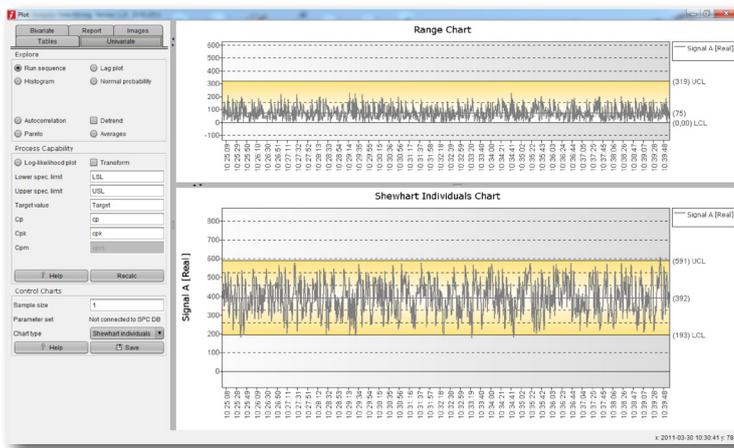


Apis Statistical Process Control



Statistical Process Control

Create real-time SPC charts with just one click

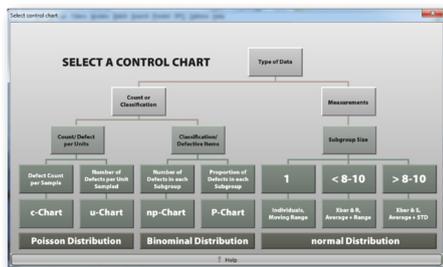


Statistical Process Control (SPC) is a technique that can be used to decide if a process is within (statistical) control and to detect assignable causes of variation. This technique allows the customer to set alarms on process parameters that, if they are not under control, may affect the quality of the end product. Through SPC, lead time for products can be reduced due to reduced need for rework, and the yield of the process can be increased due to increased control over process parameters that cause quality deviations.

Prediktor's SPC offering consists of both analytical and online SPC. The offline analytical software is used to statistically analyse data sets collected from a process to find parameters that most likely affect product quality. The online SPC is used to visualize to operators in real-time whether the operation is under control, as well as alert the operators with an alarm if the process goes out of statistical control.

Chart Types

The figure below shows chart selection dialog implemented in APIS Analytics:



The following chart types are implemented:

Normal distributed data

Shewhart individuals

- Plots the measured values of each individual produced unit. Possible through automated on-line measurement.
- x, **R Chart**, (Average + Range)
 - Plots the mean Plots, where sample size is less than or equal to 10 and sample size is constant.
- x, **S Chart**, (Average + Standard Deviation)
 - Plots sub-group means, plus the moving standard deviation of the subgroups in the top plot.
 - Similar to **R** charts, but can only be used when the sample size of the sub-groups is 10 or greater.

Poisson distribution

Counts and N-Counts charts follow a Poisson distribution where you can easily count the number of occurrences.

c-Chart

- Charts the defect count per sample, sub-groups must have the same sample size.

u-Chart

- Charts the number of defects per unit samples, sample size can vary.

Binomial Data

Used when data points are binary, i.e. can have only one of two values (yes/no, pass/fail, etc.)

p-Chart

- Charts the proportion of defectives in each sub-group, i.e. the ratio of the number of defectives to the sample size.

np-Chart

- Charts the number of defectives in each subgroup. Can only be used when the sub-group sample sizes are all the same.

Control charts

A control chart contains data plotted in time, with upper and lower control limits representing the range of normal variation. The average is calculated and drawn as the centre line. The upper and lower control limits are approximately 3 standard deviations above and below the centre line.

As seen in the figure, the bottom chart shows the data points. These can either be individual points or a sample mean, depending on whether there is subgrouping or not. The upper chart shows either the moving range of the data points or moving standard deviation. These charts help to detect periods of short term variation.

Based on the criticality of the process, a corresponding rule set for the samples must be decided. This operation is done in the APIS Analytics statistical process analysis software package that also facilitates other statistical methods.

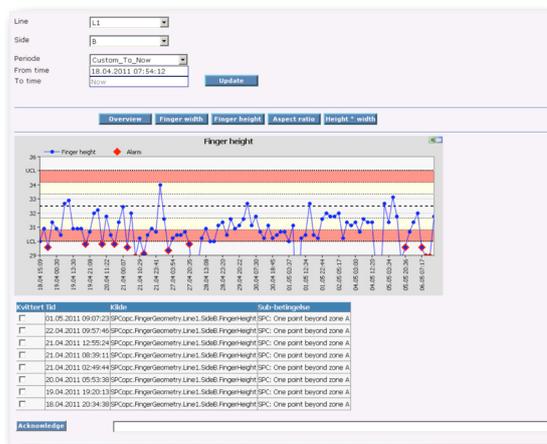
Depending on the results from the statistical analysis, the real time online SPC module may be automatically updated to reflect the new control limits or validation methods.

ONLINE SPC

Online SPC diagrams can be generated from all kind of values and signals in the APIS platform, e.g. real time process data, cycle times, lab data, reject data and more. SPC is visualized in Shewhart Control Charts and presented in the APIS Click & Trace web portal for end users. Control limits can also be calculated automatically in real time by the APIS platform, or be set via an OPC signal from a third party system or via the APIS Analytics statistical process analysis module.

The SPC diagrams are continuously updated in the background with real time data from the process. This provides operators and supervisors continuous feedback from the performance of their process. Any control limit breach will be communicated through the standard alarm infrastructure of the APIS platform, meaning that they can be delivered visually and/or audibly or through SMS or email. Prediktor's SPC solution allows the user to configure any or all of the eight different assignable causes that are collectively known as the Nelson rules.

The source signal may also be filtered with logical processing to uncover outlying values. These filters can be constructed with set values from the user, or copied from another system variable.



CAPABILITY INDICES

Both the online and analytical SPC module offers real time monitoring and trending of Capability Indices (Cp, CpM and CpK) which are a set of techniques that may be used to decide if an in-control process produces output that are within the desired specification limits. These values are calculated and displayed in real time, and can be monitored by the alarm infrastructure, thereby allowing events to be triggered based on limit breaches.

HISTORICAL ALARM REPORTING

Detected SPC limit breaches are logged in the historical alarms database of APIS Hive. Any SPC alarms will then automatically be linked to the material being processed at the station where the SPC limit alarm was triggered. A historical alarm report is provided as another option for analysing the performance and quality of the process.

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