

# **An introduction to Salome & Code\_Aster: A simple linear statics analysis of a piston**


**J.Cugnoni, CAELinux.com , 2005**

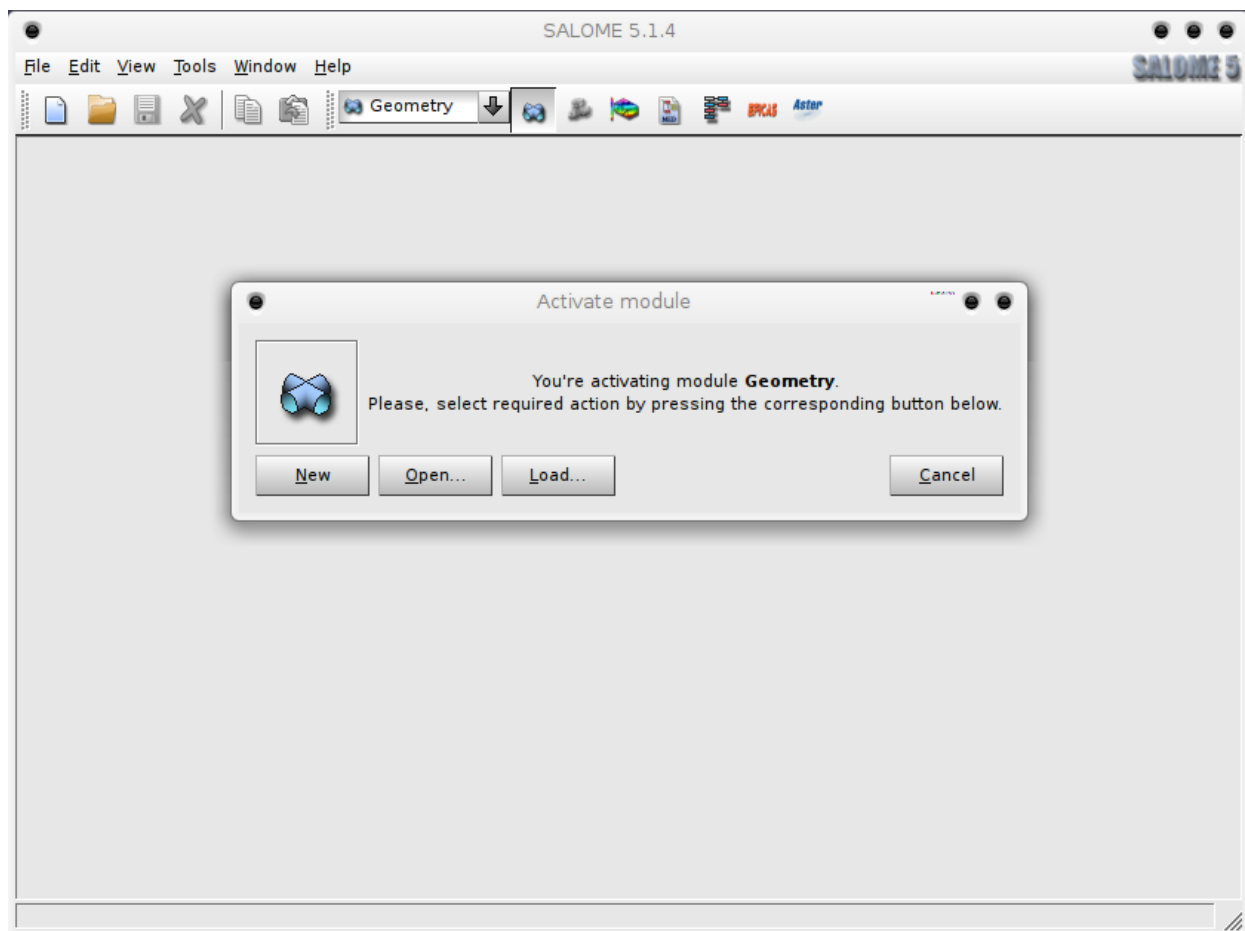
**Updated to comply with SaloméMECA 2010.2  
by  
C.Andersen, for CAELinux.com, 2010**

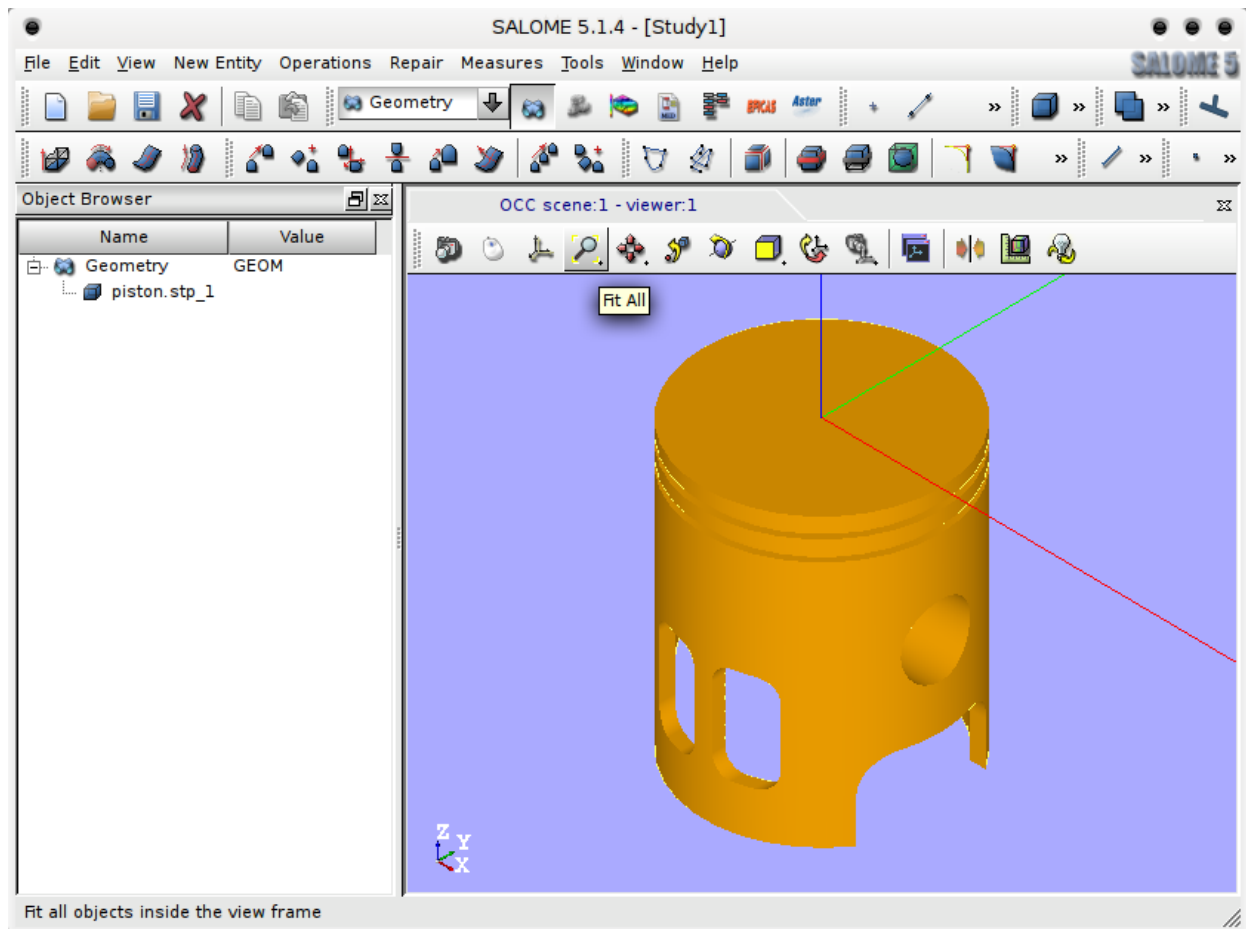
## **Overview:**

- **Geometry module:**
  - Import and prepare STEP file format geometry, group creation
- **Mesh module:**
  - Meshing geometry in preparation for FE study
- **Aster module:**
  - Creating a linear statics study using the wizard
  - Running the calculation
  - Viewing the run-time performance results
  - Editing a command file with Efficas
- **Post-processing module (VISU)**
  - Post-processing the result of the study


## **Geometry module: Importing geometry**

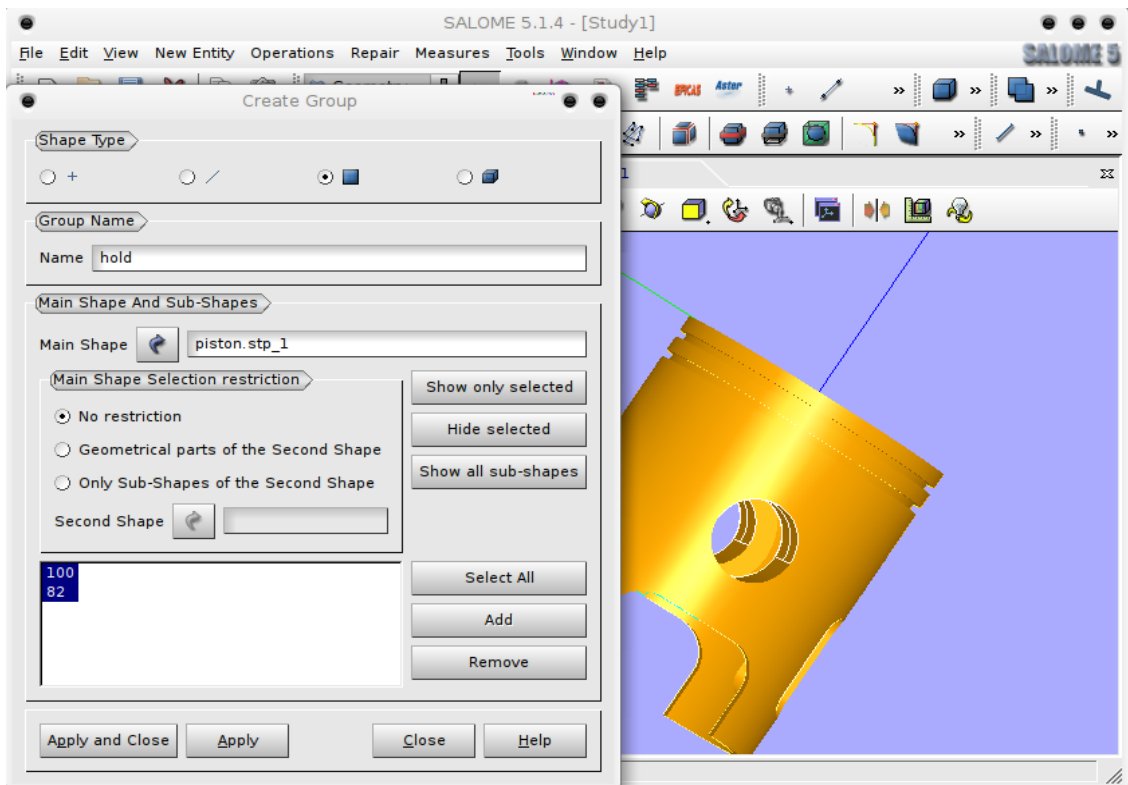
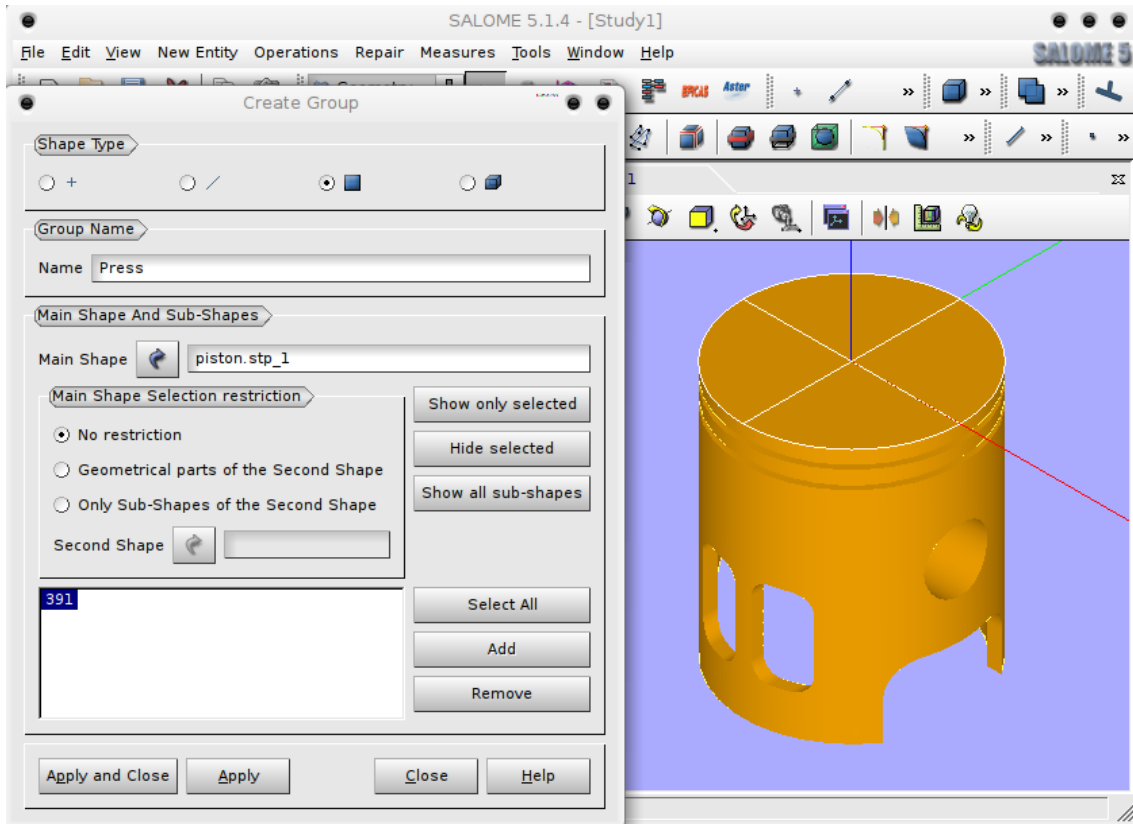
- Start SaloméMECA and select **Geometry** module, choose **New** in the dialog
- Select menu **File** → **Import**
  - Choose **STEP** file format in the pull-down menu
  - Select the file '**Piston.stp**'
- Click the **Fit All** icon in the View tool-bar 
- If the geometry is presented as a wire-frame, click menu **View** → **View Mode** → **Shading**

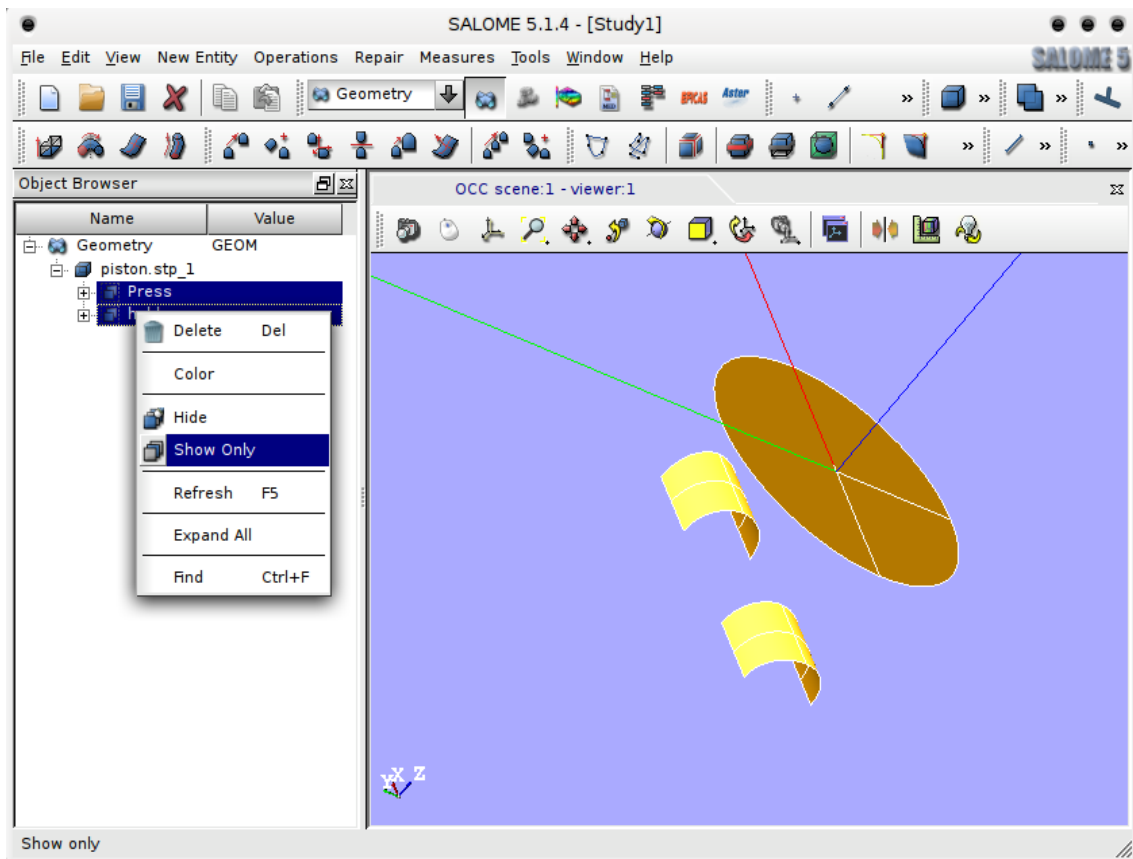







## **Geometry module: Preparing geometry; creating groups**

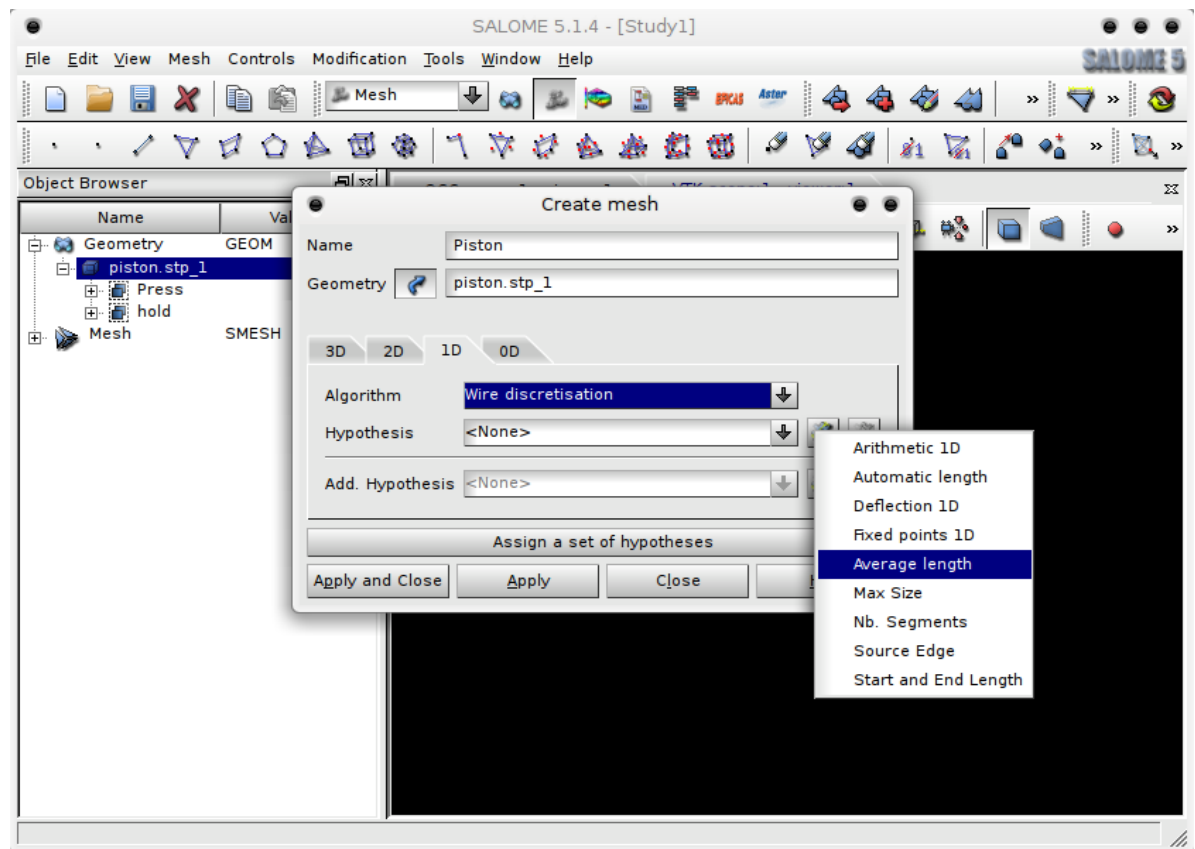
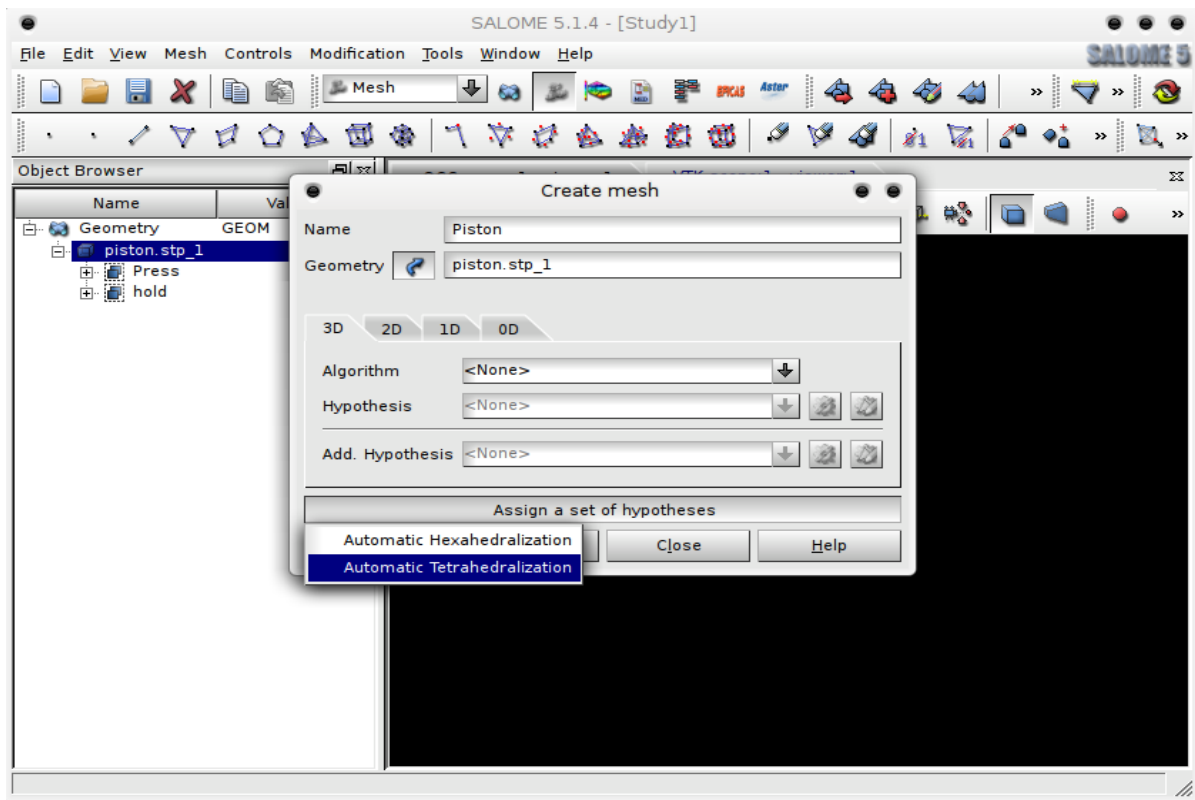
- Expand Geometry in the object browser and right-click 'Piston.stp\_1' and select Create Group
- Select Shade Type **Face** 
  - Under **Group Name** enter '**Press**'
  - Move the mouse pointer over the piston geometry and press LMB to select the top, circular face.
  - Once the top, circular face is selected, press **Add**, followed by **Apply**.
  - The geometry group '**Press**' is now created
- Creating the '**hold**' group
  - Enter the name '**hold**' for this new group
  - Pressing and holding *CTRL* while using *RMB* to rotate the piston geometry, select the two upper halves of the holes going through the piston – hold *SHIFT* to select two individual faces
  - Click **Add**, followed by **Apply and Close**
- To make sure the correct face groups have been created, expand **piston.stp\_1** in the object browser, select both groups (pressing and holding *CTRL* or *SHIFT*) in the object browser, right-click and select **Show Only**
- To return to a normal view, right-click **piston.stp\_1** and select **Show Only**



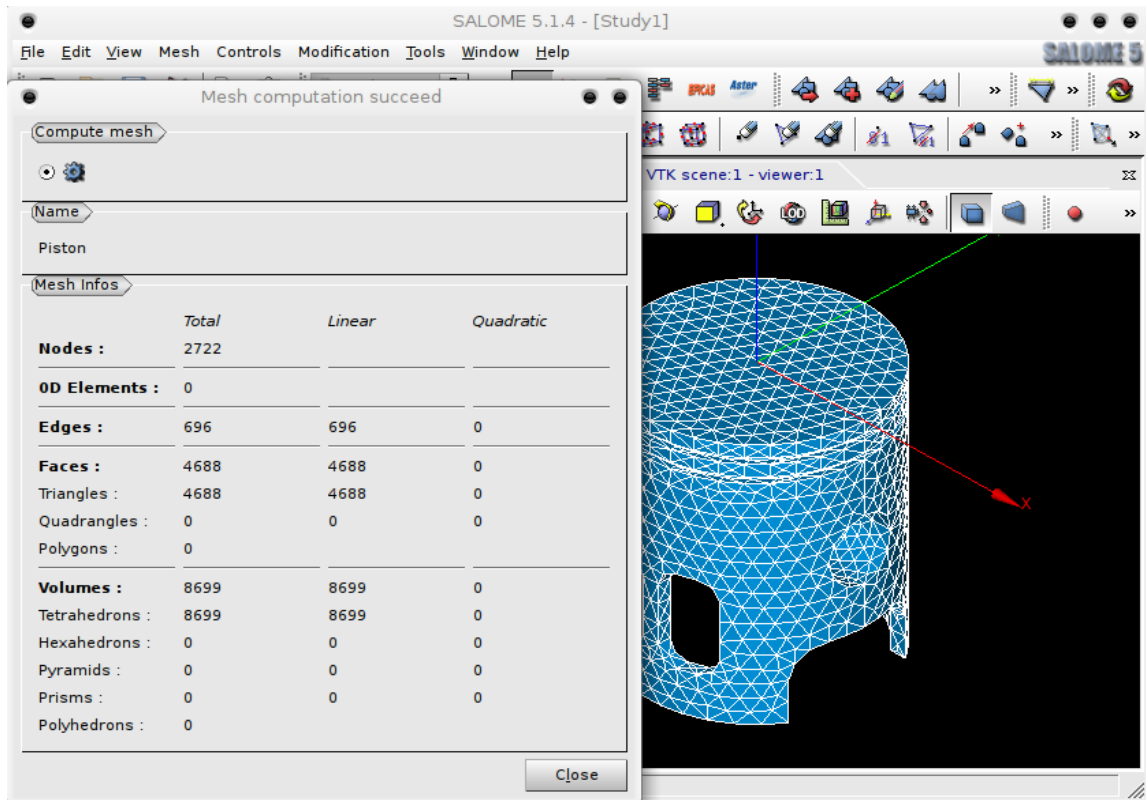
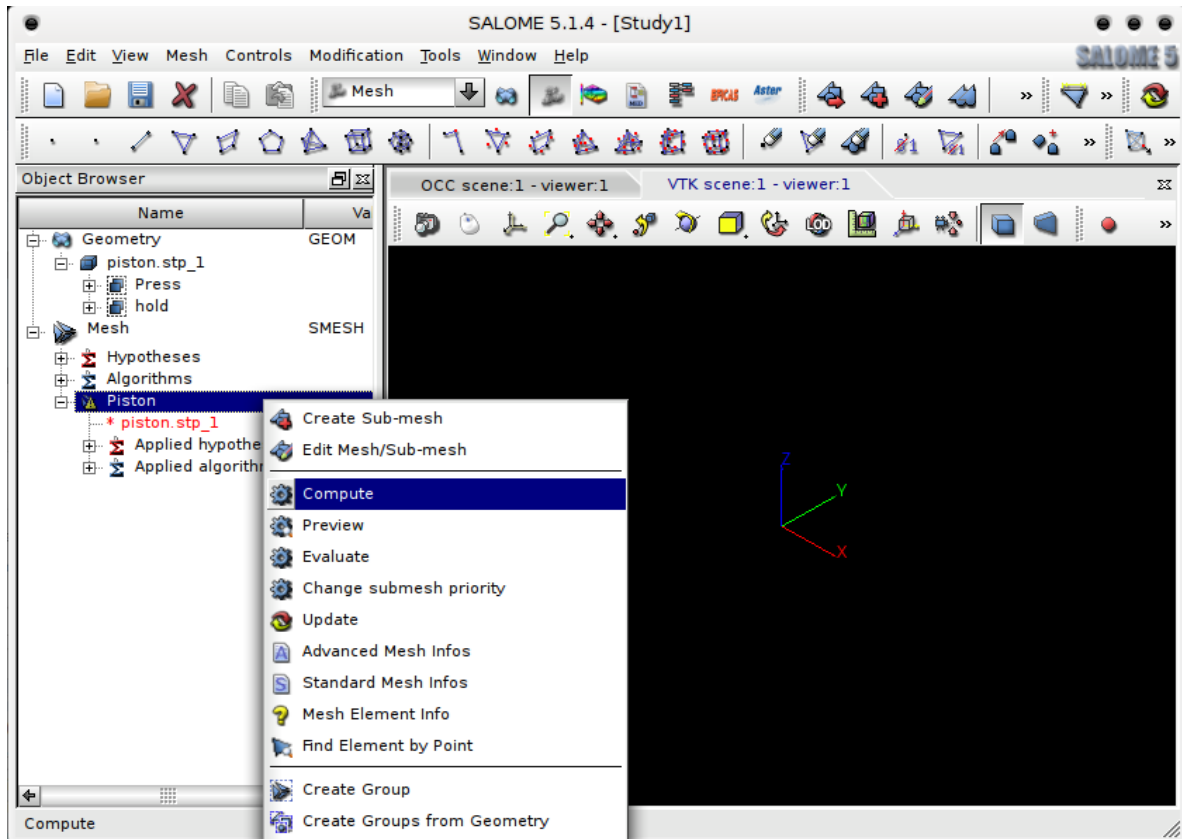


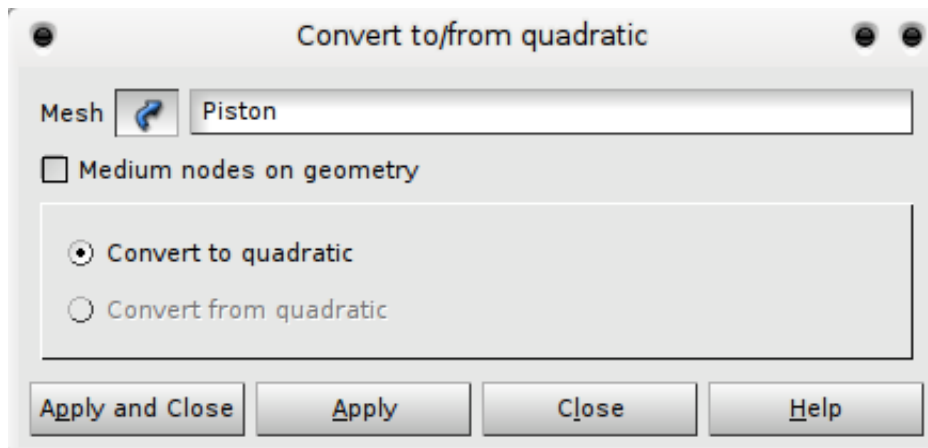
## ***Meshing the geometry***

- Switch to the **MESH** module 
- Click **Create Mesh** 
  - Change the name from **Mesh\_1** to **Piston**
  - Under **Geometry**, make sure **piston.stp\_1** is selected, otherwise select **piston.stp\_1** in the object browser and click the blue arrow.
- Click **Assign a set of hypotheses** – select **Automatic Tetrahedralization**
  - Click **Cancel** in the dialog **Hypothesis Construction – Max Length**
  - Click the **1D** tab, under Hypothesis, click the gear icon and select **Average Length**
  - Under **Length**, change the value to **0.005** – click **OK**
  - Click **Apply and Close**
- Expand **Mesh**, right-click the **Piston** mesh and select **Compute**
- When the mesh is computed, close the dialog
- Right-click on the **Piston** mesh (notice the yellow !-sign is gone) and select **Convert to/from Quadratic** 
  - **Convert to quadratic** will automatically be selected
  - Click **Apply and Close**






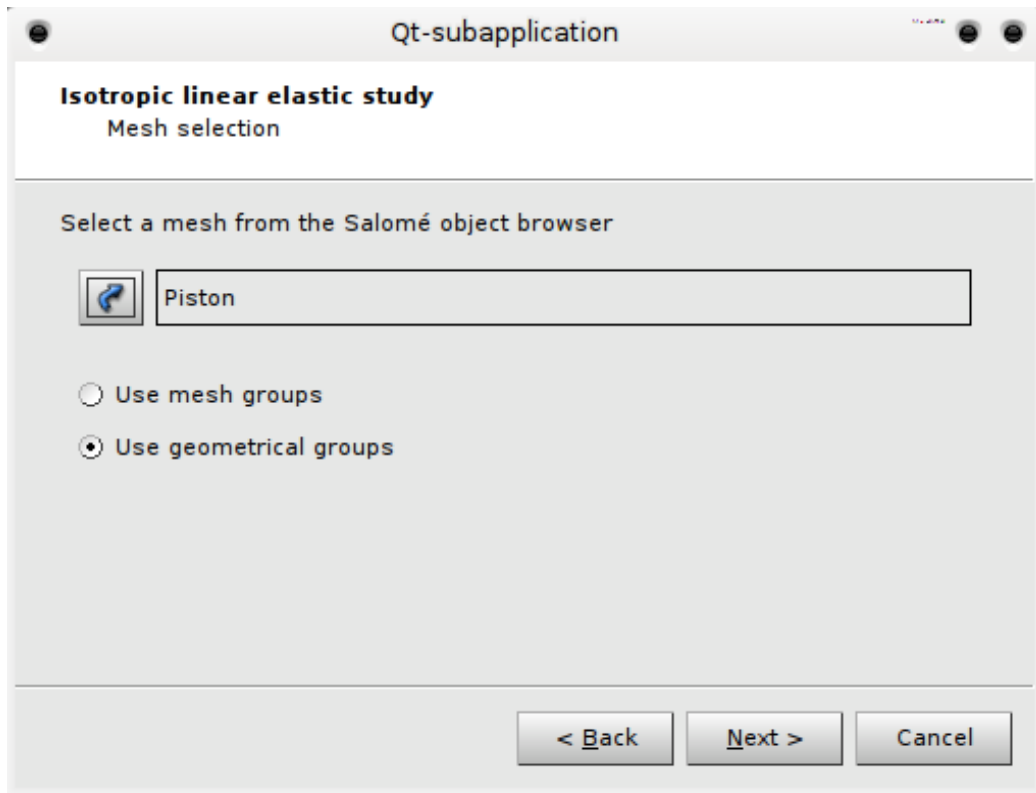
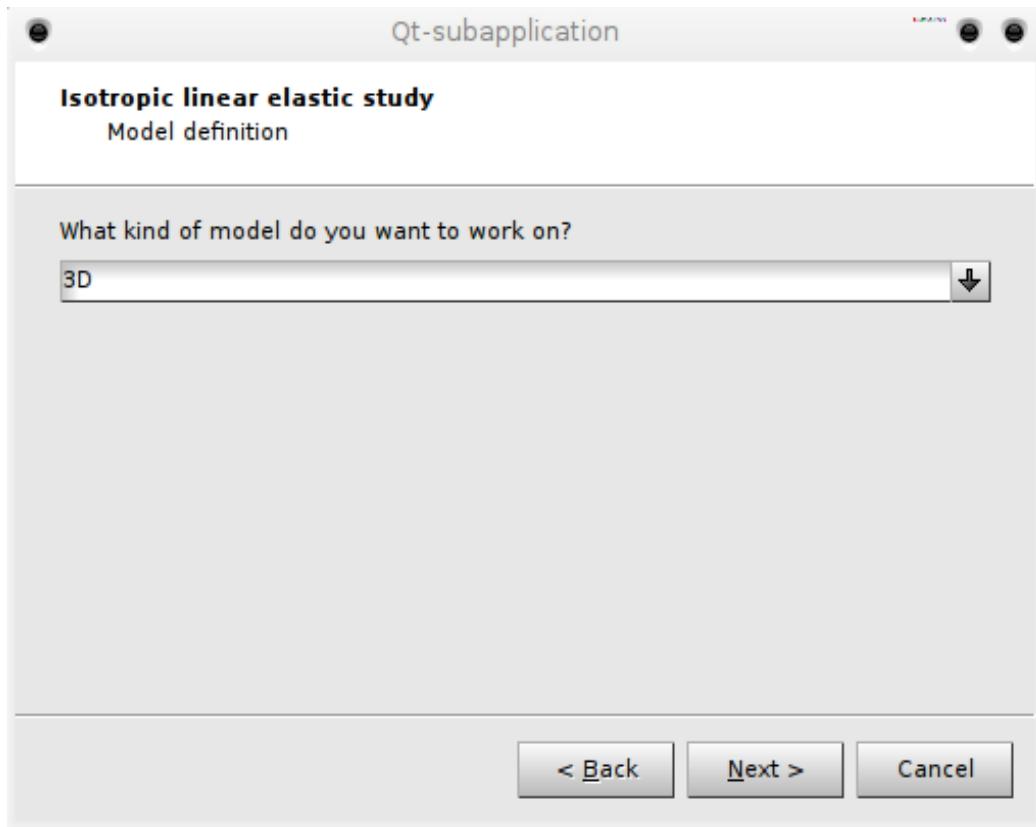


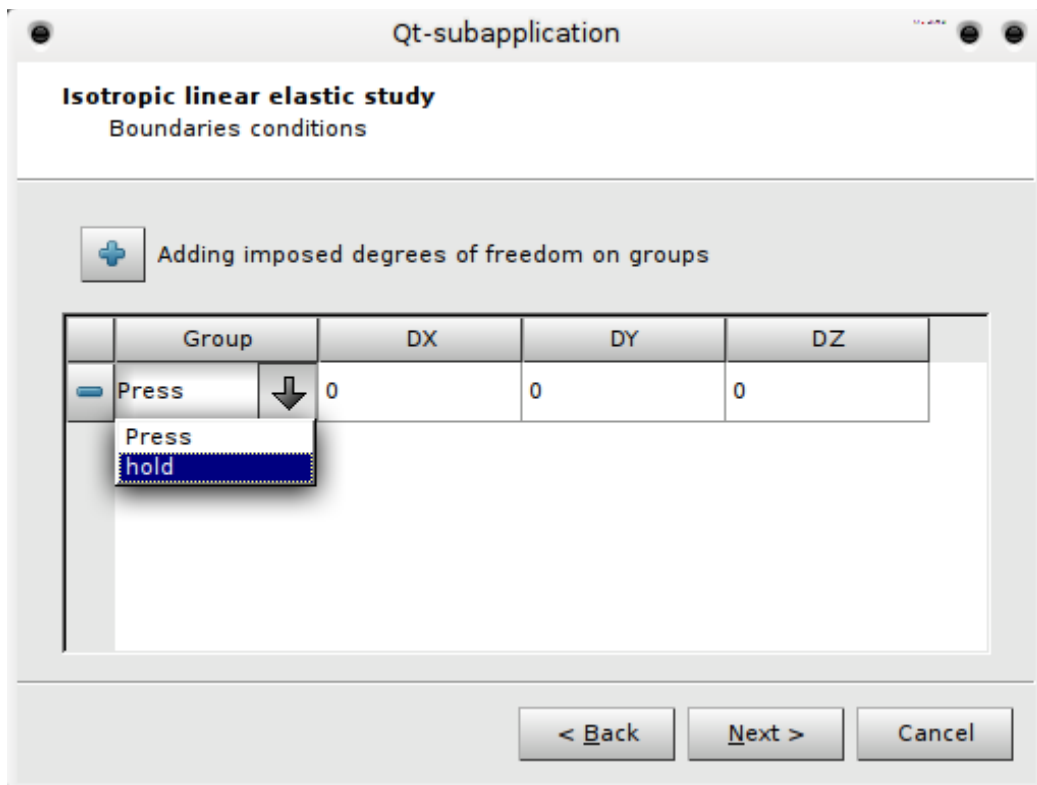
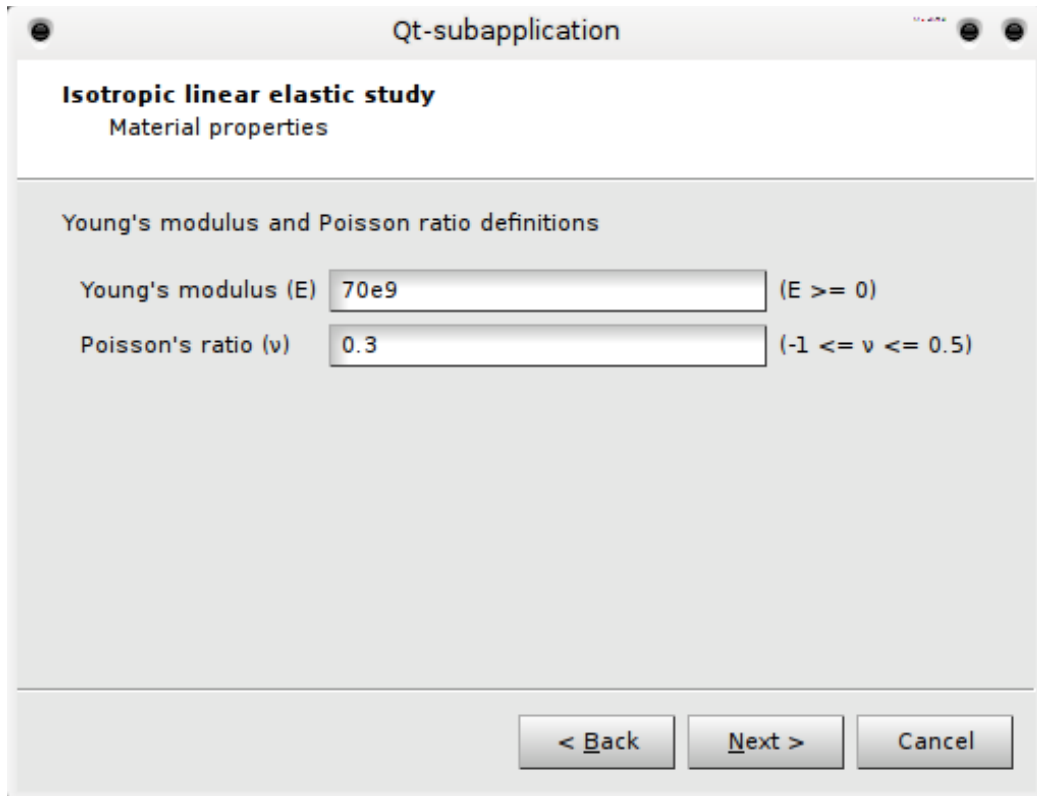


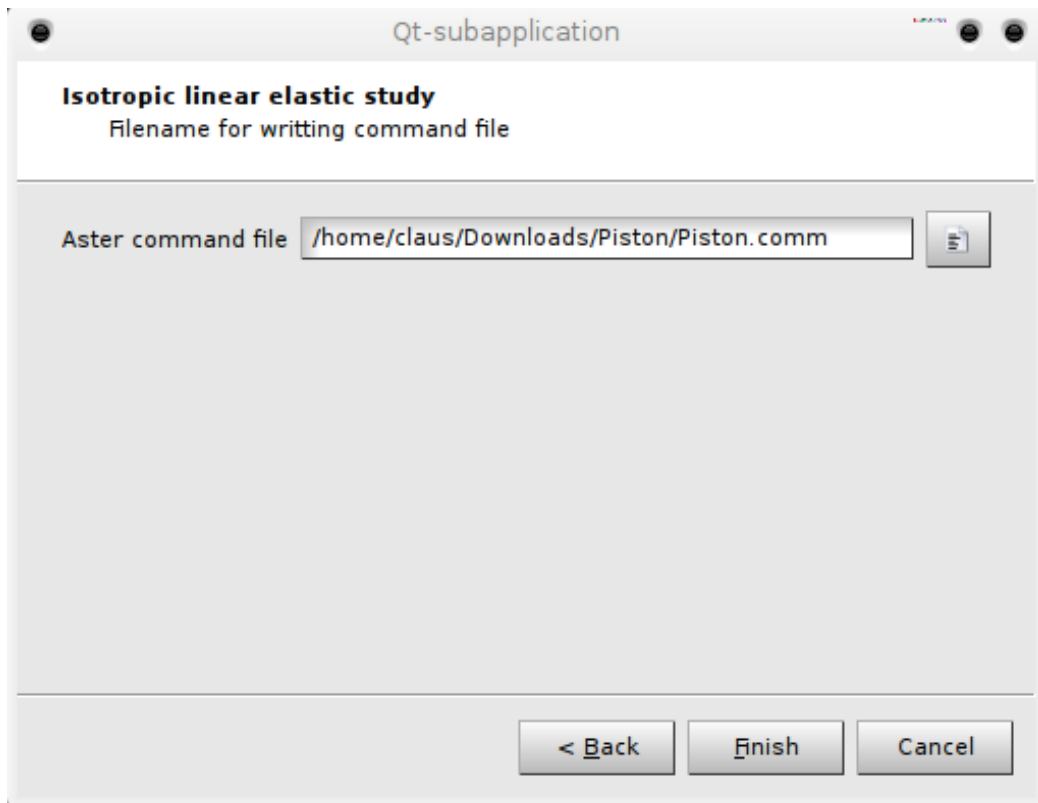
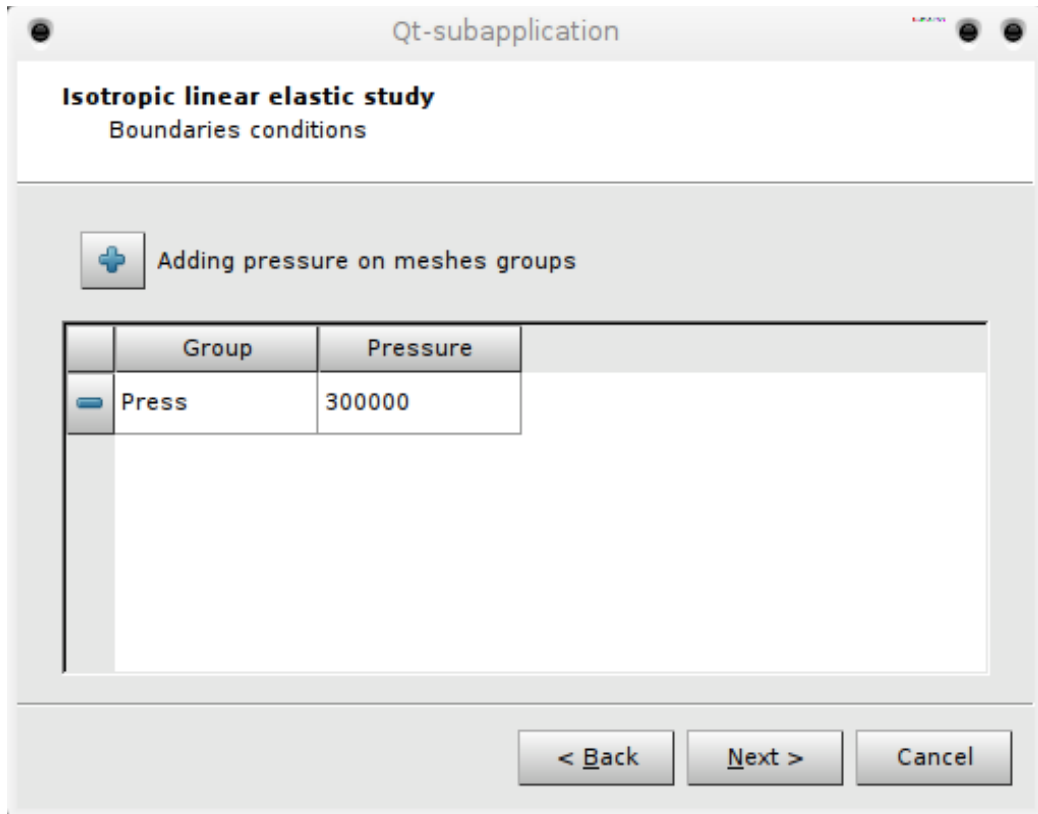


## **Aster module – Creating a study using a wizard**

- Switch to the **Aster module** 
- Click the **Linear Statics Wizard** icon 
- In the following dialog **3D** is automatically selected – click **Next**
- In the next dialog select the **Piston mesh** in the object browser under **Mesh** and click the blue arrow
  - **Use Geometrical Groups** should be selected – this will import and create mesh groups created in the **Geometry** module
  - Click **Next**
- In the next dialog enter a **Young's Modulus (E)** value of **70e9** (or 70000000000) and a **Poisson's ration** of **0.3**
  - MKS SI-system is used here and thus all dimensions are in meters, and pressure will be in Pascals – 70e9Pa corresponds to a E-module of 70GPa
  - Click **Next**
- In the next dialog **Boundary Conditions** are imposed on the model
  - Double-click the the first row in the **Group** column, press the down-arrow and select the '**hold**' group
  - Leave values for **DX,DY** and **DZ** at **0** and click **Next**
- In the next dialog a group for applying pressure must be selected
  - Again, double-click the first row in the first column, pull down the menu and select the **Press** group
  - Double-click the first row in the second column and enter a pressure value of **300e3** – or 300000
  - Click **Next**
- In the next dialog a name and a destination for the created command file must be selected
  - Click the file dialog button 
  - Navigate to the folder that should contain the study files and type in a name for the command file – click **Finish**

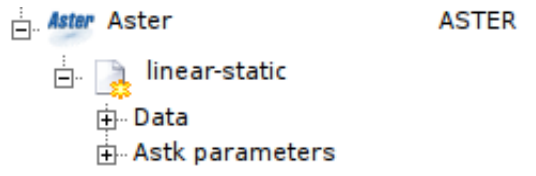






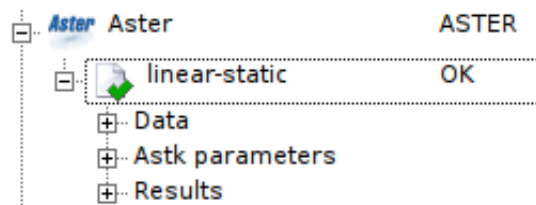
- Expanding the **Aster** tree in the object browser a new study should now be present:

- .



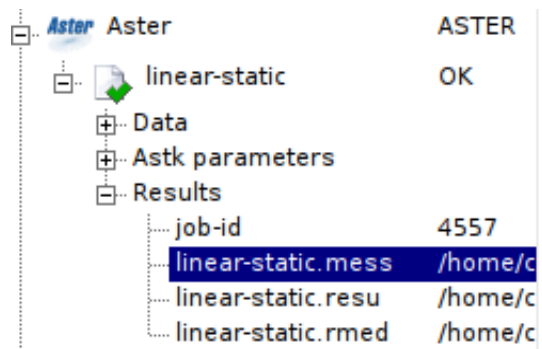
- Right-click **linear-static** and select **Run**
- A terminal window should now appear and a lot of text will scroll by
- After the calculation has finished, the terminal will disappear and you will be presented with a green tick on the linear-static study:

- .



- Take a moment to thoroughly enjoy this seemingly innocently looking icon, because you WILL learn to love it once you start playing around and your studies fail :)

- Expand the Results tree in the Object Browser, there will be 4 entries:



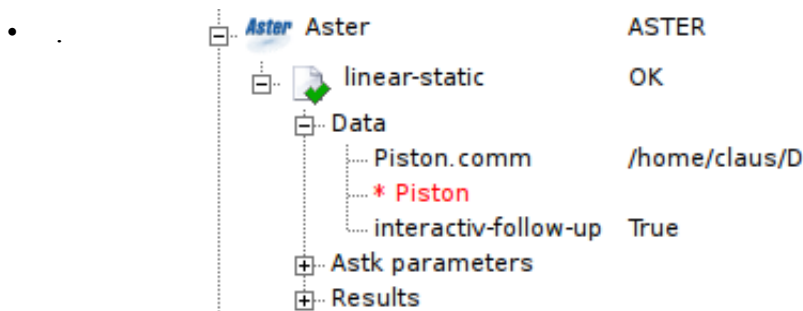
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- Right-clicking each entry will give you options to **Read as Text** or **Edit as Text** – or other
- **job-id**: Self-explanatory
- **linear-static.mess**: This file contains messages produced by the calculation and should be the first place to search for errors.
- **linear-static.resu**: This file contains among other things, short description of errors encountered and a detailed summation of run-time performance, i.e. how long time it took for each command to run and overall time consumed, in this case:  
**\*TOTAL\_JOB: ELAPSED: 9.42 seconds\***
- **linear-static.rmed**: This file containing the results to be used in the Post-processing module



## **Aster module – Editing a command file**

- Should a mistake have been made during the wizard, such as selecting a wrong group, entering a wrong value for pressure etc., the command file can easily be edited from within the Aster module:

- Expand the **linear-static** study tree and expand the **Data** branch like so:



- When right-clicking the **Piston.comm** command file, 3 choices are presented:
- **Read as Text** : Will display the command file in a window in read-only mode
- **Edit as Text** : Will open the command file in an external editor (of the users choice)
- **Run Efficas**: Will open the command file in Efficas, an editor specially designed for creating and editing Code\_Aster command files. This editor will take care of the very strict syntax Code\_Aster requires, and is highly recommended for beginners for anything other than changing simple values in a command file.
- Right-click the Piston.comm file in the object browser and select **Run Efficas**
- In this introduction only 2 entries will be mentioned:
  - **DEFI\_MATERIAU** – Define material:
    - **ELAS** – Elastic material
    - The values entered earlier are present here: **E-module**, **NU** (Poissons ratio)
  - **AFFE\_CHAR\_MECA** : Assign boundary conditions and loads:
    - **DDL\_IMPO**: The face group '**hold**' is restricted in all directions, i.e. **DX,DY,DZ = 0** (DDL: Degrés De Liberties = degrees of freedom, IMPOsed)
    - **PRESS\_REP** : A pressure of  $300 \times 10^3$  Pascals is imposed on the '**Press**' face group
- To change a group under e.g. **PRESS\_REP**, simply click **GROUP\_MA**, use the right hand arrow to move the name into the Value (Valeur) field and clear it. Either type the name of the group, *or* select the face group in the **Piston mesh** in the **MESH** module and press the button I've marked in the following picture – curiously the icon image is gone in my version. Use the left hand arrow to enter the new name, confirm with '**Valider**' – a new value/name should now be present under **PRESS\_REP** → **GROUP\_MA**

Piston.comm

Commande	Concept/Valeur
DEFI_MATERIAU :	MA
ELAS :	
E :	700000000000.0
NU :	0.3
LIRE_MALLAGE :	MAIL
MODI_MALLAGE :	MAIL
AFFE_MODELE :	MODE
AFFE_MATERIAU :	MATE
AFFE_CHAR_MECA :	CHAR
MODELE :	MODE
DDL_IMPO :	
GROUP_MA :	hold
DX :	0.0
DY :	0.0
DZ :	0.0
PRES_REP :	
GROUP_MA :	Press
PRES :	300000.0
MECA_STATIQUE :	RESU
CALC_ELEM :	RESU
CALC_NO :	RESU
IMPR_RESU :	
FIN :	

Saisir Valeur

Valeur(s) actuelle(s)

Press

Valeur

Visualiser


Select a group from Salomé - mesh module

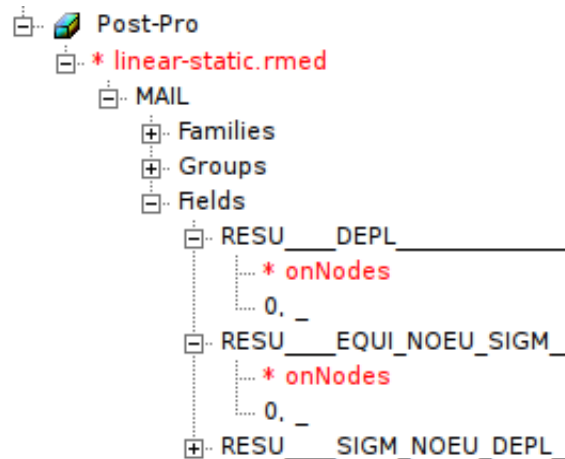
Parametres

Importer

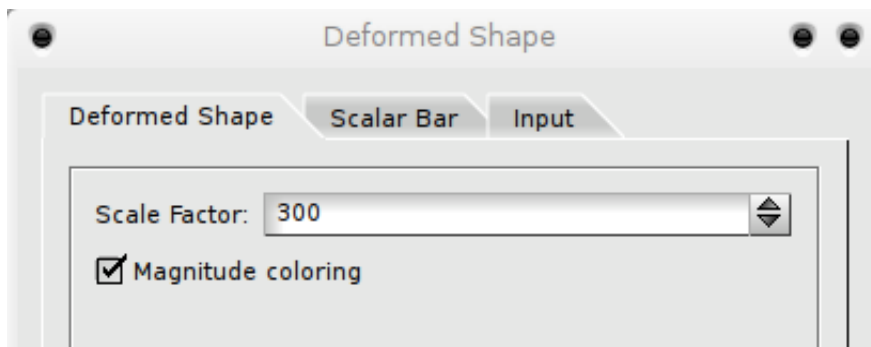
Valider

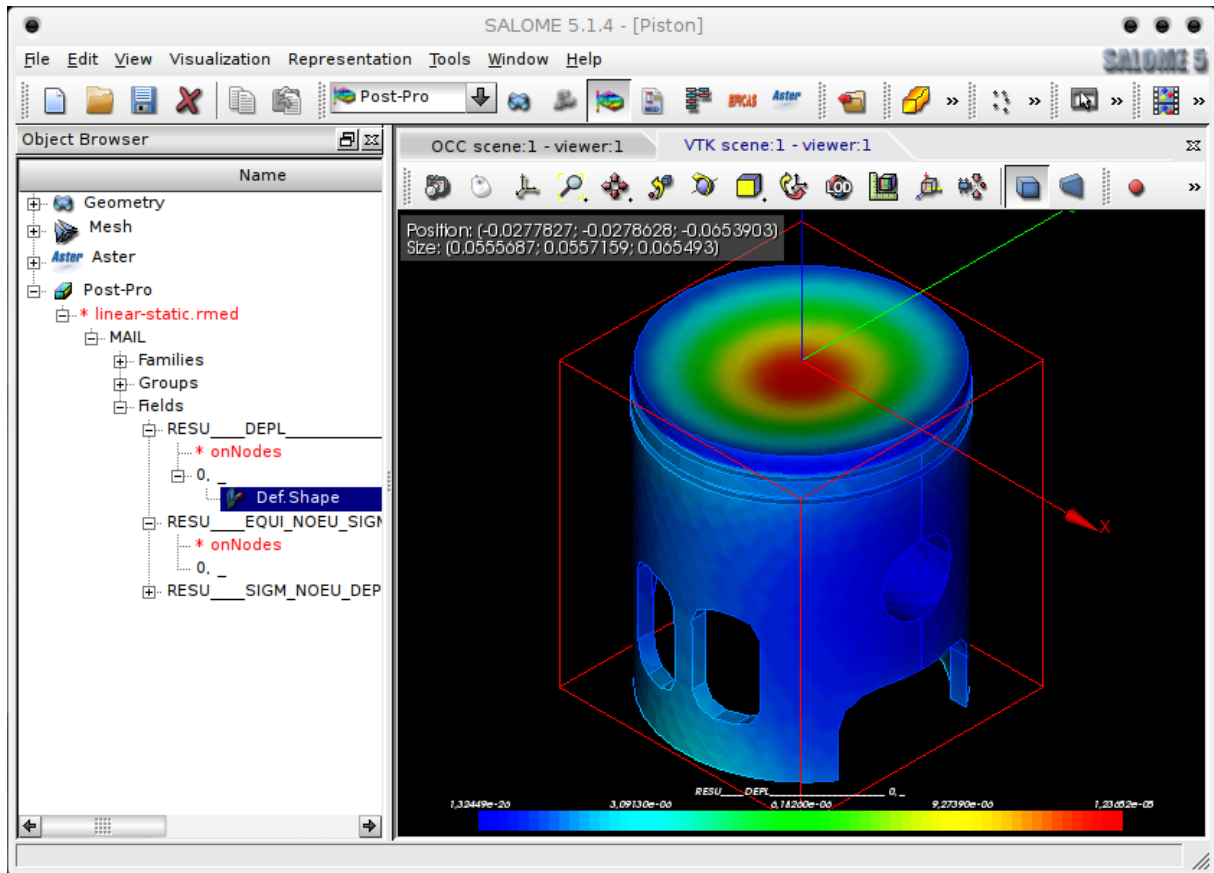
## Post processing

- Click the **Post-Pro** icon to switch to the **Post-Pro module** 
- Expand the Post-Pro tree in the object browser until it looks like this:

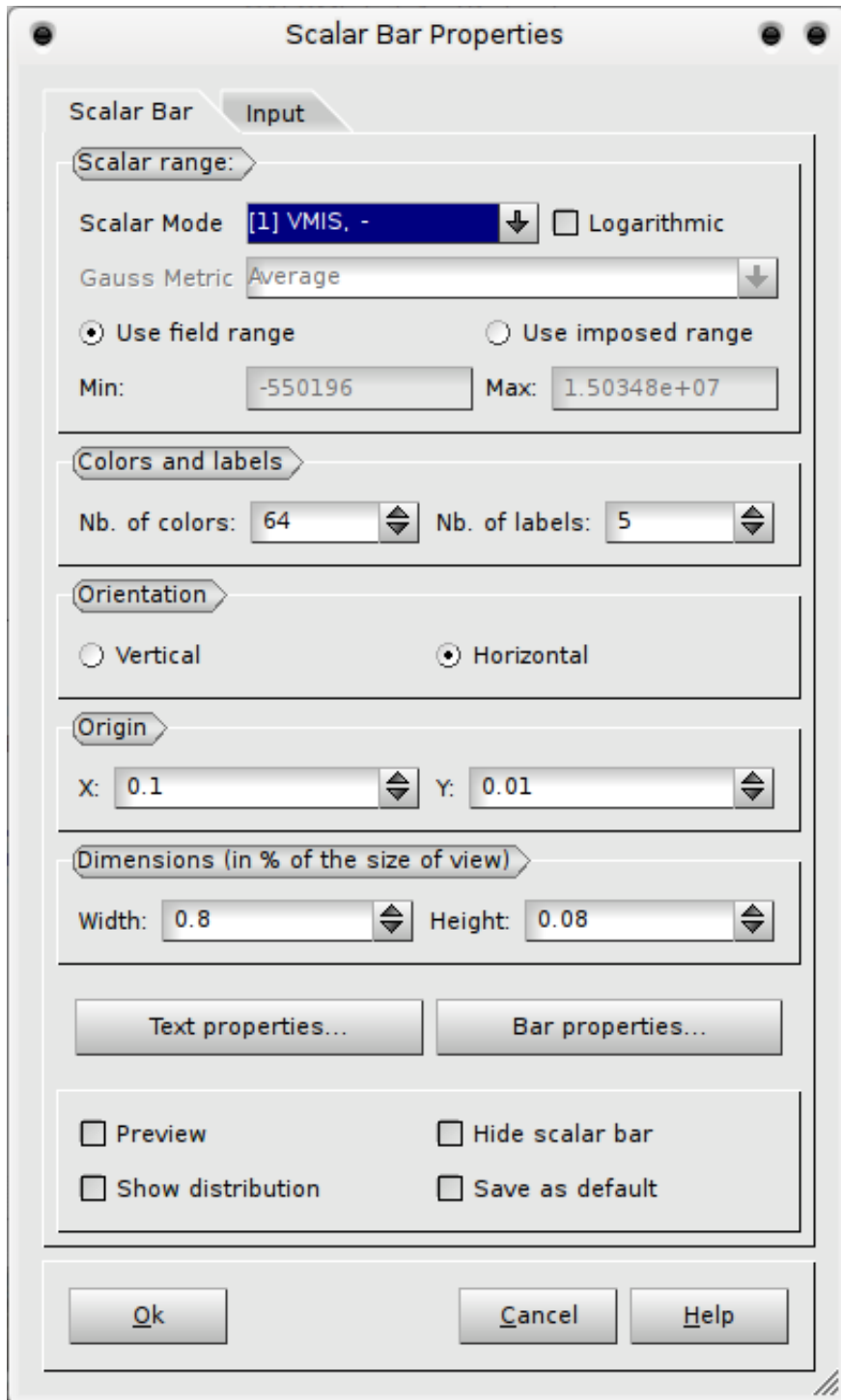


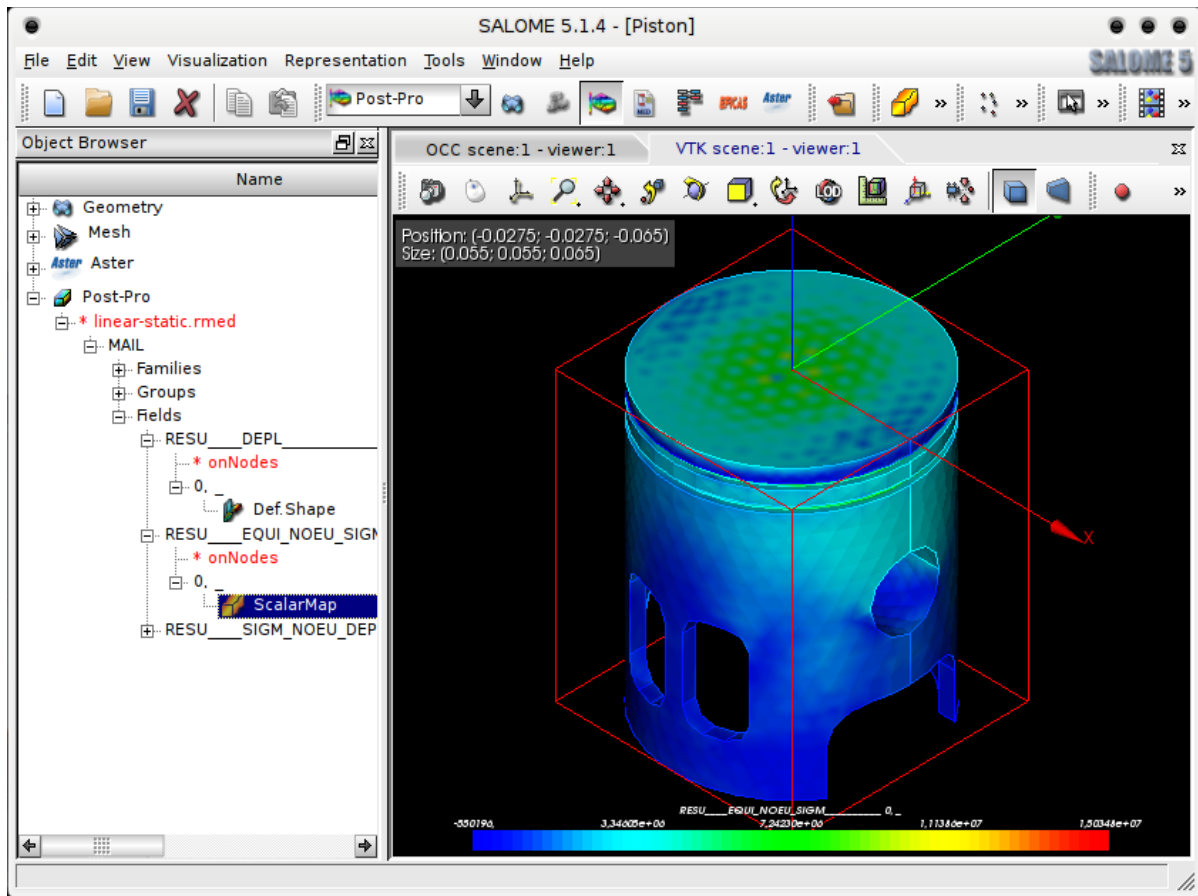
- Displacement / Deformation:
  - Under **RESU\_DEPL\_**, right-click **0,\_** and select **Deformed Shape**
  - Enter a **Scale factor** of **300**, tick **Magnitude Coloring** and press **Apply and Close**
  - Now expand **0,\_**, right-click **Def.Shape** and select **Show Only**





- Von Mises stresses:
  - Under **RESU\_\_EQUI\_NOUE\_SIGM**, right-click **0,\_** and select **Scalar Map**
  - In the pull-down menu **Scalar Mode**, select **VMIS.-** and click **OK**
  - Again, expand **0,\_** , right-click **ScalarMap** and select **Show Only**





**Congratulation , you have finished this first introduction to  
Salomé & Code\_Aster.**

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**[www.caelinux.com](http://www.caelinux.com)**

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