RobotSLAM Engine Software User Manual



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2024.07

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1.Getting to Know RobotSLAM Engine

RobotSLAM Engine is a comprehensive handheld LiDAR data application software with robust point cloud processing capabilities, which can handle up to 300 GB of point cloud data and offers features like Point Cloud viewing, Point Cloud Rendering, Point Cloud Clipping, Point Cloud Measurements, Format Conversion, Point Cloud Statistics, Accuracy Assessment, Coordinate Transformation, Point Cloud Segmentation, Manual Point Cloud Classification, Earthwork Calculations and so on. Additionally, it supports importing and preprocessing data from the RobotSLAM series of handheld LiDAR Scanners, including image registration, trajectory optimization, global adjustment, point cloud colorization, and SLAM projects merge and point cloud export, etc.

Computer	Minimum	Recommended		
Operating system	Windows10/Windows11 64-bit			
Graphics card	GTX-3060/RX6600M or above (NVIDIA series recommended)			
CPU	Intel i7-11800H/AMD R7- 5800H or above	Intel i7-12700H/AMD R7-6800H or above		
Internal Memory 16GB or above		32GB or above		
SSD	1TB or above	2T or above		

1.1 Computer Configuration

1.2 Software Installation

Before start, please note the followings:

1, it is better to install the software in the Disk D not in the system Disk(if the

client computer has two or more disks available;

2, it is a must to create the installation path without SPACE or SPECIAL CHARACTERS, better only with English letters or numbers;

The postprocessing software is **RobotSLAM Engine**, it is necessary to install both the **Engine** and **Server** at the same time as follows:



1st, double click" RobotSLAM_Server.exe" to install it;

2nd, double click" RobotSLAM **Engine**.exe" to install it, select "English(US) or English(UK)"; click "下一步(Next)"; set the installation path;



1.3 apply a software license

1. Please copy the machine code to apply a license file:

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	2 Exporter_cmt	10				
	3 Importer_dtp					
	4 Exporter_dtp					
	5 Importer_dxf					
	6 Exporter dxf	10				

2.click "BROWSE" to import the license file and click ACTIVATE;

2.Main Modules

2.1 Icons introduction



2.1.1 File

-includes Open Project, Save Project, Add File (txt format GCPs or Checkpoints coordinate file) and Insert file function:



2.1.2 Render(Point Rendering)

- includes Background, EyeDome Lighting, Model, Point cloud, Vector



Submenu-Background

- give color to the main window:



Submenu-Pointcloud

-give color to point cloud, and decide the class to display or not display:

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ADD				High Vegetati	on	
DEMOVE				Building		
REMOVE				Low Point		

### 2.1.3 Tool

refer to the functions: 3D Measure, Camera roam, Control report output, Datum points management, Homonymy point pairs management, format conversion, Partial Viewer and Translate/Rotate.



### 2.1.3.1 3D Measure



-Horizontal distance, Slant distance Dx,Dy,Dz, Area, etc.

3D Measure	×
Measurement object: Point cloud  Measurement mode:  Measurement mode:	a
ID DX(M) DY(M) DZ(M)	IORIZON DISTANCE (M SLANT DISTANCE (M)
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	PRB CLEAR ALL RECORDS Displayed information: Horizon distance (m) FILE LIST MODEL RENDER POINT CLOUD Internation II 34 121 (2004) II 34 2015 NUPE is Added successfully II 34 2015 NUPE

### 2.1.3.2 Camera Roam

Hold the right mouse button, change the view direction of the 3D point cloud, and then Click" Add key Frame," continue to add several directions of the point cloud, and then click" Start Roam",

Camera roam	- 0
CAMERA TRAJECTORY	
Key frame(-3.891,-18.148,10.478,0.090,0.000,0.005,0.996 Key frame(-3.953,-20.182,9.872,0.198,-0.001,-0.006,0.980	ADD KEY FRAME
Key frame(-4.051,-21.501,9.190,0.273,-0.004,-0.013,0.962 Key frame(-6.263,-21.958,8.533,0.323,-0.066,-0.188,0.925 Key frame(-6.140,-11.088,8.200,0.224,0.155,0.227,0.975	DELETE KEY FRAME
Key frame(-9.140, 21.000,0.300,0.324, 0.120, 0.307,0.073 Key frame(-9.864,-19.358,7.995,0.314,-0.195,-0.491,0.789 Key frame(-10.168,-17.853,8.195,0.278,-0.221,-0.583,0.73	CLEAR ALL FRAMES
Key frame(-10.586,-15.998,7.947,-0.255,0.272,0.677,-0.63 Key frame(-10.222,-14.254,7.963,-0.216,0.302,0.755,-0.54	
Key frame(-9.211,-12.024,7.755,-0.164,0.349,0.835,-0.392	SAVE KEY FRAMES TO FILE
	START ROAM END ROAM

Then the point cloud will rotate like a small video. This roam function can work when the user tries to make a demo video.



### 2.1.3.3 Control Report

After load the txt format Checkpoints coordinates list with "Add file",

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	05251.922	440099.902	2564647.443	
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1417 (Berlin V. 134)				

And then click "Control Report" to check the elevation control report:



2.1.3.4 Datum Point Management and Homonymy point pairs management

These two functions normally use together to bind the GCPs with point cloud. This part will be described detailed in the Chapter 3.10.2(Horizontal and Vertical accuracy report generation).



### 2.1.3.5 Partial Viewer



Partial viewer is a useful function, for example, before measure

horizontal distance, open partial viewer to make a profile of the point cloud, so that can see inside,



Partial viewer to see details



work together with Manual classification



work with horizontal slice

### 2.1.3.6 Translate/Rotate (Point cloud Stitching)

Point cloud stitching means to stitch the point cloud by dragging and rotating, this process involves adjusting the position and orientation of one group point cloud data to create a seamless composite.

Notes: it is a must that the two-group data to stitch should have overlapping regions.



Import Data 1 and Data 2:



Select Data 1 to Drag and Rotate and click "APPLY":



Then will pop up a toolbar-Translate/Rotate on the left:



Hold **middle mouse button** to drag point cloud in Data 1 to the direction of up, down, left or right;

Hold **right mouse button** to rotate Data 1;

When drag and rotate to the proper location, then finish and export the point cloud,





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202	24051303275	50_6.las		5/13/2024 12:20 PM	Laser Points Clo	36,608 KB	
202	24051303275	0_7.las		5/13/2024 12:20 PM	Laser Points Clo	52,412 KB	
202	24051303275	0_8.las		5/13/2024 12:20 PM	Laser Points Clo	48,030 KB	
202	24051303275	50_9.las		5/13/2024 12:20 PM	Laser Points Clo	60,290 KB	
202	24051303275	50_10.las		5/13/2024 12:20 PM	Laser Points Clo	57,704 KB	
202	24051303275	50_11.las		5/13/2024 12:20 PM	Laser Points Clo	70,973 KB	
202	24051303275	50_end.las		5/13/2024 12:20 PM	Laser Points Clo	81,401 KB	
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Data after Translate/Rotate

### 2.2 Point Cloud Rendering

Point cloud rendering is to give color to point cloud by different methods, by RGB, Elevation, GPS time, Intensity, Class, File, and so on:



Color Method Selection



By RGB(True color, point cloud after colorized can be displayed with By RGB)



By Elevation



By GPS Time



By Intensity



By Class



By File

### 2.3 Format Conversion

RobotSLAM Engine can export standard LAS format point cloud files, sometimes, the users may need other formats, txt, pts, xyz, or others. Here takes pts format conversion as an example:

* Format Conversion	×
INPUT F:/31haoji-0613data/20230614030940/LAS/20230614030940_0.las Files: F:/31haoji-0613data/20230614030940/LAS/20230614030940_1.las	1 ADD REMOVE
PROCESS         Data Filtering(0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,	2 ADD REMOVE
OUTPUT Save path: F/31haoji-0613data/20230614030940/LAS	3 CHANGE
File name suffix: _pts File format: PTS (*,pts)	FORMAT SETTINGS
Only modify the file name, not the content of the file 5	6
	RUN

- 1st, load the files;
- 2nd, add the method "data filtering";
- 3rd, change the save path;
- 4th, add the file suffix;
- 5th, select the format PTS;



6th, do the format settings, click ok to get the pts format file.

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20230614030940_0.las	2023/7/14 11:41	LAS 文件	351,754 KB
20230614030940_0_nature.las	2023/7/14 11:53	LAS 文件	351,755 KB
20230614030940_0-pts.pts	2023/7/14 12:12	PTS 文件	326,910 KB
20230614030940_1.las	2023/7/14 11:41	LAS 文件	353,662 KB
20230614030940_1_nature.las	2023/7/14 11:53	LAS 文件	353,663 KB
20230614030940_1-pts.pts	2023/7/14 12:11	PTS 文件	332,533 KB
🗋 ground.las	2023/7/14 11:57	LAS 文件	140,186 KB

### **2.4 Point Cloud Statistics**

Point cloud statistics is to calculate the number of the points in the LAS file.

Click "Point cloud"-> "Point Cloud Statistics", select "Single file", find the file path, and click " Count" to "The number of points".



### **2.5 Point Cloud Segmentation**

Point cloud segmentation is a tool, which can divide the point cloud file into several parts. Please find the tool from **Main Menu Bar** *Point cloud->Point cloud Segmentation* 









Input the width and Height value, here set 40m ,for example, and got four blocks as below:





Click save and set the save path

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Block4.las	8/8/2024 11:50 AM	Laser Points Clo	378,739 KB
Block3.las	8/8/2024 11:50 AM	Laser Points Clo	370,518 KB
Block2.las	8/8/2024 11:50 AM	Laser Points Clo	84,812 KB
🗋 Block1.las	8/8/2024 11:50 AM	Laser Points Clo	202,130 KB

### 2.6 Horizontal Slice

Horizontal Slice function- helps to check the point cloud by horizontal or vertical view



Right click Partial viewer setting icon to set the Fixed width value:



### 2.7 Manual Classification

This function is used to classify the point cloud manually, for example class one unclassified point cloud to ground, vegetation, building, noise and so on.

**Notes**: Also this function will helps to remove the moving people, cars or other objects. Take Low point(noise points) classification as an example:

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#### Browser Page



#### Manual classification



set Target class

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MAIN VIEWER	0) Created, Never Classified [1] Unclassified
	2 Ground  3 Low Vegetation  4 Medium Vegetation  0 Regime getation
	[7] Low Point (Noise)           [0] Reserved           [0] Water           [10] Rail

select "Low point(noise)" for example(or other class)

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Current viewer: Main Viewer     Input classes: Class 0-23     ☐ Target C Partial Viewer     Dint (Noise)	Selection too
MAIN VIEWER	

click "Partial Viewer"



right click" Set the displayed area for partial viewer"



set Fixed width value(0.1-0.5)



make a slice in left window with left mouse button



change the classification window to Partial Viewer (it is the right window)



Select the "Selection tools"



Select tool "Rectangular" or other tools on the right



class the noise point cloud to Low point class



The low point class (in red color in left window)

File Render Tool Pointcloud Image Model Project SLAM About		
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Export point cloud

		Select Classes	×		
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	Intensity Ra Classes EXPORT PATH	[8] Reserved [9] Water [10] Rail		PREVIEW	
		[11] Road Surface [12] Reserved [13] Wire – Guard (Shield) [14] Wire – Conductor (Phase)		CANCEL	

Select "Created, Never Classified", click OK and set the save path to export the point cloud

### 2.8 Ground Points Extraction (LAS tools)

If the user needs to extract the ground point cloud, there is a function called Las Tools.  $1^{st}$ , import the point cloud(right click "Point cloud",



2nd, Point cloud/Las Tools,



Las Tools

3rd: select terrain type and fine type, set Save Path, and then run.

📙 Las Tools		V/9207108.1-40		?	×
F:/31haoji-0	<mark>61</mark> 3data/20	23061403094	40/LAS/2023061	4030940_0.la	as
F:/31haoji-0	613data/20	23061403094	40/LAS/2023061	4030940_1.la	ac
File List:					
🔿 wilderness 🧿 na	iture C	) town	🔿 city	O metrop	olis
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Save path: F:/31haoj	i-0613data/2	20230614030	940/LAS		-
· · · · ·					
				RUN C#	NCEL

4th: load the las file saved for the previous step,

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	名称	修改日期	类型	大小
	20230614030940_0.las	2023/7/14 11:41	LAS 文件	351,754 KB
	20230614030940 0 nature.las	2023/7/14 11:50	LAS 文件	351,754 KB
	20230614030940_1.las	2023/7/14 11:41	LAS 文件	353,662 KB
	20230614030940_1_nature.las	2023/7/14 11:50	LAS 文件	353,662 KB
		_		
	1			

5th: check "ALL OFF", only display Ground to check it as below:



6th, export ground class.



Export ground class

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File Render Tool Pointcloud Image Model Project SLAM About	
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### 2.9 Earthwork calculations

First, please choose the point cloud to calculate volume. And remove noise point as much as possible.

This data is not complete, but you can learn how to remove the point.



Removed the noise point by the Manual classification tool:



Las tools will extract ground points automatically,

🛐 RobotSLAM Er	ngine
File Render Tool	Point cloud Image Model Project SLAM About
M 🗿 🖸	C Export Point Cloud
MAIN VIEWER	🕹 Correction Based On IMT
	😃 Las Tools

For example, I choose a data like this. And I want to calculate the volume of the ground.

And I use the **las tools** to remove the trees.



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		D:/DATA/RobotSLA	M/202404020558	12/LAS/202					
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								Par al	S.
	🔿 coarse	e 🔿 fine	extra_fine	O ultra_fine	hyper_fi	ine	A-D-1	180.30	7
2.2	Save path:	C:/Users/10235/0	Desktop		SELECT	DIR			14/13/18
					RUN CA	NCEL		SWEET CO	ş
		e vana se		440		1997			
Carl and	2 Anne	Start.	ALC: NO			alle.	1 C		
A		Starke	14.50					NO.	

And after this step, we will get the ground point. Yellow point.





After load the point clouds, click DEM production. And then to create TIN.





Choose the scope to calculate.



Then DEM is generated,



After that, Output the DEM model. Don't forget to choose the class- ground.



And load the DEM model and start to calculate volume.



Then choose this function.

👔 RobotSLAM Engine		
File Render Tool Point cloud Image Me	Model Project SLAM About	
🕅 😟 🗖 🐡 🔗 🔍 🕻	DEM production	
Elevation of the virtual plane: 17.268	🔹 orig 💩 Earthwork Calculation Virtual plane 🔹 🛟 CALCULATE	

The elevation of the virtual plane representative datum.



Choose this can choose boundary.



And click the calculate.





### 3. Data processing in RobotSLAM Engine software



Before Process data, open SLAM Manager, and load the project Folder,

### 3.1 Data Processing (handheld mode)

#### Case 1: handheld data WITHOUT RTK,

just open the project by clicking "SELECT DIR", tick "Process Pointcloud", and then click "Start Process"; after that, wait processing finish, and export the point cloud.

SLAM MANAGER								8
Platform:			Handheld					•
Scanning Type:			Standard	(<20min)				Ψ.
Directory Path:	D:/194-NF.	IY/3dai-703/20240731154920				SELEC	CT DI	R
		Process PointCloud		— 🔘 Replay Process				F
GENERATE PO Min Distance Msg count:	INTCLOUD (m): 1.0 0	* * *			Max Distance(m):	80.0 J	* * *	
REI Start Proc	ESS .	<b>} ≯ ⑤</b> ₪						

### **Case 2: Handheld Data with RTK Fixed**

Step 1: open the project by clicking "SELECT DIR", tick "Process Pointcloud", and then click "Start Process";

SLAM MANAGEF											ø	8
Platform:					Handheld							v
Scanning Type:					Standard	(<20min)						v
Directory Path:		JY/3dai							Γ	SELEC	T DIR	Γ
		• F	rocess PointClou	d		— 🔵 Replay Pr	ocess					
GENERATE PO Min Distance Msg count:	INTCLOUD (m): 1.0 0	* * *						Max Distance(m) Start msg SEQ:	: 8 0	0.0	* * *	
		: 1	* 🕤 ī	x 📮								
REI Start Proc	cess											

Step 2: Reply the data with GNSS adjustment,

tick "**Reply Process**" and "**Adjust with GNSS**", after that, click **Start Process** to reply the data,



After reply, it is necessary to Adjust Trajectory, click Adjust Trajectory icon to start the adjustment:

SLAM MANAGE	R					ወ	$\otimes$	Re
Platform:			Handheld				•	
Scanning Type:			Standard (<20min)				•	
Directory Path:					SELI	ECT DI	R	2
	Process PointCloud		💿 Replay I	Proces	is —		_	ł
🗌 Adjust	with loop		Adjust with GNSS	EPSG	SETTI	NG		
RTK XY Three	shold(m): 0.05	<u> </u>	RTK Z Thresho	old(m)	0.1			
	) 🛛 💾 🥍	e	) 🗟 🔛					
	FILES	Adjus	st Trajectory					
Vert File:	D:/j ar/verts.txt							
Edge File:	D:/	xt						
GCP File:	D:/ r/cpts.txt						-	
POINT CLOUE Prev.Frame(	DISPLAY s): 600000				🗌 s	how A:	xis	

After adjustment trajectory, the RTK points will show on the trajectory as below:



### 3.2 Data Processing (Backpack-mode)

For backpack working mode, set Platform to "Backpack", and then click "**Start Process**",



Backpack working mode

SLAM MANAG	ER		Ф	$\otimes$	Renderin
Platform:		AutoMobile		•	
Scanning Type		Handheld			AA
Directory Path	: D:/panadanutcar	AutoMobile UAV			
	Process PointCloud	Replay Process			Û
GENERATE F	POINTCLOUD	Max Distance(m): 80.0			é
Msg count	0	Start msg SEQ: 0	• • • • •		∽
	) 🛯 💾 🥍 🔇	) 🛱 📮 🔼			
REFERENCE	FILES				
Laser File:	D:/panadanutcar/SCANNER/I	lidarpanadanutcar_SLAM.pcap			
IMU File:	D:/panadanutcar/IMU/imupana	adanutcar_SLAM.txt			
GNSS File:	D:/panadanutcar/GNSS/gpsp	oanadanutcar_SLAM.txt			
IMG File:	D:/panadanutcar/CAMERA				

### 3.3 Data Processing (SUV-mode)

SOUTH REAL	SLAM MANAGER Platform: AutoMobile Soanning Type: Handheld Directory Path: D/panadanutcar AutoMobile @ Process PointCloud O Replay Process	€ ⊗ ^R	
	GENERATE POINTCLOUD Min Distance(m): 1.0 Mag count: 0 Start mag SEQ: 0 Start mag SEQ: 0 Mag count: 0 Start mag SEQ: 0 Start mag SEQ	*	▲ ↓
	Laser File: D/panadanutcar/SCANNER/Ildirpanadanutcar.SLAM.pcap IMJ File: D/panadanutcar/IMU/imupanadanutcar.SLAM.txt GNSS File: D/panadanutcar/GNSS/gpspanadanutcar.SLAM.txt IMG File: D/panadanutcar/CAMERA		

SUV- mode

Set Scanning Type-

AutoMobile

### 3.4 Data Processing (UAV-mode)

Before process UAV-based RobotSLAM data, set Scanning type "**UAV**", other settings keep in default, and click "Start Process",



Before process, set Platform to "UAV"

### 3.5 Data Processing (USV-mode)



USV-mode

Use default setting

If RTK function works during the scan, when finish process, set the EPSG, and click "Reply Process",

l	SLAM MANAGER	Ø	$\otimes$	R
	Platform:	Handheld	•	
	Scanning Type:	Standard (<20min)	•	
	Directory Path: E:/3dai-73/202408141457	11 SELECT DI	R	
	Process PointCloud	Replay Process		
	AJUST POINTCLOUD			
	Adjust with loop	Adjust with GNSS <b>EPSG SETTING</b>		
	RTK XY Threshold(m): 0.05	RTK Z Threshold(m) 0.10	_	
		🖻 🖬 🖳 🗠		
	REFERENCE FILES			

### 3.6 Data Processing (long time)

If the scan time is more than 20 mins, normally, it is better to make a scan within 20minutes, if a single scan time is more than 20 mins, please set the Scanning Type to LongTime(>20 min).



### 3.7 Data Processing (Outdoor RTK enabled)

For outdoor open scenarios, if when try to process with the default setting, there is something wrong with the process, please try with the Scanning type: Outdoor(RTK Enabled);



#### **Road Application**

Outdoor scenarios with less features (Like road or outdoor Mining, or etc.)

SLAM MANAGER		Ф	$\otimes$	Rendering
Platform:	Handheld		•	
Scanning Type:	Standard (<20min)		•	۸A
Directory Path: E:/3dai-73/2024081	414571 Standard (<20min) LongTime (>20min) Outdoor (RTK enabled)			
Process PointClou	d kepiay Process			
GENERATE POINTCLOUD Min Distance(m): 1.0 *	Max Distance(m): 80.0	•		<i>ब</i> ∕ ≁
◐◐◙₿シ	* 🕤 🖬 📴 🖾			

### 3.8 Trajectory Optimization (loop optimization)

Sometimes, while finish processing, zoom in the left window to the location of start scanning point, increase the value of "**Near scans**" and check "Show Axis",

when finish processing, the start scanning point or the ending point doesn't go the location as scheduled or the point cloud appears offset at the end of the trajectory, in that case, it is necessary to do the trajectory optimization.



RobotSLAM Engine				-	-	٥	×
File Render Tool Pointcloud Image Model Project SLAM About							
₩ \$ \$ \$ \$ \$ \$ \$							
MAIN VIEWER	SLAM	MANAGEMENT				© ^{R6}	nderi
	Vehici Enviro Direct EPSG	le Type: omment: tory Path: F/gene O Gene Code: 4548 I I I I I I I I I I I I I I I I I I I		andheld Ilverse 182334-Minus I F Replay SS Factor Use Loop Use Loop Use Loop	CHANG Detect	• • ion	
	Ne	ar scans: 600000		🔳 Show Scans 🔲 :	Show A	iis	
		SCAN NAME	POSE INDEX	EDGE COUNT			
		43.600000					
		43.800000					
		43.900000					
		44.000000					

Click one point on the starting line, and the other point on the ending line, so that check whether the point cloud is misaligned in the joint area. Under normal status, in the joint area, there is only one layer of ground point cloud from vertical view; if there two layers of ground point cloud, it is abnormal and need to be adjusted.



If the point cloud is misaligned or point cloud has deviations in joint area, please adjust with LOOP DETECTION method to optimize the point cloud:



The starting point and ending point don't go to the same position

SLAM MANAGE	2		₽ ⊗
Platform:		Handheld	•
Scanning Type:		Standard (<20min)	▼
Directory Path:	E:/3dai-73/20240814145	711	SELECT DIR
	O Process PointCloud	Replay Proces	ss -
AJUST POINTO	vith loop	Adjust with GNSS EPSG	SETTING
	▶ 🖁 🥕	5 🖻 📮 🗖	

Optimize the point cloud with LOOP DETECTION optimization

### 3.9 Merge Projects (Projects Stitching)

In the case of large-area multiple collections, perform multiple stitching according to the overlapping areas.

- 1. create a new folder, then open the A software.
- 2. select the new folder here in Merge Project.

Merge Project		SELECT DIR
Add Project:		SELECT DIR
1	BEGIN	

3. select the folder you want to splice here one by one in Add Project and then choose to start.

Y Merge Pro	ojects	×
RobotSLAM		•
Merge Project:	E:/A-RobotSLAM/data1218/1218	SELECT DIR
Add Project:	E:/A-RobotSLAM/data1218/20231218164459-2	SELECT DIR
	BEGIN	
E:/A-RobotSL/ E:/A-RobotSL/	AM/data1218/20231218163216-1 AM/data1218/20231218164459-2	

4. Then click SLAM Manager , open the new folder, click on the point

cloud **Replay**, then find the loop frame match, and click optimize

the match is completed, finally click to save the trajectory.

RobotSLAM Engine		J ×
File Render Tool Pointcloud Image Model Project SLAM About		
₩ 4 4 & + & 9 • 4 • • • • • • • • • • • • • • • • •		
MAIN VIEWER	SLAM MANAGEMENT Ø	Renderin
	Platform Type: Handheld v Scanning Duaration: <20min v	
0	Directory Path: E/A-RobotSLAM/data1218/1218 CHANGE	<b> </b> 🎲
	Generate   Replay	s and a second s
	Use Loop Detection Use GNSS Factor EPSG SETTING	] 🤸
	000 🖉 💾 🥕 🖻 🗟 🖳 🏯	
	Vert File: E/A-RobotSLAM/data1218/1218/verts.txt CHANGE	
	Edge File: /A-RobotSLAM/data1218/1218/edges.txt CHANGE	
	Cpts File: E:/A-RobotSLAM/data1218/1218/cpts.txt CHANGE	
EDGES MANAGEMENT S S EDGE VIEW WINDOW		
Tools: 🕞 🕣 📴 📅 🔛 ScanNum: 30 🛟 🖩 Edgel 🖷 Edgel		
EDGETYPE SCANFROM SCANTO TRANK TRANY	Near scans: 60 📫 🔲 Show Scans 🛄 Show Axis	
1	ILLES BLAM MARASEMENT	
	100.74 /071 Provinse Julializadi	
	109 26:2001 Frog and installation 109 28:06) Finish merging projects! 109 28:06) Finish merging projects!	

### 3.10 Accuracy Assessment

# 3.10.1 Import checkpoint file and generate the vertical accuracy report

If the user already has some checkpoints before scanning, and when collect data, the RTK function works, and receive absolute coordinates. Please import the checkpoints coordinate file, and check the accuracy report by clicking "Control report".

RobotSLAM Engine				
File Render Tool Pointcloud Image Model Project S	LAM About			
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MAIN VIEWER				
		CERR VENICE \	112 112	
X	🕞 Open Text File			×
0	Filename: F/31haoji-0613data/06			
<u> </u>	File type: Datum points *			
	Skip lines: 0			
	Separator: WHITESPACE			
	Here are the first lines of this file. Choo	se an attribute for each column:		
	Point name 🔹	X(m)/Latitude(deg)/East(m) 🔻	Y(m)/Longitude(deg)/North(m) +	Z(m)
	0525LP10	440166.891	2564735.682	24.68
	0525LP16	440035.017	2564808.884	24,459
	0525LP16	439982.617	2564735.199	27.11
	0525LP22	440099.902	2564647.443	26.217
1. No. X				
A SALE				
Star P				
			APPLY APPLY ALL CA	NCEL
		antika. Bottora	The second second second second	
	and the second that		8 <b>日</b> ,1880年,11月	



# **3.10.2 Horizontal and Vertical accuracy report** generation

After get the absolution point cloud, the horizontal and vertical accuracy can be verified by the following method:

First, import the point cloud with absolute coordinates



Import the GCPs coordinates file or Checkpoint coordinates file by clicking "Insert file" icon,



Set file type to Datum points,

🗐 Open Text File			×
Filename: D:/130-Nigeria/cponther	wall.txt		
Skip lines: Point cloud Trajectory of camera Trajectory of IMU Separator Datum points			
Here are the first lines of this file. Choo	ose an attribute for each column:		
	X(m)/Latitude(deg)/East(m)	•	
1,-61.9355,114.0029,-79.8440			
2,-40.3669,107.3810,-79.8624			
3,-28.7820,113.7238,-79.9909			
4,-13.1286,102.5264,-79.9012			
5,0.9237,99.9947,-80.0827			
		APPLY APPLY ALL CAN	





Click "Datum points management",







Then, click "Homonymy point parrs management"

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MAIN VIEWER	Homonymy point pairs mar	agement	
$\times$			
			(Point name: 6)
	int name 2	Point name: 4) (Point name: 5)	

And create a new file,



Input the file name and save it,

🗞 Create a new homonymy p	point pairs file					×
$\leftrightarrow$ $\rightarrow$ $\checkmark$ $\uparrow$ $\blacksquare$ $\diamond$	This computer > LENOVO (D:) > 130-Nigeri	a >		~ C	在 130-Nigeria 中搜索	م
组织 • 新建文件夹					≣	- 🕐
🛃 视频   🖈	名称 ^	修改日期	类型	大小	S.	
📁 Video tutorial	20240423021242	4/23/2024 10:57 AM	文件夹			
📒 130-Nigeria	20240424100059	4/24/2024 10:13 AM	文件夹			
🎦 英语手册						
2024-08						
I						
🗸 📮 This computer						
> 👪 Windows (C:)						
> 🚽 LENOVO (D:)						
> 🛋 E (E:)						
> 🛬 网络						
文件名(N): report						~
保存类型(I): HMP (	*.hmp)					~
▲ 隐藏文件夹					保存(S) 取	湖

Check Point 1 in the right side-Datum points management, and it will be lighted,

MAIN VEWER		G. O. 1999	AL VILWOR	e 0	CALOM POINTS MAR	WEMENT		
RB								CHAN
N. 7		<b>1</b>				0 = 0		
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$\bigcirc$					POINT ROOM	e Ajagica modelo	obitive ritel i ritelarona u enclaro fuena	H(M)
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	and the second							
	Point name: 3	and the second sec						
<b>a</b>								
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	and the second s							
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					2029:45 2024042	3021242_0 las Added successf 3021242_1 las Added successf	aly alv	
X(M(/LATITUDE(DEG)/EAST(M)					2029.45 2024043 2024043 2029.45 2029.45 2024043	3021242_2 las Added successf 3021242_3 las Added successf	ay ay	
					[20 29:45] 2024043 [20 29:45] 2024043	3021242_4 las Added successf 3021242_5 las Added successf	dy dv	
					[20 29:45] 2024042 [20 29:45] 2024042	3021242_6 las Added successf 3021242_7 las Added successf	dly dly	
					[20:29:45] 2024042 [20:32:54] cponthe	3021242_end las Added succes wall.dtp Added successfully	stuły	

And then click" Add point pair" to add the first point,



Make a horizontal slice in the left view, and then find the location of Point 1 in the partial viewer, right click the accurate location of Point 1, and save it,





Mark 3 more points with the same method( 3 steps to mark the point),

When finish mark 4 points or more,



Click the icon "Point pair accuracy report icon" report icon" to save the report file to TXT format,

MAIN VIEWER	е ⊗	PARTIAL VIEWER	e 8	DATUM POINTS MANAGEMENT	
				Filename: cponthewall.dtp	
$\times$				Tools: 🕁 🖧 🔍	` ∞
$\phi$		<b>F</b>		POINT NAME	X(M)/LATITU
		Ĩ		1 🔲 1 -61.935	1
					'
				3 3 -28.782	
				4 4 10.129	·
		Save path			
		$\leftrightarrow$ $\rightarrow$ $\checkmark$ $\uparrow$ $\square$ $\rightarrow$	This computer > LENOVO (D:) > 130-Nigeria	a >	
		组织 * 新建文件夹			
		🚺 视频 🔹 🖈	名称 ^	修改日期	类型
Point name 10		📜 Video tutorial	20240423021242	4/23/2024 10:57 AM	文件夹
		📁 130-Nigeria	20240424100059	4/24/2024 10:13 AM	文件夹
		英语手册	🧧 0059-3F-8F.txt	4/24/2024 10:10 AM	TXT 文
and the second		2024-08	📔 0206-桌面原地测试.txt	4/23/2024 9:15 AM	TXT 文
		_ 2024 00	🧧 1242-车库-刺点-精度正常.txt	4/23/2024 10:26 AM	TXT 文
			₩ 4101-大楼一圈.txt	4/23/2024 4:10 PM	TXT文
HOMONYMY POINT PAIRS MANAGEMENT		<ul> <li>This computer</li> </ul>	₩ 5012-楼顶开了RTK.txt	4/23/2024 2:01 PM	TXT 文
Filename: report.hmp		> 🔛 Windows (C:)	📔 cponthewall.txt	4/22/2024 9:50 AM	TXT 文
Tools: 🛨 😼 🔟 🖹 🕳		> 🛁 LENOVO (D:)			
4) DATUM POINT Y(M)/LONGITUDE(DEG)/NORTH(M)	DATUM POINT Z(M)/HEIGHT(M)/L	up(M) > 🛋 E (E:)			
1 114.003		> 🎽 网络			
2 105.661					
3 74.412	-79.611	文件名(1))			
4 02.010	-79.000	保存类型(I): TXT (*.*	ixt)		

### Save the accuracy report:

	Point pair accuracy	report	×		
	SETTINGS				
	Vertical distance threshold:	0.010	<u></u> m		
	Horizon distance threshold:	0.010	<u></u> m		
	Slant distance threshold:	0.015	🔶 m		
	Save path: D:/130-Nigeria/A	.ccuracy report.txt	BROWSE		
				<b>_</b>	
		ок	CANCEL	J	
Karacy report.txt		8/22/2024 8:4	I3 PM	TXT 文件	2 KB
newall txt 🔣 🔚 Accuracy report tyt 🕅					
Homonymy point pairs file: D:/130-Ni	geria/report.hmp				
X(m)/Latitude(deg)/East(m) Y(m)/Lon -61.962 113.998 -79.831 964.400 -61. 16.423 105.679 -79.758 829.200 16.3	gitude(deg)/North(m) Z(m 935 114.003 -79.844 0.013	<pre>i)/Height(m)/Up(m) 0.027 0.020</pre>	GPS time	(s) Datum point X	(m)/Latitude(deg)/Ea
2.171 74.432 -79.583 732.700 2.15 -28.664 62.593 -79.812 1082.900	92 105.661 -79.740 0.018 1 74.412 -79.611 0.028 -28.698 62.616 -79.806 0.0	0.036 0.040 0.028 0.040 006 0.041 0.041			
2.171 74.432 -79.583 732.700 2.15 -28.664 62.593 -79.812 1082.900 Vertical error	92 105.661 -79.740 0.018 1 74.412 -79.611 0.028 -28.698 62.616 -79.806 0.0	0.027 0.030 0.036 0.040 0.028 0.040 06 0.041 0.041			
2.171 74.432 -79.583 732.700 2.15 -28.664 62.593 -79.812 1082.900 Vertical error average value: 0.016 maximum value: 0.028	92 105.661 -79.740 0.018 1 74.412 -79.611 0.028 -28.698 62.616 -79.806 0.0	0.036 0.040 0.028 0.040 0.028 0.040 0.041 0.041			
2.171 74.432 -79.583 732.700 2.15 -28.664 62.593 -79.812 1082.900 Vertical error average value: 0.016 maximum value: 0.028 root mean square value: 0.018 threshold: 0.010	92 105.661 -79.740 0.018 1 74.412 -79.611 0.028 -28.698 62.616 -79.806 0.0	0.036 0.040 0.028 0.040 0.028 0.040 006 0.041 0.041			
2.171 74.432 -79.583 732.700 2.15 -28.664 62.593 -79.812 1082.900 Vertical error average value: 0.016 maximum value: 0.028 root mean square value: 0.018 threshold: 0.010 total number of point pairs: 4	92 105.661 -79.740 0.018 1 74.412 -79.611 0.028 -28.698 62.616 -79.806 0.0	0.027 0.040 0.036 0.040 0.028 0.040 06 0.041 0.041			
2.171 74.432 -79.583 732.700 2.15 -28.664 62.593 -79.812 1082.900 Vertical error average value: 0.016 maximum value: 0.028 root mean square value: 0.018 threshold: 0.010 total number of point pairs: 4 number of point pairs exceeding	92 105.661 -79.740 0.018 1 74.412 -79.611 0.028 -28.698 62.616 -79.806 0.0	0.027 0.030 0.036 0.040 0.028 0.040 06 0.041 0.041			
2.171 74.432 -79.583 732.700 2.15 -28.664 62.593 -79.812 1082.900 /ertical error average value: 0.016 maximum value: 0.028 root mean square value: 0.018 threshold: 0.010 total number of point pairs: 4 number of point pairs exceeding /orizontal error	92 105.661 -79.740 0.018 1 74.412 -79.611 0.028 -28.698 62.616 -79.806 0.0	0.027 0.030 0.036 0.040 0.028 0.040 06 0.041 0.041			
2.171 74.432 -79.583 732.700 2.15 -28.664 62.593 -79.812 1082.900 /ertical error average value: 0.016 maximum value: 0.028 root mean square value: 0.018 threshold: 0.010 total number of point pairs: 4 number of point pairs exceeding Horizontal error average value: 0.033 maximum value: 0.041	92 105.661 -79.740 0.018 1 74.412 -79.611 0.028 -28.698 62.616 -79.806 0.0	0.027 0.030 0.036 0.040 0.028 0.040 006 0.041 0.041			
2.171 74.432 -79.583 732.700 2.15 -20.664 62.593 -79.812 1082.900 Vertical error average value: 0.016 maximum value: 0.028 root mean square value: 0.018 threshold: 0.010 total number of point pairs: 4 number of point pairs exceeding Horizontal error average value: 0.033 maximu value: 0.031 root mean square value: 0.034 root mean square value: 0.034	92 105.661 -79.740 0.018 1 74.412 -79.611 0.028 -28.698 62.616 -79.806 0.0	0.027 0.030 0.036 0.040 0.028 0.040 006 0.041 0.041			
2.171 74.432 -79.583 732.700 2.15 -28.664 62.593 -79.812 1082.900 Vertical error average value: 0.016 maximum value: 0.028 root mean square value: 0.018 threshold: 0.010 total number of point pairs: 4 number of point pairs exceeding Vorizontal error average value: 0.033 maximum value: 0.031 root mean square value: 0.034 threshold: 0.010 total number of point pairs: 4	92 105.661 -79.740 0.018 1 74.412 -79.611 0.028 -28.698 62.616 -79.806 0.0	0.027 0.030 0.036 0.040 0.028 0.040 006 0.041 0.041			
2.171 74.432 -79.583 732.700 2.15 -28.664 62.553 -79.812 1082.900 Vertical error average value: 0.016 maximum value: 0.028 root mean square value: 0.018 threshold: 0.010 total number of point pairs: 4 number of point pairs exceeding Horizontal error average value: 0.033 maximum value: 0.031 root mean square value: 0.034 threshold: 0.010 total number of point pairs: 4 number of point pairs exceeding	<pre>92 105.661 -79.740 0.018 1 74.412 -79.611 0.028 -28.698 62.616 -79.806 0.0 the threshold: 3 the threshold: 4</pre>	0.027 0.030 0.036 0.040 0.028 0.040 006 0.041 0.041			
2.171 74.432 -79.583 732.700 2.15 -28.664 62.553 -79.812 1082.900 Vertical error average value: 0.016 maximum value: 0.028 root mean square value: 0.018 threshold: 0.010 total number of point pairs: 4 number of point pairs exceeding Horizontal error average value: 0.031 maximum value: 0.041 root mean square value: 0.034 threshold: 0.010 total number of point pairs: 4 number of point pairs exceeding Error	92 105.661 -79.740 0.018 1 74.412 -79.611 0.028 -28.698 62.616 -79.806 0.0 the threshold: 3	0.027 0.030 0.036 0.040 0.028 0.040 006 0.041 0.041			
2.171 74.432 -79.583 732.700 2.15 -28.664 62.553 -79.812 1082.900 Vertical error average value: 0.016 maximum value: 0.028 root mean square value: 0.018 threshold: 0.010 total number of point pairs: 4 number of point pairs exceeding Horizontal error average value: 0.033 maximum value: 0.041 root mean square value: 0.034 threshold: 0.010 total number of point pairs: 4 number of point pairs: 4 number of point pairs exceeding Error average value: 0.038 maximum value: 0.041	92 105.661 -79.740 0.018 1 74.412 -79.611 0.028 -28.698 62.616 -79.806 0.0 the threshold: 3	0.027 0.030 0.036 0.040 0.028 0.040 06 0.041 0.041			
2.171 74.432 -79.583 732.700 2.15 -28.664 62.593 -79.812 1082.900 Vertical error average value: 0.016 maximum value: 0.028 root mean square value: 0.018 threshold: 0.010 total number of point pairs: 4 number of point pairs exceeding Horizontal error average value: 0.033 maximum value: 0.041 root mean square value: 0.038 maximum value: 0.038 maximum value: 0.031 root mean square value: 0.038	92 105.661 -79.740 0.018 1 74.412 -79.611 0.028 -28.698 62.616 -79.806 0.0 the threshold: 3	0.027 0.030 0.036 0.040 0.028 0.040 06 0.041 0.041			
2.171 74.432 -79.583 732.700 2.15 -28.664 62.553 -79.812 1082.900 Vertical error average value: 0.016 maximum value: 0.028 root mean square value: 0.018 threshold: 0.010 total number of point pairs: 4 number of point pairs exceeding Horizontal error average value: 0.033 maximum value: 0.031 total number of point pairs: 4 number of point pairs exceeding Error average value: 0.038 maximum value: 0.041 root mean square value: 0.038 maximum value: 0.041 root mean square value: 0.038 threshold: 0.015 total number of point pairs: 4	92 105.661 -79.740 0.018 1 74.412 -79.611 0.028 -28.698 62.616 -79.806 0.0 the threshold: 3	0.027 0.030 0.036 0.040 0.028 0.040 06 0.041 0.041			

### 3.11 Coordinate Transformation

### 3.11.1 Coordinate transformation with GCPs marks

If the user has some known points on the ground or on the walls, then it is convenient to mark 4GCPs or more during the scan, after that when export point cloud, load the GCPs coordinate file to transform coordinates.



Marking GCPs on the ground

### Method to mark ground control point:

1.Put the cross on the base plate to the location of the ground control point;

2. Press the **BLACK BUTTON** on the RobotSLAM to record the ground control point.

If some Ground Control Points are marked and get the coordinates file for the GCPs, please tick" **Transform Point Cloud**" and **"Enable GCP records**", click "**IMPORT CSV**" to load CSV or TXT format GCP file, and then click "**CONFIRM**" to export absolute coordinates;



The GCPs coordinate file should be *.txt or *.csv format, in the sequence of Point name, E, N, Z:



For example, after load the four points marked during the scan, import CSV

А	В	С	D	
8	1.9673	60.8371	-79.6854	
6	16.3917	105.6609	-79.7401	
2	-40.3669	107.381	-79.8624	
10	-28.6977	62.6163	-79.8058	

format GCPs points when export point cloud,

LAS	Save L	AS File	e													?	×
PI (	DINTCLOUE Save De	REFINE	MENT ized Poir	ntCloud	Sav	ve in Seper	rated File:	3 →	ATTEN	TION: I	T IS RECOMMENDED	TO BE CHEC	KED WHEN PROCE	ESSING LARGE DA	TA WITH LIMITED	COMP	UTER MEMO
	Save Su	intCloud	to Las Fi	ile	VOXEIII	nerval(m).		<u> </u>							Colorize	Origin	al PointCloud
Sav	e Directory:	D:/13	0-Nigeria	9/20240	4230212	42/LAS/				_							
Erro	Transform or Count: 0	PointClc Error Pe	rcentage	Enable :: 0	RTK Rect	ord: 🔲 I	Enable G	CP Rec	ords		AJUST TRACK	CALCULATE	TRANSFORMATIC	IMPORT CSV	DELETE RECOR	DS S	AVE RECORDS
								8	9	10							
	778.300					60.837	-79.685	0.025	0.017	0.008							
	840.900		53.988		16.392	105.661	-79.740	0.019	0.030	0.001							
	1003.300	-53.278	47.672	0.989	-40.367	107.381	-79.862	0.034	0.012	0.011							
															CONF	IRM	CANCEL

In the column 8, 9, 10, find good results in green, click "CONFIRM" to export the coordinates.

### 3.11.2 Coordinate transformation with RTK service

If RTK service is available during the scan, and RTK got Fixed most of the time, after processing, click "**Replay Process**" and tick "**Adjust with GNSS**", and then click **Start Process** icon to replay the project(here Take RobotSLAM Engine *1.3.3 version* as example).

LAM MANAG	SER	 ச	
latform:		Handheld	•
canning Typ	e:	Standard (<20min)	•
irectory Pat	n: D:/182-shate/20240529111	1134 SELECT DIR	2
	Process PointCloud	Replay Process	_
🗌 Adjus	it with loop	Adjust with GNSS EPSG SETTING	
RTK XY Thr	eshold(m): 0.05	RTK Z Threshold(m) 0.10	
00	) 🛯 💾 🥍 🔇	) 🗟 🖳 🔤	
REFERENCE			
Vert File:	D:/182-shate/20240529111134	4/verts.txt	
Edge File:	D:/182-shate/2024052911113	34/edges.txt	-
		47.877.777.877.987.87	

And when export point cloud, please check the followings:

LAS Save LAS File					? ×
	T RointCloud 🔲 Save in Set				
Save Subsampled Po	intCloud Voxel Interval(i	m): 0.015 $\downarrow$ $\rightarrow$			
Save PointCloud to L				Colorize Ori	ginal PointCloud
Save Directory: D:/182-sh	ate/20240529111134/LAS/				
Transform PointCloud	Enable RTK Records	Enable GCP Records			
Statistics:		CALCULATE TR	ANSFORMATION IMPO	RT CSV DELETE RECORDS	SAVE RECORDS
1					
				CONFIRM	1 CANCEL

If all the RTK points are Fixed solution and in green status as below, just click OK to export the absolute coordinates.

LAS SI	ave LAS Fi	le											?	×
	Save Smo	oth Point(	loud							Recolorize S	mooth PointClo	ud 🔲 Delete Orig	jin Point(	loud
								oxel Space			0.02			
												🔲 Colorize Ori	gin Point(	loud
Save	Directory:	F/20230	51909273	1-louding/L										
	ransform P	ointCloud						use RTH	(points		🗌 us	e GCP points		
		Inqualified	Rate: 0						COMEPUT		IMPORT CSV			
	TIME	XSOURCE	YSOURCE	ZSOURCE	XTARGET	YTARGET	ZTARGET	XERROR	YERROR		Zi	RROR		
	5324.000				440314.523	2564765.678		0.001	0.001	0.008				
						2564767.013		0.004						
						2564767.791		0.007						
					440311.159	2564769.457		0.007						
						2564770.236		0.007						
						2564772.013		0.002						
	5334.000				440308.409	2564772.902		0.004						
					440307.593	2564773.791		0.008	0.003	0.019				
					440306.982	2564774.679		0.007						
					440306.167	2564775.569		0.007	0.005					
								0.007	0.009	0.010				
												ОК		ICEL

If some RTK points are in red, check and delete them, and then save points before export point cloud, the sample shows as below,

select line 37, DELETE POINT and SAVE POINTS, after that, click OK to export the point cloud:

1000										
37	13340.000	-7.592	7.916	1.011	534046.336	2533587.440	96.357			
38	13343.000	-6.399	7.052	0.960	534047.159	2533586.224	96.373	0.096		0.065
39	13346.000			0.983	534047.983	2533585.118	96.350	0.066		0.015
40	13349.000	-4.109	5.475	0.968	534048.806	2533584.012	96.377	0.090		0.051
41	13352.000	-3.234	4.720	0.932	534049.321	2533583.017	96.331	0.037		0.035
42	13354.000	-2.352		0.939	534050.041	2533582.243	96.339	0.073	0.001	0.030
43	13357.000	-0.830	3.982	0.928	534051.274	2533581.360	96.343	0.003		0.040
44	13360.000	0.541	4.260	0.969	534052.711	2533581.142	96.379	0.036		0.034
45	13363.000	1.740	4.705		534053.942	2533581.145	96.342	0.024	0.044	0.008
46	13488.000		-2.465	0.810	534049.647	2533574.933	96.259	0.072		0.055
47	13490.000	-0.268	-1.447	0.828	534050.055	2533575.931	96.228	0.057	0.039	0.017
48	13494.000	-0.083	-0.061	0.616	534050.771	2533577.151	96.058			

### 3.12 Export colorized point cloud

If during the scanning, the Pano camera works and record the video normally, When export point cloud, tick" Colorized Original PointCloud", and click **CONFRIM** to export colorized point cloud



# **APPENDIX**

# 1. Convert LAS format to RCP format (for AutoCAD design purpose)

Run Autodesk ReCap software



Create new project by clicking "New project", then click "import point cloud" load create new project interface:



Input the project name and proceed:

+	select files to import	select	t folder to import
	create ne	w project	
	first, we need	a project name	
	new project (2)		
	then a place to	save your files	
	E:\ReCap		
	🗙 cancel	✓ proceed	
	6	ッ	
	drag files or	folders here	

select fi	les to import select folder to import				
_	create new project				
	first, we need a project name				
	0103 T				
	then a place to save your files				
	E:\ReCap				
	X cancel V proceed				
	drag files or folders here				
select fi	les to import select folder to import				
	create new project				
	first, we need a project name				
	0103				
then a place to save your files					
E:\ReCap					
	Cancel Proceed				
	drag files or folders here				

Select files to import to load all Las files to change format,

select files to import	select folder to import						
or							
0							
drag files o	r folders here						

Click "import files" in the right bottom, and then click import files,



Wait importing...



Wait index scans, when finish, click" launch project"



Wait loading



Input the file name and click "Save",

	1.2	^			<b>V</b>
3D 对象	^	名称	修改日期	类型	大小
视频		CER	2023/9/1 9:05	文件夹	
📰 图片		📕 crypto	2023/9/1 9:05	文件夹	
文档		document	2023/9/1 9:05	文件夹	
▶ 下载		imageformats	2023/9/1 9:05	文件夹	
▶ 音乐		📕 Images	2023/9/1 9:05	文件夹	
桌面		📕 plugin	2023/9/1 9:05	文件夹	
C (C:)		resource	2023/9/1 9:05	文件夹	
		📕 Setup	2023/9/1 9:05	文件夹	
E (E:)	÷.	📕 UPI	2023/9/1 9:05	文件夹	
F (F·)	~ <				
文件名(N):					~
保友 <del>迷</del> 刑(T)·	Unified	RCP(* rcp)			~

