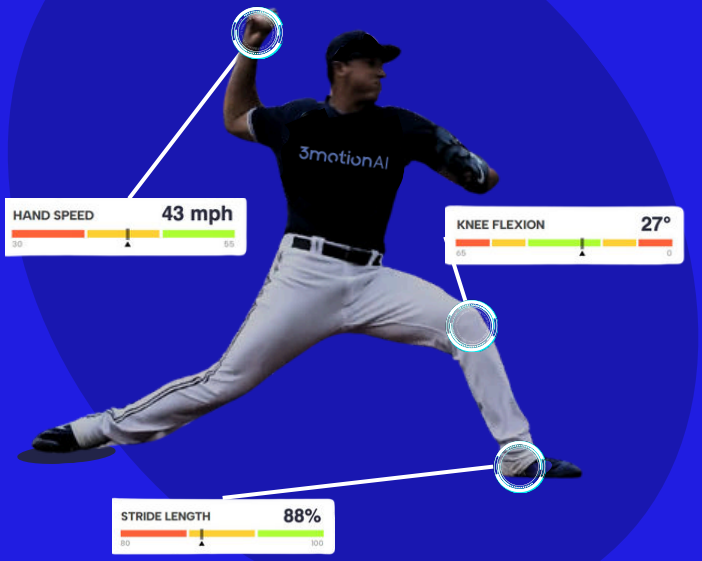
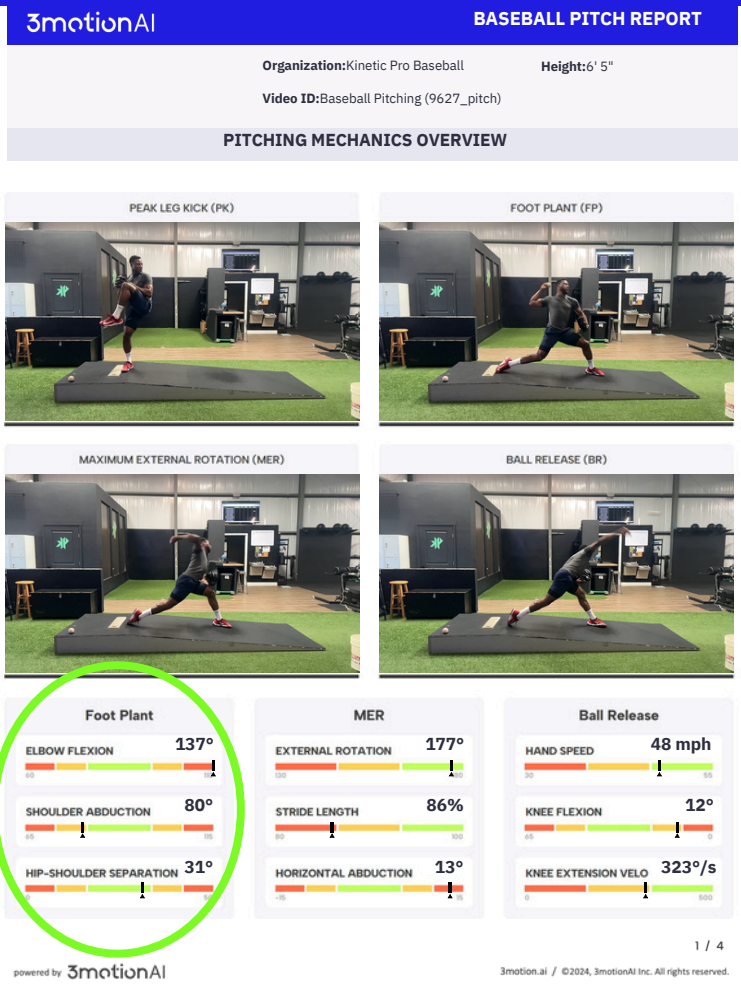
3motionAI
BASEBALL



PITCHING REPORT GUIDE

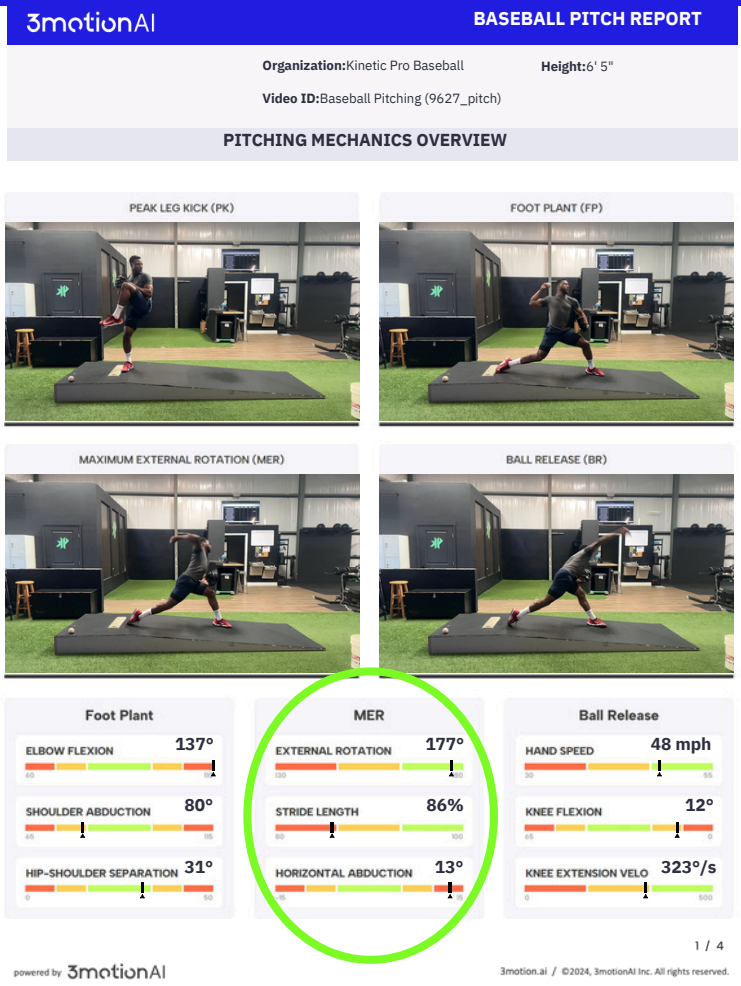
3motion.ai/baseball



Elbow Flexion- how flexed your elbow is at foot plant. A fully straightened (extended) arm would be 0 degrees.

Shoulder Abduction- is when you lift your arm up and away from your body, kind of like when you're making a "T" shape with your arms. Imagine standing straight, then raising your arm out to the side until it's sticking straight out. At foot plant you generally want between 80 and 100 degrees.

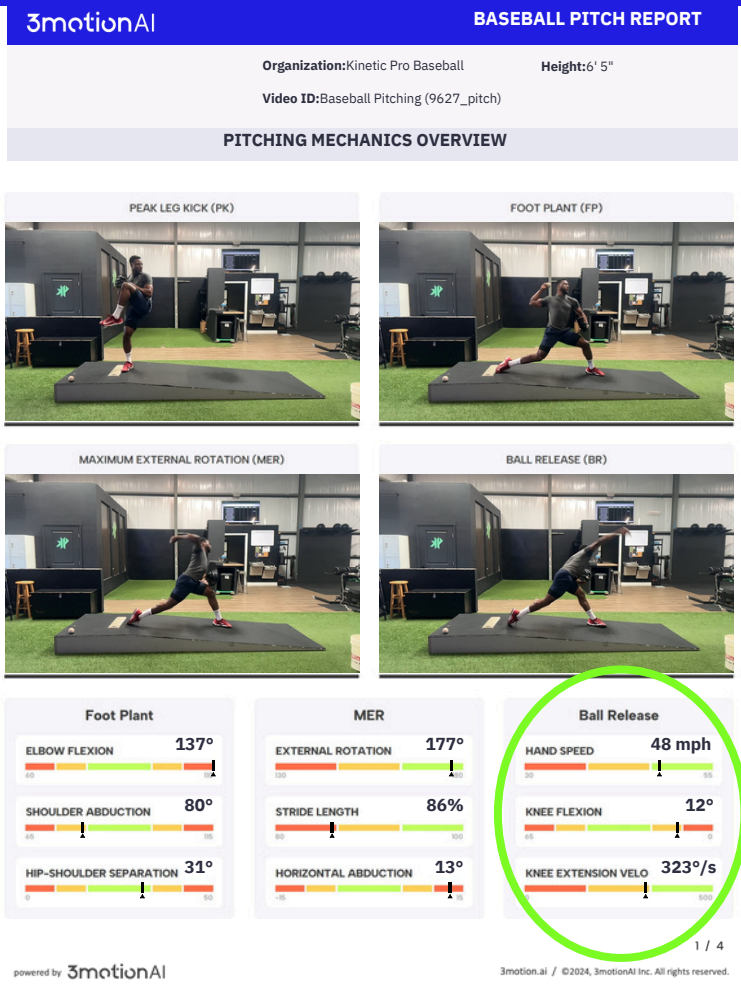
Hip-to-Shoulder Separation is measured as the difference between the angle of the shoulders and the angle of the hips. Research illustrates that harder throwers have greater hip-to-shoulder separation than their softer throwing counterparts, but some discretion is required here: having “too open” of a hip position (i.e., hips square to the open side) can make it difficult to make use of the lead leg block. The main reason to achieve hip-to-shoulder separation is to CLOSE hip-to-shoulder separation rapidly, using the trunk as an elastic band to transfer energy from the lower half to the arm, accelerating the ball towards home plate.



External Rotation- is the "lay back", or how far the shoulder rotates backwards prior to releasing the ball. This is a good measure of the pitcher's shoulder flexibility, and research has illustrated greater external rotation is associated with higher pitching velocities.

Stride Length- is how far the pitcher steps forward and down the mound, in units of % of their total height.

Horizontal Abduction- an example of horizontal abduction is when you would start with your arms out in front of you raised to shoulder height. Then you would move your arm out to the side, like opening up your arms to make a big "T" shape. With the throwing arm this happens and the throwing arm will go slightly behind the throwing shoulder. We generally want horizontal abduction to be close to 0 at max external rotation.



Hand Speed- simply put, this is how fast the hand is moving in the direction of home plate throughout the delivery.

Knee Flexion- this represents how much your lead knee is flexed at ball release. Typically high ball velocity pitchers will extend their lead knee from just before MER to ball release. This extension represents force being placed into the ground and aiding in the acceleration of the trunk into flexion. A player should generally land around 45 degrees and extend to around 15 to 20 degrees by ball release.

Knee Extension Velo- this represents how fast your lead leg is extending at ball release. Typically high ball velocity pitchers will extend their lead knee from just before MER to ball release. This extension represents force being placed into the ground and aiding in the acceleration of the trunk into flexion. A player should generally be extending over 250 degrees per second by ball release.

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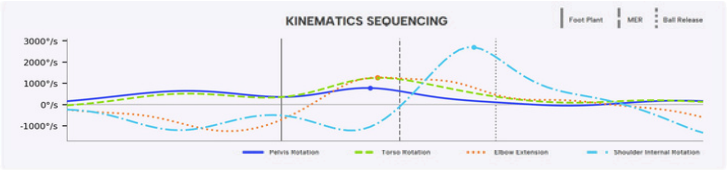
BASEBALL PITCH REPORT

Organization: Kinetic Pro Baseball **Height:** 6' 5"

Video ID: Baseball Pitching (9627_pitch)

SEQUENCING AND KEY METRICS



KINEMATICS SEQUENCE

1	Pelvis	770°/s
2	Torso	1250°/s
3	Elbow	1270°/s
4	Shoulder	2700°/s

SEQUENCING

90

%

0 100

Performance Score Update Coming Soon

HAND SPEED

48

MPH

30 55

BALL PATH

164

% HEIGHT

90 175

STRIDE LENGTH

86

% HEIGHT

80 100

SHOULDER ROTATION

177

DEG

130

TRUNK FLEXION

778

DEG / S

500 900

HIP-SHOULDER SEPARATION

212

DEG / S

70 350

Kinematics Sequencing (and Sequencing) is a commonly studied biomechanics concept broadly describing how energy is transferred from the lower half to the ball, along a series of body parts often referred to as the kinetic chain.

In theory, the optimal kinetic chain results in a kinematics sequence of the force from the lead leg transferring into the pelvis, causing a peak rotational velocity of the pelvis, transferring energy next through the hip-to-shoulder separation, and a peak rotational velocity of the upper body and trunk. This energy is passed along to the arm, and a peak extension velocity of the elbow is followed by a peak internal rotation velocity of the shoulder.

The Sequencing score represents how many of the components of the kinetic sequence are in the proper order - with a 100% being a perfect score with the sequence described above. If the pelvis came first, followed by the trunk, but then the elbow and shoulder - that would be a 50% score.

Throwing harder exposes the body to higher forces, and a higher torque on the elbow. However, how you move can cause one pitcher that throws 95 mph to have higher forces on their elbow compared to another pitcher throwing the same velocity.

The Efficiency metric in 3MotionAI represents the ratio between arm speed and torque. In our database of close to 300 professional and NCAA Division 1 pitchers, we know what the average ratio is for all pitchers- in the 3MotionAI app, we convert that value to a percentile. This produces an efficiency score in units of 0-100 - an efficiency of 95% means that this pitcher is more efficient than 95% of the pitchers in our database.

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BASEBALL PITCH REPORT

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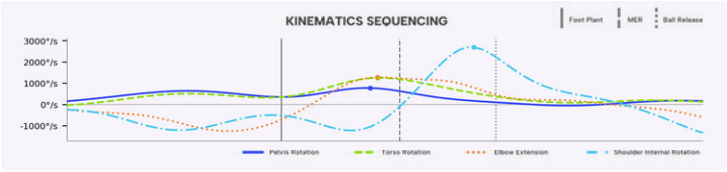
SEQUENCING AND KEY METRICS



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Hand Speed- simply put, this is how fast the hand is moving in the direction of home plate throughout the delivery.

Shoulder Rotation- is the "lay back", or how far the shoulder rotates backwards prior to releasing the ball. This is a good measure of the pitcher's shoulder flexibility, and research has illustrated greater external rotation is associated with higher pitching velocities.

Ball path- is in units of % total height, and is the total of the distance travelled by the throwing hand between peak kick height (PK), and front foot plant (FP).

Trunk Flexion (Velocity)- is how fast the trunk is flexing toward the plate at the time of ball release.

Stride Length- is how far the pitcher steps forward and down the mound, in units of % of their total height.

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BASEBALL PITCH REPORT

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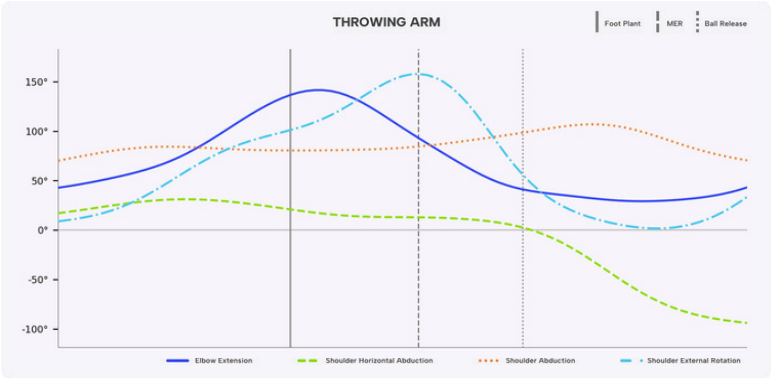
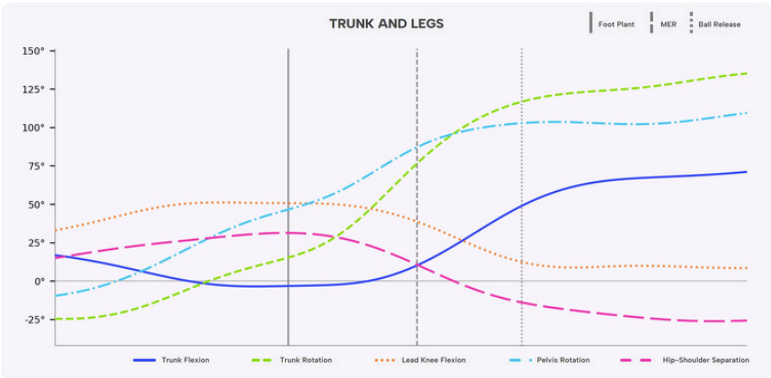
JOINT ANGLES





The lines on these graphs represent different joints of the body and the angle these joints are at through the throwing motion. Below you will find definitions of these segments.

On these graphs, you will also notice 3 vertical lines. These lines represent some key points in time that are traditionally associated with biomechanical analyses: Foot Plant (FP), Maximum External Rotation (MER), and Ball Release (BR). Think of these as snapshots in time that have been used to compare different athlete in research.

Measured Joint Angles

Knee Flexion - Bending the knee as far as you can is peak knee flexion and a fully straight knee is considered zero degrees of flexion.
Trunk Lateral Tilt - Standing straight up, hinge at the waist to the side of the body. Bending towards home plate would be positive lateral trunk tilt, and negative trunk tilt would be bending away from home plate.
Pelvis Rotation - The turning of the pelvis towards home plate. 0 degrees is facing completely on the open side, and 90 degrees is facing home plate.
Trunk Rotation - the turning of the trunk towards home plate. 0 degrees is facing completely on the open side, and 90 degrees is facing home plate.
Hip-to-shoulder separation - the difference in rotation? angles between trunk and pelvis.
Trunk Flexion - Standing upright, hinging at the waist and bending toward the ground is positive trunk flexion.

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BASEBALL PITCH REPORT

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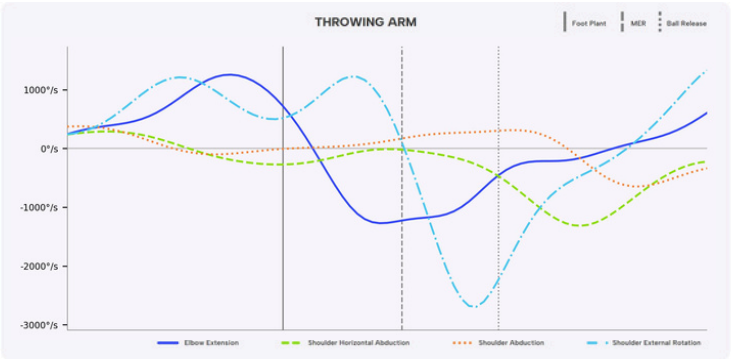
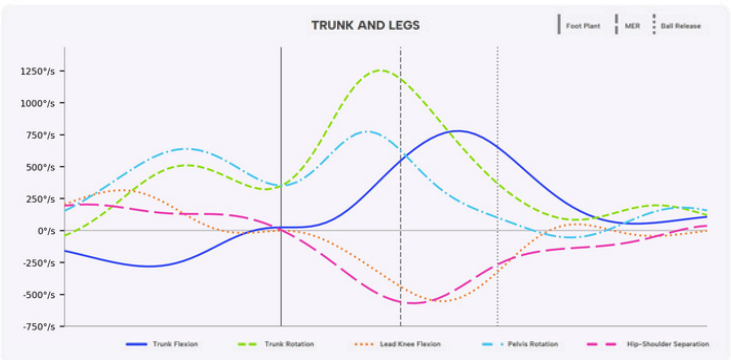
JOINT VELOCITIES (ANGULAR)





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