Pitch Characteristics' Impact on Home Runs

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Outline of research

- Goal
  - Determine what pitch characteristics lead to a "good pitch" therefore limiting the likelihood of that pitch being hit for a home run.
- Methodology
  - Retrieve pitch-by-pitch data for 2016 and 2017 seasons from Baseball Savant.
  - Determine which pitch type was hit for home run most frequently. Pitches broken into three categories: fastball, breaking ball, and off-speed.
  - Create hit quality and pitch quality models.
  - Analyze trends in the data from the two years.
- Results

Part I: Highest home run frequency – by pitch

▶ Each pitcher was then broken into one of three categories: Velocity, Breaking Ball or Off-Speed. Categories based on percentage of pitch type thrown to total pitches

  ▶ Velocity = Fastball usage > 61%

  ▶ Breaking Ball = Breaking usage > 30%

  ▶ Off-Speed = Off-Speed usage > 15%

*Baseline percentages limits based on average league usage in 2017

	Approach	Pitcher Count	HR %
1	Breaking Ball	167	3.30%
2	OffSpeed	111	3.28%
3	Velocity	183	3.00%

2017 home runs hit per total batter faced by each player within each approach category.

Part I cont.: What are we seeing and why?

- Velocity pitchers are less likely to give up home runs than pitchers with other approaches.

- Velocity pitchers must be throwing "better" fastballs than off-speed and breaking ball pitchers.

- Can we quantify what is considered a "good" fastball?

Part II: Modeling Hit Quality

2017 Hit Quality Model
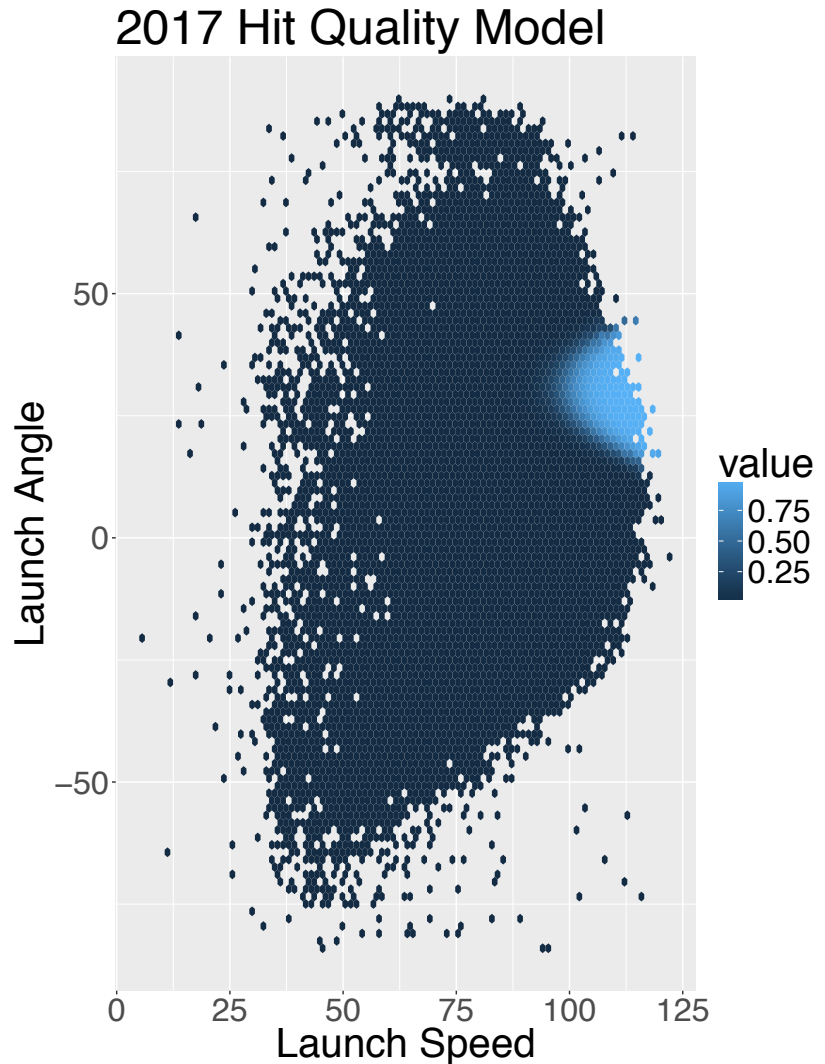
- ▶ Logistic regression of transformed launch speed and launch angle variables

- ▶ Determined the quality of contact for each batted ball

- ▶ Balls hit between 95-115 mph with around a 25 degree launch angle have a high likelihood of being hit for a home run

2016/2017 Hit Quality Comparison
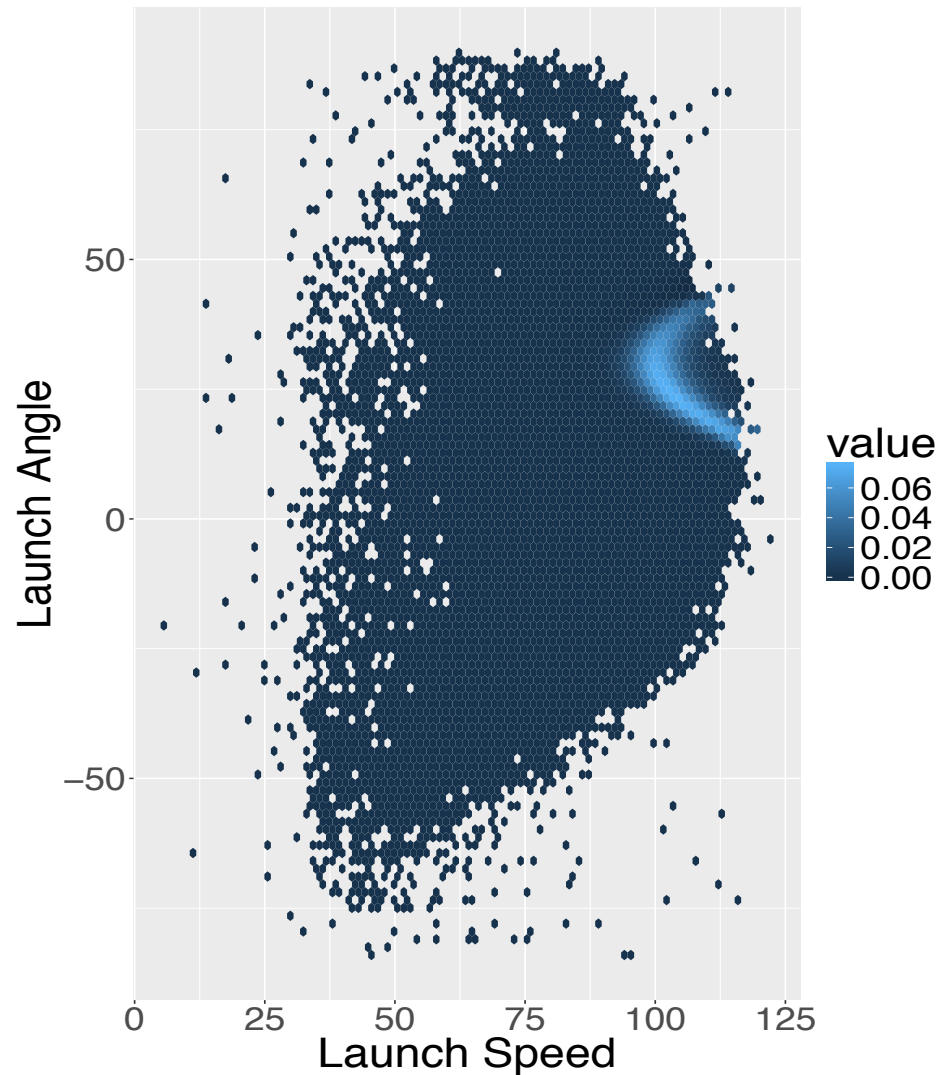
- ▶ Borderline batted fastballs were up to 8% more likely to be hit for a home run

- ▶ Breaking ball and off-speed pitches saw an increase in hit quality on a much larger range of batted balls

- ▶ What used to be warning track outs, are now being hit out of the park

Part III: Modeling Pitch Quality

2017 Fastball Pitch Quality Model
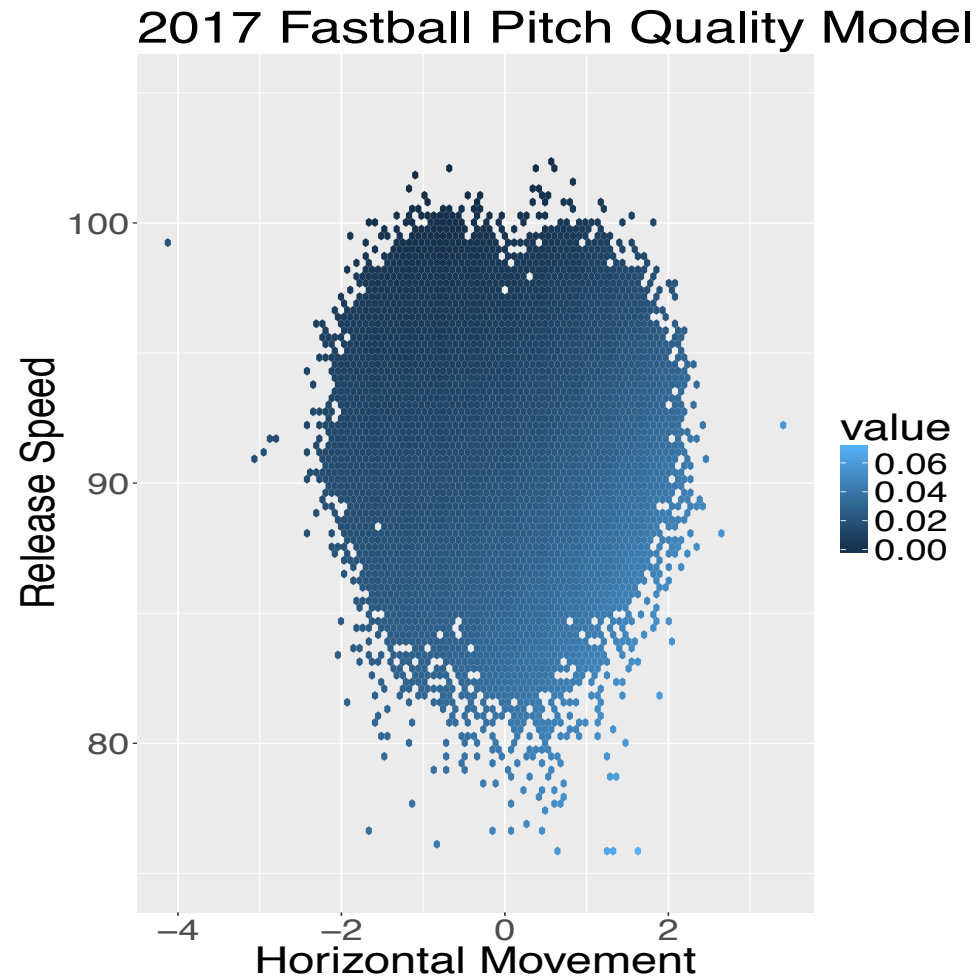
- Linear regression of release speed, location, spin rate, and transformed movement on Hit Quality

- Determined the likelihood of a home run being hit from each pitch thrown

- As the speed of a pitch increases and moves in towards a batters hands the likelihood of a home run drastically decreases
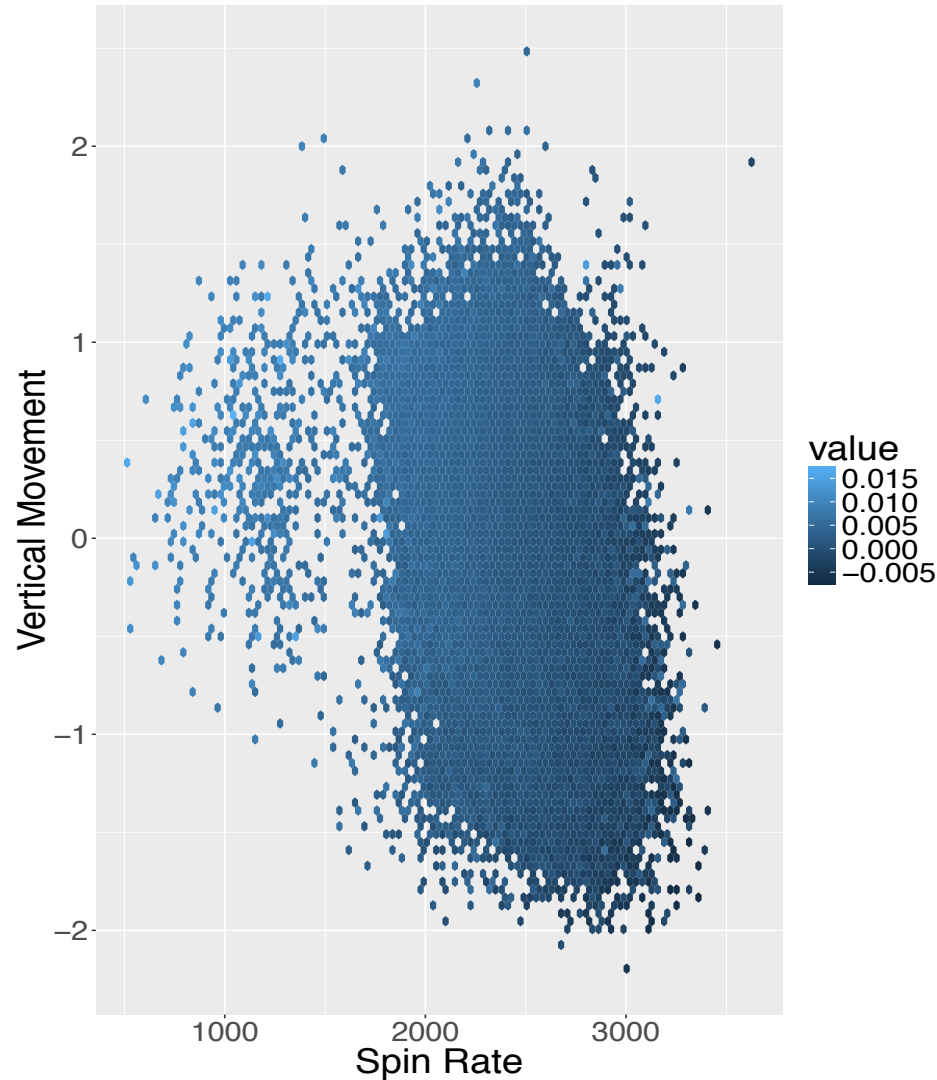
2016/2017 Fastball Pitch Quality Comparison

▶ Fastball characteristics that have made pitches more difficult to hit in 2017

  ▶ High velocity pitches that move away from the batter

 ▶ Slower pitches that move towards the batters hands
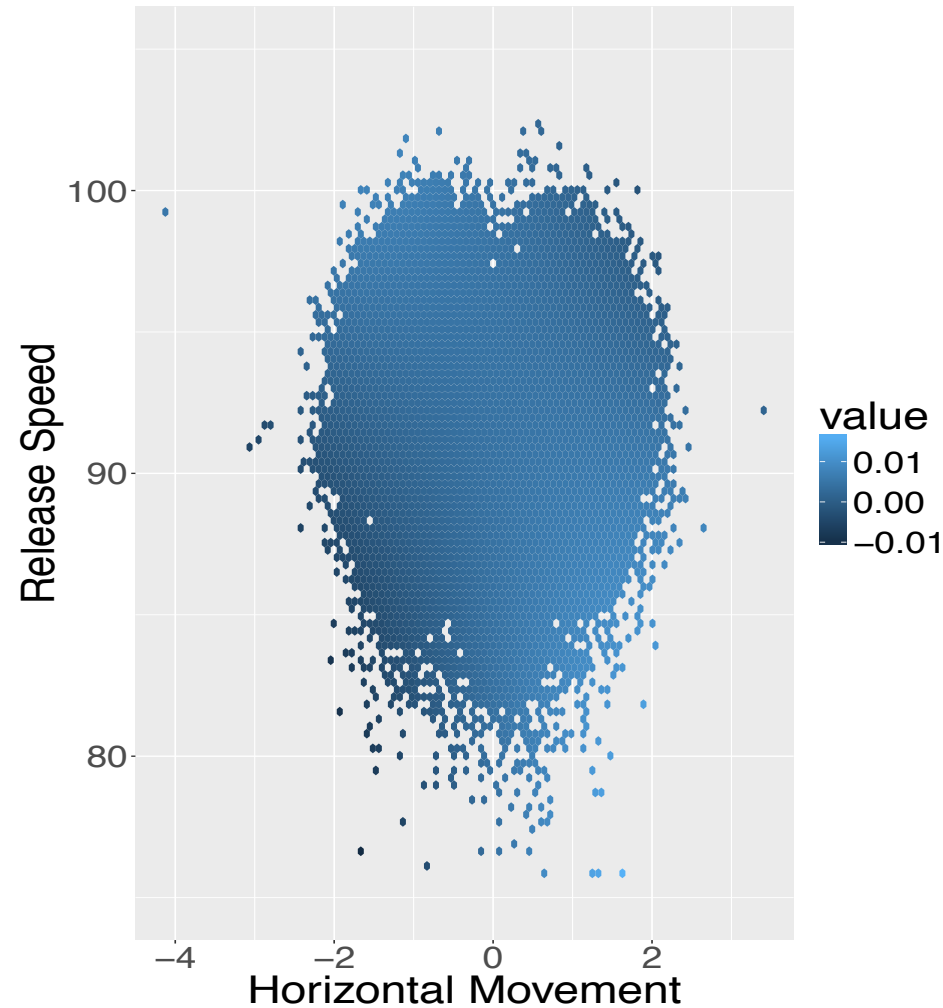
2016/2017 Breaking Ball Pitch Quality Comparison

- ▶ Breaking Ball characteristics that have made pitches more difficult to hit in 2017
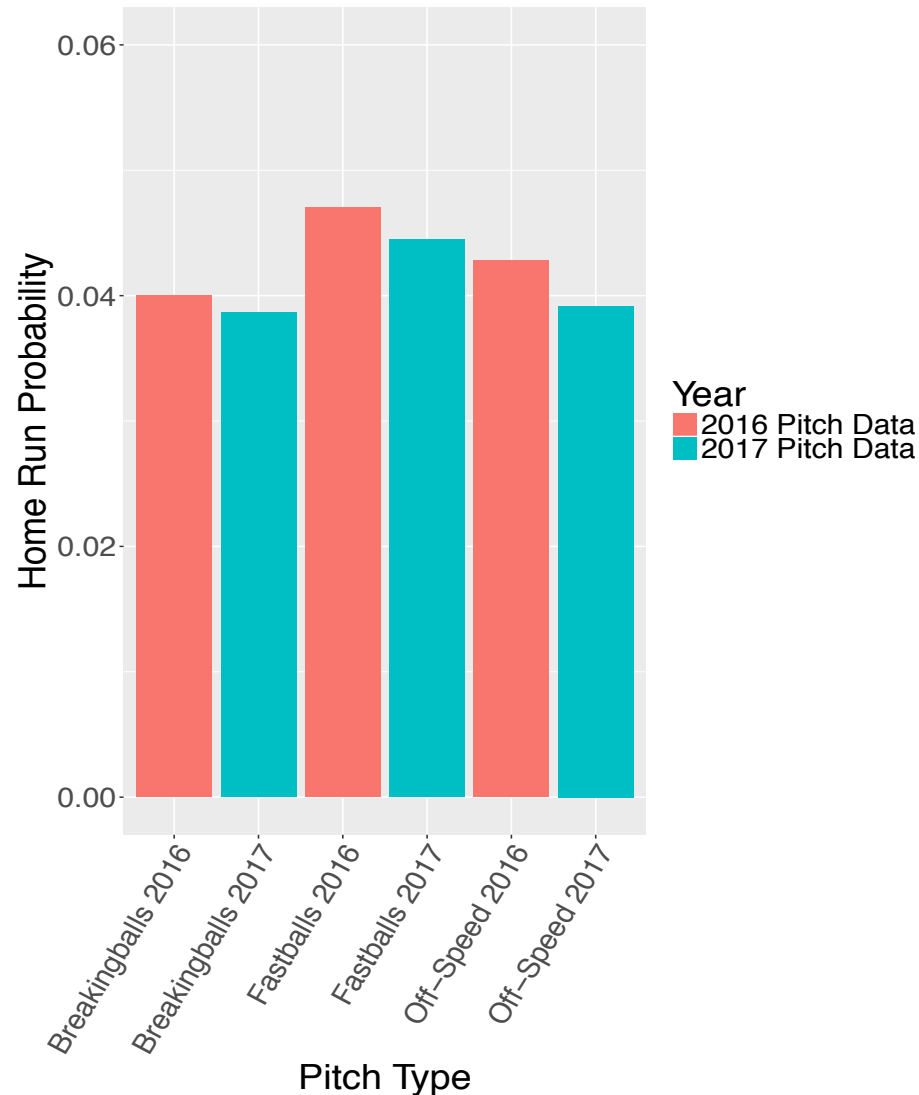 - ▶ Downward vertical movement
  - ▶ High spin rate

2016/2017 Off-Speed Pitch Quality Comparison

▶ Off-speed characteristics that have made pitches more difficult to hit in 2017

  ▶ Good rise

  ▶ Higher velocity has a slight edge
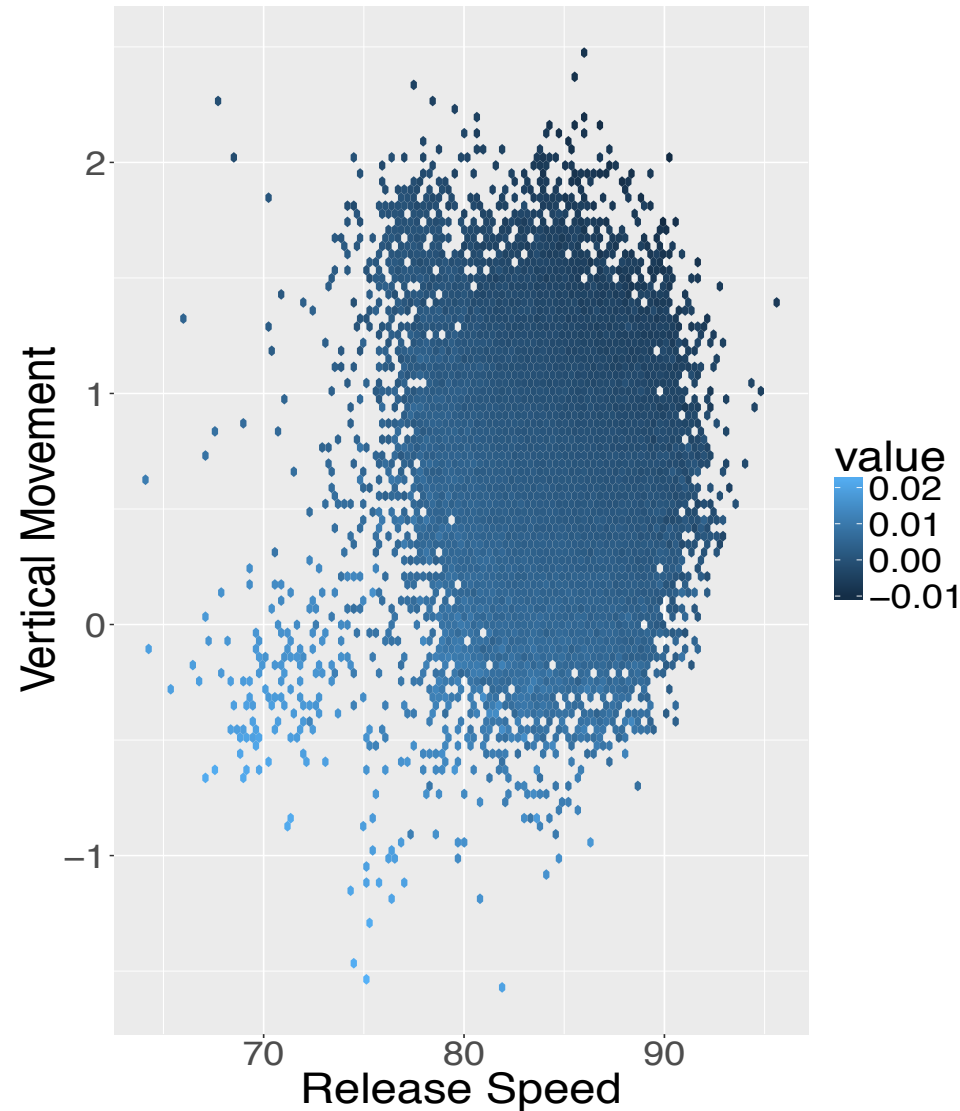
2016/2017 Pitch Quality Comparison

- ▶ Pitch data was derived from both 2016 & 2017 and run through the 2016 pitch quality model

- ▶ Fastballs thrown were 0.3% more likely to be hit for a home run in 2016

- ▶ Breaking balls were 0.2% more likely to be hit for a home run in 2016

- ▶ Off-Speed were 0.4% more likely to be hit for a home run in 2016

Conclusions

▶ Fastballs are hit for home runs more frequently than any other pitch type

▶ "Velocity" pitchers are allowing fewer home runs

▶ Increased home run frequency on borderline batted balls

▶ Fastballs thrown with high velocity and inward movement are most difficult to hit

▶ Pitchers were throwing better pitches in 2017