

Hands-on-Session 1: JHelioviewer

David Berghmans, Royal Observatory of Belgium

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
- #jheliviewer_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 $4,096 \times 4,096$ 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.

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GEORGE DIMITOPOULOU, BENJAMIN W. CAPLINS,
AND DESMOND E. AMADIORE
Hood College
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University of Almería
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University of Maryland, Baltimore County
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ADNET Systems

38 THIS ARTICLE HAS BEEN PEER-REVIEWED. COMPUTING IN SCIENCE & ENGINEERING

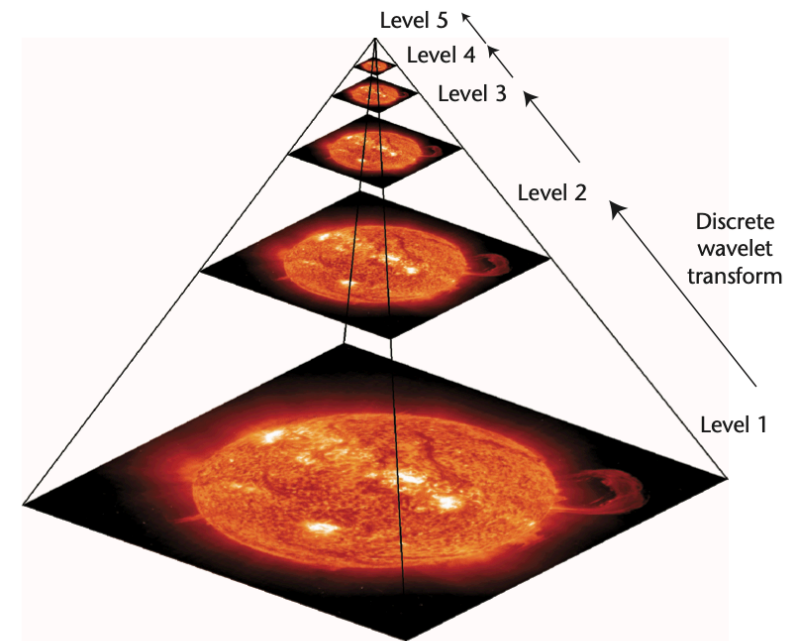
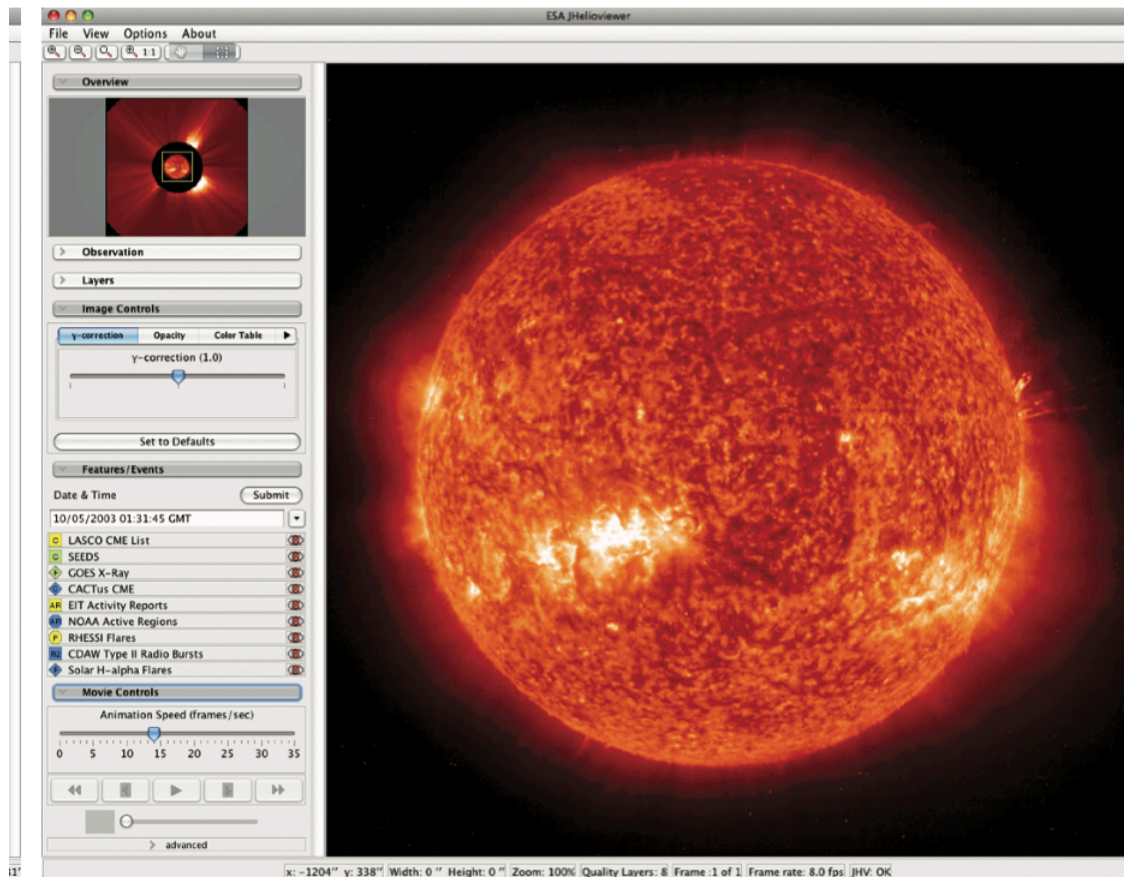


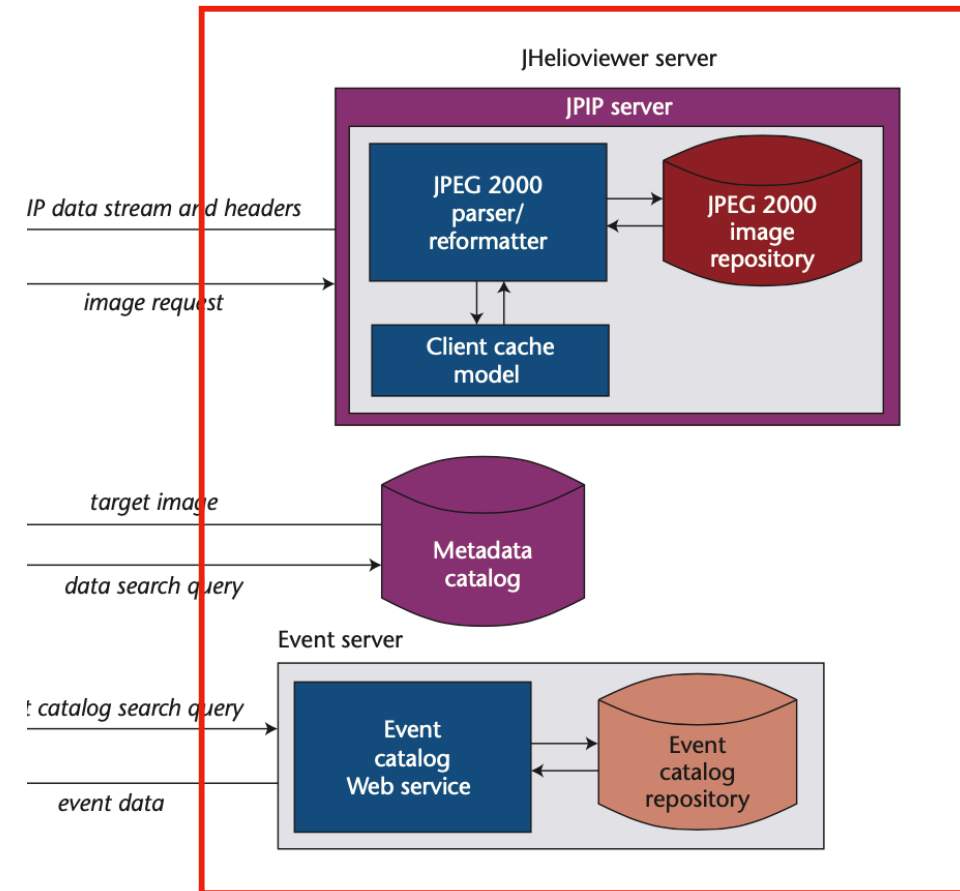
Figure 2. JPEG 2000 pyramid of image representations. Starting from the original image, each resolution level is constructed by applying a discrete wavelet transform to the level below.

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
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Astronomy
&
Astrophysics

JHelioviewer

Time-dependent 3D visualisation of solar and heliospheric data

D. Müller¹, B. Nicula², S. Felix³, F. Verstringe², B. Bourgoignie², A. Csillaghy³, D. Berghmans², P. Jiggins¹,
J. P. García-Ortiz⁴, J. Ireland⁵, S. Zahniy⁵, and B. Fleck⁶

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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.

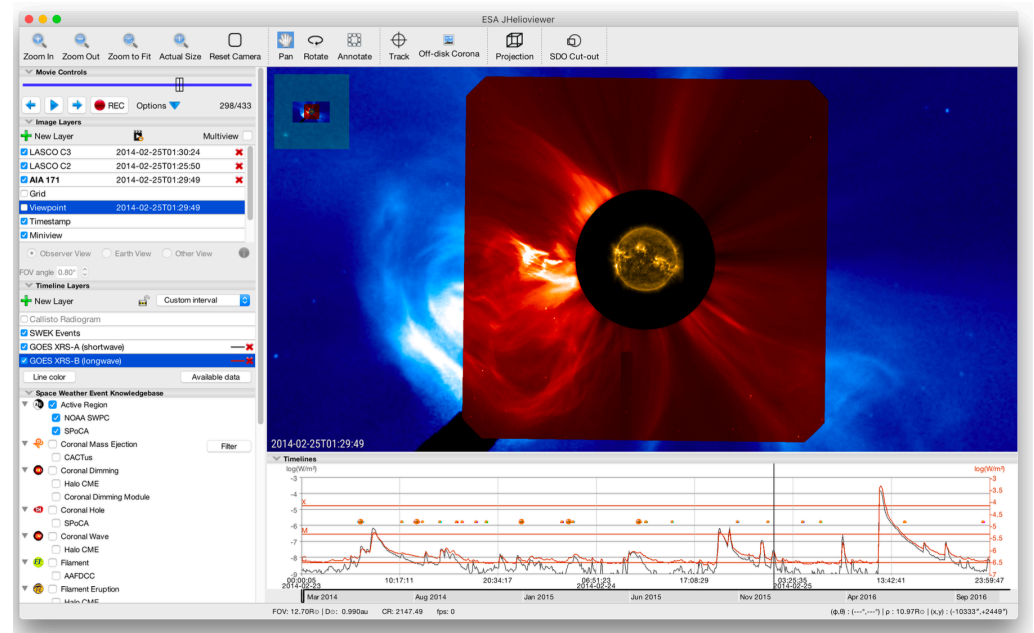
Aims. To address these challenges, we have developed JHelioviewer, a visualisation tool for solar data based on the JPEG 2000 compression standard and part of the open source ESA/NASA Heliviewer Project. Since the first release of JHelioviewer in 2009, the scientific functionality of the software has 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)



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Astronomy
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⁴ Department of Informatics, University of Almería, 04120 Almería, Spain

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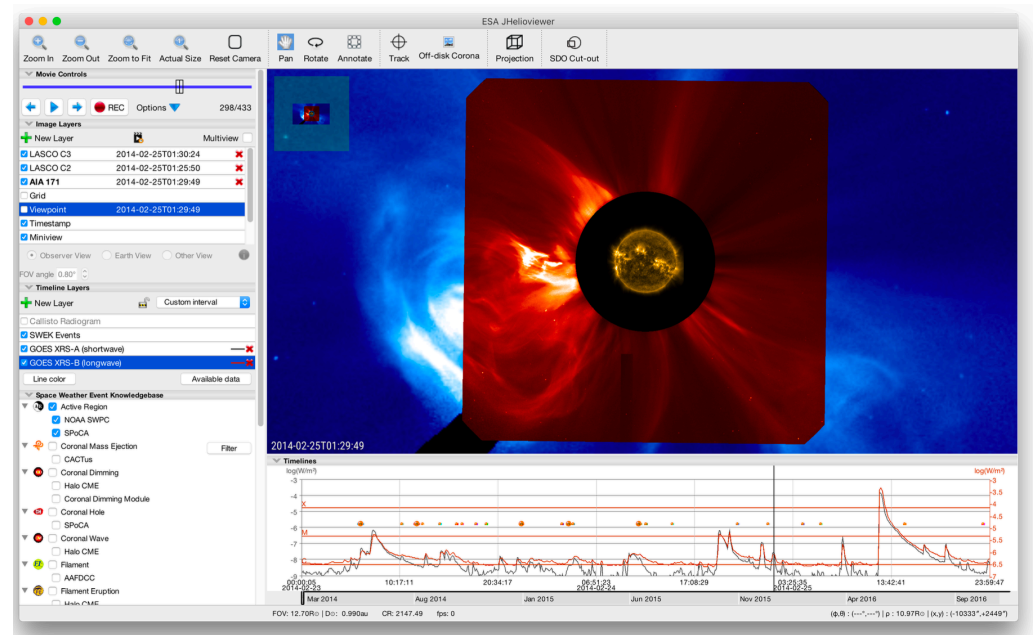
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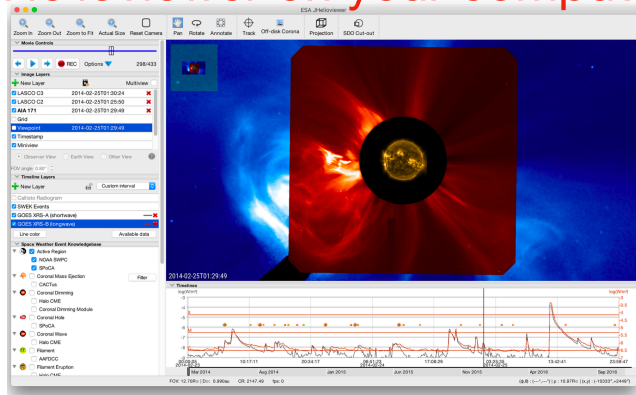
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Main developer: Bogdan Nicula (ROB)



>2017: “Space Weather JHelioviewer”

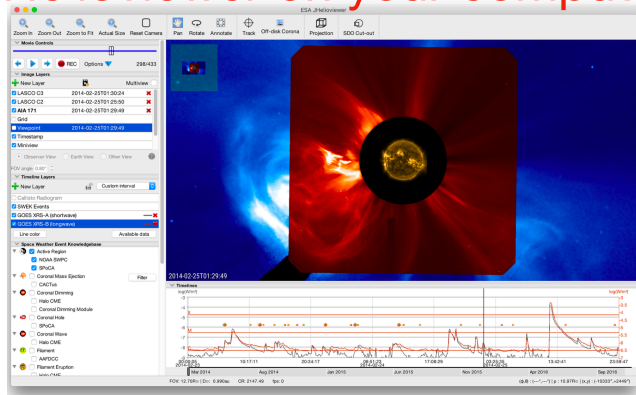
JHelioviewer on your computer



Server at (GSFC)

>2017: “Space Weather JHelioviewer”

JHelioviewer on your computer



Server at (GSFC)

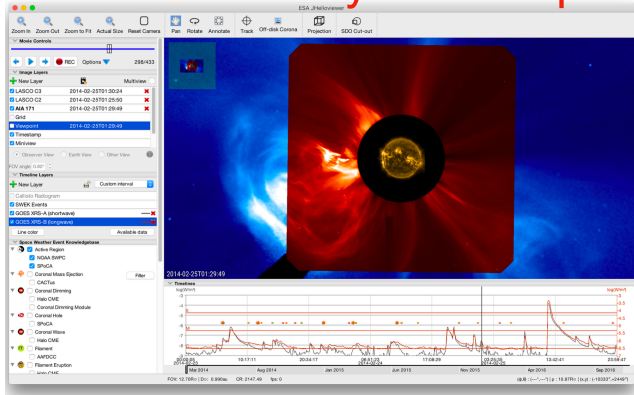
Server at IAS (Paris)

Server at ROB
(Brussels)

Server at ESAC
(Madrid)

The Helioviewer landscape

JHelioviewer on your computer



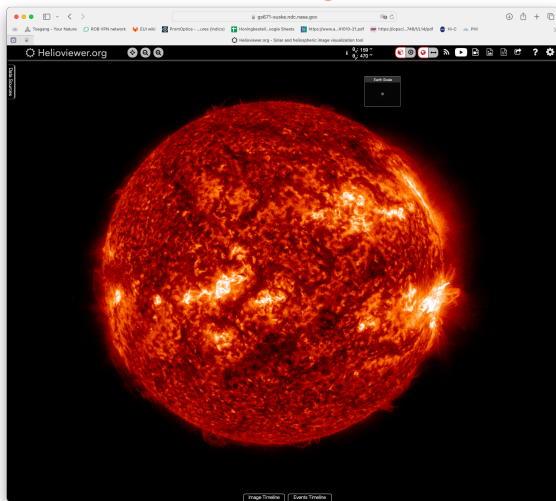
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Server at IAS (Paris)

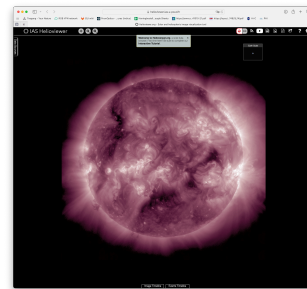
Server at ROB
(Brussels)

Server at ESAC
(Madrid)

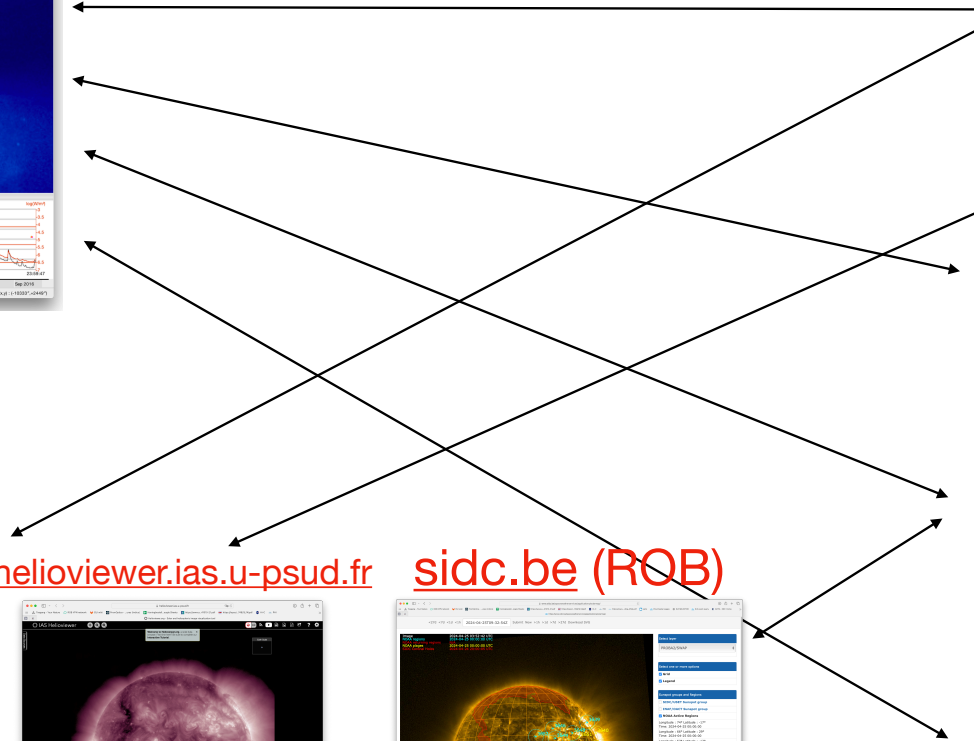
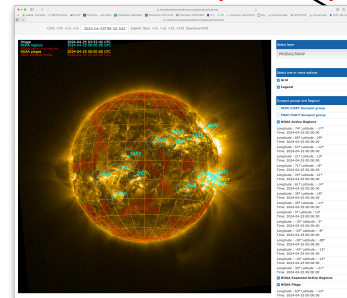
helioviewer.org (GSFC)



helioviewer.ias.u-psud.fr

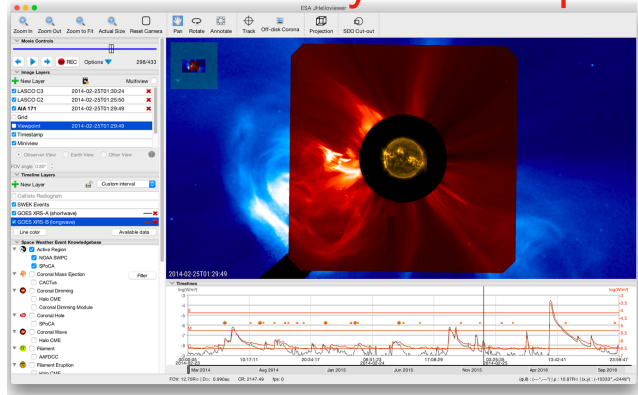


sidc.be (ROB)



The Helioviewer landscape

JHelioviewer on your computer



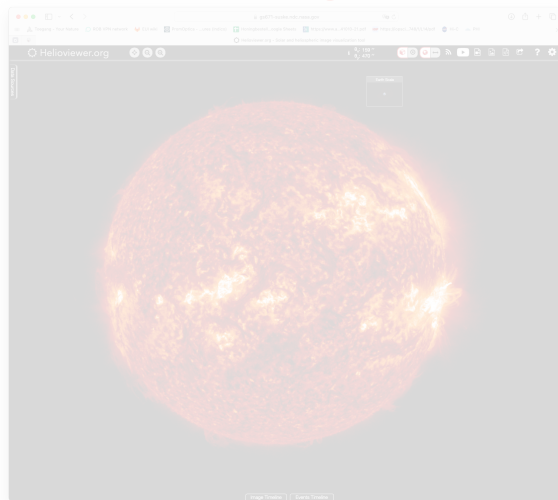
Server at (GSFC)

Server at IAS (Paris)

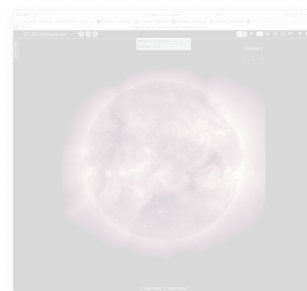
Server at ROB
(Brussels)

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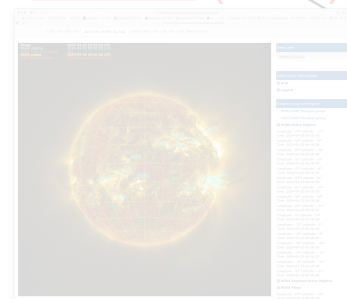
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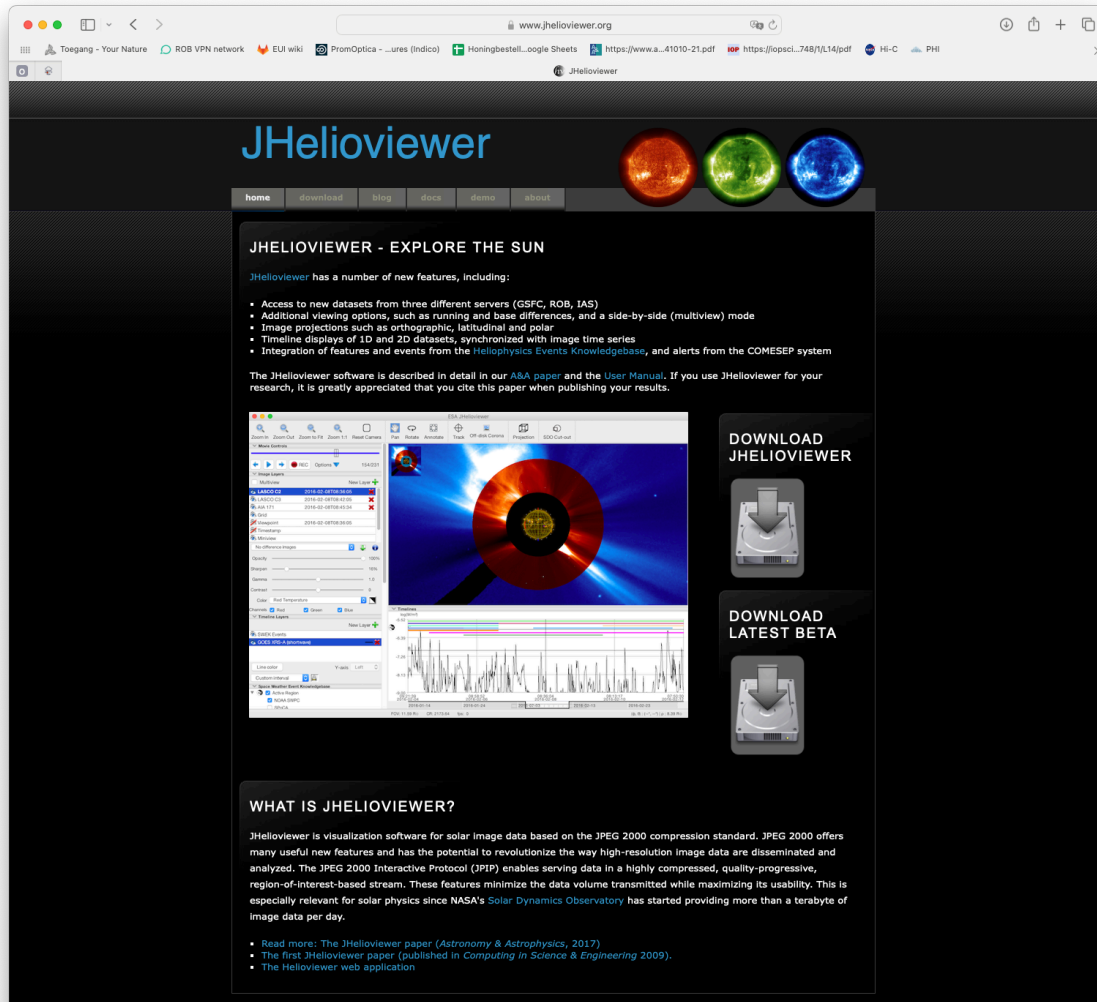
helioviewer.ias.u-psud.fr



sidc.be (ROB)



Download & Install

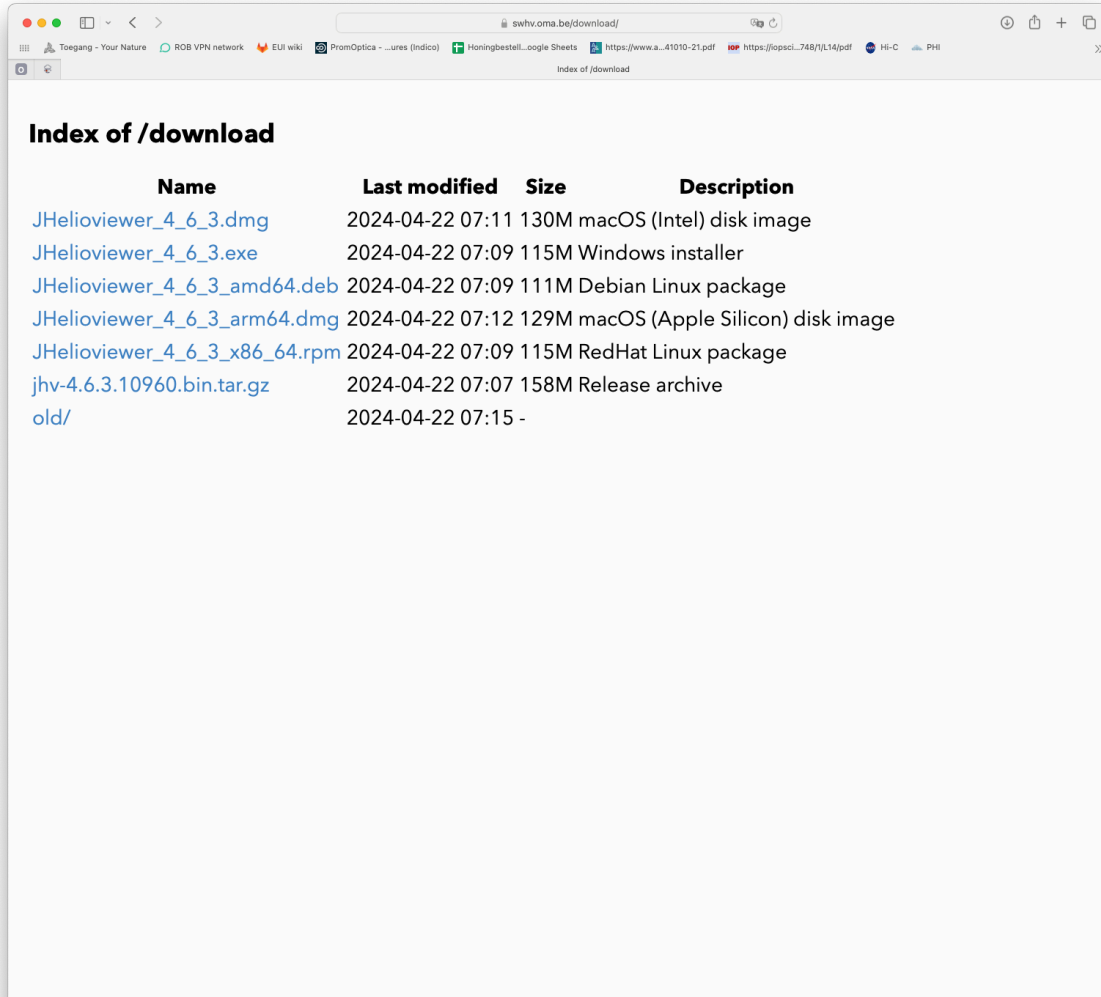


The screenshot shows the JHelioviewer website with the following content:

- Navigation menu: home, download, blog, docs, dump, about
- Section: JHELIOVIEWER - EXPLORE THE SUN
- Text: JHelioviewer has a number of new features, including:
- List of features:
 - Access to new datasets from three different servers (GSFC, ROB, IAS)
 - Additional viewing options, such as running and base differences, and a side-by-side (multiview) mode
 - Image projections such as orthographic, latitudinal and polar
 - Timelapse displays of 1D and 2D datasets, synchronized with image time series
 - Integration of features and events from the HelioPhysics Events Knowledgebase, and alerts from the COMESEP system
- Text: The JHelioviewer software is described in detail in our [ASA paper](#) and the [User Manual](#). If you use JHelioviewer for your research, it is greatly appreciated that you cite this paper when publishing your results.
- Image: A screenshot of the JHelioviewer software interface showing a solar image and a data plot.
- Buttons: DOWNLOAD JHELIOVIEWER and DOWNLOAD LATEST BETA
- Section: WHAT IS JHELIOVIEWER?
- Text: JHelioviewer is visualization software for solar image data based on the JPEG 2000 compression standard. JPEG 2000 offers many useful new features and has the potential to revolutionize the way high-resolution image data are disseminated and analyzed. The JPEG 2000 Interactive Protocol (JPIP) enables serving data in a highly compressed, quality-progressive, region-of-interest-based stream. These features minimize the data volume transmitted while maximizing its usability. This is especially relevant for solar physics since NASA's [Solar Dynamics Observatory](#) has started providing more than a terabyte of image data per day.
- List of references:
 - [Read more: The JHelioviewer paper \(Astronomy & Astrophysics, 2017\)](#)
 - [The first JHelioviewer paper \(published in Computing in Science & Engineering 2009\)](#).
 - [The Helioviewer web application](#)

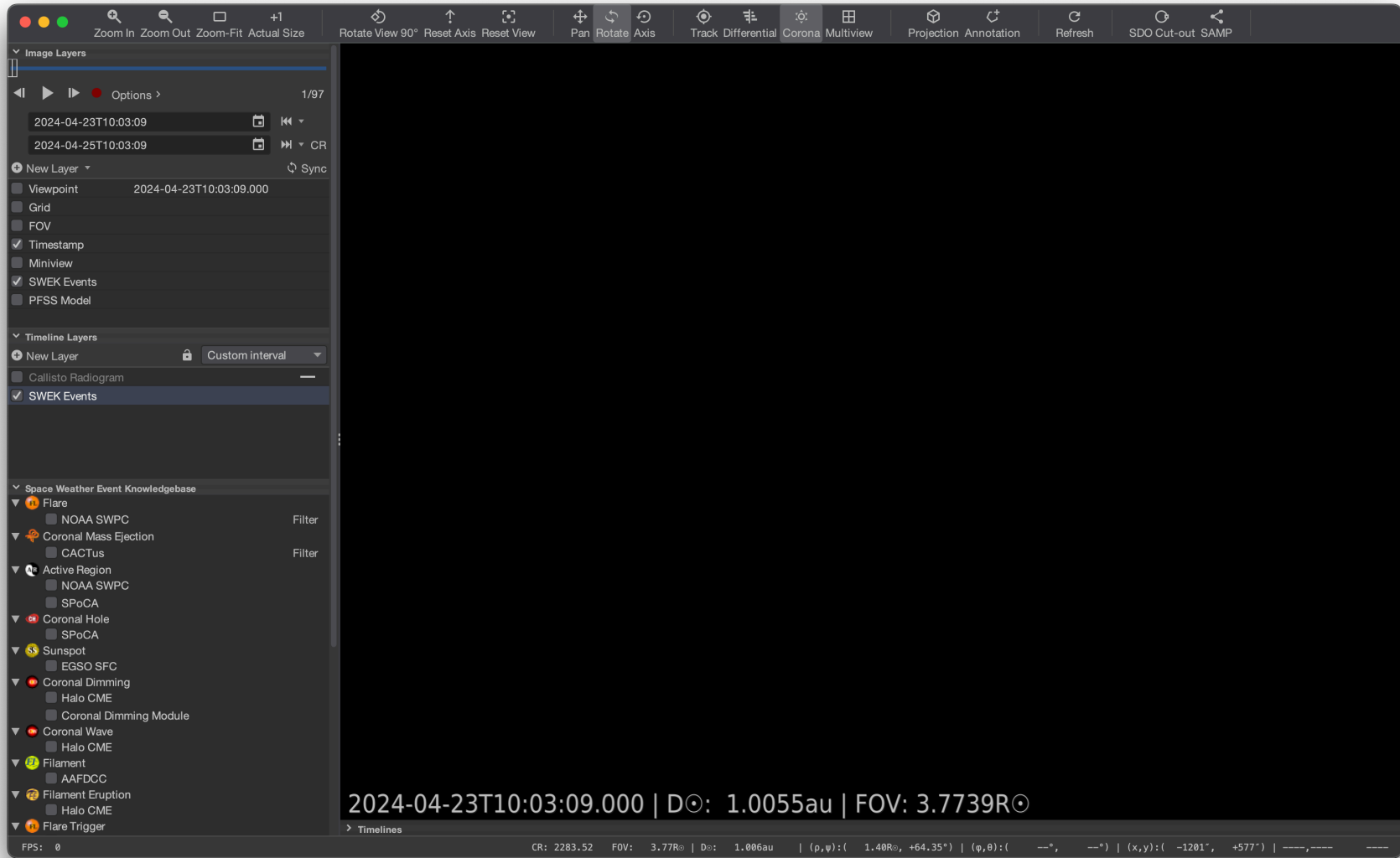
<https://www.jhelioviewer.org/>

Download & Install



<https://www.jhelioviewer.org/>

Start-it-up



Load recent SWAP movie

The screenshot displays a software interface for loading a SWAP movie. The top toolbar includes navigation and view controls: Zoom In, Zoom Out, Zoom-Fit, Actual Size, Rotate View 90°, Reset Axis, Reset View, Pan, Rotate, Axis, Track, and Differential. The main interface is divided into two sections: Image Layers and Timeline Layers.

Image Layers:

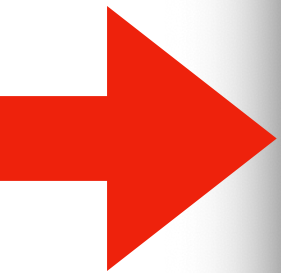
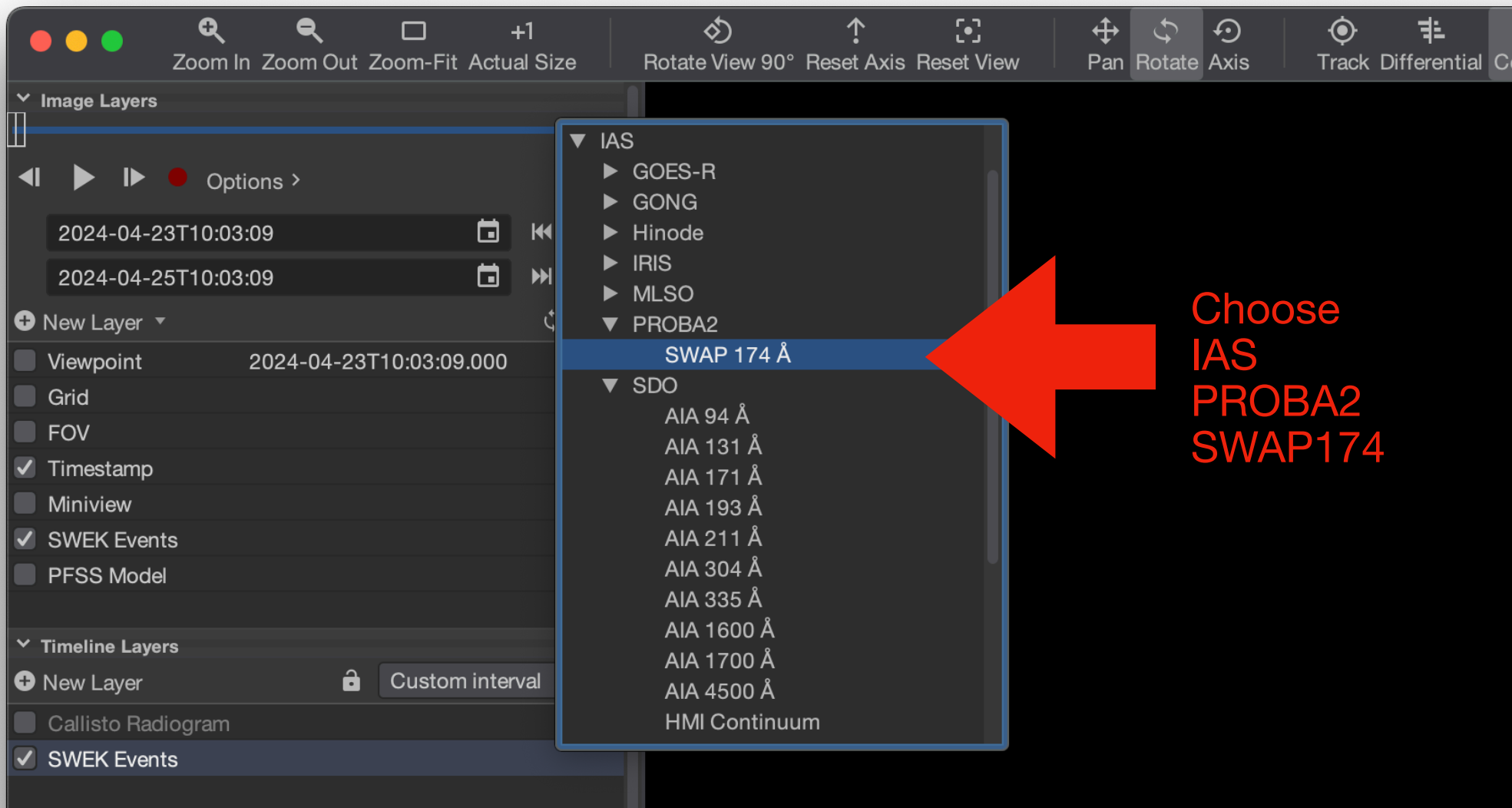
- Options > 1/97
- 2024-04-23T10:03:09 (selected) [Calendar icon] [Play/Pause icon]
- 2024-04-25T10:03:09 [Calendar icon] [Play/Pause icon]
- + New Layer ▾ [Refresh icon] Sync
- Viewpoint 2024-04-23T10:03:09.000
- Grid
- FOV
- Timestamp
- Miniview
- SWEK Events
- PFSS Model

Timeline Layers:

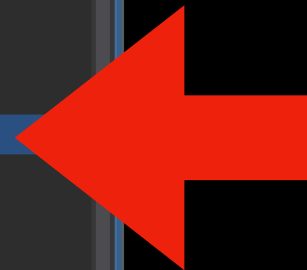
- + New Layer [Lock icon] Custom interval ▾
- Callisto Radiogram
- SWEK Events

A red arrow points to the first layer, '2024-04-23T10:03:09', with the text: **Choose birthday (00:00 - 23:59) in 2022**

Load recent SWAP movie

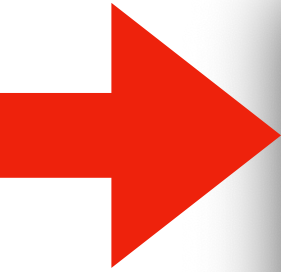


press
"New
Layer"



Choose
IAS
PROBA2
SWAP174

Play the movie



press
Play

The screenshot shows a software interface for viewing astronomical data. The top toolbar includes icons for Zoom In, Zoom Out, Zoom-Fit, Actual Size, Rotate View 90°, Reset Axis, Reset View, Pan, Rotate, Axis, Track Differential, Corona, Multiview, and Project. The left sidebar is titled "Image Layers" and contains a list of layers with a play button icon circled in red. The main window displays a large, detailed image of the Sun's surface, showing solar activity and the solar disk.

Image Layers

- 2024-04-23T10:03:09
- 2024-04-25T10:03:09
- New Layer
- SWAP 174** 2024-04-23T10:12:30.137
- Viewpoint 2024-04-23T10:12:30.137
- Grid
- FOV
- Timestamp
- Miniview
- SWEK Events
- PFSS Model

Difference None Running Base

Opacity 100%

Blend 50%

Sharpen 0%

Levels 0% 100%

Color SDO-AIA 171 Å

Channels Red Green Blue

Toolbar: Manipulate the movie



A screenshot of a software interface for manipulating a movie. The top toolbar is highlighted with a red box and contains icons for Zoom In, Zoom Out, Zoom-Fit, Actual Size, Rotate View 90°, Reset Axis, Reset View, Pan, Rotate, Axis, Track, Differential, Corona, Multiview, and Project. Below the toolbar is a layer panel with a list of layers including 'SWAP 174' and 'Viewpoint', and various settings like 'Difference', 'Opacity', 'Blend', 'Sharpen', 'Levels', and 'Color'. The main view area shows a solar image with a bright yellow and orange sun against a dark background.

Live demo

Do it yourself

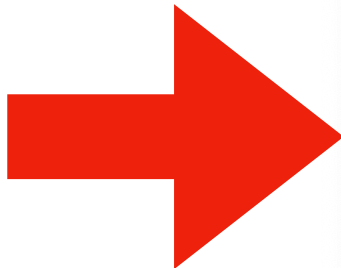
- install jHelioviewer from <https://jhelioviewer.org>
- start the application
- open SWAP movie (New Layer/IAS/PROBA2/SWAP) of your last birthday
- manipulate the movie

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>

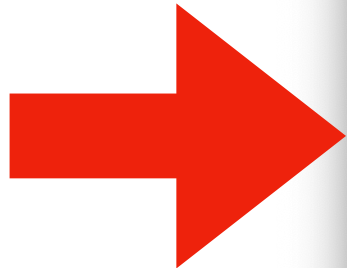
JHelioviewer image processing & combination

Image layer settings



The screenshot displays a software interface with a dark theme. At the top, there is a toolbar with icons for zooming (Zoom In, Zoom Out, Zoom-Fit, Actual Size) and view manipulation (Rotate View 90°, Reset Axis, Reset View, Pan, Rotate Axis, Track Differential, Coro). Below the toolbar is a panel titled 'Image Layers' containing a list of layers with checkboxes and timestamps. The selected layer is 'SWAP 174' with a timestamp of '2024-04-23T10:12:30.137'. Below the layer list are various settings: 'Difference' (radio buttons for None, Running, Base), 'Opacity' (slider at 100%), 'Blend' (slider at 50%), 'Sharpen' (slider at 0%), 'Levels' (two sliders at 0% and 100%), 'Color' (dropdown menu set to 'SDO-AIA 171 Å'), and 'Channels' (checkboxes for Red, Green, and Blue, all checked). A red rectangular box highlights these settings. Below the settings is a 'Shape Adjustments >' link. At the bottom, there is a 'Timeline Layers' section with a 'New Layer' button and a 'Custom interval' dropdown, and a list of layers including 'Callisto Radiogram' and 'SWEK Events' (checked).

Load a second movie



press
"New
Layer"

Zoom In Zoom Out Zoom-Fit Actual Size Rotate View 90° Reset Axis Reset View Pan Rotate Axis Track Differential Corona Multiview Projection Annotation

Image Layers

Options > 1/95

2024-04-23T10:03:09

2024-04-25T10:03:09

+ New Layer > Sync

SWAP 174 2024-04-23T10:12:30.137 x

Viewpoint 2024-04-23T10:12:30.137

Grid

FOV

Timestamp

Miniview

SWEK Events

PFSS Model

Difference None Running Base

Opacity 100%

Blend 50%

Sharpen 0%

Levels 0% 100%

Color SDO-AIA 171 Å

Channels Red Green Blue

Shape Adjustments >

Timeline Layers

+ New Layer Custom interval

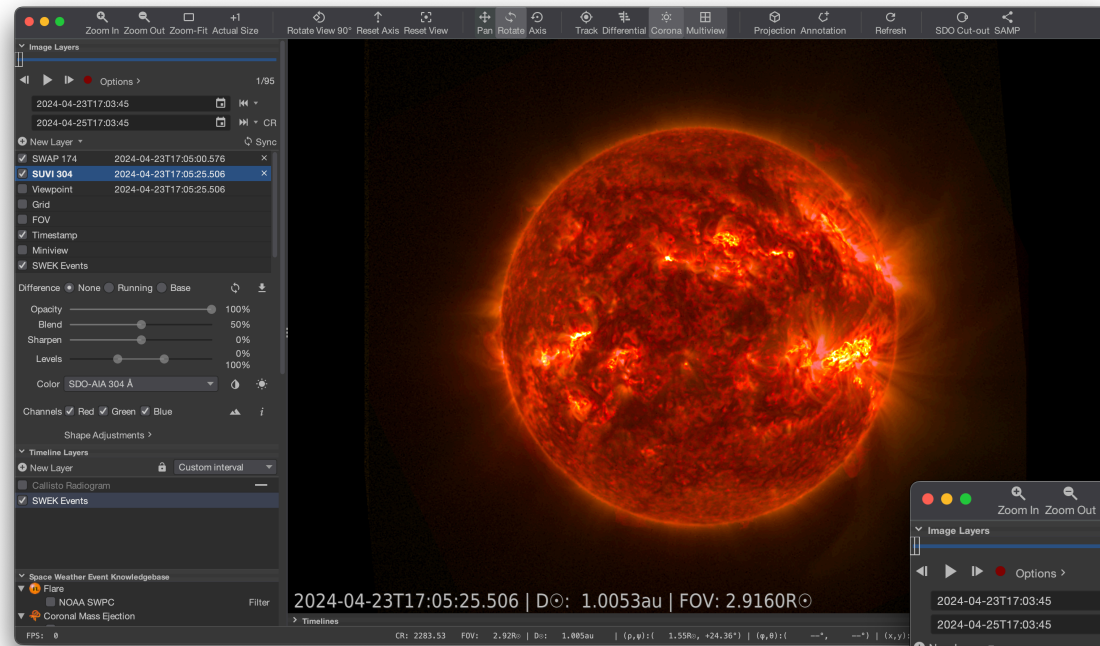
Callisto Radiogram

Datasets

- ▶ ROB
- ▼ IAS
 - ▼ GOES-R
 - SUVI 94
 - SUVI 131
 - SUVI 171
 - SUVI 195
 - SUVI 284
 - SUVI 304**
 - ▶ GONG
 - ▼ Hinode
 - XRT Al_med Open
 - XRT Al_poly Open
 - XRT Al_poly Ti_poly
 - XRT Be_med Open
 - XRT Be_thin Open
 - XRT Open Al_mesh
 - XRT Open Al_thick
 - XRT Open Be_thick

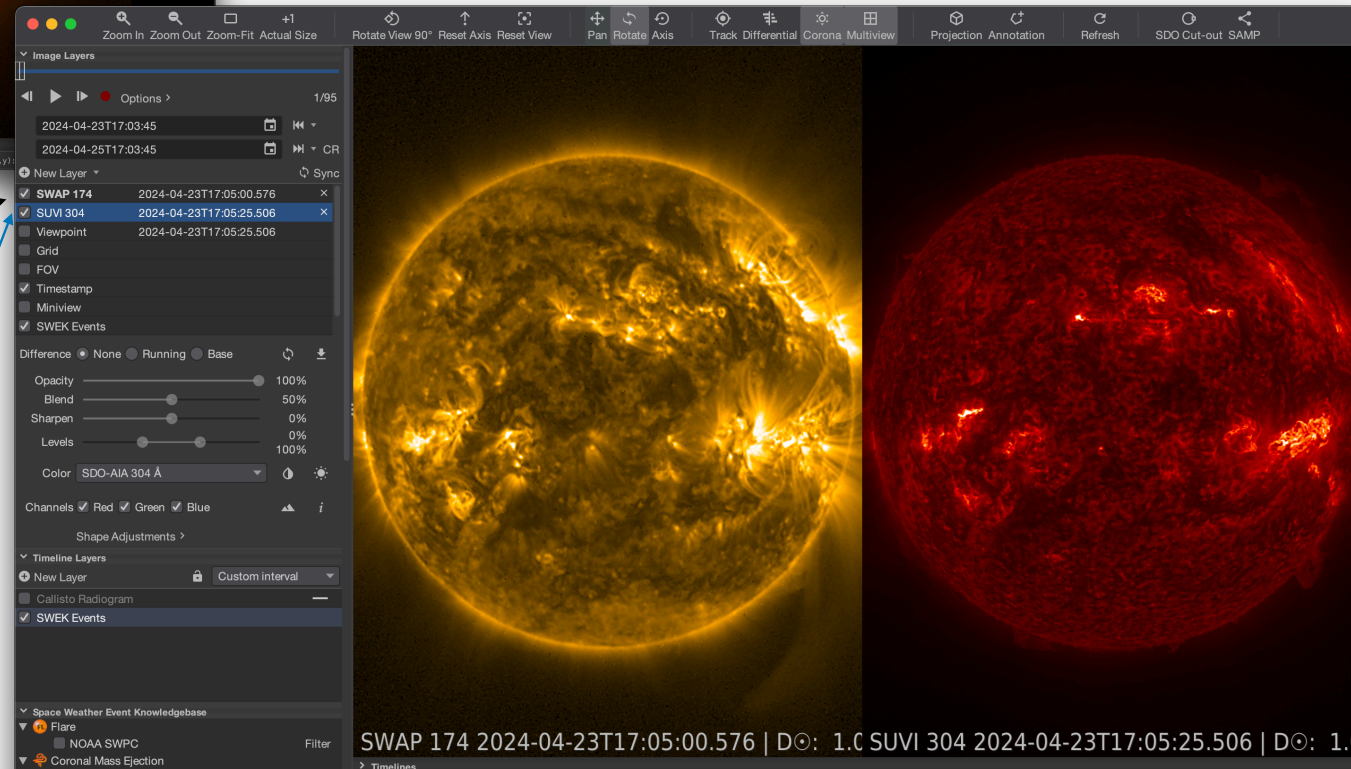
Choose
IAS
GOES-R
SUVI304

multiview



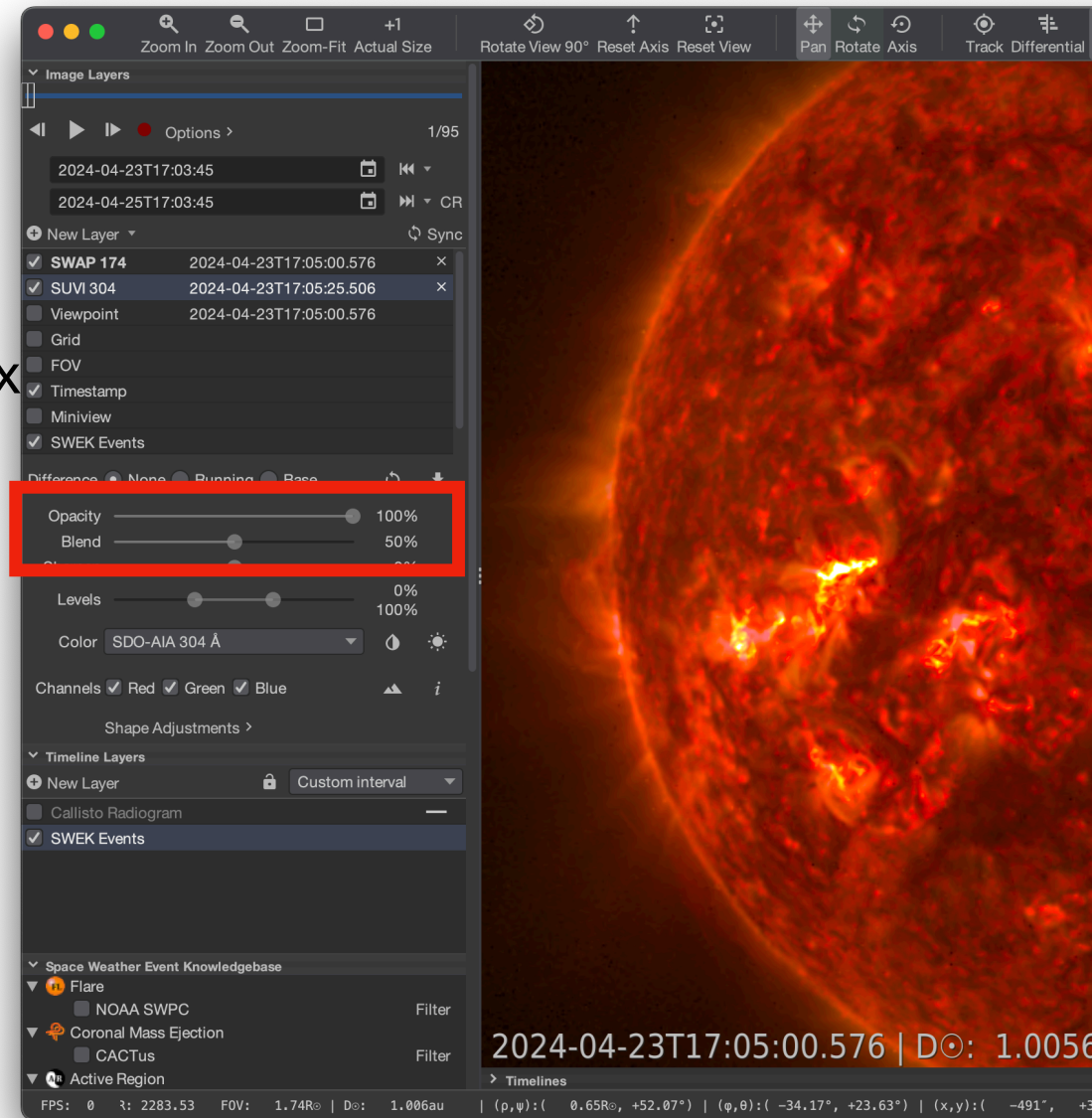
The image layer in bold is the Master determining the times when playing the movie

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

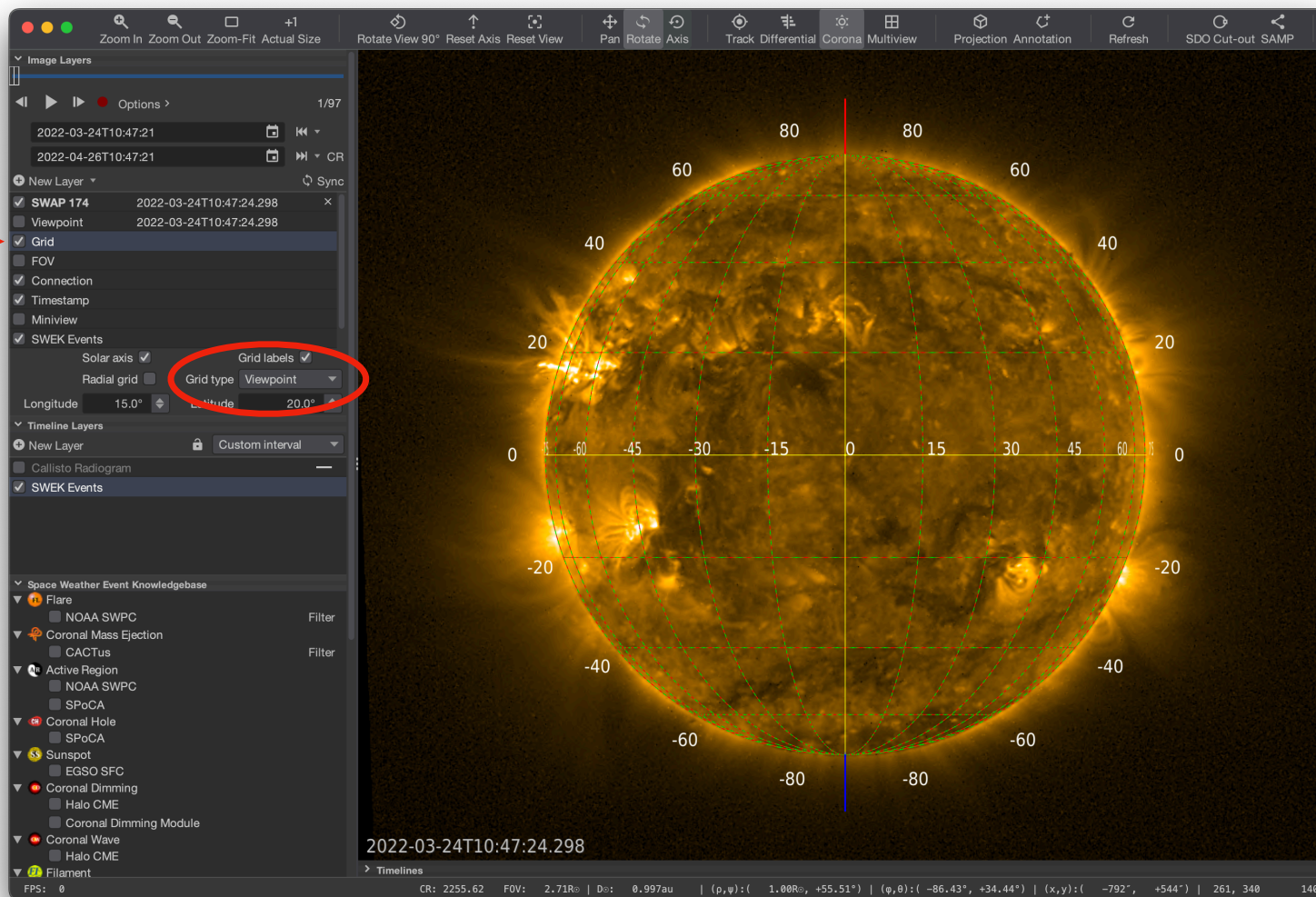
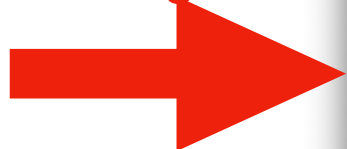
- Change brightness, color, contrast of your SWAP movie
- Load IAS/GOES-R/SUVI 304 data
- Experiment with Multiview, transparency, masking, etc

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)

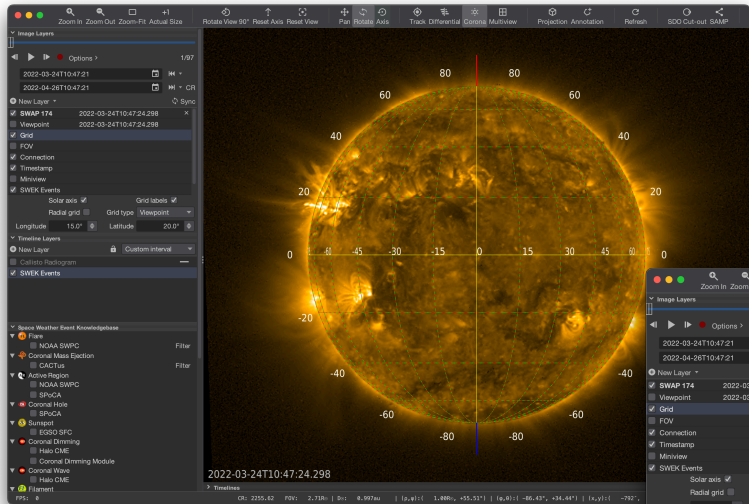
JHelioviewer grids & projections

Switch-on grid

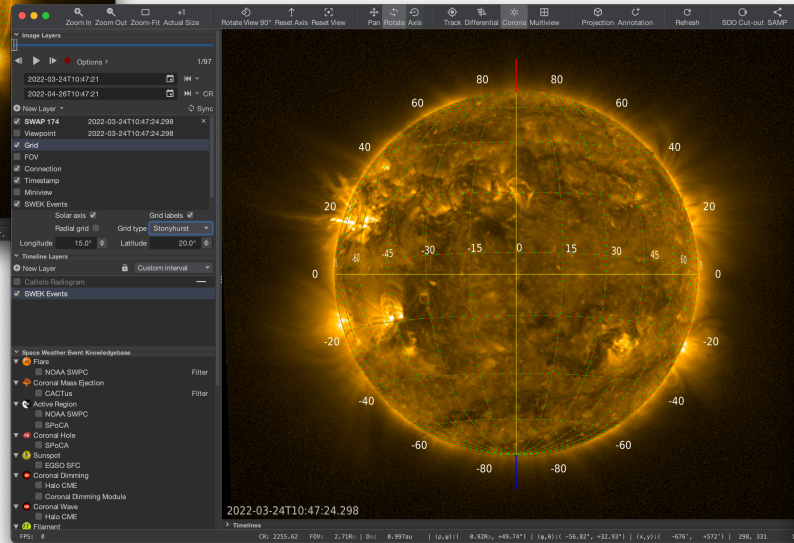


Timelines	
CR: 2255.62	FOV: 2.71R _☉ D _☉ : 0.997au (ρ,ψ):(1.00R _☉ , +55.51°) (φ,θ):(-86.43°, +34.44°) (x,y):(-792", +544") 261, 340 140

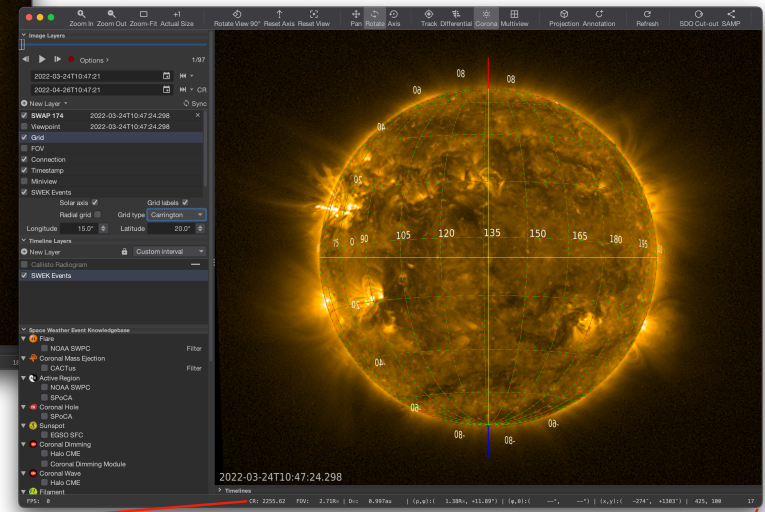
Grid type = Viewpoint



Grid type = Stonyhurst



Grid type = Carrington



Timelines

CR: 2255.62 FOV: 2.71R_☉ | Do: 0.997au | (ρ,ψ):(1.00R_☉, +55.51°) | (φ,θ):(-86.43°, +34.44°) | (x,y):(-792", +544") | 261, 340 140

Live demo

Do it yourself

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

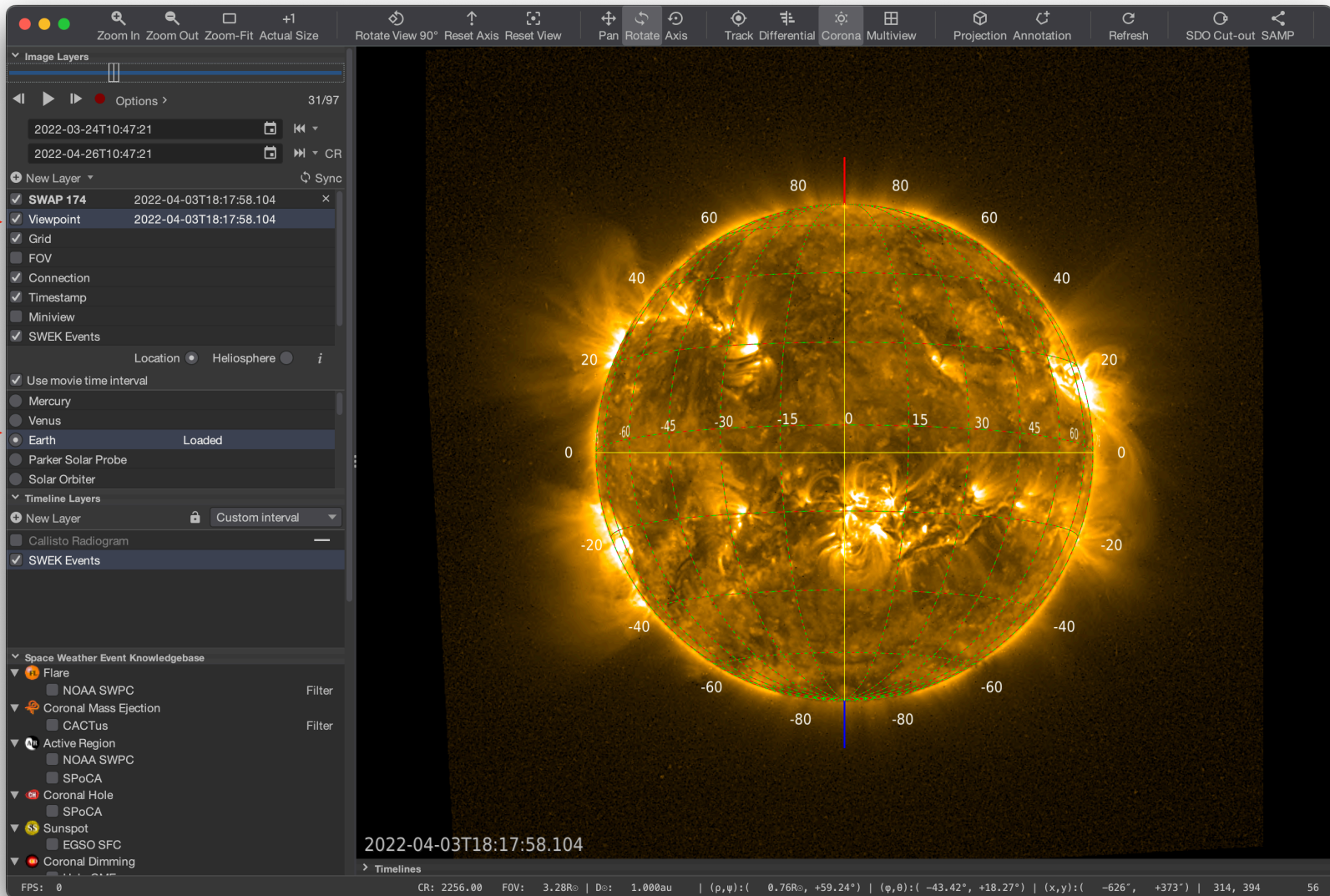
If you have spare time

- Try out the other grid options

Viewpoint



Earth



Viewpoint

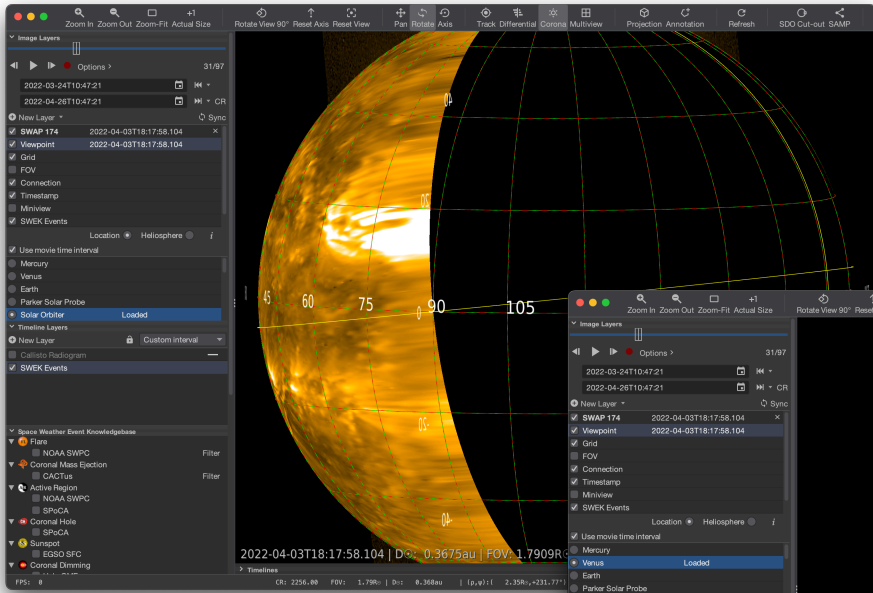


Earth

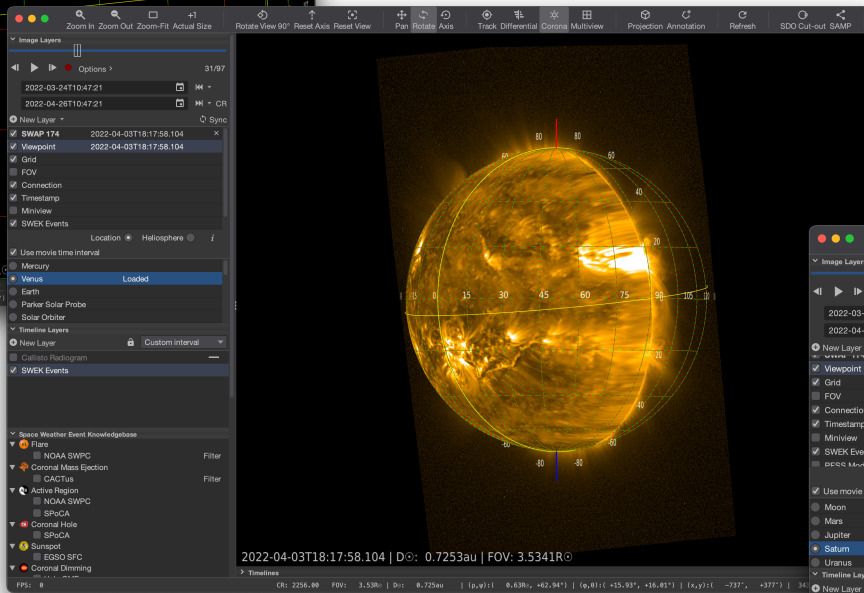


The screenshot displays a solar visualization application. The main window shows a 3D view of the Sun with a coordinate grid. The grid has latitude lines at 20, 40, 60, and 80 degrees, and longitude lines at 0, 15, 30, 45, 60, 75, and 90 degrees. The Sun's surface is rendered in a golden-yellow color, showing solar activity. The interface includes a top toolbar with navigation tools like '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', and 'SDO Cut-out SAMP'. The left sidebar contains several panels: 'Image Layers' with a timeline and layer list (including 'SWAP 174', 'Viewpoint', 'Grid', 'FOV', 'Connection', 'Timestamp', 'Miniview', 'SWEK Events', and 'Location' circled in red), 'Timeline Layers' with 'SWEK Events', and 'Space Weather Event Knowledgebase' with categories like 'Flare', 'Coronal Mass Ejection', 'Active Region', 'Coronal Hole', and 'Sunspot'. The bottom status bar shows technical data: 'CR: 2256.00', 'FOV: 3.28R_☉', 'D: 1.000au', and coordinates in (ρ, ψ) , (ϕ, θ) , and (x, y) formats. The timestamp '2022-04-03T18:17:58.104' is displayed in the bottom right of the main view area.

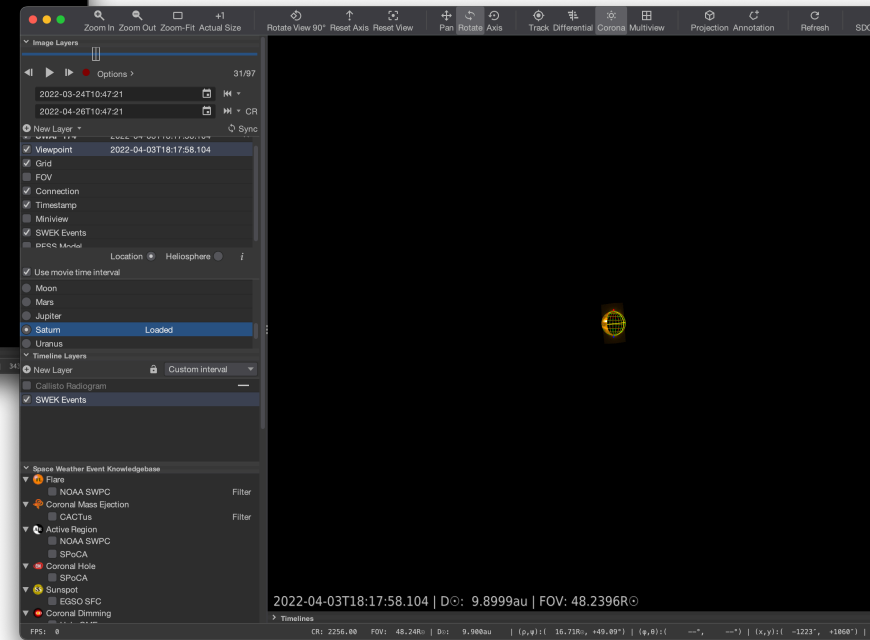
Viewpoint = Solar Orbiter



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 SA

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 x
- EUJ FSI 304 2022-03-24T10:55:55.179 x
- 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

2022-03-24T10:47:24.298

Timelines

FPS: 0 CR: 2255.62 FOV: 5.92R \odot | D \odot : 0.997au | (p, ψ):(1.71R \odot , +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

2022-03-24T10:47:21 1/97

2022-04-26T10:47:21 CR

New Layer Sync

- SWAP 174 2022-03-24T10:47:24.298 x
- EUI FSI 304 2022-03-24T10:55:55.179 x
- 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
 - NOAA SWPC
 - SPoCA
- Sunspot
 - EGSO SFC
- Coronal Dimming
 - Halo CME
 - Coronal Dimming Module

2022-03-24T10:47:24.298

SWAP

EUI/FSI

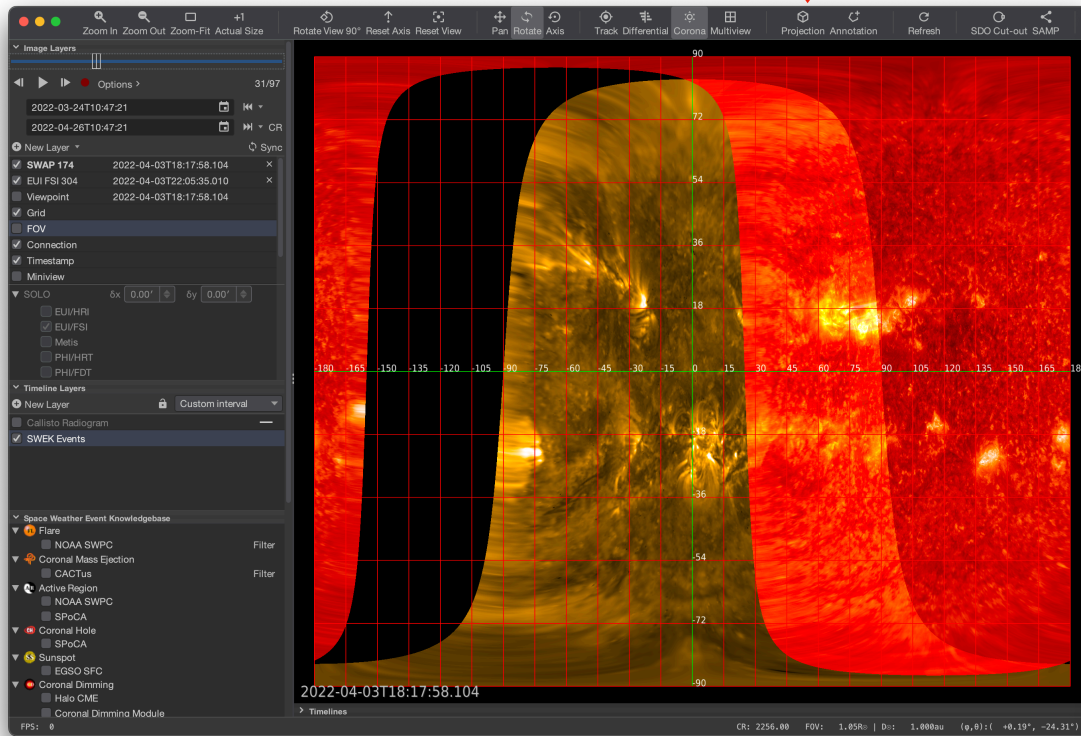
FPS: 0 CR: 2255.62 FOV: 5.92R \odot D \odot : 0.997au | (ρ, ψ): (1.75R \odot , +74.72 $^\circ$) | (ϕ, θ): (-- $^\circ$, -- $^\circ$) | (x,y): (-1625 $^\circ$, +

New Layer:
ROB
SOLO
EUI FSI 304

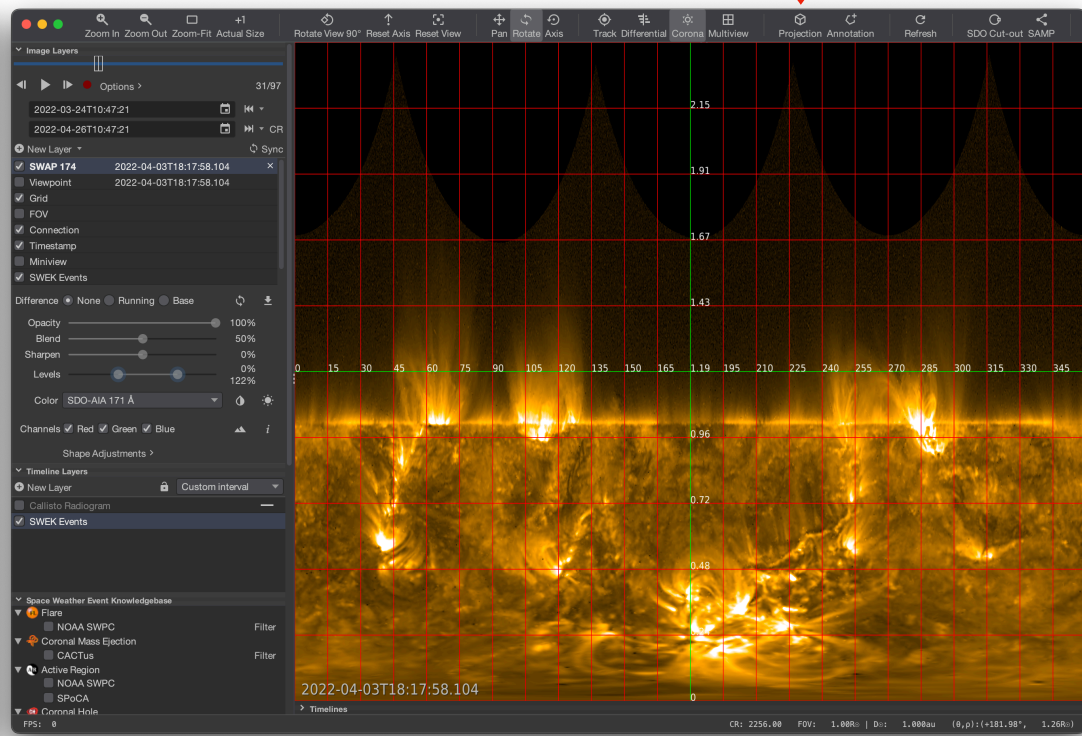


The screenshot shows a software interface for solar observation. The main window displays a 3D visualization of the Sun, with a red and yellow color scale representing intensity. The Sun is shown in a perspective view, with a grid of latitude and longitude lines. The labels 'SWAP' and 'EUI/FSI' are visible on the visualization. The interface includes a top toolbar with various navigation and viewing tools, and a left sidebar with a control panel. The control panel has several sections: 'Image Layers' with a 'New Layer' button and a list of layers including SWAP 174, EUI FSI 304, Viewpoint, Grid, FOV, Connection, Timestamp, and Miniview; 'SOLO' with sub-layers EUI/HRI, EUI/FSI, Metis, PHI/HRT, and PHI/FDT; 'Timeline Layers' with 'SWEK Events'; and 'Space Weather Event Knowledgebase' with categories like Flare, Coronal Mass Ejection, Active Region, Coronal Hole, Sunspot, and Coronal Dimming. The bottom status bar shows the current timestamp '2022-03-24T10:47:24.298' and various technical parameters like CR, FOV, D, and coordinates.

Projection: Latitudinal



Projection: Polar

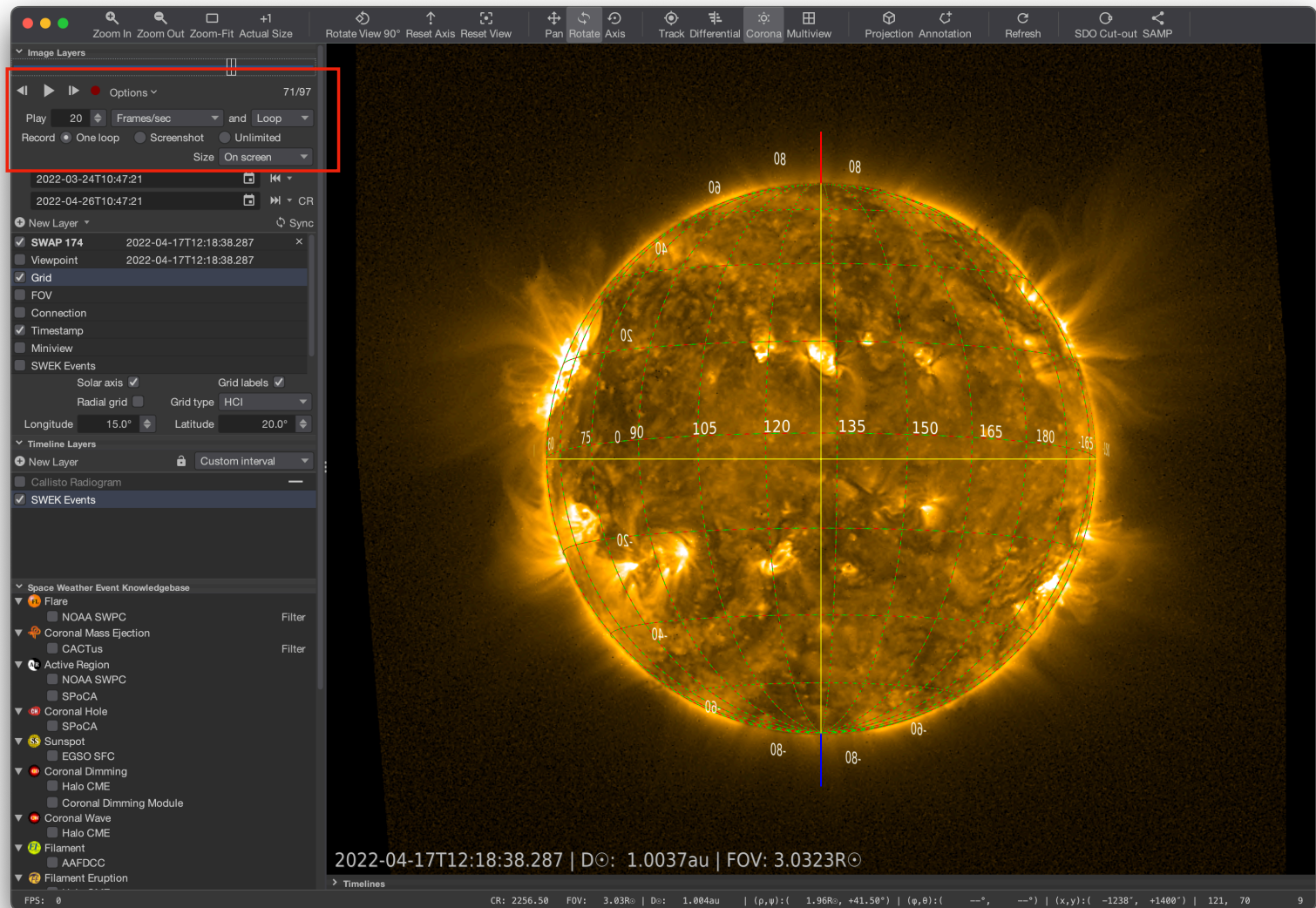


Do it yourself

- 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

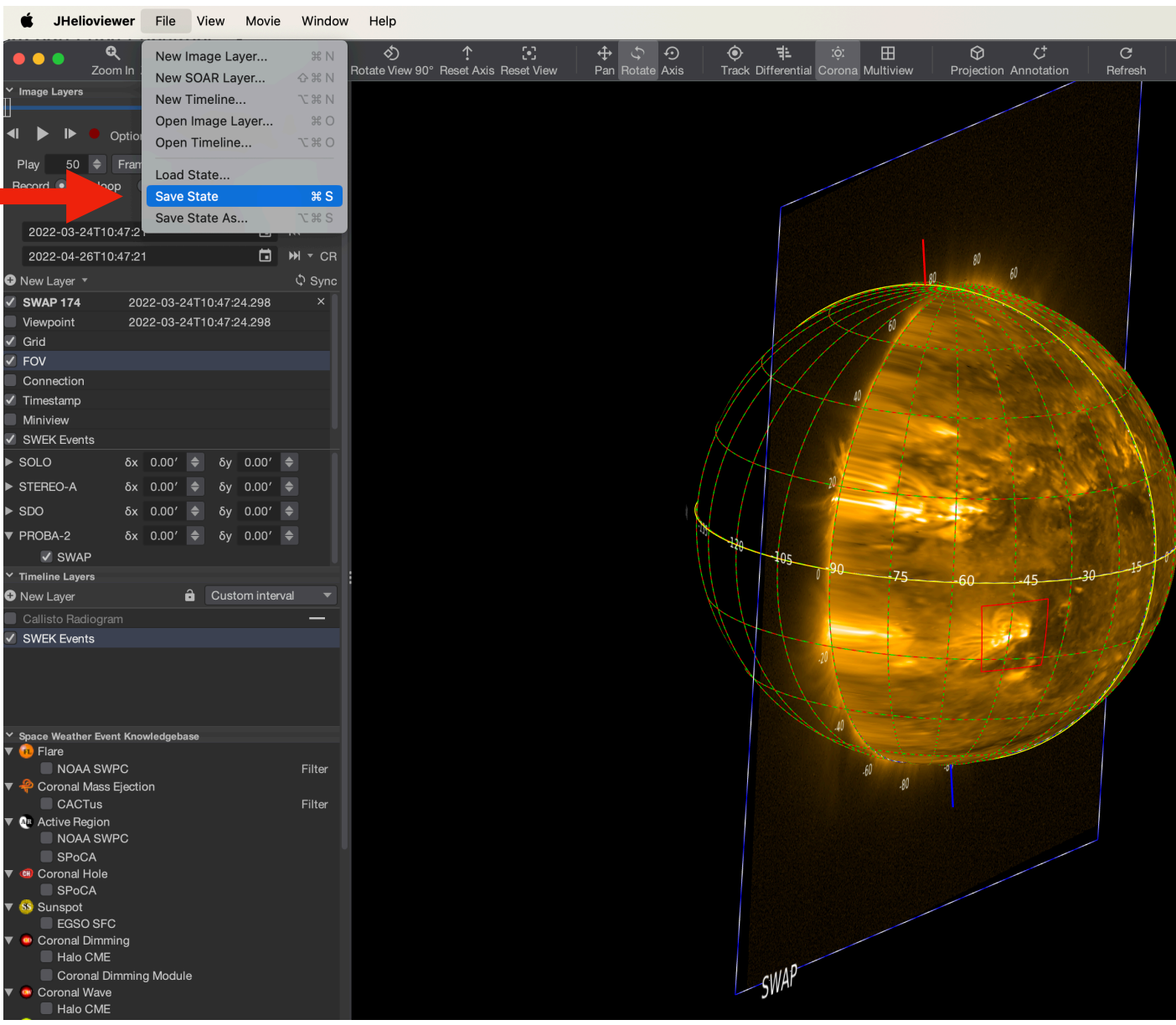
Click on "options"



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

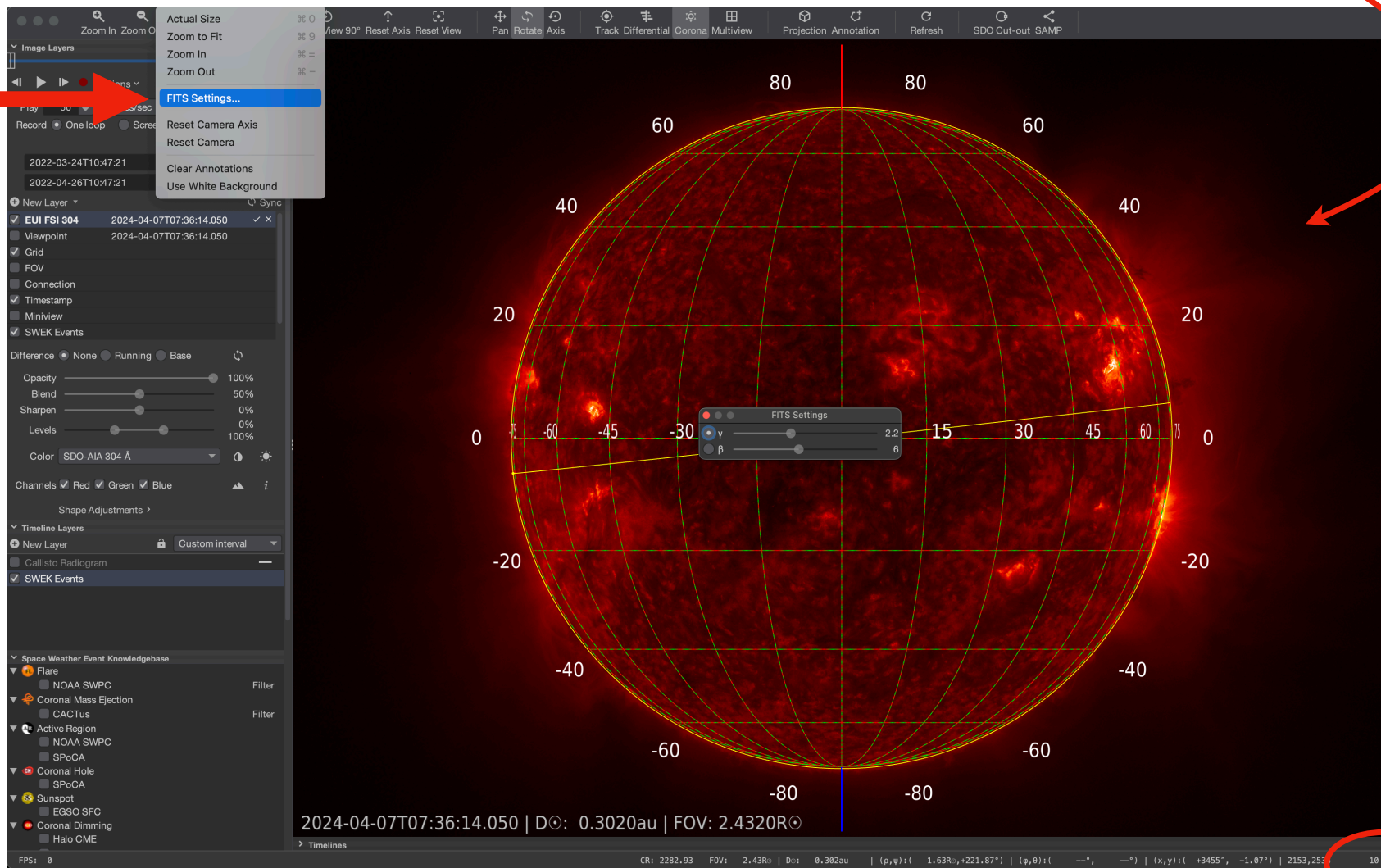
<http://sidc.be/EUI/data/states>

dataname	num files	sequence	context	start	end	cadence (s)	distance (AU)	SoL0-EarthAngle dur
hrievopn	225	Sequence	FSI 174 FSI 304	2023-04-24T23:15:00.165	2023-04-24T23:44:52.168	8	0.43	131.36
hriev174	206	Sequence	FSI 174 FSI 304	2023-04-23T12:42:50.368	2023-04-23T12:59:55.197	5	0.41	128.3
hriev174	513	Sequence	FSI 174 FSI 304	2023-04-23T12:00:00.194	2023-04-23T12:42:40.195	5	0.41	128.3
hriev174	720	Sequence	FSI 174 FSI 304	2023-04-22T12:00:00.162	2023-04-22T12:59:55.168	5	0.39	124.96
hriev174	720	Sequence	FSI 174 FSI 304	2023-04-21T12:00:00.259	2023-04-21T12:59:55.263	5	0.38	121.33
hriev174	360	Sequence	FSI 174 FSI 304	2023-04-17T07:59:58.237	2023-04-17T08:59:48.244	10	0.33	103.44
hriev174	140	Sequence	FSI 174 FSI 304	2023-04-16T17:59:58.270	2023-04-16T18:23:08.273	10	0.32	98.08
hriev174	360	Sequence	FSI 174 FSI 304	2023-04-16T02:59:58.176	2023-04-16T03:59:48.182	10	0.32	98.08
hriev174	71	Sequence	FSI 174 FSI 304	2023-04-15T05:17:27.285	2023-04-15T05:20:57.284	3	0.31	92.38
hriev174	688	Sequence	FSI 174 FSI 304	2023-04-15T04:43:00.285	2023-04-15T05:17:21.284	3	0.31	92.38
hriev174	1201	Sequence	FSI 174 FSI 304	2023-04-15T03:03:00.274	2023-04-15T04:43:00.285	5	0.31	92.38
hriev174	121	Sequence	FSI 174 FSI 304	2023-04-15T02:43:00.272	2023-04-15T03:03:00.274	10	0.31	92.38
hriev174	60	Sequence	FSI 174 FSI 304	2023-04-11T23:44:57.277	2023-04-12T00:04:37.279	20	0.29	67.01
hriev174	600	Sequence	FSI 174 FSI 304	2023-04-11T23:14:55.279	2023-04-11T23:44:52.277	3	0.29	67.01
hriev174	1201	Sequence	FSI 174 FSI 304	2023-04-11T21:34:55.268	2023-04-11T23:14:55.279	5	0.29	67.01
hriev174	90	Sequence	FSI 174 FSI 304	2023-04-11T21:04:57.259	2023-04-11T21:34:37.263	20	0.29	67.01
hriev174	165	Sequence	FSI 174 FSI 304	2023-04-10T22:52:25.239	2023-04-10T23:19:45.242	10	0.29	60.39
hriev174	134	Sequence	FSI 174 FSI 304	2023-04-10T22:29:55.242	2023-04-10T22:52:05.239	10	0.29	60.39
hriev174	432	Sequence	FSI 174 FSI 304	2023-04-10T22:08:22.234	2023-04-10T22:29:55.242	3	0.29	60.39
hriev174	1368	Sequence	FSI 174 FSI 304	2023-04-10T20:59:55.261	2023-04-10T22:08:16.234	3	0.29	60.39
hriev174	301	Sequence	FSI 174 FSI 304	2023-04-10T20:09:55.226	2023-04-10T20:59:55.261	10	0.29	60.39
hriev174	2160	Sequence	FSI 174 FSI 304	2023-04-10T03:29:55.242	2023-04-10T09:29:45.276	10	0.29	60.39
hriev174	360	Sequence	FSI 174 FSI 304	2023-04-07T05:50:00.282	2023-04-07T06:49:50.288	10	0.3	41.24
hriev174	1801	Sequence	FSI 174 FSI 304	2023-04-07T04:20:00.272	2023-04-07T05:50:00.282	3	0.3	41.24
hriev174	361	Sequence	FSI 174 FSI 304	2023-04-07T03:20:00.265	2023-04-07T04:20:00.272	10	0.3	41.24
hriev174	60	Sequence	FSI 174 FSI 304	2023-04-05T22:08:00.199	2023-04-05T22:12:55.200	5	0.31	29.79

Be careful: only click on small sequences

Open FITS settings

Drag and dump local FITS file



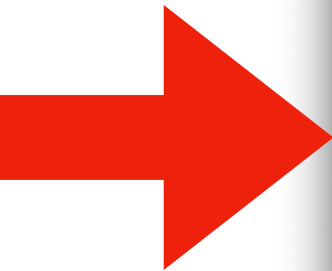
brightness value at pointer

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

The screenshot displays a solar simulation software interface. The main window shows a 3D model of the Sun with a complex network of magnetic field lines in white, blue, and red. The interface includes a top toolbar with various navigation and simulation controls, a left sidebar with a layer management panel, and a bottom status bar with technical data.

Image Layers Panel:

- 2024-04-23T17:03:45
- 2024-04-25T17:03:45
- New Layer
- SUVI 304 2024-04-23T17:05:25.506
- Viewpoint 2024-04-23T17:05:00.576
- Grid
- FOV
- Timestamp
- Miniview
- SWEK Events
- PFSS Model 2024-04-23T16:04:00.000

Timeline Layers Panel:

- New Layer
- Callisto Radiogram
- SWEK Events

Space Weather Event Knowledgebase Panel:

- Flare
 - NOAA SWPC Filter
- Coronal Mass Ejection
 - CACTus Filter
- Active Region
 - NOAA SWPC
 - SPoCA
- Coronal Hole
 - SPoCA
- Sunspot
 - EGSO SFC
- Coronal Dimming

Status Bar:

2024-04-23T17:05:00.576 | D \odot : 1.0056au | FOV: 3.3974R \odot

FPS: 0 | CR: 2283.53 | FOV: 3.40R \odot | D \odot : 1.006au | (ρ,ψ):(1.32R \odot , +47.87°) | (φ,θ):(--°, --°) | (x,y):(-935", +846") | 216, 244 | 23

Viewpoint

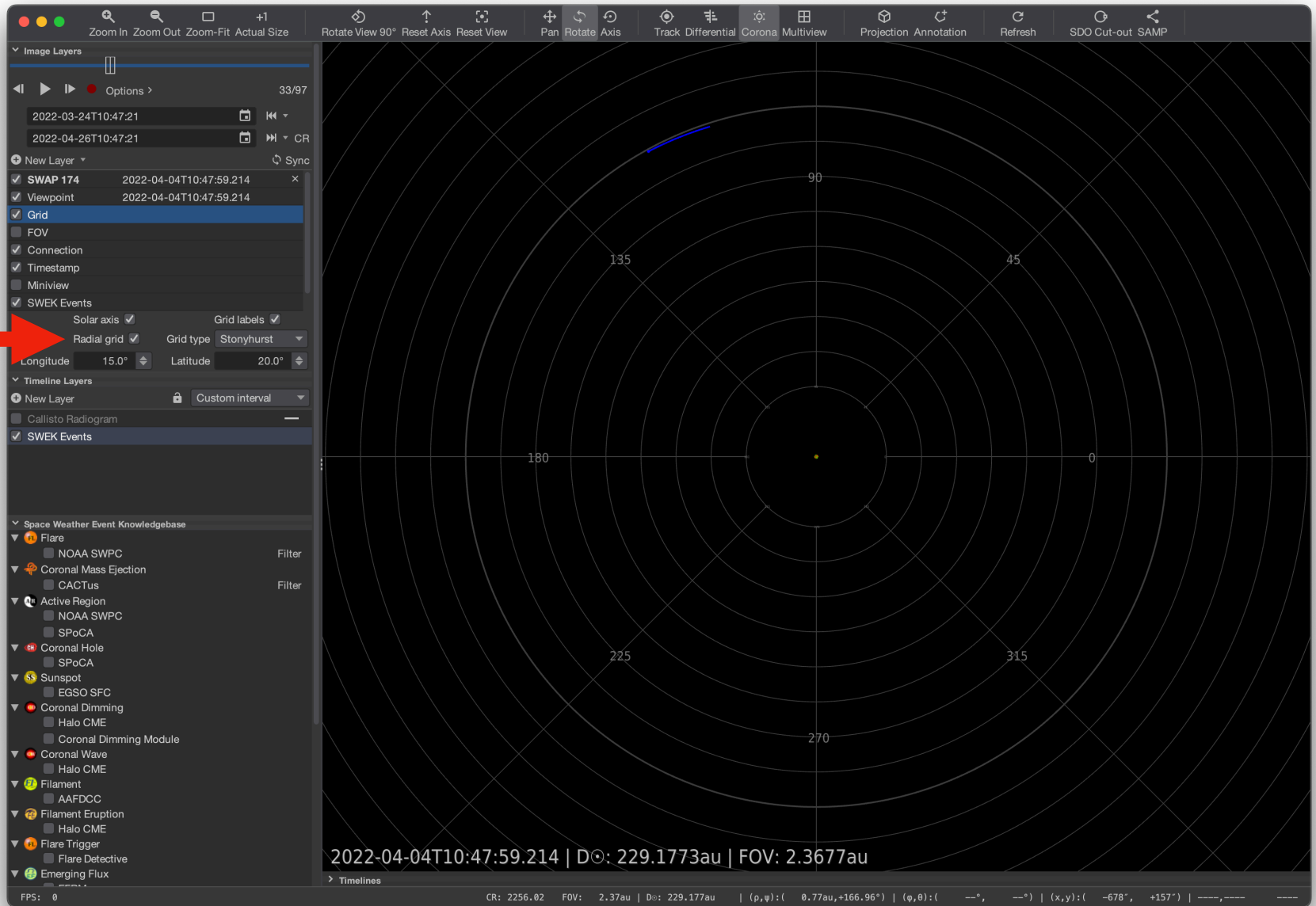
The screenshot displays a software interface for solar observation. The main window shows a 3D visualization of the heliosphere, a golden sphere with a grid of green lines, and a satellite probe. The left sidebar contains a control panel with the following sections:

- Image Layers:** Includes playback controls (62/97), a list of layers (2022-03-24T10:47:21, 2022-04-26T10:47:21), and a 'New Layer' dropdown. The 'Viewpoint' layer is selected and highlighted with a red circle. Other layers include SWAP 174, Grid, FOV, Connection, Timestamp, Miniview, and SWEK Events. The 'Location' is set to 'Heliosphere'.
- Timeline Layers:** Includes 'New Layer' (Custom interval), 'Callisto Radiogram', and 'SWEK Events'.
- Space Weather Event Knowledgebase:** Lists various events such as Flare, Coronal Mass Ejection, Active Region, Coronal Hole, Sunspot, Coronal Dimming, and Coronal Wave.

The bottom status bar displays the following information:

2022-04-14T10:01:43.481 | D☉: 229.1773au | FOV: 3.3882R☉

Timelines: CR: 2256.39 | FOV: 3.39R☉ | D☉: 229.177au | (p,ψ):(0.68R☉, +69.60°) | (φ,θ):(-59.00°, +47.12°) | (x,y):(+1°, +3°) | 583, 319 | 99

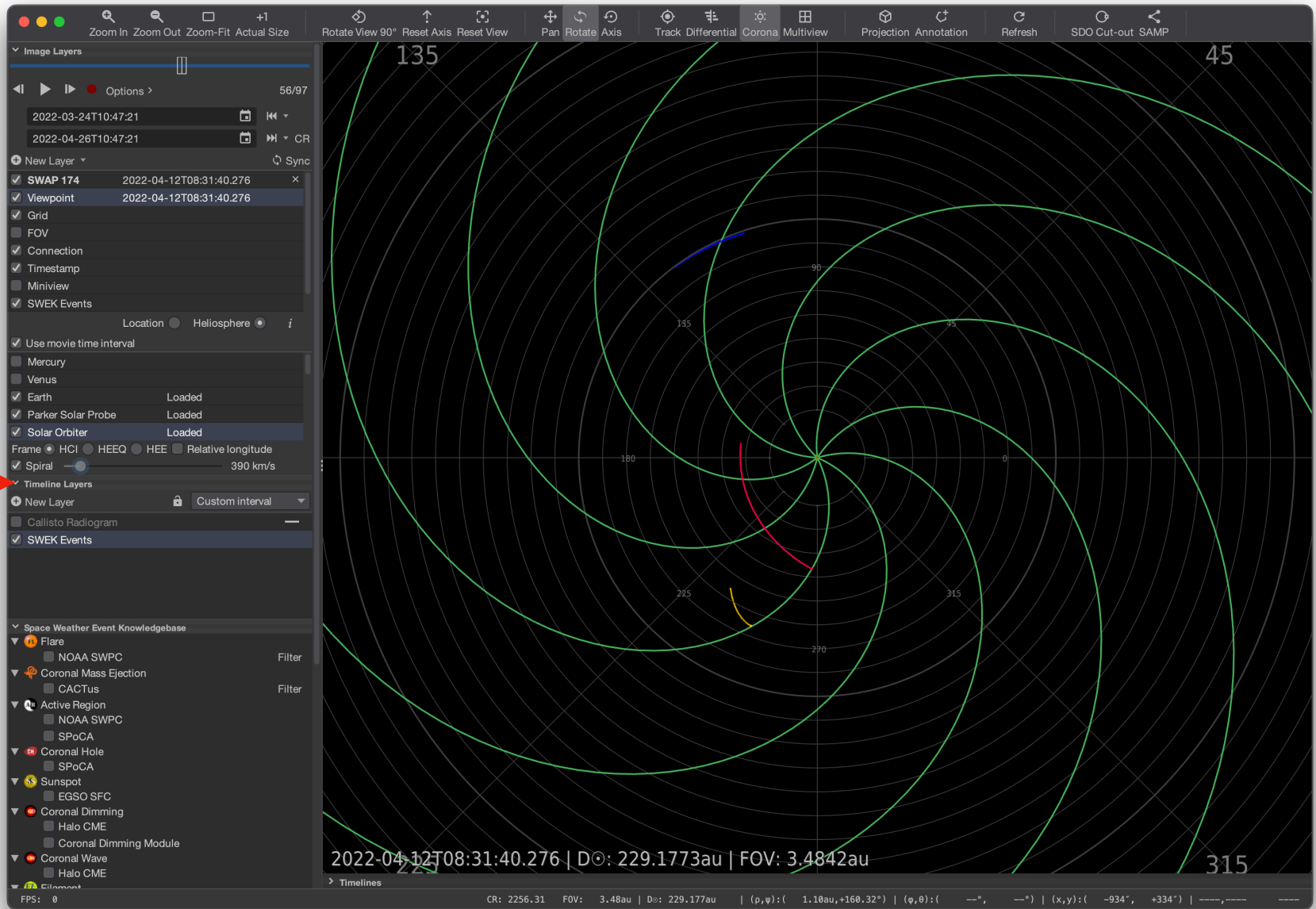


Grid

Radial Grid

... zoom out ...

Play movie



Solar Orbiter
& PSP

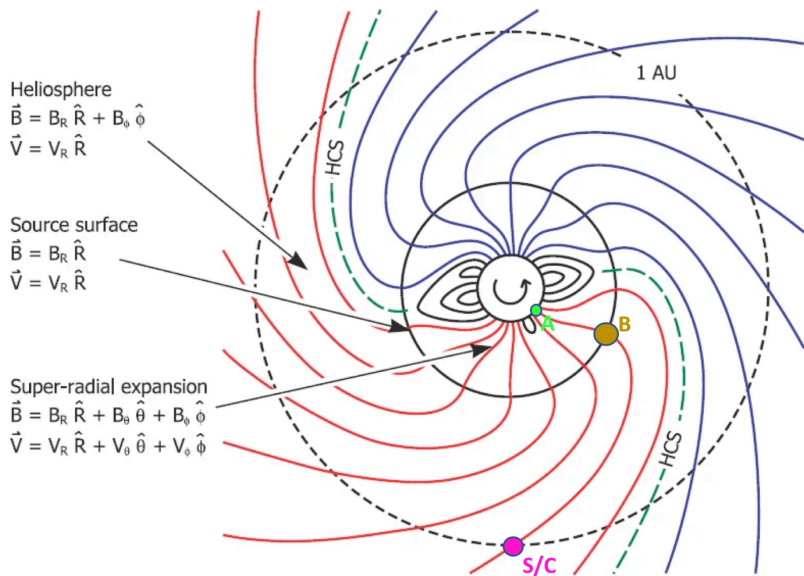


Parker spiral
with configurable
speed

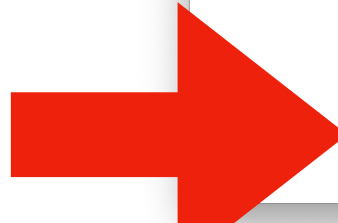
Live demo

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



Not Secure — connect-tool.irap.omp.eu

HOME FORECAST SHOCK-TOOL NEWS CONTACTS TUTORIAL

Magnetic Connectivity Tool

Close form

CORONAL MAGNETIC FIELD :
 WSO MFM PFSS/SCS
 NSO DUMFRIC WSA
 ADAPT

PROPAGATION MODE :
 SC SUN
 SUN SC
 SW LAG EM LAG

DATE: 04/26/2024

TIME (UTC):
 00:00
 06:00
 12:00
 18:00

Search

- 1d
- 6h

EARTH PSP STEREO A SOLAR ORBITER BEPI COLOMBO ALL OPTIONS

ADAPT

SUNTIMEBW: 2024-04-26T05:59:59 2024-04-29T14:02:57 CR2283 Magnetogram: ADAPT

Mode : FORECAST
 Coronal Model : PFSS (rss = 2.5 Rsun)
 Magnetogram : ADAPT -1
 (2024-04-26 06:00:00 UTC)
 Reliability Test (WL) : unknown

NOAA 13639
NO DATA

NOAA 13643
NO DATA

NOAA 13644

Powered by SolarMACH

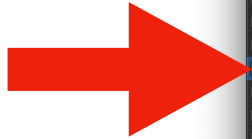
▼ DOWNLOAD DATA DOWNLOAD IMAGE

Connectivity file [ASCII](#) [JSON](#)

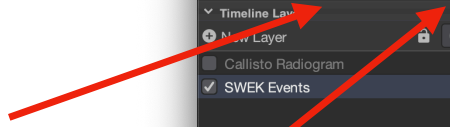
HCS file [ASCII](#) [JSON](#)

Fieldline file [ASCII](#) [JSON](#)

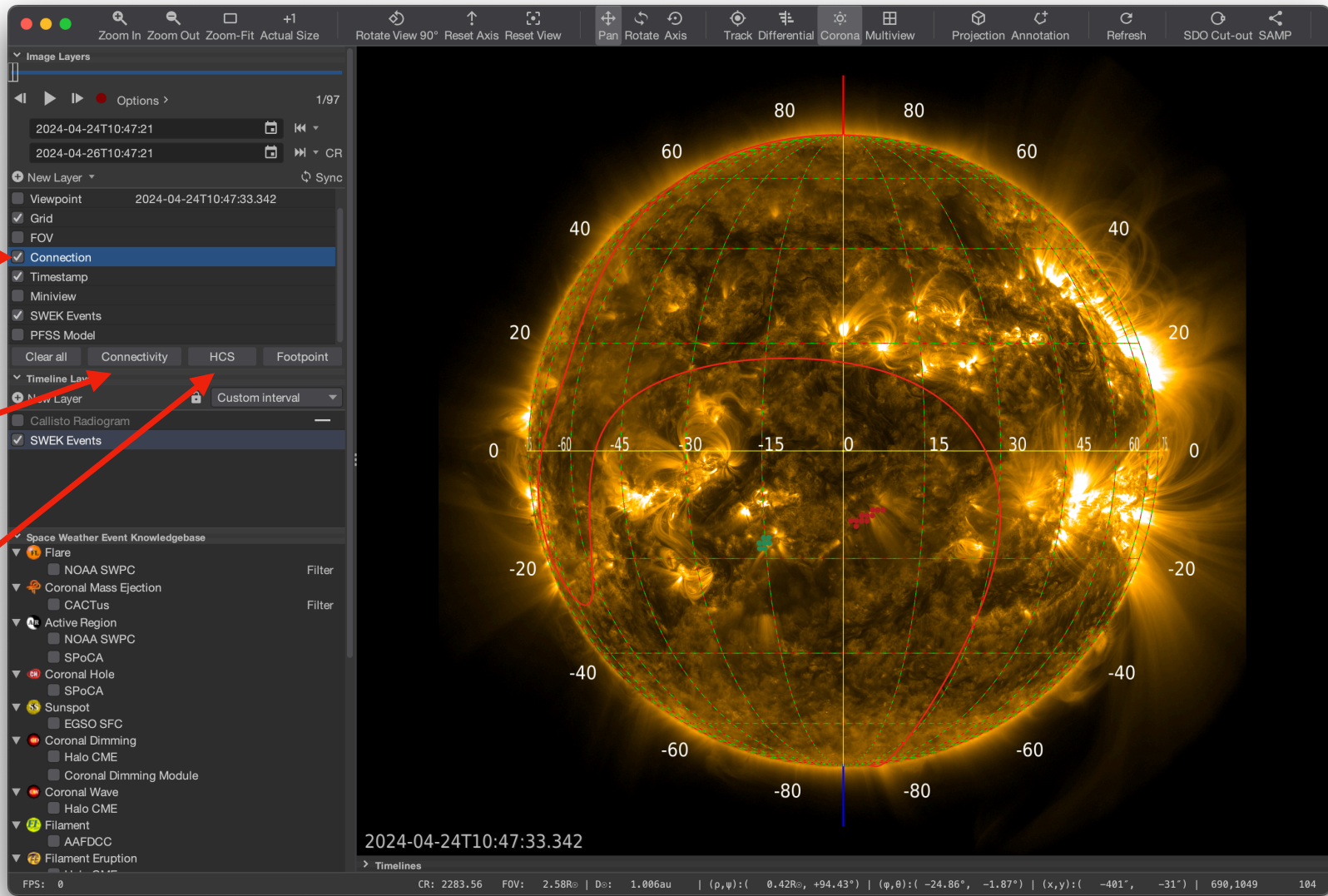
Switch-on
'connection'



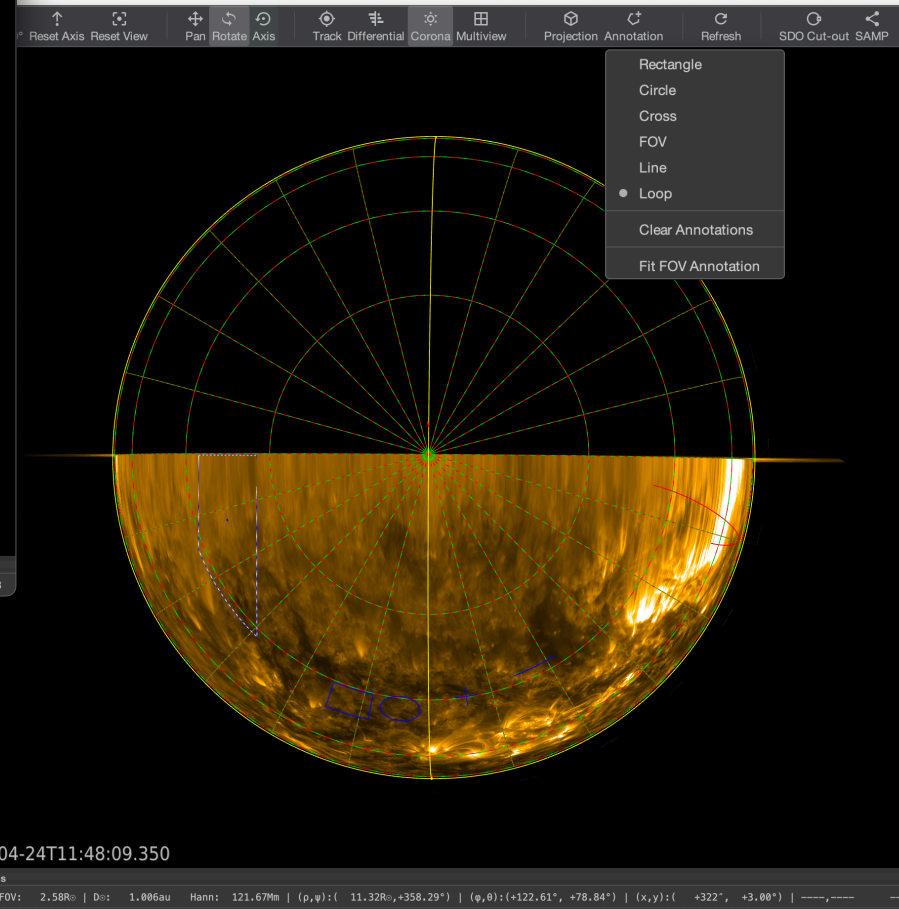
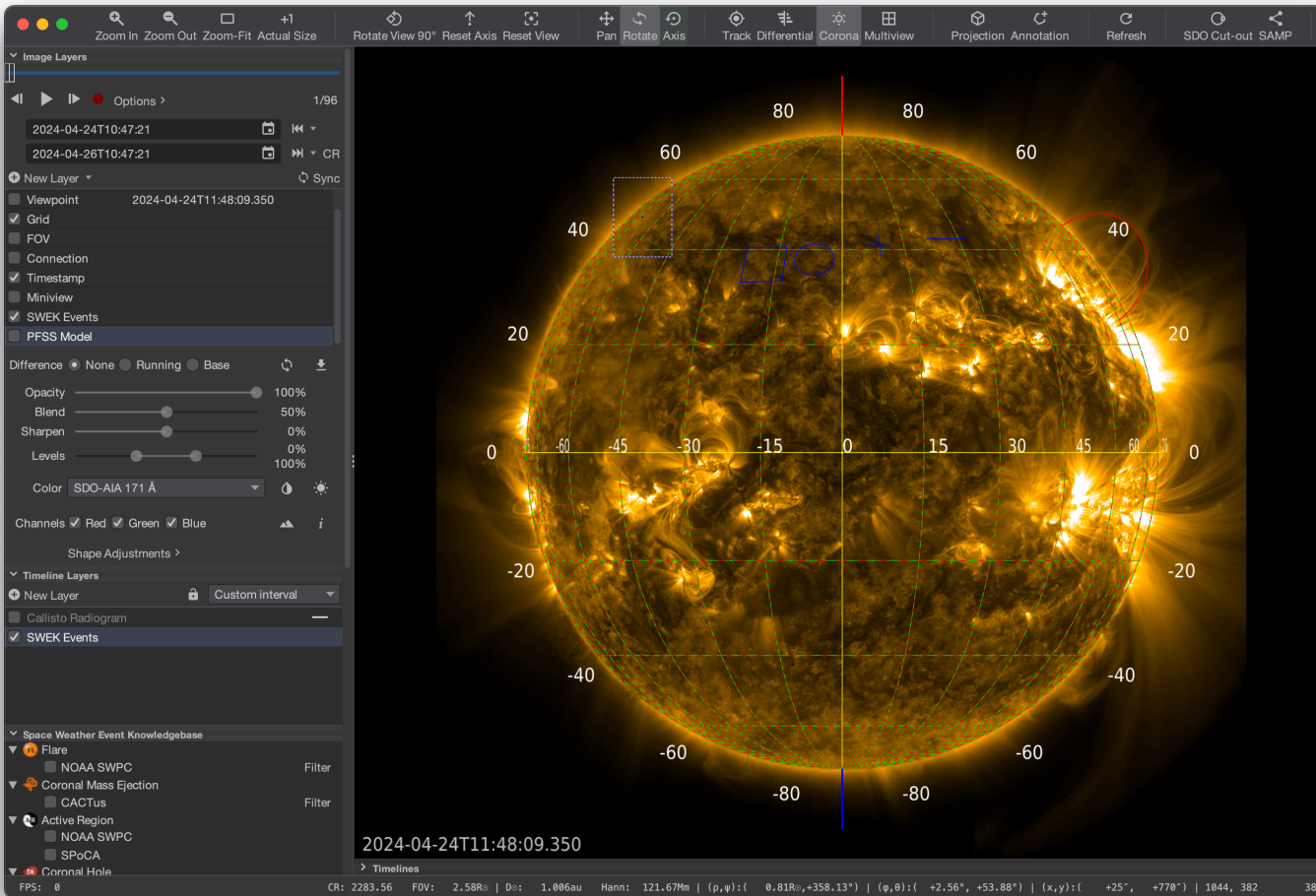
Load ASCII
connectivity file



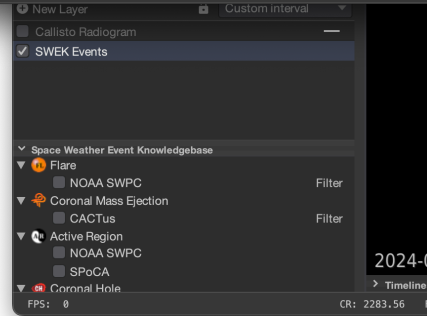
Load ASCII
HCS file



annotations



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(previous), another annotation will become red.



Live demo

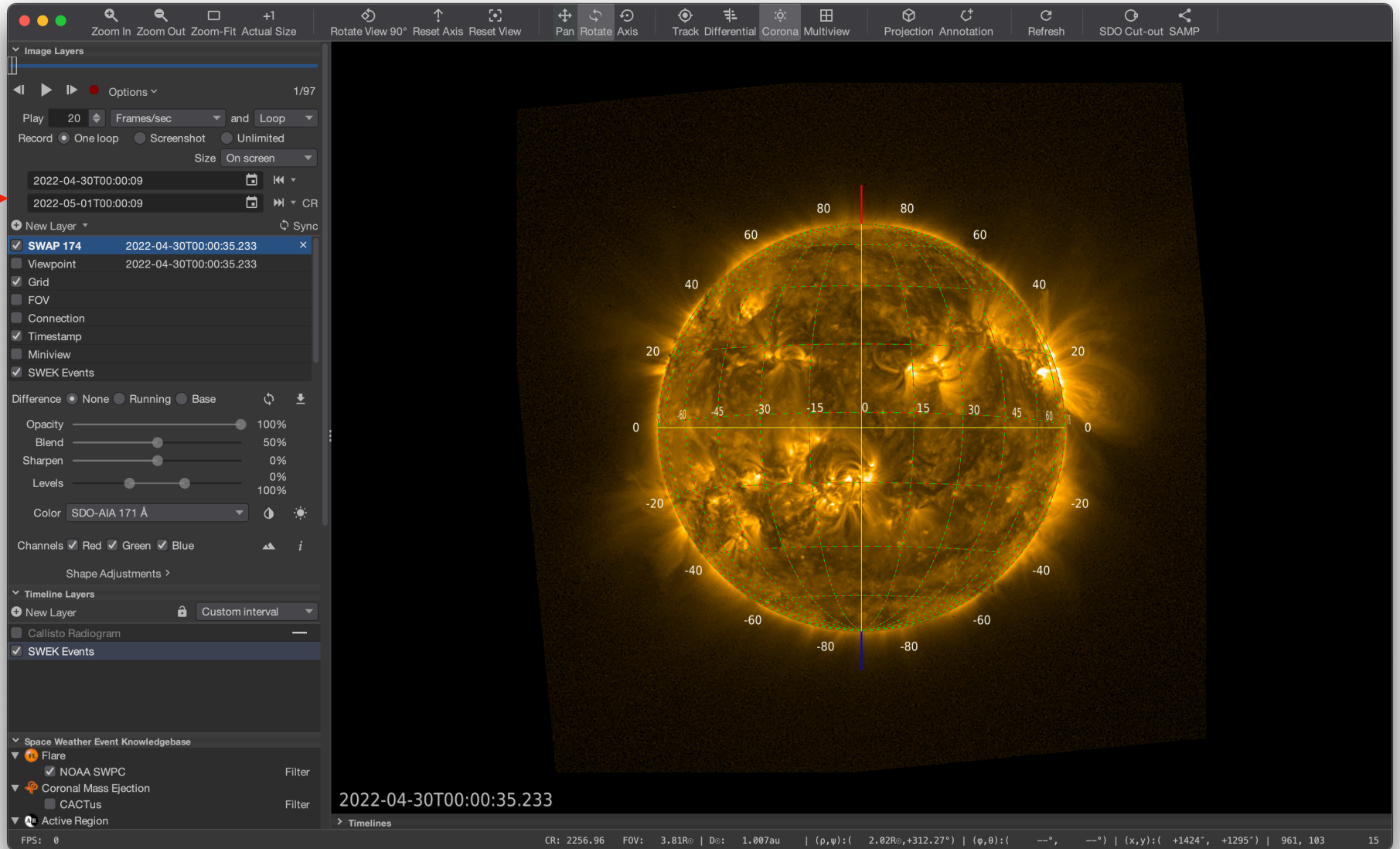
Do it yourself

- 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



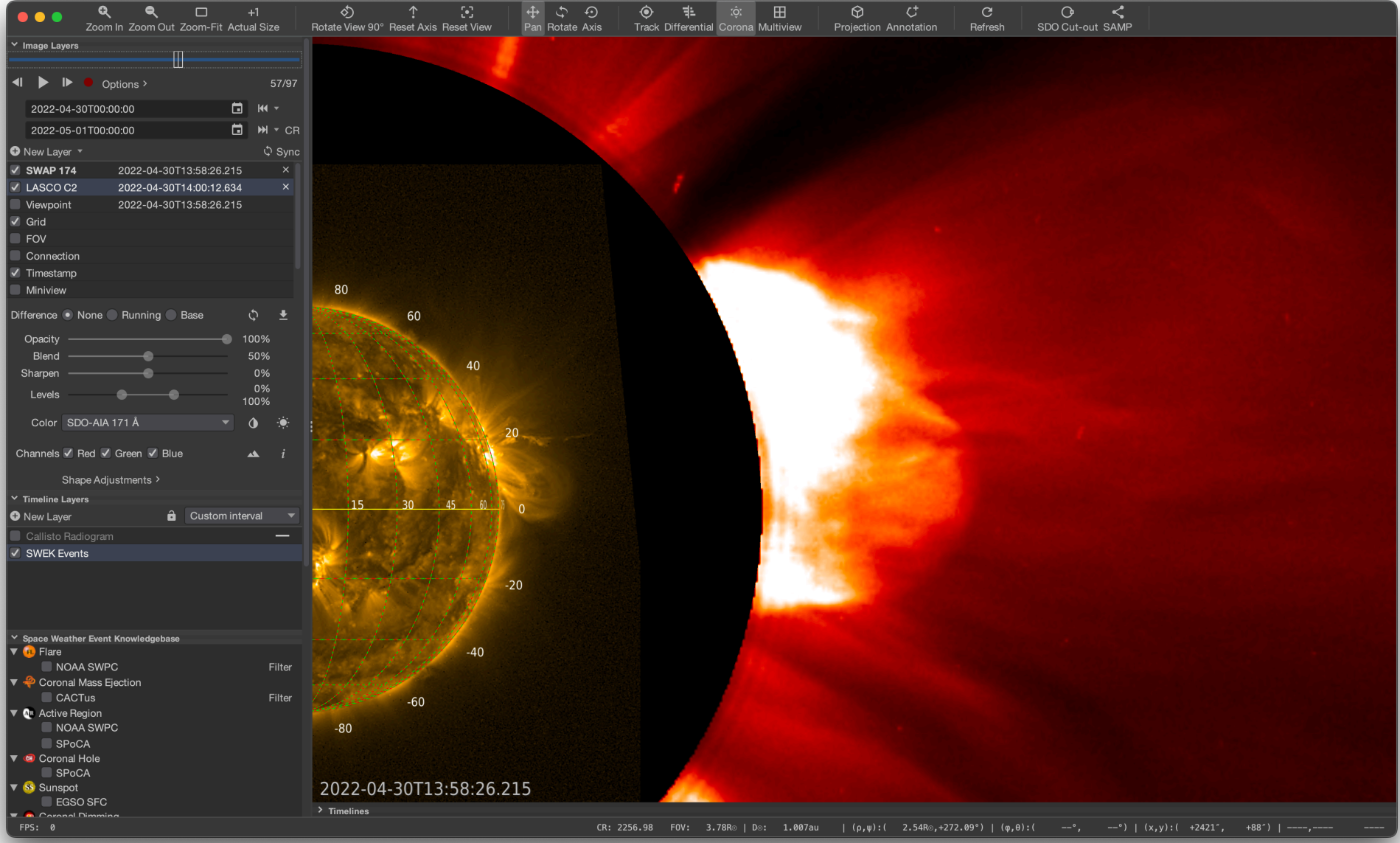
NOAA AR



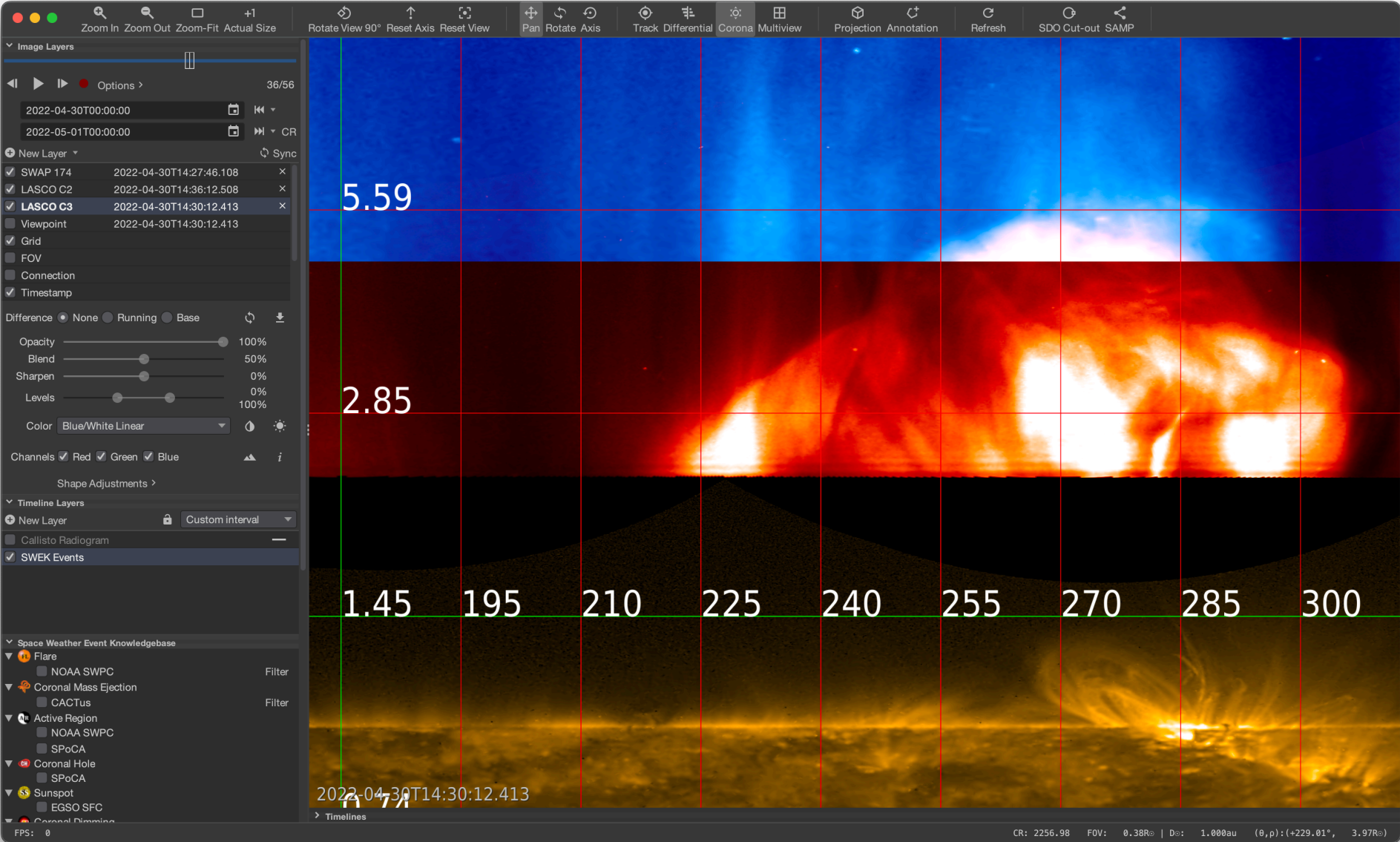
The screenshot shows the Helioviewer.org web interface. The browser address bar displays 'gs671-suske.ndc.nasa.gov'. The page title is 'Helioviewer.org'. The interface is divided into several sections:

- Observation Date:** Date: 2022/04/30, Time: 13:47:37 UTC, Location: NEWEST. Jump: 1 Day.
- Images:** AIA 304, 2022/04/30 13:47:29 UTC. Opacity: [slider]. Observatory: SDO, Instrument: AIA, Measurement: 304, Difference: No difference im.
- Features and Events:** HEK, 2022/04/30 13:47:37 UTC. Includes checkboxes for 'check all' and 'check none'. A tree view shows various solar features, with 'NOAA SWPC Observer (2)' checked.
- Main View:** A large solar image showing the sun's surface. Two active regions are labeled: 'AR NOAA 12994' and 'AR NOAA 13000'. A 'Data Sources' panel is visible on the left side of the main view.
- Bottom:** 'Image Timeline' and 'Events Timeline' buttons.

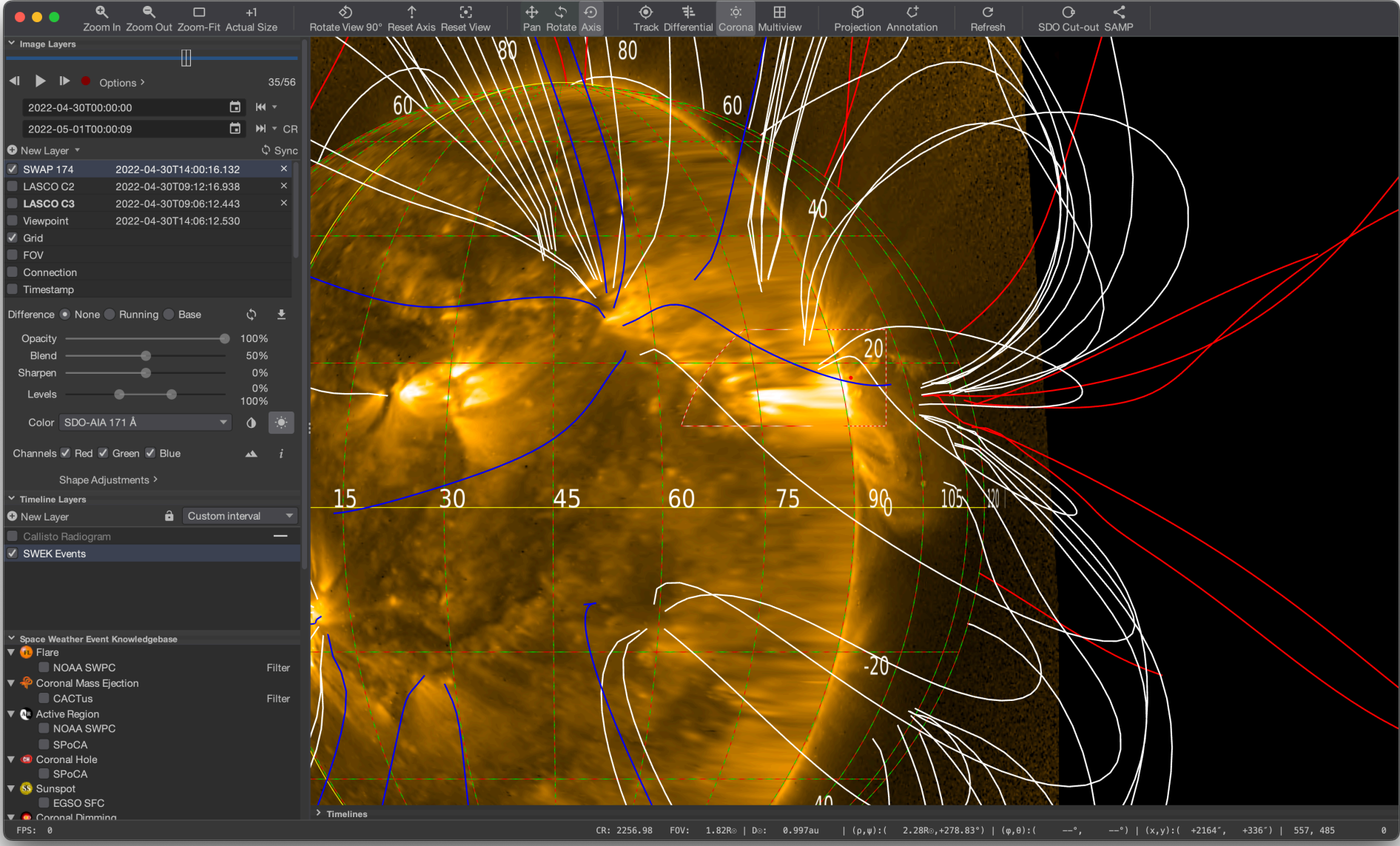
Add LASCO to check for a CME



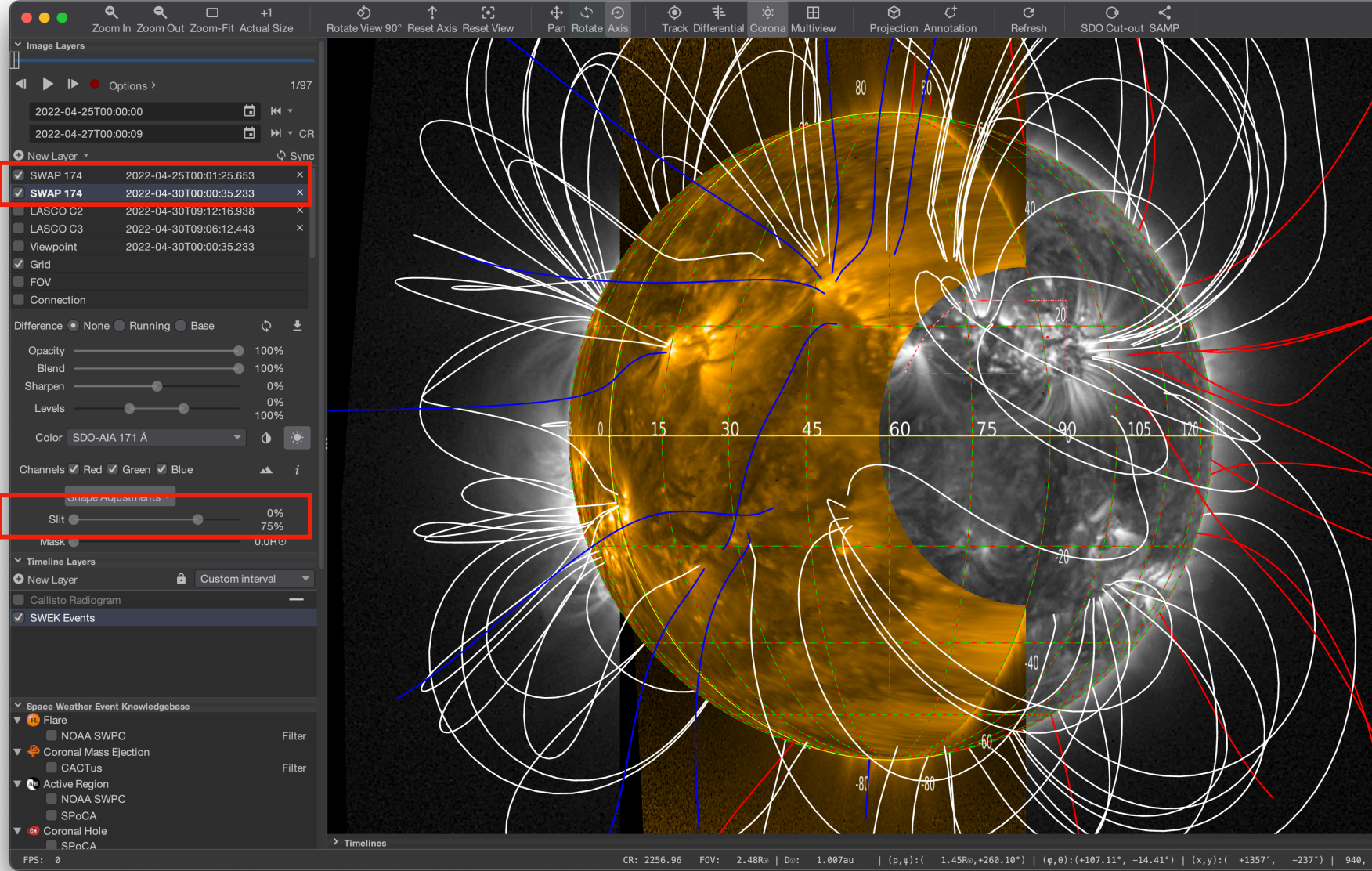
Projection: Log Polar



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
- #jheliviewer_questions_and_answers