DÉVELOPPEMENT D'UN SYSTÈME POUR FILTRER LES PARTICULES EN MILIEU SEMI-CONFINÉ

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TECHNOLOGY RE'AIR

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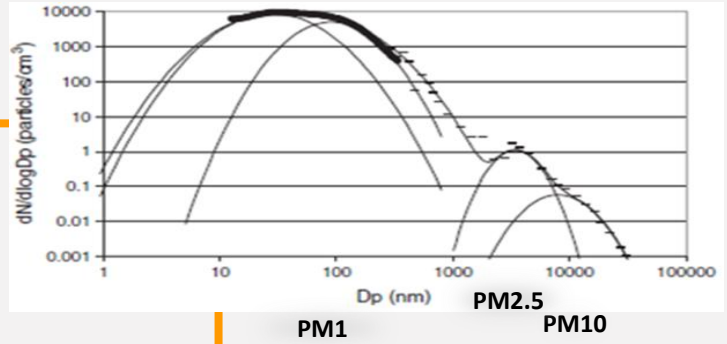
PROBLEMATIC

➔ **Improving air quality:**

- Size distribution from nm to tens of µm
- Different natures: metallic, organic and mineral



Source : ANSES source originale : Midander et al.2012

TECHNOLOGY

- Choice of suitable filters 2 types (/ size and nature of the particles):
  - Magnets
  - granular filter

Objectives :

Removing particles of any nature (organic, mineral, metallic,...) from the SFE

PROTOTYPE BENCH TESTING

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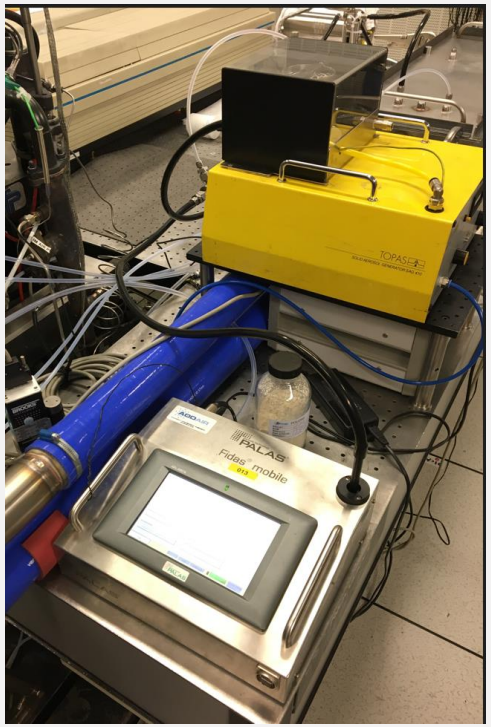
- First short tests (a few minutes):
  - ⇨ **Selecting the type and arrangement of the filter elements**
- Longer duration tests (90 min).
  - ⇨ **Potential evolution of the result over time (disturbance of iron powders)**
- Long test campaigns (over several days)
  - ⇨ **Ageing of filter elements and evaluation of maintenance times in the range of 20 days**



SHORT TESTS

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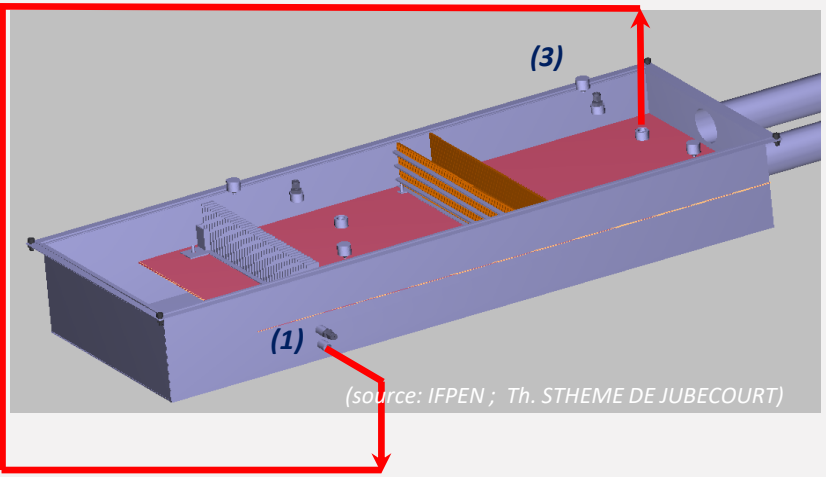
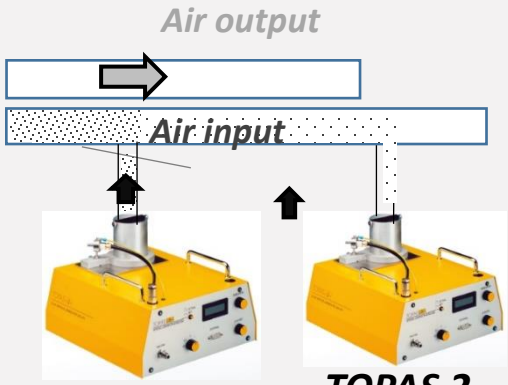
DEKATI
ELPI

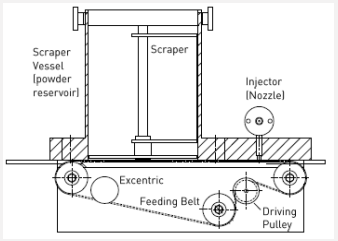


(source: IFPEN ; Th. STHEME DE JUBECOURT)



TOPAS 1
SAG-410 L

TOPAS 2
SAG-410 L



Different particles (Arizona dust, fer, Arizona dust + fer)
Mesure : Real-time particle size analyzer (ELPI ; DEKATI)

2 dispersers

POWDER MIXING DIFFICULTY (SIZE)

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Powders used :

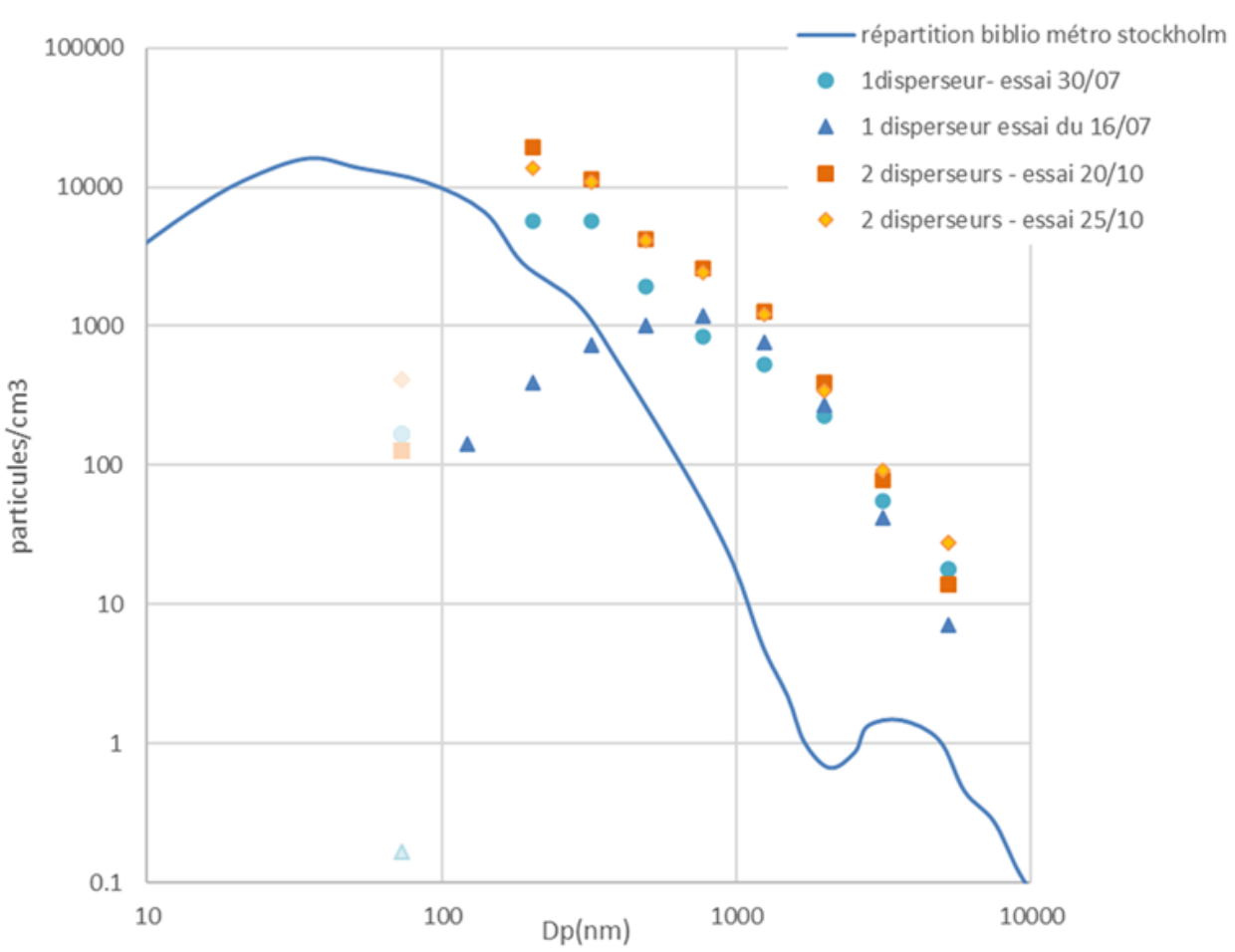
- Arizona Dust (silice) Powder A1-ultrafine : inférieure à 10 µm
- Fer : 50 – 100 nm et inférieur à 5µm

1 disperser :

- Powder mixing for a ratio Fer/AD and a ratio PM2.5/PM10
- Only Iron powder

2 dispersers :

- Fer – Arizona Dust (Differentiated injection)



Particle seeding requires a rigorous methodology

SHORT TESTS

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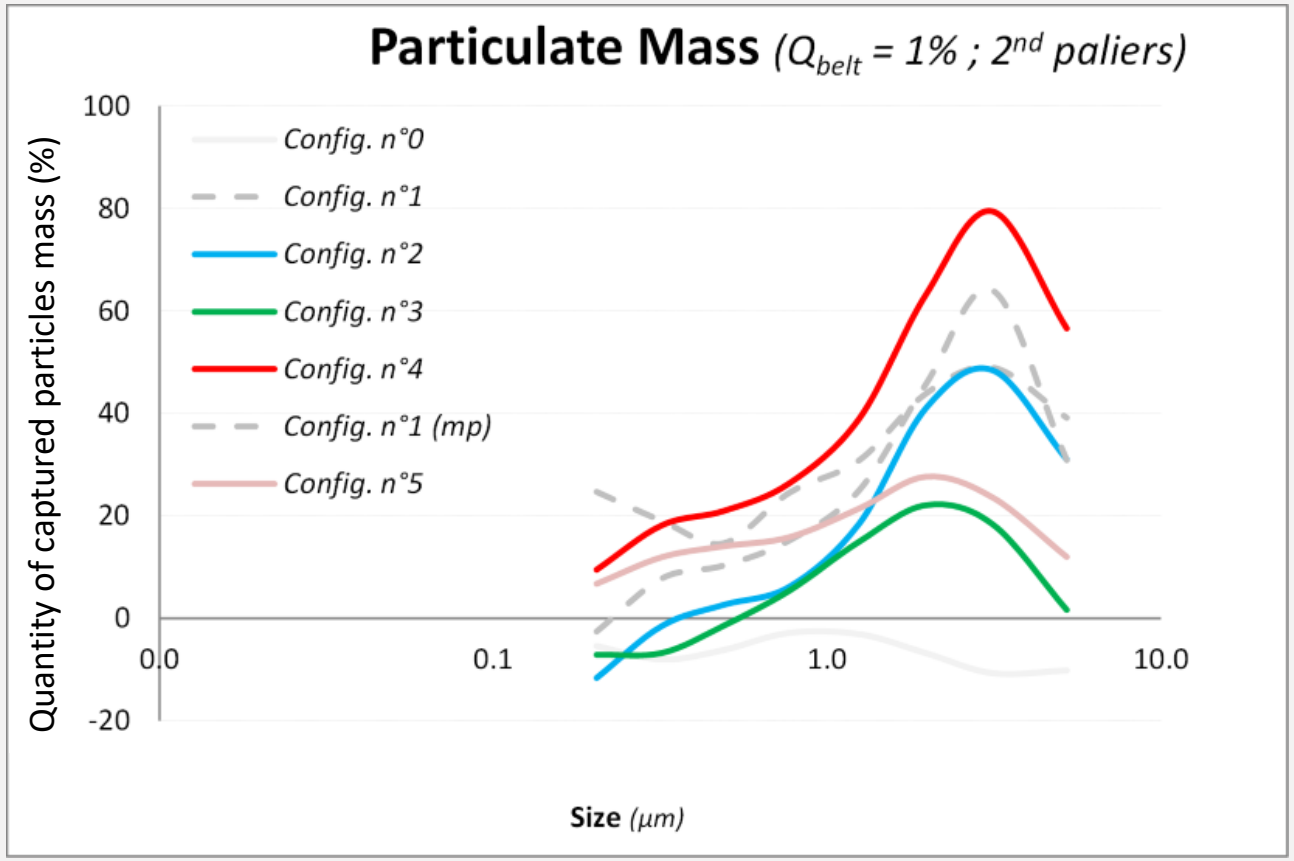
Different configurations tested & 1st interesting results obtained

⇨ Choice configuration n°4 (magnets + ball filter)



LONG TEST (90MIN)

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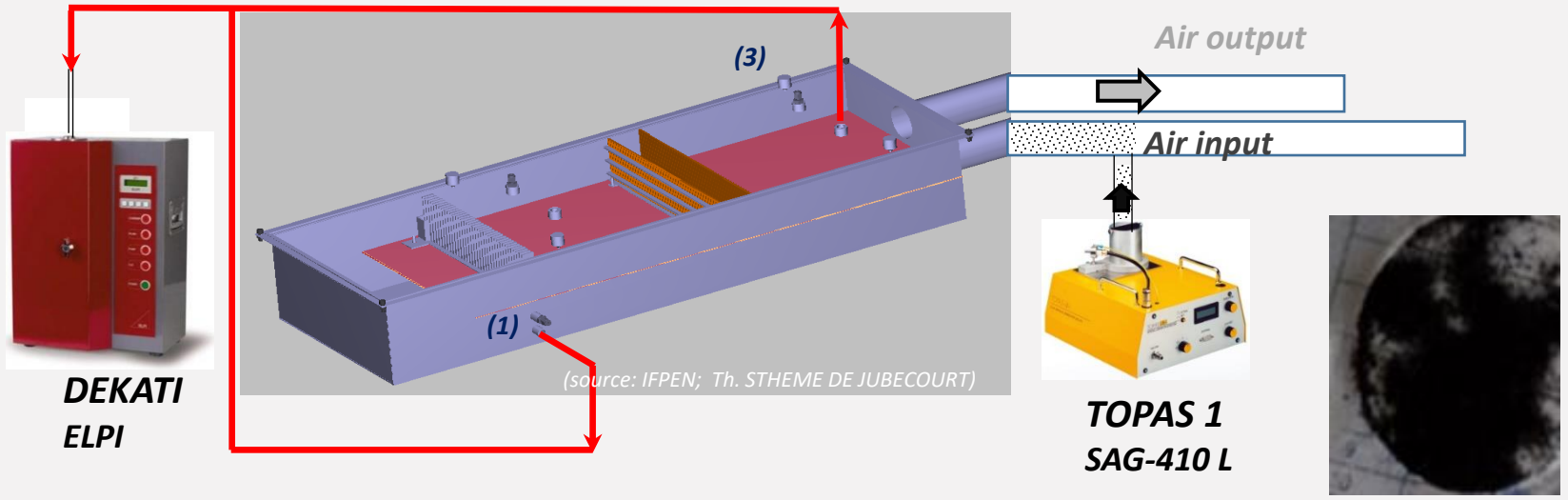

DEKATI
ELPI

TOPAS 1
SAG-410 L

Iron Particles
Mesure : Real-time particle size analyzer (ELPI ; DEKATI) and filter weighings

1 disperser

LONG TEST (90MIN)

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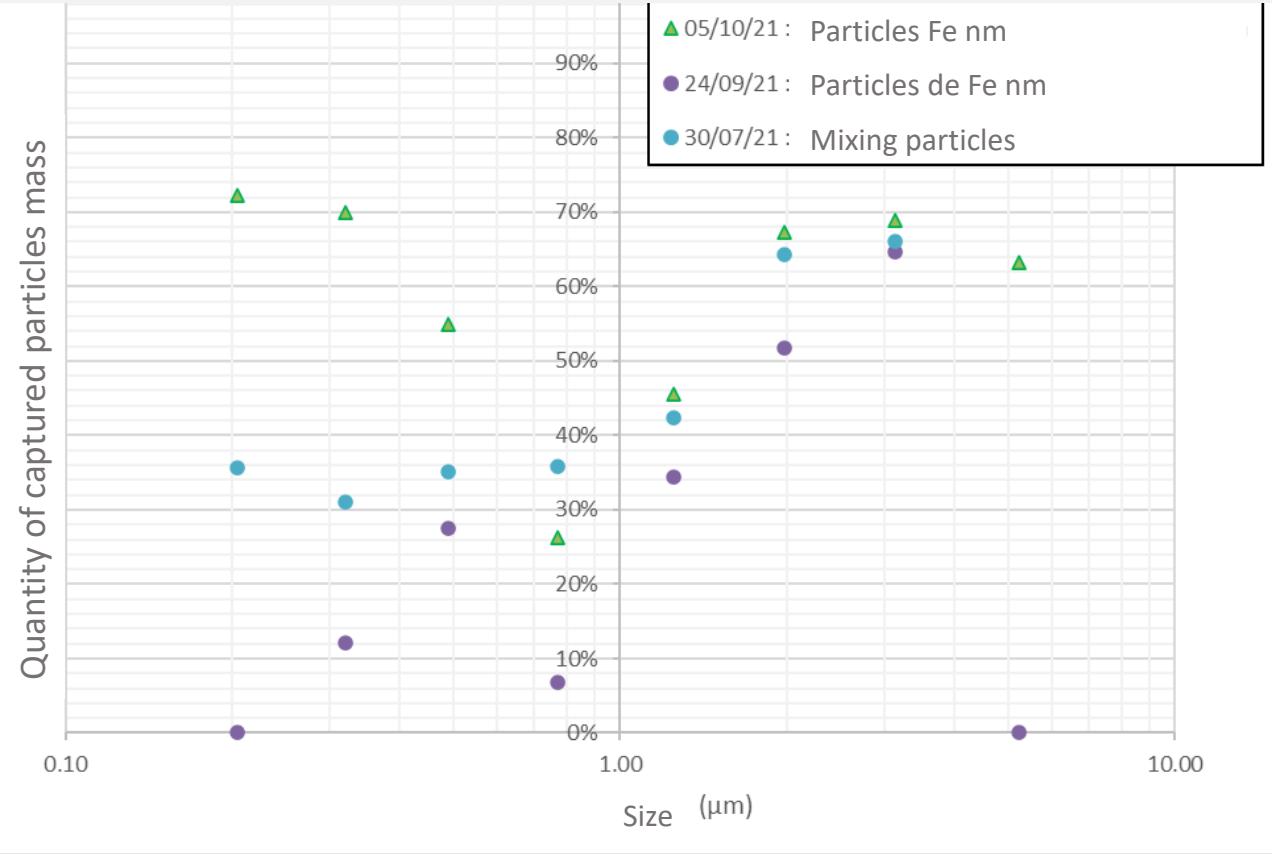
- Increased particle filtration efficiency for the smallest particles but uncertain reliability with Fe (diameter 50 – 100 nm and less than 5µm)
- Constraints/difficulties for the particle seeding (magnetic character Fe)



LONG TEST(OVER SEVERAL DAYS)

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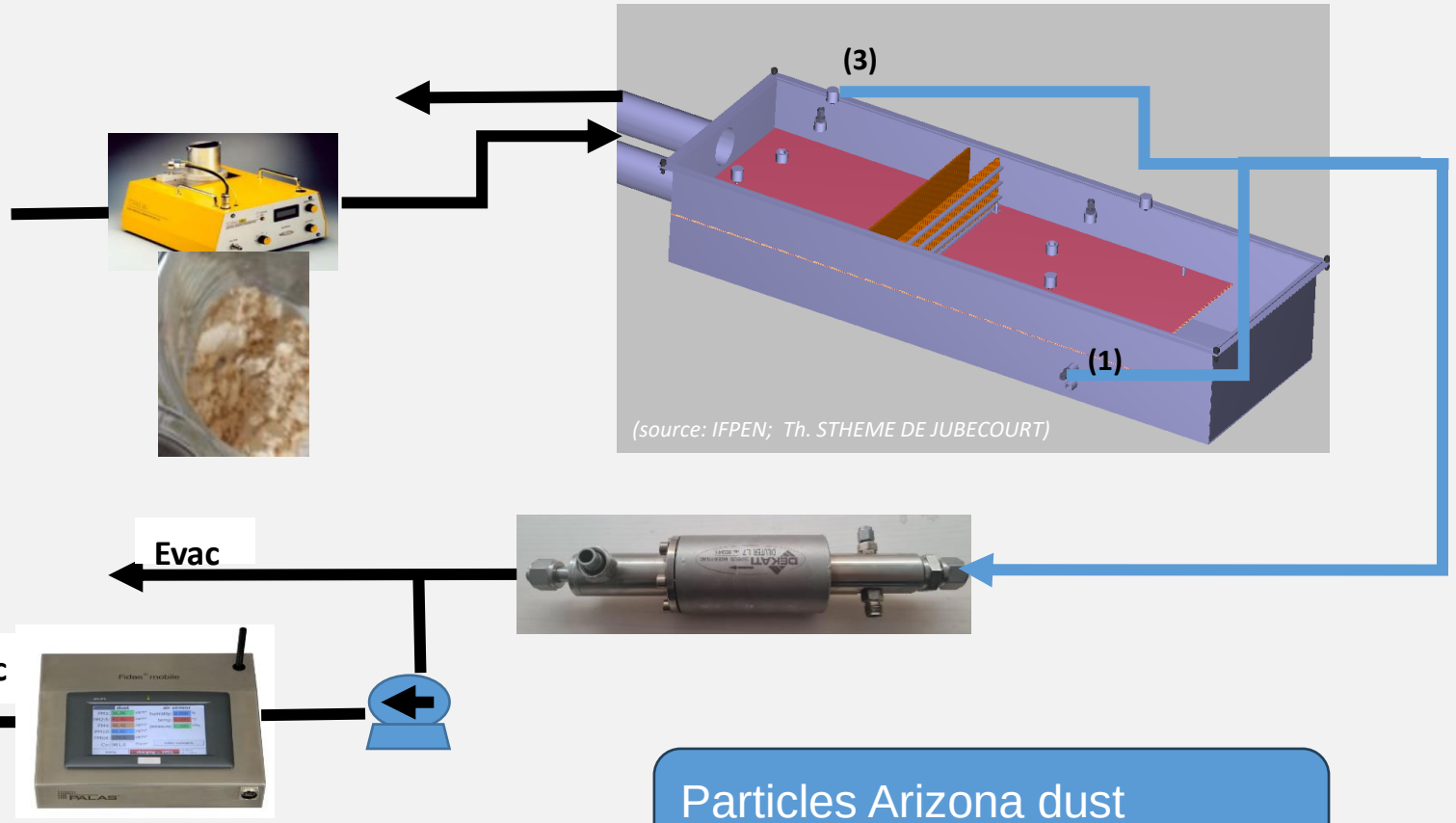

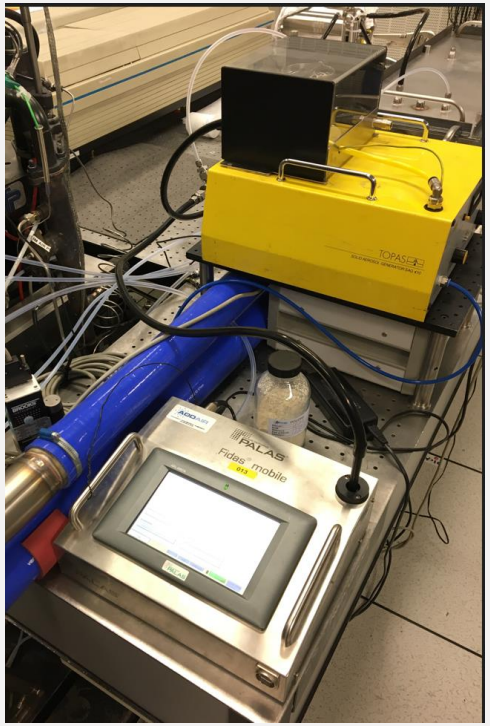

Particles Arizona dust
Mesure : Fidas mobile

LONG TEST (OVER SEVERAL DAYS)

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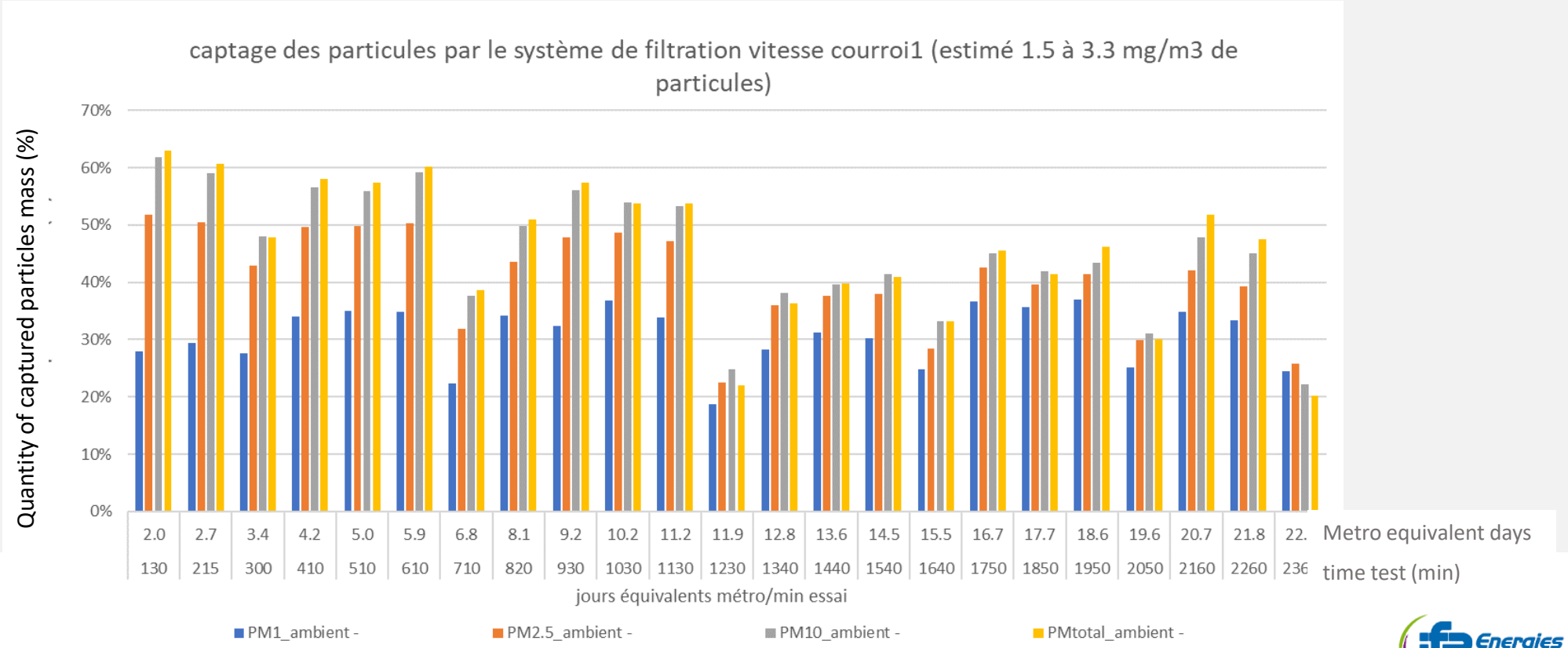
Particle rate 12 times higher than the average value of 150 µg/m3 of particles in the subway

⇨Accelerated testing



CARACTÉRISTIQUES D'UN MODULE DE FILTRATION

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- Plusieurs architectures imaginées.
- Objectifs :
  - Flow velocity at the filter element: max 5 m/s
  - Treated air flow: 7500 m3/h
  - Granular media filtration (a few cm deep)
  - Magnet filtration
  - Power consumption: approx. 500 W (potential annual consumption of 3800 kWh)
  - Noise pollution: less than 65db
  - Total weight< 350kg (surface 1.4m2)

Example of an application

SCHEMATIC DRAWING

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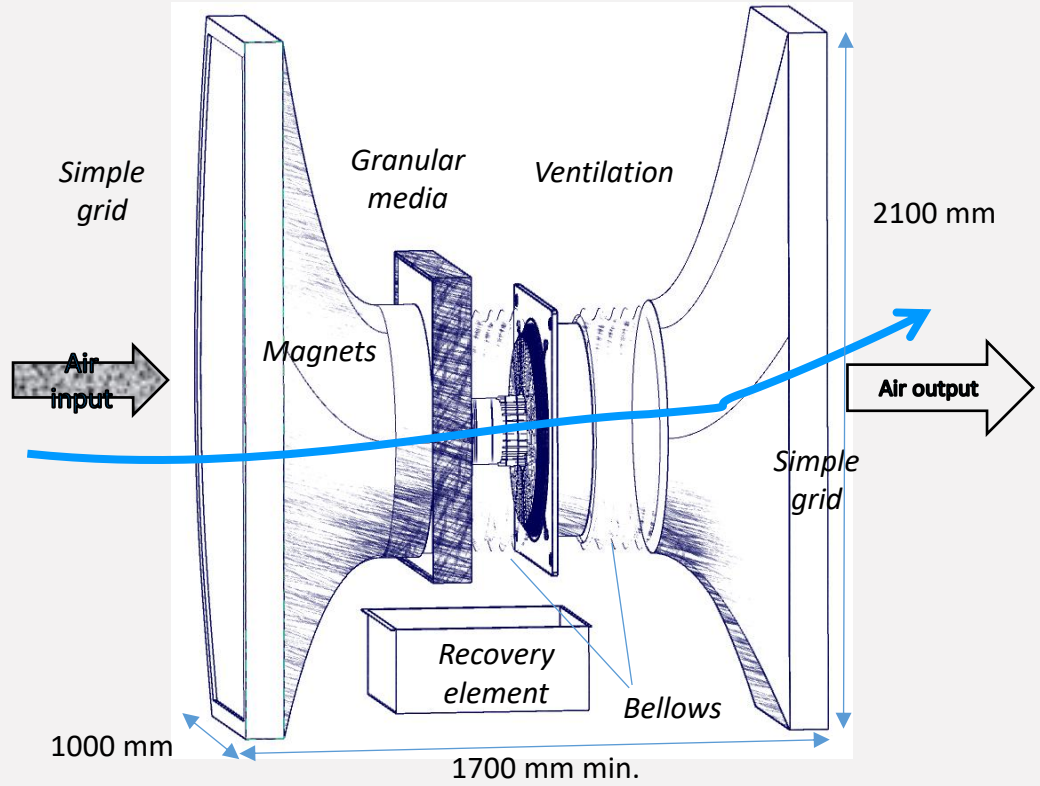
- Advantage of the solution:
  - Compact and modular, Easily adaptable (depending on application and location constraint)
  - Reduced power consumption and no other utilities
  - Negligible effects (T°, RH)
  - Simple filtration without toxic elements



QUESTIONS ?

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- Merci pour votre attention

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