Quintic Software

Tutorial 7a

Manual Digitisation

V33

Contents Page

1. Digitisation

Digitisation allows you to track the location of certain parts of the body or pieces of equipment throughout the duration of a video clip. Quintic software can then calculate linear and angular distances, velocities and accelerations of the points you have tracked.

The 3 different levels of software will allow you to digitise a different number of points:

Quintic Sports v33 – 1 Point Manual Digitisation

Quintic Coaching v33 – 2 Point Manual Digitisation

Quintic Biomechanics v33 – 21 Point Manual Digitisation

2. Calibration

To begin digitisation, you must first calibrate the video clip. This means that the computer can then convert a distance on the computer screen (pixels) to its relative distance in the real world. Video recording speed also needs to be set so that time-based data e.g. velocity and acceleration, can also be calculated accurately.

Open the video you wish to digitise within Quintic software.

Click on the **'Digitisation'** tab and then on the **'Digitisation'** menu.

```
Create Frame Templates
Default Frame Template                                    >
Default Learnt File                                       >
------------------
Video File Calibration                                    >
Load an External Calibration File
------------------
Manual Digitisation of a New Trace
Automatic Digitisation of a New Trace (White or Black Markers)
Intelligent Digitisation of a New Trace (White Markers)
```
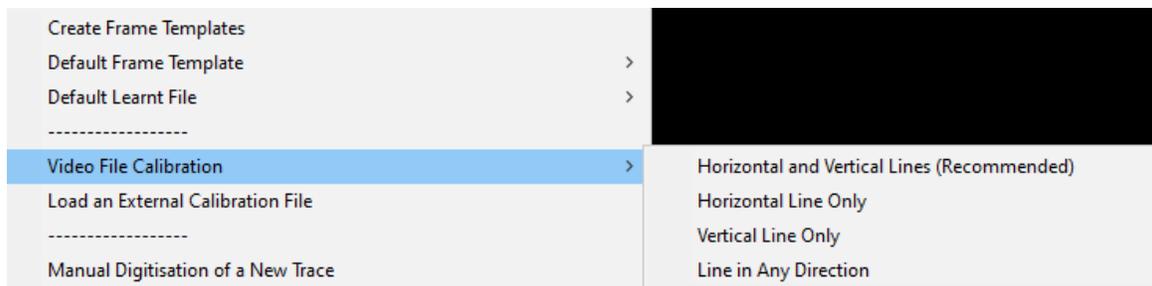
Either:

a) Select **'Video File Calibration'** from the drop down menu, if you know the length of something that is part of the action (e.g. a javelin, cricket bat, leg length or stump height).

Choose one of the options presented:
- If you know certain distances in both the horizontal and vertical directions then choose '**Horizontal and Vertical Lines'**
- If only the horizontal distance is known then choose **'Horizontal Line only'**
- If only the vertical distance is known then choose **'Vertical Line only'**
- If any other distance is known then choose **'Line in any Direction'**.

Hold the cursor over one end of the known distance, click the left mouse button and drag the cursor to the other end. Enter the distance and click **'Accept'**

Once the distance has been completed, the software will ask for the frames per second (FPS) of the video. If a Quintic High Speed Camera is used, this will be the true frames per second of the video. If a mainstream camera is used, you may be required to input the frames per second that was used.

Create Frame Templates		
Default Frame Template	>	
Default Learnt File	>	

Video File Calibration	>	Horizontal and Vertical Lines (Recommended)
Load an External Calibration File		Horizontal Line Only
------------------		Vertical Line Only
Manual Digitisation of a New Trace		Line in Any Direction

Or

b) Select **'Load an external calibration file'** if you have used the same background and camera position as a previous video that has already been calibrated.

Important: The camera must not have been moved between the filming of the two clips.

An accurate video recording speed is required to calculate accurate velocity and acceleration. Please make sure this is correct before using the linear or angular analysis functions.

PRACTICAL EXAMPLE

Open the video **'Bowling – Side view'** from the **'Cricket'** folder.

Click on the **'Digitisation'** tab and then on the **'Digitisation'** menu.

3. Create a Frame Template

N.B. Only one point is available in Quintic Sports, 2 points in Quintic Coaching and 21 points in Quintic Biomechanics. The following template has been created in Quintic Biomechanics.

Quintic have already created a range of templates that you are able to use, depending on which level of Quintic software you are using. You are able to find these within your **'Quintic Sample Videos'** folder then **'Templates'**.

Should you wish to create your own template, please see below.

From the **'Digitisation'** menu click '**Create Frame Template'**. The following window will appear
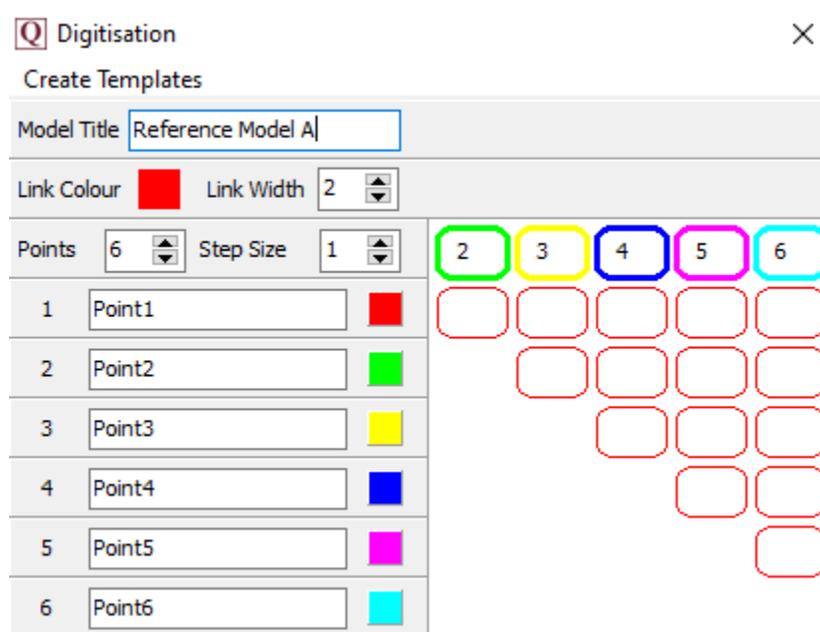
Model: Name your model so that in the future you can use it again.

Points: Select the number of points you are going to track in the movement. Sports is able to do 1 point, Coaching 2 points and Biomechanics 21 points.

Step Size: This states how frequently frames will be digitised (1 = every frame, 5 = every 5th frame etc).

Link Width: This is the width of the lines that join up the points. 1 = Thin line, 10 = Thick line.

Point Names: You can change the names from **'point 1'**, **'point 2'** etc to specific names of the anatomical points you are going to use.

Point Colour: Left click on the coloured box next to each point and select a colour from the palate. This will allow you to change the colour of each point.

Links between points: To join points together simply click on the box which links the two points you wish to join together. You can find this next to the named points. If you click the coloured box next to **'Default Colour'** this will control what colour you would like the link to be between each point. To remove the colours from one of the squares, right click on it.
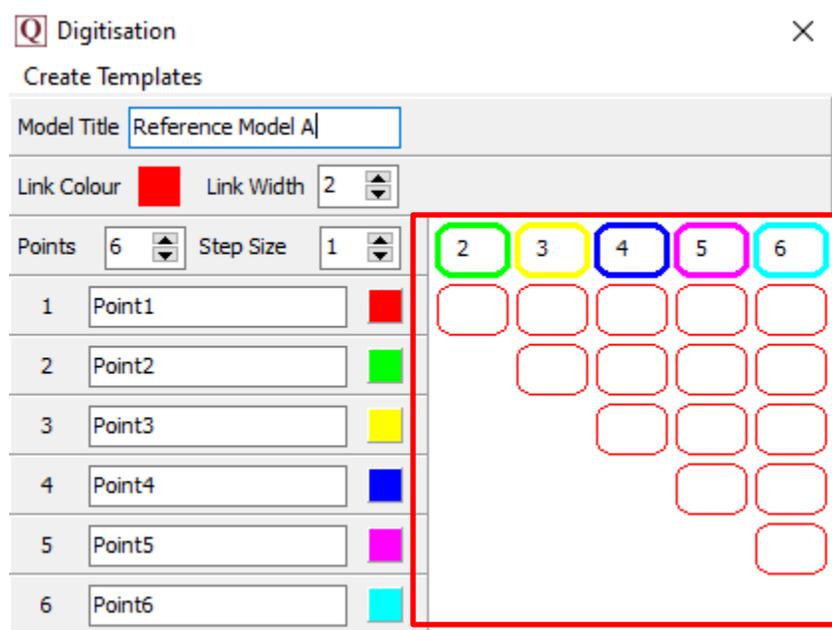
To save the template Click **'Create templates'** in the top-left of this window and click **'Save As'**.

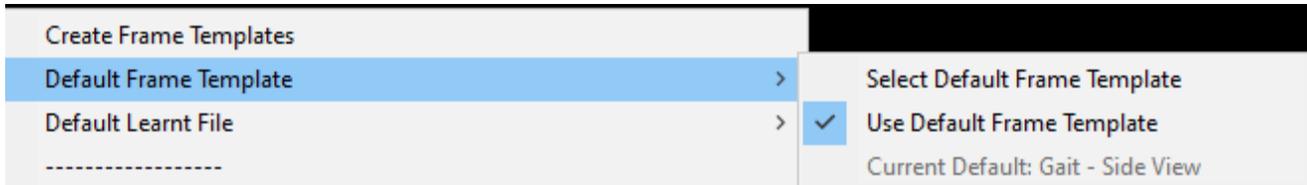**N.B.** This will replace any previous traces with the same name.

PRACTICAL EXAMPLE

Create a 4-point template. We will be digitising every frame so have the step size set to 1. We want a thin line to be drawn so have the link width set to 1. The 4 points we will be digitising are the 'Hip', 'Knee', 'Ankle' and 'Toe' therefore name the points as such. We would like to connect the hip, knee, ankle and toe together - this can be done by connecting points 1 to 2, 2 to 3 and 3 to 4. You could also change the colour of each link just so this is easily identifiable.

Save the template as 'Bowler leg – 4 point' and save it in the 'Cricket' folder.

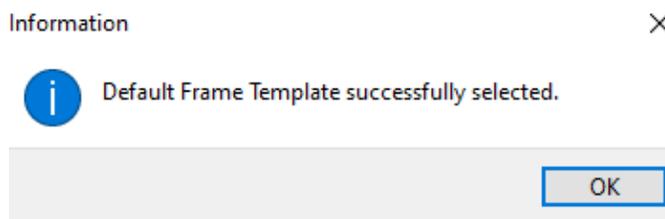### a. Default Digitisation Template

Users also have the option to choose a default digitisation template, removing the need to select it each time. Ideal for users who use the same digitisation template on a regular basis.

Create Frame Templates		
Default Frame Template	>	Select Default Frame Template
Default Learnt File	> ✓	Use Default Frame Template
------------------		Current Default: Gait - Side View

To begin, click on 'Default Frame Template' within the Digitisation Menu.

Then click 'Select Default Frame Template' and choose your preferred template.

Once you have selected your preferred digitisation template, the following pop up will appear, confirming you have selected your default digitisation template:

Information	✕
ⓘ Default Frame Template successfully selected.	
	OK

To use the default template, simply click 'Use Default Frame Template' if you want this to be used all the time.

The current default template is shown at the bottom of this menu:

Create Frame Templates		
Default Frame Template	>	Select Default Frame Template
Default Learnt File	> ✓	Use Default Frame Template
------------------		Current Default: Gait - Side View
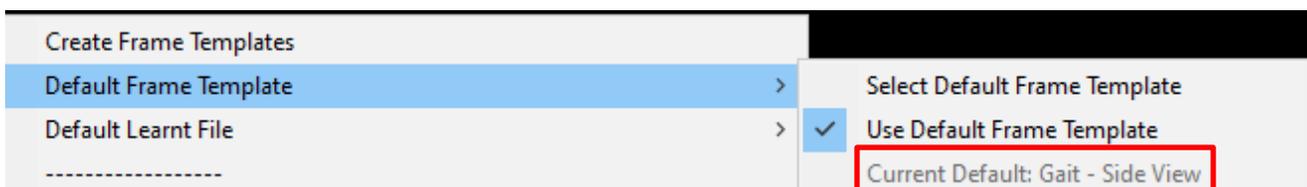
4. Manual Digitisation

Once you have calibrated the video and you have created/located the digitisation template you would like to use, you are ready to manually digitise.

To do this, open the video you are looking to digitise within Quintic software.

Click on **'Digitisation'** tab then the **'Digitisation'** menu and then click on **'Manual Digitisation of a New Trace'**

This will pop up a new window where you will be required to find the template you are going to use for manual digitisation.

N.B If the video has not been calibrated a window will pop-up asking you to calibrate the video.

N.B If a video has already been digitised, a window may pop-up asking if you want to overwrite the existing trace.

For the practical example, please navigate to the cricket folder and open '**Bowler leg – 4 point'** template.

Once you have selected the template, this will pop up
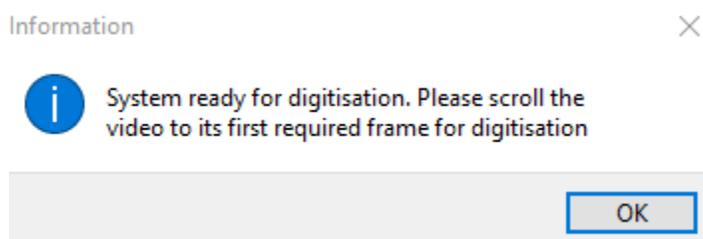
We are going to digitise the left leg of the bowler so scroll to the first frame in which their whole left leg is visible (Frame 12). Now we are ready to digitise.
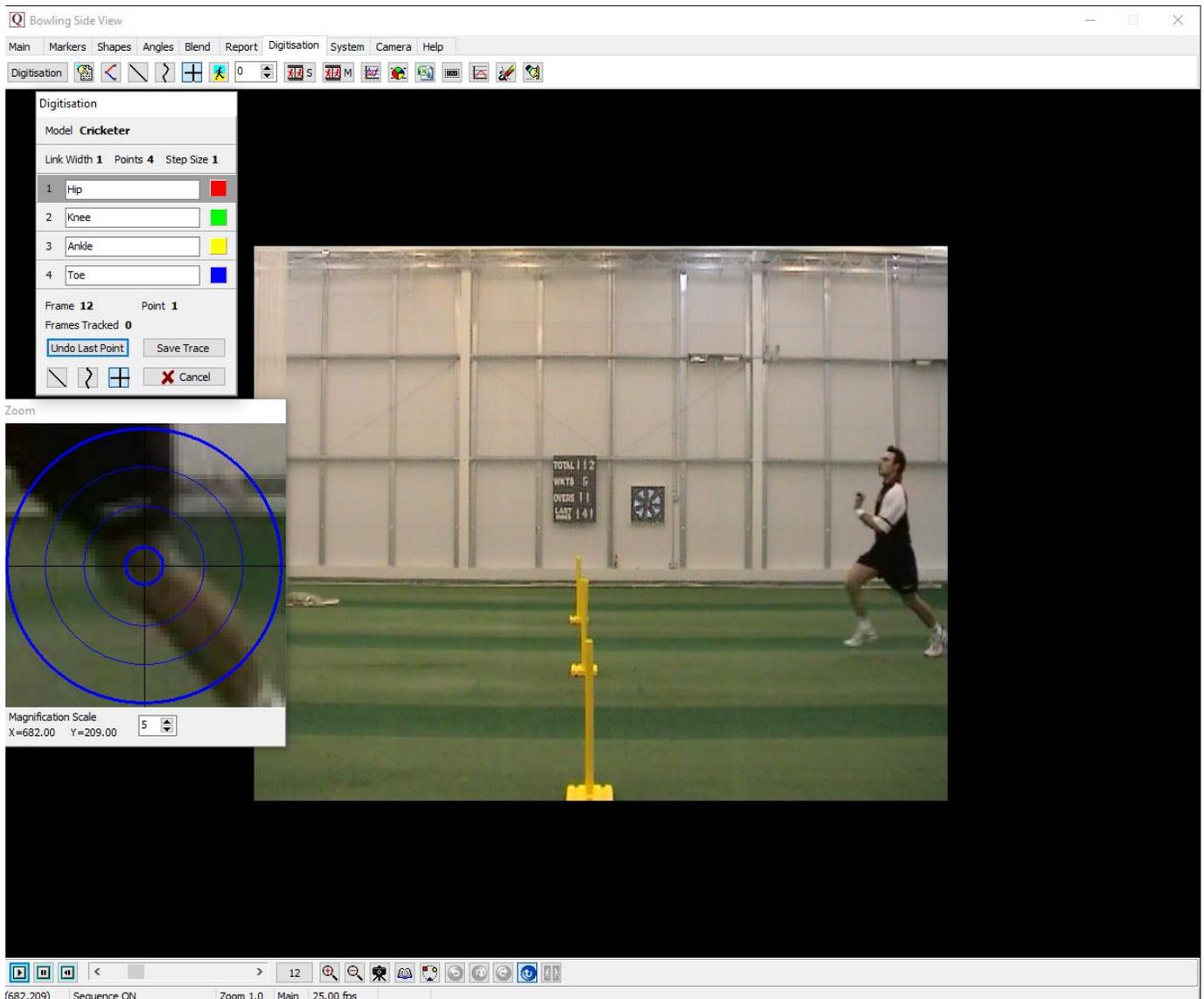
As the cursor moves across the screen, the zoom window shows a larger version of the area under the cursor. Use this to pinpoint the exact locations of the hip, knee, ankle and toe, per frame.

To manually digitise, simply click on the relevant points on the video. This must be done in the correct order as the template and as accurately as possible. Once you have completed a frame, this pop up will appear asking to accept the frame.
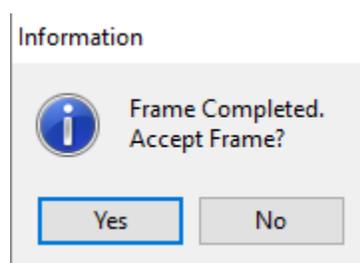
If they are correct, click **'Yes'** and the video will automatically advance to the next frame ready for digitisation.

If you make a mistake, click the **'Undo Last Point'** button.

The following buttons can be used to change how the trace is viewed during digitisation:
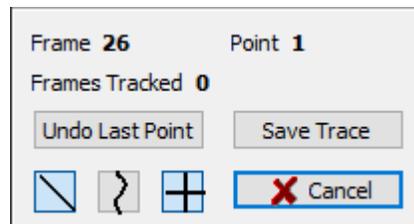
 - Show/hide figure lines

 - Show/hide smoothed trace

 - Show/hide crosses

Continue to digitise until the bowler moves off the screen or until you do not wish to digitise any further, then click **'Save Trace'**.

If you click the Cancel button, this will quit the Manual Digitisation and any digitisation that has taken place up to that point will be lost.

You are able to save a digitisation trace and then carry on Manually digitising it at a later point. This can be done by clicking the Digitisation button within the Digitisation tab, then clicking **'Continue Manual Digitisation of an Existing Trace'.**

This will allow the user to carry on digitising from the next frame after the last frame previously digitised. Please note, you are unable to re-edit previously digitised frames within this window.

5. Review/Editing an Existing Digitisation Trace

Should you like to edit a trace, you are able to do this by clicking on the 'Review/Edit an Existing Trace' button which is found by clicking the Digitisation button, within the Digitisation Tab.

This will pop up the following window, where you are able to Review, Edit, Re-Calibrate or Filter the digitisation trace.

IT MUST BE A SINGLE STEP TRACE IN ORDER FOR IT TO BE EDITED.
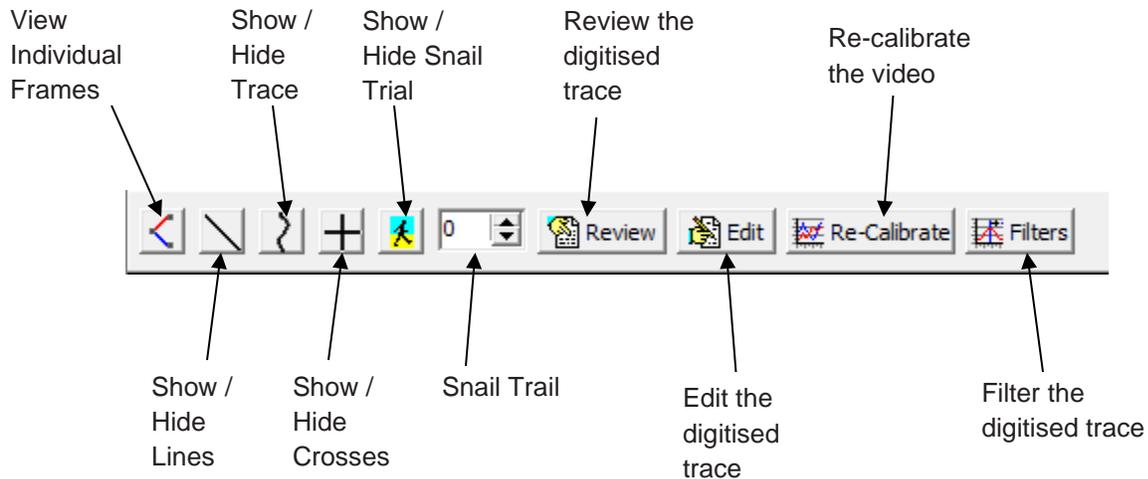
View Individual Frames – Shows the digitisation trace at that particular frame. If there are any links joining the points together, this will be displayed.

Show / Hide Lines – Shows the lines between the digitisation points. This will also include the current and all previous digitised frames (depending on whether the snail trail is in use).

Show / Hide Trace – Shows the smoothed digitisation trace. This will also include the current and all previous digitised frames (depending on whether the snail trail is in use).

Show / Hide Crosses – Shows the crosses of where the software has tracked each point. This will also include the current and all previous digitised frames (depending on whether the snail trail is in use).

Show / Hide Snail Trace – Shows a snail trail, where the user is able to control how many previous frames are to be displayed.

Snail Trail – Allows the user to control how many frames are to be displayed behind the current frame.

*Review the digitised trace* – This will allow the user to review the digitised trace.

Edit the digitised trace – This will allow the user to edit the digitisation trace. Please see the heading 'Editing a Digitised Trace' below for more information on how to do this.

Re-calibrate the video – This will allow the user to re-calibrate the video. Please see the heading 'Re-Calibrating an already Digitised Video' below for more information on how to do this.

Filter the digitised trace – This will allow the user to filter the digitisation trace using a Butterworth filter. Please see the heading 'Filtering a Digitised trace' below for more information on how to do this.

a. Editing a Digitised Trace

Press 'Edit' within the Edit Trace Data Window, which will pop up the 'Edit Marker Position' window.
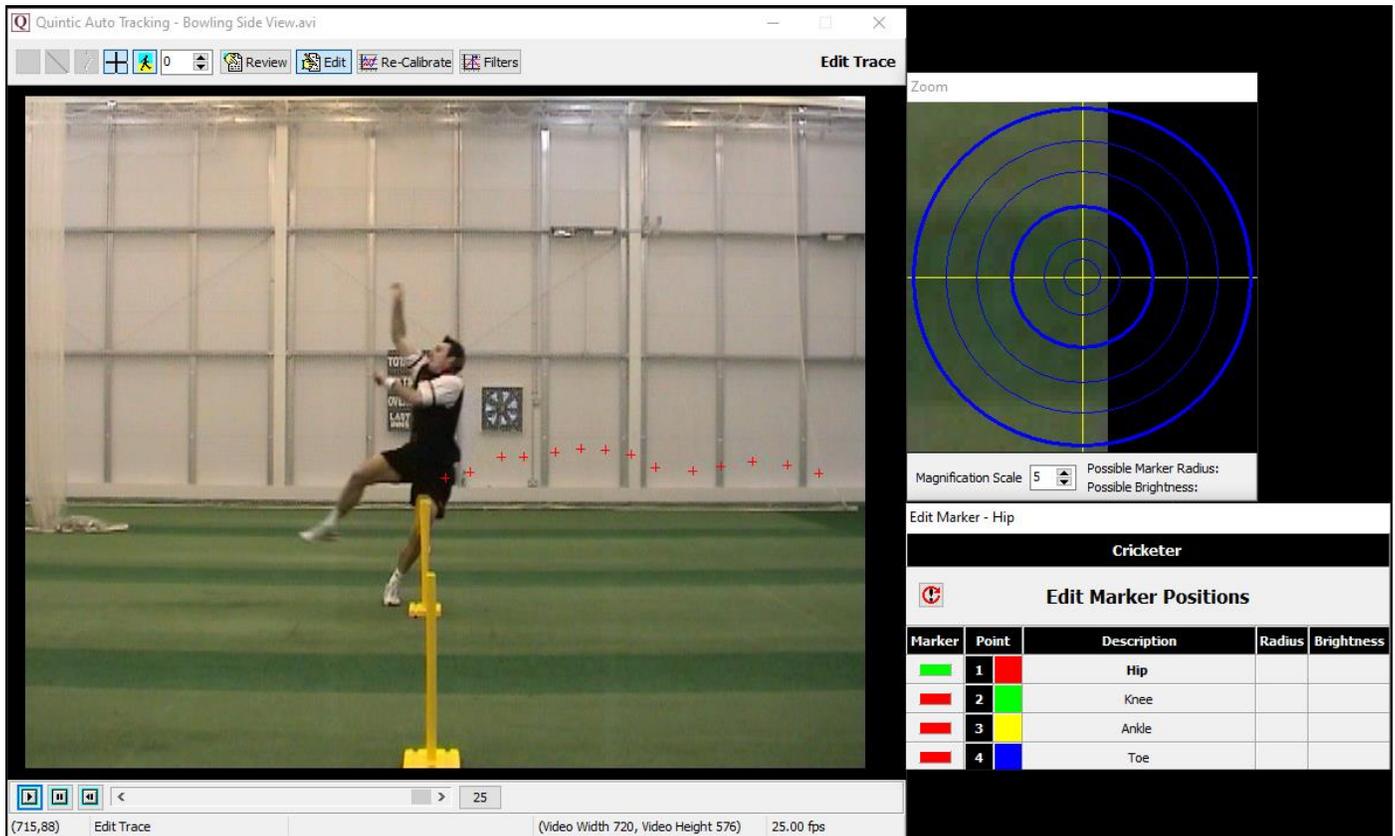

This will bring up all of the digitisation points for every frame that has been digitised, one point at a time. The point that is currently active will be displayed in green, so for the example above, the hip point is displayed. All the other points in the marker set will be highlighted in red within the Edit Marker Positions box.

N.B. You can only edit one trace at a time.

To edit, simply click on the marker point of interest and scroll to the frame(s) of which you want to edit and click on the screen to overwrite that digitisation point for that frame.

Once clicked, it will bring up a pop up to confirm that you are happy to accept the new point in the digitisation trace. Simply click YES if you are or NO to locate that point again.
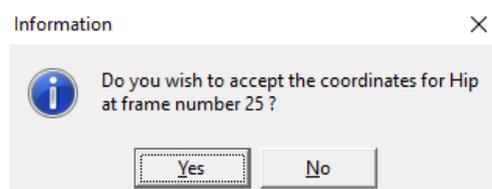
b. Re-Calibrating an Already Digitised Video

Should you ever be required to re-calibrate a digitised video, please select the 'Re-Calibrate' Button within the Edit Window. This will pop up a new window stating this video already has a calibration file and asking if you would you like to Re-Calibrate. If you would like to, simply click yes, if not, click no and this will continue to use the existing calibration file.
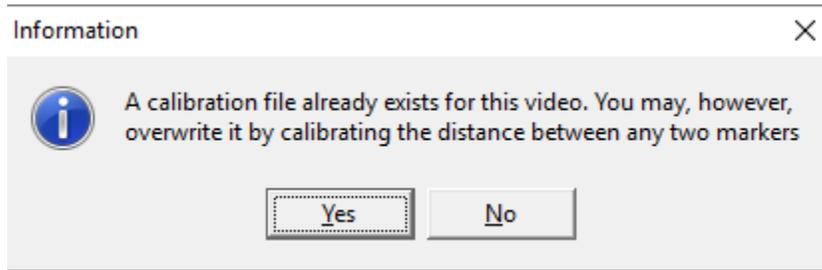
If you clicked yes, you will be brought to the following pop up window, where you will be required to scroll to the frame you wish to use for re-calibration, identify the two markers you wish to use for re-calibration, then enter the distance between them.
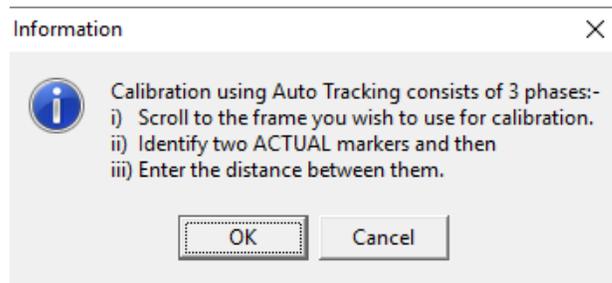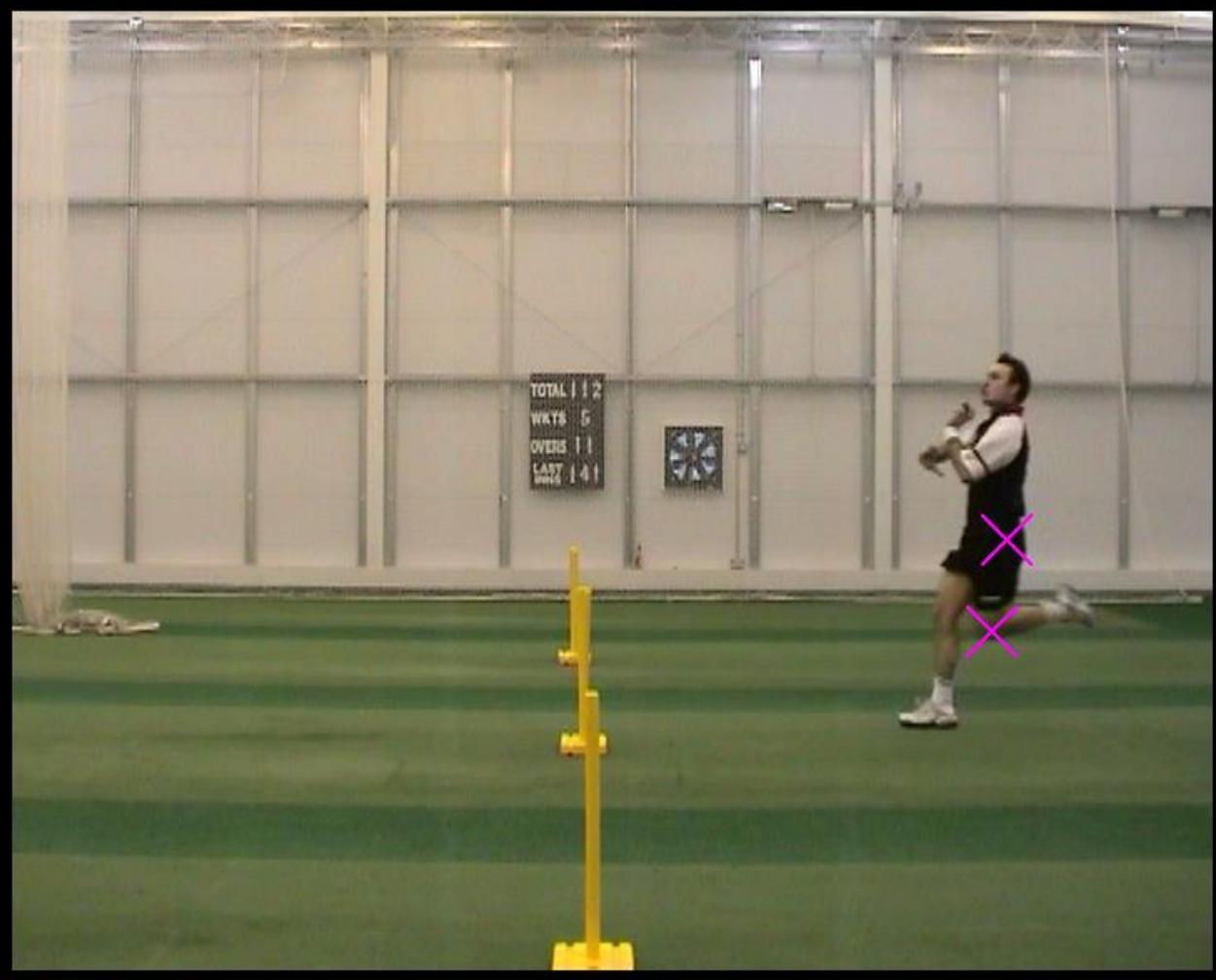

When re-calibrating, the software will only calibrate between two markers that have been digitised. Once you have selected the two markers and entered the distance between them, it will say calibration complete. Please see example below.

The software will 'lock on' to the nearest real marker point to where the user clicks.

c. Filtering a Digitised Trace

It is important to smooth data that has been produced by digitising to remove any errors that may have occurred during the digitisation process, e.g. marker /skin / clothing movement errors.

If you would like to filter the digitised data, please select the 'Filters' Button within the Edit Window.
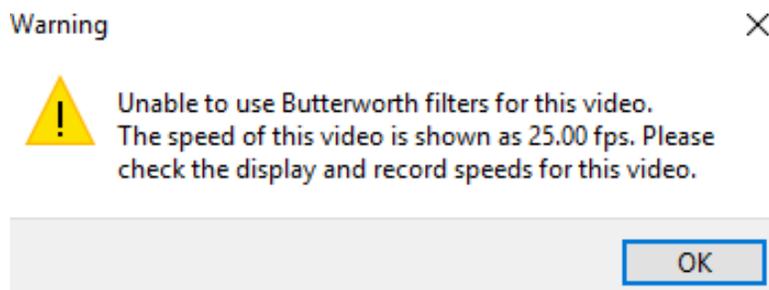
This will bring up the following window.
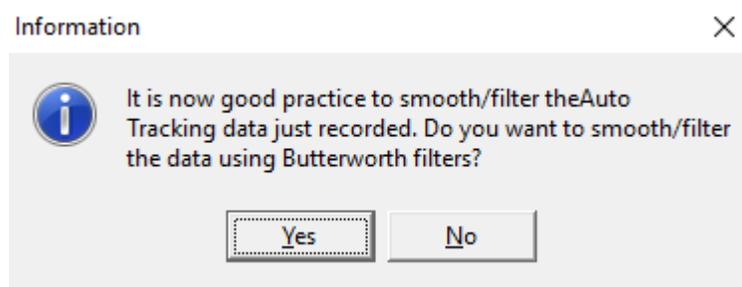
N.B The recording speed of the video has to be above 25 fps in order for that video to be filtered.

If you click No, no Butterworth filters will be applied.

If you click Yes but your video is less than or equal to 25 fps, the following message will appear.

If you clicked Yes and your video is greater than 25 fps, you will be brought to the screen below, to begin the data filtering procedure.

The **'Quintic Data Smoothing'** window will now load, illustrating the optimal Butterworth Filter values that have been placed on the data to smooth any data anomalies that may have occurred during the digitisation process.

Each point that has been digitised has its X and Y co-ordinates smoothed independently. These smoothing values are show in the Quintic Data Smoothing window above, e.g. 47.40.

To move between each filter value, please click on the Next or Back buttons.

Should you like to review the filter settings to confirm optimal filters have been used, you are able to consider these values in the additional window. Please see below for more information on this window.

Raw Data v Smoothed Data

Spectral Density Function
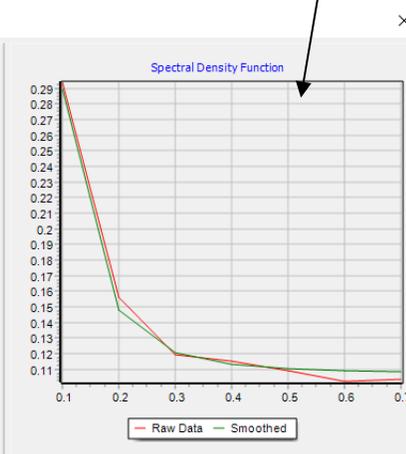
Residuals at Cut Off Frequency

Interactive Frequency Analysis

Raw Data v Smoothed Data - This graph illustrates values for both the raw and smoothed data.

Spectral Density Function - Describes how the energy (or variance) of a signal or a time series is distributed with frequency. I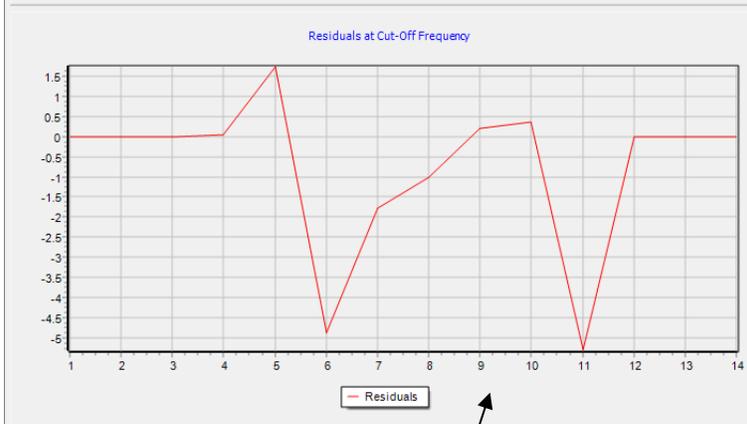n physics, the signal is usually a wave, such as an electromagnetic wave, random vibration, or an acoustic wave. The spectral density of the wave, when multiplied by an appropriate factor, will give the power carried by the wave, per unit frequency.

Residuals at Cut off Frequency - This illustrates the difference between the raw and smooth data. Good values should oscillate around 0. If predominantly positive or negative values are produced, an incorrect filter value has been used.

Interactive Frequency Analysis - This function allows the user to control the level of filtering that is placed upon the raw data, by using the scroll bar. To reset the filters back to their optimum value, click on the 'Best Filters' button.

Once you are happy with the filter values that have been applied, simply click the Save Filter Values [Save Filter Values] button and close the smoothing window(s).
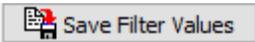
Question Sheet

Recap

1) When capturing video footage what are the Trim In and Trim Out functions?

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2) What is the maximum duration you should capture in one go?
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3) What is the name of the piece (hardware) that links the video camera to the computer?
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4) What is the difference between capturing at **'Half'** and **'Full'** size?
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Using the video **'Bowling – Side View'** from the **'Cricket'** folder

1) Calibrate the video by assuming that the bowler's right forearm (elbow to wrist) is 0.3 metres long (draw vertical line on frame 19) and the base of the middle set of stumps is 0.2m wide (draw horizontal line).

2) Calibration measures the distance between 2 points on the video and relates this to the real life distance. Distances on a video are measured in **'Digitising Points'** (dp), which is the number of coordinate points it covers in the horizontal and vertical directions.

   (i) Which letter represents coordinate measurements in the horizontal direction?

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   (ii) Which letter represents coordinate measurements in the vertical direction?

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3) A scale is created which tells you how many metres are represented by 1 digitising point.

   (i) Use the scale 1dp = 0.1 metres to calculate the real lengths of these objects

Object	Lengths on video (dp)	Real lengths (m)
Example: Rugby ball length	*3*	*0.3*
Cricket bat	9	
Rugby player's shoulder width	4	
Football goal width	70	
Netball post height	30.5	
Cyclist's lower leg length	3.5	
Hockey stick	10	

(ii) Can you use the scale **5dp = 0.1metres** to calculate the real lengths of these objects. *(Hint: it may help to change this scale to work out how many metres are represented by 1 digitising point.)*

Object (NO VIDEOS REQUIRED)	Lengths on video (dp)	Real lengths (m)
Example: Ballet shoe length	*13*	*0.26*
Long jump pit length	350	
Diving platform height	500	
Tennis ball diameter	5	
Basketball Net diameter	22.5	
Javelin length	105	
Trampolinist's hip width	20	

4) Can you calculate the scale when given the lengths on video and in real life in these examples? This time calculate the scale by working out how many digitisation points represent 1 metre – '1m = ?? dp'

Object (NO VIDEOS REQUIRED)	Lengths on video (dp)	Real lengths (m)	Scale
Example: long jump pit	*180*	*6*	*1m: 30dp*
Diving board length	50	5	
Volleyball net height	300	3	
Cricket stump	20	1	
Kayak paddle	50	2.5	
Rowing oar	70	3.5	
Squash racket	125	1.5	

5) Imagine you have digitised video clips of two different swimmers performing the same stroke. Explain why it is important to calibrate both clips in order to compare the speeds of the two swimmers.

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Open the video **'Sprint _Start_side_on'** from the **'Athletics'** folder.

6) You are going to digitise one complete cycle of the runner's left leg.
   (i) At which frames are you going to start and finish your digitisation? Justify your answer.

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   (ii) Create this template for your digitisation. (If you are using Quintic Sports use 1 point, if you are using Quintic Coaching use 2 points of your choice).
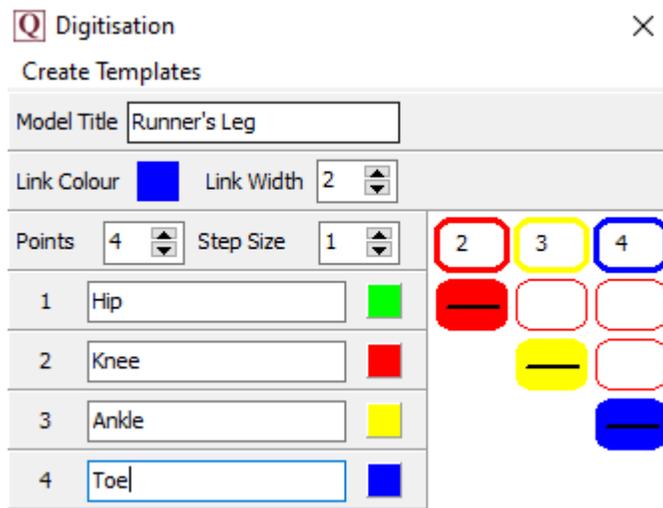
   (iii) Why can't you continue to digitise after frame 65?

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(iv) Which point do you think will show the greatest peak values of Horizontal Velocity – hip, knee, ankle or toe? Explain your answer.

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(v) Which point will show the lowest peak values of Horizontal Velocity throughout the stride – hip, knee, ankle or toe?
Explain your answer.

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