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TRACKMAN'S TEN FUNDAMENTALS

TrackMan technology has been impacting the golf industry for more than 6 years. From R&D, to club fitting, to instruction and practice, TrackMan has improved the way the golf industry develops equipment, evaluates technique, and measures performance - all benefitting how golfers play the game.

During this time, TrackMan with its own research and technology has sought to not only measure the golf swing and the resulting ball flight, but to shed light on some of the mysteries of golf as well: more precisely, why the ball goes where it goes. Backed by cutting-edge analytics, TrackMan has been able to discover, confirm, and/or quantify several fundamental principles about golf.

TrackMan has now launched a campaign called "TrackMan's Ten Fundamentals." The ultimate purpose is to help the golfing population understand why the ball does what it does. This newsletter article is just the start. We will be continuously refining and expanding on each of our Ten Fundamentals in future newsletters, industry publications, events, and other appropriate venues.

We want this to be a collaborative process, with key players in the industry, including you, the reader of this newsletter, providing feedback.

Without further ado, here we present the Fundamentals for the first time in a raw technical form. Note: It may be helpful to refer to the Glossary at the end of the article as you read it.

1

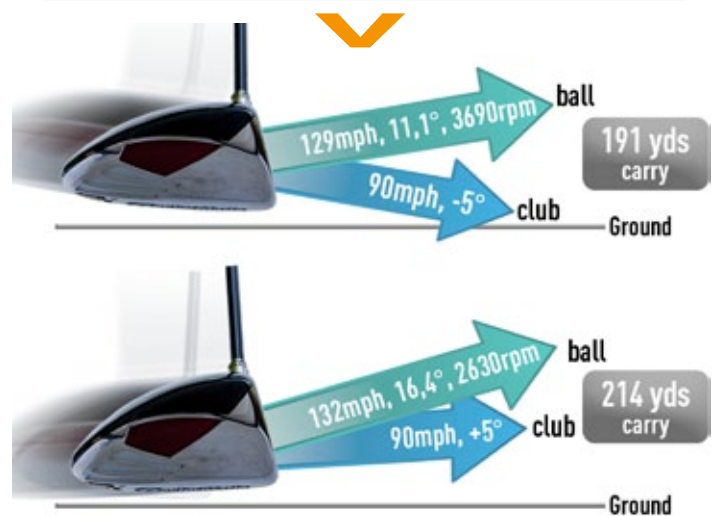
Maximizing Distance

The optimal combination of ball speed, launch angle, and spin rate needed to maximize driving distance for a particular golfer are primarily dictated by the golfer's club speed and attack angle.

a) The reason has to do with a tradeoff between ball speed, launch angle, and spin rate. Distance is maximized with a high ball speed, high launch angle, and low spin rate – however, increasing launch angle by increasing the dynamic loft has the side-effect of increasing spin rate and decreasing ball speed. So, a tradeoff must be made, and the optimal tradeoff depends on how an individual delivers the club to the ball. Maximizing ball speed also implies making center impact – or at least close to center impact – as well squaring up club path and face angle.

b) TrackMan helps pinpoint the tradeoff because it precisely measures club speed and attack angle for all golfers. This information can be used to determine the optimal launch conditions for a particular golfer, which again, can be validated by TrackMan since it also measures ball speed, launch angle, and spin rate, along with carry to validate the end result.

c) As an example, someone with a club speed of 90 mph and an attack angle of -5 degrees would maximize carry distance with a ball speed of 129 mph, launch angle of 11.1 degrees, and spin rate of 3690 rpm. Meanwhile, someone else with the same club speed of 90 mph, but an attack angle of +5 degrees would maximize carry distance with a ball speed of 132 mph, launch angle of 16.4 degrees, and spin rate of 2630 rpm. Note in this example, the golfer who hit up on the ball would end up with more carry: 214 versus 191 yards.



Launch conditions to maximize distance

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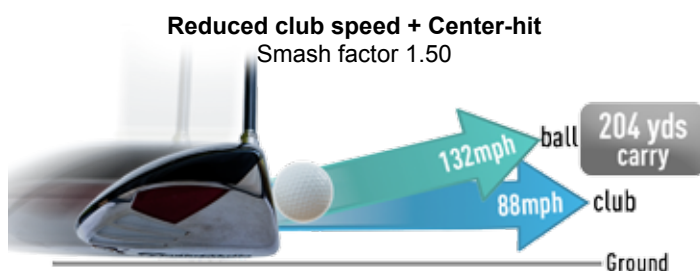
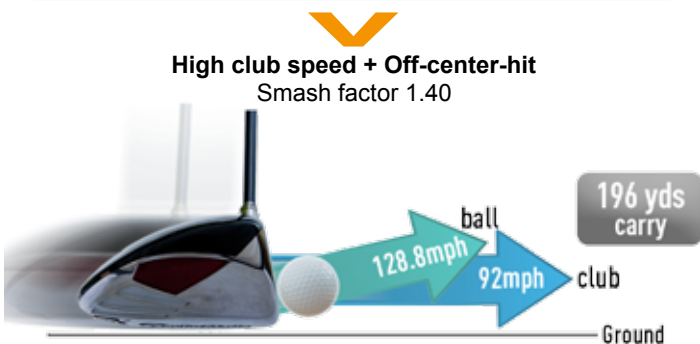
TRACKMAN'S TEN FUNDAMENTALS

2

Smash Factor

Generally speaking, to maximize ball speed it is more important to improve centeredness of impact than to increase club speed.

- a) An off-center impact is less efficient in transferring energy from the club to the ball, thus some of the power of the club speed is lost, resulting in a lower initial ball speed and consequently less carry distance.
- b) TrackMan can help by reporting smash factor, which correlates highly with impact. Smash factor describes the efficiency of impact and equals the ratio ball speed divided by club speed. Note that in addition to impact, the spin loft and club and ball properties also affect smash factor.
- c) This is important because it is common for amateurs to "over-swing". While over-swinging might increase club speed, it may negatively affect centeredness of impact, and net out in decreased ball speed, resulting in reduced carry distance.
- d) As an example, assume someone with a club speed of 90 mph and smash factor of 1.45 can drive a ball so it has a carry of 200 yards. Increasing the club speed to 92 mph but reducing smash factor to 1.40 due to off center hit would result in a new carry of only 196 yards. Instead of increasing the club speed, the golfer could lower the club speed to 88 mph in order to swing under control and increase his or her impact, thereby increasing the smash factor to 1.50 resulting in a carry of 204 yards.
- e) TrackMan has seen that for drives, golfers should attempt to achieve a smash factor of 1.47 or higher.

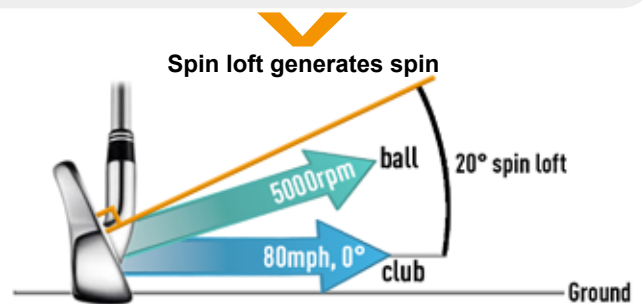


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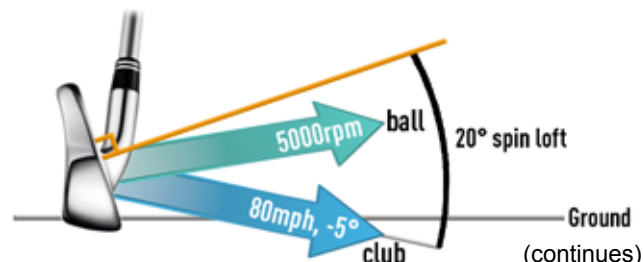
Spin Rate

Spin rate is generated primarily by spin loft and club speed; additionally, impact position and friction between the club and the ball (subject to a threshold) affect the amount of spin.

- a) In general, a club with more loft generates more spin, up to the point where there is not enough friction to achieve "grip on the ball."
- b) For iron shots, TrackMan has seen that **spin loft** (the difference between angle of attack and dynamic loft; $SPIN\ LOFT = DYNAMIC\ LOFT - ANGLE\ OF\ ATTACK$) remains virtually constant for a particular golfer, given club loft and club speed, no matter what the attack angle is. This means the myth that "hitting down on the ball creates more spin" is not true. For example, Moving the ball back in the stance generally creates a more negative attack angle, but the dynamic loft will be offset by a similar amount, resulting in an unchanged spin loft and thereby unchanged spin rate.
- c) When impact is below center on the club face, more spin is generated, all else equal. Conversely, when impact is above center, less spin is generated, all else equal. This effect is pronounced on clubs where the center of gravity is significant behind the club face such as on drivers, woods and hybrids.
- d) Reducing the friction below a certain threshold also reduces the spin rate. For example, if there is grass and/or water between the ball and the club, friction will be reduced, and a low spin "flier" is a likely result.



Decreasing attack angle & dynamic loft - same spinrate



TRACKMAN'S TEN FUNDAMENTALS

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Launch Angle

Dynamic loft will have a greater influence than attack angle in determining the launch angle of a shot.

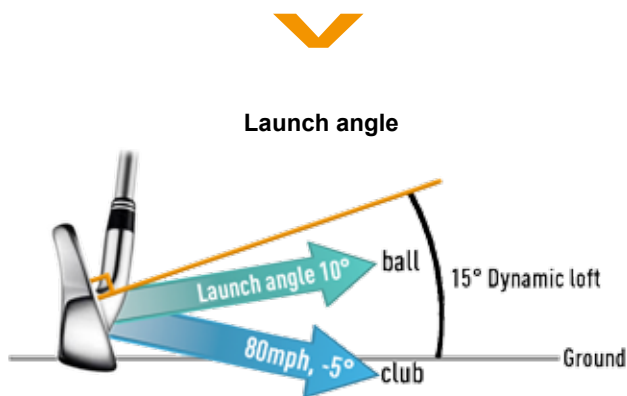
a) The initial launch angle of the ball always falls between the dynamic loft and attack angle at impact.

b) TrackMan data has shown for drivers, that dynamic loft normally accounts for about 85% of the launch angle, while attack angle accounts for the remaining 15%. For irons, the ratio is around 75% dynamic loft and 25% attack angle.

For example, a 10° launch angle would result from a iron shot where the attack angle is -5 degrees and the Dynamic Loft is +15 degrees ($15 * 75\%$ plus $-5 * 25\%$ equals 10).

c) When friction between the club and ball is too low to get "grip on the ball," the launch angle will be even more weighted toward the dynamic loft. This explains why "fliers" carry more – they come out at a higher launch angle (based on this fundamental) and with lower spin (see fundamental #3).

d) Note that the static club loft together with attack angle primarily determines the dynamic loft, but the "lead/lag" of the shaft and the club head position relative to the hands (also described by the left arm/shaft angle) also play a role.



5

Launch Direction

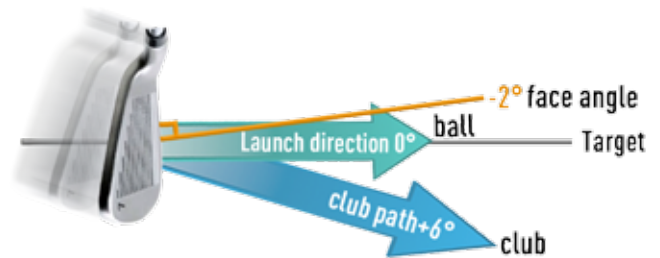
Face angle will have a greater influence than club path in determining the launch direction of the ball.

a) The initial launch direction of the ball always falls between the club path and face angle.

b) For drivers, TrackMan has discovered that face angle accounts for roughly 85% of the initial direction, and for irons face angle accounts for around 75% (club path accounts for the remaining 15% and 25%, respectively).

c) If a golfer wants to launch the ball in the direction of the target (zero launch direction), the player could either have both club path and face angle be zero, or the player could balance out the two so the net result is a zero launch direction. For example, a zero launch direction would result from a iron shot where the face angle is -2 degrees and the club path is +6 degrees (because: $-2 * 75\%$ plus $+6 * 25\%$ equals 0).

Launch direction



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TRACKMAN'S TEN FUNDAMENTALS

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Club Path

To create a zero club path, the appropriate swing direction will depend on the golfer's attack angle.

a) If the golfer hits up on the ball (driver), the swing direction must be in-to-out to generate a zero club path. If the golfer hits down (iron) on the ball, the swing direction must be out-to-in to generate a zero club path.

For example If a right handed golfer hits up on the ball, the swing (plane) direction must be positive (to the right) to generate a zero club path. If the right handed golfer hits down on the ball, the swing (plane) direction must be negative (to the left) to generate a zero club path.

b) The magnitude of in-to-out/out-to-in needed to compensate for the attack angle depends on the (vertical) steepness of the swing plane.

c) Example For an iron shot with a swing plane of 60 deg (typical for 6-7 iron) and an attack angle of -5 deg (close to PGA TOUR average for 7 iron), the swing direction needs to be -2.5 deg (outside-in) in order to zero the club path. For a driver shot with a swing plane of 45 deg (typical for most golfers) and with a positive attack angle of +5.0 deg, the swing direction needs to be +5.0 deg (inside-out) in order to zero the club path. So when you hit your irons downwards as you should, and hit upwards with your driver to maximize distance (fundamental #1) you need two different swing directions: outside-in for irons and inside-out for Driver.



Zeroing club path

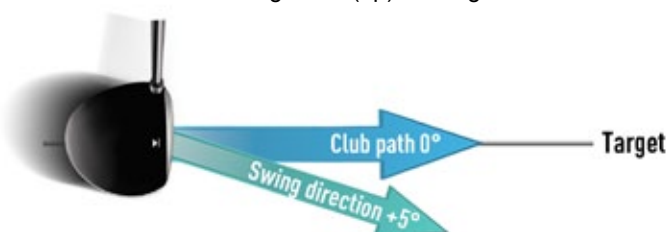
Iron

Attack Angle - 5° (down) - Swing Plane 60°



Driver

Attack Angle +5° (up) - Swing Plane 45°



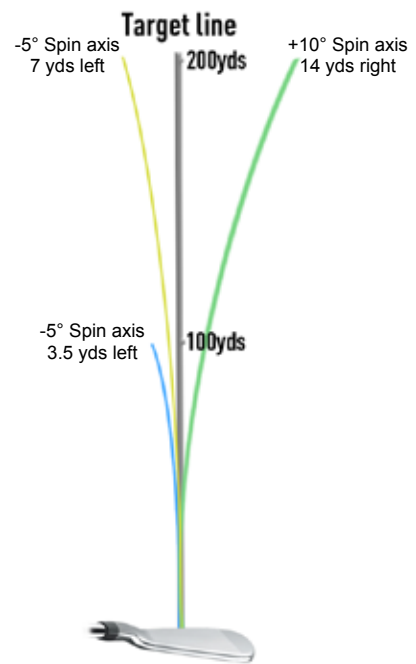
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Spin Axis I

The curvature of a shot is directly related to the tilt of the ball's spin axis. There is physically no such thing as "side spin" – the golf ball rotates around one single spin axis.

a) For every 5 degrees of tilt in spin axis the ball will curve approximately 3.5 yards to the side per every 100 yards of carry.

b) For a right handed golfer, if the spin axis is tilted to the right (positive), the ball will fade or slice. If the spin axis is tilted to the left (negative), the ball will draw or hook.



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TRACKMAN'S TEN FUNDAMENTALS

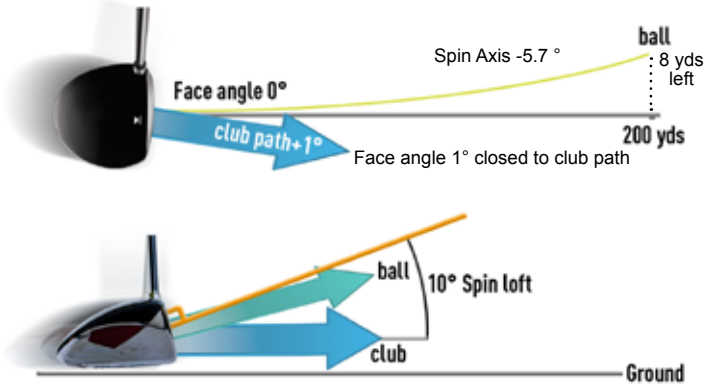
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Spin Axis II

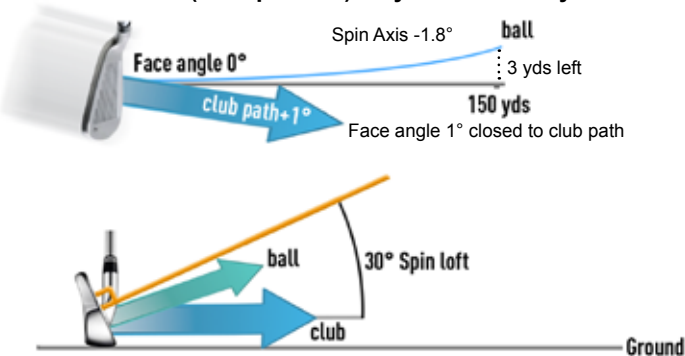
Ball spin axis is tilted by a difference between face angle and club path. A horizontal off-center impact (heel or toe) location will also tilt the spin axis for driver shots, and to a lesser degree for iron shots.

- a) If club face is open relative to the club path, the spin axis tilts positively resulting in a fading shot, while if the club face is closed relative to the club path, the spin axis tilts negatively resulting in a drawing shot.
- b) The larger the difference between face angle and club path, the more the spin axis will tilt. Furthermore, the smaller the spin loft (lower lofted clubs) the more the spin axis will tilt for a given difference between face angle and club path.
- c) Regarding centeredness of impact for driver shots: For right handed golfers, heel shots tilt the spin axis positively toward the right resulting in a fading shot, while toe shots tilt the spin axis negatively toward the left resulting in a drawing shot.
- d) For a center impact, if face angle equals club path, but these do not equal zero, the result will be a straight shot (zero spin axis tilt) off the target line (push or pull).

Driver (10° Spin Loft) - 8 yds left at 200 yds



7 Iron (30° Spin Loft) - 3 yds left at 150 yds



9

Straight Shot

There are 3 ways to strike the ball such that it travels in a straight line to the target; however, a shot with a zero degree club path, zero degree face angle, and center impact location is definitively the most effective.

- a) The three ways to achieve an on-target straight shot are:
 1. Zero club path, zero face angle, center impact
 2. Inside-out club path, closed face angle, heel impact
 3. Outside-in club path, open face angle, toe impact
- b) In shot types 2 and 3, the player must exactly counterbalance club path and face angle to make launch direction zero (see fundamental #5), while simultaneously hitting it in the exact right part of the heel/toe, to counterbalance the spin axis tilt to level. This is tough to do intentionally.
- c) Type 1 – zero club path, zero face angle, center impact – generates the most ball speed (smash factor) and carry, thus is the most efficient.

Three Ways to Hit a Straight Shot

	Method 1 ("Classic")	Method 2	Method 3
Club path	0 deg	Positive (inside-out)	Negative (outside-in)
Face Angle	0 deg	Negative (closed)	Positive (open)
Impact Location	Center	Towards Heel	Towards Toe
Carry Distance	Longest	Shortest	Short

Assumption: Right Handed Golfer

In Methods 2 and 3, player must exactly balance out:
 >Club Path and Face Angle to launch the ball on the target line
 >Impact location to counter-act draw/fade caused by delta in club path and face angle

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TRACKMAN'S TEN FUNDAMENTALS

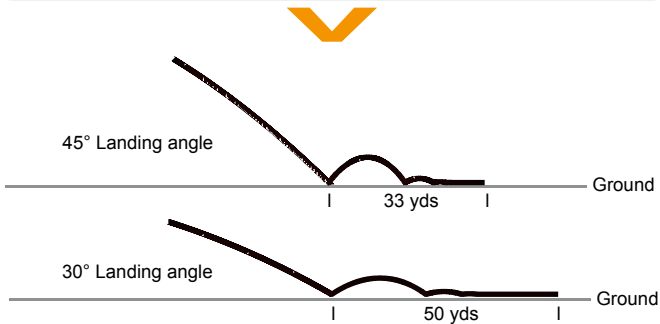
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Bounce & Roll

For given turf conditions, bounce and roll is primarily determined by landing ball speed, landing angle, and landing spin rate; however, TrackMan has found landing ball speed to be relatively consistent for all full shots.

a) Thus, to control bounce and roll, the golfer should focus on landing angle and landing spin rate. Landing angle and landing spin rate are determined primarily by the initial launch angle and initial spin rate.

b) For a normal dry fairway a drive will bounce and roll 33 yds at a landing angle of 45° , whereas at a landing angle of 30° the bounce and roll is increased to 50 yds.



TRACKMAN GLOSSARY

TrackMan users will notice that a few of the data parameters measured by TrackMan and listed below have slightly different names. The name changes, some requested by TrackMan users, were initiated with the primary objective of making the comprehension and use of the TrackMan data more intuitive for our customers and their clients.

We are aware that the name changes may require a re-education for some users, their staffs, and clients – we apologize for this inconvenience. For those who may see this as an inconvenience, we hope in short order the changes will be understood as an improvement for all concerned. Future software from TrackMan will use the new glossary terms as listed below.

Club speed: the speed of the center of the clubface at impact (first contact with the ball)

Attack angle: the vertical (up-down) angle at which the club head is moving at impact. Positive means hitting up on the ball, while negative means hitting down on the ball

Club path: the horizontal (left-right) angle at which the club head is moving at impact. Positive means to the right (inside-out for a right hand golfer), negative means to the left (outside-in for a right hand golfer)

Dynamic loft: the loft (angle) of the part of the club that makes impact with and influences initial direction of the ball, relative to vertical (vertical = zero degrees)

Face angle: the angle of the part of the club that makes impact with and influences initial direction of the ball, relative to the target line (left-right). Positive means to the right (open relative to target for right hand player), negative means to the left (closed relative to target for right hand player)

Spin loft: the difference between dynamic loft and attack angle. The spin loft is related to the static loft of the club, however shaft flex and hands leading or lagging the clubhead will alter this.

Swing plane (formerly vertical swing plane): a measure of how vertical the swing is, where a high value represents a very up and down (steep) swing plane and a low value a relatively flat (to the ground) arc. More technically, it is the angle made between the ground and the plane of club head trajectory at the bottom of the swing arc

Swing direction (formerly horizontal swing plane): the orientation of the swing arc, relative to the target line, where positive means to the right, negative means to the left. More technically, it is the horizontal direction the club head is traveling in at the bottom of the swing arc

Ball speed: the ball's initial velocity

Smash factor: the ratio 'ball speed divided by club speed', which describes the efficiency of impact. Note that the smash factor depends on the spin loft and impact location, where the lower the spin loft the higher the smash factor and the more centered the impact the higher the smash factor

Launch angle (formerly vertical launch angle): the ball's initial vertical angle relative to ground (horizon) level

Launch direction (formerly horizontal launch angle): the initial direction of the ball relative to target line. Positive means to the right, negative means to the left

Spin rate: how many times the ball rotates per minute when leaving the clubface. This is independent of the orientation of the spin axis. Note that the spin rate drops during ball flight - typically 4% for each second

Spin axis: as the ball spins around an axis, the measure of axial tilt. Positive means the axis is tilted to the right (thus resulting in a fade or slice for a right handed golfer), negative means the axis is tilted to the left (thus resulting in a draw or hook for a right handed golfer)

Height: the apex point of the ball flight, measured relative to the height of the starting/launch position of the ball

Carry: how far the ball travels in the air. The number reported is carry "flat," meaning how far the ball would carry if the ground were perfectly flat relative to where the ball was launched from

Side: how far off-line the ball lands relative to the target line (right or left carry). Similar to carry, this is side "flat," meaning how far the ball would land off-target if the ground were perfectly flat relative to where the ball was launched from

Total: the sum of measured carry "flat" distance plus calculated bounce and roll. The calculated bounce and roll model depends on three parameters measured by TrackMan: landing angle, landing spin rate, and landing speed

Side total: how far off-line the ball ends up, after calculated bounce and roll, relative to the target line (right or left). This is reported "flat," meaning how far the ball would end up off-line if the ground were perfectly flat relative to where the ball was launched from

Landing angle: descent angle of the ball as it lands (carry "flat" landing point), measured relative to ground level

Last data: distance at which TrackMan last recoded data. If the range is sloping upwards last data should be shorter than carry "flat," if the range is sloping downwards and the TrackMan radar has a line-of-sight to the landing area last data should be longer than carry "flat"

Hang time (formerly flight time): elapsed time from impact to carry "flat"

OPPORTUNITY: TRACKMAN GOES MAINSTREAM

Until now, TrackMan's industry-leading swing and shot analysis solutions have been enjoyed by just that, the industry. Sure, golfers at every level have taken advantage of TrackMan to get fitted and learn more about their game, but for the most part, they have done it under the watchful eye of a PGA Professional, college coach, or fitting expert. That is about to change!

TrackMan now introduces its first product geared to the general golfing public – TrackMan Range.

TrackMan Range is a user-friendly, stand-alone golf gaming and practice station created for golf facilities with a driving range. TrackMan Range is an entirely new and exciting way for golf facilities to attract more golfers and generate revenue! And, a completely new way for golfers to improve their game – on their own and at their own pace!

WOW!

- TrackMan Range is about to change the way golf facilities make more money and engage customers!

- TrackMan Range is going to change the way anyone that enjoys golf gets better!

TrackMan Range brings together the best in game improvement, instruction, and entertainment. Giving golfers and golf facilities alike the power and precision of TrackMan to enjoy and improve their game and business.

How it Works

TrackMan Range features a TrackMan radar unit and touch screen monitor permanently installed in a covered bay on the driving range and connected to the internet. Targets coordinated with the TrackMan radar are placed on the range at fixed distances. The TrackMan radar then precisely analyzes and records every shot golfers hit at the targets, with real time graphics and numerical results displayed on the touch screen monitor.

All playing sessions, stats, and images are uploaded in real-time to the user's profile on mytrackman.com. Later, the player can log on to mytrackman.com golf community to review, share, and compare sessions at their leisure. Here they can also set up monthly matches, contests, get golf improvement tips, and much, much more.



Screenshot: Live ball tracking



TrackMan Range on driving range at Smørum Golf Center, Denmark.

New Revenue Stream

Like any business, golf facilities are always looking for new ways to make more money while improving the client experience. While range ball sales might deliver a steady cash flow, there are not too many innovative marketing or business strategies a facility can use to create more wealth from its range. Not until now.

TrackMan Range makes a driving range stand out from the crowd. It gives golfers a new and powerful reason to visit your facility.

Golf facilities can install TrackMan Range and let it run itself. Administration of the system from player registration and payment to booking and usage are automated and managed online. All end-user/golfer account information and playing sessions are also updated and stored on mytrackman.com so tracking client use, managing events, marketing facility initiatives, and accounting are made simple.

Importantly, TrackMan Range enables facilities to decide how much to charge for system use based on multiple payment models, e.g., monthly subscriptions, pay per hour, corporate sponsorships, memberships, and more. Ranges can tailor their customer payment models specifically to match their clientele's needs.

Facilities can charge one monthly fee for unlimited use, or have peak or off peak prices. The TrackMan Range payment application is flexible to enable facilities to pinpoint what works best for them.

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OPPORTUNITY: TRACKMAN GOES MAINSTREAM

New Marketing Channels

The way the TrackMan Range is set up is a marketer's dream. Not only does it open up new marketing channels and advertising opportunities for facilities to take advantage of, it enables them to track usage and document the success of campaigns and promotions as well.

Golfers use the TrackMan Range for target practice, shot analysis, club comparison and distance control, as well to take part in matches and competitions. The very idea of participating in a tournament instantly drives social marketing and opens the door to innovative initiatives.

The opportunities are limitless for a facility to set-up matches, contests, and competitions. TrackMan Range contains multiple applications to socially engage users and drive loyalty. Plus, because all information is uploaded to mytrackman.com, the website and its monthly newsletter become another forum/channel for the facility to share and reach out to customers.

Driving ranges can build relationships and develop sponsorships with local businesses by creating VIP clubs, company days, subscription programs, tours, tournaments – any number of strategies that drive customer engagement and earnings.

Facilities will discover exactly who is playing on their range, their handicap, age, and more – they can even learn what a client's swing faults are and give this information to club pros as a great tool with which to engage members. You cannot buy that kind of customer insight. Well actually... now you can.



Compare clubs application



TrackMan Range iPhone and Android application

Target Your Game

Arguably, the greatest golfer of all-time, Jack Nicklaus, writes in his book *Golf My Way*, "I always shoot to a specific target."

TrackMan Range has taken his recommendation to the max. When players use the TrackMan Range for target practice, each shot is measured precisely for distance and accuracy relative to a target. Players learn exactly how far and well they hit every ball. They also get invaluable flight data like ball speed, launch angle, spin rate, landing angle, and more.

Having specific targets on the range (not just yardage markers) focuses a golfer's training. Receiving immediate and accurate feedback on how close each shot is to the target significantly enhances the effectiveness of practice. Having the option to go home and review sessions and identify trends, benchmark improvement, and share goals and progress via social media creates an engaging, enticing, and reinforcing product for any golfer.

Mr. Nicklaus adds in his book, to be a better golfer: "Go to the driving range a little more and to the course a little less." The TrackMan Range makes it easy for golfers at any level to take full advantage of his advice and have a great time in doing so.

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OPPORTUNITY: TRACKMAN GOES MAINSTREAM

ROI

For golf facilities, the marketing insight and usage data the TrackMan Range system provides takes the guesswork out of their price modeling and ROI projections. Facilities can decide what consumer pricing works best for them, thus making TrackMan Range an extremely transparent investment.

For golf facilities looking to drive member engagement, add value, and a new source of revenue to their business, TrackMan Range is a terrific opportunity.

TrackMan Range Business Model

TrackMan has developed a business model where golf facilities rent TrackMan Range, which significantly reduces start-up costs. The rental agreement includes on-site installation of the TrackMan Range, full staff training, and ongoing support from TrackMan.

TWO SYSTEMS - ONE LOW PRICE

With the launch of TrackMan Range, TrackMan has additionally sought to create a total package that enables golf facilities to provide members with the ultimate in instruction, golf improvement, club fitting, self practice, and entertainment.

The solution is to add a TrackMan Pro, geared to the facility's professional staff, in the package with a TrackMan Range. TrackMan is offering TrackMan Range customers the option to add a TrackMan Pro rental to the lease agreement and get both systems for one very cost effective annual lease payment.

In other words, facilities can start the season with a TrackMan Range and TrackMan Pro - the same technology used by golf's top teaching professionals, college coaches, tour professionals, club fitters, and manufacturers around the world. TrackMan Range is changing the way all golfers – from beginners to professionals – enjoy and improve their game. On the same lease, golf facilities have the option to also significantly upgrade the club fitting and teaching services their professional staff provides.

If you are in the industry, you have a special opportunity to maximize the benefits TrackMan technology can offer your business and your clients. For further details on TrackMan Range, visit mytrackman.com and contact your regional TrackMan sales representative.

TrackMan Range promotional material



Hole sponsored events & matches



POP marketing support from TrackMan
(Price can be customized for each customer)



TrackMan subscribers' monthly newsletter

TRACKMAN ABLE TO MEASURE SPIN INDOORS AT 10 FEET (3m)

In the past, TrackMan needed 15 feet (5 meters) of ball flight to directly and accurately measure spin rate.

Now using just 10 feet (3 meters) of ball flight, TrackMan is able to achieve our own industry-leading standard of precision for measuring spin. This is a major breakthrough for indoor golf facilities using launch monitors. Unlike other launch monitor technologies that estimate or simply imply spin rate, TrackMan has always directly measured spin rate, in addition to club delivery. Now that TrackMan is able to precisely measure spin rate with a ball flight distance of just 10 feet (3 meters), facilities with limited space can now take advantage of our world-class technology.



TrackMan indoor club fitting enabled, despite limited space

TrackMan's co-founder and CEO Klaus Eldrup-Jørgensen said, "We see this as a crucial feature for customers around the world, wherever you encounter tight spaces."

“ We are very excited to announce this technological advancement – TrackMan continues to stay at the forefront of the market in its ability to directly and accurately measure spin ”

Fredrik Tuxen

TrackMan co-founder and CTO

TrackMan co-founder and CTO Fredrik Tuxen says "Measuring spin directly and accurately is important for two reasons: first of all, knowing a golfer's spin rate is essential when making driver fitting recommendations. And secondly, if you do not track the ball for the entire flight, as is the case indoors, the results of a ball flight model will be significantly impacted by the quality of the spin rate assumption entered in the model."

To illustrate Tuxen's second point, imagine a golfer hits a drive with a ball speed of 150mph, launch angle of 13 degrees, and spin rate of 3000 rpm. According to the laws of physics (and assuming a premium golf ball), this ball will travel around 255 yards (233 meters), including bounce and roll. TrackMan has seen that other technologies that estimate, rather than directly measure, spin rate have a margin of error of +/- 1000 rpm on the spin rate. So, if you assume 2000 or 4000 rpm in the ball flight model, rather than the "real" 3000 rpm, you would get total distances of 276 yards or 230 yards, respectively (252 and 210 meters). This is a discrepancy of 46 yards (42 meters)! That margin of error would make the numbers entirely misleading, resulting most likely in a poor equipment recommendation. See the table below for clarification.

Influence of spin rate on carry distance

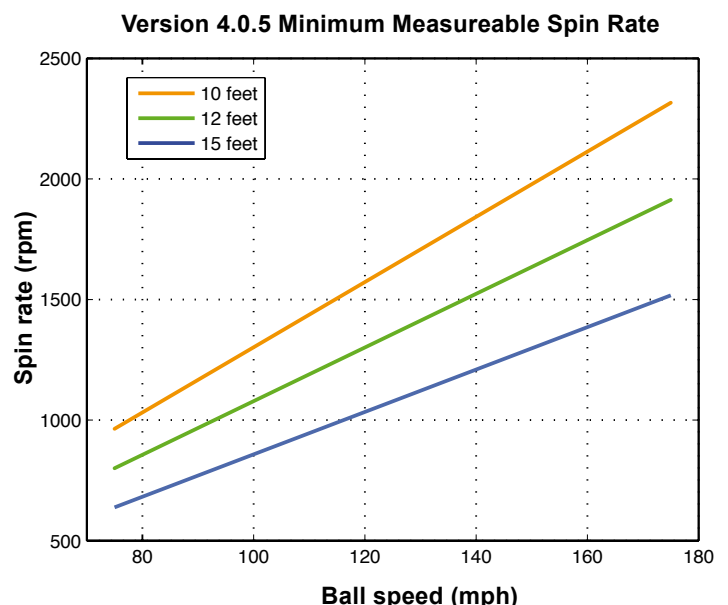
Ball Speed (mph)	Launch Angle (deg)	Spin Rate (rpm)	Carry Distance (yards)	Total Distance (yards)
150	13	2000	261	276
150	13	3000	246	255
150	13	4000	224	230

“ This enhancement will help our customers make better fitting and coaching decisions when using TrackMan indoors ”

Klaus Eldrup-Jørgensen

TrackMan co-founder and CEO

To enable this feature, TrackMan customers who are current on their software subscription can simply download TrackMan Software Version 4.0.5 by following the instructions in the customer support section of www.trackman.dk. Customers who would like to re-join the subscription program, to take advantage of this exciting new benefit, should contact their local sales representative to inquire about pricing.



PROGRESS REPORT: TRACKMAN COMBINE

Since its birth in May, hundreds of golfers, ranging from the world's top tour professionals all the way to high handicappers, have tested their shot-making abilities with the TrackMan Combine.

We've received tremendous positive feedback not just on the benchmarking merit of Combine, but on the game improvement and practice value of the process itself. Before we go into details let's quickly remind you what the TrackMan combine is.

What is the TrackMan Combine?

1. Player hits shots at 10 targets/zones (60, 70, 80, 90, 100, 120, 140, 160, and 180 yds plus drives)
2. Player receives the following feedback:
 - >Average Distance from Pin at each target yardage
 - >Average Drive Distance
 - >Average Offline for Drives
 - >Score (0-100) for every shot category
 - >Percentile Rankings for every shot category
 - >Aggregate TrackMan Combine Score

This article highlights the top results so far and provides additional insight on TrackMan Combine scoring benchmarks by using PGA TOUR ShotLink data and more.

Top scores to date

While the maximum possible TrackMan Combine score is 100, such a score may prove impossible for any one player to achieve in a single session. To date, our best score is an 87 accomplished by LPGA Tour Professional and Rolex World Ranked #26 Sun Young Yoo.

Ms. Yoo's combine was completed during a training session with her coaches at David Leadbetter Golf Academy in ChampionsGate, FL, just prior to her winning the Sybase Match Play Championship in Gladstone, NJ. In reviewing Ms. Yoo's TrackMan Combine results below, you can see she is a model of consistency with no glaring weaknesses:

TrackMan Combine: Sun Young Yoo

Target	Points	Avg. Dist from pin (yds)
60 yds	81	3.0
70 yds	90	2.4
80 yds	90	3.0
90 yds	85	4.3
100 yds	88	3.9
120 yds	95	2.8
140 yds	90	4.4
160 yds	91	5.5
180 yds	90	5.9
Drives	74	Carry 231.7 Side 7.2
Total score: 87		

Luke Donald and James Morrison currently share the lead for best men's Combine score with 86. Days after making his Combine score of 86, Luke Donald finished in 2nd place at the European PGA Tour's BMW PGA Championship at Wentworth Club and was tournament champion the following week at the Madrid Masters. Earlier in the season, James Morrison was the European PGA Tour's champion at Madeira Islands Open BPI event. You can review Donald's and Morrison's TrackMan Combine results below:

TrackMan Combine: Luke Donald

Target	Points	Avg. Dist from pin (yds)
60 yds	83	3.4
70 yds	85	3.2
80 yds	88	3.3
90 yds	86	3.6
100 yds	89	3.5
120 yds	96	2.8
140 yds	83	7.4
160 yds	84	7.7
180 yds	86	6.5
Drives	79	Carry 255.8 Side 9.1
Total score: 86		

TrackMan Combine: James Morrison

Target	Points	Avg. Dist from pin (yds)
60 yds	86	2.6
70 yds	75	4.7
80 yds	90	3.0
90 yds	80	5.0
100 yds	89	3.8
120 yds	88	4.8
140 yds	85	6.1
160 yds	86	7.0
180 yds	89	6.6
Drives	79	Carry 252.1 Side 6.4
Total score: 86		

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PROGRESS REPORT: TRACKMAN COMBINE

Our best Combine score turned in by an amateur is from Casey Baker, co-owner of Miles of Golf in Ann Arbor, MI. Baker, a top Michigan amateur, scored 84 on his Combine and later in the golf season captured the championship at one of Michigan's most prestigious amateur events, the GAM Championship. Baker commented, "The TrackMan Combine is an awesome test and process. It helped me realize my best layup yardage was 80 yards and not 100 yards as I had been playing to, not to mention it gave me a clear understanding of my strengths and weaknesses. It allowed me under pressure to have total confidence in my yardages. Following the combine, I've played some of the best tournament golf of my life, including a final round 65 at Flint Golf Club which helped me win the GAM Championship."

TrackMan Combine: Casey Baker

Target	Points	Avg. Dist from pin (yds)
60 yds	76	4.0
70 yds	85	3.3
80 yds	94	2.2
90 yds	83	4.8
100 yds	84	4.6
120 yds	85	5.2
140 yds	85	6.2
160 yds	83	8.3
180 yds	90	6.7
Drives	75	Carry 246.8 Side 9.6
Total score: 84		

Average Golfer

When describing the "average golfer", most industry professionals refer to the 18-handicapper. Using the TrackMan Combine database, we took all the 18-handicap results and averaged them for each scoring zone and drives, as well assigned the corresponding Combine score. In Table 1, you can see the shot-making ability for the "average 18-handicapper" produced a TrackMan Combine score of 42, with 90 yards being the strongest scoring zone.

Table 1: TrackMan Combine: 18 HCP average

Target	Points	Avg. Dist from pin (yds)
60 yds	34	13.7
70 yds	47	10.6
80 yds	50	12.5
90 yds	51	14.1
100 yds	50	15.8
120 yds	49	19.2
140 yds	49	24.0
160 yds	36	31.7
180 yds	24	50.6
Drives	30	Carry 160 Side 16.6
Total score: 42		

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PROGRESS REPORT: TRACKMAN COMBINE

Combine versus Shotlink

Knowing that no golfing reference is complete without comparisons to PGA TOUR data, we took 2010 PGA TOUR ShotLink statistics and contrasted them to TrackMan Combine scoring using Combine's scoring system. We looked at the average distance from the pin on shots hit at various target yardages, as well as drive carry and side during PGA TOUR events, which had been gathered by ShotLink. We then calculated each "implied scoring result" using TrackMan Combine's scoring system. The two tables below are the results. Table 2 represents best performance at each target. To clarify, this is not the same person hitting through all scoring zones, but rather a composite of PGA player statistics and our choosing the #1 stat/result for each target. Table 3 shows PGA TOUR averages.

Table 2: Best PGA TOUR implied score
Best for each target

Target	Points*	Avg. Dist** from pin (yds)
60 yds	89	2.9
70 yds	90	3.2
80 yds	91	3.5
90 yds	91	3.9
100 yds	92	4.2
120 yds	91	5.1
140 yds	91	6.2
160 yds	90	7.4
180 yds	89	8.8
Drives	96	Carry 285 Side 7.4
Total score: 91		

* ShotLink data converted to Combine scoring
** ShotLink Data

Table 3: Average PGA TOUR implied score

Target	Points*	Avg. Dist** from pin (yds)
60 yds	72	5.3
70 yds	76	5.5
80 yds	79	5.8
90 yds	81	6.1
100 yds	83	6.4
120 yds	85	7.1
140 yds	85	8.0
160 yds	85	9.1
180 yds	85	10.6
Drives	83	Carry 268 Side 8.5
Total score: 82		

* ShotLink data converted to Combine scoring
** ShotLink Data

implied TrackMan Combine Total Score is 82. A technical note: standard TrackMan Combine results are based on landing (carry), but the two tables above that use ShotLink data are based on the final resting result for each scoring zone (including roll) and driver side result. As with Combine, the PGA TOUR computes its driving distance based on carry. It should further be noted that TrackMan Combine scores may be slightly better relative to the above PGA TOUR scores, because in the TrackMan Combine, golfers take 4 consecutive shots at the same target (so the participant effectively gets to make adjustments based on feedback very quickly), while naturally the PGA TOUR scores are based on course performance, where players just get one shot at a time.

Importance of hitting it close

How do we know these TrackMan Combine Scores map to improved scoring performance on the course, besides the testimonials we have received? One thing we looked at is the relationship between distance from the pin on approach shots and percentage of one putts made. Take a look at Table 4 below, where we took the PGA TOUR ShotLink results from each TrackMan Combine Scoring Zone and compared those under the assumption of being an Average PGA TOUR putter trying to one putt from the shot result distance.

Unbelievably, From 60 to 100 yards, assuming an average putter on the PGA TOUR (based on percentage of one putts from each distance), the #1 player on the PGA TOUR at TrackMan Combine yardages (60, 70, 80, 90, and 100 yards) is twice as likely to get up and down as the average PGA TOUR player. In other words, improving and benchmarking your accuracy with target practice using Combine or the TrackMan Range directly translates into superior results on the golf course.

Table 4: One putt made

Target	PGA TOUR Best for each target		PGA TOUR Average	
	Avg. Dist from pin (yds)	One Putt made	Avg. Dist from pin (yds)	One Putt made
60 yds	2.9	44.3%	5.3	20.7%
70 yds	3.2	40.1%	5.5	19.6%
80 yds	3.5	35.9%	5.8	18.6%
90 yds	3.9	31.8%	6.1	17.3%
100 yds	4.2	28.0%	6.4	16.1%
120 yds	5.1	21.6%	7.1	13.7%
140 yds	6.2	16.8%	8.0	11.0%
160 yds	7.4	12.7%	9.1	8.6%
180 yds	8.8	9.2%	10.6	6.2%

As you can see from the above, taking the #1 result at each target from all players on the PGA TOUR results in an implied TrackMan Combine Total Score of 91, while the PGA TOUR average

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PROGRESS REPORT: TRACKMAN COMBINE

How to get started

In summary, we look forward to sharing future results in TrackMan Combine scoring, as well telling more stories about players and coaches who are using TrackMan Combine to achieve game improvement and tournament success. For starters, see the case study about Stanford University below.

If you are a TrackMan customer who is current on your subscription and interested in implementing the TrackMan Combine in your lesson and coaching programs, please register at www.mytrackman.com/combine or call us.

CASE STUDY: STANFORD UNIVERSITY

Every year, for one week of junior camp season, Stanford coaches Conrad Ray and Caroline O'Connor host Players Camp at Stanford University and the Siebel Golf Complex.

New for this year was the integration of TrackMan Combine for all 50 participants aged 12 – 18. Stanford Men's Head Coach Conrad Ray said of the combine, "It was a great addition to our Players Camp to integrate TrackMan Combine. We not only helped all participants learn about the importance of focusing on specific targets while practicing, but also how difficult it is to hit a specific yardage upon command.

Further, we as coaches learned a lot about each player. For example, as the players were hitting drivers for distance and accuracy, as opposed to for a fitting, we realized that half of our camp participants were playing a driver that was not properly fit for their swing!" Coach Ray continued, "I really look forward to my team returning in the fall so we can fully integrate the TrackMan Combine into our focused golf training – hitting shots with a purpose and getting the immediate feedback, realizing strengths, knowing what to work on... I can't recall any more effective and efficient golf practice protocol."



TrackMan on the Stanford range during a practice session



“ I can't recall any more effective and efficient golf practice protocol ”

Conrad Ray

Head Coach Stanford University

TRACKMAN USER: MARTIN KAYMER - HOTTEST PLAYER ON TOUR

Who is the hottest player on the PGA TOUR? TrackMan owner, Martin Kaymer.

Kaymer recently put an exclamation point on an otherwise incredible season by becoming the first player since Tiger Woods to win three European Tour events in a row and of course, winning this year's final major, The PGA Championship.

Kaymer has been a regular on TrackMan for the past few years and the results are evident. His improvement has been remarkable with him now ranked #1 in the Race to Dubai and #3 in the world.

At the PGA Championship at Whistling Straits, Kaymer finished level with Bubba Watson at 11 under par. He then held on to beat the American in the three-hole play-off, a testament to his supreme confidence and trust in his shot making ability under extraordinary pressure. The victory marks the first time a continental European has won the PGA Championship and only the second German after Bernhard Langer to capture a major title.

"I cannot win anything bigger," said a smiling Kaymer to reporters after the victory. "The majors, they are the biggest tournaments we play. It's cool to see my name (on the trophy) next to Jack Nicklaus, Arnold Palmer and all those guys. It will take me a while to realize what has happened."

DIALING IN ON TRACKMAN

Kaymer uses his own personal TrackMan to pinpoint distances and for club fitting. He is ranked #2 on the European Tour with a 69.82 stroke average and its leading money winner after his historic PGA Championship win. Over his five-year European Tour career, Kaymer has won eight times, with four victories and the just-accomplished extraordinary hat trick in this past year alone.



”TrackMan has certainly helped me with my distance control, especially the wedges. Knowing my precise distances and the swing I need to produce them, gives me a lot of confidence on the course”

Martin Kaymer
Winner - 2010 PGA Championship



TrackMan user Martin Kaymer on the Tee

"The insight TrackMan provides also enables me to optimize the clubs in my bag. I know for instance, that the driver I am using will give me the best result because of the extensive testing I've done with TaylorMade on TrackMan. When you can trust and document that the clubs you are using are the right equipment for you, it is a definite confidence booster," says Kaymer.

Kaymer is not the first TrackMan user to win a major this year. Graeme McDowell, who won this year's US Open, has also been a TrackMan owner. McDowell is also coincidentally in second place, behind Kaymer, in the Race to Dubai.

Kaymer is currently preparing for the upcoming Dubai World Championship taking place in the end of November.

VIDEO: FITTING SESSION
See Martin Kaymer
using TrackMan
www.trackman.dk

