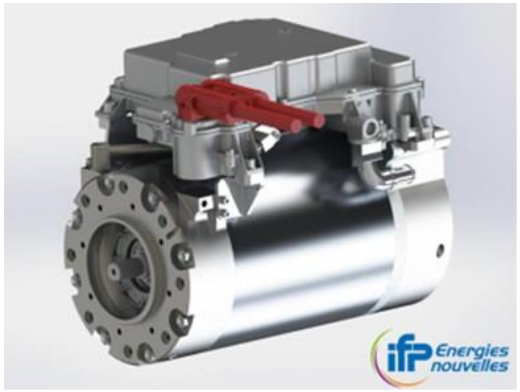
CHALLENGES AS SEEN BY

IFP ENERGIES NOUVELLES

R&I FOR ENERGY, TRANSPORT AND THE ENVIRONMENT



ABOUT US

A public sector **R&I** body

A **training** center

An industrial **group**

An international scope in the fields of energy, transport and the environment

1,635 people

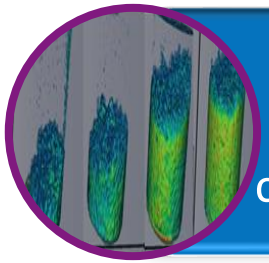
1,190 engineers and technicians dedicated to research

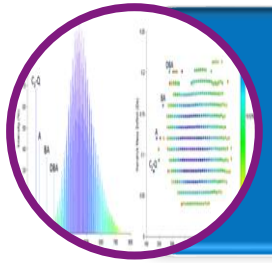
€120.5m budget allocation In 2020

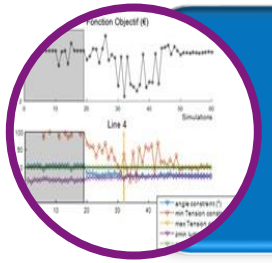
€146.5m own resources In 2020

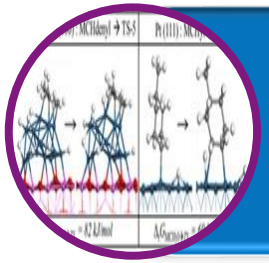
FUNDAMENTAL RESEARCH AROUND 9 SCIENTIFIC CHALLENGES

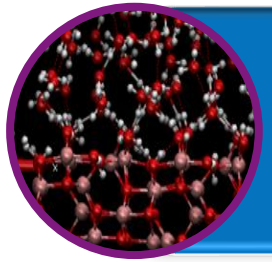
From the understanding of physical phenomena to the evaluation of a complete system, via numerical modeling of these phenomena

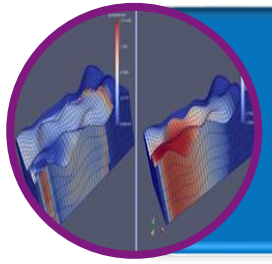

Material and fluid characterization

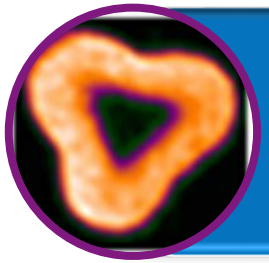

Massive data flows

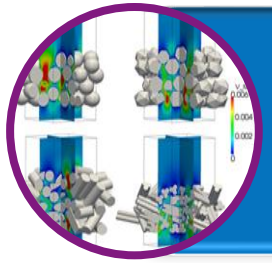

Command and optimization

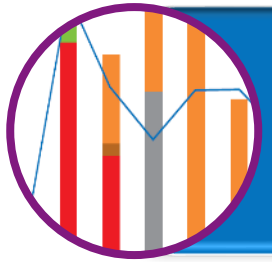

Reaction mechanisms


Descriptors


Code performance


Containment effect


Modeling of coupled phenomena


Economic and environmental evaluations

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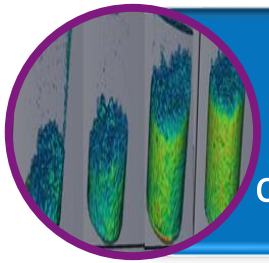
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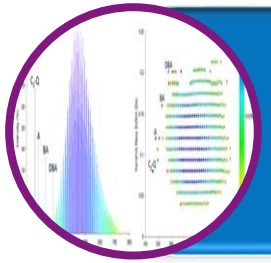
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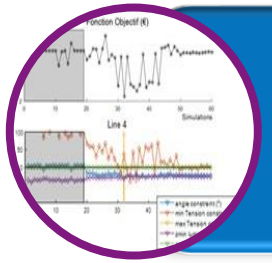
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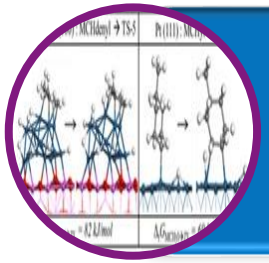
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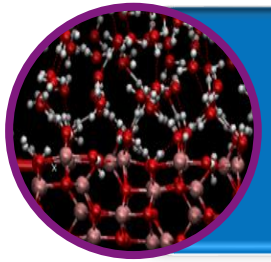
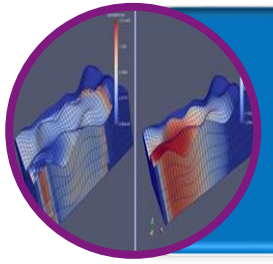

Descriptors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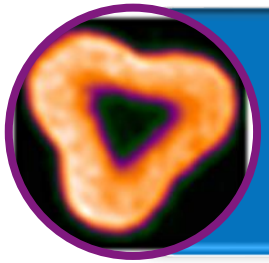
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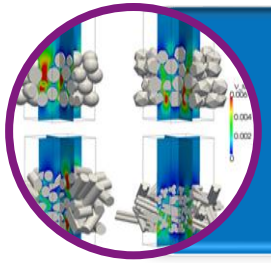
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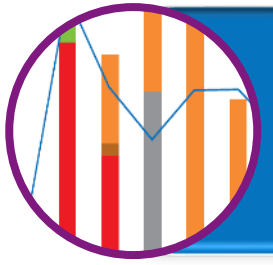
Economic and environmental evaluations

OUR FIELDS OF COMPETENCE

Earth sciences

- Geology – Sedimentology
- Geochemistry
- Geostatistics – Geological modeling
- Geomechanics
- Petrophysics and transfers in porous media

Chemical Sciences

- Catalysis and reaction kinetics
- Organic and mineral synthesis
- Separation and adsorption techniques
- Theoretical chemistry

Analysis and Characterization

- Chemical analysis
- Structural analysis and imaging
- Mechanical testing
- Microfluidics
- High throughput experimentation (HTE)

Physical Sciences

- Transfer and transport physics
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- Complex fluids, colloids and condensed matter
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Biosciences and Biotechnology

- Microbiology
- Genomics
- Biocatalysis
- Fermentation

Engineering Sciences

- Solid mechanics
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- Chemical and process engineering
- Combustion and engine technologies
- Electrical and electronic engineering
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- Systems modeling and simulation

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- Numerical methods and optimization
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- Software design
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- High performance computing
- Bio-informatics

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SAMOURAI PROJECT (2021-2025)

SIMULATION ANALYTICS AND META-MODEL-BASED SOLUTIONS FOR OPTIMIZATION, UNCERTAINTY AND RELIABILITY ANALYSIS

Coordinated by IFPEN with partners from MascotNum network

Real test cases in the fields of renewable and low-carbon energies and reduced CO2 air transport

3 PhDs, 3 postdocs

WP1 - Large-scale metamodels with a limited budget in simulations

WP2 - Efficient sequential enrichment of simulated data for large-scale reliability optimization and inversion

IFPEN test case : wind turbine reliability

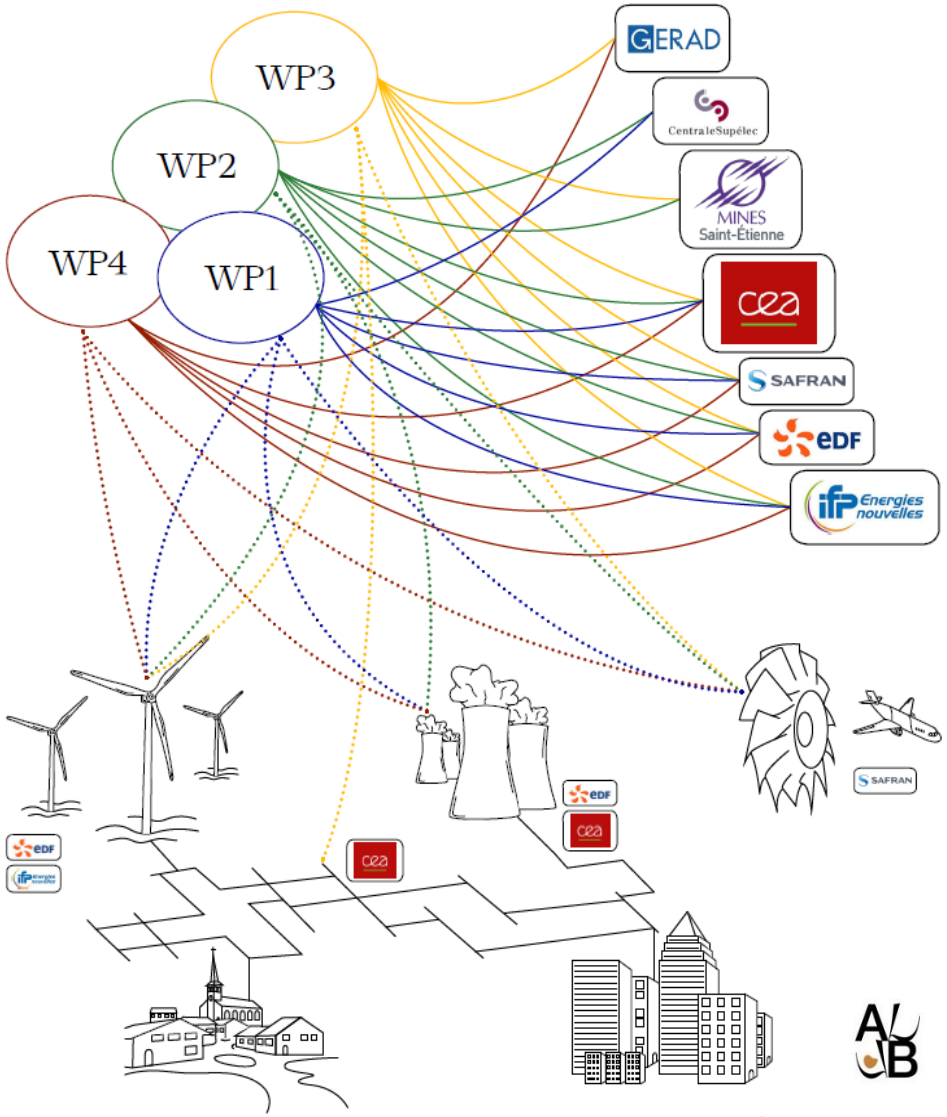
WP3 - Meta-models and optimization with mixed set of continuous and categorical variables

IFPEN test case : design of floating wind turbine platform

WP4 - Learning "hidden" constraints in iterative processes of metamodel building and optimization

IFPEN postdoc: Morgane Menz

Poly. Montréal - IFPEN postdoc: Stéphane Jacquet

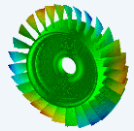


https://www.ifpenergiesnouvelles.fr/samourai

IFPEN PHD THESIS WITH ACADEMIC PARTNERS FROM MASCOTNUM NETWORK (I)

Optimization, reliability, robustness

Alexis Cousin (2021) *Reliability based design optimization* – dir.: J. Garnier (CMAP, INRIA)
+ New **phD position** (2022) Inria

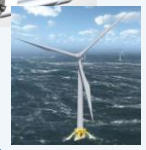


Thi Thoi Tran (2021) *Blackbox optimization for mixed continuous and categorical variables*
dir.: M. Mongeau (ENAC) SAFRAN

Adan Reyes Reyes (in progress) *Robust optimization of electrical engines* – dir.: S. Hlioui (Paris Saclay)

Noé Fellman (in progress) *Sensitivity analysis for reliability based design optimization*
dir.: C. Helbert, C. Blanchet-Scalliet (ECL)

CIROQUO

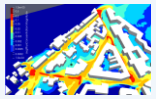


Clément Duhamel (in progress) *Robust inversion with functional inputs*
dir.: C. Prieur (LJK, INRIA), C. Helbert (ECL) Inria

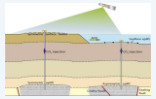
IFPEN PHD THESIS WITH ACADEMIC PARTNERS FROM MASCOTNUM NETWORK (II)

Uncertainty reduction: calibration and data assimilation

Adrien Hirvoas (2021) *Uncertainty quantification and uncertainty reduction by data assimilation*
dir.: C. Prieur, E. Arnaud (LJK)



Mathis Pasquier (in progress) *Uncertainty quantification and calibration of Lattice-Boltzmann models for urban pollutant dispersion* – dir.: P. Sagaut (M2P2)



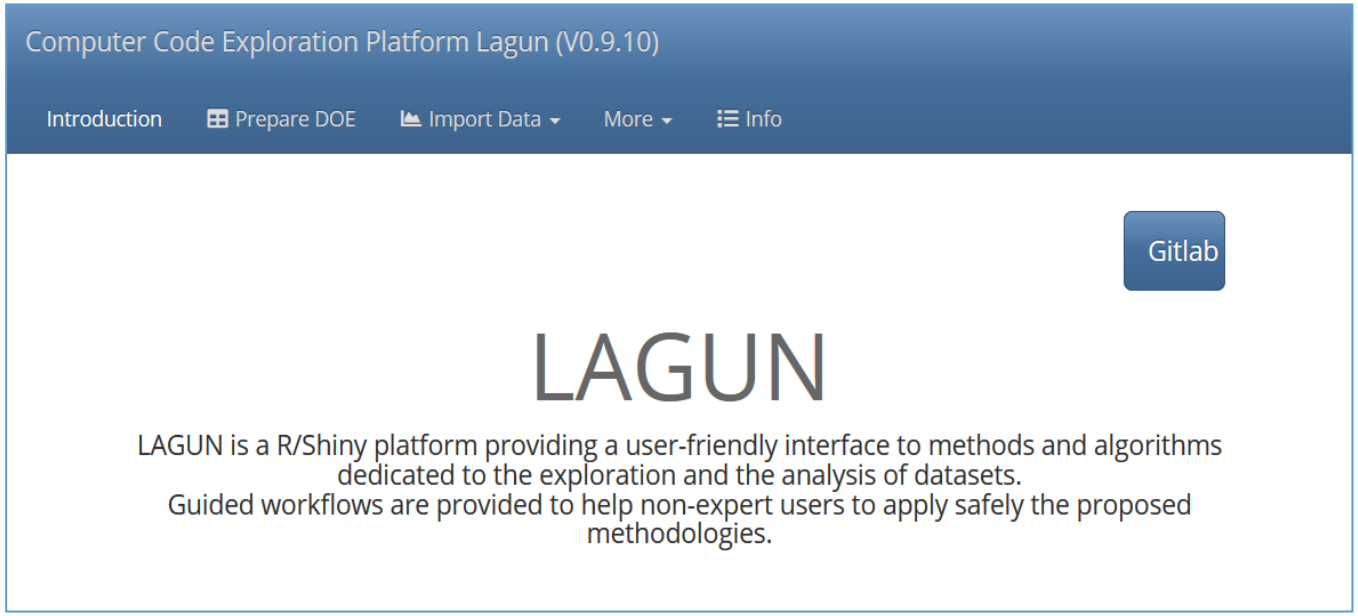
Adama Barry (in progress) *Design of experiments for calibration and prediction – CO2 storage*
dir.: F. Bachoc (IMT), C. Prieur (LJK)

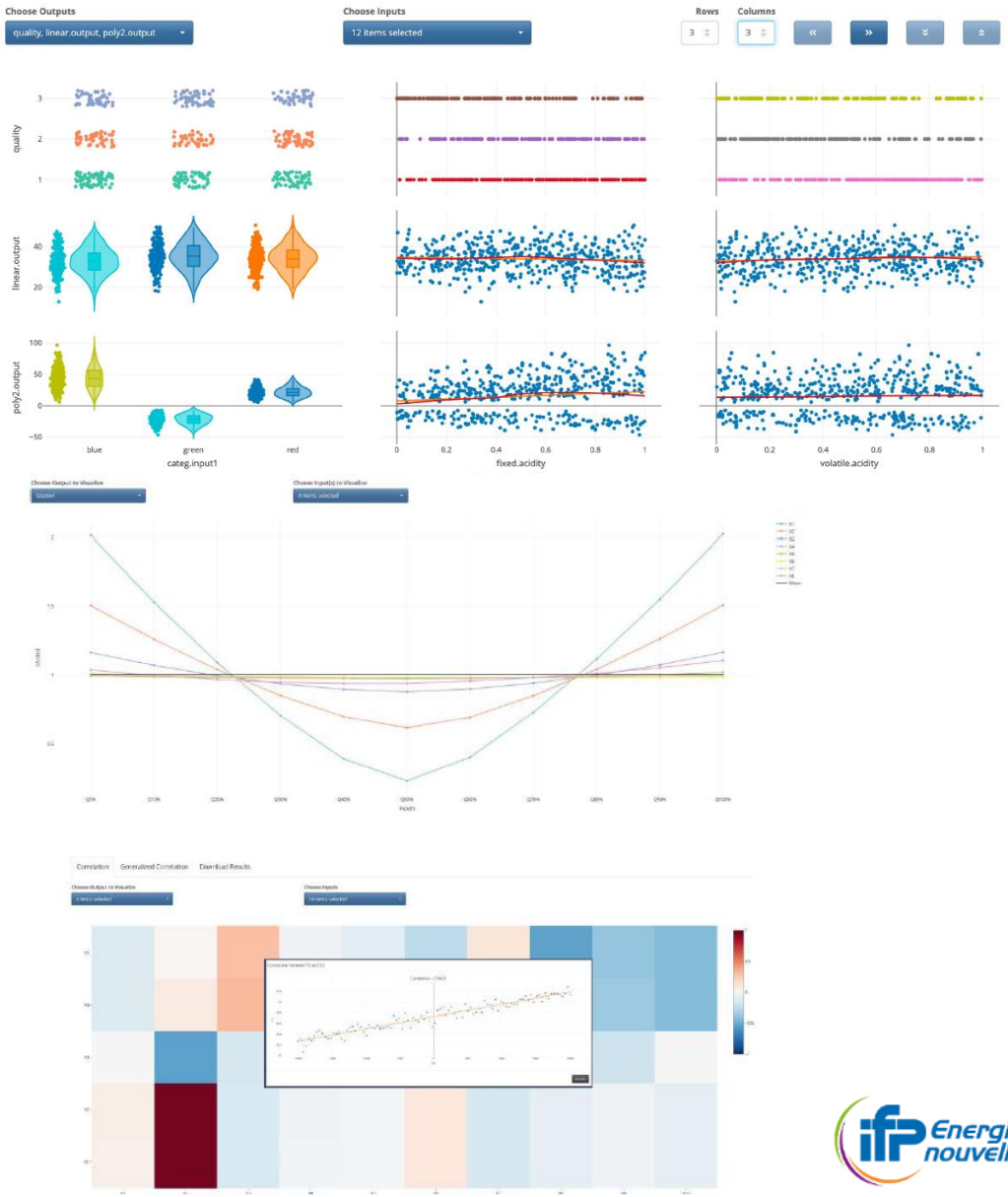
Surrogate modelling and dimension reduction

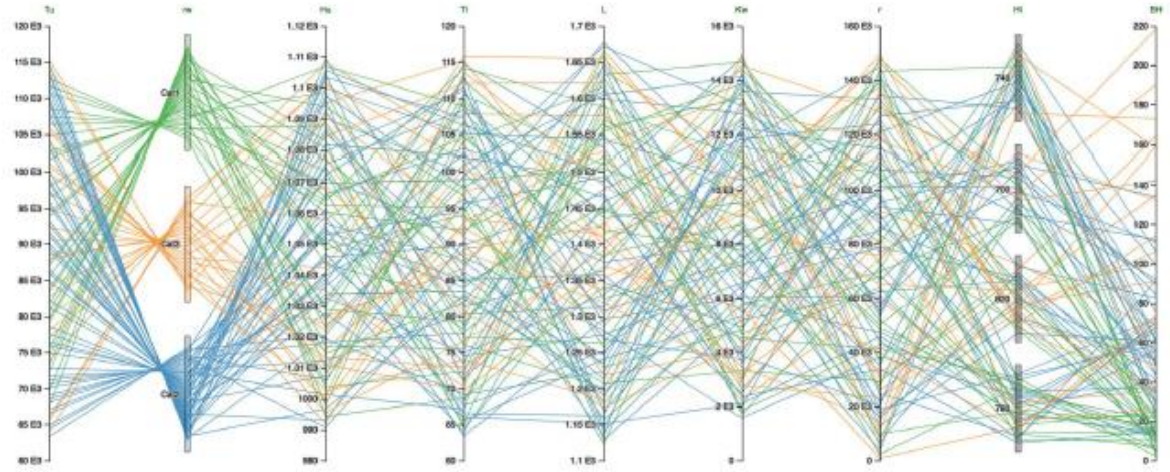
New **phD position** (2022) *Surrogate modeling for floating offshore wind turbine fatigue and power prediction in wind farm context based on I/O dimension reduction*
dir.: E. Vazquez (CSupelec) GIS LARTISSTE

LAGUN OPENSOURCE PROJECT: SAFRAN / IFPEN COLLABORATION

http://gdr-mascotnum.org/lagun/







REMEMBERING FRANÇOIS

François Wahl, research engineer at IFPEN during more than 30 years, was one of the co-founders of the Mascot-Num network in 2006, and its coordinator until 2009 with Fabrice Gamboa.