BBIPED Platform

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Version of GUI : V1.5.0

Collaborator

The BBIPED Platform was developed within the project " Development of an efficient, flexible and innovative CFD Computational Platform to optimally simulate and design industrial products and processes", co-funded by:

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Graphical Interface User Guide

Motivation:

✔ BBIPED GUI is an standardized **interface** for the whole CFD process, integrating the main tools used by the engineers.

✔ This **interface** will address the provision of a set of **basic functionality** to graphically **connect with BBIPED CORE functionality.**

✔ The **BBiped platform** will integrate several tools that belongs to the whole process, as it is shown in the graphic

Features (Version Beta 1.0.0)

- ✔ **Common platform** that homogenizes the generation of configuration files
- ✔ Easing **project version** & associated documentation storage and tracking within a common folder structure
- ✔ Possibility to run the configuration using different Solver Engines (at the moment, only BBIPED core compatibility)
- ✔ The **Solver** configuration file features:
  - ✔ Easing the configuration of the simulation with different **views**
    - ✔ **Basic configuration view**: Only for those engineers that need to change some values, but they have no depth knowledge about Solver
    - ✔ **Advanced configuration view**: For expert users for a more customized configuration
    - ✔ **Personalized configuration view** based on a custom template (defined by the user)
  - ✔ **Automatic generation of configuration files** for simulation according the user input
  - ✔ **Automatic detection of the boundary names**, loaded from your mesh file. This prevents naming errors and keep the boundary configuration error-safe
  - ✔ **Automatic run your Solver** with your own configuration and mesh files from the platform
  - ✔ Customized solver facilities supporting Virtual execution
  - ✔ Get the **help** associated to each variable
- ✔ **Simulation features** :
  - ✔ **Graphical evolution** of the simulation
  - ✔ **Save** your simulation evolution image
  - ✔ **Customized graphical views** based on the different user parameters
  - ✔ **Integration with Paraview** or any similar technology

Technical Requirements

This GUI is only tested to run under the following technical requirements :

✔ OS 64 bit

Note : *This platform cannot be run under OS 32 bit*

✔ Linux Ubuntu 12.04

✔ Qt libraries (v4.8)

✔ LibQwt v 6.0 installed.

Note : *If you get the error that this library is missing, you need to go to the Ubuntu SW center to download the corresponding version. Please, be aware of the version of this library, it is the stable version v6.0.0*

Other Tools

✔ The GUI can automatically connect to different tools. Please, go to the official site to download the stable version

✔ **Meshing**. The default viewer is Salome. This version of the GUI has been tested to open the **Salome V7.2.0**.

✔ **The Solver Engine.** By default, this GUI is intended to provide support for the BBIPED CORE which includes some facilities from SU2 (v2.04)

✔ **The Viewer tool. Paraview** has been considered for viewing the final results. If you install it through the Ubuntu Software Center, make sure that you can call it from console, if not, then you will need to manually select in the configuration section of BBIPED. This must be done in those cases where you manually download Paraview and compile it for your machine

Installing the GUI

A customized installer for the BBIPED platform is provided. This installer has been made using BitRock facility.

Installing the GUI : Using installer

The BBIPED GUI can be installed by means of the installer (see picture).

1. Unzip the file
2. Double click on the executable Installer
3. Follow the instructions of the graphical installer

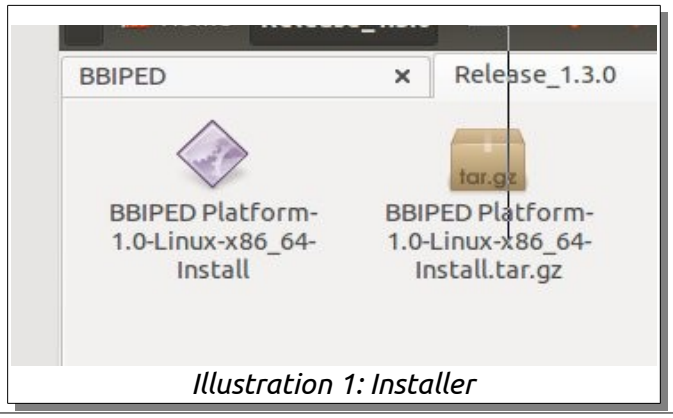

Illustration 1: Installer

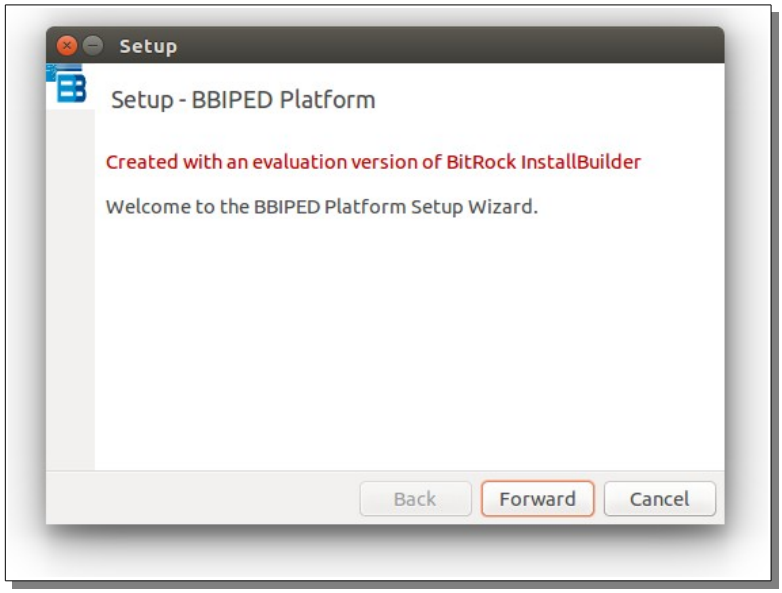

Illustration 2: Installer Wizard Welcome

Since, the libqwt library is needed, the installer will ask you for your admin password to install it automatically.

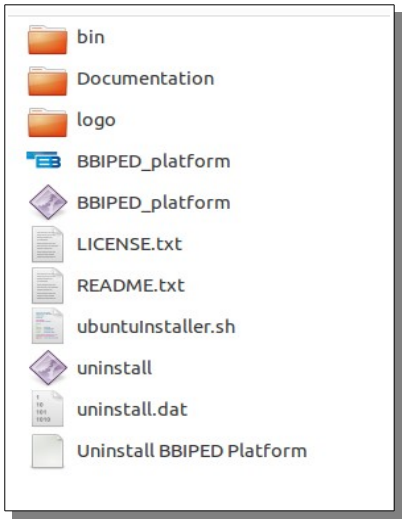

Illustration 3: Folder where the BBIPED platform was installed

Once the tool is installed, you will see the following files in the path where you installed it:

To execute the tool you can click any of the BBIPED_platform elements. Uninstalling the tool is easily managed by the uninstall executable

The GUI in a nutshell

When you launch the GUI, the first thing you notice is that everything is disabled. This is because you need to create or open an project to start working on it.

The layout of the GUI is shown in the following image :

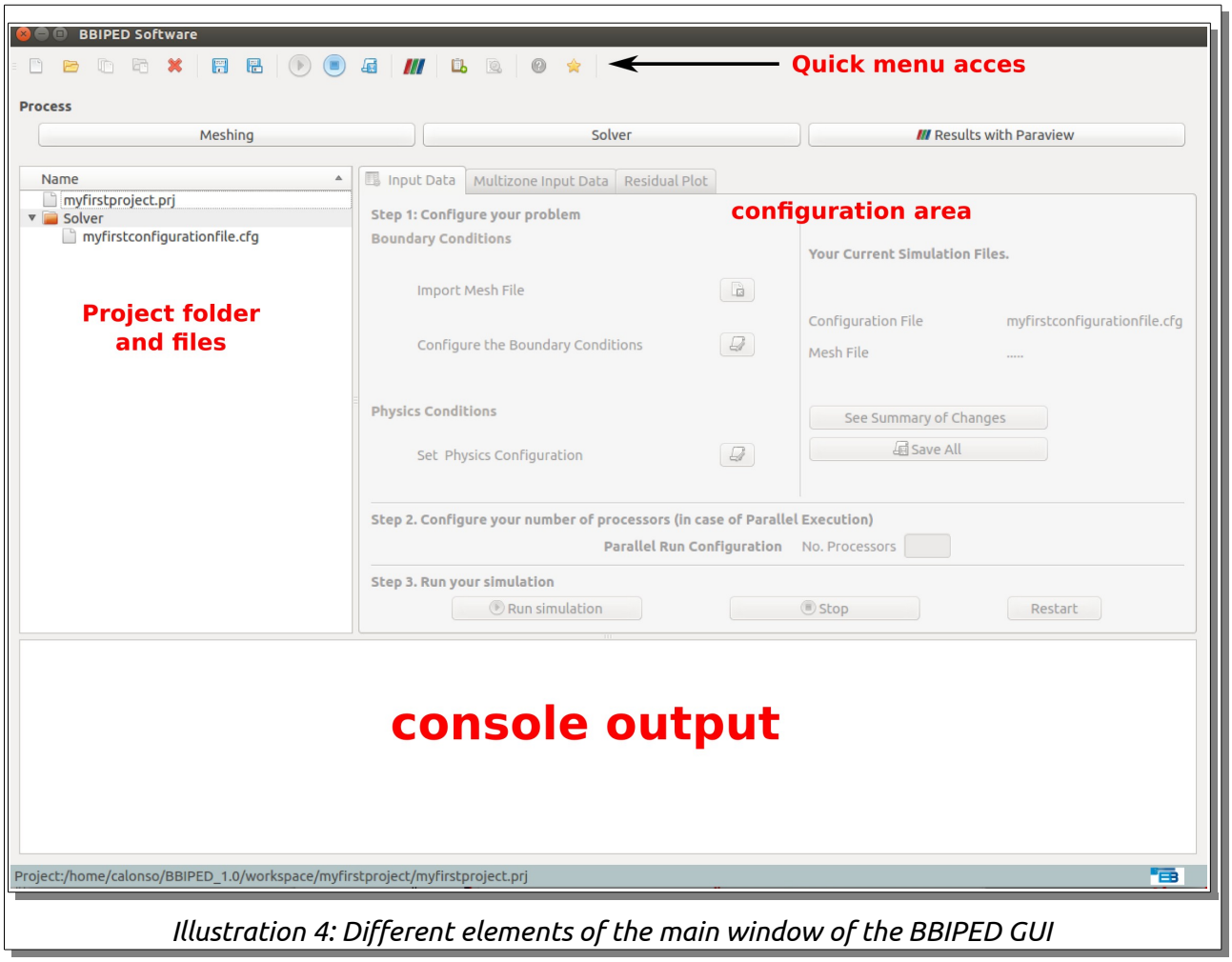

Illustration 4: Different elements of the main window of the BBIPED GUI

There is a full menu, that appears only when the whole tool is maximized. But, there is also a quick menu to access the main functionality. There is an area where the project tree is shown and where all the project files are shown. A Console area shows the output when the running process is made. Please, see the following sections for a detailed explanation.

Setting up the Solver Engine

This version allows to use different user predefined Tools. You can go through the menu Edit → Preferences

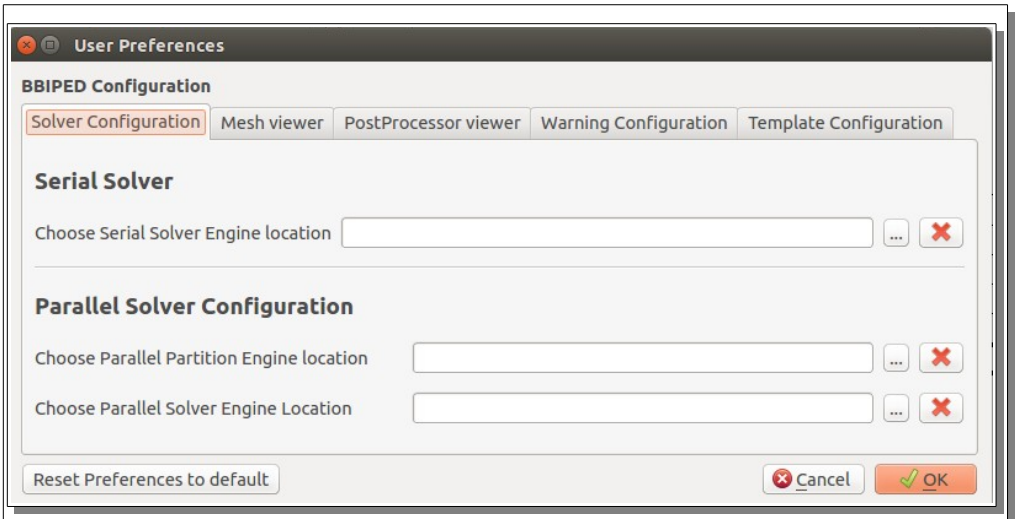

Illustration 5: Configuration window. The user can set up the solver engine that want to use

- ✔ **Solver Configuration:** The user can select their own Solver Engines. This solve engines must be compatible or based on the BBIPED CORE structure for variable definition.
- ✔ **Mesh Viewer:** By default, BBIPED has been tested using Salome Tool as a mesh viewer. The user must configure the path of the mesh tool.
- ✔ **PostProcessor viewer:** By default, BBIPED has been tested to launch Paraview tool. The user can select other postprocessor viewer tools, and they must select the paraview tool path, that is installed in their machine
- ✔ **Warning Configuration:** The different warning windows that appear in the BBIPED platform can be enabled or disabled in this tab
- ✔ **Template Configuration:** A user can define its own template for the configuration file, in order to show only those variables that really needs. To use the template, you must select it in this tab.

Project Details

The project details, this is which files are belonging to the current project can be also checked in a dedicated window, go to the menu

Edit → Project Settings

or through the quick icon. In this menu, you can delete the pair of configuration file + mesh file you want to remove from the current project configuration. Moreover, the user

can customize the project details to automatically appear in the generated files.

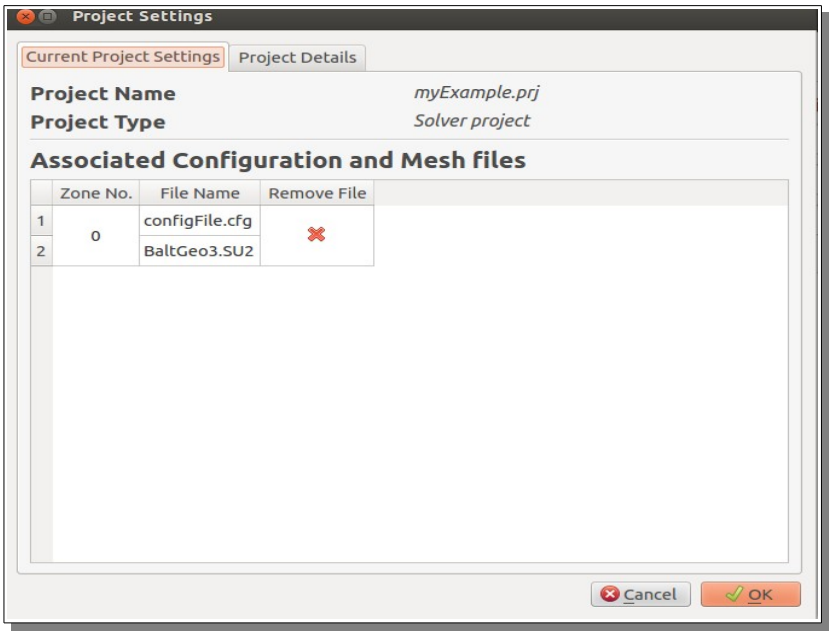

Illustration 6: Project Settings Dialog. Here, the user can see which files are currently in the project

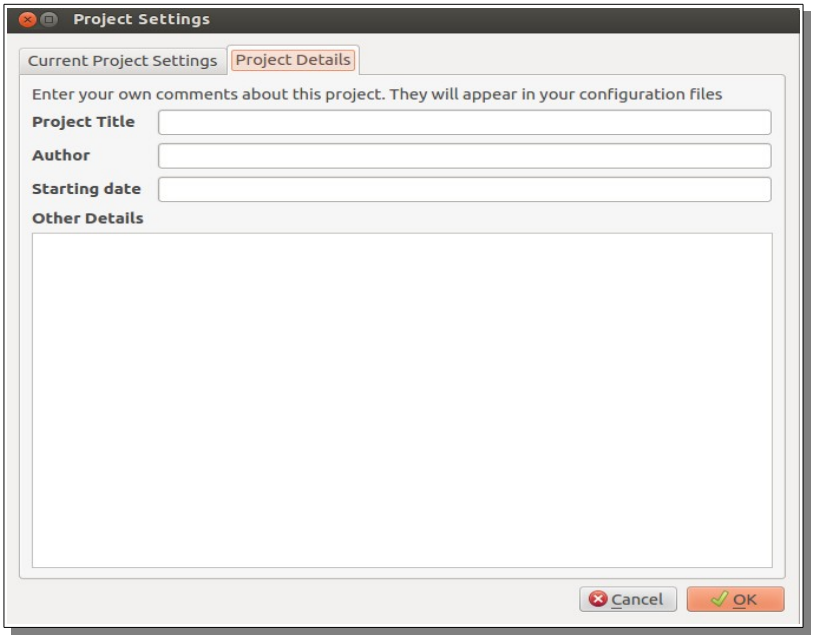

Illustration 7: Project Settings Dialog. Here, the user can customize the information of the associated project, like author, date, or project title

The Project

As a general basis, any project will have these elements :

- ✔ A project file
  - ➔ **Single Project:** one configuration file and 1 mesh file → Project with extension of .prj
  - ➔ **Multizone Project:** Several configuration files and mesh files → Project with .mprj extension (Not available in this version)
- ✔ A Solver folder that contains:
  - ➔ The configuration and mesh file(s). Once a running is made, then the correspondent files generated by the Solver will be stored in that folder.

If double click in the project file(* .prj or *.mprj) , or a configuration file (*.cfg), a new tab will be open the text version of those files.

HOWTO: Create/Open a project

The creation and opening of projects can be done from the main menu or the quick menu.

HOWTO: Open a simple Project

For a single project, a dialog will appear asking for the name of the project and the location.

The creation or opening of a project, will be shown in the Project tree Area of your window, where you can see the folders of the different tools (and their contents) as well as the project file. As a convention, the name of this file is the name of the project with a .prj extension. If you open an existent project, all the Solver variables and files will be automatically loaded.

Note that importing the mesh file it will create a soft link to the real mesh location.

The SOLVER

The open or creation of a new project is compulsory to access to the Solver facilities. Once you have your project opened or created, the tool buttons are enabled. In the following sections, the main functionality shown in the tabs will be explained. The Solver tool button, once is clicked, enables the tabs for input data and the residual tab where you can see the graphical evolution of any of the run simulations.

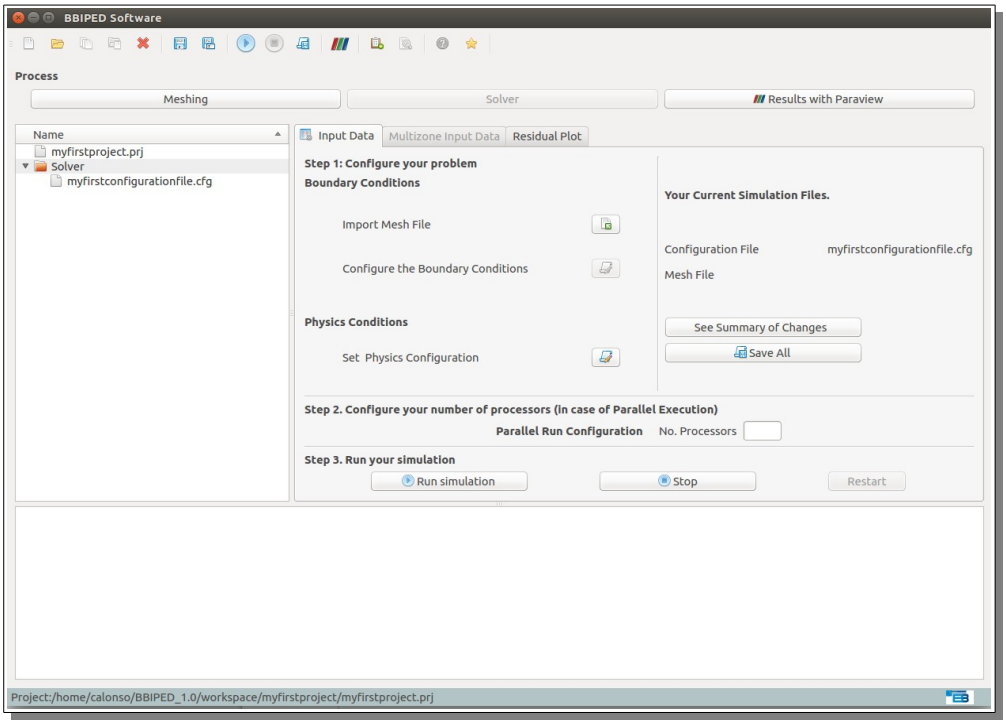

Illustration 8: Simple Solver Example (No Multizone support)

Input Data

For the Solver, two main tabs have been implemented, one for the configuration and running of the simulation, and another one to provide some graphical evolution of the residual values during the simulation.

The **Input Data Tab (IDT)** asks for the input to the users in a specific order.

- **Step 1,** firstly it is needed the selection of the mesh and the configuration of the role of the boundaries. And then, the user must configure the physical parameters and equations related to the problem.
- **Step 2.** This step allows the user to select a number of cores to run the project, according to its machine for parallel executions. However, in this version only serial running is available.
- **Step 3.** User can run the simulation from scratch or restart a previous simulation (restart buttom) from a pre-existent execution. In any moment, the simulation can be stopped.

HOWTO : Set up the variables, the Physics and the Boundaries

The Physics and the Boundary conditions can be set up with different assistants. In the case of the Physics, the user can choose among a basic and an advanced view.

- The **basic** Configuration view, shows the basic elements for **NON-EXPERT** users

- The **Advanced** Configuration View shows all the variables that can be currently configured. You **MUST** be an expert
- A **personalised** configuration View will show the variables selected by the user in a template. A Template file must be defined first, and loaded, otherwise this option won't be available.

There are the possibility to search for specific variables. The search function looks within the variable names.

On the left side, there are the main groups. For each group, a set of configurable variables appears on the right side with the allowed options for each one. Customized help for each variable can be obtained clicking on the help icon in each row.

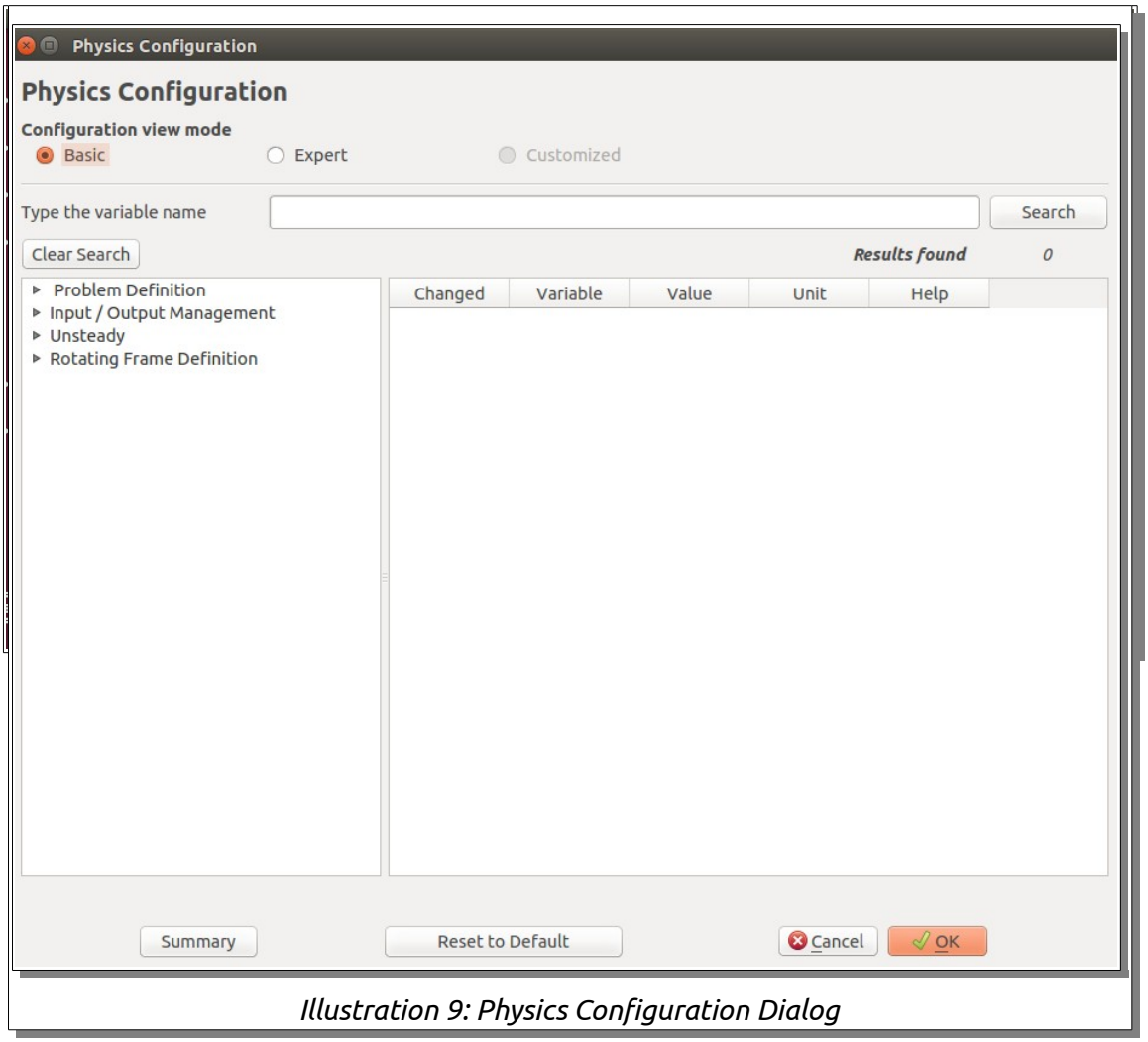

Illustration 9: Physics Configuration Dialog

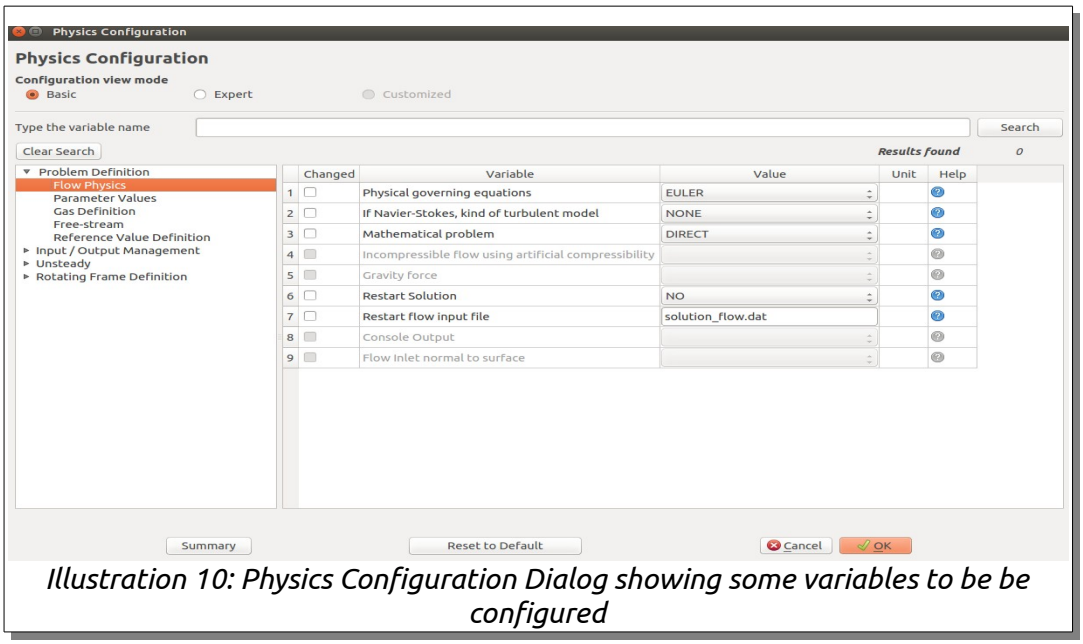

Illustration 10: Physics Configuration Dialog showing some variables to be be configured

Once you select a new value or modify any value, a check will appear in the table. In any case, the **Summary** button will show you the changes in a quick tabular format. Quick changes can be made and saved prior closing the **Summary button**.

In case you need to reset all the values to default, the button « RESET TO DEFAULT » will reset all the variables of the configuration file to default. Please, notice that this button resets **ALL** the variables, not only those appearing at that precise moment.

The **Advanced View** provides more options, regarding the Numerics behind the Solver configuration.

In any case, you need to press **Ok** button to store your changes into the correspondent file, before running the simulation

HOWTO: The Boundary Configuration Menu

The **boundary conditions** are set up according with a **specific mesh file.** So, for the configuration of the boundary conditions, the user must import the correspondent mesh file (in this case under the SU2 format). Then, the program will detect automatically the boundary names and the user will be able to set up the correspondent values in the correspondent window. See an example below :

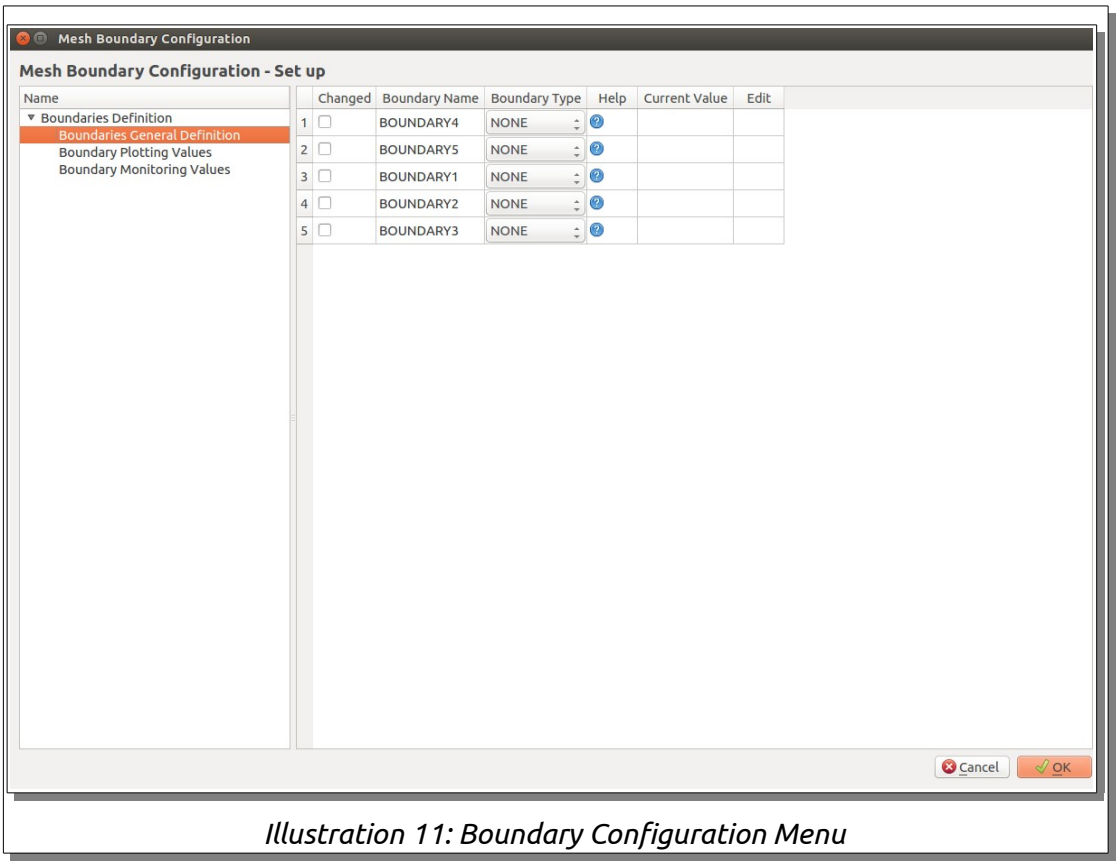

Illustration 11: Boundary Configuration Menu

HOWTO: Running a Simulation

Once the configuration file has been saved, the simulation can starts. The user must click on the run button. If everything is ok, the Solver output can be seen into the console. The current simulation can be stop at any moment (in the main menu, or the quick menu element). Once it has been stopped, this simulation could be initialized from scratch (**Run** button) or restart from a previous simulation (**RESTART**).

Notice that all the generated files of the simulation are stored in the project folder, under the Solver folder.

The Residual Tab

The residual tab shows the graphical evolution of the simulation

HOWTO: The Residual Tab plot

Int he residual tab, is it possible to see the evolution of the simulation. The legend items are checkable, allowing the user to see all, some or none of the variables. The graphical evolution image can be saved to a pdf file from the Menu:

Solver-> Save Residual Image

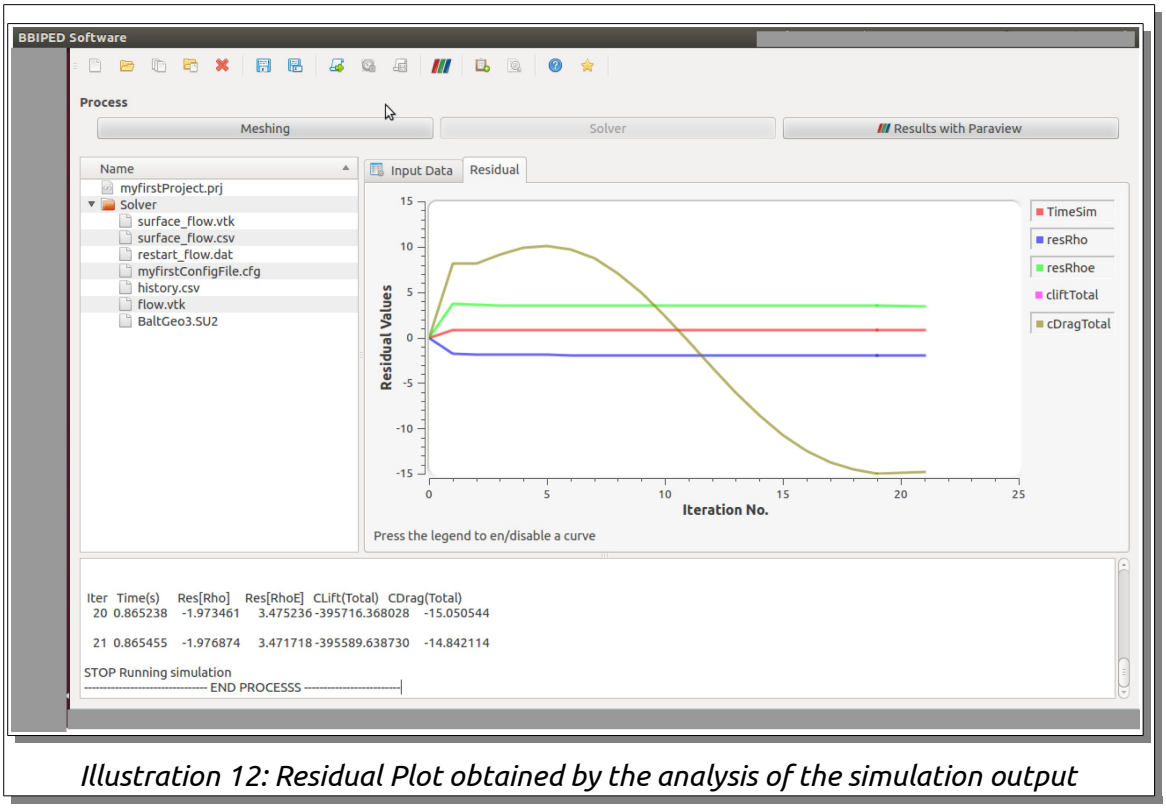

Illustration 12: Residual Plot obtained by the analysis of the simulation output

Creating our own Template

BBIPED allows the user to create a customized template, selecting only those variables to be shown in the **Physics configuration Menu.** Notice that the value associated to those variables that are not shown will be set to their default values.

The template can be created from scratch through the menu:

Solver → Create Configuration Template

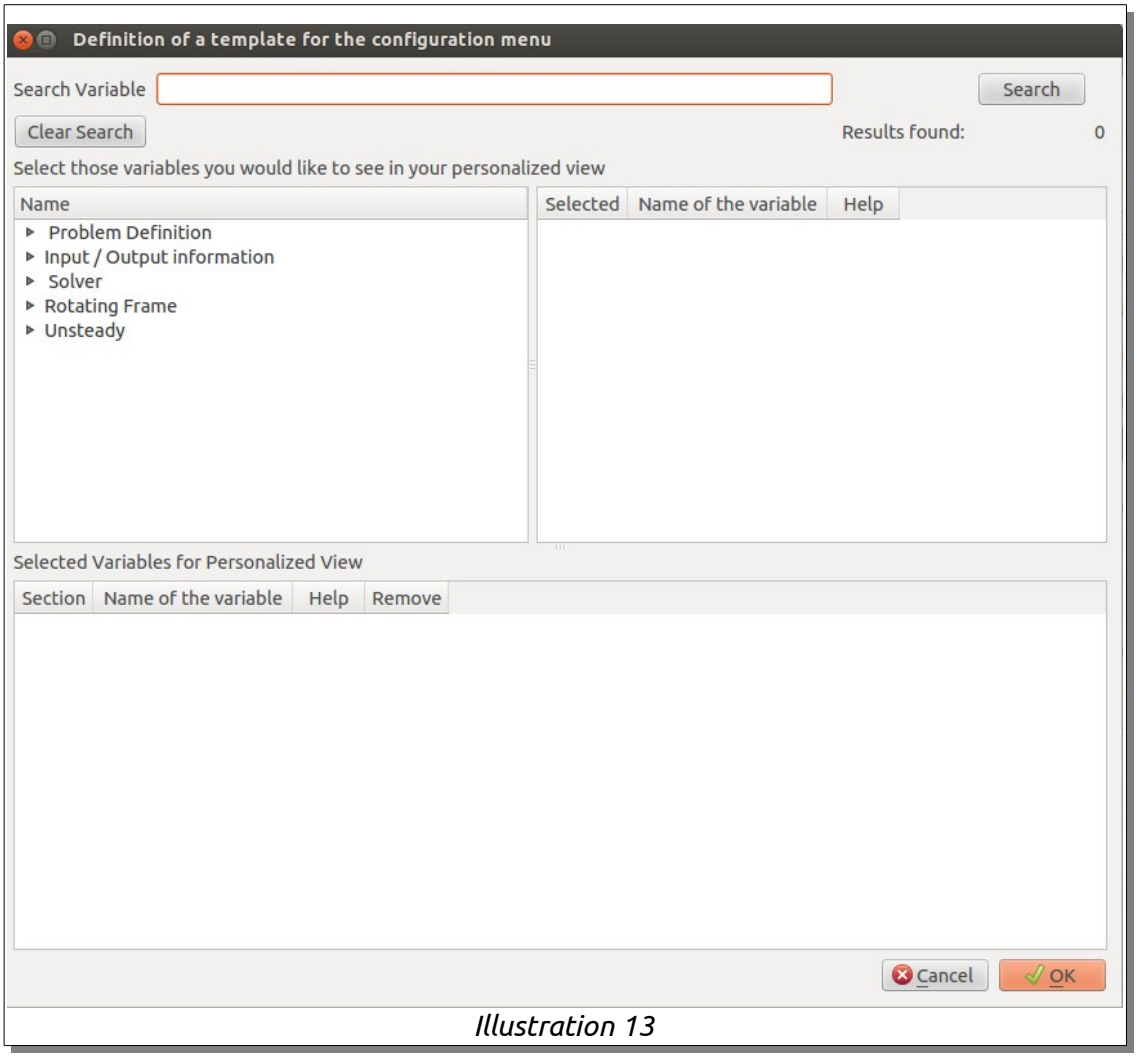

Illustration 13

Once the template has been saved, it is needed to be loaded in order to be used. It can be loaded through the Menu:

Solver → Load Configuration Template

or through the Preferences Menu

Edit → Preferences

where you can set the Template in the Template Tab

Any Template file can be edited at any time and updated according user needs, use the menu

Solver → Edit Configuration Template

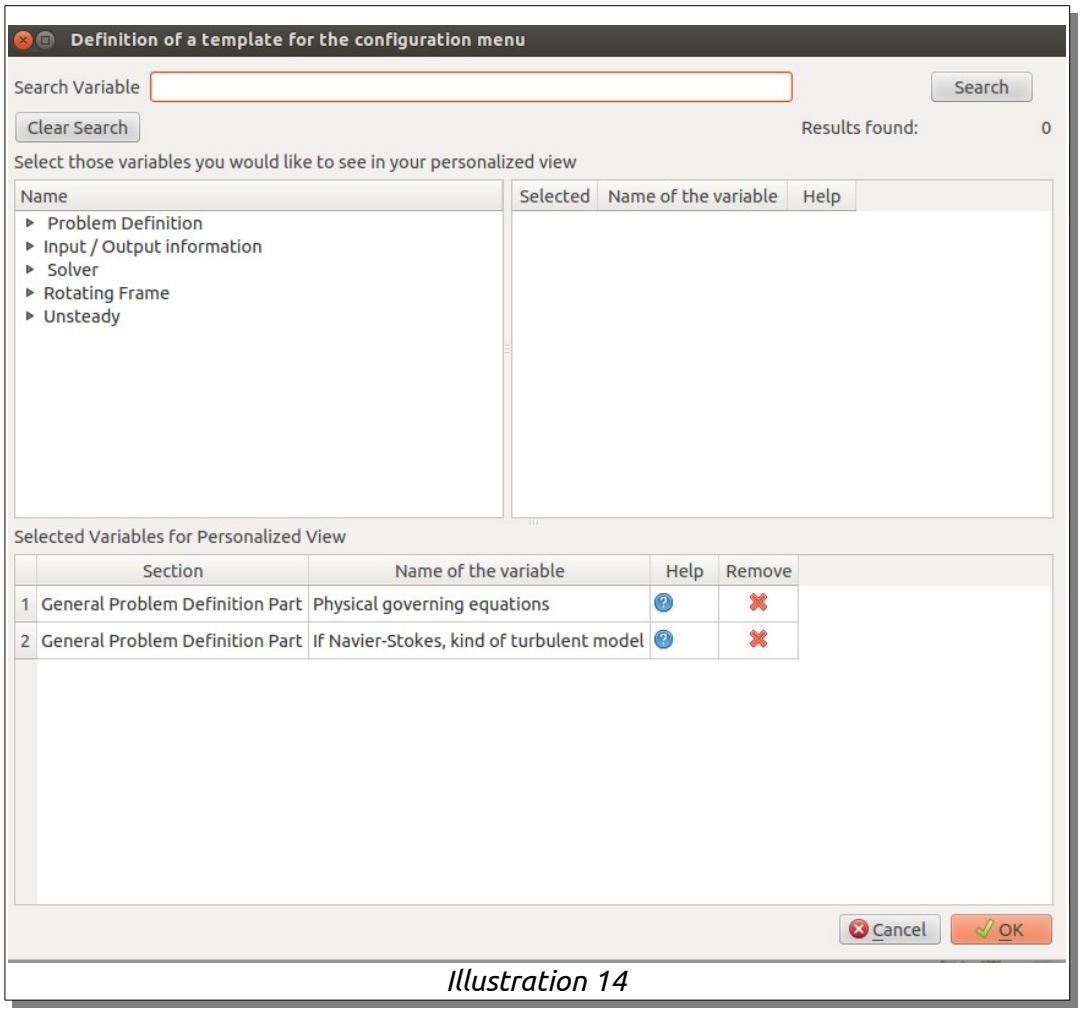

Illustration 14

BBIPED Platform Documentation

The BBIPED platform is an open source platform. Some documentation for users and developers are available.

The developers guide

A developers guide can be directly accessed from the GUI Help menu. The documentation has been generated by means of Doxygen and it is available in web and pdf formats.

Acknowledgements

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This job has partly funded under the research project "***Development of an efficient, flexible and innovative CFD Computational Platform to optimally simulate and design industrial products and processes***" (**BFA/DFB - 6/12/TK/2012/00020**), funded by the **Department of Economic Promotion of the Biscay Foral Council**, through the funding plan for **Research Projects in Excellence Centres 2012**

This work has been developed using the following technologies:
The installer of this GUI has been made using **BitRocket installer** (http://bitrock.com/)

QT and Qwt

For the Documentation, we used the **Doxygen** tool

The images of the menus belongs to **Fatcow Co**. (http://www.fatcow.com/free-icons)

This GUI serves as common framework to launch the following tools: