



3° SCIENTIFIC INTERNATIONAL CONFERENCE ON CBRNE

(Comments on) Performance Evaluation Metrics and Advances for Standoff CBRN Detection

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PRESENTATION AGENDA



1. Performance metrics

- Sensitivity: For light scattering and absorbing agents
- Response Time: For large area CBRN scanning

2. Examples

- Chlorine gas detection
- Mobile CBRN detection

SELECTION FACTORS.....

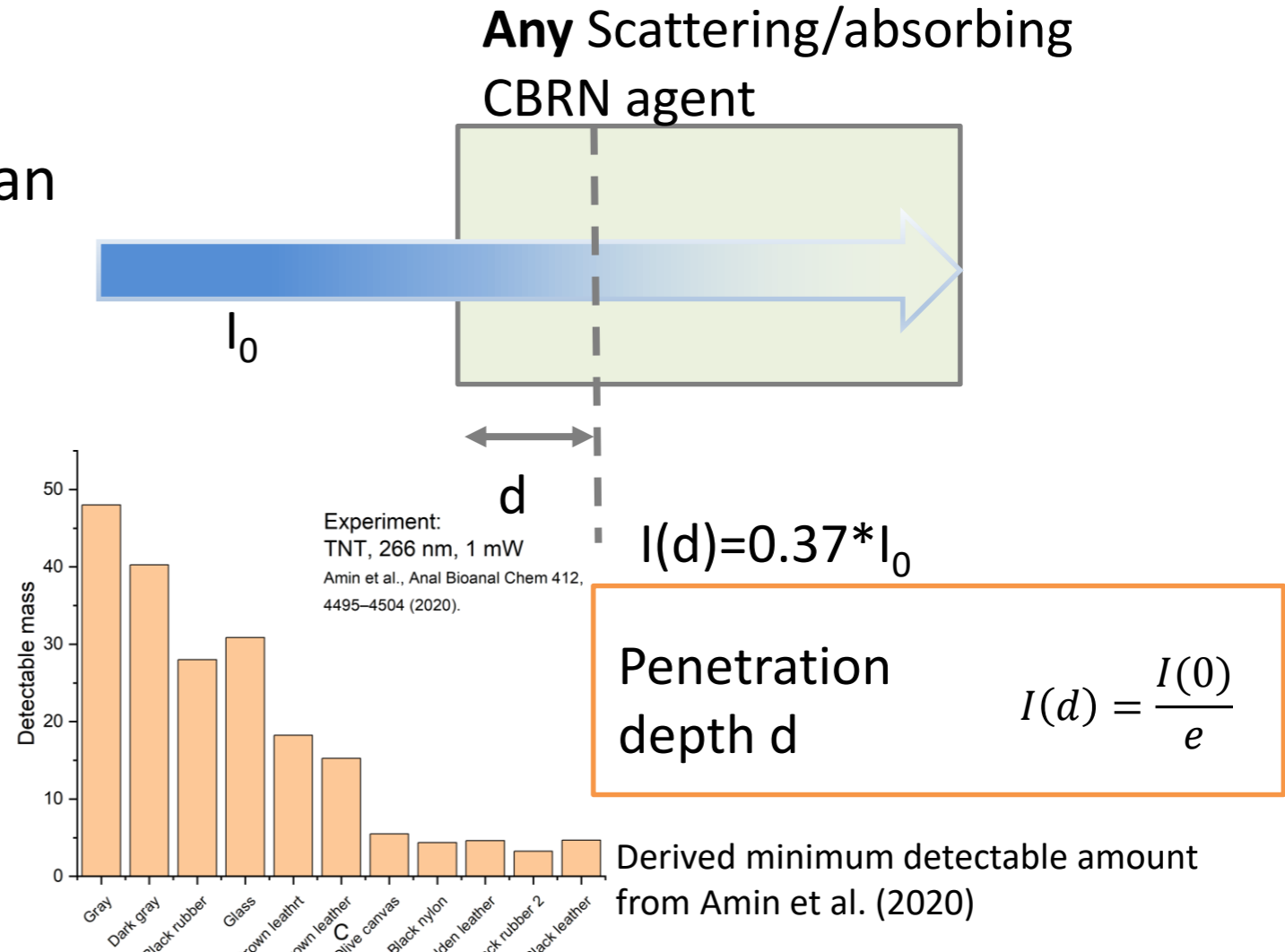
- 5.1 Unit Costs.....
- 5.2 Chemical Agents Detected.....
- 5.3 Toxic Industrial Materials Detected.....
- 5.4 Sensitivity
- 5.5 Resistance to Interferents.....
- 5.6 Response Time.....
- 5.7 Start-up Time
- 5.8 Detection States
- 5.9 Alarm Capability.....
- 5.10 Portability.....
- 5.11 Battery Needs.....
- 5.12 Power Capabilities
- 5.13 Operational Environment.....
- 5.14 Durability
- 5.15 Operator Skill Level.....
- 5.16 Training Requirements.....



Comments on sensitivity performance of optical & standoff sensors



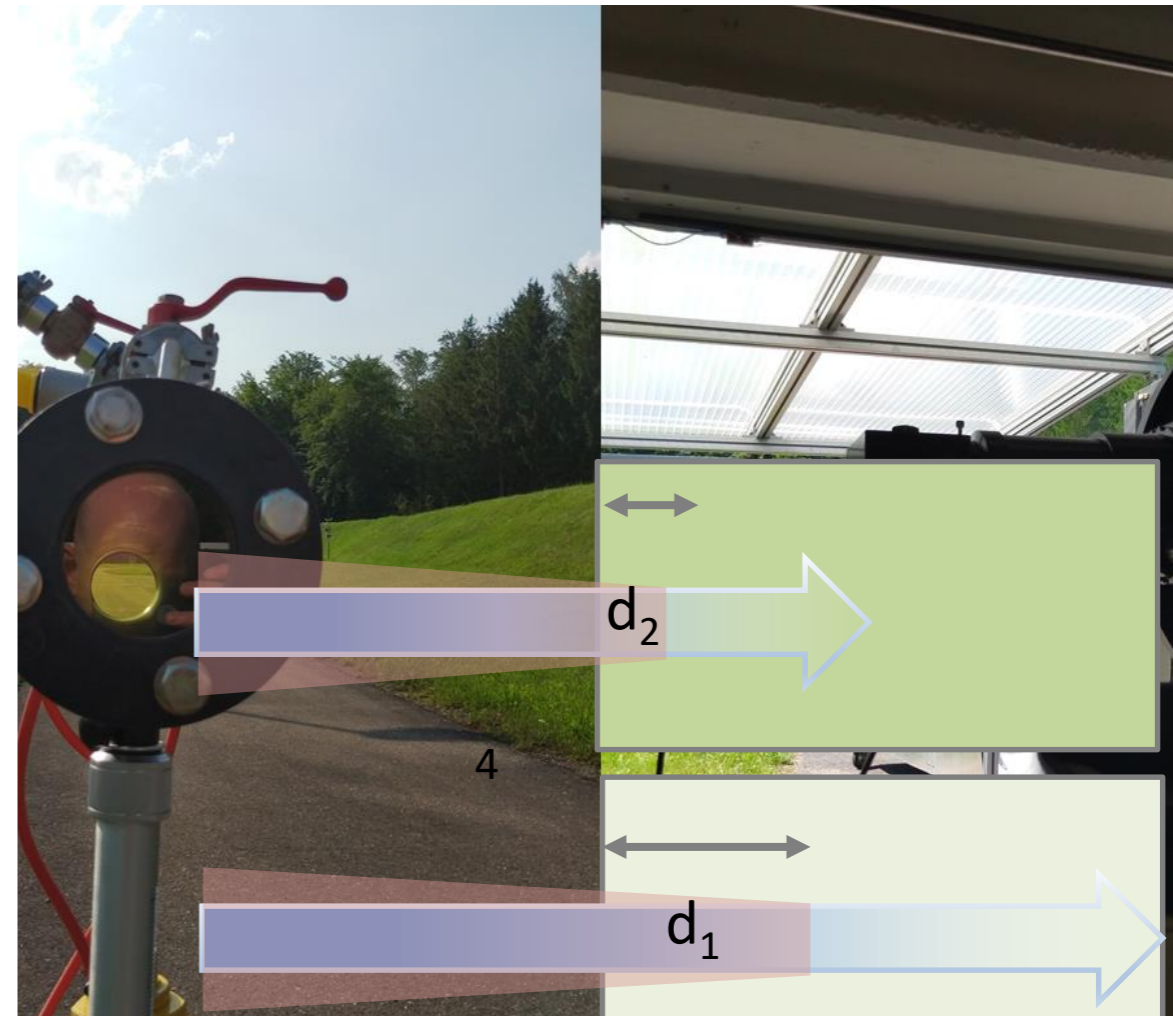
- „Sensitivity is the lowest **concentration** a CA or TIC/TIM can be detected at by a detector or instrument.“ (Guide for the Selection of Chemical Detection Equipment for Emergency First Responders, US DHS)
- (Strictly) true?
- Additionally: how about inhomogeneous samples?



Example: chlorine gas detection by UV Raman spectroscopy



- DLR Experiment:
 - UV Raman scattering @ 266nm, 20 mm beam diameter
 - Gas cell: 1 m, 200 hPa Cl₂
 - Absorption (266 nm): 2%
 - Penetration depth: 20 cm
 - Interacting volume: 60 ml
 - 500 μMol Cl₂

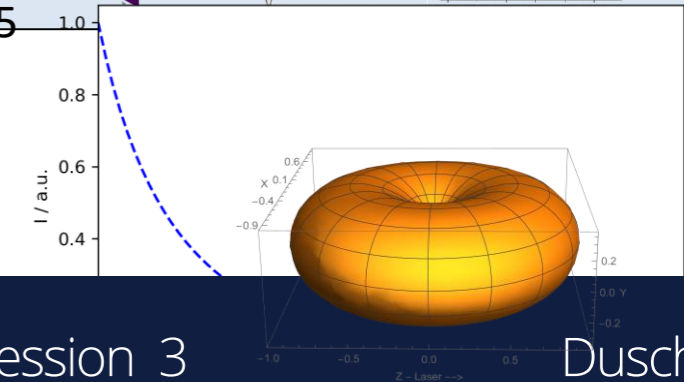
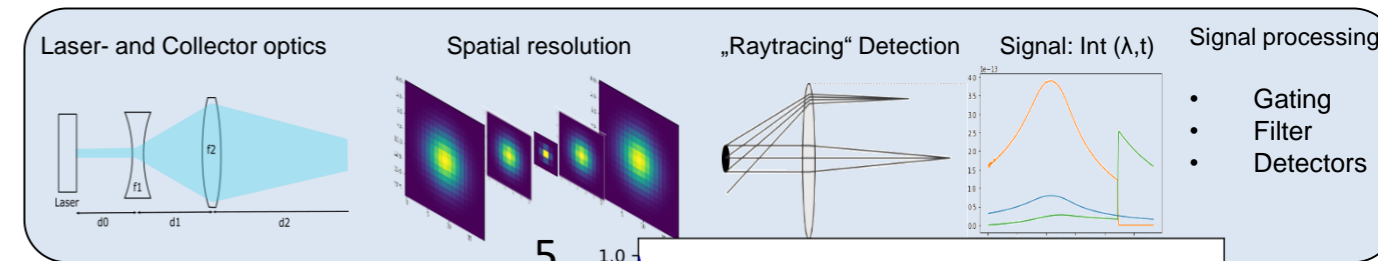
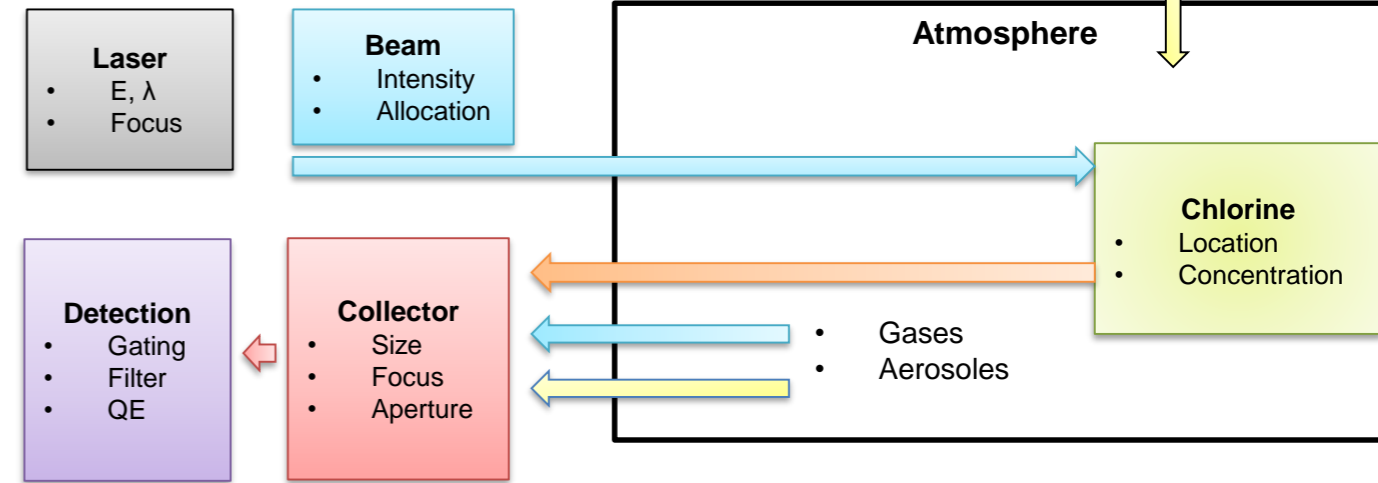


Example: chlorine gas detection by UV Raman spectroscopy



Comments:

- Optical collection unit is focused on interacting volume
- Dependence on distance, equipment (SN-ratio etc)
- Observation of chlorine cloud (LD_{50} : 50 ppm): diameter 800 m
- Potential to detect and monitor sources of chlorine at higher partial pressures



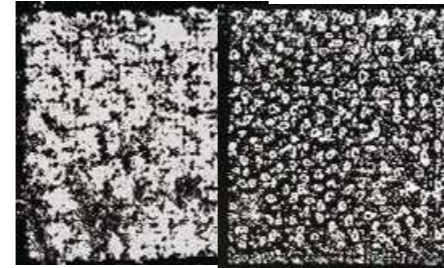
Finding CBRN agents by Compact Standoff Sensor Systems



Local information on the presence of CBRN agents is usually **not *a priori* given** e.g.

- gases and aerosol clouds move in windy environment
- Small amounts of agents in a larger areas cannot be found (Novitschok)
- Inhomogenic dispersion of low volatile surface agents

Agent dispersion on surfaces



Novitschok in Salisbury*



Sensing of CBRN contaminated surfaces

- Finding CBRN: Random sampling/measurements
- Wide area screening
 - Isochronous
 - Non-isochronous
- Performance parameter:
Detection time needed for a given amount of CBRN agent and area



Mobile sensor systems

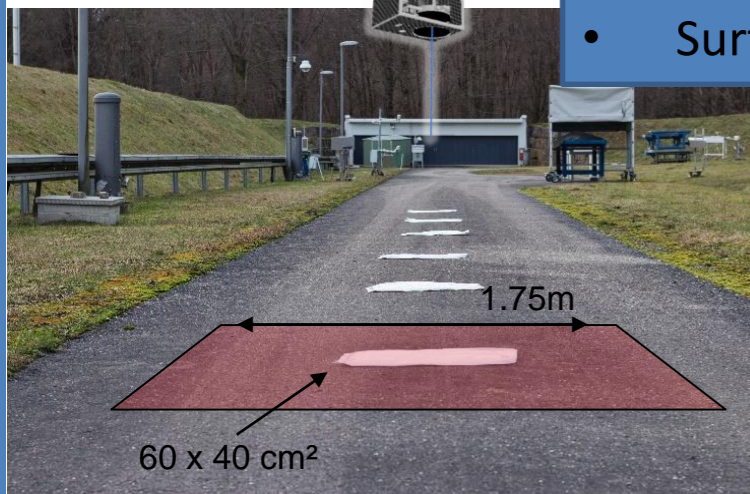
LUCS platform



- Optimized LIF detection system with sequential agent and background detection (by LIF)
- Day and night operation at 10 m
- System's infrastructure independent of carrier platform e.g. (UAV, rover...) i.e.

Open questions

- Target agents for LIF
- Detection level (classification)
- Detectable size of agents on surface (in m²)
- Detectable amount (in g)
- Surface scanning speed at defined amounts (in m²/s)



Visualisierung

Summary

Take away

- Concentration is not (always) an appropriate measure for sensitivity
- Optical and standoff technologies assist to quickly find sources of CBRN material (esp. with compact/mobile sensor systems)

Future pathways

- Imaging: isochronic or sequential image creation
- Airborne & surface contamination
- Fusion of (orthogonal) sensor data and processing of weak features