

Institut français
des sciences et technologies
des transports, de l'aménagement
et des réseaux

Vers un plaidoyer pour SHM-France

IFSTTAR, 14 mars 2019

Frédéric Bourquin , Directeur du département COSYS
Et al.



IFSTTAR

Bienvenue à l'équipe de France du SHM





Cité Descartes

**Top1
french R&D cluster
on sustainable cities**

- 840 000 m²
- 16 000 students
- 1200 academics
- 34 laboratories



FUTURE

French University on Urban Research and Education

VILLE
ECONOME
EN
RESSOURCES

LA VILLE
DE
DEMAIN

VILLE
CONNECTEE

VILLE SURE
ET
RESILIENTE



Université Gustave Eiffel

Appel à projet I-SITE / IDEX
2nd programme d'Investissements d'avenir

INVENTING THE CITY OF TOMORROW

Du Monitoring des ouvrages et équipements critiques ...

fonctionnement réel

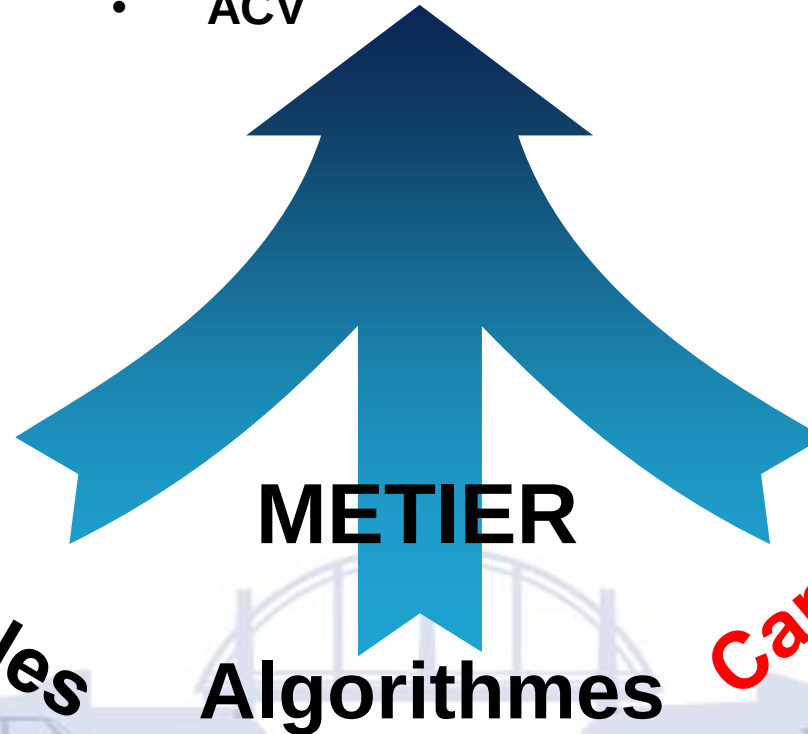
- Chargements
- Réponse
- Comportement des Matériaux
- Et des systèmes

Etat de santé

- Sécurité
- Capacité portante
- Durée de vie résiduelle
- Maintenance Prédictive
- BIM
- ACV

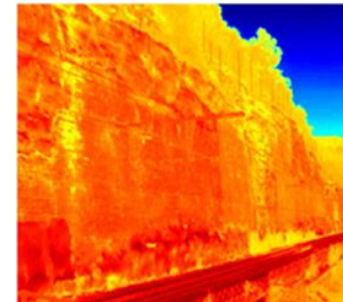
Améliorer n+1

- Conception
- Matériaux
- Exploitation
- Maintenance



Modèles

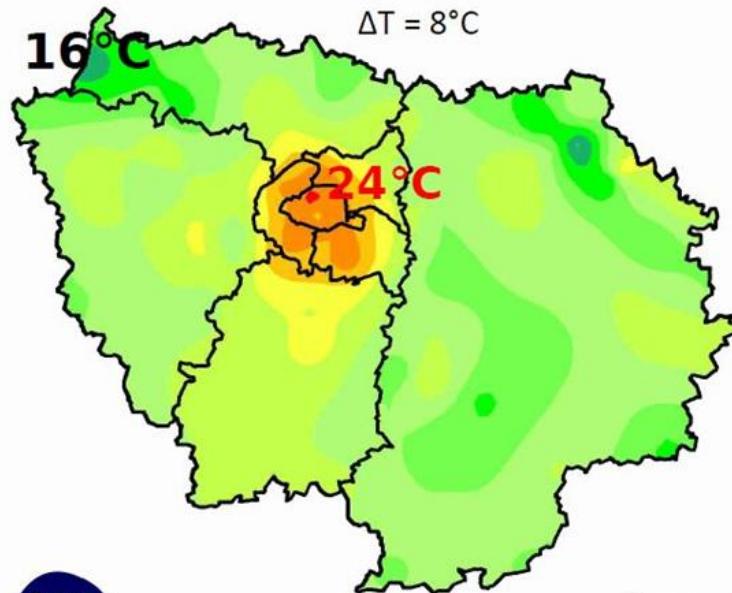
**Capteurs
DATA**



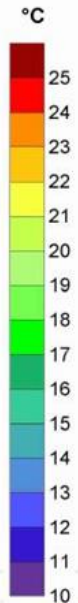
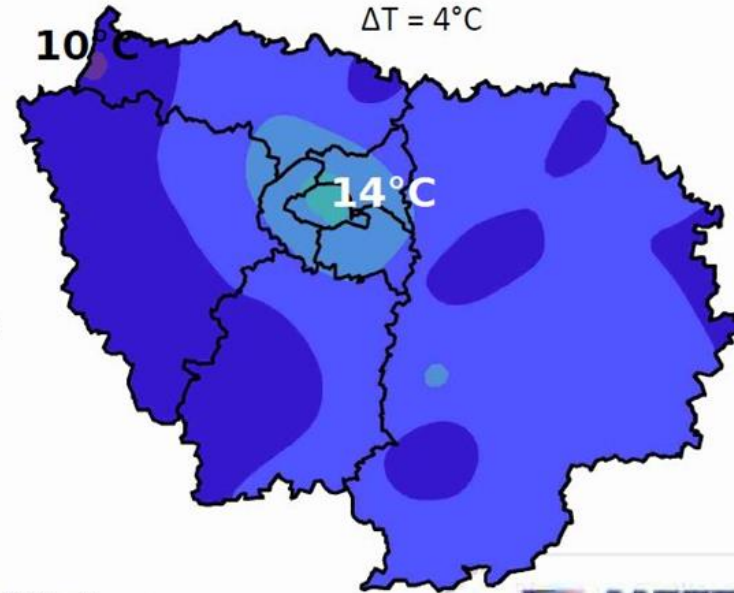
... au Monitoring des Territoires



Températures nocturnes (8-13 août 2003)



Températures nocturnes (août 2000)



histoire locale et «*capacity building*»

- Travaux **pionniers** sur les capteurs à fibre optique 1974+
- Une trentaine de brevets
- Animation de la communauté internationale (SHM) et nationale (au sein de la COFREND)
- Un Equipex : **Sense-City**
- Une ERC avec l'école Polytechnique : **NACRE**
- Une EPC avec Inria : **I4S**
- Un LIA en création : **ASTI**
- Un élément important du programme d'innovation national **R5G**

Apprendre, Innover, Créer, Sauver

- Sauvetage de plusieurs grands ouvrages

- Pont d'Aquitaine (émission acoustique)
- Pont de Normandie, Ile de Ré (Ondes ultra-sonores)
- Barrage de Salanfe (RGIB)

- *recherche-action*

- A63 (Colas)
- A10 (Vinci)
- NBT
- Tabarly
- LGV-BPL (Eiffage et Railenium)



- Création de 3 start-ups :

Altaroad (grand Prix I-Lab) + Power-Lan + Ecotropy + Solamen +...

- 2 start-ups en maturation (Sense-Hydre, BIKAIR)

- Transferts techno : Vinci, SVS (via Inria)

- Un outil de simulation métier : **CESAR LCPC**

- Coopérations étendues avec Vinci, Eiffage, SNCF, SVS, Siemens ...

www.ifsttar.fr

The logo for Sense City, with 'sense' in black and 'CITY' in blue, set against a white background.

sense CITY

A large, bold title 'Smart technologies for sustainable cities' overlaid on a background image of a modern building with a blue glass facade and a paved walkway with people.

Smart technologies for sustainable cities

The logo for CSTB, with 'CSTB' in bold black letters and 'le futur en construction' in smaller text below.

CSTB
le futur en construction

The logo for IFSTTAR, featuring a stylized blue and green circular graphic and the text 'IFSTTAR' in blue.

IFSTTAR

The logo for École Polytechnique, featuring a large blue 'X' with a crest in the center and the text 'ÉCOLE POLYTECHNIQUE UNIVERSITÉ PARIS-SACLAY' below.

ÉCOLE
POLYTECHNIQUE
UNIVERSITÉ PARIS-SACLAY

The logo for LPICM, with 'LPICM' in blue and a stylized orange and blue graphic to the left.

LPICM

The logo for ESIEE Paris, with 'ESIEE' in bold black letters and 'PARIS' in smaller text below.

ESIEE
PARIS

The logo for CNRS, with 'cnrs' in white lowercase letters inside a dark blue circle, and 'dépasser les frontières' in smaller text below.

cnrs
dépasser les frontières

The logo for Université Paris-Est, with 'UNIVERSITÉ' in black and '— PARIS-EST' in bold black letters below.

UNIVERSITÉ
— PARIS-EST

The logo for UP EM, with 'UP' in orange and 'EM' in red, and 'UNIVERSITÉ PARIS-EST MARNE-LA-VALLÉE' in smaller text below.

UP
EM
UNIVERSITÉ
PARIS-EST
MARNE-LA-VALLÉE

The logo for Inria, with the word 'Inria' in a stylized red script font.

Inria

A large, bold title 'Smart technologies for sustainable cities' overlaid on a background image of a modern building with a blue glass facade and a paved walkway with people.

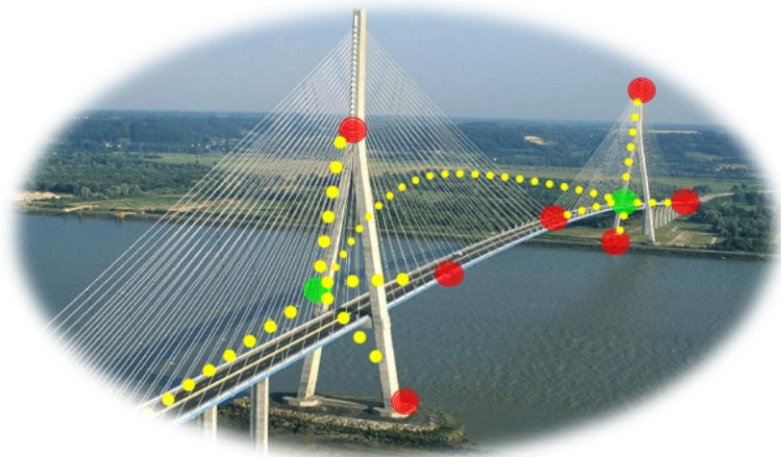
Bérengère Lebental, Anne Ruas (*UERA coordinator*),
Frédéric Bourquin, Eric Dimnet et al.

The website address 'www.ifsttar.fr' in black text.

www.ifsttar.fr

The full name of the organization in French: 'Institut français des sciences et technologies des transports, de l'aménagement et des réseaux'.

Institut français des sciences et technologies des transports, de l'aménagement et des réseaux



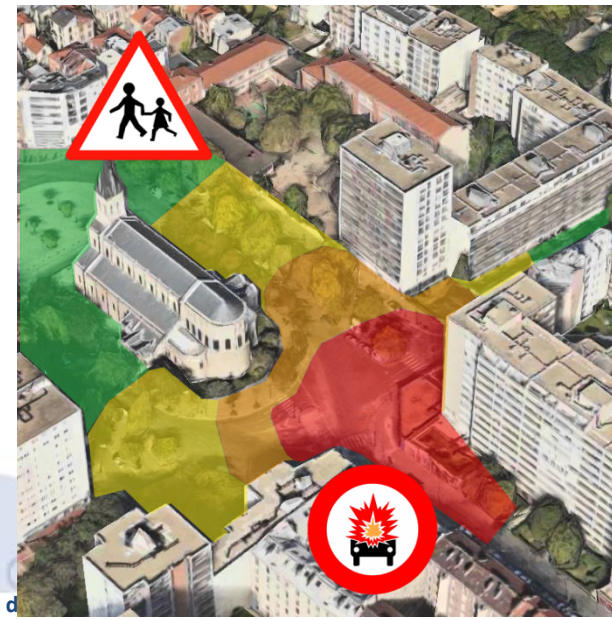
Build an internet of sensors

Measuring in real time, everywhere

Create **sensitive** environments to
optimize everyday urban operations,
create high-value **services** based on **reliable**
data at citizen scale

To empower decision-
support tools

Throughout the value chain

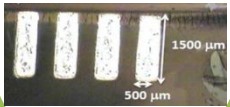


Targets

- Environment
 - Indoor & outdoor **air quality, water, soils**
 - Noise and electromagnetic exposure
 - **Environmental exposure** and **health** impacts
 - **Crisis management**
- Energy performances
 - Low-carbon districts
 - **urban heat islands**
 - Smart grids including **5th generation (augmented) road**
- Infrastructures and networks
 - **Durability**, performance and resilience
 - Bio-additive-bots building : **biomaterials**, 3D printing, robotics
 - Traffic management, **Weigh-in-motion**

A repertoire of nanosensors for everyday life

Graphene-based humidity sensors on glass



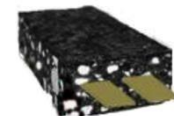
Building monitoring via core-embedded carbon nanotube strain sensors on plastics



Water quality sensors on plastics and silicon with functionalized carbon nanotubes

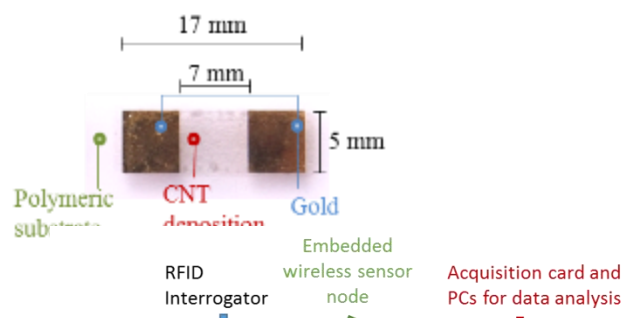
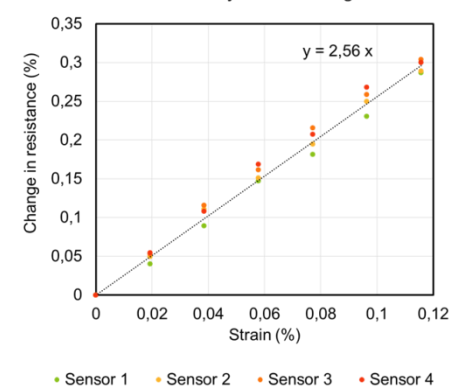
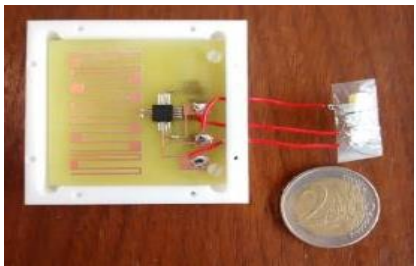


Road monitoring via nanoparticle layers in asphalt

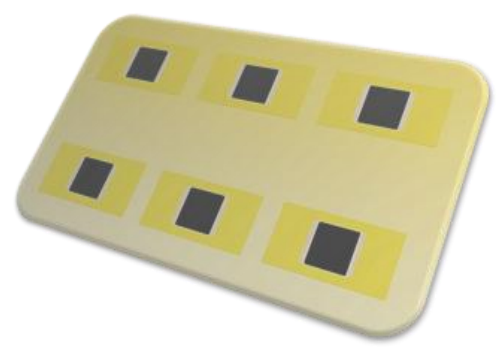


Advanced nano-sensors : 2 world records, 3 start-ups

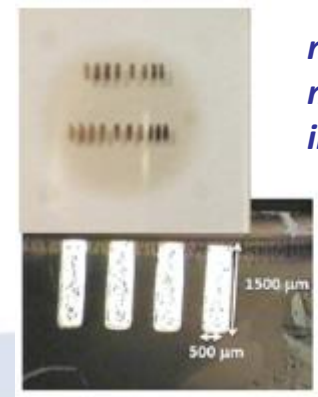
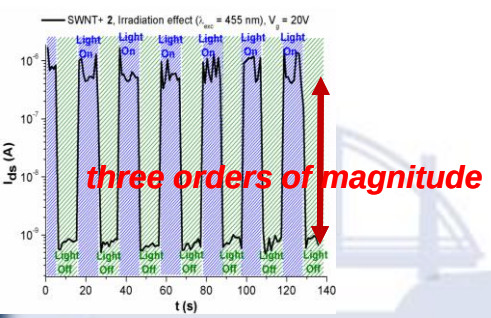
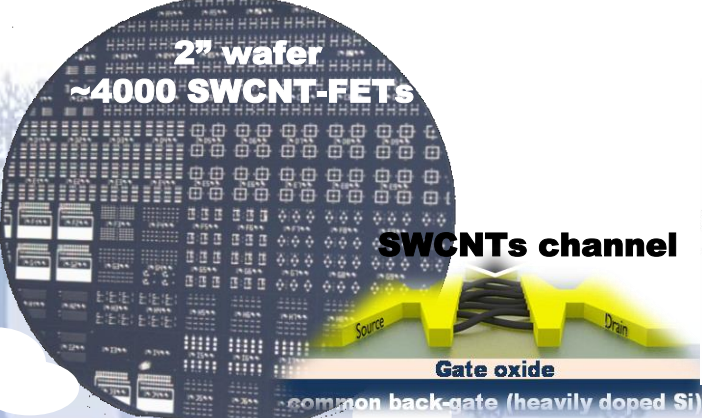
Resistive devices batch-fabricated by ink-jet printing



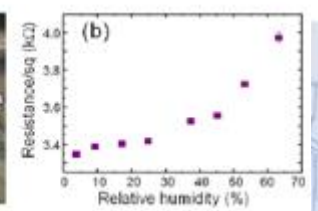
Road sensors



low noise ultimate CNT-FET transduction for gas sensors



n-graphene based moisture sensors by inkjet-printing

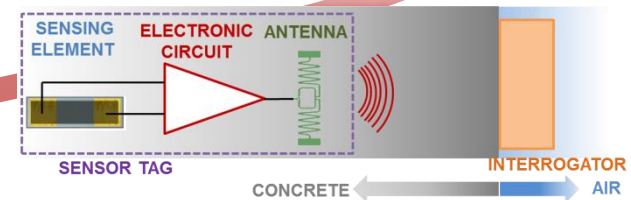


Concrete instrumentation via nanosensor

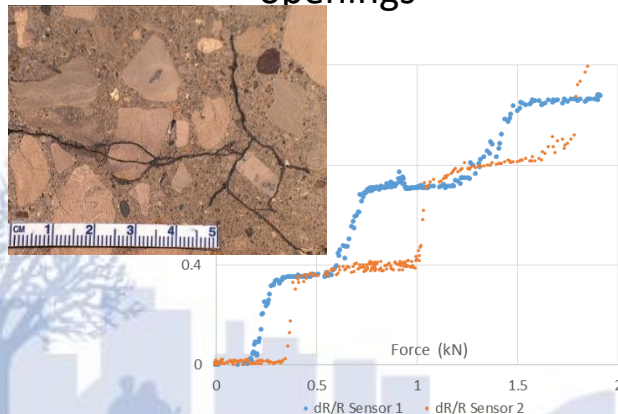
Serial inkjet printing of carbon
nanotube strain sensor



Embedded wireless
electronics



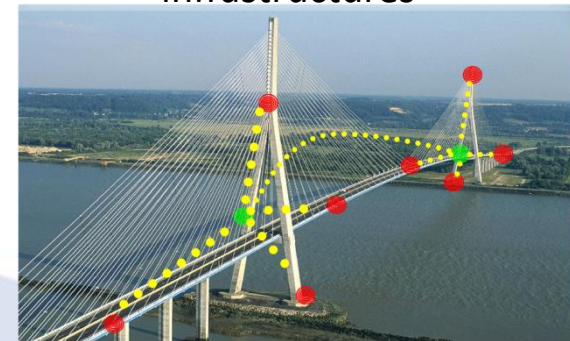
Detection of microcrack
openings



Sensor deployment into
Sense-City



Toward safer and greener
infrastructures

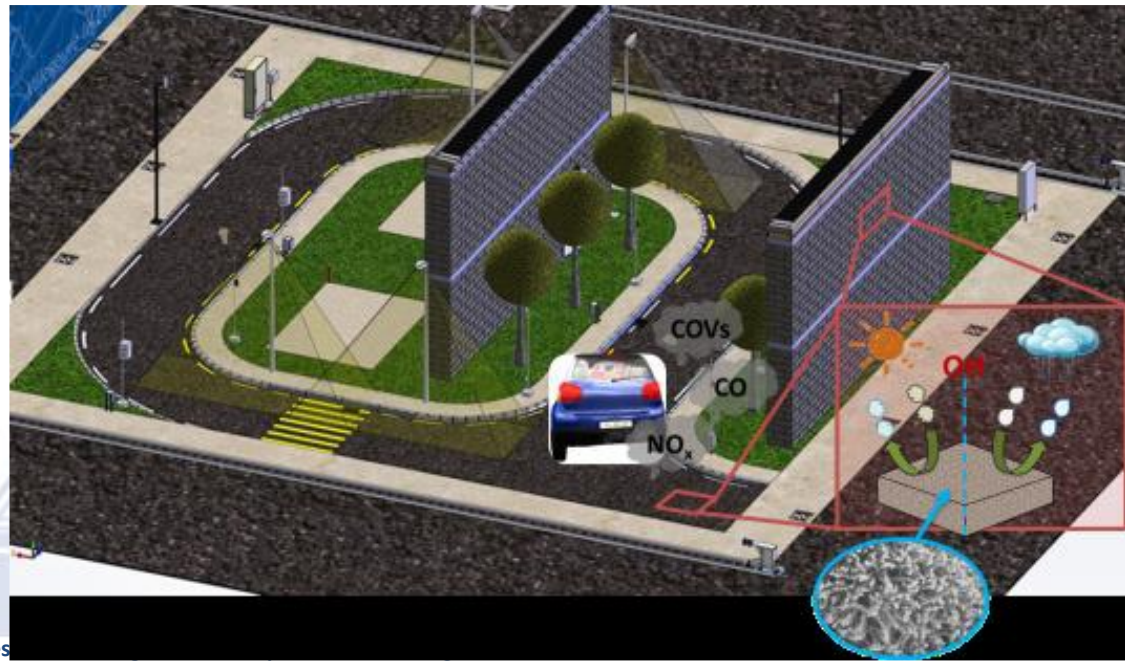
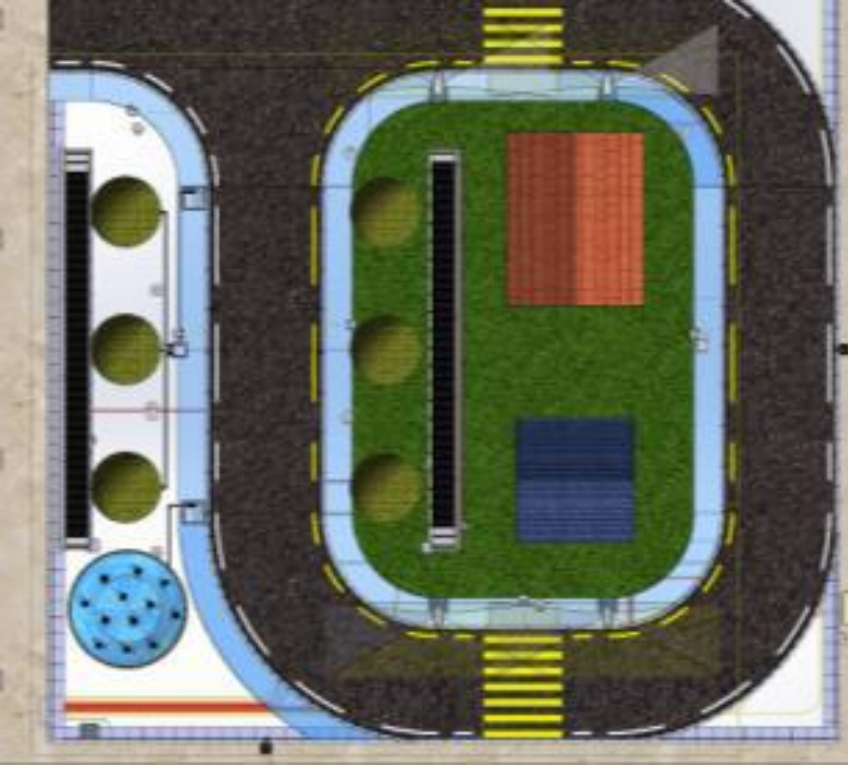


www.ifsttar.fr

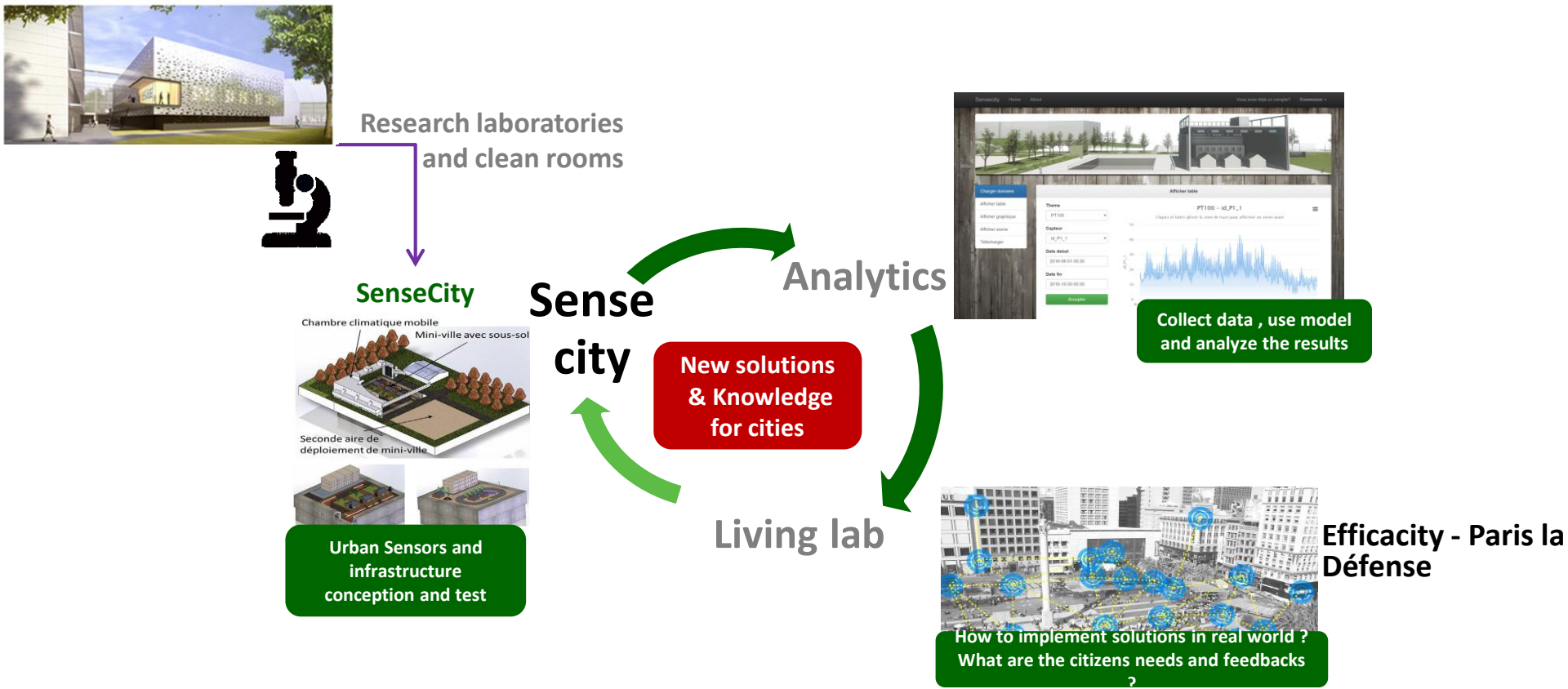
Sense-City Innovation Lab & Climate Simulator



2nd island



From laboratories to the real world : **TRL5**



Merci de votre attention

et à votre service

