Running the Tests

The Geo-Resistivity-Meter algorithm is a program developed for the design and construction of an automated and programmable resistivity meter for shallow subsurface investigation.

The objective of this study was to develop a multi-layered, modular, automated, and programmable geophysical resistivity meter, capable of customization and user programming. For this purpose, a conceptual prototype was developed based on open-source software and open hardware technologies, as a cost-effective alternative to commercial equipment, while maintaining data accuracy and quality at the same level.

The example presented in this text is a demonstration of the algorithm responsible for processing the measurements obtained by the equipment. In this case, the algorithm is executed based on data collected through the electrorresistivity method using in the field.

In this development phase, the code initiates the process from a root data. Other configuration steps related to the functioning of the electronic part are still under testing and will be incorporated into the interface later.

All functions are directly available on the main screen, allowing users to interact with the application in a user-friendly manner.

Upon execution, the program starts by displaying a window titled Geo-Resistivity-Meter, with an image of the logo.

The interface contains two main buttons: Start and Close. The Start button activates the loading process represented by a progress bar. This bar advances gradually until the loading is complete.

When the loading process is finished, the program automatically closes the initial window and opens a new window (Figure 1) that runs the "run" function from the main.py file. This function is responsible for performing processing and inversion operations of the measurements taken by the instrument.

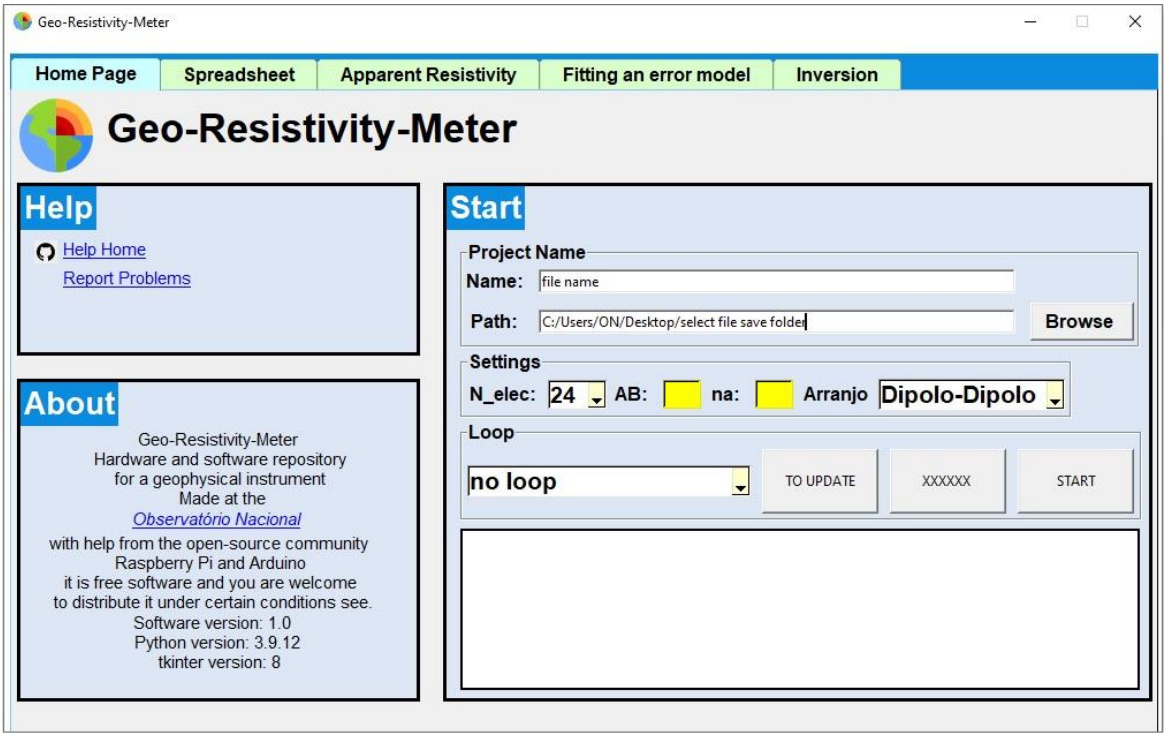


Figure 1: Interface gráfica do Geo-Resistivity-Meter

Functioning of the Interface

1. The GUI is created using the Tkinter library and is divided into several tabs, namely: Home Page, Spreadsheet, Apparent Resistivity, Fitting an error model, and Inversion. Each tab represents a specific functionality of the process of analyzing data obtained by the geophysical resistivity meter.

2. The **Home Page** tab displays information about the Geo-Resistivity-Meter instrument and provides links to get help, access the project's software repository, and additional information.

3. The **Spreadsheet** tab displays the measurement data collected by the equipment (Figure 5).

4. In the Apparent Resistivity tab, the program reads the data from the previously created spreadsheet file and displays it in a pseudo-section graph, generated using the Matplotlib library and shown in the interface (Figure 6).

5. In the **Fitting an error model** tab, the representation of fitting the error model to the measurement data takes place (Figure 7).

6. In the **Inversion** tab, the results of data visualization and post-processing are presented (Figure 8).

Interface Testing

In this test, we used a root data, and the user must specify the directory where the root file is located in the **testdir** variable in the main.py file, as shown in Figure 2.

```
sys.path.append((os.path.relpath('../src'))) # add here the relative path of the API folder
testdir = "../src/examples/dc-2d/"
from resipy import Project
k = Project(typ='R2') # create a Project object in a working directory (can also set using k.setwd())
k.createSurvey(testdir + 'root_file.csv', ftype='Syscal') # read the survey file
```

Figure 2: Root File Path

In another line of code, the user needs to put the full path of the root file (Figure 3).

```
# Here should be the path of the root file that contains the measurement data

df = pd.read_csv('path to root file /root_file.csv')

create_folder_and_save(df, path.get(), folder.get())
```

Figure 3: Root file full path

1. With the interface initialized:
2. In the **LabelFrame Project Name**, the user can define a name and the location where a file will be created to store and save the measurement data and generated results. The **Browse** button allows specifying this path.
3. Inside the **LabelFrame Settings**, the user will be able to configure the type of arrangement for the test, which in this case will be Dipole-Dipole, as shown in figure 4.
4. Note: The **Comboboxes N_elec**, **AB**, and **na** do not need to be filled in this test.
5. In the **LabelFrame Loop**, the user can define the number of repetitions that the instrument will perform. Each repetition will generate a new storage folder with the file name, date, and time. The **No Loop** option instructs the equipment to perform only one measurement.
6. The **START** button initiates the process.

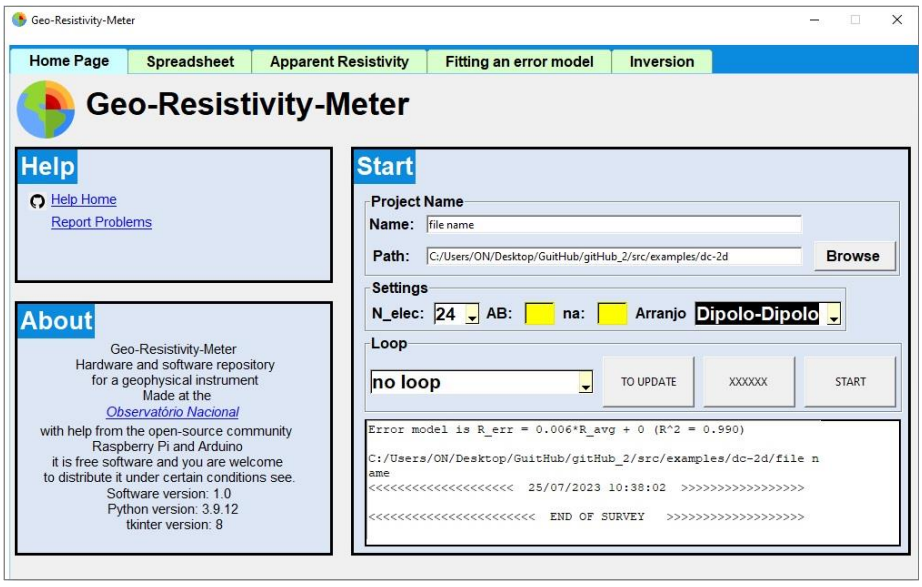
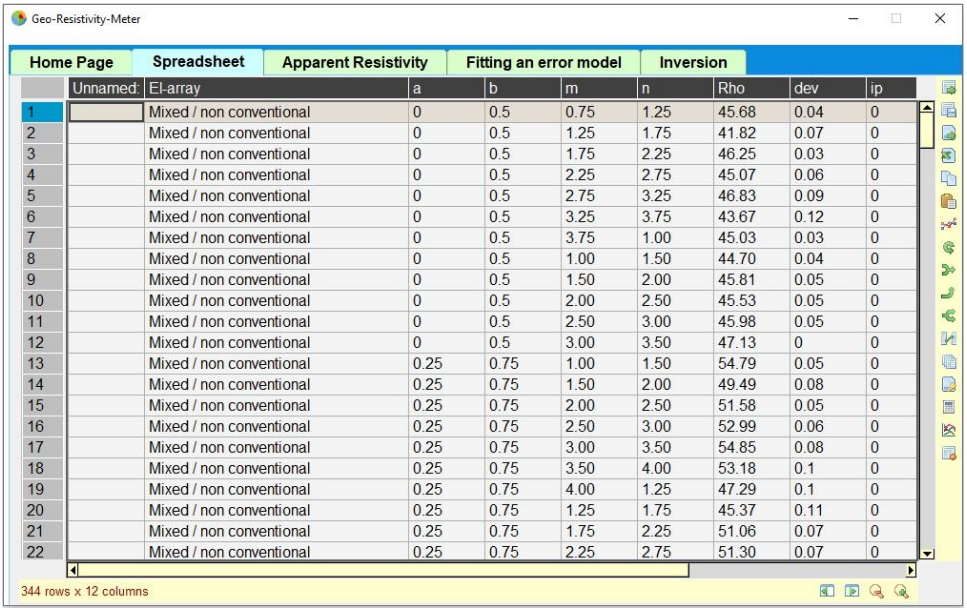


Figura 4: Processamento finalizado

After the measurements are completed, a message with the Error model, storage location, date, and time of closure.



	Unnamed:	El-array	a	b	m	n	Rho	dev	ip
1		Mixed / non conventional	0	0.5	0.75	1.25	45.68	0.04	0
2		Mixed / non conventional	0	0.5	1.25	1.75	41.82	0.07	0
3		Mixed / non conventional	0	0.5	1.75	2.25	46.25	0.03	0
4		Mixed / non conventional	0	0.5	2.25	2.75	45.07	0.06	0
5		Mixed / non conventional	0	0.5	2.75	3.25	46.83	0.09	0
6		Mixed / non conventional	0	0.5	3.25	3.75	43.67	0.12	0
7		Mixed / non conventional	0	0.5	3.75	1.00	45.03	0.03	0
8		Mixed / non conventional	0	0.5	1.00	1.50	44.70	0.04	0
9		Mixed / non conventional	0	0.5	1.50	2.00	45.81	0.05	0
10		Mixed / non conventional	0	0.5	2.00	2.50	45.53	0.05	0
11		Mixed / non conventional	0	0.5	2.50	3.00	45.98	0.05	0
12		Mixed / non conventional	0	0.5	3.00	3.50	47.13	0	0
13		Mixed / non conventional	0.25	0.75	1.00	1.50	54.79	0.05	0
14		Mixed / non conventional	0.25	0.75	1.50	2.00	49.49	0.08	0
15		Mixed / non conventional	0.25	0.75	2.00	2.50	51.58	0.05	0
16		Mixed / non conventional	0.25	0.75	2.50	3.00	52.99	0.06	0
17		Mixed / non conventional	0.25	0.75	3.00	3.50	54.85	0.08	0
18		Mixed / non conventional	0.25	0.75	3.50	4.00	53.18	0.1	0
19		Mixed / non conventional	0.25	0.75	4.00	1.25	47.29	0.1	0
20		Mixed / non conventional	0.25	0.75	1.25	1.75	45.37	0.11	0
21		Mixed / non conventional	0.25	0.75	1.75	2.25	51.06	0.07	0
22		Mixed / non conventional	0.25	0.75	2.25	2.75	51.30	0.07	0

Figure 5: Spreadsheet tab

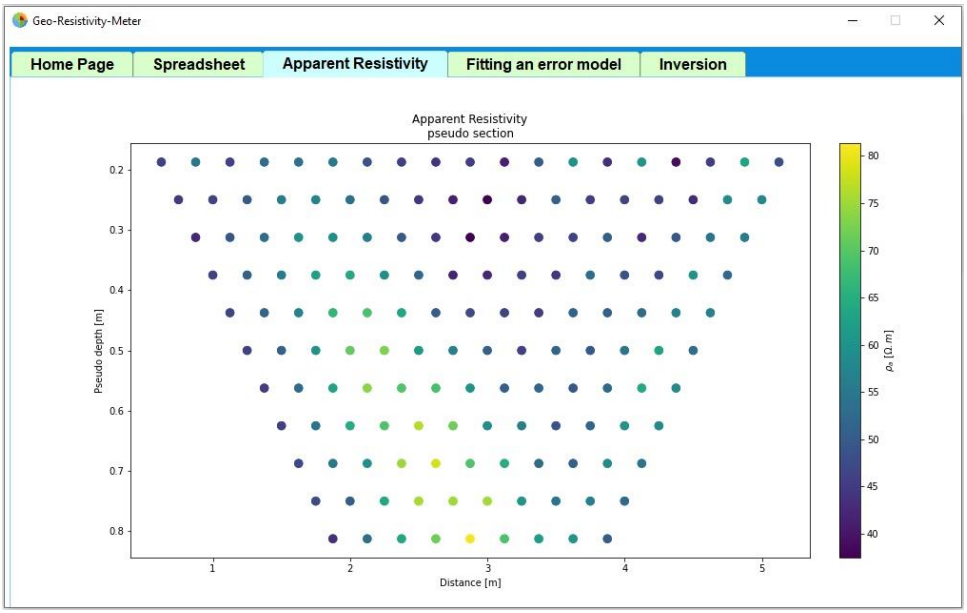


Figura 6: Apparent Resistivity tab

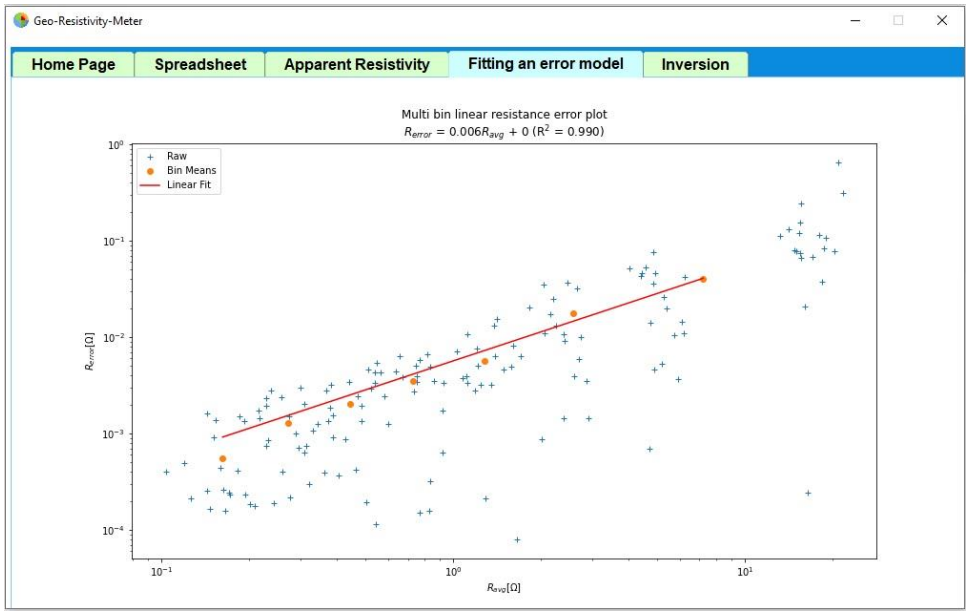


Figura 7: Fitting an error model tab

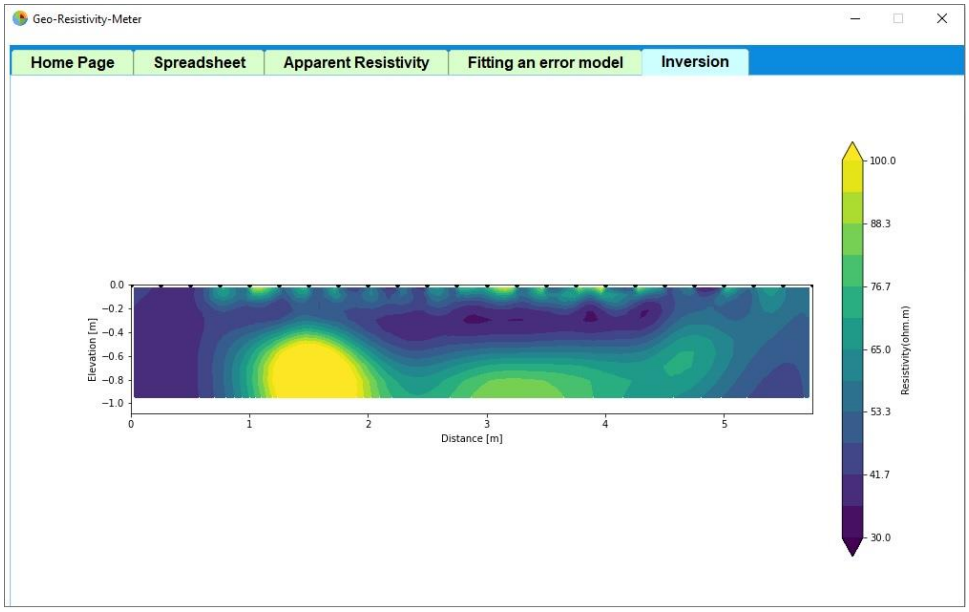


Figura 8: Inversion tab