

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**.

Name	Size	Type
data	0 items	Folder
> edf-files-buffer	62 items	Folder
> NW-usAg-GSH-2mgml	138 items	Folder
2024-07-10-water-without-absolute-inte...	1,4 GB	Video
2024-07-12-NW-usAg-GSH-2mgml.flv	1,5 GB	Video
name_videos.dat	481 bytes	MOPAC

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(mm²),
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.
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Analysis droplet parameters.

Load Video

Cut Image

Information of Video

C (mg/ml)

Type the value of concentration (mg/ml)

Pixel/mm

Type the value of pixel/mm:

Interval

Type the value of frame interval:

Time limit

Type the value of time limit (s):

Analysis droplet parameters

Root Name File

Type the name of root files:

Sort edf files by time

Sort edf files by size droplet

Concatene edf files samples and background

☐ Print PDF with images

Figure 2:Graphical interface of the DrAP program.

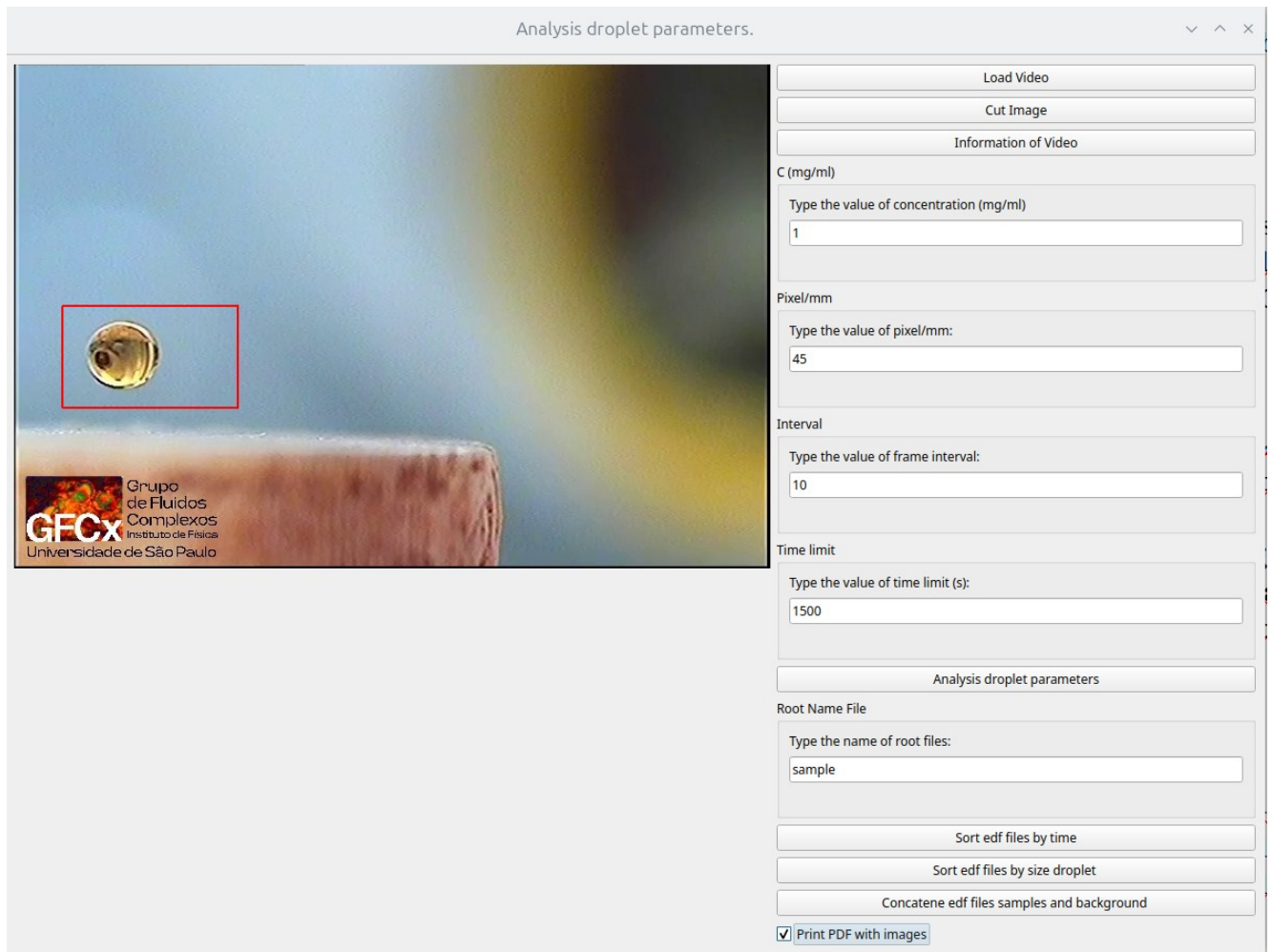


Figure 3: Example of using Drap with Interface

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.

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How to Export a Video and Reduce Its Size by Lowering the FPS Rate and Image Dimensions

It is possible to reduce the size of a video file. In this case, the user should first load a video by clicking the **“Load Video”** button and then export it. The image size of the video can be reduced by drawing a square over the image and then clicking the **“Crop Image”** button.

To export the video with either the original or cropped image, simply click **“Export Video.”** A new window will open showing the available codec options for export. It is recommended to use mp4v with the .mp4 format.

Next, the user defines the folder and output file name, and chooses the export parameters.

Step by Step:

1. Click **“Load Video”**

Load a video file from your computer.

2. (Optional) Crop the image:

- Draw a rectangle over the image to define the area of interest.
- Click **“Crop Image”** to apply the crop.
This reduces the visible area and, consequently, the size of the exported video.

3. Click **“Export Video”**

A new window will open with export options.

4. Choose the codec and output format:

- It is recommended to use the **“mp4v”** codec in .mp4 format, which offers good compression and wide compatibility.

5. Set the output file location and name.

6. Configure the export parameters:

-
- Start frame: the first frame to include.
 - End frame: the last frame to include.
 - Choose the export mode:
 - (Keep): Keeps a specific interval of frames — that is, defines the frame sampling interval. In this mode, the frame rate (FPS) of the output video is modified.
The minimum value is 1, and the maximum is the FPS of the original file.

Examples:

- Enter 1 to keep all frames (output with the original FPS).
 - Enter 2 to keep half of the frames (output with half the FPS — keeps one frame and skips the next).
 - Enter 10 to keep one out of every ten frames.
 - For a 30 FPS video, entering 10 results in an output of approximately 3 FPS.
 - Entering 15 results in approximately 2 FPS.
- (Reduce): Reduces the total duration of the video.
In this mode, DrAP automatically selects a frame sampling rate according to the new desired duration.

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