RMI
ANALYTICAL & TESTING INSTRUMENTS

Využití Standoff Ramanovy spektrometrie při detekci nebezpečných látek a drog

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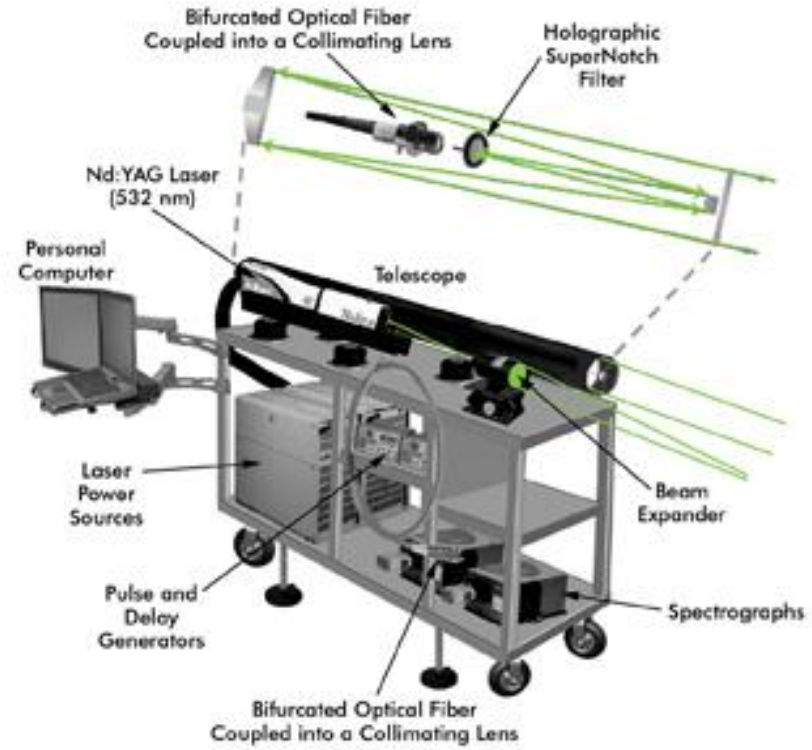
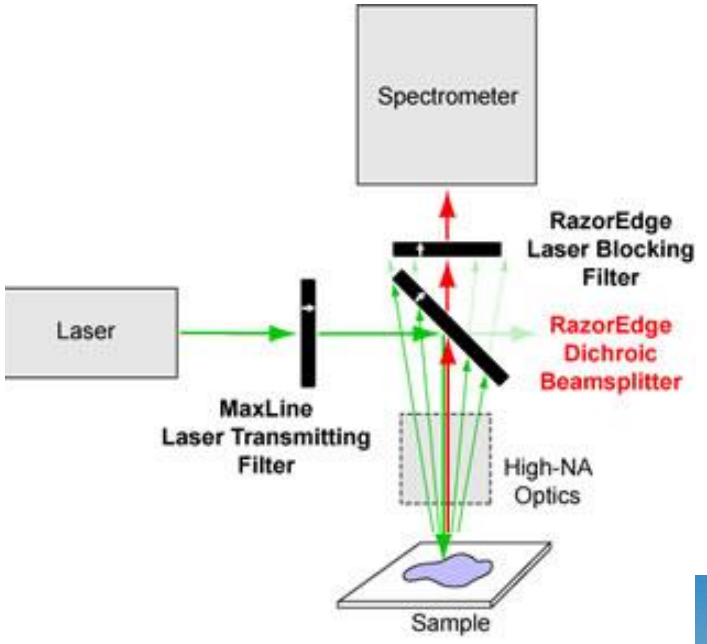
StandOFF Raman – bezkontaktní měření ze vzdálenosti





Long range – 2 až 30 m

Short range – 10 až 200 cm

RMI
ANALYTICAL & TESTING INSTRUMENTS

Pendar X-10 Stand OFF diferenční Ramanova spektrometrie

Unikátní technologie Ramanovy spektrometrie vyvinutá pro bezpečnostní technologie, otevírá nové možnosti při analýze nebezpečných a obtížných vzorků

První generace 2019

Druhá generace 2020 - 2021

Pendar X-10 Stand OFF diferenční Ramanova spektrometrie

- Umožňuje měření ze vzdálenosti až 200 cm
- Motorizované fokusování na vzorek s rozlišením v ose z 1 mm
- Funkce automatického zaostření na vzorek na základě analýzy Ramanova signálu
- 100% nedestruktivní analýza – nízká energie laseru (max. 60 mW) s rastrováním po 100 ms. Nízké tepelné zatížení vzorku, možnost bezpečně měřit i černé vzorky.
- Hardware potlačení fluorescence. Schopnost měření i extrémně fluoreskujících vzorků při vysoké rychlosti měření.

RMI
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Standoff Advantage

- Handheld, short-range (**up to 2 m now**) standoff point-and shoot measurement
- Through barrier analysis prevents handling of sensitive materials

  Readings taken through thick, translucent containers

  Measure through closed plastic bags, chemical hoods, even closed windows

- Measure hard to reach samples

PENDAR TECHNOLOGIES

Safety Advantage

- Fast, fail-safe beam rastering:

  2 mm x 2 mm sampling area at 30 cm standoff distance

  Only app. 100 ms on one point

  A fail-safe mechanism constantly monitors the mirror movement and automatically shuts off laser in case of failure

- No ignition observed

  with gunpowder and black powders, sensitive primaries, sensitive HMEs (e.g. TATP, HMTD), fulminates, etc…

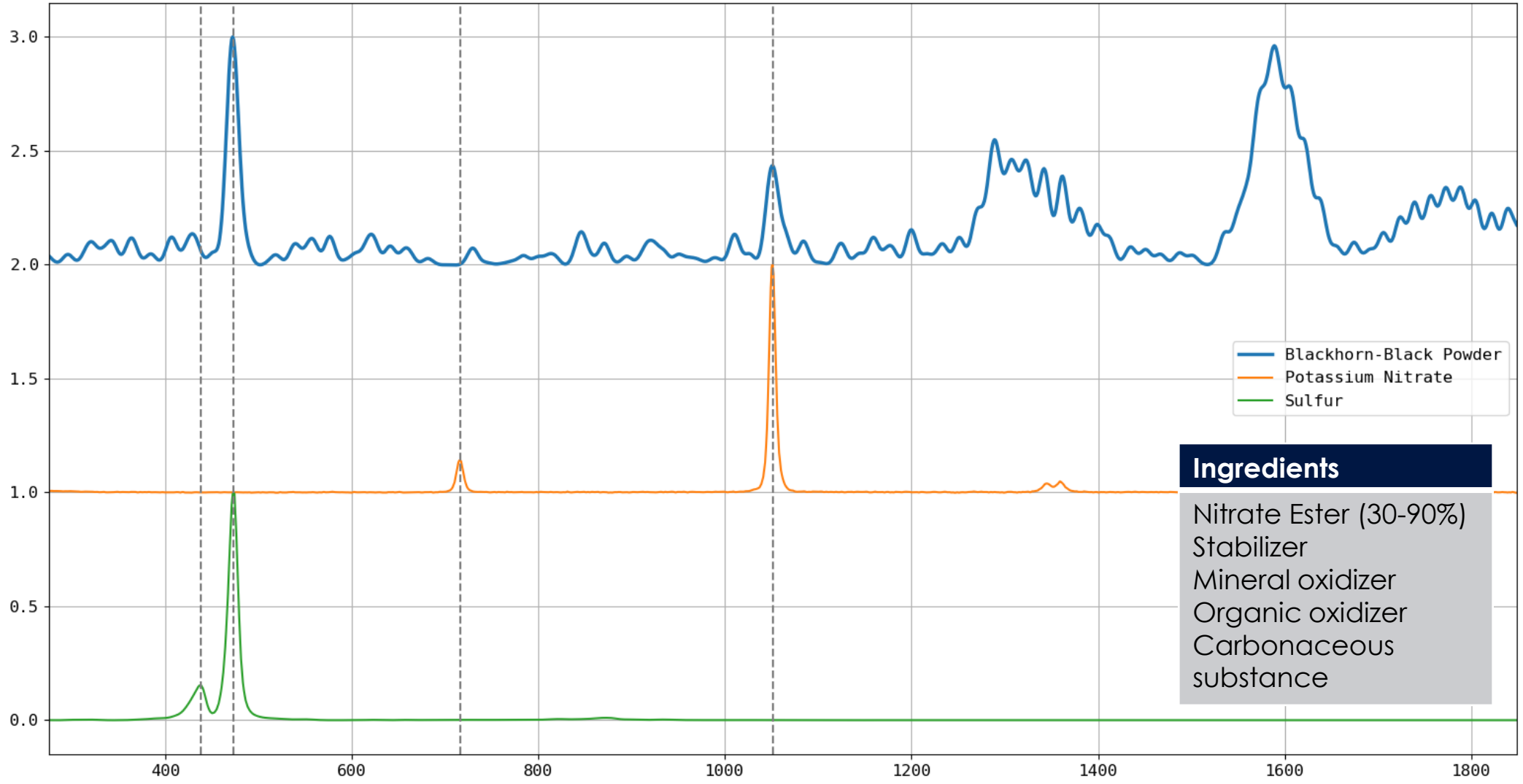
- Class 3R laser

  => Minimal risk of eye injury, no eye protection required

PENDAR TECHNOLOGIES

Bezpečnost na prvním místě

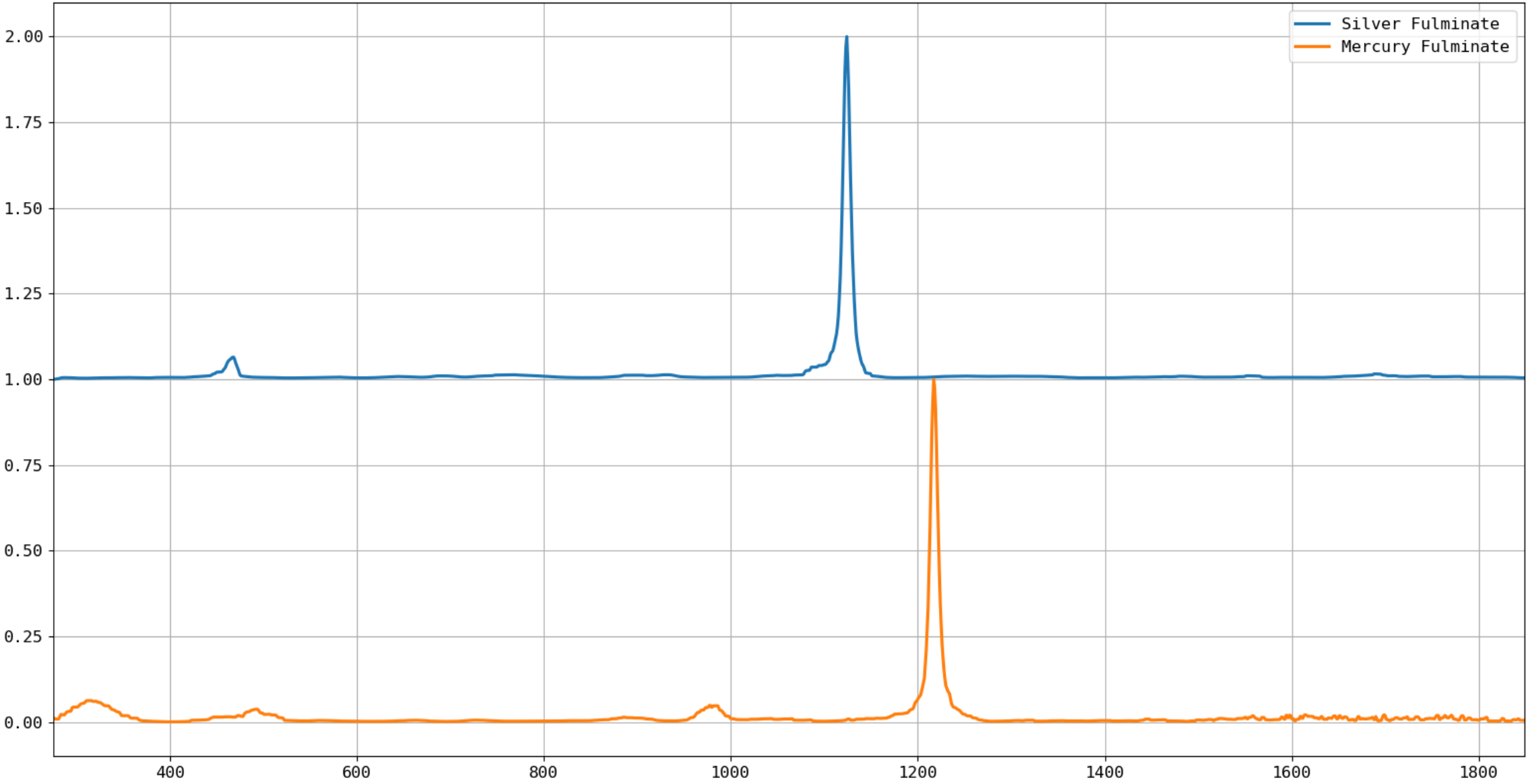
Blackhorn Black Powder



Ingredients

Nitrate Ester (30-90%)
Stabilizer
Mineral oxidizer
Organic oxidizer
Carbonaceous substance

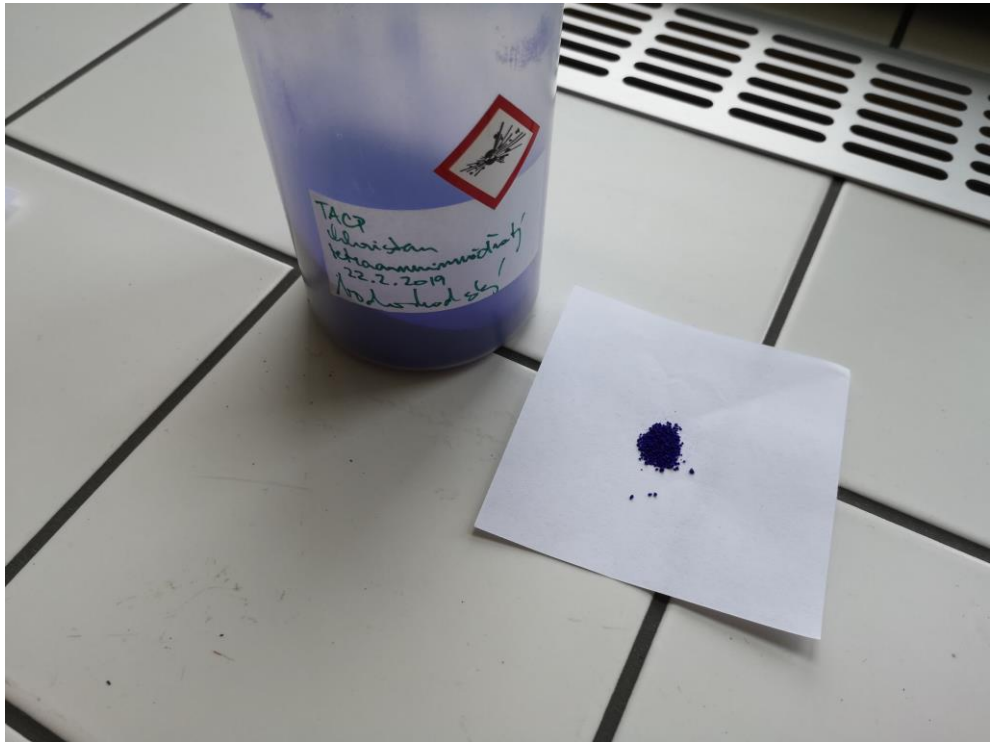
Mercury and Silver fulminate



Pendar X10 –safe identification of new generation of highly fluorescent and sensitive explosives

TACN, TACP, ...

Stand OFF Raman spectrometer Penadar X10 allows you **safe measurement without risk of ignition**. It was verified with integration times up to 10 minutes (collection of signatures to library). Typical time of measurement for identification **is less than 60 seconds** including highly fluorescent types.



Rychlost a elminace fluorescence

- Bez manipulace se vzorkem

- Dvouvlnová diferenční Ramanova spektrometrie

  Rychlá identifikace vysoce fluorescenčních materiálů

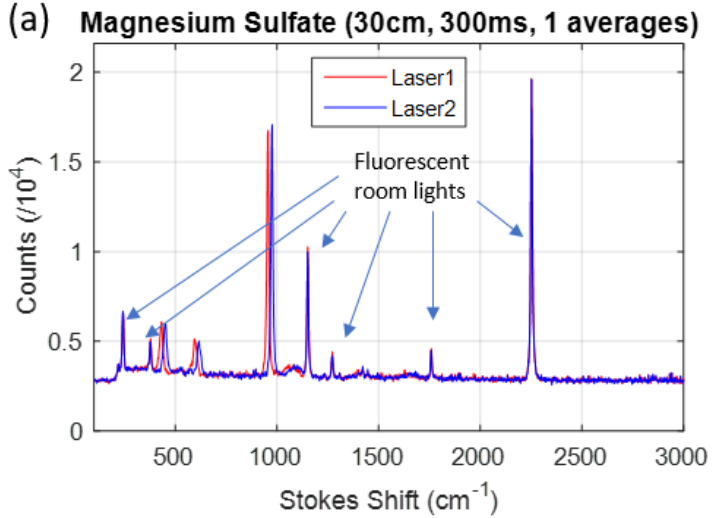
  - vysoce fluoreskující materiály <30 sekund,
  - bílé přášky 5 až 10 sekund
  - černé vzorky 1 – 3 minuty

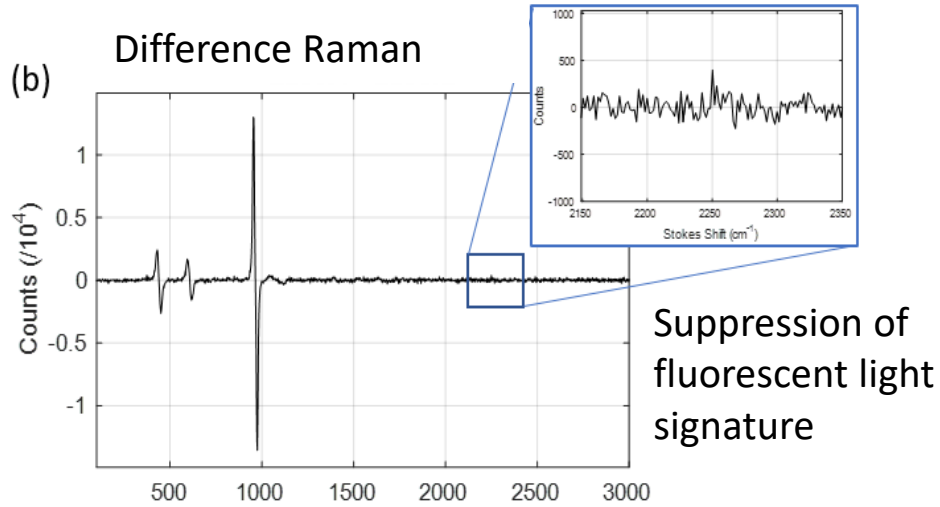
  Potlačení okolního záření

PENDAR TECHNOLOGIES

Two-wavelength (Difference) Raman: Ambient light subtraction

- Sunlight or other ambient light sources can interfere with the Raman signature
- Typical mitigation involves sampling the chemical in a vial and measuring it in a dark sample compartment
- Our approach:
  - Two lasers with closely spaced wavelengths are used
  - Two Raman spectra are acquired in succession using each pump laser
  - Fluorescence and ambient light are common to the two resulting Raman spectra
  - Raman chemical signatures are shifted spectrally between the two measurements
  - By taking the difference, fluorescence and ambient light is suppressed, while the Raman information is preserved



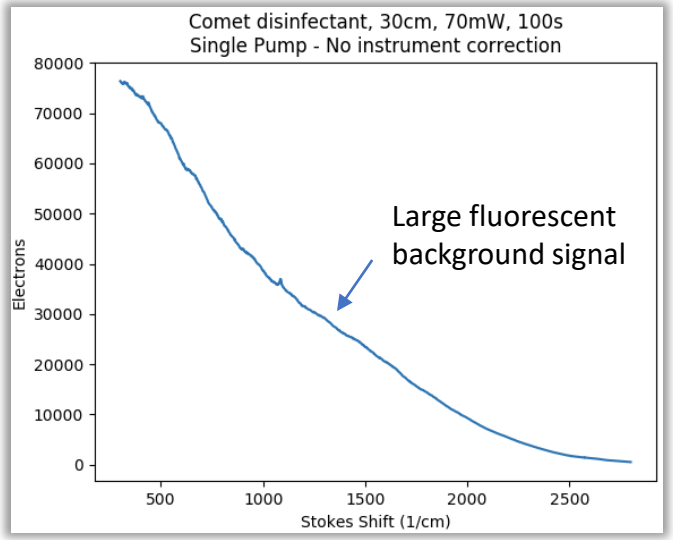


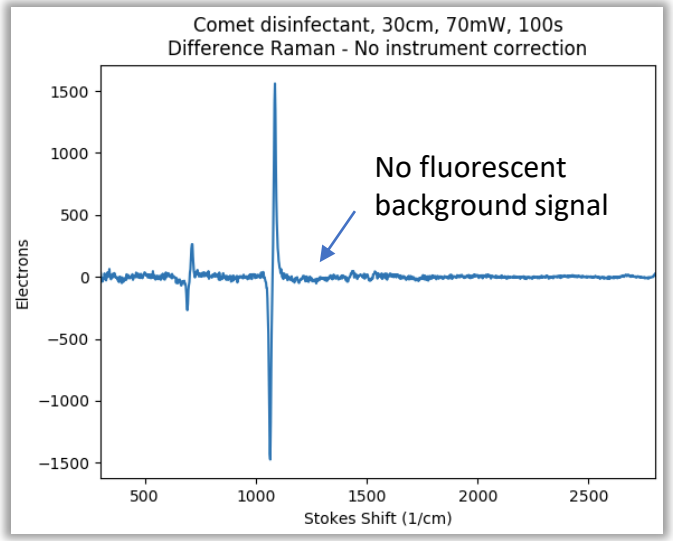
Suppression of fluorescent light signature

Two-wavelength (Difference) Raman: Fluorescence mitigation

- Strongly fluorescent materials can have their Raman signature swamped under a large background
- Any anomaly of that background (e.g. instrument calibration drift) will negatively impact chemical ID performance
- Differential Raman removes that fluorescent background and extracts the richest component of the spectral signature
- Differential Raman is resilient against calibration drift

Improves speed of chemical identification

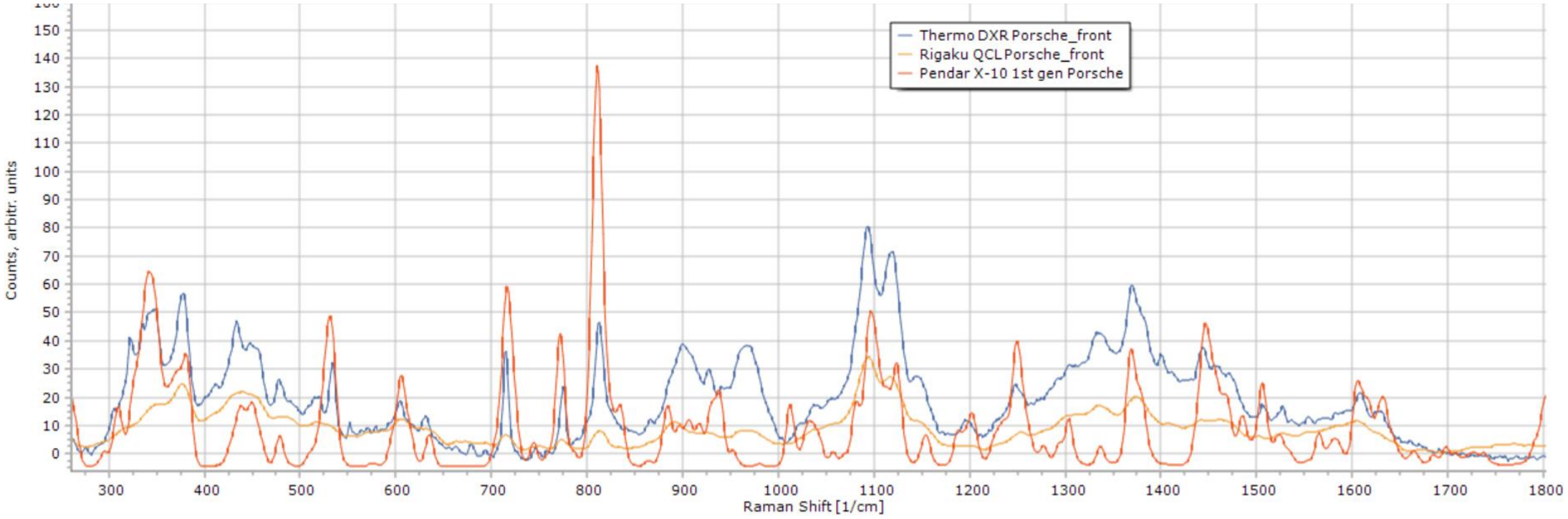




PENDAR TECHNOLOGIES

Pendar X-10 měření vzorků s vysokou fluorescencí

(MDMA)_3-4 methylenedioxymethamphetamine and Cellulose



Rigaku CQL – No Identification, **Low resolution spectrum**

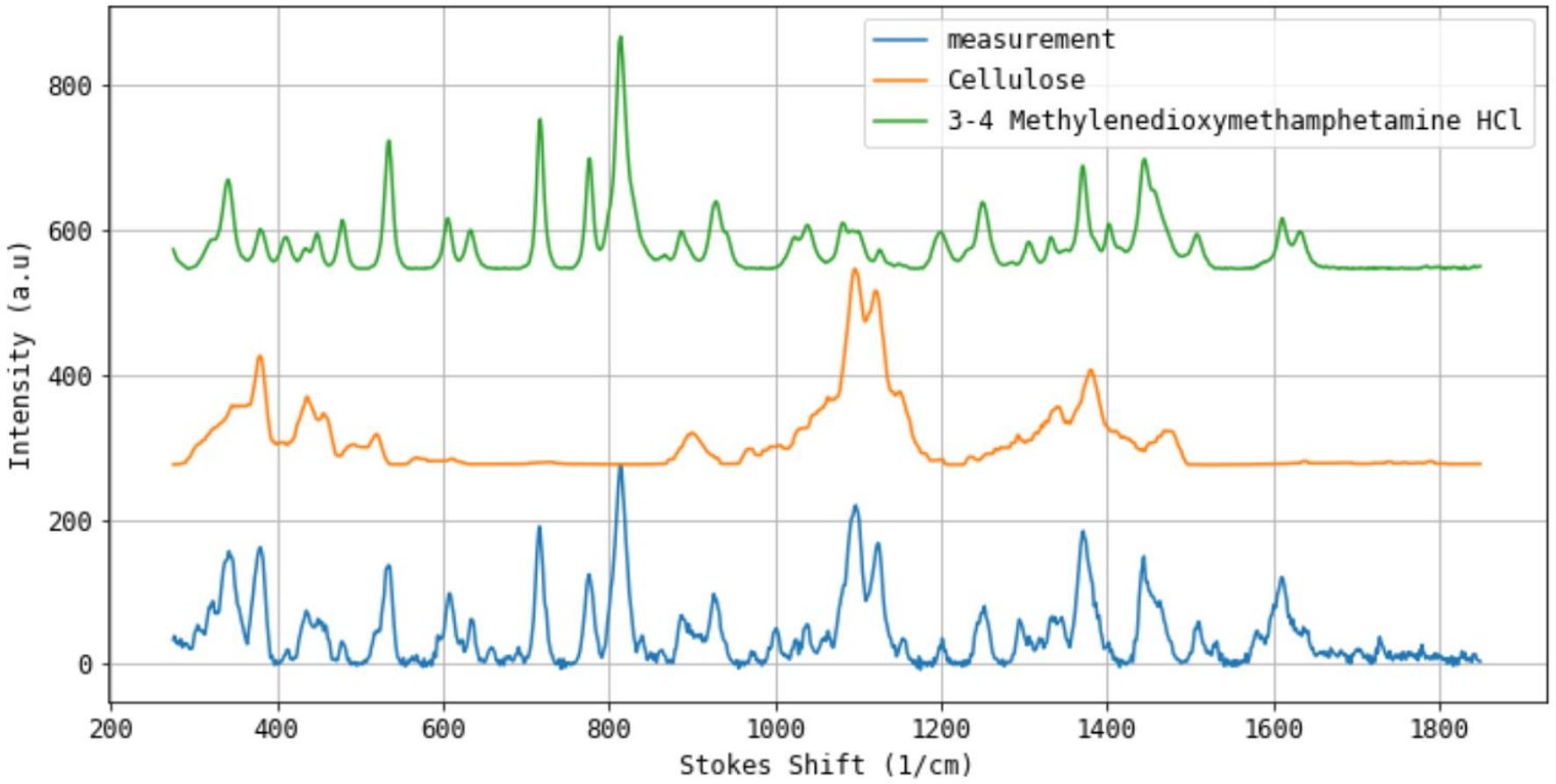
Thermo DXR – integration time 2 700 s, high resolution spectrum

Pendar X-10 1st gen – correct identification (MDMA-Cellulose) Integration time 60 s, **low noise and high resolution spectrum**

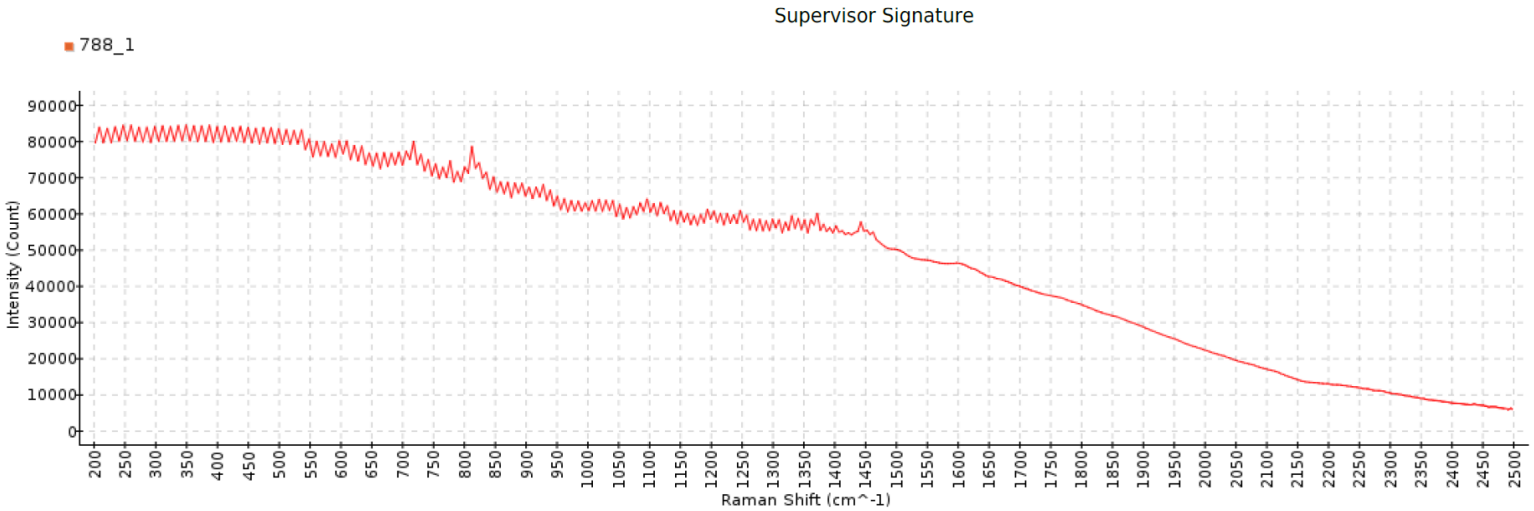
Sample:
Ecstasy pill

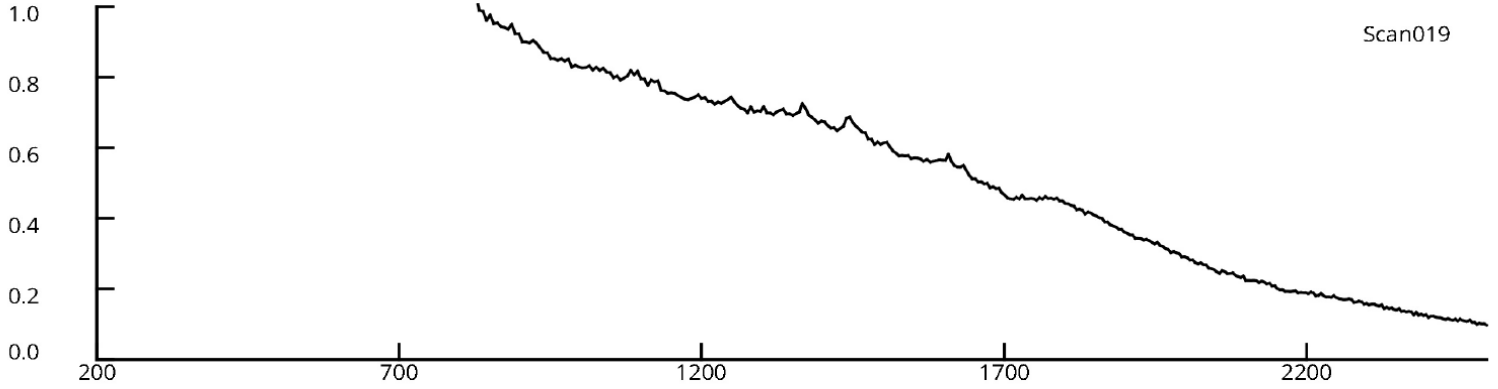
MDMA Tablete with high fluorescence

Pendar X-10 time of integration 30 s



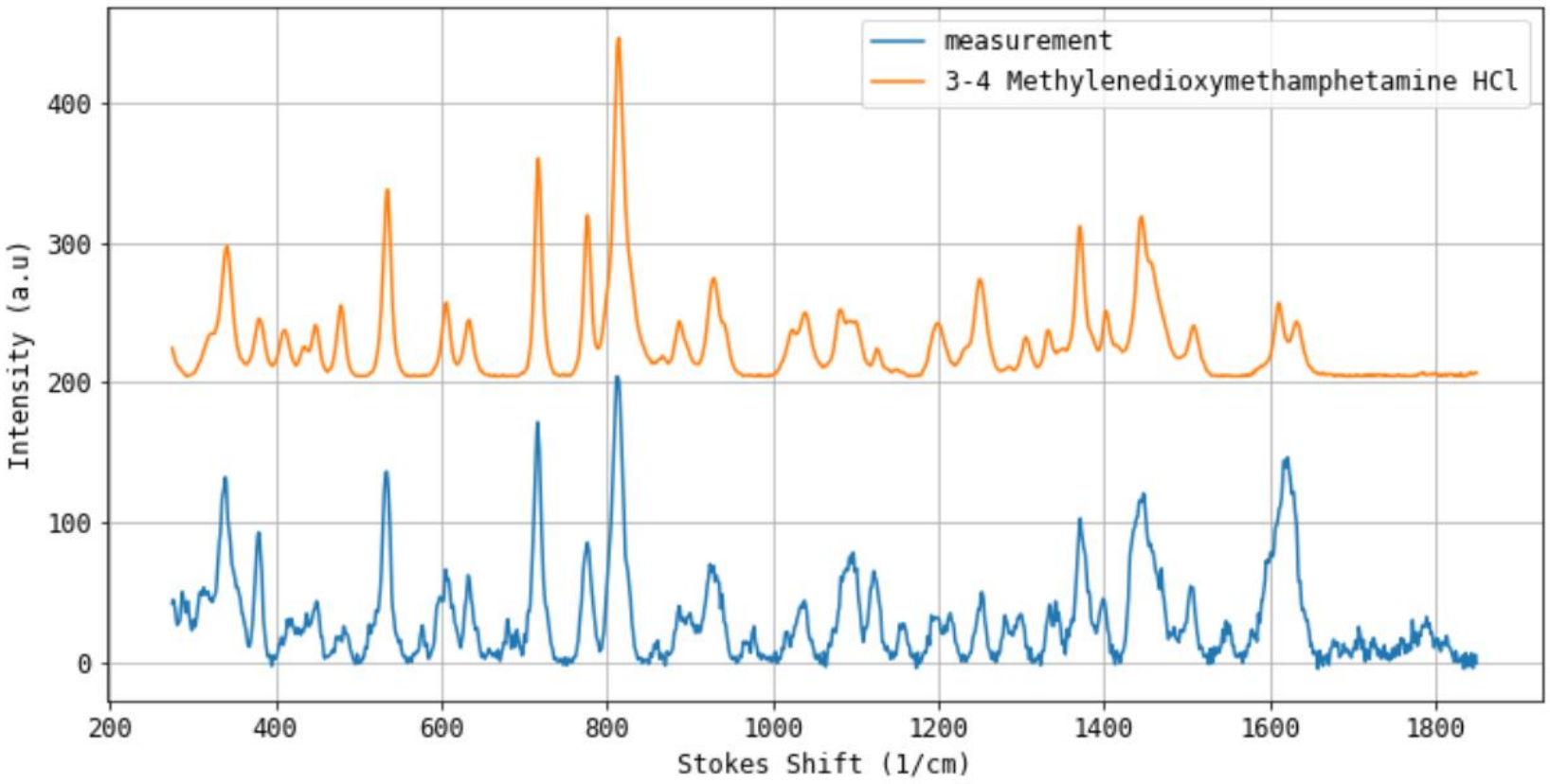
Extrémně fluoreskující vzorek – systémy s laserem 1064 nm – saturace detektoru



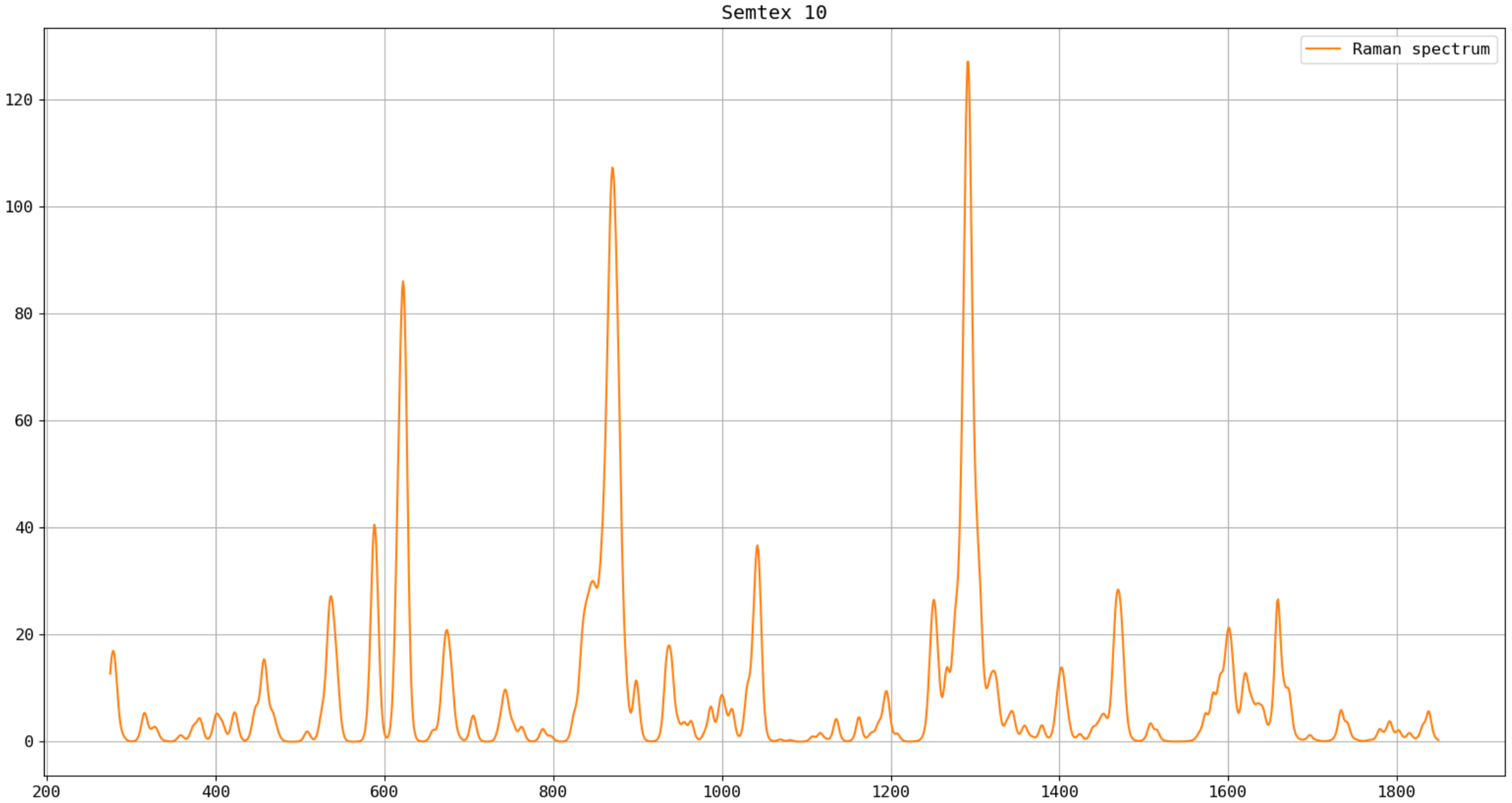


No Match Found

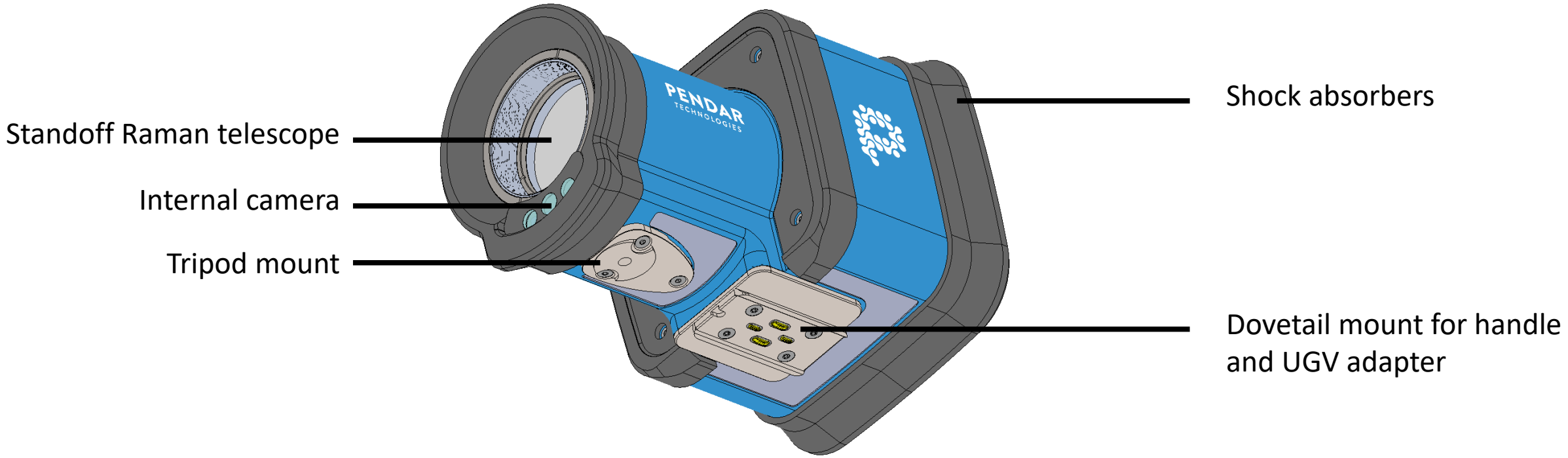
Extrémně fluoreskující vzorek – Pendar X-10



Semtex 10


Semtex 10
Raman spectrum
120
100
80
60
40
20
0
200
400
600
800
1000
1200
1400
1600
1800

Pendar X10 - Gen 2: Core



Pendar X10 - Gen 2: Core

Capacitive scratch resistant touchscreen
Optimized GUI

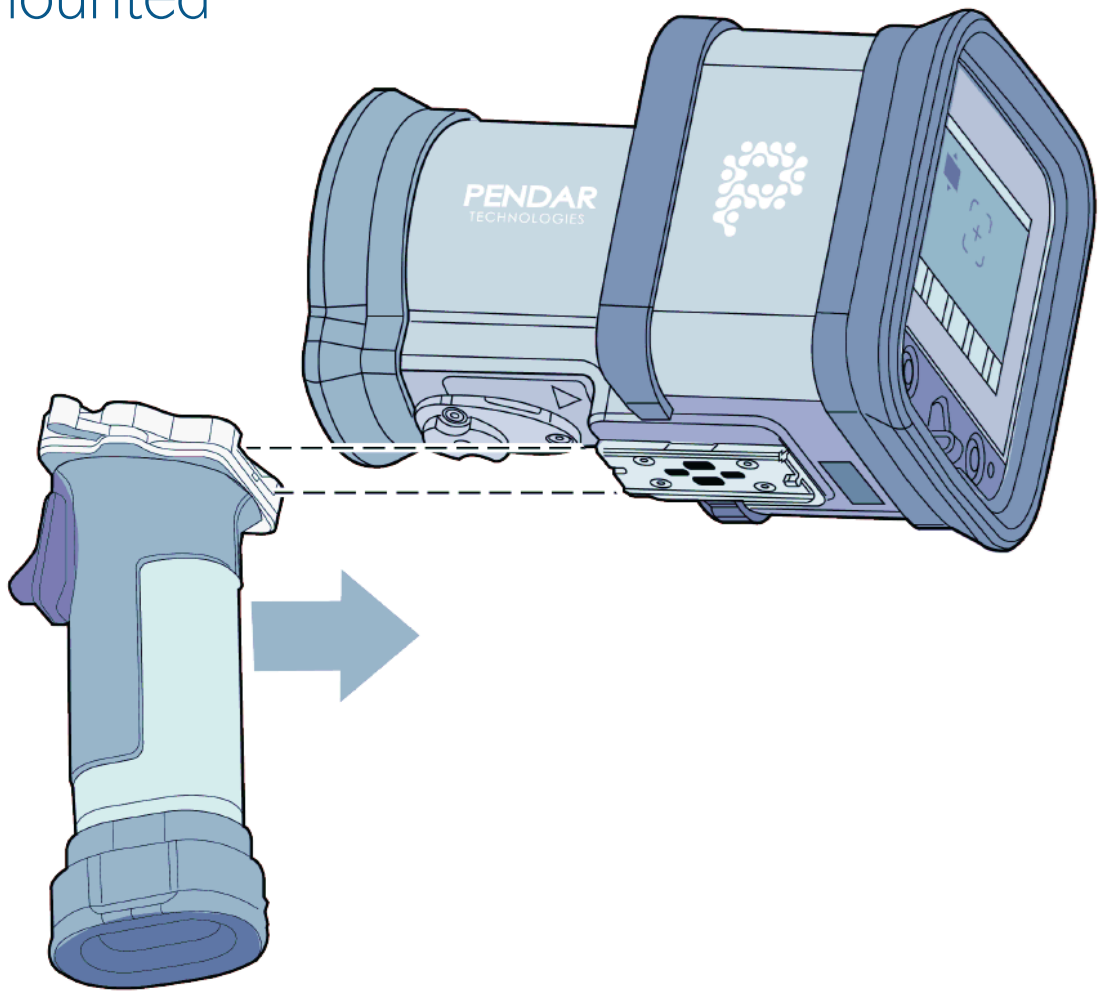
Can be operated with all types of protection gloves, including three layers heavy protection chem gloves

PENDAR TECHNOLOGIES

Modular Design

Rapid re-configuration handheld to UGV-mounted

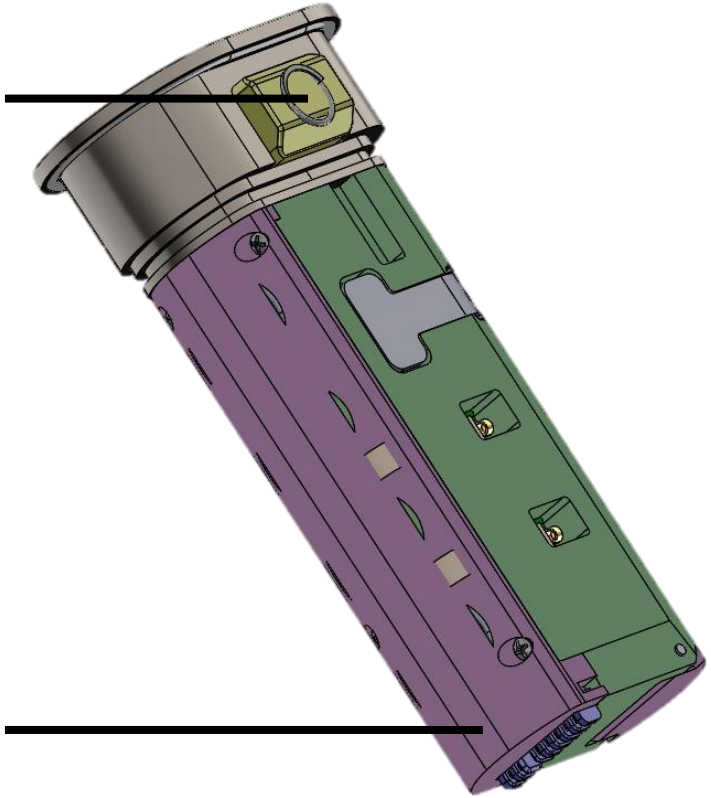
- Detachable handle can be swapped for UGV-adapter
- Tool-free operation
- Same battery cartridge used in both handle and UGV-adapter

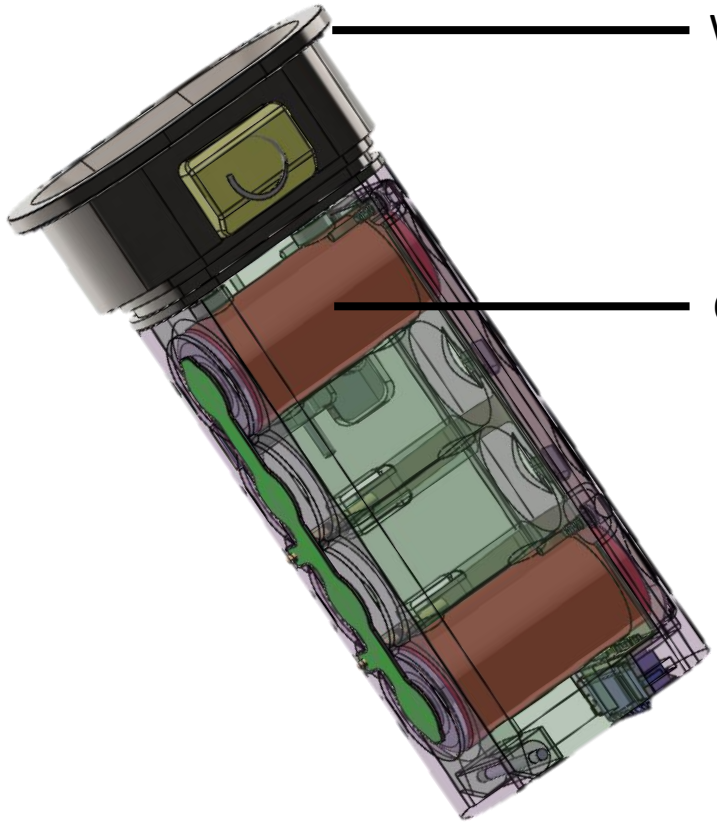


Pendar X10 - Gen 2: Battery Magazine

Large buttons to eject magazine

Gate to secure batteries in magazine

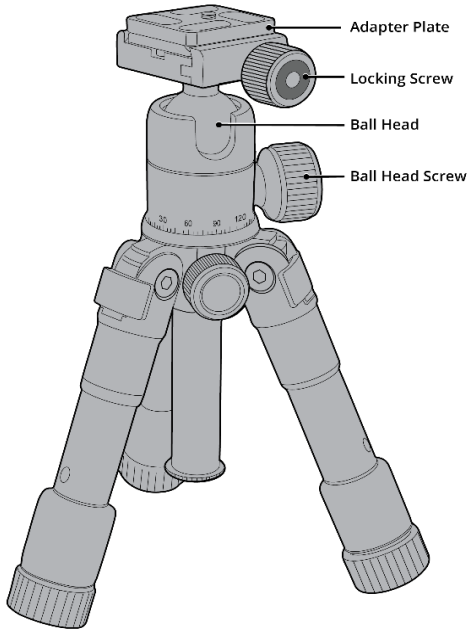


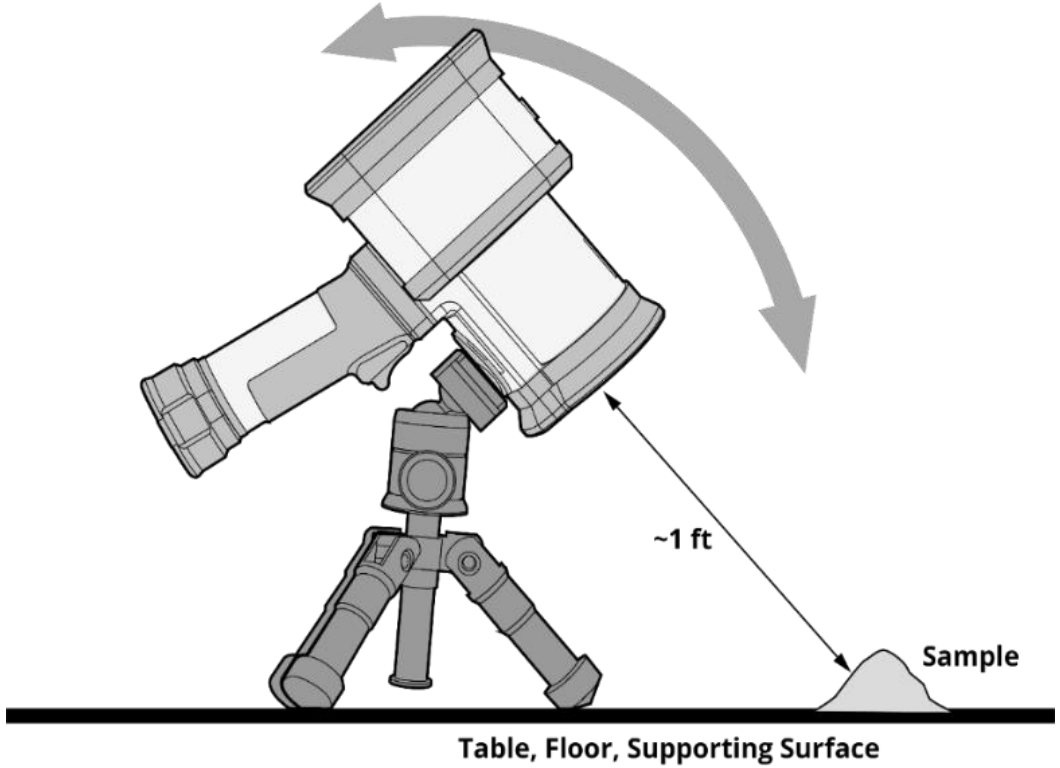


Waterproofing seal

CR123A (x4)

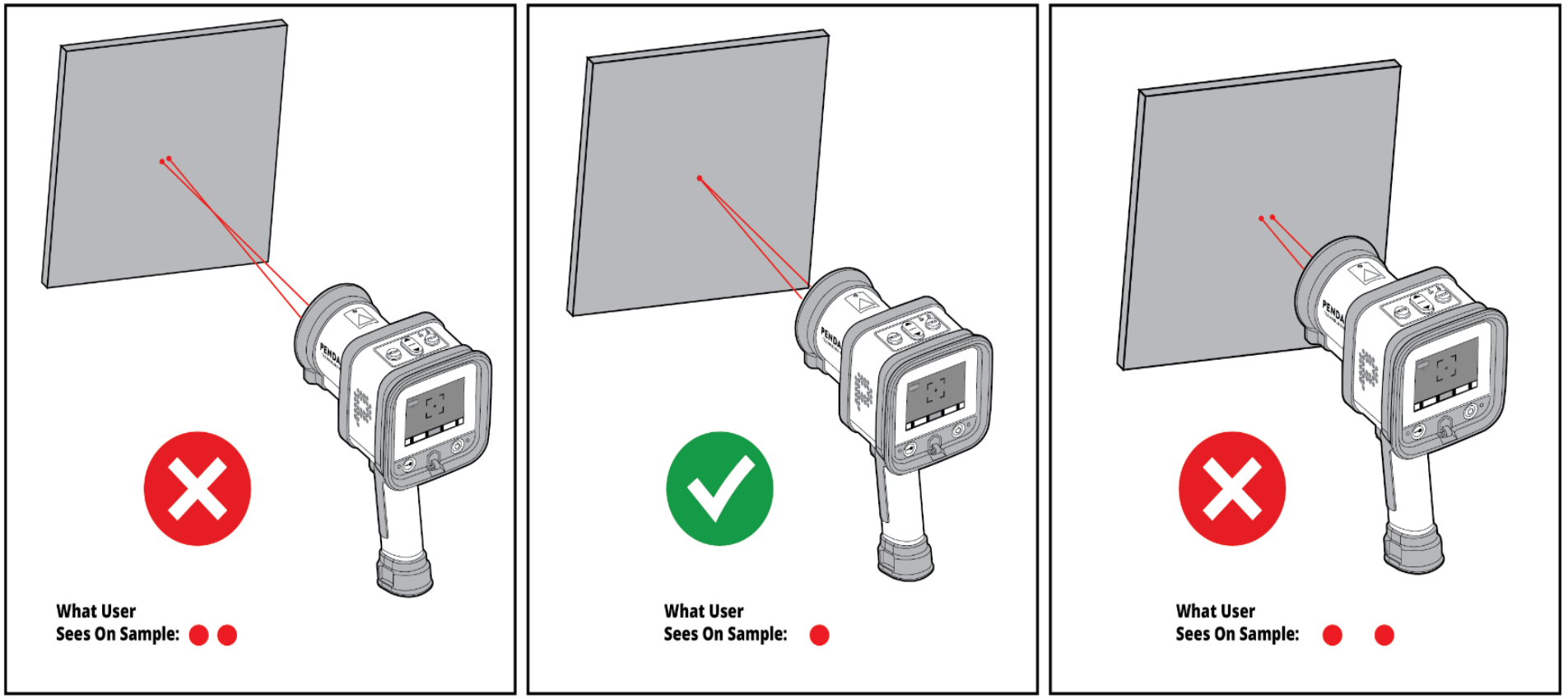
Možnost „ručního“ měření i měření ze stativu





PENDAR TECHNOLOGIES

Vizualizace zaostření s pomocí dvou červených laserů

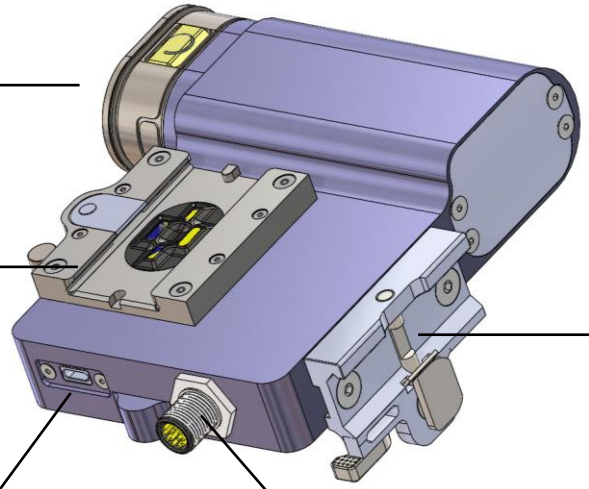


POZOR – Správná fokusace je KRITICKY DULEZITA

Funkce automatického zaostření na vzorek

https://drive.google.com/file/d/1bRinT8PE49bZmZeV1VVJxE47OBisLKXM/view?usp=sharing

UGV Adapter



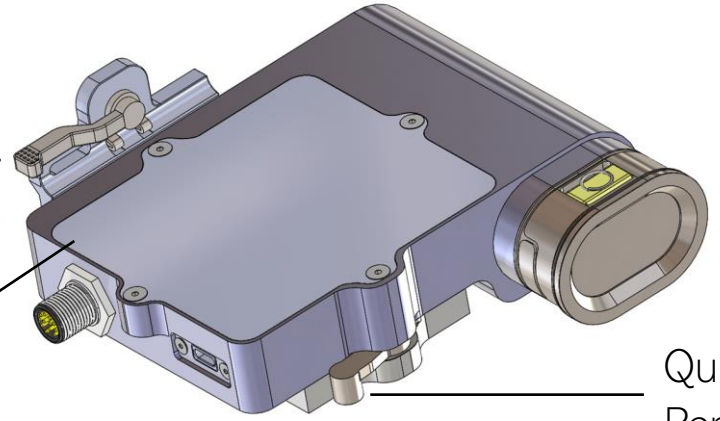
Same battery cartridge fits in Pendar X10 handle

Dovetail to Pendar X10 core (power connection)

Picatinny Rail

USB to Pendar X10

M12 Connector to UGV or radio ethernet



Quick release lever

IP 67 sealing

Quick release lever for Pendar X10 attachment

PENDAR TECHNOLOGIES

Robot-Mounting

- First Raman system designed for both handheld and UGV-mounted operation
- IWTSD(CTTSO)-sponsored development
- Simple mechanical adapters to fit wide range of robots available
- Self-powered (can sip power from UGV if desired)

Remote Chemical Identification

With Pendar X10

- Standoff measurement
  Maintain a safe distance between sample and UGV

- Adjustable working distance
  (From 1 to 6 ft)
  Allow fine adjustment of the instrument focus
  Remove requirement for precise positioning of the arm

- Integrated camera
  Increase situational awareness
  Facilitate aim and focus

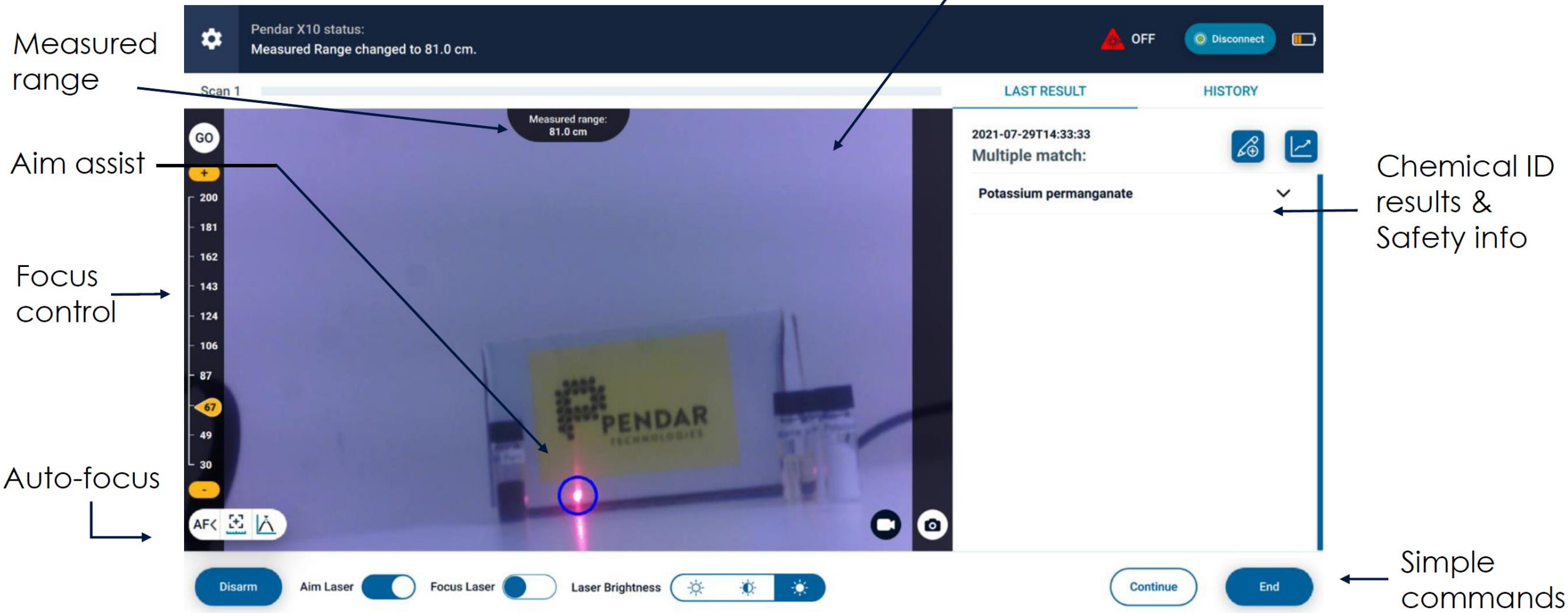
PENDAR TECHNOLOGIES

UGV integration

PENDAR TECHNOLOGIES


DOOR
LOCKED

Remote control interface



Pendar X10 - Explosives

HMEs

Examples:
- Peroxides (TATP, MEKP, ...)
- Nitrate-based (HMTD, ..)

Military Explosives

Examples:
- RDX
- HMX
- TNT
- C-4
- Tetryl
- etc...

Sensitive Primary Explosives

Examples:
- Fulminates

Explosive Precursors

Examples:
- Oxidizers
- Acid mixtures
- H_2O_2
- etc...

Dark, Absorptive Materials

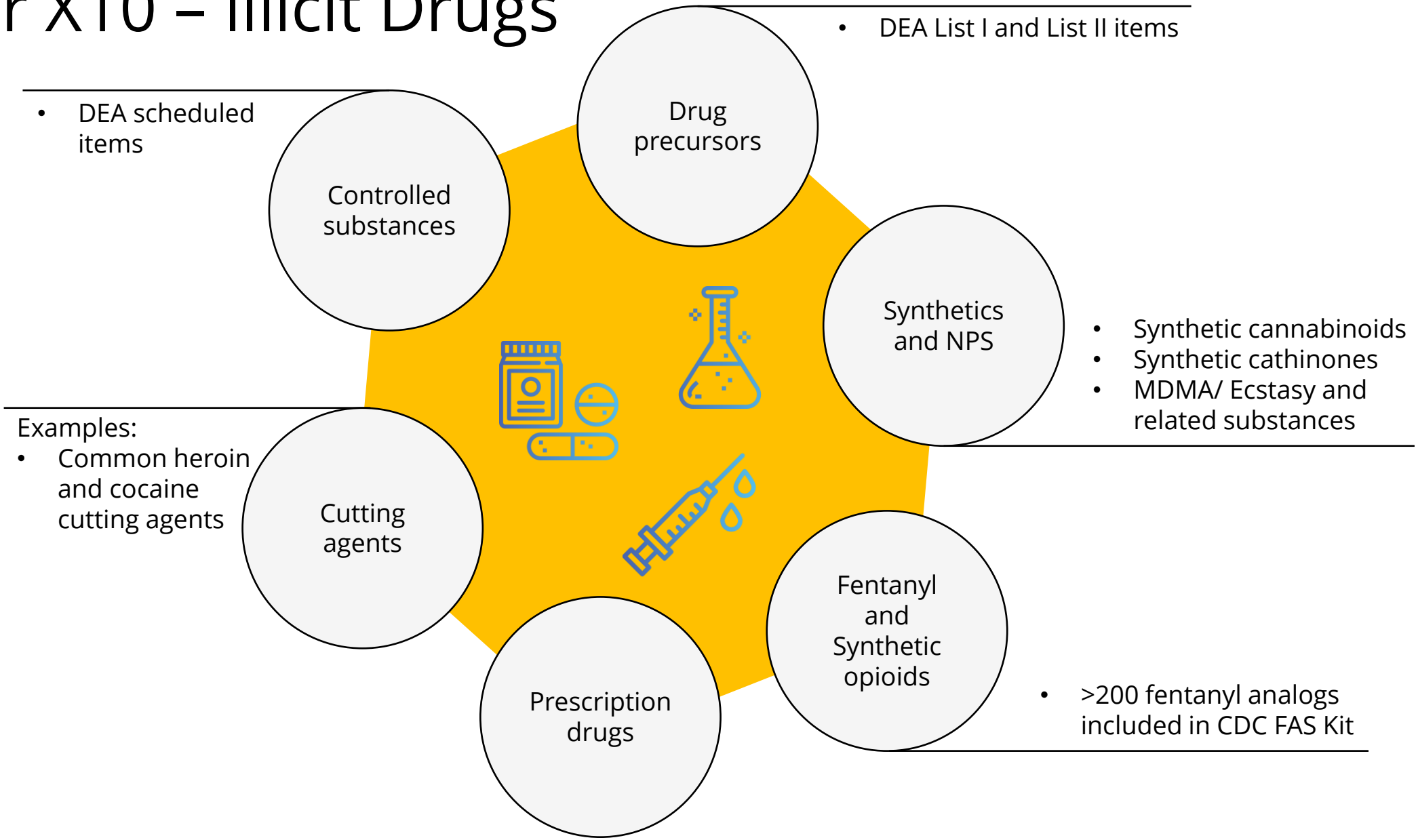
Examples:
- Gunpowder
- Iron oxide
- Potassium permanganate
- Dark fibers in filter paper

Dyed/ Fluorescent Materials

Example:
Semtex, Honey, Gasoline, etc...

PENDAR TECHNOLOGIES

Pendar X10 – Illicit Drugs



- DEA List I and List II items

- DEA scheduled items

- Synthetic cannabinoids
- Synthetic cathinones
- MDMA/ Ecstasy and related substances

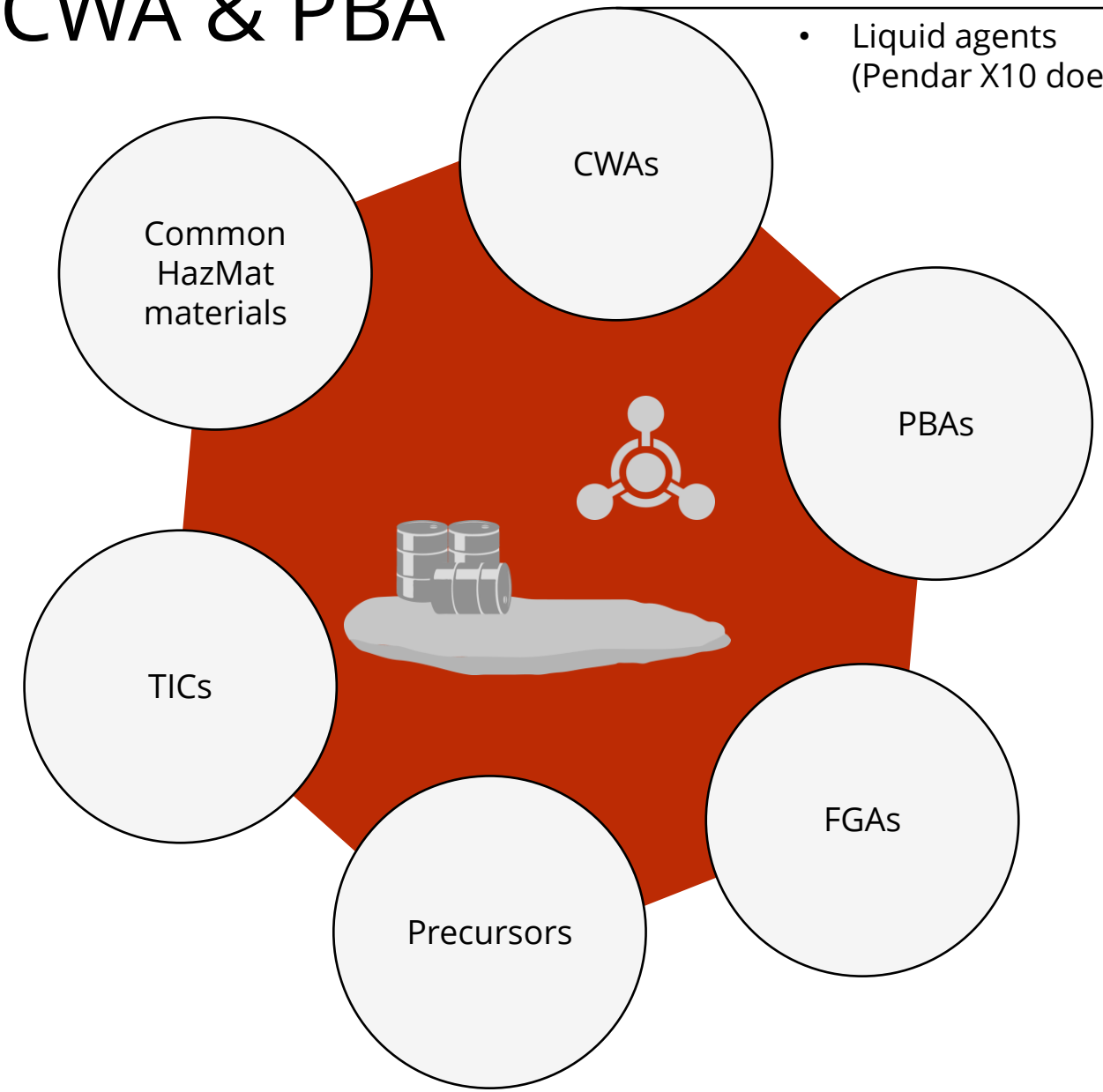
Examples:
- Common heroin and cocaine cutting agents

- >200 fentanyl analogs included in CDC FAS Kit

PENDAR TECHNOLOGIES

Pendar X10 – CWA & PBA

- Liquid agents
  (Pendar X10 does not detected gases)



PENDAR TECHNOLOGIES