

# Non-Invasive, Point-of-Care Detection of Infectious Disease

R. P. Manginell, M. W. Moorman and K.E. Achyuthan  
Sandia National Laboratories  
Albuquerque, NM 87185-0892  
rpmangi@sandia.gov

## MicroChemlab VOC Sensing System Concept

### Volatile Organic Compound Sources

- Human
- Wounds
- Bacteria
- Viral Infection

### Preconcentrator (PC) Stage

- Ambient collection of VOCs and chemicals
- Reduces false alarms

### Gas Chromatography (GC) Stage

- Separates complex chemical mixtures
- Increases analysis confidence
- Conventionally used with MS

### PDID Detection Stage

- Sub-ppb sensitivity
- Near universal
- BW, CW, etc.

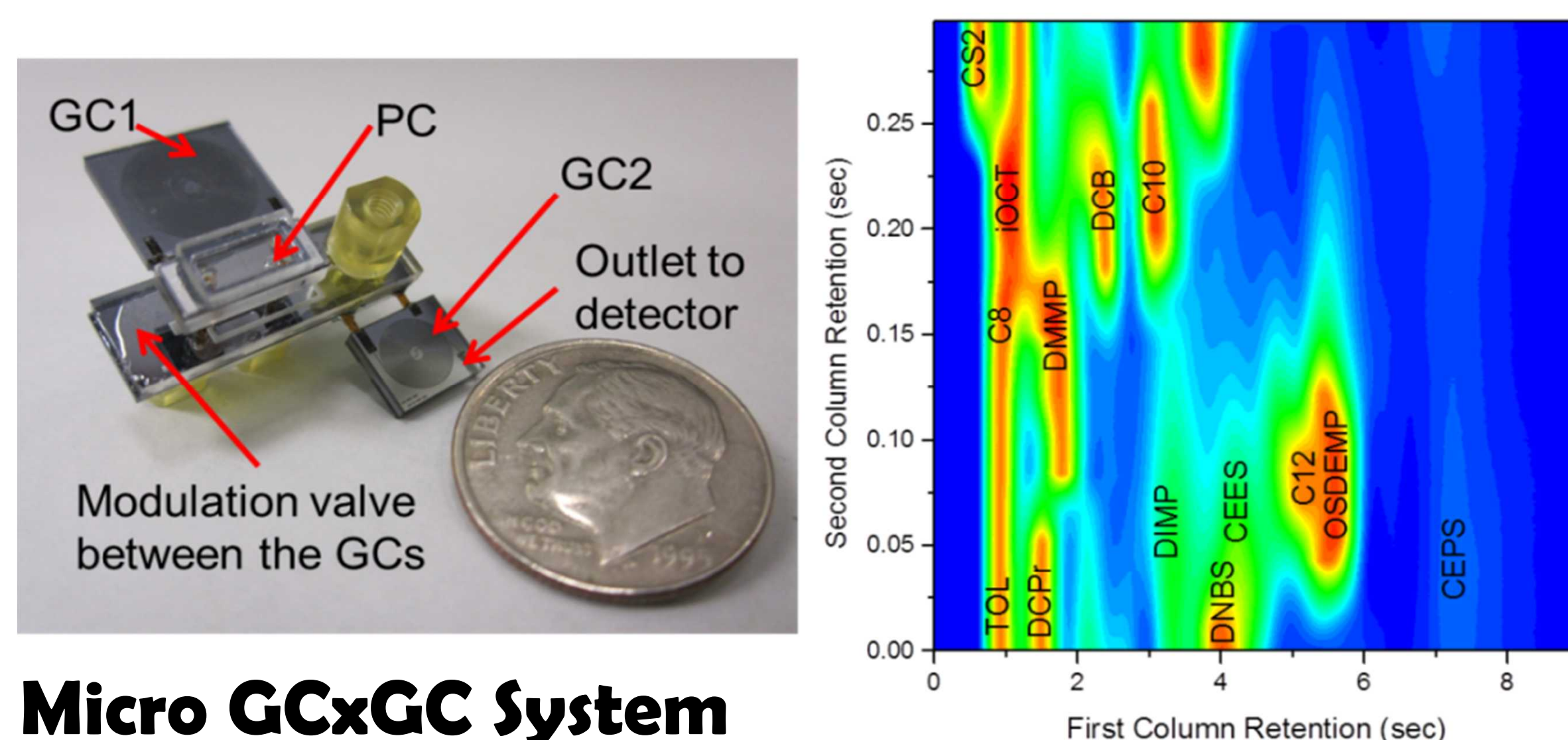
### Biomarker Identification

- Disease diagnosis
- Infection cause
- Contamination origin

## Estimated System Specifications

- Volume  $\sim 0.0015 \text{ m}^3$
- Analysis time  $\sim 10 - 10^2 \text{ sec}$
- Power  $\sim 2\text{W}$ , runs on batteries for  $\sim 8 \text{ hrs}$
- Sensitivity  $\sim \text{ppb} - \text{ppt}$
- Push button operation for unskilled users
- Unrivalled combo of sensitivity/selectivity
- Handheld, UAS-mounted, installed
- Proprietary and field tested Sandia technology

## Proprietary Sandia Technology



## Military Applications

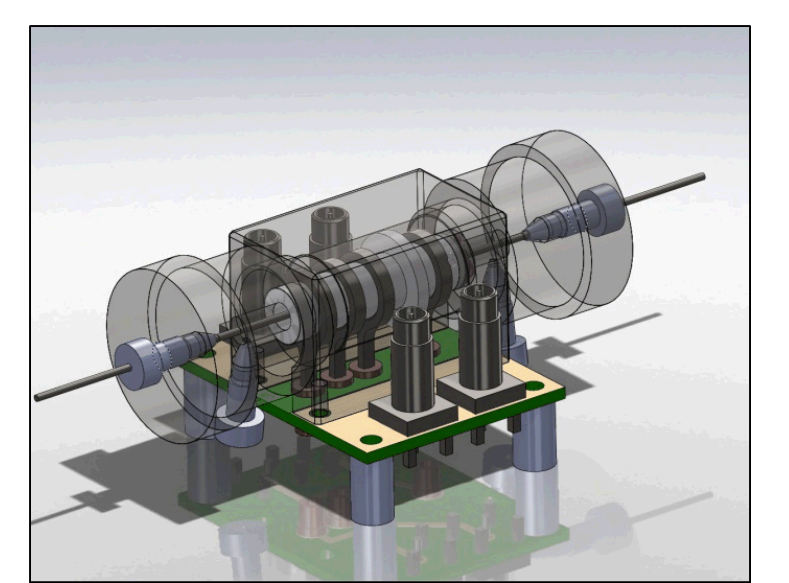
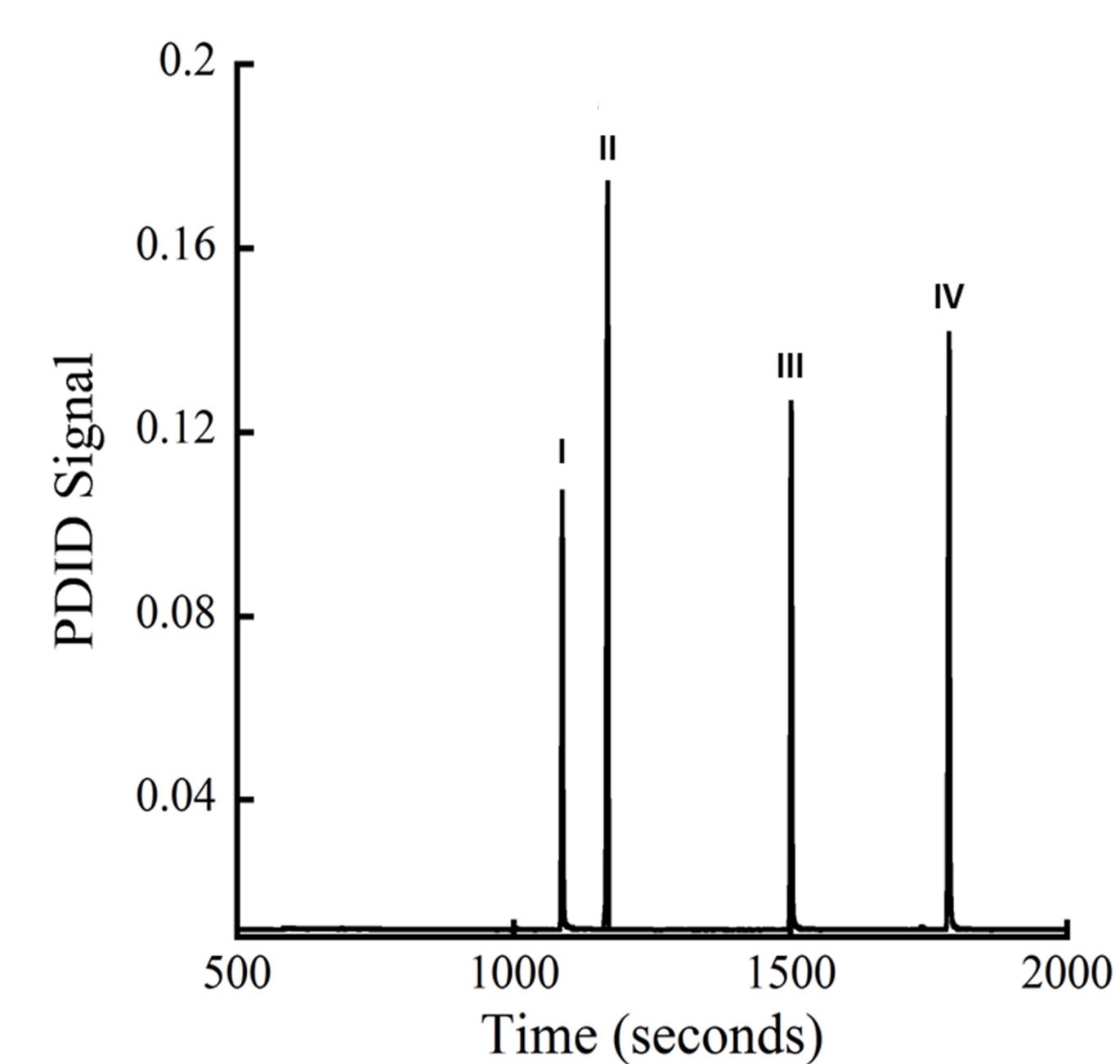
Non-invasive and rapid detection of:

- Infections, sepsis, gangrene
- Human presence, clandestine graves
- Human stress/performance
- BW, CW, TICs, explosives

Performance comparable to mass spectrometry (MS) in a handheld system

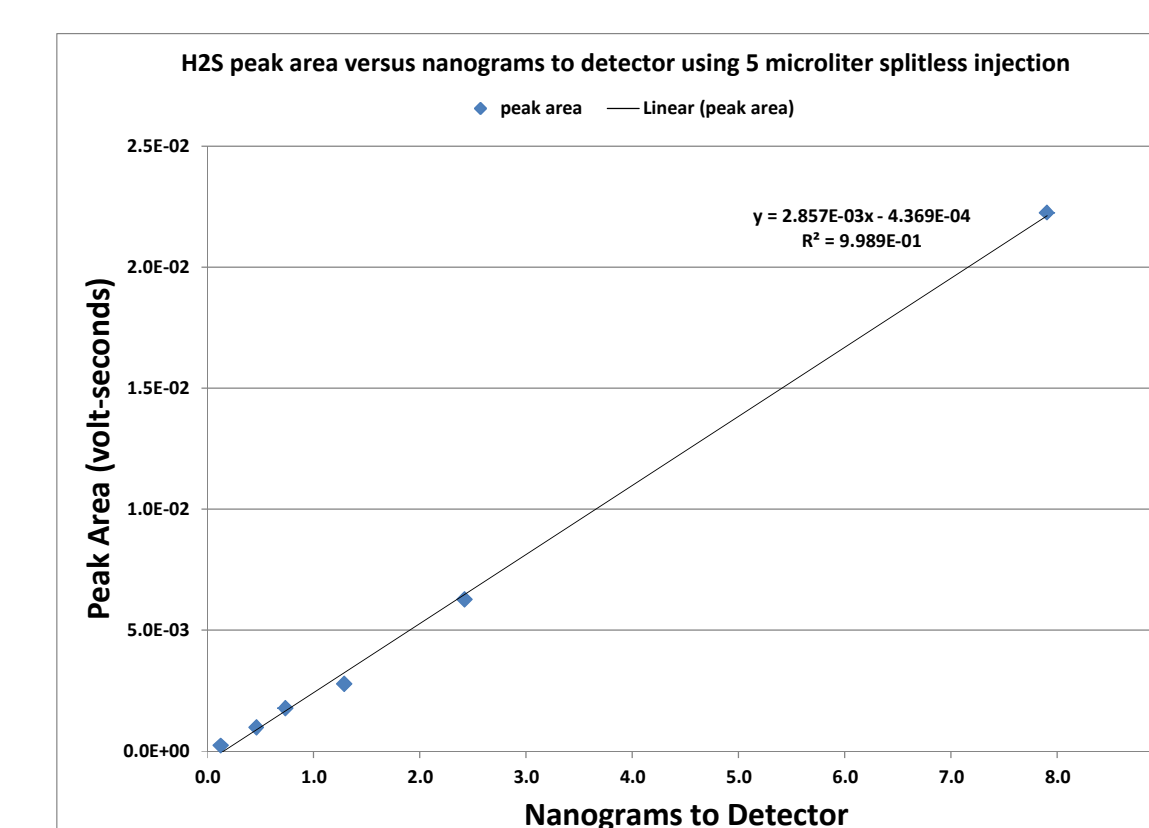
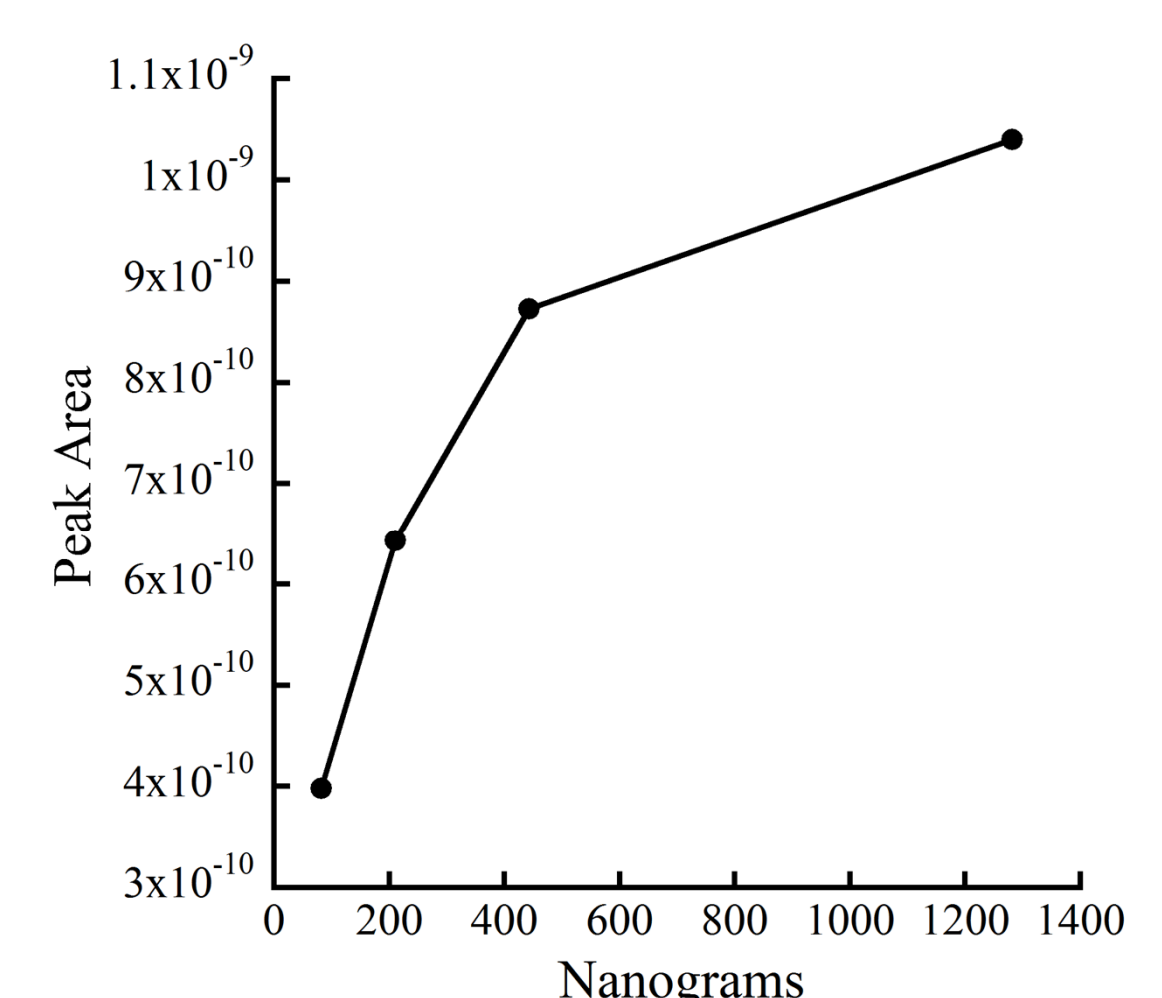
### Sandia's Pulsed Discharge Ionization Detector (PDID)

- Nearly universal response
- Minimal performance degradation with miniaturization: ppb to ppt
- Analyzed VOCs from TB, *E. coli* (e.g. sepsis, gangrene), *Y. pestis* (Anthrax)



GC/MS detection of VOC markers of Tuberculosis with sensitivity matching MS

GC/MS detection of hexenoic acid, a unique human VOC produced by skin bacteria



Trace GC/MS detection of hydrogen sulfide, a stress indicator, TIC and Bio VOC

## Summary

- VOCs can identify bacteria, viral infections...
- Human presence, identity, performance, stress
- High-performance needed for Point of Care, field use

Sandia's advantage:

- Universal platform for CW, BW and medical
- Field-tested CW platform expanded to Bio VOCs
- Handheld - Point of Care, UAS or installed
- Unmatched separations, no detector compromises
- Non-contact, non-invasive
- Low power, light weight, rapid