
Player Driveline Hitting Snapshot

Apr 01, 2020 - Apr 04, 2020

A Driveline EDGE product designed to generate insights from a player's combination of batted ball and swing tracking technology. As currently designed, this report will take in either Rapsodo, Trackman, or HitTrax as a batted ball input, and either BlastMotion or Diamond Kinetics as a swing tracker input -- if no swing tracking technology, a fuller, richer batted ball report will be generated (to see the richer swing report, try out swing profile!). In this case this report consists of Rapsodo Baseball and Diamond Kinetics data. This report will give you tabular and visual representations of your data, and allow you to compare against different playing levels of hitters, both in batted ball metrics and swing metrics (percentile and quartile rankings will always be designed to have the higher values be represented by the 99th percentile and the 1st quartile). Automatically generated text insights from our trainers, along with goal recommendations and accompanying continued education links will give you an idea of where you lie as a hitter and how to continue to educate yourself with available resources.



Recommendations Summary

Swing: Diamond Kinetics

| Metric | Current | Goal |
|---------------------|----------------|----------------|
| Avg BarrelSpeed | 51.1 | 63+ |
| Avg Attack Angle | 7.3 | 4-16 |
| Attack Angle Range | 0.343 | 65%+ |
| Avg TriggerToImpact | 188.424 | <180 |
| Avg MaxHandSpeed | 20.1 | 21+ |
| Avg SpeedEfficiency | 98.3 | - |

Batted Ball: Rapsodo Baseball

| Metric | Current | Goal |
|---------|--------------|--------------|
| Peak EV | 102.2 | 102+ |
| Avg EV | 94.5 | 84+ |
| HHB LA | 16.6 | 10-25 |
| Avg LA | 15.9 | - |

Swing Metrics

Athlete does not possess sufficient barrel speed (51.1 mph) in comparison to other in gym pro hitters. Athlete does not swing with a proper attack angle (30.0 percent) on a consistent basis. Athlete has a swing that is "long" to the ball from the time the hands begin moving forward to contact (188.424 sec) and may be susceptible to velocity. Athlete sufficiently transfers hand speed into barrel speed and efficiency (98.3) is in a good range in comparison to other in gym pro hitters. Athlete does not possess sufficient average peak hand speed (20.1 mph) in comparison to other in gym pro hitters.

Batted Ball Metrics

Athlete possesses sufficient peak exit velocity (102.2 mph). Athlete possesses sufficient average exit velocity (94.5 mph). Athlete's hardest hit balls are line drives in the air, above the infielders (16.6 deg).

Performance Benchmarking

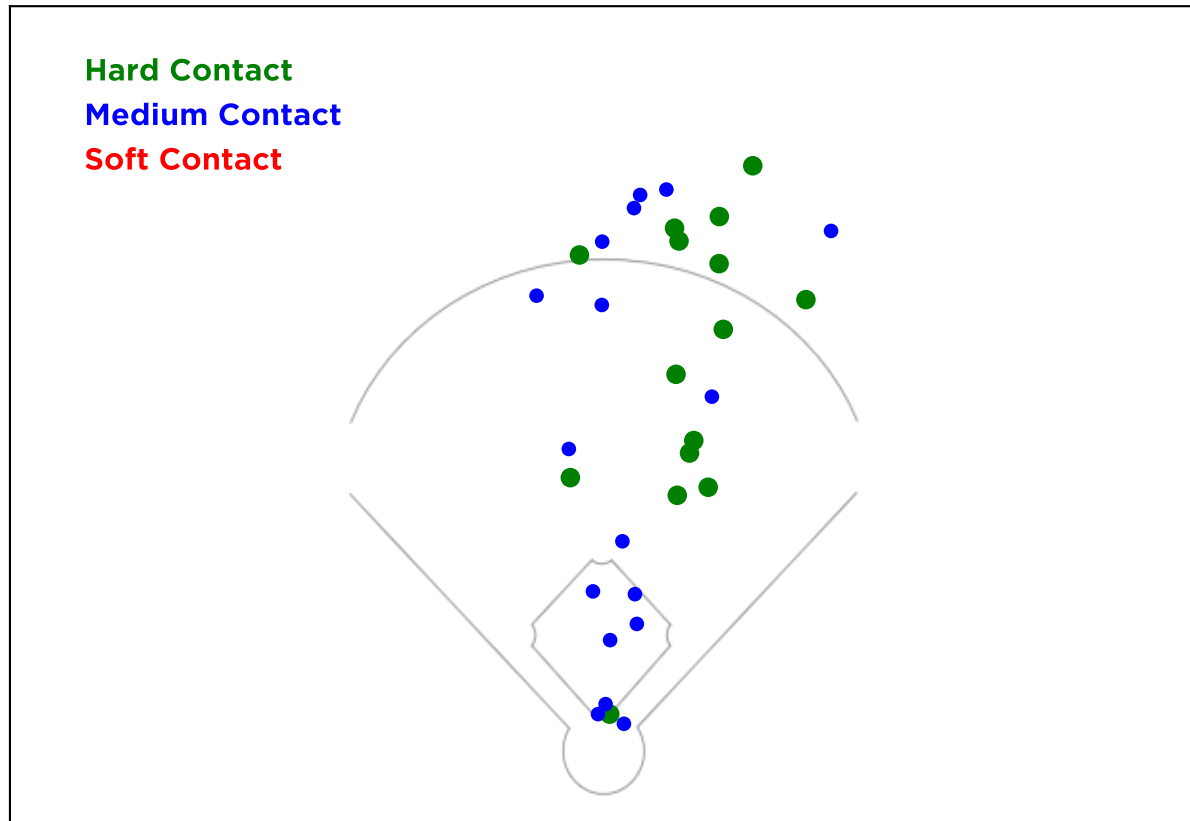
A set of player averages from the specific imported player data versus four playing level averages of all qualified hitters. Conditional green and red shades are applied to the batted ball metrics below, plus the bat speed, efficiency, time to contact, attack angle and peak hand speed averages based on the imported player being either 0.5 Std Devs above (green) or below (red) the selected playing level averages (in this case the selected level was: affiliate)!

| | Description | Player | Affiliate | Indy | College | HS | Youth |
|------------------------------------|--|------------------------|-------------------|------------------|-------------------|-------------------|-------------------|
| Avg EV | The average EV of a hitter's BIPs | 94.5 +/-5.6 | 85.49 +/-4.7 | 85.99 +/-3.1 | 81.57 +/-4.7 | 74.54 +/-7.5 | 58.4 +/-8.7 |
| Peak EV | The average exit velocity of a hitter's top 8th hardest hit BIPs | 102.2 +/-1.3 | 98.71 +/-3.5 | 98.12 +/-3.5 | 94.44 +/-4.2 | 86.75 +/-7.7 | 70.19 +/-10.5 |
| Avg LA | The average launch angle of a hitter's BIPs | 15.9 +/-11.5 | 18.77 +/-4.6 | 18.68 +/-4.5 | 17.57 +/-5.0 | 16.51 +/-5.4 | 12.4 +/-5.0 |
| HHB LA | The average LA of a hitter's top 8th hardest hit BIPs | 16.6 +/-4.5 | 15.55 +/-4.4 | 14.74 +/-5.8 | 12.86 +/-5.7 | 11.47 +/-6.5 | 8.78 +/-6.8 |
| Avg BarrelSpeed | The average of the hitter's barrel speed, from the sweet spot Sweet Spot is measured at 20% from the tip of the bat | 51.1 +/-5.3 | 61.75 +/-4.4 | 59.17 +/-4.6 | 58.64 +/-4.1 | 54.67 +/-5.8 | 49.214 +/-5.0 |
| 90th% BarrelSpeed | The 90th percentile of the hitter's barrel speed values | 57.0 | 70.13 | 68.18 | 67.38 | 62.34 | 49.89 +/-4.0 |
| Avg SpeedEfficiency | The % of the max barrel speed achieved at impact | 98.3 +/-7.85 | 99.94 +/-0.1 | 99.93 +/-0.1 | 99.94 +/-0.1 | 99.94 +/-0.1 | 99.95 +/-0.1 |
| Avg TriggerToImpact | The average of the hitter s time between trigger of the swing to impact Trigger is measured in ms & defined when 10% of MaxAccel is reached | 188.424 +/-23.17 | 181.25 +/-19.4 | 180.0 +/-21.9 | 181.25 +/-20.4 | 186.56 +/-20.6 | 213.93 +/-31.3 |
| Avg Attack Angle | The average of a hitter's attack angle values Values are measured over the 5 frames right before impact | 7.3 +/-14.9 | 4.26 +/-11.8 | 4.91 +/-11.6 | 4.21 +/-11.4 | 5.29 +/-11.4 | 6.73 +/-11.6 |
| Attack Angle Range | The proportion of swings where attack angle is between 4 and 16° | 34.3 | 0.35 | 0.35 | 0.35 | 0.4 | 0.4 +/-4.0 |
| Avg MaxHandSpeed | The average of the hitter s peak hand speed values -- the hands are measured as being 2" up from the knob of the bat | 20.1 +/-2.1 | 21.99 +/-2.8 | 21.06 +/-3.4 | 21.21 +/-2.7 | 20.32 +/-2.6 | 16.13 +/-2.5 |
| Avg MaxAccel | The avg of the max (gravitational) acceleration -> within swing --rotational acceleration is not incorporated in this figure | 24.5 +/-7.4 | 29.74 +/-8.2 | 27.51 +/-7.8 | 26.36 +/-5.9 | 24.63 +/-5.5 | 16.79 +/-3.7 |
| DK Swings/ Rapsodo BIPs | The # of swings recorded in a hitter's session on Diamond Kinetics + the number of balls in play registered on Rapsodo Baseball | 172 32 | 10000 8485 | 10000 17385 | 10000 91057 | 10000 24286 | 10000 259302 |



Performance Detail

Batted Balls by Field



Percentile Rankings by Level

| | Affiliate % | Indy % | College % | HS % | Youth % | |
|------------------------|-------------|------------|------------|------------|------------|--------------|
| Avg EV | 93.1 | 94.9 | 99.2 | 99.9 | 100.0 | ← Percentile |
| | <i>1st</i> | <i>1st</i> | <i>1st</i> | <i>1st</i> | <i>1st</i> | ← Quartile |
| HHB LA | 58.6 | 83.6 | 80.6 | 80.5 | 79.7 | |
| | <i>2nd</i> | <i>1st</i> | <i>1st</i> | <i>1st</i> | <i>1st</i> | |
| Avg BatSpeed | 14.3 | 23.4 | 16.9 | 28.2 | 89.5 | |
| | <i>4th</i> | <i>4th</i> | <i>4th</i> | <i>3rd</i> | <i>1st</i> | |
| Avg AttackAngle | 61.0 | 59.7 | 61.0 | 56.7 | 52.2 | |
| | <i>2nd</i> | <i>2nd</i> | <i>2nd</i> | <i>2nd</i> | <i>2nd</i> | |

Batted Ball Data by Field- Distance and bearing values from Rapsodo are used to plot BIPs on a 330-ft field

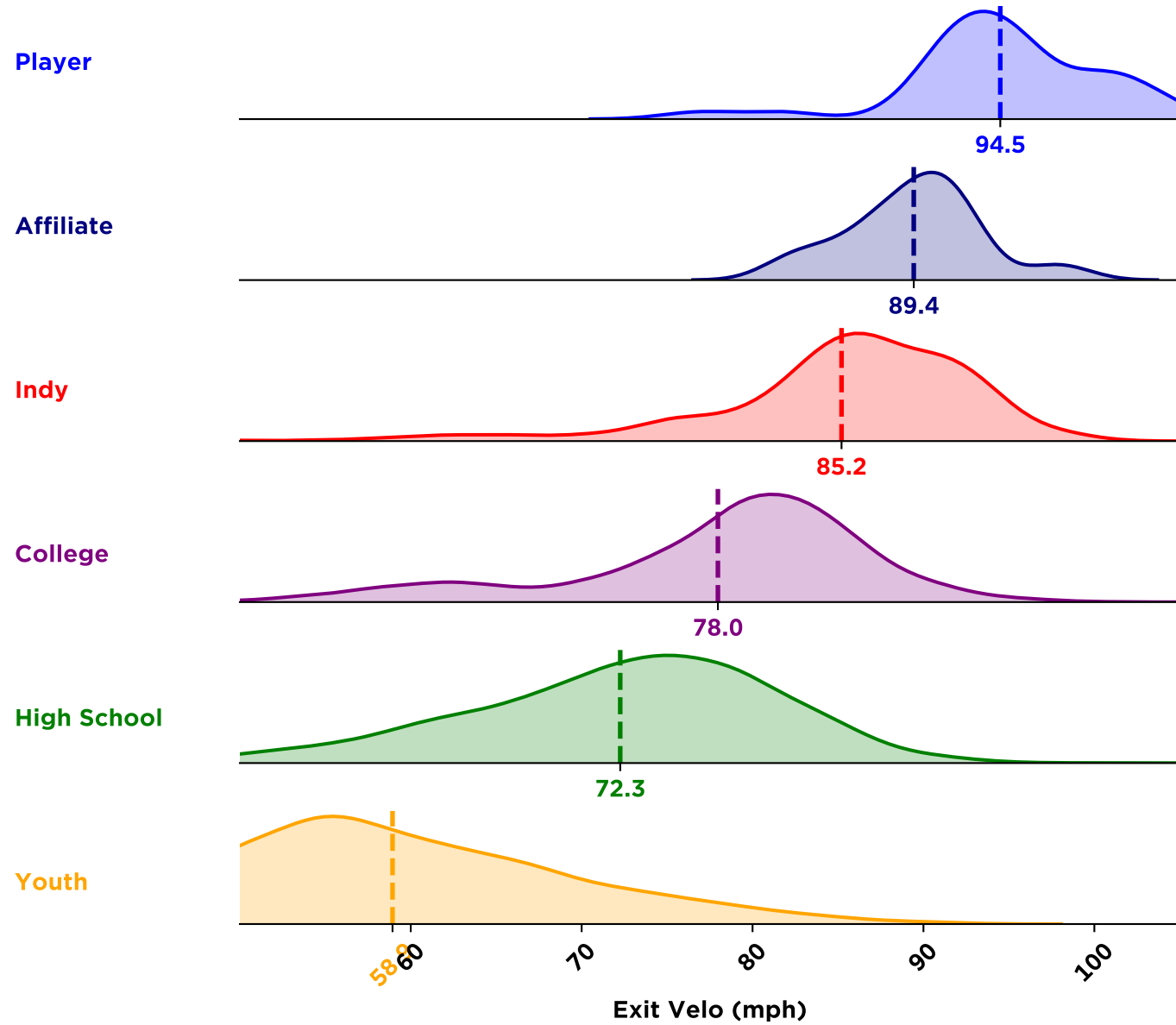
Contact Types

Hard contact: 95+ EV
 Medium contact: 75 to 95 EV
 Soft contact: Below 75 EV

Performance Detail

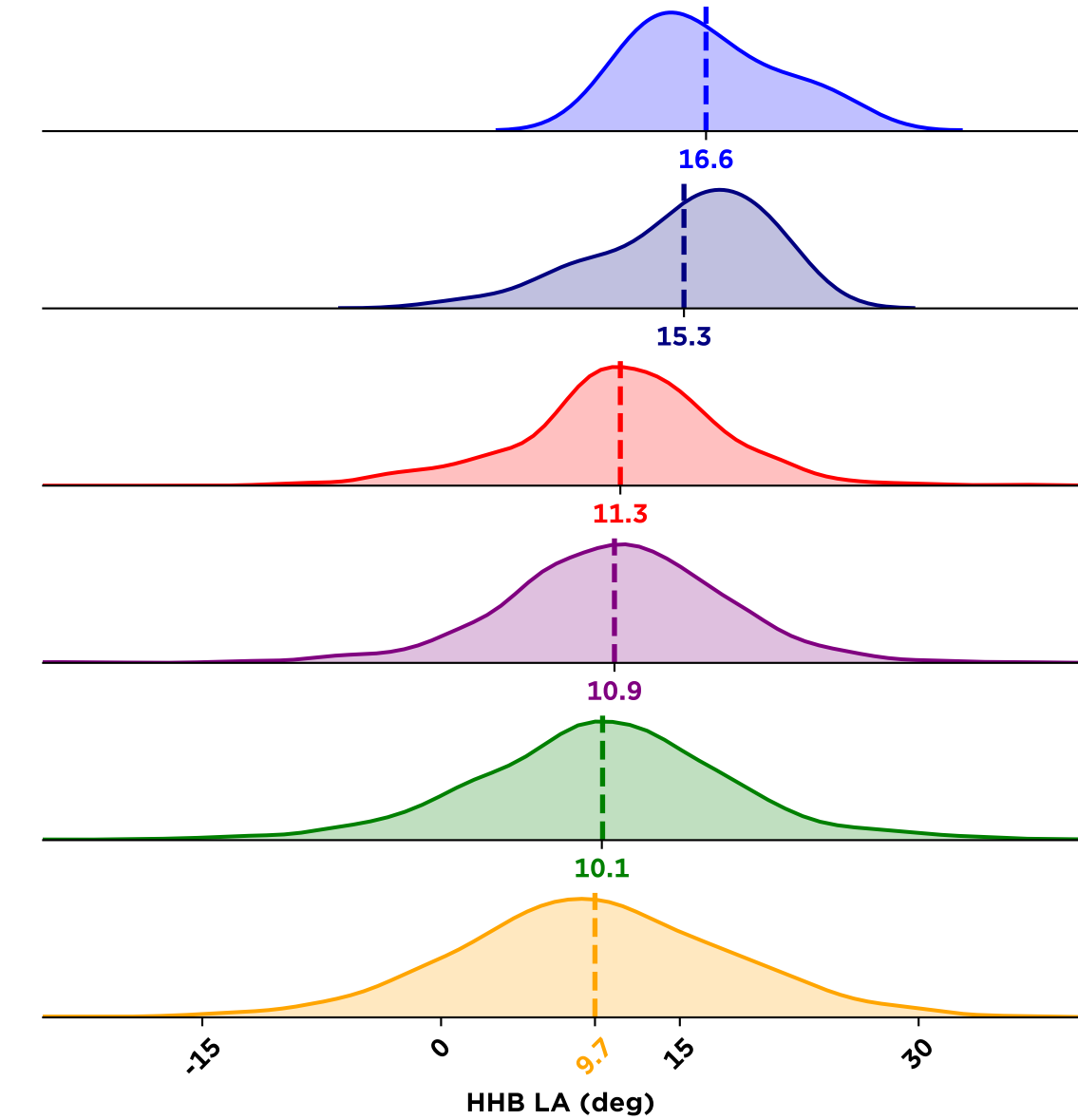
Exit Velo Distributions

A density plot distribution of a hitter's exit velocity values against in-gym hitter averages, split out by playing levels.



Top 8th Hard Hit Ball LA Distributions

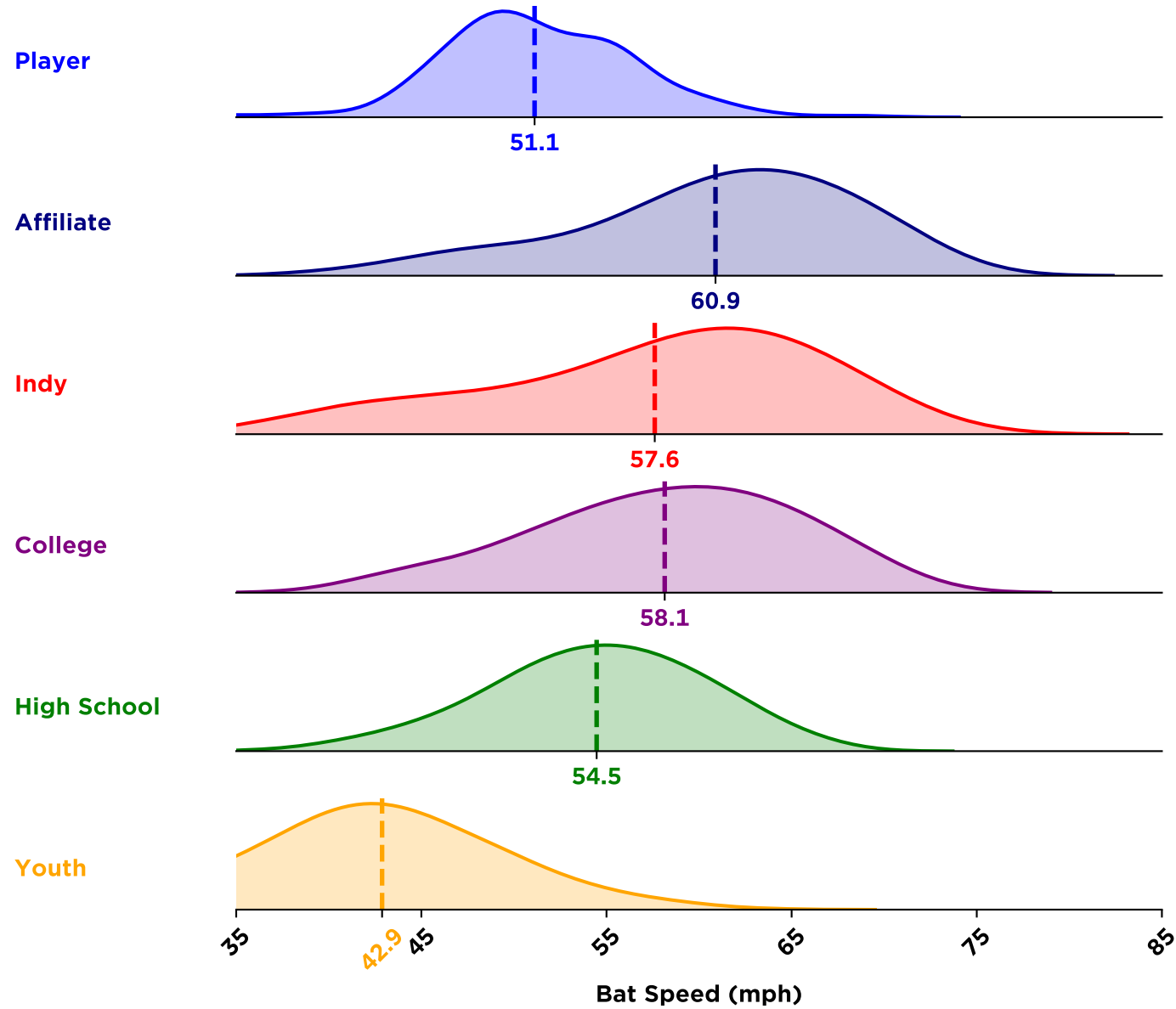
A density plot distribution of a hitter's hard hit launch angle values against in-gym hitter averages, split out by playing levels.



Performance Detail

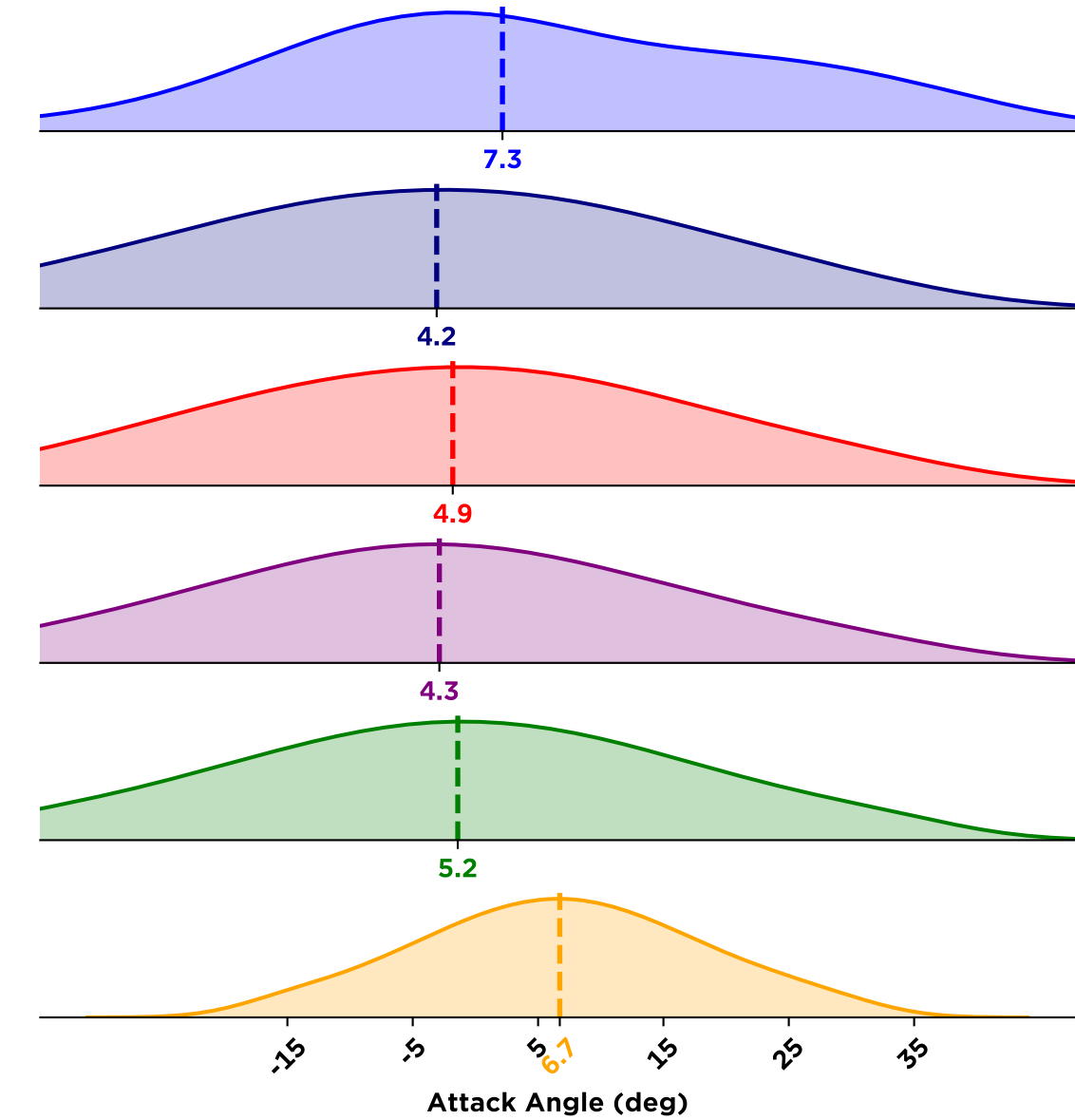
Barrel Speed

A density plot distribution of a hitter's barrel speed values against DK database hitter averages, split out by playing levels.



Attack Angle

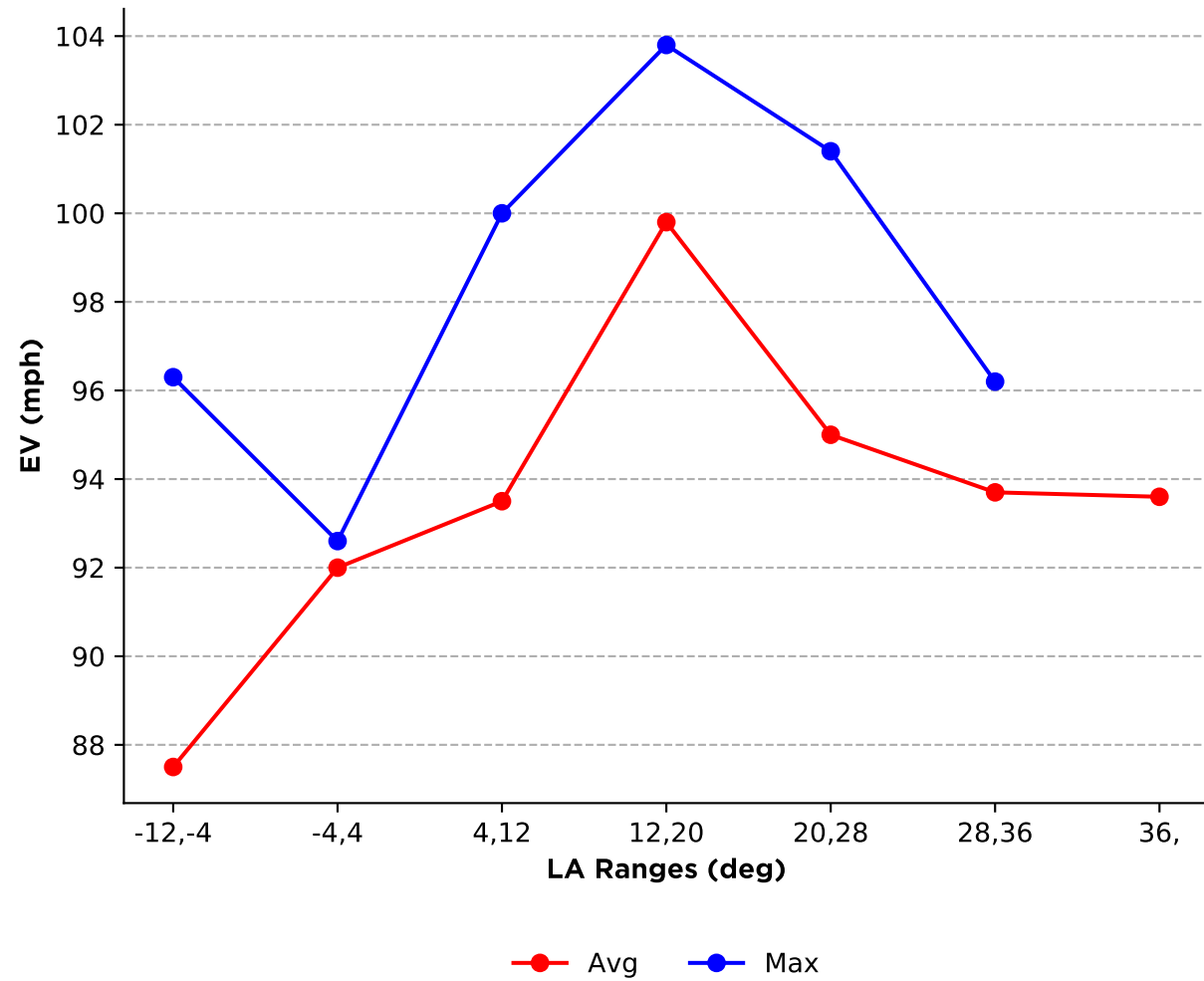
A density plot distribution of a hitter's attack angle values against DK database hitter averages, split out by playing levels.



Performance Detail

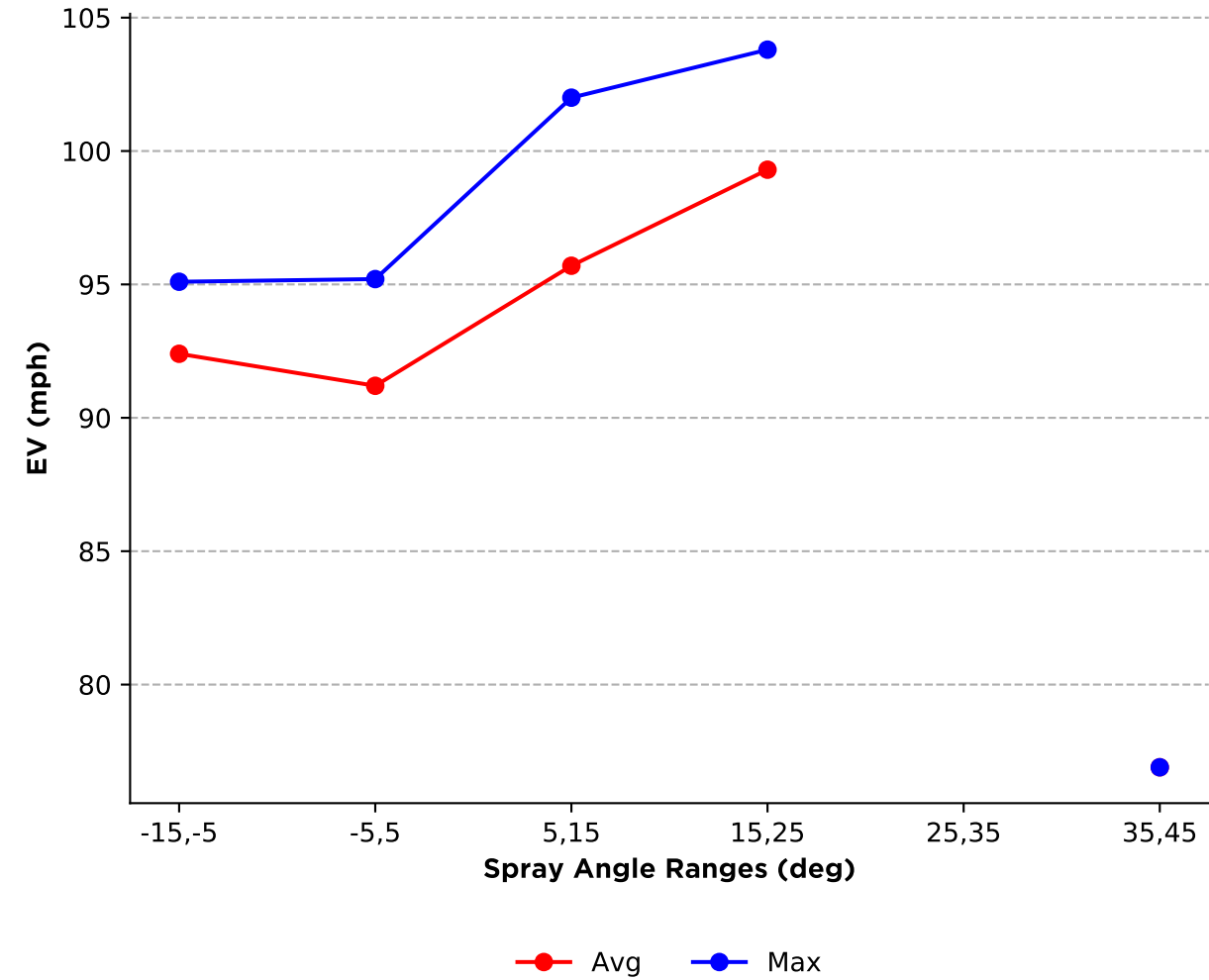
Max, AVG EV x LA Ranges

Maximum, average exit velocity plotted by launch angle ranges from <-12 degrees; -12 to -4; -4 to 4; 4 to 12; 12 to 20; 20 to 28; 28 to 36; >36. If there is no batted ball data for any one of these ranges, it will not be plotted.



Max, AVG EV x Spray Angle Ranges

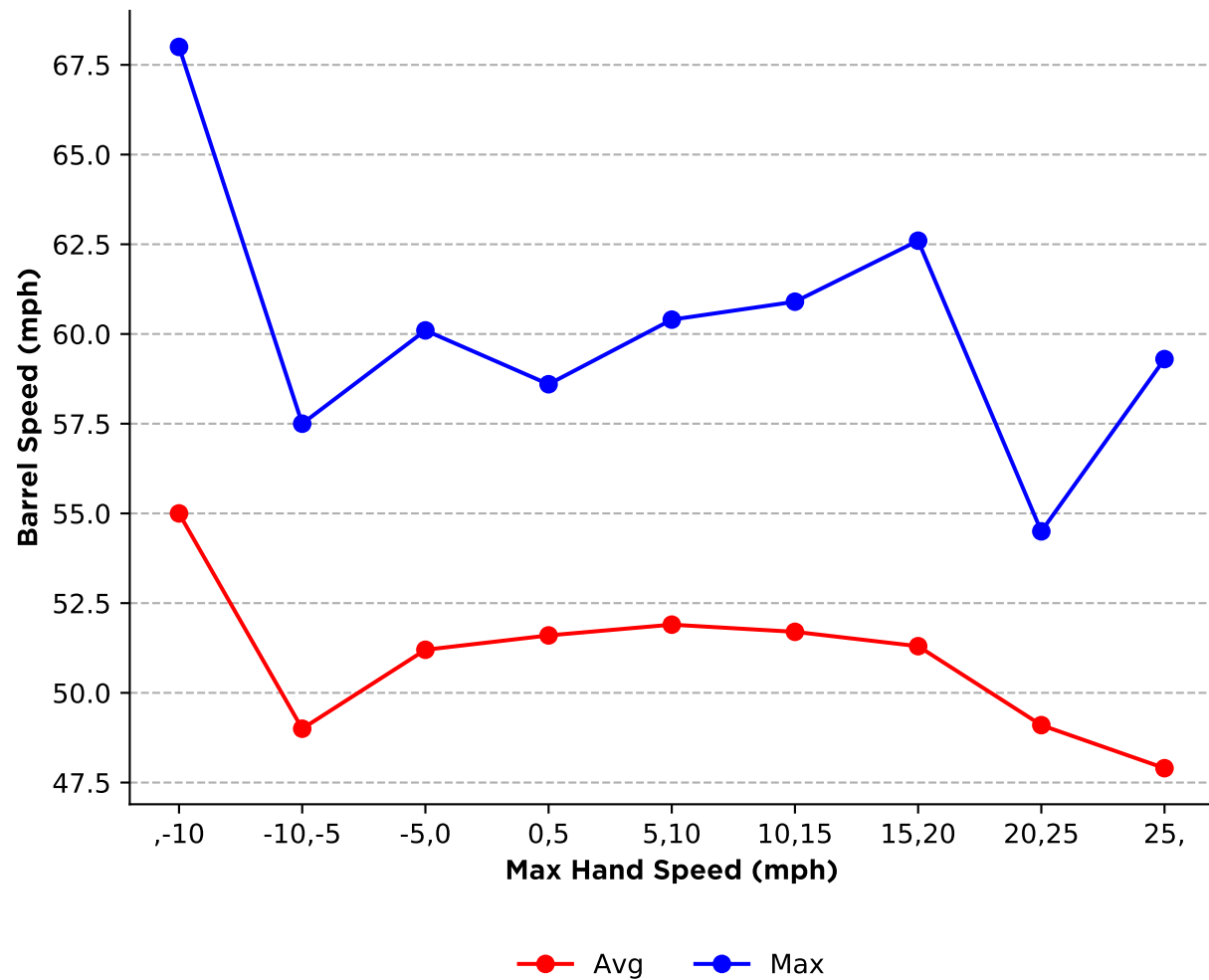
Maximum, average exit velocity plotted by spray angle ranges from -45 to 45 degrees in ten angle increments. If there is no swing level data for any one of these ranges, it will not be plotted.



Performance Detail

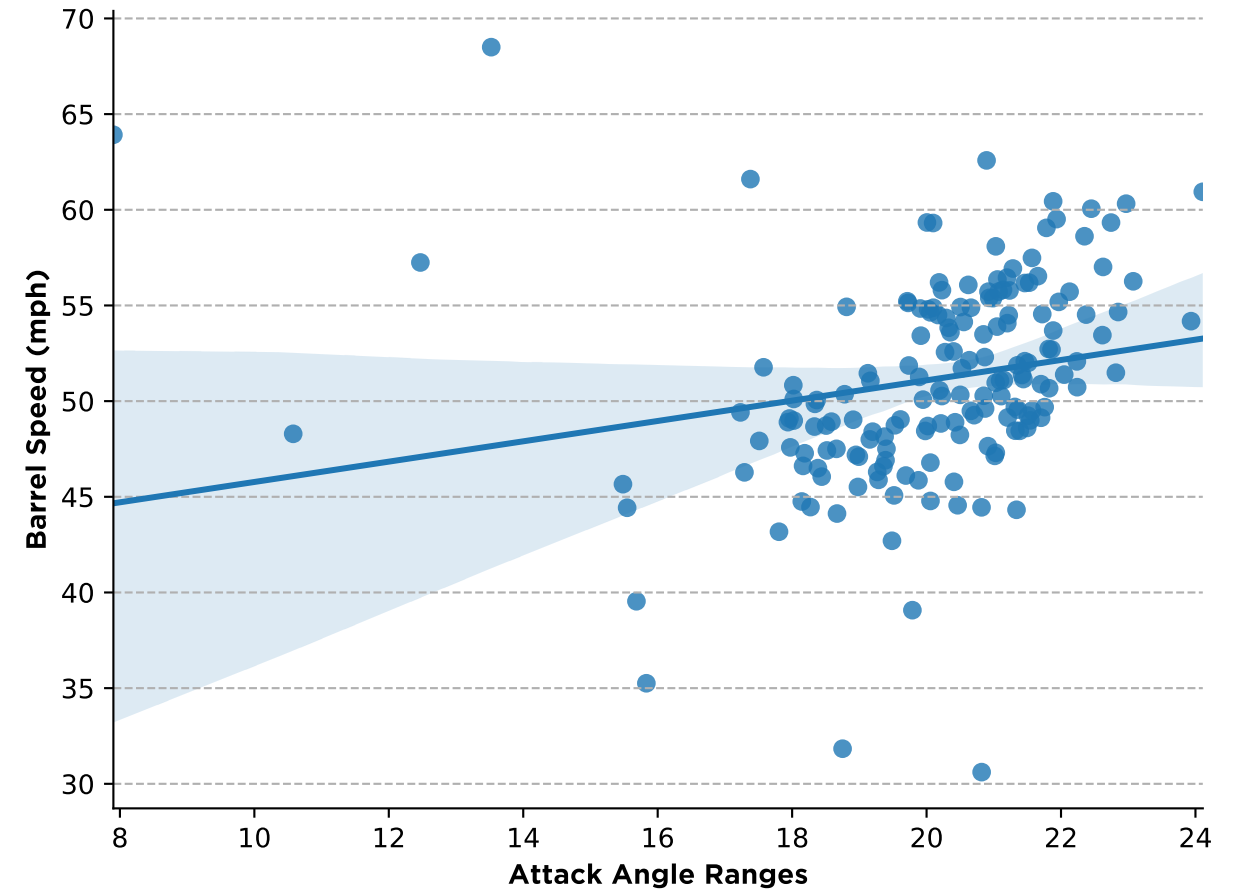
Avg, Max Barrel Speed by Attack Angle

Average barrel speed plotted by attack angle ranges from: Below -10 degrees, -10 to -5; -5 to 0; 0 to 5; 5 to 10; 10 to 15; 15 to 20; 20 to 25, 25+. If there is no swing data for any one of these ranges, it will not be plotted.



Barrel Efficiency

A linear model for Barrel Speed plotted against Hand Speed, in an attempt to see how efficiently a hitter is transferring his or her hand speed into barrel speed.



Continuing Education

Swing Profile: Introducing Expected Batted Ball Results

Knowing that bat sensor data is both reliable and often very descriptive of a hitter's batted ball talent, we decided to build a more powerful report, termed here as Swing Profile, based on *only* swing characteristics... the report also features two new predicted batted ball metrics: Peak Exit Velocity and Launch Angle at Peak Exit Velocity. In this case, we use Peak EV to reference the average EV of an individual's top eighth hardest hit balls, a proxy for exit velocity that has been used for years by the sabermetric community and has been validated by Driveline's own findings.

Learn More: <https://rb.gy/4tedu7>

Driveline Hitting KPI's

...at Driveline, we have a little bit more data to use, as our concerted data collection efforts on the hitting floor have allowed us to pair tens of thousands of rows of Blast and HitTrax data by their timestamps and users, allowing us now to put a concrete bat speed figure with batted ball data. Regressing completely off this we have found a simple linear regression explaining around 80 percent of the variation (or $.8 R^2$) of bat speed.

Learn More: <https://rb.gy/s9j5tp>

Debunking Bat Speed Myths

With the ability to measure bat speed and pair the findings to launch monitors and 3D motion devices, the claims on the relationship between bat speed and batted-ball characteristics can finally be examined. These are the ways to produce higher exit speeds:
--increase the speed of the most distal segment (the bat)
--decrease vibration on contact (sweet spot)
--increase the speed at which the ball is pitched

Learn More: <https://rb.gy/erjuxv>

Pairing Blast and Hittrax Data

Exit velocity increases (in order of strength) with Blast's power metric, bat speed, peak-hand speed, and the rotation metrics, while decreasing with time to contact. Launch angle has a positive significant correlation with attack angle which, while completely different metrics, are often either confused for one another or believed to not be correlated at all.

Learn More: <https://rb.gy/mwm721>

Pairing Blast and Hittrax Data Part II: Specific Focuses

In this piece, we take a look at commonly held, specific beliefs that have been touched upon by our hitting trainers and see whether the data backs it up. We also take a more nuanced view of a popular sabermetric proxy for evaluating attack angle via unsupervised learning.

Learn More: <https://rb.gy/qmj2um>

Rotational Acceleration, Sequencing, and the Swing

Our R&D team has paired Blast, K-Vest, and HitTrax data, allowing us to take a deeper dive into rotational acceleration to evaluate claims surrounding it. We have found relevant correlations with sequence percentage, time to contact, and peak hand speed.

Learn More: <https://rb.gy/j4mmkr>