

Thermography plugin

User Manual

Thermography Plugin User Manual_20230531



REVISION HISTORY

Issue	Date	Para	Details
1.0.0	31/05/2022	All	Initial release
2.0.0	31/05/2023	5	Update for drag & drop



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1. INTRODUCTION

First Light Vision offers a thermography plugin to enable a Planck-based thermal calibration of an imaging device based on one of First Light Imaging's camera.

An imaging device comprises a camera, an objective lens of fixed aperture and eventually spectral or optical density filters. The following cameras are supported: C-RED 3, C-RED 2 Lite, C-RED 2.

Note: No accuracy is guaranteed.

2. HOW TO USE THE PLUGIN

2.1. Installation

The thermography plugin must be used with First Light Vision 2.5.1 software. It allows to enable/disable the thermography mode of First Light Vision.

To install the thermography plugin, the "Plugin_thermography_x_x_x.zip" should be unzipped in the installation directory of First Light Vision.

Please refer to the First Light Vision documentation if it is your first use.

2.2. Getting started

Open First Light Vision and go in the "Plugins" tab. If the plugin has been unzipped in the correct location, you be able to display the menu:

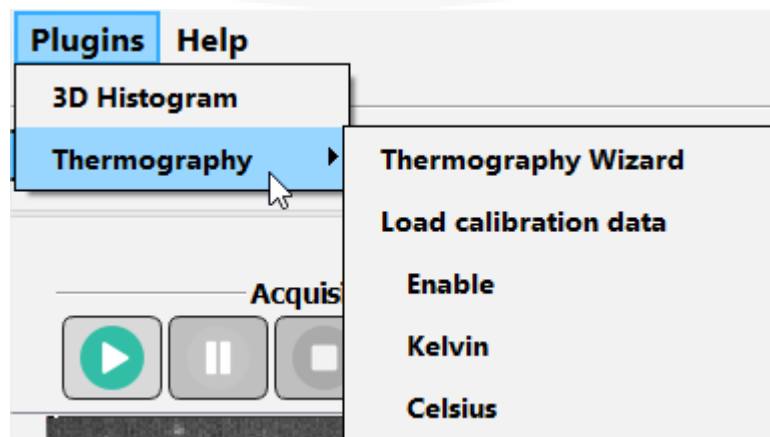


Fig. 1 : Plugins menu

Click on "Enable" to switch to the thermography display and "Kelvin" or "Celsius" to choose your unit. When thermography is enabled, all display and image statistics in First Light Vision will be in degree instead of ADU.

A thermal calibration must be done beforehand, either through the thermography wizard or by loading a calibration file.



3. THERMOGRAPHY WIZARD

A thermal calibration wizard is available with the plugin. To display it, click on “Thermography Wizard”. This wizard will guide you through the calibration process.

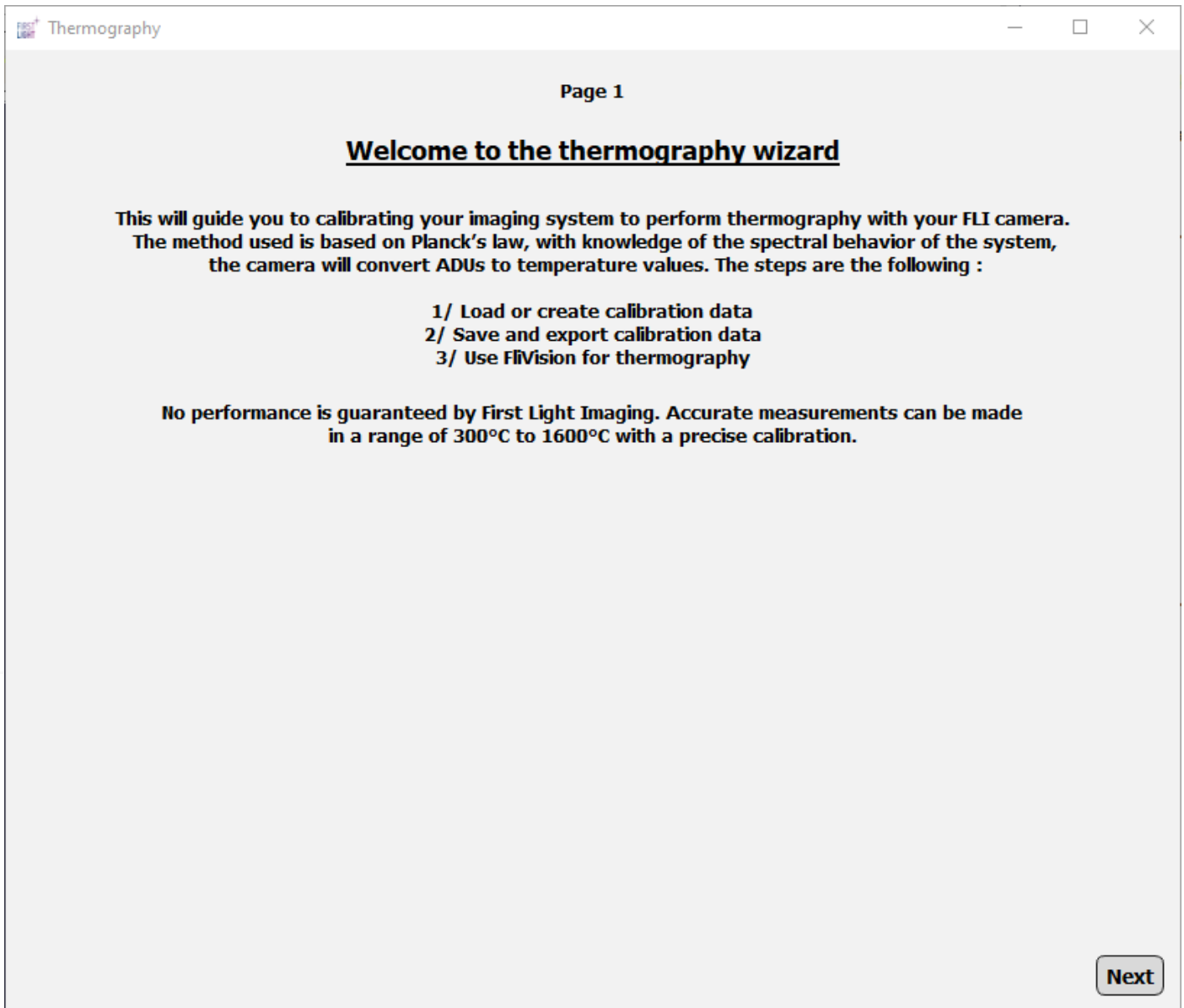


Fig. 2 : Wizard page 1



3.1. Emissivity map

On page 3 of the wizard, the emissivity of the studied objects' surfaces can be defined.

Emissivity is a value between 0 and 1 that characterises the ability of a surface to emit heat radiation. It is defined as the ratio of the radiance of the studied surface to the radiance of an ideal black body. Hence, the surface of an ideal blackbody has an emissivity of 1. In the plugin, the dependence of emissivity on wavelength is assumed to be negligible.

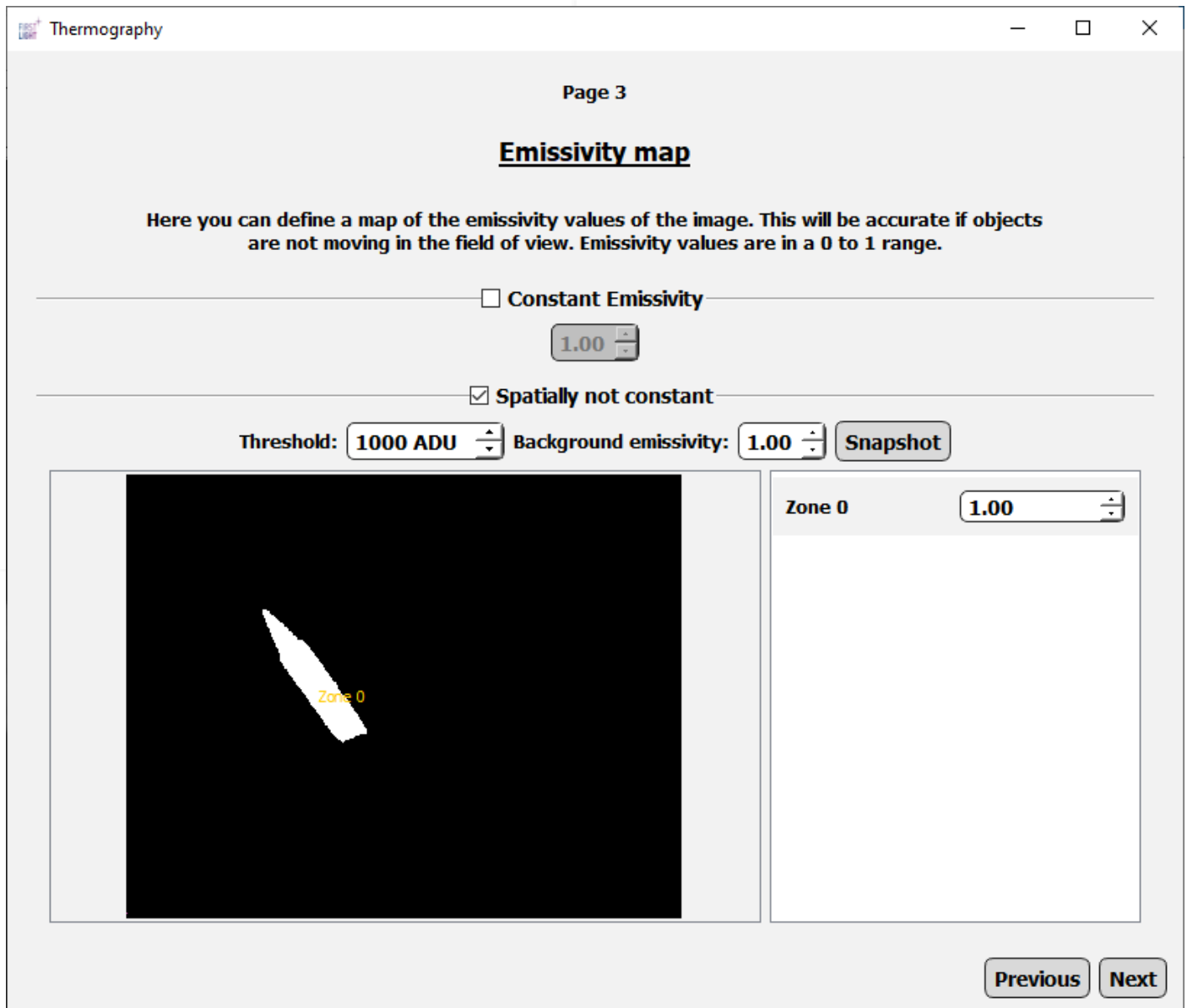


Fig. 3 : Wizard page 3

The wizard offers two solutions:

- “Constant Emissivity”: a constant emissivity is applied to all the image
- “Spatially not constant” allows to define a map of emissivity with several regions. The “snapshot” button allows to capture the image that will be used for defining the regions. By tuning the ADU threshold, the user can create a map of regions of interests, labelled “Zone 0”, “Zone 1”, etc. For each detected regions, an emissivity value can be set. The “background emissivity” is the value for the background region.

3.2. Reference temperature



On page 5, a region of interest is used to create a temperature reference.

The object used for this step should have known, stable and homogeneous temperature and emissivity. These values have to be provided to the wizard.

The wizard enables the user to set the threshold min and max values in order to accurately detect the reference zone.

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Reference

Please place a calibration object in the field of view of the camera. Ideally this would be a black body at a temperature within the measurement range. Alternatively, you can use a grey body of known emissivity.
Please select the region of interest where temperature is known, stable and homogeneous.
For simplicity purposes, the emissivity is considered to be independent of the wavelength.

Body emissivity: Body temperature:

Please choose a good range of threshold to detect the reference.

Threshold min: - Threshold max:

Fig. 4 : Wizard page 5



3.3. Save the calibration file

Once the user has gone through all the calibration steps, the wizard will enable saving the calibration data and turning on the thermography display.

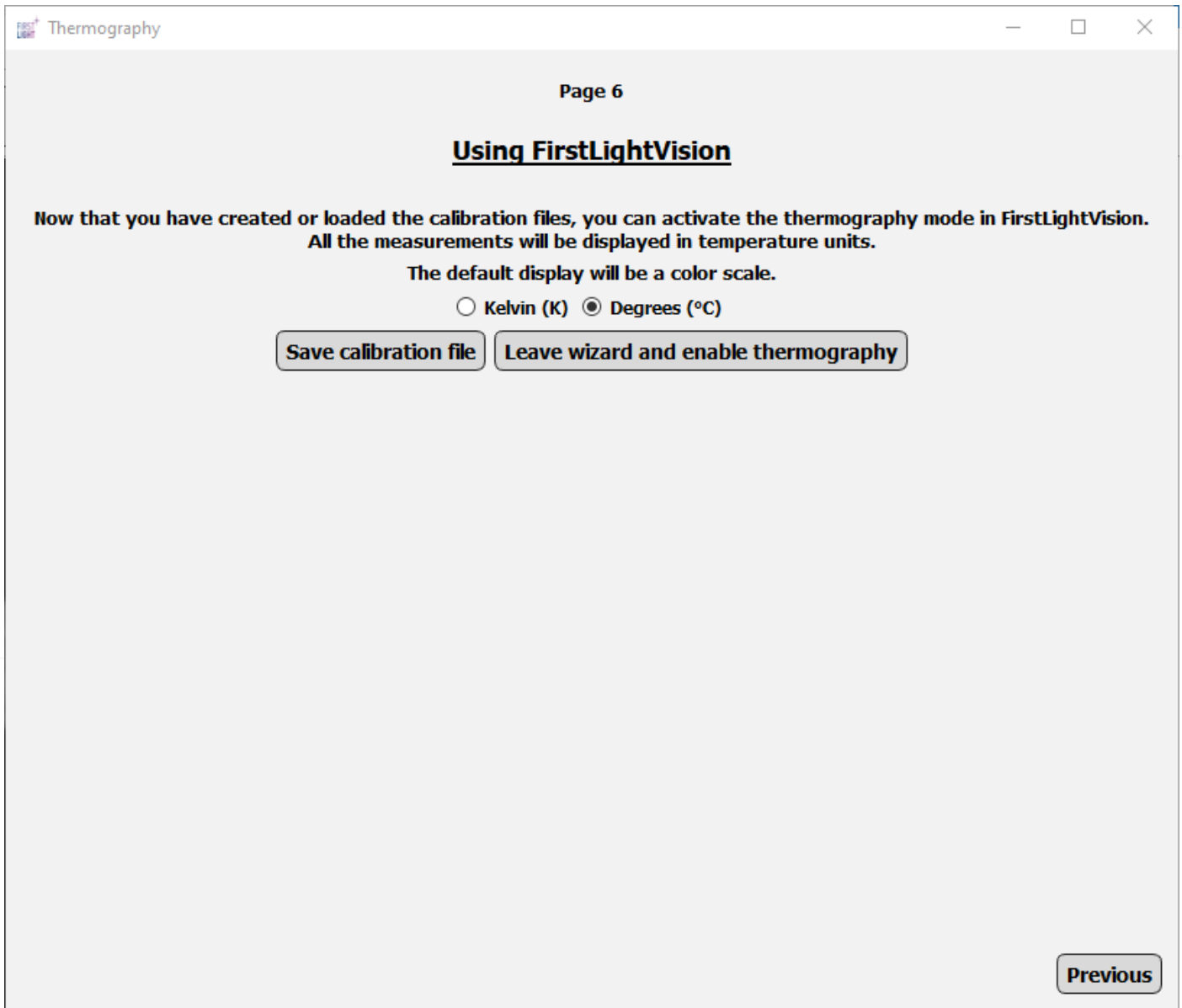


Fig. 5 : Wizard page 6

4. LOAD CALIBRATION DATA



Once a calibration file has been created and saved using the wizard, it is possible to load it by clicking on “Load calibration data”, then enabling the thermography mode.

The calibration file is a JavaScript Object Notation (JSON) format data, composed of all the data entered by user during the wizard:

- QeFile: corresponds to the quantum efficiency file used by the plugin (depending on the camera)
- ambientTemp
- BodyEmissivity
- bodyTemperature
- isConstantEmissivity
- isKelvin
- refAduMean
- waveLengthMax
- waveLengthMin
- emissivity

All these values can be changed manually in the file by the user.



5. DISPLAY

When the thermography mode is enabled, the software will display the current image in a false color scale and in temperature units. All the usual features of First Light Vision will be available.

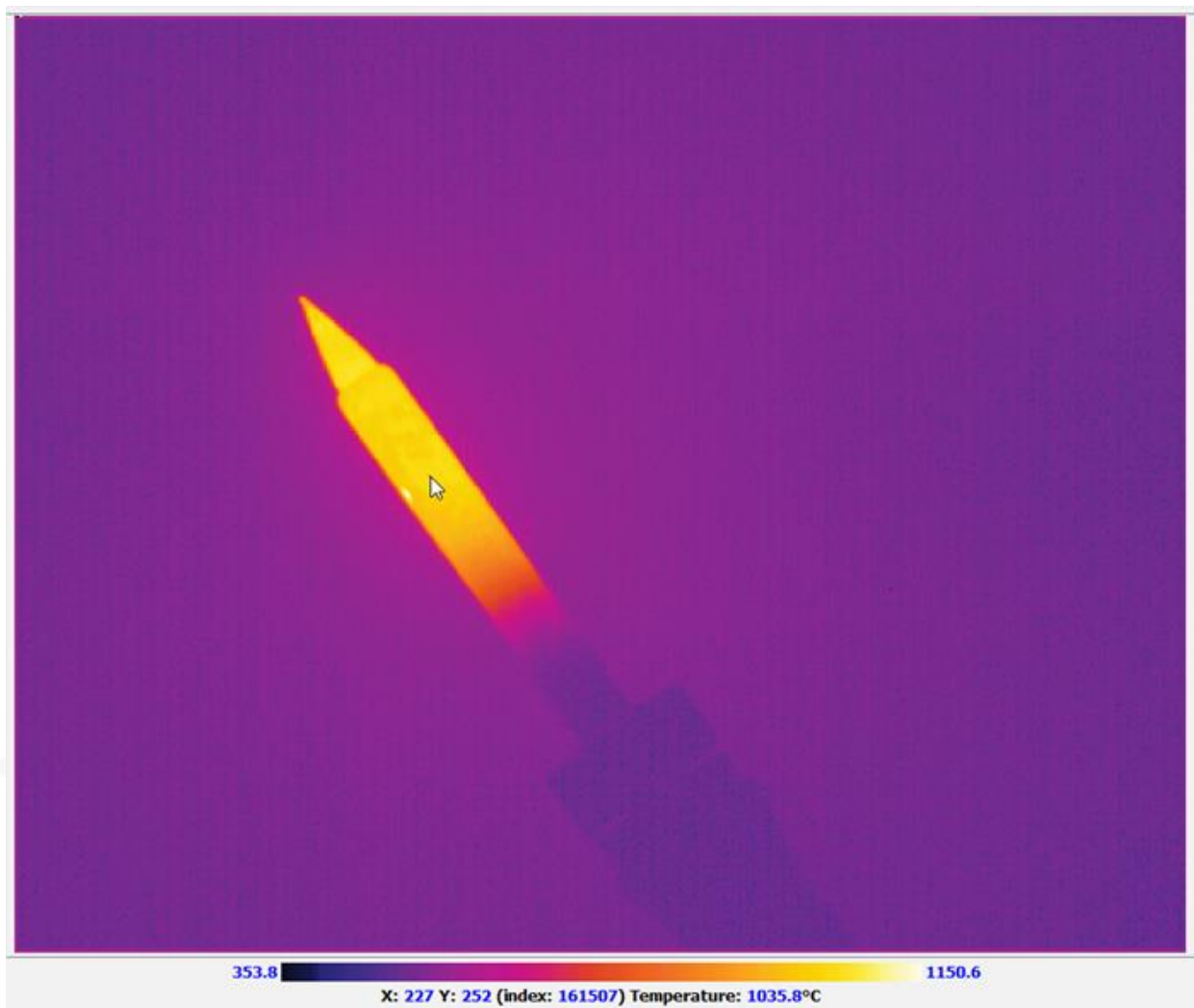


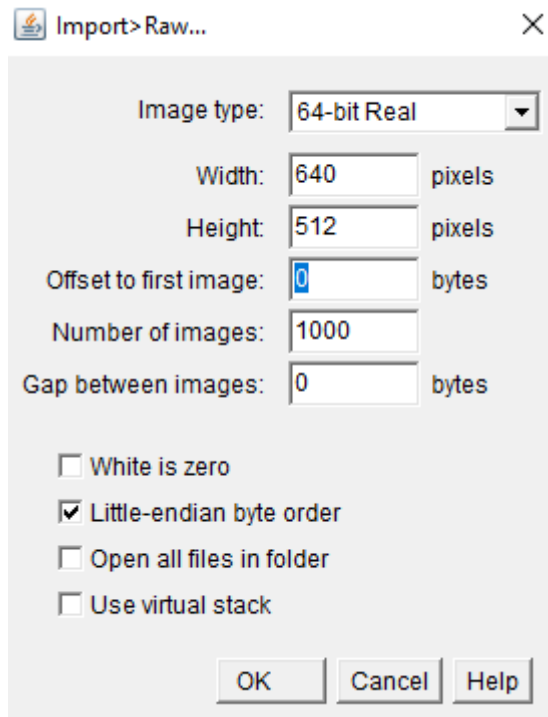
Fig. 6 : Display image with thermography mode enabled

The user can save the image stack in a custom “.thr.raw” format. In this format, the pixel values in degrees are multiplied by 10. This format can be opened by any software keeping in mind that the degree value is the pixel value divided by 10.

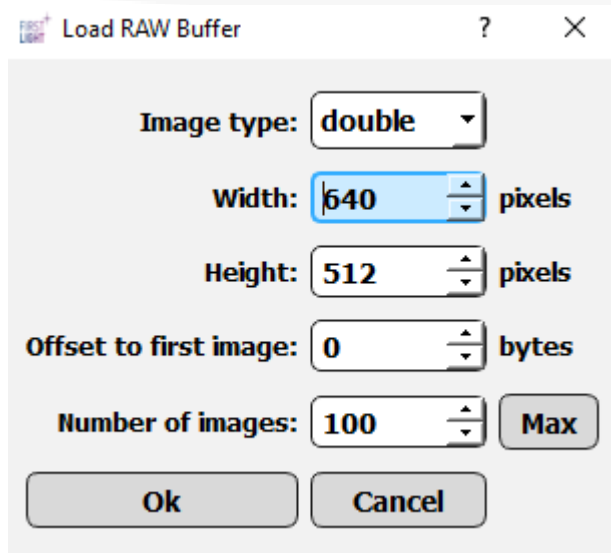


The “.thr.raw” format store the temperatures (x10) as double (64 bits) therefore to open such a file in a image software you will have to specify the image type such as 64-bit Real, the size of the image and check the number of images.

To open it inside Imagej for instance you will need to specify (for instance):



The import of a “.thr.raw” file inside First Light Vision is made possible by a simple drag & drop of the file in the Buffer area, the image type will be automatically detected as double. The dialog box will look like that (for instance):



The thermography plugin is not needed to read these files since they already store some temperature values.