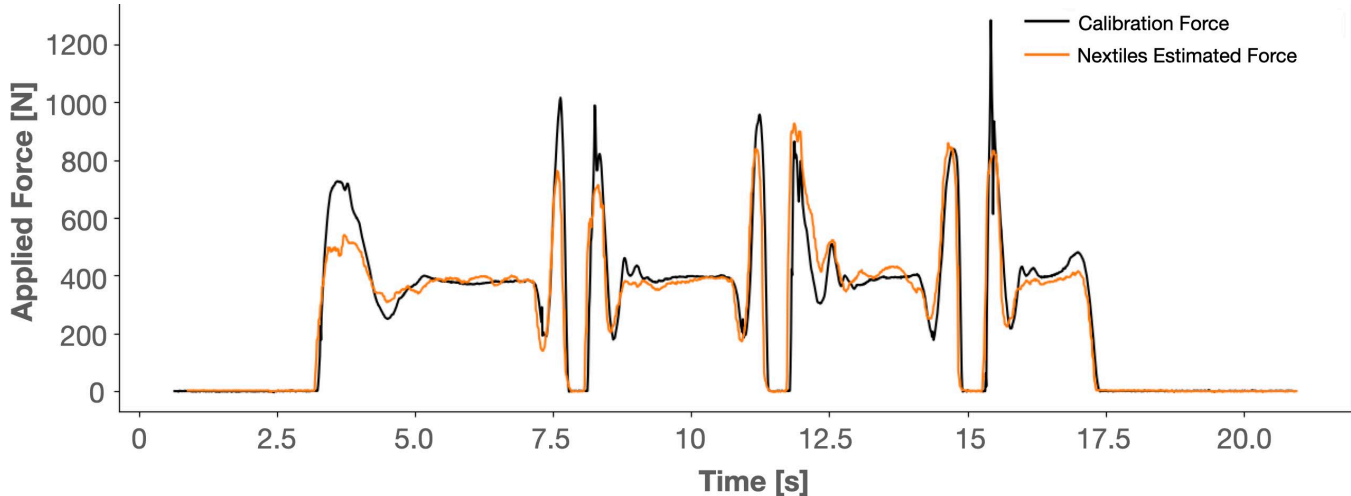


## Introduction

The Nextiles Fabric Force Plate achieves portability and versatility while delivering key performance metrics of the counter-movement jump. Throughout a jump, the properties of our specialized fabrics within the force plate convert exerted force into electrical signals. These electric signals are then used to estimate the downward force as determined from a calibration curve, with strong reconstruction accuracy. These forces are then analyzed to provide insight into three major performance areas of a counter movement jump — strength, power, and symmetry — **through the jump height, reactive strength index, and Nextiles Symmetry Score**. An example jump force profile from which these metrics are extracted is shown in **Figure 1**.



**Figure 1:** Plot of the estimated force against the calibration result, showing excellent timing resolution and good reconstruction of the applied force. Importantly, the phases of the countermovement jump are clearly delineated.

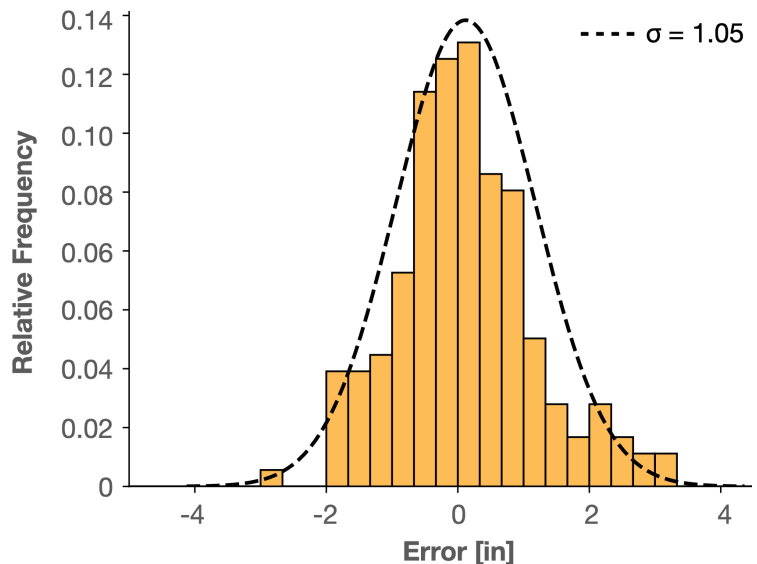
## Jump Height

Jump height is a simple yet important indicator of an athlete’s performance. An individual’s jump height is calculated from the airtime using the time-in-air method. The jump airtime is first determined by the time between last contact on takeoff ( $t_o$ ) to the first contact on landing ( $t_d$ ):

$$t_{air} = \min(t_{ld}^L, t_{ld}^R) - \max(t_{to}^L, t_{to}^R)$$

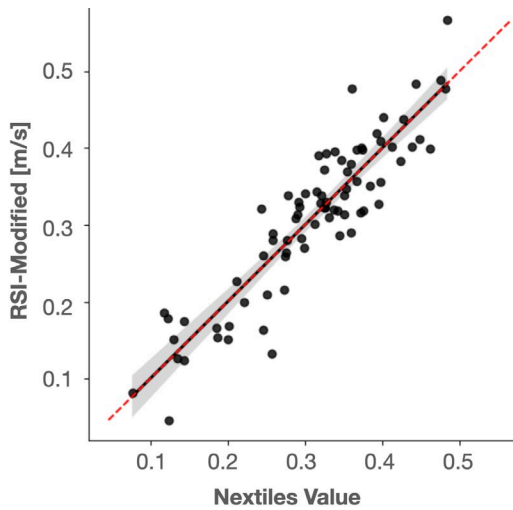
Height is then calculated assuming constant in-air, gravitational acceleration, an assumption that holds true for well-performed countermovement jumps.

When compared against industry standard methods to calculate jump height, **our values replicate the standard error for jump height (~1 in)** under test-retest procedures, as shown in **Figure 2**. Overall, 50% of jumps were **accurate to 0.6 in**.



**Figure 2:** Distribution of jump measurement errors. A gaussian fit with the same statistics as the error distribution is shown, representing the standard error.

## Reactive Strength Index



**Figure 3:** Concordance of RSI against reference RSI values.

The Reactive Strength Index (RSI) is a measure of an athlete's ability to generate power in a short amount of time, indicating their neuromuscular tone. It is defined as the jump height as a function of airtime  $h(t_{air})$ , divided by the takeoff period,  $\Delta t_{to}$ .

$$RSI = \frac{h(t_{air})}{\Delta t_{to}}$$

Nextiles' algorithms compute the jump initiation point,  $t_{start}$  by working backwards through the unweighting, eccentric, and concentric phase. The sum of these periods constitutes the entire takeoff phase.

$$\Delta t_{to} = t_{takeoff} - t_{start} = t_{unweighting} + t_{eccentric} + t_{concentric}$$

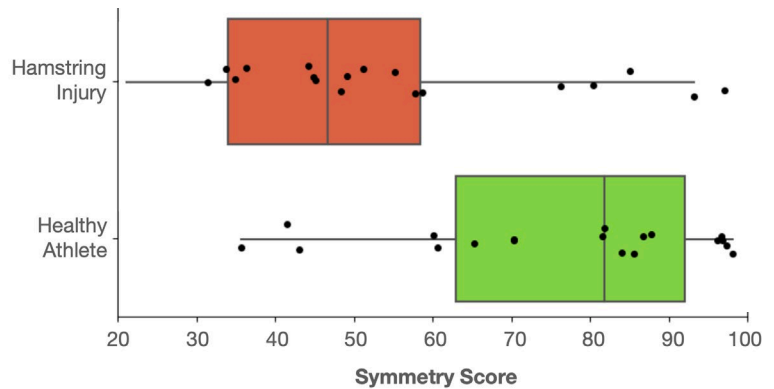
We observed **strong concordance with a reference RSI** value through validation studies, as shown in **Figure 3**.

## Jump Symmetry Score

Another key indicator of an athlete's performance is jump symmetry. Nextiles takes a holistic approach to measuring symmetry by considering both takeoff and landing coordination between the left and right foot and force application throughout the entire takeoff and landing phases. The takeoff symmetry, takeoff timing, landing symmetry, and landing timing are then averaged together as percentages, and reported as an overall score out of 100. The equation below shows the full calculation, where  $\delta_{takeoff}$ ,  $\delta_{landing}$  represent the takeoff and landing asymmetries.

$$symmetry\ score = 100 - average \left( \frac{\delta_{takeoff}}{\Delta t_{takeoff}}, \frac{\delta_{landing}}{\Delta t_{landing}}, \frac{|t_{to}^L - t_{to}^R|}{t_{air}}, \frac{|t_{ld}^L - t_{ld}^R|}{t_{air}} \right)$$

Nextiles performed qualitative validation of this symmetry score, finding that it is significantly correlated with subjective observations of symmetry. **The distribution of this score can identify athletes with high jump asymmetries.** For example **Figure 4** shows the distribution of symmetry scores comparing an athlete with a hamstring injury vs. one without.



**Figure 4:** Comparison of symmetry scores between two athletes with different subjective asymmetries.

## Mobile App

These metrics can then be monitored and tracked over time for multiple athletes in the Nextiles Performance App. Athletes can log sessions individually and then share their data with coaches. With Admin access, Coaches can manage players remotely to monitor performance. To get started, download the [Nextiles Performance App](#) from the Apple Store.