

EM Speed and Power Analytics and FlightScope Glossary of Terms

PITCH data

1. **Pitch Velocity (VELO)/Release Speed** = Speed of pitch when it leaves the pitcher's hand
2. **Spin Rate (SR)** = How fast the ball is spinning as it leaves the pitcher's hand, reported in the number of times the pitched ball would spin per minute ("revolutions per minute" or "rpm")
3. **Vertical Break** = Distance between where the pitch actually crosses the front of home plate height-wise, and where it would have crossed home plate height-wise if had it traveled in a perfectly straight line from release, completely unaffected by gravity. Note: This number will be quite large for pitches released with a positive vertical release angle.
4. **Horizontal Break** = Distance between where the pitch actually crosses the front of home plate sidewise, and where it would have crossed home plate side-wise if had it traveled in a perfectly straight line from release. A positive number means the break was to the right from the pitcher's perspective, while a negative number means the break was to the left from the pitcher's perspective.
5. **Vertical Movement (pfx_z)** = The vertical (up-down) movement of the pitch during the last 40 feet before the front of home plate, as compared to a theoretical pitch thrown at the same speed with no spin-induced movement
6. **Horizontal Movement (pfx_x)** = The horizontal (left-right) movement of the pitch during the last 40 feet before the front of home plate, as compared to a theoretical pitch thrown at the same speed with no spin-induced movement. Note: Unlike the Horizontal Break number above, this movement is from the batter's perspective, meaning positive numbers break toward the 1B side, while negative numbers break to the 3B side
7. **Vertical Release Angle/Pitch Launch Vertical** = Initial vertical (up-down) direction of the ball when it leaves the pitcher's hand, reported in degrees. A positive number means the ball is released upward, while a negative number means the ball is released downward
8. **Horizontal Release Angle/Pitch Launch Horizontal** = Initial horizontal (left-right) direction of the ball when it leaves the pitcher's hand, reported in degrees. A positive number means the ball is released to the right from the pitcher's perspective, while a negative number means the ball is released to the left from the pitcher's perspective.
9. **Flight Time/Zone Time/Batter Reaction Time** = Amount of time elapsed from pitcher's release until it crosses the front of home plate.
10. **Extension (EXT)/Release Distance** = Distance from the rubber at which the pitcher releases the ball.
11. **Pitch trajectory** = 3D visualization and tracing of pitched ball flight path
12. **Zone Command** (Strike Zone Mapping) = Pitch location and sequence numbered

13. **Tagged Pitch Type** = Pitch classification (fastball, curveball, etc.) selected manually by system operator

14. **Tagged Pitcher Set/Pitch Mechanics** = Indication of whether a pitcher is throwing from the windup or stretch, as tagged by system operator

15. **Tagged Pitch Result** (see hit data)

16. **Spin Axis** = Direction the ball is spinning, reported in degrees of tilt. Note that:

a. A ball thrown with a spin axis of 0 has pure top spin. The top of the ball is moving away from the pitcher and the bottom of the ball is moving away from the batter. This is a classic “12-6” curveball. This kind of spin will cause the ball to drop more than gravity would cause alone.

b. A ball thrown with a spin axis of 180 has pure backspin and is a classic four seam fastball, with the top of the ball moving towards the pitcher and the bottom of the ball moving toward the batter. This kind of spin will cause the ball to drop less than gravity would cause alone.

c. A ball thrown with a spin axis of 90 is spinning squarely toward the left, from the pitcher’s perspective (and would create a break to the left), while a ball thrown with a spin axis of 270 is spinning squarely toward the right, from the pitcher’s perspective (and would create a break to the right).

17. **Spin Tilt** = Spin axis converted into clock time, rounded to the nearest 15 minutes. As a rule of thumb, the ball will break in the direction of the number on the clock face. For example:

a. 6:00 is perfect top spin (classic “12 – 6” curveball), causing the ball to break down

b. 12:00 is perfect back spin (Four seam fastball, with no left-right movement), causing the ball to break upward relative to how it would have moved due to gravity alone – cutters are around 11:00 and sinkers are around 2:00 for a RHP, while cutters are around 1:00 and sinkers around 10:00 for a LHP.

c. 3:00 is a “Frisbee” spinning and breaking to the right, while 9:00 is a “Frisbee” spinning and breaking to the left.

18. **Induced Vertical Break** = Distance between where the pitch actually crosses the front of home plate height-wise, and where it would have crossed home plate height-wise if had it traveled in a perfectly straight line from release, but affected by gravity. Note: If this number is positive, the ball broke “upwards”, or in reality dropped less than it would have due to gravity alone – it does not necessarily mean that the ball actually rose.

HIT DATA

1. **Exit Velocity (EV)/Exit Speed** = The speed of the ball as it comes off the bat at the moment of contact (In golf, the data definition is Ball Speed = Launch speed of the golf ball. Ball speed has the biggest effect on carry distance. Centeredness of impact and an increase in club speed will ensure a higher ball speed).

2. **Launch Angle (LA)**/Vertical Exit Angle = How steeply up or down the ball leaves the bat, reported as an angle. A positive number means the ball is initially traveling upward, while a negative number means the ball is initially traveling downward. As a guideline, here are the Launch Angles for different types of contact:

- a. Ground ball: Less than 10 degrees
- b. Line drive: 10-25 degrees
- c. Fly ball: 25-50 degrees
- d. Pop up: Greater than 50 degrees

Hitters can be evaluated by their average Launch Angle, but the tool is generally more valuable in discussing pitchers. In the case of pitchers, the statistic is referred to as "average Launch Angle Against" (aLAA), and it does a good job of telling us what type of pitcher is on the mound. Is he a fly-ball pitcher? Is he a ground-ball pitcher? Average Launch Angle Against attempts to answer those questions.

Generally, pitchers who can limit their Launch Angle Against (keeping the ball on the ground) are more successful, because they are the most adept at avoiding home runs and extra-base hits, which come almost exclusively via fly balls and line drives.

(In golf, the data definition is Vertical launch angle = Angle at which the golf ball is launched relative to the horizon of the radar. Launch angle will influence the shot height and is mostly determined by the dynamic loft and angle of attack).

3. **Batted Ball Direction (BBD)**/Horizontal Exit Angle = Left-right (horizontal) direction in which the ball leaves the bat, reported as an angle. A negative number represents a ball initially traveling toward the third base side of second base while a positive number represents a ball initially traveling toward the first base side. Batted Ball Direction represents the horizontal direction at which the ball leaves a player's bat after being struck. Average Batted Ball Direction (aBBD) is calculated by dividing the sum of all Batted Ball Directions by all Batted Ball Events.

As a guideline, a direction of 0 degrees is a ball hit to straightaway center field. A positive direction is a ball hit to the right of center, and a negative direction signifies a ball hit to left of center. If a batted ball is hit directly down the right-field line, it would have a batted-ball direction of 45 degrees. Conversely, a batted-ball hit directly down the left-field line would have a batted-ball direction of -45 degrees.

Average Batted Ball Direction can show whether a hitter is more prone to pulling the ball or hitting it to the opposite field. For example: A right-handed "pull" hitter, who hits a high percentage of batted balls to the left side of the field, would have an Average Batted Ball Direction in the negative degrees. Conversely, a right-handed hitter with a propensity to hit the ball to the "opposite field" (right field for him; left field for a left-handed hitter) would have an Average Batted Ball Direction in the positive degrees.

(In golf, the data definition is **Horizontal launch angle** = Direction in which the golf ball gets launched relative to the radar's target line. Club face angle will have the biggest effect on the horizontal launch angle of the ball).

4. **Bearing** = Indicates where on the field the ball lands or would have landed, had it not been caught or obstructed. It is reported in degrees relative to home plate. A bearing of 0 degrees means the ball

landed on a straight line from home through second base. A positive number means the ball landed on the first base side, while a negative number means the ball landed on the third base side.

5. **Hit Distance (DST) Estimated Carry/Carry Distance** = The estimated “carry flat” distance, meaning the distance that the ball travels before it lands, or would have landed if it were not caught or obstructed.

(In golf, the data definition is **Carry distance** = Landing distance of the ball from the tee. Ball speed, spin rate, spin axis, and vertical launch angle are all factors that will determine the carry distance).

(In golf, the data definition is **Roll distance** = Amount of roll from carry distance to final position of the ball. Lower spin rate and lower effective angle of descent will increase the amount of roll on the surface).

(In golf, the data definition is **Total distance** = Final position of the ball on the ground from the tee).

6. **Vertical descent angle** = Angle at which the ball approaches the landing area. A lower descent angle will increase distance and a steeper descent angle will give a player more stopping power.

(In golf, the data definition is **Vertical descent angle** = Angle at which the ball approaches the landing area. A lower descent angle will increase distance with a driver, and a steeper descent angle will give a player more stopping power on the green with an iron).

7. **Lateral landing** = Distance of the ball’s impact point measured perpendicular to the target line. (From golf, this is a new ball flight parameter)

8. **Shot dispersion** = Grouping of the landing positions of shots with the selected club showing forward and lateral deviation of that cluster of shots. (From golf, this is a new ball flight parameter)

9. **Hit Spin Rate** = How fast the ball is spinning as it leaves the bat, reported in the number of times the hit ball would spin per minute (“revolutions per minute” or “rpm”)

10. **Flight Time/Hang Time** = Amount of time elapsed from when the ball hits the bat until the ball lands or would have landed, had it not been caught or obstructed.

11. **Max Height (HI)** = Maximum height of the ball trajectory. (In golf, the data definition is Apex Height = Maximum height of the ball trajectory).

12. **Hit Trajectory** = 3D visualization and tracing of batted ball flight path

POP TIME DATA

1. **Pop Time (POP)** = On steal or pickoff attempts by a catcher, Pop Time represents the time elapsed from the moment the pitch hits the catcher's mitt to the moment the intended fielder receives his throw. Pop Time is a combination of a catcher's footwork (getting into throwing position), Exchange (glove to release), and Arm Strength (velocity of throw). Pop Time is a much better assessment of a catcher's ability to throw out baserunners than the strength of his arm alone. A catcher with a great arm isn't going to throw out many baserunners if it takes him a while to transfer the ball to his throwing hand and then release the throw.

2. **Exchange Time (XCH)** = refers to the amount of time elapsed between the moment a fielder receives the ball and the moment he unleashes his throw afterward. This is most frequently applied in the following situations:

- a. For catchers on stolen base attempts or pick-off throws
- b. For outfielders on assist attempts
- c. For middle infielders on double-play transfers (In the case of double-play transfers, the middle infielder's Exchange time is referred to as a separate metric known as "Pivot.")

There's a lot that goes into a good Exchange. First, a defender must position his body and feet, so he's ready to throw as quickly as possible upon receiving the baseball. He also must field the ball and get it out of his glove and into his throwing hand in an efficient fashion.

3. **Arm Strength (ARM)** = is the maximum velocity of any throw made by a fielder. It can be used to evaluate outfielders on attempted assists, catchers on stolen base and pickoff throws, and infielders on throws across the diamond. Fielders -- especially outfielders -- often get a running start before throwing. As a result, the velocity on their throws can exceed that of pitchers, who throw to batters from the mound.

4. **Catch Location** [new] = the accuracy of the throw

5. **Throw to Second Trajectory** = 3D visualization and tracing of thrown ball flight path