Chronojump Manual

http://www.chronojump.org

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5th September 2023

Find the last version of this document in last version of Chronojump software and here:

http://www.chronojump.org/documents.html

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Part I

Obtaining and configuring the software and the hardware

Chapter 2

Obtaining the software and the hardware

To use Chronojump technology is necessary:

Detection device one or more contact platforms or photocells or one encoder.

Chronopic (chronometric device responsible to receive the changes in the detection device)

Chronojump management software.

Computer with Windows, OSX or Linux operating system connected to chronometer Chronopic and executing the software Chronojump.

2.1 Chronojump software installation

Chronojump is free software which works with Windows, OSX and Linux operating systems. To be download at the web page `http://chronojump.org/software.html`.

For more information consult the frequent asked questions of the software (FAQ) `http://chronojump.org/faq_software.html`.

2.2 Acquisition and construction of the detection device

If you like to buy measuring device please check online shop at the web page `http://www.chronojump.org/hardware_store.html`

To build your own contact platform or photoelectric cell, consult at the hardware section at the web page `http://chronojump.org/documents.html`

2.3 Acquisition and construction of the Chronopic chronometer

If you like to buy the Chronopic chronometer, please check online shop at the web page: `http://chronojump.org/pricing.htm`

If you want to build your own Chronopic please check the section Hardware at the web page: `http://chronojump.org/documents.html#hardware`

For more information consult the frequent questions of the software (FAQ) `http://www.chronojump.org/faq_hardware.html`

Chapter 3

Configuring Chronopic

Chronopic is an integrated circuit used by Chronojump to detect the test done at the detection device. To obtain the Chronopic please check section 2.3.

For more information about Chronopic consult the web page: `http://chronojump.org/documents.html#hardware`

Current Chronopic version is Chronopic3 (fig 3.1).

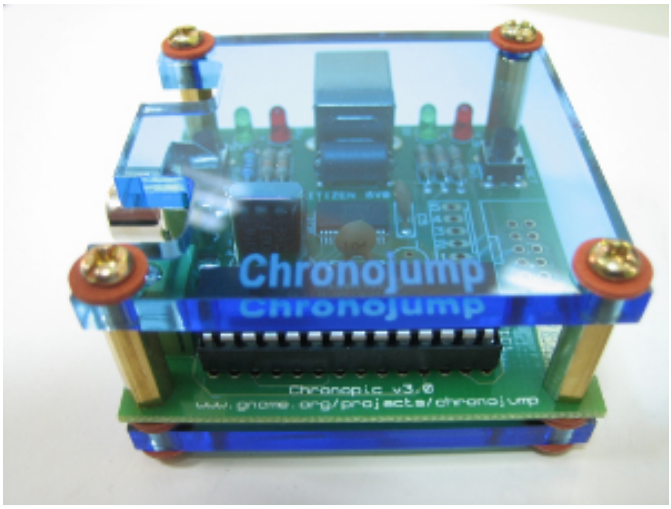


Figure 3.1: Chronopic3.

3.1 Chronopic connections

Chronopic 3 is a USB powered hardware. Using USB cable it receives data from PC and also power. To complete the connection, this cable will also be connected to the socket.

There are two types of Chronopics:

- Multitest: Used in jumping and racing tests.
- Encoder: Used to connect linear, rotary and friction encoders.

The first time you connect a Chronopic and open Chronojump a Chronopic connection window will ask you to identify the type of Chronopic you have connected.

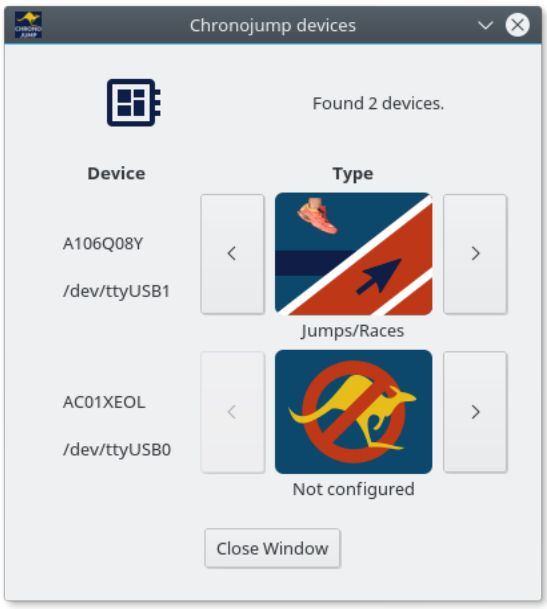


Figura 3.2: Chronopic connection

3.1.1 Multitest

Chronopic will be connected to the contact platform or photocell barrier through the RCA connection 
, the terminal block  or both.

Name	USB-A	USB-B	RCA	RCA 2-1 adaptor	Plug
Connected to:	Computer	Chronopic	Device	Device + RCA cables	Electric socket
					

Figura 3.3: Multitest connections

Using Chronopic RCA (and / or fuse) it is possible to connect 'n' networking platforms to any Chronopic. This model is useful to chronometer situations where an athlete should not be able to be in more than one platform at the same time. Both cables of each platform must be connected to the RCA connector or the terminal block.

Software allows the connection up to 4 Chronopics with an independent signal, each connected to one or more sensing devices. This makes possible chronometer independently various subjects, complex paces or other applications.

3.1.1.1 Chronopic working process

Chronopic detect changes in the contact platform and sends it to the computer by USB cable, USB-serial or serials. You can also use the test button  to simulate changes in the platform.

Chronopic has a green light to indicate when the subject is on the platform or the photoelectric barrier (light stays off) or outside (light is on).

3.1.2 Encoder

The encoder to Chronopic connection will be done with the RJ45 cable of the encoder. The Chronopic to computer connection is made with the USB A-B cable.

USB-A (Computer)	USB-B (Chronopic)	RJ45 (Chronopic)
		

Figura 3.4: Encoder Chronopic

3.2 USB ports

The operating system assigns names to ports, as shown in Table 3.1.

Operating system	Port	Name	Comments
MS Windows	USB	COM1, COM2, COM3, ... (seen to COM27)	Driver required
GNU/Linux	USB	**/dev/ttyUSB0**, /dev/ttyUSB1	
Mac OSX	USB	/dev/tty.usbserial-[serial number]	Driver required

Table 3.1: Names of each operating system port.
The most common names are in bold type text.

The use of the driver is explained in the next section.

3.2.1 Windows USB Driver

A driver is a small program that indicates the computer how to operate a new device.

Chronopic plate requires a driver to run on Windows. This driver is automatically installed when you install any version later than Chronojump 0.7.

If you connect the Chronopic to the computer, and it's detected "New hardware found", then the driver is not required, in other case it will be necessary to run the driver.

3.3 Modification port assigned by Windows

If the port assigned is COM5 or higher it may cause problems in some computers detection. If this happen, it's recommended to assign a lower port than COM5, preferably COM1 or COM2.

To manually assign a port, repeat the steps described in **??** to know which port is assigned, then do the following steps:

1. Click "Port Settings".
2. Click on "Advanced Options".
3. Select one of the ports COM1-4 (preferably COM1 or COM2).
4. Accept and close the assistant.
5. Disconnect the USB cable and reconnect it after a few seconds.

At this point it should be assigned a COM port that device that will last forever. Alternatively, return to perform the steps described in **??** to verify that the change was made directly.

En este momento ya debería tener el puerto COM asignado para siempre a dicho dispositivo. Opcionalmente, si quiere puede comprobar que el cambio se ha realizado directamente puede volver a realizar los pasos descritos en **??**.

3.4 Chronopic solution problems

In case of detection failure when changing Chronojump platform, we propose the following battery of tests. If Chronopic is not working after performing these tests, please noted at the Forum `http://foro.chronojump.org`.

Perform each of the tests until it's working correctly. Remember to check that the cables are connected properly.

1. Power Problem: The red light will turn on when you connect the USB cable (this will happen when the computer is turned on except when there is a connected platform and someone stepping on it, or pushing the test button ).
2. Problem networking platform: Connect the contact platform to Chronopic and the Chronopic to the computer (no need to open chronojump)and check the Chronopic by clicking on the platform and checking if the light turns on and off. If the light doesn't turn on and off, but it did in the previous step, then the cables are in touch when they are connected to Chronopic. Insulate them, check if they are poorly connected or if the platform has a bad contact (disassemble and repair).
3. Port problem on Windows: If the contact platform doesn't have any problem, unplug it and continue the testing only with the Chronopic. Then, check if the port is detected and connect the cables to the computer, the power should also be detected in the Chronopic as described in Section **??**. Windows may detect more than one type of port COM, do the following test to both. If the port assigned is higher than COM4, it's recommended to modify the port to one less than COM4, preferably COM1 or COM2 as described in Section 3.3.
4. Execute Chronojump, select the port configuration in the Chronopic window. A dialog will appear asking you to click "OK" and after this click on the button Chronopic, shortly Chronopic should be detected and ready to be used with the platform connected if desired.

Part II

Using Chronojump

Chapter 4

Using Chronojump

When Chronojump is opened, a window will allow you to select the type of tests you are gone to work with.

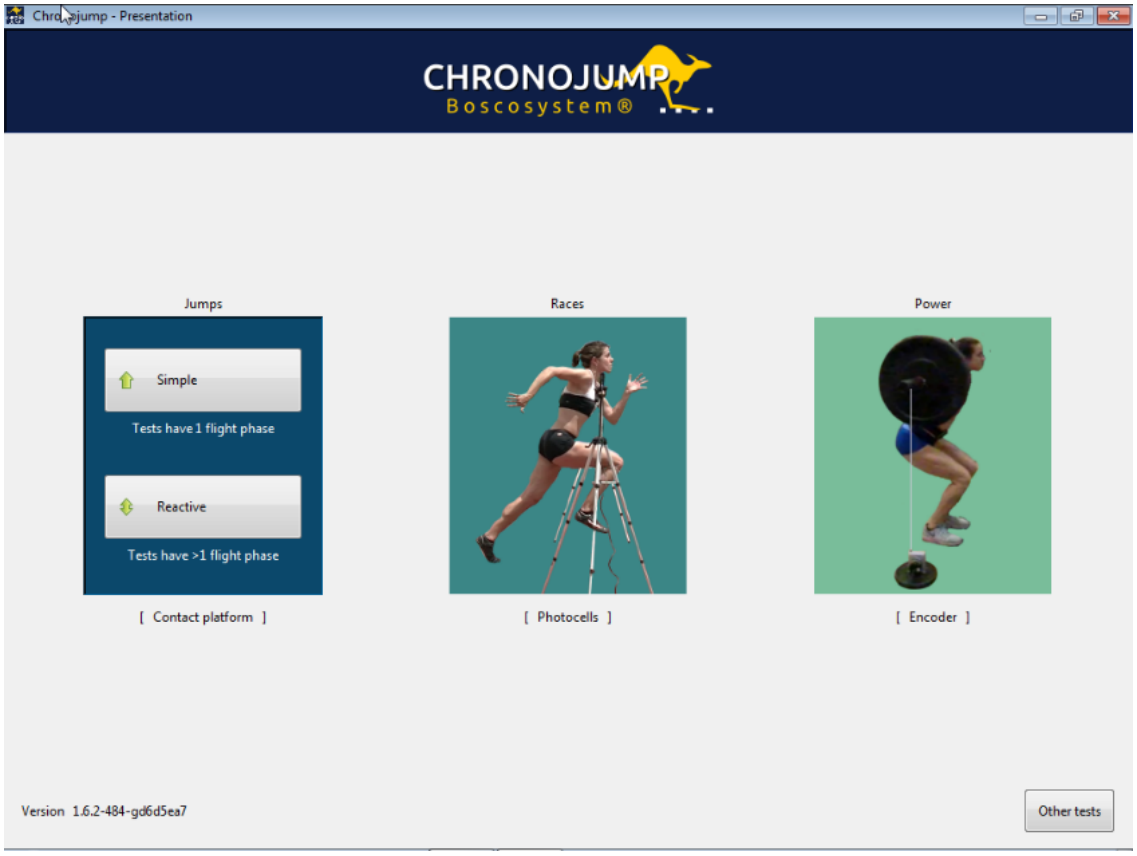


Figure 4.1: Chronojump splash screen.

Once you have selected, if you want to go back to this windows you can go to *Menu -> Mode: -> Main window*

You can also configure some parameters related to the automatic hardware detection. If you experience problems at start or while capturing try the different options.

4.1 Chronojump main window

When chronojump is opened you will be asked the mode you want to work with. Chronojump has 4 modes and in each one there is a lot of diferent tests.

Figure 4.2 shows Chronojump main window. This is divided into the following parts:

The menu where you find the access to session and help.

Edit subject provides a quick access to individual operations.

Subject selection where you can select the subject and edit it with the menu that appears when you click on the right button of the mouse.

Chart selected test If there is a drawing of the test selected or targeted by the mouse, it will be shown. Also, if the program has expanded information on the test, displays an icon to indicate it. By pressing this button it will display a help window on this test chart containing the expanded and test information.

Tabs that allow you to change the work form: Contacts (platform of photocell), Encoder and Server.

Test type with the functionality of executing each of the tests on the tab or active labor module.

Viewing and editing the tests shows different selectors for viewing and editing the jumps and runs. User Notification displays information about the last action.

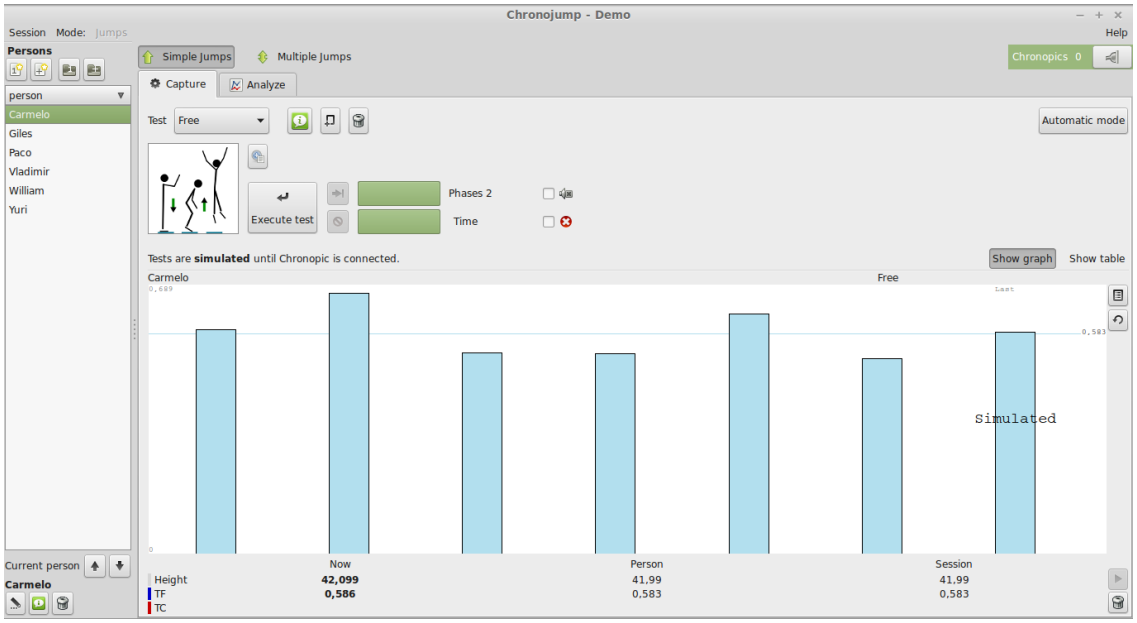


Figure 4.2: Chronojump main window.

4.2 Chronojump Menu

In the following pictures you can see the drop down menu of the program.

Session Menu see figure 4.3.

Mode Menu see figure 4.4.

Help Menu (Top-right corner of the window) see figure 4.5.

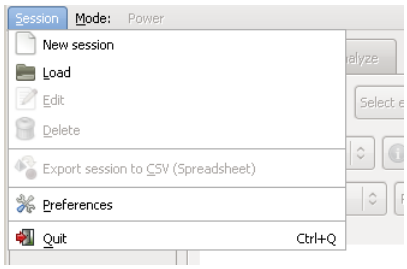


Figure 4.3: Session Menu.

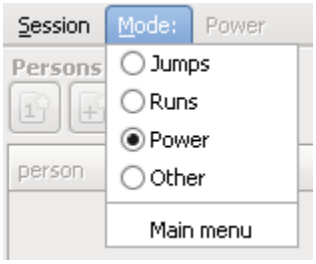


Figure 4.4: Mode Menu.

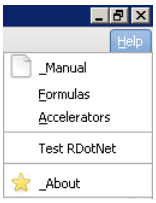


Figure 4.5: Help Menu.

4.3 Chronopic/s Connection.

Is possible to connect one or more Chronopics on the menu: *Tools / Chronopic*. In Figure 4.6 two Chronopics connected are shown. The connection to the Chronopic timer is specifically addressed in section 3.

The first time a Chronopic is connected to a computer, the typ of Chronopic (Jumps/Races or Encoder) must be configured. This configuration will be stored for future Chronojump use. Chronojump will detect automatically all the Chronojump previously configured.

4.4 Database: sessions, subjects and tests

Chronojump stores all data in one database file. Thus, instead of collecting the information in individual files for each session, all information is organized in a single file to facilitate the study of relationships between:

- sessions
- people
- tests (jumping, running, reaction times, pulses (rates), multi Chronopic)

All modifications in session, subjects and tests, will be updated at any time in the database. So there isn't need to save the information periodically and make data loss to a computer error. If rare case, the program crash, you wouldn't lose any data except sometimes the one that is being performed at the time.

4.4.1 Sessions

The sessions represent situations where the coach or evaluator gathers many athletes (subjects) for a series of tests. Every time you gather a group of athletes to be tested in a short space of time (usually one day), you should create a new session. Although the subjects to assess are the same as in other session, you should create a new one to keep adding subjects and tests in an old session. In this way, you can make comparisons between data.

Figures 4.7 and 4.8 demonstrate the creation of a session.

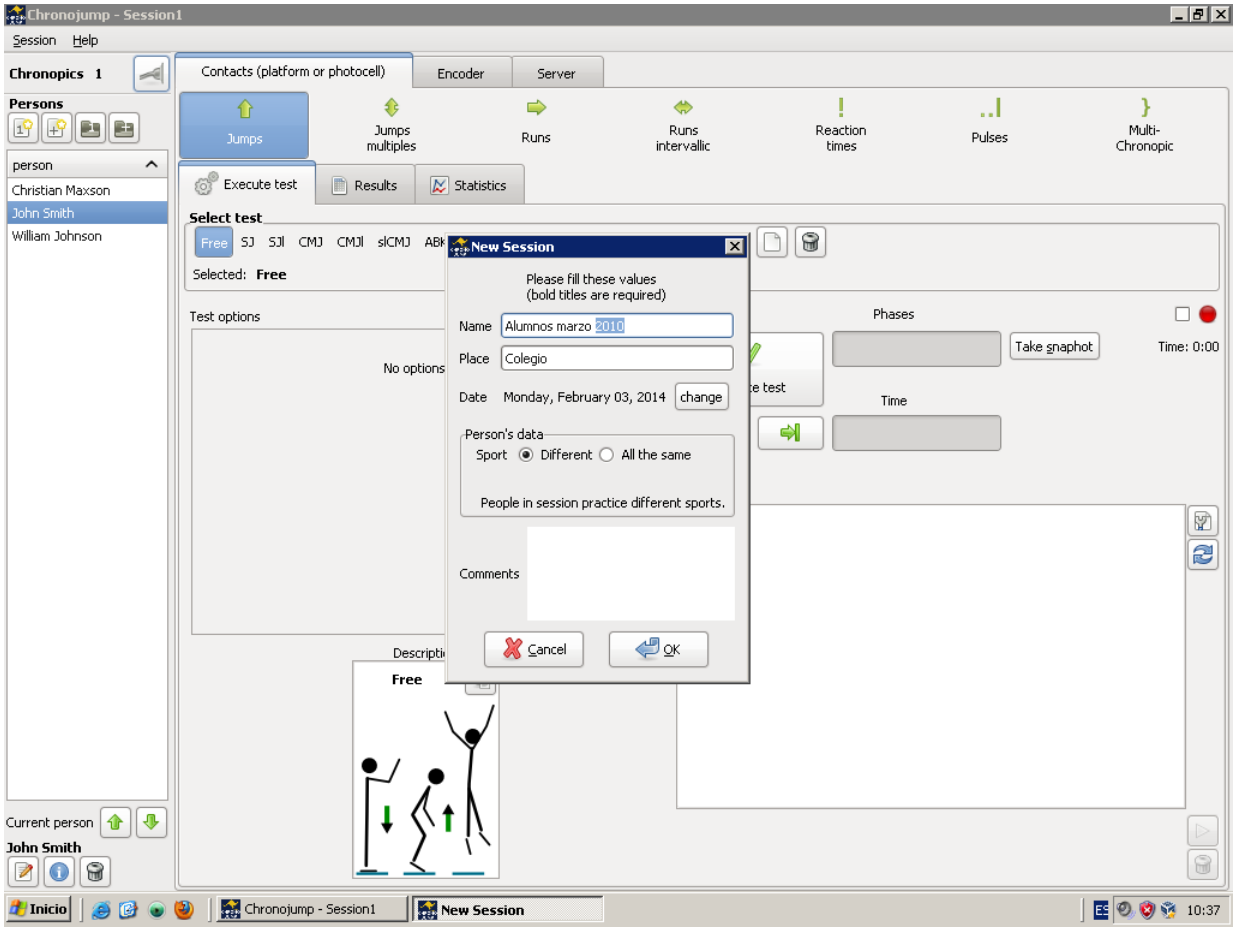


Figure 4.7: New Session. School students.

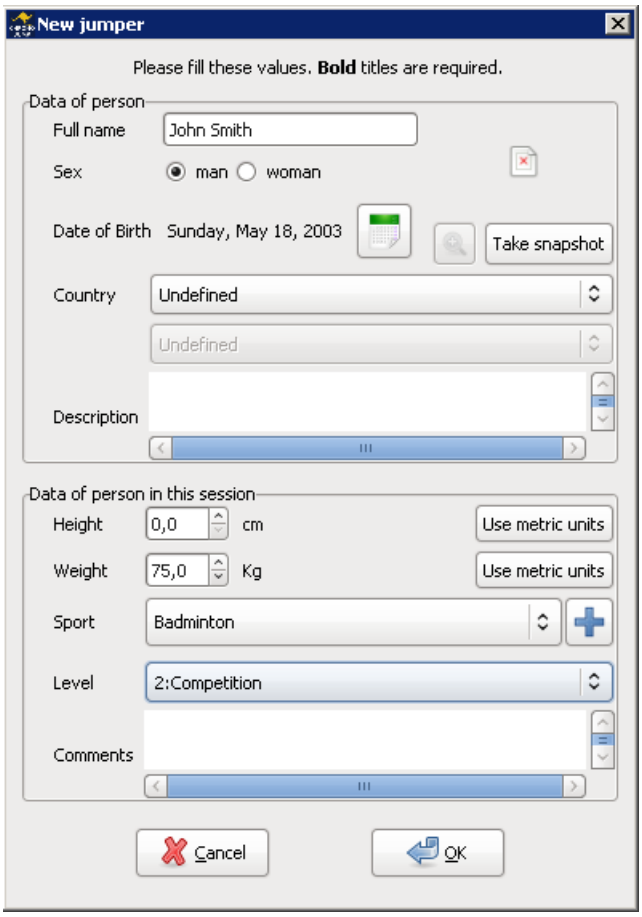


Figure 4.8: New Session. Rhythmic competitors.

4.4.1.1 Creation

Click on the menu *Session menu / Create session* and one window will be opened where you must enter the name of the session, the date and the sport practiced. Optionally you can also indicate the place where is done and even add comments.

4.4.1.2 Load

If you want to load a session already created to study, add subjects and / or to test, click on the *Session menu / Load session*. It will show a list of sessions created and information of the subjects enrolled in each of them and the tests performed.

4.4.1.3 Edición

Click on *Session menu / Edit session* to modify the parameters that have been inserted earlier. Normally, it's used the edition of sessions to add comments about the evolution.

4.4.1.4 Delete

To delete a **session and all tests** performed, click on the *Session menu / Remove session*. A confirmation window will appear.

4.4.2 subjects

All individuals able to perform the tests are known as subject. It's strongly recommended to create one subject only once in order to study the evolution over time. In following sessions the subject must be loaded.

Figure 4.9 shows the creation of a person.

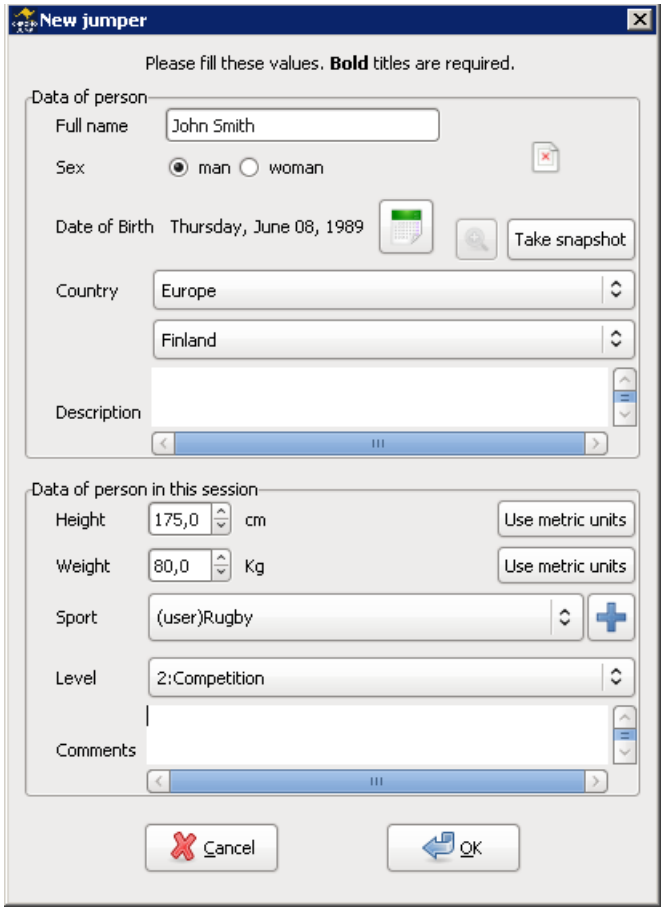


Figure 4.9: Creation of a person.

4.4.2.1 Current person

The subject on the left side of the main window is known as *current person*. All tests done shall be linked to that subject. The latter subject created or loaded is assigned as current person.

Tests shall not start until the current person is assigned.

4.4.2.2 Creation

Click on the *Person menu / Create person* or use the Create button to create a person. You may indicate the full name, gender, date of birth, height, weight, country, sport, mode and level. It's important to enter the full name to avoid further conflicts with other different subjects.

In order to accelerate the creation of multiple subjects, click on the menu *Subject / Create subjects [multiple]*. A window will appear where you can create multiple subjects at once. You can choose between *Add entries from CSV (spreadsheet)* or *Add entries manually*.

In the first case you will need a coma separated value file (.csv) previously created with the information of the name, surname, genre and weight in diferent fields. The format of the file can be specified with headers  or without it  . Additionally you can have a file with a single column for the full name  or two columns for the name and surname  .

In the second case, you can create manually a set of subjects as shown in the figure.

Once created, if you still want to create more subjects, you can click again on the same menu item. Figure 4.10 shows the creation of 11 subjects at once.

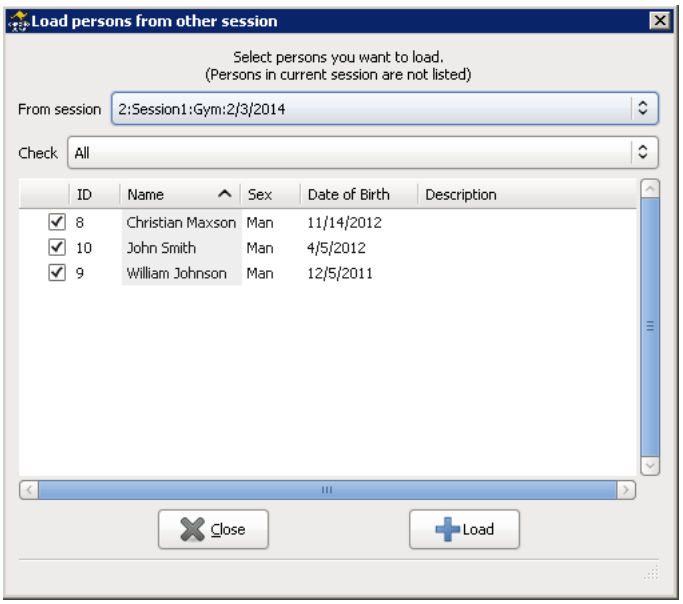


Figure 4.10: Load subjects.

4.4.2.3 Load

If a person has participated in another session, and you want to evaluate him/her again in the current session, click on *Load person*, and enter the same subject to the new session. The program will distinguish between tests (jump, run, reaction times and rhythms) made by the same person in two or more sessions.

If you created a session and you want to continue with the same person/s in another session click *Load subjects from another session* and check all subjects who participated in the other session or multiple session. If you wish you can always discard any subject.

Figures 4.11 and 4.12 show the load of subjects.

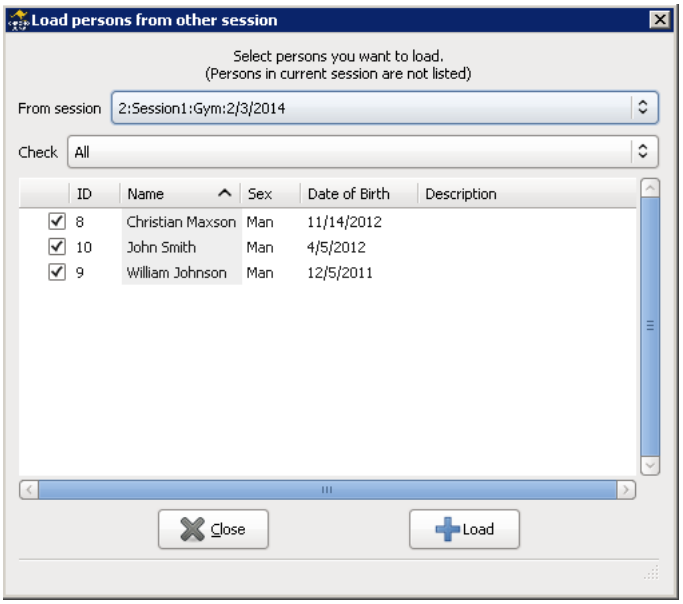


Figure 4.11: Load subjects.

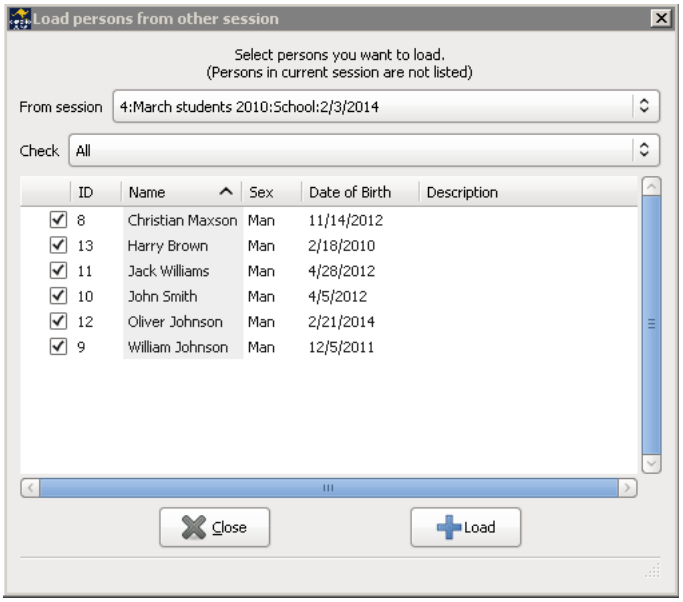


Figure 4.12: Load subjects from other session.

4.4.2.4 View subject tests

Click *Show all tests of current person* to see all the tests that this person has done in the different sessions. You can also select other subjects of the current session.

4.4.2.5 Edit

Click *Edit person* or press *p* (person) to modify the data that was entered at the same time as the creation. You can also add comments.

4.4.2.6 Delete

Click *Delete current person* to be removed of the session. This operation will remove all tests from any person in the current session. It's important to know that the subject will not be removed from the database and the tests in other sessions remain intact.

After deleting this subject, another subject will become the *current person*. Otherwise any test can be provided.

4.4.3 Tests

So far Chronojump manages five types of tests: jumping, running, reaction times, rhythms and Multi-Chronopic. Later Chronojump can handle other tests. These tests are detected by the signals sent by the contact platform when the subject steps on and off it.

The database stores the tests and links to other data tables.

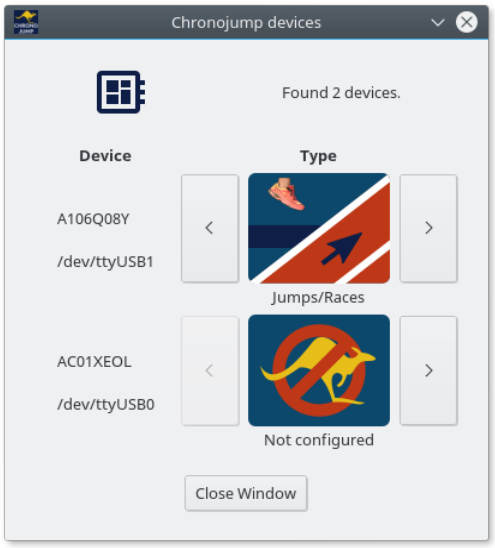


Figure 4.6: Chronopic connection.
The figure corresponds to the program Chronojump whith two connected Chronopics.

Chapter 5

Tests

At the following text, it describes the management of the all types of tests allowed in Chronojump software.

5.1 Jump tests

There is basically two types of jumps: simple and repetitive. Chronojump detect a **single jump** as one phase of flight. That's why there are two types of simple jumps:

1. Those who start and finish on the platform (single hop).We obtain the variable flight time (TF)
2. Those who started outside the platform (drop from a height or do a jump before) to fall on the platform and then jump. Variables obtained: Contact time (TC) (time between reception and takeoff on the platform) and flight time (TF). Usually jumps will pursue minimum contact time and maximum flight time as a power indicator.

A **multiple jump** (also called reactive) is when you obtain more than one flight time. For example: make two consecutive jumps initiated on the platform in the order TF, TC, TF or start outside the platform and continue with the order TC, TF, TC, TF.

Assuming that the body during the takeoff position is the same as in the landing, the flight time indicatives the height of center of gravity of the athlete in this jump.

Videotutorial: Right execution of the Bosco Tests `https://youtu.be/wa6-KgTOwkw`

5.1.1 Simple jumps execution

From the Simple Jumps button, you can select from the drop-down list the following options:

- Free, normal jump without restriccions
- *SJ*, Squat Jump
- *SJl*, Squat Jump with extra load (extra weight)
- *CMJ*, countermovement jump
- CMJl, coutermovement jump with extra load (extra weight)

- *ABK*, jump with arms Abalakov
- *ABKl*, jump with arms Abalakov with extra load (extra weight)
- *D*Ja, drop jump with arms using
- DJna, drop jump without arms using
- *Rocket,* Rocket Jump is simple jump similar to the squat jump but it starts with a full flexion of the legs.
- *TakeOff*, only records the contact time
- *TakeOffWeight*, take off with extra load. It only records the contact time
- *slCMJleft*, left leg countermovement jump.
- *slCMJright*, right leg countermovement jump.

Sometimes you will be asked to provide additional information as the extra weight of the subject (SJL) or the height of the drop (DJ).

The original protocol of Bosco for the *DJ* test indicates that the arms don't participate in the jump. Instead many coaches ask their athletes to use the arms because is more similar to the techniques used in sports. The original *DJ* is called *DJna* (no arms), while the *DJ* with arms is called *DJ*a. When you start a DJ test, the program will ask whether to use arms or not and automatically appoint the jump properly.

If Chronopic has not been connected and activated from Chronopic window, a jump will be simulated. In the other hand, if Chronopic is connected, real jump will be done. Note that for some jumps the athlete should be on the platform, while other jumps it's essential to be elsewhere. You will be notified if the athlete's situation is not correct. The progress barr shows the progress of the jump, which may be stopped by clicking on the *Finish* or *Cancel* button.

5.1.1.1 Automatic mode

In order to accelerate the process of testing multiple subjects you can click on the *Automatic mode* button. This mode allows you to perform tests creating or loading sequences of diferent jumps or people.

Defining the sequence can be done either loading a preconfigured one (*Load sequence*) or creating a new one (*Create new sequence).*

When a new sequence is created the order of the test must be defined. There are three different options:

- *By persons*: Each person of the session performs all the tests before changing to the next person. Example: *Chronojump profile*.
- *By tests*: Each test in the sequence is perfomed by all the people in the session before changing to the next test. Example: *Bilateral profile by persons*
- *By sets*: Each person of the session performs the first set of tests before changing to the second set of tests. It can be defined up to 3 different sets of tests. Example: *Bilateral profile by sets*

To define a new sequence click on the type of sequence it is about to be created and click on the *Next* button. Then, in the new window, the order of the tests can be defined. If the *By sets* option was selected, each set must be defined separately.

After defining the sequence, it can be saved clicking on the *Save* button.

Once the *Next* button is pressed a new windows will show the whole sequence indicating the order of the person and the test.

When the *Accept* button is pressed the automatic mode is activated. In this mode the person frame will be disabled and the name of the next jumper and what test is going to be done will be shown in the upper left corner of the Capure frame. The selection of the test will also disappear, not allowing to change

After performing each jump test, the person and the test will change automatically.

Clicking on the *See order* button  the whole sequence of the test can be viewed.

To skip all the tests of a person and execute it at the end of the sequence click on the *Skip*  .

To delete a person from the sequence click on *Remove* button  .

Clicking on the *End automatic mode* will return to the normal way of work of Chronojump, allowing you to select the person and the test to be performed.

5.1.2 Repetitive jumps execution

Click in the button on the Repetitive jumping tab:

- *RJ(j)*, Repetitive Jump (jumps) or repetitive jumping limited number of hops
- *Rj(t)*, Repetitive Jump (time) or time-limited repetitive jumping
- *RJ(unlimited*), unlimited repetitive jumping.
- *RJ(hexagon)*, reactive jump on an hexagon until three full revolutions are done.
- *Triple jump*, triple jump starting from a falling height
- *Unlimited multiple jump with extra load*

Sometimes is necessary to provide additional information as the height of the initial drop, the extra weight or value of the limiting factor (hops or seconds). Click on *More* to get a list of all the available of the reactive jumps and execute them clicking OK. The jump menu also provides access to these actions.

If Chronopic has not been connected and activated from Chronopic window, a jump will be simulated. In the other hand, if Chronopic is connected, real jump will be done. Note that for some jumps the athlete should be on the platform, while other jumps it's essential to be elsewhere.

If you want to execute the same type of jump to various subjects and you don't want a button (only available on the tab more), you can change the subject and use the Last button to allow another person to perform the same jump.

5.1.3 Auditive and visual feedback in repetitive jumps: bells

In order to add a visual and auditory feedback during execution of the jumps, you can set values of flight time, contact time, or the relationship of both. To be shown a red bell (poor performance) or green (good performance) together with a distinctive sound. Click on the "Bells" to configure these actions as shown in Figure 5.1.

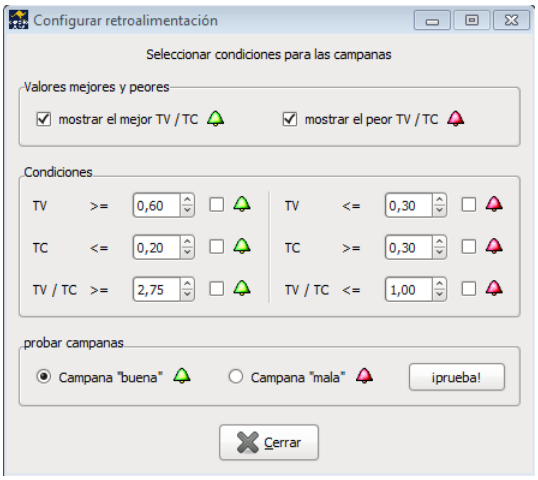


Figure 5.1: Bells - auditive and visual feedback.

5.1.4 Chronojump profile

Chronojump incorporates a quick method for generating an athlete profile in which different variables are shown:

- Maximum force: Hability of moving an load equal to the double of the body weight.
- Explosive force: Hability of moving a load equal to the body weight.
- Elasticity: Force increment due to the elastic energy acumulated during the shortening-stretching cycle.
- Arms using: Force increment due to the arms using.
- Reacitve reflex: Force increment due a previous falling from certain heigth (activation of reflex mechanisms)

In order to generate a complete profile it is necessary to have been performed this jumps:

- SJl with an external load equal to the body weight.
- SJ
- CMJ
- Abalakov
- DJ with a falling height near the one that generates the maximum jump height.

Si desea ver el perfil de un atleta haga clic en la pestaña de *Perfil de saltos.*

To generate the Jumps profile go to Jumps profile tab.

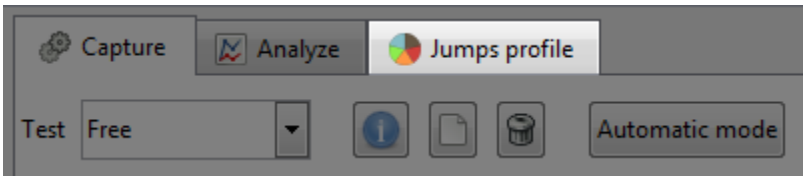


Figure 5.2: Jumps profile tab

Once there, and if al the jumps are performed a graph similar to this will be shown.

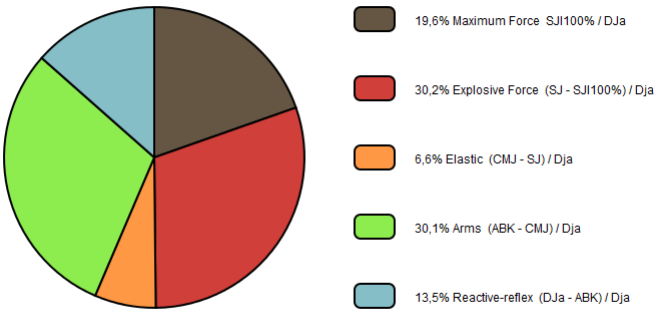


Figure 5.3: Chronojump jumps profile

5.1.5 Jumps view

Simple jumps are shown on the *Jumps* tab and the reactive Jumps on the *Jump Reactive* tab. In both cases, it's included a filter for all the possible tests or only a particular type.

Tests are associated with the jumpers. The order of the tests presentation of each jumper is chronological so, the last test appears at the end of the list. It's included a button that allows sorting the tests by the type of jump and not in chronological order.

All jumps are selected in the view filter. A series of values are presented at each hop. It's possible to change the view by accessing at the Preferences (more information in section 8.1 en la página 94).

You can use the *magnifying glass* button (or press *z*) to facilitate the view of the tests.

5.1.6 Jumps edition

You can add comments to a jump or change the person (if you forgot to change the current person previously) If you select the desired jump and click on the Edit button on the selected jump, you can also find it on the menu, or by pressing the button *e*.

In the reactive jumps, since they are composed of a set of jumps, this change will affect all the jumps even if only one is selected.

5.1.7 Repair repetitive jumps

Using *Repair selected* button or pressing *r*, you can add a jump, modify a contact time or flight time or delete a jump. If a repetitive jump type has been defined to be limited to max *n* jumps, or max *n* seconds, this conditions will limit the repair functionality. When this happens, you will find an information text on the bottom of the window.

5.1.8 Jumps delete

To delete a jump, select it and click the *Delete selected jump* button. Its equivalent in the menu or press *d* (delete). By deleting the test you will be asked to confirm it if the delete confirmation option is activated in the *Preferences* menu (more information in section 8.1 en la página 94).

Deleting a repetitive jump will delete all it's jumps.

5.1.9 Creation of new jump types

In order to adapt the software to the needs of each user, it has been included the function: *Add jump type* (on *Jumps* menu). This allows trainer to define easily and powerully the desired jump types.

Created jump type will be available on database to be used at any session, and it will be listed clicking on the *More* button at the *Jump* or *Jump repetitive* tabs (depending on which kind of jump it's created). This new jump type will be also differentiated on statistics, graphs and reports.

On creation, you should give it a distintive name and classify between simple or repetitive. If jump is repetitive, then you can limit is by jumps, time, or leave it unlimited.

The limit by time or jumps options can be defined as a fixed value or leaved as undefined. If it's defined fixed, all new jumps of this type will be limited to that value; in the other hand, if the type is not fixed, user will be asked by limit value everytime a new jump is done.

Last settings include: start inside or outside the platform, allow to jump with an extra weight, and add a description to the jump type. In the figure 5.4 you can see the creation of new jump type.

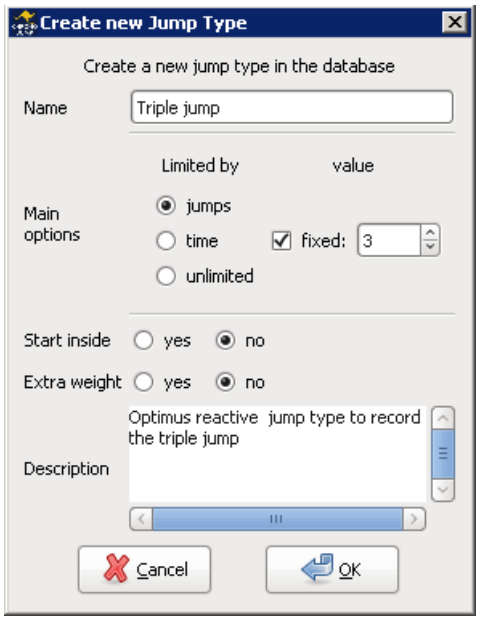


Figure 5.4: Creation of a new jump type.

5.1.10 Examples on creation of new jump types

Here you can find some examples on creating new jump types. The names of the types have been invented in this manual. The table 5.1 is also useful to understand the different variables.

- *"SJ-N"* Jump like Squat Jump but the hands are on the nape instead of hips.
- *"DJ-Rope2"* Jump like Drop Jump but after executing the Drop jump, person have to jump again doing two turns with the skipping rope on the air.
- *"Triple"* Repetitive jump starting outside the platform and including three jumps.
- *"50%fatigue"* Repetitive jump that has to be done until arriving to 50% of the person's fatigue. The number of seconds needed to be fatigued is personal and is known previously by the trainer. Starts inside.
- *"RopeUnlimited"* Person has to jump the rope until trainer (or jumper) decides to finish. Start inside the platfom and can be done with an extra weight.

Name	Tipe	Limited by	Fixed	Start in	Additional weight
SJ-N	Simple	-	-	Yes	No
DJ-Rope2	Simple	-	-	No	No
Triple	Repetitive	Jumps	Yes(3)	No	No
50%fatigue	Repetitive	Time	No	Yes	No
RopeUnlimited	Repetitive	Unlimited	-	Yes	Yes

Table 5.1: Examples on jump types created by user.

5.2 Races with photocells

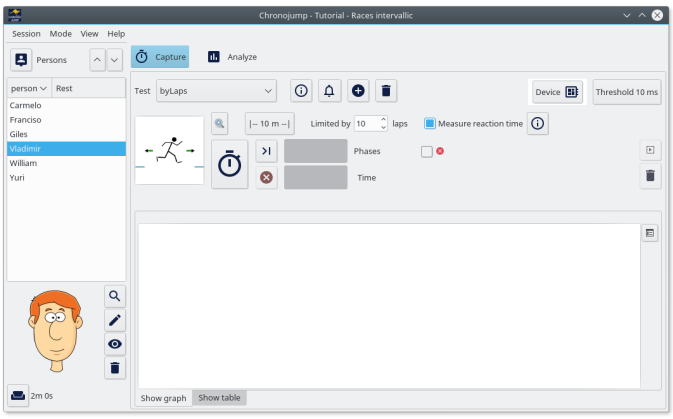


Figure 5.5: Drawing of two barriers and a switch to measure races.

Running can be detected by three kind of devices:

- platform/s
- photocell/s

- push button/s

On a run test Chronojump detects time between detection devices. If the run is "circular", it can be used a single device (platform, photocell or push button), in the other circuits, there's a need of more than one detection device (of any type).

From now on, *device in contact* means that the person is on the platform or blocking a photocell signal or pressing the push button. Is important to note that the person should never be in contact in more than one device at the same time.

The figure 5.6 shows a drawing of the position of two platforms to measure run.

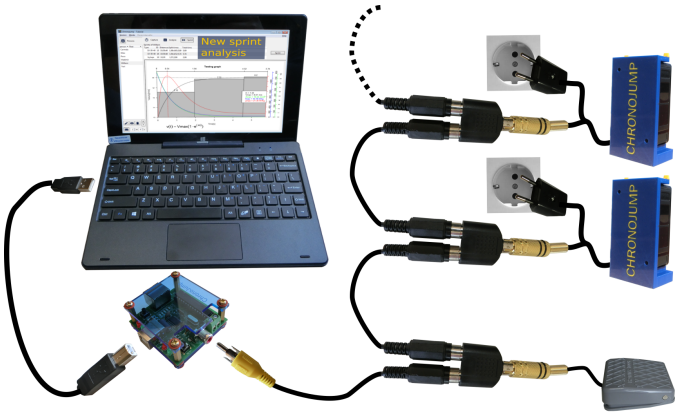


Figure 5.6: Drawing of two barriers and a switch to measure races.

In order to calculate average speed, user will be asked about the distance between platforms.

Runs can be of two types: simple and repetitive. On Chronojump a **simple run** means that there's only one track. There are two kinds of **simple runs**:

Running from stop Start on contact in a device and end in contact in the same or other device.

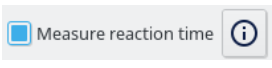
Running with initial speed Start before the contact, after a while, a contact is done and chronometer starts, then person leaves the detection device until it produces contact again. This allows to measure a run where person has an initial speed.

In both situations, the registered data is the time between one device and the other, also speed will be calculated.

An **intervallic run** is a run where there's more than one track, it should be understanded as "run along two or more tracks limited by devices at a fixed distance".

5.2.1 Raction time

Chronojump allows to measure the reaction time. This time is the elapsed time between a starting signal and the moment at which the subject starts the movement.

To activate this option clic on "Measure reaction time" 

The results will be shown in the tab "Show table" and the column".

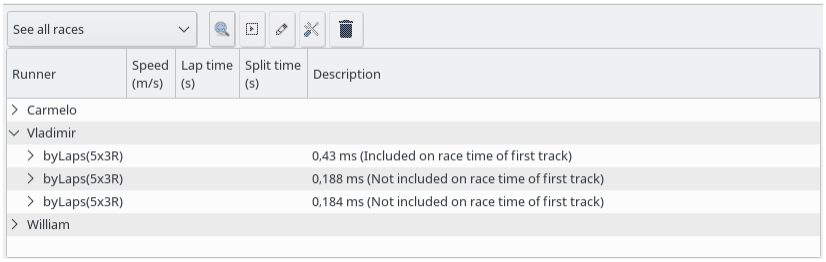


Figure 5.7: Races results table

5.2.2 Correction of multiple contacts

Chronojump allows to fix the situations where the subject activates the contact device more than once due to different parts of the body contact the device in different instants. (example: an athlete arrive to a photocell, makes contact with a hand, ends the contact and after that make contact with body).

To prevent this type of situations in Menu -> Preferences -> Runs check *Prevent double contacts*

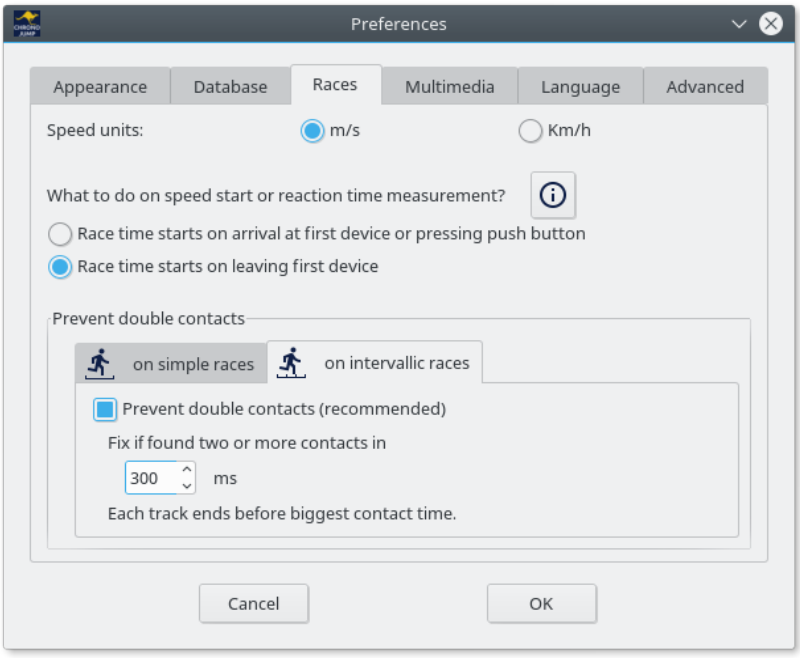


Figure 5.8: Double contact configuration

This dialog box allows to set the minimum time between contacts to be considered as correct. If the time between contacts is lesser than the configuration in the dialog Chronojump will consider the instant when the longest contact start.

in the figure 5.9 is shown an example of a race with multiple contacts situation.

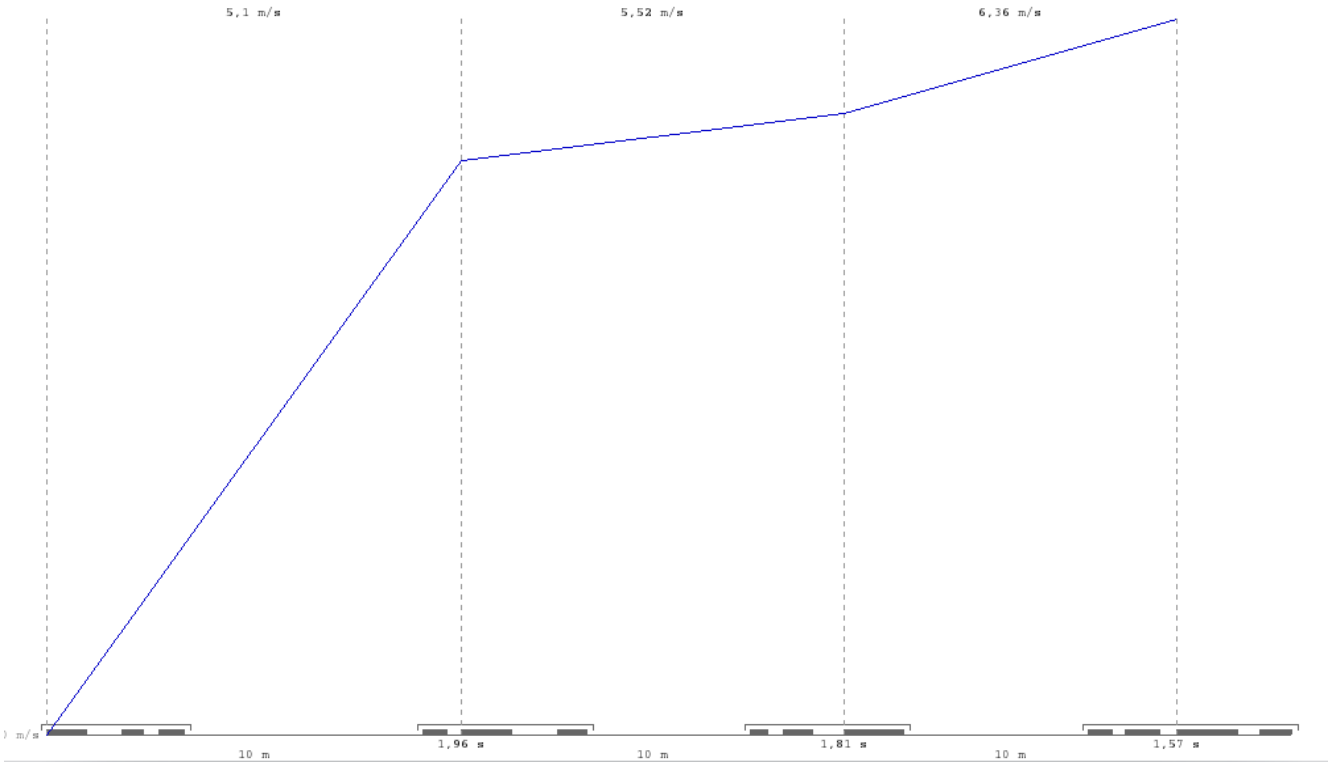


Figure 5.9: Double contacts example

In the lower part of the graph, each real contact is shown as a segment with a length equal to the duration of the contact. The segments are grouped so that each cluster is treated as a single contact. The vertical dashed lines show the instant when the start of the contact is considered.

5.2.3 Simple races execution

To execute a simple run, click the following buttons on *Runs* tab:

- *Custom* to run after introduce the track's distance
- *20m-400m*, to run on the preselected track's distance
- Agility runs, this tests are available: 20 Yards, 505, Illinois, Shuttle Run, Zig-Zag test. The figure 5.10 shows the information available on software about the 505 test.

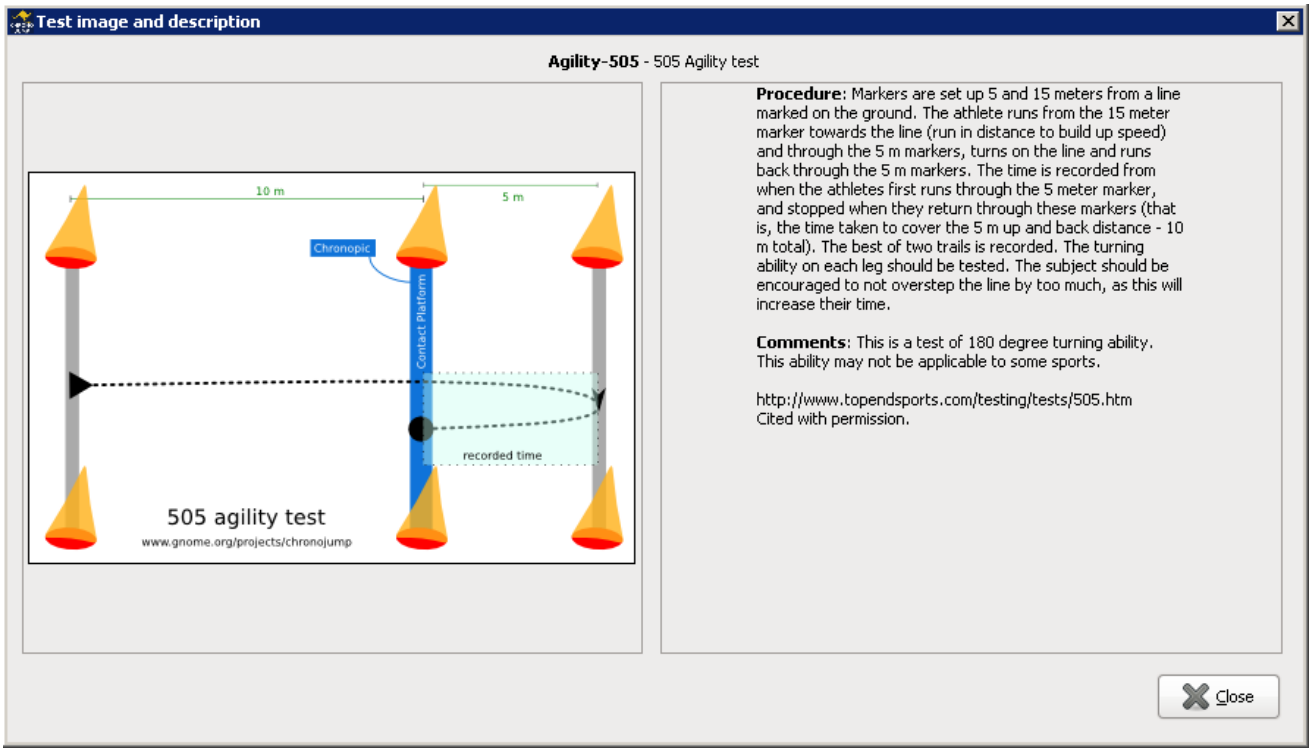


Figure 5.10: 505 Agility test.

Click on *More* to see all simple runs available, and execute them clicking *Ok*.

If Chronopic has not been connected and activated from Chronopic window, a run will be simulated. In the other hand, if Chronopic is connected, real run will be done. Software allows to start run in contact with the device or before the contact. On the later situation, time between starting of the run and contact on the first device is deleted.

In the pop-up window it shows the progress of the run, which may be stopped by clicking on the *Finish* or *Cancel* button.

If you want to execute the same type of run to various subjects and you don't want a button (only available on the tab *More*), you can change the subject and use the *Last* button to allow another person to perform the same run.

5.2.4 Executing intervallic runs

To execute an intervallic run, click the following buttons on *Intervallic Runs* tab:

By tracks: intervallic run limited by number of tracks

By time: intervallic run limited by number of tracks

Unlimited: unlimited intervallic run

At som run types, user interaction will be needed, like track distance and limit factor: tracks or seconds. Click on *More* to get a list of all the available of the intervallic runs and execute them clicking OK. The run menu also provides access to these actions.

If Chronopic has not been connected and activated from Chronopic window, a run will be simulated. In the other hand, if Chronopic is connected, real run will be done. Software allows to start run in

contact with the device or before the contact. On the later situation, time between starting of the run and contact on the first device is deleted.

In the pop-up window it shows the progress of the run, which may be stopped by clicking on the *Finish* or *Cancel* button.

If you want to execute the same type of run to various subjects and you don't want a button (only available on the tab *More*), you can change the subject and use the *Last* button to allow another person to perform the same run.

5.2.5 Feedback auditive and visual at the intervallic runs: bells

Similarly to the repetitive jumps, you can configure minimum and maximum values dor each track. A red bell will be shown on a bad execution, and a green bell on the opposite, also a distintive sound will be played.

Configure this actions clicking on "Bells".

5.2.6 Runs view

Simple races are shown on the *Races - Simple* mode and the intervallic runs on the *Races - intervallic* mode. In both cases, it's included a filter for all the possible runs or only a particular type.

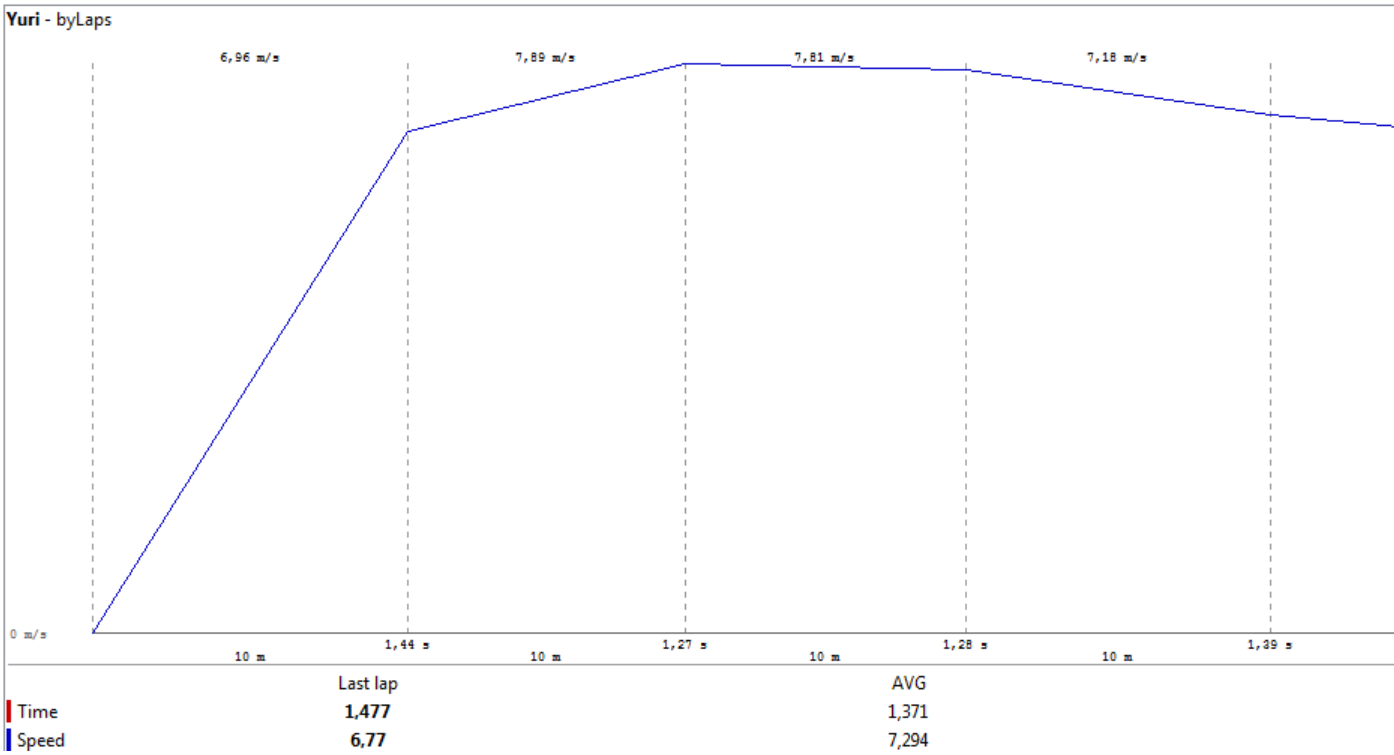


Figure 5.11: Lap race display

Tests are associated with the runners. The shown order of the tests of each jumper is chronological so, the last test appears at the end of the list. It's included a button that allows sorting the tests by the type of run and not in chronological order.

It's possible to change tests view by accessing at the Preferences (more information in section 8.1 en la página 94).

You can use the *magnifying glass* button (or press *z*) to facilitate the view of the tests.

5.2.7 Runs edition

You can add comments to a run or change the person (if you forgot to change the current person previously) If you select the desired run and click on the *Edit* button on the selected run, you can also find it on the menu, or by pressing the button *e*.

In the intervallic runs, since they are composed of a set of runs, this change will affect all the runs even if only one is selected.

5.2.8 Repair intervallic runs

Using *Repair selected* button or pressing *r*, you can add a track, modify a time or delete a track. If an intervallic run type has been defined to be limited to max *n* tracks, or max *n* seconds, this conditions will limit the repair functionality. When this happens, you will find an information text on the bottom of the window.

5.2.9 Runs delete

To delete a run, select it and click the *Delete selected run* button. Its equivalent in the menu or press *d* (delete). By deleting the test you will be asked to confirm it if the delete confirmation option is activated in the *Preferences* menu (more information in section 8.1 en la página 94).

Deleting an intervallic run will delete all it's tracks.

5.2.10 Creation of new run types

In order to adapt the software to the needs of each user, it has been included the function: *Add run type* (on *Runs* menu). This allows trainer to define easily and powerully the desired run types.

Created run type will be available on database to be used at any session, and it will be listed clicking on the *More* button at the *Run* or *Run intervallic* tabs (depending on which kind of run it's created). This new run type will be also differentiated on statistics, graphs and reports.

On creation, you should give it a distintive name and classify between simple or intervallic. If run type is intervallic, then you can limit is by tracks, time, or leave it unlimited.

The limit by tracks or time options can be defined as a fixed value or leaved as undefined. If it's defined fixed, all new runs of this type will be limited to that value; in the other hand, if the type is not fixed, user will be asked by limit value everytime a new run is done.

User can also fix the distances of the tracks. La ventana de creación de nuevo tipo de carrera concluye con la posibilidad de añadir una descripción textual. En las figura 5.12 y 5.13 puede observar la ventana de creación de nuevos tipos de carreras.

Last settings include: fix the distance of the tracks, and add a description to the run type. In the figure 5.12 you can see the creation of new run type.

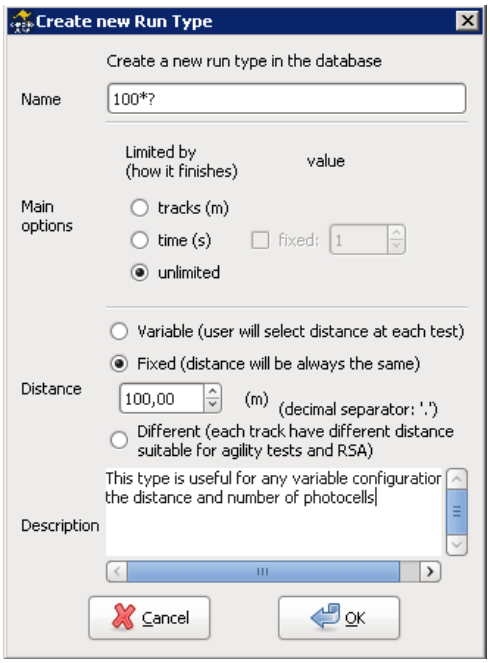


Figure 5.12: Creation of a new run type.

From Chronojump version 0.9, you can create intervallic runs with variable track distance. This is suitable to calculate speed in the different tracks of agility tests. In the test you can set the resting time.

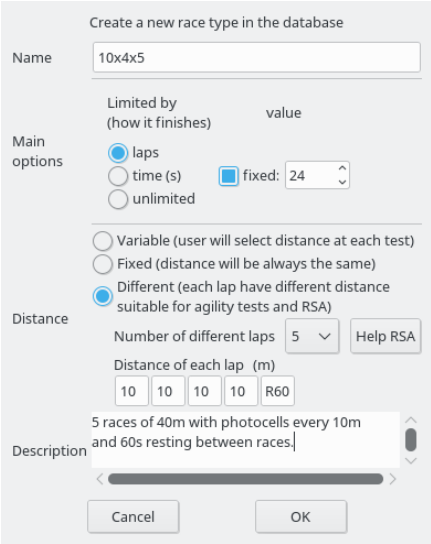


Figure 5.13: Creation of a new run type with variable tracks.

5.2.10.1 Examples on creation of new run types

Here you can find some examples on creating new run types. The names of the types have been invented in this manual. The table 5.2 is also useful to understand the different variables.

- *"Sprint10"* 10 meters of sprint run.
- *"SprintShortVariable"* Run below 20 meters, each runner will have run at a different distance defined by the trainer.
- *"20*5"* 100 meters run in 5 tracks of 20 meters.
- *"20*n"* 100 .Run 20*n meters (n tracks de 20 meters).
- *"40*50%fatigue"* Intervallic run where each person runs until 50%fatigue is reached. Time needed to fatigue is individual and known by trainer. Each track has 40m.
- *"100*?"* Person has to run tracks of 100m until trainer (or runner) decides to finish.
- *"2 min of 20-10-7"* Agility run on 3 tracks that have to be repeated during 2 minutes. First track has 20m, second 10m and third 7m.

Name	Type	Limited by	Fixed	Track length
Sprint10	Simple	-	-	Fixed(10)
SprintShortVariable	Simple	-	-	Variable
20*5	Intervallic	Laps	Yes (5)	Fixed(20)
20*n	Intervallic	Laps	No	Fixed(20)
40*50%fatigue	Intervallic	Time	No	Fixed(40)
100*?	Intervallic	Unlimited	-	Fixed(100)
2 min 20-10-7	Intervallic	Time	Yes(120")	Different(20,10,7)
10x4x5	Intervallic	Laps	Yes(24)*	Different(10,10,10,10,R60)

*The last resting is not accounted. 24 = 5*4 + 4

Table 5.2: Examples on run types created by user.

5.3 Races with RaceAnalyzer

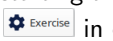
Chronojump RaceAnalyzer allows the analysis of the race by taking the time elapsed every 3cm traveled

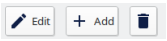
Figure 5.14: Simple analysis of a sprint

5.3.1 Data acquisition

The first time you connect the RaceAnalyzer in Chronojump you will be asked to select a device. Select the RaceAnalyzer compatible device from the detected devices list.

5.3.2 Acquisition config

Before starting the capture, select the type of race to be performed and, if necessary, click the Exercise button  in order to set up the race.

You can edit, add or delete test types by clicking the corresponding button  .

When editing or adding a type of test, a window like the one in the figure 5.15 will appear.

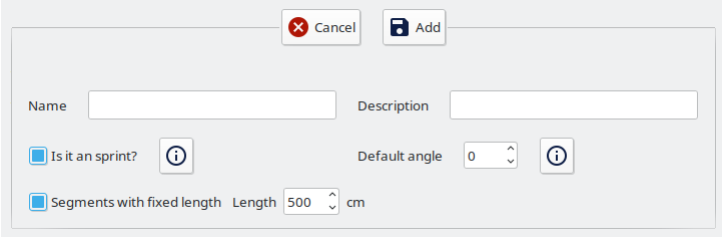


Figure 5.15: Properties of the test

The parameters are described below:

- Name: A short text to identify the test.
- Description: A longer text with a brief explanation of the test.
- Is it a sprint?: This parameter requires that the test be executed with maximum acceleration and speed during the duration of the test. When exporting multiple tests, those with this option will be analyzed as such, giving all the parameters that can be extracted from the model
- Fixed length segments: Segments that will have the length established in the length field will be analyzed. If this option is unchecked, an arbitrary number of segments and their corresponding lengths can be set.

Once the type of race to be used has been established, the conditions of the moment must be established.

- Distance: Specifies to what extent it will be analyzed. It does not affect data recording since data continues to be recorded as long as the end button is not pressed.
- Angle: If the test is not performed on a horizontal surface (0 degrees), the angle must be specified as positive if the test is uphill or negative if it is downhill.
- Temperature: The ambient temperature at the time of the test. This temperature affects the strength and power calculations of the analysis.

5.4 Encoder tests

5.4.1 Safety instruccions for linear encoders

An encoder is a precise instrument that has to be managed ALWAYS with care. Please follow this safety instructions.

If you broke your encoder contact us at hardware@chronojump.org

5.4.1.1 Safety magnets

Fix the encoder on iron or metal surface like the weights on a gym. Note some gym weights are covered with rubber and have not magnet power.

Figure 5.16: Magnets on a metal surface

5.4.1.2 Do not release

Do not release the wire when it is extended because it will return at high speed and will break it.

Figure 5.17: Wire handle

5.4.1.3 Make sure that the cable is correctly fixed

Allways be careful when manipulating the carabiner. Ensure that it is well secured in your fingers. A wrong grab could end up with a broken encoder. When possible, try to put a finger inside the carabiner to avoid it slipping from your fingers.

Fixing on a barbell

Fixing on a plates loads

Figure 5.18: examples of fixing

5.4.1.4 Do not exceed the 2.5m of range of movement

The encoder cable is 3m long but it never must be fully extended.

Remember that this limitation refers to the range of movement. If necessary, you can lengthen the thread by attaching another thread to the encoder.

5.4.1.5 Perpendicular use

Perpendicular use: Encoder measures distance, speed and power of the wire assuming it's perpendicular to the surface. If you pull/push the wire with an inclination, data will not be accurate and the wire can be damaged.

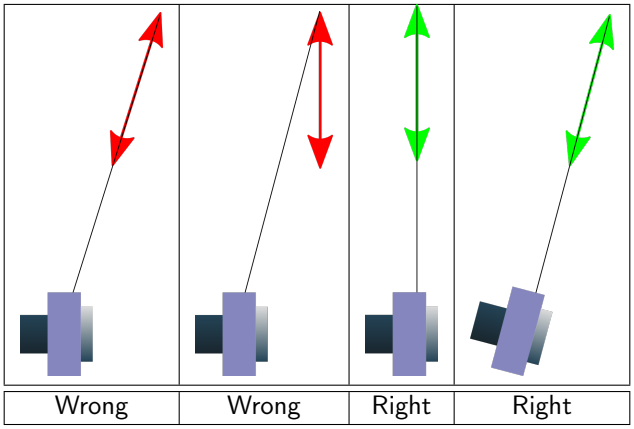


Figure 5.19: Examples of wrong and right using of the encoder

5.4.2 Concepts

This manual briefly describes some concepts. Understanding them is important to use the software appropriately.

5.4.2.1 Database

Chronojump stores data in one database file. Thus, instead of collecting the information in individual files for each session, most of the information is organized in a single file to facilitate the study of relationships between:

- sessions
- subjects
- exercises
- repetitions

All modifications in session, subjects and exercises, will be updated at any time in the database. So there isn't need to save the information periodically. If rare case, the program crash, you wouldn't lose any data except sometimes the exercise that is being performed at the time.

5.4.2.2 Sessions

The sessions represent situations where the coach or evaluator gathers subjects for a series of tests. Every time you gather a group of athletes to be tested in a short space of time (usually one day), you should create a new session. Although the subjects to assess can be the same as in other session, you should create a new one and load them from the other session. In this way, you can make comparisons between data over time.

5.4.2.3 subjects

All individuals able to perform the tests are known as subjects. It's strongly recommended to create one person only once in order to study the evolution over time. In following sessions the person can be loaded.

5.4.2.4 Exercices

Every time you want to measure, you perform an exercise. Exercise has a name (e.g. Bench press), an extra weight (e.g. 40Kg), type of contraction (e.g. concentric), laterality (e.g. both limbs), recording time (e.g. 45s) and others.

5.4.2.5 Sets (formerly signals)

When the person does the exercise, encoder generates a lot of data and sends it to the computer. Exercise duration is defined by the user who manages the software, but can be shortened if wanted. All the data received is called a "set". This set is saved automatically when capture ends. The set is meaningless, it doesn't have any information on how many repetitions of the movement has been done by the person who executed the exercise.

5.4.2.6 Repetitions (formerly curves)

When set is analysed, a number of repetitions are found. This repetitions have the mechanical data wanted by the evaluator: start, duration, speed, force, power. The repetitions are detected by the software automatically following user criteria. Videotutorial: Saving Repetitions `https://youtu.be/MoFKMGGLbdw`

5.4.3 Using the encoder

Chronojump main windows

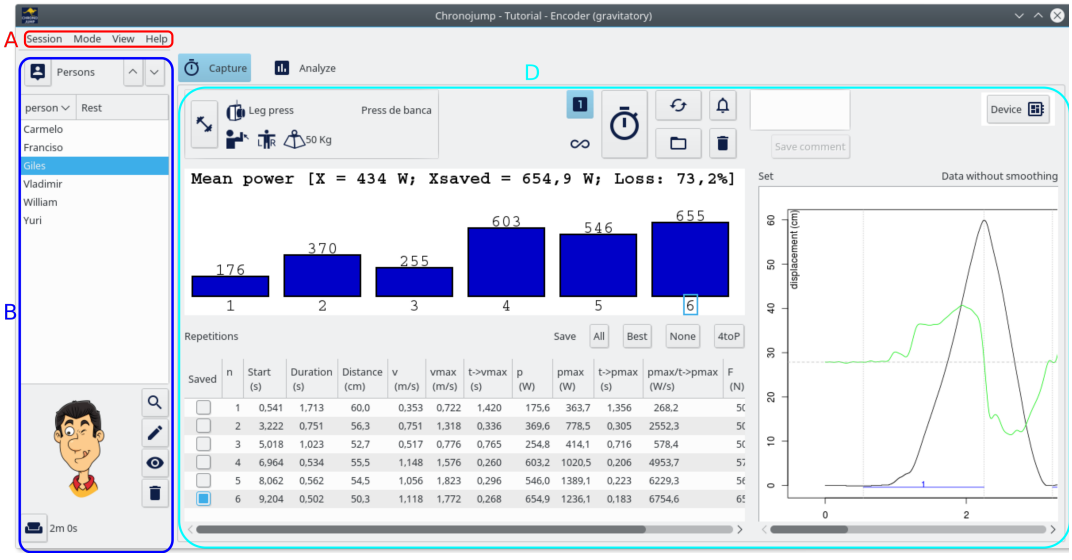


Figure 5.20: Main window

A) Starting on the top left of main window, there's a menu bar with session options and help. You should start your work creating a new session or loading an existing one.

B) The rest of the left part of the screen is related to subjects. On the top you can create new subjects or load from another session. Below you can select the current person and finally, at the bottom you can edit the person, see all it's tests and delete it.

C) The centre-right part of the screen is for managing the tests (or exercises). At the top there are two tabs: contacts and encoder. Select the encoder tab.

Inside the capture area there's six different areas

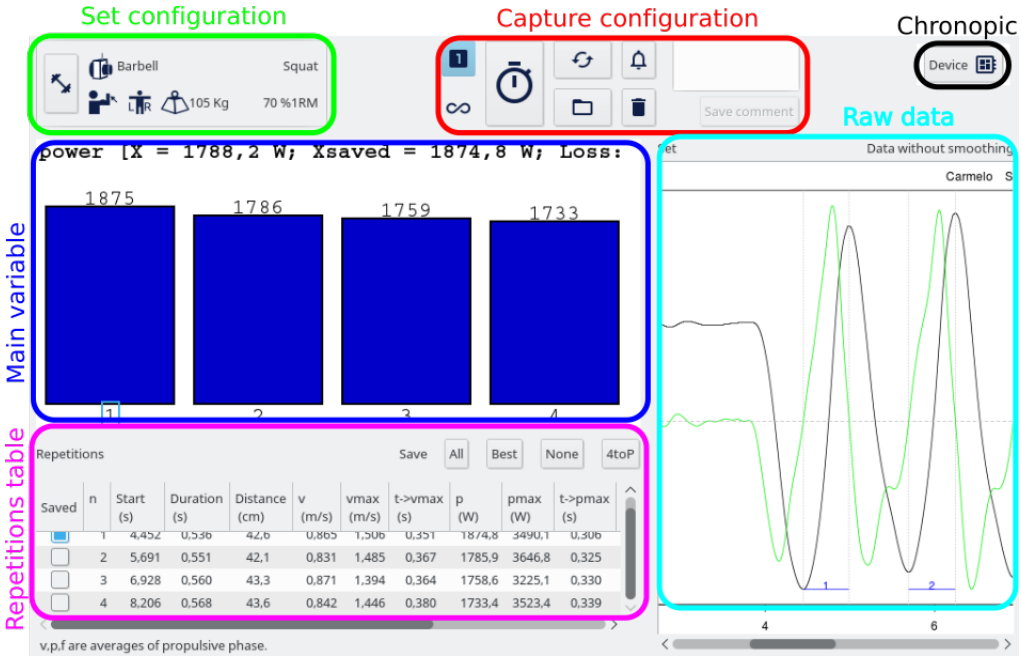


Figure 5.21: Capture area

5.4.3.1 Set configuration

This area shows the configuration of the set (machine used, exercise typo of contraction, laterality and load)

Clicking on the set configuration button will expand the corresponding dialog.

Figure 5.22: Set config button

This will expand the set configuration dialog.

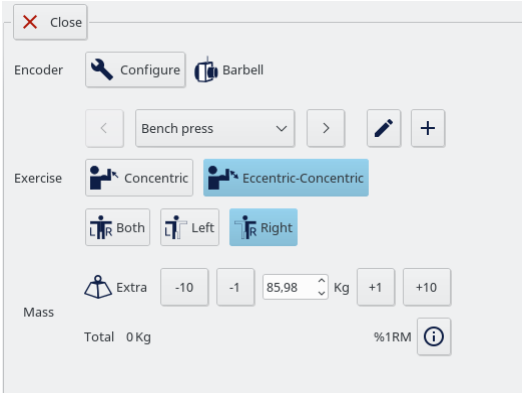


Figure 5.23: Set configuration

5.4.3.2 Encoder configuration

The first step for configuring the set consists in selecting the type of encoder connected, the type of machine at which the encoder is connected and the exercise that will be performed.

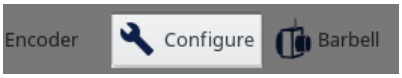


Figure 5.24: Encoder config button

Clicking on *Configure* button will show a new windows with different combinations of encoders/machines. Each type of encoder has a different set of configurations. The arrow buttons allow to change between different configuration of each encoder.

In 1.7.0 and newer versiona Chronojump can manage multiple encoder config. This way you can Create, delete, import and export diferent encoder configuration.

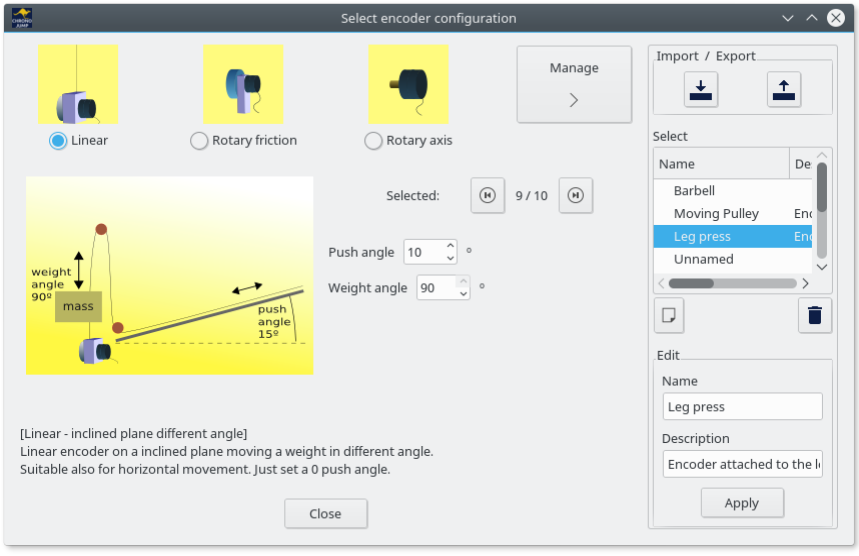


Figure 5.25: Encoder configuration admin

Each type of encoder has a diferent set of configurations. Clicking on the arrow buttons will change the configuration for this type of encoder.

There are three types of encoder:

- Linear.
- Rotary friction.
- Rotary axis.

Some configurations need additional parameters as angle, diameter or inertia momentum. Videotutorial: Capturing on an inclined plane machine `https://youtu.be/s-8Zel1RtGs`

5.4.3.2.1 Inertial machines configuration The characteristics of the inertial machines make necessary to enter a set of extra parameters that are being descrived below:

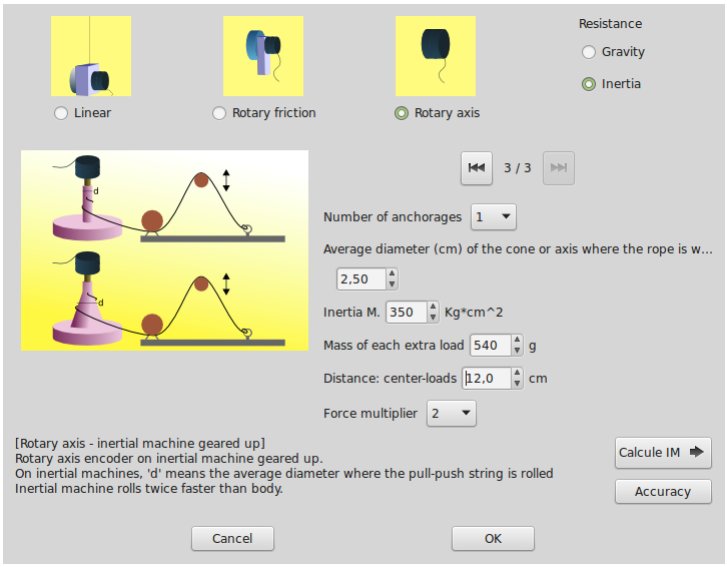


Figure 5.26: Inertial machines parameters

Using the rotary axis encoder (the most common), there's four types of intertial machines configuration depending on whether its movement is vertical or horizontal and wether the force is applied directly on a rope/ribbon or the force is applied on a moving pulley:

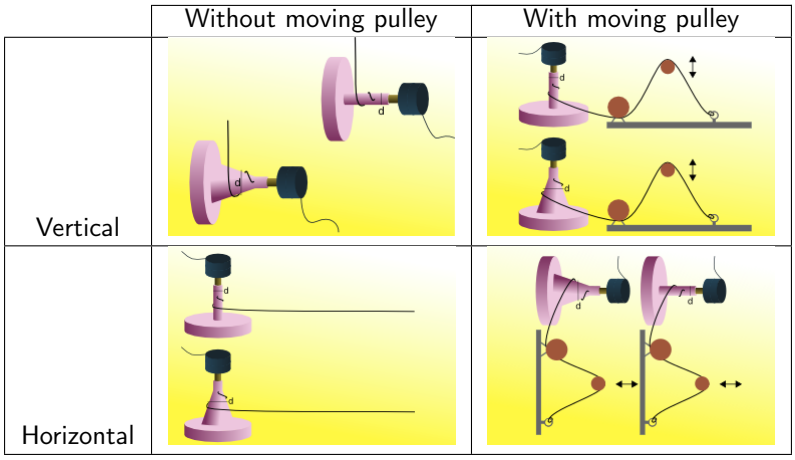


Figura 5.27: Rotary axis encoder configuration

Below are descrived the needed parameters:

- Number of anchorages: Some models of inertial machines have more than one anchorage allowing to change the mean diameter where the rope is wrapped. Selecting the number of anchorages will add or supress the options to enter the diameter of each one.
- Inertia momentum: This is a parameter that depends on each machine and is reffered to the machine without any extra load. Chronojump implements a system to calculate the inertia momentum that allows to config an encoder in almost all type of inertial machines. Follow the instructions in section to calcuate the inertia momentum of your machine configuration.
- Mass of each extra load: If the inertial machine allows to add extra loads to augment the inertia momentum, Chronojump will calcule it from the mass of eache one of this loads. This way, you have to enter the mass o only one load.
- Distance center-load: It is the distance between the center of the extra load and the axis of the inertial machine.
- Force multiplier factor: This parameter especifies the configuration of the pulleys set that allows the resistance of the machine to be a multiple or a fraction of the force that the machine would offer without the pulleys set.

Calculation of the inertia momentum The firs part of this section will explain how to calculate the inertia momentum (IM) of the disk in an inertial machine. The calculus of the IM of a disk with attached weights will be discussed in the second part. In the following link you can see a video of the process.

Calculing inertia momentum video

Inertia momentum of the disk To calculate the IM of the bare disk without weights we will use a reference weight. Remember, although we will use an attached to the disk weight, the results given by Chronojump in this part of the process refers only to the disk without any weight.

1. Put the machine in a any position that makes the disk rests in a vertical plane.

2. Attach a known weight to known distance from the center of the disk. This way the disk will be unbalanced and after lifting and living the weight it will start to oscilate like a pendulus.

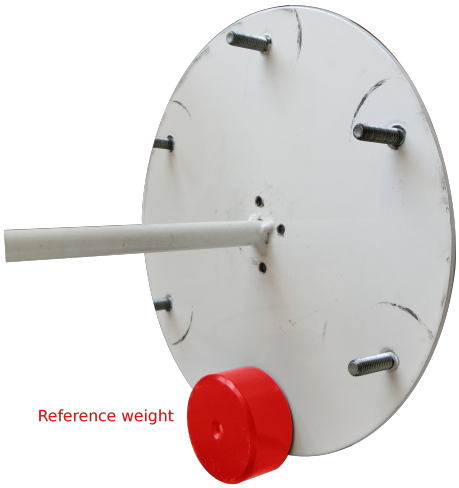


Figure 5.28: Reference weight

3. In chrono jump software, with the encoder connected go to Select encoder.

Figure 5.29: Select encoder button

4. Choose type of encoder you will use, and select the Inertial machine option.

5. In this windows you will be asked for the diameter where the rope is wrapped and the IM of the machine. Note that in conical machines this diameter changes continuously as the disk is spinning. We recommend you to use the mean diameter of the part of the cone where the rope is wrapping at.

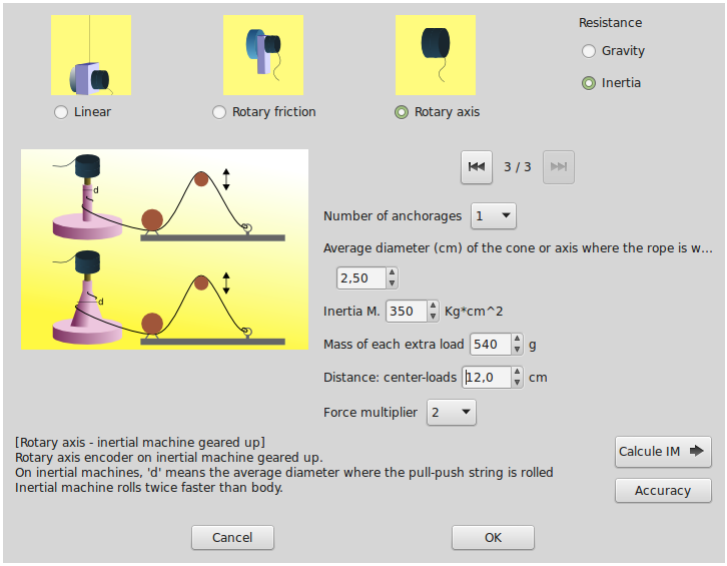


Figure 5.30: Parameters of the inertial machine

6. As you want to know the IM, click on "Calculate IM"
7. Enter the weight (in grams) of the reference load and the distance (in centimeters) to the center of the disk.

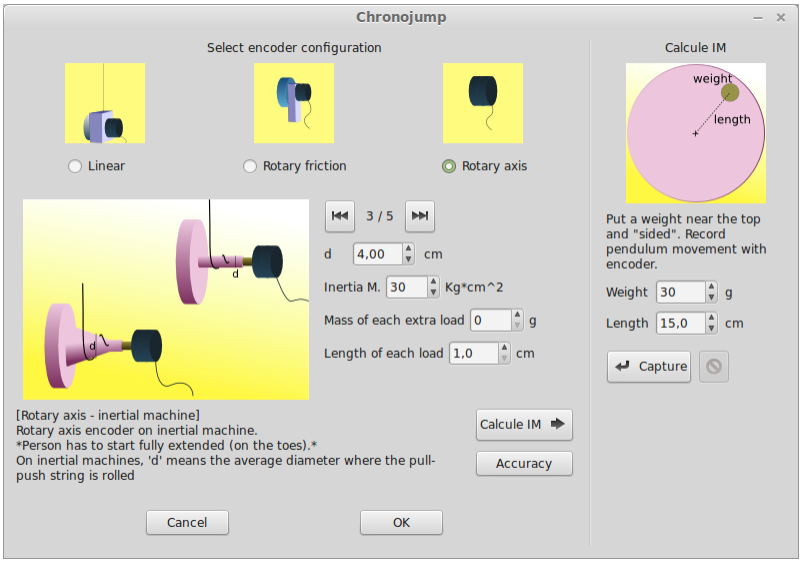


Figure 5.31: Parameters for calculating the IM

8. Pull the weight to approximately 90 degrees position and leave it. The disk should start swinging.
9. Quickly, click on the capture button. You will see the signal sent by the encoder. Chrnonojump will detect when the machine stops moving and will return the calculated IM.

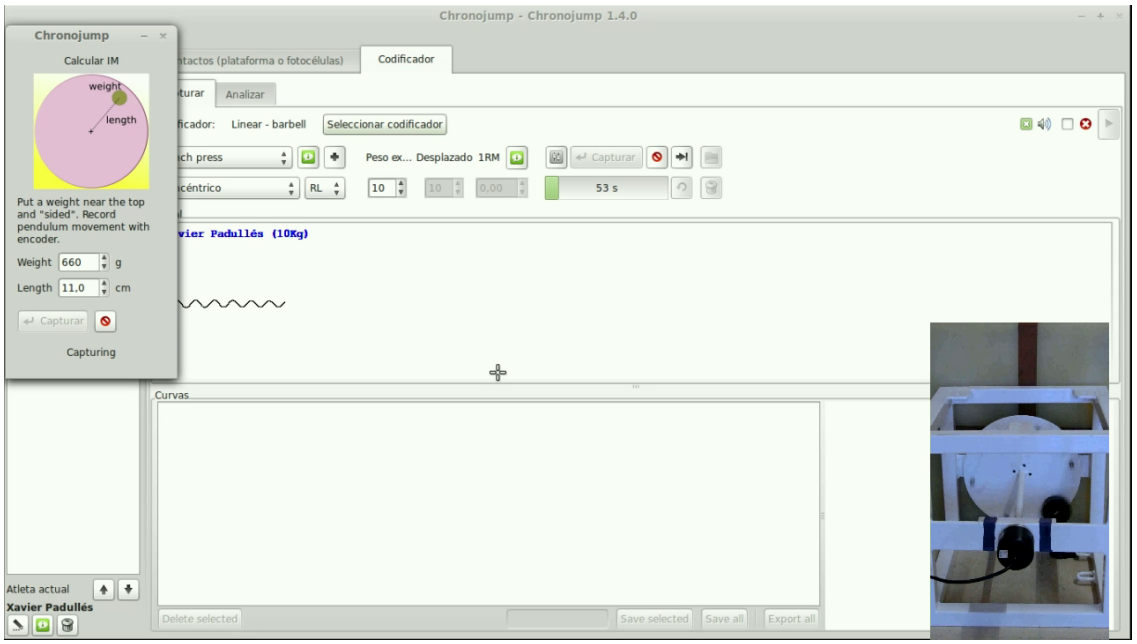


Figure 5.32: Capturing the oscilation

Inertia momentum of the disk with attached weights. In the encoder configuration you should enter the distance from the center of the extra loads to the axis of the disk as well as the weight of the extra weights. This way in the exercise capture windows you will be asked for the extra weights that are attached to the disk as shown in the figure below.

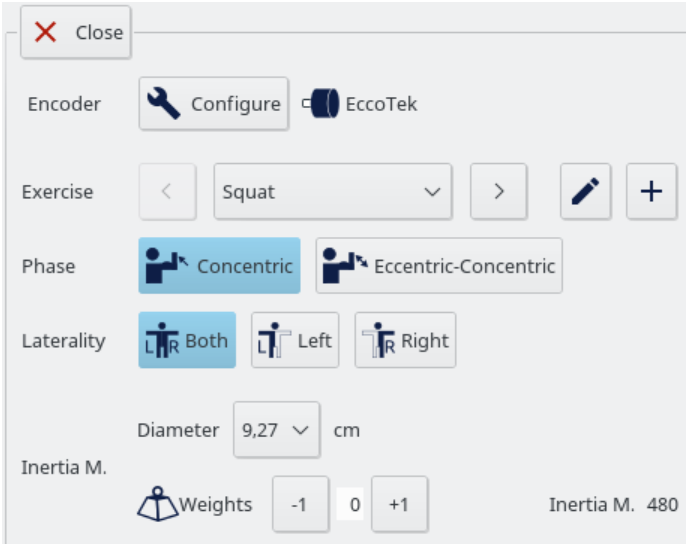


Figure 5.33: Exercise capturing with inertial configuration

Below the extra loads selection box the total inertial momentum is shown in Kg*cm²

Chronojump uses the next formulae:

$I_w = M * d^2$

Where:

- I_w is the Inertia momentum that each weigth will add to the system.
- M is the mass of the weight.
- d^2 is the square of the distance from the center of the disk to the center of the weight.

And the inertia momentum of the disk with the attatched weights

$I = I_d + n * I_w$

Where:

I is the total inertia momentum. This is the value you must enter in the chronojump software.

I_d is the inertia momentum of the disk calculated in the first part of this section.

n is the number of weights added to the disk. - is the inertia momentum of each weight calculated above

5.4.3.3 Exercise configuration

In the exersise section you will find a drop-down with some preconfigured exercises. Chronojump allows to edit an exercise  or create a new one  .

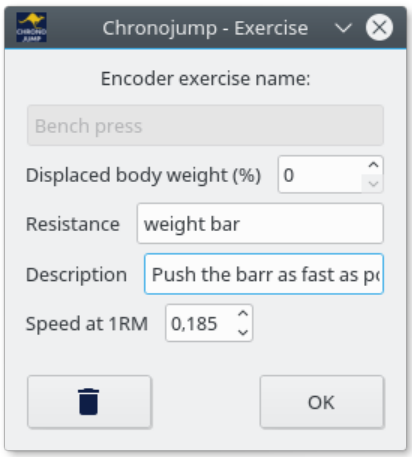
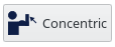


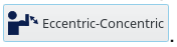
Figura 5.34: Exercise configuration window

In the exercise configuration window the following parameters will be shown:

- Name of the exercise: Identifying text that will be shown in the exercise drop-down.
- Displaced body weight: Percentage of the body that is displaced during the exercise.
- Resistance: Descriptive text where is specified the type of resistance used.
- Description: Short information text with the description of the exercise.
- Speed at 1RM: Speed of execution when the load is the one that allows to only one repetition. This parameter is mandatory if you want to calculate the 1RM with the method "1RM any exercise".

5.4.3.4 Selection of phase or phases analysed

At the time of showing or analyzing you must select if the concentric phase (force in the same way that speed) 

or both (excentric and concentric) 

.

5.4.3.5 Laterality

For information purpouses the laterality with which is executed the exercise is also stored. This will be usefull is you want to see asymmetries in different muscle groups.

5.4.3.6 Resistance

Finally, the resistance that will be used is configured.

In the gravitatory exercises. the extra mass that will be moved will be introduced without taking in account the mass of the athlete.

Figure 5.35: Configuring the extra mass

The extra mass of the exercise will be calculated using the formula

$$TotalMass = \frac{PersonMass * \%DisplacedBodyWeight}{100} + ExtraMass$$

At the right of the total mass will be shown at which percentage of the 1RM of the person the extra mass corresponds.

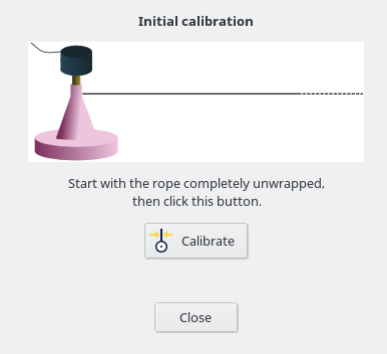
In the case of inertial exercises, the diameter (depending on the ancorages) and the extra loads need to be entered.

Figure 5.36: Inertia config

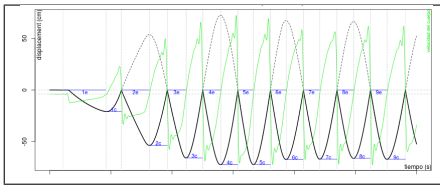
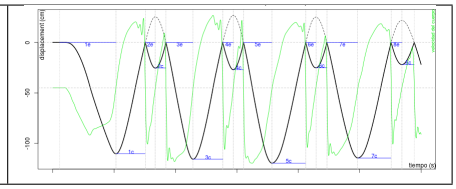
5.4.4 Capture configuration

In the acquire area a new set can be captured  or a previusly captured one can be loaded 
.

Important!: Using inertial machines, after opening the software the first time that an aquisition is made, a calibration of the machine must be done. It requires to unwrap completely the rope/ribbon and clicking on calibrate.



When using inertial machiens, remember always start with the rope fully unwrapped when you press the capture button. I you don't do that, you will see that half of the repetitions have a much smaller range of movement than the other half.

Right execution	Wrong execution
	

During the capturing process you can finish  or cancel  the set. In the first case the capture will finish and the data will be saved. In the second case the data will be discarded as well as all the associated data.

Feedback /Rhythm

This window shows the information that will be shown during the capturing process.

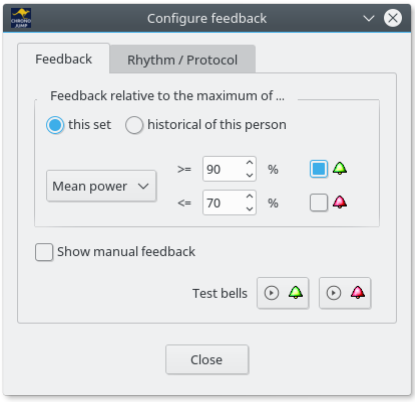


Figure 5.37: Feedback options

In the Feedback tab you can configure the visual and sound signals in function of the selected variable

and referred to the best repetition or to the history of the athlete with this load and exercise.

The drop-down allows to select the variable that will be used to colour in green, blue or red each repetition.

The bells allow to config the threshold at which the bars will be shown in green (greater than the specified value) or red (less than the specified value)

The Rhythm tab allows to configure an advanced metronome in which you can select the desired time of each phase of the execution.

Selecting *Show rhythm while capturing* will show a set of options that will allow to config the duration of the excentric and concentric phase.

If you want to use cluster of sets, click on *Use clusters*. This option allows to execute the specified number of repetitions in a cluster and rest the amount of seconds specified between clusteres.

Load

The load button  of this frame allows to load a set, save set again with a comment (just write comment in the area and press update), or delete the set. The load set window is used also to manage all the sets of current person. Right click on it to change the person who performed the exercise, add a comment or delete any set of a given person. Videoturotial: Edit set `https://youtu.be/UiZJKbU4OSg`

Recalculate

Recalculate can be used after capturing or loading. When user detects that some parameter has not been set correctly and wants to perform calculations of the set again, user can change the selector and press "recalculate"  . E.g. 40 seconds squat has been done and the extra weight introduced was 40Kg but user forgot to add the weight of the lift bar. After capture, user can change 40Kg to 55Kg and then press "recalculate" in order to have the force and power calculated correctly.

Delete

If you need to delete a set, click on the trash icon  .

5.4.5 Chronopic

The device button allows to specify which typo of device is going to be used. Each time a new device is connected to Chronojump the type of device must be specified. This configuration will be remembered by Chronojump for future uses.

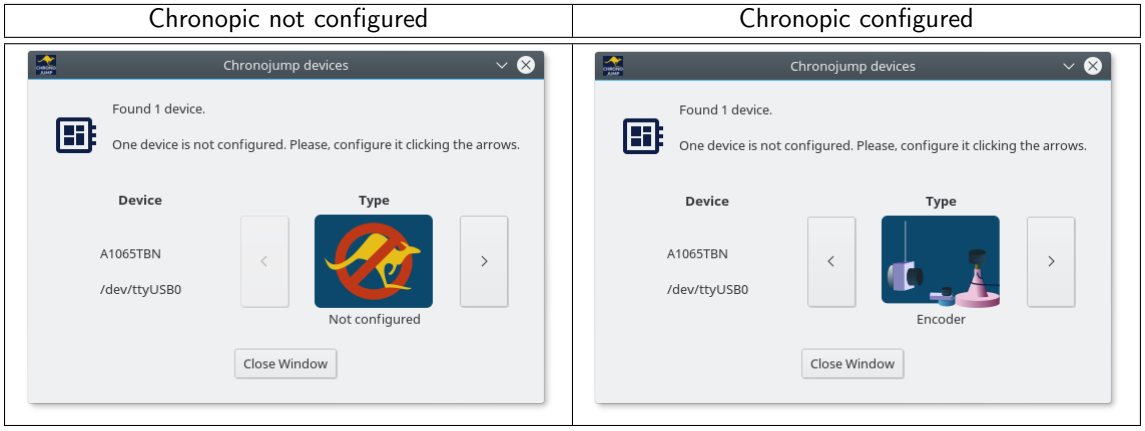


Figure 5.39: Device window

5.4.6 Bars of the main variable

The bars frame shows, during the exercise, the main variable in real time. This way the athlete can have an instant feedback of every execution of the exersice.

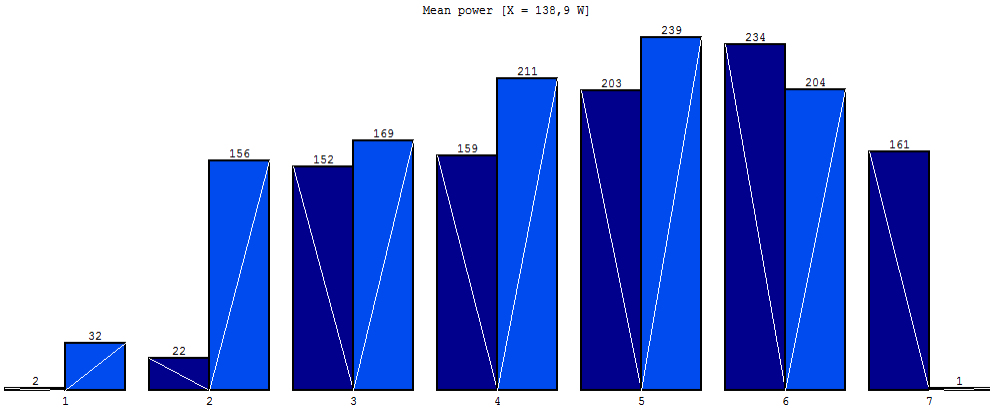


Figure 5.40: Power bars

The descending white line in the bar indicates an excentric repetition. An ascending line, a concentric.

The saved repetitions apears with a framed number below.

5.4.7 Repetitions table

Once set is loaded, captured or recalculated, Chronojump will find repetitions and write their data on a table. Here you can delete a repetition, save the selected repetition, save all or export them to an spreadsheet software. Most users will save only a repetition, or delete a repetition and the press "save all". This repetitions can be analysed at the Encoder analyse tab.

Saved	n	Start (s)	Duration (s)	Distance (cm)	v (m/s)	vmax (m/s)	t->vmax (s)	p (W)	pmax (W)	t->pmax (s)	pmax/t->pmax (W/s)	F (N)	Fmax (N)	t->Fmax (s)
☑	1e	5,514	0,670	31,1	0,488	0,914	0,001	970,8	1651,5	0,051	32383,0	1989,1	2209,3	0,148
☑	1c	6,183	0,532	44,8	0,922	1,661	0,330	1849,9	3698,2	0,292	12665,1	2112,7	2643,1	0,230
☐	2e	6,714	0,716	43,1	0,598	1,118	0,002	1120,9	2112,7	0,025	84506,7	1877,4	2204,4	0,469
☐	2c	7,429	0,544	44,2	0,868	1,676	0,352	1759,1	3968,6	0,311	12760,8	2093,0	2713,8	0,287
☐	3e	7,972	0,738	45,5	0,355	0,541	0,002	656,1	903,2	0,029	31145,4	1893,1	2235,6	0,169
☐	3c	8,710	0,569	46,5	0,871	1,677	0,374	1731,3	3773,4	0,332	11365,6	2057,9	2695,8	0,289

Figure 5.41: Saving and deleting repetitions

To save or delete a repetition just click on the checkbox "Saved" of the repetition you want to save or delete.

In excentric-concentric mode, saving a excentreic (concentric) repetition will also save the corresponding concentric (excentric) repetition of the exercise.

5.4.8 Raw data

During the capture this frame will show the set sent by the encoder. Once finished Chronojump will calculate all the repetitions and show them in the same frame with some basic graphic information.

5.4.9 Encoder settings and preferences

In order to configure the encoder capture parameter, in "Menu -> Session -> Preferences -> Encoder capture" you will find the next parameters:

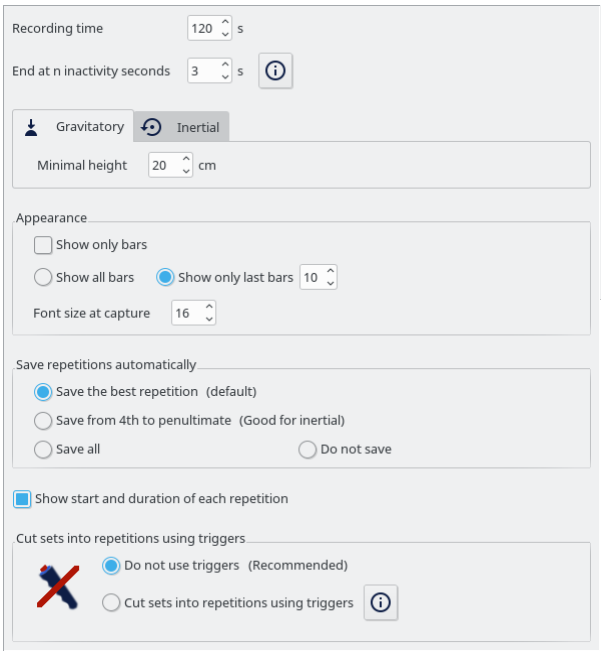


Figure 5.42: Encoder preferences

- Recording time. Sets how long Chronojump will register during the set in case the capture is not cancelled manually.

- End at n inactivity seconds. If Chronojump detects that the encoder is not measuring any movement during this seconds, the program will finish the capture process.
- Minimal height. The minimum range of movement of a repetition in centimeters. For example, in a bench press taking the bar for the first time (from a bar support) won't be considered as a repetition because the rang of movement is less than the value specified.
- (Inertial) On inertial discard first repetitions: Allows to discard the submaximum repetitions in whitch the subject has not reached the maximum velocity of execution. This repetition will not be taken in account when calculing the mean values of the set and will be drawn in gray.
- Show only bars. This option allows that the repetitions table to be shown in another table and not show the raw data area, reserving much more space for the bars area. To see the repetitions table click on the tab "table" in the left lower part of the area.

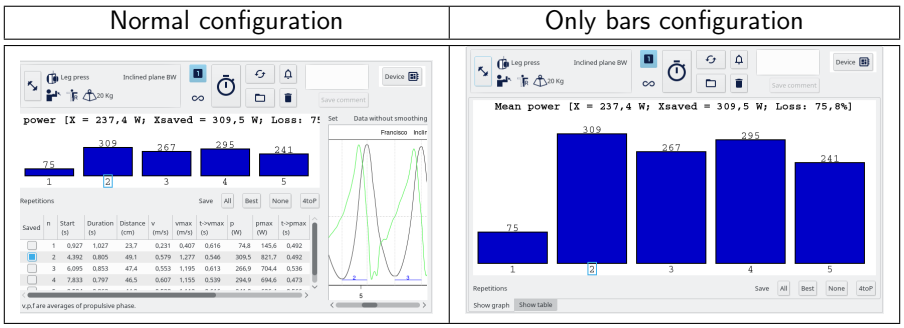


Figure 5.43: Only bars option

  - Show all bars. If this option is selected all the repetitions will be shown and after each repetition all the bars will be resized to fit in the bars area.
  - Show only last n bars. Allows to show only the last bars of the set. In this mode the bars won't be resized but at each repetition the bars wil slide from right to left.
- Save repetitions automatically. Allows to save the repetitions automatically depending on the specified criterion.
- Cut sets into repetitions using triggers. In the section the use of the triggers during the set is detailed.

5.4.10 Other encoder configurations

In the tab called "Encoder other" some preferences that are less commonly used can be found.

- If you want to do calculations of mechanical parameters only in the propulsive phase just ensure the parameter "propulsive" is active. The meaning is the following: In a fast concentric movement where there's little weight displaced, the brake action of the person in the final phase of the movement will not be used in the calculations. Nowadays most coaches prefer this option active because they noticed that the comparison of mean power between a light weight and a heavy weight exercise is not fair because the brake phase in the light weight exercise is related to negative force and the power values get very low. Then, if "propulsive" phase is active, only this is used, and not the "brake" phase.
- The next options are related to smoothing of the capture and we recommend to leave them untouched.

- In the *1RM prediction,* the method to get the linear regression can be selected. The exponent in the weight means that the larger is the mass of the point used the larger is the weight used for the regression. The function of the weight can be zero (non wighted), one (linear), two (quadratic) or three (cubic).

5.4.11 Using triggers

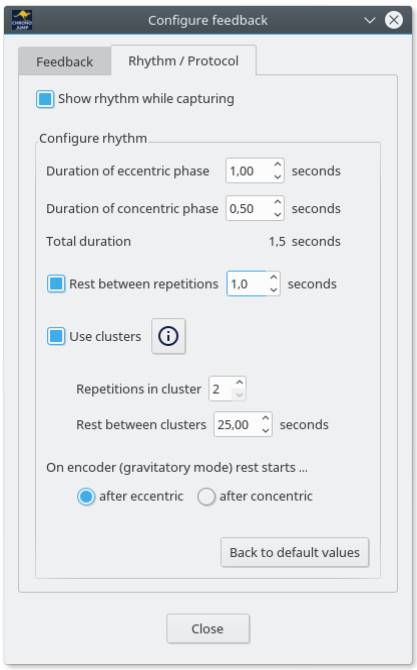


Figure 5.38: Rhythm

Since 2017, the Chronopic new models allows to read external synchronization signals or triggers. These signals will be generated using any device that close an electric contact (button, photocell, contact platform...). You can check if your Chronopic can read it by pressing the test button in it. If a green LED turns on it means that your device can receive trigger signals.

Figure 5.44: Push Button

These signals can be used to cut the set into repetitions so that each signal indicates the start of a repetition or simply to highlight an instant that could be of interest. To specify this behavior go to Menu -> Session -> Preferences -> Encoder -> Cut sets into repetitions using triggers.

If you want to identify certain instants inside the execution of the exercise, in the instantaneous analysis of the repetition you will see a dashed vertical yellow line that indicates the moment at which was produced the trigger signal.

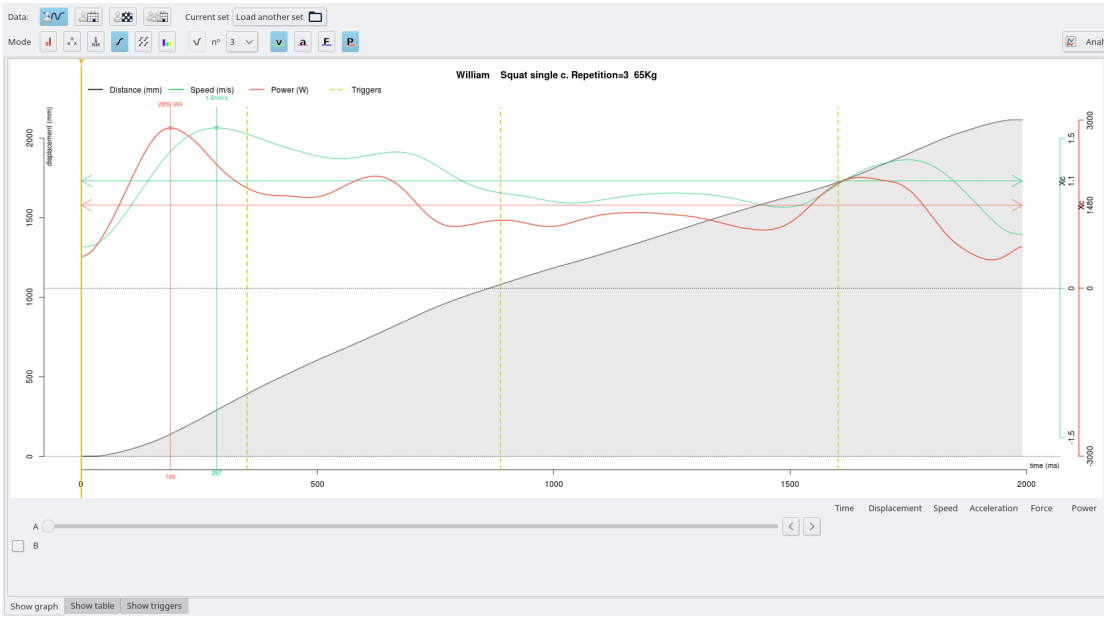


Figura 5.45: Triggers

Besides, if you want to se the instants in milliseconds of the rising (In) and falling (Out) flank you can click on the tab "Show triggers" on the lower side of the analysis frame.

5.4.12 Examples of encoder use

At the Gym:

1. On the floor, at the side of the weight bar, put a gym weight (not made by rubber) and encoder on the top of it (attached with the magnets).
2. The carabiner is attached to the barbell or the training machine.
3. Athlete1 and athlete2 start the warming up slowly and full range of movement (in a different place) while evaluator prepare the software.
4. Evaluator starts Chronojump software, loads a session prepared the day before (session parameters and subjects were already introduced).
5. Evaluator connects Encoder-Chronopic to the computer using USB cable.
6. Evaluator selects the port at Chronopic window, at the encoder tab.
7. On main window, go to encoder, capture tab.
8. Select exercise options: bench press, extra weight: 20Kg (10 bar + 10 gym weights).
9. Select athlete1. Click on capture. See the results but have no time to analyse them now. The set is automatically saved.
10. Select athlete2. Click on capture. See the results but have no time to analyse them now. The set is automatically saved.

11. Select exercise options (extra weight: 30Kg). Change weight of bar + gym weights to 30Kg. Then repeat [9] and [10].
12. Repeat the process every time with 10Kg more until one repetition cannot be done.
13. Close the software and carefully detach the encoder hook from the weight bar.

Later, at home:

Open software.

1. Load session, select athlete1, load first set, and "Save all" repetitions.
2. Repeat [2] for all the sets of Athlete1 and Athlete2.
3. Go to analyse tab. Click on group intrasession . Select the exercise. Choose repetitions, "Power / Load" and click on "Analyze.
4. Use the resulting values to prepare training related to power.

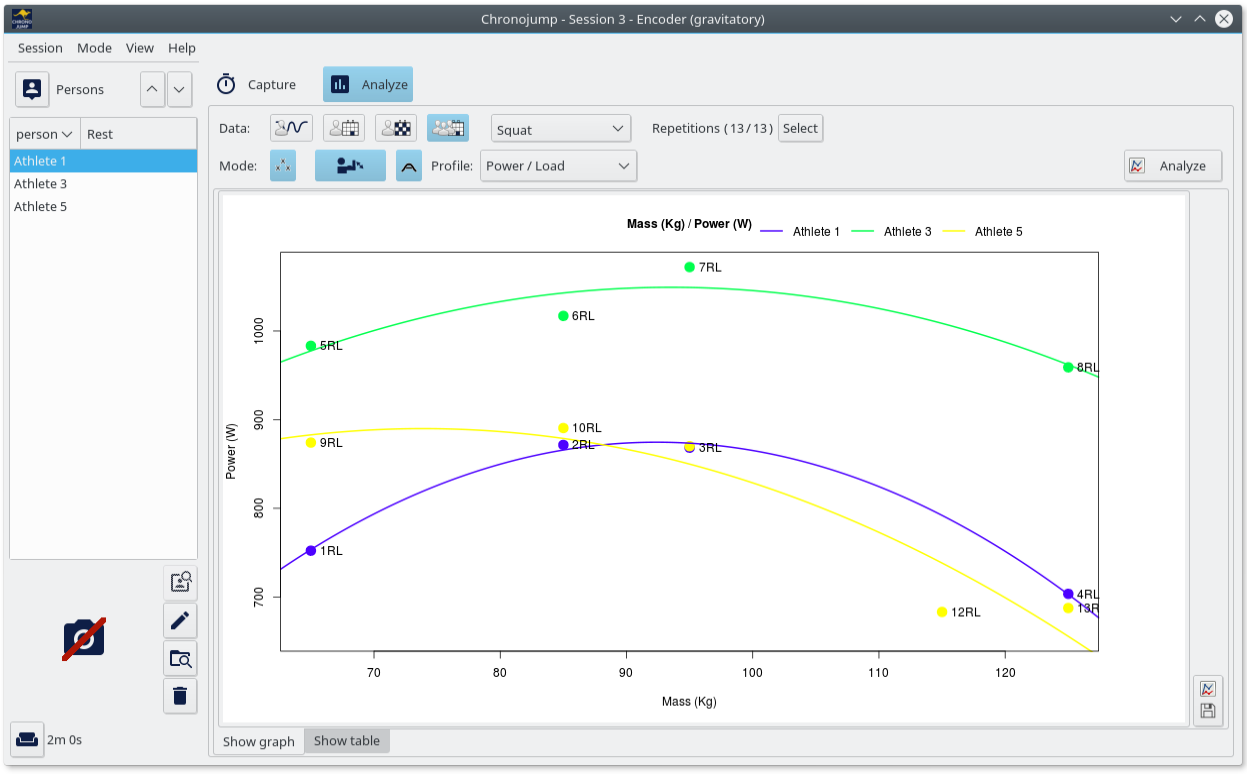


Figure 5.46: Example of encoder use

5.5 Force test

Chronojump allows to measure in realtime the force applied on a force sensor. This force can be transmited to the force sensor with ropes, straps, rubber bands or rigid objects. This way the measured force can be isometric if you are using non elastic elements or dynamic if elastic elements are used.

5.5.1 Safety instructions

The force sensor has an attached cable that never should be disassembled, since it would irreparably damage its internal electronics.

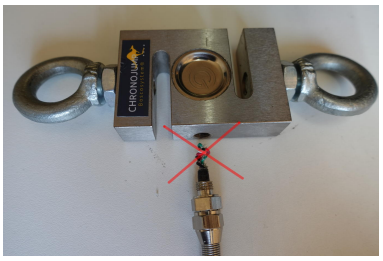


Figura 5.47: Broken cable

5.5.2 Connecting the force sensor

In order to connect the force sensor to Chronojump, connect the strength gauge to the converting device and this to the computer with the mini-USB cable.

The first time you connect the device to the computer you must config it clicking on the *device* button 

. A window with a list of connected devices will be shown where you should identify the type of device. Click on the device compatible with the force sensor.

5.5.3 Tare and calibrating the force sensor

Due to the analog nature of the force sensor, it must be tared and calibrated.

The tare process consists of indicating the state in which the sensor should register a force of 0 Newtons.

The calibration process consists in increasing the force that the sensor receives and establishing a linear relationship between force increase and the electrical response of the sensor increase.

To perform the tare and calibration process you must press the Adjust button 

.

The following options will appear:

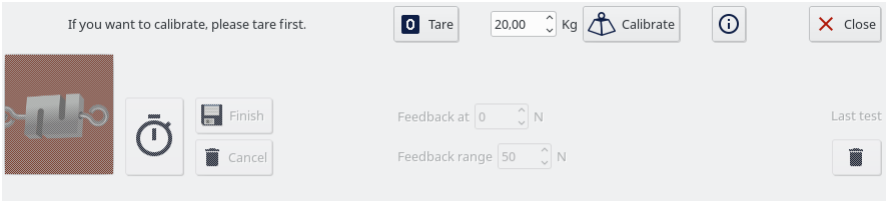


Figura 5.48: Force sensor adjusting

5.5.3.1 Tare (previous to calibration)

To carry out this process place the sensor hanging from one end without supporting any external force apart from the elements necessary to anchorage the load that will be used later for the calibration

(carabiners, ropes, webbing, etc). Then press on the Tare button. Chronojump will record for a few seconds and save the result.

Figura 5.49: Vertical taring of the force sensor

5.5.3.2 Calibration

Calibration consists in establishing a linear relationship between the electrical signal of the sensor and the real force. This ratio may vary depending on the sensor, temperature, humidity ... Therefore it is recommended to do a calibration the first time you use the sensor. By default Chronojump will use a generic calibration.

To perform the calibration, type in Chronojump the mass in kg of an object whose weight is known. Assuming you want to measure tensile forces, attach the object to the sensor and lift it so that the sensor supports the weight of the object.

Figura 5.50: Force sensor calibration

In case you want to measure compression forces, let the weight rest on the sensor having previously removed the eyebolts from it.

Ii necessary, in the configuration of the capture you can invert the sign of the signal.

The closer the weight is to the forces to be performed, the more accurate the measurements with that calibration will be. Once the weight is stable and stable, click on the calibrate button.

5.5.3.3 Tare (after calibration)

In most cases the weight of the force sensor must be taken into account when measuring the force exerted by the analyzed subject. In this case, before performing the data acquisition, a new tare must be done but this time with the sensor in a horizontal position on a stable horizontal surface and without any external force.

Figura 5.51: Horizontal tare of the force sensor

In this way the sensor will also register its own weight and any element you add (carabiners, ropes, webbing, etc).

In the case where the subject does not have to support the weight of the force sensor, it will not be necessary to do this new tare.

5.5.4 Data acquisition

Each record will be associated with a subject, an exercise and a laterality.

Data recording will be done using the stopwatch button  .

During the data acquisition you will see a line that will vary in height depending on the force that is being detected by the sensor.

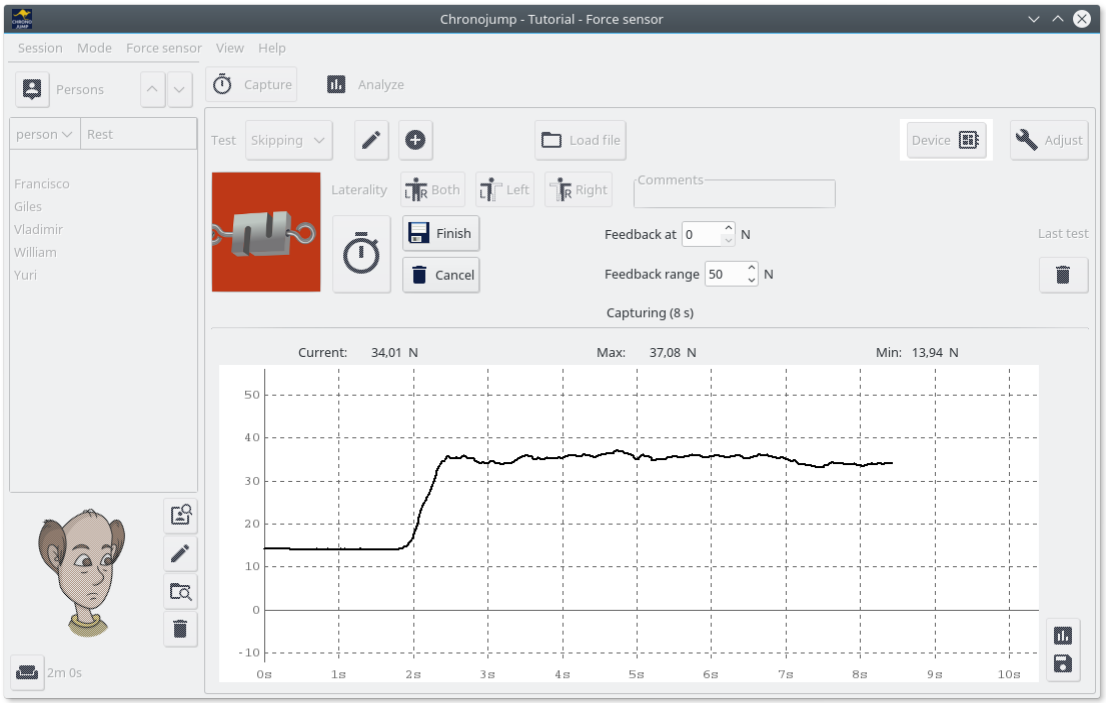


Figura 5.52: Realtime data acquisition

To finish and save the exercise data you can click on the "Finish" button or press the "Enter" key

Pressing the “Cancel” button will not save the data and consequently the capture will be lost.

The data of the signal can be shown as standard data, absolute data or inverted data

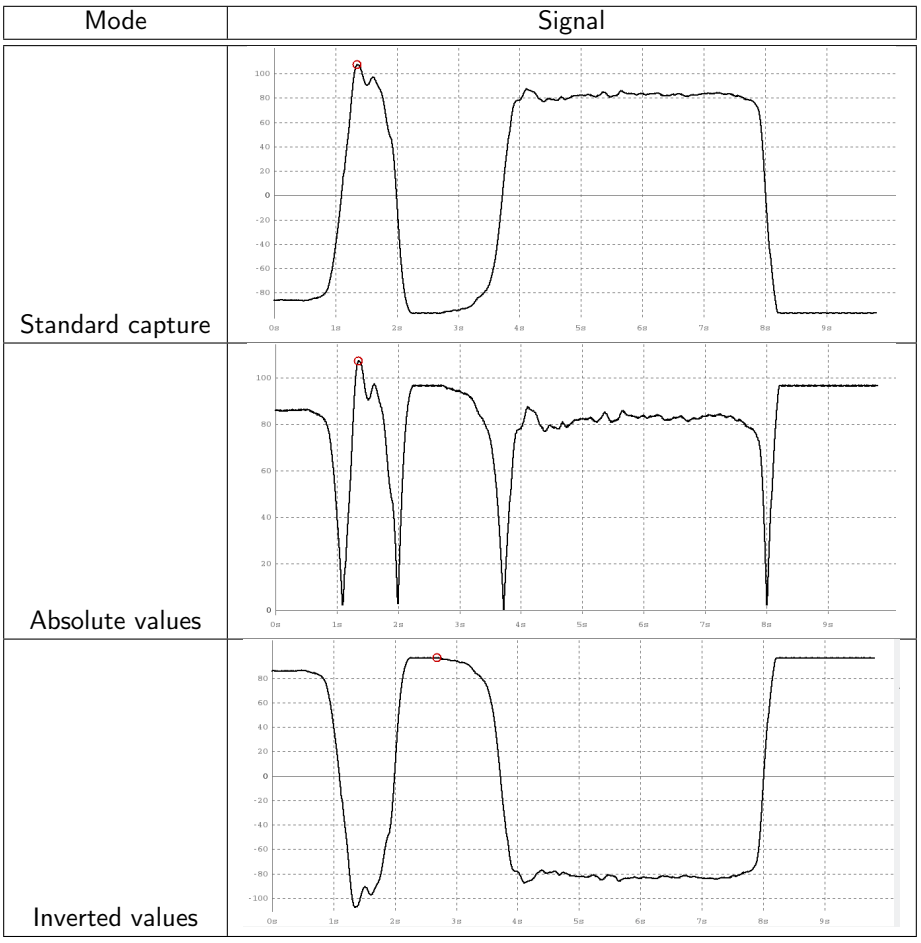


Figura 5.53: Signal treatment

During the data aquisition it can be shown a fixed time range or a range that will grow as the elapsed time is increased. If you want to use the first option you can go to Menu -> Session -> Preferences -> Force sensor and select the option Scroll

5.5.4.1 Feedback

During registration, a horizontal line can be displayed at the specified force as well as a yellow interval around it.

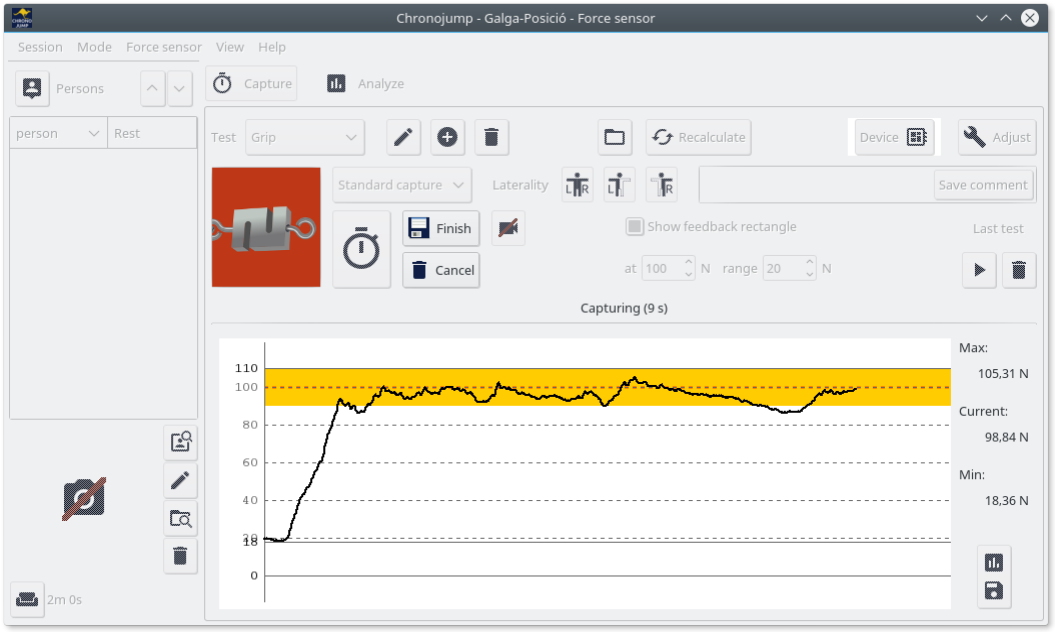


Figura 5.54: Feedback during the exercise

This option allows to analyze the stability of the signal.

Subsequently, in the analysis you can analyze the average error between the real force and the specificity force in the Feedback

5.5.5 Creation and edition of the test types

You can edit or create as many tests as you want clicking on and .

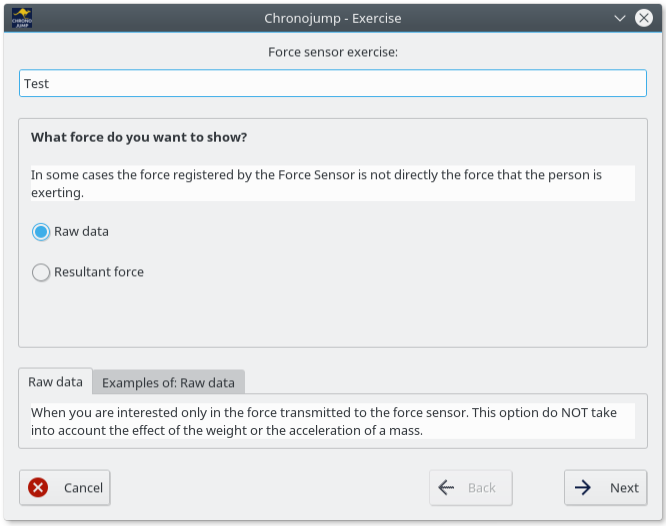


Figure 5.55: Creation/Edition of a test type

5.5.6 Set edition

All the Chronojump sets can be edited.

If you want to change the athlete or the comment associated to the set click on the load button  and in the dialog that will be appear click on Edit.

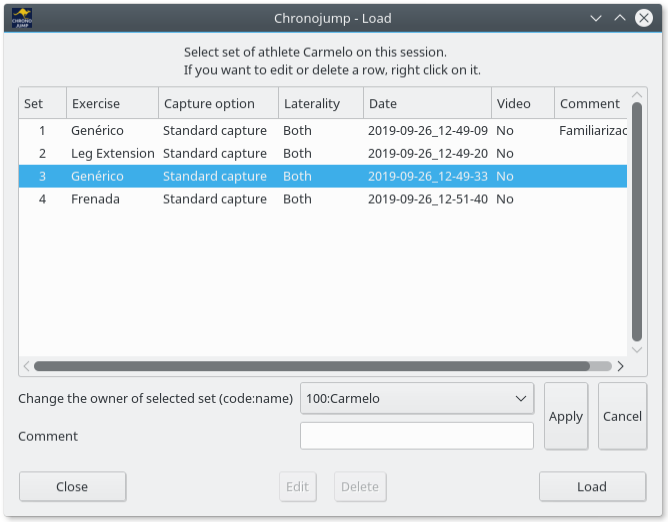
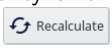


Figure 5.56: Edit the athlete or comment

If you want to change the test type of a set, la laterality or the signal treatment, load first the set, change the desired parameter and click on recalculate 

.

5.5.7 Exercise analysis

There are two types of analysis:

- Manual analysis: Allows the different variables to be analyzed millisecond to millisecond.
- Automatic RFD analysis: Performs an automatic analysis of an isometric force test in which, starting from a minimum or zero force, the subject tries to reach the maximum force possible in the shortest time possible. This force will remain for a few seconds.

5.5.7.1 Manual analysis

Clicking on the analyze button 

you will enter the general analysis mode.

If you do not have a loaded exercise, it will not be necessary to load one using the “Load file” button

Figura 5.57: General analysis of an instant

Using the A slider you can analyze the instantaneous values over time.

The time in milliseconds, the force in Newtons and the RFD of the analyzed moment will be indicated in the lower right.

Activating slider B can analyze a time interval.

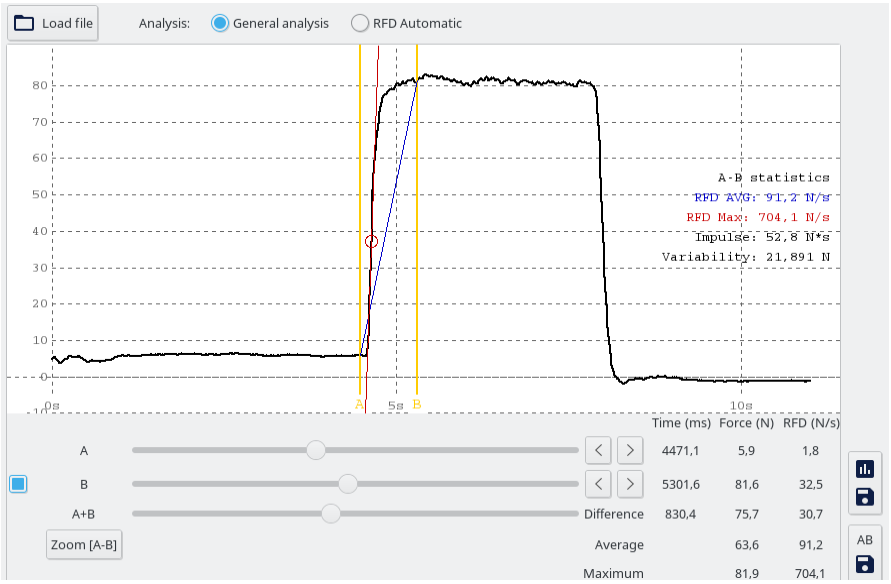


Figura 5.58: General analysis of a time interval

With the slider B activated, in addition to the data of a second instant, the difference, the average and the maximum of each variable in the specified range will be shown. Impulse, variability and, in the case of having the feedback activated, average error values will also be given.

The "A + B" slider allows you to simultaneously move the A and B sliders.

In addition, once the "A + B" slider has been activated, the zoom button Zoom [A-B] will appear. Once it is clicked, only the selected interval will be displayed.

5.5.7.2 Automatic RFD test

Chronojump allows, using a sensor force, to perform a test of maximum isometric force to measure some parameters like:

- Instant force
- Maximum force
- RFD
- Impulse

This parameters can be measured from:

- Real force or raw data (Black).
- Modeled force using an inverse monoexponential function (Blue).

The RFD refers to Rate of Force Development. This variable is the derivative or the slope of the function force versus time.

5.5.7.2.1 Configuring the maximum isometric force test The onset of the test is allways calculated automatically. The duration of the test can be configured automatically or manually.

- Automatically: The test will be considered that is finished when the force falls a 5% of the maximum force.
- Fixed: A fixed number of seconds from the begining of the test

In the Menu -> Session -> Preferences -> Force sensor tab you can config up to 4 values of RFD and 1 of impulse.

In the figure is shown an complete example of configuration.

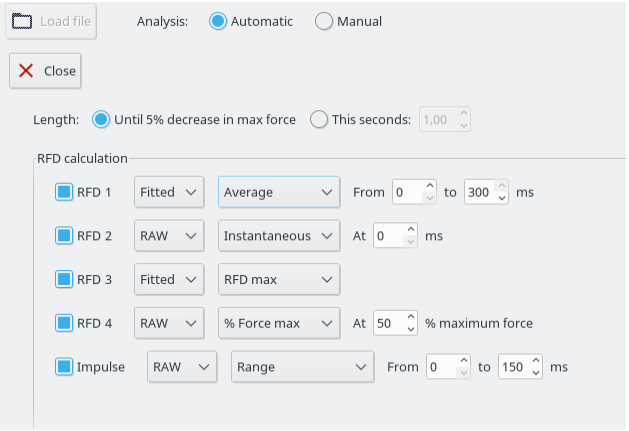


Figura 5.59: Maximum isometric force test configuration

Each value of the RFD can be calculated from two types of signals:

- The Raw signal shows the values of force registered by the sensor during the test. All that is refered to this signal will be black.
- The fitted signal refers to the inverse monoexponential function that better fits the raw data. This fitting is made adjusting the Fmax (maximum force) and K (the speed at which the maximum force is reached) or τ (tau).[1]. All that is refered to this signal is blue.

$$F = Fmax \cdot \left(1 - e^{-k \cdot \mathrm{t}}\right)$$

Besides, the RFD can be calculated in various ways:

- Instantaneous. The RFD is calculated at the instant specified in milliseconds.
- Average. The RFD is calculated measuring the increment of force between two instants, specified in milliseconds, divided by the elapsed time.
- % Force max. The RFD is calculated in the instant when the force is equal to a percentage of the maximum force.
- RFDmax. The RFD calculated is the maximum of the test.

In all cases the RFD is plotted as a line with a slope equal to the RFD and located at the points specified.

In the 5.3 table are shown some examples of a maximum isometric test .

[1] Some papers express $k = \frac{1}{\tau}$, where τ means the time necessary to reach the 63.2% of the Fmax. Another way of expressing K is as the initial RFD normalized by Fmax ($k = \frac{RFD0}{Fmax}$) because $RFD0 = k * Fmax$.

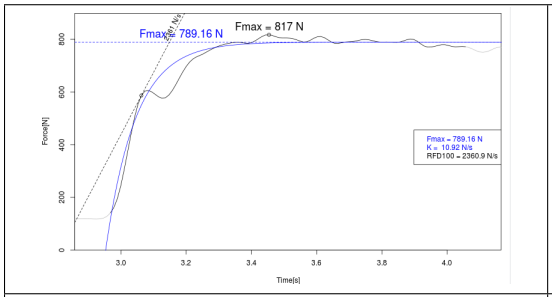
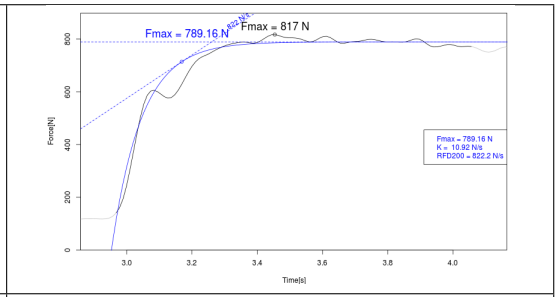
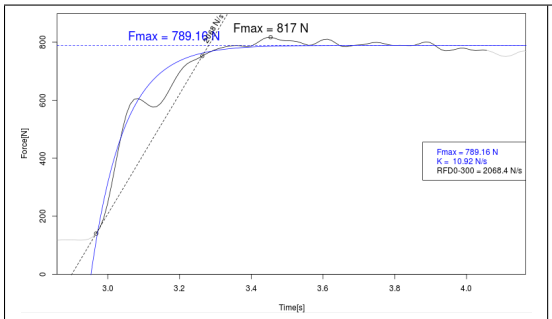
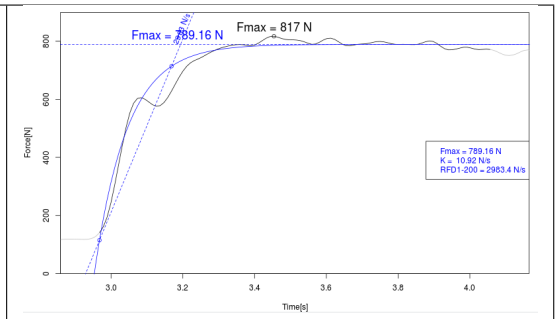
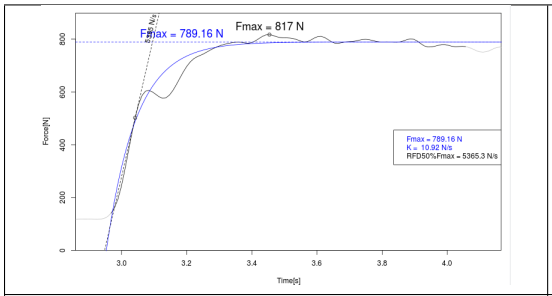
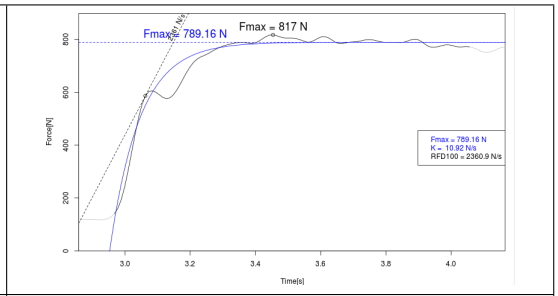
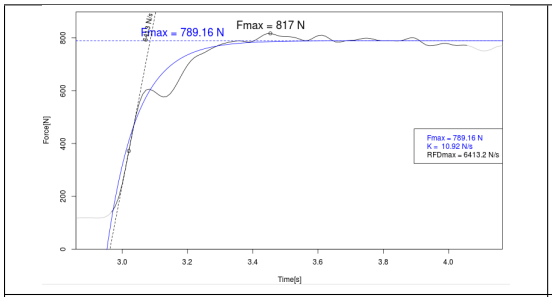
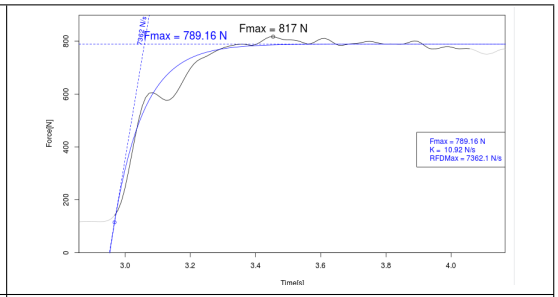
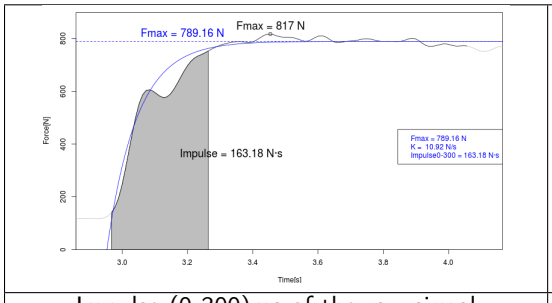
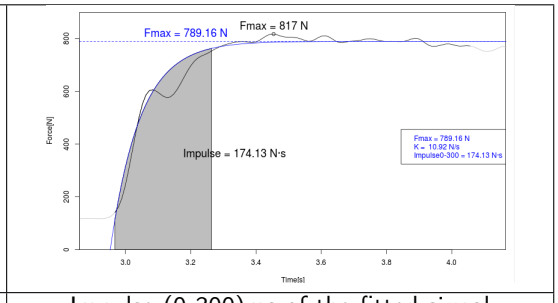
Raw	Fitted
	
Instantaeous RFD of the raw signal	RFD Instantaeous of the fitted signal
	
Average (0-300)ms RFD of the raw signal	Average (0-300)ms of the fitted signal
	
RFD at 50% of Fmax of the raw signal	RFD en el 50% of Fmax of the fitted signal
	
Maximum RFD of the raw signal	Maximum RFD of the fitted signal
	
Impulse (0-300)ms of the raw signal	Impulse (0-300)ms of the fitted signal

Table 5.3: Different analysis of the RFD in a maximum isometric force test

5.5.7.2.2 Execution of the maximum isometric force test To perform the test it is recommended to exert a minimum initial force to avoid the any jerks that could spoil the results.

Once the subject is applying a minimum force, click the *capture* button  .

The subject must start exerting his maximum force as fast as possible. It is recommended to hold the maximum force for at least 3 seconds.

Finally, press the the *finish* button  . Automatically a graph will be plot with all the necessary calculi.

To load a previous test, click on *load* button.

5.6 Other tests

5.6.1 Reaction time

In order to detect reaction time of the person, there's a need of an assistant, because Chronojump and Chronopic are still unable to produce random signals that can be measured accurately.

5.6.1.1 Protocol

Assistant will produce contact in a contact device: push-button, platform, photocell, ... and at any moment (when athlete is prepared), assitant will release the contact and instantly the Chronopic green led will light. At this moment, the athelete will produce contact in another contact device and green light will be off. The reaction time registered will be the time between light starts glowing and athelete produces contact. It's important that athlete doesn't see or hear the assistant.

5.6.1.2 Executing reaction time

To execute a reaction time, have the assitant producing contact in device, click on *Execute reaction time* and follow the protocol described above.

If Chronopic has not been connected and activated from Chronopic window, a reaction time will be simulated. In the other hand, if Chronopic is connected, real reaction time will be done.

5.6.1.3 Reaction times view

Reaction times are shown on the *reaction time* tab. Tests are associated with the athletes. The shown order of the tests of each jumper is chronological so, the last test appears at the end of the list

You can use the *magnifying glass* button (or press *z*) to facilitate the view of the tests.

5.6.1.4 Reaction times edition

You can add comments to a reaction time or change the person (if you forgot to change the current person previously) If you select the desired test and click on the *Edit* button on the selected test, you can also find it on the menu, or by pressing the button *e*.

5.6.1.5 Reaction times delete

To delete a reaction time, select it and click the *Delete selected reaction time* button. Its equivalent in the menu or press *d* (delete). By deleting the test you will be asked to confirm it if the delete confirmation option is activated in the *Preferences* menu (more information in section 8.1 en la página 94).

5.6.2 Pulses (Simple rhythms)

A simple rhythm or pulse can be measured on the *Pulse* tab. On the other hand, if a comple rhythm has to be measured, use a MultiChronopic as described at 5.6.3 en la página siguiente.

There are two kind of tests:

Free Person tries to be regular on the freely selected pulse. Evaluator will decide te moment where the test end.

Custom Person has to follow a predefined tempo. If desired, the total duration of the test can be defined.
Tempo can be defined in one of this ways:

seconds how many seconds pass between pulsations

ppm how many pulsations per minute

Both methods are interrelated, if eg. seconds value is changed, then ppm changes. As an example, 0.5 seconds are 120 ppm. Evaluator will decide what is more suitable.

5.6.2.1 Ejecución de pulsos

Desde la pestaña de *pulso* y con el ayudante sin tocar el pulsador o plataforma, haga clic en el botón: *Libre*, o en el botón *Personalizado*.

En caso que no este conectado el Chronopic, el programa simulará un pulso. En la ventana emergente se mostrará la progresión del test, que podrá ser detenido haciendo clic en el botón *Terminar* o cancelado con *Cancelar*.

5.6.2.2 Pulses view

Puede usar los botones de *lupa* (o la tecla *z*) para facilitar la visualización de los tests.

Pulses are shown on the *pulses* tab. Tests are associated with the athletes. The shown order of the tests of each jumper is chronological so, the last test appears at the end of the list

You can use the *magnifying glass* button (or press *z*) to facilitate the view of the tests.

5.6.2.3 Pulses edit

You can add comments to a pulse or change the person (if you forgot to change the current person previously) If you select the desired test and click on the *Edit* button on the selected test, you can also find it on the menu, or by pressing the button *e*.

5.6.2.4 Pulses delete

To delete a pulse, select it and click the *Delete selected pulse* button. Its equivalent in the menu or press *d* (delete). By deleting the test you will be asked to confirm it if the delete confirmation option is activated in the *Preferences* menu (more information in section 8.1 en la página 94).

5.6.3 Multi Chronopic

Multi Chronopic allows any type of test that uses two, three or four independent measurements Chronopics. Remember that for the other tests it's possible to connect multiple devices to a single Chronopic, but it's understood that that always have to be in touch in one or both of them.

Unlike previous tests, Multi Chronopic allows the use of several Chronopics, each connected to one or more detection devices, so that contact can be more than Chronopic at a time. Their operating depends on the program user, but here are some examples:

1. Static Test running on two platforms: the aim is to assess the tempo of tread of the left and right foot. It's required that each Chronopic is connected and independent since the sportsman is often stepping on both platforms
2. The study of the contact times in a volleyball jump: One foot in each platform, then both take off at the same time. To know various times is needed 2 Chronopics platforms and 2 independents ones.
3. Plate Tapping with extra coordinative action: Construction of a device type detection Plate Tapping, where the tester must touch either side as quickly as possible with a single hand. Connect a conductive part to any side and to one Chronopic to record the different times. Moreover, if the subject should do something with his foot every 3 contacts we can locate a contact platform on the floor and connect it to a second Chronopic.
4. Two, three or four athletes do a round trip timed race on a track: there is placed a platform at the beginning and final of each lane. A Chronopic will be connected to the beginning and end platform because a person can't be at both at once. Thus, if there are 4 subjects it will be 4 lanes, 4 Chronopic and 8 platforms. We will be able to measure the times and speeds of each 4 independently.

5.6.3.1 Synchronization

Some of these tests require a synchronization to intend that the various Chronopics start at the same time. However, in others the synchronization is not required. In the first three examples cited above, synchronization is required so there is no error in the comparison of time between a tread and the other (example 1 and 2) or from contact with the tapping and the tread on the ground (Example 3). This sync can be selected from a check box and carried out by making contact with several devices at once, or by touching the Test button  of Chronopics. In the Chronojump Forum `http://forum.chronojump.org` is described a method for the construction of a professional sync device.

The sync in the fourth example requires discussion. If the subjects leave when they want and the aim is to record only the time between contact and the next synchronization is not required. On the other hand, sync is needed if we use the signal of an external evaluator, and when we expect to know the time between the signal (of any contact) and the first contact each athlete.

5.6.3.2 Erase first time

In some tests, the time of the first contact until the first change of state is not relevant.

Perhaps, the subject can begin whenever he wants. If you want to compare the subject's ability to follow an independent press with both hands (two Chronopics). The time registered since the start until the first contact is not relevant and should be removed to avoid contaminating averages.

5.6.3.3 Port configuration

Obviously, it's imperative to set up two Chronopic in the window Chronopic: *Tools / Chronopic*, to run the tests proposed.

5.6.3.4 Multi Chronopic results view

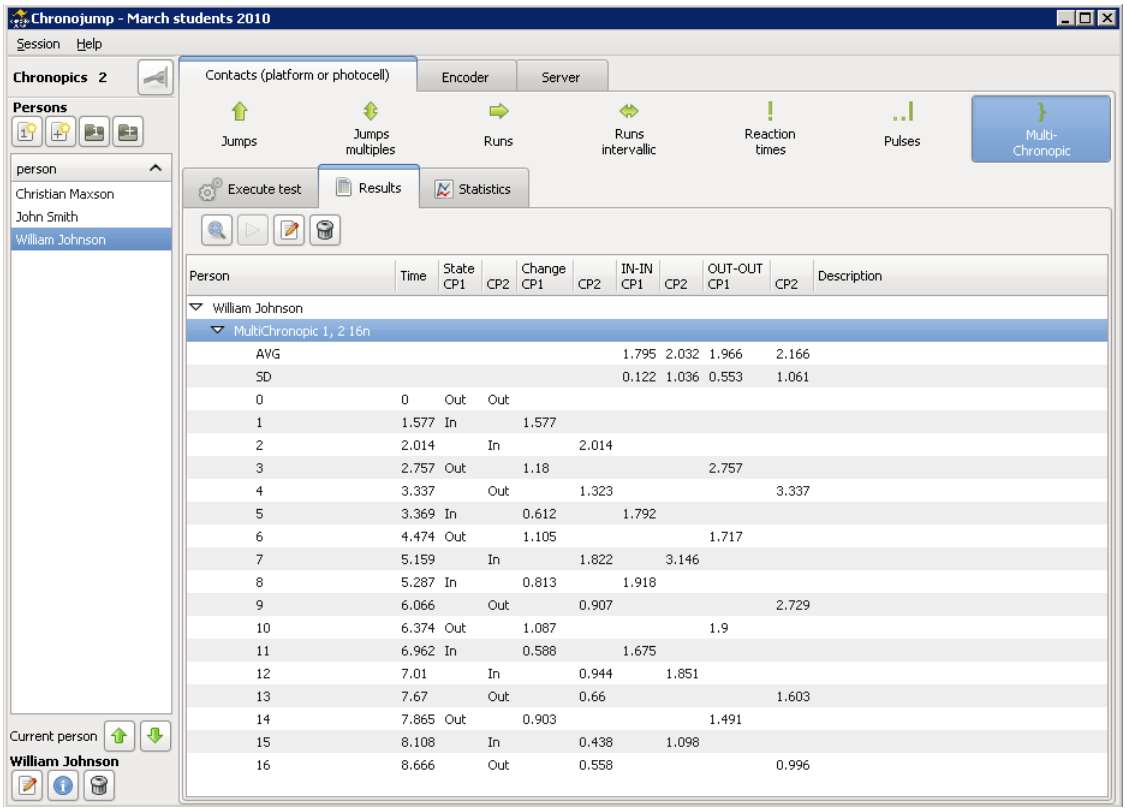


Figure 5.60: Multi Chronopic screenshot.

In the results window, we can observe different columns, if two Chronopic have been used:

- Time: The time from the beginning of the test CP1 and CP2
- State: Information on which change has occur in each Chronopic (if any) at the time point indicated in the previous column.
- CP1 and CP2 Change: Time elapsed since the last change of state in each Chronopic.

- IN-IN CP1 and CP2: Time elapsed since each Chronopic changed the state IN until he returned to the same state.
- OUT-OUT CP1 and CP2: Time elapsed since each Chronopic changed the state OUT until he returned to the same state.
- Description: Comments on the particular test run.

In the example in Figure 5.60 it shows a Multi Chronopic test duration: 0.928 seconds in which there are 10 state changes. Multi Chronopic 1, 2, 10n is called so because is used 2 Chronopics (Chronopics 1 and 2), and has 10 changes. If we observe the change number 5 it occurs at 0.539 seconds. This represents a change of status Out Chronopic 1 (no contact) within a (contact). As indicated in CP1 Change, 0.225 seconds have elapsed since the Chronopic was in its previous state (Outside) and 0.353 seconds since this was Chronopic (Inside) as reflected in IN-IN CP1.

Also note that the column IN-IN and OUT-OUT have average values and standard deviation (SD).

Just as the other tests, the tests are associated with the performers. The order of presentation of each test in each performer is chronological so the latter carried out by a subject appears at the bottom of the list of the tests. You can use the magnifying glass button (or press *z*) to facilitate the visualization of the tests.

5.6.3.5 Multi Chronopic test edition and erase

You can add comments to a test or change the performer (if you forgot to change the current subject previously) by selecting the desired test and click on the *Edit Multi Chronopic* button. It can also be done in the menu or press *e*.

To delete a Multi Chronopic test, select it and click the *Delete Multi Chronopic* button selected. Its equivalent in the menu or press *d* (delete). By deleting the test you will be asked to confirm it if the delete confirmation option is activated in the *Preferences* menu (more information in section 8.1 en la página 94).

5.6.3.6 Run analysis

In addition to the examples given we have to include a test to analyze the run produced by Josep Maria Padullés as part of his doctoral thesis. As sense devices it's used two photocells barriers and a track with contacts platforms.

The two photocells are connected to the **first** Chronopic to know the time between them. The program evaluator will indicate the distance between them and thus it can be known the average speed. The track of platforms will be connected to the **second** Chronopic, which will give us the contact time and flight time. In this case the synchronization between Chronopics or deleted the first time is not required.

From the data obtained by both Chronopics, you will get the average speed of the race, and the following data for each of the steps:

- Contact times
- Flight Times
- Total Time
- Frequency
- Amplitude

- Height
- Takeoff angle

You can see an example in Figure 5.61. Note that the execution button Running Analysis will be activated when the distance between the photocells and the two Chronopics are connected.

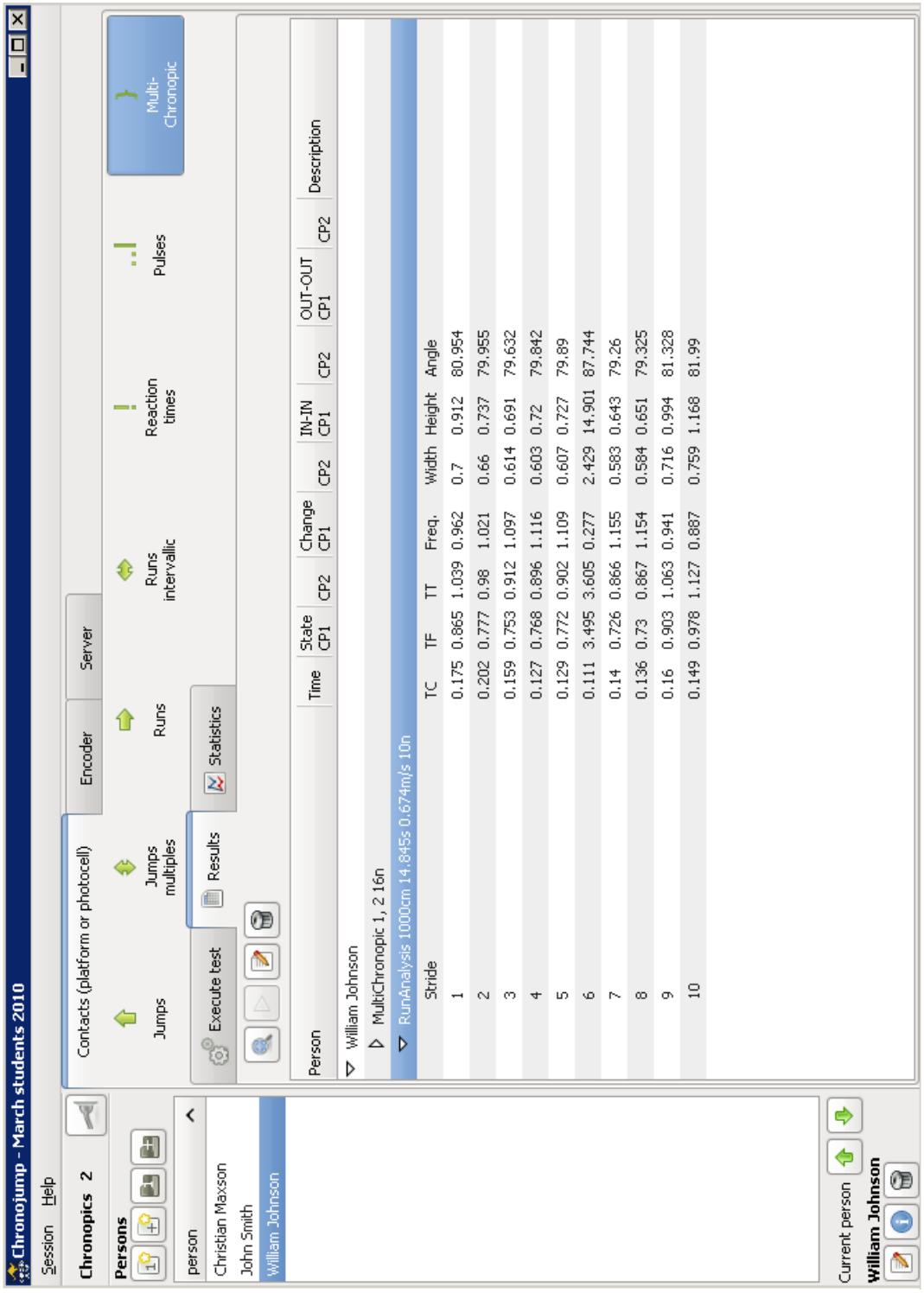


Figure 5.61: Multi Chronopic screenshot with Run Analysis results.

Chapter 6

Statistics and graphics

Chronojump has multiple indices to study the tests proposed. Unlike general spreadsheets purpose, the provision of statistical and graphics has been designed specifically to measure jumps and running. Figure 6.1 shows the statistics window that appears when you click on *Tools / Statistics*.

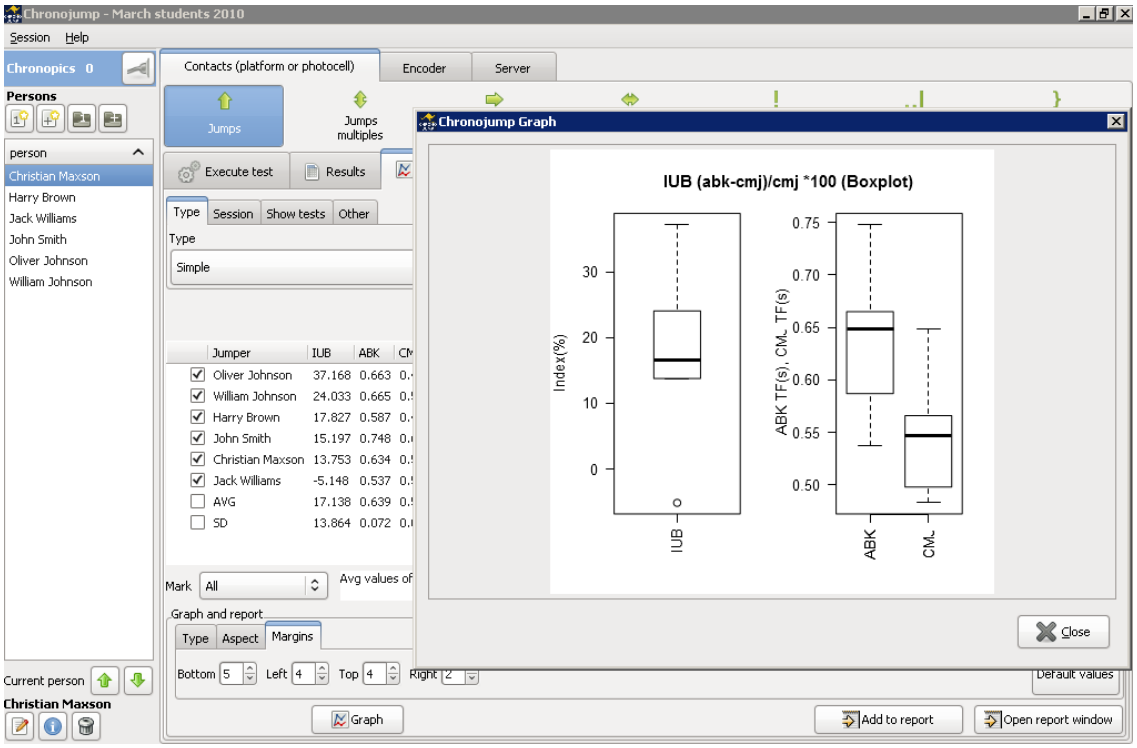


Figure 6.1: Chronojump statistics window.

6.1 Jumps and races

6.1.1 Statistic type, subtype and applications

Each statistic can be classified by type, among which are:

Simple jumps which offers several ways to analyze simple jumps without contact time.

Simple jumps with contact time which offers various ways to analyze simple jumps with contact time.

Reactive jumps which presents several ways to analyze repetitive jumps.

6.1.1.1 Simple jumps

The simple hop statistical show various ways to analyze simple jumps without contact time, which can be classified into several subtypes:

- No index
- Force-velocity
- Elasticity rate (IE)
- Use of arms index (IUB)
- Power peak of Lewis, Harman, Sayers (2), Shetty, Canavan, Lara (5)

6.1.1.1.1 No index Statistical simple jump that shows all the jumps or a particular type as selected on the *application* field.

6.1.1.1.2 Force-velocity Statistical simple jump that shows the force-velocity relationship according to the formula

$$FV = \frac{SJ+(100\%}{SJ} * 100$$

SJ jumps with 100% extra charge to the body weight, and SJ with no additional charge.

6.1.1.1.3 Elasticity index Statistical simple jump that shows the elasticity index formula

$$IE = \frac{(CMJ-SJ)}{SJ} * 100$$

between SJ and CMJ jumps.

6.1.1.1.4 Use of arms index Statistical simple jump that shows the rate of the use of arms from the formula

$$IUB = \frac{(ABK-CMJ)}{CMJ} * 100$$

between CMJ and ABK jumps.

6.1.1.1.5 Substraction between tests Statistical tha shows the relative difference between two tests.

$$\%dif = \frac{(test1-test2)}{test2} * 100$$

6.1.1.1.6 Peak power Figure 6.2 is the ratio of power peak of the individual authors and their formulas. In the future, is expected to include expanded documentation for each formula and literature.

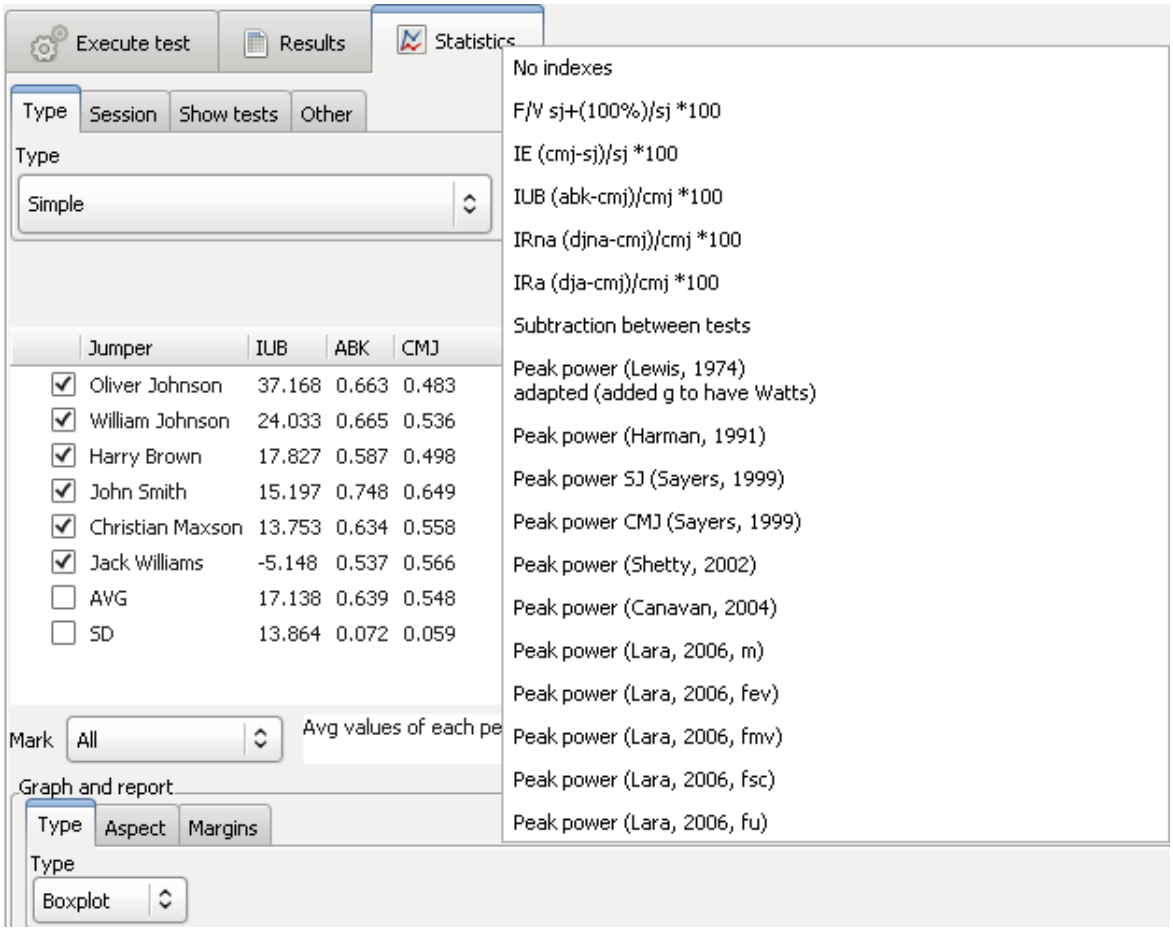


Figure 6.2: Statistics of simple jumps.

6.1.1.2 Contact time jumps

The most important in this type of jump is the relationship between flight time and contact time. In many sports it's necessary to generate a high power (reflected in the flight time) in a short time (represented by the contact time). We present two indexes to study the relation:

- Dj Index
- Index Q

The application field in both cases refers to the type of jump that is applied to the statistic.

6.1.1.2.1 Dj index Study of the relationship between time of flight / time of contact in a single jump from the formula

$$DJindex = \frac{TF-TC}{TC} * 100$$

6.1.1.2.2 QIndex Study of the relationship between time of flight / time of contact in a single jump from the formula

$$QIndex = \frac{TF}{TC}$$

6.1.1.3 Repetitive jump

In the repetition of a jump test specified by a number of jumps, time, or unlimited ends when the coach or athlete decides it. It represents the evolution of flight time with respect to the contact time in the different jumps. With this objective are the following statistics:

- Average index
- Power (Bosco)
- Evolution
- Mean and standard deviation using RjIndex
- Mean and standard deviation using QIndex

In all cases the application field refers to the type of jump that is applied to the statistic.

6.1.1.3.1 Average index Study of the relationship of flight time / contact time in the repetitive jump according to the formula

$$AverageIndex = \frac{TFmean - TCmean}{TCmean} * 100$$

6.1.1.3.2 Power (Bosco) Study of the relationship of flight time / contact time in the repetitive jump according to the formula

$$Power = \frac{9.81^2 * TFmean * jumps * totalTime}{4 * jumps * (totalTime - TFmean * jumps)}$$

6.1.1.3.3 Evolution Study of the relationship of flight time / contact time over the repetitive jump according to the evolution of the formula $Evolution = \frac{TF}{TC} * 100$ for each twitching.

Sometimes some athletes do a jump with a very good TF / TC because of the execution of a low one before or afterwards. For this reason it has arranged the option to make the best 'n' row to get a selection of the best range following this index. To the right of this option you can find the amount of jumps you want to study. If you select a value of 1 then the best jump will be highlighted.

6.1.1.3.4 Mean and standard deviation using RjIndex Study Index

$$RjIndex = \frac{TF - TC}{TC} * 100$$

for each of the jumps of the repetitive jump test it's shown the average and standard deviation obtained.

6.1.1.3.5 Mean and standard deviation using QIndex Study Index

$$Qindex = \frac{TF}{TC} * 100$$

for each of the jumps of the repetitive jump test it's shown the average and standard deviation obtained.

6.1.2 Multisession statistics

All statistical presented except the Evolution in the repetitive jumps can be used for the comparison of different jumps or subjects in several sessions. This will submit a column for each selected session and facilitates comparison between the different values shown.

It also includes the average and standard deviation of each row displayed.

To access to the statistics multisession click on *session / selected* and select the sessions you want to use in the window that appears when you click on *Select*. You can select as many sessions as desired and is not required to display the current session between them.

6.1.3 Selection of the jumps to be shown

There are four selection modes for the jumps shown as a condition in the generation of statistical expectation:

All shows the results of the selected statistics.

Limit n shows the first n selected statistical results.

Average shows the average of each jumper in the selected statistic.

Max /s of the jumper show *n* maximum values of each jumper in the selected statistic.

Most of the statistics offers the four options. Those omitted is because is not a purpose generate them.

6.1.4 Other settings

Other related action buttons presented below.

6.1.4.1 Statistics formulation

All statistics have a statement that is automatically created based on the selections made by the user in the statistics window. The statement can help you understand the statistics.

6.1.4.2 Genus distinction

It presents the option of distinguish between genders for the presentation of the results. Selecting this option you can have a dual behavior:

- When the result rows correspond to the statistical index or jumping, gender selection will lead automatically to the creation of a row for each of them.
- When the result rows of statistical correspond to the subjects, it will appear a letter at the end of the subject to indicate the gender.

This button can help intra and inter genus comparisons.

6.1.4.3 Automatic actualization

The statistics window Chronojump is designed so each change in the database (new jump, subject rename, delete, jump, change jumper who has made a jump ...) is updated directly.

6.1.5 Marked rows

In the first column of each row you will find a small box that allows you to select whether or not a row is taken into account for the graphs and reports generated with Chronojump. The first row contains a checkbox that lets you quickly select and deselect all values. Furthermore, we show a selection box at the left bottom that allows you to expedite the selection of rows based on different criteria. For more information on charts and reports in paragraphs check 6.1.6 and 7.1 respectively.

6.1.6 Graphic creation

Chronojump can create any graphics of any of the data shown in the statistics window. To do this simply click on the Graph button that appears in the statistics window. In the figures 6.3, 6.4, 6.5, 6.6 there are some examples of graphics generated.

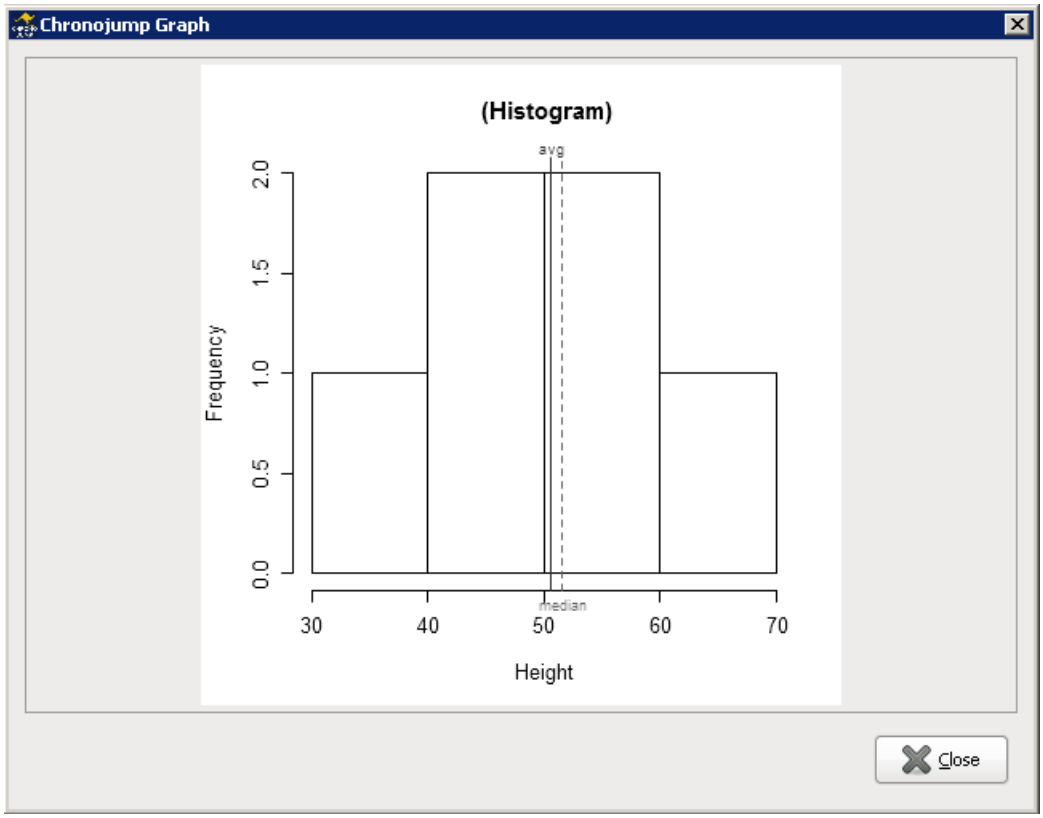


Figure 6.3: Graph example: Histogram of a height of jump.

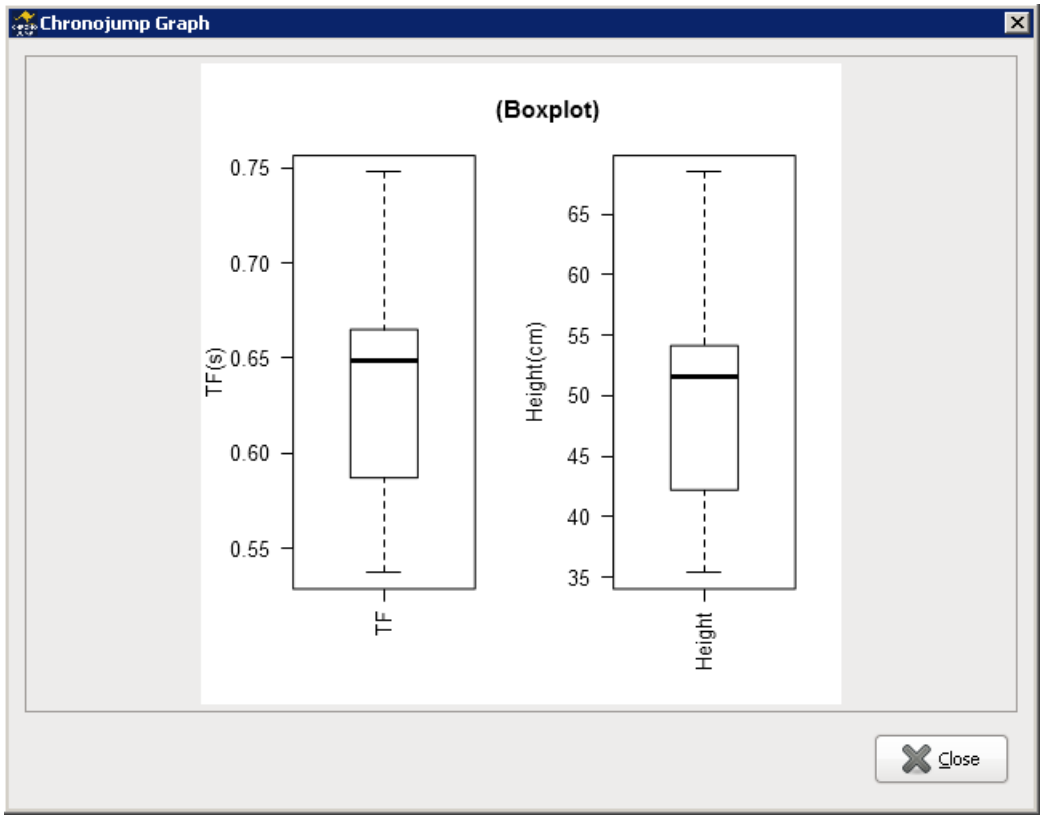


Figure 6.4: Box diagram of the same values.

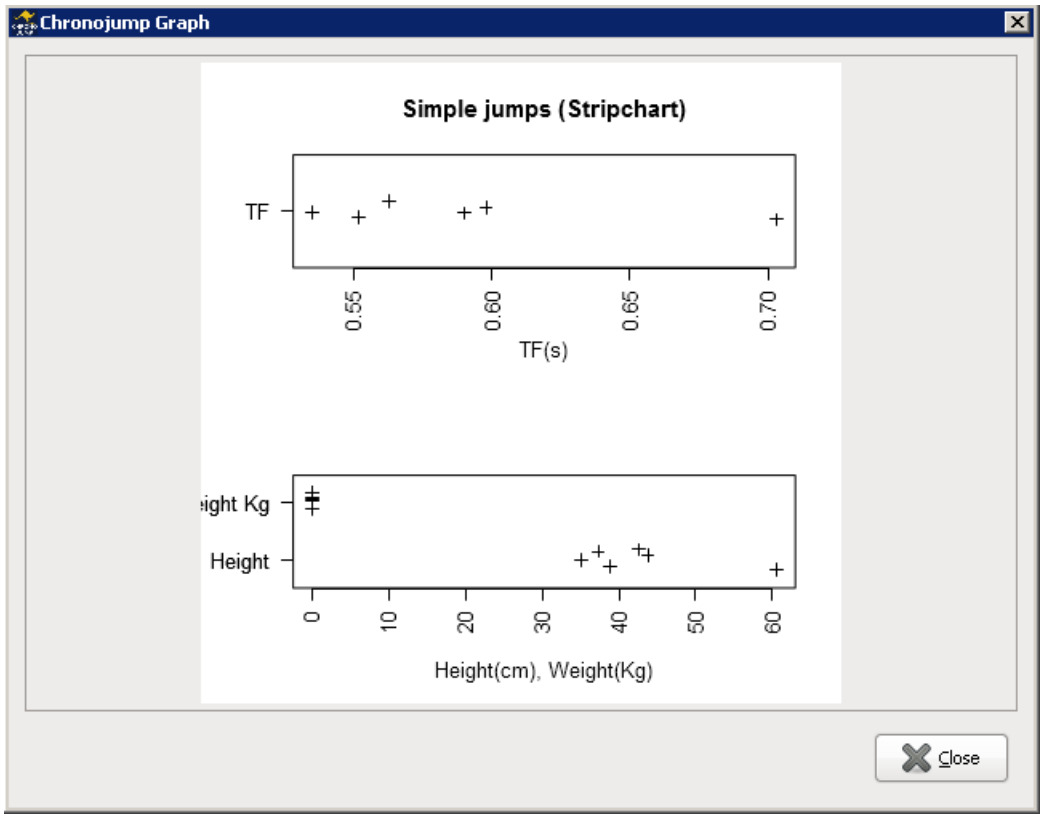


Figure 6.5: Graph stripchart of the same values.

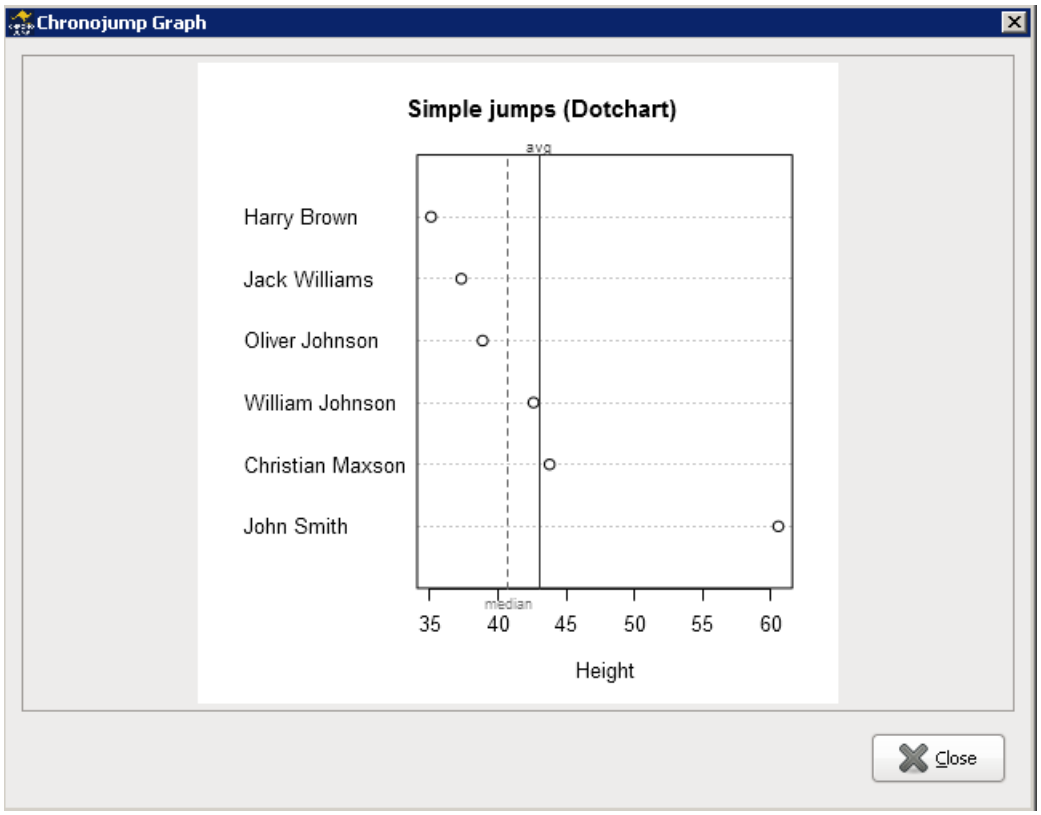


Figure 6.6: Graph dotchart a subset of the above values.

6.1.6.1 Sprint analysis

If the race is a sprint measured with at least 2 laps you can perform the sprint test in Analysis -> Sprint.

To execute this analysis the height of the subject must be specified.

Select the race and click the Analyze button.

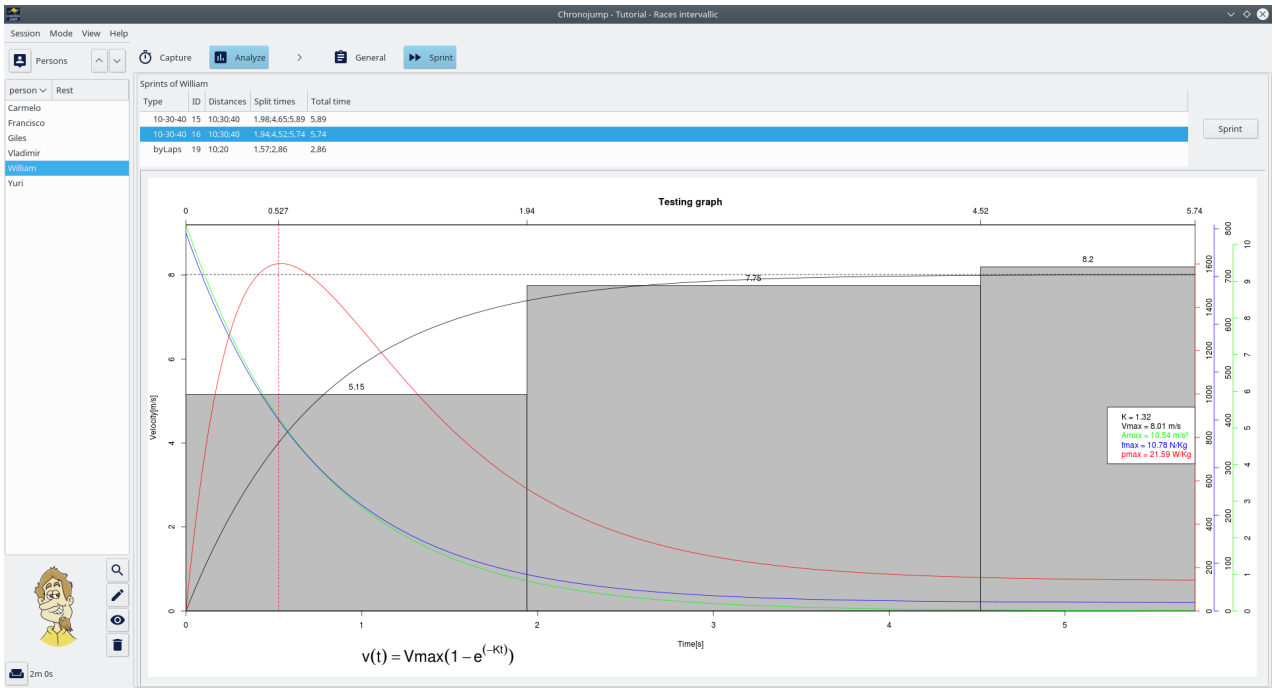


Figure 6.7: Sprint test

This analysis returns a model of the speed that allows to know the speed in each instant as well as the acceleration, force and power.

The K variable indicates how fast the subject reaches his maximum velocity, independently of this maximum velocity. Force and power are relative to the body weight.

6.2 RaceAnalyzer

In the analysis section, after registering a test or loading it, by clicking on the "Analyze" button, a graph like the one in the figure will be displayed.

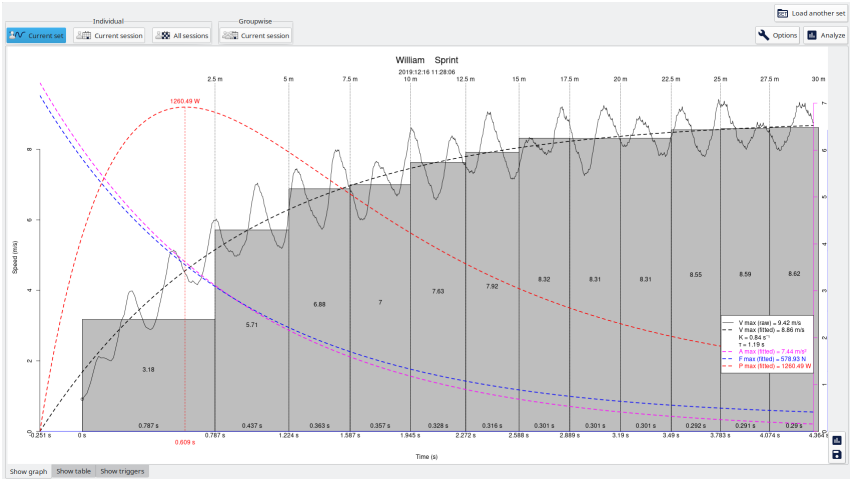


Figure 6.8: RaceAnalyzer sprint analysis

Chronojump will try to fit the recorded data to a mathematical model that allows a much simpler analysis than with raw data. In this way, the data displayed can be referred to the raw data or the data inferred from the model.

In addition, the time and average speed will be displayed every 5 m in the form of gray bars. On the horizontal axis the split times are shown every 5 m

The following variables will always be displayed in the legend:

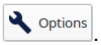
• V max (raw): The peak raw speed measured with the device.

• V max (fitted): The theoretical maximum speed that is achieved with the model.

• K: This parameter indicates how fast the speed approaches its theoretical maximum. It can also be interpreted as the maximum slope on a graph normalized by the maximum speed of the model.

• τ: Tau is the inverse of the K parameter and indicates the time it takes to reach 63.2% of the maximum speed.

In addition to the previous variables, acceleration, force and power can be displayed both raw and modeled.

To activate or deactivate these variables click the options button 

.

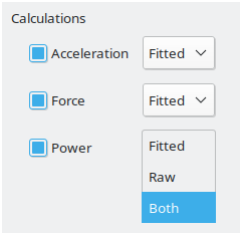
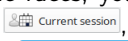
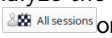
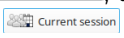


Figure 6.9: Visualization options of sprint analysis

The maximum of each selected variable will be shown in the legend.

If you want to obtain a table with the results of the analysis of multiple races, you can click on the different buttons to analyze the current session of the current individual 

, all the sessions of the current individual 

or the current session of the current group 

By clicking on the Export button, a folder will be generated with the results in table form and the graphs and raw data in separate subfolders.

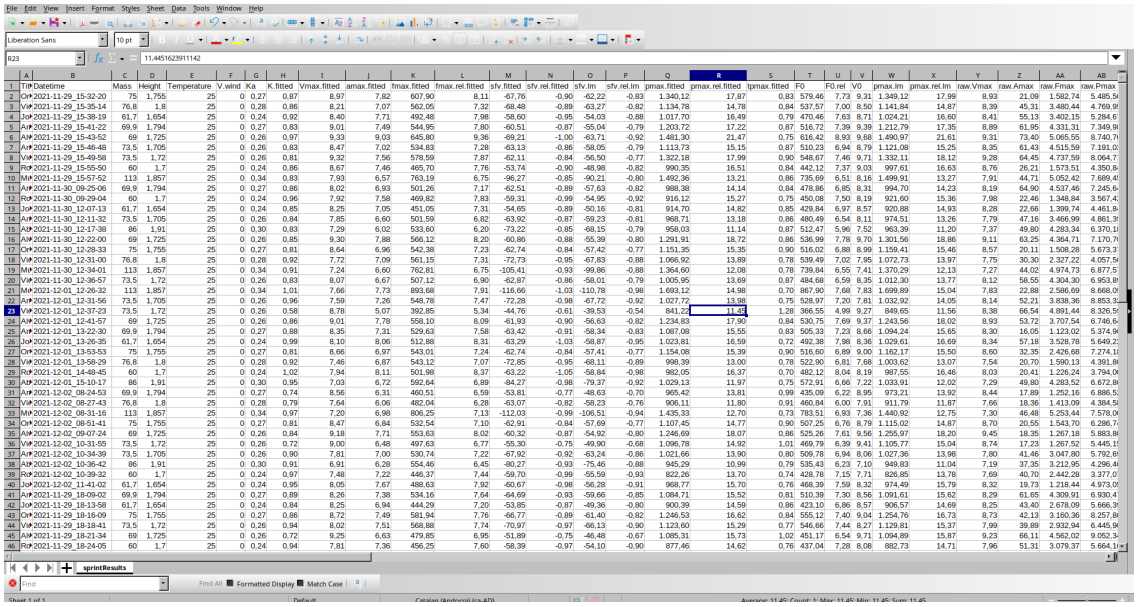


Figure 6.10: Export table of RaceAnalyzer

6.3 Linear encoder

6.3.0.1 Encoder analyze tab

There are four modes of analysis:

- Individual / Current Set  : Analysis of all repetitions of the current set.
- Individual / Current session  : Analysis of the saved and selected repetitions.
- Individual / All sessions  : Analysis of all repetitions saved in the selected sessions.
- Groupal / Current session  : Analysis of current session and selected subjects.

Within each mode there's various types of analysis:

- Power bars  : Shows power, peak power, time needed to arrive to peak power, range of movement and the mechanical impulse.

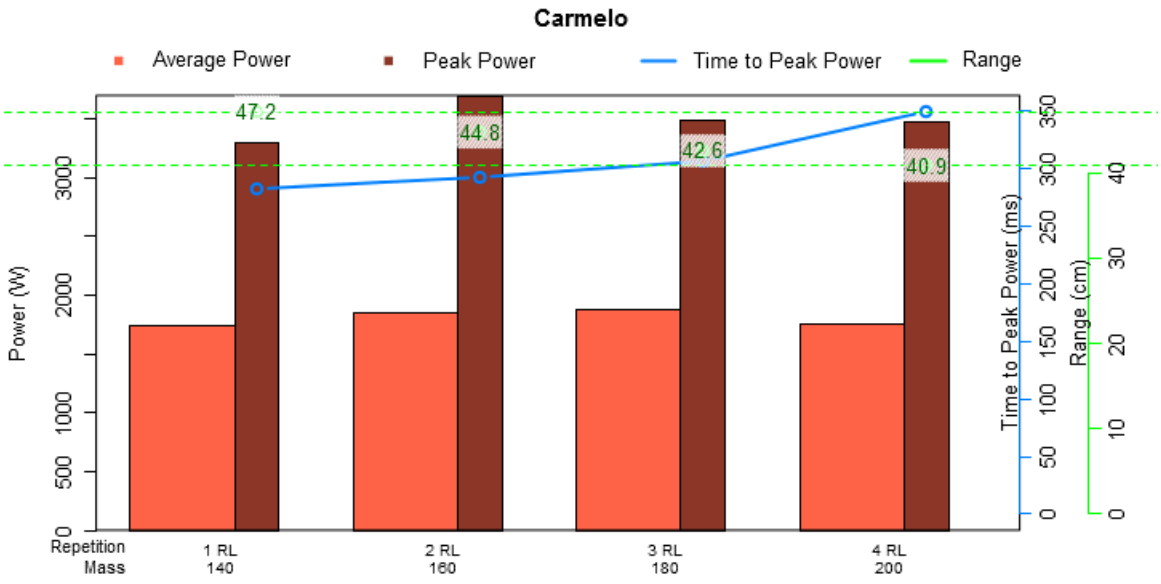


Figure 6.11: Power bars graph

- Cross variables  : to show relationships between variables like "Power / Load". Includes the 1RM calculation. Cross variables is the only analysis that can be done on "compare" mode. Videotutorial: Power vs Load curve `https://youtu.be/mynNxYELja4`

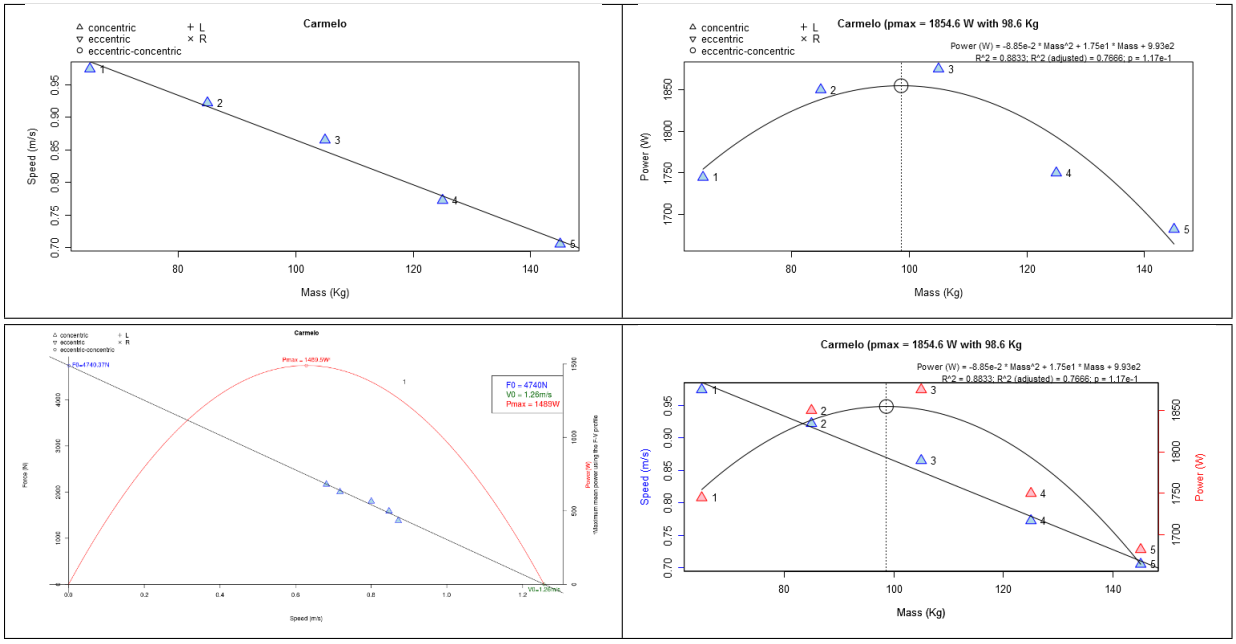


Figure 6.12: Cross variables graphs

- 1RM  : It allows to make different calculations of the maximum repetitions that can be performed with different loads. Videotutorial: Chronojump tutorials: Estimate nRM indirectly `https://youtu.be/sd40bI2UQ9c`

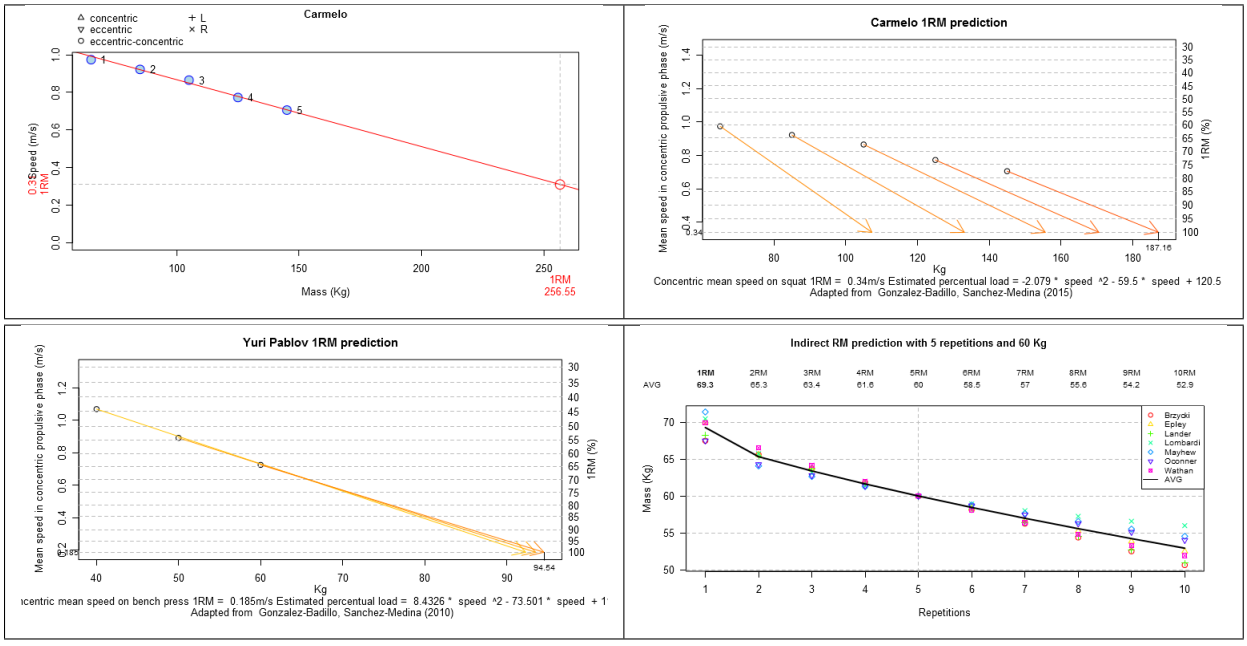


Figure 6.13: 1RM graphs

- Instantaneous analysis  : Shows the mecanical variables at each millisecond. There are four kind of graphs:

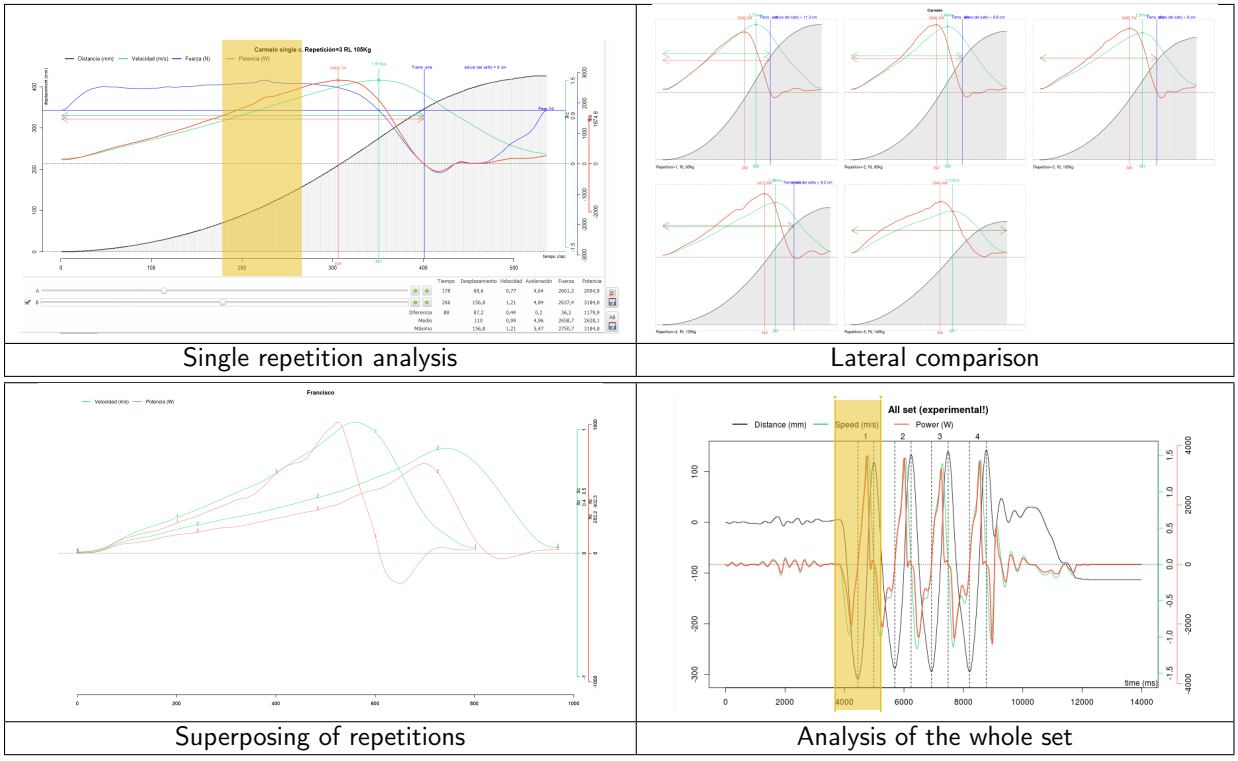


Figura 6.14: Instantaneous analysis

- Neuromuscular profile  : to see the neuromuscular profile of the three best jumps of a set of six. At least six jumping repetitions are needed to performe that kind of analysis.

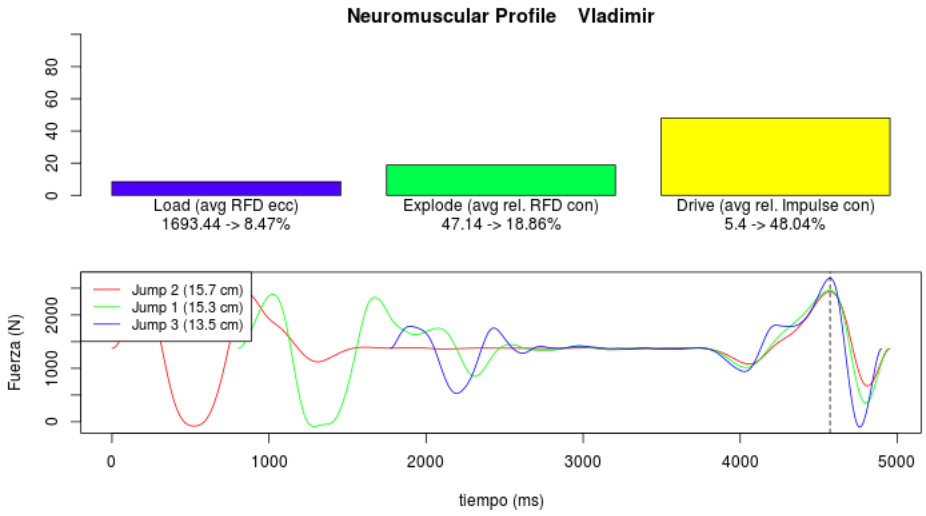
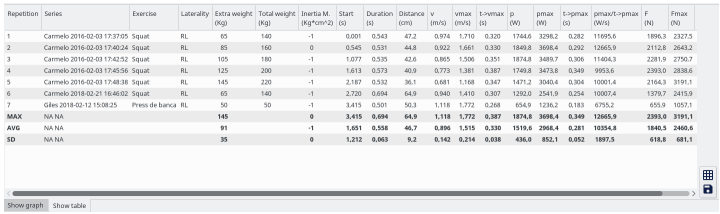


Figure 6.15: Neuromuscular profile

The analysis starts when user click in "Analyse". After a while, a graph and a table will appear, both can be saved using each save button in the lower right corner.



Repetition	Series	Exercise	Laterality	Extra weight (Kg)	Total weight (Kg)	Inertia M. (Kg*cm^2)	Start (s)	Duration (s)	Distance (cm)	v (m/s)	vmax (m/s)	t->vmax (s)	p (W)	pmax (W)	t->pmax (s)	pmax/t->pmax (W/s)	F (N)	Fmax (N)
1	Carmelo 2016-02-03 17:37:05	Squat	RL	65	140	-1	0,001	0,543	47,2	0,974	1,710	0,320	1744,6	3298,2	0,282	11695,6	1896,3	2327,5
2	Carmelo 2016-02-03 17:40:24	Squat	RL	85	160	0	0,545	0,531	44,8	0,922	1,661	0,330	1849,8	3698,4	0,292	12665,9	2112,8	2643,2
3	Carmelo 2016-02-03 17:42:52	Squat	RL	105	180	-1	1,077	0,535	42,6	0,865	1,506	0,351	1874,8	3489,7	0,306	11404,3	2281,9	2750,7
4	Carmelo 2016-02-03 17:45:56	Squat	RL	125	200	-1	1,613	0,573	40,9	0,773	1,381	0,387	1749,8	3473,8	0,349	9953,6	2393,0	2838,6
5	Carmelo 2016-02-03 17:48:38	Squat	RL	145	220	-1	2,187	0,532	36,1	0,681	1,168	0,347	1471,2	3040,4	0,304	10001,4	2164,3	3191,1
6	Carmelo 2018-02-21 16:46:02	Squat	RL	65	140	-1	2,720	0,694	64,9	0,940	1,410	0,307	1292,0	2541,9	0,254	10007,4	1379,7	2415,9
7	Giles 2018-02-12 15:08:25	Press de banca	RL	50	50	-1	3,415	0,501	50,3	1,118	1,772	0,268	654,9	1236,2	0,183	6755,2	655,9	1057,1
MAX	NA NA			**145**		**0**	**3,415**	**0,694**	**64,9**	**1,118**	**1,772**	**0,387**	**1874,8**	**3698,4**	**0,349**	**12665,9**	**2393,0**	**3191,1**
AVG	NA NA			**91**		**-1**	**1,651**	**0,558**	**46,7**	**0,896**	**1,515**	**0,330**	**1519,6**	**2968,4**	**0,281**	**10354,8**	**1840,5**	**2460,6**
SD	NA NA			**35**		**0**	**1,212**	**0,063**	**9,2**	**0,142**	**0,214**	**0,038**	**436,0**	**852,1**	**0,052**	**1897,5**	**618,8**	**681,1**

Show graph Show table

Figure 6.16: Data table

Chapter 7

Report and export in jumps and races

We propose two ways to work with raw data using Chronojump. First of all: *Reporting*, with the utility to create a web page with the content of the session as well as selected statistics and graphs. After this: *Export to spreadsheet* data. Export to the tests program analysis with general purpose spreadsheet (spreadsheet).

7.1 Report generation

Reporting on the program Chronojump is the best way to collect information, statistics and graphs, in one session. This information can be in one study or with the comparison of various.

Clicking on *View report window*  , the figure shown is Figure 7.1. The users have the ability to create a report in web format (HTML) which can include session data, the subjects who participated and the tests chosen. Furthermore, using the *Add to report* button  is allowed to prepare each of the statistics displayed. Do the apparition in the report generated and the customization that was chosen by the user in the statistical window. The user can also organize each of the statistics to do the final report.

Clicking on *Make Report*, you can choose the filename images/to save the HTML document. Also, you can generate a folder that will include all necessary images and styles to display the page properly.

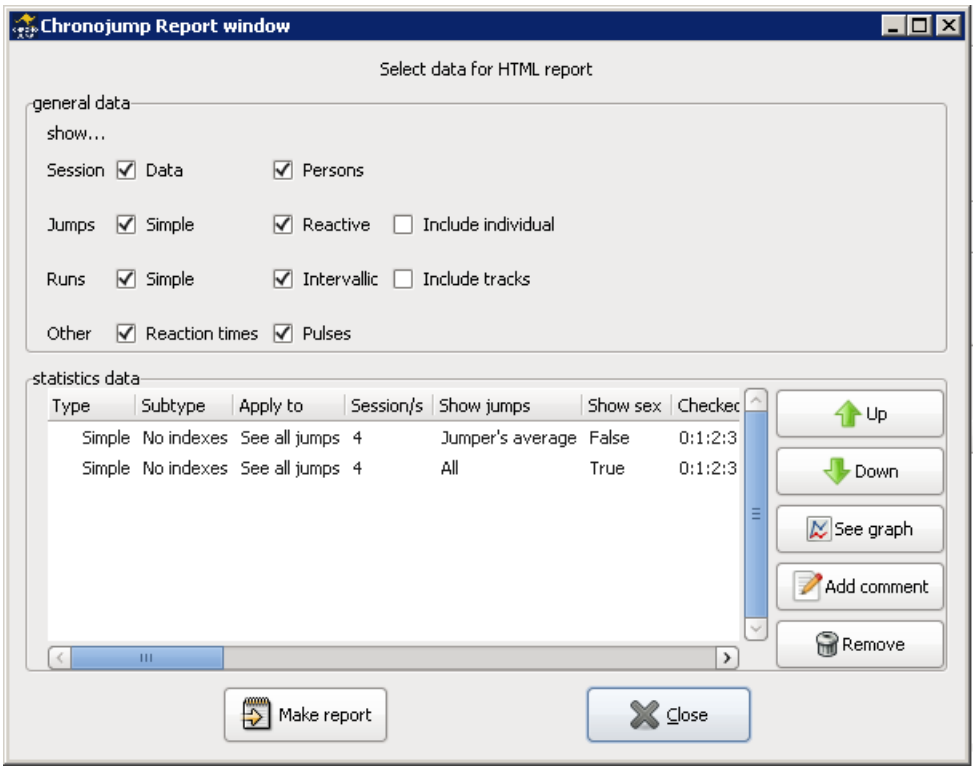
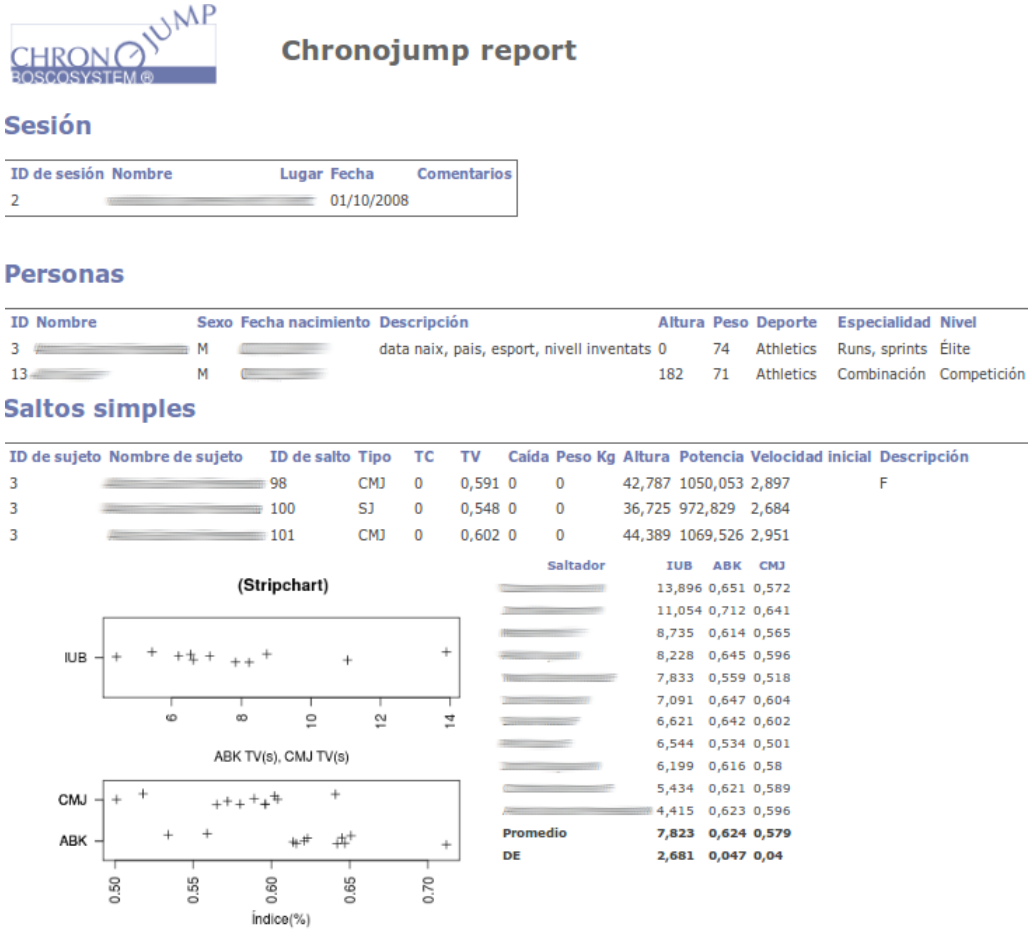


Figure 7.1: Example of report window preparation.



To print the report, we strongly recommend using the free browser Mozilla Firefox. In Figure 7.2 you can see a photo of a report.

7.2 Export to a spreadsheet

Clicking on *Session / Export session to CSV* to create a CSV file format (Comma Separated the Values) which can be easily imported into any spreadsheet program. This file contains the records of all the tests produced, but it shall not include statistical or graphics.

To export to CSV we chose the semicolon character (instead of comma character) to separate the different columns of data. Remember to indicate it when you import the CSV file in the spreadsheet.

Chapter 8

Preferences of Chronojump

The preferences window *Session / Preferences*, is divided into seven tabs *Database*, *Jumps, Runs, Encoder, Camera, Language and Other.*

8.1 Using Chronojump on more than one computer

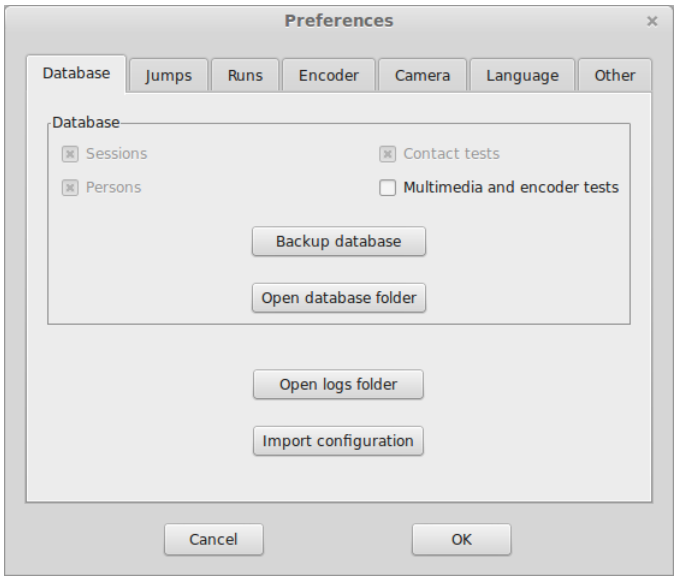


Figure 8.1: Preferences. Database tab.

Database tab shows where Chronojump data are located, allows to open the folder, and make one copy of it in a directory of choice for the users. Maybe it shows two possible locations for the database because some Windows systems offer a place to store data while the program runs, and another when it's closed.

Use this tab to have a copy of your data in order to avoid loosing your sessions, subjects and tests on a hard disk problem or if operating system is reinstalled. Also you can use this tab to have Cronojump database in more than one computer.

In version 1.7.0 and above Chronojumps is able to import sessions from other computers. The export must be done of the whole database following the next steps:

On the origin computer:

1. Menu -> Session -> Preferences -> Database -> Backup database
2. Select the path where the folder called Chronojump will be created. This folder contains all the information needed for exporting the data to other computer or, simply, have a backup of the sessions in this computer. You can choose a removable media to copy it later in the destination computer

There's two options for importing the data in the destination computer.

8.1.1 Option1: Add the imported data to existent Chronojump data.

This option allows you to import data without loosing any data in the destination computer. The counterpart is that you will have to import each session one by one.

On the destiny computer:

1. Copy the Chronojump folder to the destiny computer. You can copy this, for example, in the Desktop or any other path.
2. Go Menu -> Session -> Import session from another Chronojump database
3. Select where you want to import the session. In the current loaded session or in a new session.
4. Click on "Open" button. You will be asked to select the file "chronojump.db" that is located in the "Chronojump/database folder"
5. It will appear a list of available sessions to import. Select the desired session and click on "Accept".
6. If you want to import more sessions go to the step 2.

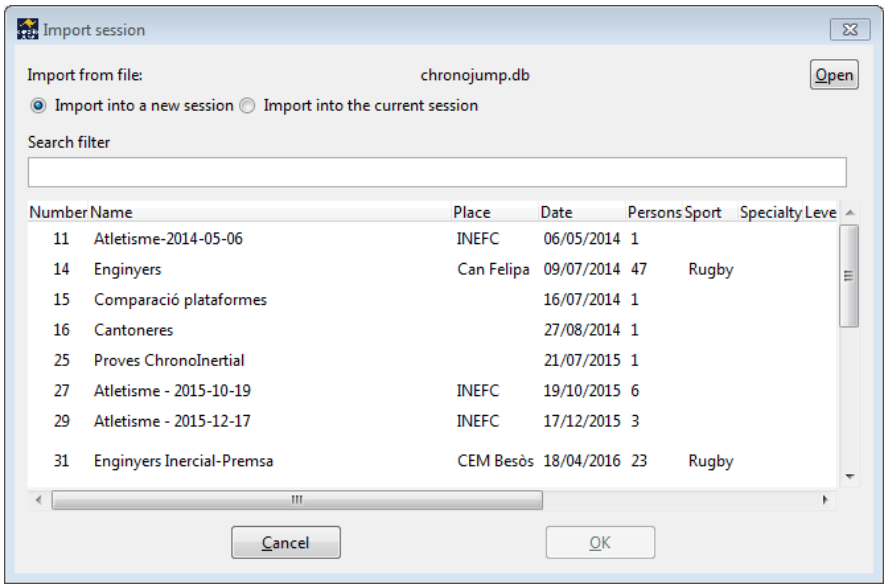


Figura 8.2: Import an existing Chronojump database

8.1.2 Option2: Substitute any previous data existing in the destination computer

This option will erase the existing data in the destination computer. If you aren't sure that this is what you want, please don't use this method.

On the destination computer:

1. Go to Menu -> Session -> Preferences -> Database -> Open data folder
2. A file browser windows will appear with a some folders and files like "database", "encoder", "logs"...
3. Close the Chronojump preferences window and the Chronojump itself.
4. Substitute all the mentioned files and folders by files and folders the stored in the previously exported Chronojump folder.
5. Open Chronojump to check that all the sessions from the origin computer are imported.

8.2 Jumps

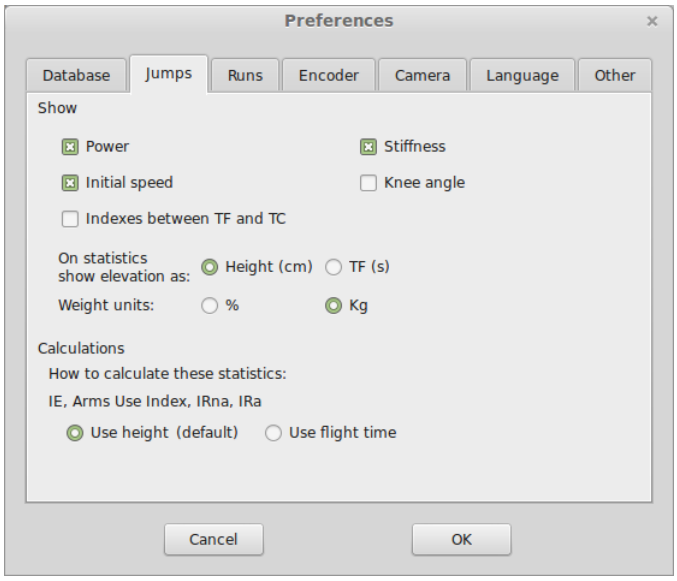


Figure 8.3: Preferences. Jumps tab.

Jumps tab allows to select the information columns that you want to show in the data windows and statistics window.

8.3 Runs

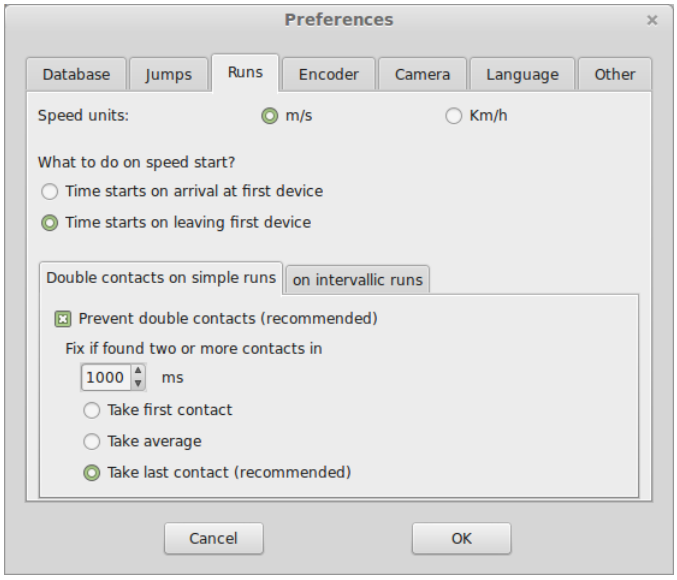


Figure 8.4: Preferences. Runs tab.

This tab allows to configure the behavior of Chronojump in the running tests.

The first option refers to the behavior of Chronojump in the firs contact of a race. It allows to define if the time starts to count when the first contact occurs (stepping on a platform or a photocell gate) or at the moment that the contact is over (step off on a platformm or a photocell gate).

The second option allows you to manage the contacts that are produced in a short time period.

Example: In a race with a couple of photocell gates separated by 10m, an athlete, arriving to one of the gates cross it with the hand and after that with the body with a difference of 20ms. In this case you could set that contacts separated in the time less than 500ms are considered as only one.

8.4 Encoder

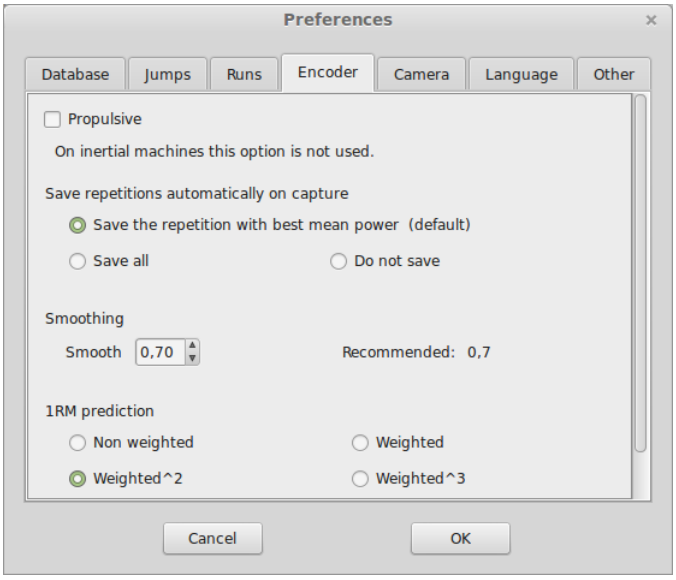


Figure 8.5: Preferences. Encoder tab.

This tab allows to config the behavior of Chronojump in the encoder tests.

The propulsive option is used for calculating for only using only the part of the movement where the acceleration is superior to gravity, in other words, when some force is applied.

You can also select the options of automatic repetition save, as well as the options of the smoothing used in the calculus.

About the 1RM prediction you can select whe method used to weight the statistical data depending on the load used.

8.5 Camera

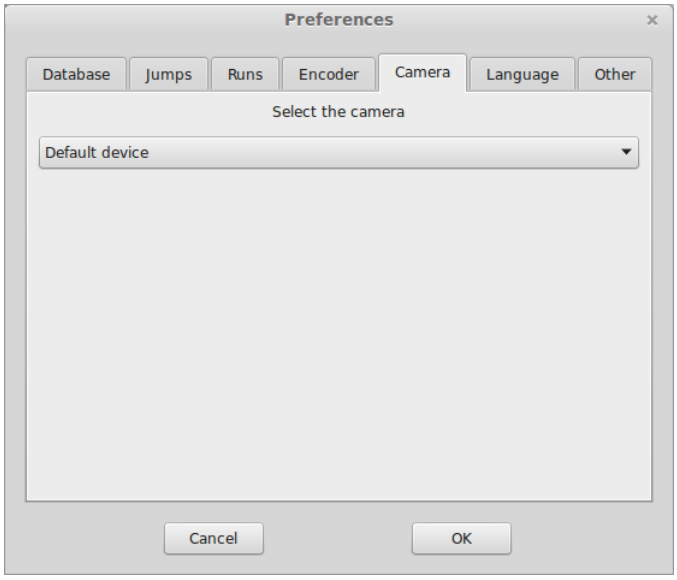


Figure 8.6: Preferences. Camera tab.

This tab allow to select the camera that will be used to take photos or videos with Chronojump

8.6 Language

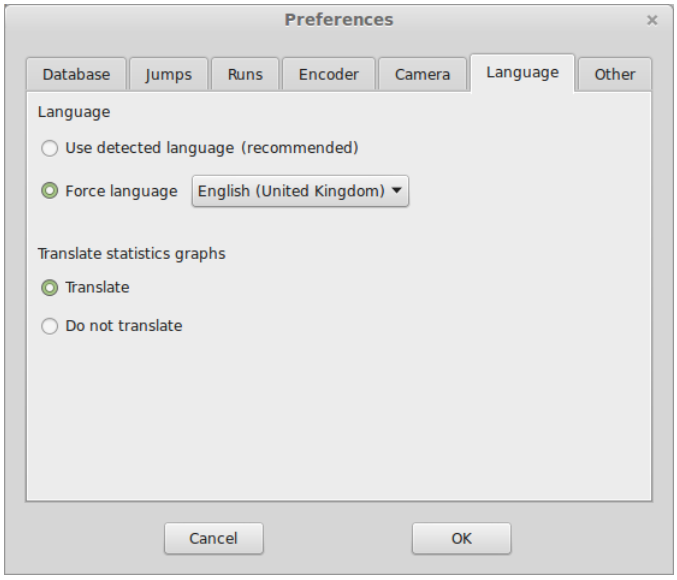


Figure 8.7: Preferences. Database tab.

With this tab you can select the language and translation options.

8.7 Other

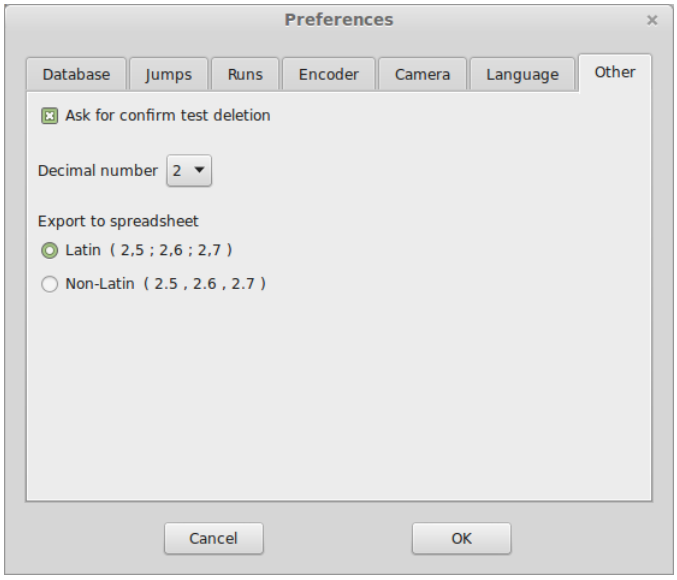


Figure 8.8: Preferences. Database tab.

Other tab has three options. First refers to the number of decimals (recommended 3). If second option is active, then a confirmation window will be shown every time that user wants to delete a test. The last action is specific to the time that limits reactive jumps. If this option is checked, then a reactive jump limited by time will accept a jump where the person is in the air in the moment that time finishes. If is unchecked then this last jump will be rejected.

Part III

Troubleshooting

Chapter 9

General

As a general recommendation, always try to have the software updated to the last published version. This way you'll be sure that already corrected bugs are not the cause of the problems.

9.1 In Mac OSX, while executing Chronojump, it appears a message saying "Maybe R is not installed".

In Mac OSX you need to install the R package independently. Be sure that you have installed it. In the next linx you will find information about how to install it.

http://chronojump.org/en/software/#MacOSX

9.2 Chronojump buttons are disabled in all modes

Make sure that you created or loaded a session with the corresponding athletes.

Chronojump stores automatically all the tests associating them to a session and a person. If there is no active session with athletes you won't be allowed to perform any test.

9.3 The data exported cannot be read correctly

Chronojump allows to export the data of the session, set or repetition in CSV format. Files in this format can be read by spreadsheed applications as MS Excel, libreOffice or Numbers.

When importing the data to any of these programs remember to specify the UTF-8 format and the field and decimal separator characters accordindg to your configuration in Chronojump preferences (Menu -> Session -> Preferences -> Language)

9.4 The RCA cables don't transmit the device signal to the Chronopic

In order to check the RCA cables or adapters connect the Chronopic to the computer with the USB cable and after that connect the RCA adapter or cable. Make sure that no device is connected to the

RCA cable or adapter. The LED to the right of the USB socket should stay on. In the case it isn't, it means that the cable or adapter should be replaced.

In the case it is not turning off, with the side that is not connected, use some metallic piece to shortcircuit the central pin and the exterior metallic part of the RCA connector as shown in the picture. At this moment the green LED should turn off. If this is not the case it would indicate also that the cable or adapter should be replaced.

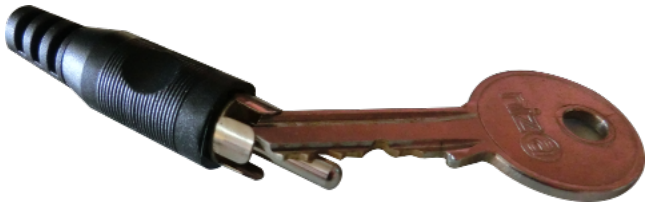


Figura 9.1: Checking the RCA cable

Chapter 10

Chronopic

10.1 The Chronopic doesn't appear in the list of devices connected.

10.1.1 Windows systems

In some occasions, Windows or some antivirus, can disable the Chronopic driver. To solve this issue it is recommended to follow this steps:

- Downlod Chronojump installer from http://chronojump.org/en/software/
- Disable any antivirus on your system.
- Reinstall Chronojump by executing the installer and making sure that the Chronopic driver checkbox is marked.

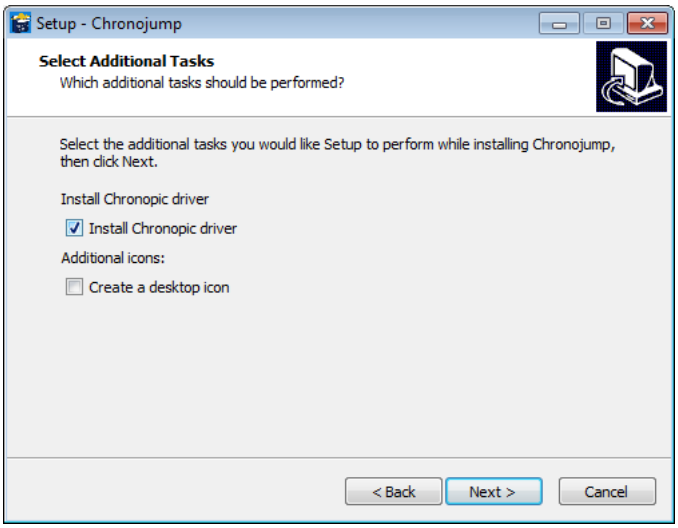


Figura 10.1: Chronopic driver installation

10.1.2 MacOS

In previous versions of OSX you need to install Chronopic drivers.

Since the update of MacOS to the version 10.13 it is not necessary to install the Chronopic drivers.

If you are using the 10.13 version (High Sierra) or above and you have installed Chronopic drivers previously and they are not working correctly ... We recommend you to uninstall the Chronopic drivers following this steps:

1. Open a Finder window
2. Go to Menu -> Finder -> Preferences
3. On General tab -> Show this items on the desktop:, check Hard disks
4. On your desktop, open your Macintosh HD
5. Go to /System/Library/Extensions.
6. Locate FTDIUSBSerialDriver.kext and move it to trash.
7. Go back three times and go to /Library
8. Locate FTDIUSBSerialDriver.pkg and move it to trash.
9. Go to Menu -> Finder -> Preferences
10. On General tab -> Show this items on the desktop:, uncheck Hard disks
11. Make sure there's no USB devices connected to the computer and reboot it.

10.2 The multitest Chronopic doesn't send any information to Chronojump

The green LED to the right of the USB socket should be on if the Chronopic is receiving no signal at all and should turn off in the other case. Check RCA connections following the instructions on the 9.4 section.

First of all you must check that the LED D4 of the Chronopic is on once it is connected to the computer with the USB cable. Without no devices connected to the Chronopic, the RED LED to the right of the USB connector should be on. In case it is not check that the USB cable is OK and connected to the computer.

The green LED to the right of the USB port shows the state of the device connected to the Chronopic. If no device is connected the LED shoud be on.

- If the green LED is on, check the communication between the Chronopic and Chronojump running it and, with the Chronopic connected, perform some test. It is not necessary to connect any device to the Chronopic. You can use the test button to simulate any interruptor device as a contact platform or a photocell. When pressing the test button the green LED should switch off and Chronojump should detect the contact. If it is not the case see the next chapter.
- If the green LED is off, It probably is a hardware problem and a Chronopic or USB cable substitution is needed.

Chapter 11

Jumps

11.1 The contact platform doesn't detect any jump.

Check the RCA cables following the instructions on the 9.4 section.

If the cable doesn't show any of the above simptoms, connect the contact platform to the RCA cable already connected to the Chronopic. If the green light to the right of the USB connector turns off, it means that the two inner copper plates of the platform are in contact or that the RCA connector is in bad condition.

In that case, check that there is no knocks on the corners of the platform that causes the two copper being in contact. If it is this way, you can use a flat screwdriver to separate the two copper plates and introduce some piece of paperboard or other insulating material.

In the case that the problem is in the RCA connector it would require a substitution or cable repairing.

11.2 The height of the jumps is random and independent of the real height.

Check that the jump you are viewing in the software is not a simulated one. Before the 1.6.2, in the case of not having a Chronopic connected, Chronojump performs a simulated jump with random values. This can be checked in the bars and seeing if there is a "Simulated" word inside the height bars.

To connect the Chronopic go to the section 4.3

From 1.6.2 version and above this behavior only happens in the "Simulated" session

11.3 In countermovement jumps, the height of jump are very low.

In some subjects, specialy those with low weight, during the excentric phase is detected a loss of contact with the platform. This is because of a too quick descent with an acceleration close to the gravity. This negative acceleration provoques the force exerted on the platform to be very little and, in conjuction with the light weight of the subject, his presence is not detected.

In this occasions it is recommended to give instructions to the subject to not fall so quickly.

Besides, the evaluator can press the Chronopic Test button until the subject starts the concentric phase of the jump.

Chapter 12

Races

12.1 The photocell barriers doesn't work when the athlete passes at high speed.

Check that the elapsed time between crossing one barrier and the next is greater than the time set to avoid double contacts. You can see the configuration at Menu -> Session -> Preferences -> Races.

12.2 The photocell doesn't switch on

The photocells need to be powered with altern current or direct current. Make sure that beside the RCA that connects the Chronopic and the photocells, they are connected to the power. To check that the photocell is switched on you there's is a LED in the front side that switch on when the photocell is powered. If the photocell is aligned with the reflector you should ear a clic each time you interrupt the beam with your hand.

12.3 The time counter doesn't start when the athlete crosses the photocell

If you have all the photocells powered and the time counter doesn't start it can be caused by a misaligned photocell. If this is the case the green light of the Chronopic will be switched off. If this is the case Chronojump interprets this situation as if the athlete is in the first photocell and have not started yet.

To know if a photocell is aligned you can interrupt the beam with your hand. If the interruption causes a click, it means that is alligned. In other cases it means that the photocells is not aiming to the reflector.

Figura 12.1: Alignment of the photocell

Chapter 13

Encoder

13.1 When capturing with an encoder Chronojump doesn't receive any signal at all.

Check that the Chronopic is connected to the computer with a USB calbe. If this is well connected the red light to the right of the USB connector should be switched on.

Check that the encoder is connected to the Chronopic. Is older versions of the Chronopic the encoder is soldered directly to the Chronopic, but in the newer versions the connections are made with an RJ45 connector (the same type as in the LAN connections)

In most of the inertial machines the Chronopic is integrated in the machine itself and can be more difficult to see the RJ45 connector. If you cannot locate this connector, contact your provider to ask for it.

13.2 When analysing a progressive loads test, all the repetitions have the same load.

Check that you have selected the mode Individual / current session  and you have selected the repetitions of each set previously saved.

13.3 In the 1RM analysis, Chronojump doesn't show any 1RM

To show the value of the 1RM after a progressive loads test three conditions are needed.

1. The exercise must have defined the speed at which the 1RM is performed.
2. It must have been performed a progressive loads test with at least three different loads.
3. The loads mus be gravitational loads. In the inertial machines it doesn't exist the 1RM concept.

Appendix A

Chronopics prior to Chronopic 3

This appendix is only useful to users who own an old Chronopic (sold before March 2008).

A.1 Chronopic versions

Version	Launched	Connection	available at*	Price*
Chronopic3 (fig 3.1)	March 2008	USB	Sent to all the World	37€
Chronopic2-USB (fig A.1)	September 2007	USB	Argentina	150$ argentina
Chronopic2-Seral (fig A.2)	September 2007	Serial	Argentina	150$ argentina
Chronopic1 (fig A.3)	2005	Serieal	Spain	70 €

* Currently, only Chronopic3 is commercialized. If you want it, just visit Chronojump store: `http://chronojump.org/pricing.html`

Table A.1: Chronopic versions.

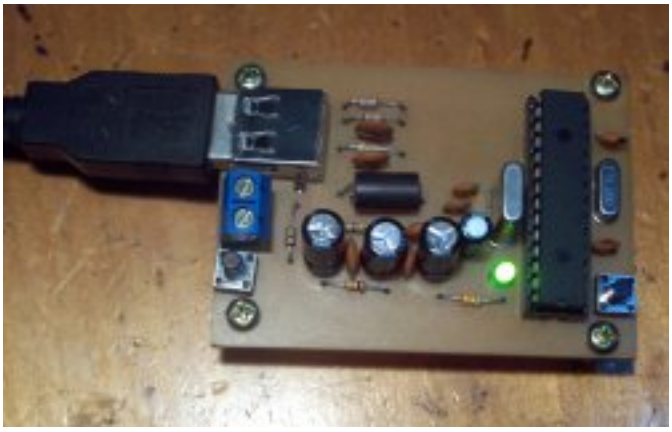


Figure A.1: Chronopic2-USB.

Figure A.2: Chronopic2-Serial.

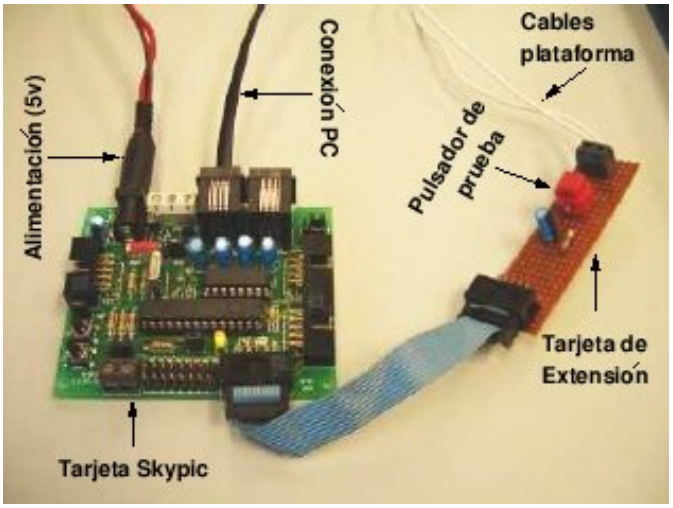


Figure A.3: Chronopic1.

A.2 Connections in Chronopics serial

Chronopics serial require external power therefore it should be connected to a feeder. In addition, these Chronopics requires to be connected to the computer by a cable. If your computer has serial port, it's enough with a telephone cable serial. If it doesn't have USB port, you must convert to USB, it's required a USB-serial cable or a PCMCIA adapter or with another adapter with the same functionality. See figure A.1 for an example of Chronopic1 connection.

Serial Chronopics use 4.5 to 6 volts feeder. Is possible the purchase of a conventional power supply (which is connected to a power source) or create a homemade feeder with 3 x 1.5 volts batteries. This option provides the field tests in Chronopics serials.

With old Chronopics series, the battery connection should automatically turn the light on even if the Chronopic isn't connected to any computer. This is a good test to know if the power is working.

If it doesn't work, is recommended to connect the power to the Chronopic and verify that the light is on (no need of computer) If the light doesn't turn on, this mean that the failure is in the Chronopic or in the feeder. Try this again with another feeder or Chronopic to determine the origin of the failure. The feeder should be between 4.5 and 6 volts. Some feeders have two polarities, ask the seller and connect with the correct polarity.

A.3 USB and serial ports

Chronopic should be connected to the contact platform and the computer. PC connection is via port as shown in Table A.1.

Currently, most laptops do not have a serial port, so the USB port is required by most users. Users without serial port should get a pcmcia card or similar type to add serial port to the computer. The latest and favorite choice is to get a USB-serial cable. In many cities it's difficult to find these cables in stock if they haven't been previously requested. Another option is to buy them online.

The operating system assigns names to ports, as shown in Table A.2.

Operating system	Port	Name
MS Windows	Serial	**COM1** or COM2
MS Windows	USB	COM1, COM2, COM3, ... (seen to COM27)
GNU/Linux	Serial	**/dev/ttyS0** or /dev/ttyS1
GNU/Linux	USB	**/dev/ttyUSB0**, /dev/ttyUSB1

Table A.2: Names of each operating system port.
The most common names are in bold type text.

The plate-USB Chronopic2 may require a driver if Windows is not able to detect it. Windows should automatically assign a name (COM1. COM8 ..) to the USB port connection, but in many Windows installations this process is not completed therefore it's required the driver (According to the manufacturers is not necessary the cable because is automatically detected). Therefore is recommend to download a USB-serial driver: `http://www.serialgear.com/wd_pl2303h-hx-x_v20019v2021.zip`, or any other provided by the manufacturer or obtained by the network looking for "USB-serial driver ".

A.4 Chronopic3 assembly process (initial units)

Chronopic was initially distributed in two parts: the circuit and the elements that made up the box: methacrylate, screws and washers. Figure A.4 shows the assembly. Note: These instructions are only necessary for the first step of the assembly process. The latest Chronopic versions are fabric build.

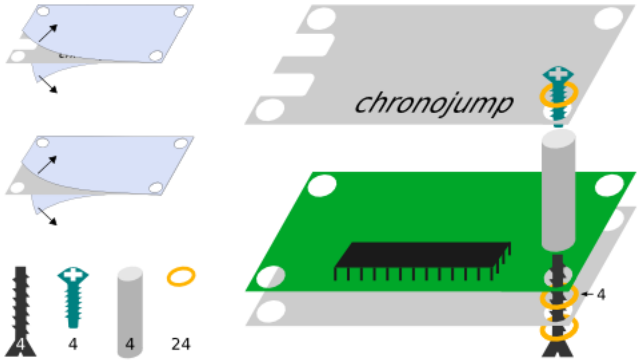


Figure A.4: Chronopic3 assembly process (initial units).