ESTACA'LAB RESEARCH LABORATORY

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ESTACA
ECOLE D'INGENIEURS

CREATEUR DE NOUVELLES MOBILITES

Groupe Isae

1. Introduction

West Campus

ESTACA'LAB
1 Research laboratory

2 Campuses

Paris Saclay Campus

ESTACA'LAB

- **System research department**
- **Mechanic research department**
- Technical support
- Administrative support

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1. Introduction: ESTACA'LAB in few key figures

- 25 Research-Professors
- 25 PhD students
- 3 HDR

- 15 ongoing industrial collaborations and projects

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SYSTEM RESEARCH DEPARTMENT

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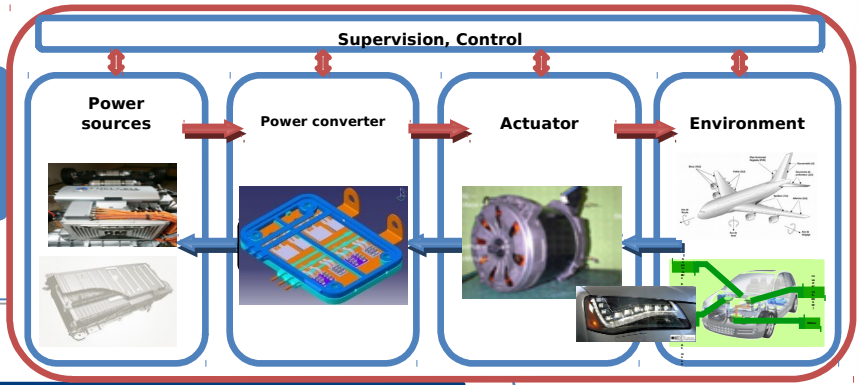
2. Research activities context and positioning

- «Mechatronics systems» approach
- Good mastering of technology targets and use

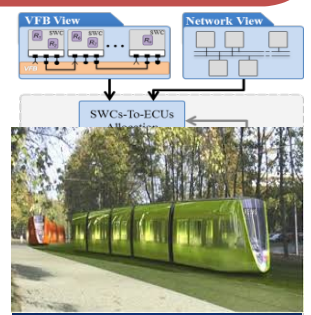
Green, intelligent and safe transport, well fitted to new mobility



Two research topics :

- Energy and intelligent mechatronics systems :
  - Energy and design of mechatronics systems : design methodologies using optimization under multi-physics constraints, embedded energy sources and energy management *(reliability by design)*
  - Control and diagnosis of systems: Fault Tolerant Control architectures *(reliability by control)*

- Embedded Systems and Connected Mobility:
  - Optimization of Embedded SW architectures (response time, ECU and network load, cost, reliability…), effective integration and management of V2X information's)



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PROJECTS

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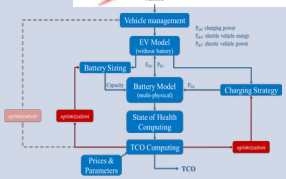
3. Examples of industrial projects and collaborations

Electric vehicles

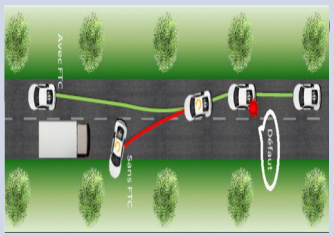
- GRUAU: Electrification of a light-duty vehicle and TCO optimization, Ph.D thesis A.BABIN



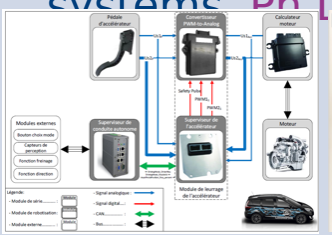
- Electrification of two seats plane with ultra-fast charging battery s… …nger

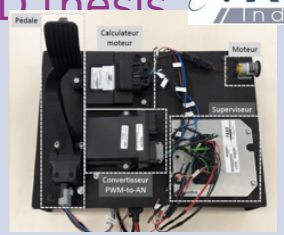
Autonomous vehicles

- VEDECOM: Faults Tolerant Control Strategy for trajectory planning of autonomous vehic… …UKH



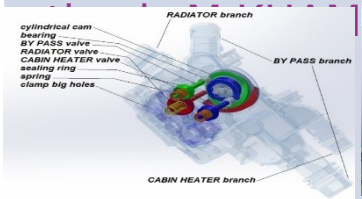
- FAAR Industry: Develop safety analysis methodology of embedded software… …systems, Ph.D thesis

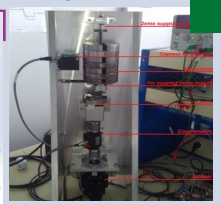




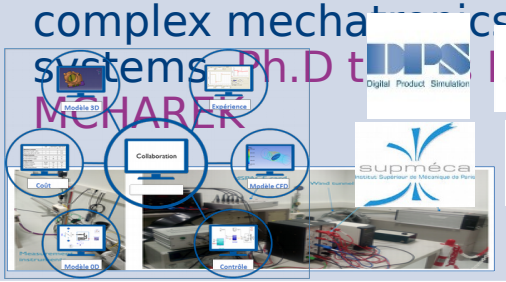
Mechatronics systems

- MANN+HUMMEL: Optimization of an automotive active thermal management valve (re… fuel consumption), Ph.D …





- Develop collaborative tool to design and optimize complex mecha… …systems, Ph.D t… … MCHAREK



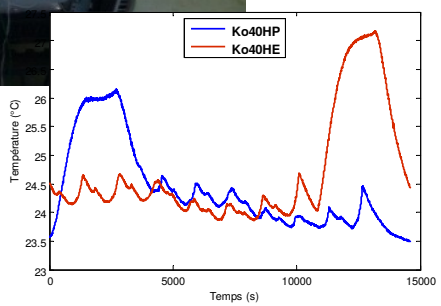
Experimental benches

3. Experimental benches

- 24kW/80kW
- 600A/200A
- 160V/800V
- 40kHz
- Control & Acquis.: by NI-FPGA
- 64 measurements
- 24h/24h cycling

Sources

Test and characterization of energy storage systems (Batteries/Supercapacitors)



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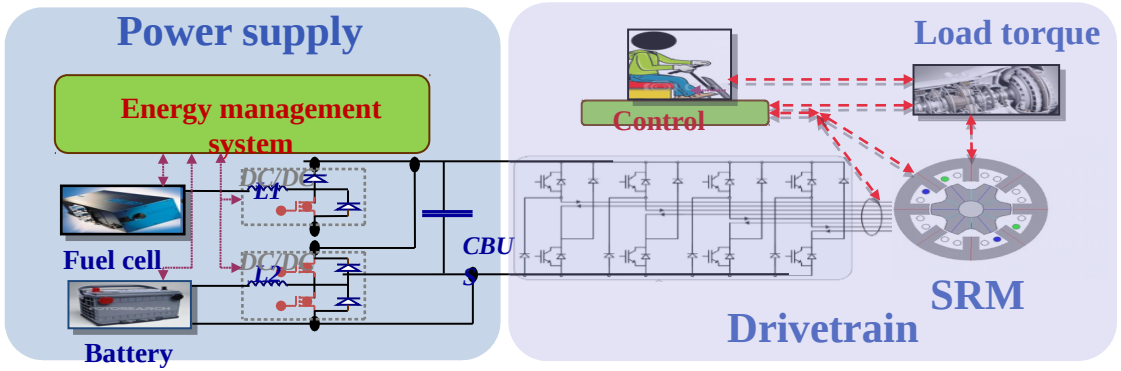
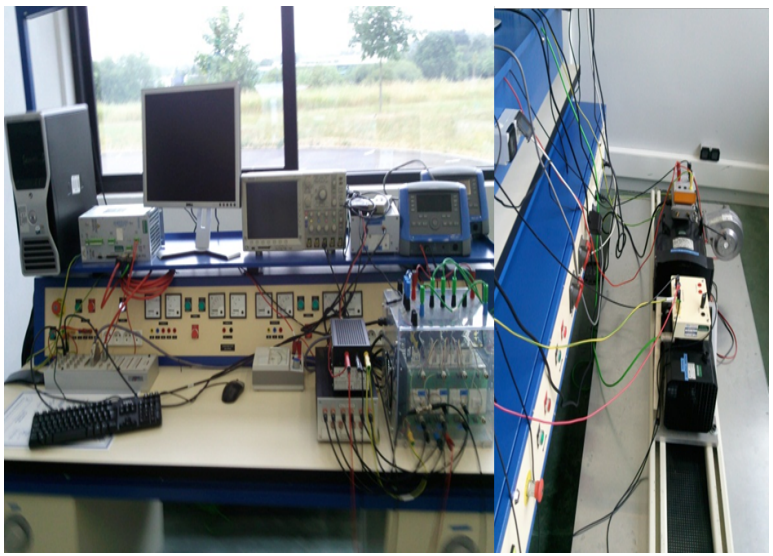
3. Experimental benches

Test benches using different technologies of electrical machines





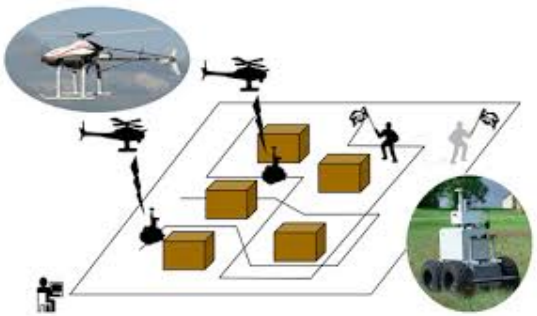
Synchronous machine

Induction machine

Switched reluctance machine

3. Experimental benches benches under development (Laval)

Electric power propulsion test bench
for electric and more electric aircraft



Connected drone platform

Cooperation between drone and autonomous vehicles at reduced scale

Test benches developed thanks to our local partners support (Laval)

LA MAYENNE CONSEIL GÉNÉRAL · LAVAL agglo · CCI MAYENNE · Région PAYS DE LA LOIRE

Research and training use

Characterization of a complete battery pack

Light-duty electric connected and autonomous vehicle

Hybrid bicycle test bench

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3. Experimental benches benches under development (SQY)

Autonomous electric vehicle

Energy management platform using fuel cell and PV systems

Test benches developed thanks to our local partners support (SQY)

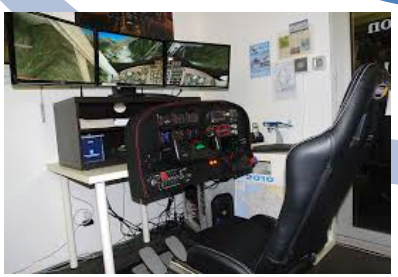
Yvelines Conseil général

St-Quentin en-Yvelines COMMUNAUTÉ D'AGGLOMÉRATION

Research and training use

Indoor autonomous drone

Flight simulator



Helicopters test benches at reduced scale

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Functional Structures
Composites

Air Quality and
Depollution

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MECHANIC RESEARCH DEPARTMENT

Groupe Isae

Two research topics :

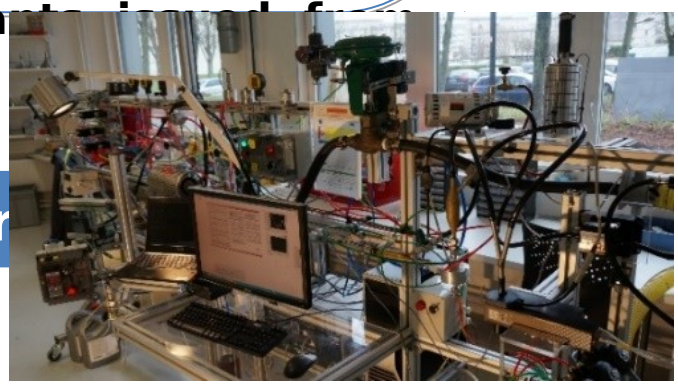
- **Functional Structures Composites (FSC)**

Understanding of the "modeling-process-(mechanical characterization)" relationships of functional structures excited by a complex dynamic loading in a harsh (**hygrometry , thermal and vibration)** environment **to ensure structural and functional continuity**

- **Air Quality and Depollution (AQD)**

Better expertise in the physics of these pollutants and technological solutions **to improve the air quality** in the interiors of different means of transport. Two main research topics dealing with air quality pollution : **Characterization of pollutants issued from ortation systems and Study of the ics of micro/nanoparticles and their ence**

Clean, smart, safe transpor



PROJECTS

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Projects

CIM/SNCF : Rolling stock research center (Thesis)

- Train breaking systems emitted particles (PM10 to PM2.5) dispersion simulation

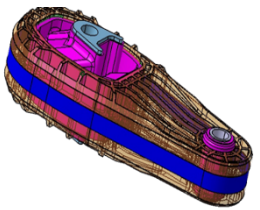
- Study of mechanical characterization of a fibrous composite material for transport application. Evaluation of the post-impact strength of composit structures.

AIRBUS GROUP (Thesis)

Definition of an aeronautical composite structure integrating electric conductors of control signals

DYNAFIB (FUI)

Produce anti-vibration systems with a composite thermoplastic which include local continuous fiber reinforcement. Goal : CO_2 emissions reduction, 25% weight saving compared to a metallic solution



CAPHTIV (ADEME)

Characterization and Analysis of Pollutants issued from ground transportati and infiltrating Vehicles in-cabin.

Increasing our understanding of pollutants infiltration dyna the flow/ Particles interactions at the air intakes and the in-cab efficiency

Projet CAPNAV

CAPNAV

Caractérisation des émissions Particulaires des Navires

- AAP CORTEA (ADEME) « COnnaissances, Réduction à la source et Traitement des Emissions »
- Durée de **36 mois, To: septembre 2019**
- Demande de subvention **de 212 k€**

Objectifs du projet CAPNAV

- **Acquérir des connaissances sur les émissions en particules fines des navires à propulsion MGO et GNL (« Dual Fuel », GNL/MGO)**

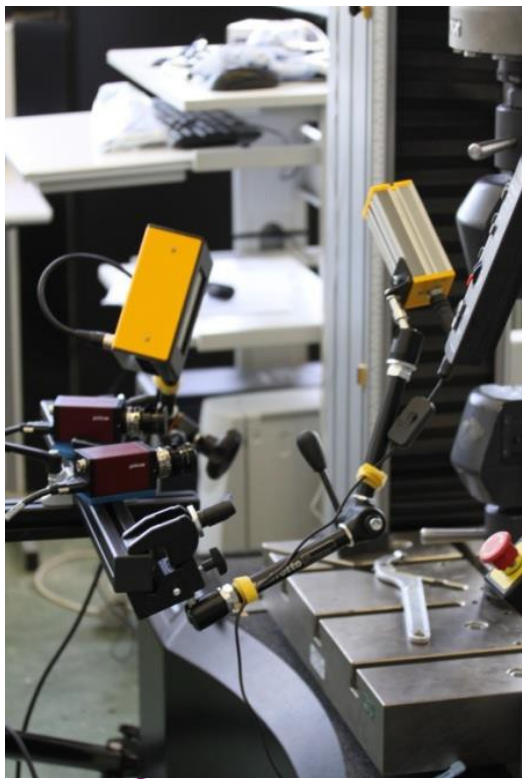
- **Evaluer l'impact des manœuvres (charges, vent, …) sur les émissions. Zonage des émissions (GPS, paramètres du navire)**

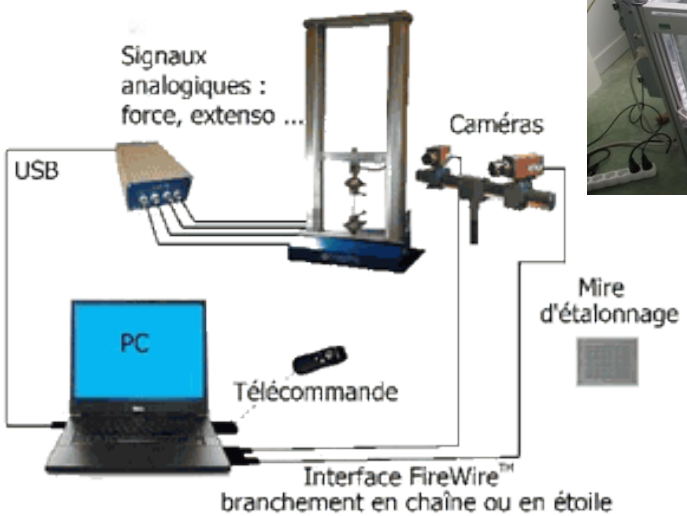
- **Impact en *sur l'environnement à bord* (mesure qualité de l'air)**

- **Test de solutions en termes d'émissions particules fines :**
  - Solution de réduction des émissions moteurs diesels au gasoil marine par additifs.
  - Solution « dual fuel » GNL/MGO

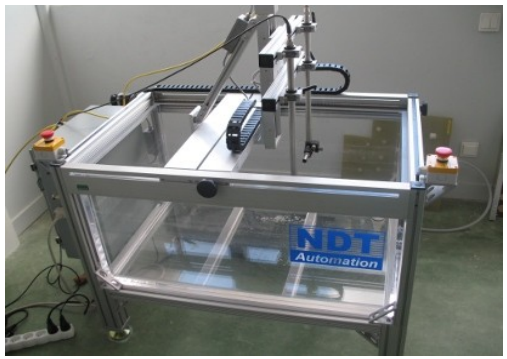
Experimental benches

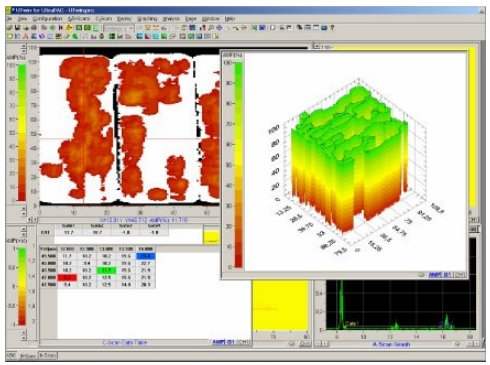
•Field measurement(stress and strain)





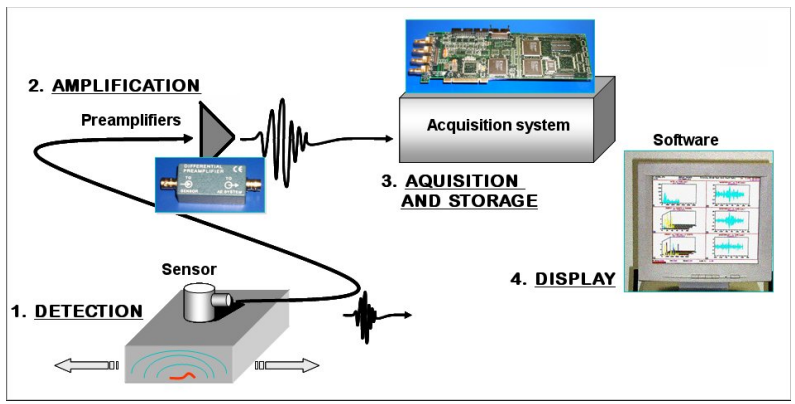
•Non destructive testing





Ultrasound

C-SCAN 3 axes



Acoustics method

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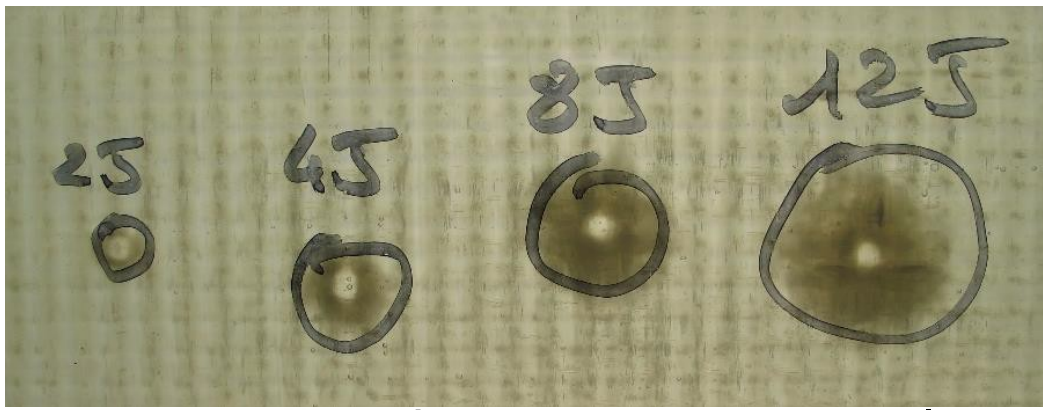
Dynamic test for impact loading : Drop tower

10-4000 Joules, falling speed up to 10 m /s

Damage Initiation for low impact



Energybetween5 –100 Joules

Large energy absorption

Energybetween100 –4000 Joules

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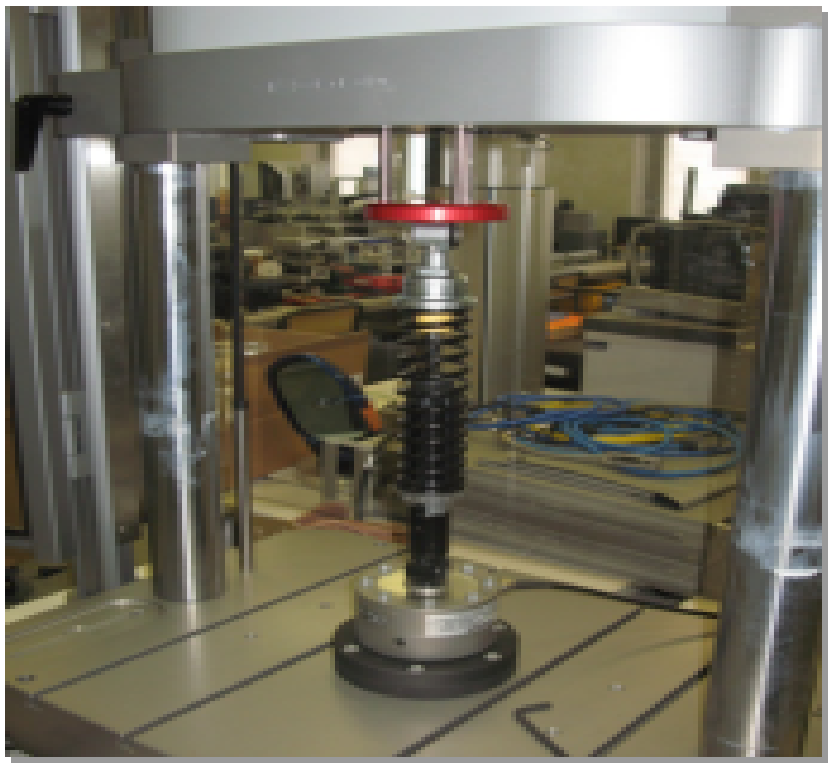
Electromechanical universal static testing systems that perform tensile, compression, bend testing : 50kN, 150kN



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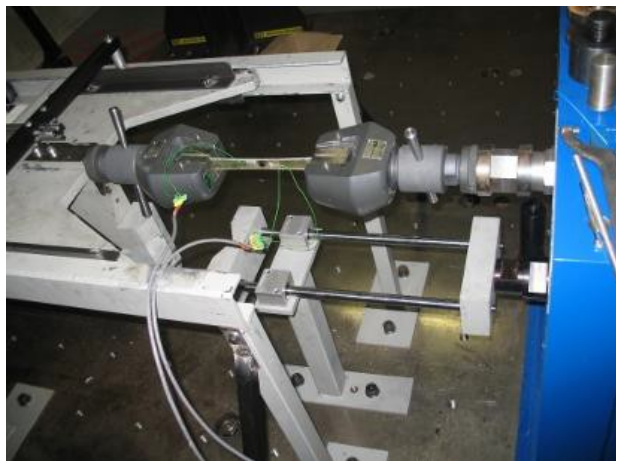
A servo hydraulic testing system is suited for high- and low-cycle fatigue testing, thermomechanical fatigue testing, and fracture mechanics. The higher capacity of up to 100 kN.

With an environmental chamber,
Temperature range: Ambient to +350 °C (+660 °F).

Dynamic actuator :15m/s, 80kN : High speed tensile test



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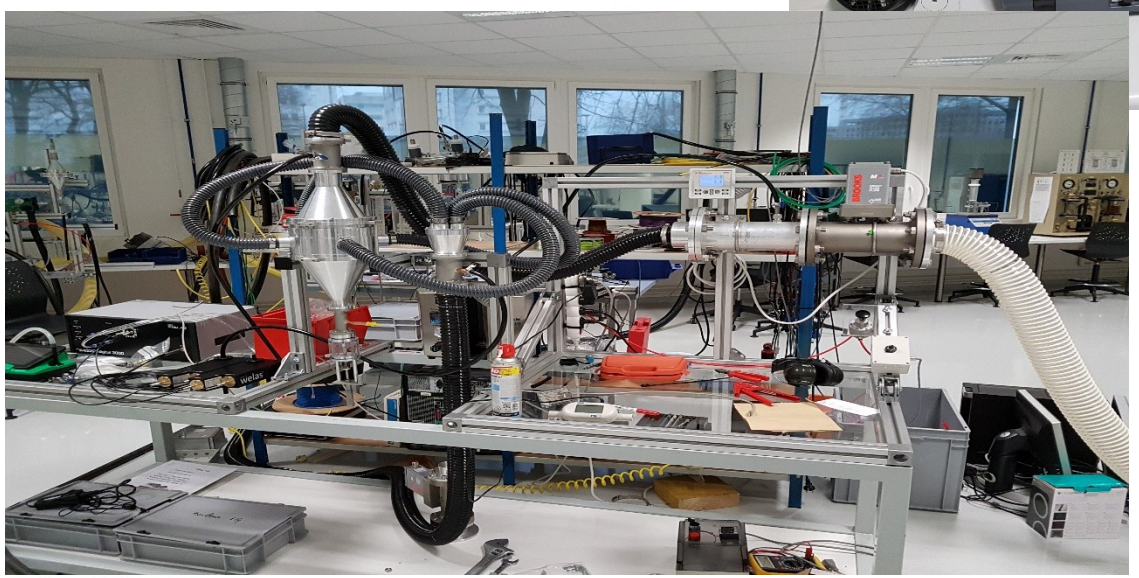
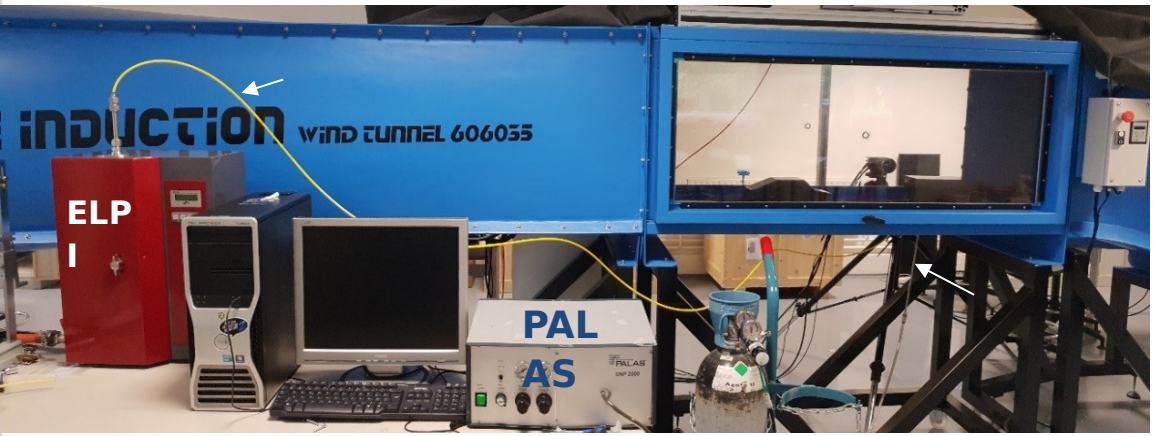
Air Quality and Depollution

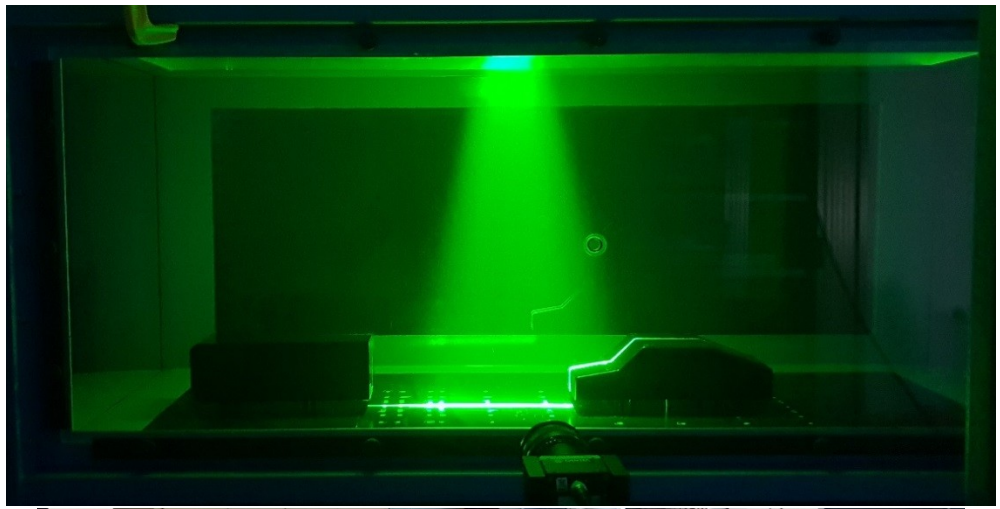
- **Different home-designed benches**
- **Particle generators (Palas, RBG 1000, AGK 2000)**
- **Field instrumentation (including DustTrak and P-Trak which are able to measure particle mass and number concentrations, Nox and CO2)**
- **Phase Doppler Anemometry (PDA)**
- **Granulometers(ELPI +, Grimm Mini-Wras, SMPS, Fi**

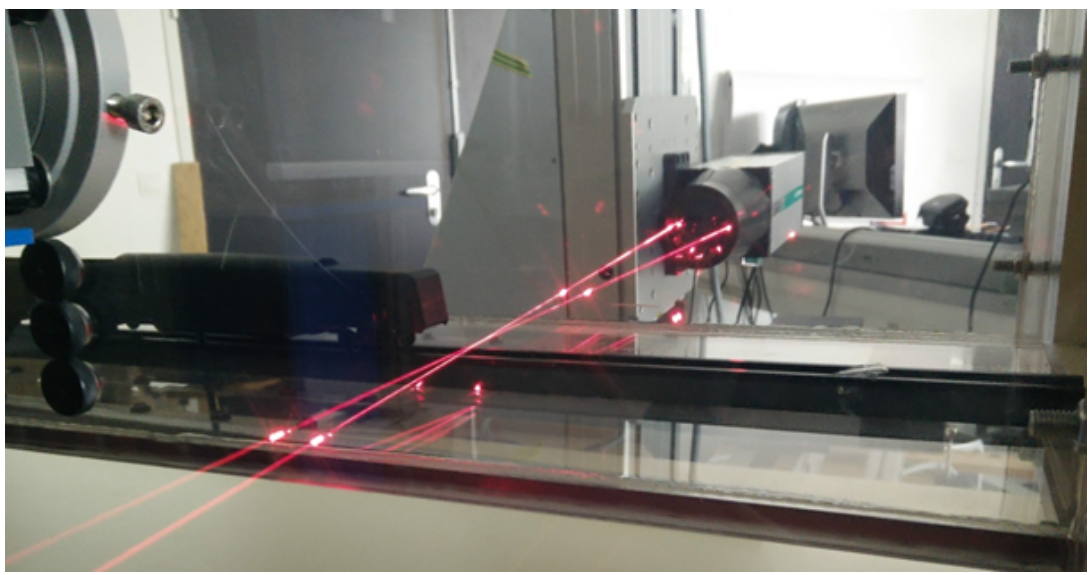


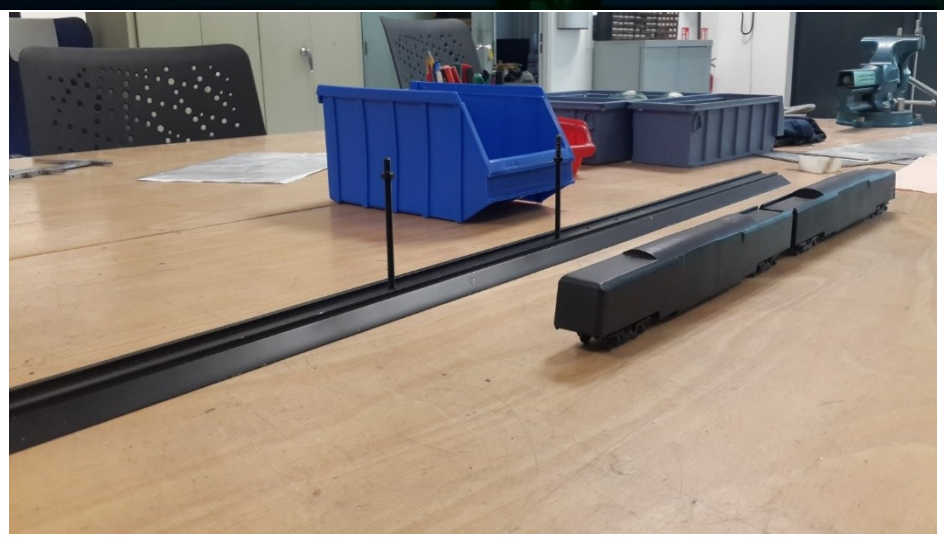
Air Quality and Depollution

- **Wind tunnels equipped with Particle Image Velocimetry 2D and Laser Doppler Velocimetry,**
- **Train and automotive models design and fabrication**









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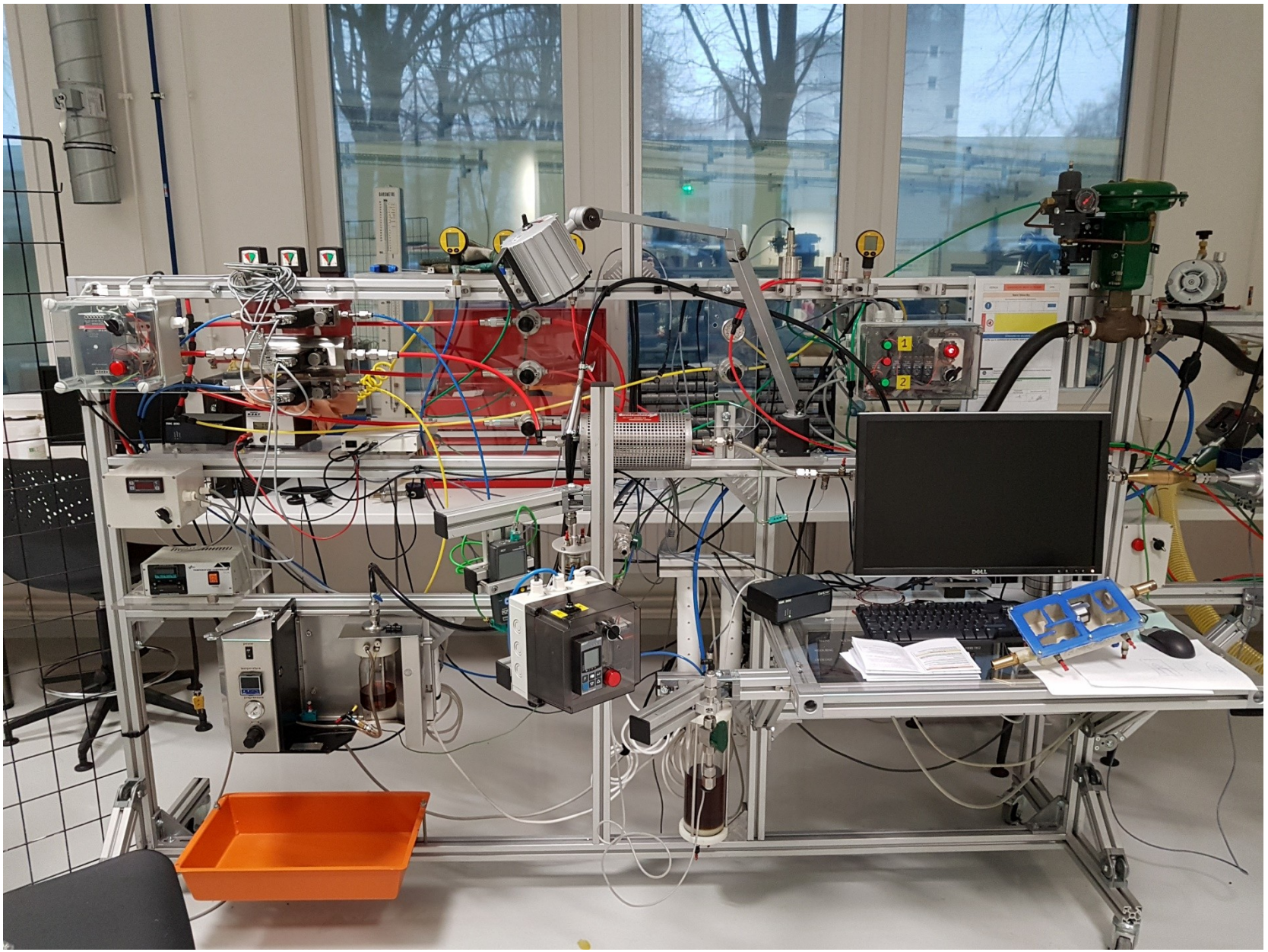

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