Visual Analysis for **E**xtremely **La**rge-**S**cale **S**cientific **Co**mputing

Evaluation Event

**USE CASE 1: Barcelona Model Simulation (FEM)**

Simulation Tool: GiD

Table of Contents

1 GiD Installation Guide

1.1 Download and installation of GiD

- Enter to **www.gidhome.com/download/developer-versions**
- Download the **13.1.1d** (developer version) for your operating system
- Install it in your computer.

1.2 Get a password of GiD 13

- The first time you open GiD, the Help->Register GiD window will appear:
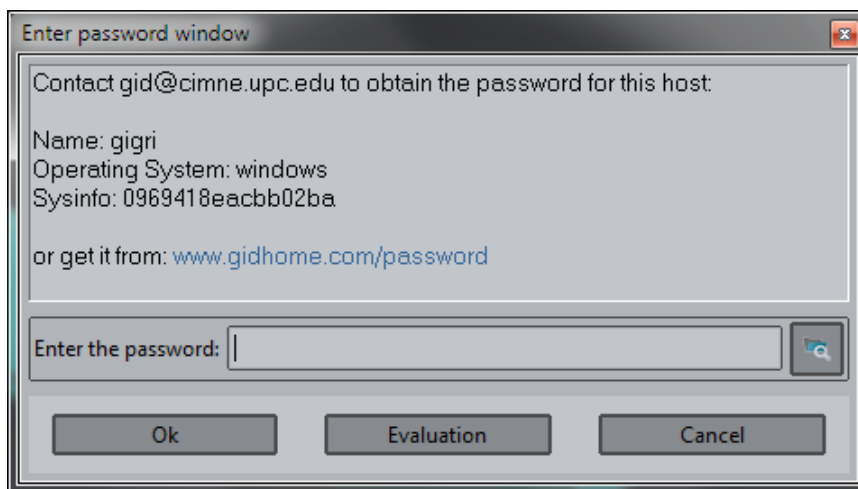

- **In case you already have a password for a GiD v13** installed in your computer, you can get the password from it by clicking the button in the lower right part of the window (icon with a folder) and selecting the path where the other GiD is installed.
- **In case you don't have a password for GiD v13**, you should ask for a free temporary password:
    - ○ Go to:
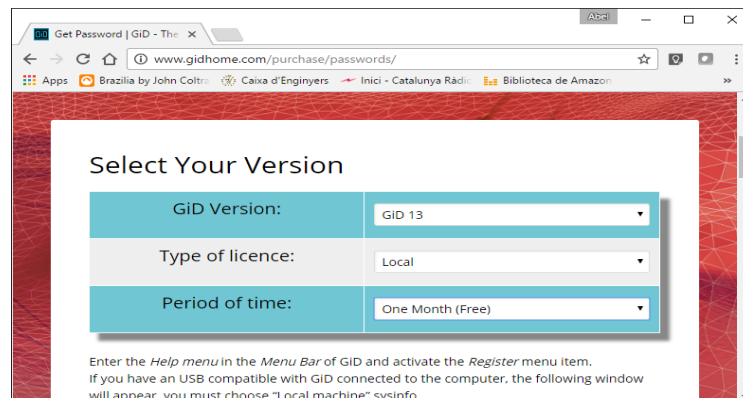
- o Select 'Local' type of license, and 'One month (free)' period of time
- o Follow the instructions and click 'Send'
- o A free password for one month of duration will be given to you in the web site, and you should put in the 'Register GiD window' and click ok.
- o In the upper right part of GiD window, the icon indicating if GiD has password or not should be changed from red to green.

1.3 Installation of VELaSSCo plug-in

- Select the option '*Problem type -> Internet Retrieve…*' from the '*Data*' menu.
- In the appearing window (see Figure below), select the module '*VELaSSCo*' and click '*Retrieve module*'. Note that you need internet connection for retrieving it.
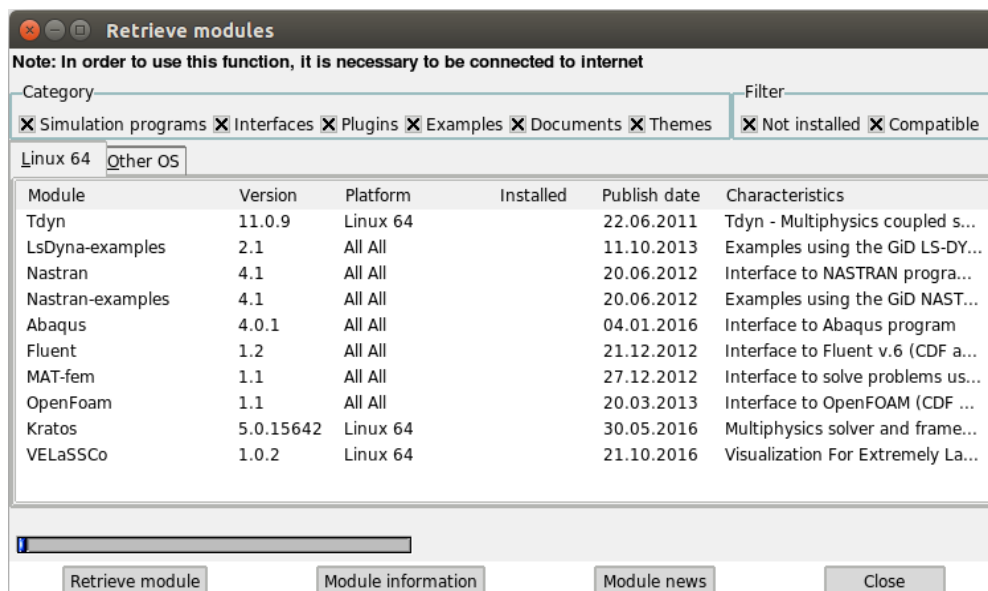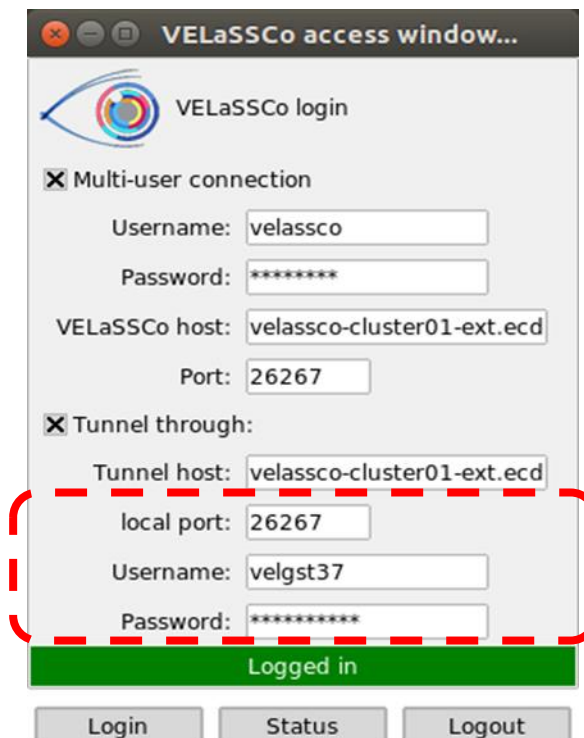

1.4 Connect to EDDIE Cluster

- The usernames created for the Evaluation Event to connect to the VPN network are **velgst2** to **velgst50** (the first 9 have only 7 characters).
- Each one has an initial/registration EASE password set to **"VELaSSCo"**. This will have to be changed through the EASE webpage (https://www.ease.ed.ac.uk/).
- Setup VPN connection to EDDIE cluster following the instructions provided in the URL: http://www.ed.ac.uk/information-services/computing/desktop-personal/vpn/vpn-service-using
- Once connected to VPN, to login in into VELaSCCo will be need provided the following info into the GiD access window:

- o Multi-user connection:

    - Username: velassco (default)
    - Password: --- (default)
    - VELaSSCo host: velassco-cluster01-ext.ecdf.ed.ac.uk
    - Port: **provided individually by mail. Please check the invitation mail.**

- o Tunnel through:

    - Tunnel host: velassco-cluster01-ext.ecdf.ed.ac.uk
    - Local Port: same value that Port.
    - Username: **provided individually by mail. Please check the invitation mail.**
    - *(Linux version)* Password: **provided individually by mail. Please check the invitation mail.**
    - *(Windows version)* Pass entry delay (s): **enter here the number of seconds to wait for the user to enter the password in the next window, please look at the images on next page.**

Next, it is provided an example of an instantiation of GiD access windows for the user "velgst37" in Linux:
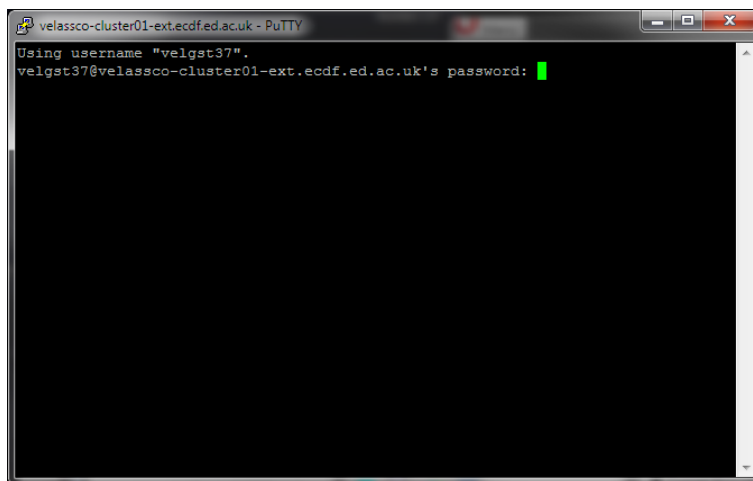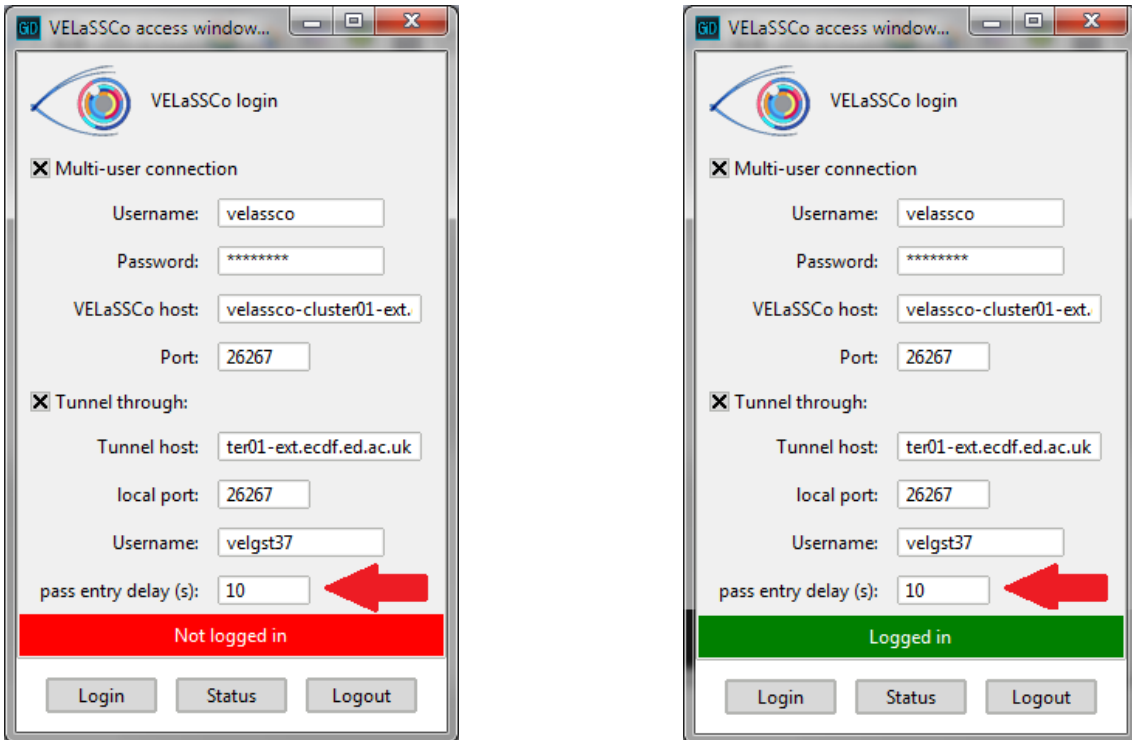
In MS Windows the connection window is slightly different because you need to enter the password on a separate window:

2   User instructions and brief tasks description

Thank you for your participation in this study. You will carry out the tasks on your own in the presence of a facilitator. The facilitator will be giving hints, asking questions, observing your responses to the exercises and supporting you during the whole process. The study will comprise a series of tasks, to be completed one at a time; i.e. once the facilitator, who would be observing your interactions, agrees that you have concluded one task, you will be presented another one.

The study is about the use of VELaSCCo Platform by means of GiD or IFX visualizations clients to operate with a FEM or DEM simulation previously calculated and injected into the Platform. You will be asked to carry out tasks that involve simple simulations actions on the client side.

During the session you have the following tools at your disposal:

- **VELaSSCo Open Platform**
- **GiD Client V.13.1.1d** (Visualization Tool)
- Text editor and viewer (e.g. Notepad, Word,…)
- Web browser

Your work may be monitored and at the end you will be asked to fill in a simple questionnaire. This will help us understand how people use VELaSCCo Platform and Visualization Clients, how efficient and effective is the VELaSCCo Platform, etc.

2.1 Barcelona Model Description

The Barcelona model selected has the following settings:

- Air flow around Barcelona city considering the Digital Model of the Terrain (DMT) and a simplified version of the buildings.
- Simulation run on 3072 cores by Kratos Multiphysics solver ()
- 3072 sub-domains (partitions):
    - Total of **60 M** nodes and **340 M** Tetrahedra
    - **240 time-steps** with:
        - Partition Index
        - Pressure
        - Velocity vector

Note: to have an order of magnitude of the size of the simulation, the results file of this simulation written by the solver occupies around **2TB** in ASCII format.
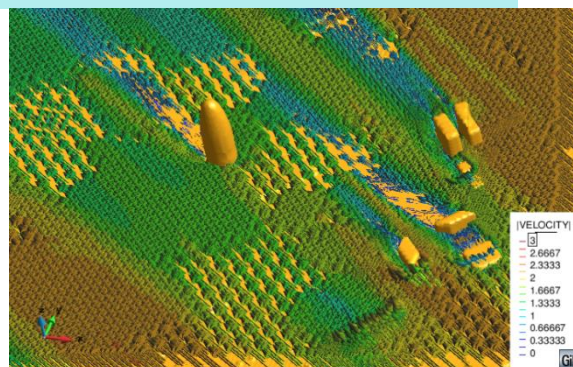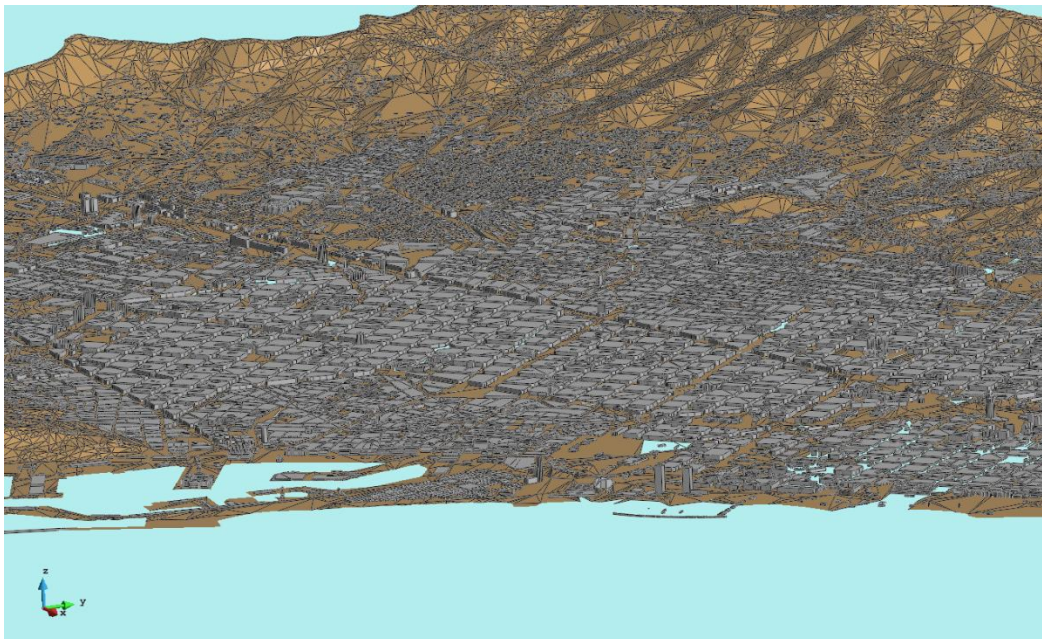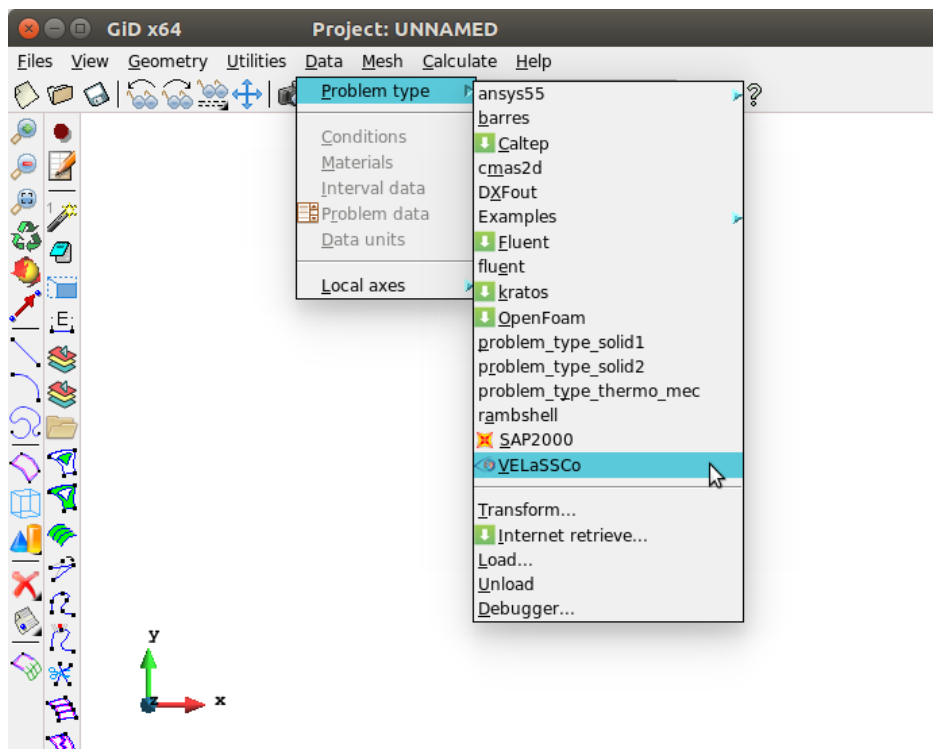
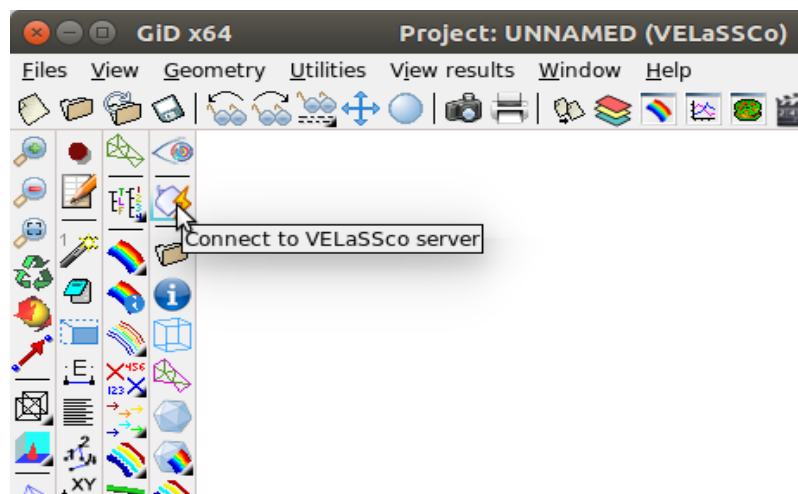## 2.2   Task 1: Use case FEM.M2-01

2.2.1   Motivation

Have a look of the model, visualize the boundary mesh of the model, and see the contour-fill of a result onto that boundary, in concrete the pressure.
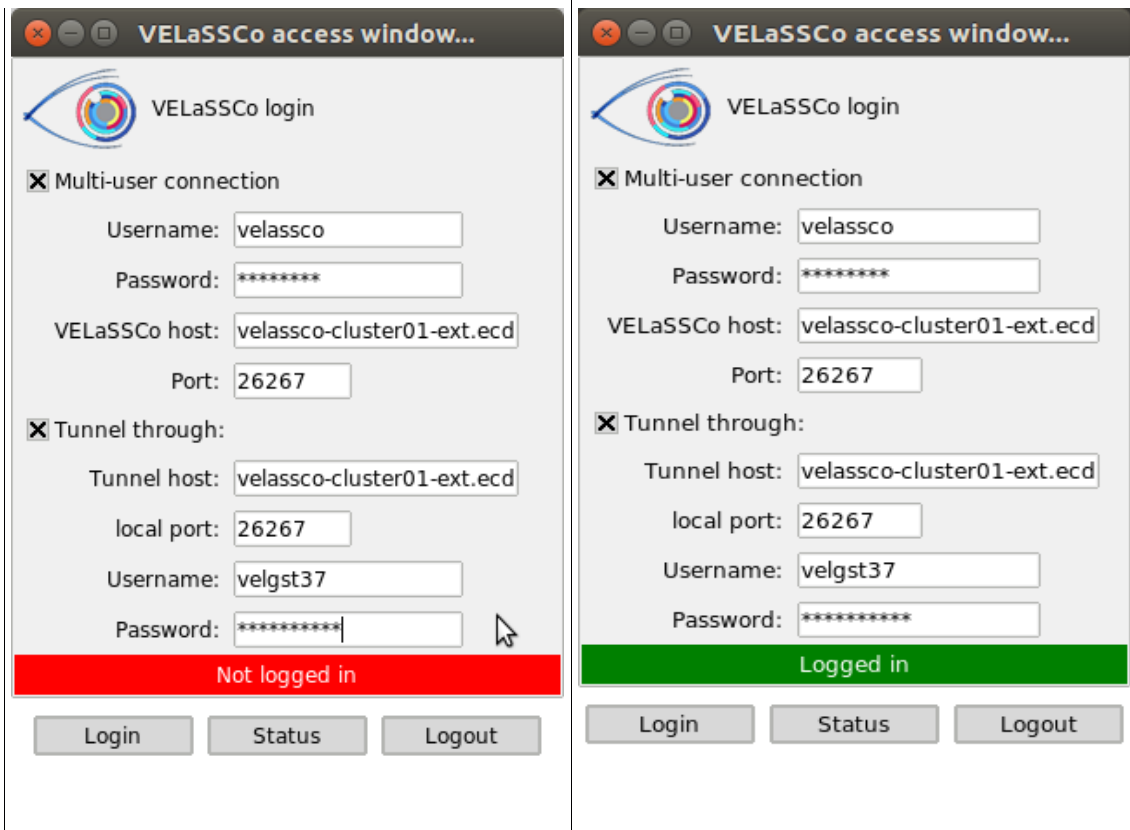
2.2.2   Specification
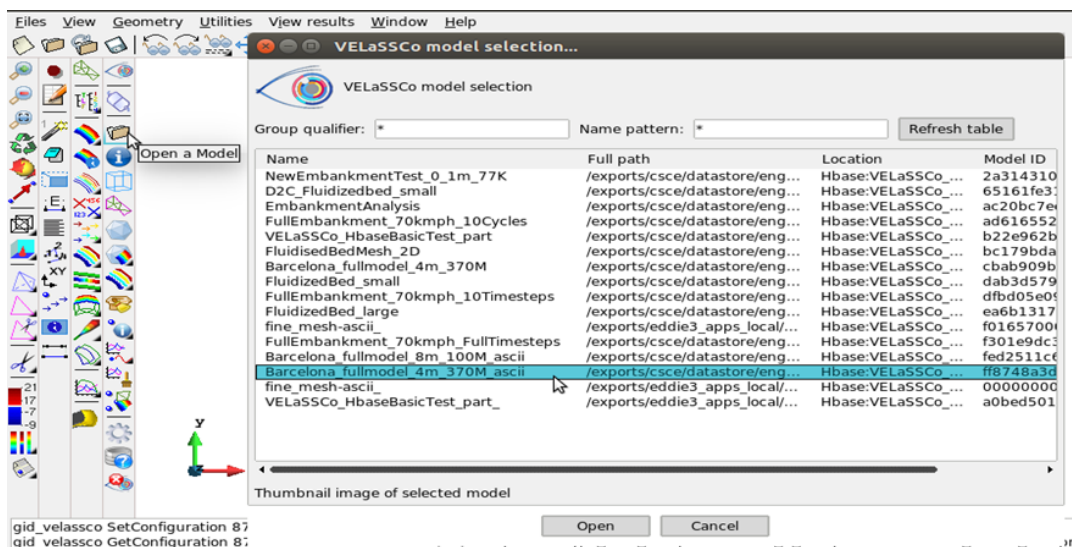
- Load VELaSCCo module:

- Connect to VELaSCCo Server using GiD:

- o **Credentials**: VELaSSCo host and Tunnel host must be equal to velassco-cluster01-ext.ecdf.ed.ac.uk, the password for tunnel must be provided, in this case for user velgst37 the password is velassco37
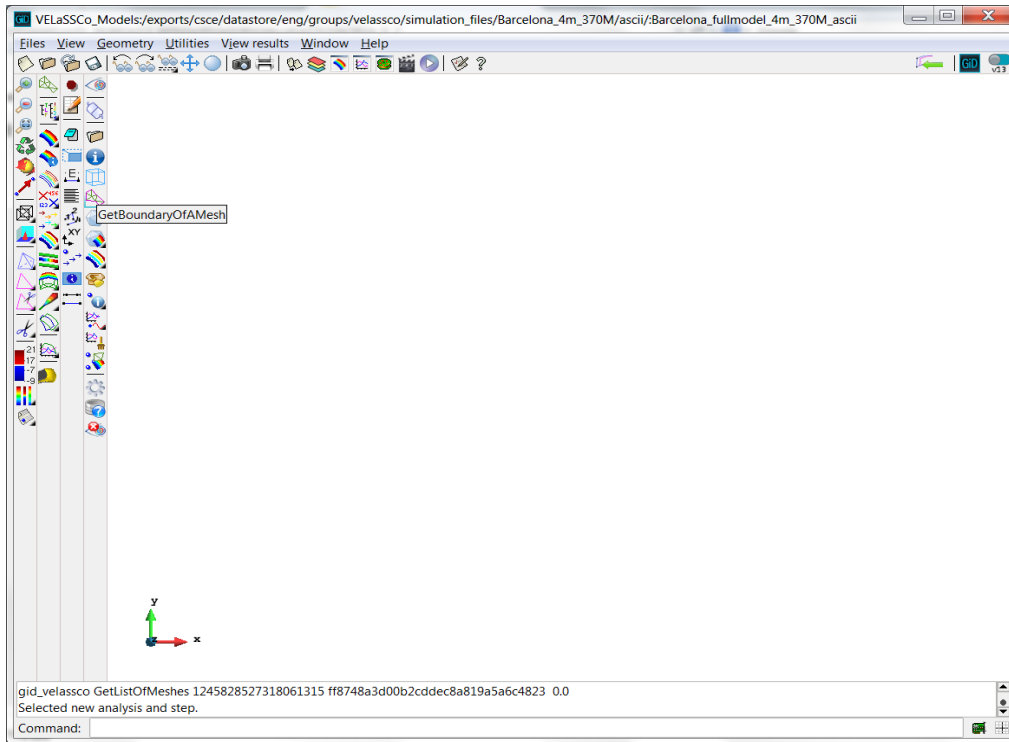

- Open a simulation model:
 - o Select the model **Barcelona_fullmodel_4m_370M_ascii**

**Note**: Ensure that there are tetrahedral meshes by using the info icon:
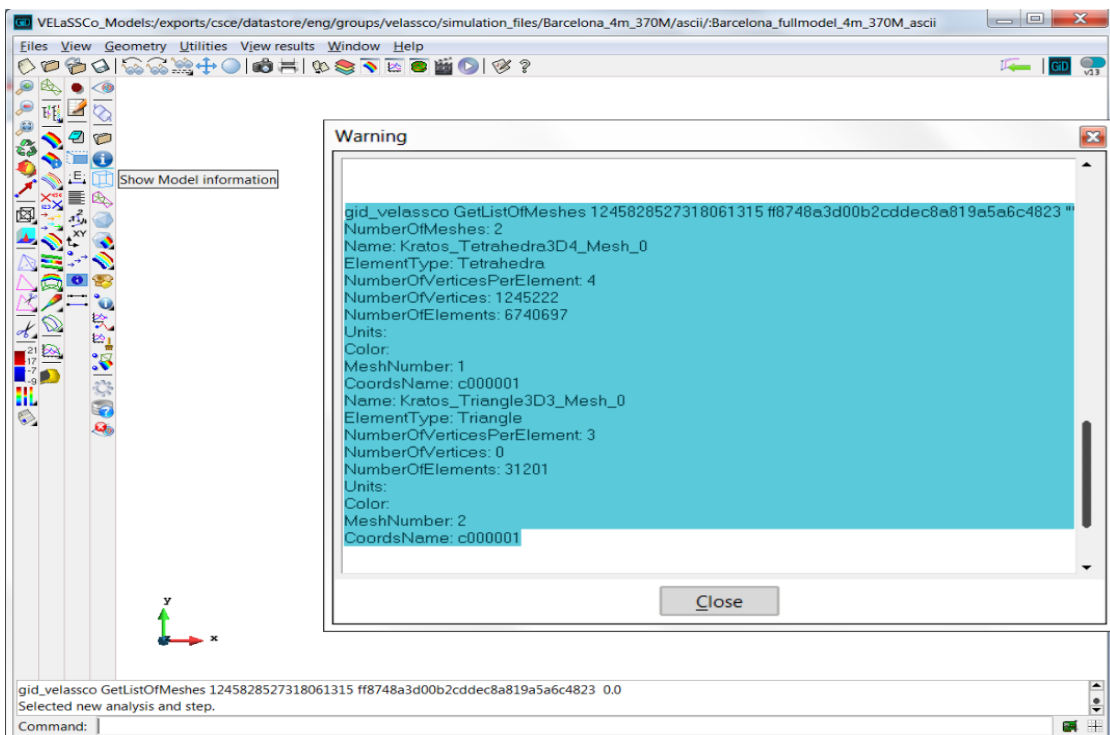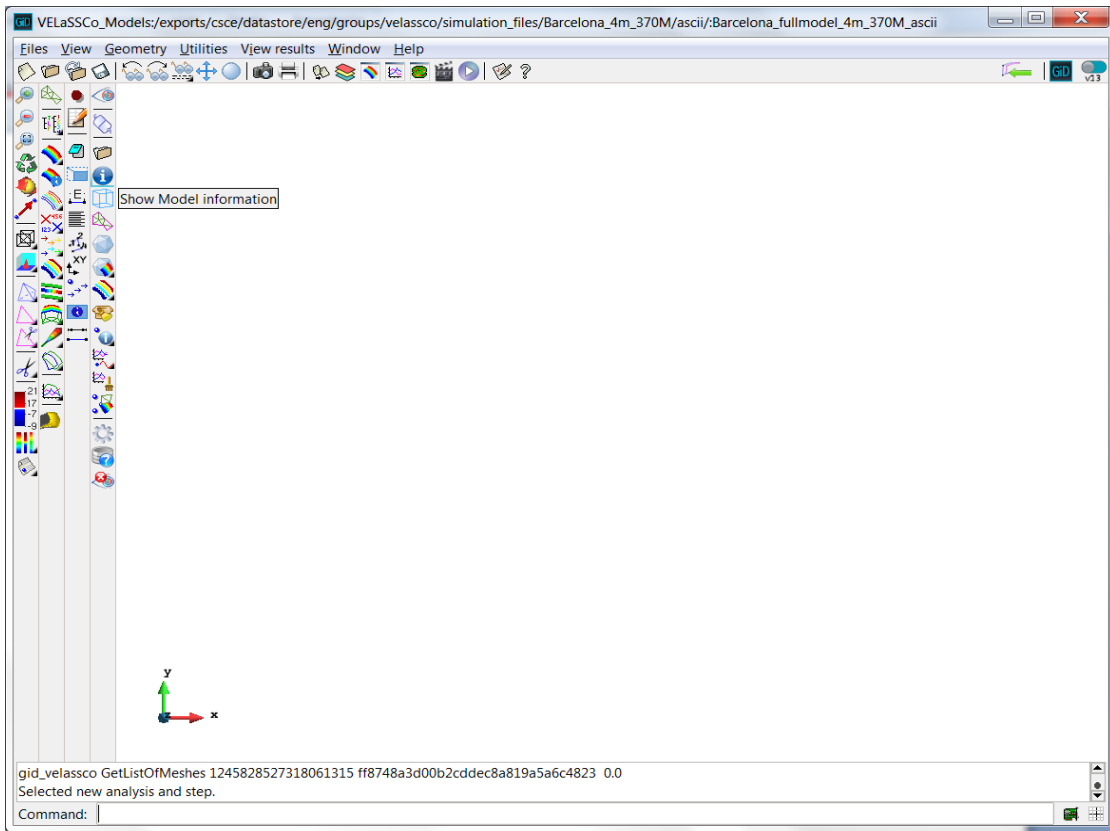
- Visualize the boundary mesh of the model. Select the option from the VELaSSCo toolbar as shown below:


You can now zoom in, applying different visualization styles using GiD, etc…
Note that the Digital Terrain Model is not visualized (neither the buildings), because this results comes from an embedded simulation.
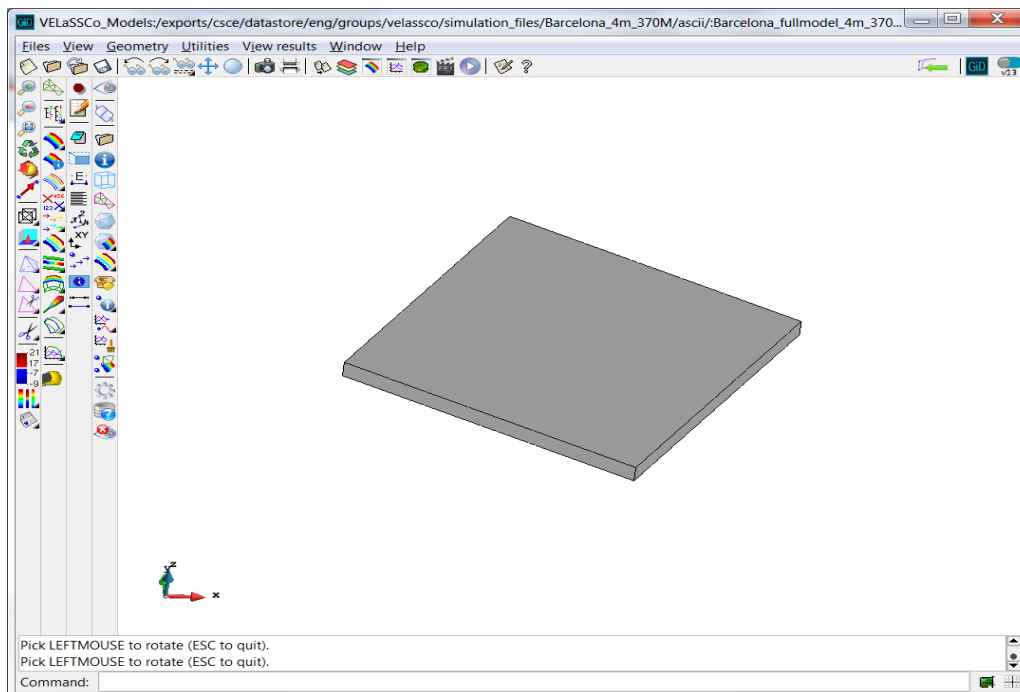
- Visualize the contour fill of **pressure** in the skin of the volume mesh at **time step value 2600:**
  - o First you should change the current time step to 2600, using the VELaSSCo toolbar as shown below:
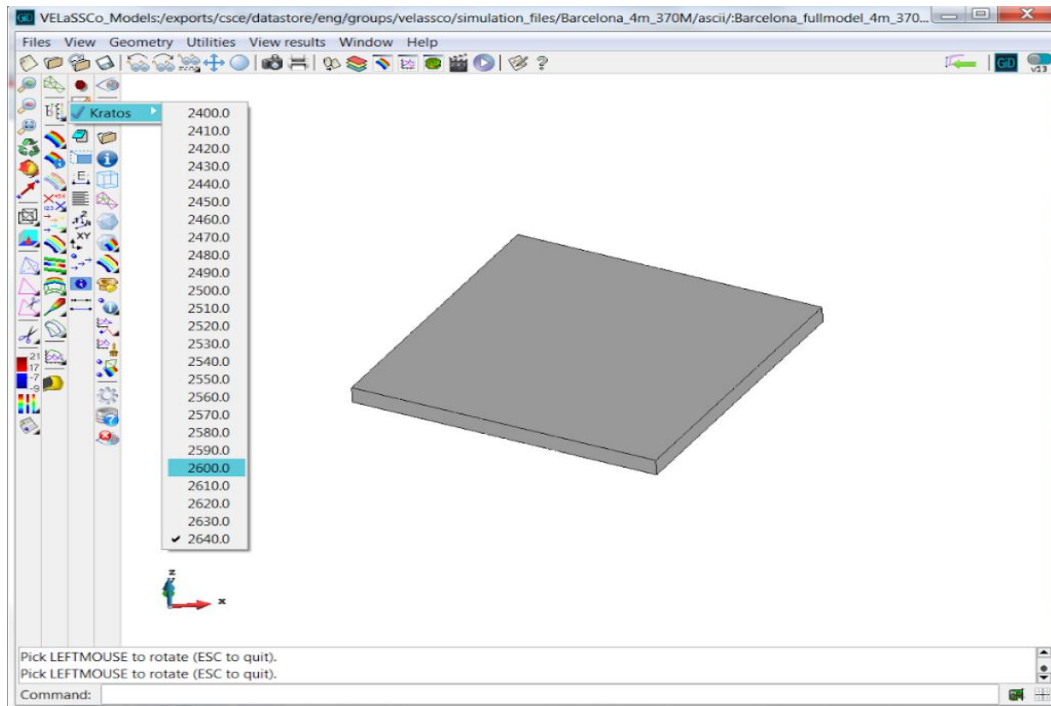
- Then select the contour fill option for PRESURE field:
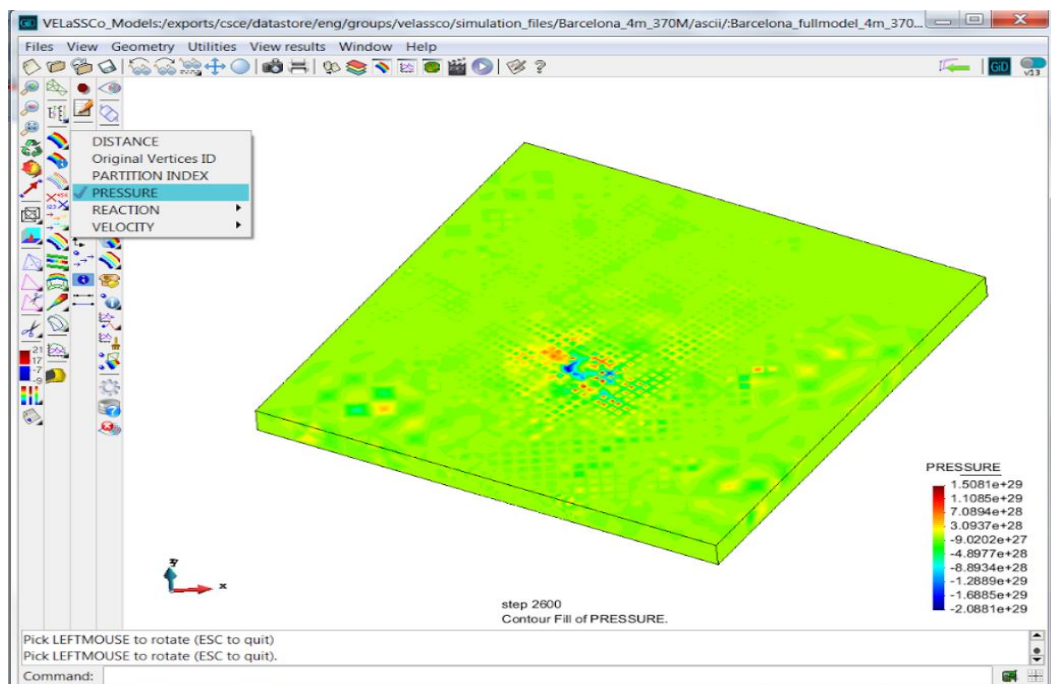
Note: Don't logout, because the following use case is also using this model.

2.3   Task 2: Use case FEM.M2-02

2.3.1   Motivation

Get quantitative information about some result. Specifically, to get the result (pressure) of a specific node, and to get the evolution of the result on a node over time.
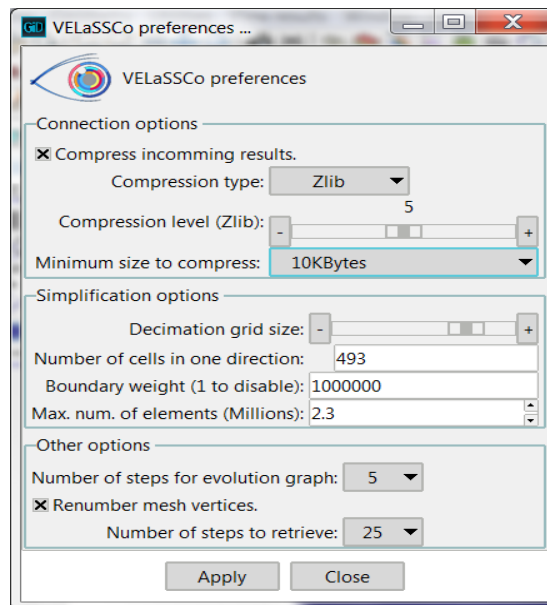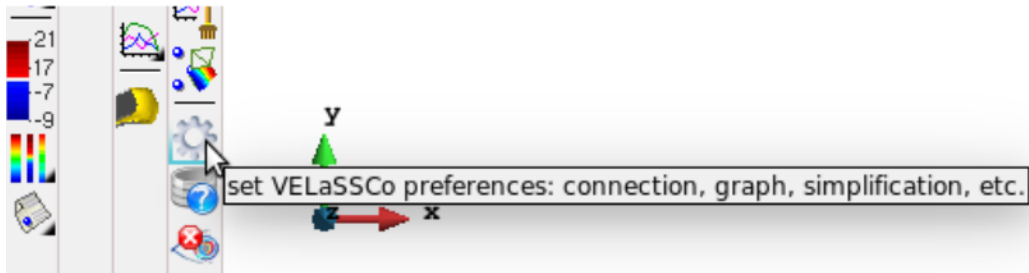
2.3.2   Specification

- Get a result on a node:

  - Get the pressure value for:

    - Analysis = **Kratos**
    - Time-steps: 2600
    - Result = **Pressure**
    - Node number **2376** -> (check the value of the result is equal to **9.76700701e+26**)
    - Node number 2400 -> (check the value of the result is equal to **8.09815828e+26**)
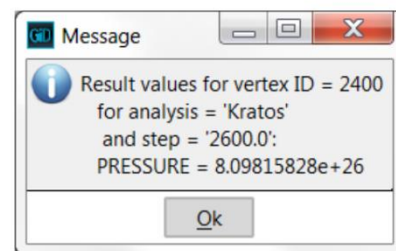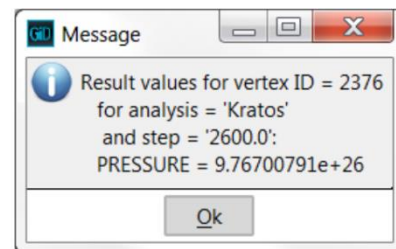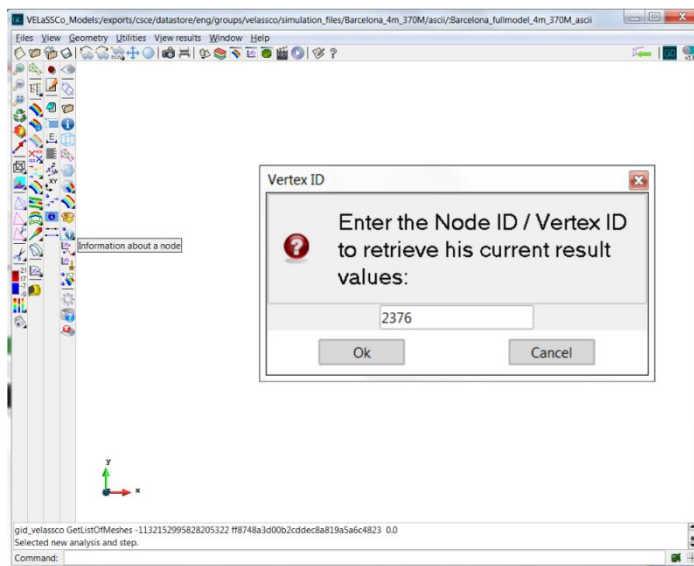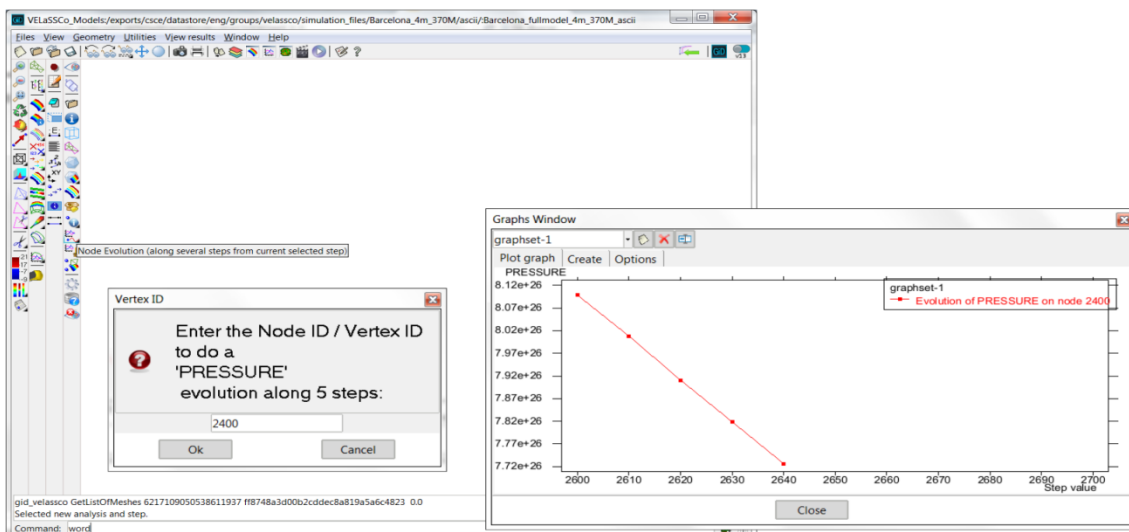

- Get the evolution of a result on a node over time.

  - Get the **pressure** value for:

    - Analysis = **Kratos**
    - Time-steps: **next 5 steps from timestep = 2600**
    - Result = **Pressure**
    - Node number = **2400**

In order to set the number of timesteps to plot you have to set it at the VELaSSCo preference window:

Then you can compute the node evolution:

2.4 Task 4: Use case FEM.M2-04

2.4.1 Motivation

Use a simplified volume model to interact with it more efficiently.

2.4.2 Specification
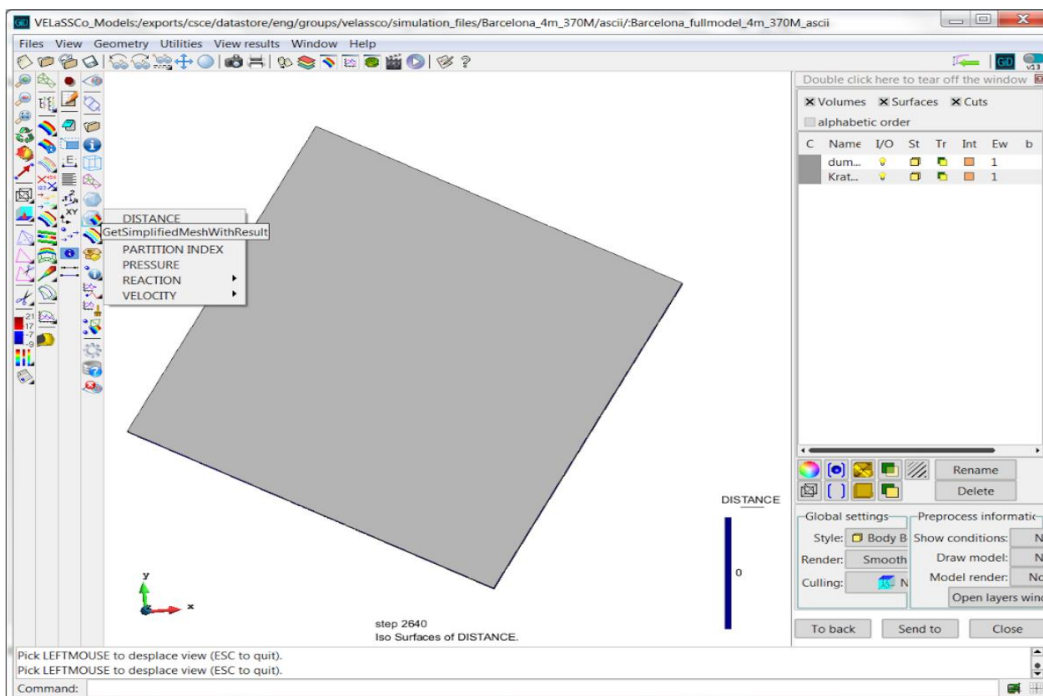
- User: Get the simplified version of the model considering the mesh and results.
  - Get the simplified version of the model considering the parameters. Decimation grid size=**493**, Boundary weight=**100000**, Max. Num. of elements=**2.3 million**.

  Make sure the parameters are set in the preference window for VELaSSCo:
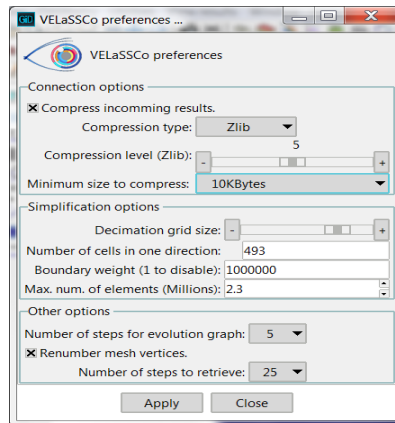
Now compute the simplified mesh with result **DISTANCE**.

Note that now, the simplified model is in local in your visualization client (tetrahedra). You can now run standard post processing operations using GiD and applying different visualization styles, like:

- Do cuts over the domain
- Visualize iso-surfaces
- View stream-lines
- etc.

In order to get the desired result you must set the render to smooth mode from the contextual menu:
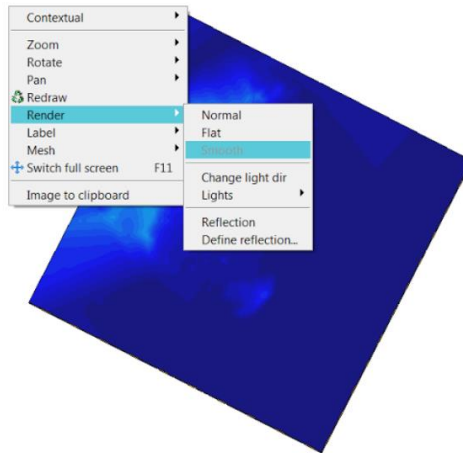
Now you must compute the Isosurface for DISTANCE=0:
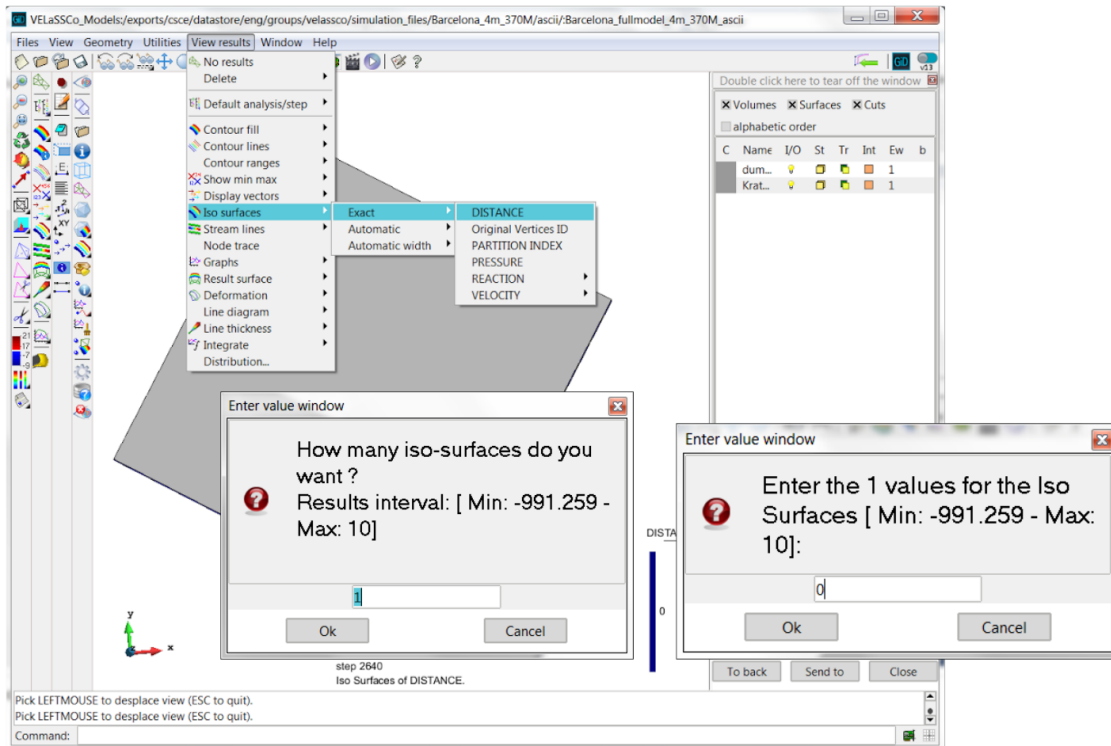
Now you must hide the volume in order to see only the Isosurface. For that open the View style windows and "turn off" the "Kratos ..." mesh.
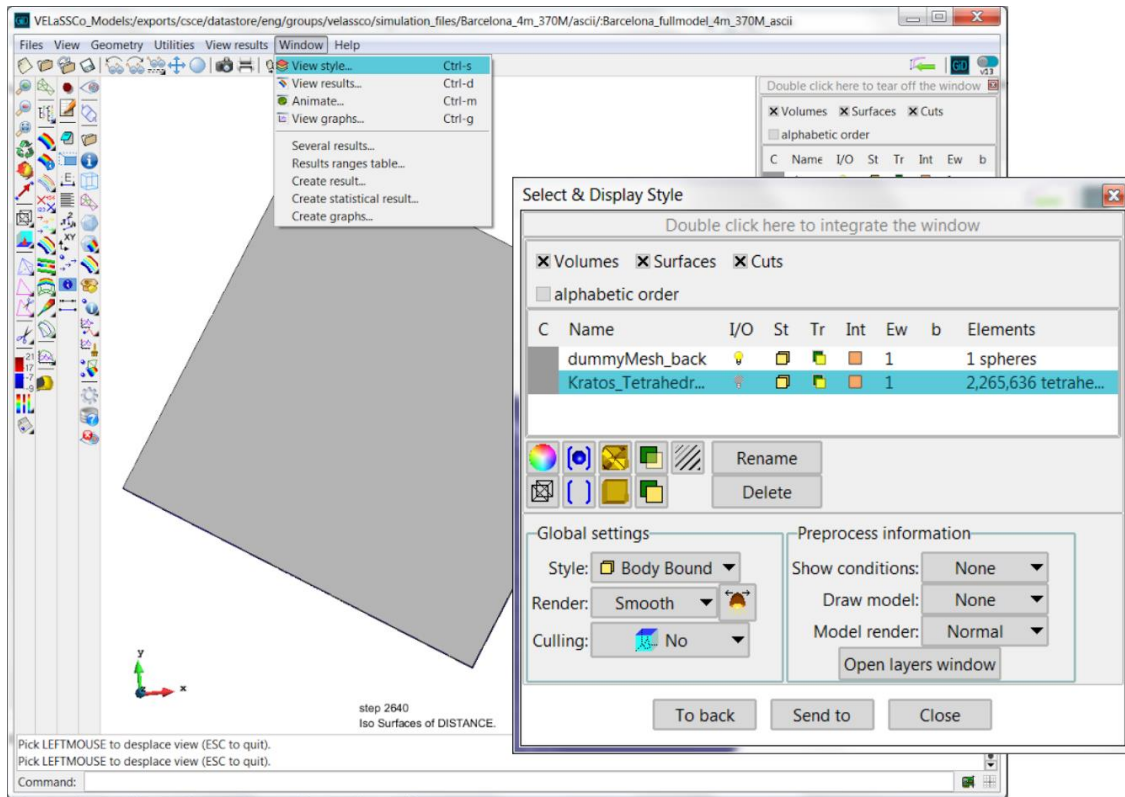
The Isosurface should look like this:

If you want you can visualize a higher resolution mesh. For that set the parameter as below: Decimation grid size=1097, Max. Num. Of elements=12 million.

The result should look like this:

3 Questionnaire for participants

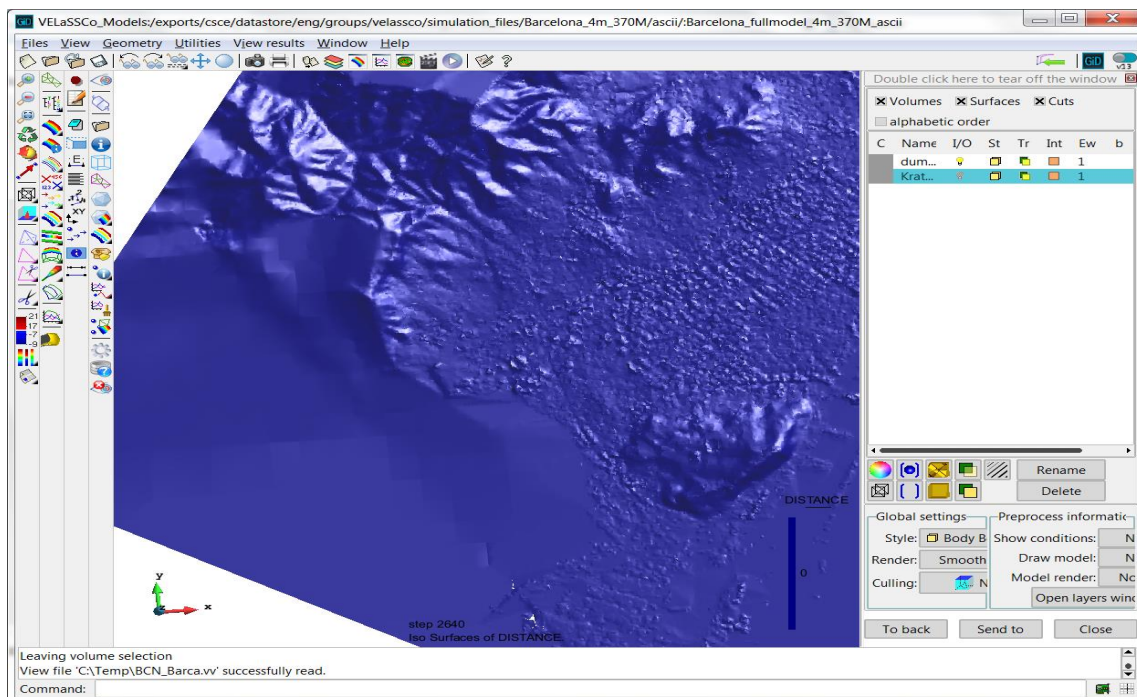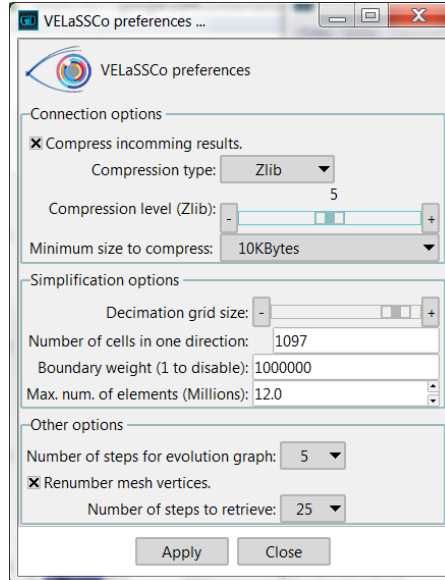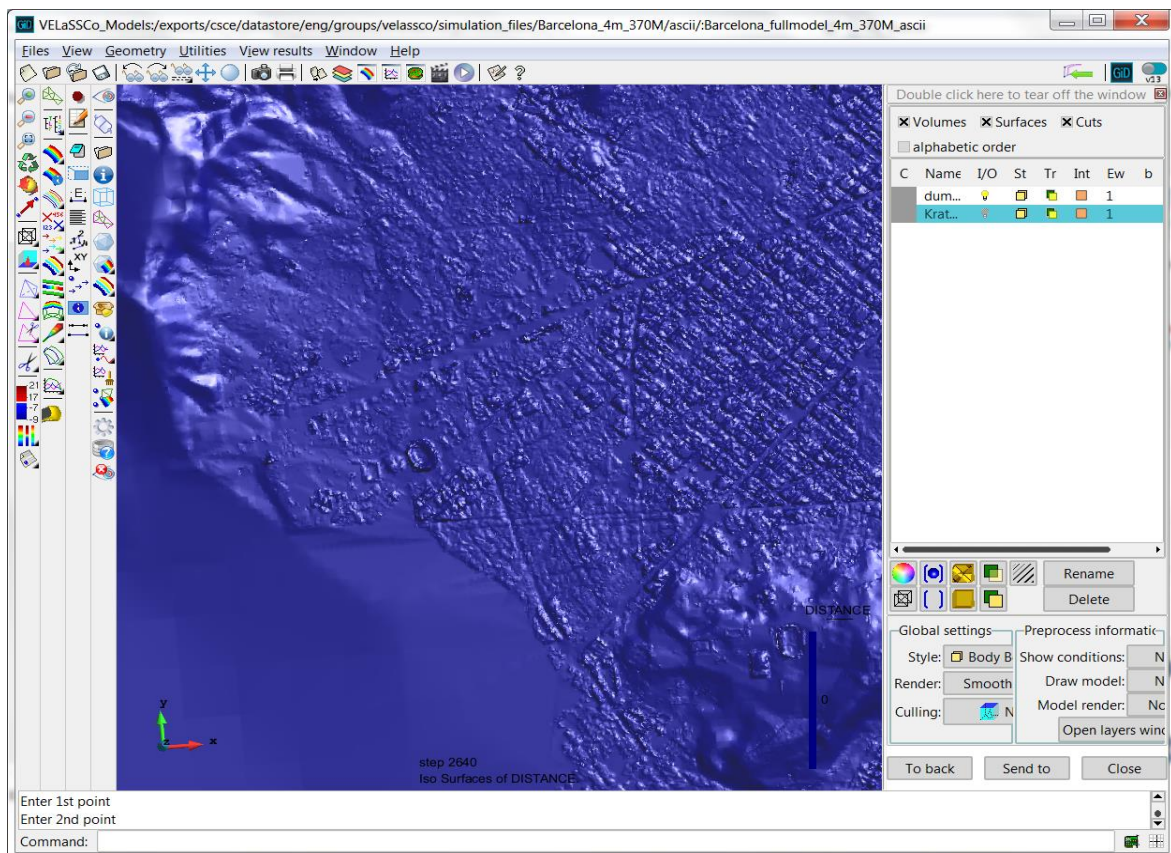Measuring the quality of a service can be a very difficult exercise. Unlike product where there are specific specifications such as length, depth, width, weight, colour etc. a service can have numerous intangible or qualitative specifications. In addition there is there expectation of the customer with regards the service, which can vary considerably based on a range of factors such as prior experience, personal needs and what other people may have told them.

The questionnaire below is in three sections. On the one hand the first section asks you to rank all software tools for pre and post processing of numerical simulations in science and engineering according to your expectations i.e. what you expect all these tools to provide. On the other hand the second section asks you to rank the VELaSSCo Plugin for GiD according to your experiences and perceptions. The third section asks you about the overall satisfaction of VELaSSCo Plugin for GiD.

Expectations deals with your opinions of software tools for pre and post processing of numerical simulations. What we are interested in here is a number that best shows you expectations about software tools for pre and post processing of numerical simulations offering services.

Perceptions relate to your feelings about the VELaSSCo Plugin for GiD. Please show the extent to which you believe this tool has the feature described in the statement. Here, we are interested in a number from 1 to 7 that shows your perceptions about the VELaSSCo Plugin for GiD.

You should rank each statement following a seven-point Likert-style scale from 1=very unimportant to 7=very important

The questionnaire is available in the following URL to be filled:

https://docs.google.com/forms/d/e/1FAIpQLSdnbKEbF7703zyOU0S6Kg9lLCLXfiyDJEZ NkJsrHU2qXJcRgg/viewform#responses

In summary, our purpose is to get your valuable feedback about your experience with the VELASSCO Platform and its usability against expectations.

We would also appreciate your impressions on practical issues and any other comment or criticisms that you may find interesting.

Please send your completed questionnaires telematics using the URL indicated above.

Thanks for your time.

The VELASSCO project.