

To Shuffle or not to Shuffle?

Effects on Aerodynamics and power output

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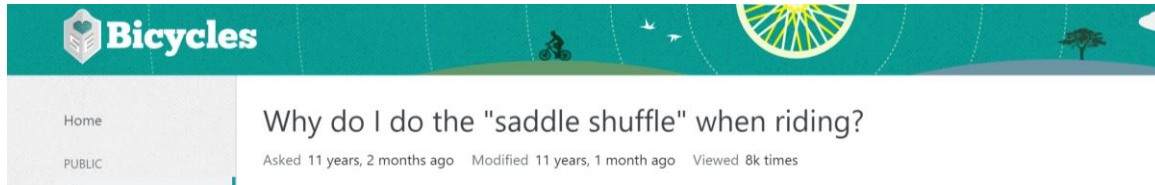
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BODY ROCKET



Shuffling



Cycling StackExchange

<https://bicycles.stackexchange.com/questions/9042/why-do-i-do-the-saddle-shuffle-when-riding>



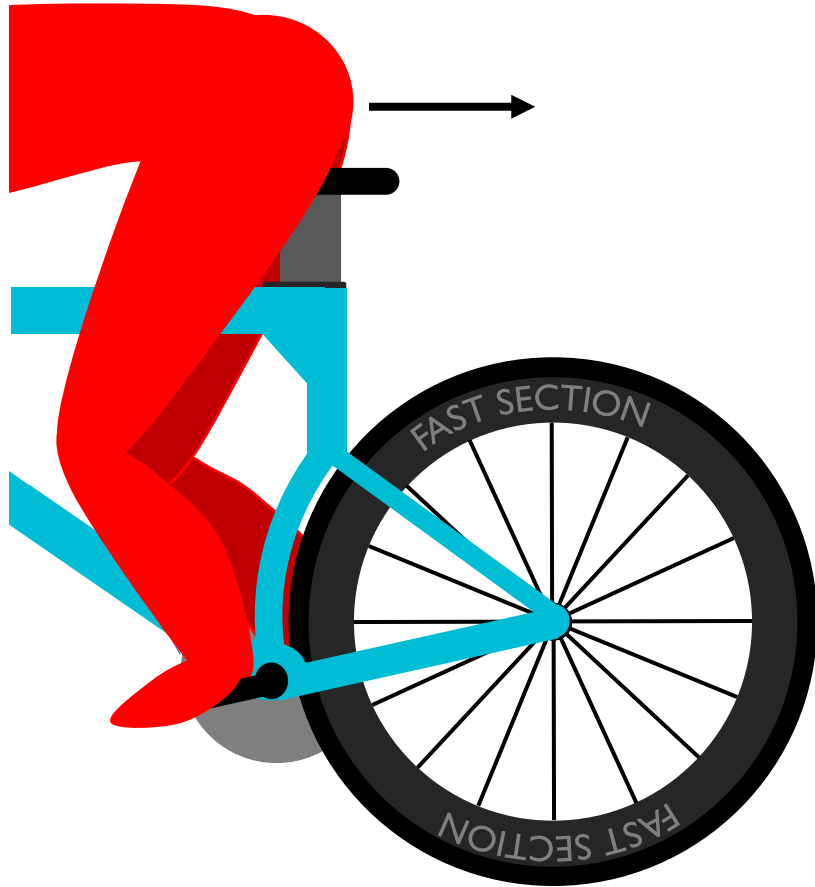
Cycling UK Forum

<https://forum.cyclinguk.org/viewtopic.php?t=109403>



Tony Martin – 2015 (The aftermath of a personal shuffling investigation...using sandpaper)
<https://www.cyclingweekly.com/news/latest-news/sandpaper-saddle-injury-adds-to-pain-of-tony-martins-world-championships-defeat-192829>

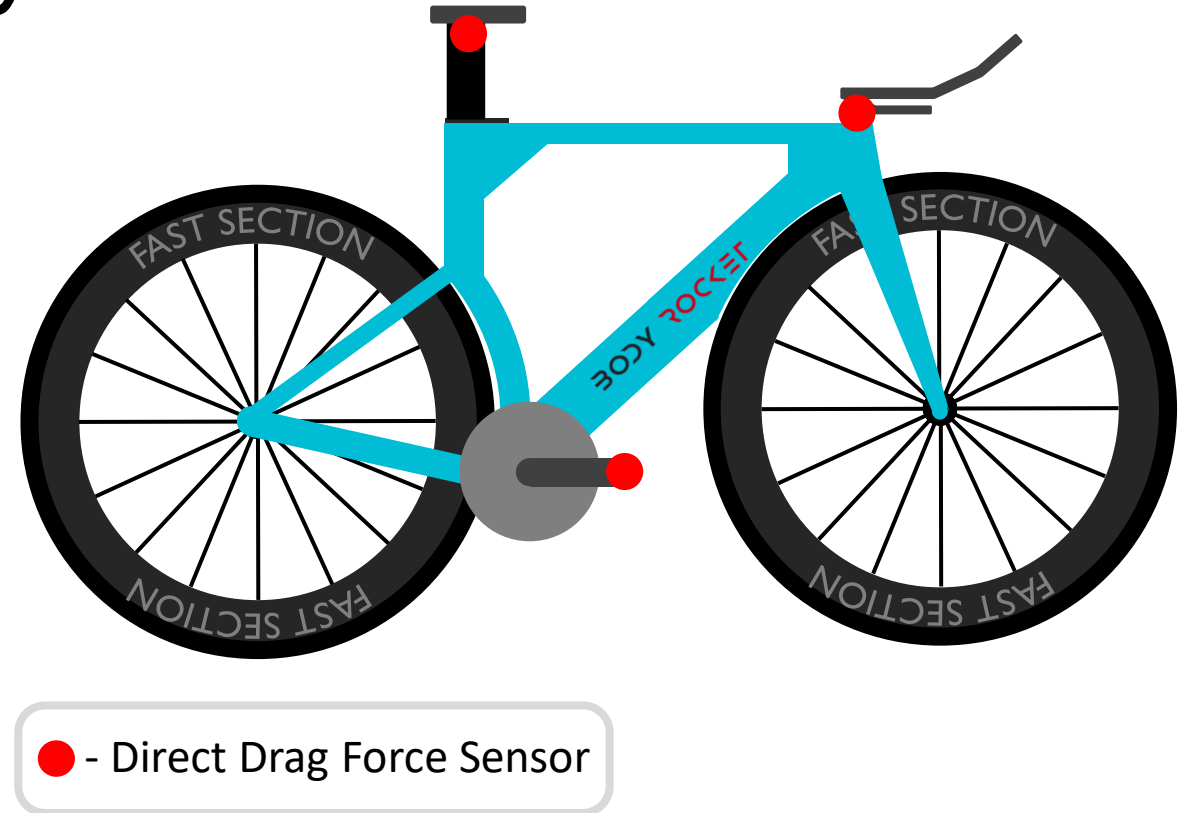
What is shuffling?



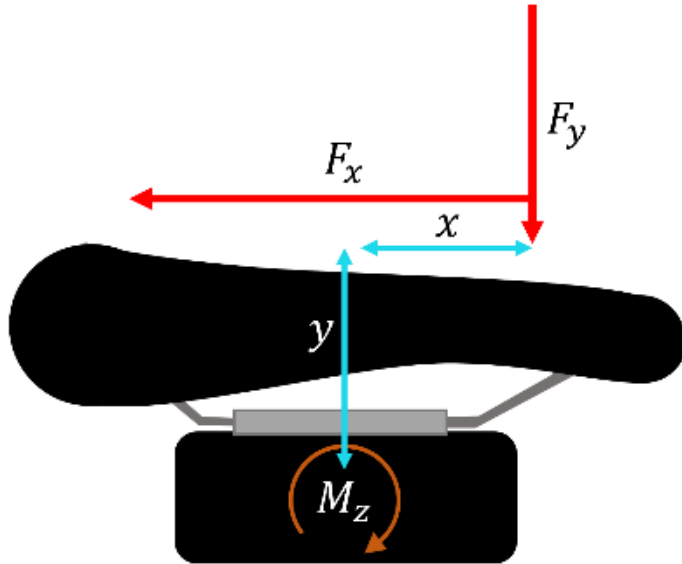
- Shuffling is when a rider moves forward on the saddle then pushes back.
- Due to the movement on the saddle the effective saddle height is decreased this impacts lower limb kinematics and as a result cycling efficiency (Ferrer-Roca et al., 2014).
- The aim of this study is to quantify the impact of shuffling on cycling aerodynamics and power output

Determining the impact of shuffling on CdA - The Body Rocket System

- Using sensors that fit to the handlebar saddle and pedals, the system can directly measure the drag force on a rider.
- Using a wind-speed measurement device it is then possible to determine a real-time CdA.

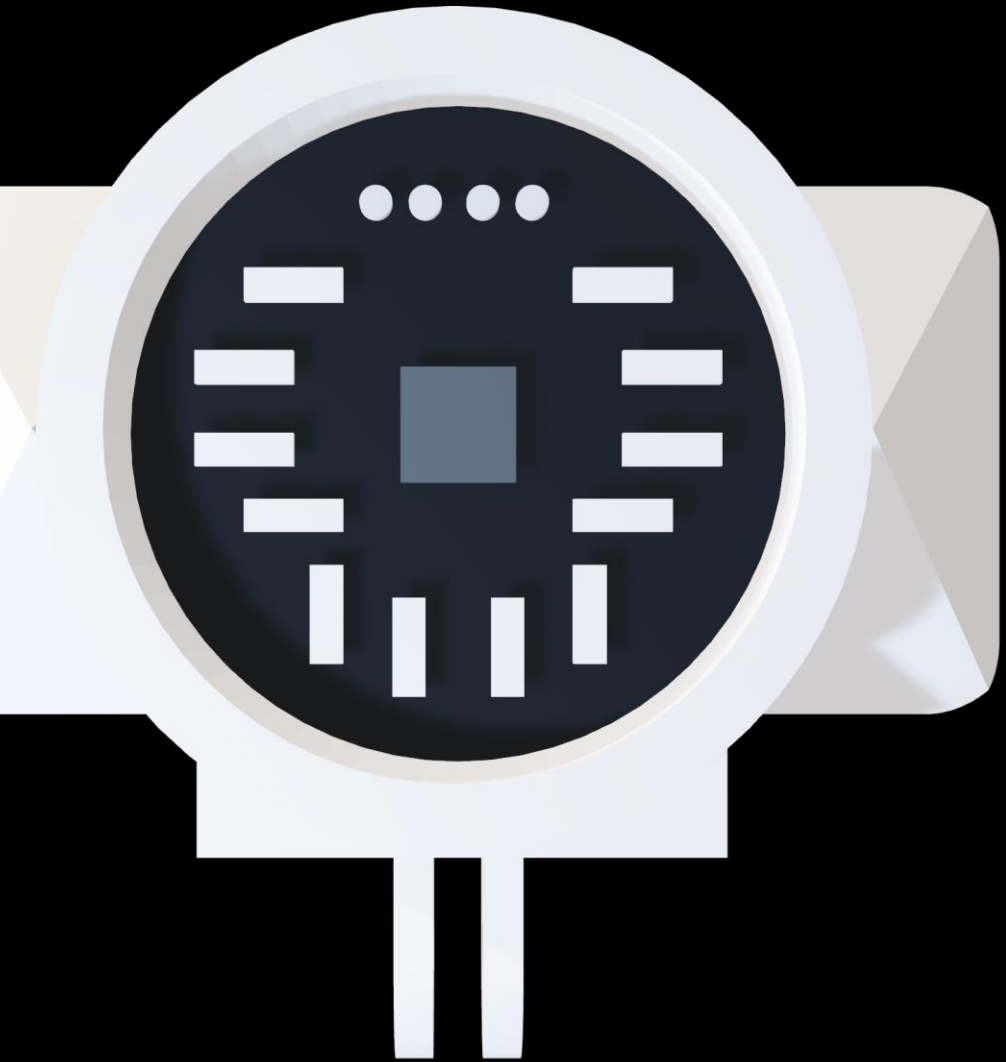


Determining position on the saddle – Method 1



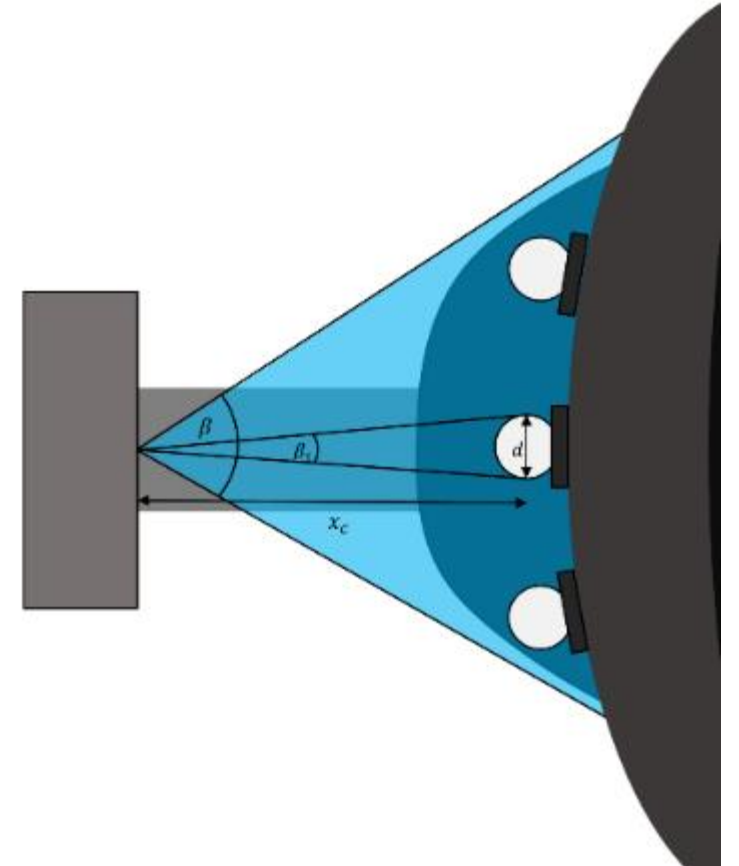
- Using the novel device from (Body Rocket Ltd, Sussex UK) the forces and moments on the saddle are measured. This gives the ability to determine the position of a rider on the saddle.

$$x = \frac{M_z - yF_x}{F_y}$$



Determining position on the saddle – Method 2

- The ShuffleCam was created as an optical method to monitor the position of a rider on the saddle.
- With markers attached to the rear of the rider, the ShuffleCam uses computer vision techniques to identify the markers and their measured size in the image frame. The change in size can then be used to determine the distance from the camera, therefore, the position on the saddle.



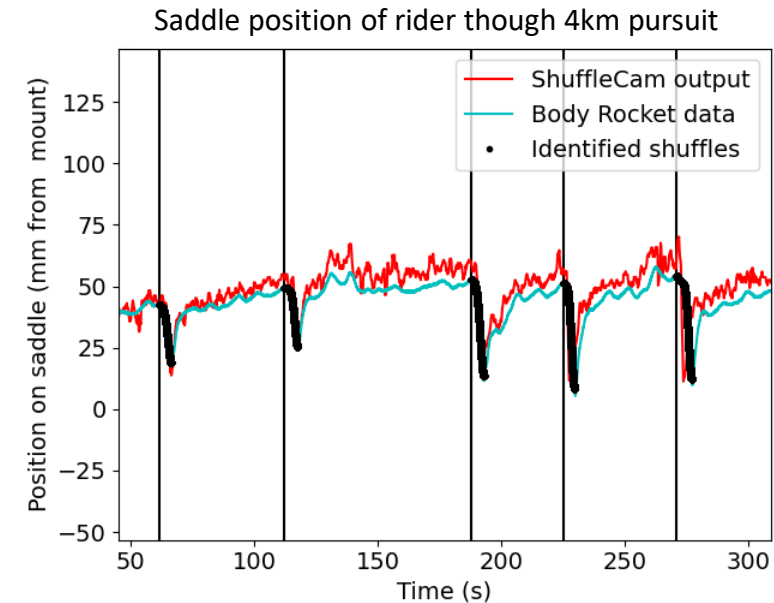
The Experimental Design



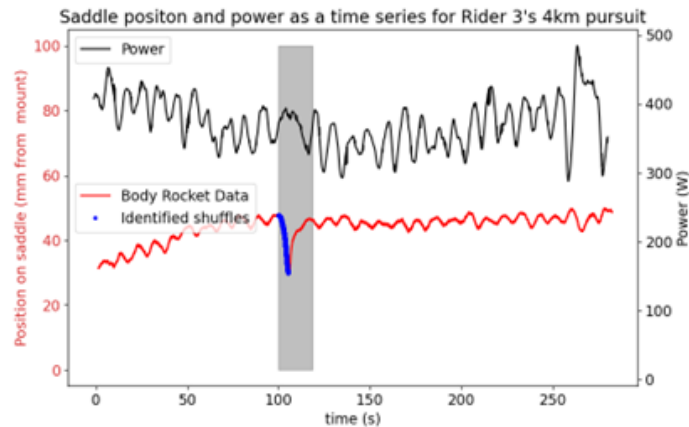
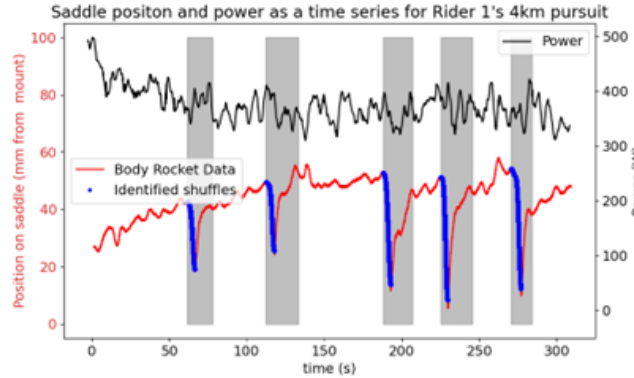
- After institutional ethical approval, five experienced track riders were invited to the velodrome (Geraint Thomas National Velodrome of Wales, Newport).
- Two test bikes were used, both individually set up for each rider's preferred set-up with the ShuffleCam installed.
- As the aim of the study is to investigate the impact of shuffling on performance, the riders were instructed to perform a 4km pursuit effort at race pace.
- After the first day of testing one rider came back for a repeat run under the same testing conditions.

ShuffleCam and Body Rocket comparison

- Once the data was collected, the Body Rocket data was compared to the ShuffleCam data. After collecting the data, the Body Rocket system showed consistency with the ShuffleCam.
- The mean bias between systems was 5.18mm with a lower limit of agreement -2.85mm with upper limit of agreement of 13.21mm.



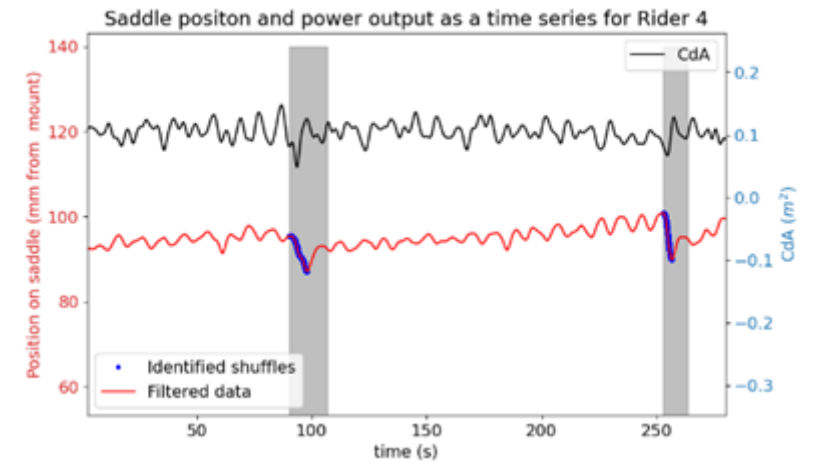
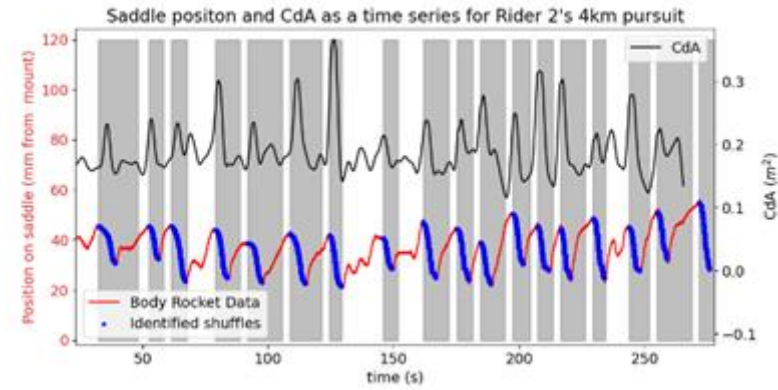
The impact of shuffling on power output



- Out of the five riders tested, three exhibited power losses during shuffling, whereas two showed spikes in power during their shuffles.
- The largest average power drop for a rider during a shuffle was 6.93W, conversely, the largest power spike as a result of a rider shuffling was 5W.

The impact of shuffling on CdA

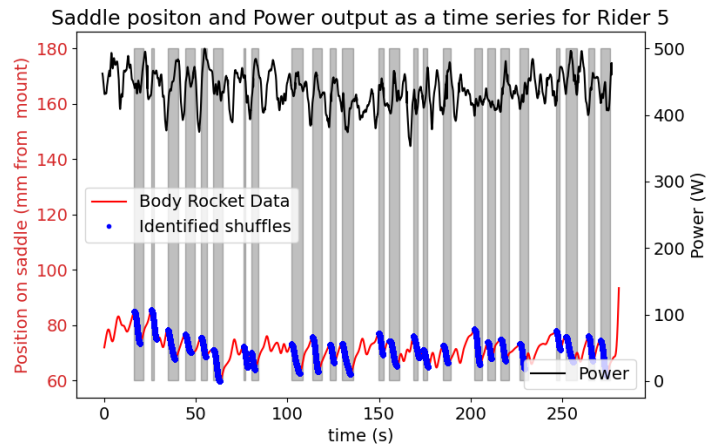
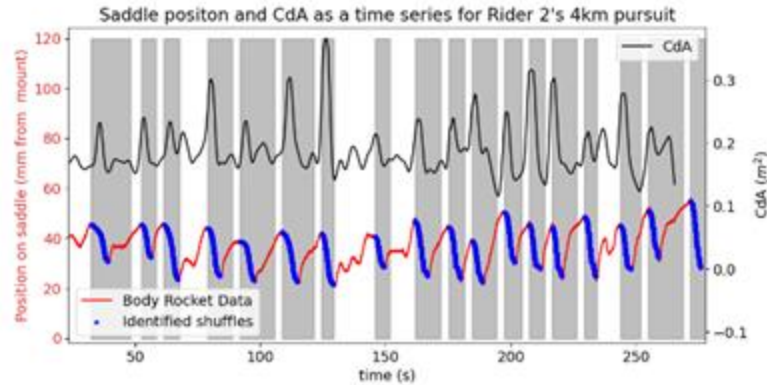
- The impact of shuffling on CdA is similar to the results obtained from a rider's power output.
- Interestingly three of the five riders were more aerodynamic when they shuffled, however, not the same three that lost power during their shuffling.



Discussion

- From the results obtained, it is clear that a rider dependence exists. With the majority of riders having a drop in power output. The prolonged riding in a tucked position is likely to cause discomfort and therefore movement on the saddle (Polanco et al., 2017).
- The reason why there may be different impacts on power and CdA may be due to the way in which they reposition.
- With the repeat run the rider showed a repeatable shuffle characteristic and the same trend in power output and CdA change.

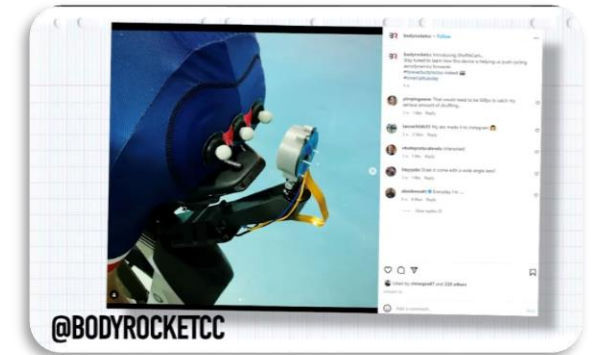
Discussion



- In this study two riders had a high rate of shuffle; both of these riders were outputting over 400W and every time they shuffled a corresponding drop in power occurred. With one of these riders each time they shuffled their CdA increased dramatically .
- For these two riders, the results obtained indicate that shuffling negatively impacts their performance.

So...To shuffle or not to shuffle?

- As this research is in early stages, more data is required. However, this preliminary study reveals that the answer to the question "To shuffle or not to shuffle?" is not as straightforward as initially believed.
- Although; most riders do show a drop in power and some an increase in CdA a rider dependence has been uncovered, with some riders suffering significantly from losses due to shuffling and others less so, verified with some repeat testing.
- From the data collected from two riders it indicates that if a rider shuffles with a high rate they are more likely to have losses due to shuffling.



Thank you for listening!

- Feel free to chat or contact me by email: cb835@kent.ac.uk

