Application Note AN-RS-046

Through-container analysis with Raman spectroscopy

Safely identify materials without contact

The innovative Metrohm TacticID-1064 ST allows users to test through packaging and analyze the contents. See-through analysis is fast, easy, and prevents operator and material exposure to potential contaminants. TacticID-1064 ST is the first handheld 1064 nm Raman device capable of testing through paper, plastic, and glass barriers—even mixed, multi-layer, or colored materials.

First responders facing potentially deadly substances and situations benefit most from see-through sampling. From content ID of a suspicious bag during a traffic stop to analysis of homemade incendiary devices, every second counts and nothing can be left to chance. TacticID-1064 ST also benefits manufacturers who perform raw material verification. Operators can test container contents without exposure and get results in seconds. This streamlines QC and supports 100% testing of incoming goods. It also enables 90% of testing to happen at the point of receipt and avoids delays in production due to laboratory wait times.

INTRODUCTION

All Raman systems have some inherent ability to test through thin and transparent barriers like glass vials and clear plastic. Thick barriers—especially opaque or colored glass, plastic, and multiple layers of paper—require a modified optical system. TacticID-1064 ST (TID1064ST, Figure 1) handheld Raman system uses 1064 nm laser excitation to penetrate through packaging and analyze the contents of almost any container.

The ability to identify the contents of containers without opening them significantly expands a device's application range. This means that users can perform non-invasive scans for identification of unknowns or quality control in manufacturing. Ultimately, TID1064ST can enhance the safety, efficiency, and accuracy of material identification.

Figure 1. Finding contraband—from fentanyl to anthrax—in the mail is a very real issue. The ability of Raman to scan through paper is an invaluable asset.

SEE-THROUGH CAPABILITIES

TID1064ST with the See-Through (ST) Smart Attachment can measure samples situated inside bottles, envelopes, and even dense chemical storage containers. A unique data analysis algorithm quickly identifies and separates the container signature from the sample signature, accurately identifying both. Users can obtain reliable data in seconds, enhancing decision-making processes and streamlining workflows. A comprehensive library significantly enhances the device's versatility, enabling users to confidently identify thousands of materials.

SAMPLING OPTIONS FOR SEE-THROUGH ANALYSIS

Each TID1064ST Smart Attachment is recognized by the device, which automatically adjusts sampling specifics. The ST Attachment is ideal for thicker, opaque containers and packaging. This includes multiple layers of mixed materials like a solid sample wrapped in plastic inside of an envelope. It is not appropriate for liquid samples.

Other TID1064ST Smart Attachments (Figure 2) can be used in some through-packaging scenarios:

- General: 5.5 mm working distance. Suitable for solid, gel, and liquid samples in transparent/translucent containers.
- Long Working Distance: 8 mm working distance. Suitable for solids and liquids in thick-walled bottles and containers. The Bottle Adapter is an optional addition that optimizes contact between the device and curved surfaces.
- Short Working Distance: Suitable for direct contact surface testing and sampling of solid, gel, and liquid samples in thin transparent containers, such as thin plastic baggies.

Figure 2. TID1064ST has a suite of sampling attachments for any scenario.

BEST PRACTICES FOR GOOD RESULTS

Avoid exposure to ambient light at the aperture by holding the Smart Attachment firmly against the sample container during the entire scan. Do not move the device or the sample during acquisition.

Choose the appropriate attachment for the sampling situation. The General Attachment is suitable for most use cases.

While the Auto setting on TID1064ST is the fastest way to obtain accurate results, the device has options to improve results:

- Auto: The default setting that uses algorithms to automatically determine the best results.
- New container: Allows the user to create a temporary new container spectrum for unknown container types.
- Container type: Select a container from the known container library.
- Transparent/none: Select this option to optimize the matching algorithms for clear containers.

Finally, the visual sampling guides on the TID1064ST screen provide helpful tips on which attachment is best for a particular situation along with sampling guidelines (Figure 3).

SAMPLE REPORT

The TID1064ST PDF report includes key acquisition parameters and sample spectra overlaid with library references (Figure 4). When Container mode is selected for sampling, the Sample Report will include sample, container, and reference spectra.

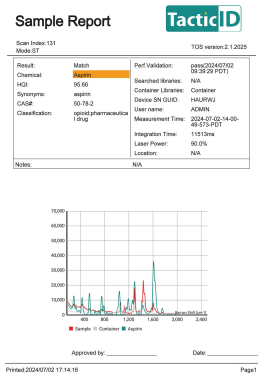

Figure 4. A TID1064ST PDF report. The container spectrum is included here as the light grey trace.

CONCLUSION

TacticID-1064 ST is the first 1064 nm Raman system capable of «see-through» analysis, allowing users to identify the contents of containers without opening them. The ability to test through barriers ensures that users can perform more scans in more locations, enhancing safety, efficiency, and accuracy in their work.

APPLICATIONS

Through-container analysis significantly expands TacticID-1065 ST's application range, enabling users to perform non-invasive scans in a variety of situations, from hazardous material identification to quality control in manufacturing.

Table 1. Sample and container types accompanied by relevant application use.

Sample	Container	Application
Caffeine	Plastic bag + 3-layer pink plastic bag Two-layer light blue nitrile glove	Known narcotic cutting agent
Mannitol	Plastic bag + 8-layer pink plastic bag	Known narcotic cutting agent
Sodium bicarbonate	Plastic bag in blue nylon stuff sack	See-through white powder analysis
Sodium bicarbonate	Plastic bag in green manila folder	Quick, on-the-spot testing of mail
Aspirin	Manufacturer's bottle	Quality control checks
Absinthe (65%)	Clear glass	Authentication
Cyclohexane	Amber glass	Raw material identification
Glycerin	Polyethylene bottle	Raw material identification
Acetaminophen	Blister pack	Authentication of black-market drugs

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CONFIGURATION

TacticID-1064 ST Advanced

The TacticID®-1064 ST is a 1064 nm handheld Raman analyzer for rapid field identification of explosives, narcotics, and other suspicious materials. The see-through capability of the TacticID-1064 ST can nondestructively analyze samples through opaque and transparent packaging, with sample threat level displayed prominently for first responders, safety personnel, law enforcement, bomb squads, customs and border protection, and hazmat teams to act quickly with minimal sample contact.

The TacticID-1064 ST utilizes proven Raman spectroscopy, in combination with patented STRaman® technology, allowing users to get real-time actionable identification of unknown chemicals, narcotics, pharmaceutical drugs, explosives and many other substances even through opaque barriers, significantly reducing operational uncertainty and response time.

The TacticID-1064 ST with 1064 nm laser excitation and the ST Attachment for see-through applications scans a large sample area, producing a fluorescence-free spectrum, allowing users to identify tough street samples, inhomogeneous mixtures and materials directly through packaging.

This IP68-rated system features a high brightness display with touchscreen and/or hardware button interface for ease of use even through protective gear.

Metrohm TacticID-1064 ST Advanced package includes the See-Through Attachment, General Attachment, SWD Attachment, Vial Holder, LWD Attachment, Right Angle Attachment, Polystyrene Attachment, Immersion Probe, Rugged Carry Case, cables, power supply, and laser safety goggles.

TacticID-1064 ST Basic

The TacticID®-1064 ST is a 1064 nm handheld Raman analyzer for rapid field identification of explosives, narcotics, and other suspicious materials. The see-through capability of the TacticID-1064 ST can nondestructively analyze samples through opaque and transparent packaging, with sample threat level displayed prominently for first responders, safety personnel, law enforcement, bomb squads, customs and border protection, and hazmat teams to act quickly with minimal sample contact.

The TacticID-1064 ST utilizes proven Raman spectroscopy, in combination with patented STRaman® technology, allowing users to get real-time actionable identification of unknown chemicals, narcotics, pharmaceutical drugs, explosives, and many other substances even through opaque barriers, significantly reducing operational uncertainty and response time.

The TacticID-1064 ST with 1064 nm laser excitation and ST adapter for see-through applications scans a large sample area, producing a fluorescence-free spectrum, allowing users to identify tough street samples, inhomogeneous mixture,s and materials directly through packaging.

This IP68-rated system features a high brightness display with touchscreen and/or hardware button interface for ease of use even through protective gear.

Metrohm TacticID-1064 ST Basic package includes the See-Through Attachment, General Attachment, Polystyrene Attachment, Rugged Carry Case, cables, power supply, and laser safety goggles.

Metrohm TacticID-1064 ST Comprehensive Raman Library

Metrohm Comprehensive Raman Library - More than 29,000 spectral entries of chemicals, organic chemicals, solvents, polymers, dyes and pigments, TICs, TIMs, inorganics and organometallics, personal care products, and illicit materials for the Metrohm TacticID-1064 ST. CWA, explosives and mineral are optional libraries.

Metrohm TacticID-1064 ST Illicit and General Chemicals Library

Metrohm Illicit and General Chemicals Raman Library for the Metrohm TacticID-1064 ST includes drugs, TICs, TIMs, precursors, and general chemicals.

TDL-EXP: Metrohm TacticID-1064 ST Explosives Library

TDL-EXP: Explosives library for the Metrohm TacticID-1064 ST

TDL-XM-CWA: Metrohm TacticID-1064 ST CWA Library

TDL-XM-CWA: Chemical Warfare Agents (CWA) library for the Metrohm TacticID-1064 ST.