

# RELATIONSHIP BETWEEN SMASH SPEED AND IMPACT LOCATION

Idrees Afzal, Michael Hiley, Stuart McErlain-Naylor and Mark King

Loughborough University, SSEHS, Leicestershire, UK



## Introduction

The offensive nature and high speeds produced by the overhead smash make it a stroke that is frequently used for scoring points in Badminton (El-Gizawy and Akl, 2014). Badminton is often heralded as the 'fastest racket sport in world' with smash speeds reported as fast as 330 kmph (Kwan and Anderson, 2011).

**Purpose:** To determine the relationship between shuttle speed and racket impact location.

## Methods

14 participants three-dimensional kinematic data from the BWF All England Championships 2016 and World Championships 2017 were collected. All participants were elite international badminton players. Data was collected using the Vicon 3D motion analysis system, which consisted of an 18 camera setup (400 Hz).

**Data analysis:** Pre and post impact curves were fit in the anterior-posterior direction. A cubic spline function was selected in Matlab R2015b to fit racket markers. Output produced 2D coordinates of impact locations on the racket face.

## Results

- The majority of the fastest smashes (100% maximum speed) were located above centre vertically (maximum of 40 mm).
- Drop off in speeds can be up to 70% maximum speed for a 40 mm off centre impact location.



Figure 1. Badminton smash performance and marker set up



Figure 2. 3D motion capture setup

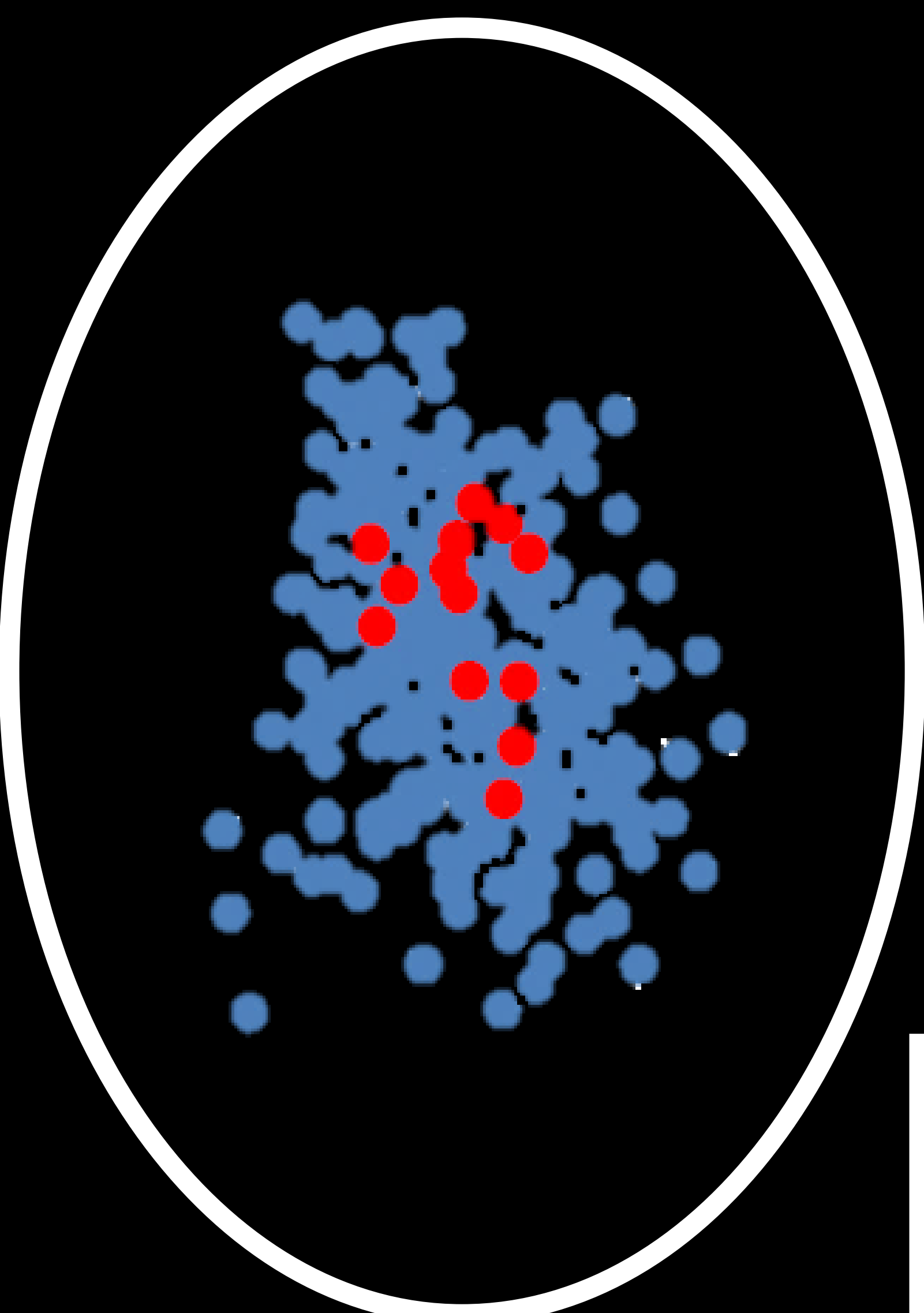


Figure 3. Racket-shuttle impact locations (fastest per player)

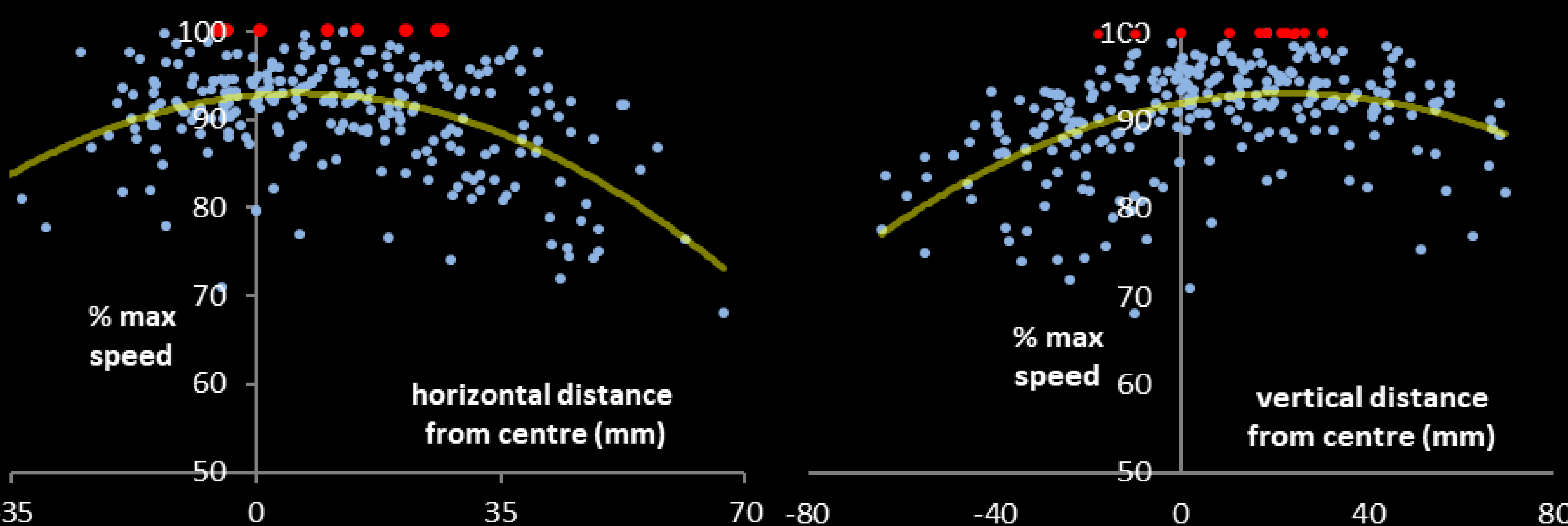
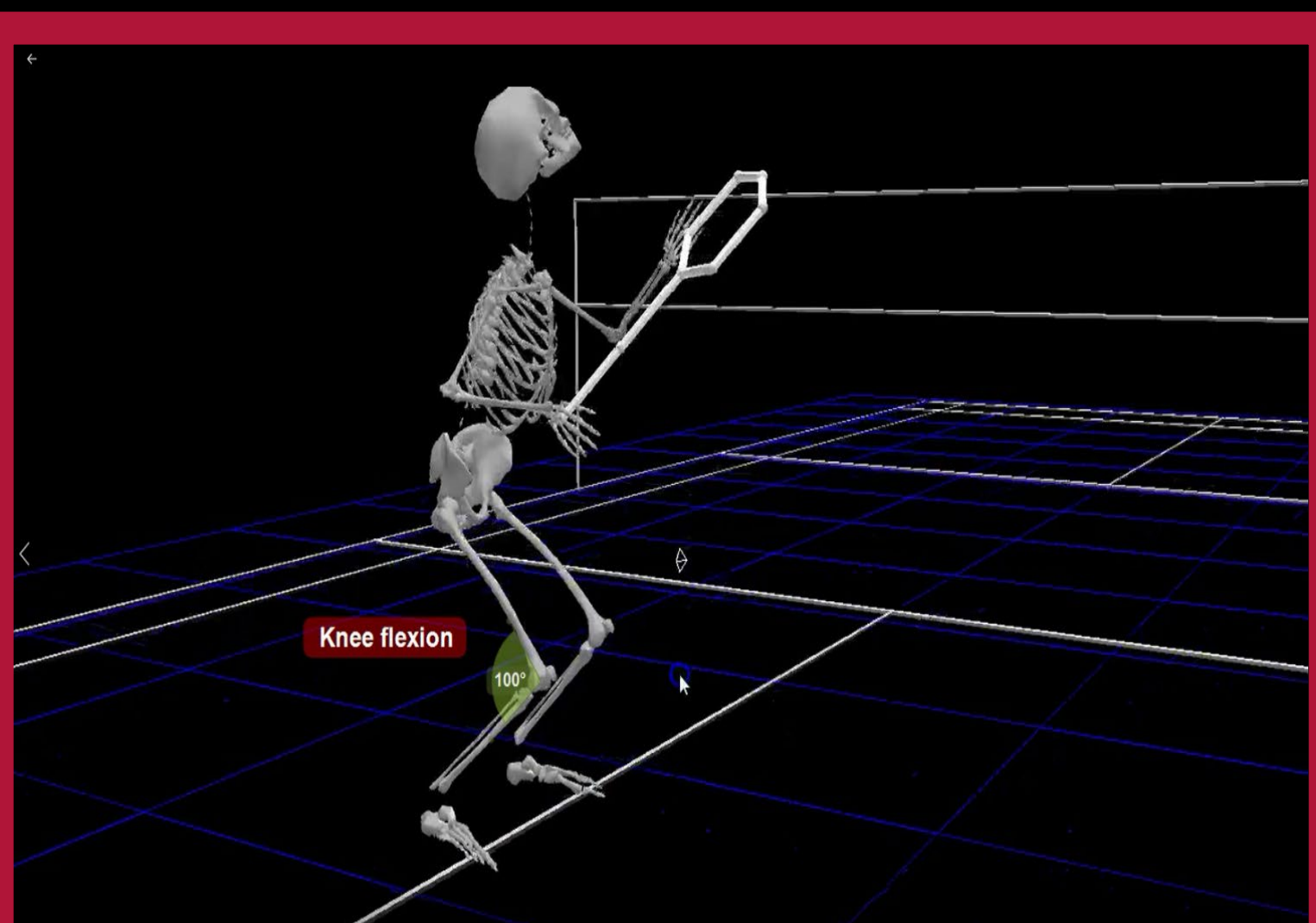


Figure 4. Racket-shuttle impact locations and relationship to shuttle speed – all players (fastest per player)

## Conclusion

- Focus for coaches needs to be on ways to develop coordination of movement and desired impact location to produce fast and accurate smashes.
- Future directions: looking at technical parameters of the badminton smash in relation to shuttle speed.



• El-Gizawy H., Akl A.R. (2014) Relationship between reaction time and deception type during smash in badminton. Journal of Sport Research, 1:49–56.  
 • Kwan, M., Andersen, M. S., Cheng, C. L., Tang, W. T., & Rasmussen, J. (2011). Investigation of high-speed badminton racket kinematics by motion capture. Sports Engineering, 13 (2), 57-63.

