

Hazardous Material ID Through Opaque Containers with Agilent Resolve—a Handheld SORS System



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Introduction

The Agilent Resolve Raman handheld through-barrier identification system uses Agilent proprietary spatially offset Raman spectroscopy (SORS) technology to identify solid and liquid hazardous materials concealed behind single or multiple barriers. These barriers can be colored or opaque plastics, glass, paper, card, wrapping, and fabrics.

Through-barrier identification capability improves:

Safety: No need to open or move containers—the hazard remains contained.

Decision making: Evidential and public safety information is preserved, and can be obtained early in an operation, before escalation.

Efficiency: Operators can spend less time in protective gear.

This Application Note details how the Resolve system can easily identify chemicals inside a range of opaque containers, in approximately one minute without any container being opened.

Experimental

To conduct a Resolve system measurement, simply select the container type. The tests described are through-barrier measurements (Thick, Colored, or Opaque selected) (Figure 1).



Figure 1. Selections for through-barrier, point-and-shoot, or glass vial measurements.

The Resolve system can be operated using a time delay or alternatively by a remote trigger cable. Either selection allows the operator to move to a safe distance before starting a measurement (Figure 2).



Figure 2. Risk assessment screen for setting a time delay or reducing laser power.

Resolve has been tested against a wide variety of toxic industrial chemicals and other hazardous materials, and through many different barriers.

Liquid samples were decanted into containers directly and scanned in through-barrier mode. Solid samples were either loose or contained within a thin plastic bag that was taped to the inside of the larger vessel.

All materials were correctly identified from the on board library. Classes of petrochemical products can be identified from the petrochemicals library.

Examples of materials tested

- Toxic industrial chemicals
- Acids
- Organic solvents
- Chlorinated solvents
- Oxidizers
- Hydrocarbons
- Flammable liquids
- Alcohols

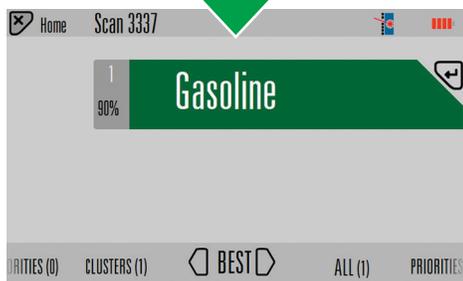
Also available

- Explosives
- Narcotics
- New psychoactive substances
- Chemical agents

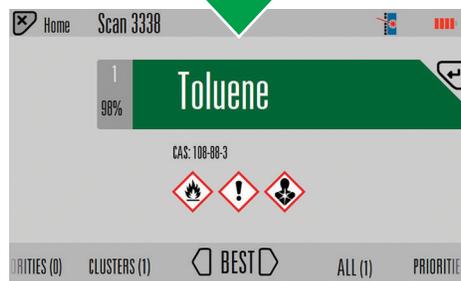
Measurements and Results

- Scan times are adjusted automatically based on the Raman signal strength, but typically take approximately one minute in through-barrier mode.
- The single best match result is presented—other display modes are available.
- Library items can be tagged as a Priority when searching for specific materials. Priority matches display in red, all other matches display in green. In this case, oxidizing materials were set as a Priority category; therefore, potassium permanganate displays in red.
- All four tests easily identified the concealed material (Figures 3 and 4). In each case, the measured spectrum is a high-quality match with the library spectrum, despite being measured through the container.

Gasoline



Toluene



Potassium permanganate

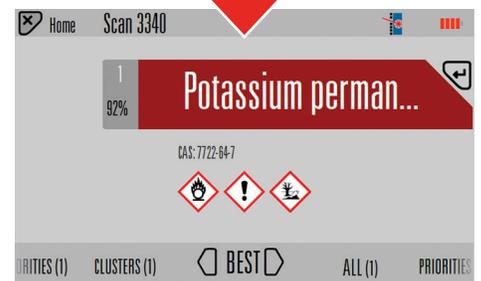


Figure 3. Results from three measurements conducted through thick colored plastics and dark brown glass.

How SORS Identifies Chemicals Through Containers

Sucrose, a relatively weak Raman scatterer, is a challenging sample to identify, particularly through barriers. The Agilent Resolve system easily identifies sucrose through a white HDPE plastic tub, automatically removing the signal from the barrier without previous knowledge or user input.

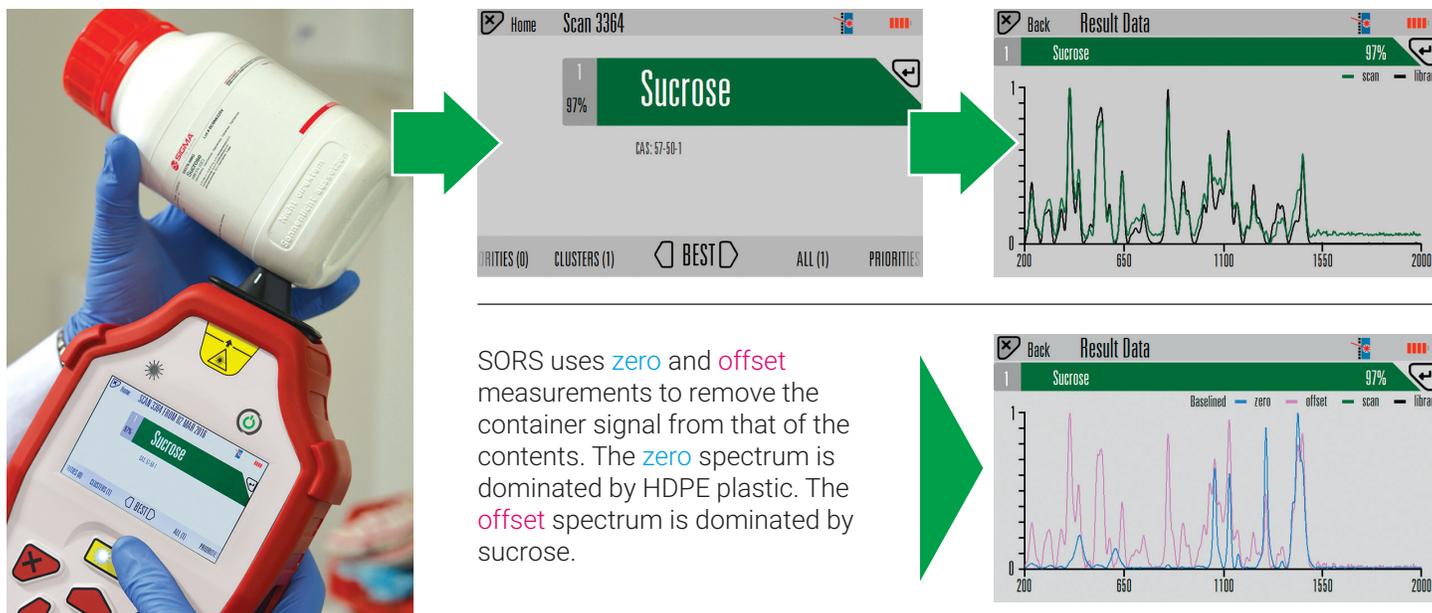


Figure 4. SORS combines zero and offset measurements to obtain a high quality spectrum of a container's contents.

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