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A. General Description of AnyGait

What can I do with the AnyGait application?

AnyGait is a powerful application to analyze motion capture trials from gait labs. AnyGait is based on the AnyBody Modeling System, the very general and comprehensive musculoskeletal simulation package, and it is packaged so it is easy to setup and use in a laboratory or clinical environment.

It uses standard measured motion from MOCAP and ground reaction forces measured with standard force plates collected in a c3d file as input. In addition to joint angles and netto joint reaction forces and moments, which are calculated directly from the measurements, AnyGait predicts muscle activities and associated joints reactions. The underlying AnyBody body model consists of all major bones and over 1000 muscles branches. Each of these muscles activities, or their forces, can be displayed separately as well as a large number of other and related properties.

AnyGait is pre-setup to output the most important results in a condensed and easy-to-read form. Currently, this standard output contain joint angles of ankle, knee, and hip, joint reaction forces of ankle, knee, and hip, and muscle activity of major muscle branches, but it is customizable to meet the needs and requirements of a given laboratory, application, and patient group.

What input do I need to use the AnyGait application?

AnyGait uses motion capture including ground reaction forces for input in the form of C3D files. You will need a static and a dynamic trial, the way they are captured in most GaitLabs. AnyGait must be setup with the marker protocols used. A number of standard setups are available for use with different MoCap systems such as Vicon, Qualysis, and SIMI, and the system can easily be customized to other protocols. AnyBody Technology assists with any such laboratory specific setups. Additional to the C3D files, you will need the anthropometric data such as weight and height of the subject.

What technical requirements are needed for the AnyGait application?

AnyGait requires a basic Windows based computer or Laptops. It has been developed using Microsoft Windows 7. However, previous Windows versions are also running fine. For further details read more at www.anybodytech.com.

What do I have to do to start the AnyGait application?

In order to use the AnyGait application, you will need the AnyBody Modeling System (AMS) and a valid license for that. There is a separate manual on how to install it. Once you have installed the AMS, you will be able to start AnyGait by double clicking on the AnyGait.Main.Any file in your AnyGait folder (see Figure 1).

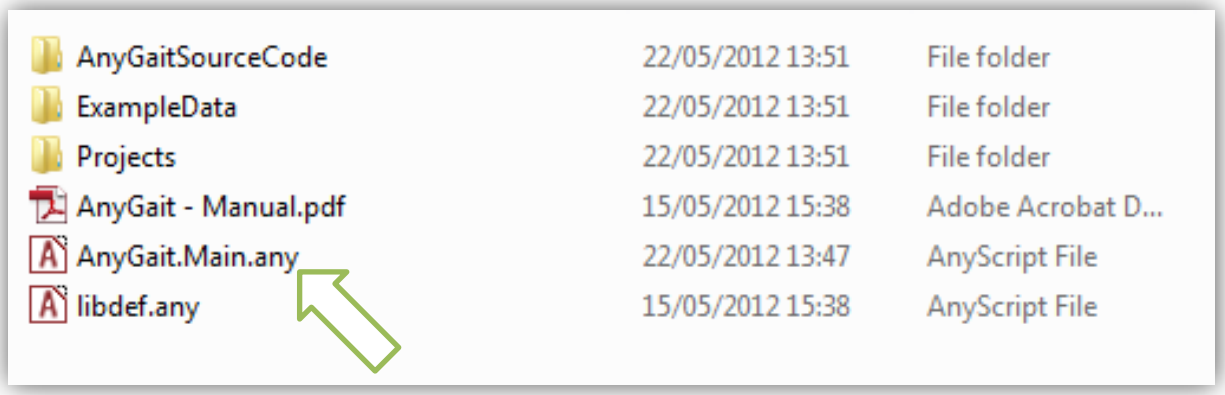

Figure 1: Screenshot of AnyGait folder with purple arrow pointing at the AnyGait.Main file (green arrow) to start AnyGait.

How can I navigate through the AnyGait application?

There are 6 important areas in the AnyGait:

1. Task List (in the Projects tab)
2. Explanation page
3. Execute buttons
4. Space for Model View
5. Shows progress of study
6. Current actions

If you go through the tasks in the "Task List" (1) and follow all steps, you will run the full analysis. In (2) you will get a explanation of the current step and you will have different buttons showing up in (3) that will execute the individual steps of the tasks. In the current screenshot of Figure 2, area (4) marks an empty space; this is where the Model View can be displayed once a trial is loaded.

Areas (5) and (6) show messages to indicate the current progress and actions of the analysis.

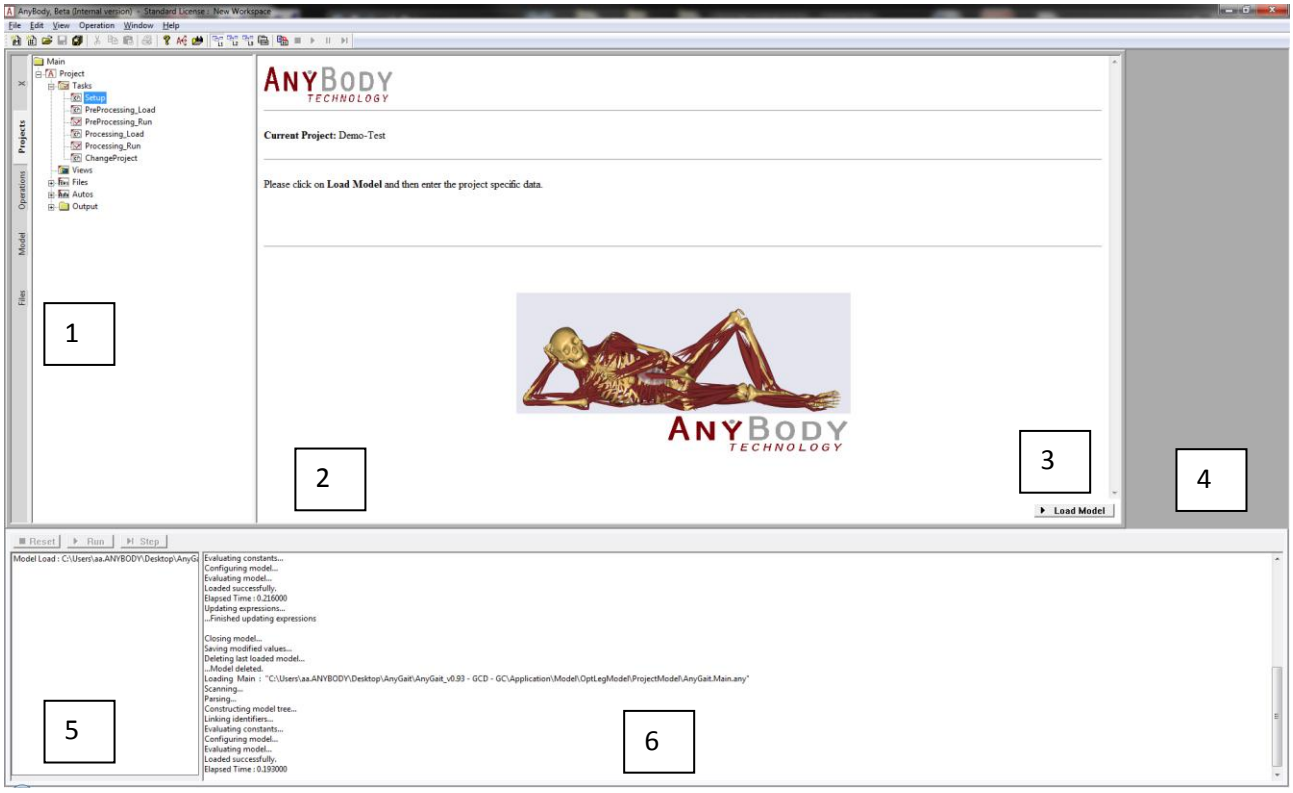

Figure 2: Screenshot of started AnyGait folder with (1) to (6) indicating various important graphical areas in the program.

B.Steps through the AnyGait Application

1. Start New or Existing Project

Starting the AnyGait application by double-clicking on the AnyGait icon in the main AnyGait folder will lead you to this task, see Figure 3. In this task you define the Project Name. Please type in the name of the existing or new project you want to work with. By entering the Project Name, you will create a folder in your AnyGait folder:

e.g. : C:\Users\abc\Desktop\AnyGait\Projects\Trial_1

Please try to find a matching and appropriate name for your trial: Patient name and type of trial. Additional, avoid spaces:

JohnDoe_Gait1
JaneDoe_KneeBend2

If you have typed in the correct name of the project click the link ***Save Project Name*** to start a folder with that name.
Please be aware, that after running the full AnyGait, all reports and results will be saved in that folder.

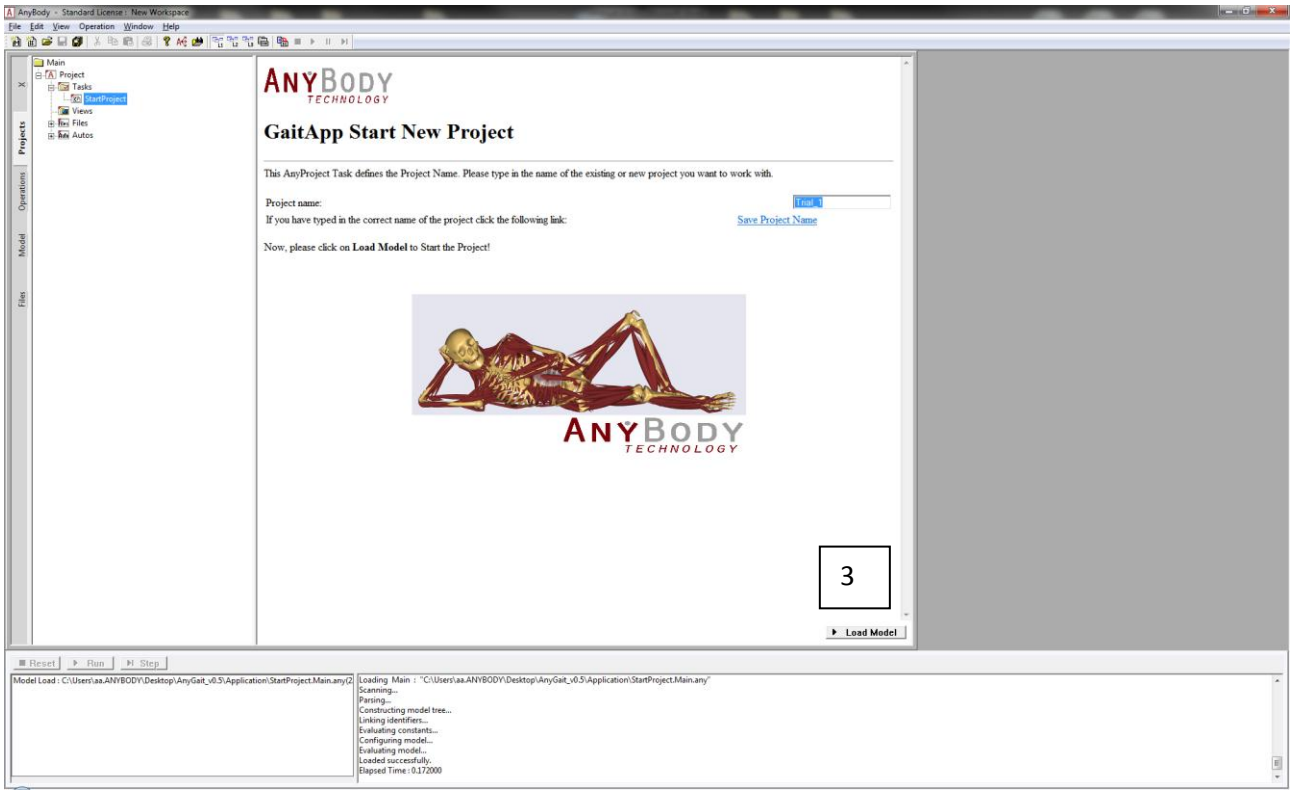

Figure 3: Screenshot of Start Project task.

If you click now on **Load Model** in area (3), see Figure 3, you will transfer to the main window where you can run the analysis. In this main window you see a new task list with 4 tasks, figure 4. You can unfold each and see the specific tasks you need to perform to run the analysis. Some of these tasks are done in few seconds; but a normal full analysis including all steps is done in 10 minutes depending on the complexity of your MoCap recordings.

In the first task (**Setup**), you have to enter data, you need to specify your trial, e.g. subject weight, height, and name of the C3D trials. In the second task (**PreProcessing**), you'll generate the kinematics of the trial (transfer MoCap motion into joint angles). In the third task (**Processing**), you can run the final analysis and calculate Joint forces and Muscle Activities.

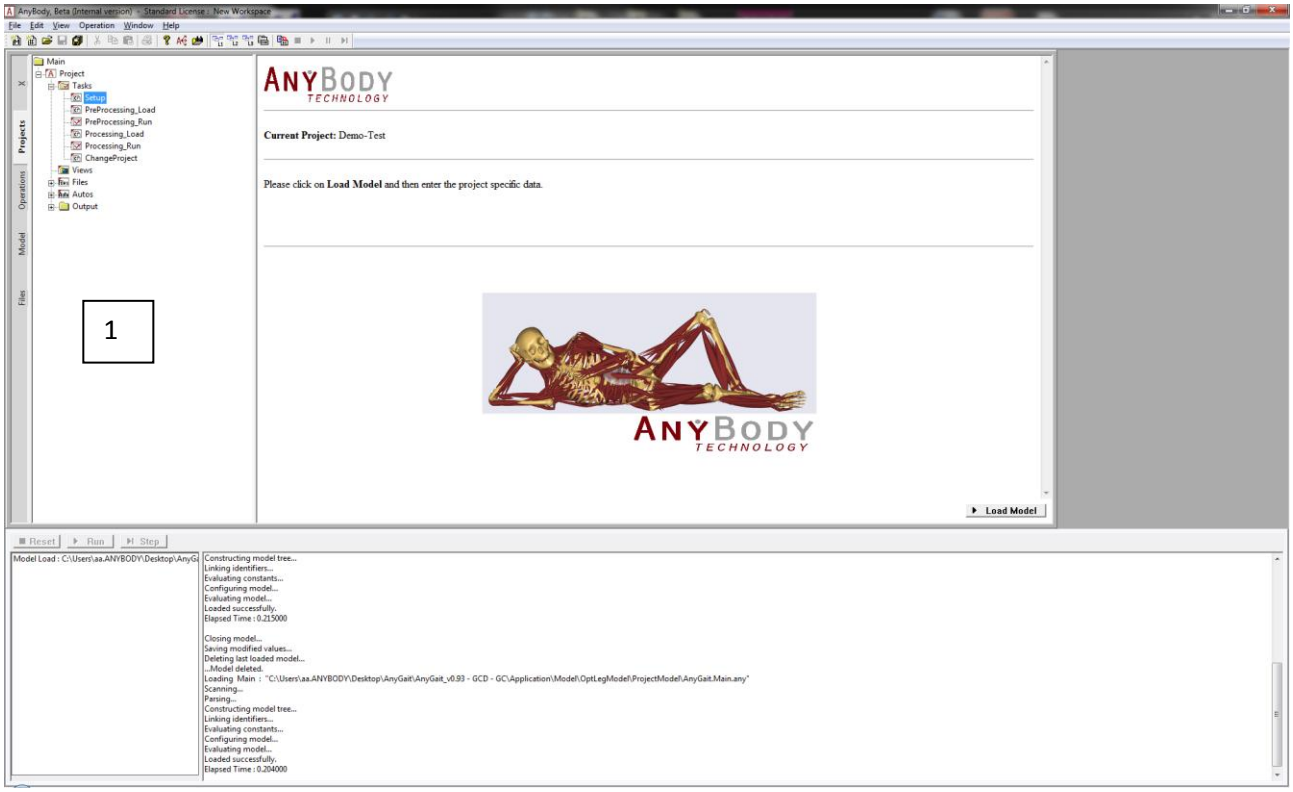

Figure 4: Screenshot of main analysis window with following tasks in the task list: SetupData, PreProcessing, Processing and ChangeProject.

2. SetupData

In the **Setup** section, you enter project specific data. Please start with subtask **Load** and then fill out the comments.

To run the analysis you must :

- enter height and weight of the subject
- upload your static and dynamic *C3D files* (there are example files under AnyGait/ExampleData)
- enter start and end frame (if nothing is inserted here, the start and end values form the C3D file are used.
- Enter a Marker Prefix if it is used in the C3D file.
- Define Left and Right HeelStrike and ToeOff values in sec.

Please click "**save values**" after filling out all necessary forms.

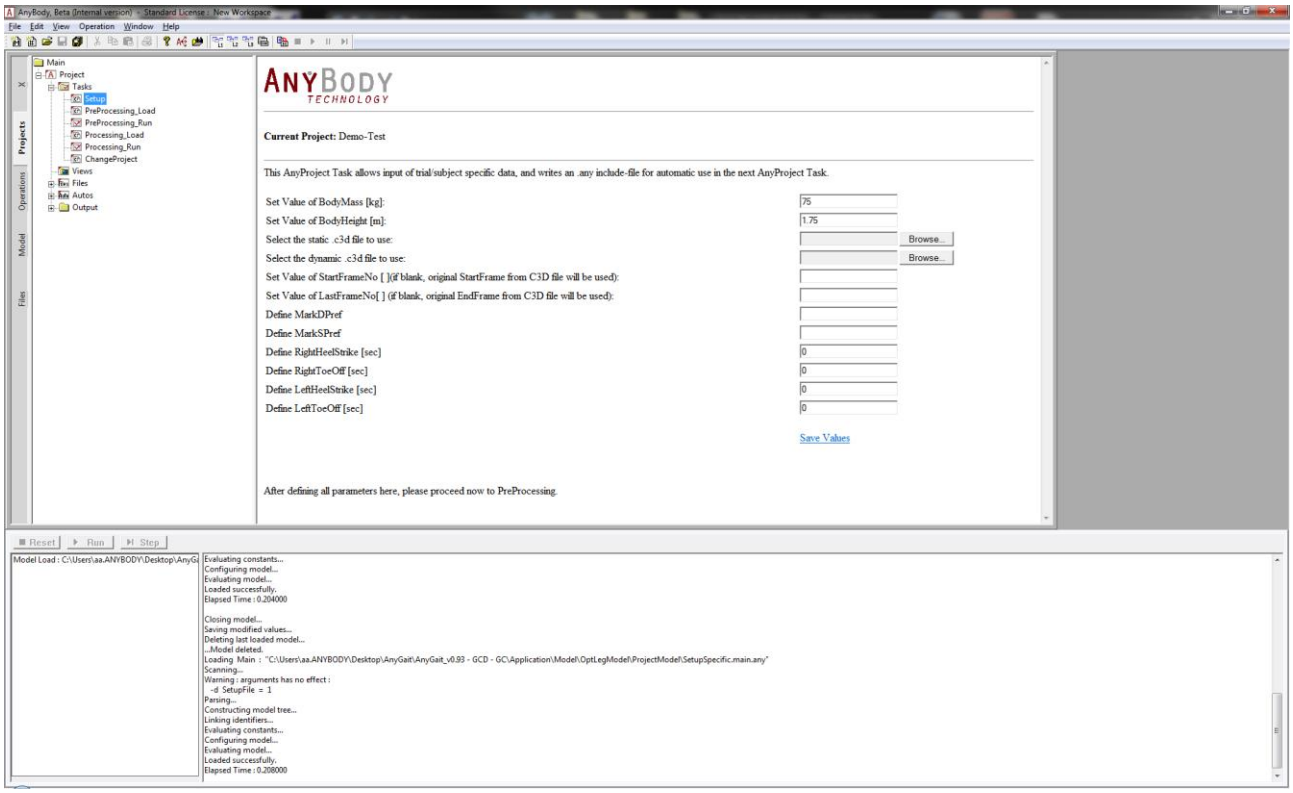

Figure 5: Screenshot of Setup window.

3. PreProcessing

In this section you run the **PreProcessing**. This pre-process uses the C3D files, and calculates joint axes and joint angles for the different joints. The pre-process executes a kinematical model that prepares the kinematical data for the subsequent dynamic analysis.

Please start with the **PreProcessing_Load** subtask, press **Load** there and then proceed to **PreProcessing_Run**.

If you click on **Set Task View**, you will open the Model View. You see some of the blue markers from your trial and a stick figure of the lower extremity next to it, se Figure 5. If you click on **Execute Task** now, you will see the stick figure making the motion you captured in your trial.

After running this pre-process, please proceed now to **Processing**.

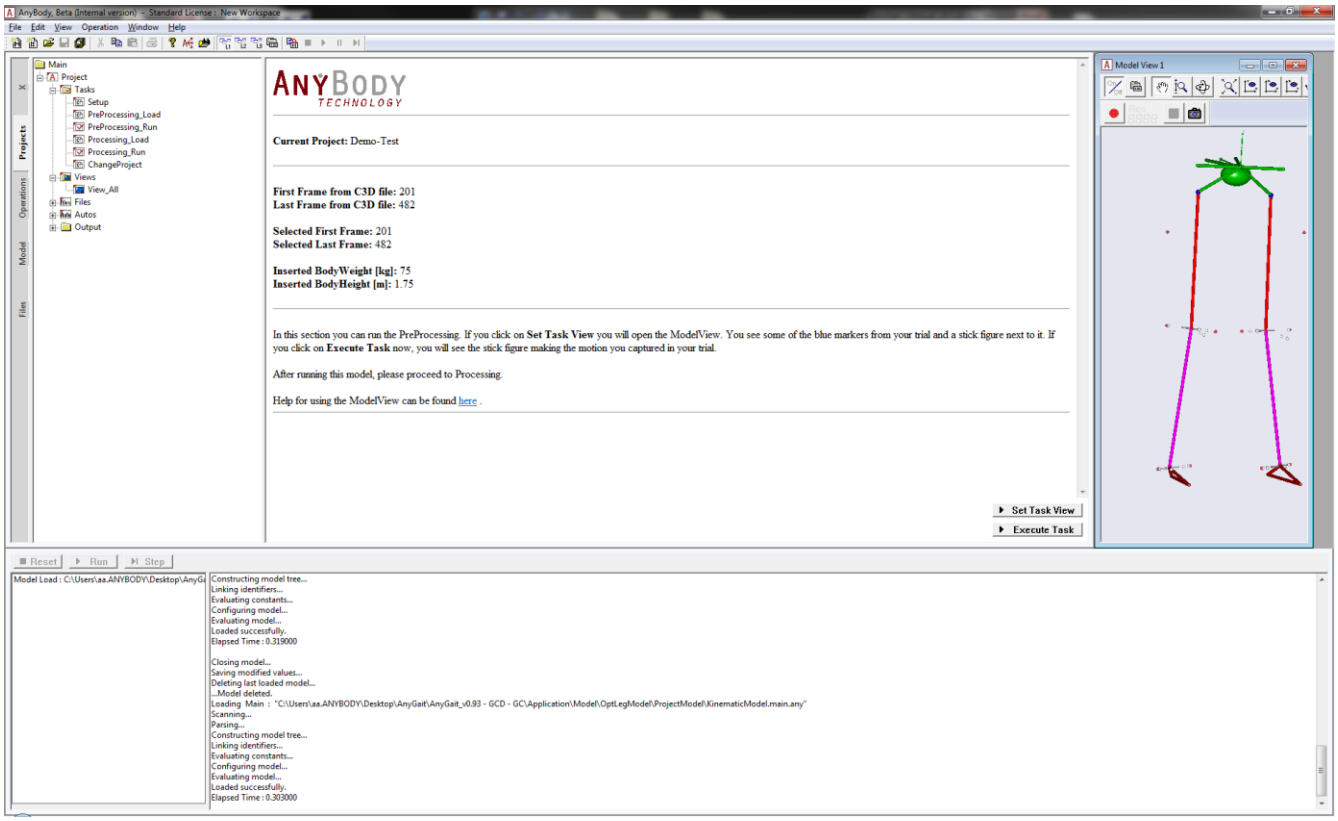

Figure 6: Screenshot of PreProcessing window with open ModelView showing the C3D markers and the stick figure.

4. Processing

In this section you can run the **Processing** model. This will run the actual musculoskeletal analysis, where the muscle activities and joint reaction forces are calculated.

First, the standard AnyBody body model will be scaled into the analyzed subject using the applied markers. The model will then reproduce the measured motion from the C3D file using the joint axes and joint angles that have been calculated in the PreProcessing step. Muscle forces, muscle activities and joint reaction forces are calculated using motion and the force plate data as input to an inverse dynamic simulation.

However first start with **Processing_Load**, click **Load** and then proceed to **Processing_Run**. Click on **Execute Task** to run the Processing. If you still have the Model View open, you will see the body model next to the stick figure see Figure 7. Displaying the Model View will lead to a slightly slower performance. If you don't see an **Execute Task** button here, then the model is not loaded. Please go back to **Processing_Load** and click on **Load Model** there. Then try to go to come back to **Run**.

While the analysis is running, you will see the current step in Area (4), see Figure 7.

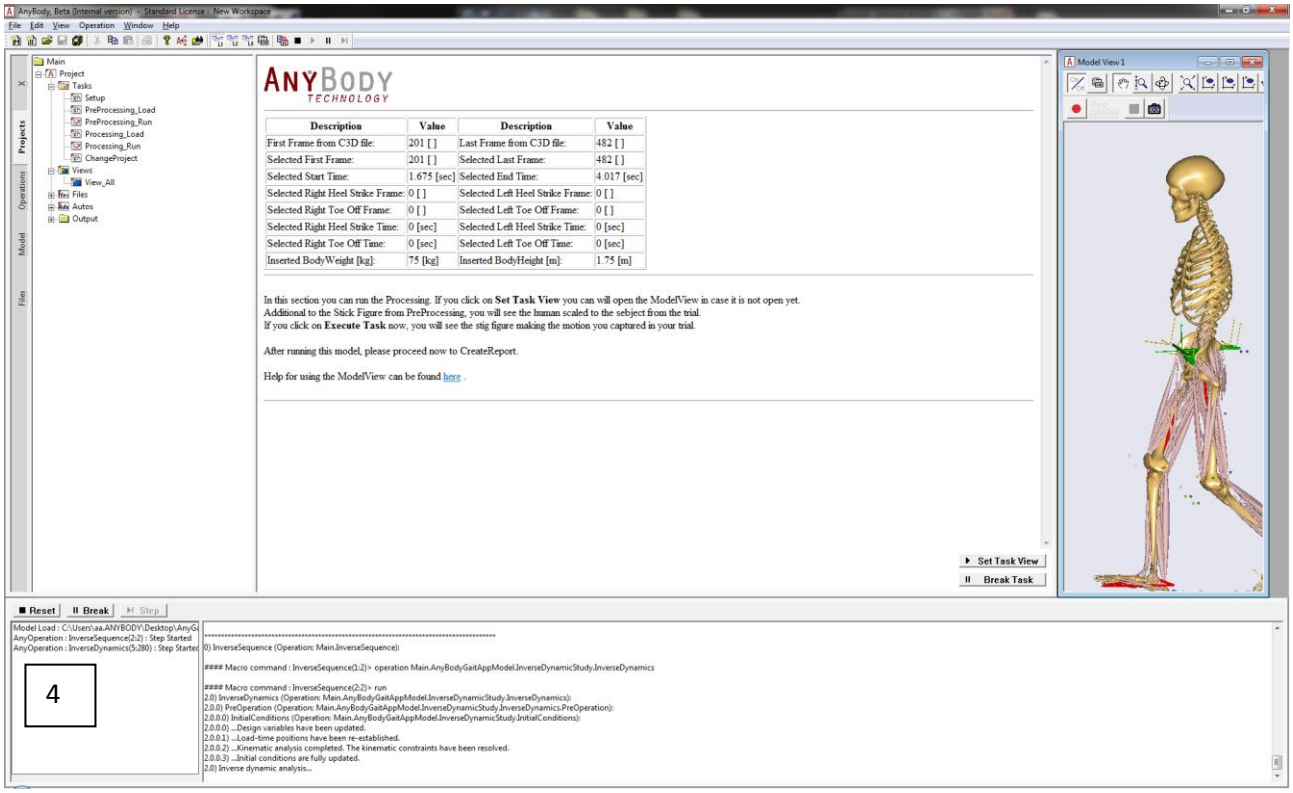

Figure 7: Screenshot of Processing window during an actual run of a Gait trial.

5. Results

In the task list, you will find under Output several predefined Charts, Figure 8. Charts displaying Joint Reaction Forces of Hip, Knee and Ankle are predefined, it is of course possible to setup more charts in the same way.

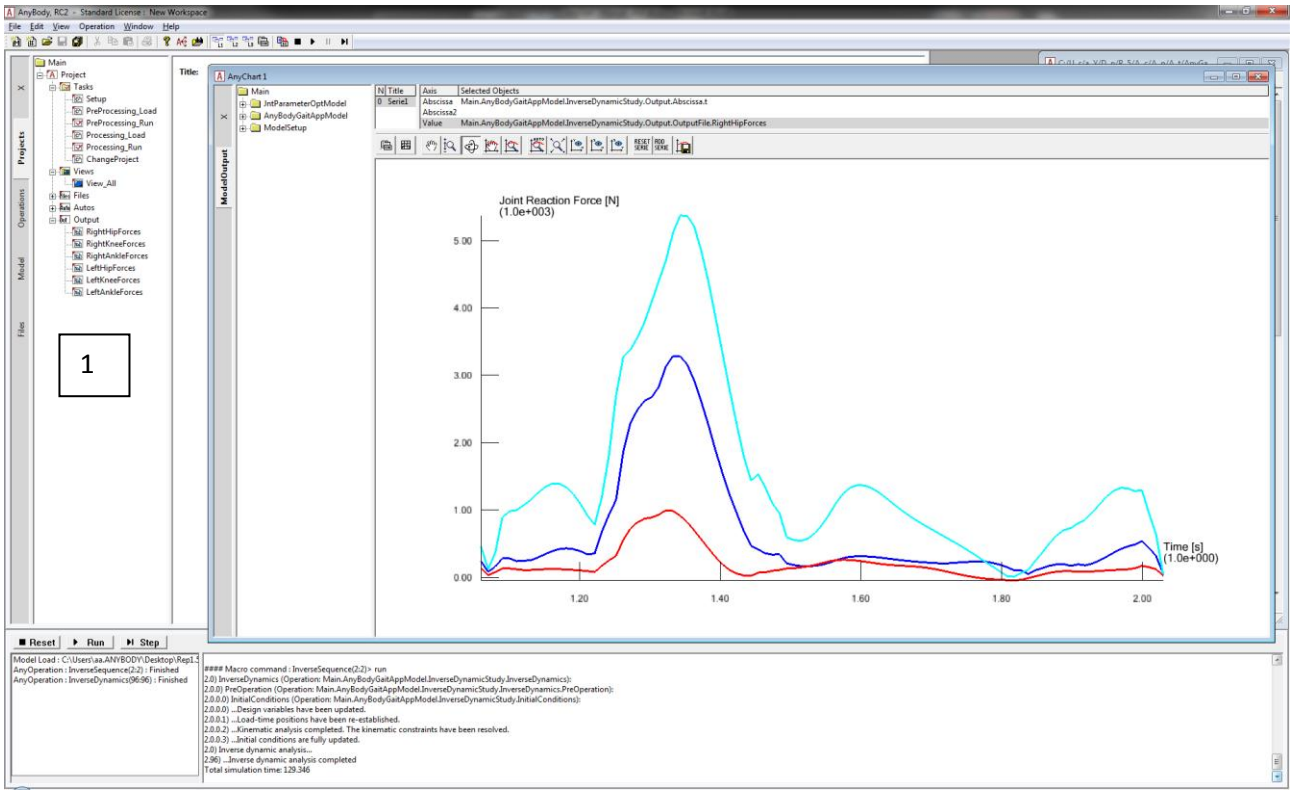

Figure 8: Screenshot of Chart window displaying Hip Joint Reaction Forces for the trial.

In the AnyChart Window, you can display all values that are calculated in the AMS, Figure 9.

Under:

- AnyBodyGaitAppModel/InverseDynamicStudy/Output/HumanModel

You can find either some selected output values or all single joint and muscle values for trunk, right or left leg.

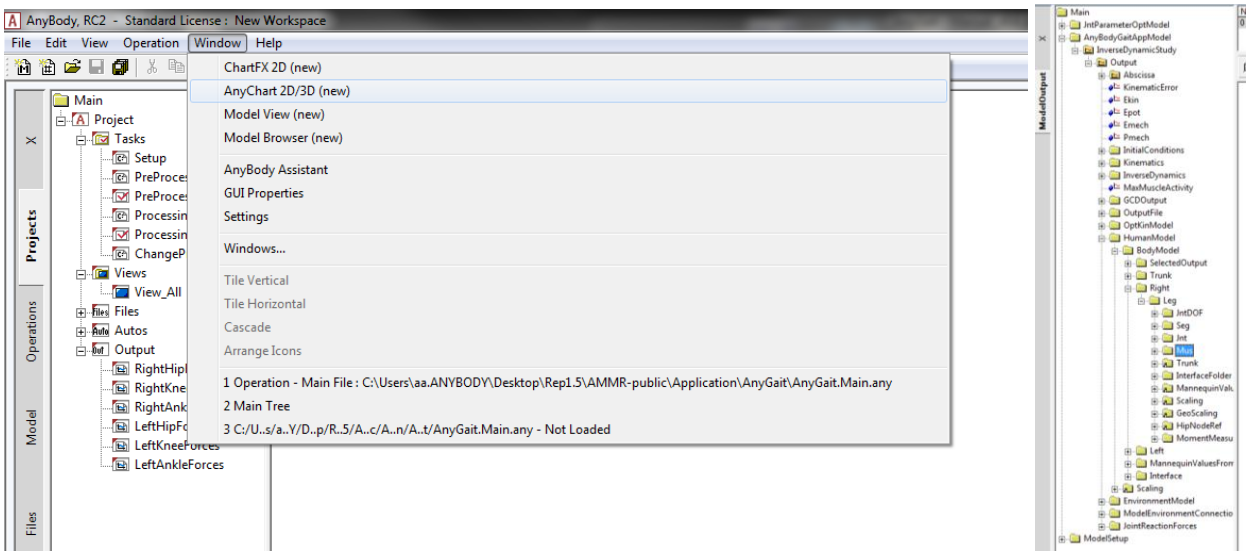

Figure 9: Screenshot of where to find the AnyChart window and where typical results can be found.

6. Change Project

In this task, you can start a new project, or switch to another existing project. Please click on **Load Model.**