Quintic Software

Tutorial 9

Digitisation Analysis

Contents Page

1. Viewing a Trace

N.B. Further information on Quintic Analysis can be found within Appendix J.

Once you have digitised the video clip, you can use the digitised data output provided for sporting, medical, educational or scientific analysis and presentations.

GO TO RECAP ON THE QUESTION SHEET (PAGE 21)

Load the video clip **'Cycling_100fps'** from the **'Cycling'** folder.

A digitisation trace has already been completed for this video along with calibration and data smoothing. To use the output data it needs to be re-loaded onto the video.

Click on the **'Digitisation'** tab and select **'Load an existing trace'** from the **'Digitisation'** menu on the left.
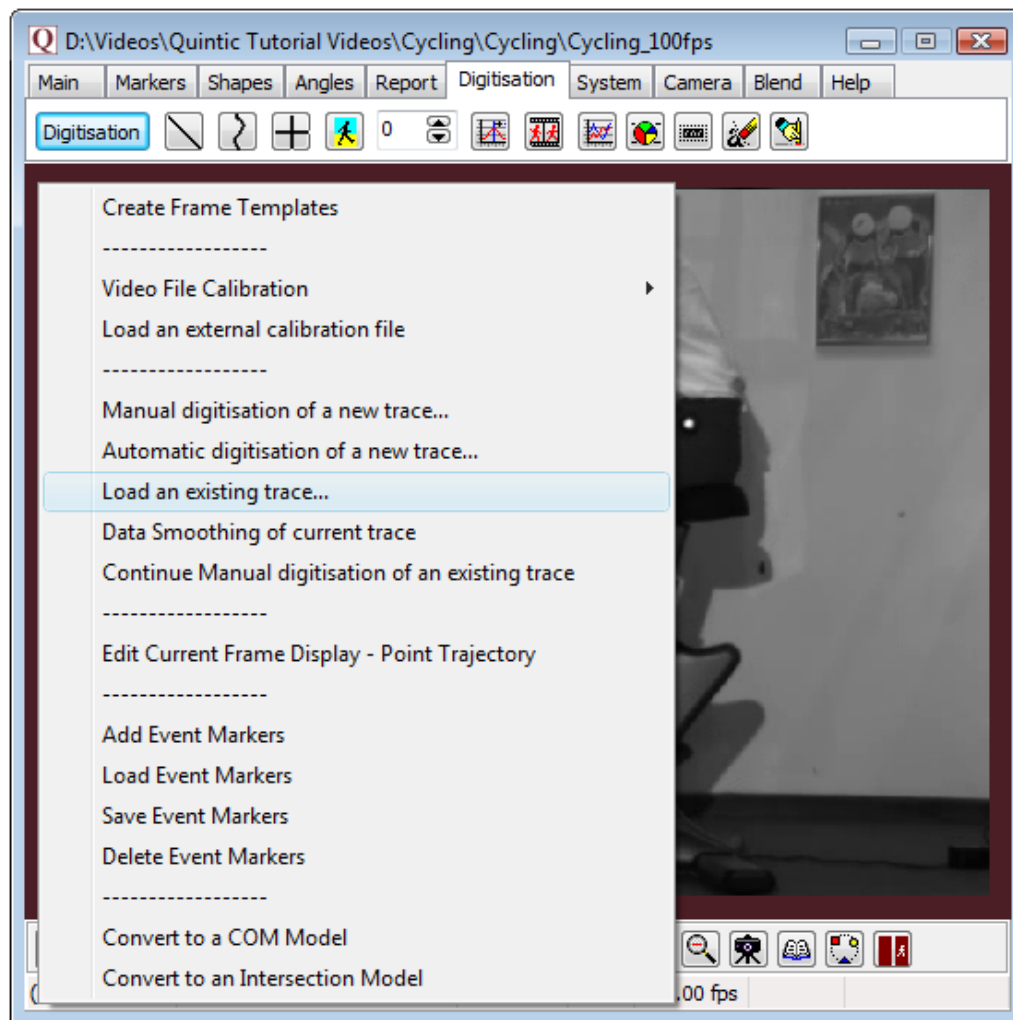
There are a number of functions available to vary the way in which the trace is displayed on the video clip:

Shows the traces from individual frames.
(This function is not available in Quintic Coaching).

Joins the traces of each point between frames.
(i.e. it will show the path of the knee throughout the clip).

Shows the crosses created during the digitisation for every frame.

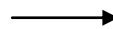View Individual Frames: The trace is displayed frame-by-frame.

Snail Trail: Allows the user to see the last 'x' number of frames.
(5 will show the current frame plus the trace for the previous 5 frames).
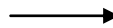
Show/ Hide Trace:

When this button is **not** selected, the entire trace will be displayed when you play the clip.

When this button **is** selected, the trace will develop as the clip is played.

N.B. one of these functions must be selected for the trace to appear on the video**.**

GO TO QUESTION 1 ON THE QUESTION SHEET (PAGE 22)

a. Other Functions

 - **Line Drawing/Ruler:** This acts as a ruler. It can be used to measure distances on the image once the video has been calibrated. Select this function and draw a line along the athlete's left forearm. The measurement is displayed at the bottom of the window below the '**Memo-pad**' and '**Single Image Capture**' buttons. The measurement here states that the forearm is 0.36m long.
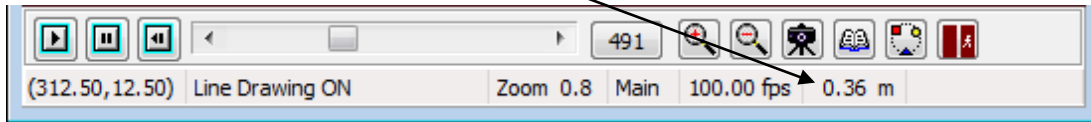
  - These buttons can again be used to erase the line drawn.

Event Markers: Once a digitisation trace has been created Event Markers can be added so that when graphs are produced, the timing of particular events is marked (e.g. ball impact, maximum knee flexion).
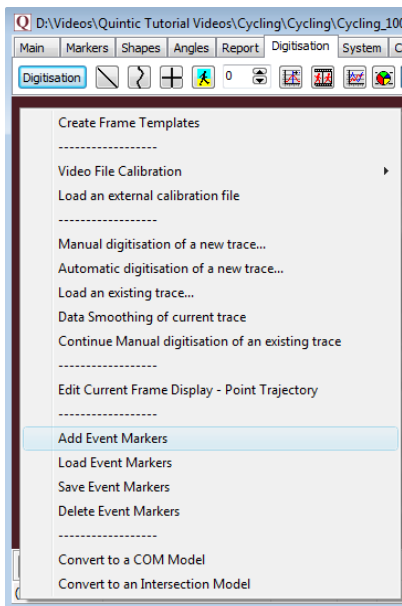
Ensure that the trace is visible on the screen by pressing the button.

Under the **'Digitisation'** menu, select **'Add Event Markers'**. Scroll to the frame when the cyclist's toe reaches the bottom of the cycling movement and draw a line bisecting the toes path.

You can then **'Save'** or **'Clear'** these markers and **'Load'** them again when you restart the system as you did with the shapes function. These are selected from the **'Digitisation'** menu as above.

<div align="center" style="color:red">GO TO QUESTION 2 ON THE QUESTION SHEET (PAGE 23)</div>

2. Animation Window

⊞ - This button opens the animation window. It is a black screen that shows only the digitisation traces when the video is played through.

Click this ◱ button so that the traces are visible on screen.

The traces are visible against the black screen. Now press **'Play'** in the main window.

By right clicking in the animation window the background colour can be changed.

These buttons change the way the trace is viewed in the animation window in the same way they do in the main window.

◱ ⟩ ✛ 🚶 0 ⬍ 📉

Experiment with these buttons. See what images you can create.

GO TO QUESTION 3 ON THE QUESTION SHEET (PAGE 24-25)


Tutorial 9 – Digitisation Analysis
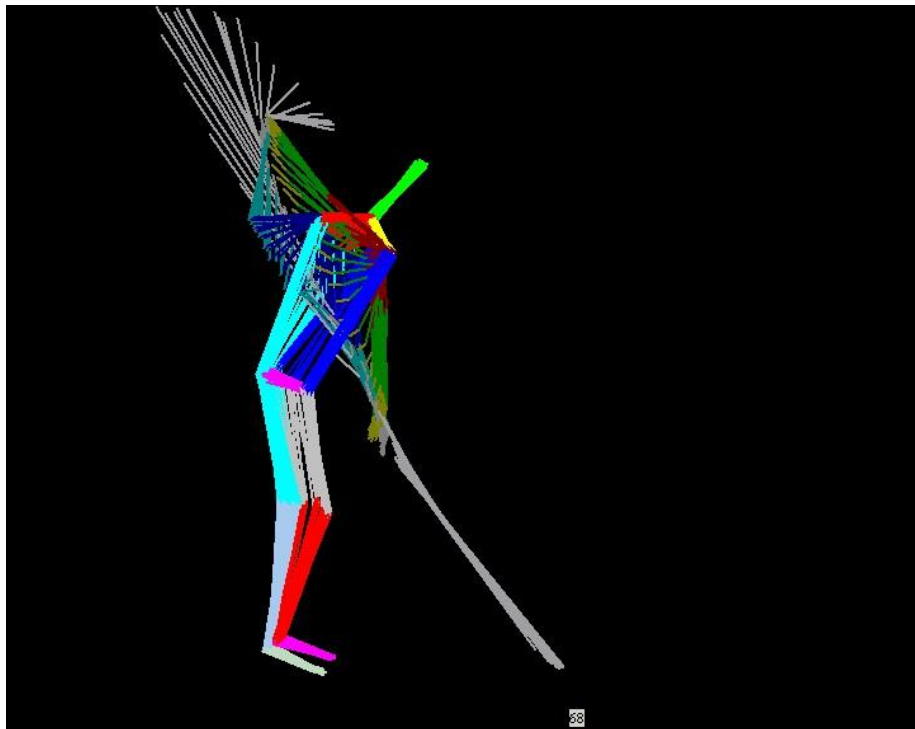
3. Analysis Systems

Quintic allows the user to analyse the digitised movement. These values are automatically 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.
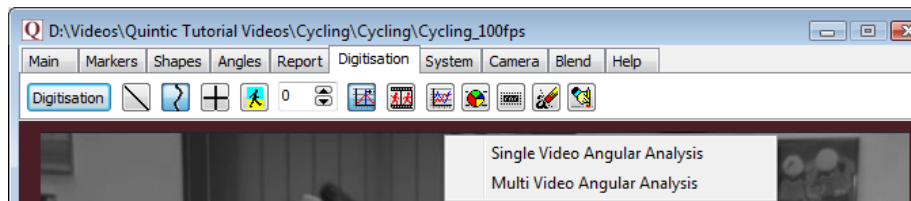
N.B. The video has to be calibrated.

 - Linear analysis (Distance, Velocity and Acceleration)
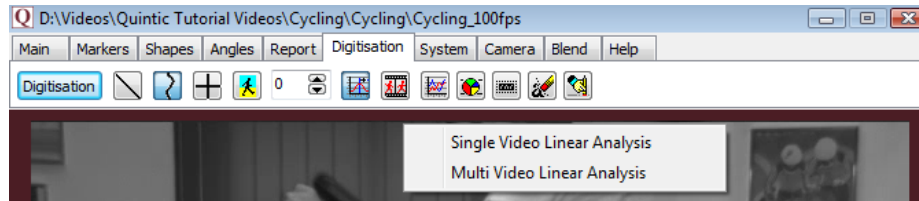
 - Angular Analysis (Angular Displacement, Angular Velocity and Angular Acceleration)


Multi Video Analysis allows you to view up to 21 videos providing they have the same frame rate and digitisation template. They must also be located in the same folder for comparison. The first frame of digitisation should be a common point across all videos (e.g. heel contact) in order for the analysis to be meaningful.
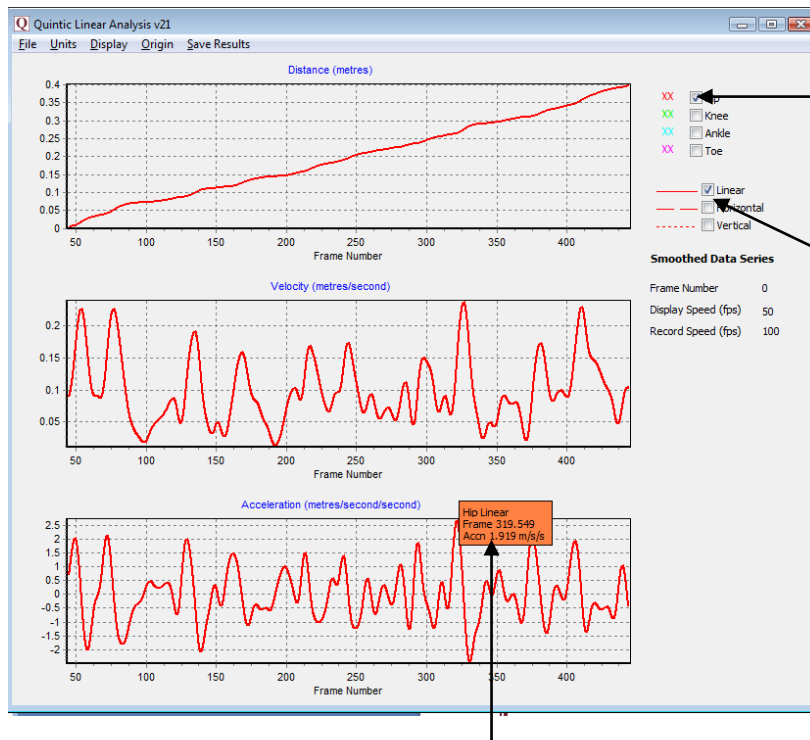
The data for each individual video is displayed as well as the averages, prediction intervals and confidence intervals of the selected videos.

N.B. Data must be smoothed before multi video analysis.

a. Single Video Linear Analysis

Open the video **'Cycling_100fps'** from the **'Cycling'** folder.

Click on the [icon] button and then select **'Single Video Linear Analysis'**.

Select which markers you want to display on the graph by ticking the relevant boxes.

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

Scroll the cursor over the graph to see the data for each frame.

Both the video 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.
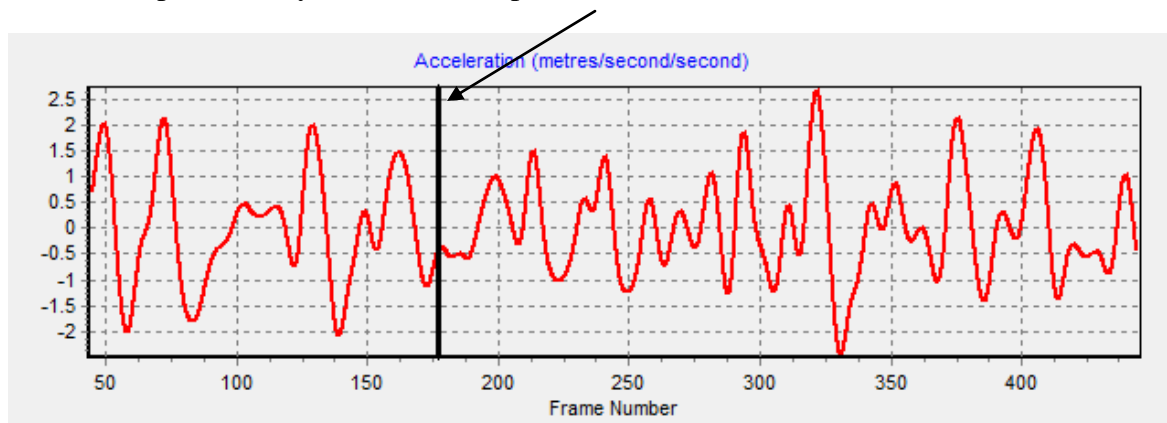
<u>Functions from the top menu:</u>

File: This function allows you to print, save or copy any of the graphs into any other document (i.e. word, excel, PowerPoint).

Units: This function allows the you to change the units between metres, feet, kph (kilometres per hour) and mph (miles per hour).

Display: This function allows the user to turn the series values off and on, as well as the frame indicator and any event markers that appear on the screen.

Origin: This function changes the origin of the data from either the start point of the marker (relative) or from the (0,0) coordinate (absolute).

Save Results: You can save the results as an Excel file (.xls). The results will be automatically saved within the same folder as the video and with the same name as the video as well (see image below).
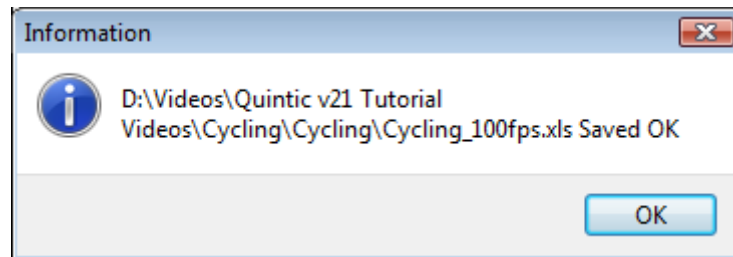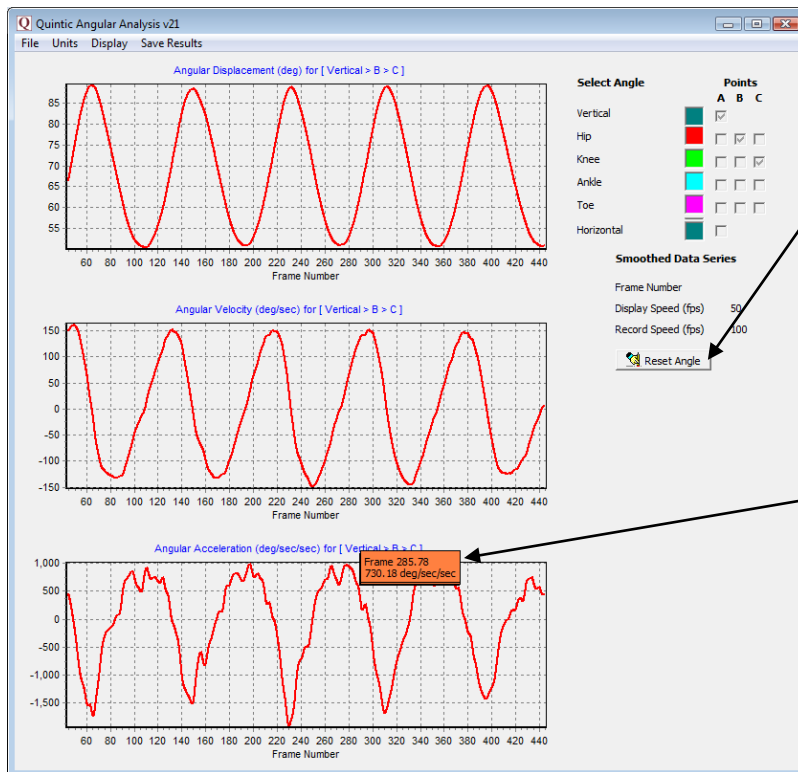

NB: Graphs can be zoomed by clicking on the graph and then highlighting the area of interest.

GO TO QUESTIONS 4, 5, AND 6 ON THE QUESTIONS SHEET (PAGES 25-26)

b. Single Video Angular Analysis

Click on the [icon] button and then select **'Single Video Angular Analysis'**.

To select an angle for analysis first click on the [Reset Angle] button. This refreshes the angle selection grids and allows you to select a particular angle.

Scroll the cursor over the graph to see the data for each frame.

E.g. To select the knee angle tick the following boxes:

Column A tick the Hip box

Column B tick the Knee box

Column C tick the Ankle box

<u>Other functions from the top menu:</u>

File: This function allows you to print, save or copy any of the graphs into any other document (i.e. word, excel, PowerPoint).

Units: this function allows the user to change the units between degrees and radians.

Display: This function allows the user to turn off and on the series values, as well as the frame indicator and any event markers that appear on the screen. The reflex angle function also allows the user to flip the measured angle.

Save Results: You can save the results as an Excel file (.xls). The results will be automatically saved within the same folder as the video. When saving angular results a file name needs to be given, as only the results for the current angle will be saved (see image below).
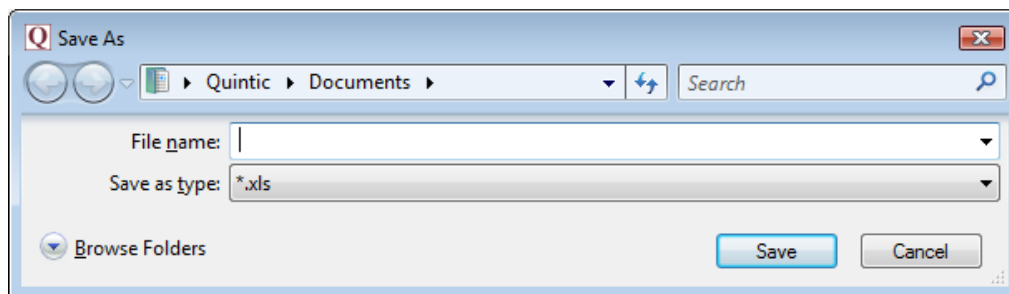
c. Multiple Video Linear Analysis

Open the video **'CMJ-AS1'** from the **'6 jumps'** folder.

N.B. In this folder all 6 videos and associated digitisation traces can be found. In this occasion the 6 videos all have the same calibration file, template and frame speed. The videos are trimmed via the Quintic editor to insure toe off occurs at frame 202. It is not necessary to have the same calibration file for all 6 videos. For example if you wish to compare a video from another session/time/date etc. this is possible.

Go to the **'Digitisation'** tab and select **'Load an Existing Trace'** and the trace will appear on the video.

Now click on the [icon] button and then select **'Multi Video Linear Analysis'** and a new window named **'Quintic Multi-Linear Analysis'** will open.

Click on **'Select Folder'** from the top menu.

Highlight the **'6 Jumps'** folder and click **'OK'**.

The data for the video **'CMJ_AS1'** will be displayed on the graphs.
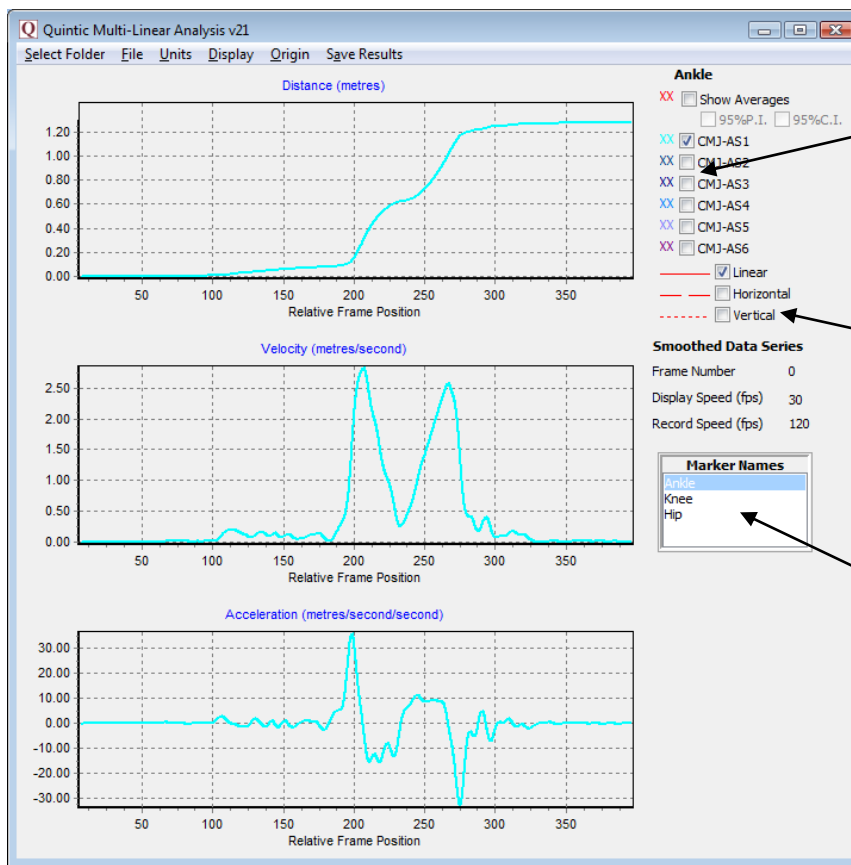
1. Select which videos to display on the graphs by ticking these boxes.

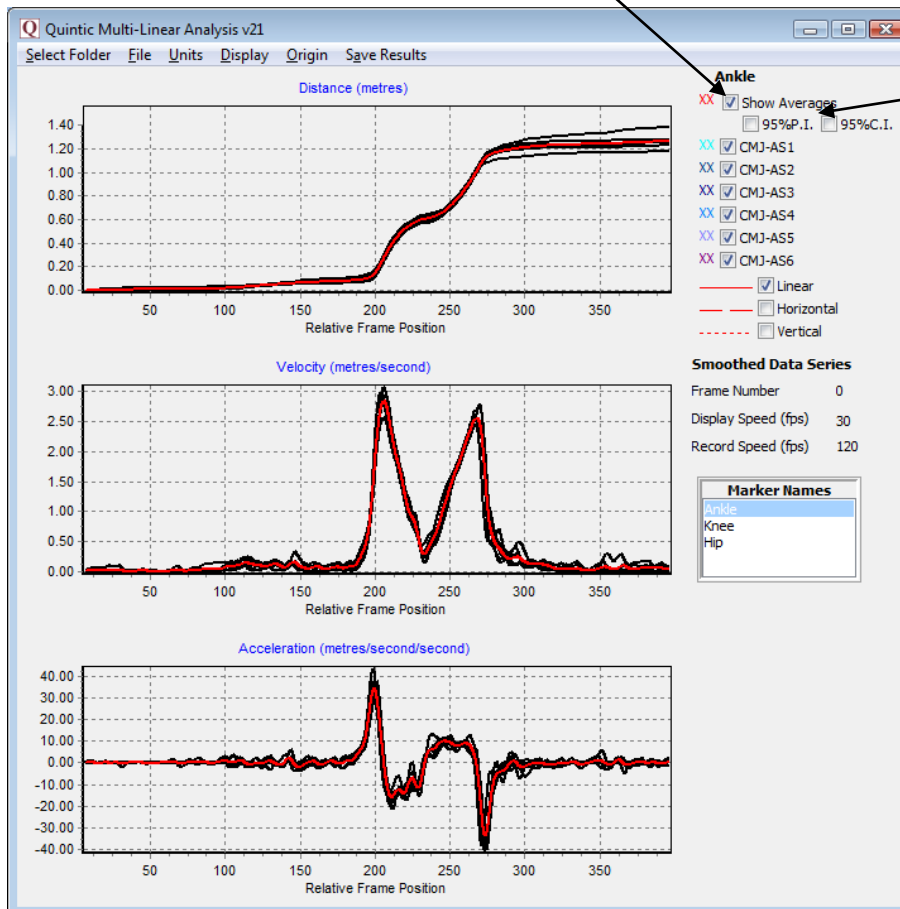2. Select whether to display linear, horizontal or vertical values by ticking these boxes.

3. Select which marker to display from the menu.

Displaying Averages

The averages will be calculated from only the videos selected.
The average is shown in red and the individual video data is now displayed in black.

1. Select this box to display the averages.

2. These boxes can be ticked to display the Prediction Intervals and Confidence Intervals (shown as a red dotted line).

Save Results: You can save the results as an Excel file (.xls). Both the series data and average results will be automatically saved within the same folder (see image below).
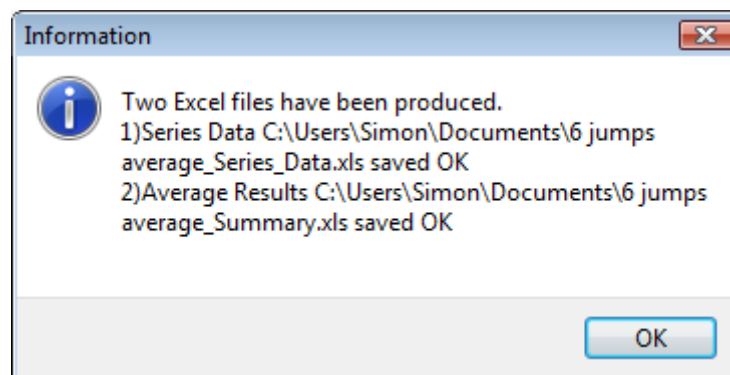
d. Multiple Video Angular Analysis

Open the video **'CMJ-AS1'** from the **'6 jumps'** folder.

Go to the 'Digitisation' tab and select **'Load an Existing Trace'** and the trace will appear on the video.

Click on the [icon] button and then select **'Multi Video Angular Analysis'** and a new window named **'Quintic Multi-Angular Analysis'** will open.
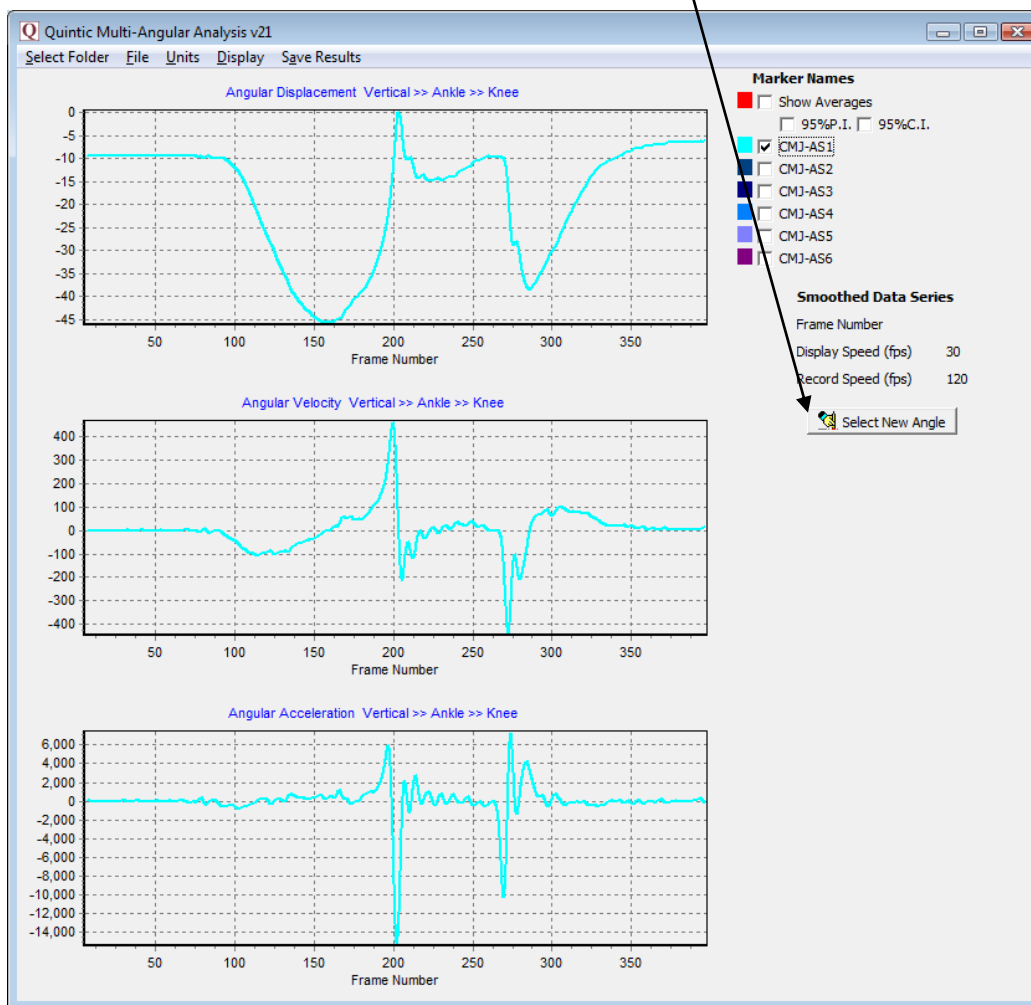
Click on **'Select Folder'** from the top menu.

Highlight the **'6 Jumps'** folder and click **'OK'.**

The data for the video **'CMJ_AS1'** will be displayed on the graphs.

Select videos and averages as previously explained for the 'Multiple Video Linear Analysis'.

To change the selected angle click on the **'Select New Angle'** icon.
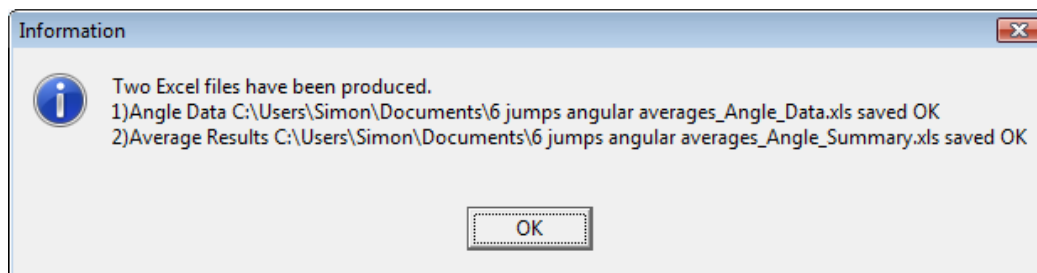
The following window will now open and the angle can be selected.

E.g. To select the knee angle tick the following boxes:

Column A tick the Ankle box

Column B tick the Knee box

Column C tick the Hip box
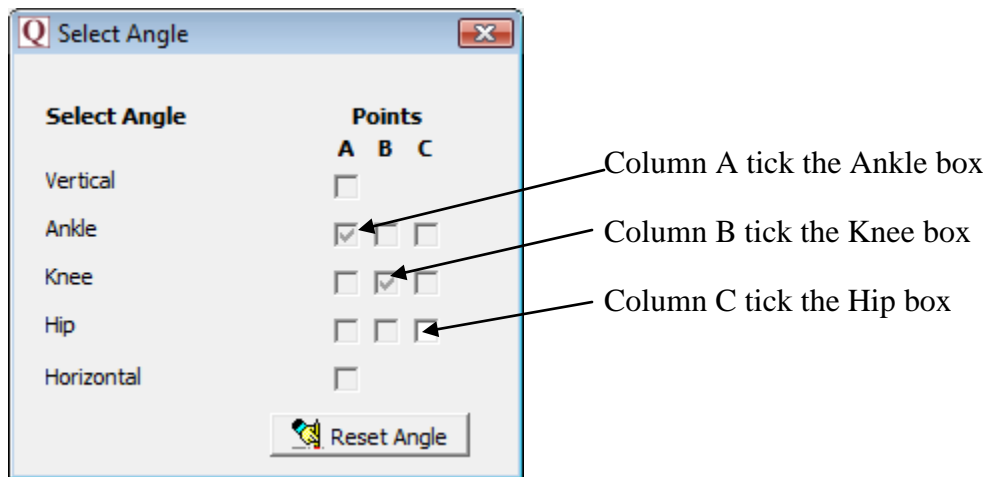
Save Results: You can save the results as an Excel file (.xls). Both the angular data and average results will be automatically saved within the same folder (see image below).

4. COM (Centre of Mass) Models

Open the **'Cricket Bowl'** video from the '**COM**' folder. (There is already a completed COM trace and data to be viewed initially before creating your own... you may wish to create a duplicate video in order to compare results...)
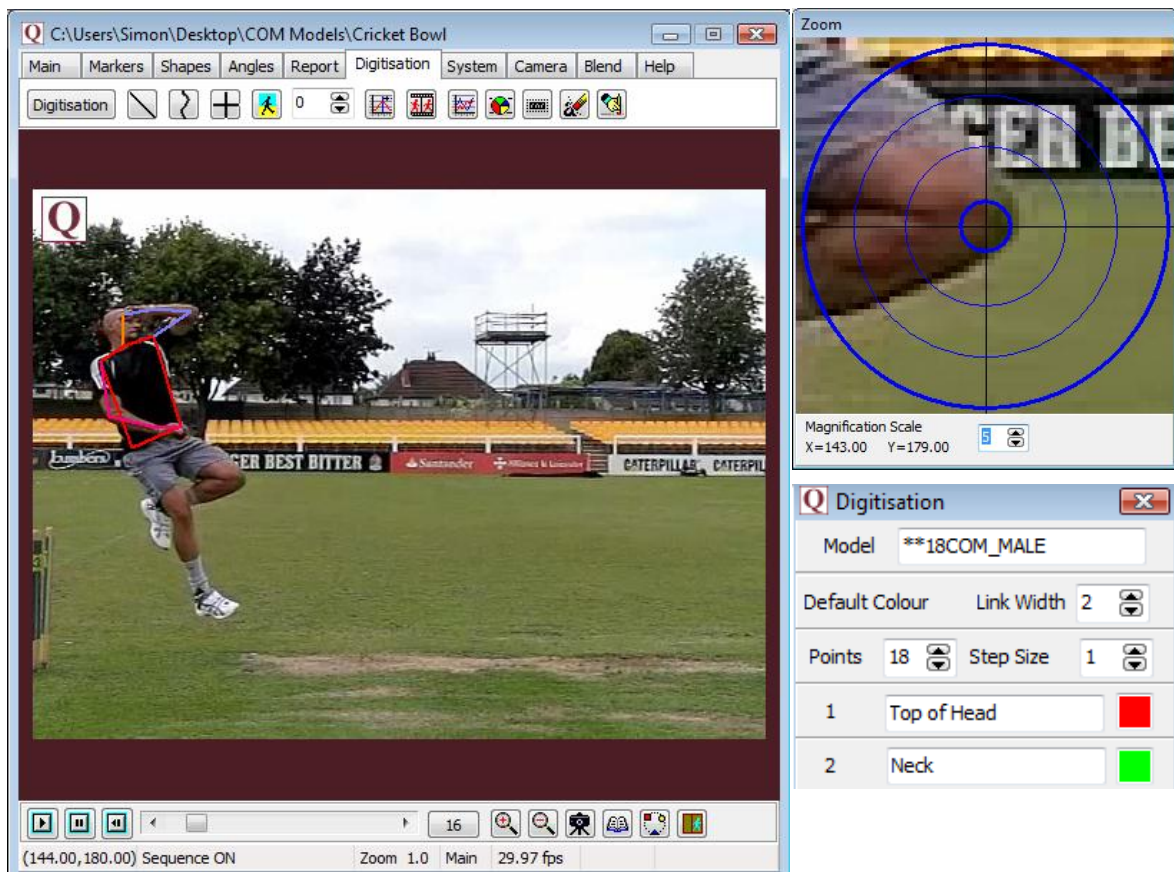
Select the **'Digitisation'** tab. From the digitisation drop down menu select **'Video File Calibration'** and calibrate the video (refer to tutorial 6a).

Once calibrated select **'Manual Digitisation of a New Trace'** and you will be asked to open a frame template.

Open the relevant male or female COM template from the **'COM'** folder (i.e. '18COM_FEMALE.qrm 'or '18COM_MALE.qrm').

Now digitise the 18 point model (refer to tutorial 8a).

The image below shows digitisation of frame 16, point 13 (left knee) using the **'**18COM_MALE'** model.
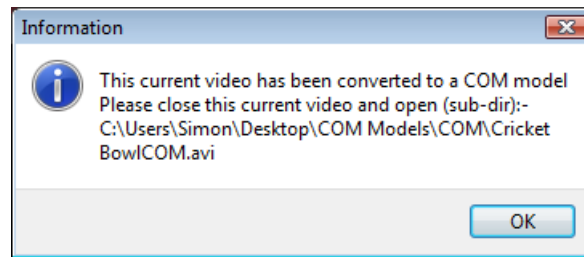

Once you have finished digitising click on **'Save Trace'**.
N.B. A minimum of 12 frames must be digitised in order to create a COM model.

Click the **'Digitisation'** tab, **'Data Smoothing of Current Trace'** and **'Save Filter Values'**.

Now click on the **'Digitisation'** tab, **'Convert to a COM model'** then click **'OK'.**

Open the avi. file (named **'Cricket BowlCOM'**) located in the newly produced COM folder. This is found within the folder that the original video is saved in.

Click the **'Digitisation'** tab and **'Load an existing trace'**.

Click the **'Digitisation'** tab, **'Data Smoothing of Current Trace'** and **'Save Filter Values'**.

Now click the **'Digitisation'** tab and **'Edit Current Frame Display – Point Trajectory'**.

It can now be seen that a 19th point has been added at the bottom of the list, labelled COM. This will automatically be selected, whilst the other points are deselected. This will then show only the COM trace on the video.
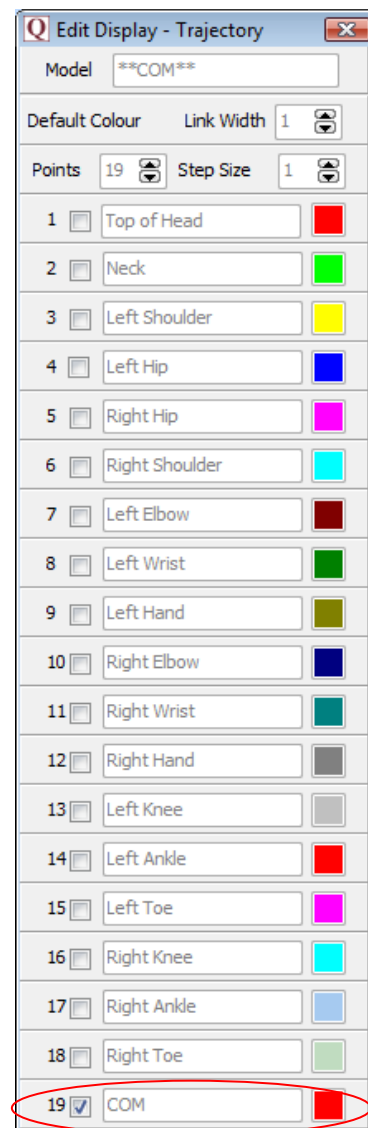
N.B. Individual points can be selected as normal.
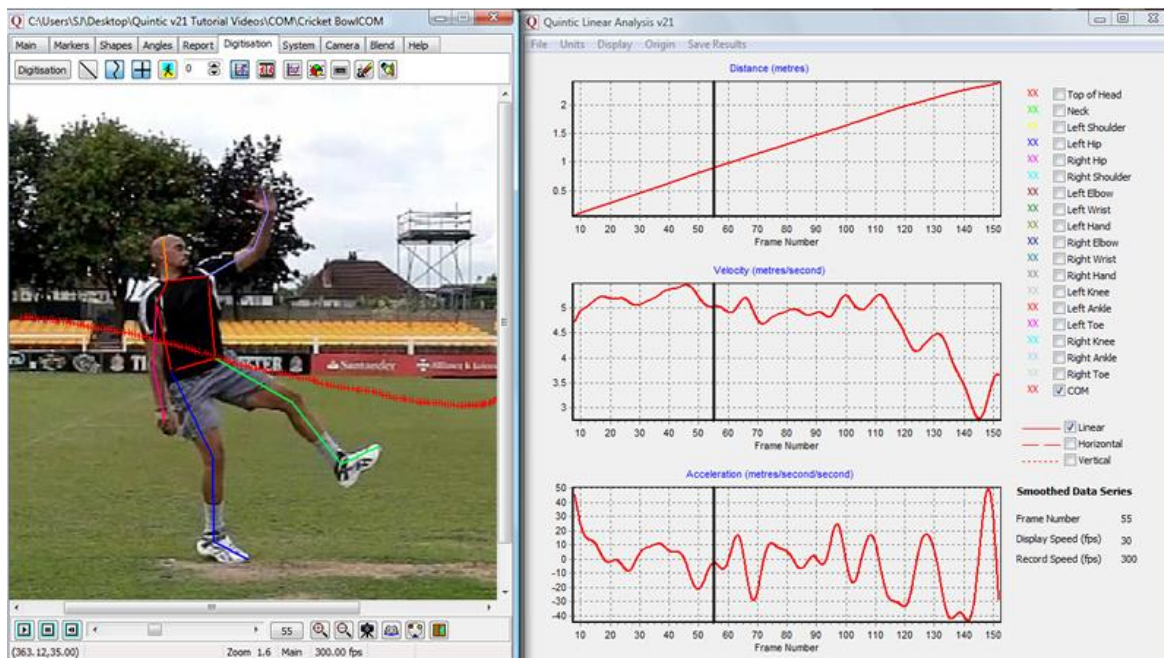
Quintic Biomechanics – COM model

'The 'Centre of Mass' (COM) model has been implemented, with the assistance of Philip Graham-Smith, into the Quintic Biomechanics video analysis software following the 18 point manual digitisation process. The 'COM' model calculations have been developed and adapted using the biomechanics published literature below.

Zatsiorsky, V. and Seluyanov, V. (1983). The mass and inertia characteristics of the main segments of the human body. In Biomechanics VIII-B (Edited by Matsui, H. and Kobayashi, K.), pp. 1152-l 159. Human Kinetic, Illinois.

Adjustments To Zatsiorsky-Seluyanov's Segment Inertia Parameters. Paolo de Leva : Kinesiology Department, Indiana University, Bloomington, IN 47405, U.S.A. Journal Biomechanics Vol 29, 9, 1223-1230. 1996'.

5. Intersection Models

This model can be used to identify the point at which 2 separate lines, which connect digitised points, intersect.

Looking at the example below, if P1 and P2 were markers on the outer thigh and P3 and P4 were markers on the outside of lower leg, Intersection 1 (i1) would be the axis around which the knee pivots.

Additionally if P5 and P6 were markers on the side of the foot, Intersection 2 (i2) would represent the axis around which the ankle pivots.
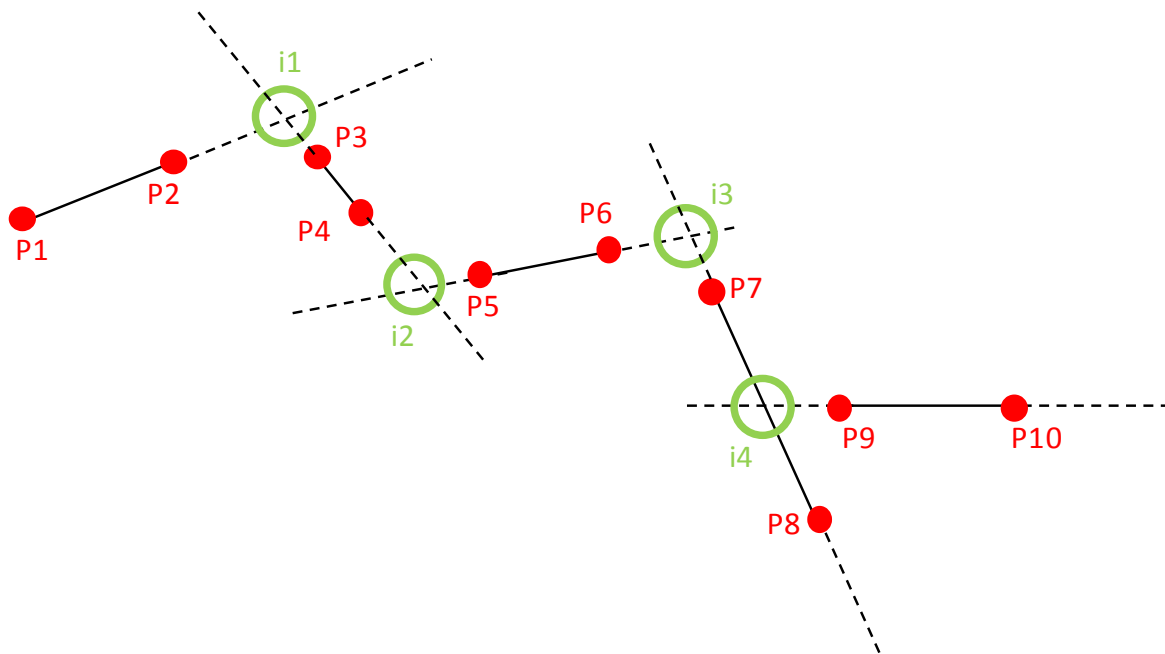
Open the video **'Putt3_#3'** from the **'Intersection'** folder.

Calibrate the video (refer to Tutorial 8a) and then open the **'Golf Template'** from the **'Intersection'** folder.

The template needed depends upon the number of intersections required. Example templates are available at C:\Quintic Sample Videos\Templates.
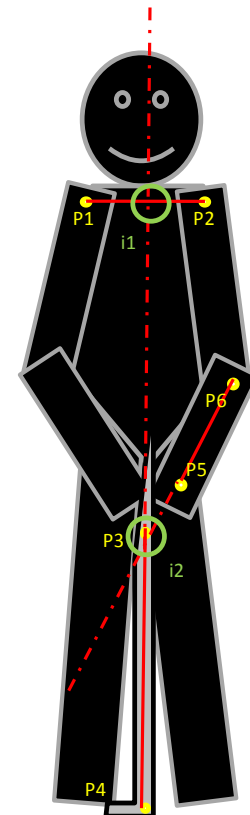
- Intersection 1
- Intersection 2
- Intersection 3
- Intersection 4

If creating your own template then the following should be added to the template name:

Number of Intersections	Template
1	*4
2	*6
3	*8
4	*10

N.B. When creating the template, points must be ordered in an appropriate way for the intersections you wish to calculate.
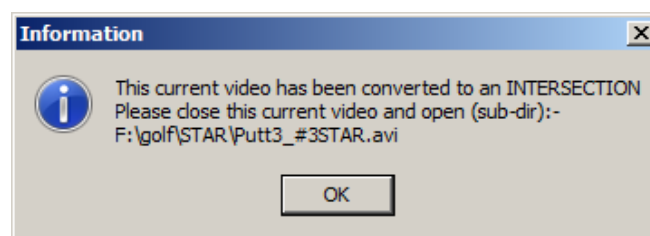
For this golfing example:

This will give you the intersection between:
- The line joining the shoulders and the line of the club (I_1).
- The line joining the club and the line of the left arm (I_2).

Digitise the video, smooth the data and save the filter values (refer to tutorial 8a).

Click the **'Digitisation'** button and **'Convert to an Intersection Model'**.

In the **'Main'** tab, click **'Open'**. Open the new file that has been created in the subfolder **'STAR'**. This will be found within the same folder as the original video clip (the file name will have the suffix **'STAR'** (for this example putt3_#3STAR).

Click the **'Digitisation'** tab and **'Load an Existing Trace'**.

Now click the **'Digitisation'** tab and **'Data Smoothing of Current Trace'**.

By clicking on **'Edit Current Frame Display – Point Trajectory'**, found within the **'Digitisation'** menu, you can select which points/intersections to display.
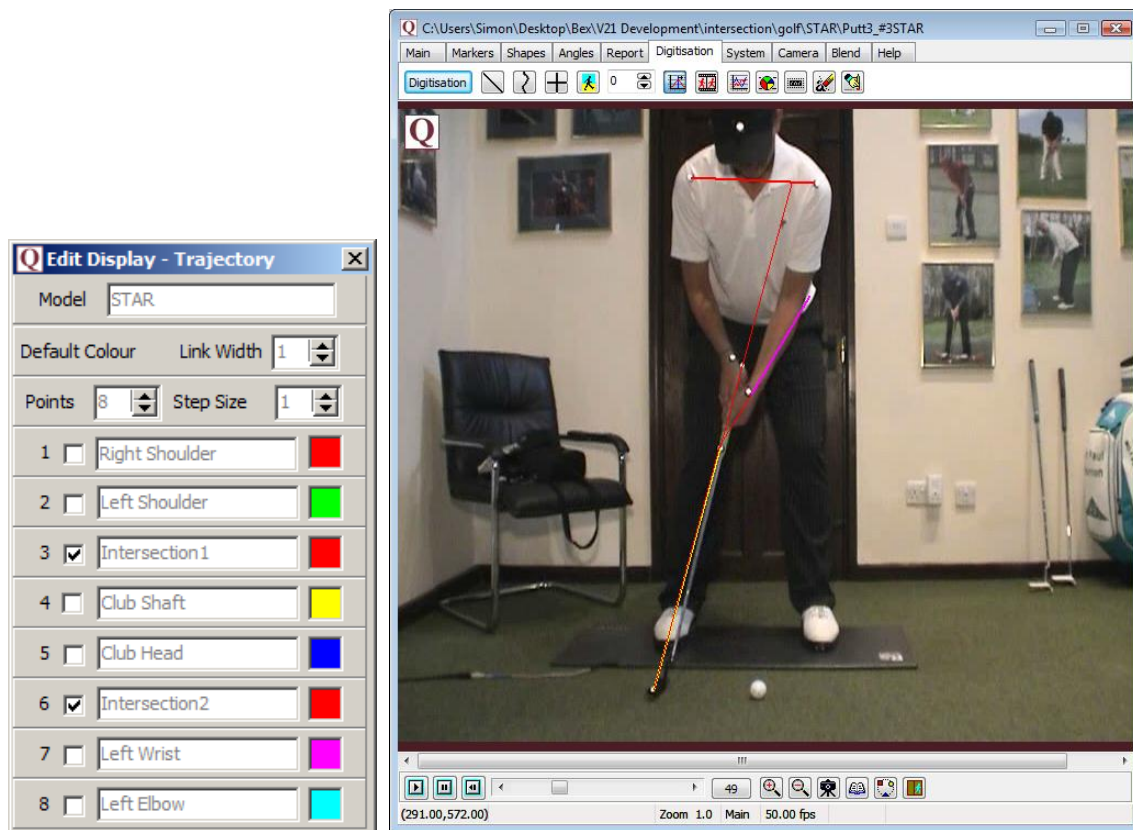
a. Angular Analysis of Intersections

To select an angle for analysis first click on the [Reset Angle] button. This refreshes the angle selection grids and allows you to select a particular angle.

To find the intersection angle A and C need to be the points either side of the intersection (see below).
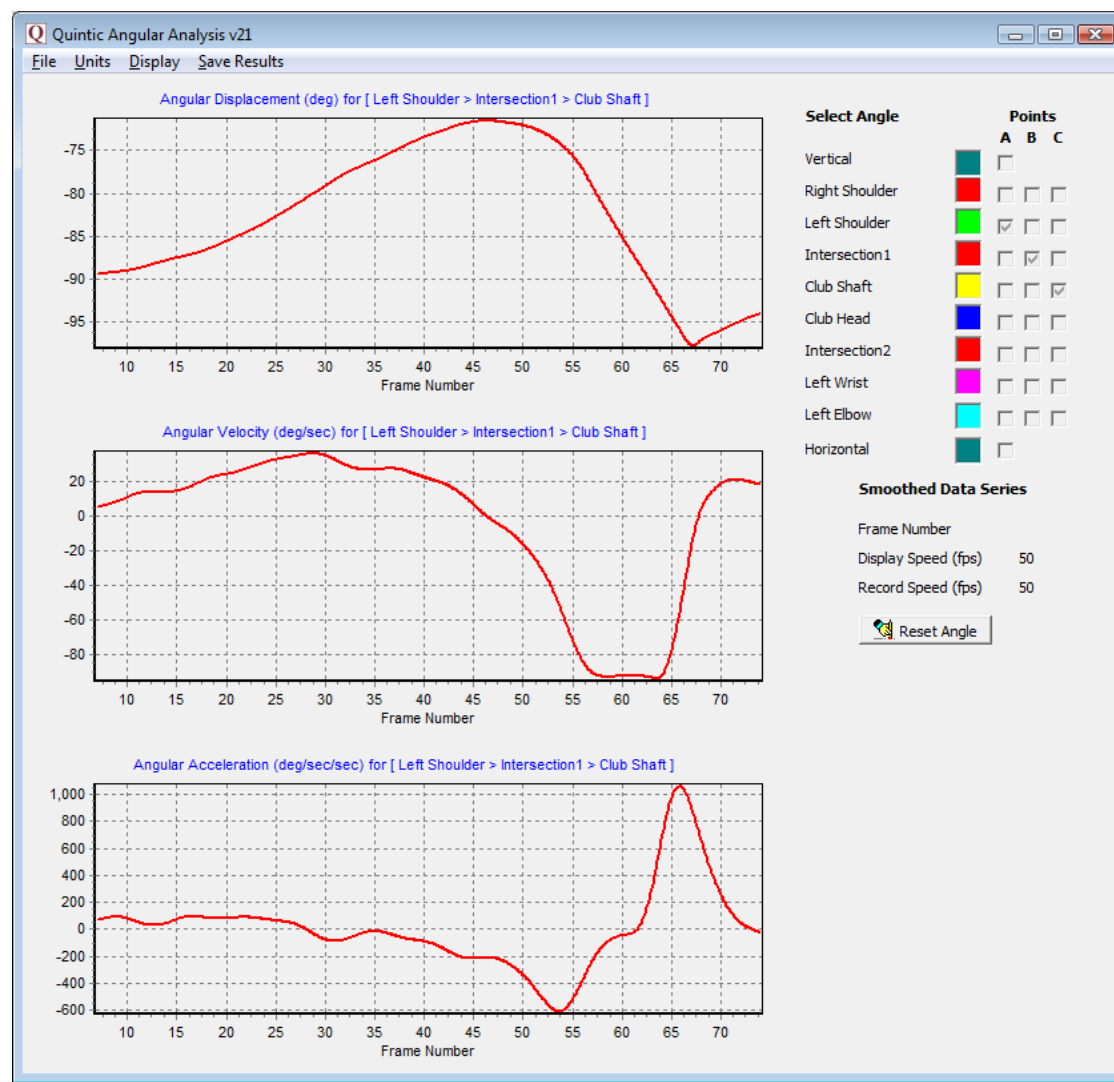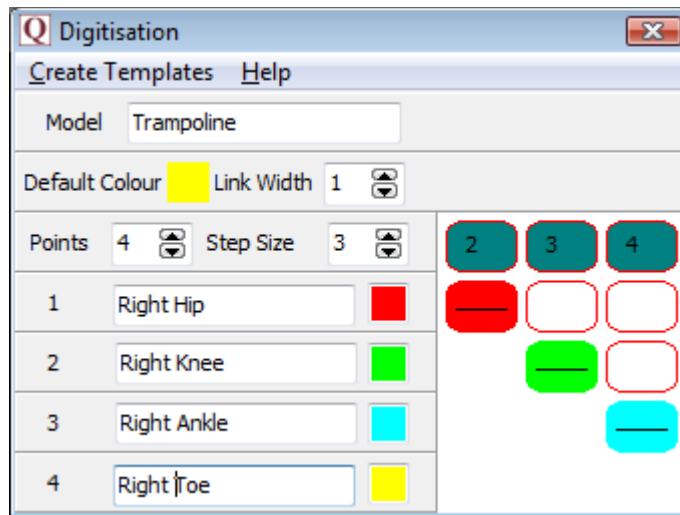

Save Results: You can save the results as an Excel file (.xls). The angular data will be automatically saved within the same folder.

Question Sheet

RECAP

Open the **'No Twist SV'** from the **'Trampoline'** folder.

1) Create this digitisation template. (If you are using Quintic Coaching create a 1 point template and trace a point of your choice).

2) Calibrate the video by drawing a line in the horizontal direction across the bed of the trampoline. It is 4.28 in length.

3) Digitise the video between frames 117 and 168.

4) Save the digitisation trace.

<p style="text-align:center; color:red;">BACK TO TUTORIAL SHEET (PAGE 3)</p>

Open the video **'No Twist SV'** from the **'Trampoline'** folder.

1) (i) Set markers at frames 8, 46, 62, 88, 145, 209. What key points during the movement do these frames represent?

Frame 8: …………………………………………………...……………..

Frame 46: …………………………………………………….……………..

Frame 62: …………………………………………………………………

Frame 88: …………………………………………………………………

Frame 145: …………………………………………………………………..

Frame 209: …………………………………………………………………..   (3)

 (ii) Load the digitisation trace you created in the **'RECAP'** section.

(iii) Create a 6 frame 'multiple screen capture' displaying some parts of the digitisation trace on the 6 marked frames in accordance with the following instructions. Do this by pressing down the following buttons:

Frame 12 = +

Frame 15 = +

Frame 17 = +

Frame 19 = +

Frame 22 = + +

Frame 34 = + + +

(iv) Save this sequence as a JPEG and ask your teacher if you can print.   (6)

BACK TO TUTORIAL SHEET (PAGE 5)

2) Body segments are always measured between joints (i.e. the lower leg is measured between the knee and the ankle bone; not the floor).

Use the ruler function to measure the following lengths of body segments:

| Body segment	Length
Forearm	
Foot	
Lower leg	
Upper arm	
Hand	
Thigh	
Trunk (shoulder to hip)	

(7)

3) Open the Animation Window. Scroll to frame 117. These buttons are used in various combinations to display the digitisation trace in this window.
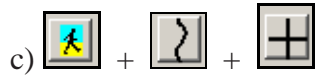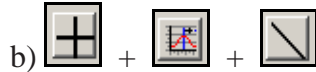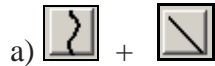

(i) Which buttons are used in combination to create the following pictures?

(Hint: Take note of the frame number in the bottom right hand corner of each animation.)

a)

b)

c)

d)
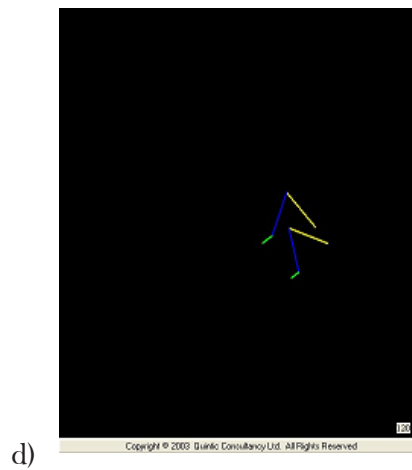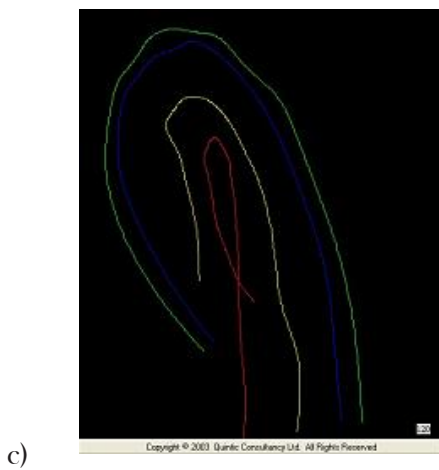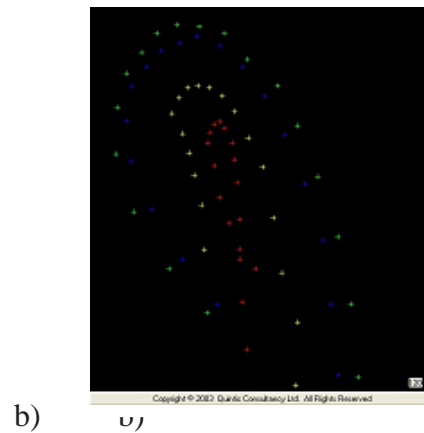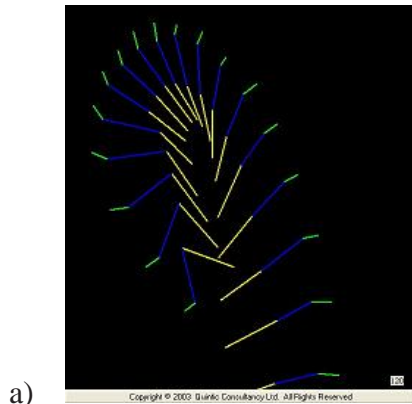
(4)

(ii)   In the Animation Window create images using the following combinations of tools. Each time save it as a JPEG:

a) +

b) + +

c) + +

d) + +

(iii)   In Microsoft Word, open all four JPEGs you have just created in part (ii) of this question. Adjust their sizes to ensure they all fit on one page.

(iv)   Type in the title **'Animations of Trampolinist'** and type your name at the top of the page.   (6)

Using the video **'No Twist SV'** from the **'Trampoline'** folder.

Open the Linear Analysis Window by clicking on this button

4)   When you press **'Play'** in the main window what happens in the Analysis Window?

…………………………………………………………………….…………………

…………………………………………………………………….…………………

...............……………………………………………………………….………….

…………………………………………………………….………………...........

………............……………………………….…………………..………....... (1)

5)   Answer the following questions by holding the cursor over the relevant points on the graph.

Use absolute measurements for distances.

a) What is the horizontal distance of the toe at frame 119? ……………..

b) What is the horizontal distance of the knee at frame 155? …………...

c) What is the velocity of the hip at frame 152? ………………………..

d) What is the velocity of the knee at frame 167? ………………………

e) What is the horizontal distance of the ankle at frame 146? ……………

f) What is the velocity of the toe at frame 128? ………………………..   (6)

6) Select **'Save Results'** from the menu across the top of the analysis window and then 'Save results as an Excel file' from the drop-down menu.

Open Microsoft Excel from your desktop and open the results you just saved.

Use these results to answer the following questions:

Use absolute measurements for distances.

(i)   What is the horizontal distance of the right toe at frame 116?
    ……………………………………………………………

(ii)   What is the horizontal distance of the right hip at frame 167?
    ……………………………………………………………

(iii)   What is the horizontal distance of the right ankle at frame 149?
    …………………………………………………………..

(iv)   What is the horizontal distance of the right knee at frame 131?
    …………………………………………………………..

(v)   What is the vertical distance of the right ankle at frame 116?
    …………………………………………………………..

(vi)   What is the vertical distance of the right toe at frame 134?
    …………………………………………………………..

(vii)   What is the vertical distance of the right hip at frame 158?
    …………………………………………………………...

(viii) What is the vertical distance of the right knee at frame 167?
    …………………………………………………………   (8)

(/ 55)

<p style="color:red;text-align:center">BACK TO TUTORIAL SHEET (PAGE 10)</p>