

HESAI

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PandarView 2

Point Cloud
Visualization Software
User Manual

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■ About this manual

Please make sure to read through this user manual before your first use and follow the instructions herein when you operate the product. Failure to comply with the instructions may result in product damage, property loss, personal injuries, and/or a breach of warranty.

Access to this manual

To obtain the latest version, please do one of the following:

- Visit the Download page of Hesai's official website: <https://www.hesaitech.com/downloads/>
- Contact your sales representative of Hesai.
- Contact Hesai technical support at service@hesaitech.com.

Technical support

If your question is not addressed in this user manual, please contact us at:

- service@hesaitech.com
- <https://www.hesaitech.com/technical-support/>
- <https://github.com/HesaiTechnology>

Legends and format



Warnings: Instructions that must be followed to ensure safe and proper use of the product.



Notes: Additional information that may be helpful.

Names of data fields are in monospace font.

For example: **Distance** represents the Distance field.

1. Introduction

PandarView 2 is a second-generation software that displays and records point cloud data from Hesai lidars, available in:

- 64-bit Windows 10/11
- Ubuntu 20.04/22.04/24.04

Current software version: **2.1.7**

Supported product models:

Pandar	OT	QT	XT	AT	FT
Pandar40	OT128	PandarQT	PandarXT	AT128E2X	FT120
Pandar40P		QT128C2X	PandarXT-16	AT128P	
Pandar64			XT32M2X	ATX	
Pandar128E3X					

1.1. Installation

1. Download the installation package from <https://www.hesaitech.com/en/download>
2. Install PandarView 2.



In Ubuntu, run PandarView.sh in a file path that only contains ASCII characters.

3. Turn off the computer's firewall for public networks, or add PandarView 2 to firewall exceptions.

1.2. User interface

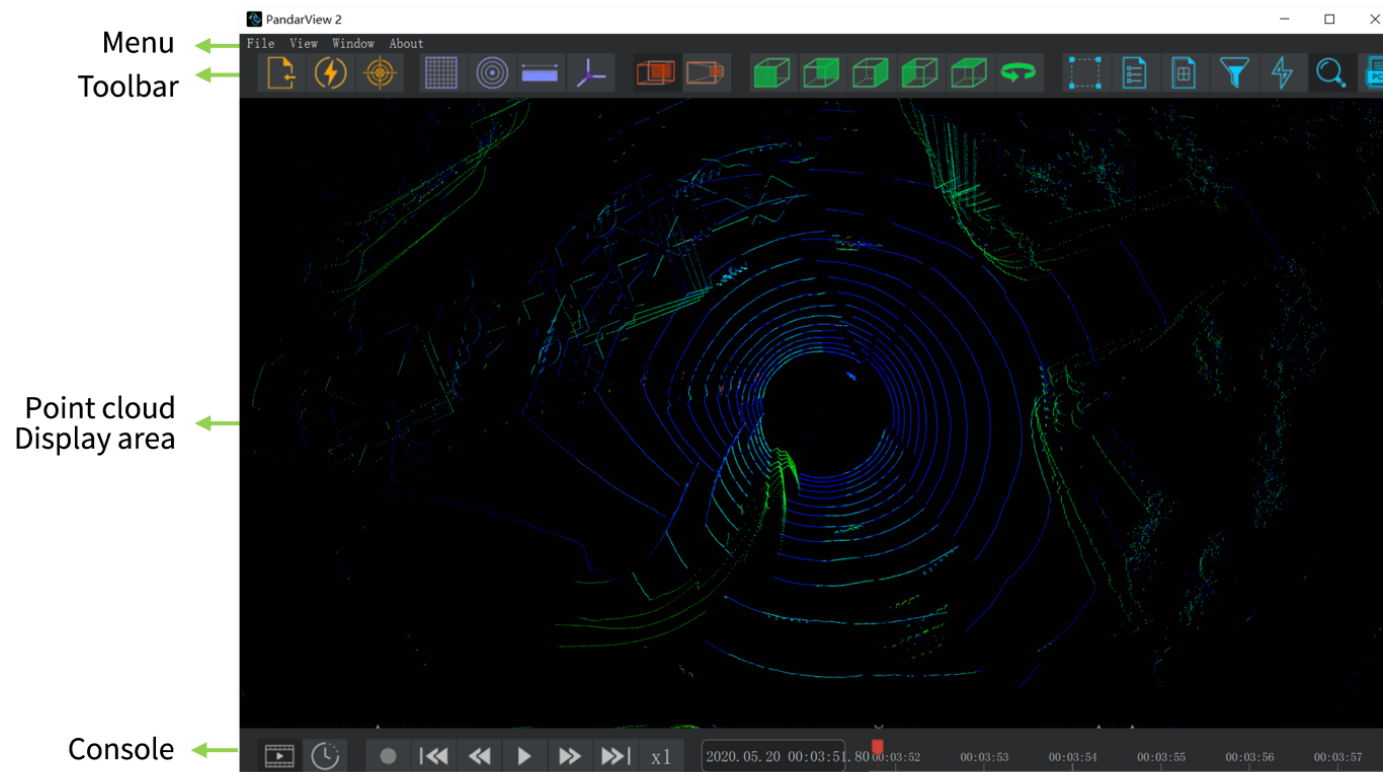


Figure 1. User interface



- User interface can be different for each product model.
- Click [**About**] in the menu bar to find the software version.

2. View live point cloud

2.1. Cybersecurity settings

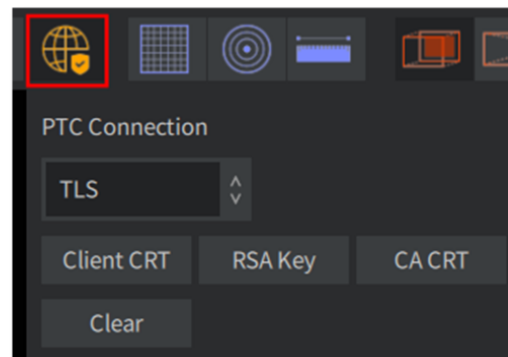
For the product models supporting Cybersecurity, [**Cybersecurity**]  will appear in the toolbar.

Users may select one of the three modes:

TLS mode

In TLS Mode, PandarView 2 obtains the lidar unit's correction files using PTCS (PTC over TLS) commands.

Security page of web control	Turn ON the Cyber Security Master Switch.
	Select TLS for PTC Connection.
PandarView 2	Select TLS for PTC Connection.
	Click the [CA CRT] button and specify the file path of Hesai's CA certificate chain (Hesai_Ca_Chain.crt).



mTLS mode

In mTLS Mode, PandarView 2 obtains the lidar unit's correction files using PTC commands.

Security page of web control	Turn ON the Cyber Security Master Switch.
	Select mTLS for PTC Connection; upload user CA certificate chain.
PandarView 2	Select mTLS for PTC Connection.
	Click the [CA CRT] button; specify the file path of Hesai CA certificate chain (Hesai_Ca_Chain.crt).
	Click the [Client CRT] button; specify the file path of user end-entity certificate.
	Click the [RSA Key] button; specify the file path of the user private key (corresponding to user end-entity certificate).



Click [**Clear**] button to remove the specified file paths for CA CRT, Client CRT, and RSA Key.

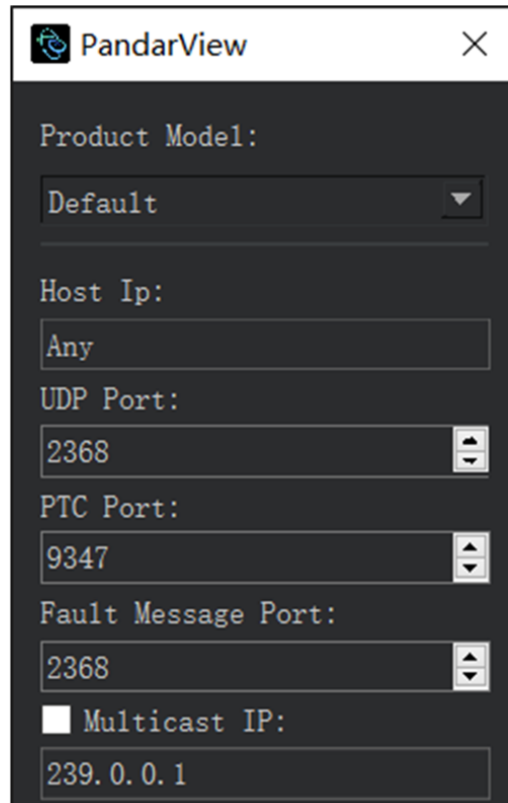
When Cybersecurity is OFF

PandarView 2 obtains the lidar unit's correction files using PTC commands.

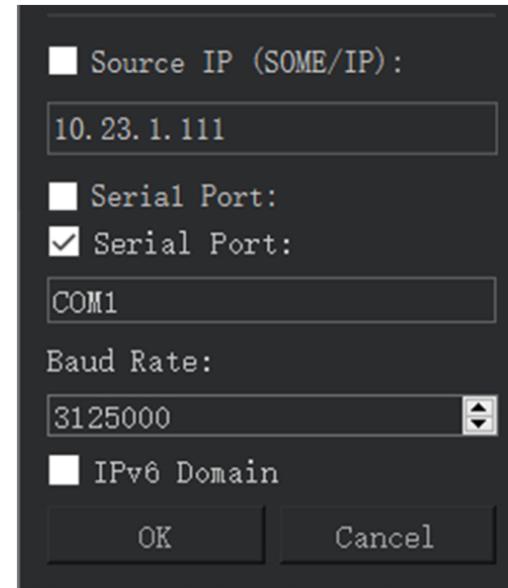
Security page of web control	Turn OFF the Cyber Security Master Switch.
PandarView 2	Select Non-TLS for PTC Connection.

2.2. Network settings

1. Perform *Network settings on the host computer* in the lidar's User Manual.
2. Click [**Listen for Data**]  in the toolbar, and input these parameters:

A screenshot of the PandarView application window. The title bar says 'PandarView' with a close button. The settings are as follows:

- Product Model: Default (dropdown)
- Host Ip: Any (text field)
- UDP Port: 2368 (spin box)
- PTC Port: 9347 (spin box)
- Fault Message Port: 2368 (spin box)
- Multicast IP: 239.0.0.1 (text field)

A screenshot of a secondary settings dialog. The settings are as follows:

- Source IP (SOME/IP): 10.23.1.111 (text field)
- Serial Port: COM1 (text field)
- Baud Rate: 3125000 (spin box)
- IPv6 Domain: (checkbox, unchecked)
- Buttons: OK, Cancel

Product Model	Default
Host IP	Any
UDP Port	The lidar's destination port for point cloud transmission

PTC Port (optional)	To use PTC API.  PTC API is used to obtain the lidar's angle correction file and state information.
Fault Message Port (optional)	To obtain fault information .
Multicast IP (optional)	In multicast communication: 1. Check this checkbox. 2. Input the lidar's destination IP (between 224.0.0.0 and 239.255.255.255).
Source IP (SOME/IP) (optional)	IP address under SOME/IP protocol Only available to certain models.
Serial Port (optional)	Serial port for transmitting point cloud data Only available to certain models. Common format of serial port number:  • In Windows: COM[number] • In Ubuntu: /dev/ttyUSB[number] (Replace [number] with the actual number.)
Baud Rate (optional)	Baud rate for serial communication. Only available to certain models.
IPv6 Domain (optional)	Only available to certain models.

1. Click [**OK**] and start viewing live point cloud data.

3. Record a point cloud file

1. Click [**Record**]  in the console.
2. Specify a file directory.
3. Click [**Save**] to start recording a PCAP file.



When naming PCAP files in Ubuntu, include the filename extension (.pcap).

4. Play back a point cloud file

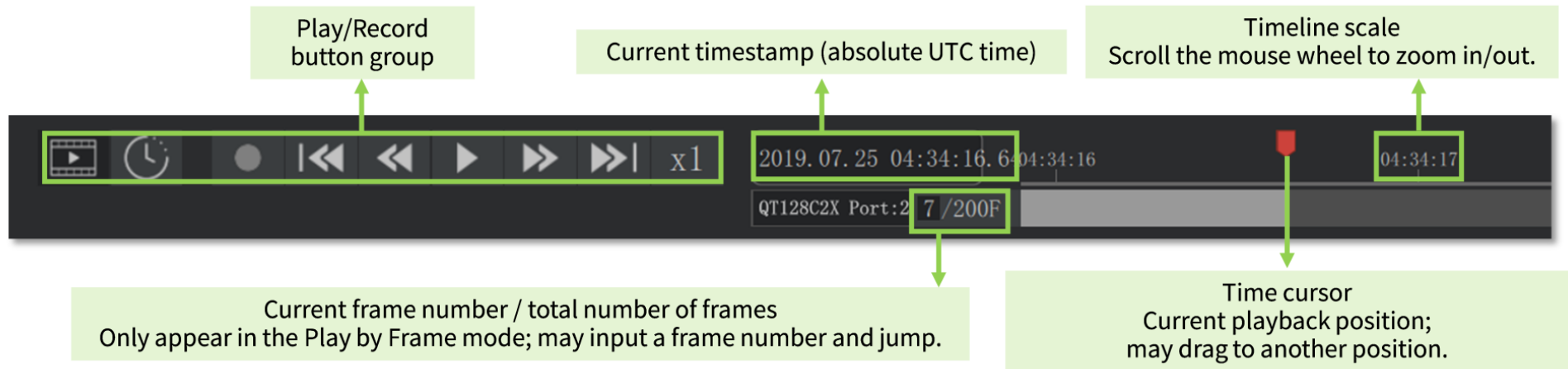
4.1. Load a PCAP file

Method 1	Method 2
Click [Open File]  in the toolbar and select a PCAP file.	Drag a PCAP file into PandarView 2.



- Only tcpdump PCAP format is supported.
- Only one file at a time.
During playback, if you open another PCAP file or switch to receiving live point cloud, the previous file will be unloaded.
- Large PCAP files may take a while to load.
To stream point cloud data while loading the file, click [**Live Streaming**] .

4.2. Play control



Button	Description	Button	Description
	Play by frame (default).		Play by time.
	Jump to the beginning		Jump to the end of the file.
	Adjust the rewinding speed (1x, 1/2x, 1/4x, 1/8x, ..., 1/64x).		Adjust the forwarding speed (1x, 2x, 4x, 8x, ..., 64x).
	After loading a file, click to play.		While playing a file, click to pause.

Button	Description
	Display the current speed.
	- When loading a file, click to play at once.  When file loading is complete, the button will disappear. - When receiving live data, click to stream with minimum latency.

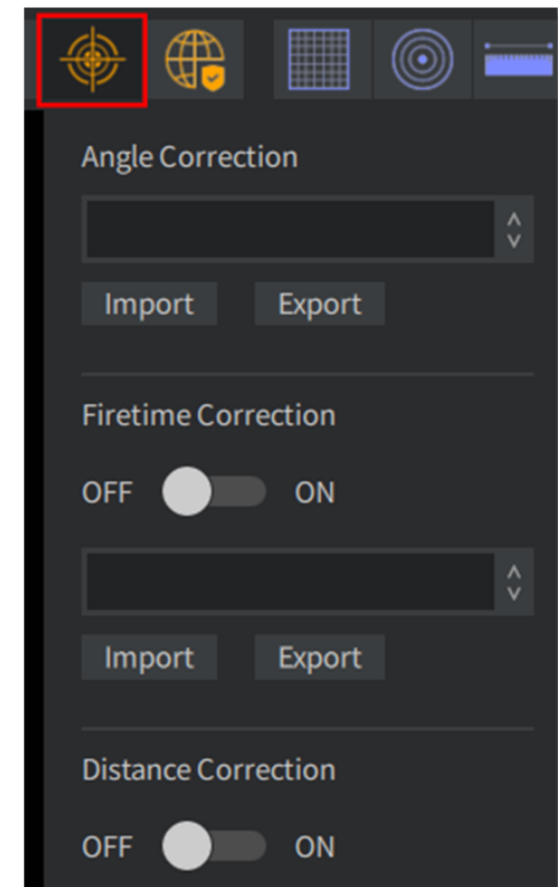
5. Correction and configuration

When viewing live point cloud or playing back recorded point cloud, correction files and configuration files may be used.

5.1. Point cloud correction

[**Correction**]  in the toolbar provides these types of correction:

Correction type	Purpose	Note
Angle correction	To correct the azimuth and elevation of each data point	Refer to the <i>Channel Distribution</i> Section in the lidar's user manual.
Firetime correction	To correct the azimuth and absolute time of each data point	Available only to certain product models.
Distance correction	To correct the distance of each data point	Available only to certain product models.



Angle correction

When viewing live data	During playback
The correction file of this lidar unit will be loaded. Correction takes effect automatically.	- The general correction file for this product model will be loaded. Correction takes effect automatically. - For the best display, click [Import] and upload the correction file of this lidar unit.

Firetime correction

Product model	When viewing live data	During playback
QT128C2X	The correction file of this lidar unit will be loaded. To begin correction, switch to [ON].	The general correction file for this product model will be loaded. To begin correction, switch to [ON].
Others	- For the best display, click [Import] and upload the correction file of this lidar unit. - If the lidar unit's correction file is not available locally, select a general correction file for this product model in the drop-down menu. To begin correction, switch to [ON].	

Distance correction

Switch to [**ON**] to begin correction.

5.2. Channel config

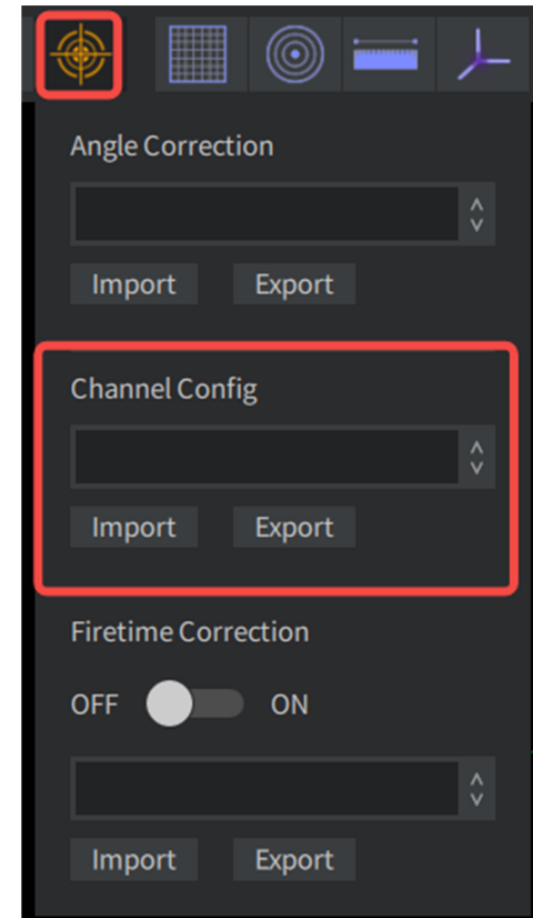
A channel config file selects a subset from all the available channels. Only the point cloud from the selected channels will be generated.



- Only available to QT128C2X.
- The channel config file also defines the number of blocks in a Point Cloud Data Packet, and specifies the channels to be stored in each block.

Channel config

When viewing live data	During playback
The channel config file of this lidar unit will be loaded. Channel config takes effect automatically.	Click [Import] and upload the channel config file of this lidar unit. Channel config takes effect automatically.



5.3. File import and export

5.3.1. Import

The imported files in [Section 5.1](#) and [Section 5.2](#) will be added to the bottom of the drop-down menu.



- The imported files can be deleted from the following path: **Documents\PandarViewDataFiles\csv**
- Deletion takes effect after restarting PandarView 2.

5.3.2. Export

To export the correction or configuration file of this lidar unit:

1. When viewing live point cloud, click [**Correction**]  in the toolbar.
2. Keep the drop-down menu empty.
3. Click the [**Export**] button.

To export the correction or configuration file for this product model:

1. When viewing live point cloud or during playback, click [**Correction**]  in the toolbar.
2. Select the product model in the drop-down menu.
3. Click the [**Export**] button.



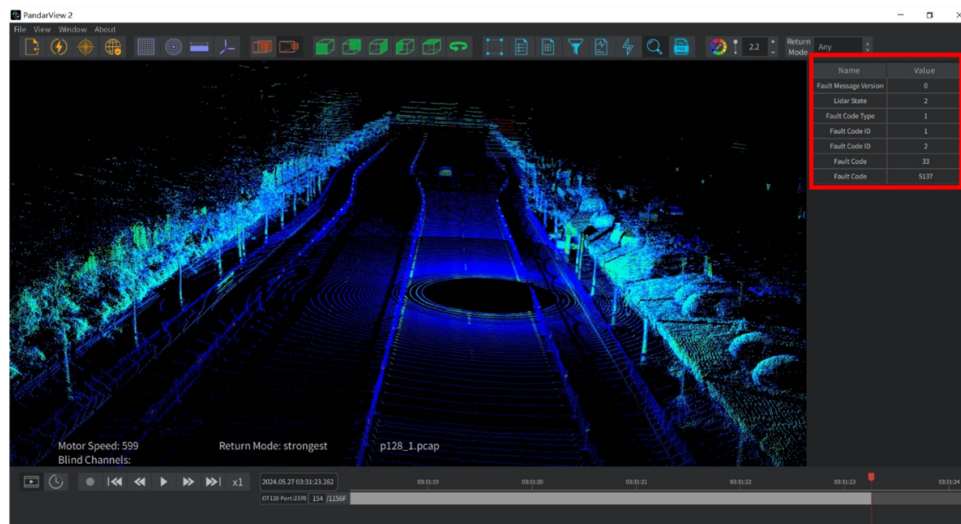
When naming correction or configuration files in Ubuntu, make sure to include the filename extension (.dat or .csv).

6. Other features

6.1. Fault info

To display the fault info of this point cloud frame:

When viewing live data	During playback
1. Make sure to input the fault message port number in Section 2.2 Network settings. 2. Press Ctrl + Alt + F.	Press Ctrl + Alt + F.



Name	Value
Fault Message Version	0
Lidar State	2
Fault Code Type	1
Fault Code ID	1
Fault Code ID	2
Fault Code	33
Fault Code	5137



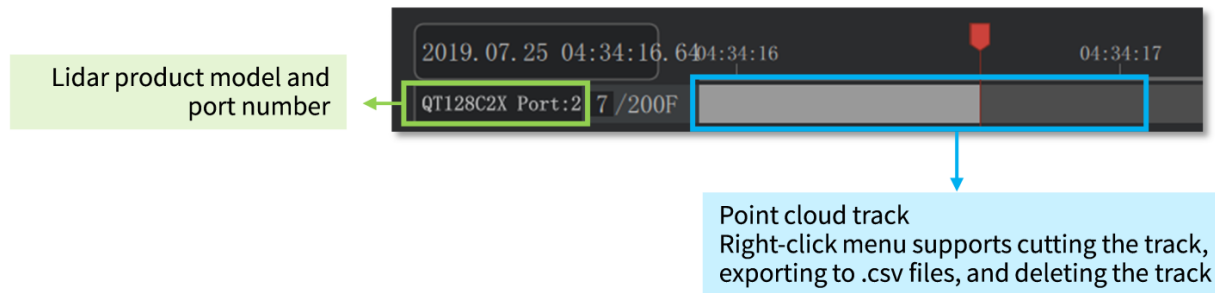
- Only available to standard models. May be different for customized models.
- Each frame corresponds to multiple Point Cloud Data Packets. A fault code ID or a fault code that appears in multiple packets is only displayed once.
- Fault messages are described in the Safety Manual. For more information, please contact Hesai technical support.

6.2. Mouse shortcuts

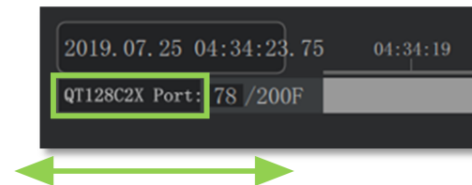
Left-button drag	Rotate the point cloud
Right-button drag	Zoom in/out: Drag left to zoom out, and drag right to zoom in.
Scroll the wheel	Zoom in/out: Scroll down to zoom out, and scroll up to zoom in.
Press the wheel and drag	Pan the view.
Shift & left-button drag	Spin the point cloud around the viewing direction (the direction from the viewpoint to the origin of coordinates).
Shift & right-button drag	Pan the view.

6.3. Point cloud track

After loading a PCAP file (see [Section 4.1](#)), a point cloud track will appear in the console:



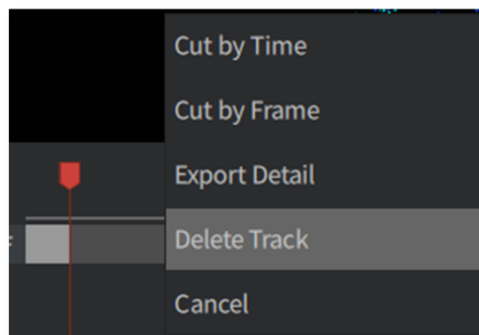
If the product model and port number are not displayed in full, scroll the mouse wheel.



Right-click on the point cloud track to open a menu:

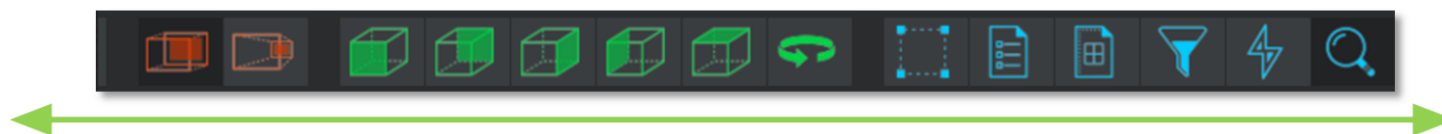
Cut by Time	Specify the starting and end timestamps, cut the current track, and save it to a new PCAP file.
Cut by Frame	Specify the starting and end frames, cut the current track, and save it to a new PCAP file.
Export Detail	Specify the starting and end frames, and export the point cloud data to CSV files (one frame per file). - By default, all points will be exported; to export only the specific points, click [Select] in the toolbar to select points (see Section 6.4.5 Point selection and data table). - When naming files in Ubuntu, make sure to include the filename extension (.csv).
Delete Track	Delete the current track.

Cancel	Close the menu.
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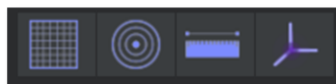


6.4. Toolbar

If the toolbar cannot be displayed in full, scroll the mouse wheel to view all the buttons.



6.4.1. Coordinate grids, coordinate system, and distance measurement



Button name	Function
Cartesian	Show/Hide the grid. To set the color and spacing, refer to Section 6.4.7 Coordinate grid settings and points coloring .
Polar	Show/Hide the equidistant circles. To set the color and spacing, refer to Section 6.4.7 Coordinate grid settings and points coloring .
Ruler	Left-button drag to measure the distance between two points.
Coordinates	Show the rectangular coordinate system.

6.4.2. Projection modes



Button name	Description
Orthographic Projection	Object size does not change with distance; parallel lines remain parallel.
Perspective Projection	Objects appear smaller as they recede into the distance, giving a sense of depth and spatial awareness.

6.4.3. Point of view and spinning



Button name	Function
Front/Back/Left/Right/Top	-
Spin	Spin the viewing direction (the direction from the viewpoint to the origin of coordinates) around the Z-axis.

6.4.4. Channel selection



Click [**Channels**]  to view or change the currently displayed channels.

Display or hide channels

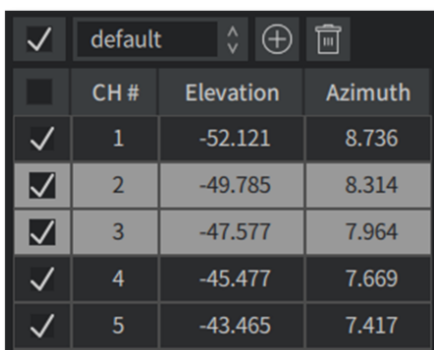
- Check/Uncheck the boxes on the left of each channel to display/hide its point cloud data.
- By default, all channels are displayed.

Select and toggle channels

- Click on a channel (excluding the area of its checkbox) to select this channel.
- Press down Shift while clicking to select multiple neighboring channels.
- Press down Ctrl while clicking to select multiple separate channels.
- Click [**Toggle Selected Channels**]  in the top-left corner to toggle the status of the selected channels (checked/unchecked).

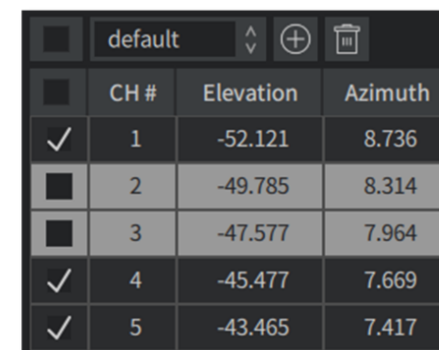
Save channel groups

- Click  to save the checked channels as a configuration and name it.
- Previously saved configurations exist after restarting PandarView 2; they can be selected in the  drop-down menu.
- To delete the currently selected configuration, click .



☒	CH #	Elevation	Azimuth
☒	1	-52.121	8.736
☒	2	-49.785	8.314
☒	3	-47.577	7.964
☒	4	-45.477	7.669
☒	5	-43.465	7.417

Figure 2. Before toggling channels



☐	CH #	Elevation	Azimuth
☒	1	-52.121	8.736
☐	2	-49.785	8.314
☐	3	-47.577	7.964
☒	4	-45.477	7.669
☒	5	-43.465	7.417

Figure 3. After toggling channels

6.4.5. Point selection and data table



- Click [**Select**]  and drag the mouse to highlight an area of points.
- Click [**Spread Sheet**]  to view the data of the highlighted points, as shown below.

Points: 112										
Ch^	AziCorr(deg)	Dist(m)	Rfl	Azi(deg)	Ele(deg)	t(us)	x(m)	y(m)	z(m)	field
12	236.10	23.012	0	190.330	10.40	110980	-18.786	-12.624	4.154	0
12	236.00	23.044	1	190.280	10.40	110938	-18.790	-12.674	4.160	0
12	235.90	23.056	3	190.230	10.40	110897	-18.778	-12.714	4.162	0
12	235.80	22.992	4	190.180	10.40	110855	-18.704	-12.711	4.150	0
12	236.40	22.052	4	190.480	10.40	111105	-18.066	-12.003	3.981	0
12	236.30	22.016	1	190.430	10.40	111064	-18.015	-12.015	3.974	0

The name of each column also acts as a button. When double-clicking a column name multiple times, the following actions are performed (one action for each double-click):

- Auto-adjust the column width.

Column width can also be manually adjusted:



1. Place the mouse cursor between two column names (so that the cursor becomes a left-right arrow).
2. Drag the mouse.

- Sort the table in the ascending order of this column. An up arrow  will appear on the right.
- Sort the table in the descending order of this column. A down arrow  will appear on the right.
- Cancel the sort.

The button group on the top-left corner:



Select All	Click to display all points. Click again to display only the selected points.
Export Points Info	Export the current data table to a CSV file.  When naming files in Ubuntu, make sure to include the filename extension (.csv).
Save Column Order	Save the current order of columns.  • This setting remains effective after restarting PandarView 2. • To change the column order, drag the column names.

The column names in the data table are defined below:

Ch	Channel number
AziCorr	Azimuth corrected by the angle correction file
Dist	Distance
Rfl	Reflectivity  Same as the Intensity field in PandarView 1.
Azi	Current reference azimuth
Ele	Elevation
t	Timestamp

Field	For the product models in the AT family: the Mirror Surface on which this measurement is made.  Fields 1/2/3 correspond to Mirror Surfaces 0/1/2, respectively.
AziState	Azimuth State Used for calculating the firing time offset of each channel; only available to certain lidar models.
Confidence	Confidence level

6.4.6. Points filtering

Click [**Points Filter**]  and set the allowed range of each parameter. Only the eligible data points will be displayed.

 **Points Filter** ×

Azimuth (deg) Range

Min. − + Max. − +

Elevation (deg) Range

Min. − + Max. − +

Polar Distance (m) Range

Min. − + Max. − +

X (m) Range

Min. − + Max. − +

Y (m) Range

Min. − + Max. − +

Z (m) Range

Min. − + Max. − +

Intensity Range

Min. − + Max. − +

Confidence Range

Min. − + Max. − +

Weight Factor Range

Min. − + Max. − +

For example, discrete noise points (e.g., rain, fog, dust, or exhaust fumes) can be filtered out by setting the range of Weight Factor.

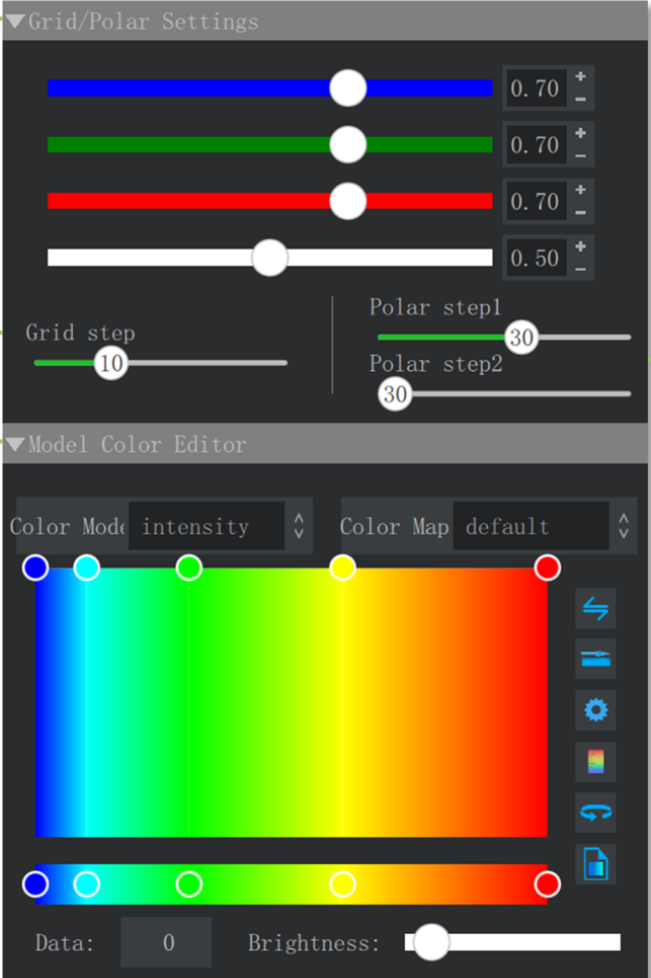


- For each product model, the available parameters may different; Weight Factor is only available to OT128.
- The higher the Weight Factor, the more likely this point is a discrete noise point.

6.4.7. Coordinate grid settings and points coloring

Click [**Color Map**]  to perform these settings:

- Set the color and unit distance of coordinate grids.
- Change the colormap of data points.



The screenshot displays the 'Grid/Polar Settings' and 'Model Color Editor' panels. The 'Grid/Polar Settings' panel includes four color-coded sliders (blue, green, red, white) with values 0.70, 0.70, 0.70, and 0.50 respectively. Below these are sliders for 'Grid step' (10) and 'Polar step1' (30). The 'Model Color Editor' panel shows a color map with a gradient from blue to red, a 'Data' value of 0, and a 'Brightness' slider. Annotations with arrows point to specific settings: 'Coordinate grids settings' points to the top of the 'Grid/Polar Settings' panel; 'Unit distance of grid coordinate system' points to the 'Grid step' slider; 'Data points color settings' points to the 'Model Color Editor' panel; 'Polar step 1: Unit distance of the inner 12 circles in the polar coordinate system' points to the 'Polar step1' slider; and 'Polar step 2: Unit distance of the outer 10 circles in the polar coordinate system' points to the 'Polar step2' slider.

Coordinate grids settings

Unit distance of grid coordinate system

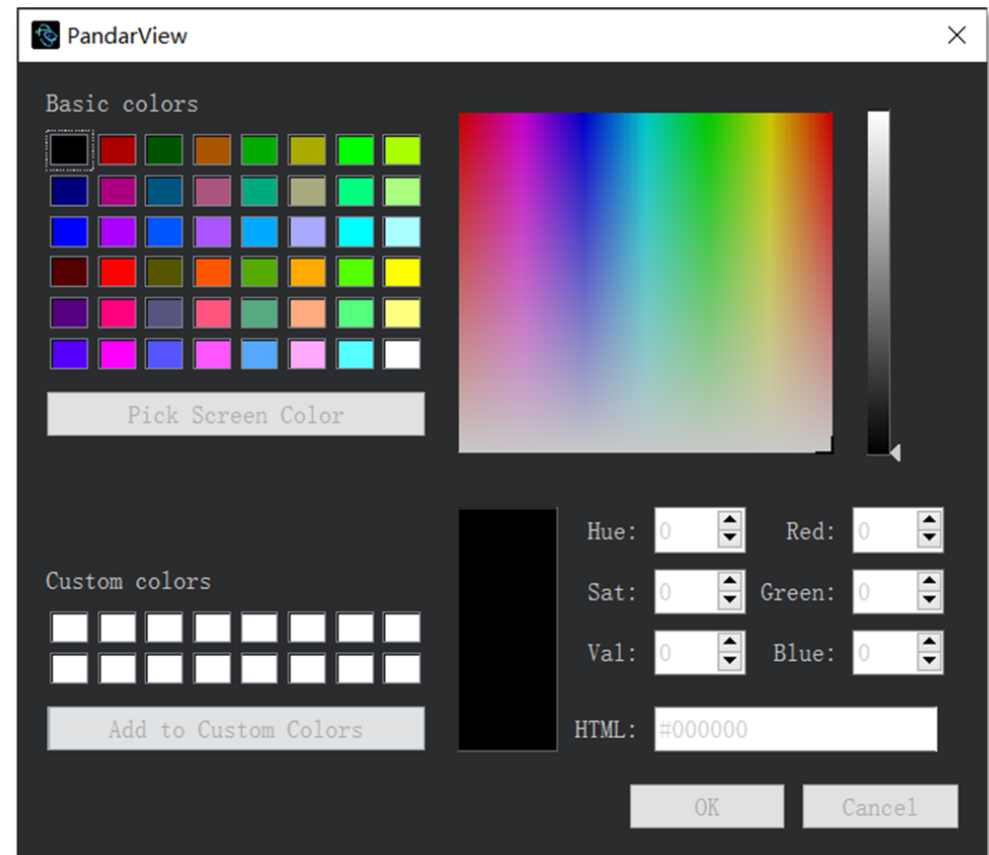
Data points color settings

Polar step 1: Unit distance of the inner 12 circles in the polar coordinate system

Polar step 2: Unit distance of the outer 10 circles in the polar coordinate system

For example, discrete noise points (e.g., rain, fog, dust, or exhaust fumes) can be colored differently when using Weight Factor as the color mode.

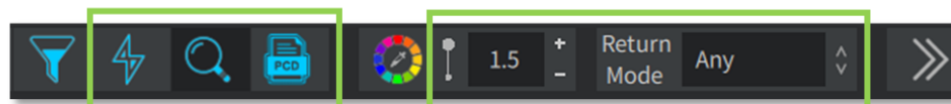
1. Select [**Weight Factor**] in [**Color Mode**].
2. Click [**Set Data Range**]  and set a range for Weight Factor.
 - The data points whose Weight Factor fall within the specified range are colored according to the mapping from Weight Factor to the colormap.
 - The data points with Weight Factor below Min or above Max default to blue or red, respectively. To customize these two colors, tick [**Reset color out of range**], click [**Below range color**] and [**Above range color**], and select colors.





- For each product model, the [**Color Mode**] options may different; Weight Factor is only available to OT128.
- The higher the Weight Factor, the more likely this point is a discrete noise point.

6.4.8. Other display controls

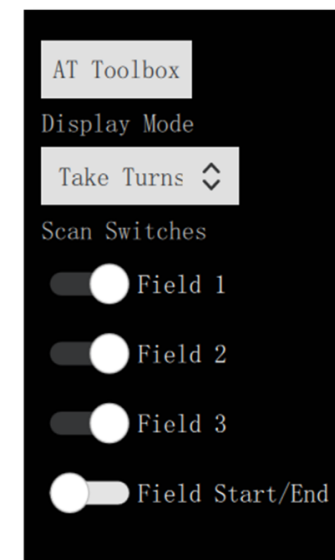


Button name	Function
Laser Tracing	Show the laser beams of this lidar unit.
State Info	Display status information at the bottom-left corner of the point cloud display area, such as return mode and PCAP filename. • To show state information, make sure to input the PTC port number in Section 2.2 Network settings. • The available state information can be different for each product model.
Dump PCD	Dump the current frame into a .pcd (Point Cloud Data) file and specify the file location.
Point Size	Set the display size of data points.
Return Mode	Select the returns to be displayed.

6.4.9. AT family toolbox

Only available to the product models in the AT family.

Display Mode	• Take Turns (default): The measurements from Mirror Surfaces 0/1/2 are output to Frames 0/1/2, respectively. The frames are not stitched. • Combination: The measurements from Mirror Surfaces 0/1/2 are output to one frame. That is, three frames are stitched as one. • Tradition: The measurements from Mirror Surfaces 0/1/2 are output to one frame according to their encoder angles in Point Cloud Data Packets. No angle correction is performed.
Scan Switches	Display/Hide the measurements from each mirror surface. Fields 1/2/3 correspond to Mirror Surfaces 0/1/2, respectively.
Field Start/End	Specify the start/end encoder angles of each Mirror Surface.



Appendix A: Legal notice

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