Underwater system unit

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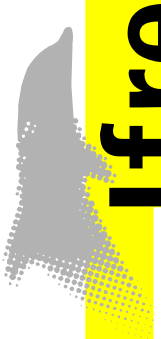

Matisse 3D Quick Start Guide

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1. Introduction

This document is a quick start guide to help you to process a complete dataset with Matisse, mainly oriented toward 3D reconstruction. It treats about pre-processing and processing.

The first step is the pre-processing of the dataset. This step is mandatory when using video dataset, as it converts video to images and recommended for images only. The pre-processing tool allows to reduce resolution (for faster reconstruction), and to color correct images.

The second and last step is the selection of a reconstruction algorithm and launching of the reconstruction.

2. Installation of Matisse 3D

This is the easiest step. Just launch matisse-setup.exe and follow the instructions.

3. Pre-processing the dataset

Once Matisse is installed, the pre-processing tool can be launched from the start menu ("MatissePreprocessing") or from Matisse (Tools->Launch preprocessing tool). The preprocessing tool comes as a wizard with the following first page (Fig. 1):

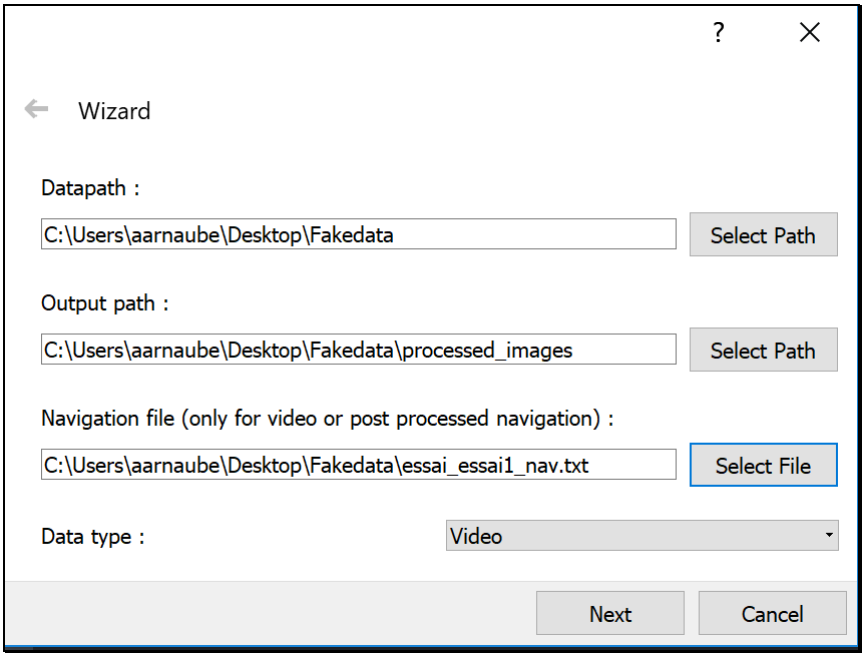

Fig 1. First preprocessing wizard page

In the first page you must enter the datapath with "Select path" and select the folder containing video(s) or images to be processed. Be careful: if you want to synchronize video with navigation (which is a major point if you want a scaled reconstruction) the video must have its name corresponding to its starting date and time.

Two file formats are supported:

- Ifremer historical format: missionname_divenumber_YYMMDDHHmmSS_CAMID.mp4 (Where missionname, divenumber are what you want but must be present, YY is year with 2 digits, MM is

month, DD is day, HH is hour, mm is minutes, SS is seconds and CAMID is a number identifying the camera channel).

- Second is ISO Time naming: YYYYMMDDTHHMMSS.FFFZ.mp4 following the same convention as before but with FFF representing milliseconds.

Then output path is automatically filled to datapath\processed_images but can be changed as you like.

Finally, you can select a navigation file (again if you need navigation synchronization) and select the data type (video or photos).

Once you press “Next”, you arrive on the second wizard page (see Fig. 2):

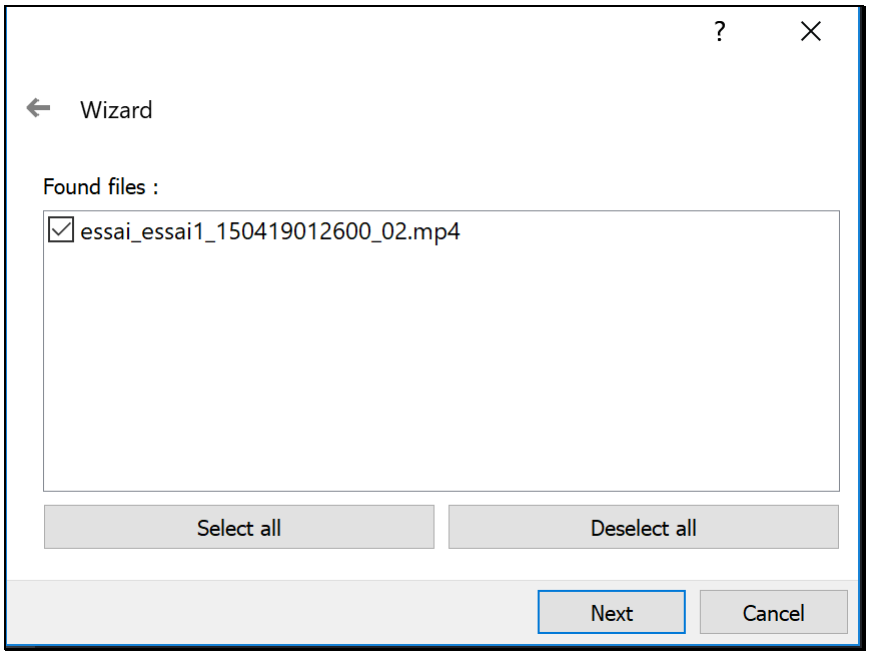

Fig. 2 Selection of files to be processed

You can see a list of the supported files that has been found. You can select a subsample of the files you want to process.

Then clicking “Next” again you arrive to the last page (see Fig. 3):

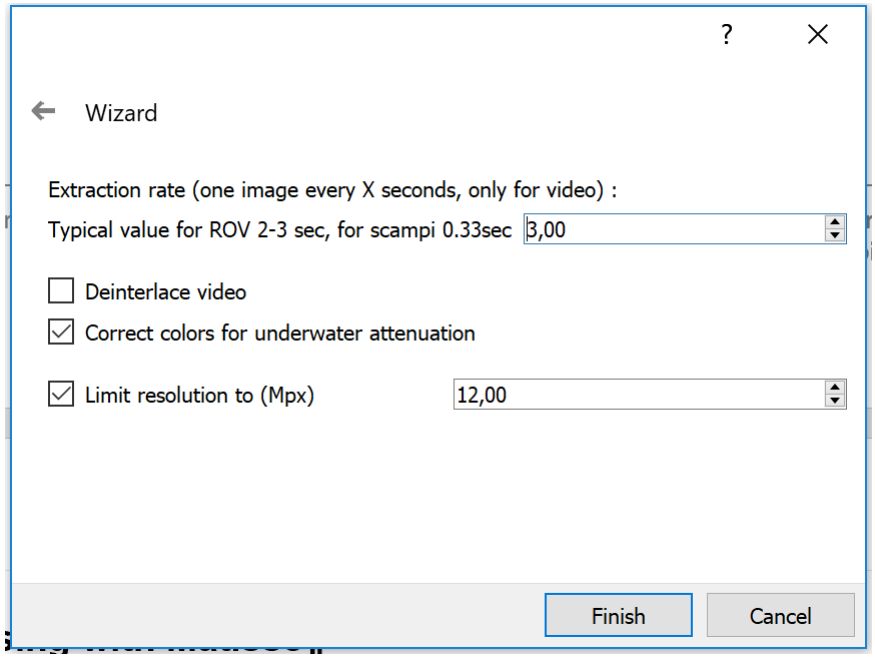

Fig. 3 selection of preprocessing parameters

In this page, you can select the processing parameters. There are 4 parameters:

- Extraction rate: This parameter is only used for video and represent the time left between two images extracted from the video. The more the camera moves quickly, the shorter this time should be. A typical value is 2-3 seconds for ROV and Nautile and 0.33 seconds for scampi.

- Deinterlace video: This parameter is only used for video. Must be checked if the input video is interlaced (eg. Scampi HD or old Victor HD format)

- Correct colors: Check this case if you want to correct images for colors, meaning removing underwater colors artefacts.

- Limit resolution (in Mpx): This option is very useful if you don’t want to spend a month on the same reconstruction. If the resolution of images is higher than this value, then images are scaled down to this value.

Finally click on finish button and the dataset is preprocessed.

4. Processing with Matisse

4.1. Matisse modes

Matisse can be started from the start menu (Matisse 3D). At start you see the following welcome screen:

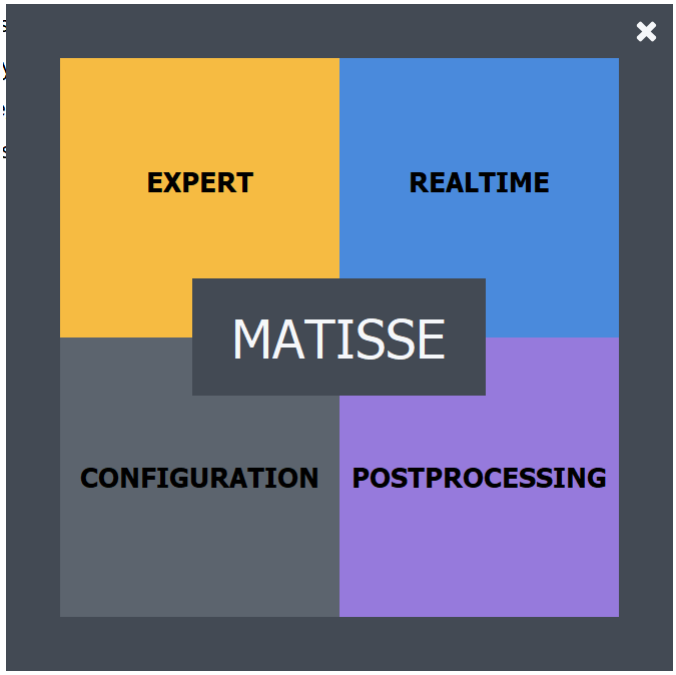

Fig. 4 Matisse welcome dialog. Let ou choose the running mode

There are three launching modes:

Expert mode, corresponding to yellow top left square in figure 3, which, as the name suggest, is mainly for expert, giving access to all Matisse settings and processing chains creation. This mode is grayed by default and can be activated in configuration (bottom left). You should not need to go there but the technical support can ask you to go into this mode mainly for helping solving your particular case.

Realtime mode for realtime image processing. This mode is not used at the moment as no realtime algorithm has been released.

Postprocessing mode, which is the main user mode for launching reconstructions on already acquired data. This quick guide will treat about this one.

4.2. Post processing with Matisse

Once you have images you can run Matisse 3D in post-processing mode (purple button on welcome screen) for launching the reconstruction. You should obtain a purple/gray windows like this one (Fig. 5):

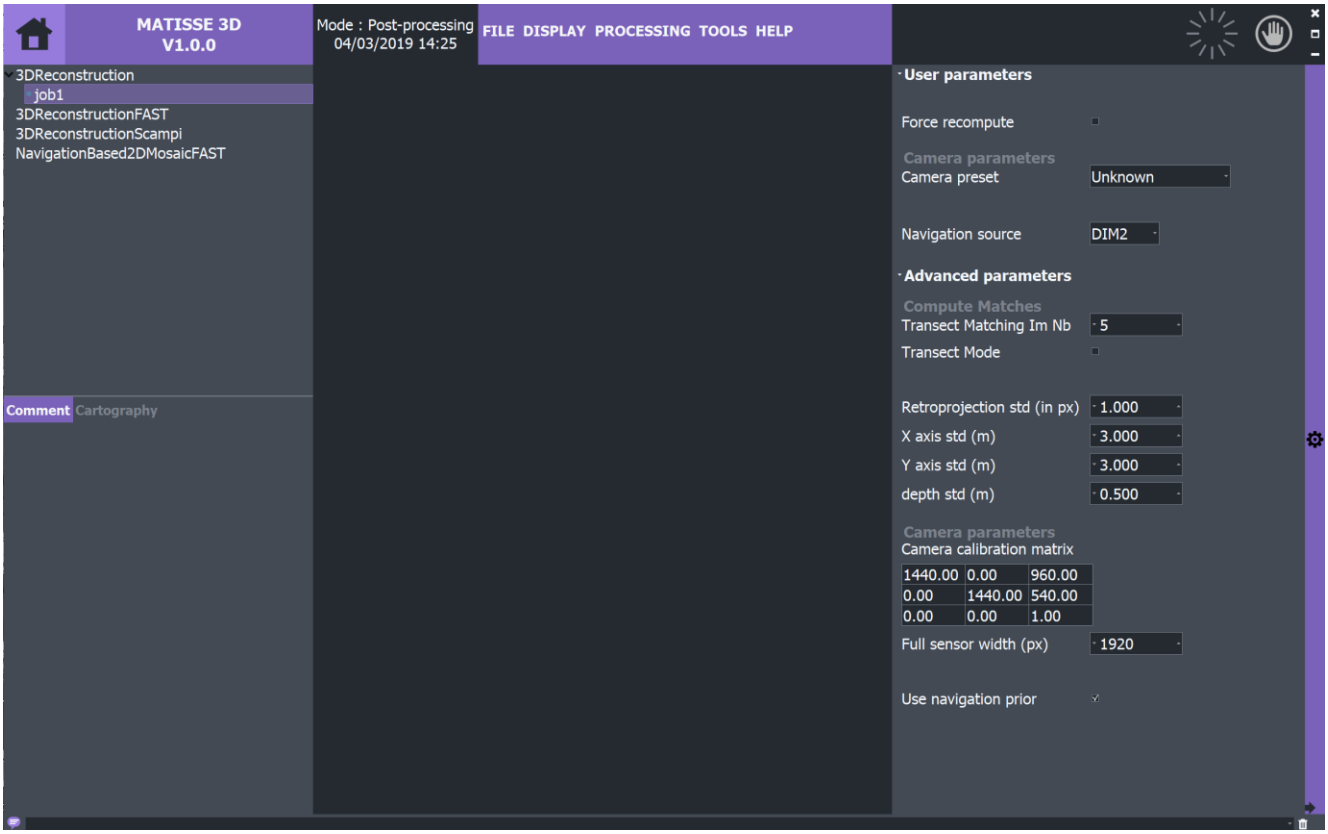

Fig. 5 Matisse post processing interface.

The house button is for going back to welcome screen. The left panel lists the available processing, the main menu is at the top, with a wheel to tell it's processing and a hand to stop the current process. The right panel is for tuning algorithm parameters. Parameters are classified in to categories: user (very easy to understand) and advanced (deeper lever of comprehension but not expert).

First action is to select the right algorithm for your purpose. The choice is quite easy, here is a description of the algorithms:

- 3DReconstruction: This is the most generic algorithm for 3D reconstruction. You can use with images acquired with an ROV or Nautile.
- 3DReconstructionFAST: Same as the previous one but faster. Very useful for low capacity computer but the result is not as good as
- 3DReconstructionScampi: As the name suggest, it is mainly for scampi (http://flotte.ifremer.fr/fleet/Presentation-of-the-fleet/Underwater-systems/Scampi). It is based on the first one but it is faster as it supposes acquisition are in transects. It also supposes the navigation quality is lower as scampi only has USBL.
- 3DReconstructionSparse: This is the fastest technique but provide the less 3D details about the scene. Can be used for low power computer, when overlap between images is too low or just to simply have a result as fast as possible.

To apply an algorithm to your dataset you have to right click on the algorithm of your choice (left panel) then click “create new task”. This will open the following window:

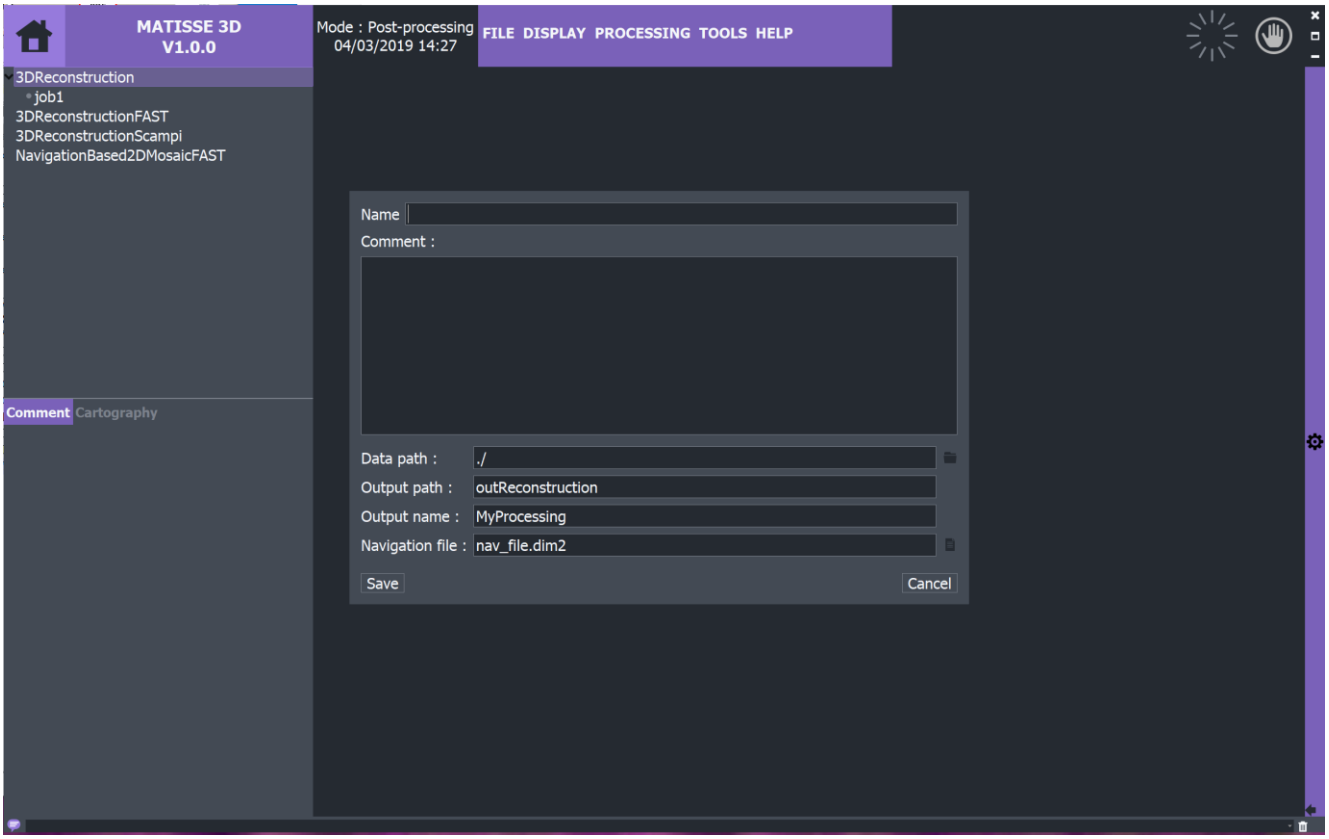

Fig. 6 Required information to start processing.

You have to give a name to your task. You can optionally enter a comment. You must also select data path (where data is located). You can leave the default output folder which is “outReconstruction”. You can select a name for the reconstruction (this is the name that will be given to 3D files). And finally you select the navigation file (if you have one, which is mandatory if you want scaled reconstruction) and click on “Save”.

The task (we also call it job) appears under the algorithm name on the left panel. The right panel opens and gives you the opportunity to tune some parameters for the acquisition. The main ones are:

- Camera preset: select the camera you used for the acquisition. If you don’t know the camera you can select “unknown” but result quality can be a lot lower. You can also use custom for your own camera but you have to fill the camera calibration matrix and the full sensor width.
- Navigation source: Use dim2 navigation file or EXIF. If EXIF is selected, the standard GPS data is used from image metadata.
- Navigation and image quality parameters (they can differ for USBL only vs PHINS):
    - Reprojection std (in px), this is the confidence of point localization in camera frame
    - X axis std, standard deviation in navigation x axis.
    - Y axis std, same as X for Y
    - Depth std, same as X for depth

Then you can right click on the task to save parameter with “Save” button. Then right click again to run it with the “Run button”.

As long as the wheel is turning, it means that the program is not crashed. It can take very long time to process a big dataset, not meaning that the software is frozen. For example, with a 2018 gen core i7, 4000 thousand images in HD resolution can take around 1 week to process.

5. Description of the output files of the reconstruction

There could be multiple destination folders if it were not possible for the algorithm to join all images in a single model. Multiple files will be found in each destination folder. Here is an example of files you will find if the reconstruction is called “MyProcess”:

- Result files:
  - **cloud_and_poses.ply** -> 3D sparse reconstruction, first step of the reconstruction
  - **MyProcess_X_dense.ply** -> same as the previous one but with more points (densification)
  - **MyProcess_X_dense_mesh.ply** -> meshing (surface) made with the previous one
  - Final reconstruction files (with texture reconstruction). You need all those files for further treatments:
    - **MyProcess_X_texrecon.kml**: geo-localization file
    - **MyProcess_X_texrecon.obj**: 3D data of the model
    - **MyProcess_X_texrecon.mtl**: list of textures
    - **MyProcess_X_texrecon_materialYYYY_map_Kd.png**: images for texturing

- Temporary files that can be removed if you’re satisfied with the result:
  - All mvs files
  - Files beginning with xxxx_Resection.ply (where xxxx is a number)
  - spt and vec files
  - MVE folder
  - “Matched” and “splitted_matches” folders