



New Features

HAIP BlackStudio Software
Version 0.2.0

- ➔ On-Camera Classifier
- ➔ Database for Data Management
- ➔ Canvas View for Analysis and Training

1 ABOUT THE GUIDE

Please read these instructions on the new features of the HAIP BlackStudio software version 0.2.0 carefully. The basic functions of the software can be found in the original user manual.

We hope that this guide and the accompanying user manual answer all your questions. If this is not the case or if you would like to report a service or warranty claim, please contact our support team via our website:

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2 HAIP BLACKSTUDIO SOFTWARE – OVERVIEW

The software is divided into five different main tabs:

- **Capture Tab** to perform and overview the data acquisition
- **Analysis Tab** to process and analyze the acquired data
- **Database Tab** for permanently managing and analyzing data
- **Settings Tab** to select basic settings
- **Manuals Tab** for looking up the User Manual and Quick Start Guide

3 CAPTURE TAB – NEW FEATURES

Please note that some functions are only available for the HAIP products of the BlackIndustry SWIR series. For other cameras some functions are not applicable.

3.1 CAMERA SETTINGS: SPATIAL BINNING

- By activating the checkbox **Spatial Binning**, the newly recorded pixel lines are automatically scaled down from 1280 spatial pixels to 640 spatial pixels per recorded line (available only for BlackIndustry SWIR 1.7 Max cameras).
- Please note that spatial binning is performed as the last step on the camera and not in the BlackStudio software. This reduces the load on the Ethernet connection, but does not mean that the data can be read from the sensor any faster.

3.2 WATERFALL WINDOW: ENABLE LIVE CLASSIFIER

- This function is still available but is deprecated. It is recommended to use the new **Classified Color** tool (see chapter 4.2.1).

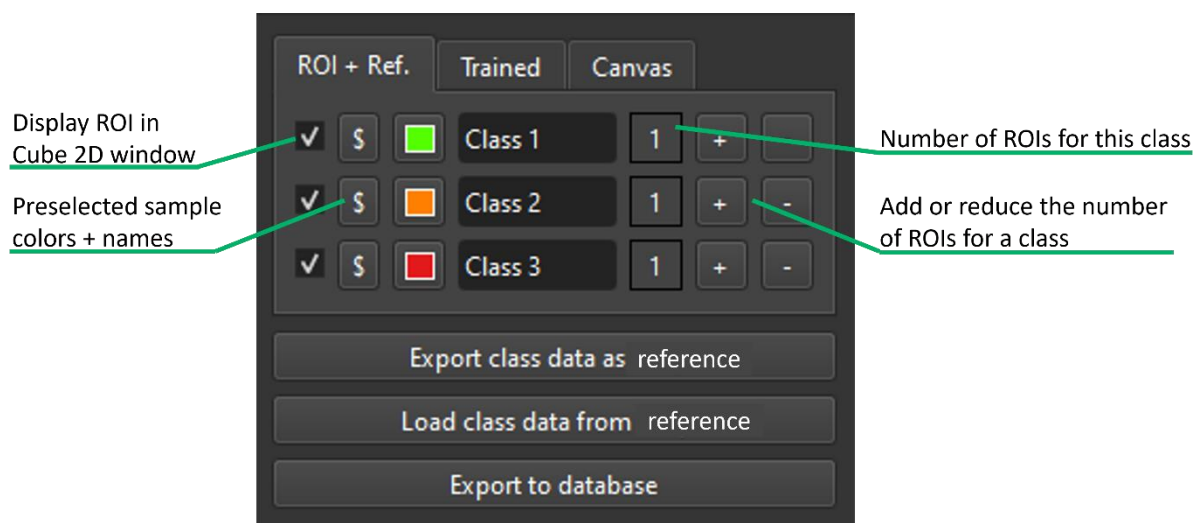
4 ANALYSIS TAB – NEW FEATURES

Please note that some functions are only available for the HAIP products of the BlackIndustry SWIR series. For other cameras some functions are not applicable.

4.1 ROI & REFERENCES

Newly created or imported ROIs are displayed in the **ROI + References (Ref.)** section.

- Each ROI can be assigned its own color and a meaningful name.
- The **\$** button can be used to select predefined classes including coloring if required (The classes can be customized according to requirements under /config/sample-table.csv in the program directory).
- Add additional ROIs of the same class or delete them using the **+** and **-** symbol.
- The current number of ROIs displayed for each class is indicated by the number next to it. If you add reference data to the ROI, the background gets colored green. (see below).
- **Export class data as reference:** Export the ROIs as reference file (.hpr) into a suitable directory. They can later be imported together with other reference files to train a classifier. For advanced management of reference data, you might want to use the database.
- **Load class data from reference:** Import selected reference file (.hpr) to train a classifier based on them. For advanced management of reference data, you might want to use the database.
- **Export to database:** (RECOMMENDED FOR BEST MANAGEMENT OF YOUR SAMPLES) Export a selected area from Cube2D with all associated information to the database. These "**Snippets**" can later be loaded together in the **Canvas View**. (More information see chapter 5.3).

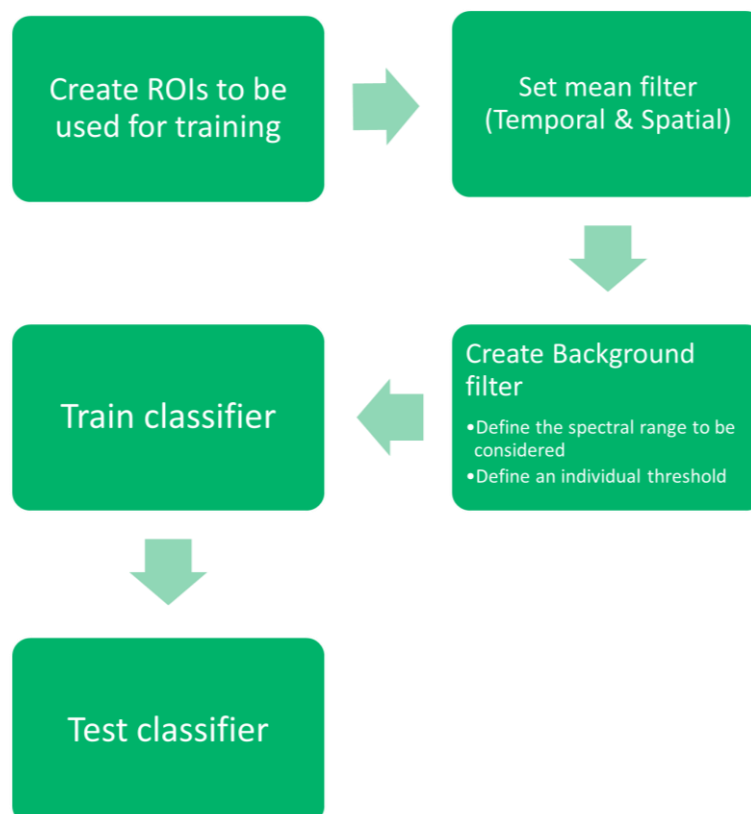


4.2 CLASSIFIER

Setting options:

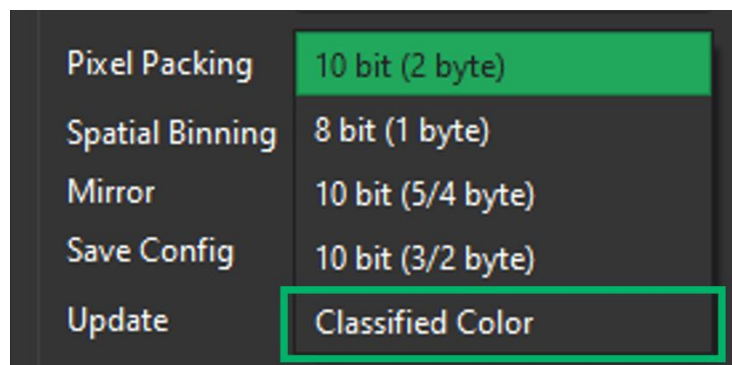
- **Mean Filter Temp:**
 - By setting a mean filter in the temporal direction, pixel values in a defined neighborhood (3 or 5 pixels) are replaced by their mean values. This leads to an effective noise reduction.
- **Mean Filter Spatial:**
 - By setting a mean filter in the spatial direction, pixel values in a defined neighborhood (3 or 5 pixels) are replaced by their mean values. This leads to an effective noise reduction.
- **Create Background Filter:**
 - The background filter filters out the background of the image so that it is not included in the later classification.
 - Currently optimized for dark/black background (for white background available soon).
 - Select the **spectral range** to be considered (in nm). The background filter is based on the variance values, which is why a noise-free range should be selected.
 - Select a suitable **threshold**.

General classification workflow:

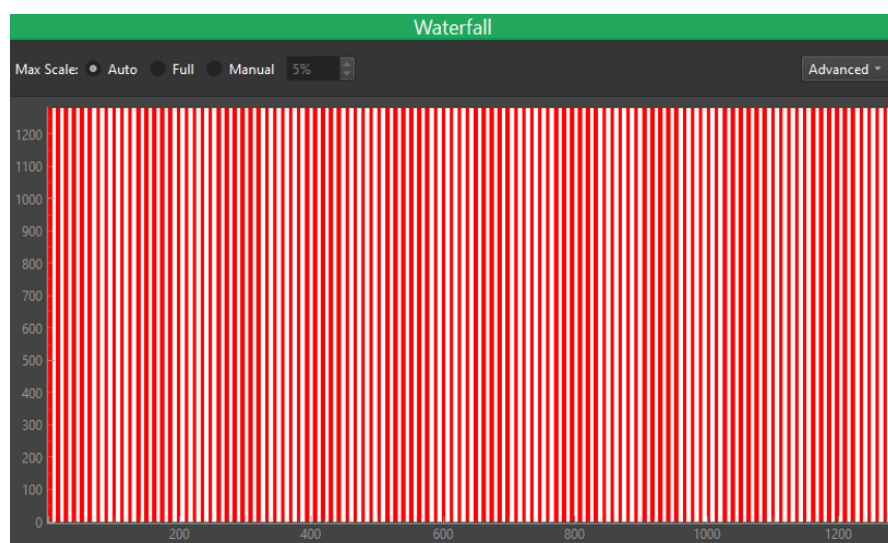


4.2.1 TRANSFER CLASSIFIER – ON CAMERA CLASSIFIER

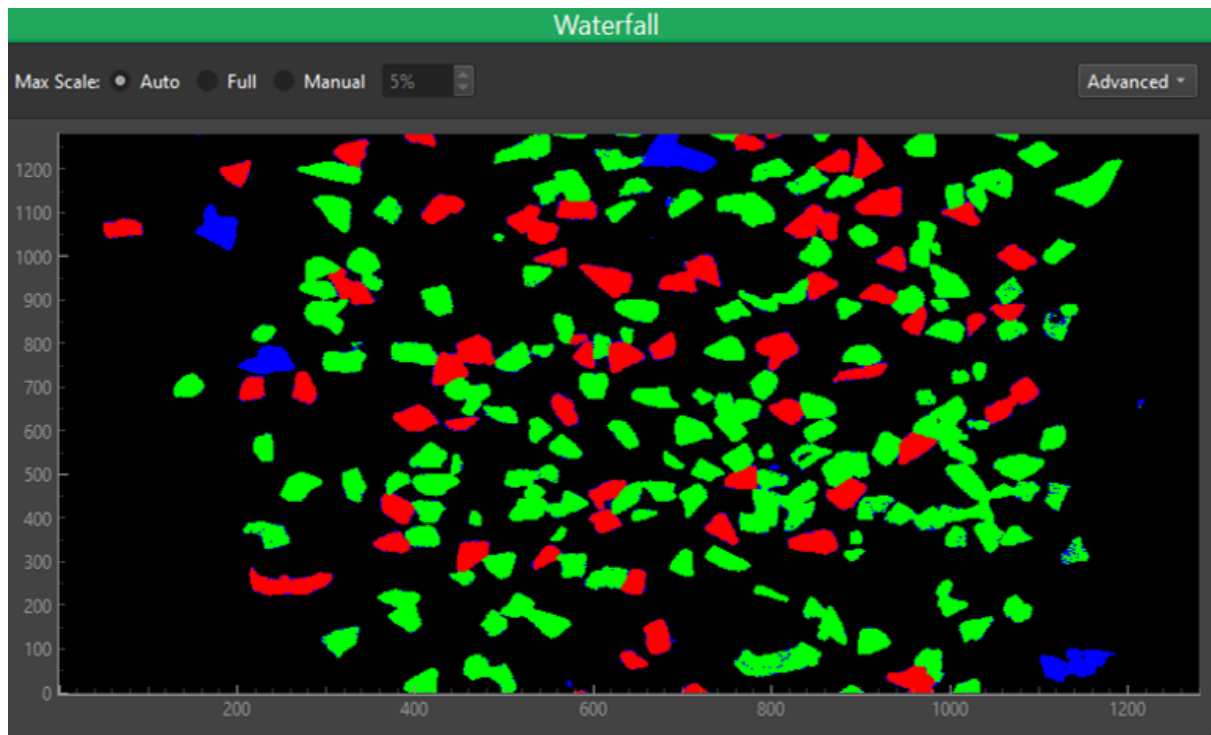
- For BlackIndustry SWIR cameras with software version 1.0.13 and later only.
- Once a classifier was created, it can be transferred to the currently connected camera:
 1. Choose whether to use and transfer the recorded **Blackbalance** or **Whitebalance**.
 2. Activate the Checkbox **Transfer Classifier**.
 3. Press **Transfer**.
 4. Change into the **Capture Tab**.
 5. Select **Classified Color** in the **Pixel Packing** section:



6. Newly acquired data will now be classified on camera and directly displayed in the **waterfall window** or can be received using the **API** or **GenICam**.
- ➔ Please consider that the use of the mean temporal filter in the on-camera classifier increases the latency
- ➔ Please note that the spectral dimension of the classifier and the transferred White and Blackbalance must match the selected camera mode. If this is not the case, an **error screen** consisting of white and red stripes is transferred instead:



Classified Waterfall window via on-camera classifier:



5 THE DATABASE

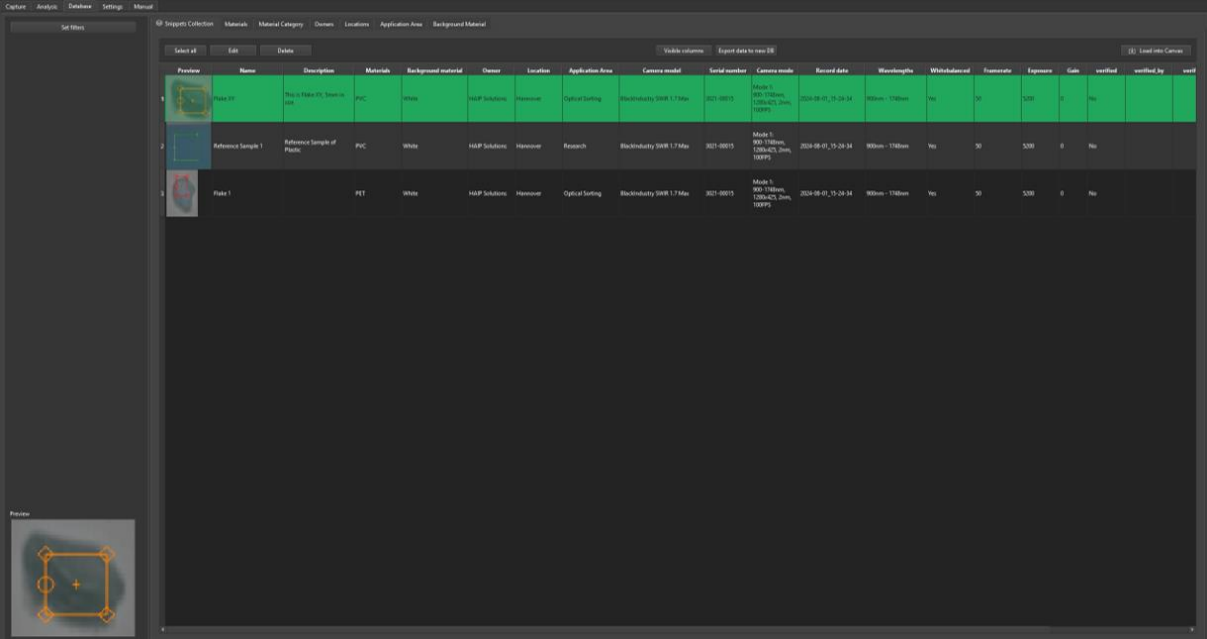
The database is a completely new feature, which allows you to save, sort, filter and analyze collected data, the so-called **snippets**.




5.1 DATABASE STRUCTURE

The database consists of the **Snippets Collection** overview and six other tabs that contain the database categories:

- **Materials**
- **Material Category**
- **Owners**
- **Locations**
- **Application Area**
- **Background Material**

On the left side there is a **filter option** (more information see chapter 5.1.2) and the **preview image** of the selected snippet.



Preview	Name	Description	Materials	Background material	Owner	Location	Application Area	Camera model	Serial number	Camera mode	Record date	Wavelengths	Whitebalanced	Exposure	Gain	verified	verified by	export
	Plate 11	This is Plate 11, Serial 11	PVC	White	HAIP Solutions	Intersect	Optical Sorting	BlackIndustry SWR 1.7 Max	2021-08-15	Mode 1: 1000x1000, 1000x1000, 1000x1000	2020-08-01_15_28-34	900nm - 1100nm	Yes	50	1250	0	Yes	
	Reference Sample 1	Reference Sample of Plastic	PVC	White	HAIP Solutions	Intersect	Research	BlackIndustry SWR 1.7 Max	2021-08-15	Mode 1: 1000x1000, 1000x1000, 1000x1000	2020-08-01_15_28-34	900nm - 1100nm	Yes	50	1250	0	Yes	
	Plate 1		PET	White	HAIP Solutions	Intersect	Optical Sorting	BlackIndustry SWR 1.7 Max	2021-08-15	Mode 1: 1000x1000, 1000x1000, 1000x1000	2020-08-01_15_28-34	900nm - 1100nm	Yes	50	1250	0	Yes	

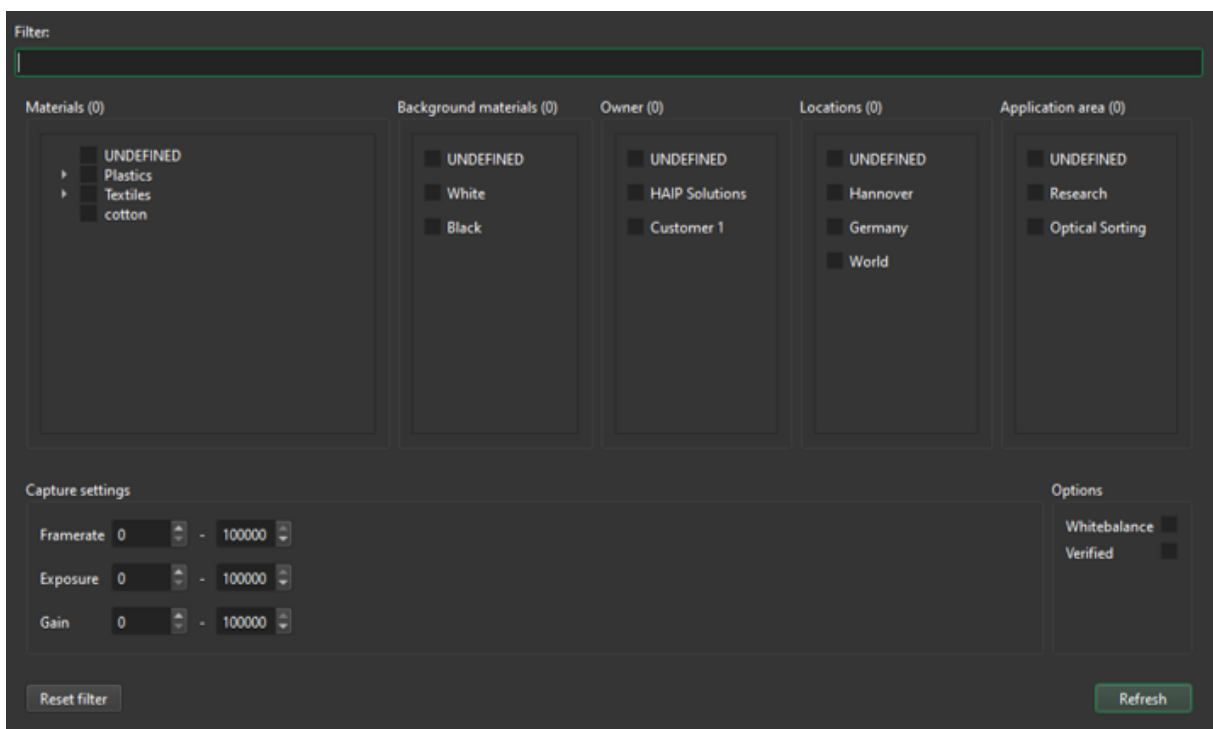
5.1.1 ACTIONS

- **Select all:** Press to **Select all** currently displayed snippets. Selected snippets will be marked in green.
- **Edit:** Select one snippet and press **Edit** to edit its information.
- **Delete:** Select at least one snippet and press **Delete** to delete them.

- **Visible columns:** Press to select which information columns will be shown in the Snippets Collection. Tip: Deactivating the preview image reduces the size of the rows.
- **Export data to new DB:** Select at least one snippet and press the button to export the data to a new database folder.
- **Load into Canvas:** Select at least one snippet that should be imported into the canvas window in the Analysis tab (More information see 5.3)

5.1.2 FILTER

You have the option of filtering the Snippets Collection according to your needs based on the stored categories or capture settings. After applying the filter, only the snippets that match the selected categories are displayed.



The screenshot shows the HAIP Filter interface. At the top is a 'Filter:' input field. Below it are five filter categories, each with a list of items and a count in parentheses: 'Materials (0)', 'Background materials (0)', 'Owner (0)', 'Locations (0)', and 'Application area (0)'. Each category has a list of items with checkboxes. Under 'Materials', there is 'UNDEFINED', 'Plastics', 'Textiles', and 'cotton'. Under 'Background materials', there is 'UNDEFINED', 'White', and 'Black'. Under 'Owner', there is 'UNDEFINED', 'HAIP Solutions', and 'Customer 1'. Under 'Locations', there is 'UNDEFINED', 'Hannover', 'Germany', and 'World'. Under 'Application area', there is 'UNDEFINED', 'Research', and 'Optical Sorting'. Below these categories are 'Capture settings' with three sliders: 'Framerate' (0 to 100000), 'Exposure' (0 to 100000), and 'Gain' (0 to 100000). To the right of the sliders are 'Options' with two checkboxes: 'Whitebalance' and 'Verified'. At the bottom left is a 'Reset filter' button, and at the bottom right is a 'Refresh' button.

The following **information** can be stored for each **snippet** created:

- Preview image
- Name (Can be added manually)
- Description (Can be added manually)
- Materials (Can be added manually)
- Background material (Can be added manually)
- Owner (Can be added manually)
- Location (Can be added manually)
- Application Area (Can be added manually)
- Camera model (Added automatically)

- Serial number (Added automatically)
- Camera mode (Added automatically)
- Record date (Added automatically)
- Wavelengths (Added automatically)
- Whitebalanced (Added automatically)
- Framerate (Added automatically)
- Exposure (Added automatically)
- Gain (Added automatically)
- Verified (Can be added manually)
- Verified by (Can be added manually)
- Verification time (Added automatically)
- Change time (Added automatically)
- Creation time (Added automatically)


5.2 FIRST STEPS – PREPARE DATABASE AND CREATE SNIPPETS

Before the first data snippets are added to the database, the following steps should first be considered:

1. Select a suitable **storage location** for the database. This location can also be on a network drive or USB flash drive. The current storage path can be checked in the **Database settings** (Settings Tab → Database Settings).
 - a. Select whether you want to use the materials as ROI name or the original name (Settings Tab → Database Settings).
2. Now **add groups** to the six database categories that are relevant to you (e.g. Material Category → Add new material category → 'Plastics').
 - a. It is advisable to start with the category on the far right when creating the groups and to proceed further to the left.
3. The first snippets can now be created.
4. Capture data or import previously acquired data in the **Cube 2D window**.
5. If desired, create **ROI markers** of relevant data within the Cube 2D window.
6. Press the button **Export to database**, the following window will open:
 - a. Via the button **Select Area**, a snippet can be created by manually defining the extent.
 - i. It is not mandatory to include a ROI marker into the snippet, but it is advantageous, as the spectral information within the ROI will also be stored (It is also possible to add an ROI at a later time).
 - b. Define a snippet **name** and add a **description**, if desired.
 - c. Select a previously created **group for the five database categories** (Material, Background material, Owner, Location, Application Area).

- d. If the snippet is an object that has already been identified and verified, the **Verified** checkbox can be activated and a responsible person can be specified.
- e. Press **Add** to add the snippet to the database.
- f. The snippet will be displayed in the **Snippet Collection** Tab in the database.

Preview



Select Area

Name

Flake XY

Description

This is a plastic flake, 5 mm in size

Material

PET

Background material

White

Owner

HAIP Solutions

Location

Hannover

Application Area

Optical Sorting

Verified

☐

Verified by

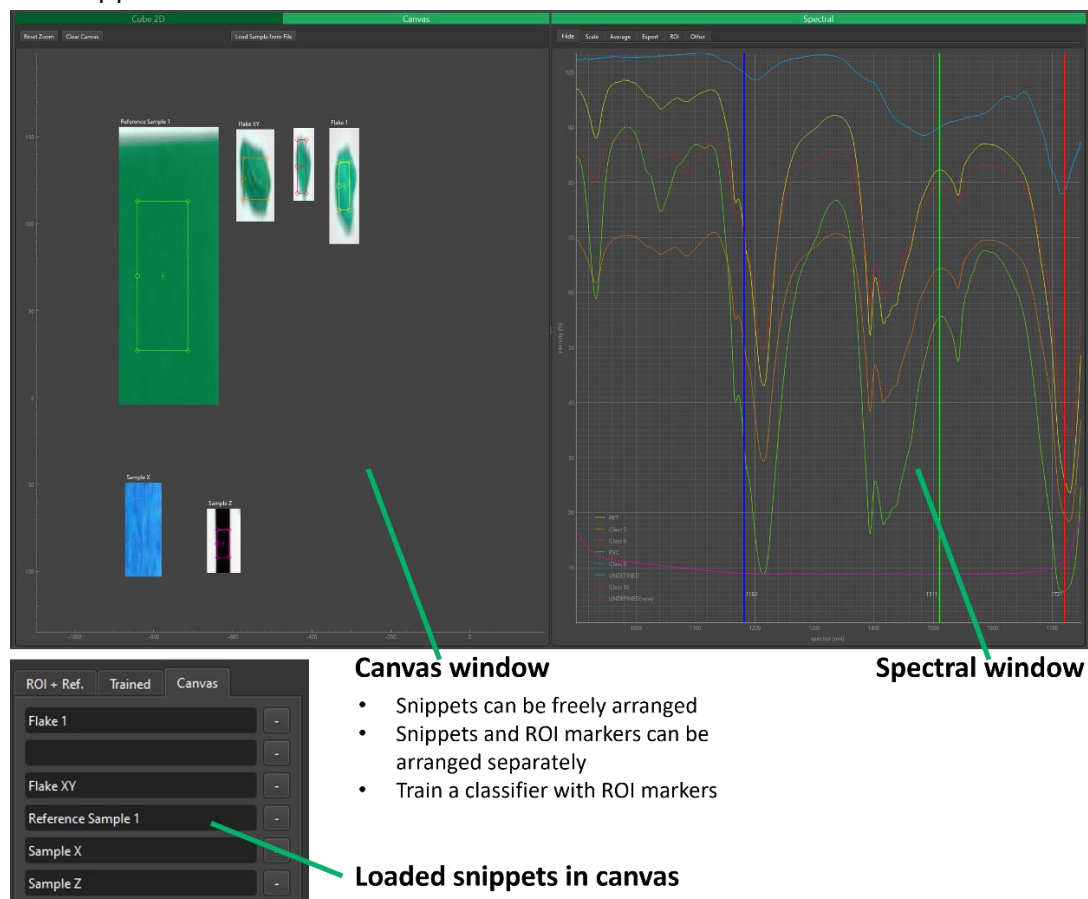
Add

5.3 FIRST STEPS – LOAD TO CANVAS

A **canvas window** was developed to supplement the database. Any number of snippets can be loaded into it and arranged as desired. The spectral curves of loaded or newly created ROI markers are displayed in the spectral window. The ROI markers can also be used to train a classifier again.

Please proceed as follows:

1. Open the database.
2. Select desired snippets by clicking on the respective rows.
3. Press the button **Load into Canvas**.
 - a. You will be re-directed to the **Canvas window** in the Analysis tab.
 - b. If there are still unwanted spectral curves in the spectral window, these can be deleted using the **Clear Cube 2D** button in the Cube 2 D window
4. The snippets can be freely arranged and sorted in the canvas window without spatial reference to each other.
 - a. The images and the ROI markers can be moved separately from each other.
5. New ROI markers can be created at any time.
6. The ROI markers can be used as training data for the classifier.
7. The **Clear Canvas** button removes all the contents of the window. However, the snippets are still saved in the database.



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