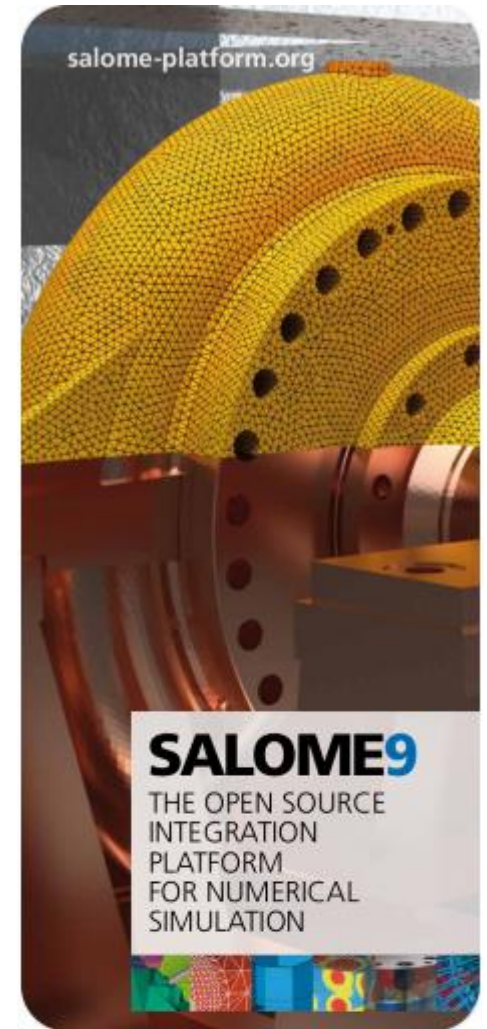




# Inside SALOME : General introduction

EDF SALOME Team (EDF R&D)

September 19, 2019



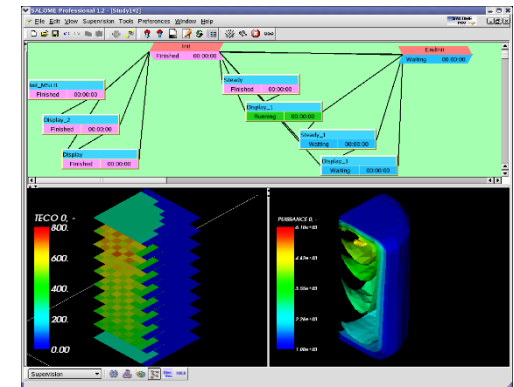
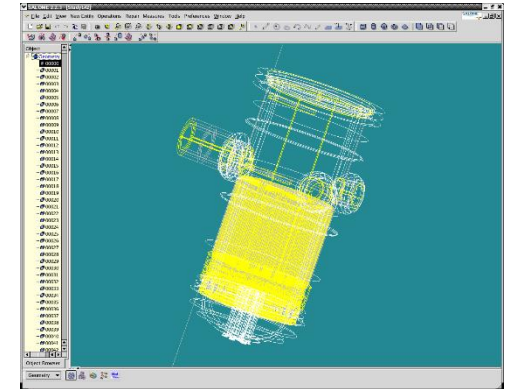


## INSIDE SALOME

- ▶ Goals
- ▶ Technical choices
- ▶ Main features
- ▶ Launch SALOME
- ▶ The Graphic User Interface
- ▶ Main components
- ▶ Some specific components

## Goals

- ▶ **Provide an easy-to-use generic interface that:**
  - ▶ Reduces learning times
  - ▶ Helps reduce costs and delays
- ▶ **Facilitate:**
  - ▶ Integrating new components for numerical simulations
  - ▶ The interaction between CAD and calculation
- ▶ **Make all features accessible via python commands**





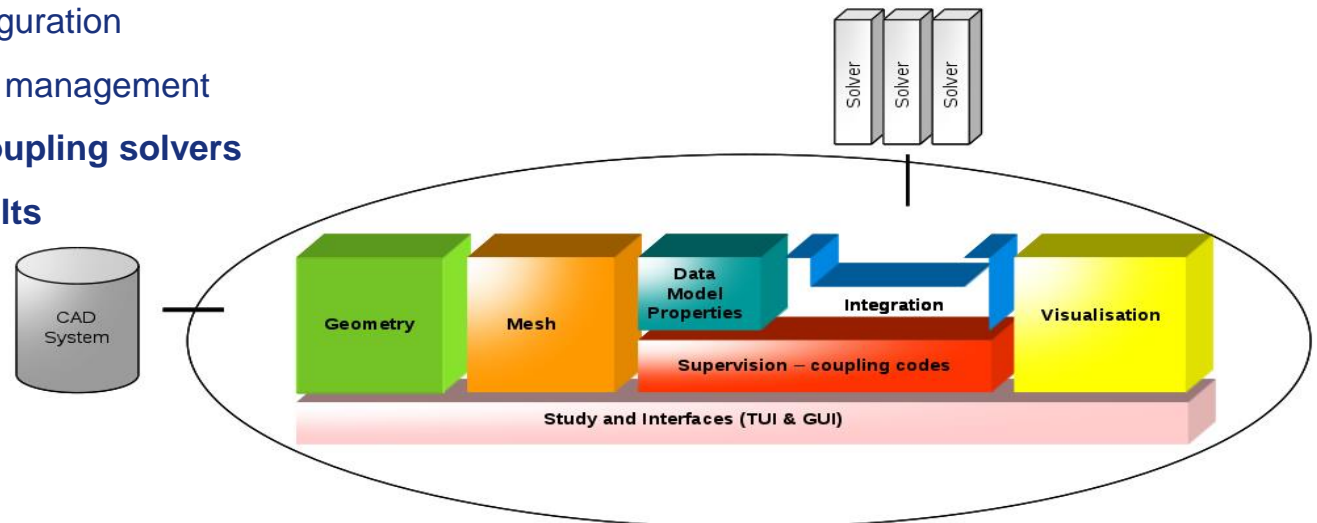
## Technical choices

- ▶ **Standards adherence:**
  - ▶ Operating system: Linux (also available on Windows but not yet supported by EDF)
  - ▶ Distributed object management: CORBA
  - ▶ CAD exchange format: STEP, IGES
  - ▶ Graphic: OpenGL, VTK, Paraview
- ▶ **Joining the world of open source**
  - ▶ Distributed under LGPL license
  - ▶ Use of open source software



## Main Features

- ▶ **Create /modify geometry, import / export, repair, clean**
- ▶ **Meshing geometries, doing quality checks, importing, exporting**
- ▶ **Edit physical or numerical properties**
- ▶ **Use an external solver to solve a study**
  - ▶ Input data management
  - ▶ Solver configuration
  - ▶ Output data management
- ▶ **Chaining and coupling solvers**
- ▶ **Display the results**



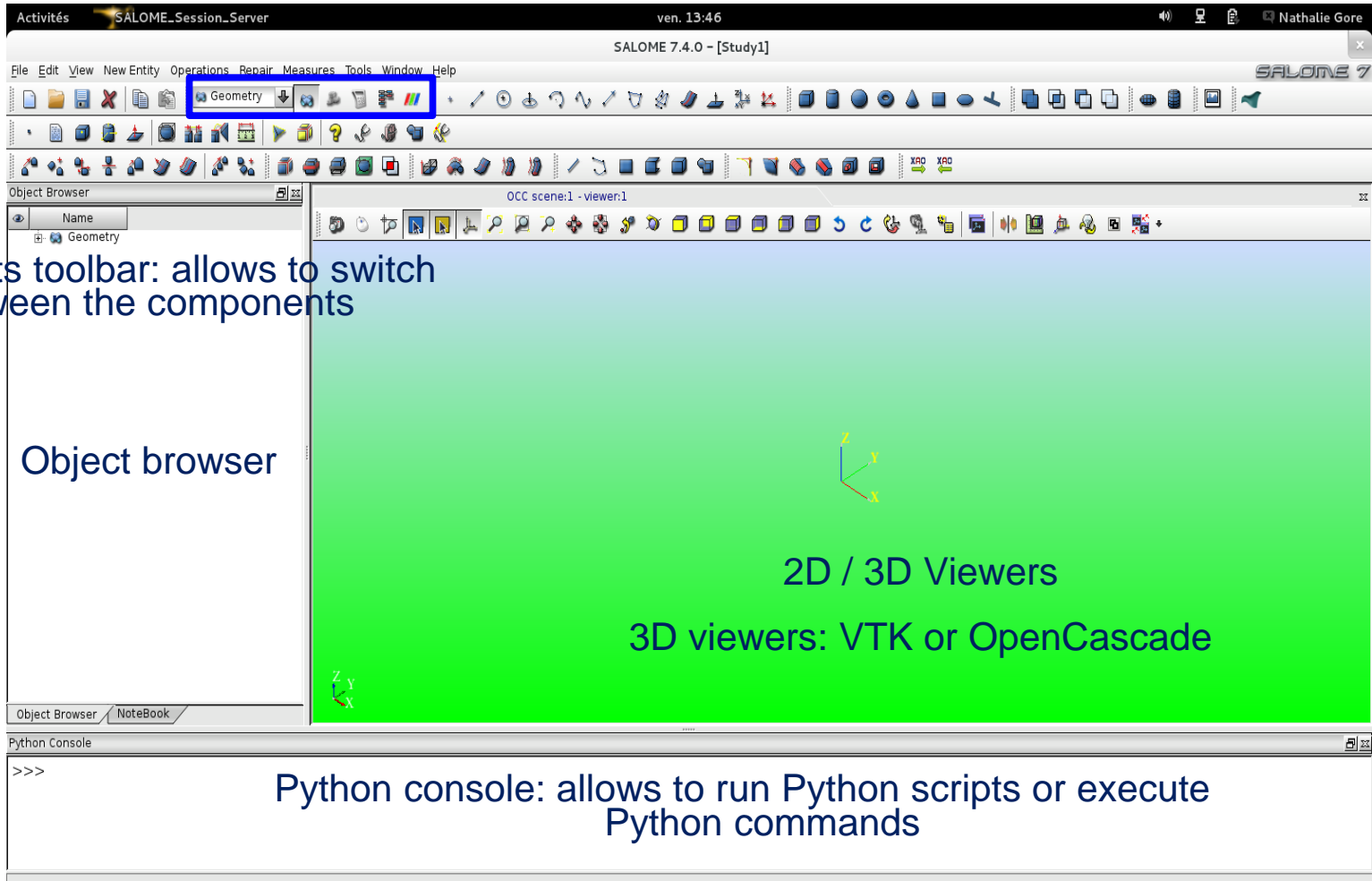




## Launch SALOME

- ▶ **From SALOME 7.4.0 :**
  - ▶ `PATH_TO_APPLI/salome`
- ▶ **Main options:**
  - ▶ `-h` : help!
  - ▶ `-k` : launch SALOME and kill all other Salome sessions (from same user)
  - ▶ `myScript.py` : launch SALOME and executes the Python script myScript.py
  - ▶ `-t` : launch SALOME without the GUI (Graphic User Interface)

## The Graphic User Interface



Components toolbar: allows to switch between the components

Object browser

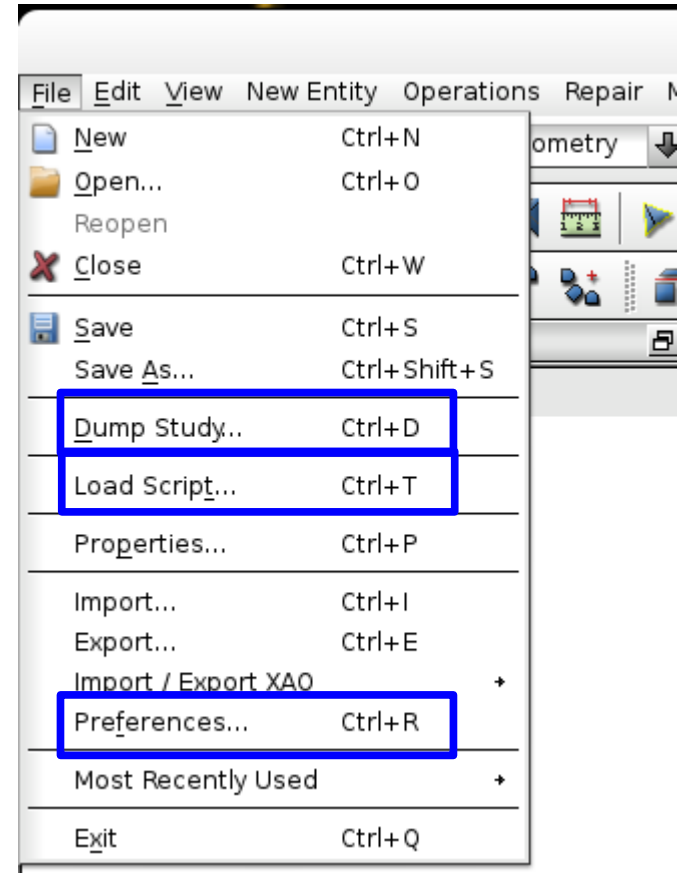
2D / 3D Viewers

3D viewers: VTK or OpenCascade

Python console: allows to run Python scripts or execute Python commands

## The Graphic User Interface

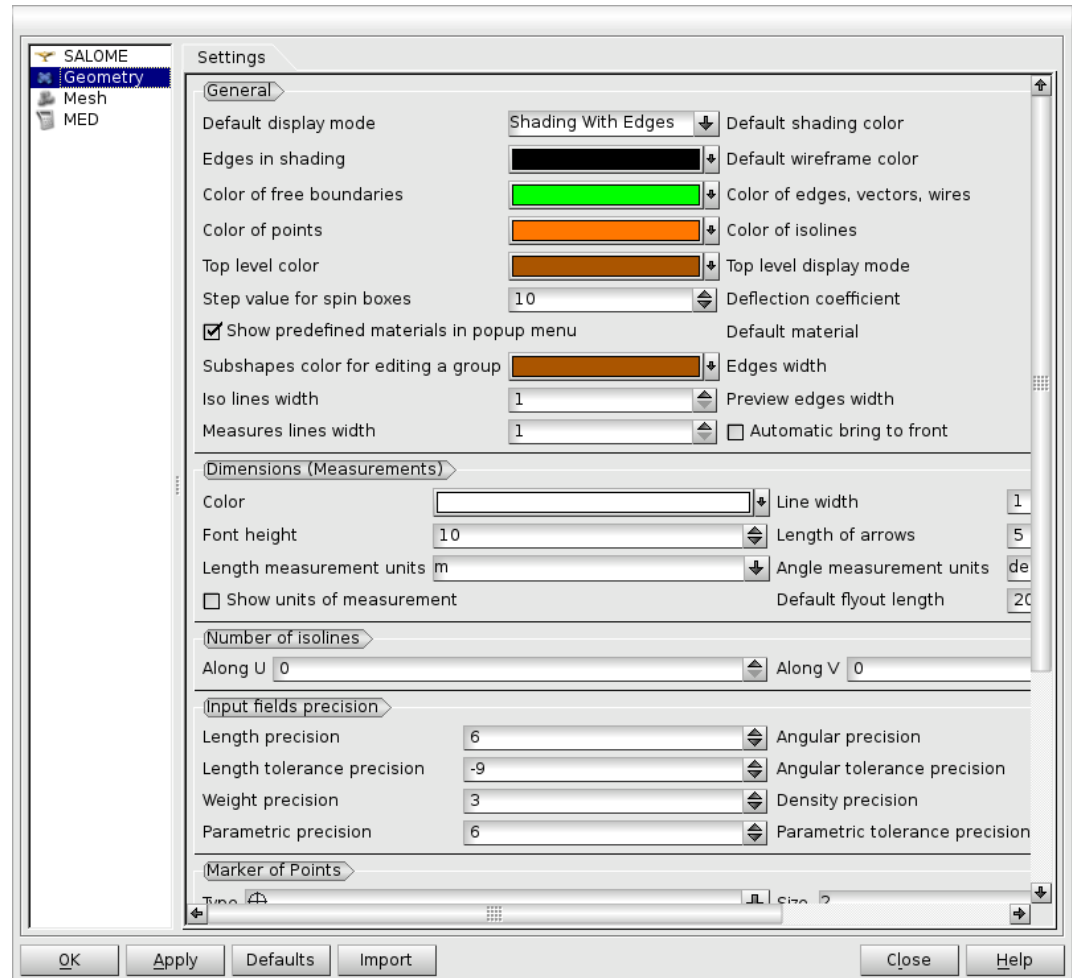
- ▶ **File Menu: some useful functions**
  - ▶ Dump Study
    - ▶ Generate Python commands corresponding to interactive actions.
    - ▶ The python script rebuilds the current state of the study (with some limitations on some modules, or on some complex interactions).
    - ▶ The Python script can be edited to make it parametric or more robust.
  - ▶ Load script
  - ▶ Preferences...





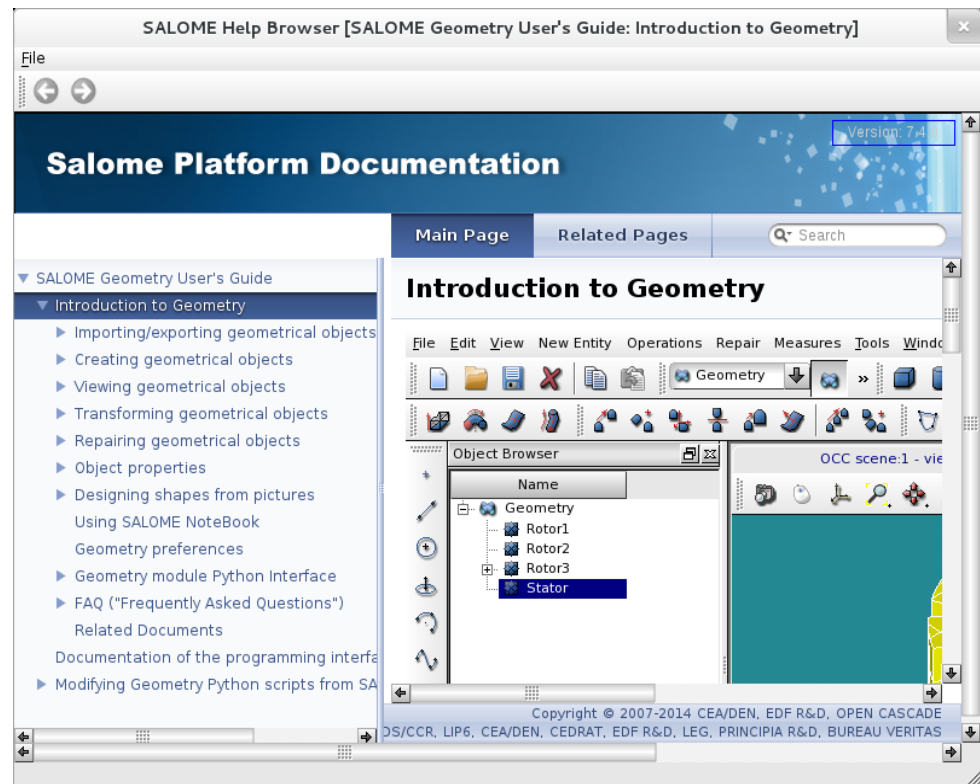
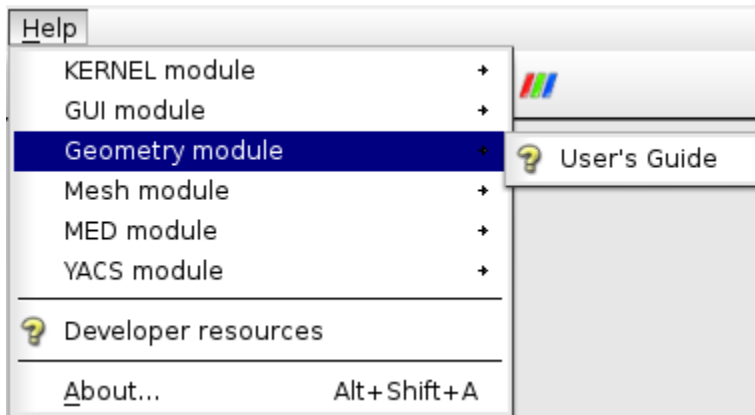
## The graphic user interface - preferences

- ▶ **Preference panel**
  - ▶ One page for each component
  - ▶ The preference page is only available after the load of the component



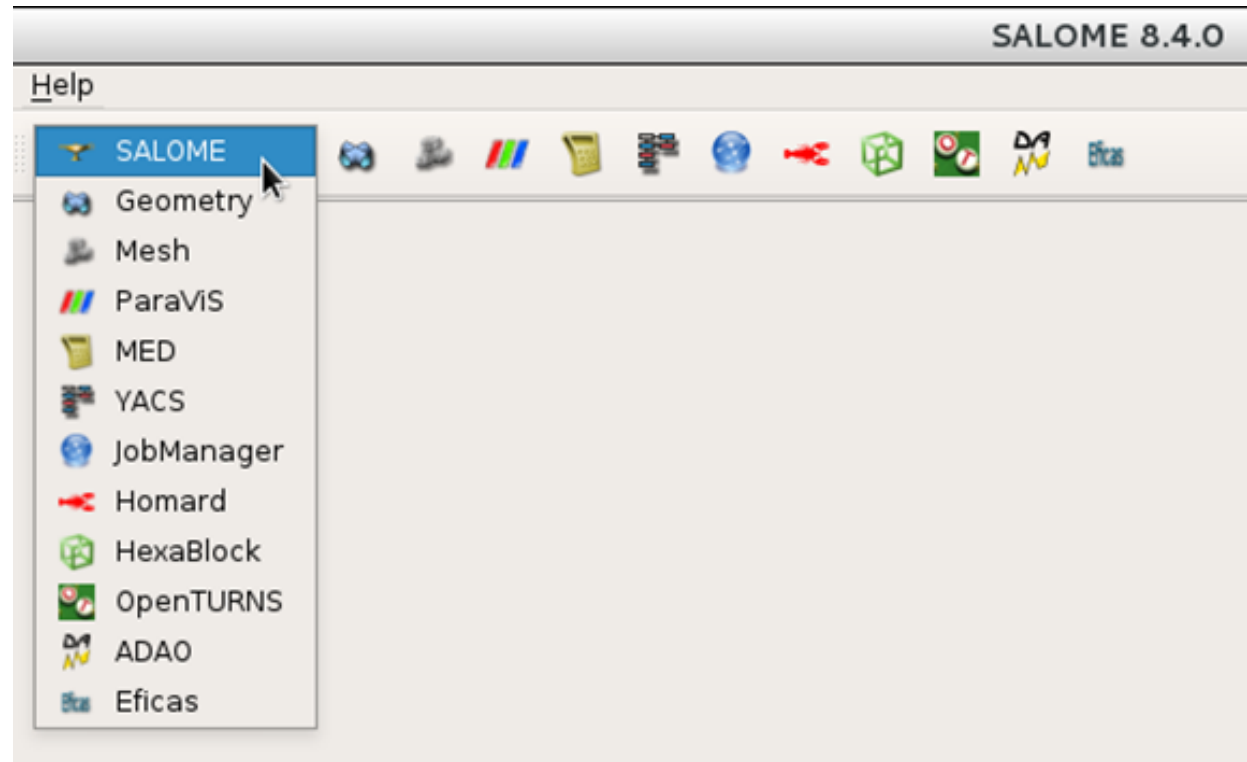
## The Graphic User Interface – HELP

- ▶ Help Menu
- ▶ One guide per component
- ▶ Also accessible via the dialog boxes



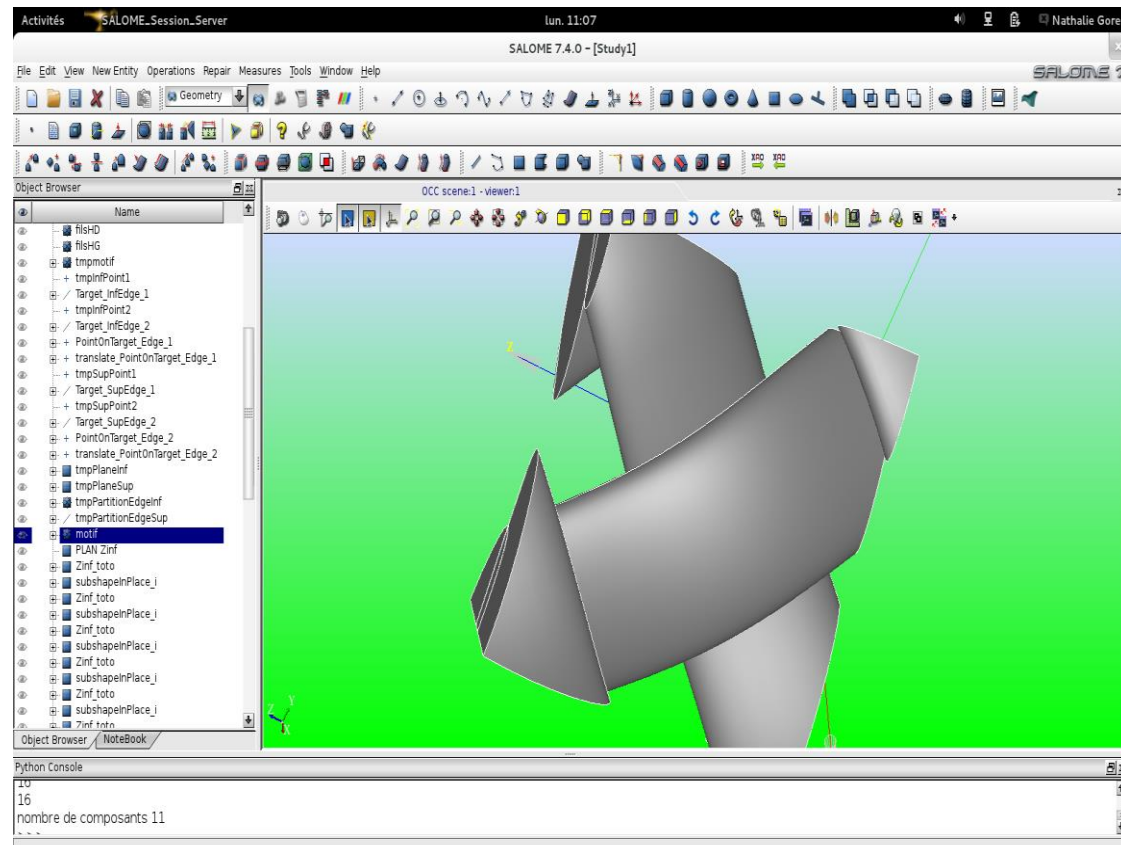
## Main components

- ▶ GEOM
- ▶ SMESH
- ▶ PARAVIS
- ▶ YACS



## Main components - GEOM

- ▶ Create / modify geometries
- ▶ Import / export geometries
- ▶ Clean / repair geometries
- ▶ Prepare the CAD for calculation
  
- ▶ Based on Cascade technology



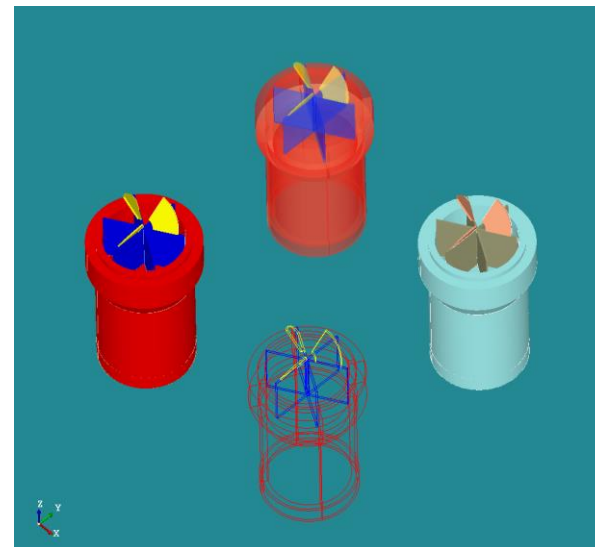
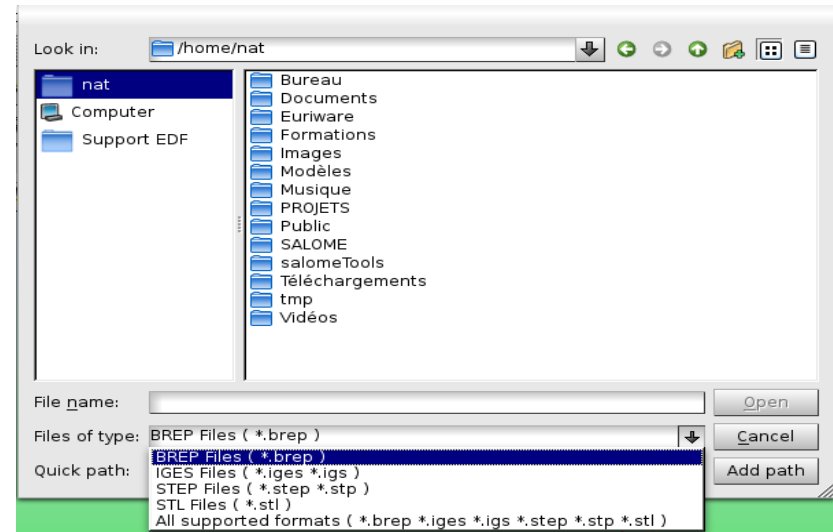
## Main components - GEOM

- ▶ **Several import export formats:**

- ▶ STEP / XAO
- ▶ IGES
- ▶ BREP
- ▶ STL

- ▶ **Main graphic features**

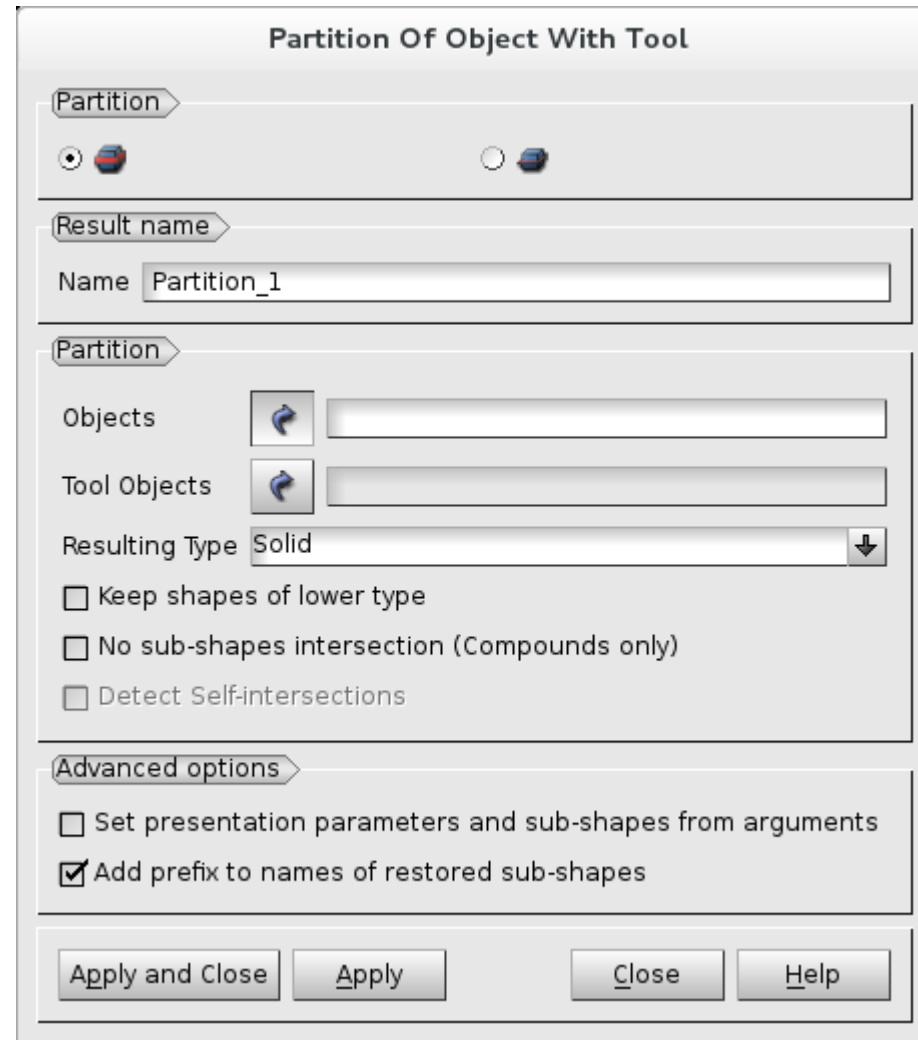
- ▶ Wireframe, Shading
- ▶ Transparency
- ▶ Color, textures
- ▶ Clipping
- ▶ Dimension display
- ▶ ...







## Main components - GEOM

- ▶ **Partition: very useful operation, to prepare CAD for meshing and calculation**
  - ▶ Allows automatic conformal meshes with several solids sharing faces
  - ▶ Helps to define parts in a CAD
  - ▶ identify different materials (different properties)
  - ▶ Identify boundary condition zones



**Partition Of Object With Tool**

Partition

Result name

Name

Partition

Objects

Tool Objects

Resulting Type  ↓

Keep shapes of lower type

No sub-shapes intersection (Compounds only)

Detect Self-intersections

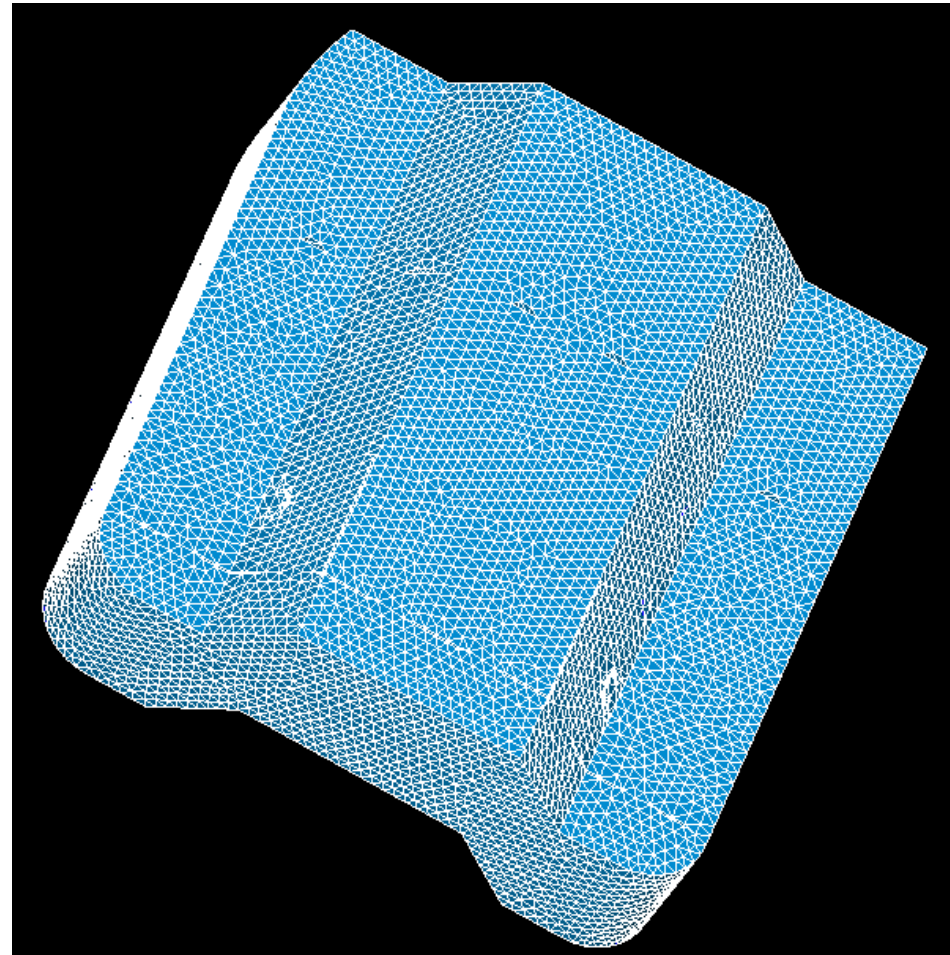
Advanced options

Set presentation parameters and sub-shapes from arguments

Add prefix to names of restored sub-shapes

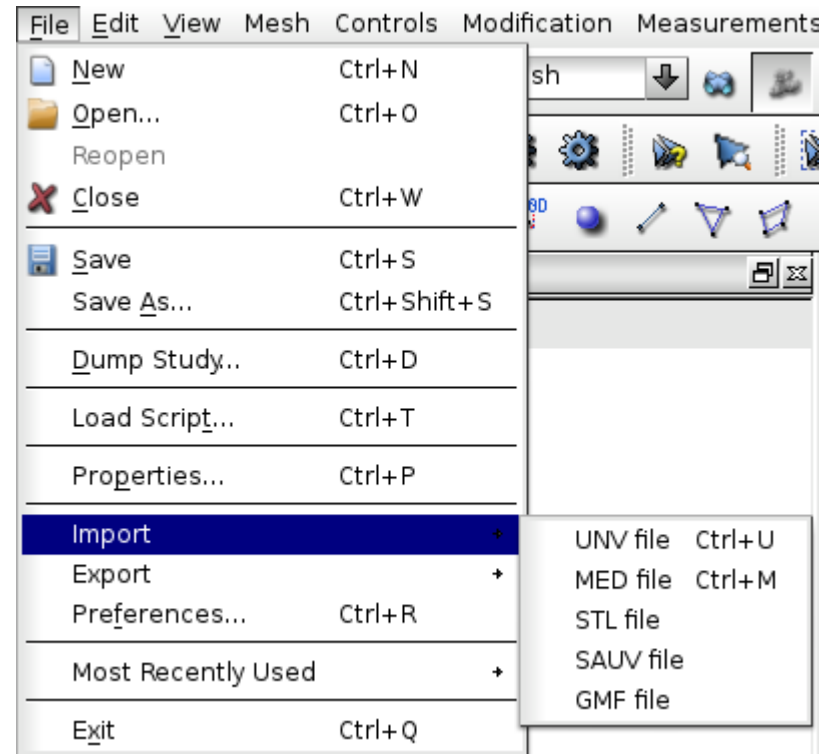
## Main components - SMESH

- ▶ Meshing geometries
- ▶ Modify existing meshes
- ▶ Quality checks
- ▶ Create groups of elements or nodes / manipulating the groups
- ▶ Display information and statistics
- ▶ The C++ API allows to add a new mesher as a Plugin.



## Main components - SMESH

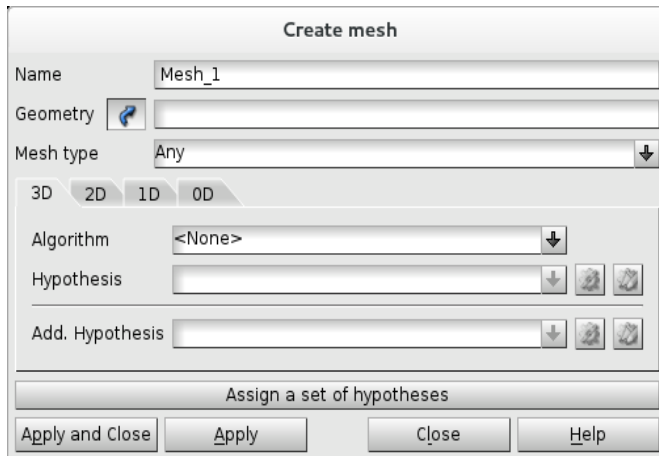
- ▶ **Several import export formats:**
  - ▶ Med (SALOME native, used by all EDF codes)
  - ▶ Unv (Ideas)
  - ▶ Stl (triangles)
  - ▶ Sauv (CEA)
  - ▶ Gmf (for Distene meshers)
- ▶ **Inside SALOME, between components: MED**
  - ▶ Save the Meshes
  - ▶ Save the Groups
  - ▶ Save the fields (on meshes and groups)



# Main components - SMESH

## ▶ Create Meshes

- ▶ From a geometry, an existing mesh
- ▶ Several meshing algorithms



## ▶ Display information

- ▶ Number of nodes
- ▶ Number of elements
- ▶ Nodes coordinates
- ▶ Connectivity
- ▶ Quality criterion

**Mesh Information**

Base Info | **Element Info** | Additional Info | Quality Info

**Name:** Mesh\_1  
**Object:** Mesh

**Nodes:** 677

Elements:	Total	Linear	Quadratic	Bi-Quadratic
	3128	3128	0	0

**0D:** 0  
**Balls:** 0

**1D (edges):** 60 | 60 | 0

**2D (faces):** 1168 | 1168 | 0 | 0

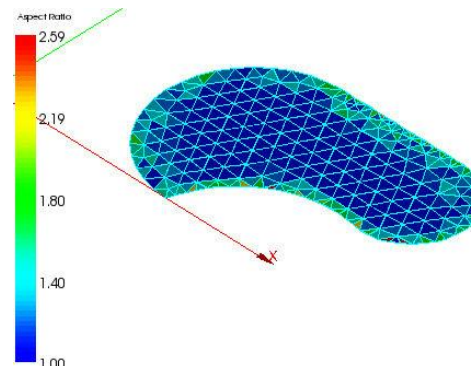
	Triangles	Quadrangles	Polygons
	1168	0	0
	0	0	0
	0	0	0

**3D (volumes):** 1900 | 1900 | 0 | 0

	Tetrahedrons	Hexahedrons	Pyramids	Prisms	Hexagonal Prisms	Polyhedrons
	1900	0	0	0	0	0
	0	0	0	0	0	0
	0	0	0	0	0	0

Ok | Dump | Help

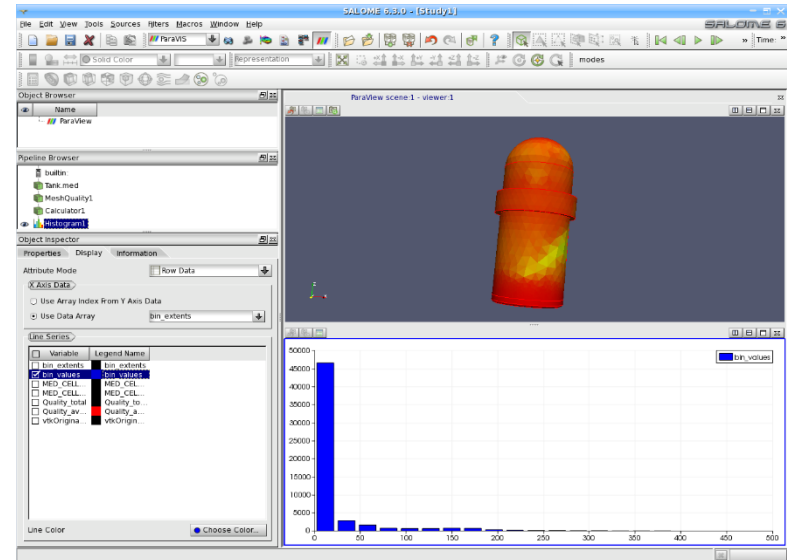
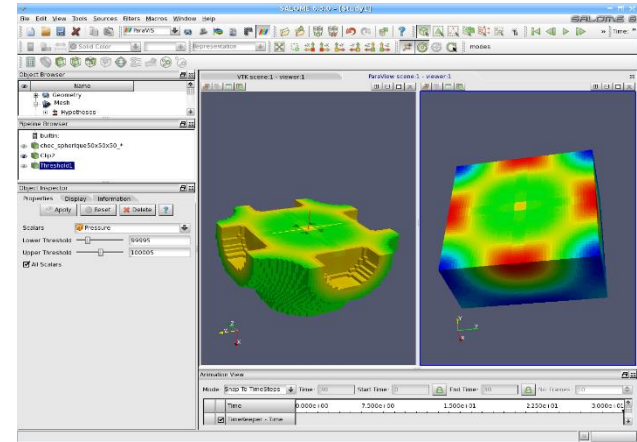
## ▶ Several quality checks





## Main components - PARAVIS

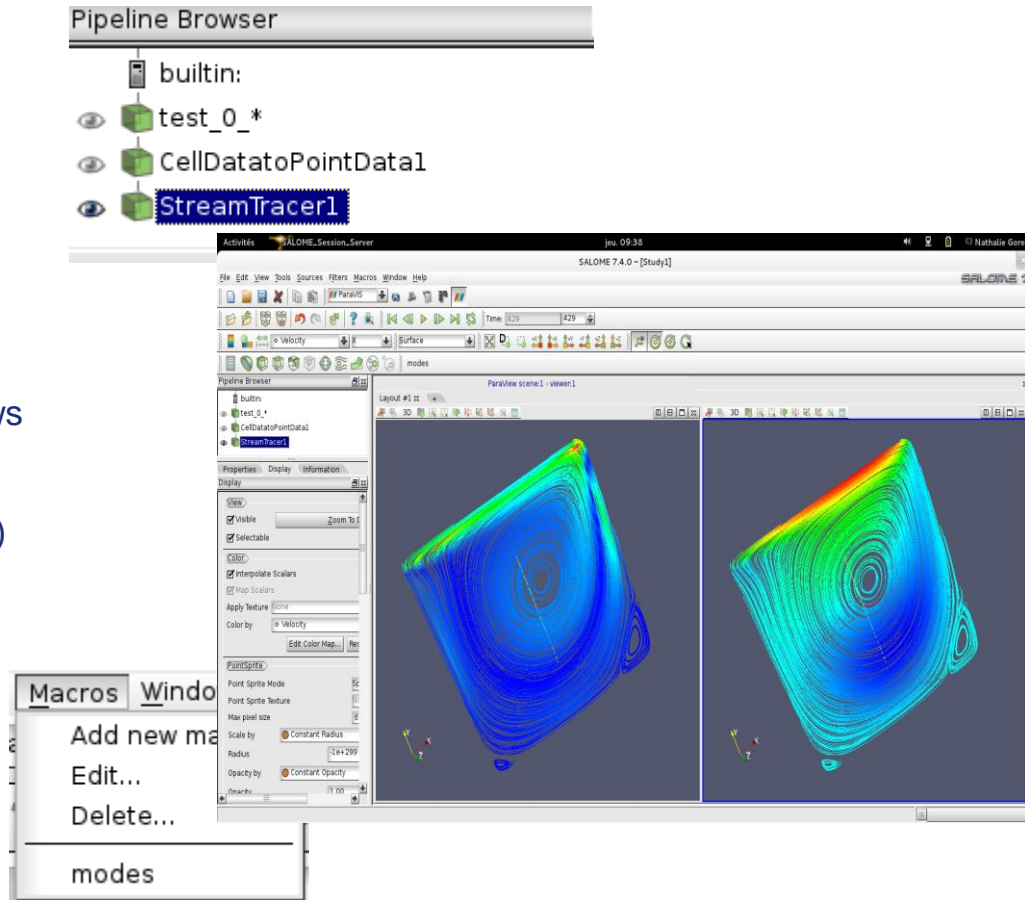
- ▶ **Paravis is Paraview in SALOME**
  - ▶ Plugins and add-ons
  
- ▶ **Post processing results:**
  - ▶ Graphical tools
    - ▶ Scalars
    - ▶ Vectors
    - ▶ Deformation
    - ▶ Stream lines
    - ▶ Histogram
    - ▶ 2D / 3D plots
  - ▶ Animations
  - ▶ Stereoscopy
  - ▶ ...





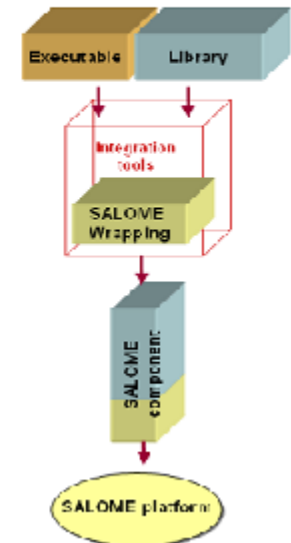
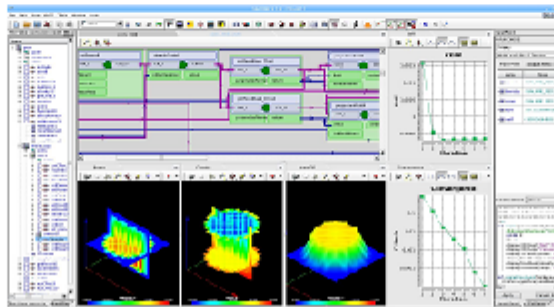
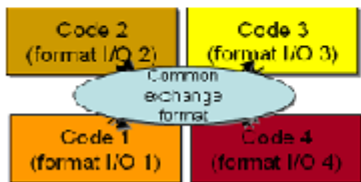
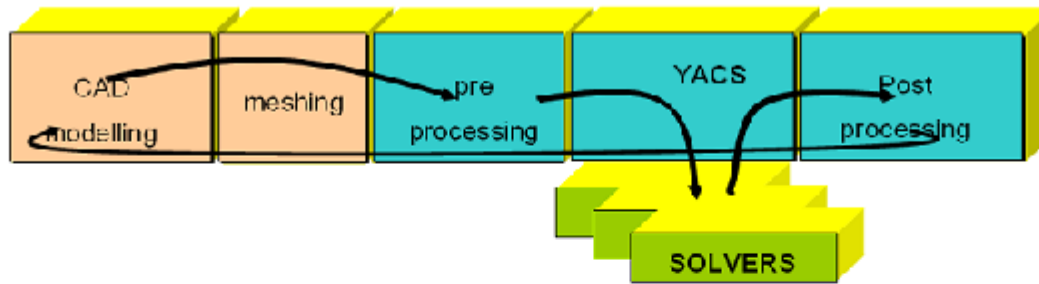
## Main components - PARAVIS

- ▶ **Pipeline notion**
  - ▶ Chaining filters
  
- ▶ **Multi views**
  - ▶ Different kinds of views
  - ▶ Camera control
  - ▶ Link the views (or not)
  
- ▶ **Macro functions**

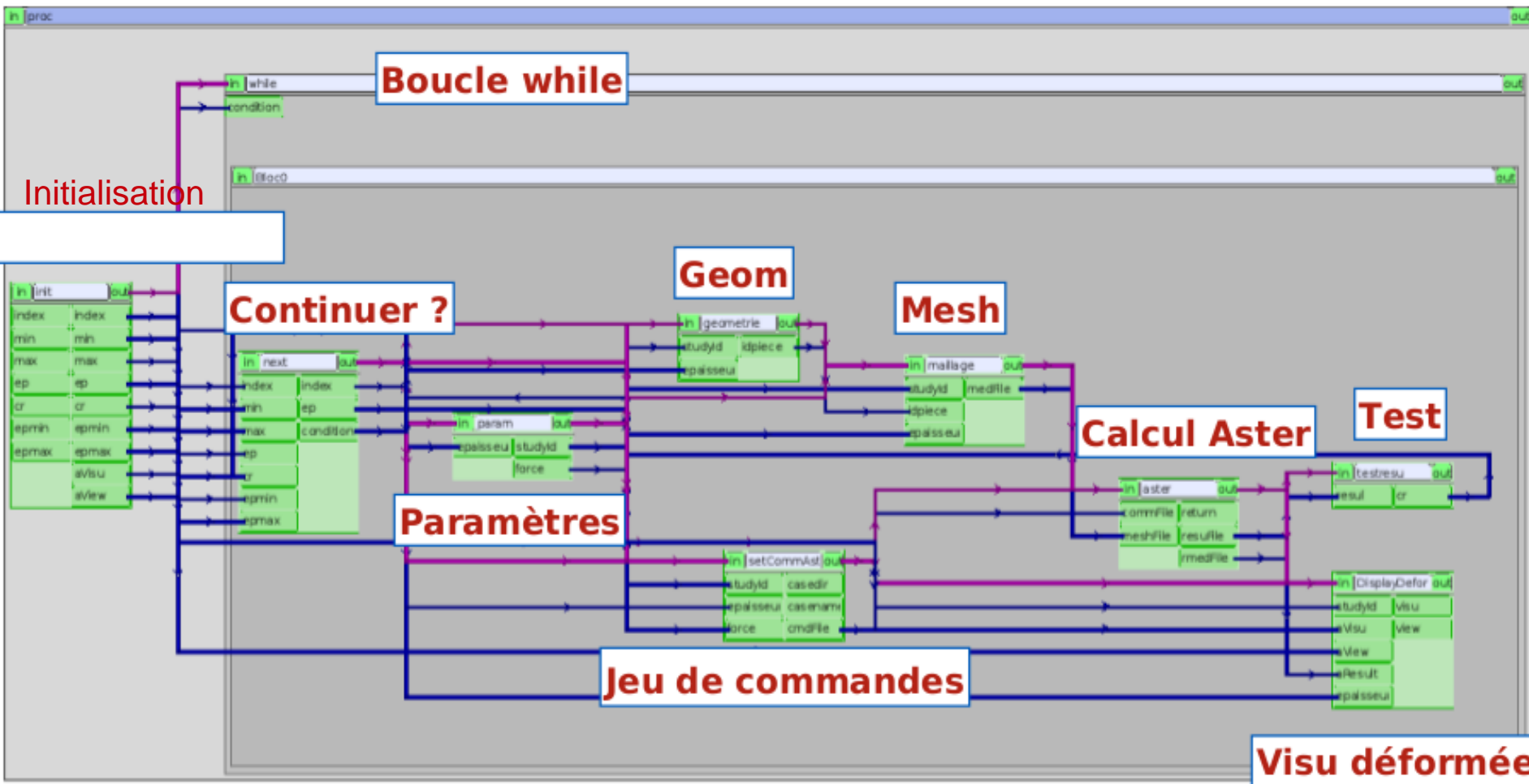


# Main components- YACS

- ▶ Module for the implementation of a calculation scheme in the SALOME environment

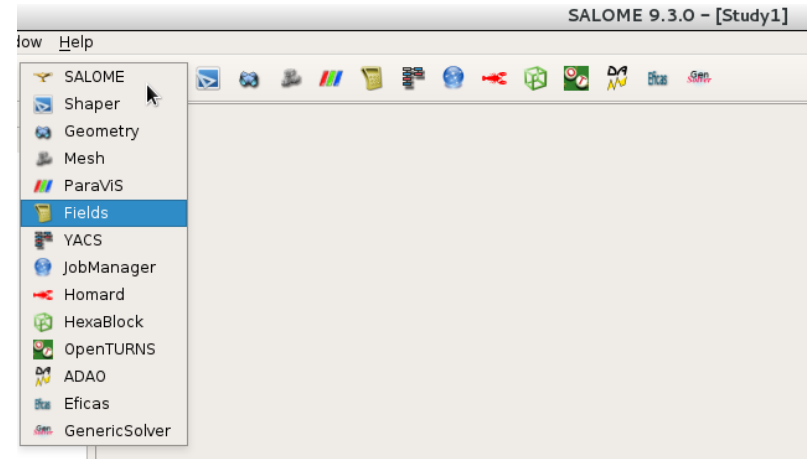


- ▶ Data exchange model (meshes and fields) : **med**
- ▶ Build, executes and controls the coupling chain
- ▶ **Tools for integrating a solver**
  - ▶ YACSGEN



## Some specific components

- ▶ **JobManager**
  - ▶ Define resources for distributed calculations
  - ▶ Create and launch jobs, follow the calculation
- ▶ **OpenTURNS**
  - ▶ Define and perform uncertainty studies
- ▶ **ADAO**
  - ▶ Data Assimilation: “compute the optimal estimate of the inaccessible true value of a system state over time”.
- ▶ **Homard**
  - ▶ Mesh refinement / coarsing on various criteria (following field values...)
- ▶ **Eficas**
  - ▶ Data input for solvers: GUI built on data definition, with input control
- ▶ **Fields**
  - ▶ Simple 3D display on fields, using Paraview macros
- ▶ **Hexablock**
  - ▶ Split geometries in hexahedral blocs, to facilitate structured hexahedral meshing





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