SALOME

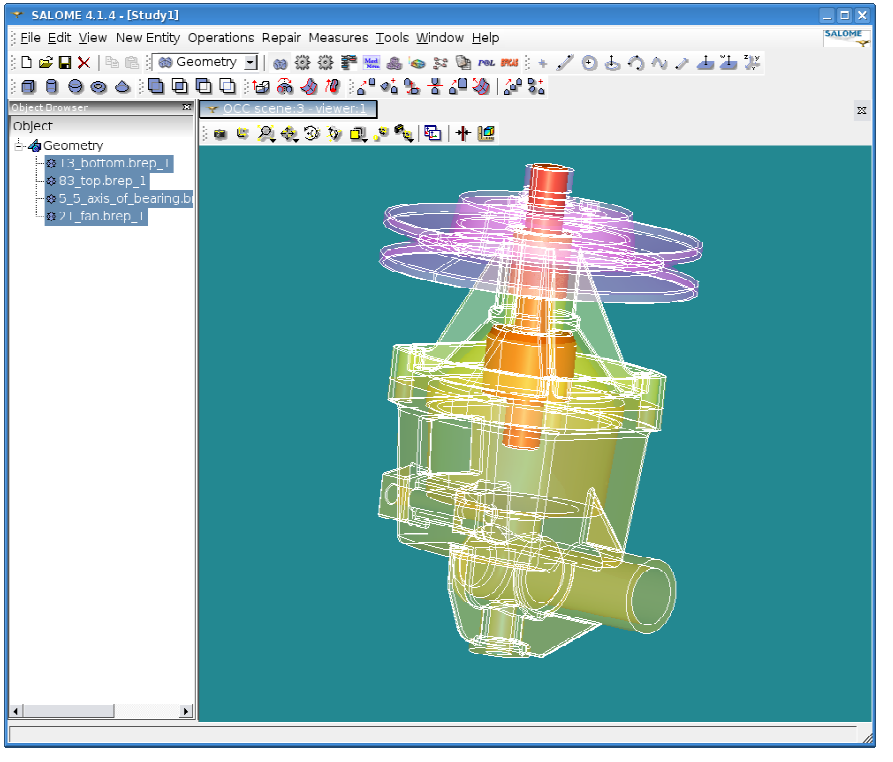
Geometry, Meshing, Post processing and Code coupling modules

EDF R&D

GEOM : Geometry

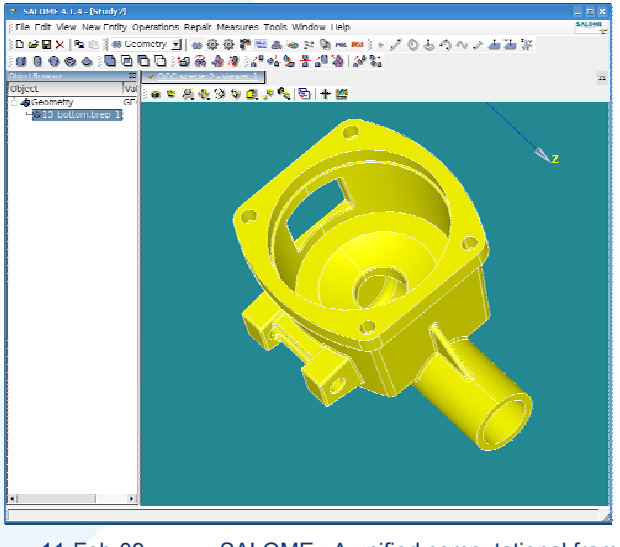
GEOM : Geometry

- Main features
  - Import/Export CAD from standards formats
  - Design geometric objects
  - Repair/correct CAD models
- Based on Cascade Technology

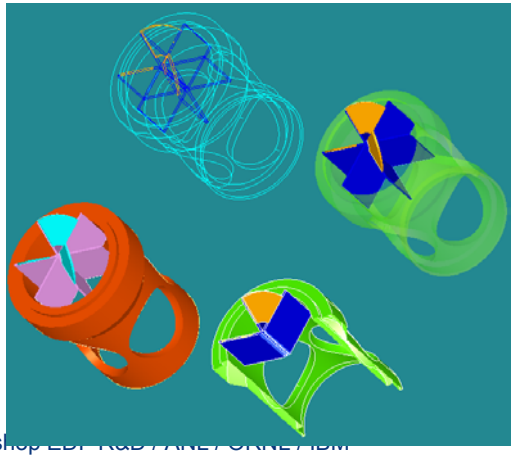


GEOM : Geometry

- Import/Export file operations
  - STEP
  - IGES
  - BREP (internal format)
  - STL (only export)
  - ACIS (CATIA V5)



- Graphical capabilities
  - Displaying and graphical editing of CAD models
    - Specialized 3D viewer (Open Cascade and VTK)
  - Graphical selection mechanism
  - Graphical properties
    - Wire frame, Shading
    - Transparency
    - Color

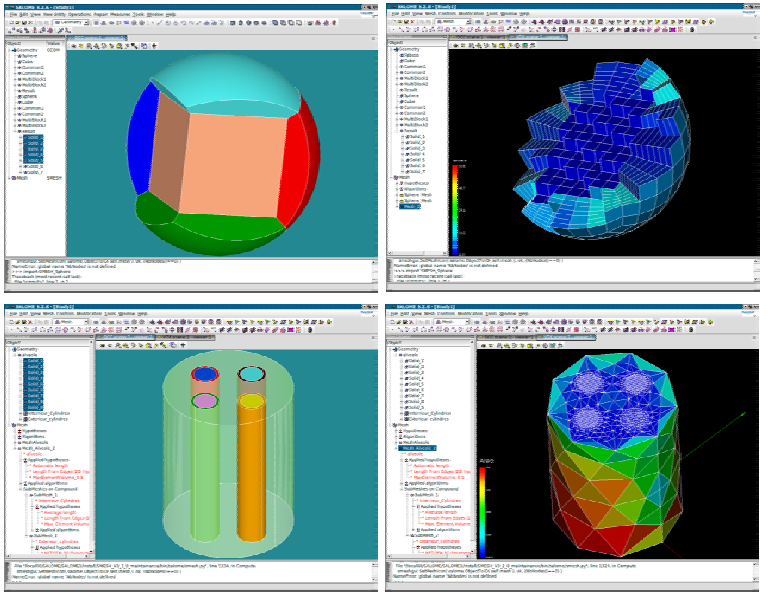


GEOM : Geometry

- Build geometric objects
  - Geometric primitives
    - 1D : line, circle, ellipse, arc, cuve, vector
    - 2D : plane, working plane
    - 3D : box, cylinder, sphere, torus, cone
    - Sketch : build a complex line or a face
    - Fundamental build : vertex, edge, wire, face, shell, solid, compound
  - Operations
    - Boolean : fuse, common, cut, section
    - Fillet, chamfer, partition, Archimedes
    - Explode in more basic geometric object
  - Generations
    - Extrusion, revolution, filling, pipe
  - Transformations
    - Translation, rotation, mirror, scale, offset
    - Multi-translation, multi-rotation
  - Informations
    - What is ?
    - Center of mass
    - Inertia
    - Bounding box
    - Distance
    - Coordinates

GEOM : Geometry

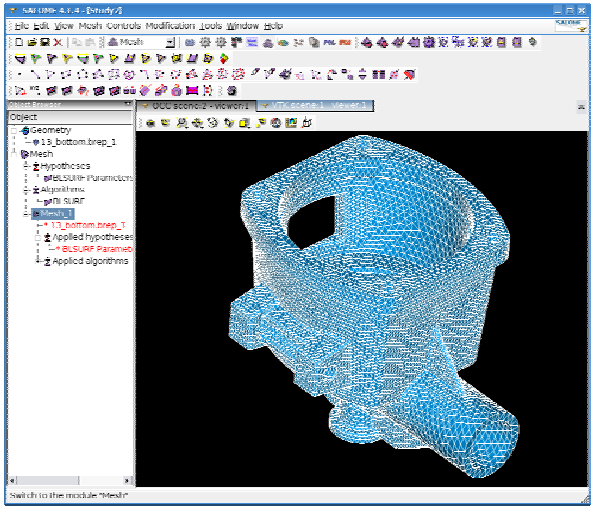
- Repair geometric objects
  - Suppress faces
  - Close wire, bounding of faces
  - Supress internal wires
  - Suppress holes
  - Sewing
  - Check free boundaries
  - Shape processing
- Geometric objects partition
  - To build hexahedron mesh
  - …



SMESH : Meshing

SMESH : Meshing

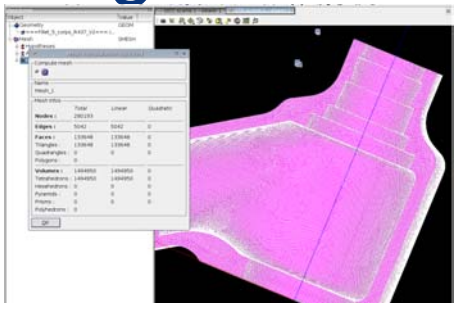
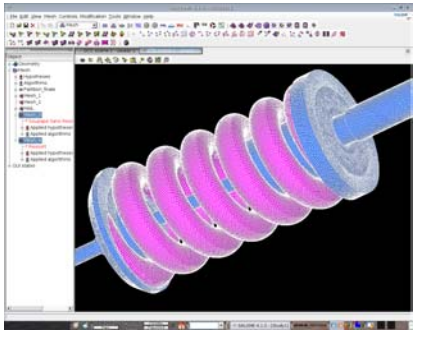
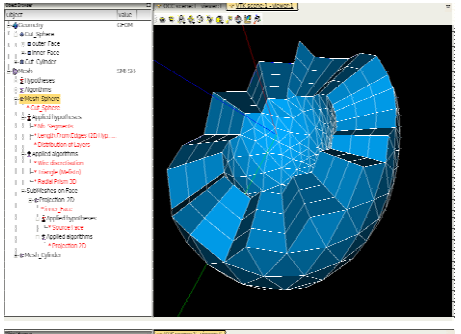
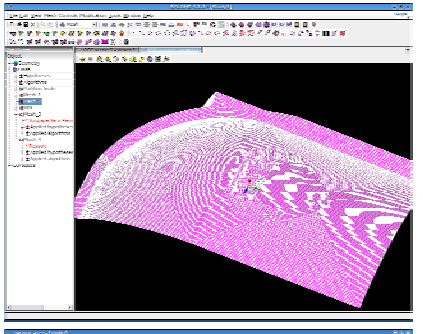
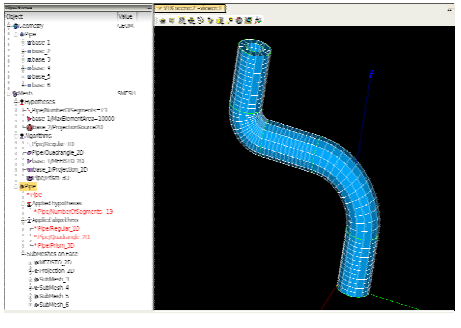
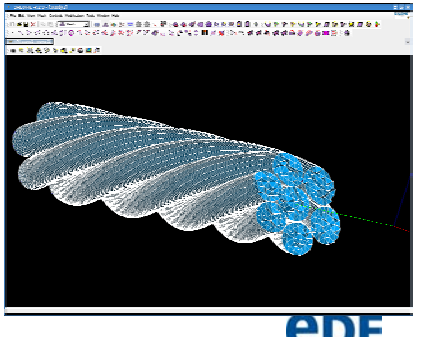
- Main features
  - Meshing geometrical models created or imported by the GEOM module
  - Modification of generated meshes
  - Quality control of meshes on a set of criteria
  - Grouping mesh elements and performing operations on these groups
  - Displaying information on meshes
  - Import and export of meshes in formats
    - MED (internal model)
    - UNV (IDEAS)
    - STL (only export)



- C++ API to connect external mesh algorithms (plug-in)

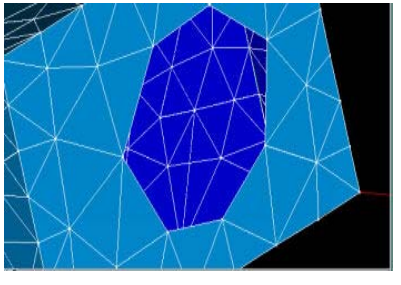
SMESH : Meshing

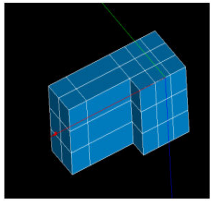
- Meshing algorithms available
  - MEFISTO (triangle)
  - BL-SURF (triangle)
  - NETGEN (tetrahedron)
  - GHS3D (tetrahedron)
  - I,J,K (hexahedron)
  - Mapping (quadrangle)
  - Projection 2D-3D
  - 3D Extrusion 3D
  - Radial Prism 3D

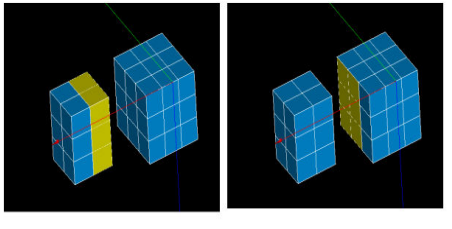







SMESH : Meshing

- Modifying a mesh
  - Add/delete node, edge, triangle, quadrangle, tetrahedron, hexahedron
  - Move node
  - Renumbering nodes, elements
  - Diagonal inversion
  - Union of two or more triangles
  - Cutting of quadrangles
  - Orientation
- Transformations
  - Translation, rotation, symmetry
  - Sewing, merge nodes, smoothing
  - Extrusion along a vector or a path
- …





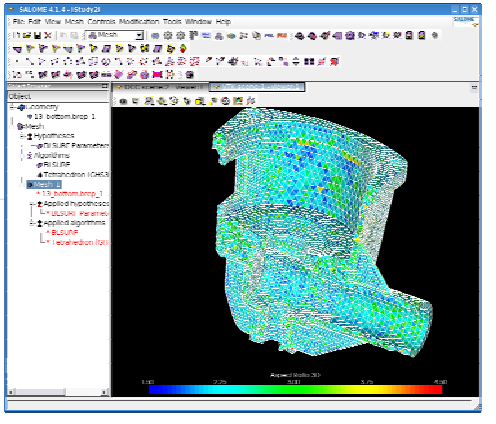


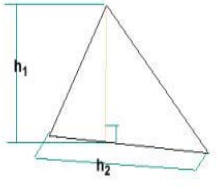
SMESH : Meshing

- Quality control
  - Free borders
  - Length 1D, 2D
  - Area, volume
  - Minimum angle
  - Warping
  - Skew angle
  - Aspect ratio
  - …

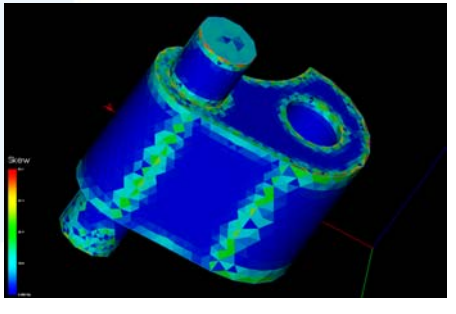
JA = 0.25 * (A1 + A2 + A3 + A4);

TAPER = MAX(| A1 / (JA - 1) |, | A2 / (JA - 1) |, | A3 / (JA - 1) |, | A4 / (JA - 1) |)

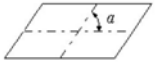


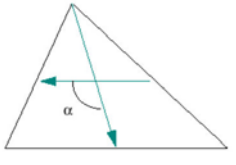


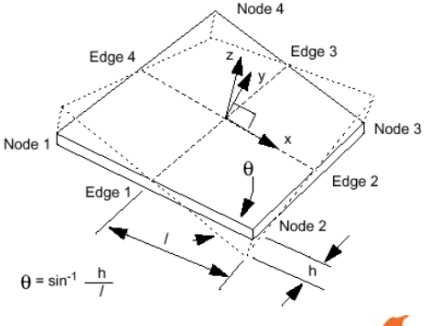
ASPECT RATIO = $\frac{a}{b}$



Aspect Ratio = $\frac{\sqrt{3}h_2}{2h_1}$



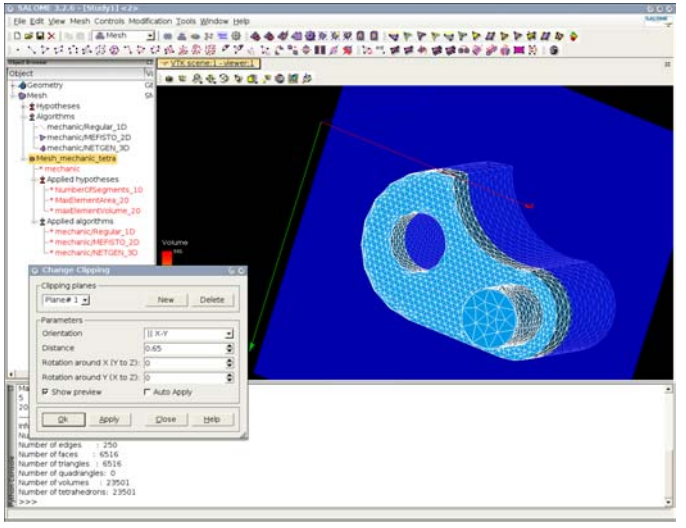


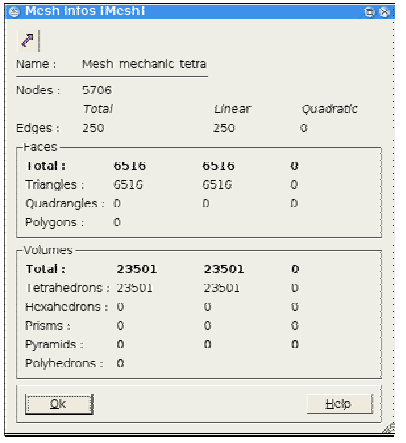


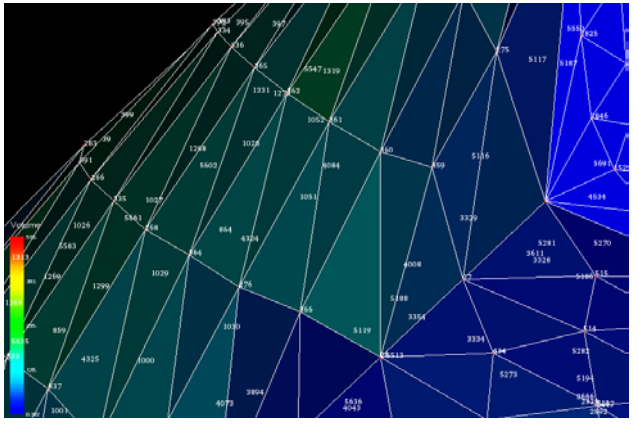
$\theta = \sin^{-1}\frac{h}{l}$

SMESH : Meshing

- Displaying
  - Mode :
    - wire frame,
    - shading,
    - shrink,
    - color
  - Entities : node, element
  - Informations







VISU : Post processing

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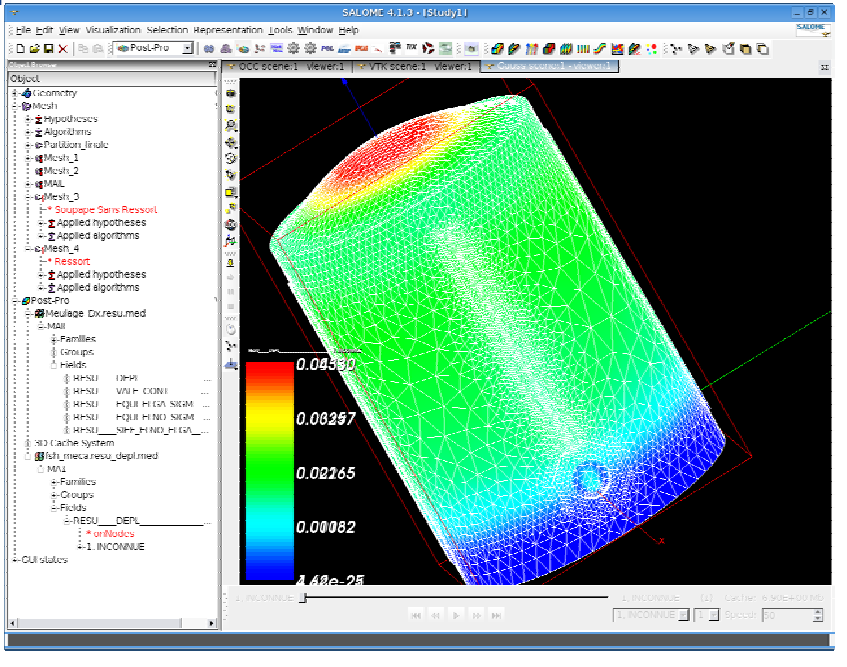
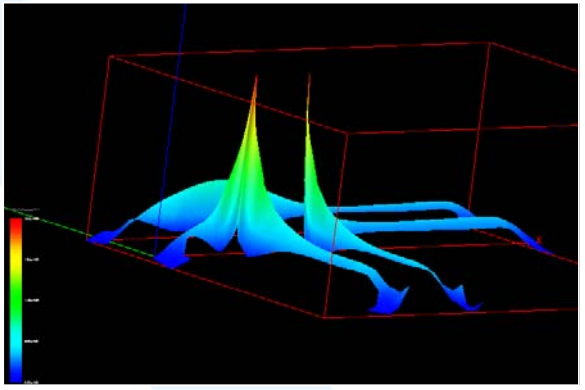
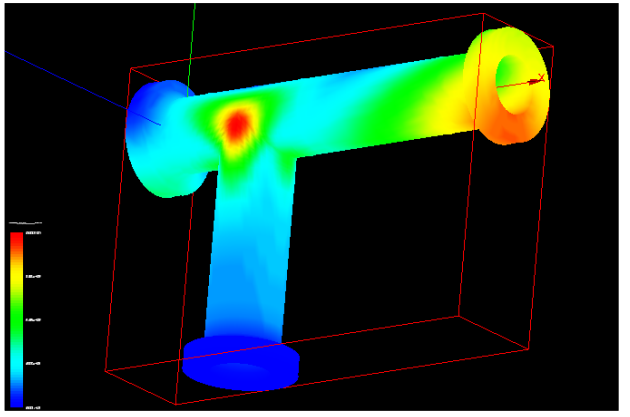
- Main features
  - Tools for graphics representation and use of the results from the numerical simulations codes (MED)
    - 3D graph representation
      - Scalar Map
      - Deformation, iso-values
      - Section plane
      - Vector
      - Stream lines
      - Animations
    - 2D evolution curve display (Plot) 2D / 3D
  - Printing of graph results



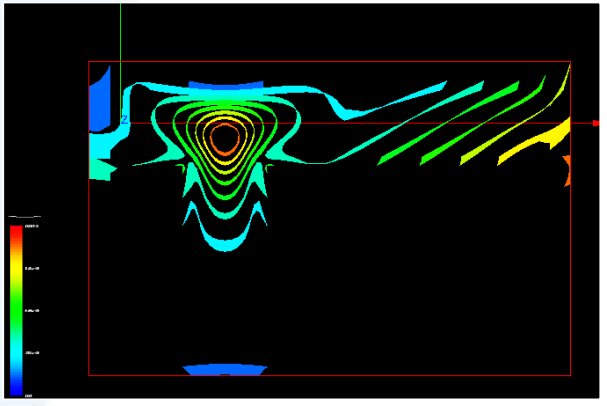
VISU : Post processing



Plot 3D



Scalar Map



Iso surfaces