Underwater Systems Unit

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3DMetrics
Quick Start Guide

Ifremer

TABLE OF CONTENTS

1. Introduction **3**

2. User interface overview **3**

3. Opening data **4**

3.1. Supported formats 4

3.2. Load model in 3DMetrics 4

4. Make measurements **5**

4.1. Quick measurements 5

4.2. Measurements layers 6

1. Introduction

3DMetrics is a software to analyse 3D georeferenced models, generated both with optical and acoustic data. This document is a quick start user guide to describe the supported file formats, the program's tools and features. We have put a lot of effort into optimizing the models display performance, so that even large files from optical models can be exploited adequately.

2. Installation

This software is available through Github at:

https://github.com/IfremerUnderwater/3DMetrics

3D Metrics can be compiled in Linux from the source code, and instructions are provided through the github pages for installation.

For Windows, a binary executable file can be downloaded and launched, and the executable includes instructions for the installation.

3. User interface overview

Figure 1 shows an overview of 3DMetrics interface. Here is the vocabulary used in the document to describe the software graphical areas:

- 1: Main menu
- 2: Quick measurement toolbar
- 3: Geographic coordinates label
- 4: View tools
- 5: Layers' tree
- 6: 3D view
- 7: attributes table

Fig 1. 3DMetrics interface

4. Opening data

4.1. Supported formats

3DMetrics is based on the open source library OpenSceneGraph (OSG : http://www.openscenegraph.org), hence all formats supported by OSG are natively supported by 3DMetrics. This includes the frequently used ply and obj formats for 3D textured models, and that are output by Matisse.

In order to geo-reference these models, the user has to crat create a kml file (same type of file used by GoogleEarth) associated with with the model file . Here is an example of kml file:

```
<kml>
 <Placemark>
  <name>Example</name>
  <Model>
   <altitudeMode>absolute</altitudeMode>
```

```
    <Location>
      <longitude>2.3562122</longitude>
      <latitude>48.8446129</latitude>
      <altitude>-800</altitude>
    </Location>
    <Orientation>
      <heading>0</heading>
      <tilt>0</tilt>
      <roll>0</roll>
    </Orientation>
    <Scale>
      <x>1</x>
      <y>1</y>
      <z>1</z>
    </Scale>
    <Link>
      <href>Example.obj</href>
    </Link>
   </Model>
  </Placemark>
</kml>
```

Using this kml file, 3DMetrics will consider that the point (0,0,0) of the model “Example.obj” will be located at the latitude, longitude, and altitude given in the files (see above). The 3D Model is assumed to be in local Cartesian coordinates, hence meaning that there is no projection, that the X axis (positive) is pointing East, that the Y axis (positive) is pointing North, and that the Z axis is pointing up.

Note: if you use Matisse software to generate the 3D Models, the results follow the convention and requirements for 3DMetrics and listed above, the kml file is automatically created and provided with the output files.

4.2. Loading 3D models in 3DMetrics

To open a 3D model, from the main menu the user can access “File->Open 3D Model” and select a model in a supported file format. The model is represented in a layer within the 3DMetrics interface, in the “Layers’ tree” area (5 in figure 1), and a checkbox can control its visibility.

Please note that an optical 3D model alone is not georeferenced, so for example if you both have a kml and an obj file you must open the kml in 3DMetrics in order to make georeferenced measurements. The models generated in Matisse are scaled and oriented, with all the X, Y and Z axis units in m, relative to the position of the model origin.

For large projects with multiple layers, it is possible to group layers together in folders. To do so, right click in the layers’ tree and create a new group. You can then slide layers into any given group.

5. 3D model measurements

3DMetrics features 2 measurement modes. A quick measurement mode, which as the name suggests provide tools for easy and quick measurements, but that are not intended to be saved nor exported. The second measurement mode is for complete quantitative exploitation of a 3D model, and allows the user to create measurement layers that the user can customize, save, load back, include in a project and export for exploitation in other programs (e.g., shapefiles for GIS systems).

5.1. Quick measurements

Quick measurements can be done using the “Quick measurement toolbar” represented as area 2 in figure 1. Here is a description of the 4 available buttons:

This button opens the distances measurement tool

This button opens the surface measurement tool

This button opens the geographic coordinates point picking tool

This button cancels the current measurement (for both quick measurement or other)

Pressing one of the 3 first buttons above opens a windows as shown in figure 2 (showing a distance measurement example). The measurement can be started either by double clicking the windows tool icon (here) or the start button. You then use multiple left click to create a polygon whose total length is written in the measurement windows. To end the measurement, use the right click. The same principle applies to other tools.

In case of clicking a wrong point, the user can use ctrl-z to remove the last point, or the cancel button to remove all points.

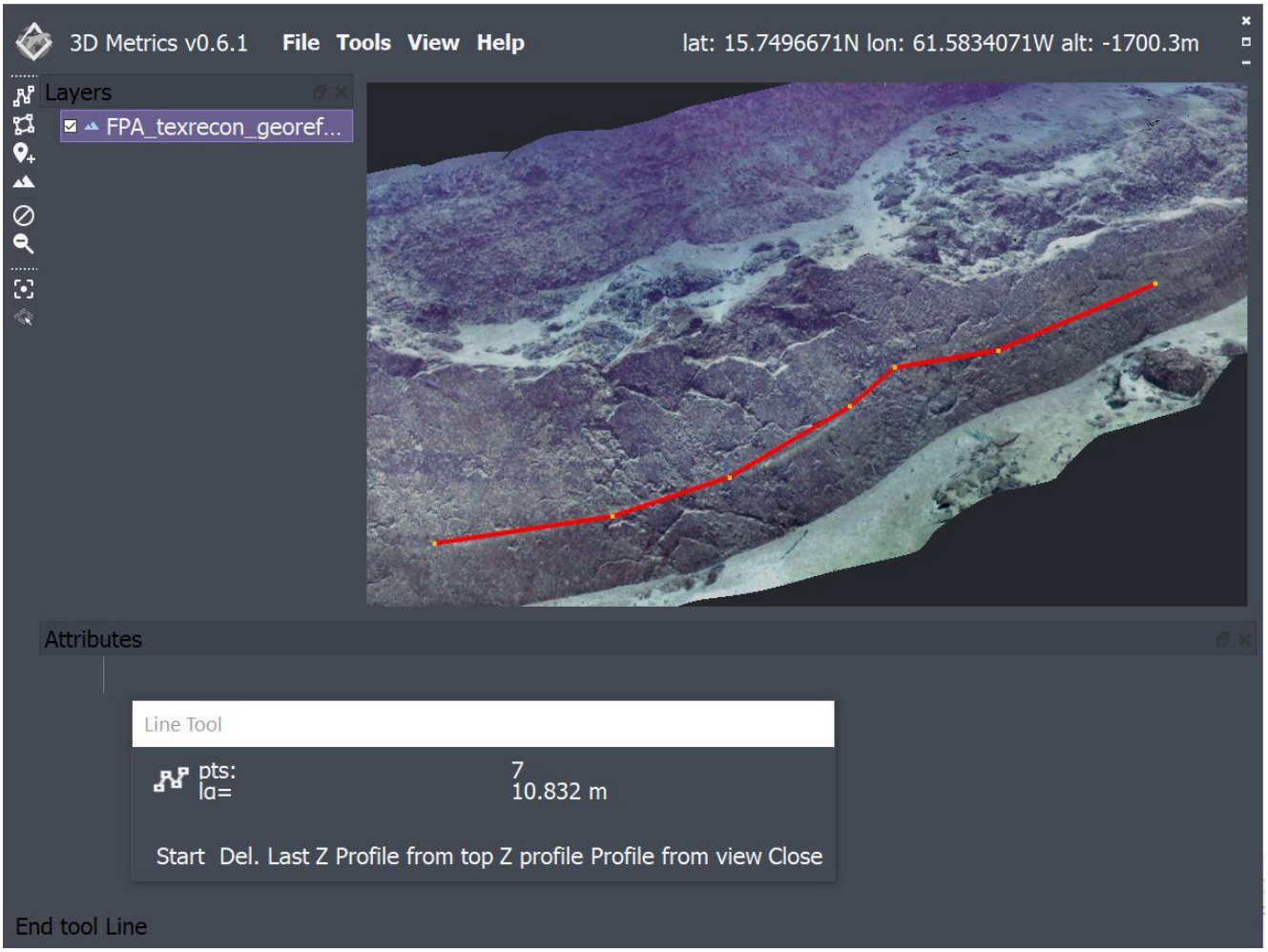

Fig 2. Example of quick measurement with a line measurement

5.2. Measurements layers

For more complex analyses of 3D models, 3DMetrics provides an interface to store measurements in layers, to save these, load them back, and export the measurements. It also allows to couple different types of measurements together.

To create a measurement layer, the user has to right click in an empty area of the layers' tree and then select "create new measurement". You can then give it a name with right click and rename.

Measurement layers associated with an attribute table (area 7 in figure 1), with lines that record measurement results for measured entities (each line is a measurement for an entity). Columns of the attribute table are the different fields needed for the characterization of a measured entity.

The available field types are:

- Line: for distance measurement
- Area: for surface area measurement
- Point: for geo coordinates point picking
- Text: For comments
- Category: predefined categories assignable to an entity

Each case of the attribute table will contain the result of the measurement for a given field. For a distance measurement reported it is the total length, for a surface measurement the area, and for a point the geographic coordinates (latitude, longitude, altitude).

The measurement layer fields have to be adapted to the entities analyzed by the user. For example, if a user wants to perform measurements on coral colonies, the parameters (lengths) to measure may include the width, height, localization (position), surface, in addition to some annotations or comments. In the case example shown in Figure 3, the measured entity is a single coral colony and hence the number of lines in the attribute table is the number of measured colonies. For this example, the 5 fields of the measurement layer shown are:

- 2 line measurement fields for width and height
- 1 area measurement field for total surface
- 1 point field for localization
- 1 text field for annotation comments

To define the measurement layer fields, the user right clicks on the layer and selects “edit measurement”. This opens the measurement edition windows (see figure 3). The user can click on the “+” to add as many fields as needed, and then provide a field name and type. Once this done, the users needs to click “apply” for the changes to be effective.

If the same patterns are often used, these can be saved into a file, that can be uploaded through this window interface (button on the bottom left).

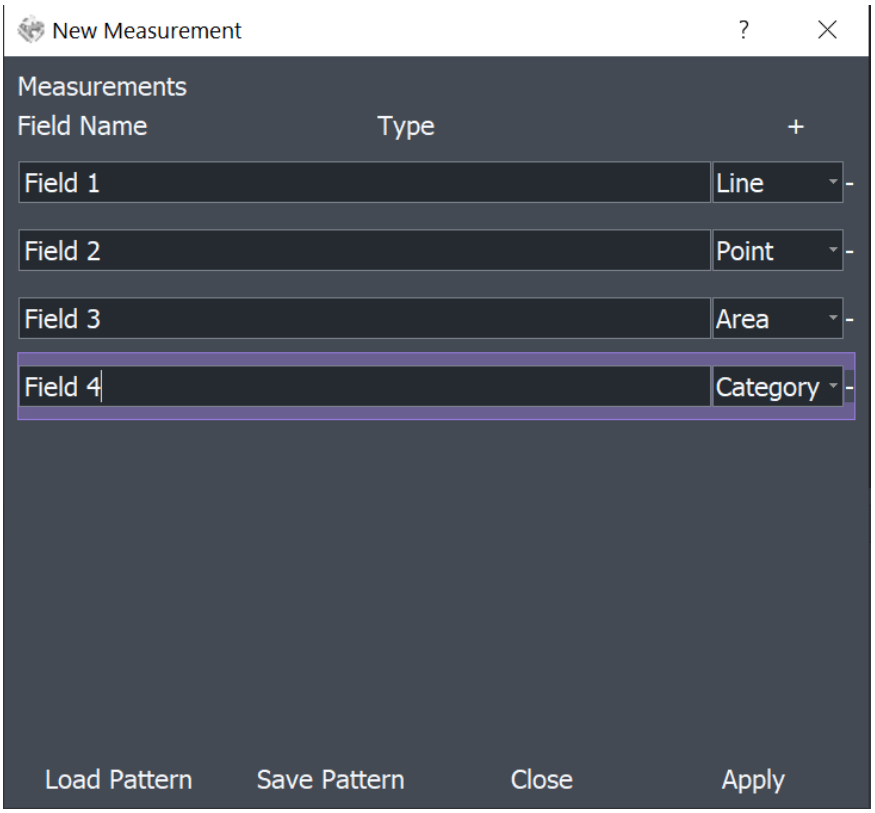

Fig 3. Measurement edition windows

After the measurement layer edition, the attribute table column header should contain the name of each field. To add a new measurement line for measuring an entity the user can right click in the attribute table and then select “add line”. Alternatively the key F2 provides a shortcut. To make a measurement, the user double clicks the measurement icon, and then the tool will work as explained in the “quick measurement tool” section above. Red color symbols indicate measurements that are empty.

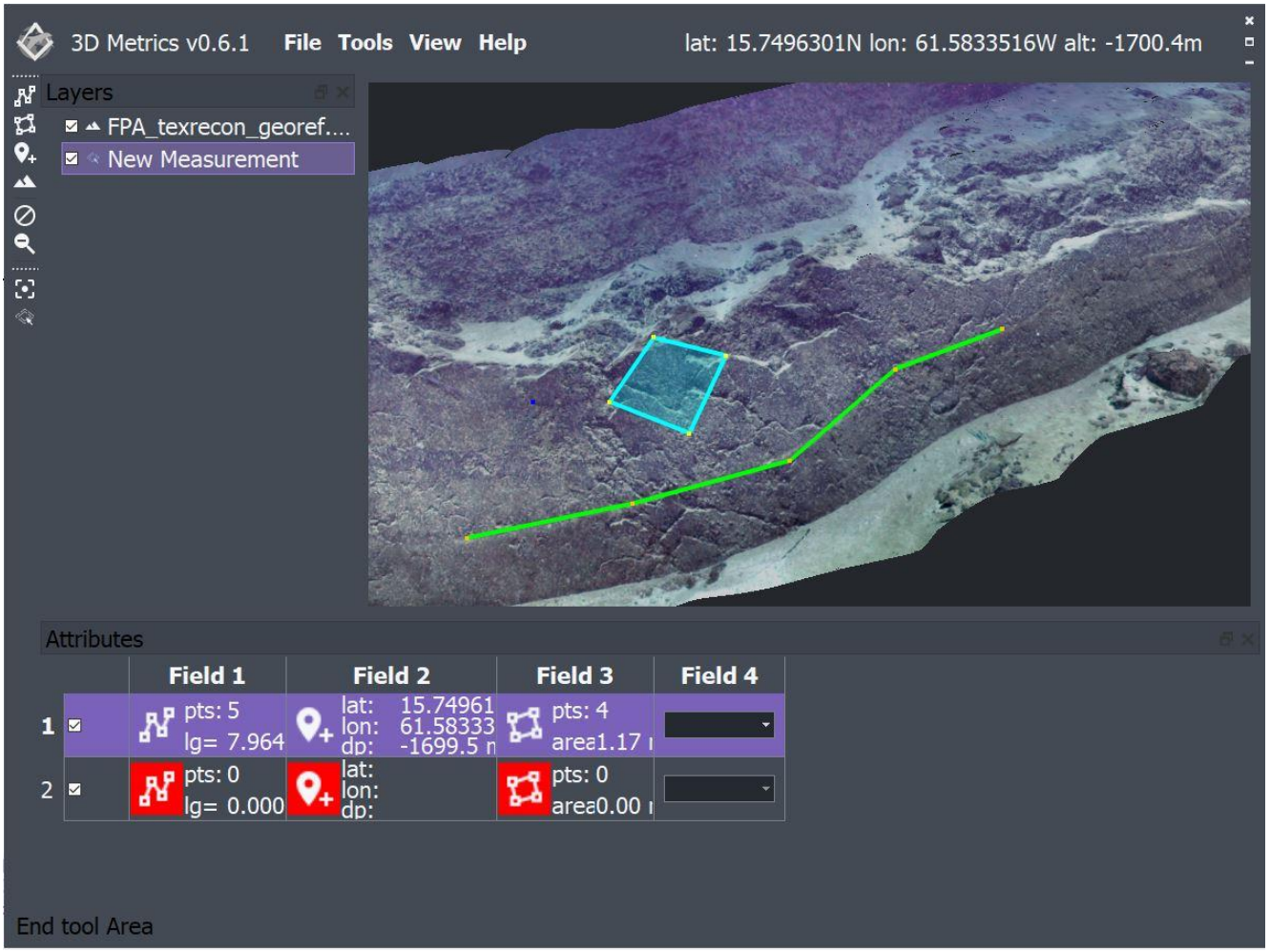

Fig 4. Making measurements in a measurement layer

6. Working with a complete project

As explained above, multiple layers can be opened or created in the software. They can also be grouped in a folder for a better management of the data. Everything that is opened in a session of the software (data, measurements) can be saved and loaded back at a later time, at the start-up of the software.

In the main menu the user can access “File->Save measurement…” to save the selected measurement (on an existing file) or as a new file. The user can also save the complete project as a file (“File->Save project”), preserving the configuration for the next working session. In the same way , the user can load back data using “File->Open measurement file” or “File-> Open project”.