Hands-on-Session 1: JHelioviewer

David Berghmans, Royal Observatory of Belgium

1st European solar physics division (ESPD) summerschool: Energisation and heating in the solar plasma, Dubrovnik, 2024 April 29

An introduction to JHelioviewer functionalities

- 14:30 intro & basics
- 15:00 image processing
- 15:30 input/output

- 16:30 physics support
- 17:00 study an event
- … till 18:00: online Q&A

Each 30 min block:

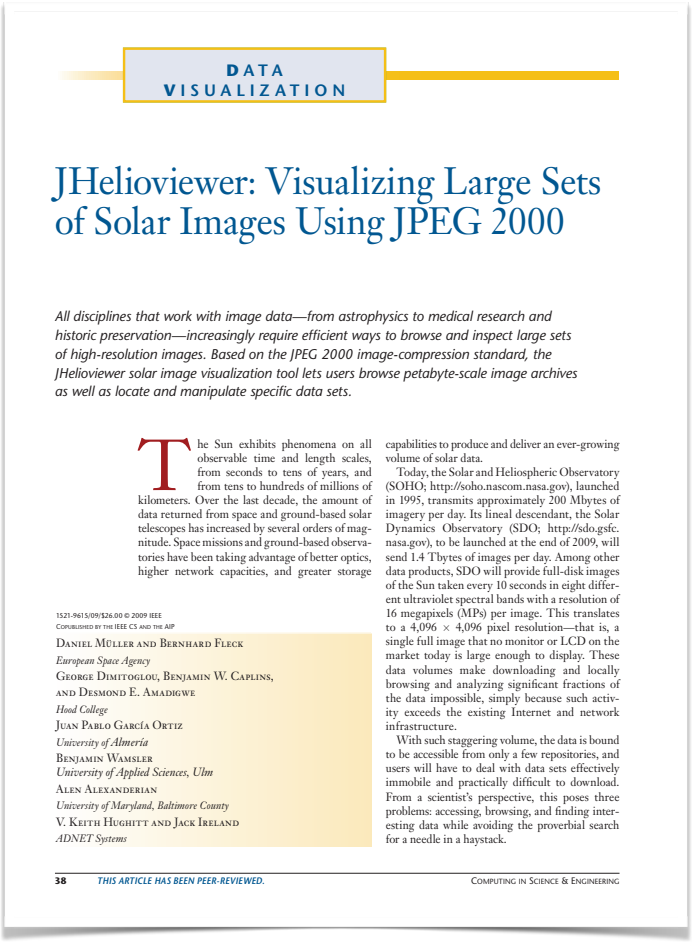
- Intro
- demo
- do-it-yourself

All Questions: Slack

- ESPDschool2024
- #jhelioviewer_questions_and_answers

JHelioviewer intro & basics

2009, Daniel Mueller et al:
How can the user visualise the daily TB of SDO images?



DATA VISUALIZATION

JHelioviewer: Visualizing Large Sets of Solar Images Using JPEG 2000

All disciplines that work with image data—from astrophysics to medical research and historic preservation—increasingly require efficient ways to browse and inspect large sets of high-resolution images. Based on the JPEG 2000 image-compression standard, the JHelioviewer solar image visualization tool lets users browse petabyte-scale image archives as well as locate and manipulate specific data sets.

The Sun exhibits phenomena on all observable time and length scales, from seconds to tens of years, and from tens to hundreds of millions of kilometers. Over the last decade, the amount of data returned from space and ground-based solar telescopes has increased by several orders of magnitude. Space missions and ground-based observatories have been taking advantage of better optics, higher network capacities, and greater storage capabilities to produce and deliver an ever-growing volume of solar data.

Today, the Solar and Heliospheric Observatory (SOHO; http://soho.nascom.nasa.gov), launched in 1995, transmits approximately 200 Mbytes of imagery per day. Its lineal descendant, the Solar Dynamics Observatory (SDO; http://sdo.gsfc.nasa.gov), to be launched at the end of 2009, will send 1.4 Tbytes of images per day. Among other data products, SDO will provide full-disk images of the Sun taken every 10 seconds in eight different ultraviolet spectral bands with a resolution of 16 megapixels (MPs) per image. This translates to a 4,096 × 4,096 pixel resolution—that is, a single full image that no monitor or LCD on the market today is large enough to display. These data volumes make downloading and locally browsing and analyzing significant fractions of the data impossible, simply because such activity exceeds the existing Internet and network infrastructure.

With such staggering volume, the data is bound to be accessible from only a few repositories, and users will have to deal with data sets effectively immobile and practically difficult to download. From a scientist's perspective, this poses three problems: accessing, browsing, and finding interesting data while avoiding the proverbial search for a needle in a haystack.

1521-9615/09/$26.00 © 2009 IEEE
Copublished by the IEEE CS and the AIP

Daniel Müller and Bernhard Fleck
European Space Agency
George Dimitoglou, Benjamin W. Caplins, and Desmond E. Amadigwe
Hood College
Juan Pablo García Ortiz
University of Almería
Benjamin Wamsler
University of Applied Sciences, Ulm
Alen Alexanderian
University of Maryland, Baltimore County
V. Keith Hughitt and Jack Ireland
ADNET Systems

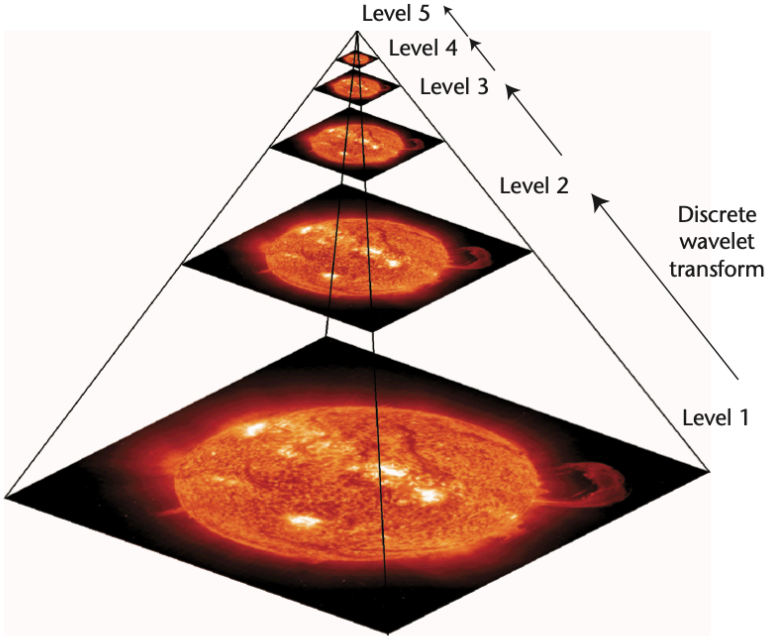
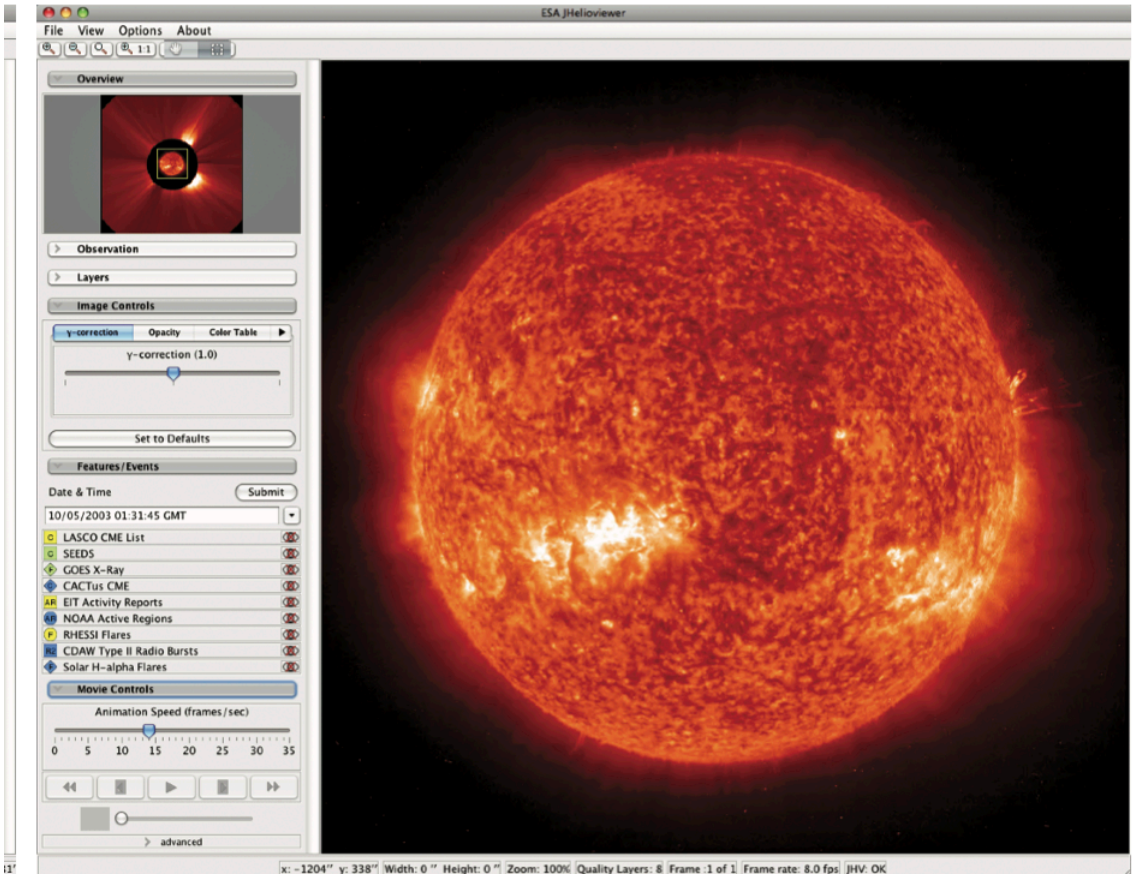


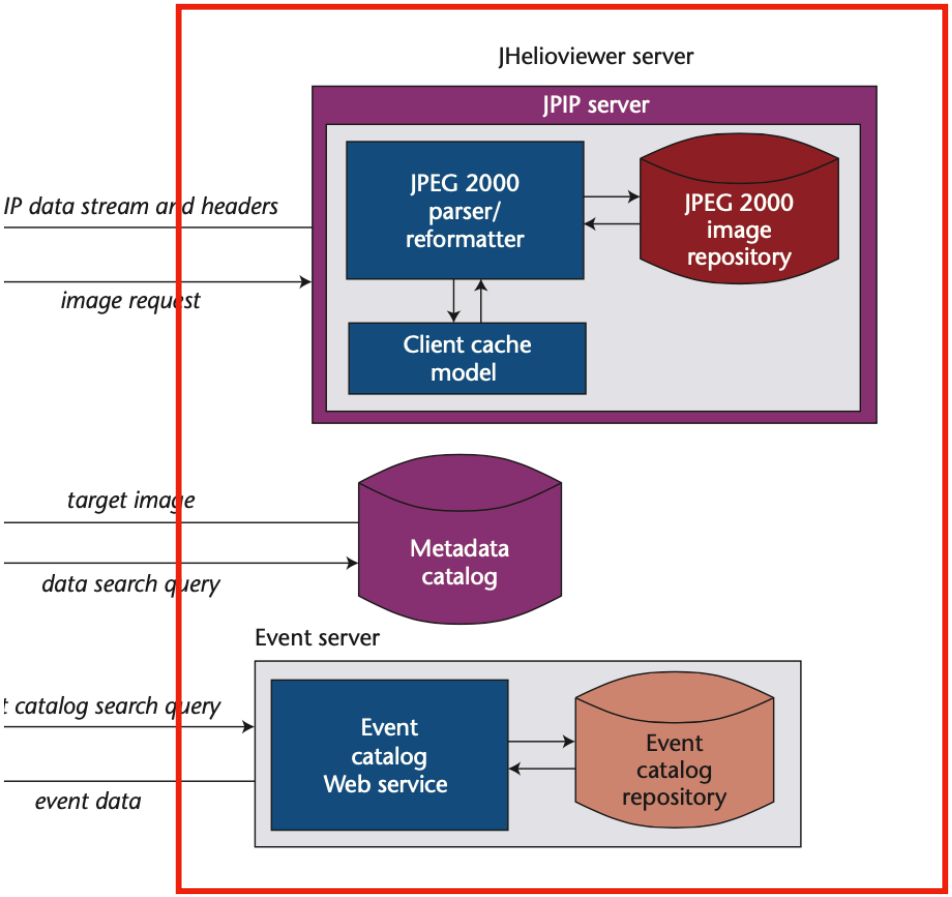
Figure 2. JPEG 2000 pyramid of image representations. Starting from the original image, each resolution level is constructed by applying a discrete wavelet transform to the level below.

2009, Daniel Mueller et al:
How can the user visualise the daily TB of SDO images?

Application on your own computer



Server at Goddard NASA (GSFC)



>2017: “Space Weather JHelioviewer”

A&A 606, A10 (2017)
DOI: 10.1051/0004-6361/201730893

Astronomy & Astrophysics

JHelioviewer

Time-dependent 3D visualisation of solar and heliospheric data

D. Müller[1], B. Nicula[2], S. Felix[3], F. Verstringe[2], B. Bourgoignie[2], A. Csillaghy[3], D. Berghmans[2], P. Jiggens[1], J. P. García-Ortiz[4], J. Ireland[5], S. Zahniy[5], and B. Fleck[6]

[1] European Space Agency, ESTEC, PO Box 299, 2200 AG Noordwijk, The Netherlands
e-mail: Daniel.Mueller@esa.int
[2] Royal Observatory of Belgium, Ringlaan – 3 – Av. Circulaire, 1180 Brussels, Belgium
[3] University of Applied Sciences Northwestern Switzerland, 5210 Windisch, Switzerland
[4] Department of Informatics, University of Almería, 04120 Almería, Spain
[5] ADNET Systems Inc., NASA Goddard Space Flight Center, Greenbelt, MD 20771, USA
[6] ESA Operations Department, c/o NASA Goddard Space Flight Center, Greenbelt, MD 20771, USA

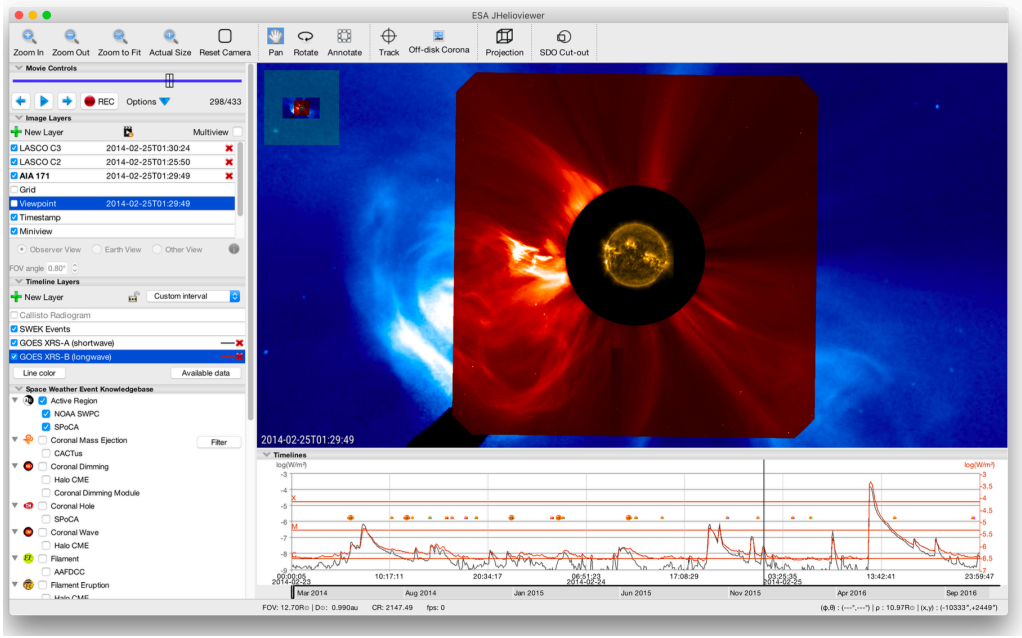
Received 30 March 2017 / Accepted 15 May 2017

ABSTRACT

Context. Solar observatories are providing the world-wide community with a wealth of data, covering wide time ranges (e.g. Solar and Heliospheric Observatory, SOHO), multiple viewpoints (Solar TErrestrial RElations Observatory, STEREO), and returning large amounts of data (Solar Dynamics Observatory, SDO). In particular, the large volume of SDO data presents challenges; the data are available only from a few repositories, and full-disk, full-cadence data for reasonable durations of scientific interest are difficult to download, due to their size and the download rates available to most users. From a scientist's perspective this poses three problems: accessing, browsing, and finding interesting data as efficiently as possible.
Aims. To address these challenges, we have developed JHelioviewer, a visualisation tool for solar data based on the JPEG 2000 compression standard and part of the open source ESA/NASA Helioviewer Project. Since the first release of JHelioviewer in 2009, the scientific functionality of the software has been extended significantly, and the objective of this paper is to highlight these improvements.
Methods. The JPEG 2000 standard offers useful new features that facilitate the dissemination and analysis of high-resolution image data and offers a solution to the challenge of efficiently browsing petabyte-scale image archives. The JHelioviewer software is open source, platform independent, and extendable via a plug-in architecture.
Results. With JHelioviewer, users can visualise the Sun for any time period between September 1991 and today; they can perform basic image processing in real time, track features on the Sun, and interactively overlay magnetic field extrapolations. The software integrates solar event data and a timeline display. Once an interesting event has been identified, science quality data can be accessed for in-depth analysis. As a first step towards supporting science planning of the upcoming Solar Orbiter mission, JHelioviewer offers a virtual camera model that enables users to set the vantage point to the location of a spacecraft or celestial body at any given time.

Key words. Sun: general – Sun: activity – virtual observatory tools – methods: observational – methods: data analysis – methods: numerical

Main developer: Bogdan Nicula (ROB)



>2017: “~~Space Weather~~ JHelioviewer”

A&A 606, A10 (2017)
DOI: 10.1051/0004-6361/201730893

Astronomy & Astrophysics

JHelioviewer

Time-dependent 3D visualisation of solar and heliospheric data

D. Müller[1], B. Nicula[2], S. Felix[3], F. Verstringe[2], B. Bourgoignie[2], A. Csillaghy[3], D. Berghmans[2], P. Jiggens[1], J. P. García-Ortiz[4], J. Ireland[5], S. Zahniy[5], and B. Fleck[6]

[1] European Space Agency, ESTEC, PO Box 299, 2200 AG Noordwijk, The Netherlands
e-mail: Daniel.Mueller@esa.int
[2] Royal Observatory of Belgium, Ringlaan – 3 – Av. Circulaire, 1180 Brussels, Belgium
[3] University of Applied Sciences Northwestern Switzerland, 5210 Windisch, Switzerland
[4] Department of Informatics, University of Almería, 04120 Almería, Spain
[5] ADNET Systems Inc., NASA Goddard Space Flight Center, Greenbelt, MD 20771, USA
[6] ESA Operations Department, c/o NASA Goddard Space Flight Center, Greenbelt, MD 20771, USA

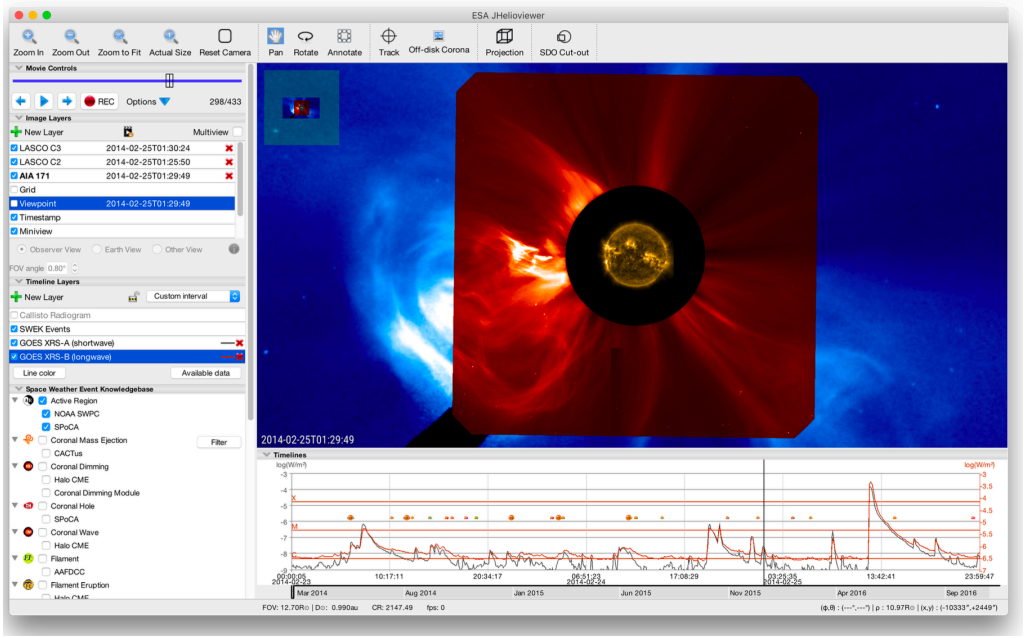
Received 30 March 2017 / Accepted 15 May 2017

ABSTRACT

Context. Solar observatories are providing the world-wide community with a wealth of data, covering wide time ranges (e.g. Solar and Heliospheric Observatory, SOHO), multiple viewpoints (Solar TErrestrial RElations Observatory, STEREO), and returning large amounts of data (Solar Dynamics Observatory, SDO). In particular, the large volume of SDO data presents challenges; the data are available only from a few repositories, and full-disk, full-cadence data for reasonable durations of scientific interest are difficult to download, due to their size and the download rates available to most users. From a scientist's perspective this poses three problems: accessing, browsing, and finding interesting data as efficiently as possible.
Aims. To address these challenges, we have developed JHelioviewer, a visualisation tool for solar data based on the JPEG 2000 compression standard and part of the open source ESA/NASA Helioviewer Project. Since the first release of JHelioviewer in 2009, the scientific functionality of the software has been extended significantly, and the objective of this paper is to highlight these improvements.
Methods. The JPEG 2000 standard offers useful new features that facilitate the dissemination and analysis of high-resolution image data and offers a solution to the challenge of efficiently browsing petabyte-scale image archives. The JHelioviewer software is open source, platform independent, and extendable via a plug-in architecture.
Results. With JHelioviewer, users can visualise the Sun for any time period between September 1991 and today; they can perform basic image processing in real time, track features on the Sun, and interactively overlay magnetic field extrapolations. The software integrates solar event data and a timeline display. Once an interesting event has been identified, science quality data can be accessed for in-depth analysis. As a first step towards supporting science planning of the upcoming Solar Orbiter mission, JHelioviewer offers a virtual camera model that enables users to set the vantage point to the location of a spacecraft or celestial body at any given time.

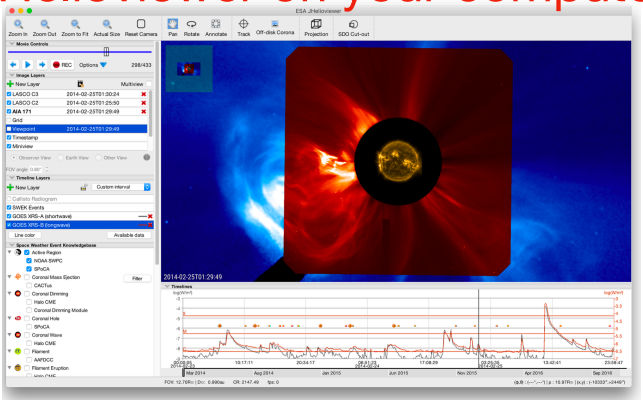
Key words. Sun: general – Sun: activity – virtual observatory tools – methods: observational – methods: data analysis – methods: numerical

Main developer: Bogdan Nicula (ROB)



>2017: “~~Space Weather~~ JHelioviewer”

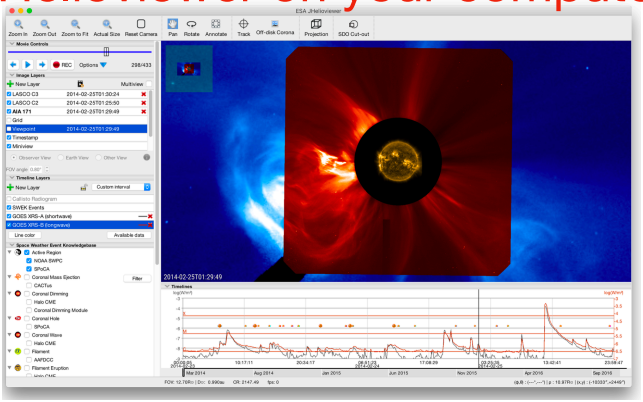
JHelioviewer on your computer



Server at (GSFC)

>2017: “~~Space Weather~~ JHelioviewer”

JHelioviewer on your computer



Server at (GSFC)

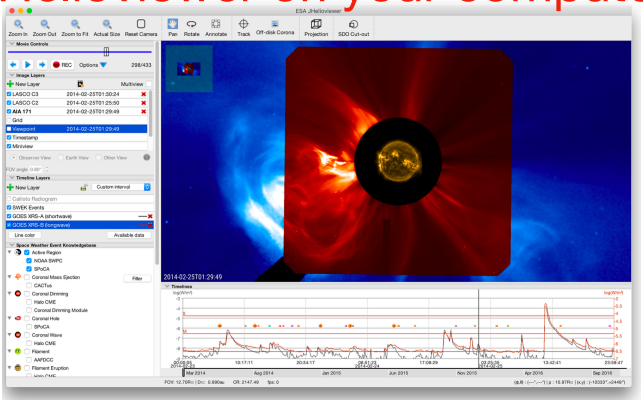
Server at IAS (Paris)

Server at ROB (Brussels)

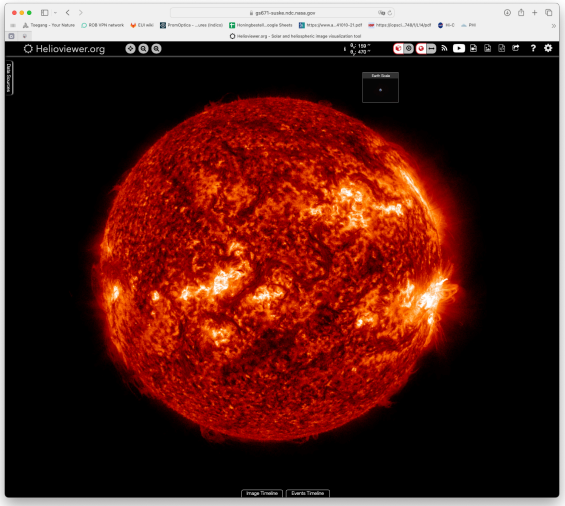
Server at ESAC (Madrid)

The Helioviewer landscape

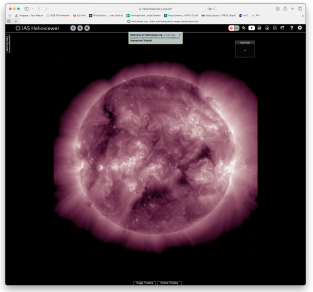
JHelioviewer on your computer



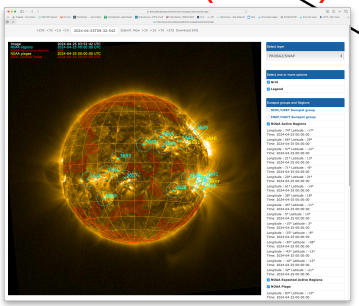
helioviewer.org (GSFC)



helioviewer.ias.u-psud.fr



sidc.be (ROB)



Server at (GSFC)

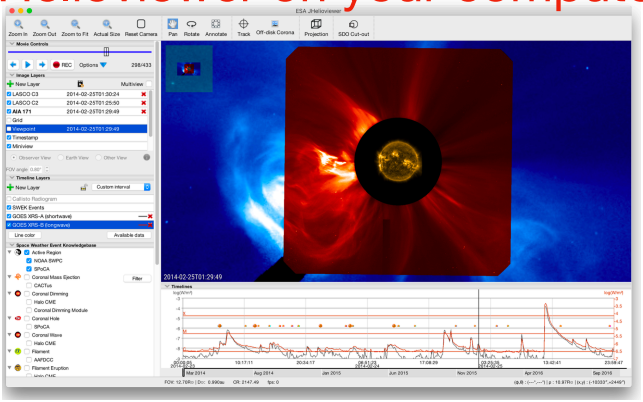
Server at IAS (Paris)

Server at ROB (Brussels)

Server at ESAC (Madrid)

The Helioviewer landscape

JHelioviewer on your computer



helioviewer.org (GSFC)

helioviewer.ias.u-psud.fr

sidc.be (ROB)

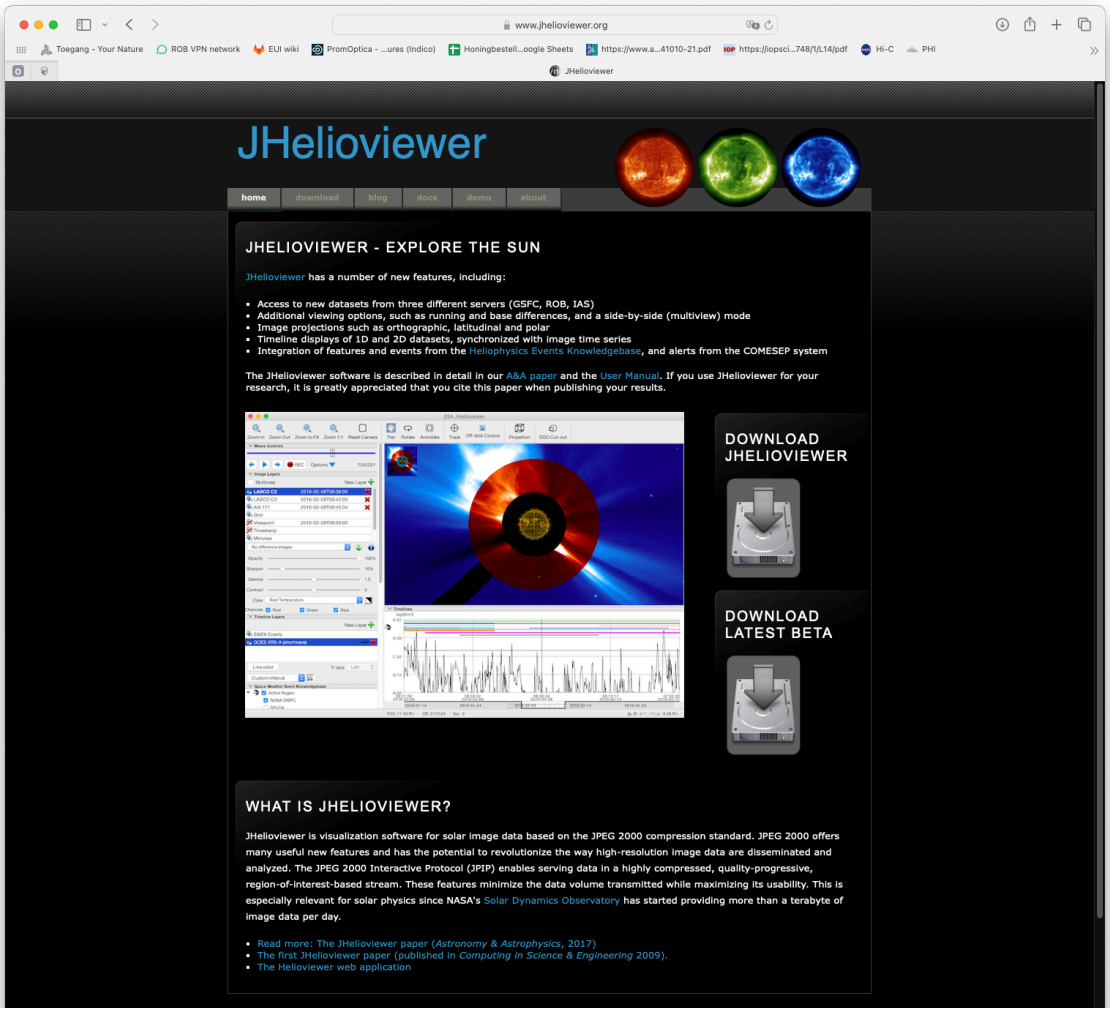
Server at (GSFC)

Server at IAS (Paris)

Server at ROB (Brussels)

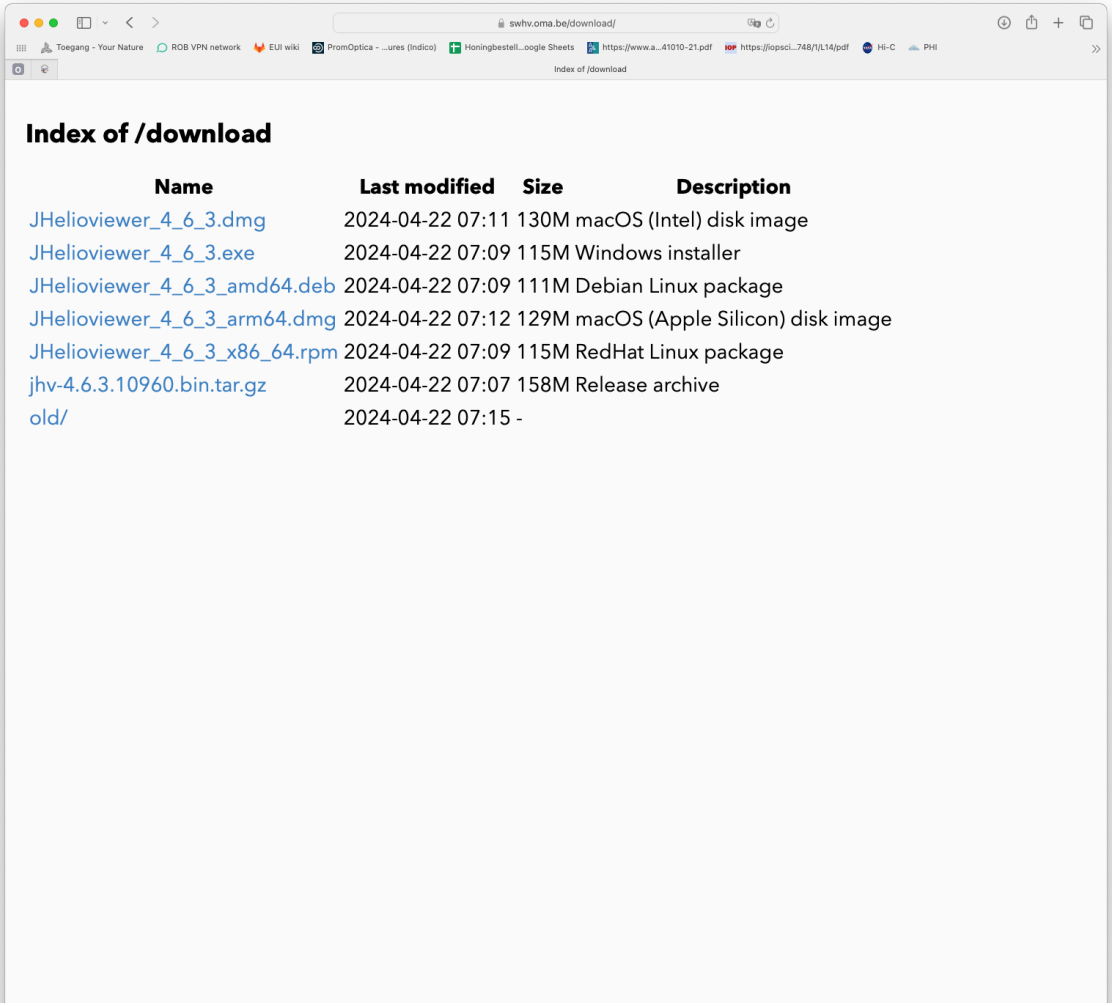
Server at ESAC (Madrid)

Download & Install



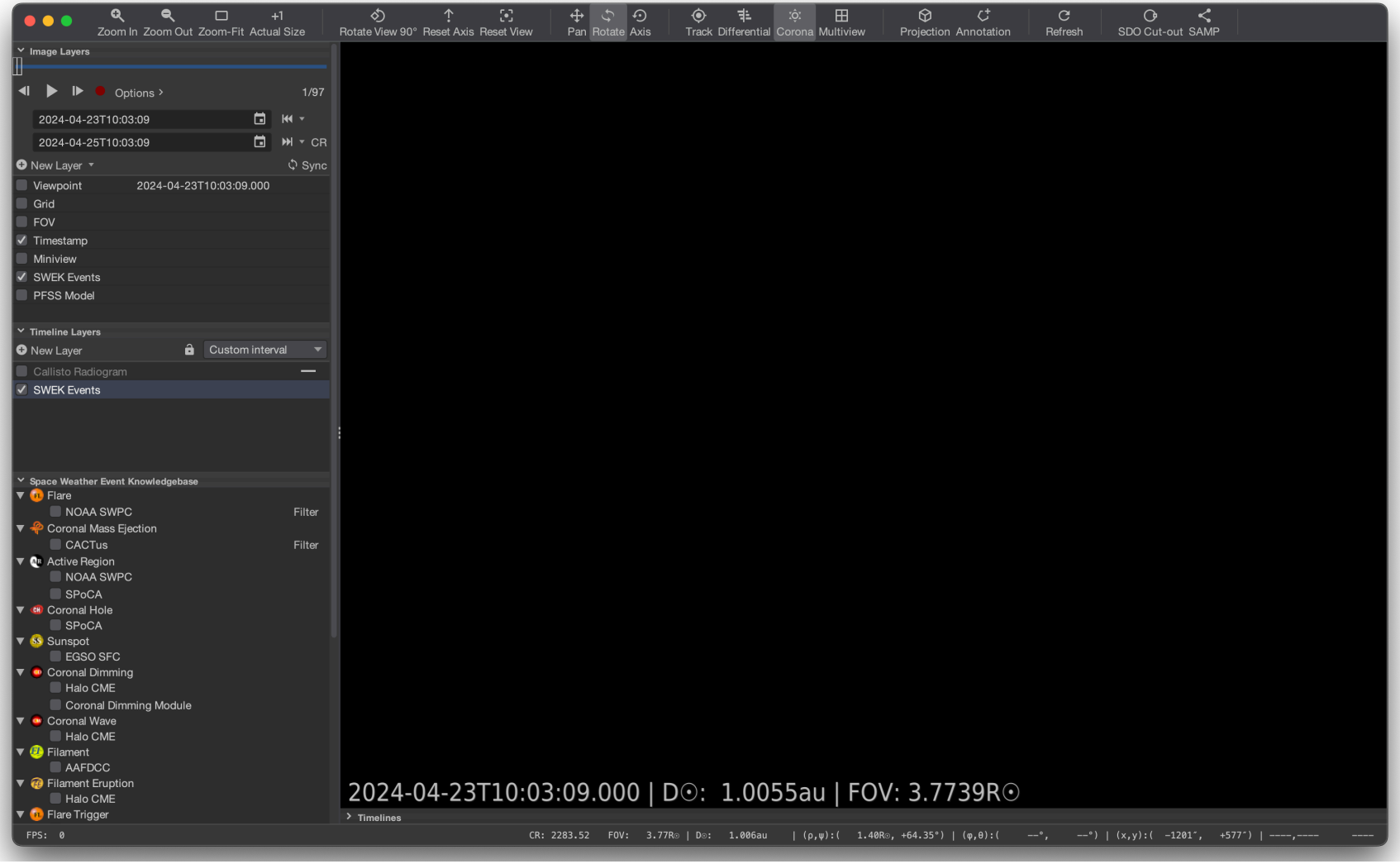
https://www.jhelioviewer.org/

Download & Install

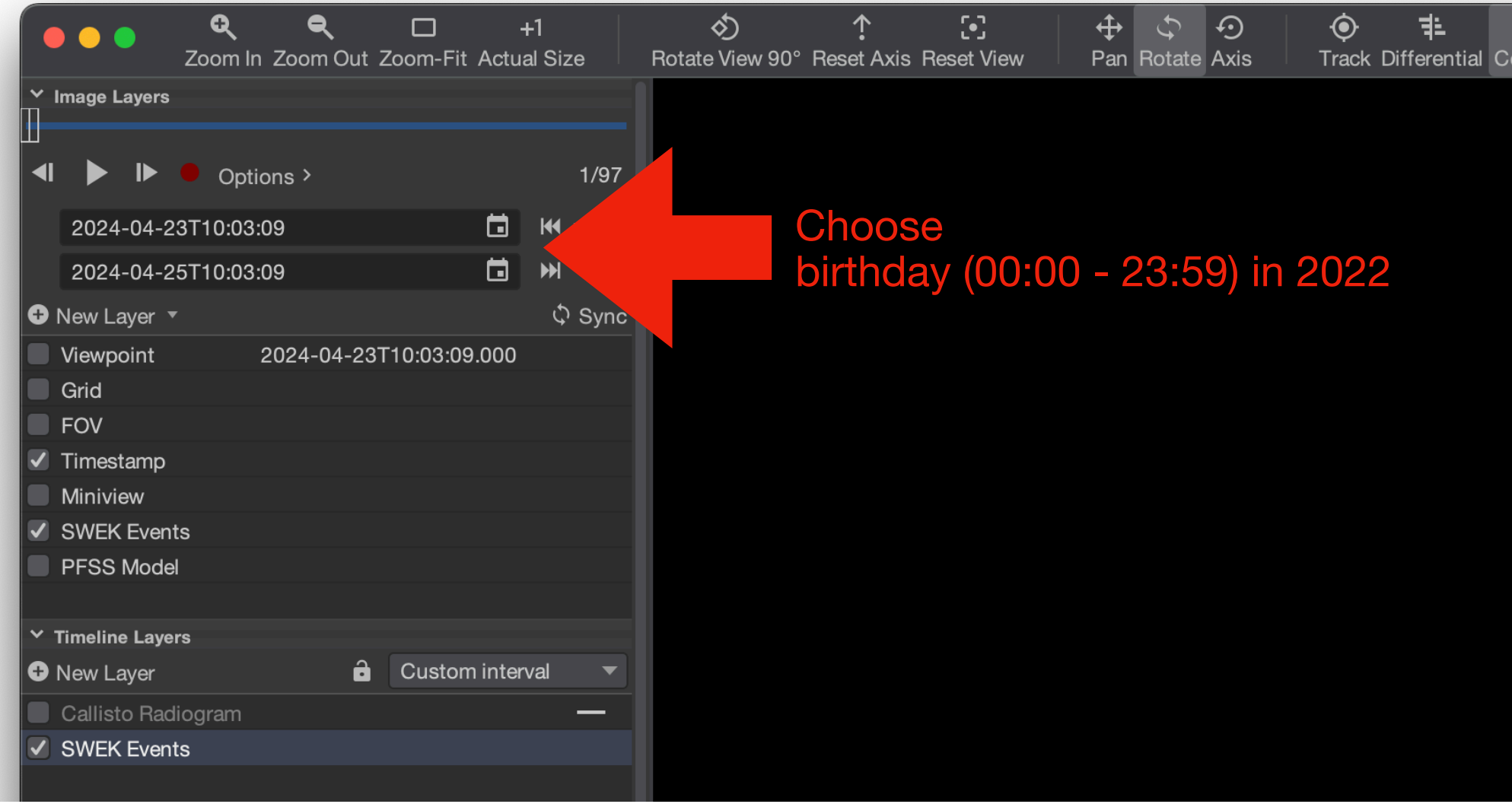


https://www.jhelioviewer.org/

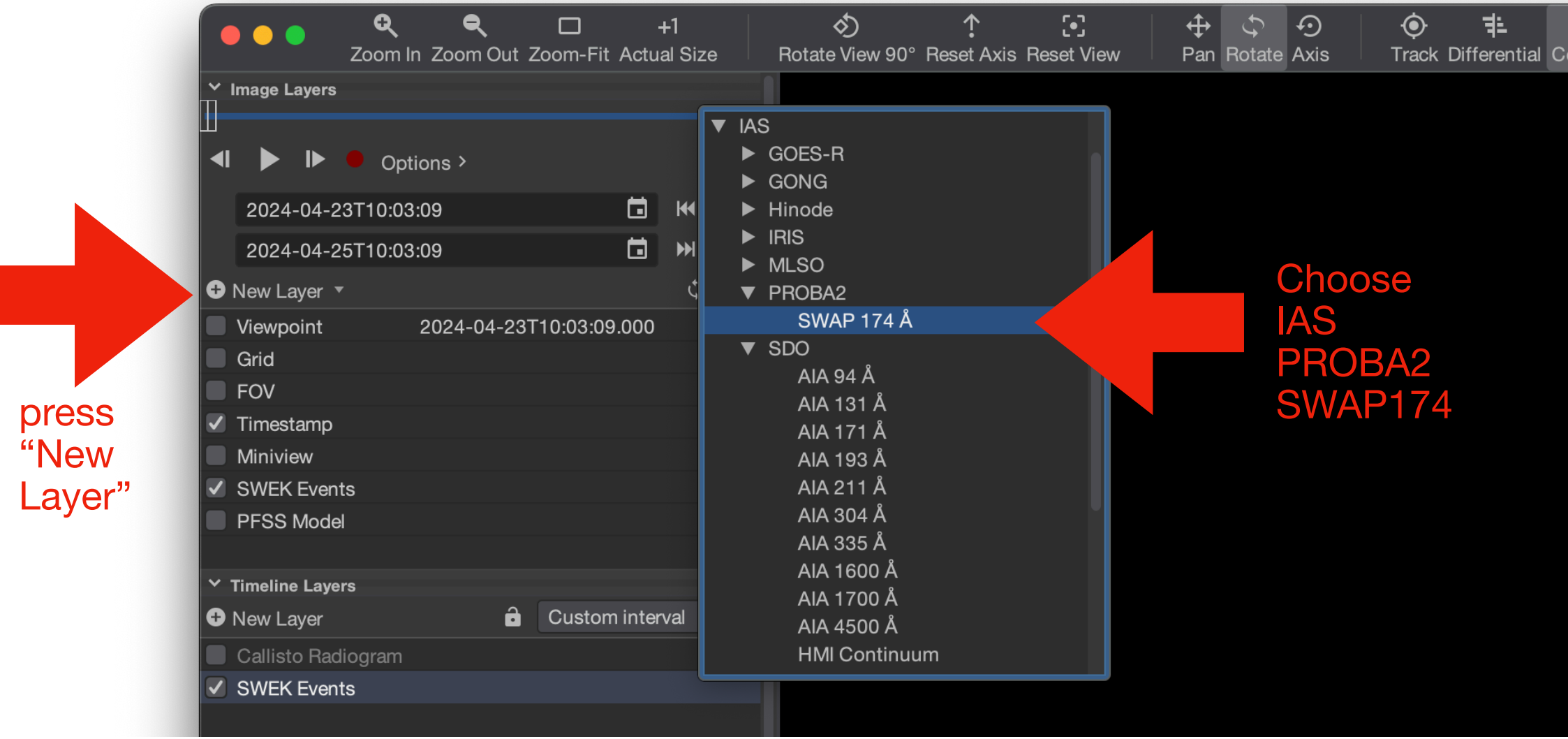
Start-it-up


Zoom In
Zoom Out
Zoom-Fit
Actual Size
Rotate View 90°
Reset Axis
Reset View
Pan
Rotate
Axis
Track
Differential
Corona
Multiview
Projection
Annotation
Refresh
SDO Cut-out
SAMP
Image Layers
Options
1/97
2024-04-23T10:03:09
2024-04-25T10:03:09
CR
New Layer
Sync
Viewpoint
2024-04-23T10:03:09.000
Grid
FOV
Timestamp
Miniview
SWEK Events
PFSS Model
Timeline Layers
New Layer
Custom interval
Callisto Radiogram
SWEK Events
Space Weather Event Knowledgebase
Flare
NOAA SWPC
Filter
Coronal Mass Ejection
CACTus
Filter
Active Region
NOAA SWPC
SPoCA
Coronal Hole
SPoCA
Sunspot
EGSO SFC
Coronal Dimming
Halo CME
Coronal Dimming Module
Coronal Wave
Halo CME
Filament
AAFDCC
Filament Eruption
Halo CME
Flare Trigger
2024-04-23T10:03:09.000 | D☉: 1.0055au | FOV: 3.7739R☉
Timelines
FPS: 0
CR: 2283.52
FOV: 3.77R☉ | D☉: 1.006au
| (ρ,ψ):(1.40R☉, +64.35°) | (φ,θ):(--°, --°) | (x,y):(-1201″, +577″) | ----,----

Load recent SWAP movie



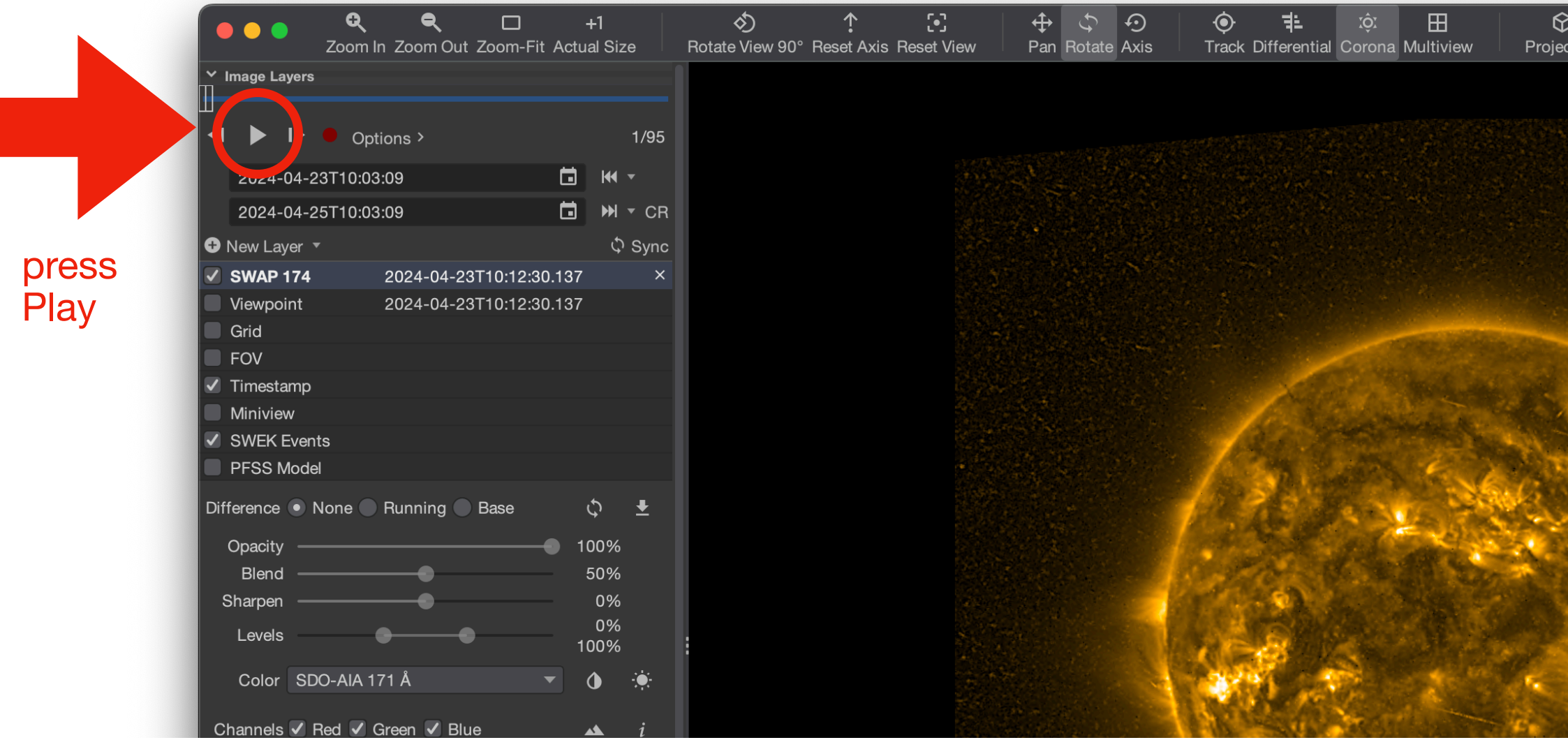
Load recent SWAP movie



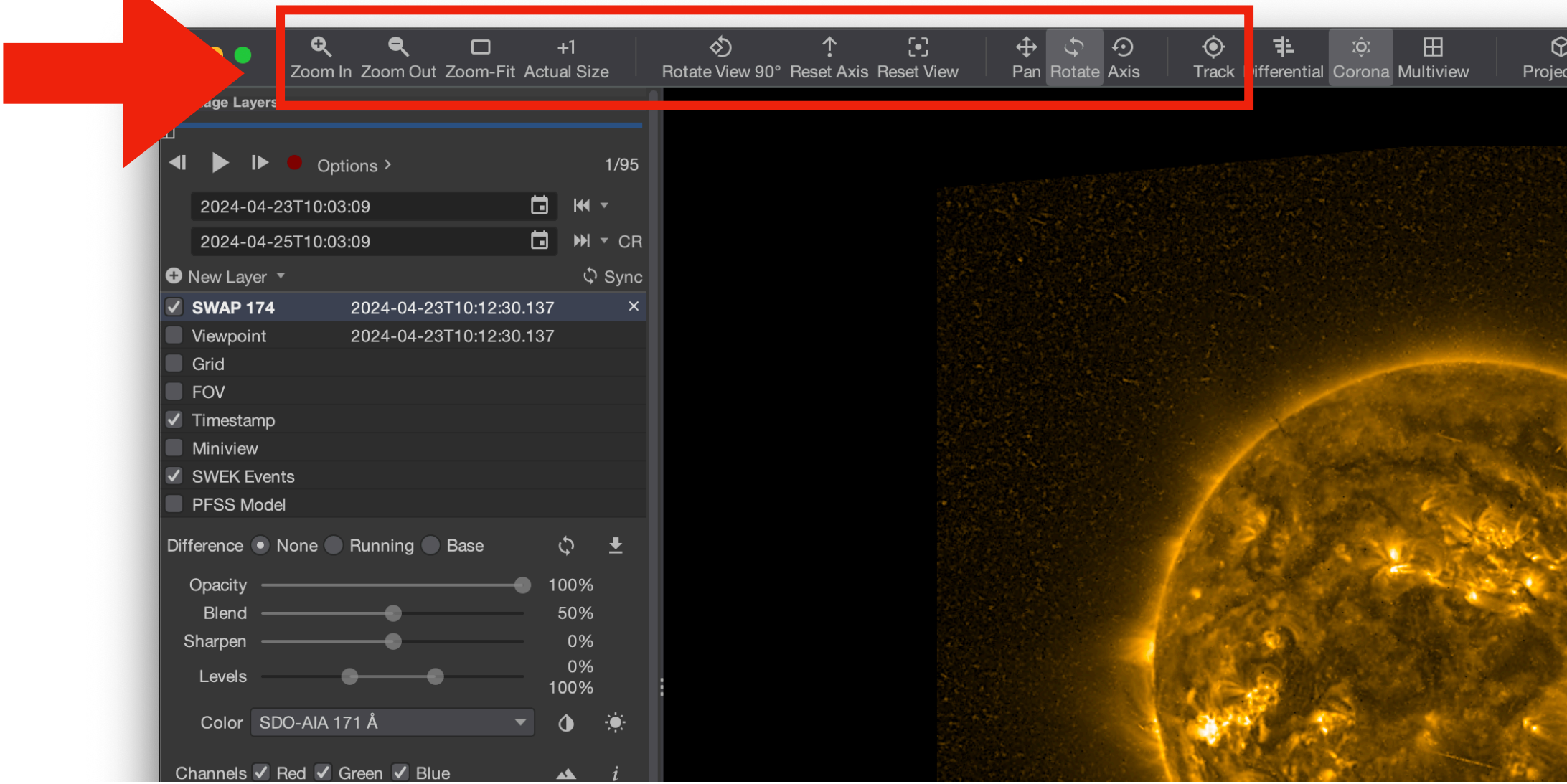
press "New Layer"

Choose IAS PROBA2 SWAP174

Play the movie



Toolbar: Manipulate the movie



Live demo

Do it yourself

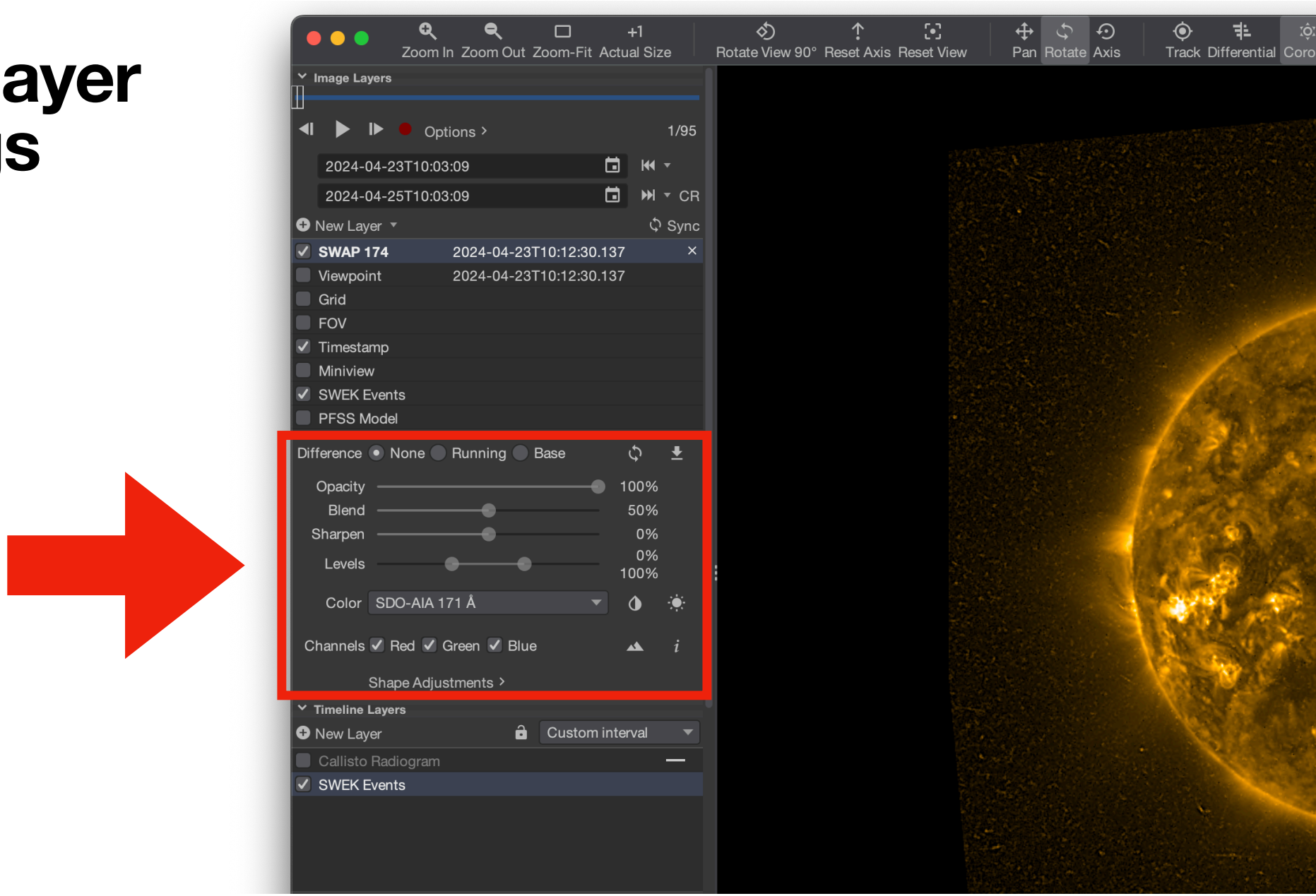
- install jHelioviewer from https://jhelioviewer.org
- start the application
- open SWAP movie (New Layer/IAS/PROBA2/SWAP) of your last birthday
- manipulate the movie

If you have spare time

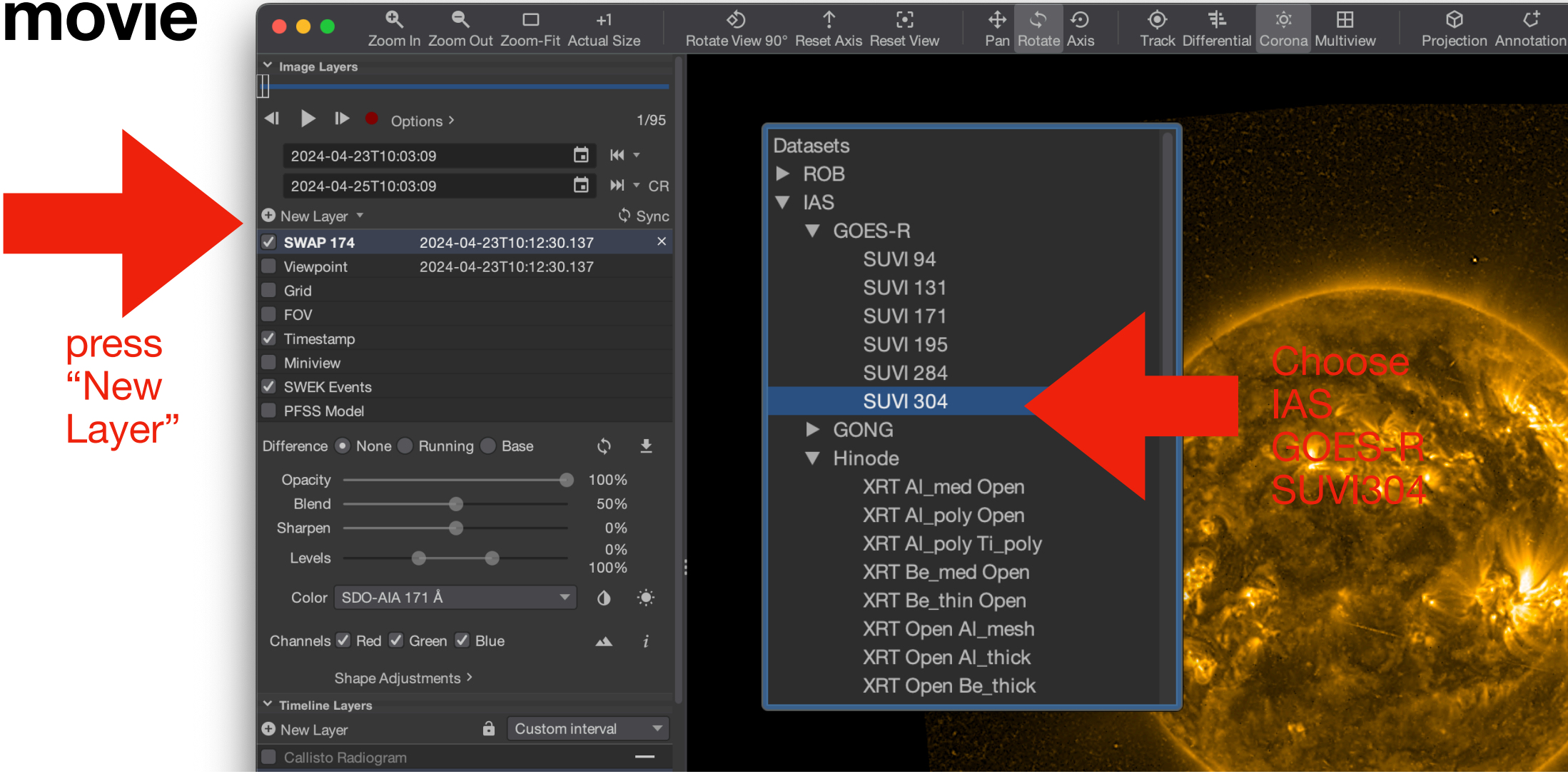
- discover new features in the user manual https://swhv.oma.be/user_manual/
- experiment with the alternative in-browser version: https://helioviewer.org

JHelioviewer image processing & combination

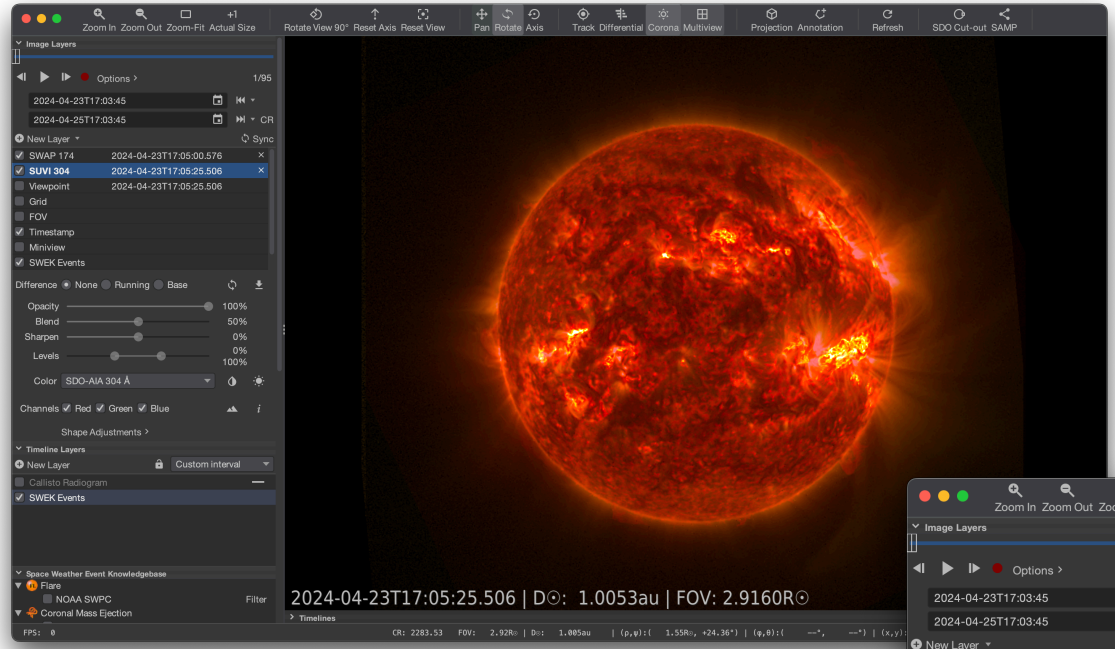
Image layer settings

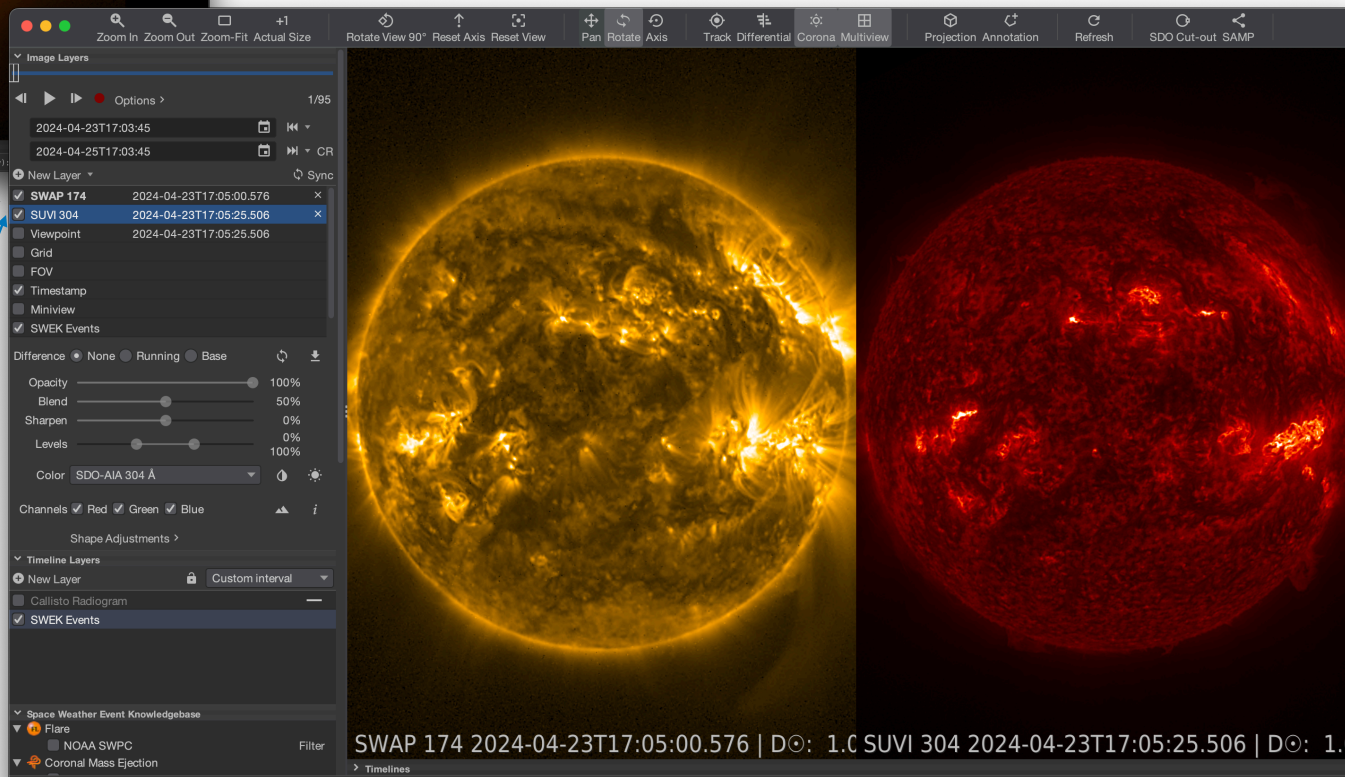


Load a second movie



multiview



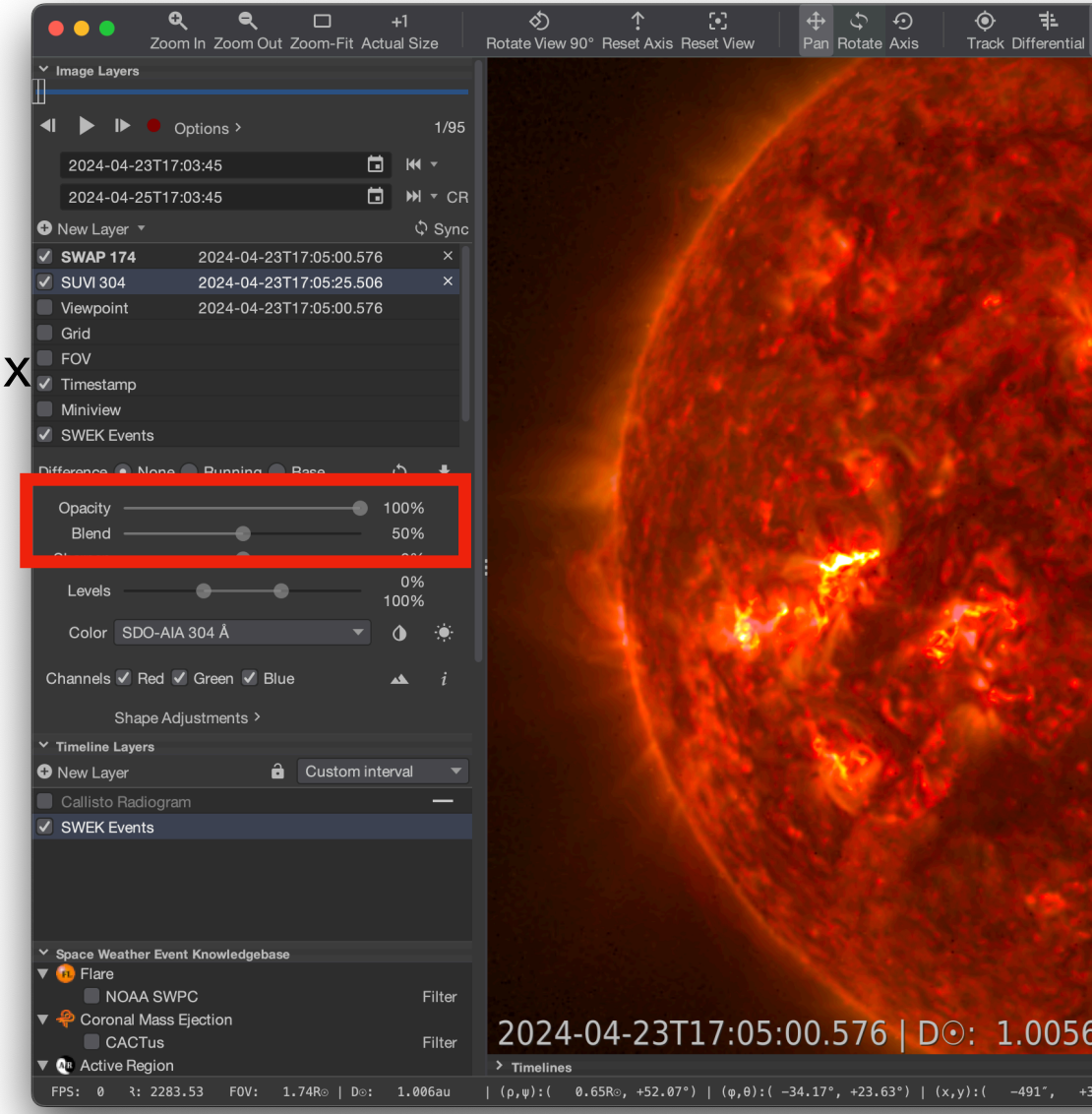


The image layer in bold is the Master determining the times when playing the movie

The ‘selected’ image layer in blue is the one for which the image layer settings apply

opacity is the brightness of the current layer in the mix of layers: decreasing this will make the current layer darker in the mix where-ever the current layer has signal

blending says how much the current layer dominates the lower layers: 100% means total dominance, nothing of the previous layers comes through



Live demo

Do it yourself

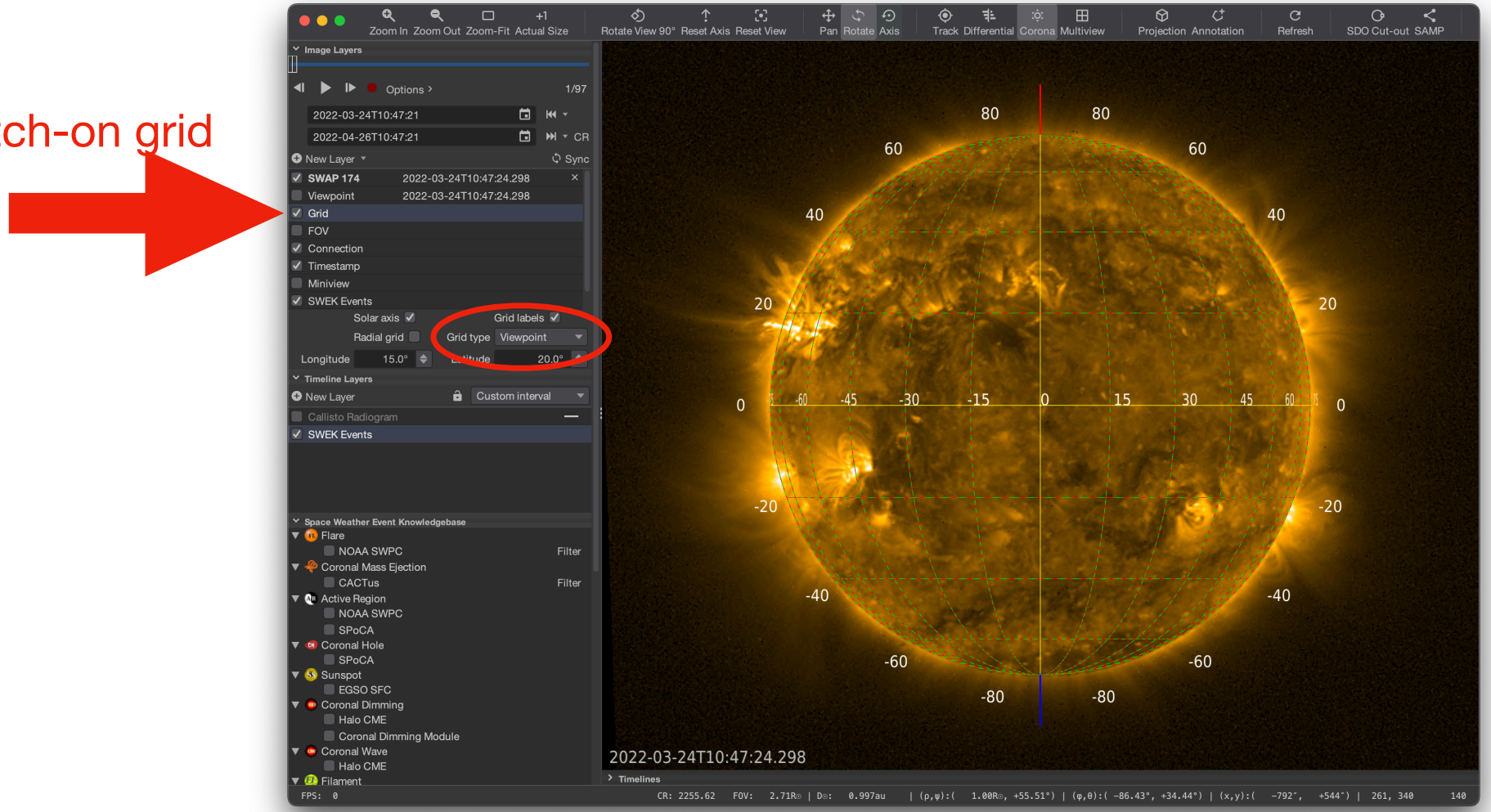
- Change brightness, color, contrast of your SWAP movie
- Load IAS/GOES-R/SUVI 304 data
- Experiment with Multiview, transparency, masking, etc

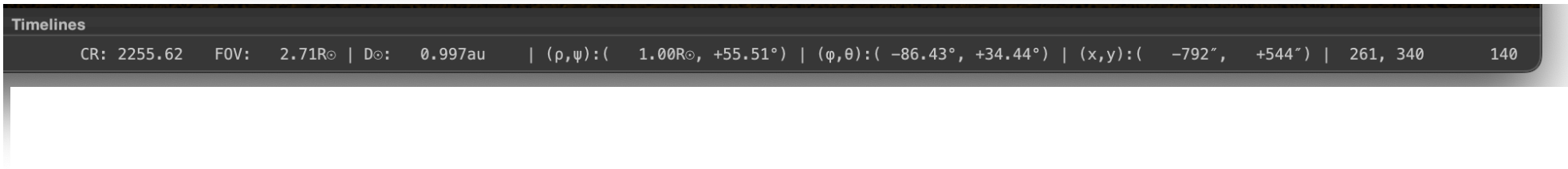
If you have spare time

- Combine your SWAP movie with LASCO C2
- Maximize the SWAP off-limb brightness but make sure that LASCO C2 is plotted on top (no transparency of the SWAP corners)

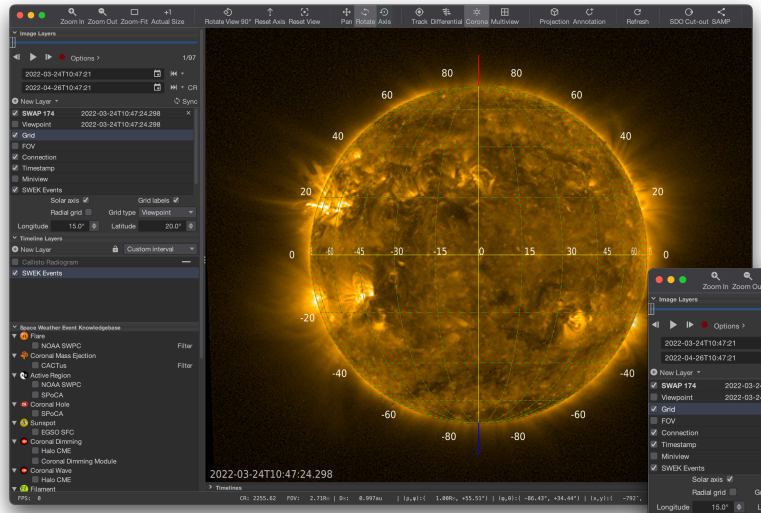
JHelioviewer grids & projections

Switch-on grid

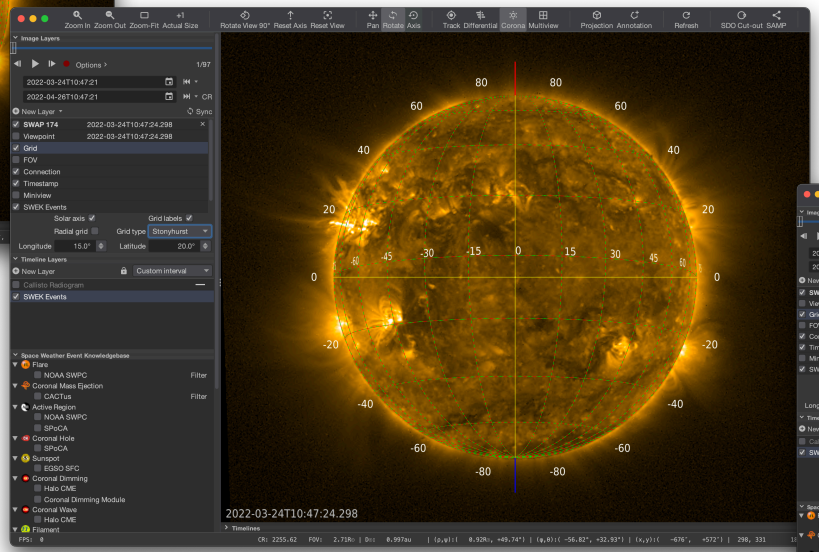




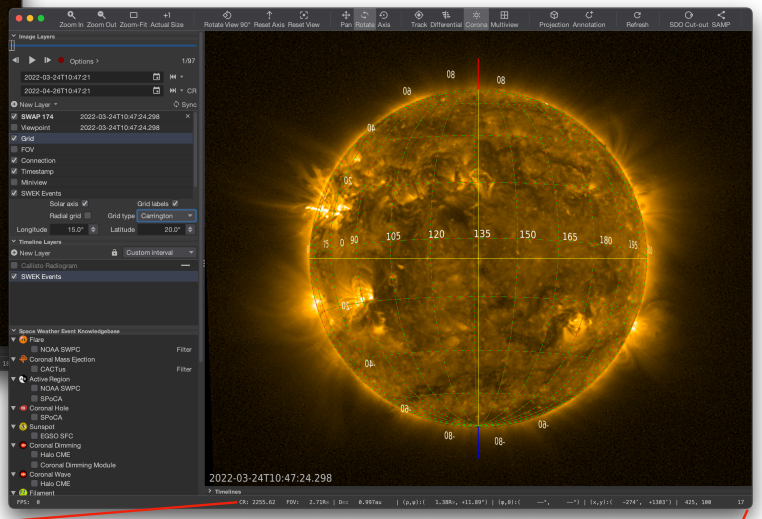
Grid type = Viewpoint

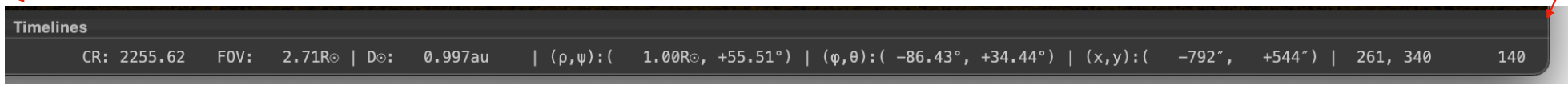


Grid type = Stonyhurst



Grid type = Carrington





Live demo

Do it yourself

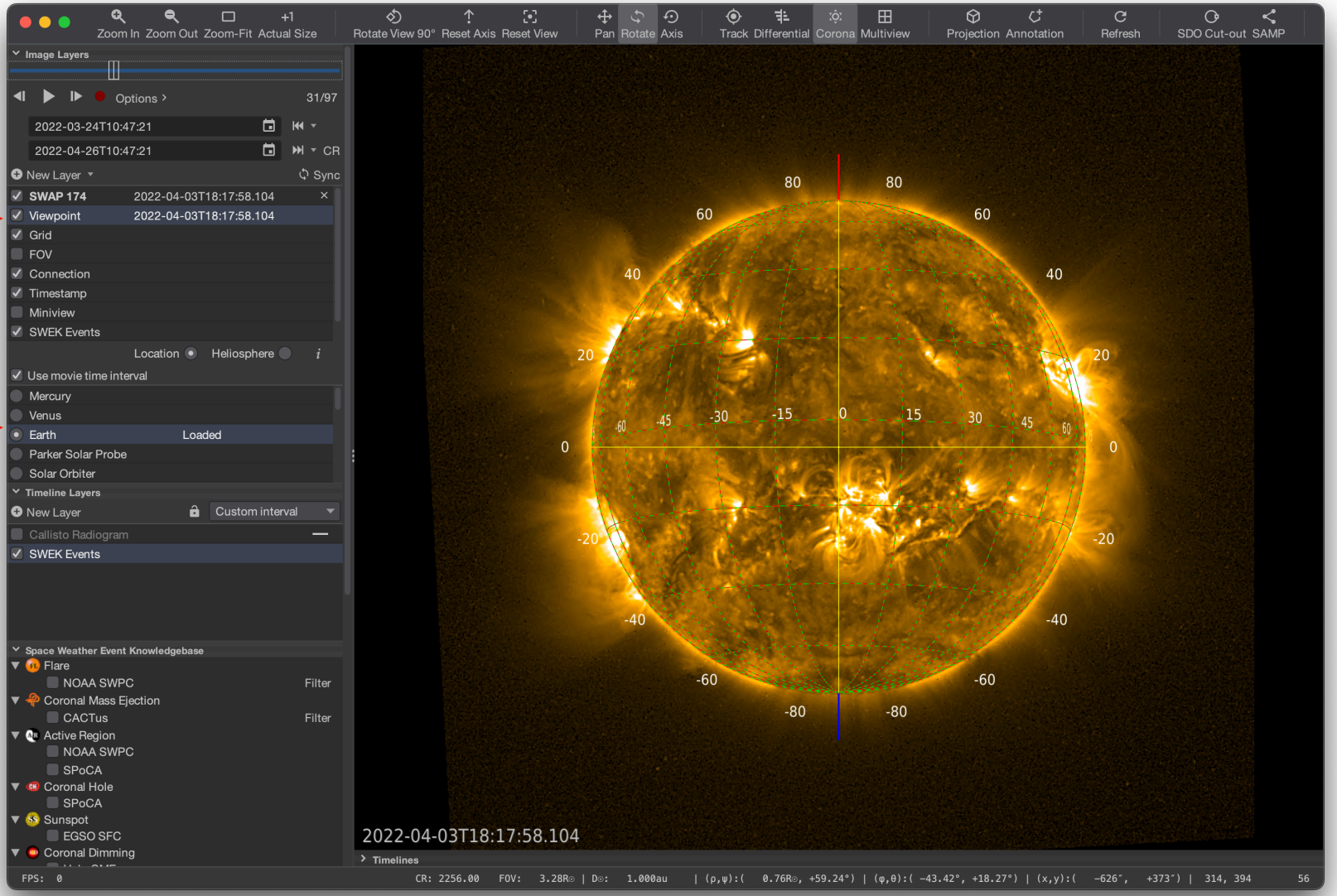
- Try out the 3 grid types
- Copy the pointer bar (right-click) to a text file

If you have spare time

- Try out the other grid options

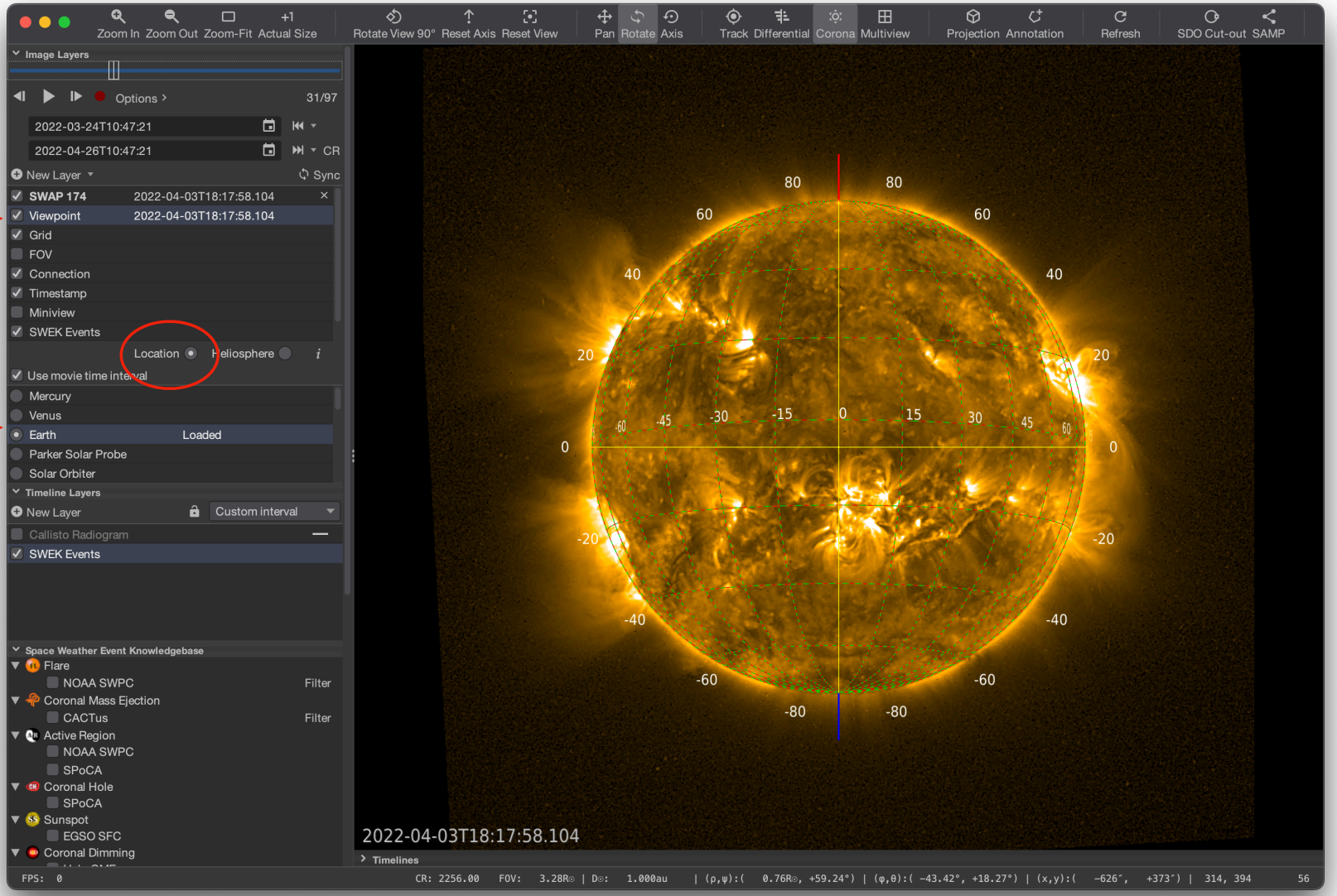
Viewpoint

Earth

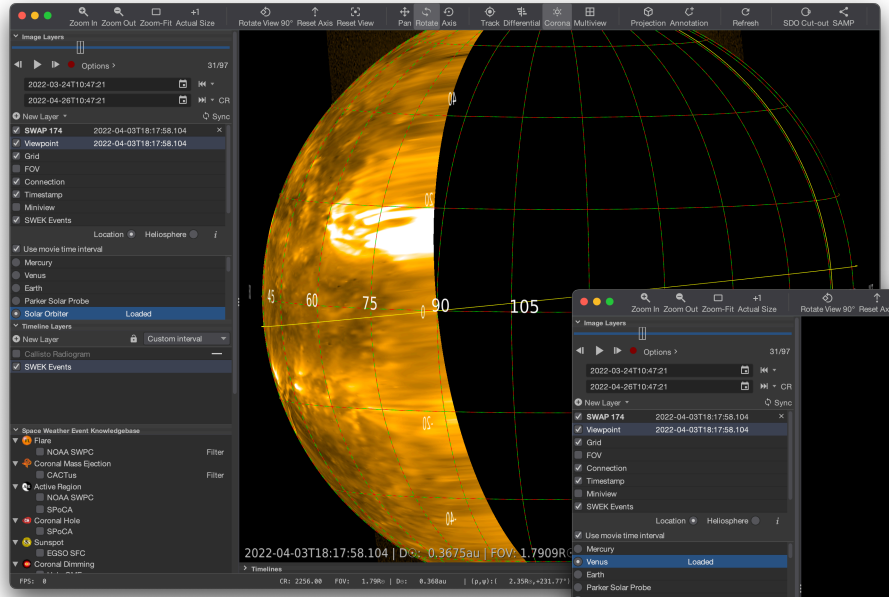


Viewpoint

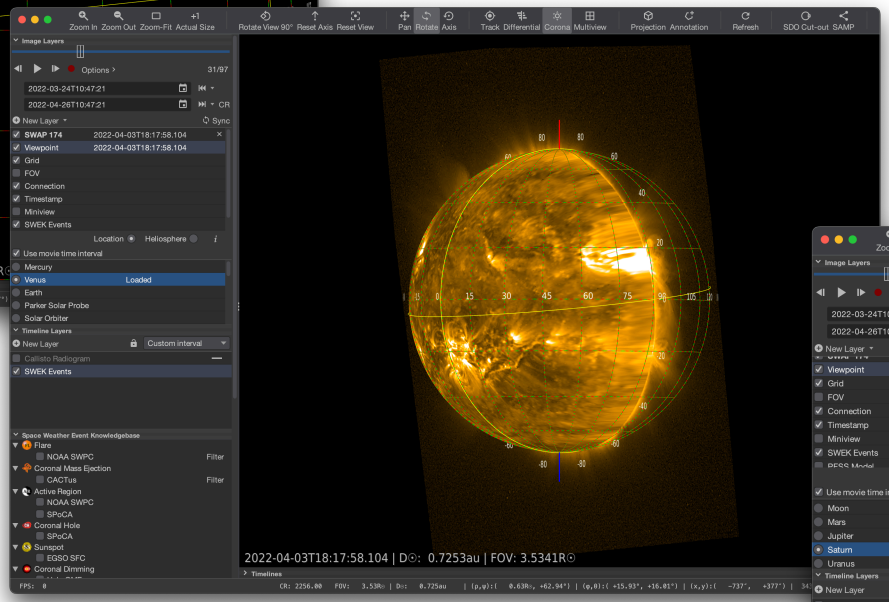
Earth



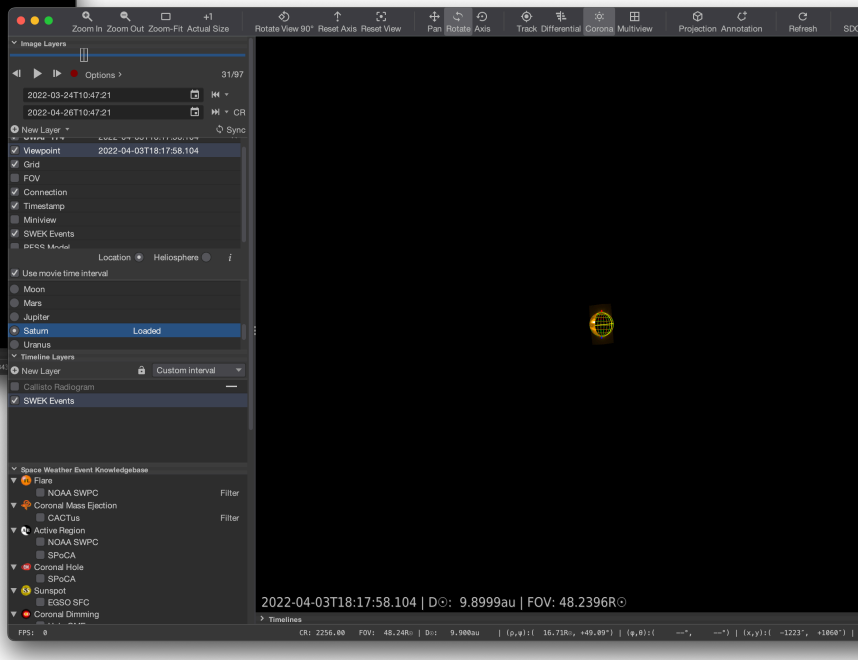
Viewpoint = Solar Orbiter



Viewpoint = Venus

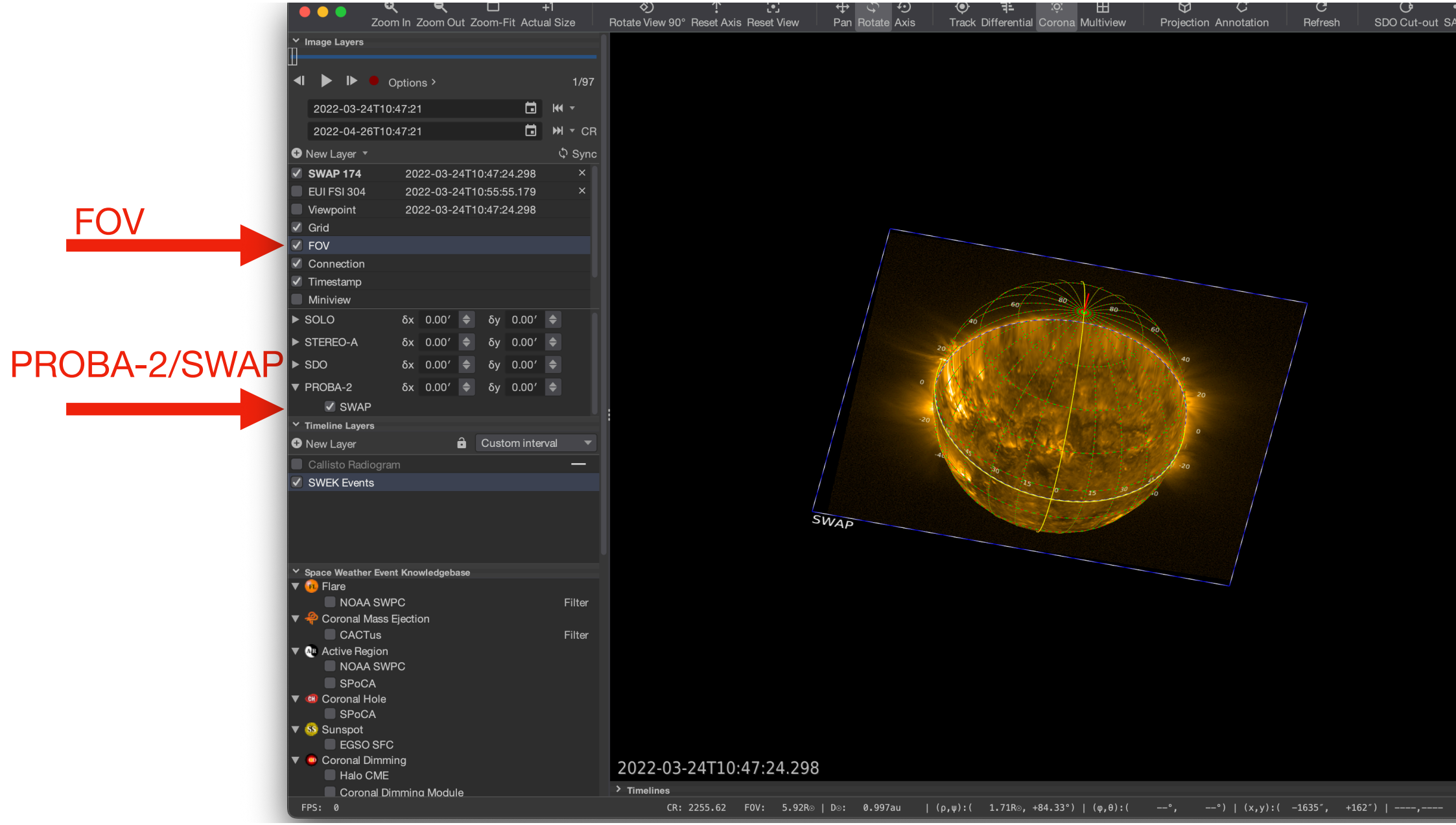


Viewpoint = Saturn

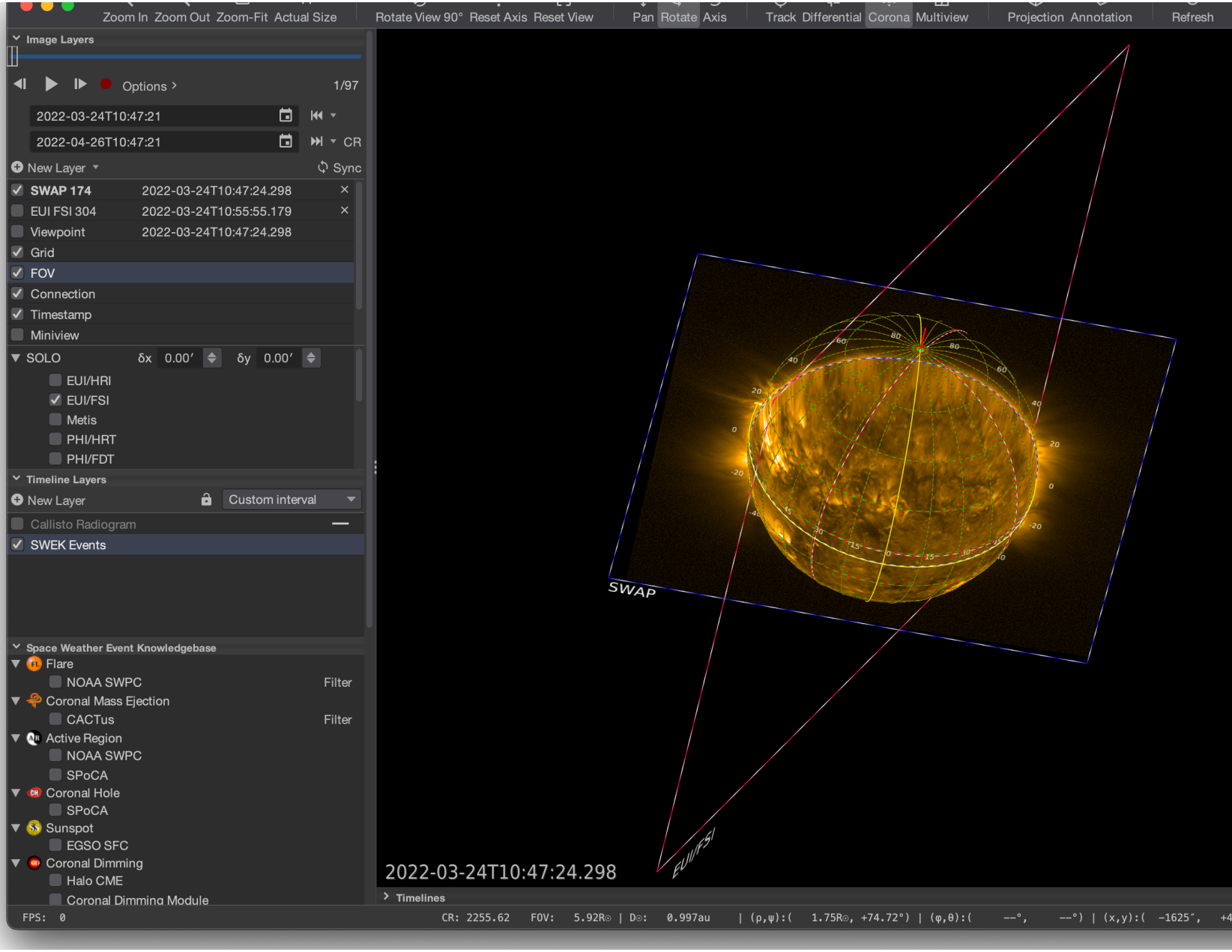


Play the movie!

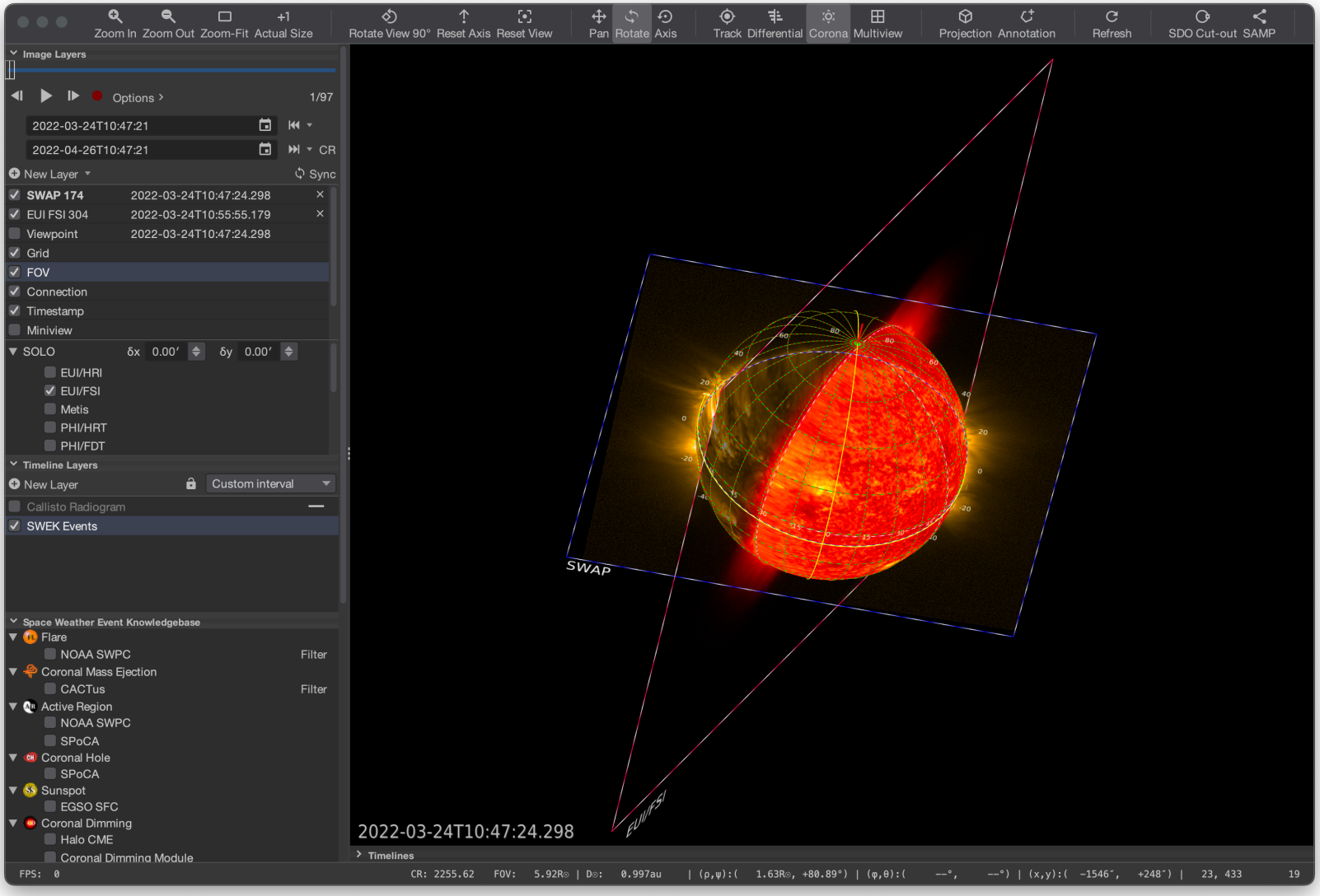
Live demo


FOV
PROBA-2/SWAP
Zoom In
Zoom Out
Zoom-Fit
Actual Size
Rotate View 90°
Reset Axis
Reset View
Pan
Rotate
Axis
Track
Differential
Corona
Multiview
Projection
Annotation
Refresh
SDO Cut-out
Image Layers
Options
1/97
2022-03-24T10:47:21
2022-04-26T10:47:21
CR
New Layer
Sync
SWAP 174 2022-03-24T10:47:24.298
EUI FSI 304 2022-03-24T10:55:55.179
Viewpoint 2022-03-24T10:47:24.298
Grid
FOV
Connection
Timestamp
Miniview
SOLO δx 0.00′ δy 0.00′
STEREO-A δx 0.00′ δy 0.00′
SDO δx 0.00′ δy 0.00′
PROBA-2 δx 0.00′ δy 0.00′
SWAP
Timeline Layers
New Layer
Custom interval
Callisto Radiogram
SWEK Events
Space Weather Event Knowledgebase
Flare
NOAA SWPC
Filter
Coronal Mass Ejection
CACTus
Filter
Active Region
NOAA SWPC
SPoCA
Coronal Hole
SPoCA
Sunspot
EGSO SFC
Coronal Dimming
Halo CME
Coronal Dimming Module
SWAP
2022-03-24T10:47:24.298
Timelines
FPS: 0
CR: 2255.62 FOV: 5.92R⊙ | D⊙: 0.997au | (ρ,ψ):(1.71R⊙, +84.33°) | (φ,θ):(--°, --°) | (x,y):(-1635″, +162″) | ----,----

SOLO/EUI/FSI

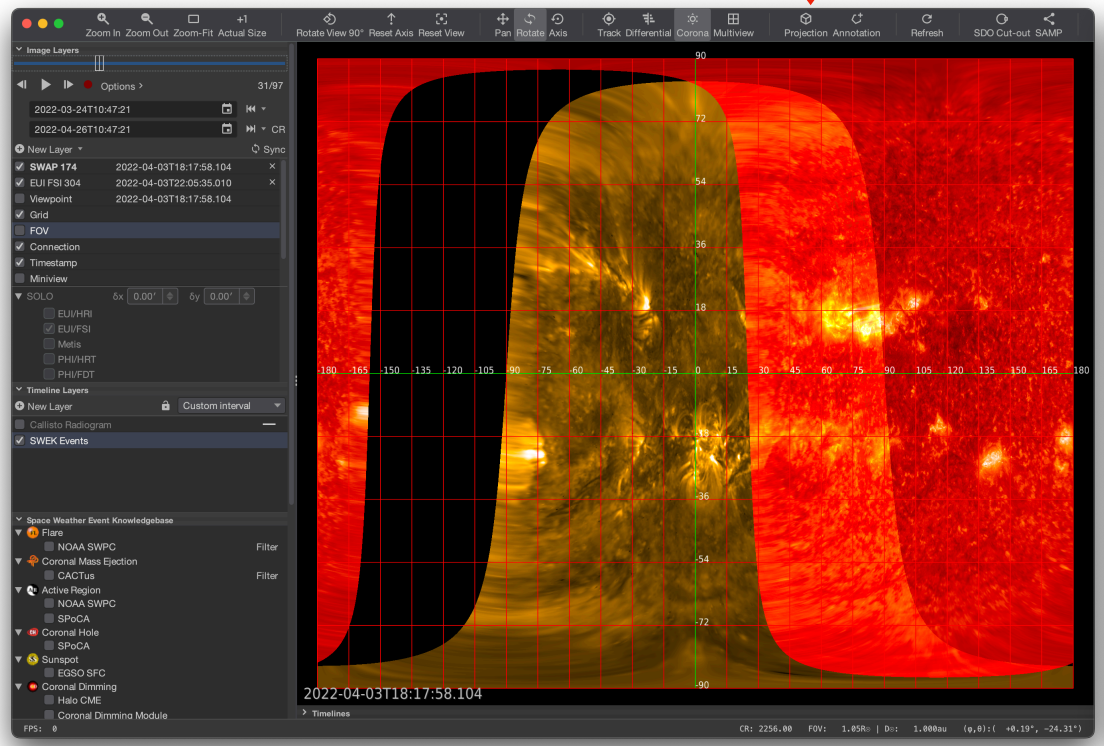

Zoom In Zoom Out Zoom-Fit Actual Size
Rotate View 90° Reset Axis Reset View
Pan Rotate Axis
Track Differential Corona Multiview
Projection Annotation
Refresh
Image Layers
Options
1/97
2022-03-24T10:47:21
2022-04-26T10:47:21
CR
New Layer
Sync
SWAP 174 2022-03-24T10:47:24.298
EUI FSI 304 2022-03-24T10:55:55.179
Viewpoint 2022-03-24T10:47:24.298
Grid
FOV
Connection
Timestamp
Miniview
SOLO δx 0.00′ δy 0.00′
EUI/HRI
EUI/FSI
Metis
PHI/HRT
PHI/FDT
Timeline Layers
New Layer
Custom interval
Callisto Radiogram
SWEK Events
Space Weather Event Knowledgebase
Flare
NOAA SWPC Filter
Coronal Mass Ejection
CACTus Filter
Active Region
NOAA SWPC
SPoCA
Coronal Hole
SPoCA
Sunspot
EGSO SFC
Coronal Dimming
Halo CME
Coronal Dimming Module
SWAP
EUI/FSI
2022-03-24T10:47:24.298
Timelines
FPS: 0
CR: 2255.62 FOV: 5.92R⊙ | D⊙: 0.997au | (ρ,ψ):(1.75R⊙, +74.72°) | (φ,θ):(--°, --°) | (x,y):(-1625″, +4

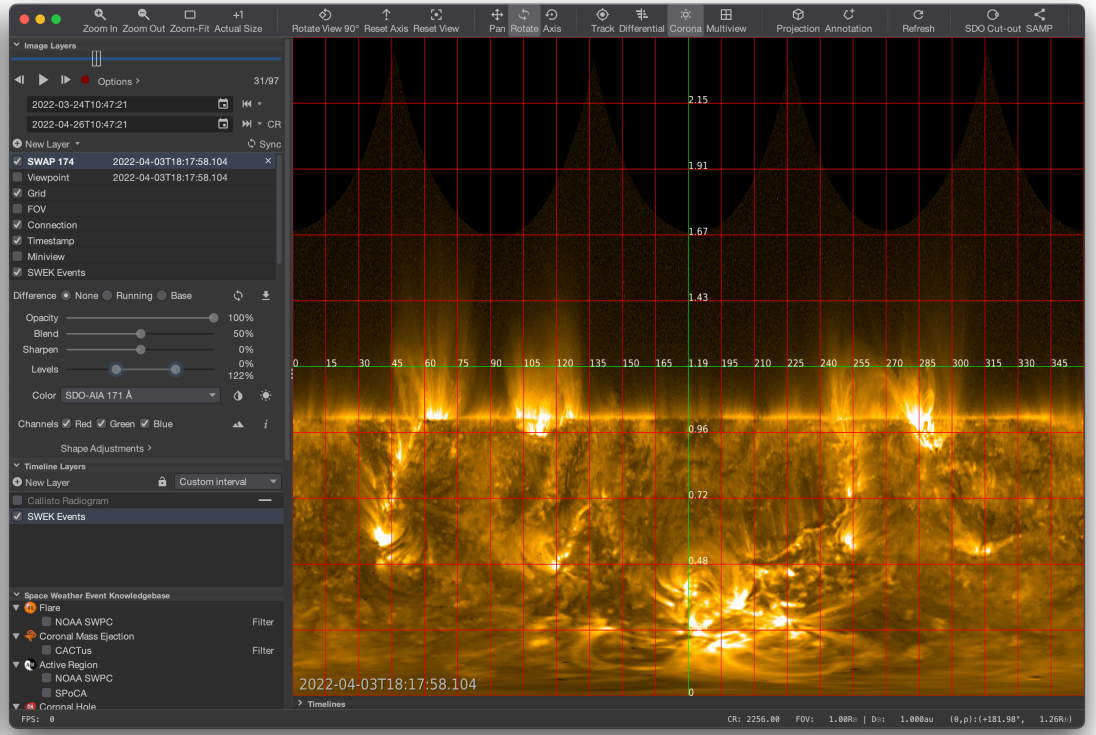
New Layer:
ROB
SOLO
EUI FSI 304



Projection: Latitudinal

Projection: Polar



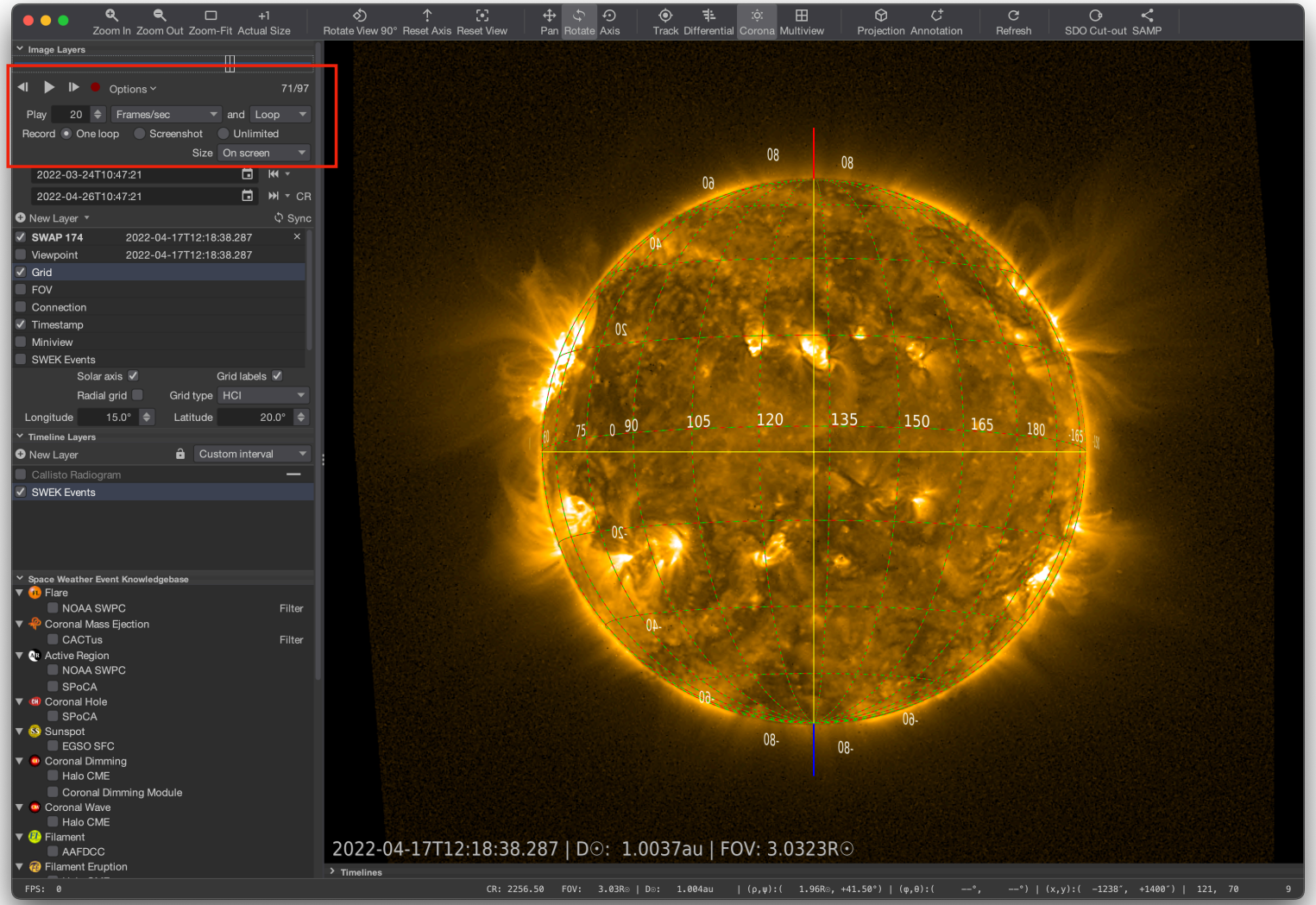


Do it yourself

- Change the viewpoint to another planet
- Load ROB/EUI/FSI304
- Experiment with “FOV” for both SWAP and FSI, see that the plane-of-the-sky is different
- Under projections, try ‘latitudinal’ and ‘polar’

JHelioviewer input/output

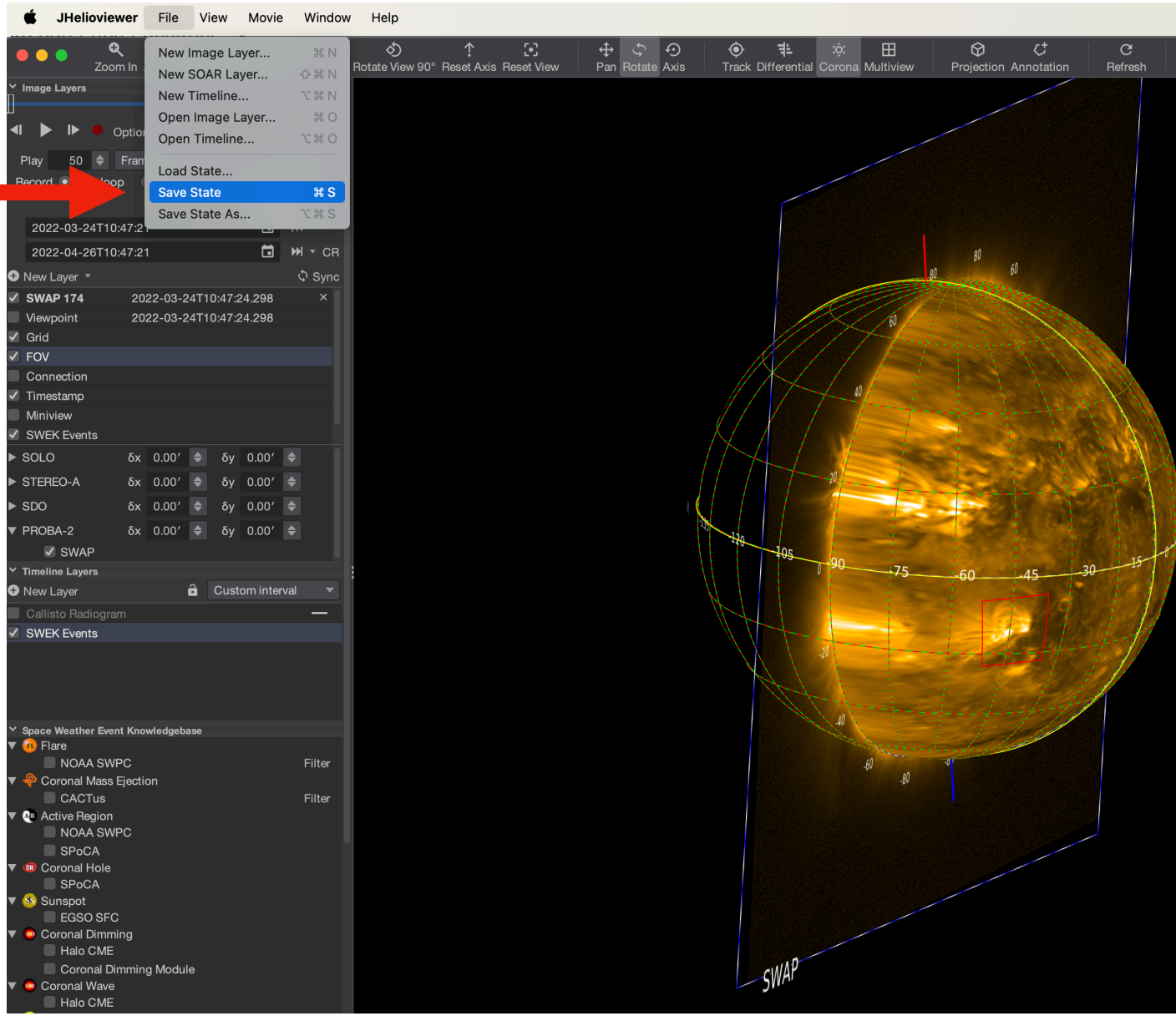
Click on “options”



Exports mp4 movie to jHelioviewer-SWHV/Exports

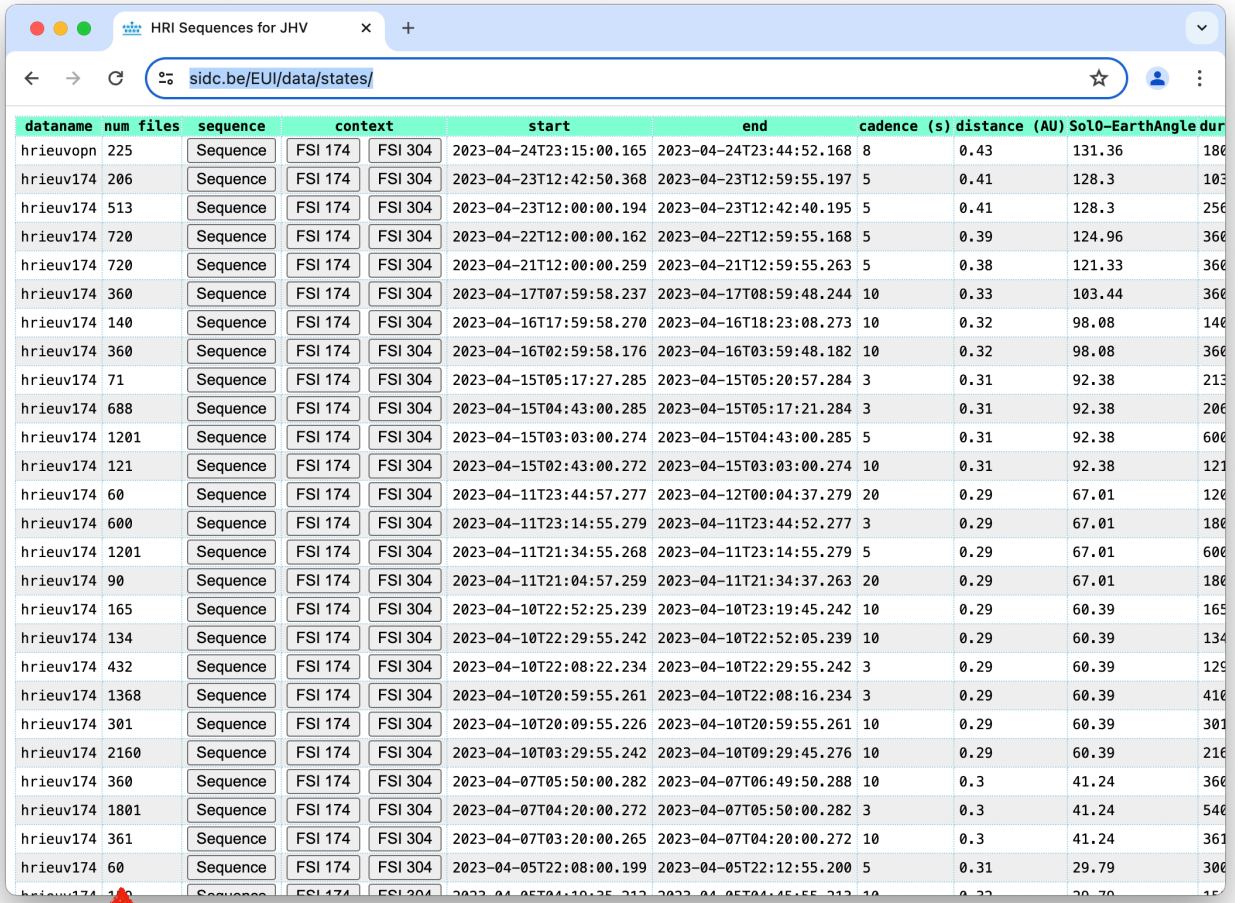
Saves as small “state” file to JHelioviewer-SWHV/States

This file can be eg emailed to another user to see exactly what you saw without transferring the data



Pre-packed states, download through SAMP

http://sidc.be/EUI/data/states

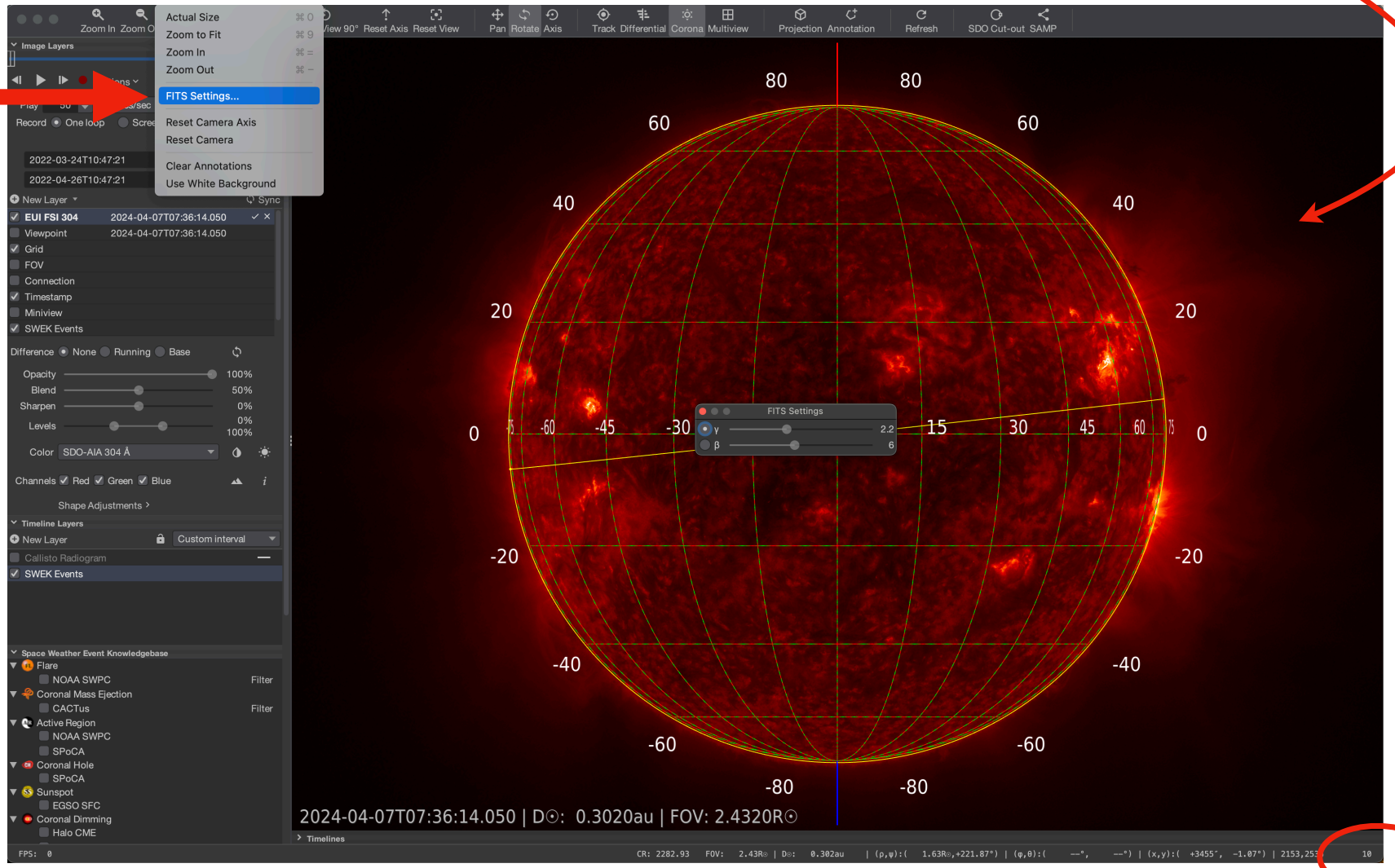


dataname	num files	sequence	context		start	end	cadence (s)	distance (AU)	SolO-EarthAngle	dur
hrieuvopn	225	Sequence	FSI 174	FSI 304	2023-04-24T23:15:00.165	2023-04-24T23:44:52.168	8	0.43	131.36	180
hrieuv174	206	Sequence	FSI 174	FSI 304	2023-04-23T12:42:50.368	2023-04-23T12:59:55.197	5	0.41	128.3	103
hrieuv174	513	Sequence	FSI 174	FSI 304	2023-04-23T12:00:00.194	2023-04-23T12:42:40.195	5	0.41	128.3	256
hrieuv174	720	Sequence	FSI 174	FSI 304	2023-04-22T12:00:00.162	2023-04-22T12:59:55.168	5	0.39	124.96	360
hrieuv174	720	Sequence	FSI 174	FSI 304	2023-04-21T12:00:00.259	2023-04-21T12:59:55.263	5	0.38	121.33	360
hrieuv174	360	Sequence	FSI 174	FSI 304	2023-04-17T07:59:58.237	2023-04-17T08:59:48.244	10	0.33	103.44	360
hrieuv174	140	Sequence	FSI 174	FSI 304	2023-04-16T17:59:58.270	2023-04-16T18:23:08.273	10	0.32	98.08	140
hrieuv174	360	Sequence	FSI 174	FSI 304	2023-04-16T02:59:58.176	2023-04-16T03:59:48.182	10	0.32	98.08	360
hrieuv174	71	Sequence	FSI 174	FSI 304	2023-04-15T05:17:27.285	2023-04-15T05:20:57.284	3	0.31	92.38	213
hrieuv174	688	Sequence	FSI 174	FSI 304	2023-04-15T04:43:00.285	2023-04-15T05:17:21.284	3	0.31	92.38	206
hrieuv174	1201	Sequence	FSI 174	FSI 304	2023-04-15T03:03:00.274	2023-04-15T04:43:00.285	5	0.31	92.38	600
hrieuv174	121	Sequence	FSI 174	FSI 304	2023-04-15T02:43:00.272	2023-04-15T03:03:00.274	10	0.31	92.38	121
hrieuv174	60	Sequence	FSI 174	FSI 304	2023-04-11T23:44:57.277	2023-04-12T00:04:37.279	20	0.29	67.01	120
hrieuv174	600	Sequence	FSI 174	FSI 304	2023-04-11T23:14:55.279	2023-04-11T23:44:52.277	3	0.29	67.01	180
hrieuv174	1201	Sequence	FSI 174	FSI 304	2023-04-11T21:34:55.268	2023-04-11T23:14:55.279	5	0.29	67.01	600
hrieuv174	90	Sequence	FSI 174	FSI 304	2023-04-11T21:04:57.259	2023-04-11T21:34:37.263	20	0.29	67.01	180
hrieuv174	165	Sequence	FSI 174	FSI 304	2023-04-10T22:52:25.239	2023-04-10T23:19:45.242	10	0.29	60.39	165
hrieuv174	134	Sequence	FSI 174	FSI 304	2023-04-10T22:29:55.242	2023-04-10T22:52:05.239	10	0.29	60.39	134
hrieuv174	432	Sequence	FSI 174	FSI 304	2023-04-10T22:08:22.234	2023-04-10T22:29:55.242	3	0.29	60.39	129
hrieuv174	1368	Sequence	FSI 174	FSI 304	2023-04-10T20:59:55.261	2023-04-10T22:08:16.234	3	0.29	60.39	410
hrieuv174	301	Sequence	FSI 174	FSI 304	2023-04-10T20:09:55.226	2023-04-10T20:59:55.261	10	0.29	60.39	301
hrieuv174	2160	Sequence	FSI 174	FSI 304	2023-04-10T03:29:55.242	2023-04-10T09:29:45.276	10	0.29	60.39	216
hrieuv174	360	Sequence	FSI 174	FSI 304	2023-04-07T05:50:00.282	2023-04-07T06:49:50.288	10	0.3	41.24	360
hrieuv174	1801	Sequence	FSI 174	FSI 304	2023-04-07T04:20:00.272	2023-04-07T05:50:00.282	3	0.3	41.24	540
hrieuv174	361	Sequence	FSI 174	FSI 304	2023-04-07T03:20:00.265	2023-04-07T04:20:00.272	10	0.3	41.24	361
hrieuv174	60	Sequence	FSI 174	FSI 304	2023-04-05T22:08:00.199	2023-04-05T22:12:55.200	5	0.31	29.79	300

Be careful: only click on small sequences

Drag and dump local FITS file

Open FITS settings



brightness value at pointer

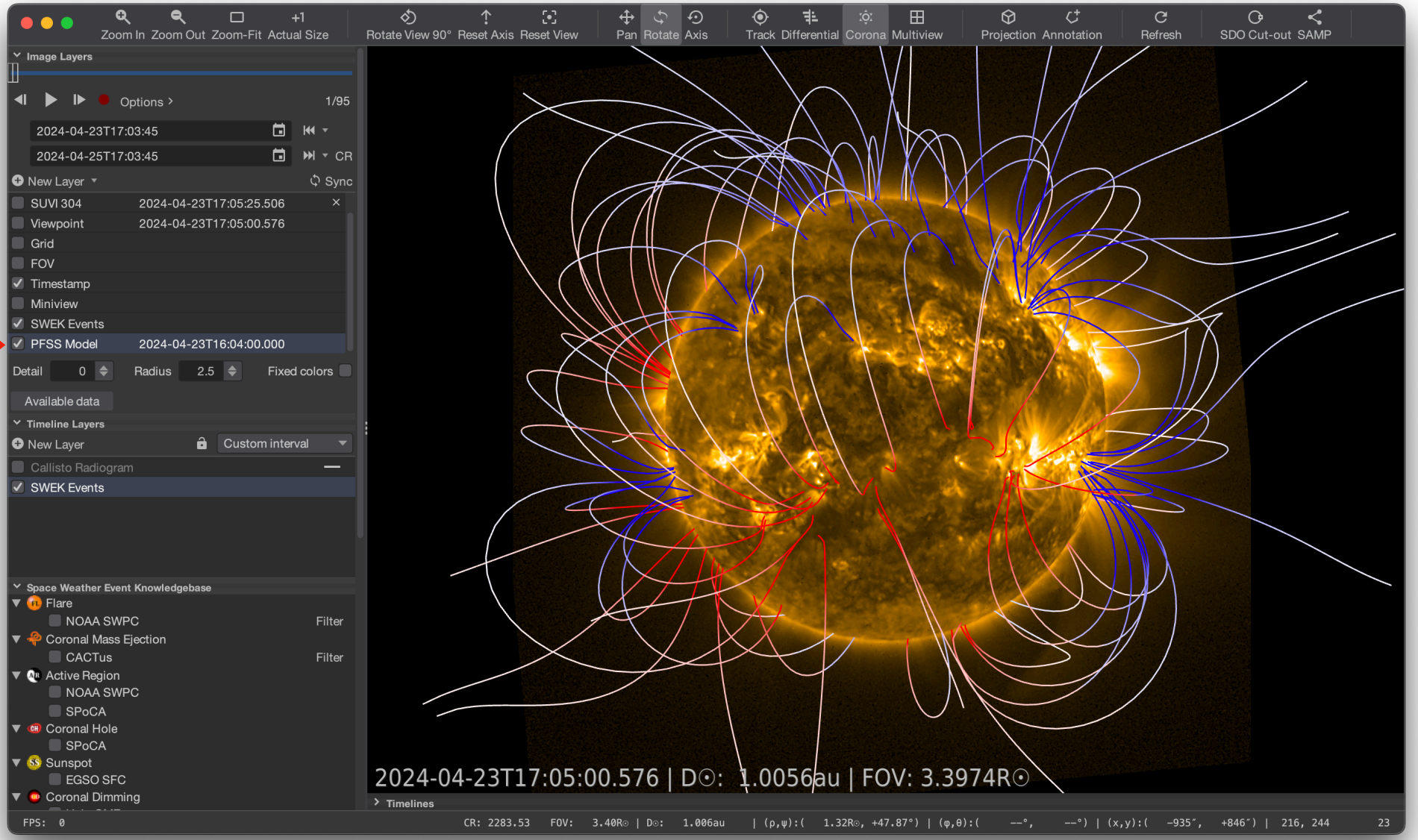
Do it yourself

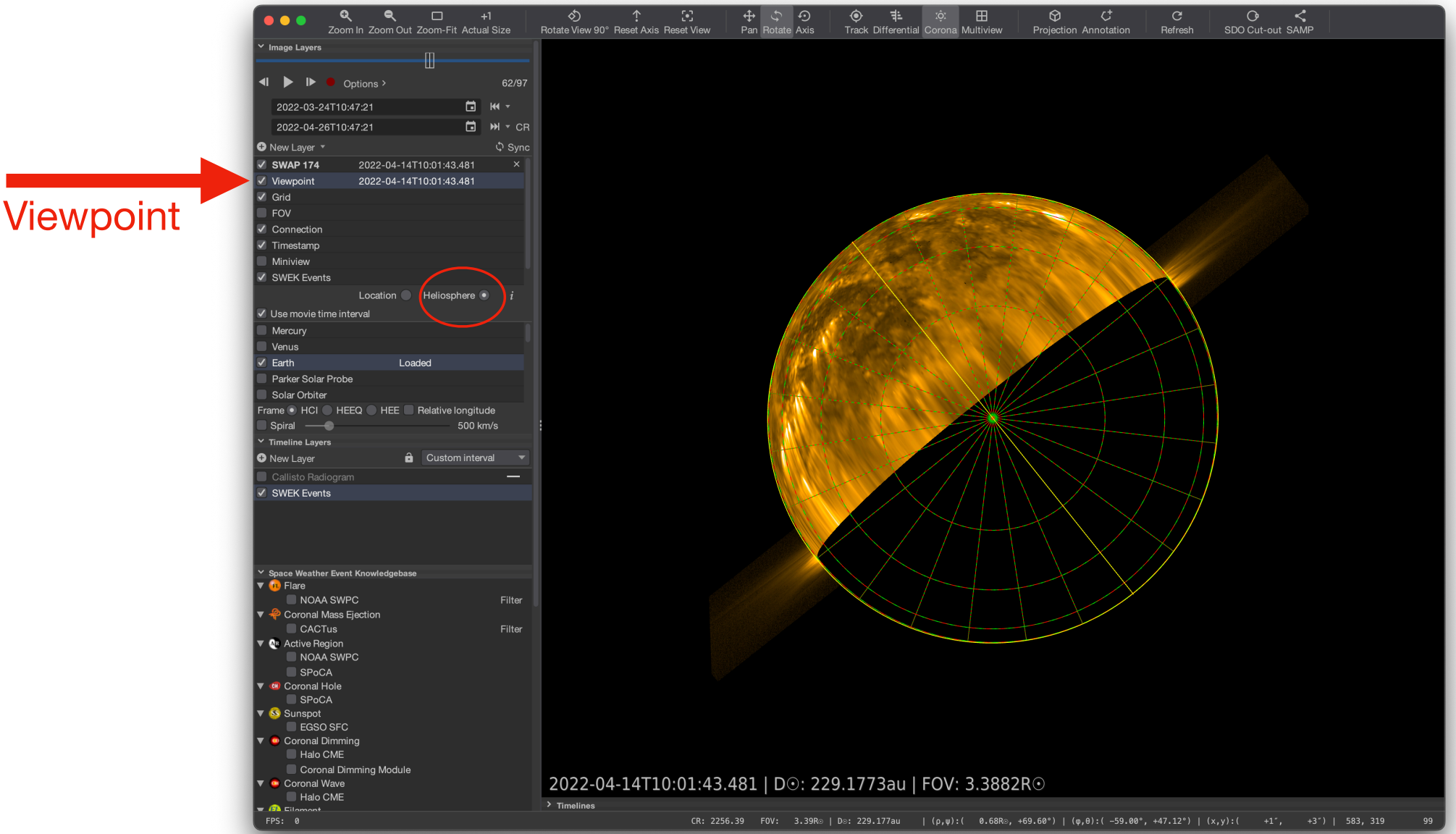
- Save an mp4 movie and view it externally
- Save a state-file, close jhelioviewer, restart and load the state-file
- Download the latest EUI/FSI FITS file from https://www.sidc.be/EUI/data/lastDayFSI/ and drop it into jHelioviewer
- Read intensity values (bottom-right of window)
- Change the scaling of the FITS file (View menu)

Coffee-break

JHelioviewer physics support

+ Rotate the Sun manually to get a 3D feeling



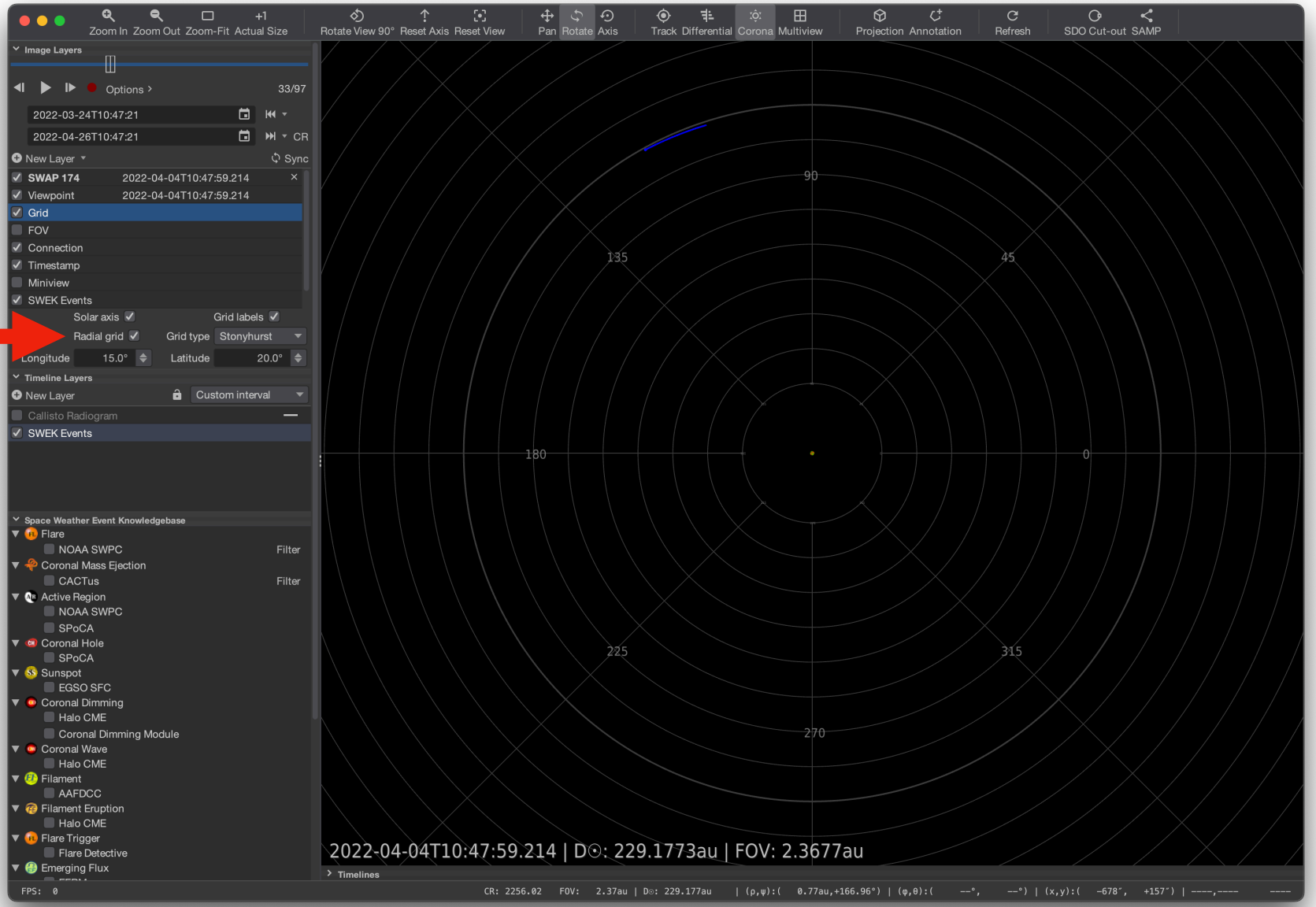

Viewpoint
Zoom In
Zoom Out
Zoom-Fit
Actual Size
Rotate View 90°
Reset Axis
Reset View
Pan
Rotate
Axis
Track
Differential
Corona
Multiview
Projection
Annotation
Refresh
SDO Cut-out
SAMP
Image Layers
Options
62/97
2022-03-24T10:47:21
2022-04-26T10:47:21
CR
New Layer
Sync
SWAP 174 2022-04-14T10:01:43.481
Viewpoint 2022-04-14T10:01:43.481
Grid
FOV
Connection
Timestamp
Miniview
SWEK Events
Location
Heliosphere
Use movie time interval
Mercury
Venus
Earth Loaded
Parker Solar Probe
Solar Orbiter
Frame HCI HEEQ HEE Relative longitude
Spiral 500 km/s
Timeline Layers
New Layer
Custom interval
Callisto Radiogram
SWEK Events
Space Weather Event Knowledgebase
Flare
NOAA SWPC Filter
Coronal Mass Ejection
CACTus Filter
Active Region
NOAA SWPC
SPoCA
Coronal Hole
SPoCA
Sunspot
EGSO SFC
Coronal Dimming
Halo CME
Coronal Dimming Module
Coronal Wave
Halo CME
2022-04-14T10:01:43.481 | D☉: 229.1773au | FOV: 3.3882R☉
Timelines
FPS: 0
CR: 2256.39
FOV: 3.39R☉ | D☉: 229.177au
| (ρ,φ):(0.68R☉, +69.60°) | (φ,θ):(-59.00°, +47.12°) | (x,y):(+1˚, +3˚) | 583, 319
99

Grid

Radial Grid

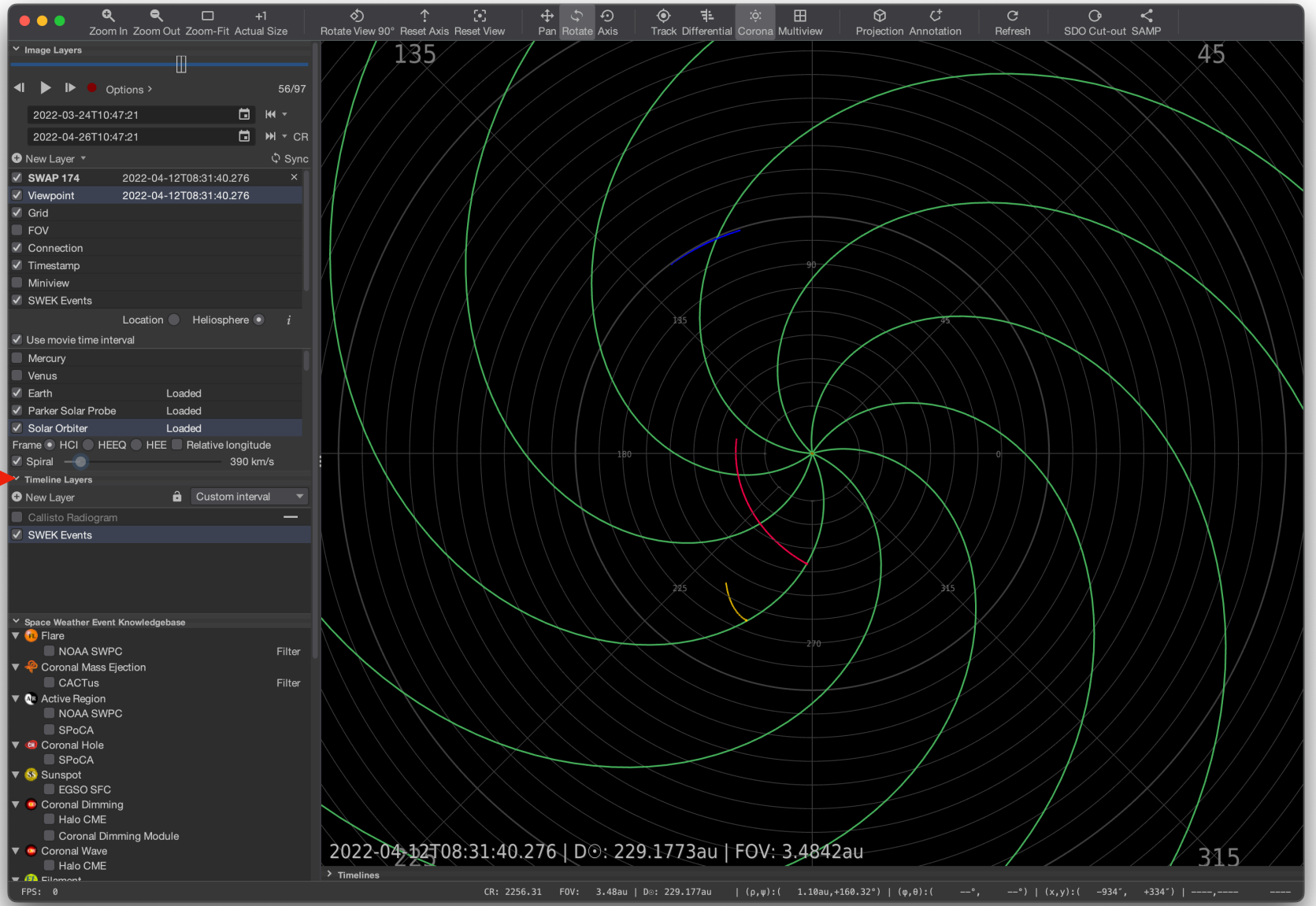
… zoom out …

Play movie



Solar Orbiter
& PSP

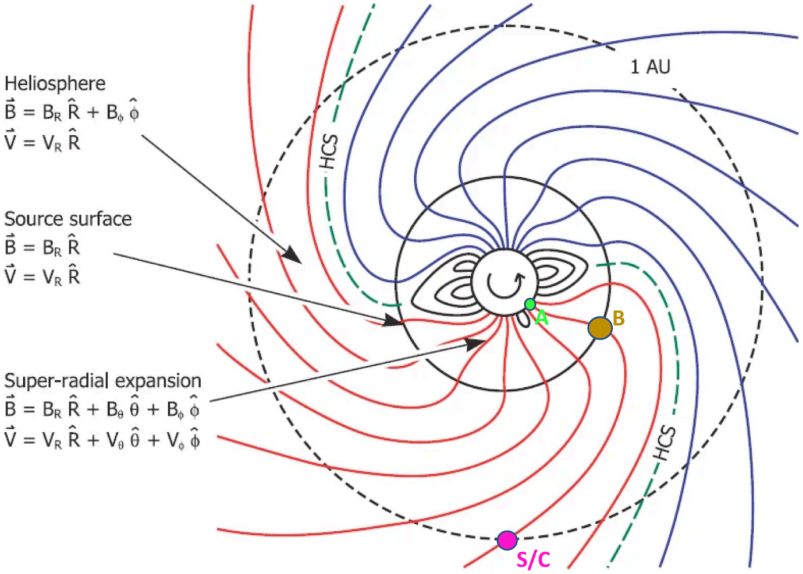
Parker spiral
with configurable
speed



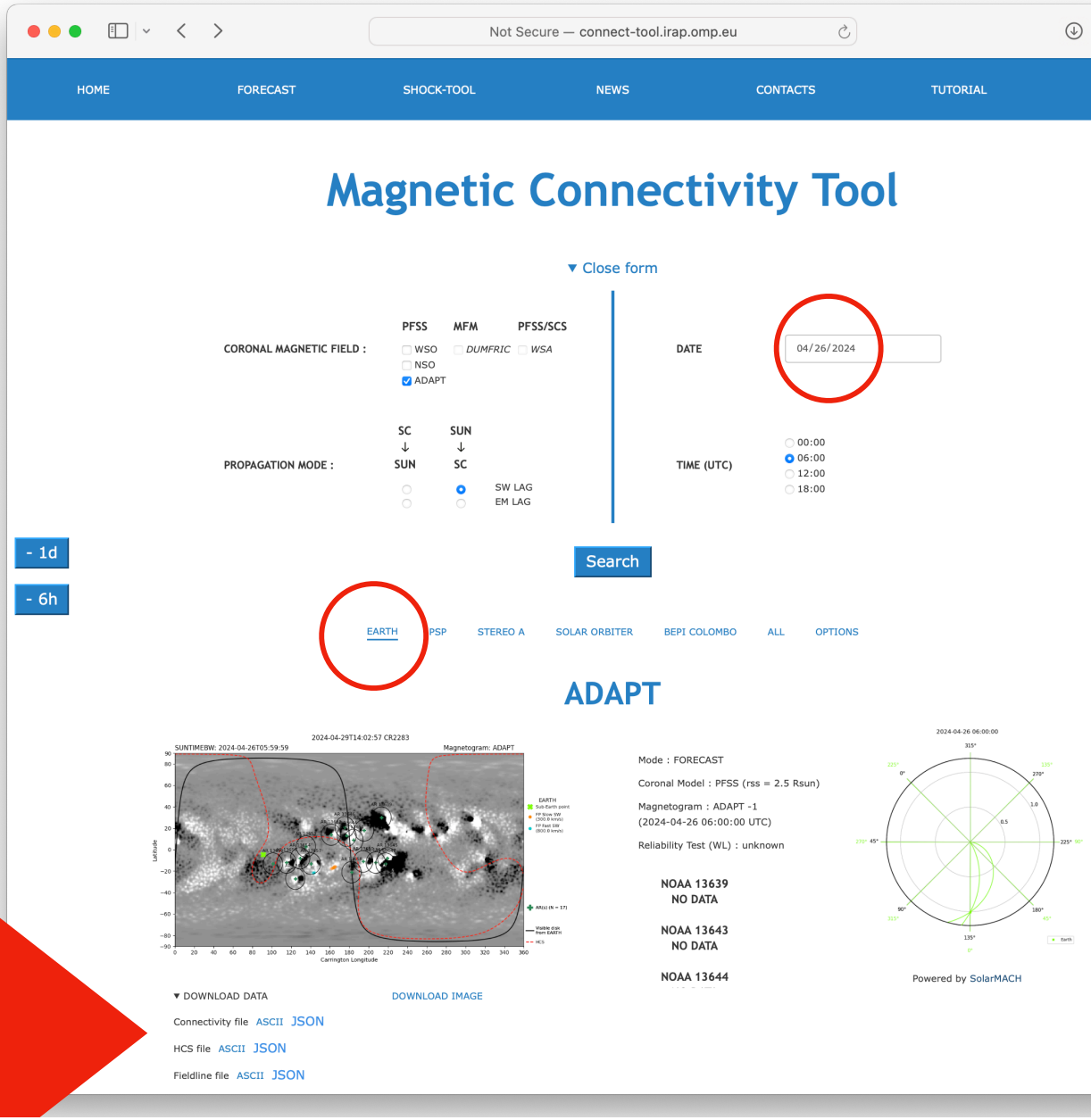
Live demo

Do it yourself

- Load a SWAP movie of roughly 1 months
- Switch on PFSS, switch to fixed colors
- Switch on ‘viewpoint’ and choose ‘heliosphere’, check “Earth”, “Solar Orbiter” and “Parker Solar Probe”
- Under ‘grid’ choose radial grid
- Zoom out
- Click on “spiral” and change the solar wind speed



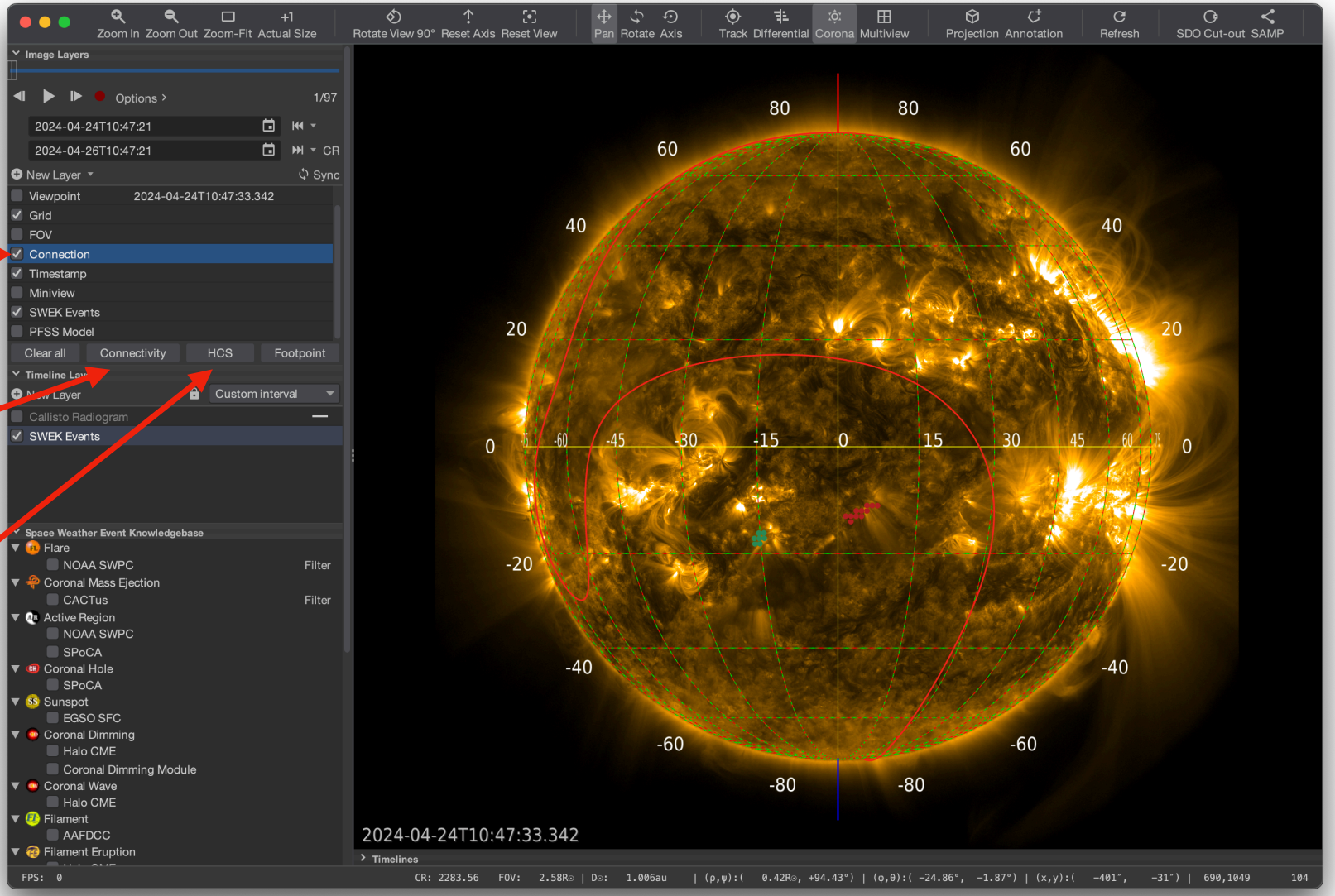
Download ASCII files for connectivity and HCS

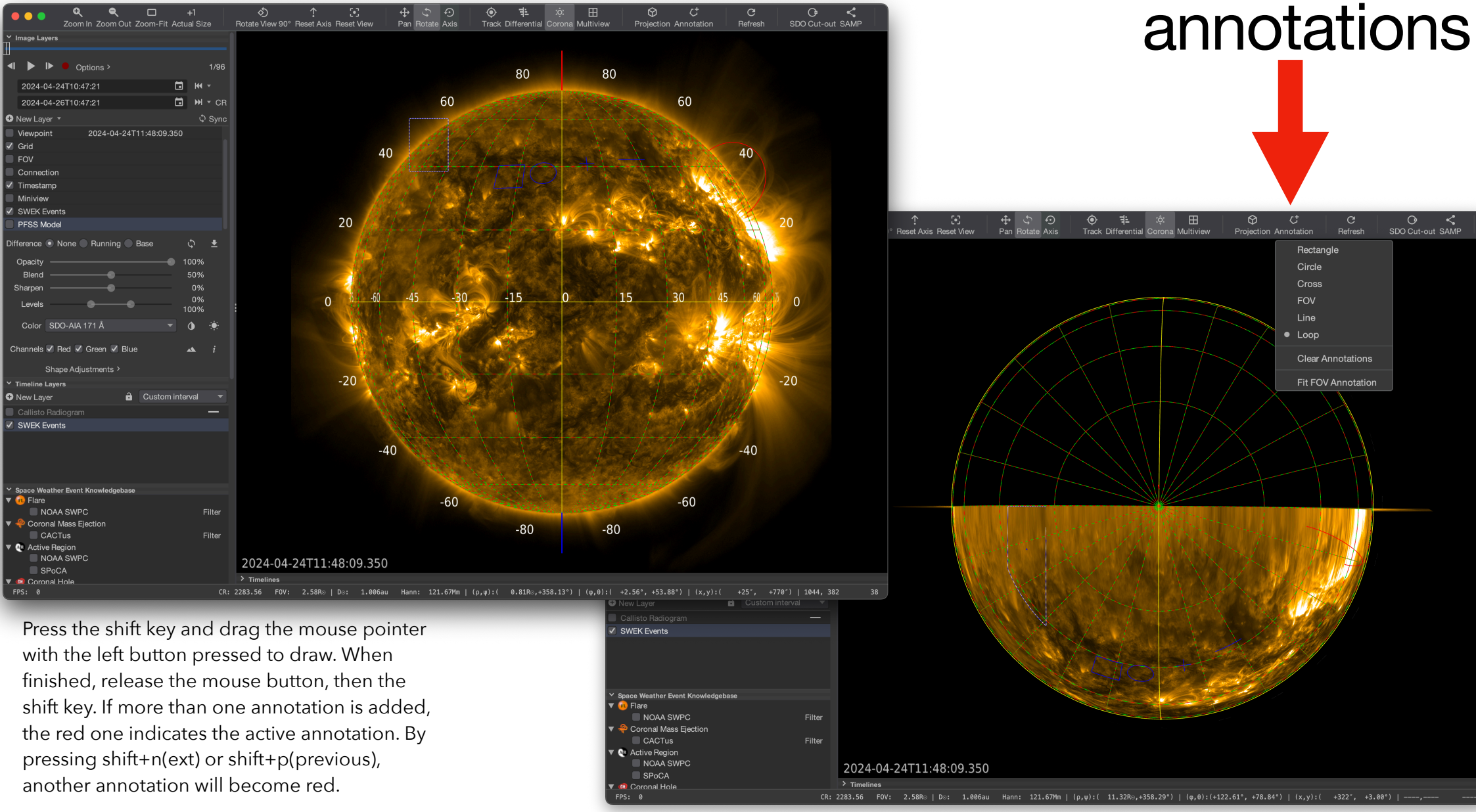


Switch-on ‘connection’

Load ASCII connectivity file

Load ASCII HCS file





Press the shift key and drag the mouse pointer with the left button pressed to draw. When finished, release the mouse button, then the shift key. If more than one annotation is added, the red one indicates the active annotation. By pressing shift+n(ext) or shift+p(revious), another annotation will become red.

Live demo

Do it yourself

- Put on a SWAP movie for your favorite day
- Use http://connect-tool.irap.omp.eu/ to produce Connectivity and HCS ASCII files
- Switch on ‘’Connection” and import these files
- Familiarize yourself with “Annotations”

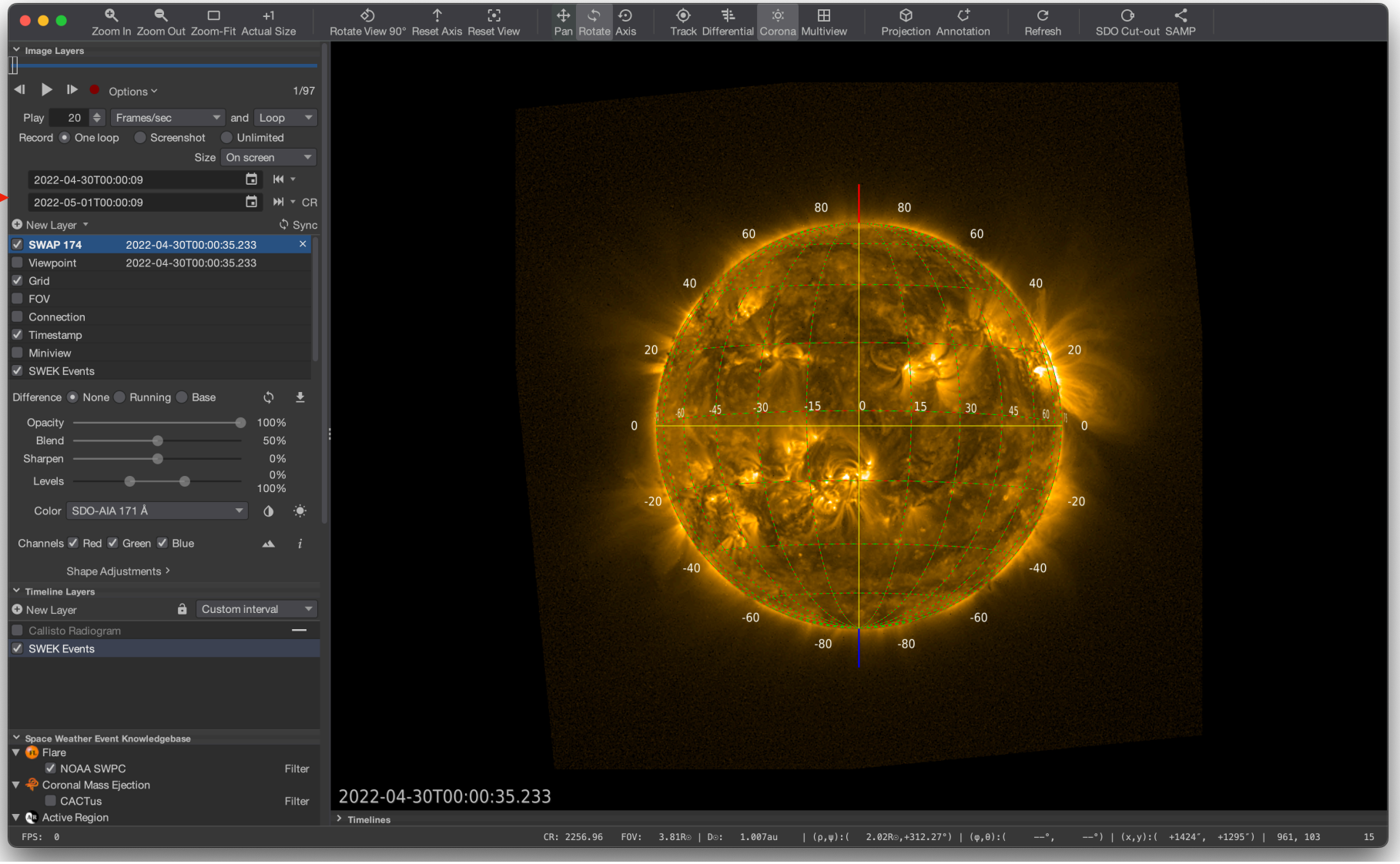
Study an event

Example Event “AR 12994 X1.1 2022-04-30T13:47:00"

Example Event “AR 12994 X1.1 2022-04-30T13:47:00"

Load the day

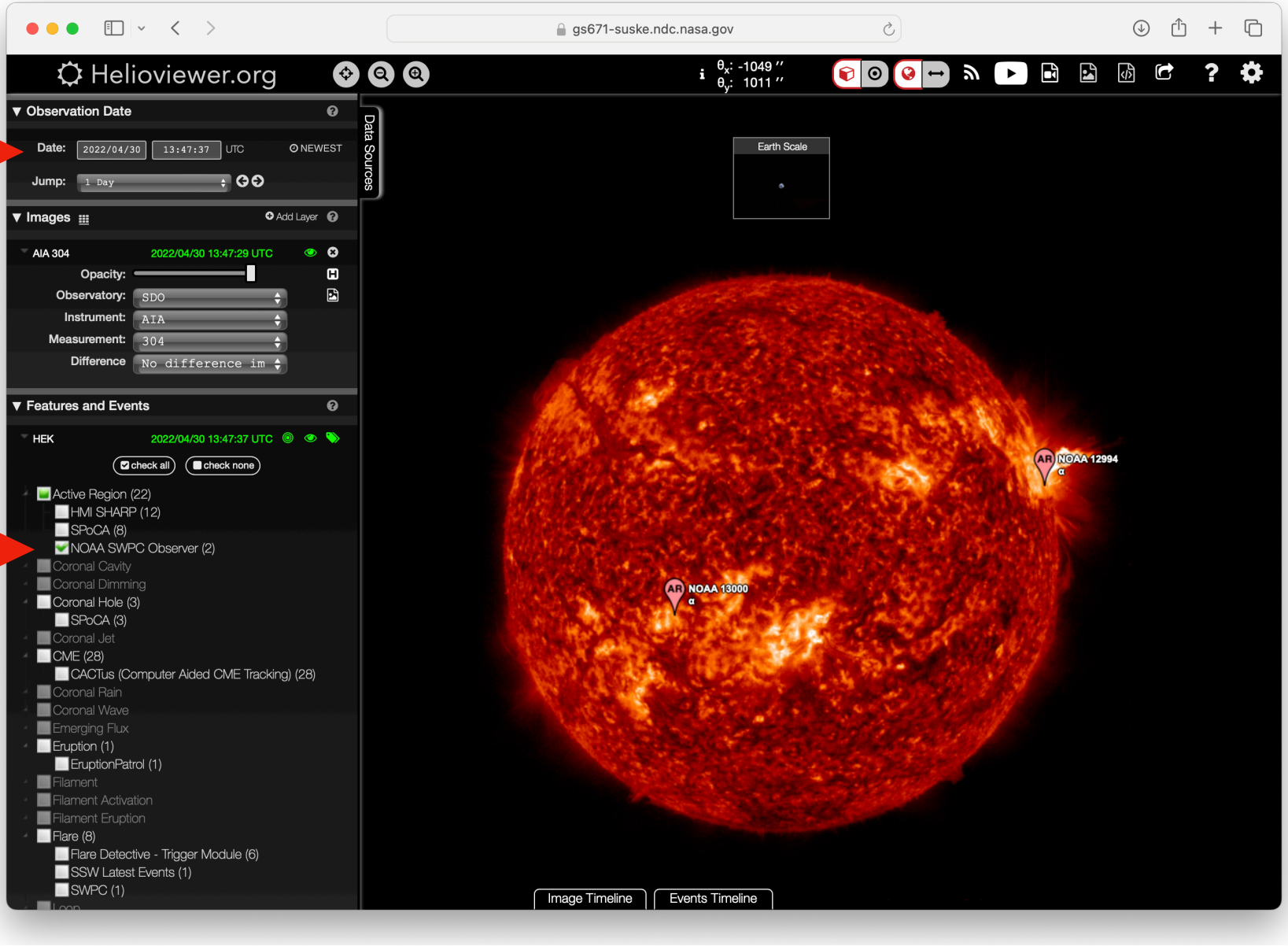
Play movie, spot the flare



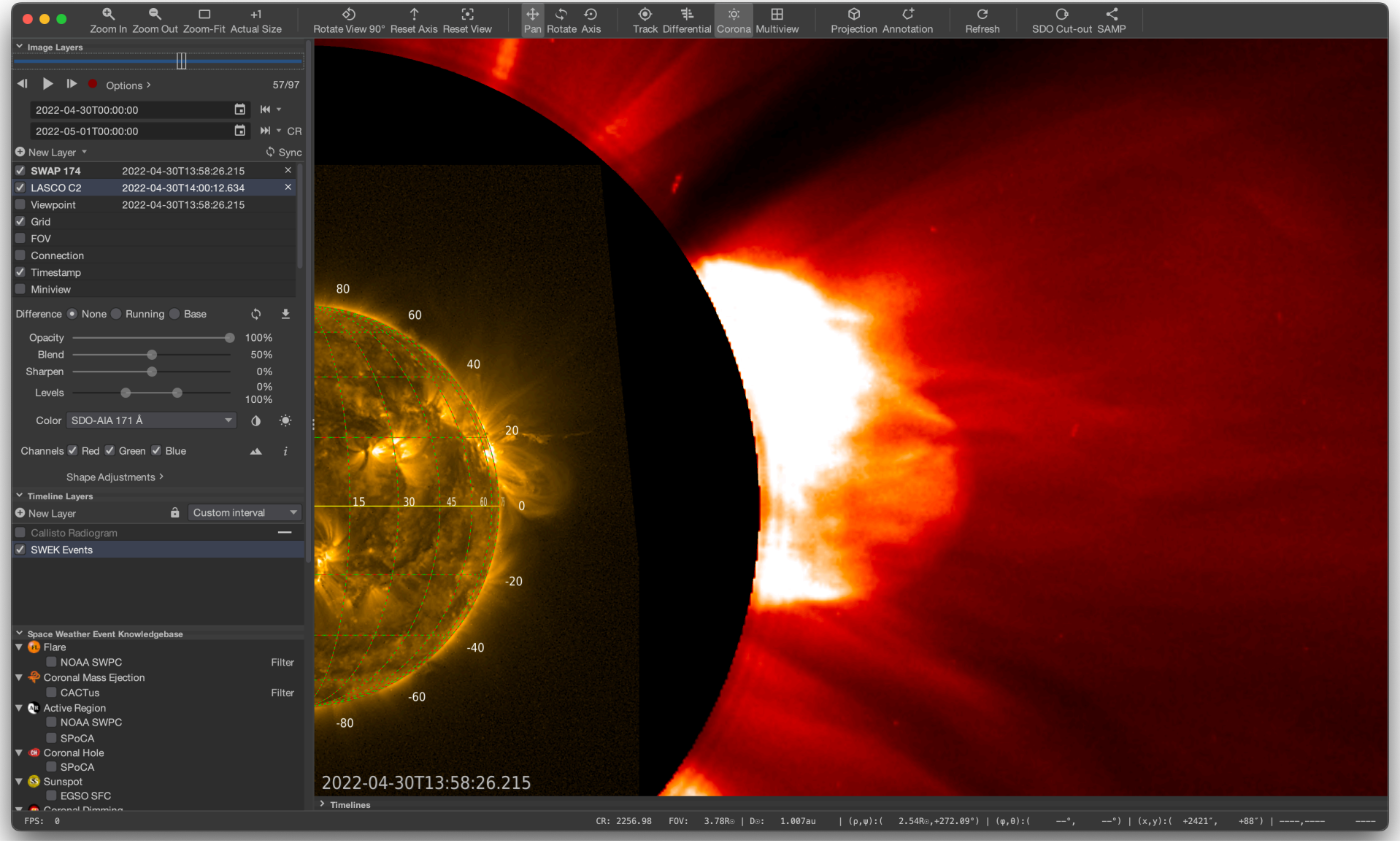
Confirm this is AR 12994?

Load the day

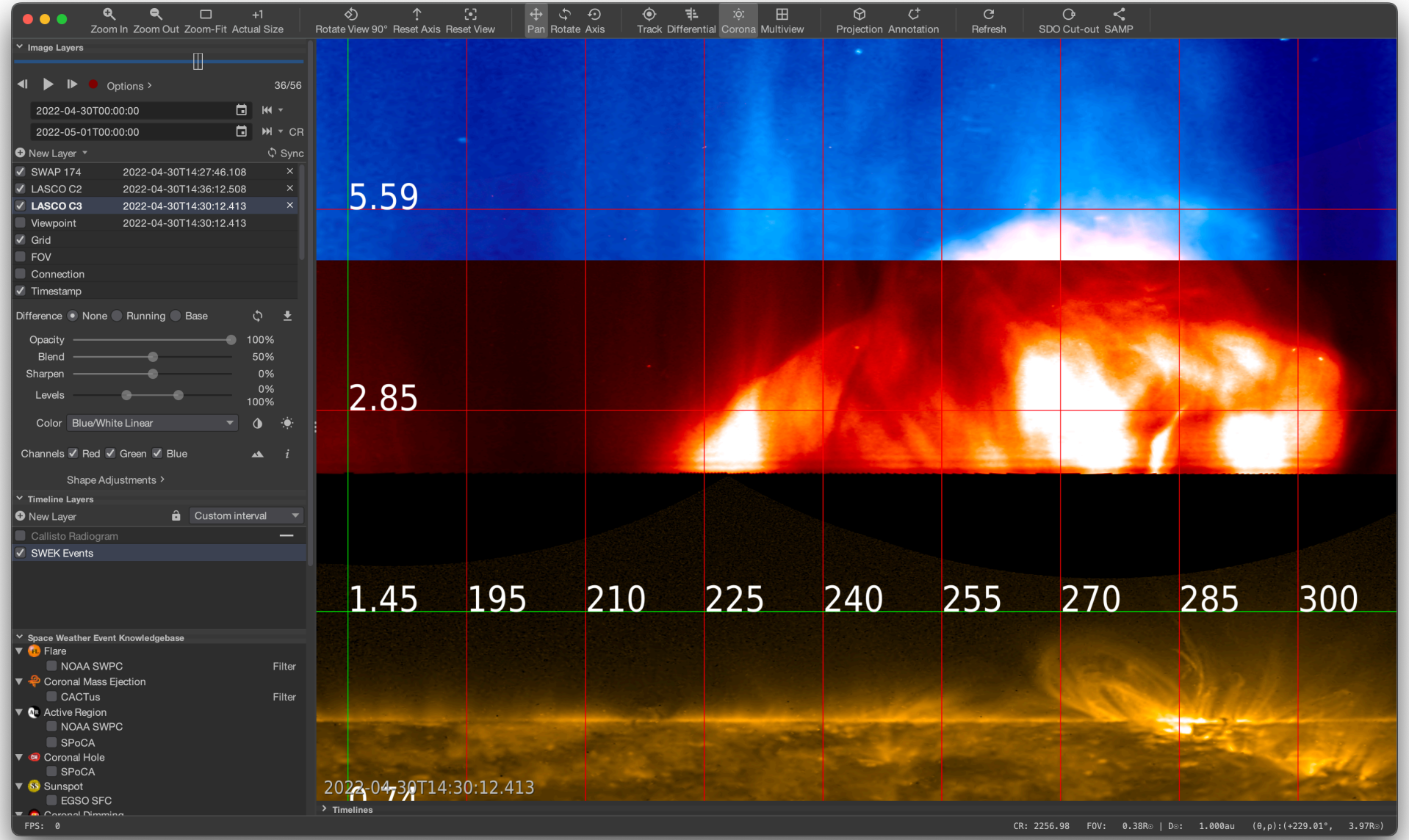
NOAA AR



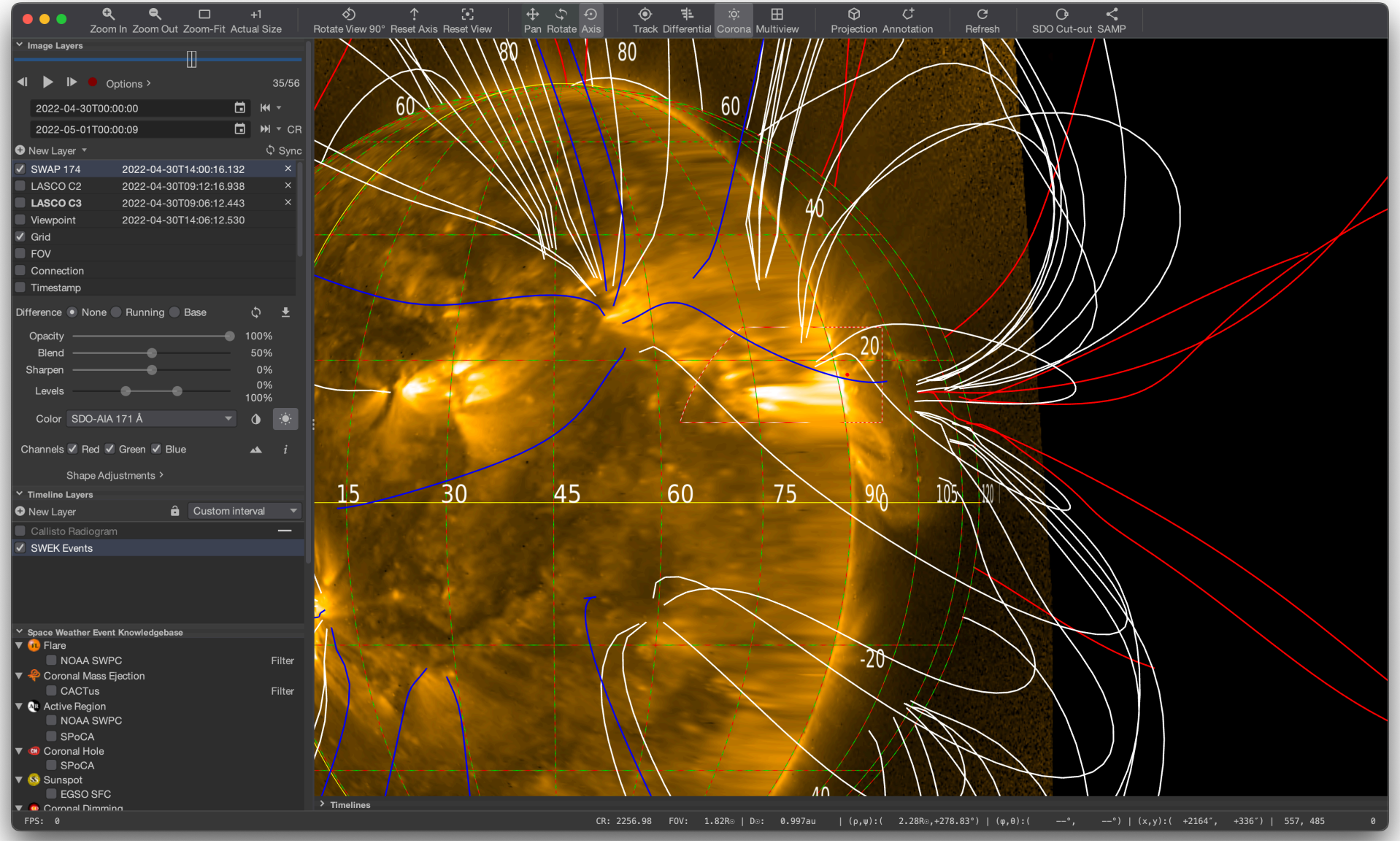
Add LASCO to check for a CME



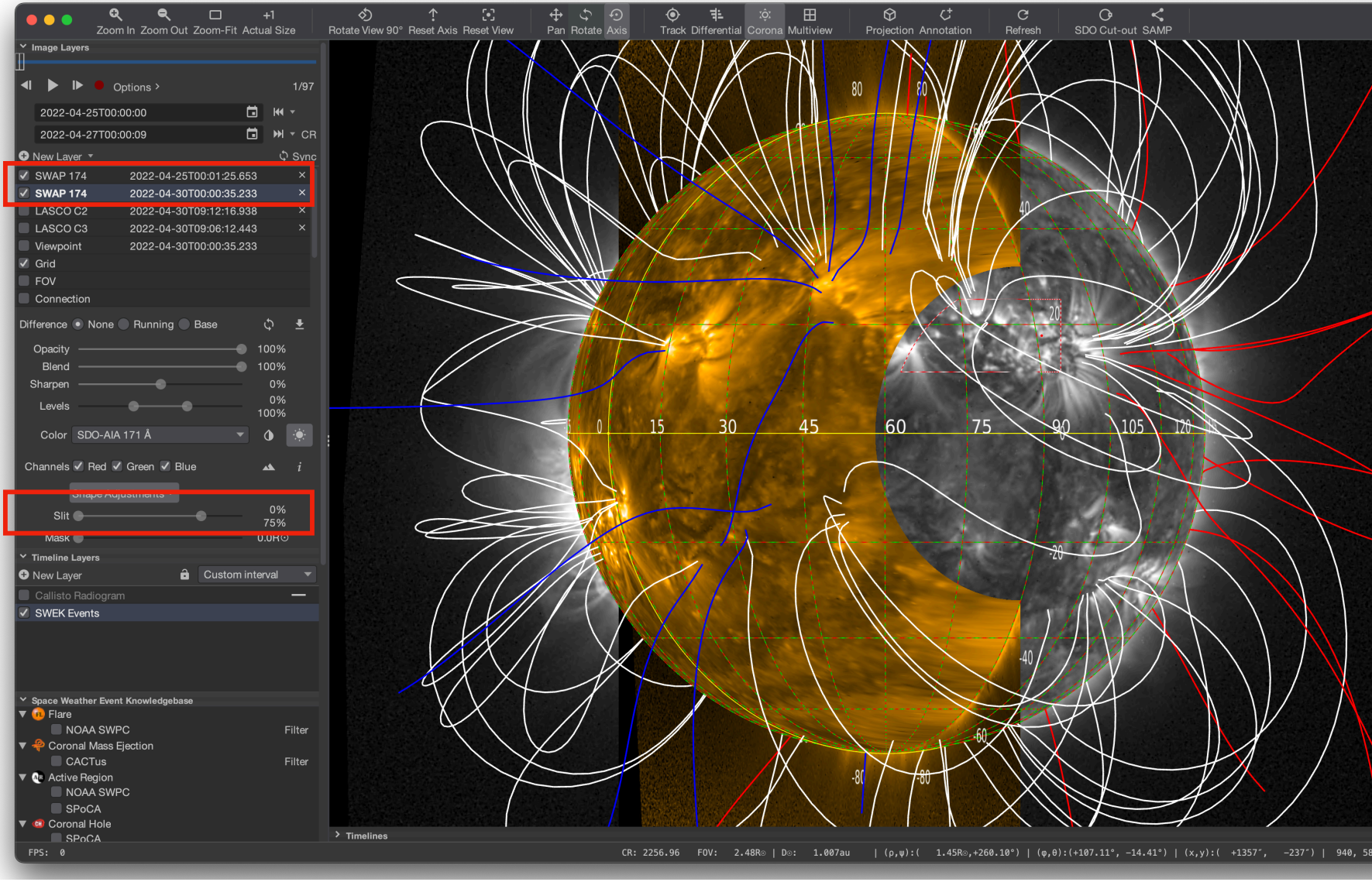
Projection: Log Polar



PFSS at time of eruption



Second SWAP movie of 5 days earlier, put to gray and drawn ‘under’ event movie in yellow
Slit on yellow movie



Do it yourself

- Study your event
- Ask questions

All Questions: Slack

- ESPDschool2024
- #jhelioviewer_questions_and_answers