Process Control Workbench

An Application Framework for Harnessing the Power of Statistical Process Control & Multidimensional Data Analysis

Dimensional Insight's Process Control Workbench (PCW) is a software framework for building applications that combine traditional Statistical Process Control (SPC) capabilities with multi-dimensional data analysis. Applications built using the PCW provide users with a dashboard-based analytical tool for exploring and configuring SPC charts, defining business rules, and analyzing process control data across multiple dimensions. Example data dimensions include work shift, facility, hospital ward, product line, or surgical procedure. Built on the Diver Platform, Dimensional Insight's end-to-end business intelligence platform, the PCW can be used to analyze archived process data as well as for real-time process monitoring.

SPC Charts And Run Rules

SPC is a methodology for ensuring product quality and improving processes and is widely used in both manufacturing and service-based industries such as healthcare. The SPC chart is a central tool of this methodology. (See Figure 1.) Process improvement engineers and analysts use these charts to characterize processes, and to determine if processes are behaving according to expectations or if they require corrective action. Patterns within SPC charts, referred to as run rules, possess quantifiable predictive capabilities.
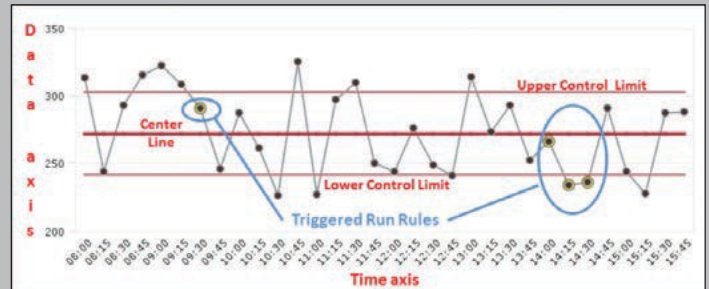

Figure 1: SPC chart with examples of triggered run rules

Run rule description	Default N
1 data point > N standard deviations from the SPC chart mean	3
N data points in a row on same side of SPC chart mean	7
N data points in a row, all increasing or all decreasing	7
N data points in a row, alternating up and down	14
N out of N + 1 data points greater than 2 standard deviations from SPC chart mean on same side	2
N out of N + 1 data points greater than 1 standard deviations from SPC chart mean on same side	4
N data points in a row within 1 standard deviation of SPC chart mean on either side	15
N data points in a row greater than 1 standard deviation from SPC chart mean on either side	8

Figure 2: Run rules and default parameter values

Commonly used run rules and their default parameter values are listed in Figure 2. When one or more of these rules are triggered, it signals a high likelihood that a process is out of control. Some rules indicate potential causes of the underlying process misbehavior, such as stratification or mixing.

Applying SPC Across Multiple Data Dimensions

The PCW lets users define SPC charts and run rules quickly and easily, and store those definitions as templates for reuse. Due to the ease with which this can be accomplished, hundreds of charts can quickly be set up to focus on a particular combination of data dimensions. This allows engineers and analysts to fine tune individual processes rather than being tied to a "one-size-fits-all" approach. For example, SPC chart definitions can be defined for each of the following combinations of data dimensions in Figure 3.

FACILITY	WORK SHIFT	PRODUCT	MACHINE PARAMETER
Byfield	Day	Wheat Bagels	Temperature
Byfield	Night	Wheat Bagels	Temperature
Byfield	Day	Wheat Bagels	Pressure
Byfield	Night	Wheat Bagels	Pressure
Newbury	Day	Plain Bagels	Temperature
Newbury	Night	Plain Bagels	Temperature
Newbury	Day	Plain Bagels	Pressure
Newbury	Night	Plain Bagels	Pressure

Figure 3: Individual SPC charts and run rules can be defined for each combination of data dimensions

Process Visualization And Analysis

With the PCW, users can conveniently view any combination of dimensions across user-defined time intervals to gain insight into process failures or quality issues. For example, the charts in Figure 4 display pressure and temperature for a particular machine, work shift and product.

Just as easily, the same parameter across two different machines could be displayed. Engineers and data analysts can use this capability to understand which data dimensions or parameters are the source of excess process variance as in Figure 5.

In addition to conventional SPC charts, the PCW also provides a summary view, as in Figure 6, that displays frequency counts of triggered run rules. This allows for
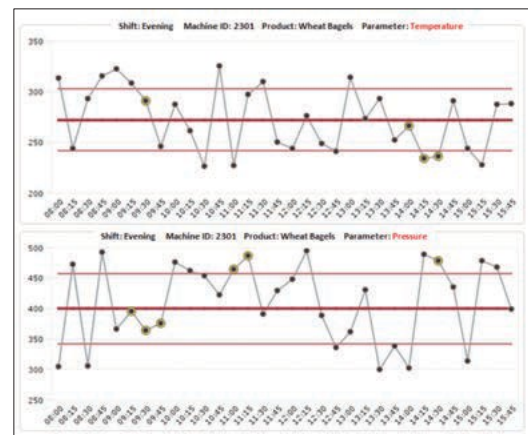
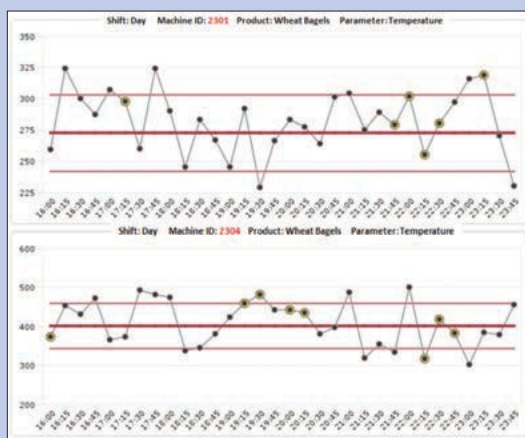Figure 4: Visualizing temperature vs. pressure for a single machine

Figure 5: Visualizing temperature across two different machines

a much longer time frame of process information to be displayed than what is found on an SPC chart and is useful for characterizing process behavior over the long term.

Role-Based Capabilities

Diver provides secure, role-based access to SPC chart templates, run rules and business rule definitions. Engineers and analysts can define, edit and delete templates and use the PCW to analyze and understand the root causes of process variance and failures. The process technician deploys these templates to the corresponding process, manufacturing asset or time period. Finally, the operator will utilize the deployed templates and respond to out of control processes in a first responder role.

Put The Power Of The Process Control Workbench To Work For Your Organization

The PCW leverages the full functionality of Diver's business intelligence platform. Robust data integration of virtually any data source and format, real-time alerts, and self-service analysis and reporting help you gain unprecedented insight into process behavior and facilitates root cause analysis by allowing engineers and analysts to understand process behavior across multiple data dimensions.
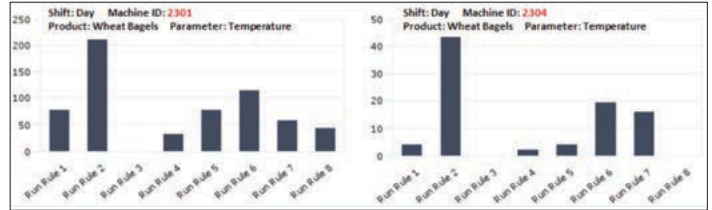

Figure 6: Monthly run rule frequency counts for two machines provide a long term process perspective

Figure 7: Based on Diver, the PCW delivers role-appropriate process information and functionality

Quality Engineer
Define, Analyze & Visualize

Process Technician
Deploy

Machine Operator
Utilize

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About Dimensional Insight

Dimensional Insight is the leading provider of integrated business intelligence and performance management solutions. Our mission is to make organizational data accessible and usable so everyone from analysts to line of business users can get the information they need to make an informed, data-driven decision.

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