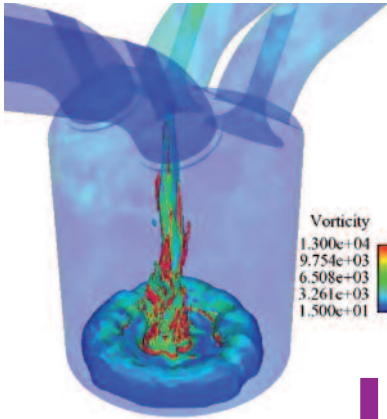


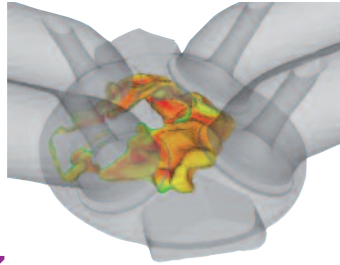
# Les Rencontres Scientifiques de l'IFP

IFP, Rueil-Malmaison, France ■ 18-19 November 2010

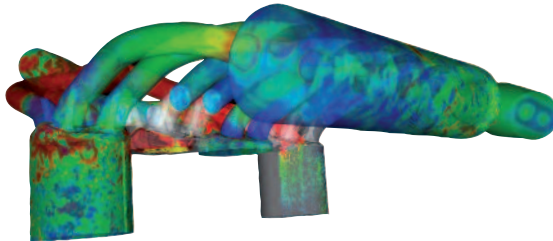
## International Conference on LES for Internal Combustion Engine Flows



Second  
Announcement  
and Registration Form



LES  
+ICE



Under the auspices of the French Academy of Sciences  
*Sous les auspices de l'Académie des sciences*



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# Context and objectives

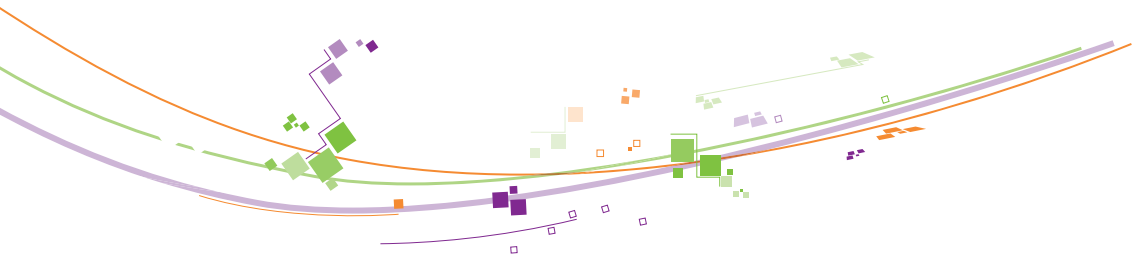
The LES4ICE conference will provide a forum for exchange concerning recent advances in Large-Eddy Simulation (LES) research applied to internal combustion engine (ICE) flows and related experimental techniques. It will bring together engine designers and research scientists working in the field of ICE to debate the state of the art in LES applied to ICEs and examine advanced experimental techniques capable of supporting and validating its development.

A major factor driving R&D in the automotive industry is an increasing demand on the part of our society to reduce CO<sub>2</sub> and pollutant emissions from road vehicles. Although alternative solutions are emerging, the ICE can be expected to remain the dominant energy converter, and it is therefore crucial to further improve its environmental

performance. The key to this is being able to move beyond the present state of the art in order to reliably predict and control individual engine cycles under realistic operating conditions, rather than being limited to a cycle-averaged understanding.

Today's state of the art in the field of Computational Fluid Dynamics (CFD) applied to ICE flows is based on the Reynolds Averaged Navier-Stokes (RANS) approach. This technique has proven its ability to address cycle-averaged phenomena, making it possible to characterize the dependency of combustion efficiency and emission levels on engine geometry and operating parameters. In terms of the future, however, RANS is limited to steady engine operation, with low levels of cyclic variability.

Due to its inherent principle of explicitly resolving large flow scales, which depend of the geometry studied, and of only modelling small scales, which can be assumed to be universal, the use of LES opens up new avenues for extending the scope of application of CFD for ICEs.

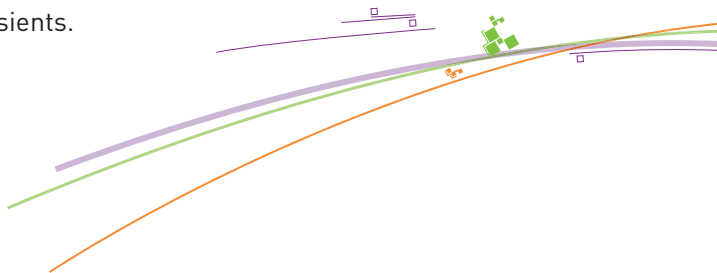


A major impetus for this is the continuous development of High Performance Computing (HPC) centers, and their support of LES research and application. The availability of ever better computational power will enable LES to resolve a significant part of the flow kinetic energy, thus potentially improving the prediction of engine aerodynamics and local turbulence conditions. In turn, this will lead to better prediction of liquid injection, mixing, combustion and pollutants, although related phenomena will hardly be resolved on meshes of practical interest, and thus require models that need experimental validation.

One of the expected benefits of LES is that it will offer a deeper and more detailed insight into complex coupled phenomena inside the engine, by predicting local instantaneous flow features in spatially filtered, individual engine cycles. This also gives unprecedented access to non-cyclic engine phenomena, such as cyclic variability, knock, cold starts or transients.

A central requirement for industrial use of LES in the future will be the availability of dedicated engine experiments capable of supporting the development of LES methodologies by providing reliable data of sufficient quality for validation. In particular, conventional experiments are aimed at providing a cycle-averaged view, while access to a more detailed understanding as envisaged with LES requires cycle-resolved, local and quantitative data. The ability to correlate local measurements with global engine characteristics on a cycle basis is also vital to understanding non-cyclic phenomena.

A number of questions still need to be answered before LES can be used on an industrial scale. These include basic modelling issues, appropriate numerical methods, methodology and CPU time issues. It will also be necessary to have access to advanced experimental data for validation. The LES4ICE conference will provide its participants with a unique opportunity to keep up with the relevant R&D being conducted worldwide.



# General information

*The international conference  
will be held at IFP in  
Rueil-Malmaison (France)  
on Thursday 18 and  
Friday 19 November 2010.*

## Scientific correspondent

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For more information on this  
international conference and other  
events organized by IFP:

<http://events.ifp.com>

## Scientific committee

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**Dr. T. Baritaud**

(Ferrari, Italy)

**Pr. K. Boulouchos**

(ETH Zürich, Switzerland)

**Dr. S. Candel**

(École Centrale Paris, France)

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**Pr. N. Peters**

(RWTH Aachen, Germany)

**Pr. T. J. Poinot**

(Institut de Mécanique des Fluides de Toulouse,  
France)

**Dr. F. Ravet**

(Renault, France)

**Pr. C. Rutland**

(Univ. of Wisconsin-Madison, USA)

**Pr. D. Thévenin**

(Univ. Magdeburg, Germany)

**Dr. P. Trouillet**

(PSA Peugeot Citroën, France)

**Dr.-Ing. T. Unger**

(Dr. Ing. h.c. F. Porsche AG, Germany)

# Information about the program

*The program will be divided in four main sessions. The sessions will be introduced by a keynote address and illustrated by oral presentations and posters.*

## Topics

- Engine aerodynamics
  - Engine combustion
- LES modelling of sprays
- Applying LES to engine sprays

## Oral presentations

- 35 minutes allotted for keynote speakers, including 5 minutes discussion
- 25 minutes oral presentations, including 5 minutes discussion

## Poster sessions

Posters are an integral part of the conference. They will be displayed throughout the duration of the conference. Posters should be set up on Thursday 18 November between 8.15 and 9.00 am, before the beginning of the conference.

## Official language

English will be the official language. Simultaneous interpretation will not be provided.

## Conference proceedings

Abstracts from the oral and poster presentations will be included in a volume given out on site to all registered participants.

Authors of the oral presentations will be invited to submit a full paper for publishing in the conference proceedings.

Manuscripts will be peer reviewed by the scientific committee and, upon acceptance, published after the conference in a special issue of *Oil & Gas Science and Technology - Revue de l'IFP*.

Each registered participant will receive one volume.

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# The conference at a glance

## Thursday 18 November

- 8.15 Registration
- 9.00 Beginning of the conference
- 9.15 **Session 1 - Engine aerodynamics**
- 12.45 *Lunch*
- 14.15 **Session 2 - Engine combustion**
- 18.10 End of the presentations
- 18.15 *Cocktail*
- 19.45 Bus departure to Paris (place Charles de Gaulle-Étoile, at the corner of Avenue Mac-Mahon)

## Friday 19 November

- 9.00 **Session 3 - LES modelling of sprays**
- 12.10 *Lunch*
- 13.40 **Session 4 - Applying LES to engine sprays**
- 15.05 Closing of the conference
- 15.30 Bus departure to Rueil-Malmaison RER station (connections to the airports and the railway stations)

# Program

## Thursday 18 November

8.15 Registration

9.00 Welcome address by S. Jullian, Scientific Director (IFP, France)

### Session 1 – Engine aerodynamics

9.15 **Keynote address: In-cycle structure and cycle to cycle variability of a tumbling flow. What can we learn from high speed PIV?**  
J. Borée (Institut Pprime, France)

9.50 **Characterisation of cyclic variability in an optically accessible IC engine by means of phase-independent POD**  
B. Boehm<sup>1</sup>, F. di Mare<sup>2</sup>, A. Dreizler<sup>1</sup> (1 TU Darmstadt, 2 DLR, Germany)

10.15 **Development and assessment of POD for analysis of turbulent flow in piston engines**  
K. Liu, D. C. Haworth (Pennsylvania State Univ., USA)

10.40 **A strategy for evaluation of LES applied to diesel engine in-cylinder flow - joint effort of simulation and experimental PIV flow analysis**  
E. Brußies<sup>1</sup>, V. Neubert<sup>1</sup>, G. Bittlinger<sup>1</sup>, J. Janicka<sup>2</sup>, A. Dreizler<sup>2</sup>, W. Bauer<sup>3</sup>  
(1 Robert Bosch, 2 TU Darmstadt, 3 ANSYS, Germany)

11.05 Break

11.30 **LES of the flow in a DISI engine: analysis of turbulent scalar - velocity correlations**  
F. di Mare<sup>1</sup>, D. Goryntsev<sup>2</sup>, J. Janicka<sup>2</sup> (1 DLR, 2 TU Darmstadt, Germany)

11.55 **Development and validation of a new LES turbulence model for wall-bounded flows**  
H. Baya Toda<sup>1</sup>, K. Truffin<sup>1</sup>, G. Bruneaux<sup>1</sup>, O. Cabrit<sup>2</sup>, F. Nicoud<sup>2</sup> (1 IFP, 2 i3M, France)

12.20 **A common engine platform for engine LES development and validation**  
V. Sick<sup>1</sup>, D. Reuss<sup>1</sup>, C. Rutland<sup>2</sup>, D. Haworth<sup>3</sup>, J. Oefelein<sup>4</sup>, J. Janicka<sup>5</sup>,  
T.-W. Kuo<sup>5</sup>, X. Yang<sup>5</sup>, M. Freitag<sup>6</sup> (1 Univ. of Michigan, 2 Univ. of Wisconsin,  
3 Pennsylvania State Univ., 4 Sandia National Lab., USA; 5 TU Darmstadt,  
Germany; 6 General Motors, USA)

12.45 Lunch

## Session 2 - Engine combustion

- 14.15 **Keynote address: Numerical experiments using DNS of turbulent flames at high Reynolds numbers**  
D. Thévenin (Univ. Magdeburg, Germany)
- 14.50 **LES of a growing turbulent premixed flame kernel using a dynamic flame surface density model**  
G. Wang<sup>1</sup>, M. Boileau<sup>1</sup>, D. Veynante<sup>1</sup>, K. Truffin<sup>2</sup> (1 École Centrale Paris, 2 IFP, France)
- 15.15 **LES of a spark-ignition engine using different combustion models**  
F. Magagnato (Univ. Karlsruhe, Germany)
- 15.40 **Evolutions of the ECFM-LES model for premixed combustion and applications to spark-ignited engines**  
K. Truffin, S. Richard, O. Colin, O. Laget, B. Réveille (IFP, France)
- 16.05 **Break**
- 16.30 **LES of turbulent combustion in a spark assisted homogenous charge compression ignition engine**  
T. Joelsson, R. Yu, X.-S. Bai (Lund Univ., Sweden)
- 16.55 **Using LES to quantify and analyse cycle-to-cycle variability in spark-ignition engine**  
V. Granet<sup>1,2</sup>, B. Enaux<sup>1,3</sup>, O. Vermorel<sup>1</sup>, V. Dugue<sup>2</sup>, L. Thobois<sup>3</sup>, T. Poinso<sup>4</sup>  
(1 CERFACS, 2 Renault SAS, 3 PSA Peugeot Citroën, 4 Institut de Mécanique des Fluides de Toulouse, France)
- 17.20 **Development of chemical kinetics tabulation method for the prediction of diesel engine pollutants**  
D.-E. Tudorache<sup>1,2</sup>, P. Auzillon<sup>1</sup>, L. Thobois<sup>2</sup>, N. Darabiha<sup>1</sup>, R. Vicquelin<sup>1</sup>, O. Gicquel<sup>1</sup>, B. Fiorina<sup>1</sup> (1 École Centrale Paris, 2 PSA Peugeot Citroën, France)
- 17.45 **A LES-CMC method for the numerical simulation of diesel engine combustion**  
F. Bottone<sup>1</sup>, A. Kronenburg<sup>2</sup>, D. Gosman<sup>1</sup>, A.-J. Marquis<sup>1</sup> (1 Imperial College London, UK; 2 ITV Stuttgart, Germany)
- 18.15 **Cocktail**

19.45 Bus departure to the meeting point in Paris

## Friday 19 November

### Session 3 - LES modelling of sprays

9.00 Keynote address: **Stochastic models of atomizing sprays; coupling with LES**  
M. Gorokhovski (École Centrale Lyon, France)

9.35 **Numerical study of primary break-up of liquid sheets: LES and instability analysis**

S.-K. Kannan, B. Peters (Univ. of Luxemburg, Luxemburg)

10.00 **Scalar dissipation rate and spray source term modelling for IC Engine LES**  
C. Rutland (Univ. of Wisconsin, USA)

10.25 Break

10.55 **LES predictions of the vortical flow structures in diesel injector nozzles**  
M. Gavaises, A. Theodorakakos, D. Papoulias (City Univ. London, UK)

11.20 **Eulerian-Eulerian and Eulerian-Lagrangian LES of diesel sprays**  
L. Martinez, A. Vié, C. Habchi, D. Muthusamy (IFP, France)

11.45 **Comparison of diesel spray combustion in different high-temperature, high-pressure facilities**

L. M. Pickett<sup>1</sup>, C. L. Genzale<sup>1</sup>, G. Bruneaux<sup>2</sup>, L.-M. Malbec<sup>2</sup>, L. Hermant<sup>2</sup>, C. Christiansen<sup>3</sup> (1 Sandia National Lab., USA; 2 IFP, France; 3 TU Denmark, Denmark)

12.10 Lunch

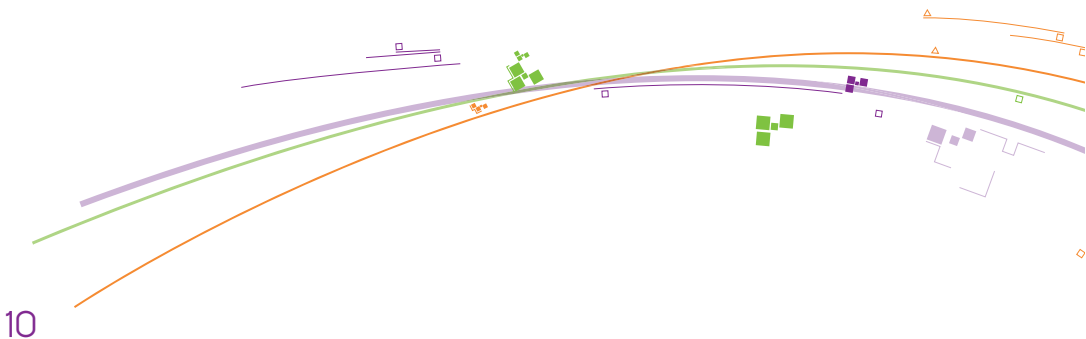
### Session 4 - Applying LES to engine sprays

13.40 Keynote address: **The role of unsteadiness and coherent structures in the internal flow of automotive injectors: LES improving the understanding of the atomisation generation**  
J. Hélie (Continental, France)

- 14.15 **LES of fuel injection nozzles in cold start conditions**  
R. Payri, F.-J. Salvador, J. Gimeno, G. Bracho (CMT, Spain)
- 14.40 **LES and optical studies of GDI pulsed liquid jets**  
B. Befrui, G. Corbinelli (Delphi, Luxemburg)
- 15.05 Closing of the conference
- 15.30 Bus departure to Rueil-Malmaison RER station (connections to the airports and the railway stations)

## Posters

- **Reliable prediction of particle dispersion with LES**  
D. Dimitrova<sup>1</sup>, M. Braun<sup>2</sup>, A. Sadiki<sup>1</sup>, J. Janicka<sup>1</sup> (1 TU Darmstadt, 2 ANSYS, Germany)
- **Evaluation of car aerodynamic and cylinder intake phase influences on the airbox efficiency of a Formula 1 car by using LES approach**  
F. Brusiani<sup>1</sup>, G.-M. Bianchi<sup>1</sup>, A. Bianchi d'Espinosa<sup>2</sup> (1 Univ. di Bologna, 2 Ferrari GeS, Italy)



# Registration

## Conference fees (VAT incl.)

**Before 4 October 2010**

- €450 for academics or public institute affiliates
- €650 for industry affiliates

**After 4 October 2010**

- €550 for academics or public institute affiliates
- €750 for industry affiliates

Special rate for students: €150 (\*)

(\*) Students will benefit from reduced conference fees in order to help them take part in this event. This special rate will be granted upon presentation of their student card and a letter of approval from the laboratory supervisor.

The conference fees cover attendance at the conference, conference proceedings, lunches, breaks, shuttle service, and the cocktail on Thursday 18 November.

They do not cover accommodation or the dinners.

## Registration

You can choose to register

- on-line through IFP web site: <http://events.ifp.com>
- or with the enclosed registration form to be completed and sent with your payment, to *Le Public Système*.

Upon receipt of the registration and the relevant payment, the administrative department will send a letter of acknowledgement.

## Payment

All fees are payable in Euros only:

■ by check sent to  
Ms. Claire Langlois  
Le Public Système  
40 rue Anatole France  
92594 Levallois-Perret Cedex, France

■ by wire transfer to the bank CIC  
**Agency:** CIC SAINT AUGUSTIN GCE SUD  
**Account owner:** LPS / REGISTRATION CONGRESS

**Account number:** 30066 10947 00010026840 37  
**IBAN:** FR76 3006 6109 4700 0100 2684 037  
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On the wire transfer order, please mention the reference **LPS0110W** and the **delegate's name**.

Participants are responsible for the wire transfer order bank charges. Please send a copy of the bank transfer order to: [clanglois@le-public-systeme.fr](mailto:clanglois@le-public-systeme.fr)

■ by credit card (Visa, Eurocard, Mastercard)  
Credit card payments are subject to additional charges to cover bank fees.

## Cancellation conditions

All cancellations must be notified in writing to *Le Public Système*.

**Before 4 October 2010**

All cancellations will be subject to a €40 cancellation fee.

**After 4 October 2010**

50% of the total will be held.

**After 18 October 2010**

No refund

# Accommodation

The conference registration fees do not cover accommodation. Participants are required to make their own reservations. The organizers have arranged special rates in the following hotels for 2 nights (Wednesday 17 and Thursday 18 November).

The hotels are located in Rueil-Malmaison with easy access to IFP or in Paris in the area of the place Charles de Gaulle-Étoile. Hotels cannot guarantee room availability for these dates after their deadline has passed.

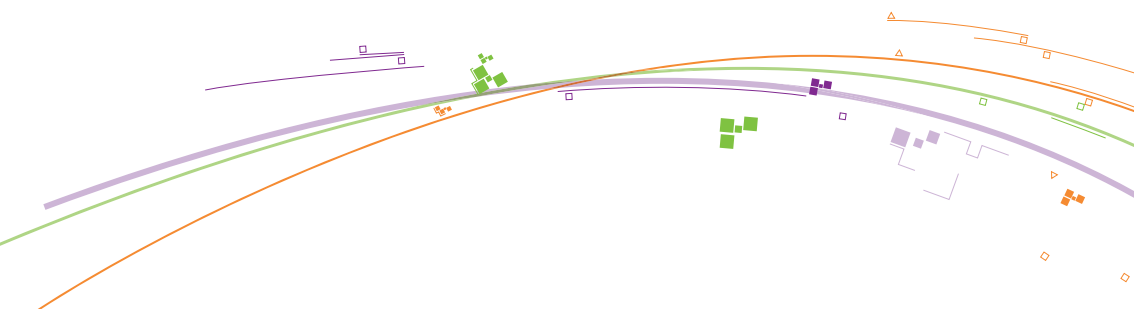
In order to benefit from the prices indicated below, please mention "IFP LES4ICE" when booking.

## Hotels in Rueil-Malmaison

Hotel	Address	Rate per night (including breakfast)	Deadline
QUALITY HOTEL RUEIL LA DÉFENSE ***	20 avenue Albert 1er, 92500 Rueil-Malmaison Tel.: +33 1 47 32 20 92 <a href="mailto:hotel-chaumiere@wanadoo.fr">hotel-chaumiere@wanadoo.fr</a>	€123	18 October
HÔTEL DES ARTS ***	3 bd Maréchal Joffre, 92500 Rueil-Malmaison Tel.: +33 1 47 52 15 00 <a href="mailto:contact@hoteldesartsrueil.fr">contact@hoteldesartsrueil.fr</a>	€99	18 October
QUALITY HOTEL RUEIL CENTRE ***	1 place Richelieu, 92500 Rueil-Malmaison Tel.: +33 1 47 08 20 20 <a href="mailto:hotel@hotel-rueil-centre.com">hotel@hotel-rueil-centre.com</a>	€123	18 October
IBIS PARIS RUEIL-MALMAISON **	16 bd de l'hôpital Stell, 92500 Rueil-Malmaison Tel. : +33 1 47 32 96 96 <a href="mailto:h1407@accor.com">h1407@accor.com</a>	€133	18 October

## Hotels in Paris

Hotel	Address	Rate per night (including breakfast)	Deadline
MAGELLAN ***	17-19 rue Jean-Baptiste Dumas 75017 Paris Tel.: +33 1 45 72 44 51 <a href="mailto:paris@hotelmagellan.com">paris@hotelmagellan.com</a>	€136	18 October
HÔTEL CÉCILIA ***	11 avenue Mac-Mahon, 75017 Paris Tel.: +33 1 43 80 32 10 <a href="mailto:hotelcecilia@gmail.com">hotelcecilia@gmail.com</a>	€135	18 October
PRINCESSE CAROLINE ***	1bis rue Troyon, 75017 Paris Tel.: +33 1 58 05 30 00 <a href="mailto:contact@hotelprincessecaroline.fr">contact@hotelprincessecaroline.fr</a>	€140	18 October
MERCURE PARIS ARC DE TRIOMPHE WAGRAM ***	3 rue Brey, 75017 Paris Tel.: +33 1 56 68 00 01 <a href="mailto:H2053@accor.com">H2053@accor.com</a>	€205	18 October
HÔTEL ÉLYSÉE ÉTOILE **	5 rue de l'Étoile, 75017 Paris Tel.: +33 1 43 80 22 19 <a href="mailto:elysee.etoile@wanadoo.fr">elysee.etoile@wanadoo.fr</a>	€105	18 October
HÔTEL DES DEUX AVENUES **	38 rue Poncelet, 75017 Paris Tel: + 33 1 42 27 44 35 <a href="mailto:hotel-des-deux-avenues@wanadoo.fr">hotel-des-deux-avenues@wanadoo.fr</a>	€110	18 October





# What is IFP?

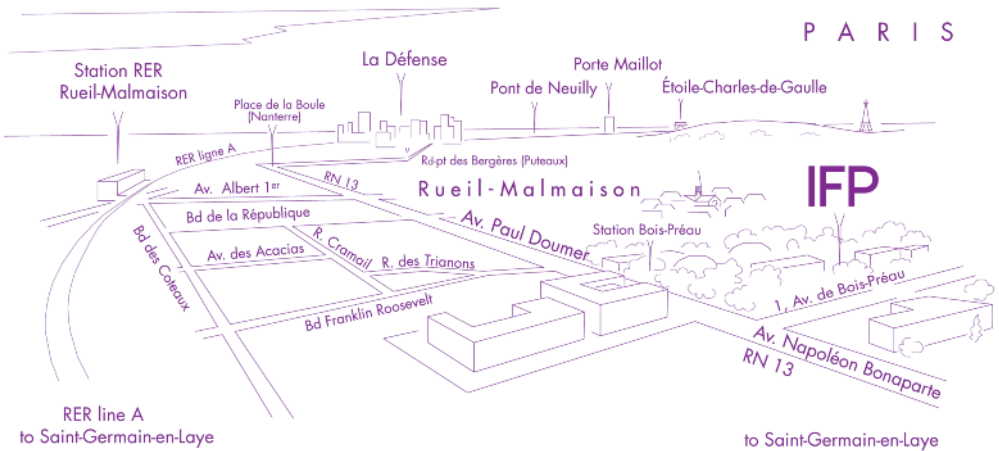
IFP is a world-class public-sector research and training center, aimed at developing the technologies and materials of the future in the fields of energy, transport and the environment. It provides public players and industry with innovative solutions for a smooth transition to the energies and materials of tomorrow – more efficient, more economical, cleaner and sustainable.

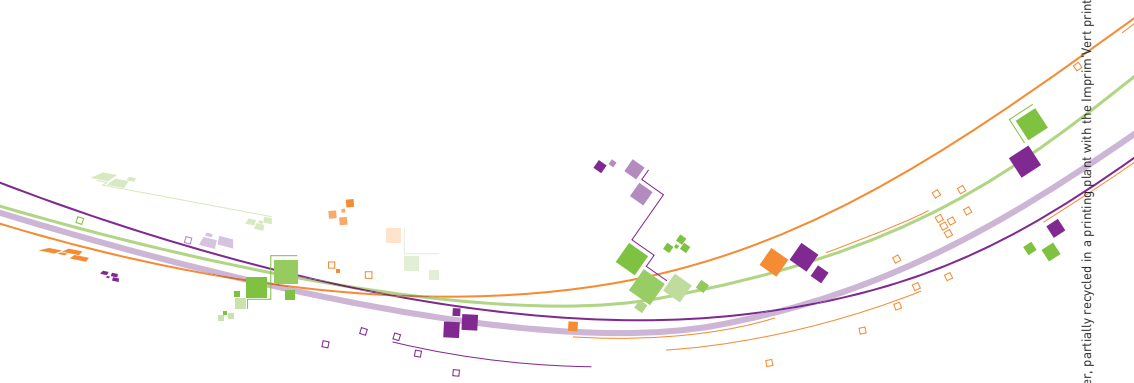
To fulfill its mission, IFP has 5 complementary strategic priorities:

- capturing and storing CO<sub>2</sub> to combat the greenhouse effect,
- diversifying fuel sources,
- developing clean, fuel-efficient vehicles,
- converting as much raw material as possible into energy for transport,
- pushing back the boundaries in oil and gas exploration and production.

An integral part of IFP, its graduate engineering school prepares future generations to take up these challenges.

More information on <http://www.ifp.com>





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