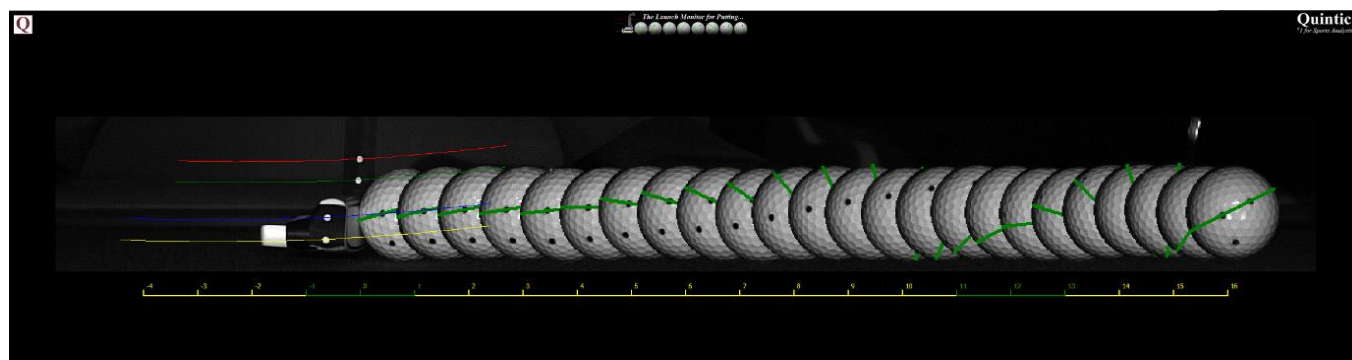


# Quintic Ball Roll

## *The Launch Monitor for Putting*

Version 2.4, 3.4, 4.4 & v4.4 Research Systems  
March 2022



### **Introduction**

The putter... the most used club in the bag so often the most 'overlooked' part of the average golfer's practice. Golfers around the world are using the technology available in today's market to help analyse and improve their golf swing. Technology has transformed golf tuition and club fitting, offering golfers three dimensional frame by frame swing analysis, high-speed video and precise spin rates and launch angles that apply to the golf ball after impact. However, when it comes to putting, rather than analysing what the putting stroke and the ball are doing in detail, more often than not we simply opt to try another putter with little more than hope as to whether it will truly improve our putting performance. Factors such as length, lie, loft, head style, colour, head weight, swing weight, overall weight, grip style, swing weight can all affect how the putter and golf ball interacts and therefore how the golf ball interacts with the putting surface.

Quintic Ball Roll gives you the chance to now objectively measure all of these factors and to make informed decisions on putter design, putter fitting and putter swing mechanics.

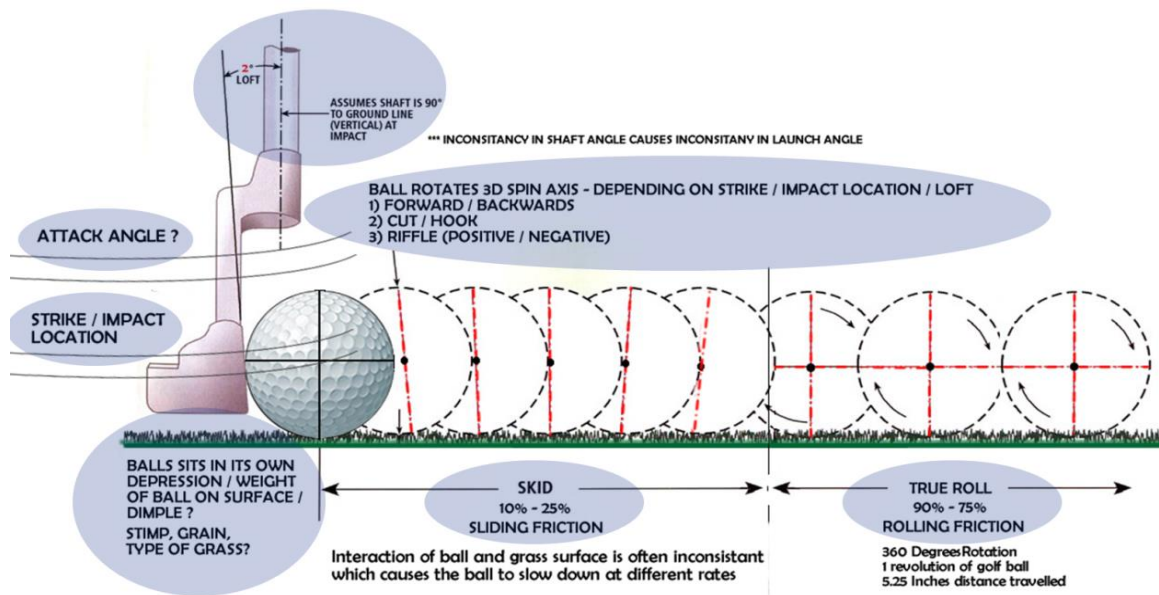
### **Quintic Ball Roll Technology**

**Quintic** Consultancy Ltd specializes in Premier Sports Biomechanics Video Analysis Software, Sports Biomechanics & Performance Analysis Consultancy. It is through our extensive biomechanics consultancy and constant liaison in the fields of elite golf performance analysis and coaching that our **Quintic** Ball Roll software has evolved.

Our latest **Quintic** Ball Roll software and hardware package has been designed to meet the various needs of our wide range of clients - from Club manufactures, Teaching professionals, Universities, Research and development and of course the golfer themselves. It is this unique contact that allows us to produce market leading putting analysis software that specialises in the performance of the putter and golf ball.



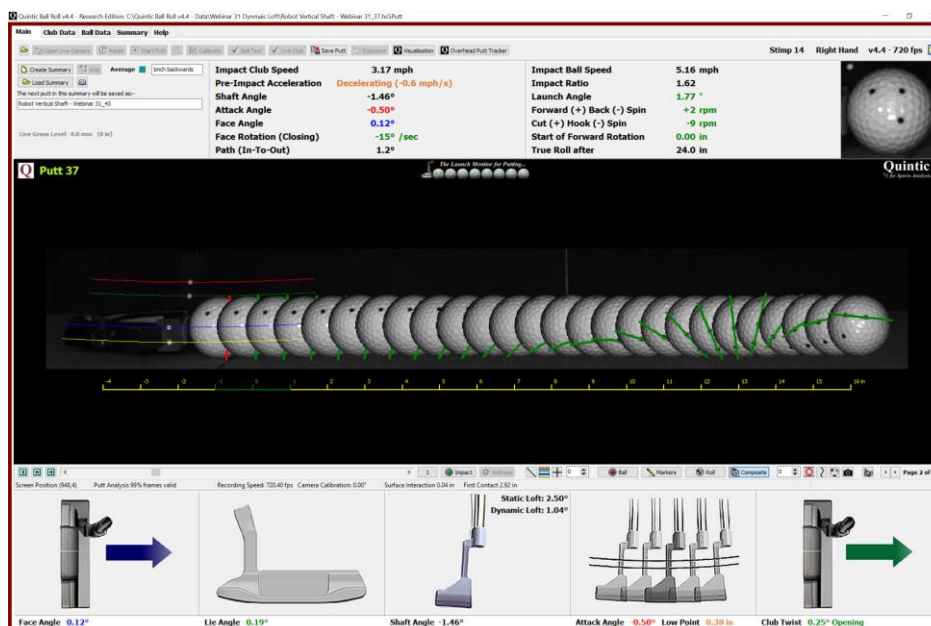
**A lot is happening at Impact!**



**What is Quintic Ball Roll Software?**

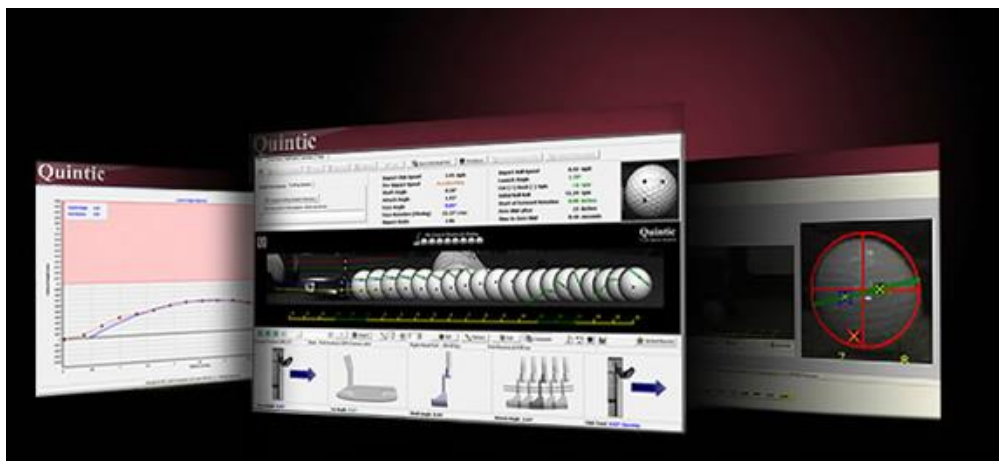
Quintic Ball Roll software utilises a high-speed camera (up to 1080 frames per second) tracking the golf ball for the first 16 inches (40cm) of the putt or 20 inches (50cm) if in “Ball Only” mode. The system will track the putter head both pre and post impact without any significant attachments to the golf club! It then automatically provides all of the information you need regarding the putter and ball, both graphically and numerically in a way that was formerly only available for full swing analysis software for irons and woods. Following a simple calibration procedure using a laser block the Quintic software can be used for either right or left handed golfers, indoors in a controlled putting studio or outdoors on the putting green with the same degree of accuracy.

*\*Information regarding the putter is not available in v2.4 Ball Only or when the system is turned on to “Ball Only” mode in all other versions.*



## Quintic Ball Roll System Options

There are four Quintic Ball Roll Systems available that have been designed to meet the needs of our worldwide clients. Each system includes all the hardware a client requires to begin performing putting analysis. Comprehensive user support and software updates are provided via the Quintic Ball Roll Accreditation Programme. Systems are initially purchased as indoor systems with the option to add the 'Outdoor Accessory Pack' which will allow your system to be used outdoors (both on the flat and on a slope). All that is required is a smooth putting surface with a minimum size of 3 metres by 4 metres.



**Quintic Ball Roll v2.4 System:** The Quintic Ball Roll v2.4 (Ball Only) System is our introductory system and designed for clients wanting to offer custom putter fitting services. Quintic Ball Roll v2.4 (Ball Only) Systems specialise in the performance of the golf ball throughout impact, capturing at 360 frames per second (fps), without any attachments to either the player or the club!

This system includes the latest Quintic Ball Roll v2.4 software and hardware required for custom putter fitting. The Quintic USB3 Camera measures the performance of the golf ball throughout the first 20 inches at 360 fps and the purpose built LED Bar Light ensures clear and focused images throughout the recording. As ball transfer stickers are used, clients can use the golf ball of preference to them or their client!

**Quintic Ball Roll v3.4 System:** The Quintic Ball Roll v3.4 System has been designed for both custom putter fitting and golf putting coaching, for players of all levels and ability. Quintic Ball Roll v3.4 Systems specialise in the performance of both the golf club and ball throughout impact, capturing at 360 fps, without any attachments to either the player or the club!

This system includes the latest Quintic Ball Roll v3.4 software, hardware and training aids needed for both custom putter fitting and golf putting coaching. The Quintic USB3 Camera measures the performance of both the club and golf ball throughout the first 20 inches and the purpose built LED Bar Light ensures clear and focused images throughout the recording. As ball transfer stickers are used, clients can use the golf ball of preference to them or their client!

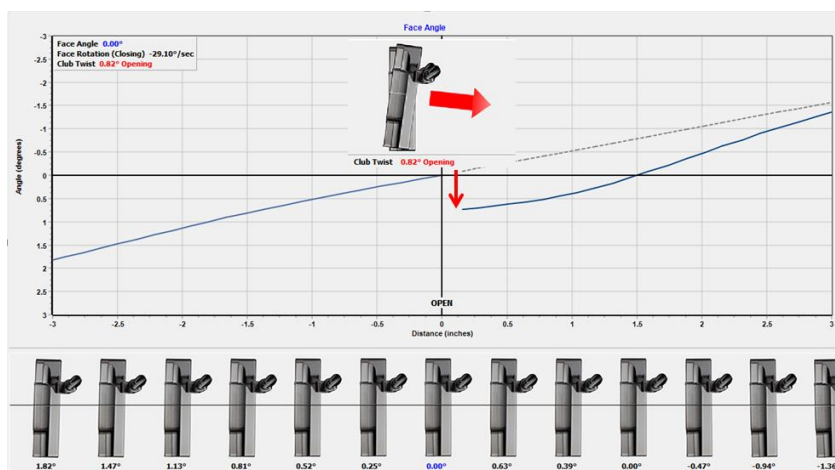


**Quintic Ball Roll v4.4 System:** The Quintic Ball Roll v4.4 System has been designed specifically to meet the needs of our advanced club fitter and specialist putting coach. Quintic Ball Roll v4.4 Systems specialise in the performance of both the golf club and ball throughout impact, capturing at 720 fps, without any attachments to either the player or the club!

This system includes the latest Quintic Ball Roll v4.4 software, hardware and training aids needed for both advanced custom putter fitting and golf putting coaching. As ball transfer stickers are used, clients can use the golf ball of preference to them or their client! The Quintic Ball Roll v4.4 System measures all the parameters of the Quintic Ball Roll v3.4 System with even greater accuracy, as it includes the Quintic USB3 1.3MP camera with the ability to capture at up to 720 fps! Unlike the v2.4 (Ball Only) and v3.4 systems this system also measures: clubhead path throughout the impact area, clubface angle relative to path throughout the impact area, club shaft deflection at impact.

**Quintic Ball Roll v4.4 Research System:** The Quintic Ball Roll v4.4 Research System is our most advanced system, designed specifically for our club manufacturers, research and development and elite club fitters. Quintic Ball Roll v4.4 Research Systems specialise in the performance of both the golf club and ball throughout impact, capturing upto 1440fps, without any attachments to either the player or the club! Quintic Ball Roll Systems are used extensively worldwide by the majority of putter manufacturers for R&D, validation, fitting and marketing of their latest putter and shaft designs. In addition to this, the systems are also used by other organisations, such as universities, interested in golf research. The capability to analyse the putting stroke and ball impact data in such detail, within realistic timeframes, opens up huge opportunities for golf research and club manufactures for their research and development programs.

This system includes the latest Quintic Ball Roll v4.4 Research software and hardware for superior research capability. It includes a Quintic USB3 camera and a purpose built LED Bar Light - which ensures clear and focused images of the golf ball, allowing accurate ball spin calculations even at 1080 fps. As with all other Quintic Ball Roll Systems, golf ball transfer stickers are used, allowing clients to use the golf ball of preference to them or their client!



*For full details on all Quintic Ball Roll Systems Available and which features are provided in each system please visit the [Quintic Ball Roll Website](#)*



## Indoors – QBR

- **Controlled Environment**
- **What Surface to use ?**
- **100% Data**
- **Only Straight Putts ?**
- **3% Slope Indoors**
- **Moveable Slopes**
- **Coaching**
- **Club Fitting**
- **Research & Development**
- **Robot Testing**



## Outdoors – QBR

- **Natural Environment**
- **Sunlight ? New LED / Filter**
- **Straight Putts ?**
- **Any type of slope ...**
- **Different types of grass**
- **Grain, Stimp ...**
- **Coaching**
- **Club Fitting**
- **Research & Development**





## Single Putt Key Parameters

Face Angle

-10 to -50° / sec

Face Rotation  
(approx 3mph Club Speed)

**Individual Putt**

- The Face angle at impact as close to 0.00° as possible with a face rotation of between -10 & -50° / sec (Please note this will be determined by the amount of spine angle, distance from the golf ball and distance of putt!)
- Minimal clubhead twist caused by impact location (less than 0.10°) – find the centre of the putter face!
- The ball started **forward rotation immediately after impact**
- The point of 'Zero Skid' occurs after 10 - 25% of the total distance travelled (depending on the surface)
- The 'Launch Angle' is positive and less than 2.50 degrees (surface dependent?)
- Positive Attack Angle between 0 - 2 degree (up-swing)
- Below 10 rpm of side spin (this is negligible and will have no effect on the balls travel)
- Minimal Lie angle change of less than 0.50°
- Path (between -2 to +2 degrees) A face to path reading of less than 1 degree throughout the impact zone.

**Quintic**  
For Sports Analysis

### Optimal Single Putt Key Parameters in Quintic Ball Roll

Quintic Ball Roll v4.4 - Research Edition C:\Quintic Ball Roll v4.4 - Data\Webinar 31 Dynamic Loft\Robot Vertical Shaft - Webinar 31.37 hc5Put

Right Hand	Club Data	Ball Data	Summary	Help							
Overview	Face	Path	Impact Speed	Ball Speed	Ball Launch	Shaft/Lie/Attack	Vertical Bounce	True Roll	Initial Spin	Putter fitting	Custom
Min/Max & SD Range	Launch Angle (°)	Flight Angle (°)	Difference (°)	Surface Interaction (in)	Maximum Height (in)	First Contact (in)					
29	0.95	4.14	3.19	0.67	0.06	2.81					
30	-0.90	4.14	5.04	0.67	0.06	2.81					
31	3.75	3.12	-0.63	0.11	0.04	1.98					
32	3.66	4.02	0.36	0.05	0.04	2.05					
33	2.92	2.22	-0.70	0.02	0.03	2.84					
36	3.45	2.92	-0.53	0.18	0.04	2.14					
37	1.77	2.15	0.38	0.04	0.03	2.92					
38	1.15	2.74	1.59	0.16	0.02	2.41					
39	3.18	3.33	0.15	0.00	0.04	2.40					
40	4.46	2.92	-1.54	0.20	0.05	2.08					
41	2.01	2.79	0.78	0.27	0.03	1.63					
42	1.25	3.12	1.88	0.37	0.02	1.36					
Minimum	2.20	0.99	-2.85	0.00	0.05	2.22					
Maximum	4.38	4.83	1.29	1.59	0.10	5.48					
Average	3.41	3.76	0.36	0.28	0.07	3.55					
± SD	0.61	1.29	1.21	0.55	0.02	0.90					
Range	2.18	3.83	4.13	1.59	0.05	3.26					
Minimum	3.15	4.53	0.39	0.00	0.07	3.60					
Maximum	5.32	5.71	1.38	0.17	0.12	5.08					
Average	4.37	5.04	0.67	0.04	0.10	4.32					
± SD	0.70	0.42	0.34	0.06	0.02	0.55					
Range	2.17	1.18	0.99	0.17	0.05	1.48					
Minimum	1.33	2.22	-0.63	0.02	0.03	1.98					
Maximum	3.75	4.02	1.52	0.38	0.06	4.05					
Average	2.58	2.91	0.33	0.10	0.04	3.15					
± SD	0.88	0.56	0.68	0.11	0.01	0.78					
Range	2.42	1.81	2.15	0.36	0.03	2.08					
Minimum	-0.90	4.14	3.19	0.56	0.06	2.81					
Maximum	0.95	5.12	5.41	0.67	0.11	5.15					
Average	-0.21	4.68	4.41	0.61	0.09	4.33					
± SD	0.60	0.50	1.13	0.06	0.03	1.32					
Range	1.86	0.98	2.22	0.12	0.05	2.34					
Minimum	1.15	2.15	-1.54	0.00	0.02	1.36					
Maximum	4.46	3.45	1.86	0.37	0.05	2.92					
Average	2.60	2.93	0.32	0.16	0.03	2.23					
± SD	1.22	0.40	1.11	0.13	0.01	0.56					
Range	3.31	1.30	3.40	0.37	0.04	1.57					

Ball Launch

Some lines in this summary may not be displayed due to no first bounce data (no average line can therefore be shown)

Ball position (n=10)  
  1inch forward (n=7)  
  high (n=8)  
 Putts: 29 30 31 32 33 36 37 38 39 40 41 42  
  Data  
  Averages  
  95% CI

*The Summary – Average or Range?*

Once 6 or more putts are saved into the summary, the range values change colour based on Quintic research and recommendations. Please see summary table for the specific range numbers for each category (Elite, Good, Average, Poor). Click on one of the 18 specific tabs to expand the relevant data in this section. For example, Face Angle, will show the (Average, Min, Max, Standard Deviation, Range) for the Face Angle at Address, Impact, Difference, Twist, Pre and Post Face rotation.

		Range Colours			
Measurement		Blue	Green	Amber	Red
		Elite/Eagle	Good/Birdie	Average/Par	Poor/Bogey
FACE	Face Angle	0.50°	1.00°	2.00°	> 2.00°
	Face Rotation (°/sec)	5	15	30	> 30
TWIST	Twist	0.10°	0.30°	0.75°	> 0.75°
PATH	Path	1.0°	2.0°	4.0°	> 4.0°
SPEED	Impact Ball Speed (mph)	0.35	0.50	1.00	> 1.00
	Impact Club Speed (mph)	0.20	0.35	0.55	> 0.55
	Impact Ratio	0.02	0.04	0.08	> 0.08
	Pre-Impact Acceleration (mph/s)	1.0	2.0	3.0	> 3.0
	Post-Impact Acceleration (mph/s)	1.0	2.0	3.0	> 3.0
LAUNCH	Launch Angle	1.00°	1.75°	2.50°	> 2.50°
	Shaft Angle	0.50°	1.00°	2.00°	> 2.00°
	Attack Angle	0.50°	1.25°	2.50°	> 2.50°
	Lie Angle	0.50°	1.00°	2.00°	> 2.00°
	Low Point (in)	0.50	1.00	2.00	> 2.00
SPIN	Zero Skid (in)	2.0	7.0	15.0	> 15.0
	Zero Skid (secs)	0.02	0.04	0.08	> 0.08
	Forward/Back Spin (rpm)	15	40	75	> 75
	Start of Forward Rotation (in)	0.00	1.00	2.00	> 2.00
	Side Spin (rpm)	10	20	40	> 40

**Blue** : The equivalent of a robot, it is not possible to do any better as a human being, please don't try and improve this parameter, just ensure the player understands what it is he or she does to create such consistency for this parameter.

**Green** : These are still very consistent numbers created by the player. Again ensure the player understands what it is he or she does to create such consistency for this parameter.

**Amber** : Average range numbers, you are not going to set the world on fire, however they are still more than acceptable ranges.

**Red** : Irrespective of the level of golf played by the golfer, ranges in the red are going to hurt them, they display significant levels of inconsistency. Technique and club fitting need to be considered if putting performance is to be improved.



## Quintic Ball Roll Button Functions

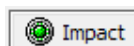
➤ Underneath the main video image, on the left you have your **Play**, **Pause**, **Reset** and **Scroll Bar**. These buttons enable the individual frame (composite turned off) to be viewed. It is also possible to scroll frame by frame by clicking on the arrows on the scroll bar, or 10 frames per click (inside the scroll bar).



➤ **Frame Number**: Please note 'Impact' is always between frames 1-2.



➤ **Impact** returns the video playback back to frame 1.



➤ **Address** shows the putter position at when the 'Start Putt'.



➤ **Putter Shape**, **Putter Trajectory** and **Putter Crosses** can be overlaid on to the video playback.



➤ **Snail Trail** can be set from 1-50 frames, this will effect the the putter shape, putter trajectory and putter crosses if they are turned on.



➤ **Ball** places the red outline of the ball on the ball's current position in the video playback.



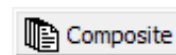
➤ **Markers** places the three coloured crosses on the ball's current position in the video playback.



➤ **Roll** shows the roll angle of the ball in it's current position in the video playback.



➤ **Composite** provides a number of still images (every 3<sup>rd</sup> frame for example) of the ball throughout the putt.



➤ **Vertical Bounce** places parallel white lines indicating the top and bottom of the ball in its initial position, the red outline indicates the ball position at each frame and the green line indicates the oscillation of the centre of the ball throughout the putt.



➤ **Loop** puts the slow playback of the putt into a continuous loop.



➤ The **Camera** icon takes a screenshot of the current frame, you are then able to copy, print or save the image as a JPEG file.



➤ The **Video Camera** icon enables you to save a frame by frame video file (in .avi format) of the current putt. These videos can then be played back frame by frame in the 'Quintic Player' Software. (Free download via [www.quintic.com](http://www.quintic.com))



➤ The **Arrows** in the bottom right can be used to move to the next information panel at the bottom of the main screen.



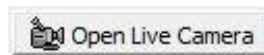
➤ **Open** a single previously recorded putt for analysis and playback.







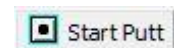
➤ **Open Live Camera** will be available if a successfully set up camera can be detected by the software.



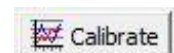
➤ **Reset** takes the image back to a live video including removing the video from Start Putt mode.



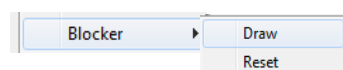
➤ **Start Putt** can be used when the ball and putter have been calibrated and the ball has been positioned within the correct region, after this has been pressed next putt will be recorded.



➤ **Calibrate** is used to calibrate both the balls and the putter, for full instructions on how to perform this please visit the Calibration and Set-up Tutorial.



➤ **Blockers** can be found with the drop down calibrate menu. Blockers are used to mask out a potential region that may cause Quintic to miss a club marker. This is done by drawing a square over a region on the screen.

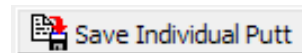


➤ **Ball Test** is used to test both the position and lighting of the two balls while setting up the system.

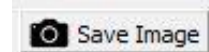


➤ **Live Club** is used to calculate LIVE Club parameters, AUDIO Biofeedback

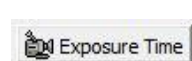
➤ **Save Individual Putt** provides you the option to save a putt from within a session to a single putt file.



➤ **Save Image** takes a screenshot of the entire front page which can then be copied or save as a JPEG image file.



➤ **Exposure Time** is used to adjust the brightness of the image, for full information on how to adjust this correctly please visit the Calibration and Set-up Tutorial.



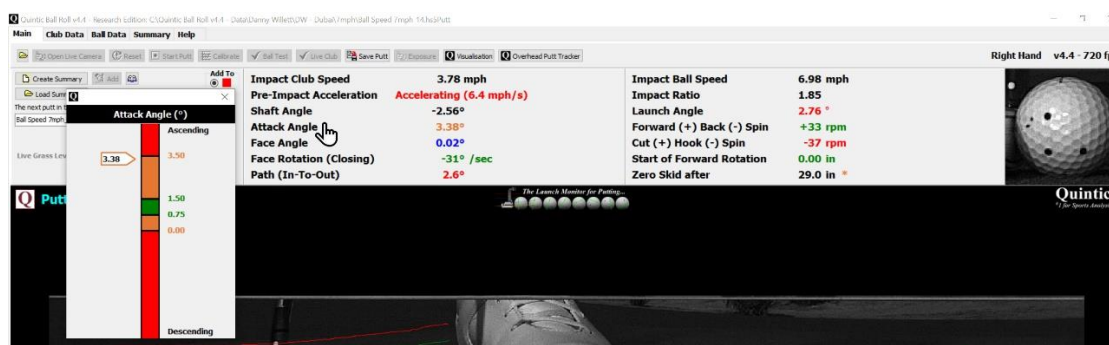
➤ **Save to PDF** is found in the bottom right of the page when in summary tab and allows you to quickly convert a screenshot of every page in the summary into a PDF file.



➤ **Save to Excel** is found in the bottom right of the page when in the summary and allows you to quickly create an Excel file with all the numerical data that is within the summary.



➤ Hover the mouse over any of the buttons, labels, if it changes to a hand, left click to open the information tab / range-o-meter. See the example below of the Attack Angle 'range-o-meter'





**Shortcut Key** – Click on the Question Mark Icon (Top right-hand corner of the Main software page)


**Impact Club Speed** 2.87 mph  
**Pre-Impact Acceleration** Accelerating (2.0 mph/s)  
**Shaft Angle** 0.29°  
**Attack Angle** 1.44°  
**Face Angle** -0.12°  
**Face Rotation (Closing)** -37° /sec  
**Path (In-To-Out)** 1.7°


**Impact Ball Speed** 4.87 mph  
**Impact Ratio** 1.70  
**Launch Angle** 5.42°  
**Forward (+) Back (-) Spin** -4 rpm  
**Cut (+) Hook (-) Spin** +2 rpm  
**Start of Forward Rotation** 1.06 in  
**True Roll after** 24.0 in

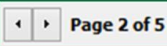
**Club Analysis:**  
 Face Angle: -0.12° 0.04° (-0.16°)  
 Lie Angle: -0.54° -0.18° (-0.36°)  
 Shaft Angle: 0.29° -0.32° (+0.60°)  
 Attack Angle: 1.44° Low Point: -1.82 in  
 Club Twist: 0.10° Opening


## Shortcuts


**Ctrl + R = Reset    Ctrl + P = Start Putt**

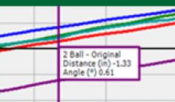
 **Cursor changes from the standard arrow to a hand. This indicates you can single left click to open an additional information box.**

 **Double left click on the Ball Roll logo on the Main Tab, any graph where there is a double arrow or any coloured column or the word 'Average' within the summary tab to expand/shrink the corresponding video / graph / table.**

 **Left click on the arrows to slide the page options along the bottom of the software window.**

 **Right Click : Delete Putt from Summary**

 **Double Left click on coloured square to cycle through the SIX Average options. (Red, Blue, Green, Purple, Turquoise, Orange). It is possible to enter text - this provides a name for the average selected.**

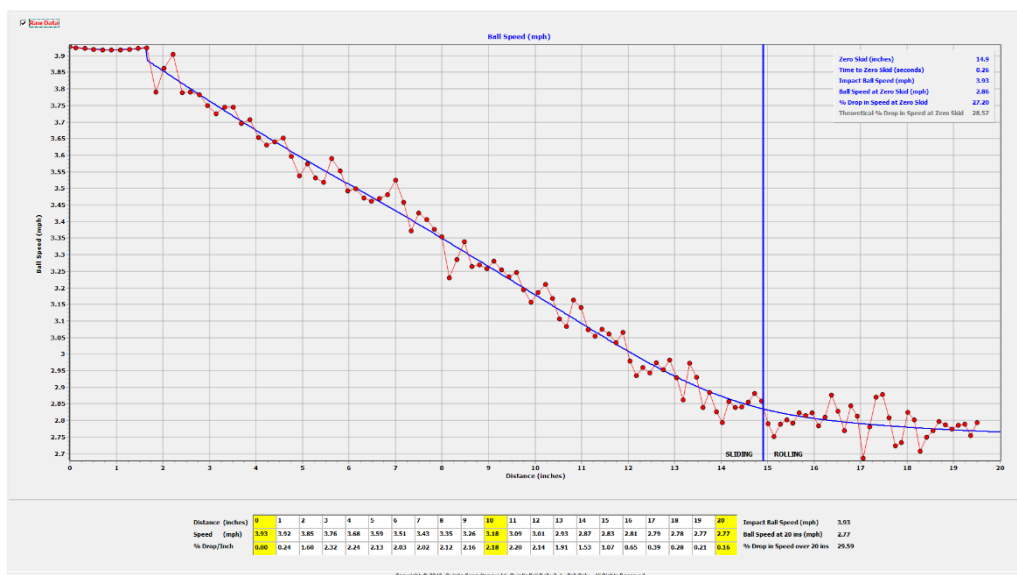
 **Hover the cursor over any line on a graph to highlight the values in more detail.**



## Main Page Parameters

*(The following parameters are shown in all versions of Quintic Ball Roll)*

**Impact Ball Speed:** The average speed of the ball during the first 6 frames. Consistency is the key with ball speed, have a person take ten putts of the same distance. If, for example, the results show a range of more than 1 mph on a fifteen foot putt, then there is likely to be an issue with pace control for that golfer. Factors to consider would be not always hitting the ball on the same spot (hopefully sweet spot) on the putter face, inconsistent ball position or too much acceleration or deceleration in the stroke. One possible suggestion would be to try using a putter with a bigger sweet spot. Every putt is a straight putt, so unless the golfer has good pace control (consistent energy transfer from club to ball) then it will be very difficult to read a green correctly. It is also possible using the Ball Speed tab and graph (both single putt and summary (see image below), to view the ball speed over the first 16 inches (or first 20 inch) if using Ball Only mode). It is interesting to note how the ball does not lose speed while it is in the air but does as a result of its contact with the ground. The smoother the ball rolls out, the more consistent and predictable to control distance.





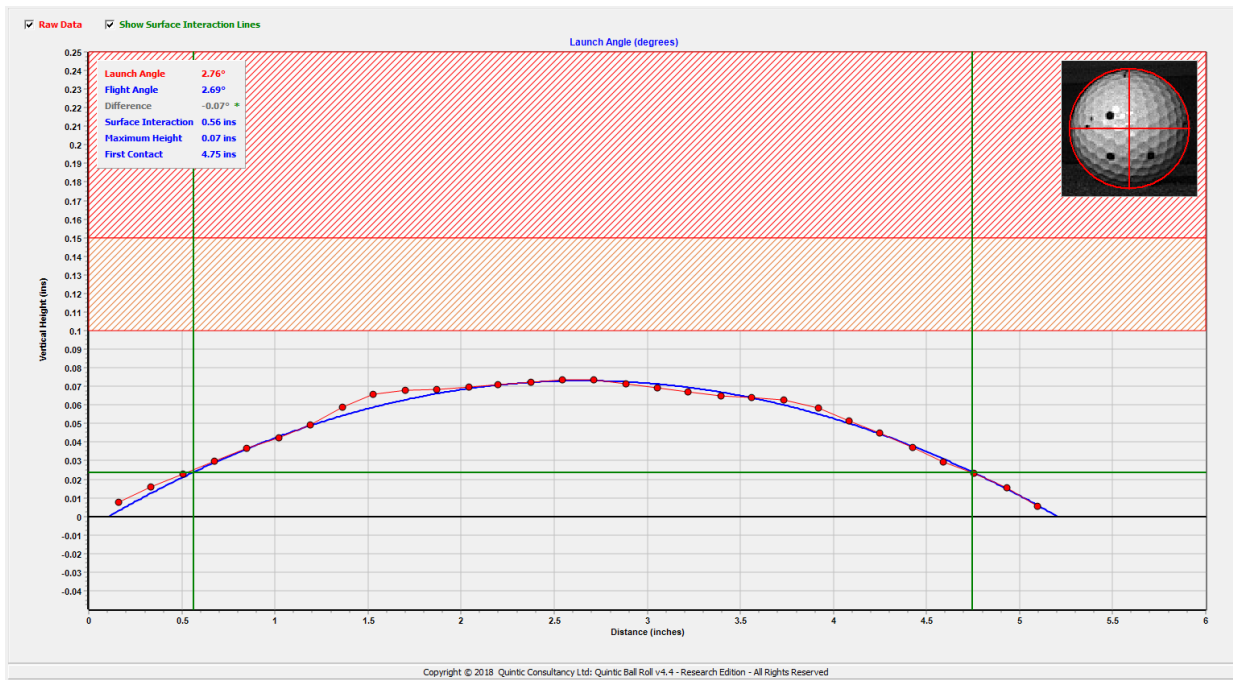
The individual Ball Speed Graph plots the ball speed over the first 20 inches of the putt in v2.4 (Ball Only) or when in Ball Only Mode, otherwise it displays the first 16 inches of the putt. In the example, the initial ball speed is 3.93 mph and the ball speed at 20 inches is 2.77 mph, resulting in a 29.59% drop in speed after impact. The type of surface you are putting on has a significant impact on the drop off percentage (for example, putting into grain) however; it is the slope of the graph that becomes very significant.

The initial drop in ball speed immediately after impact is very small, this is due to the ball not being in contact with the ground, and therefore air resistance is the only factor reducing the ball speed. The drop in ball speed then begins to happen at a much greater rate as the ball makes contact with the surface, with friction slowing the ball down. If the ball is being hit into the grain the speed drop off will be much larger than that down the grain, this makes judgement of pace very difficult if the ball is jumping and slowing indifferently.

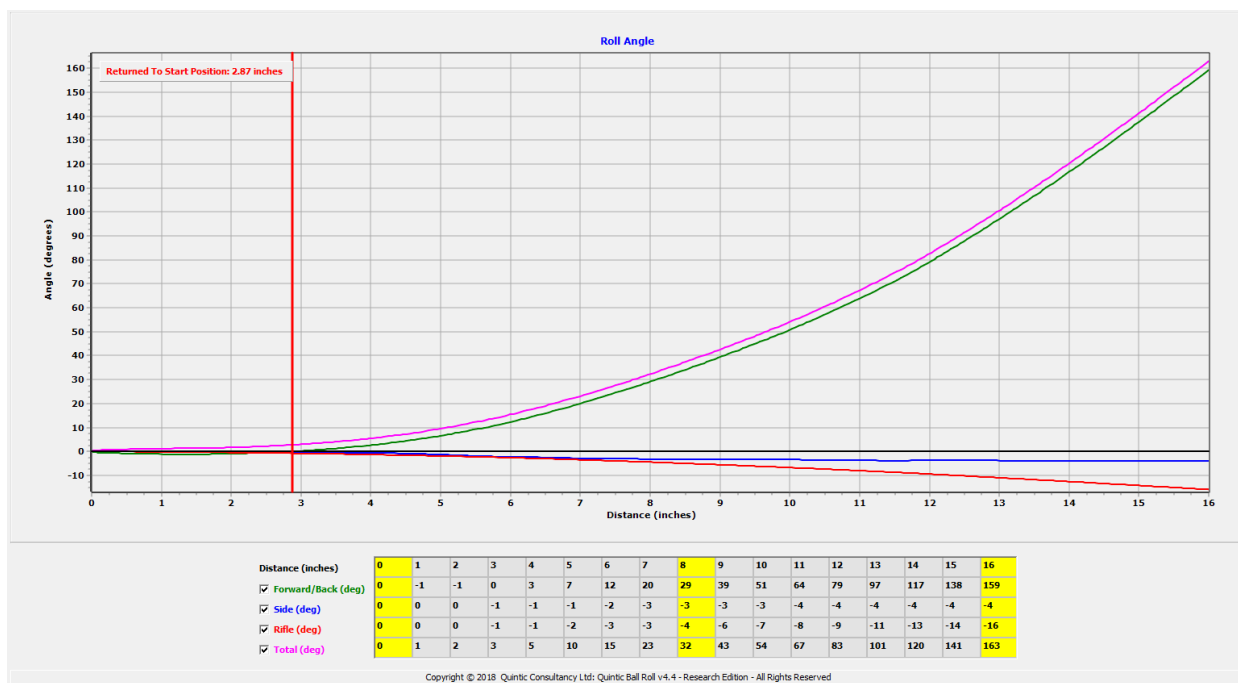
In an ideal situation, you should look for a constant slope as ball speed decreases. Pace determines line, a uniform deceleration of the golf ball ensures the ball is hugging the ground, thus enabling the golfer to have a better feel for the pace and line. Two good comparison values between putts are the percentage drop in speed over the first 16/20 inches and the % drop in speed at zero skid.

**Ball Launch Angle:** Provides you with the launch angle of the ball leaving the putter face (ball and putter). In addition Quintic calculates the 'Flight Angle' of the golf ball. This is helpful to see if the ball is going too high in the air or being driven downwards into the ground and bouncing back up! Any differences of greater than 1 degree indicate significant surface interaction during launch. This will create unwanted spin and unpredictability in ball speed and distance to true roll. The ideal launch angle is based upon the green speed and type of grass; however, ideally you are looking for a launch angle of between 0.75 degrees and 2.0 degrees (**Green**). Between 2.0 and 2.5 degrees the number will turn **Orange**, but over 2.5 and the number will turn **Red!**

The goal of launch angle in putting is to get the ball up out of the "nest" of grass it is sitting in just high enough to ride up on top of it. If you launch the ball too high, it is more likely to bounce when it lands and not roll smoothly. If the ball is not launched high enough the grass may pop the ball up (creating high initial over spin values) causing an unexpected loss in speed and again not allowing a smooth roll. For further analysis of the Launch Angle, click on the 'Launch Angle' Tab (see below).



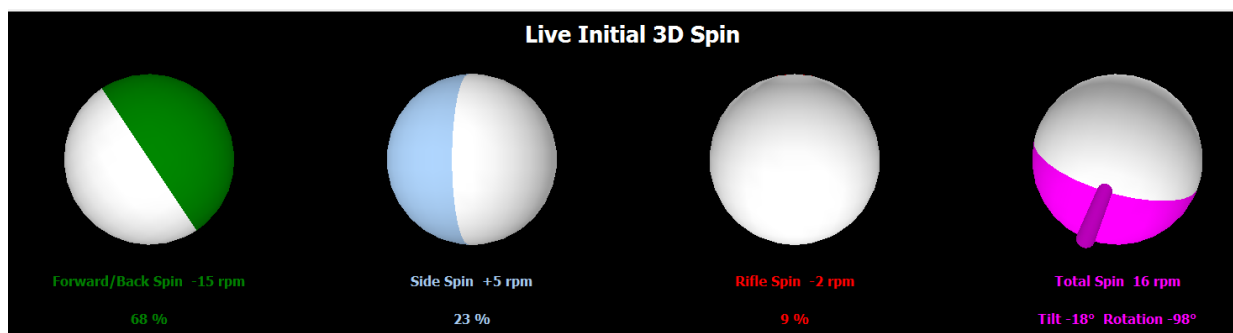
**Start of Forward Rotation:** This will tell you whether the golf ball has positive RPM **Forward Spin (+)** rotation or negative rotation **Back Spin (-)** at the point of impact. In certain instances, during impact, the golf ball is imparted with backspin and hence has a negative rotation. In this instance, the ‘Start of Forward Rotation’ is the point the ball stops spinning backwards and starts to rotate forwards due to the friction with the surface. The example below takes 2.87 inches to return to its original start position.



The start, halfway and final recorded inch are highlighted in yellow so you can use as quick comparison against other putts, technical changes or other putter styles.

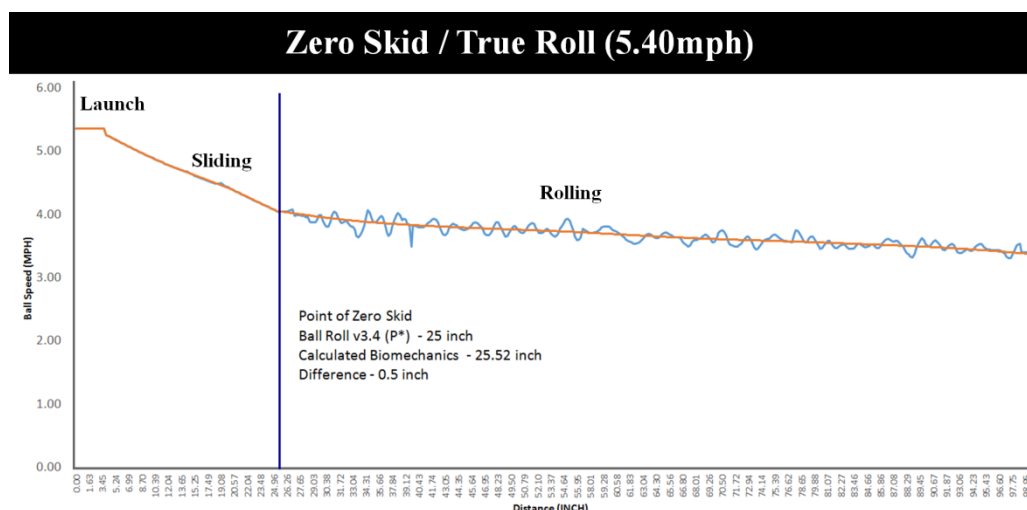


**Cut (+) / Hook (-) Spin:** Will tell you whether they are putting cut or hook spin on their putts. Spin rate between 10–20 rpm (either cut or hook) the number will turn **Orange**, anything over 20 rpm it will turn **Red**, however under 10 rpm it will be **Green**. Anything under 20 rpm either cut or hook is an acceptable degree of spin and will not have a significant effect on the path of the ball. Once the RPM starts to go above 20 rpm you may need to change the strike location, face to path number at impact and ultimately the fitting of the putter. For example changing lie angle, using a face balanced instead of a toe heavy design may correct the side spin rate without actually changing the technique of the golfers putting stroke. A spin rate over 40 rpm, you may need to also fix/address their putting stroke. Greater than 20 rpm of Cut or Hook spin is enough side spin that converts to rifle spin as the ball interacts with the surface potentially causing the golf ball to change its intended path.



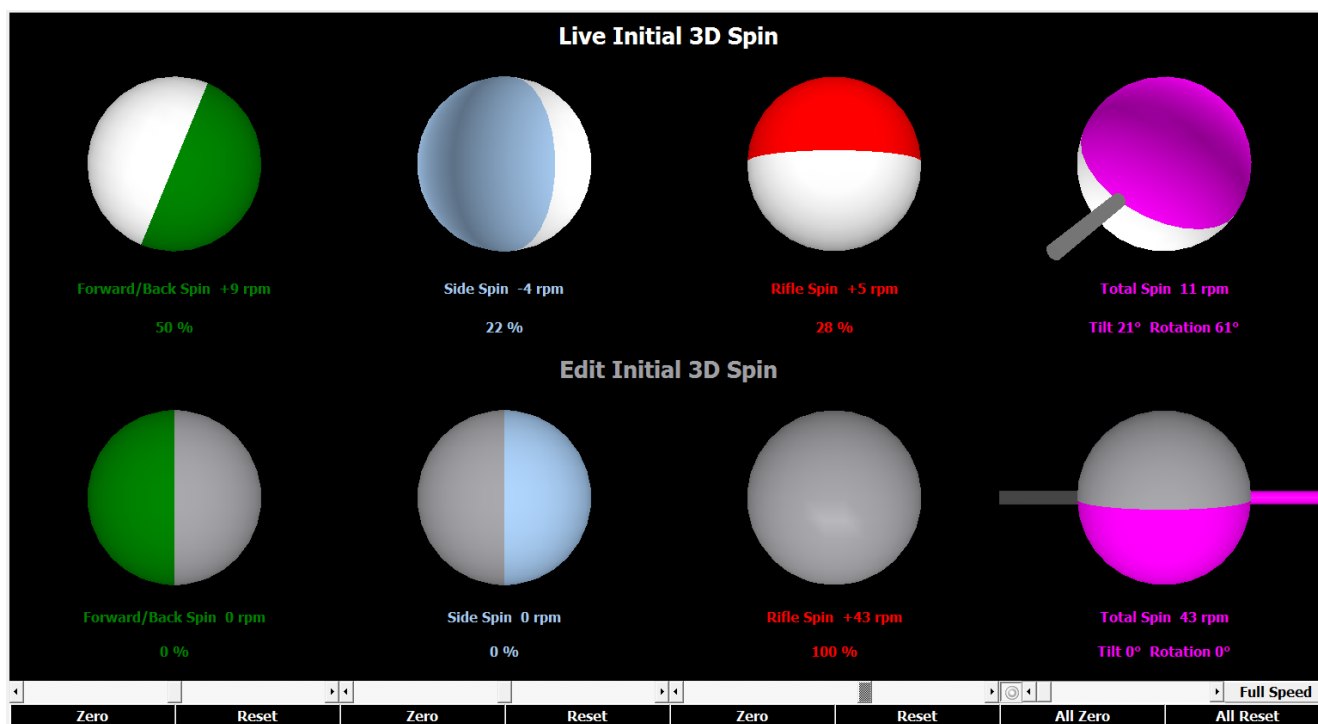
**Zero Skid / True Roll :** This is the point where all skid has been eliminated from the golf ball’s roll (the ball will rotate 360 degrees in the circumference of the golf ball approx. 5.25 inches). A ball after contact has three distinct stages, Launch, Sliding and Rolling. When a ball reaches true roll it is more consistent at holding its intended path. The point at which a ball reaches true roll is also very important; changes in this value (even with a consistent initial ball speed) will cause the ball to break at different stages on its path across the green. The speed the ball is travelling determines how much break it is going to take! (Sliding Friction and Rolling Friction are two different equations).

Side spin is detrimental when trying to minimise the distance to True Roll (no skid!). True roll has been a significant focus of putter design and stroke mechanics; however consistency of this value is also very important for pace control and green reading skills. True roll should be approximately 10% to 20% of the distance of the putt, depending on green speed and friction. For example a 20ft putt should be able to achieve ‘True Roll’ by 2ft (24 inches) on a fast, smooth surface.

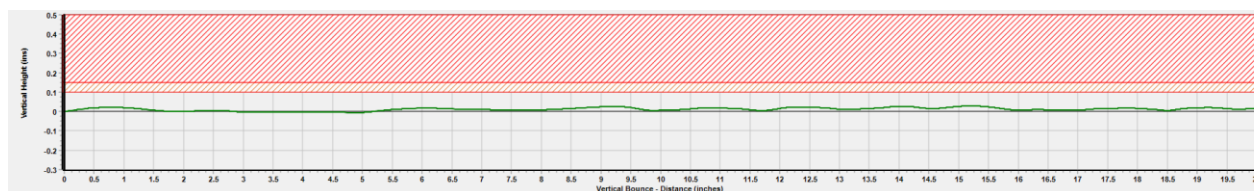




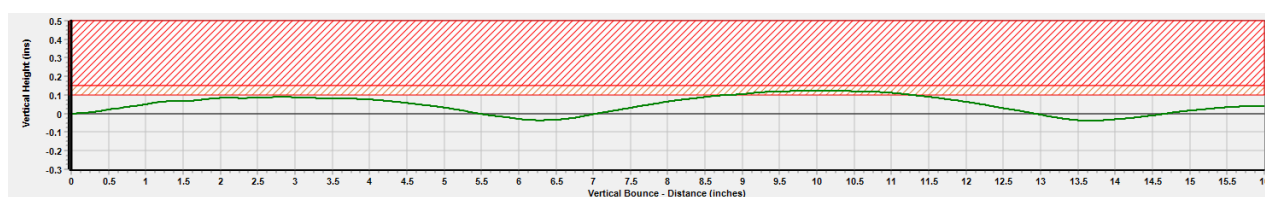
**3D Ball Spin:** A golf ball can only have one spin axis (as indicated by the grey axis in the purple ball = Total Spin). The spin axis is made up of the resultant of the forward/backward, side spin and rifle spin values. The initial 3D spin is made up of the average of the first six frames (360fps), first twelve frames (720fps), the first eighteen frames (1080 fps) and first twenty four frames (1440fps). It is possible to view the balls 3D spin axis per individual frame by using the scroll bar to advance the video image (displayed underneath the main image once the bottom panel has been scrolled across using the arrow buttons). It is also possible with the 'Edit Initial 3D Spin' to help highlight the 3 different spin axes.



**Vertical Bounce Graph:** Displayed underneath the main image once the bottom panel has been scrolled across using the arrow buttons. This graph is helpful to see if the person is launching the ball into the air, or driving it into the ground. This information will help identify what loft they need on their putter to get a smooth roll. Try not to go into the **RED!** This graph will display the ball's vertical height over the first 20 inches of the putt in v2.4 or when in Ball Only Mode (top image), in any other version this graph will be 16 inches long (bottom image)



Smooth Ball Roll – ball in contact with the surface

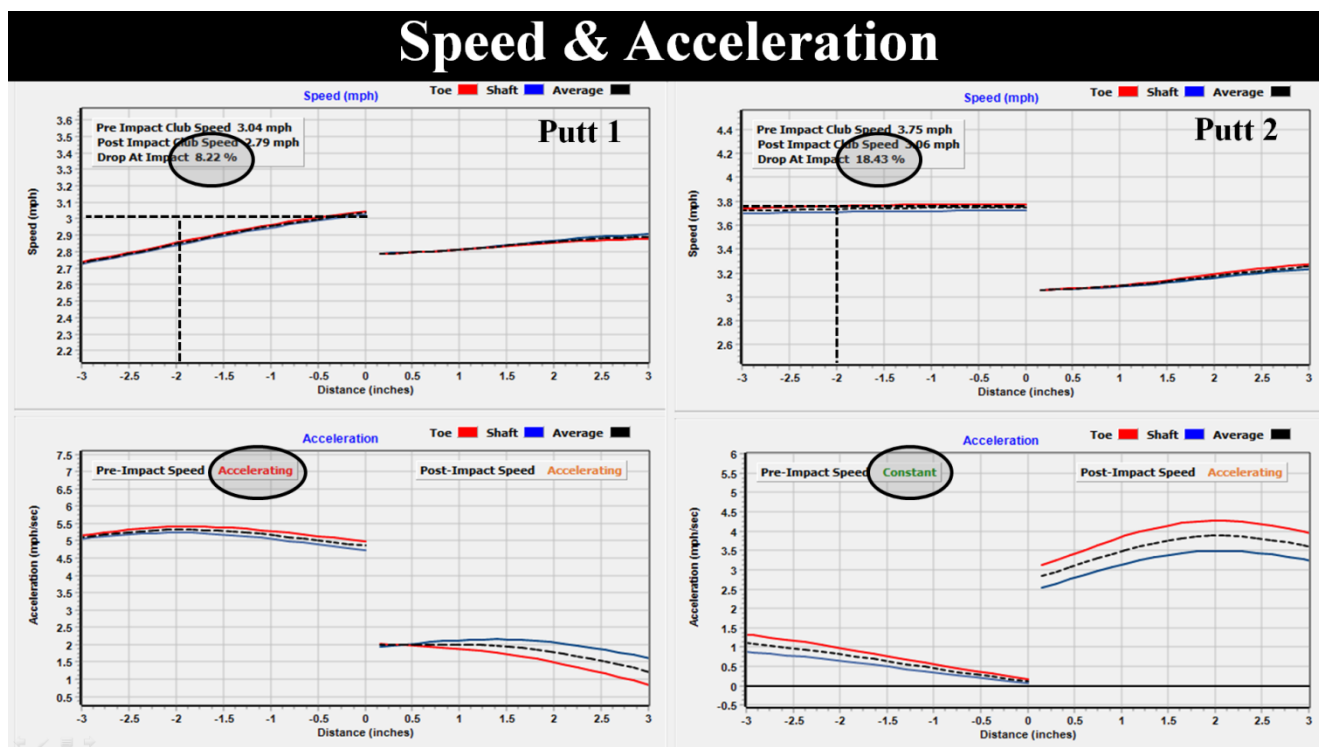


High Launch Angle, first bounce at 6 inches! ball only in contact with the surface twice in 16 inches?



*The following parameters are shown in version 3.4, 4.4 and 4.4 Research.*

**Impact Club Speed:** The velocity of the club head at impact. This is a very simple tool for determining if the golfer is swinging the golf club consistently. A range of more than 0.5 mph on a fifteen foot putt then there is likely to be an issue with pace control for that golfer. Factors to consider would be tempo, length of backswing and through swing, along with the amount of acceleration of the club head prior to impact.



**Pre-Impact Speed: Constant, Accelerating/ De-Accelerating, Accelerating/ De-Accelerating:**

The acceleration of the putter is classified by the Quintic Ball Roll Software as constant, acceleration and deceleration. Quintic also categorizes them in green, amber and red. In a pendulum stroke the speed around impact should be constant (Green) – there should not be any acceleration or deceleration of the putter head. When the putter accelerates, the ball position again becomes a significant factor for pace control.

Causes of too much Acceleration

- Too short a backswing, leading to a rapid acceleration during the downswing
- Poor Tempo / Rhythm
- Manipulation of the club with both lead and trail wrists – poor shoulder movement
- Incorrect ball position – the ball should be position at the bottom of the arc

Quintic have found that good long distance putters will maintain a constant (Green) or at very least a gradual acceleration (Amber) through impact. It is unlikely to see good distance control with (Red) acceleration numbers.





**Shaft Angle:** Shaft angle has the largest correlation to changing the Launch Angle. The Shaft angle is displayed numerically on the front screen, in diagram form on the bottom panel and graphically with the Club data. The difference between address and impact is also displayed in the bottom panel along with the Summary, Club Launch Tab. Quintic would strongly recommend that the static loft of the putter is known (measured via a loft and lie machine) before interpreting the shaft angle values and their effect of ball launch angle.

Main | Club Data | Ball Data | Summary | Help

---

Open Live Camera | Reset | Start Putt | Calibrate | Test | Save Individual Putt | Print/Save | Camera Exposure Time | Camera Frame Speed

---

Single Putt Analysis | Putting Session

Create Putting Session Directory

The next putt in this session will be saved as:-

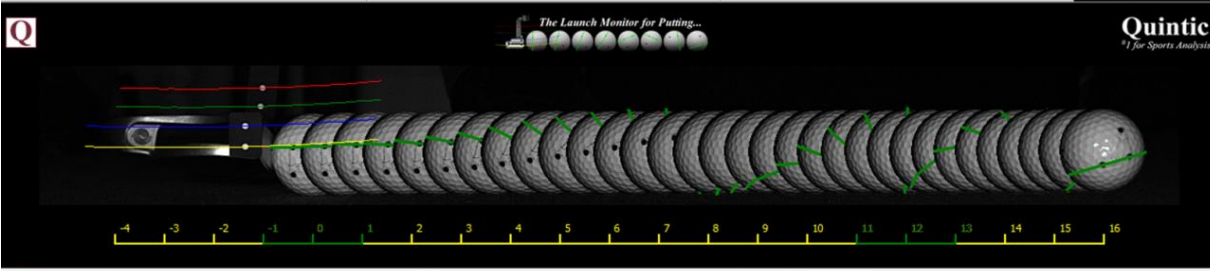
---

Impact Club Speed	2.46 mph	Impact Ball Speed	4.26 mph
Pre-Impact Speed	Accelerating	Launch Angle	1.32°
Shaft Angle	-1.29°	Cut (+) Hook (-) Spin	-8 rpm
Attack Angle	1.46°	Forward (+) Back (-) Spin	+29 rpm
Face Angle	-1.69°	Start of Forward Rotation	0.00 inches
Face Rotation (Closing)	-18.86°/sec	Zero Skid after	14 inches
Impact Ratio	1.73	Time to Zero Skid	0.23 seconds




---

The Launch Monitor for Putting...

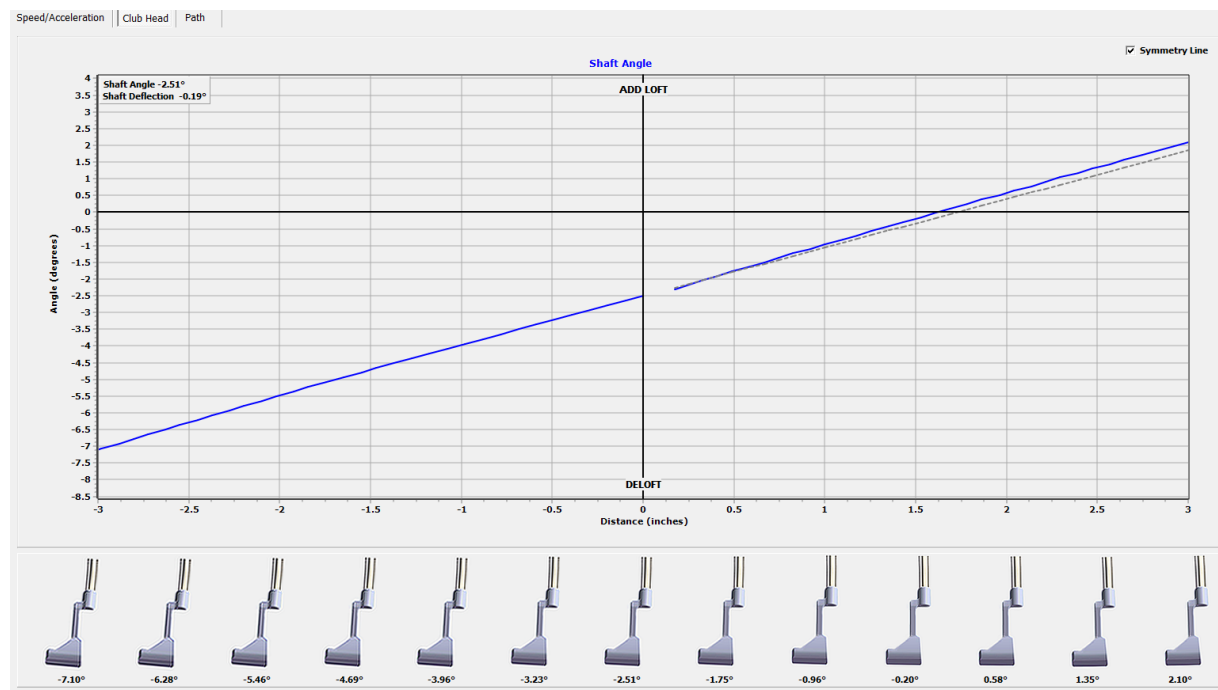



---

Screen Position (485,6) | State - Putt Analysis 100% frames valid | Right Hand Putt - 360.31 fps | First Bounce at 3.20 ins

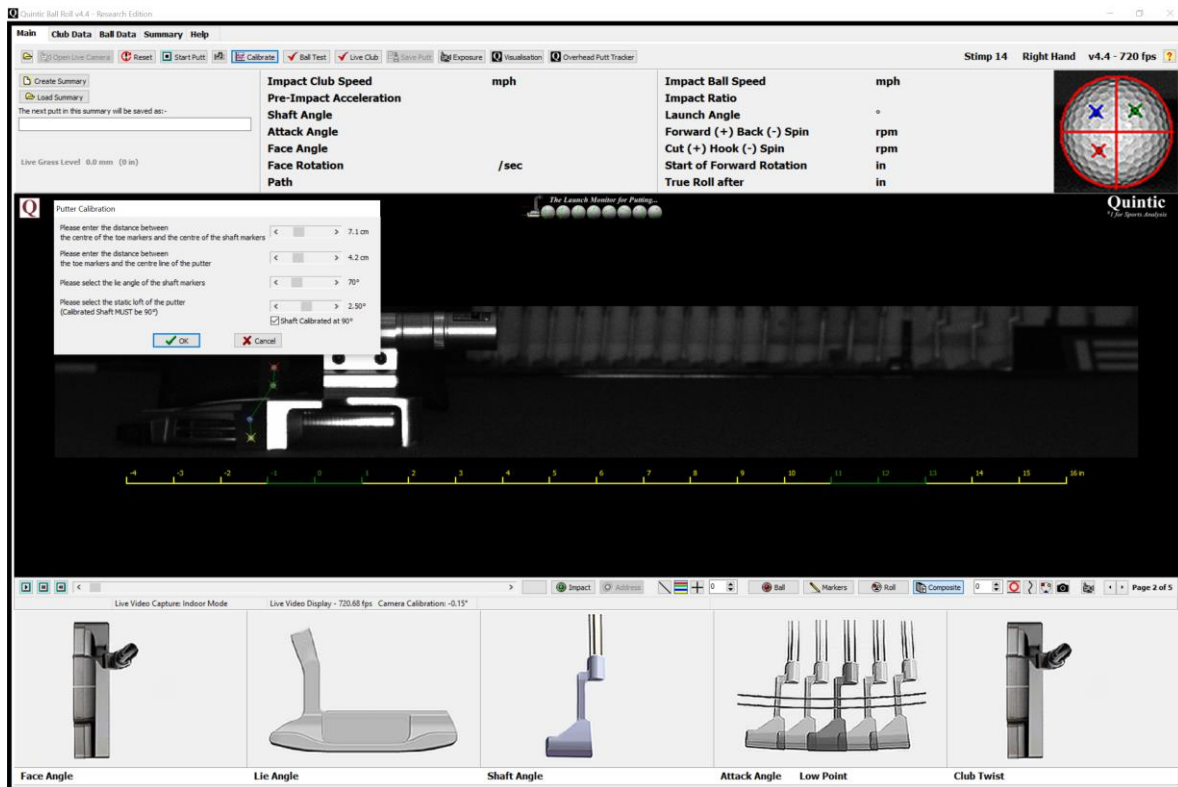
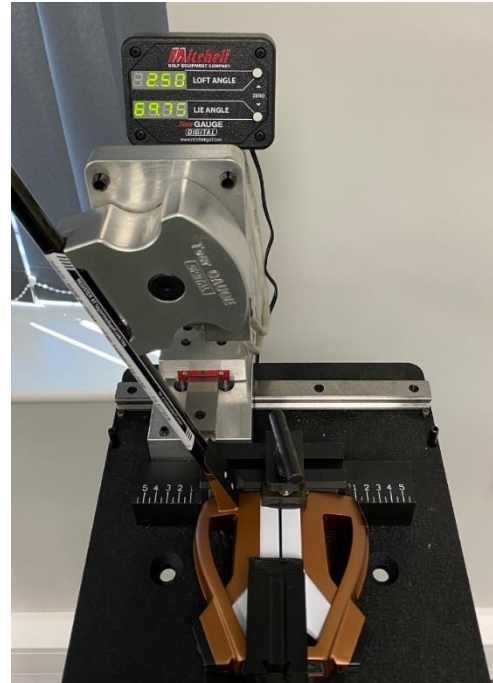
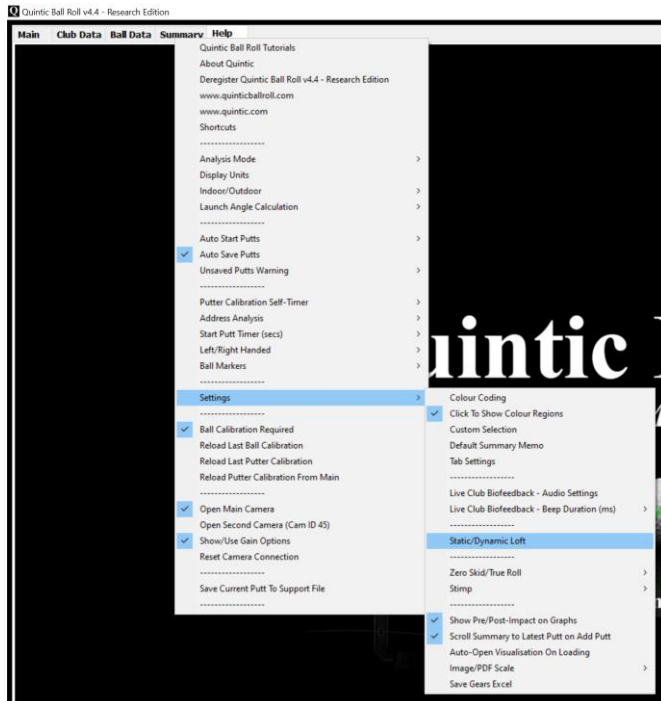
---

Face Angle -1.69° -2.45° (+0.76°) | Lie Angle -0.45° 2.14° (-2.59°) | Shaft Angle -1.29° 2.80° (-4.09°) | Attack Angle 1.46° | Club Twist -0.26° Closing





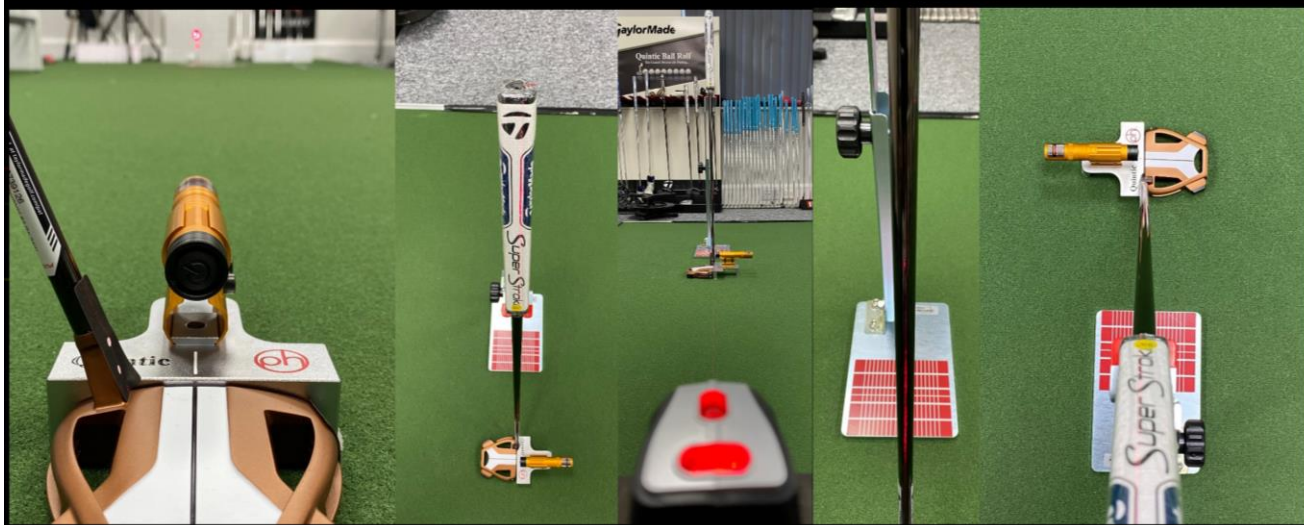
**Dynamic Loft / Static Loft :** The user has the option to calibrate the putter shaft at 90°. During the calibration the user can enter the Static Loft of the Putter. The system will then calculate the dynamic loft at impact. The interesting point regarding dynamic loft is how it relates to the launch angle of the ball.



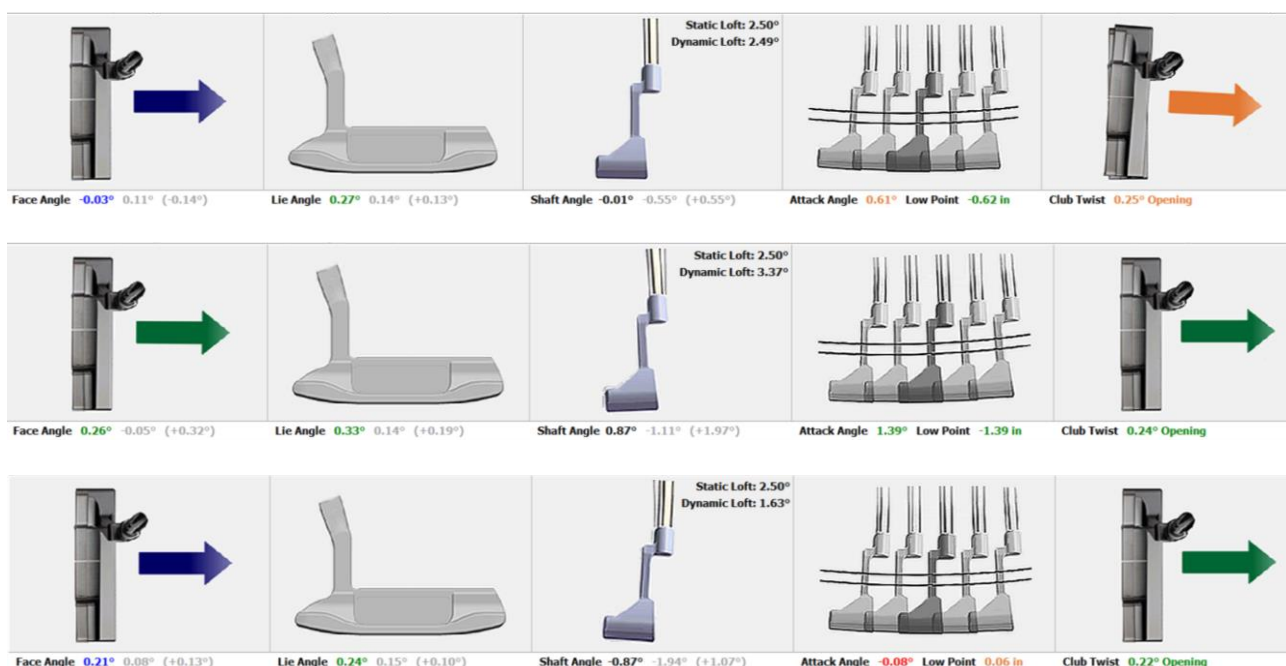
Tick the box for Shaft calibrated at 90° Enter the static loft of the putter. You must use a loft and lie machine for this measurement. Enter to the nearest 0.25°.



# How to ensure the putter shaft is vertical?



Use the line laser to ensure the putter shaft is vertical, place the putter in a clamp. It is also a good idea to ensure the lie of the putter is flat. Using this as a calibration, the face, shaft and lie of the putter are all zero.

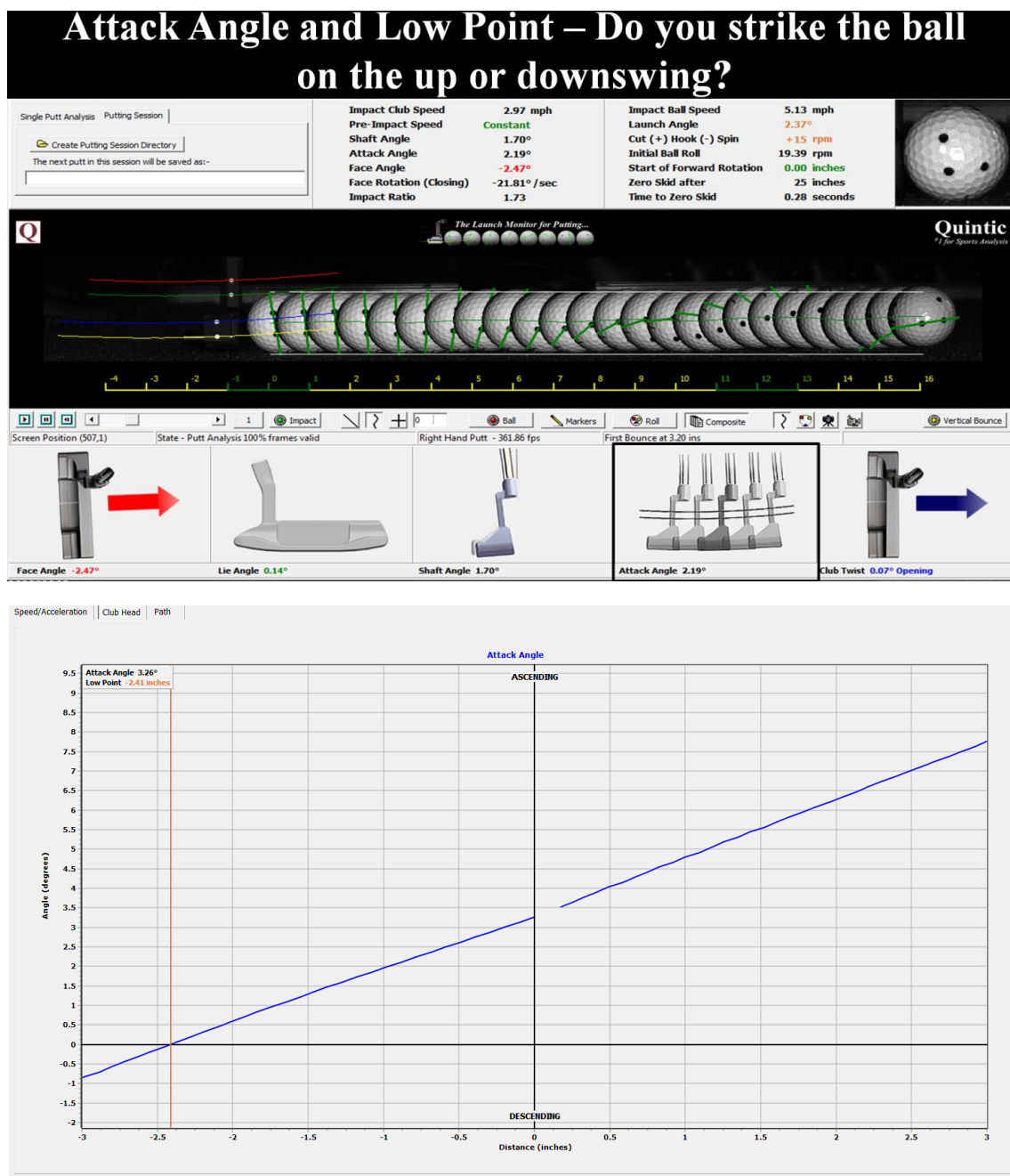


**Attack Angle:** The putter can be swung from one pivot point (a single pendulum, typically the anchoring of a belly / long putter) or it can involve multiple pivot points making it a double or even triple pendulum. A single pendulum action allows the player to control the stroke directly from one pivot point. This will ensure a consistent 'Attack Angle', with ball position the only variable as to whether it is struck on the upswing, downswing or the bottom of the arc. When a golfer manipulates the putter with wrist break and /or elbow movement then a double or even triple pendulum effect is created through the additional pivot points at the wrists and elbows. In the majority of putting actions



this scenario is complicated by lateral motion of pivot points caused by golfers allowing their bodies or legs to move. All of these variables affect the 'Attack Angle' of the putter at the point of impact.

Ideally, we are looking for consistency, however, ideally Quintic would recommend an Attack Angle of between 0.5 – 1.5 degrees. Any negative 'Attack Angle' will create a descending blow, backspin and an inconsistency in the launch angle and spin rate.

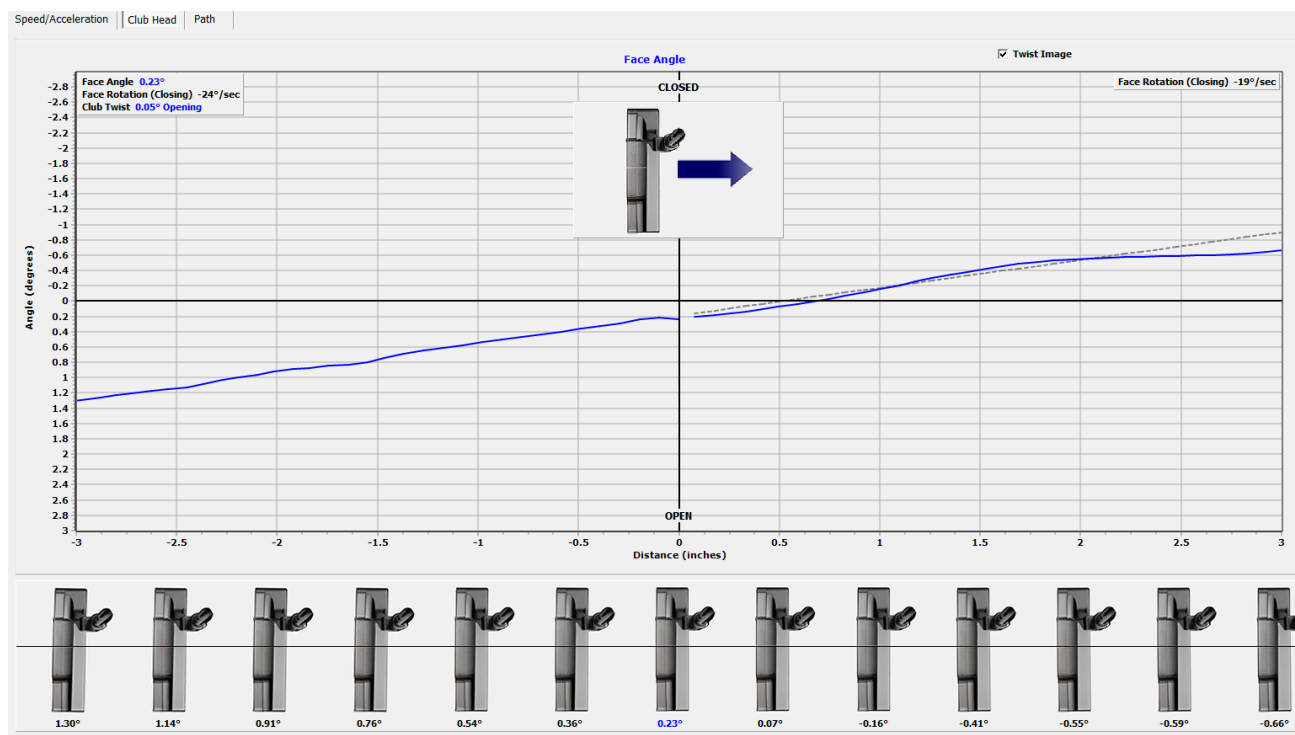
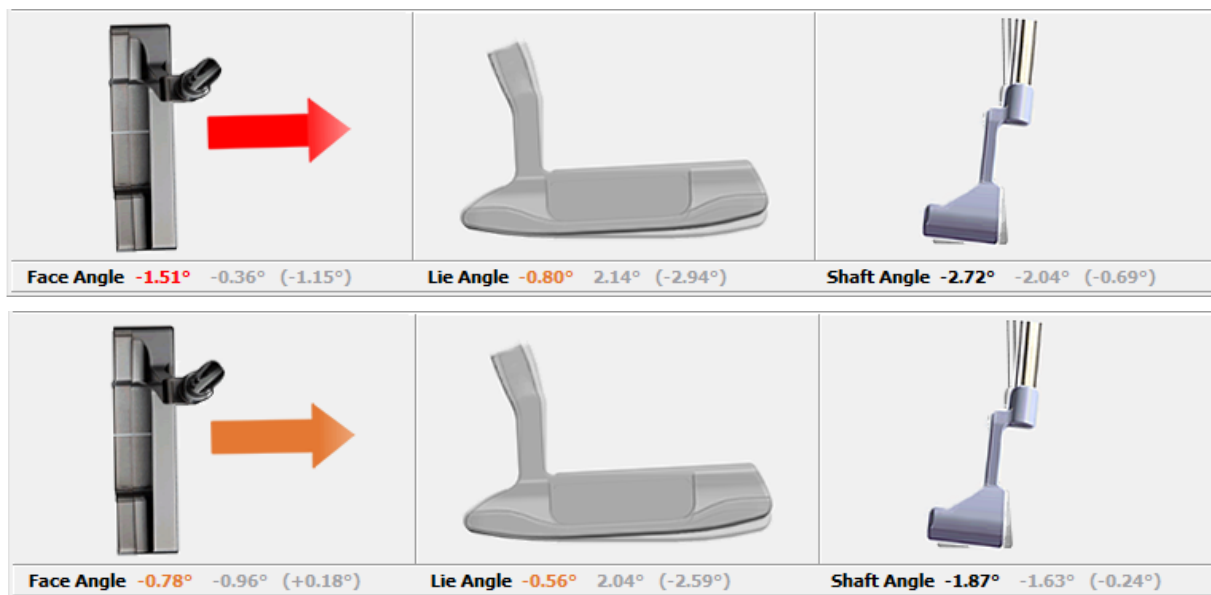


**Face Angle:** A putter face that is 2 degrees open at impact will miss the hole from 5 feet! For a putt to go in at 8 feet the angle of the face needs to less than 1 degree open or closed. Increase the distance to 15 feet and the putter face needs to less than 0.5 of a degree open or closed. Can you tell the difference between 1 degree closed / open to your target line? Putter Face at Impact is the most important factor for determining start direction of the golf ball. Every wonder why the percentage putts on the PGA Tour drop off so quickly after 8 feet?



Quintic undertook a study to explain which is the more influential and by how much? To download the article please click here: [A Rolling Brief](#). Interestingly, our study proved that Face Angle at impact accounted for as much as 90-92% of the starting direction of putts (centre strike with a two degree dynamic loft at impact). The question, then, is how does this translate into making or missing putts and can you even align your putter consistently at address? Do you have a face aim bias?

- **The Face Angle at impact as close to 0.00° with a face rotation of between -10 & -50°/sec**  
*(Please note the amount of face rotation will be determined by the amount of spine angle, distance from the golf ball, grip, length of club, swing weight, overall weight, head design...)*



The image above can be found via the Club Data Tab, Club Head Tab, Face Angle. Remember you can double click on the graph to fully expand the graph. The putter images reflect the Face Angle at ever 0.5 inch distances.

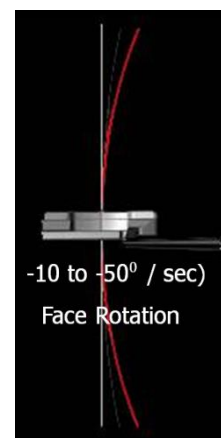


**Face Rotation (Pre and Post Impact):** Face rotation is the speed at which the club face opens or closes during impact. It is calculated on the average of available frames prior to and after impact. A consistent face rotation (Range of 6 or more putts of <5 degrees per second) is a very good indicator that the style of putter you have matches your type of putting stroke.

The Face angle at impact as close to 0.00° as possible with a face rotation of between -10 & -50° / sec

Causes of too much or inconsistent Face Rotation

- Upper spine angle is too upright, Too much forearm rotation.
- Manipulation of the wrists (flipping).
- Anchor point of the putter is too low (low hands – putter too long?)
- Excessive movement in posture during the putting stroke.
- Poor visuals of the putt line, the line is viewed a curve.



Remember, a putter face which is open 2 degrees at impact will miss the hole from 5 feet! For a putt to go in at 8 feet the angle of the face needs to less than 1 degree open or closed. Increase the distance to 15 feet and the putter face needs to less than 0.5 of a degree open or closed. Can you tell the difference between 1° closed or open to your target line? Does it become harder or easier to start the ball on your intended line with a club face that is rotating inconsistently?

Please note: A positive face rotation means the putter is moving from a closed position to open!

**Club Twist :** The amount the club face twists as a result of the impact collision with the golf ball.

## Face Twist

(Calculated as the difference in the last frame before impact and the first frame after)

Single Putt Analysis   Putting Session	Impact Club Speed: 2.66 mph	Impact Ball Speed: 4.59 mph
Create Putting Session Directory	Pre-Impact Speed: Accelerating	Launch Angle: 1.00°
The next putt in this session will be saved as:-	Shaft Angle: -0.54°	Cut (+) Hook (-) Spin: -81 rpm
	Attack Angle: 2.67°	Initial Ball Roll: 80.14 rpm
	Face Angle: 1.24°	Start of Forward Rotation: 0.00 inches
	Face Rotation (Closing): -41.72° / sec	Zero Skid after: 19 inches
	Impact Ratio: 1.72	Time to Zero Skid: 0.24 seconds

The Launch Monitor for Putting... Quintic  
#1 for Sports Analysis

Screen Position(0,0) | State - Putt Analysis 100% frames valid

Face Angle 1.24°

Right Hand Putt - 361.04 fps

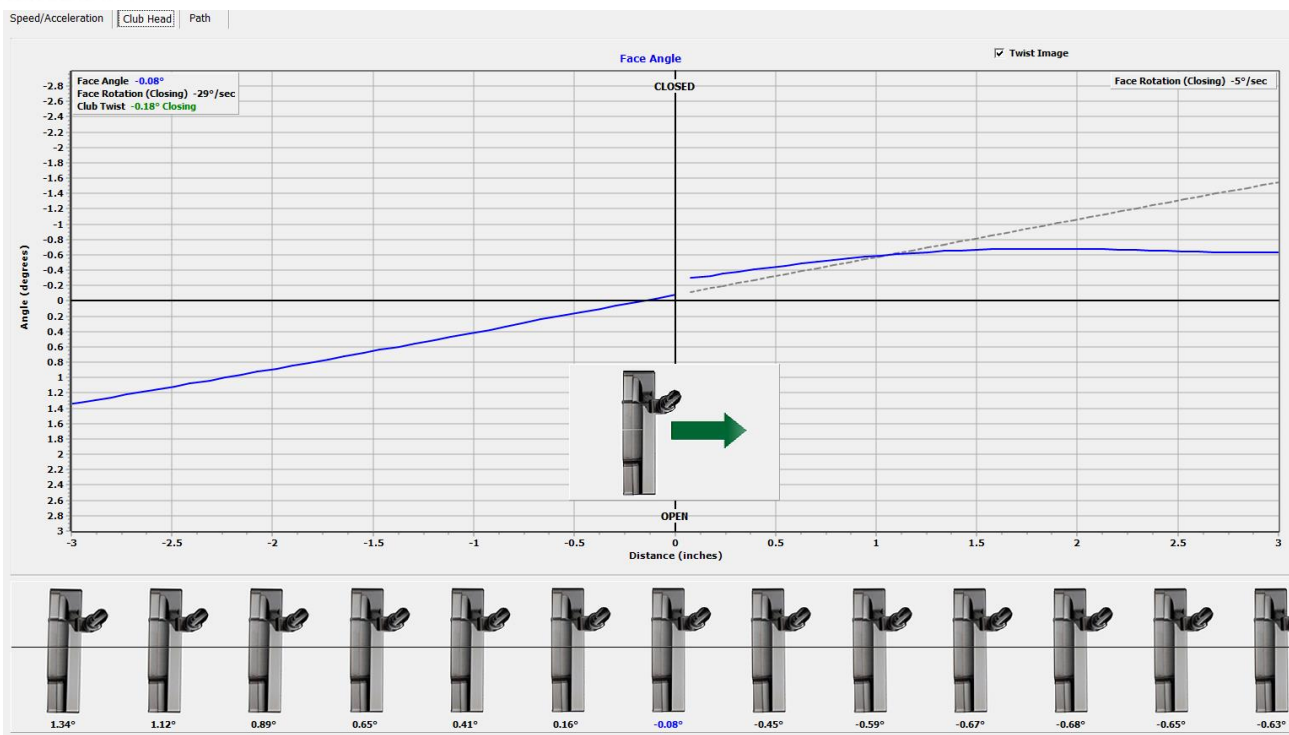
Lie Angle -2.85°

First Bounce at 2.91 ins

Shaft Angle -0.54°

Attack Angle 2.67°

Club Twist 0.97° Opening



The image above can be found via the Club Data Tab, Club Head Tab, Face Angle. Remember you can double click on the graph to fully expand the graph. In this example the Face Angle at Impact is  $-0.08^{\circ}$  closed and as a result of a heel strike has closed a further  $0.18^{\circ}$  meaning the putter is  $0.26^{\circ}$  closed the frame immediately after impact. Can you find the impact location on your putter that ensures no twist at impact?

**Impact Ratio:** Controlling the speed and energy transfer of the putter at impact is vital for distance control and good green reading.

*“Every putt is a straight putt – it just depends on how hard you hit the putt as to whether the ball takes the break or not”*

Because putting is such a significant part of golf, the ability to strike the putter consistently out of the ‘sweet spot’ is crucial. The ‘sweet spot’ is the point on the clubface where contact is the most solid, eliminating the rotation and wobble of the putter during impact. By striking the ball out of the ‘sweet spot’ the maximum energy possible from the club will be transferred into the ball. It is possible for a player to miss the ‘sweet spot’ in both the vertical plane (bottom or top of the putter face) along with the horizontal plane (Heel or Toe of the putter face). If the golfer misses the ‘sweet spot’ by even a fraction, this will result in a miss-hit and a reduction in energy transfer to the golf ball (club face twist). The more consistent a player can be in transferring energy to the golf ball, the greater control they will have on the speed of the golf ball. The distance a golf ball travels is determined by speed. The speed of the ball, dictates how much the ball will break and therefore the line of the putt. Consistently striking the ball out of the ‘sweet spot’, will greatly improve a player's ‘touch and feel’.

*“Most three putts aren’t caused by bad green reading, but by bad judgement of speed”*  
(Ben Crenshaw, 1981).

A 'sweet spot' putt involves two variables;

- putts struck on the same area of the face as well as;
- ensuring that the striking surface is 100% square to the target line during impact (non-glancing blow);

The 'Impact Ratio' is the amount of energy that is transferred from the club to the ball at impact.

**For example: Impact Ball Speed (5.6 mph) / Impact Club Speed (3.5 mph) = 1.6**

Clubhead Speed	Impact Ratio	Resultant Ball Speed	Difference
3.5 mph	1.6	5.6 mph	0.8 mph
4.0 mph	1.6	6.4 mph	

Clubhead Speed	Impact Ratio	Resultant Ball Speed	Difference
3.5 mph	1.9	6.6 mph	1 mph
4.0 mph	1.9	7.6 mph	

Factors which will affect this include the type of contact between the club head and the ball. Look what happens with the same clubhead speed 3.5 mph with an impact ratio of 1.9, the golf ball suddenly is 1mph faster (6.6 mph) with no change in clubhead speed.

If the centre of mass of the club head does not make contact with the centre of mass of the club head at impact then the impact ratio will be reduced (See Table below). This inconsistency in strike pattern also highlights how difficult it will be for the player to control the speed of the golf ball. The distance a golf ball travels is determined by speed. The speed of the ball, dictates how much the ball will break and therefore the line of the putt.

	<i>TOE</i>	<i>CENTRE</i>	<i>HEEL</i>
<i>HIGH</i>	1.60	1.65	1.50
<i>CENTRE</i>	1.62	1.71	1.53
<i>LOW</i>	1.59	1.64	1.37

#### Factors affecting Impact Ratio

- Off centre strikes (as measured by Club Head Twist)
- Type of material of putter face – softer materials i.e. inserts will reduce the Impact Ratio
- Type of ball used
- Grip pressure
- To a lesser extent, the temperature of the ball.





A very simple drill, involving 'lipstick' can be used to see if the ball is being struck on the centre of the clubface. Simply smear lipstick on the face of the club. Hit a putt and see where the ball is being struck by the mark that is left.



**Lie Angle:** Lie angle provides you with the change in lie angle from the calibrated position of the golf club. This is helpful to see if the toe of the putter is getting higher in the air at impact, compared with address (or vice versa). Are the hands of the player dropping, or is it a total body movement that causes the putter to change its position? Lie Angle change of less than 0.5 degrees will be shown as **Green** (either positive or negative) between 0.5 and 1.5 degrees the number will turn **Orange**, but over 1.5 degrees the number will turn **Red**.

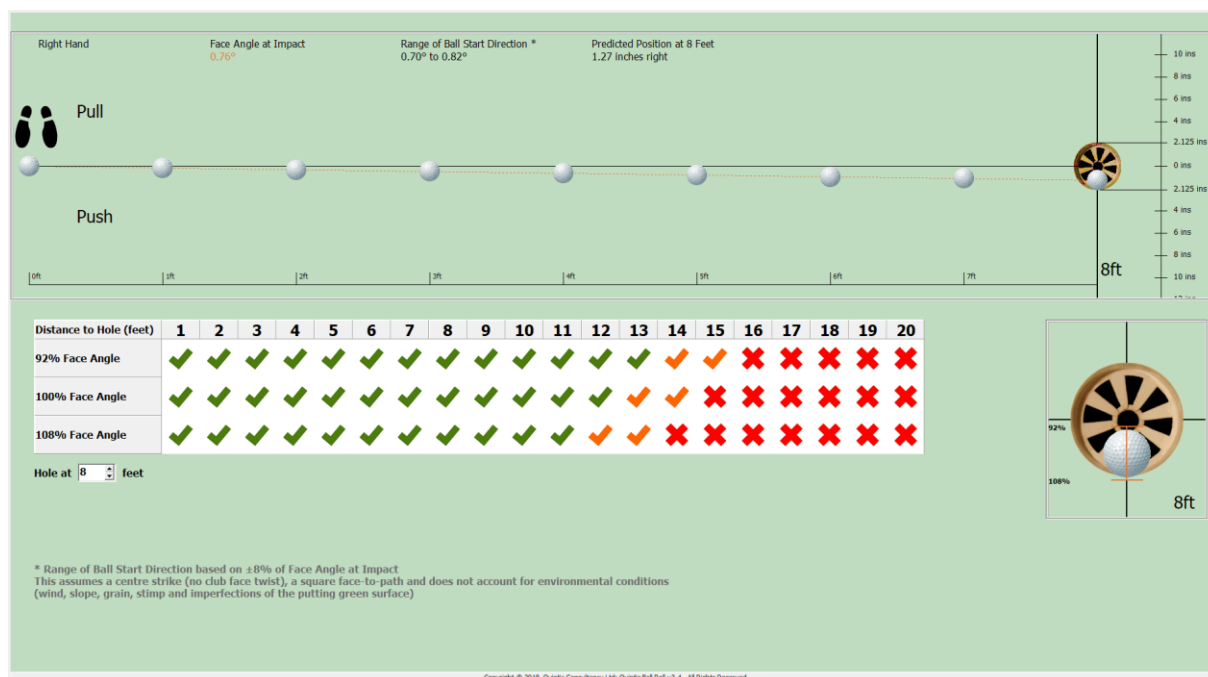
-ve indicates the toe of the putter has gone up in the air (heel down) – hands lower

+ve indicates the toe of the putter has gone down (heel up) – hands higher





**Push & Pull:** This provides you with the predicted position of where the golf ball would have finished (right or left of the hole) based on a 1ft to 20ft putt. The animation of the ball can be adjusted using the option below the table. The prediction is based on a flat putt; there is no accounting for slope, grain, speed of green, wind, moisture, launch angle, rotation or even side spin. The green ticks indicate a high chance of the putt being holed at that distance, the orange indicates a moderate probability of the putt being holed at that distance and the red indicates a low probability of it being holed at that distance.



\* Range of Ball Start Direction based on ±8% of Face Angle at Impact  
 This assumes a centre strike (no club face twist), a square face-to-path and does not account for environmental conditions (wind, slope, grain, stimp and imperfections of the putting green surface)

1° closed or open at impact will cause the ball to miss the hole from 8ft. Do you ever wonder why the percentage putts on the PGA Tour drop off so quickly after 8 feet?

During the PGA Tour 2016, 2017, 2018, 2019, 2020 & 2021 seasons, a small handful of players made 100% (min 400) of all putts inside 3 feet. The putter face angle can be up to 2.60 degrees open or closed relative to the ball to target line and still hole the putt from 3 feet! But at after 8ft, the putter must be less than 1° accurate.

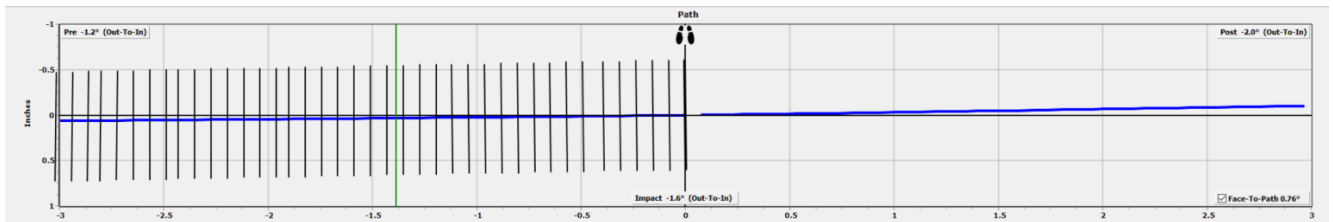
Distance	Angle of Ball	Putter Face Angle (92%)
3 feet	2.80°	2.60°
4 feet	2.20°	2.02°
5 feet	1.90°	1.75°
6 feet	1.60°	1.47°
7 feet	1.40°	1.29°
8 feet	1.20°	1.10°
9 feet	1.00°	0.92°
10 feet	0.90°	0.83°
12 feet	0.75°	0.69°
15 feet	0.60°	0.55°

**Is it possible for a human to align a putter with a 1° accuracy?**

*The following results are shown in version 4.4 and 4.4 Research.*

**Path:** The putter path (3 inches before impact and 3 inches after impact) is displayed when recording at a frame rate of 720 fps or 1080 fps. The data can be accessed via the Club Data Tab. The putter path animation can also be seen by using the **left arrow** (slide across). As you move the scroll bar frame by frame (or even playing the video), the corresponding position of the **putter face** will be reflected within the animation window. The image below has a Face-To-Path angle of  $-0.07^\circ$  at the point of IMPACT. The path at the point of Impact is  $0.8^\circ$  (square) with the average path Pre Impact of  $0.5^\circ$  (Square) and a average path Post Impact of  $1.1^\circ$  (In-to-Out). In the example below, the Face Angle is  $0.86^\circ$  Open (Path  $0.8^\circ$ ) resulting in a Face-To-Path angle (difference) of only  $0.07^\circ$ . As a result, the ball had minimal side spin  $+5$  rpm cut spin. This particular put also had minimal twist at impact.

*Please note: It is also possible to use the scroll bar (far right) to move the putter face animation.*



**Low Point - Green Line 1.4 inches**

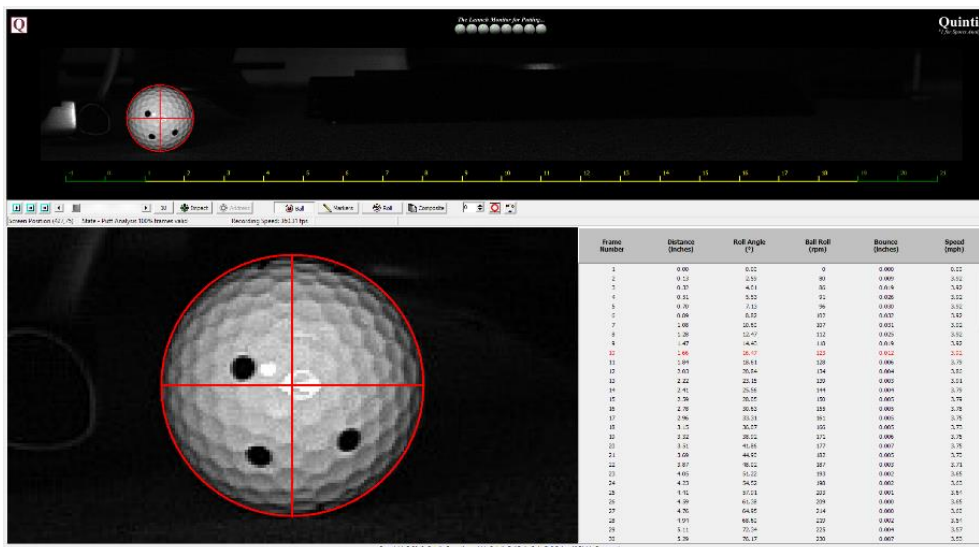
*Please note: Any 'Path' reading less than 1 degree is reported as Square.*

Single Putt Analysis	Putting Summary	Impact Club Speed	3.66 mph	Impact Ball Speed	6.62 mph
Create Summary		Pre-Impact Speed	Accelerating (4.2 mph/s)	Impact Ratio	1.81
Load Summary		Shaft Angle	-2.04°	Launch Angle	2.88°
The next putt in this summary will be saved as:-		Attack Angle	2.82°	Forward (+) Back (-) Spin	-15 rpm
		Face Angle	0.86°	Cut (+) Hook (-) Spin	+5 rpm
Grass Level 5.5 mm (0.22 inches)		Face Rotation (Closing)	-21° /sec	Start of Forward Rotation	1.43 inches
		Path (Square)	0.8°	Zero Skid after	32.0 inches

Quintic  
For Sports Analysis

Screen Position (919,20)	State - Putt Analysis 99% frames valid	Recording Speed: 721.12 fps	Surface Interaction 0.66 ins	First Contact 4.53 ins
--------------------------	--	-----------------------------	------------------------------	------------------------

**Research:** Each individual frame of the ball data can be viewed within this tab, along with a zoomed image of the markers and ball centre. In the example below, the image is showing frame 10 (this is highlighted red in the table), overlay can be placed on to the video, similar to that of the main screen.



Frame Number	Distance (inches)	Roll Angle (°)	Ball Roll (rpm)	Bounce (inches)	Speed (mph)
1	0.00	0.00	0	0.000	0.00
2	0.12	2.59	80	0.000	2.50
3	0.37	4.71	95	0.018	3.80
4	0.52	5.52	92	0.020	2.50
5	0.70	7.12	96	0.030	3.50
6	0.88	8.23	107	0.037	7.80
7	1.08	10.42	107	0.051	5.50
8	1.28	12.47	112	0.025	3.50
9	1.47	14.47	118	0.018	3.50
10	1.86	16.17	123	0.022	3.50
11	2.04	16.61	138	0.006	3.75
12	2.63	18.54	174	0.064	3.50
13	2.22	21.82	159	0.002	2.10
14	2.41	23.58	144	0.004	3.75
15	2.76	25.20	150	0.005	5.75
16	2.79	26.52	149	0.002	2.75
17	2.96	31.11	161	0.005	3.75
18	3.12	32.77	161	0.005	2.75
19	3.32	38.24	172	0.006	2.75
20	3.31	40.86	177	0.007	3.75
21	3.05	44.57	187	0.005	5.75
22	2.87	46.12	187	0.002	2.75
23	4.60	51.22	183	0.002	3.40
24	4.73	54.52	180	0.002	3.50
25	5.76	57.11	202	0.002	2.80
26	4.39	61.58	209	0.000	3.40
27	4.30	64.85	214	0.000	3.50
28	1.93	68.82	232	0.004	2.80
29	1.13	73.34	235	0.004	3.50
30	0.26	76.47	230	0.007	3.50

**Summary Tab:** The Putting Session Summary Function can be used to analyse multiple putts as the session is automatically updated after each putt and saved into a session folder (Please select which Average the data will be saved into: Red, Blue or Green). This can be done by clicking on the respective **Add to**. The summary can store up to 200 putts and will show you the minimum, maximum, average, standard deviation and range of all measured variables, as well as displaying the data graphically. You can navigate the list of putts from within the session via the arrow buttons in the top left of the table. Putts can be removed from the calculations of the average, standard deviation etc. values below the table by de-selecting the box next to each putt. To permanently delete a putt from the summary you can right click on this tick box. An individual putt from within the summary can be loaded up into the Main Tab by left clicking on the coloured number of the putt.

Create a session by using the 'Create Summary' button on the Main Tab, you will then be prompted to pick a file location, we recommend creating a new folder for each new summary as this will make navigating your summaries far more easy in future. You will then be able to add putts one by one after completing them by using the 'Add' button on the main screen (Please note: there is also an AUTO save option within the HELP menu)



Quintic Ball Roll v4.4 - Research Edition: C:\Quintic\... Data\Webinar 31 Dynamic LoftTM Spider 2-50\_41 ho5Putt

Main Club Data Ball Data Summary Help

Open Live Camera Start Putt Calibrate Live Club Save Putt Exposure Visualisation Overhead Putt Tracker

Stimp 14 Right Hand v4.4 - 720 fps

Average Vertical Bottom

Impact Club Speed	2.93 mph	Impact Ball Speed	5.02 mph
Pre-Impact Acceleration	Accelerating (2.5 mph/s)	Impact Ratio	1.71
Launch Angle	0.08°	Launch Angle	3.72°
Attack Angle	2.49°	Forward (+) Back (-) Spin	-9 rpm
Face Angle	-3.01°	Cut (+) Hook (-) Spin	-5 rpm
Face Rotation (Closing)	-38° /sec	Start of Forward Rotation	3.15 in
Path (Out-To-In)	-1.6°	True Roll after	24.0 in

TM Spider 2-50\_42

Live Grass Level 0.0 mm (0 in)

Putt 41

Static Loft: 2.50°  
Dynamic Loft: 2.58°

Screen Position (0,0) Putt Analysis 99% frames valid Recording Speed: 719.47 fps Camera Calibration: -0.15° Surface Interaction 0.01 in First Contact 3.65 in Address to Impact Time: 0.86 secs (70 bpm)

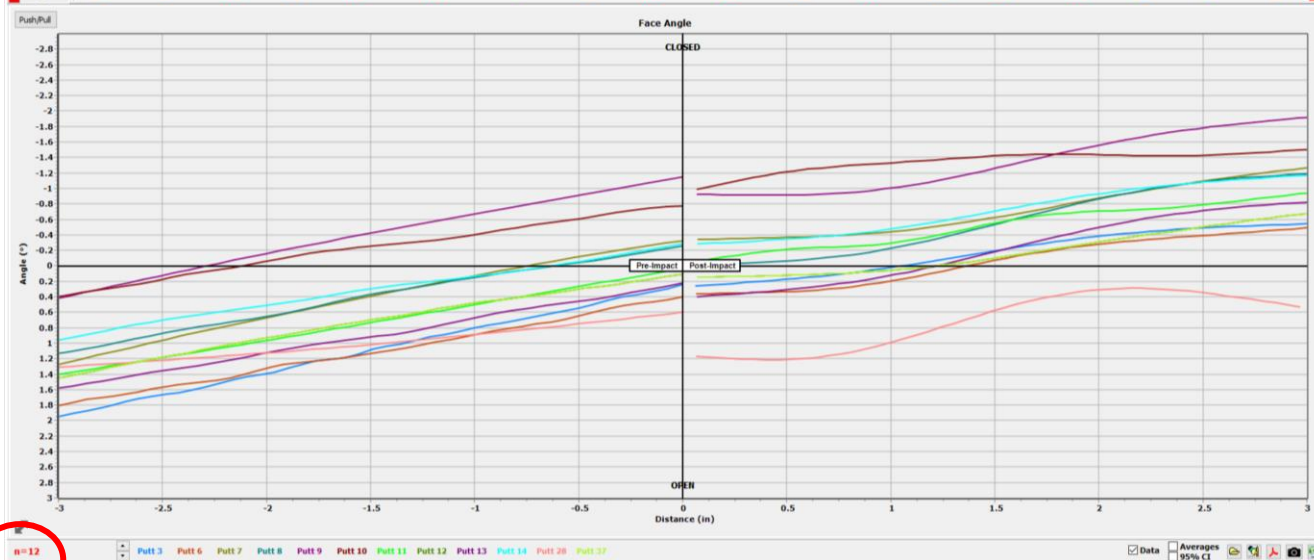
Double click the coloured box to scroll through the number of averages to be used in the summary – it is possible to also name the average. The names are displayed on the bottom panel of each of the Summary Tab options.

0.91° 0.58° 0.30° 0.00° -0.28° -0.57° -0.85° -0.76° -1.02° -1.35° -1.59° -1.70°

Vertical (n=8) Hands Back (n=8) Hands Forward (n=8) Putts: 27 28 29 31 32 34 36 37 38 39 40 41 Display Data Averages 95% CI



Right Hand	Overview	Face	Path	Impact Speed	Ball Speed	Ball Launch	Shaft/Lie/Attack	Vertical Bounce	Zero Skid	Initial Spin	Putter Fitting	Custom						
#	Face Angle (°)	Face Rot (°/sec)	Twist (°)	Path (°)	Ball Speed (mph)	Club Speed (mph)	Pre Acc (mph/s)	Post Acc (mph/s)	Impact Ratio	Launch Angle (°)	Shaft Angle (°)	Lie Angle (°)	Attack Angle (°)	Low Point (in)	Zero Skid (in)	Forward Rot (in)	F/B (rpm)	Side (rpm)
12	0.24	-28	0.05	1.0	4.85	2.82	2.8	1.5	1.72	2.35	-0.71	-0.96	1.25	-1.17	20.0	0.00	11	-5
8	0.40	-23	0.00	0.6	4.78	2.76	2.4	1.4	1.73	3.97	-0.43	-1.61	1.50	-1.24	22.0	1.67	-23	-1
7	-0.33	-34	0.04	0.2	5.80	3.48	2.0	1.7	1.66	0.66	0.87	1.57	-0.24	-0.19	35.0	0.00	22	-8
9	-0.26	-28	0.07	-0.9	5.66	3.36	1.7	1.2	1.68	-0.07	-0.09	0.20	0.78	-0.70	33.0	0.00	39	2
10	-1.15	-29	0.26	0.1	5.26	3.10	1.8	1.6	1.70	-0.14	0.16	1.59	0.43	-0.42	30.0	0.00	22	-1
9	-0.78	-21	-0.17	-0.2	5.25	3.12	2.2	1.6	1.88	-0.34	-0.21	1.05	-0.15	-0.12	28.0	0.00	33	-10
11	0.03	-24	-0.06	0.8	5.22	3.05	2.3	1.5	1.71	0.72	1.11	1.33	0.32	-0.12	26.0	0.00	14	10
12	0.11	-25	0.07	0.0	5.21	3.13	1.8	1.3	1.67	0.63	0.38	0.80	0.88	-0.82	25.0	0.00	34	-2
13	0.22	-26	0.21	-0.4	5.43	3.26	2.1	1.2	1.66	1.18	0.02	0.20	0.43	-0.40	28.0	0.00	30	5
14	-0.29	-24	0.01	1.1	5.32	3.16	2.1	1.2	1.69	0.66	0.06	0.38	1.46	-1.33	26.0	0.00	35	-29
28	0.60	-12	0.58	0.3	4.67	2.86	1.1	-0.6	1.63	0.52	0.12	-1.81	1.75	-2.98	14.8	0.00	31	-11
11	0.11	-25	0.07	0.0	5.21	3.13	1.8	1.3	1.67	0.63	0.38	0.80	0.88	-0.82	25.0	0.00	34	-2
Minimum	-1.15	-34	-0.17	-0.9	4.67	2.76	1.1	-0.6	1.63	-0.34	-0.71	-1.81	-0.24	-2.98	14.8	0.00	-23	-29
Maximum	0.60	-12	0.58	1.1	5.80	3.48	2.8	1.7	1.73	3.97	1.11	1.59	1.75	-0.19	35.0	1.67	39	10
Average	-0.09	-25	0.11	0.2	5.22	3.10	2.0	1.2	1.68	0.90	0.14	0.31	0.76	-0.81	26.1	0.14	24	-4
+SD	0.50	5	0.20	0.6	0.33	0.21	0.4	0.6	0.03	1.19	0.51	1.18	0.65	0.86	5.5	0.48	17	10
Range	1.75	23	0.75	2.0	1.13	0.73	1.7	2.2	0.10	4.31	1.82	3.40	1.98	3.17	20.2	1.67	62	39



Summary OVERVIEW Tab:

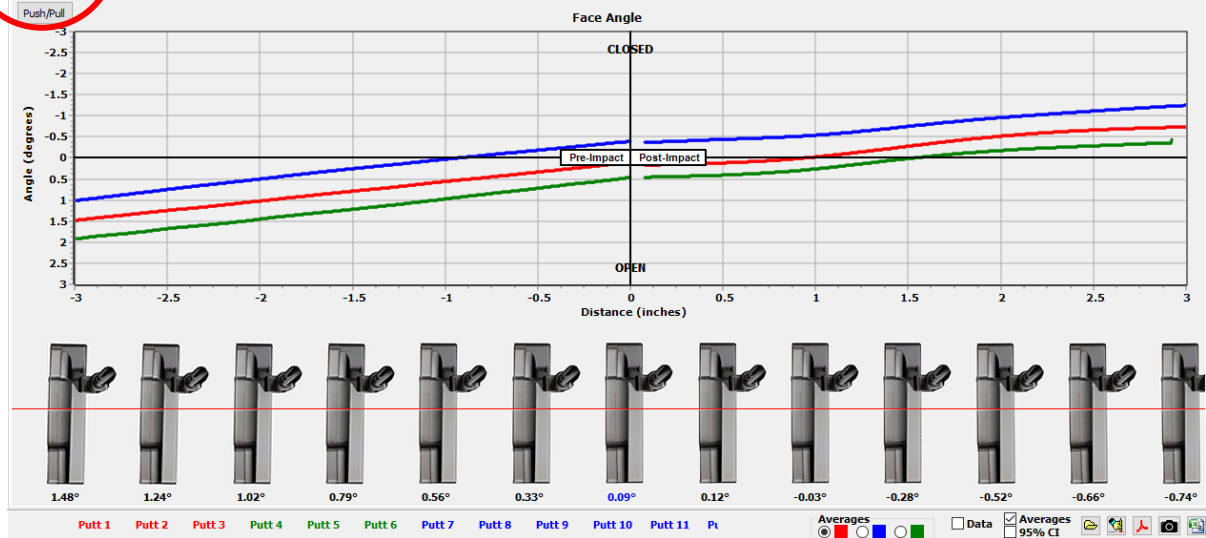
Double click on the graph or arrow in bottom left to expand graph to full screen: If more than 10 putts have been saved into the summary (max 200) then you can use the up / down arrows to select the putts on display (Maximum 10 at a time). There are various options to view the data (show individual putts), average line and confidence interval (V4.4 Research Only). The summary can be saved to PDF and Excel file, with also the option to load previously saved PDF files. If more than 10 putts have been saved into the summary (maximum 200) then you can use the up / down arrows to select the putts on display (maximum 10 at a time). To return back to the combined layout (table and graphs) please double left click the graph or click on the arrow.

# Quintic Ball Roll®

The Launch Monitor for Putting...



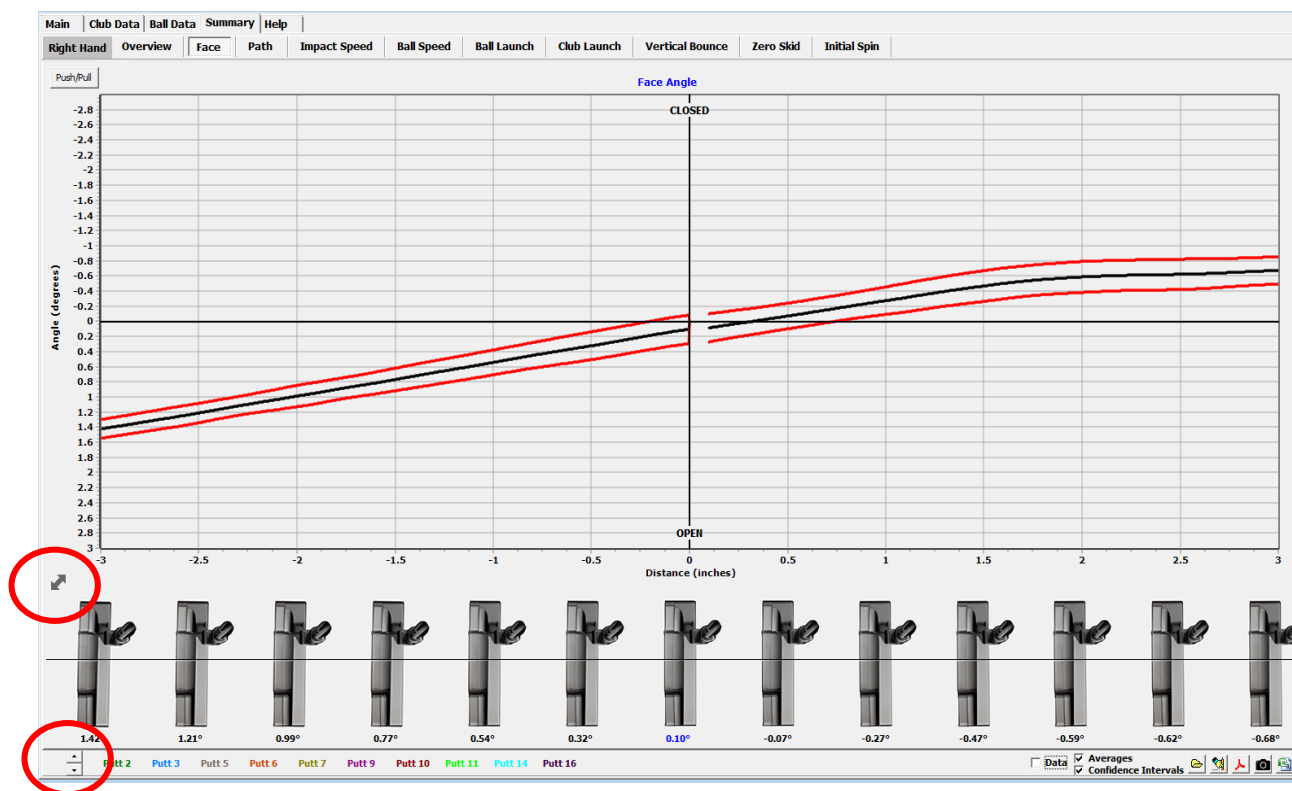
Push/Pull	Face Angle (°)	Face Rot (°/sec)	Twist (°)	Path (°)	Ball Speed (mph)	Club Speed (mph)	Pre Acc (mph/s)	Post Acc (mph/s)	Impact Ratio	Launch Angle (°)	Shaft Angle (°)	Lie Angle (°)	Attack Angle (°)	Low Point (ins)	Zero Skid (ins)	Forward Rot (ins)	F/B (rpm)	Side (rpm)	
n=6 n=3																			
Average	0.09	-25	0.10	0.6	5.17	3.04	2.5	1.2	1.70	2.54	-0.33	-0.54	1.12	-1.03	24.6	0.23	17	-2	
Average	0.40	-27	0.07	0.0	5.40	3.21	2.0	1.5	1.68	0.24	0.37	1.11	0.30	-0.29	29.8	0.00	27	-1	
Average	0.45	-24	0.03	1.5	4.71	2.74	2.5	1.3	1.72	2.94	-0.57	-0.76	1.58	-1.51	20.5	1.20	-12	-4	



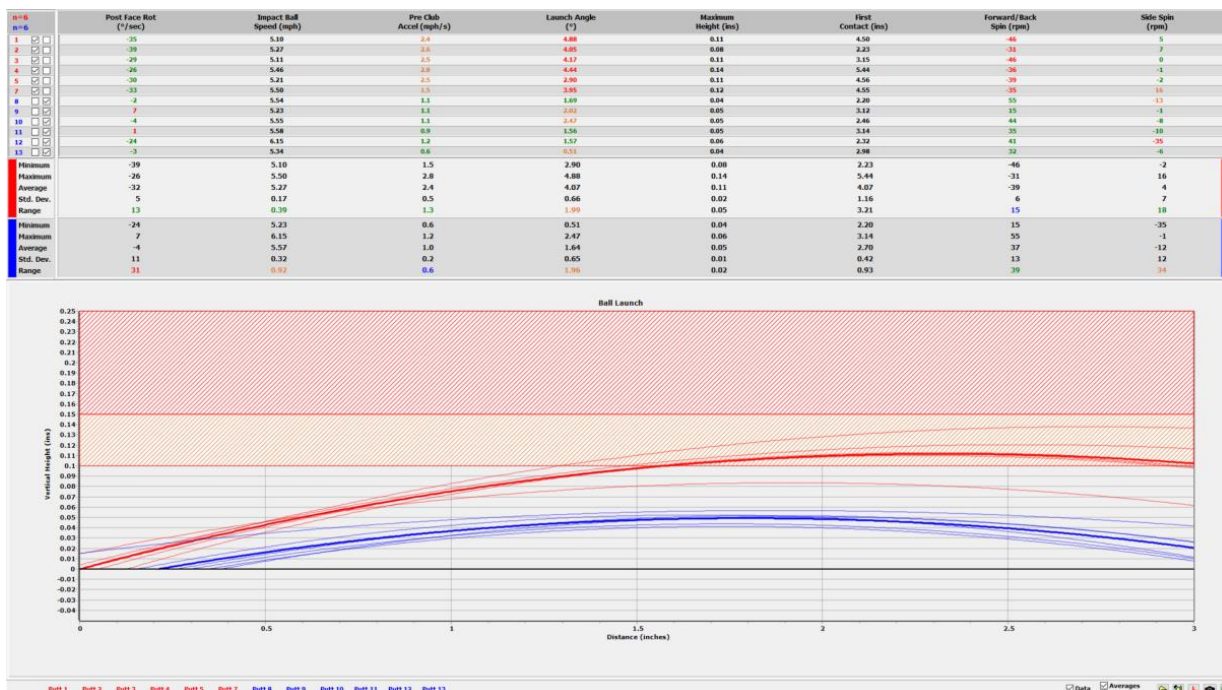
- Double click on Red, Blue, Green box to only display the Minimum, Maximum, Average, SD and Range.
- Double click on the word AVERAGE to reduce further and just display the Averages.

## Summary – IMPACT SPEED

(Double click on the graph or arrow in bottom left to expand graph to full screen)



## Summary – FACE



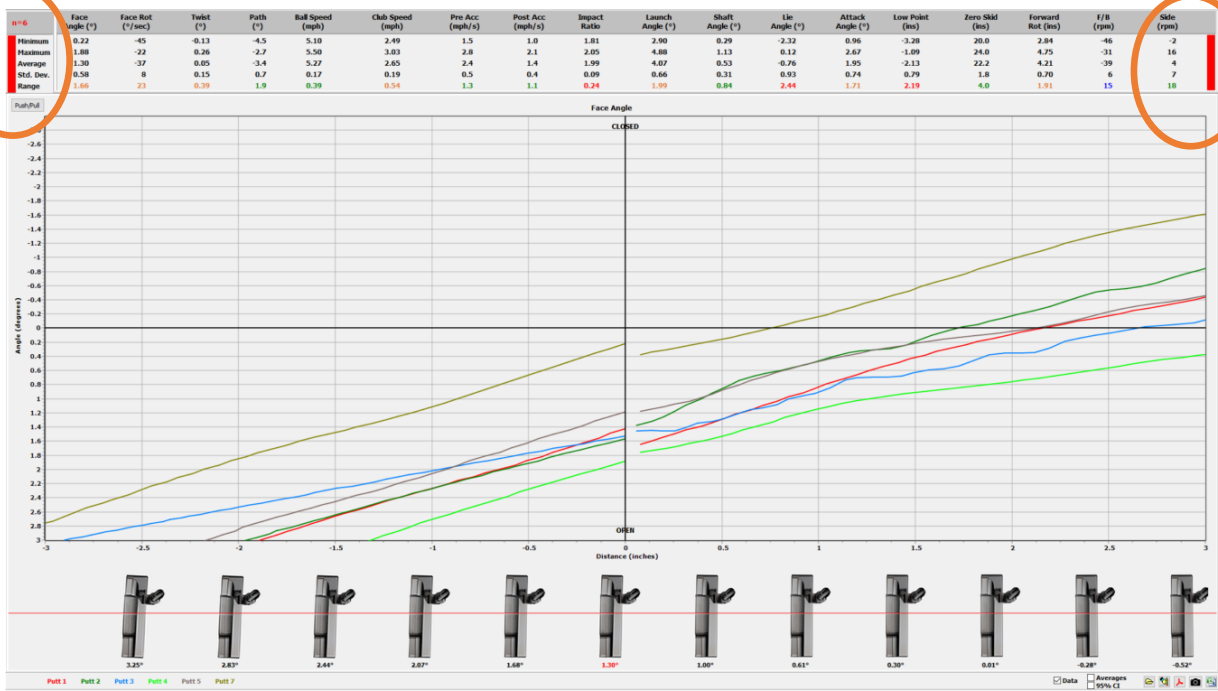
## Summary – Six Average (Double click on the Coloured box to scroll round the averages)

Manually tick in the check box to assign the putt into either the RED, BLUE, or GREEN Average calculations. Once you have more than 6 putts in either (the Range Colours will be highlighted). It is worth making a note of which putts are which in the MEMO Pad on the front screen. You can assign two different putters and compare the performance difference in each category.

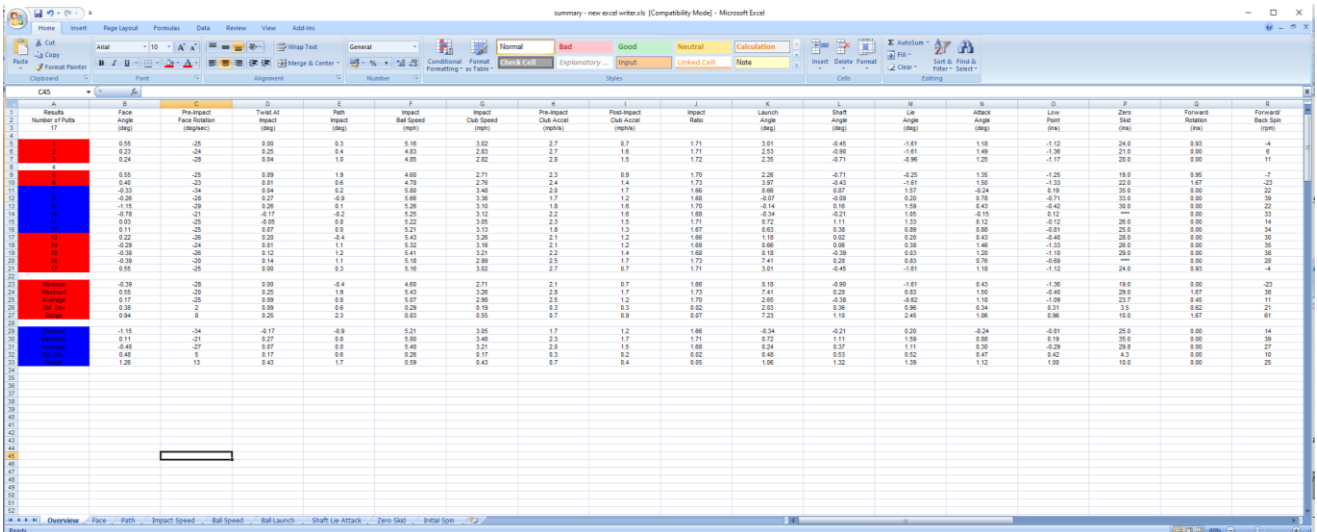


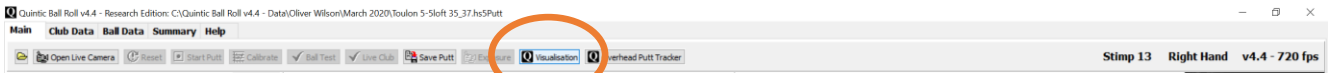


- **Summary Page:** Ability to double click the Averages section (RED rectangle) within the summary to display just the averages and the graphs (i.e. don't show individual putt rows in the table). Double click on the word AVERAGE to reduce further and just display the Averages.

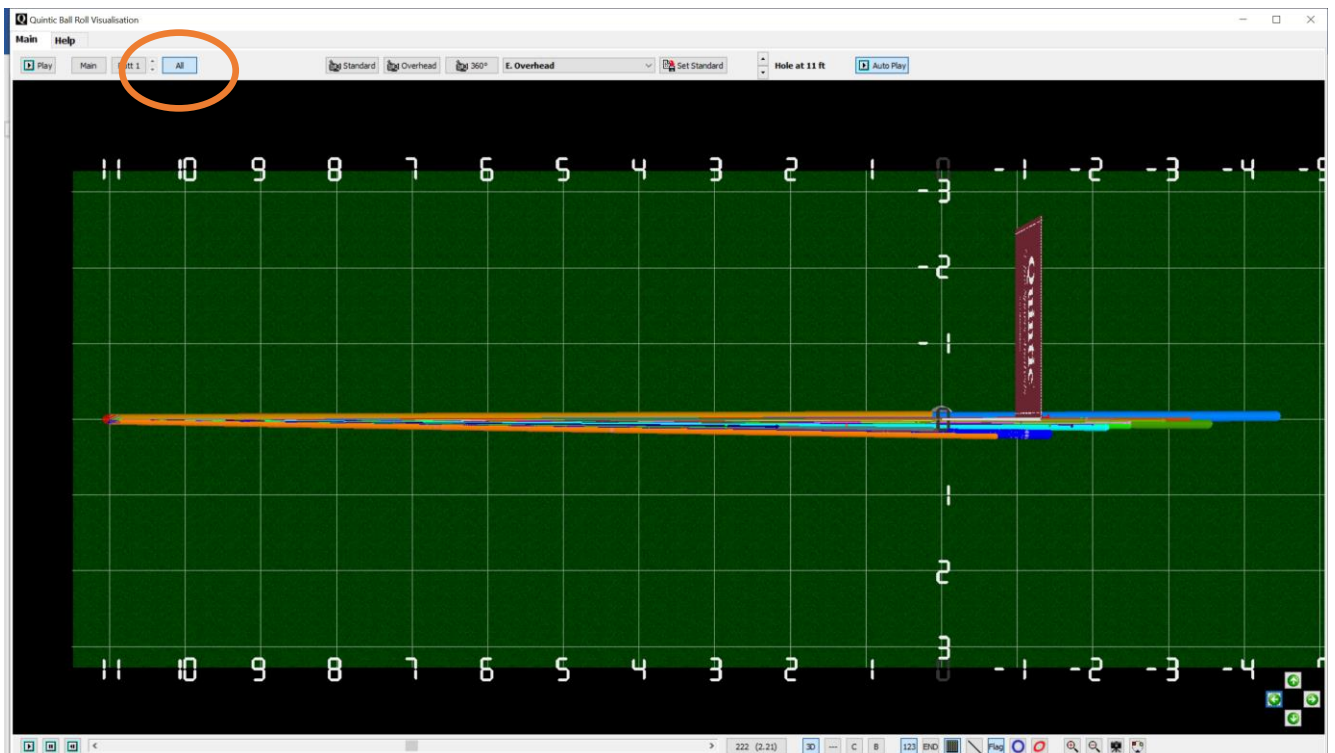
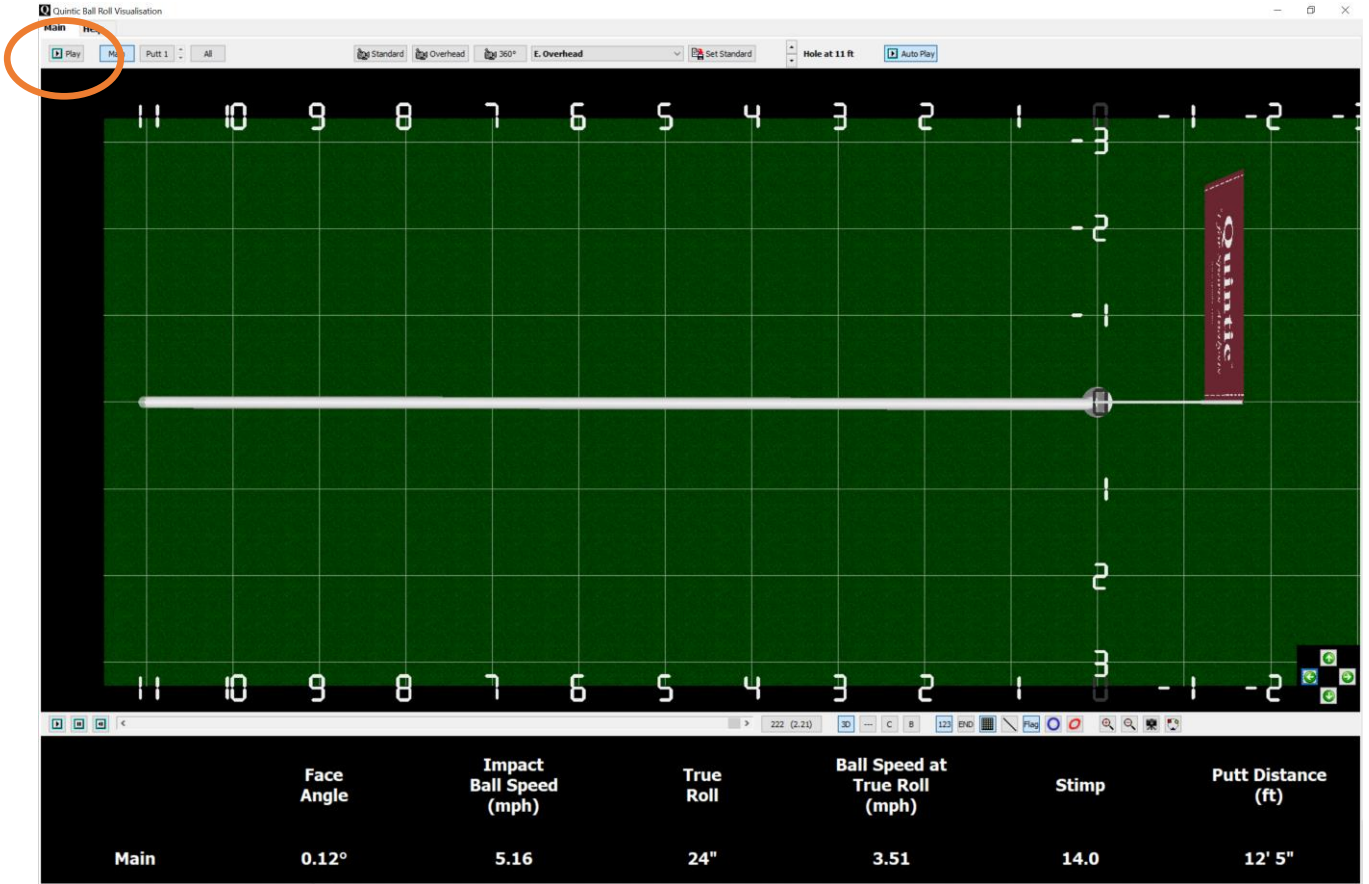


**EXCEL Summary :** It is possible to save the summary to an excel file for further statistical analysis. The end user has the option to create and save the excel file in any location. Please note, that every time single putt is saved, an excel file is automatically created with the same file name and putt number.





**3D Visualisation Window** : A new window which uses the face angle, speed at zero skid and your chosen stimp to predict where the ball would have finished in the real world on a flat surface – allows full session to be viewed in one go and grouping of putts to be analysed. Select different views, zoom in / out, grid, flag...





**Front Screen Expander :** Expand the video to hide the variables at the top if they are not of interest. Double Left Click on the Quintic Ball Roll Logo in the centre to expand the video. Provided you have Auto Save On, a Summary loaded, then all the putts will still go into the summary as normal. Double click to return.

**Putt 37**

Impact Club Speed	3.13 mph	Impact Ball Speed	5.21 mph
Pre-Impact Acceleration	Accelerating (1.8 mph/s)	Impact Ratio	1.67
Shaft Angle	0.38°	Launch Angle	0.63 °
Attack Angle	0.88°	Forward (+) Back (-) Spin	+34 rpm
Face Angle	0.11°	Cut (+) Hook (-) Spin	-2 rpm
Face Rotation (Closing)	-25° /sec	Start of Forward Rotation	0.00 in
Path (Square)	0.0°	Zero Spin after	25.0 in

**Launch Angle (°)**  
**0.63°**

**Flight Angle (°)**  
**1.62°**

**Launch/Flight Diff (°)**  
**0.98°**

**Putt 37**

Impact Club Speed	3.13 mph	Impact Ball Speed	5.21 mph
Pre-Impact Acceleration	Accelerating (1.8 mph/s)	Impact Ratio	1.67
Shaft Angle	0.38°	Launch Angle	0.63 °
Attack Angle	0.88°	Forward (+) Back (-) Spin	+34 rpm
Face Angle	0.11°	Cut (+) Hook (-) Spin	-2 rpm
Face Rotation (Closing)	-25° /sec	Start of Forward Rotation	0.00 in
Path (Square)	0.0°	Zero Spin after	25.0 in

**Launch Angle (°)**  
**0.63°**

**Flight Angle (°)**  
**1.62°**

**Launch/Flight Diff (°)**  
**0.98°**

The summary style for v2.4, v3.4, v4.4 and v4.4 Research. As such, the number of variables and graphs that are now available in the Summary of each level of the Quintic software is as follows:

Level	Variables In Summary	Graphs In Summary	Third Average	Confidence Intervals
v2.4 (Ball Only)	Over 20	4	Yes	No
v3.4	Over 30	5	Yes	No
v4.4	Over 50	12	Yes	No
v4.4 Research	Over 50	12	Yes	Yes

## General Functions

### Graphs

- Raw Data – there is often a tick box above the graph that allows you to display the ‘raw’ data on the graph, hovering the cursor over any line on the graph will allow you to see the values at that specific point.
- Zoom in – When viewing the Roll Angle, RPM, Launch Angle or Ball Speed graphs within the Ball Data tab you are able to zoom into the a particular area of the graph. Click and hold the left mouse button and draw a rectangle, starting from top left of the rectangle and moving to bottom right, around the area of interest. The graph will then zoom to the size of the rectangle drawn.
- Zoom out – By drawing a rectangle starting from bottom right and moving to top left (opposite of zoom in) it will reset the graph to the default view.
- Moving the Graph Around – By clicking and holding the right mouse button you can drag the graph around, both horizontally and vertically. To reset the graph just draw a rectangle starting from the bottom right and moving to the top left as described above.
- Enlarging the Graph – When viewing graphs within the summary tab, you can enlarge the graph so that it takes up the whole screen by double left clicking on any area within the graph. It can be set back by just double clicking on the graph again.

### Help Tab

- Analysis Mode – Allows you to change between Club and Ball and Ball Only as well as changing your recording framerate if using v4.4 or 4.4 Research.



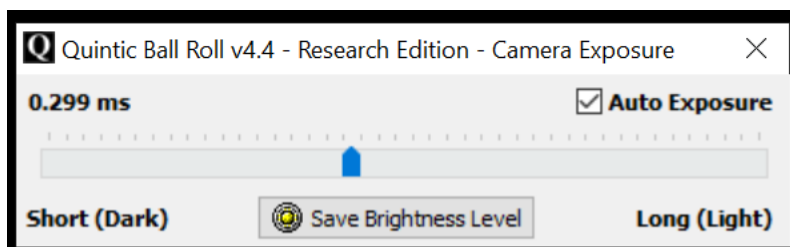
- **Display Units** – Allows you to change the results displayed between Imperial and Metric units. There is a choice of four possible units when displaying speeds and accelerations.



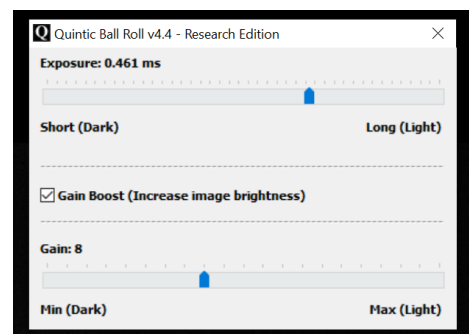
- **Indoor/Outdoor** – When set in Outdoor Mode you have the option to adjust the grass level when calibrating.
- **Show Use Gain Options** – This is recommended when indoors to artificially increase the image brightness of the image.



**Auto Exposure** – There is also the option to set the Auto-Exposure when in Outdoor Mode. This will automatically adjust the exposure of the camera to keep the image as consistent as possible when the sun is going in and out of the clouds. Once the desired image has been achieved on the LIVE image, please ‘Save Brightness Level’ Please ensure Auto Exposure is ticked / selected.



Outdoor Mode



Indoor Mode

# Quintic Ball Roll®

The Launch Monitor for Putting...



Quintic Ball Roll v4.4 - Research Edition

Main Club Data Ball Data Summary Help

Open Live Camera Reset Start Putt Calibrate Ball Test Live Club Save Putt Exposure Visualisation Overhead Putt Tracker

Stimp 14 Right Hand v4.4 - 720 fps

Create Summary Load Summary

The next putt in the summary will be saved as:-

Live Grass Level: 0.0 mm (0 in)

Impact Club Speed	mph	Impact Ball Speed	mph
Pre-Impact Acceleration		Impact Ratio	=
Shaft Angle		Launch Angle	
Attack Angle		Forward (+) Back (-) Spin	rpm
Face Angle		Cut (+) Hook (-) Spin	rpm
Face Rotation	/sec	Start of Forward Rotation	in
Path		True Roll after	in

Quintic Ball Roll v4.4 - Research Edition

Exposure: 0.461 ms

Short (Dark) Long (Light)

Gain Boost (Increase image brightness)

Gain: 8

Min (Dark) Max (Light)

Live Video Capture: Indoor Mode Live Video Display - 720.09 fps Camera Calibration: -0.19°

Face Angle Lie Angle Shaft Angle Attack Angle Low Point Club Twist

No Gain Boost

Quintic Ball Roll v4.4 - Research Edition

Main Club Data Ball Data Summary Help

Open Live Camera Reset Start Putt Calibrate Ball Test Live Club Save Putt Exposure Visualisation Overhead Putt Tracker

Stimp 14 Right Hand v4.4 - 720 fps

Create Summary Load Summary

The next putt in the summary will be saved as:-

Live Grass Level: 0.0 mm (0 in)

Impact Club Speed	mph	Impact Ball Speed	mph
Pre-Impact Acceleration		Impact Ratio	=
Shaft Angle		Launch Angle	
Attack Angle		Forward (+) Back (-) Spin	rpm
Face Angle		Cut (+) Hook (-) Spin	rpm
Face Rotation	/sec	Start of Forward Rotation	in
Path		True Roll after	in

Quintic Ball Roll v4.4 - Research Edition

Exposure: 0.300 ms

Short (Dark) Long (Light)

Gain Boost (Increase image brightness)

Gain: 8

Min (Dark) Max (Light)

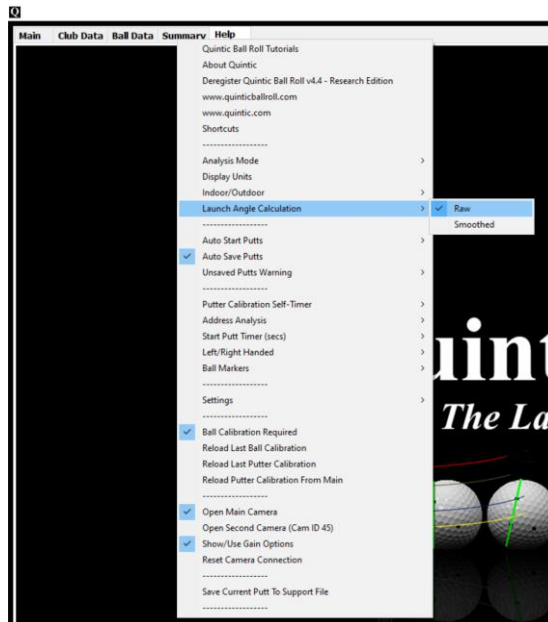
Live Video Capture: Indoor Mode Live Video Display - 719.85 fps Camera Calibration: -0.19°

Face Angle Lie Angle Shaft Angle Attack Angle Low Point Club Twist

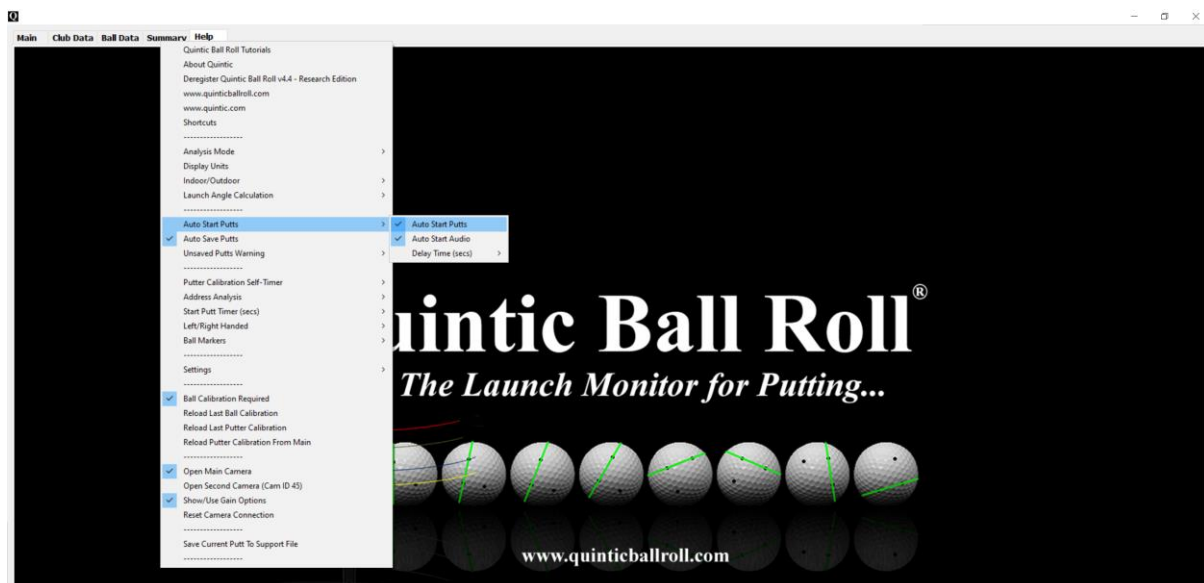
Gain Boost Option selected. Notice the increase in image brightness. Using this option enables the user to keep the exposure shorter (0.300ms) is an optimal number for Quintic Ball Roll.



- Raw Launch Angle Calculation – Effects the launch angle value within the Ball Data Tab. Raw or Smooth. The default setting is ‘Raw’.

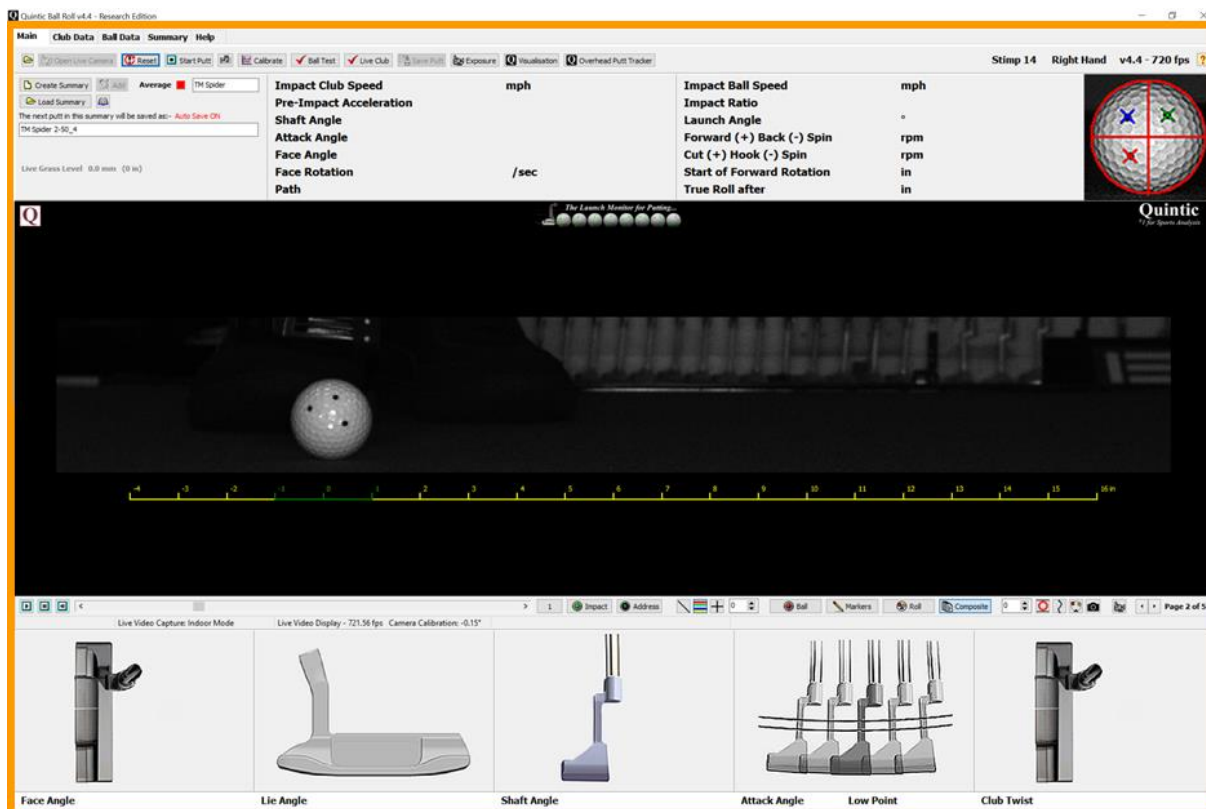


- Auto-Save Putts – Turning this on removes the need to manually add each putt into the session manually.
- Set Putter Calibration Self-Timer – Allows you to add a delay before the putter calibration is taken, this is often used when performing any analysis on your own.
- Address Analysis – This software records the position of the putter, it is constantly updating the angle (just as LIVE Club). The Address values are taken the moment the club initiate the backswing.
- The putter can be introduced after Start Putt has been pressed, or if using Auto Start / Identify ball, after the software has identified the ball and ready for impact detection. Select Auto Start Putt from the Help menu along with the delay time.

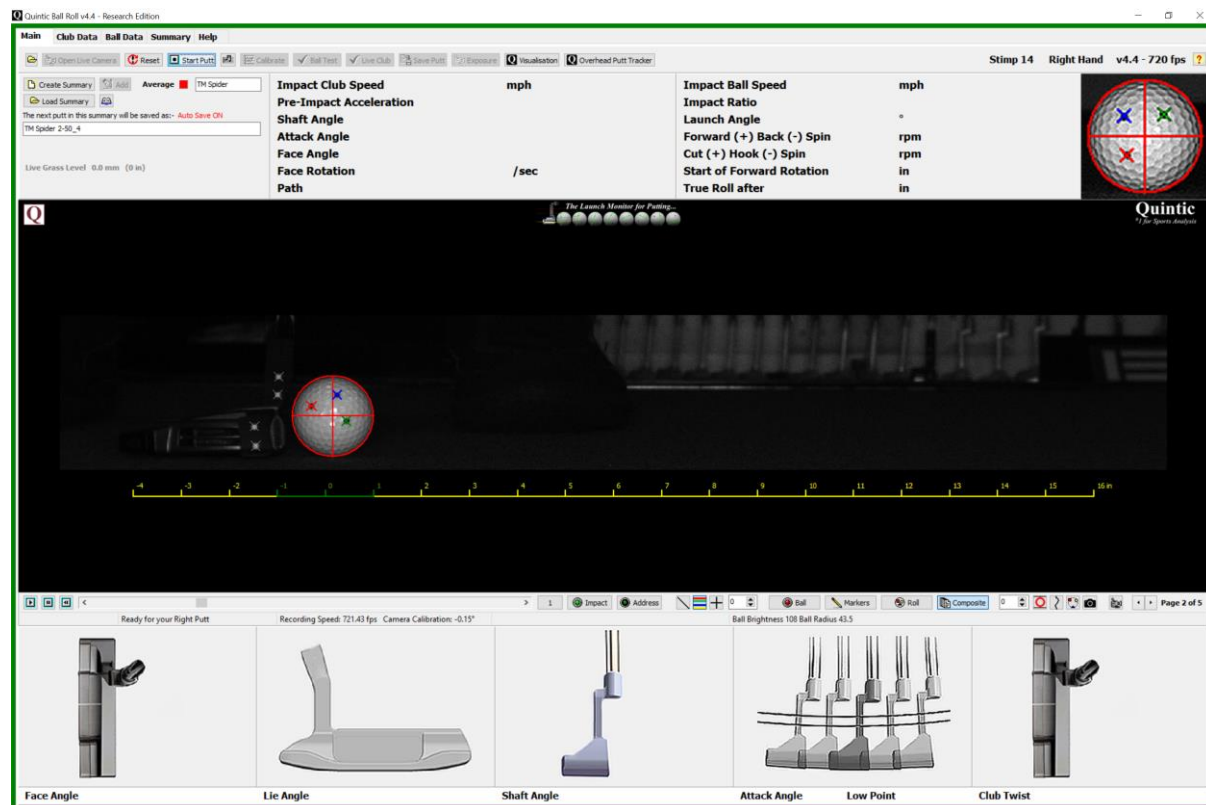


# Quintic Ball Roll®

The Launch Monitor for Putting...



The Quintic software has identified the golf ball correctly (position, markers, brightness and location). The orange border will remain for the duration of the 'Delay Time' set in the Help Menu. Once the time has expired, the border will go green enabling the putt to be taken. There is also an option for an audio beep to indicate the putt may be taken.

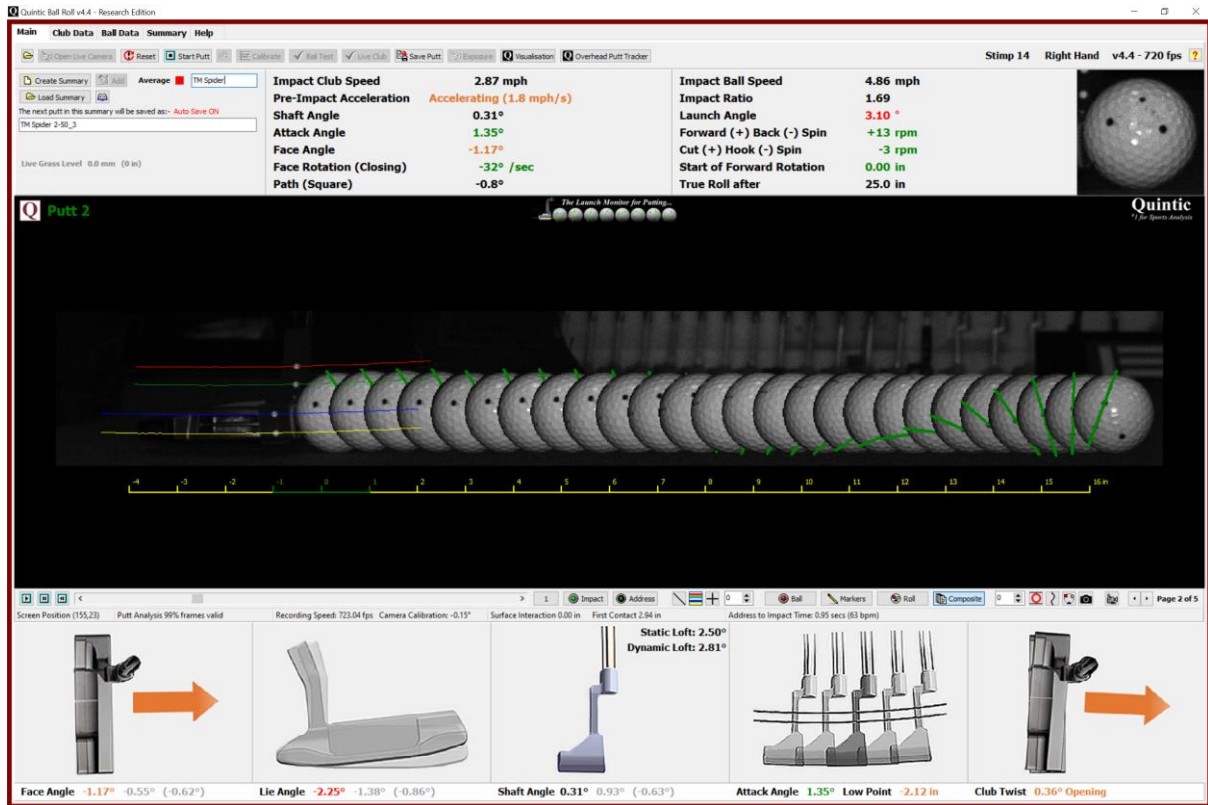


Green border = Quintic software ready for putt

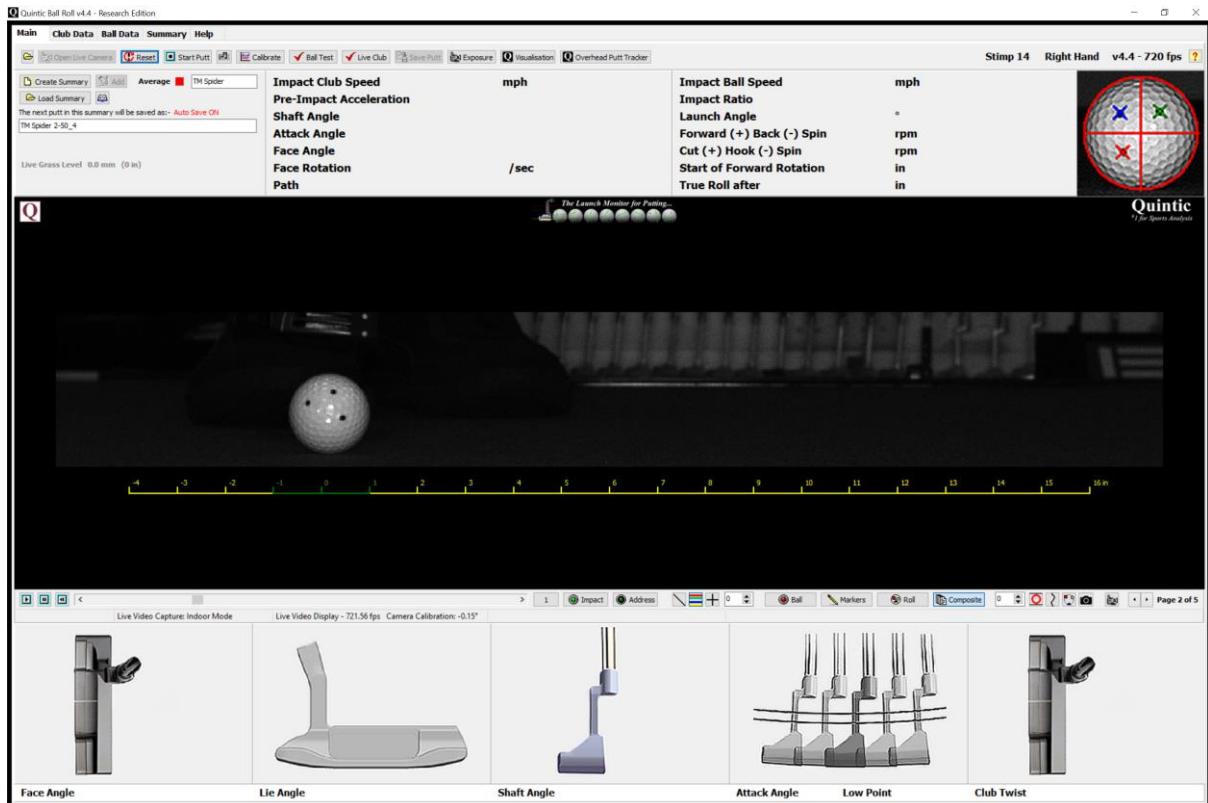


# Quintic Ball Roll

The Launch Monitor for Putting...



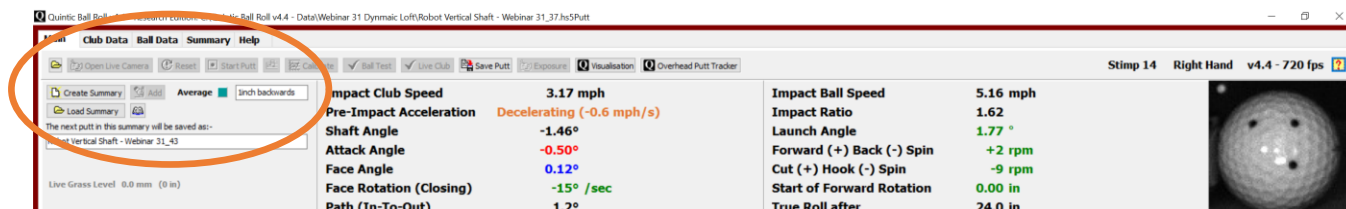
Red border = No ball detected or the software still processing the previous putt



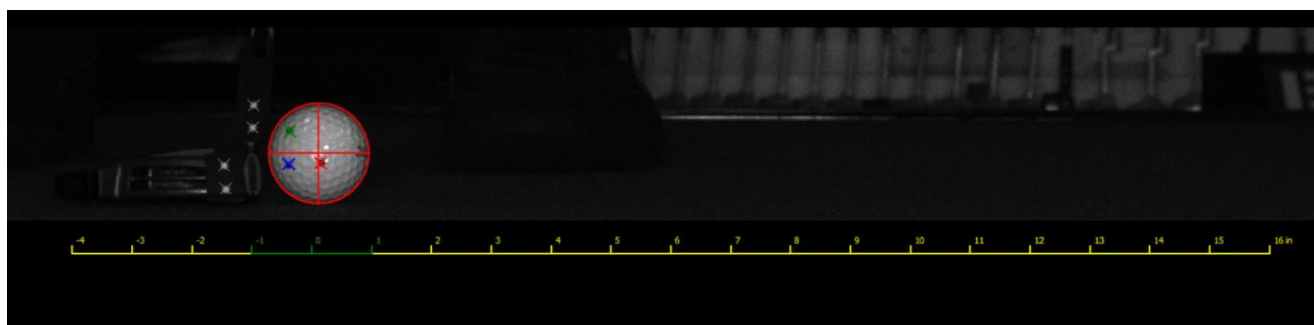
Black Border – The software is not looking for the ball. You will require a manual Start Putt.



Please note to use Auto Start effectively, it is recommended to create a summary and have Auto Save turned on!



➤ Set Address Timer – This adds a selected delay between the clicking of ‘Start Putt’ and when the address image is taken. Address values are taken the moment the club initiates the backswing. Once Start Putt has been activated, notice the four grey crosses tracking the movement of the putter. The player may fidget the putter whilst getting comfortable. It doesn’t matter if the start putt has been activated before the putter is in the video image.



➤ Left/Right Handed - Please select the correct mode before starting to gather data. If changing modes, the software will shut down and reopen in the new mode.



➤ Colour Coding – The user has the ability to select which variables are colour-coded within the software – this allows players/coaches to focus on certain variables without getting distracted by ones you're not currently working on. Click on HELP, Settings, Colour Coding.

Impact Club Speed	3.13 mph	Impact Ball Speed	5.21 mph
Pre-Impact Acceleration	Accelerating (1.8 mph/s)	Impact Ratio	1.67
Shaft Angle	0.38°	Launch Angle	0.63 °
Attack Angle	0.88°	Forward (+) Back (-) Spin	+34 rpm
Face Angle	0.11°	Cut (+) Hook (-) Spin	-2 rpm
Face Rotation (Closing)	-25° /sec	Start of Forward Rotation	0.00 in
Path (Square)	0.0°	Zero Skid after	25.0 in

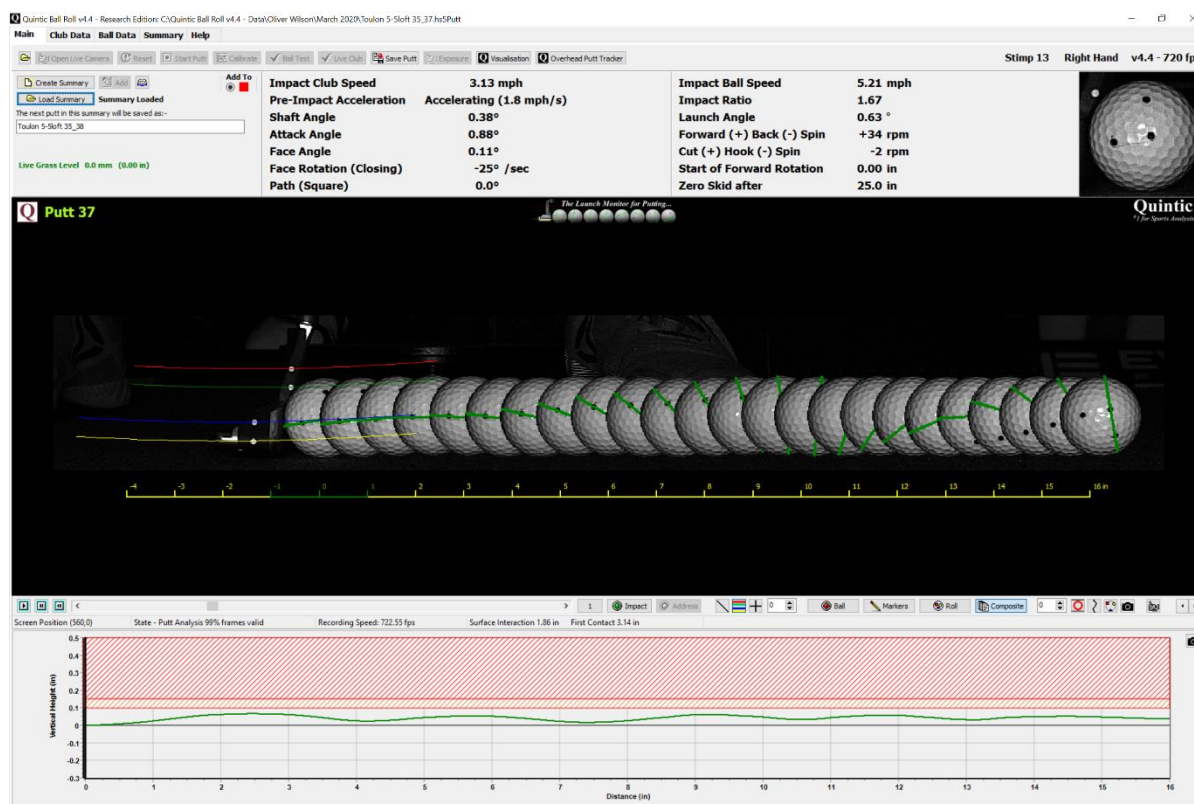
**Quintic Ball Roll** [X]

### Colour Coding

- Attack Angle
- Club Acceleration
- Club Twist
- Face Angle
- Face Rotation
- Forward Rotation
- Forward/Back Spin
- Impact Ball Speed \*
- Impact Club Speed \*
- Impact Ratio \*
- Launch Angle
- Launch/Flight Angle Difference
- Lie Angle
- Low Point
- Path at Impact
- Shaft Angle \*
- Side Spin
- Zero Skid (ins) \*
- Zero Skid (secs) \*

\* Variable colour coded for Summary Range ONLY

The image below is with all the colour coding unticked

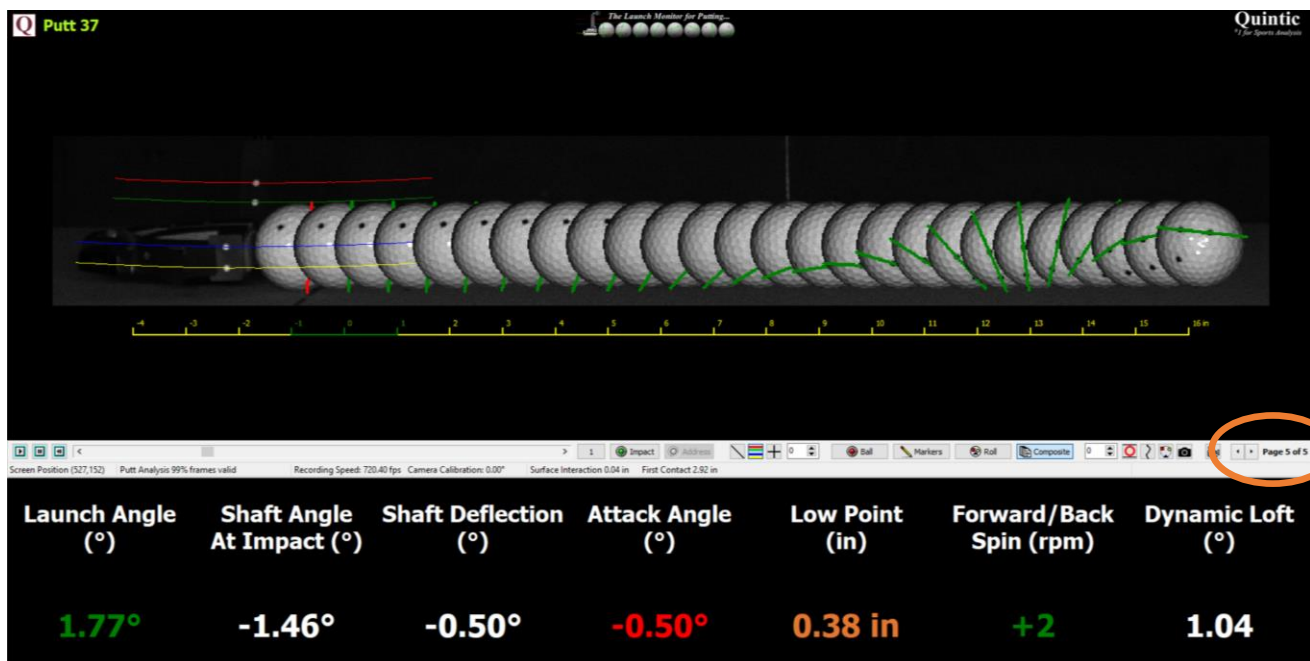
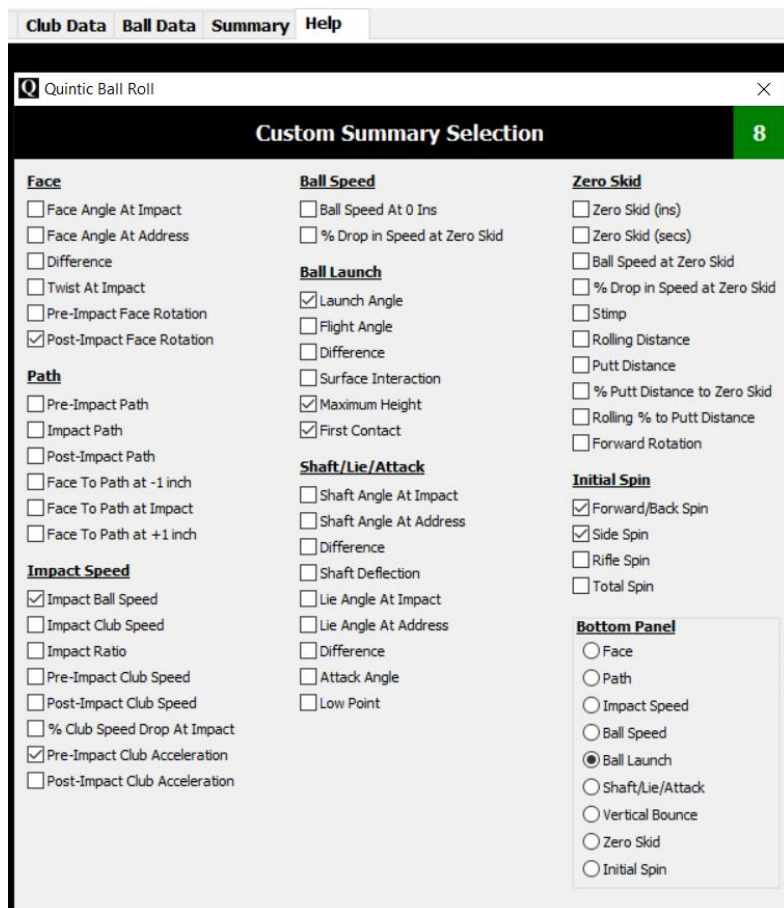




➤ Custom Summary Selection: The user has the ability to select which variables are displayed in the CUSTOM Summary tab – allows players/coaches to focus on certain variables without getting distracted by ones you're not currently working on.

➤ HELP, Settings, Custom Summary. Maximum of 12 variables can be displayed.

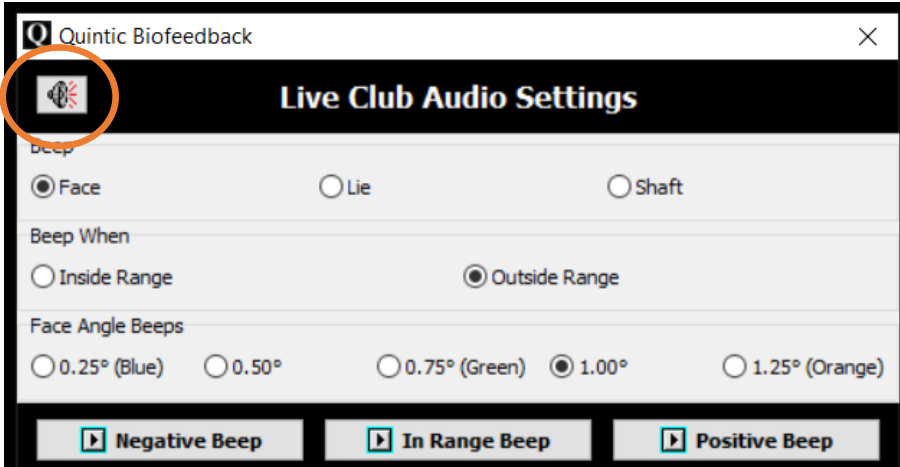
The data selected in the Custom Summary Selection is also displayed on the Main Tab (use the two arrows to slide the appropriate page and display the selected custom variables)



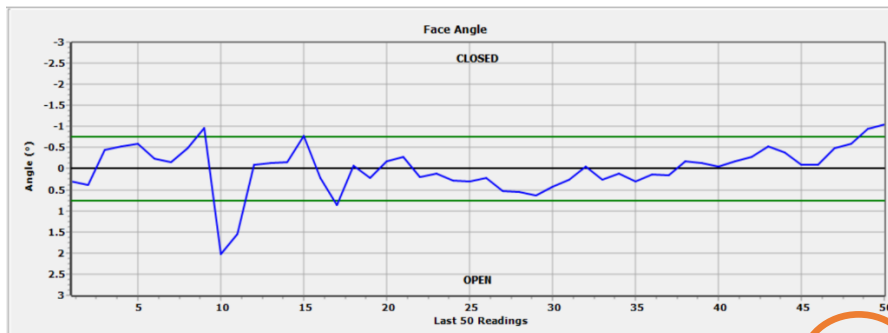
Custom selection can be viewed on Page 5 of 5



➤ Live Club feature – Ability to display LIVE FACE, LIE or SHAFT data for a putter held in address position – great for practising face aim and address position. The user has the ability to select audio Biofeedback – i.e. the software will “beep” when the club is inside/outside a chosen face, lie or shaft angle range). Click on Help, Settings, Live Biofeedback – Audio Settings. The speak button will turn On/Off the audio beeps / biofeedback.



Live Club Data		
FACE	LIE	SHAFT
-0.38°	-0.99°	-3.66°
-1.04°	-1.70°	-1.27°
-0.07°	-1.84°	-1.62°
0.00°	-1.82°	-1.35°



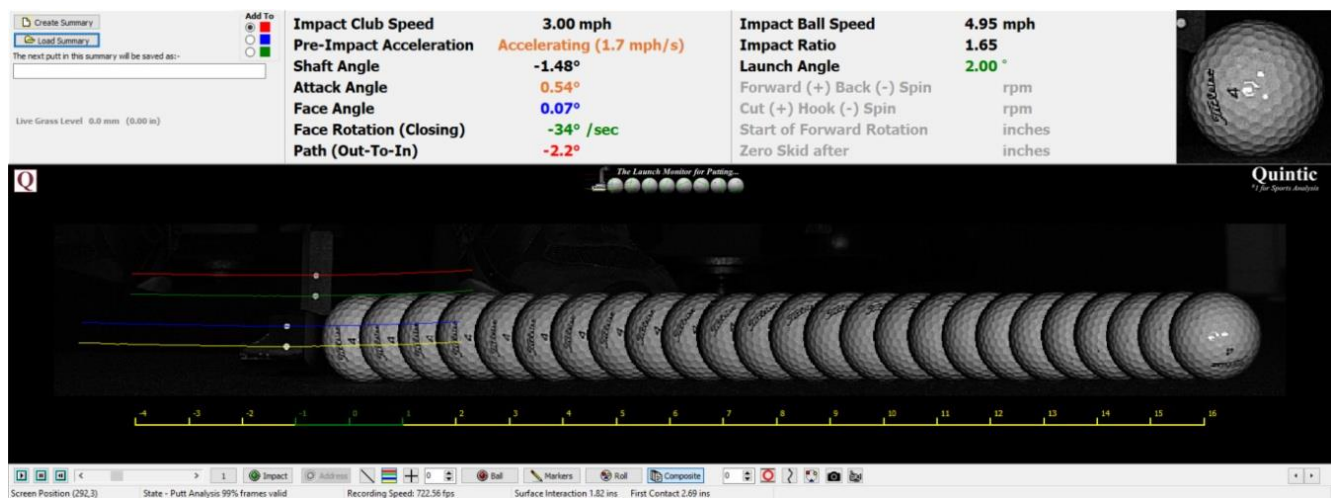
Live Club Settings: Face Outside Range 0.75° (Green)

➤ Angle button will load the Live Club Graph, this is constantly updating from one of the three LIVE Club angles (face, lie or shaft). The Pen button will manually add data to the Angles Table. This is a nice feature to use with the audio turned off. Ask the player to get into Address, click Add and see the readings.

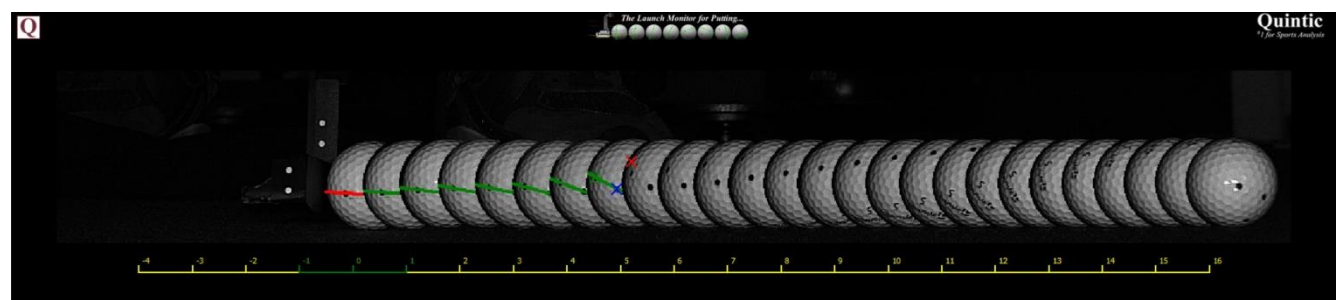


➤ Ball Markers - Track Ball Markers On / OFF No Ball Spin / Rotation / Zero Skid

This is particularly useful when Outdoors with no LED light. Quick, simple set-up. See example data collected with no ball markers.

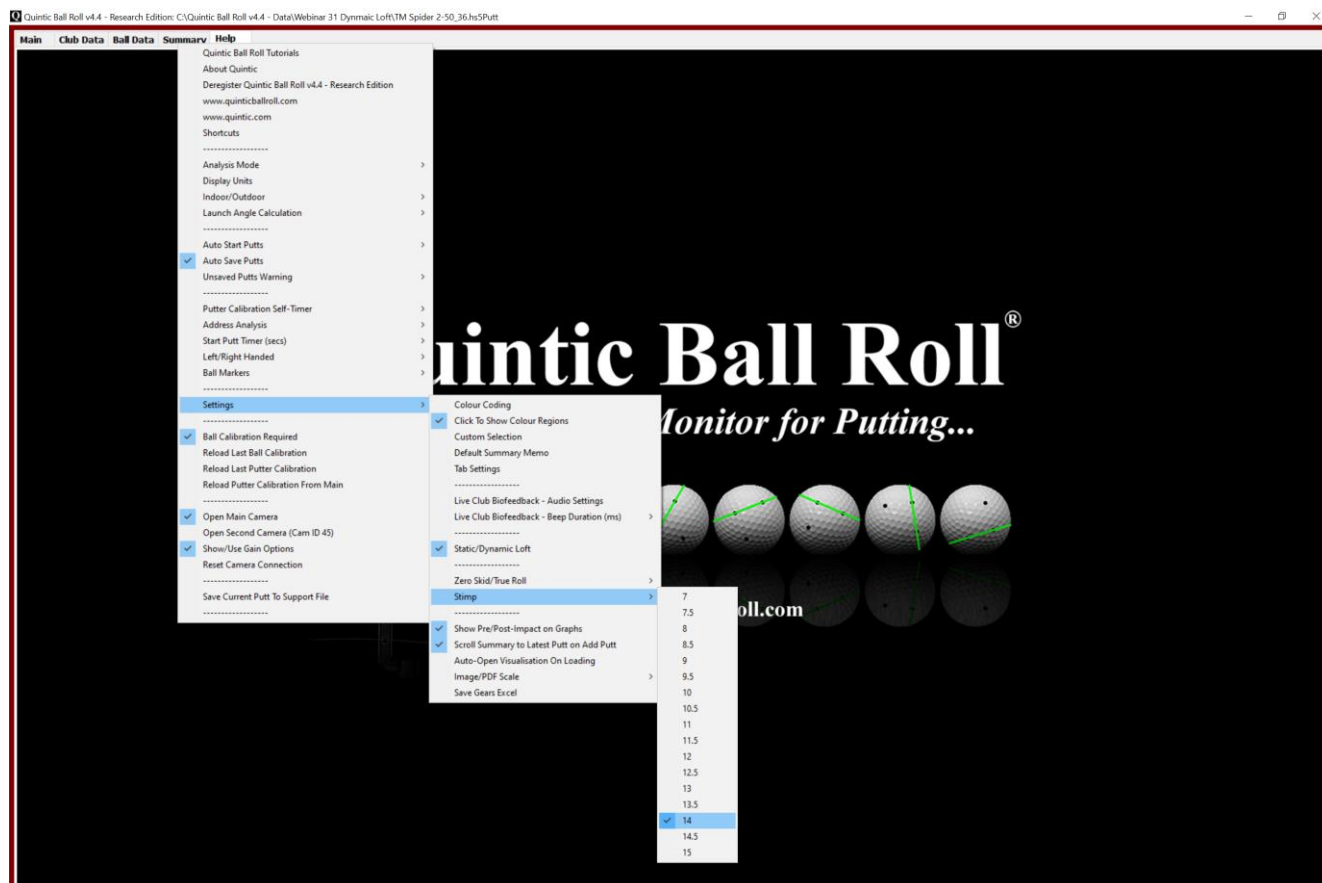


➤ Ball Markers - SPIN OUT - Stop Tracking or Track to End. If one or more of the three black dots are lost during the movement of the putt, the software will stop tracking, or continue to track to the end (continuing with Ball Speed and Vertical bounce data)





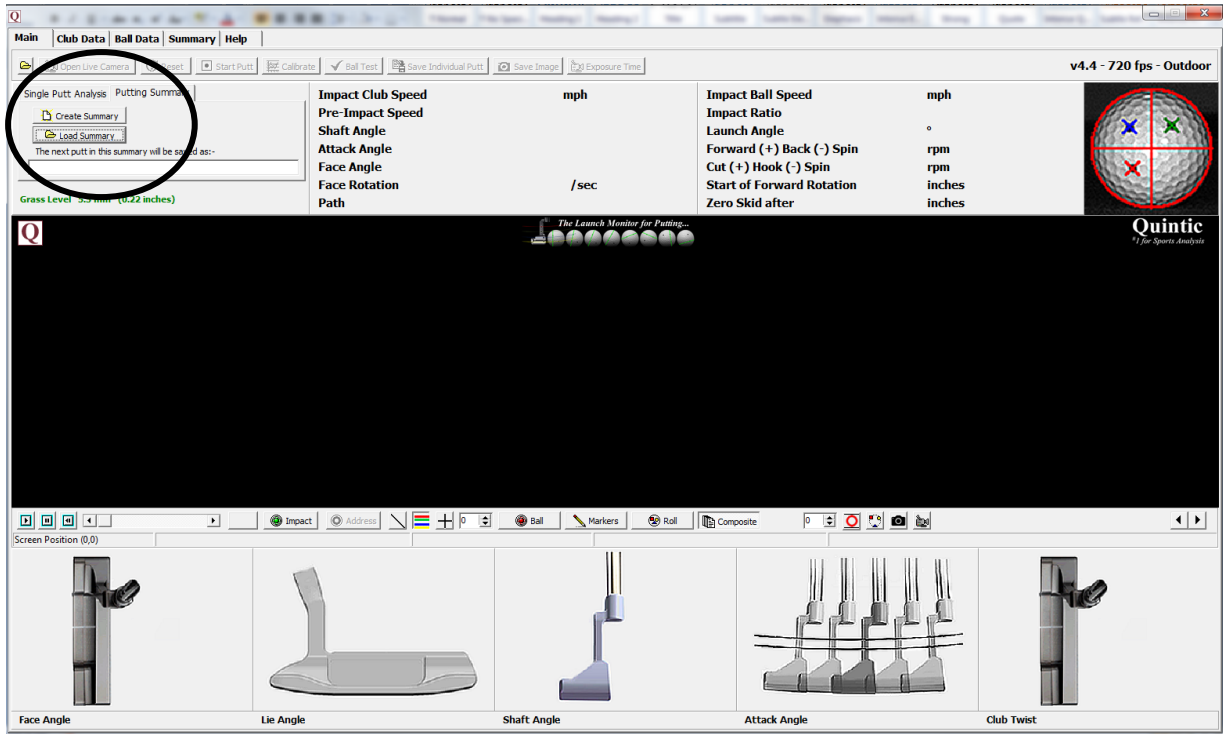
- Choice of Stimp resulting in new data for “Rolling Distance,” “Putt Distance,” “Sliding % of Putt Distance” and Rolling “% of Putt Distance” (Included on Ball Speed page and in Summary). Click on Help, Settings, Stimp and select your stimp value for the surface you are using.



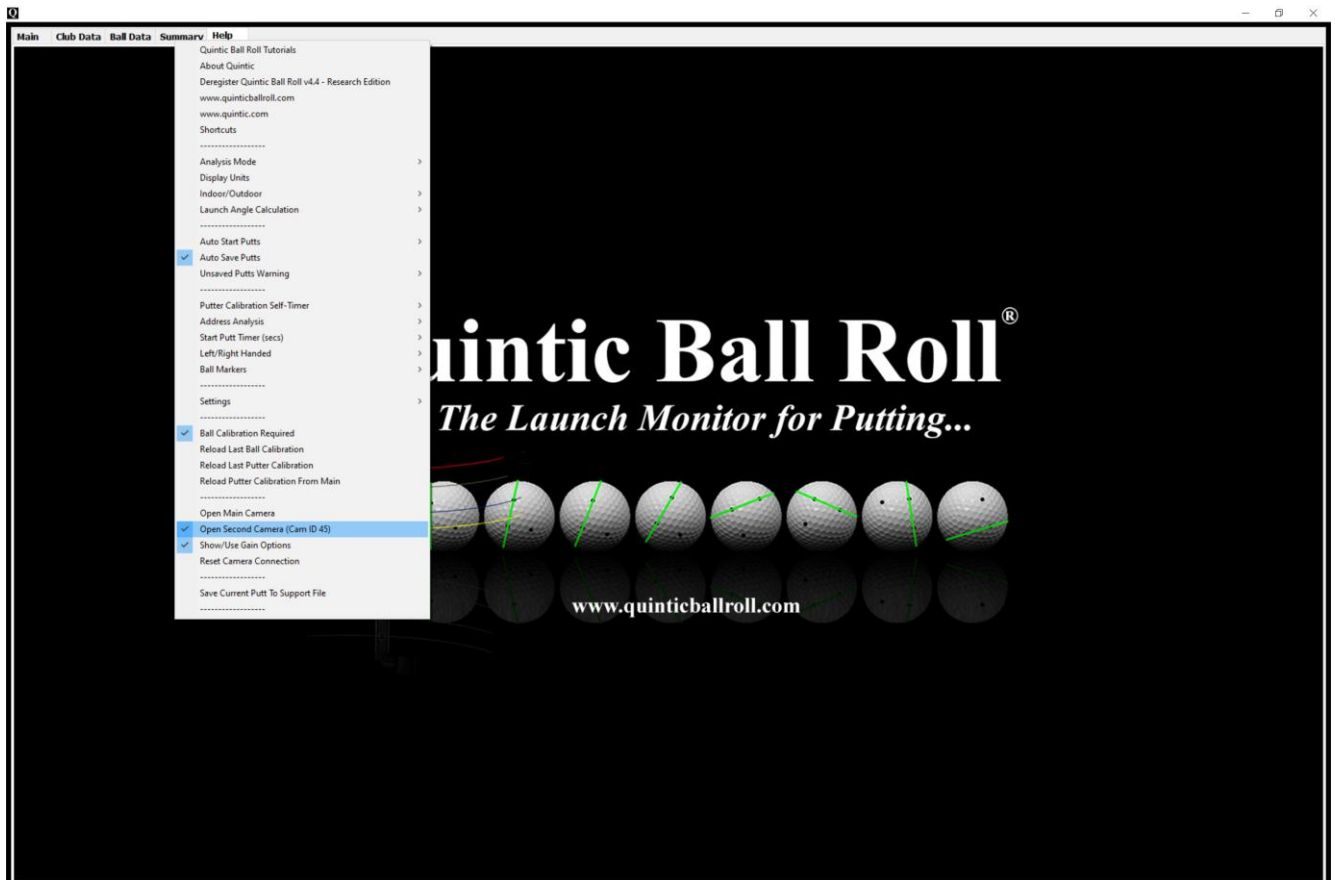
- **Reload Last Ball Calibration** – This loads the last used ball calibration, removing the need to perform another. We would only recommend using this if you are certain that the camera hasn't moved. However, if you need to shut down Quintic for some reason, then the Reload Last Ball Calibration is a new addition, you can be up and running very quickly.
- **Reload Last Putter Calibration** – This loads the last used putter calibration, removing the need to perform another. We would only recommend using this if you are certain you are using the same putter and the same set up. However, if you need to shut down Quintic for some reason, then the Reload Last Putter Calibration is a new addition, you can be up and running very quickly.
- **Reset Camera Connection** – Can be used to re-open the camera in the case that any camera related error occurs.
- **Create / Load Summary** – It is also possible to reload a 'session folder'. Please check you are in the correct mode in order to see previously saved putts. For example, you can't be in v4.4 720 fps and see putts previously saved in v3.4 mode. You would need to change mode (via Help).

# Quintic Ball Roll®

The Launch Monitor for Putting...



- Ability to “Use Second Camera” CAM ID 45 so you can have a left and a right-hand camera plugged in at the same time and choose which one to use. Option to purchase second light if required.

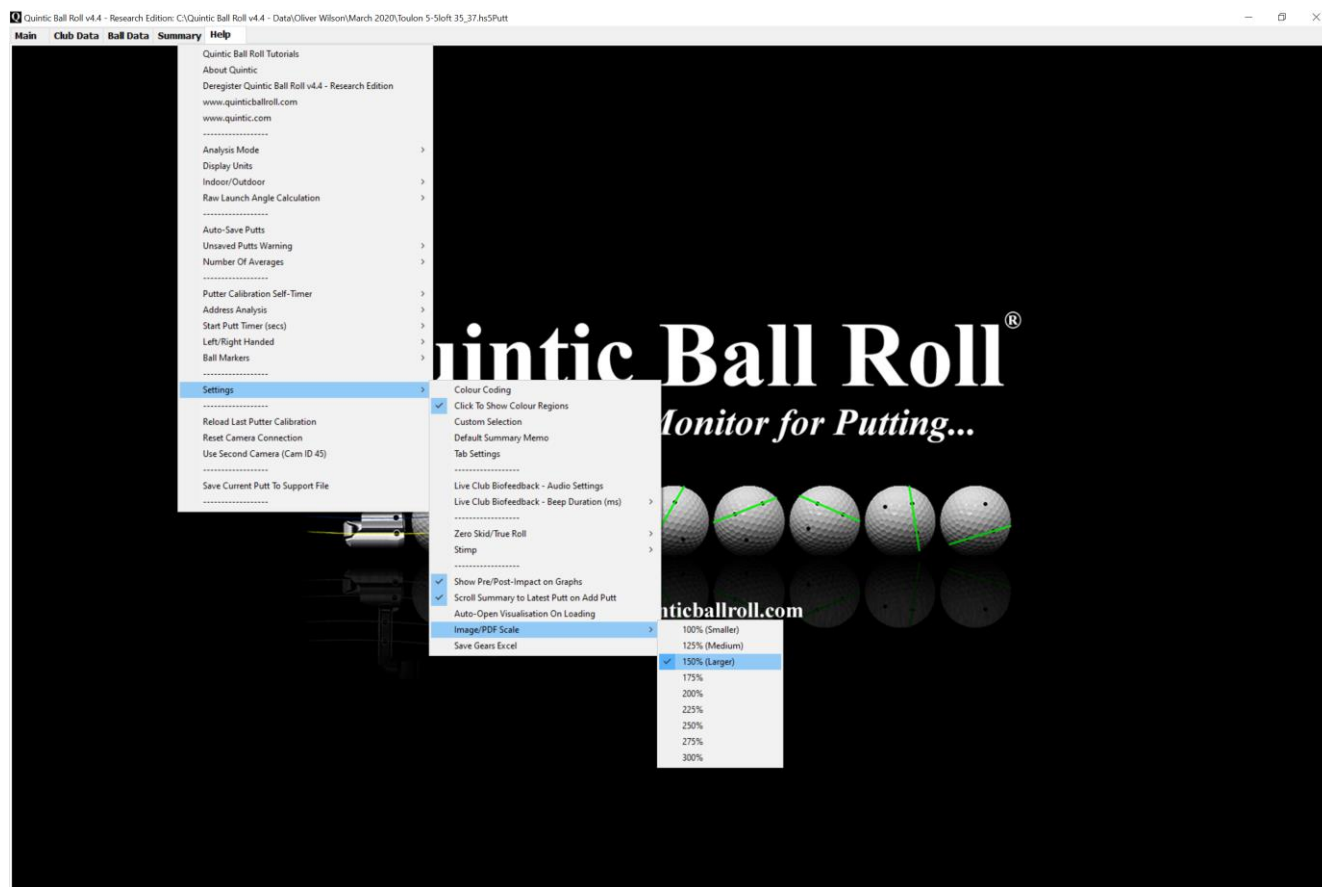








- **Advanced Settings – Image / PDF Scale** – It is possible to adjust if your monitor is set to a zoom level other than 100% and the PDF / screenshots are not saving the correct area of the window. Display settings can be adjusted via the Control Panel



- **Save Current Putt to Support File** – if you have any particular issues with a putt you would like to discuss with Quintic, or even share a putt with another Quintic Ball Roll user, clicking this option will create a zip file of the current putt in the Main window. It is then possible to email the zip file.