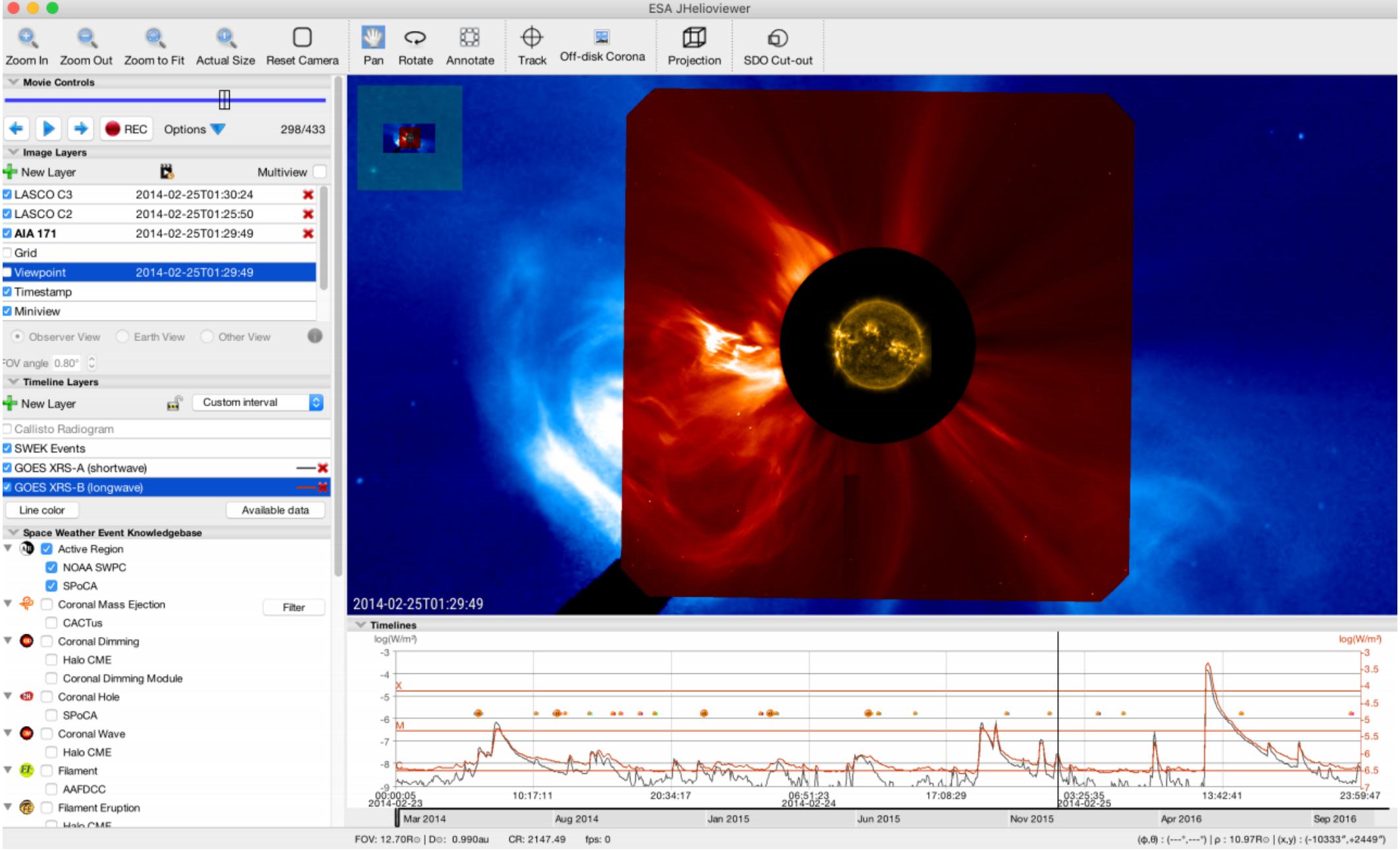
jHelioviewer for Solar Orbiter

ROB: Bogdan Nicula, Freek Verstringe, Bram Bourgoignie, **David Berghmans**

Royal Observatory
of Belgium

ESTEC Contract No. 4000107325/12/NL/AK

2019-05-15 Gottingen/MPS
SPICE consortium meeting



http://swhv.oma.be/download

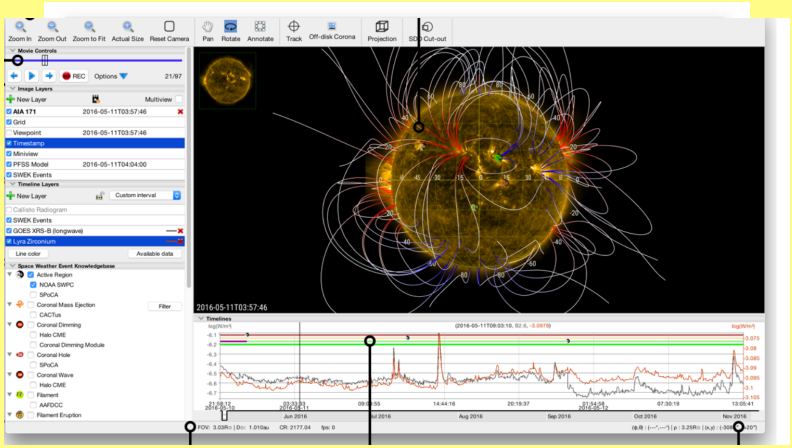
Overview

1. The Helioviewer ecosystem
2. A tour of jHelioviewer functions
3. jHelioviewer for Solar Orbiter
4. Discussion: SPICE?

http://swhv.oma.be/download

The Helioviewer ecosystem

jHelioviewer ecosystem

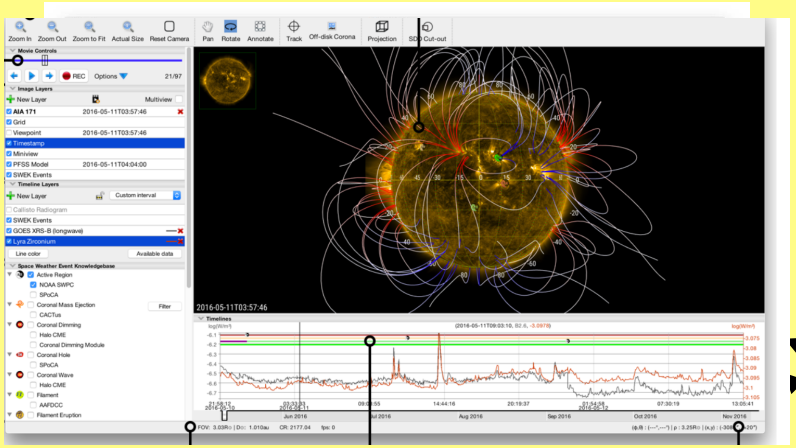


http://helioviewer.org
in the browser application

Image
Server
GSFC

Instrument online
FITS archives

jHelioviewer ecosystem



http://helioviewer.org
in the browser application

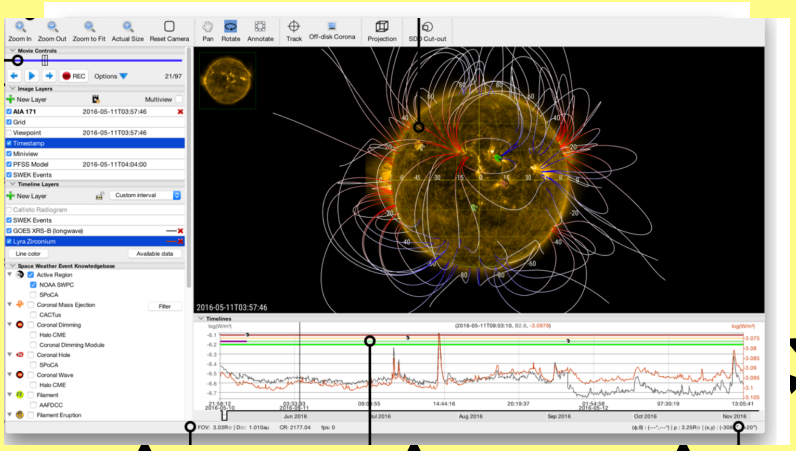
Image Server ROB

Image Server IAS

Image Server GSFC

Instrument online FITS archives

jHelioviewer ecosystem



http://helioviewer.org
in the browser application

Geometry Server ROB

Fieldline Server ROB

Timeline Server ROB

Image Server ROB

Image Server IAS

Image Server GSFC

HEK event database

SPICE kernel repository

GONG network

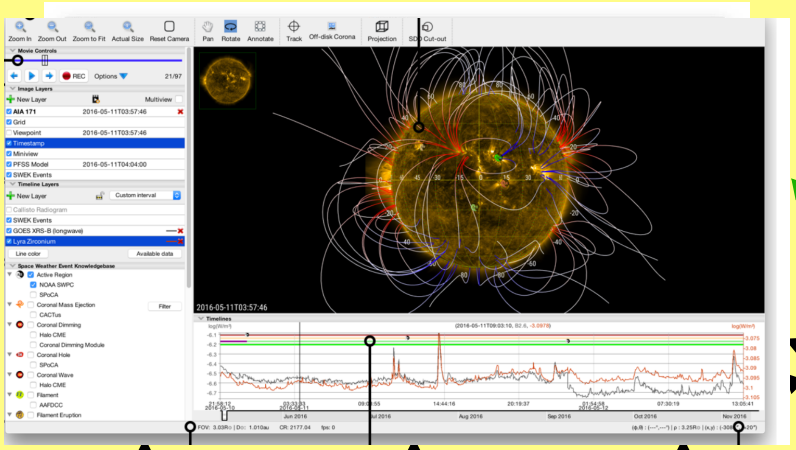
Instrument online FITS archives

jHelioviewer ecosystem

SunGlobe

IDL session

SunPy



http://helioviewer.org
in the browser application

Geometry Server ROB

Fieldline Server ROB

Timeline Server ROB

Image Server ROB

Image Server IAS

Image Server GSFC

HEK event database

SPICE kernel repository

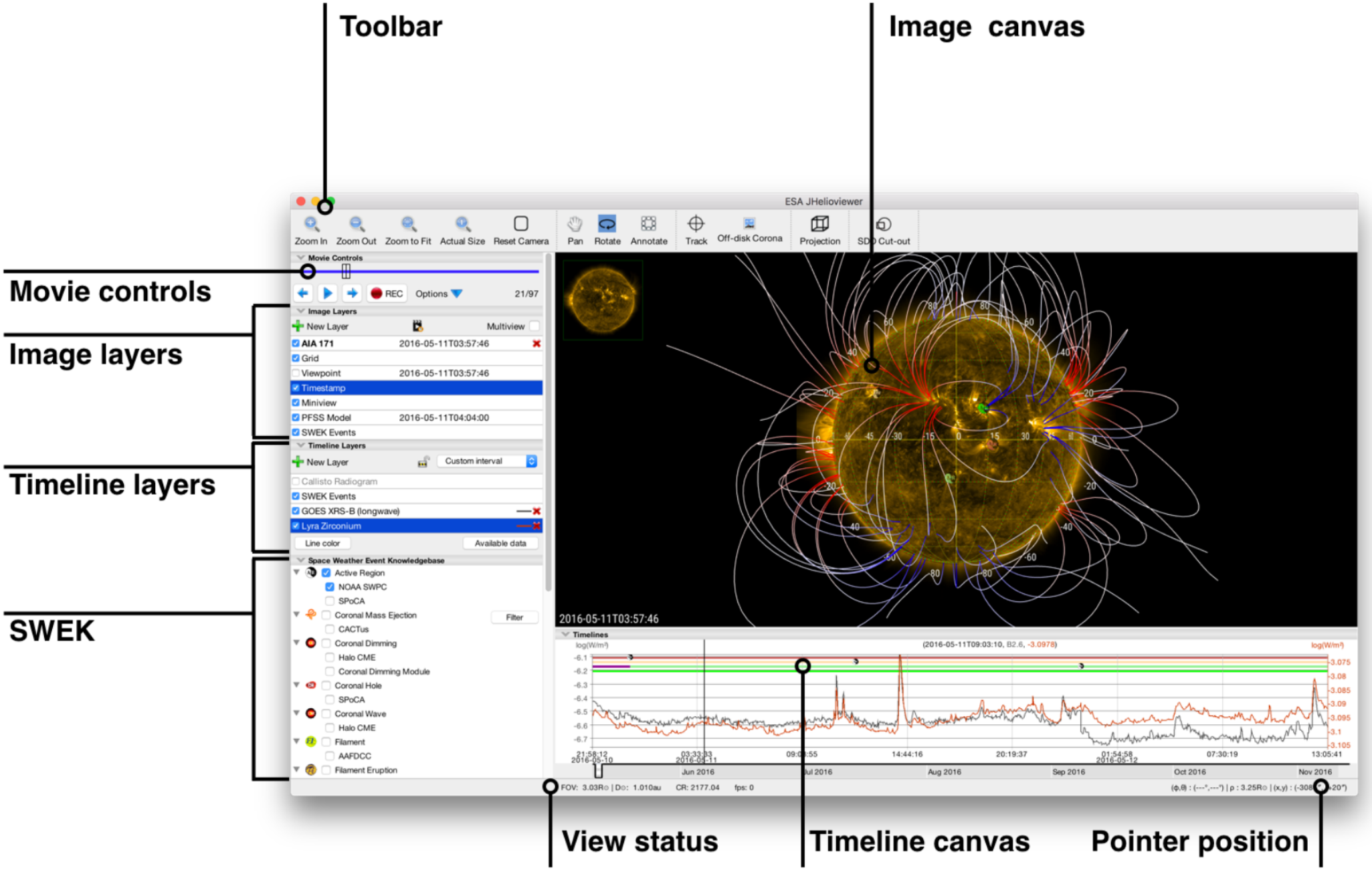
GONG network

Instrument online FITS archives

ESAC archive

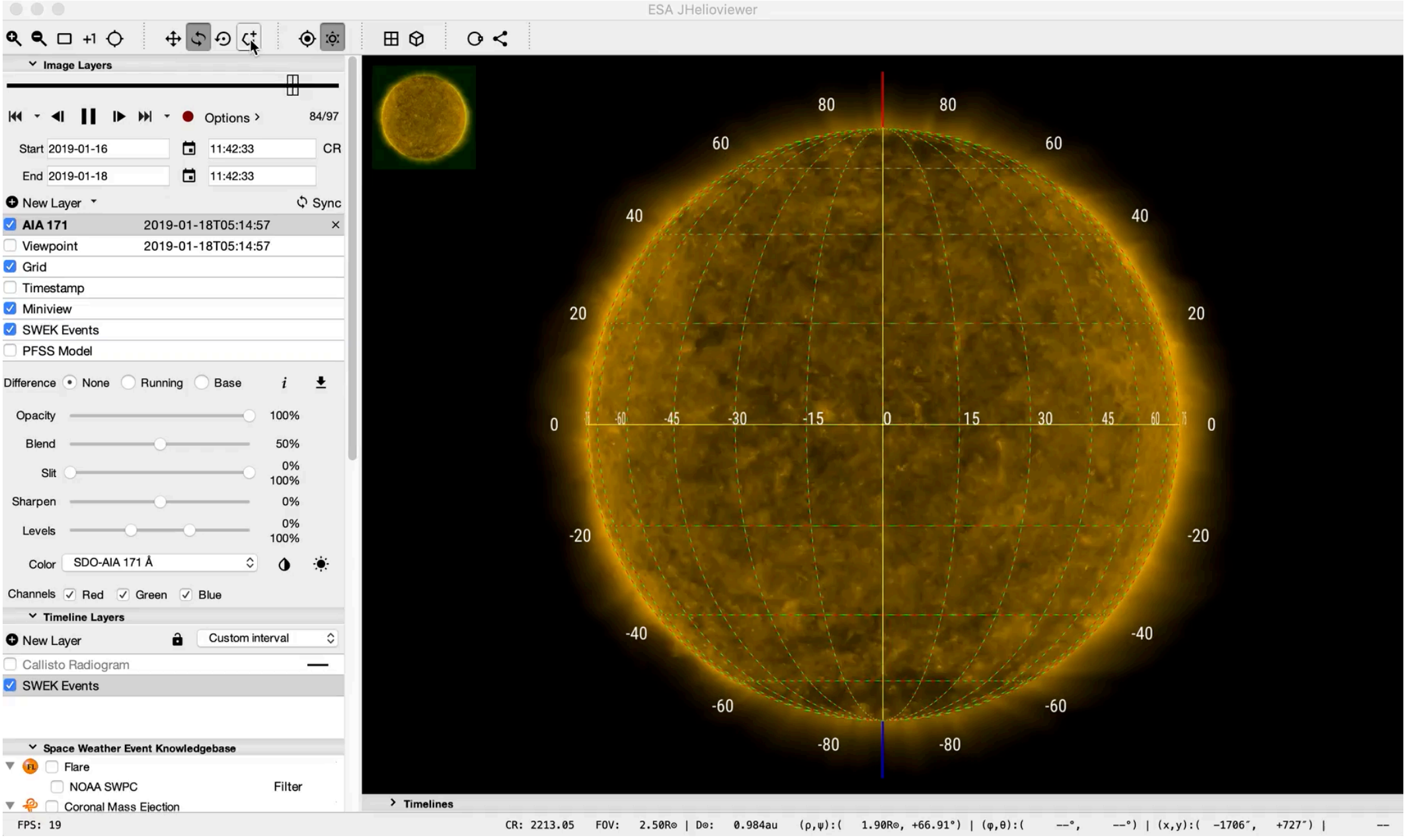
SOLARNET SVO

Basic jHelioviewer usage

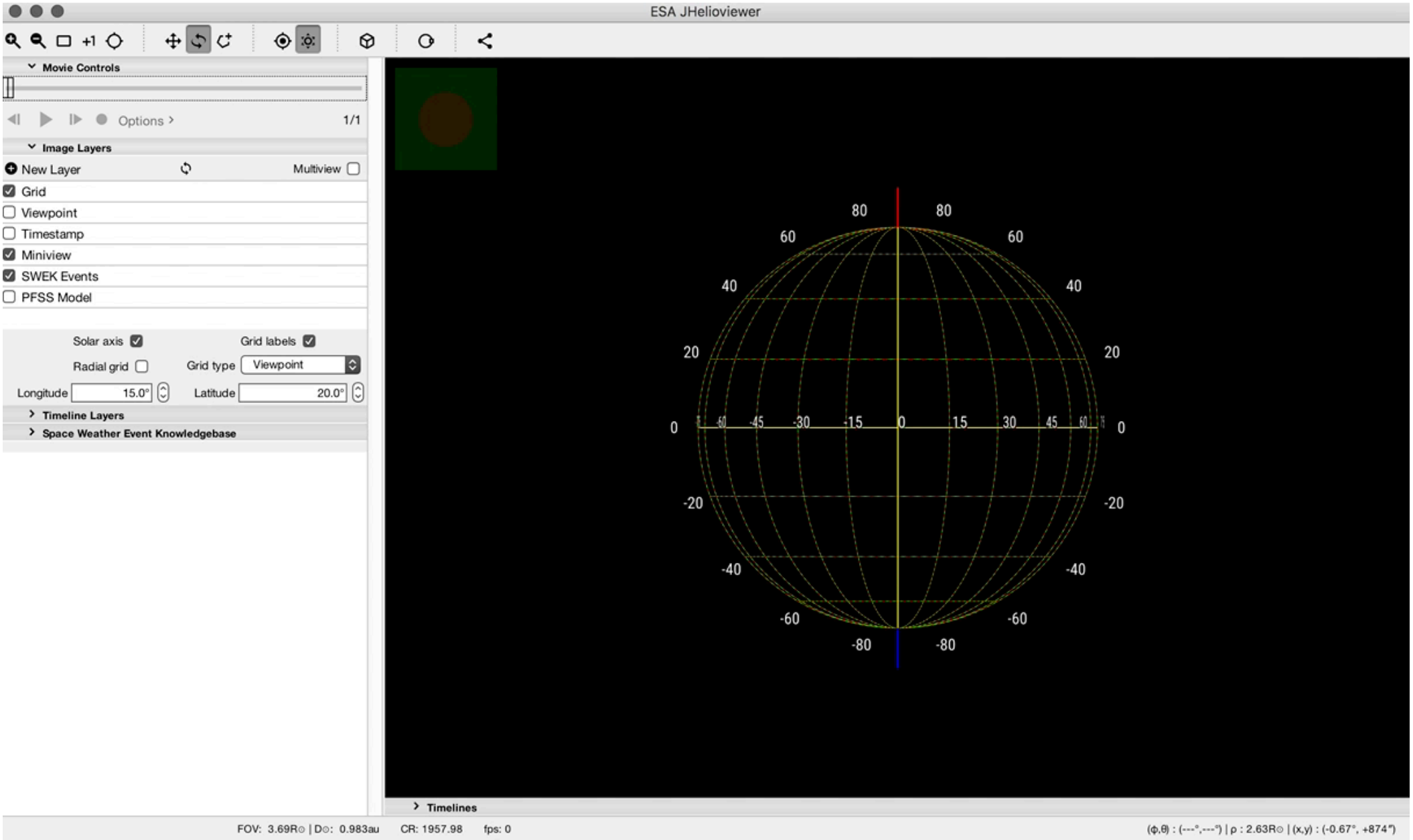

Toolbar
Image canvas
Movie controls
Image layers
Timeline layers
SWEK
View status
Timeline canvas
Pointer position
ESA JHelioviewer
Zoom In
Zoom Out
Zoom to Fit
Actual Size
Reset Camera
Pan
Rotate
Annotate
Track
Off-disk Corona
Projection
SDO Cut-out
Movie Controls
REC
Options
21/97
Image Layers
New Layer
Multiview
AIA 171
2016-05-11T03:57:46
Grid
Viewpoint
2016-05-11T03:57:46
Timestamp
Miniview
PFSS Model
2016-05-11T04:04:00
SWEK Events
Timeline Layers
New Layer
Custom interval
Callisto Radiogram
SWEK Events
GOES XRS-B (longwave)
Lyra Zirconium
Line color
Available data
Space Weather Event Knowledgebase
Active Region
NOAA SWPC
SPoCA
Coronal Mass Ejection
Filter
CACTus
Coronal Dimming
Halo CME
Coronal Dimming Module
Coronal Hole
SPoCA
Coronal Wave
Halo CME
Filament
AAFDCC
Filament Eruption
2016-05-11T03:57:46
Timelines
log(W/m²)
(2016-05-11T09:03:10, B2.6, -3.0978)
log(W/m²)
21:58:12
2016-05-10
03:33:33
2016-05-11
14:44:16
20:19:37
01:54:58
2016-05-12
07:30:19
13:05:41
Jun 2016
Jul 2016
Aug 2016
Sep 2016
Oct 2016
Nov 2016
FOV: 3.03R⊙ | D⊙: 1.010au
CR: 2177.04
fps: 0

Recent jHelioviewer extensions

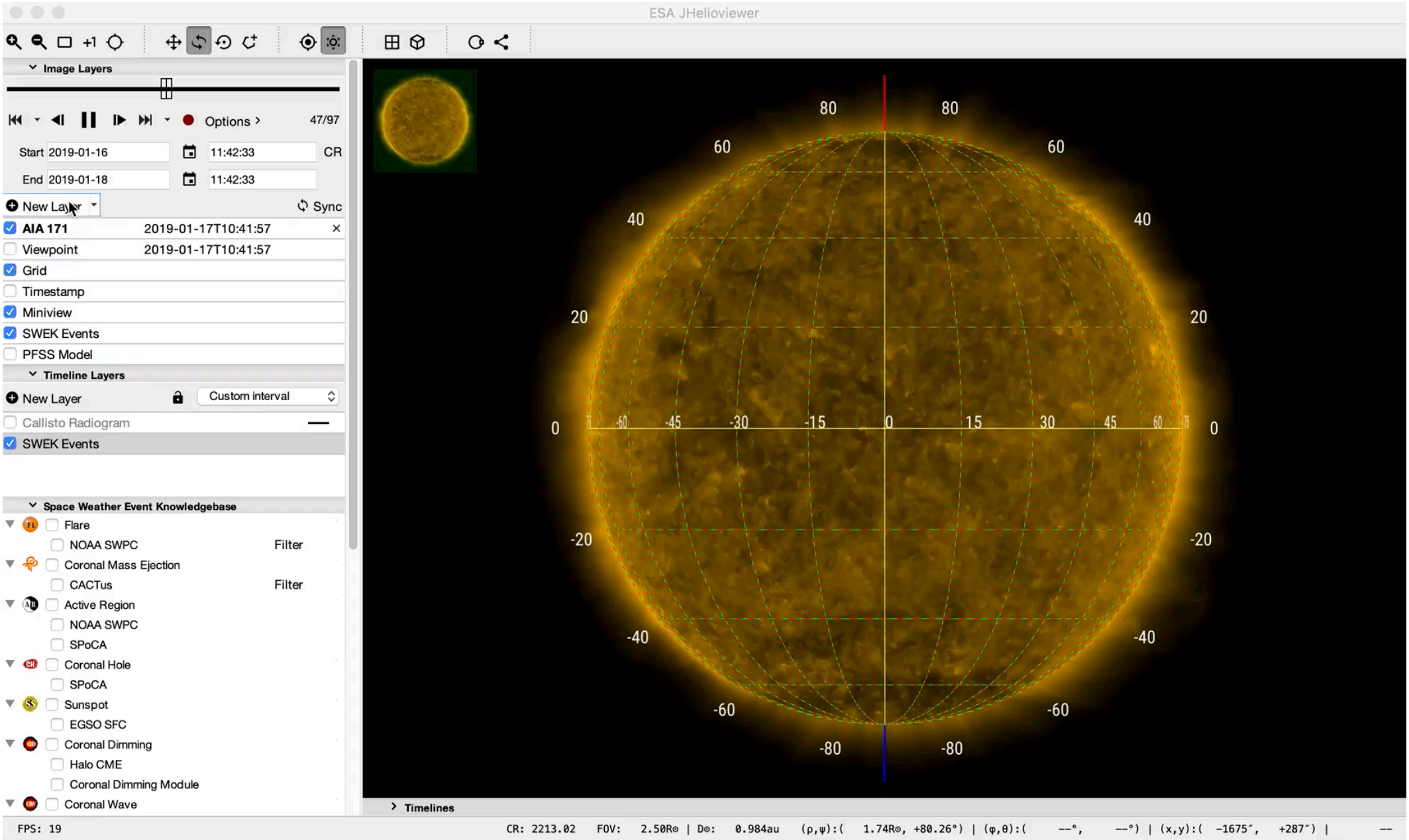
Annotations



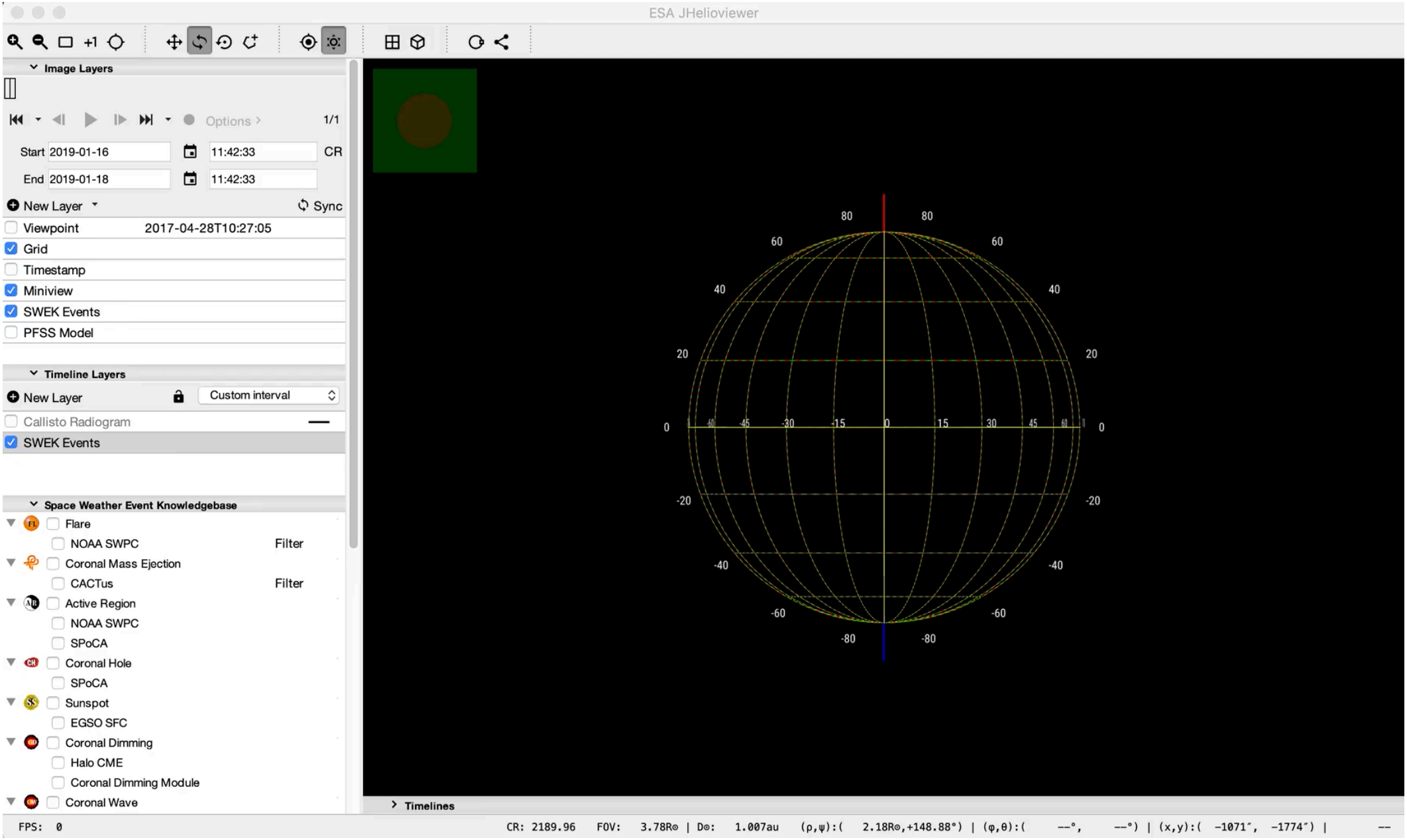
States


ESA JHelioviewer
Movie Controls
Options
1/1
Image Layers
New Layer
Multiview
Grid
Viewpoint
Timestamp
Miniview
SWEK Events
PFSS Model
Solar axis
Grid labels
Radial grid
Grid type
Viewpoint
Longitude
15.0°
Latitude
20.0°
Timeline Layers
Space Weather Event Knowledgebase
Timelines
FOV: 3.69R⊙ | D⊙: 0.983au
CR: 1957.98
fps: 0

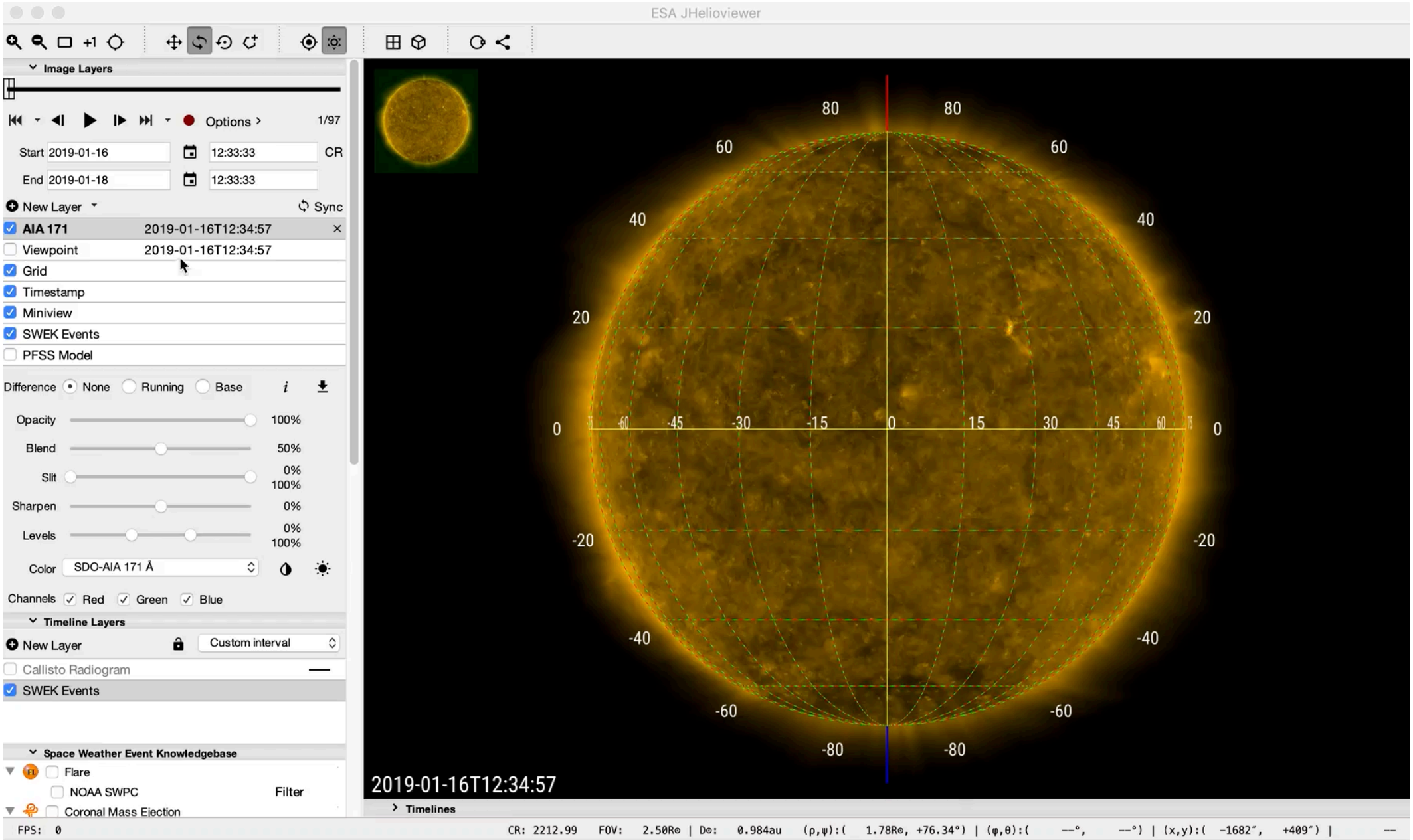
Slits


ESA JHelioviewer
Image Layers
Options >
47/97
Start 2019-01-16
11:42:33
CR
End 2019-01-18
11:42:33
New Layer
Sync
AIA 171 2019-01-17T10:41:57
Viewpoint 2019-01-17T10:41:57
Grid
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
Timelines
FPS: 19
CR: 2213.02 FOV: 2.50R⊙ | D⊙: 0.984au (ρ,ψ):(1.74R⊙, +80.26°) | (φ,θ):(--°, --°) | (x,y):(-1675″, +287″) |

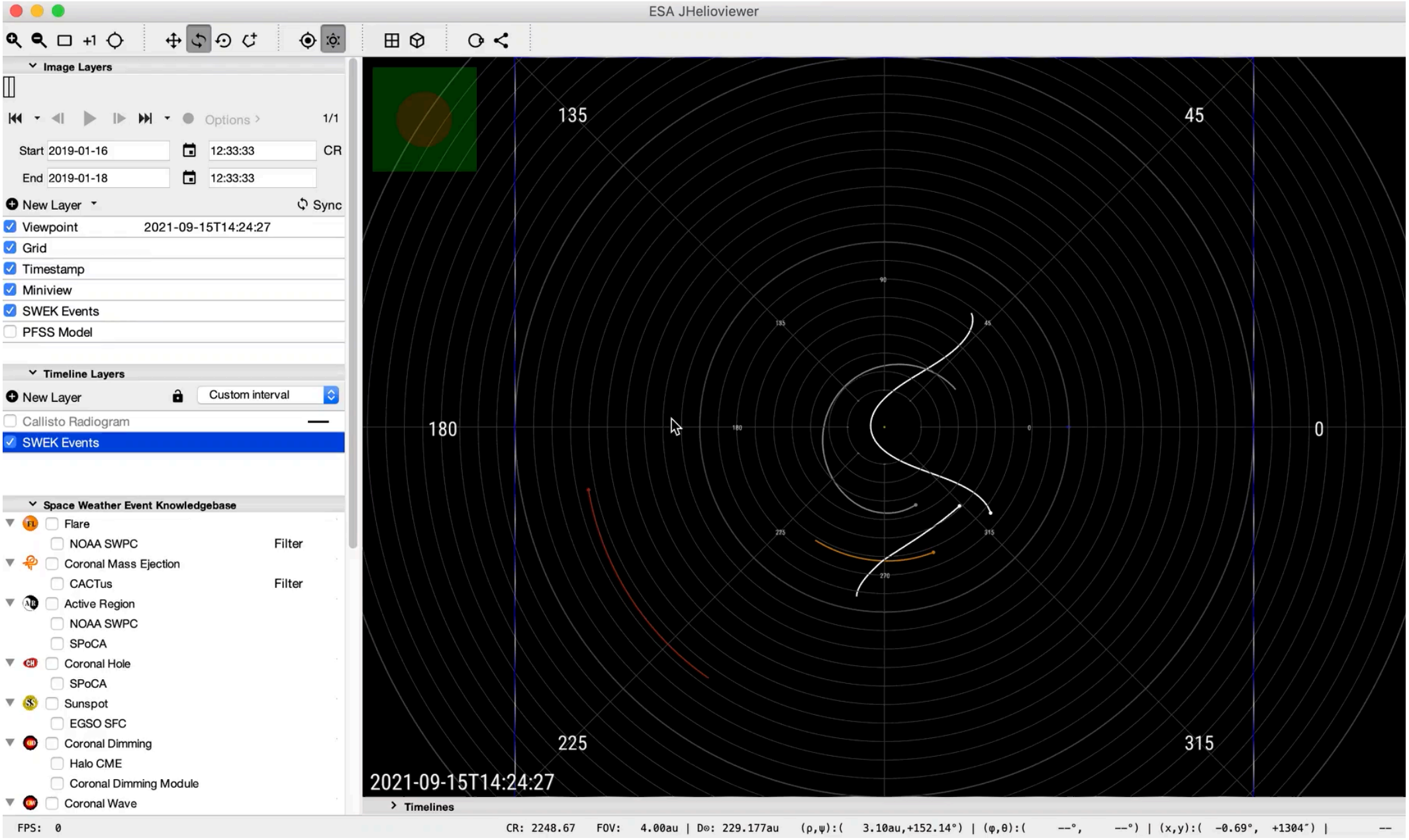
SAMP, interoperability



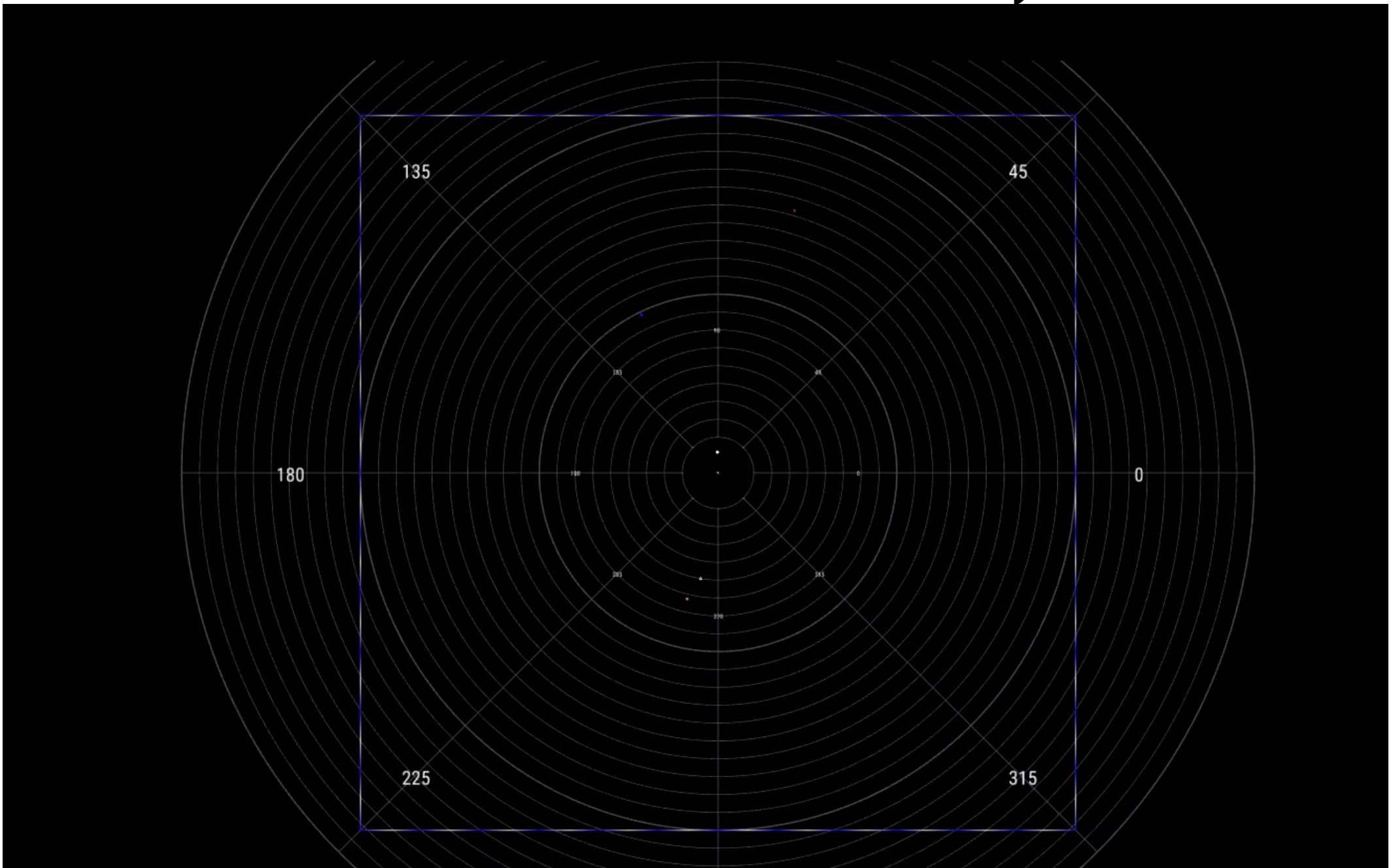
Equatorial projection



Model visualisation, orbits

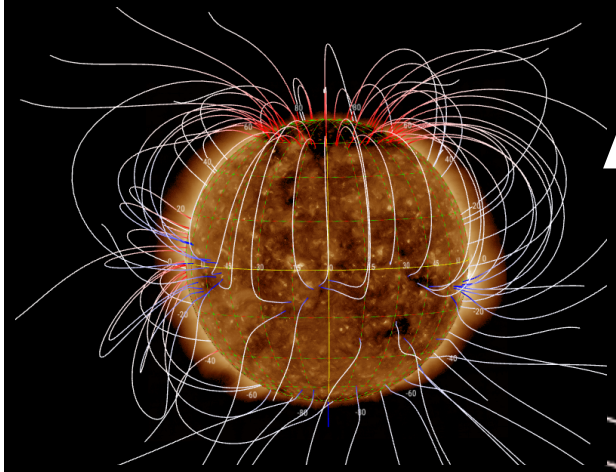


Model visualisation, orbits



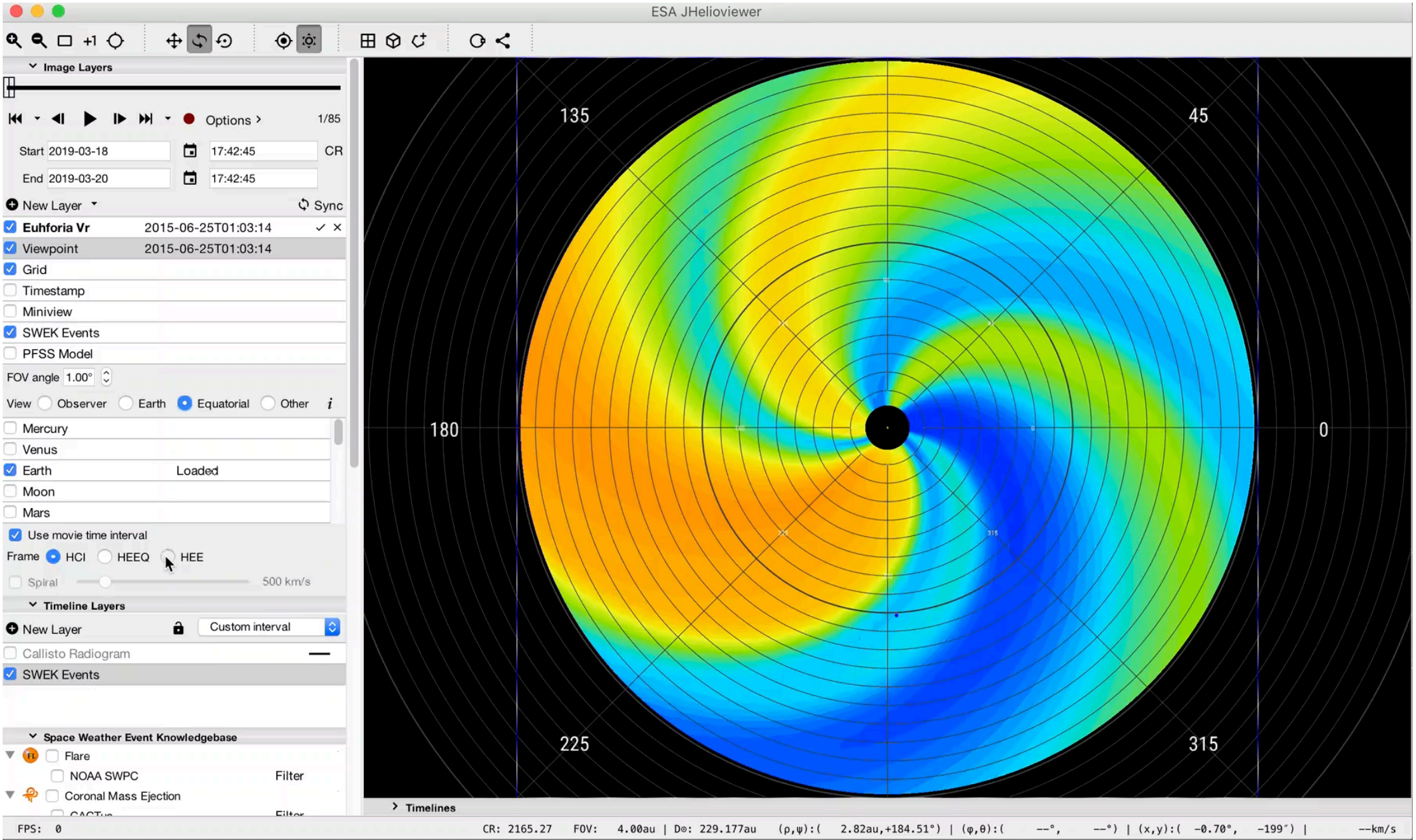
jHelioviewer for Solar Orbiter

A view on the poles

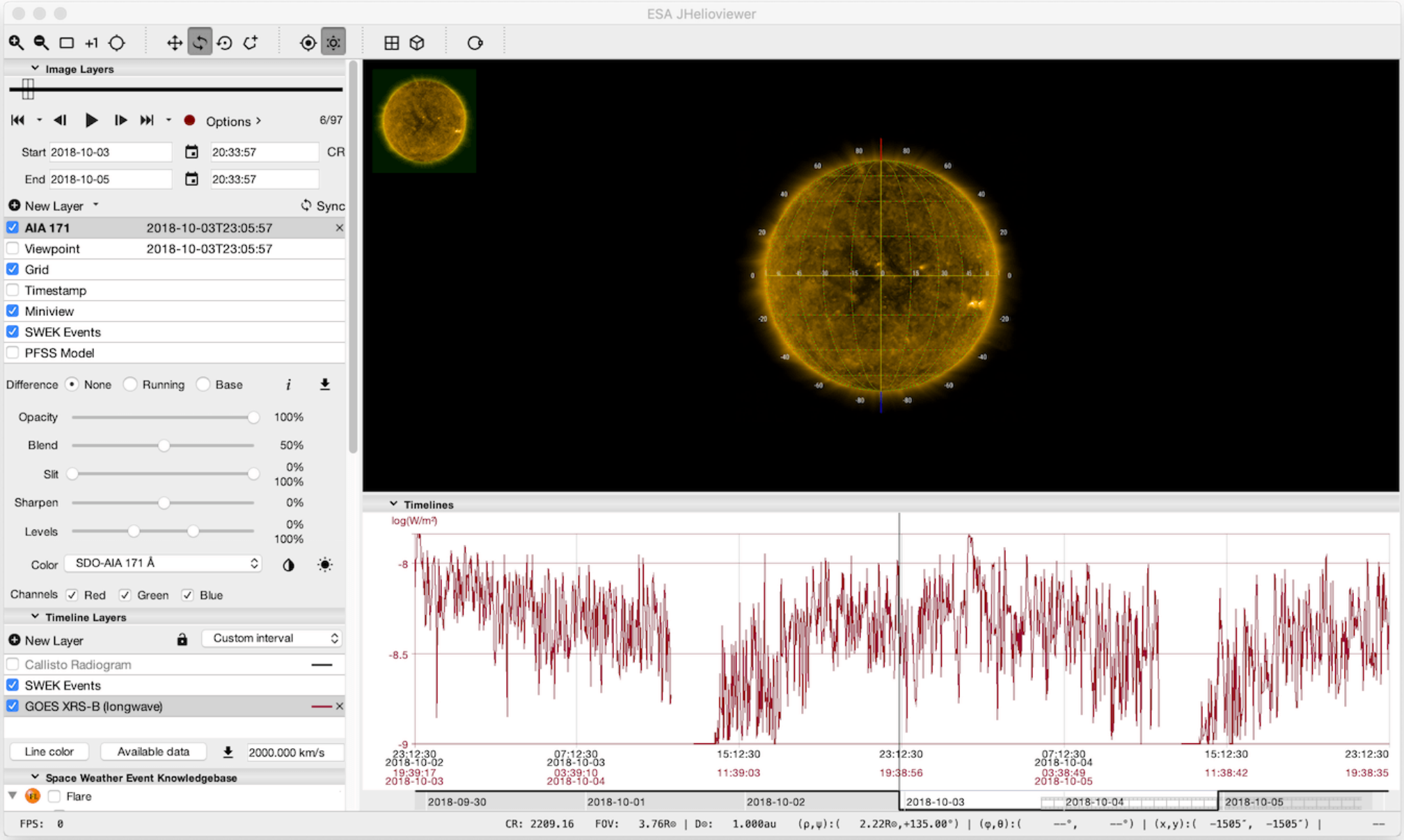


jHelioviewer

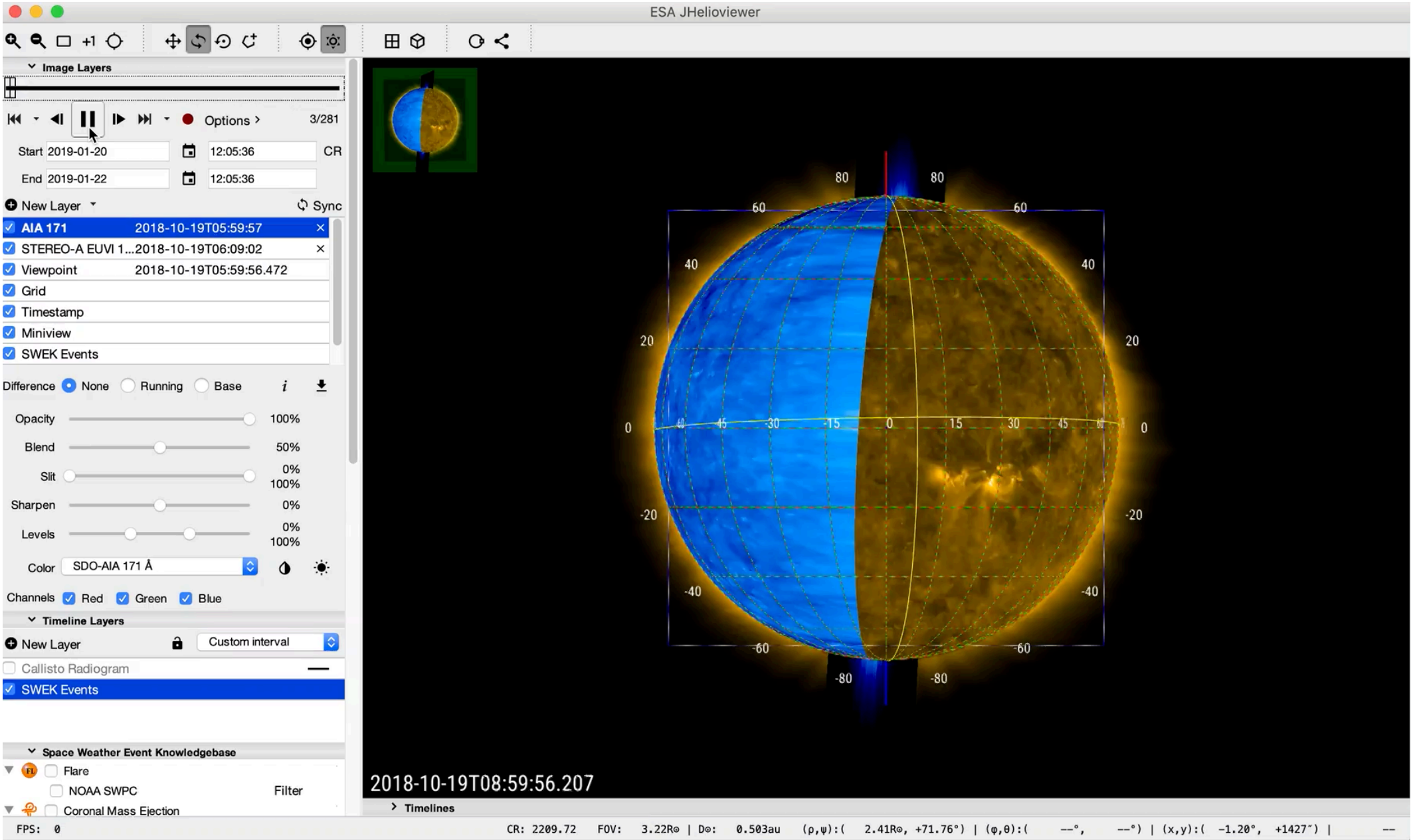
Heliospheric connection



Combining remote sensing with in-situ?



Parker Solar Probe



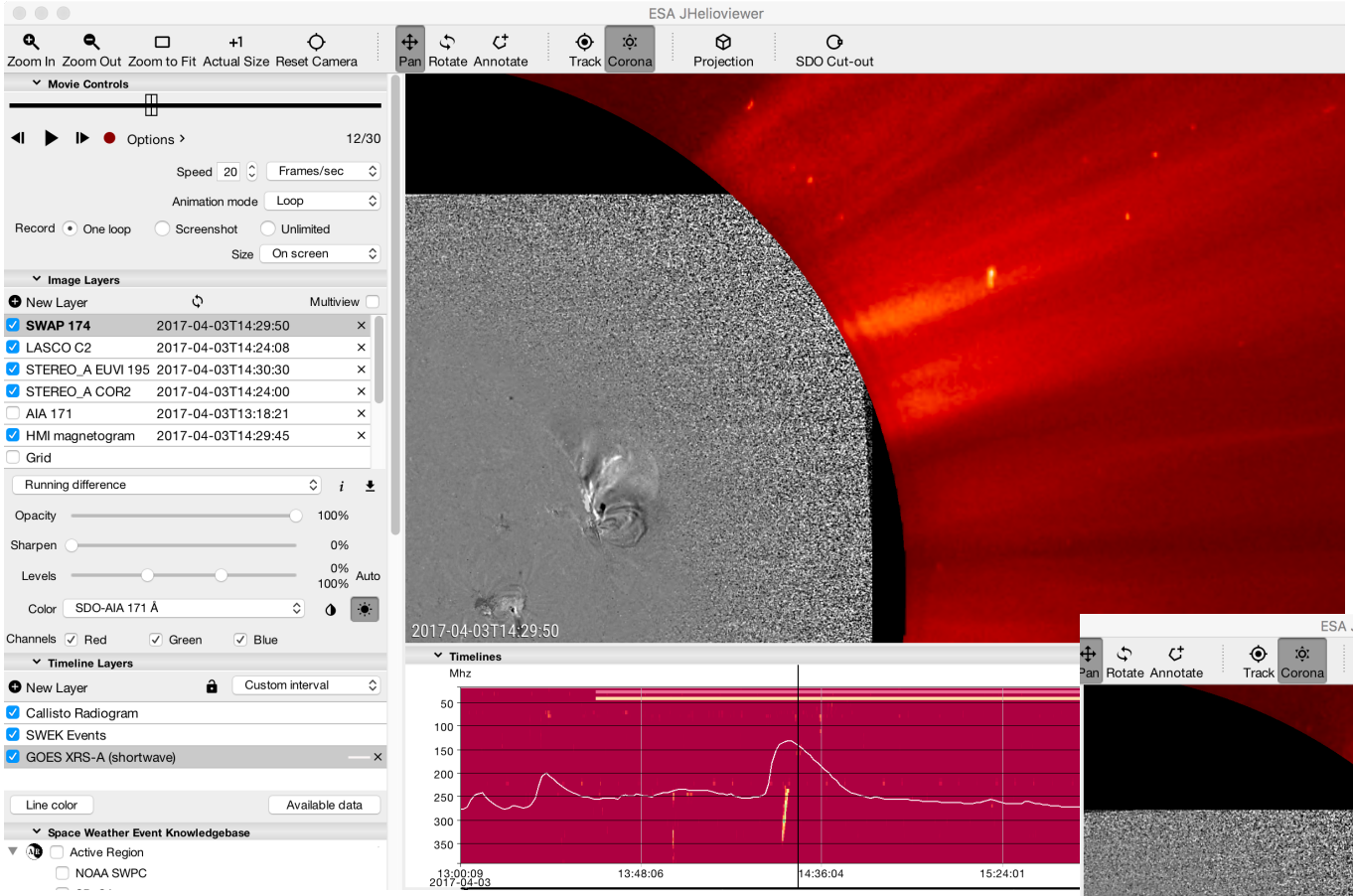
A planning use case

1. The user loads JHelioviewer with the most recent low latency or other data available
2. The user configures the camera so it displays the Sun from the point of view of Solar Orbiter at the time the displayed data were taken, assuming the spacecraft was pointed at disk centre.
3. The user advances the time until three or four days in the future. The camera tracks the motion of Solar Orbiter and continues to display the sun from the point of view of the spacecraft. The software also rotates and deforms the displayed images according to solar differential rotation, therefore displaying the predicted state of the Sun at the time in the future the user has selected.
4. The user switches on an overlay which draws the fields-of-view of the Solar Orbiter's remote sensing instruments so they can see which solar features lie within the fields-of-view.
5. The user then drags the fields-of-view around the solar disc in order to choose a science target.
6. The user finds a target and outputs the heliographic latitude and either Stonyhurst or Carrington longitude of the centre of the fields of view to pass to the SOC, who will then use their own tools to generate the equivalent pointing request.
7. *The user now configures some connection overlays, starting by choosing a solar wind speed and selecting to overlay the ballistic connection point. The software then calculates when solar wind of that speed will intercept Solar Orbiter along its future orbital path and overlays the source point that is ballistically connected to the spacecraft at that time on the source surface.*
8. The user then chooses to display the instantaneous parker spiral magnetic connection point, which is then overlaid on the disk/source surface.

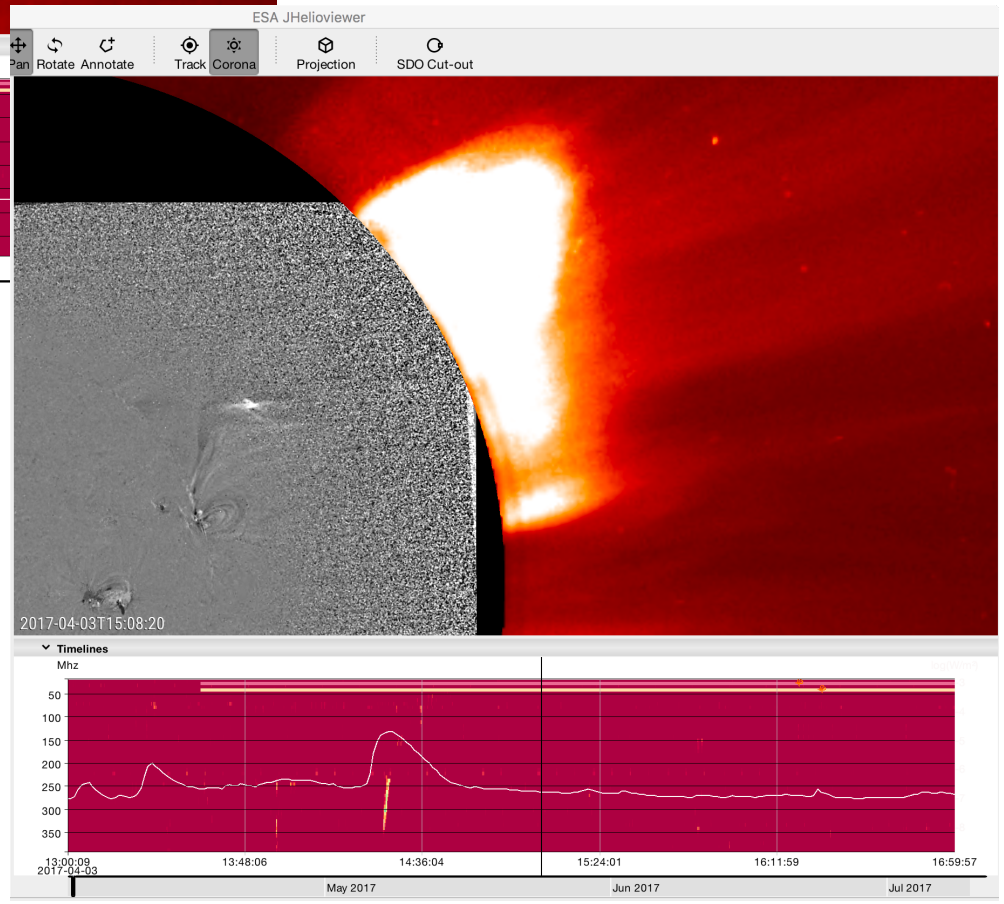
Solar Orbiter User Requirements Document for JHelioviewer

Royal Observatory of Belgium

Discussion: SPICE


ESA JHelioviewer
Zoom In
Zoom Out
Zoom to Fit
Actual Size
Reset Camera
Pan
Rotate
Annotate
Track
Corona
Projection
SDO Cut-out
Movie Controls
Options ›
12/30
Speed 20 Frames/sec
Animation mode Loop
Record One loop Screenshot Unlimited
Size On screen
Image Layers
New Layer
Multiview
SWAP 174 2017-04-03T14:29:50
LASCO C2 2017-04-03T14:24:08
STEREO_A EUVI 195 2017-04-03T14:30:30
STEREO_A COR2 2017-04-03T14:24:00
AIA 171 2017-04-03T13:18:21
HMI magnetogram 2017-04-03T14:29:45
Grid
Running difference
Opacity 100%
Sharpen 0%
Levels 0% 100% Auto
Color SDO-AIA 171 Å
Channels Red Green Blue
Timeline Layers
New Layer
Custom interval
Callisto Radiogram
SWEK Events
GOES XRS-A (shortwave)
Line color
Available data
Space Weather Event Knowledgebase
Active Region
NOAA SWPC
2017-04-03T14:29:50
Timelines
Mhz
50
100
150
200
250
300
350
13:00:09
2017-04-03
13:48:06
14:36:04
15:24:01

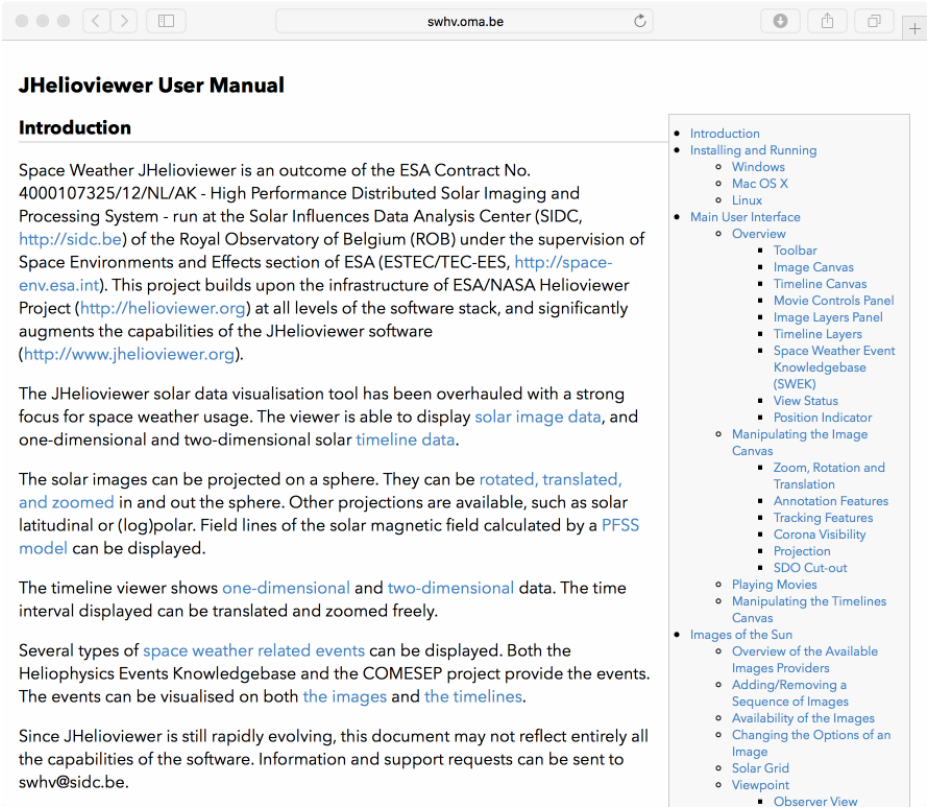
Spectra?


ESA JHelioviewer
Pan
Rotate
Annotate
Track
Corona
Projection
SDO Cut-out
2017-04-03T15:08:20
Timelines
Mhz
50
100
150
200
250
300
350
13:00:09
2017-04-03
13:48:06
14:36:04
15:24:01
16:11:59
16:59:57
May 2017
Jun 2017
Jul 2017

More information

http://jhelioviewer.org

http://swhv.oma.be/user_manual



JHelioviewer. Time-dependent 3D visualisation of solar and heliospheric data
D. Mueller, B. Nicula, S. Felix, F. Verstringe, B. Bourgoignie, A. Csillaghy, D. Berghmans, P. Jiggens, J. P. Garcia-Ortiz, J. Ireland, S. Zahniy, B. Fleck
A&A, Forthcoming article
Received: 30 March 2017 / Accepted: 15 May 2017
DOI: https://doi.org/10.1051/0004-6361/201730893

swhv@oma.be