DrAP User Guide

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DrAP

Droplet levitation Monitoring Software

The DRAP (Droplet Analysis Program) is a software developed for analyzing the size and concentration of droplets during levitation experiments with droplet evaporation and simultaneous X-ray scattering (SAXS/WAXS) measurements. The program provides a graphical interface, a terminal interface, and batch mode execution.

Using DrAP:

Gathering the files for using the DrAP program:

Initially, in a main directory (where DrAP will be installed), you should have the following files:

- A video of the evaporation kinetics of the buffer;
- A video of the evaporation kinetics of the sample;
- A directory containing only the `.edf` files of the buffer (X-Ray images);
- A directory containing only the `.edf` files of the sample (X-Ray images);
- To run in batch mode, it is necessary to use a standardized file called: `name_videos.dat`;
- A directory named “data”, which will contain all the results generated by DrAP.

An example directory structure can be seen in **Figure 1**.

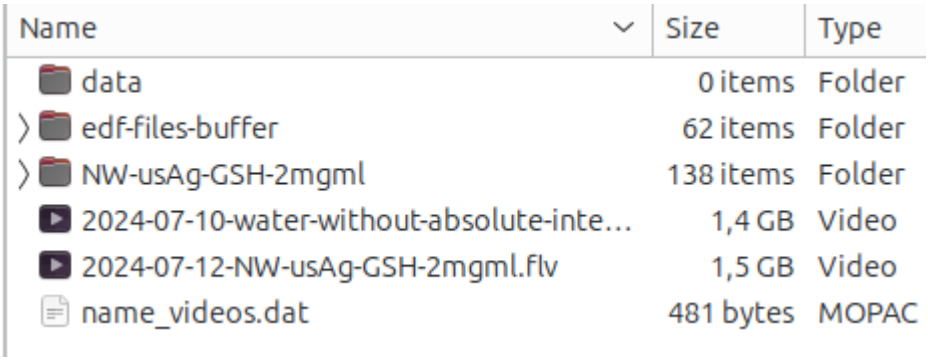

Figure 1: Files required to use DrAP.

Installing the DrAP Program:

- **Open the terminal/command prompt (for Windows, we recommend using Anaconda) in the main directory;**
- **Type the following commands to install DrAP and its libraries:**

```
python -m venv venv
source venv/bin/activate or venv\Scripts\activate
pip install drap
```

Using the DrAP Program in GUI Mode (Graphical Interface)

- Open the terminal/command prompt (for Windows, we recommend using Anaconda) in the main directory;
- Type:

```
drap -o 1
```

DrAP can be used in four options:

- **VIDEO ANALYSIS**
- **SORT EDF (Scattering images) FILES by TIME**
- **SORT EDF (Scattering images) FILES by DROPLET SIZE**
- **MATCH LIST OF EDF FILES**

Mode: VIDEO ANALYSIS

In this function, it is possible to generate a `.csv` file with the following droplet parameters:

Frame,
dropDX(mm),
dropDY(mm),
surface(mm^2),
Volume(µL),
RelativeConcentration(%),
date,
time(s),
time(min).

The values **dropDX** and **dropDY** correspond to the droplet size along the horizontal and vertical axes of the frame, respectively.

Procedure:

- In the graphical interface, Figure 2, start by loading the video.
- Once loaded, the first frame of the video will appear.
- Use the mouse to draw a shape on the frame to select the Region of Interest (ROI). The ROI is used to perform morphological operations on the image, separating the background of the frame from the droplet image. The ROI must be larger than the droplet and cover possible translational movements of the droplet throughout the recording.
- After drawing the ROI, click the Cut image button.
- Fill in the fields for Concentration, Frame calibration (how many millimeters correspond to 1 pixel). To fill in the interval field, click the video information button (Figure 3) to determine how the

frames were captured. It is possible to analyze all frames obtained per second, or, for example, analyze frame intervals. For a video recorded at 30 frames per second (fps), selecting a rate of 10 frames means analyzing 3 frames per second.

- Optionally, you may select Print PDF with images to generate a PDF containing images of the droplet from some analyzed frames. This option increases processing time.
- Press the Analysis droplet parameters button to generate the file `_Video_time_size.csv` and visualize the evolution of droplet parameters over time. This step may take longer depending on the video size and the processor's performance.
- The `_Video_time_size.csv` file includes, in its first rows, the coefficients of the interpolation polynomials for the droplet's horizontal and vertical sizes, as well as for surface area and relative concentration.

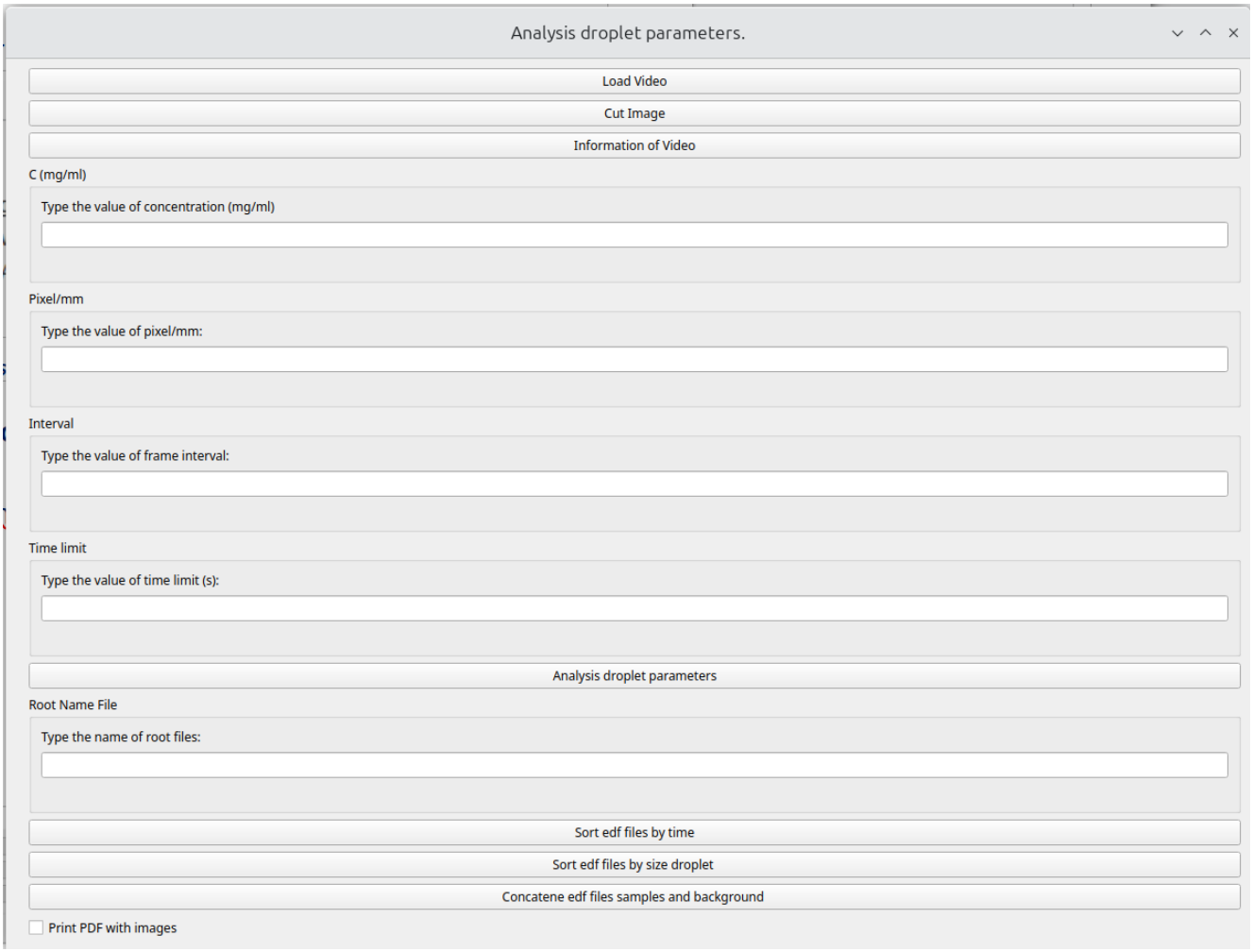

Figure 2:*Graphical interface of the DrAP program.*

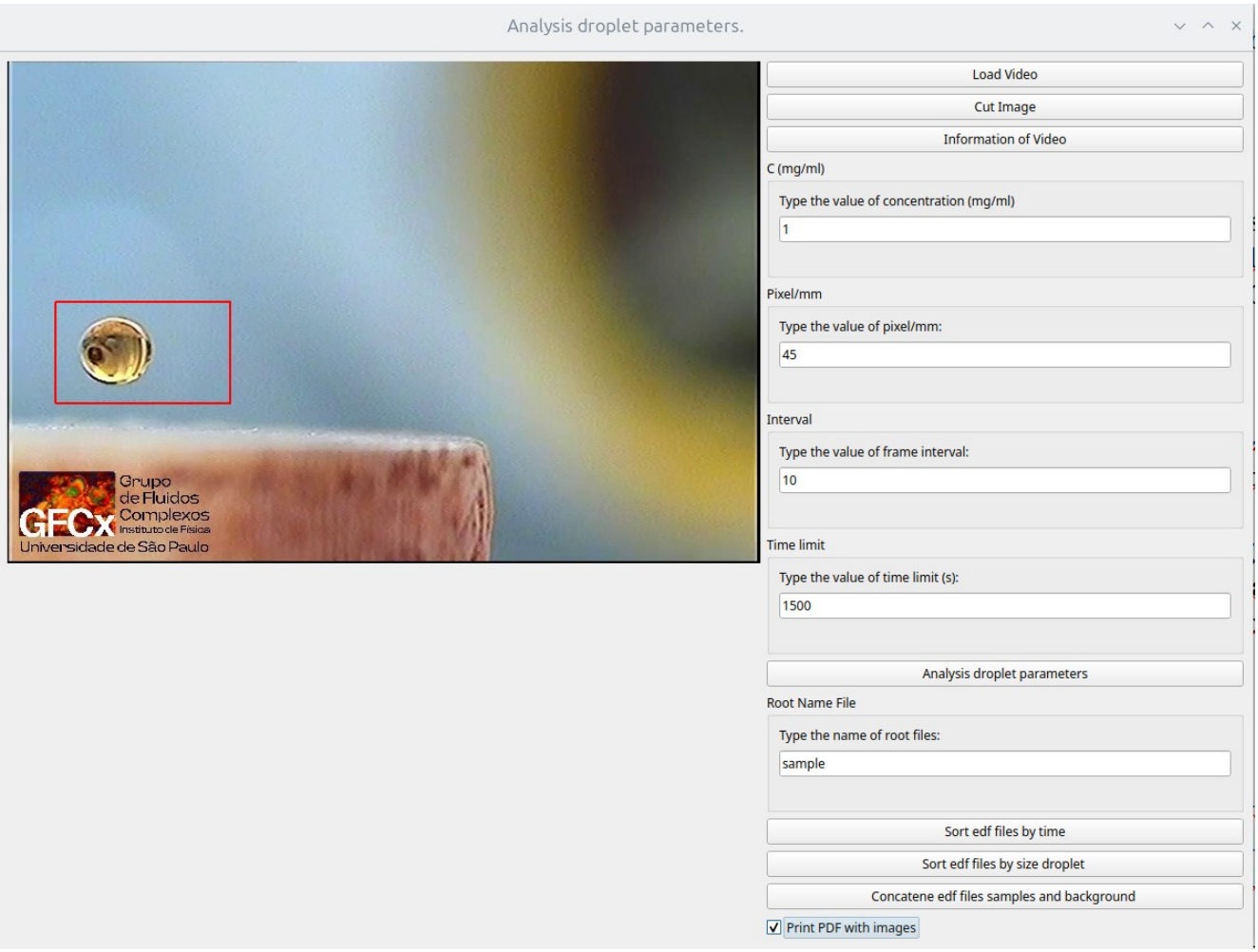

Figure 3: *Example of using Drap with Interface*

Mode: SORT EDF (Scattering Images) FILES by TIME

DrAP can also generate a **.csv** file containing the list of **.edf** files ordered by their chronological acquisition time.

Procedure:

1. In the field Root Name File, type the root name of the output file that will contain the ordered list of .edf files.

2. Click Sort EDF Files by Time to generate the file with the extension _EDF_data_Time.csv.
3. When clicking the button, the user must select the directory containing the .edf files corresponding to the droplet video.
4. Note: To use this mode, it is necessary to first run the VIDEO ANALYSIS mode.

Mode: SORT EDF (Scattering Images) FILES by DROPLET SIZE

DrAP can also generate a **.csv** file containing the list of **.edf** files ordered according to the droplet size.

Procedure:

1. In the field **Root Name File**, type the root name of the output file that will contain the ordered list of **.edf** files.
2. Click **Sort EDF Files by Droplet Size** to generate the file with the extension **_EDF_data_Size_Drop.csv**.
3. **Note:** To use this mode, it is necessary to first run the **VIDEO ANALYSIS** mode.

Mode: MATCH FILES FROM SAMPLES AND BACKGROUND

This mode matches the X-ray scattering .edf files from samples and background (buffer) according to the droplet size.

Procedure:

1. **Click Match Files from Samples and Background to generate the file FINAL_data_scat_back.lis.**
2. **This file establishes the correspondence between the .edf files of the**

sample and those of the background, based on the droplet sizes of each.

3. **Note: To use this mode, it is necessary to first run the VIDEO ANALYSIS mode for both the sample data and the buffer data.**

1.