



## UI Specification

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The background is a dark, textured surface, possibly a planet's surface or a microscopic view, with a mix of dark blue, black, and brownish tones. A white rectangular box is centered horizontally and vertically, containing the word "OVERVIEW" in a bold, white, sans-serif font.

# OVERVIEW

## INTRODUCTION

NASA Jet Propulsion Lab's (JPL) upcoming mission, Mars 2020, is the next stage in the robotic exploration of Mars. The mission has multiple scientific goals: searching for previous signs of life on Mars, characterizing the planet's climate and geology, and preparing for potential human exploration. An accurate understanding of weather on Mars is critical to the success of the mission since weather conditions on Mars influence where and how science experiments are conducted. Atmospheric opacity, for example, informs exposure time, power usage, and temperature considerations among other factors when planning instrument usage.

As Mars lacks liquid water, weather is driven by solar longitude (Ls). This means the weather patterns on Mars are highly predictable up to 1 Martian Year (600 Earth days) out. We designed the Long-term Routing for Rover Opacity Instrumentation tool (L-RROI) to take advantage of the predictable weather patterns on Mars to aid mission teams by forecasting the optimal opacity levels to use a set of instruments while also providing context around geography and general weather information. In doing so, scientists will be able to quickly rule out certain activities, saving them time in the planning process and moving them closer to the 1:1 uplink goal set by NASA.

L-RROI is browser-based, similar to many of NASA's current tools. This ensures fast updates and machine compatibility while enabling easier sharing between users through URLs. We intend for this feature to enhance collaboration and transparency amongst users during the campaign planning process.

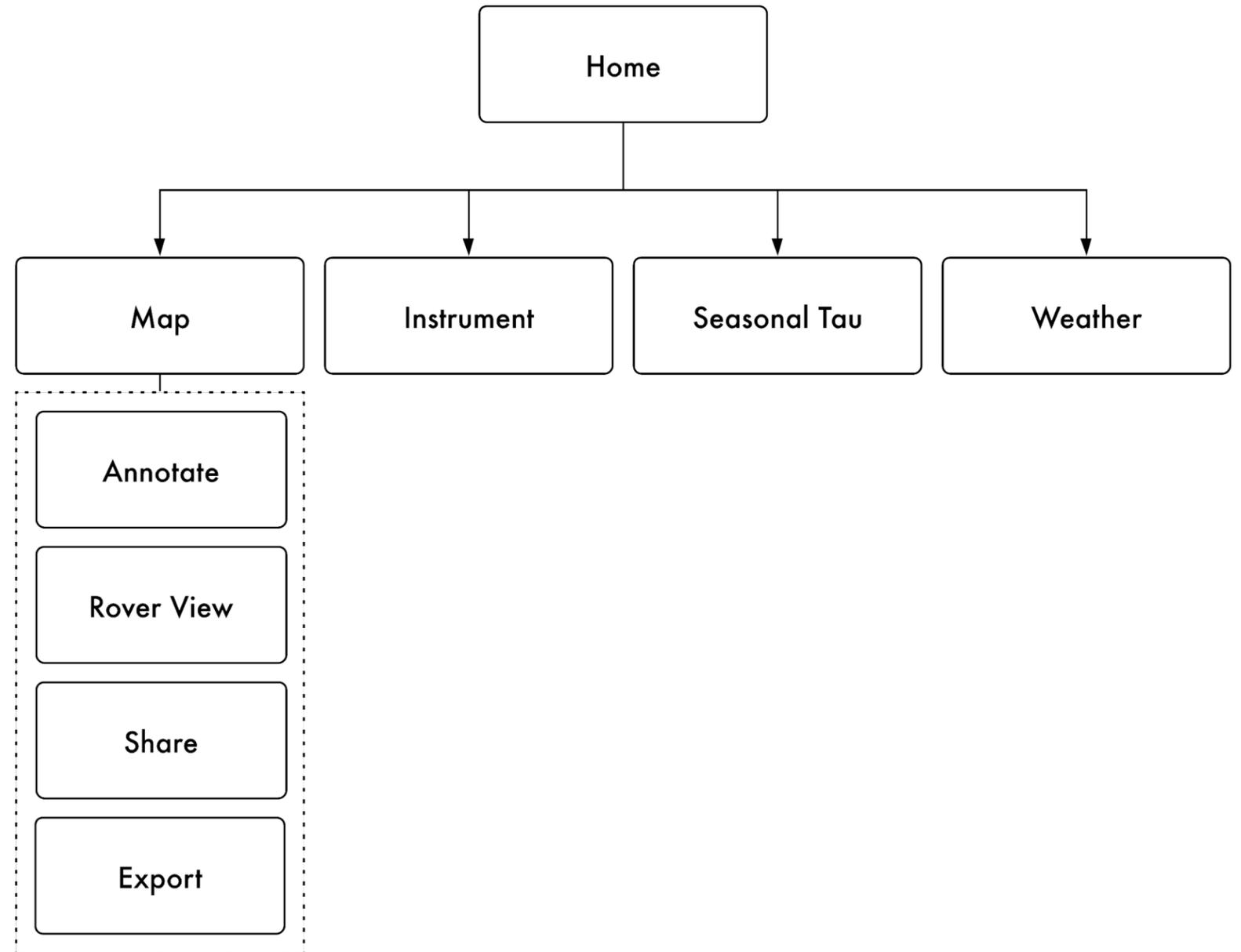
This Design Specification is meant to describe L-RROI in full to create as little friction as possible during the development process. It is composed of an architecture, system flow, interaction model and visual system to create a holistic definition of the application.

An aerial photograph of a dry, cracked, brown landscape, possibly a desert or a dried-up riverbed. The ground is heavily textured with deep, irregular cracks and ridges. A prominent, bright yellowish-gold line runs diagonally across the upper right portion of the image. In the center, a white rectangular box with a thin border contains the word "STRUCTURE" in a bold, white, sans-serif font.

**STRUCTURE**

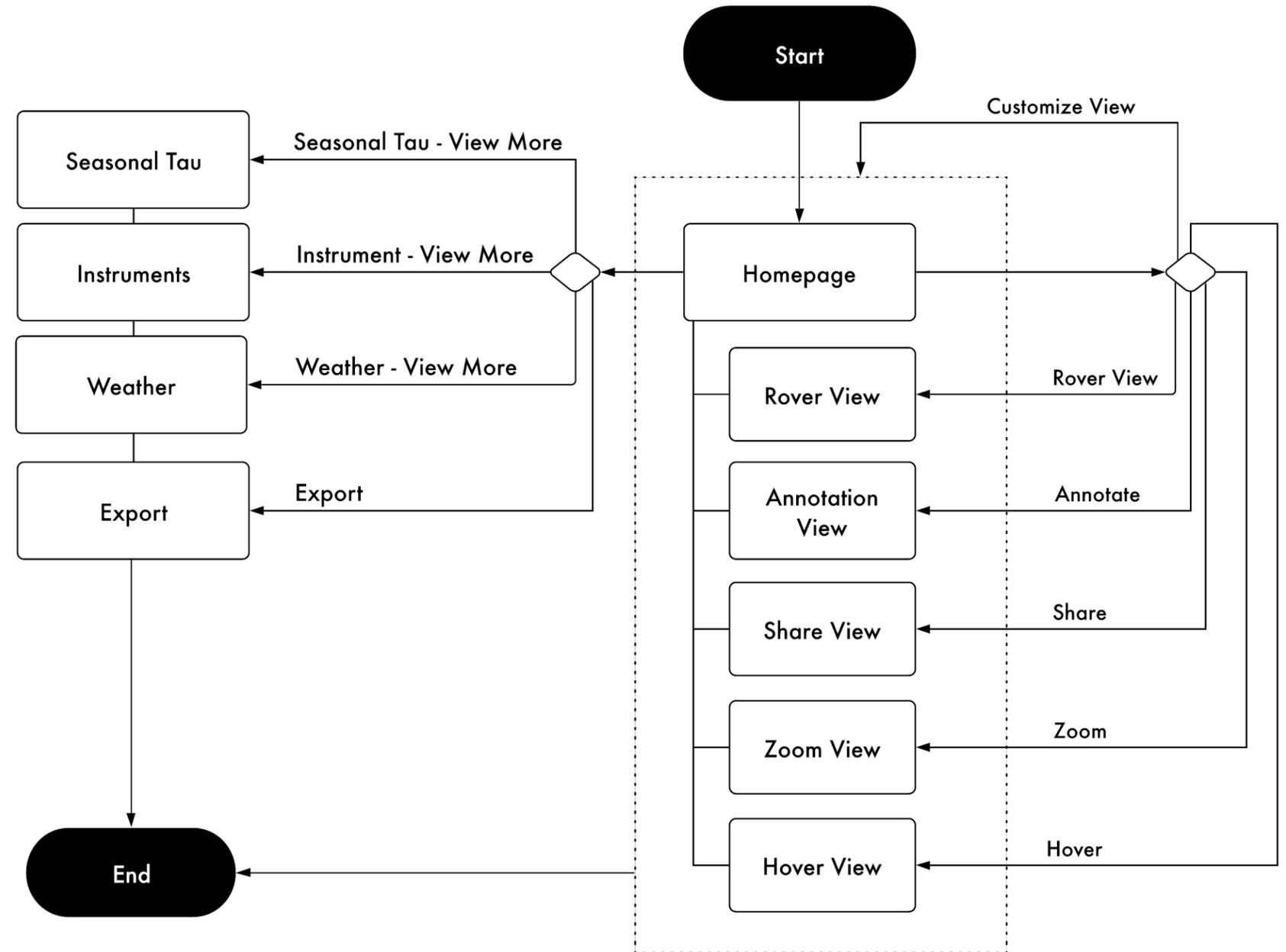
## SITEMAP

L-RROI consists of four main pages. The homepage, instrument detail page, seasonal tau page, and weather page. The homepage provides a view of the rover's traverse on the map. This acts as a gateway to other features such as annotation, rover view, share and export. The main pages have multiple states which are described in the individual user flows.



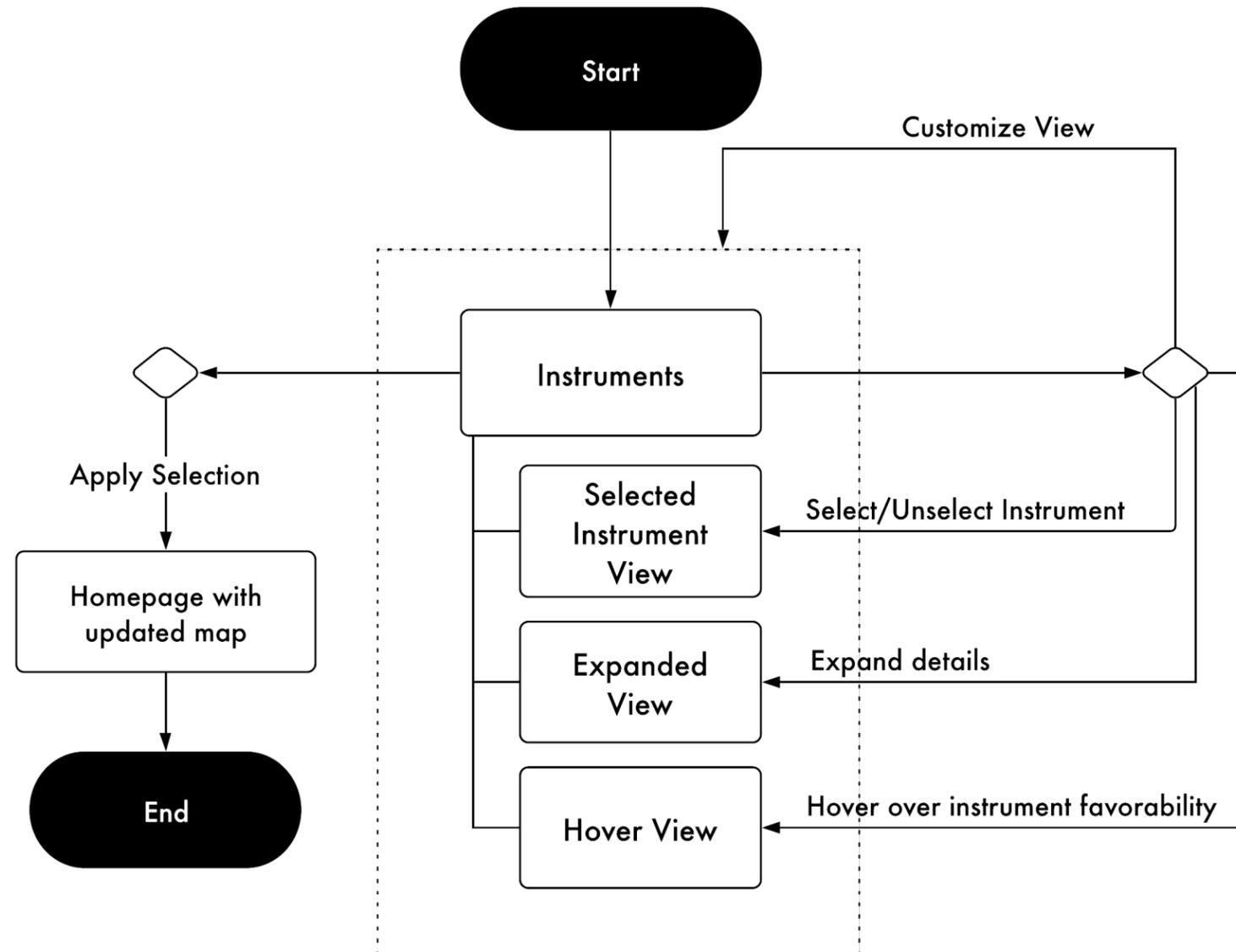
## USER FLOW • HOME

The homepage acts as the gateway to all the detailed pages. From the homepage, users can enter the instruments flow, seasonal tau flow, and weather flow. Additionally, the homepage is an interactive dashboard and the different modules on it can be customized through the header filters. Users can also interact with the homepage by hovering on different elements or clicking on the different icons in the tool box.

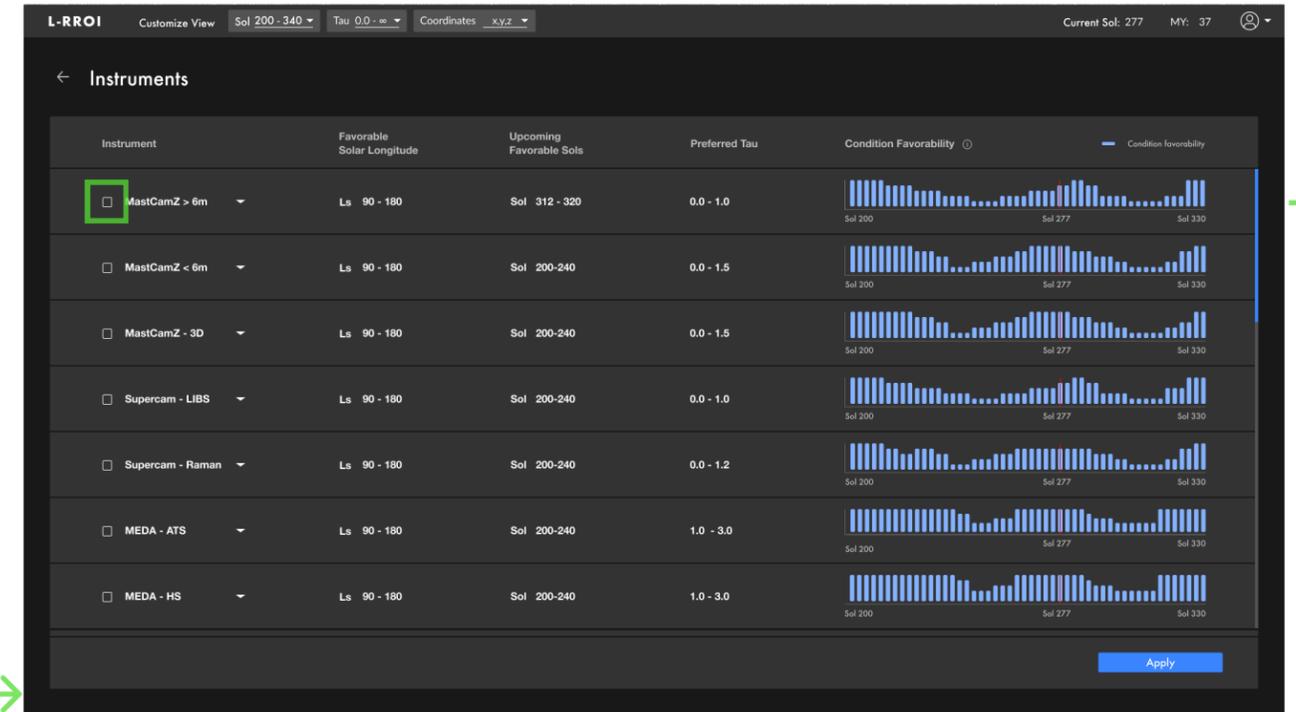


## USER FLOW • INSTRUMENTS

On the instruments page, users can adjust the timerange of the favorability graph through the header filters. Users can hover over the favorability graph of different instruments to get additional context about the instrument's condition in a given timerange. If users want to learn more about an instrument, they can expand an instruments state to see additional details such as instrument description and upcoming favorable sols.



# INTERACTION DIAGRAM • INSTRUMENTS



# INTERACTION DIAGRAM • INSTRUMENTS

The screenshot shows the 'Instruments' configuration page in the L-RROI interface. It features a table with columns for Instrument, Favorable Solar Longitude, Upcoming Favorable Sols, Preferred Tau, and Condition Favorability. The 'MastCamZ > 6m' instrument is selected. A green arrow points to the 'Apply' button at the bottom right of the table.

Instrument	Favorable Solar Longitude	Upcoming Favorable Sols	Preferred Tau	Condition Favorability
<input checked="" type="checkbox"/> MastCamZ > 6m	Ls 90 - 180	Sol 312 - 320	0.0 - 1.0	[Bar chart]
<input type="checkbox"/> MastCamZ < 6m	Ls 90 - 180	Sol 200-240	0.0 - 1.5	[Bar chart]
<input type="checkbox"/> MastCamZ - 3D	Ls 90 - 180	Sol 200-240	0.0 - 1.5	[Bar chart]
<input type="checkbox"/> Supercam - LIBS	Ls 90 - 180	Sol 200-240	0.0 - 1.0	[Bar chart]
<input type="checkbox"/> Supercam - Raman	Ls 90 - 180	Sol 200-240	0.0 - 1.2	[Bar chart]
<input type="checkbox"/> MEDA - ATS	Ls 90 - 180	Sol 200-240	1.0 - 3.0	[Bar chart]
<input type="checkbox"/> MEDA - HS	Ls 90 - 180	Sol 200-240	1.0 - 3.0	[Bar chart]

The screenshot shows the mission overview page in the L-RROI interface. It features a top-down view of the lunar surface with a rover path. A green arrow points from the 'Apply' button in the previous screenshot to the 'MastCamZ > 6m' instrument in the dashboard. The dashboard includes sections for Instruments, Seasonal Tau, and Weather.

**INSTRUMENTS**

Instrument	Favorable Tau Value	Condition Favorability
<input checked="" type="checkbox"/> MastcamZ > 6m	0.0 - 1.0	[Bar chart]
<input type="checkbox"/> Supercam - LIBS	0.0 - 1.0	[Bar chart]
<input type="checkbox"/> MEDA - ATS	1.0 - 3.0	[Bar chart]
<input type="checkbox"/> MOXIE	0.0 - 0.5	[Bar chart]

**SEASONAL TAU**

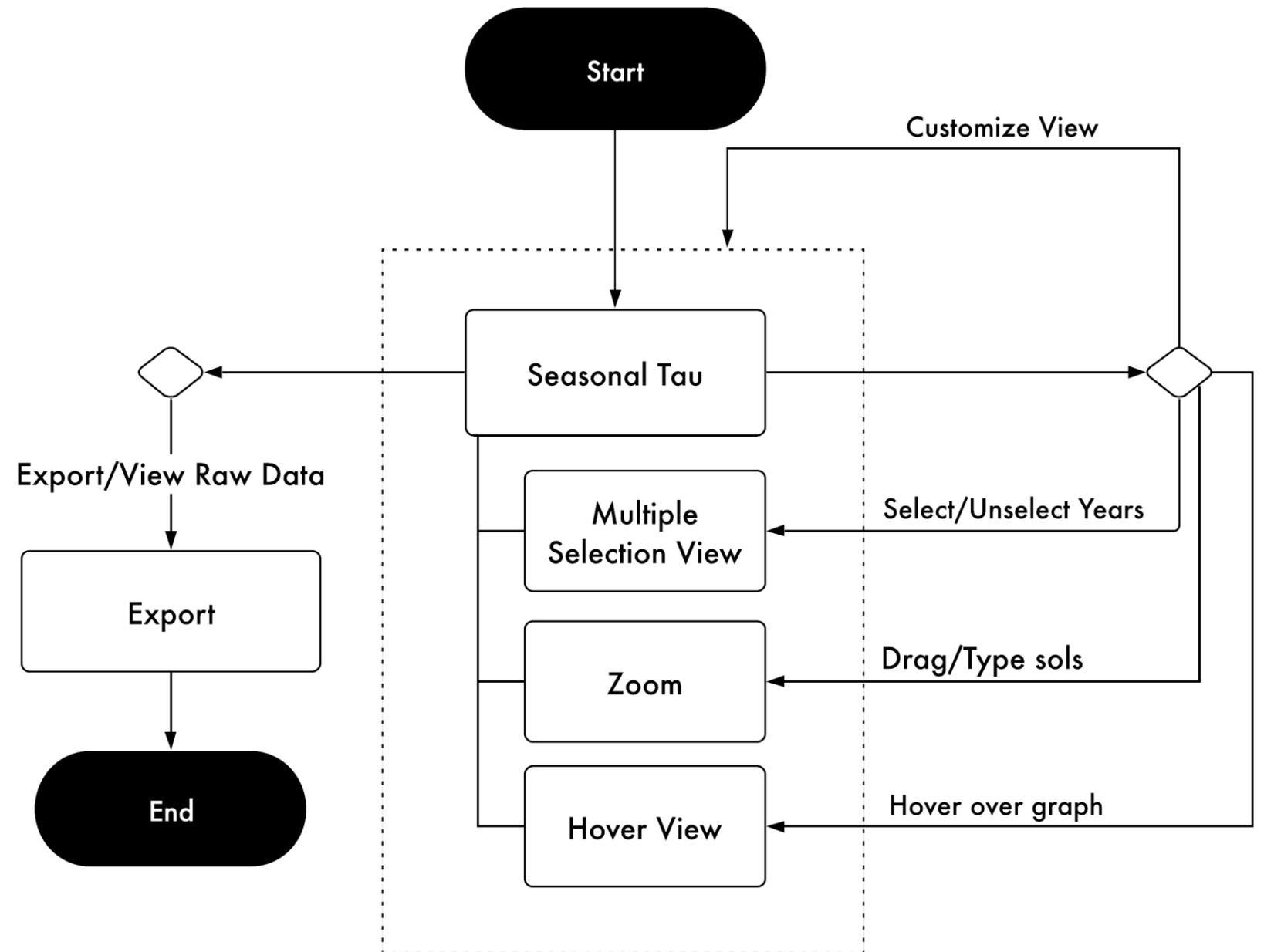
Tau (t) vs Solar Longitude (deg). Past Tau (solid line), Predicted Tau (dotted line), Error Margin (shaded area).

**WEATHER**

Parameter	Value
Tau	1.12
Temp (C)	-68
Pressure (Pa)	764
Wind (mph)	9.4
Humidity (%)	1
Solar Longitude	120°

## USER FLOW • SEASONAL TAU

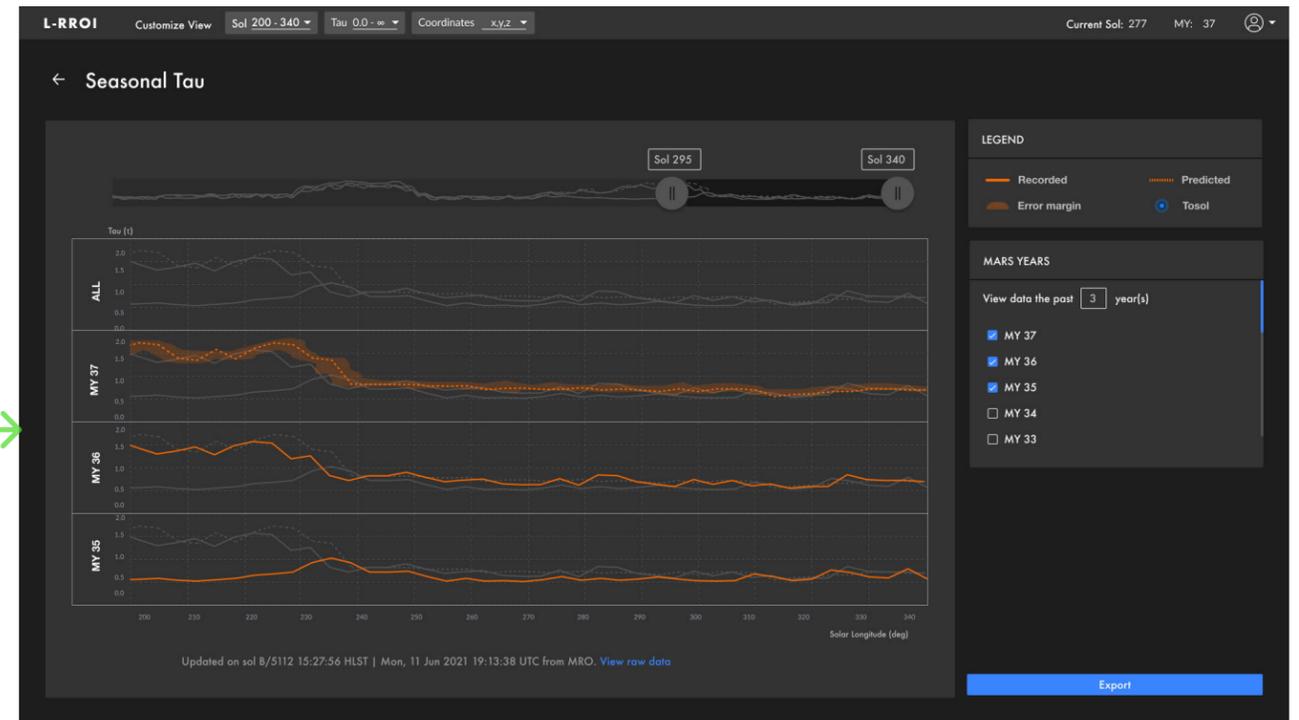
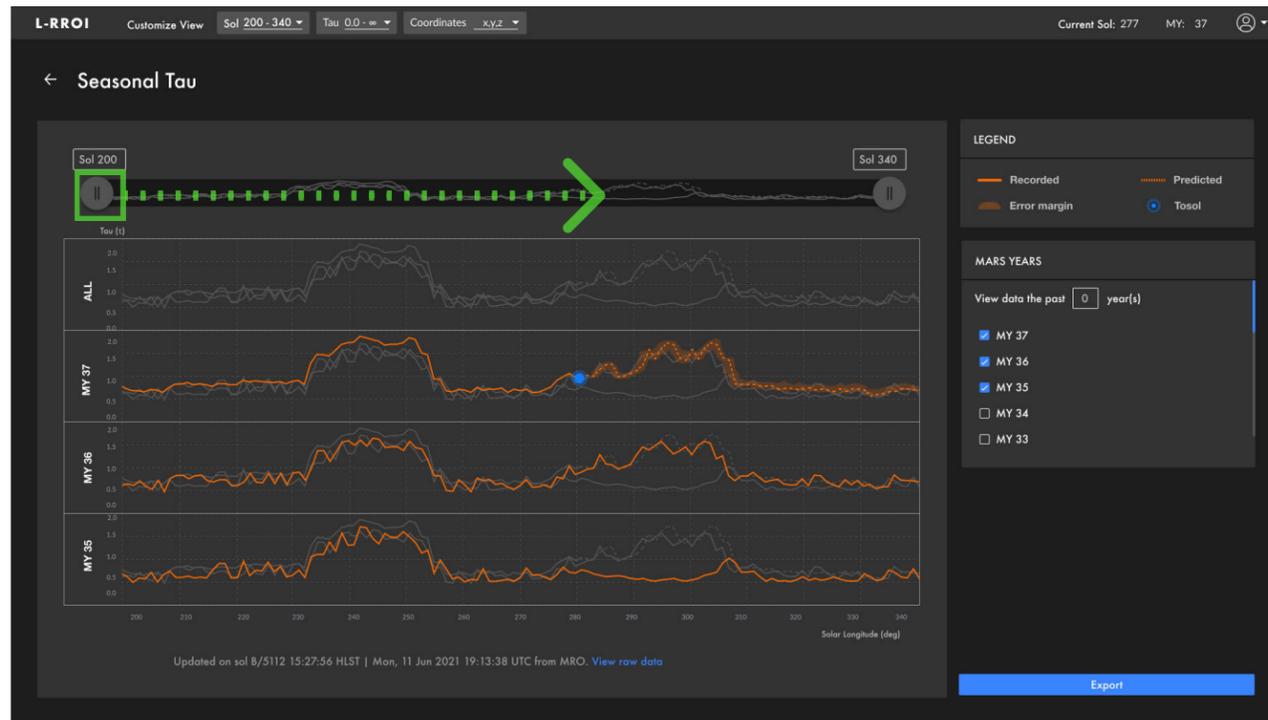
On the seasonal tau page, users can adjust the timerange of the graph through the header filters. Users can hover over the graph to get the exact tau value for the point they're hovered over. If users want to compare years, they can select multiple years from the years panel. Additionally, users can zoom into smaller timeranges by using the drag toggle or typing the specific days they want to see. Finally, users can click on Export or View Raw Data to export the data.



# INTERACTION DIAGRAM • SEASONAL TAU

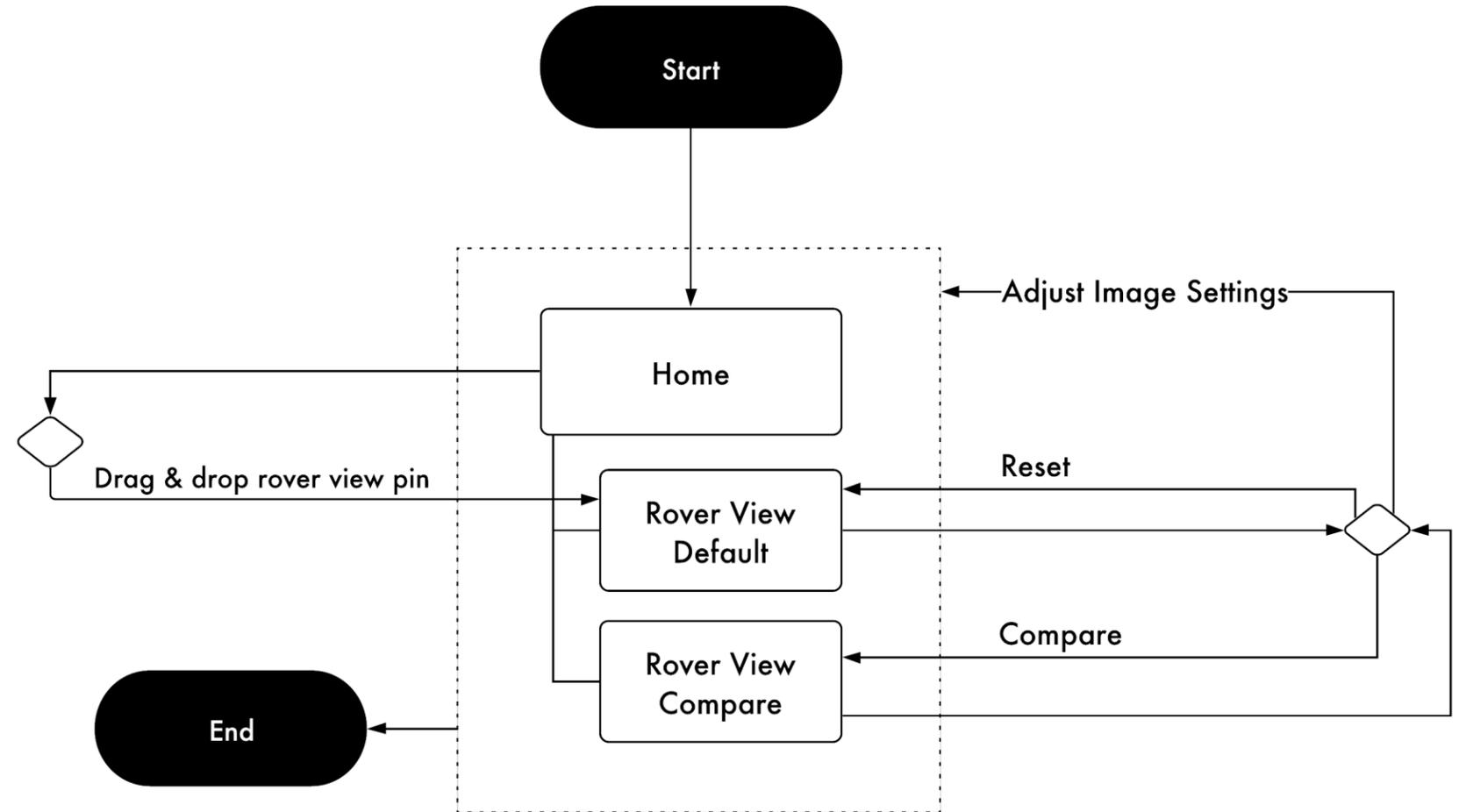


# INTERACTION DIAGRAM • SEASONAL TAU

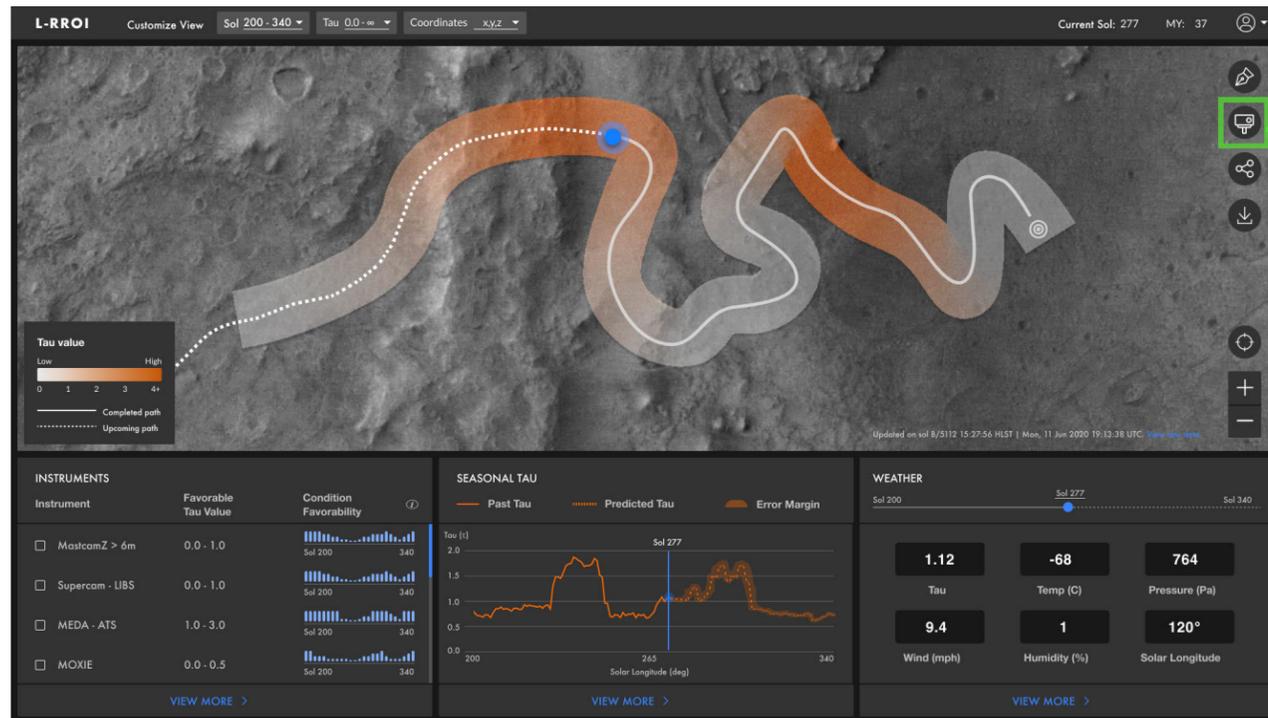


## USER FLOW • ROVER VIEW

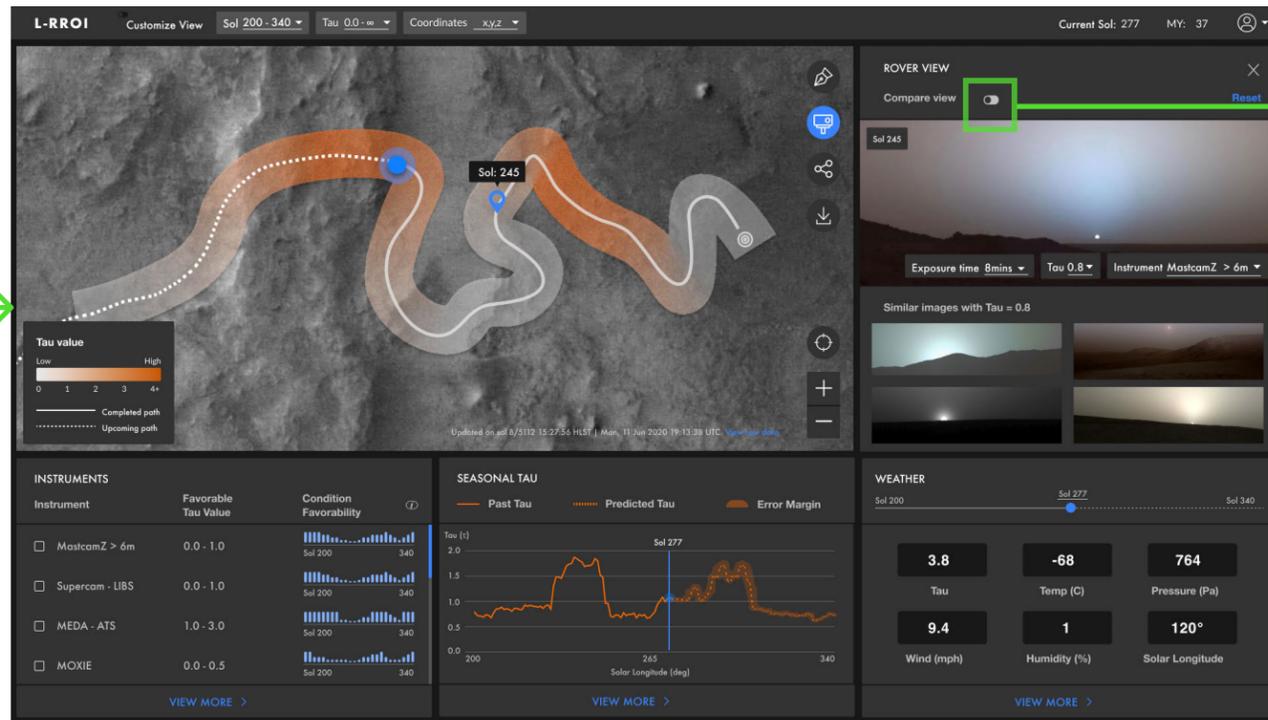
When users drop the rover view pin at any spot on the traverse, the rover view panel becomes visible. Users are able to adjust settings on the image such as instrument, exposure time, and tau value. Users can also compare different image settings against one another by clicking on the compare toggle.



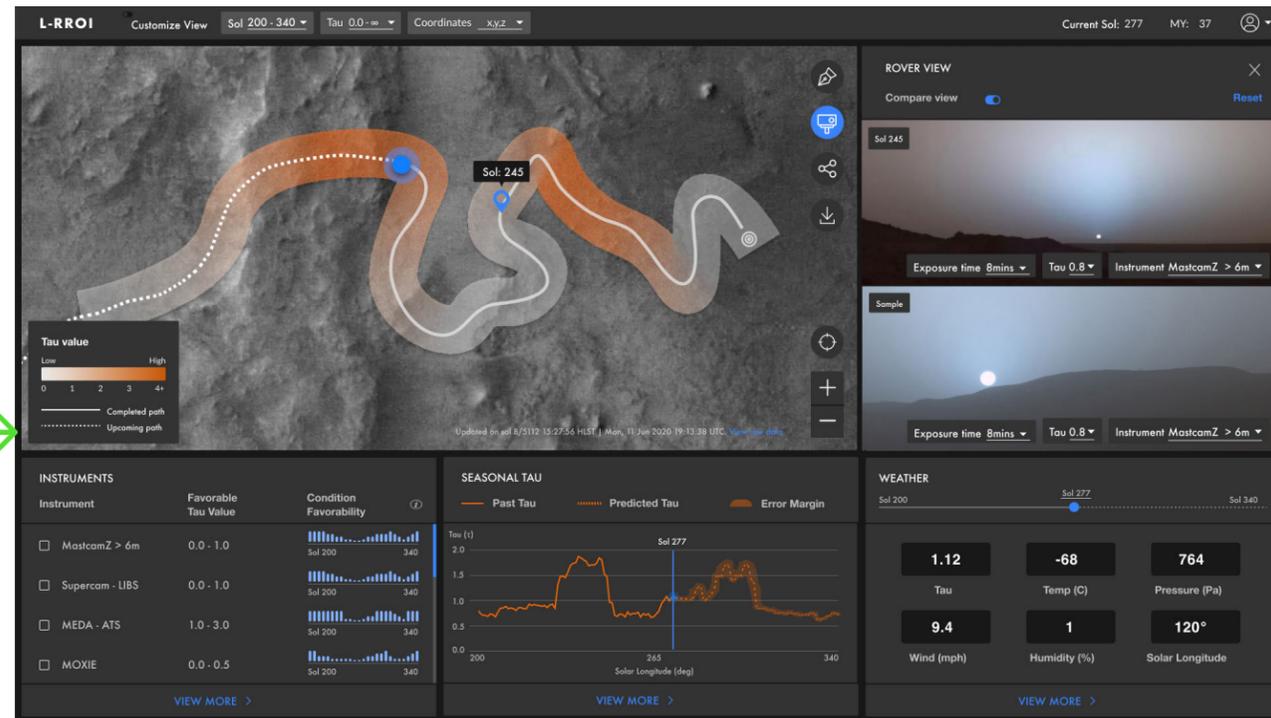
# INTERACTION DIAGRAM • ROVER VIEW



# INTERACTION DIAGRAM • ROVER VIEW



# INTERACTION DIAGRAM 3 • ROVER VIEW



# ANNOTATED SCREENS • MAP



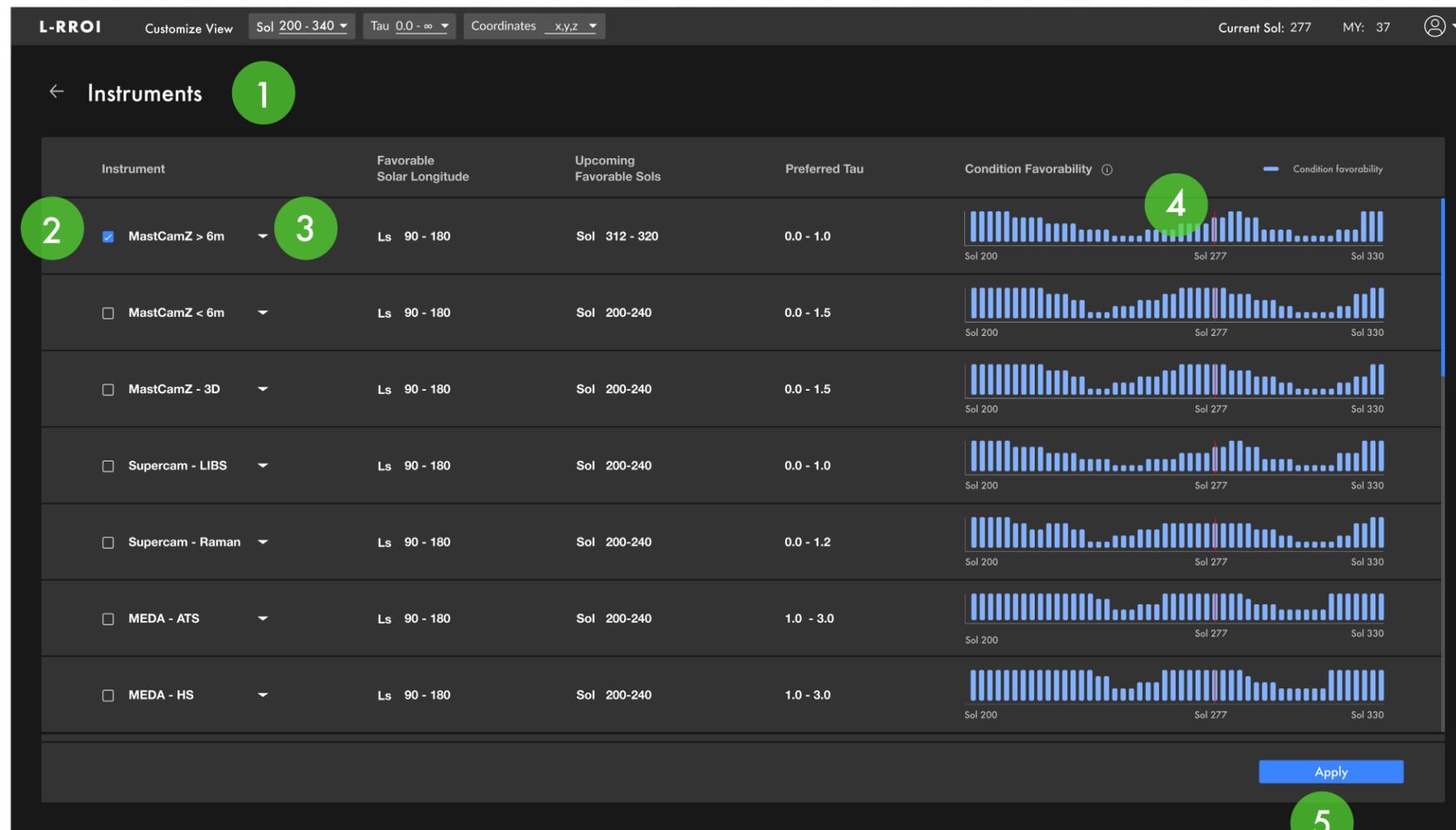
- 1 The header allows the user to customize their view according to sol range, tau value/range or specific coordinates.
- 2 A blue marker appears on the map to denote the location of the rover on the current sol.
- 3 The toolbar on the right side offers tools such as annotations, rover view, share, and export.
- 4 The + and - buttons allow the user to zoom in and out of the map. The locator allows the user to quickly return to the rover's current location.
- 5 A fixed legend provides information the map and rover path.

# ANNOTATED SCREENS • TOOL PANELS



- 1 The left panel offers a quick view of rover instruments and their favorable tau values.
- 2 Selecting the checkbox(es) next to an instrument will adjust the map to show the areas of the path with the favorable tau conditions.
- 3 The blue graph shows an easy to read view of how the favorable the conditions are for each instrument over the selected sol range.
- 4 The center panel offers a quick view of seasonal tau information for the selected sol range. The blue line on the graph denotes the current sol.
- 5 The right panel shows basic weather information on a given sol. The slider at the top of the panel allows the user to look at weather on a specific sol within the selected sol range.
- 6 At the bottom of each panel, users can select "view more" for additional information.

# ANNOTATED SCREENS • INSTRUMENTS



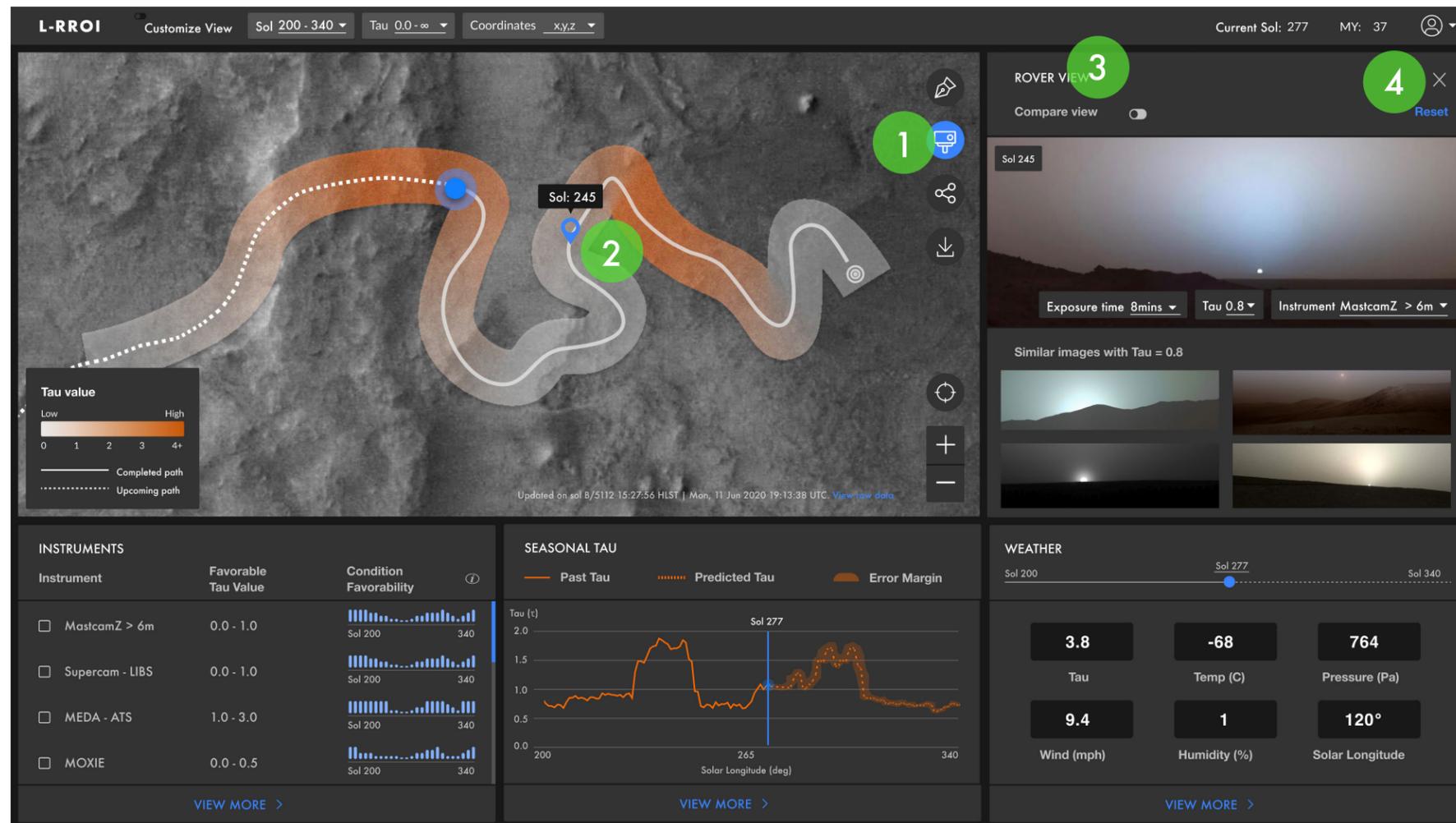
- 1 This is the detailed instrument panel view. It shows additional information with more details. Select the back arrow to return to the homescreen.
- 2 Selecting a checkbox next to an instrument will adjust the map on the home screen to show the areas of the path with the favorable tau conditions.
- 3 Clicking on the down arrow will expand the view even further to show additional favorable sol ranges, a description on the instrument, and show factors that may contribute to the condition favorability.
- 4 On this view, the condition favorability graph is larger and easier to read.
- 5 Select apply to return to the home screen and see the map view with the selected instrument(s).

## ANNOTATED SCREENS • SEASONAL TAU



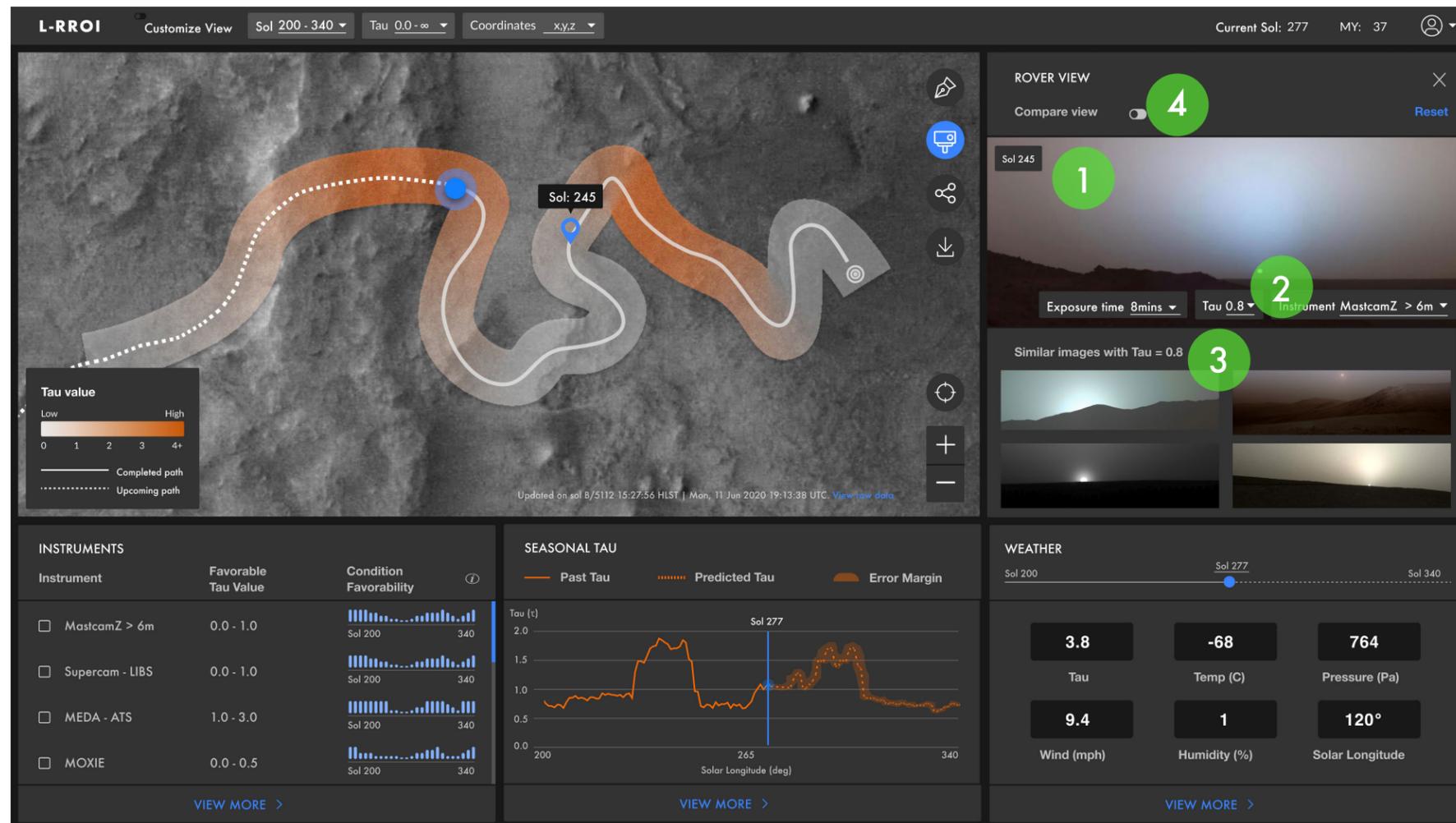
- 1 This is the detailed Seasonal Tau view. Here, the user can see visualizations of tau information. Select the back arrow to return to the homescreen.
- 2 This slider allows the user to adjust the view to further zoom into selected dates within the selected sol range.
- 3 The graph shows tau as a function of solar longitude.
- 4 The legend shows that the solid orange line shows historical tau, while the dotted orange line shows the predicted tau. The error margin for the predicted tau is also noted as shaded orange. The blue symbol on the graph is shows today's sol.
- 5 Users are able to select multiple mars years to show on the graph. If more than one year are selected, the graph breaks into small multiples.
- 6 The export button directs the user to a form that allows them to export this visualization.

# ANNOTATED SCREENS • ROVER VIEW



- 1 When the rover view button is selected, it will remain blue. Hovering over the button, a "rover view" label will appear.
- 2 Once rover view has been selected, a pin will appear and the user can drop it anywhere on the path. A label will appear above the pin to show the sol where the pin is dropped.
- 3 A panel also will appear on the right side.
- 4 The user can also reset any changes they have made to the rover view panel and press x to exit rover view.

# ANNOTATED SCREENS • ROVER VIEW



- 1 The top image shows a photo taken of Mars when the tau was the same condition (exposure time, tau value, instrument used) as where the user has dropped the pin.
- 2 The user is able to change exposure time, tau value, instrument used in order to find a particular sol with their desired conditions.
- 3 At the bottom, they will see other images with a similar tau level. By clicking on one of those photos, the image at the top will change to the selected photo.
- 4 The user can toggle "compare view" on and off if they wanted to compare 2 photos. Once they toggle "compare view" on, the user can type in the exposure time, tau value, instrument used and the bottom half of the panel will be replaced with a second photo that meets the parameters that the user has set.



# VISUAL SYSTEM

# GRID SYSTEMS

L-RROI uses a 12-column grid for both 1920x1080 and 1440x1024 screen sizes.

## GRID SYSTEM 1

12 columns - 20 margin - 10 gutter

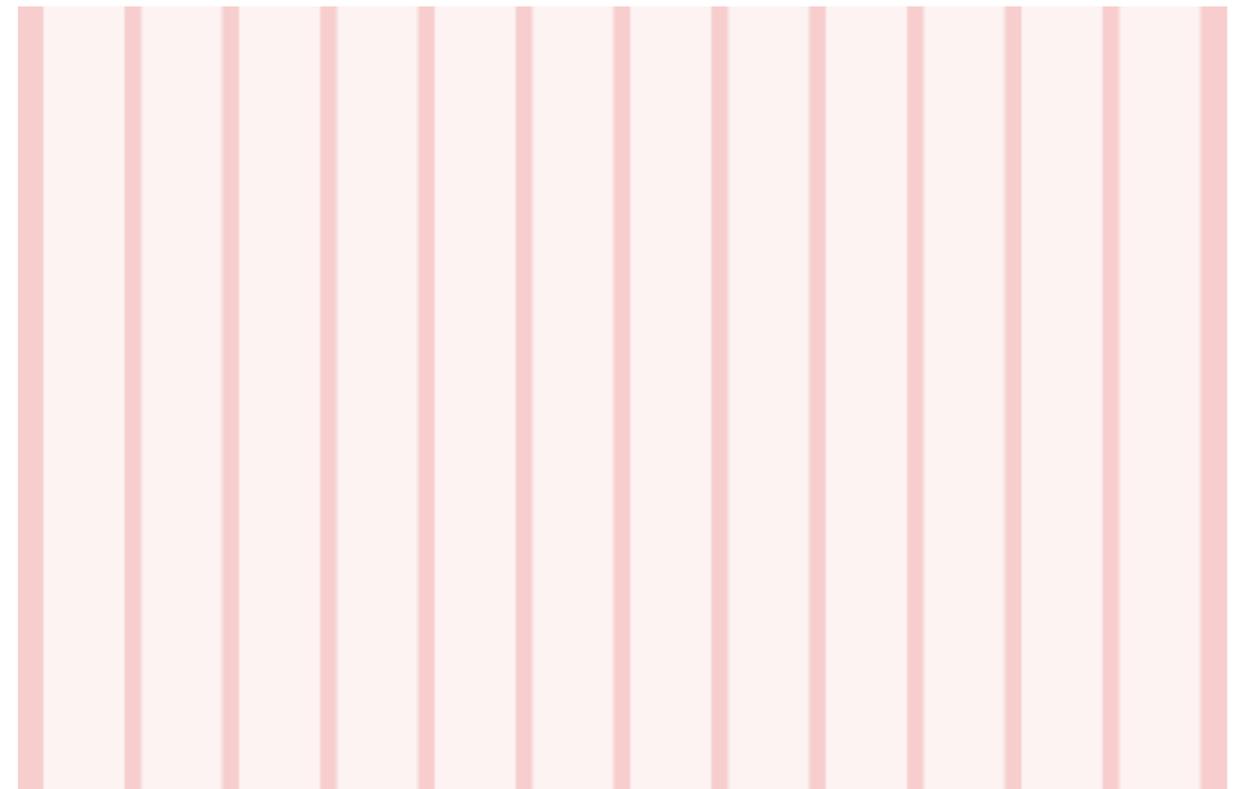


### ? When to use

Dashboard screens will take the grid system with smaller margin and gutter in order to provide more real estate to the map.

## GRID SYSTEM 2

12 columns - 40 margin - 20 gutter



### ? When to use

All screens without a map.

# COLOR

The primary color is orange which mimics the dusty surface of Mars. Blue was chosen as a complementary color.

## Rationale

We envision L-RROI as a platform to be inserted in the middle of the rover planning process. Scientists will open L-RROI, quickly get tau information, and come back to complete their intended tasks. In order to minimize the cost of task-switching between platforms, L-RROI limits color usage to orange and blue.

## PRIMARY

Tau orange



#FF6B00

Opacity: 100%

Opacity: 20%

### ? When to use

Primary color will be used for any tau-related elements.

## SECONDARY

Water blue



#FF6B00

Opacity: 100%

Opacity: 100%

### ? When to use

Any blue element in the platform demonstrates a call-to-action or highlights important interactive elements.

## GRADIENT

Dust Devil



#FFFFFF - #FF6B00

Opacity: 70%

### ? When to use

Gradient will be used to visualize tau on the rover traverse. Higher tau will have darker orange.

## GREYS

Grey



#000000

Opacity: 90%

#000000

Opacity: 80%

#000000

Opacity: 70%

#000000

Opacity: 50%

#000000

Opacity: 20%

#FFFFFF

Opacity: 100%

# TYPOGRAPHY

L-RROI uses the Futura typeface and its variation across the platform. The san-serif font’s simplicity makes it easy to read at speed, and on the go.

## Rationale

We want to embrace NASA’s culture of heritage by choosing a typeface that has a long history with the organization. Futura was the first typeface to be sent to the moon. One of the objectives of the Mars 2020’s mission is to “Prepare for Future Human Exploration”. Using Futura conveys our hope that L-RROI could contribute to NASA’s space exploration program, making it one step closer to sending the first human to Mars.



## LOGO

font-family: Futura;  
font-style: normal;  
font-weight: bold;  
font-size: 20px;  
line-height: 27px;  
letter-spacing: 2px;

## Heading 1

font-family: Futura;  
font-style: normal;  
font-weight: 500;  
font-size: 30px;  
line-height: 40px;

## HEADING 2

font-family: Futura;  
font-style: normal;  
font-weight: 500;  
font-size: 16px;  
line-height: 21px;

## Body

font-family: Futura;  
font-style: normal;  
font-weight: 500;  
font-size: 16px;  
line-height: 21px;

## Description

font-family: Futura;  
font-style: normal;  
font-weight: 500;  
font-size: 12px;  
line-height: 16px;

## LINK LARGE

font-family: Futura;  
font-style: normal;  
font-weight: 500;  
font-size: 16px;  
line-height: 21px;  
color: water blue;

## Link small

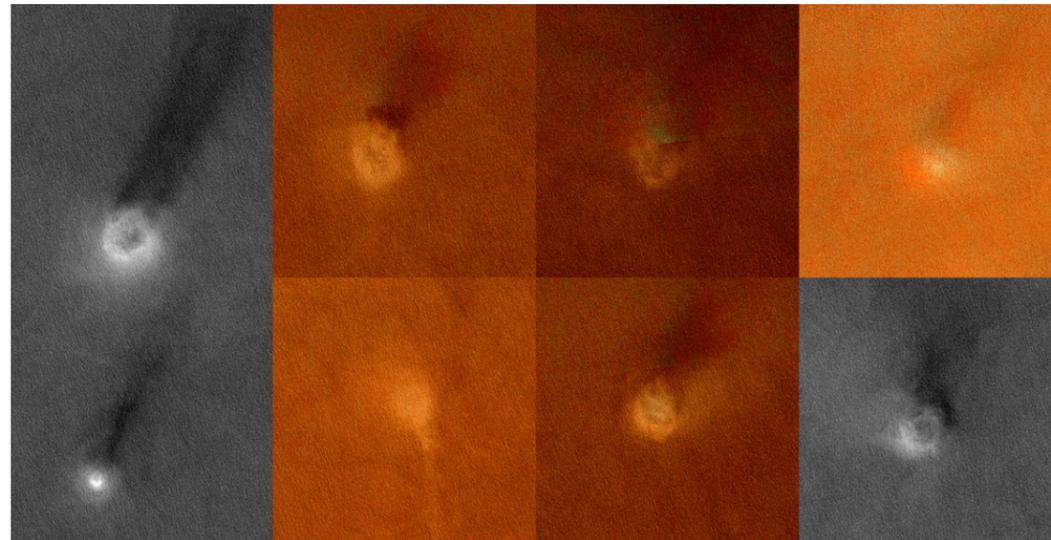
font-family: Futura;  
font-style: normal;  
font-weight: 500;  
font-size: 16px;  
line-height: 21px;  
color: water blue;

# LOGO

The L-RROI logo uses the variation of orange to demonstrate the impact of tau on the red planet. It is simple and semiotic.

## Rationale

During a global dust storm, wind carries dust into the air, hindering rover cameras to take clear images. The more dust in the atmosphere, the darker the image. We leverage this scientific phenomenon to create a logo for L-RROI.

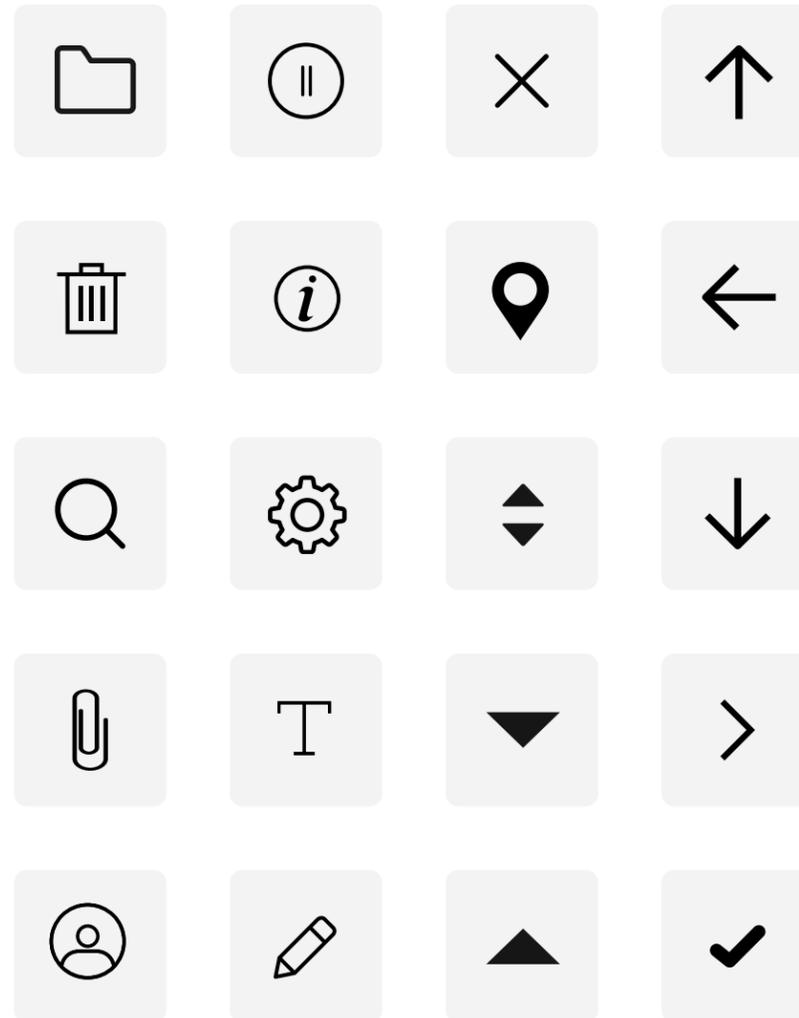


## LOGO



# ICONOGRAPHY

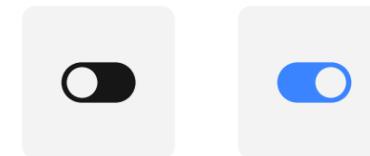
## System icon



## Checkbox



## Toggle



## Location



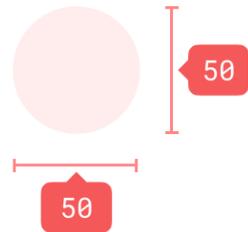
# ICONOGRAPHY

## Construction

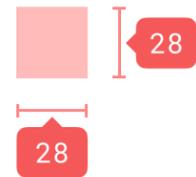
Full icon



Background



Vector



## States

Default



Greys  
#000000  
Opacity: 80%

Hover



Greys  
#000000  
Opacity: 90%

Selected



Water blue  
#FF6B00  
Opacity: 100%

Default

Hover

Selected



Annotate



Rover view



Share



Export



Locate



Zoom in



Zoom out



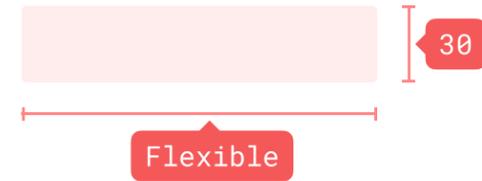
# BUTTON

## Construction

Full CTA



Background



Text



## States

Default



Water blue  
#FF6B00  
Opacity: 100%

Hover



#6BA3FF  
Opacity: 100%

On-click



#3169C5  
Opacity: 100%

Disabled



#000000  
Opacity: 70%

# INPUT FIELD

## Construction

Full CTA



Border



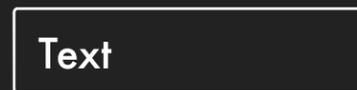
Text



Text Style: Body  
#FFFFFF  
Opacity: 100%

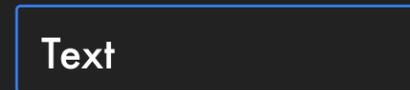
## States

Default



Border radius: 2px  
Color: #FFFFFF  
Opacity: 100%

Active



Border radius: 2px  
Color: Water blue  
Opacity: 100%

Filter applied



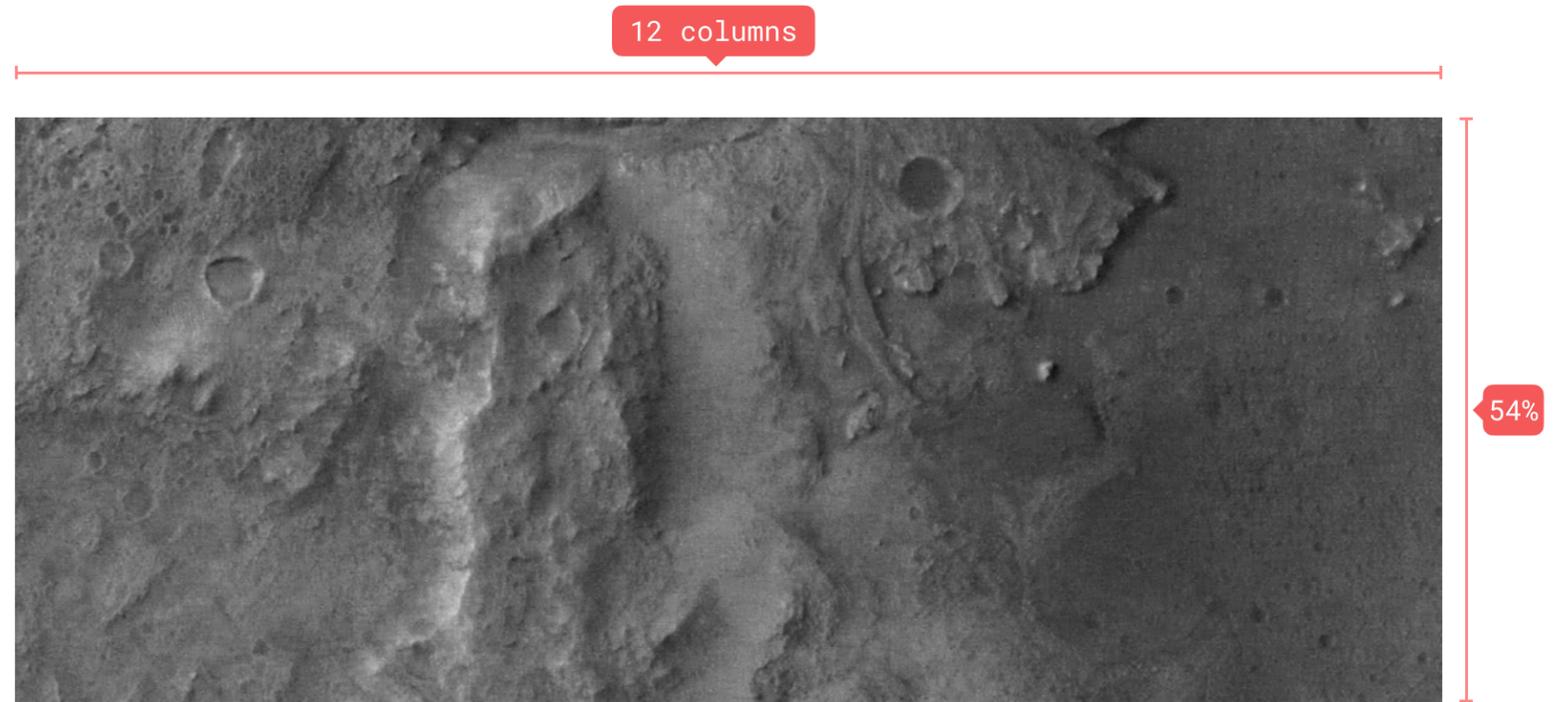
Border radius: 2px  
Color: Tau orange  
Opacity: 100%

# MARTIAN MAP

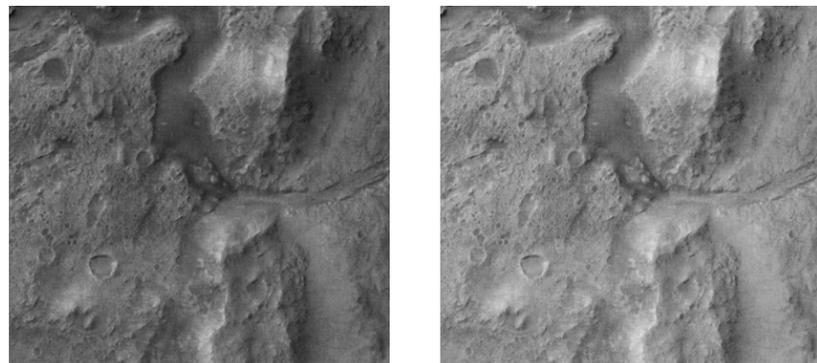
L-RROI uses Mars orbiter images as the main source for the map. The map reflects the actual location of Jerezo Crater where the Mars 2020 rover will be operating.

## Rationale

Similar to our color rationale, we want scientists to focus on the task at hand and L-RROI would be a tool to support their workflow. To highlight the impact of tau on the map and to minimize distractions, L-RROI will not use color images so that scientists can quickly assess the impact of tau along the rover traverse and how it affects instruments.



## DO



Use Light to Medium gray

## DON'T



Color images

Underexposed

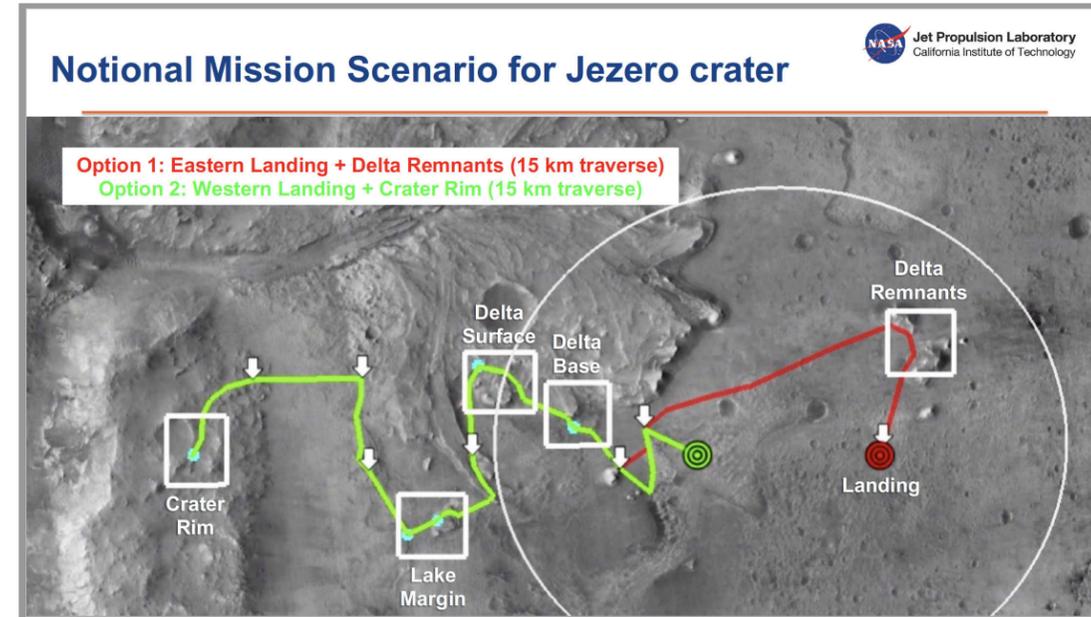
Overexposed

# ROVER TRAVERSE

The rover traverse in L-RROI demonstrates the nominal path and timeline of the Mars 2020 mission.

## Specs

- Line thickness: 5px
- Color: #FFFFFF
- Opacity: 80%
- Dotted line: 5,5

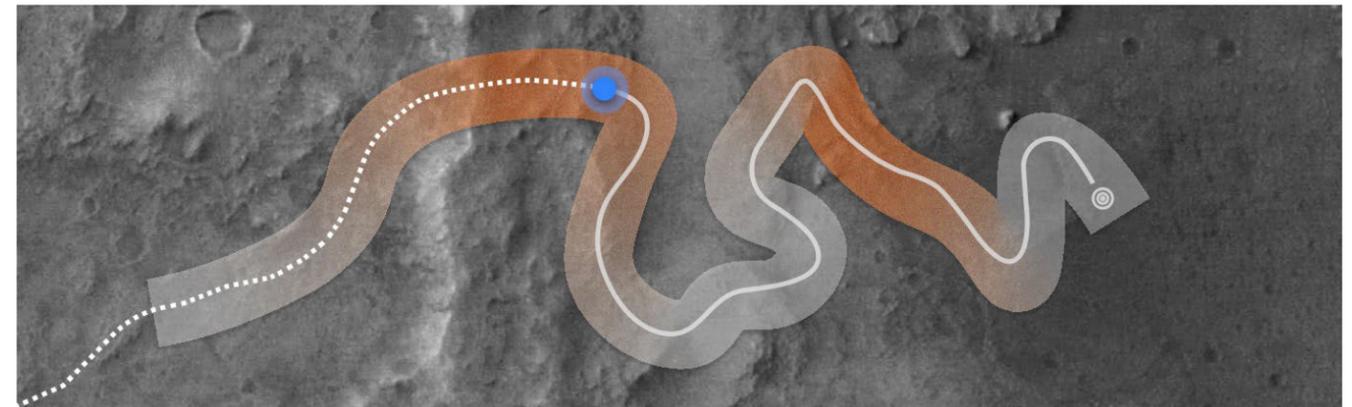


# TAU PATH

Tau path will use the 'Dust Devil' gradient to illustrate concentration of dust at a certain time in the mission.

## Rationale

The shape and gradient of tau path was inspired by images of dust devils taken by spacecraft orbiting around Mars. The path will have an opacity of 70% in order to allow scientists to still see through to the Martian terrain.

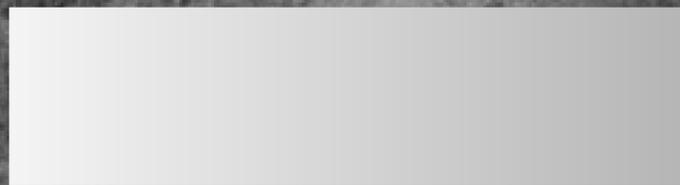


DO



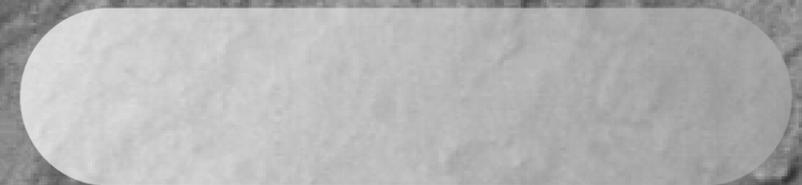
Opacity 70% with No cap

DON'T



Opacity 100%

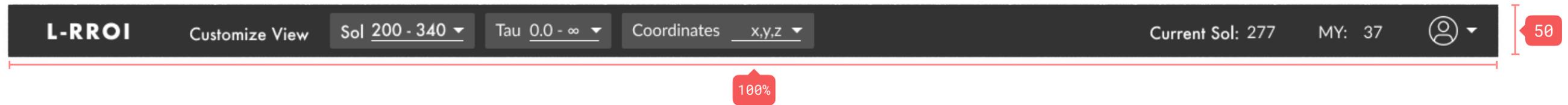
DON'T



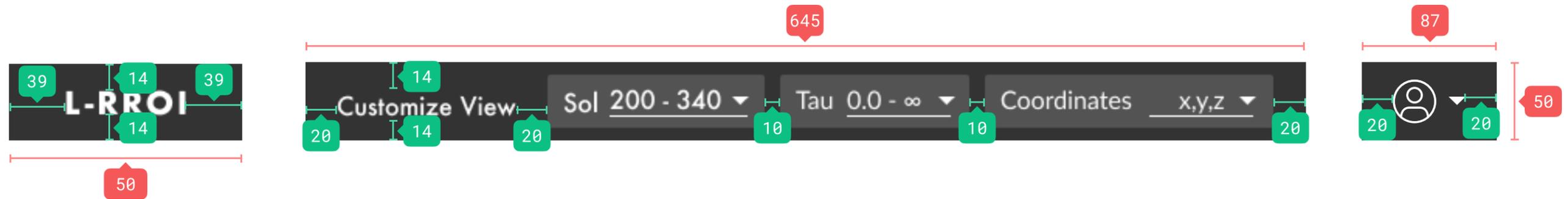
Rounded caps signify no clear cut in time, giving untrustworthy impression.

# HEADER

## Full Header

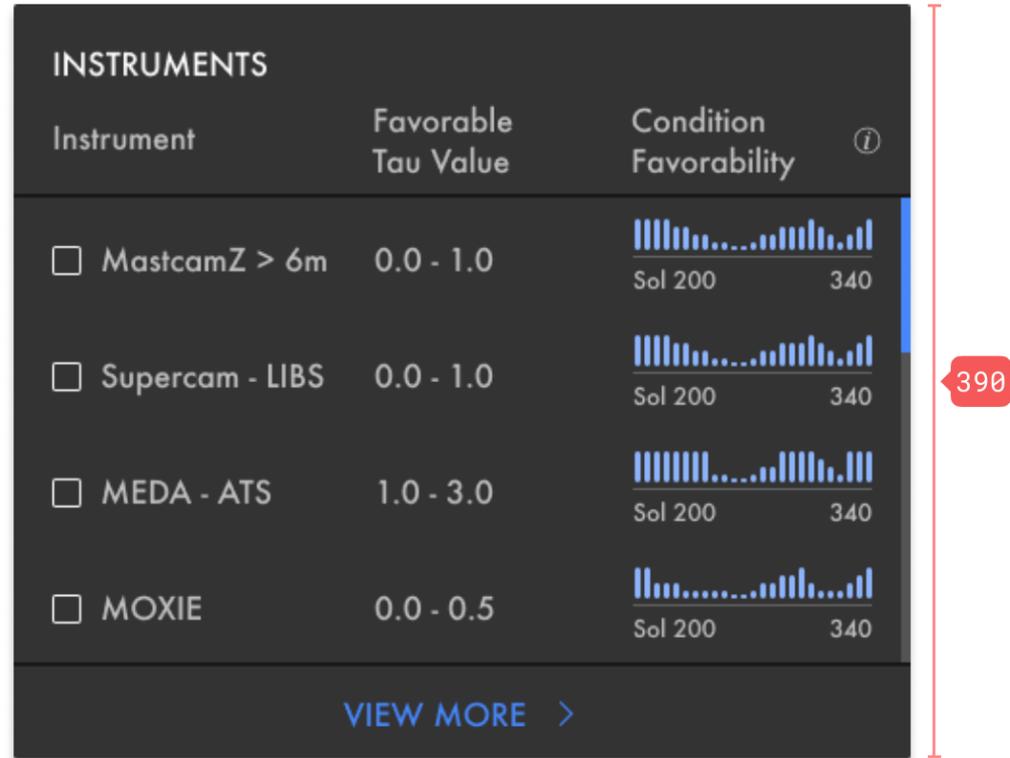


## Components

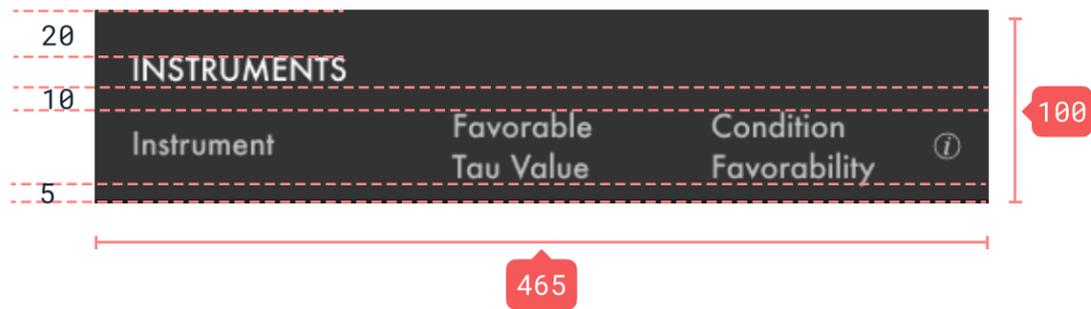


# INSTRUMENT PANEL

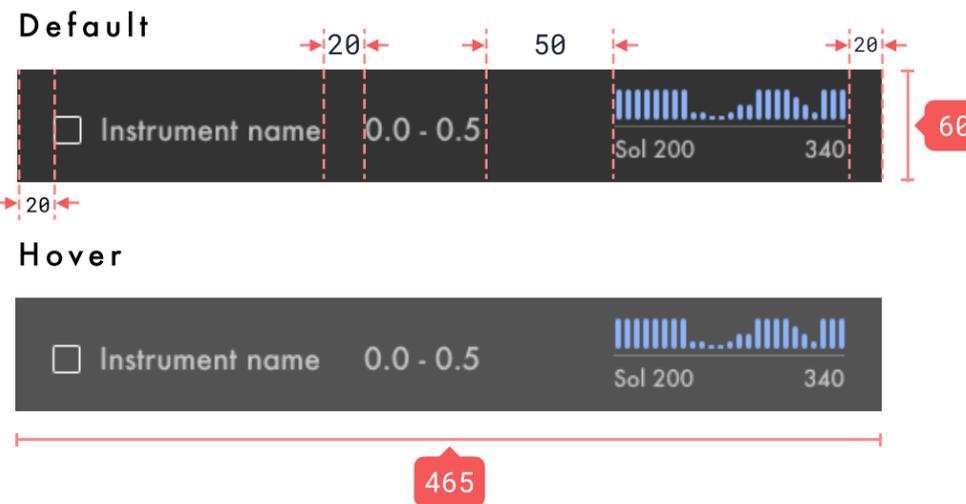
## Full panel



## Header



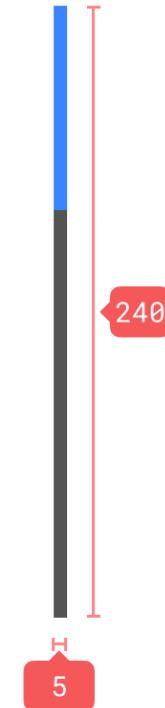
## Individual instrument



## View more

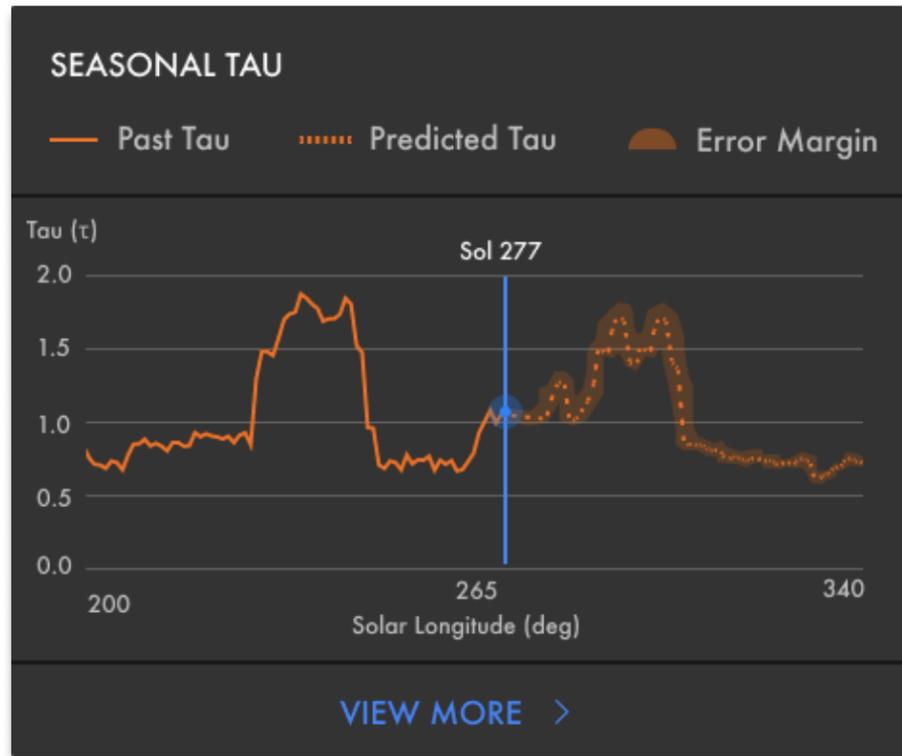


## Scroll bar



# SEASONAL TAU PANEL

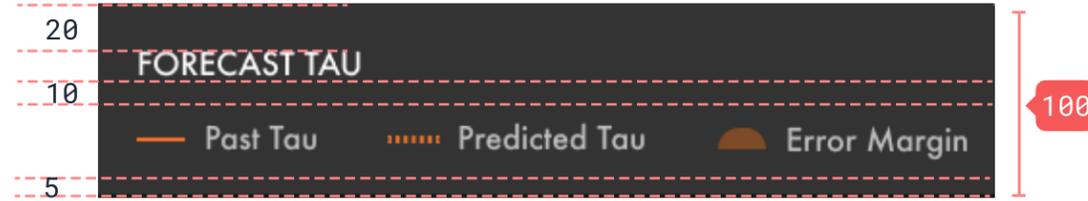
## Full panel



465

390

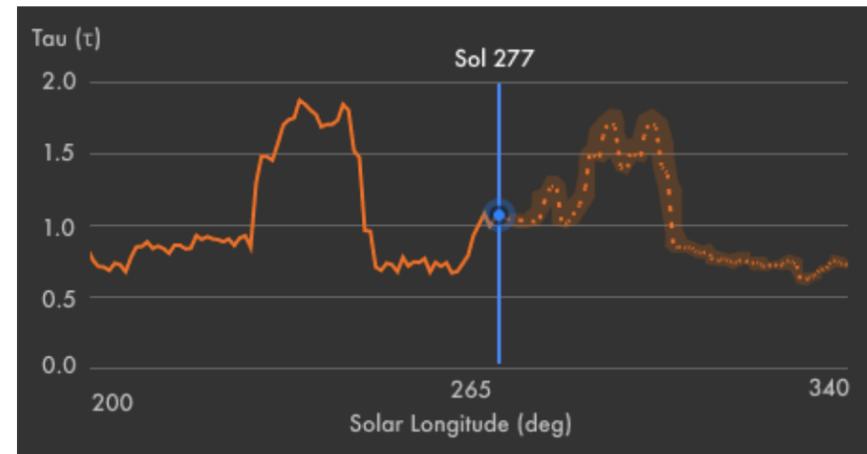
## Header



100

465

## Graph

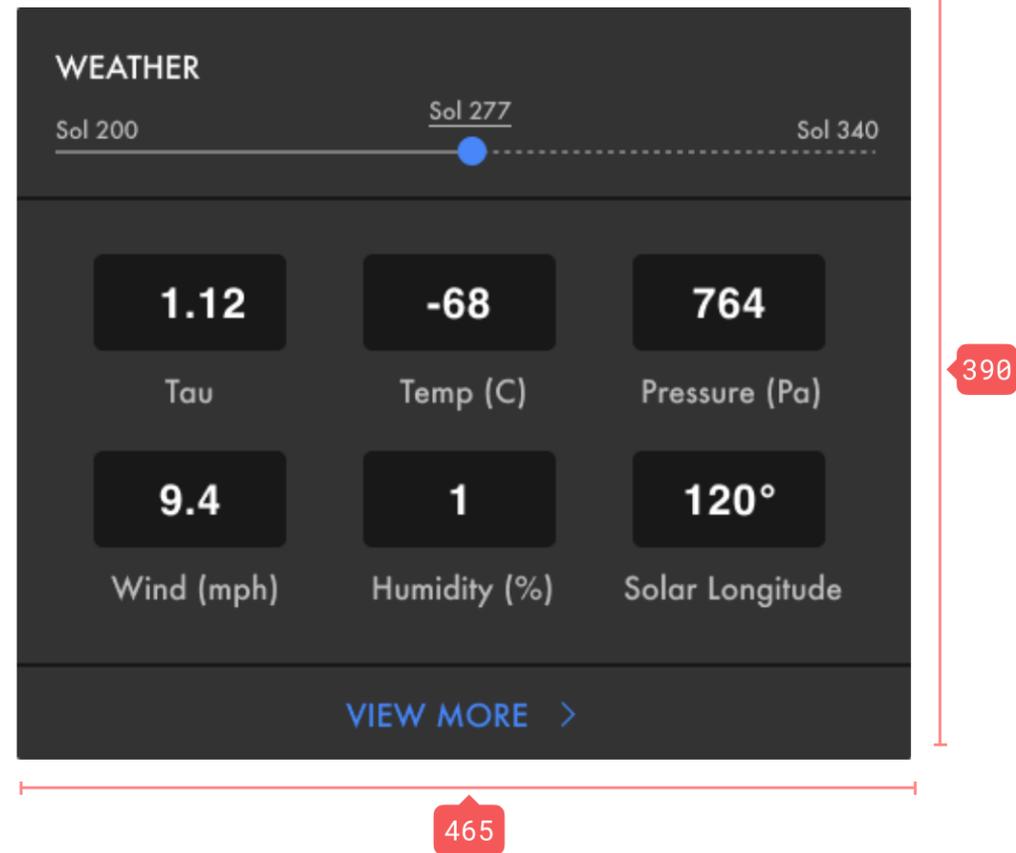


240

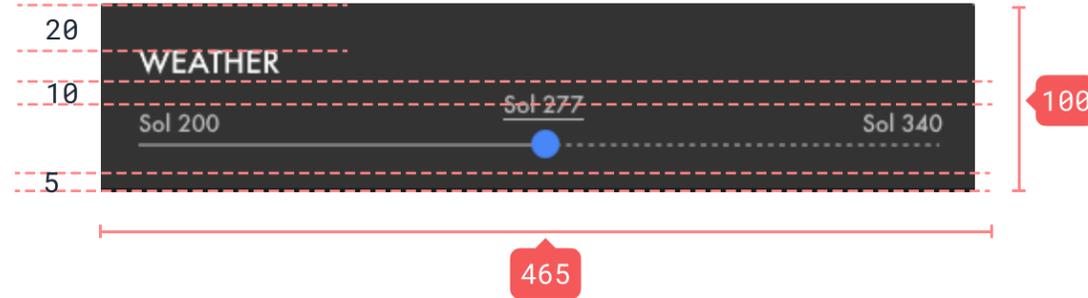
465

# WEATHER PANEL

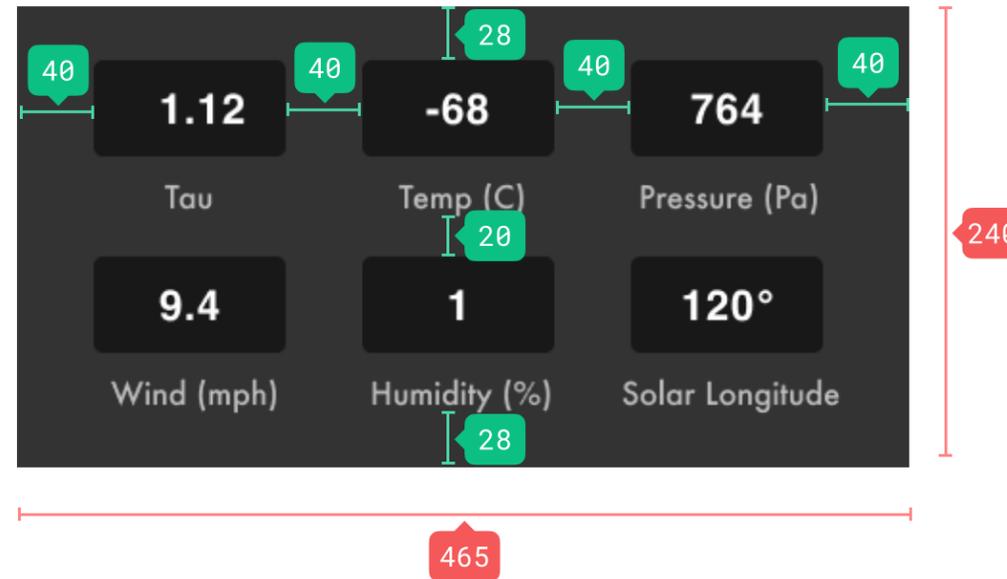
## Full panel



## Header

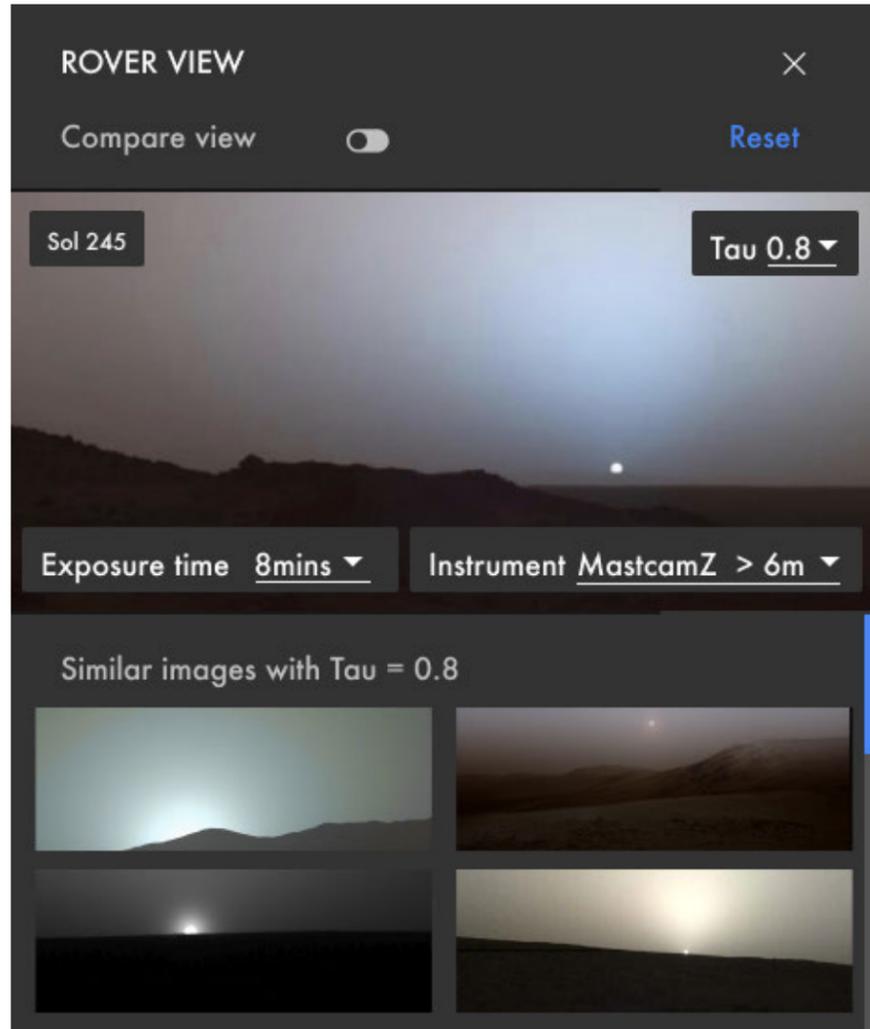


## Weather variables

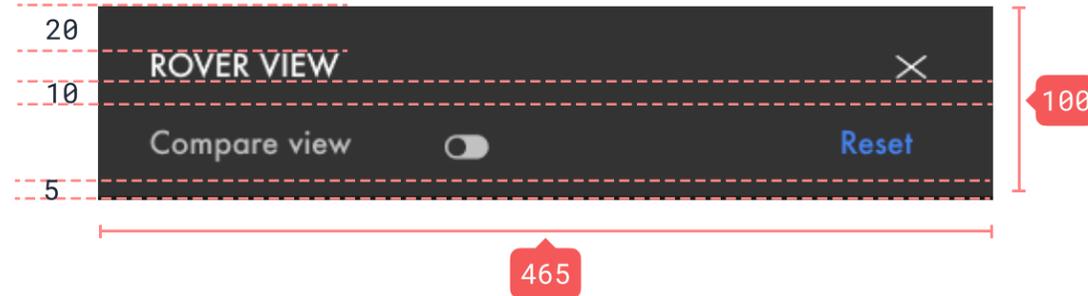


# ROVER VIEW PANEL

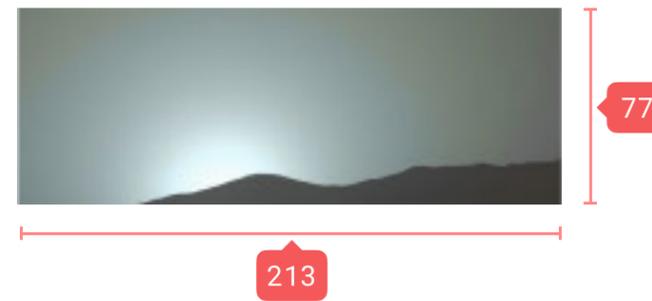
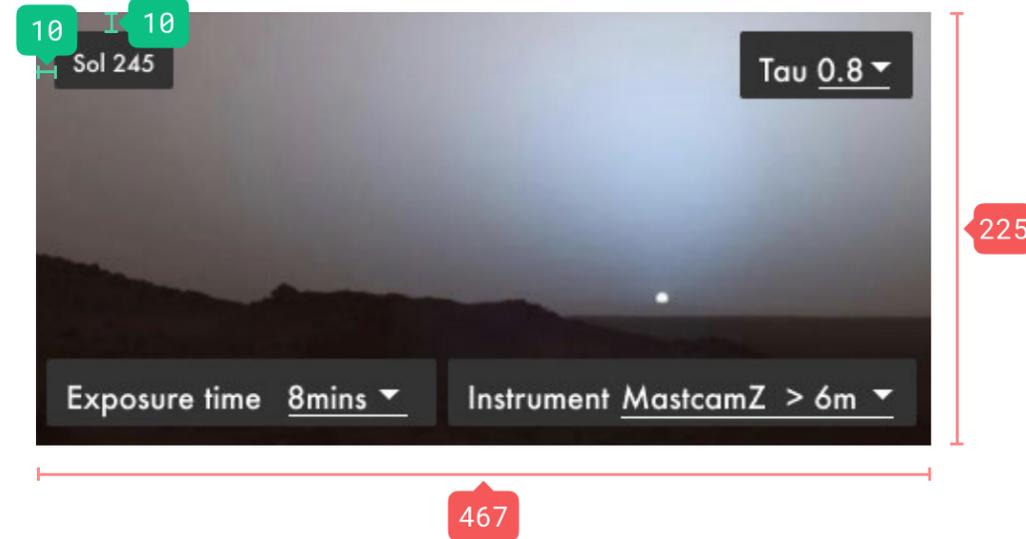
## Full panel



## Header

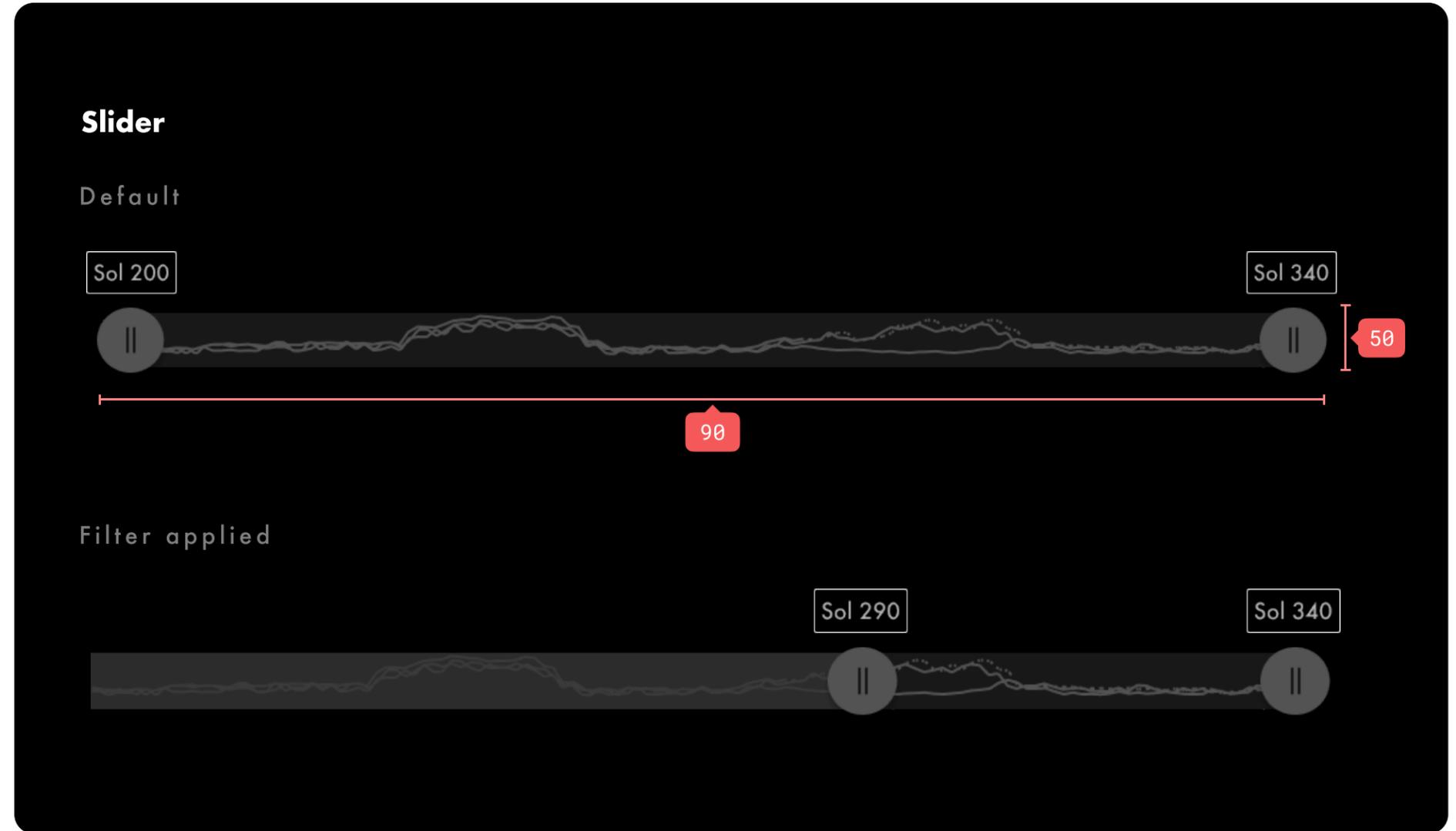
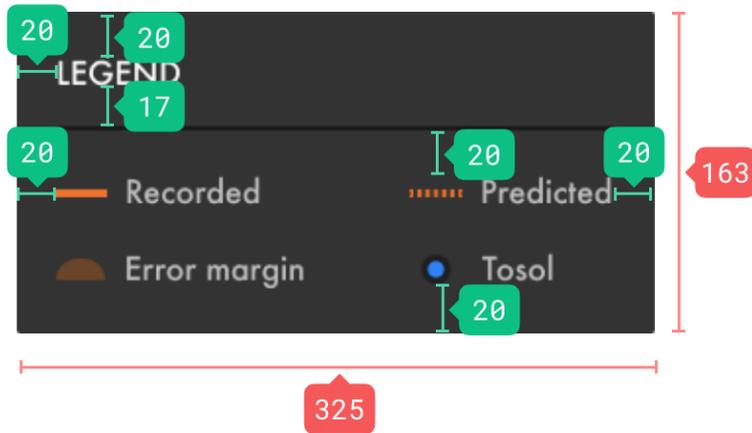
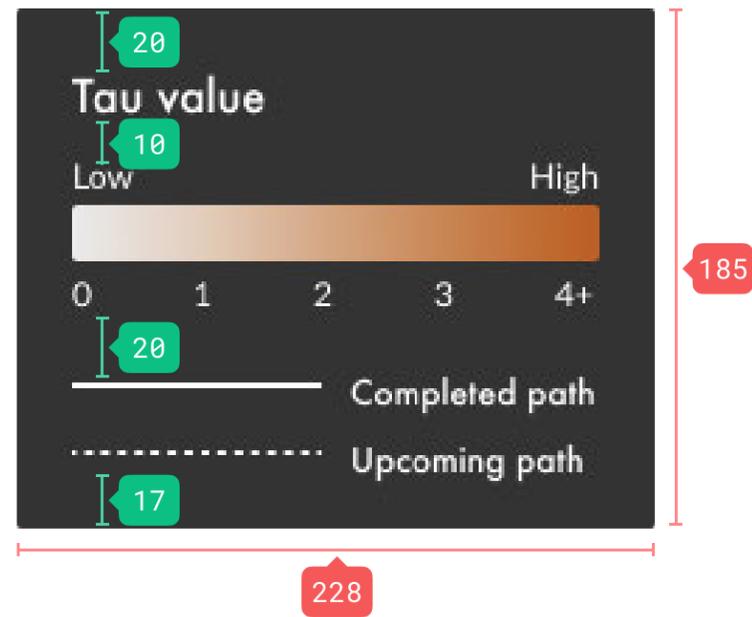


## Images



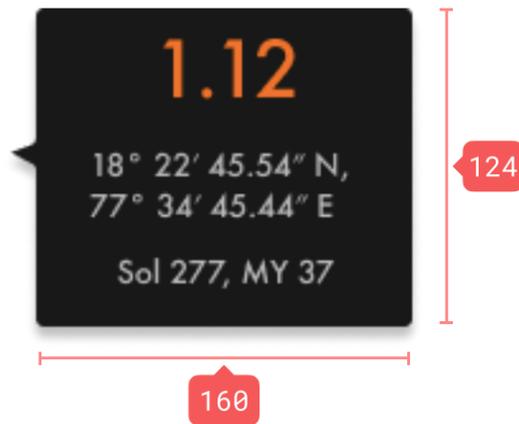
# OTHER MODULES

## Legend

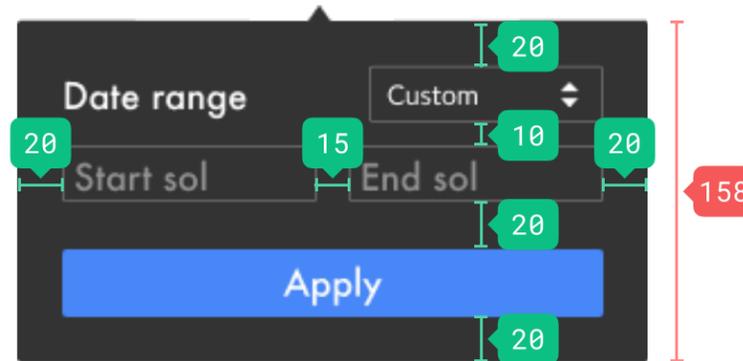


# POPUPS

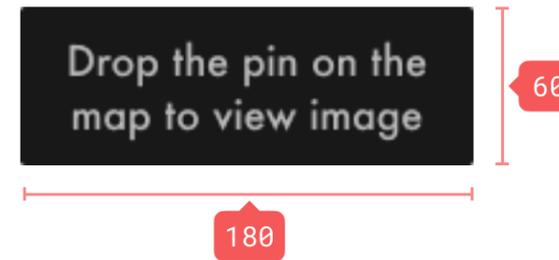
### Tau on hover



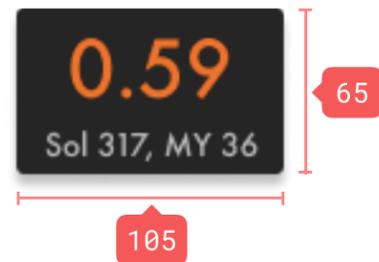
### Sol range



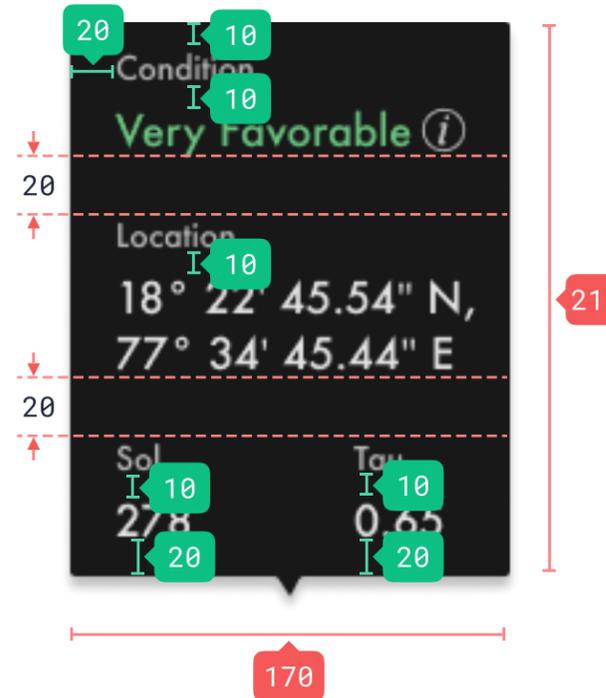
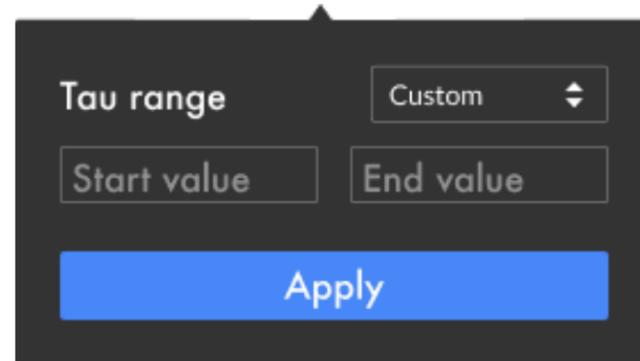
### Tool tips



### Graph on hover



### Tau range



**L-RROI**
Customize View
Sol 200 - 340
Tau 0.0 - ∞
Coordinates x,y,z
Current Sol: 277 MY: 37

**ROVER VIEW**

Compare view

Sol 245

Exposure time 8mins | Tau 0.8 | Instrument MastcamZ > 6m

Similar images with Tau = 0.8

**INSTRUMENTS**

Instrument	Favorable Tau Value	Condition Favorability
<input type="checkbox"/> MastcamZ > 6m	0.0 - 1.0	
<input type="checkbox"/> Supercam - LIBS	0.0 - 1.0	
<input type="checkbox"/> MEDA - ATS	1.0 - 3.0	
<input type="checkbox"/> MOXIE	0.0 - 0.5	

[VIEW MORE >](#)

**SEASONAL TAU**

— Past Tau    - - - - - Predicted Tau    Error Margin

[VIEW MORE >](#)

**WEATHER**

Sol 200 — Sol 277 — Sol 340

<b>3.8</b> Tau	<b>-68</b> Temp (C)	<b>764</b> Pressure (Pa)
<b>9.4</b> Wind (mph)	<b>1</b> Humidity (%)	<b>120°</b> Solar Longitude

[VIEW MORE >](#)

**L-RROI** Customize View Sol 200 - 340 Tau 0.0 - ∞ Coordinates x,y,z Current Sol: 277 MY: 37

**Instruments**

Instrument	Favorable Solar Longitude	Upcoming Favorable Sols	Preferred Tau	Condition Favorability
<input checked="" type="checkbox"/> MastCamZ > 6m	Ls 90 - 180	Sol 312 - 320	0.0 - 1.0	
<input type="checkbox"/> MastCamZ < 6m	Ls 90 - 180	Sol 200-240	0.0 - 1.5	
<input type="checkbox"/> MastCamZ - 3D	Ls 90 - 180	Sol 200-240	0.0 - 1.5	
<input type="checkbox"/> Supercam - LIBS	Ls 90 - 180	Sol 200-240	0.0 - 1.0	
<input type="checkbox"/> Supercam - Raman	Ls 90 - 180	Sol 200-240	0.0 - 1.2	
<input type="checkbox"/> MEDA - ATS	Ls 90 - 180	Sol 200-240	1.0 - 3.0	
<input type="checkbox"/> MEDA - HS	Ls 90 - 180	Sol 200-240	1.0 - 3.0	

1597

Apply

