VELaSSCo

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

D1.2 – End-users requirements and Users panel

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1 Introduction

This deliverable presents the conclusions of the analysis of the current status of the platform from the point of view of the end-user requirements. This has been conducted after analysing the feedback from the user panel that was gathered during the evaluation of the first prototype of the VELaSSCo platform held concurrently in UEDIN and CIMNE premises on the 4th of February, 2016. An overview of the evaluation event is provided including a description of the simulation scenarios used. Additionally, the current status of the user panel, actions taken to increase the number of members and their engagement with the VELaSSCo project are reported.

1.1 Structure of the document

The report is structured as follows:

- **User panel** is described. This includes the current status of the user panel and some statistics about the profile and interest of the members.
- The **strategy** followed to **enhance engagement** of the user panel members is described. Moreover, a description of the actions planned for 2016 is included which aims to keep the members of the user panel informed and obtain further feedback for the development of the final prototype of the platform.
- An overview of the **evaluation event** of the first prototype of the VELaSSCo platform involving user panel members is provided. This includes a description of the profile of the people involved in the evaluation event and the approach used to run the event and gather feedback about the platform.
- **End-user requirements** for DEM and FEM gathered at the beginning of the project (D1.2) are reviewed based on the feedback of the user panel during the evaluation event. Also, potential end-user requirements for the final prototype are identified.

1.2 Conventions

The requirements have a priority assigned according to the user's specifications:

- **key**: the requirement is key for the usability and good performance and evaluation of the system
- **added-value**: the requirement is considered an extra plus point for the final evaluation of the platform.

2 User Panel

A User Panel with a potential membership of scientists and industrial R&D engineers including research centres, SMEs and larger companies from key European industrial sectors such as aerospace, household products, chemical, pharmaceutical and civil engineering was created at the beginning of the project. The consortium sent invitations to different potential end-users to join the panel and to encourage their participation, emphasising the benefits of being part of the user panel.

This user panel has been directly connected to the development of WP1 and WP5, by defining the requirements of the platform and testing the platform. So far, the User Panel has been involved in the different key aspects of the project including:

- Defining the initial end-user requirements (visualization and data analytics) for the VELaSSCo platform.
- Testing the first prototype of the VELaSSCo platform.
- Providing feedback based on the evaluation of the first prototype of the platform to identify potential improvements required for the final VELaSSCo platform.
- Future provision of real industrial simulation datasets for testing the final prototype of the platform.

2.1 Status of the User Panel

The number of members in the user panel has increased gradually during the project as can be seen in Figure 1. During the second year of the project, an effort has been made in order to increase substantially the number of members of the user panel. To this end, additional potential members were identified by exploiting the synergies of the consortium with other relevant projects such as T-MAPPP and existing collaborations with industry. In this context, invitations were sent to the identified potential members to join the user panel. As a result, the user panel currently consists of 51 members from over 30 different organisations. This represents an increase of more than 54% with respect to the number of members in February, 2015.

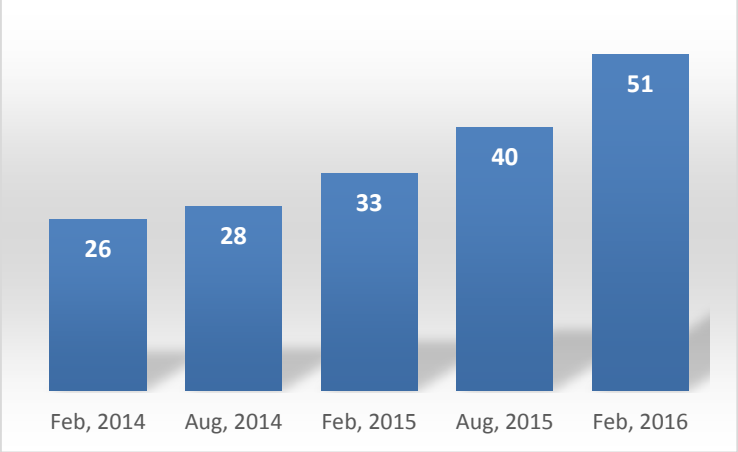

Figure 1 - *Evolution of the number of members in the User Panel during the project.*

The profile of the user panel members has been characterized by their institutional affiliation, interest about simulation methodology and potential application scenarios. Figure 2 shows the distribution of the user panel according to the organization type of the members. It can be observed that the majority are academic members. The academic institutions of the members of the user panel include a diverse range of global universities: The University of Surrey, University of Twente, Technical University of Madrid, University of Manchester, Technical University of Munich and Peking University. This high percentage of the academic members is consistent with the level of access to HPC infrastructures. Academic institutions typically have easy access to large HPC clusters that allow researchers to run large simulations involving hundreds or even thousands of computational nodes.

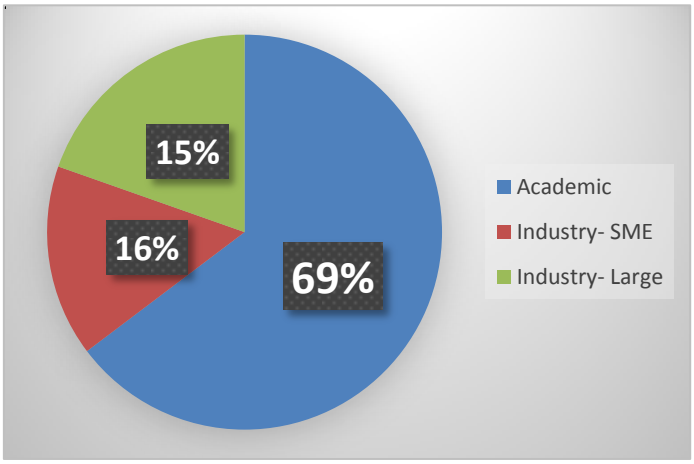

Figure 2 - Distribution of the user panel by organization type.

It is also noticeable that more than 30% of the people in the panel work for SMEs and large industry including some multinational companies such as Procter & Gamble, Johnson Matthey and Airbus. This fact demonstrates the interest created by the VELaSSCo consortium outside of the academic sector and the current and future need of the industry to analyse and visualise large simulation datasets that currently represent a challenge in terms of the infrastructures needed and time needed to address these scenarios.

User panel members have been polled on their key interests and the distribution of these interests is shown in Figure 3. It should be noted that the panel members may be interested in multiple computational methods and hence the percentages sum to more than 100%. Most of the user panel members are interested in Discrete Element Methods (DEM), Finite Element Methods (FEM) and Computational Fluid Dynamics (CFD). Indeed, this is in line with the main simulation methodologies taken into account during the development of the VELaSSCo platform. Additionally, a large proportion of the user panel indicated an interest in very large scientific simulations and industrial applications, which aligns with the key targets of the VELaSSCo platform.

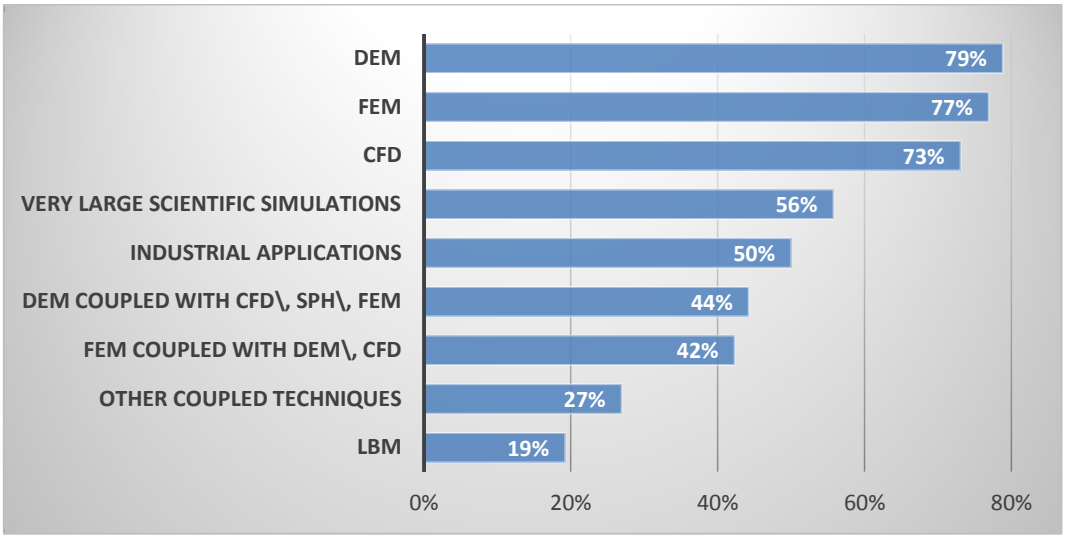

Figure 3 *- Distribution of the user panel by computational method of interest.*

2.2 Engagement with the User Panel

The importance of the user panel for the project has been reflected in the effort expended to engage them in participating in the project by providing feedback. To this end, the user panel has been contacted periodically in order to update them about the progress of the project and the next steps to be carried out in the development of the platform. Efforts have been made to convey to them the importance of feedback to the success of the project and for identifying potential improvements to be considered for the development of the VELaSSCo platform.

A key role for the user panel has been to provide the end-user requirements for a platform such as VELaSSCo and feedback from the user panel on the end-user requirements of the platform has driven the development of the VELaSSCo platform through the technical work packages. An example of this interaction with the user panel was the evaluation event held in Barcelona and Edinburgh for testing the first prototype of the platform where feedback from the user panel on the VELaSSCo platform was gathered. A more detailed description of the evaluation event is provided in section 3 of this deliverable.

In addition to a general way of communication with the user panel, a more personalized approach was also adopted. In this context, UEDIN and CIMNE directly approached several relevant companies of the user panel. The objective of this strategy was to get in a more effective way their expectations and requirements for the VELaSSCo platform and ensure the provision of real industrial engineering simulation datasets to test the platform.

UEDIN contacted two multinational companies: Procter & Gamble and Johnson Matthey. These companies have shown their interest in participating in the testing of the VELaSSCo platform and confirmed that they will provide DEM simulation datasets relevant to industrial processes such as powder mixing and milling of particulate materials.

CIMNE contacted two software companies: Altair and Quantech ATZ. These companies are in charge of the development of the Click2cast and Stampack software tools, respectively. These companies also showed their interest in participating in the testing of the platform and providing simulations datasets for these purposes. Specifically, Click2cast provided simulation data of the modelling of casting processes and Stampack provided simulations related to metal forming.

It is planned to involve these companies more actively during the third year of the project in order to test the new developments to be included in the platform after analysing the results of the evaluation of the first prototype.

2.3 Future actions involving the User panel

The expected interactions with the user panel for the final year of the project are:

- Periodic e-mail communication.
    - Feedback for the review meeting.
    - Videos showing the capabilities of the platform.
        - DEM use case using IFX.
        - FEM use case using GiD.
        - Use of LR B-splines for DEM and FEM simulation datasets.
    - Update on new event and plan for the next months:
        - Presentation/demo during the GiD conference (June 2016).
        - Presentation/demo during in Oslo, Norway (October 2016).
        - Possible interactive webinars or interim evaluation event
        - Evaluation event of the final prototype (Oct- Nov 2016)
    - Update of the end-user requirements/queries/capabilities planned for the final prototype.
- Increase the number of members of the User Panel by exploiting the LinkedIn and Twitter accounts of the VELaSSCo project.
- Exploiting social networks for the communication with user panel

2.4 Current workflow for post-processing and visualisation

The process of interrogating and visualising simulation data can vary significantly from institution to intuition within any given sector. The following section aims to highlight the most typical methodologies.

2.4.1 Academic scenarios

- Simulation solvers run on existing HPC infrastructure in their academic institutions. HPC systems are used by many different research groups and jobs are submitted by means of standard queue systems.
- Post-processing and visualisation of a large simulation dataset represents a challenge. The settings for the output data from the simulation solver can be highly conditioned by the post-processing and visualisation methodology. Therefore, the user needs to predefine the output of the data based on what they expect to be most relevant while also considering the size of the output for the post-processing and visualisation of the

results. In some cases this may lead to the re-running of simulations because additional data not initially specified as necessary is found to be required.

- The post-processing is commonly conducted by gathering all the output files from the simulation. In some cases, these files are transferred to a local machine in order to conduct the post-processing and the visualisation. This transfer implies long waiting times (days, rather than hours) in the case of large simulation datasets and in some cases the impossibility to conduct the post-processing of the simulation in a local machine. Therefore, sometimes the post-processing needs to be performed on the HPC system.

2.4.2 Industrial scenarios

- Large industries often have their own HPC systems on which to run the simulations.
- SME: small HPC systems and nowadays some of them are starting to use Cloud services

3 Evaluation event of the first prototype

An evaluation event was organized in collaboration with WP5 in order to test the first prototype of the VELaSSCo platform. This evaluation event was initially planned for November, 2015. However, due to some delays in the development and deployment of the first prototype of the platform, this was delayed until 2016: the evaluation event was held concurrently in CIMNE and UEDIN on the 4th of February, 2016.

A total of 13 members of the user panel participated in the evaluation event. The participants included mostly researchers working within academia (Figure 4).

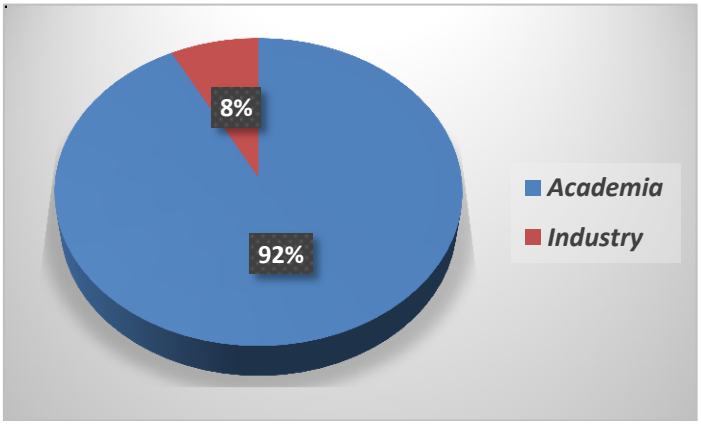

Figure 4 *- Distribution of the evaluation group by organization type*

The expertise of the evaluation user panel members was mainly in Discrete Element Methods (DEM), Computational Fluid Dynamics (CFD) and Finite Element Methods (FEM). A detailed profile of the interests of the researchers is presented in Figure 5.

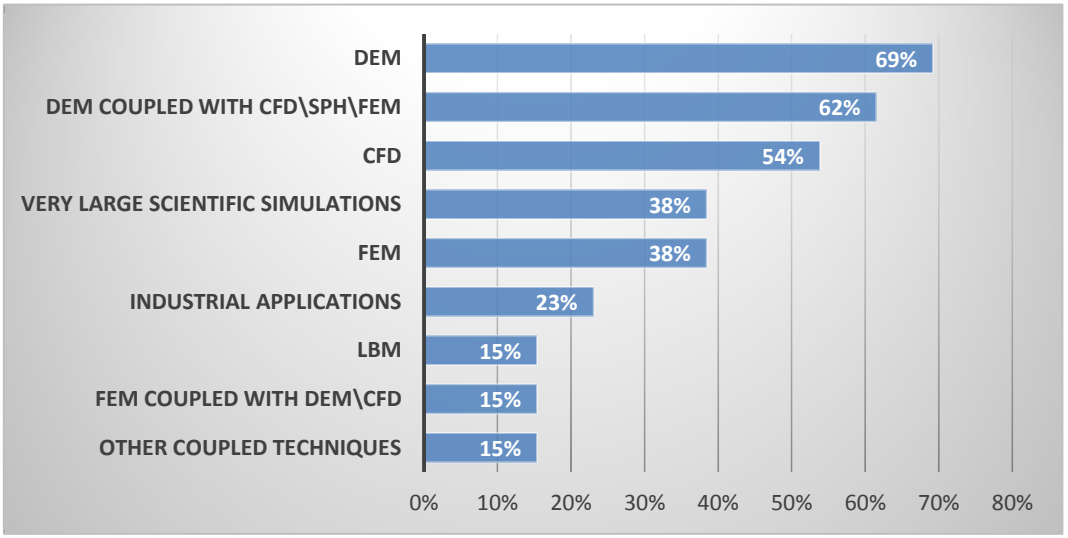

Figure 5 *- Distribution of evaluation event user panel by interest*

During the evaluation, the user panel members conducted a specific set of use cases. These use cases were chosen based on the initial end-user requirements reported in the deliverable D1.1 and on the capabilities implemented in the first prototype of the platform. The use cases included scenarios of the two main simulation methodologies addressed by the platform: DEM and FEM.

In the case of DEM simulations, the use case scenario represents the simulation of a fluidized bed (see Figure 6). This is a very common process used for mixing and coating of particulate materials in different industries including pharmaceutical, food and chemical engineering. The simulation data consists of 40000 time-steps with 12000 particles and around 3000 contacts per time-step. Moreover, the simulation data contains the scalar (mass and volume) and vector (particles velocity and contact forces) results for each particle and contact in the different time-steps.

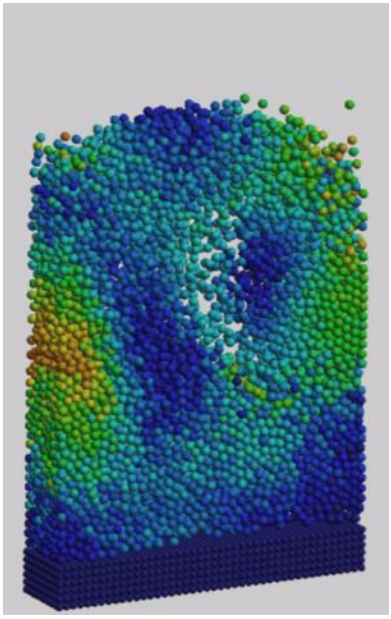

Figure 6 *- Snapshot of the fluidized bed simulation model used for DEM use cases in the evaluation event.*

In the case of FEM simulations, the use case scenario represents the modelling of the air flow around a big telescope (see Figure 7). The simulation data consists of 128 sub-domains (partitions) with a total of 4 x 10^6 nodes and 2.8 x 10^7 tetrahedrons. It contains the results data related to the partition index, pressure and velocity vector for 19 time-steps.

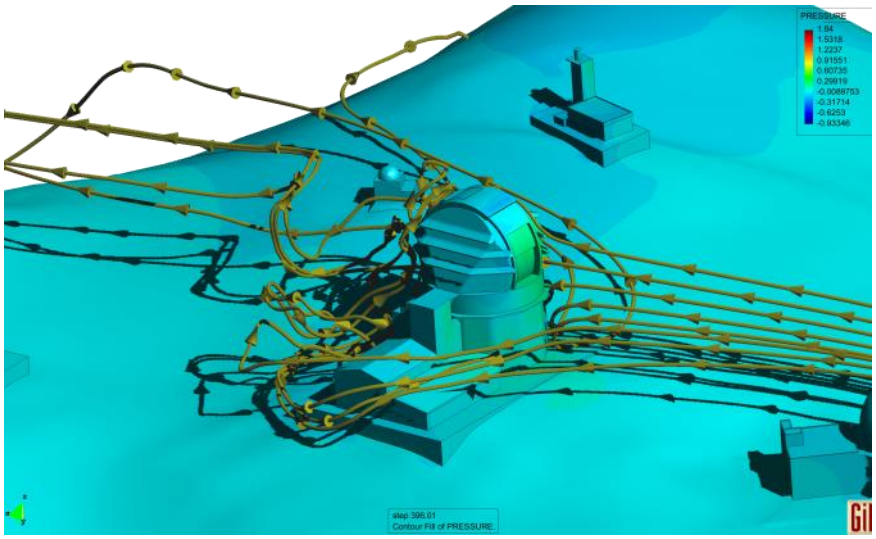

Figure 7 - *Snapshot of the telescope simulation model used for FEM use cases in the evaluation event.*

Moreover, in collaboration with WP5, the participants were asked to fill in a set of questionnaires in order to provide their impressions about the prototype of the platform. A detailed description of the use case actions is provided in Annex I and the questionnaires provided to the participants are provided in Annex II. A quantitative analysis of the questionnaire data based on the GQM methodology is provided in the deliverable D5.2.

Feedback for the evaluation event was both insightful and encouraging and also highlighted areas of the platform where further improvements could be made. Some excerpts:

"Very interesting project, could potentially become a leading software but not mature enough to compare with other commercial software yet"

"…D2C transform seemed very quick …"

"The benefits of a continuum representation of discrete data provide new insights…"

"Improved or centralised UI would be a big improvement…"

"Changing timesteps was difficult to find and non-intuitive…"

"It is a bit slow.... I thought getting a single data would be faster…"

The feedback provided during the evaluation event has been used as the basis for analysing the status of the platform and identifying potential improvements for the final prototype from the end-user's point of view.

Finally, some pictures taken during the two evaluation events are shown in Figures 8 and 9.

Figure 8. *Photographs taken during the evaluation event of the first prototype held in CIMNE's premises.*

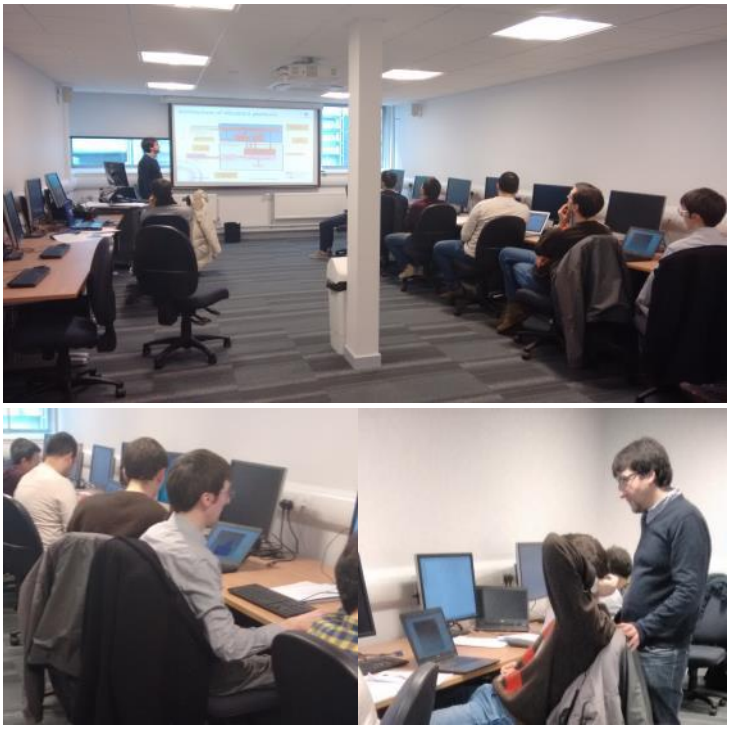

Figure 9. *Photographs taken during the evaluation event of the first prototype held in UEDIN's premises.*

4 End-user requirements

This section presents the end-user requirements defined at the beginning of the project based on the feedback from the user panel and experts in DEM and FEM simulations. These end-user requirements were taken into account for the design of the VELaSSCo platform. Some of them have been included in the first prototype and others are planned for the final prototype. In section 5, a review of these user-requirements based on the feedback of the user panel during the evaluation event is reported.

4.1 DEM – Discrete data User requirements

The VELaSSCo platform should handle three groups of scenarios:

- One big model with few time steps.
- One small model with a lot of time steps.
- One model run several times to investigate parameter sensitivity.

4.1.1 Data handling

- Fast Handling of big data size involving very large number of particles and time steps (key).
- Reduce the storage requirements by optimization of the data files size (key).
- Standard format to import simulation data into the post-processing tool (key).
- Efficient communication between simulation solver and post-processing:
    - Run time & Offline analytics (key).
    - Selective parameters for run time/ offline (key).
    - Self-optimization of simulation parameters (added-value).

4.1.2 Visualisation

- Real time visualisation of results to make decisions on the simulations (key).
- Temporal and Spatial averaging of the results:
    - Adjustment of the interval time for temporal averaging (key).
    - Adjustment of length scale for spatial averaging (key).
    - Tools to decide the relevant temporal and spatial averaging scales for each problem (added-value).
- Visualisation and tracking of complex particle shapes:
    - Easy way to import and define particle shape (key).
- Visualisation of large data sets over many time steps
    - Fast visualisation of results (key).
    - Adaptive resolution for the different zoom scales (key).
- Multi-platform and portable visualisation: from HPC to PC (key).
- Visual comparison of results from different datasets (key).

4.1.3 DEM Analysis

- Analysis of different datasets and easy comparison (key).
- Easy customization of analysis procedures (added-value).
- Statistical analysis of results and easy comparison (added-value).

4.1.4 Usability

- Friendly and intuitive graphical user interface (key).
- Detailed user manual and tutorials (key).

4.2 FEM – Continuum data User requirements

The VELaSSCo platform should handle two possible scenarios:

- Huge simulation with distributed results and several time steps of an HPC cluster.
- Plenty of simulations distributed on several computers.

4.2.1 Data handling

- Handling of big distributed simulation data (key):
  - from ~30 GB (100 M elements, 40 steps) to 12 TB (1G elements, 1,500 steps),
  - from ~140 GB (8 M elements, 2,300 steps) to 50 TB (240 M elements, 25,000 steps),
  - Between 1 GB and 10 GB of distributed results per time-step.
- Able to track errors in data, control of missing data (key).
- Visualisation and modification of simulation parameters (key).
- Usage of open data formats, optimization of data representation for storage, communication and visualisation (added-value).
- Able to export and store animations and results from queries (added-value).

4.2.2 Visualisation

- Ensure usability and interactivity:
  - Efficient communication between simulation solver and post-processing (key).
  - Run time (added-value) & Offline analytics (key).
  - Able to interact with the model (or a simplified representation) at interactive rates: zoom, rotate, etc. (key).
  - Able to get full-resolution results (key).
  - Acceptable waiting time of minutes for some queries, if longer, some feed-back should be provided (key).
- Visualisation of results over the results of the queries like:
  - Contour fill of user selected result over skin (key), cut-planes (key) or iso-surfaces (key).

- Vector visualisation (with some kind of filtering or coarsening) on the volume data (added-value), skin (key), cut-planes (key) or iso-surfaces (key).

4.2.3 FEM Analysis

- Able to perform 0D queries:
  - inquiries about selected nodes, point (requires interpolation) and element (key).
- Able to perform 1D queries:
  - graph of a node or point along the time-steps (key),
  - line-cut and line-graph across the domain and showing the results along this line for a given time-step (key),
  - stream-line or particle tracing (added-value).
- Able to perform 2D queries:
  - boundary/skin extraction of the volume mesh (key),
  - cut planes on the volume domain, and get results interpolated on them (key),
  - iso-surface extraction of a result and interpolation of other results on this iso-surface (key).
  - computation of pressure forces over a structure (normal integral) (added-value).
- Able to perform animated queries, some of the above queries along some or all time-steps of the analysis, for instance:
  - animation of results over iso-surfaces, cut-planes, skin (key),
  - animation of stream-lines, graphs (added-value).
- Able to perform statistic queries:
  - minimum, maximum and average of a result on the whole model for a single time-step (added-value),
  - minimum, maximum and average for each node of the results along some or all time-steps (added-value).

4.2.4 Context

- The system should be able to co-exist with existing HPC resource management systems (key).
- Different users should be able to use it without interference and ensuring security and confidentiality (key).

4.2.5 Usability

- Friendly and intuitive graphical user interface (key).
- Detailed user manual and tutorials (key).

5 Review of the end-user requirements

This section presents a review of the end-user requirements described in section 3. This review has been conducted based on the feedback of the user panel during the evaluation event of the first prototype of the platform held in CIMNE and UEDIN premises in February 2016. Following the event, a review of the end-user requirements was discussed with all partners and especially with those one involved in technical WPs in order to identify the required improvements on the design of the architecture and modules of the VELaSSCo platform for the final prototype.

Additionally, a more detailed description from the point of view of the technical requirements of the platform is provided in the deliverable D1.4 based on the review of the end-user requirements presented in this section. A more quantitative analysis using the Goal, Questions and Metrics (GQM) approach is presented in the end-user functionalities of the deliverable D5.2.

5.1 DEM – Discrete data User requirements

The end-users were able to test the first prototype of the platform against the scenario of one small model with a lot of time-steps. This means a model with a relatively small number of particles/contacts per time-step but the total simulation size becomes large since it includes many time-steps. There should not be any problem concerning the platform design for addressing the scenario of a lot of particles and few time-steps.

5.1.1 Data handling

As previously explained, the first prototype of the platform has proved to be capable of handling the scenario of a relatively small number of particles/contacts and many time-steps. The design of the platform was also carried out taking into account the scenario of a lot of particles per time-step but these needs to be tested further in order to ensure its capability to address this scenario.

Concerning the storage requirements, it has been observed that the size of the data increased in HBase data format with respect to the original data size produced by the simulation solver. This was expected due to the data redundancy and metadata generated by HBase in order to provide quick selective access to specific simulation data by using HBase filters. Some improvement in the HBase data format could be considered in order to minimize as much as possible this impact.

The first prototype of the platform has also shown the capability to import DEM simulation data using a common format used by different simulations solvers. A point that needs to be considered for the final prototype is the possibility to import walls mesh data used in the DEM simulation in standard formats, such as iges/stp/stl files.

Finally, regarding the communication between the simulation solver and post-processing, the first prototype is able to conduct analytics in an offline mode. The possibility to carry out analytics on run time (while the simulation solver is running) needs to be explored for the final prototype of the platform.

5.1.2 Visualisation

Concerning the visualisation end-user requirements, the first prototype of the platform has shown capability for visualisation of spherical particles, temporal evolution of the particle results and temporal and spatial averaged results produced by the discrete2continuum query. Moreover, the visualisation was accessible for the end-users from their personal laptop and PCs providing a portable visualisation solution through the visualisation client connected to the platform.

The main feedback from the end-users during the testing of the platform was related to the performance of the visualisations. In some cases, the visualisation times using the VELaSSCo platform were not satisfactory and this is an important point for improvement in the final prototype. Moreover, some other aspects that need to be explored from the point of view of the end-users are:

- Visualisation and tracking of complex particles shapes (key).
- Fast (eventually real time) visualisation of results (key).
- Adaptive resolution for different zoom scales (added-value).
- Visual comparison of results from different datasets (key).

5.1.3 DEM Analysis

The first prototype of the platform has been able to efficiently implement the complex DEM analysis conducted by the discrete2continuum query that involves the projection of discrete data to a continuum field by means of spatial and temporal averaging techniques. The feedback from the end-users during the evaluation event was positive in terms of the capabilities and the performance.

A part from this capability, some additional DEM analyses will be explored for the final prototype of the platform:

- Spatial integrals of discrete2continuum results (key).
- Statistical analysis of results and easy comparison (key).

5.1.4 Usability

The main end-user requirements in this category are related to a friendly and intuitive graphical user interface and detailed user manual and tutorials. Concerning the graphical user interface, improvements need to be made to the VELaSSCo plug-ins of the visualization clients. Some key aspects reported by the end-users during the evaluation event are:

- Easy connection from the visualization client to the platform (key).
- More intuitive and descriptive menus (key).
- Provide descriptive info when errors or crashes occur (key).
- Detailed documentation and tutorials (key).

5.2 FEM – Continuum data User requirements

The end-users were able to test the first prototype of the platform against the scenario of a large simulation with distributed results and several time-steps in a HPC cluster. Some comments about the different categories of end-user requirements and based on the feedback and the status of the platform are provided in the next subsections.

5.2.1 Data handling

The first prototype has shown the capability to handle distributed simulation data, specifically the scenario of a large number of nodes and elements and few time-steps. Additional scenarios including larger simulations models are planned to be used for testing the current status of the platform and the final prototype of the platform.

Concerning other end-user requirements related to data handling, the following points have not been explored yet with respect to the initial end-user requirements:

- Capability to track errors in data, control of missing data (key).
- Visualisation and modification of simulation parameters (key).
- Usage of open data formats, optimization of data representation for storage, communication and visualisation (added-value).
- Capability to export and store animations and results from queries (added-value).

5.2.2 Visualisation

Concerning the visualisation end-user requirements, the first prototype of the platform has shown to be able to produce visualisation of finite element meshes and contour fills of selected results over the skin of the mesh. Moreover, by means of the visualisation client (GiD and IFX), the user was able to interact with the model: zoom, rotate, etc.

The main feedback from the end-users during the testing of the platform was related to the performance and interactive rates for the visualisation. In some cases, the visualisation times were not satisfactory and this is an important point to be improved in the final prototype. Moreover, some other aspects that need to be explored from the point of view of the end-users are:

- Run time visualisation (added-value).
- Improve the interaction rates with the model (or a simplified representation) (key).
- Visualisation of results over the results of the queries like:
    - Contour fill of user selected cut-planes (key) or iso-surfaces (key).
    - Vector visualisation (with some kind of filtering or coarsening) on the volume data (added-value), cut-planes (key) or iso-surfaces (key).

5.2.3 FEM Analysis

The end-users were able to conduct some simple queries over the FEM cases during the testing of the first prototype of the platform. These queries were classified as key end-user requirements by the user panel. These queries of the first prototype include:

- 0D queries: inquiries about selected nodes.
- 1D queries: graph of a node or point along the time-steps.
- 2D queries: boundary/skin extraction of the volume mesh.

The feedback of the members of the user panel about these queries was positive in terms of the accuracy of the results shown. Nevertheless, the running times of the queries were not very fast. This is an important point that it is planned to be improved for the last prototype of the platform. In addition, some other queries need to be explored for the final prototype:

- 0D queries: inquiries about point (requires interpolation) and element (key).
- 1D queries:
  - line-cut and line-graph across the domain and showing the results along this line for a given time-step (key),
  - stream-line or particle tracing (added-value).
- 2D queries:
  - cut planes on the volume domain, and get results interpolated on them (key),
  - iso-surface extraction of a result and interpolation of other results on it (key),
  - computation of pressure forces over a structure (normal integral) (added-value).
- Animated queries along some or all time-steps of the analysis:
  - animation of results over iso-surfaces, cut-planes (key),
  - animation of stream-lines, graphs (added-value).
- Able to perform statistic queries:
  - minimum, maximum and average of a result on the whole model for a single time-step (added-value),
  - minimum, maximum and average for each node of the results along some or all time-steps (added-value).

5.2.4 Context

The first prototype of the platform has been successfully deployed in two different HPC infrastructures (Eddie at UEDIN and Acuario at CIMNE). The deployments were conducted by using nodes of the clusters only dedicated for computations of the VELaSSCo platform. Therefore, there was no interaction with the queue job management systems existing in these HPCs. In this context, an improvement to be explored for the final prototype is this potential integration in a HPC system without using dedicated nodes and how it can co-exist with the general queue job system.

Finally, the first prototype has been also able to run with different simultaneous users without interference. In the evaluation event, this was achieved by pre-assigning different port numbers for different users before they connected to the platform. As an improvement for the final prototype, the connection of multiple simultaneous users to the platform (without the need of pre-assigning port numbers) will be explored.

5.2.5 Usability

As already mentioned in section 4.1.4 related to DEM end-user requirements, the feedback of the user panel suggests that some improvements are needed in the documentation/tutorials of the platform in order to describe how to conduct the different queries required by the user. Moreover, the plug-in of the visualization clients needs also to be improved in order make them more user-friendly and intuitive:

- Easy connection from the visualization client to the platform (key).
- More intuitive and descriptive menus (key).
- Provide descriptive info when errors or crashes occur (key).

6 Conclusions

In summary, the second year of the project has shown further growth of the user panel with more than 50 members from across industry and academia. The completion of the initial prototype of the VELaSSCo platform provides the stimulus to grow the user panel further, prior to the final user evaluation in month 33-35. Several suitable events have been identified for demonstrating the VELaSSCo platform which will help increase the exposure of the VELaSSCo platform and help grow the user panel.

A selection of the full user panel has taken part in an initial evaluation of the VELaSSCo platform, providing feedback on the platform. The technical decisions on the architecture of the platform and more quantitative evaluation of end-user functionalities are provided in the other deliverables (see D1.4 and D5.2).

In addition to helping define the end-user requirements, some of the industrial participants have been approached with respect to providing simulation datasets for testing on the platform. Altair and Quantech ATZ are two software companies providing simulation data sets, while Procter & Gamble and Johnson Matthey are providing DEM simulation data.

7 Annex I – Use cases definition

7.1 DEM Use Cases

7.1.1 Use case DEM.M1-01

1. User: Connect to VELaSSCo
2. User: Open a simulation model
   - *model DEM.M1.*
3. User: Rotate the model.
4. User: List particles
   - List particles from id 2000 to 2015
5. User: List p2p contacts
   - List p2p contacts from id 140 to 155
6. User: Change validation status
7. User: Save the model.
8. User: Logout.

7.1.2 Use case DEM.M1-02

1. User: Connect to VELaSSCo
2. User: Open a simulation model
   - *model DEM.M1.*
3. User: Get a result on a particle.
   - *Get the **velocity** value for:*
     - *Analysis = **DEM***
     - *Coordinates = **Particles***
     - *Time-step **# 2939000***
     - *Result = **Velocity***
     - *Node number 10 → **value = 0, 0, 0***
     - *Node number **2724** → **value = 0.016432, 0.36734, -0.0045605***
4. User: Logout.

7.1.3 Use case DEM.M1-03

1. User: Connect to VELaSSCo
2. User: Open a simulation model
   - *model DEM.M1.*
3. User: Get the evolution of a result on a particle over time.
   - *Get the velocity y-component value for:*
     - *Analysis = **DEM***
     - *Coordinates = **Particles***
     - *Time-steps: **ALL***
     - *Result = **Velocity-Y***
     - *Node number **2724***
4. User: Logout.

7.1.4 Use case DEM.M1-04

1. User: Connect to VELaSSCo
2. User: Open a simulation model
   - *model DEM.M1.*
3. User: Visualize a contour fill of a particle result.
   - *Visualize the **velocity-Y** in the skin of the particles in **time step 2939000***
4. User: Logout.

7.1.5 Use case DEM.M1-05

1. User: Connect to VELaSSCo
2. User: Open a simulation model
   - *model DEM.M1.*
3. User: Compute d2c of the model
   - *Compute discrete to continuum for:*
     - *Static mesh = d2c_1*
     - *D2C analysis name = d2C_FB1*
     - *Time-step options = ALL*
     - *Coarse-graining method = Gaussian*

- *Coarse-graining options:*
  - *Width = 0.003*
  - *Cut-off factor = 3*
- *Process contacts = True*
- *Do temporal averaging = False*

4. User: Get the result in a specific node of the d2c mesh.
   4.1. User: Open d2c_1 model
   4.2 User: *Get the **density** value for:*
   - *Analysis = d2c_FB1*
   - *Time-step **# 2939000***
   - *Result = **Density***
   - *Node number **300***
   - *Node number **1000***
5. User: Logout.

7.1.6 Use case DEM.M1-06

1. User: Connect to VELaSSCo
2. User: Open a simulation model
   - *model DEM.M1.*
3. User: Compute d2c of the model
   - *Compute discrete to continuum for:*
     - *Static mesh = d2c_1*
     - *D2C analysis name = d2C_FB1*
     - *Time-step options = ALL*
     - *Coarse-graining method = Gaussian*
     - *Coarse-graining options:*
       - *Width = 0.003*
       - *Cut-off factor = 3*
     - *Process contacts = True*
     - *Do temporal averaging = False*
4. User: Get the result in a specific point for the computed d2c.
   4.1. User: Open d2c_1 model

4.2 User: *Get the **density** value for:*

- *Analysis = d2c_FB1*
- *Time-step **# 2939000***
- *Result = density*
- *Point on (0.02, 0.04, 0.0) → **value = 214.84***

5. User: Logout.

7.1.7 Use case DEM.M1-07

1. User: Connect to VELaSSCo
2. User: Open a simulation model
   - *model DEM.M1.*
3. User: Compute d2c of the model
   - *Compute discrete to continuum for:*
     - *Static mesh = d2c_1*
     - *D2C analysis name = d2C_FB2*
     - *Time-step options = ALL*
     - *Coarse-graining method = Gaussian*
     - *Coarse-graining options:*
       - *Width = 0.003*
       - *Cut-off factor = 3*
     - *Process contacts = True*
     - *Do temporal averaging = True*
     - *Temporal averaging options = ALL*
4. User: Visualize a contour fill of a result.

   4.1 User: Open model d2c_1

   4.2 User: *Visualize the contour fill of **velocity-Y** in the skin of the volume mesh of the computed d2c (model "d2c_1" and analysis name "d2c_FB2") for **time step 0***

5. User: Logout.

7.1.8 Use case DEM.M1-08

1. User: Connect to VELaSSCo
2. User: Open a simulation model
   - *model DEM.M1.*
3. User: Compute d2c of the model
   - *Compute discrete to continuum for:*
     - *Static mesh = d2c_1*
     - *D2C analysis name = d2C_FB2*
     - *Time-step options = ALL*
     - *Coarse-graining method = Gaussian*
     - *Coarse-graining options:*
       - *Width = 0.003*
       - *Cut-off factor = 3*
     - *Process contacts = True*
     - *Do temporal averaging = False*
4. User: Open d2c model: d2c_1
5. User: Do a cut plane in the d2c mesh.
   - *Do and visualize a cut in the d2c mesh, parallel to Y direction, and passing through (0, 0, 0) coordinates.*
6. User: Visualize a result of d2c onto the cut plane
   - Visualize the velocity-y vectors onto the cut plane for analysis name d2c_FB2 in time step ***0***
7. User: Logout.

7.1.9 Use case DEM.M1-100

1. User: Connect to VELaSSCo
2. User: Open a simulation model
   - *model DEM.M1.*
3. User: Visualize a contour fill of a particle result.
   - *Visualize the **velocity-Y** in the skin of the particles for **time step 2939000***
4. User: Rotate model.
5. User: Get the evolution of a result on a particle over time.

- *Get the velocity y-component value for:*
  - *Analysis = **DEM***
  - *Coordinates = **Particles***
  - *Time-steps: **ALL***
  - *Result = **Velocity-Y***
  - *Node number **2724***

6. User: Visualize a contour fill of a p2p result for a time-step.
   - *Visualize the **Force-Y** in the skin of the p2p contacts for **time step 2939000***
7. User: Compute d2c of the model
   - *Compute discrete to continuum for:*
     - *Static mesh = d2c_1*
     - *D2C analysis name = d2C_FB2*
     - *Time-step options = ALL*
     - *Coarse-graining method = Gaussian*
     - *Coarse-graining options:*
       - *Width = 0.003*
       - *Cut-off factor = 3*
     - *Process contacts = True*
     - *Do temporal averaging = True*
     - *Temporal averaging options = ALL*
8. User: Open model d2c_1
9. User: Do a cut plane in the d2c mesh.
   - *Do and visualize a cut in the d2c mesh, parallel to Y direction, and passing through (0, 0, 0) coordinates.*
10. User: Visualize a result of d2c onto the cut plane
    - Visualize the **Velocity-Y** onto the cut plane for analysis name d2c_FB2 in time step ***0***
11. User: Logout.

7.2 FEM

7.2.1 Use case FEM.M1-01

1. User: Connect to VELaSSCo
2. User: Open a simulation model
   - *model FEM.M1.*
3. User: Rotate the model.
4. User: List elements
   - List elements number from 10 to 15
5. User: List nodes
   - List nodes number from 200 to 205
6. User: Change validation status
7. User: Save the model.
8. User: Logout.

7.2.2 Use case FEM.M1-02

1. User: Connect to VELaSSCo
2. User: Open a simulation model
   - *model FEM.M1.*
3. User: Get a result on a node.
   - *Get the **pressure** value for:*
     - *Analysis = **Kratos***
     - *Time-step **# 3**, value = **61.0***
     - *Result = **Pressure***
     - *Node number **5** → **value = 0***
     - *Node number **2,814,146** → **value = 0.2462438…***
4. User: Logout.

7.2.3 Use case FEM.M1-03

1. User: Connect to VELaSSCo
2. User: Open a simulation model
   - *model FEM.M1.*

3. User: Get the evolution of a result on a node over time.
   - *Get the **pressure** value for:*
     - *Analysis = **Kratos***
     - *Time-steps: **ALL***
     - *Result = **Pressure***
     - *Node number **2,814,146***
4. User: Logout.

7.2.4 Use case FEM.M1-04

1. User: Connect to VELaSSCo
2. User: Open a simulation model
   - *model FEM.M1.*
3. User: Get the result in a specific point.
   - *Get the **velocity** value for:*
     - *Analysis = **Kratos***
     - *Time-step **# 12**, value = **241.0***
     - *Result = **Velocity***
     - *Point on (8907.5, 2341.0, 2389.5)*
4. User: Logout.

7.2.5 Use case FEM.M1-05

1. User: Connect to VELaSSCo
2. User: Open a simulation model
   - *model FEM.M1.*
3. User: Visualize a contour fill of a result.
   - *Visualize the contour fill of **pressure** in the skin of the volume mesh in **time step 8***
4. User: Logout.

7.2.6 Use case FEM.M1-06

1. User: Connect to VELaSSCo
2. User: Open a simulation model
   - *model FEM.M1.*
3. User: Do a cut in the volume mesh.
   - *Do and visualize a cut in the volume mesh, parallel to AA direction, and passing through (x, y, z) coordinates.*
4. User: Logout.

7.2.7 Use case FEM.M1-07

1. User: Connect to VELaSSCo
2. User: Open a simulation model
   - *model FEM.M1.*
3. User: Do a cut plane in the volume mesh.
   - *Do and visualize a cut in the volume mesh, parallel to XXXX direction, and passing through (x, x, x) coordinates.*
4. User: Visualize a result onto the cut plane
   - Visualize the velocity vectors onto the cut plane in time step 7.
5. User: Logout.

7.2.8 Use case FEM.M1-08

1. User: Connect to VELaSSCo
2. User: Open a simulation model
   - *model FEM.M1.*
3. User: Select coarser mesh.
   - *Select coarser mesh for all time steps.*
4. User: Rotate model.
5. User: Select original mesh
6. User: Logout.

7.2.9 Use case FEM.M1-100

1. User: Connect to VELaSSCo
2. User: Open a simulation model
   - *model FEM.M1.*
3. User: Select coarser mesh.
   - *Select coarser mesh for all time steps.*
4. User: Rotate model.
5. User: Select original mesh
6. User: Get the evolution of a result on a node over time.
   - *Get the **pressure** value of **node number 5** for **all time steps***
7. User: Visualize a contour fill of a result.
   - *Visualize the contour fill of **pressure** in the skin of the volume mesh in **time step 8***
8. User: Do a cut in the volume mesh.
   - *Do and visualize a cut in the volume mesh, parallel to AA direction, and passing through (x, y, z) coordinates.*
9. User: Visualize a result onto the cut plane
   - Visualize the velocity vectors onto the cut plane in time step 7.
10. User: Logout.

8 Annex II – Use cases evaluation event and questionnaires

8.1 USE CASE 1: Telescope Simulation (FEM) Simulation Tool: GiD

VELaSSCo

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

Evaluation Event

USE CASE 1: Telescope Simulation (FEM)
Simulation Tool: GiD

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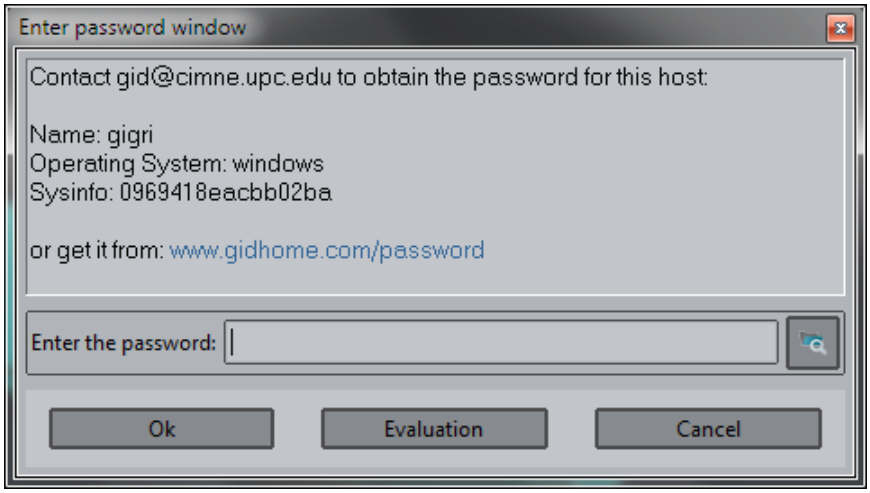
1 GiD Installation Guide

1.1 Download and installation of GiD

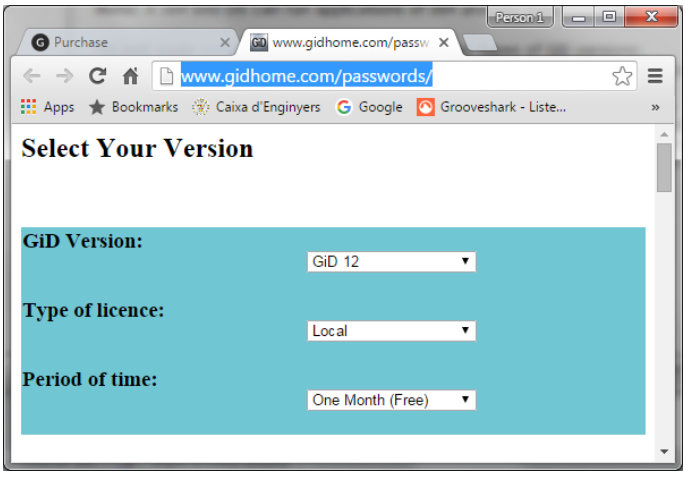
- Enter to www.gidhome.com/download/developer-versions
- Download the 12.1.10d (developer version) for your operating system
- Install it in your computer.

1.2 Get a password of GiD 12

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



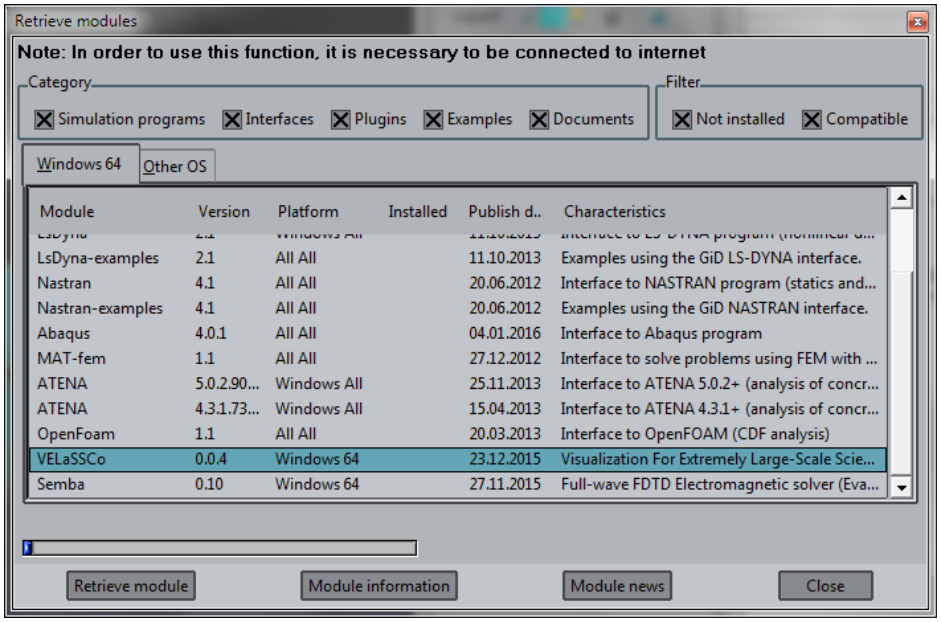
- **In case you already have a password for a GiD v12** installed in your computer, you can get the password from it by clicking the button in the lower right part of the window (icon with a folder) and selecting the path where the other GiD is installed.
- **In case you don't have a password for GiD v12**, you should ask for a free temporary password:
  - Go to www.gidhome.com/passwords/



- Select 'Local' type of license, and 'One month (free)' period of time
- Follow the instructions and click 'Send'
- 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.
- 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

- Setup VPN connection to EDDIE cluster if necessary (documented in alfresco, ask advisor):
  - http://www.ed.ac.uk/information-services/computing/desktop-personal/vpn/vpn-service-using
  - **Credentials**: user = velassco and passwd = vela702ssco_VPN

- Figure out the port where the QueryManager is running (ask advisor)

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 clients side.

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

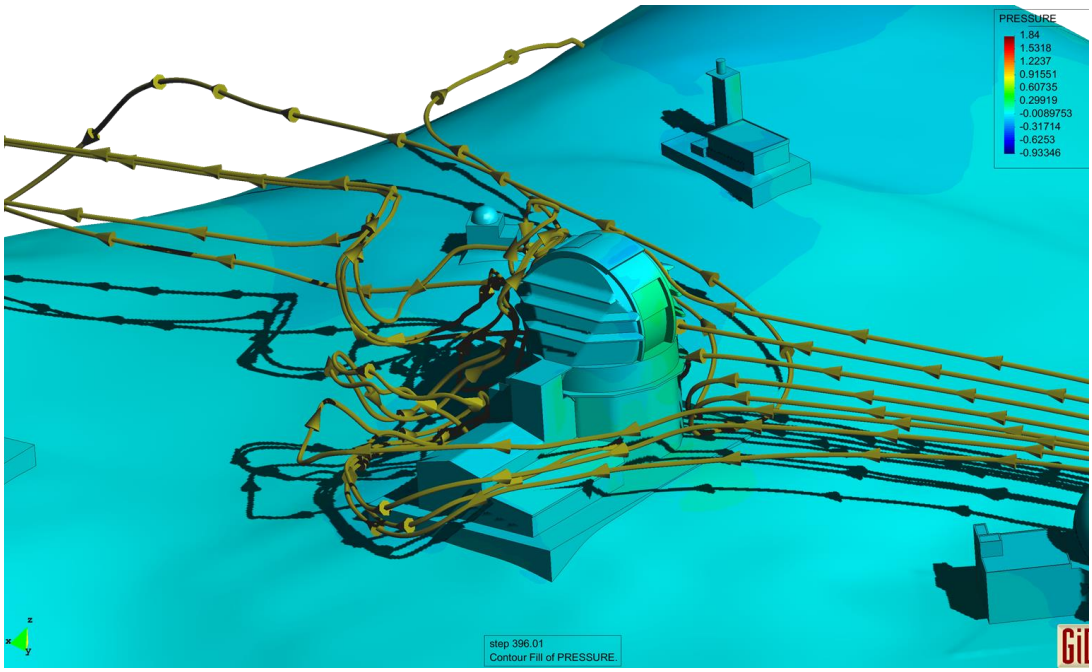
- **VELaSSCo Platform Beta Version**
- **GiD Client V.12.1.10d** (Visualization Tool)
- Text editor and viewer (e.g. Notepad, Word,…)
- Web browser
- Notepad, pens and pencils
- PuTTY 0.64 (free ssh and telnet client)

Your work may be recorded and at the end you will be asked to fill in a simple questionnaire. The facilitator may take notes and ask questions about what you are doing and why. This will help us understand how people use VELaSSCo Platform and Visualization Clients, how efficient and effective is the VELaSSCo Platform, etc.

2.1 Telescope Model Description

The Telescope model selected has the following settings:

- Air flow around a telescope on a terrain
- Simulation run on 128 cores
- 128 sub-domains (partitions):
    - Total of 4 M nodes and 28 M tetrahedrons
    - 19 time-steps with:
        - Partition Index
        - Pressure
        - Velocity vector



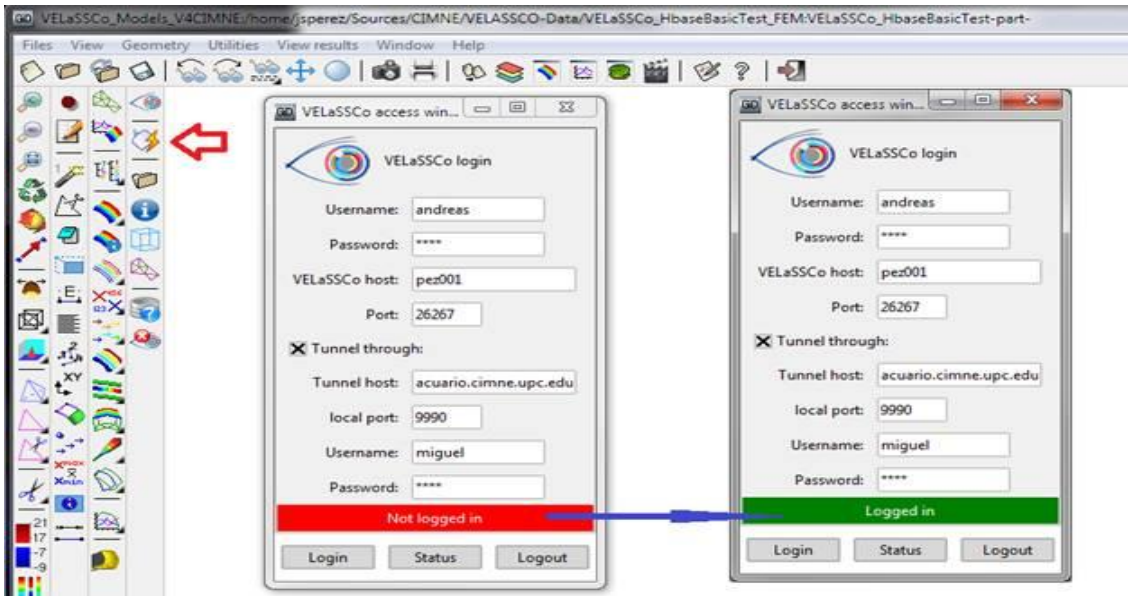
2.2 Task 1: Use case FEM.M1-02

2.2.1 Motivation

Get a result on a concrete node, in concrete the pressure.

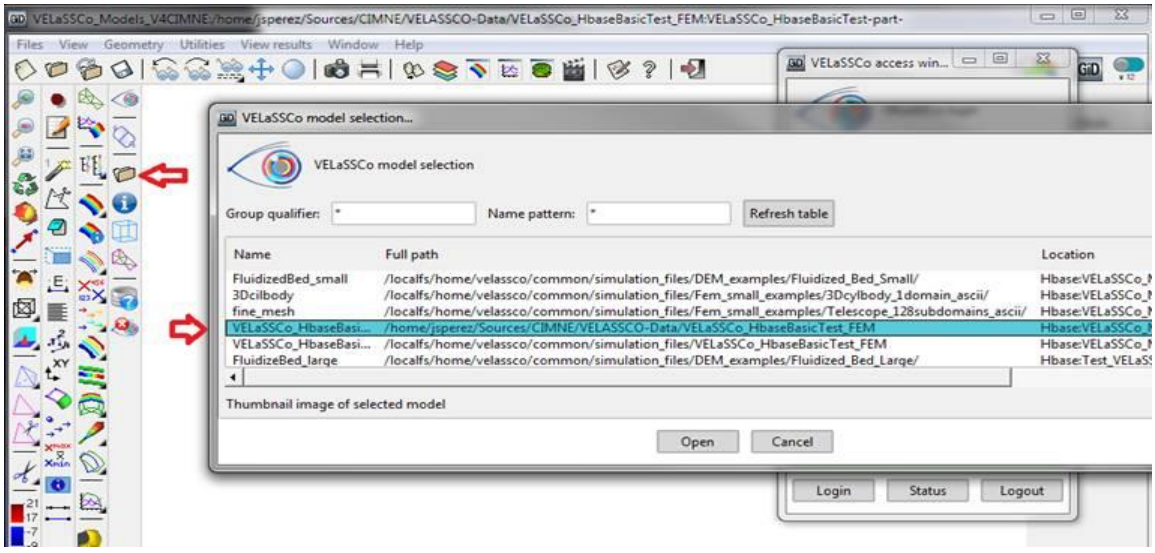
2.2.2 Specification

- Connect to VELaSSCo Server using GiD

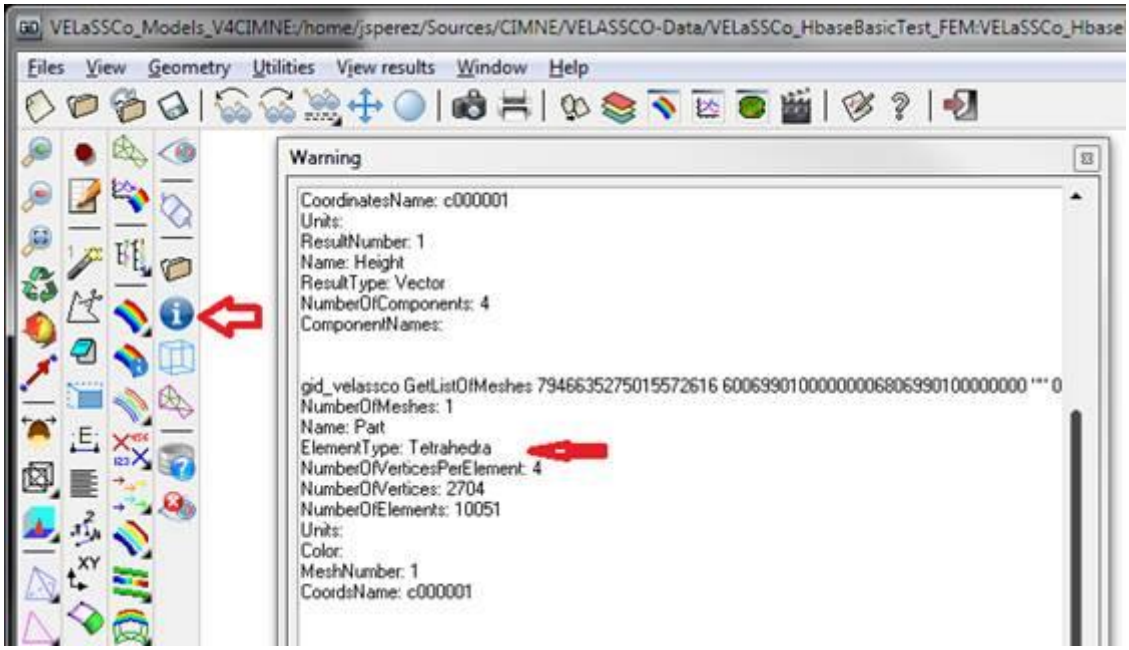


  - **Credentials**: user: velassco, password: vela702ssco

- Open a simulation model
  - *Select **Telescope** model(fine mesh)*



Note: Ensure that there are tetrahedral meshes by using the info icon:



- Get a result on a node.
  - *Get the **pressure** value for:*
    - *Analysis = **Kratos***
    - *Time-step # **3**, value = **61.0***
    - *Result = **Pressure***
    - *Node number 5 → value = **0***
    - *Node number **2,814,146** → value = 0.2462438…*

2.2.3 Participants notes

2.3 Task 2: Use case FEM.M1-03

2.3.1 Motivation

Get the evolution of a result (pressure) on a node over time.

2.3.2 Specification

- Get the evolution of a result on a node over time.
  - *Get the **pressure** value for:*
    - *Analysis = **Kratos***
    - *Time-steps: **ALL***
    - *Result = **Pressure***
    - *Node number **2,814,146***

2.3.3 Participants notes

2.4 Task 3: Use case FEM.M1-05

2.4.1 Motivation

Visualize the contour fill of pressure in the skin of the volume mesh for a concrete time.

2.4.2 Specification

- User: Visualize a contour fill of a result.
  - *Visualize the contour fill of **pressure** in the skin of the volume mesh in **time step 8 (161.0)***
- Logout

2.4.3 Participants notes

3 Questionnaire for participants

In the following questionnaire we have three main goals:

- To gather the usability and effectiveness information on the VELASSCO Platform from the use case considered
- How to improve the VELASSCO Platform
- How to promote VELASSCO Platform.

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 via email to ivan.martinez@atos.net

Thanks for your time.

The VELASSCO project.

Setting

A-1. How would you rate your previous experience with the VELaSSCo Prototype and GiD Client used in the test?

Beginner	Moderate	Expert	NA/DK[1]

Tasks observation

B-1. How would you rate your previous experience in science and engineering simulations?

Beginner	Moderate	Expert	NA/DK

B-2. Please, indicate how you perceived the amount of time needed to execute each of the tasks of the experiment:

Task 1:

Low	Average	High	NA/DK

Task 2:

Low	Average	High	NA/DK

Task 3:

Low	Average	High	NA/DK

B-3. Your understanding of the tasks comprised in the experiment was:

Low	Average	High	NA/DK

[1] NA/DK: Not Applicable/Don't Know

B-4. Please, briefly describe your approach and the difficulties found when performing Task 1 of the experiment.

B-5. Please, briefly describe your approach to Task 2 of the experiment.

B-6. Please, briefly describe your approach to Task 3 of the experiment.

B-7. The difficulties you needed to overcome due to the VELaSSCo Prototype and other tools used during the experiment in order to complete each task were:

	Low	Average	High	NA/DK	Positive/negative functionalities you found
Task 1					
Task 2					
Task 3					
Task 4					

B-8. How did you find the support provided by the facilitator?

Inadequate	Adequate	Excellent	NA/DK

3.1 Usability Questionnaire

This questionnaire gives you an opportunity to tell us your reactions to the system you used. Your responses will help us understand what aspects of the system you are particularly concerned about and the aspects that satisfy you.

To as great a degree as possible, think about all the tasks that you have done with the system while you answer these questions.

Please read each statement and indicate how strongly you agree or disagree with the statement by circling a number on the scale. If a statement does not apply to you, circle N/A.

Please write comments to elaborate on your answers.

As you complete the questionnaire, please do not hesitate to ask any questions.

Thank you!

System Quality

C1. Overall, I am satisfied with how easy it is to use this system.

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

C2. It was simple to use this system.

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

C3. I could effectively complete the tasks and scenarios using this system.

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

C4. I was able to complete the tasks and scenarios quickly using this system.

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

C5. I was able to efficiently complete the tasks and scenarios using this system.

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

C6. I felt comfortable using this system.

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

Information Quality

C7. It was easy to learn to use this system.

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

C8. I believe I could become productive quickly using this system.

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

C9. The system gave error messages that clearly told me how to fix problems.

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

C10. Whenever I made a mistake using the system, I could recover easily and quickly.

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

C11. The information (such as on-line help, on-screen messages and other documentation) provided with this system was clear.

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

C12. It was easy to find the information I needed.

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

Interface Quality

C13. The information provided for GiD was easy to understand.

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

C14. The information was effective in helping me complete the tasks and scenarios.

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

C15. The organization of information on the GiD screens was clear.

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

Note: *The "interface" includes those items that you use to interact with the system. For example, some components of the interface are the keyboard, the mouse, the microphone, and the screens (including their use of graphics and language).*

C16. The interface of this GiD was pleasant.

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

3.2 Effectiveness Questionnaire

This questionnaire gives you an opportunity to tell us your reactions to the system you used. Your responses will help us understand what aspects of the system you are particularly concerned about and the aspects that satisfy you.

To as great a degree as possible, think about all the tasks that you have done with the system while you answer these questions.

Please read each statement and indicate how strongly you agree or disagree with the statement by circling a number on the scale. If a statement does not apply to you, circle N/A.

Please write comments to elaborate on your answers.

As you complete the questionnaire, please do not hesitate to ask any questions.

Thank you!

Effectiveness Questions

D1. Does the visualization present valid and accurate information?

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

D2. Do you think that the elements chosen for showing/representing the data information(tables, charts, etc.) are the best choice in a way that users can get much more information in less time?

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

D3. Is the data representation correct respect to defined metrics and data language?

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

D4. Is the visualization what you expected it to be?

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

D5. Do you consider that this visualization gives you insights that you may not get from some other means?

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

D6. Is the complexity of the visualization adequate?

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

D7. Do you consider that GiD has a good visual design?

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

D8. Is relevant all information shown in the visualization?

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

D9. Do you consider that the visualization has a good performance?

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

D10. Do you consider that the visualization is user-friendly?

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

D11. Do you consider that the visualization presents a useful formatting?

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

D12. If VELaSSCo GiD/Platform has not met your needs as a user, in terms of performance, usability and effectiveness would use an alternative commercial application that meets these requirements?

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

8.2 USE CASE 1: Telescope Simulation (FEM) Simulation Tool: IFX

VELaSSCo

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

Evaluation Event

USE CASE 1: Telescope Simulation (FEM)
Simulation Tool: IFX

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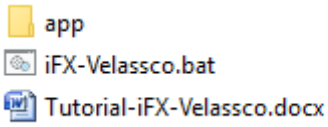
1 IFX Installation Guide

1.1 Installation

- Download current package from https://cloud.igd.fraunhofer.de/owncloud/public.php?service=files&t=940509e044dfab56bea54394696381bc
- Unzip downloaded package
- Directory structure should look like this



1.2 Connect to EDDIE Cluster

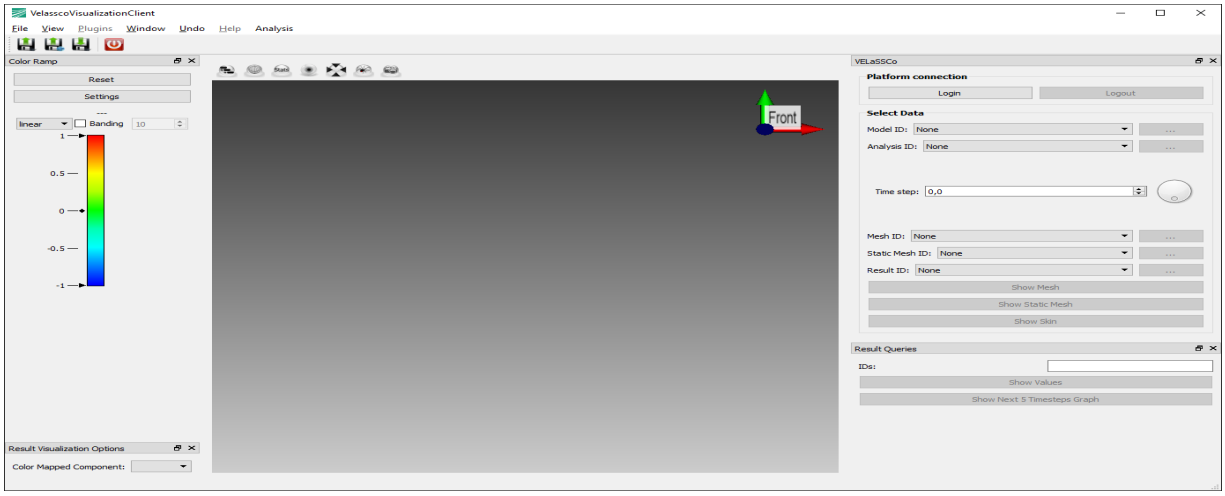
- Setup VPN connection to EDDIE cluster if necessary (documented in alfresco, ask advisor):
  - http://www.ed.ac.uk/information-services/computing/desktop-personal/vpn/vpn-service-using
  - **Credentials**: user = velassco and passwd = vela702ssco_VPN

- Setup tunnel (if needed):
  - start putty -L **26267**:velassco-cluster01-ext.ecdf.ed.ac.uk:26268 velassco@velassco-cluster01-ext.ecdf.ed.ac.uk

- Figure out the port where the QueryManager is running (ask advisor)

1.3 Start iFX VELaSSCo Client

- Start / double-click iFX-Velassco.bat



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 VELaSSCo 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 clients side.

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

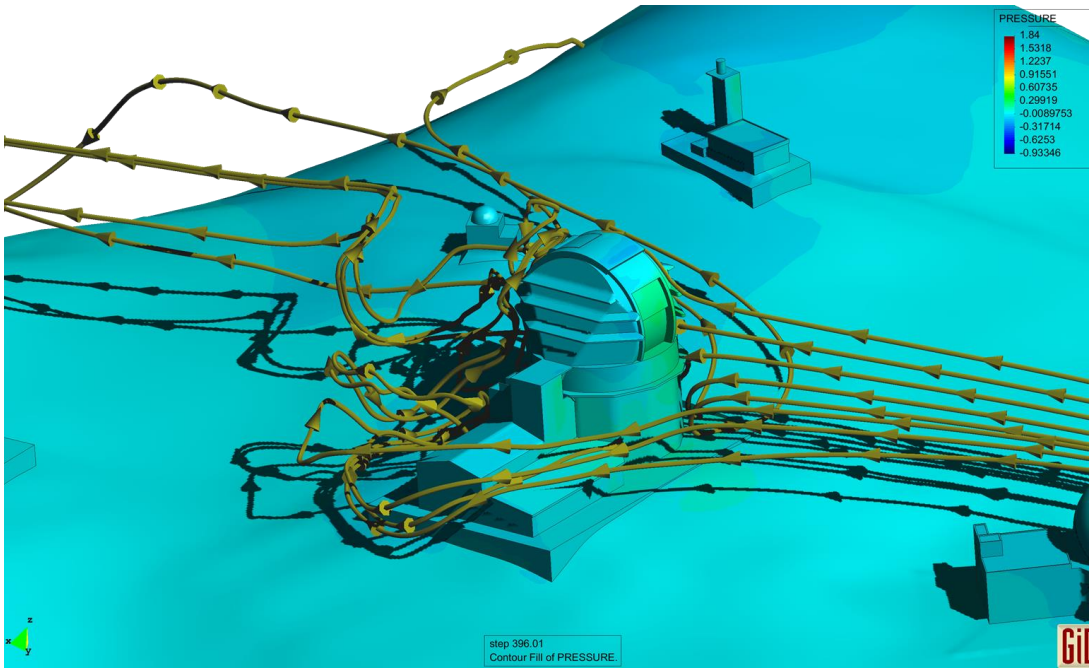
- **VELaSSCo Platform Beta Version**
- **IFX Client for VELaSSCo Project** (Visualization Tool)
- Text editor and viewer (e.g. Notepad, Word,…)
- Web browser
- Notepad, pens and pencils
- PuTTY 0.64 (free ssh and telnet client)

Your work may be recorded and at the end you will be asked to fill in a simple questionnaire. The facilitator may take notes and ask questions about what you are doing and why. This will help us understand how people use VELaSSCo Platform and Visualization Clients, how efficient and effective is the VELaSSCo Platform, etc.

2.1 Telescope Model Description

The Telescope model selected has the following settings:

- Air flow around a telescope on a terrain
- Simulation run on 128 cores
- 128 sub-domains (partitions):
    - Total of 4 M nodes and 28 M tetrahedrons
    - 19 time-steps with:
        - Partition Index
        - Pressure
        - Velocity vector



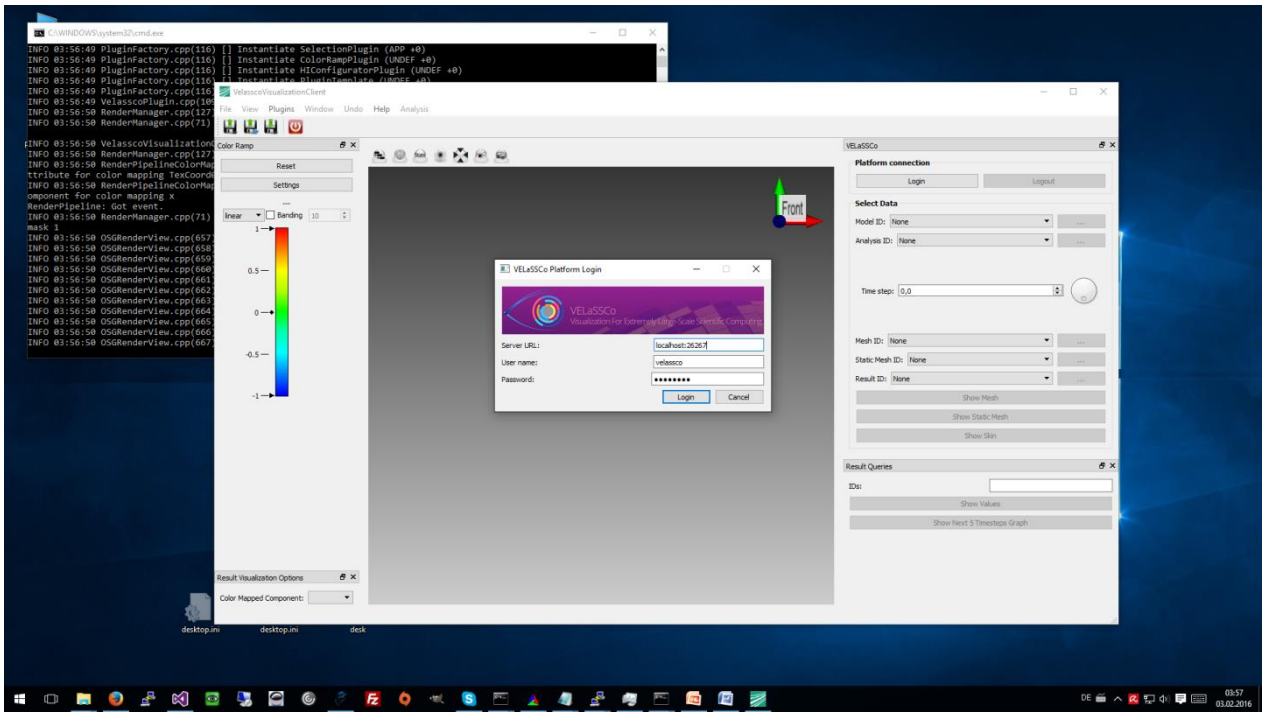
2.2 Task 1: Use case FEM.M1-02

2.2.1 Motivation

Get a result on a concrete node, in concrete the pressure.

2.2.2 Specification

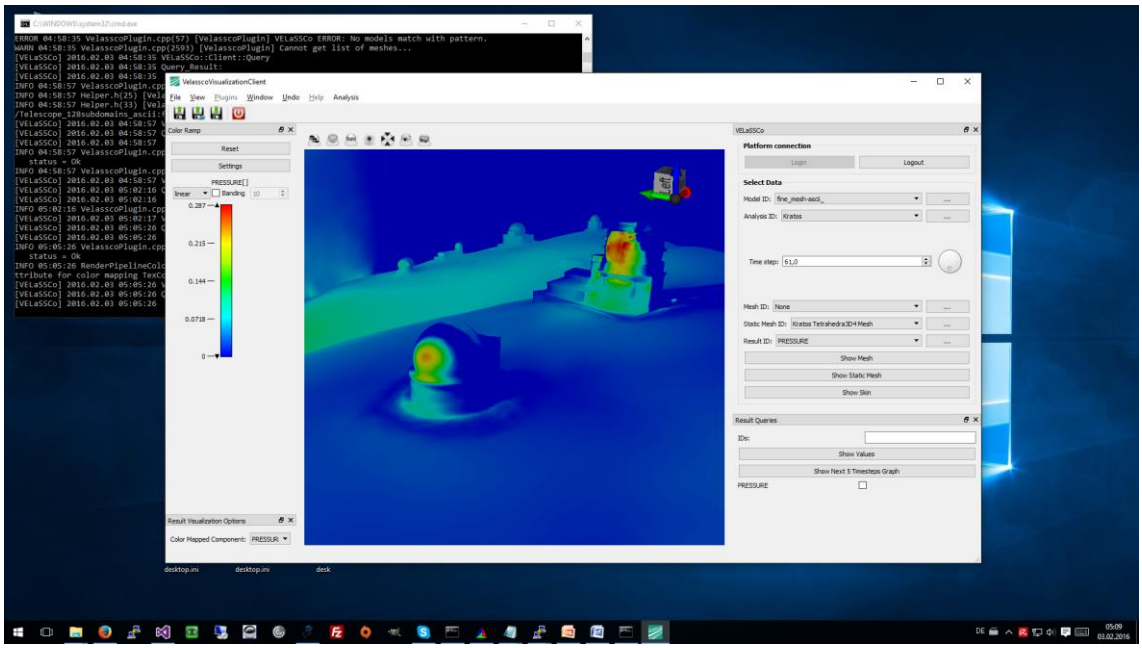
- Connect to VELaSSCo Server using IFX
    - Select Login Button in the top-right corner



    - Enter port of QueryManager after localhost: (i.e. replace 26267 with current port)
    - **Credentials**: user: velassco, password: vela702ssco
- Open a simulation model:
    - Select menu Analysis->Main
    - In the tab on the right-hand side
        - Select Model ID: fine_mesh (Telescope)
        - Select Analysis ID: FEM
- Get a result on a node.
    - *Get the **pressure** value for:*
        - *Analysis = **Kratos***
        - *Time-step # **3**, value = **61.0***
        - *Result = **Pressure***

- *Node number 5 → value = **0***
- *Node number **2,814,146** → value = 0.2462438…*

Note: To show single values input use case data and press “Show Values” button:



2.2.3 Participants notes

2.3 Task 2: Use case FEM.M1-03

2.3.1 Motivation

Get the evolution of a result (pressure) on a node over time.

2.3.2 Specification

- Get the evolution of a result on a node over time.
  - *Get the **pressure** value for:*
    - *Analysis = **Kratos***
    - *Time-steps: **ALL***
    - *Result = **Pressure***
    - *Node number **2,814,146)***

2.3.3 Participants notes

2.4 Task 3: Use case FEM.M1-05

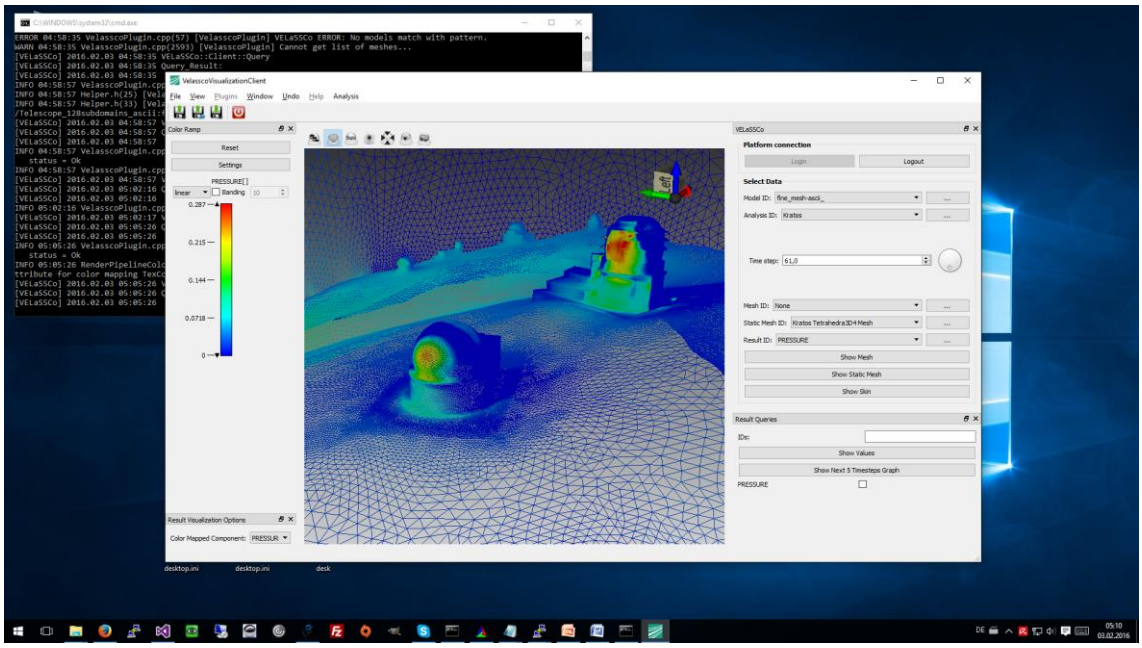
2.4.1 Motivation

Visualize the contour fill of pressure in the skin of the volume mesh for a concrete time.

2.4.2 Specification

- User: Visualize a contour fill of a result.
  - *Visualize the contour fill of **pressure** in the skin of the volume mesh in **time step 8 (161.0)***
- Logout

Note: To show contour plot of mesh input use case data and press “Show Skin” button:



2.4.3 Participants notes

3 Questionnaire for participants

In the following questionnaire we have three main goals:

- To gather the usability and effectiveness information on the VELASSCO Platform from the use case considered
- How to improve the VELASSCO Platform
- How to promote VELASSCO Platform.

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 via email to ivan.martinez@atos.net

Thanks for your time.

The VELASSCO project.

Setting

A-1. How would you rate your previous experience with the VELaSSCo Prototype and IFX Client used in the test?

Beginner	Moderate	Expert	NA/DK[2]

Tasks observation

B-1. How would you rate your previous experience in science and engineering simulations?

Beginner	Moderate	Expert	NA/DK

B-2. Please, indicate how you perceived the amount of time needed to execute each of the tasks of the experiment:

Task 1:

Low	Average	High	NA/DK

Task 2:

Low	Average	High	NA/DK

Task 3:

Low	Average	High	NA/DK

B-3. Your understanding of the tasks comprised in the experiment was:

Low	Average	High	NA/DK

[2] NA/DK: Not Applicable/Don't Know

B-4. Please, briefly describe your approach and the difficulties found when performing Task 1 of the experiment.

B-5. Please, briefly describe your approach to Task 2 of the experiment.

B-6. Please, briefly describe your approach to Task 3 of the experiment.

B-7. The difficulties you needed to overcome due to the VELaSSCo Prototype and other tools used during the experiment in order to complete each task were:

	Low	Average	High	NA/DK	Positive/negative functionalities you found
Task 1					
Task 2					
Task 3					
Task 4					

B-8. How did you find the support provided by the facilitator?

Inadequate	Adequate	Excellent	NA/DK

3.1 Usability Questionnaire

This questionnaire gives you an opportunity to tell us your reactions to the system you used. Your responses will help us understand what aspects of the system you are particularly concerned about and the aspects that satisfy you.

To as great a degree as possible, think about all the tasks that you have done with the system while you answer these questions.

Please read each statement and indicate how strongly you agree or disagree with the statement by circling a number on the scale. If a statement does not apply to you, circle N/A.

Please write comments to elaborate on your answers.

As you complete the questionnaire, please do not hesitate to ask any questions.

Thank you!

System Quality

C1. Overall, I am satisfied with how easy it is to use this system.

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

C2. It was simple to use this system.

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

C3. I could effectively complete the tasks and scenarios using this system.

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

C4. I was able to complete the tasks and scenarios quickly using this system.

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

C5. I was able to efficiently complete the tasks and scenarios using this system.

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

C6. I felt comfortable using this system.

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

Information Quality

C7. It was easy to learn to use this system.

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

C8. I believe I could become productive quickly using this system.

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

C9. The system gave error messages that clearly told me how to fix problems.

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

C10. Whenever I made a mistake using the system, I could recover easily and quickly.

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

C11. The information (such as on-line help, on-screen messages and other documentation) provided with this system was clear.

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

C12. It was easy to find the information I needed.

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

Interface Quality

C13. The information provided for IFX was easy to understand.

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

C14. The information was effective in helping me complete the tasks and scenarios.

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

C15. The organization of information on the IFX screens was clear.

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

Note: *The "interface" includes those items that you use to interact with the system. For example, some components of the interface are the keyboard, the mouse, the microphone, and the screens (including their use of graphics and language).*

C16. The interface of this IFX was pleasant.

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

3.2 Effectiveness Questionnaire

This questionnaire gives you an opportunity to tell us your reactions to the system you used. Your responses will help us understand what aspects of the system you are particularly concerned about and the aspects that satisfy you.

To as great a degree as possible, think about all the tasks that you have done with the system while you answer these questions.

Please read each statement and indicate how strongly you agree or disagree with the statement by circling a number on the scale. If a statement does not apply to you, circle N/A.

Please write comments to elaborate on your answers.

As you complete the questionnaire, please do not hesitate to ask any questions.

Thank you!

Effectiveness Questions

D1. Does the visualization present valid and accurate information?

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

D2. Do you think that the elements chosen for showing/representing the data information(tables, charts, etc.) are the best choice in a way that users can get much more information in less time?

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

D3. Is the data representation correct respect to defined metrics and data language?

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

D4. Is the visualization what you expected it to be?

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

D5. Do you consider that this visualization gives you insights that you may not get from some other means?

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

D6. Is the complexity of the visualization adequate?

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

D7. Do you consider that IFX has a good visual design?

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

D8. Is relevant all information shown in the visualization?

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

D9. Do you consider that the visualization has a good performance?

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

D10. Do you consider that the visualization is user-friendly?

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

D11. Do you consider that the visualization presents a useful formatting?

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

D12. If VELaSSCo IFX/Platform has not met your needs as a user, in terms of performance, usability and effectiveness would use an alternative commercial application that meets these requirements?

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

8.3 USE CASE 2: Fluidized Bed (FEM) Simulation Tool: GiD

VELaSSCo

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

Evaluation Event

USE CASE 2: Fluidized Bed (FEM)
Simulation Tool: GiD

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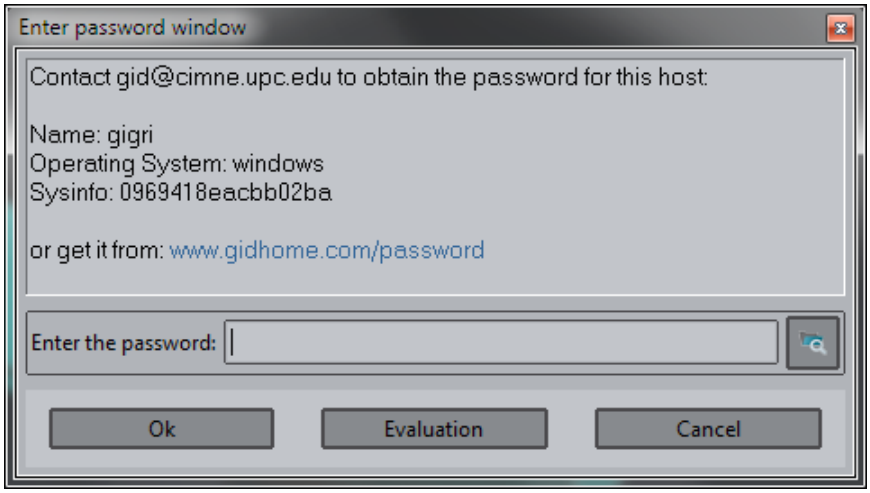
1 GiD Installation Guide

1.1 Download and installation of GiD

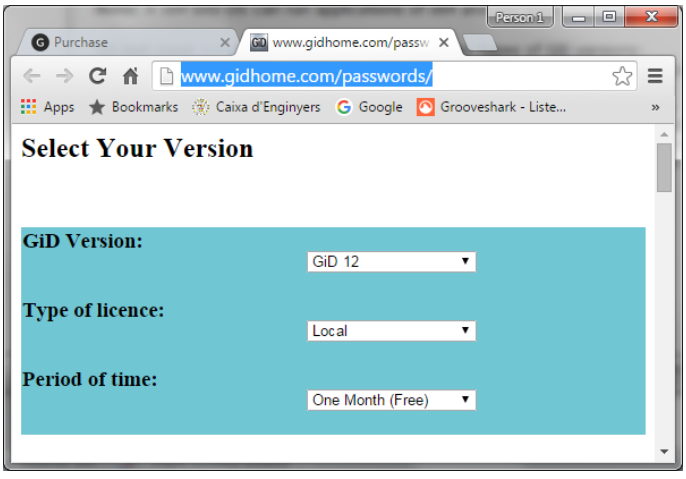
- Enter to www.gidhome.com/download/developer-versions
- Download the 12.1.10d (developer version) for your operating system
- Install it in your computer.

1.2 Get a password of GiD 12

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



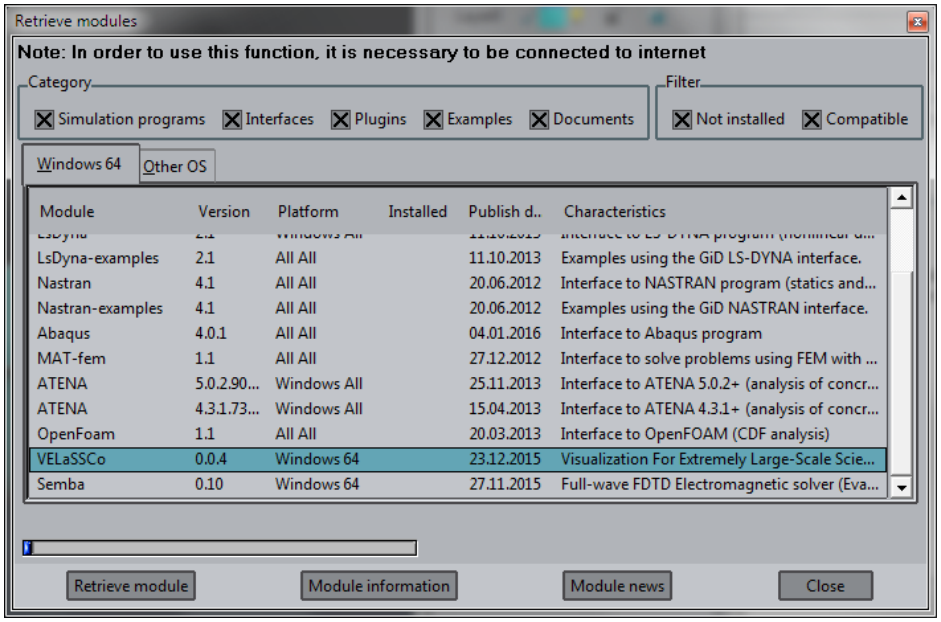
- **In case you already have a password for a GiD v12** installed in your computer, you can get the password from it by clicking the button in the lower right part of the window (icon with a folder) and selecting the path where the other GiD is installed.
- **In case you don't have a password for GiD v12**, you should ask for a free temporary password:
  - Go to www.gidhome.com/passwords/



- Select 'Local' type of license, and 'One month (free)' period of time
- Follow the instructions and click 'Send'
- 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.
- 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

- Setup VPN connection to EDDIE cluster if necessary (documented in alfresco, ask advisor):
  - http://www.ed.ac.uk/information-services/computing/desktop-personal/vpn/vpn-service-using
  - **Credentials**: user = velassco and passwd = vela702ssco_VPN

- Figure out the port where the QueryManager is running (ask advisor)

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 previosly calculated and injected into the Platform. You will be asked to carry out tasks that involve simple simulations actions on the clients side.

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

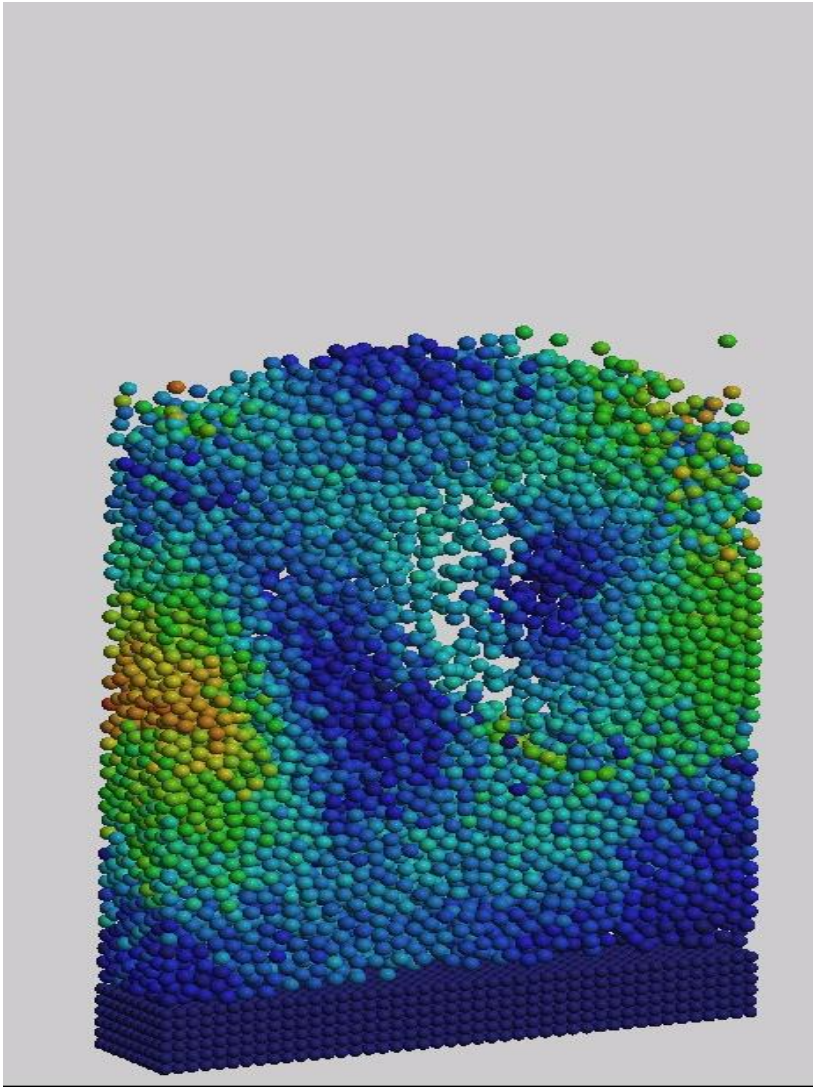
- **Velassco Platform Beta Version**
- **GiD Client V.12.1.10d** (Visualization Tool)
- Text editor and viewer (e.g. Notepad, Word,…)
- Web browser
- Notepad, pens and pencils
- PuTTY 0.64 (free ssh and telnet client)

Your work may be recorded and at the end you will be asked to fill in a simple questionnaire. The facilitator may take notes and ask questions about what you are doing and why. This will help us understand how people use VELaSCCo Platform and Visualization Clients, how efficient and effective is the VELaSCCo Platform, etc.

2.1 Fluidized Bed Model Description

The Fluidized Bed model selected has the following settings:

- Fluidized bed process very common in pharmaceutical and chemical industries.
- ~ 12000 particles / time-step
- ~ 3000 contacts (p2p and p2w) / time-step.
- 40 000 time-steps.
- Particle results: mass, volume, velocity vector
- Contact results: Force vector.



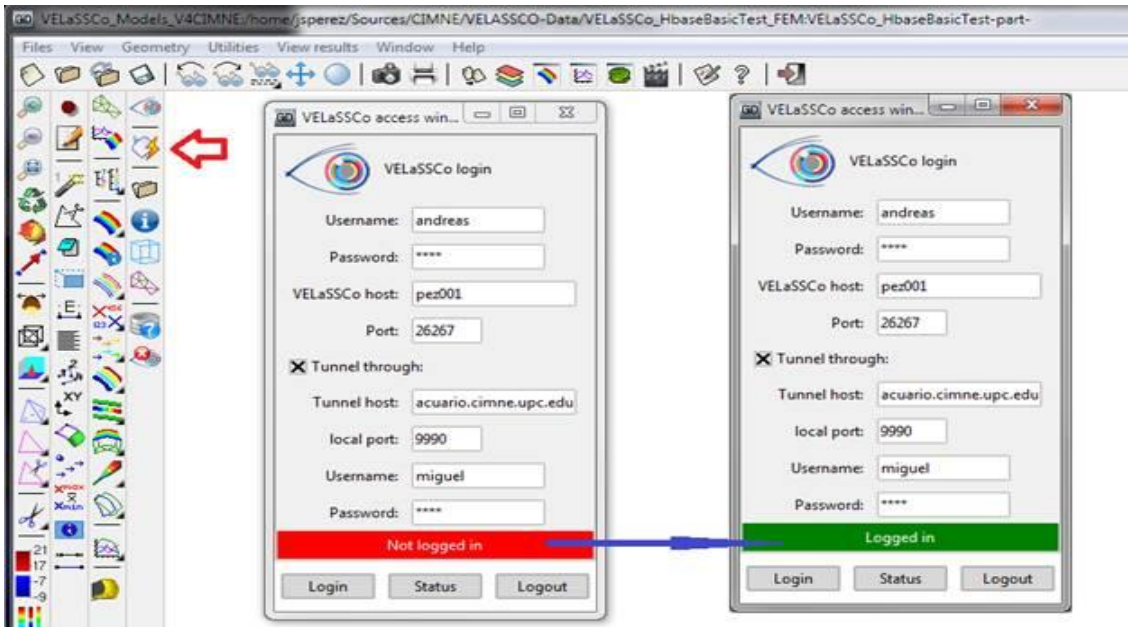
2.2 Task1: Use Case DEM.M1-02

2.2.1 Motivation

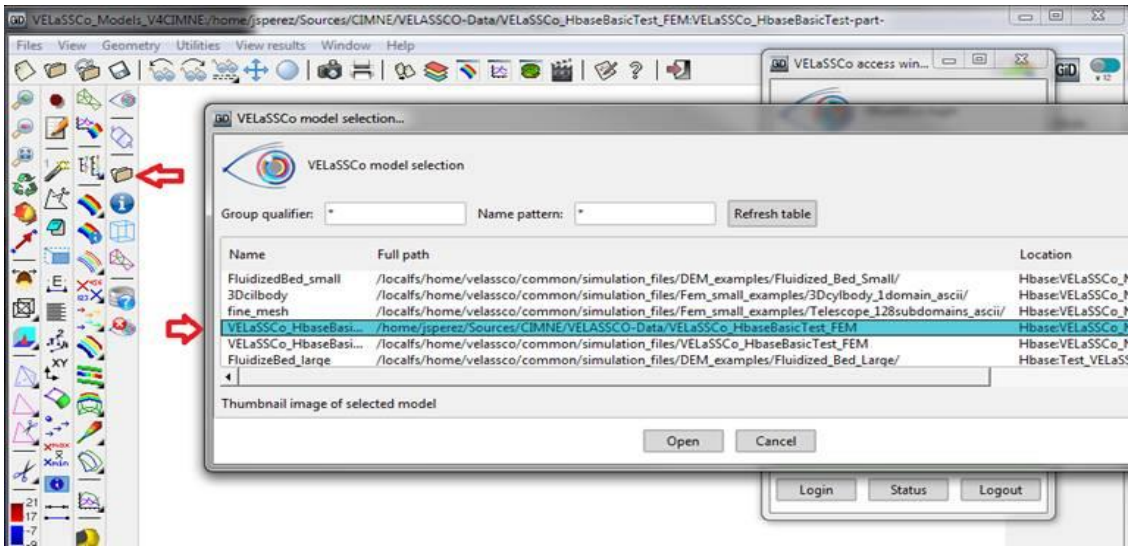
Get a result on a particle; concretely get the velocity value specifying a concrete particle id and time-step.

2.2.2 Specification

- Connect to VELaSCCo Server using GiD:



- Open a simulation model
  - *Select **Fluidized Bed Large** model (FluidizedBed_large)*



- Get a result on a particle.
  - *Get the **velocity** value for:*
    - *Analysis = **DEM***
    - *Coordinates = **Particles***
    - *Time-step **# 2939000***
    - *Result = **Velocity-Y***
    - *Node number 10 → **value = 0, 0, 0***
    - *Node number **2724** → **value = 0.0391976, -0.0161821, -0.0002547***

2.2.3 Participants notes

2.3 Task 2: Use case DEM.M1-03

2.3.1 Motivation

Get the evolution of a result on a particle over time; for instance, get the velocity y-component value for all simulation time-steps of specific particle id.

2.3.2 Specification

- Get the evolution of a result on a particle over time.
  - *Get the velocity y-component value for:*
    - *Analysis = **DEM***
    - *Coordinates = **Particles***
    - *Time-steps: **ALL***
    - *Result = **Velocity-Y***
    - *Node number **2724***

2.3.3 Participants notes

2.4 Task 3: Use case DEM.M1-04

2.4.1 Motivation

Visualize the particles coloured as a function of the velocity y-component for a specific time-step.

2.4.2 Specification

- Visuzalize a countour fill of a particle result.Compute d2c of the model
  - *Visualize the **velocity y-component** in the skin of the particles in time step 2939000.*

2.4.3 Participants notes

2.5 Task 4: Use case DEM.M1-05 and DEM.M1-07

2.5.1 Motivation

Compute Discrete to Continuum (d2c) values of the model, get the result in a specific node of the d2c Mesh and visualize the contour fill of a discrete2continuum result.

2.5.2 Specification

- Compute d2c of the model
  - *Compute discrete to continuum for:*
    - *Static mesh = D2C_Mesh*
    - *D2C analysis name = user initials + "_D2C_FB"*
    - *Time-step options = INTERVAL*
    - *List of time-steps = 2799000,4799001*
    - *Coarse-graining method = Gaussian*
    - *Coarse-graining options:*
      - *Width = 0.0024*
      - *Cut-off factor = 3*
    - *Process contacts = True*
    - *Do temporal averaging = True*
    - *Temporal averaging options = ALL*
- Get the result in a specific node of the d2c mesh
  - User: Open D2C_Mesh model
  - User: *Get the **density** value for:*
    - *Analysis = user initials + "_d2c_FB"*
    - *Time-step **# 3799000.5***
    - *Result = **Density***
    - *Node number **300***
    - *Node number **1000***
- Visualize a contour fill of a result
  - User: *Visualize the contour fill of **velocity-Y** in the skin of the volume mesh of the computed d2c (model "D2C_Mesh" and analysis name "user initials + "_d2c_FB"") for **time step 3799000.5***
- Logout

2.5.3 Participants notes

3 Questionnaire for participants

In the following questionnaire we have three main goals:

- To gather the usability and effectiveness information on the VELASSCO Platform from the use case considered
- How to improve the VELASSCO Platform
- How to promote VELASSCO Platform.

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 via email to ivan.martinez@atos.net

Thanks for your time.

The VELASSCO project.

Setting

A-1. How would you rate your previous experience with the VELaSSCo Prototype and GiD used in the test?

Beginner	Moderate	Expert	NA/DK[3]

Tasks observation

B-1. How would you rate your previous experience in science and engineering simulations?

Beginner	Moderate	Expert	NA/DK

B-2. Please, indicate how you perceived the amount of time needed to execute each of the tasks of the experiment:

Task 1:

Low	Average	High	NA/DK

Task 2:

Low	Average	High	NA/DK

Task 3:

Low	Average	High	NA/DK

Task 4:

Low	Average	High	NA/DK

B-3. Your understanding of the tasks comprised in the experiment was:

Low	Average	High	NA/DK

[3] NA/DK: Not Applicable/Don't Know

B-4. Please, briefly describe your approach and the difficulties found when performing Task 1 of the experiment.

B-5. Please, briefly describe your approach to Task 2 of the experiment.

B-6. Please, briefly describe your approach to Task 3 of the experiment.

B-7. Please, briefly describe your approach to Task 4 of the experiment.

B-8. The difficulties you needed to overcome due to the VELaSSCo Prototype and other tools used during the experiment in order to complete each task were:

	Low	Average	High	NA/DK	Positive/negative functionalities you found
Task 1					
Task 2					
Task 3					
Task 4					

B-9. How did you find the support provided by the facilitator?

Inadequate	Adequate	Excellent	NA/DK

3.1 Usability Questionnaire

This questionnaire gives you an opportunity to tell us your reactions to the system you used. Your responses will help us understand what aspects of the system you are particularly concerned about and the aspects that satisfy you.

To as great a degree as possible, think about all the tasks that you have done with the system while you answer these questions.

Please read each statement and indicate how strongly you agree or disagree with the statement by circling a number on the scale. If a statement does not apply to you, circle N/A.

Please write comments to elaborate on your answers.

As you complete the questionnaire, please do not hesitate to ask any questions.

Thank you!

System Quality

1. Overall, I am satisfied with how easy it is to use this system.

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

2. It was simple to use this system.

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

3. I could effectively complete the tasks and scenarios using this system.

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

4. I was able to complete the tasks and scenarios quickly using this system.

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

5. I was able to efficiently complete the tasks and scenarios using this system.

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

6. I felt comfortable using this system.

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

Information Quality

7. It was easy to learn to use this system.

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

8. I believe I could become productive quickly using this system.

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

9. The system gave error messages that clearly told me how to fix problems.

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

10. Whenever I made a mistake using the system, I could recover easily and quickly.

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

11. The information (such as on-line help, on-screen messages and other documentation) provided with this system was clear.

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

12. It was easy to find the information I needed.

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

Interface Quality

13. The information provided for the GiD was easy to understand.

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

14. The information was effective in helping me complete the tasks and scenarios.

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

15. The organization of information on the GiD screens was clear.

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

Note: *The "interface" includes those items that you use to interact with the system. For example, some components of the interface are the keyboard, the mouse, the microphone, and the screens (including their use of graphics and language).*

16. The interface of this GiD was pleasant.

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

3.2 Effectiveness Questionnaire

This questionnaire gives you an opportunity to tell us your reactions to the system you used. Your responses will help us understand what aspects of the system you are particularly concerned about and the aspects that satisfy you.

To as great a degree as possible, think about all the tasks that you have done with the system while you answer these questions.

Please read each statement and indicate how strongly you agree or disagree with the statement by circling a number on the scale. If a statement does not apply to you, circle N/A.

Please write comments to elaborate on your answers.

As you complete the questionnaire, please do not hesitate to ask any questions.

Thank you!

Effectiveness Questions

1. Does the visualization present valid and accurate information?

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

2. Do you think that the elements chosen for showing/representing the data information(tables, charts, etc.) are the best choice in a way that users can get much more information in less time?

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

3. Is the data representation correct respect to defined metrics and data language?

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

4. Is the visualization what you expected it to be?

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

5. Do you consider that this visualization gives you insights that you may not get from some other means?

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

6. Is the complexity of the visualization adequate?

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

7. Do you consider that GiD has a good visual design?

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

8. Is relevant all information shown in the visualization?

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

9. Do you consider that the visualization has a good performance?

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

10. Do you consider that the visualization is user-friendly?

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

11. Do you consider that the visualization presents a useful formatting?

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

12. If VELaSSCo GiD/Platform has not met your needs as a user, in terms of performance, usability and effectiveness would use an alternative commercial application that meets these requirements?

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

8.4 USE CASE 2: Fluidized Bed (FEM) Simulation Tool: IFX

VELaSSCo

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

Evaluation Event

USE CASE 2: Fluidized Bed Simulation (FEM)

Simulation Tool: IFX

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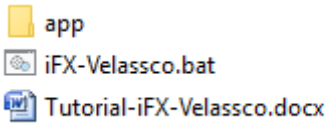
3.2 Effectiveness Questionnaire ____ 109

1 IFX Installation Guide

1.1 Installation

- Download current package from https://cloud.igd.fraunhofer.de/owncloud/public.php?service=files&t=940509e044dfab56bea54394696381bc
- Unzip downloaded package
- Directory structure should look like this



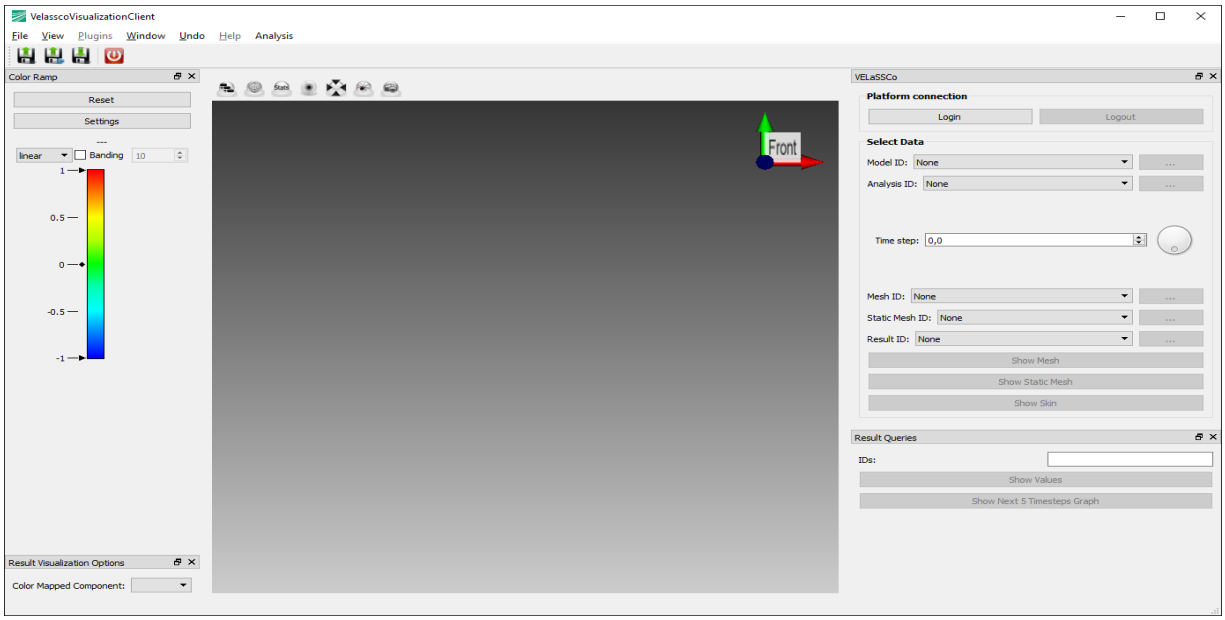
1.2 Connect to EDDIE Cluster

- Setup VPN connection to EDDIE cluster if necessary (documented in alfresco, ask advisor):
  - http://www.ed.ac.uk/information-services/computing/desktop-personal/vpn/vpn-service-using
  - **Credentials**: user = velassco and passwd = vela702ssco_VPN

- Figure out the port where the QueryManager is running (ask advisor)

1.3 Start iFX VELaSSCo Client

- Start / double-click iFX-Velassco.bat



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The study is about the use of VELaSSCo 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 clients side.

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

- **VELaSSCo Platform Beta Version**
- **IFX Client for VELaSSCo Project** (Visualization Tool)
- Text editor and viewer (e.g. Notepad, Word,…)
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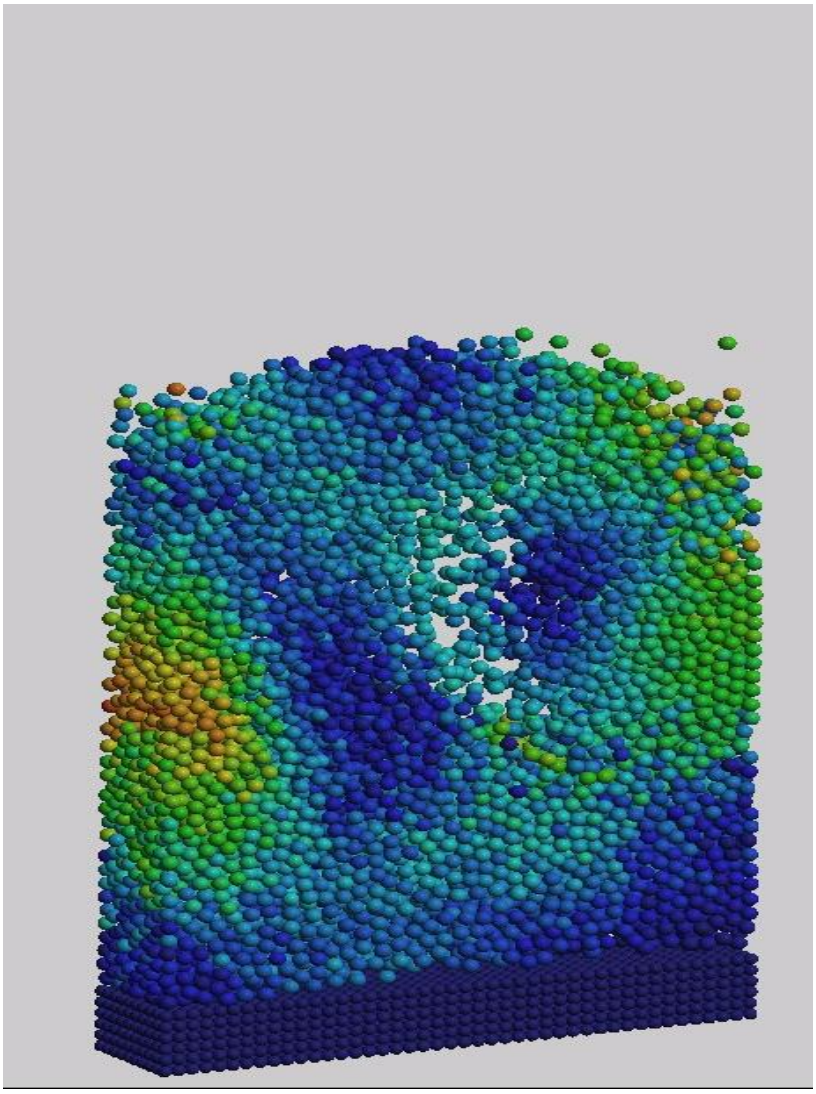
- Notepad, pens and pencils
- PuTTY 0.64 (free ssh and telnet client)

Your work may be recorded and at the end you will be asked to fill in a simple questionnaire. The facilitator may take notes and ask questions about what you are doing and why. This will help us understand how people use VELaSSCo Platform and Visualization Clients, how efficient and effective is the VELaSSCo Platform, etc.

2.1 Fluidized Bed Model Description

The Fluidized Bed model selected has the following settings:

- Fluidized bed process very common in pharmaceutical and chemical industries.
- ~ 12000 particles / time-step
- ~ 3000 contacts (p2p and p2w) / time-step.
- 40 000 time-steps.
- Particle results: mass, volume, velocity vector
- Contact results: Force vector.



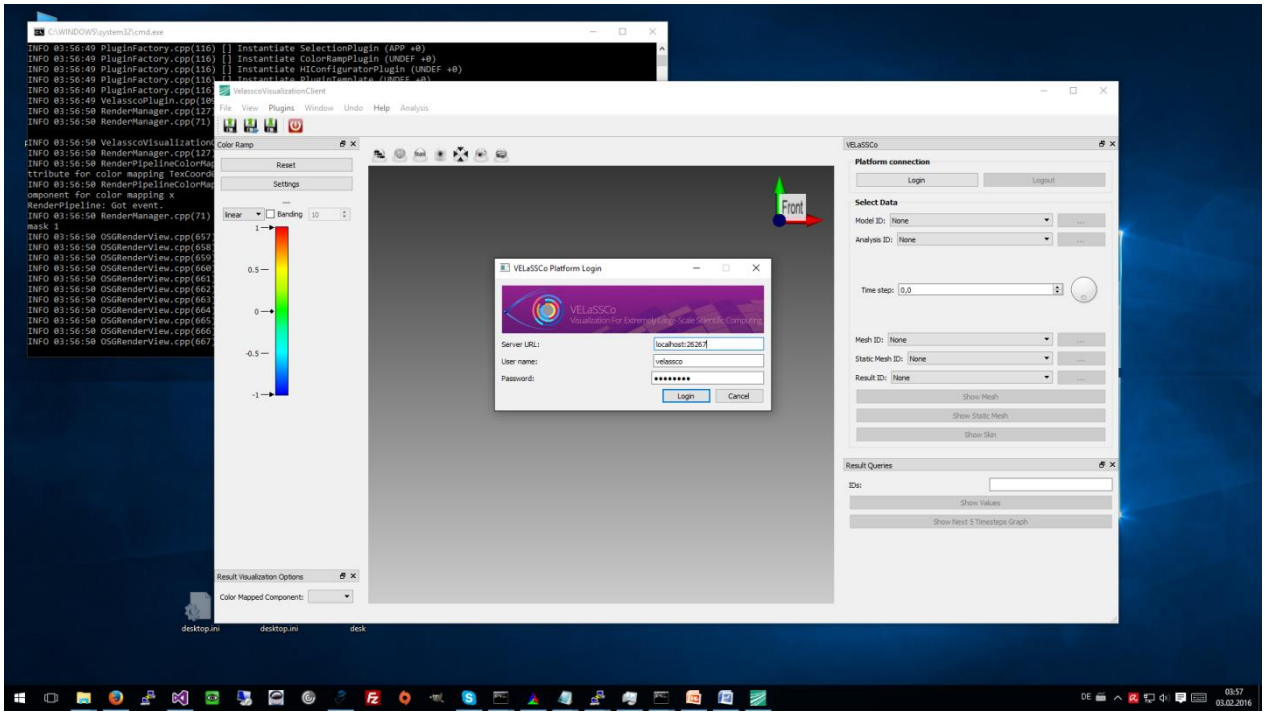
2.2 Task1: Use Case DEM.M1-02

2.2.1 Motivation

Get a result on a particle; concretely get the velocity value specifying a concrete particle id and time-step.

2.2.2 Specification

- Connect to VELaSSCo Server using IFX
    - Select Login Button in the top-right corner

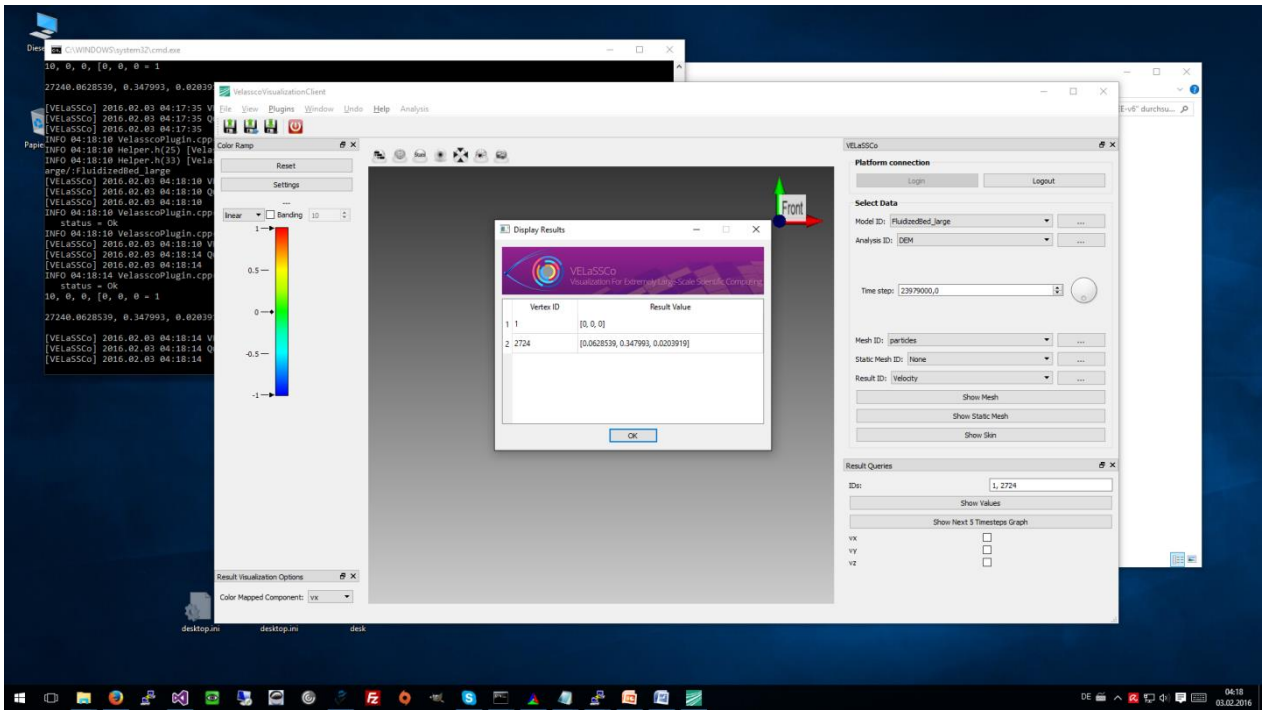


    - Enter port of QueryManager after localhost: (i.e. replace 26267 with current port)
    - **Credentials**: user: velassco, password: vela702ssco
- Open a simulation model:
    - Select menu Analysis->Main
    - In the tab on the right-hand side
        - Select Model ID: FluidizedBed_large
        - Select Analysis ID: DEM
- Get a result on a particle.
    - *Get the **velocity** value for:*
        - *Analysis = **DEM***
        - *Mesh ID = **Particles***

- *Time-step* ***# 2939000***
- *Result ID =* ***Velocity***
- *Node number 10* → ***value = 0, 0, 0***
- *Node number 2724* → ***value = 0.0391976, -0.0161821, -0.0002547***

Note: Show Single Node Value:

- Enter all relevant data according to use case and push “Show Values” button
- You may show values for multiple nodes by using comma as separator (e.g. 1, 2724)
- Result will be displayed in a separate window (if it does not show it may be in the background – use ALT-TAB to bring it to front or move top-level windows aside).



2.2.3 Participants notes

2.3 Task 2: Use case DEM.M1-03

2.3.1 Motivation

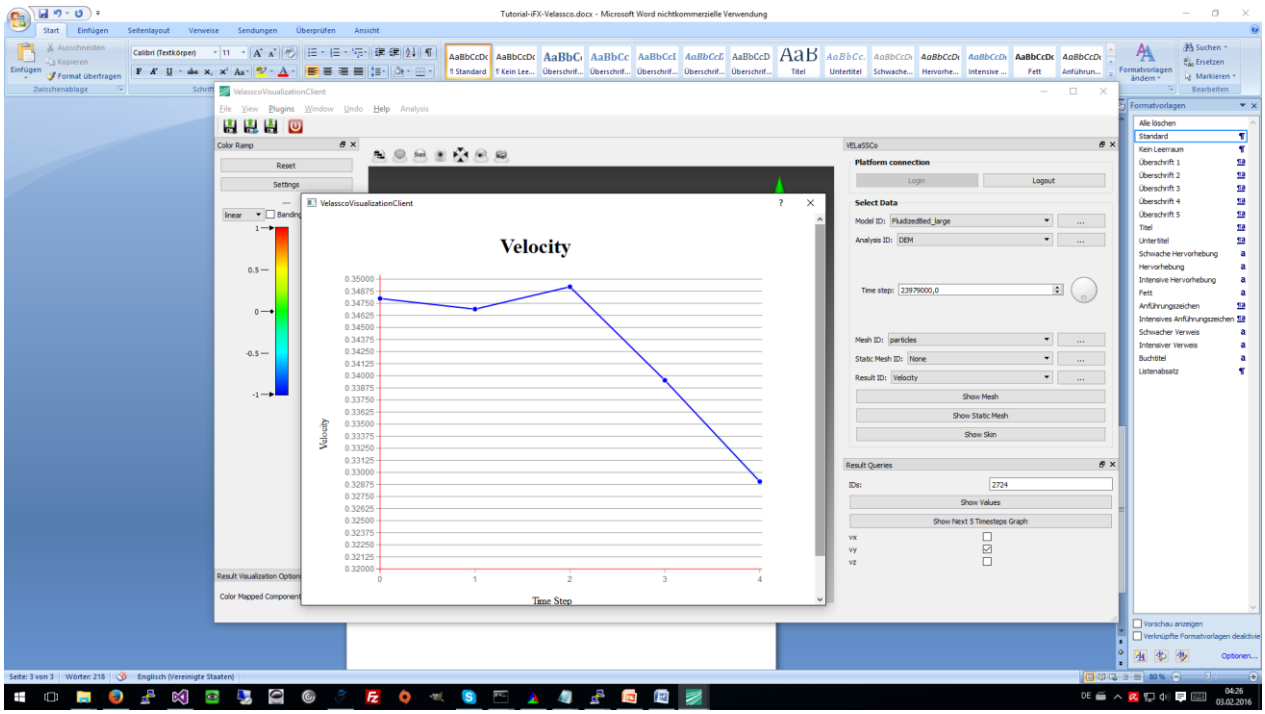
Get the evolution of a result on a particle over time; for instance, get the velocity y-component value for all simulation time-steps of specific particle id.

2.3.2 Specification

- Get the evolution of a result on a particle over time.
  - *Get the velocity y-component value for:*
    - *Analysis = **DEM***
    - *Coordinates = **Particles***
    - *Time-steps: **ALL***
    - *Result = **Velocity-Y***
    - *Node number **2724***

Note: Show Time Evolution of a Node (restricted to current time step + 5)

- Input all relevant values according to use case
- Select the component to show in the 2D graph (e.g. x, y, or z)
- Click “Show Next 5 Time Steps” button
- To show more or less result components use the available checkboxes at the right-bottom part of the window. Click “Show Next 5 Time Steps” button again to update the graph.



2.3.3 Participants notes

2.4 Task 3: Use case DEM.M1-04

2.4.1 Motivation

Visualize the particles colored as a function of the velocity y-component for a specific time-step.

2.4.2 Specification

- Visuzalize a countour fill of a particle result.
  *Visualize the **velocity y-component** in the skin of the particles in time step 2939000.*

2.4.3 Participants notes

2.5 Task 4: Use case DEM.M1-05 and DEM.M1-07

2.5.1 Motivation

Compute Discrete to Continuum (d2c) values of the model, get the result in a specific node of the d2c Mesh and visualize the contour fill of a discrete2continuum result.

2.5.2 Specification

- Compute d2c of the model
  - *Compute discrete to continuum for:*
    - *Static mesh = D2C_Mesh*
    - *D2C analysis name = user initials + "_D2C_FB"*
    - *Time-step options = INTERVAL*
    - *List of time-steps = 2799000,4799001*
    - *Coarse-graining method = Gaussian*
    - *Coarse-graining options:*
      - *Width = 0.0024*
      - *Cut-off factor = 3*
    - *Process contacts = True*
    - *Do temporal averaging = True*
    - *Temporal averaging options = ALL*
- Get the result in a specific node of the d2c mesh
  - User: Open D2C_Mesh model
  - User: *Get the **density** value for:*
    - *Analysis = user initials + "_d2c_FB"*
    - *Time-step **# 3799500.0***
    - *Result = **Density***
    - *Node number **300***
    - *Node number **1000***
- Visualize a contour fill of a result
  - User: *Visualize the contour fill of **velocity-Y** in the skin of the volume mesh of the computed d2c (model "D2C_Mesh" and analysis name "user initials + "_d2c_FB"") for **time step 3799500.0***
- Logout

2.5.3 Participants notes

3 Questionnaire for participants

In the following questionnaire we have three main goals:

- To gather the usability and effectiveness information on the VELASSCO Platform from the use case considered
- How to improve the VELASSCO Platform
- How to promote VELASSCO Platform.

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 via email to ivan.martinez@atos.net

Thanks for your time.

The VELASSCO project.

Setting

A-1. How would you rate your previous experience with the VELaSCCo Prototype and IFX Client used in the test?

Beginner	Moderate	Expert	NA/DK[4]

Tasks observation

B-1. How would you rate your previous experience in science and engineering simulations?

Beginner	Moderate	Expert	NA/DK

B-2. Please, indicate how you perceived the amount of time needed to execute each of the tasks of the experiment:

Task 1:

Low	Average	High	NA/DK

Task 2:

Low	Average	High	NA/DK

Task 3:

Low	Average	High	NA/DK

B-3. Your understanding of the tasks comprised in the experiment was:

Low	Average	High	NA/DK

[4] NA/DK: Not Applicable/Don't Know

B-4. Please, briefly describe your approach and the difficulties found when performing Task 1 of the experiment.

B-5. Please, briefly describe your approach to Task 2 of the experiment.

B-6. Please, briefly describe your approach to Task 3 of the experiment.

B-7. The difficulties you needed to overcome due to the VELaSCCo Prototype and other tools used during the experiment in order to complete each task were:

	Low	Average	High	NA/DK	Positive/negative functionalities you found
Task 1					
Task 2					
Task 3					
Task 4					

B-8. How did you find the support provided by the facilitator?

Inadequate	Adequate	Excellent	NA/DK

3.1 Usability Questionnaire

This questionnaire gives you an opportunity to tell us your reactions to the system you used. Your responses will help us understand what aspects of the system you are particularly concerned about and the aspects that satisfy you.

To as great a degree as possible, think about all the tasks that you have done with the system while you answer these questions.

Please read each statement and indicate how strongly you agree or disagree with the statement by circling a number on the scale. If a statement does not apply to you, circle N/A.

Please write comments to elaborate on your answers.

As you complete the questionnaire, please do not hesitate to ask any questions.

Thank you!

System Quality

C1. Overall, I am satisfied with how easy it is to use this system.

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

C2. It was simple to use this system.

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

C3. I could effectively complete the tasks and scenarios using this system.

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

C4. I was able to complete the tasks and scenarios quickly using this system.

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

C5. I was able to efficiently complete the tasks and scenarios using this system.

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

C6. I felt comfortable using this system.

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

Information Quality

C7. It was easy to learn to use this system.

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

C8. I believe I could become productive quickly using this system.

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

C9. The system gave error messages that clearly told me how to fix problems.

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

C10. Whenever I made a mistake using the system, I could recover easily and quickly.

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

C11. The information (such as on-line help, on-screen messages and other documentation) provided with this system was clear.

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

C12. It was easy to find the information I needed.

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

Interface Quality

C13. The information provided for IFX was easy to understand.

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

C14. The information was effective in helping me complete the tasks and scenarios.

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

C15. The organization of information on the IFX screens was clear.

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

Note: *The "interface" includes those items that you use to interact with the system. For example, some components of the interface are the keyboard, the mouse, the microphone, and the screens (including their use of graphics and language).*

C16. The interface of this IFX was pleasant.

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

3.2 Effectiveness Questionnaire

This questionnaire gives you an opportunity to tell us your reactions to the system you used. Your responses will help us understand what aspects of the system you are particularly concerned about and the aspects that satisfy you.

To as great a degree as possible, think about all the tasks that you have done with the system while you answer these questions.

Please read each statement and indicate how strongly you agree or disagree with the statement by circling a number on the scale. If a statement does not apply to you, circle N/A.

Please write comments to elaborate on your answers.

As you complete the questionnaire, please do not hesitate to ask any questions.

Thank you!

Effectiveness Questions

D1. Does the visualization present valid and accurate information?

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

D2. Do you think that the elements chosen for showing/representing the data information(tables, charts, etc.) are the best choice in a way that users can get much more information in less time?

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

D3. Is the data representation correct respect to defined metrics and data language?

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

D4. Is the visualization what you expected it to be?

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

D5. Do you consider that this visualization gives you insights that you may not get from some other means?

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

D6. Is the complexity of the visualization adequate?

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

D7. Do you consider that IFX has a good visual design?

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

D8. Is relevant all information shown in the visualization?

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

D9. Do you consider that the visualization has a good performance?

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

D10. Do you consider that the visualization is user-friendly?

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

D11. Do you consider that the visualization presents a useful formatting?

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS:

D12. If VELaSCCo IFX/Platform has not met your needs as a user, in terms of performance, usability and effectiveness would use an alternative commercial application that meets these requirements?

STRONGLY AGREE 1 2 3 4 5 6 7 STRONGLY DISAGREE

COMMENTS: