UNDERSTANDING
BALL & CLUB DATA

This guide is designed to provide a foundational understanding of the ball launch and club performance data measured by Foresight Sports Launch Monitor Technology. A basic description of how these conditions impact ball flight performance has also been included, as well as reference guides for determining optimal ball launch conditions.

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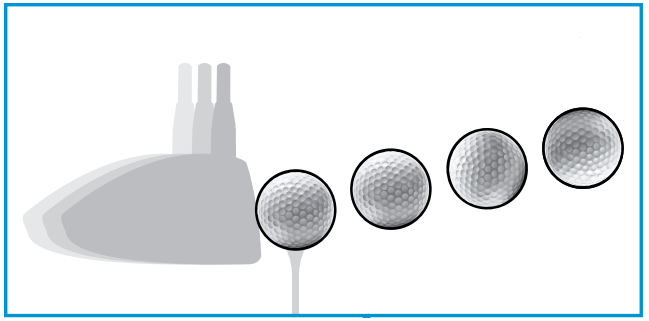
INTRODUCTION TO BALL LAUNCH DATA

Foresight Sports Launch Monitors use highspeed, high-resolution cameras to capture ball launch conditions with a high degree of accuracy.



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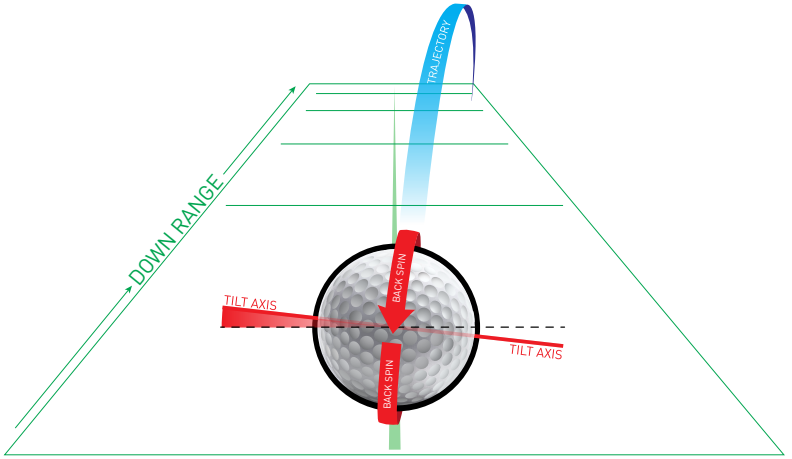


INTRODUCTION TO BALL LAUNCH DATA

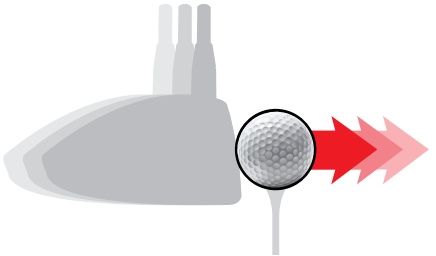
The launch condition is described by a combination of the following measured ball launch parameters:

- **Ball Speed**
- **Total Spin**
- **Launch Angle**
- **Azimuth**
- **Spin Tilt Axis**

The combination of these measured launch characteristics will determine the ball trajectory, peak height, decent angle, carry and total distance. The following pages will describe each of these measured ball launch parameters and calculated ball flight parameters.

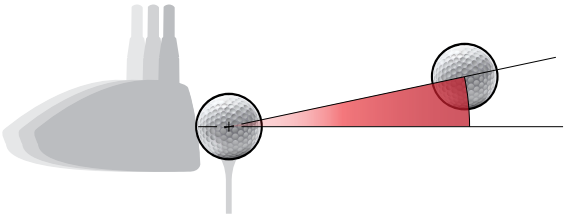
BALL SPEED

The measurement of the golf balls velocity measured just after impact. Ball speed is the main component in generating distance.



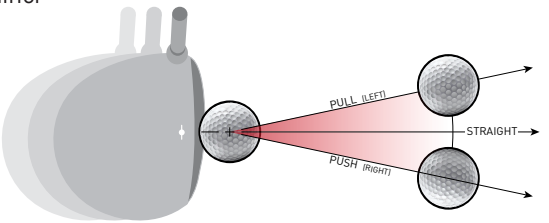
LAUNCH ANGLE

The initial vertical angle of ascent relative to the ground plane measured in degrees. The launch angle, combined with ball spin and speed, will determine the ball carry and total distance.



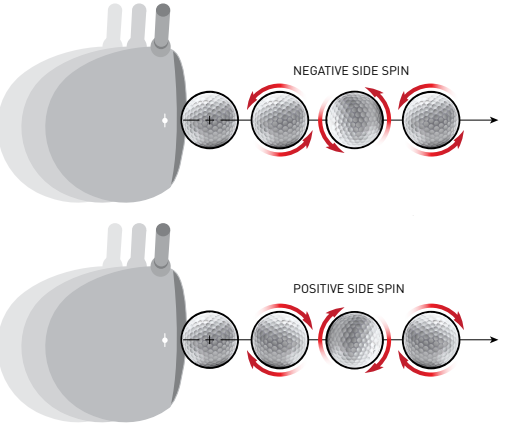
AZIMUTH

(Also known as side angle or deviation angle) The initial horizontal angle relative to the target line. The azimuth, combined with side spin, will determine the final ball position down range relative to the target-line.



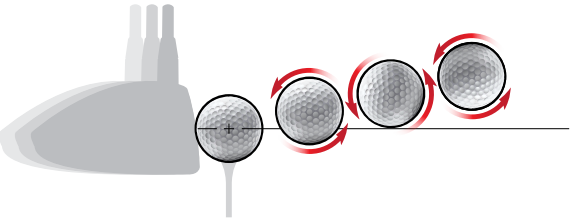
SIDE SPIN

A component of total spin that defines ball curvature or shot shape. Also related to the spin-tilt axis.



BACK SPIN

A component of total spin that defines ball lift and trajectory.



TOTAL SPIN

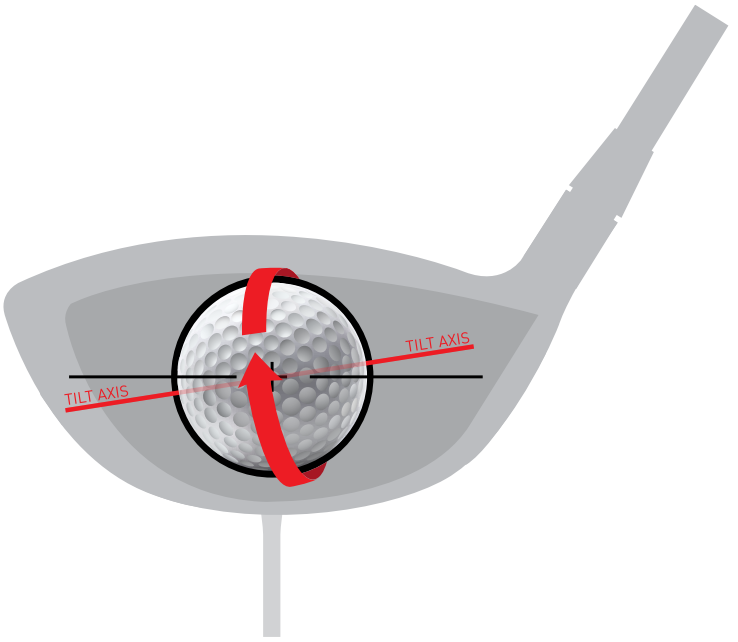
A component of total spin that defines ball curvature or shot shape. Also related to the spin-tilt axis.

SPIN-TILT AXIS

The Spin-Tilt Axis is the axis that the golf ball rotates around to create shot curvature and lift.

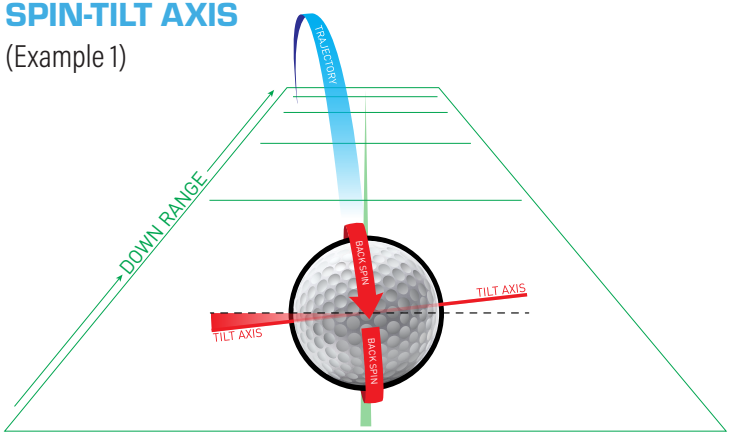
When the spin-tilt axis is oriented to the left (looking down range), the ball's trajectory will move from right to left. (See example 1)

When the spin-tilt axis is oriented to the right (looking down range), the ball's trajectory will move from left to right. (See example 2)



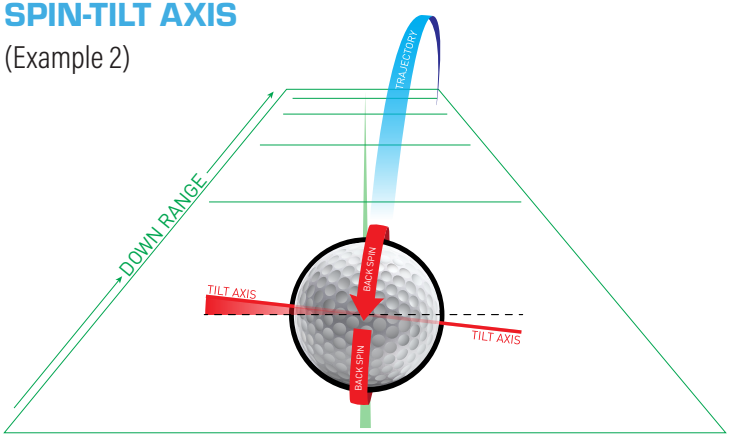
SPIN-TILT AXIS

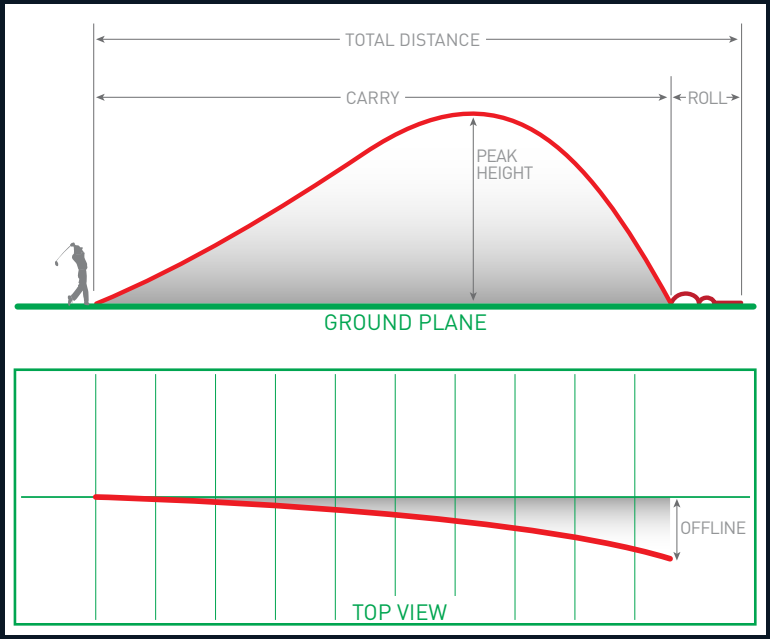
(Example 1)



SPIN-TILT AXIS

(Example 2)





PEAK HEIGHT

The apex of the trajectory measured from the ground plane.

OFFLINE

The end position distance right or left measured from the target-line.

CARRY

The total distance of flight produced by initial launch condition.

TOTAL DISTANCE

The combined ball flight with bounce and roll.

OPTIMIZED LAUNCH DATA

DRIVER - OPTIMAL LAUNCH CONDITION TABLE

Club Speed	Ball Speed	Optimum Launch Angle Range	Optimum Spin Range	Typical Carry Distance Range	Typical Total Distance Range
MPH	MPH	DEGREES	RPM	YARDS	YARDS
69	100	10.0-14.0	3500-2500	130-142	159-169
76	110	10.0-14.0	3400-2400	157-170	181-194
83	120	10.0-14.0	3300-2300	183-197	204-221
90	130	10.0-14.0	3200-2200	207-223	227-246
97	140	10.0-14.0	3100-2100	231-249	250-272
103	150	10.0-14.0	3000-2000	254-275	273-299
110	160	10.0-14.0	2900-1900	276-301	295-325
117	170	10.0-14.0	2800-1800	298-325	318-349
124	180	10.0-14.0	2700-1700	320-349	340-386
131	190	10.0-14.0	2600-1600	342-372	378-401
138	200	10.0-14.0	2500-1500	360-389	381-418
145	210	10.0-14.0	2400-1400	383-408	405-438

BALL LAUNCH TABLE

SLOWER SWING SPEEDS

Club	Club Speed	Ball Speed	Launch Angle	Spin Rate	Carry Distance
1W	94	141	14	2628	220
3W	92	137	10.3	3234	208
5w	90	134	11.6	4238	203
hy-22	87	125	12.9	5415	184
3i	85	126	12.8	4038	190
4i	84	123	13.7	4593	184
5i	82	118	14.7	4939	169
6i	80	114	16.2	5986	156
7i	78	109	18.4	6979	147
8i	76	104	20.6	7196	140
9i	74	98	23	8025	126
pw	72	91	24.7	8873	117
sw	72	81	30.4	9341	96
lw	68	65	37.7	5569	72

FASTER SWING SPEEDS

Club	Club Speed	Ball Speed	Launch Angle	Spin Rate	Carry Distance
1w	112	165	11.2	2685	270
3w	107	157	8	3801	250
5w	103	151	8.8	4624	230
3i	98	140	10.6	4378	210
4i	96	135	11.4	4716	199
5i	94	131	12.8	5115	191
6i	92	128	13.9	6036	181
7i	88	122	15.1	6585	166
8i	86	116	16.5	7725	152
9i	85	109	18.4	9018	139
pw	84	102	20.3	10399	127
sw	83	90	24.4	11265	106
lw	78.8	76	28.3	11852	84

INTRODUCTION TO CLUB HEAD DATA

Foresight Sports Launch Monitors use high-speed, high-resolution cameras to capture club head information with a high degree of accuracy.

This portion of the reference guide provides a basic description of the club head conditions that are measured by the HMT Head Measurement Technology.

INTRODUCTION TO CLUB HEAD DATA

Head Measurement is the measurement of the delivery of the club head described by path, face plane, velocity and impact location of the golf ball.

The following pages will briefly describe each of these measured parameters.

CLUB SPEED

The velocity that the club head travels measured just prior to ball contact.

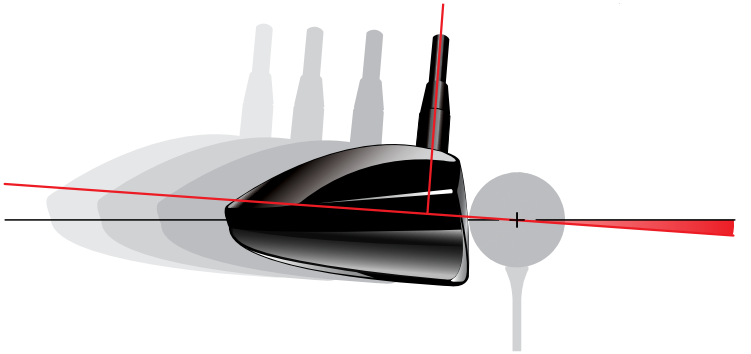
EFFICIENCY

The ratio between club head and golf ball velocities to determine the quality of the ball strike.

Described as ball speed divided by head speed = ratio, efficiency or smash factor.

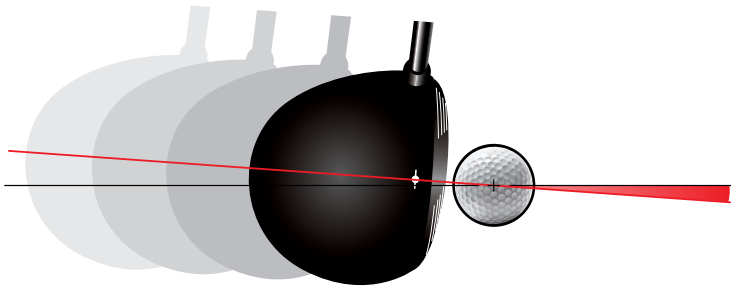
ANGLE OF ATTACK

The descending or ascending path of the club-head measured in degrees.



CLUB PATH

The swing path measured in a horizontal plane relative to the target-line.

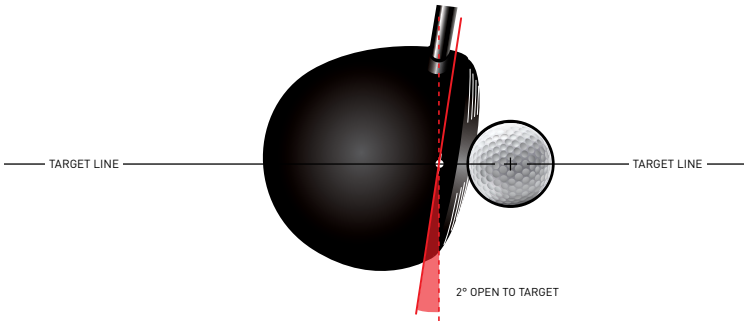


FACE ANGLE

The dynamic measurement (in degrees) of the club head's face plane position at a right angle 90 degrees perpendicular relative to the target line or swing path. Also known as yaw.

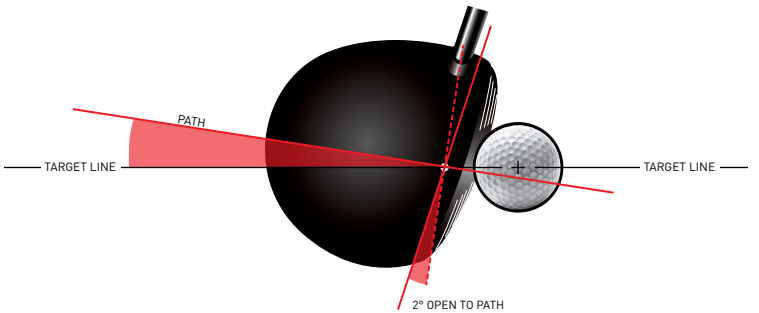
FACE TO TARGET

The face angle relative to the target-line at impact.



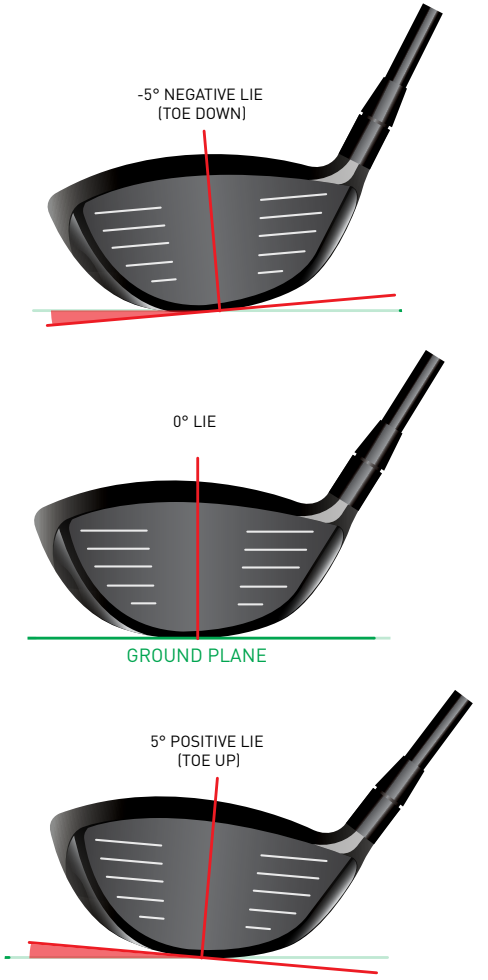
FACE TO PATH

The face angle relative to the club path. The main components in generating side angle and the curvature of the golf ball.



LIE

The dynamic measurement in degrees of the club head's face plane position horizontally relative to the ground plane. Also known as roll.

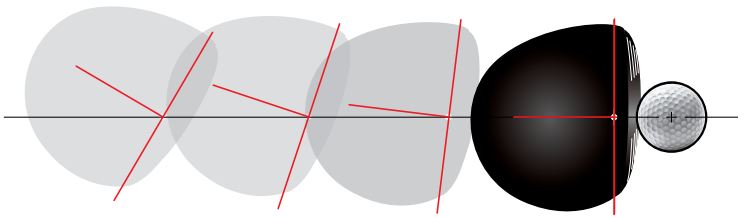


LOFT

The dynamic measurement in degrees of the club head's face plane position vertically relative to the ground plane. Also known as pitch.

CLOSURE RATE

The rotation of the club head heel to toe measured about the shaft in degrees per second or rpm.

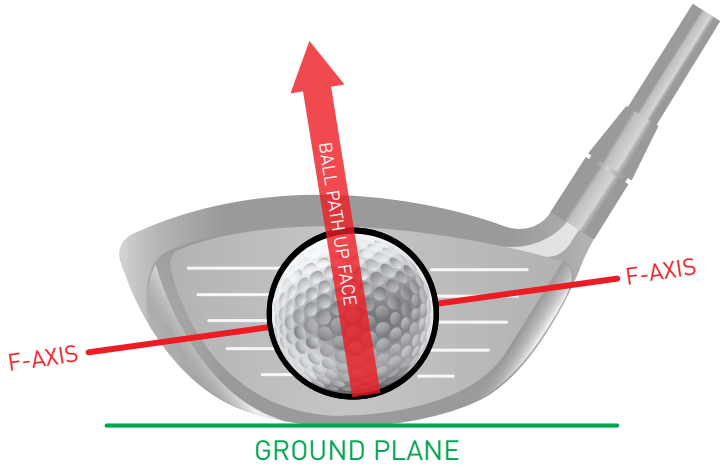


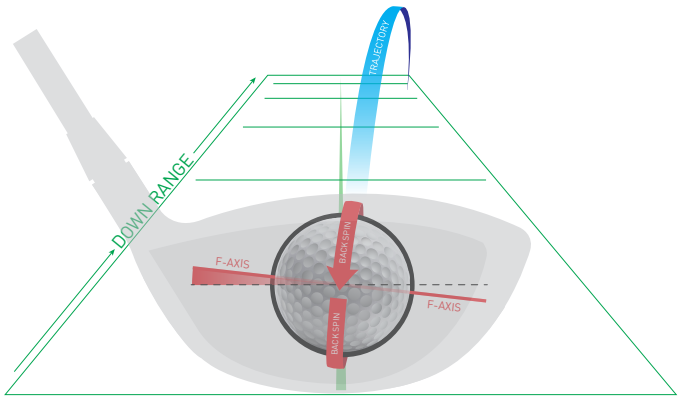
IMPACT LOCATION

The measurement (in millimeters) of the contact point of the golf ball on the club face relative to face center.

F-AXIS

The perpendicular axis measured relative to the directional path that the golf ball rolls or slides up the club face.





In a typical shot where ball impact is centered on the club, the F-Axis and Spin-Tilt Axis should coincide.