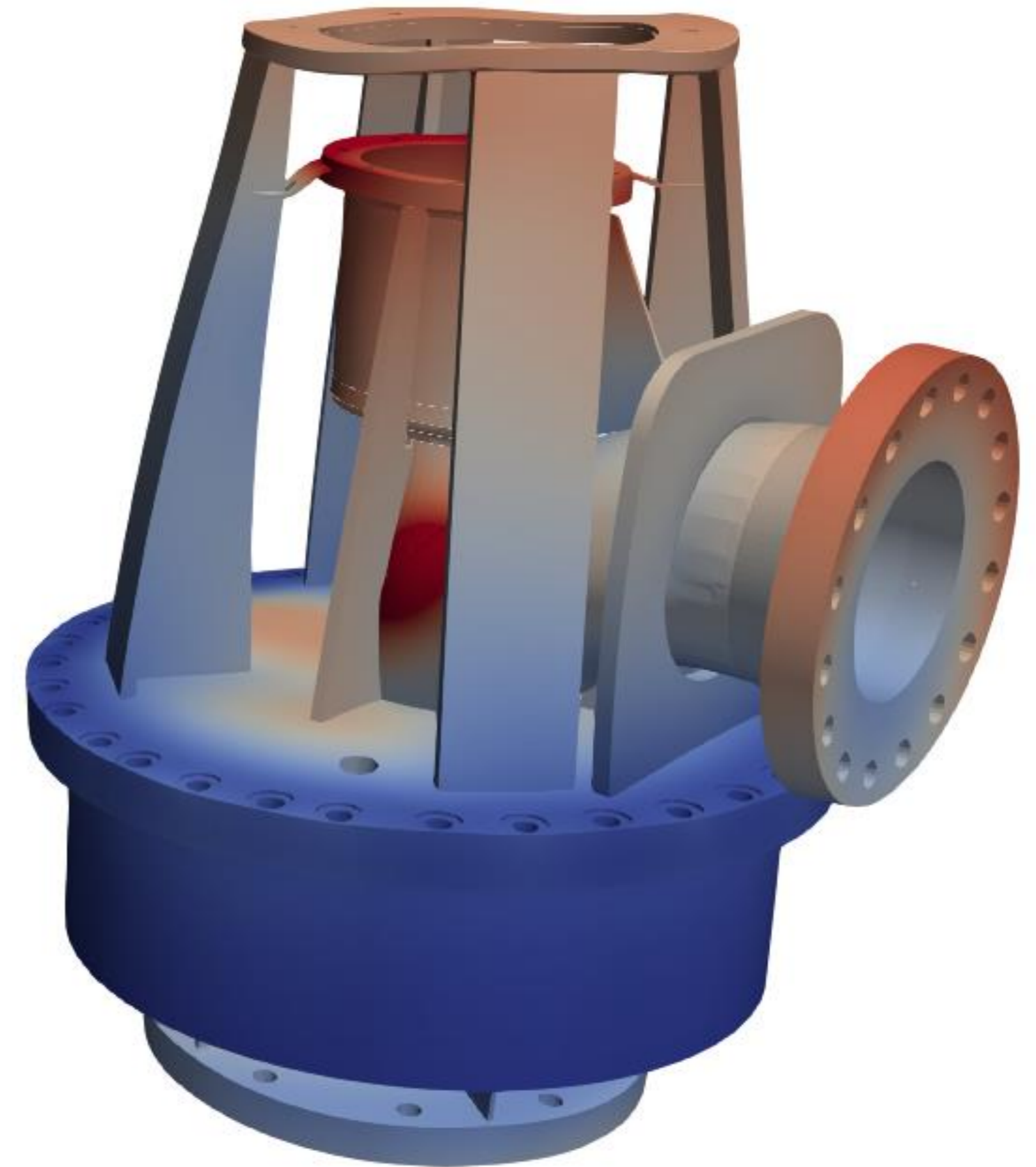




# salome\_meca

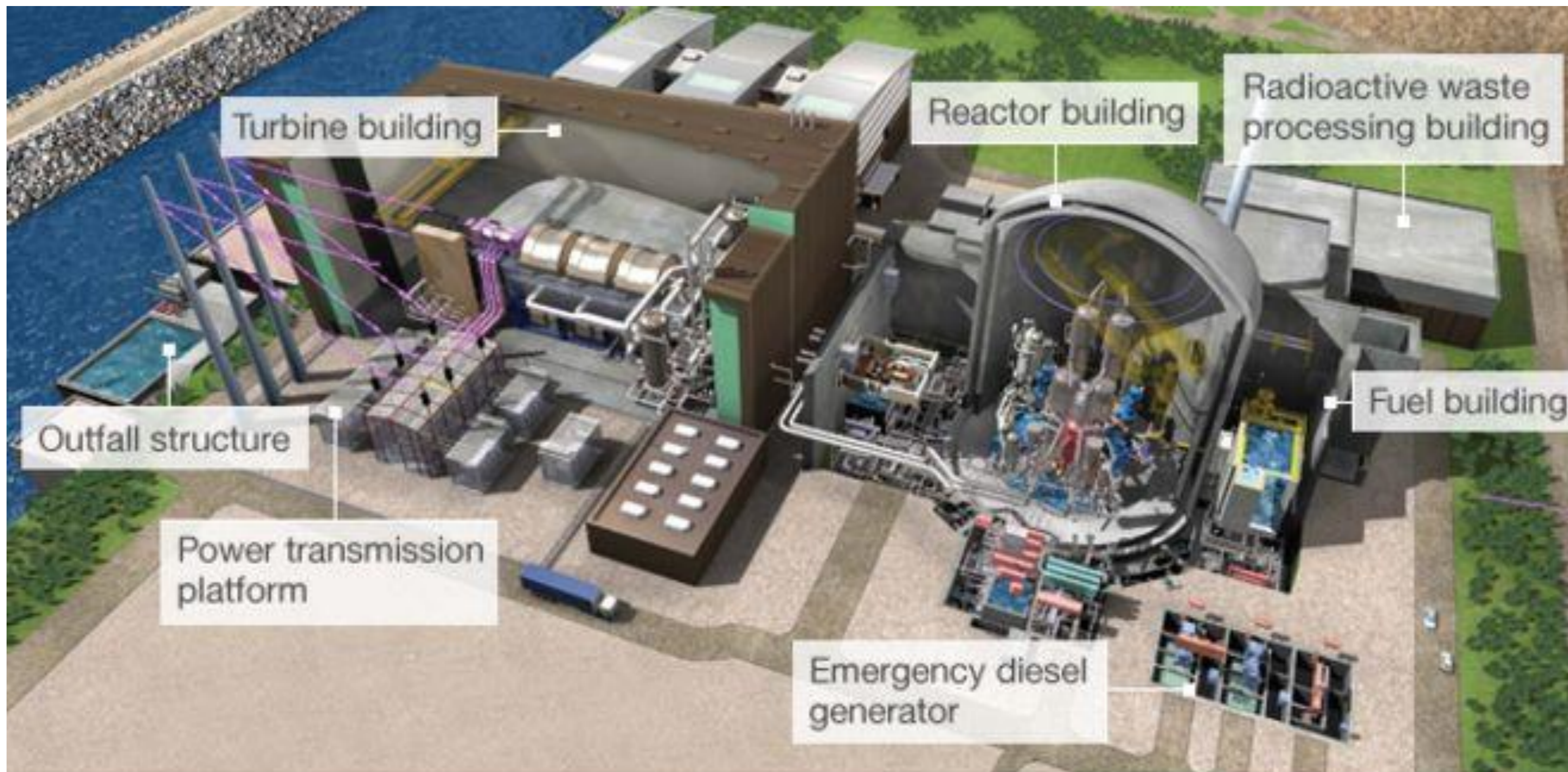
EDF's open-source simulation platform  
for structural mechanics

SNETP TS8  
February 4, 2021



# Introduction

**EDF operates facilities with many mechanical components**



Source: EDF Energy

Note: Image shows generic EPR reactor layout

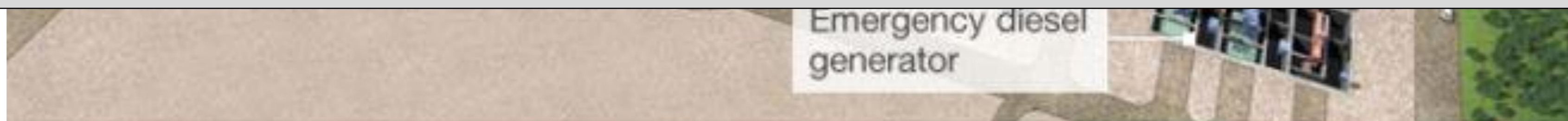
# Introduction

**EDF operates power plants with many mechanical components**



In order to ensure safety, EDF must show the structural integrity of buildings and components

→ Under specific conditions, simulation can be used to assess safety



Source: EDF Energy

Note: Image shows generic EPR reactor layout

# Simulation in structural mechanics

**A wide range of mechanical fields and applications**

- Civil engineering**
- Fracture / Fatigue**
- Seismic analyses**
- Soil mechanics**
- Welding**
- Fuel assemblies**
- Rotating Machines**
- .. And many more!**

# Simulation in structural mechanics

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Every field has specific and different needs : functionalities, ergonomic, performance, etc.

Thus, many simulation software are employed

# Drawbacks of such strategy

**A wide variety of software must be available**

- ❑ Licenses are expensive**
- ❑ Dependent on the software provider for specific applications**
- ❑ Different simulation environments generate compatibility issues**
- ❑ Ensuring a 100 years-old archive of the numerical studies may be complicated**

# Solution : Our own platform!

Simulation platform available for our engineers



Development has a cost – but so do software licenses  
(and significantly more with HPC capabilities!)

A strategy can be built in order to be :

- cost-efficient
- User-friendly
- satisfy all fields of mechanics

# What is salome\_meca ?



## Generic Platform



- CAD design
- Meshing
- Visualisation
- Generic modules





# What is salome\_meca ?



**Generic Platform**



**FEM Solver**



# What is salome\_meca ?



**Generic Platform**



**FEM Solver**



**Thus, one is now able to perform a simulation in structural mechanics. Yet :**

- No interactions between the mechanical solver and the platform**
- Although powerful, significant lack of user-friendliness**

# What is salome\_meca ?



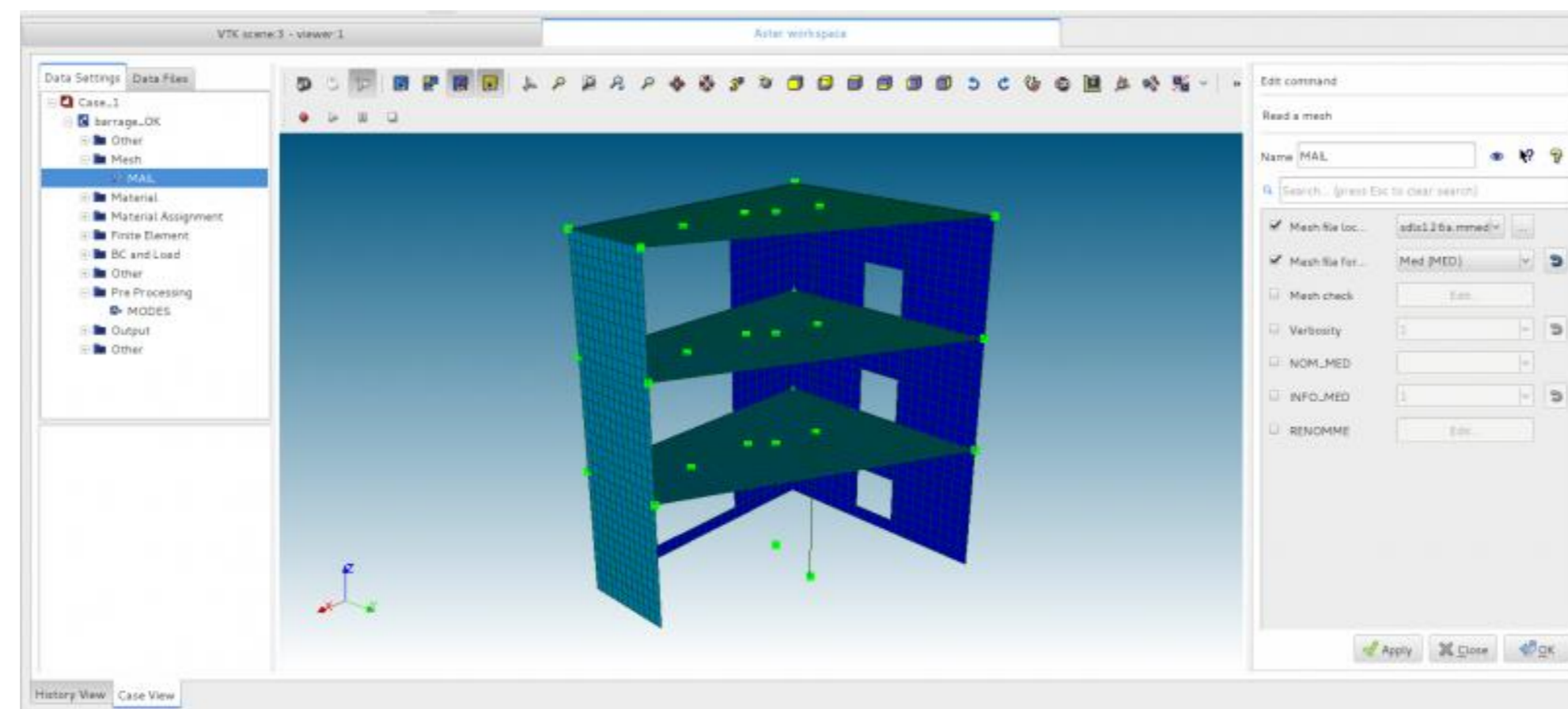
Generic Platform



FEM Solver



AsterStudy GUI



# What is salome\_meca ?



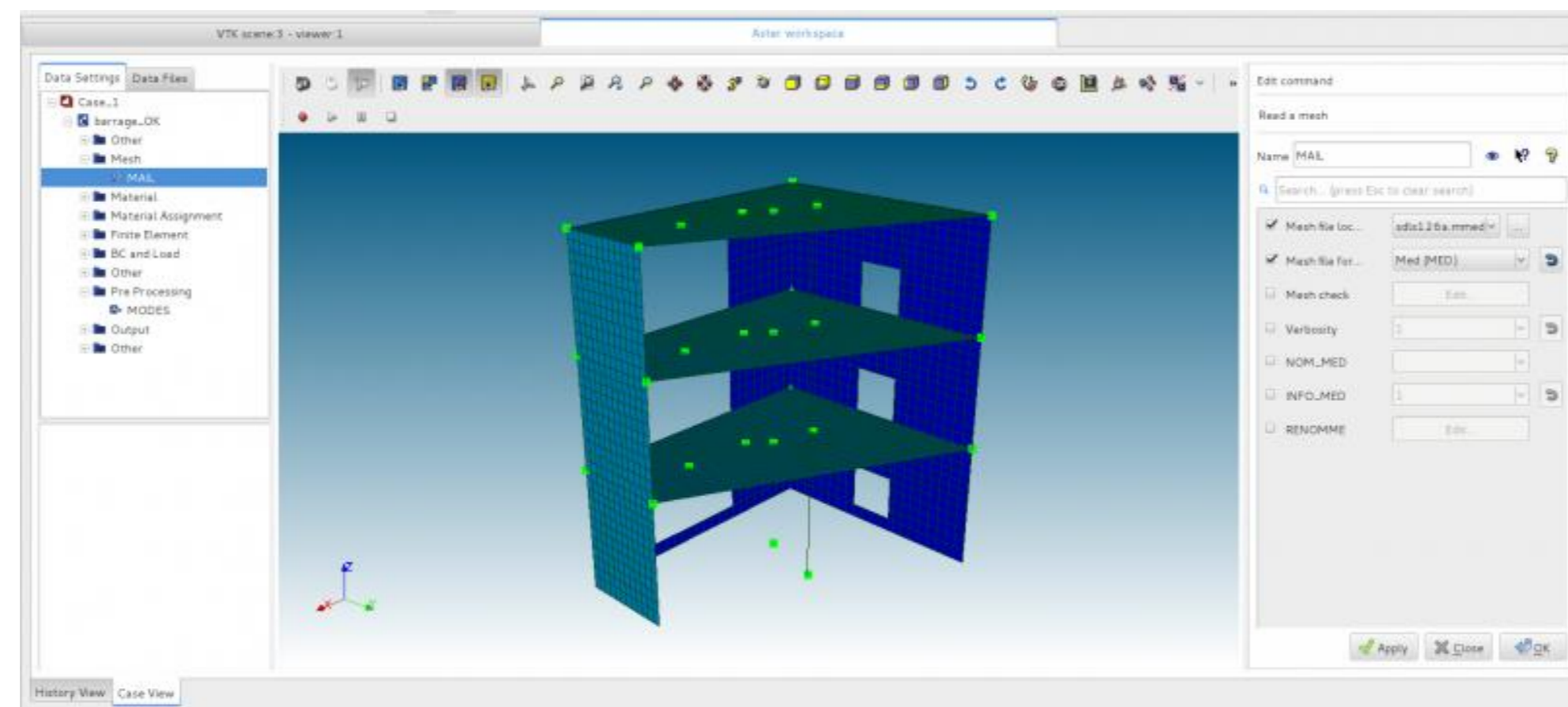
Generic Platform



FEM Solver



AsterStudy GUI



# What is salome\_meca ?



**Combining the Generic Platform + FEM solver + GUI allows all end-users to perform their studies in a user-friendly environment**

**Yet, for specific usage :**

- Most engineering units are not specialized in simulations. Their day-to-day tasks include but are not limited to numerical simulation**
- Some studies must be performed several times under different hypothesis.**



# Additional possibilities!

## Custom app

**Generic Platform**



**FEM Solver**



**code\_aster**



**Additional specs**



# Benefits of the Custom Apps



- ❑ Give access to numerical simulation to new end-users
- ❑ Can have their own GUI, and post-processes (ASME, RCC/RSE-M, etc.) within the platform
- ❑ Automatically generate studies from A to Z for specific applications :
  - Mesh Generation
  - Data input
  - Post-process
  - Reports generation
- ❑ Ensure quality of the studies
  - V&V process of the platform used for the custom app
  - Methodologies are embedded within the custom app



# Example (fictive)



## Parameter fitting of material properties

**Workflow is as follows :**

- Generate the experimental data from samples**
- Produce the CAD models of the samples**
- Generate the meshes**
- Create the numerical studies which represent the experimental conditions**
- Implement an optimization algorithm in order to fit the parameters**
- Post-process using some standards**
- Write down a report**





# Example (fictive)

## Parameter fitting of material properties

### Using a custom app :

- Generate the experimental data from samples
- Produce the CAD models of the samples
- Generate the meshes
- Create the numerical models and present the experimental comparison
- Implement an algorithm in order to fit the parameters
- Post-process the results according to standards
- Write down a report

Elements which can be automatized using the input data

## Custom app

# salome\_meca outside of EDF



## Can be used for other application / fields

- ❑ Everything except the Custom Apps are under GPL/LGPL Licences
- ❑ One can create its own custom Apps
- ❑ Can be downloaded : [www.code-aster.org](http://www.code-aster.org)

## EDF is open to discuss partnerships using open source tools

- ❑ Co-development of new functionalities in our FEM mechanical solver
- ❑ Benchmarks with other software
- ❑ Co-development of Custom Apps



# Conclusion

**EDF develops salome\_meca in order to**

- ❑ Create a single simulation environment used by all engineering units**
- ❑ Ensure the required functionalities are available**
- ❑ Optimize dedicated workflows using custom applications.**

**The platform is open source, thus :**

- ❑ One can use it for its own needs**
- ❑ EDF is interested in co-development partnerships**