Benaco laser export instructions

v74, last updated 2025-06-27

This document describes how to export data from common laser scan and photogrammetry software for use with Benaco.

Table of contents

Prerequisites and points cleaning (read this first)

Stationary (terrestrial) scanners

- Faro SCENE
- Leica Cyclone REGISTER 360
- Leica Cyclone CORE
- **Z+F** Laser Control (terrestrial)
- Trimble RealWorks
- Riegl RiScan
- Topcon MAGNET
- PinPoint
- <u>PointCab</u>
- LupoScan
- <u>Autodesk ReCap</u>
- <u>Matterport</u>

Mobile scanners

- Z+F FlexScan
- Viametris PPiMMS
- Gexcel HERON mobile mappers
- Emesent Hovermap
- **Topcon** mobile mappers
- Trimble TIMMS
- Faro Orbis Connect / GeoSLAM Connect
- XGrids Lixel Studio
- NavVis Ivion

Benaco's pano-against-laser

• Placing additional panos against laser data

Photogrammetry software

- Agisoft Metashape
- <u>RealityCapture</u>
- **Pix4D** PIX4DMapper
- <u>3DSurvey</u>
- <u>Combining photogrammetry with lasers</u>

Prerequisites and points cleaning (read this first)

Both RGB point clouds and RGB panorama images are needed for Benaco to process your data. We cannot process datasets with only point clouds at the moment.

The displayed export methods ensure that Benaco understands which points were seen from which scan position, and that the associated RGB photos are included in the export.

You should clean the point clouds first in the programs of your choice.

Benaco can also display (drone) photogrammetry results exported as textured meshes.

In case of questions

If you have question, or find that the instructions or screenshots no longer agree with the current version of your software, please use the support chat on the <u>benaco.com</u> or email <u>support@benaco.com</u>

Faro SCENE

Provide Benaco with an export folder containing the following:

- 1. The point cloud in E57 format, into subfolder "pointclouds":
 - a. In SCENE's **Export** tab, click the **Export Scans** button; from the dropdown choose **Export Scans Ordered**.
 - b. Choose **E57** as the format.
 - c. Tick the checkbox [X] Export each scan into a separate file.
 - d. Tick the checkbox [X] Full Color Resolution Panorama Image.
 - If this checkbox is missing or if you have some scans that were scanned without colour, go to <u>Exporting full resolution panos from</u> <u>SCENE</u>.
 - If you use the Faro + Ricoh Theta integration instead of the builtin scanner RGB camera, go to <u>Exporting Ricoh panos</u>.

Do not submit "Unordered" point clouds or "Project Point Clouds", as these do not contain the original scanner positions.

2. Highly recommended:

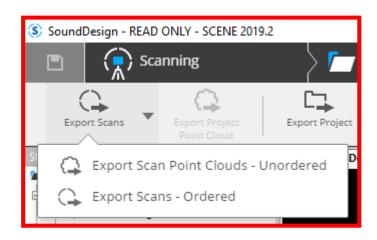
The Project Point Cloud as E57 into subfolder "**coloring-pointclouds**". SCENE's Project Point Cloud with Color Correction enabled makes for much better colors. Unfortunately they do not retain scanner positions, which is why they are needed *in addition* to the "Ordered Scans" export.

- a. Disable all clipping boxes to ensure the project point cloud is not truncated.
- b. In SCENE's **Explore** tab, click the **Project Point Cloud** button; from the dropdown choose **Create**.
 - Tick the checkbox [**X**] Apply Color Balancing.
 - (Optional but recommended): Tick Homogenize Point Density. Choose a Cell Size of 2mm.
- c. In SCENE's Export tab, click the Export Project Point Cloud button.
 - Choose **E57** as the format.

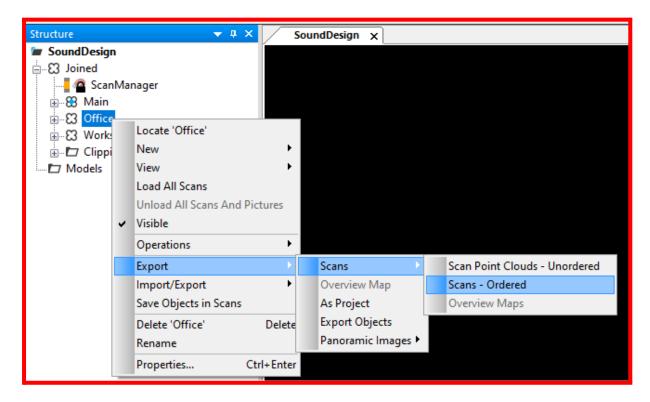
Double-check that the number of files in the export folder is as expected.

You can find a screenshot of what the final export folder should contain in the section <u>Reviewing a SCENE export</u>.

Step 1: Exporting **ordered** Scans via the Export tab:



Step 1 (alternative): Exporting a subset of the project as **ordered** scans via right-click in the project structure:



Steps 1 (b),(c),(d): Choosing the **E57** file format, enabling **separate** files and **pano images**:

Export Scan Points	;	×
Format: File Name:	E57 Files (*.e57) ✓ D:\Ablage\000_Demos\Export_Gorch_Fock\Scans\\$ Image: Demos Content of the separate file Image: Demos Content of the separate file	
Export Full scan Selection	Min. Distance: 0 (m) Max. Distance: 70 (m)	
Subsample Rows: Columns: Color and G Export Scan		

Step 2: Creating and exporting a color-corrected Project Point Cloud:

Explore	xport
esh Selection Create Virtual Mark Point	Project Point
	Create
Project Point Cloud / Scan Point Cloud Settings ×	Update
Filter Settings	C Delete
Full Color Detail Homogenize Point Density	
Cell Size 4 [mm]	
Apply Color Balancing	
Distance Filter Maximum Distance 30 [m]	
Export Project Point Cloud Format: E57 Files (*.e57)	×
File Name:	

Exporting full resolution panos from of SCENE

You should follow the steps in this section if either:

- your version of SCENE is too old to have the checkbox [X] Full Color Resolution
 Panorama Image to embed the panos into the E57 files, or
- you scanned some scans without colour and you want to display them in grayscale in Benaco (SCENE cannot currently embed grayscale panos into E57 files); in that case choose option (b) below.

Then you should export the panos as separate files:

- Export the RGB image data, into subfolder "panos". You have two choices:
 - Full-quality panoramas (recommended):
 Right-click on the desired Project or Cluster, and choose Export,
 Export Panoramic Images, Full Color Resolution.
 - b. Downsampled quality panoramas (not recommended, but faster and smaller): Choose Scan Resolution instead of Full Color Resolution. This will allow you to choose the image file type. Prefer PNG (a lossless format) over JPEG (a lossy format).

Structure	→ ậ X	SoundDesign 🗙	
ש SoundDesign ביים Scans	New		
Models	View •		
	Operations •		
	Import/Export	Export Objects	
	Delete 'SoundDesign' Delete	📃 Export Project	
	Rename	Overview Map	
	Properties Ctrl+Ente	Export Positions	
	Visibility •	Export Panoramic Images >	Scan Resolution
	Layer Manager		Full Color Resolution
	cayer managerii		

Exporting Ricoh panos from SCENE

Only if you use the Ricoh Theta camera integrated with the Faro scanner as a *replacement* of the Faro internal RGB camera, you cannot use "Full Color Resolution Panorama Image" because the Ricoh images do not count as "full resolution". Instead:

 In newer versions of SCENE (at least >= 2023.1), ensure each scan has a matching "PanCam Scan" otherwise, only grayscale intensity panos will be exported in the next step.

If they do not exist yet, right-click your project and choose **Operations, Create PanoCam Scans.**

Into subfolder "panos", export the Ricoh images that SCENE reprojected onto the laser origin (noticeable as it creates white outlines around the edges of objects). Right-click on the desired Project or Cluster, and choose Export, Export Panoramic Images, Scan Resolution.

Structure	<u>≁</u> û ×	SoundDesign x	
SoundDesign ⊕ Scans	New View		
i 🗁 Models	Operations •		
	Import/Export	Export Objects	
	Delete 'SoundDesign' Delete	📃 Export Project	
	Rename	Overview Map	
	Properties Ctrl+Enter	Export Positions	
	vertices the second sec	Export Panoramic Images >	Scan Resolution

• Optional, but very recommended:

Into the subfolder **"external-panos**", save the original Ricoh RGB photos. You cannot retrieve them from SCENE, but instead from the scanner's SD card, from the folder of each scan ("fls") in the subfolder "PanoCam".

Note these images need to be in **equirectangular**, **not double-fisheye** format. **Benaco can currently only process equirectangular** Ricoh panos in this step. If your panoramas are double-fisheye, you can skip this entire optional step. If you provide these images, Benaco can register them against the SCENE-reprojected images above, so that they are shown in the tour as well. Please check that these images are stitched equirectangular photos, not double-fisheye circles.

Any double-fisheye circle photos need to be stitched into equirectangular first.

See <u>Reviewing a SCENE export</u> for the expected folder structure.

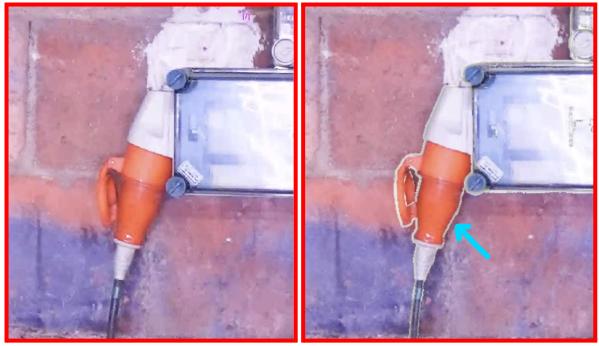
Exporting images from a non-Faro camera

SCENE optionally also supports importing photos that are made not by the laser scanner itself, but by a different camera mounted onto the scanner tripod in the same or a close-by position. It can colorize the scans using this external imagery.

You may want to use this external imagery in your Benaco tour. In this case, the export steps remain the same, but you need to additionally provide the external imagery into a folder: external-panos

Be aware that if you have used external imagery for colorization, the **Export Panoramic Images** functionality in SCENE will not export the external imagery, but re-colorized laser scans. You can recognize this by black or white outlines around objects:

Comparison between original external image vs. exported colorised scan panorama with outline:

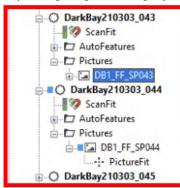


It would be desirable to show only the original imagery in the Benaco tour, using the image positions that SCENE has already computed ("PictureFit"). However, to our knowledge, SCENE does not provide a way to export the exact pose data of the original images. Their positions can be slightly offset, and the images will usually be placed with an arbitrary rotation around the laser's vertical rotation axis.

In absence of an export method, you can provide Benaco with the original images, and we will use photogrammetry to register (place) them automatically against the colorized scans you provided.

- If your original panoramic images (must be in equirectangular format) are managed outside of SCENE (preferable), simply copy them into the external-panos folder.
- If you can access them only through SCENE, re-export them by expanding the Pictures section of each Scan in the Structure view, Right-click on the image file -> Export, and choose preferably a lossless format (e.g. PNG).

Exporting original imagery that was imported into SCENE:



Reviewing a SCENE export

When you are done, the export folder should look as follows:

```
name-of-your-export-folder
      pointclouds
            myproject001.e57
            myproject002.e57
             . . .
      panos (only if your SCENE version cannot embed them into the .e57)
            myproject001.png
            myproject002.png
            Pano_FAR0_Scan_000.jpg (if you use the Faro-Ricoh integration
                                             the files are named this way
                                             instead)
             . . .
      coloring-pointclouds
            myproject-project-pointcloud-4mm.e57
      external-panos (if you use the <u>Faro-Ricoh integration</u> or make
                          additional panocam shots; must be equirectangular)
```

R0011533.JPG (named this way if you got the Ricoh equirectangular photo directly from the Faro SD card)

• • •

export					_		\times	
$\leftarrow \rightarrow \cdot \uparrow$ k example-faro	-project > export	~	ū	,∕⊂ Se	arch export			
☐ Name	Date modi	ified	Туре		Size			
pointclouds	22/02/202	1 16:55	File fold	ler				
panos	22/02/202	1 16:53	File fold	ler				
coloring-pointclouds	22/02/202	1 16:54	File fold	ler				
pointclouds			_	_				×
								^
$3 \text{ items} \leftrightarrow \rightarrow \checkmark \uparrow \checkmark \leftrightarrow \checkmark \bullet$	port > pointclouds		~	ū	,⊂ Sea	rch pointclo	ouds	
Name ^		Date modifie	d	Туре	e	Size		
C myproject000.e57		20/02/2021 18	3:45	E57	File	907.	861 KB	
C myproject001.e57		20/02/2021 18	3:46	E57	File	922.	640 KB	
C myproject002.e57		20/02/2021 18	3:47	E57	File	869.	073 KB	
panos						_		×
$\leftarrow \rightarrow \checkmark \uparrow$ - ex	port > panos		~	Ū	,⊂ Sea	rch panos		
□ Name ^	Date	Туре	2		Size	Tags		
属 myproject000.png	21/02/2021 05:19	PNG	6 File		180.464 KB			
📰 myproject001.png	21/02/2021 06:46	PNO	6 File		181.239 KB			
🔚 myproject002.png	21/02/2021 08:02	PNG	6 File		180.135 KB			
coloring-pointclouds						-		×
← → ~ ↑	(port > coloring-poi	intclouds	~	ۍ ،	,⊂ Sea	rch coloring	g-pointcl	ouds
□ Name		Date modifie	d	Тур	e	Size		
C myproject-project-	pointcloud-4mm.e	21/02/2021 2	0:55	E57	File	351.	772 KB	

Screenshot of the export folder and its subfolders:

Leica Cyclone REGISTER 360

Provide Benaco with an export folder containing the following:

- 1. In the **Report** stage tab, choose subtab **Properties** -> subtab **Publish options.**
- 2. Tick the box [x] E57 (as separate files).
- Conditional: If you scanned the entire project without colour, additionally export grayscale image panoramas by ticking the box [x] Pano images.
- 4. Click "Publish".

If you scanned with colour, you do not need to export panorama images separately; the E57 files already contain them.

When you are done, the export folder should look as follows:

```
name-of-your-export-folder/
BLK360_3501552_Setup3.e57
BLK360_3501552_Setup4.e57
...
```

Settings for best quality

1. **Before importing** your scans ("setups") into REGISTER 360, in the **Settings**, change the **Pano image** dropdown to the highest resolution.

This is optional. It will increase the import time, but also the photo resolution.

2. Also in the Settings, tick the checkbox **[x] Export cleaned point cloud...** such that your point cloud cleaning reflects in the export.

Screenshot of the E57 publishing options:

IZE	\rightarrow		
Assistant	Properties		
Report O	ptions Publish Option	s	
ים 📗	TruView Local		
	TruView Enterprise		
יש	TruView Cloud		
· 🛛 📙	etStream Enterprise		
	PTS (cloud)		
	PTG (setups)		
	PTX (as one file)		
]_ [[separate files		
	57 (as one file)		
	57 (as separate files)	C:/Users/Francesco/Downloads/test-project	
	rt Options		
	RCP (cloud)		
L	setups		
		Publish ×	Cancel

Screenshot of the Pano images publishing option; tick this for grayscale-only projects:



Setting import and export options:

Settings	×
General Links Licenses Cloud-to-Cloud Filtering Rendering	
Units:	
Length unit meter	
Foot type International -	
Max decimal digits 3 🗘	
Temperature unit celsius 🔻	
Measurement Annotation Style Simple 🔻	
Animations:	
✓ Use animations for view transitions	
Import:	
Create SiteMap tab on pre-import of RTC360 jobs & P-Series projects (After changing this setting, un-check then re-check the RTC360 job)	
BLK2GO: create 1024	
Import Performance 4096	
Pano Image 5120	
External Camera Auto-adjust if camera orientation not done 🔻	
Export: Export cleaned point cloud for E57, PTG, PTX and RCP formats	
Export panoramic scan with panorama export	
Create point cloud during finalized registration creation	
OK Cancel	

Exporting Cyclone REGISTER projects without colour

If you want to show scans that were scanned without colour (laser intensity only) in Benaco, you need to use the following workaround to extract laser intensity renderings from Cyclone REGISTER 360.

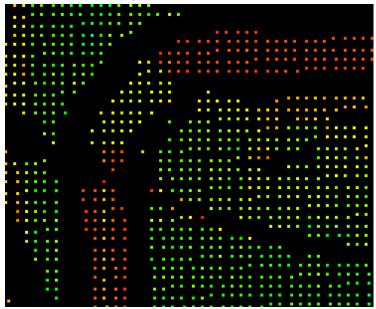
In the Settings, enable "[x] Export panoramic scan with panorama export".



In the Setups list on the left, select all Setups, right-click, and choose **Export Panoramic Images...** -> **Export as jpg...**

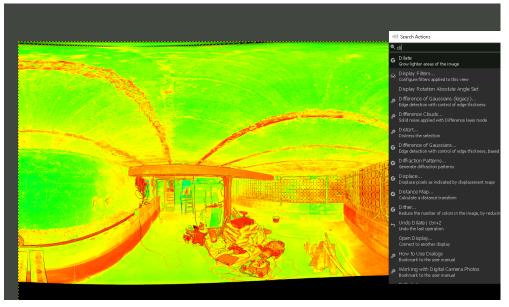
Collapse Bundle Collap	se All		
🔽 🚺 k4-cellar-buildingsite-rtc360-1 (1)			
🔻 👶 Bundle 1 (4)			
🕨 💿 k4-cellar-buildingsite-rtc36	0- 0 📧		
🕨 💿 k4-cellar-buildingsite-rtc36	0- 0 📧		
🕨 💿 k4-cellar-buildingsite-rtc36	0- 0 📧		
🕨 💿 k4-cellar-buildingsite-rtc3ন			
	Edit HDR Image		
	Batch Import Image		
	Generate Setup Archive(s)		
	Export Panoramic Images	Þ.	Export as jpg
	Re-Import Panoramic Images		Export as exr
	Restore Deleted Points	•	Export as jpg and exr
	Delete Links for selected Setups		
	Rename Selected Setups		
	Import images		

This creates (next to each exported JPG image) a PNG image with intensity values, in the resolution of the imported image (e.g. 5120 if that's what's configured in the settings), but only with those pixels filled in that are in scan resolution. Thus, we have sparse pixels on a black surface. This makes the image appear almost black until we zoom in:



The almost-black images are not yet suitable for Benaco.

You need to process them for normal display, using e.g. GIMP's "Dilate" filter, e.g. applying it twice for the above; this fills in the black parts:



You have to do that for all PNG files, ideally automatically. You can do that e.g. with GIMP's batch scripting functionality. It is recommended to export the improved photos as JPG instead of PNG for faster uploads.

You may optionally turn the colours into greyscale with GIMP, if you prefer that over Cyclone's green/red colour renderings.

Then you can upload those images into a **"panos**" folder along with your normal E57 upload. If your uploaded improved files are named like your scan files (but with **.jpg** or **.png** instead of **.e57**), our processing will pick them up.

Adding higher-resolution Cyclone photos later

If you are working with a project where the "Pano Image" resolution setting was set low during import, and you want to upgrade their the resolution after the import, you can use the following workflow:

- a. Ensure you have a "Cyclone PUBLISHER Pro" license, otherwise the required context menu items will be missing.
- b. Create a completely new project, importing the original source data with the highest resolution setting (takes a while).
 Do not perform any registration in the new project.
- c. In the workflow tab "REVIEW AND OPTIMIZE", select all setups in the setups list, **Right click -> Export Panoramic Images...** -> **Export as esr...**, into a temporary folder.
- d. Switch back to the registered project that has the low-quality photos.
- e. Select all setups in the setups list, **Right click** -> **Re-Import Panoramic Images...**, from the temporary folder.

Re-importing higher resolution images for a project whose **Pano image** resolution was set lower than desired at original import time:

Collapse Bundle Collap:	se All	
🔽 🔰 k4-cellar-buildingsite-rtc360-1 (1)		
👻 👶 Bundle 1 (4)		
k4-cellar-buildingsite-rtc360	D- O 🔝	
🕨 💿 k4-cellar-buildingsite-rtc360	D- O 🔝	
🕨 💿 k4-cellar-buildingsite-rtc360)- O 🔝	
🕨 🕒 k4-cellar-buildingsite-rtc360		
	Edit HDR Image Batch Import Image	
	Generate Setup Archive(s)	
	Export Panoramic Images 🕨	Export as jpg
	Re-Import Panoramic Images	Export as exr
	Restore Deleted Points	Export as jpg and exr
	Delete Links for selected Setups	
	Rename Selected Setups Import images	
	import images	
Collapse Bundle Colla	apse All	
Collapse Bundle Colla		
💌 🎵 k4-cellar-buildingsite-rtc360-1 (*	D	
 k4-cellar-buildingsite-rtc360-1 (* & Bundle 1 (4) 	1) 360- 0 🗔	
 k4-cellar-buildingsite-rtc360-1 (* Bundle 1 (4) k4-cellar-buildingsite-rtc3 	1) 360- 0 🗔	
 k4-cellar-buildingsite-rtc360-1 (Bundle 1 (4) k4-cellar-buildingsite-rtc3 k4-cellar-buildingsite-rtc3 k4-cellar-buildingsite-rtc3 	1) 360- 0 🛋 360- 0 🛋 360- 0	
 k4-cellar-buildingsite-rtc360-1 (Bundle 1 (4) k4-cellar-buildingsite-rtc3 k4-cellar-buildingsite-rtc3 k4-cellar-buildingsite-rtc3 	1) 860- 0 🖃 860- 0 🖃 860- 0 🔄 860- 0 Edit HDR Image	
 k4-cellar-buildingsite-rtc360-1 (Bundle 1 (4) k4-cellar-buildingsite-rtc3 k4-cellar-buildingsite-rtc3 k4-cellar-buildingsite-rtc3 	1) 360- 0 💽 360- 0 💽 360- 0 💽 360- 0 Edit HDR Image Batch Import Image	
 k4-cellar-buildingsite-rtc360-1 (Bundle 1 (4) k4-cellar-buildingsite-rtc3 k4-cellar-buildingsite-rtc3 k4-cellar-buildingsite-rtc3 	1) 360- 0 360- 0 360- 0 360- 0 Edit HDR Image Batch Import Image Generate Setup Archive(s)	
 k4-cellar-buildingsite-rtc360-1 (Bundle 1 (4) k4-cellar-buildingsite-rtc3 k4-cellar-buildingsite-rtc3 k4-cellar-buildingsite-rtc3 	1) 860- 0 860- 0.	
 k4-cellar-buildingsite-rtc360-1 (Bundle 1 (4) k4-cellar-buildingsite-rtc3 k4-cellar-buildingsite-rtc3 k4-cellar-buildingsite-rtc3 	1) 360- 0 360- 0 360- 0 Edit HDR Image Batch Import Image Generate Setup Archive(s) Export Panoramic Images Re-Import Panoramic Images	
 k4-cellar-buildingsite-rtc360-1 (Bundle 1 (4) k4-cellar-buildingsite-rtc3 k4-cellar-buildingsite-rtc3 k4-cellar-buildingsite-rtc3 	1) 360- 0 360- 0 360- 0 Batch Import Image Generate Setup Archive(s) Export Panoramic Images Re-Import Panoramic Images Restore Deleted Points	
 k4-cellar-buildingsite-rtc360-1 (Bundle 1 (4) k4-cellar-buildingsite-rtc3 k4-cellar-buildingsite-rtc3 k4-cellar-buildingsite-rtc3 	1) 860- 0 860- 0 800- 0	
 k4-cellar-buildingsite-rtc360-1 (Bundle 1 (4) k4-cellar-buildingsite-rtc3 k4-cellar-buildingsite-rtc3 k4-cellar-buildingsite-rtc3 	1) 360- 0 360- 0 360- 0 Batch Import Image Generate Setup Archive(s) Export Panoramic Images Re-Import Panoramic Images Restore Deleted Points	

Leica Cyclone CORE

Proceed analogous to the section "*Leica Cyclone REGISTER 360*", with the following special settings:

 Check [x] Use Setup Name as Scan Name (Otherwise your scans will be named "Scan 1", "Scan 2", ... instead of their semantic names.)

Step 1: Enabling "Use Setup Name as Scan Name"

O Cyclone - Navigator		1	12		×
File Edit View Conf	igure Create Tools User Apps He	lp			
юсь 🖁 💼 🛪	🕻 📑 🗃 🦓 🦑 🛤 🛃 🗷	ſ			
SERVERS MODO MODO MODO MODO Mastro Apart Market ScanW ScanW	009 (unshared) ments _2024_03_01_02_04_ _2024_03_01_02_04_ /orld [LXT]				
	S Export ScanWorld X	L			4.1
	 Export Scans Export the Point Intensities Export the Point Colors Export the Point Normals Export Images Use Setup Name as Scan Name 				
Show License Informati	Use Unit Specified in Preferences		Lice	nse Man	ager
CYCLONE MODULES IN L	REGISTER				

Z+F Laser Control (terrestrial)

Provide Benaco with an export folder containing the following:

- 1. Optional (but recommended):
 - a. Perform color correction for more consistent colors.
 - Use Color > Color adjustment with neighbourhood scans.
 - b. Thin out the scan for a more equal point distribution.
 - Use Processing filters, enable the Thin filter, and set
 Distance = 0.001 m (1 mm)
- 2. The point cloud in E57 format, into subfolder "pointclouds":

Use the function **Export scan**.

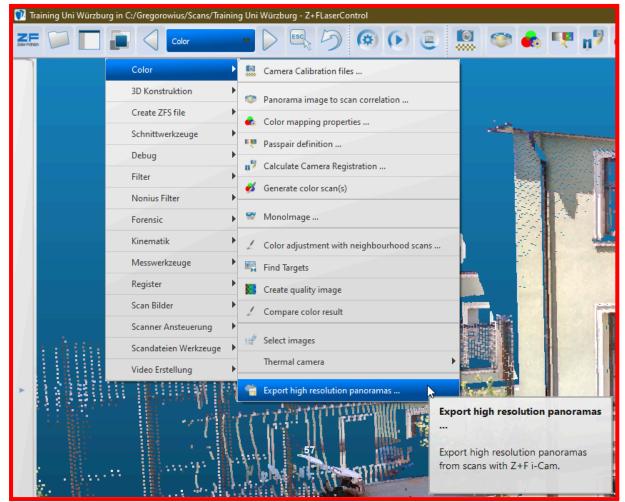
- a. In the tab Format, choose E57.
- b. In the tab Format settings:
 - 1. Tick the checkbox [X] Export RGB values for each point
 - 2. Set the dropdown Primary view mode to Color.
- 3. The RGB image data, into subfolder "panos".

Use the function **Color > Export high resolution panoramas**.

- a. Set the Image type:
 - Prefer **PNG** (a lossless format) over JPEG (a lossy format).
- b. Set the resolution to the highest possible.

Step 2: Export format settings to ensure color is present:

🔃 Export project iter	ms	•		
Scans		Format Format settings Data selection Filter settings		
201907		Choose color mode for exported points		
201907				1
201907		Export RGB values for each point		
201907			_	
201907		Primary view mode Color	•	
201907		•		
201907				
201907				
201907				
201907				
201907				
Choose all	Choose none Advanced selection			
Export path	C:/Gregorowius/Scans/Training Uni Würzbur	rg/Export		
Coordinate system	UTM		•	
		Result		
		Export	Clo	ose



Step 3: Opening the "Export high resolution panoramas" function:

When you are done, the export folder should look as follows:

```
name-of-your-export-folder

pointclouds

myproject_1001.e57

myproject_1002.e57

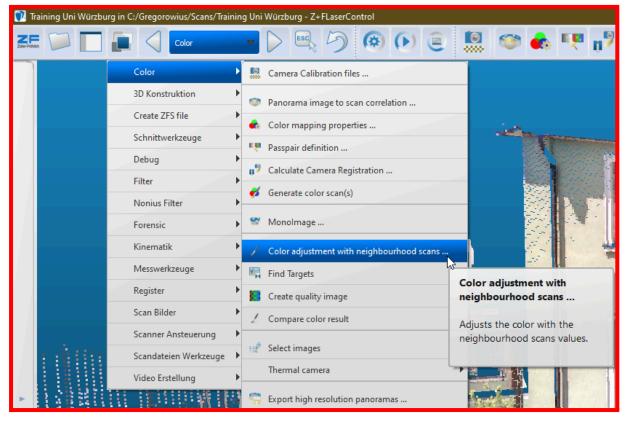
...

panos

myproject_1001.col-panorama_sh.png

myproject_1002.col-panorama_sh.png

...
```



Optional Step 1: Opening the "Color adjustment with neighbourhood scans" function:

Optional Step 1: Applying a "Thin filter":

Preprocessing filters	\triangleright		—	×
	Additional			
Move to '.temp' folder				
Scans		Filters		_
Scan	Filter	Parameter Value	Unit	
20190716-1	Vertical invalid filter	Distance 0.001	m	
20190716-2	☑ Intensity filter			
20190716-3	Range filter			
20190716-4	Mixed pixel filter			
20190716-5	Mixed pixel filter (enhanced)			
20190716-6	Single pixel filter			
20190716-7	🗹 Thin filter			
20190716-8	Critical compensation			
20190716-9	0			
20190716-10				
20190716-12				
20190716-12_Selektion_1				
	Removes pixels to obtain the minimum required distance Pixels of neighbouring lines are not considered. Maybe switch it off.	e between pixels/pixel spacing per scan i	line.	
Advanced selection	Force		Reset to defau	ılts
			Run	ancel

Trimble RealWorks

For all operations, first **select your project** (it is the child of "WorkSpace" in the "Scans" project tree explorer). For large projects, you need to wait a few seconds after this.

Provide Benaco with an export folder containing the following:

1. The point clouds in E57 format, into subfolder "pointclouds".

From the **Home** tab, choose **Export** and **Export TZF Scans of Selected Stations** (Structured E57, ...).

For older versions (< 2024.00), this option is called **Convert to E57**. In the dialog, choose **E57**.

- 2. The equirectangular panorama images, into subfolder "panos".
 - a. For current versions of RealWorks (>= <u>2024.00</u>):
 - 1. From the **Imaging** tab, choose **Export Panorama with Location and Orientation**.
 - b. For versions >= <u>12.4.2</u> but < <u>2024.00</u>:
 - 1. From the Home tab, choose Export and Export TZF Images.
 - c. For older versions of RealWorks (< <u>12.4.2</u>):
 - From the Edit tab, click Create Station Images from TZF Color. (If this button is greyed out, see Exporting laser-intensity panos from RealWorks.) This generates cube maps and ensures they are in the RTF below.
 - 2. For each scan station separately, click it in the upper "WorkSpace" panel, select all 6 cube sides from the lower panel (e.g. "Scan 1_front", "Scan 1_top" etc.), and in the Home tab click Export -> Export Images, which pops up 6 save dialogues. This workflow is a bit tedious (takes a few seconds per scan station); we recommend upgrading to RealWorks >= 12.4.2 if possible.
- 3. The poses of the images, into the top-level folder.
 - a. For current versions of RealWorks (>= <u>2024.00</u>):
 - 1. Move the file "panos*.csv" to the top-level of your folder, and rename it to "trimble-cameras.csv".
 - 2. From the **Home** tab, choose **Export** and **Export Station Positions to CSV File**.

Save the file as "trimble-positions-mm.csv".

- In the popup, set **Unit** to **Millimeters**.
- b. For versions $\geq 12.4.2$ but ≤ 2024.00 :
 - 1. Select your project (it is the child of "WorkSpace" in the "Scans" project tree explorer).
 - 2. From the **Imaging** tab, choose **Export** and **Export Location and Orientation**.

(If this button is greyed out, see <u>Exporting laser-intensity panos from RealWorks</u>.) Save the file as "trimble-cameras.csv" with CSV format. Open it with a text editor and verify that it has the format "filename, x, y, z, qx, qy, qz, qw".

c. For older versions of RealWorks (< <u>12.4.2</u>):

- Increase the pose precision by going into the RealWorks: In the Preferences, go to Units and change Decimal Places to "8".
- 2. From the **Home** tab, choose **Export** and **Export Object Properties**. Save the file as "trimble-poses" with **RTF File Format**.

If you use RealWorks < 12.4.2, please upgrade. The older format is a pain to maintain and not very reliable to use. It will also cause you lots of manual clicking.

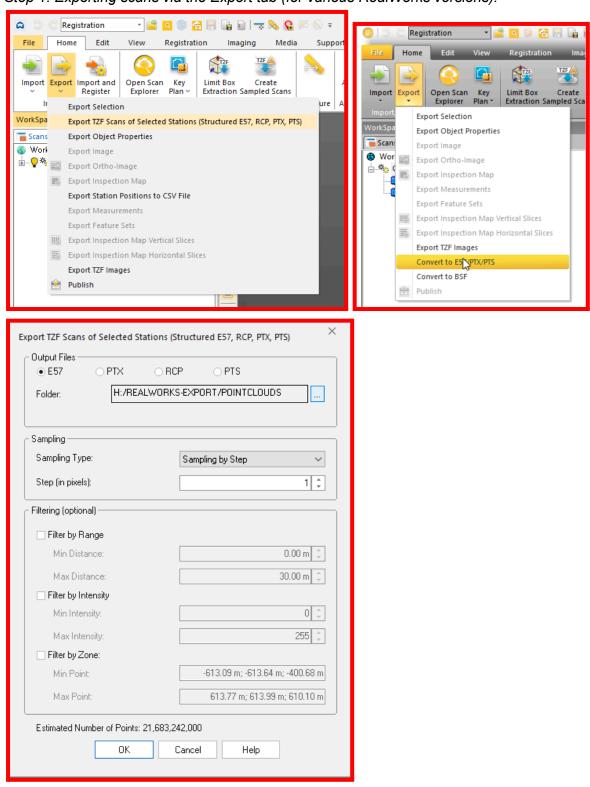
Note we are aware of a bug in Trimble RealWorks that makes the export of "trimble-cameras.csv" fail, producing an almost-empty CSV file if scan station names contain non-English (non-ASCII) characters. As a workaround, each station name can be renamed individually in RealWorks.

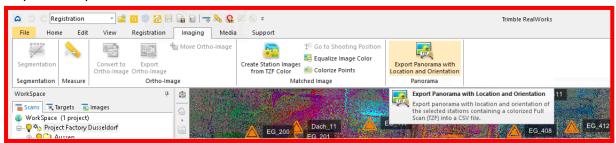
When you are done, the export folder should look as follows:

For current versions of RealWorks:

```
name-of-your-export-folder
           trimble-cameras.csv
           pointclouds
                 Station_1.e57
                 Station 2.e57
                  . . .
           panos
                 Station_1_Color.jpg
                 Station_2_Color.jpg
                 . . .
For older versions of RealWorks (< <u>12.4.2</u>)::
     name-of-your-export-folder
           trimble-poses.rtf
           pointclouds
                 Station_1.e57
                 Station_2.e57
                 . . .
           panos
                 Scan 1_back.jpg
                 Scan 1_bottom.jpg
                 Scan 1_bottom.jpg
                 Scan 1_front.jpg
                 Scan 1_left.jpg
                 Scan 1_top.jpg
                 Scan 2_back.jpg
                 . . .
```

Step 1: Exporting scans via the Export tab (for various RealWorks versions):





Step 2a1: Export Panorama with Location and Orientation:

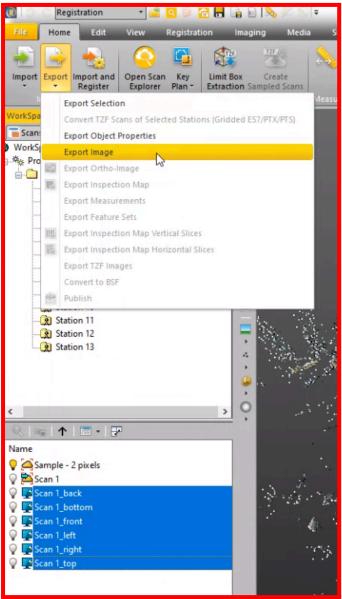
Step 2b1: Exporting pano images as TZF:

) C 🕦	R	Registration 🔹 🖻 📴 🗐 📑 📄	🔊 🔓 📈	S =		
File	Ho	me Edit View Registration Imagin	ng Media	Si		
Import E	xpo		Create ampled Scans			
lr.		Export Selection		ası		
WorkSpa		Convert TZF Scans of Selected Stations (Gridded E57	7/PTX/PTS/RCP)			
Scans		Export Object Properties				
🚳 Worl		Export Image	_		~	
	22	Export Ortho-Image	Export	TZF Images	×	
	6)	Export Inspection Map				
		Export Station Positions to CSV File Export Measurements	cSt	elect Layer(s) to Export		
	125	Export Measurements Export Feature Sets				
		Export Inspection Map Vertical Slices		 Luminance only 		
		Export Inspection Map Horizontal Slices				
		Export TZF Images		 Color only 		
f	<u>e</u>	Publish				
				 Both Luminance and Color 		
				OK Cancel		

Step 2c1: Creating Station Images:

C Registration	• 🖆 🔍 🌑 🔂 🗟 🔓	🖻 🔫 🗞 🚱	¢≊ 💿 🔤 × ∓	
File Home Edit Vi	ew Registration Ima	ging Media	Support	
🍲 Cut 🛛 💥 Delete	🏐 Shift Project	6	👔 👕 Modify TZF Path 🛛 🛛 🚳 Create Th	umbnails
🚡 Copy 🎼 Delete Geometry	🔯 Flip Project Vertical Axis		🕰 💿 Color Points by Height 👼 Create Sta	ation Images from TZF Color
📄 Paste 🛛 🙀 New Group	🔯 Merge Projects	RealColor TZF	Scan 📅 Re-Project TZF Scans 🛛 📑 Get TZF S	can Files Ex
General	Project		TZF Scan	
WorkSpace		چې ډ	🖉 Create S	tation Images from TZF Color
🔚 Scans 🛛 🔁 Images				tation Images from TZF Scan elect a set of stations that
		+	contain	TZF Scans or the entire project 🕻
🖓 🎅 ST_00_19			then sta	rt this command.

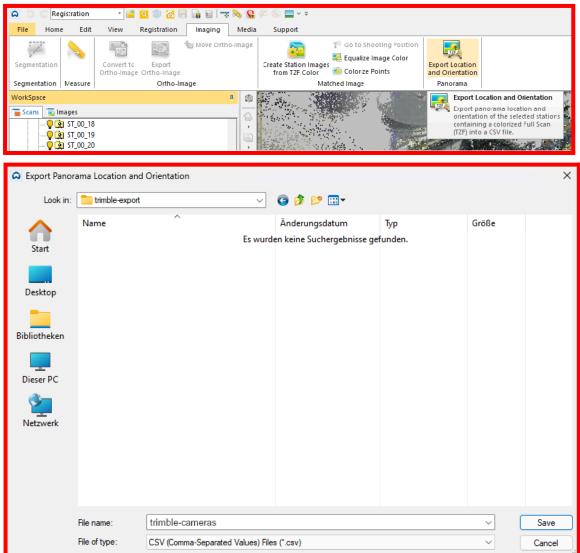
Step 2c2: Exporting cube side images:



File	Home	Edit	View	Registrat	ie			
					Export Station Position	is to CSV File		\times
Import	Export	mport and Register	Open Scan Explorer		Export Frame	Home	~	
li	EX	oort Selectio			Unit	Millimeters	~	
WorkSpa		oort TZF Sca	ns of Selecte	d Statior				
🔚 Scans		oort Object I	Properties		Export	Cancel	Help	
🌍 Work	Exp	ort Image						
<u>⊨</u> … ₽ *	Exp	ort Ortho-I	mage	L				
P. 1	🖪 Exp	ort Inspecti	ion Map					
	Exp	ort Station	Positions to	CSV File				
	Exp	ort Measur	ements					
pan	ios ntclouds				11/18/2024 3:41 PM 11/18/2024 4:16 PM	File folder File folder		
	ntciouus nble-cam	aras c.s.			11/18/2024 3:41 PM	CSV File		
		tions-mm.c	sv		11/19/2024 10:00	CSV File		
- sin	1010 0001				11,15,24211444	0001110		
<						>		
File name	:	trimble-posit	tions-mm.csv		~	Save		
File of typ			na-Separated V	/alues) File	es (*.csv) 🗸 🗸	Cancel		

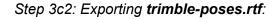
Step 3a2: Exporting station positions as CSV:

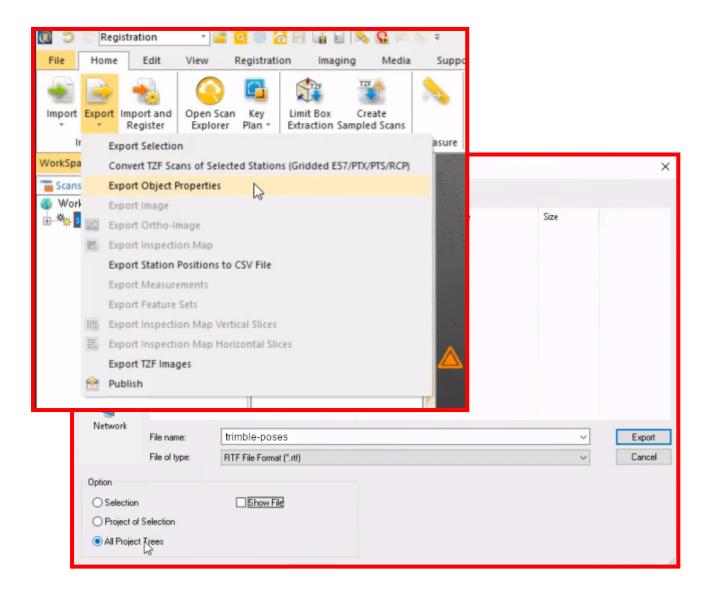
Step 3b1:	Exporting	pano	images	as	CSV:
-----------	-----------	------	--------	----	------



Step 3c1: Setting decimal places high:

Viewer	Display Property	lies			
	Decimal Places:				
Tools					
HD Display					
Navigation					
General	Unit System -				
	Length:	Meters			
Units	Diameter	Matau			
Print	Diameter.	Meters			
Improvement Program	Angle:	Degrees			





Exporting laser-intensity panos from RealWorks

RealWorks cannot currently directly export uncoloured scans as panorama photos. Some important buttons, such as "Create Station Images from TZF Color" and "Export Location and Orientation", will be greyed out.

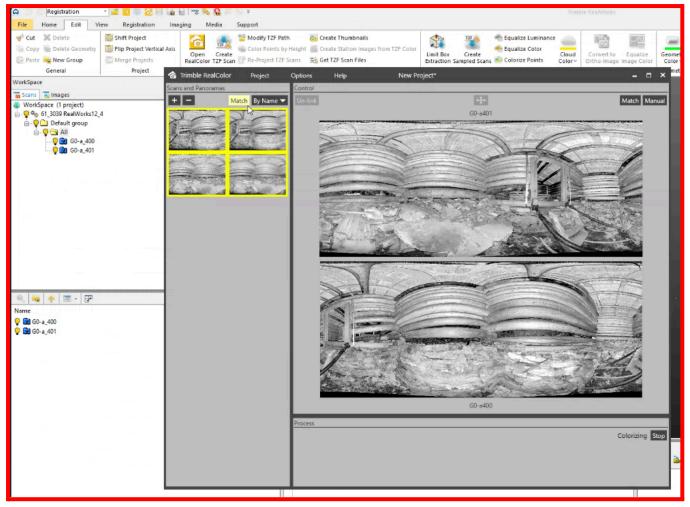
If you wish for Benaco to show grayscale intensity laser panoramas in Benaco for situations where you scanned without colour, you need to use the following workaround:

Export laser intensity panos from RealWorks and re-import them; then RealWorks will treat the greyscale images as RGB images, and make the above needed buttons available.

Steps:

- Export all greyscale panoramas as JPG into a folder via Home -> Export -> Export TZF images. These images are not useful for Benaco, do not upload them to Benaco.
- 2. Edit -> Open RealColor.
- 3. Drag-drop in the JPGs you exported in step 1.
- 4. In the RealColor GUI, order the images by Name, ensure images match in the left column.
- 5. Select all images with the mouse. Click Match.
- 6. **Save** the project, close the RealColor GUI.
- 7. Delete (in Windows Explorer) the greyscale panoramas folder you created in step 1.
- 8. Proceed to export normally as per our instructions in section Trimble RealWorks.

Re-importing intensity-only panos into RealWorks to make them RGB panos:



Riegl RiScan

Provide Benaco with an export folder containing the following:

- 1. The point clouds in E57 format, into subfolder "pointclouds".
 - Select all scans, choose Export pointclouds and select ASTM E57 (.e57) as format.
 - a. Set "Color" to True Color.
 - b. Untick the checkbox [] Keep uncolored points in.
 - c. Under Coordinate System Settings, choose your coordinate system:
 - i. If you do not wish to use any geo-referencing, choose **Project Coordinate System (PRCS)**.
 - ii. If you wish to use a specific coordinate system, choose it from the settings icon, and place in your export folder a text file
 "source-crs.txt" containing as a single line the EPGS name of
 the coordinate system, for example: EPSG:2056
 - iii. If you do not care which coordinate system shall be used for geo-referencing, choose Global Coordinate System (GLCS) (which is WGS 84), and place in your export folder a text file "source-crs.txt" containing as a single line: EPSG:4978
 - d. Optional:

You may enable **Export Amplitude as E57 extension attribute** and **Export Amplitude as E57 extension attribute**. They are currently unused but Benaco may be able to display them in the future.

You may choose to **Save settings...** to easily re-use these settings.

- 2. The equirectangular panorama images, into subfolder "panos".
 - Select all scans, choose Panorama Export.
 - a. Untick the checkbox [] Autocrop panoramas.
 - b. Tick [X] Photo panoramas and choose image quality Very high.

Paths to steps 1 and 2: The export button:



Step 1: Pointcloud export settings:

Export	pointclou	ud(s)			>	<		
Export Se	ttings				Page 2 o	f2		
Export Form	nat: AST	TM E57 (.e57)	 Restore d 	lefault Save	Settings 🖛			
Export Format Settings								
Intensity:	Reflecta	eflectance as Intensity V						
	-25][5 dB						
Color:	True Col	or	~					
Write In	ntensity a	s positive numbers star	ting at 0.0					
States in		as E57 extension attrib						
0		ce as E57 extension att						
		om SCANPOSIMAGES fo						
	inages in	SIT SCARE OSTINACES IN	luci					
Coordinate	Systems	Settings						
Global coor	dinate sy	stem (GLCS)	~	Ľ.	Unit: m 🗸			
Split In	to Files - I	By Named Point Attribut	e Value					
Point Attrib	ute Name	Window Echo Imp	act Corrected		~	I		
Point Attrib	ute Value			1		1		
Sele	Select All							
Selec	t None							
Output Set	tings					•		
Folder: E	:\6970\69	70.RISCAN\RIPANO\			2			
Combine	Data	Keep uncolor	ed points in:	White	~			
🖛 Bac	ł	Next 📫		ОК	Cancel	Ť		
Dac	N.	IVEXL -		UK	Cancer			

Step 2: Panorama export settings:

🚸 Wizard Panorama Export
Panorama Export Settings
General Settings
Autocrop panoramas: Export CSV: Coordinate Syst
Panoramas
Scan data panoramas
Export depth panorama
Export for each Scanposition: 💿 One scan data panorama
 COLLECTIONS VIEWTYPES Reflectance (grayscale) Reflectance (reflector) Reflectance (chrome orange) True color Single color (white)
Add new View Type
Photo panoramas
Image quality: Very high 🗸
Export to
Folder: D:\Test Benaco\Bilder
Open folder after export
Hext 🛶

When you are done, the export folder should look as follows:

```
name-of-your-export-folder

source-crs.txt ← if you chose a point cloud coordinate system

pointclouds

ScanPos001 - SINGLESCANS - 230428_170714.e57

ScanPos002 - SINGLESCANS - 230428_170853.e57

...

panos

ScanPos001.jpg

ScanPos002.jpg

...
```

Topcon MAGNET

Preparation:

1. During processing, ensure that your scans are colorized ("Colorize Scan from Images") and panoramas are created ("Stitch Panoramas").

Provide Benaco with an export folder containing the following:

- 2. Right-click the project to export in the Workspace panel, choose Export...
- 3. Point clouds as E57, panos as JPEGs:
 - In the **Exporters** list, **Add...** the following entries:
 - a. Scans as **E57** file format.
 - b. Panorama as JPEG file format.

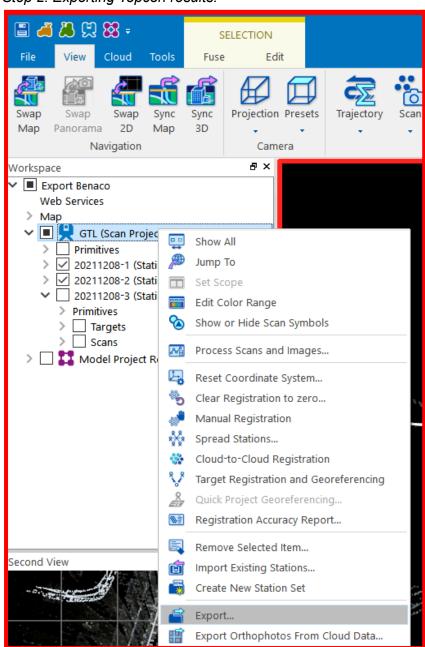
Choose "Transform coordinates" as **Registered**, "Distance Units" as **Meters**.

When you are done, the export folder should look as follows:

name-of-your-export-folder 1_SCN0001.e57 1_SCN0001.jpg 2_SCN0001.e57 2_SCN0001.jpg ...

neral		
Pose Scan		
Status: 🗹 Current		
Prerequisites: None		
Precision	: 0,001m ‡	
	: 0,001m \$	
		Start
Edge Noise Reduction		
Surface Smoothing Limit Distance		
Prerequisites: 🗹 Pose Scan	- Current	Start
Stitch Panoramas		
Stiter Faroranias		
Status: 🗹 Current		
Status: ☑ Current Prerequisites: None	8000 x 4000 ~	Start
Status: 🗹 Current Prerequisites: None Resolution:	8000 x 4000 × 20,00m ‡	Start
Status: 🗹 Current Prerequisites: None Resolution:		Start
Status: 🗹 Current Prerequisites: None Resolution:		Start
Status: 🗹 Current Prerequisites: None Resolution: Radius:		Start
Status: 🗹 Current Prerequisites: None Resolution: Radius: Filter Scan	20,00m ÷	
Status: ✓ Current Prerequisites: None Resolution: Radius: Filter Scan Status: ✓ Current Prerequisites: ✓ Pose Scan	20,00m ÷	Start
Status: 🗹 Current Prerequisites: None Resolution: Radius: Filter Scan Status: 🗹 Current	20,00m ÷	

Step 1: Processing options to enable scan colorization and pano stitching:



Step 2: Exporting Topcon results:

Export Scan Project - SCN0001, SCN0	001, SCN0001		×
Locate output			
Output path:	D:\Benaco		Choose
Format data			
	Data type	File format	
	Scans	E57 file format (*.e57)	
	Panorama	JPEG file format (*.jpg, *.csv)	
			Add
Exporters:			Edit
Exporters.			
			Remove
Transform coordinates			
	O Unregistered	Registered Geodetic	
Coordinate system:			Choose
Convert units			
Distance Units			
Meters	O US Feet	○ I Feet	
Angle Units			
O Degrees		ddd,mm,ss	
			OK Cancel

Step 3: Configuring data types to export:

Steps 3a and 3b: Adding the "Scans" and "Panorama" exports:

log Add Expo	orter		×	
Data type: File format:	Scans E57 file format (*.e57)	*	
Polar Co		neters regardless of the dialog setting.		
	Add Expo	orter		×
	Data type:	Panorama		•
	File format:	JPEG file format (*.jpg, *.csv) JPEG file format (*.jpg, *.csv)		<u>ب</u>

PinPoint

Provide Benaco with an export folder containing the following:

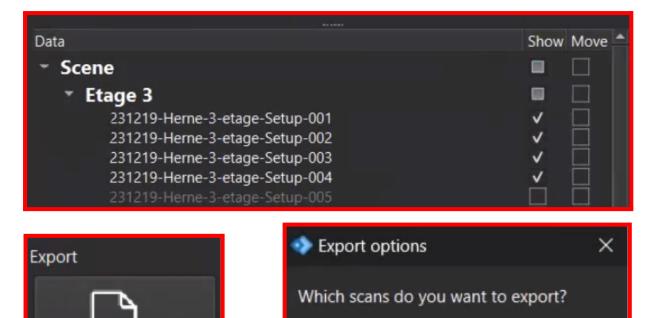
- 1. Mark all scans you want to export as **Show**.
- 2. Click the **E57** export button.

E57

3. Ensure to check [x] Mark deleted points as invalid.

When you are done, the export folder should look as follows:

```
name-of-your-export-folder/
Myproject-Setup-001.e57
Myproject-Setup-001.e57
```



- All scan positions
- Visible scan positions only

Export options

- Write to single file
- Colorize using intensities if possible

Cancel

Mark deleted points as invalid

OK

PointCab

Provide Benaco with an export folder containing the following:

- 1. Add a **Cloud Export** action to the job list.
 - a. Set **Filter** to **Separate scans**.
 - b. Set Format to e57.
 - c. Ensure **Color** is enabled.
- 2. Export all scan images as PNG or JPEG, with file names matching the E57 files.
 - a. In the **Advanced Importer**, right-click a list entry and choose **All Scans > Save all Panoramas**

Note that PointCab (as of September 2024) cannot yet export the *original* panoramas captured by the device for all laser scanners; it may export panorama images generated by *reprojecting* the color point cloud onto an image.

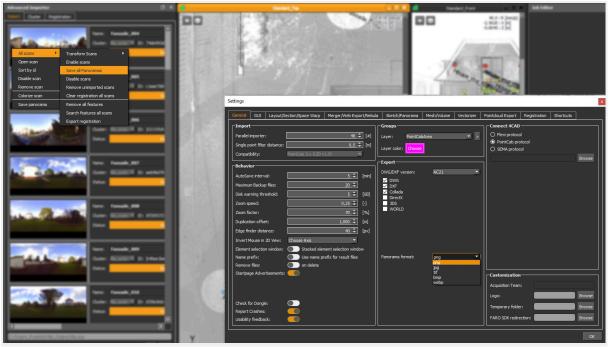
When you are done, the export folder should look as follows:

```
name-of-your-export-folder/
pointclouds/
myproject001.e57
myproject002.e57
...
panos/
myproject001.png
myproject002.png
...
```

Step 1: Exporting point clouds:

Prozessierung	-		_
Filter:	Separate Scans		
Reduktion:			
Blockgröße:		0,100	[m]
Format:	e57		
ASCII-Trennzeichen:			
Reflektivität:			
Farbe:			
Scan-Radius:	10000 m		
🤝 Scan Positione	n		-
Image: V Scans			
💼 Job-Liste 🗙			
Standard_T	op.lse	Grundriss	î
Standard_F	ront.lse	Section	
Standard_L	eft.lse	Section	
Cloud_0.e57		Cloud Export	Ţ
			ø
	┝ Alle Jobs b	erechnen	

Step 2: Exporting panoramas:



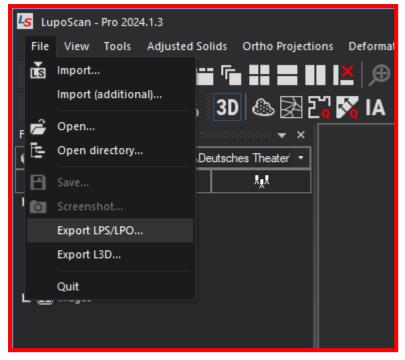
(Image from https://pointcab-software.com/en/category/tips_and_tricks/)

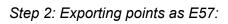
LupoScan

Provide Benaco with an export folder containing the following:

- The point cloud in E57 format, into subfolder "pointclouds": Use the function File > Export LPS/LPO. In the tab Format, choose E57.
- The RGB image data, into subfolder "panos".
 Use the function File > Export LPS/LPO.
 In the tab Format, choose Colour.
- 3. A file "exporter.txt" containing this text: luposcan

Step 1: Selecting the export menu:





Export LPS/LPO		×
D:\Lupos3D\Testdaten_Farbe\Deutso D:\Lupos3D\Testdaten_Farbe\Deutso D:\Lupos3D\Testdaten_Farbe\Deutso D:\Lupos3D\Testdaten_Farbe\Deutso	hes Theater\DT_B_622.lps hes Theater\DT_B_623.lps	
Export LPS/LPO	3D Remove a	all Remove
Format	E57	•
Toront disardary	D:\Lupos3D\Testdaten_Farbe\Deutso	nhas Thester/Banaco
Target directory		
Increment	<u>'</u>	
Interval of intensities	auto	· ·
Interval		
RGB from intensities		
Background colour		
LPS/LPO/E57: Turn upside down		
Channel	Intensities	•
Transparency		
		Start

Step 3: Exporting panoramas:

Export LPS/LPO			····· ×
D:\Lupos3D\Testdaten_Farbe\Deutso D:\Lupos3D\Testdaten_Farbe\Deutso D:\Lupos3D\Testdaten_Farbe\Deutso D:\Lupos3D\Testdaten_Farbe\Deutso	hes Theater\DT_B_622.lps hes Theater\DT_B_623.lps hes Theater\DT_B_624.lps		
Export LPS/LPO	AgA 3D	Remove all	Remove
Format	Colour		•
Target directory	D:\Lupos3D\Testdaten_F	Farbe\Deutsches Th	eater\Benaco\
Increment	1		÷
Interval of intensities	auto		•
Interval			
RGB from intensities			
Background colour			\sim
LPS/LPO/E57: Turn upside down			
Channel	Intensities		•
Transparency			
			Start

Autodesk ReCap

Provide Benaco with an export folder containing the following:

- 1. The point cloud in E57 format:
 - a. From the ReCap main window, click the House button, expand the Arrow-down menu, and click the Arrow-up (Export) button.
 Alternatively, press Ctrl+E.
 - b. Choose **E57** as file type.
 - c. Choose structured point cloud only (no edits).
 In older ReCap versions (< 2025), choose button ✓ complete instead.
- 2. The RGB image data:
 - a. From the location where your ReCap project is stored, copy the .rcp file and the <Myprojectname> Support folder into the export folder.
 From the Support folder, only the .rcc files are required; you may optionally delete the other files from the export folder to reduce the storage space.

Step 1a: Exporting the point clouds:



Step 1c: Choosing structured export (screenshots show multiple ReCap versions):

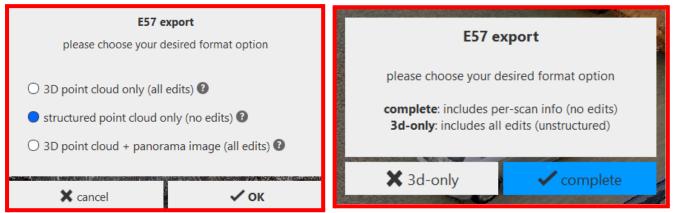


Image: Image			
\leftarrow \rightarrow \checkmark \uparrow \square \Rightarrow This PC \Rightarrow big (J:) \Rightarrow	my-recap-project-benac	o >	
Name	Date modified	Туре	Size
📊 my-recap-project Support	2021. 02. 16. 21:24	File folder	
my-recap-project.e57	2021. 02. 11. 23:00	E57 File	18 310 491
🔜 my-recap-project.rcp	2021.02.11.23:08	Autodesk ReCap P	2 751 KB

Matterport

Buy the official E57 export from Matterport as described in:

https://support.matterport.com/s/article/Overview-of-Matterport-E57-File?language=en_US

Please **unpack ZIP** files downloaded from Matterport before uploading to Benaco.

```
name-of-your-export-folder/
cloud_0.e57
cloud_1.e57 (only present if there are many scan positions in your project)
...
mesh (optional, to upload an existing mesh, e.g. from a Matterpak)
*.obj
*.obj
*.mtl
*.jpg
```

Z+F FlexScan

Requires LaserControl >= 10.0.9.

Provide Benaco with an export folder containing the following:

- 1. In the processing batch dialogue, **SLAM settings > Export**, choose settings:
 - a. [x] Panoramas
 - [x] Enhance image quality
 - **[x] Use Stitching** (optional but recommended)
 - (this enables stitching vs blending in camera overlap areas)
 - b. [x] Database
 - LOD: 0 (this means all data, 1 defaults to 5mm, 2 is 10mm)
 - Format: **e57**
 - c. **[x] Track**

This creates point clouds with embedded stitched equirectangular panoramas in **.e57** format, and a sensor trajectory in **.laser_0.txt** format.

- 2. Only if you used geo-referencing:
 - a. A file "source-crs.txt" containing as a single line the EPGS name of the coordinate system, for example: EPSG:2056

Multiple separately recorded data sets ("walks") can be combined into the same project if they are in the same coordinate system.

It is recommended to place them into separate folders.

When you are done, the export folder should look as follows for a project with 2 walks:

```
name-of-your-export-folder
walk1
2024-09-24_backpack_log_1_1_complete.e57
2024-09-24_backpack_log_1_1_complete.laser_0.txt
In the above, the naming is important:
If the E57 file is called <u>SOMETHING.e57</u>,
then the trajectory file must be called
<u>SOMETHING.laser_0.txt</u>
walk2
2024-09-25_backpack_log_1_1_complete.e57
2024-09-25_backpack_log_1_1_complete.laser_0.txt
source-crs.txt ← if you used geo-referencing
```

🕅 SLAM setting	gs						×
Preprocessing	Optimize	Database	Database filter	HQ color	Imagelist E	Export	
Export the filter	ed and cold	orized databa	se to a public for	mat. Each in	nterval you defin	ned will be exported.	
Coordinate syste	em				Default		•
				✓ Pano	oramas		
Height [pixel]		5000					
Width [pixel]		10000	R	esolution: 5	0.0 MPx		
	e image qu	ality					
					_		
vise Stic	ning						
				✓ Dat	abase		
LOD	•	0					
Format	e57						•
	The ima	iges are inte	grated into the es	57 file.			
Clipbox							•
Track							
Apply				Apply to al	l records		Close

Step 1: Exporting the point clouds with images and trajectory:

Viametris PPiMMS

Provide Benaco with an export folder containing the following:

- 1. Point clouds in **.laz** or **.las** format.
 - a. Right-click on your result data set, choose Export Point Cloud.
 - b. Set Output Format to LAZ.
 - c. Leave the **Output File Name** automatically determined; if you changed it, bring it back with **Reset**.
- 2. Sensor trajectories.
 - a. Right-click on your result data set, choose Export Sensor Trajectory.
 - b. Tick the checkbox [**X**] **System**.
- 3. Stitched panorama images and their image trajectories.
 - a. Right-click on your result data set, choose **Export Images**.
 - b. Set MultiCams mode to Dynamic Range Panoramic.
 - c. Leave the **MultiCams Image Name Prefix** automatically determined; if you changed it, bring it back with **Reset**.
- 4. Only if you used geo-referencing:
 - a. A file "source-crs.txt" containing as a single line the EPGS name of the coordinate system, for example: EPSG:2056

Multiple separately recorded data sets ("walks") can be combined into the same project if they are in the same coordinate system.

When you are done, the export folder should look as follows for a project with 2 walks; the <u>underlined</u> file name prefixes **must match**:

```
name-of-your-export-folder
Images
<u>20230413_175004_</u>Image_Trajectory.xyz
<u>20230413_175004_</u>Image_000001.jpg
...
<u>20230413_175846_</u>Image_Trajectory.xyz
<u>20230413_175846_</u>Image_000001.jpg
...
PointClouds
20230413_175004_Lider_Side_lag to be su
```

20230413_175004_Lidar_Side.laz ← be sure to match prefix 20230413_175846_Lidar_Side.laz ← with SensorTrajectories

SensorTrajectories

<u>20230413_175004</u>_System.xyz

<u>20230413_175846</u>_System.xyz

source-crs.txt 🗧 🗕 if you used geo-referencing

Step 1: Exporting the point clouds:

✓ Media Data MultiCams ✓ Tratectories ✓ Udar 100 ✓ Udar Side ✓ Bern merce	Result Restoration Colorize Point Cloud Filter Point Cloud Export Point Cloud Export Sensor Trajectory	
P Settings	- 0	×
Lidar Top		
Lidar Side	\checkmark	
Output Format	LAZ	Ŧ
Output Folder	veiz/BernScan3/Result/PointClou	ds/ 🔳
Output File Name	20230621_100204	
Texture Lidar Side	LIDAR_SIDE_RGB.rgb	-
16 bits colors		
Filter Lidar Side	LIDAR_SIDE_NoiseFilter.fid	Ŧ
Split Point Cloud		
Minimum/Maximum Range	0.50 m 🗘 30.00 m	\$
Minimum/Maximum Z-Relative	-100.00 m 🗘 100.00 m	\$
Minimum Speed	0.15 m/s	\$
Remove null reflectivity points	\checkmark	
Export Additional Fields		
Translation		
Shift X	0.000 m	\$
Shift Y	0.000 m	\$
Shift Z	0.000 m	\$
SubSampling method	No Subsampling	Ŧ
Export active blocks	~	
₽ ₽		
Set to a	OK Load Save	Reset

Constraints 20230621 100204 Constraints Co	 Result Restoration Colorize Point Cloud Filter Point Cloud Filter Point Cloud Export Point Cloud Export Sensor Trajectory Export Images 	4
P Settings	-	D X
Output Folder Path	rnScan3/Result/Sense	orTrajectories/ 🔳
Output Format	XYZ (ASCII)	*
System	\checkmark	N
MultiCams		45
Translation		
Shift X	0.000 m	\$
Shift Y	0.000 m	\$
Shift Z	0.000 m	\$
Export Active Blocks	\checkmark	
	OK Load	I Save Rese

Step 2: Exporting the sensor trajectory:

Step 3: Exporting images:

 ✓ Media Data Media Data Me	ult Restoration prize Point Cloud r Point Cloud prt Point Cloud prt Sensor Trajectory prt Images prt Localization Data
P Settings	- 🗆 X
MultiCams	\checkmark
MultiCams Output folder	Schweiz/BernScan3/Result/Images/
MultiCams Image Name Prefix	20230621_100204_Image_
MultiCams Indexes	0 \$ 2662 \$
MultiCams Image Extension	jpg 💌
MultiCams Mode	Dynamic range panoramic 🔹
MultiCams Distance between images	2.0 m 🌩
MultiCams Exported image width	12800
MultiCams Exported image height	6400 \$
MultiCams Lidar Range Min/Max	0.50m \$ 50.00m \$
MultiCams Overwrite	\checkmark
MultiCams Trajectory Format	xyz file 💌
Export Active Blocks	~
	OK Load Save Rese
MultiCams Mode Dy	Igle Images ed range panoramic namic range panoramic vanced Dynamic range panoramic

Gexcel HERON mobile mappers

Provide Benaco with an export folder containing the following:

- The laser trajectory: trajectory.csv
- The colorized point cloud in **.e57** format.
 - It embeds the panoramas (preferably 8K resolution still photos).

When you are done, the export folder should look as follows:

name-of-your-export-folder trajectory.csv myproject.e57

Emesent Hovermap

Provide Benaco with an export folder containing the following:

- The laser trajectory: myproject_traj.xyz
- The colorized point cloud in .laz or .las format.
- The panorama photos (currently only projects with the Emesent GoPro panocam attached are supported).
- The **frames.json** file that carries pose information of the panorama photos.

```
name-of-your-export-folder
myproject.laz
myproject_traj.xyz
frames/
frames.json
frame_000000.jpg
frame_000025.jpg
frame_000050.jpg
frame_000075.jpg
...
```

Topcon mobile mappers

Provide Benaco with an export folder containing the following:

- The colorized point cloud in .las format.
- The panoramas in stitched .jpg format.
- The laser trajectory in **.csv**. format.

```
name-of-your-export-folder
IP-S3-myproject.las
IP-S3-myproject Panoramas/
ladybug_panoramic_000000.jpg
ladybug_panoramic_000001.jpg
...
Trajectory/
ipsx_trajectory.csv
```

Trimble TIMMS

Provide Benaco with an export folder containing the following:

- 1. Point clouds in .laz or .las format. Ensure they have "Gps time" time stamps.
- 2. Sensor trajectory: TIMMSpath.txt
- 3. Camera trajectory: area_eo.txt
- 4. Stitched panorama images
- 5. Geo-referencing zone info file: USR_frame.txt

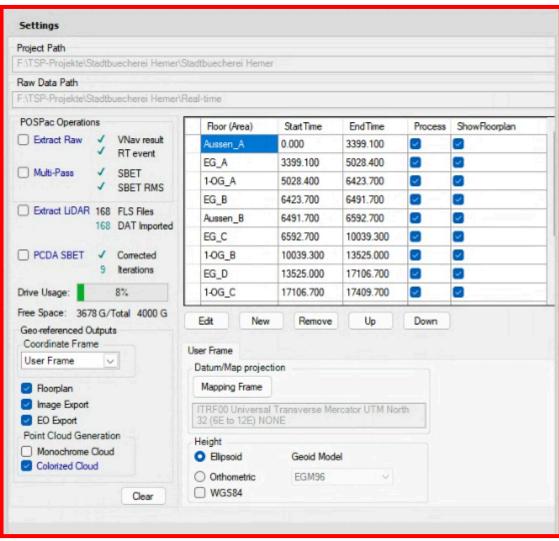
See the below screenshot for the settings.

These files will typically appear in the Processed sub-folder of your "Project Path" of your TIMMS Spatial Processor (TSP) software. You can upload the entire Processed folder.

When you are done, the export folder should look as follows:

```
name-of-your-export-folder
     Processed/
           Myproj1/
                 Color_LAS_USR/
                       full/
                             L1_Myproj1_color_001.las
                             L1_Myproj1_color_002.las
                             . . .
                 TCC/
                       TIMMSpath.txt
                       area_eo.txt
                       HD-Pics/
                             ladybug_panoramic_000000.jpg
                             ladybug_panoramic_000001.jpg
                             . . .
           Myproj2/
                 . . .
```

•••



Steps 1-5: Exporting data from TIMMS

Step 1 validation: Checking in <u>CloudCompare</u> that the .las/.laz has "Gps time":

	Version	1.2			
	Point forma				
	Number of		05 087		
	Number of	points 12,3	00,007		
ading Tilling					
tandard Fields					
cariuaru Fielus					
			select all	unselect a	all
Intensity				- 100.000	
Return Num	ber				
Number Of	Returns				
Scan Directi	on Flag				
EdgeOfFligh	ntLine				
Classificatio	n				
Synthetic Fl	ag				
Keypoint Fla	g				
Withheld Fla					
Scan Angle	Rank				
User Data					
Point Source	e ID				
Gps Time					
Ignore fields w	ith default va	lues only			_
		ides only			
	assification				
	ors				
Decompose Cla		0.00			

Faro Orbis Connect / GeoSLAM Connect

Benaco requires projects that include the ZEB Vision camera (or any other, newer camera that allows colorizing the point cloud).

In Faro Connect or GeoSLAM Connect, process your project:

Ensure all **images are stitched** and the point **cloud is colorized**.

Applying the GeoSLAM provided filters helps reduce outliers for better results.

If you have **multiple datasets** that you registered together, do not forget to use the "Vision Calculate Image Poses" dialog to apply the found transformation onto the .gs-traj files, thus creating new, transformed .gs-traj files (see screenshot further down).

As of writing (2025-06-23), you need to use Faro Connect, **not Faro SCENE**, because the orbis in Faro SCENE cannot do the above-mentioned step yet. Benaco can/will only add Orbis+SCENE support (for both single- and multi-datasets) once that works.

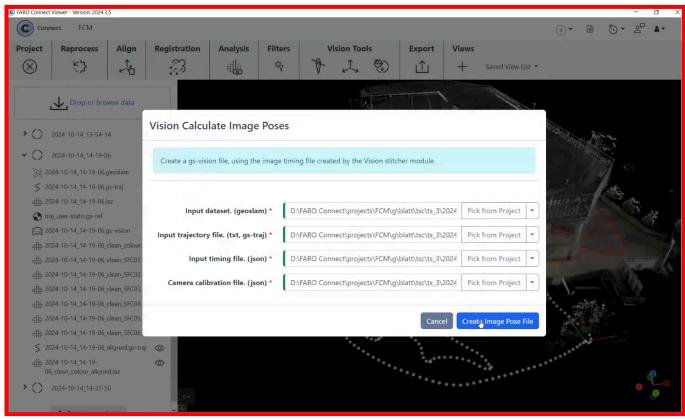
Provide Benaco with an export folder containing the following:

From your GeoSLAM project folder's "Input" folder, these files and folders:

images/	(folder of stitched images)
*.traj.txt	(if it exists)
*.gs-traj	
*.gs-vision	
*_colour.laz	(colored point cloud; the file name may be longer depending on the filters you applied)

Highlighted in grey: The files to provide from GeoSLAM Connect (you need to additionally provide traj.txt if it exists):

PC > DATA (D:) > Connect > Projects > Sanssouci > In	put > 2022-07-01_08-38-50	ע ע	○ 2022-07-01_(
Name	Änderungsdatum	Тур	Größe
📜 images	06.12.2022 13:05	Dateiordner	
Project_4	06.12.2022 13:08	Dateiordner	
2022-07-01_08-38-50.geoslam	04.07.2022 15:21	GEOSLAM-Datei	1.221.248
2022-07-01_08-38-50.gs-traj	04.07.2022 15:21	GS-TRAJ-Datei	16.332 KB
2022-07-01_08-38-50.gs-vision	05.07.2022 07:44	GS-VISION-Datei	224 KB
2022-07-01_08-38-50.laz	04.07.2022 15:25	LAZ-Datei	634.419 KB
2022-07-01_08-38-50_transient.laz	04.07.2022 15:37	LAZ-Datei	598.391 KB
2022-07-01_08-38-50_transient_outlier.laz	04.07.2022 15:48	LAZ-Datei	584.334 KB
2022-07-01_08-38-50_transient_outlier_colour.laz	05.07.2022 11:38	LAZ-Datei	749.696 KB



Creating transformed .gs-vision and .gs-traj/.txt trajectory files for merged multi-walk projects

XGrids Lixel Studio

Provide Benaco with an export folder containing the following:

• The project subfolder of the **Output** folder created by Lixel Studio's processing. The subfolder is usually stored with a naming scheme similar to:

Output / ResultData2025-01-28-064125_0 / **2025-01-28-064125**

- \circ $\;$ In the processing options, you need to enable:
 - [x] Coloring
 - [x] Output panoramic image

You can upload the entire project output folder, or only the files mentioned below.

When you are done, the export folder should look as follows:

```
name-of-your-export-folder
panoramicImage/ ← folder containing panorama images
2025-01-28-064125result.las ← cloud; name depends on project name
high_frequency_poses.csv
panoramicPoses.csv
```

Processing and exporting XGrids data:

				🗄 Anzeigen 🗸 🚥	🔟 🛝 Sortieren 🗸 🗮
		Größe	Тур	Änderungsdatum	me
			Dateiordner	28.01.2025 10:00	nages
>	Project processing		Dateiordner	28.01.2025 10:00	anoramicImage
			Dateiordner	28.01.2025 10:00	erspective
		3.336.314 KB	AutoCAD-Layerst	28.01.2025 09:57	025-01-28-064125result.las
	Project File	1 KB	Textdokument	28.01.2025 09:56	blor_accuracy.txt
	D:/Ablage/TAR/2025-01-28-064125	11.201 KB	Microsoft Excel-C	28.01.2025 09:43	gh_frequency_poses.csv
)		86 KB	Microsoft Excel-C	28.01.2025 09:56	ng_traj.csv
neter setting	Coordinate Transformation External parameter	79 KB	Microsoft Excel-C	28.01.2025 09:56	ng_traj_rpy.csv
(GCP	31 KB	Microsoft Excel-C	28.01.2025 09:59	anoramicPoses.csv
		531 KB	Microsoft Excel-C	28.01.2025 09:43	DSes.CSV
	GNSS	3.414 KB	L3I-Datei	28.01.2025 09:56	m_perspective.13i
D,0000000 ►					
	🗹 Coloring				
	Internal camera				
nt: 🔻 Type3	Camera mount:				
	🗌 Backpack mode 🗹 Output panoramic image				
	Advanced Setting 🔹				
	✓ Dynamic object removal				
	Start-to-end loop closure				
ing 🕜	Automatic importing point cloud after data processing				
	Robust mode 🕜				

NavVis Ivion

Provide Benaco with an export folder containing the following:

- The point cloud .e57 format with embedded pano photos.
 - You need to enable processing of pano photos, otherwise they will be missing from the .e57.

When you are done, the export folder should look as follows:

name-of-your-export-folder myproject.e57

Placing additional panos against laser data

Benaco can automatically register separately-shot **stitched equirectangular** panorama photos (e.g. from Ricoh Theta or Insta360 cameras) against your laser data.

This creates additional panorama positions to which visitors of the 3D tour can navigate, "filling the gaps" in photo coverage between wider-spaced laser positions.

Because small panocams are extremely fast (1 second for a full pano shot) it allows to capture up to **20x more positions per time** compared to the slow cameras integrated in most stationary laser scanners.

These additional shots can be captured e.g. while the stationary laser scanner is still running, allowing greatly increased pano photo coverage at little to no extra time cost for the surveyor.

This can be especially useful for capturing device labels in the environment. A professional extendable monopod is recommended. Camera features such as Ricoh's <u>Time Shift Shooting</u> plugin help to remove the photographer from the image by triggering panocam lenses separately. Additional panos may also be handheld but must not be blurry.

Additional panos only add more pano positions to the tour. They are not used for meshing or texturing (only the laser data is used for that).

The panos are placed against the laser color panos using **photogrammetry**. This requires a significant amount of **visual overlap** between a to-be-placed additional pano and the nearby laser color panos: The additional pano must "see the same things" as a nearby laser pano so that the visual feature matching algorithm succeeds. It is difficult to quantify exactly what "enough visual overlap" means; rough guideline:

- In **large**, **featureful** environments (e.g. football stadium) the view of what a camera sees changes insignificantly even when moving larger distances, so larger offsets between additional panos and laser positions can work, often up to multiple meters.
- In **large**, **featureless** environments with repeating visual patterns (e.g. flat outdoor areas, desert, large parking spaces), the visual features will not be distinct, making automatic placement more challenging. Place panos close to laser positions.
- In **narrow** environments (real estate, dense industrial) moving a small distance can significantly change what a camera sees. Place panos close to laser positions.

To add additional panos against your laser data, place them in the external-panos folder of your upload. It must have a **flat folder structure** (no subfolders inside, only image files). Your export folder should look as follows:

name-of-your-export-folder (... your other laser data files here ...) external-panos ← additional panocam shots; must be equirectangular R0011533.JPG R0011534.JPG ← file names do not matter; but must be JPEGs ...

Agisoft Metashape

Provide Benaco with an export folder containing the following:

- 1. A textured OBJ mesh.
 - a. Ensure that your project does not have huge coordinates.

In the bottom left panel, click "Reference" and check that for your cameras and markers (if you have any), the X/Y/Z values are < 10000 instead of e.g. +/- multiple millions.

If you see large coordinates, first click the "Reference Settings" button above the Cameras panel, and switch from "WGS 84" to "Local coordinates". If you still have large coordinates in markers (e.g. because you used them to define a scale bar to set the mesh scale), re-create those markers from the 3D mesh view instead from a camera 2D view, as otherwise Agisoft will create markers that associate 2D and 3D, when you only want to scale 3D.

Ensure that your mesh is not too large.
 For Benaco use you should decimate meshes to 1M - 10M faces.

Be aware that Agisoft generates higher-quality meshes if you first create a mesh with high face count and then decimate it.

This preserves thin objects (such as poles, railings) better than when you ask Agisoft to directly create a low-face-count mesh.

The reason is that the mesh creation and simplification algorithms work differently.

To decimate large meshes:

 Duplicate the current Agisoft Chunk that contains the original mesh so that you do not lose it after decimation.

Double-click the duplicate Chunk to activate it.

- Choose Tools -> Model -> Decimate Model... and set Target face count to e.g. 1,000,000.
- Re-texture the decimated mesh (see below).
- c. Ensure you have created textures using the **Workflow -> Build Texture** dialog, with these settings:
 - Texture size: 4096 pixels
 - Texture count: **10**

(higher counts are acceptable but will result in longer loading times)

d. Choose File -> Export -> Export Model.

Save the file as "model.obj" with Wavefront OBJ format, into a "mesh" folder.

- Tick the checkbox [**X**] **Export Texture**.
- Set "Coordinate system" to Local Coordinates (m).
- Tick the checkbox [X] Write metadata.xml file.
 This is only necessary for geo-referencing in Benaco (optional but recommended).

This option is only available in Metashape >= 2.1.

2. The camera positions and parameters:

a. Choose File -> Export -> Export Cameras.

Save the file as "cameras.opk.txt" with Omega Phi Kappa format. If a "Select Projection" popup appears, choose Local Coordinates (m), because Metashape's OBJ coordinates are also local.

- b. Again choose File -> Export -> Export Cameras.
- Save the file as "agisoft-cameras.xml" with Agisoft XML format.
- 3. The image files.
 - a. Save them into an "images" folder.

Step ra. Ensuring the mean has	Z Y X
faces: 2,128,611 vertices: 1,066,923	
Workspace Workspace Workspace (2 chunks, 195 images Chunk 1 duplicate (lower face Chunk 1 (high face count) (9 Set Active Duplicate	count) (98 images, 56,258 tie points) [R]
<u>T</u> ools <u>H</u> elp	
Markers <u>T</u> ie Points <u>P</u> oint Cloud ►	
<u>M</u> esh ►	<u>R</u> efine Mesh
DEM Orthomosaic	Decimate Mesh
Camera Camera Calibration Comparing Camera Calibration	Decimate Mesh X Parameters Source face count: 2,128,611
Calibrate Reflectance Calibrate Colors	Target face count: 1,000,000 Apply to selected faces
Set Primary Channel Set Brightness Set Raster Transform Generate Contours	OK Cancel Measure Area and Volume Filter by Selection
Plan Mission Reduce Overlap Detect Powerlines Survey Statistics	Reset Filter
Run Script Ctrl+R	

Step 1a: Ensuring the mesh has a suitable face count

Step 1b: Creating a textured mesh

Build Texture		\times
- 🔻 General		
Texture type:	Diffuse map	-
Source data:	Images	•
Mapping mode:	Generic	•
Blending mode:	Mosaic (default)	•
Texture size/count:	4096 × 10	\$
► Advanced		
ОК	Cancel	

<u>F</u> ile	<u>E</u> dit	<u>V</u> iew	<u>W</u> orkflow	<u>M</u> odel	<u>P</u> hoto	<u>O</u> rtho	<u>T</u> ools	F
	<u>N</u> ew			Ctrl+N			A	
-	<u>O</u> pen			Ctrl+O				
,	Append				Model	Ortho		
	<u>S</u> ave			Ctrl+S	Persp	ective 30°		
	Save <u>A</u> s							
	Cloud			+]			
	Export				Evn	ort Points.		
	Import					ort Model		
	Upload Da			ŕ	_	ort Tiled N		
	opioad Di	aca			rvh	orcinear	noueim	
L	oordinate S; ocal Coordi nift: X: 0 (port Param Vertex co Vertex no	nates (m) leters llors	Y: 0		t to 8 bit R(→ 	<u>*</u>	
	Vertex no			Camera				
	Export te		JPEG			⊖ exr		
	- aster transf			None			\sim	
] Include co	omment	Generated w	ith Agisoft Me	tashape			
	Binary en	coding	Precision:	6				
	Use UDIM	_						
	_] Save alph							
	Clip to bo							
	Write met	tadata.xn	nl file					
			ОК	Cance				

Step 1c: Exporting the textured mesh

<u>F</u> ile	<u>E</u> dit	<u>V</u> iew	<u>W</u> orkflow	<u>M</u> odel	<u>P</u> hoto	<u>O</u> rtho	<u>T</u> ools	<u>H</u> elj	
	<u>N</u> ew Open Append Save Save <u>A</u> s Cloud			Ctrl+N Ctrl+O Ctrl+S	Model Pers	Ortho pective 30°	4 • <i>1</i>	•	
	Export Import Upload Da	ita		¥ 	_		oordinates		Cancel

Step 2: Exporting the camera positions

```
name-of-your-export-folder

agisoft-cameras.xml

cameras.opk.txt

mesh

model.obj

model.mtl

model.jpg ← the texture files

model1.jpg

...

model9.jpg

images

photo1.jpg

...
```

RealityCapture

Preparation: Add a custom camera position exporter to RealityCapture. Open the following file with a text editor, such as Notepad:

C:\Program Files\Capturing Reality\RealityCapture\calibration.xml

We recommend making a backup of the file before changing it. Scroll down to the end of the file, and insert this snippet just before </Calibration>.

(Note that writer="cvs" in the snippet is not a typo for "csv", see <u>RealityCapture documentation</u>. The syntax of RealityCapture's calibration.xml files is unfortunately not documented, and it does not seem to contain a proper CSV exporter. Thus your image file names must not contain double-quotes, as they will not be properly CSV-escaped.)

The result should look similar to this

(but use the link provided above for the text, do not type down the contents of the screenshot):

🧐 calibration.xml - Notepad			- 0	\times
File Edit Format View Help				
\$(R20) \$(R21) \$(R22) \$(tz))) 				^
<pre></pre>				

Provide Benaco with an export folder containing the following:

- 1. A textured OBJ mesh.
 - a. Ensure your mesh has approximately **1M triangles**. More can be too much for smartphone browsers.
 - b. Ensure you have created textures using the correct settings: In the Mesh Model tab, in section Mesh Color & Texture, choose Settings and set:
 - Maximal texture resolution: 4096 x 4096
 - Maximal texture count: 10
 - (higher counts are acceptable but will result in longer loading times)
 - c. In the Mesh Model tab, in section Export, choose Dense Mesh Model
 Export the file as "model.obj" into a folder "mesh".
- 2. The camera positions and parameters.

In the Alignment tab, in section Export, choose Registration.

Save the file as "**realitycapture-cameras.csv**" with **Benaco CSV** format (this format is only present after you followed the "Preparation" step above and restarted RealityCapture).

- 3. The image files.
 - a. Save them into an "images" folder (flat, no subfolders).

Step 1a: Creating a textured mesh

		v) Q: ₹	SCEN	E 2D	IMAC	GE 2D	SCEI	NE 3D	
WORKFLOW ALI	GNMENT	MESH MOD	DEL VIE	W	VIEW	TOOLS	VIEW	TOOLS	
Set Reconstruction Region 👻 Import Reconstruction Region	Normal Detail	Preview High Detail Settings		U ture	forrect Col Inwrap ettings	Che	ck Integrity ck Topology in Model		
Pre-steps (Optional)	Crea	te Model	Mesh	Color &	Texture		Ana	lyze	

	Texture Settings t unwrap parameters		××	
Gutter		2		
Maxima	l texture resolution	4096 x 4096		
Large tr	riangle removal thres	10		
Style		Maximal texture count		
Maxima	l texture count	10	÷.	
Imported-r	nodel default texture	4096 x 4096		
Coloring m	ethod	Multi-band		
Coloring st	yle	Visibility-based		
Coloring in	nage layer	Geometry layer		
Texturing s	ityle	Visibility-based		
Texturing i	mage layer	Geometry layer		
Downscale	images before textur	1		
Downscale	images before colori	2		
Fill in unco	lored parts	Yès		
Fill in unte	ctured parts	Yés		
Recolor mo	odel after texturing	Yes		
Correct col	lors	No		
Ignore cole	or correction	No		
🛨 Prefer 16-b	it/HDR textures gene	Yes		

Step 1b: Exporting the mesh

Dense Mesh Model	Depth and Mask				
Levels of Detail	Cross Sections				
Reconstruction Region					
Export					

Step 1b: Exporting the camera positions

A	LIGNMENT	MESH M	ODEL VIEW	VIEW TOOLS	VIEW		
lign ages	नेन्स Merge Components	Draft Update Settings	Inspect Quality Real-time Assistance	Point Cloud Contr	data (XMP) rol Points nd Control		
	Registratior	1	Analyze	Export			
	File name:	realitycaptu	re-cameras.csv			-	~
	Save as type:						~

```
name-of-your-export-folder
realitycapture-cameras.csv
mesh
model.obj
model.mtl
model_u1_v1_diffuse.jpeg
model_u1_v2_diffuse.jpeg
...
model_u3_v3_diffuse.jpeg
images
photo1.jpg
photo2.jpg
...
```

Pix4D PIX4Dmapper

Provide Benaco with an export folder containing the following:

- 1. A textured OBJ mesh.
 - a. From the menu, choose **Process -> Processing options**. Under **Point Cloud and mesh**, configure:
 - i. ☑ Generate 3D textured mesh
 - ii. Settings: Custom
 - iii. Texture size: **4096x4096**
 - iv. Maximum number of triangles: **1M 10M** Smaller loads faster. Use 1M if it looks good.
 - v. Export: 🗹 OBJ
 - You may wish to Save Template and call it "Benaco".
 - b. Right-click your mesh and choose Export Mesh...
 Save the mesh as "model.obj", into a "mesh" folder.
 Do not enable:

 Tiled texture.
 Do not enable:

 Generate LOD Mesh and Export
- The camera positions and parameters: In Windows Explorer, navigate to your Pix4D project folder, into 1_initial\params. Copy the following files into your export directory into subfolder "pix4d-params":
 - myproject_calibrated_camera_paramters.txt
 myproject_calibrated_external_camera.parameters.txt
 myproject_calibrated_external_camera.parameters_error.txt
 myproject_calibrated_external_camera.parameters_wgs84.txt
- 3. The image files, distortion-corrected:
 - a. Choose Process -> Save Undistorted Images.
 - b. Save them into an "undistorted-images" folder.

```
name-of-your-export-folder
pix4d-params/
myproject_calibrated_camera_parameters.txt
myproject_calibrated_external_camera.parameters_txt
myproject_calibrated_external_camera.parameters_error.txt
myproject_calibrated_external_camera.parameters_wgs84.txt
undistorted-images/
100_0074_0001.JPG
100_0074_0002.JPG
....
mesh/
CP_Charco_ExpMalla_simplified_3d_mesh.obj
CP_Charco_ExpMalla_simplified_3d_mesh.mtl
CP_Charco_ExpMalla_texture.jpg
```

		Process View rayCloud Help
		다 Reoptimize
		Rematch and Optimize
Step 1a: Processing Options for the	e mesh	Quality Report
Processing Options		 Open Results Folder Output Status
Processing options		
AA	Point Cloud 3D Textured Mesh Advanced	Generate Quality Report
1. Initial Processing	Generation	Save Undistorted Images Run Point Cloud Classification
Ø	Generate 3D Textured Mesh	Generate 3D Textured Mesh
	Settings	Import Point Cloud for DSM Generation
2. Point Cloud and Mesh	O High Resolution	Generate DTM
	O Medium Resolution (default)	Generate Contour Lines (DSM)
077	Low Resolution	Generate Contour Lines (DTM)
3. DSM, Orthomosaic and Index	Custom	Send Elevation Data (DSM) to eMotion
	Maximum Octree Depth: 12 호	Send Map to eMotion
	Texture Size [pixels]: 4096x4096 🔻	Processing Options
Resources and Notifications	Decimation Criteria: Quantitative Maximum Maximum Maximum	of Triangles: 1000000 🗘
		or mangles: 1000000
	Strategy: Sensitiv	/e 7
	Use Color Balancing for Texture	
	Export	
	D PLY	
	E FBX	
	DXF	
	🗹 овј	
	Tiled Texture	
	3D PDF Logo:	Select
Current Options: No Template Load Template J Save Template Manage Temp	lates	
	NO LES	
Advanced		OK Cancel

		▼ Create	
Step 1b: Exporting the mesh	Home	Щ 🖬 🖵 🎯 😤 И 1	
Export Mesh	III		
3D Textured Mesh	Map View	▼ Layers	
Export 3D Textured Mesh	î2,	> Cameras	
3D Textured Mesh Settings	rayCloud	> Z Rays	
Texture		✓ ☑ Tie Points	
Rename Texture	Volumes	> 🗹 GCPs / MTPs	
Texture Name: CapoPedro_conCharco_texture	권	> Automatic	
Format	Mosaic Editor	Point Clouds	
D PLY	+= ×÷	> Point Groups	
FBX	Index	Triangle Meshes	
DXF	Calculator	> Display Properties	
DXF (polylines)		Mesh PW 4D-	nload Layer
✓ OBJ		Objects	port Mesh
Tiled Texture			iport mesn
30 PDF Logo:	Select		
Save As: ensification/3d_mesh/CapoPedro_conCharco_simplified_3d_mesh	Browse		
LOD Mesh (Beta)			
Generate LOD Mesh and Export			
_			
LOD Mesh Settings Number of Levels: 1 0			
Texture Quality: High - 4096x4096			
Format			
() SLPK			
○ OSGB			
Save As: conCharco/2_densification/3d_mesh/lod/CapoPedro_conCharco	Browse		
OK Cancel	Help		

Step 2: Taking camera parameters from the project folder.

Nuevo v	ol (D:) > pix4D_trabajos > ParqueCaboPedro > CapoPedro_conCharco > 1_initial > params
^	Nombre
	CapoPedro_conCharco_calibrated_camera_parameters.txt
	CapoPedro_conCharco_calibrated_external_camera_parameters.txt
	CapoPedro_conCharco_calibrated_external_camera_parameters_error.txt
	CapoPedro_conCharco_calibrated_external_camera_parameters_wgs84.txt

Step 3: Saving undistorted images

Project	Pro	cess View Map View Help			
	Ç	Reoptimize			
	Ę	Rematch and Optimize			
	ß	Quality Report			
Home	ô	Open Results Folder			
	53	Output Status			
Map Viev		Generate Quality Report			
îz,		Save Undistorted Images			
rayCloud		Run Point Cloud Classification			
P		Generate 3D Textured Mesh			
		Import Point Cloud for DSM Generation			
Volumes		Generate DTM			
Ы		Generate Contour Lines (DSM)			
Mosaic Editor		Generate Contour Lines (DTM)			
÷ Euitor ×÷	¢	Processing Options			

3DSurvey

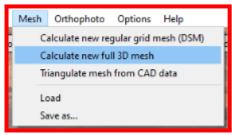
Provide Benaco with an export folder containing the following:

- 1. A textured OBJ mesh.
 - a. From the menu, choose **Mesh -> Calculate new full 3D Mesh** with options:
 - i. Textured mesh: 🗹
 - ii. Max triangles: **1M 10M**
 - Smaller loads faster. Use 1M if it looks good.
 - iii. Texture resolution: **Half**
 - This generates 4096² pixel textures. Larger does not work reliably in web browsers.
 - b. Choose Mesh -> Save as...
 Save the file as "model.obj" with Wavefront OBJ format, into a "mesh" folder.
- The camera positions and parameters: Choose Data -> Export camera parameters Save the file as "3dsurvey-cameras.csv".
- 3. The image files, distortion-corrected:
 - a. Choose Data -> Export undistorted images.
 - b. Output directory: Save them into an "undistorted-images" folder.
 - c. File prefix: undistorted_
 - d. Enable 🗹 Normalize principal point
 - e. Enable 🗹 Remove camera motion

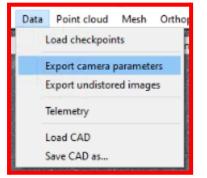
```
name-of-your-export-folder
3dsurvey-cameras.csv
undistorted-images/
undistorted_100_0060_0001.JPG
undistorted_100_0060_0002.JPG
...
mesh/
PointCloud_2023_12_09-15_30_19.obj
PointCloud_2023_12_09-15_30_19.mt1
PointCloud_2023_12_09-15_30_19_1001.jpg
...
```

```
PointCloud_2023_12_09-15_30_19_1007.jpg
```

Step 1: Exporting the mesh

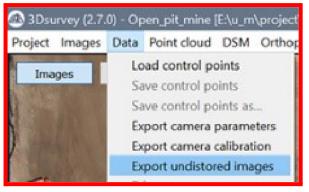


Step 2: Exporting camera parameters



A Mesh calculation	×
Point doud:	PointCloud_2023_12_09-15_30_19
Point dasses:	 ✓ 0 - Never classified ✓ 1 - Unassigned ✓ 2 - Ground
Textured mesh:	✓
Show less	
Calculation level:	High 👻
Max triangles:	1000.000
Texture resolution:	Half 🔻
Normals calculation	
Simplified doud relative size:	10,00%
Number of nearest neighbour	rs: 20 🌻
	Calculate Cancel

Step 3: Exporting undistorted images



A Export undistorted images	>
Output directory:	
G:/Mi unidad/GEOCOBET/TRABAJOSARCHIVADOS/2023/20231123_CristinaBeatriz	se
File prefix:	
undistorted_	
 Normalize principal point (it will be moved to the center of the image) Remove camera motion (will remove rolling shutter distortion) Export cancel 	el

Plain meshes

Provide Benaco with an export folder containing the following:

- Into the "mesh" folder, a textured OBJ mesh:
 - Recommended is **1M** triangles.
 - Up to **10M** triangles are accepted, but will take longer to load and may be slow to interact with (low frames per second) on end devices without powerful graphics cards.
 - Recommended are up to 10 JPEG texture files.
 Individual texture files must be <= 4096² pixels. Larger does not work reliably in web browsers.

Note the Benaco viewer currently requires at least 1 photo.

If a plain mesh is given, a black 1x1 pixel placeholder photo is generated 100m above XYZ=(0,0,0).

This placeholder will be used for the 3D tour loading screen, which makes such tours slightly less visually appealing than those that have real original photos exported from e.g. photogrammetry software (as described in other sections of this document).

When you are done, the export folder should look as follows:

```
name-of-your-export-folder
mesh/
mymesh.obj
mymesh.mtl
texture1.jpg
...
texture10.jpg
```

After the tour is processed, you need to set the correct up-axis in the 3D tour by going to the **Editor**, tab **Straighten**, and click the corresponding button (in most cases that is **+Z**).

Combining photogrammetry with lasers

It is possible to combine drone photogrammetry data from the sections above with laser data.

Do *not* upload laser and drone data together into a single tour -- only one of them will be processed into the tour in that case. Instead:

- 1. Process the laser data into a standalone tour.
- 2. Process the photogrammetry data into a standalone tour.
- 3. Combine the two tours as shown in our <u>drone combination guide</u>. See especially its section *"Adding original drone photos"*.