



HAL
open science

On-site Detection and Identification of Chemical Warfare Agents with portable LIBS system

D. L'Hermite, E. Vors, T. Vercouter, G. Moutiers

► **To cite this version:**

D. L'Hermite, E. Vors, T. Vercouter, G. Moutiers. On-site Detection and Identification of Chemical Warfare Agents with portable LIBS system. 1st International Conference on CBRN Research and Innovation Antibes 2015, Mar 2015, Antibes-Juan Les Pins, France. cea-02509067

HAL Id: cea-02509067

<https://cea.hal.science/cea-02509067>

Submitted on 16 Mar 2020

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

L'Hermite Daniel*, Vors Evelyne, Vercouter Thomas, Moutiers Gilles

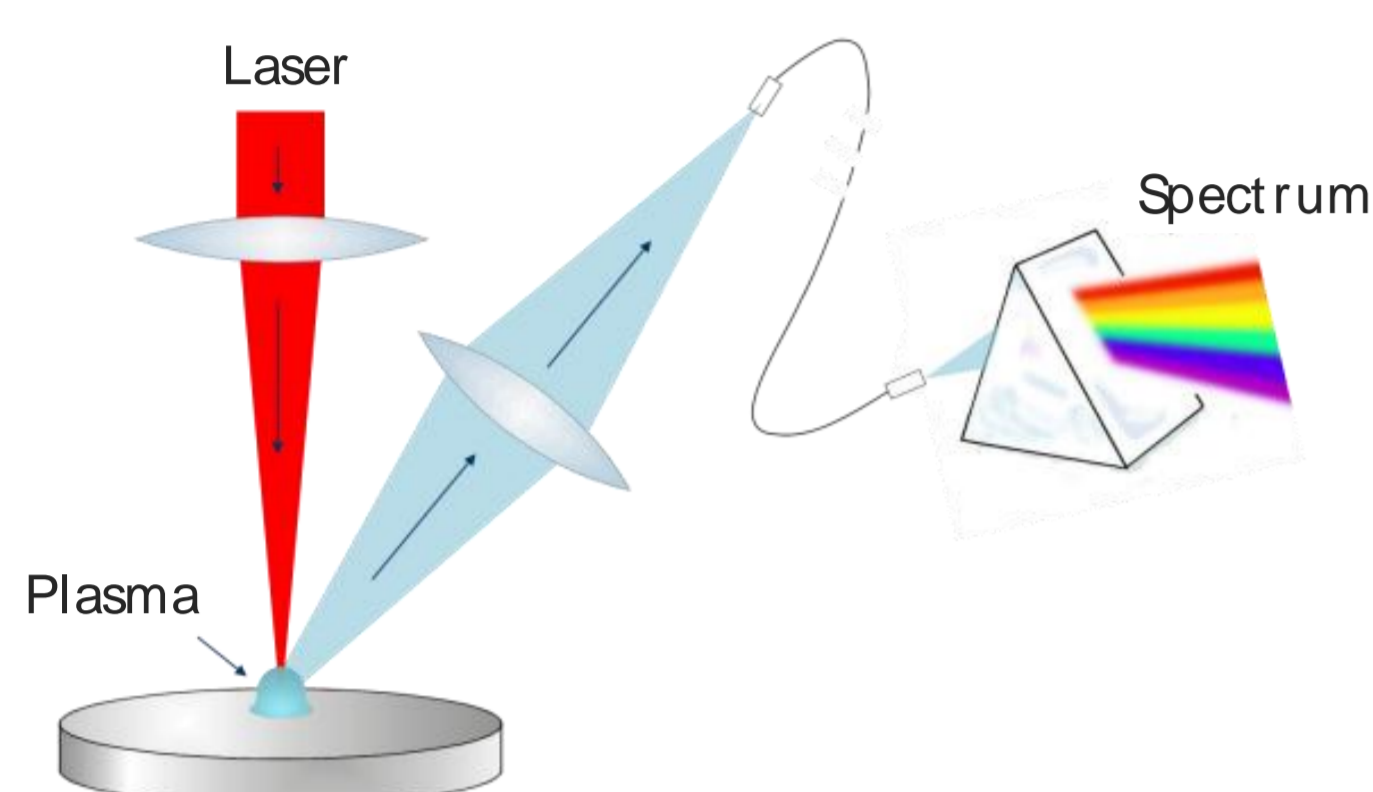
CEA Saclay, DEN, DANS, DPC, SEARS, Gif-sur-Yvette, France
*daniel.lhermite@cea.fr

THE COMPACT LIBS TECHNOLOGY IS PORTABLE AND CAN QUICKLY IDENTIFY A SURFACIQUE CONTAMINATION OF CHEMICAL WARFARE AGENT (CWA) ON ALL KIND OF MATERIALS BY LASER INTERROGATION



LIBS* principal

*Laser Induced Breakdown Spectroscopy



The LIBS* technology is able to detect contamination by the spectroscopic analysis of the plasma emission produced by a laser focused on the surface to be inspected.



- All chemical element can be detected
- Real time detection, without sample preparation, possibility of stand-off analysis

EASYLIBS™

The specific data processing methodology for CBRN issues has been developed by CEA and integrated into the commercial EASYLIBS™ system marked by the IVEA company. The NRBC EASYLIBS™ version is able to detect and identify chemical warfare agent. It enables rapid deployment and field analysis without sample preparation.



EASYLIBS™ characteristics	
Overall dimensions (cm ³)	30x20x10 (probe), 40x30x30 (bag)
Weight	1 kg (probe), 15 kg (total)
Autonomy	3-5h

Performances measurement on CWA

Quick identification of atomic markers in a complex substrate

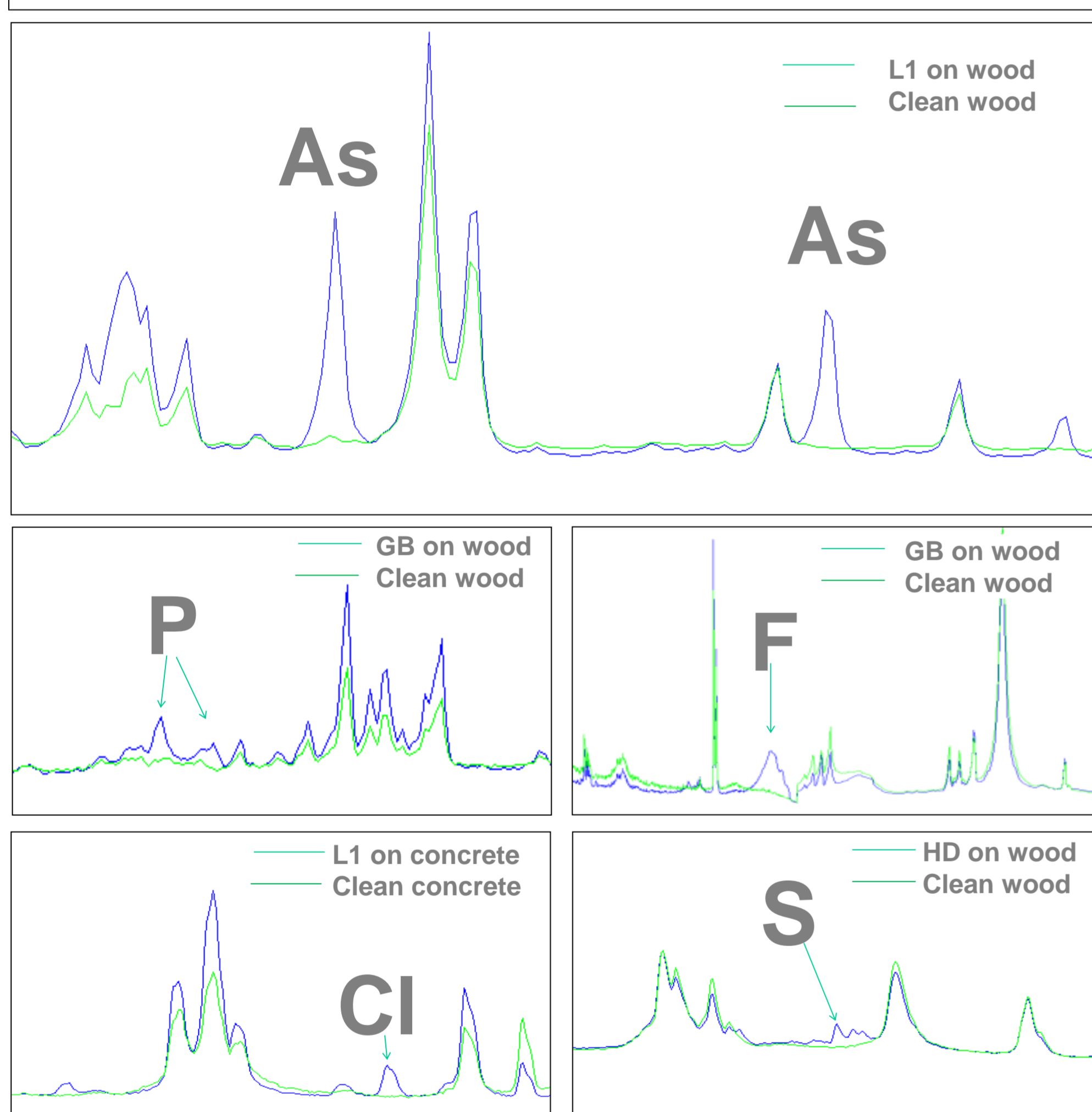
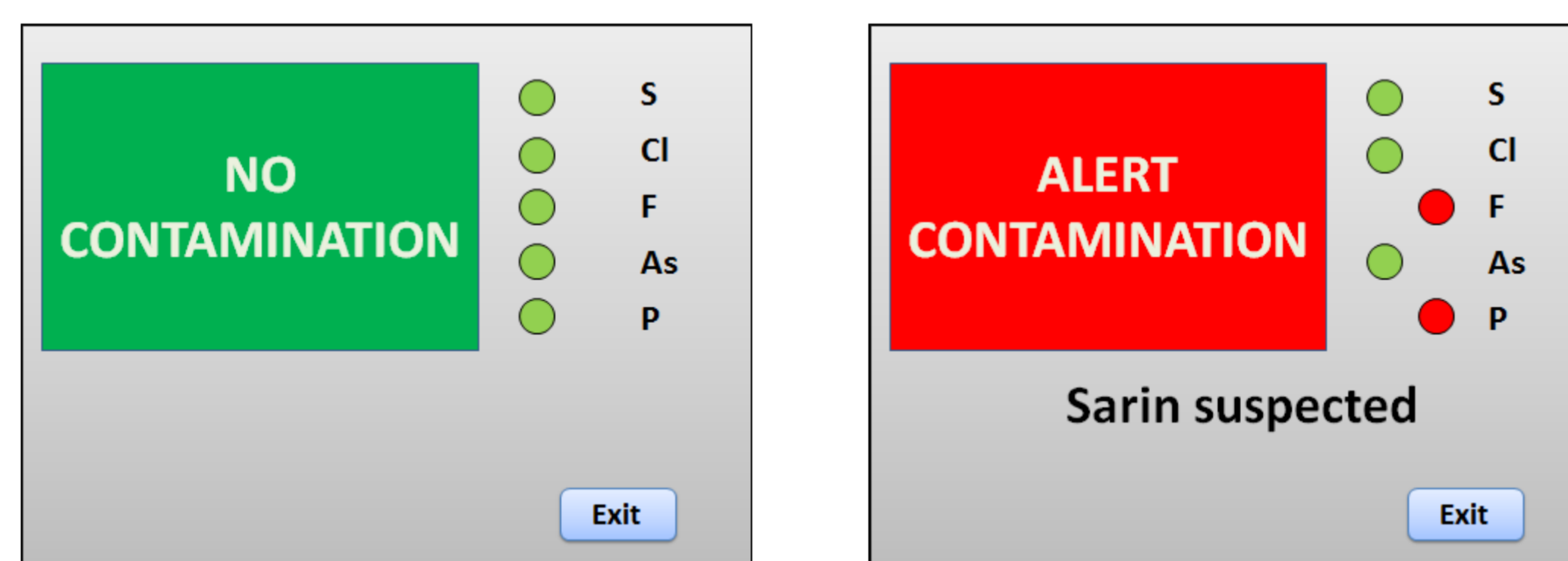


PHOTO CREDIT CEA 2013,2014



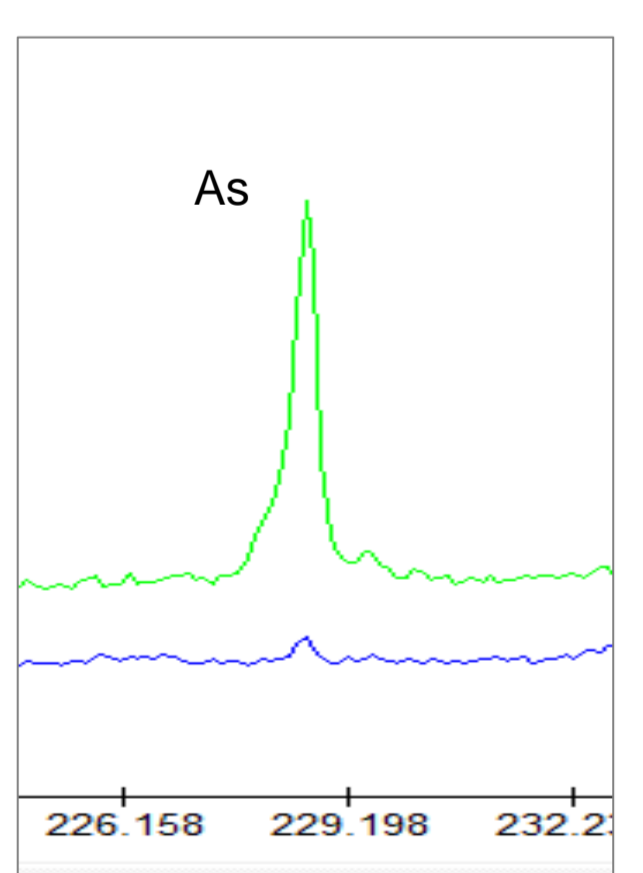
Substrates

Aluminum, Wood, Concrete, Gloves, CARC, Ceramic

Compound	DMMP	P
GB	P, F	
VX	P, S	
L1	As, Cl	
HD	Cl, S	
GD	P, F	
Blank		

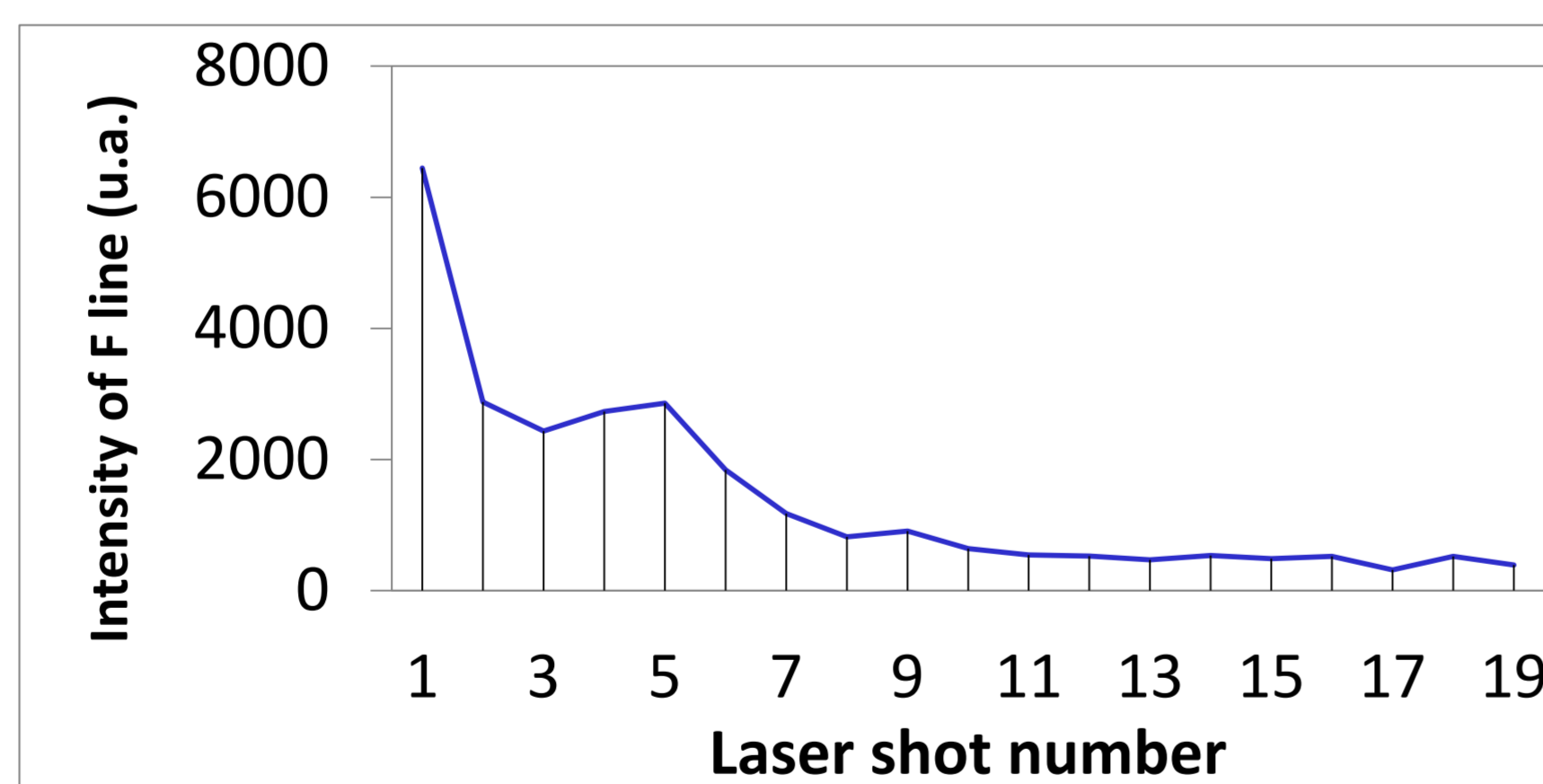
Results

Sensitivity : 10µg/cm² (obtained with sarin (GB) on concrete)



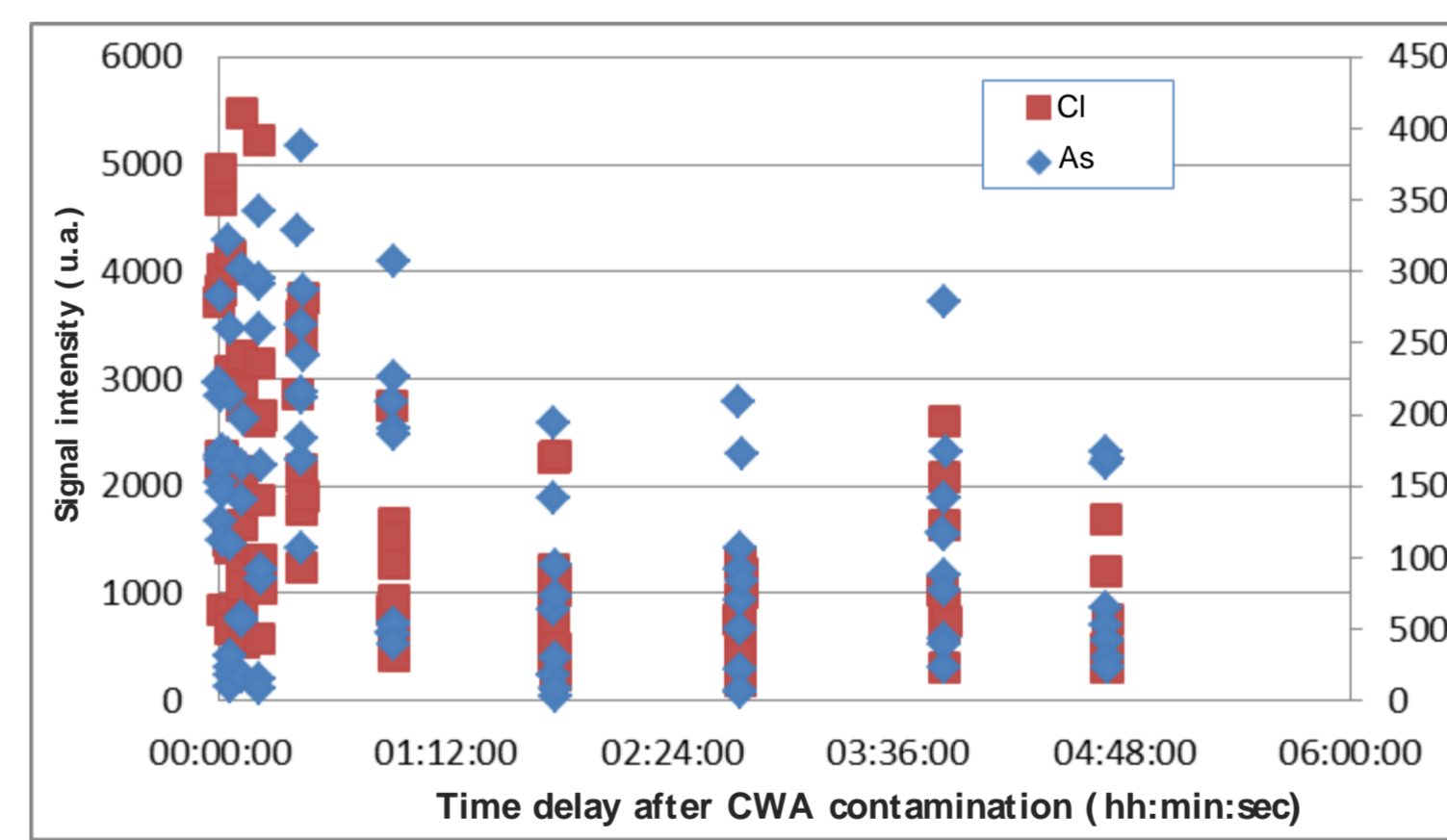
As signal before (green) and after decontamination (blue)

CONTROL OF DECONTAMINATION



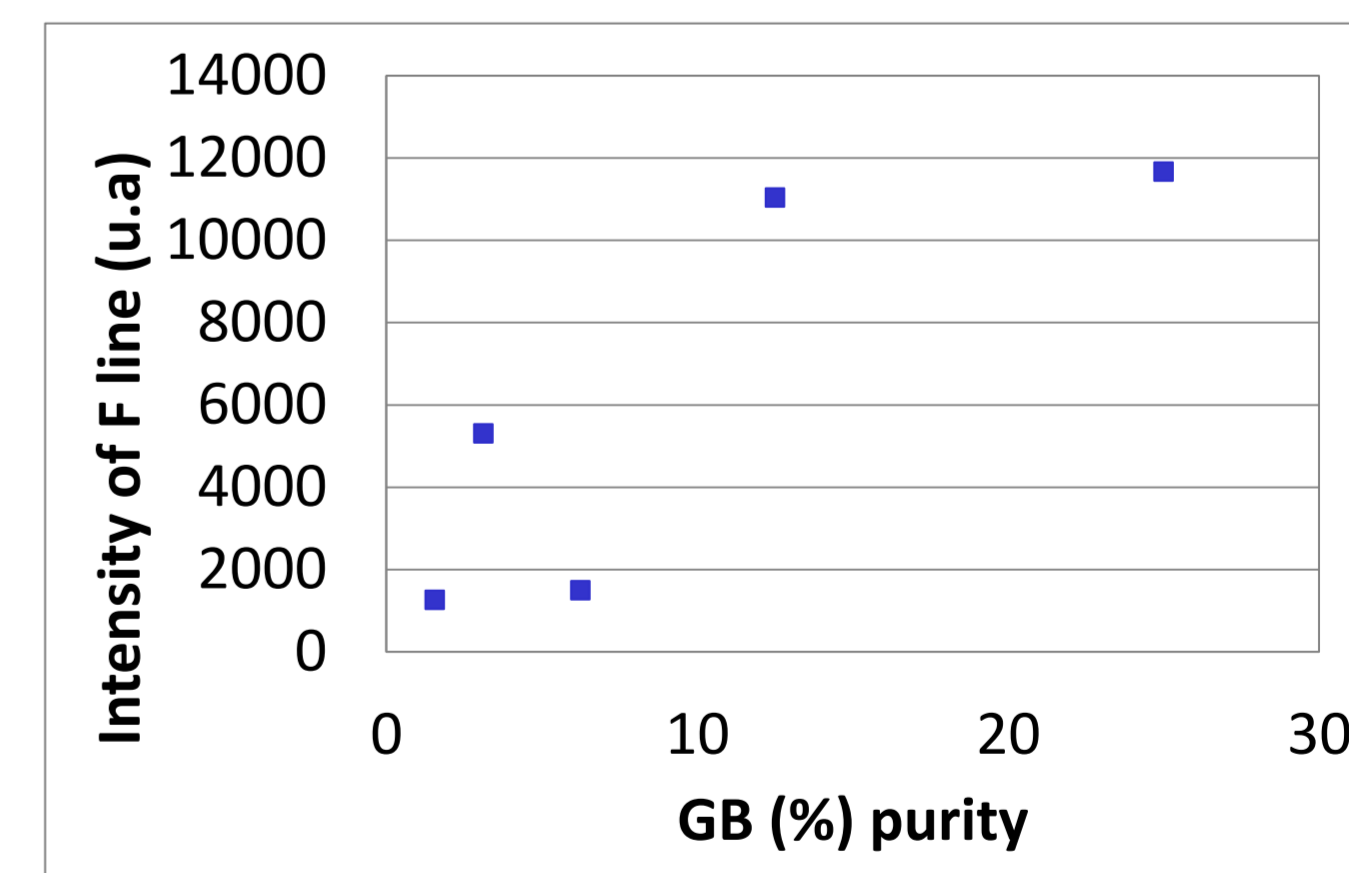
Cl signal vs. number of laser shot (with Lewisite (L1) on wood)

DEPTH PROFILING



Cl and As signal vs. time (with Lewisite on concrete). Decreasing of signal corresponds to evaporation of L1 with time in the fume hood.

CONTAMINATION'S MONITORING



F signal vs. sarin (GB) purity (diluted in hexane). (100% correspond to pure toxic)

SENSITIVITY

Conclusion

- Capability of detection and identification of CWAs instantaneously (one laser shot).
- Complementarity between AP4C equipped with S4PE and Easylibs (best sensitivity for As, F et Cl with LIBS)
- Sensitivity of 10µg/cm²
- Sub-surface analysis (for old contamination for example)
- No memory effect

Perspectives

Futures evolution of EASYLIBS™ :

- Disposable tips
- Volume and weight decrease

Concepts of uses :

- Quick diagnostic of contamination for sorting (no memory effect)
- Control of decontamination
- Zoning of dangerous perimeters
- Identification of CWAs