Feedback from NANOBADGE use

Combination with real-time counters

Who are we ?

- NANO INSPECT company, ALCEN group

  Analysis laboratory specialized in nanoparticles measurement and nano risk management

- Conception and development in partnership with PNS (Nanosafety Platform) at CEA Grenoble (public research institute)

Contents

- NANOBADGE presentation
- How we manage nano risk
- Feedback from users
- Leads and proposal

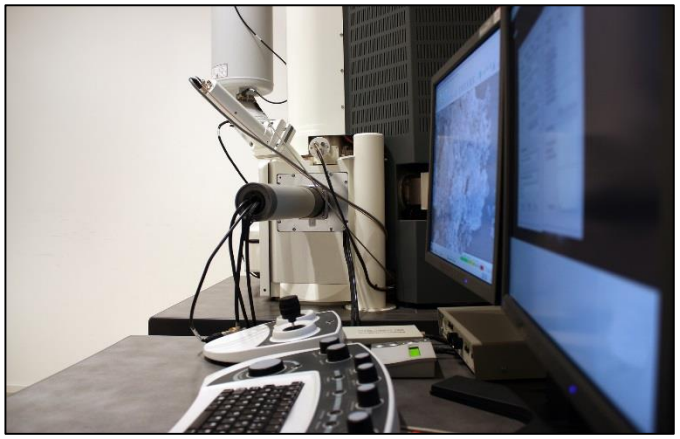
NANOBADGE presentation

The NANOBADGE principle

1. Particle sampling

2. Cassette shipment

3. Analysis at NANOBADGE laboratory



Control of full chain

Analysis : metal mass approach

– **Respirable mass concentration of metals** (X-ray spectrometry)

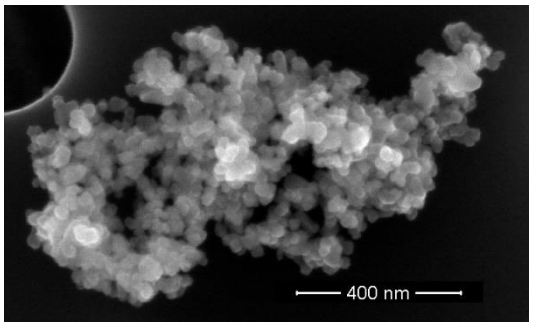
- Detection (screening on a given list of metals + estimation of quantity)

↓

- Quantification of investigated metals

(Limits of detection (8h) < 0,1 µg elemental mass /m^3)

↓



TiO_2 ©NANOINSPECT

– **Electron microscopy analysis** (SEM/EDX)

- Level 1 : Investigated particles detection (LOD (8h) 1 to 0,01 particles of interest /cm^3)

↓

- Level 2 : Size distribution and agglomerate density

% of investigated particles in mass

Analysis : carbon mass approach

– **Respirable mass concentration of carbon** (thermal optical)

- Quantification of organic carbon / elemental carbon (NIOSH protocol)

(Limits of detection (8h) < 0,3 µg elemental mass /m^3)

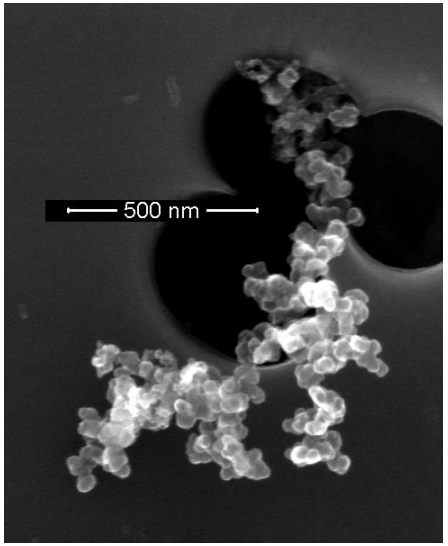
– **Electron microscopy analysis** (SEM/EDX)

- Level 1 : Investigated particles detection

(LOD (8h) 1 to 0,01 particles of interest /cm^3)

- Level 2 : Size distribution and agglomerate density

% of investigated particles in mass



Black carbon ©NANOINSPECT

Very broad range of use

- Particle size range : respirable fraction
- Mass concentration range : 0,1 µg to 10 mg/m^3
- Size distribution range : possible from 1 particles / cm^3

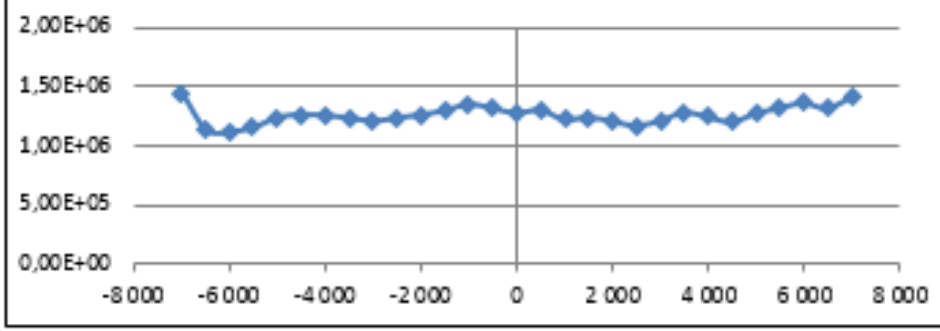
- Typical range of number concentration for a nanopowder OEL of 0,3 mg/m^3 is between 1 to 100 particles/cm^3

  Reminder : 10 particles/cm^3 of 5µm diam agglomerates (density 0,4) = 0,3 mg/m^3
- TiO_2 NIOSH OEL of 0,3 mg/m^3 detected in 0,3 s

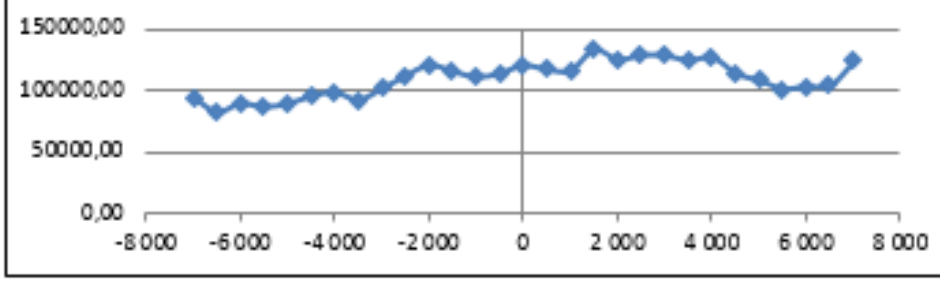
Performances due to good deposition homogeneity

Counting 1

Number concentration per zone (per cm2)

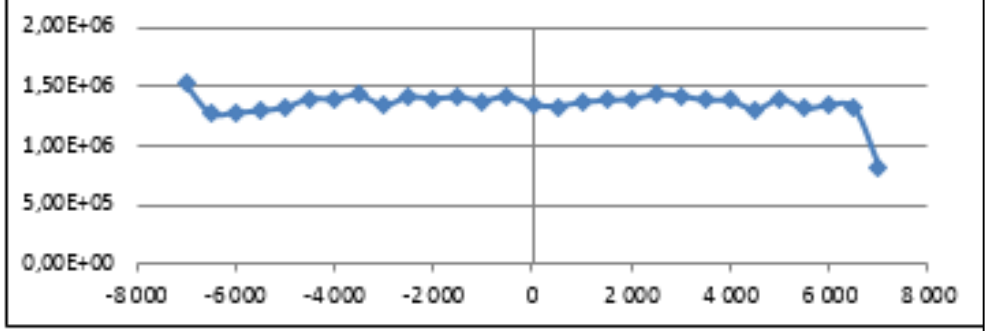


Mass concentration per zone(ng per cm2)

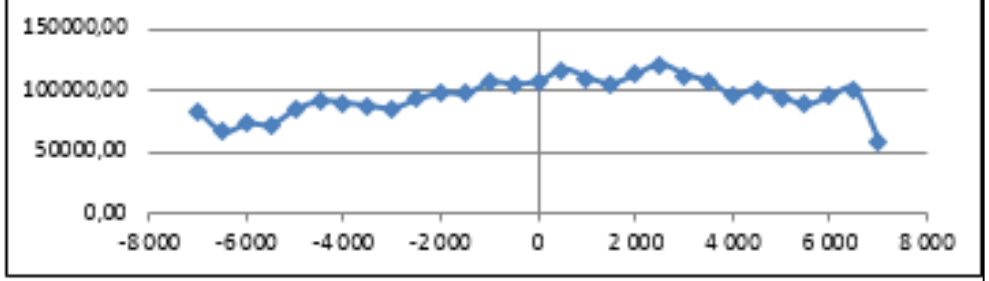


Counting 2 (repeatability after 2 weeks)

Number concentration per zone (per cm2)

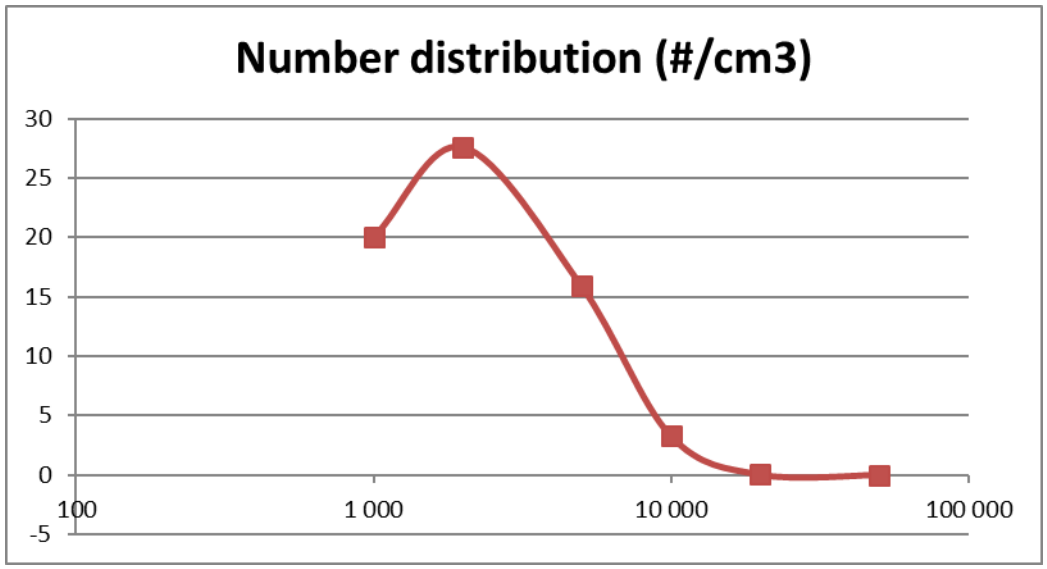


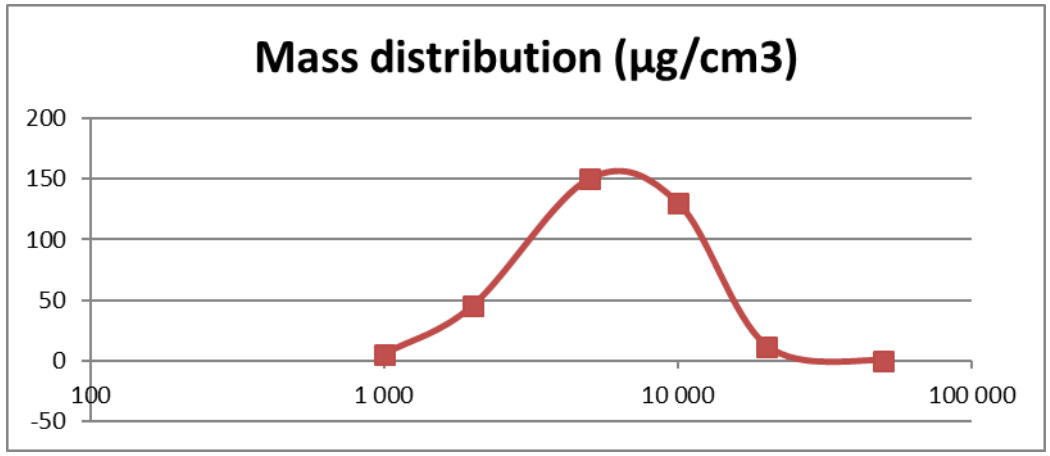
Mass concentration per zone(ng per cm2)



Nano SiO2 powder (size of agglomerates > 1 µm)

How NANOBADGE measures agglomerate density





Combination of volume distribution and elemental mass

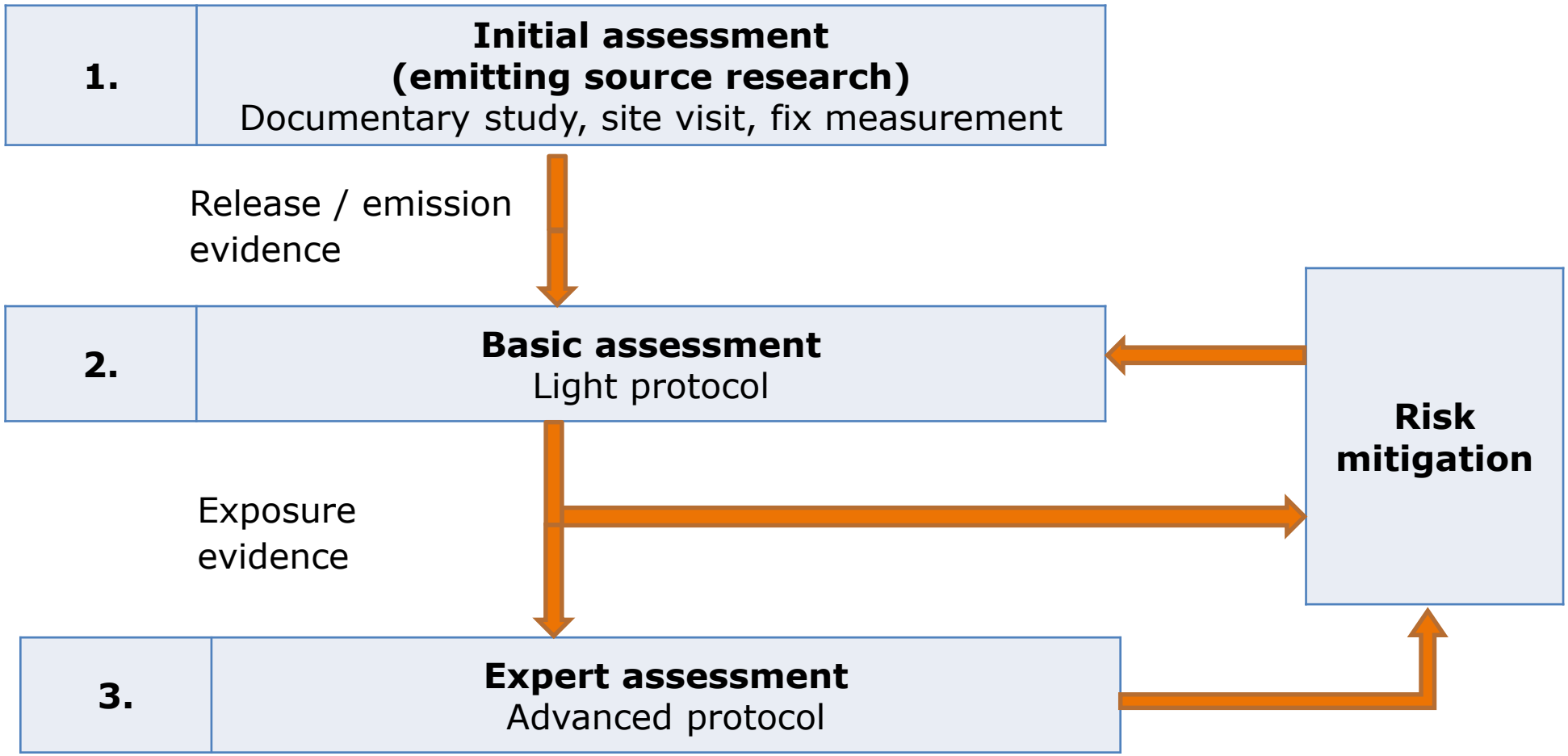
Resulting in geometric agglomerate density and mass distribution

How we manage nano risk

Substances Domains

1. Nanoparticulate substances (manufactured nanomaterials)
   - 1a. massively used substances for long time
     - Black C, SiO_2, TiO_2, $CaCO_3$, Al_2O_3, …
   - 1b. New substances (ex : carbon nanotubes,…)
2. Non-intentionally generated nanoparticules chemically specified
   - Ex : weld fumes, metal works, scraping...
3. Ultrafine particles (atmospheric pollution)

The tiered approach (OECD / future EU standard)



Exposure objectives

	A	B	C	D	E
Hazard	No significant	Slight	Moderate	Serious	Severe
Dust exposure limit (inhalable mg/m^3)	1 -10	0,1 - 1	0,01 – 0,1	< 0,01	Expert advice
Substances			1a. Nanos long time	Ag, Cd, Co, Hg, Pb	Fibers / 1b. nanos without analogous
Recommended limit value (respirable mg/m^3)		nanos without toxicity *0,5 (DE) / 0,066xVLE analogous (UK)* nanos with toxicity *0,1 (DE) / 0,1xVLE analogous (UK)* nanoTiO_2 *0,3 (US, FR) / 0,6 (JP)*			fibers *0,01 nb/cm^3 (DE, UK)* C nanotubes *0,001 (US) / 0,03 (JP)*

Exposure objectives

Exploring new approach for granular biopersistent : BAUA 2015

- 75 µg/m3 for agglomerate density of 1
- Proportional to agglomerate density

  ex: 7,5 µg/m3 for agglomerate density of 0.1

  ex: 300 µg/m3 for agglomerate density of 4

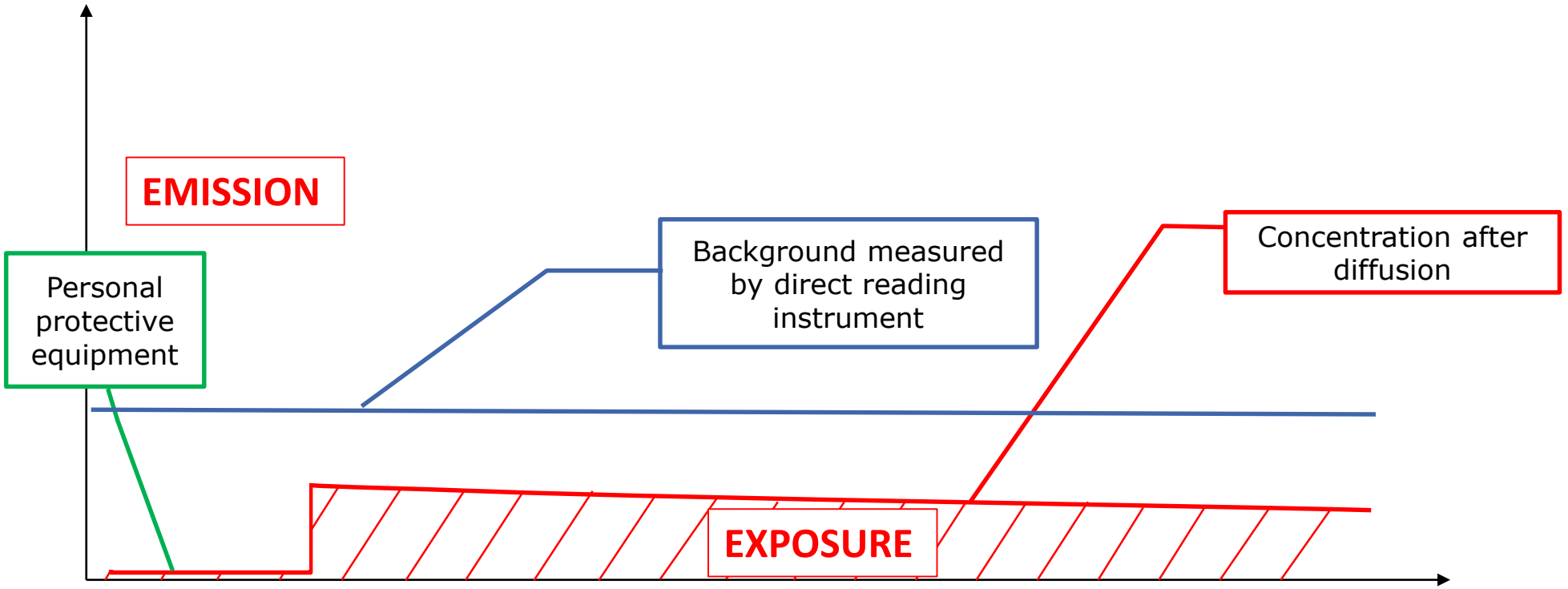
Pragmatic and efficient for complex mixtures of nano/non-nanos

WE WON'T EVER NEED TO CLASSIFY NANO AND NON-NANO !!!

Feedback from users

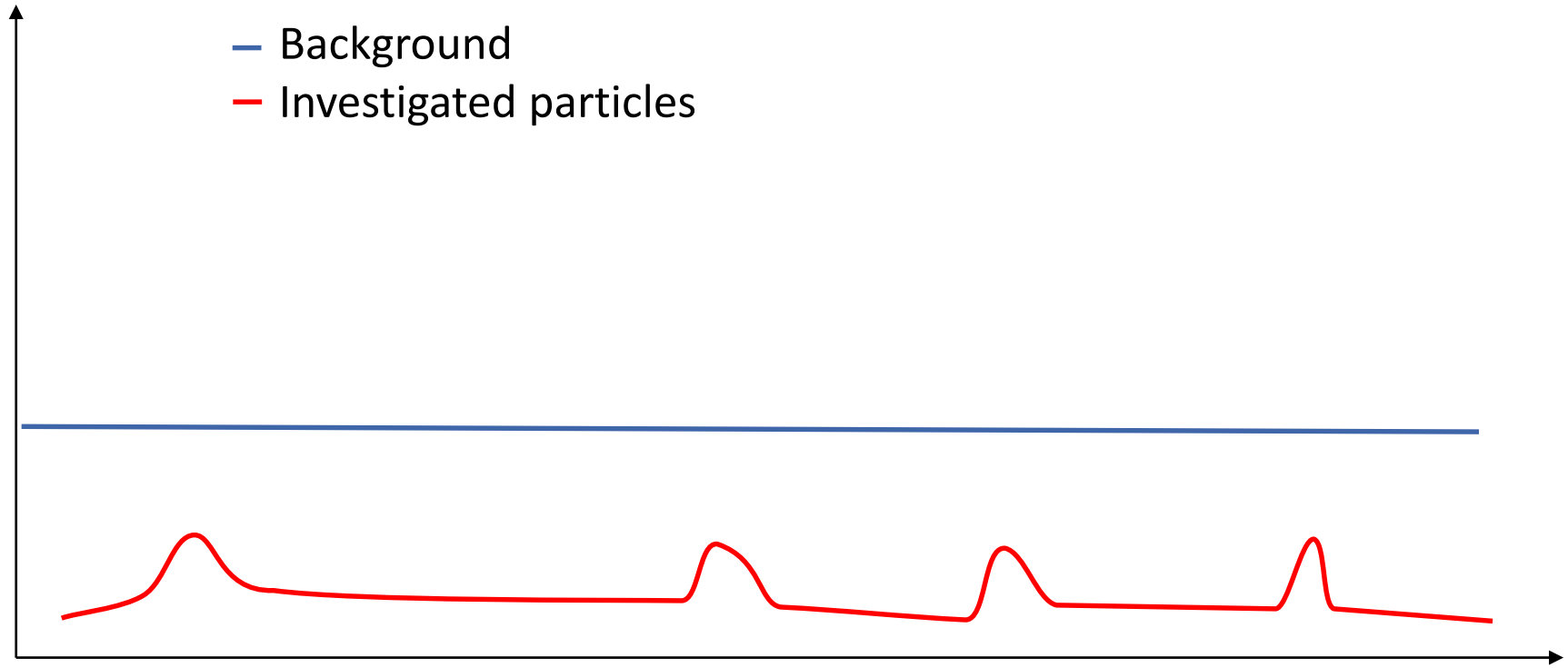
The devices used for basic assessment

Ambiance and background



- Possible stagnancy during days or weeks

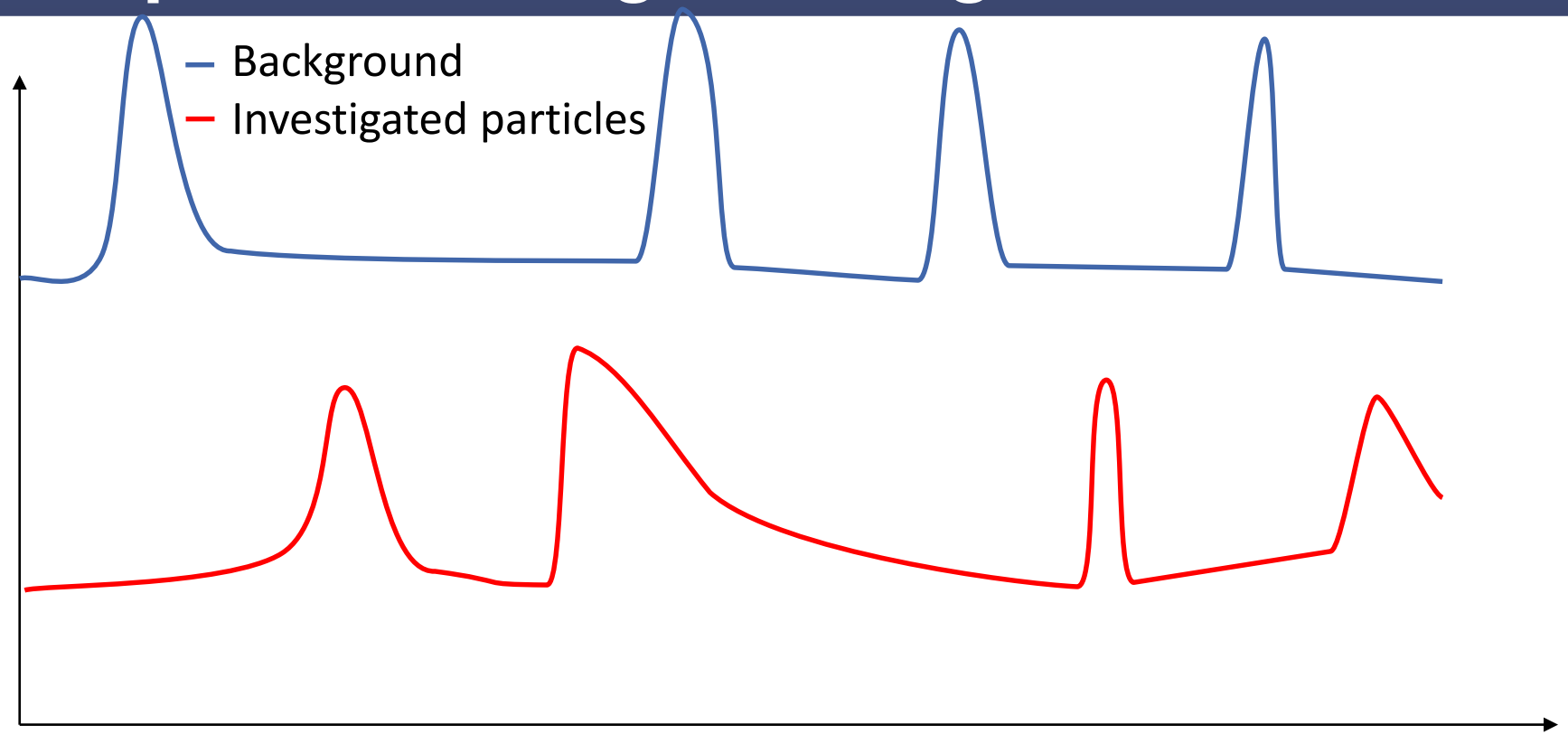
Example : 3D printing Ti Al V



LDSA	**30 No elevation**

Ti mass	**> 1 µg/m3** **< 10 µg/m3**

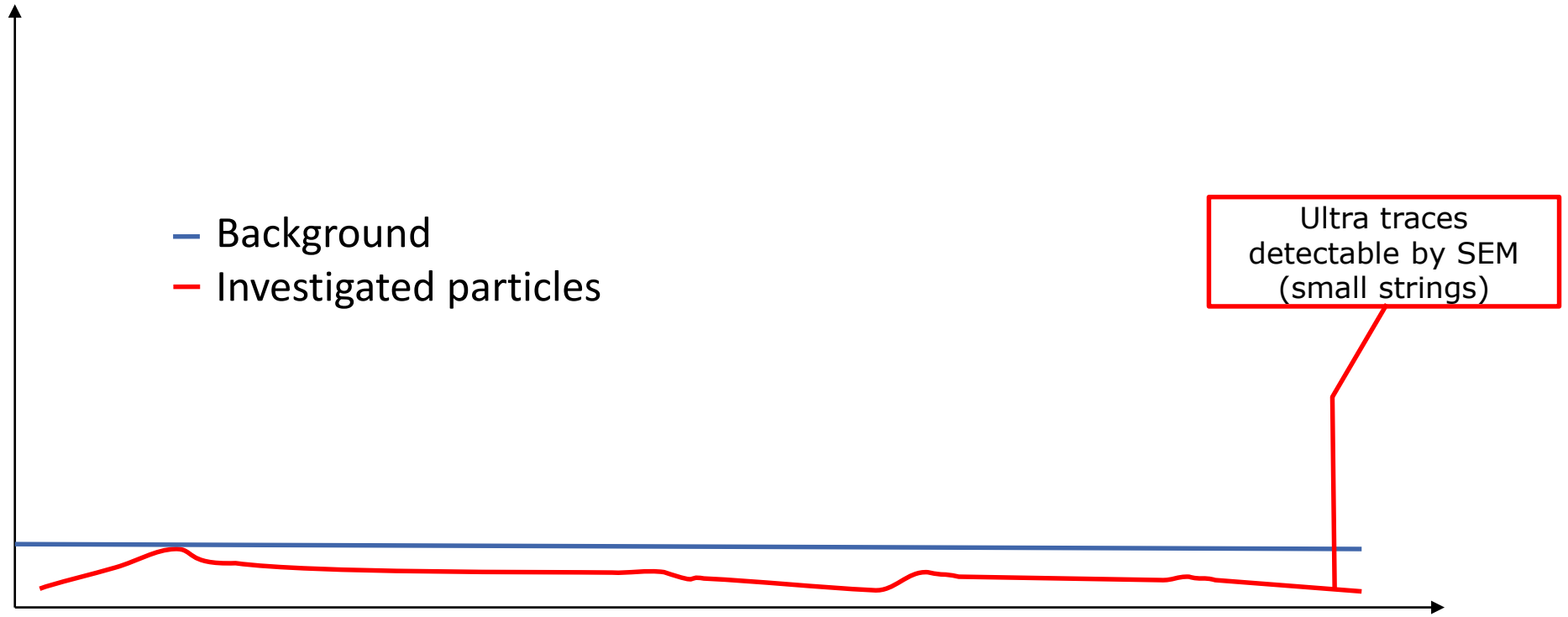
Example : nano high tonnage manufacturing



LDSA	**High peaks > 1000 Furnaces particle**

Investigated particles mass	**0,5 mg/m3**

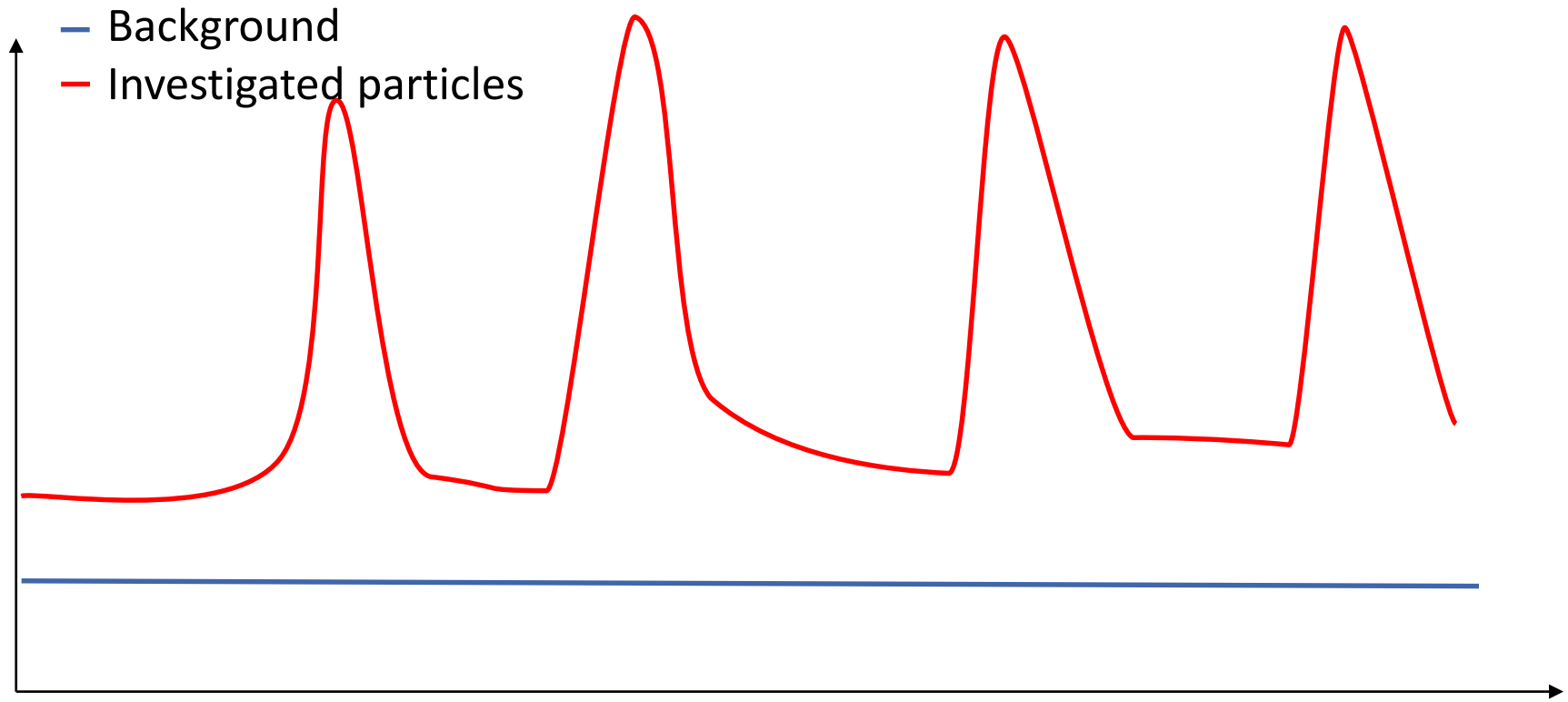
Example : nano manufacturing in clean room



LDSA	**1 No elevation**

Investigated particles mass	**< 1 µg/m3**

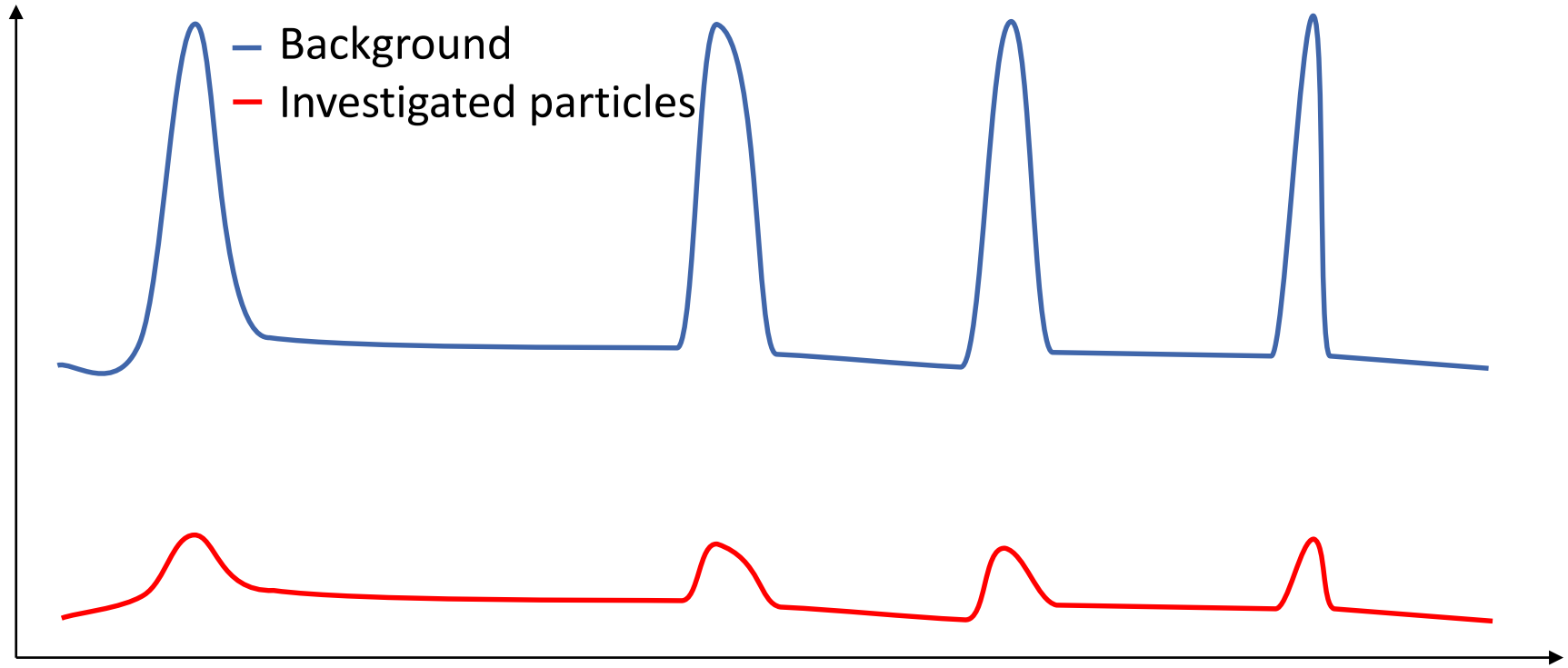
Example : heavy powders in metal industry



LDSA	**20 No peak**

Investigated particles mass	**7 mg/m3**

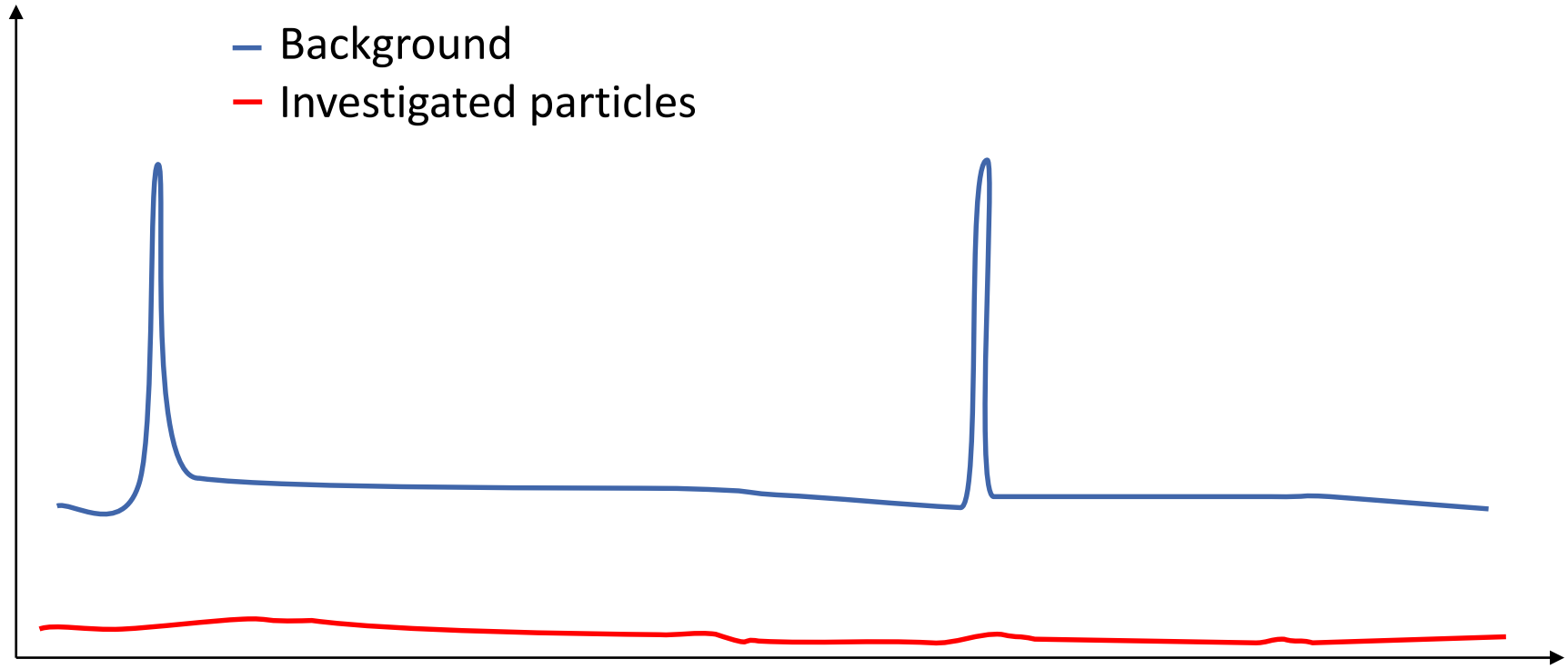
Example : light aircrafts with propeller



LDSA	**Peak 200 (even 30 meters behind aircraft)**

Several metal mass	**> 1 µg/m3 < 10 µg/m3**

Example : glass-bead blasting



LDSA	**Peak 200**	**As mass**	**< 1 µg/m3**

Leads and proposal

Proposal – Initial assessment

	Mean	Protocol
1. Manufactured	Data gathering	Ask to supplier
	Substance check	Identification by SEM
2. Non-intentionally generated chemically specified	Real-time counter (CPC or DC)	Held in hand to measure emissivity from process
	Sampling for offline analysis (NANOBADGE)	1 or 2 steady point in ambiance
3. Ultrafine	Real-time counter (CPC or DC)	Held in hand to detect sources and measure general concentration

Proposal – Basic assessment

	Mean	Protocol
1. Manufactured	Sampling for offline analysis (NANOBADGE)	1 on operator + 1 near field simultaneous (recommended) + 1 before process or far field (optional)
2. Non-intentionally generated chemically specified	Sampling for offline analysis (NANOBADGE)	Idem
	Real-time counter (optional)	Useful to prove non-exposure
3. Ultrafine	Real-time counter (DC)	1 on operator + 1 near field simultaneous (recommended)
	Sampling for offline analysis (NANOBADGE) (optional)	To determine organic carbon / elemental carbon / metallic components

Our strategy

Transform nano measurement from tens of places

to <u>thousands</u> of places measured per country per year

Please think to us and include NANOBADGE in your strategy !

Special NANOSAFE offer to test NANOBADGE

PAY CONSUMABLES, WE OFFER ANALYSIS !

One-shot NANOBADGE hire 380€

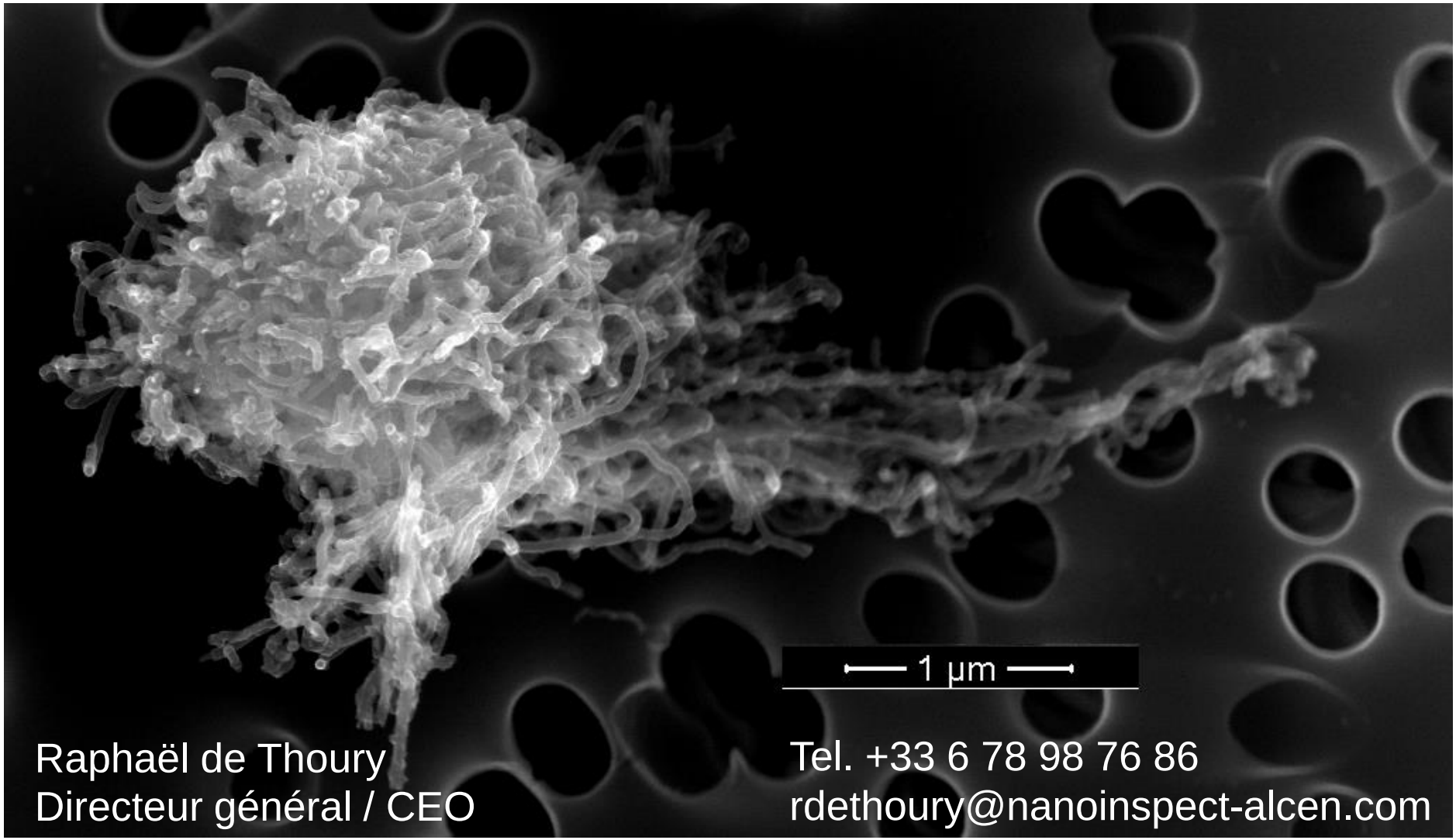
Cassettes 50€

10 metal detection offered

2 detection by electron microscope offered

Please come to our booth or contact us

Thank you for your attention



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