
MICMAC INTERFACE TUTORIAL

July 3, 2019

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0.1 Introduction

This Interface is based on MicMac. It has been developed during an internship in the Department of Classics and Archaeology of the University of Malta. It aims to facilitate the creation of photogrammetric products and adds features regarding the merging of different photo sets.

Micmac is a French software which allowed the treatment for 3D model, DEM and orthophotomosaic. You can use any type of devices, to take photos, like drones (Phantom, Mavic, Spark...) or simple cameras. You need to have a good overlap between your photos.

This tutorial is proposed by Hugo De Paulis and the working practices of my teacher, Antoine Pinte (ENSG).

0.2 Planned your workflow

0.2.1 Create a new project

First of all, you must have a folder containing the photos that you want to use. These photos must have a good overlap and must have been taken by the same camera with the same settings.

If you want to use photos taken by different cameras, you have to put them in different folders and process them separately. I will explain later how to merge these different sets of photos.

After completing this step, go to menu **Edit** and select **Create a new chunk**. A new window appears with different fields. You can't let the Name's field blank and you must not use space. Next, you can select the folder containing the photos with the button **Open**. Finally, select the correct extension of your photos and click on **Ok**.

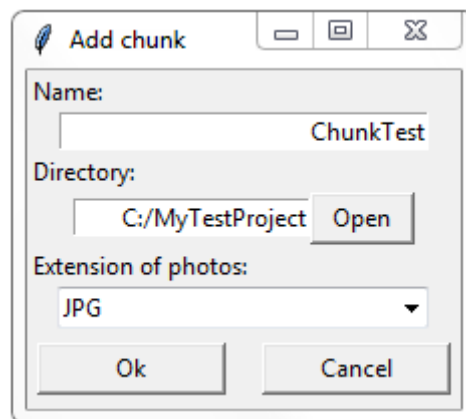


Figure 1: Add chunk Window

If the interface displays "0 photos", it means that there is a problem that must be solve if you want to continue.

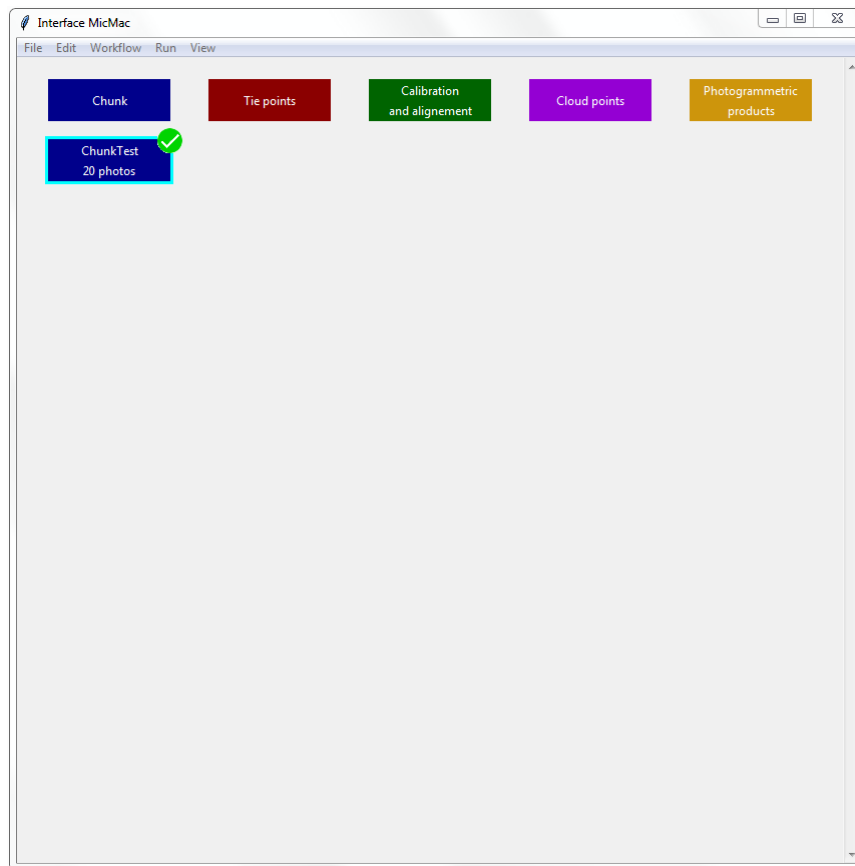


Figure 2: Result

0.2.2 Find the tie points

The first photogrammetric process to do is to find the tie points between your different photos. Click on the chunk you want to process, go in the menu **Workflow** and select **Find tie points**. First, fill the Name's field without space. The next field is the resolution of the images that will be used in this process. You can work at full resolution by writing -1, but in most of the case a resolution between 1000 and 1500 is sufficient. Then, you have to select the mode of calculation.

- **All:**

Compute tie points between all images in a given resolution. You can use this mode if you are not sure of what to use. However, the processing time can be very long if there is a lot of photos.

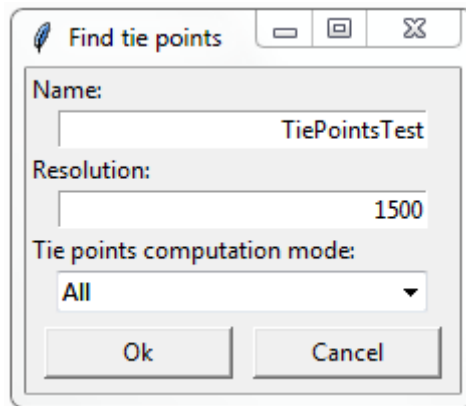


Figure 3: Tie Points : Mode All

- **GPS coordinates:**

Compute tie points between close images by using GPS coordinates. The GPS coordinates must be in the metadata of the photos. This mode is the best if you want to create an orthophotomosaic. You should specify the coordinates system that you want to use thanks to its Proj4 code. You can find it on the website <https://spatialreference.org/ref/epsg/> or create your own if you use your own coordinates system.

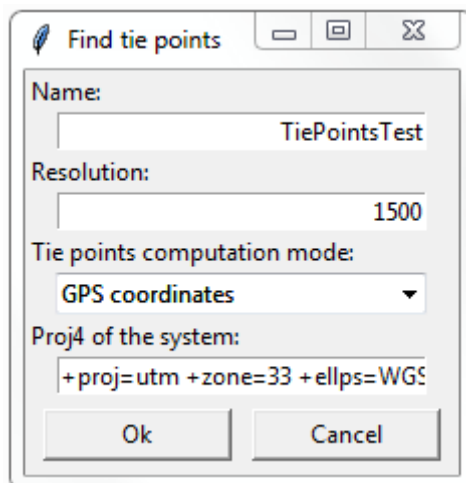


Figure 4: Tie Points : Mode GPS coordinates

- **Line:**

Compute tie points for linear image canvas. You should specify the number of adjacent images to look for in the field **Number of adjacent images**. If your canvas is

a loop (your last photo overlaps the first), you can tick the box **Circular acquisition**.

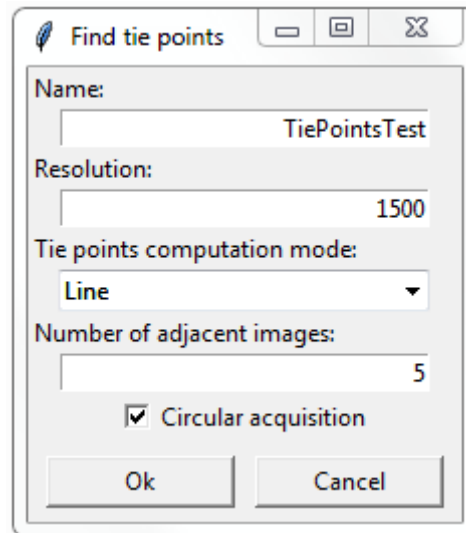


Figure 5: Tie Points : Mode Line

- **Muscale:**

Compute tie points for images in low resolution and then for high resolution. In this mode, a first computation of tie points is made for all the pairs of images at a low resolution (so it is quite fast). Then the computation is done at high resolution only for the pairs having, at low resolution, a certain number of tie points.

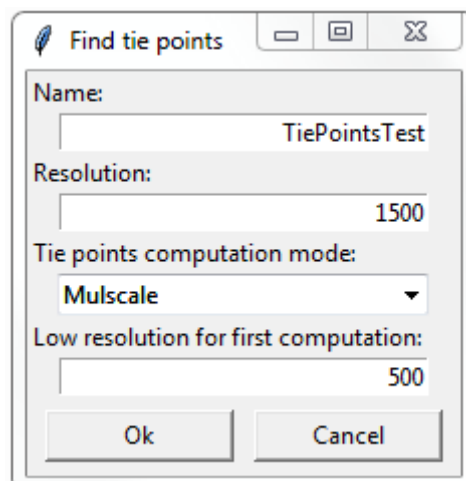


Figure 6: Tie Points : Mode Mulscale

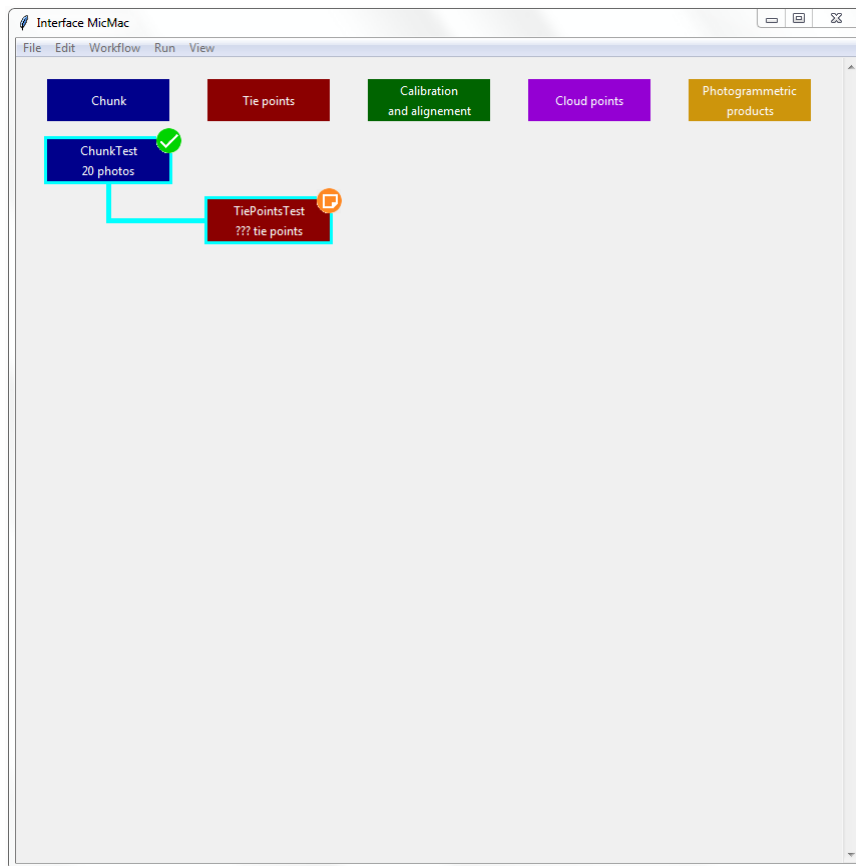


Figure 7: Tie Points : Result

0.2.3 Calculate calibration and align photos

The next step is to calculate the calibration of the camera and align the photos. Click on the Tie Points you want to be processed, go in the menu **Workflow** and select **Calculate calibration and align photos**. First, fill the Name's field without space. The next field is the type of calibration that will be used in this process. You can see their specification in the table. The last type **Fige** allows to use a calibration that you have already calculate in the same chunk.

Mode	PPA/PPS	Polynomial correction	Decentric/Affine correction	Parameters
RadialBasic	Equals	r3, r5, r7	No	5
RadialStd	Different	r3, r5, r7	No	8
RadialExtended	Different	r3, r5, r7, r9, r11	No	10
FraserBasic	Equals	r3, r5, r7	Yes	10
Fraser	Different	r3, r5, r7	Yes	12

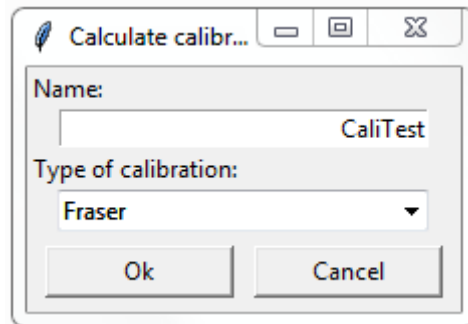


Figure 8: Calculate calibration and align photos

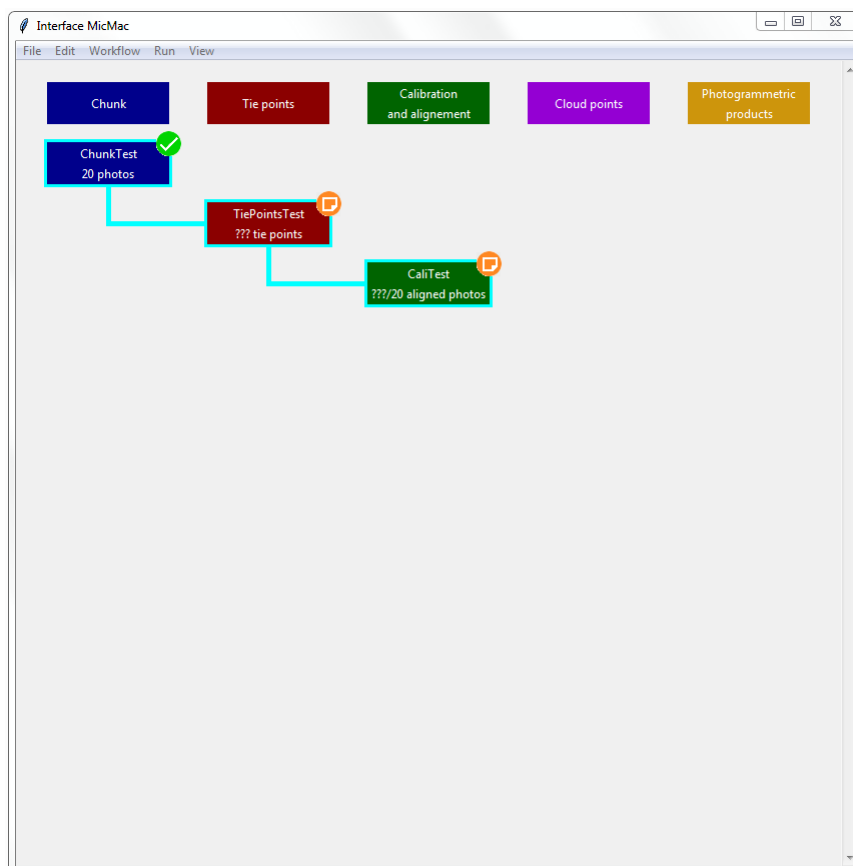


Figure 9: Calculate calibration and align photos : Result

0.2.4 Switch to a new coordinate system

The process **Calculate calibration and align photos** will align your photos in a relative coordinate system, but it can be useful to align your photos in an absolute coordinate system. In order to do this, click on the Calibration and Alignment you want to be processed, go in the menu **Workflow** and select **Switch to a new coordinate system**. First,

fill the Name's field without space. Next, choose the method of positioning that you want to use.

- **GPS coordinates**

To use this method, the GPS coordinates must be in the metadata of the photos. You should specify the coordinates system that you want to use thanks to its Proj4 code. You can find it on the website <https://spatialreference.org/ref/epsg/> or create your own if you use your own coordinates system.

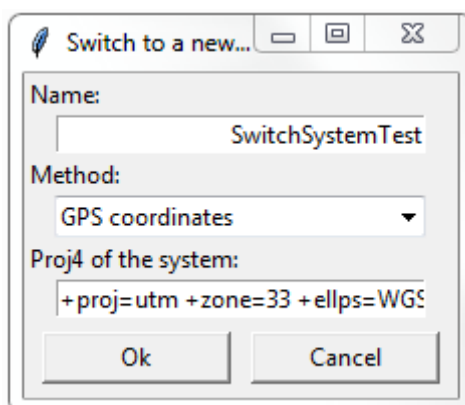


Figure 10: Switch coordinates system : GPS coordinates method

- **GCP and markers**

To use this method, you must have specific points on your photos whose coordinates are known (GCP). These coordinates must be written in the following format in text file: PointName X Y Z. Select this file with the Open button. You will have to place on the photos the markers corresponding to the known points when you will run the process.

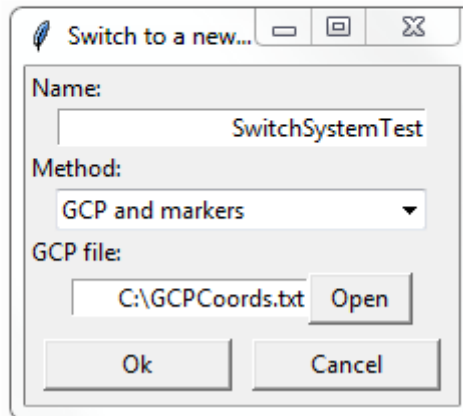


Figure 11: Switch coordinates system : GCP and markers method

0.2.5 Build dense cloud

After aligning your photos, you can build a dense cloud point. Click on the Calibration and Alignment you want to be processed, go in the menu **Workflow** and select **Build dense cloud**. First, fill the Name's field without space. The next field is the **Offset** is the translation that you will applied to your points cloud. If you just align photos, you can let $[0, 0, 0]$, but if you switch to a new coordinate system, it's recommended to put the approximate coordinates of the center of your project. The field **Quality** is the resolution that you want for your point cloud.

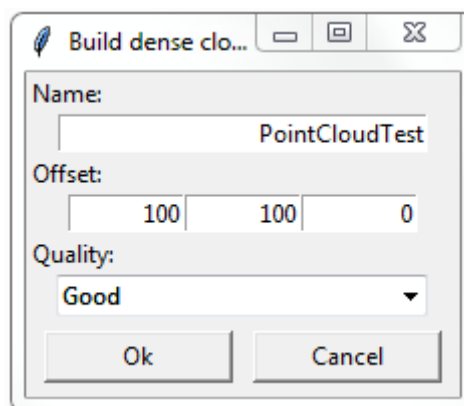


Figure 12: Build dense cloud Window

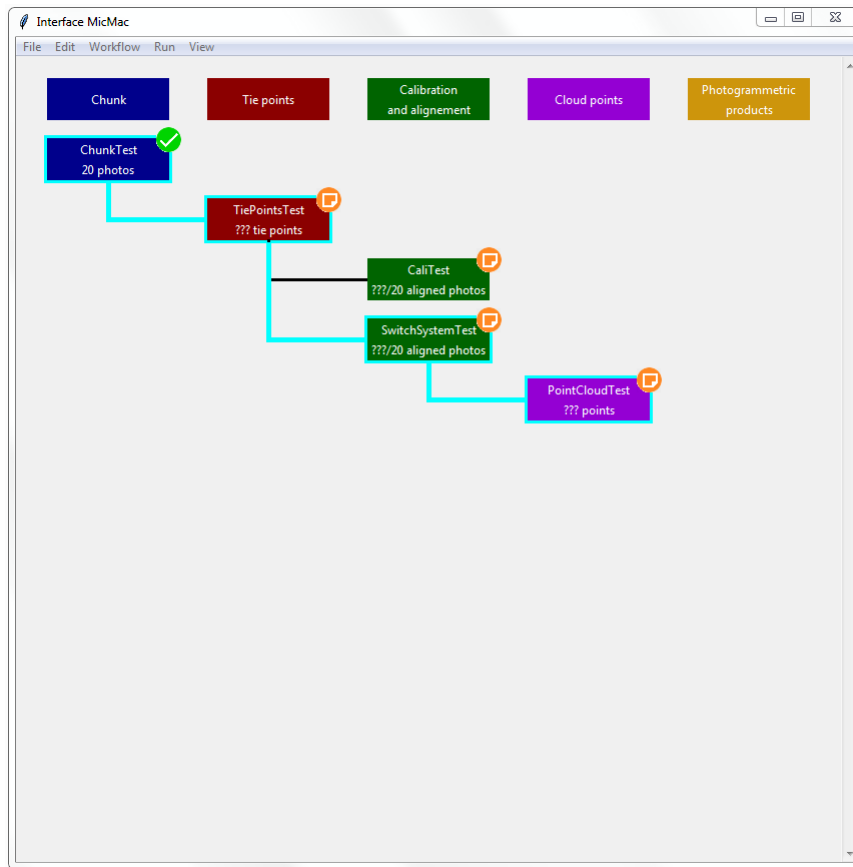


Figure 13: Build dense cloud : Result

0.2.6 Build orthomosaic

After building your dense cloud, you can create an orthomosaic based on it. Click on the Point Cloud you want to be processed, go in the menu **Workflow** and select **Build orthomosaic**. First, fill the Name's field without space. If you want a radiometric equalization in order to get a result that looked good, you can tick the box **Radiometric equalization**. Next you can choose what type of orthomosaic you want with the field **Mode**.

- **Parallel to the ground:**
- **Perpendicular to the ground:**
(Not implemented yet)

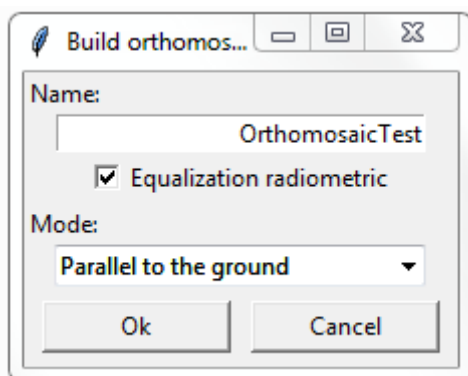


Figure 14: Build orthomosaic : Parallel to the ground mode

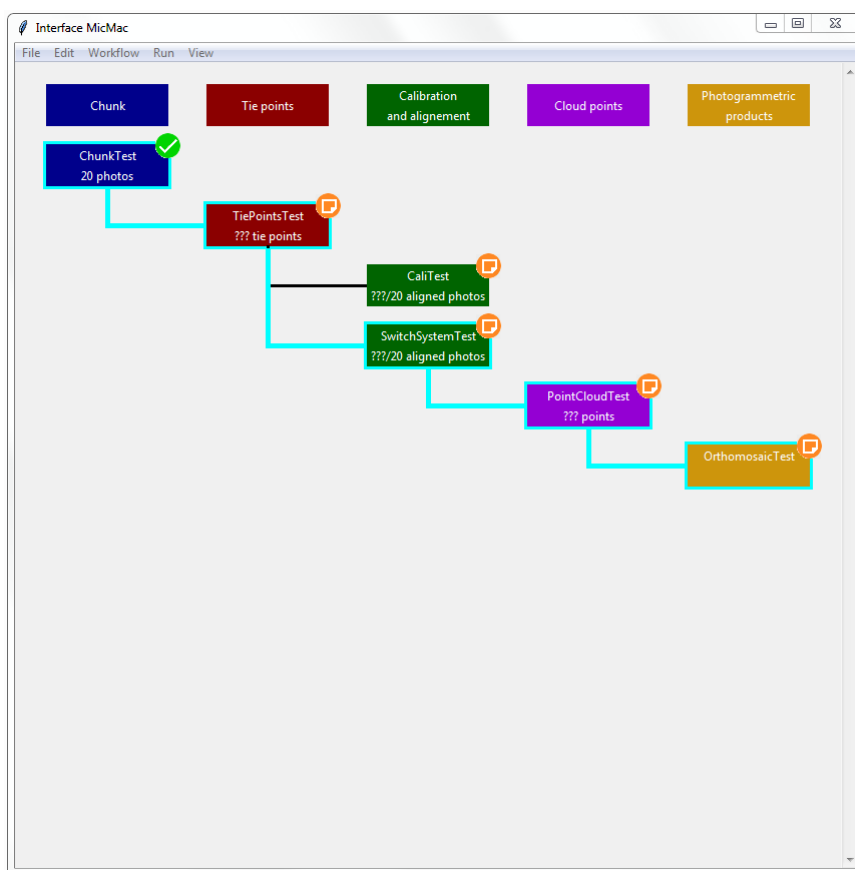


Figure 15: Build orthomosaic : Result

0.2.7 Build mesh

After building your dense cloud, you can create a mesh of this cloud. Click on the Point Cloud you want to be processed, go in the menu **Workflow** and select **Build mesh**. First, fill the Name's field without space. Then, you can select the depth of the Poisson

reconstruction algorithm that you want to use. It's recommended to let 8. You can tick the box **With texture** to have a textured mesh.

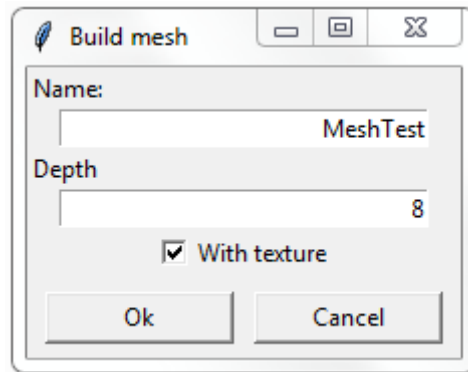


Figure 16: Build mesh Window

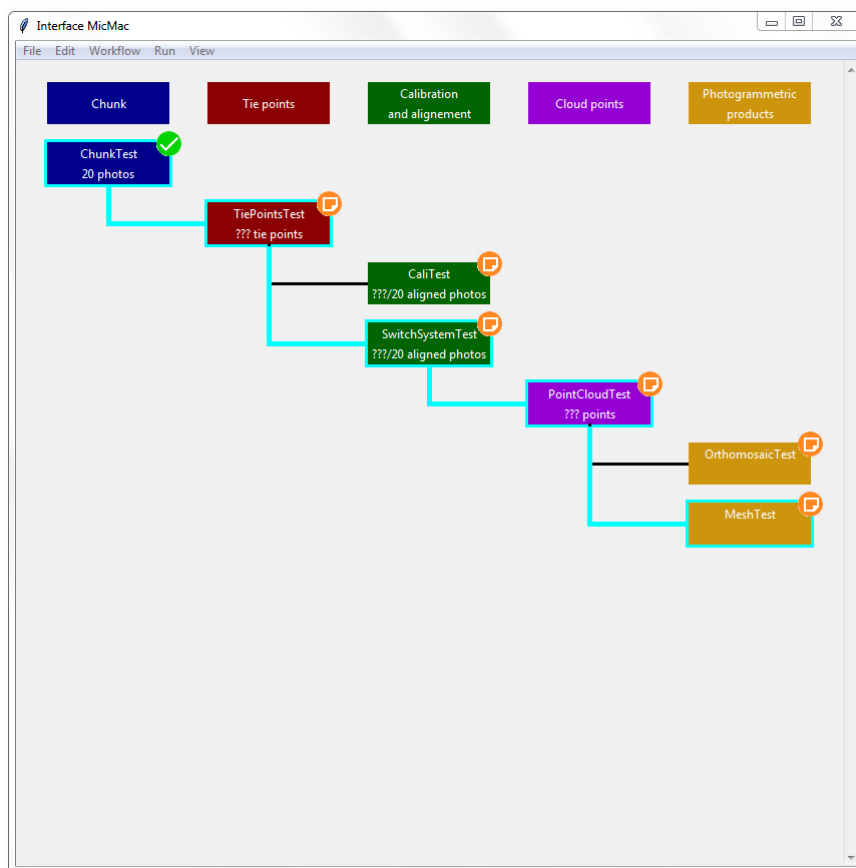


Figure 17: Build mesh : Result

0.3 Execute your workflow

After building your workflow, you can execute it. Click on the process that you want, go in the menu **Run** and select **Execute selected workflow**. If your process need a previous process that you don't have executed yet, it will be automatically executed before the one you selected.

You can check if a process has been executed by looking at the logo in the top right corner. If the logo is **orange**, it means that the the process is planned and doesn't have been executed yet. If the logo is **green**, it means that the process is done.



Figure 18: Tie Points execution



Figure 19: Calibration and alignment execution



Figure 20: Point cloud execution

To execute your full project, you can go in the menu **Run** and select **Execute all**. It will execute all the process you have planned in the correct order.

0.4 View the result

If a process is done and have a graphic result (all process except Tie Points), you can display this result. Click on the process that you want to display, go in the menu **View** and select **View the selected process**. If you want to see the 3D products, you must have a software able to read .ply file (CloudCompare, MeshLab) installed on your computer and put as a default software for the .ply file.

0.5 Merge two or more sets of photos

This part will explain how merge two or more sets of photos taken by different cameras. Two methods have been developed to do this. The first one is **Merge chunks**, it follows the same pattern that a traditional workflow with the only difference being the use of several calibrations instead of one. The second, **Merge by Point Cloud**, will use a different strategy. Instead of using Tie Points for aligning the two sets of photos, it will use the geometry of their Point Cloud.

0.5.1 Merge chunks

To use the this method, you need a calibration (Calibration and alignment) for each chunk that you want to merge. If this prerequisite is fulfilled, go in the menu **Workflow** and select **Merge chunks**. First, fill the Name's field without space. Next, you can select the folder of your new chunk with the button **Open**. The photos will be automatically copied in it. Finally, tick the chunks that you want to use (at least 2).

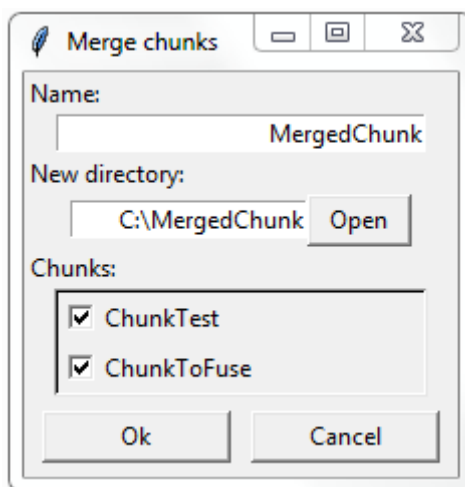


Figure 21: Merge chunks Window

The process to find the tie points is exactly the same as that described above, but in order to correctly find the tie points between the two sets of photos, it is recommended to use the mode All and a better resolution.

The next step, **Calculate calibration and align photos**, is different from the traditional one. First, fill the Name's field without space. As you have already calculate the calibration of the cameras, we use them here. For each chunk, select the **Calibration and alignment** that you want to use. If you have one that is in a absolute coordinates system

you can keep this alignment by ticking the corresponding box. So all of the photos will be aligned in the correct system, even if the other chunks are in a relative coordinates system.

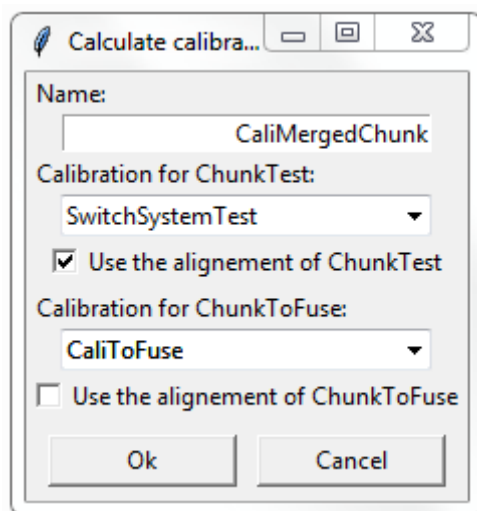


Figure 22: Calculate calibration and align photos Window

The following steps are exactly the same that the one describe in a classic workflow.

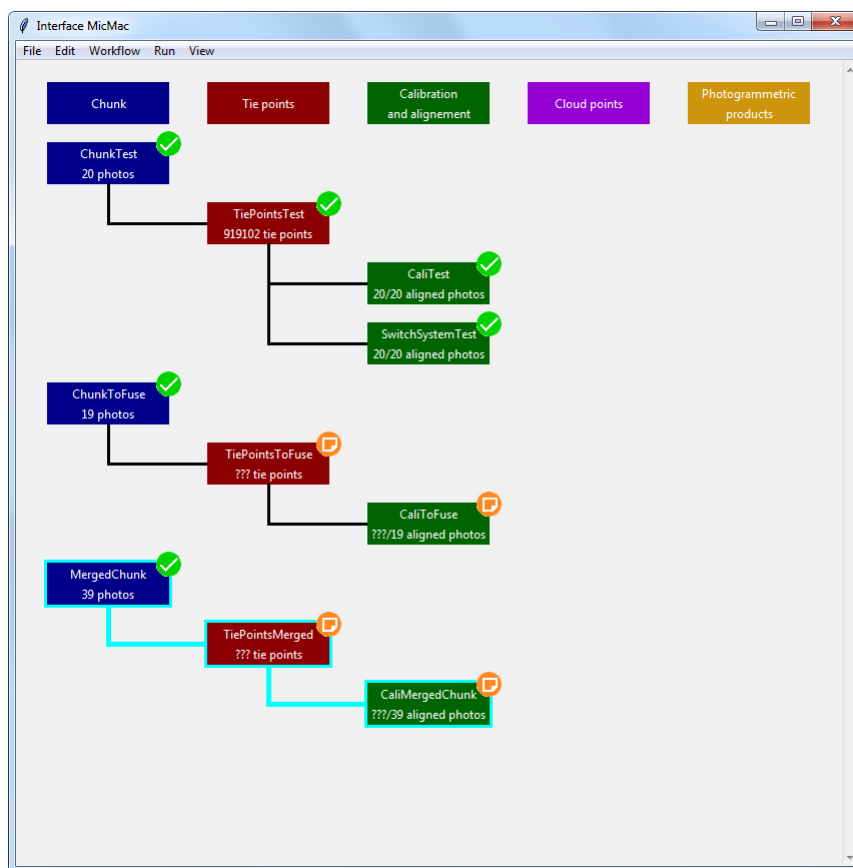


Figure 23: Calculate calibration and align photos : Result

0.5.2 Merge by Point Cloud

This method allow you to merge only two chunks at the same time. To use it, you need a Point Cloud for the two chunks that you want to merge. If this prerequisite is fulfilled, go in the menu **Workflow** and select **Merge by point cloud**. First, fill the Name's field without space. Next, you can select the folder of your new chunk with the button **Open**. The photos will be automatically copied in it. Then, tick the two point cloud that you want to use for the merging. After that, select the point cloud that you want as reference, the result will in its coordinates system. The following steps depend of your situation :

- If the two point cloud are in the same coordinates system and are approximately well placed, you don't have to use the initial transform matrix. To activate the ICP in order to finely register the two point cloud, you have to input a number of iterations higher than 0 (10 is good compromise). You can use the Sampling parameter to increase the speed of the ICP algorithm (80 means that only 80% of the point cloud will be use). You can also manually clean the point clouds to help

the ICP algorithm, but don't change their position and orientation.

- If the two point clouds are not in the same coordinates system, the ICP will not be sufficient. You have to manually register them and enter the matrix of this transformation as the initial matrix transform (don't save the modification of position or rotation). You can do this with free software such as CloudCompare. If you are already satisfied by manual registering, let 0 in the field Number of ICP iterations to deactivate the ICP, otherwise check part above to correctly set up the ICP.

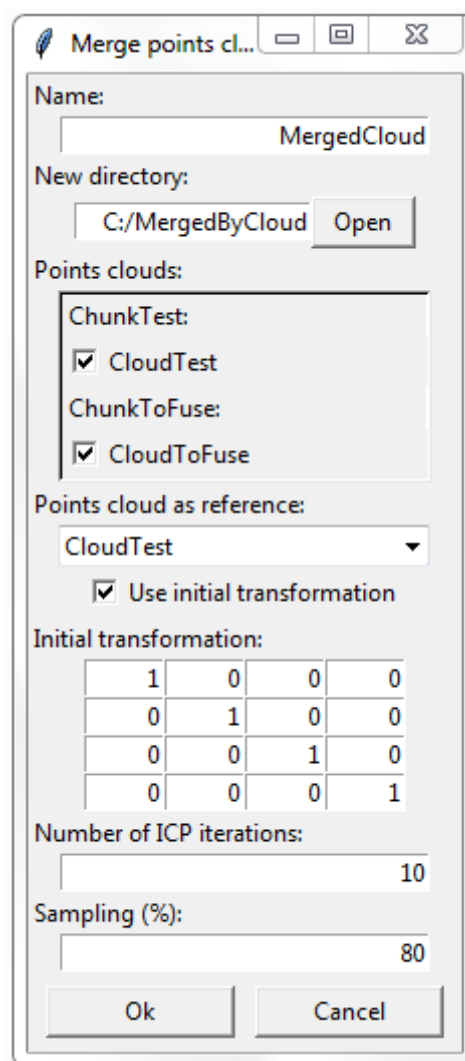


Figure 24: Merge by point cloud Window

As you can see on the workflow, this method don't use tie points which are replaced by the two points clouds using in the merging.

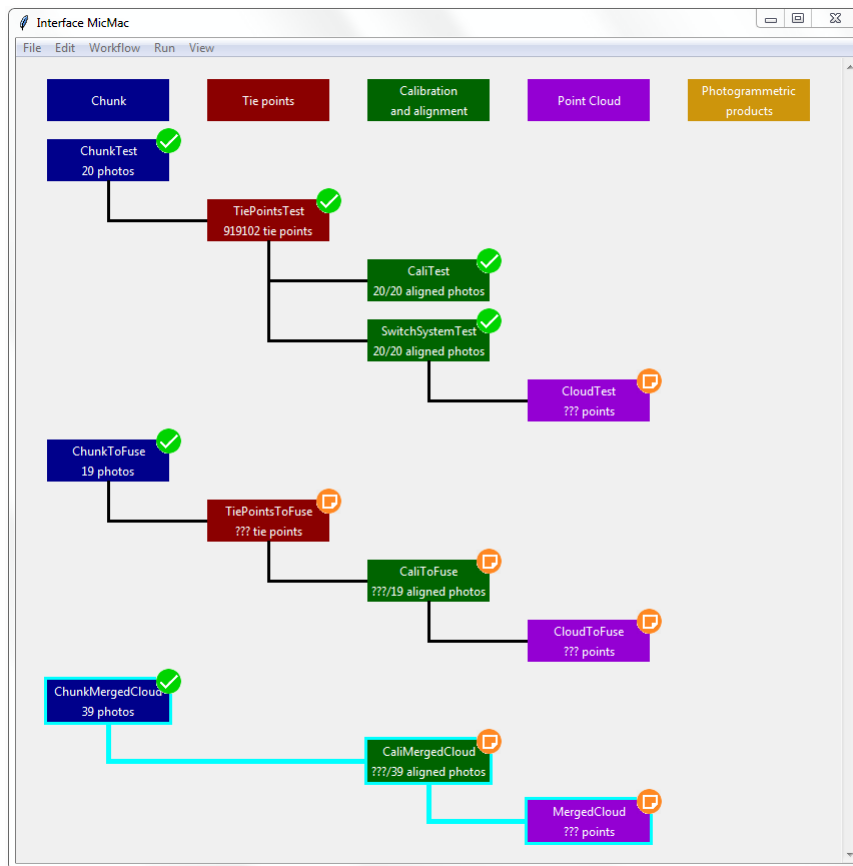


Figure 25: Merge by point cloud : Result

WARNING: The point cloud directly created by this method can't be use in other processing. If you want to create photogrammetric products, you have to create a new point cloud from the calibration and alignment created by this method.

References