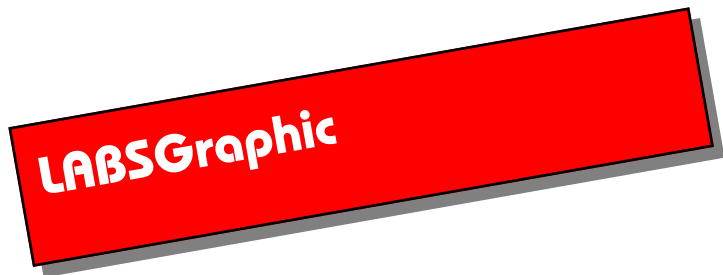


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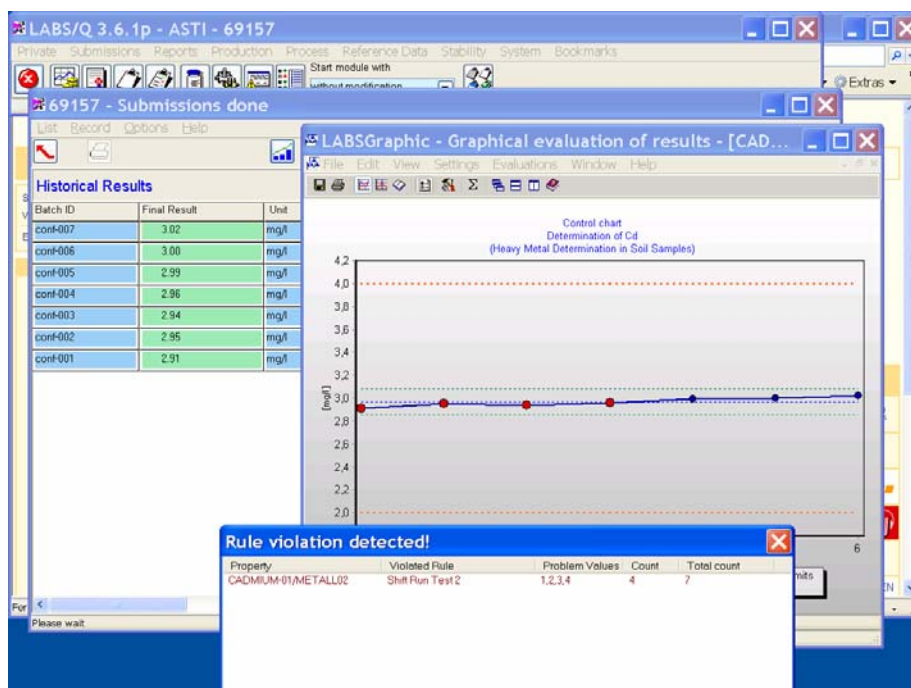
Graphical and statistical evaluation by shortcuts in LABS/Q®

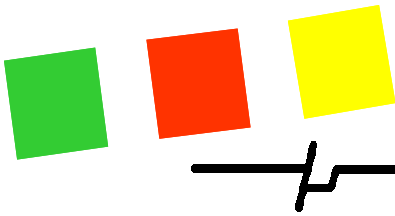
Modern analytical laboratories generate a huge amount of result values. In order to base decisions on these results they can be graphically displayed on control charts or histograms. They can also be statistically evaluated. In order to do this all information must be presented simply but effectively.

Optionally to standard configurable SVG graphics (Scalable Vector Graphics; standardised by the W3C consortium) **LABS Graphic** is a cost-effective option. When developing **LABS Graphic** the main aim was to create an easy to use tool for fast graphical and statistical evaluation of final results. Subsequently the major features of **LABS Graphic** are described.

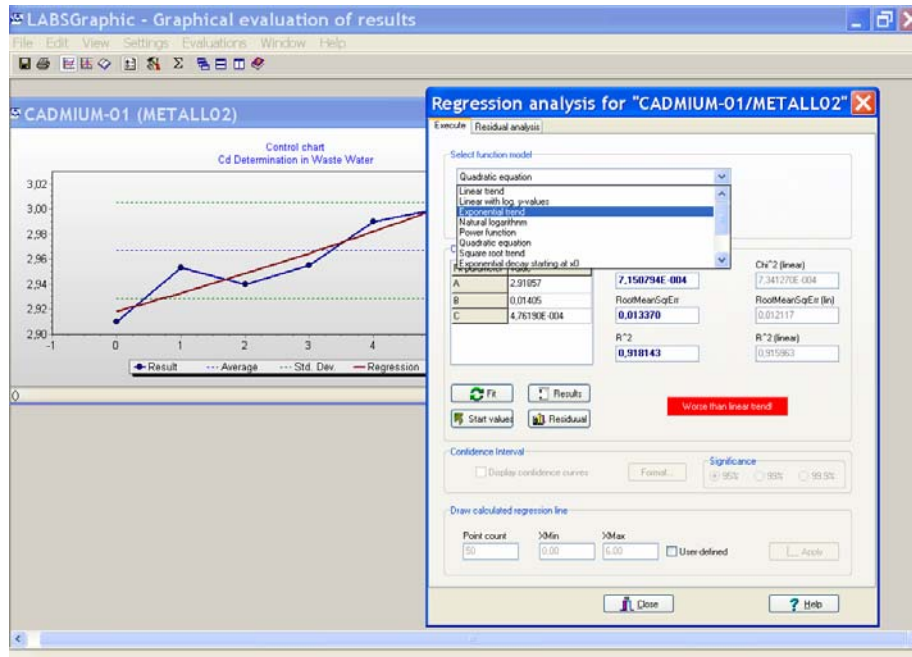
Functions for quality and process control

Apart from comparing results with warning limits, action control limits and specification limits it is crucial to notice trends among result values at an early stage. **LABS/Q®** offers the option to select **LABS Graphic** during result entry. Historical results are compared to the trend rules lodged in **LABS Graphic**. Outliers are checked and violations are displayed on a list as well as on a control chart. The trend rules provided by the program may be changed by the user as well as supplanted by new trend rules.





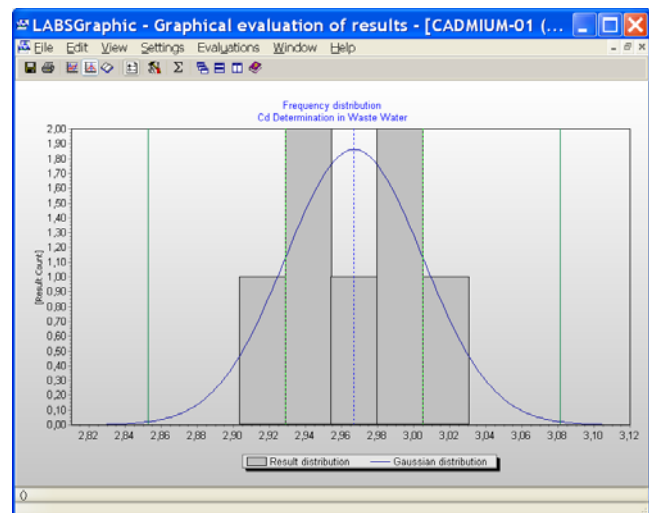
The user can determine which information should be displayed on the rule chart. User settings are saved automatically so they are available again after leaving the program and starting it anew. Further statistical evaluations such as regression models, residuum plot and normal (Gaussian) distribution are offered additionally.

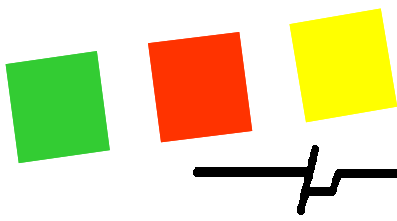


| Statistics | |
|--|------------------------------|
| File Edit Cp/Cpk Help | |
| Specification | |
| Method | |
| Result Count | 7 |
| Violations (Warning limit) | 0 |
| Dimension | |
| Average | 2,967 |
| Standard deviation | 0,038 |
| Relative standard deviation | 1,29 % |
| Lower Warning limit | 2,000 |
| Upper Warning limit | 4,000 |
| Cp (Warning limit) | 8,736 |
| Cpk (Warning limit) | 8,447 |
| Rule violation | |
| Problem values | |
| Number of removed values because of rule violation | 0 |
| Number of removed values because of canceled samples | 0 |
| David test | Normal distribution accepted |

Additional statistical characteristics like standard deviation, relative standard deviation and averages are displayed. Depending on the preset limits process capabilities Cp and Cpk are calculated. Additionally the David test shows whether a normal (Gaussian) distribution exists.

There is the option to display the results as a histogram.

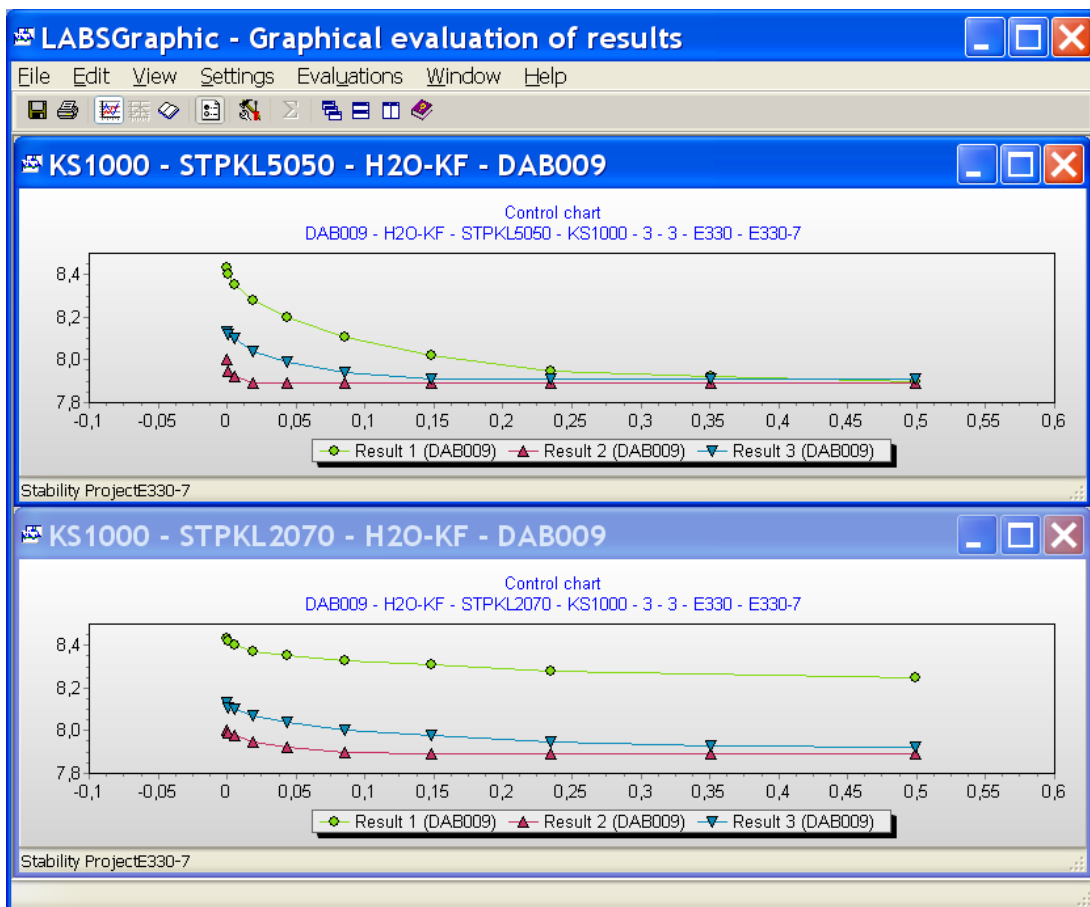


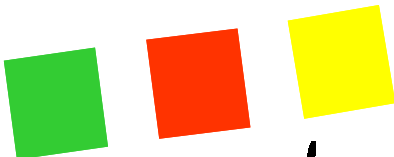


Graphical evaluations for stability studies

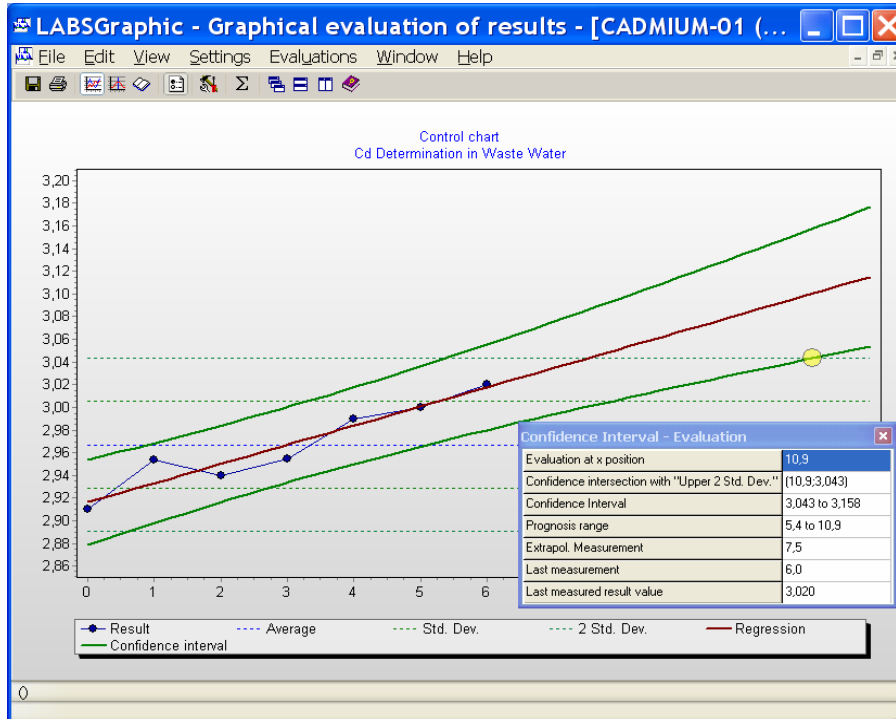
For stability and durability studies there is also a demand to evaluate results as easy as possible graphically and statistically. **LABS Graphic** offers the following options.

Results for a study, a material, a batch, packaging as well as storage conditions can be selected and contrasted.





An additional option here is to project the observed trend based on various regression models.



As can be seen on the evaluation the specification will probably be undercut in 975,6 days.

The following statistical methods are offered:

Statistical characteristics

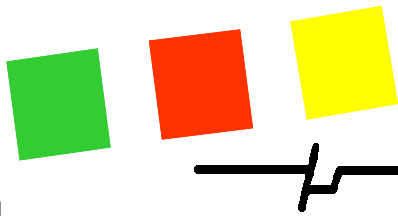
Selected results may be evaluated in various ways. As a standard the following characteristics for row of measured values are generated:

- average
- standard deviation
- relative standard deviation
- process capabilities C_p and C_{pk}
- David test for normal distribution
- Grubbs outlier test (recommended by DIN 53 804)
- Neumann trend test

Grubbs outlier test

Outliers within a row of measured values may be determined by the Grubbs method. Outliers can be marked or removed from the measuring row:

- Recommended by DIN 53 804 for quantities of measured values > 30
- Use of tabulated test statistics for 95% and 99% significance (rM table)
- Source of rM table and basis for calculation:
W. Gottwald, Statistik für Anwender, Wiley-VCH 2004
- Test statistics for non-tabulated quantities of measured values are determined via a computation formula



Neumann trend test

The occurrence of a trend within a row of measured values can be determined with the Neumann method. Values suspected to be a trend can be marked or removed from a row of measured values:

- Use of tabulated test statistics for 99% significance limits
- Source of significance table and basis for calculation:
W. Gottwald, Statistik für Anwender, Wiley-VCH 2004

David test for normal distribution

A row of measured values can be checked for normal distribution with the David test. Together with the row of measured values the information is displayed whether normal distribution can be assumed.

- Use of tabulated test statistics for 99% significance limits
- Source of significance table and basis for calculation:
W. Gottwald, Statistik für Anwender, Wiley-VCH 2004
- Test statistics for non-tabulated quantities of measured values are determined via a computation formula

Trend rules (out of control situations)

There is the option to lodge user defined trend rules to detect trends and outliers among the measured values. The results are then checked against the trend rules. Possible violations are recorded and are shown on the rule cards. The following trend rules are preset:

- 1 values is outside 2x sigma
- 7 values in succession are above averages
- 7 values in succession are below averages
- 7 values in succession show a sloping tendency
- 7 values in succession show an increasing tendency
- 2 of 3 values in succession are outside of a caution limit

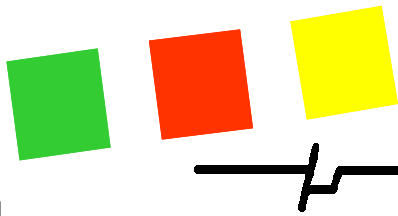
Regression analysis

Various regression methods can be used to evaluate result data. This is especially important when predictions have to be made for further progress in case of stability studies. The following methods are used and supported:

- Linear regression, also with confidence intervals
- Non-linear regression for various model functions (e.g. quadratic, exponential)
- Direct comparison between linear trend and selected model function
- Calculation of extrapolated X-values based on the regression

To judge and compare the quality of regression adaptation the following statistical characteristics are generated with each regression:

- Linear / non-linear correlation coefficient
- Degree of freedom of regression
- Square of correlation coefficient, freedom grade corrected
- Residual standard deviation
- Residuum diagram
- Calculation of extrapolated x-values in case of limit transgression



Confidence intervals for linear regression

The confidence interval for linear regression can be calculated and displayed. The characteristics are:

- Confidence interval at x
- Projection interval for measured value y
- Extrapolated intersection point of the lower or upper confidence curve with limit

Source of calculation basis for confidence intervals:

W. Gottwald, Statistik für Anwender, Wiley-VCH 2004

Graphic report

Results including limits, statistical evaluations (regression) and trend violations are displayed on the rule card. The following graphics are possible:

- Averages rule card
- Primal value card (Charting the smallest/highest raw value)
- Results for interval features (display of interval arbors for each result value)
- Histogram
- Result curve with user defined statistical subsidiary lines (e.g. average \pm 3xStddev, trend line and so on)
- Arrangement in groups (placing multiple result rows in the same diagram for reasons of comparison)
- Charting confidence intervals and intersection points with limits

Statistical as well as graphical evaluations for instrument and control type management

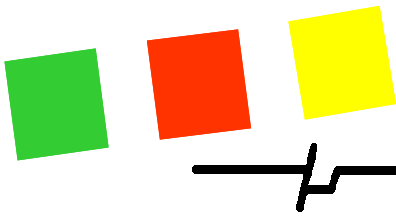
On checking control types and instruments lots of measuring data accumulate. Here it also makes sense to register trends like e.g. the drift of an instrument or the modification of a calibration solution as early as possible.

LABS/Q[®] therefore offers an evaluation of instrument and control type management results. Results for an instrument and a calibration batch may be selected, evaluated and displayed over any user defined period of time. With an instrument independent analysis you can discover quickly whether a modification of instrument or control type is existent.

Transfer to third applications

Embedding measuring results, statistical results and graphics into programs like MS Office (Excel or Word) is often necessary.

LABS Graphics offers the option to copy all information and evaluation via a clipboard into a different application.



Functional range

Statistical evaluations

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- Neumann trend test

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Regression analysis

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- Residuum diagram
- Calculation of extrapolated x-values in case of limit transgression

Graphic report

Results including limits, statistical evaluations (regression) and trend violations are displayed on the rule card. Apart from the rule card a histogram can be displayed.