Presentation and missions of a noise observatory

Development of a sound radar to track down excessively noisy vehicles

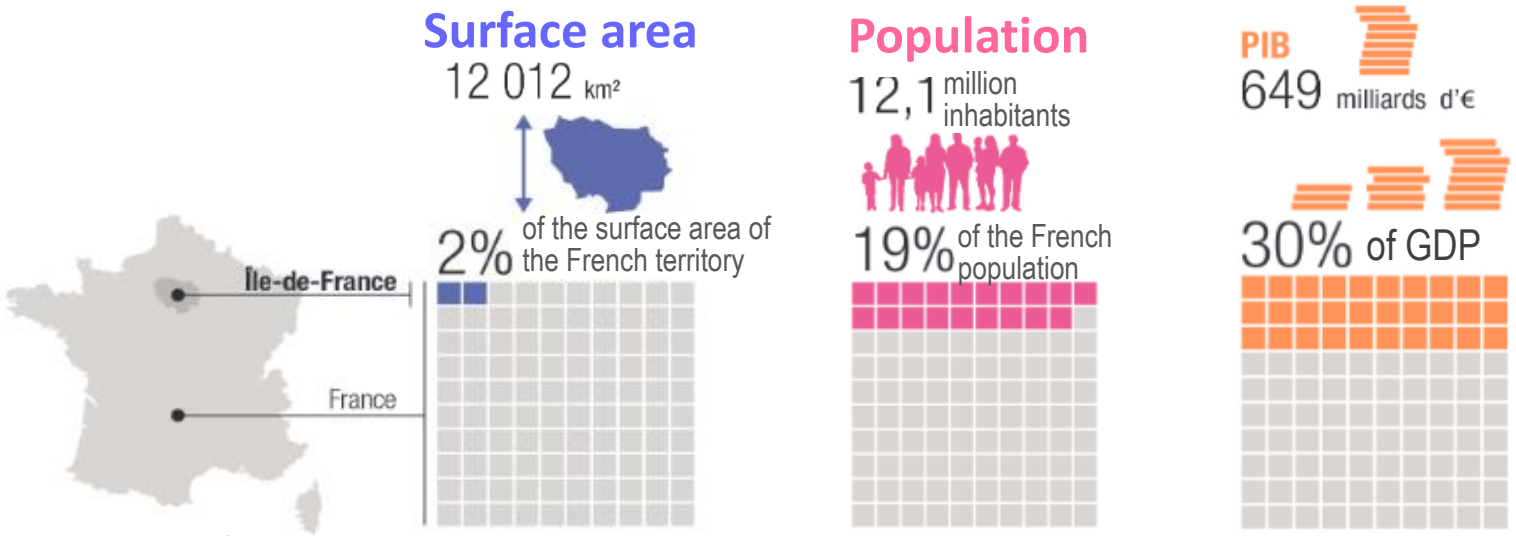
Fanny Mietlicki, Director of Bruitparif

BRUITPARIF

Urban Sound Symposium 2025, 28-30th April
Empa, Dübendorf, Greater Zürich Area

Bruitparif, the noise observatory in Ile-de-France

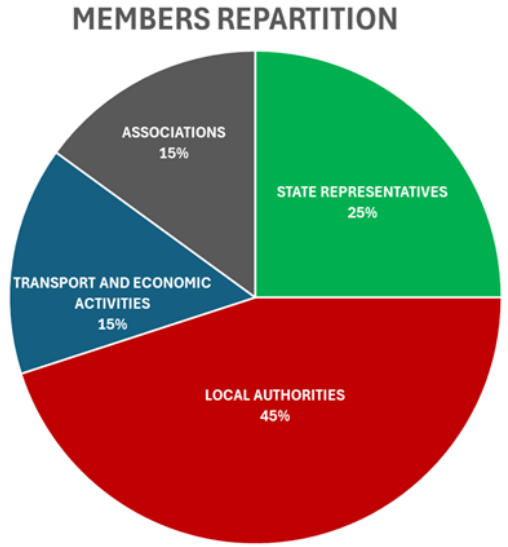
The Ile-de-France region: key figures



- **40,000 km of roads**
- **2,000 km of railways**
- **3 main airports**: DGC, Orly, Le Bourget with more than **755,000 aircrafts movements per year**

Bruitparif, a non-profit association

- **Created in 2004 by the Ile-de-France regional council**
- A **balanced governance**, which gathers **111 members** representing the various stakeholders concerned by noise: **local authorities, French State, economic actors and associations**



A major objective

To contribute to improving the sound environment in Île-de-France

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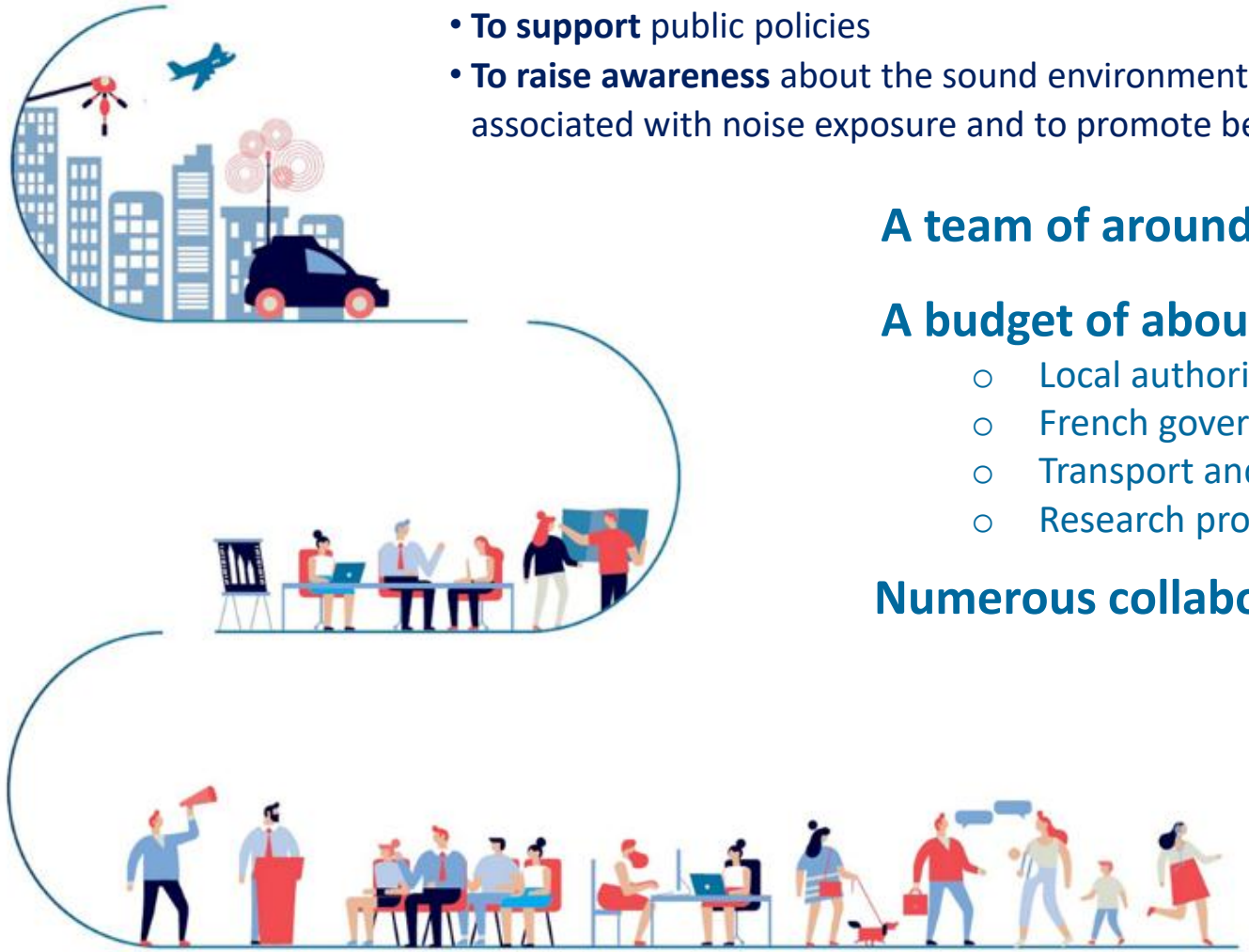
Bruitparif, the noise observatory in Ile-de-France

4 missions of general interest

- **To observe** the noise in the environment
- **To improve the knowledge** about noise and its impacts
- **To support** public policies
- **To raise awareness** about the sound environment preservation, the risks associated with noise exposure and to promote best practices.



Observation contexts

- Urban areas with multiple noise exposure
- Proximity of land transport infrastructures
- Overflown areas
- Neighborhood of industrial activities or major construction sites
- Recreational and lively districts
- Quiet areas.

A team of around 18 people

A budget of about 3 Millions €

- Local authorities (65 %)
- French government (12 %)
- Transport and economic activities (8 %)
- Research projects, European fundings, services (15 %)

Numerous collaborations and partnerships

viginoiz

A commercial subsidiary entirely owned by Bruitparif

www.viginoiz.com

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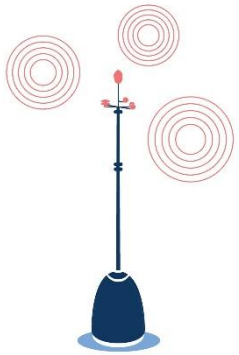
Observing

MEASUREMENT

The « RUMEUR » monitoring network

- The world's **largest urban noise monitoring network (Guinness World Records 2022)**
- **210 permanent noise measurement stations**
- Numerous **short-term measurement campaigns**
- An **internet platform providing data in real time**
- **Statistics and indicators** to monitor trends.

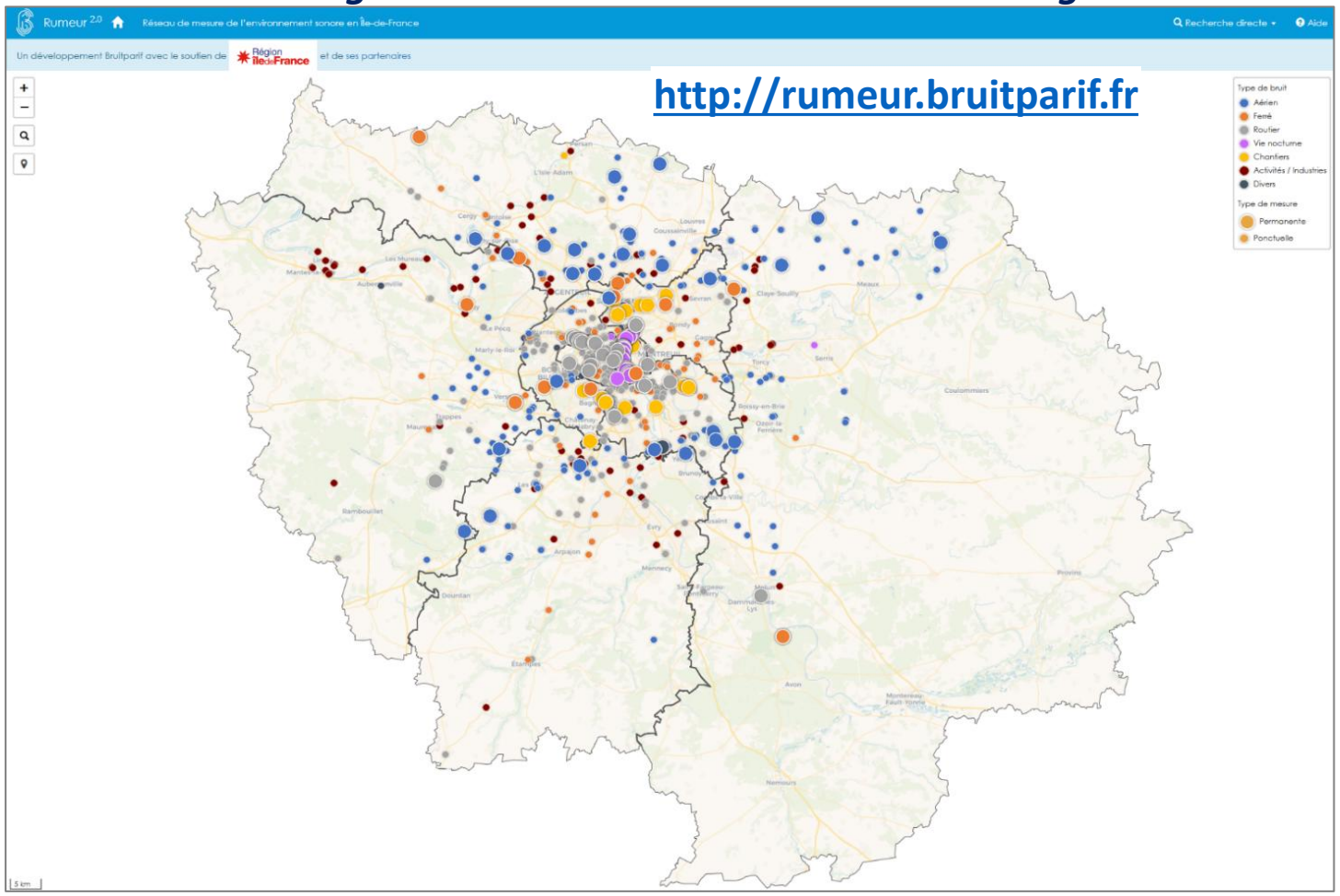


Thematic observatories

Direct and contextualized access to data on a specific issue

- Air traffic (survol.bruitparif.fr)
- Rail traffic (reseau.sncf.bruitparif.fr)
- Recreational and lively districts (monquartier.bruitparif.fr)
- Construction sites (for example: chantiers.sgp.bruitparif.fr)
- Urban planning operations (for example: alleesdeneuilly.bruitparif.fr).

Characterizing the noise environment and monitoring trends



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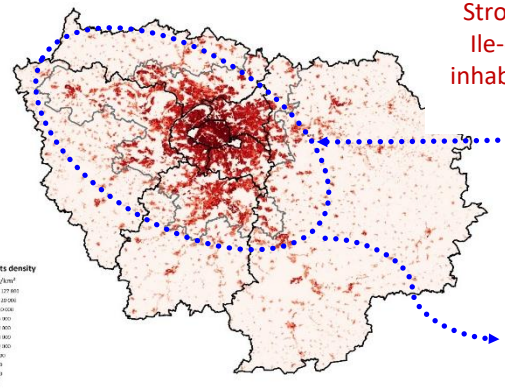
Observing

Characterizing the noise environment and monitoring trends

MODELLING **carto.bruitparif.fr**

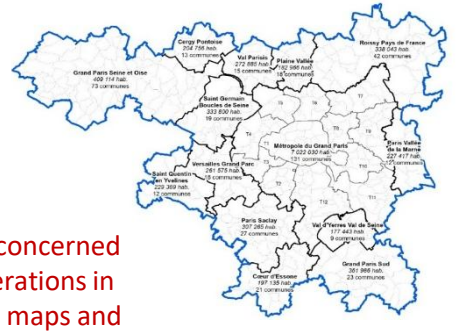
Producing the strategic noise maps

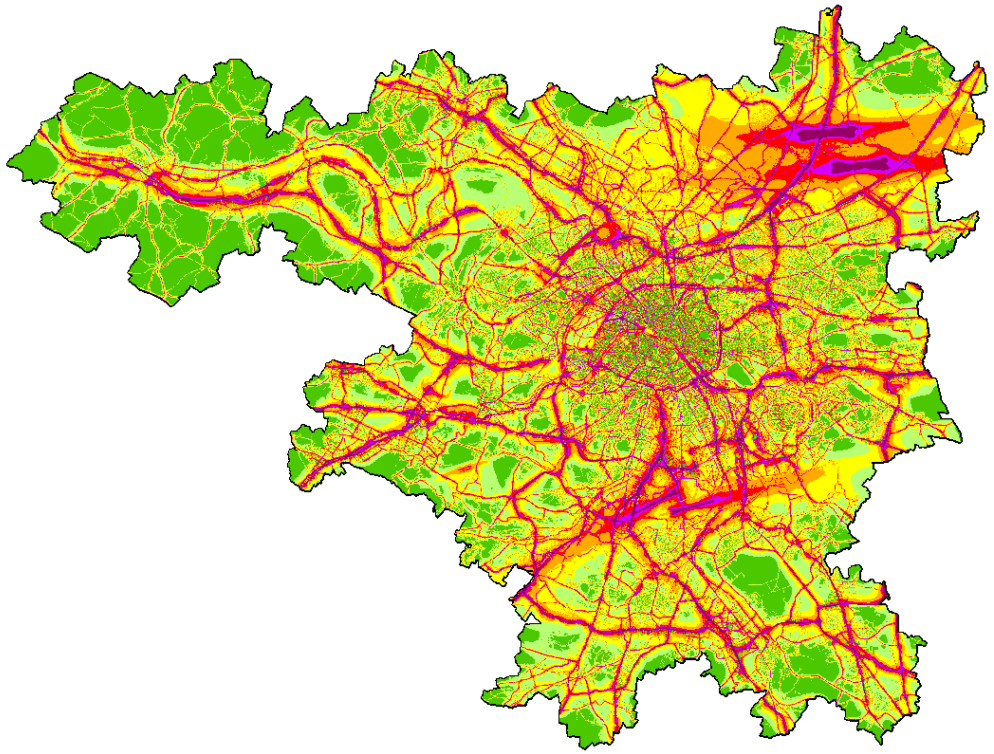
- Compliance with the **European Directive 2002/49/CE**
- For **14 agglomerations** with more than 100,000 inhabitants
- A territory covering more than **3,000 km²** and counting more than **10.5 millions inhabitants**
- An **internet platform providing** all maps and population exposure statistics at local level.

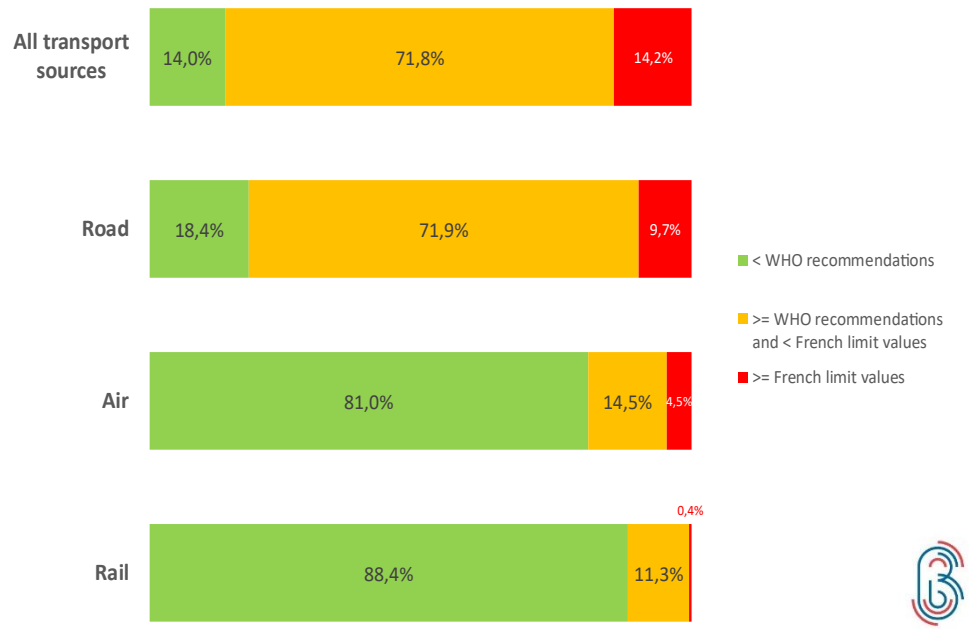


Strong density disparity inside Ile-de-France region: 86 % of inhabitants (10.5 millions) live in 25 % of the region

The dense area directly concerned by the END (14 agglomerations in charge of strategic noise maps and action plans)







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Observing

Characterizing the noise environment and monitoring trends

SURVEYS

Surveys of residents and users

Survey of **3,000 residents** of the Ile-de-France region **every 5 years**

To take into account perceptions of situations experienced in order to better target monitoring and actions to be taken

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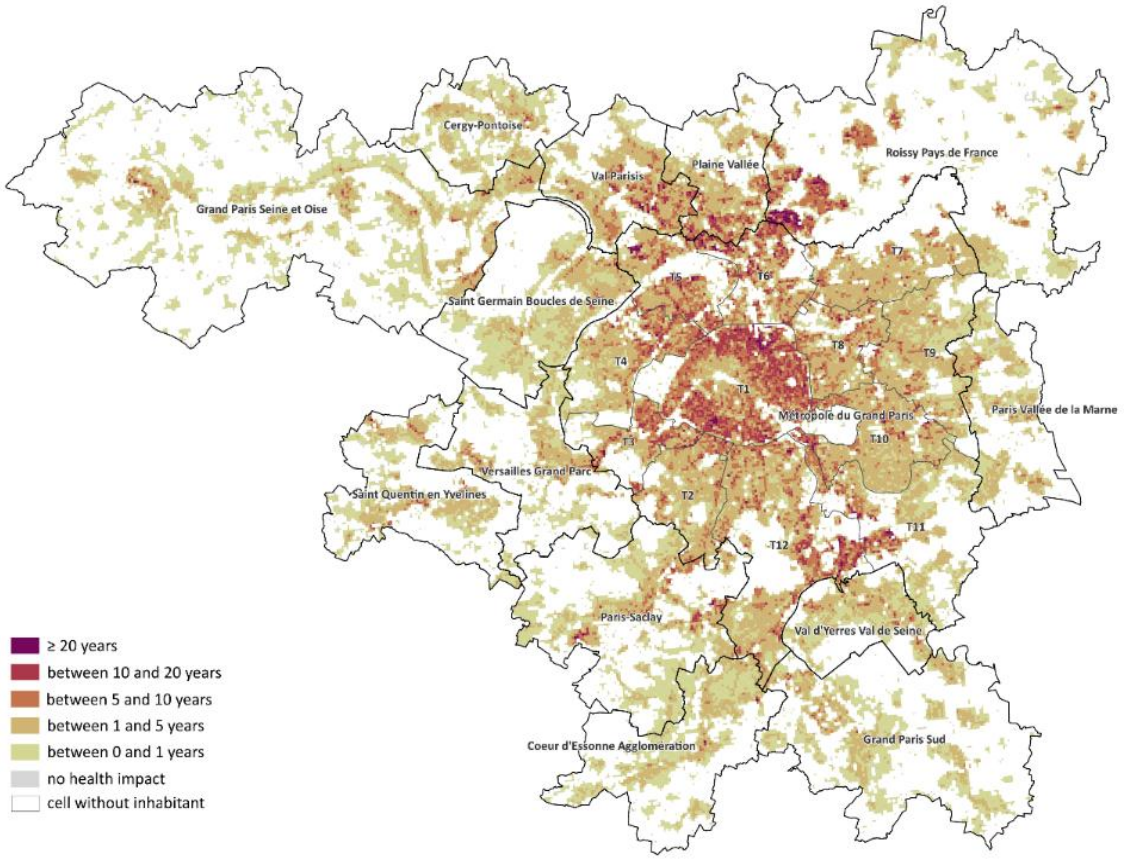
PILOT PROJECTS

- **First maps of the health impacts of transport noise**

DALY	Road	Rail	Air	Total
HSD	33,589	8,176	11,169	52,934 *(53%)*
HA	32,341	5,970	7,955	46,266 *(47%)*
Total	65,930 *(66%)*	14,146 *(14%)*	19,124 *(19%)*	99,200



DALY at the 200 meters grid resolution
for the three sources of transport noise cumulatively

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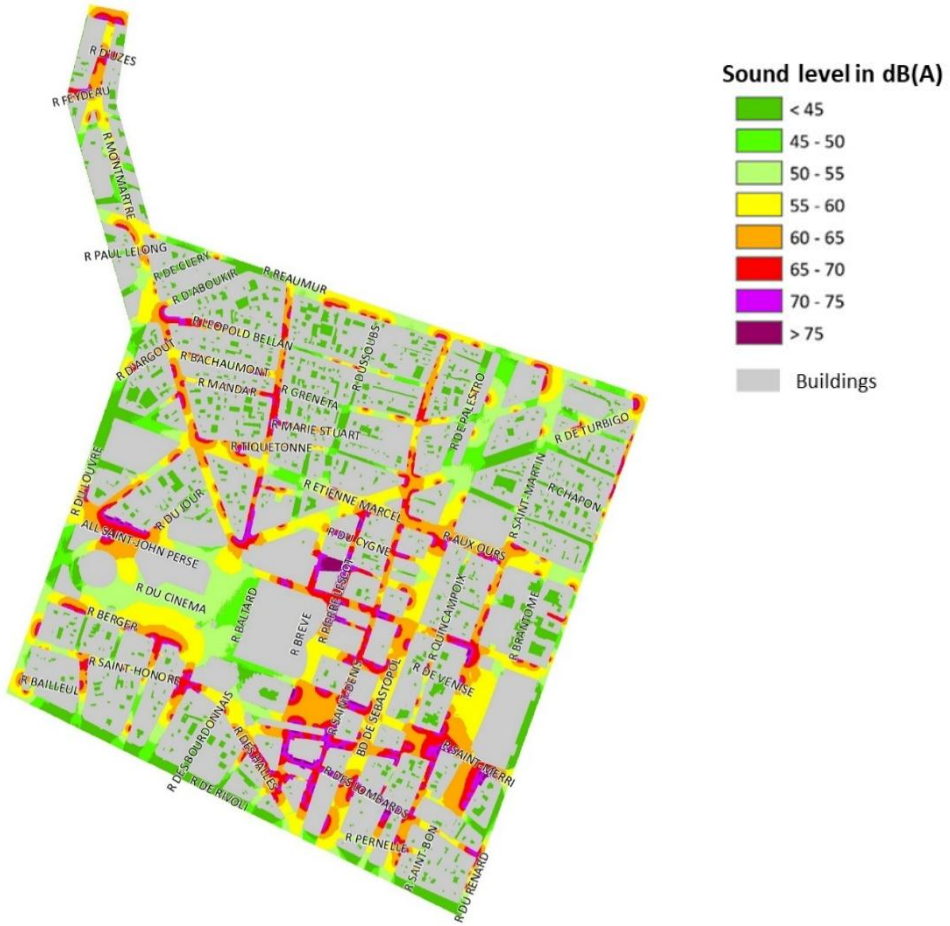
PILOT PROJECTS

- First maps of the health impacts of transport noise
- **Noise mapping of night-time recreational activities**

Acoustic diagnosis of the noise generated by nighttime recreational activities in a district of Paris



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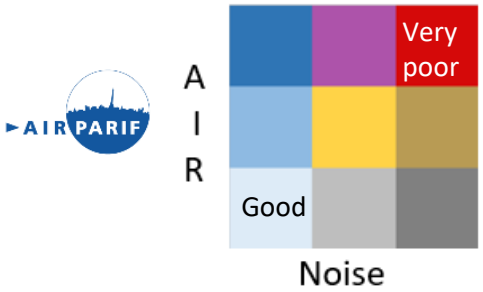
- First maps of the health impacts of transport noise
- Noise mapping of night-time recreational activities
- **Representation of coexposure to air and noise pollutions**

Air and Noise pollutions map

https://carto.airparif.bruitparif.fr



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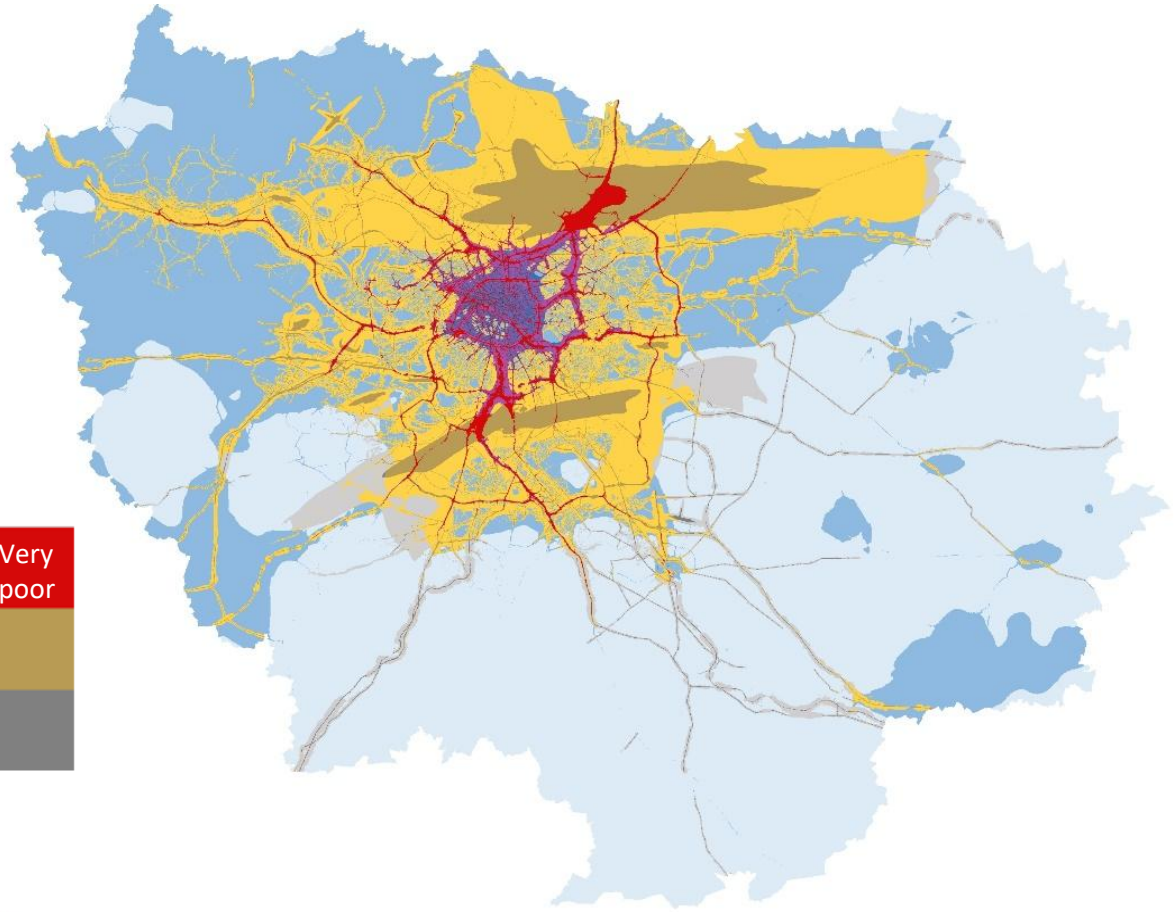

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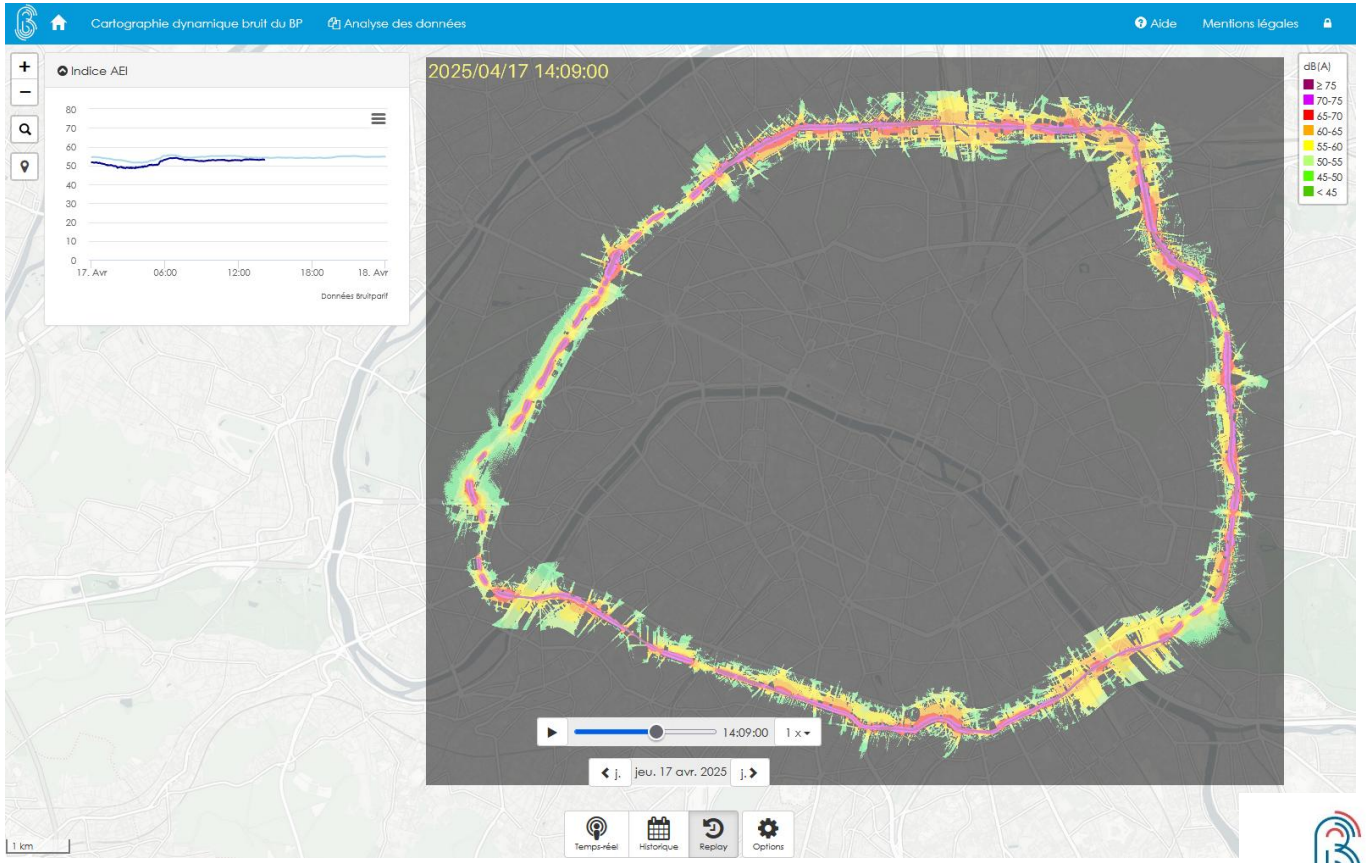
PILOT PROJECTS

- First maps of the health impacts of transport noise
- Noise mapping of night-time recreational activities
- Representation of coexposure to air and noise pollutions
- **Real-time dynamic mapping of Paris ring road noise**



Soon available on https://periph.bruitparif.fr/

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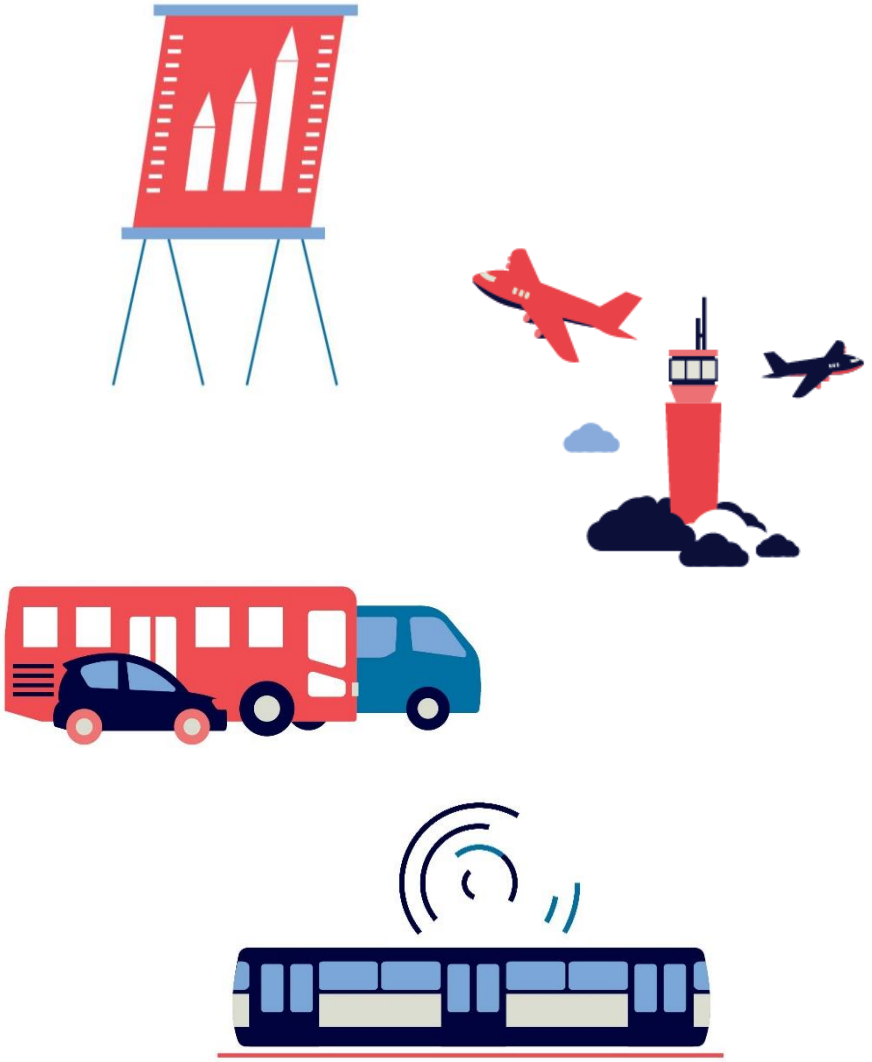
Improving knowledge

Enhancing understanding on noise and its health and socio-economic effects

Participation to applied research projects

- Development and experiment of **new indicators**
  - . The **Harmonica index**, a noise index easy to understand by the general public, developed as part of the LIFE Harmonica project
  - . Co-construction, with residents, of an air traffic noise indicator (**noise point counter**), as part of the **COGEN'AIR** study, led by Bruitparif and supported by ANSES*
- Study on the **social cost of noise**
- Contribution to works on **territorial inequalities** in environmental health
- Participation to **scientific studies on noise and health**
  - . **DEBATS** program (health effects of aircraft noise), coordinated by Gustave Eiffel University (UMRESSTE)**
  - . **BROUHAHA** project (exposure to transport noise and risk of cardio-metabolic diseases), coordinated by INSERM**
  - . **SOMNIBRUIT** study (noise impacts on the sleep of people living in the Île-de-France region), coordinated by Bruitparif and supported by the Health Data Hub* & the Green Data for Health*
  - . **GENIFER** study (improve knowledge of instantaneous noise annoyance railway), coordinated by Bruitparif and supported by ANSES*



** French health and/or environmental agencies*
*** French Research institutes*

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Supporting

Acting for public policies that integrate noise management

Implementing the European Environmental Noise Directive

- **Prioritization** of territorial noise issues: acoustic diagnosis, identification of quiet areas…
- Supporting public authorities in drawing up their **action plans** (PPBE for *« Plans de Prévention du bruit dans l'environnement »*)
- **Monitoring and promoting** actions taken to combat noise
- **An internet platform** to provide access to all published action plans in the Île-de-France region.

ppbe.bruitparif.fr

Contributing to consider noise in public policies

- Participation to the **French National Noise Council*** and working groups on regulatory evolutions
- Promotion of noise management in **urban planning and public health policies**
- **Information and training** for elected members and public services on noise management actions
- Evaluation and promotion of **noise abatment solutions**

  LIFE *Harmonica, Quadmap* et *Cool & Low Noise Asphalt* projects…

COOL & LOW NOISE ASPHALT PROJET LIFE

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Raising awareness

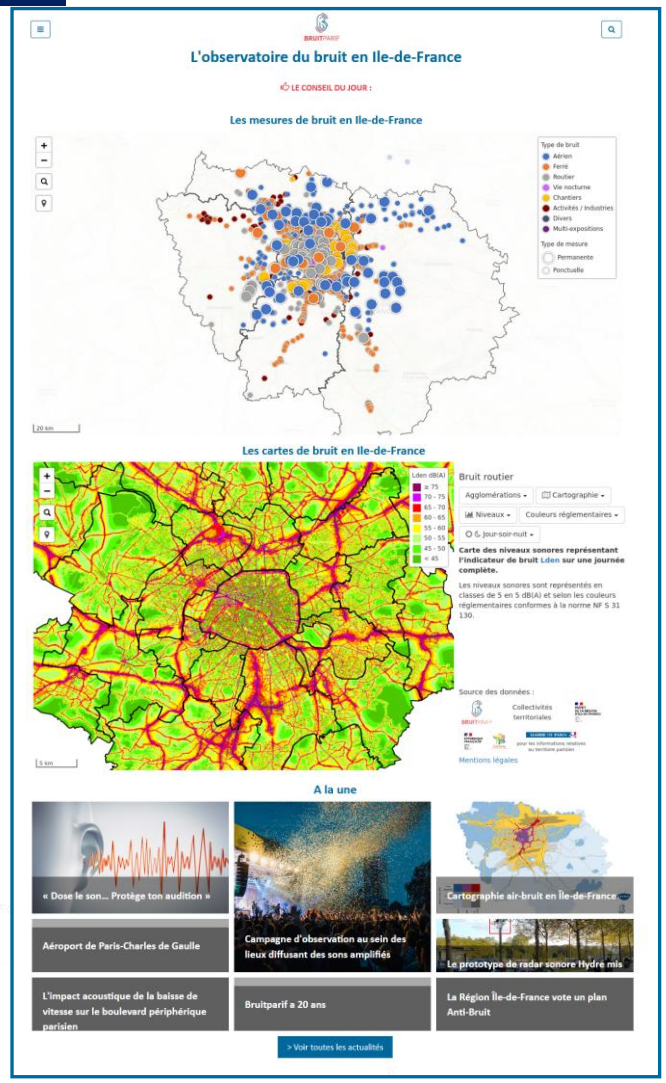
Providing information on environmental noise issues and encouraging best practices

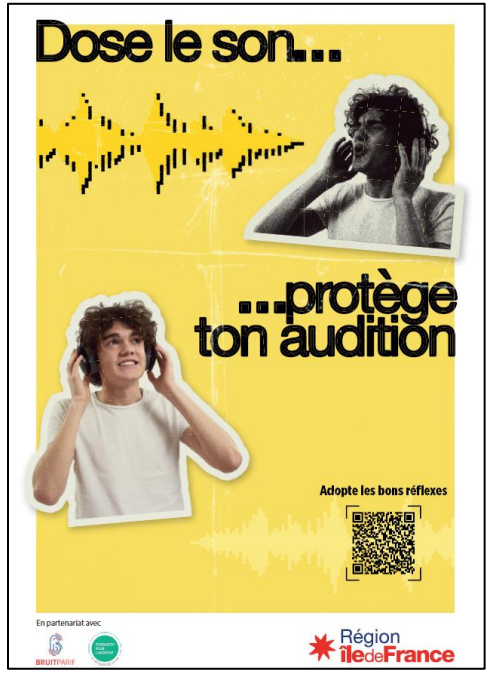
A website for everyone

« Le Francilophone » a reference magazine

Public interventions

Awaireness campaigns





Find all our data, studies and news on our website

www.bruitparif.fr

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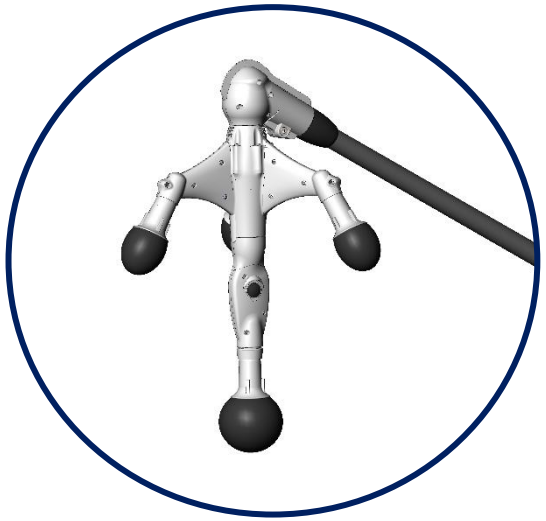
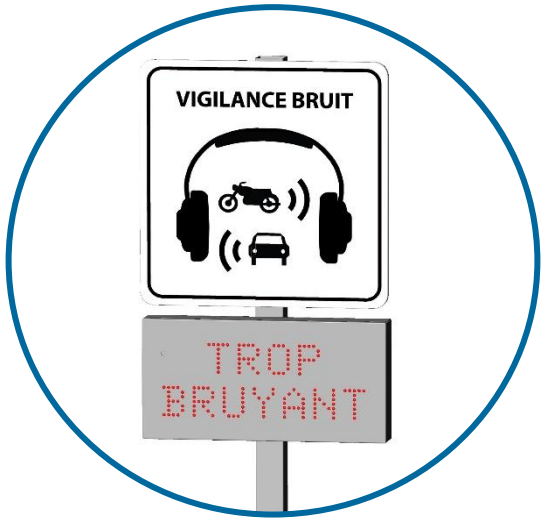
INNOVATING IN MEASUREMENT TECHNOLOGIES

- The **« Medusa » sensor** makes it possible to " see " noise and its origin. This patented device determines the sound level, but above all the main direction of noise sources

- The **educational noise radar** is designed to provide simple, operational information to drivers whose vehicles emit excessive noise, similar to what already exists with speed radars

- The **« Hydra » noise radar** is designed to control and fine excessively noisy vehicles. It is currently being tested in France and several other European countries.





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Medusa: The environmental sensor which enables to see noise

- **Tetrahedric shaped acoustic goniometer**
  - Side length of about 20 cm (7,9 in)
  - 4 MEMS microphones (½ inch)
- **Acoustic calculations**
  - LAeq, LCeq every 100ms
  - Dominant sound direction every 100ms
  - Azimuth and elevation angles with 1° precision
- **Imagery**
  - 360° photo every 15min
  - Blurring/masking on server
- **No audio recording**

  → respect privacy laws and GDRP compliant
- **Can be installed on street lights or railings**
- **Patented system**
- **Winner of the French « Decibel d'Or » award**

LAUREAT 2019
DECIBEL D'OR

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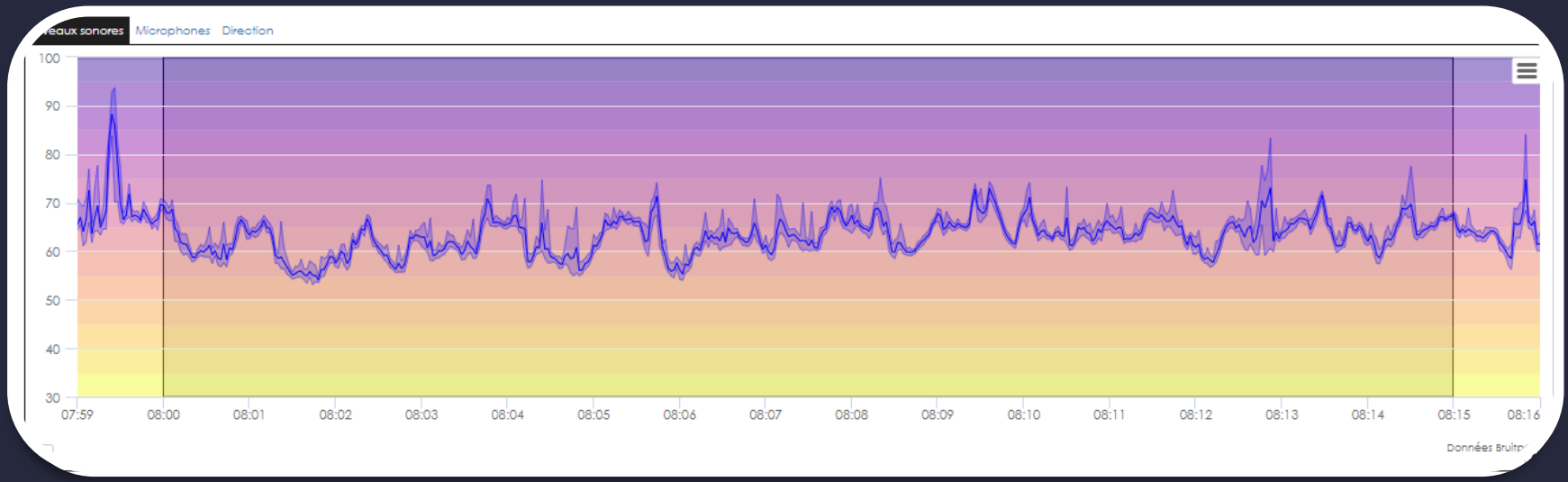
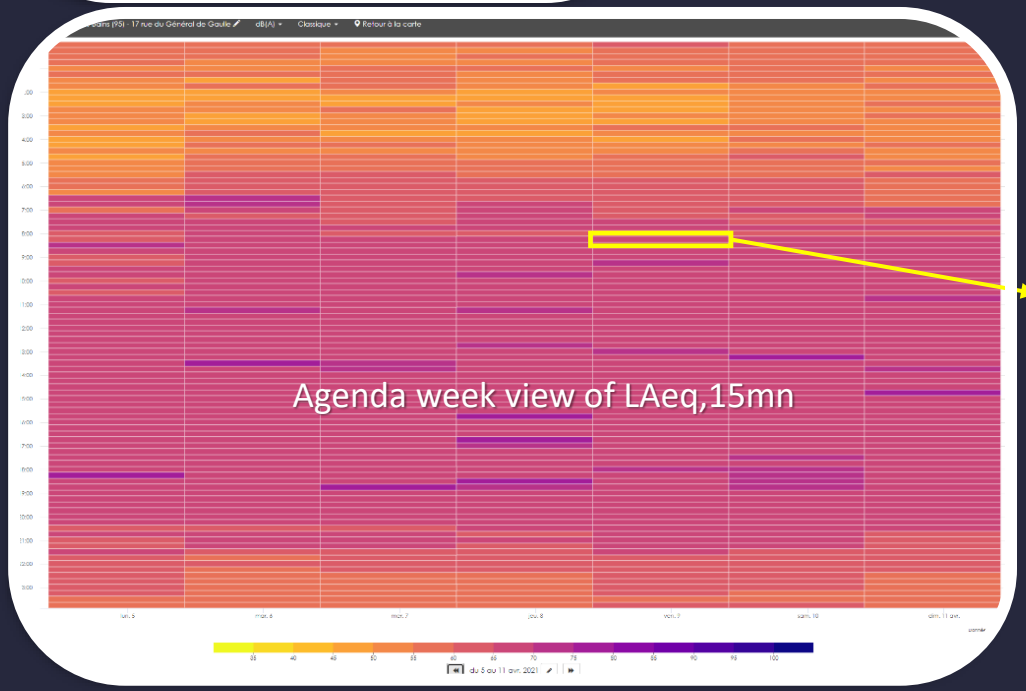
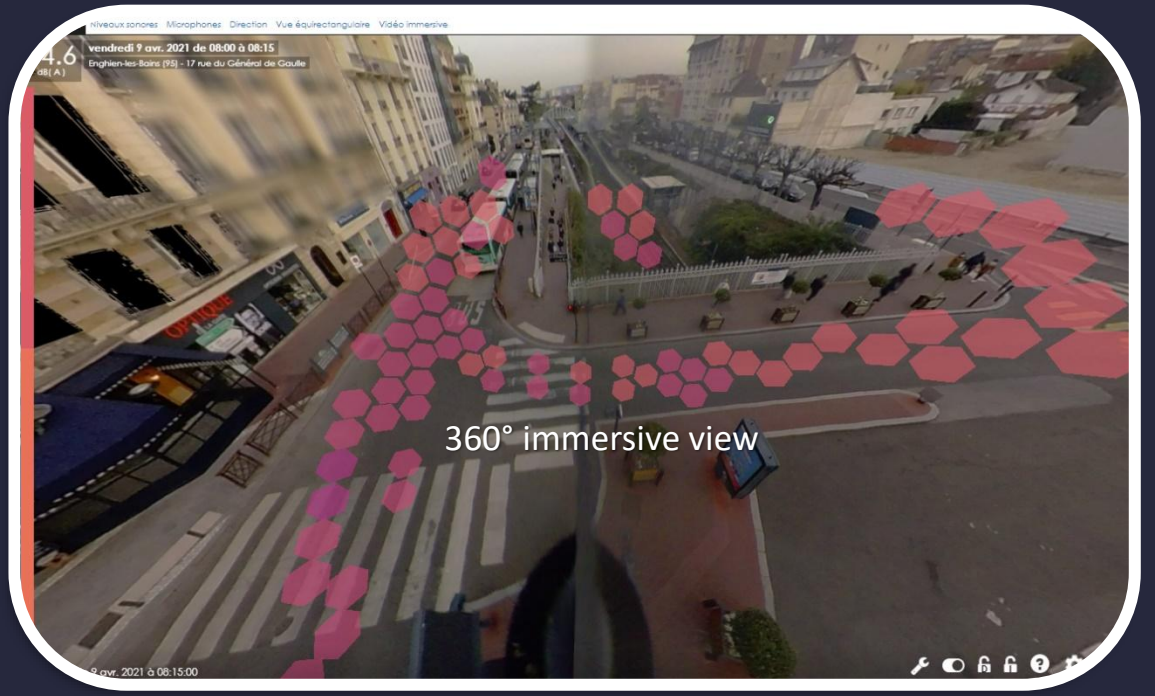
Data visualization







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Many possible applications

- Help regulating nuisances in neighborhoods exposed to nightlife noise (live districts)
- Provide Information on noise generated by construction sites or industrial installations
- Help in processing complaints regarding professional activities (ventilation systems, air conditioners…)
- Monitor air trafic noise
- Track noise emission of vehicles on the road

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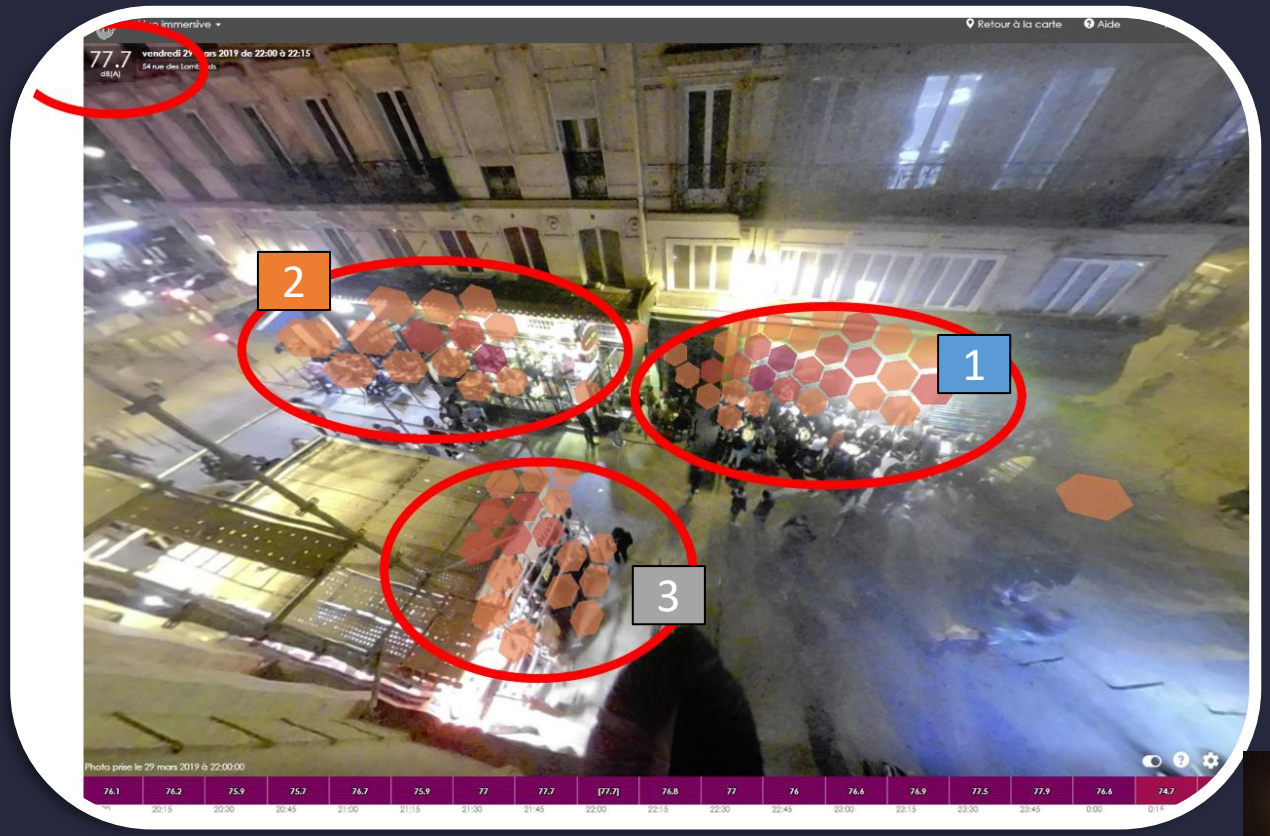
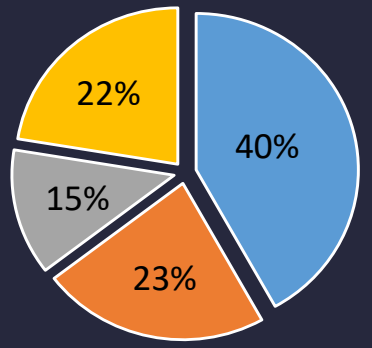
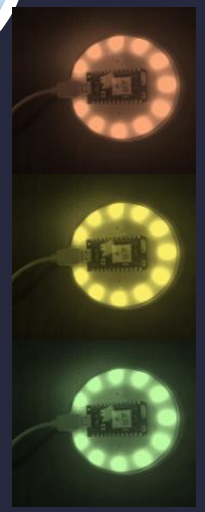
Management of public tranquility in lively districts

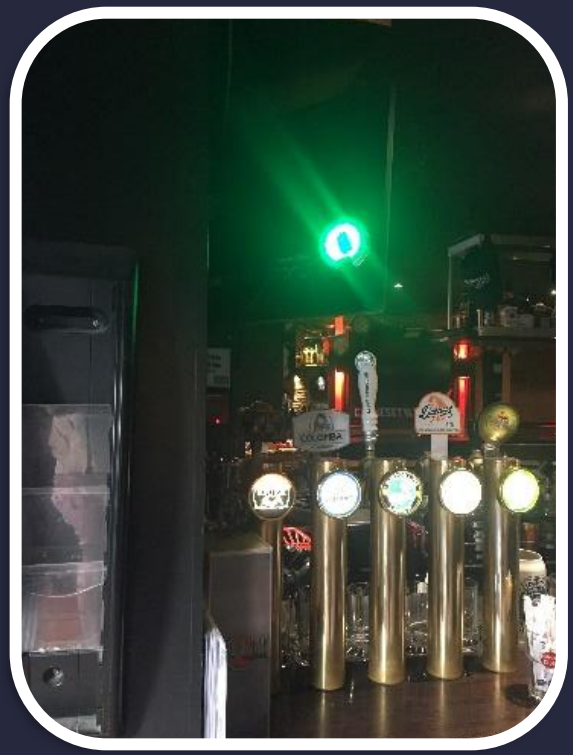


Contribution of the different bars in noise



BAR 1 BAR 2 BAR 3 OTHER





Provide feedback
to customer and bar holders
to encourage self regulation

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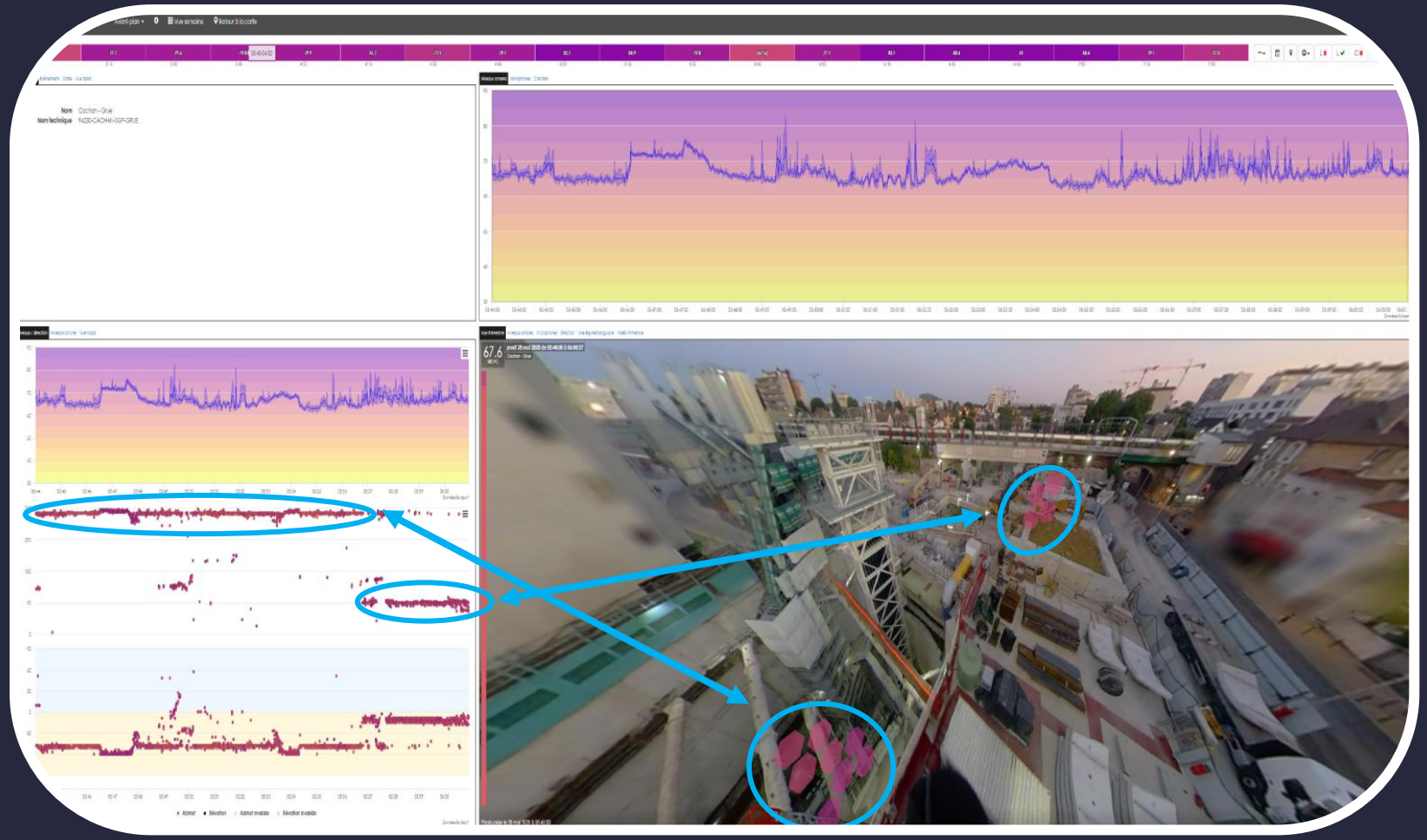
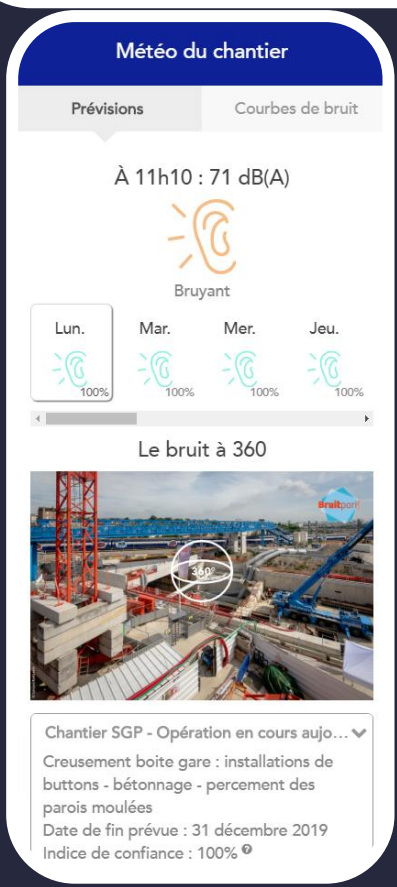
Construction site application





Data integration in the app called « Météo du chantier »

→ Real-time information on noise levels (levels and 360° vizualisation of noise)
→ Forecast according to the phasing of the works on the construction site

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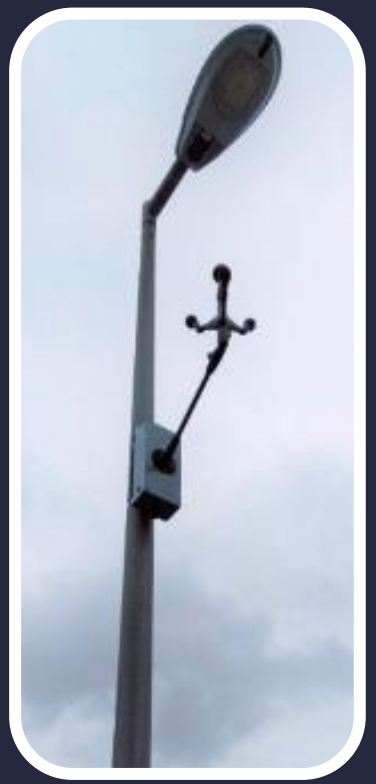
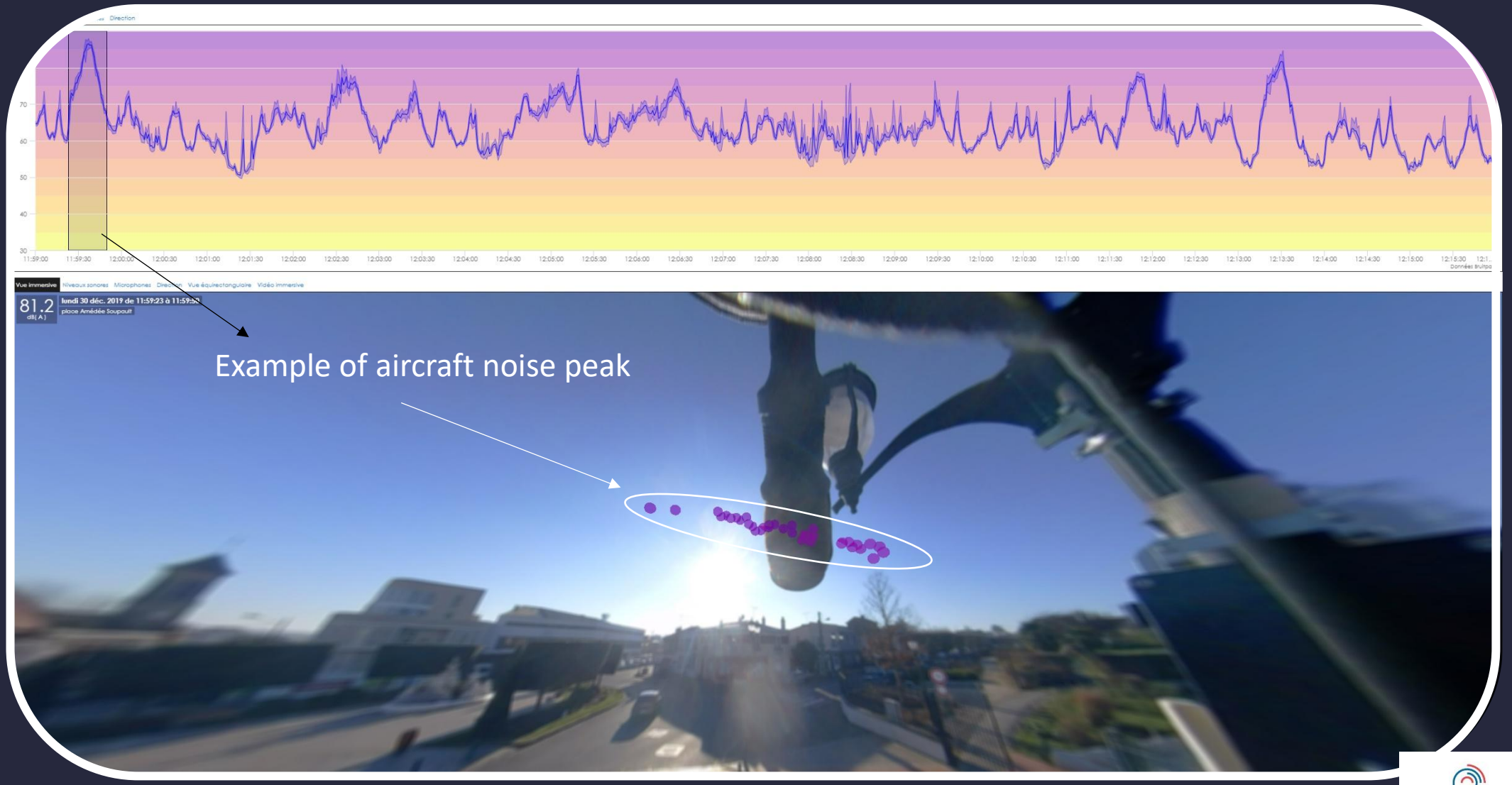
Air traffic noise monitoring





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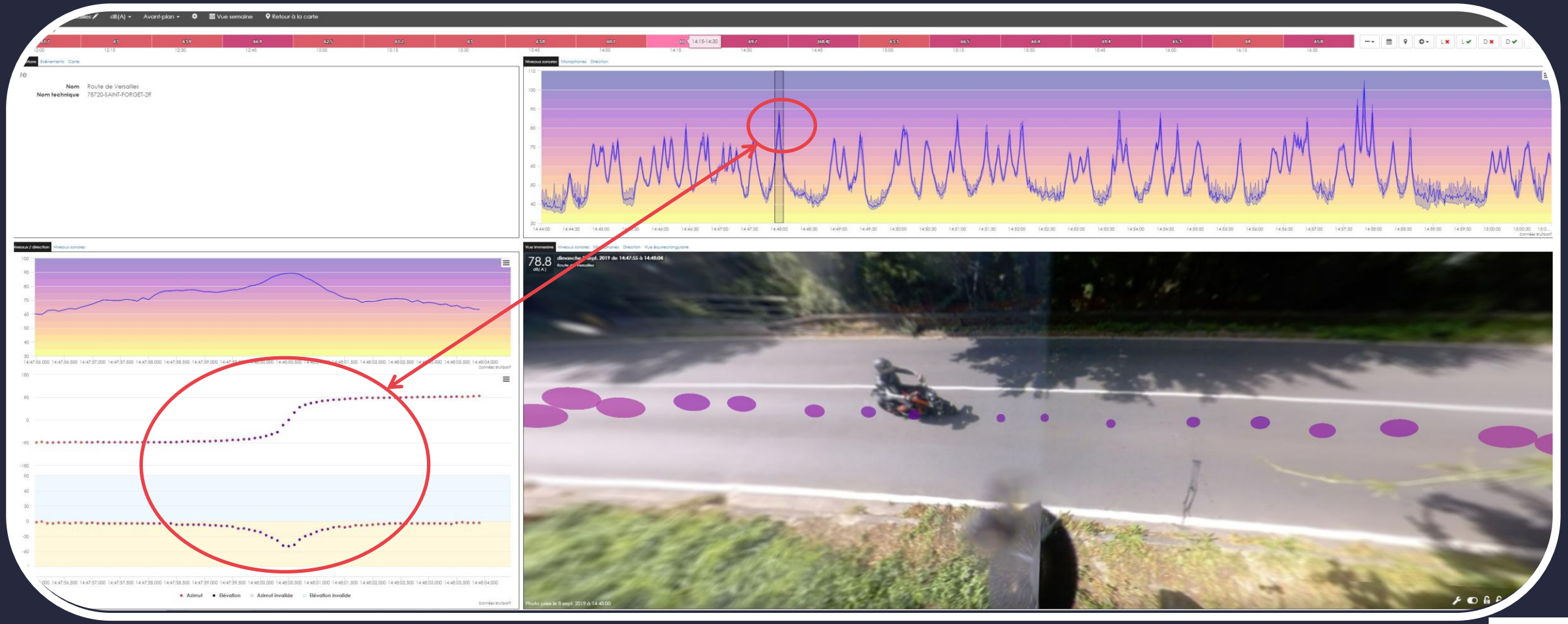
Vehicle noise event detection application

Passage of one biker



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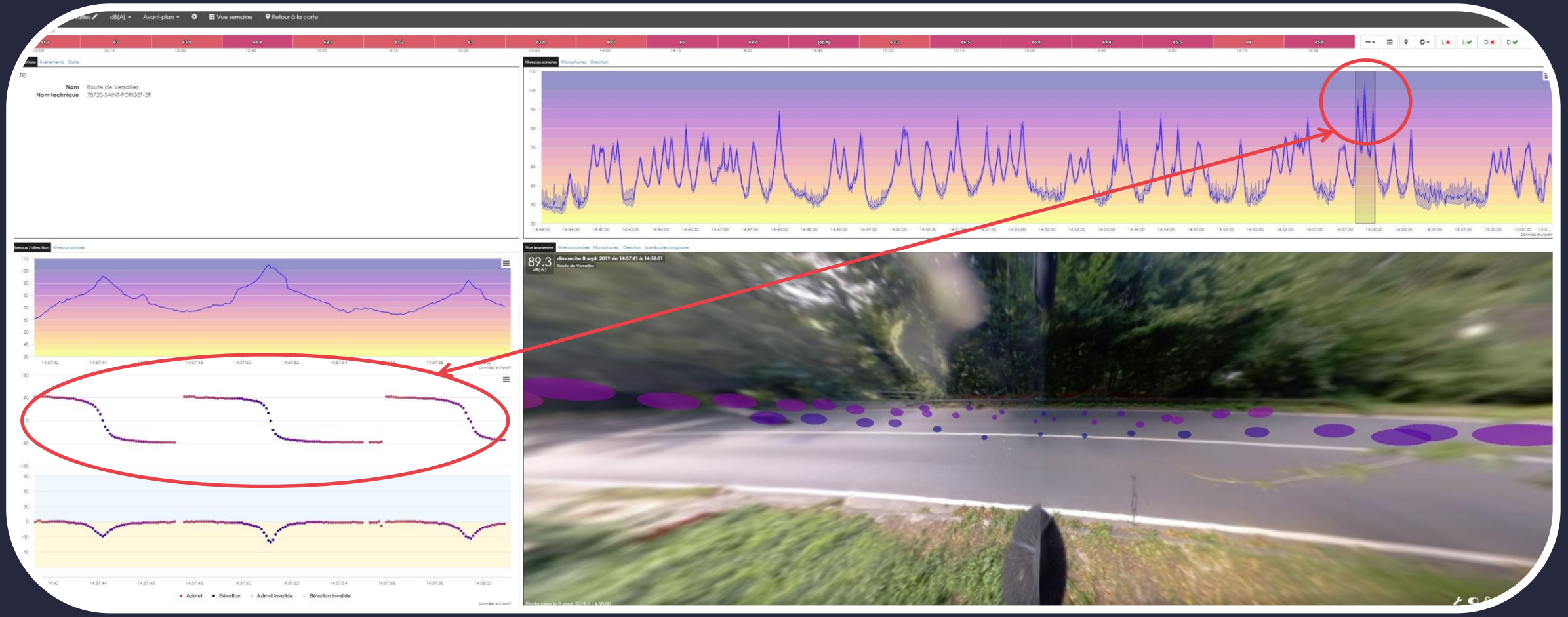
Vehicle noise event detection application

Passage of three bikers



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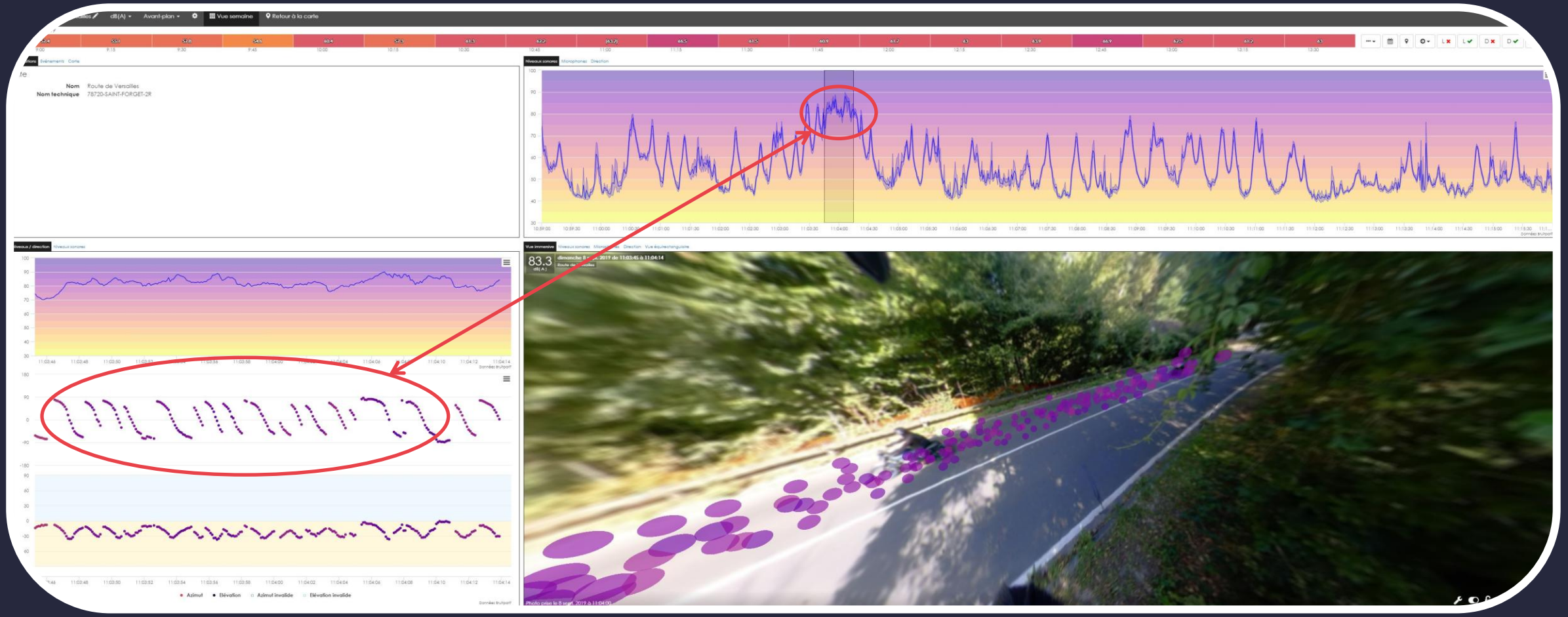
Vehicle noise event detection application

Many bikers!



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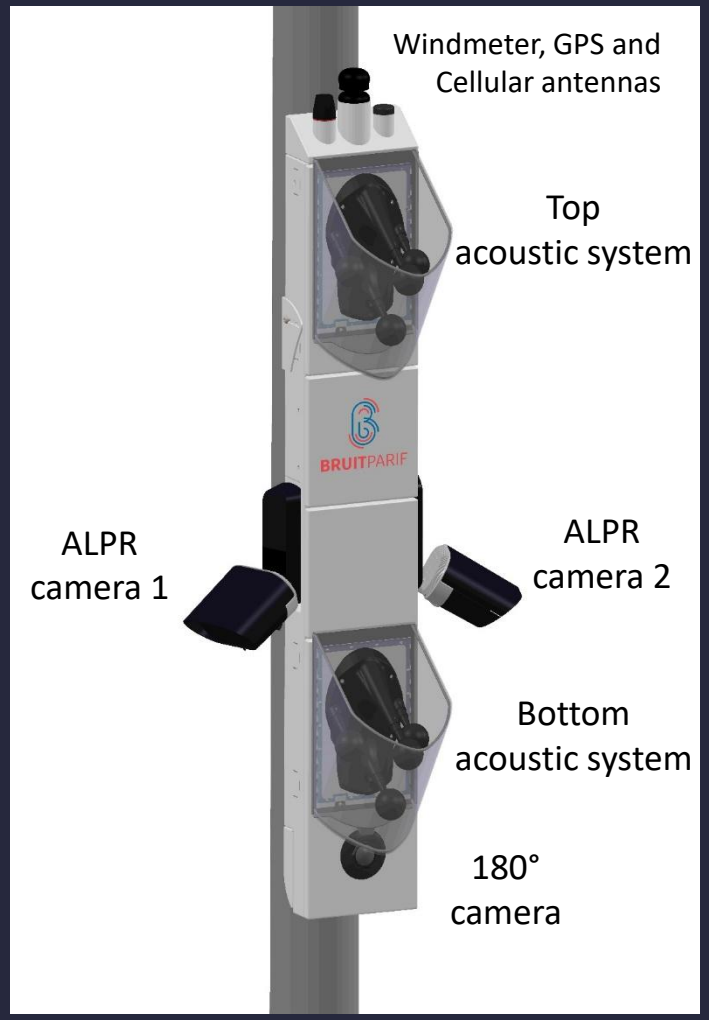
Hydra: the sound radar

- **Acoustic measurements**
  - 2 medusa sensors protected in metallic cages
  - Precise detection of the dominant sound emitter
  - Audio recording and noise level indication
  - Meteorological sensors to adjust sound recordings
- **Imagery**
  - 180° video recording with a wide-angle camera
  - Licence plate recognition with 2 ANPR cameras
- **Secure mecanical design**
  - All sensitive parts are protected against vandalism
- **Secure data transmission**
  - Antenna sends encrypted files to the competent authorities
- **Easy installation and electrical connection on public lighting pole**



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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 essential to estimate precisely at any time the distance to the noise source in order to calculate the 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

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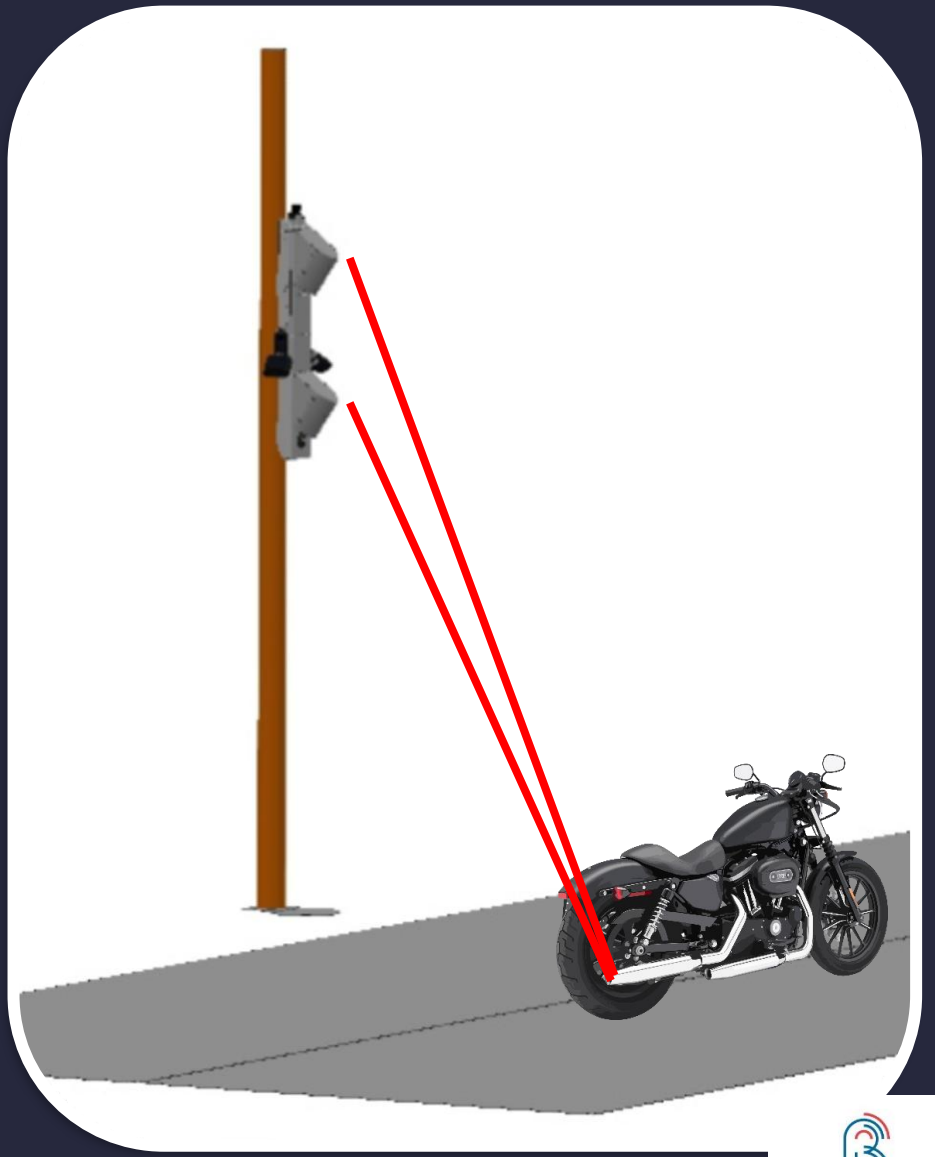
How it works

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



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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

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92.8
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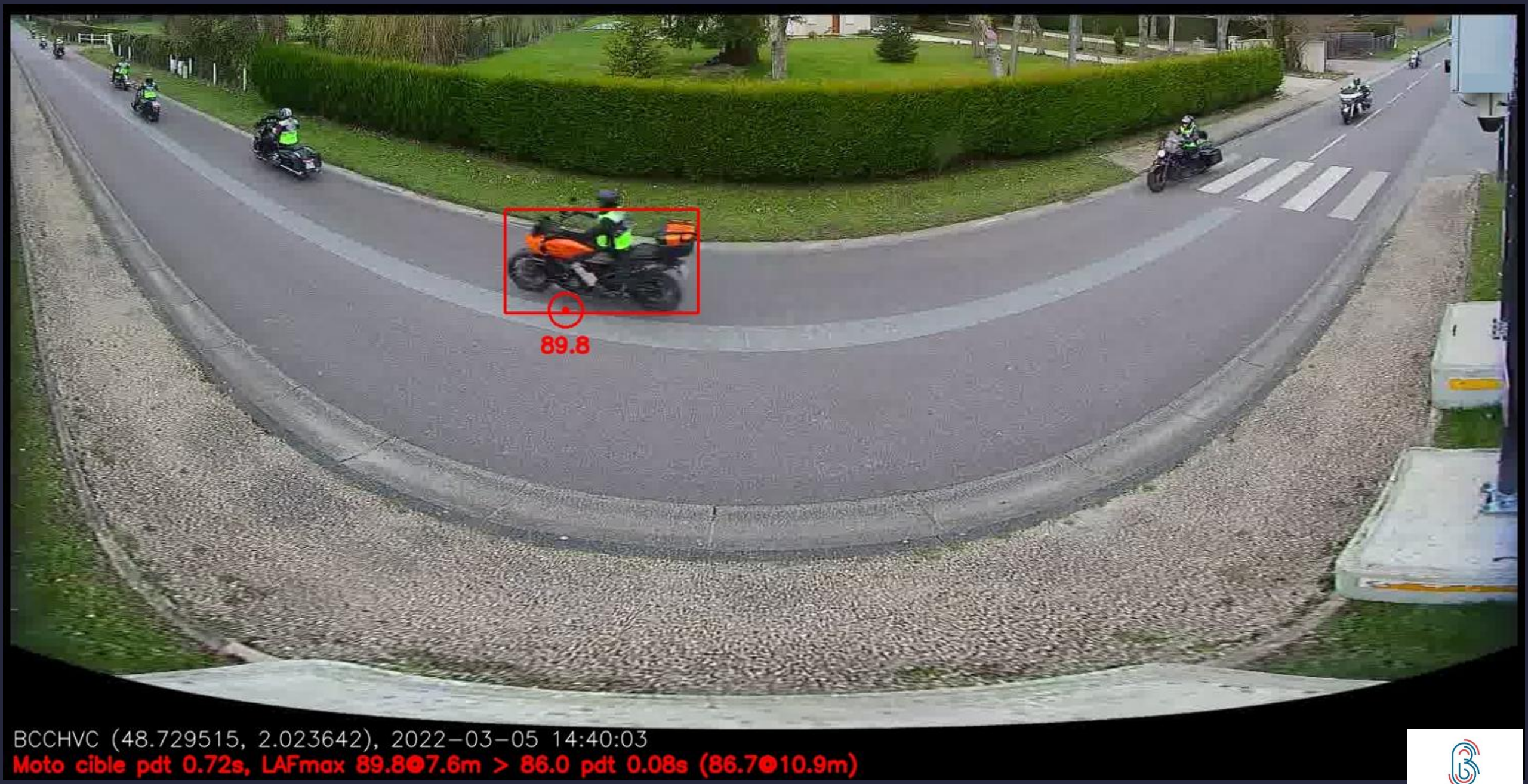
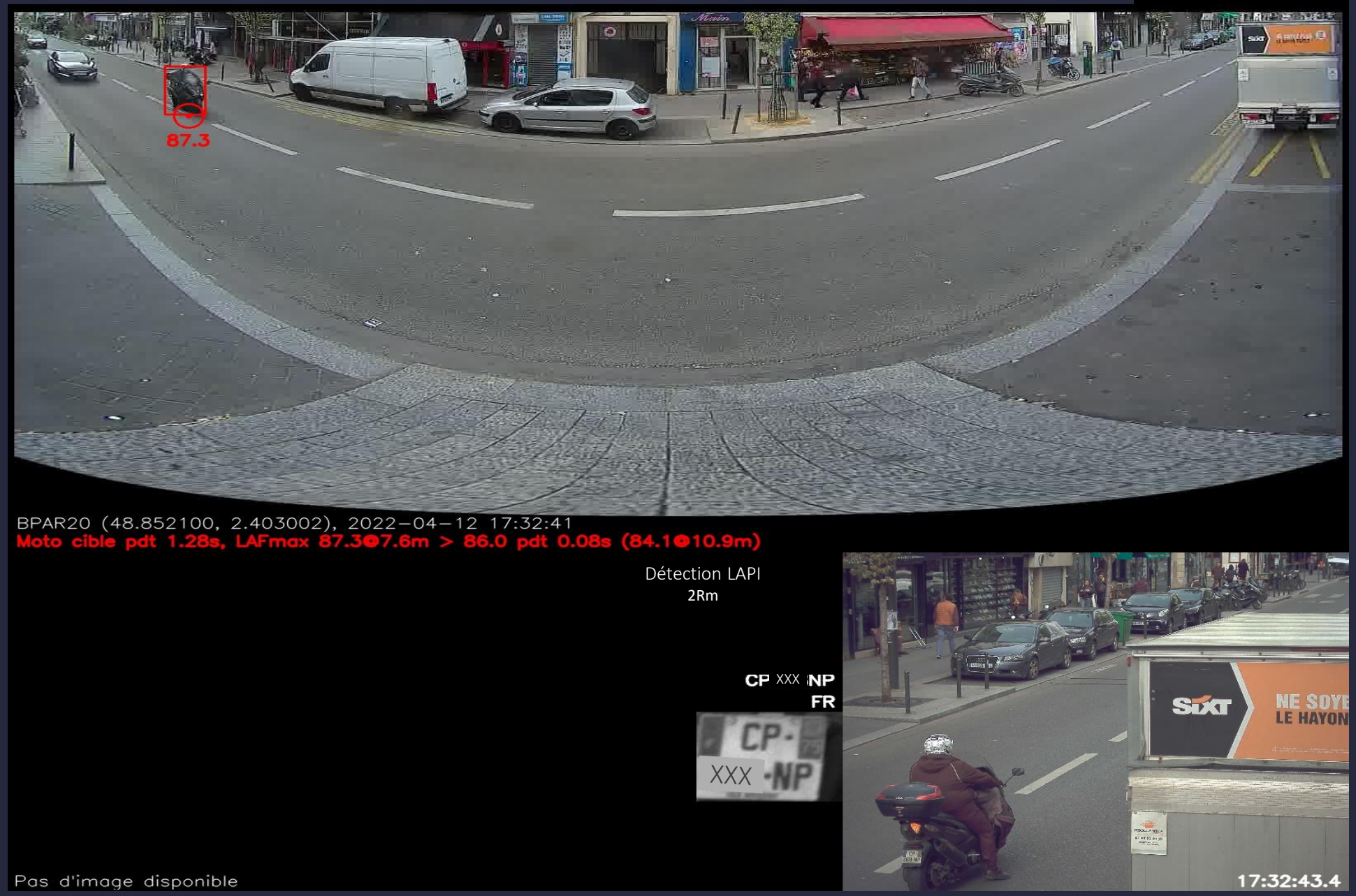
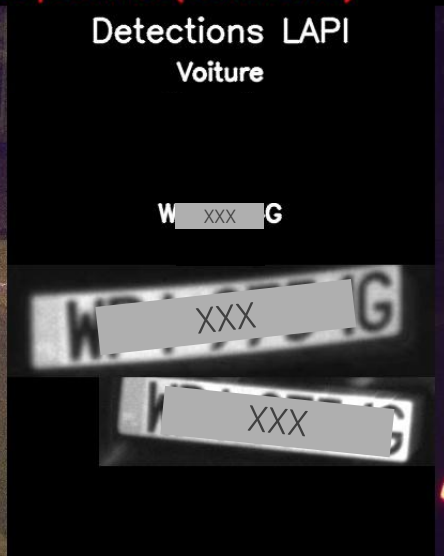

89.8
BCCHVC (48.729515, 2.023642), 2022-03-05 14:40:03
Moto cible pdt 0.72s, LAFmax 89.8●7.6m > 86.0 pdt 0.08s (86.7●10.9m)


87.3
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)
Détection LAPI
2Rm
CP XXX NP
FR
CP-
XXX -NP
Pas d'image disponible
SIXT
17:32:43.4

88.1
BPAR20 (48.852100, 2.403002), 2022-04-10 01:51:12
Voiture cible pdt 0.28s, LAFmax 88.1@7.6m > 86.0 pdt 0.16s (83.0@13.6m)

01:51:12.3


Detections LAPI
Voiture
W XXX G
XXX
XXX

01:51:13.6

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Hydra experiments

4 experimentation sites in France

- Paris 20th
- Villeneuve-le-Roi (RD5)
- Vallée de Chevreuse (RD86)
- Rueil-Malmaison

5 other experiments in Europe

- Berlin
- Brussels (2 sites)
- Barcelona (4 sites)
- Geneva (4 sites)
- Basel

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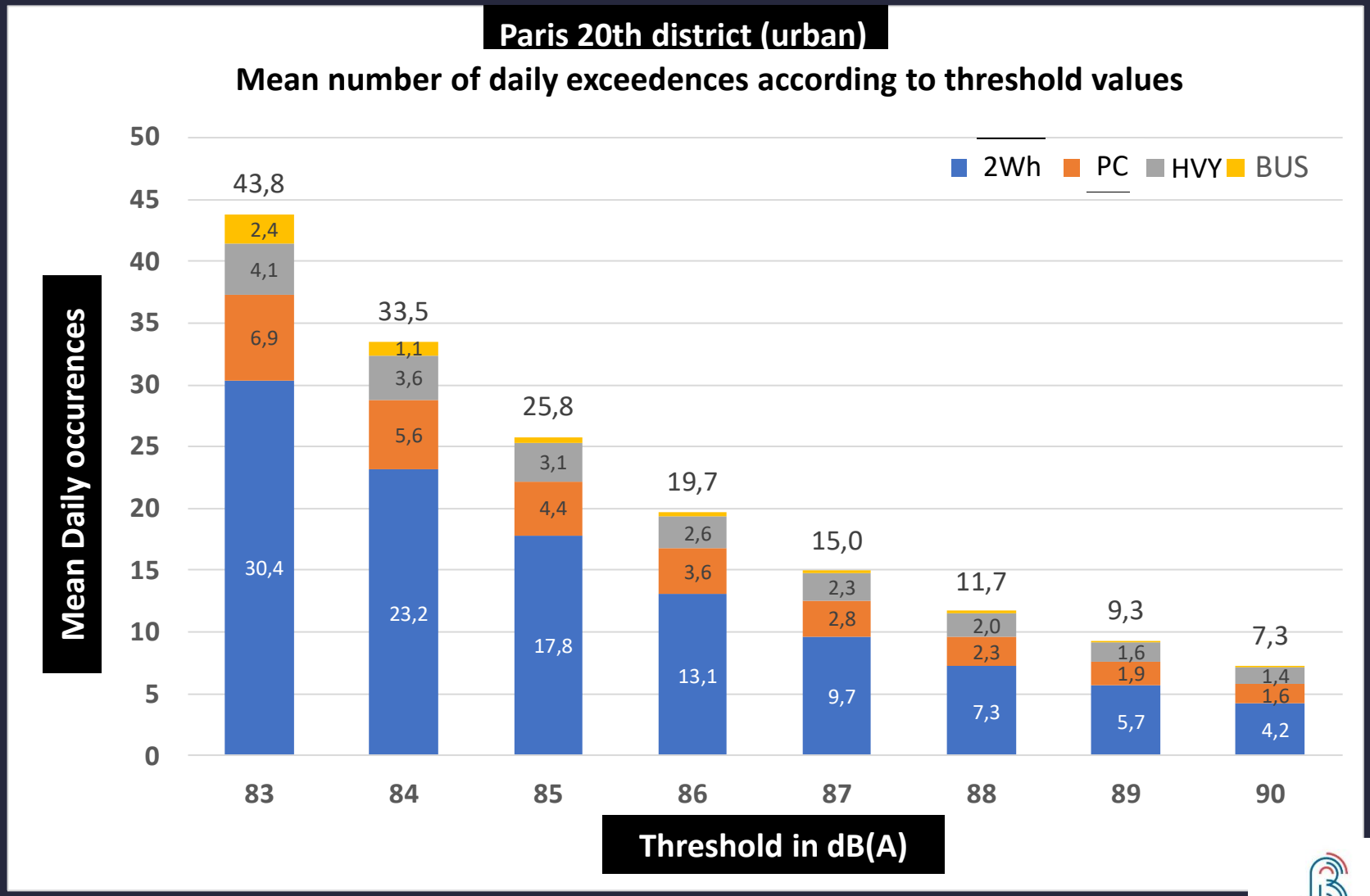
Average number of exceedances per day

With a 85 dB(A) threshold:

- Around 1% of excessive emitters
- Between 20 to 30 exceedences per day
- 60% to 80% are 2-wheelers
  10% to 20% are cars
  10% to 20% are heavy vehicles or bus



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And now…

Since the initial trials carried out in the Ile-de-France region and elsewhere in Europe, the Hydra device has been improved to:

→Incorporate Class 1 microphones

→Further enhance its detection capabilities, especially at night

→Revise its mechanical design to facilitate its integration into urban environments while ensuring protection against vandalism.

The new version was delivered in early April to the French Testing Laboratory (LNE) for legal metrology approval.

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THANK YOU
FOR YOUR ATTENTION!

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