

Smart Acquire

Automated Raman Material ID
for Defense and Security Professionals

Addressing the needs of first responders

An analytic chemist in your back pocket. A forensic laboratory in a suitcase. A HazMat team in the trunk of your car. First responders need all the help they can get when faced with potentially dangerous substances. Mira DS from Metrohm Raman is a sophisticated chemical analyzer that *replaces the specialist* with automation. The push of a button initiates proprietary Smart Acquire routines to optimize acquisition parameters and collect the highest quality spectra. These spectra are automatically subjected to library search and Mixture Matching routines capable of identifying up to three components of a mixture. When hazardous substances are detected, the user is alerted to immediate action with color-coded warnings.



Metrohm White Paper



Life saving decision making in the palm of your hand

Raman analysis is an established technique for detection of illicit substances by field professionals. In the presence of a potentially deadly white powder, defense and security teams require safe, fast, and accurate identification to initiate a proper response, for example:

- Confiscated Street Drugs
- Illicit Lab Residue
- Potential Explosives

Not everyone is an expert at Raman analysis: Metrohm Raman's Mira DS combines *automated acquisition* with sophisticated analysis in a rugged handheld unit, putting *instant actionable intelligence* in the palm of your hand.



Raman Spectra

All substances have unique molecular properties that can be used to identify them, like a person's unique fingerprints. For example, **Figure 1** illustrates Raman spectra of TNT, RDX, and PETN: high explosives that are used to make Improvised Explosive Devices (IEDs). The resolution and location of peaks permit each of these materials to be easily identified, and spectral quality is an important factor in accurate identification.

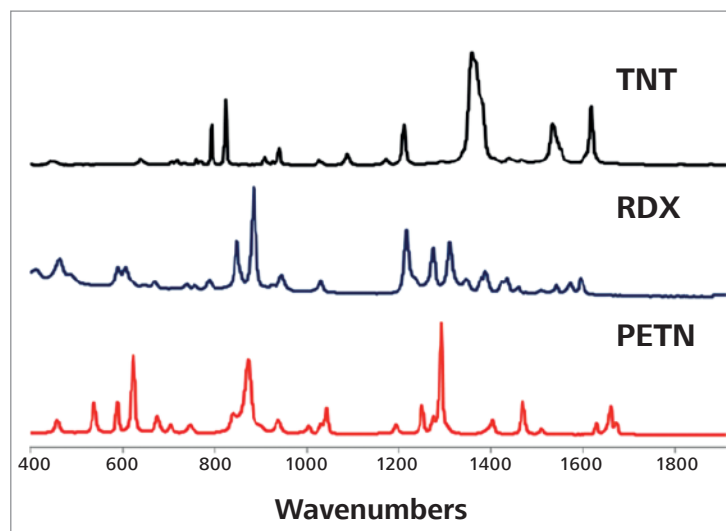


Figure 1. Raman spectra of high explosives

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Field personnel using Raman instruments may not have the training or the response time to determine ideal acquisition parameters and collect quality spectra. Smart Ac-

quire algorithms *automatically optimize acquisition parameters* at the press of a button. The full process is shown below in **Figure 3**.

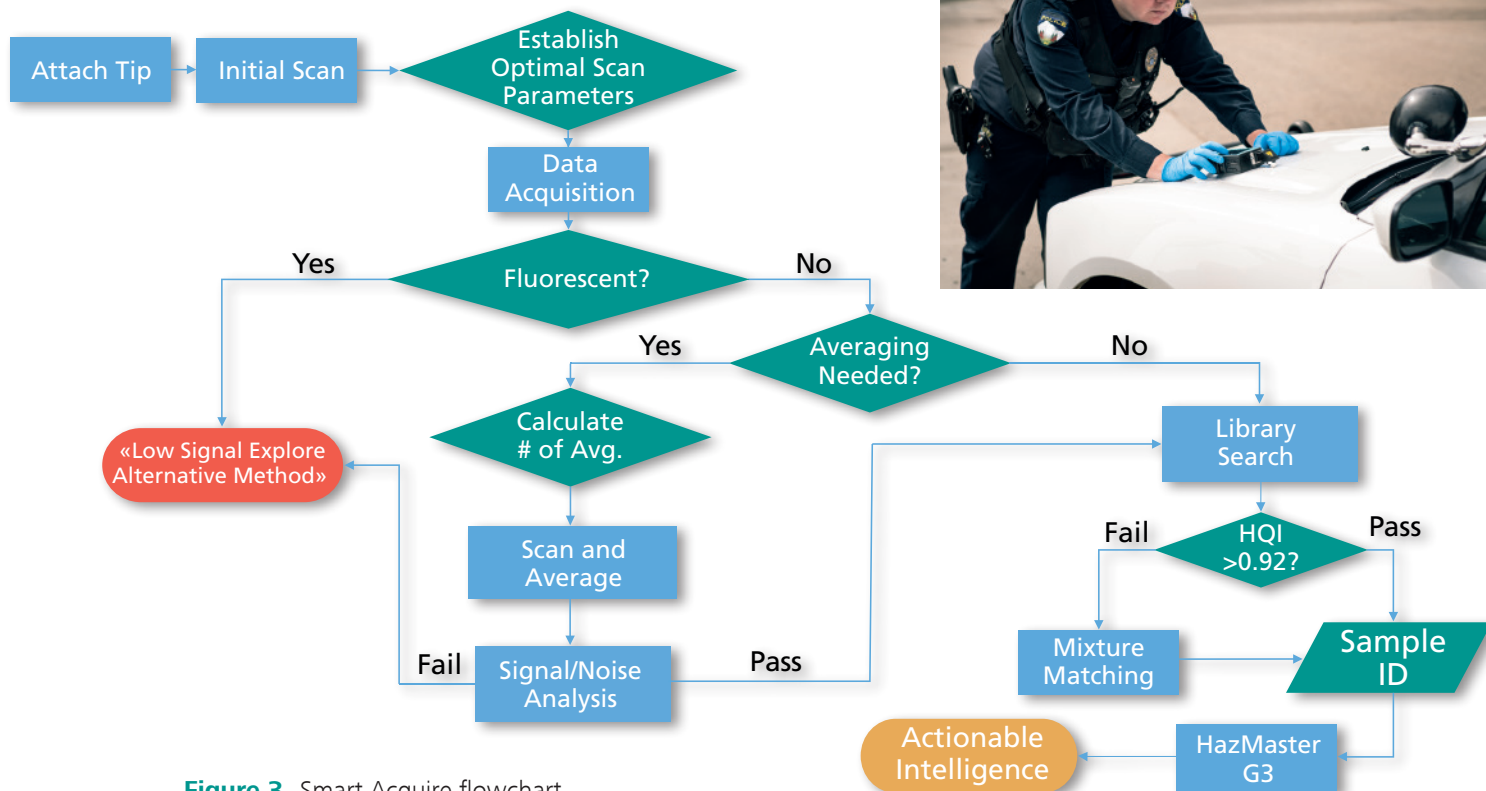


Figure 3. Smart Acquire flowchart

Mixture Matching

Smart Acquire routines result in optimal data collection for *any* operator – this leads to accurate, reliable identification of substances. It also ensures that the highest quality spectra are submitted into Mixture Matching routines. Mixture Matching analyzes whether a spectrum could possibly represent a combination of substances.

First responders frequently encounter mixtures of chemicals: an explosive and its activator, drug «cocktails» made of narcotics mixed with cutting agents, and residual chemicals from production or refinement processes. Research into known combinations of illicit materials results in tagged and treed libraries that can deconvolute multiple spectra from complex mixtures.

Cocaine in a Complex Mixture

Consider the following spectra: The blue curve in **Figure 5** is real data collected from a street drug sample. A preliminary library search results in a positive match for sodium bicarbonate (**Figure 5**, green). However, sodium bicarbonate is a well-known cutting agent for cocaine. This relationship is specified in treed libraries, which establish correlations between commonly associated substances. Detection of this suspicious chemical automatically activates Mixture Matching algorithms.

In less than a second, Mixture Matching confirms the second component as cocaine, the red spectrum in **Figure 5**. Note that Mira DS accurately identified cocaine, although it is clearly the minor component in the street sample.

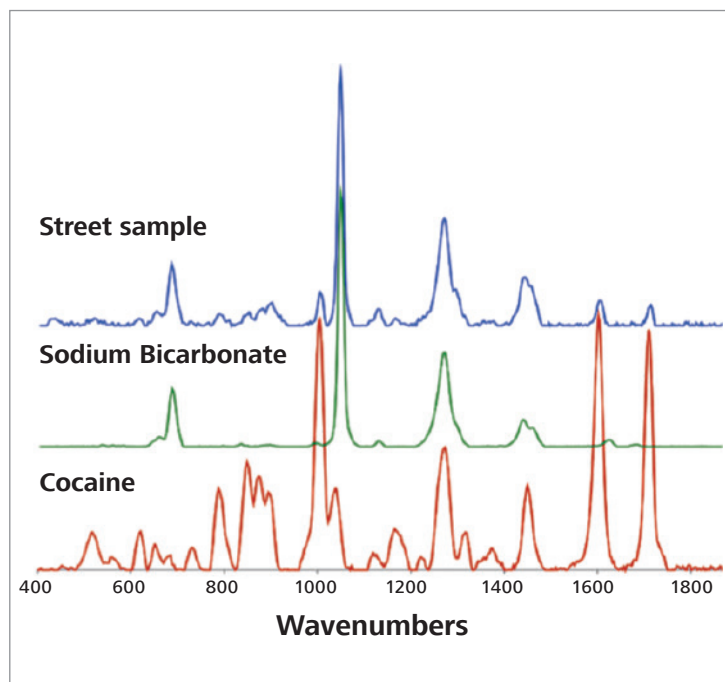


Figure 5. Identifying cocaine in a drug cocktail

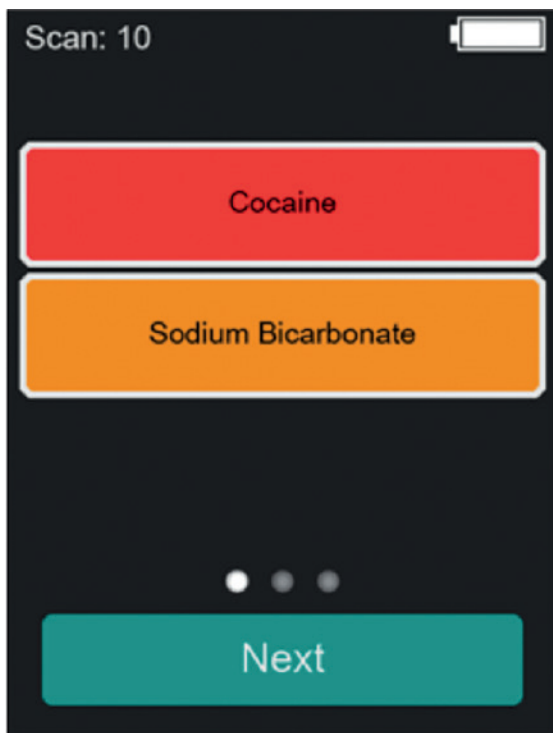


Figure 6. Color-coded hazard warning

Informed Reporting

Upon successful identification of an illicit substance, tagged libraries will produce a color-coded warning message. The screenshot at left (**Figure 6**) is the final result of the street drug analysis described above. This visual response allows for immediate action and preserves the safety of first responders.

Mira DS is designed specifically for a field-based defense and security professional that has safety, *theirs and yours*, in mind 24/7. The powerful combination of automated data collection and analysis with clear visual results puts lifesaving decision-making in the palm of your hand!