Quintic Software Tutorial 8c

Multi Trial Analysis

V35

Contents Page

1. Analysis Systems

Quintic allows the user to analyse up to 21 different videos within our Multi Video analysis option. The data from these videos are calculated for you and can be viewed in graphical form by pressing either the Linear Analysis or the Angular Analysis buttons.

From this you can then select Single Video Analysis or Multi Video Analysis.
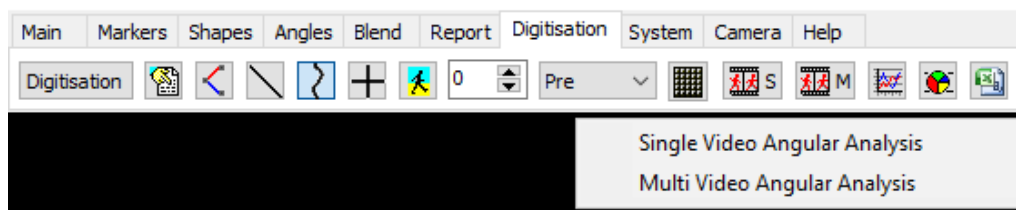
Linear Analysis

Click on the Linear Analysis button, then either select **'Single Video Linear Analysis'** (this is covered in Tutorial 8B) or **'Multi Video Linear Analysis'**.
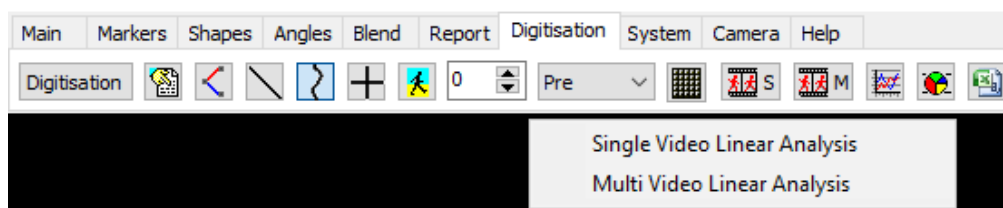
Linear analysis will provide data on the Distance, Velocity and Acceleration of the points that have digitised.

Angular Analysis

Click on the Angular Analysis button, then either select **'Single Video Angular Analysis'** (this is covered in Tutorial 8B) or **'Multi Video Angular Analysis'**.

Angular Analysis will provide data on Angular Displacement, Angular Velocity and Angular Acceleration of the points that have been digitised.

2. Folder Setup

Multi trial analysis allows you to display the data from multiple trials on the same graph.

In order to complete this analysis, all of the relevant files for each trial must be placed in the same folder (up to 21 different trials).

Video file (AVI in picture below) – The video file format must be one that is compatible with Quintic. At least one of the trials must have the original corresponding video file, in order to open the video and begin analysis.

CAL – The CAL file contains the information of the known length used to calibrate the corresponding video file. All calibration files must be present with the corresponding video file and related QDF. It is recommended that each video trial also has the same frames per second.

QDF – The QDF file contains the coordinates of the raw digitisation trace for a given video. The QDF of each trial is required.

QBC – The QBC file contains the parameters of the Butterworth filter applied to the digitised trace. This file isn't necessary as it is possible to analyse raw data. However, if you wish to analyse smoothed data, every QDF file must have a corresponding QBC file. You cannot analyse data with a mix of raw and smoothed data. If smoothed data series are used, the same smoothing parameters do not have to be applied for all trials.

MRK – The MRK file is the location of up to 10 frame markers placed on the video within Quintic. These files aren't essential when analysing data, however, can be used to synchronise video traces to a common time event. If you wish to synchronise the videos relative to a common marker then all MRK files must be present and correspond to a QDF file.

Below is an example of the files (highlighted) required to complete multi-trial video analysis with traces synchronised to a common frame marker. Analysis can be completed with a folder containing extra files, such as the video files for each trial shown above. However, this is not essential.

If you wish to compare one average against another (eg. that of the right fore leg during equine analysis) then add the relevant files for each trial to the same folder as above.

Name	Date modified	Type	Size
Left_Fore_1	23/07/2014 16:11	AVI File	63,476 KB
Left_Fore_1	16/01/2017 16:35	CAL File	1 KB
Left_Fore_1	16/01/2017 12:38	FPS File	1 KB
Left_Fore_1	16/01/2017 16:35	HCAL File	1 KB
Left_Fore_1	16/01/2017 12:40	MRK File	1 KB
Left_Fore_1	16/01/2017 12:39	QBC File	1 KB
Left_Fore_1.qdf	16/01/2017 12:39	QDF File	98 KB
Left_Fore_1	16/01/2017 12:38	VCAL File	1 KB
Left_Fore_2	23/07/2014 16:12	AVI File	70,505 KB
Left_Fore_2	16/01/2017 12:40	CAL File	1 KB
Left_Fore_2	16/01/2017 12:42	MRK File	1 KB
Left_Fore_2	16/01/2017 12:41	QBC File	1 KB
Left_Fore_2.qdf	16/01/2017 12:41	QDF File	103 KB
Left_Fore_3	23/07/2014 16:13	AVI File	67,001 KB
Left_Fore_3	16/01/2017 12:42	CAL File	1 KB
Left_Fore_3	16/01/2017 12:43	MRK File	1 KB
Left_Fore_3	16/01/2017 12:43	QBC File	1 KB
Left_Fore_3.qdf	16/01/2017 12:43	QDF File	92 KB
Left_Fore_4	23/07/2014 16:15	AVI File	46,407 KB
Left_Fore_4	16/01/2017 12:43	CAL File	1 KB
Left_Fore_4	16/01/2017 12:47	MRK File	1 KB
Left_Fore_4	16/01/2017 12:47	QBC File	1 KB
Left_Fore_4.qdf	16/01/2017 12:47	QDF File	75 KB

A folder containing all the files necessary for multi linear/angular analysis of the left fore leg of a horse during equine gait analysis.

3. Multi Video Linear Analysis

Once all the videos have been digitised and the folder has been set up correctly, you are able to perform a Multi Video Linear Analysis. Simply open a video from your Multi Video Analysis folder and load the digitisation trace. Then click on the **'Multi Video Linear Analysis'** option after the Linear Analysis button has been pressed.

If the digitisation trace has not been loaded on the video, the following pop up will appear, asking you to load the digitisation trace, please click **'Yes'**.
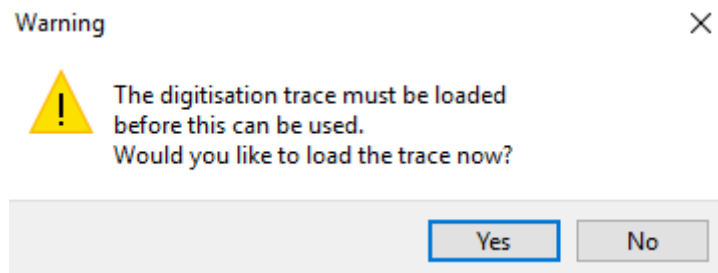
Once the digitisation trace is loaded and the **'Multi Video Linear Analysis'** button has been pressed, the Multi Video Linear analysis window will load.

This will display the Distance, Velocity and Acceleration in 3 different graphs, for all the videos within the folder, which have been set up correctly within the multi-video analysis folder.

If there are any Time Event Markers (please see Tutorial 2 for further information) that have been saved with the videos, they will also be displayed onto all 3 graphs. This will allow the user to quickly identify on the graph the key events of interest to them (i.e Impact, Low Point, Toe Off etc) and the data to be synchronised to these common time events. The Time Event Markers will be displayed on the graphs by a blue line, with the default name of Marker 1, Marker 2 (if the Time Event Markers have not been named) or the relevant name of that marker if they have been named. The time event markers displayed are only relating to the associated video which is open within the Quintic Window (unless synchronised to a marker and then that one marker is true for all videos within the Multi analysis).

Any Interpolation Markers that have been added to the digitisation trace and saved, will also be shown on the graphs. These are shown with a burgundy line on the graphs.

Please see below an example of the Multi Video Linear Analysis Window within Quintic Biomechanics v35 software.

File Units Frames/Page Display Origin Save Results Settings

Linear Distance (m)

Linear Speed (m/s)

Acceleration (m/s/s)

Relative Frame Number

Show Averages   Settings   ✓
95% PI   95% CI   Data   Avg Only

Av   Opp
☑ ☐ Left_Hind_1
☑ ☐ Left_Hind_2
☑ ☐ Left_Hind_3
☑ ☐ Left_Hind_4
☑ ☐ Right_Hind_1
☑ ☐ Right_Hind_2
☑ ☐ Right_Hind_3
☑ ☐ **Right_Hind_4**

☑ Linear
☐ Horizontal
☐ Vertical

Trial Details
Live Data

Raw Data Series
Moving Average: 5pts

Equine - Hind Leg

Marker Names
Tuber Coxe
Hip
Stifle
Hock
Fetlock
Coronet

Highlights the different video trials which are displayed on the graphs. Each trial has its own colour. The user is able to select and deselect which trials are displayed on the graphs. Users are also able to opposite the horizontal direction of the trace.

Select linear, horizontal or vertical values by ticking the relevant box. These values will then also be displayed on the corresponding graphs.

Digitisation Trace Information. Please see below for further information

Select which marker to display from the menu. This corresponds to the amount of points in the digitisation trace.

Data Series Type – Either smoothed or raw data. In this example smoothing parameters have been applied to the traces.

Raw Data Series
Moving Average: 5pts

Moving Average – This displays the moving average that is applied to the data. Please see the heading "Moving Average" below for more information.

Live Data

Live Data Table – This button will pop open the Live Data table, which allows the user to easily identify data values at specific points of interest, throughout the video. Please see the heading Live Data Table for more information.

Trial Details

Trial Details – This button will pop open the details of the trials included within the analysis. Details include: Frames per second of the videos, whether smoothing has been applied and number of frame markers.

Select All – When pressed, this will show all of the digitised traces on all the graphs.
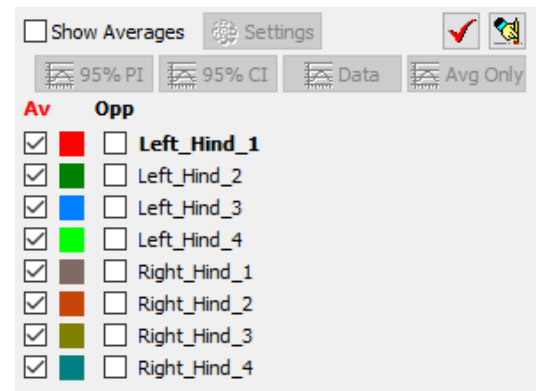
Deselect All – When pressed, this will hide all of the digitised traces on all the graphs.

This allows the user to create an average from the video trials which are displayed. The user is able to display one, two and/or the normative average on the graph.

When Show Averages is unticked:
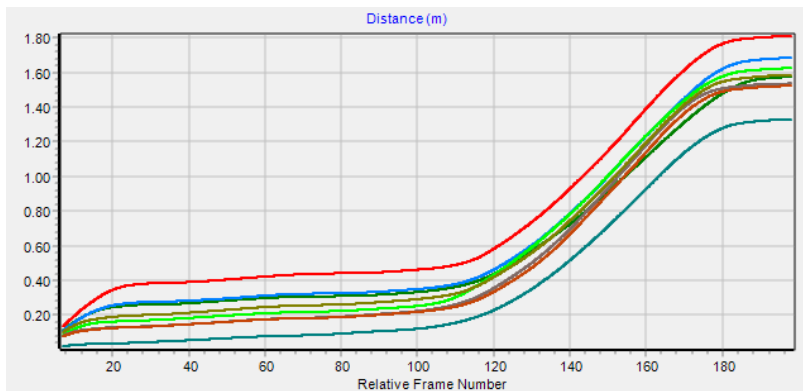
When Show Averages is ticked:

When the show averages option is ticked, all of the other buttons related to the average will also become active.

These are as follows:

Avg Only | Avg Only

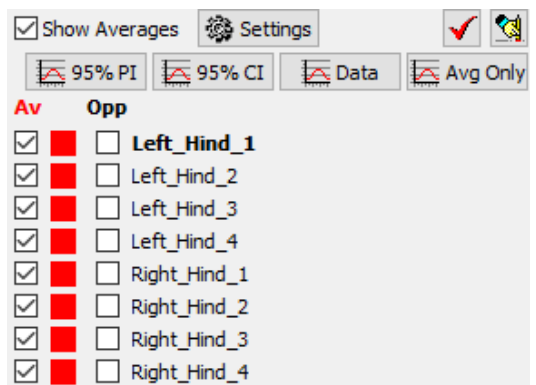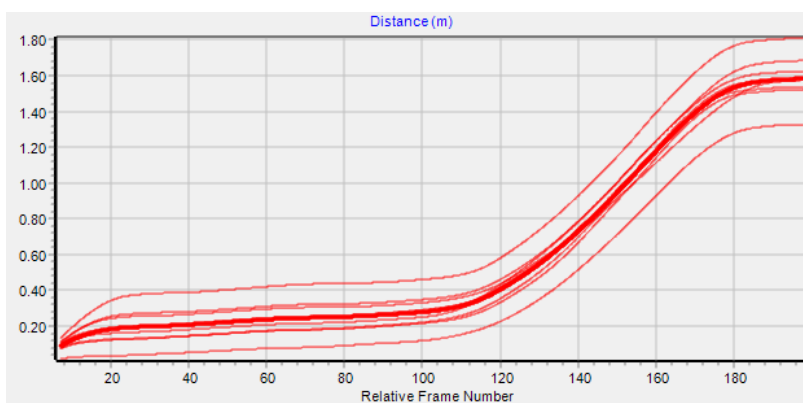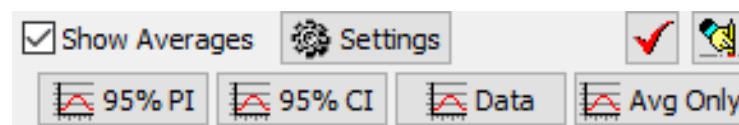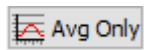This will display the average only on the three graphs (Distance, Velocity and Acceleration). If you have more than one average displayed (i.e 2nd/normative) this will also display the average only of these averages.

Data

This will display the average as well as all of the individual data traces on the three graphs (Distance, Velocity and Acceleration). If you have more than one average displayed (i.e 2nd/normative) this will also display the average and data traces for these averages. The associated data traces are appropriate colour to the average they are in i.e Red/Blue.

95% CI 95% CI

This will display the average as well as the 95% confidence intervals on the three graphs (Distance, Velocity and Acceleration). If you have more than one average displayed (i.e 2nd/normative) this will also display the average and 95% confidence intervals for these averages.

95% PI 95% PI

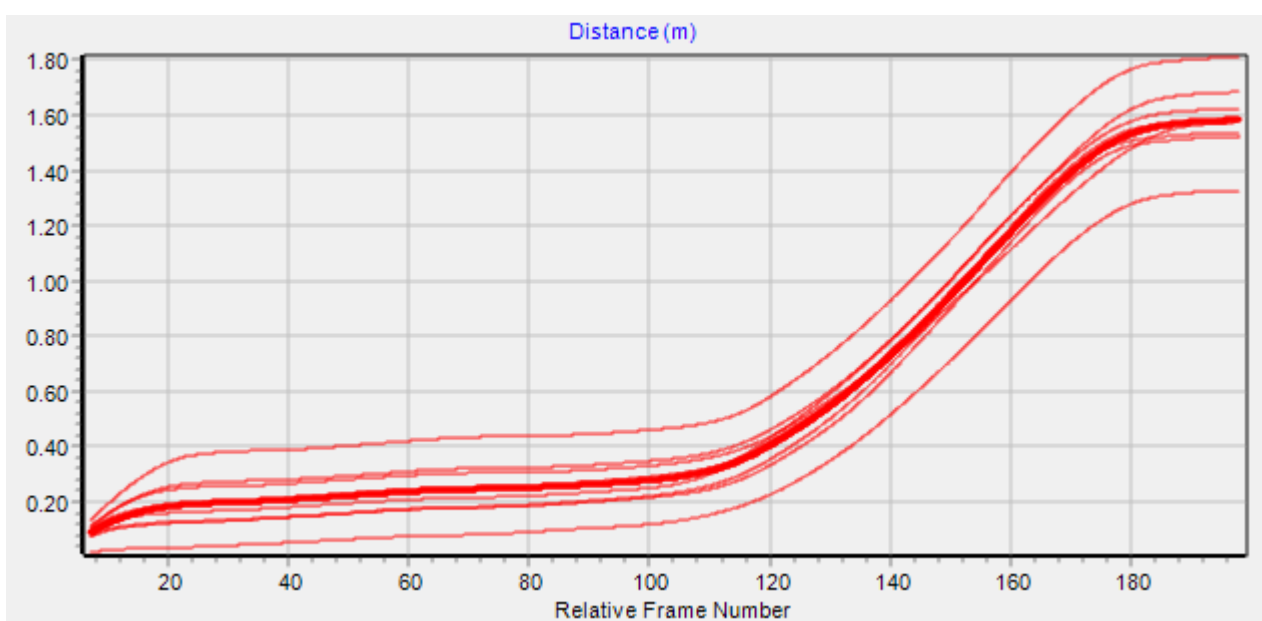This will display the average as well as all of the 95% prediction intervals on the three graphs (Distance, Velocity and Acceleration). If you have more than one average displayed (i.e 2nd/normative) this will also display the average and 95% prediction intervals for these averages.
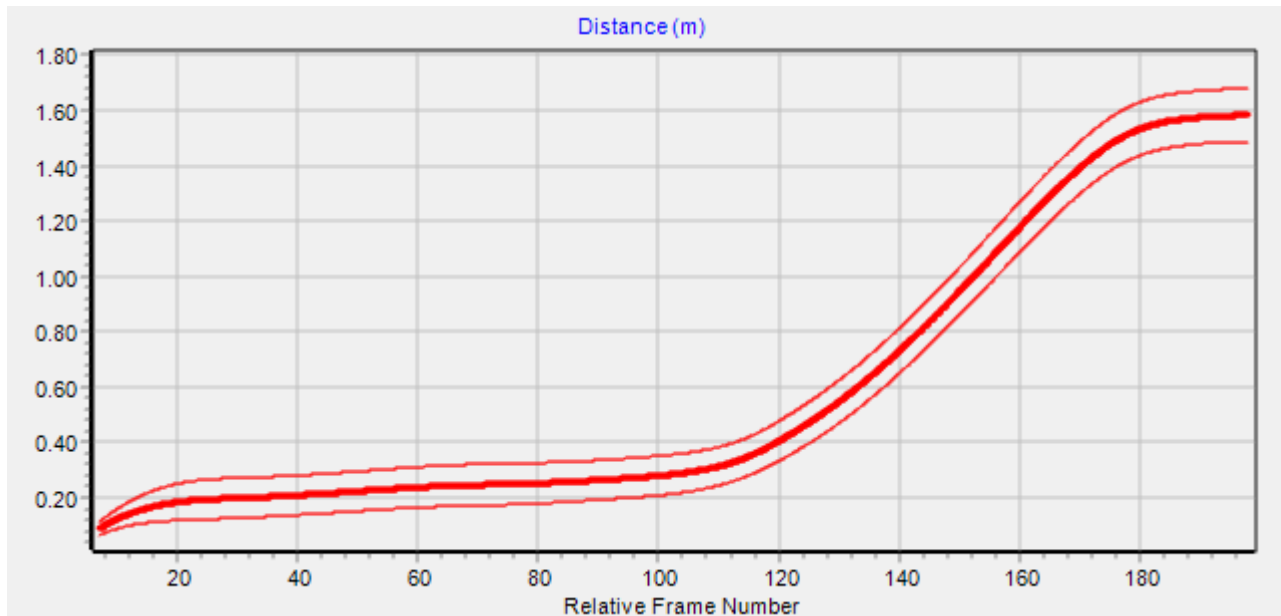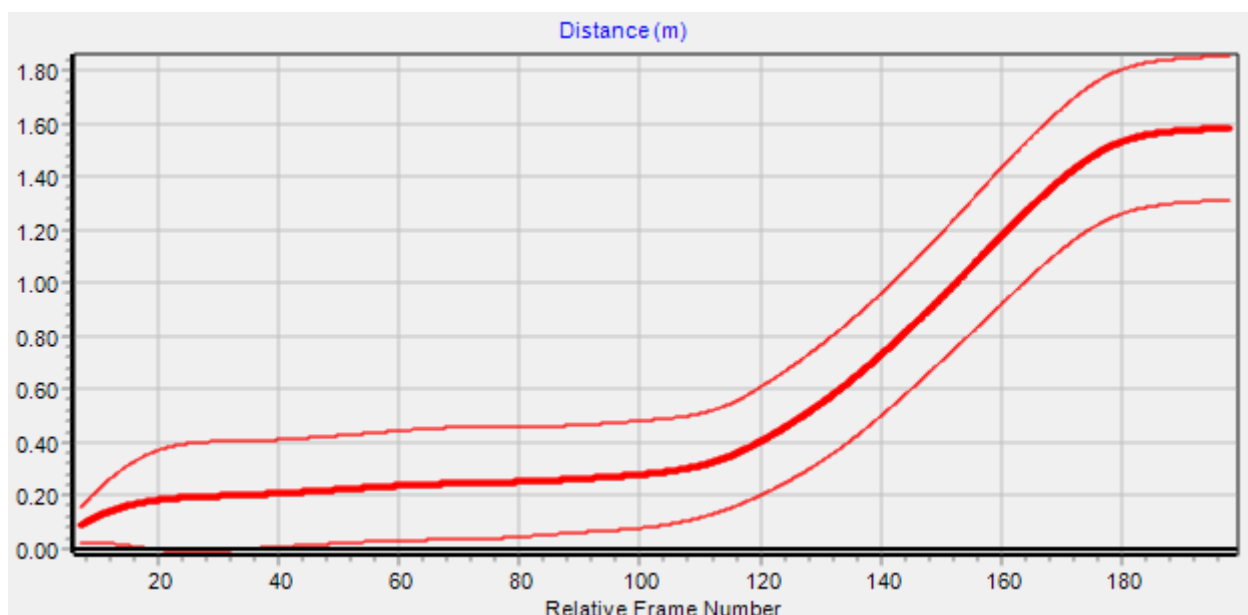
Both the video in the main window and multi - analysis windows are synchronised, therefore if the video is played while the separate analysis window is open, a black line indicates the current video frame.

The video which is synchronised with the analysis window will be displayed in bold where the video files are listed.

Each graph can be expanded to the size of the analysis window by double clicking on the relevant pane.

Alternatively, to zoom in on a specific area of the graph drag the cursor over the area you wish to zoom in on. The graph will resize and rescale in order to fill the graph area.

a. Functions

Within the Multi Video Linear Analysis window there are a range of functions which the user is able to change, which directly affect the distance, velocity and acceleration graphs.

The functions are available at the top of the Multi Video Linear Analysis Window and are as follows:

File   Units   Frames/Page   Display   Origin   Save Results   Settings

b. File

Within the File menu, the user is able to Print, Print Preview, Save as JPEG or Copy to Clipboard the individual Distance, Velocity and Acceleration graphs. The user is also able to Print, Save as JPEG or Copy to Clipboard the Distance, Velocity and Acceleration Graphs with or without the side bar as one image.
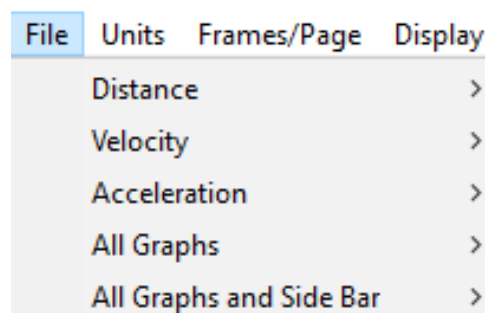
c. Units

Within the Units menu, the user can change the units for the Distance and Speed/Acceleration graphs. The Distance options are Metres or Feet. The Speed/Acceleration options are as follows: Metres/Second, Kilometres per hour, Feet/Second or Miles per hour.
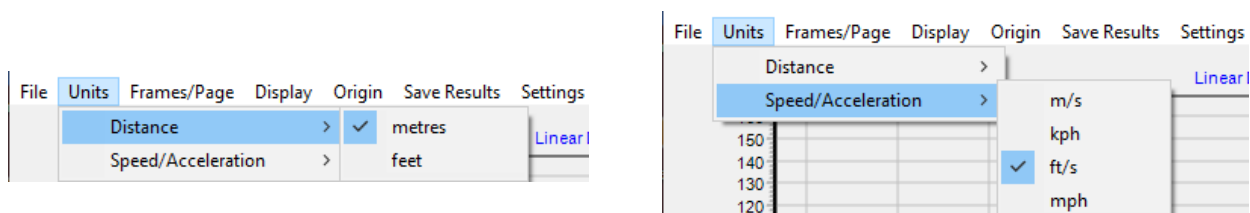
d. Frames/Page

Within the Frames/Page menu, the user is able to select how many frames are displayed on the graphs within the analysis window. This is ideal for users who have long digitisation traces.

As default, the analysis windows will display all of the points on the graphs. Should users want to change this, they are able to do this by going to the Help tab within the main Quintic software. To do this, click the 'Help' button, then Settings, Analysis Defaults, Frames/Page and then select your preferred option. This will apply to all analysis windows.

e. Display

Within the Display menu, the user is able to able to adjust certain display settings which affect the Distance, Velocity and Acceleration graphs.
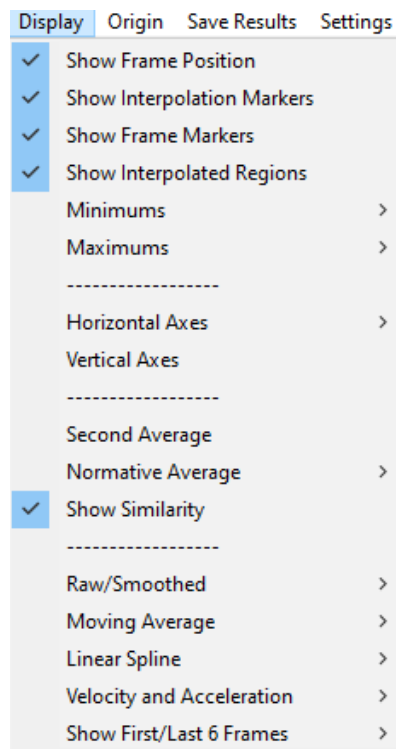
Show Frame Position – Ticking and Unticking the Show Frame Position (Default – Ticked/On) will show and hide the black line which appears to highlight the current frame position in relation to the current frame in the video. Current frame position for the video that is bold within the multi analysis window.

Show Frame Position ON:
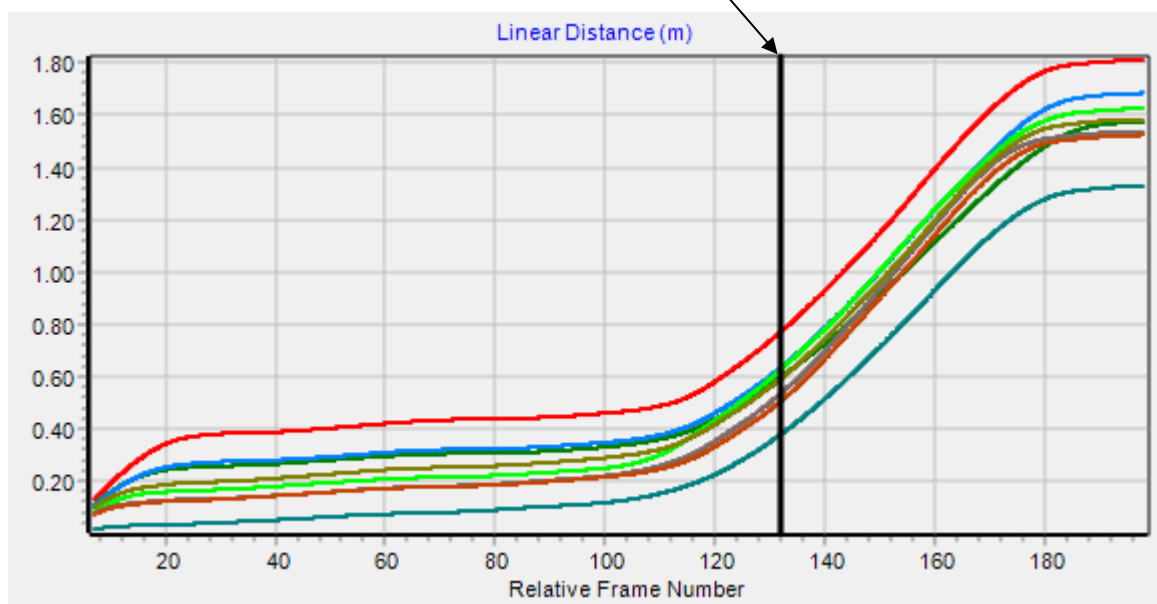
Show Interpolation Markers – Ticking and Unticking the Show Interpolation Markers (Default – Ticked/On) will show and hide any Interpolation markers which are saved onto the associated digitisation trace. They will be shown on the graph by a burgundy line(s). Interpolation markers displayed are in relation to the video that is bold within the multi-analysis window.

Show Interpolation Markers ON:
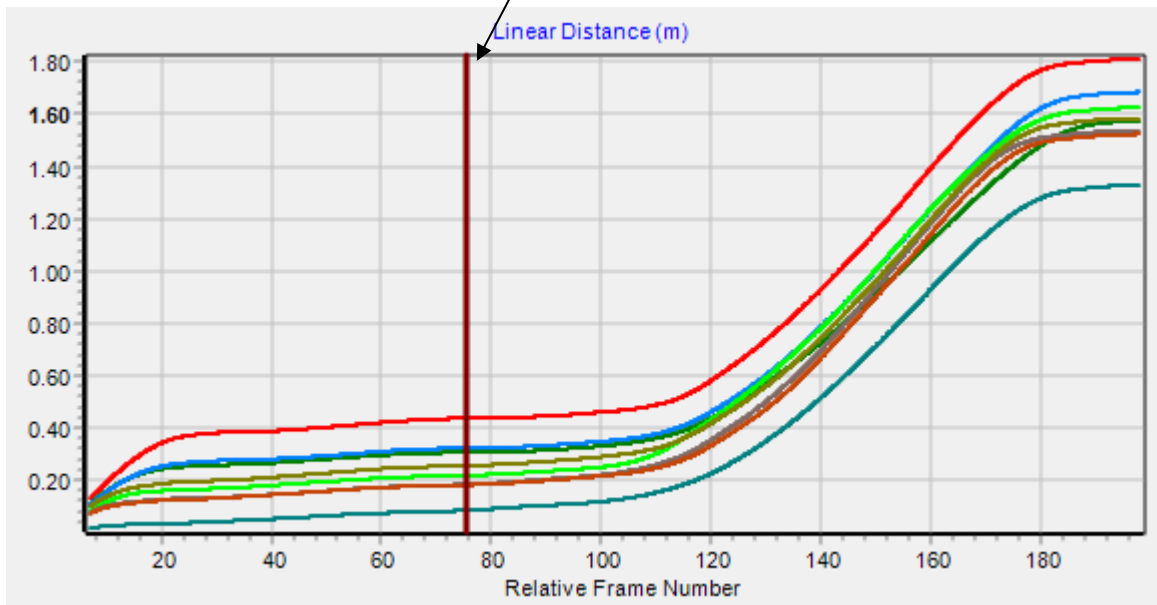
Show Frame Markers – Ticking and Unticking the Show Frame Markers (Default – Ticked/On) will show and hide any frame (Key Event) markers if there are any saved and within the digitisation range. They will be shown on the graph by blue line(s) and will either say Marker 1, Marker 2 etc if they have not been named or the relevant names if they have been named. The time event markers displayed are in relation to the video that is bold within the multi analysis window.

Show Frame Markers ON:
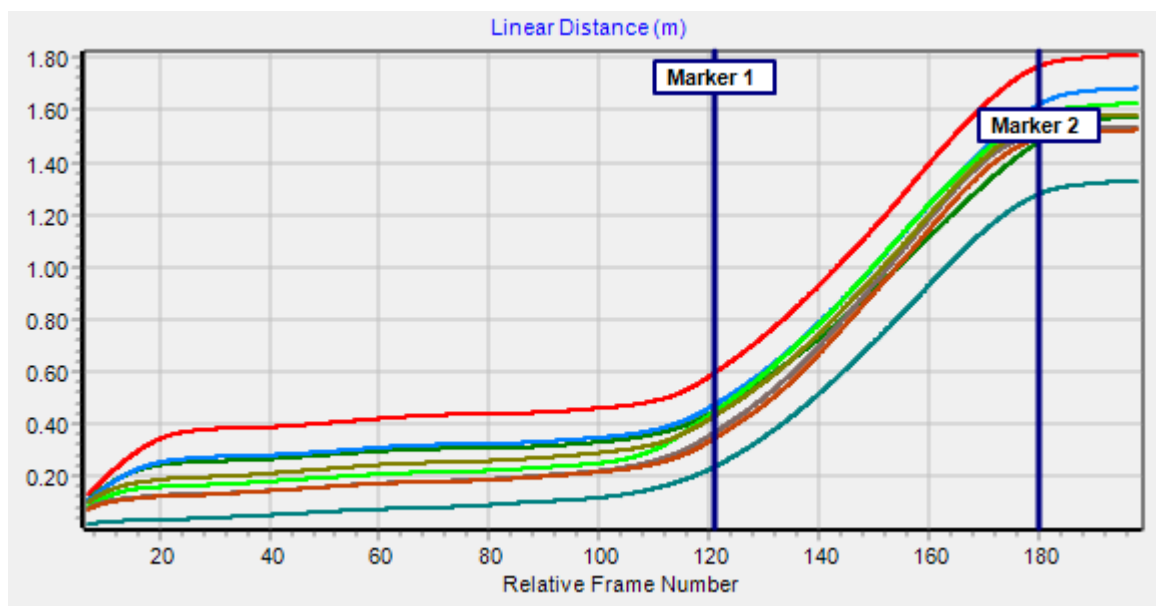
Show Interpolated Regions (Intelligent) – Ticking and Unticking the Show Interpolated Regions (Intelligent) will show and hide any regions where the reflective markers were lost or occluded and the marker(s) are interpolated within that region. When analysing trial data in Quintic, the regions where interpolation has occurred are shown using different colours of box and hatching:

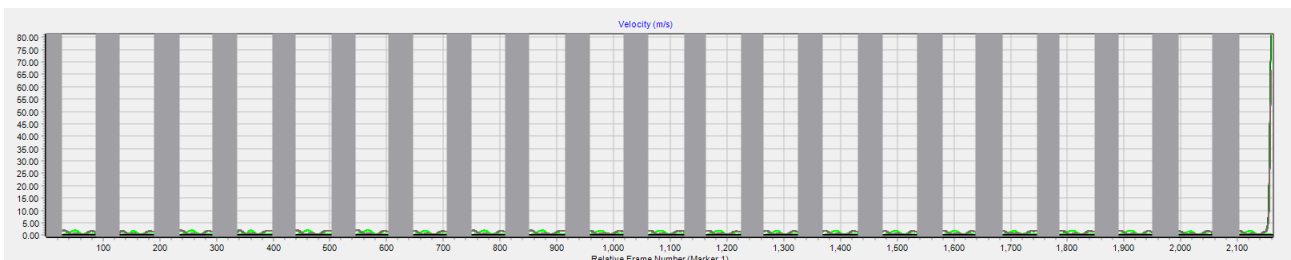*Solid Grey Box* – This occurs when the whole reference template has been lost from the Area of Interest (AOI). The solid grey box appears on the graph between the frame where the template was completely lost and the frame where the whole template was re-found. The data series in this region is obscured from view.

Coloured Hatching – Covers the region of the graph where a single marker has been lost. The colour of the box is dependent on the colour of the marker selected when creating the reference model.

Interpolated Regions ON:
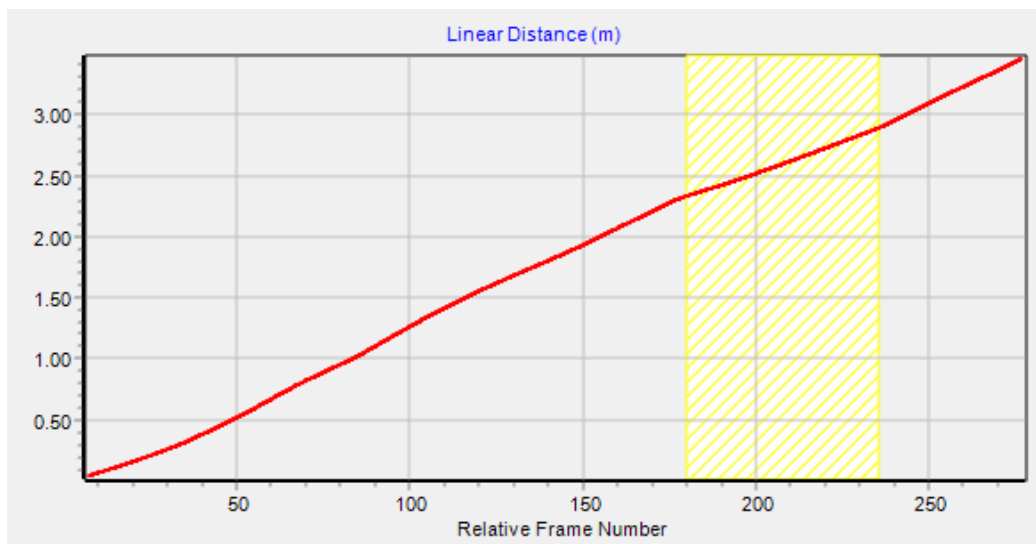
When using Multi Angular Analysis hatching will only be displayed when the selected angle includes the marker that has been interpolated. E.g. When analysing the knee angular velocity during a gait analysis, regions where the hip marker has been interpolated, the hatchings will be displayed.

However, in order to show interpolated regions, all videos must be digitised using the Intelligent Digitisation function in Quintic Coaching or Biomechanics v29/v31/v33/v35.

Minimums – The user is able to identify the minimum point on the Distance, Velocity and Acceleration graphs. Options are Min, Min and Value and Min, X Pos and Value.

Min – This will draw a small notch for each individual point at the minimum position for distance, velocity and acceleration.
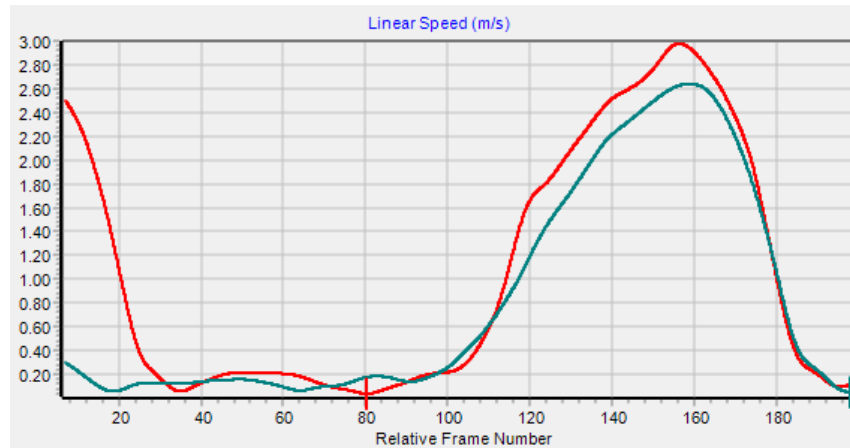
Min and Value – This will draw a small notch and give the minimum value at the minimum position for distance, velocity and acceleration.
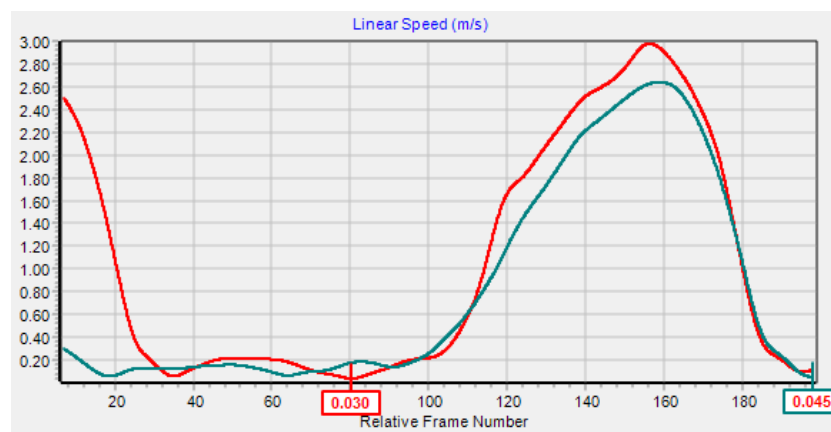
Min, X Pos and Value – This will draw a small notch, give the X position (whether this be time or frame number) and the minimum value at the minimum position for distance, velocity and acceleration.
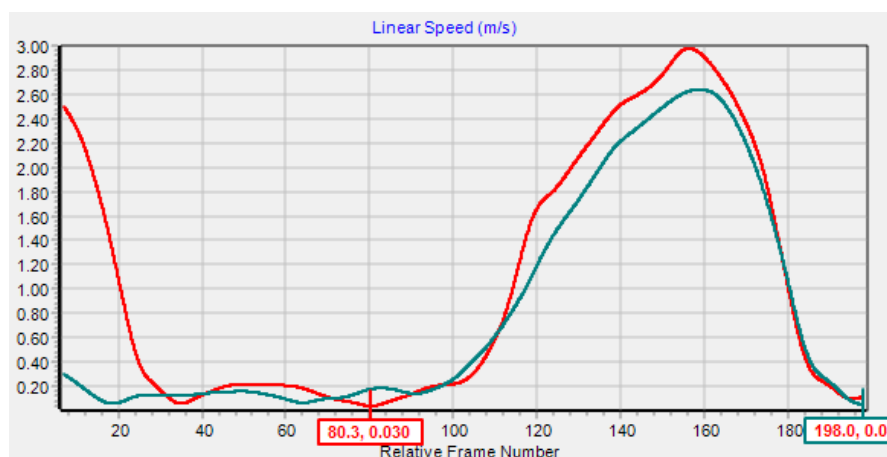
Maximums – The user is able to identify the maximum point on the Distance, Velocity and Acceleration graphs. Options are Max, Max and Value and Max, X Pos and Value.

Max – This will draw a small notch for each individual point at the maximum position for distance, velocity and acceleration.

Max and Value – This will draw a small notch and give the maximum value at the maximum position for distance, velocity and acceleration.

Max, X Pos and Value – This will draw a small notch, give the X position (whether this be time or frame number) and the maximum value at the maximum position for distance, velocity and acceleration.
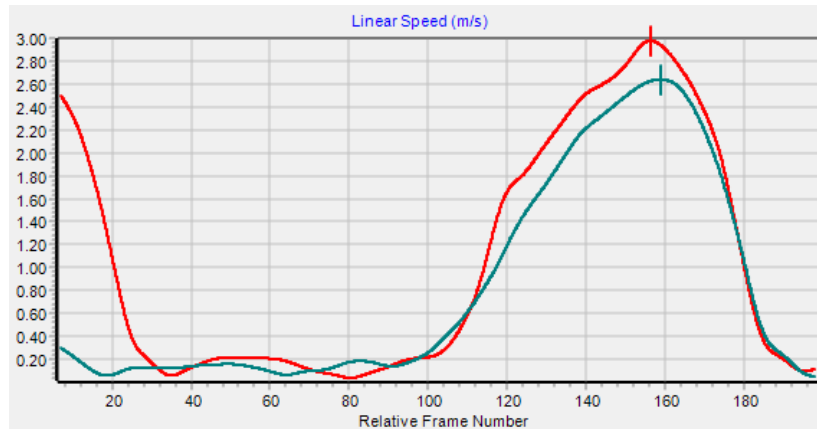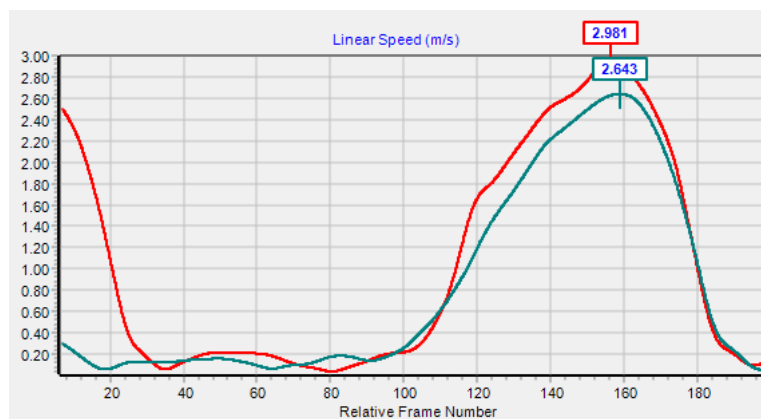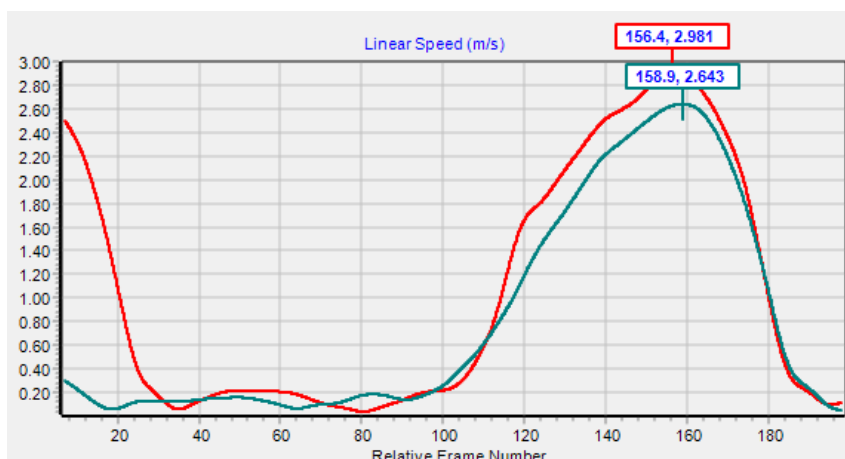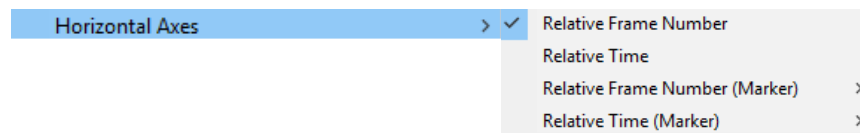
Horizontal Axes – This allows the user to edit the horizontal axes on the Distance, Velocity and Acceleration graphs. The options available to the user are: Relative Frame Number, Relative Time, Relative Frame Number (Marker) and Relative Time (Marker).

Relative Frame Number – The horizontal axis will start from 1, with 1 being the start of the digitisation trace as it is relative to the first digitised frame for each video within the multi-trial analysis, regardless of length of the trace or time event in the video. The end of the traces are subsequently cut to the shortest trace, to be displayed on the graphs.

Relative Time – The horizontal axis will start from 0, with 0 being the start of the digitisation trace as it is relative to the first digitised frame for each video within the multi-trial analysis. The end of the traces are subsequently cut to the shortest trace, to be displayed on the graphs.

Relative Frame Number (Marker) – This allows the user to change the 0 point of the graph to a Marker (Key Event) of their choice, if all the videos within the multi-trial analysis have markers set. Graph data series are aligned to eg. Frame marker 1 (eg. first fore leg contact) and trimmed to the shortest digitisation trace. The x axis displays the common marker as 0. Both ends of the traces are trimmed to the shortest trace, to be displayed on the graph. The markers have to be in the same order to be synchronised effectively.

Relative Time (Marker) - This allows the user to change the 0 point of the graph to a Marker (Key Event) of their choice, if all the videos within the multi-trial analysis have markers set. This allows all the videos within the multi-trial analysis to be synchronised to a marker (e.g toe off, contact, impact etc). The x axis is displayed as time relative to the marker (0). Both ends of the traces are trimmed to the shortest trace, to be displayed on the graph. The markers have to be in the same order to be synchronised effectively.

Vertical Axes – This will allow the user to adjust the Vertical Axes of the Distance, Velocity and Acceleration graphs independently. As default, Quintic will automatically scale the Vertical Axis to the best possible fit, so that both the minimum and maximum values are displayed in each graph.

Users are able to manually adjust the Vertical Axes, by unticking the 'Automatically Scale Vertical Axis' for the graph they would like to manually scale, whether this be Distance, Velocity or Acceleration. Then simply enter in the Minimum and Maximum values you would like the vertical axis to display. You should notice the graph being updated live. Once you have set the vertical axes, simply close the Vertical Axes Settings Window.

Second Average – The user is able to turn on the second average function which allows a second average to be displayed on the Distance, Velocity and Acceleration graphs. This will add a blue average column next to the red average column for each trial. Select the trials you wish to display as an average for each condition
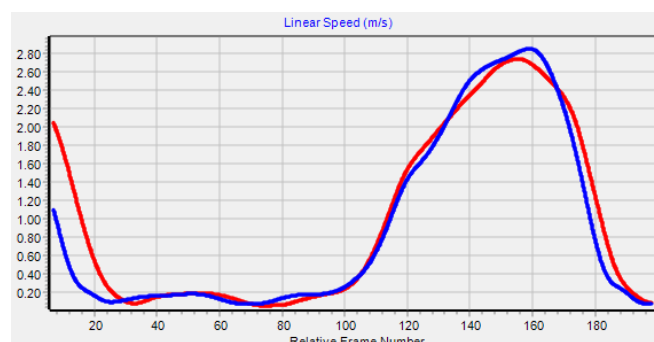

Click "Show Averages" and this will display the Red and Blue average.

Normative Average – Please see below under the heading 'Normative Average' for more information on this feature.

Show Similarity – Please see below under the heading 'Similarity Value' for more information on this feature.

Raw/Smoothed – This allows the user to display either the Raw or Smoothed data (if all the videos within the multi-trial analysis have smoothing filters applied) for the distance, velocity and acceleration graphs.

Moving Average – As default, a moving average is applied to the digitised data. This will be a moving average of 5 i.e the average of 2 frames previous to your current frame, your current frame and 2 frames after your current frame. This applies to all of the distance, velocity and acceleration graphs. The user is able to control how many frames should be taken into account for the moving average (3, 5, 7, 9, 11) or turn the moving average off completely (1).

Linear Spline – As default, a Linear spline is applied to the digitised data, in order for this to appear smoother. The user has the ability to turn this linear spline on or off by either selecting or deselecting this option within the analysis window.

Velocity and Acceleration – This allows the user to edit the way velocity and acceleration is calculated, this can either be one frame before or one frame before and one after.

Show First/Last 6 Frames – This controls whether the first 6 and last 6 digitised frames are displayed within the analysis windows. As default, Quintic will not display these frames due to any potential smoothing filters applied to the data which may skew these points. The user is able to control whether this should be on or off.

f. Origin

Within the Origin Menu, the user is able to change the origin of the data. The origin options are either: Relative (from either the start point of the marker) or Absolute (the 0,0 coordinate). As default the Quintic analysis windows will be set to relative. If the user has a Custom Origin set, the user should select Absolute, which will use your Custom origin as the 0,0 coordinate.
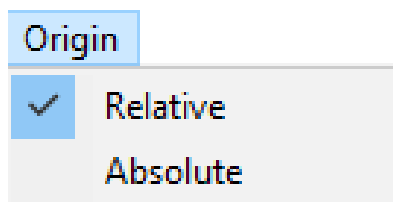
g. Save Results

Within the Save Results menu, the user is able to save the results which are displayed on the Distance, Velocity and Acceleration graphs into an excel document for further analysis.
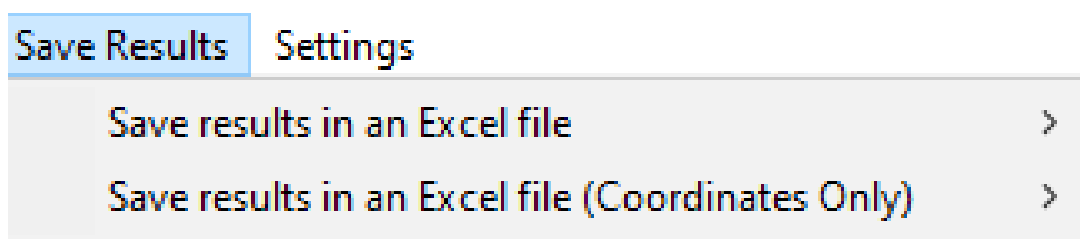

Users have the option to:

Save Results in Excel File – Saves whatever points is displayed on the distance, velocity and acceleration graphs for each of the video trials selected.

If averages are calculated, a separate excel will be created for these. Within the Average Excel, it states which trials are included within the average.

Save Results in Excel File (Co-Ordinates Only) – Saves the co-ordinates of the point only for each of the video trials selected. The user is then able to calculate the distance, velocity and acceleration manually.

With both options, users can either save the excel as an .xls (97-2003) or an .xlsx (2007 +). Once Save Results in Excel File has been selected, users will have to choose the file name and location where they would like the excel files to be created.

h. Settings

Within the Settings menu, the user is able to choose their preferred settings for 'Use Focus Region (Saving/Min/Max)' or 'Multi Linear Analysis Defaults'.

Use Focus Region (Saving/Min/Max) - Users can also choose to save all the data on the graph or a particular region of the graph. They are able to do this by going to Settings, then 'Use Focus Region (Saving/Min/Max)'.
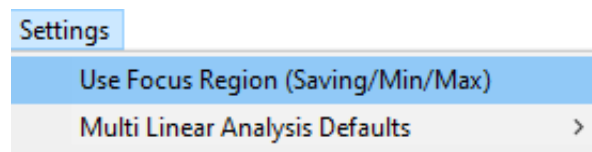
When the 'Use Focus Region (Saving/Min/Max)' is activated, the focus region will show on the graphs in Gold vertical lines.
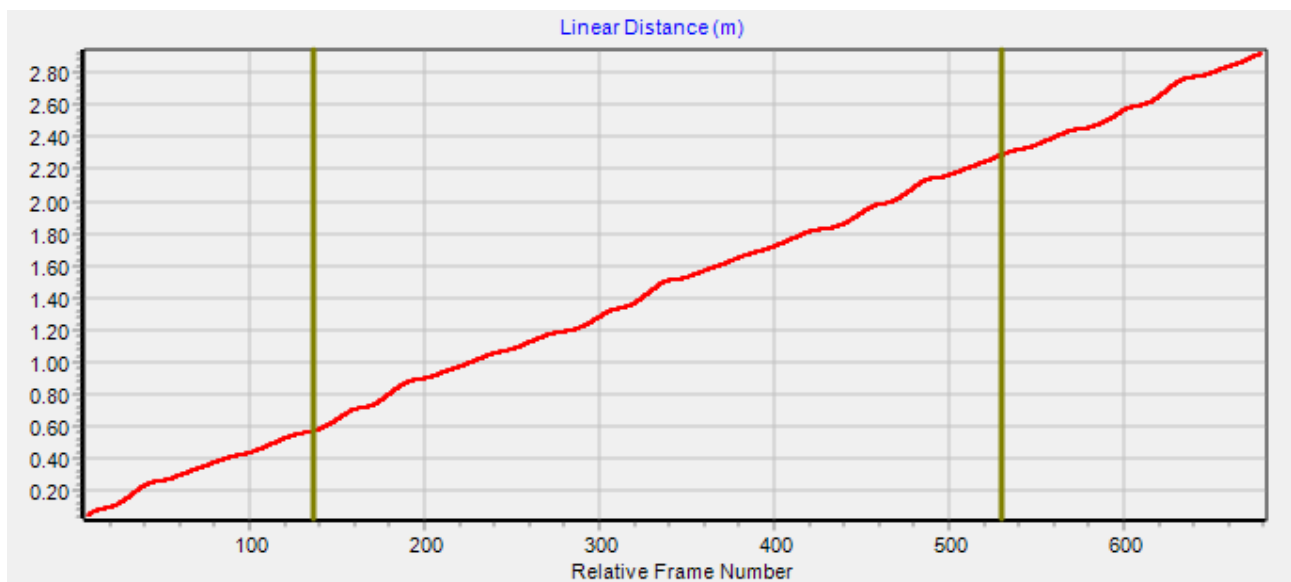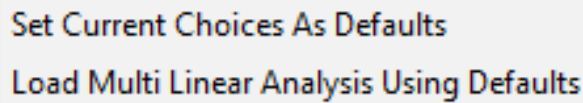
Users can control the save region by using the Focus Region sliders on the right-hand side of the Single Linear Analysis Window.

To use the particular region you have selected, click 'Use Save Region' and when you save results as an Excel (by going to the Save Results tab), only the points within the saved region will be saved to the Excel.

The Focus Region also effects the Min and Maxs. If the focus region is in use, and Min/Max are also in use, only the Min/Max within the Focus Region will be displayed on the graphs.

Multi Linear Analysis Defaults – This gives the user the option to set their default analysis window settings. Every time you open the Multi Linear Analysis window, your preferred analysis settings will be remembered and used.

Set Current Choices As Defaults

Load Multi Linear Analysis Using Defaults

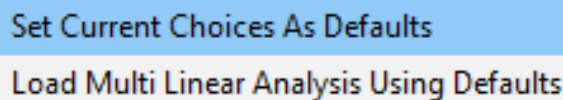Once you are happy with the settings that you have chosen, go to the settings option within the analysis window. Then select 'Multi Linear Analysis Defaults' then 'Set Current Choices As Defaults' and this will remember your preferred settings.

Set Current Choices As Defaults

Load Multi Linear Analysis Using Defaults

An information window will pop up to confirm that the defaults have been set.

Information   ✕

ⓘ   Defaults Set Successfully

                                                          OK
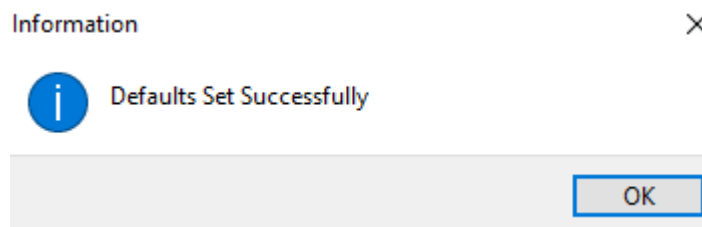
In order for the software to load your default analysis settings, please select 'Load Analysis Using Defaults' for the Multi Linear Analysis Window. You would have to do this for each of the analysis windows (Single Linear, Single Angular, Multi Linear and Multi Angular).

Set Current Choices As Defaults

✓ Load Multi Linear Analysis Using Defaults
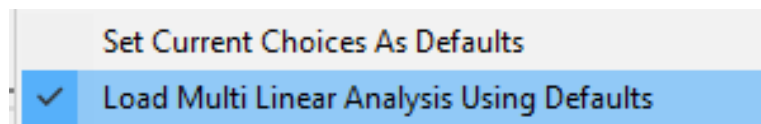
Please see below for more information on what will be remembered in the Multi Linear Analysis window:

- Template Point Names (to check that when Multi Linear is next loaded, it is the correct template)
- Assuming template matches default template, it also reloads whichever linear point was previously selected – i.e. if you had selected Knee within Multi Linear, it would reload with Knee, assuming the templates all matched the default
- Linear/Horizontal/Vertical choice
- Whether you have expanded a graph
- Which your preferred Unit is in the Units drop-down
- Your display preferences (specifically: Show Series Values, Show Interpolation Markers, Show Frame Position, Show Frame Markers, Show Interpolated Regions)
- Min/Max display choices
- Whether second average is on
- Whether similarity is on
- Origin drop-down choice

4. Multi Video Angular Analysis

Once all the videos have been digitised and the folder has been set up correctly, you are able to perform a Multi Video Angular Analysis. Simply open a video from your Multi Video Analysis folder and load the digitisation trace. Then click on the **'Multi Video Angular Analysis'** option after the Linear Analysis button has been pressed.

If the digitisation trace has not been loaded on the video, the following pop up will appear, asking you to load the digitisation trace, please click **'Yes'**.
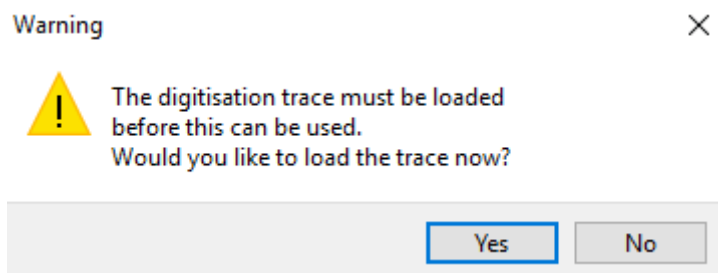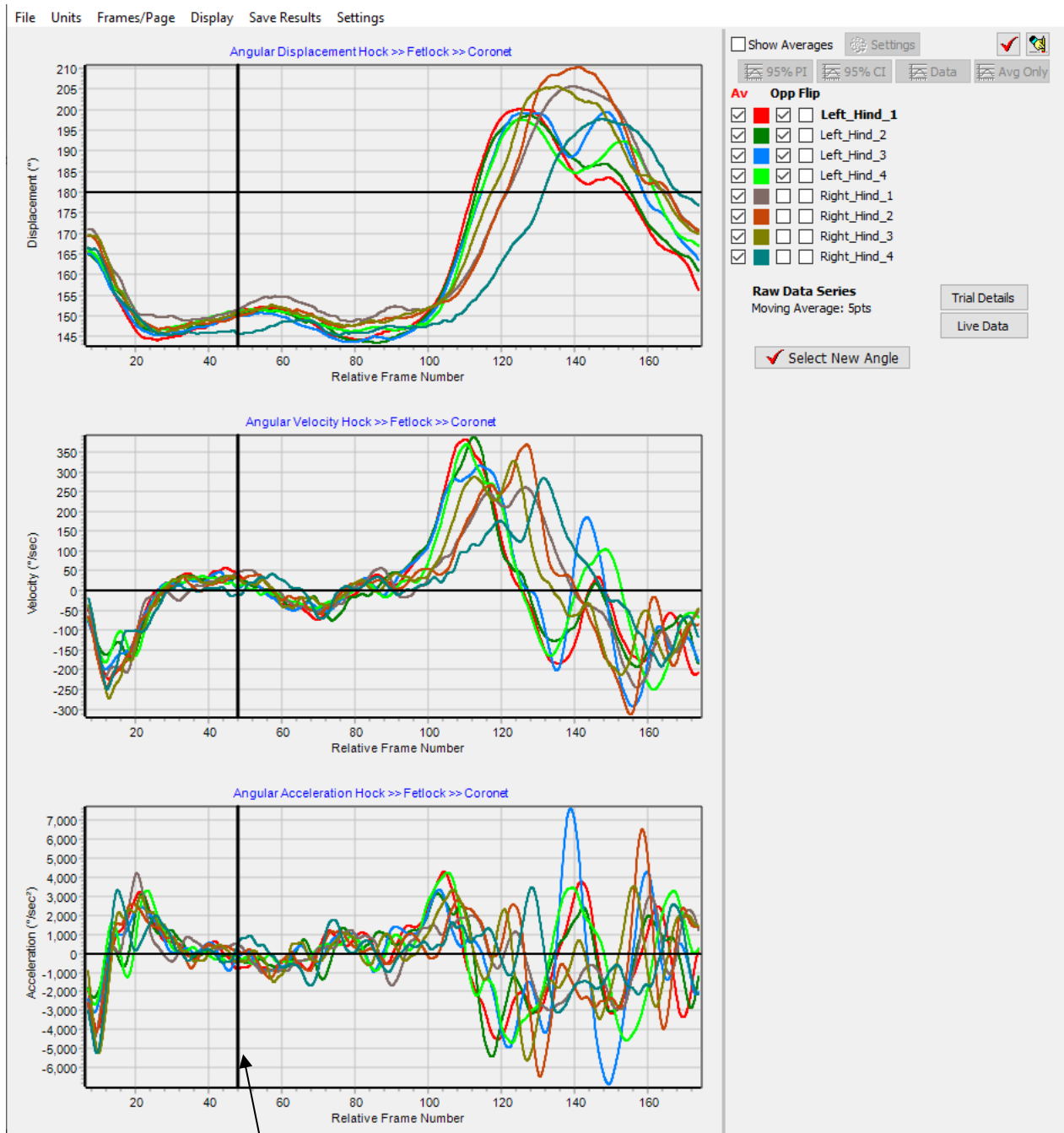

Once the digitisation trace is loaded and the **'Multi Video Angular Analysis'** button has been pressed, the Multi Video Angular analysis window will load.

This will display the Displacement, Velocity and Acceleration in 3 different graphs, for all the videos within the folder, which have been set up correctly within the multi-video analysis folder.

If there are any Time Event Markers (please see Tutorial 2 for further information) that have been saved with the videos, they will also be displayed onto all 3 graphs. This will allow the user to quickly identify on the graph the key events of interest to them (i.e Impact, Low Point, Toe Off etc) and the data to be synchronised to these common time events. The Time Event Markers will be displayed on the graphs by a blue line, with the default name of Marker 1, Marker 2 (if the Time Event Markers have not been named) or the relevant name of that marker if they have been named. The time event markers displayed are only relating to the associated video which is open within the Quintic Window (unless synchronised to a marker and then that one marker is true for all videos within the Multi analysis).

Any Interpolation Markers that have been added to the digitisation trace and saved, will also be shown on the graphs. These are shown with a burgundy line on the graphs.

Please see below an example of the Multi Video Angular Analysis Window within Quintic Biomechanics v35 software.

Both the video within the main window and analysis windows are synchronised, therefore if the video is played while the separate analysis window is open a black line indicates the current video frame. The video which is synchronised with the analysis window will be displayed in bold where the video files are listed.
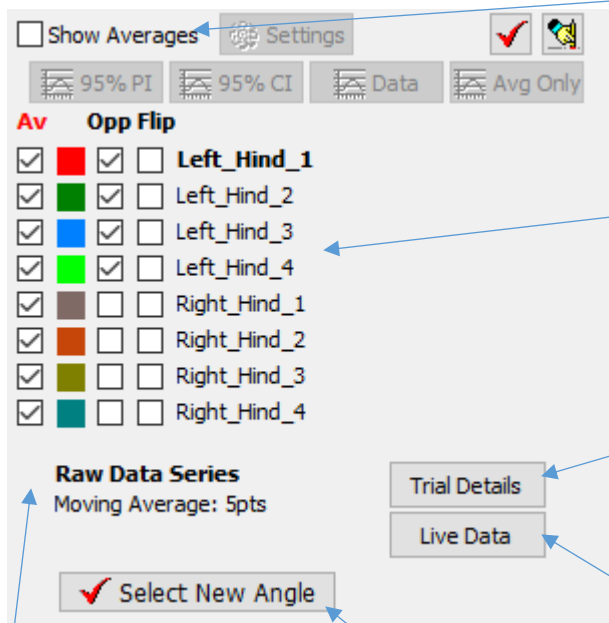
This allows the user to create an average from the video trials which are displayed. The user is able to display one, two and/or the normative average on the graph.

Lists the different video trials which are displayed on the graphs. Each trial has its own colour. The user is able to select and deselect which trials are displayed on the graphs. Users are also able to opposite the angle as well as flip the angle from negative to positive or vice versa.

Trial Details – This button will pop open the details of the trials included within the analysis. Details include: Frames per second of the videos, whether smoothing has been applied and number of frame markers.

Live Data Table – This button will pop open the Live Data table, which allows the user to easily identify data values at specific points of interest, throughout the video. Please see the heading Live Data Table below for more information.

Digitisation Trace Information. Please see below for further information

Select which angle to display from the menu. This corresponds to the amount of points in the digitisation trace.

Data Series Type – Either smoothed or raw data. In this example smoothing parameters have been applied to the traces.

Raw Data Series
Moving Average: 5pts

Moving Average – This displays the moving average that is applied to the data. Please see the heading moving average below for more information.

Select All – When pressed, this will show the angle selected from all of the digitised videos on the associated graphs.
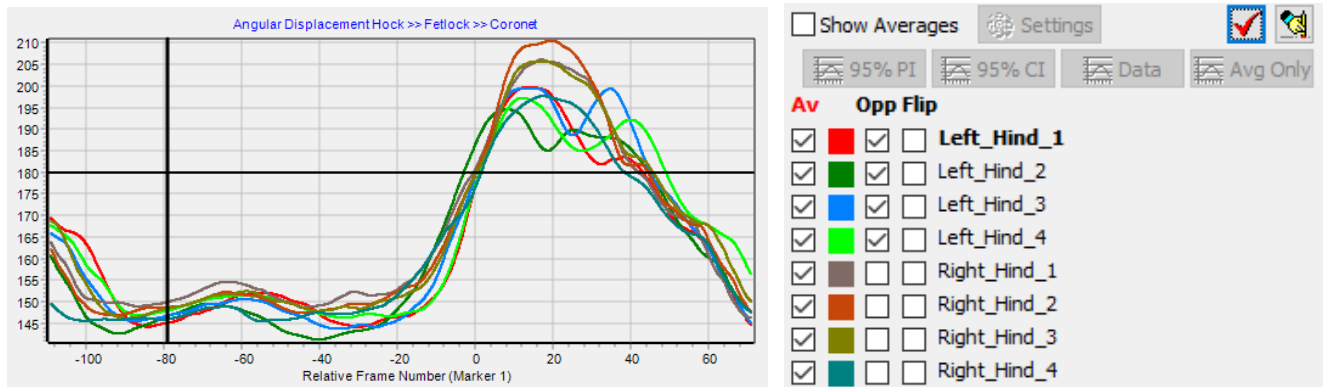
Deselect All – When pressed, this will deselect the angle from all of the digitised videos on the associated graphs.
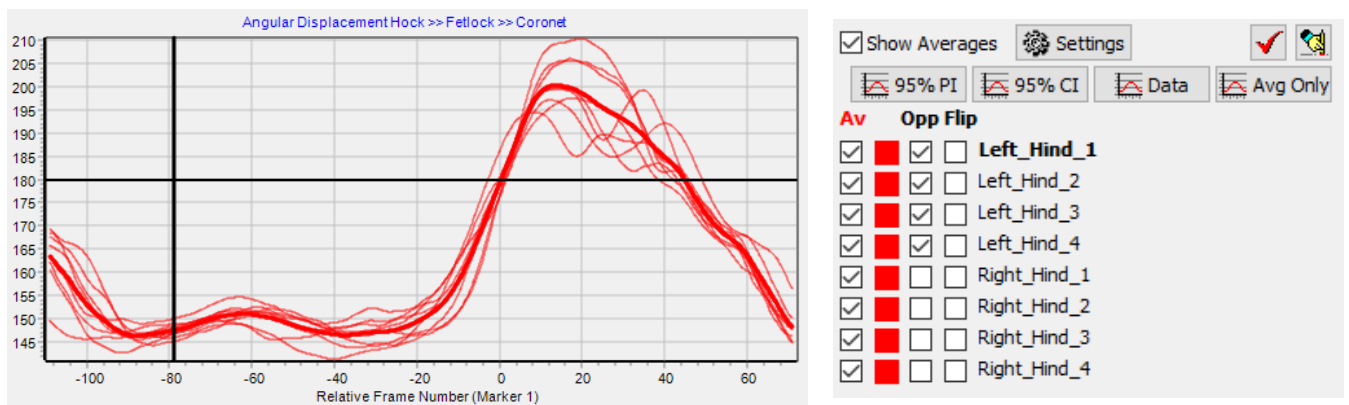
Each graph can be expanded to the size of the analysis window by double clicking on the relevant pane.

Alternatively, to zoom in on a specific area of the graph drag the cursor over the area you wish to zoom in on. The graph will resize and rescale in order to fill the graph area.
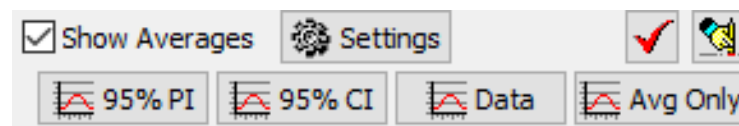
When Show Averages is unticked:
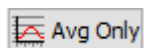

When Show Averages is ticked:

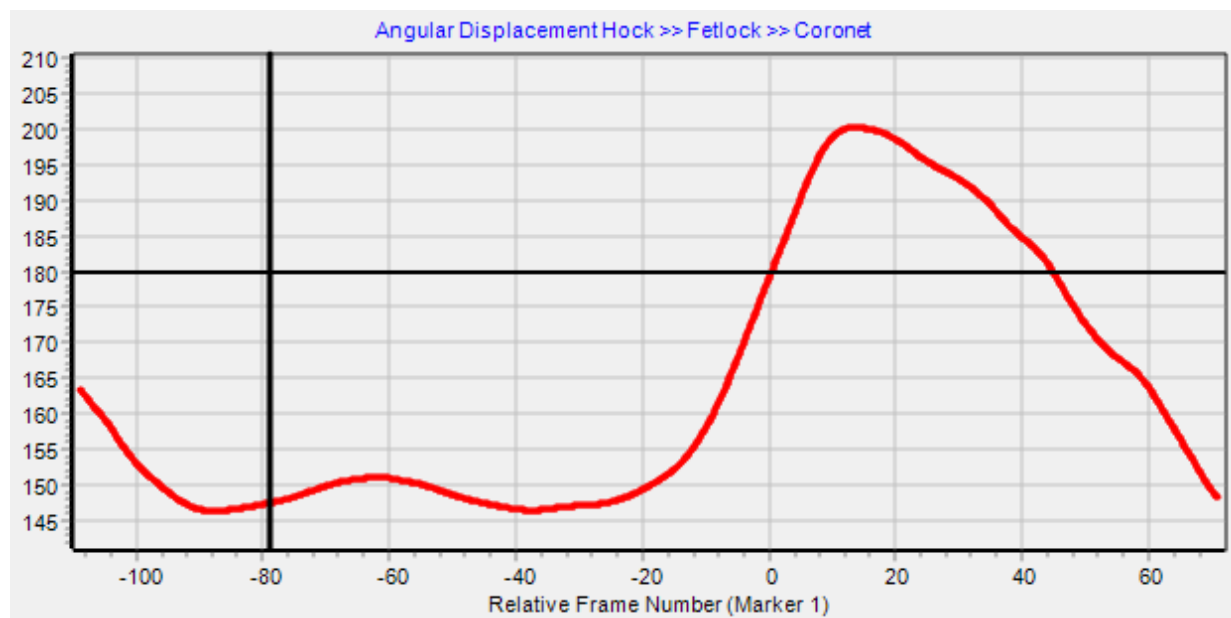When the show averages option is ticked, all of the other buttons related to the average will also become active.
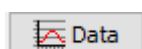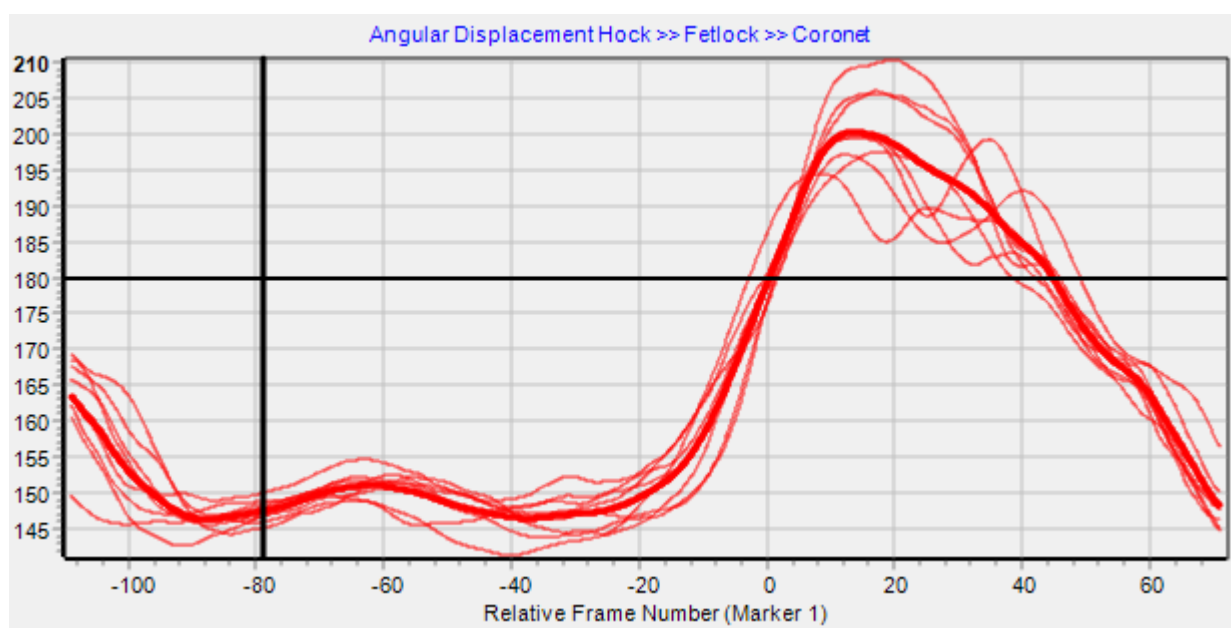
These are as follows:

Avg Only   ⟨Avg Only⟩

This will display the average only on the three graphs (Displacement, Velocity and Acceleration). If you have more than one average displayed (i.e 2nd/normative) this will also display the average only of these averages.
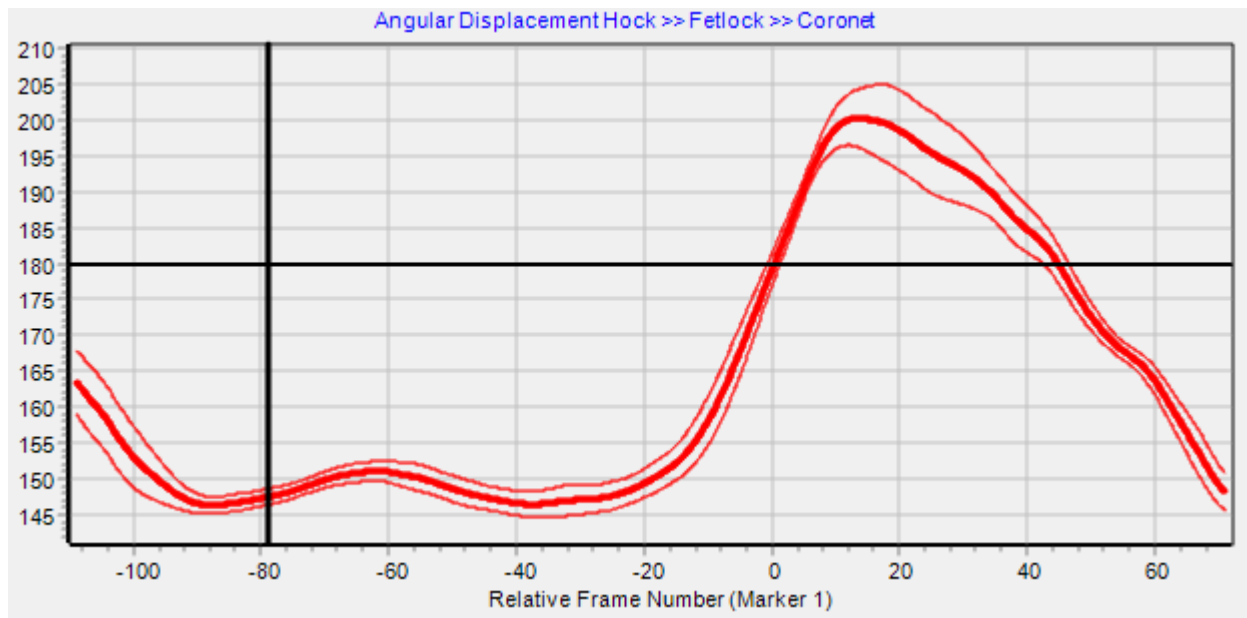

Data   ⟨Data⟩

This will display the average as well as all of the individual data traces on the three graphs (Displacement, Velocity and Acceleration). If you have more than one average displayed (i.e 2nd/normative) this will also display the average and data traces for these averages. The associated data traces are appropriate colour to the average they are in i.e Red/Blue.
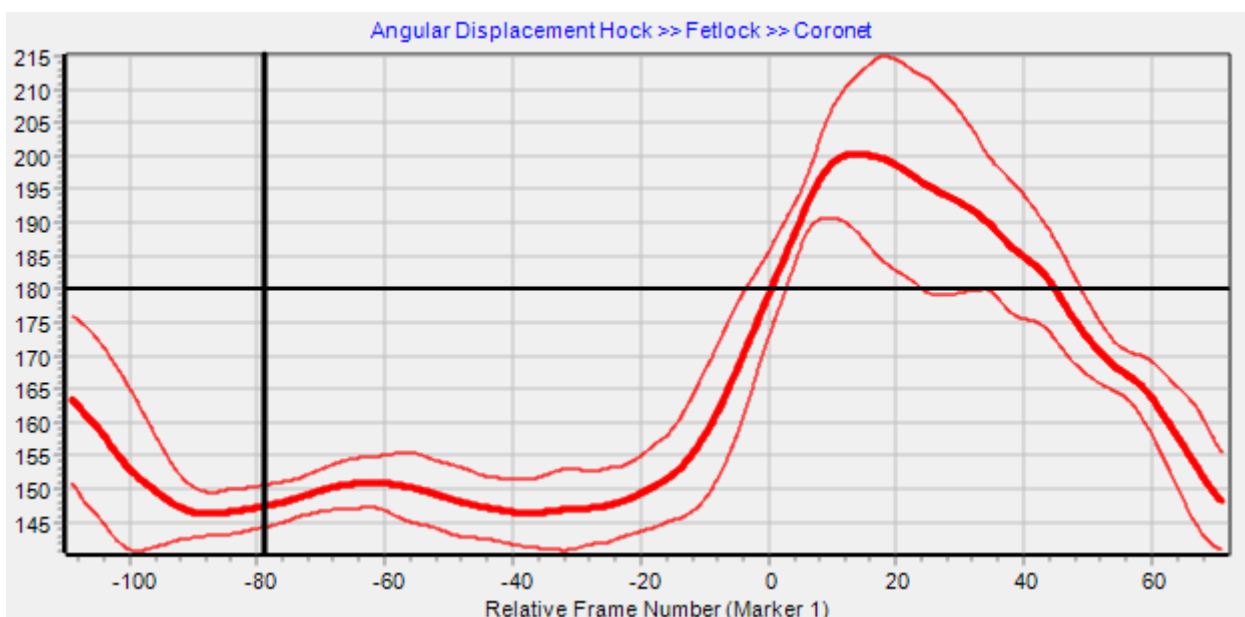
95% CI ⟋ 95% CI

This will display the average as well as the 95% confidence intervals on the three graphs (Displacement, Velocity and Acceleration). If you have more than one average displayed (i.e 2nd/normative) this will also display the average and 95% confidence intervals for these averages.

Angular Displacement Hock >> Fetlock >> Coronet

95% PI ⟋ 95% PI

This will display the average as well as all of the 95% prediction intervals on the three graphs (Displacement, Velocity and Acceleration). If you have more than one average displayed (i.e 2nd/normative) this will also display the average and 95% prediction intervals for these averages

Angular Displacement Hock >> Fetlock >> Coronet

a. Functions

Within the Multi Video Angular Analysis window there are a range of functions which the user is able to change, which directly affect the Angular displacement, velocity and acceleration graphs.

The functions are available at the top of the Multi Video Angular Analysis Window and are as follows:

**File   Units   Frames/Page   Display   Save Results   Settings**

b. File

Within the File menu, the user is able to Print, Print Preview, Save as JPEG or Copy to Clipboard the individual Angular Displacement, Velocity and Acceleration graphs. The user is also able to Print, Save as JPEG or Copy to Clipboard the Angular Displacement, Velocity and Acceleration Graphs with or without the side bar as one image.

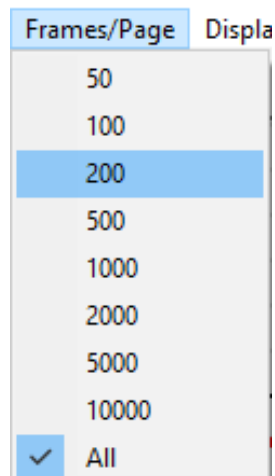| File	Units	Frames/Page	Display
Distance			>
Velocity			>
Acceleration			>
All Graphs			>
All Graphs and Side Bar			>
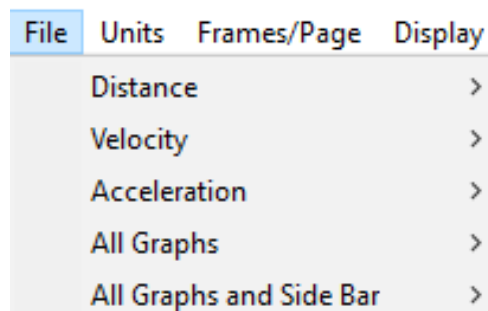
c. Units

Within the Units menu, the user is able to change the units for the data within the Angular Displacement, Velocity and Acceleration Graphs. The options are as follows: Degrees, Radians.
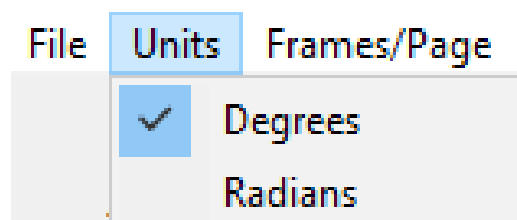
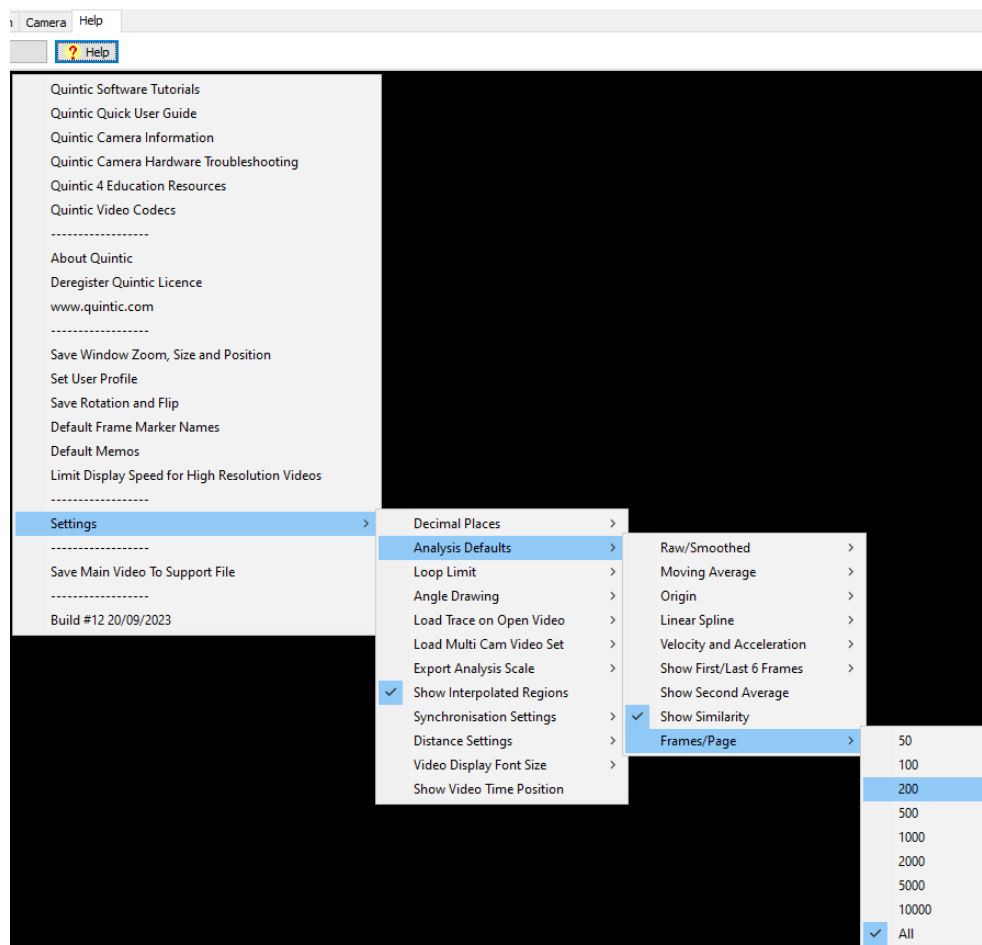| File	Units	Frames/Page
	✓ Degrees	
	Radians	

d. Frames/Page

Within the Frames/Page menu, the user is able to select how many frames are displayed on the graphs within the analysis window. This is ideal for users who have long digitisation traces.


As default, the analysis windows will display all of the points on the graphs. Should users want to change this, they are able to do this by going to the Help tab within the main Quintic software. To do this, click the 'Help' button, then Settings, Analysis Defaults, Frames/Page and then select your preferred option. This will apply to all analysis windows.

e. Display

Within the Display menu, the user is able to able to adjust certain display settings which affect the Angular Displacement, Velocity and Acceleration graphs.
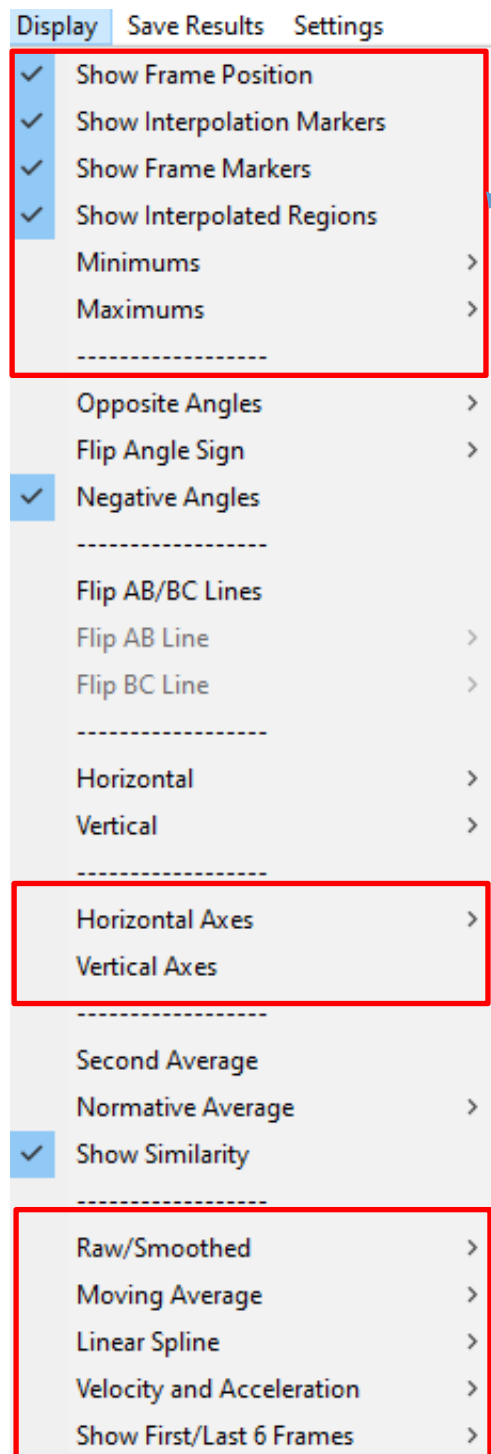
These have already been covered. Please see above under 'Multi Video Linear Analysis' for more information on these features.

Opposite Angles – Opposite will display the opposite angle from the one currently being displayed.

Flip Angle Sign – This will change the angle from positive to negative or vice versa.

Flip AB/BC Lines – This will activate the Flip AB/BC Line options. Once this has been clicked, 'AB' and 'BC' will appear as tick boxes next to the list of trials within the Multi Angular Analysis window. You can then choose to flip the AB or BC lines for the certain trials within your analysis, for the angle in question.

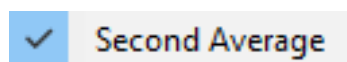***Flip AB Line –*** This will allow the user to Flip AB Line for all of the trials within the Multi Angular Analysis Window.

Flip BC Line - This will allow the user to Flip BC Line for all of the trials within the Multi Angular Analysis Window.

Negative Angles – This allows negative angles to be displayed. As default, this setting is switched on. This is particularly useful when looking at an angle which fluctuates around 0.
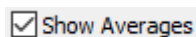
Horizontal – If an angle has been created using the horizontal, the user is able to choose whether the horizontal will be to the left or to the right. As Default this is set to the right.

Vertical – If an angle has been created using the vertical, the user is able to choose whether the vertical will be to the top or bottom. As default this is set to the top.
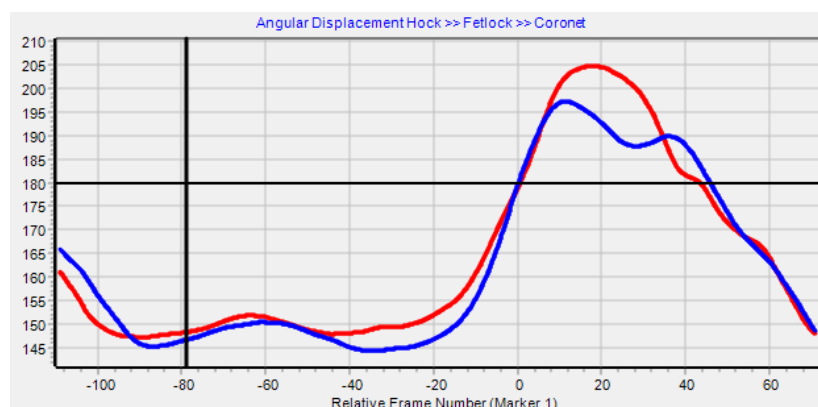
Second Average – The user is able to turn on the second average function which allows a second average to be displayed on the Displacement, Velocity and Acceleration graphs. This will add a blue average column next to the red average column for each trial. Select the trials you wish to display as an average for each condition

Click "Show Averages" and this will display the Red and Blue average.

Normative Average – Please see below under the heading 'Normative Average' for more information on this feature.

Show Similarity – Please see below under the heading 'Similarity Value' for more information on this feature.

f. Save Results

Within the Save Results menu, the user is able to save the results which are displayed on the Angular Displacement, Velocity and Acceleration graphs into an excel document for further analysis.
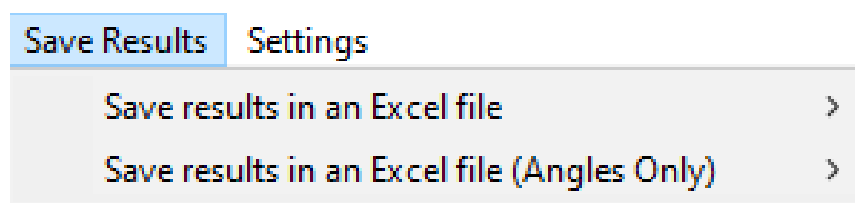
Users have the option to:

Save Results in Excel File – Saves whatever angle is displayed on the angular displacement, velocity and acceleration graphs.

If averages are calculated, a separate excel will be created for these. Within the Average Excel, it states which trials are included within the average.

Save Results in Excel File (Angles Only) – Saves the angles only. The user is then able to calculate the angular velocity and acceleration manually.

With both options, users can either save the excel as an .xls (97-2003) or an .xlsx (2007 +). Once you have chosen your preferred file type, simply choose where you would like the file to be saved and name it appropriately.

g. Settings

Within the Settings menu, the user is able to choose their preferred settings for 'Use Focus Region (Saving/Min/Max)' or 'Multi Angular Analysis Defaults'
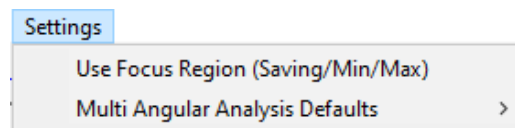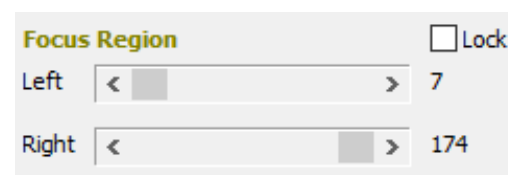

Use Focus Region (Saving/Min/Max) – Users can choose to save all the data on the graph or a particular region of the graph. They are able to do this by going to Settings, then 'Use Focus Region (Saving/Min/Max)'.
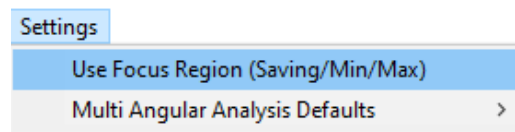
When the 'Use Focus Region (Saving/Min/Max)' is activated, the save region will show on the graphs in Gold vertical lines.
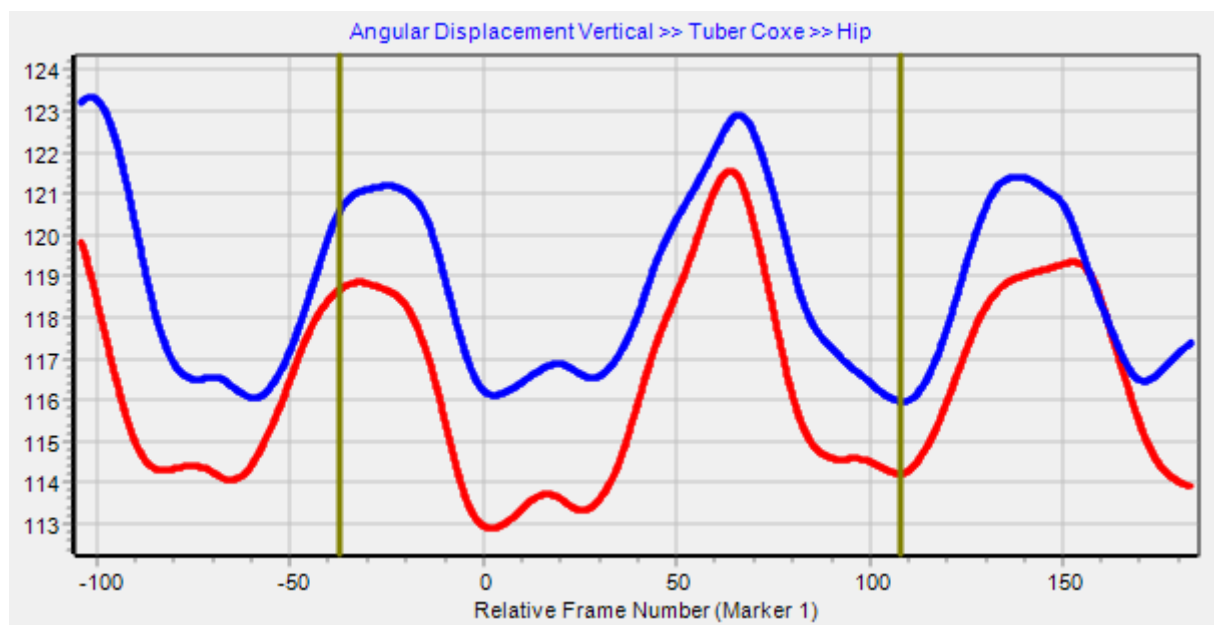
Users can control the save region by using the 'Focus Region' sliders on the right-hand side of the Multi Angular Analysis Window.

To use the particular region you have selected, click 'Use Focus Region (Saving/Min/Max)' and when you save results as an Excel (by going to the Save Results tab), only the points within the saved region will be saved to the Excel.

Multi Angular Analysis Defaults – This gives the user the option to set their default analysis window settings. Every time you open the Multi Angular Analysis window, your preferred analysis settings will be remembered and used.

Set Current Choices As Defaults

Load Multi Angular Analysis Using Defaults

Once you are happy with the settings that you have chosen, go to the settings option within the analysis window. Then select 'Set Current Choices As Defaults' and this will remember your preferred settings.

Set Current Choices As Defaults

Load Multi Angular Analysis Using Defaults

An information window will pop up to confirm that the defaults have been set.

Information   ✕

ⓘ   Defaults Set Successfully

OK
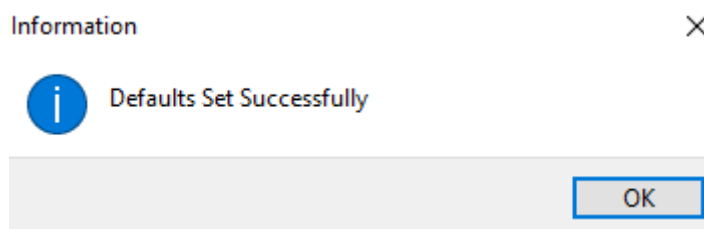
In order for the software to load your default analysis settings, please select 'Load Analysis Using Defaults' for the Multi Angular Analysis Window. You would have to do this for each of the analysis windows (Single Linear, Single Angular, Multi Linear and Multi Angular).

Set Current Choices As Defaults

✓   Load Multi Angular Analysis Using Defaults

Please see below for more information on what will be remembered in the Multi Angular Analysis window:

- Template Point Names (to check that when Multi Angular is next loaded, it is the correct template)
- Which angle you have selected angle to analyse, assuming template matches default template
- Whether you have expanded a graph
- Which your preferred Unit is in the Units drop-down
- Your display preferences (specifically: Show Series Values, Show Interpolation Markers, Show Frame Position, Show Frame Markers, Show Interpolated Regions)
- Min/Max display choices
- Allow Negative Angles choice
- Horizontal – Left/Right choice
- Vertical – Up/Down choice
- Whether second average is on
- Whether similarity is on

5. Live Data Table

Within the Linear and Angular analysis windows, there is an option to display the live data table.

To display the Live Data Table, simply click the Live Data button within the Linear or Angular analysis window.

This will then display the data which is displayed on the Distance/Angular Displacement, Velocity and Acceleration graphs.

As the video plays through, the Live Data table will be updated with the current frame data.

Within the Analysis windows, if any points of the digitisation trace are unticked these will not be displayed in the Live Data Table. If Horizontal and Vertical (Linear Analysis only) are ticked on the graph, they will also be displayed on the Live Data Table.

6. Normative Average

The Normative Average function is a feature which is available within our Quintic Coaching v35 and Quintic Biomechanics v35 software. This allows the user to create their own Normative Average of up to 100 digitised videos which can be displayed on the Linear/Angular graphs. The user creates their own normative average folder and selects this within the Multi Linear/Angular analysis window from which the average will be calculated and displayed.

The user also has the ability to select Prediction Intervals/Confidence Intervals/Data and/or Average traces for each Average separately – i.e. 1st, 2nd, Normative (unable to display data).

To create your own Normative Average Folder, the user must first create their own folder where the digitisation traces are to be added to.

Once the digitisation process has been completed (can be Manual, Automatic or Intelligent) the user is then able to add the digitisation trace to the Normative Average folder in two ways this either '*Through the Digitisation Menu'* (recommended) or '*Manually'.*

Through the Digitisation Menu

To add the completed digitisation trace to the normative average folder, click on the digitisation tab within the Digitisation menu.

Click the Add Trace to Normative Average Folder
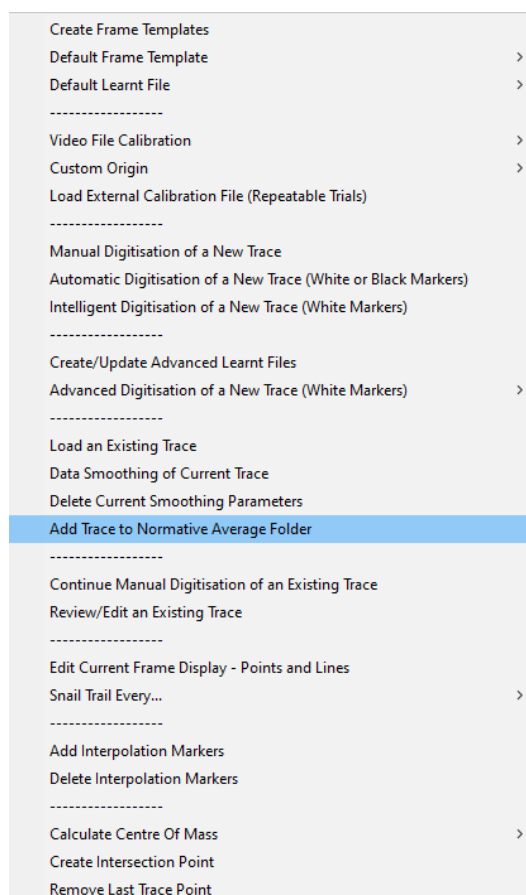
This will add the Digitisation Trace and all of the associated files (except from the Video File) to this folder.

Manually

Users are also able to manually add their digitisation traces to the Normative Average Folder.

The following files are required:

Interpolation Markers .ent

Frame Markers .mrk

Rotation .rot

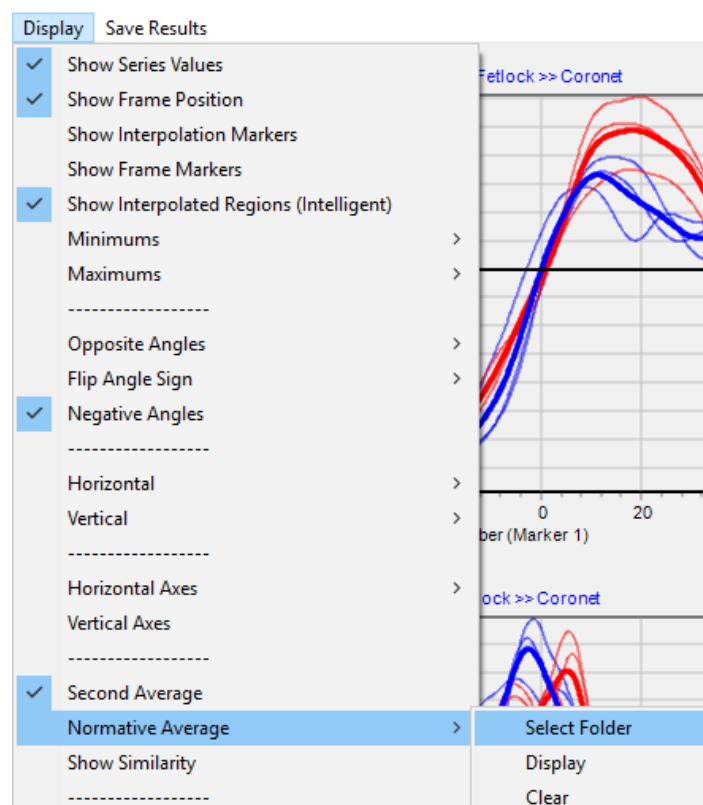FPS .fps

Horizontal Calibration .hcal

Vertical Calibration .vcal

Calibration .cal

Digitisation Trace .qdf

Butterworth Smoothing .qbc

Once you have added the digitisation traces to the normative average folder (up to 100 digitisation traces) you then simply select the normative average folder within the Display Menu in either the Multi Linear/Angular window.

Go to Display > Normative Average > Select Folder and select the normative data folder you have created. The normative data will then appear on the same graph when 'Show Averages' has been selected.
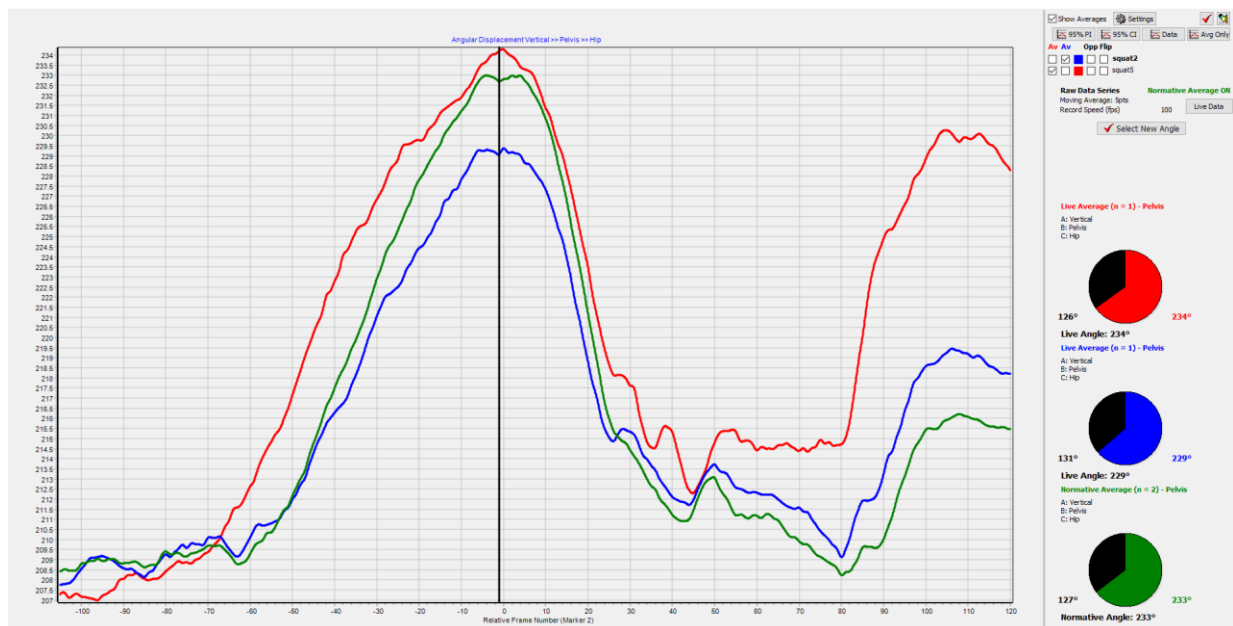
N.B The same template must be used in both the Multi Trial videos and the Normative Average folder in order for the Normative Average to be loaded.

Once the Normative Average folder has been selected, the user is able to turn the Normative Average On and Off by going to Display > Normative Average > Display.
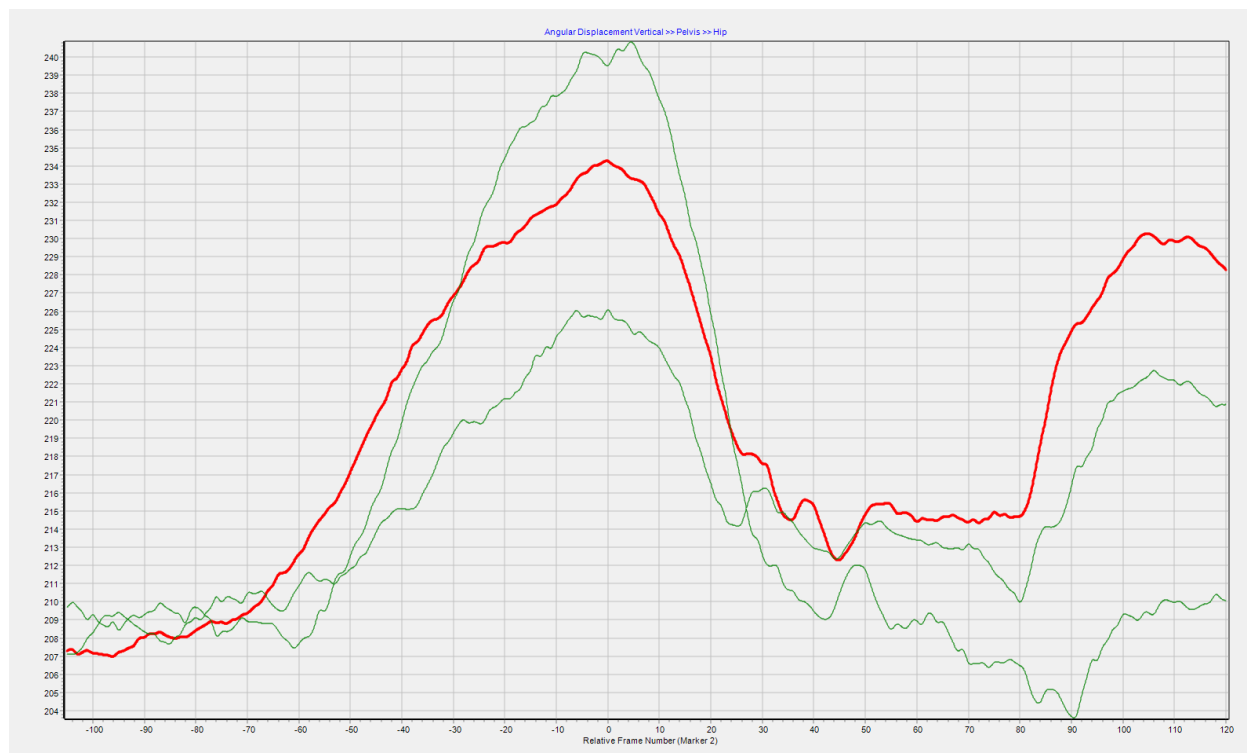
The user also has flexibility in how the Normative Average is displayed on the graphs.

By clicking the [⚙ Settings] button, the user is able to independently select whether the averages only are displayed, average and data (excluding normative) as well as the average and 95% CI or 95% PI.

Please see the example below for the 95% Prediction Intervals compared against the Red Average.

Angular Displacement Vertical >> Pelvis >> Hip

7. Similarity Value

The similarity value calculates how similar the averages are in comparison with each other (1st, 2nd, Normative) and gives a percentage. This is displayed between each pair of averages (i.e. 1st and 2nd, 1st and Normative, 2nd and Normative). The similarity value will appear in the top left corner of the graph when the Show Averages button has been ticked within Multi Linear/Angular analysis.
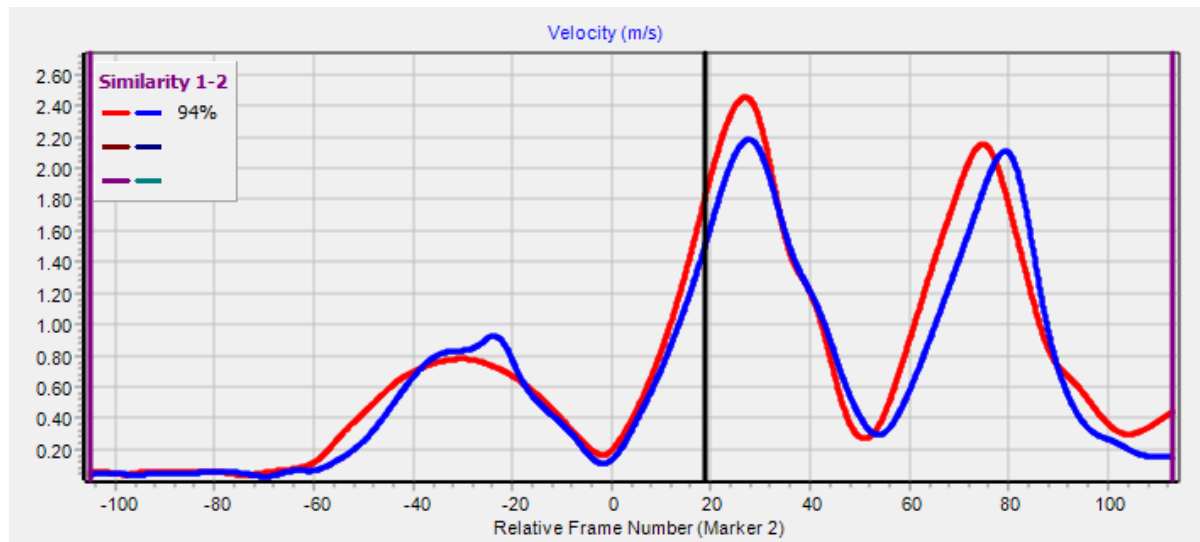
Users are able to turn the similarity value on/off by going to Display > Show Similarity.
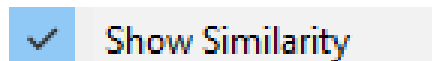
There is also the ability to select the range of the traces between which the Similarity is calculated (defaults at full trace). Users are able to do this by adjusting the Similarity boundaries. The left and right scrollbars will control the purple lines on the graph in which the similarity value is calculated.

Users also have the ability to lock their similarity boundary by ticking the lock button. Users can then move their similarity region once this has been locked, just by moving one of the left or right scrollbars.
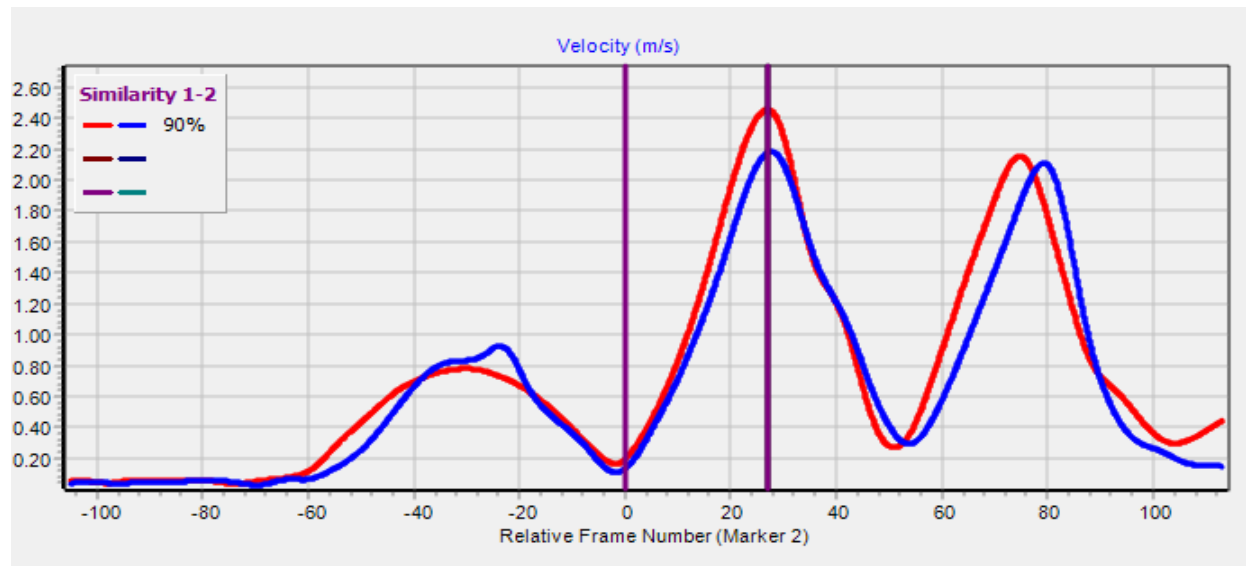
The image above shows the similarity being calculated within the similarity region (in between the purple lines) rather than the whole graph.
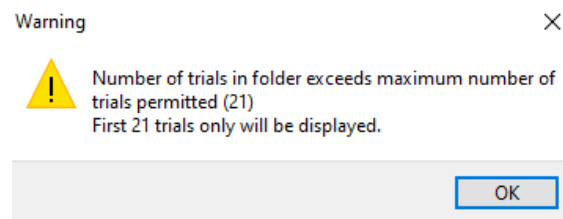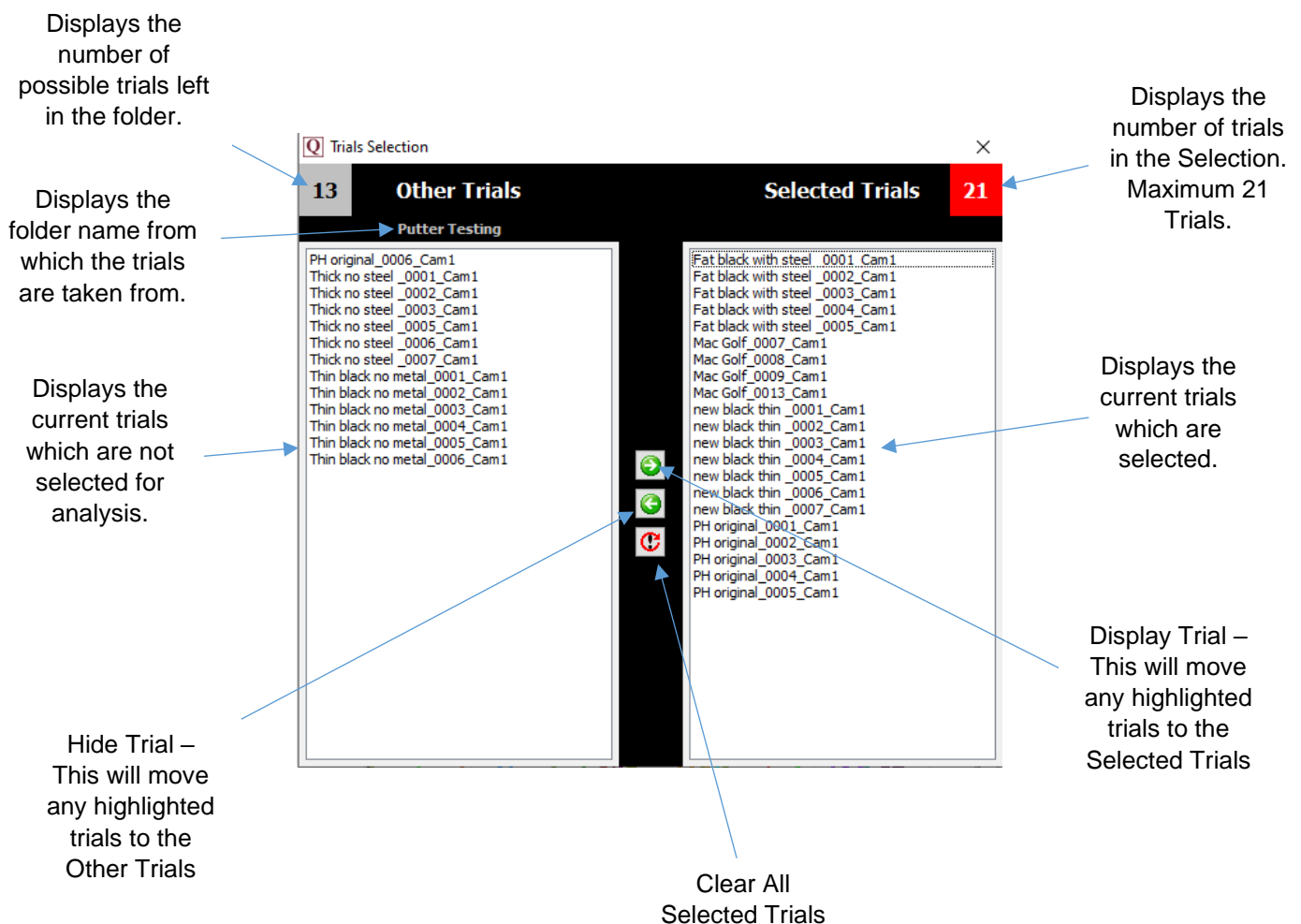
8. Trial Selection

Multi – Trial Analysis (Linear & Angular) is limited to 21 trials.

Should users have more than 21 available trials which are able to part of the Multi-Trial Analysis (Linear or Angular) from the folder in which the trials are opened from, the 'Trial Selection' will become active.

A pop up will appear as soon as the user has clicked on Multi Linear/Angular Analysis stating that there are more than 21 trials available. In this case, the first 21 trials alphabetically will be selected.

Following this, the Trial Selection window will appear.

Displays the number of possible trials left in the folder.

Displays the folder name from which the trials are taken from.

Displays the current trials which are not selected for analysis.

Hide Trial – This will move any highlighted trials to the Other Trials

Clear All Selected Trials

Displays the number of trials in the Selection. Maximum 21 Trials.

Displays the current trials which are selected.

Display Trial – This will move any highlighted trials to the Selected Trials
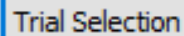
The user is then able to select which trials they would like to be included within the Multi-Video Analysis.

To remove trials from the Selected Trials, simply highlight the trials from the Selected Trials section you would like to remove (you are able to move multiple trials in one go) and click the Hide Trial button.

To add trials to the Selected trials, simply highlight the trials from the Other Trials section you would like to add (you are able to move multiple trials in one go) and click the Display Trial Button. Please bear in mind there is a maximum of 21 trials allowed to be selected at one time.

Once the user is happy with the selected trials, simply close the Trial Selection Window and use the Multi-Trial analysis window as normal.

Should the user the want to change trials whilst the Multi-Video analysis window is open, simply click the Trial Selection button.

Trial Selection

Please note that Trial Selection will only become active if the folder you are opening the Multi-Trial analysis from has more than 21 possible trials.