2016 CATALOGUE OF ITECH TRAINING COURSES

RESEARCH & DEVELOPMENT DEPARTMENT

OPEN TO PROFESSIONALS OUTSIDE THE EDF GROUP

« ITECH SHARES PRACTICES, EXPERTISE, AND INNOVATIONS RESULTING FROM RESEARCH WORK UNDERTAKEN BY THE R&D DIVISION AT EDF. »

On behalf of EDF's R&D, I am delighted to present the ITech training catalogue for 2016.

ITech, the Technology Transfer Institute (Institut de Transfert des Technologies) was created in 1998 at the request of the R&D Division at EDF. It is a specialist training organisation within the EDF Group, and provides a space for information transmission, sharing, and exchange. The goal for the organisation is to share practices, expertise, and innovations resulting from research work undertaken by the R&D Division at EDF.

The ITech Institute is aimed at EDF Group companies and is also available to professionals outside the group, research institutes, and companies who want to boost their performance and make their capacity for innovation more dynamic.

Based on the EDF R&D Division's skills, expertise, and know-how, the ITech training courses are designed and led by research engineers who are well-known in their fields of expertise.

As from 2016, R&D and ITech are based in Paris-Saclay and are located directly adjacent to the future EDF Training Campus. In this new location we will be able to use innovative training equipments and to enjoy « training » and « research » partnerships dynamic concentrated at Paris-Saclay.

We hope that this catalogue will help you in planning your training processes, whether for yourself or your staff.

Jean-Michel ROMANN,
R&D Human Resources Manager, EDF

R&D, AT THE HEART OF THE EDF GROUP'S INDUSTRIAL PERFORMANCE

EDF's R&D designs and implements tomorrow's solutions to respond to the energy challenges of the 21st century. The power of their supercomputers (modelling, digital simulation) means EDF is the world's number one industrial research centre.

The Fab Lab i2R ('breakthrough innovation incubator') brings expertise and numerical control tools together to facilitate prototype design at EDF Lab Les Renardières.

EDF'S R&D ACTIVITIES
BASED AROUND THREE MAIN STRATEGIC AXES:

1. **Consolidating and developing competitive and decarbonated generation mixes**
2. **Preparing tomorrow's electricity systems**
3. **Developing and experimenting with new energy services for customers**

Its field of activity covers the wide range of the company's concerns, from electricity generation to distribution, and from the environment to customer knowledge.

Its philosophy is solidly anchored in the reality of the various EDF activities, and its technologies are validated by considerable practical expertise.

LOCATIONS OF EDF'S TEN R&D CENTRES ACROSS THE WORLD

FRANCE
- CHATOU
- CLAMART
- LES RENARDIÈRES

UNITED KINGDOM
- LONDON
  R&D UK CENTRE

GERMANY
- KARLSRUHE
  EUROPEAN INSTITUTE FOR ENERGY RESEARCH (EIFER)

ITALY
- MILAN
  EDISON

POLAND
- CRACOW
  EDF R&D POLSKA

CHINA
- BEIJING

USA
- PALO ALTO

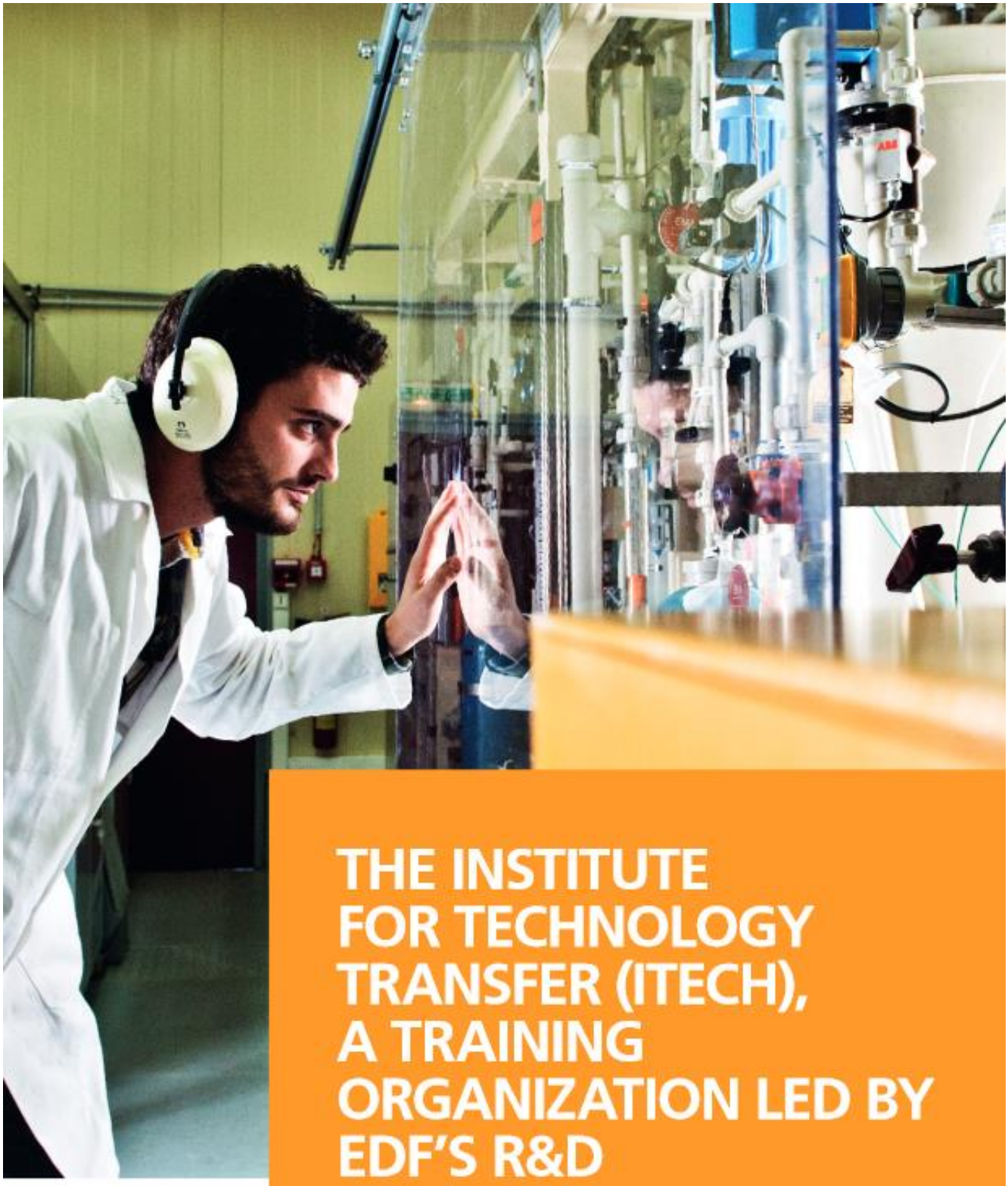
SINGAPORE

PARIS-SACLAY, A STRATEGIC SITE

With ten R&D sites in France and abroad, EDF will benefit from a further centre in 2016, located in Paris-Saclay, close to the future EDF Training Campus. Destined to welcome the Clamart research teams, this centre gives a new ambition to R&D, and places innovation and training at the heart of the Group's priorities.

By associating the EDF Lab Paris-Saclay and the Group's Training Campus, EDF's future site in Palaiseau will thus be an integrated unit into the national scientific and technological «cluster» at Paris-Saclay. The objective is to develop synergies between research and training, innovation, and skills, creators of value for the future.

Aerial view of EDF Lab Paris-Saclay in Palaiseau.



Corrosion test on a steam generator tube at EDF Lab Les Renardières.

THE INSTITUTE FOR TECHNOLOGY TRANSFER (ITECH), A TRAINING ORGANIZATION LED BY EDF'S R&D

The ITech, the Institute for Technology Transfer, was created in 1998 upon the initiative of EDF's R&D department. It's one of the group's four training organisations.

It is a place for the transmission, sharing, and exchange destined to spread best practices, expertise, and innovation from EDF R&D's research to the entire EDF Group.

Development of web sites and mobile apps to enhance customer relations, EDF Lab Clamart.

TRAINING COURSES AVAILABLE

There are 23 training courses available to professionals outside the EDF Group. The courses take place at the EDF R&D Division's sites (Les Renardières, Chatou and Paris-Saclay), for proximity to laboratories and testing equipment, and contact with EDF's researchers and technicians. Find the list of courses available at: http://researchers.edf.com.

TRAINERS WHO ARE KEY PLAYERS IN THE COMPANY

Courses are primarily led by R&D engineers and technicians whose technical expertise is recognized both in and out of the company. In their professional work, they alternate between theory and practice. Their day-to-day relationships with EDF's various operational units allow them to adapt and enrich their skills, and, as a consequence, the content of the courses they propose.

EFFECTIVE PEDAGOGICAL ORGANISATION FOR OPERATIONAL BENEFIT

For each course, a pedagogical manager supervises the participation of the different participants. Interactive sequences are developed in each course, where exercises, case studies, and practical work (digital simulations or experiments on test benches) help verify phenomena and concepts, and solidify learning. Along the same lines, lab visits are organised each time the course subject lends itself to this.

With the Open Innovation team, here in a meeting, EDF's Research and Development sites, together with EDF Inc. and the Asia Pacific Division, have an international network for identifying external innovations and passing on their findings to EDF Lab Chatou.

CHECK COURSE OFFERINGS AND SIGN UP FOR ITECH COURSES

Those interested in training courses are invited to complete the following registration request form and return it to us by e-mail.

A simplified professional development convention is then established between your company and the EDF Research and Development Technology Transfer Institute.

Participants will then receive an invitation to attend by email. A practical guide (list of hotels near the training site, access information) will be attached.

ENROLMENT FEES

The prices listed are valid for one year. They include the classroom sessions, the course materials and lunches. Lodging and transportation fees are at the expense of participants.

IN THE EVENT OF CANCELLATION

If a course participant cannot attend the scheduled training, they can be replaced by another person. Moving the registration to another session can only be done with at least 15 days notice before the beginning of the course.

If a registration is not cancelled at least 15 days before the beginning of the course, it is considered to be definitive and payment is due in full. Any course that has started is due in full.

The institute reserves the right to cancel a session if there are not enough participants.

ITECH CONTACTS

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COURSE LOCATIONS

EDF Lab Paris-Saclay
7, avenue Gaspard Monge
91120 PALAISEAU

EDF Lab Chatou
6, quai Watier
78401 CHATOU CEDEX

EDF Lab Les Renardières
Avenue des Renardières, Écuelles
77818 MORET-SUR-LOING CEDEX

EXTERNAL REGISTRATION REQUEST FORM FOR ITECH TRAINING COURSES

Return this registration request form by e-mail to:

Evelyne Fiorenza, Corinne Tripet, or Catherine Leydet
EDF Research & Development - Institut de Transfert des Technologies
EDF Lab Paris-Saclay - 7, boulevard Gaspard Monge - 91120 Palaiseau
Tel: +33 (0)1 78 19 40 27, +33 (0)1 78 19 40 32, or +33 (0)1 78 19 40 20
Email: evelyne.fiorenza@edf.fr, corinne.tripet@edf.fr, or catherine.leydet@edf.fr

TRAINING COURSE

Title: .....

Code: ..... Dates: ..... Price: ..... € excl. tax

PARTICIPANT

Surname: ..... First Name: .....

Nationality: ..... Email: .....

Telephone: .....

Address to send invitation to attend training course to: .....

.....

.....

COMPANY

Company name: _

Training manager:

Surname: ..... First Name: .....

Email: .....

Person in charge of registration (if different to above):

Surname: ..... First Name: .....

Title: ..... Email: .....

Legal Name: .....

NAF code: ..... SIRET Number (obligatory if a French company): .....

VAT ID Number (obligatory if a French or EU Company): .....

Billing address: .....

.....

Telephone .....

Company stamp

Date and signature

Please be sure to fill in the entire registration request form

SUMMARY OF THE TRAINING COURSES

STATISTICAL ANALYSIS AND CUSTOMER KNOWLEDGE

0-EF-STAT-BASE ARN3887

Fundamentals and vocabulary of statistics

Knowledge of the vocabulary, concepts, and essential tools of statistics, and a critical look at this initial processing.

This course includes other training in statistical methods and a useful introduction to other statistics courses.

Trainee profiles: Anyone who wishes to gain a better understanding of the basic concepts of statistical methods and data processing, who wishes to consult a statistician and build an independent and critical way of reviewing the results of a study.

1 day
EDF Lab Paris-Saclay
830 euros
May 10, 2016
Jérôme CUBILLÉ - Anne DE MOLINER
Commercial Innovation and Market Analysis Department

FUEL CORE, NEUTRON FLUX

4-CL-BASE-NUCL ARN4688

Basic knowledge of nuclear physics

Basic physical and theoretical principles for nuclear physics, neutronics, and reactor physics.

This module provides the basic knowledge necessary to access the following module (ARN4621).

A book entitled "La physique des réacteurs nucléaires" [The Physics of Nuclear Reactors] in the EDF R&D collection will be handed out during the course.

Trainee profiles: Engineers and technicians interested in the neutron modelling of reactor cores so as to optimise core design, operation and safety and who will have to use these tools in the future.

3 days
EDF Lab Paris-Saclay
1920 euros
25-27 May 2016
Serge MARGUET
Simulation in Neutronics, Information Technology and Scientific Computation Department

5-CL-COEURS 1 ARN4621

Neutron physics and computing of reactor cores

To refresh and further fundamental knowledge of neutrons and the application of this knowledge in tools for the modelling of phenomena involved in reactor cores.

A book entitled "La physique des réacteurs nucléaires" [The Physics of Nuclear Reactors] in the EDF R&D collection will be handed out during the course.

Trainee profiles: Engineers and technicians interested in the neutron modelling of reactor cores so as to optimise core design, operation and safety and who will have to use these tools in the future.

3 days
EDF Lab Paris-Saclay
1920 euros
21-23 September 2016
Serge MARGUET

Simulation in Neutronics, Information Technology and Scientific Computation Department

9-CL-REACTEUR ARN4874

Theory of the physics of PWR reactors

Trains engineers in theoretical calculation methods for nuclear reactors, with the objective of being able to simply calculate the general parameters of a reactor.

A book entitled "La physique des réacteurs nucléaires" [The Physics of Nuclear Reactors] in the EDF R&D collection will be handed out during the course.

Trainee profiles: Engineers and technicians concerned by the neutron modelling of reactor cores so as to optimise core design, operation and safety, who are interested in the complex physics of a pressurised water reactor.

2 days
EDF Lab Paris-Saclay
1570 euros
29-30 November 2016
Serge MARGUET
Simulation in Neutronics, Information Technology and Scientific Computation Department

ENVIRONMENT, WASTE

22-CL-DISP-1 ARN3942

Atmospheric dispersion - Module 1 : General considerations and wind tunnel studies

Acquire basic notions about atmospheric dispersion.
Learn about different approaches in digital and experimental modelling.

Trainee profiles: Engineers and technicians who wish to acquire basic knowledge in atmospheric dispersion and related digital simulation.

3 days
EDF Lab Chatou - Lyon (Ecully)
1870 euros
28-30 November 2016
Evelyne LANDRIEUX
Fluid Mechanics and Energy and Environment Department

OPERATION OF POWER GRIDS, OPERATING GRID SYSTEMS

28-CT-GEST-RESO ARN4644

Introduction to asset management through reliability of electric networks

Introduction to asset management using reliability of electric networks, with a presentation of the different methods and tools in the area (a "redline" business example is also implemented during the entire training program.)
The following areas will be covered: introduction and basic mathematical concepts; statistical modelling of equipment behaviour; Methods for maintenance via reliability; reliability-based approaches to replacing and developing power grids; applications in EDF business areas; conclusions on future issues for asset management; special features of smart grids.

Trainee profiles: Licensees, managers, and operators of electricity networks.

2 days
EDF Lab Paris-Saclay
6-7 June 2016

1520 euros
John MCDONALD - Philippe CARER
Measurements and Information Systems of Electrical Networks Department

OPERATION AND MANAGEMENT OF POWER PLANTS

36-CT-MODELICA/DYMOLA ARN4890

Introduction to modelling in Modelica of the operation of energy processes using the dymola tool

Presentation of the general principles of DYMOLA software and the MODELICA language

Presentation of the "ThermoSysPro" library of MODELICA modules developed by EDF R&D for modelling power generation plans.

Development of modules and models (energy processes).

Simulation of models (reverse calculations, sizing calculations and operations studies).

Trainee profiles: Engineers and technicians required to deal with problems related to the implementation of energy procedures.

2 days
EDF Lab Chatou
1520 euros
18-19 January 2016
23-24 May 2016
Baligh EL HEFNI
Simulation and Traitment of information for Power Generation Department

HYDRAULICS

40-CT-SEDIM ARN4860

Sedimentology in rivers and reservoirs

Understand the principles of physics governing the flow of sediment in rivers and reservoirs.

Understand the principles of river morphology and the current environmental problems linked to changes in rivers.

Know how to anticipate disturbances in sediment flow brought about by river construction.

Be able to see the relationship between the disturbances that affect solid transport and the consequences on the environment.

Trainee profiles: Technicians and engineers familiar with hydraulics and concerned by the design and operation of hydraulic facilities in rivers and the management of their environment.

2.5 days
EDF Lab Chatou
1740 euros
4-6 October 2016
Magali JODEAU
Laboratory for Hydraulics and the Environment Department

MECHANICS

50-EF-ASTER-CIVIL ARN3960

Code_Aster and Salomé_Méca - Module 4: Civil engineering

To understand the main ways in which Code_Aster is used in civil engineering. To apply its functions to examples typical of civil-engineering studies.

Prerequisites: Basic knowledge of the finite-elements method, some previous use of Code_Aster. Alternatively, participants should have taken the Introduction to Code_Aster course.

Trainee profiles: Engineers who are required to carry out or supervise advanced structural calculations for civil engineering.

2 days
EDF Lab Paris-Saclay
1520 euros
2-3 May 2016
Sylvie MICHEL-PONNELLE
Analysis in Mechanics and Acoustics Department

OPERATING RELIABILITY, SAFETY AND RADIATION PROTECTION

80-EF-FIABIL ARN2681

Reliability and safety of industrial systems

Provide trainees with a very broad overview of dependability methods. Upon completion of the course, trainees are not expected to be able to independently apply the methods presented. However, this course will provide trainees wishing to focus on a particular area with the information they need to do so at a later date.

FIABIL is targeted at EDF employees and focuses on the issues of the company, without preference for any particular area. The course however is open to the general public.

Trainee profiles: Engineers wishing to develop global knowledge about Dependability.

5 days
EDF Lab Paris-Saclay
2820 euros
21-25 March 2016
Anne DUTFOY-LEBRUN
Industrial Risk Management Department

83-CT-INCERT-METHO ARN4889

Uncertainties – Methodology introduction module: Taking account of uncertainties and learning about numerical models

Presentation of a generic methodology for quantification of uncertainties in studies involving models and codes of physics calculations (measuring channels, digital mechanics simulations, thermohydraulics, neutronics, environment, etc.)
Presentation of the basic mathematical methods associated with this methodology
Present advanced methods for handling high computation time modelling cases

The following ITECH course complement this course:
« Uncertainties – Implementation module: Open TURNS software » (ARN4888) for IT implementation

Trainee profiles: Engineers and technicians (major industries and research organisations), doctoral students, and interns

3 days
EDF Lab Chatou
1870 euros
13-15 September 2016
Bertrand IOOSS
Industrial Risk Management Department

84-CT-INCERT-OPEN TURNS ARN4888

Uncertainties – Implementation module: Open TURNS software

How to use the Open TURNS platform to perform uncertainty processing studies, via its Python interface.

How to couple Open TURNS to its business tool.

Note: Anyone wishing to learn in detail about the principles of this methodology is invited to take ARN4889 "Methodology Introduction Module: Taking account of uncertainties and learning about numerical models". This training is recommended, but is not a prerequisite for this course.

Trainee profiles: Engineers who need to perform uncertainty processing studies

3 days
EDF Lab Paris-Saclay
1870 euros
5-7 September 2016
Anne DUTFOY-LEBRUN
Industrial Risk Management Department

85-CT-KB3-BDMP ARN4875

System reliability: use of the KB3-BDMP dynamic tool

Understand why reconfiguration capacities, passive redundancies, certain repair policies, and common cause failures make static models unusable, such as fault trees or reliability diagrams used in systems operations security.
Learn about the BDMP graphic format ("Boolean logic Driven Markov Processes") which enables rapid construction of models specifying complex dynamic behaviours. See how they can be linked to stochastic Petri nets.
Master quantification of dynamic models (BDMP and others) with the two processing tools from the KB3 platform: FIGSEQ to find and calculate probability for sequences leading to a non-desired status, YAMS for calculating any indicator (reliability, availability, cost, productivity, etc.) using Monte Carlo simulations.
A book entitled "Gestion de la complexity dans les études quantitatives de sûreté de fonctionnement des systèmes" [Complexity Management in Quantitative Studies of System Operational Safety] in the EDF R&D collection will be handed out during the course.

Note: This course can be conducted in English on request.

Trainee profiles: Reliability engineers, reliability consultants who need to perform studies of complex systems.

2 days
EDF Lab Paris-Saclay
1570 euros
21-22 March 2016
Marc BOUISSOU
Industrial Risk Management Department

93B-EF-KB3 ARN4878

Using KB3 in the scope of PSAs

Learn how to use KB3 software, designed at R&D, which is the reference tool used at EDF to assist in design and updating of PSA IT models, by automatically generating fault trees.

Prerequisites: Prior knowledge of reliability. Ideally, completion of FIABIL course (ITech course ARN2681).

Trainee profiles: PSA Analysts who conduct systems analysis, and more generally, engineers who will use IT models of Probabilistic Safety Analyses (PSAs).

3 days
EDF Lab Paris-Saclay
1870 euros
16-18 March 2016
Nathalie VILLATTE
Industrial Risk Management Department

THERMAL-HYDRAULICS

109-CL-SATURNE ARN4864

Code_Saturne - Module 1: Getting started

Conduct single-phase thermo-hydraulic studies with the open source CFD (Computational Fluid Dynamics) program *Code_Saturne*, developed by EDF:
- Create a geometry and a mesh.
- Set up a computation.
- Post-process the results.

Trainee profiles: Fluid mechanics research engineers

2 days
EDF Lab Chatou
1520 euros
15-16 March 2016
8-9 November 2016
Erwan LE COUPANEC
Fluid Mechanics and Energy and Environment Department

109B- CL-SATURNE_AVAN ARN3869

Code_Saturne - Module 2: Advanced use and development

Presentation of the methods and development tools used by the Code_Saturne development team: version management software (git, svn), editors (emacs, vi), debuggers (gdb, valgrind).
Provides a base for development in Code_Saturne: use of data structures, presentation of best practices, and different subsystems.

Prerequisites: Knowledge in the following areas is highly recommended for using the software:
- Basics of computational fluid dynamics
- Use of Unix and Linux systems
Basics of fortran 90 and C programming (highly recommended to operate certain user sub-programs).

Trainee profiles: Fluid mechanics research engineers.

1 day
EDF Lab Chatou

830 euros
November 10, 2016
Martin FERRAND - Yvan FOURNIER
Fluid Mechanics and Energy and Environment Department

PROCESSING SCIENTIFIC INFORMATION

112-EF-SALOME 1 ARN4881

SALOME Platform - Module 1: Getting started

Learn about SALOME, a generic platform for preprocessing, postprocessing, and coupling of codes for digital simulation, produced as open-source software in the framework of the EDF-CEA NEPAL co-development project.

- Create a CAD model.
- Mesh a CAD model (in tetrahedrons and hexahedrons)
- Display calculation results.
- Supervise a calculation scheme.

Trainee profiles: EDF engineers in charge of conducting studies using the SALOMÉ platform, wishing to have an initial view of its features.

1 day
EDF Lab Paris-Saclay
830 euros
May 23, 2016
November 21, 2016
Paul RASCLE
Simulation in Neutronics, Information Technology and Scientific Computation Department

113-EF-SALOME 2 ARN4884

SALOME Platform - Module 2: Advanced use of preprocessing modules

Deepen understanding of geometries and meshes with the SALOME platform, for studies in physical fields (mechanics, fluid mechanics, thermal, etc.)

- Use detailed design features from CAD models.
- Mesh CAD models with different meshers from the SMESH module.
- Check the quality of the meshings obtained.

Trainee profiles: Engineers in charge of conducting studies using the SALOMÉ platform, wishing to deepen their knowledge acquired in module 1.

2 days
EDF Lab Paris-Saclay
1520 euros
24-25 May 2016
22-23 November 2016
Paul RASCLE
Simulation in Neutronics, Information Technology and Scientific Computation Department

114-EF-SALOME 3 ARN3905

SALOME Platform - Module 3: Integration and supervision with YACS

Build SALOME components, particularly by using external scientific design codes using the YACSGEN tool
Build and execute a design diagram based on the YACS supervision module and coupling on the SALOME platform
Learn how to integrate new modules into SALOME.

Trainee profiles: Engineers responsible for integrating design codes into the platform and implementing design diagrams.

2 days
EDF Lab Paris-Saclay
1520 euros
30-31 May 2016
Ovidiu MIRCESCU
Simulation in Neutronics, Information Technology and Scientific Computation Department

115-EF-SALOME 4 ARN3919

SALOME Platform - Module 4: Advanced use of the ParaViS visualisation module

Master importation of calculation results into the ParaVIS module
Acquire basic concepts to visualise study results
Generate animations to present a result
Understand mechanisms for quantitative analysis of a result
Save a session
Introduction to the advantages of scripting in ParaViS

Trainee profiles: Engineers in charge of conducting studies using the SALOMÉ platform, wishing to master the postprocessing model to visualize study results.

1 day
EDF Lab Paris-Saclay
830 euros
May 26, 2016
November 28, 2016
Patrick LEBAILLY
Simulation in Neutronics, Information Technology and Scientific Computation Department

119-EF-SALOME 7 ARN3984

SALOME Platform - Module 7: Manipulating grids and fields with Medcoupling

To write Python grid and field manipulation scripts to meet their requirements.

Prerequisites: PYTHON language programming - Experience in numerical simulation. Experience in PARAVIEW/PARAVIS is advisable for viewing the generated data in practical work.

Trainee profiles: Engineers in charge of research through numerical simulation who wish to manipulate their grids and fields using python script for the purposes of their research.

1 day
EDF Lab Paris-Saclay
830 euros
November 30, 2016
Anthony GEAY
Simulation in Neutronics, Information Technology and Scientific Computation Department

120-CT-CALIBRE ARN4896

Use of high-performance computional tools

Learn about high-performance computational tools (clusters) available at EDF R&D.
Learn to launch business code to effectively use the computational power of clusters.

Trainee profiles: Beginning users who have to run computational code on a cluster.

2 days
EDF Lab Paris-Saclay

1520 euros
5-6 October 2016
Hugues PRISKER
Technology and information system Delegation

121-CT-PARALLEL ARN4885

Introduction to parallelism: machines, languages, and algorithms

Introduction to the major issues of parallel calculations (machines, languages, and algorithms) in the context of industrial digital simulation.

Trainee profiles: Any developer of scientific code on a parallel machine.

3 days
EDF Lab Paris-Saclay
1870 euros
November 29 - December 1, 2016
Laurent PLAGNE
Simulation in Neutronics, Information Technology and Scientific Computation Department

Le groupe EDF est certifié ISO 14001 Décembre 2015

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