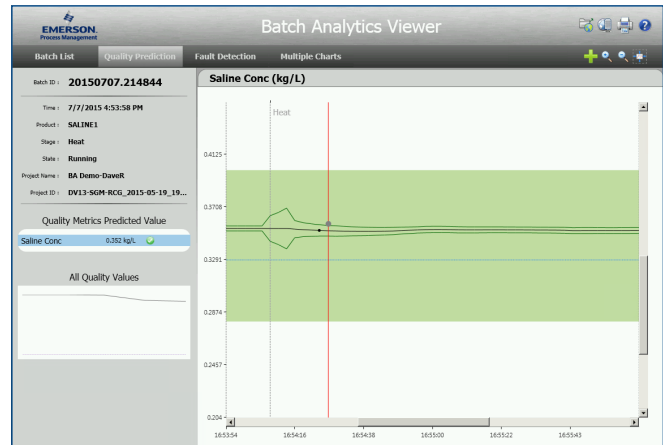# Batch Analytics

- Predicts end-of-batch quality

- Detects process faults and provides reason for deviation so operations can take action in real time

- Increases process understanding

- Minimizes batch-to-batch variation

- Real-time correlated models help improve yield

- Web-based data for real-time process analysis & adjustments

Batch Analytics provides online decision support for batch operations.

Introduction

The goal of every batch process is to safely produce the maximum yield that meets product quality specifications in the shortest amount of time. Not meeting any part of this goal can result in increased costs.

With online Batch Analytics, a multi-variate analysis of your process is performed based on models generated from a compilation of historical batches. Faults in your batch process are detected in real time giving operations the ability to take corrective action before a negative impact on production occurs. The earlier an abnormal condition is identified, the better the chance to get the batch back on track. Information about the potential impact on end-of-batch quality is also provided such that the urgency in which the problem needs be addressed can be determined. All of this means decreased costs, reduced cycle times, increased yield, reduced waste, reduced variability, and improved reliability.

Benefits

Predicts end-of-batch quality. Online Batch Analytics gives you real-time prediction of end-of -batch product quality through multivariate analysis. This predictive information serves as a window to your process, enabling operators to make adjustments as needed to preserve batch quality.

Predictability can save valuable process and equipment time for improved capacity.

Detects process faults and provides reason for deviation so operations can take action in real time. Real-time fault detection allows your operators to receive probable reasons for deviation. This allows operators to focus their attention. A streamlined view indicates when a batch has a problem, relieving operators of the need to monitor all the data–all the time. This timely, focused, actionable information can mean the difference between on-spec and off-spec product, while maximizing process yield.

Increases process understanding. Visibility of real-time, correlated data helps operations understand process interactions and their impact on end of batch product qualitythus enabling better decision-making by understanding the effect of input and process variabilities.

Minimizes batch-to-batch variation. Better understanding of and more familiarity with the interactions between parameters in your process allow for process adjustments to be made over time to help eliminate differences between batches.

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Real-time correlated models help improve yield. Batch Analytics makes complex model-building easy by stepping you through the process. You get a thorough view of your entire batch process through analysis of each independent stage, automatically integrating multiple models to analyze the batch. Visibility of real-time, correlated data helps your operations personnel understand process interactions and their impacts on end-of-batch product quality. This understanding enables your operations personnel to make better decisions, and focus on the parameters that impact the process most.

Web-based data for real-time process analysis & adjustments. The easy-to-use web-based interface in Batch Analytics allows your operators to share data anytime, anywhere, with individuals and groups for real-time analysis and action. The effect can be more eyes on your process and data, better decision-making, faster adjustment, and reduced risk of batch rework or loss.

Product Description

Batch Analytics offers you a way to improve batch operations by finding out about quality problems before a batch is lost. Typically, batch operations take place in complex, highly correlated and dynamic environments. Process holdups, access to lab data, feedstock variations, unsteady operations, data organization and concurrent batches all play into that complexity. Operators are challenged to correlate all these variables in processes they may not fully understand. These factors increase the risks of producing a poor quality batch.

Data from historically good batches is used to develop models of your batch process in an intuitive, easy-to-use model building application. Once refined, the models are deployed for comparison against batches currently executing. Operators use a web based interface to monitor for fault detection and quality prediction.

Data Alignment

While most batches are produced within specification, they all have some variation throughout the process. This makes it difficult to select just one batch to compare future batches against. The very nature of batch data can make data visualization of trends across multiple batches challenging due to the differences in batch length caused by a multitude of factors throughout the process. When trying to generate a model using that data, visualization of the data becomes critical in determining if a given batch should be used. Batch Analytics simplifies this through the use of dynamic time warping technology to align data during the data extraction and model generation process.

Multivariate Analysis

Batch Analytics employs multivariate analysis to detect faults and predict end of batch product quality. Multivariate analysis is the preferred approach as it takes into account the interactions between multiple variables, including input and process variables. Comparing a batch to a multivariate based model versus a univariate trend allows for more accurate analysis of that batch, including fault detection and end of batch quality prediction. It also allows for further learning about the process and the various interactions. Batch Analytics utilizes two primary multivariate methods:

Principal Components Analysis (PCA) for fault detection. PCA provides a concise overview of a data set. It is powerful for recognizing patterns in data: outliers, trends, groups, relationships, etc. PCA makes it possible to detect abnormal operations resulting from both measured and unmeasured disturbances.
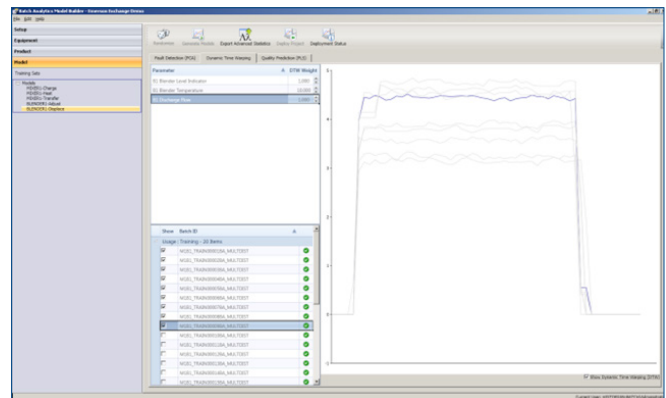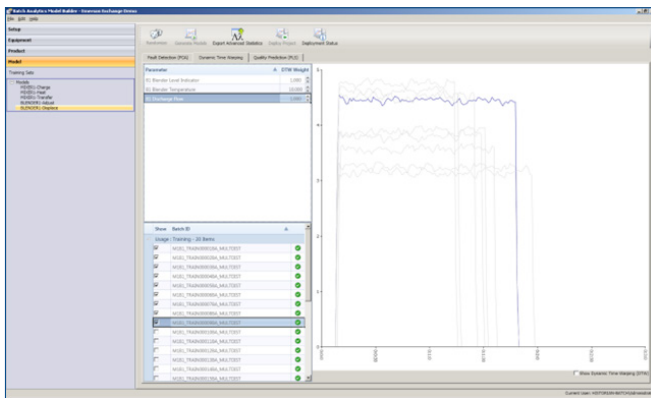
Data before and after Dynamic Time Warping applied.
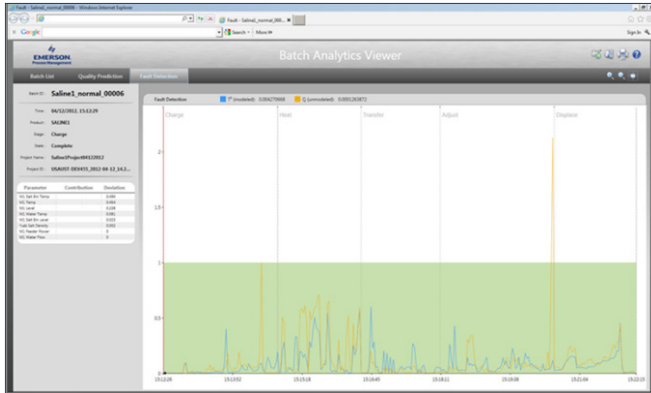
Comparison of measured and unmeasured disturbances to an upper limit for fault indication.

Projections to Latent Structures (PLS) for quality prediction. PLS aims to establish relationships between input and output variables thereby developing predictive models of a process.

Batch Analytics Applications

The Batch Analytics product can be broken into three main separate applications:

Batch Analytics Model Builder

The Batch Analytics Model Builder is the desktop application that provides a step-by-step approach to walk you through the process of building modeling projects for your process. The application was built with the mindset that the average engineer should be able to provide the information needed for the system to generate models.

Batch Analytics Monitoring Service

The Batch Analytics Monitoring Service performs the real-time monitoring of batches once their respective models have been deployed. It is intended to interact with only one DeltaV system. It can provide real-time data to multiple Batch Analytics Servers. The Model Builder can be used for creating models with an Advanced Batch license, but they cannot be deployed for real-time batch monitoring without the Professional Batch license or Batch Analytics Monitoring license.

The Batch Analytics Monitoring Service computer maintains and persists data for multiple modeling projects. Also installed on the Batch Analytics Monitoring Service Computer is the Batch Analytics Manager software.

The Batch Analytics Manager administers the Batch Analytics system. This application installs when the Batch Analytics Monitoring Service installs. Use this application to define user access, data server connections, historical data storage, authorized Batch Analytics Server web sites, and batch executive workstations. You can also view system diagnostics and perform system maintenance with this application.

Batch Analytics Server

The Batch Analytics Server is a Microsoft Internet Information Server (IIS) web-based application that provides users read-only access to real-time and historic data available in the Batch Analytics Monitoring Service to local or geographically remote users through the Batch Analytics displays. Typical installations have at least one Batch Analytics Operations Information Web Server, and possibly several; serving different security zones. The client must use Microsoft Internet Explorer (IE) web browsers, or the browser controls that can be used in DeltaV Operate displays. One Batch Analytics Server is intended to interact with only one Batch Analytics Monitoring Service, and thus indirectly, with only one DeltaV™ system.

System Compatibility

Batch Analytics is backward compatible to DeltaV v11.3. A separate Batch Analytics license and dongle is required for the machine hosting the Batch Analytics Monitoring Service.

- Existing Professional Batch users with Foundation/Guardian support should contact their local Emerson representative to obtain the Batch Analytics functionality.

- New v12.3 and later. systems will receive dongle/license with other DeltaV media.

Batch Analytics can be installed on the following (provided other system requirements are met):

- Professional Batch licensed systems.

- Advanced Batch licensed systems. Note, to enable real-time monitoring on Advanced Batch systems, a Batch Analytics Monitoring license is required. The Batch Analytics Model Builder may be used on Advanced Batch systems without additional licensing.

Batch Analytics is not supported on the following:

- DeltaV Application Station running Redundant Subsystems.

- Plant Messenger computer.

- DeltaV Web Server computer.

- DeltaV Analyze computer.

- DeltaV system that does not have Microsoft .NET Framework 4 Extended except in the case of the Batch Analytics Server, where it is supported on the Application Station.

- Advanced Batch licensed systems. Note, to enable real-time monitoring on Advanced Batch systems, a Batch Analytics Monitoring license is required. The Batch Analytics Model Builder may be used on Advanced Batch systems without additional licensing.

Installation Options

The following table explains where each component of Batch Analytics can be installed for each supported DeltaV version. Each Batch Analytics software component can be installed on different operating systems. For example, the Batch Analytics Server can be on Windows Server 2008 SP2 and the Batch Analytics Monitoring Service can be on Windows Server R2, SP1.

OPC Requirements

Batch Analytics uses OPC to connect to the data sources. There are two OPC versions that Batch Analytics can use to connect to the data sources, OPC Classic and OPC .NET 3.0. OPC Classic refers to the OPC Data Access and OPC Historical Data Access standards published by the OPC Foundation. OPC Remote is required to communicate with DeltaV systems using OPC Classic (v2.0) where the Batch Analytics Monitoring Service or Model Builder are not on the DeltaV computer where the data is stored. OPC Remote establishes a DCOM portal between the computers. OPC Remote is not required for history data sources using OPC .NET 3.0 (also named OPC Xi).

	v11	v12	v13
BA Model Builder	1. Non-DeltaV Machine (32 or 64 bit)	1. Non-DeltaV Machine (32 or 64 bit)	1. Non-DeltaV Machine (32 bit or 64 bit OS) 2. Application Station (64 bit OS) 3. Professional Plus Station (64 bit OS) - Small Installations Only
BA Monitoring Service	1. Non-DeltaV Machine (64 bit OS)	1. Non-DeltaV Machine (64 bit OS)	1. Non-DeltaV Machine (64 bit OS) 2. Application Station (64 bit OS) 3. Professional Plus Station (64 bit OS) - Small Installations Only
BA Server	1. Non-DeltaV Machine (32 or 64 bit) 2. Application Station (32 bit OS)	1. Non-DeltaV Machine (32 or 64 bit) 2. Application Station (32 or 64 bit OS)	1. Non-DeltaV Machine (32 or 64 bit OS) 2. Application Station (64 bit OS) 3. Professional Plus Station (64 bit OS) - Small Installations Only

Ordering Information

Batch Analytics is included as part of the DeltaV Professional Batch license (VE2249) beginning with DeltaV v12.3. For customers with DeltaV Professional Batch prior to v12, Batch Analytics is available with a separate Batch Analytics License (VF1102SUL). Batch Analytics is also available (VF1102S01 & VF1102UPS01) for customers with the DeltaV Advanced Batch license as noted below.

	Model Number
DeltaV Professional Batch	VE2249Syyyyy*
Batch Analytics License (for customers with Professional Batch prior to v12)	VF1102SUL
Batch Analytics Base License for DeltaV Advanced Batch, 1 Unit	VF1102S01**
Batch Analytics Add on License for DeltaV Advanced Batch, 1 Unit	VF1102UPS01

* Where yyyyy is equal to the total number of class-based Unit Modules configured under Process Cells in the system. Yyyyy is available in sizes of 2 Units, 5 Units, 10 Units, 20 Units, 30 Units, 50 Units, 75 Units, 100 Units, 150 Units, 300 Units, and >300 Units.

** DeltaV Advanced Batch users must purchase one Base License to enable real-time batch monitoring for the first unit. Additional units (limited to five total) can be purchased with the Batch Analytics Add On License. This license do not apply to DeltaV Basic Batch systems; Batch Analytics cannot be enabled with DeltaV Basic Batch. DeltaV Professional Batch already has on-line monitoring included.

Batch Analytics is backwards compatible to DeltaV v12.3 and v11.3 systems that are licensed with the Professional Batch software suite (VE2240Sxxxxx, where xxxxx is equal to the total number of batch DSTs in the system) and are covered by Foundation/ Guardian Support. Please contact your local Emerson representative to order Batch Analytics for these legacy systems.

Related Products

- **Batch Executive.** The batch engine which coordinates all batch processing activity, creates detailed batch history records and schedules recipes and resources.

- **Batch Historian.** Automatically collects and stores batch recipe execution data from the DeltaV Batch Executive and process alarm and event data from the DeltaV Event Chronicle.

- **Batch Redundancy.** Enables redundant DeltaV Batch capabilities for the Batch Executive and Campaign Manager, including automatic switchover to protect your batch operations from disruptions.

- **Recipe Studio.** Powerful yet simple to use application for graphically configuring recipes (with formulas) for successful batch production.

- **Recipe Exchange.** Provides an open, programmatic interface to the DeltaV recipe management system. Recipe Exchange is based on an XML schema that provides the ability to programmatically import and export DeltaV recipes. A Service-Oriented Architecture Web Service is also available for Recipe Exchange.

- **Campaign Manager.** Creates and manages a campaign by specifying the recipe, formula, equipment, and number of batches that are to be run within the campaign. A Service-Oriented Architecture Web Service is available to enable production-scheduling packages to initiate the creation of campaigns in the DeltaV system.

Prerequisites

- A DeltaV system licensed for Professional Batch, or licensed for Advanced Batch with a Batch Analytics Monitoring license.

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