OpenTURNS UQ Software and its Graphical User interface

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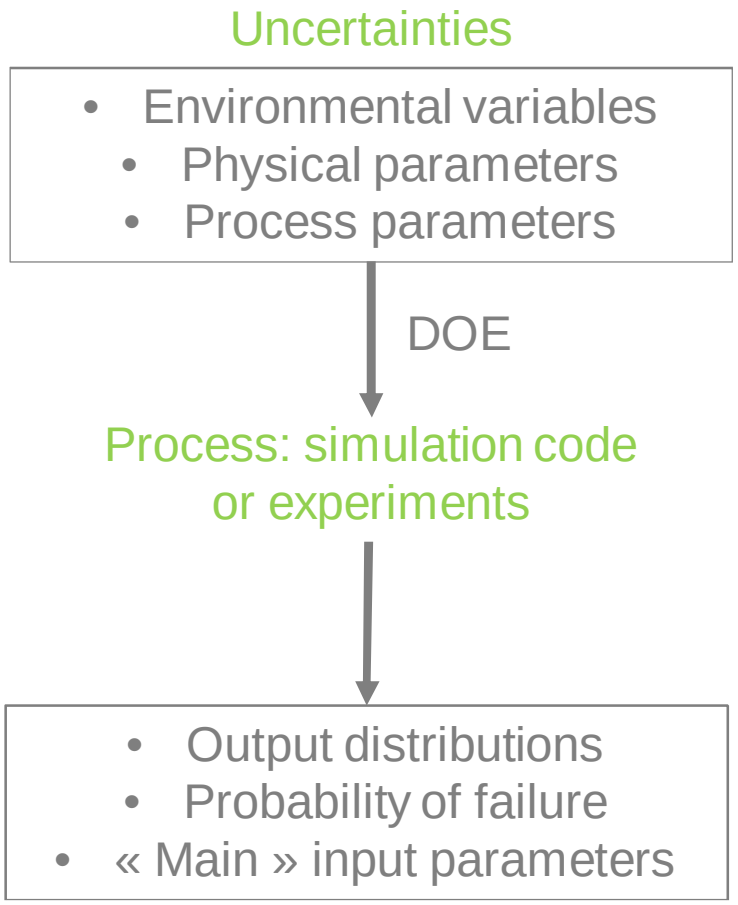
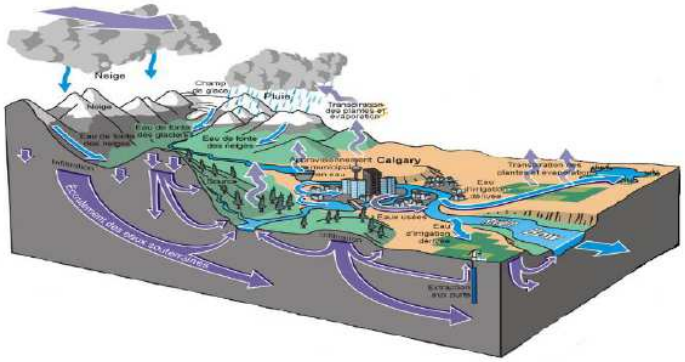
INDUSTRIAL CONTEXT - INTERESTS

- **Exploratory study : understand a phenomena, an experimental or industrial process**
- **Safety study : evaluate a safety margin (failure probability, rare events)**
- **Design study : optimizing and control the performances**



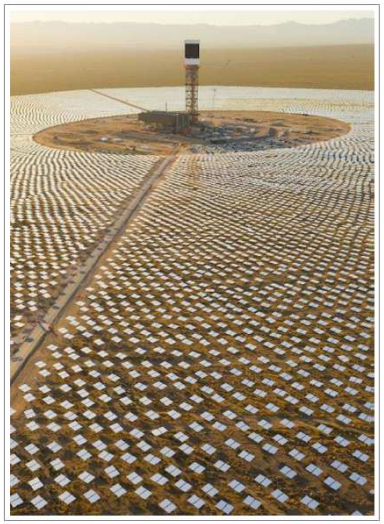
INDUSTRIAL CONTEXT - INTERESTS

- **Exploratory study : understand a phenomena, an experimental or industrial process**
  - Hydraulic model



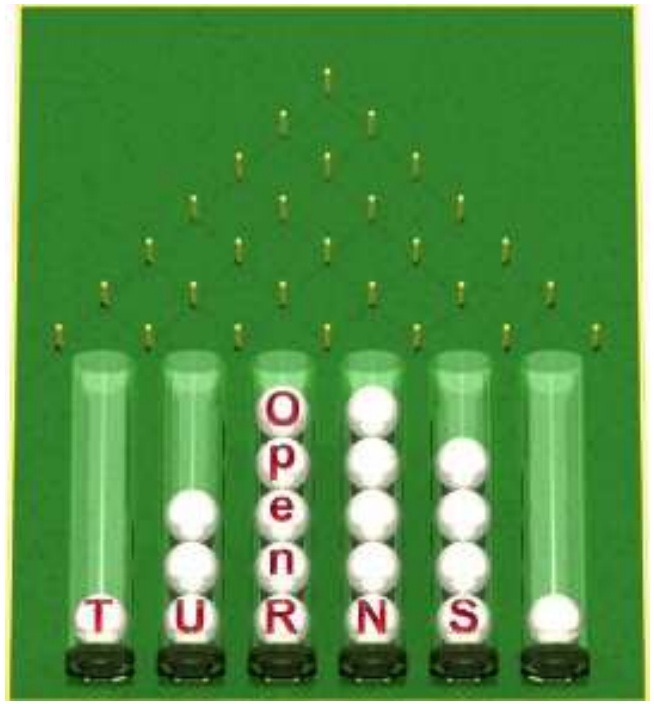
- **Safety study : evaluate a safety margin (failure probability, rare events)**
  - Nuclear lifetime studies

- **Design study : optimizing and control the performances**
  - Renewable energy producible power



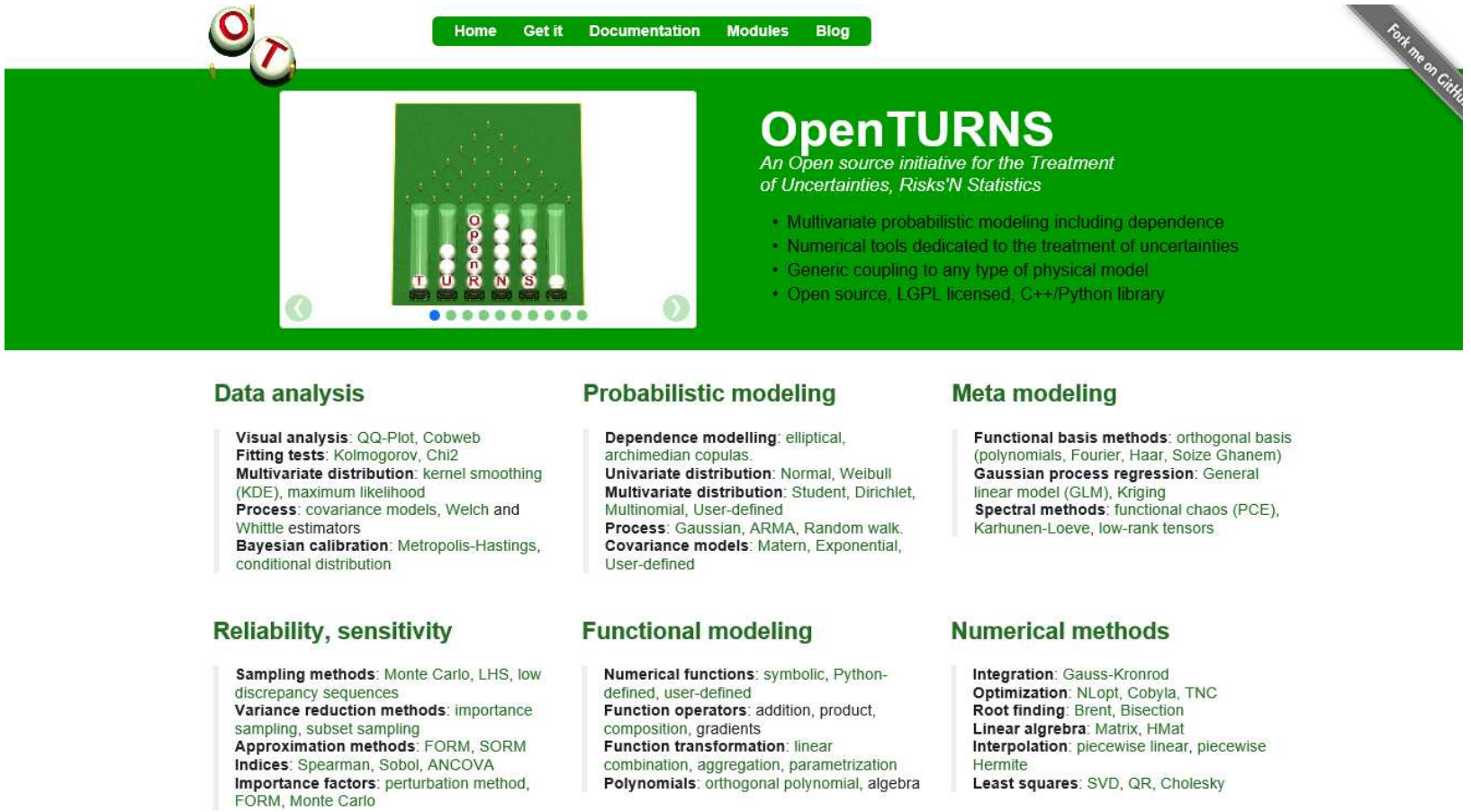
OPENTURNS : WWW.OPENTURNS.ORG

- Aims at adress a global framework : Uncertainty quantification, uncertainty propagation, sensitivity analysis and metamodeling



- 4 Partners :
- Since 2007
- LGPL licence
- Linux, Windows
- Programming:
  - Python module
  - C++ Library

OPENTURNS : WWW.OPENTURNS.ORG



- **How to install it?**
  - Conda Python package
  - Github
  - Distributed in Debian

- **Online documentation**
- **> 10000 downloads in 2017**
- **Simulator : symbolic, Python, Salome, …**

BRING UNCERTAINTY METHODOLOGY TO ENGINEERS

- **3 years ago**
  - EDF R&D wanted to maximize the use of OpenTURNS and UQ approaches by its engineer/researcher → develop a GUI to ease the use
  - Phimeca has already developed an “OpenTURNS GUI” (PhimecaSoft®) which satisfy some needs of EDF R&D but not all.
  - EDF R&D and Phimeca decided to start a specific partnership in order to develop a new GUI based on OpenTURNS and “Salome Tools” : Paraview, Yacs, ...
- **This new OT GUI is now available on Salome website, in EDF Specific Salome version**

  http://www.salome-platform.org/contributions
- **Windows versions are only for partners : please contact us !**

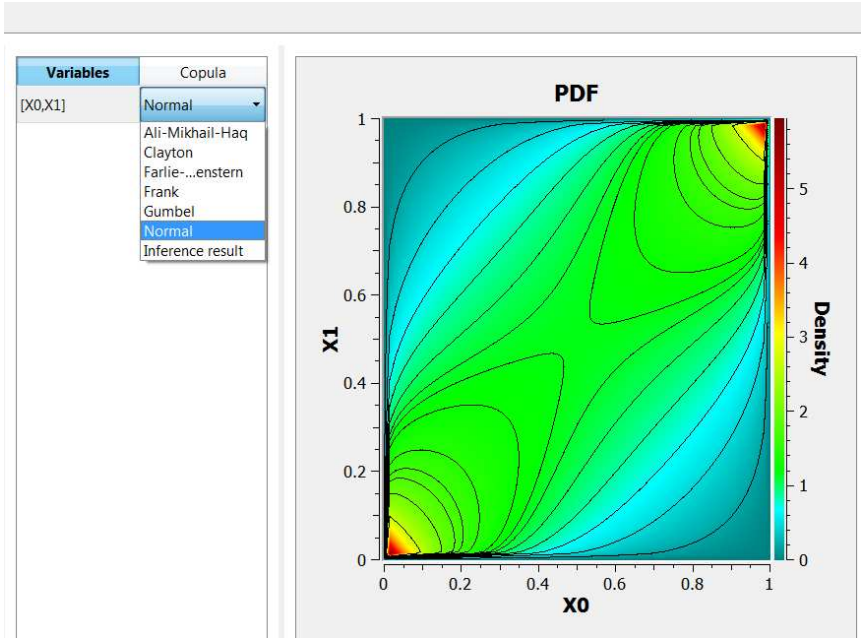
SOME EXPECTATIONS REGARDING THE GUI

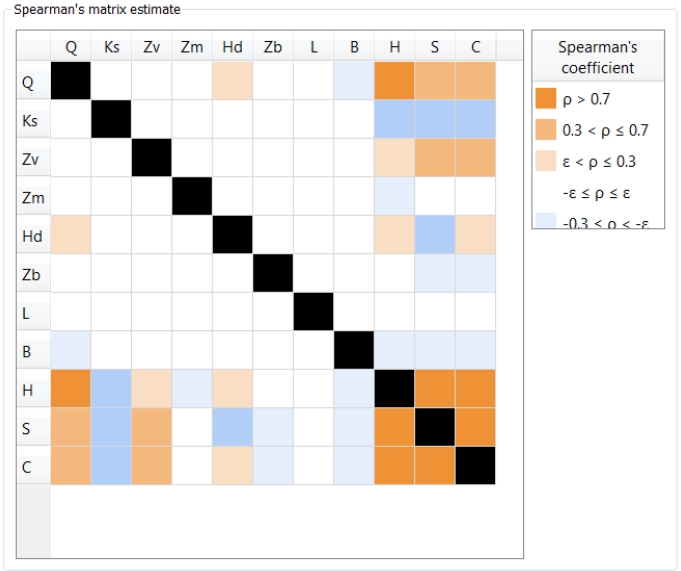
- As easy to use as possible : UQ approaches spreading should not be restricted due to a problem of usability
- Support the methodology : guide the user
- For who? Variety of physics and codes at EDF
  - Generic (not dedicated to a specific application)
  - Linux : inside simulation platform SALOME (field physics : pre and post-processing tools, HPC resources access, …)
  - Windows : address the system-models users (e.g. Modelica)
  - Trainings : symbolic formulas
- Possibility to generate a Python script usable without the platform in an “expert” mode
- GUI language : English, French

DEMO TIME

NEW FEATURES

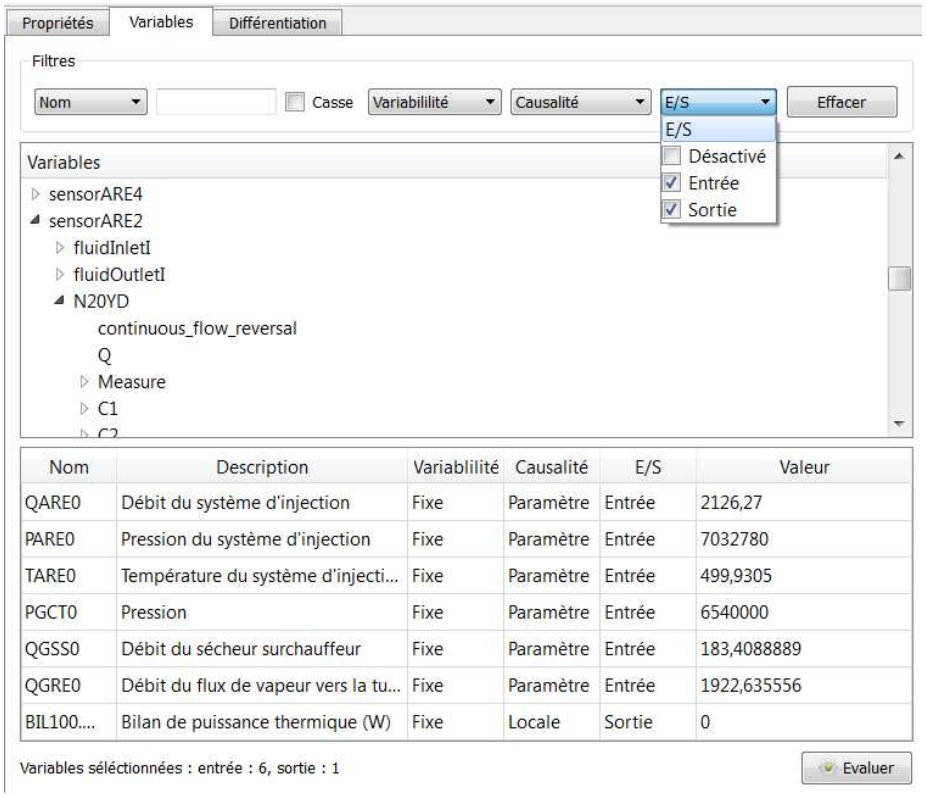
- Morris method to select input variables
- Improved metamodel validation
- Sobol' sensitivity indices have confidence intervals
- Monte Carlo analysis manages failed points
- Dependence (copula) : definition and inference
- Optimization
- Link to the FMI models





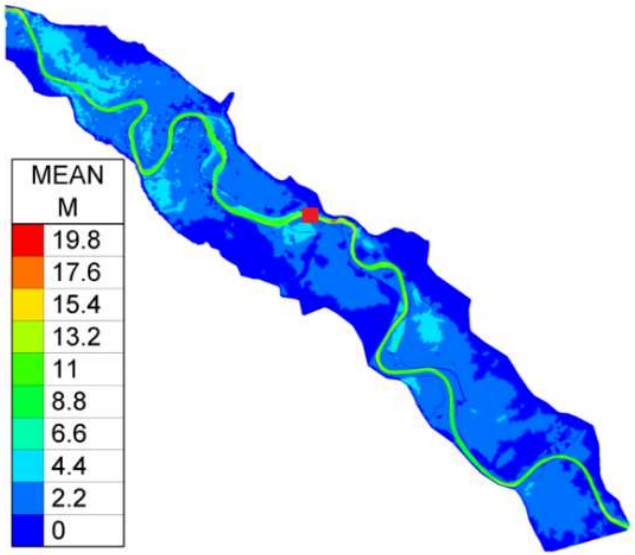
SYSTEM MODELS : LINK USING FMI STANDARD

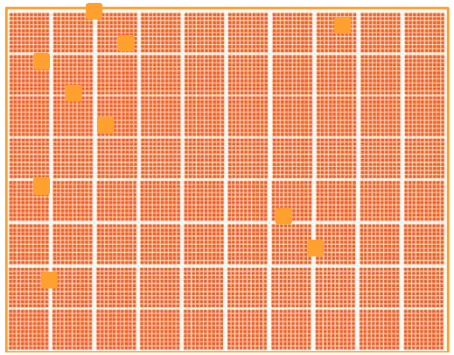
- Modelica is an open language for programming models based on differential algebraic systems of equations
- Main tools : Dymola (Dassault Systèmes, proprietary), Open Modelica (open source Modelica Consortium)
- FMI (Functionnal Mock-up Interface) is a standard for input–output data interface for numerical model.
- a FMU file contains : a xml description, a binary to evaluate the model



PERSPECTIVES AND CHALLENGES

- A new module dedicated to random fields analysis
  - Extend the methodology : more complex tools
  - Interface with codes that manage inputs and outputs as fields
  - Large data volume : in-situ challenge





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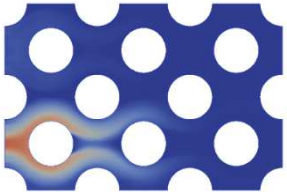

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THANK YOU FOR YOUR ATTENTION

#11 Users Day – 15th June 2018 – Saclay, France

Come and join us!

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