

# BAYVRS AT BAT

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A BASEBALL DATA STUDY

By KYLE BLACK

## A B S T R A C T

Since 1869 baseball has been a game measured by data. Data helps us know, how productive hitters are with statistics like Batting Average (Number of At Bats / Hits), On Base Percentage ((Hits + Walks + Hit by Pitch) / (At Bats + Walks + Hit by Pitch + Sacrifice Flies)), and Slugging Percentage ((Singles + Doubles \*2 + Triples \*3 + Homeruns \*4) / At Bats). They can also help recognize the effectiveness of pitchers with Earned Run Average ((9 x earned runs / innings pitched)) and Walks, Hits per Inning Pitched (WHIP) ((walks allowed + hits allowed)/ innings pitched).

These statistics among many others have been the backbone of baseball analytics for over a century. However, innovations in technology have penetrated baseball, and how baseball executives and fans analyse what's really happening in a game is rapidly changing.

With its Major League Baseball debut in 2006, PITCH F/X, a triple mounted camera system that measures pitch movement (more than just mere velocity) started to rapidly change how scouts and Major league Teams evaluated players.

In 2017, STATCAST, a camera system and doppler radar that captures every movement on a baseball field was introduced. Now a single recorded pitch produces over 86 columns of data, many of which are related to the physics of what is happening on the field. With the massive amounts of data that is produced, Major League clubs hire teams of analysts to sift through this data and produce insights that will give them an edge over league rivals.

This study will look at every pitch over the 2019 Major League Baseball season, where a batter has made fair swinging contact, excluding bunts. (\*\*\*\*\* Pitch Counts). Then it will further examine a specific type of pitch and attempt to prove a hypothesis about its effect on how well the after makes contact.

## The Data

The data is pulled from Baseball Savant, Statcast's publicly accessible database that logs every pitch of every Major League Baseball game. The data I selected is every pitch from the 2019 Major League Baseball season that resulted in fair swing contact excluding bunts.

The velocity of the pitch.

Release position of pitch from first and third base perspective.

Launch angle of ball after contact is made.

Type of pitch.

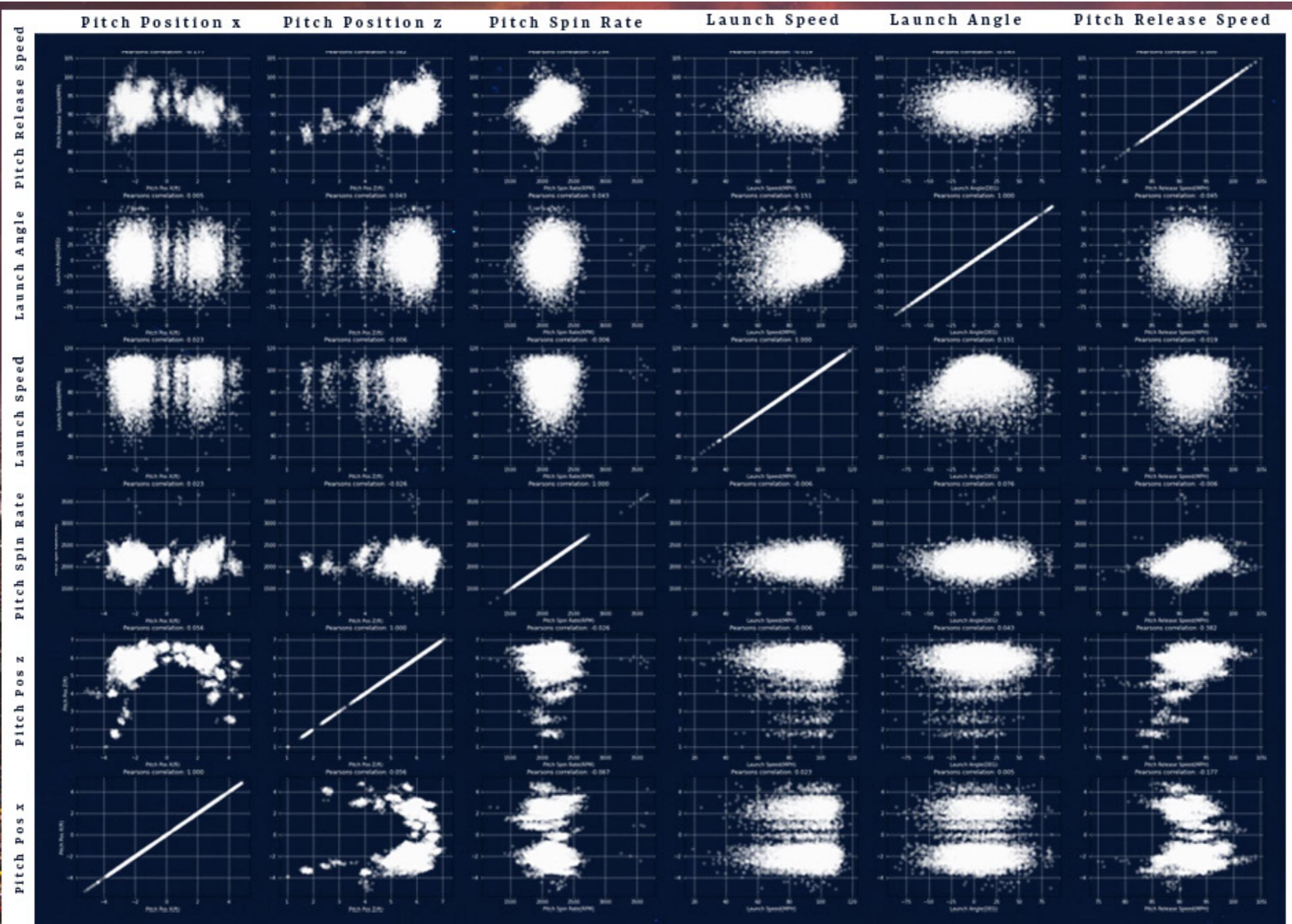
Pitcher	Release Speed(MPH)	Release Pos X(Ft)	Release Pos Z(Ft)	Launch Speed(MPH)	Launch Angle(Degrees)	Handed Match-Up	Pitch Type
Aldroidis Chapman	102.2	-2.27	6.33	102.5	21.0	Right v Right	4 Seam Fastball

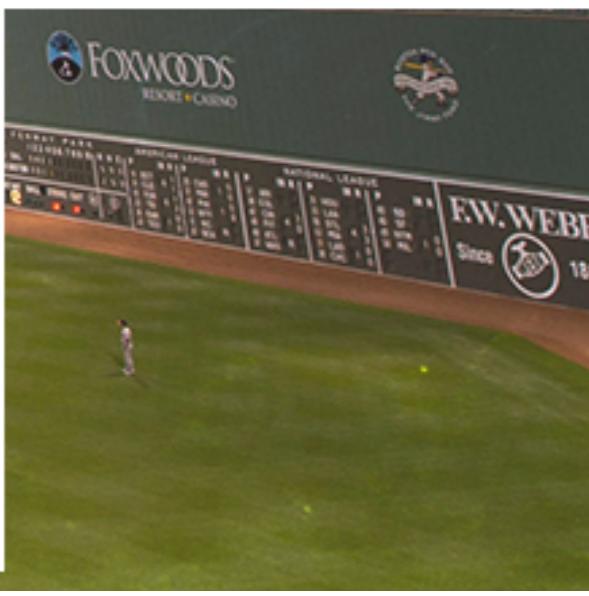
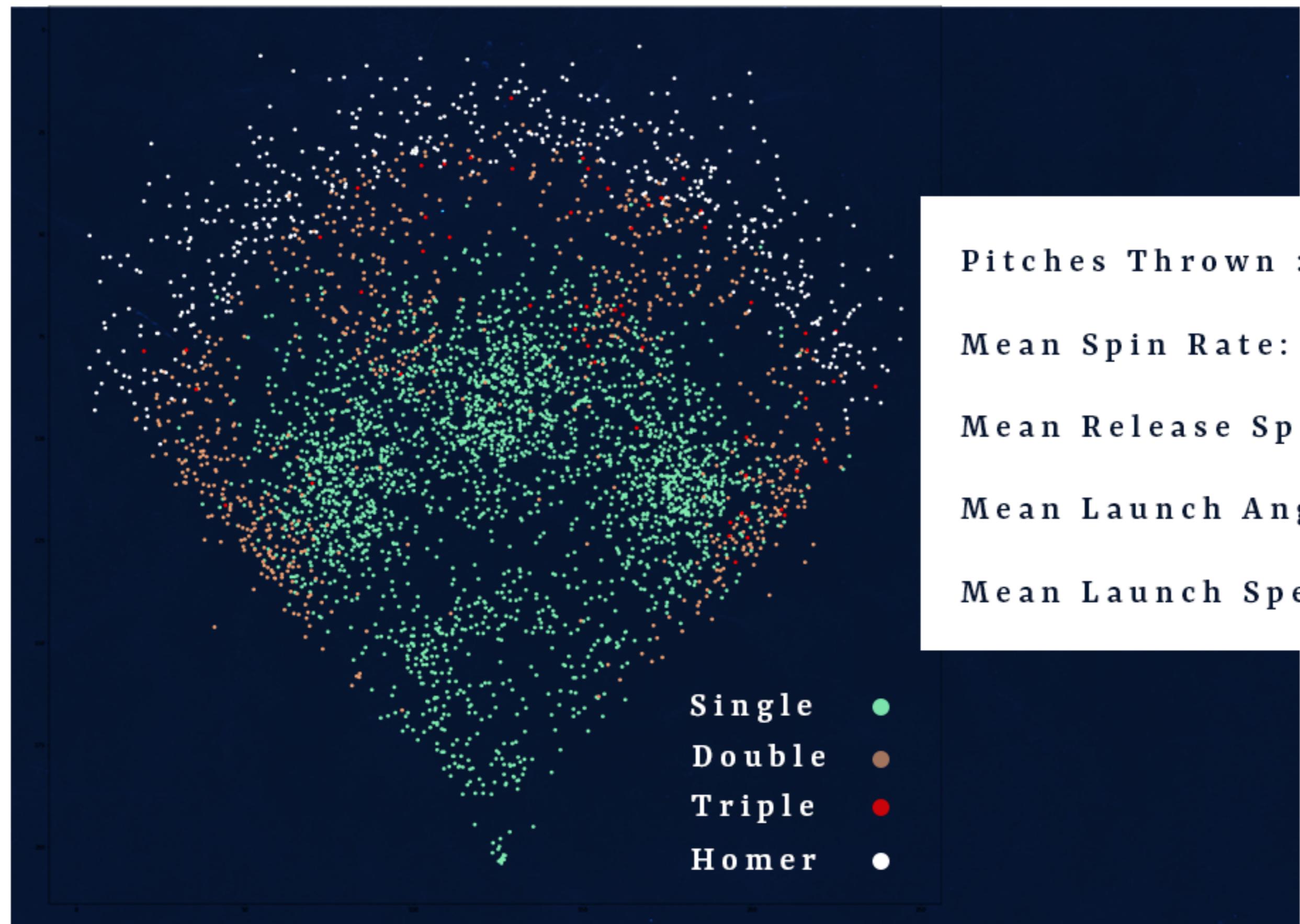
Pitcher Throwing the pitch.

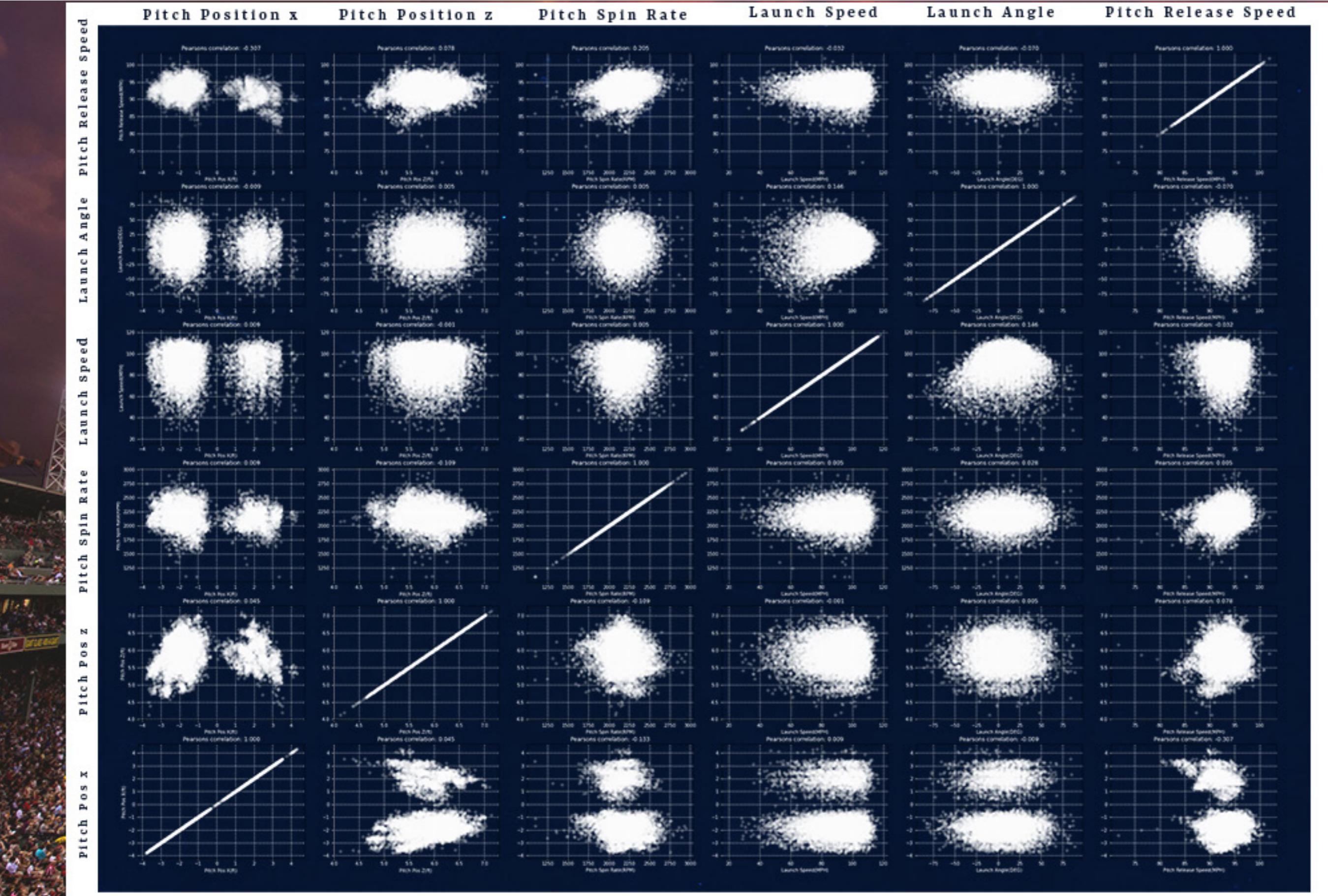
Release position of the pitch from the catcher's perspective.

Velocity of ball after contact with bat.

Match-up of handedness Pitcher vs Batter.







# Two Seem Fastball



## Two Seem Fastball

Pitches Thrown : 11702

Mean Spin Rate: 2169.45 RPM

Mean Release Speed: 92.74 MPH

Mean Launch Angle: 5.25 DEG

Mean Launch Speed: 89.6 MPH

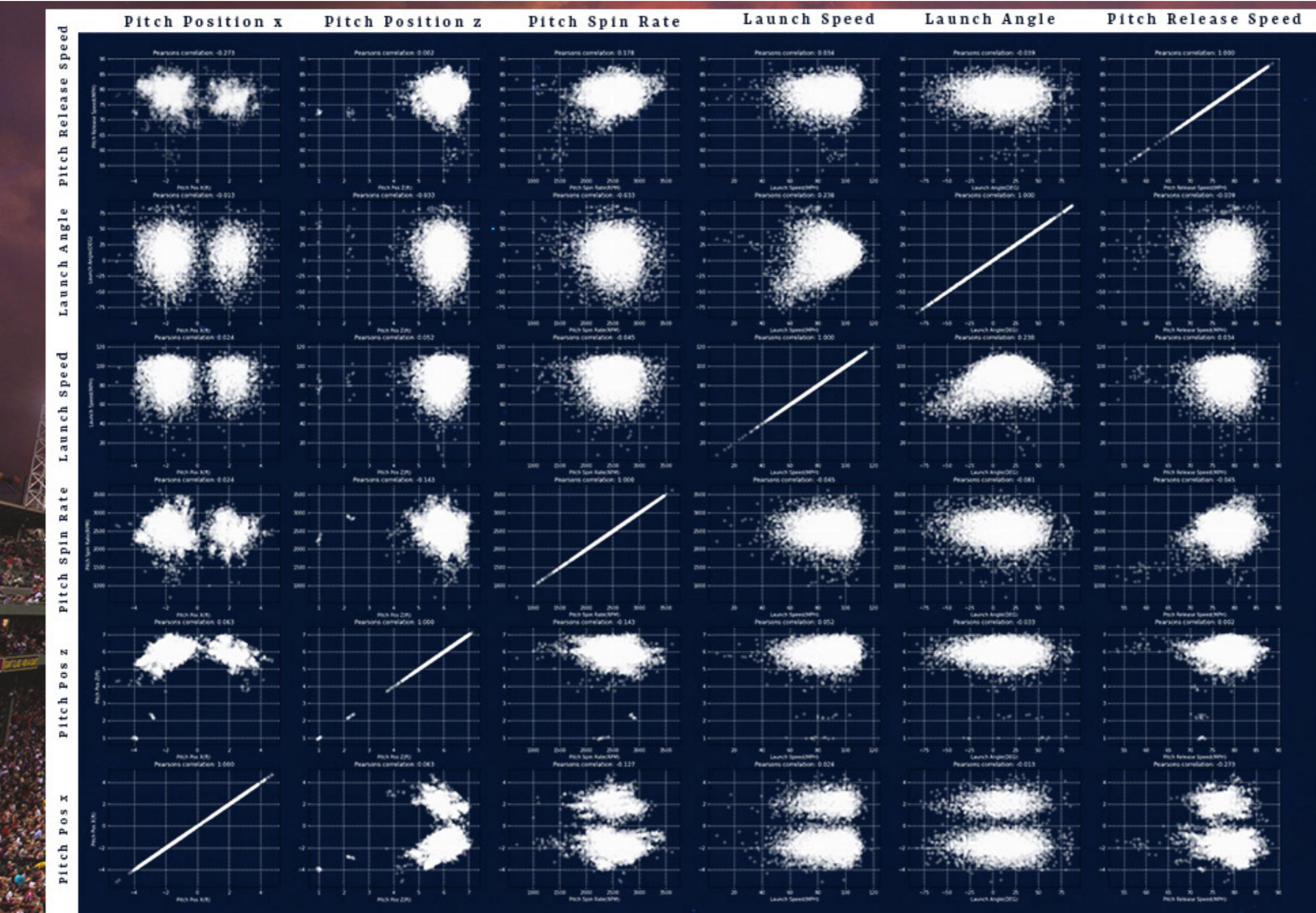
Single ●

Double ●

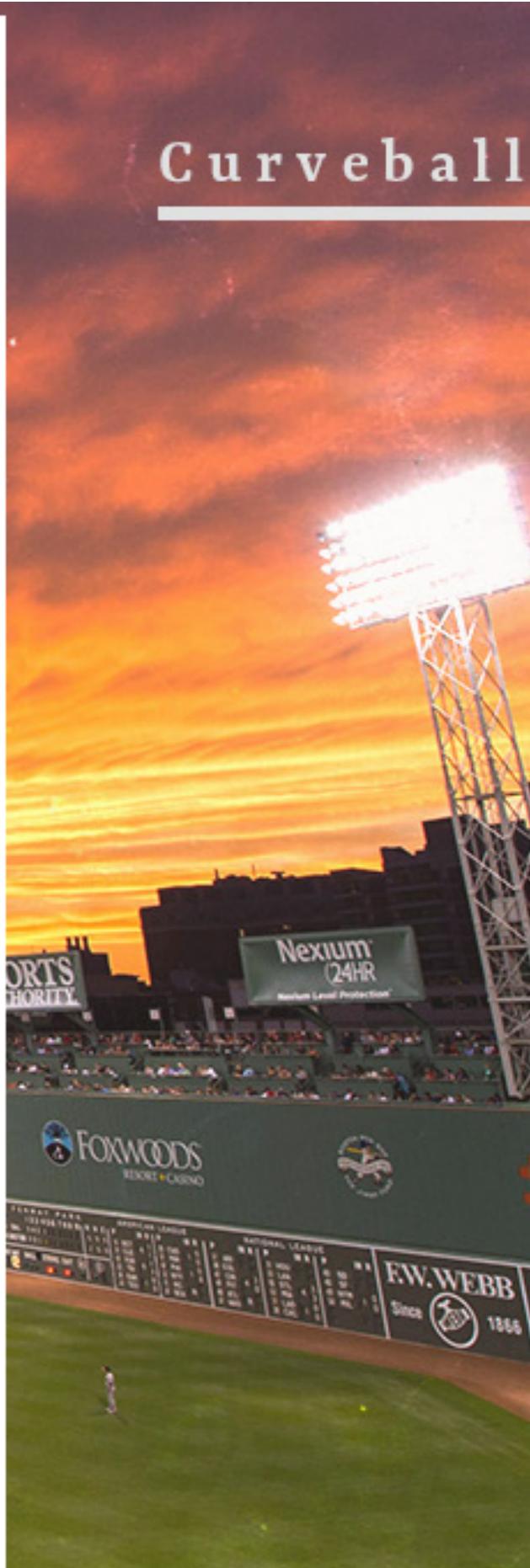
Triple ●

Hom er ●





# Curveball



## Curveball

Pitches Thrown : 8273

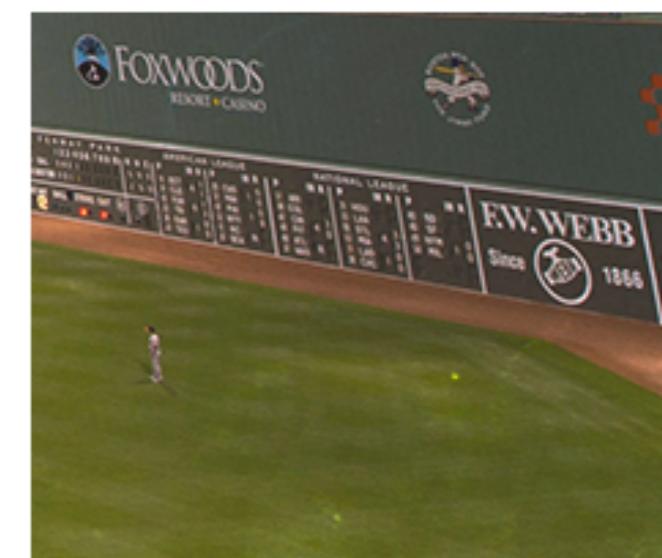
Mean Spin Rate: 2525.87 RPM

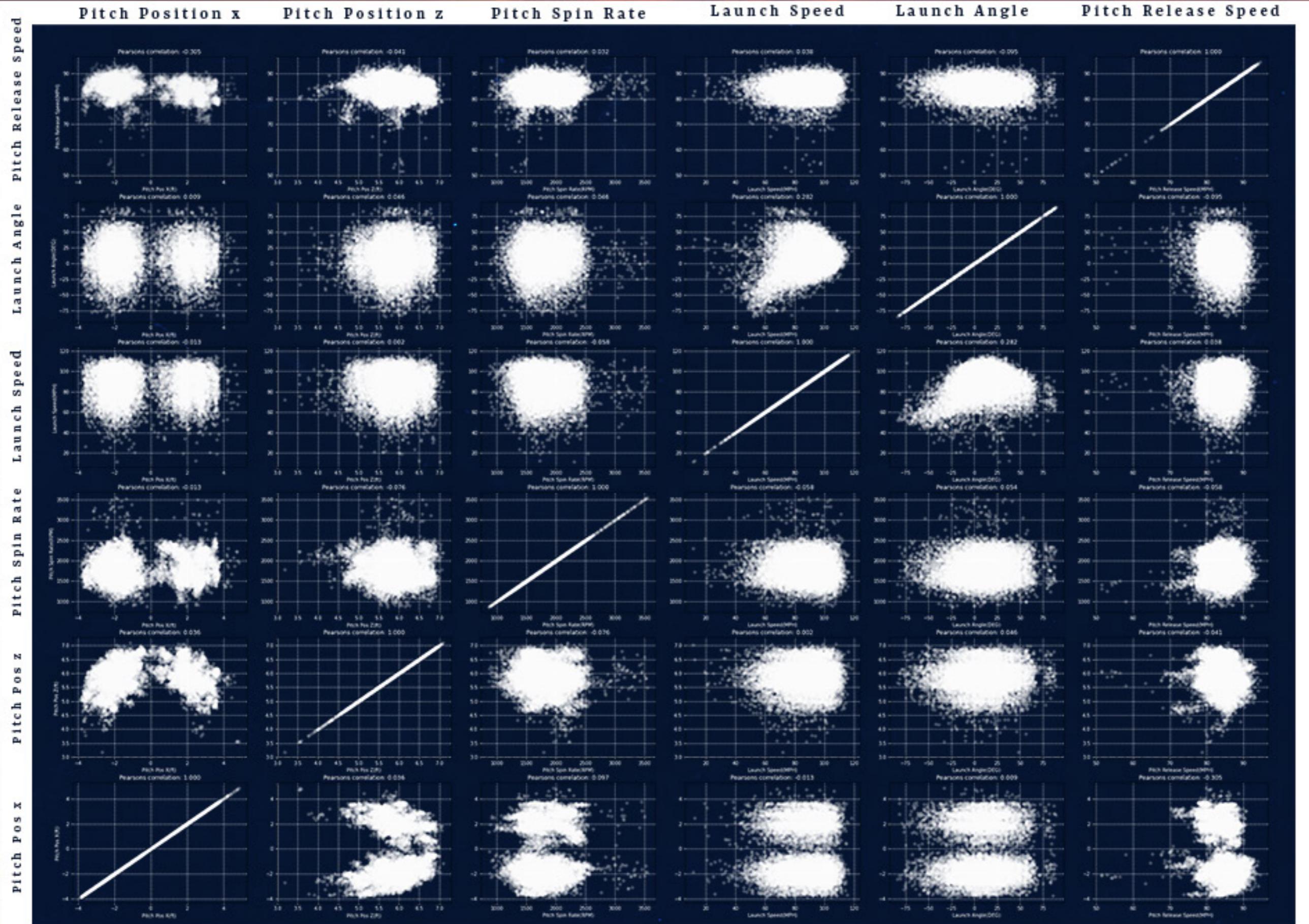
Mean Release Speed: 78.35 MPH

Mean Launch Angle: 10.17 DEG

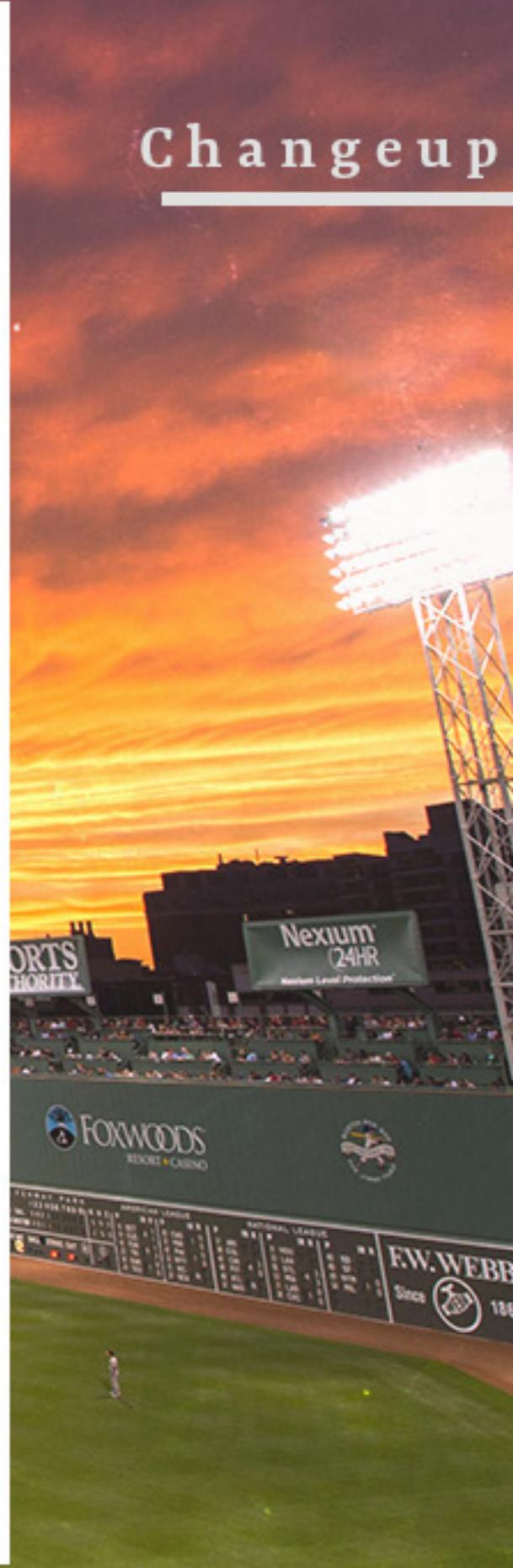
Mean Launch Speed: 87.49 MPH

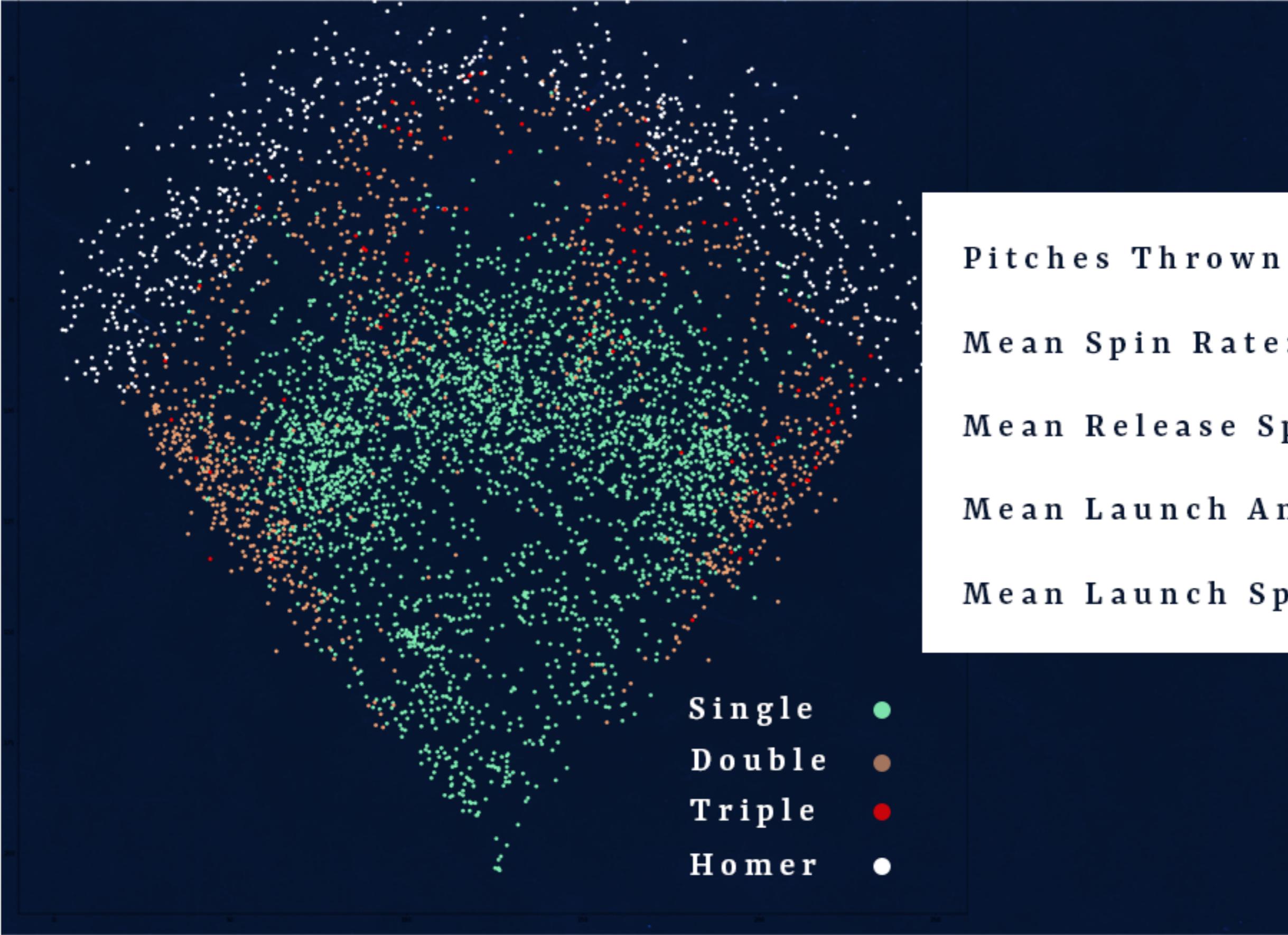
Single •  
Double •  
Triple •  
Homer •





# Change up





Changeup

Pitches Thrown : 14434

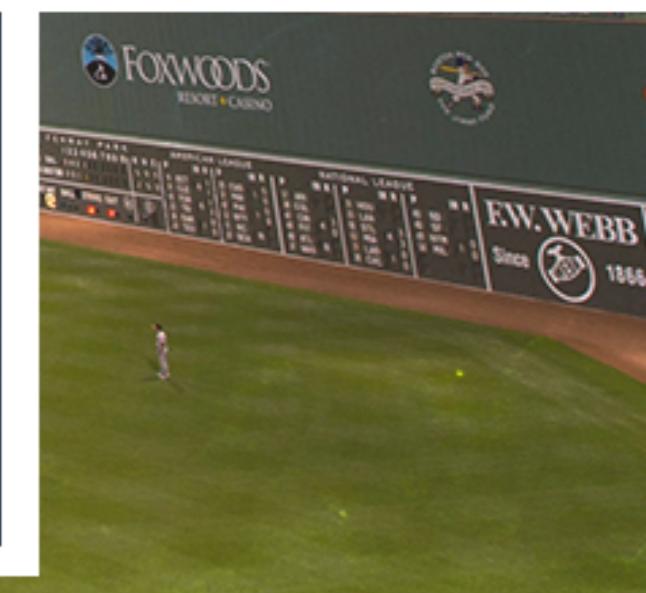
Mean Spin Rate: 1802.49 RPM

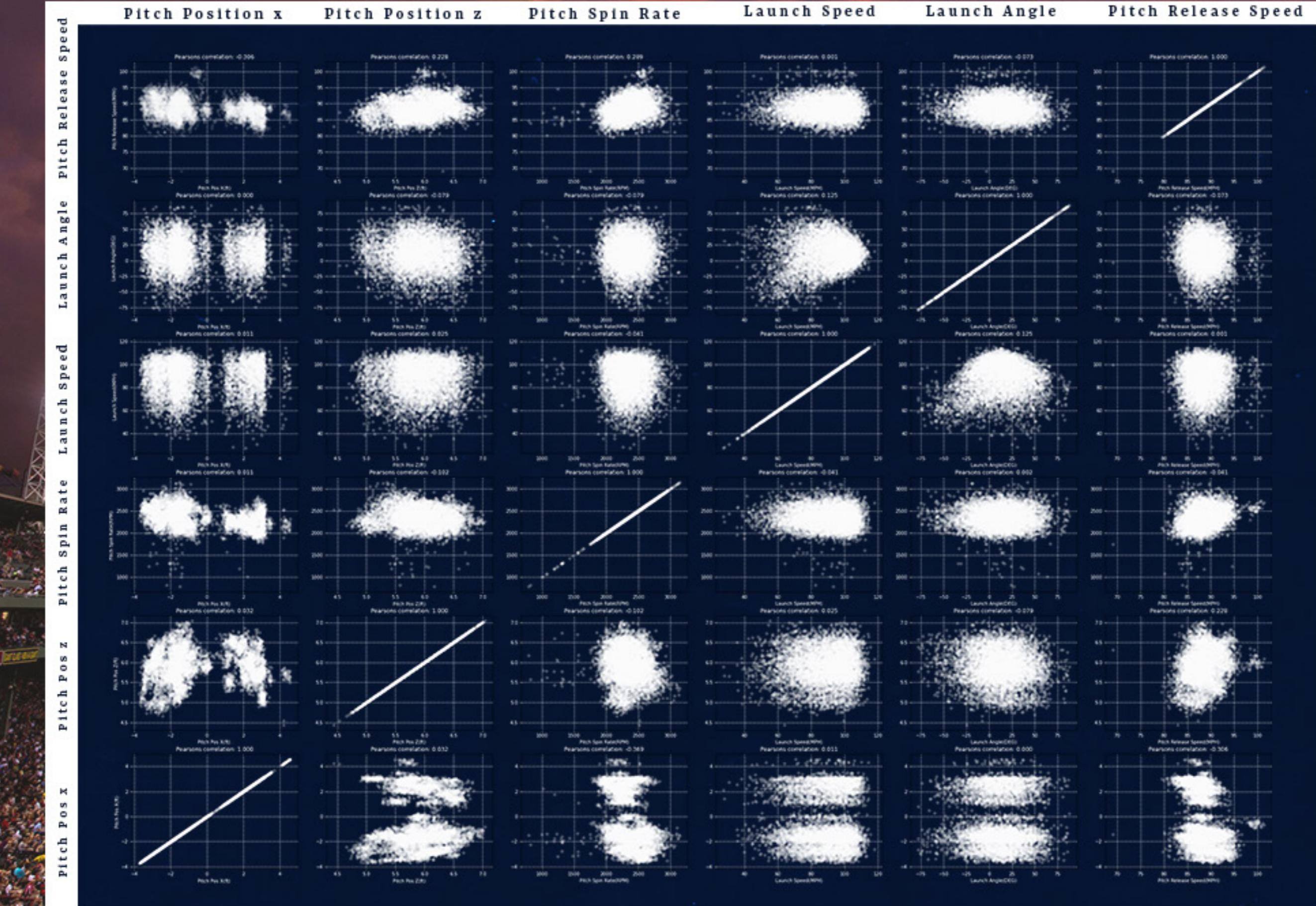
Mean Release Speed: 84.33 MPH

Mean Launch Angle: 9.13 DEG

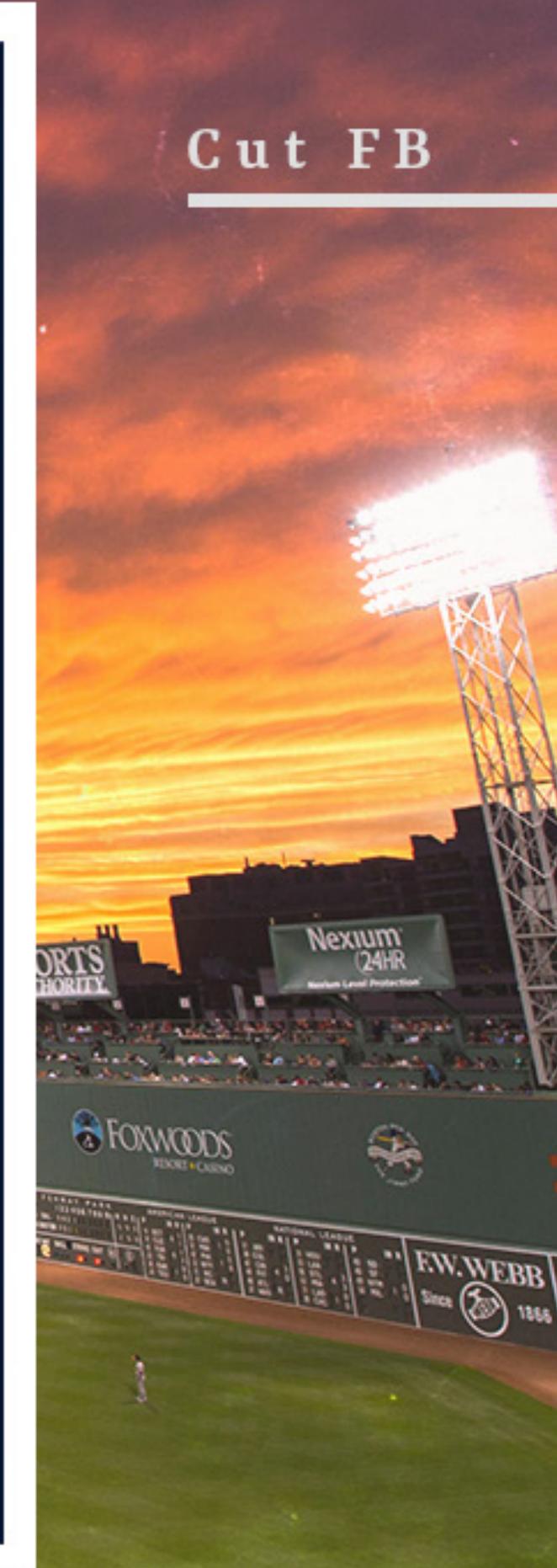
Mean Launch Speed: 86.34 MPH

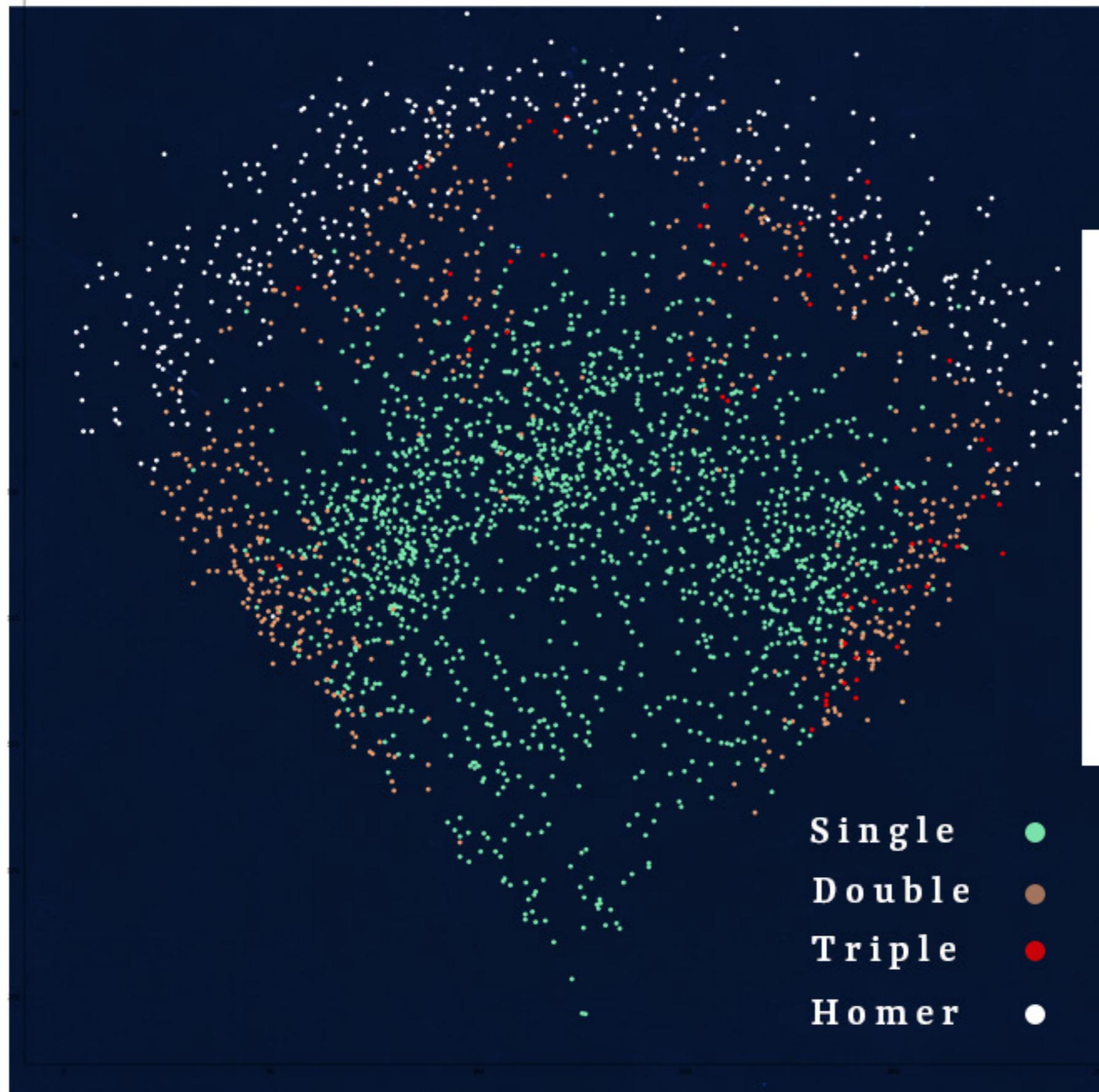
Single •  
Double •  
Triple •  
Homer •





# Cut FB





Single •  
Double •  
Triple •  
Homer •

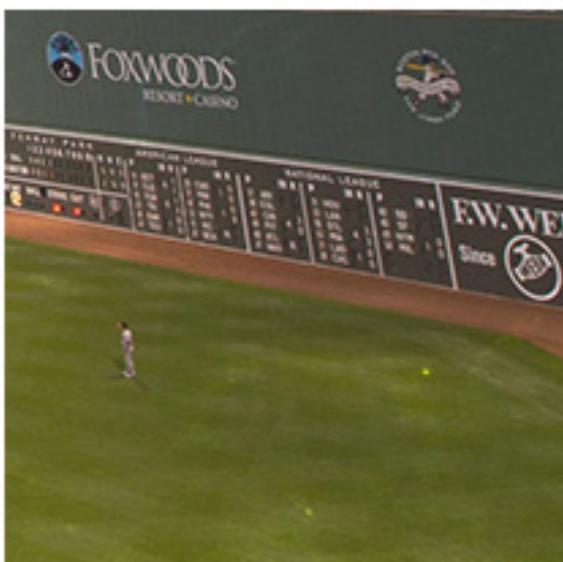
Pitches Thrown : 7721

Mean Spin Rate: 2348.27 RPM

Mean Release Speed: 88.52 MPH

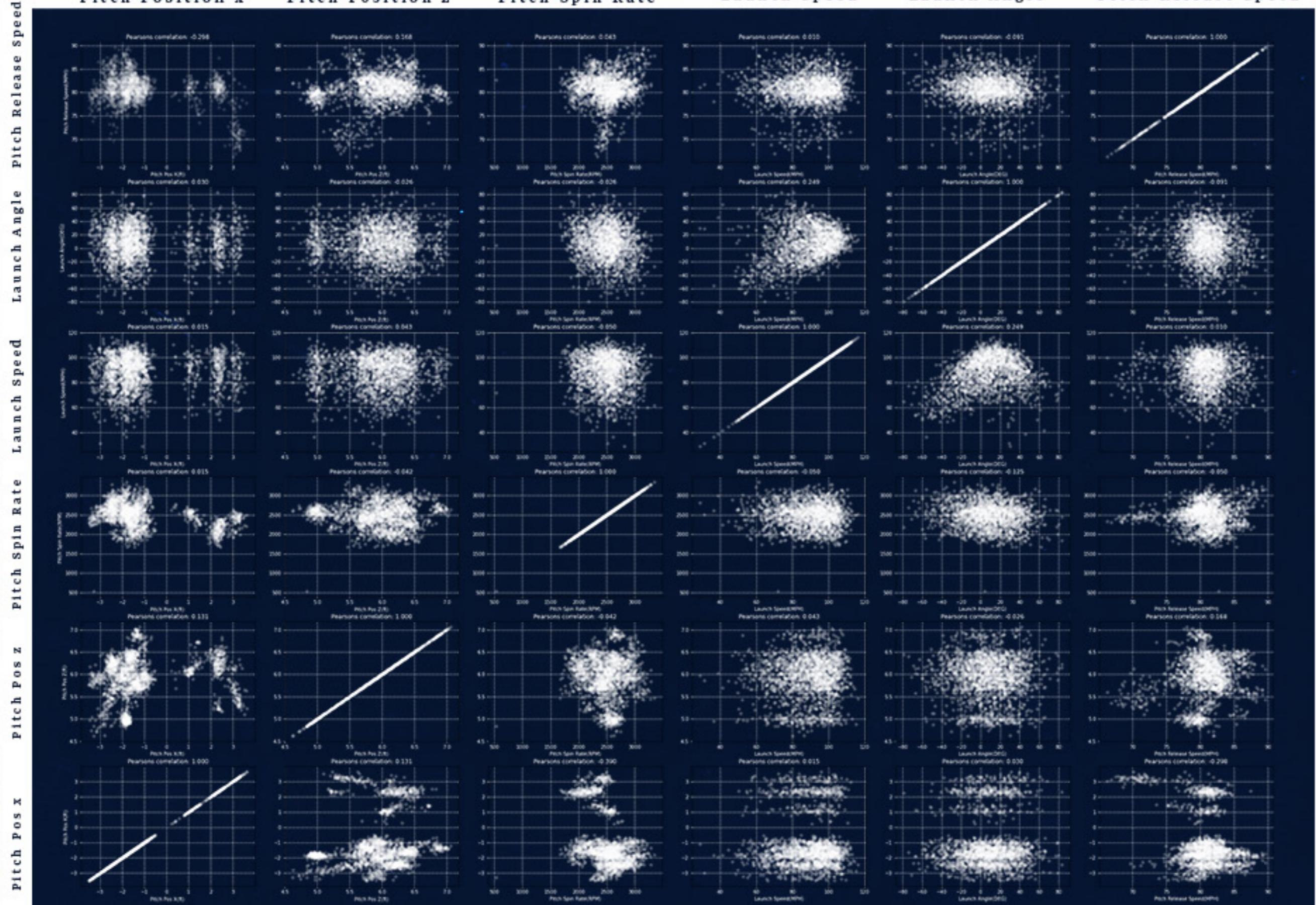
Mean Launch Angle: 11.74 DEG

Mean Launch Speed: 88.14 MPH



Cut FB

Pitch Position x   Pitch Position z   Pitch Spin Rate   Launch Speed   Launch Angle   Pitch Release Speed



# Knuckle Curve



# Knuckle Curve

Pitches Thrown : 2165

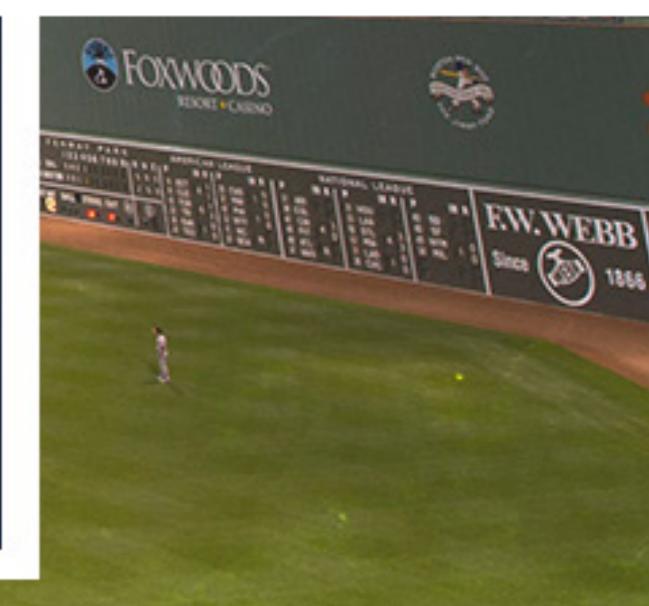
Mean Spin Rate: 2491.138 RPM

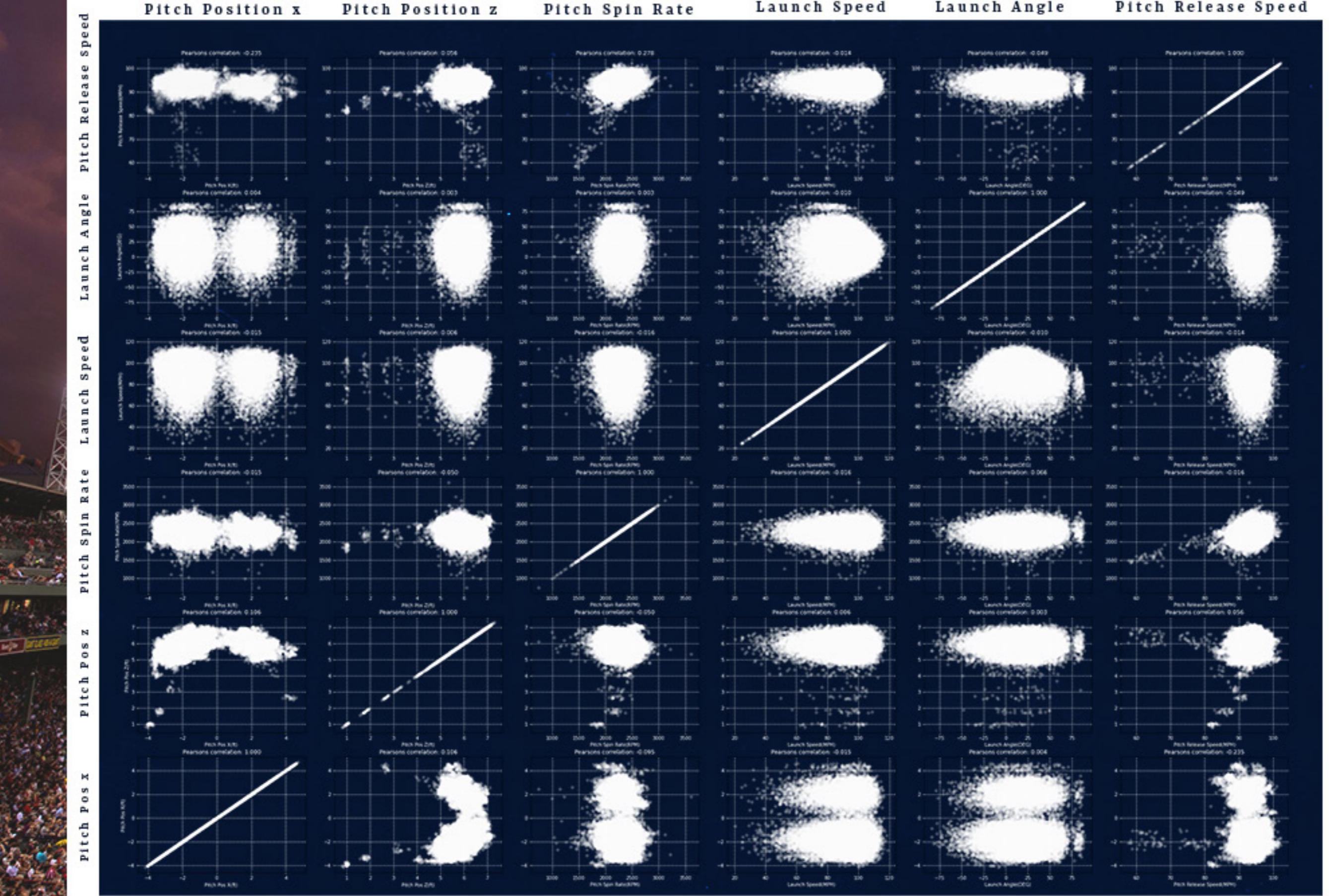
Mean Release Speed: 80.79 MPH

Mean Launch Angle: 7.84 DEG

Mean Launch Speed: 88.90 MPH

- Single ●
- Double ●
- Triple ●
- Homer ●

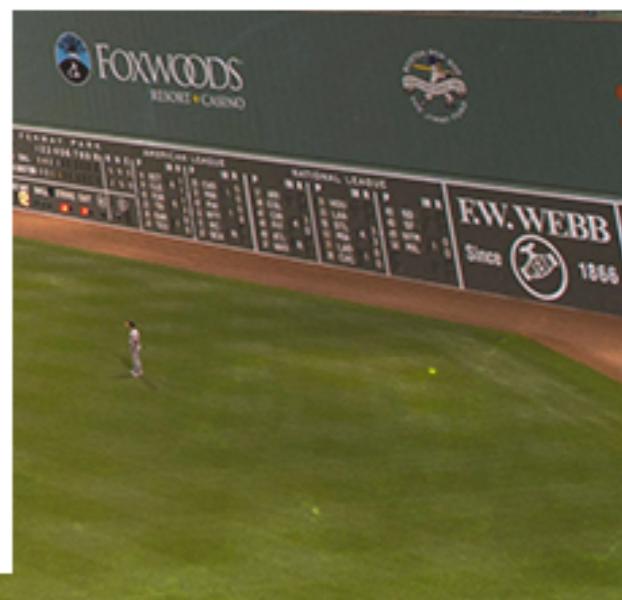
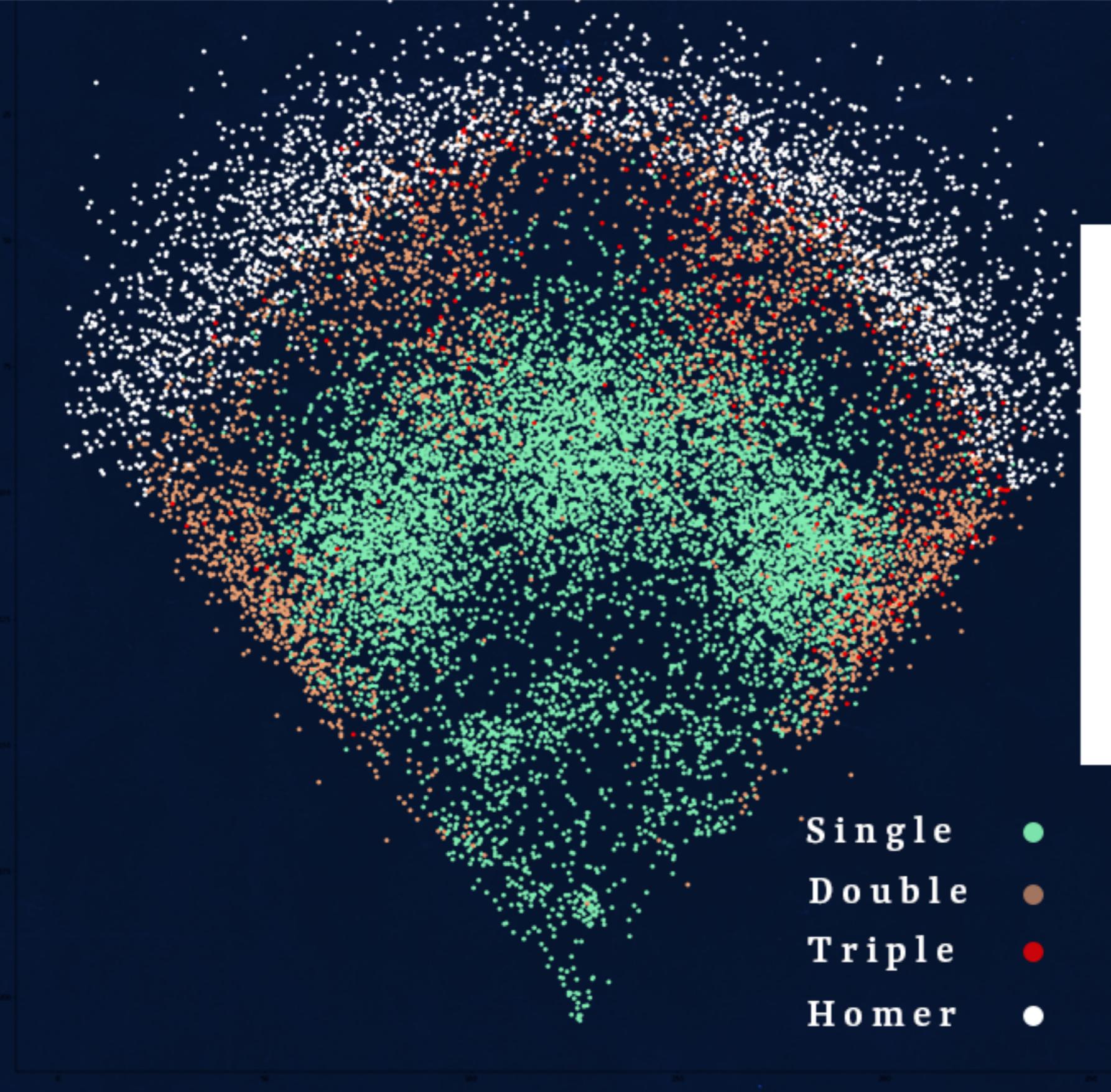




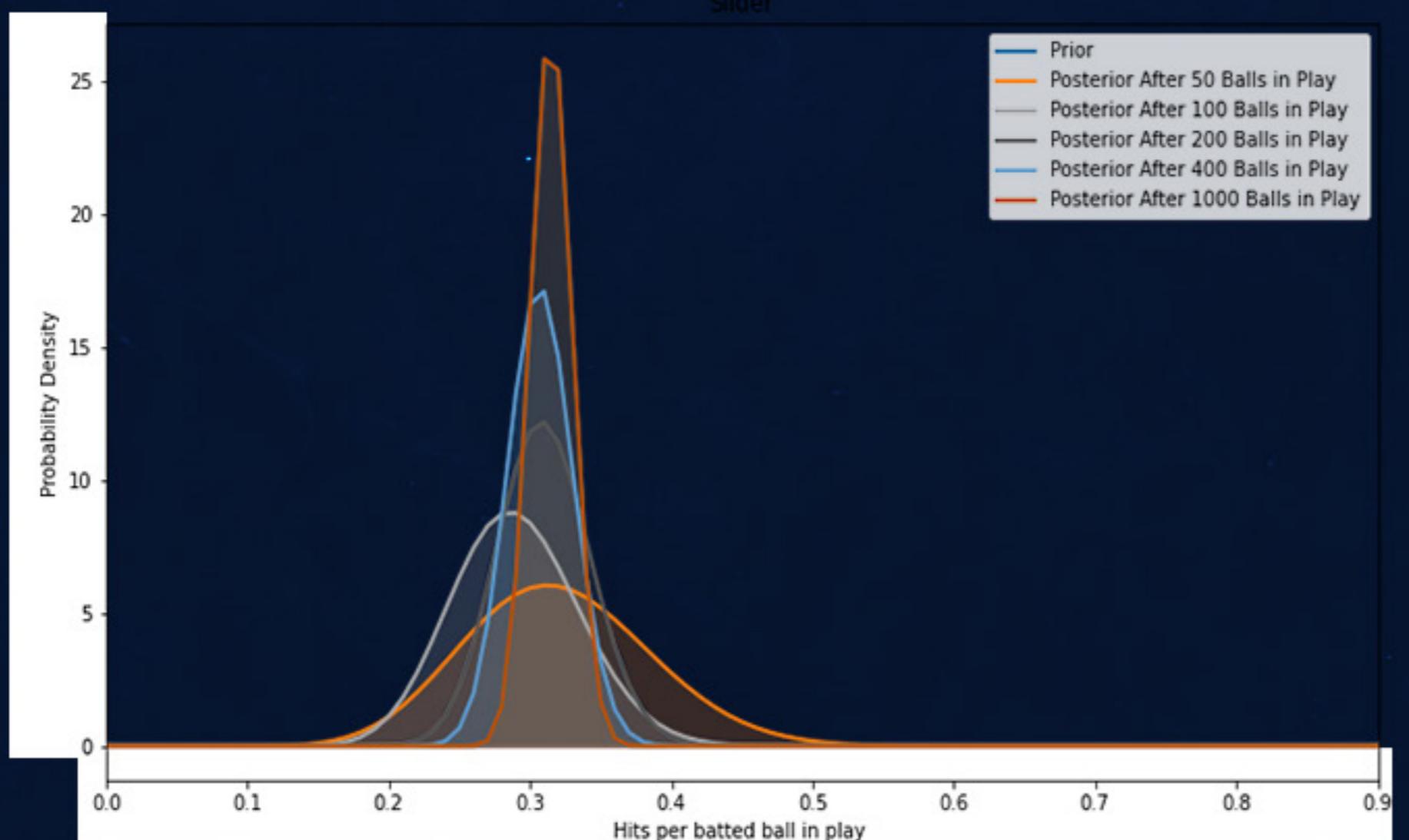
# 4 Seem Fastball



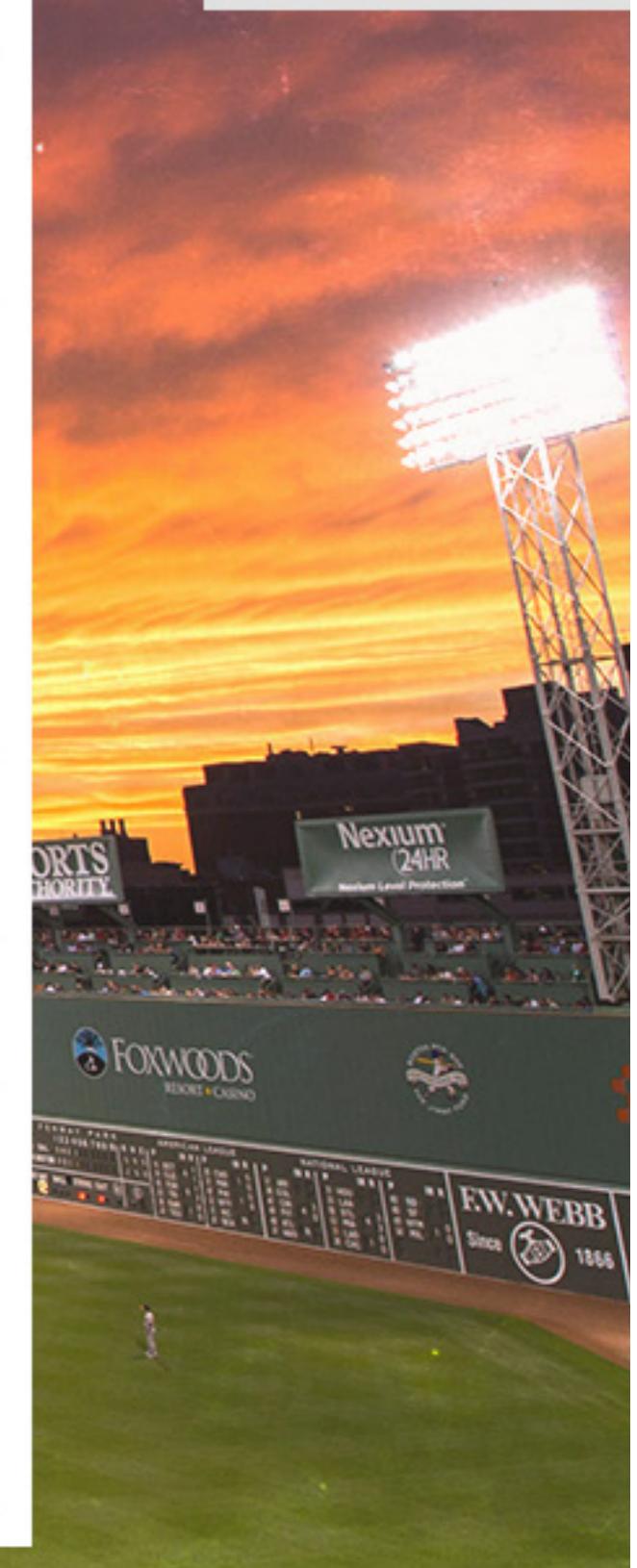
## 4 Seem Fastball



# Slider



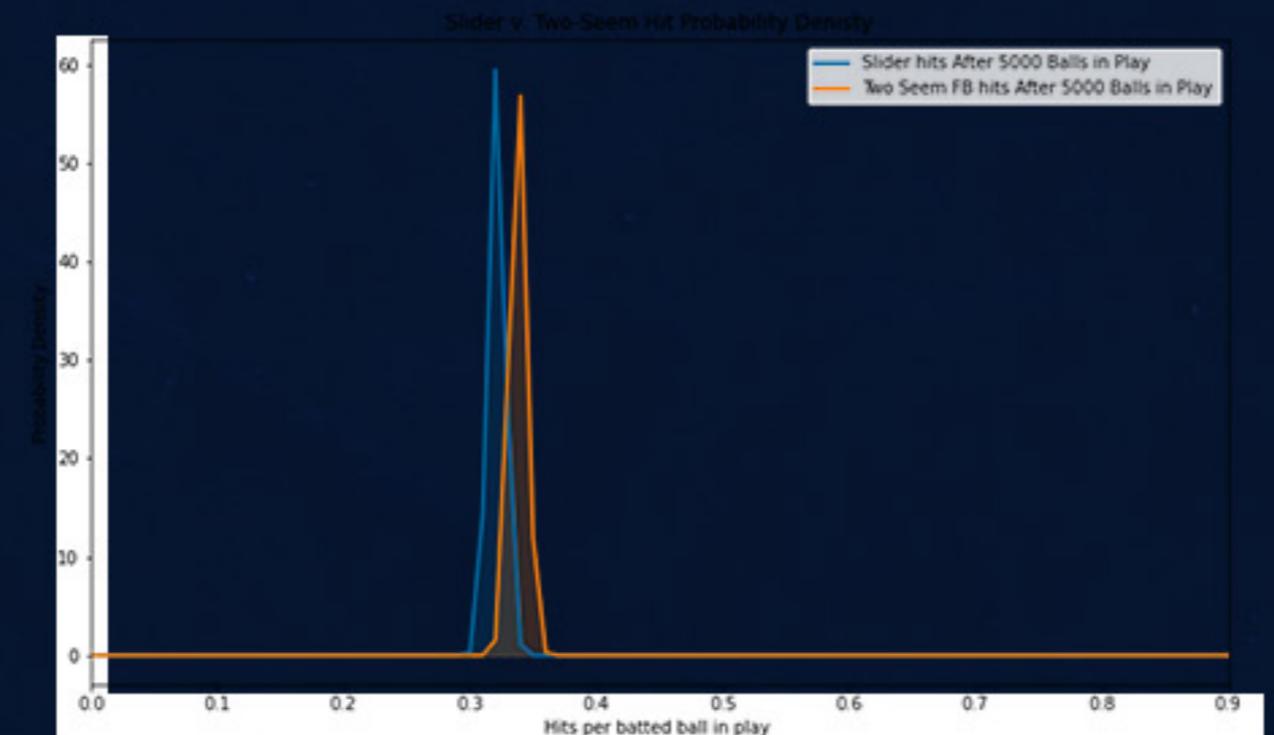
Beta distribution of Sliders



## Bayes Testing

Is it more likely to get a hit after making contact with a Slider compared to a Two Seem Fastball?

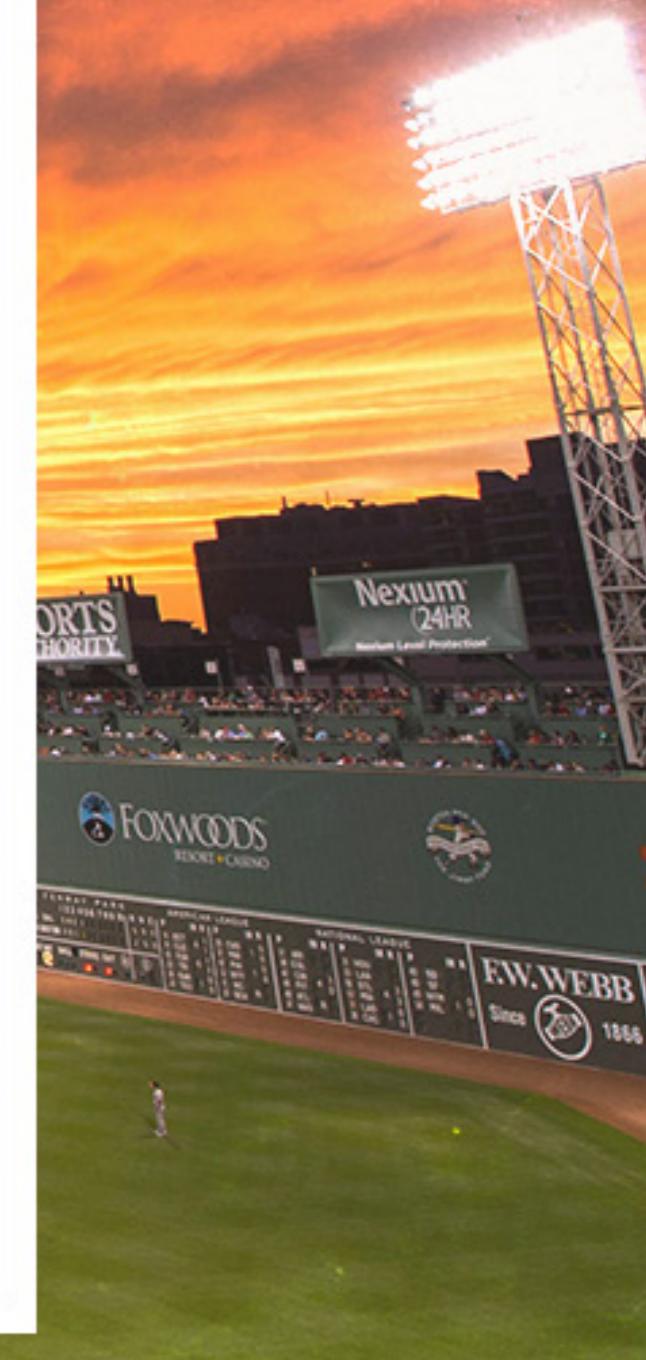
After running 5000 simulations on Sliders and Two Seem FBs:



Beta distribution of Sliders vs 2 Seem Fastball

After running 10000 random beta tests on both pitches a Slider is 8.33% more likely to produce a hit than a 2 Seem Fastball.

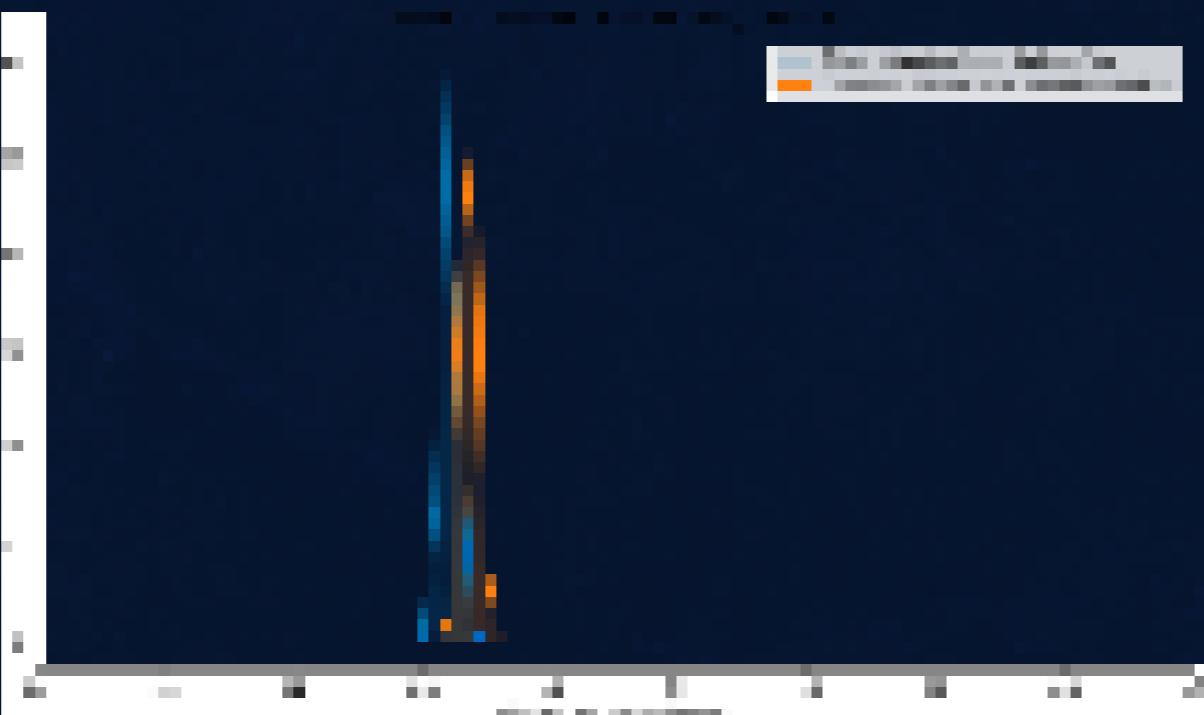
Slider vs  
Two Seem  
Fastball



## DISCUSSION

• *Concurrent validity of the CDT and PCT vs. Moberman et al.  
Int. J. Environ. Res. Public Health 2019, 16, 3438*

## Determining road distribution between Tiferni and Pernetti:



Mean distribution of distance to a road segment

• More coverage under which road needs to be taken to trip down older roads in  
Tiferni, than compared to a Curvedell

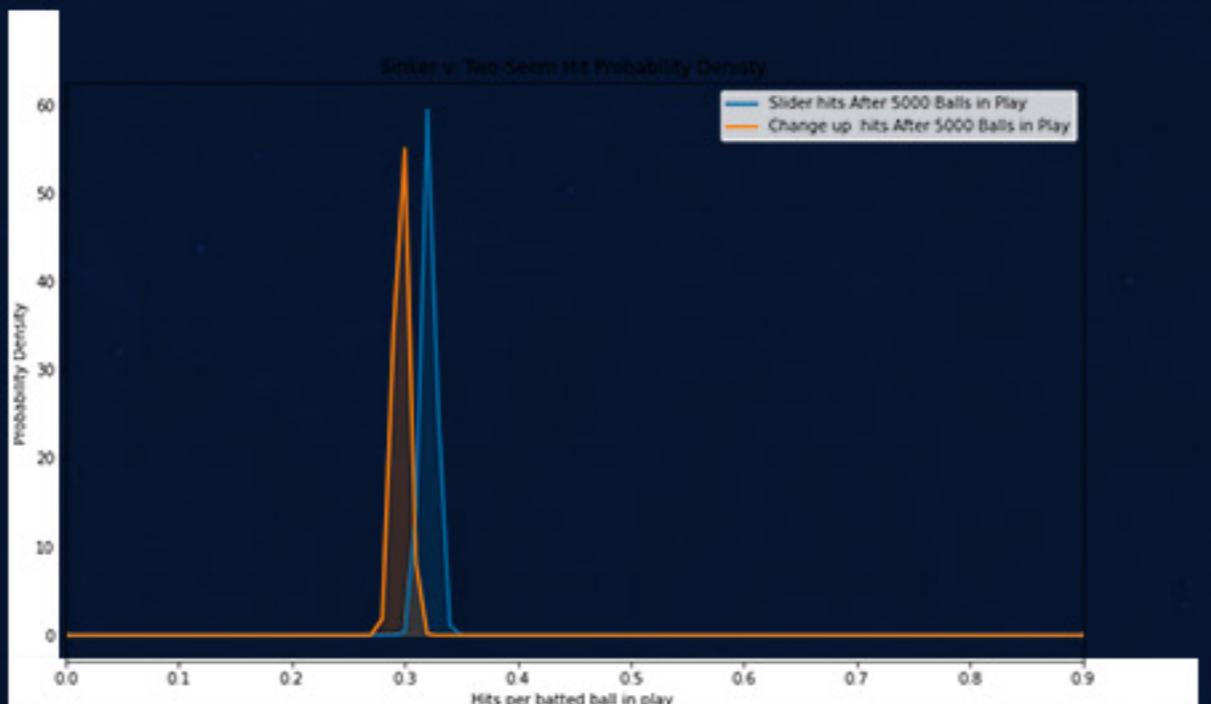
Slide 76

Enriched

## Bayes Testing

Is it more likely to get a hit after making contact with a Slider compared to a Change up?

After running 5000 simulations on Sliders and Change up:



Beta distribution of Sliders vs 2 Seem Fastball

After running 10000 random beta tests on both pitches a Slider will result in a hit 40.47% of the time compared to a Change up.

Slider vs  
Change up

