

# ASTROVISIO

PoC Manual

v1.0 31/07/2025

## Preface

The purpose of the Proof of Concept (PoC) was to gather as much feedback as possible on the functionalities during the live demo session at the Scuola Normale Superiore of Pisa.

As this was a live demonstration conducted with the support of the Astrovisio team, we opted to include features with a simplified User Experience compared to the original design. In some instances, these functionalities were managed directly via the keyboard, supported by personnel from Alkemy and Metaverso.

The MVP, scheduled for release by the end of October 2025, will feature the complete integration of the UI, ensuring the best possible User Experience.

## 00. SETUP

Astrovisio requires its backend, AstroAPI, to correctly process the input data.

AstroAPI is a Dockerized RESTful API designed to manage and process astrophysical data projects. While it functions as a standalone service, it is primarily intended to offload data processing tasks from Astrovisio's Unity desktop application.

The instructions to install Docker and properly setup the container are available in the public GIT repository at the following link: [https://github.com/Astrovisio/pisa-tutorials/blob/main/app\\_tutorials/first\\_docker\\_README.md](https://github.com/Astrovisio/pisa-tutorials/blob/main/app_tutorials/first_docker_README.md).

## IMPORTANT

Docker containers cannot access the device local storage directly.

During the Docker setup you specified the VOLUME\_SOURCE path inside the .env file you created.

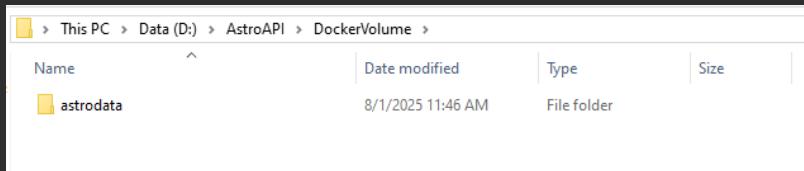
It is **mandatory** that any file (.hdf5 or .fits) you want to load and visualize in Astrovisio is placed inside a folder named "astrodata" inside the VOLUME\_SOURCE folder you specified.

If the "astrodata" folder is not there you must create it manually.

Example

.env:

```
VOLUME_SOURCE="D:\AstroAPI\ DockerVolume"
```

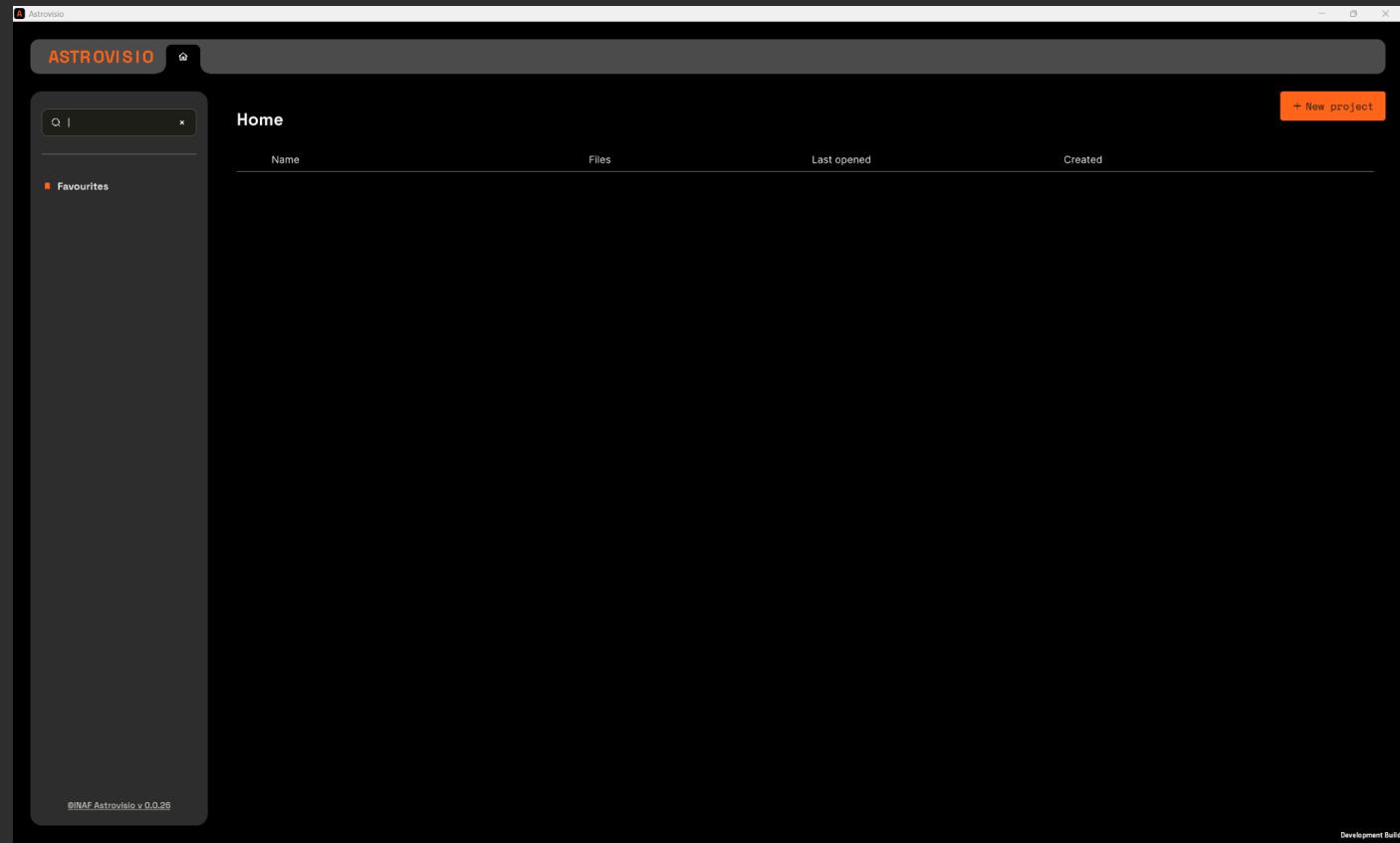


# 01. HOME PAGE

## OVERVIEW

The **Home Page** lists all the projects.

*The following is an example of the application on its first launch, where the user has not yet created any project.*



*Below is an example of a populated Project Page.*

Name	Files	Last opened	Created	
<b>Last month</b>				
521429.hdf5	1 files	13/07/2025 18:03	02/07/2025 18:05	
test_box.hdf5	1 files	13/07/2025 18:02	08/07/2025 17:23	
575356.hdf5	1 files	08/07/2025 16:56	02/07/2025 17:56	
342447_gas.hdf5	1 files	08/07/2025 16:49	02/07/2025 17:13	
test_tupsi_from_serra	1 files	08/07/2025 16:43	08/07/2025 16:41	
483594_gas.hdf5	1 files	08/07/2025 16:15	02/07/2025 17:14	
av_brightness	1 files	08/07/2025 15:40	08/07/2025 15:37	
372755_star.hdf5	0 files	08/07/2025 15:29	02/07/2025 17:16	
575356_gas.hdf5	0 files	08/07/2025 15:28	02/07/2025 17:08	
spw17.Cl.clean.freq.fits	1 files	08/07/2025 15:08	02/07/2025 17:01	
372755_dm.hdf5	0 files	08/07/2025 15:08	02/07/2025 17:19	
502nmos.fits	1 files	08/07/2025 15:04	02/07/2025 17:56	
snapshot_047.hdf5	1 files	08/07/2025 14:32	02/07/2025 17:56	
reduced_TAN_C14.fits	1 files	07/07/2025 11:20	02/07/2025 16:59	
ngc2403_fixed.fits	1 files	07/07/2025 11:20	02/07/2025 17:01	

## PROJECT LIST

The project list on the Home Page displays the following columns of information:

**Name:** The name of the project.

**Files:** The number of files contained within the project.

**Last Opened:** The date the project was last opened.

**Created:** The creation date of the project.

## SEARCH

The search function allows you to filter projects using alphanumeric characters.

**Top Screenshot (Search: 521):**

Name	Files	Last opened	Created	Actions
521429.hdf5	1 files	13/07/2025 18:03	02/07/2025 18:05	
test_box.hdf5	1 files	13/07/2025 18:02	08/07/2025 17:23	

**Bottom Screenshot (Search: 52):**

Name	Files	Last opened	Created	Actions
521429.hdf5	1 files	13/07/2025 18:03	02/07/2025 18:05	

## FAVORITES

The **Favorite** function makes your project easily accessible in the **Favorites** area, located in the left-hand panel of the **Home Page**.

**Top Screenshot (Sidebar Favorites):**

Name	Files	Last opened	Created	Actions
PoC Tutorial	1 files	30/07/2025 15:06	30/07/2025 15:06	

**Bottom Screenshot (Main Project List):**

Name	Files	Last opened	Created	Actions
PoC Tutorial	1 files	30/07/2025 15:16	30/07/2025 15:06	

## EDIT

Allows you to modify the project's **Name** and **Description**.

## DUPLICATE

Creates a copy of the project. It allows you to set a new Project Name and Project Description before the files are duplicated on the backend.

## DELETE

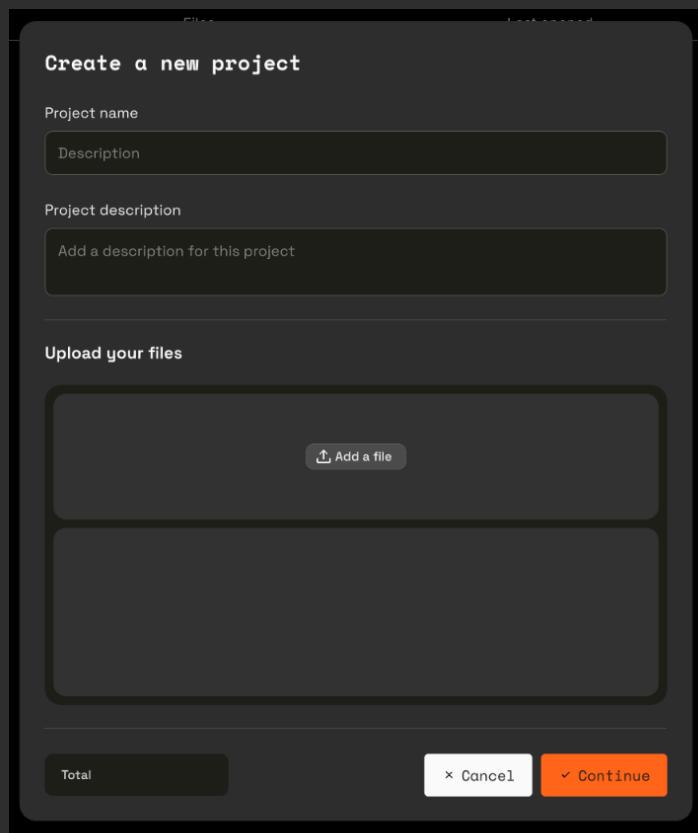
Permanently deletes the project.

## NEW PROJECT

Starts the process of creating a new project.

## 02. NEW PROJECT

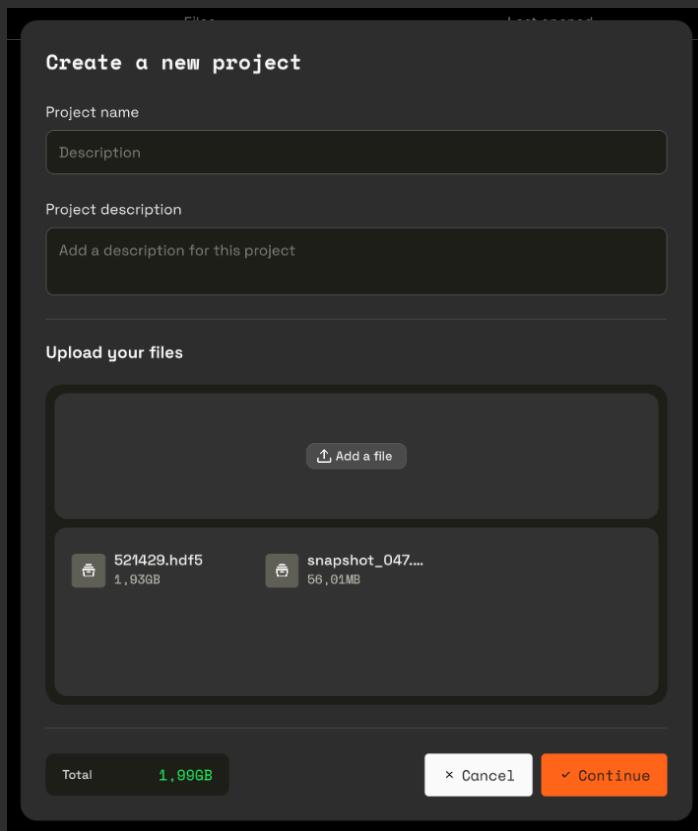
### CREATING A NEW PROJECT



Select the **New Project** option located in the top-right corner of the **Home Page**.

This action opens a window with fields for the **Project Name** and **Project Description**, as well as an area for **uploading files**.

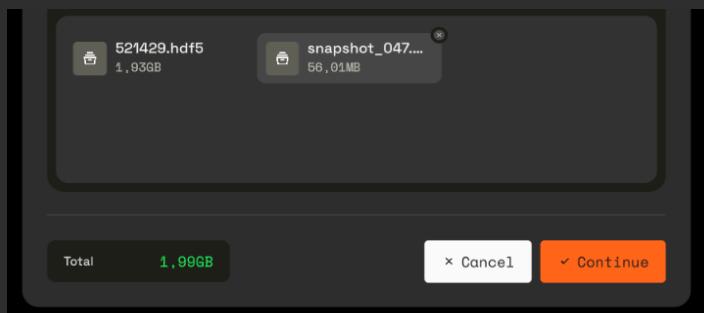
### UPLOADING FILES



Click the **Add a File** button and select the desired FITS and HDF5 files.

Once selected, the disk space occupied by the files will be shown in the bottom-left corner.

*Note* In the current version, it is recommended to upload only one file per project.



To **delete** an incorrectly uploaded **file**, hover the mouse over the file you wish to remove and click the delete icon that appears in the top-right corner of the file's name.

Click **Cancel** to abort the upload process and return to the **Home Page**.

Click **Continue** to proceed to the next screen.

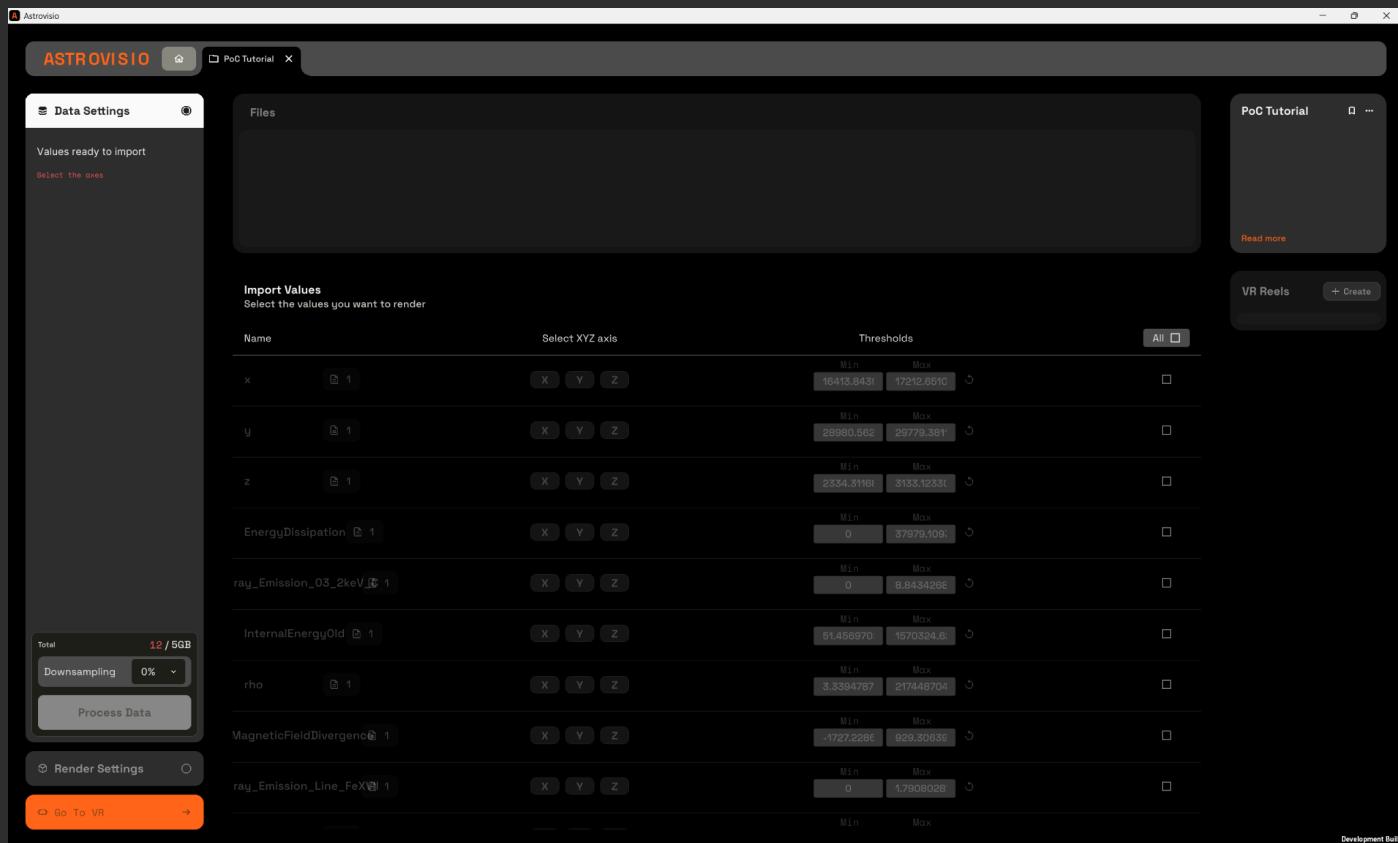
A loading spinner will appear, indicating that the Project is being processed.

Once the process is complete, the new project will be displayed as the first item in the list on the **Home Page**.

To begin the **Data Settings** phase, click on the project name.

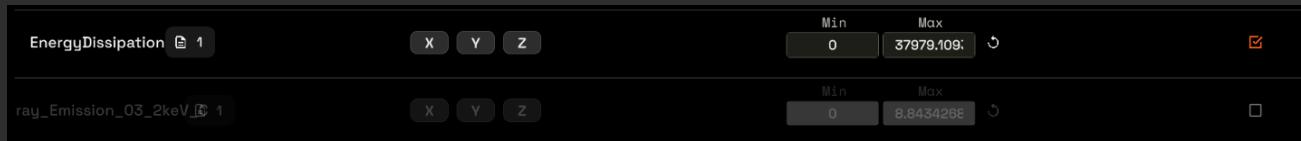
# 03. DATA SELECTION

## OPEN PROJECT / DATA SETTINGS

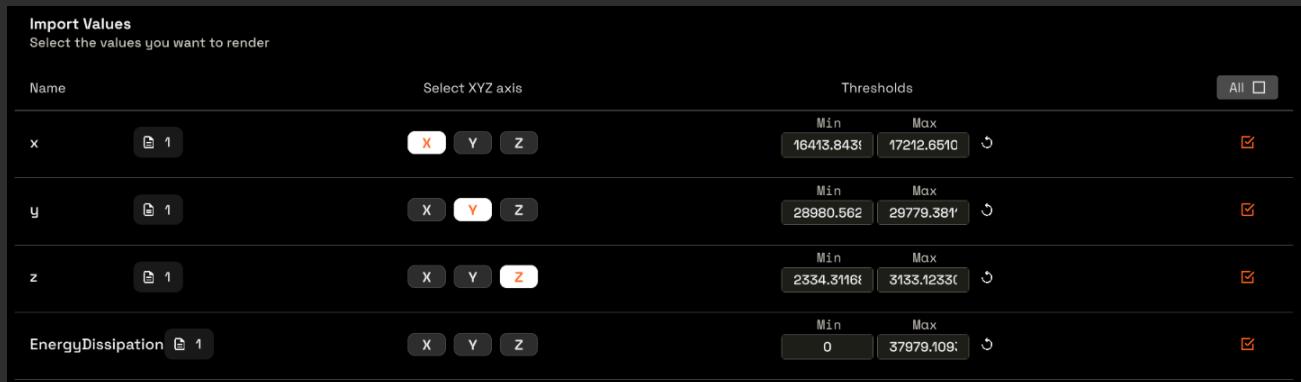


Follow these steps to configure and process your data for visualization.

1. Select Data Columns: First, you must choose the data values you want to import into the visualization. Use the selection box to highlight the desired data columns.

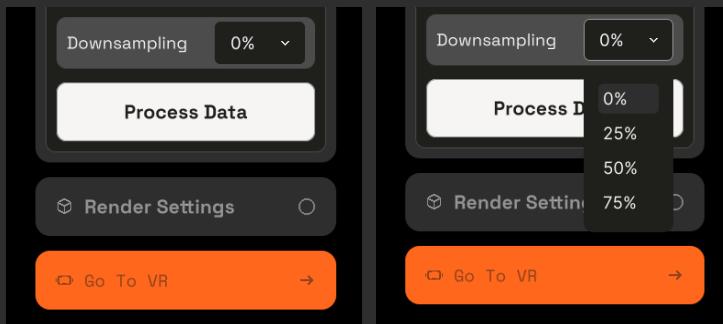


2. Set Axes: After selecting your data, you must assign which columns correspond to the X, Y, and Z axes. Use the dedicated selector for each axis to make your assignment.



3. Apply a **Threshold** (Optional): You can perform an initial filtering of the data by modifying the minimum and maximum values in the Threshold section. This is useful for refining the data range before processing.
4. Process the Data: To proceed with the 3D visualization in either desktop or VR mode, the data must be processed.

- **Downsampling:** Before processing, you have the option to downsample the selected data. This can improve performance by reducing the data's complexity. You can choose from predefined values (e.g., 0%, 25%, 50%, 75%).
- Click the **Process Data** button to finalize your selections and generate the visualization.



Once the data processing is finished, two options will become available to start the visualization:

- **Render Setting:** Select this option to interact with the real-time 3D visualization in Desktop Mode.
- **Go To VR:** Select this option to launch the application with a supported VR device.

## Compatibility and System Support

Please review the following system requirements and compatibility notes:

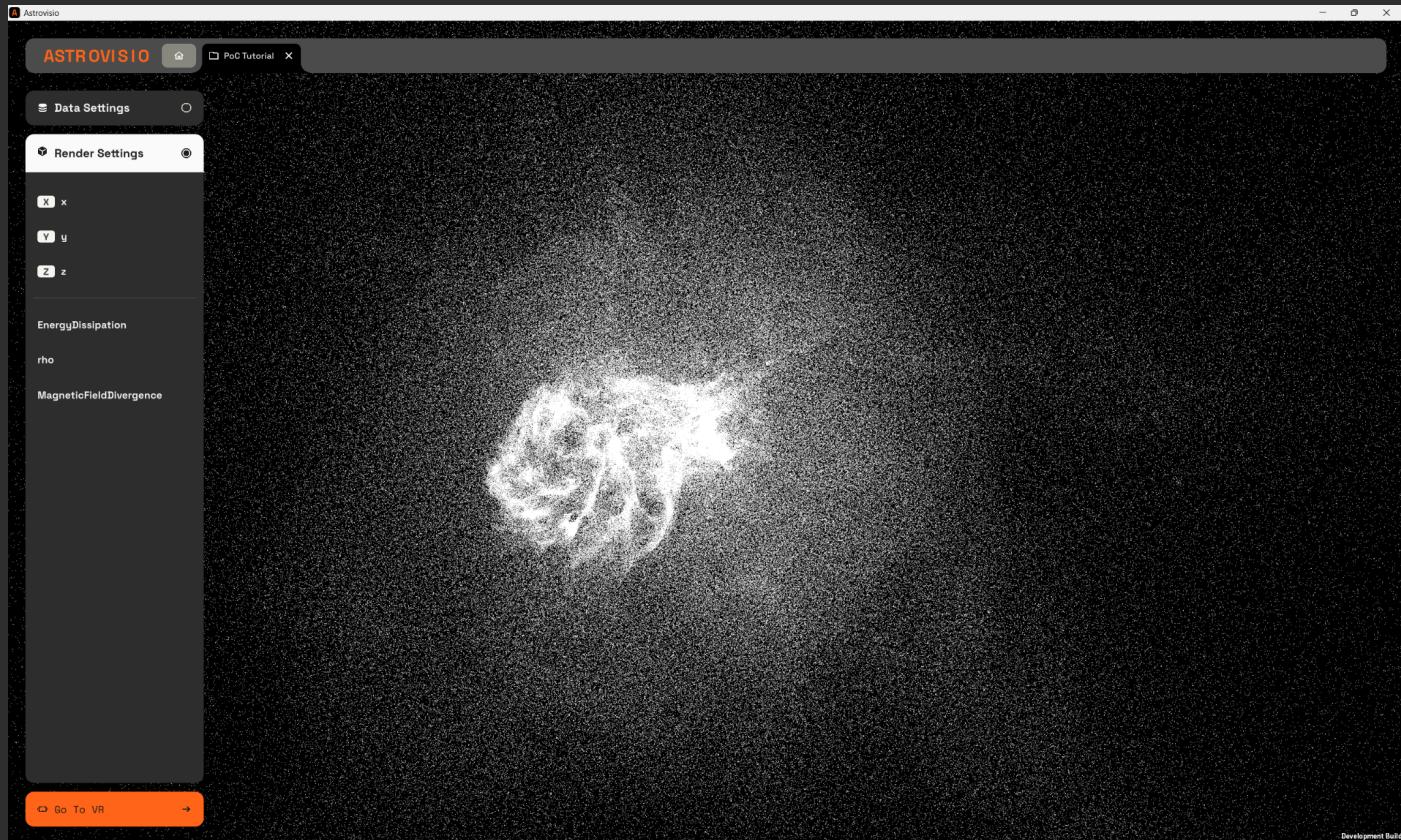
- VR Mode: The VR experience has been tested and is officially supported only on Meta Quest devices connected to a Windows operating system.
- macOS (Desktop Mode): The application can be run in Desktop mode on macOS devices with Apple Silicon (M-series) processors by using the free Whisky application. More information is available at: <https://getwhisky.app/>
- Linux (Desktop Mode): For Linux environments, compatibility for running the application in Desktop mode is managed via ProtonDB. More information is available at: <https://www.protondb.com/>

# 04. DESKTOP DATA VISUALIZATION

## RENDER SETTINGS

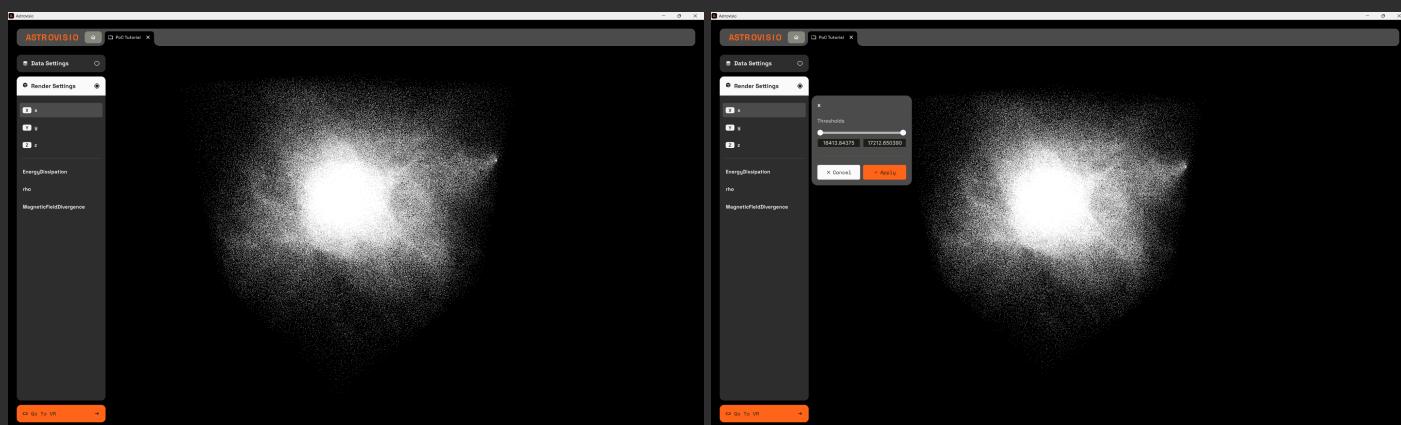
### Interacting with the 3D Visualization

- **Zoom:** Use the mouse scroll wheel to zoom in and out.
- **Rotate:** Click and drag with the left mouse button to rotate the view.
- **Pan:** Click and drag with the right mouse button to pan the view.



### Interacting with the UI

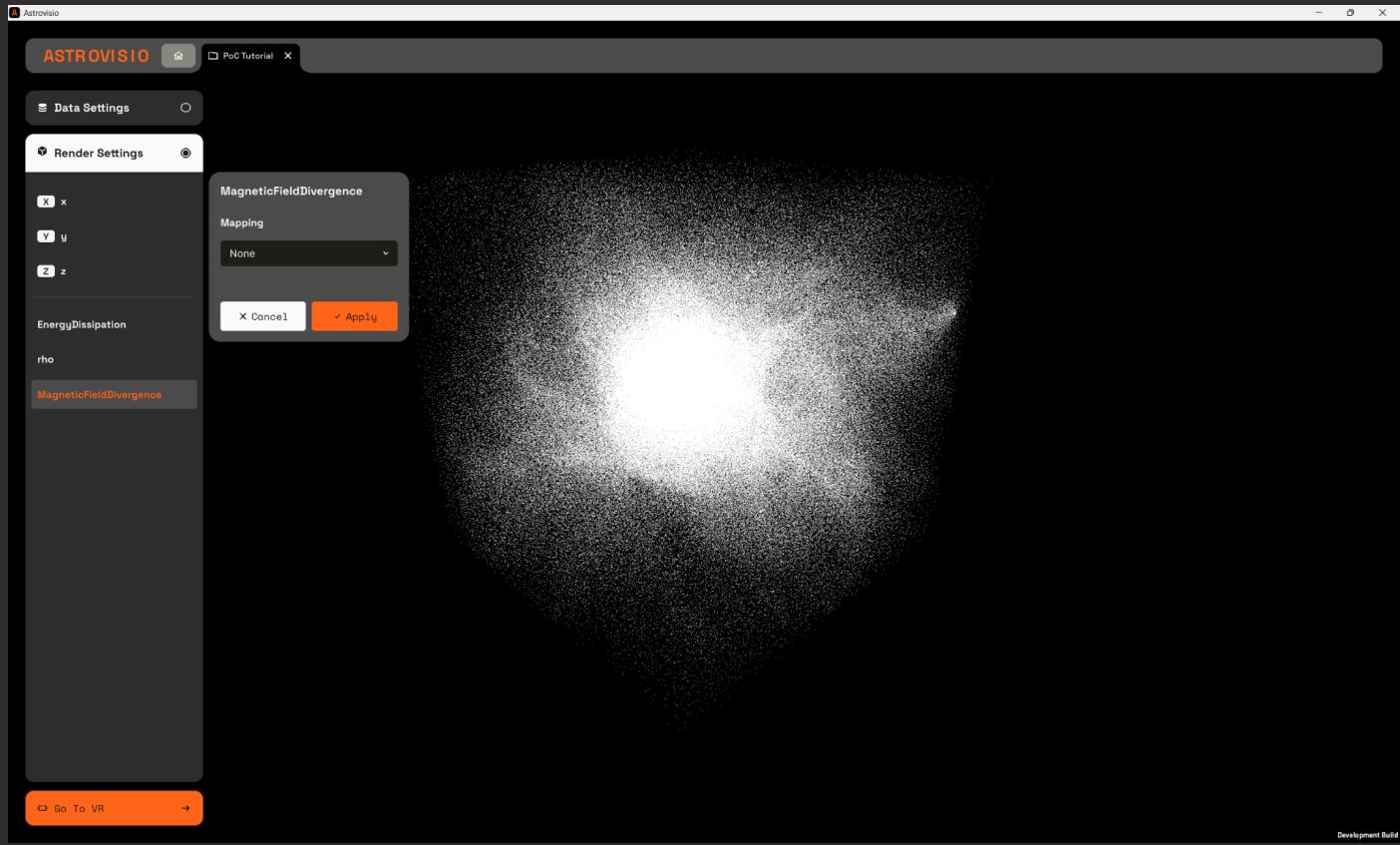
The left-hand panel displays the data you previously selected, organized into two groups: the data mapped to the X, Y, and Z axes, and all remaining data columns. Select it from the left-hand panel. When interacting with a value a contextual menu will open, showing the available options for that specific item.



For example, for the data columns assigned to the **X**, **Y**, and **Z** axes, the **only available interaction** is to adjust the **Threshold**.

For all other data columns, the contextual menu will provide three **Mapping** options: **None**, **Opacity**, **Colormap**.

**None:** No visual mapping is applied to the data. This is the default state when the visualization first initializes.



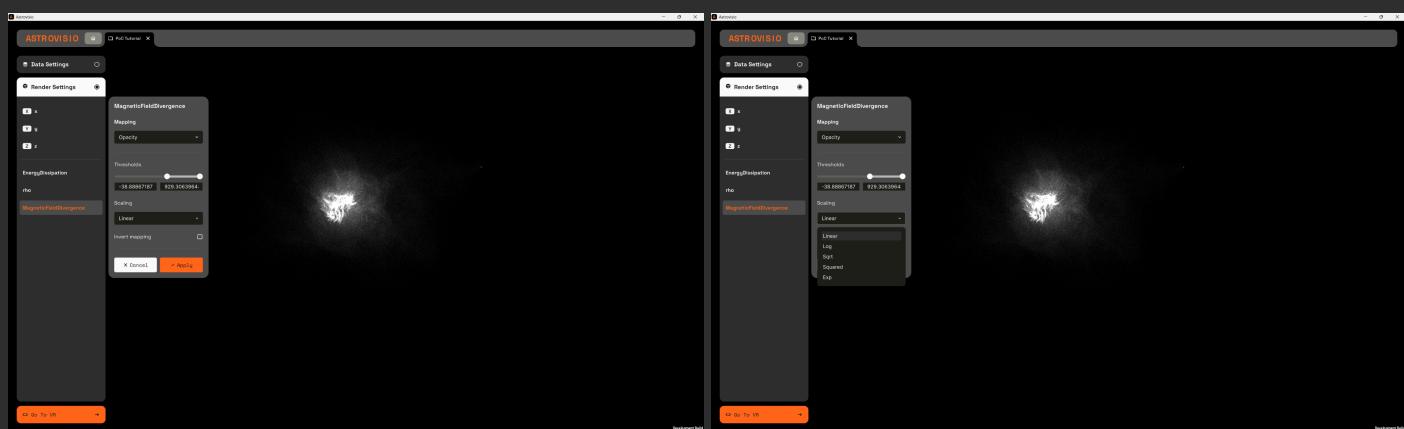
Development Build

**Opacity:** This maps the data values to an opacity level, ranging from 0% to 100%. You can define this range using the Threshold controls, either by using the sliders or by entering numerical values from your keyboard.

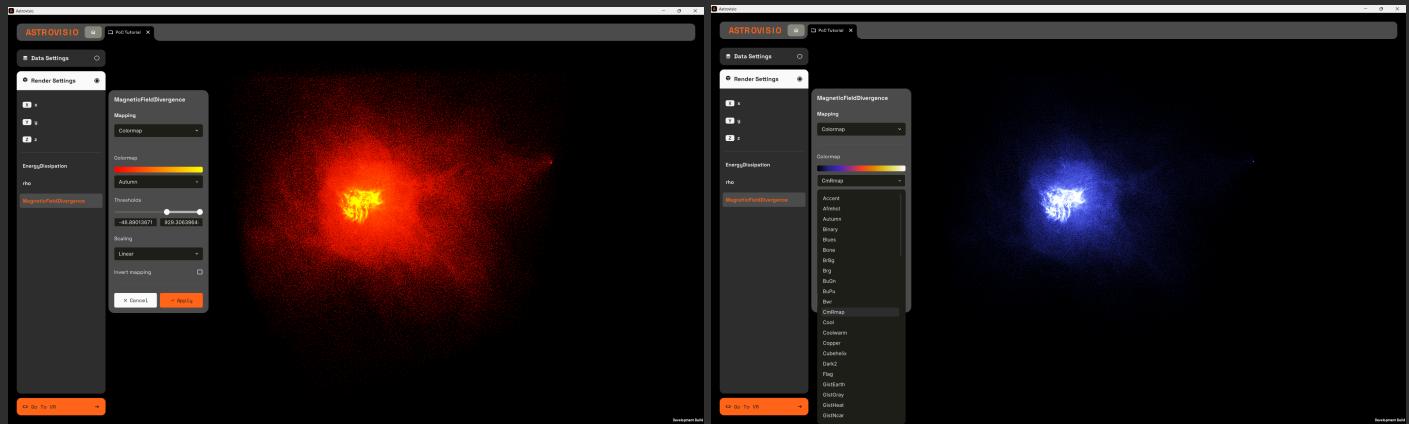
**Invert Mapping:** You can enable this option to invert the opacity mapping. For instance, low data values would be assigned high opacity, and high data values would be assigned low opacity.

**Scaling:** It's also possible to apply a scaling method to the visualized data. The available methods include:

- Linear (This is the default setting)
- Log
- Sqrt (Square Root)
- Squared
- Exp (Exponential)

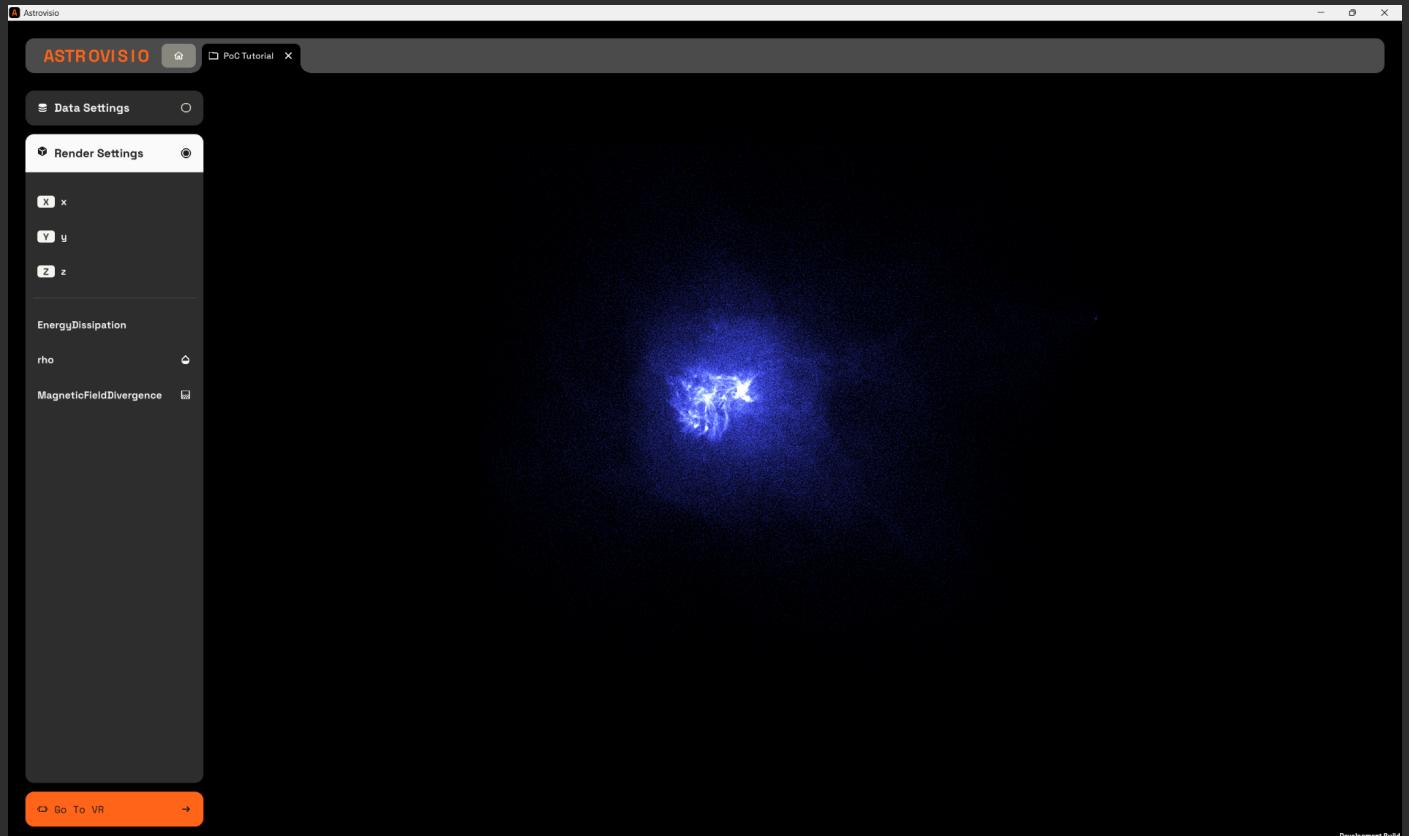


**Colormap:** This option is similar to Opacity, but differs by applying a color map (a gradient of colors) to the selected range of values. It maintains the same functionalities for adjusting Thresholds, Scaling, and Invert Mapping that were previously described. You can choose from a multitude of predefined colormaps to visualize your data.



The selected mapping will be shown as a preview. To confirm the changes and apply them to the visualization, you must click the **Apply** button.

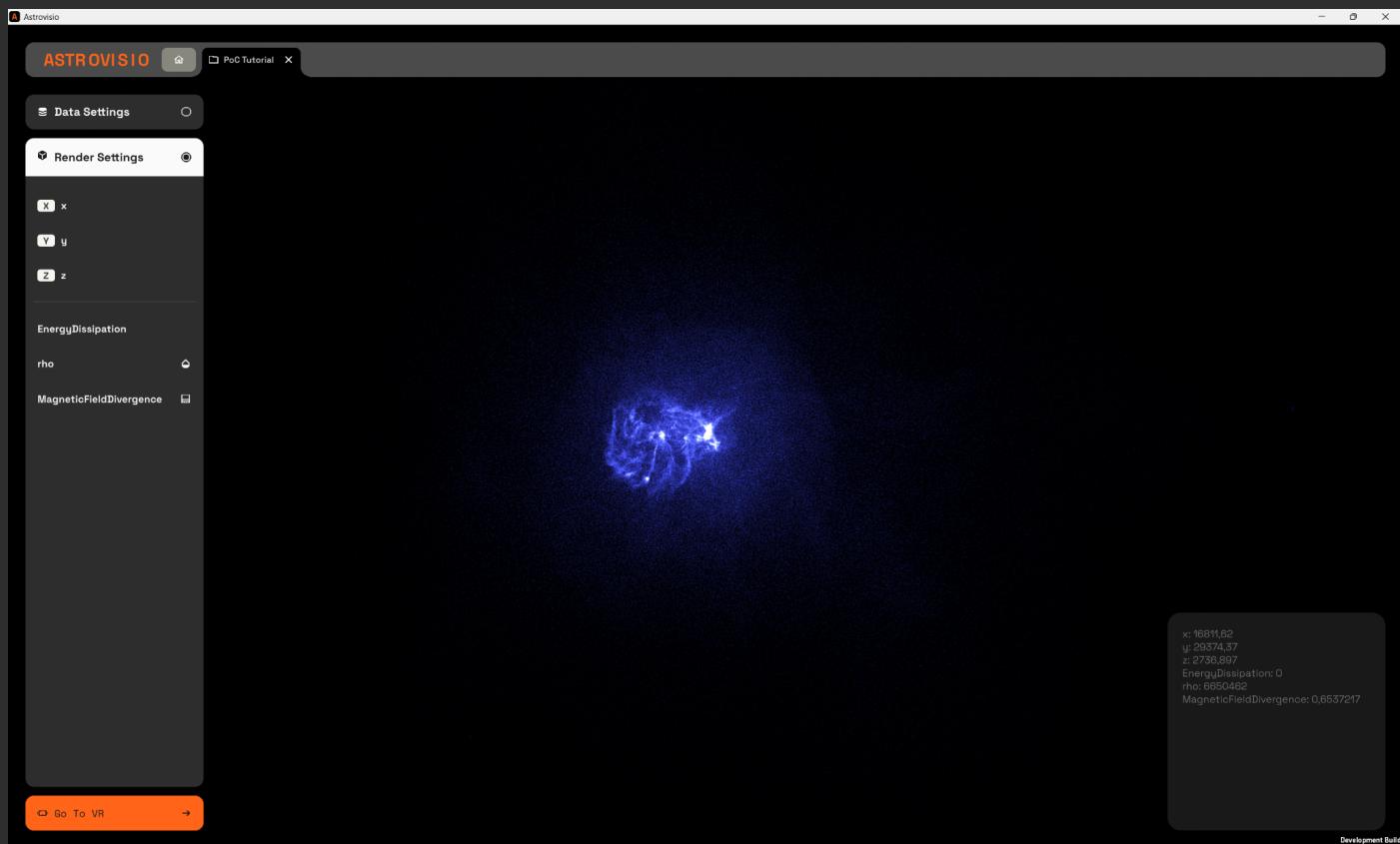
Once you apply a mapping to a data column, an icon will appear to the right of its name. This icon allows you to see at a glance which data has been mapped and which type of mapping (e.g., Opacity or Colormap) has been applied.



Please note the following rules when applying visual mappings:

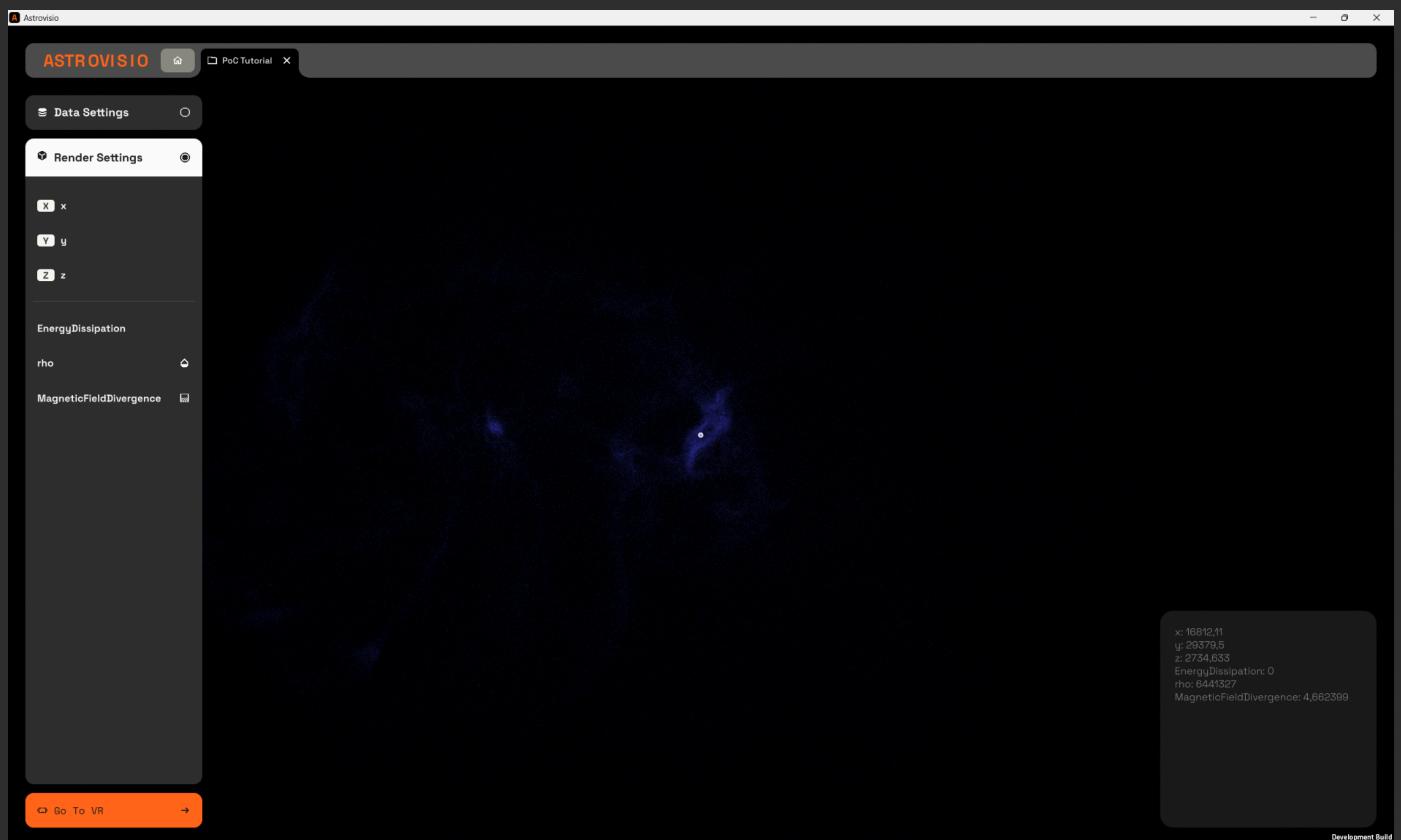
- You cannot apply the same mapping (e.g., Opacity) to more than one data column at a time.
- You cannot apply multiple mappings to a single data column.

**Inspector:** This is a toggle mode that you can activate or deactivate by pressing the '**i**' key on your keyboard. When active, it displays the specific values of a selected data point in a contextual panel.



To select a point while this mode is active, **hold down the right mouse button and pan** the view.

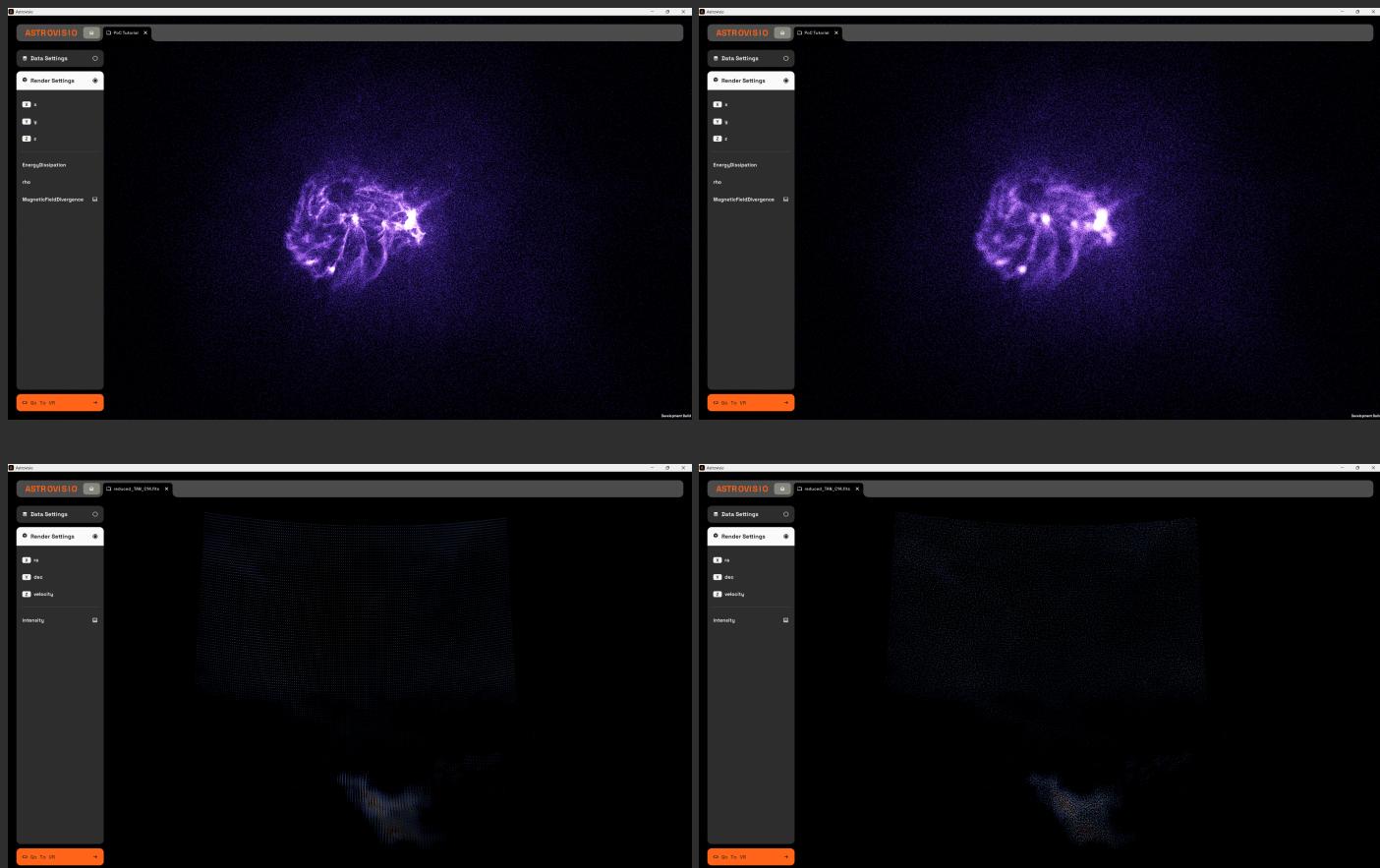
The selection sphere will magnetically snap to the nearest data point as you move.



**Noise:** This function adds a "noise" effect to the data points, which can help reduce visual artifacts in certain types of visualizations. As mentioned in the **Preface**, this feature was included for feedback purposes and does not currently have a dedicated user interface.

Similar to the Data Inspector, this function is temporarily controlled using keyboard shortcuts. The following keys adjust the noise level:

- **0:** Removes all noise (Default).
- **1:** Applies **0.5%** noise.
- **2:** Applies **1.0%** noise.
- **3:** Applies **1.5%** noise.
- **4:** Applies **2.0%** noise.
- **5:** Applies **2.5%** noise.
- **6:** Applies **3.0%** noise.



## 05. VR DATA VISUALIZATION

### LAUNCHING VR MODE: STEP-BY-STEP GUIDE

To ensure the VR visualization mode launches correctly, please verify that both the **Meta Quest desktop client** and your **headset's software** are installed and updated to the latest versions.

More information is available at: <https://www.meta.com/it-it/help/quest/1517439565442928>

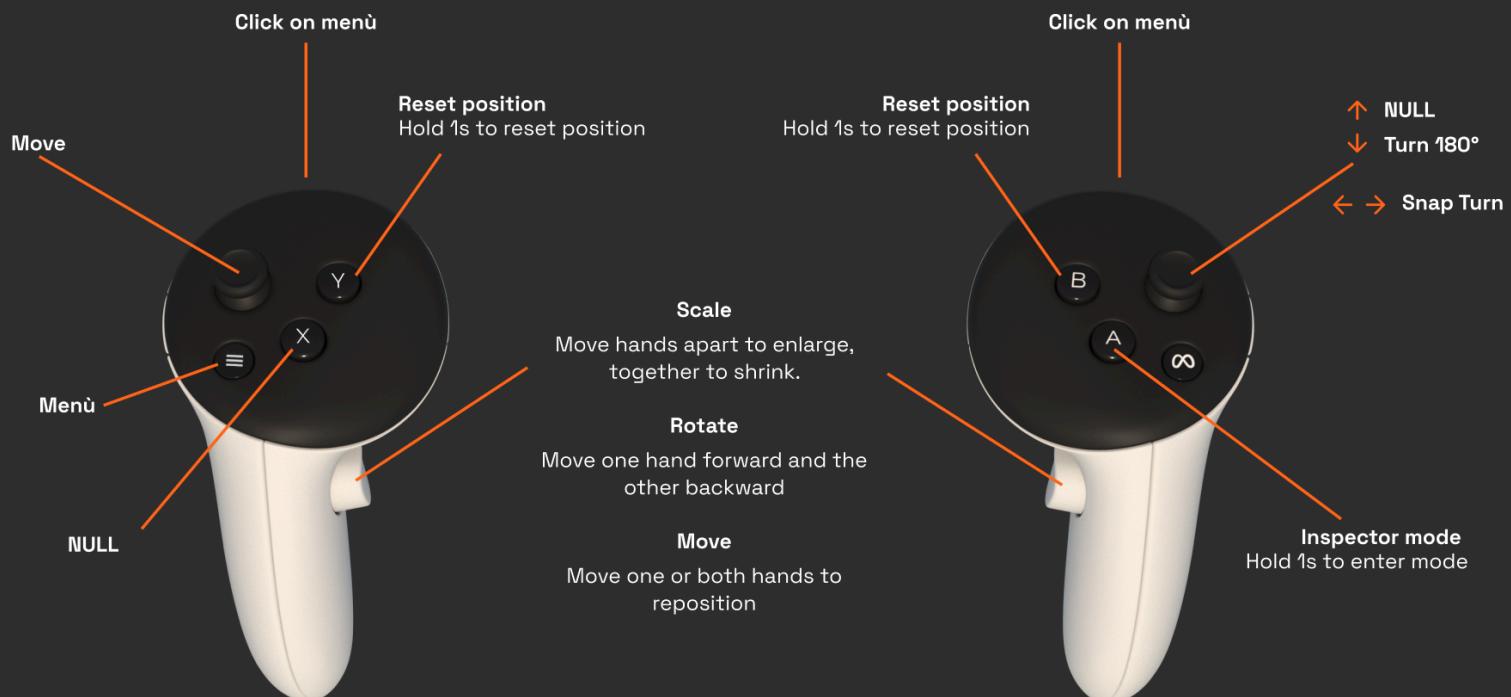
Before launching, you must establish a connection between your headset and your PC.

1. Launch the **Meta Quest desktop client** on your PC.
2. From your headset, enable either **Air Link** (wireless) or **Quest Link** (wired).

**Recommendation:** For the most stable and fluid experience, we recommend using a wired **Quest Link** connection.

3. Once the link is active, you can launch Astrovisio in VR by selecting the **Go To VR** option within the application.

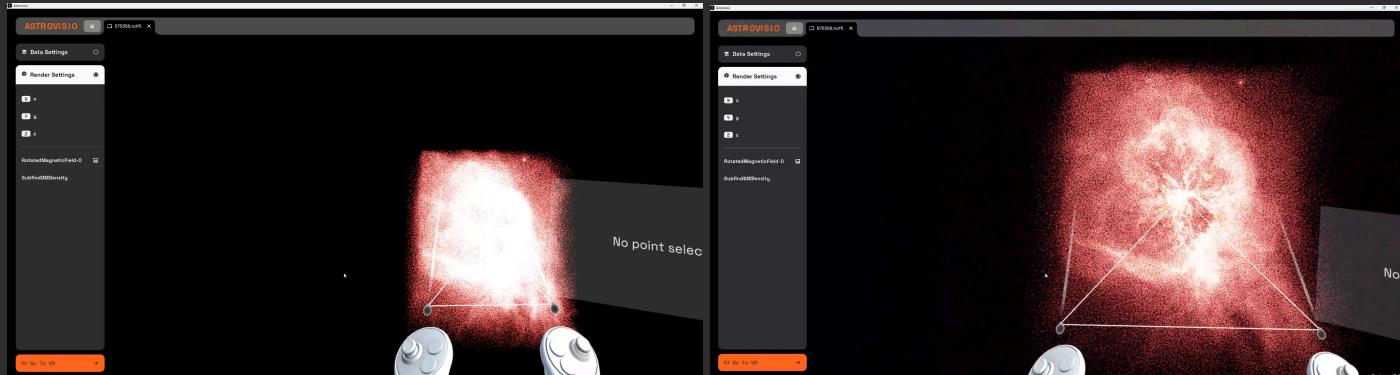
### CONTROLS



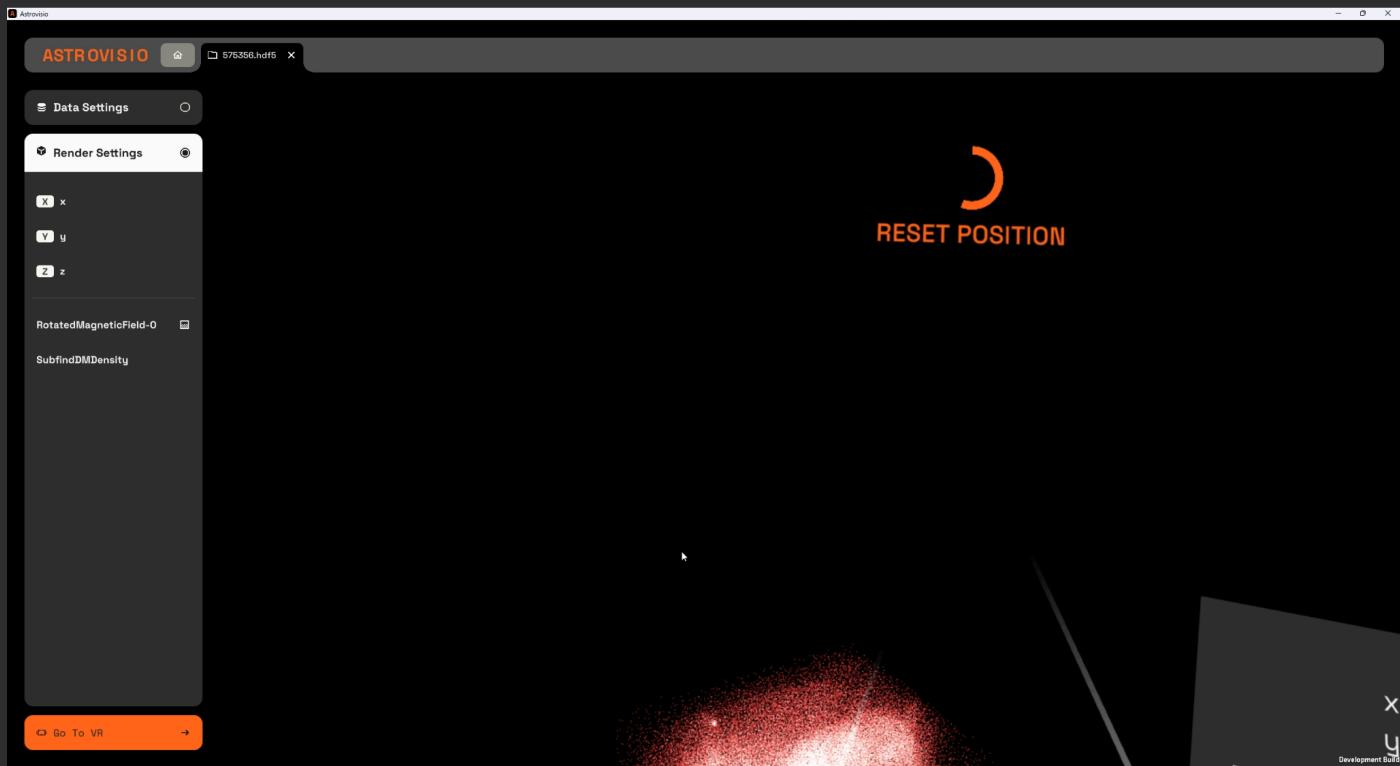
To **move** the entire visualization cube, press and hold the Grip button on either controller (the button located where your middle finger rests). While keeping the button pressed, move the controller to reposition the cube.

To **Rotate**, press and hold the Grip buttons on both controllers simultaneously. Then, move your hands as if rotating a physical object (e.g., one hand moves forward while the other moves back).

To **Scale**, press and hold the Grip buttons on both controllers simultaneously. To enlarge the view, move your hands apart. To shrink the view, bring your hands closer together.



**Reset Position:** You can restore the initial view position by pressing and holding the 'B' button on the right controller or the 'Y' button on the left controller for one second.

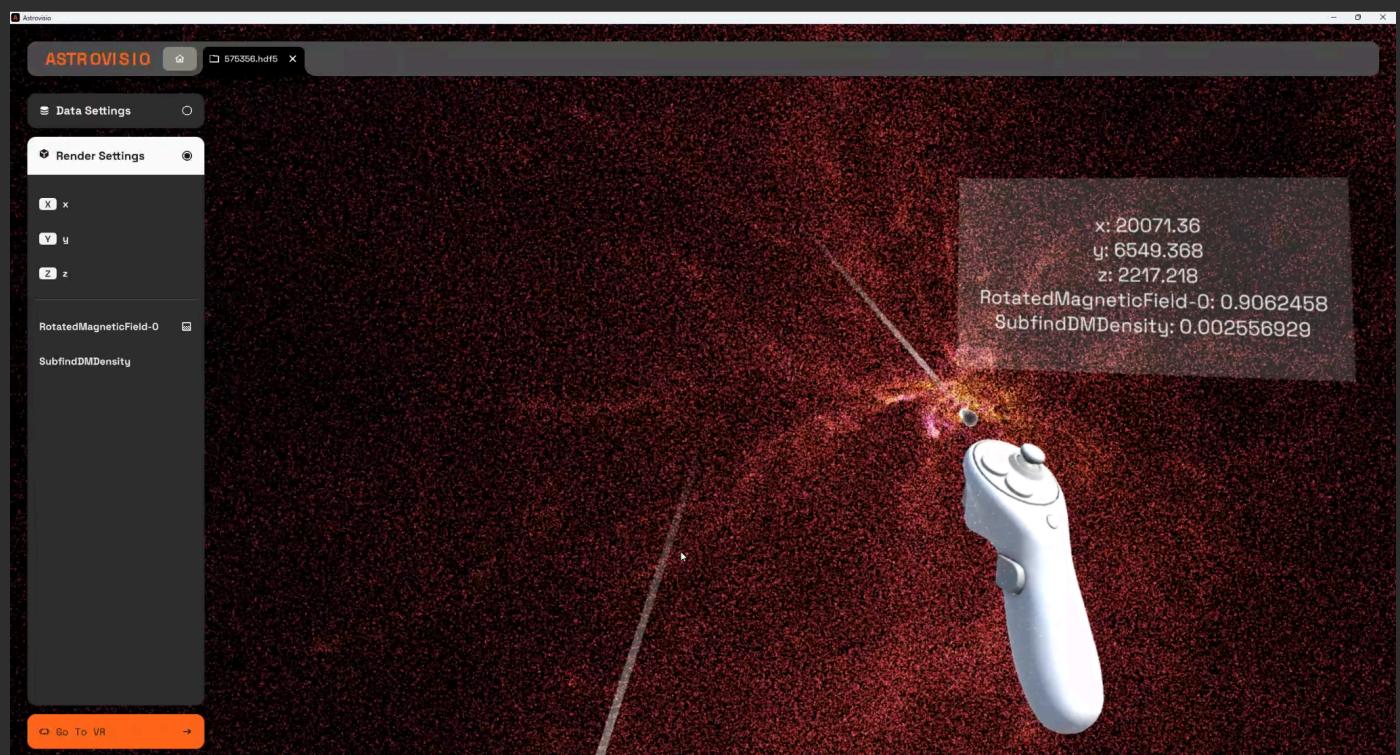


**Inspector:** the Data Inspector in VR mode functions similarly to the desktop version, but with two main differences:

1. Display: The data panel is not fixed but floats above your right controller, automatically orienting itself towards you for easy viewing.
2. Selection: The method for selecting a point of interest is more dynamic and precise, allowing you to aim the controller spatially.

To **activate** and use the Inspector:

1. Press and hold the 'A' button on the right controller. This will activate the selection mode.
2. While keeping the button held down, move the controller to aim the selection sphere at the desired data point.
3. Release the 'A' button to lock the selection area in place. The data panel will then display the information for that point.

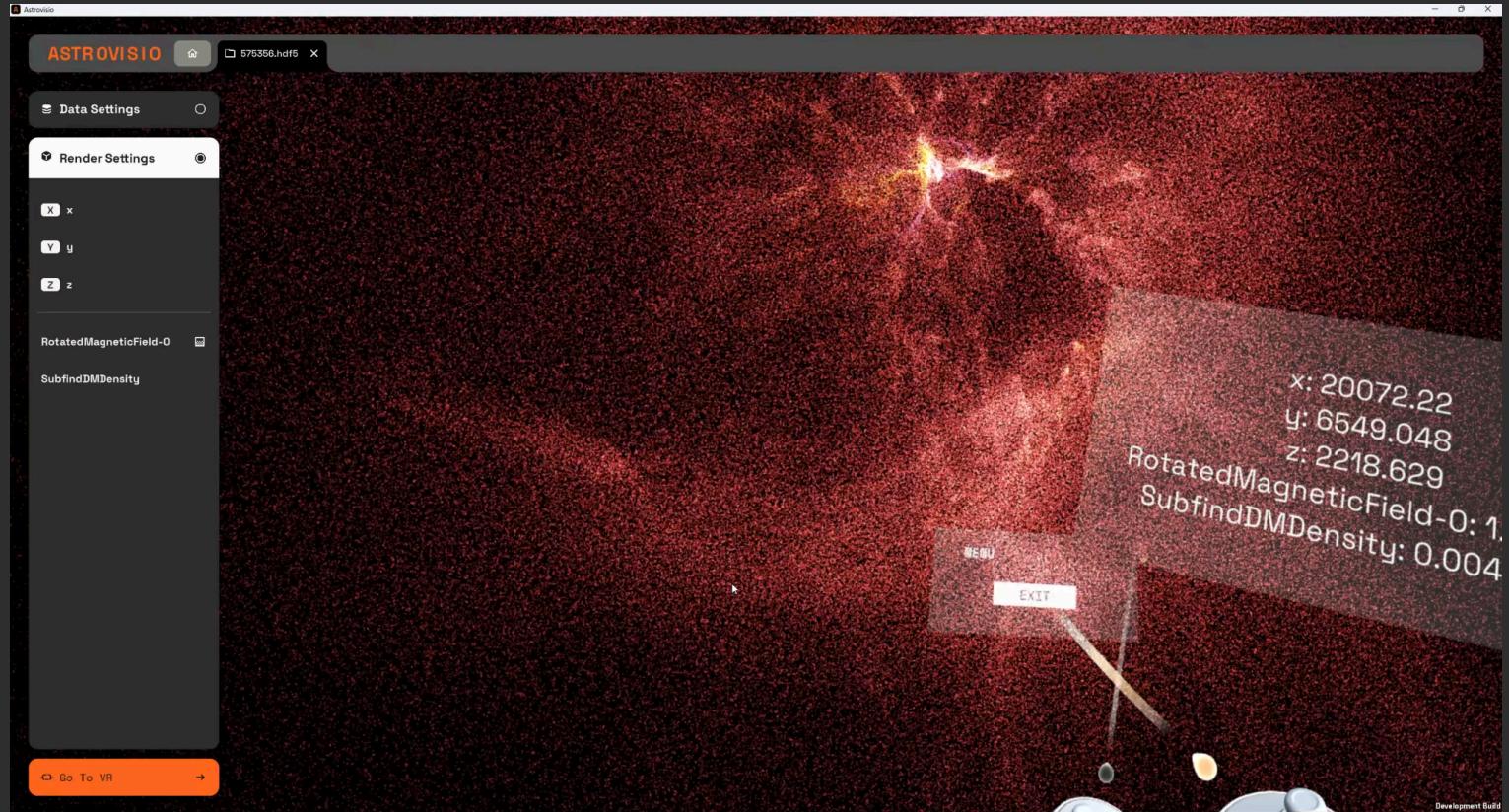


To **Exit VR Mode**:

Press the **Menu button** on your left controller. A panel will appear above it.

Using your right controller, **aim the pointer beam at the Exit button** on the panel.

**Pull the trigger on your right controller** (the button under your index finger) to confirm the selection and exit the VR session.



Enjoy Astrovisio!