

User manual

PDAnalyze Software

For use with the:

Promo[®] series

Fidas[®] series

UF-CPC

U-SMPS

U-RANGE

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1 Start of the PDAalyze Software

Please start **Promo®_Logger.exe** to open the data evaluation software.

PDAalyze is the designated data evaluation software for most of the Palas® particle measurement systems, i.e.

Promo®, Fidas®	optical aerosol spectrometers
UF-CPC	universal fluid condensation particle counter for nanoparticles
U-SMPS	universal scanning mobility particle sizer
U-RANGE	combination of U-SMPS with Fidas®

The PDAalyze user interface with the following submenus is first visible on the screen:

- 1 „files“
- 2 „overall data“
- 3 „selected intervals“
- 4 „PROMO, FIDAS“
- 5 „U-SMPS/U-RANGE“
- 6 „miscellaneous“

2 Menu-Item: files

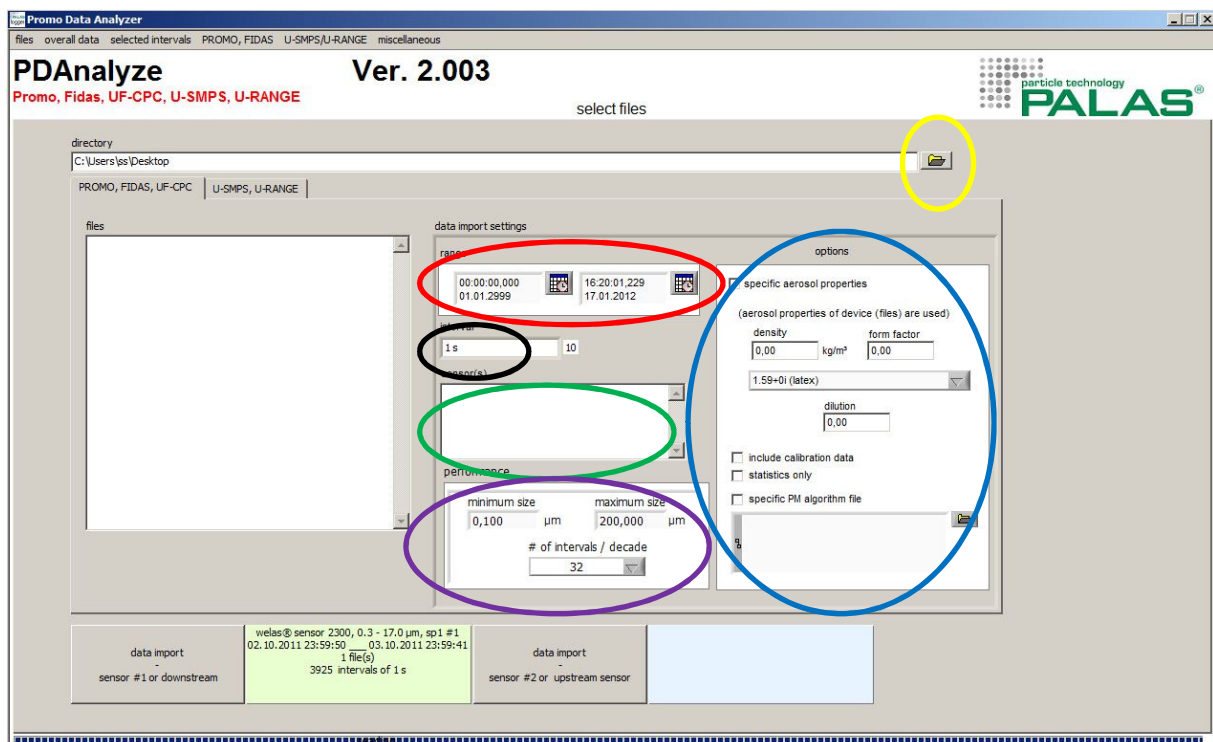


Figure 1: Display of the submenu „files“

When loading data files into the software please pay attention that the appropriate tab “PROMO, FIDAS, UF-CPC” or “U-SMPS, U-RANGE” is selected.

For the loading of one or several files the yellow file symbols (yellow circle) are used. By selecting the yellow file symbol you open a window in which you need to select the path to the folder in which the data files are stored.

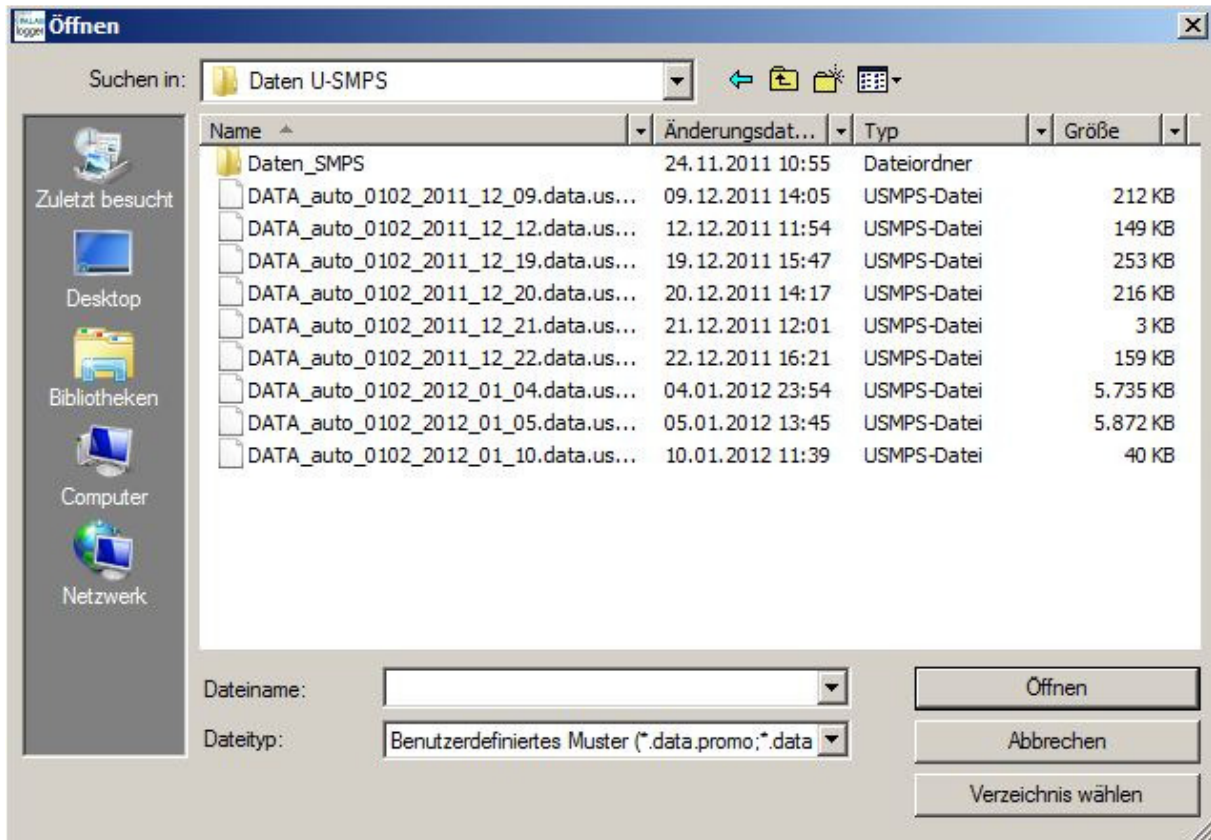


Figure 1a: Selecting the folder in which the data files are stored

Please close this window by selecting “select folder” (bottom choice, called “Verzeichnis wählen” in figure 1a). The data files in this folder will then be automatically shown in the software (red circle in figure 2)

The currently used type of sensor is mentioned under **sensor** (green circle in figure 1). Whenever it is measured with two sensors in an alternating way only the data of the selected sensor are displayed.

With **specific range distribution** (red circle) a defined record can be analyzed more precisely. Therefore the corresponding entry of time and date must be made. A further possibility can be found in „**selected intervals**“ (see item 3).

With **used aerosol properties** (blue circle) the required data for concentration and shape factor can be changed for the calculation of the mass concentration.

The data are saved during a measurement with a temporal resolution of 1 s, 10 s, 60 s or 120 s. With **interval** (black circle) these data can be displayed in correspondingly larger intervals, e. g. 600 s.

With performance the minimal and maximal value for the display and additionally the resolution, e.g. 32 channels per decade can be selected. (purple circle).

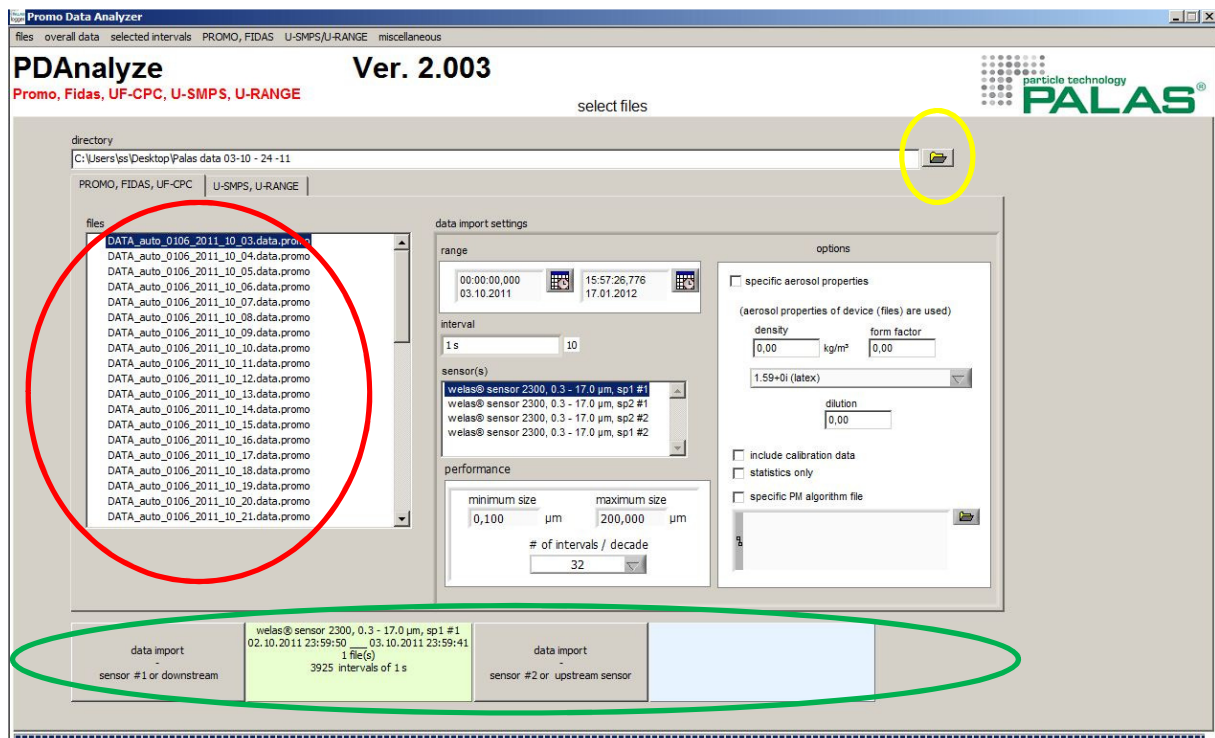


Figure 2: Loading of several data files

After selecting the yellow path symbol (yellow circle) all data files in this path automatically get displayed in window below (red circle). The corresponding data can also be available on a network drive. Via a click on the mouse button the correspondent data sets can be selected.

With the button **data import sensor # 1 or downstream data import sensor # 2 or upstream** the data are transferred to the evaluation software and displayed with a time stamp on the left side. (green circle)

2.1 Noticeable differences when importing data from the U-SMPS, U-RANGE

Under “distribution type” you can select whether you want to analyse and display the raw data, the inverted data or the inverted & diffusion corrected data (figure 2a). You need to select this before importing the data to e.g. sensor #1 and this is then used throughout the following description.

It is also possible to import for example the inverted and diffusion corrected data under sensor #1 and the raw data under sensor #2. In the now following analysis and display of the data it is then possible to switch quickly between raw and inverted data.

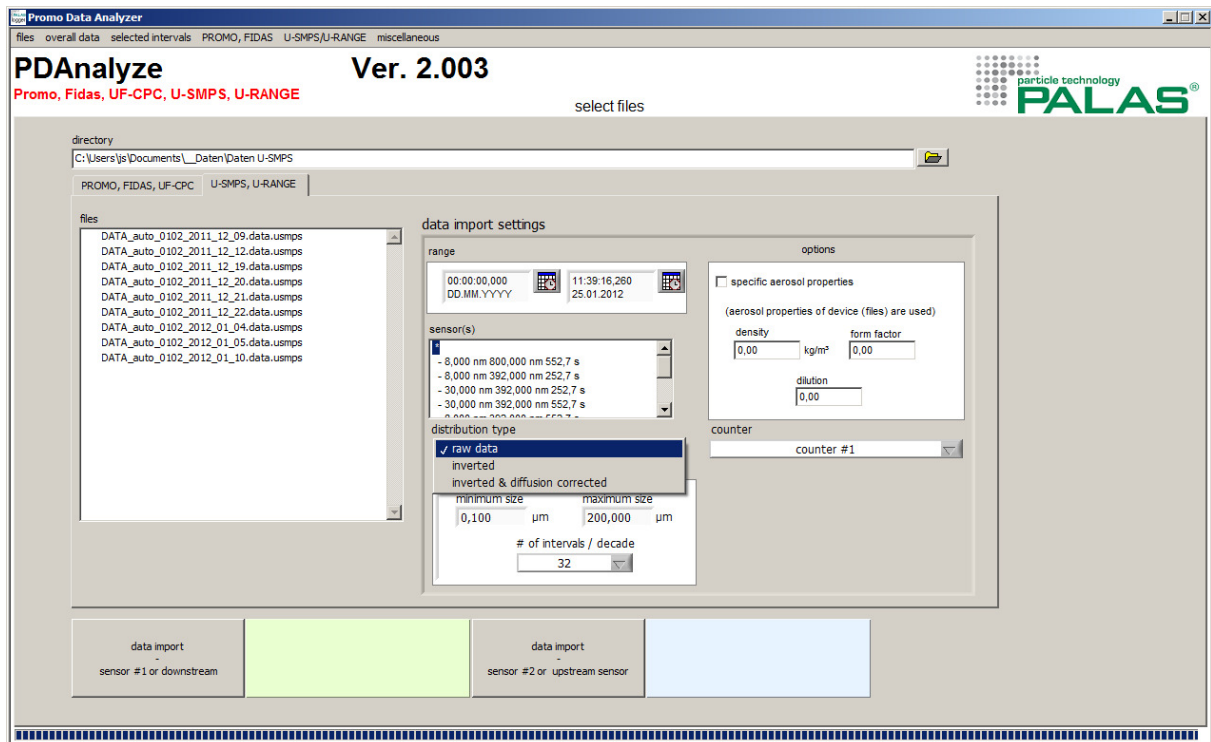


Figure 2a: Selecting the data (raw, inverted, etc.) for the following evaluation

3 Menu-Item: overall data

The menu item „**overall data**“ has two submenu items:

- „**particle size - time chart**“
- „**weather station - time chart**“

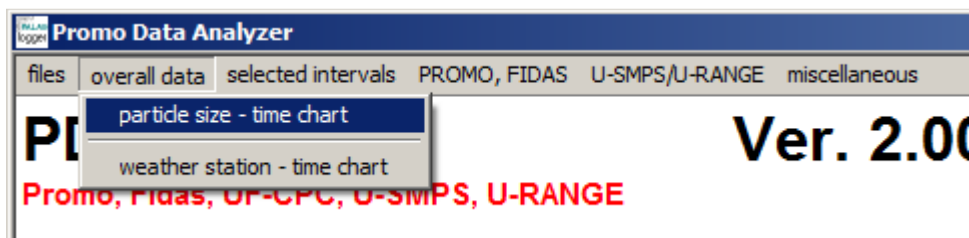


Figure 3: „**overall data**“

3.1 Particle size time chart:

Please select in the menu „**overall data**“ the submenu „**particle size – time chart**“.

When starting the submenu „**particle size –time chart**“ the display of „**overall data particle size - time chart**“ appears. In this display different data and statistical displays can be compared against each other.

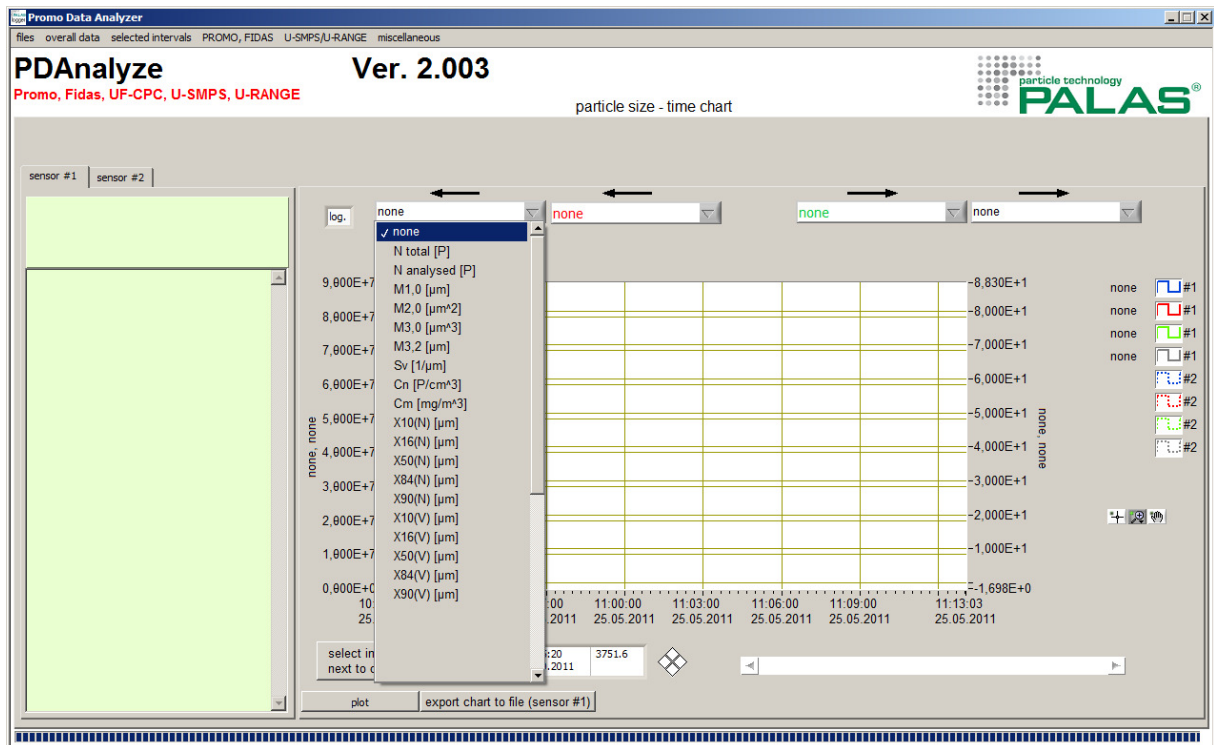


Figure 4: Display “overall data: particle size - time chart” without selection

The two selection options on the left refer to the left vertical axis, the two on the right refer to an additional right vertical axis if a selection is made. All selection options are the same and include for example total number N analyzed and total mass concentration Cm. (see figure 5)

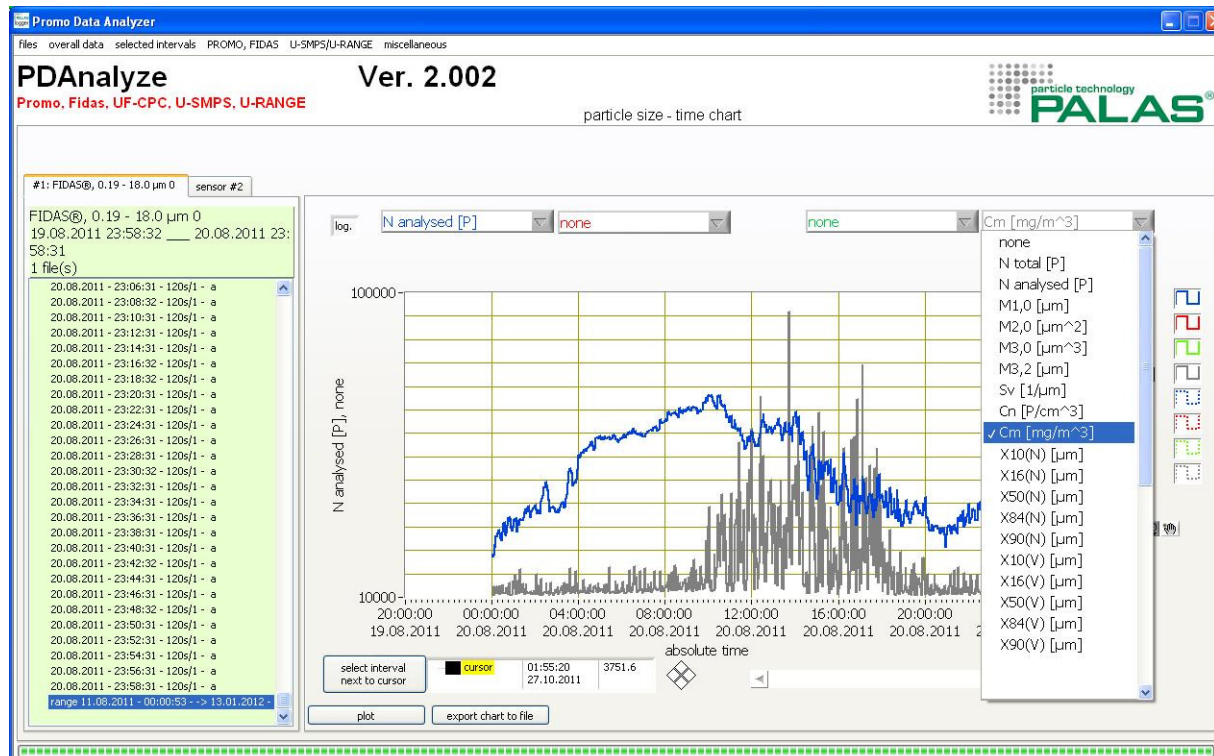


Figure 5: Selection N analyzed and Cm at „overall data“

It is possible to display other statistical values (see above). With the button **Plot** the two chosen displays are assumed into the chart.

With the button **export chart to file** those displayed distributions can be saved as txt-file for further import into software, e. g. Excel.

The devices remark the time of filter in and filter out with arrows in the chart automatically as the button **show annotations** is marked and the button **plot** will be used (see red circle in figure 6).

If one or more distributions will be marked on the left side below distribution those distributions will be also highlighted in the chart as soon as the button **show annotations** are marked and the button **plot** will be used (see 5. Menu-Item: miscellaneous).

With the cursor display also a specific time can be highlighted in the chart. Therefore the time and the date have to be inserted (see green circle in figure 6).



Figure 6: Display of several points at „overall data: particle size – time chart“ view

3.2 Weather station – time chart

When starting the submenu „overall data: weather station – time chart“ the values of the weather station will be displayed, e.g. precipitation intensity.

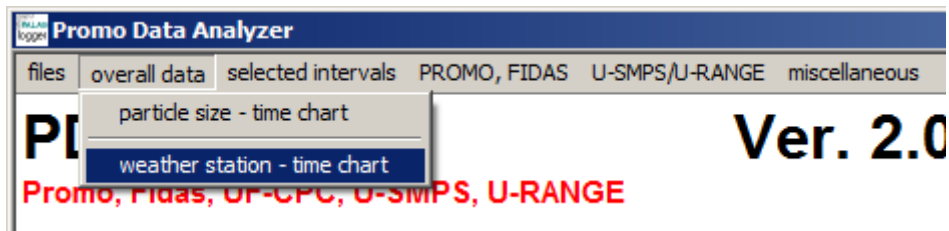


Bild 7: "overall data: weather station -time chart"

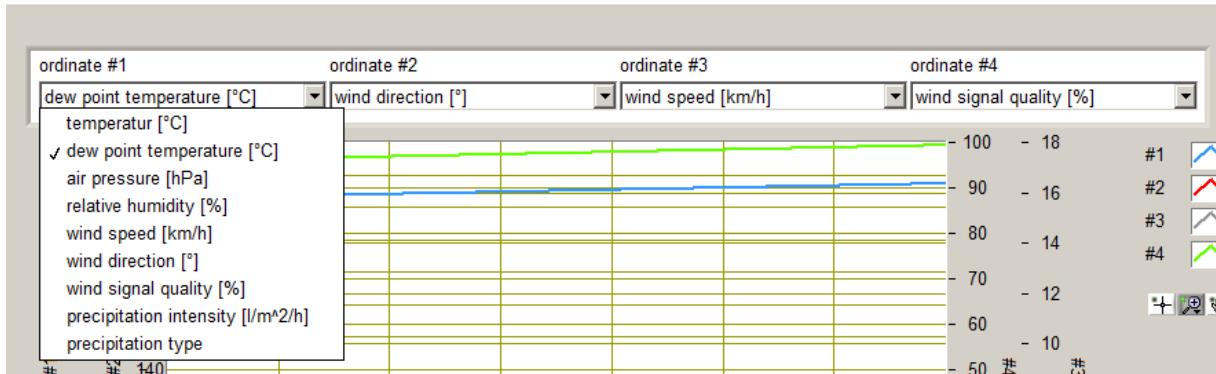


Figure 8: "overall data: weather station -time chart" selection of possible parameters

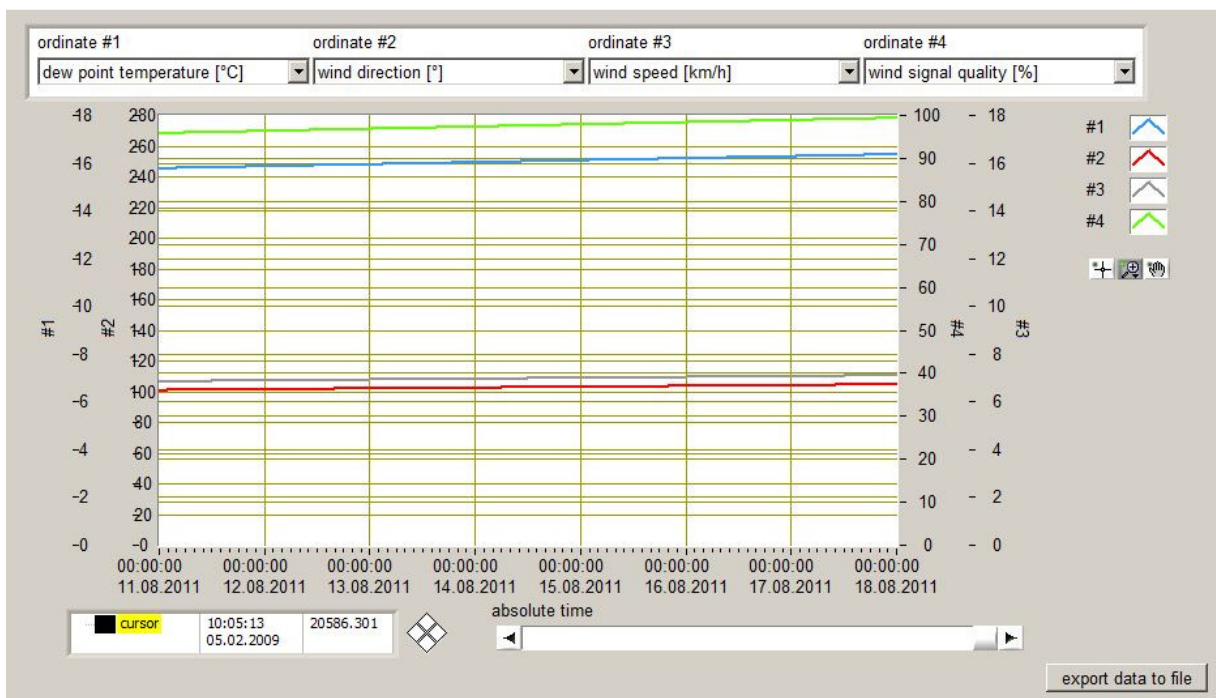


Figure 9: „overall data: weather station - time chart“ Display of several parameters

With the blue curve the dew point temperature in °C is displayed.

With the red curve the wind direction in ° is displayed.

With the gray curve the wind speed in km/h is displayed.

With the green curve the wind signal quality in % is displayed.

4 Menu-Item: selected intervals

The menu item „*selected intervals*“ offers three sub-menus:

- „*particle size distribution/statistics*“
- „*particle size distribution colour plot (sensor #1)*“
- „*fractional efficiency*“

In opposition to the display „*overall data*“, the menu-point „*selected intervals*“ displays a distribution in a given time interval, the comparison of several marked distributions or of a single distribution.

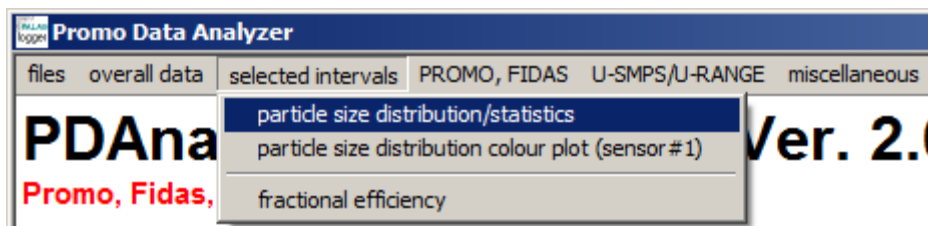


Figure10: „*selected intervals: particle size distribution/statistics*“

4.1 particle size distribution/statistics:

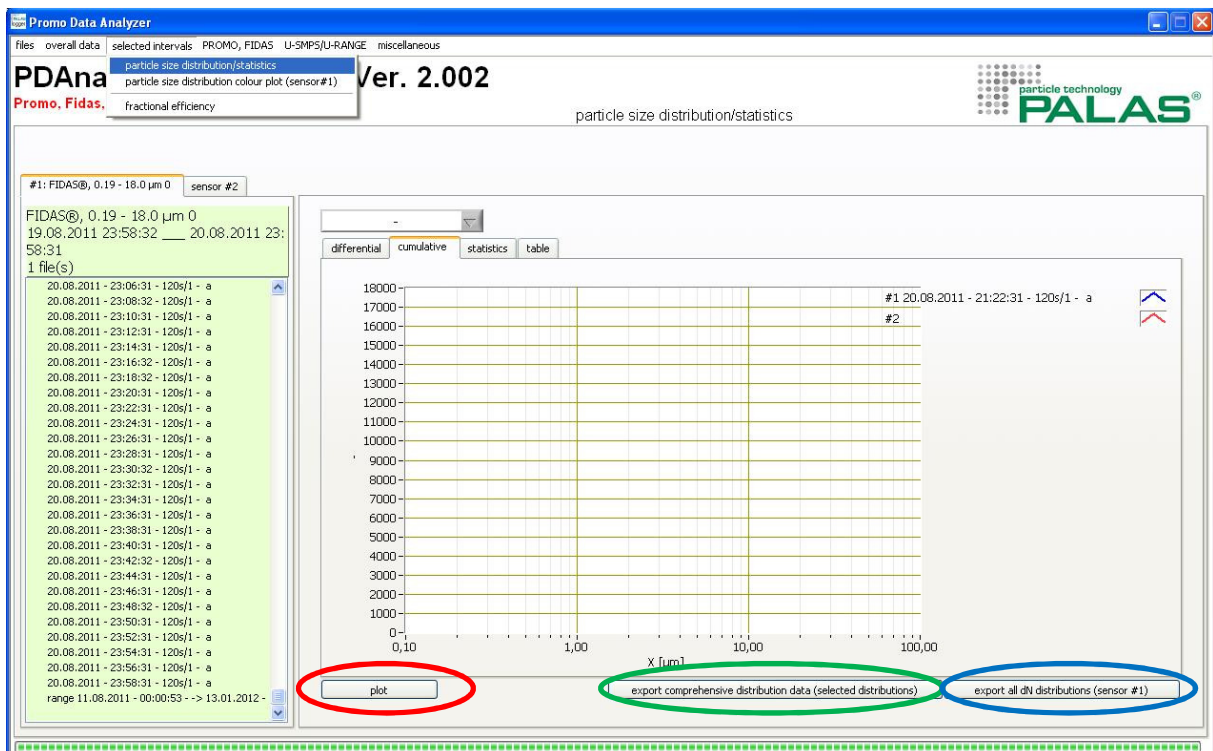


Figure11: Start screen of the menu item „*selected intervals – particle size distribution/statistics*“

In the following examples three distributions were marked out of two whole days' distribution with a time resolution of 600s and were compared against each other.

Therefore the three corresponding files were marked with control key on the left side under distribution. After this, the kind of display has to be chosen, e. g. d_N (Particle number) (see figure 11) and the **plot-Taste** has to be activated (red circle).

With the button **export comprehensive distribution data (selected distribution)** (green circle) or with the button **export all d_N distributions (sensor #1)** (blue circle) the values are save das a txt-file and can be used with other programs, e.g. Excel.

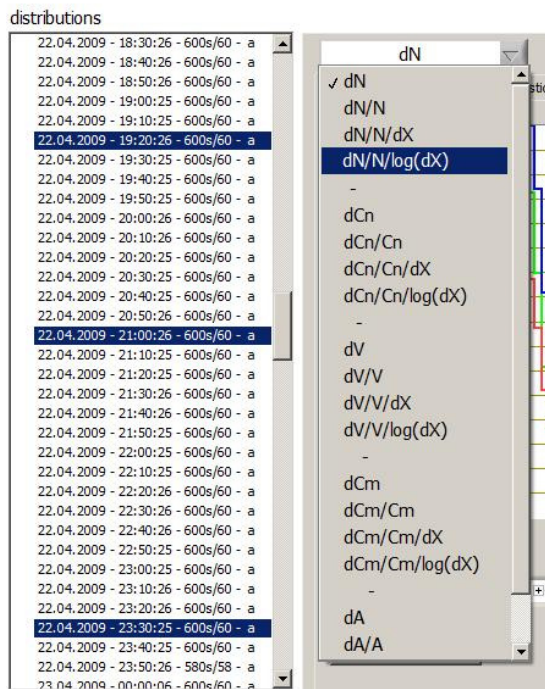


Figure 12: Drop down menu with different kinds of display for „**selected intervals –particle size distributions/statistics**“

Within the submenu „**selected intervals: particle size distributions/statistics**“ it is possible to chose between two graphical displays:

- „**differential**“
- „**cumulative**“

As well as two additional kind of displays of statistics and table:

- „**statistics**“
- „**table**“

The selected files will be shown with the corresponding color on the legend on the right side (blue circle). With the button **plot-button** (red circle) the marked files will be assumed and compared against each other and shown in a chart.

The previous selected kind of display of the data, e. g. d_N (green circle) will then be retained for the graphical display („*differential*“, „*cumulative*“, „*statistics*“ and „*table*“). The kind of display can always be changed in the pull down menu (see figure 11) and will be effective by using the *plot-button*.

4.1.1 particle size distribution/statistics: differential

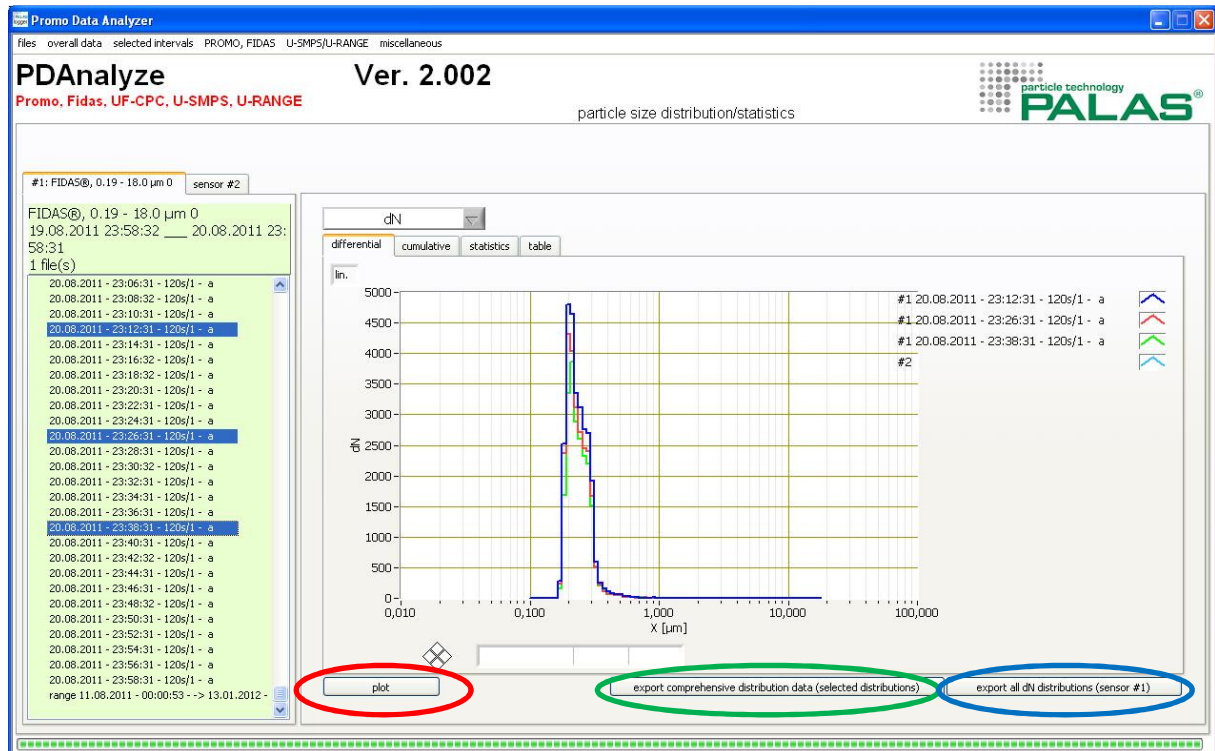


Figure 13: „*differential*“ display of the comparison of three distributions

With the button *export comprehensive distribution data (selected distribution)* (green circle) or with the button *export all d_N distributions (sensor #1)* (blue circle) the values are saved as a txt-file and can be used with other programs, e.g. Excel.

4.1.2 particle size distribution/statistics: cumulative

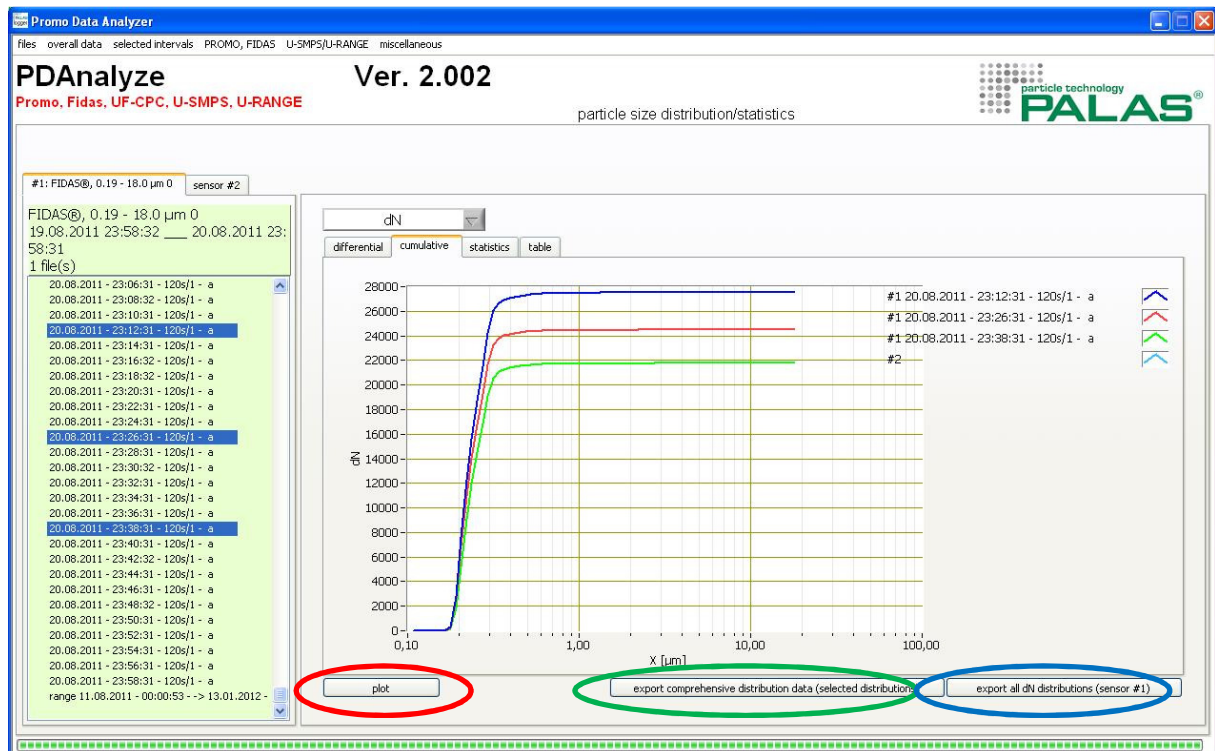


Figure 14: „cumulative“ display of the comparison of three distributions

With the button **export comprehensive distribution data (selected distribution)** (green circle) or with the button **export all dN distributions (sensor #1)** (blue circle) the values are save das a txt-file and can be used with other programs, e.g. Excel.

4.1.3 particle size distribution/statistics: statistics

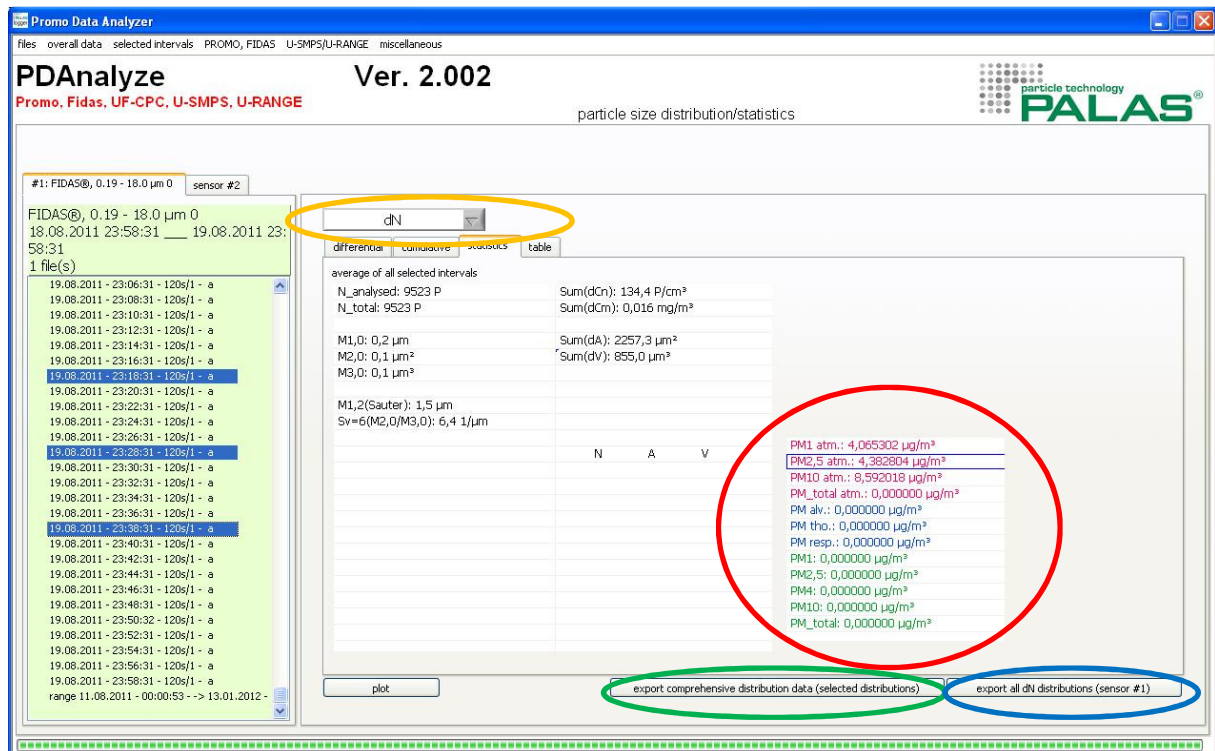


Figure 15: „statistic“ display of the comparison of three distributions

Within the statistics always the mean value of the selected files is displayed. If you measure with the Fidas[®] device the PM values will be also shown (red circle).

Always the statistical values of the selected distribution are shown. The kind of display in the above figure is dN; it can be changed at any time (see yellow circle).

With the button **export comprehensive distribution data (selected distribution)** (green circle) or with the button **export all dN distributions (sensor #1)** (blue circle) the values are saved as a txt-file and can be used with other programs, e.g. Excel.

4.1.4 particle size distribution/statistics: table

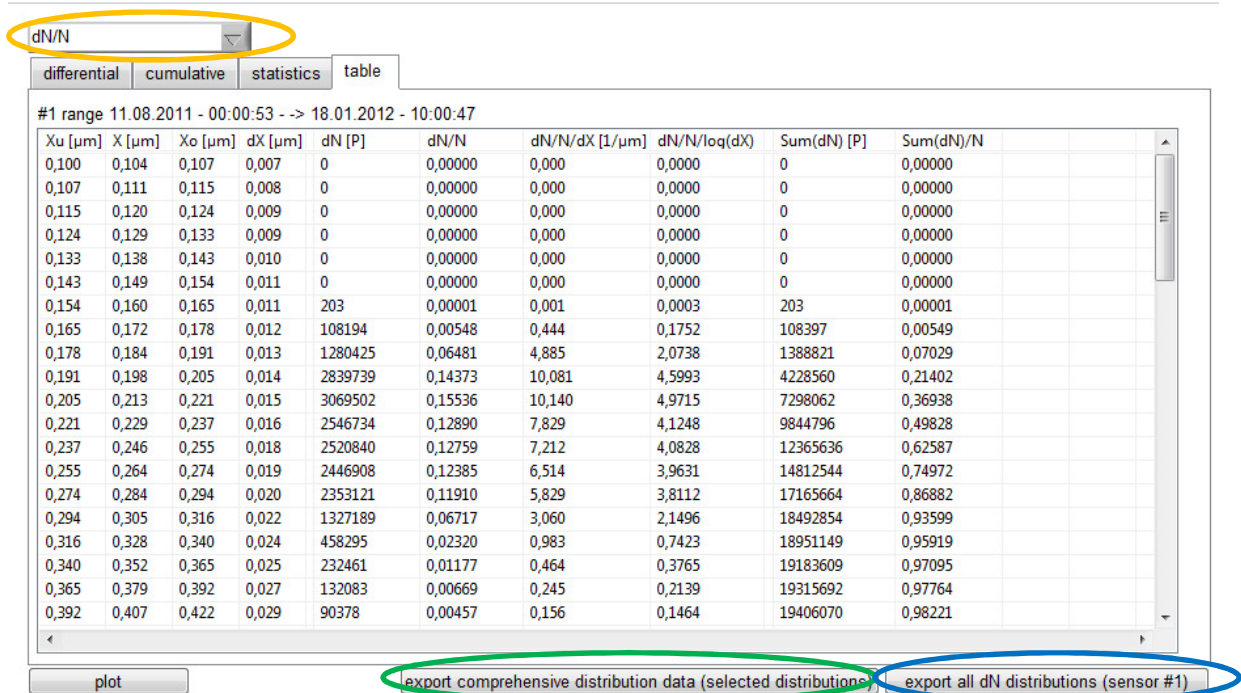


Figure 16 „table“ display of the comparison of three distributions

With this kind of display always the mean value of the selected files will be shown. The table of the selected kind of display will be shown. In this case it is dN/N; it can be changed at any time (see yellow circle).

With the button **export comprehensive distribution data (selected distribution)** (green circle) or with the button **export all dN distributions (sensor #1)** (blue circle) the values are saved as a txt-file and can be used with other programs, e.g. Excel.

4.2 „particle size distribution color plot (sensor #1)“

The menu item „particle size distribution color plot (sensor #1)“ shows the 3D graph of the distribution:

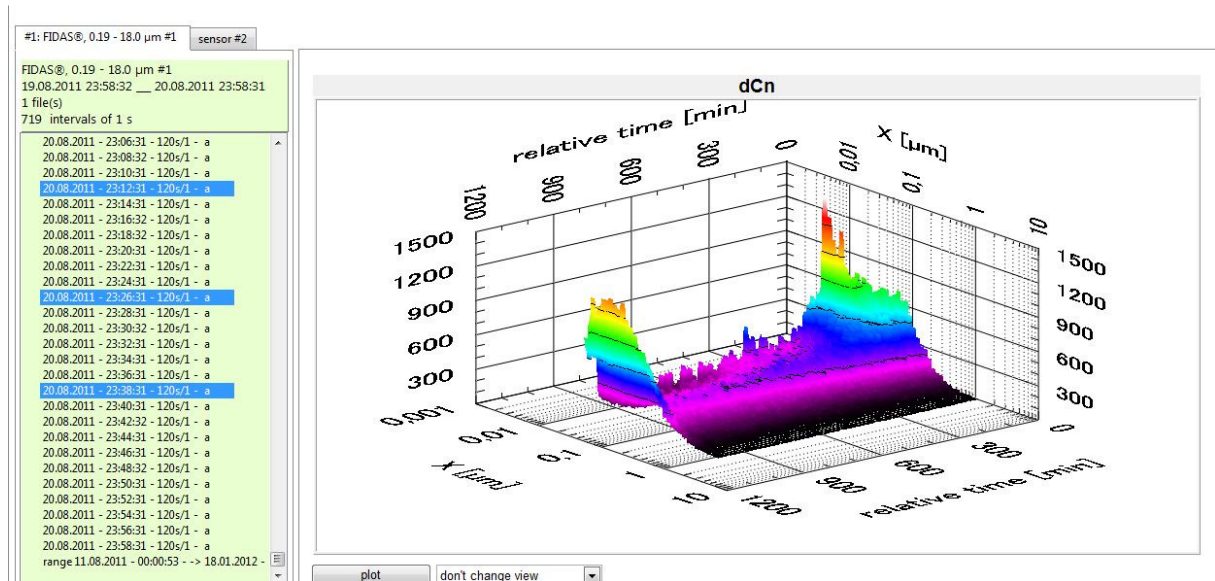


Figure 17: „selected intervals: particle size distribution – color plot (sensor #1)“

4.3 fractional efficiency:

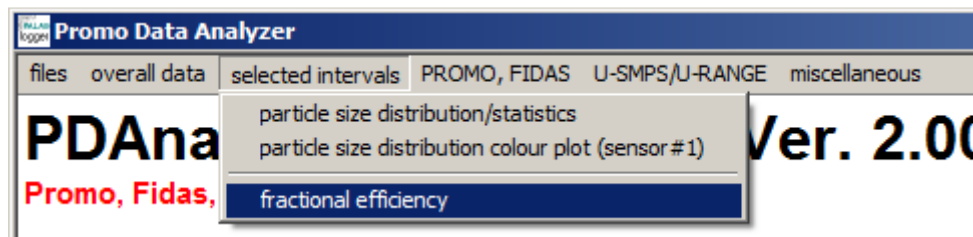


Figure 18: „selected intervals: fractional efficiency“

The menu item „selected intervals: fractional efficiency“ display the fractional efficiency curve (the efficiency over the particle size).

Selection between:

- Fractional efficiency - Timechart**
- Fractional efficiency – Timechart table**
- Fractional efficiency - efficiency**

4.3.1 Fractional efficiency - Timechart

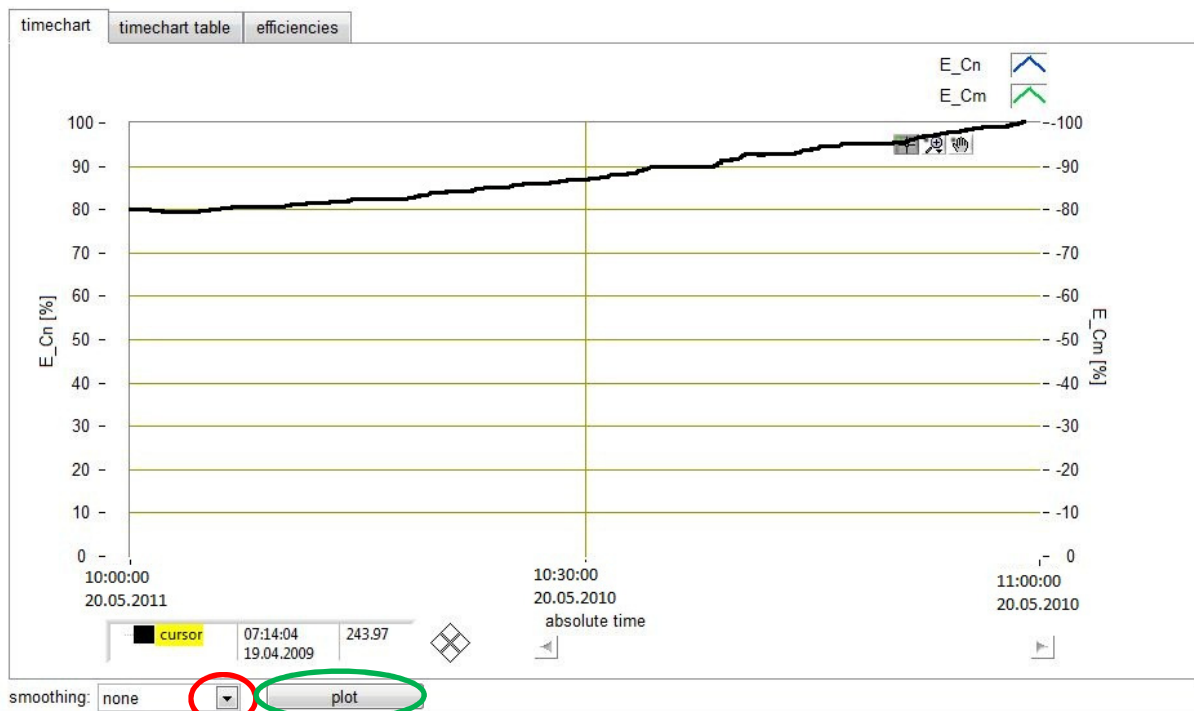


Figure 19: Display of the „fractional efficiency – time chart“

With the Plot-button (green circle) the fractional efficiency of the previous selected files will be displayed in a time chart.

With the smoothing dropdown menu (red circle), the smoothing factor can be selected (see figure 20).

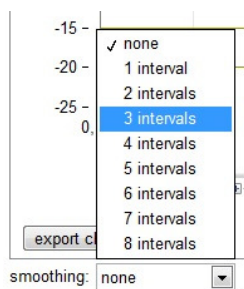


Figure 20: Smoothing factor selection

4.3.3 Fractional efficiency - efficiency

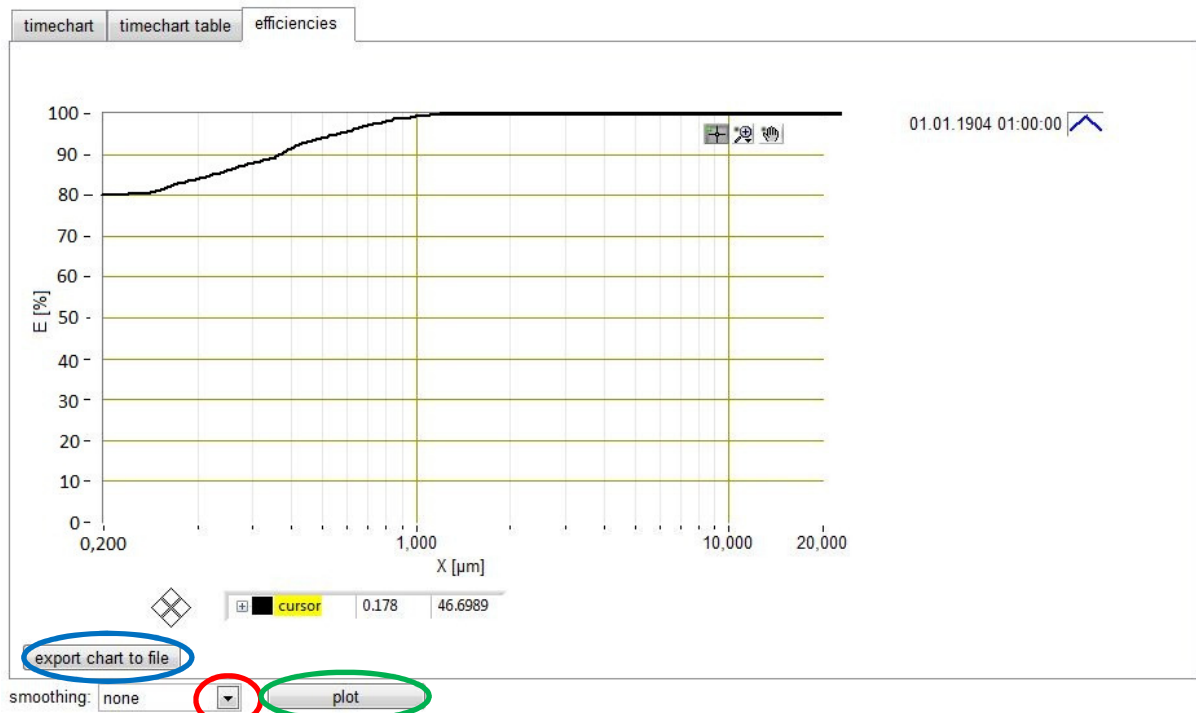


Figure 22: Display of the „fractional efficiency – efficiency“

With the Plot-button (green circle) the fractional efficiency of the previous selected files will be displayed.

With the smoothing dropdown menu (red circle), the smoothing factor can be selected (see figure 20).

With the button **export chart to file** the data are saved as a txt-file and can be used with other programs, e.g. Excel.

5 PROMO, FIDAS

“Promo, Fidas” offers the following sub-menus:

- „*Fine dust –time chart*“
- „*absolut filter system (sensor #1)*“
- „*air sensor – time chart (sensor #1)*“
- „*operating parameters – time chart (sensor #1)*“
- „*heating units –time chart (sensor #1)*“
- „*settings (sensor #1)*“
- „*raw data distribution (sensor #1)*“

5.1 „Fine dust –time chart“

The user gets the display of the PM₁, PM_{2,5} and PM₁₀ values over the time.

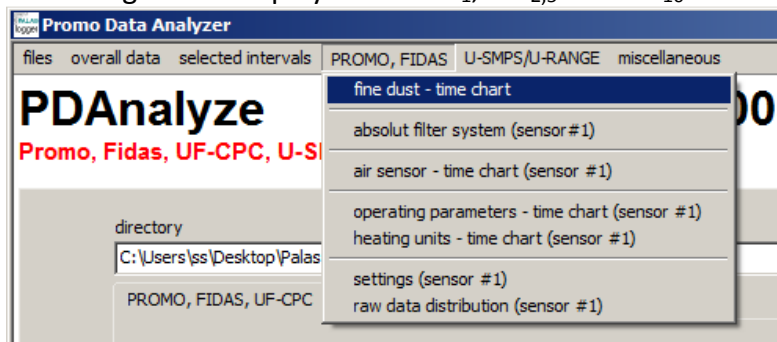


Figure 23: Promo, Fidas “*fine dust – time chart*”

Possibility to select between three different kinds of displays:

- “*atmospheric PM fine dust*”
- “*classic PM fine dust*”
- “*health related fine dust*”

The point of time of the deposit of the filter and the taking out of the filter will be marked in the chart, as a filter was inserted (therefore also see point **absolute filter**) and this was also inserted accordingly into the software. The identification of the filters is always FID (Year/Month/Day)_time(Hour/Minute)(number of sample)_In/Out, e. g. FID20090421_092223_to mean, that the Filter No. 23 on 21.04.2009 was deposited at 9.22 AM.

5.1.1 “atmospheric PM fine dust”

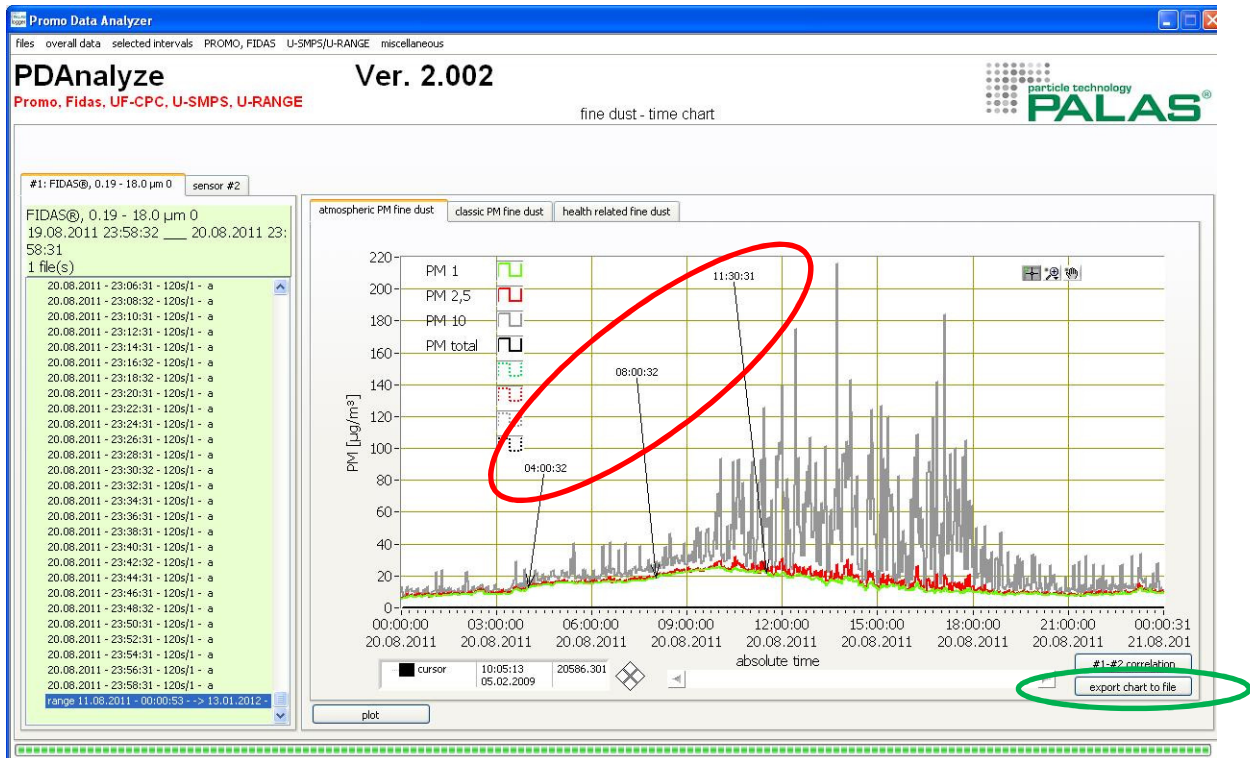


Figure 24: Display of “*fine dust - time chart - atmospheric PM fine dust*”

Display of the PM₁, PM_{2,5}, PM₁₀ and PM_{total} values over the time according to atmospheric PM fine dust evaluation algorithm, as well as the annotations (red circle) if available.

With the button “export chart to file (green circle) the graphic will be saved as a txt-file and can further be used with other programs, e.g. Excel.

5.1.2 "classic PM fine dust"

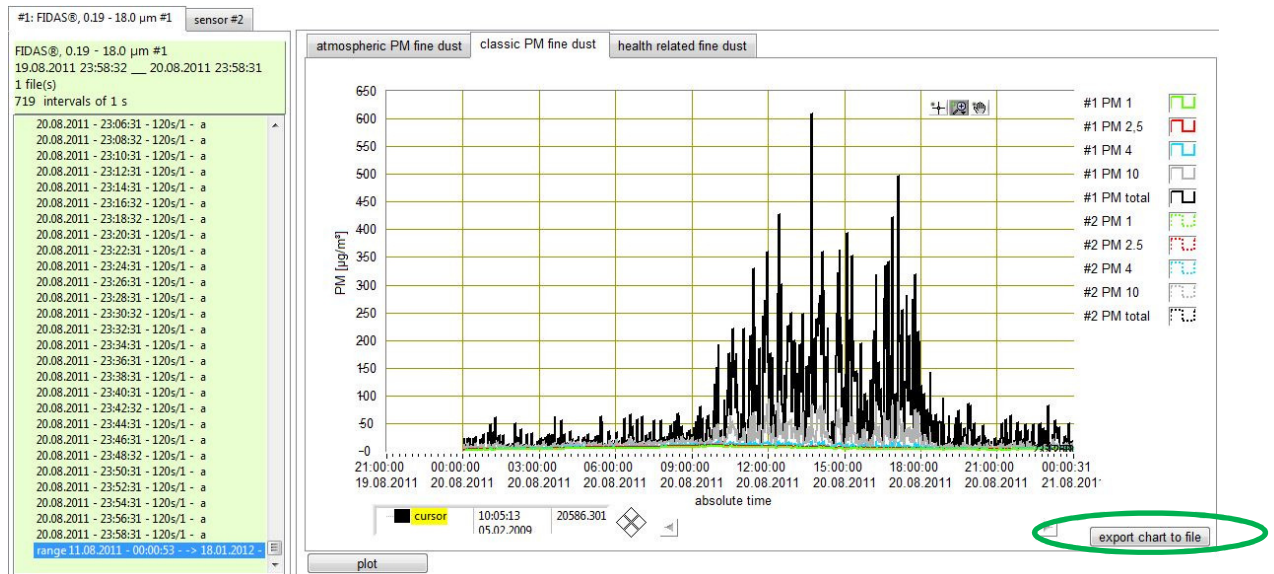


Figure 25: Display of "fine dust - time chart - classic PM fine dust"

Display of the PM₁, PM_{2,5}, PM₁₀ and PM_{total} values over the time according to **classic PM fine dust** evaluation algorithm.

With the button "export chart to file (green circle) the graphic will be save das a txt-file and can further be used with other programs, e.g. Excel.

5.1.3 "health related fine dust"

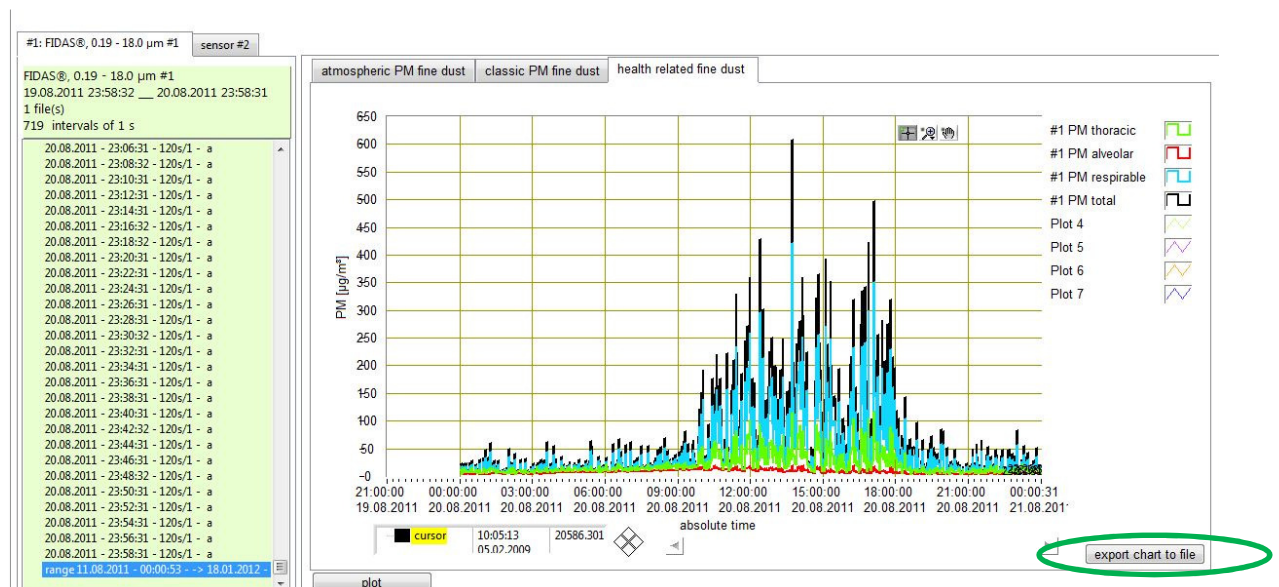


Figure 26: Display of "fine dust - time chart - classic PM fine dust"

Display of the PM₁, PM_{2,5}, PM₁₀ and PM_{total} values over the time according to **health related PM fine dust** evaluation algorithm.

With the button "export chart to file (green circle) the graphic will be save das a txt-file and can further be used with other programs, e.g. Excel.

5.2 „absolut filter system (sensor #1)“

The Fidas® systems are equipped with a „total filter“ for the gravimetric evaluation of the total mass. With the PDAnalyze software the comparison can be done between the gravimetric collected mass value and the optical measured value.

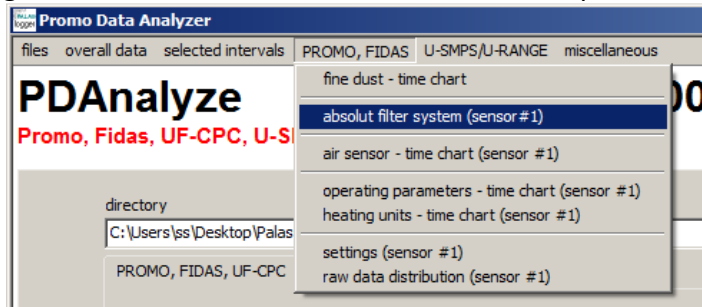


Figure 27: Selection „**PROMO, FIDAS - absolute filter system (sensor #1)**“

In order to compute the correlation between gravimetric and optical measurement, please select the appropriate files with a filter change (in/out).

After pressing the button **compute correlation for selected filter** the statistical values to the corresponding files, which are marked under distribution, are then calculated.

This computed correlation factor can then be entered in the Fidas® firmware (please see Fidas® firmware manual for details) for successive measurements.

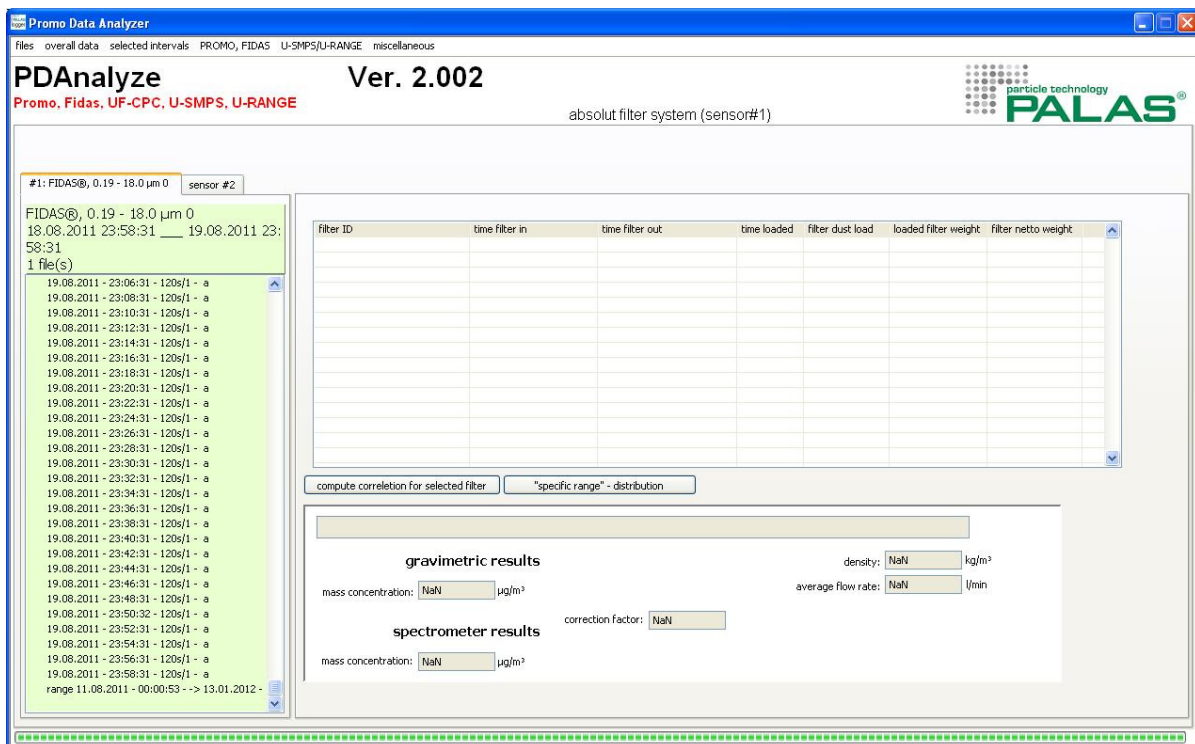


Figure 28: start screen of the menu item „**absolute filter system**“

5.3 “air sensor – time chart (sensor #1)”

At the submenu „**PROMO, FIDAS: air sensor – time chart (sensor #1)**“ the value of rel. humidity h in [%], the temperature T in [°C] and the barometrical atmospheric pressure p in [Pa] over the time will be shown in the chart.

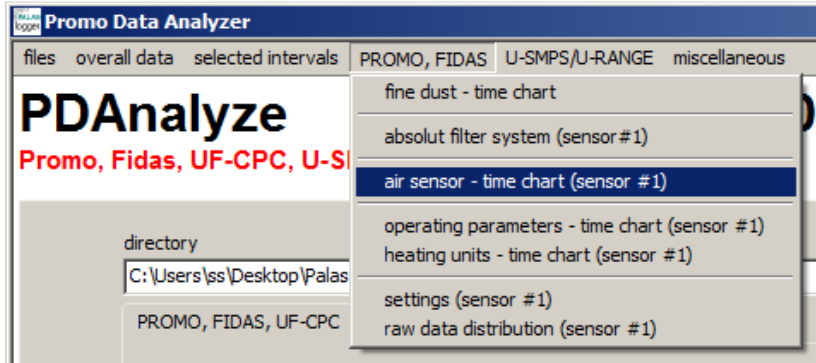


Figure 29: Selection “**PROMO, FIDAS: air sensor - time chart (sensor #1)**”



Figure 30: „**PROMO, FIDAS: air sensor - time chart**“ Display of sensor data for h , T and p

Graphical display of the chronological sequence of the relative humidity h in [%] (blue curve), the temperature T in [°C] (red curve) and the barometrical atmospheric pressure p in [Pa] (green curve).

5.4 Operating parameters – time chart

The menu item „**PROMO, FIDAS: operating parameters – time chart**“ displays the values of external sensors, e. g. particle speed.

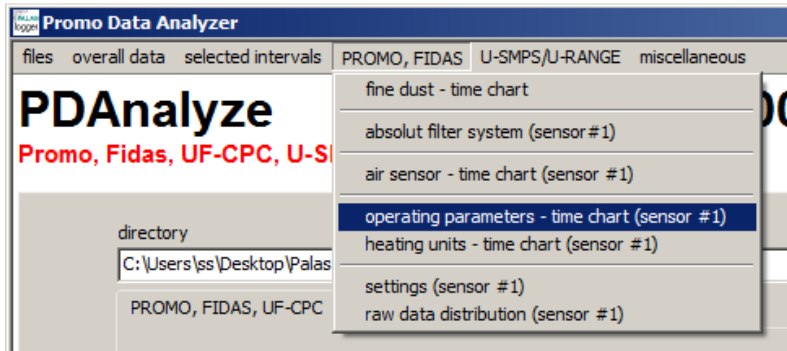


Figure 31: Selection “**PROMO, FIDAS operating parameters -time chart (sensor #1)**”

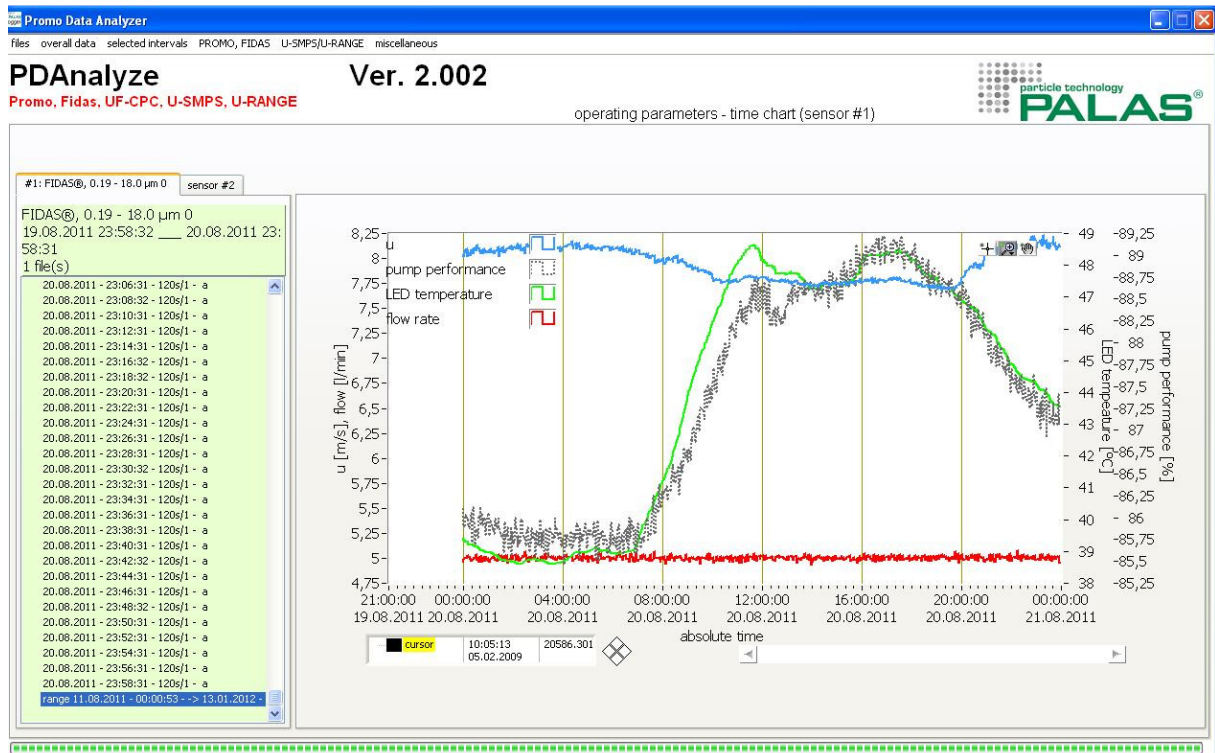


Figure 32: “**PROMO, FIDAS: operating parameters - time chart (sensor #1)**”

With this kind of display there was an external sensor for the particle speed connected. The particle speed is displayed in the blue curve over the time. The values of the suction pump are displayed in the grey curve over the time. The LED temperature is displayed in the green curve over the time. The value of the volume flow is displayed in the red curve over the time.

5.5 “heating units –time chart (sensor #1)”

The menu item „**PROMO, FIDAS: heating units – time chart (sensor #1)**“ displays the value of any external heating, for example also the IADS (Intelligent Aerosol Drying System).

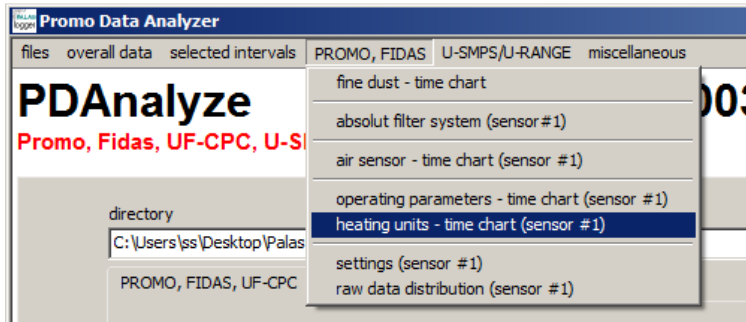


Figure 33: Selection “**PROMO, FIDAS: heating units - time chart (sensor #1)**”

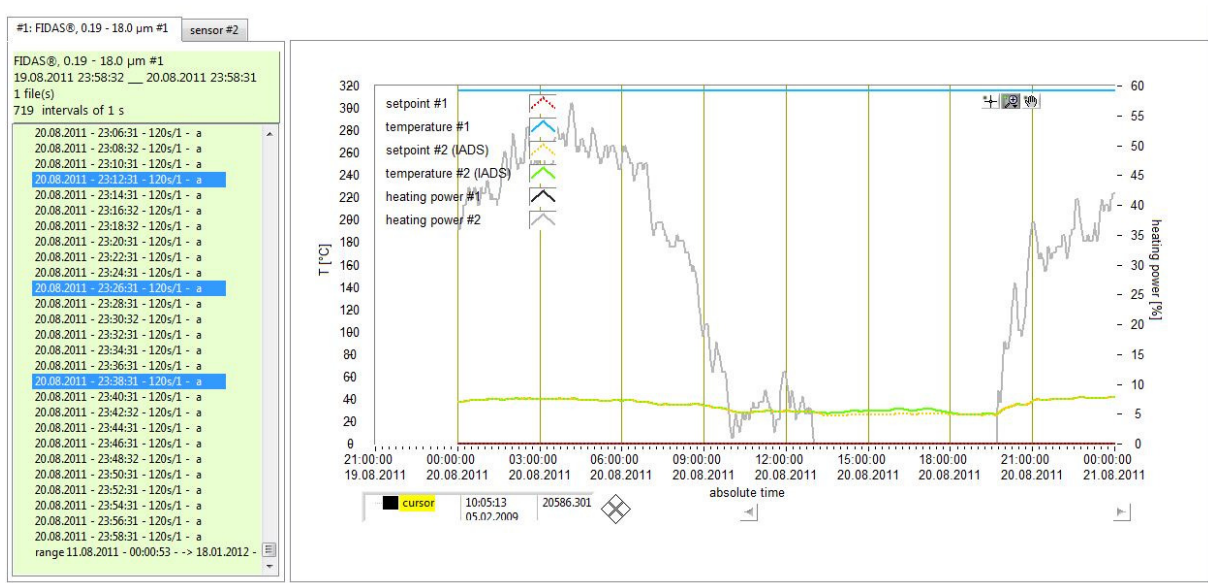


Figure 34: “**PROMO, FIDAS: heating units - time chart (sensor #1)**”

Display of the selected and the current value of temperature sensor #1, temperature #2 (IADS) and the correspondent heating temperature as a time chart.

5.6 “settings (sensor #1)”

The menu item „**PROMO, FIDAS: settings (sensor #1)**“ shows all parameters that were set and used during the measurement.

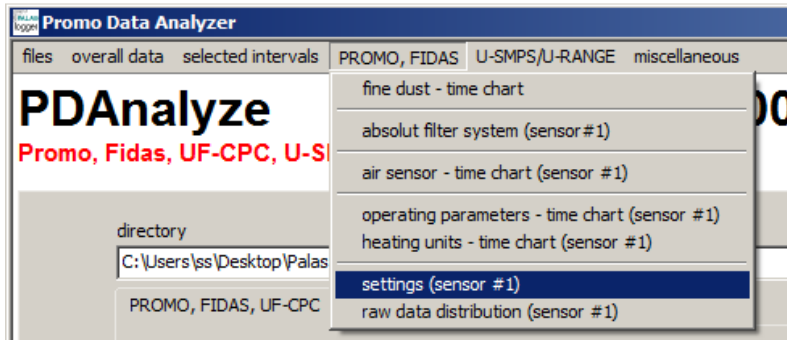


Figure 35: Selection “**PROMO, FIDAS: settings (sensor #1)**”



Figure 36: “**PROMO, FIDAS: settings (sensor #1)**”

Display of all parameters on one view, which are used for the calculation, e.g. measurement volume, temperature, volume flow and so on.

Important in this case is that the LED for the coincidence value is always green, that means the measurement is not done with coincidence error.

5.7 “raw data distribution (sensor #1)”

The menu item „**PROMO, FIDAS: raw data distribution (sensor #1)**“ display the raw data of the measurement, e.g. the particle number of the raw data channels.

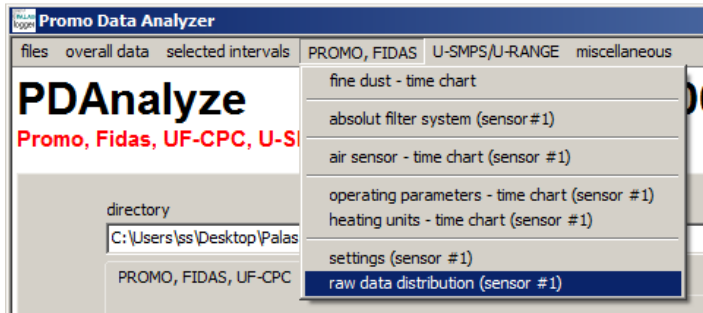


Figure 37: Selection “**PROMO, FIDAS: raw data distribution (sensor #1)**”

First of all the data has to be loaded as overall data or selected intervals and shown by pressing the plot-button. After that the raw data distribution can be shown.

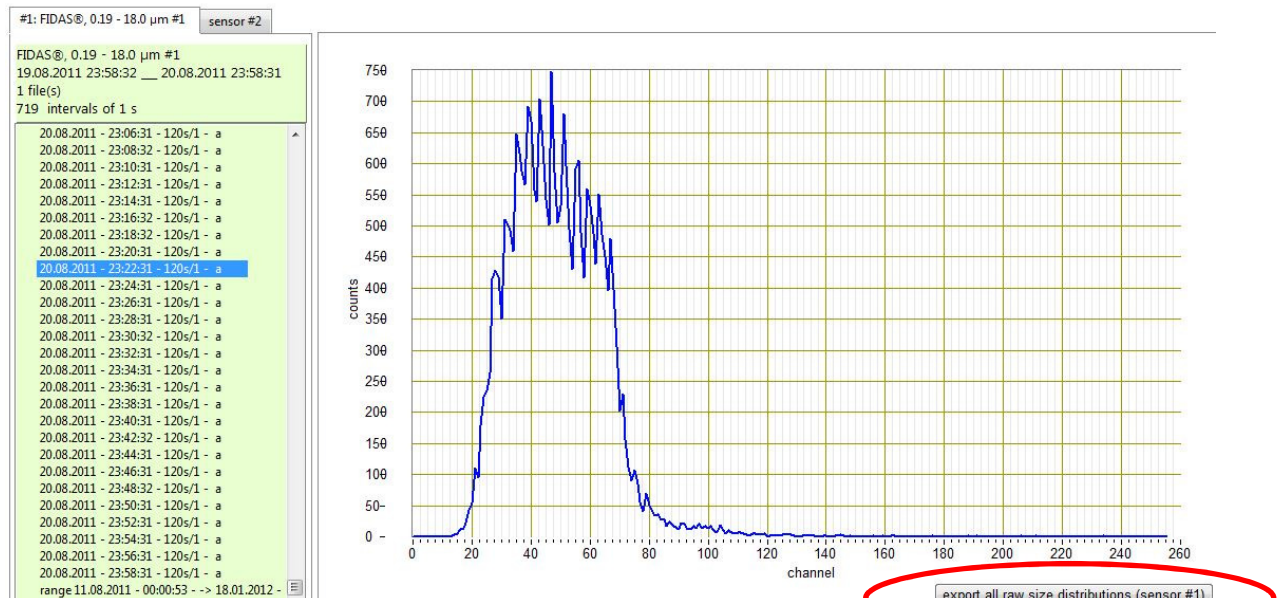


Figure 38: “**PROMO, FIDAS: raw data distribution (sensor #1)**”

With the button “**export all raw size distributions (sensor #1)**” (red circle) all the raw data values can be save das a txt-file and further be used with other programs, e.g. excel.

6 Menu-Item: U-SMPS/U-RANGE

This menu item provides extended information about the scan process of the U-SMPS. This information is only accessible if the measurement was performed with a U-SMPS or the U-RANGE.

Note: This extended information is only available for data that are imported under sensor #1 (see 2. Menu-Item: files -> select files for more information).

This extended information is categorized as follows:

UP-/DOWN-scan comparison if an up-/down-scan (averaging) was performed the two scans are averaged to yield one particle size distribution. Here both scans as well as the averaged particle size distribution are shown. If only an up-scan (scan from smallest to largest particle size) or down-scan was performed only this is shown.

Settings This lists parameters that were used during the scan, especially “aerosol properties”, “scanning procedure”, “DEMC properties” and an optional comment.

Operating parameters This is a graphical display of the sheath air flow rate, temperature, and relative humidity, the impactor pressure, and the sample air temperature and flow rate.

6.1 “UP-/DOWN-scan comparison (sensor #1)”

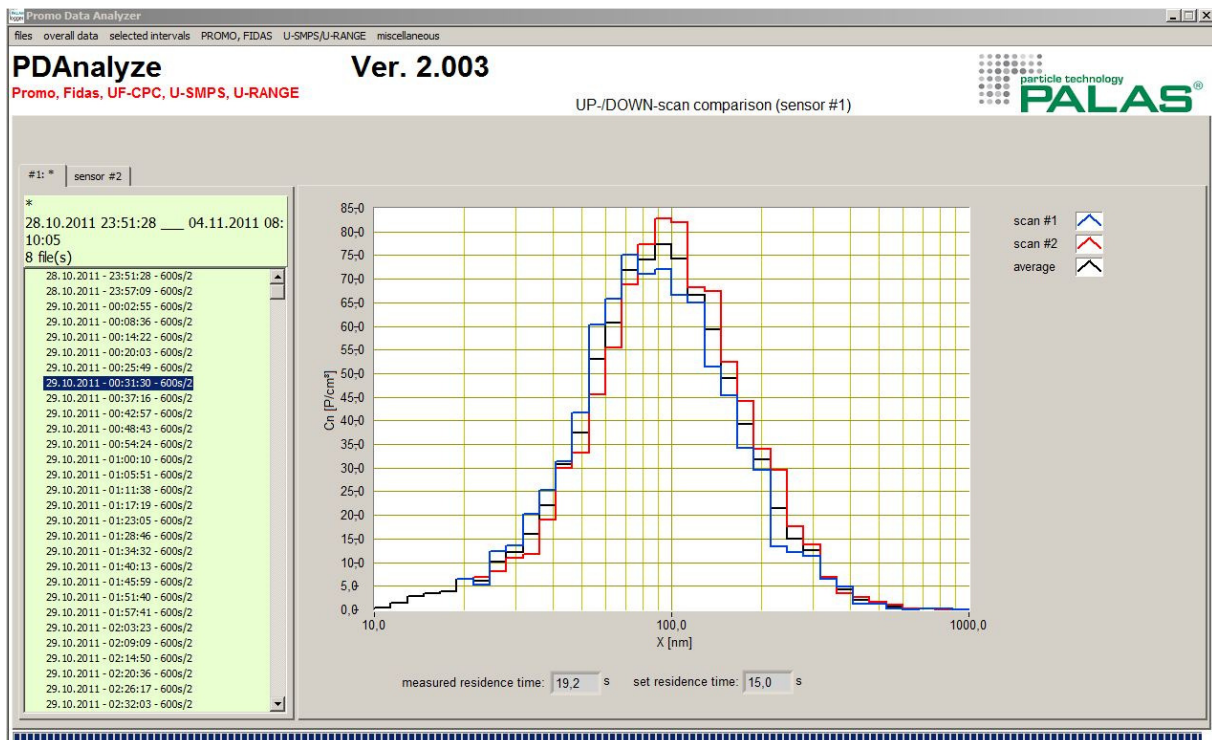


Figure 39: “UP-/DOWN-scan comparison (sensor #1)”

If a measurement was performed with the setting “Up- and DOWNSCAN (averaging)” - which is also indicated by the /2 in the file list – this screen shows the combined (black) as well as the single up-scan (blue) and single down-scan (red). At the bottom it also shows the measured residence time and the set and used residence time.

6.2 “settings (sensor #1)”

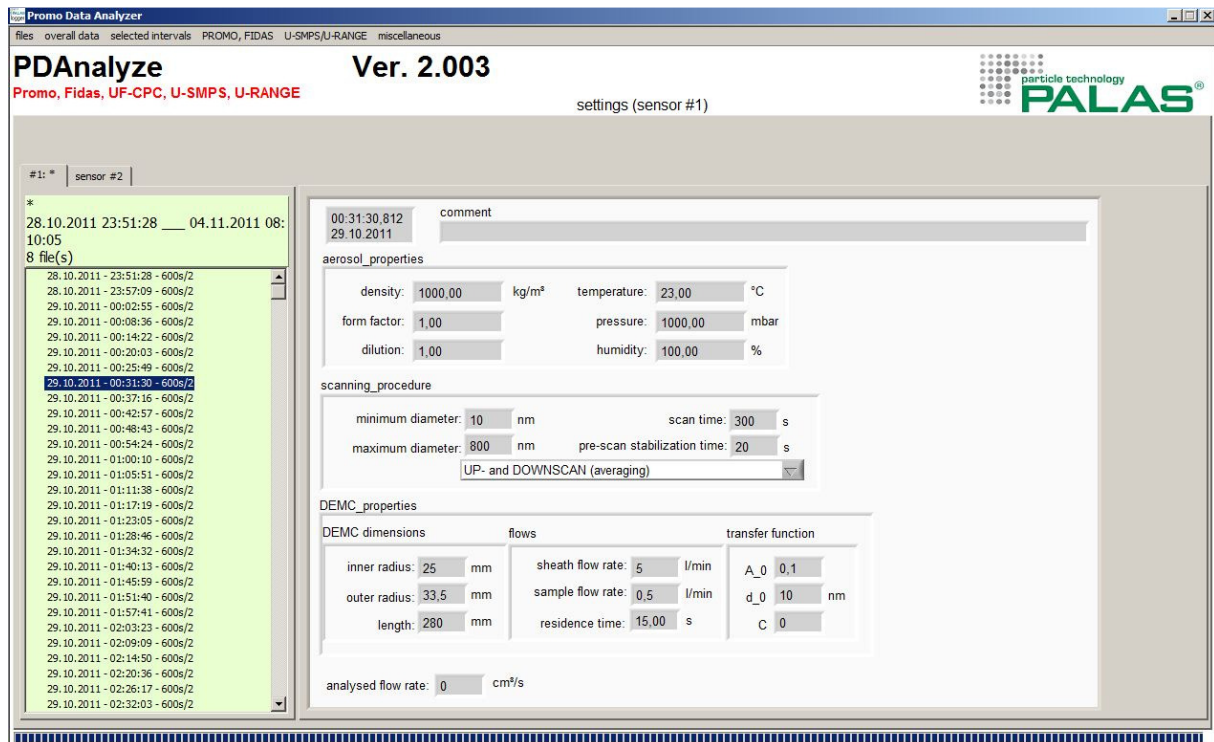


Figure 40: “settings (sensor #1)” – list of parameters

Here you see a list of parameters that were used during the scan, especially “aerosol properties”, “scanning procedure”, “DEMC properties” and an optional comment.

6.3 “operating parameters (sensor #1)”

This is a graphical display of the sheath air flow rate, temperature, and relative humidity, the impactor pressure, and the sample air temperature and flow rate.

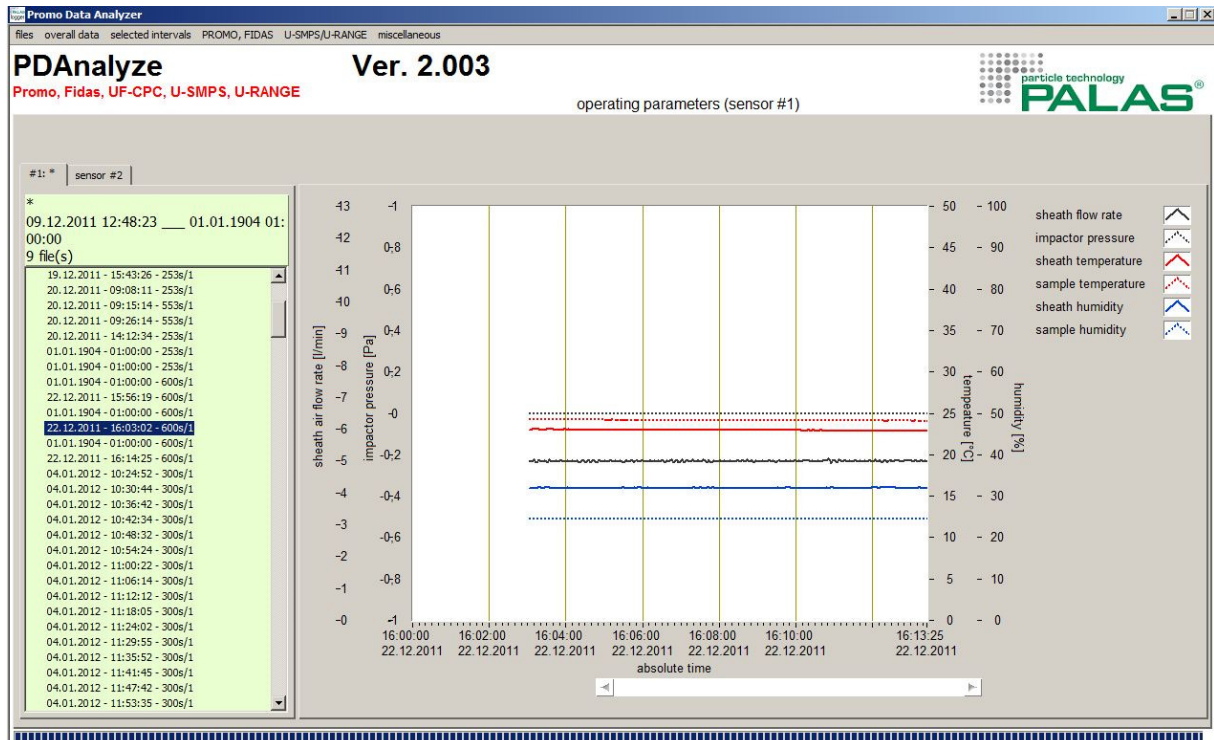


Figure 41: "operating parameters (sensor #1)"

7 Menu-Item: miscellaneous

The menu item „*miscellaneous*“ has two sub-menus:

- „*comment*“
- „*annotations*“



Figure 42: „*miscellaneous*“

7.1 Comments

With „*comments*“ it is possible to write comments during a measurement, e. g. the time when a filter was inserted or something like that.



Figure 43: Selection “*miscellaneous: comments*“

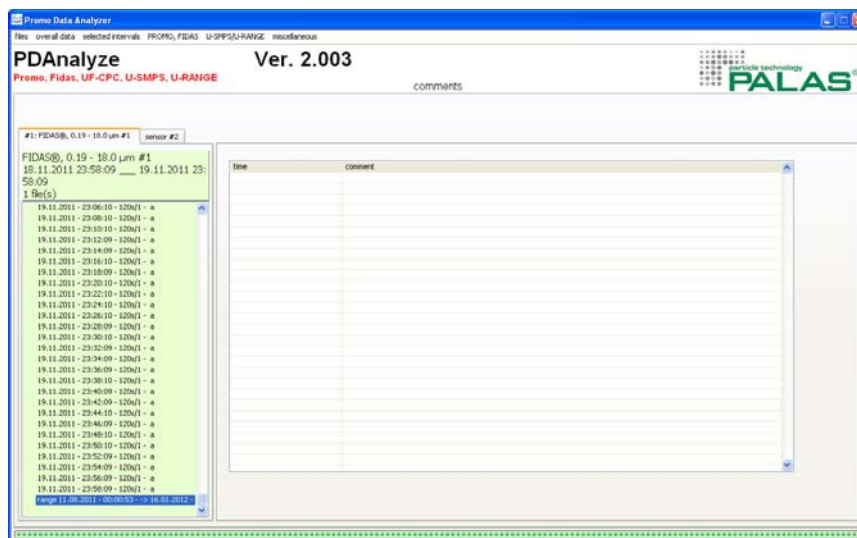


Figure 44: Selection “*miscellaneous: comments*“ (without comments)

7.2 Annotations

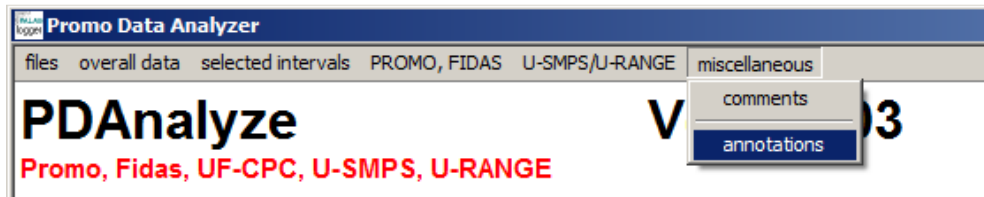


Figure 45: Selection “miscellaneous: annotations”

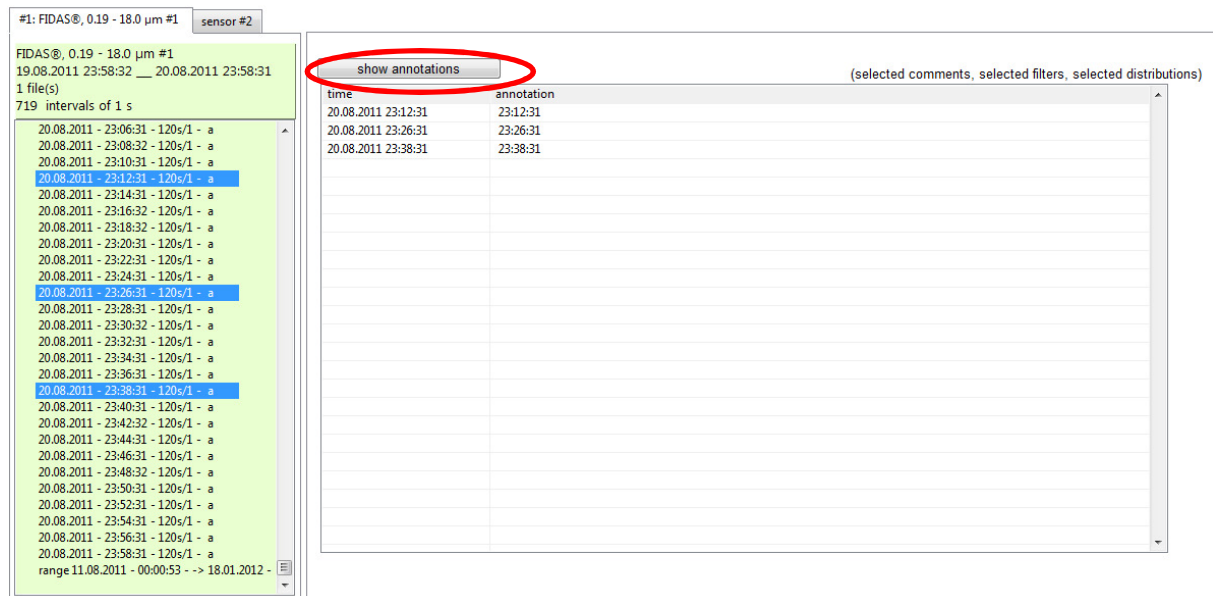


Figure 46: “miscellaneous: annotations”

By pressing the button **annotations** (red circle), all the explanations with date and time stamp are shown in the table below, as well as in the graphical displays of the different time charts (see for example figure 6 and figure 23).

8 Appendix

8.1 Steps to display a particle size distribution that was measured with the U-SMPS

1. **Files -> select files** click on the yellow folder symbol to define the folder in which the data files reside
2. **Files -> select files** select the “distribution type” i.e. the data you want to use, e.g. the “inverted & diffusion corrected” data or the “raw data”
3. **Files -> select files** select the data files you want to analyze under “files”
4. **Files -> select files** import the data into the software using e.g. “data import sensor #1 or downstream”
5. **Selected intervals -> particle size distribution/statistics** select the measurement(s) for analysis and display in the list of measurements on the left (Note: the last entry in this list covers the full range of listed measurements)
6. **Selected intervals -> particle size distribution/statistics** select the desired plot (e.g. dC_n/C_n) that is then shown. After any changes press “plot” to redraw the graph.

8.2 Steps to display PM values vs. time measured with the Fidas®

1. **Files -> select files** click on the yellow folder symbol to define the folder in which the data files reside
2. **Files -> select files** select the data files you want to analyze under “files”
3. **Files -> select files** select the sensor (e.g. Fidas® 0.19 – 18.0 μm #1) under sensor(s)!
4. **Files -> select files** import the data into the software using e.g. “data import sensor #1 or downstream”
5. **PROMO, FIDAS -> fine dust – time chart statistics** select the measurement(s) for analysis and display in the list of measurements on the left (Note: the last entry in this list covers the full range of listed measurements)
6. **PROMO, FIDAS -> fine dust – time chart statistics** after any changes press “plot” to redraw the graph.

TIP: non-wanted PM-fractions can be turned invisible by clicking on the square showing the colour of the plot and selecting the colour transparent (T).