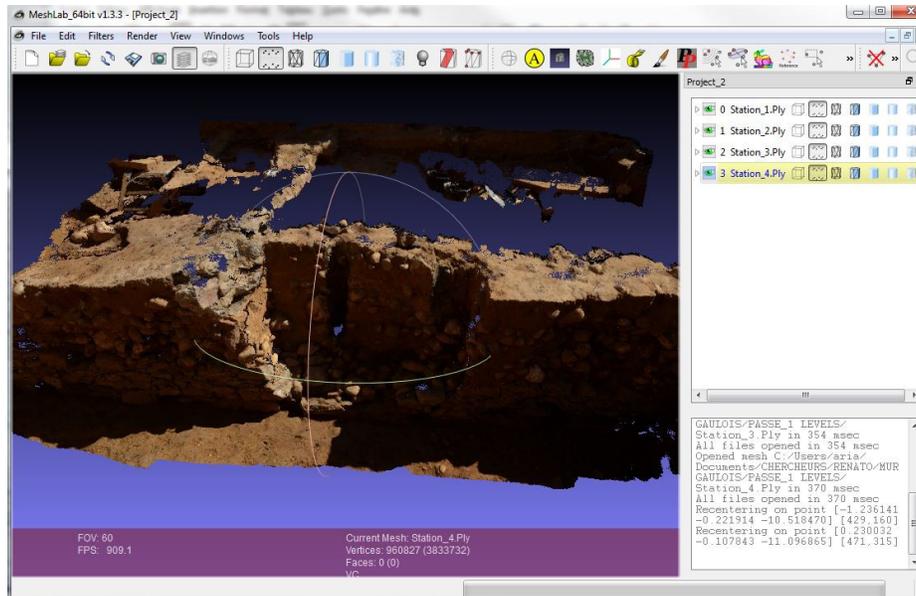


## Quick Reference Spread-Sheet for the IGN MIC MAC Visual interface



Current MicMac team :  
Marc Pierrot Desilligny, M. Deveau, J. Belvaux, G. Choqueux, G. Maillet, L. Girod

Special thanks to:  
V. Abergel, L.de Luca, N. Martin-Beaumont, N. Nony

For an accurate approach to the MicMac package download the full-tutorial :

<http://logiciels.ign.fr/IMG/pdf/docmicmac.pdf>

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laboratoire MAP UMR CNRS-MCC 3495

Renato Saleri Lunazzi

## INSTALLING MICMAC ON YOUR COMPUTER

### 1) Download and install the version supported by your computer

- 64 bits systems are preferred but there is a 32 bits version available
- MicMac download portal:  
<http://logiciels.ign.fr/?Telechargement.20> and follow the "Binaires pré-compilés " section;  
the latest update for the Windows x86 64 bits is "rev4791" but it will be updated frequently
- You can also download and install MeshLab from this site, as it might come handy for edit and – later – work on resulting meshes.  
<http://meshlab.sourceforge.net/>

### 2) Extract and Paste the "micmac" folder on your C: volume

- it should be renamed as "tapenade" and its content should look as below:

Nom	Modifié le	Type
bin	05/02/2015 15:50	Dossier de fichiers
binaire-aux	05/02/2015 15:50	Dossier de fichiers
data	05/02/2015 15:50	Dossier de fichiers
include	05/02/2015 15:50	Dossier de fichiers
LISEZMOI	02/07/2013 20:06	Fichier
README	02/07/2013 20:06	Fichier

### 3) Redefine the environment variables:

#### default access:

- from the desktop (right-click) Computer -> properties -> advanced system settings -> environment variables -> path: click "edit"

#### windows 8 users:

- from the Desktop, right-click the very bottom left corner of the screen to get the Power User Task Menu.
- from the Power User Task Menu, click System.
- click the Advanced System Settings link in the left column.
- in the System Properties window, click on the Advanced tab, click the Environment Variables button near the bottom of that tab.
- in the Environment Variables window highlight the Path variable in the "System variables" section and click the Edit button.

Paste exactly: (don't forget the semi-colon at the beginning of the strip and be sure you changed the « micmac » folder name to « tapenade »)

```
;C:\tapenade\bin;C:\tapenade\binaire-aux
```

### 4) Define the target-folder containing the pictures to process:

- open the cmd shell and type "cd (spacebar + right-click paste)" the pathway to the target folder. This step is useful when accessing the pictures dataset with text commands; when using a graphic interface, a prompt is available whenever you need to interact with specific contents.

→ Be very careful that no space should be included in the resulting pathway, which will result in data loss or uncomplete computing sequences.

```
***
***
*** Current Team: MP Deseilligny, M Deveau, J Belvaux, G Choqueux,
*** G Maillet, L Girod
***
*** Contact: Marc.Pierrot-Deseilligny@ensg.eu
***
*****
C:\Users\aria>mm3d vTapas
C:\Users\aria>mm3d vTapas
C:\Users\aria>mm3d vAperiCloud
C:\Users\aria>
```

*the micmac cmd shell*

## GETTING STARTED WITH MICMAC ENVIRONMENT

Though you can compute a dataset through a visual graphic interface, at the end of this section we will list a standard cmd-shell process.

Accessing to the micmac tools is possible by a simple text call (within the cmd shell), eg:

```
Tapioca.exe MulScale ".*JPG" 300 1500
```

You can also access to the graphic interface, available by typing "v" before the tool name, for instance:

```
mm3d vTapioca
```

...which will be the main topic of this section.

Let's step through the commands:

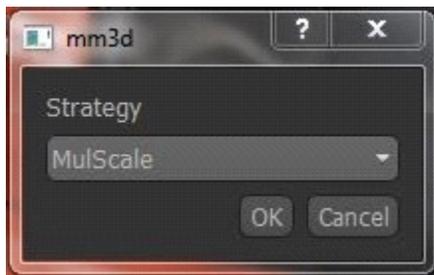
## ORIENTING THE DATASET

The first step concerns the dataset relative orientation using the Tapioca command and the SIFT data processor to automatically extract the tie points (similar pixel configurations between two images). The images will be scaled down to optimize the automatic correlation process. We will perform a Tapioca computation using the "Mulscale" strategy and then, a simple "FraserBasic" lens preset solver. The maximum size of the output images will be 1500 px and the minimum 300px.

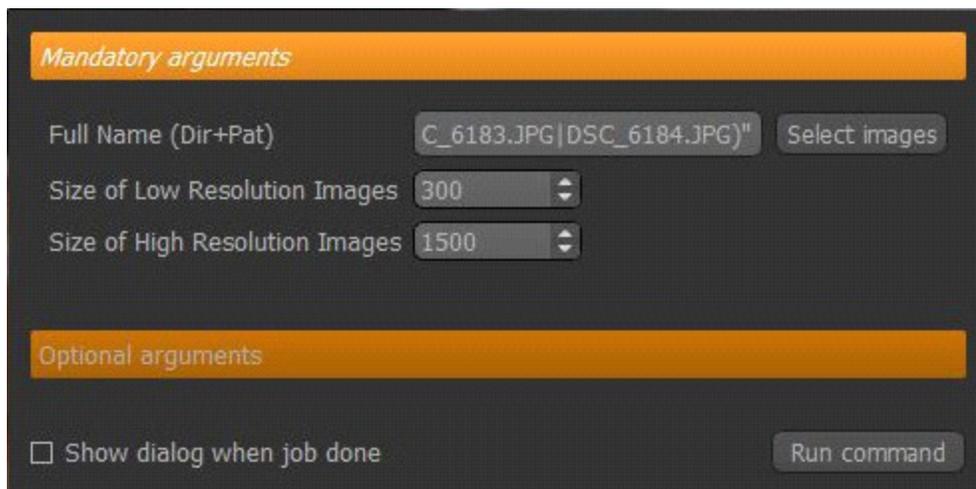
*nb: it would take too long to analyze in a row NxN images at full resolution, this is why the software performs a cascading pyramidal analysis starting with very small previews (300 pixels) and scaling them recursively up to higher definition levels, in this case 1500 pixels wide.*

### 1.

```
mm3d vTapioca
```



This next screen let's you access to the dataset folder and define the min and max size of rescaled images; 300 and 1500 are a good compromise to start. Select **all the images** of your dataset, type as shown above 300 and 1500 in the parameters section and hit the "Run Command" to complete the sequence. During this first step, the program randomly seeks the SIFT tie points in ALL the images contained within your master folder.



## 2.

mm3d vTapas

We will now choose **4 or 5 images** to calibrate the dataset. In this first example all the pictures must have the same optical parameters.

The screenshot shows the 'Mandatory arguments' section of the mm3d vTapas interface. It features a dark background with orange headers. The 'Calibration model' is set to 'FraserBasic'. The 'Full Directory (Dir+Pattern)' field contains the text 'DSC\_6174.JPG|DSC\_6175.JPG', followed by a 'Select images' button. Below this is the 'Optional arguments' section, which is currently empty. At the bottom, there is a checkbox for 'Show dialog when job done' and a 'Run command' button.

We will choose 4 or 5 pictures to perform a prior image calibration. These pictures may be part of the target frameset but can also come from a specific calibration set, capturing a more discriminant geometry: a room corner should work just fine. What is mandatory is that it must be taken with the same camera and, obviously, the same optics than the upcoming picture set...

Hit "Optional Arguments"

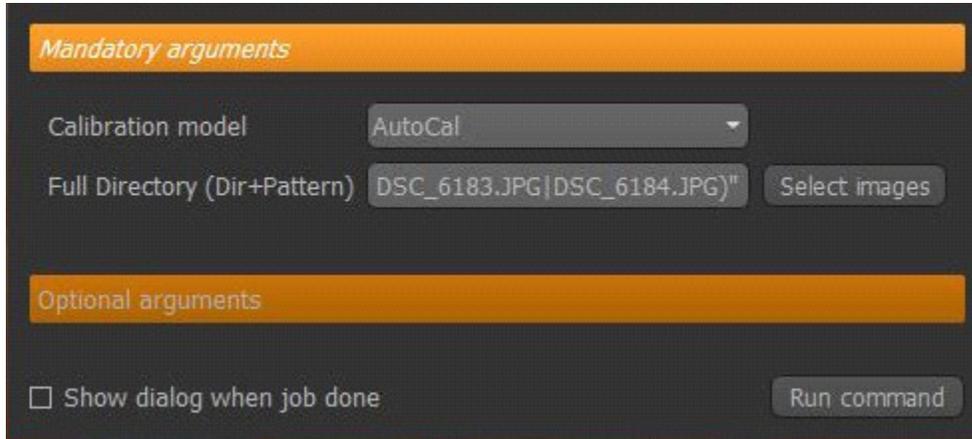
The screenshot shows the 'Optional arguments' section of the mm3d vTapas interface. It features a dark background with orange headers. The 'Out' field is highlighted with a white border and contains the text 'Calib'. Other fields include 'LibDec' (True), 'LibFoc' (True), 'LibPP' (True), 'LinkPPaPPs' (empty), 'MOI' (False), 'PPRel' (-1,00), 'PropDiag' (-1,00), 'RapTxt' (empty), 'RefineAll' (True), 'SauvAutom' (empty), 'SH' (empty), and 'VitesseInit' (2). At the bottom, there is a checkbox for 'Show dialog when job done' and a 'Run command' button.

We will also need to save to the disk the computed parameters in a specific folder, in this section we will name this folder "Calib". This information will be very useful later...

### 3.

We are now ready to extend the computed calibration to the whole frameset and pick ALL the pictures of the dataset.

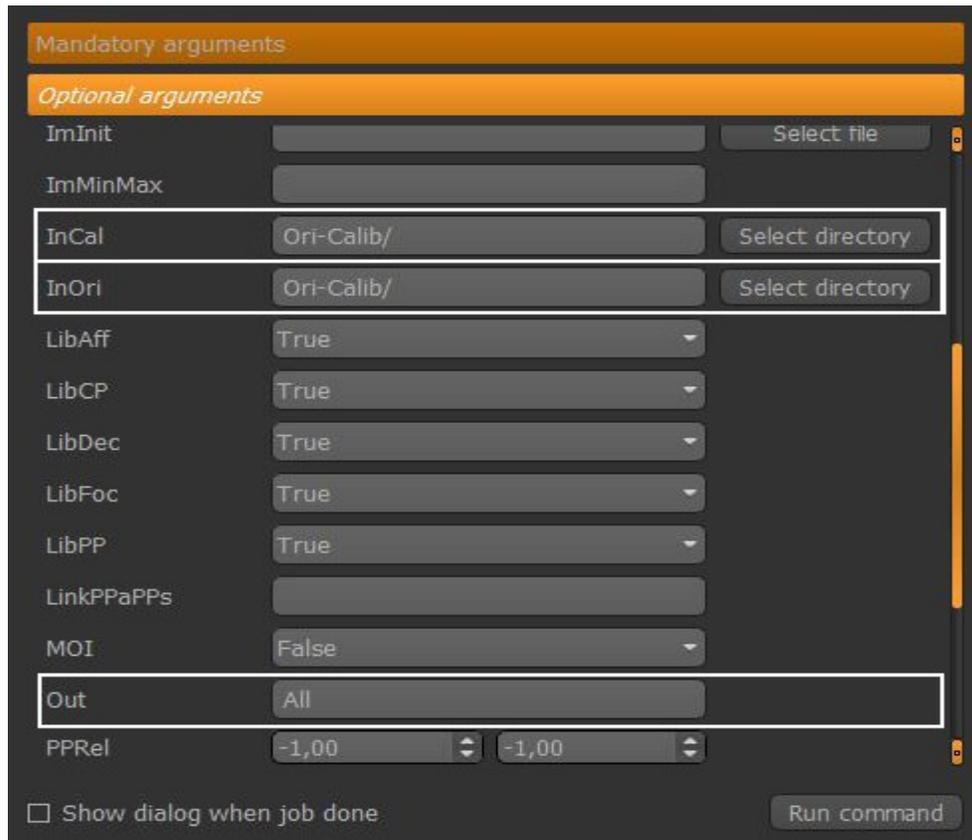
mm3d vTapas



The screenshot shows the 'Mandatory arguments' section of the mm3d vTapas interface. It features a dark background with orange headers. The 'Calibration model' is set to 'AutoCal' in a dropdown menu. The 'Full Directory (Dir+Pattern)' field contains the text 'DSC\_6183.JPG|DSC\_6184.JPG', followed by a 'Select images' button. Below this is the 'Optional arguments' section, which is currently empty. At the bottom, there is a checkbox for 'Show dialog when job done' and a 'Run command' button.

In this step the calibration model will be "AutoCal", it will inherit the computed parameters from the "Calib" folder and create a new dataset that we will call "All".

Hit "Optional Arguments"



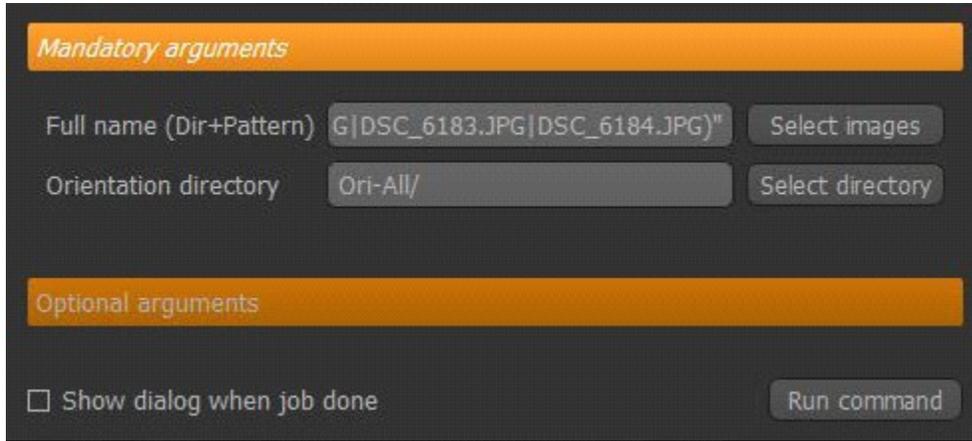
The screenshot shows the 'Optional arguments' section of the mm3d vTapas interface. The 'Mandatory arguments' section is collapsed. The 'Optional arguments' section is expanded and contains several fields: 'ImInit' with a 'Select file' button; 'ImMinMax' with an empty text field; 'InCal' and 'InOri' both set to 'Ori-Calib/' with 'Select directory' buttons; 'LibAff', 'LibCP', 'LibDec', 'LibFoc', and 'LibPP' all set to 'True' in dropdown menus; 'LinkPPaPPs' with an empty text field; 'MOI' set to 'False' in a dropdown menu; and 'Out' set to 'All' in a dropdown menu. At the bottom, there are two 'PPRel' fields both set to '-1,00' with up/down arrows, a checkbox for 'Show dialog when job done', and a 'Run command' button.

The Ori-All folder contains now a global relative orientation and calibration data for every picture of the initial frameset.

#### 4.

We will now launch AperiCloud to compute a SIFT point cloud, showing the tie points of the scene and, if desired, the position and orientation of all the cameras.

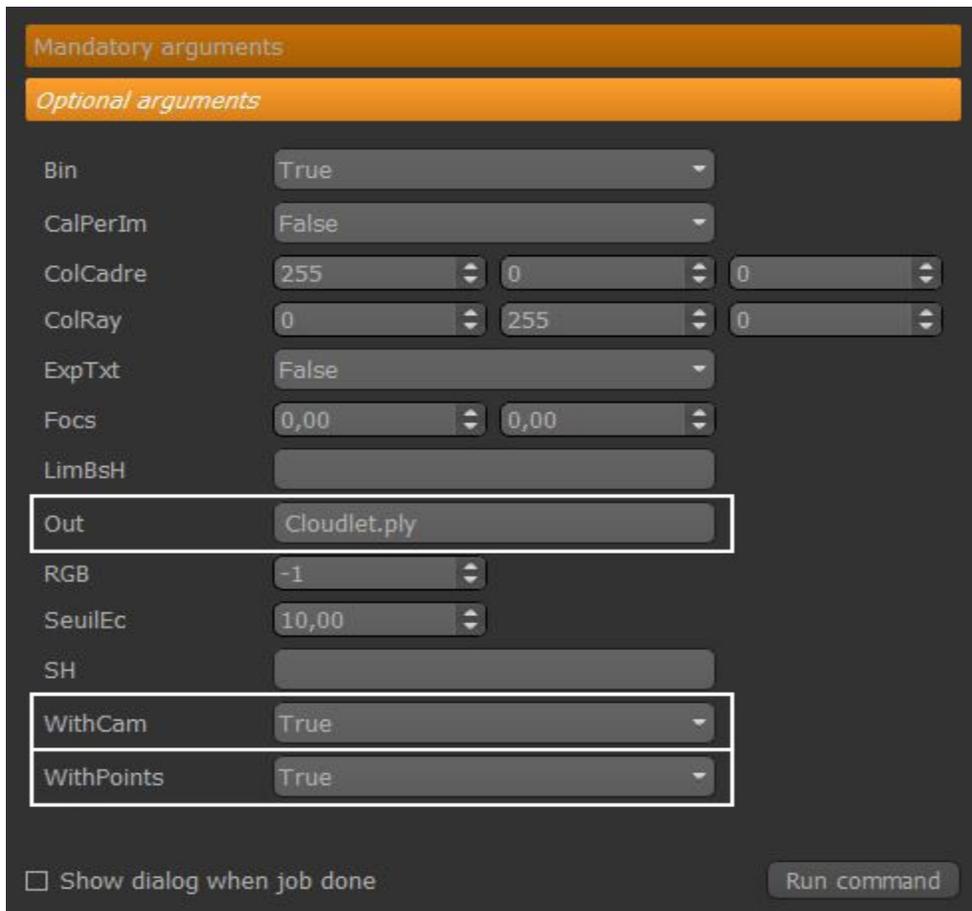
mm3d vAperiCloud



The screenshot shows the 'Mandatory arguments' section of the AperiCloud interface. It includes a text input field for 'Full name (Dir+Pattern)' containing 'G|DSC\_6183.JPG|DSC\_6184.JPG"', a 'Select images' button, a text input field for 'Orientation directory' containing 'Ori-All/', and a 'Select directory' button. Below this is the 'Optional arguments' section, which is currently empty. At the bottom, there is a checkbox for 'Show dialog when job done' and a 'Run command' button.

In this section we will pick **all the images** and select the folder containing the global positioning and orientation dataset: the "Ori-All" folder.

Hit "Optional Arguments"



The screenshot shows the 'Optional arguments' section of the AperiCloud interface. It contains several configuration options: 'Bin' (True), 'CalPerIm' (False), 'ColCadre' (255, 0, 0), 'ColRay' (0, 255, 0), 'ExpTxt' (False), 'Focs' (0,00, 0,00), 'LimBsH' (empty), 'Out' (Cloudlet.ply), 'RGB' (-1), 'SeuilEc' (10,00), 'SH' (empty), 'WithCam' (True), and 'WithPoints' (True). The 'Out', 'WithCam', and 'WithPoints' fields are highlighted with white boxes. At the bottom, there is a checkbox for 'Show dialog when job done' and a 'Run command' button.

We will here name the output pointcloud and leave the "withCam" and "withPoints" options as "true".

The resulting document should show as follows, at the root-level of the dataset folder:

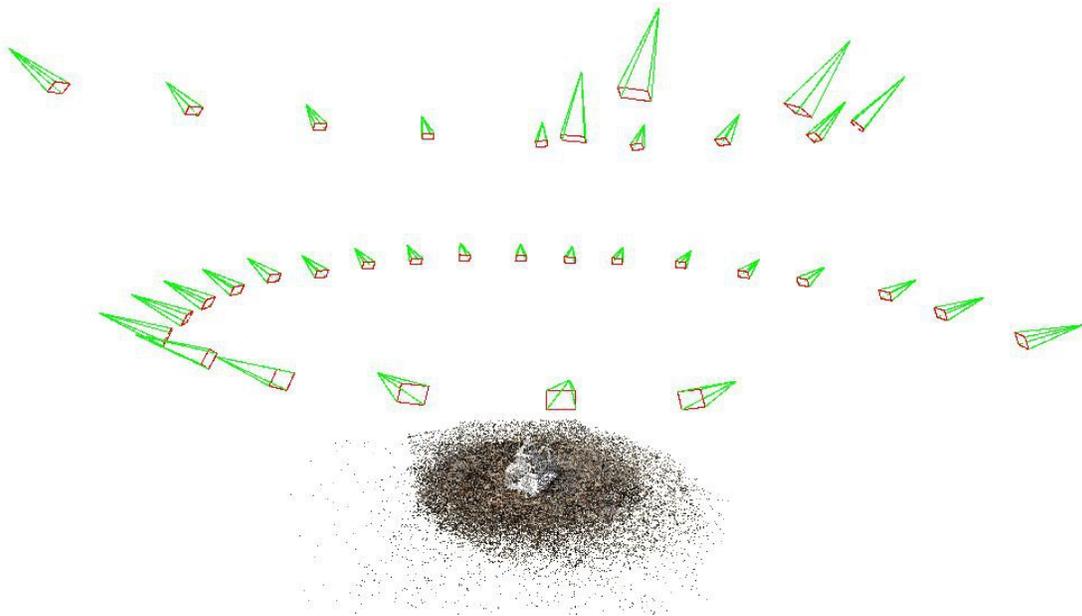


Cloudlet.ply

It's a .ply format 3D file containing, so far, color and normal vertex informations of initial tie points set plus the position and orientation of involved cameras. To open and edit huge pointsets databases, the free Meshlab software will be handy ; you can download it here :

<http://meshlab.sourceforge.net/>

At the end of this tutorial You can find a brief description of some useful features coming with this free software.



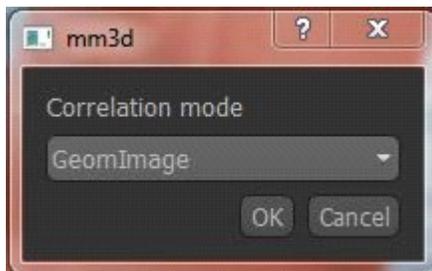
## GENERATE THE DENSE POINT CLOUD

This next step will perform a dense point cloud computation from the orientation datasets generated in the previous process. This step will use the "image-based geometry", calculating the depth of every user defined n pixels of a master image from the spatial information given by the known spatial data provided by peripheral points of view. We will use the "Malt" tool to perform a GeomImage correlation mode.

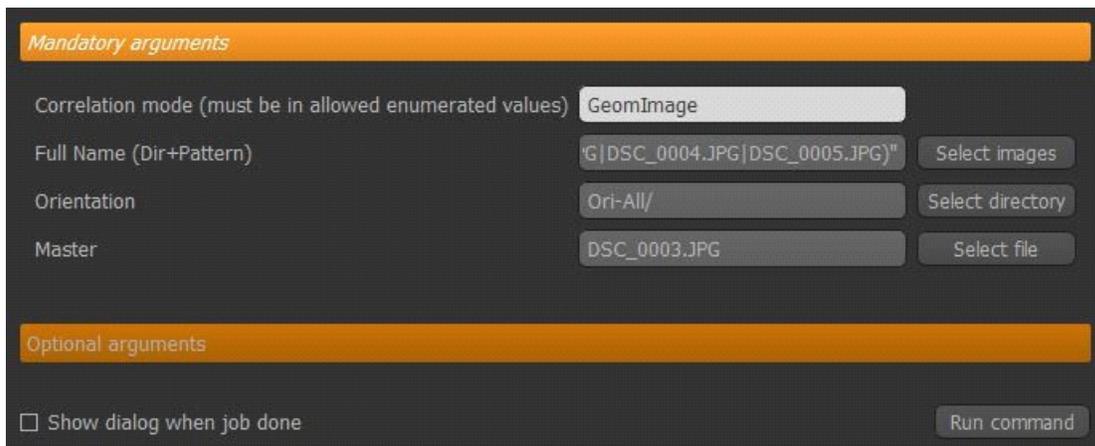
*nb : we will perform the following steps for every master image.*

### 1.

mm3d vMalt



We will first select a few "connected" images surrounding what we will call a "master view". The orientation folder will be the global one, named "Ori-All".



Hit "Optional Arguments"

Mandatory arguments

Optional arguments

ResolOrtho 1,00

ResolTerrain 0,00

Spherik False

SzRec 50

SzW 1

UnAnam True

UseGpu False

UseTA 1

WMI 25,00

ZInc 0,30

ZMoy

ZoomF 4

ZoomI

ZPas 0,40

Show dialog when job done

Run command

*It is important here to limit the computation extension by scaling down the dimension of the master image: the ZoomF factor will resize the image dimension by (here) a 1/4 ratio.*

*nb: the content of the MEC-Malt folder will be updated every time we execute a vMalt command.*

## 2.

### mm3d vNuage2Ply

We are now able to compute a dense point cloud with the "Nuage2Ply" tool.

Mandatory arguments

Name of XML file luageImProf\_STD-MALT\_Etape\_6.xml Select file

Optional arguments

Show dialog when job done

Run command

In the mandatory section of the graphic interface we will indicate the path of MEC-Malt/NuageImProf\_STD-MALT\_Etape\_7.xml file, which contains the values of the last step of the pyramidal refinement process (depending on the « ZoomF » zoom factor defined in the previous step). It will provide the overall orientation parameters needed to perform the dense cloud reconstruction.

Hit "Optional Arguments"

Mandatory arguments

Optional arguments

64B False

Attr O/INSTITUT\_LUMIERE/DSC\_0003.JPG

Bin 1

Comments

DoPly 1

DoXYZ 0

Dyn 1,00

ExagZ 1,00

Mask

Mesh False

NeighMask

Normale 0

Offs 0,00 0,00 0,00

Out INST\_1MESH.ply

P0 0,00 0,00

RatioAttrCarte 2,00

Scale 2,00

SeuilMask 1,00

Sz -1,00 -1,00

Show dialog when job done

The "Attr" parameter will indicate the pathway of the master image, used to define the color of each dot in the computed dense cloud point set. The "Out" sub menu will indicate the name of the computed \*.ply file. "RatioAttrCarte" will define the underscan of the master image (when used) and "Scale" for the overall density of the final cloud (in this case, 1/2 of the input file) .

## BUILDING AN ORTHOPHOTO

We will next use the precompute datasets to extract geometral (or parallel) views from our scene. It will be first of all mandatory to define a precise spatial reference geometry, and submitting the whole frameset to this specific new orientation (bascule in french, a flip-over) where all the images will be globally rotated AND translated to match this user-defined new spatial reference.

### 1.

First of all, we need to define a master picture that we will use to crop the work zone and set a reference plane. We will need to draw a polygon where all the dots will be roughly on the same plane.

mm3d vSaisieMasqQT

The screenshot shows the 'Mandatory arguments' section of the software interface. It features a text input field for the 'Name of input image' containing the path '/INSTITUT\_LUMIERE/DSC\_0003.JPG', followed by a 'Select file' button. Below this is the 'Optional arguments' section, which is currently empty. At the bottom of the interface, there is a checkbox labeled 'Show dialog when job done' and a 'Run command' button.

Select the location of the « master image » used to define the reference plane

Hit "Optional Arguments"

The screenshot shows the 'Optional arguments' section of the software interface. It contains several input fields: 'Attr' with the value 'MaFacade', 'Gama' with a dropdown menu set to '1,00', 'Name' (empty), 'Post' with the value '\_Masq', and 'SzW' with two dropdown menus set to '900' and '700'. At the bottom, there is a checkbox labeled 'Show dialog when job done' and a 'Run command' button.

Please note that the name of the field « Attr » will be used further for all of the upcoming steps of the process : keep it in mind (and NO spaces!)



Pick the points (CW or CCW) of a roughly plane surface and right-click on the last point. Hit space bar to validate your entry (the mask area should be highlighted in a transparent green zone). Save your mask under the « File » menu, and close the MicMac selection tool. In your master folder you should notice two extra files named (eg):

DSC\_3375\_MasqMonPlan.tif  
DSC\_3375\_MasqMonPlan.xml

*You can notice the persistence of the master image name (DSC\_3375) and the « Attr » variable name « MonPlan » that we have set in the previous step...*

We are ready to create some spatial 3D references just before applying the global « Bascule » transform:

## 2.

mm3d vSaisieBascQT

We should now pick SOME images that will set the spatial reference data around our master image ; let's select 3 or 4 contiguous images, say from (in this very case) DSC\_3373 to DSC\_3377. To ensure that MicMac will be able to formerly spatialize these contiguous images, we will indicate the pathway to the global orientation folder (Ori/All) and create an \*.xml reference file : Mesure\_Basc.xml (Basc for « Bascule » in french : « flip over »)

**Mandatory arguments**

Full Name (Dir+Pattern)

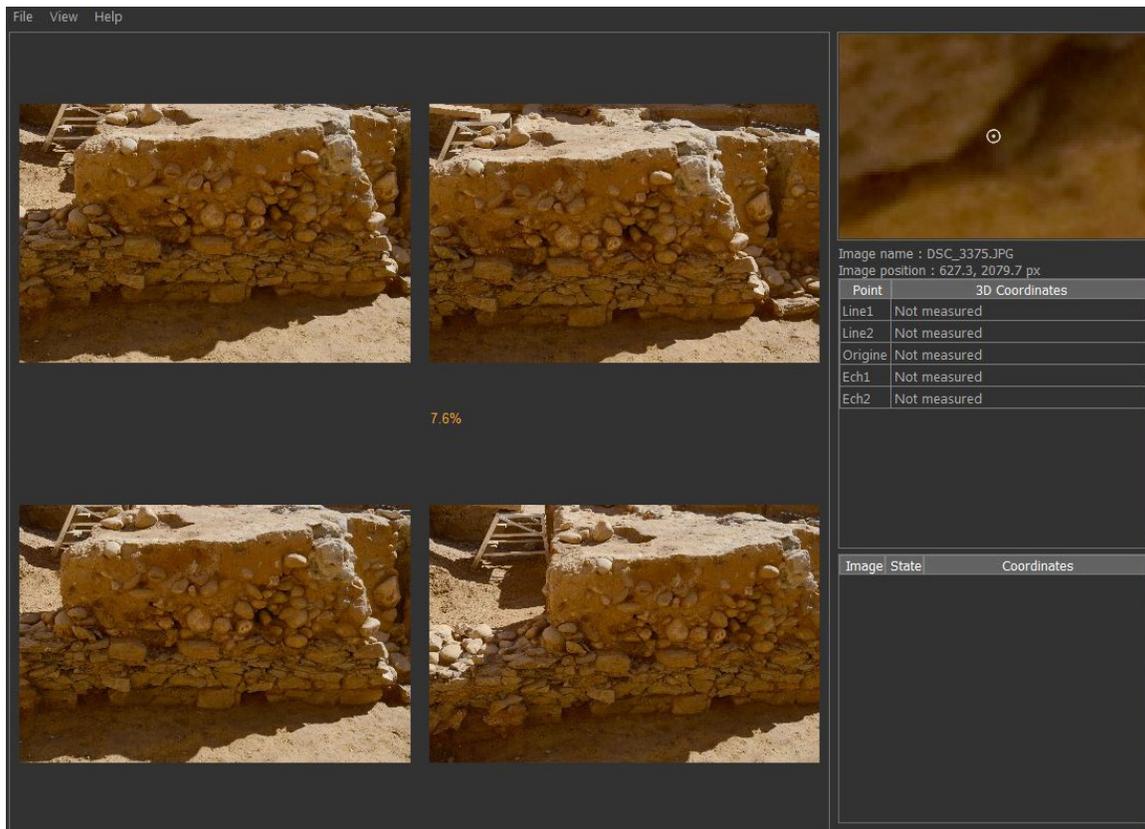
Orientation, NONE if unused

Output File

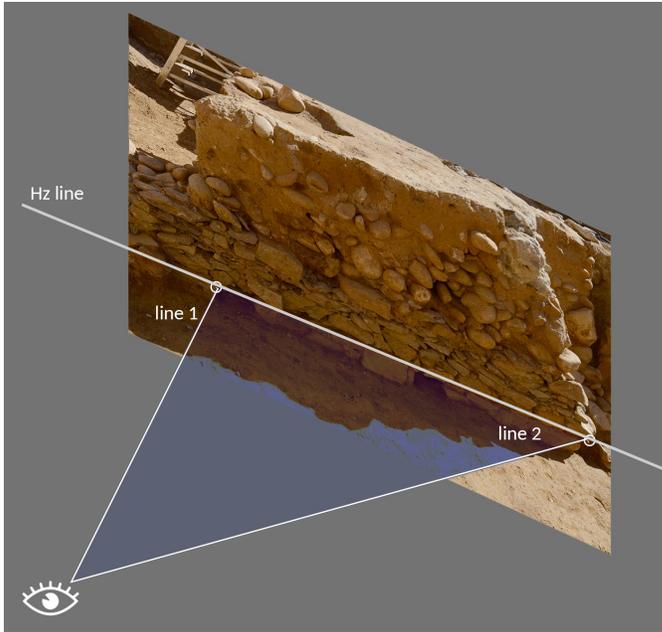
**Optional arguments**

Show dialog when job done

and then run the command :



We shall now draw an epipolar plane that will define an horizontal reference in the master image with the aid of « line 1 » and « line 2 » components. The positioning of « line 1 » and « line 2 » in the picture subset (DSC\_3373 to DSC\_3377) should be as precise as possible. When positioning the first position icon, a short line will appear in the other views to indicate the possible geometrical locations of this first placement. Do the same with the « line 2 » reference and, if desired, place « Ech 1 » and « Ech 2 » (Echelle 1 and Echelle 2 in french : scale 1 and scale 2) according to a visible measure or scale previously placed (or a known distance or measure) in the scene, it will define a reference distance used by MicMac to resize the whole geometry.



*the epipolar plane defined within the line 1 and line 2 positioning*

If more than four views are loaded in the background, you can right-click on the mouse button and choose « roll windows » to scroll all the selected pictures. Right-click on the reference spread-sheet on the right will allow to manually validate the geometric entries and to update the background xml datasheets on the run.

File View Help

The screenshot shows a software interface with four reference images of a stone wall. Each image has "Line1" and "Line2" markers. A metadata panel on the right displays the following information:

Image name : DSC\_3377.JPG  
Image position : 2576.2, 1999.8 px

Point	3D Coordinates		
Line1	-0.18	-1.37	-8.97
Line2	3.49	-1.03	-9.19
Origine	Not measured		
Ech1	Not measured		
Ech2	Not measured		

Image	State	Coordinates	
DSC_3377.JPG	to validate	2403.9	2598.0
DSC_3373.JPG	valid	3656.8	2432.7
DSC_3374.JPG	to validate	3254.6	2301.4
DSC_3375.JPG	to validate	3016.2	2306.6
DSC_3376.JPG	to validate	2881.6	2372.0

*in most cases, especially for simple planar captures, two reference images will do the job.*

We must quote here the fact that MicMac is an experimental platform, still under construction and continuously updated. So far, the last build of the program is the 4791 (march 15, 2015) and the following commands must be typed in manually. Just follow the steps :

### 3.

SBGlobBascule "\*.JPG" All MaMeasureBasc-S2D.xml LocBasc PostPlan=\_MasqMonPetitPlan

In this step you must select the whole frameset and globally compute the local transformation in reference with the epipolar plane just defined, referenced in the xxxxxx-S2D.xml file. You must name here the folder that will contain the geometric transformation data for each image of your picture set (eg. LocBasc) and finally paste the Attr value defined in the vSaisieMasqQT section right after the PostPlan=\_Masq entry! SBGlobBascule will create a new folder containing the « flip over » orientation information for all the pictures.

### 4.

Tarama "\*.JPG" LocBasc

At his step the wole frameset has been scaled and rotated according to the previous inputs and the reference plane. Tarama computes the assembly array and calculates every single tile mask.

### 5.

mm3d SaisieMasqQT TA/TA\_LeChantier.tif

This steps defines the overall editable mask for the whole picture set.

### 6.

Malt Ortho "\*.JPG" LocBasc ZoomF=1

Malt performs the dense matching computation within the TA mask boundaries defined above (reminded by the « Ortho » command). The transformation refers to the LocBasc dataset computed in the step above and you can optionally undescan the final image resolution with the ZoomF value, considering the final result as a 1/ZoomF ratio (1 means full resolution, 2 means half resolution etc). Computing an orthophoto with full resolution can be quite time consuming...

### 7.

Tawny Ortho-Mec-Malt/ Out=MurRomain.tif

This last step allows to compute and save the final orthophoto within the ortho-Mec-Malt Folder. You can superimpose this picture with the last refinement level named « AutoMask\_STD-MALT\_Num\_7.tif » that you will find in the MEC-Malt folder.

*the final recurrence number (7 in this example) depends on the scale factor selected in the previous step : setting 1 to the ZoomF parameter will perform 7 consecutive refinements and will create twice a bigger image than a ZoomF=2 input...*



*superimposing the AutoMask\_STD-MALT-Num\_7.tif picture file with the resized AutoMask\_STD-MALT-Num\_7.tif image. Within Adobe Photoshop in the layer palette, set the blend mode to « darken ».*

## COMMANDS OVERVIEW:

### Tapas:

performs the internal relative orientation with a recursive tie points research

### AperiCloud :

generates the overall pointcloud starting from the orientation and position of the cameras and the position of tie points

- you can visually control the aerotriangulation process.

### Nuage2Ply:

creates the physical point cloud from the Malt reference dataset

### Tarama :

creates the assembly array mandatory for the correlation mask input.

### Malt :

computes the correlation between the images dataset.

### Tawny :

joins the orthopictures computed with Malt.

- this program can also perform the radiometric equalization of the tiles, enhancing the visual aspect of the final document.

## QUICK REFERENCE :

A typical MICMAC session with a manual input commands :

### ORIENTING THE DATASET

*(the image incall follows obviously the name of your own pictures...)*

```
Tapioca.exe MulScale ".*JPG" 300 1500
```

```
Tapas.exe FraserBasic ".*(6232|6233|6234|6235|6236|6237).JPG" Out=Calib
```

```
Tapas.exe AutoCal ".*JPG" InCal=Calib Out=All
```

```
AperiCloud.exe ".*JPG" All RGB=1
```

```
// Out=Nuage_sift.ply to export a SIFT pointcloud out of this step.
```

```
// RGB=0; for slower machines, this parameter should be set to 0 for a faster b&w processing of the images
```

### GENERATE THE DENSE POINT CLOUD

*(these two steps will be performed for every master image in your scene – pay attention to the incall of the master image wich must be done 3 times)*

```
Malt GeomImage ".*(0015|0016|0017|0018|0019).JPG" All Master=DSC_0017.JPG ZoomF=2
```

```
Nuage2Ply "MM-Malt-Img-DSC_0017\NuageImProf_STD-MALT_Etape_7.xml" Scale=2 RatioAttrCarte=2  
Attr="DSC_0017.JPG" Out="Face1.Ply"
```

### BUILDING AN ORTHOPHOTO

```
mm3d SaisieMasqQT DSC_6177.JPG Attr=MonPetitPlan
```

```
mm3d SaisieBascQT "(DSC_6176.JPG|DSC_6177.JPG)" Calib MaMeasureBasc.xml SzW=[800,800]  
(Line1 Line2, validate...)
```

```
SBGlobBascule ".*JPG" All MaMeasureBasc-S2D.xml LocBasc PostPlan=_MasqMonPetitPlan
```

```
Tarama ".*JPG" LocBasc
```

```
mm3d SaisieMasqQT TA/TA_LeChantier.tif  
(to redefine the overall picture mask)
```

```
Malt Ortho ".*JPG" LocBasc
```

```
Tawny Ortho-Mec-Malt/ Out=MurRomain.tif
```

# MESHLAB BASIC OPERATIONS:

## 0\_DELETEING vertices

Filters / Selecting / Deleting selected vertices

## 00\_SAVE project / Export Mesh

A\_File / Export Mesh

B\_File / Save project

## 1\_MERGING

Filters -> Layer and attribute management -> Flatten Visible Layers

(X) - Merge duplicata vertices

(X) - Keep unreferenced vertices !!

## 2\_SAMPLING

Filters->Sampling->poisson disk sampling (attention! total points number!)

(X) - base mesh subsampling

nb: l diamètre du Montecarlo filtre la distance minimum entre deux points

## 3\_NORMALS

(select points)

->Filter->Point Set ->Compute normals for point sets

Launch on Main Mesh.

10 is OK

## 4\_SURFACE RECONSTRUCTION

->filters->point sets -> surface reconstruction: poisson

/ parameters : 9 - 9 - 1 - 1)

## 5\_NORMALS - (If Normals are inverted)

->Filters ->Normal, curvature and orientation ->invert faces orientation

## 6\_TEXTURE

->Filters ->Sampling -> Vertex Attribute Transfert.

\_ point Cloud is the "source"

\_ mesh is the "target"

X - transfer color

## 7\_POLYGON REDUCTION

->Filters ->Remeshing, simplification and construction >Quadratic Edge Collapse Detection.

X - preserve boundary of the mesh

X - Preserve normal

X - Optimal position of simplified vertices

X - Planar Simplification

X - Post-simplification cleaning

## \_UNION POINTCLOUD

->Filters ->Mesh layer ->Flatten Visible

X - Keep unreferenced vertices

## TEXTURE MAP GENERATION

### 6.1 TRIANGLE PARAMETRIZATION

-> Filters/Texture/TrivialPerTriangleParametrization

Quads pr lin 1000q

Texture dimension (px) 1024, 2048...

Inter-Triangl border (px) 1

X - Preview

### 6.2 TEXTURE GENERATION (Transferring the pixels colors to a new color map)

-> Filters/Texture/VertexColorToTexture

(texture dimension identique au paramètre précédent)

X - Assign texture

X - Fill texture

### 6.3 EXPORT .OBJ (export preferably all in the same folder)

-> make sure that TexCoord is enabled