An Introduction to TrackMan Baseball
SABR40

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Where is Denmark?
Objectives

• Introduce TrackMan as a company and technology

• Review what is unique about TrackMan Baseball
  • Actionable
  • Scalable

• Describe how you can get involved with the TrackMan team
TrackMan A/S: Company History

• Incorporated in May 2003 in Denmark, focus on golf
• 4 founders, 2 active in the company today
  • CEO Klaus Eldrup-Jørgensen
  • CTO Fredrik Tuxen
• Company started in Klaus’ garage with Fredrik and a handful of engineers

2003

2004

• TrackMan Pro first demoed to customers in late 2004 – 5 demos to equipment manufacturers, 5 sales

2005–2007

• The data accuracy and product quality quickly led to focus on equipment manufacturers, the USGA, and the R&A
• TrackMan became the de facto industry standard
• PGA TOUR agreement signed in 2006
• First broadcasting deals: ESPN, ABC, Golf Channel, BBC, NHK

2008+

• TrackMan expands into other sports
  • Baseball
  • Cricket
  • Soccer
TrackMan: The Technology

• Military-grade Doppler radar measurement system
• Sample rate of 48,000 measurements per second
• Precisely measures the location, spin, angles, velocity and trajectory of a ball in flight
• Radar sits high behind home plate
• Operator used computer attached or networked to radar to tag game results
TrackMan Baseball is unique in that data are actionable and technology is scalable.

**Actionable:** measures not only end results of pitches and hits, but also “why” those results happened

- TrackMan can measure things no one else does, particularly at “moments of truth” (pitch release, hit impact)
- Allows teams to answer the question: “what is coachable, and what do we need to scout for?”

**Scalable:** capture data at all levels of play

- MLB
- MiLB
- Universities
- International
- Showcases
- Academies
- High schools
Actionable: TrackMan measures both “what” happened and “why” it happened (The Pitch)

The pitch

Release conditions
- 3D Release slot (height, side, distance from home)
- Speed at release
- Release angle
- Spin rate
- Spin axis

Laws of physics

Results
- Movement (horizontal break, vertical break)
- Plate location
- Plate approach angles (horizontal, vertical)
- Time of pitch flight
- Speed at plate

“Why it happened”

“What happened”
Analysis shows high spin rates on curveballs lead to more swing and misses

Note: Based on 2109 pitches. Excludes consideration of game situation (pitch count, runners on base, etc.)
But spin is not helpful if it is in the wrong direction...

One team found a Rookie Ball position player who is being converted to pitcher that is capable of generating spin well above the MLB average.

<table>
<thead>
<tr>
<th></th>
<th>Average spin rate (rpm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MLB Curveball</td>
<td>2,450</td>
</tr>
<tr>
<td>This Rookie Ball pitcher’s Curveball</td>
<td>2,750</td>
</tr>
</tbody>
</table>

But this Rookie Ball player that he is not throwing with the proper tilt to get the desired break on his curveball.

<table>
<thead>
<tr>
<th></th>
<th>Spin direction (RHP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Typical MLB Curveball</td>
<td>Spinning toward 7:00-8:00</td>
</tr>
<tr>
<td>This Rookie Ball pitcher’s Curveball</td>
<td>Spinning toward 2:45</td>
</tr>
</tbody>
</table>
Analysis shows low launch angles on curveballs lead to more swing and misses

Note: Based on 2359 pitches. Excludes consideration of game situation (pitch count, runners on base, etc.)
Actionable: TrackMan *measures* both “what” happened and “why” it happened (The Hit)

The hit

* Impact conditions
  - Exit speed of hit
  - Exit angles of hit (horizontal, vertical)
  - Spin rate of hit
  - 3D contact position of impact*
  - Spin axis of hit*

* Laws of physics

* Results
  - Carry distance
  - Landing position
  - Maximum height
  - Time of hit flight

“Why it happened”

“What happened”

* Technically feasible, but not currently available
Slugging Percentage varies significantly by Hit Vertical Launch Angle and Exit Speed

<table>
<thead>
<tr>
<th>Hit Launch Angle (deg)</th>
<th>Exit Speed (mph)</th>
<th>&lt;75</th>
<th>75-80</th>
<th>80-85</th>
<th>85-90</th>
<th>90-95</th>
<th>95-100</th>
<th>100-105</th>
<th>105+</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;0</td>
<td>.100</td>
<td>.146</td>
<td>.281</td>
<td>.228</td>
<td>.322</td>
<td>.333</td>
<td>.587</td>
<td>.500</td>
<td></td>
</tr>
<tr>
<td>0-5</td>
<td>.273</td>
<td>.267</td>
<td>.393</td>
<td>.371</td>
<td>.592</td>
<td>.663</td>
<td>.862</td>
<td>.636</td>
<td></td>
</tr>
<tr>
<td>5-10</td>
<td>.245</td>
<td>.469</td>
<td>.643</td>
<td>.679</td>
<td>.771</td>
<td>.720</td>
<td>1.017</td>
<td>1.125</td>
<td></td>
</tr>
<tr>
<td>10-15</td>
<td>.415</td>
<td>.593</td>
<td>1.042</td>
<td>1.020</td>
<td>.987</td>
<td>1.000</td>
<td>1.074</td>
<td>1.250</td>
<td></td>
</tr>
<tr>
<td>15-20</td>
<td>.737</td>
<td>1.083</td>
<td>.805</td>
<td>.750</td>
<td>.553</td>
<td>.835</td>
<td>1.830</td>
<td>2.235</td>
<td></td>
</tr>
<tr>
<td>20-25</td>
<td>.824</td>
<td>.429</td>
<td>.375</td>
<td>.405</td>
<td>.330</td>
<td>.977</td>
<td>2.877</td>
<td>3.500</td>
<td></td>
</tr>
<tr>
<td>25-30</td>
<td>.525</td>
<td>.040</td>
<td>.000</td>
<td>.279</td>
<td>.789</td>
<td>1.92</td>
<td>3.417</td>
<td>4.000</td>
<td></td>
</tr>
<tr>
<td>30-35</td>
<td>.528</td>
<td>.000</td>
<td>.069</td>
<td>.241</td>
<td>.538</td>
<td>1.658</td>
<td>3.000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>35-40</td>
<td>.200</td>
<td>.000</td>
<td>.085</td>
<td>.213</td>
<td>.700</td>
<td>1.45</td>
<td>1.714</td>
<td>4.000</td>
<td></td>
</tr>
<tr>
<td>40-45</td>
<td>.310</td>
<td>.000</td>
<td>.000</td>
<td>.229</td>
<td>.188</td>
<td>.667</td>
<td>.000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>45+</td>
<td>.250</td>
<td>.054</td>
<td>.000</td>
<td>.018</td>
<td>.000</td>
<td>.500</td>
<td>.000</td>
<td></td>
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</tr>
</tbody>
</table>

Chart based on 4,011 balls in play.
This Hitting Analysis can help MLB clubs with both pitching and hitting considerations

- **Pitching performance evaluation.** Was the pitcher “unlucky” because several not well hit balls landed for hits, or was he roughed up by giving up too many very well hit balls?

- **Pitching coaching.** Which pitches in the pitcher’s repertoire tend to be well hit? Which ones tend to be not well hit? How can the pitcher make changes to his pitch selection to improve results? Can weaker pitches be improved so they are not as prone to being well hit?

- **Hitting scouting.** Can a player generate the necessary exit speed to be a power hitter?

- **Hitting performance evaluation.** Has a hitter lost a few MPH of exit speed or has he just hitting the ball at people?

- **Hitting coaching.** If the player cannot generate exit speed, what would be the ideal launch angle to maximize performance?
Scalability: Multiple versions of the hardware allow teams to collect and compare performance across levels of play

<table>
<thead>
<tr>
<th>TrackMan Stadium Radar</th>
<th>TrackMan Portable Radar</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Semi-permanent installation</td>
<td>• Same measurements and reports as stadium radar</td>
</tr>
<tr>
<td>• Radar tracks pitched and hit balls</td>
<td>• Designed for use in smaller venues and backfields</td>
</tr>
<tr>
<td>• Operator tags situation and results</td>
<td>• Provides real-time feedback for training</td>
</tr>
<tr>
<td>• Data output - .CSV and graphic reports</td>
<td></td>
</tr>
<tr>
<td>• Proprietary online database contains all data and reports</td>
<td></td>
</tr>
<tr>
<td>• Realtime data available for other purposes</td>
<td></td>
</tr>
</tbody>
</table>
Where can I get my hands on this data?

• TrackMan data is proprietary to its customers – so it is not possible for the general public to get access to it

• However, TrackMan has started the TrackMan Baseball Insights Lab, managed by Josh Orenstein (jko@trackman.dk)

• To get involved: email Josh your ideas for how TrackMan Baseball can add value to the baseball community

• If your idea is unique and useful, we will give you credit in our discussions with customers and/or potentially hire you on a project-basis

• Legal disclaimer: All ideas are submitted voluntarily and TrackMan may choose to use at its discretion without remuneration to the submitter
Thank you for your time

For more information contact

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