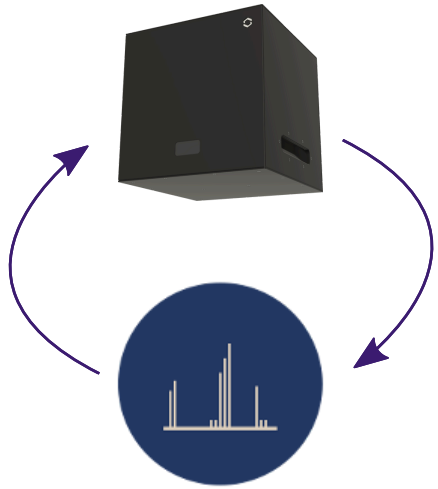
Technical Research Strategy

1. Point-of-care non-destructive Raman mapping drug screens using Scatr Series One.

2. Optionally send samples to laboratory for confirmatory LC-MS testing.

3. Use LC-MS results to improve machine learning substance detection (further explained in the following slides).



4. New machine learning model is released to all networked devices, enabling wide-spread improved detection & classification. Process iterates.

**Note: Adding substances to the database requires an exemption to purchase a reference standard, creating a bottleneck for improvement.*

Machine Learning Workflow

Creating and optimizing machine learning models requires two processes that eventually converge:

Process One: Model Training

-Reference standards are purchased to generate Scatr's Raman library. Various machine learning models are created to try to best predict the compositions of samples.

Process Two: Generating Testing Data

-Street samples are collected and analyzed using the Series One and then LC-MS to generate true positive and true negative data that is then used for model validation

Convergence: Model Validation

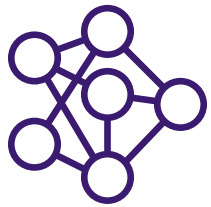
-All trained models are evaluated using the testing data. The best-performing model is selected and released over the air.

Process One: Model Training

Reference standards purchased
(via exemption 56)

Reference Raman spectra obtained

Samples scanned on
Scatr Series One

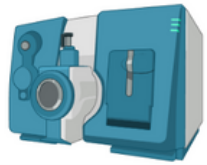


Reference spectra are stored in a library, which are used to generate/train multiple machine learning models

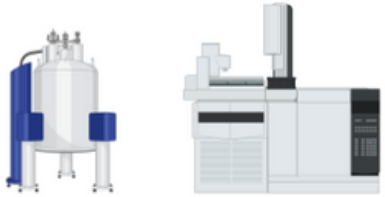
Process Two: Model Testing

Street samples delivered to UWO Laboratory

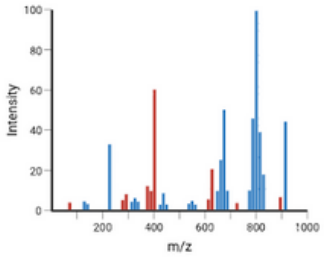
Samples scanned on Scatr Series One



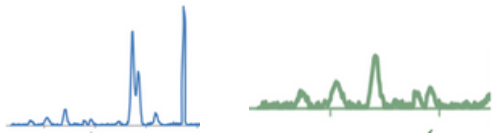
LC - MS data acquired



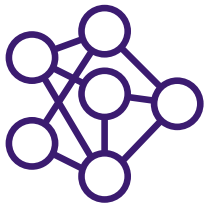
Additional (optional) confirmatory techniques performed at Drug Analysis Service



Substance(s) identified



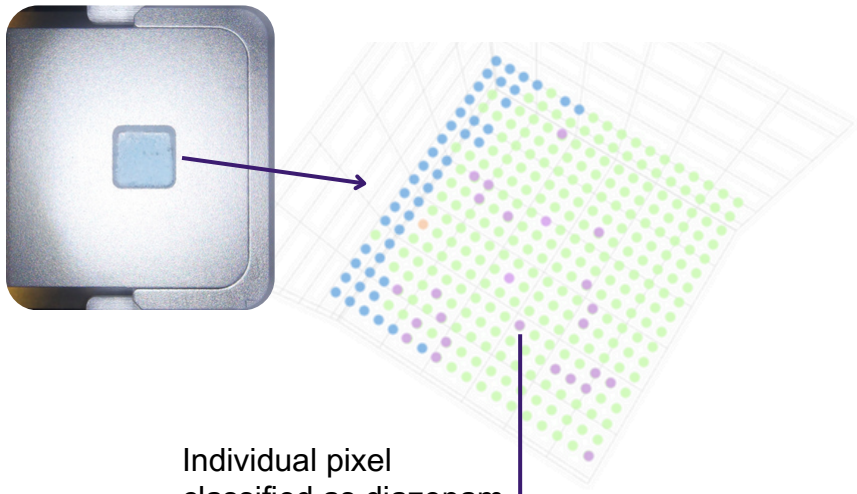
Street Raman spectra confirmed with mass spec IDs



Convergence:

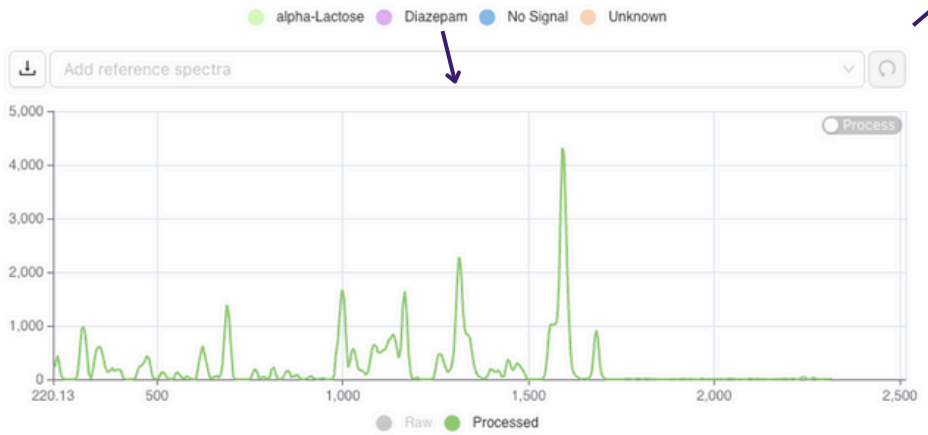
ML models' abilities to correctly classify Raman spectra are compared using the samples with confirmed LC-MS IDs. The best-performing model is then released over the air.

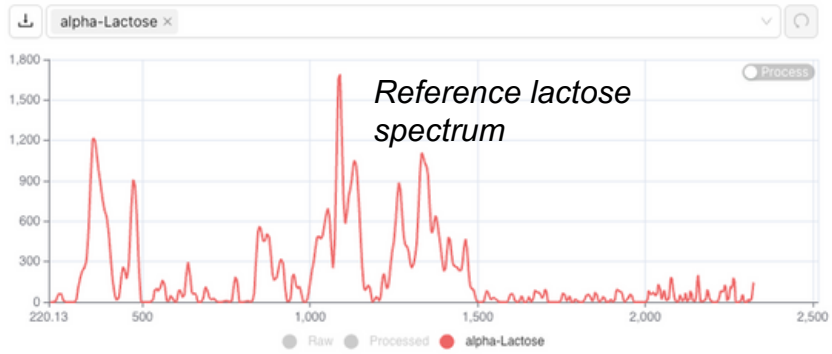
Why Mapping?



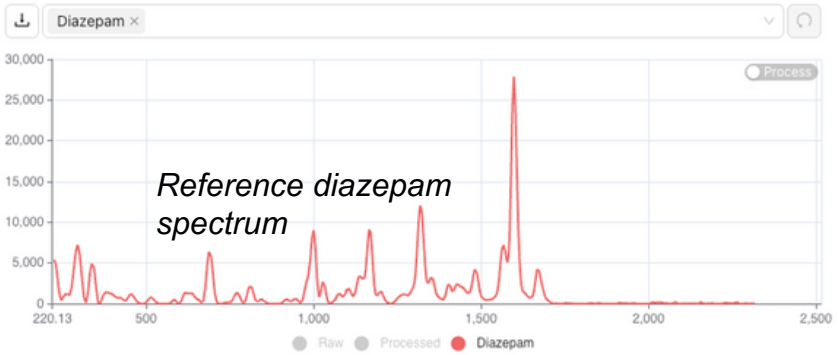
Mapping can identify pixels of active ingredients, commonly known as "*drug hotspots*" in a sea of filler (e.g. lactose).

Individual pixel classified as diazepam within a benzo pill



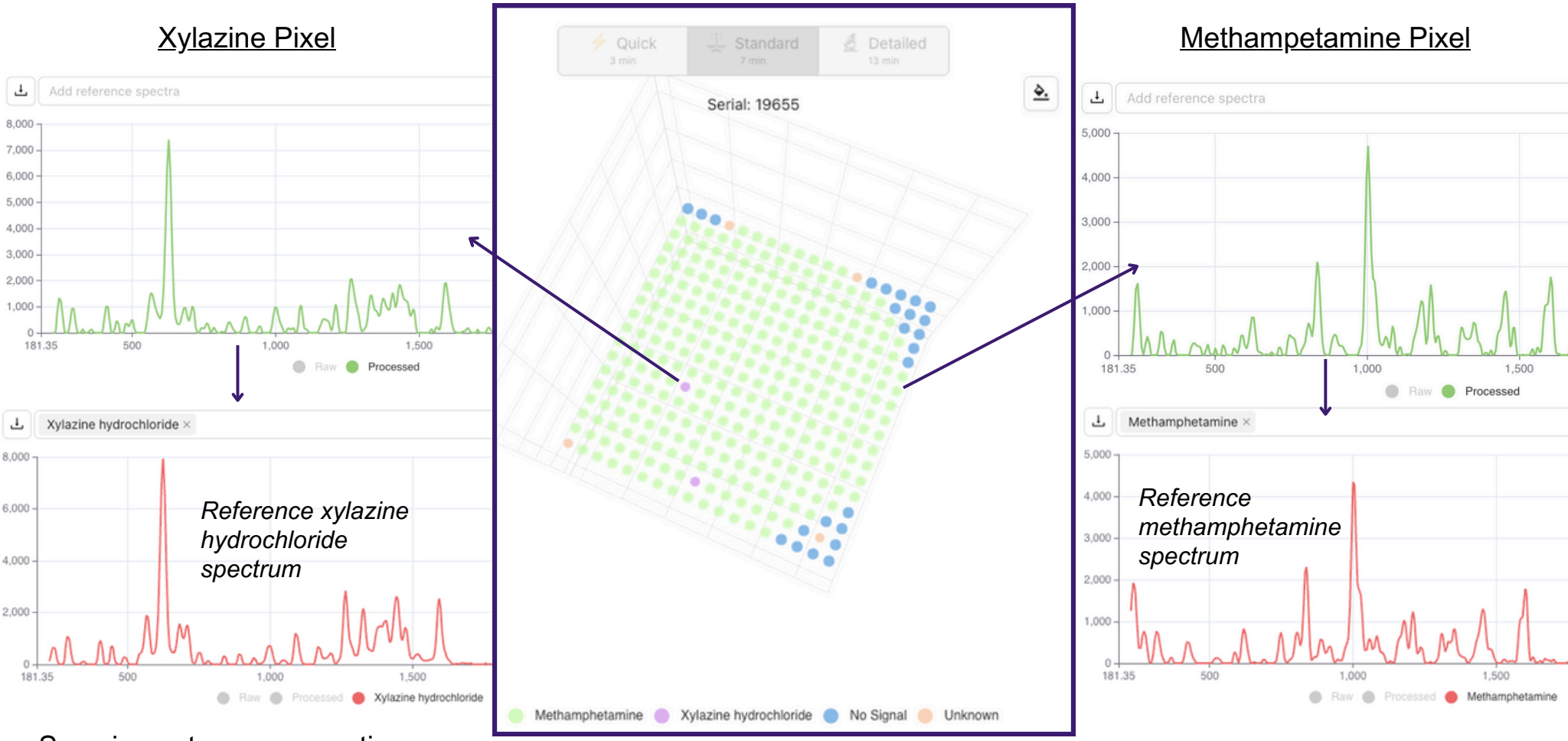


Reference lactose spectrum



Reference diazepam spectrum

Mapping identified xylazine in two pixels within a sea of methamphetamine:



Scan impact on consumption behaviour of user:

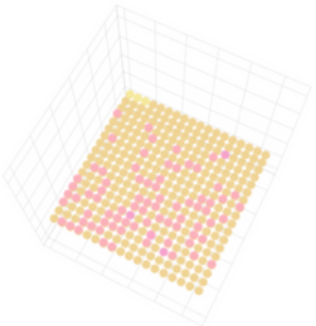
Scan Impact	Did Not Consume
Strength	⚠ Very Strong

Classification improvement of drugs **in mixtures** is gradual

Even when a spectrum can be recognized manually (its spectrum is visually distinguishable), the challenge lies in setting confidence thresholds for automated classification. This is true for all forms of machine learning technology in any analytical device.

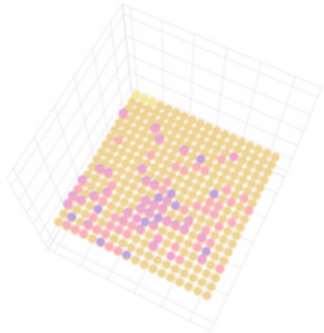
Example 1: Illustrates the results from the **same scan**, after a software update occurred, enabling the classification and reporting of xylazine in the sample.

December 2024



Xylazine **not** classified and reported as present.

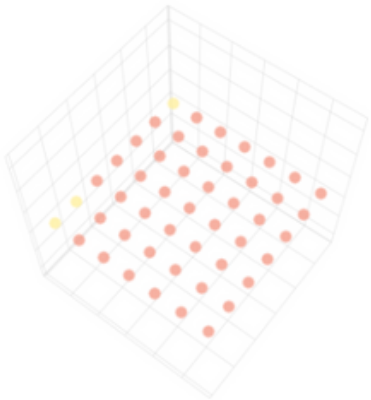
January 2025



Xylazine classified and reported as present.

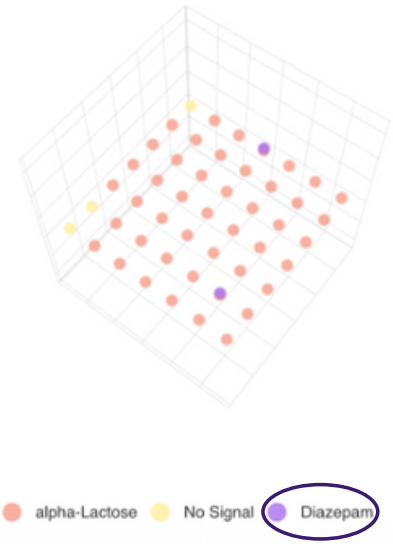
Example 2: Illustrates the results from the **same scan**, after a software update occurred, enabling the classification and reporting of diazepam in the sample.

April 2025



Diazepam **not** classified and reported as present.

May 2025

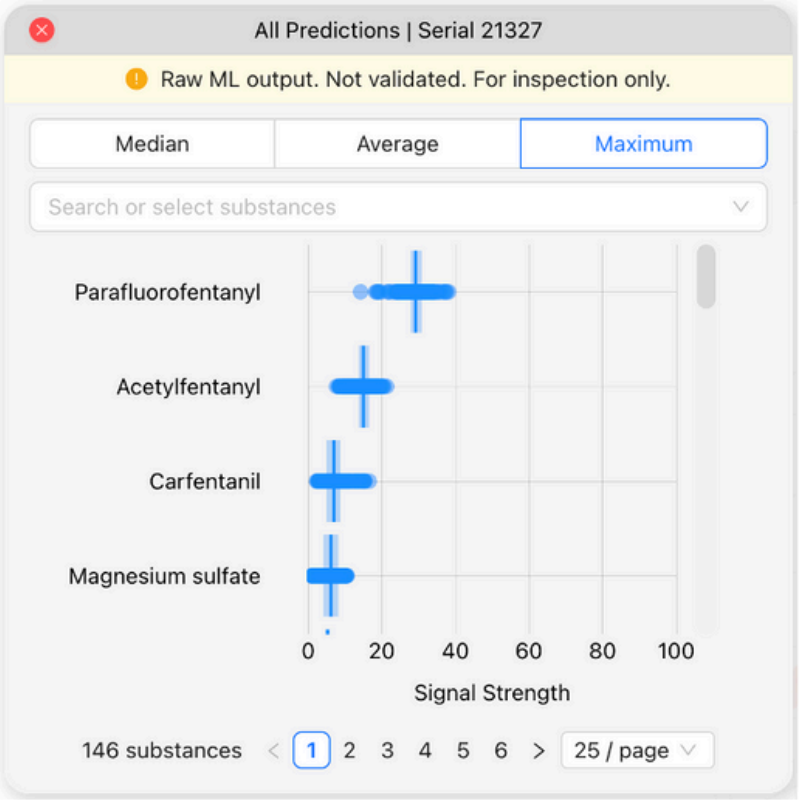


Diazepam classified and reported as present.

Coming Soon: Scatr's Pro Account

Pro Account users will have access to a **free service** that enables them to manually confirm spectra and associate them with any substance in the database:

Training may be extensive, as each map can generate **over 300 spectra**, compared to just a *single spectrum* typically produced by FTIR.



Pro Account users will be able to view the **raw machine learning outputs** for a specific scan across all substances in the database.

This allows drug-checkers to critically evaluate their scan results and further communicate with drug users about their sample.