SHAPER: a new CAD software dedicated to physical simulations (new SALOME module)

**Context:**
- LGPL platform SALOME: [https://www.salome-platform.org/](https://www.salome-platform.org/)
- co-development EDF-CEA with OpenCascade company
- oriented towards finite element computation (industrial physics)
- modules: CAD, meshing, visualisation, supervision of computation workflows, computation on cluster
- shared acknowledgement: code, architecture and GUI ergonomics of the previous CAD module GEOM were obsolete

**Shaper major challenges:**
- drawing CAD models more efficiently
- maintain the skill and the knowledge
- mastering the complete simulation chain

**A parametric and variational CAD modeler, with improved ergonomics:**
- **Variational:**
  - interactive sketch with dimensions and constraints
  - draw what you see on the technical drawing
- **Parametric:**
  - each parameter of a shape can be edited
  - the final shape is automatically updated
- CAD assembly of 3D parts

**Specific to simulation CAD models:**
- shapes are designed for conformal meshes
- definition of groups of shapes available
- multi-dimensional connected geometries
- non manifold geometry
- partitioning (“blocking” for hexahedral mesh)

**Drawing our CAD models faster:**
- Vessel tank (EDF/DT Lyon)
- Fluid junction tee pipe
- Hydro-electric plant (EDF/CHE)
- Dam of Grandval (EDF/CHE)

**Defining groups of shapes:**
- for meshing control the mesh size (sub-meshes)
- for calculation: boundary conditions, loading, physical properties of the material, calculation model, kinematical connections, etc.
- for post-processing and visualization

**Partitioning for hexahedral meshing:**
In order to automatize the hexahedral meshing in SMESH, we need to split the CAD model in “blocks” that are homeomorphic to hexahedrons. Depending on the geometry, making blocks may be very difficult and time consuming. In SHAPER, we can use several features to do this work: split the 2D geometry early in the sketch before the creation of volumes (extrusion etc.) or in 3D with “partition” or “fill”

**Python scripting:**
CAD models done from the GUI can be dumped in Python scripts and can be used for doing a specific job

**Future prospects:**
**Research:**
- user assistance for making groups
- automatic blocking or hexahedral meshing
- simplification, idealization
**Use cases:**
- parametric studies (variation of the geometry)
- moving parts (e.g. closed/opened valve)

Available in SALOME 9.3

**Contacts:**
Raphael MARC, EDF Lab Paris-Saclay, raphael.marc@edf.fr
Alexandra MARTIN SANCHEZ, EDF Lab Paris-Saclay, alexandra.martin-sanchez@edf.fr