GSR QC Analysis Tool
Individual Evaluation of GSR PT Samples Quick Guide

Online application for the automatic analysis of GSR PT samples

In cooperation with the ENFSI expert working group Firearms/GSR

Expert Working Group
Firearms / GSR

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1   Introduction

GSR QC Analysis Tool – Individual Evaluation of GSR PT Samples – Quick Guide provides a web tool for the automatic online evaluation of quality control measurements of the standard GSR Proficiency Test samples from the years 2010 to 2024 as well as of the PLANO-Standard (W 2016). The website address is **https://gsr-ie.quodata.de/**.

Once you have imported your data, a dynamic chart is provided which allows an individual analysis and a specific examination of the measurement by means of several available selection criteria like the particle classification.

After completion of the respective GSR PT, your results will also be provided as a PDF report which includes:

- A chart of the detected particles
- An overview of the number of correctly detected particles
- A z score evaluation of the corresponding GSR PT
- A plot of the detection capability

The PDF report cannot be only be made available earlier, as the results from the proficiency test are incorporated in the results presented in the PDF report.

2   Registration

If you participate in one of the annually PTs announced on

      https://quodata.de/gsr-quality-scheme

you will automatically receive your username and an initial password by email.

3   Login

First, please go to the website **https://gsr-ie.quodata.de/**. Here, you can enter the user name and password that were sent to you. Then click on the button *Login*.

Figure 1:   **Registration as a user of the GSR QC Analysis Tool**

For security reasons, the first time you log in you will be asked to change your password. The password can be changed anytime by selecting the item *My Account* from the navigation bar and following the instructions.

In case you forgot your password, please contact forensics-pt@quodata.de.

4 Data import

Once you are logged in, the user interface will look like the start screen depicted in Figure 2. In the header line, your user name as well as the number of your remaining evaluations is displayed.
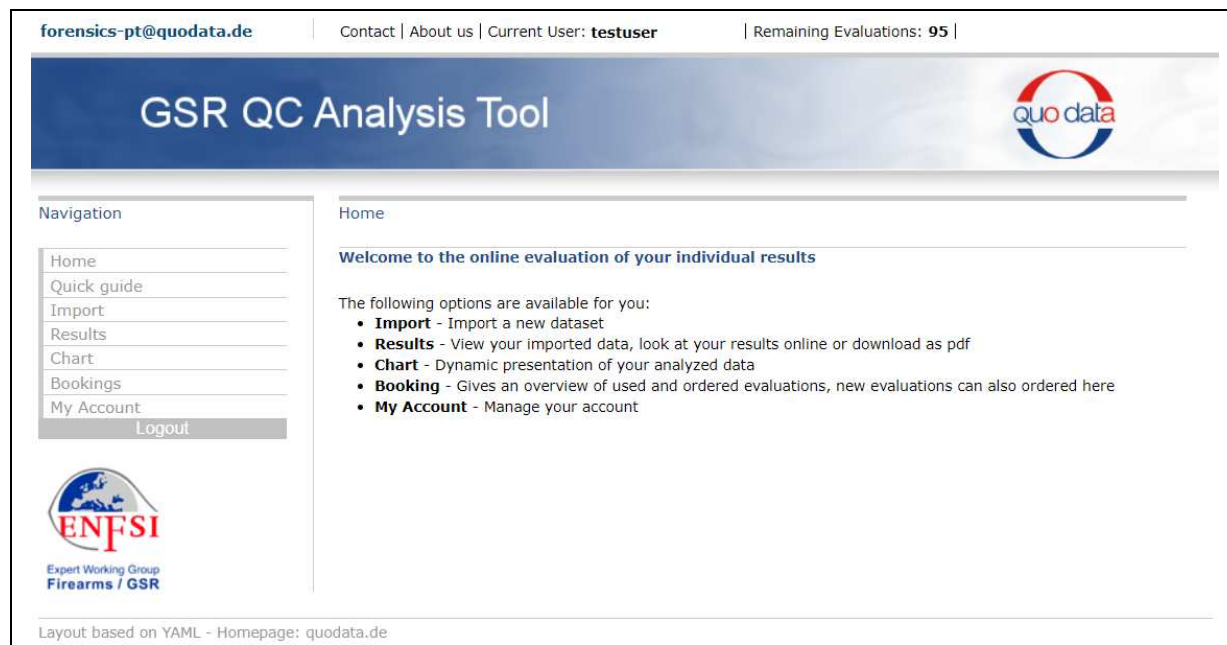
Figure 2:   **Start screen of GSR PT Sample – Individual Evaluation**

Please start the import by **clicking** on the **button *Import*** on the navigation bar on the left. Then perform the following steps to submit your data to the webserver:

1. **Select** the relevant **GSR PT**, e.g. GSR2020, from the dropdown menu and click ***Next***.

2. **Choose** the **sample code** and click ***Next***.

3. **Enter** a **dataset name** and click ***Next***.

4. Did you use a **FEI-GSR** (EDAX based) system? **Choose the respective option** and click ***Next***.
    For the analysis of data obtained with a FEI-GSR (EDAX based) system, the stage data as well as the beam data must be imported. Otherwise, only stage data will be taken into the analysis.

5. An empty input field appears for you to copy your test results into it. The data should be submitted by means of **Copy and Paste** from a tab-delimited file (we recommend MS Excel). The following data are mandatory:

    - Measured size of the particles (ECD, diameter, in μm)
    - Classification of the particles
    - <u>Not</u> using a FEI-GSR (EDAX based) system: absolute X and Y coordinates
    - Using a FEI-GSR (EDAX based) system:
        - Stage X and Stage Y coordinates
        - Beam X and Beam Y coordinates

The Feature ID can be imported optionally.

Please complete the data import by clicking **Next**.

6. **Assign your data** to the labels in the dropdown menus.
   The following labels are available (depending on the option chosen in step 4)
   - not using FEI-GSR (EDAX based) system:
     [X], [Y], [Diameter], [FeatureID] and [Class]
   - using FEI-GSR (EDAX based) system:
     [Stage X], [Stage Y], [Beam X], [Beam Y], Diameter], [FeatureID] and [Class]

   For columns containing neither mandatory information nor the featureID, leave the selection at [Ignore].
   If the first row of your data contains the copied headers from your original data, it will be excluded during import automatically.
   Please complete the assignment of your data by clicking **Next**.

7. **Assign the various imported classes to** the three classifications **Characteristic, Consistent,** or **Other** according to the following scheme:

Classification Name	Characteristic	Consistent	Other
Sb/Ba/Pb	◉		
Pb/Ba		◉	
Pb/Sb		◉	
Ba/Sb		◉	
Ba			◉
Pb			◉
Sb			◉
Other			◉

   - *Characteristic:* Particles containing at least ALL THREE elements Pb/Ba/Sb, typical of GSR particles. Also particles containing additional elements like Sn are characteristic.
   - *Consistent:* Particles containing TWO of the THREE elements typical of GSR particles, i.e. Pb/Ba, Pb/Sb or Ba/Sb.
   - *Other:* All remaining particles on the sample. Those particles will not be considered in the evaluation.

   You must assign at least one of your classes to either *Charateristic* or *Consistent*.
   Please confirm the assignment of the classes by clicking the button **Next**.

8. Your data are now presented in tabular form. Please ensure that
   - your data are complete,
   - column assignments are correct (correct column headers chosen),

- class assignments are correct.

If you click **Next**, your data will be imported and analyzed automatically, and **corrections will not be possible any longer**.

In case corrections of data or assignments are necessary, all import steps need to be repeated, and your account will be charged again for the subsequent analysis.

Examples for the import steps 5, 6, 7 and 8 can be found in Figure 3 (for analysis NOT using FEI-GSR) and in Figure 4 (for analysis with FEI-GSR), respectively.

Example for the import of data in case of <u>not</u> using a FEI-GSR (EDAX based) system

Import of absolute X and Y coordinates only

Step 5 – Data input

Step 5 - Paste data in the field below:

Id	Subclass			Class	ECD (µm)
Stage X	Stage Y				
1	Sb	Ba	Pb	SbBaPb	53,38476751
11,1000492		-17,1524819			
2	Sb	Ba	Pb	SbBaPb	1,99817458
11,15399159		-17,09384662			
3	Sb	Ba	Pb	SbBaPb	1,99817458
17,35363674		-16,96763453			
4	Sb	Ba	Pb	SbBaPb	53,28584485
17,4127686		-17,02298876			

Step 6 – Assignment of labels

Step 6 - Assign columns:

Select the corresponding datafields for the columns. If the column does not match, select [Ignore].

FeatureID ⌄	[IGNORE] ⌄	Diameter ⌄	X ⌄	Y ⌄
Id	[IGNORE]	ECD (µm)	Stage X	Stage Y
1	X	53,38476751	11,1000492	-17,1524819
2	Y	1,99817458	11,15399159	-17,09384662
3	Diameter	1,99817458	17,35363674	-16,96763453
4	FeatureID	53,28584485	17,4127686	-17,02298876
5	Class	1,510478004	14,34114091	-16,63760887
6	SbBaPb	1,412922796	14,55634323	-16,6274402

Step 7 – Assignment of classes

Step 7 - Define classification:

Classification Name	Characteristic	Consistent	Other
SbBaPb	●	○	○
Cu	○	○	●
Pb	○	○	●
PbSb	○	●	○
Other	○	○	●
SbBaPbSn	●	○	○
CuZn	○	○	●

Step 8 – Overview of data to be imported

Step 8 - Confirm data:

If you press next, your measurement will be imported. Afterwards, corrections cannot be made any longer.

X	Y	ECD	Feature ID	Class	Assignment Class
11.1000492	-17.1524819	53.38476751	1	SbBaPb	Characteristic
11.15399159	-17.09384662	1.99817458	2	SbBaPb	Characteristic
17.35363674	-16.96763453	1.99817458	3	SbBaPb	Characteristic
17.4127686	-17.02298876	53.28584485	4	SbBaPb	Characteristic
14.34114091	-16.63760887	1.510478004	5	SbBaPb	Characteristic
14.55634323	-16.6274402	1.412922796	6	SbBaPb	Characteristic
11.57782999	-16.21825826	1.06806924	7	SbBaPb	Characteristic

Figure 3: Example for the import of data in case of not using a FEI-GSR (EDAX based) system

Example for the import of data in case of using a FEI-GSR (EDAX based) system
Import of Stage X and Stage Y data as well as of Beam X and Beam Y data

Step 5 – Data input

Step 5 - Paste data in the field below:

```
Feature Area     Field    Rank     Beam X (pixels) Beam Y (pixels) ECD
(μm)     Stage X (mm)    Stage Y (mm)
1        Rectangle1    1        GSR Charac.    1045,5  229,5
51,23573685     59,93860626      56,09111786
2        Rectangle1    1        GSR Charac.    845,5   653,5
2,083288908     59,98897552      56,19881058
3        Rectangle1    9        Unclassified   1591    450,5
2,102850676     63,95521927      56,15992355
4        Rectangle1    13       GSR Charac.    605     672,5
51,28446198     66,28259277      56,22376633
```

Step 6 – Assignment of labels

Step 6 - Assign columns:

Select the corresponding datafields for the columns. If the column does not match, select [Ignore].

▼	Class ▼	X-Beam ▼	Y-Beam ▼	Diameter ▼	X-Stage ▼	Y-Stage ▼
	[IGNORE] X-Stage Y-Stage X-Beam Y-Beam Diameter FeatureID **Class**	Beam X (pixels)	Beam Y (pixels)	ECD (μm)	Stage X (mm)	Stage Y (mm)
		1045,5	229,5	51,23573685	59,93860626	56,09111786
		845,5	653,5	2,083288908	59,98897552	56,19881058
		1591	450,5	2,102850676	63,95521927	56,15992355
		605	672,5	51,28446198	66,28259277	56,22376633
		825	1076,5	2,003132105	66,22647095	56,32603836
		178,5	1042,5	0,286161751	60,67617798	56,68897247
	GSR Charac.	671	1503,5	2,063541651	62,62827682	56,81246185

Step 7 – Assignment of classes

Step 7 - Define classification:

Classification Name	Characteristic	Consistent	Other
GSR Charac.	●	○	○
Unclassified	○	○	●
GSR Cons.	○	●	○
GSR Elements	○	○	●

Step 8 – Overview of data to be imported

Step 8 - Confirm data:

If you press next, your measurement will be imported. Afterwards, corrections cannot be made any longer.

X-Stage	Y-Stage	X-Beam	Y-Beam	ECD	Feature ID	Class	Assignment Class
59.93860626	56.09111786	1045.5	229.5	51.23573685	1	GSR Charac.	Characteristic
59.98897552	56.19881058	845.5	653.5	2.083288908	2	GSR Charac.	Characteristic
63.95521927	56.15992355	1591	450.5	2.102850676	3	Unclassified	Other
66.28259277	56.22376633	605	672.5	51.28446198	4	GSR Charac.	Characteristic
66.22647095	56.32603836	825	1076.5	2.003132105	5	GSR Charac.	Characteristic
60.67617798	56.68897247	178.5	1042.5	0.286161751	6	GSR Charac.	Characteristic
62.62827682	56.81246185	671	1503.5	2.063541651	7	GSR Charac.	Characteristic

Figure 4:   Example for the import of data in case of using a FEI-GSR (EDAX based) system

5   Data analysis

After clicking *Next* in step 8 of the import, the data analysis starts automatically, and you will be redirected to the results page. **This page can also be opened manually by clicking on the item *Results* in the navigation bar on the left.**

Here you will find the current processing stage of your dataset in the first line (example in Figure 5). The following terms are used:

- *Queued* means that the analysis has not started yet, but is in the queue
- *Working* means that the analysis of your data is running
- *Finished* means that the analysis is finished and the results can be viewed

Please note that the calculation of your data may require up to a few minutes due to the optimization algorithms involved, especially in case of a large number of detected particles.

Results

Your data is being evaluated at the moment.

Dataset	Chart	Report	Status		Action	
analysis #5	chart	PDF	Working		Restart	x
analysis #4	chart	PDF	Finished		Restart	x
analysis #3	chart	PDF	Finished		Restart	x
analysis #2	chart	PDF	Finished		Restart	x
analysis #1	chart	PDF	Finished		Restart	x

Figure 5:   **Results page**

By clicking on the name of the data set, you will be able to view the respective imported data set and to rename it if necessary.

6   Results and presentation of data

6.1   Dynamic chart

A dynamic chart of your data is available by clicking on the item *Chart* on the navigation bar. Alternatively, you can also find the dynamic chart by clicking on the item *Results* on the navigation bar, and then on the hyperlink *Chart* in the row of the respective dataset.

There are the three dropdown menus in the upper left corner of the chart window (see also Figure 6):

1. **Dataset**: Select the dataset you would like to view from the dropdown menu.
2. **Classification**: Select the class of submitted particles which shall be visualized (*Characteristic*, *Consistent*, *Characteristic & Consistent*, or [*All*]). These particles are shown as black diamonds.
3. **Detection**: Select the actual positions of

    *   all particles – [*All*]
    *   the particles you did not detect – *no detection*
    *   the particles you detected once – *single detection*
    *   or the particles you detected more than once – *multiple detection*

    which shall be shown in the diagram. These particles are shown as dots colored according to their size.

By clicking on the items in the legend below the chart, the measurement data or particles of a specific size can be deselected and will not be shown in the chart anymore. By clicking on deselected (grey) legend items, they can be reactivated and will again show up in the chart.

You can print or save an image (PNG, JPG or SVG vector file) of the chart with the current settings by clicking on the symbol ≡ in the upper right corner of the diagram (green circle in Figure 6), selecting the desired printing or saving option.

In addition, by moving the mouse over the chart, you can visualize the submitted data for each particle (mouse pointer on center of black diamond; example in grey box in Figure 6) or the actual particle properties (mouse pointer on center of colored dot).

In the upper right corner of the chart window, the number of your detected particles against the counts of particles present in the sample is given – depending on the particle size.
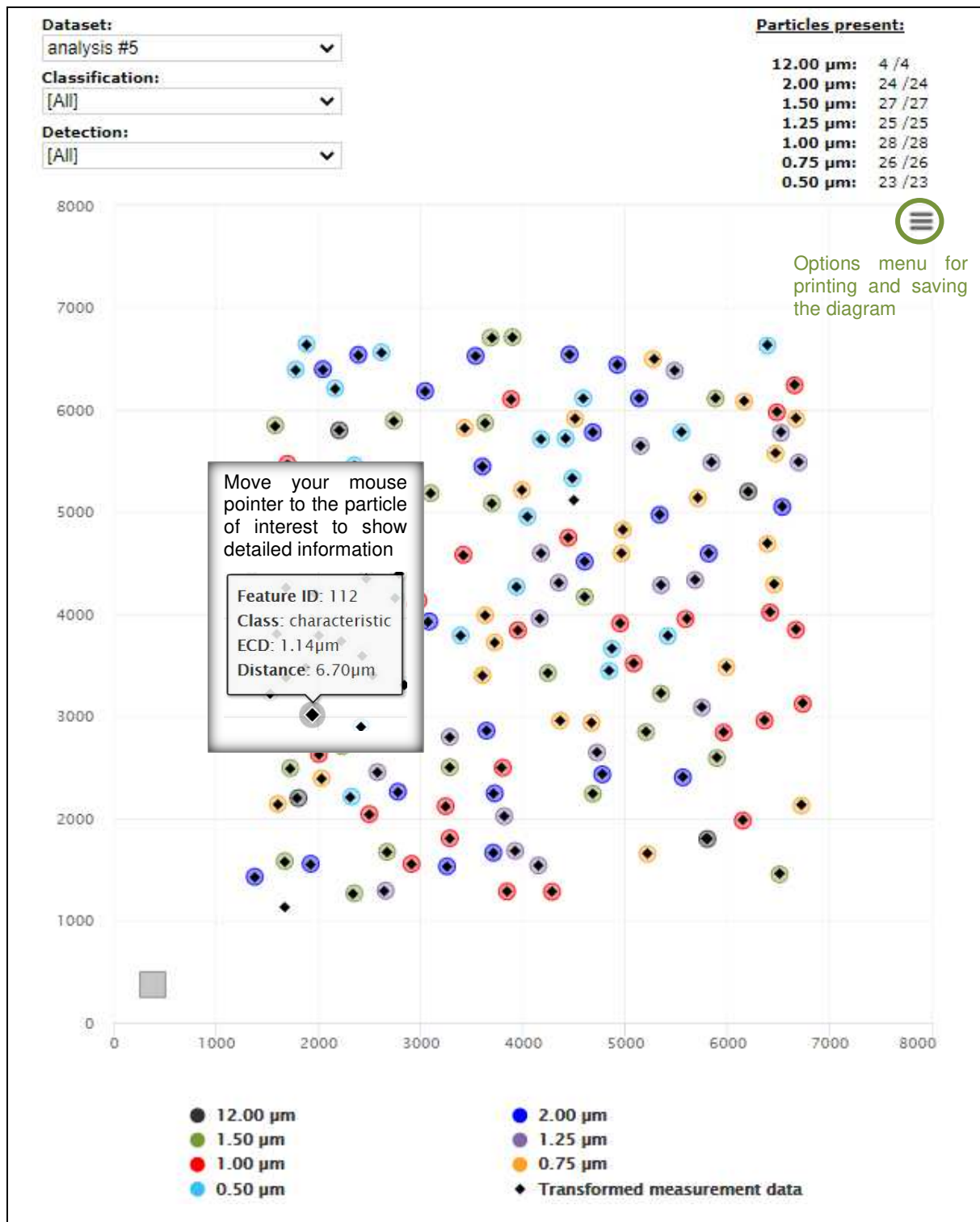
Figure 6:   **Example for the dynamic chart and its functions**

6.2   PDF report

After completion of the respective GSR PT, your individual results will also be provided as a PDF report.

It is accessible by clicking on the item *Results* on the navigation bar, and then on the hyperlink *PDF* in the row of the respective dataset.

The PDF includes

- a chart (similar to the exemplary dynamic chart in Figure 6) showing
    - the actual position and size of all particles in the sample
    - as well as the position of the detected particles classified as characteristic or consistent (all evaluated particles),
- an overview of the number of correctly detected particles,
- a z score evaluation based on the final evaluation across laboratories of the corresponding GSR PT and
- a plot showing the detection capability of your laboratory as well as the overall detection capability obtained in the respective GSR PT. A table below the diagram specifies the particle size at a detection capability of 50% or 90%, respectively, for your laboratory.