

ICP - Mass Spectrometry



Key Features:

- Patented particle detection algorithms
- Dedicated software module provides ease of use and automation
- Unmatched data acquisition speed for accurate particle profiling

Syngistix Nano Application Software Module for Single Particle ICP-MS

PerkinElmer's Syngistix™ Nano Application Module, an extension of Syngistix for ICP-MS software and the NexION® series of ICP-MS instruments, is the first commercially

available software that combines real-time single particle acquisition by ICP-MS (100,000 points/sec at 10 μ s dwell time) with fast data processing for routine analytical use. These capabilities provide users with several important nanoparticle (NP) characteristics such as inorganic composition, concentration, size, size distribution, and agglomeration, as well as the ability to differentiate between ionic and particulate fractions – all through a single interface that eliminates the need for labor-intensive data processing.

Benefits of Syngistix Nano Application Module for Single Particle Acquisition

- Multi-elemental analysis
- Ease of use
- Speed
- Flexibility
- Automation
- Rapid sample analysis

Ease of Use

The Syngistix Nano Application Module incorporates all single particle analysis needs into an intelligent workflow. The Analysis panel (Figure 1) contains all the parameters necessary to set up methods and batches:

- Analyte drop-down menu
- Analytical profile selection (Standard or Reaction)
- Multi-point calibrations (both ionic and dissolved)
- Automated transport efficiency calculation
- Batch analysis capabilities with Smart Sampling
- Calibration Library
- Integrated trigger functionality for interfacing with other technologies

In addition, an “Advanced” button allows access to even more parameters, including threshold over-ride and user-defined binning size and range. The patented data processing algorithm allows real-time background correction, enabling instant data visualization of both pulse intensity vs. time and the intensity histogram displaying the frequency vs. peak area. This powerful combination of method and data acquisition parameters provides a great deal of flexibility for a wide variety of laboratory operations.

The Results panel (Figure 2) allows users to review and interact with the data once it has been acquired. Options include: changing the threshold, changing the bin sizes, setting integration parameters, and applying both ionic and particle calibrations, among others.

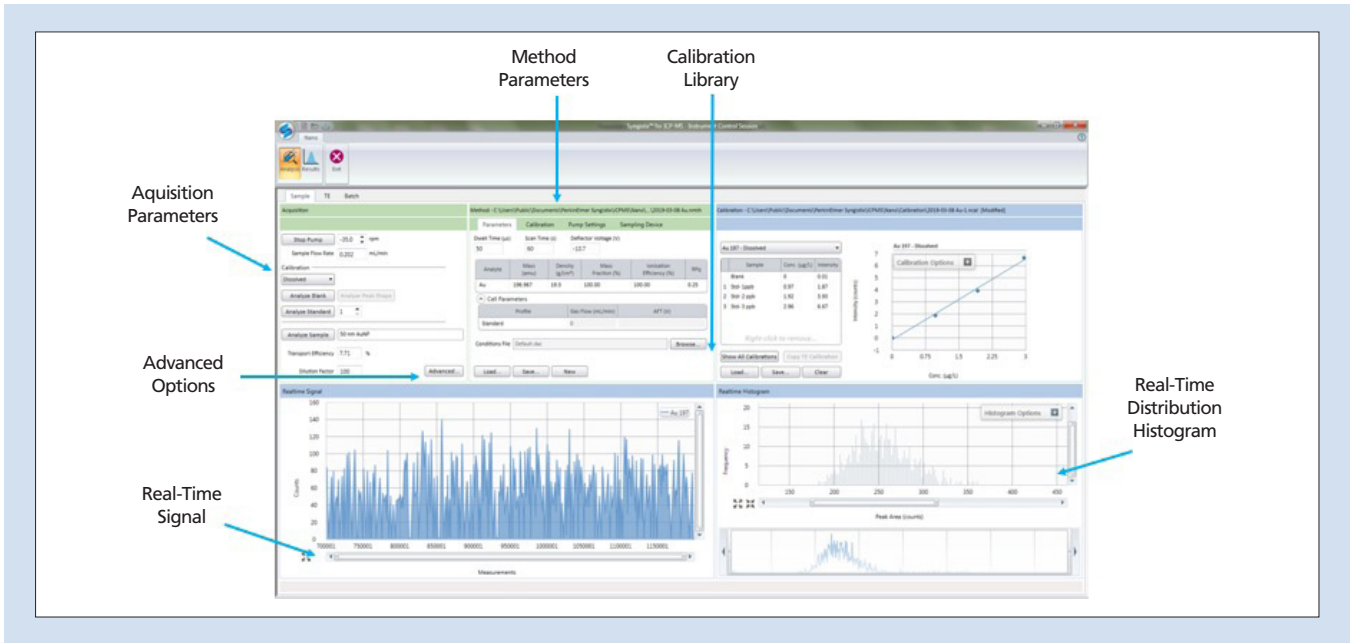


Figure 1. The Analysis panel, featuring acquisition, method, and calibration parameters, as well as advanced options and real-time views of the signal and distribution histogram.

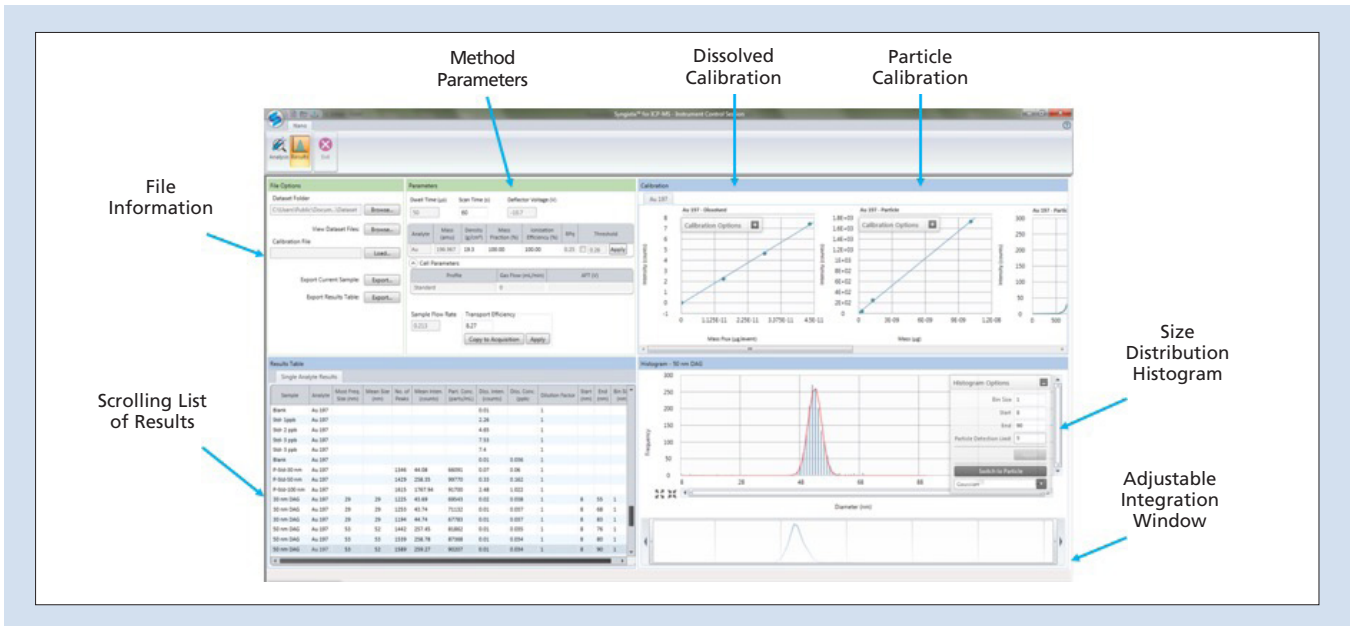


Figure 2. The Results panel, featuring method parameters, file information, both dissolved and particle calibration curves, and a scrolling list of results which reflects changes to the integration window on the size distribution histogram.

Automation

Using the batch functionality available in the Syngistix Nano Module, combined with Smart Sampling and the Calibration Library, multiple methods and multiple analytes can be calibrated for and analyzed without the need for rinsing between analytes. This combination saves time, allowing for rapid scanning of samples for particulate matter, delivering high throughput and maximum flexibility, while eliminating the need for user intervention. An example of this Batch functionality feature is displayed in Figure 3.

Smart Sampling

Smart Sampling allows multiple methods to be run on the same sample, optimizing sample analysis time by reducing unnecessary sample uptake and rinse steps. As highlighted in Figure 4, Smart Sampling enables two- to three-fold faster analysis.

Trigger Functionality

The Trigger feature will allow for automated coupling between instrumentation such as field flow fractionation (FFF), hydro dynamic chromatography (HDC), and laser ablation, providing automated particle analysis of a solution following other analysis.

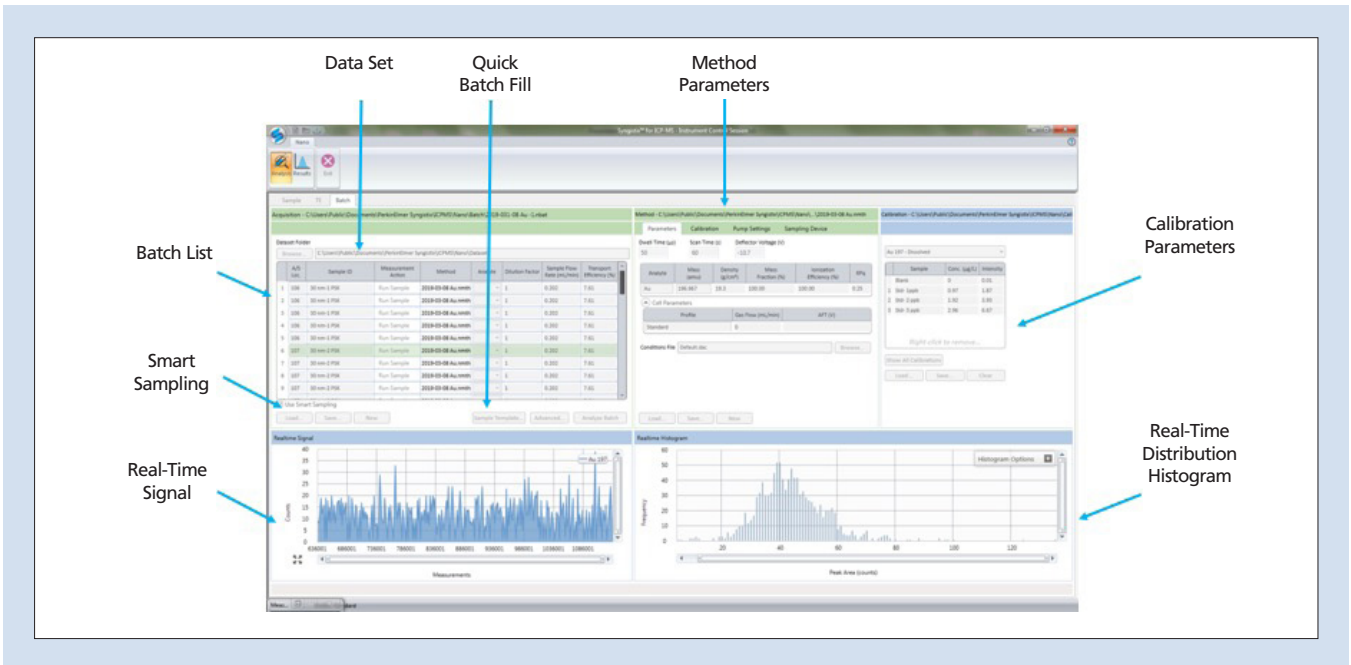


Figure 3. Analysis panel featuring the Batch sample list, allowing for unattended analysis when using an autosampler.

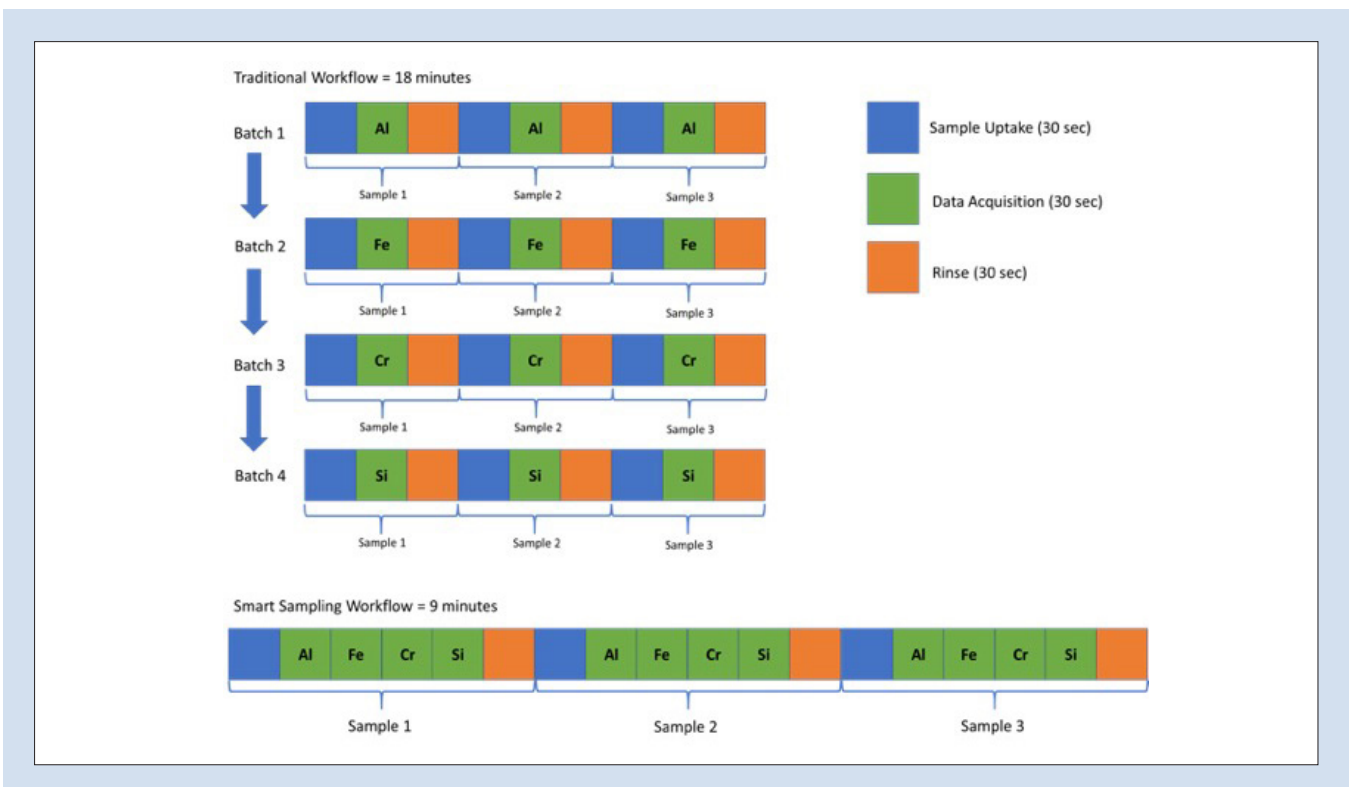


Figure 4. Traditional versus Smart Sampling workflow.

Data Acquisition Speed

The duration of the signal emitted from the bursting event of a NP in an ICP-MS is only a few hundred microseconds. In order to get enough data points to properly profile a particle signal, the instrument should be capable of taking a reading every 50 microseconds (minimum eight points per peak at 400 microsecond wide peaks), thereby acquiring upwards of 20,000 points/second. Not only is the NexION ICP-MS capable of acquiring at 100,000 points/sec, but also the Syngistix Nano Application Module is powerful enough to handle the large quantity of data generated while being able to clearly distinguish between NPs and ions, providing an essential tool to analysts.

With the Nano Application Module, data can be viewed as it is being acquired in real-time: individual nanoparticle events are displayed and converted to a background-corrected intensity histogram which continuously updates during data acquisition, thanks to the Syngistix Nano Module's patented algorithm for automated threshold detection. Figure 5 is a snapshot of the Analysis panel taken during data acquisition, showing both the real-time signal and histograms. The real-time display of results is unique to the Syngistix Nano Module and provides users with instant information on the sample being analyzed, including whether further dilution is necessary to avoid particle coincidence.



Figure 5. A snapshot of the Analysis panel taken during acquisition showing both the real-time data (zoomed-in to show individual pulses) and the real-time distribution histogram.



Figure 6. The Results panel, featuring reprocessed data saved as subsequent results in green color.

Results

Once data acquisition has been completed, the results environment allows the user to review the data, both through a Results table and accompanying histograms.

These formats allow for ease of verification, offering a multitude of additional information, such as the most frequent size (nm), mean size (nm), number of peaks detected within an acquisition period, mean particle counts, particle concentration (part/mL), mean dissolved counts, mean dissolved concentration ($\mu\text{g/L}$) and the binning range.

The user can interact with the data in the histogram for each sample and adjust a variety of parameters, including: dynamic fitting window, bin range, and peak fit algorithm (Gaussian, log normal, maximum intensity).

Whenever changes are made to the histogram, the Results table is instantly updated, with the changes appearing in green, as shown in Figure 6. The original data remains, so the user can quickly compare the effects of the changes. With this intelligent workflow, users will be able to focus on what matters most – the results.

Last but not least, the Syngistix Nano Module provides two different types of export options, allowing data to be shared with collaborators or colleagues:

- The Results table can be exported for quick review
- All the information on a single sample (including sample data, size and intensity histograms, as well as calibration information) can be exported for post processing and other data manipulations.

PerkinElmer's Syngistix Nano Application Software Module is the ideal tool for laboratories analyzing nanomaterials. This unique application module allows the differentiation and quantification between the dissolved and particulate fractions of the same analyte. In a single analysis, particle composition, concentration, size, and size distribution can be determined without the need for subsequent data processing. Coupled with the NexION series ICP-MS systems, the Syngistix Nano Application Module is the world's first single particle ICP-MS dedicated analysis software, delivering speed, flexibility, automation, and ease-of-use.