DIGITISATION OF HERITAGE

TRAINING COURSE



Tech4Heritage



- 1- Introduction to Photogrammetry
- 1.1 3D heritage documentation techniques
- 1.2 History of photogrammetry as a 3D documentation technique
- 1.3 Basics of photogrammetry
- 1.4 Photogrammetry vs. scanner: a basic comparison
- 1.5 Uses and applications of photogrammetry in heritage

2 - Camera basics and data capture

- 2.1 Data capture: introduction and basic concepts
- 2.2 Imaging strategies (I): large structures and spaces
- 2.3 Imaging strategies (II): small and medium sized objects
- 2.4 Lighting control
- 2.5 Camera basics
- 2.6 Practical tips for capturing photos
- 2.7 Other media and accessories: poles and drones

3 - Processing workflow and 3D model editing

- 3.1 Download, installation and activation
 3.2 User interface and menus
 3.3 Workflow
 3.3.1 Photo Quality
 3.3.2 Aligning meshes
 3.3.3 Positioning of the model
 3.3.4 Creating and Cleaning the Dense Cloud
 3.3.5 Creating Meshes and Textures
 3.3.6 Scaling of photogrammetric models in Metashape
 3.7 Exporting models
- 4 Photogrammetry and Drones
- 4.1 How to operate the drone
- 4.2 Capturing photos from the air
- 4.3 Drone Harmony App for planned flights
- 4.4 Metashape workflow for data processing
- 4.5 Uses and Applications of Aerial Photogrammetry in Cultural Heritage

1- INTRODUCTION TO PHOTOGRAMMETRY

1.1 3D HERITAGE DOCUMENTATION TECHNIQUES

1.2 HISTORY OF PHOTOGRAMMETRY AS A 3D DOCUMENTATION TECHNIQUE

1.3 BASICS OF PHOTOGRAMMETRY

1.4 PHOTOGRAMMETRY VS SCANNER: A BASIC COMPARISON

1.5 USES AND APPLICATIONS OF PHOTOGRAMMETRY IN CULTURAL HERITAGE



3D MODEL?

Image Capture Technologies – Photogrammetry



Volume Capturing Techniques – 3D Scanning





Direct modelling using a 3D design program **1.2 HISTORY OF PHOTOGRAMMETRY AS A 3D DOCUMENTATION TECHNIQUE**

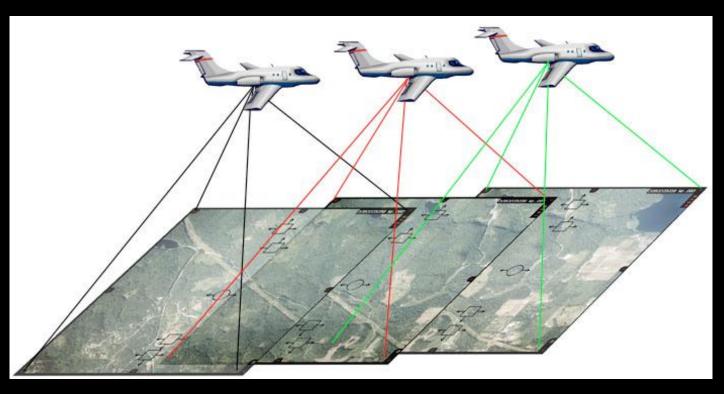
What is Photogrammetry?

The "art, science and technology of obtaining reliable information about physical objects and the environment through the process of recording, measuring and interpreting photographic images and patterns of electromagnetic radiant imagery and other phenomena." (American Society for Photogrammetry and Remote Sensing 1980)

1.2 HISTORY OF PHOTOGRAMMETRY AS A 3D DOCUMENTATION TECHNIQUE

Aerial and analogue photogrammetry (1950–1990)

- Recording large areas from the air was the first application of photogrammetry. Widely used to document large cities or archaeological sites.
- In the 1970s, analogue terrestrial photogrammetry began to be practiced, in this case to document buildings and large archaeological sites by obtaining orthophotos – rectified images that lose all perspective and can be used as planimetry.



1.2 HISTORY OF PHOTOGRAMMETRY AS A 3D DOCUMENTATION TECHNIQUE

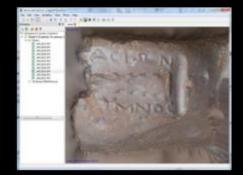
Digital Photogrammetry (1990-Current)

In recent years, there has been an increase in the use of photogrammetric data for Archeology, due to the combination of several factors:

- Development of affordable photogrammetric processing software packages;
- The progress of digital cameras, with cheap models capable of capturing high quality images;
- Improvement in the processing capacity of personal computers;
- In the aerial case, the use of unmanned devices (UAVs or drones) as platforms for capturing high-resolution low-altitude aerial images.

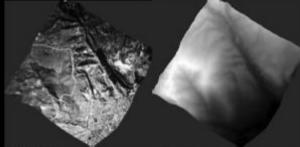
Close-range DSLR Scale

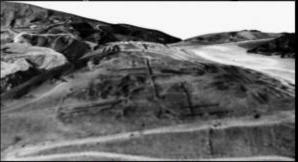




Amphora stamps from Ancient Athenian Agora (with American School of Classical Studies at Athens

Aerial Photo Scale



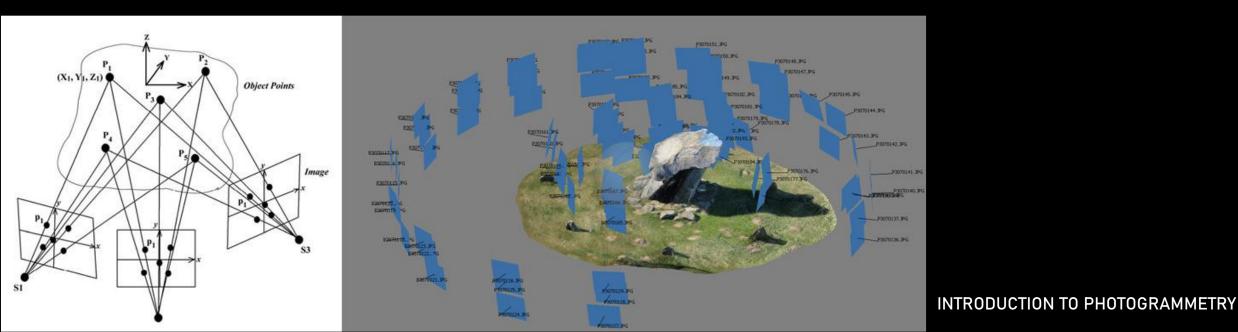


DEM generated from historic images of Cusco, Peru Cotsen Institute/UCLA Geomatics Field school 2009)

1.3 BASICS OF PHOTOGRAMMETRY

Photogrammetry: the production of 3D models from photographs

• Photogrammetry consists of making 3D models from photographs. The photographs are taken in such a way that the images can later be superimposed on each other.



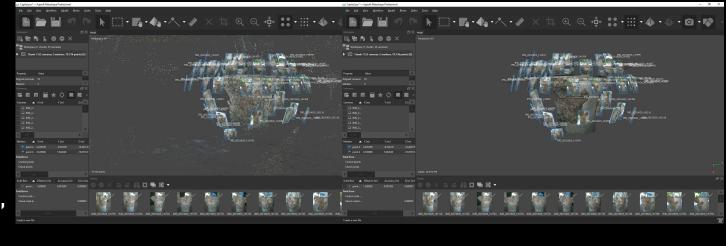
1.3 BASICS OF PHOTOGRAMMETRY

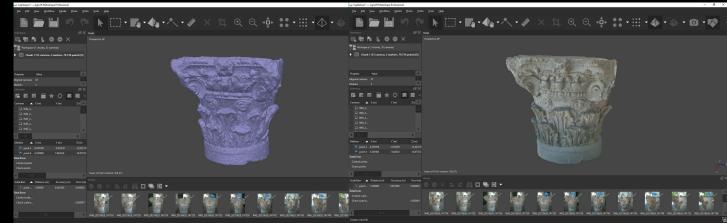


1.3 BASICS OF PHOTOGRAMMETRY

Photogrammetry: the production of 3D models from photographs

 A specialised program processes the images, finds coincident points, and then calculates their location in threedimensional space to produce a point cloud, which reproduces the shape of the original object. If these points are joined with lines, a network of triangles, or mesh, is created, on the surface of which it is possible to add the colours and textures captured in the photographs. At the present time the most frequently used photogrammetry programs are Metashape and ReallityCapture.





1.4 PHOTOGRAMMETRY VS SCANNER: A BASIC COMPARISON

3D scanner, registering position points

- 3D scanners register position points using laser beams, in the case of laser scanners or, in the case of structured-light 3D scanners, by means of projecting stripes of white light.
- The laser scanner works by firing a laser beam at the surface of an object, which is then sent back to the device in such a way that the position of the point of impact is registered. An extremely precise three-dimensional image of the scanned object's shape is produced by the automatic repetition of this procedure over every few millimetres of the object's surface. This information is then processed, using programs such as Leica Cyclone, Scene or ReCap, to produce a point cloud which, as with photogrammetry, enables three-dimensional models to be created.



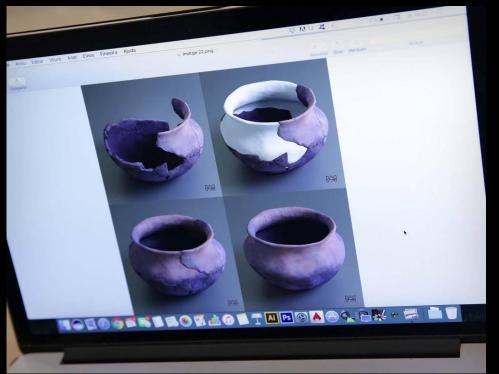
3D models have been used for many years for special effects in cinema and 3D videogames. They have also been used in cultural heritage for decades, but only very occasionally. Over recent years, however, technical advances have been such that many institutions, and people working in the field of cultural heritage, now have this technology within reach. With it they can perfect some of their previous procedures and they can also use it to explore completely new avenues.

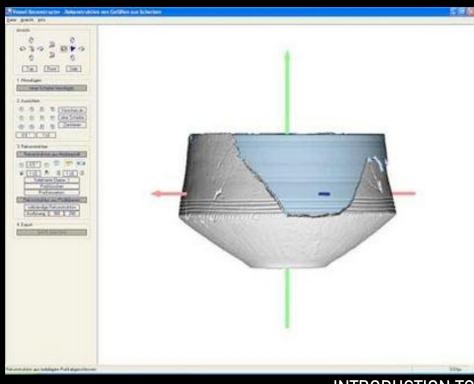


The Giza Plateau painted by Jean-Claude Golvin. Photograph: Jean-Claude Golvin

D The same area as seen in Assassin's Creed Origins. Photograph: Ubisoft

Restoration/conservation: In the field of restoration the use of 3D models can detect deterioration
and deformations that would otherwise be invisible. It can also be used to create a register of
these flaws over time by capturing data at regular intervals. In the case of fragmented works, it
makes it possible to study the way in which the fragments fit together, without having to touch
them, and it also makes it possible to create moulds of the missing pieces, or supports which are
perfectly adapted to the pieces themselves.





INTRODUCTION TO PHOTOGRAMMETRY

 Documentation: For years the documentation accompanying elements of cultural heritage, especially buildings, has been produced with the use of photography and plans. In a few years' time, it will be difficult to find documentary databases without 3D models because they constitute an integrated registry of information, and they provide a visualisation that is much closer to reality. In the case of buildings at risk, or in areas of conflict, detailed documentation such as this can be a very useful tool for use in partial or total reconstruction.





INTRODUCTION TO PHOTOGRAMMETRY

• **Research:** When we publish a 3D model of a Baroque sculpture or a prehistoric axe, we are placing a very valuable resource at the disposal of researchers throughout the world. To be able to see the object from all points of view, to be able to amplify the image, and even change the position of the light source illuminating it in order to find irregularities on its surface, is almost like having the original object in one's hand.







INTRODUCTION TO PHOTOGRAMMETRY

 Dissemination: The ability we now have to show three-dimensional objects via the Internet on any device, including tablets and mobile phones, means that we can reach a very wide public and make cultural heritage more accessible to a younger audience. 3D models also open up new possibilities for communication, such as Augmented Reality, in which the object appears on screen, integrated into the environment being captured by the camera of a mobile phone, or Virtual Reality whereby, with some simple cardboard VR glasses, it is possible to see the object in three dimensions in a completely realistic way.



2 - CAMERA BASICS AND DATA CAPTURE

2.1 DATA CAPTURE: INTRODUCTION AND BASIC CONCEPTS
2.2 IMAGING STRATEGIES (I) - LARGE STRUCTURES AND SPACES
2.3 IMAGING STRATEGIES (II) - SMALL AND MEDIUM SIZE OBJECTS
2.4 LIGHTNING CONTROL
2.5 CAMERA BASICS
2.6 PRACTICAL TIPS FOR CAPTURING PHOTOS
2.7 OTHER MEDIA AND ACCESSORIES: POLES, TRIPODS AND DRONES



PLANNING

Know your object/site beforehand and adapt your workflow

Know the ultimate purpose of our work. This may imply different levels of detail, resolution and precision may be required.

The "outputs" or infographic materials we must produce (3D file, video virtual tour, web viewer, orthophotos, integration into virtual recreation, etc.)

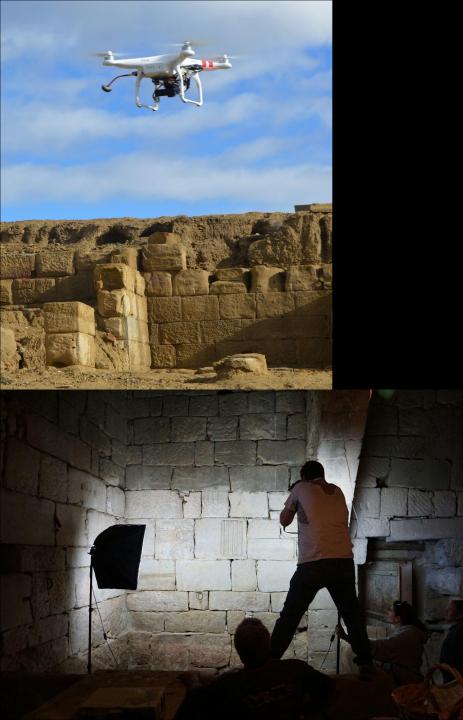
The "audience" for which said products are intended.

Required level of geometric accuracy: The accuracy we want reflected from the real object in our geometric model.

Detail level ("resolution") of the three-dimensional model: is determined by the number of polygons in the three-dimensional model.

Surfaces to scan: we will determine them depending on the type of object, the purpose of the work and possible constraints





ANALYSIS

Object size: photogrammetry can be useful both for small objects (for example, a coin) and for large surfaces (a building or an archaeological site), however, obviously, both require different equipment to do it correctly (from a macro lens for small objects, even a drone for large surfaces).

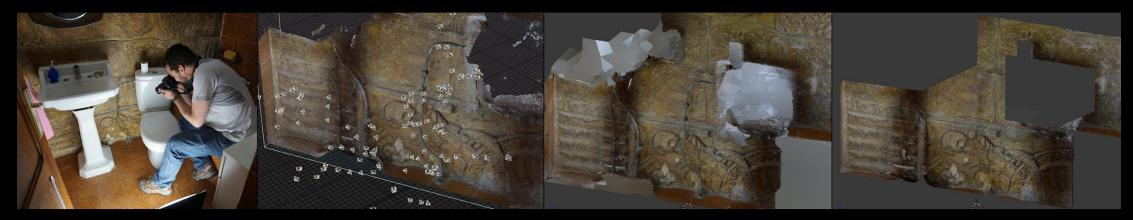


ANALYSIS

Location: when objects cannot be moved, their location can completely affect capture (available angles, narrow surroundings, elevation, orientation, etc.). In some cases we will need accessories or special equipment.

ANALYSIS

Obstacles: We must consider the possibility that foreign bodies interfere with data collection (vegetation, presence of the public, objects or equipment on the public road, etc.) We may need prior cleaning, narrow the area or dismantle some installation .



ANALYSIS

Contrast: it is convenient for the object to stand out as clearly as possible against the background, which can be easily achieved in studio conditions, but almost never when done in situ.







ANALYSIS

Lighting: being able to take photographs with controlled lighting or depending on the existing conditions (especially outdoors) is important to make decisions that allow us to obtain adequate photographs.

Brightness, shadows and backlighting: these are the main constraints for the photogrammetric software to obtain good geometry. We will see later how to mitigate its effects.

Things to avoid

- Very dark surfaces
- Reflective surfaces
- Transparent surfaces (including water)
- Uniform textures and solid color surfaces
- Moving light sources/shadows
- Capturing your own shadow

2.2 IMAGING STRATEGIES (I) - LARGE STRUCTURES AND SPACES

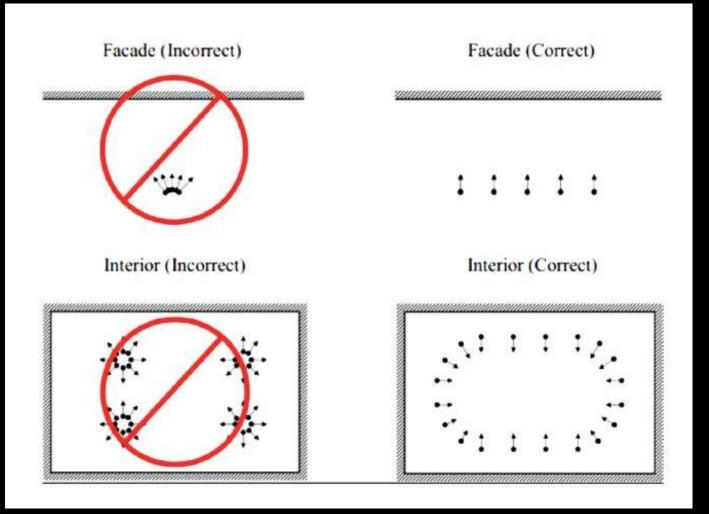
ASPECTS TO CONSIDER WHEN TAKING PHOTOGRAPHS

Planning the camera position

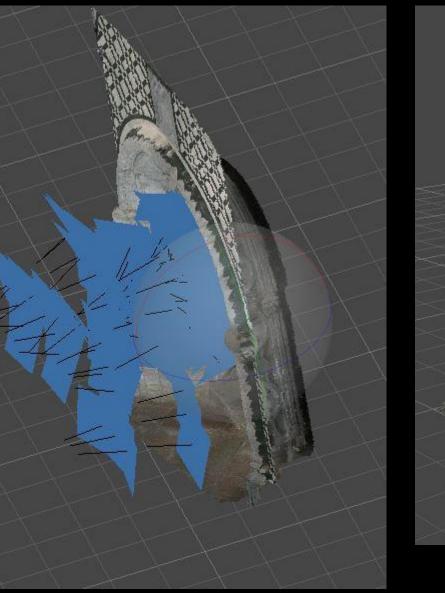
Overlap of the images at least 60%

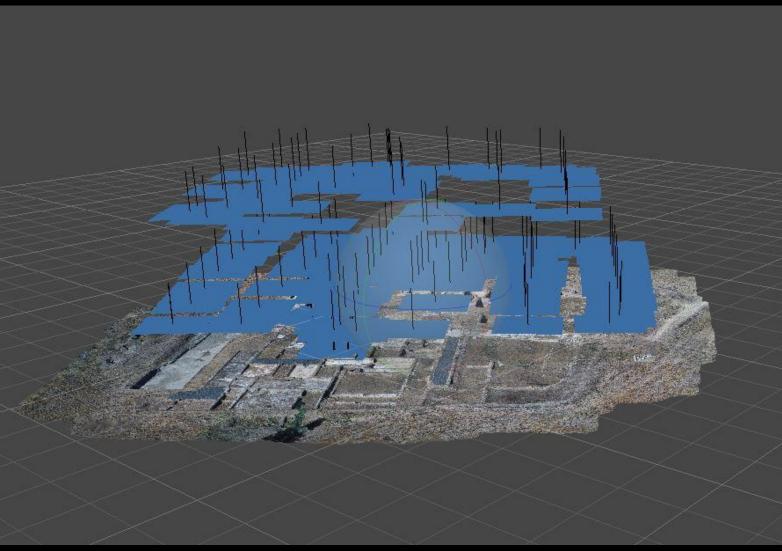
Provide some detail in keypoints/features

Move Camera between shots



2.2 IMAGING STRATEGIES (I) - LARGE STRUCTURES AND SPACES





CAMERA BASICS AND DATA CAPTURE

2.3 IMAGING STRATEGIES (II) - SMALL AND MEDIUM SIZED OBJECTS

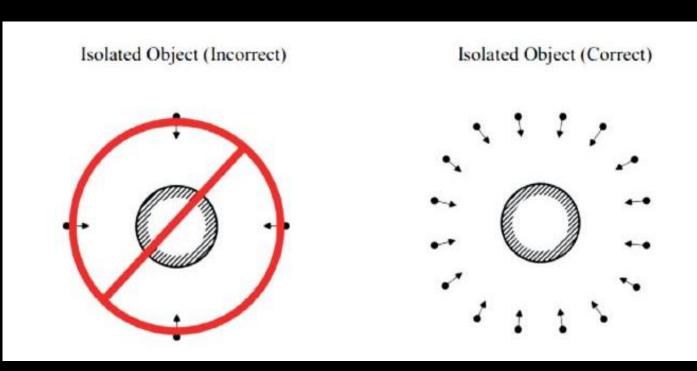
ASPECTS TO CONSIDER WHEN TAKING PHOTOGRAPHS

Planning the camera position

Overlap of the images at least 60%

Provide some detail in keypoints/features

Move Camera between shots



2.3 IMAGING STRATEGIES (II) - SMALL AND MEDIUM SIZED OBJECTS

Setup the lightning and shooting environment

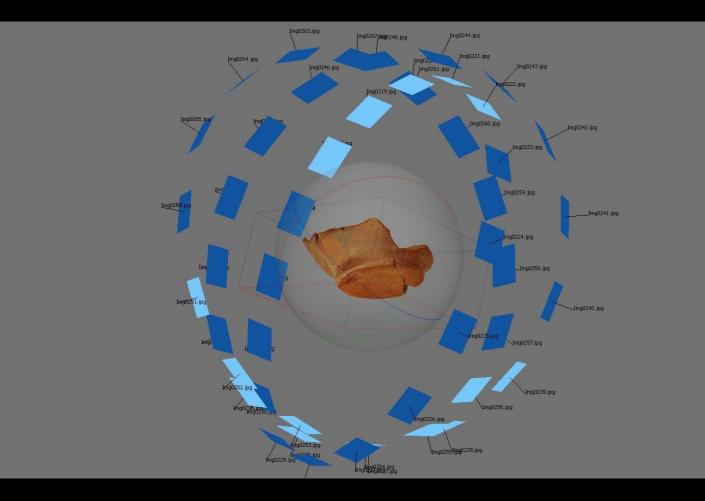
Position the object

Set the camera focus, aperture and shutter time

Photograph the object around from all sides

Reposition the camera, focus if needed, and repeat

Reposition the object



Can we control existing lighting?

If we have to use natural lighting, what time is it most suitable?

Remember that the best lighting is diffused, without strong light-shadow contrasts.



2.4 LIGHTNING CONTROL

2.4 LIGHTNING CONTROL

If we can't control the conditions, can we somehow mitigate them with the equipment? Can we improve the photos with later adjustments?

Available lighting is never completely neutral and can distort colors. In order to be able to correct it through image treatment software, we can embed a color checker



CAMERA BASICS AND DATA CAPTURE

2.5 CAMERA BASICS

CAMERA SETUP

Manual focus



2.5 CAMERA BASICS

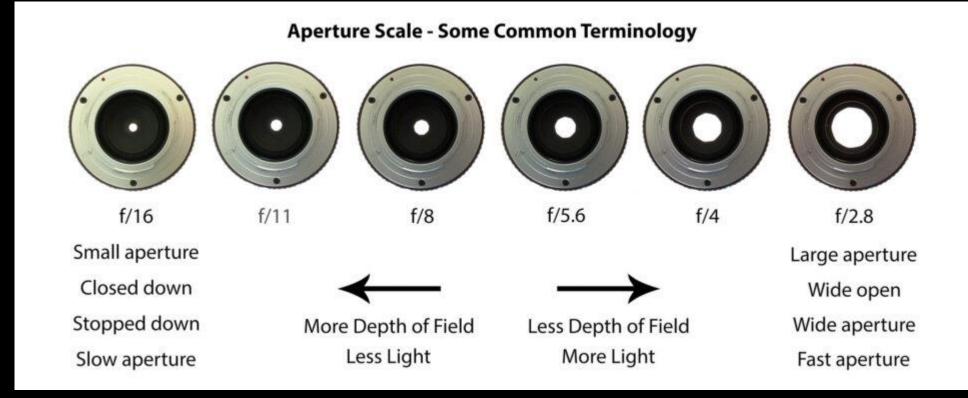
CAMERA SETUP Focus Point Focus Distance Large Depth of Field ∢→ Narrow Depth of Field Focus Point Focus Distance -Large Depth of Field

CAMERA BASICS AND DATA CAPTURE

2.5 CAMERA BASICS

CAMERA SETUP

Aperture



2.6 PRACTICAL TIPS FOR CAPTURING PHOTOS

What's necessary

- Contiguous photos with 80% overlap
- Move camera between shots
- Minimize/eliminate moving shadows
 - Static light source
 - Diffuse light

- 5+ megapixel camera
- Wider lenses (50 mm or less)
- Maximize depth of field
 - Aperture between F8 and F16
 - This varies with lens
 - Tip: use aperture priority mode
- Include scale in a few extra photos or precisely measure and record a few features
- Color checker









Softlight Boxes

Background

Flash Diffuser



Turntable

Ruler

Markers







Tripod

Camera remote trigger

Markers

CAMERA BASICS AND DATA CAPTURE



Pole

CAMERA BASICS AND DATA CAPTURE



Lifting Platforms



Drones

3 - Processing workflow and 3D model editing

3.1 Download, installation and activation

3.2 User interface and menus

3.3 Workflow

3.3.1 Photo Quality

3.3.2 Aligning meshes

3.3.3 Positioning of the model

3.3.4 Creating and Cleaning the Dense Cloud

3.3.5 Creating Meshes and Textures

3.3.6 Scaling of photogrammetric models in Metashape

3.3.7 Exporting models

3.1 DOWNLOAD, INSTALLATION AND ACTIVATION

eatures Support Community Downloads Buy About v English



Discover intelligent photogrammetry with Metashape

Process digital images and generate 3D spatial data. Fast and highly accurate.

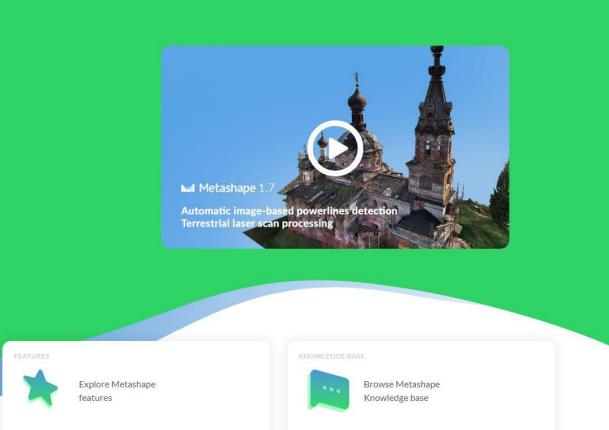
Watch featured

Metashape videos

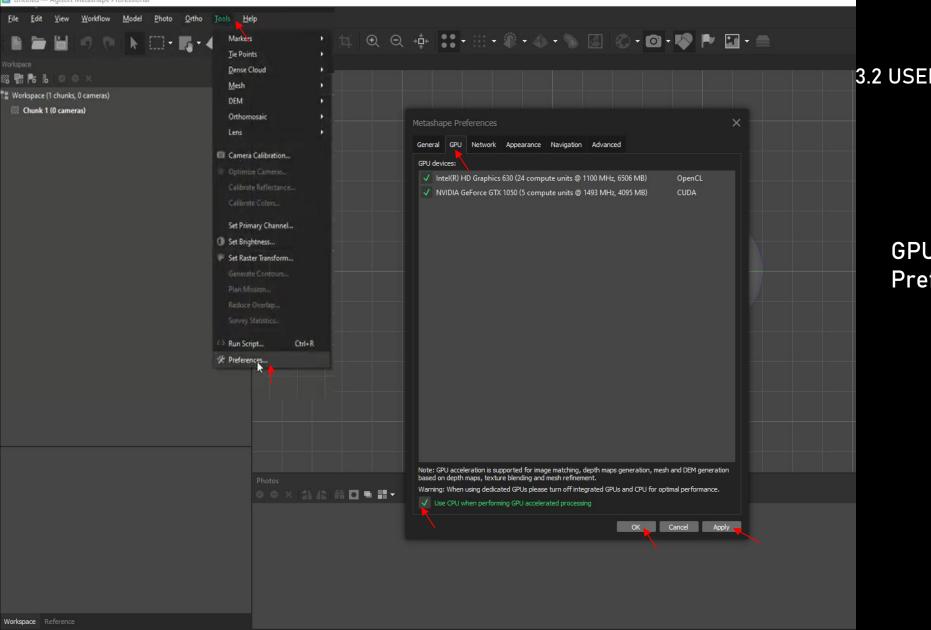
Already using Agisoft Metashape Professional or have 30-day trial? **Check out Agisoft Cloud**

TRY IT NOW

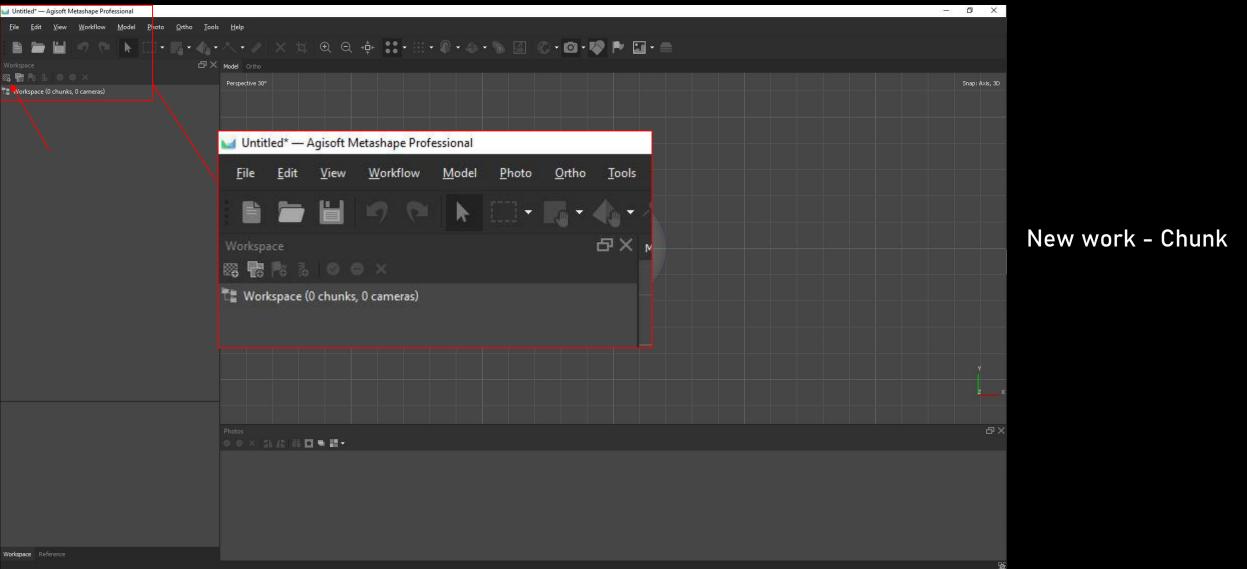
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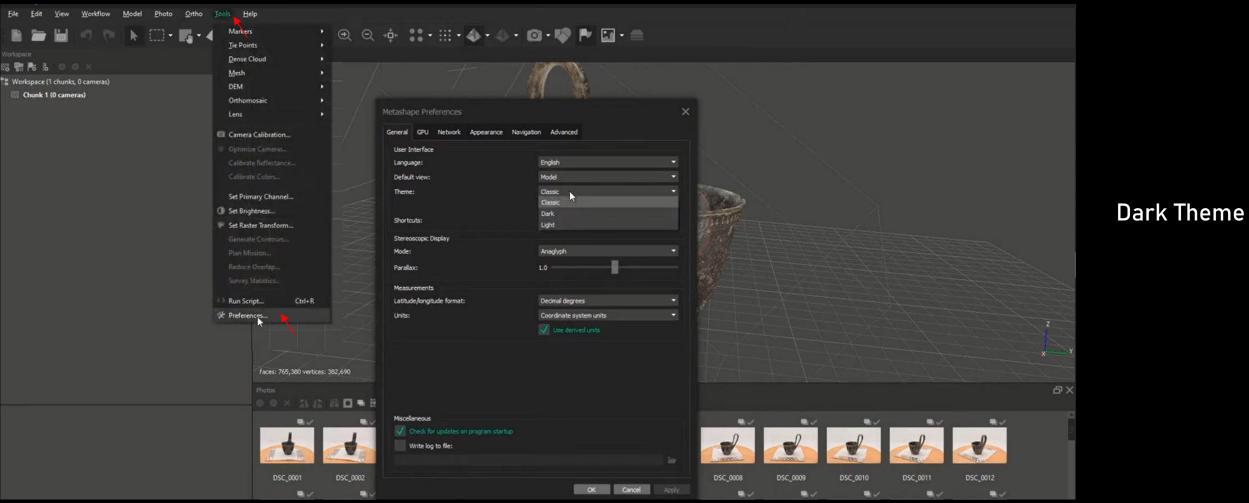


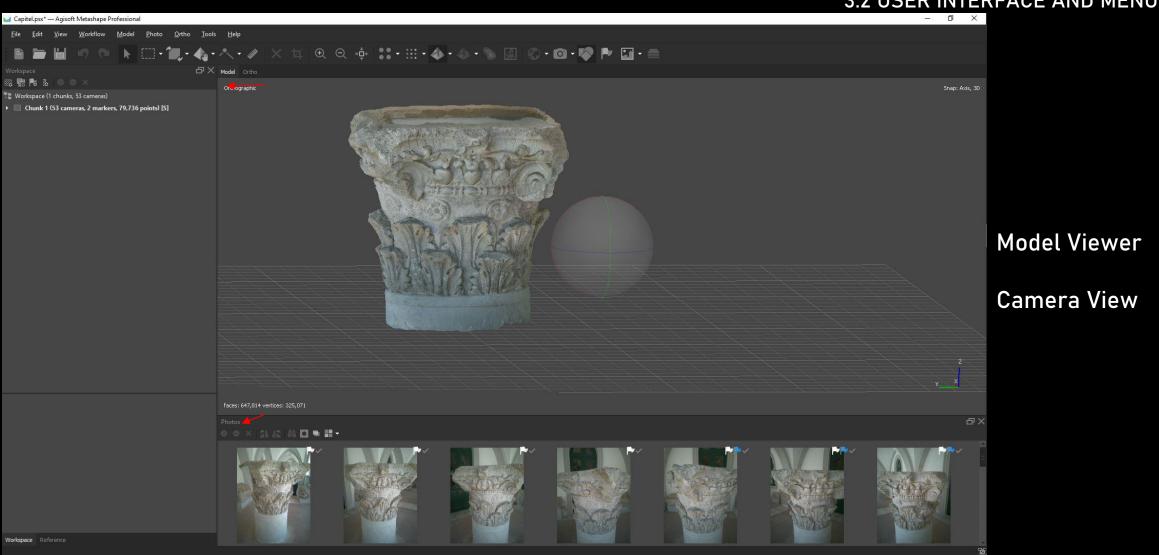


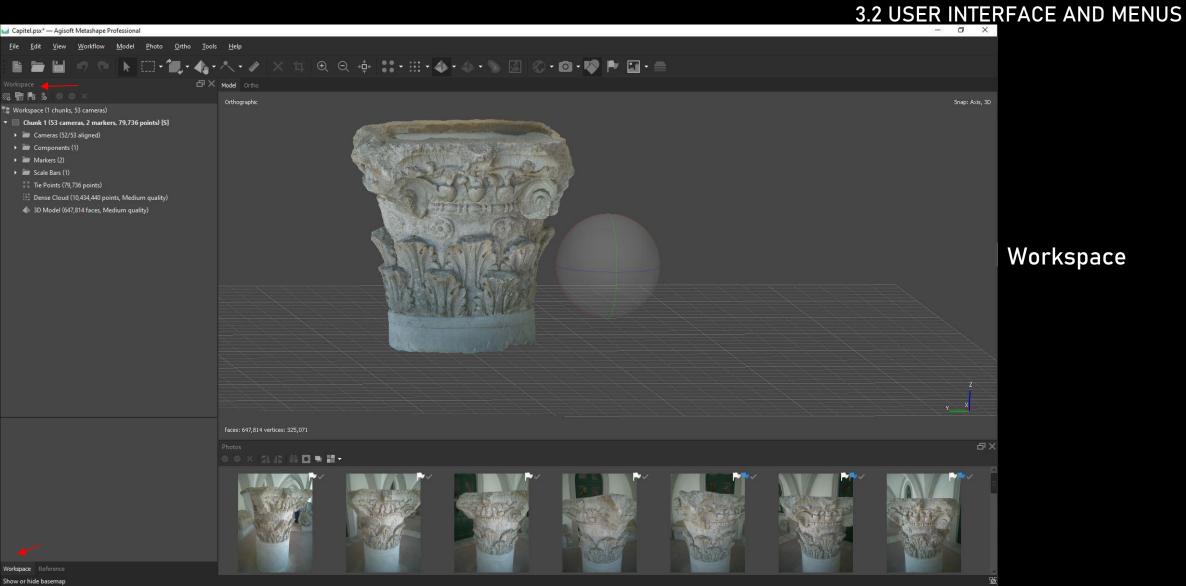


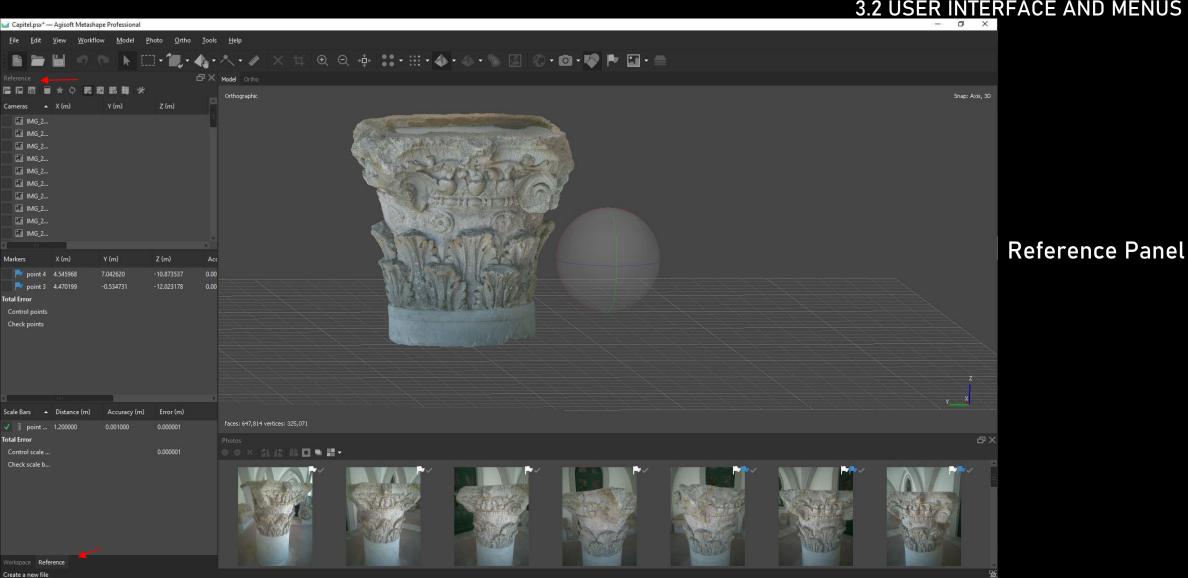
GPU Activation - Go Tools and then Preferences

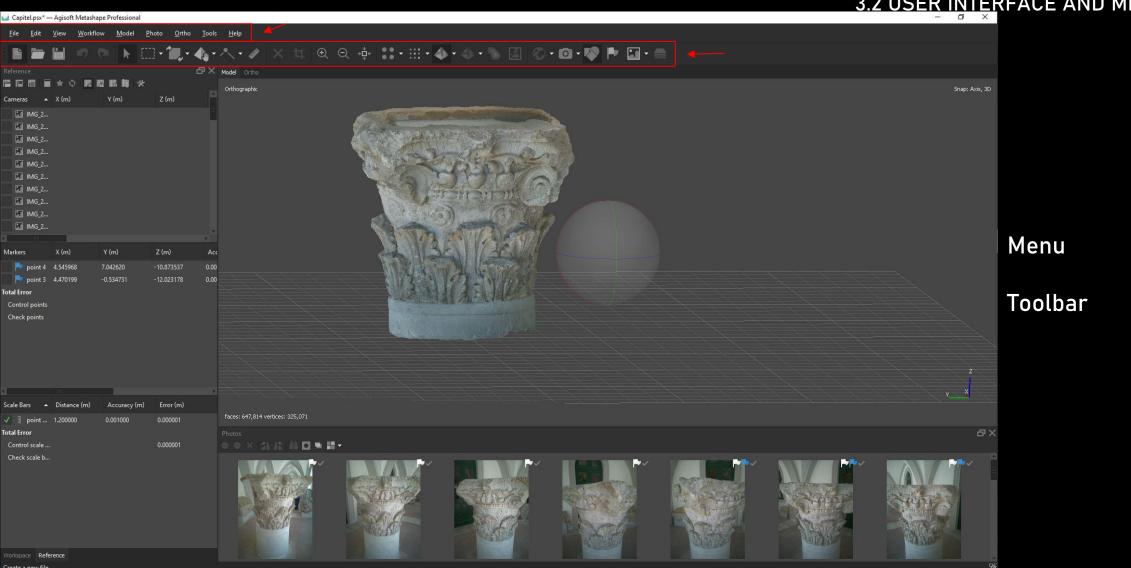




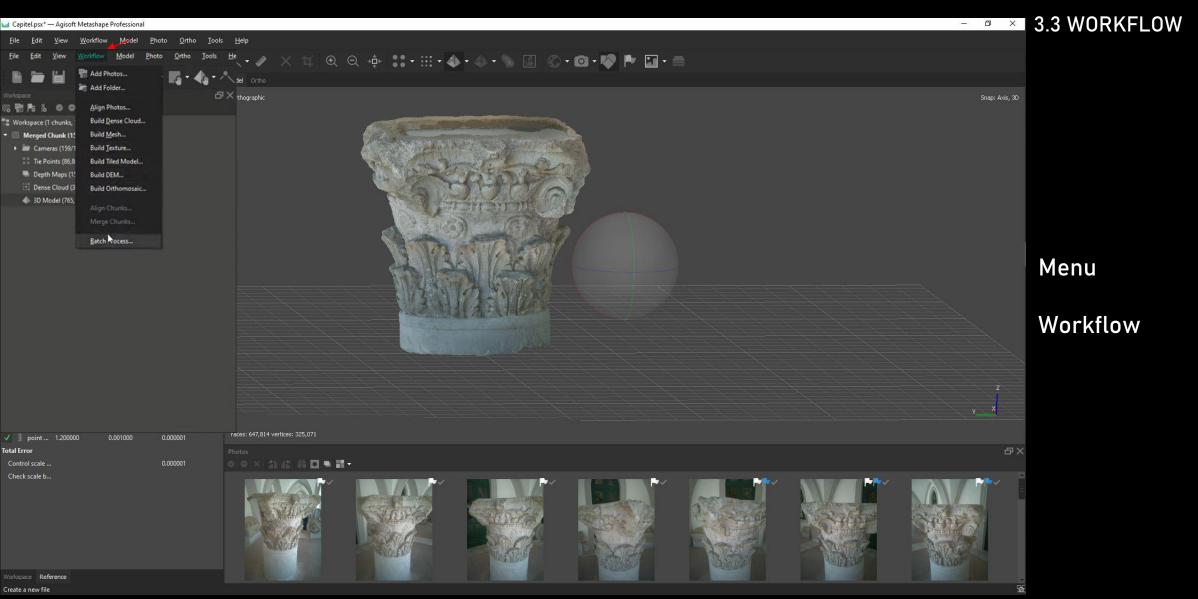


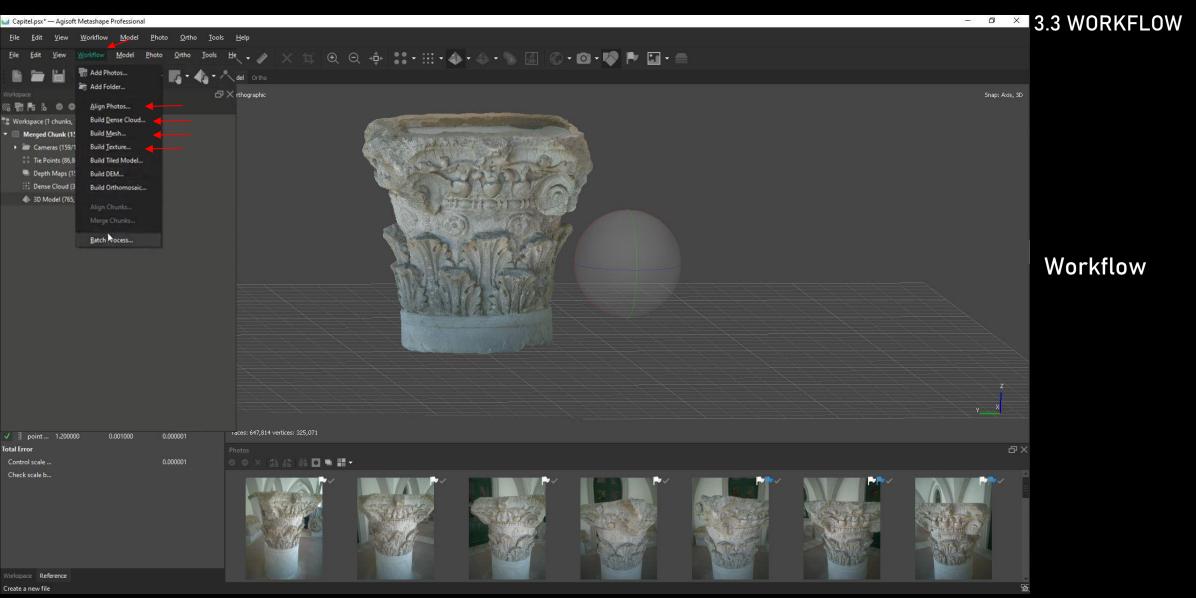


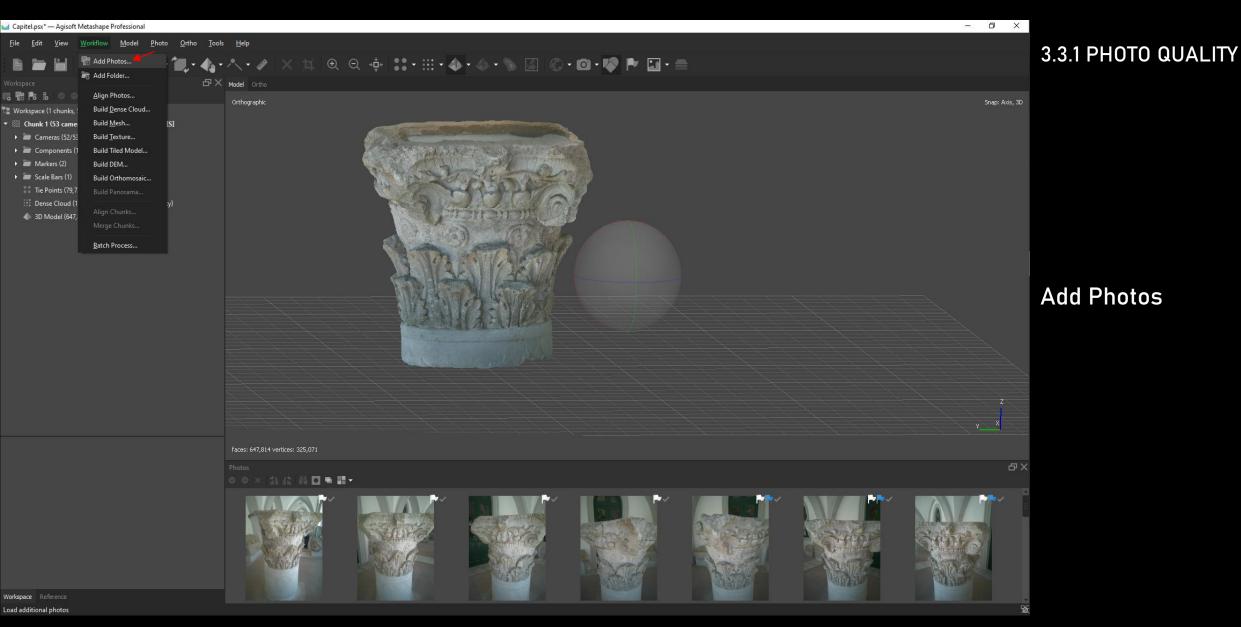


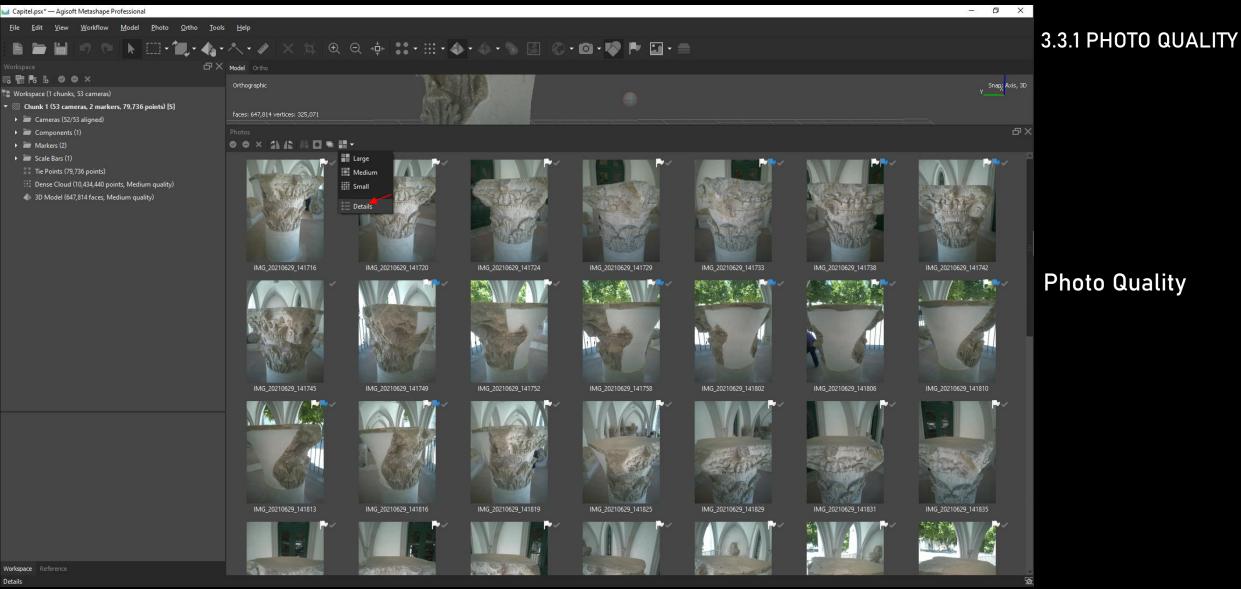


Create a new file





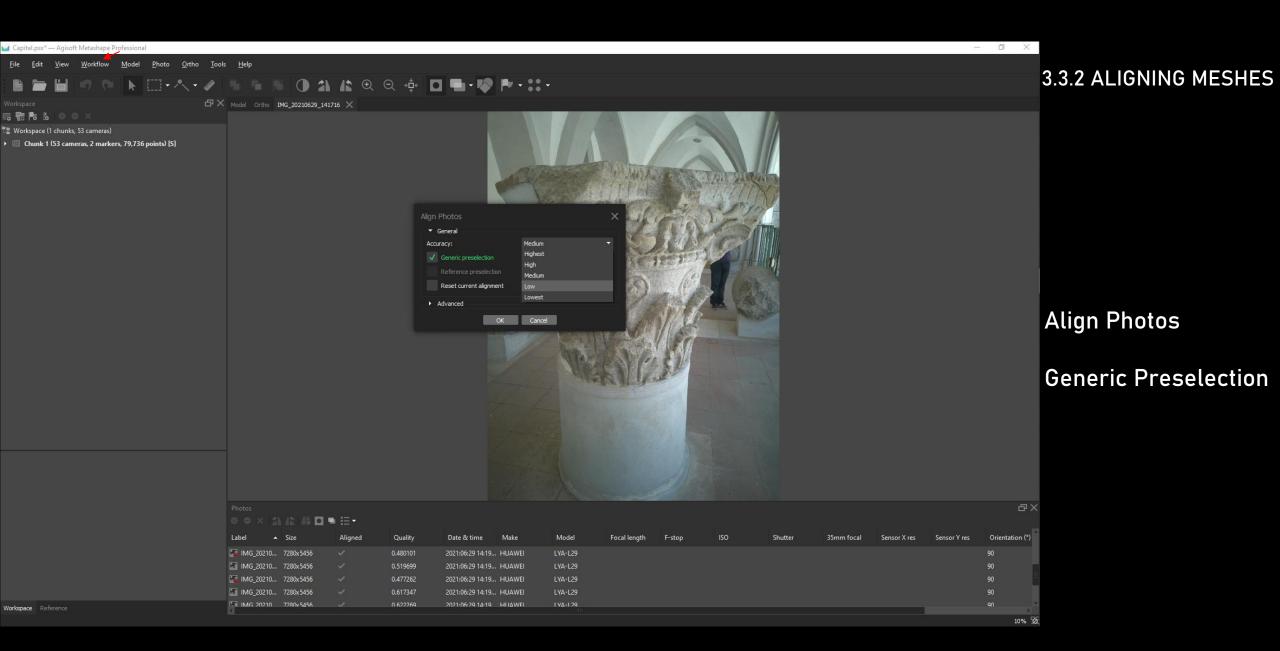




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	IMG_20210			0.458531	2021:06:29 14:18		LYA-L29								90	
	IMG_20210			0.547634 0.490628	2021:06:29 14:18		LVA-L29								90	
	IMG_20210			0.490628	2021:06:29 14:18 2021:06:29 14:18		LYA-L29 LYA-L29								90	
	IMG_20210			0.435256	2021:06:29 14:18		LYA-L29								90	
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	IMG_20210			0.392805	2021:06:29 14:18	HUAWEI	LYA-L29								90	
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	🔝 IMG_20210	7280x 5456		0.391025	2021:06:29 14:19	HUAWEI	LYA-L29								90	
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Workspace	X Model Ortho															
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 Workspace (1 chunks, 53 cameras) Chunk 1 (53 cameras, 2 markers, 79,736 points) [S] 																
Cameras (52/53 aligned)	faces: 647,814 vert	ices: 325,071														
 E Components (1) 															₽×	
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🕨 🔚 Scale Bars (1)	Label Disable Car	neras	Aligned	Quality	Date & time	Make	Model	Focal length	F-stop	ISO	Shutter	35mm focal	Sensor X res	Sensor Y res	Orientation (°)	
Tie Points (79,736 points)	MG_20210 7	280x5456		0.563257	2021:06:29 14:17	. HUAWEI	LYA-L29								90	
Dense Cloud (10,434,440 points, Medium quality)	MG_20210 7	280x5456		0.620911	2021:06:29 14:17	. HUAWEI	LYA-L29								90	
4 3D Model (647,814 faces, Medium quality)	MG_20210 7	280x 5456		0.592203	2021:06:29 14:17	. HUAWEI	LYA-L29								90	
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	MG_20210 7	280x 5456		0.480263	2021:06:29 14:18	. HUAWEI	LYA-L29								90	
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	MG_20210 7	280x 5456		0.576888	2021:06:29 14:18	. HUAWEI	LYA-L29								90	
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	MG_20210 7			0.578642	2021:06:29 14:18		LYA-L29								90	
	MG_20210 7			0.518054	2021:06:29 14:18		LYA-L29								90	
	MG_20210 7			0.516362	2021:06:29 14:18		LYA-L29								90	
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	edium	IMG_20210 7280x5456		0.490666	2021:06:29 14:17 HUAWEI	LYA-L29					90	
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3.3.2 ALIGNING MESHES

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Property	Value	IMG_20210			0.557906	2021:06:29 14:17 HUAWEI	LYA-L29							90	
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Point colors	3 bands, uint16	IMG_20210			0.529344	2021:06:29 14:17 HUAWEI	LYA-L29							90	
Key points	No	IMG_20210			0.469131	2021:06:29 14:17 HUAWEI	LYA-L29							90	
Average tie point multiplicity	2.32021	IMG_20210			0.531674	2021:06:29 14:17 HUAWEI	LYA-L29							90	
Alignment parameters	Medium	IMG_20210			0.490666	2021:06:29 14:17 HUAWEI	LYA-L29							90	
Accuracy Generic preselection	Yes	IMG_20210	7280x5456		0.603723	2021:06:29 14:18 HUAWEI	LYA-L29							90	
Key point limit	Yes 40,000	IMG_20210	7280x5456		0.458531	2021:06:29 14:18 HUAWEI	LYA-L29							90	
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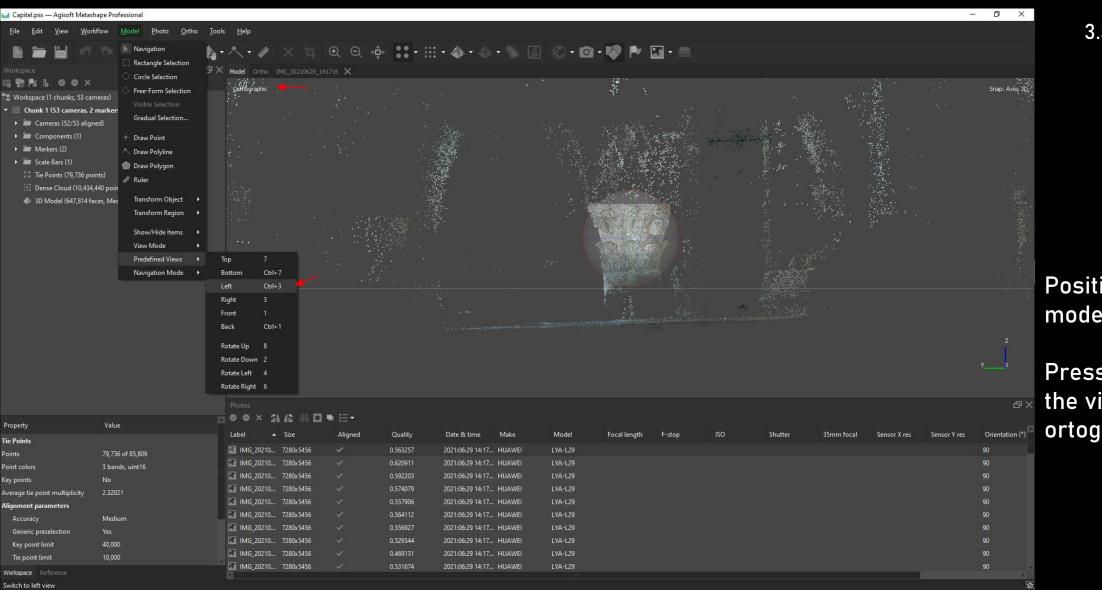
IGNING MESHES

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Tie Points		Label	▲ Size	Aligned	Quality	Date & time Make	Model	Focal length	F-stop	ISO	Shutter	35mm focal	Sensor X res	Sensor Y res	Orientation (°)	
Points	79,736 of 85,809	IMG_202	210 7280x5456		0.563257	2021:06:29 14:17 HUAWEI	LYA-L29								90	
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Key points	No	IMG_202	210 7280x5456		0.592203	2021:06:29 14:17 HUAWEI	LYA-L29								90	
Average tie point multiplicity	2.32021		210 7280x5456		0.574079	2021:06:29 14:17 HUAWEI	LYA-L29									
Alignment parameters			210 7280x5456		0.557906	2021:06:29 14:17 HUAWEI	LYA-L29									
Accuracy	Medium		210 7280x5456		0.564112	2021:06:29 14:17 HUAWEI	LYA-L29									
Generic preselection	Yes	IMG_202	210 7280x5456		0.556927	2021:06:29 14:17 HUAWEI	LYA-L29									
Key point limit	40,000		210 7280x5456		0.529344	2021:06:29 14:17 HUAWEI	LYA-L29									
Tie point limit	10,000		210 7280x5456		0.469131	2021:06:29 14:17 HUAWEI	LYA-L29									
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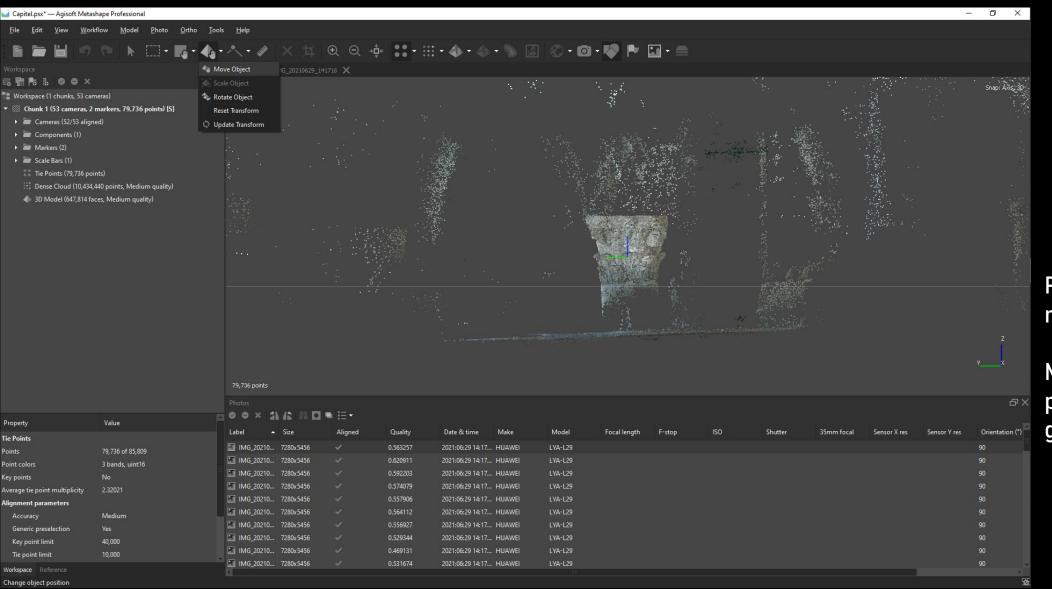
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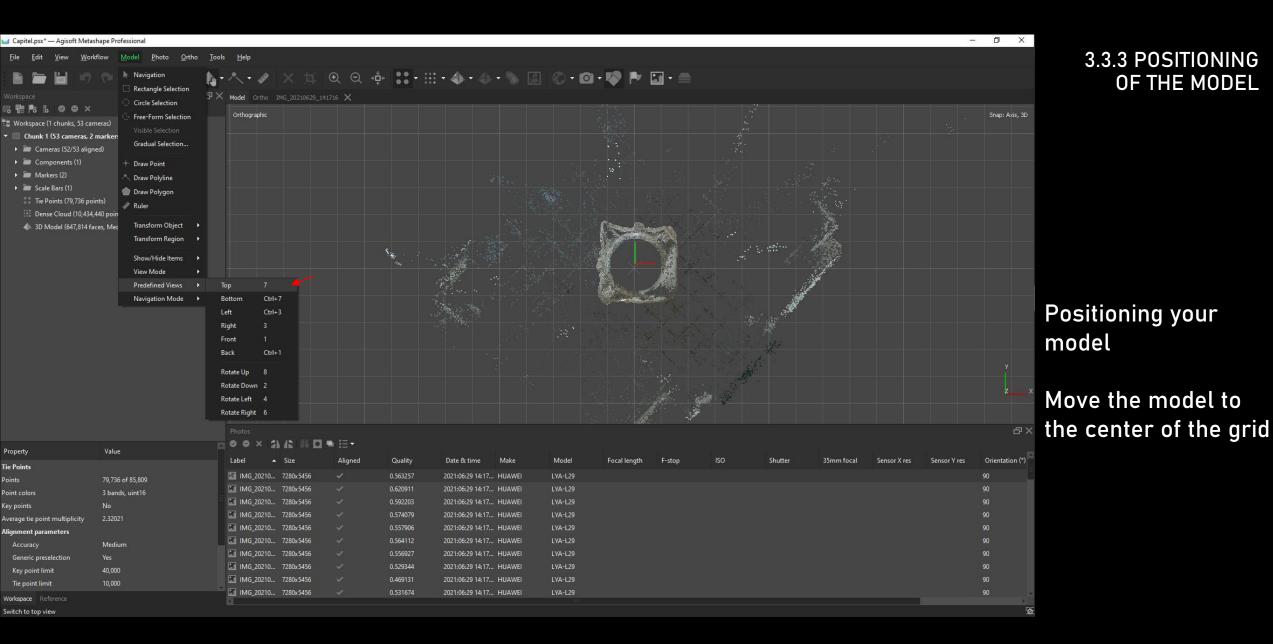
Positioning your model

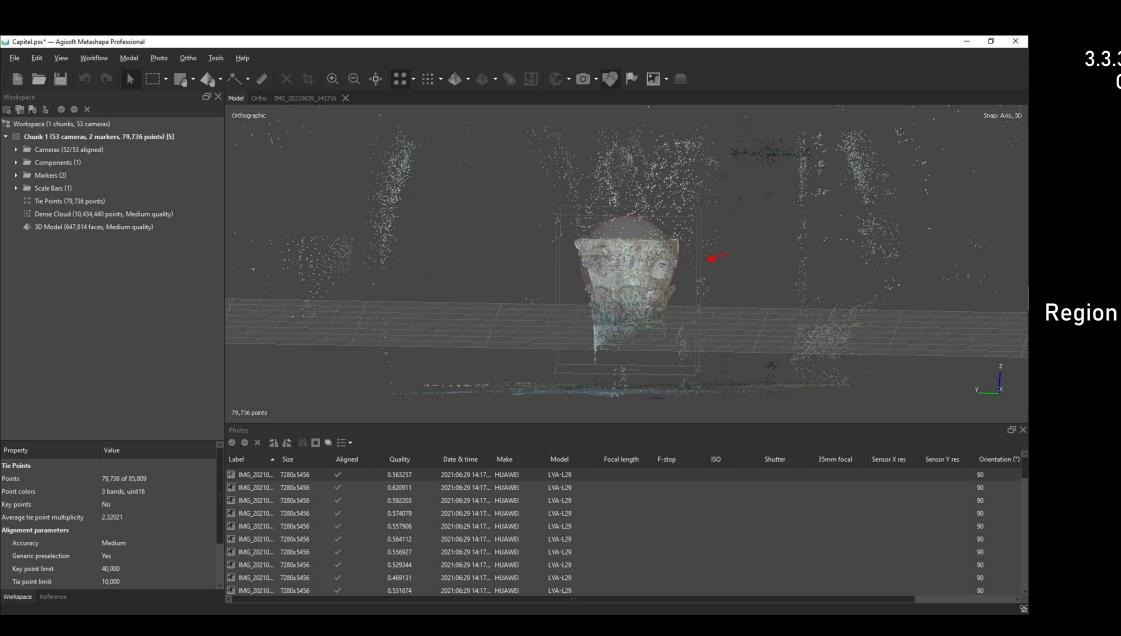
Press 5 to change the view mode to ortographic

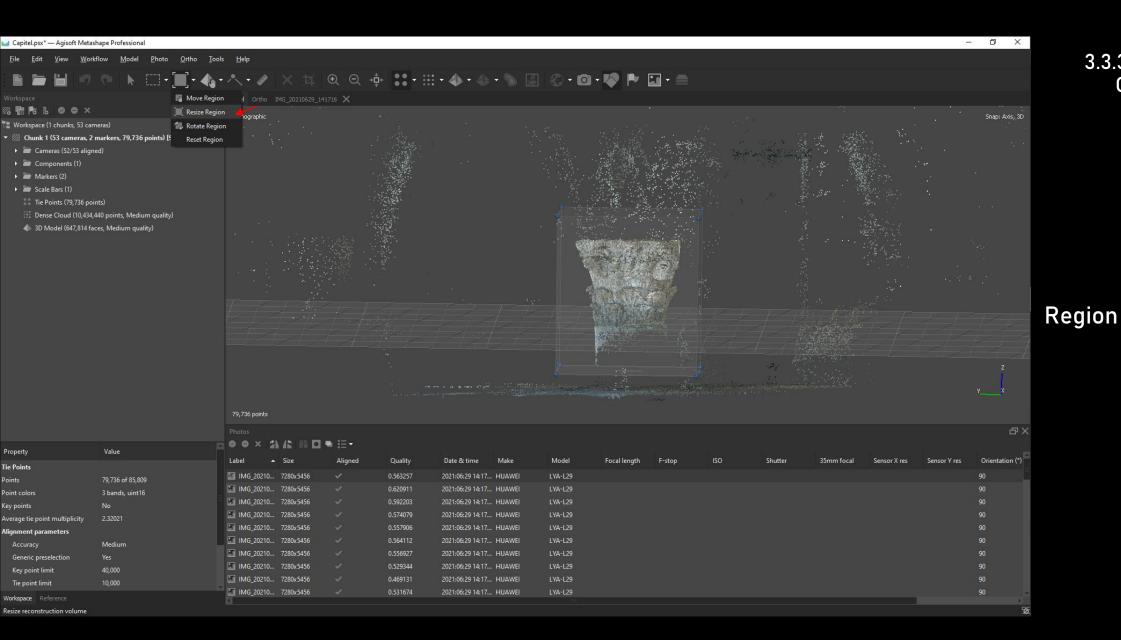


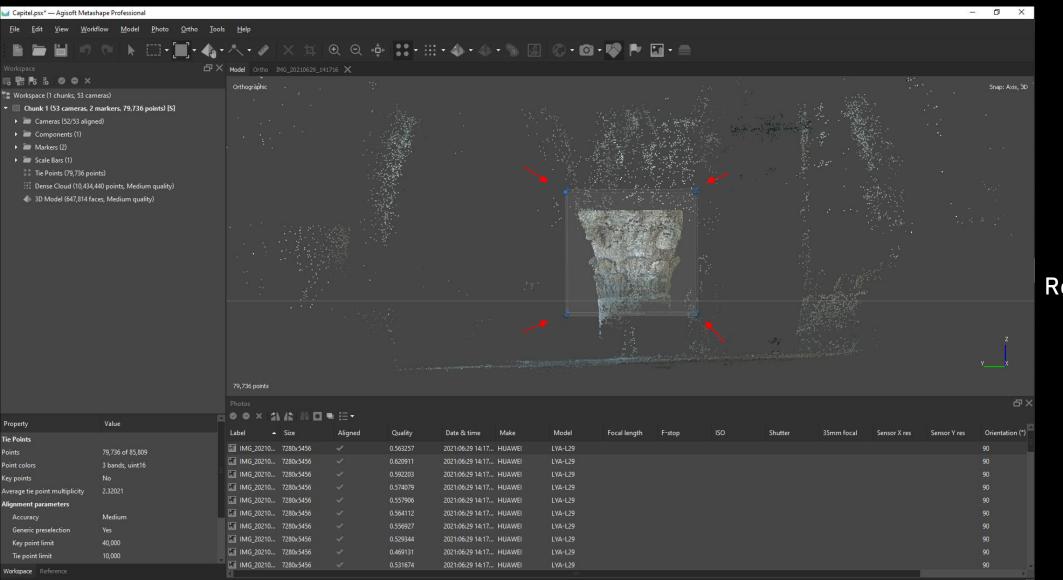
Positioning your model

Move the model to a position above the grid



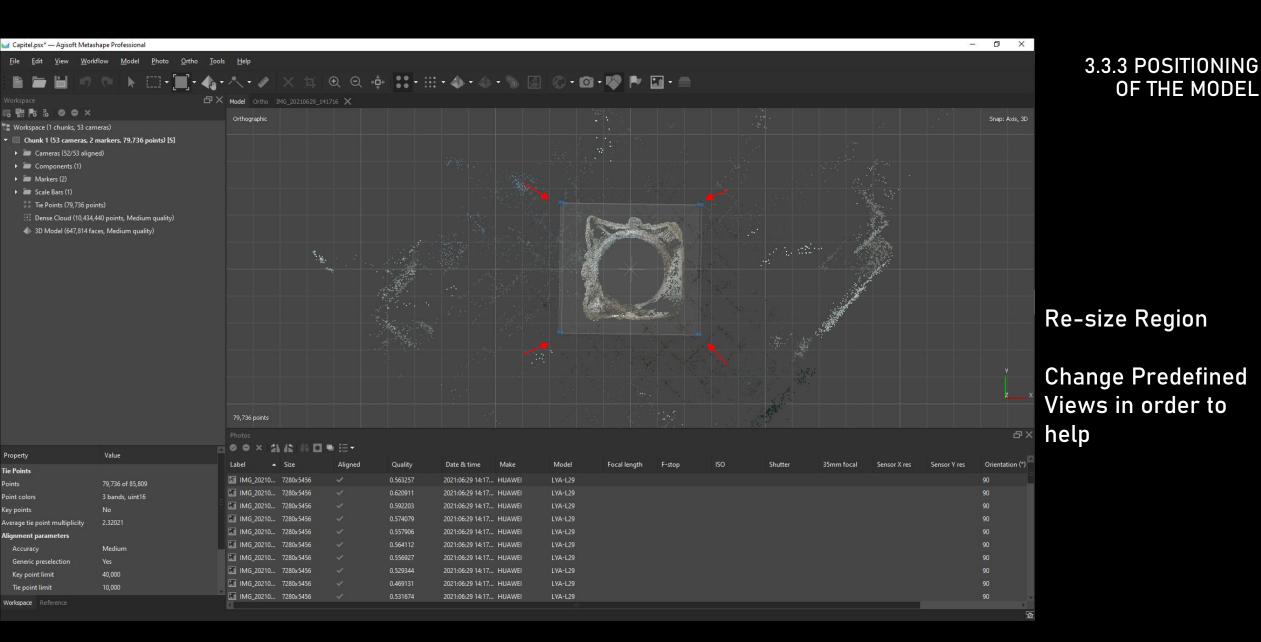


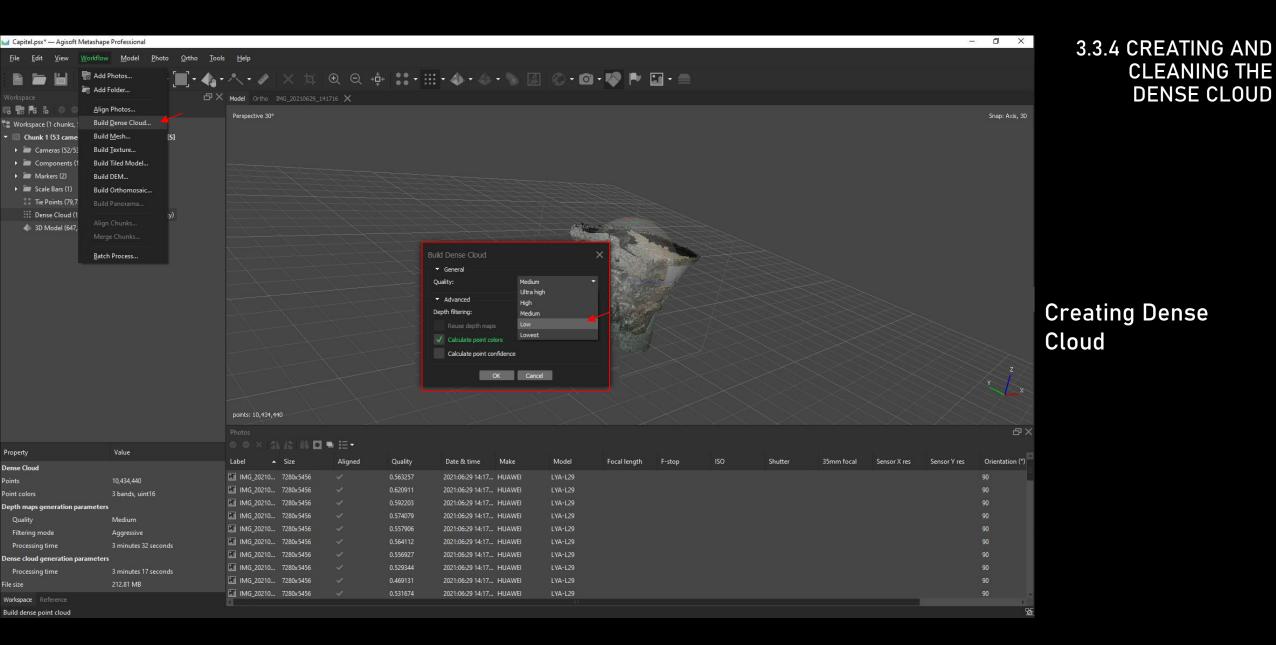




3.3.3 POSITIONING OF THE MODEL

Re-size Region





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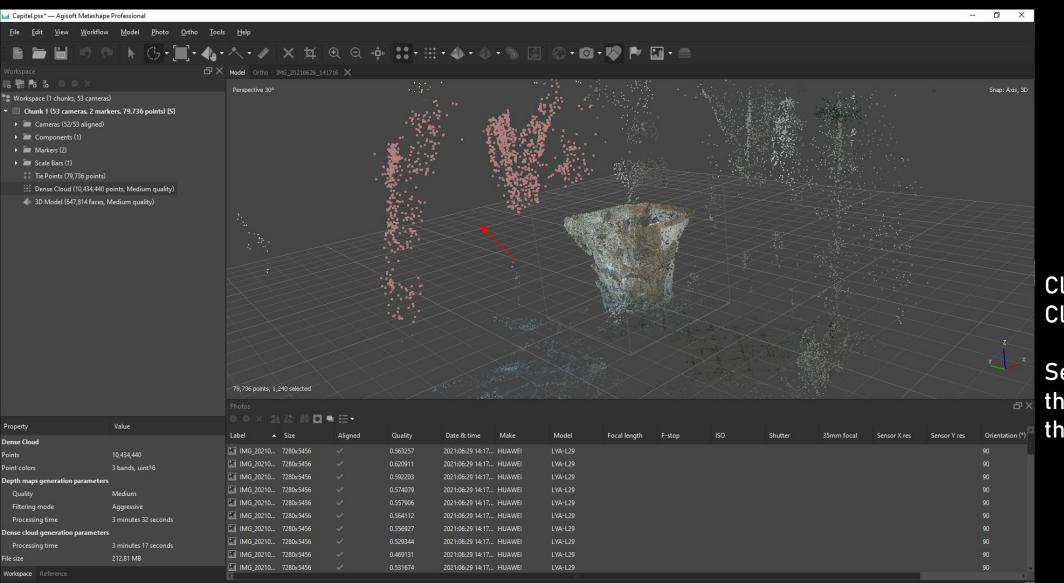
3.3.4 CREATING AND CLEANING THE DENSE CLOUD

Creating Dense Cloud

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Depth maps generation parameters		IMG_20210 7280x5456		0.592203	2021:06:29 14:17.		LYA-L29								90
Quality	Medium	IMG_20210 7280x5456		0.574079	2021:06:29 14:17.		LVA-L29								90
Filtering mode	Aggressive	IMG_20210 7280x5456		0.557906	2021:06:29 14:17.		LYA-L29								90
23 (33) (33)	3 minutes 32 seconds	IMG_20210 7280x5456		0.564112	2021:06:29 14:17.		LVA-L29								90
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3.3.4 CREATING AND CLEANING THE DENSE CLOUD

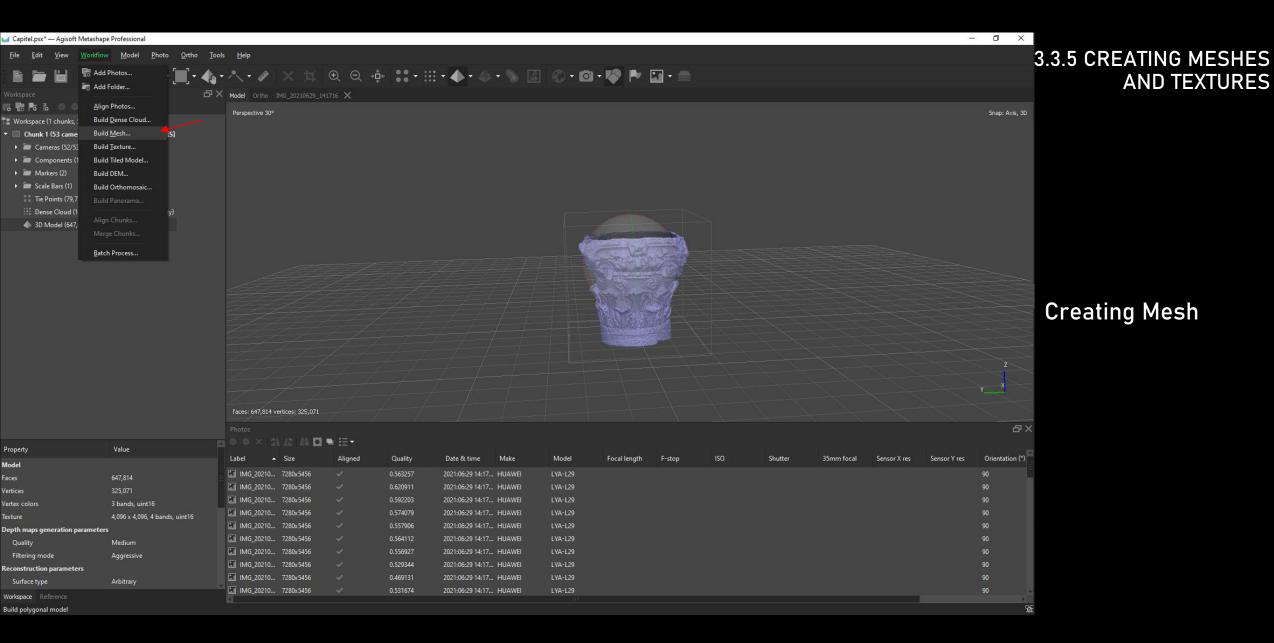
Cleaning the Dense Cloud

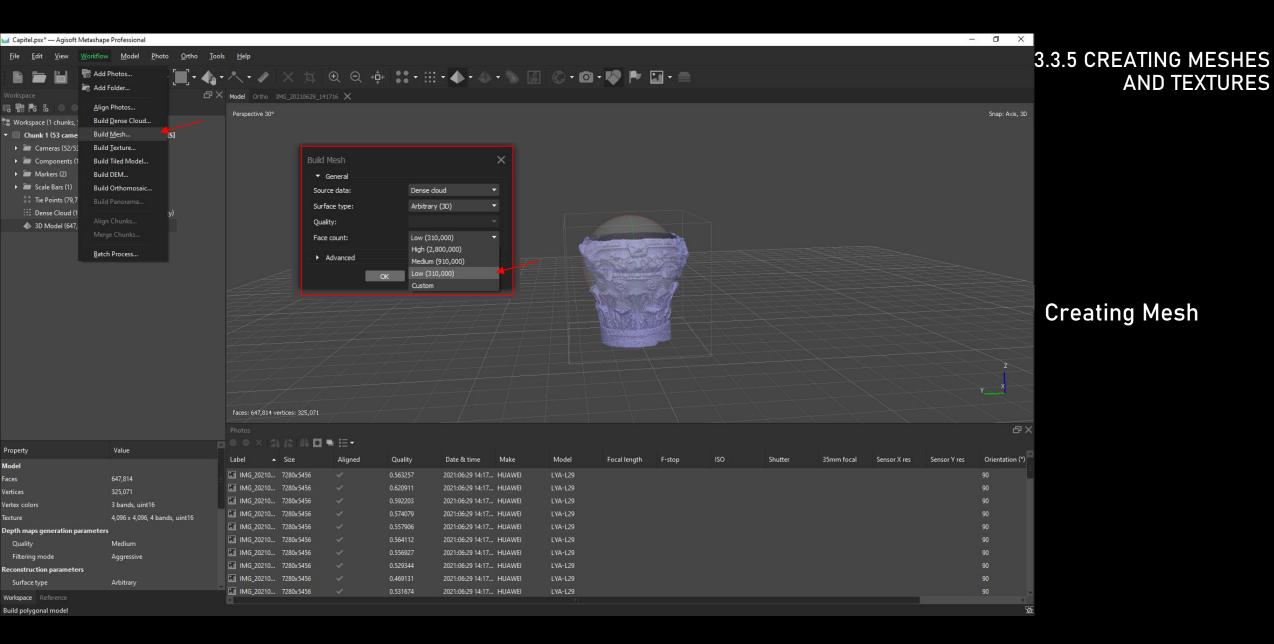


3.3.4 CREATING AND CLEANING THE DENSE CLOUD

Cleaning the Dense Cloud

Select the points that you want and then press DELETE





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Depth maps generation parameters		MG_20210 7280x5456		0.557906	2021:06:29 14:17 HUAWEI	LYA-L29						90		
Quality	Medium	MG_20210 7280x5456		0.564112	2021:06:29 14:17 HUAWEI	LYA-L29						90		
Filtering mode	Aggressive	MG_20210 7280x5456		0.556927	2021:06:29 14:17 HUAWEI	LYA-L29						90		
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Display 3D model in wireframe mode													ъ ба	

🖬 Capitel.psx* — Agisoft Metashape Professional

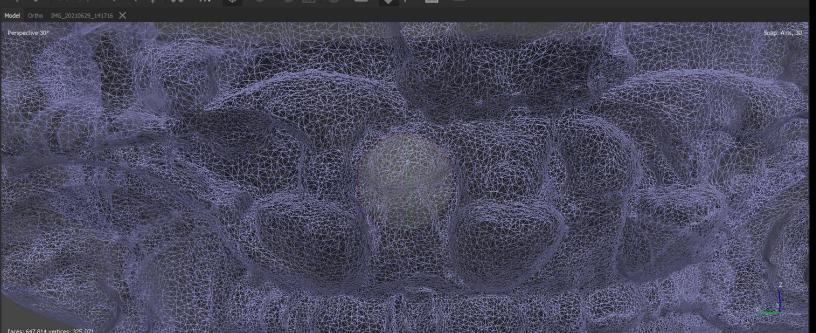
<u>V</u>iew <u>W</u>orkflow <u>M</u>odel <u>P</u>hoto <u>O</u>rtho <u>T</u>ools <u>H</u>elp Eile Edit

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Workspace (1 chunks, 53 cameras)

Chunk 1 (53 cameras, 2 markers, 79,736 points) [S]

- Eameras (52/53 aligned)
- E Components (1)
- Markers (2)
- 🔸 🚞 Scale Bars (1)
- Dense Cloud (10,434,440 points, Medium quality)
- 4 3D Model (647,814 faces, Medium quality)

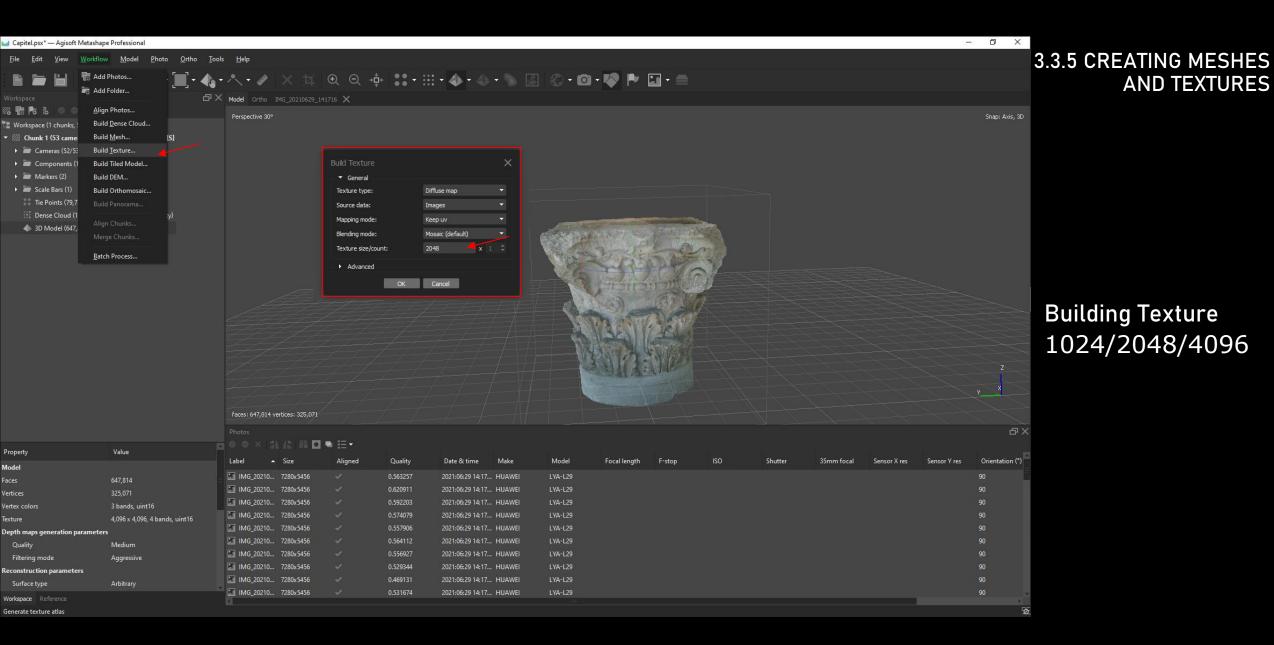


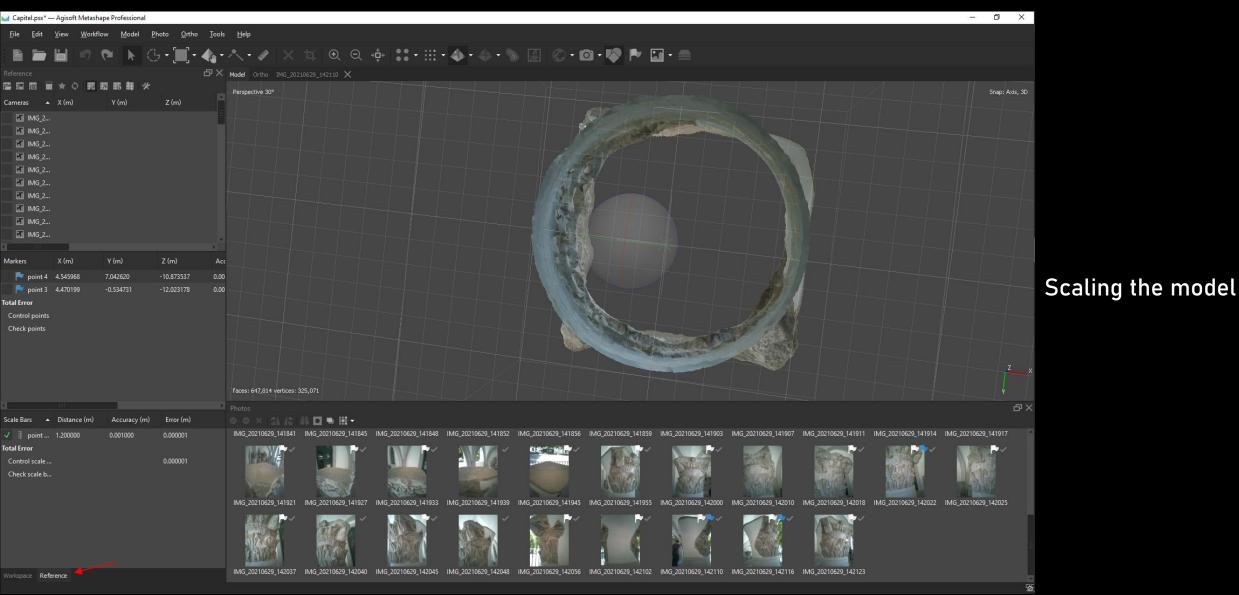
Creating Mesh Wireframe View

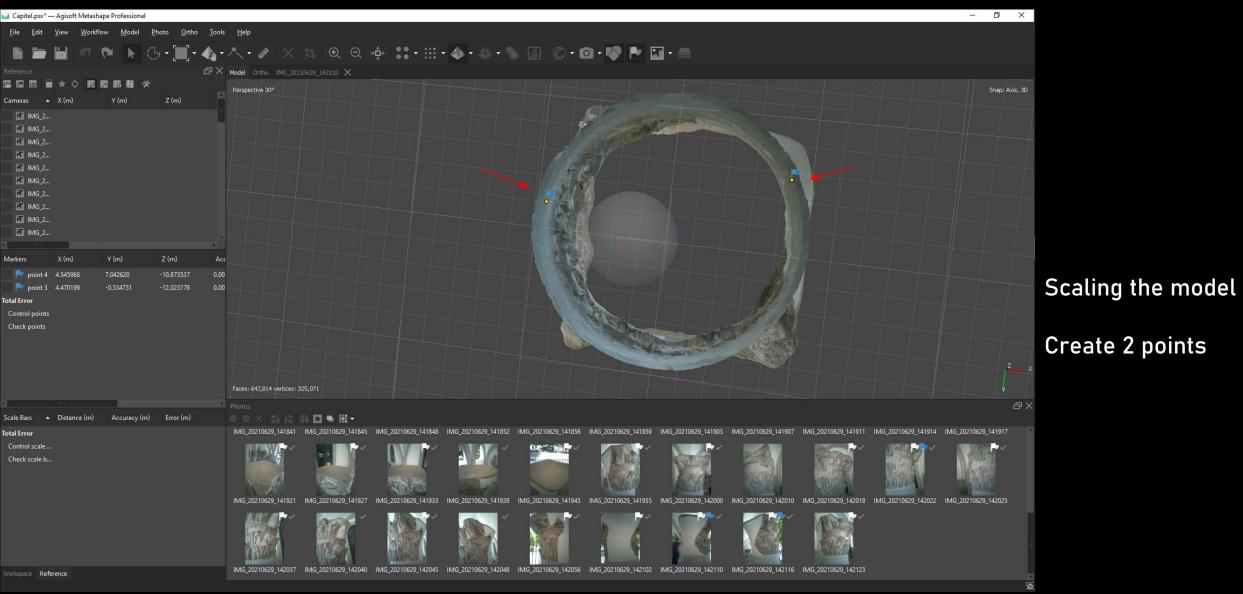
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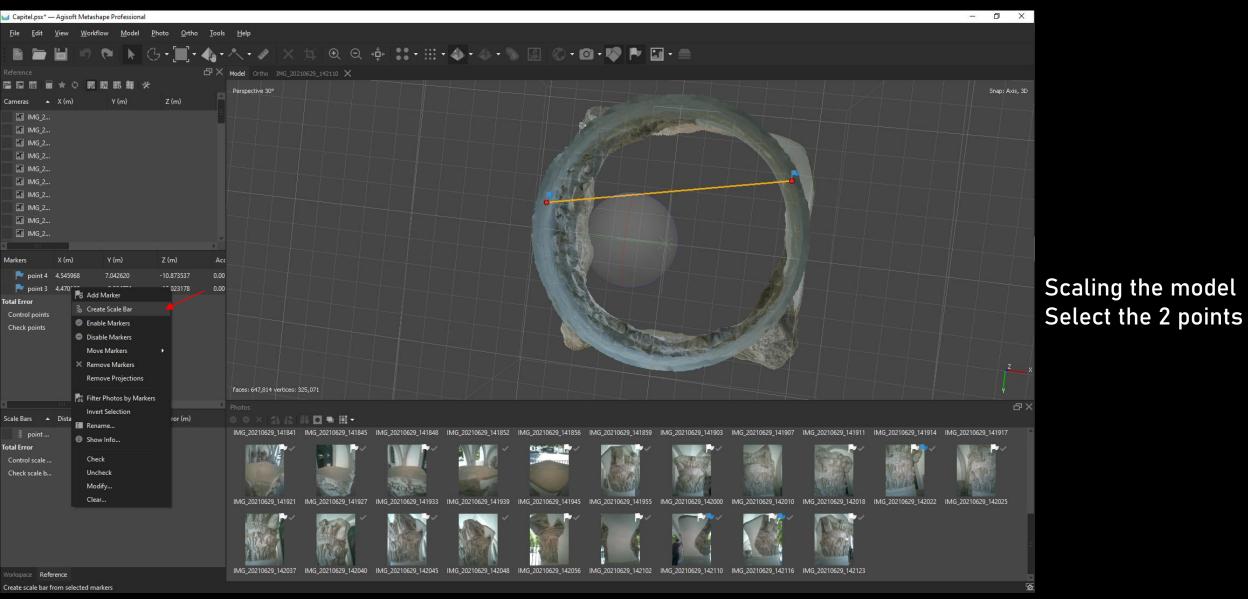
3.3.5 CREATING MESHES AND TEXTURES

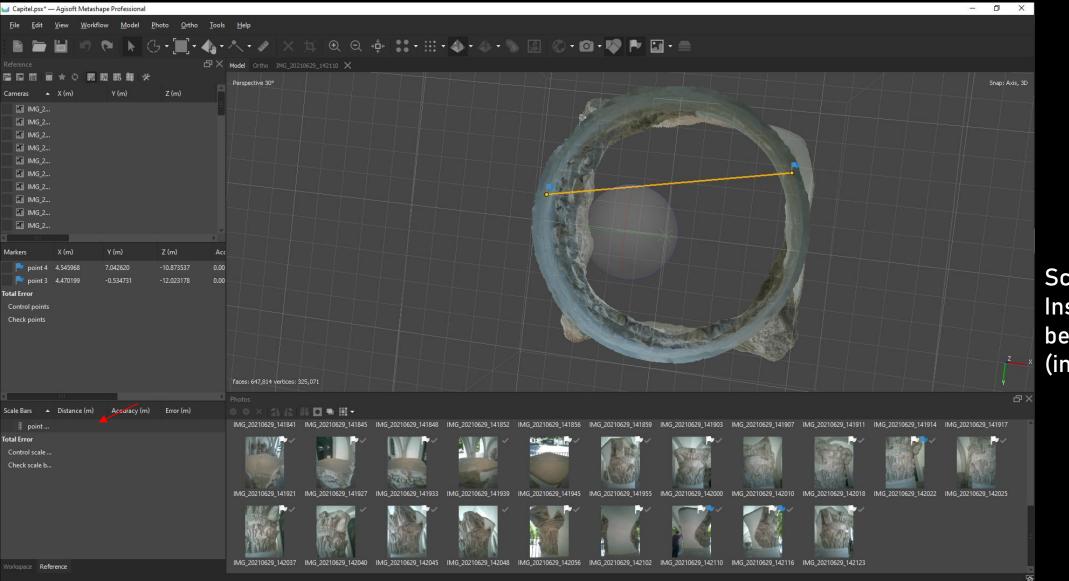
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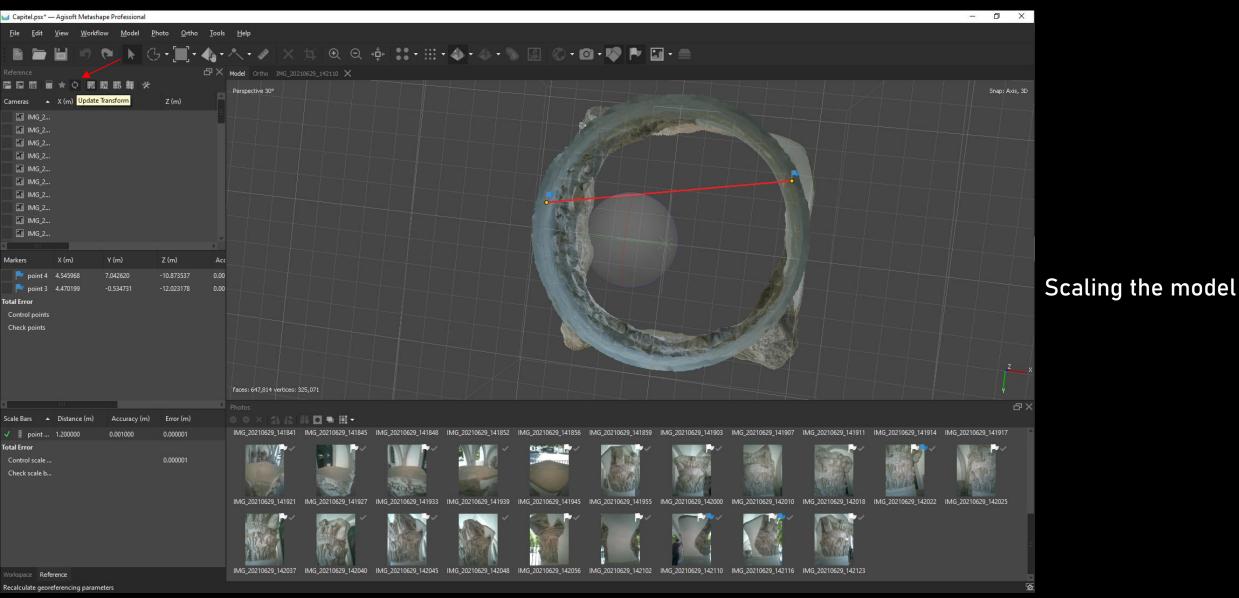


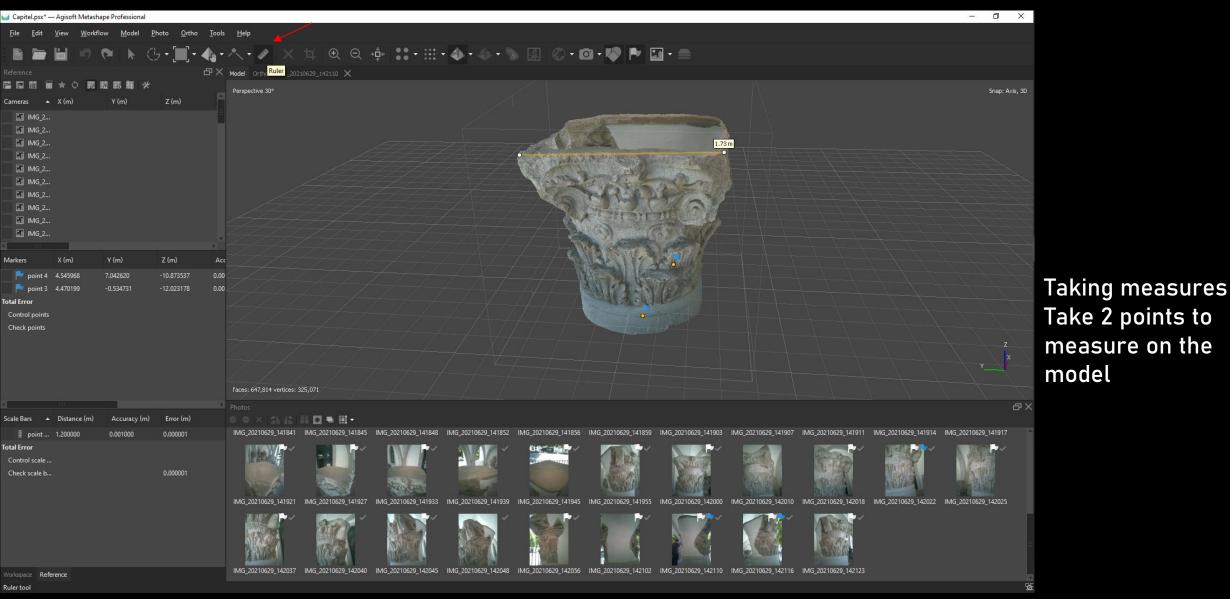




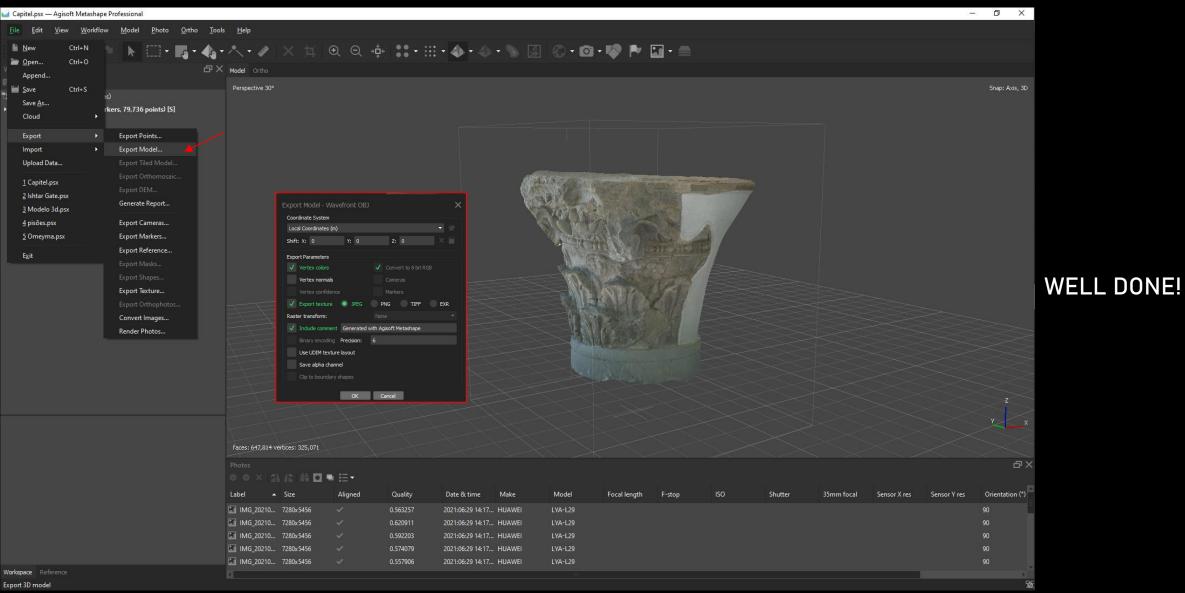


Scaling the model Insert the Distance between 2 markers (in meters)





3.3.7 EXPORTING MODELS



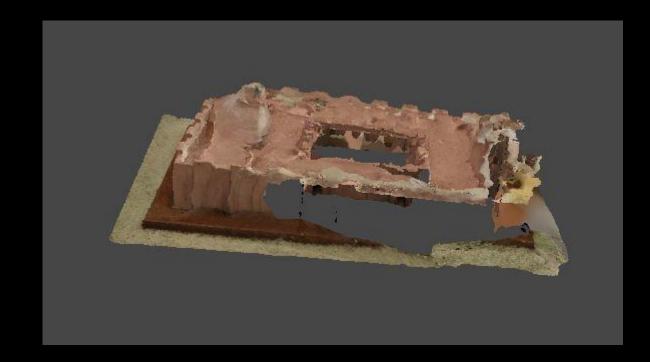
Q&A DAY

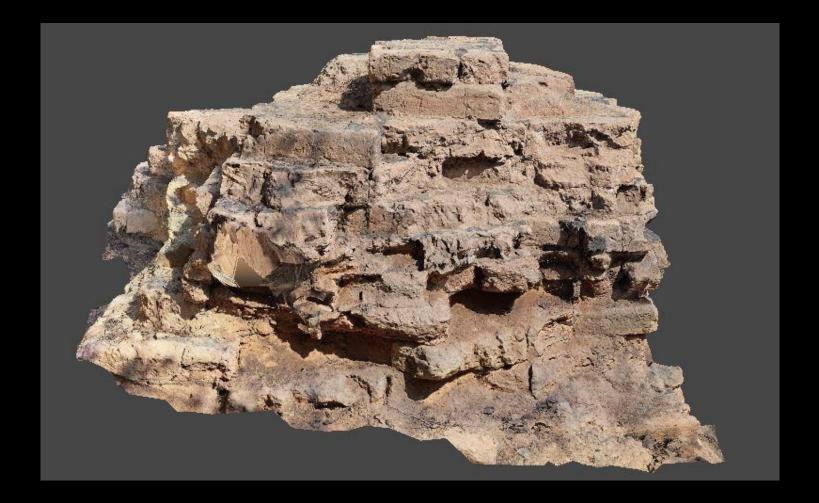
WORK EVALUATION

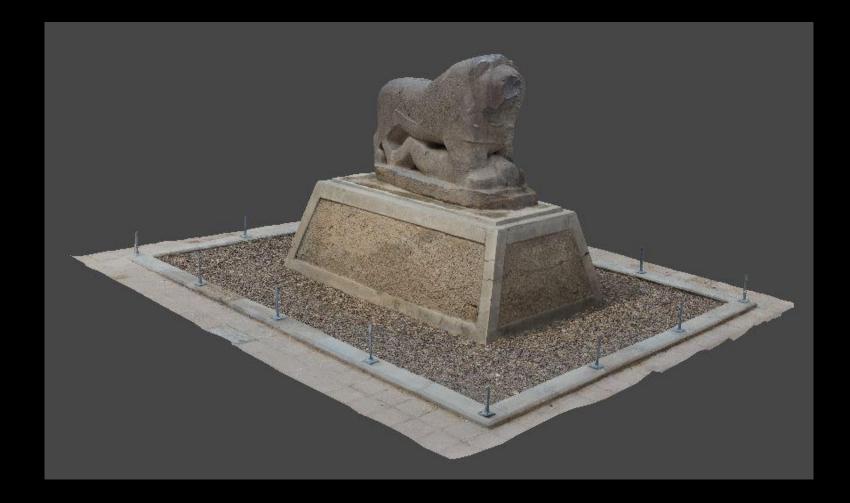




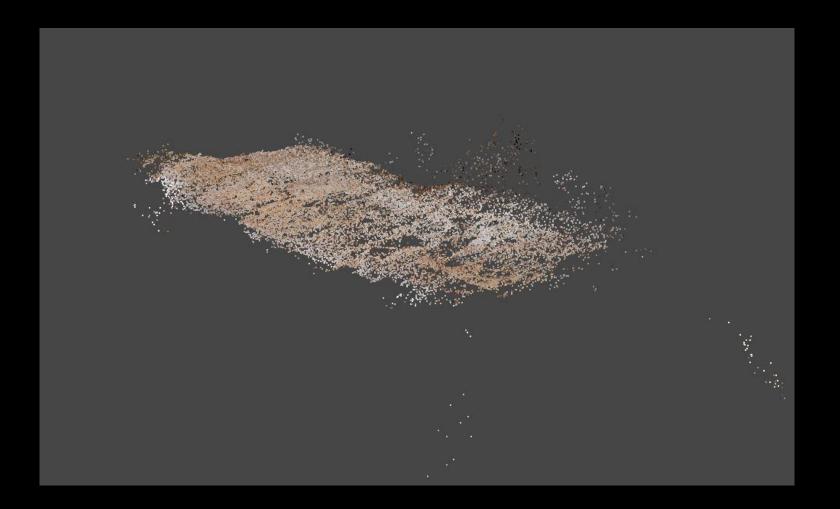














4- PHOTOGRAMMETRY AND DRONES

4.1 HOW TO OPERATE THE DRONE

4.2 CAPTURING PHOTOS FROM THE AIR

- 4.3 DRONE HARMONY APP FOR PLANNED FLIGHTS
- 4.4 METASHAPE WORKFLOW FOR DATA PROCESSING

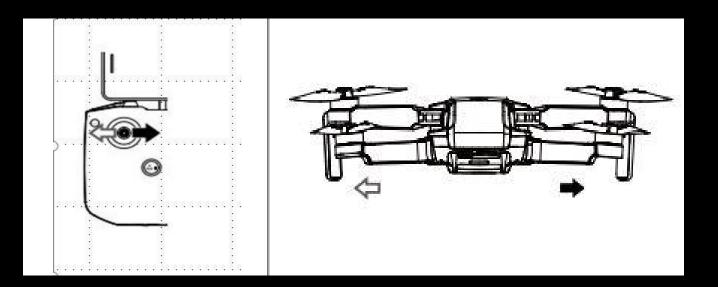
4.5 USES AND APPLICATIONS OF AERIAL PHOTOGRAMMETRY IN CULTURAL HERITAGE





There are four main drone controls:

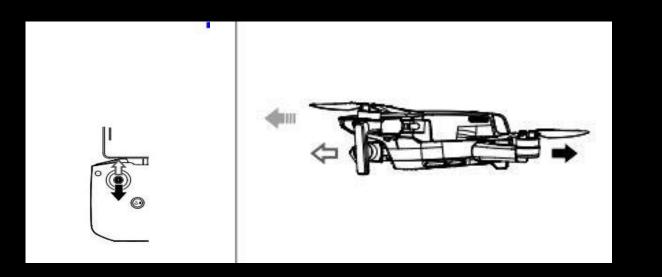
ROLL: Done by pushing the left stick to the left or right. Literally rolls the drone, which maneuvers the drone left or right.



IMPORTANT NOTE: When the drone is facing you (instead of facing away from you) the controls are all switched.

There are four main drone controls:

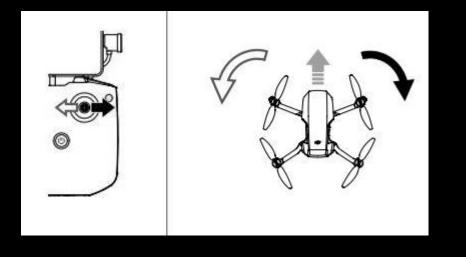
PITCH: Done by pushing the left stick forwards or backward. Tilts the drone, which maneuvers the drone forwards or backward.



IMPORTANT NOTE: When the drone is facing you (instead of facing away from you) the controls are all switched.

There are four main drone controls:

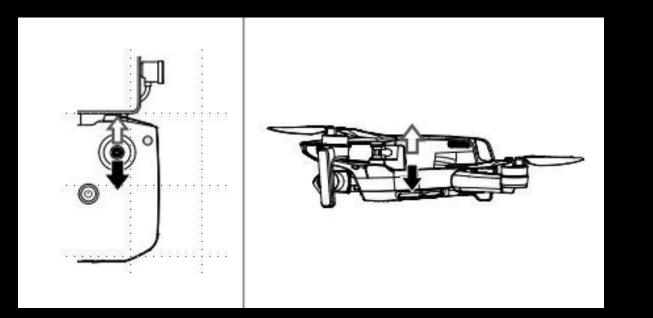
YAW: Done by pushing the right stick to the left or to the right. Rotates the drone left or right. Points the front of the copter in different directions and helps with changing directions while flying.



IMPORTANT NOTE: When the drone is facing you (instead of facing away from you) the controls are all switched.

There are four main drone controls:

THROTTLE: To increase, push the right stick forwards. To decrease, pull the right stick backward. This adjusts the altitude, or height, of the drone.



IMPORTANT NOTE: When the drone is facing you (instead of facing away from you) the controls are all switched.

Here's a checklist you can use before each flight:

WEATHER & SITE SAFETY CHECK

VISUAL AIRCRAFT / SYSTEM INSPECTION

POWERING UP

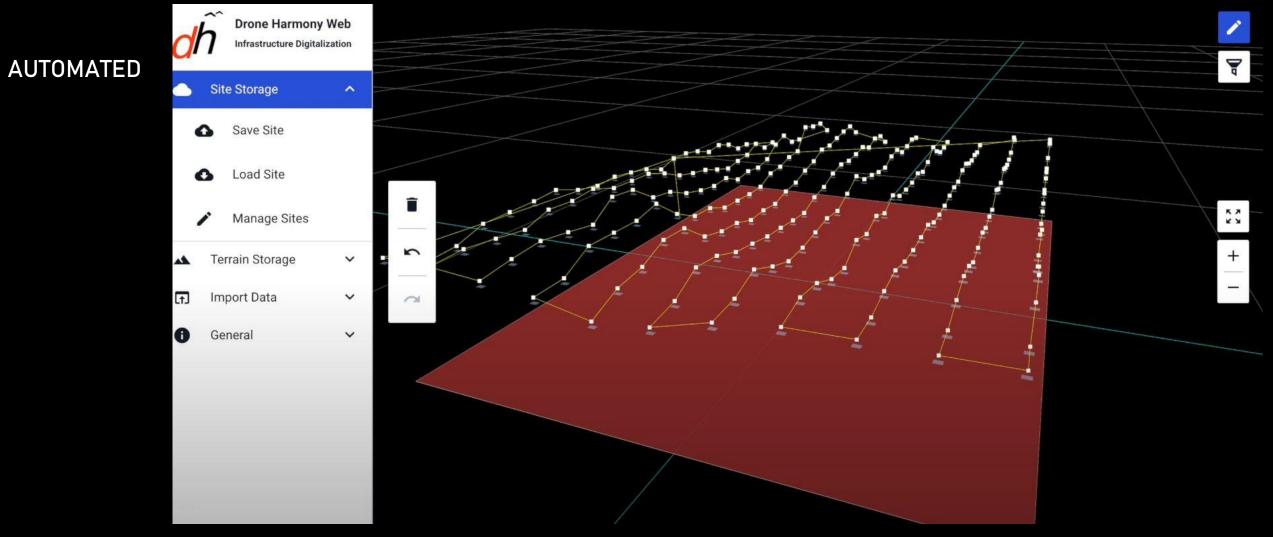
TAKING OFF

4.2 CAPTURING PHOTOS FROM THE AIR

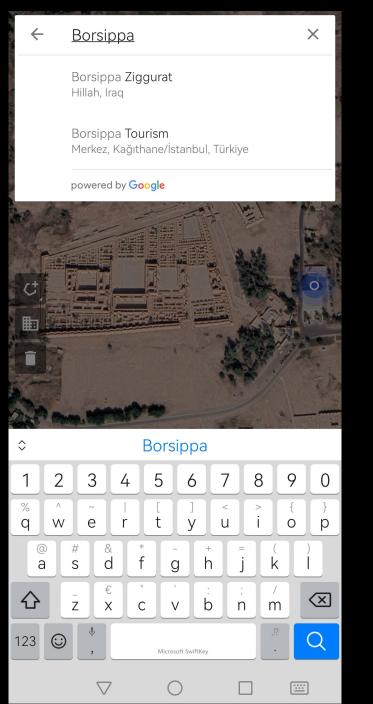


MANUALLY

4.2 CAPTURING PHOTOS FROM THE AIR







Planning from your position to another site

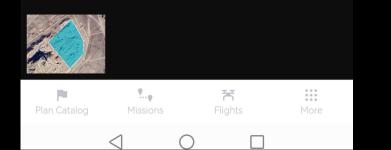


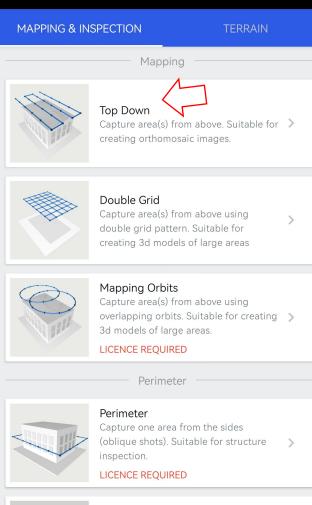


Create your workspace on the map



Creating your polygon







Circle Capture area(s) by orbiting around them along a circular path.

LICENCE REQUIRED

	Ellipse			
Plan Catalog	Missions		Flights	More
	\triangleleft	\bigcirc		1

4.3 DH APP FOR PLANNED FLIGHTS

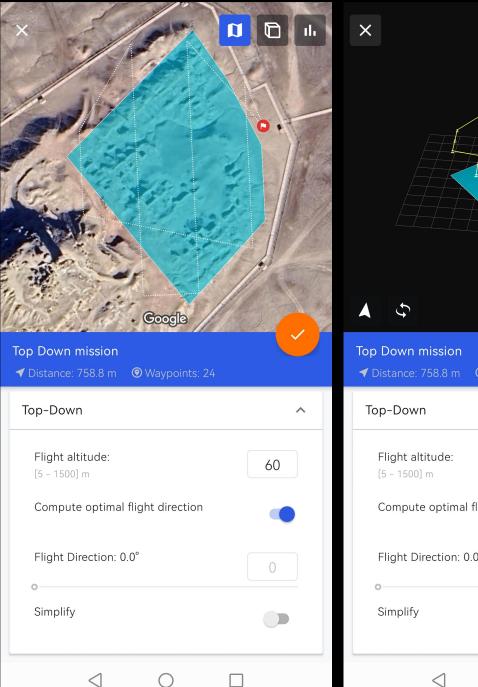
Choose the type of Capture

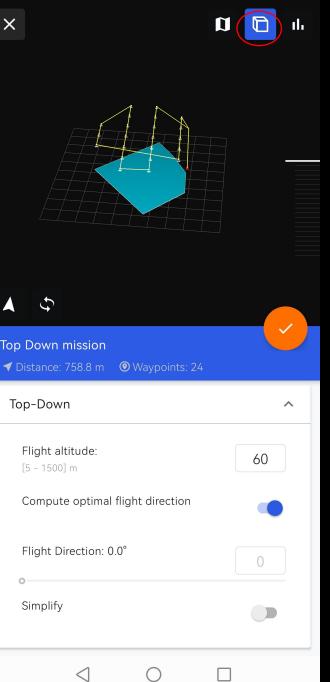




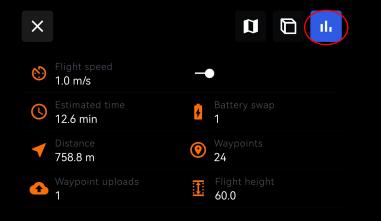
4.3 DH APP FOR PLANNED FLIGHTS

Choose the position on the map where you will Liftoff and Landing



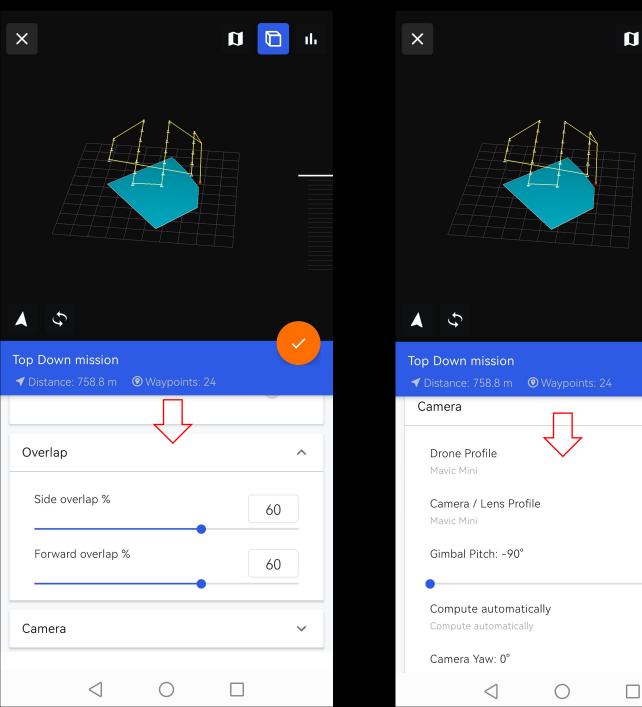


Top Down mission Planning Route



Informations about the flight

Top Down mission ◀ Distance: 758.8 m ⑨ Waypoints: 24	
Top-Down	^
Flight altitude: [5 - 1500] m	60
Compute optimal flight direction	
Flight Direction: 0.0°	0
Simplify	



PHOTOGRAMMETRY AND DRONES

4.3 DH APP FOR PLANNED FLIGHTS

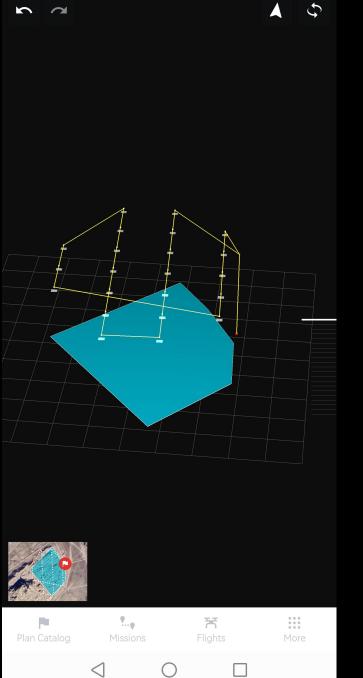
16

^

-90

Swipe down for customize of the flight





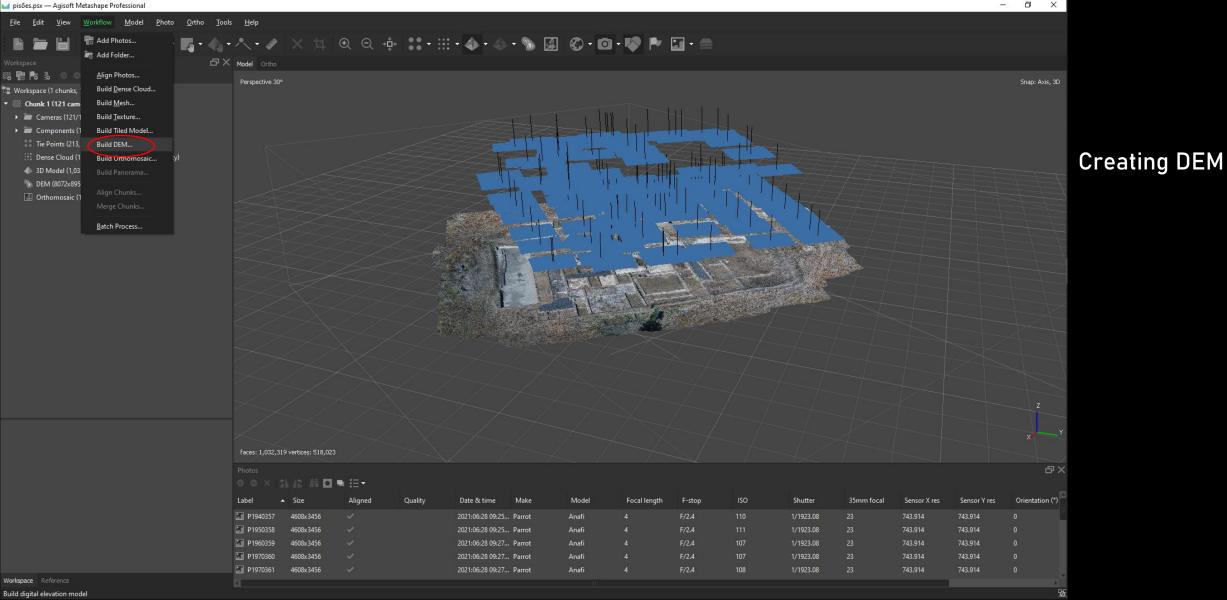
General overview of you planned flight

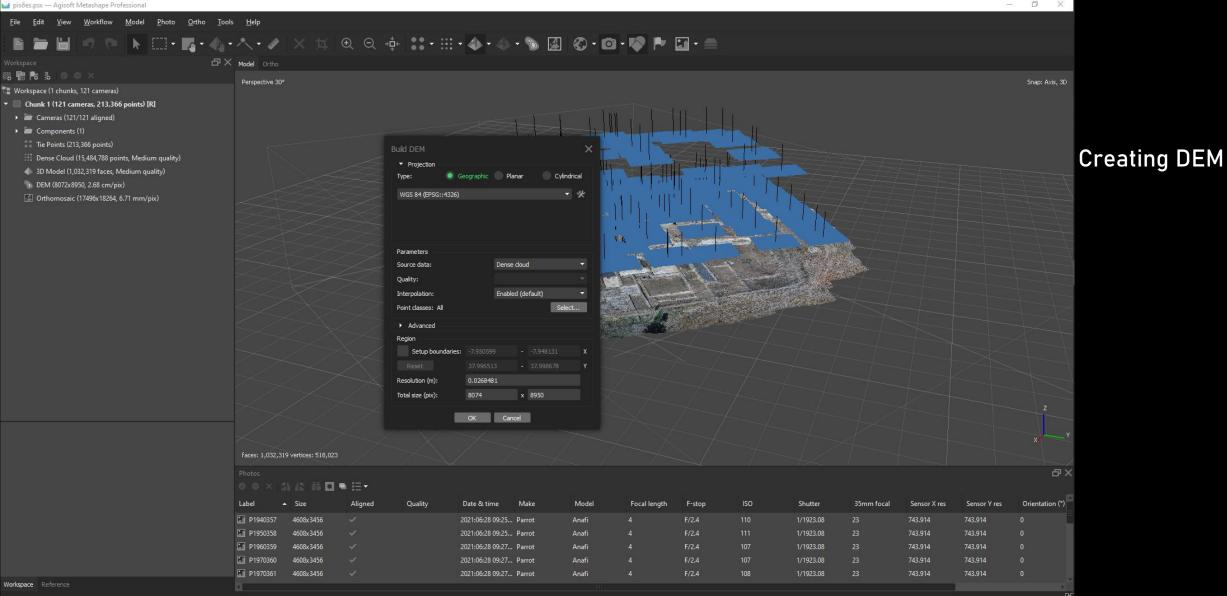
BORSIPPA TRIP!!!

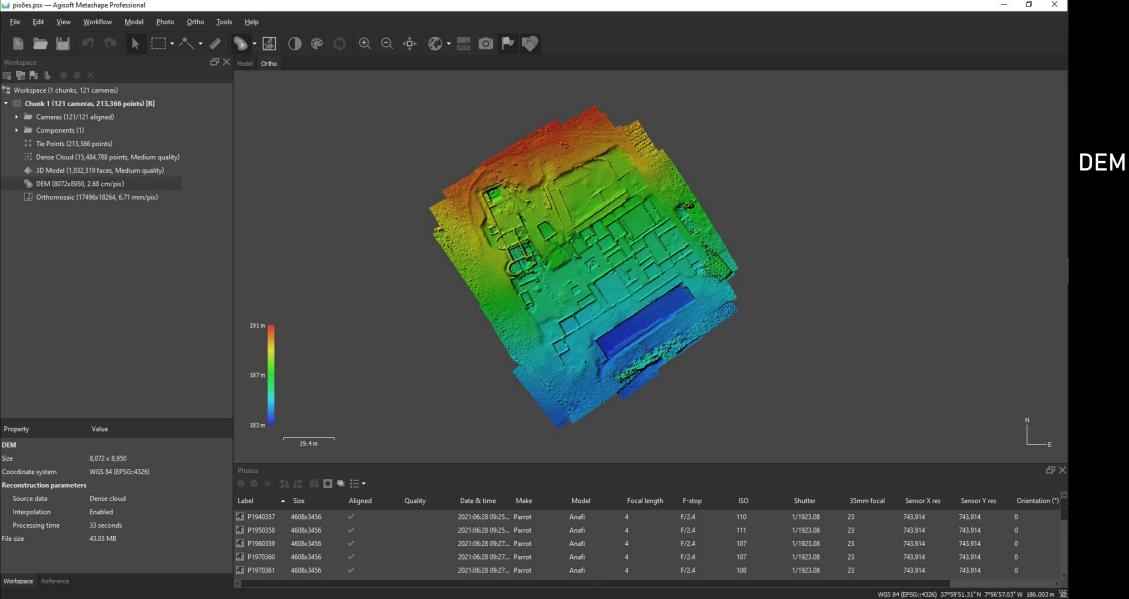
View Workflow <u>M</u>odel <u>Photo</u> <u>O</u>rtho <u>T</u>ools <u>H</u>elp ▶ □ - ▶ ・ ◆ - ヘ - ● × 丼 ◎ ◎ 🔶 : - □ - ◆ - ◆ - ● 🖾 Ø - Ø - ♥ 🕨 🖬 - ≜ 📾 🛃 🏞 🌡 💿 👄 Perspective 30° 🐮 Workspace (1 chunks, 121 cameras) Chunk 1 (121 cameras, 213,366 points) [R] 🔸 🔚 Cameras (121/121 aligned) Empirical Components (1) Dense Cloud (15,484,788 points, Medium quality) 4 3D Model (1,032,319 faces, Medium quality) DEM (8072x8950, 2.68 cm/pix) Grthomosaic (17496x18264, 6.71 mm/pix) Ъ× (4) 論 🖸 🖷 🖽 -Label Size Aligned Model F-stop Orientation (°) Quality Date & time Make Focal length Shutter 35mm focal Sensor X res Sensor Y res P1940357 4608x3456 2021:06:28 09:25... Parrot Anafi 743.914 P1950358 4608x3456 2021:06:28 09:25... Parrot Anafi P1960359 4608x3456 2021:06:28 09:27... Parrot 1/1923.08 Anafi P1970360 4608x3456 Anafi P1970361 2021:06:28 09:27... Parrot 4608x3456 Anafi

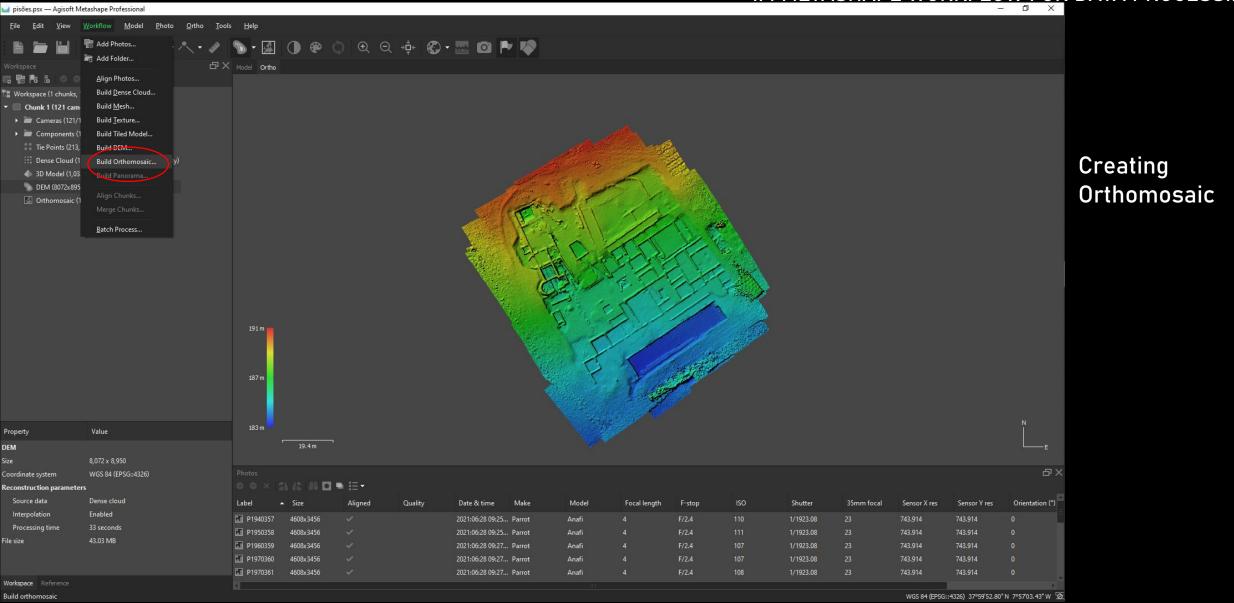
Workspace Reference Show or hide basemap

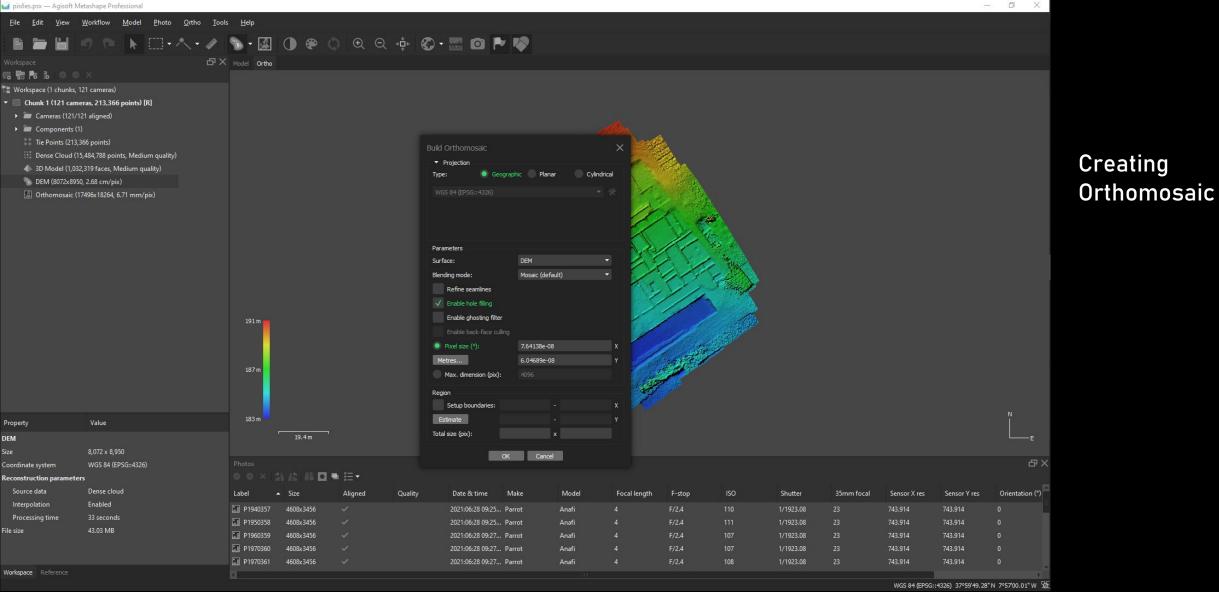
Edit









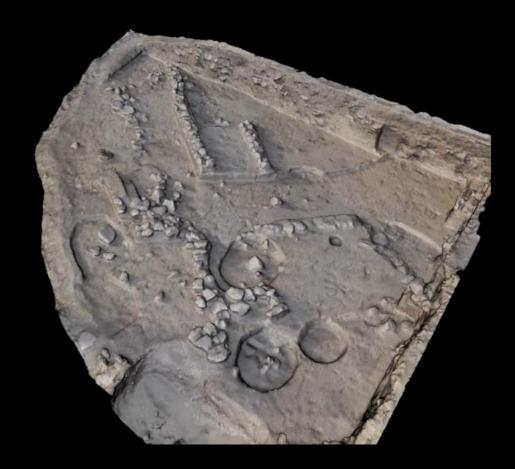


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4.5 USES AND APPLICATIONS OF AERIAL PHOTOGRAMMETRY IN CULTURAL HERITAGE





4.5 USES AND APPLICATIONS OF AERIAL PHOTOGRAMMETRY IN CULTURAL HERITAGE

