laserpoint

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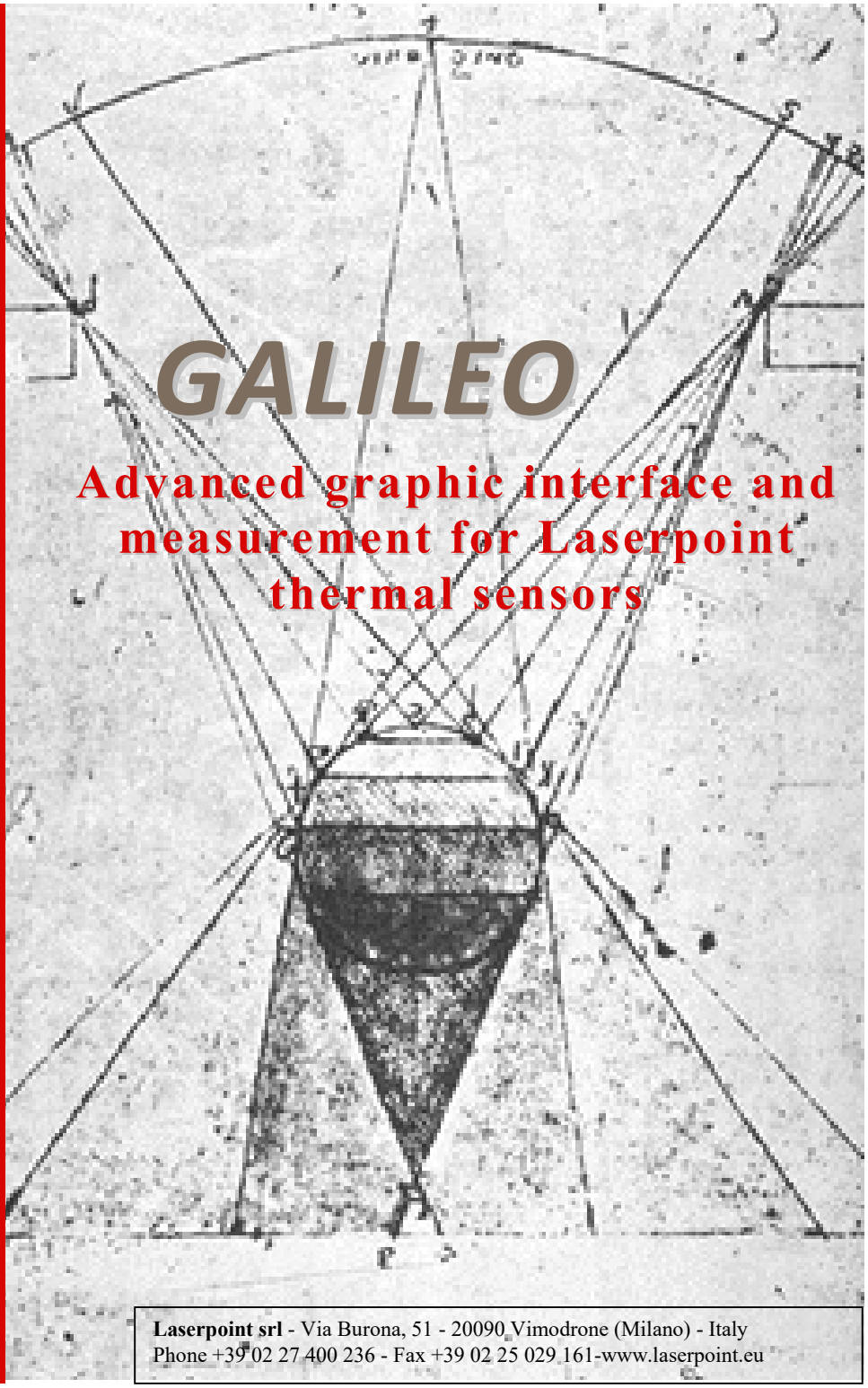
User's Manual



GALILEO

Advanced graphic interface and measurement for Laserpoint thermal sensors

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User's Manual of *GALILEO* measurement software and graphic interface for Laserpoint thermal sensors

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1. Introduction

GALILEO is a step forward in simplification and ease of use of measurement instruments: a single software compatible with all Laserpoint readout electronics, which makes any laptop a true power and energy meter. ***GALILEO*** can in fact read and display data from recent (PLUS2) to any previous electronics (PC-link, PC-Plug USB and PC-PLUG Rs232 series).A completely new graphic interface has been developed to be user friendly, intuitive and ready to use.
Users can start their measurement process within a few mouse clicks and be immediately ready for measurement. All settings related to a specific head will be stored on the PC in use: in this way the same settings can be reloaded each time the sensor is connected to the same PC. ***GALILEO*** has been enriched with new useful functions such as a visualizer of logged data (useful to load logged data in a trend graph for further analysis), a function to monitor the range of process parameters (keeps under control a laser process and the software update over internet. The visualization of trend graph has a new modern graphic interface and new functions, like zoom, auto-sizing and three displaying modes for time flow.
GALILEO can also manage up to 4 different thermal heads arranging its windows for a friendly use.

2. Software installation

To install the most updated version of ***GALILEO*** go to Laserpoint website (www.laserpoint.eu), then click on the "DOWNLOAD" tab, then "SW & Firmware" and download the zipped file "GALILEO_VXXX.zip".
The same file is stored in the USB key supplied with the sensor head.
Two drivers are available to run the software:

amd64: suitable for PCs based on 64 bit Operating Systems.

x86: suitable for PC based on 32 bit Operating Systems.

Install the proper driver by double clicking on ***dpinst_amd64*** or ***dpinst_x86*** application icons stored in the folder named "***Drivers".***
After the driver installation has been completed, unzip GALILEO_VXXX.zip and run "setup.exe" file to install ***GALILEO*** on PC.

3. Safety notes

Before operating this software and graphic interface to read out and manage the measurement data of a sensor heads, carefully review the following safety information to avoid personal injury and prevent damage to the sensor in use.

The use of lasers as well as power and energy measurement are potentially dangerous. This application may operate with sensor heads over high laser power/energy ranges and wavelengths including non-visible laser radiations.

Proper operating practice in accordance with laser manufacturer's recommendations is crucial; to ensure correct operating procedures, consult the laser manufacturer and your laser safety officer.

Eyewear and other personal protective equipment must be used in compliance with applicable laws and safety regulations.

4. Introduction to *GALILEO* graphic interface

Upon opening ***GALILEO*** a window shows the sensors connected to PC (up to 4 sensors), displaying informations relative to electronics and sensors.
The window will be updated each time a new sensor is connected or a sensor is removed (wait some seconds when inserting or removing devices to let software update the window).

"CONNECT" button let the user to start a new measurement process with selected sensors. When communication is established, the label "Connected" informs that the sensor is communicating with PC.

Fig.1 Initial page of ***GALILEO.***
The sensors in the upper left and lower right corners are already communicating with PC.
Sensors in the upper right and lower left corners are available for connection

User can start up to 4 measurement processes at the same time: the corresponding graphic interfaces will be displayed on the PC monitor.
When a graphic interface is selected the corresponding miniature in the start page is highlighted (see figure 1) so that user can rapidly identify the sensor linked with that particular graphic interface.

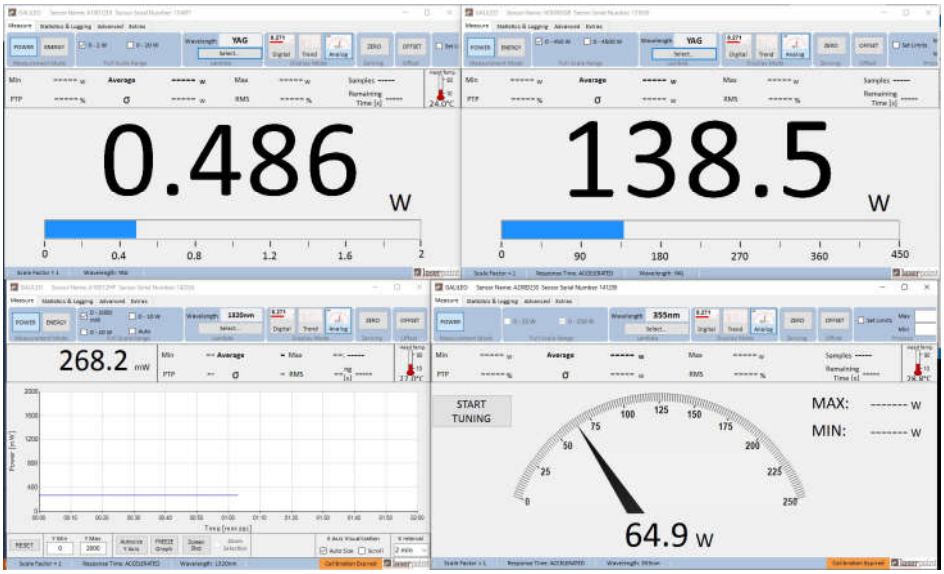

Fig.2 Example of four measurement process displayed on PC screen at the same time

"DATA VISUALIZER" opens a new page to display saved logged data as a trend graph. Previously logged data can be loaded and displayed with their statistical information. See paragraph 7 – Data logged viewer for more informations.

"ABOUT" button shows general informations on ***GALILEO***

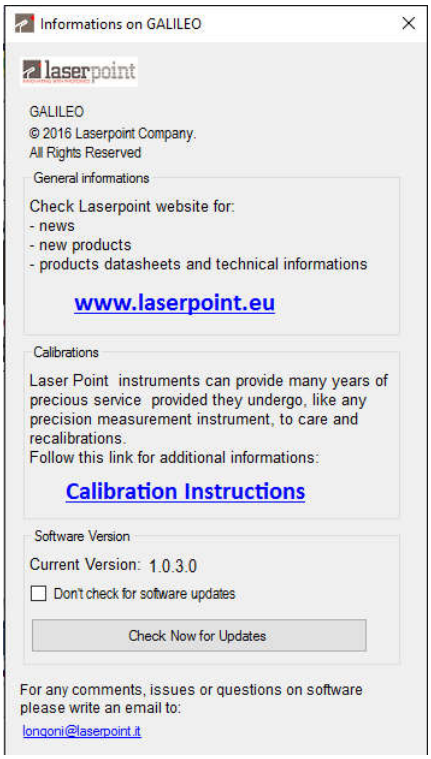

Fig.3 General informations on ***GALILEO***

Upon opening, ***GALILEO*** will automatically try to connect to Laserpoint server to check if there is a newer software version available. If *"Don't check for software updates"* is checked this feature is disabled.
If a newer version of ***GALILEO*** is available, the following page is shown:

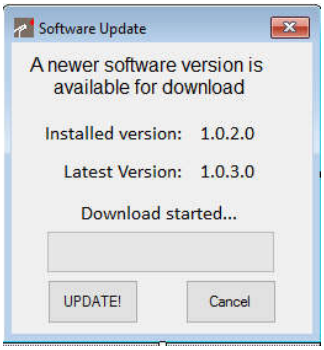

Fig.4 ***GALILEO*** updater window

Click on *"UPDATE!"* button to start download the installation file. A progress bar informs on the status of download.

5. GALILEO main graphic interface

When user starts a new measurement process, the main window graphic interface is displayed.

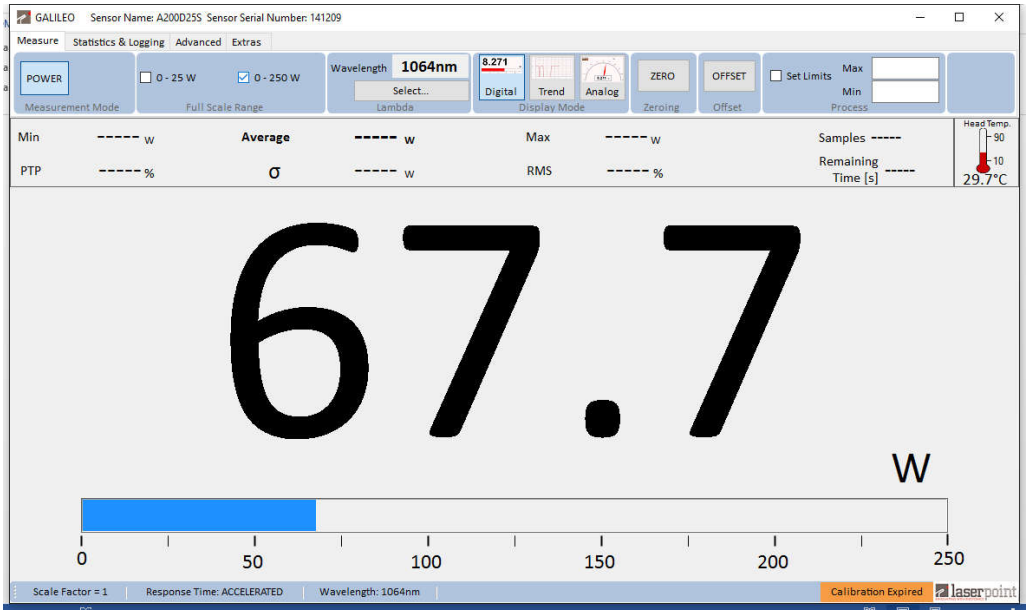

Fig.5 ***GALILEO*** main graphic interface

On top to the main window of ***GALILEO*** a tab control hosts all the relevant functions for setting up measurements in few mouse clicks. Below, a large, highly visible, area is used to show measured data, depending on the selected mode for display (Digital, Trend, Analog).
On the bottom, a status bar shows more relevant parameters and informations (like data-logging on file or the expiration of calibration).

6. Measure Tab

Measure Tab: the tab includes several functions to prepare the sensor head to the measurement process.

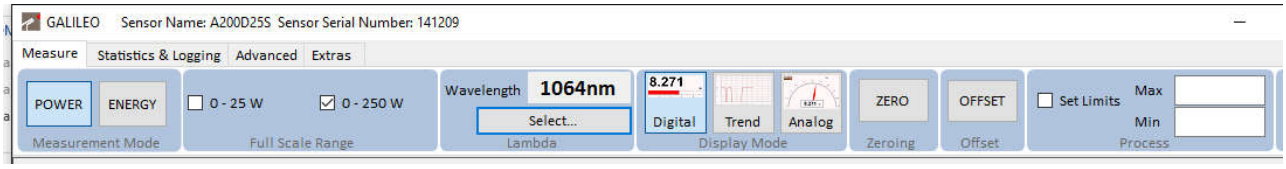

Fig.6 Measure Tab

Measurement Mode: enables the selection between Power, Energy or FIT (power probe) modes of measurement (if available for the sensor) and to display power data in Watt or in Joule.
When switching to Energy mode or FIT mode, no laser emission must reach the sensor. This measurement function can only be used with thermal heads enabled to measure the energy of a single laser pulse; the concept of single laser pulse is valid also for repeated pulses with a low enough repetition rate allowing the thermal head to recover its zero state and clearly detect two adjacent pulses without interference between them.
Important: In order to avoid measurement errors or possible misinterpretations of the measured data resetting the head before starting any pulse energy measurement action is mandatory.

Full Scale Range: enables the selection of up to four different full scale ranges (depending on the electronics) to increase the measurement resolution.
When "*Auto"* mode is selected, ***GALILEO*** will set the appropriate full scale range depending on the power or energy value measured.

Lambda: Sets the wavelength for the sensor in use. The "*Wavelength Selection*" page appears on the screen (it may be different depending on the electronic) showing a table of pre-set, most popular, wavelengths which are stored in the EEPROM of the head.
In general detectors feature different sensitivity values at different wavelengths depending on the detector nature (this is especially important for those based on semiconductor devices), so it is important to account for the sensor wavelength dependent sensitivity when measuring power and energy values.
The procedure of wavelength setting may differ between thermopile and photodiode sensor heads.

Thermal sensor heads: all LaserPoint sensor thermal heads are calibrated at 50% of its rated power/energy full scale at least at one specified wavelength. Furthermore LaserPoint thermal heads are characterised also over a broader wavelength range at low optical power; this range spans from 200nm to 2100nm and the measured sensitivity spectrum is loaded into the head EEPROM as a table of discrete wavelength dependent sensitivity values that are used by ***GALILEO*** to calculate by interpolation the sensor head sensitivity at any other specific wavelength between 200nm and 2100nm.
Any wavelength of the list can be selected by clicking on the rectangular box showing the desired wavelength. Should the sensor head be used at other wavelengths not shown in the list, those can be chosen with 1 nm resolution, clicking on the box "Edit nm": type in the blanket space the value of the wavelength, then click "*OK"* to store this value. Finally click on the wavelength button to select it and close the page.

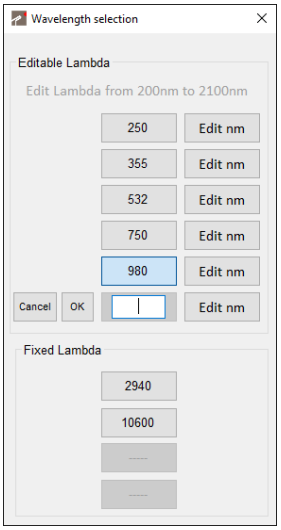

Fig.7 Wavelength selection page

Photodiode heads: in similar way the wavelength dependent sensitivity of photodiode sensor heads is stored in the sensor head EEPROM in form of a table, and due to the intrinsic characteristics of these sensors, the wavelength dependent sensitivity curve is described by a much higher number of discrete values. Upon opening the wavelength setting page at least one wavelength (in general the wavelength requested by the customer for a specific application) is shown; the specified detector range limits are shown in the notice "*Edit Lambda from **A** to **Z***" where **A** and ***Z*** are the lower and upper limits of the sensor head operating wavelength range; such wavelength range strongly depends on the photodiode material.
To enter another wavelength within the specified head operating range click on the box "Edit nm": type in the blanket space the value of the wavelength in nanometer units with 1 nm step, then click "*OK"* to store this value. Finally click on the wavelength button to select it and close the page.

Display Modes: gives access to three different display modes of measured data, namely:

1) Digital Display: shows the instantaneous value of the measured value in form of a large sized number shown as per the selected resolution of decimal digits; this display mode features also a coloured bar representing the measured value as a proportional fraction of the sensor head full scale. Both limits of the bar can be edited: double click on upper or lower limit number. A blanket box will appear. Type in the desired value (upper limit must be higher then lower limit. Lower limit cannot be negative) and then press Enter key on keyboard to store the value. Bar limits will be reset.

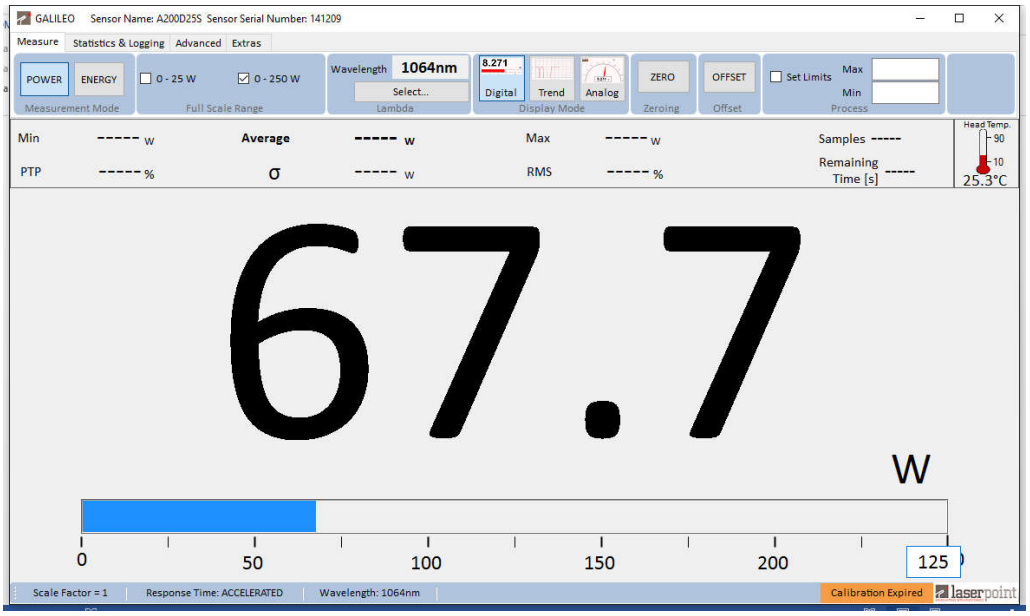

Fig.8 Digital display mode when measuring power

When measuring single shot energy (*Energy* mode selected) the digital display mode slightly change: A coloured spot showing two possible head/measurement states is shown at the upper left hand side of the last energy value

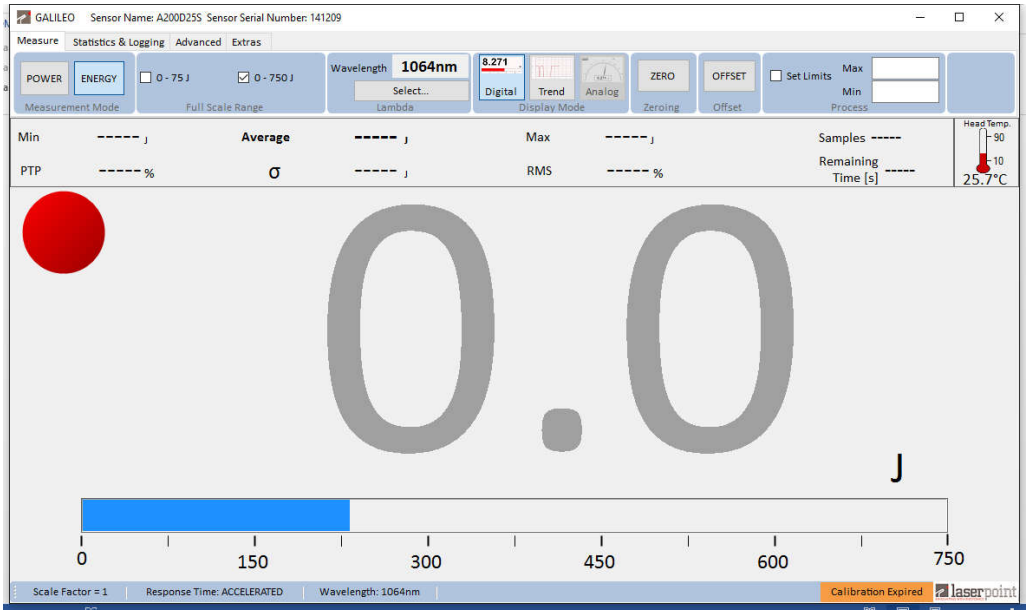

Fig.9 Digital display mode when measuring energy

When the spot is green the head is ready for a new measurement; soon after the sensor is hit by a laser pulse, the spot colour converts to red and energy value is zeroed with a grey like color, indicating that the measurement is in progress. When measurement is over, energy value is displayed. The head is ready for another measurement when the spot goes back to green again.
The energy of a single laser pulse is more complicated to measure than power, so its measurement requires some additional settings like the definition of a signal threshold and a head inhibition time in order to get a meaningful, noise free pulse peak detection. These two parameters are pre-set and their values are stored in the head EEPROM.

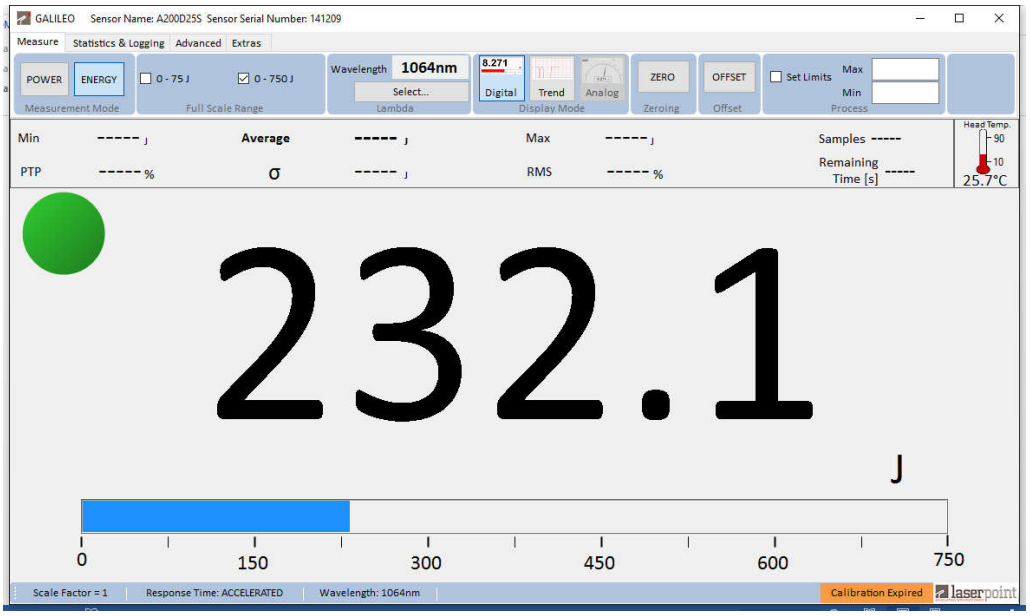

Fig.10 Measured energy value is displayed. Sensor is ready for another measurement

Similar screens are displayed when FIT mode is selected: in this case measured values are in Watt

2) Trend Display (Power Mode): shows both laser power evolution (Y axis) as a function of time (X axis) and the instantaneous value of the measured function.
Various controls are available in the bottom to customize the display of measured data.
   - *"Reset"*: clears all displayed values and sets the X axis to the time origin;
   - *"Y Min" & "Y Max"*: set the minimum and maximum of Y axis (not enabled when "*Auto*" gain is selected)
   - *"Autosize Y Axis"*: automatically calculates the minimum and maximum of Y axis and resize the the trend accordingly;
   - *"FREEZE Graph"*: freezes update of trend graph;
   - "*Screen Shot"*: get a screen shot and saves it in a bitmap file
   - *"Zoom Selection"*: when selected, the yellow selected part can be zoomed.
   - *"X Axis Visualization"*: controls how measured data are displayed on the graph. " *Auto Size*": when traces reach the end of graph, time scale is automatically updated "*Scroll*": at the end of graph, time scale shifts by a new interval as set in the "*X Interval*" box"
   - "*X Interval*": defines the interval of time scale

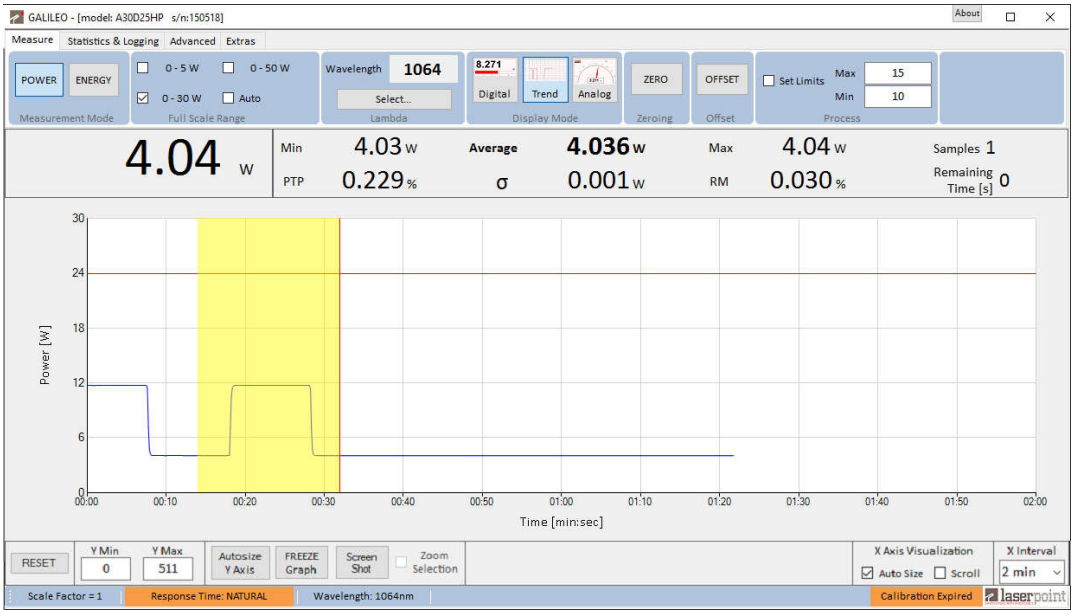

Fig.11 Trend display in power mode

Trend display in Energy and FIT (Power Probe) modes: the display becomes a histogram-like graph where the energy or power (FIT) of each measure is represented as a vertical bar; the last measured value is also digitally show. The coloured dot shows three possible head/measurement states : green when the head is ready for a new measurement; blinking green when the sensor is acquiring data (only in FIT mode), red when the sensor is cooling down.

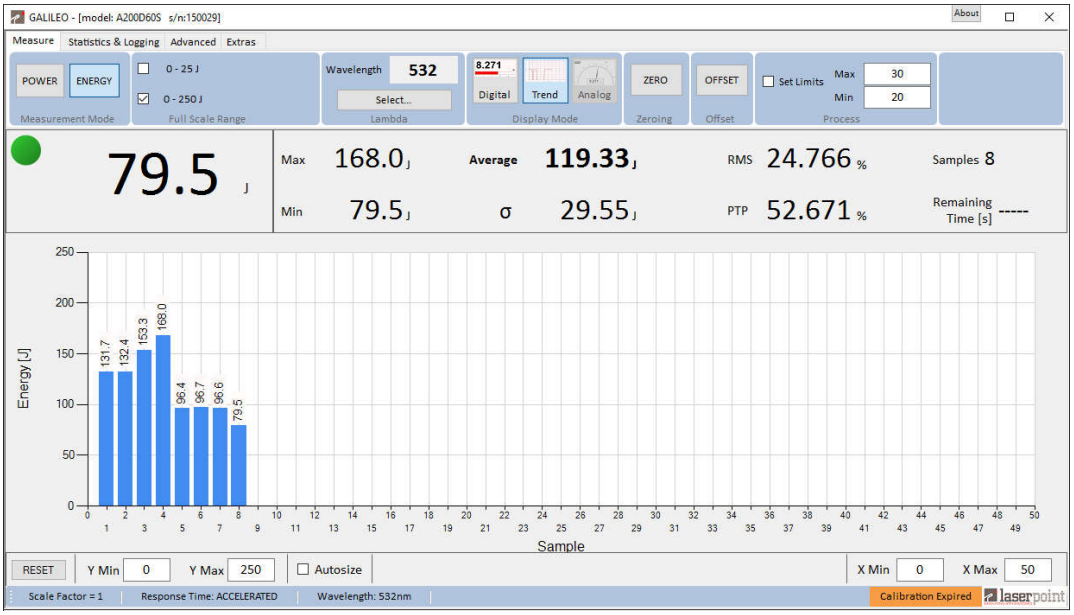

Fig.12 Trend display in Energy or FIT mode

3) Analogue Display: shows the instantaneous value of measured power both by a needle-like representation and in digital form. The “Start Tuning” key activates the tuning function for optical alignments: the MAX and MIN values reached during the operation will be updated
This measurement data representation mode is generally preferred in complex laser and optical chain alignment, where the alignment optimisation is normally carried out by a technique of active alignment based on many trials. To help the users working in these specific applications, LaserPoint introduced in this mode also a “tuning” option described in the following lines.

By clicking on the *"START TUNING"* button placed in the upper left hand side of the display, the analogue representation of the measured power changes into a tuning tool that enhances the needle dynamics and makes it more sensitive to the power value change. The absolute scale converts into a relative scale spanning from -25% to +25% of the (zero) measured value at the time of the tuning function

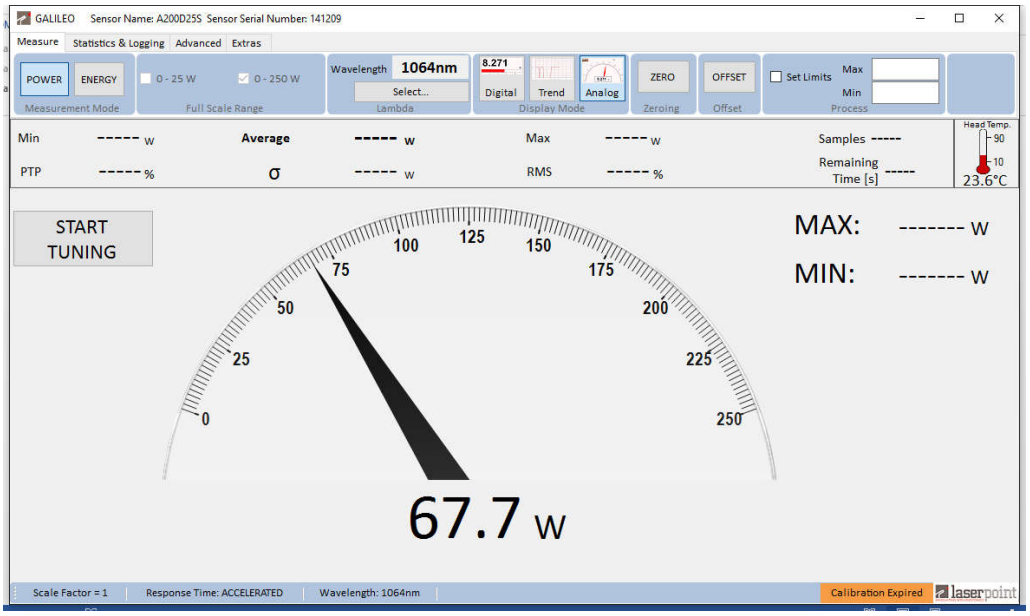

Fig.13 Analog display (available only in Power mode)

activation. The maximum value achieved during the tuning run, is shown in the upper right orner of the display. (refer to Fig. 12).
When the display is in tuning mode, the user can update the meter centre value by clicking on the *"RESET TUNING"* button and aligning it to a new (presumably improved) power maximum value and this operation can be repeated many times in order to chase, step by step the optimum alignment conditions.
Clicking on *"STOP TUNING"* button exits from the tuning tool and returns to analogue display mode.

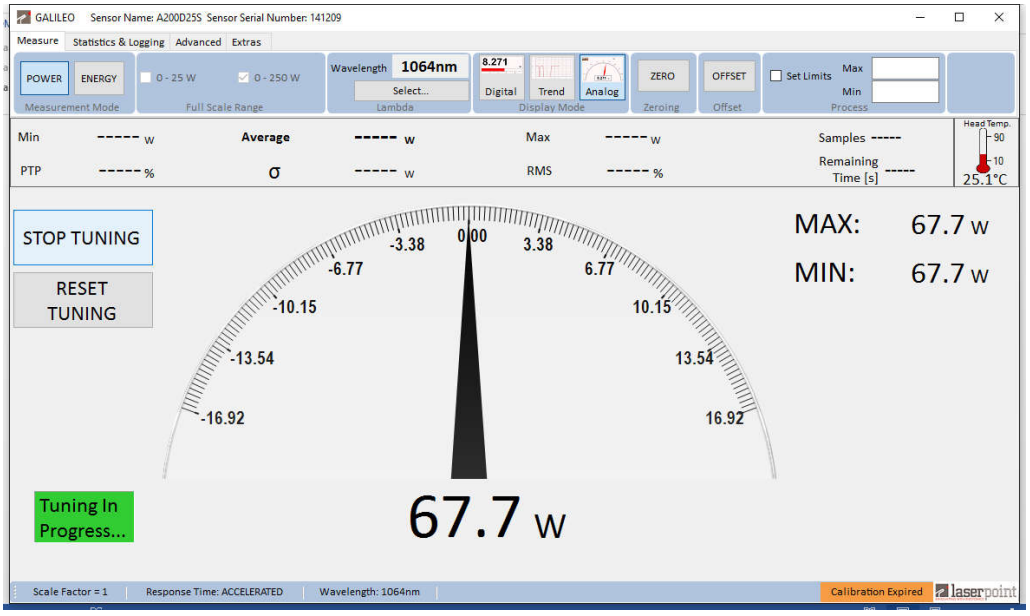

Fig.14 Analog display when tuning tool is activated

Zero: resets the ADC of the electronics and define the optical zero of the sensor head.
IMPORTANT Before starting both optical and electrical zeroing procedures, take care to ensure the sensor head is properly insulated from any type of radiation in order to avoid introducing any unwanted offset.
To electrically reset the head electronics click on "*ZERO"* button; a dialogue window with the question "Do you really want to reset ADC?" is displayed. Choose "OK" to start or "Cancel" not to change the current instrument zero conditions. The electrical resetting of the head electronics ADC takes few seconds.

IMPORTANT Before starting an electrical resetting sequence, ensure the sensor head is in thermal equilibrium with the environment and properly blinded (especially important for high sensitivity heads). Ensure that no laser radiation accidentally hits the sensor not to introduce an unwanted offset level.

Offset: defines the optical zero of the sensor by means of an offset on measured value. Click on the *"OFFSET"* button to set the actual measured value as offset. Click again on *"OFFSET"* button to disable the function.

Process: users can set a range for power or energy to keep in control the measurement process: should the running value be above or below the pre-set limits, an alarm is displayed/recorded. Process limits are available in Digital and Trend mode. When measured value is above or below process limits, the bar in case of Digital display or the line in case of Trend display will be coloured in red (refer to figure 13)

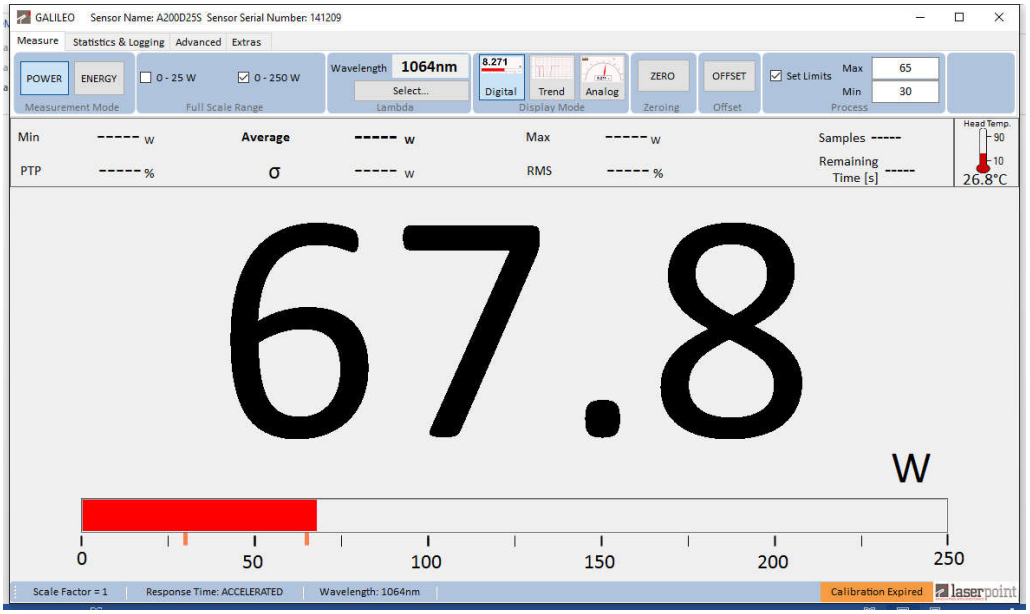

Fig.15 Measured value is outside process limits: bar is coloured in red.

To set limits, type in the *"Max"* and *"Min"* boxes the desired values (max value must be higher then minimum value) and press Enter key on the keyboard to store the values. Click on the *"Set Limits"* check box to activate the process limits function or to deactivate it.

7. Statistics & Logging Tab

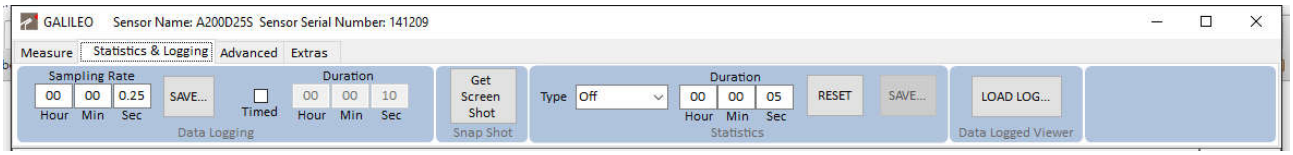

Fig.16 Statistics & Logging tab.

The tab hosts controls for elaboration of measured data, like data-logging or statistics.

Data Logging: saves measured data on a .txt file that can be open and managed using external programs (like Excel).

Sampling Rate: sets the rate for storing data in a file. Type in the desired value and then press Enter key on keyboard to store the value.

Save...: allows both the selection of file name and folder where the file with data logged is stored.

Timed: establishes a time window for the measurement session (by using the Duration commands) and the sample rate (by using the Sampling Rate commands). The overall measurement time can be selected between a minimum of 1s and a maximum limit of 744 hours (31 days) and the sample rate can be set to any value between 0.25s and 2 hours (in case of timed saving the sampling rate must be lower then time duration. For example time duration: 5s, sampling rate 10s is a wrong settings). When timed saving is selected, the data are stored in a text file at the sampling rate defined and automatically is stopped when time window is expired.
If trend graph display is selected, when data logging starts trend will be automatically reset. When data logging ends, trend will be freezed until user disable freezing.

Snap Shot*:* clicking the *"Get Screen Shot"* saves a screen shot as a bitmap image file.

Statistics: provides statistical data on measured values
Type: are available four options for acquisition and elaboration of statistical data:

-Off: no statistics.
-Continuous: data acquisition and elaboration are continuously made.
-Repeated: data are repeatedly collected and elaborated within a user's defined time period.
-Single: data are collected and elaborated over a single run within a user's defined time period.

Duration: sets the time interval for data acquisition (available on Repeated and Single modes). Type in the desired value and then press Enter key on keyboard to store the value.

Save…: is used to store statistical data in a .txt file each time they are updated (not available if *"Off"* mode is selected.

Reset: resets statistics

Data Logged Viewer: Opens a new page to display saved logged data as a trend graph. Previously logged data can be loaded and displayed with their statistical information. A portion of displayed data can be selected and zoomed. Statistical information regarding the selected data are shown in the right part of the window. It is an easy-to-use, powerful and fast tool to display saved data. This tool is also available in the start page of ***GALILEO*** to visualize saved data without starting new measurement process.

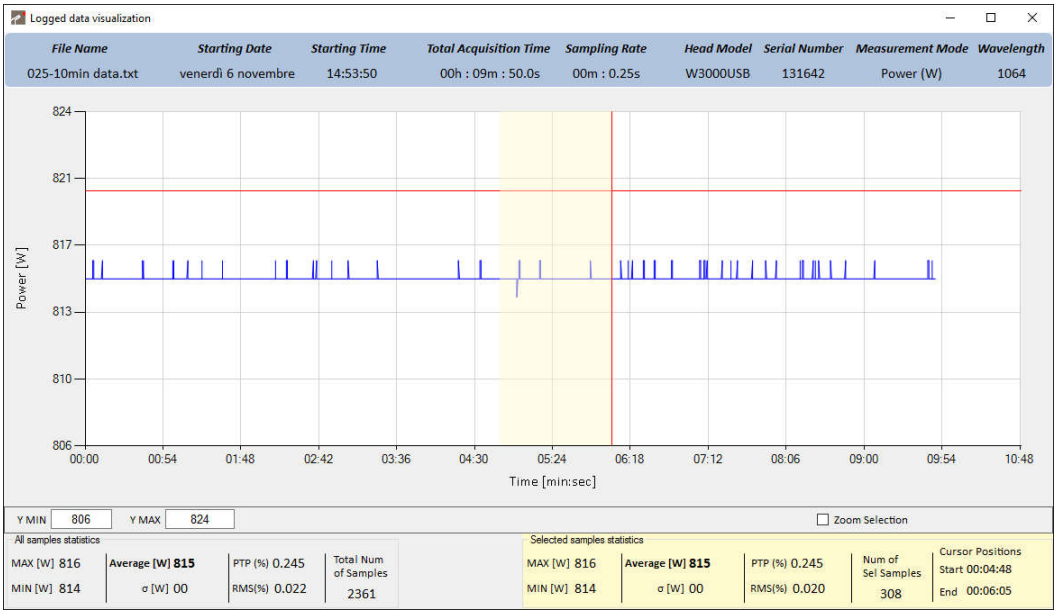

Fig.17 New page showing saved logged data.

8. Advanced Tab

The tab adds advanced functionalities to help measurements.

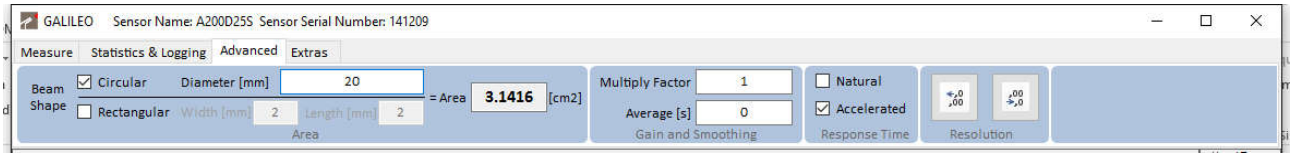

Fig.18 Advanced tab.

Area: allows the user to choose whether displaying the values of the measured function in absolute values (e.g in case of power in Watt related units) or in density values (e.g. in case of power density in W/cm^2) by entering the area parameters associated to the laser beam section intercepted by the sensor head. The procedure starts selecting the beam shape (*"Circular"* or *"Rectangular"*) and then typing in the relevant parameters (*"Diameter"* or *"Width and Length"* in millimetres format); software will automatically calculate the corresponding area in square centimetre. All numbers in graphic interface will be displayed as power or energy density. To disable the feature simply uncheck the beam shape selected.

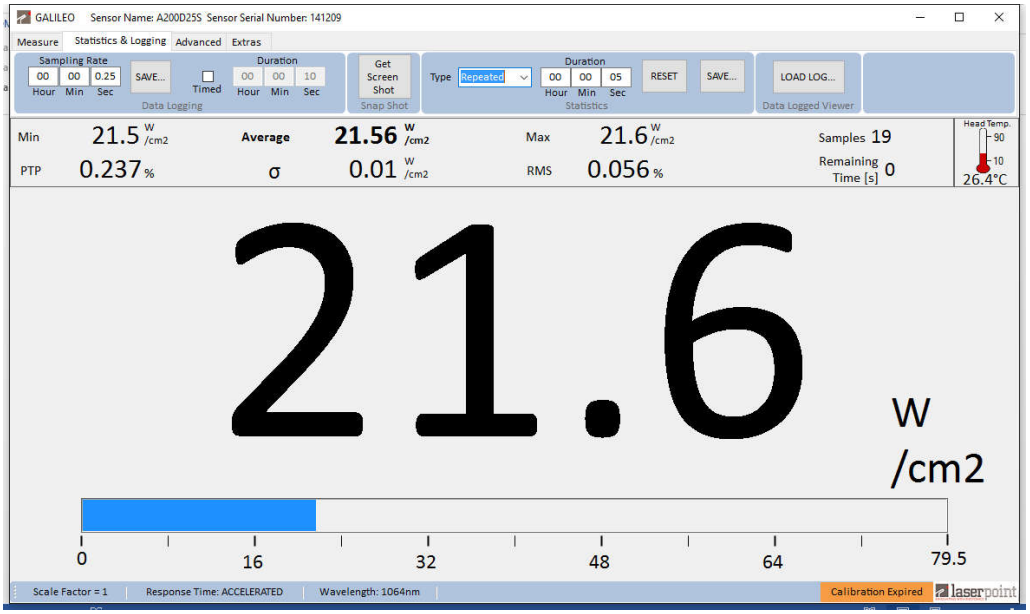

Fig.19 Power measurement as density values

Gain and Smoothing:
Multiply Factor (factory default setting = 1) is a useful tool when it is necessary to multiply the measured values by a correction factor (can be >1 or <1).
For example, when a power meter is behind a beam splitter to monitor a laser beam, the full power can be reconstructed multiplying the signal by a factor that takes in account the beam splitter attenuation.
Average: determines the time period for averaging the head signal: this is a useful function to have a cleaner signal read out, when the signal is low and noisy. This function is a low-pass filter that allows to introduce a time constant to the head signal to help smoothing the signal fluctuations in the case the head responds too quickly, thus improving the head signal stability and signal to noise ratio.
Important notice: It is advisable that Gain, Smoothing functions are used by expert users only as their settings require some experimental skill and the entered values need to be sensibly set, not to alter the measured data.

Response Time: the sensor's natural response time can be used as it is ("*Natural*") or can be "*Accelerated*": in this case an internal algorithm on the instrument will speed the response time by several factors (depends on the head)

Resolution: Increases or decreases the resolution of measured values. It allows to select the number of decimal digits after the dot.

9. Extra Tab

Tab gives access to some information concerning the product and to Laserpoint engineers (or authorized personnel) to check and change its calibration status.

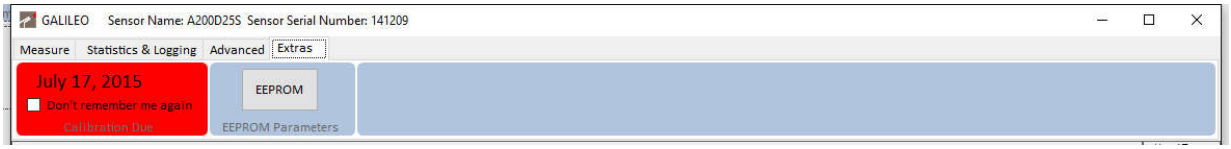

Fig.20 Extras tab

Calibration Due: reminds the next calibration date. In case suggested calibration date is overdue, the panel is coloured in red and a message is displayed in the status bar at the bottom of graphic interface. Clicking on *"Don't remember me again"* disable the message in the status bar.

EEPROM Parameters: Only authorized users can access to EEPROM parameters.

10. Alarms

GALILEO can display different types of alarms: calibration overdue alarm (not available on older electronics), no head alarm, head excess temperature alarm (only for the thermal heads equipped with a thermistor), measurement overflow alarm.

Calibration overdue alarm: In the case the head recommended calibration date has been overcome a calibration reminder appears in the status bar at the bottom of the graphic interface and in the *Extra* tab.

NO head alarm: This alarm appears on the screen when the head is being disconnected after launching ***GALILEO.*** Main graphic interface will be closed and the message *"NO HEAD"* will be displayed on start page.

Temperature Alarm (thermopiles only): This alarm appears when the thermopile sensor head temperature exceeds its specified safety limit (typically 82°C).

Overflow Alarm: This alarm appears when the signal detected by the instrument exceeds the instantaneous maximum power the sensor head can bear.

11. Specifications

■ System Requirements:
- CPU 1.2 GHz (x86 or x64-bit); 30 MB hard-disk space; 1 GB RAM; 1280x768 minimum display resolution
- Compatible Operative System: Win XP (service pack 3), Vista or Windows 7, Windows 8, Windows 8.1, Windows 10

■ Compatible Heads
- PLUS 2
- PC-Plug USB
- PC-Link
- W-12K –D55-SHC-USB

■ Measurement Features & Analysis
- Power Measurement and Display in linear units (W and related units)
- Energy Measurement and Display in linear units (J and fractional related units)
- Measurement resolution: 1/50,000 full scale
- Visual resolution: 3,4 or 5 digits (custom settable)
- Instrument Accuracy: ±1.0%
- Sampling Frequency: 1kHz
- Elaboration frequency: 64Hz
- Power measurement representation Modes: Digital, Trend, Analogue with Tuning Function
- Energy measurement representation Mode: Histogram like

■ Statistical Functions
- Full Statistics (Min., Max., Mean, RMS, Std. Dev., Peak-to-Peak).
- Programmable data collection modes

■ Additional Functions and Information
- Wavelength selection with 1nm pitch over 200nm to 2100nm. Fixed wavelength beyond 2100nm.
- Area function for Radiance (W/cm2) and Fluence (J/cm2) measurements
- Gain settable by User to compensate the beam splitting ratio or to normalise the measurement data
- Smoothing Function for head time response optimisation
- Programmable Measurement Data Saving
- Head Temperature indication
- Next Calibration date indication
- Software update over internet