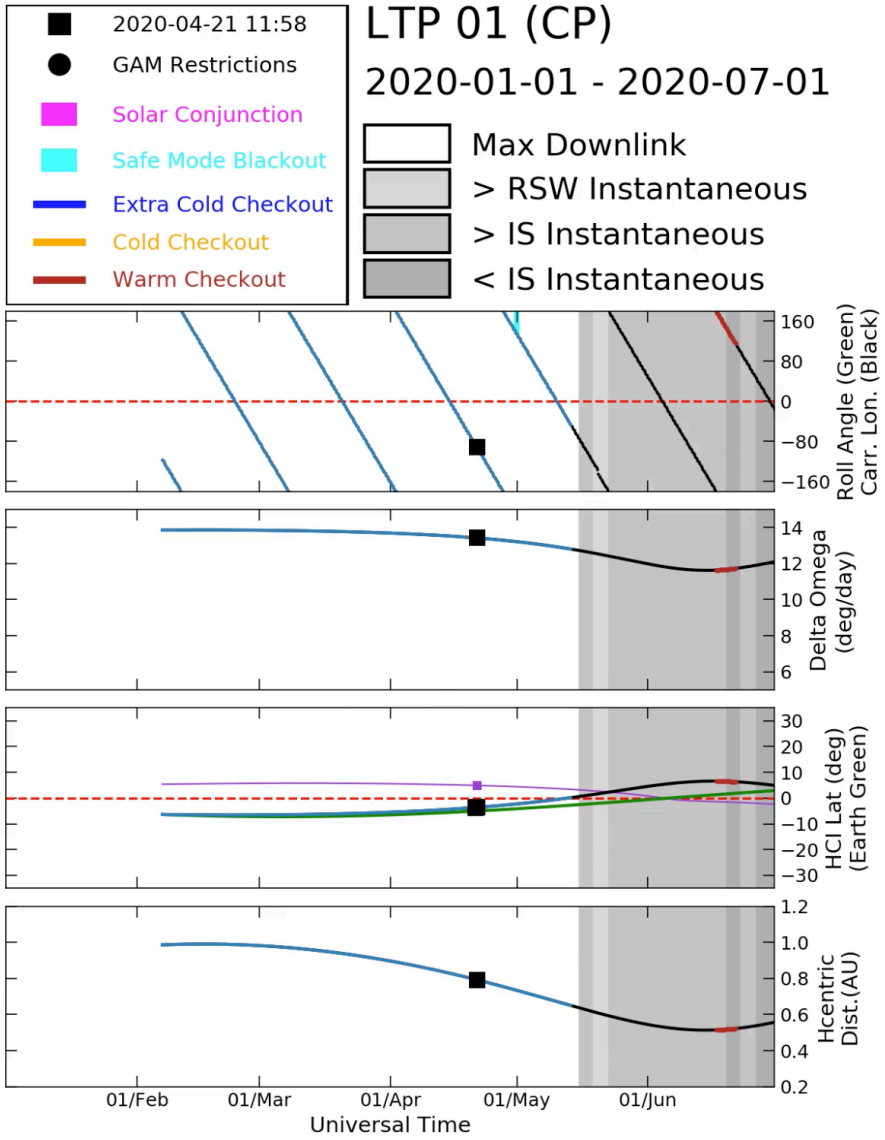


Apr 4-16 EUI 8: performance test with doors closed and detectors cold



Apr 21-22 EUI 9.5: door opening, first light

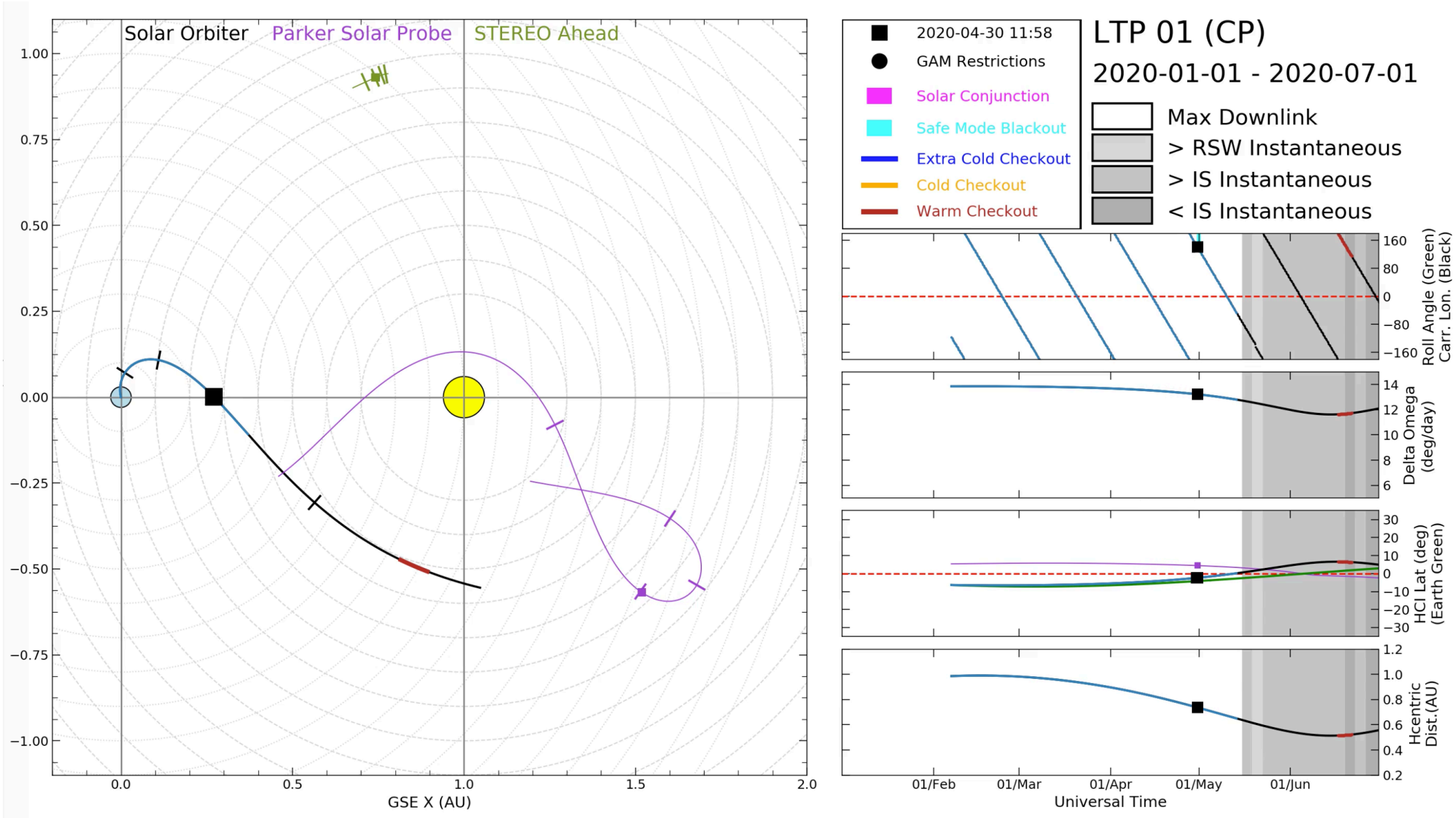




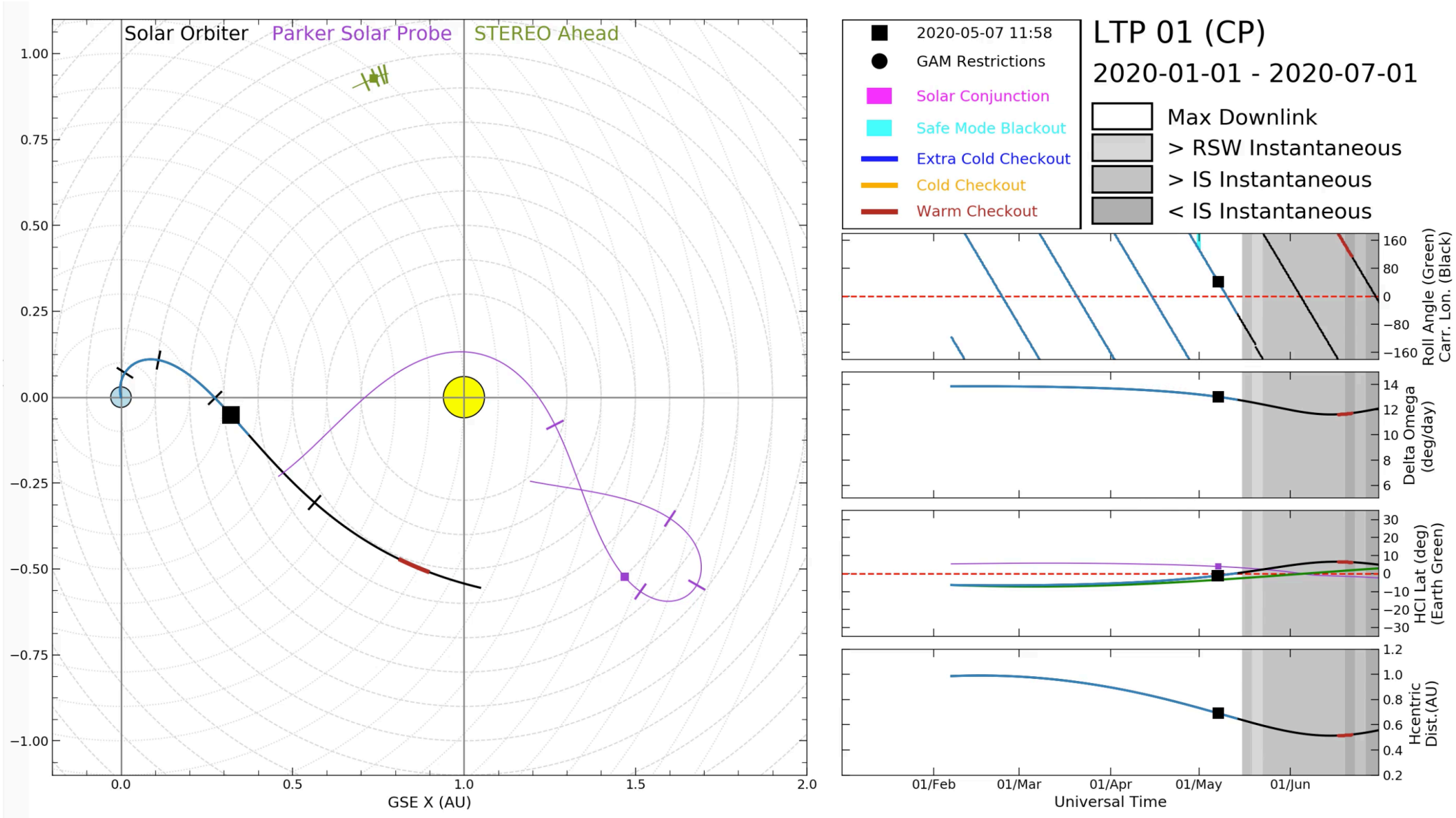
0.8AU -> FSI FOV is (11 Rsun)^2

-> HRI FOV is (.46 Rsun)^2

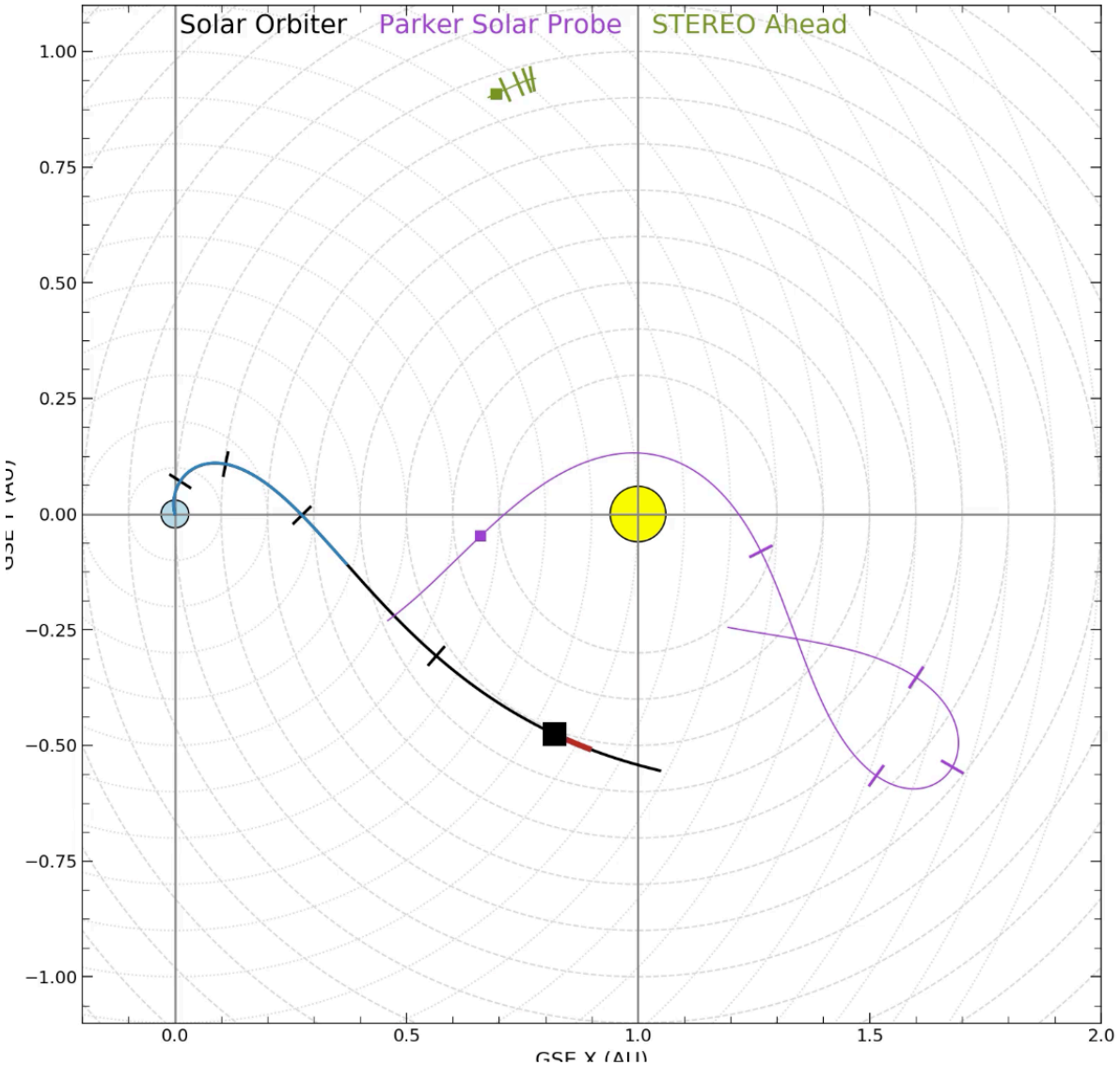
Apr 25-May 1 EUI 10: performance tests with doors open

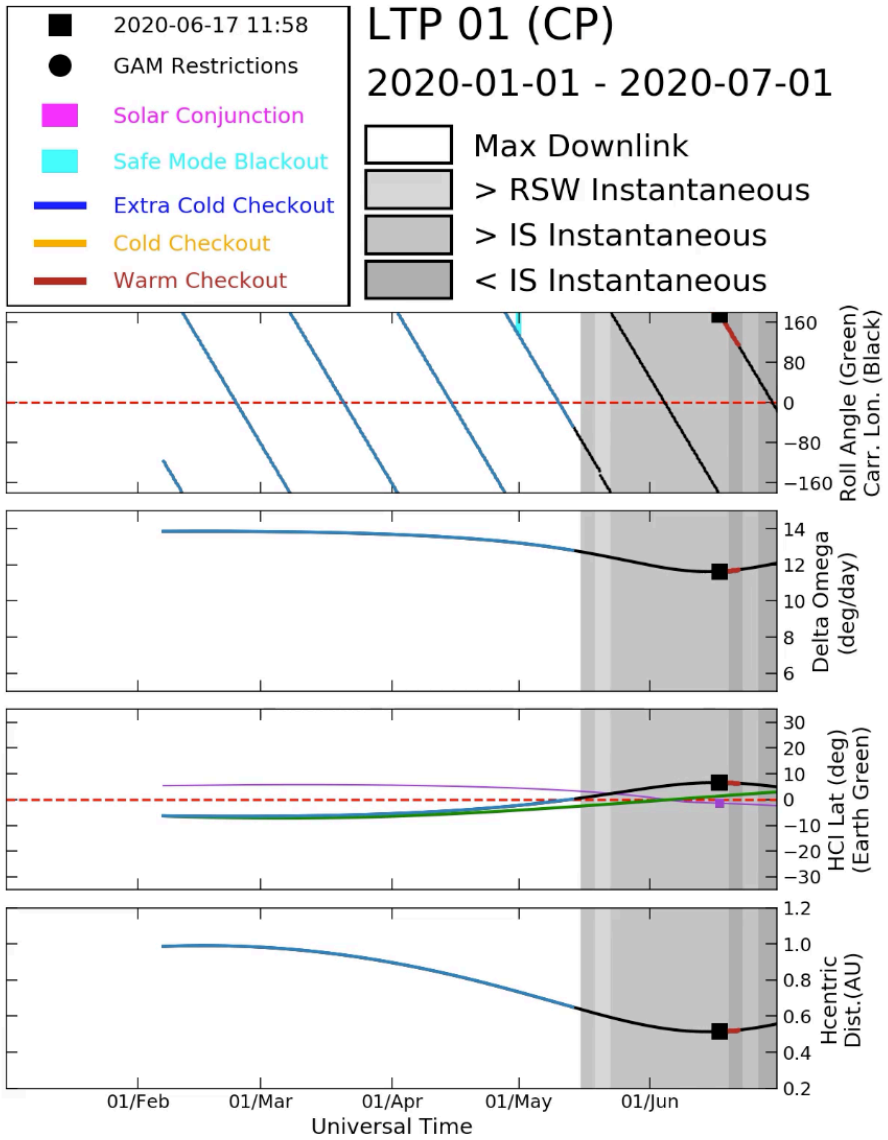


May 7 EUI 11: software upload



2020 June 17-22: RSCW1 (star, alignment, flat-field)





Period	Window/ GAM	EXT Start	Start	End	Heliocentric Distance Range [AU]		
LTP 01	**RSCW1** (warm)	n/a	2020-06-17T00:00:00	2020-06-22T00:00:00	0.514	0.517	0.523

Mission Phases

- 2020-02-06 NECP
- 2020-05-14 cruise-phase
- 2021-11-26 Nominal Mission Phase
- 2026-01-01 Extended Mission Phase

Summary

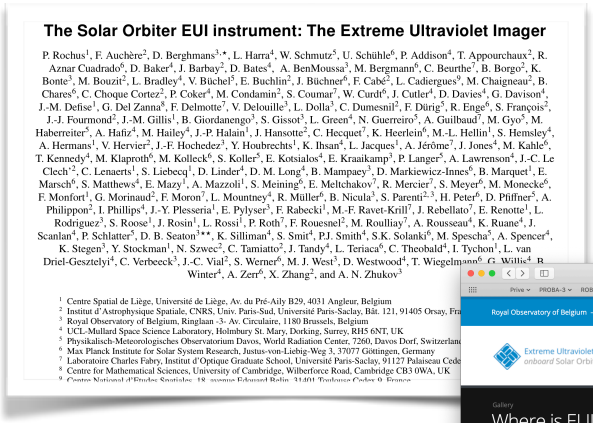
- Solar Orbiter launch February 2020
- >30deg solar latitude, <0.3 AU
- EUI is a package of 3 EUV imagers onboard
- Full Sun Imager: large FOV in 17nm & 30.4nm for connection science with heliosphere
- High Resolution Imagers: 17nm and Lyman-alpha for dynamics & structuring of solar atmosphere

EUI is brought to you by

- Centre Spatial de Liège (B)
- Institut d'Astrophysique Spatiale (F)
- Royal Observatory of Belgium (B)
- UCL-Mullard Space Science Laboratory (UK)
- Physikalisch-Meteorologisches Observatorium Davos, WRC (S)
- Max Planck Institute for Solar System Research (G)

More EUI?

- Rochus et al 2020, AA, (almost) accepted


The Solar Orbiter EUI instrument: The Extreme Ultraviolet Imager

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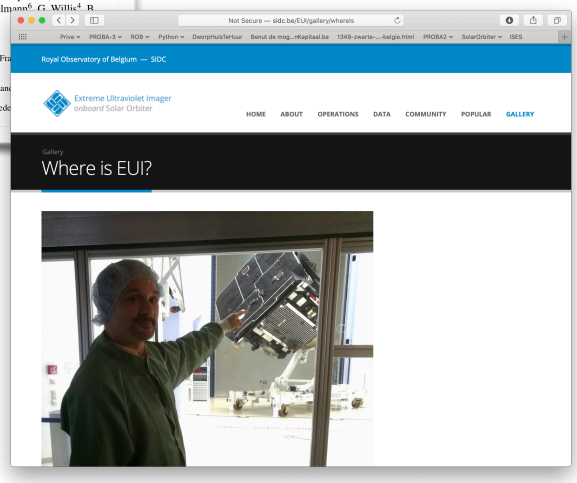

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