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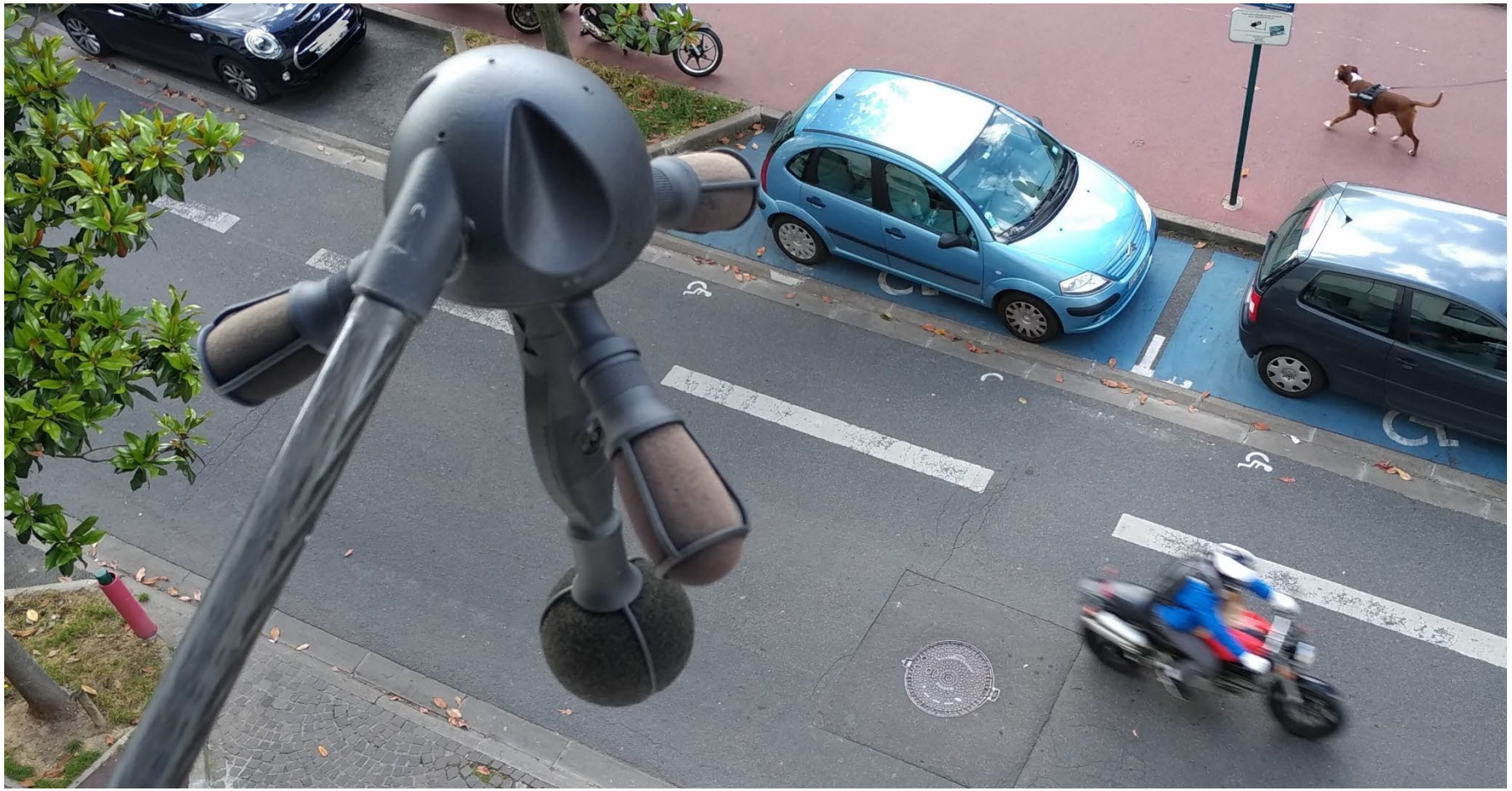
Meduse and Hydre
Tackling noise where it comes from



Technology changed the way to tackle noise

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Handheld SLM

Noise Monitoring Systems (2005)

- 24x7
- Level-based event detection

Sonopode (2010)

- DoA-based aircraft event detection
- Based on Rion NA-37 System
- 6 month autonomy (fuel cell)

Meduse (2019)

- « See » environmental noise

Hydre (2022)

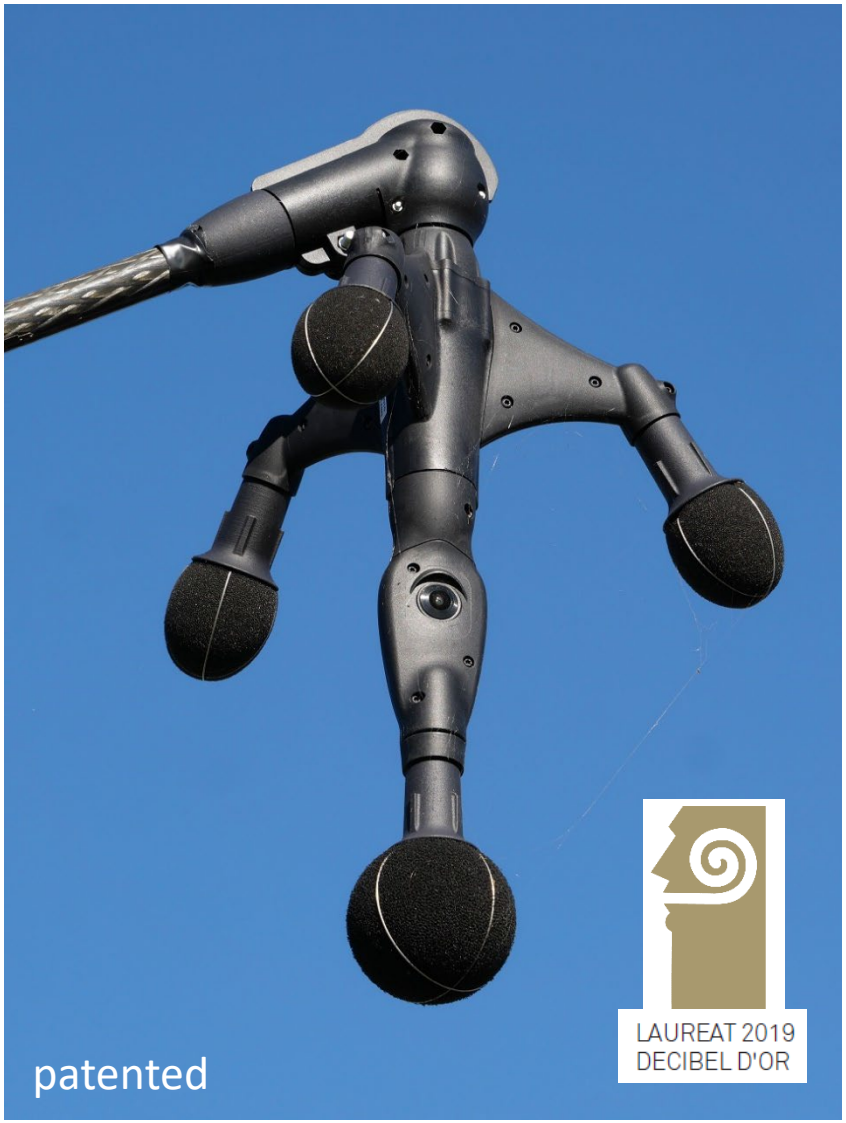
- Tackking excessive noise drivers

Meduse : the world's only patented noise sensor with source location technology and embedded 360° camera

- **Acoustics**
  - MEMS microphones (½ inch)
  - LAeq, LCeq every 100ms
  - Direction of arrival of the loudest source every 100ms (DoA)
- **Imaging**
  - 360° (still picture and video)
  - blurring and masking (privacy)

- General noise : ground oriented, on arm
- Aircraft noise : sky oriented, on pole or arm

- **Winner of the French “Decibel d’Or” award**



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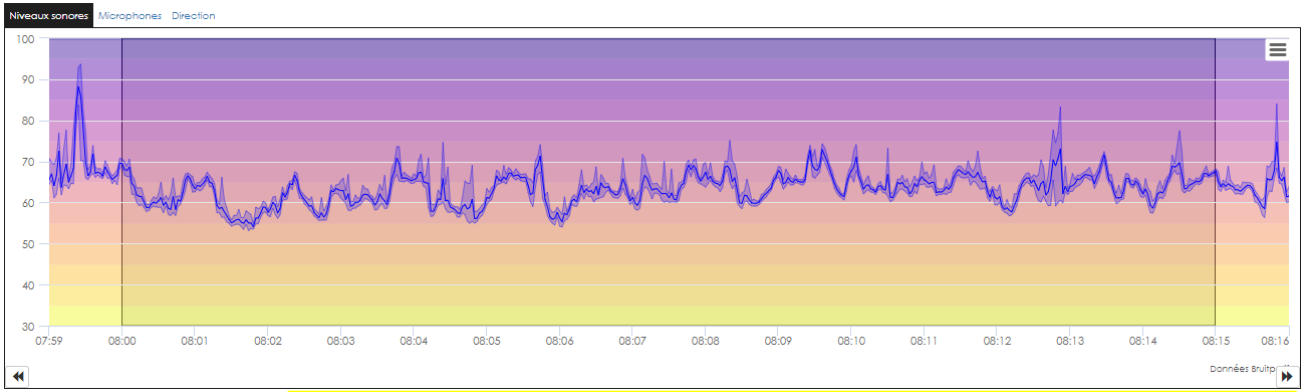
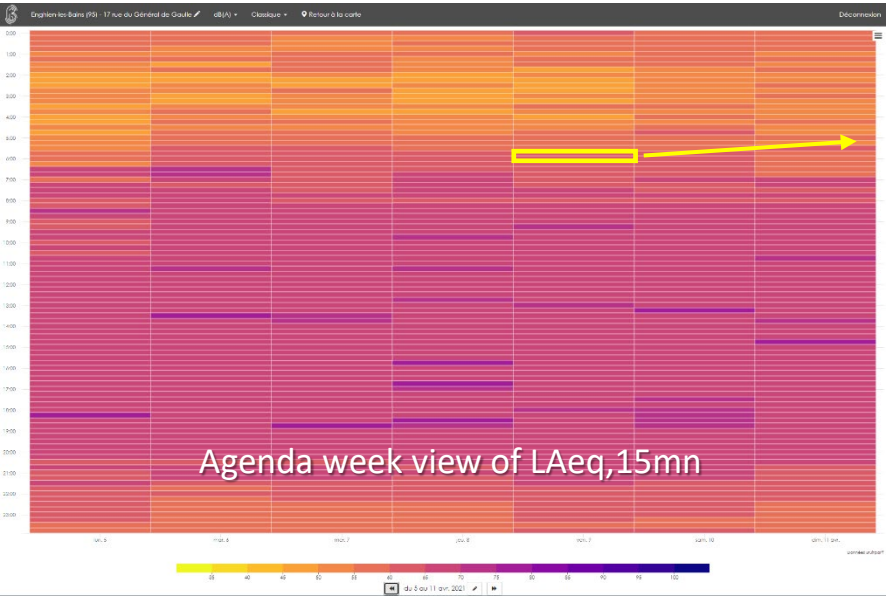
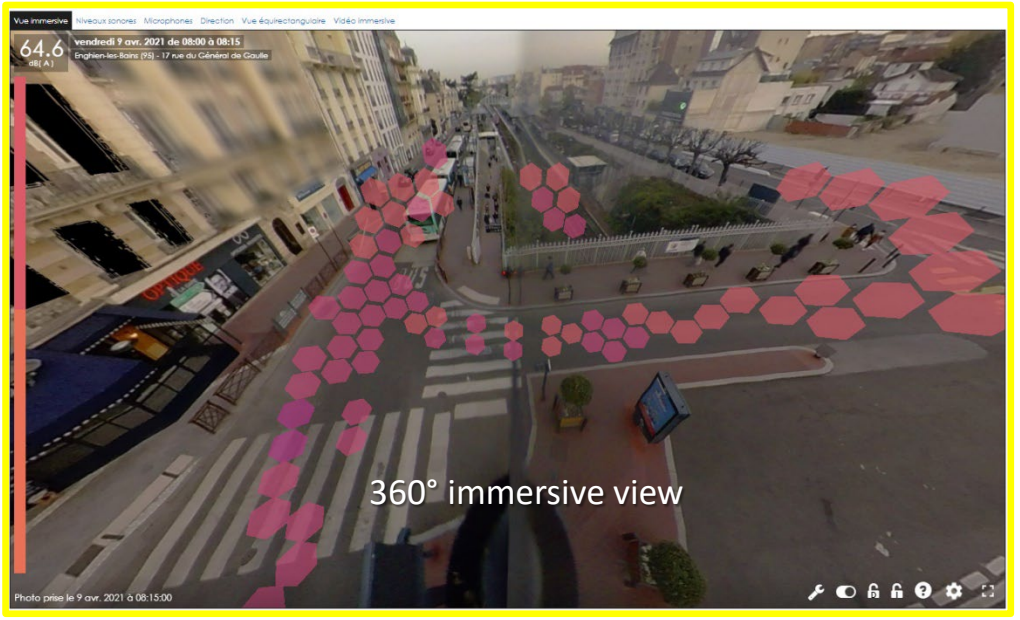
Spatialized noise distribution

Using statistics on Direction of Arrival







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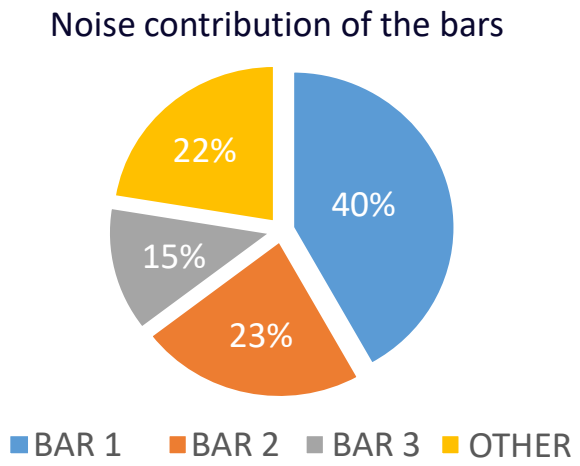
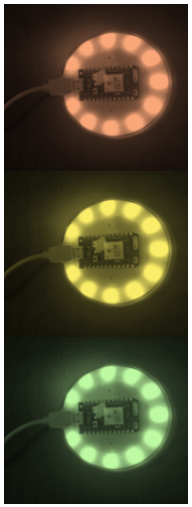
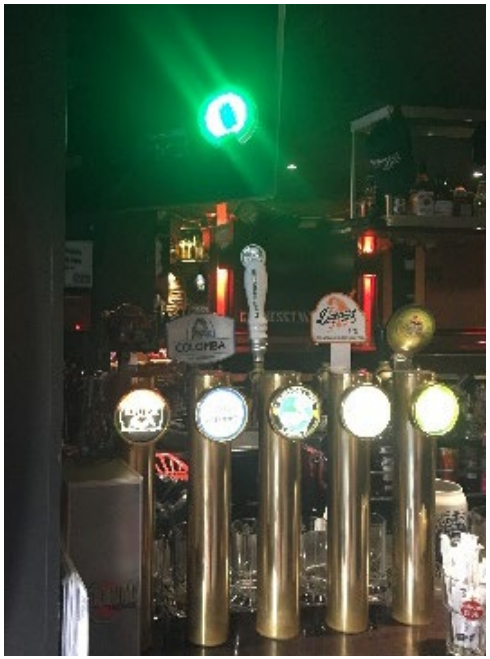
Management of public tranquility



Provide feedback
to customer and bar holders
to encourage self regulation





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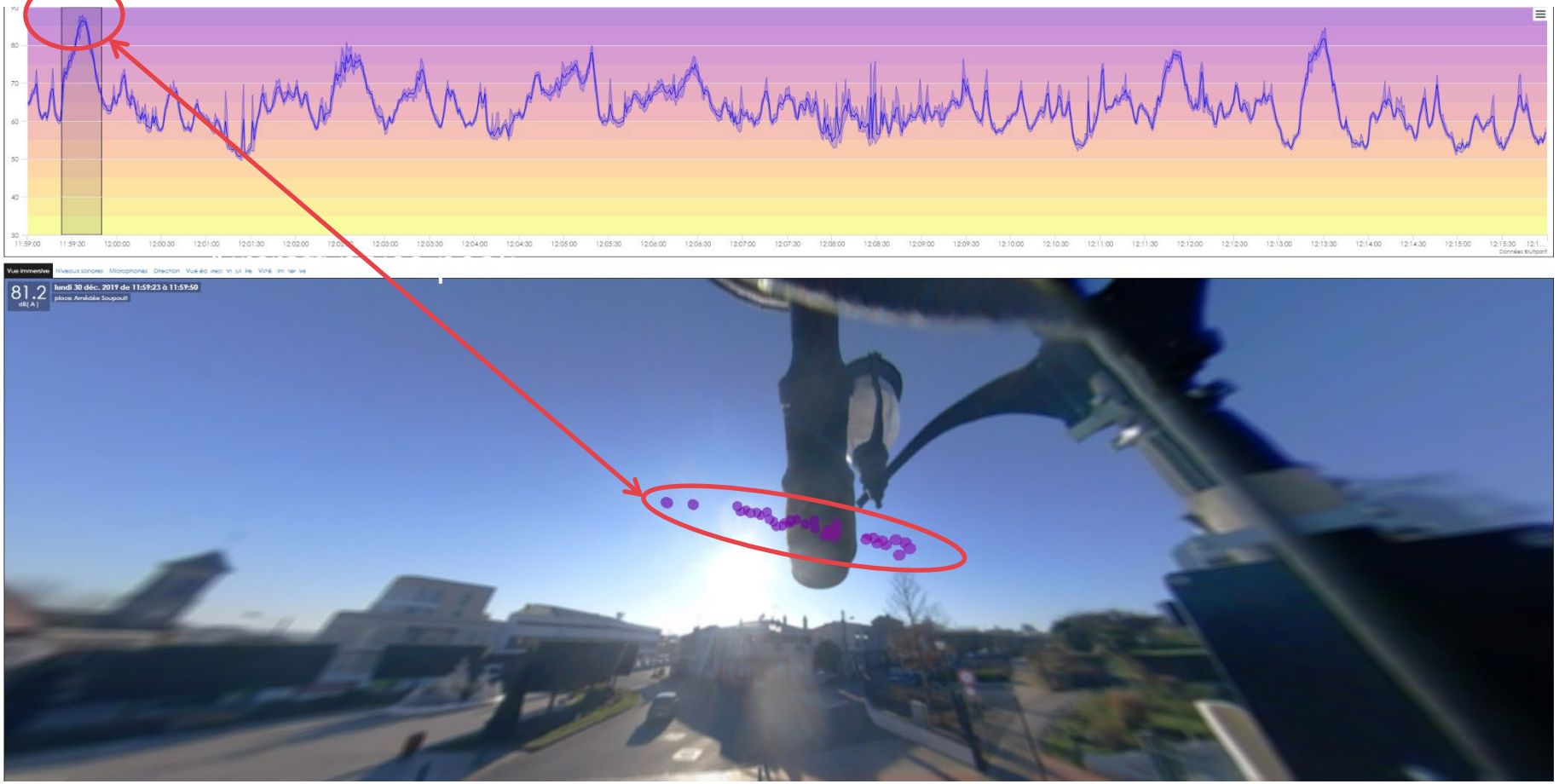
Noise event detection

Aircraft noise events detection

Other sources detection and identification through imaging



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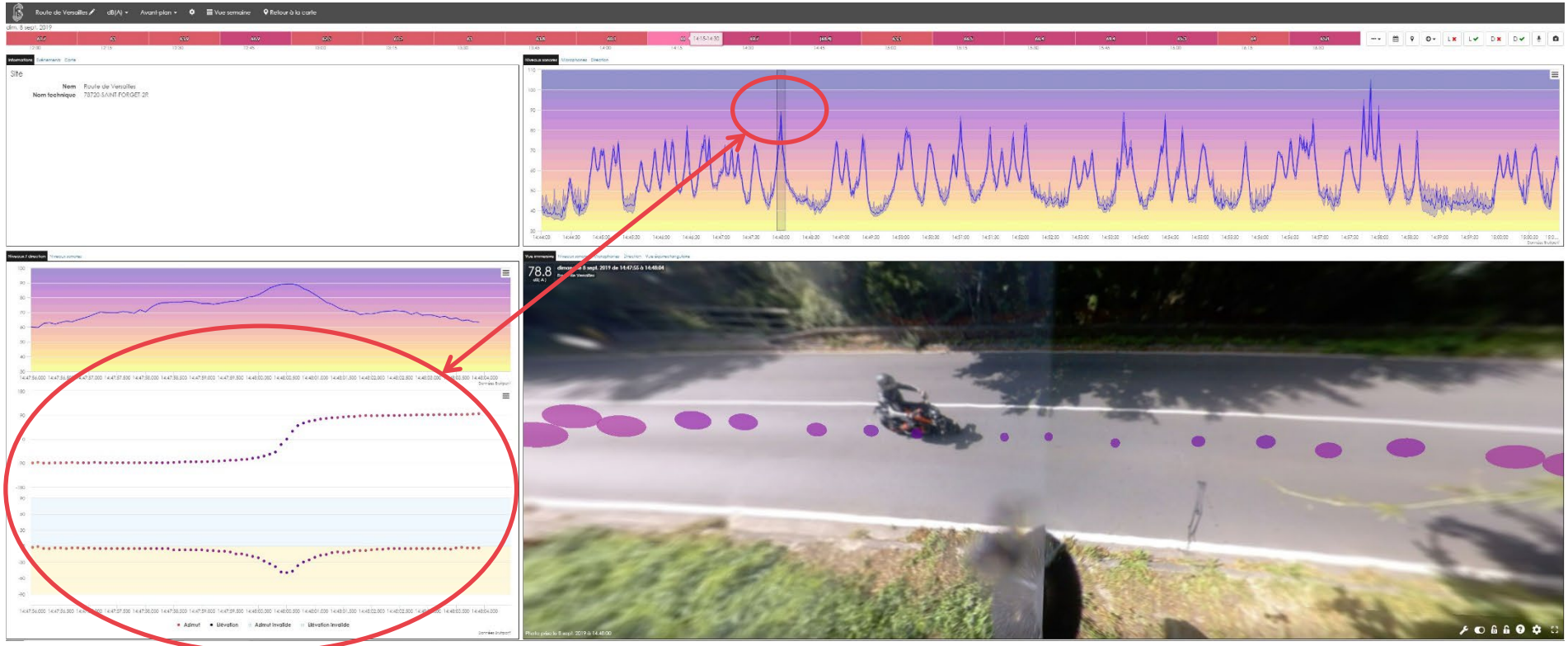
Vehicule Noise Event Detection Application

Passage of a biker



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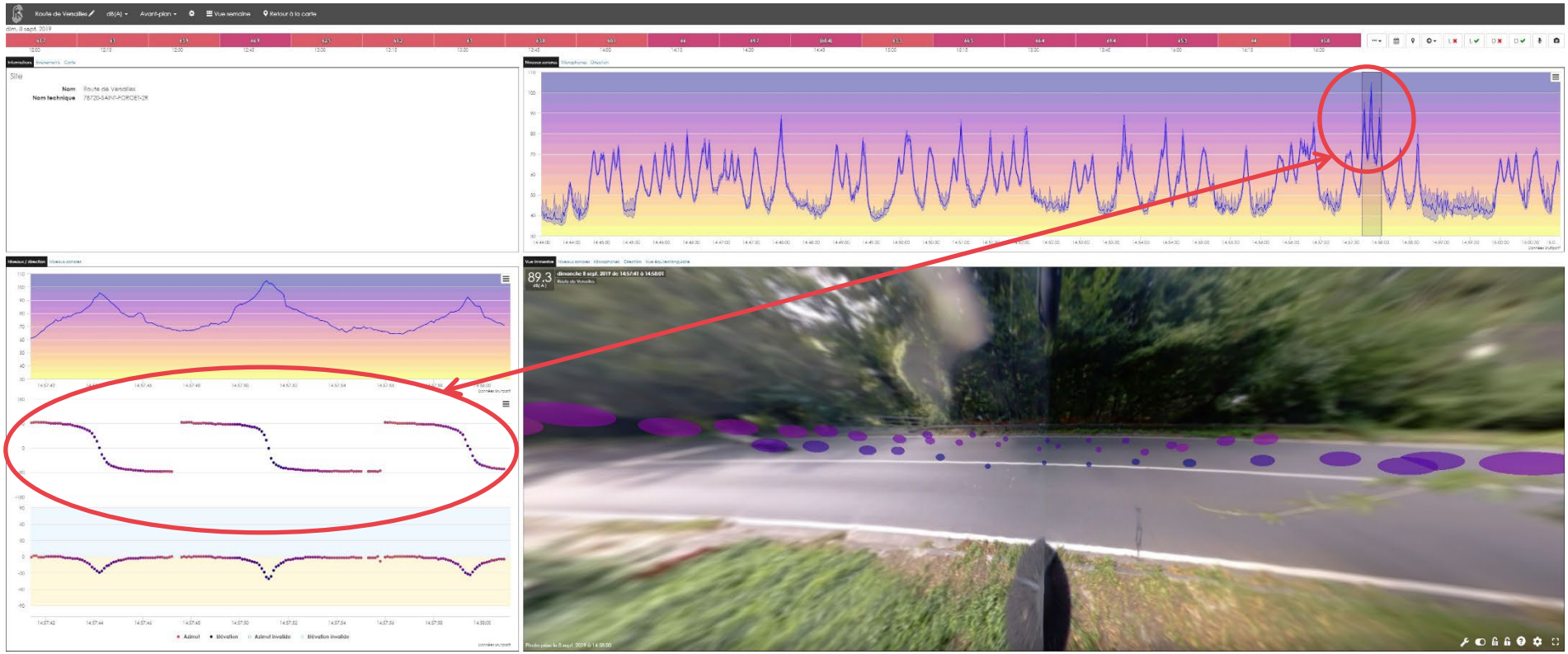
Vehicule Noise Event Detection Application

Some bikers



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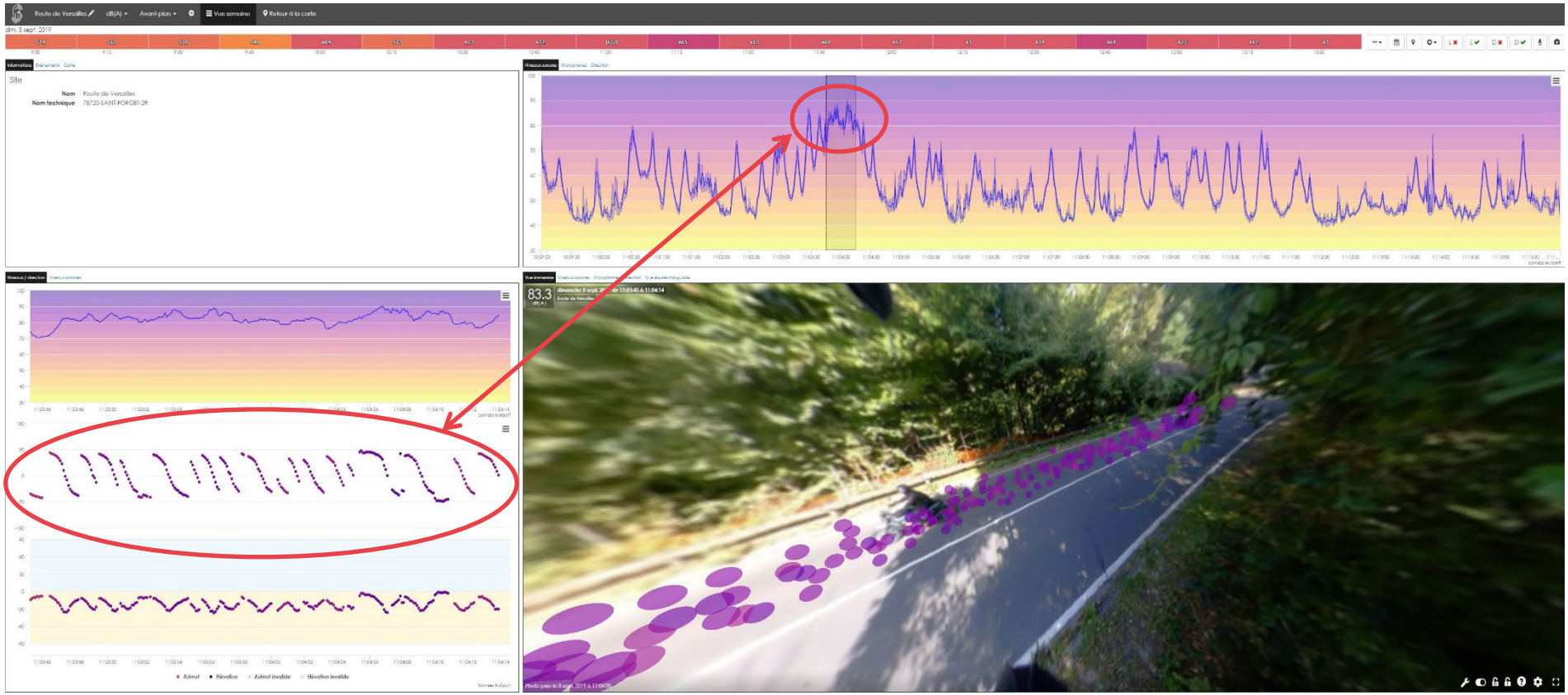
Vehicule Noise Event Detection Application

Many bikers !



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Vehicle Noise Warning System (meduse + 2 warning panels)

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HYDRE

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How to tackle drivers who make excessive noise?

- Using a simple sound level meter has a major drawback :
  - The system would not behave in an equitable manner for the different traffic lanes or vehicle trajectories
  - This could result in the driver taking risks to drive as far away from the microphone as possible, even if it means driving the wrong way.

It is mandatory to estimate precisely at any time the distance of the source, then to calculate a noise level at a standard reference distance (7.5m)

✓ Meduse has opened up a way to better analyze and separate the impact of each individual vehicle.

✓ Hydre performs this operation in an entirely acoustic way, by combining the informations of two acoustics subsystems.

HYDRE : a multi-sensor system

Windmeter, GPS and
Cellular antennas

Top
acoustic subsystem
(4 mics, hardened)

ALPR
camera 1

ALPR
camera 2

Bottom
acoustic subsystem

180°
camera

- Secured and hardened design
- Installed and powered by public light pole

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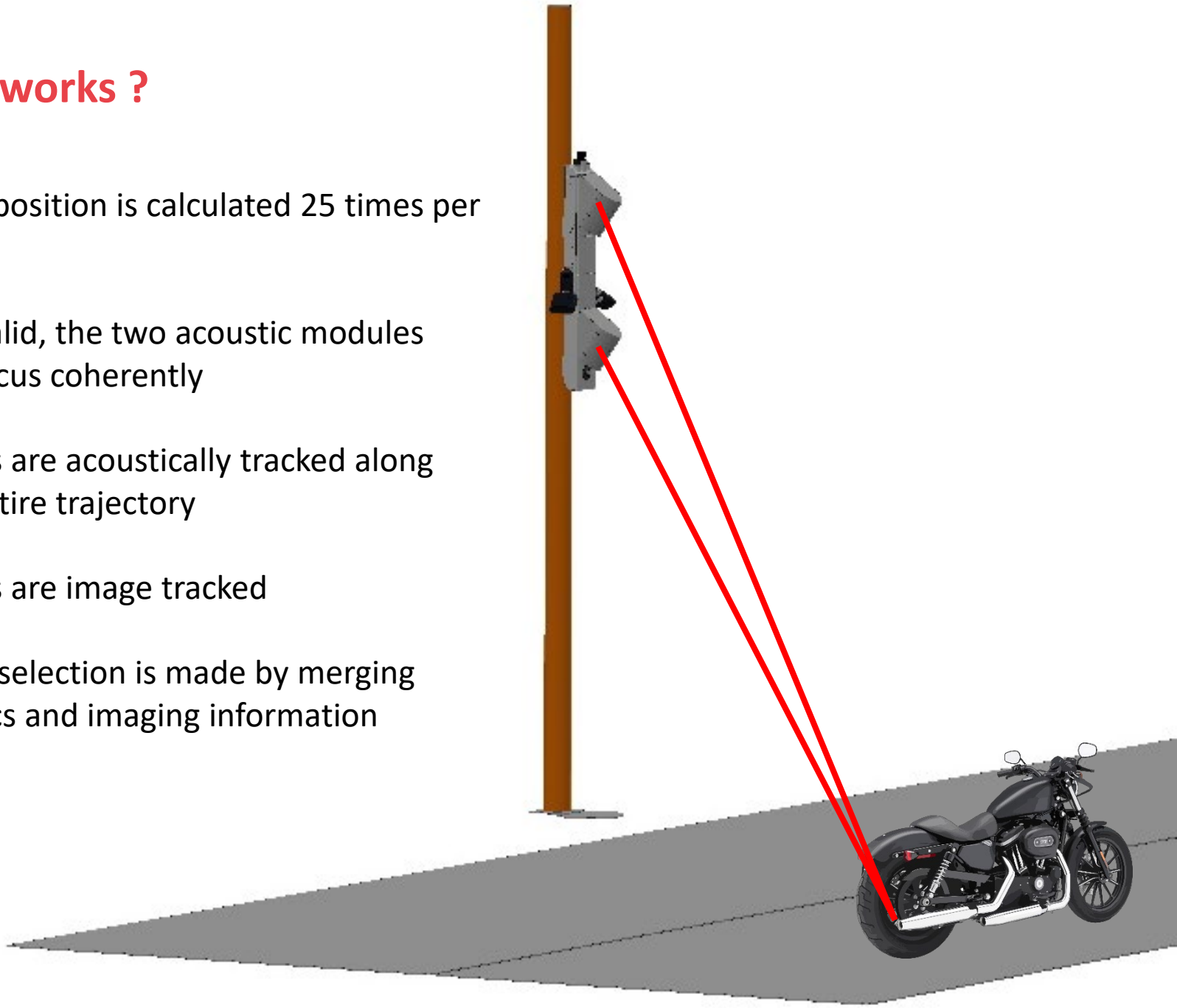
How it works ?

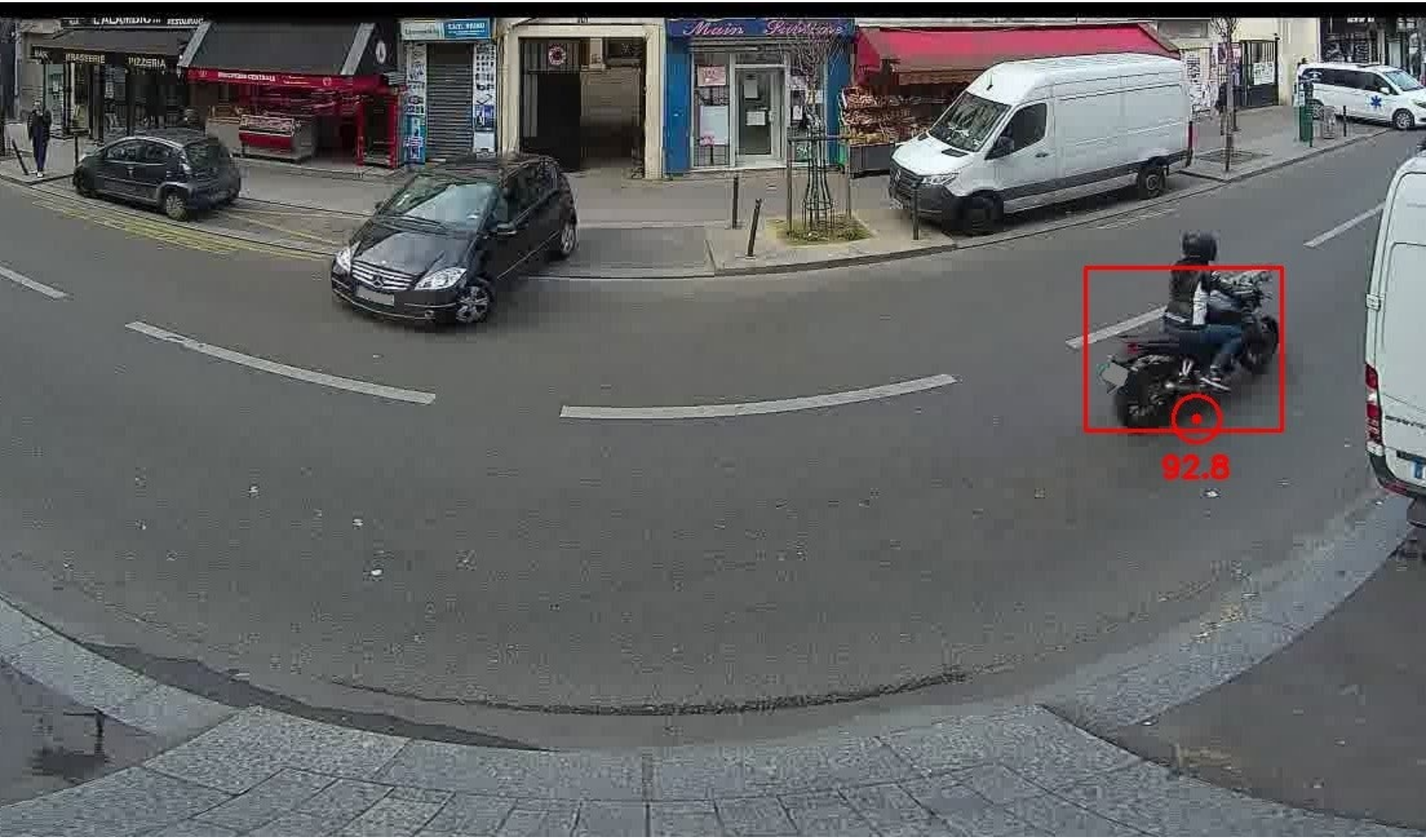
- Source position is calculated 25 times per second
- To be valid, the two acoustic modules must focus coherently
- Vehicles are acoustically tracked along their entire trajectory
- Vehicles are image tracked
- Vehicle selection is made by merging acoustics and imaging information



BPAR20 (48.852100, 2.403002), 2022-04-12 17:32:41

Moto cible pdt 1.28s, LAFmax 87.3@7.6m > 86.0 pdt 0.08s (84.1@10.9m)

Pas d'image disponible


92.8

What information is produced?

- Maximum noise level (LAFmax) and position of source (x, y, z)
- Max noise level @ ref distance (7.5m)

- Audio and video recording of the vehicle's complete passage
- Acoustic source position is displayed during all the video
- The targeted vehicle is clearly identified on the video.

- Front and rear images of the target vehicle
- Front and rear images of license plates
- Automatic license plate recognition

BCCHVC (48.729515, 2.023642), 2022-03-29 13:34:12

Voiture cible pdt 1.16s, LAFmax 64.6@7.6m (59.9@13.1m)

Detections LAPI

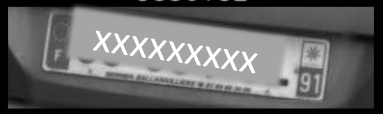
Voiture

Peugeot

207

Bleu

CC561GL




82.5
BCCHVC (48.729515, 2.023642), 2022-03-29 12:58:02
Camion cible pdt 0.56s, LAFmax 82.5@7.6m (79.6@10.6m)
Detections LAPI
Camion
Mercedes
Arocs
Blanc
FP712TA
12:58:03.6
12:58:00.3
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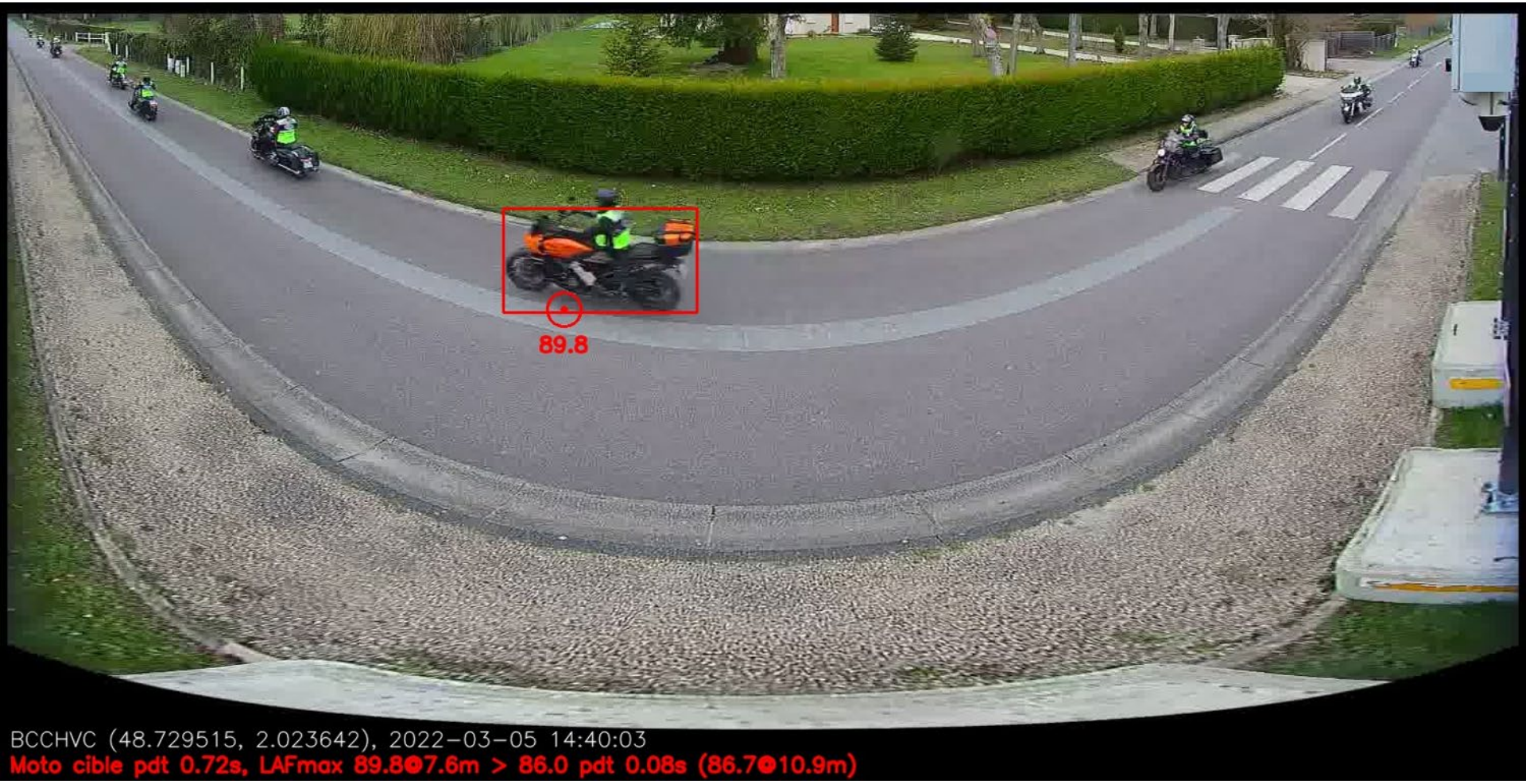
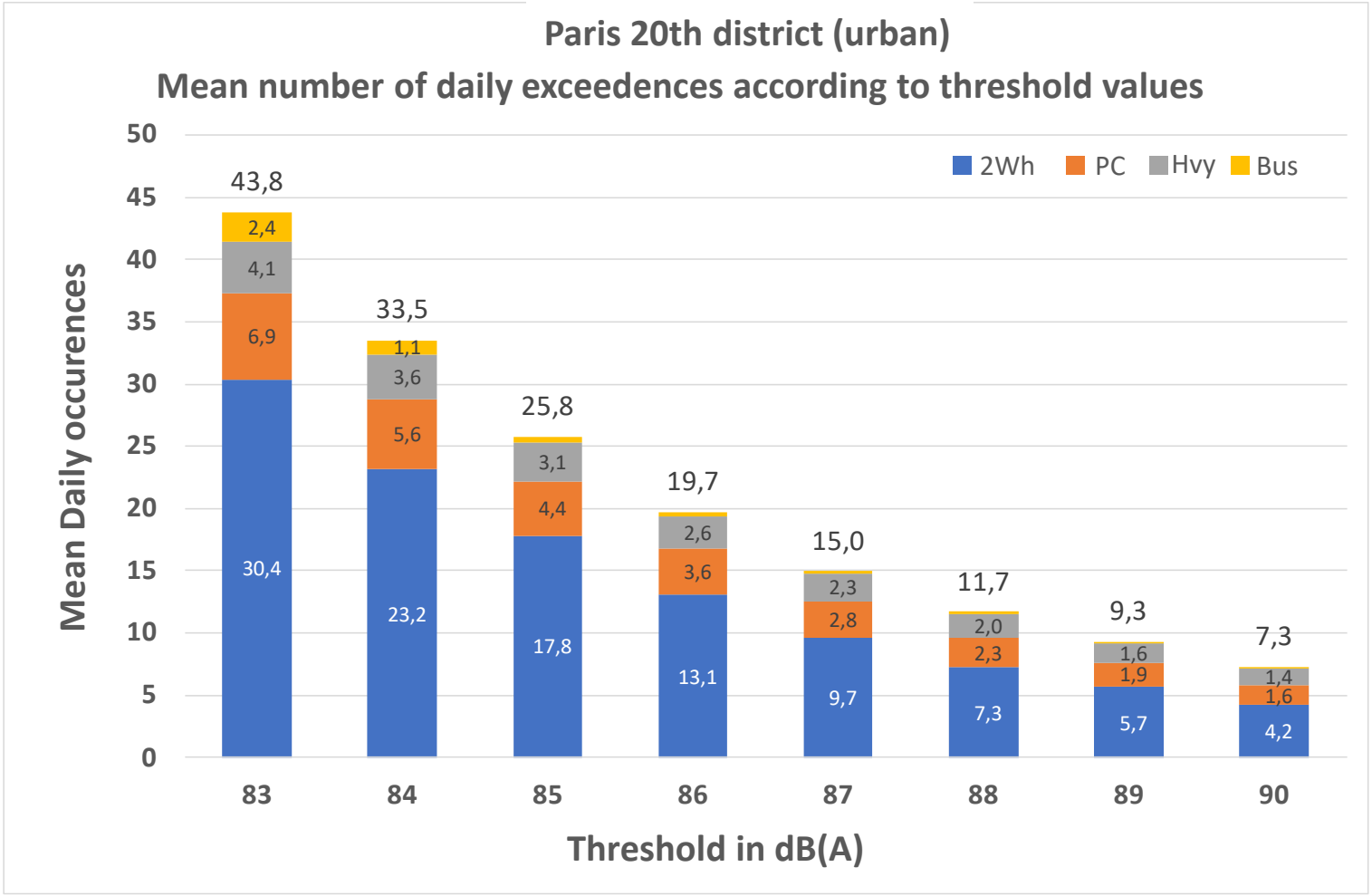
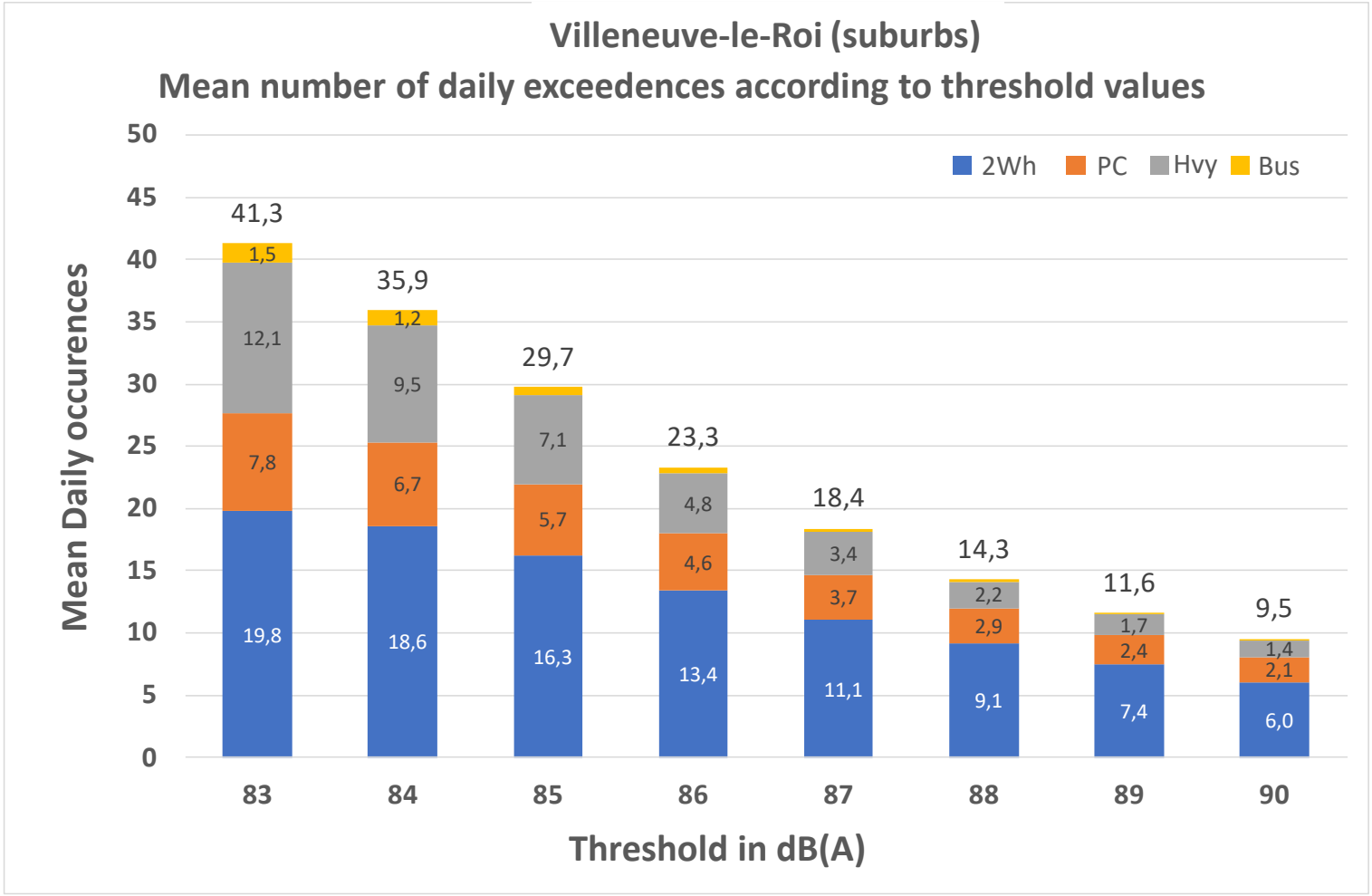

89.8
BCCHVC (48.729515, 2.023642), 2022-03-05 14:40:03
Moto cible pdt 0.72s, LAFmax 89.8●7.6m > 86.0 pdt 0.08s (86.7●10.9m)

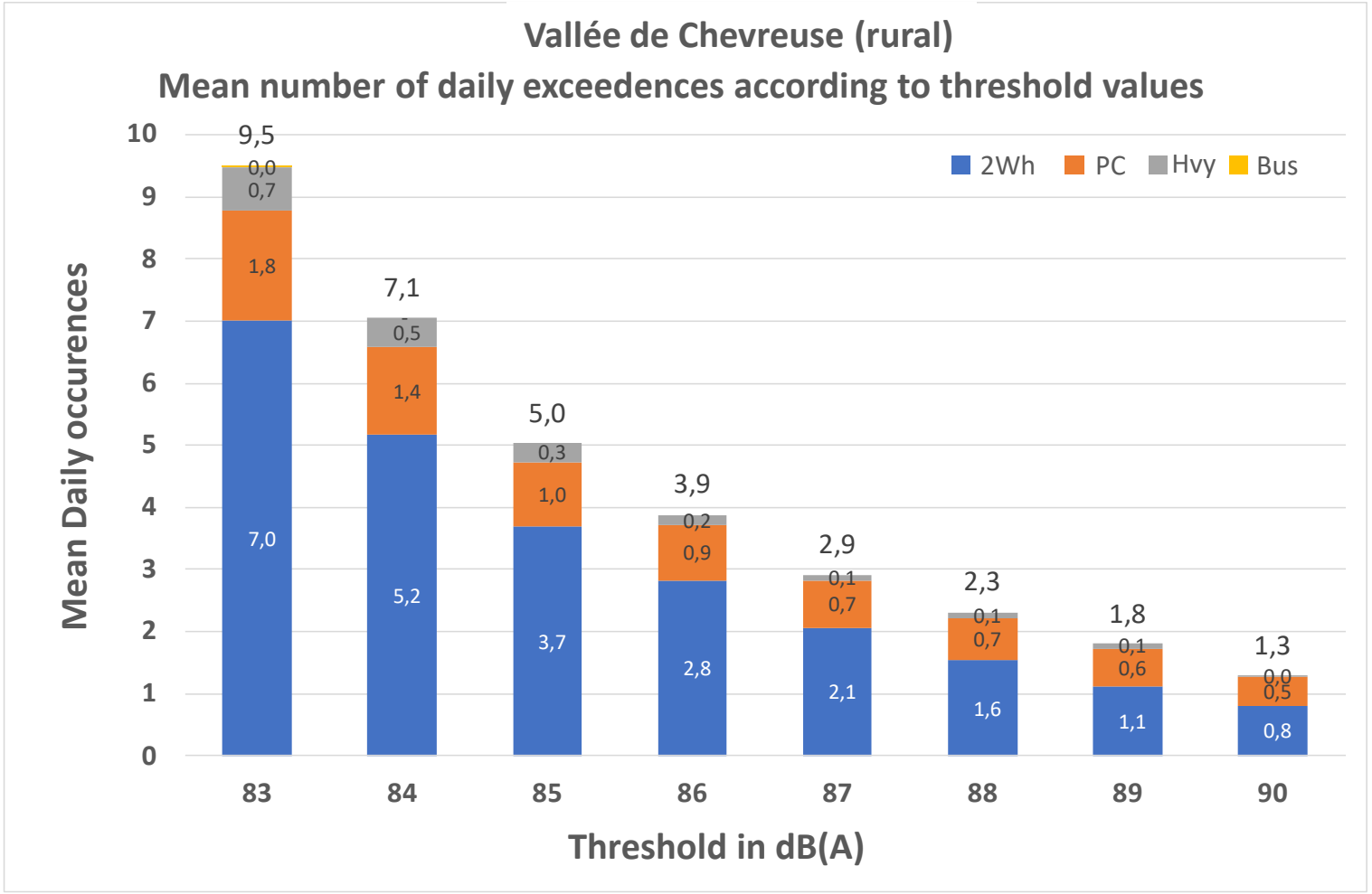
Average number of threshold exceedances per day

3 experimentation sites :

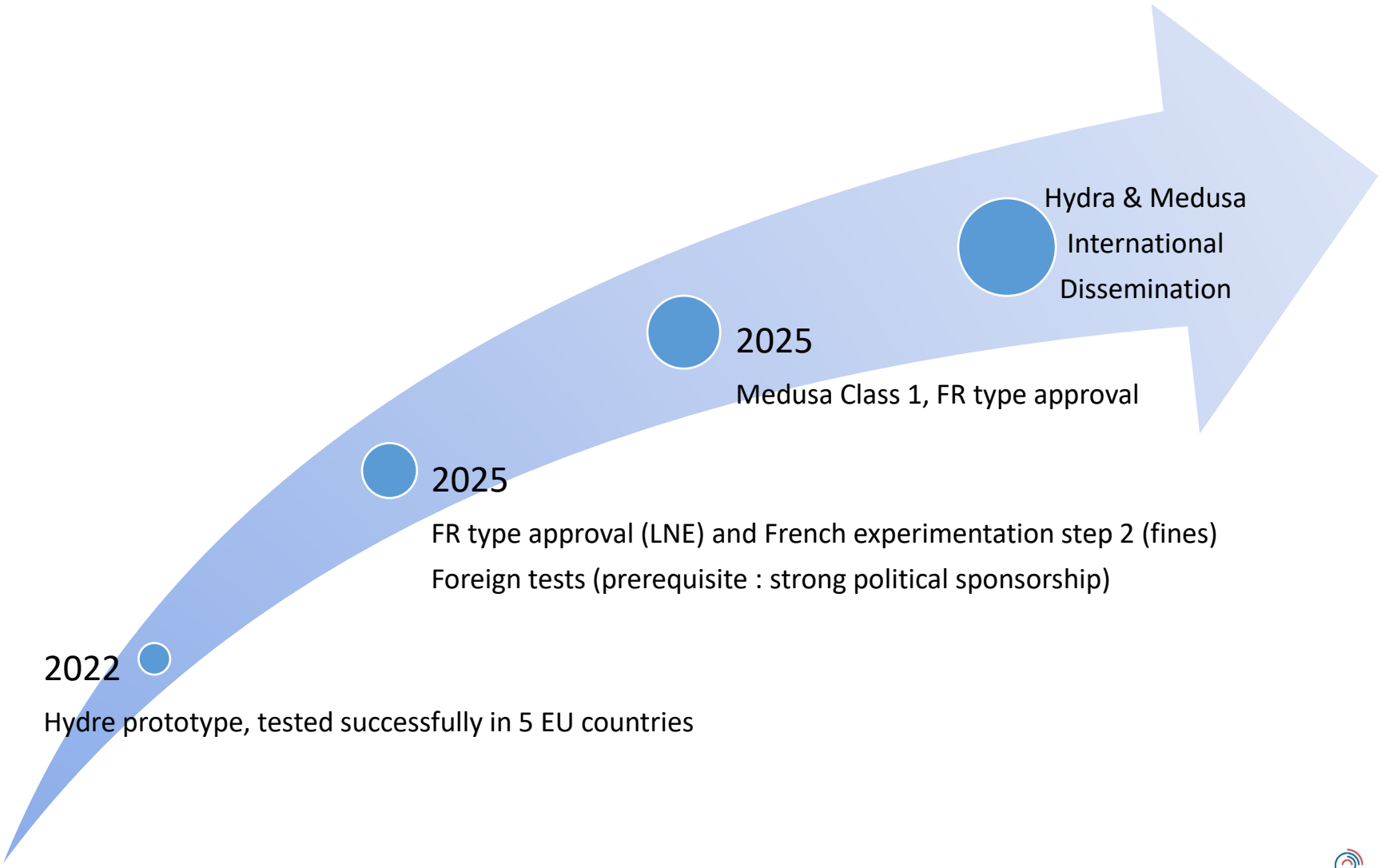
- Paris 20th (rue d’Avron)
- Villeneuve-le-Roi (RD5)
- Vallée de Chevreuse (RD86)


Paris 20th district (urban)
Mean number of daily exceedences according to threshold values
Mean Daily occurences
2Wh
PC
Hvy
Bus
50
45
40
35
30
25
20
15
10
5
0
43,8
2,4
4,1
6,9
30,4
33,5
1,1
3,6
5,6
23,2
25,8
3,1
4,4
17,8
19,7
2,6
3,6
13,1
15,0
2,3
2,8
9,7
11,7
2,0
2,3
7,3
9,3
1,6
1,9
5,7
7,3
1,4
1,6
4,2
83
84
85
86
87
88
89
90
Threshold in dB(A)


Villeneuve-le-Roi (suburbs)
Mean number of daily exceedences according to threshold values
2Wh
PC
Hvy
Bus
Mean Daily occurences
50
45
40
35
30
25
20
15
10
5
0
41,3
1,5
12,1
7,8
19,8
35,9
1,2
9,5
6,7
18,6
29,7
7,1
5,7
16,3
23,3
4,8
4,6
13,4
18,4
3,4
3,7
11,1
14,3
2,2
2,9
9,1
11,6
1,7
2,4
7,4
9,5
1,4
2,1
6,0
83
84
85
86
87
88
89
90
Threshold in dB(A)


Vallée de Chevreuse (rural)
Mean number of daily exceedences according to threshold values
2Wh
PC
Hvy
Bus
Mean Daily occurences
Threshold in dB(A)
83
84
85
86
87
88
89
90
9,5
7,1
5,0
3,9
2,9
2,3
1,8
1,3
7,0
1,8
0,7
0,0
5,2
1,4
0,5
3,7
1,0
0,3
2,8
0,9
0,2
2,1
0,7
0,1
1,6
0,7
0,1
1,1
0,6
0,1
0,8
0,5
0,0

Roadmap



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Thank you for your attention!

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