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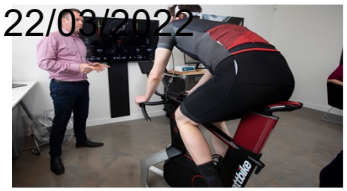
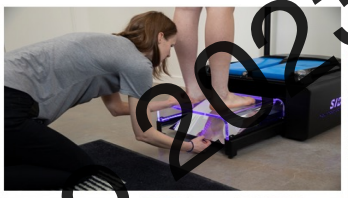
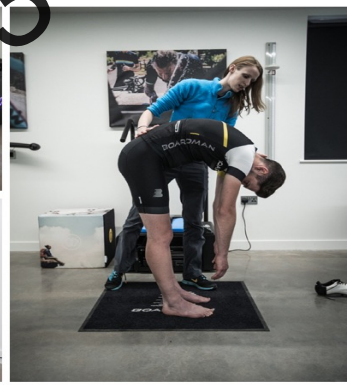
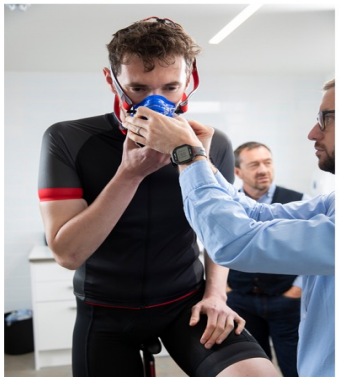
Ergonomics of Aerodynamics

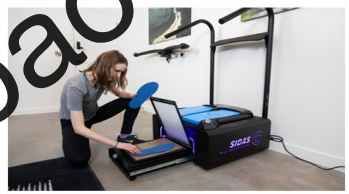
Jamie Pringle

22/03/2022



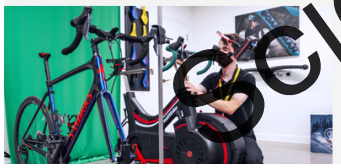


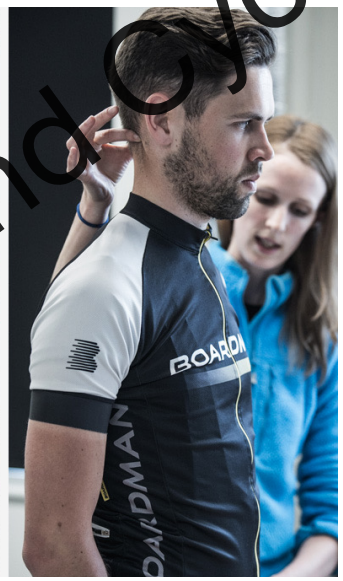










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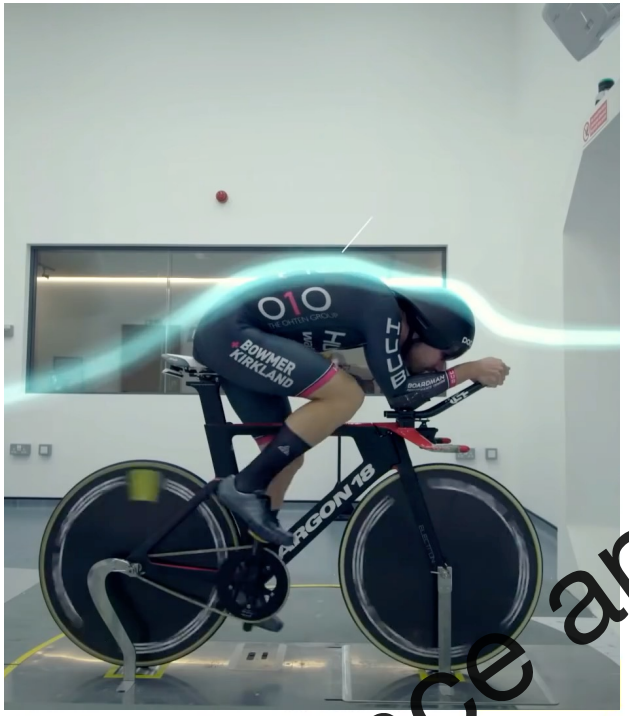
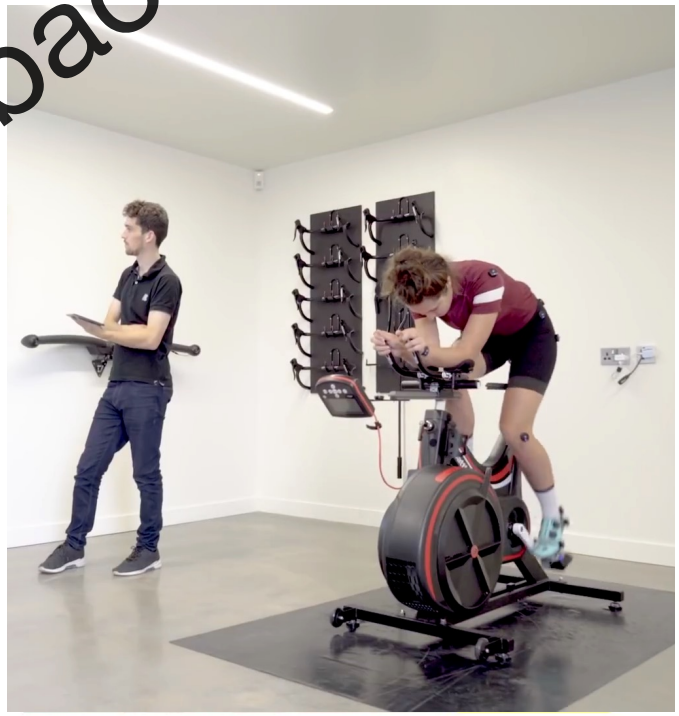


AERODYNAMIC SERVICES

HEALTH & FITNESS SERVICES



POSITION & TECHNIQUE SERVICES

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ISRAEL START-UP NATION
bryton
SLICK
FACTOR
science and cycling, Bilbao 2023

Ergonomics of Aerodynamics

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A definition

"Ergonomics is the scientific discipline concerned with the understanding of interactions among humans and other elements of a system, and the profession that applies theory, principles, data, and methods to design in order to optimize human well-being and overall system performance."

The International Ergonomics Association

A model of practice

Theory, principles, data & methods leading to optimization

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Defining the challenge

What it takes to win; what it takes to lose ....really make a pig's ear of it

Define and focus

Needs, history, and constraints

- **NEEDS:** event (what it takes to win)
- **HISTORY:** what's worked; what hasn't
- **CONSTRAINTS:** resource; time; obligations

DEFINE

Discover

Range, risk, potential – the functional window

Discover

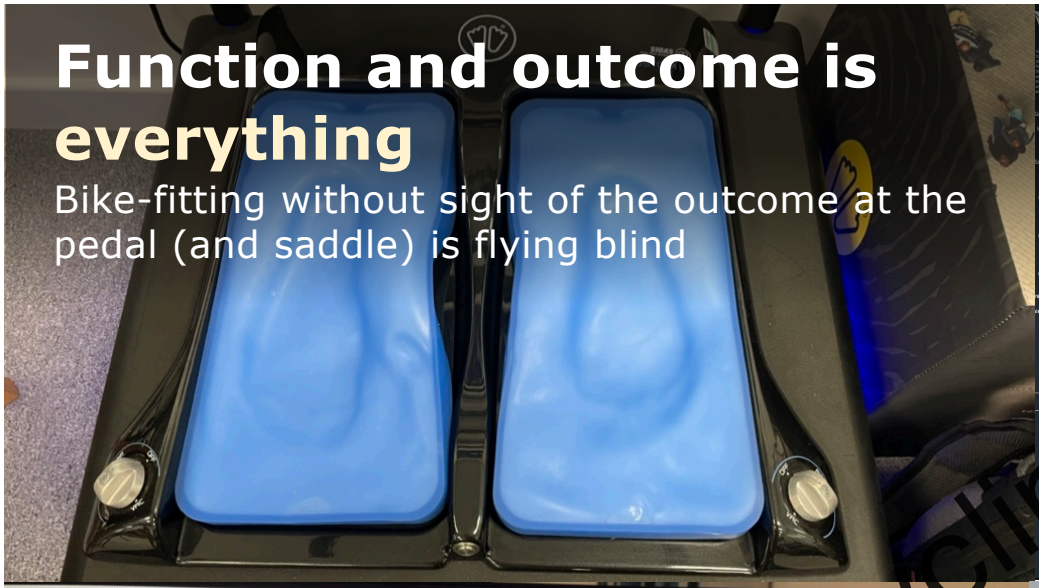
A systematic and whole-body approach to establish direction and potential, range and risk

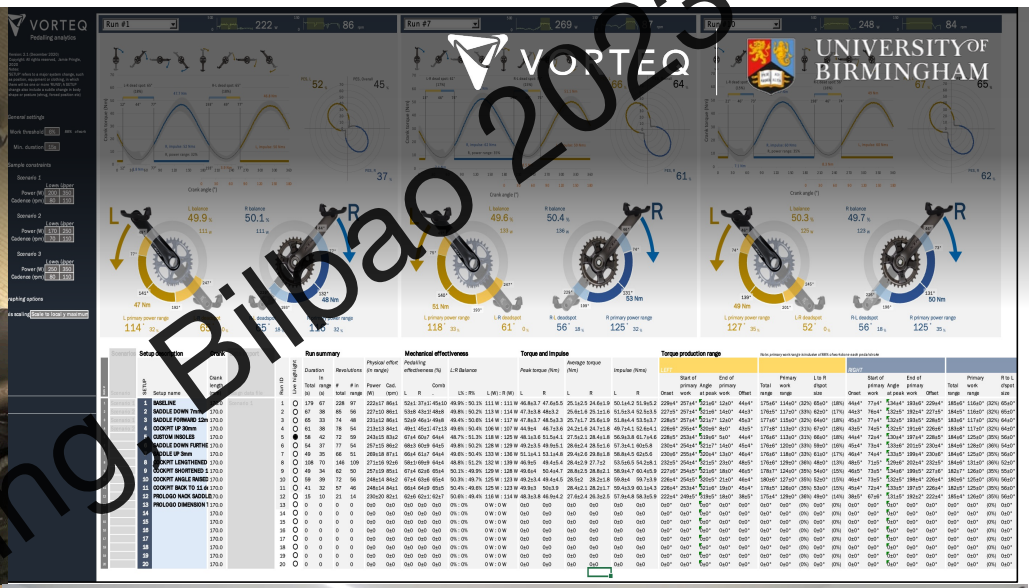
- **SYSTEMATIC:** nothing in isolation
- **TRAJECTORY:** proof of concept & direction
- **RANGE:** ‘Functional window’; edge of risk

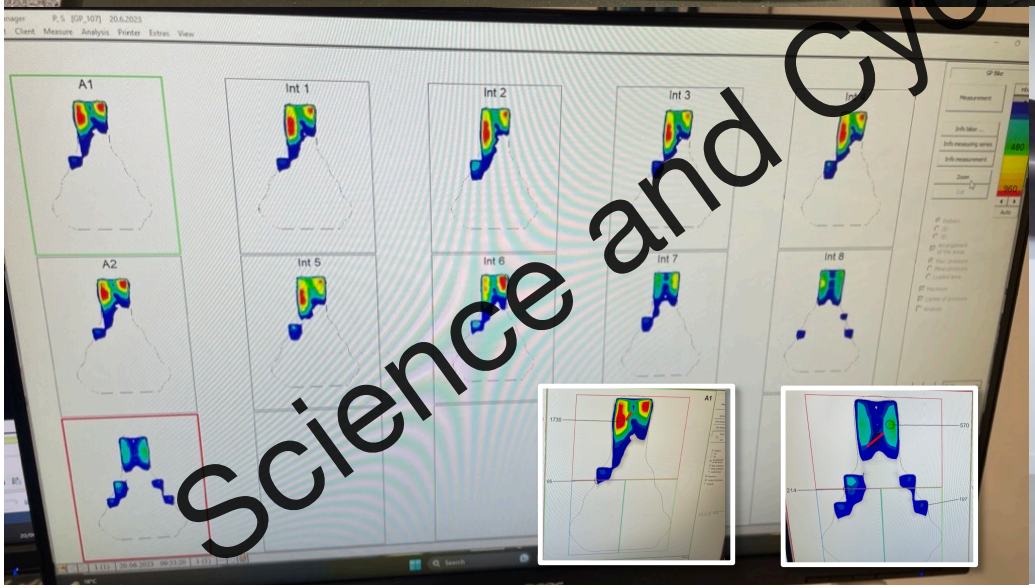
DISCOVER

Function and outcome is everything

Bike-fitting without sight of the outcome at the pedal (and saddle) is flying blind







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Development

Data-driven and evidence-based decision-making

Proof of concept

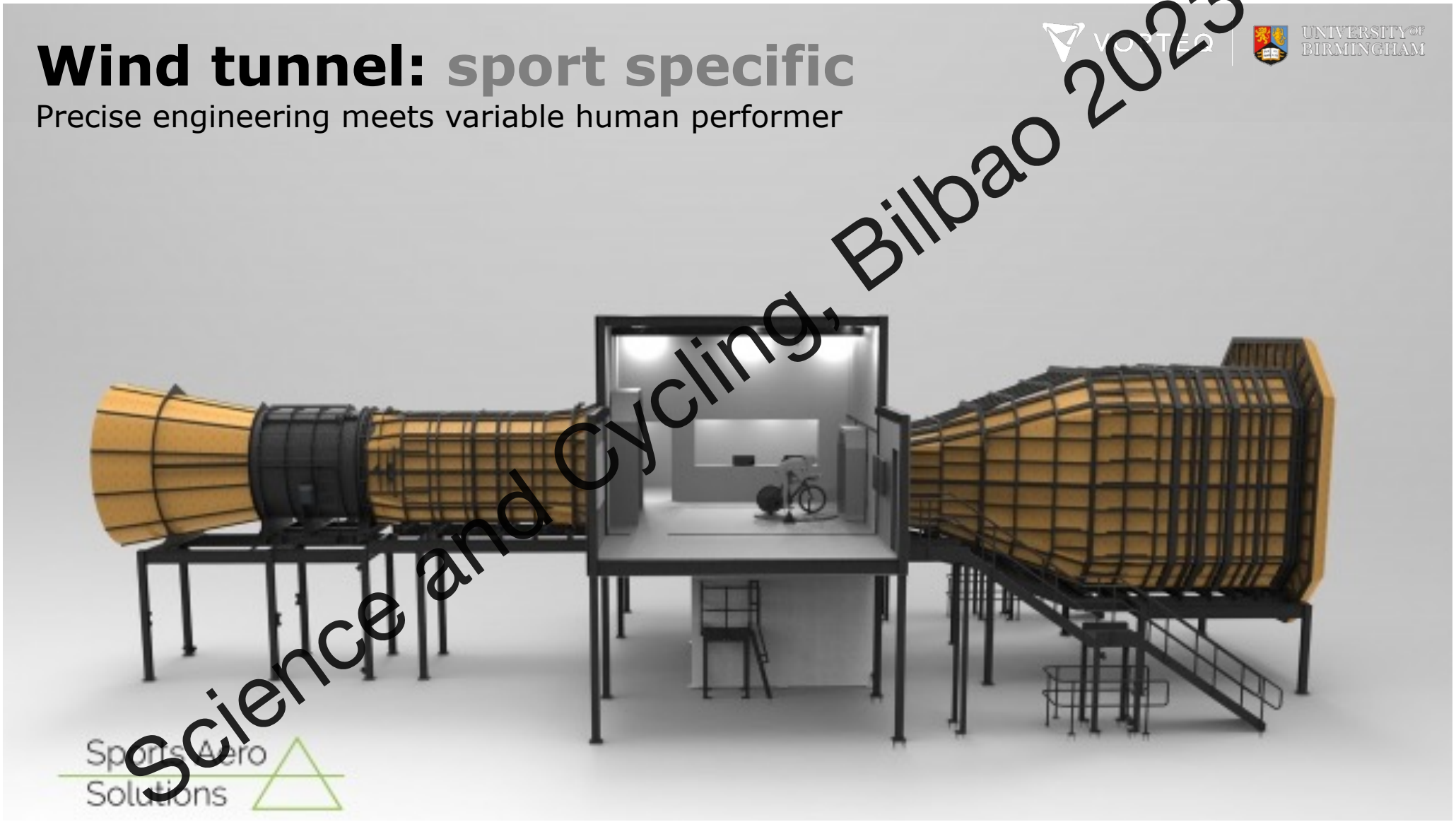
Heading in the right direction is as important as the destination

- **PRIORITY:** big ticket items first
- **BALANCE:** power versus aero? Wrong fight to pick
- **PERSPECTIVE:** short and long-term

DEVELOP

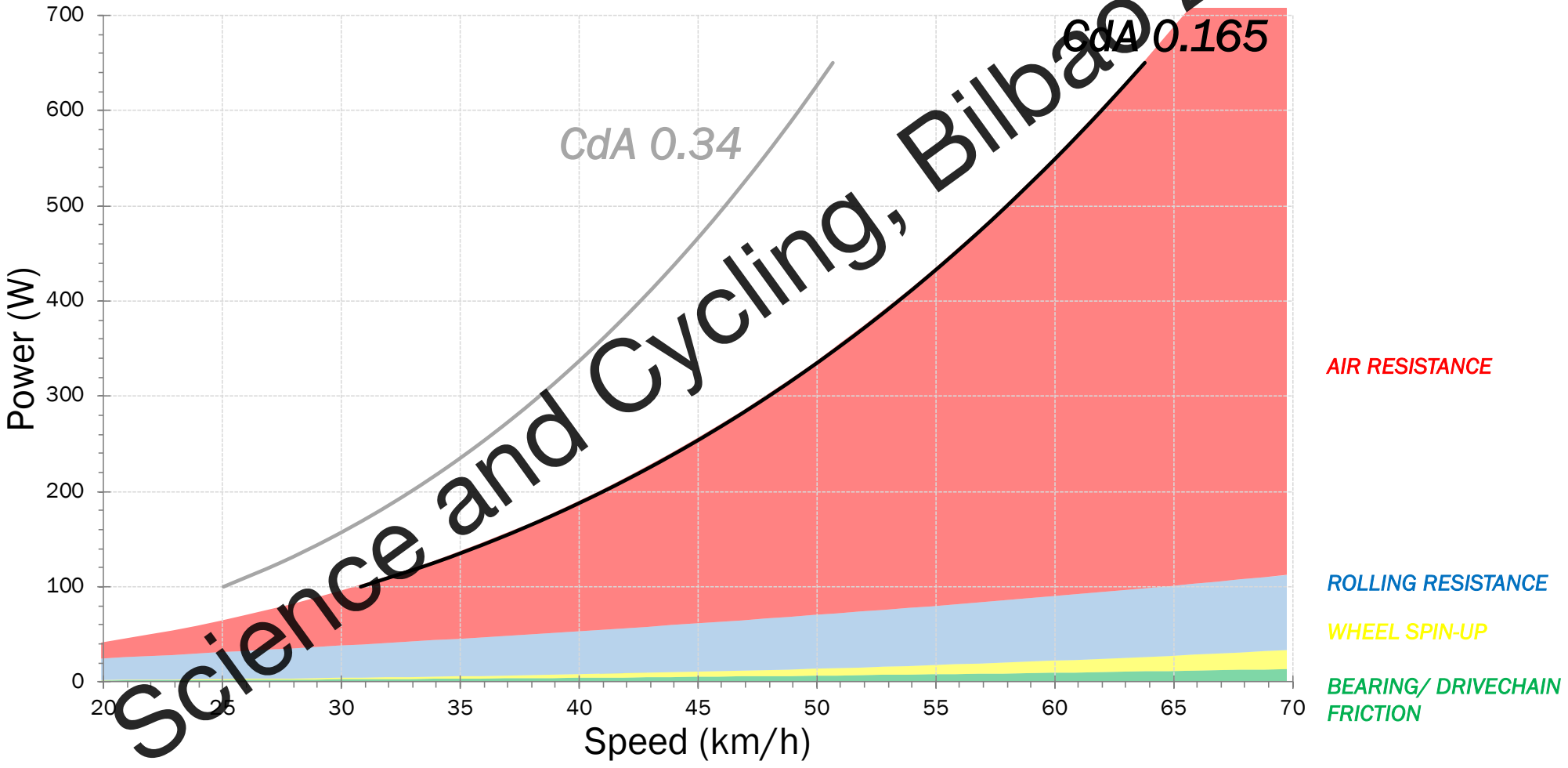
Wind tunnel: sport specific

Precise engineering meets variable human performer



Aerodynamics is (almost) everything

Aerodynamics, good or bad, determine performance



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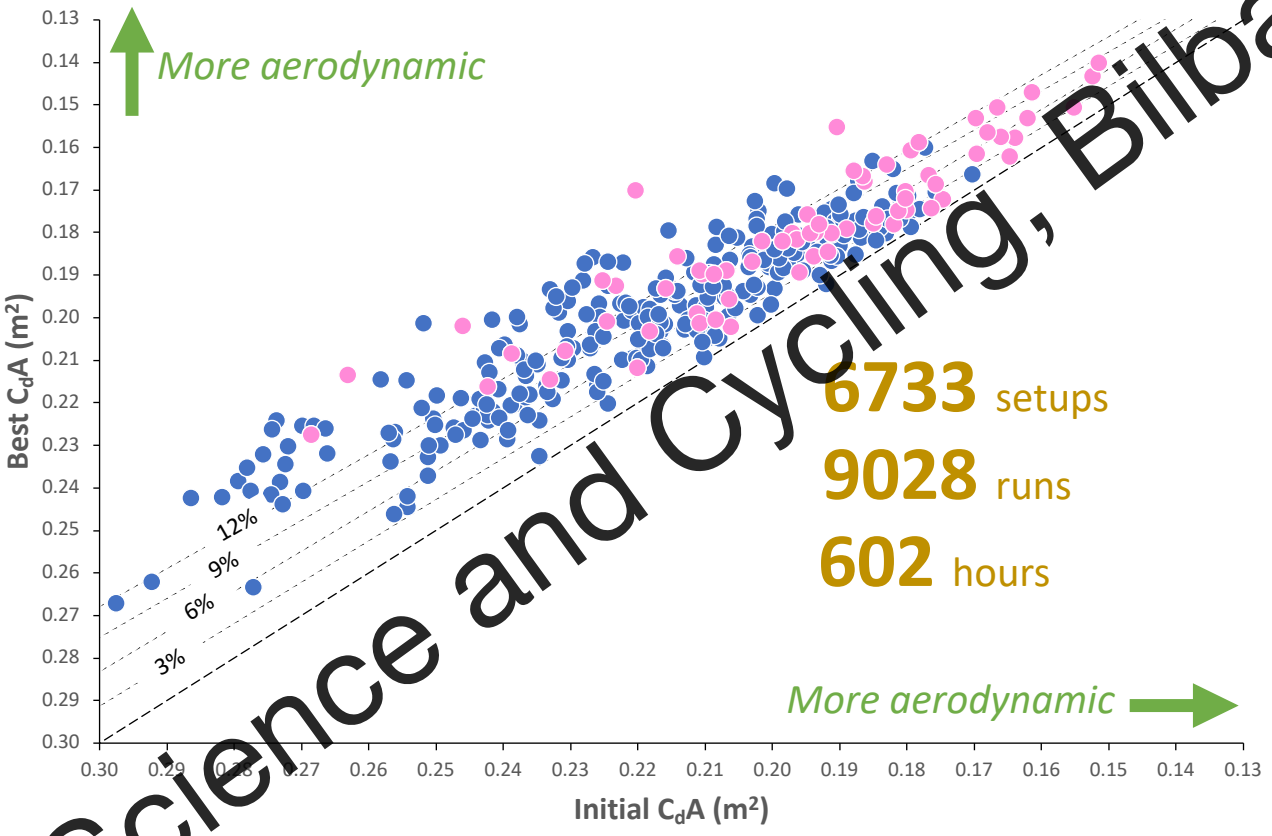

6733 setups

9028 runs

602 hours

389 sessions

287 individuals

71 females

17 avg. # setups per session

168 combined aero & biomex

TT and pursuit position focus

Science and Cycling, Bilbao 2023

Note: Coefficient of Drag Area (C_dA) corrected for 'stanchion tares'

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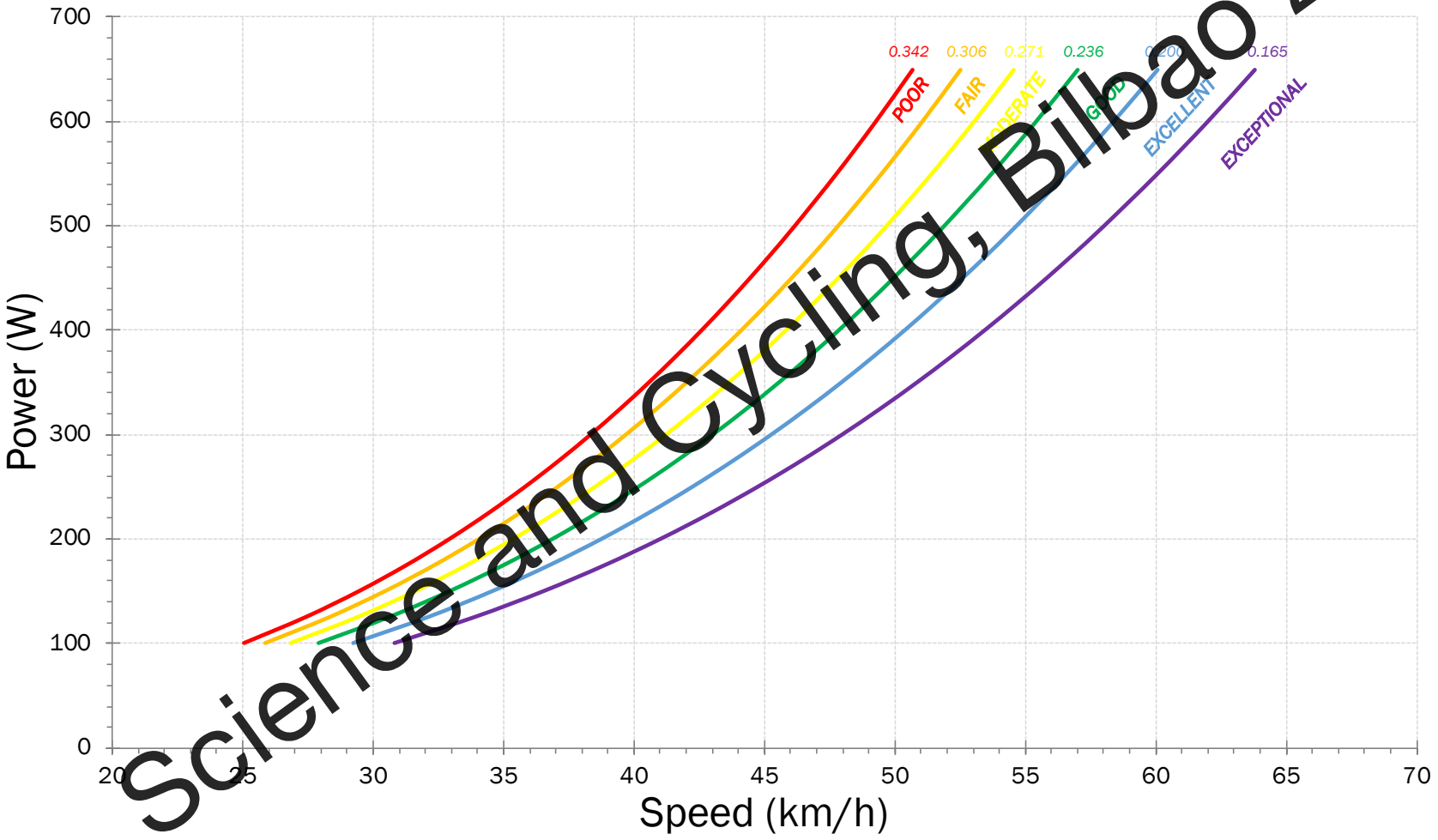

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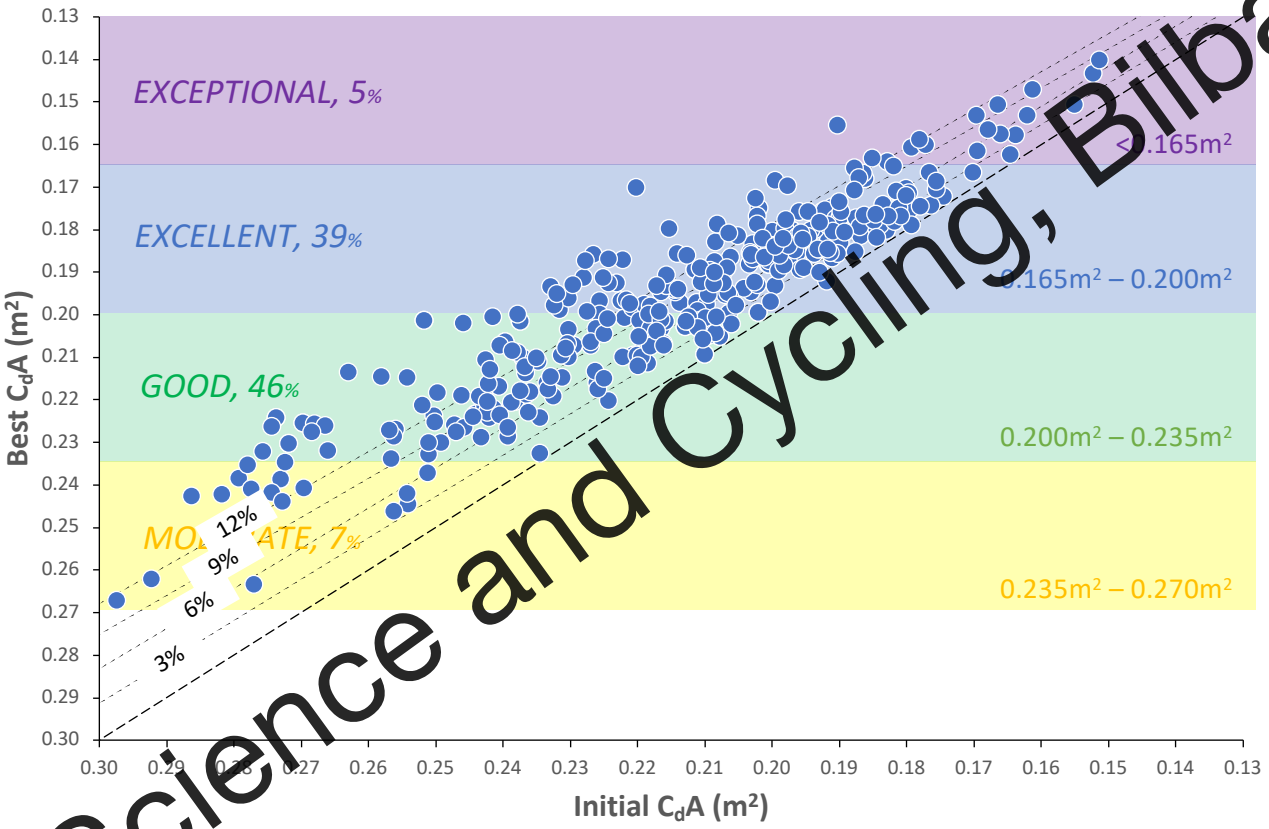

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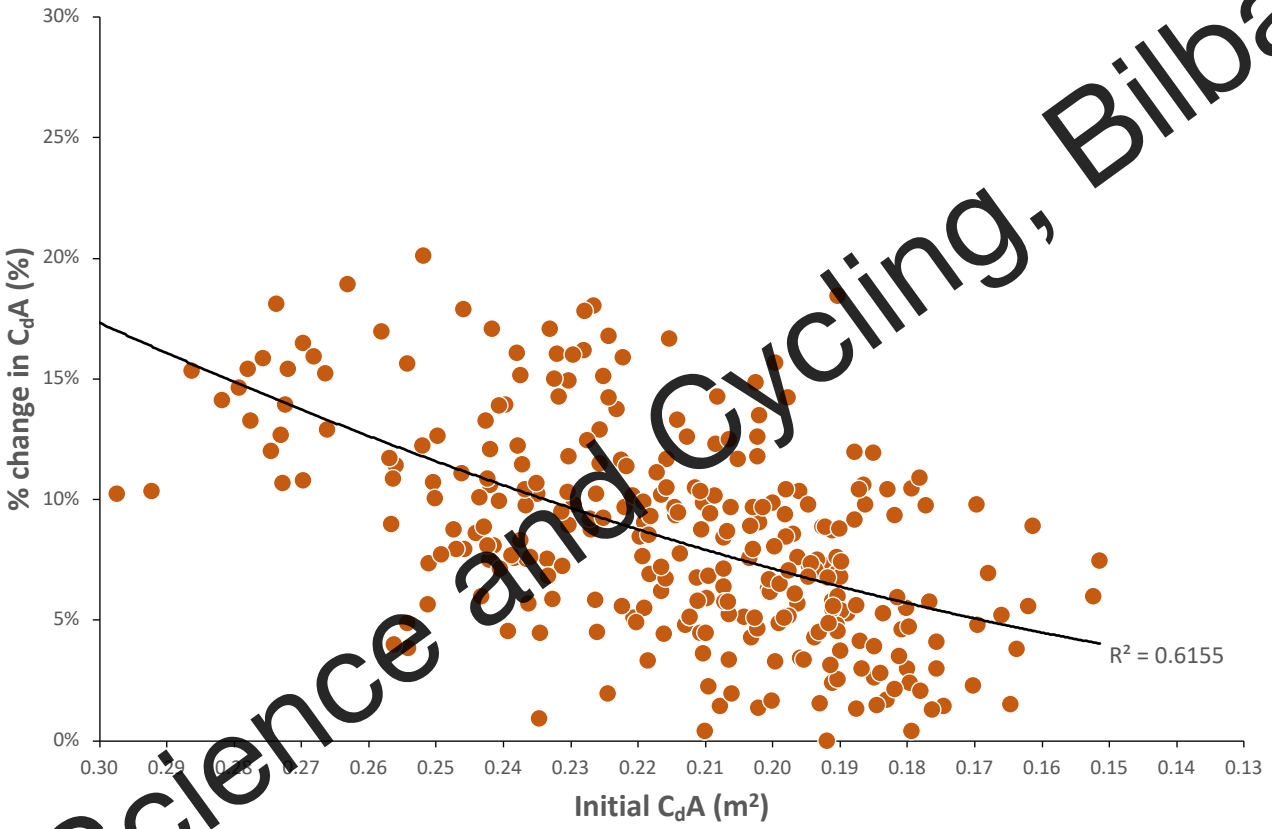


8.9% average change in C_dA

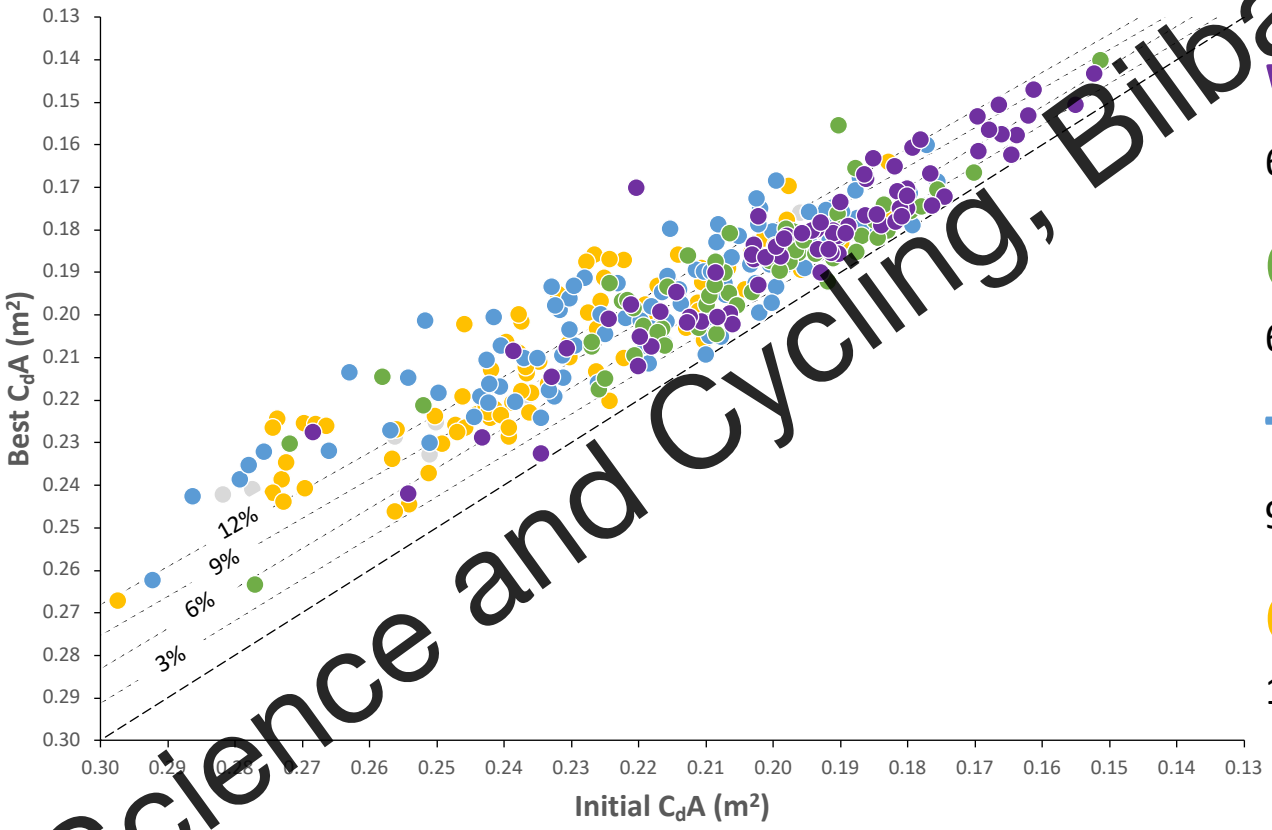
26 W saving in power

1.45 km/h gain in speed

Note: Coefficient of Drag Area (C_dA) corrected for 'stanchion tares'

Coefficient of Drag Area (C_dA)

8.9% average improvement across all groups



World Tour Pro (77)

6.6% change in C_dA | 25 W saving

Conti/Dom Pro (62)

6.9% change in C_dA | 21 W saving

Top amateur (105)

9.9% change in C_dA | 29 W saving

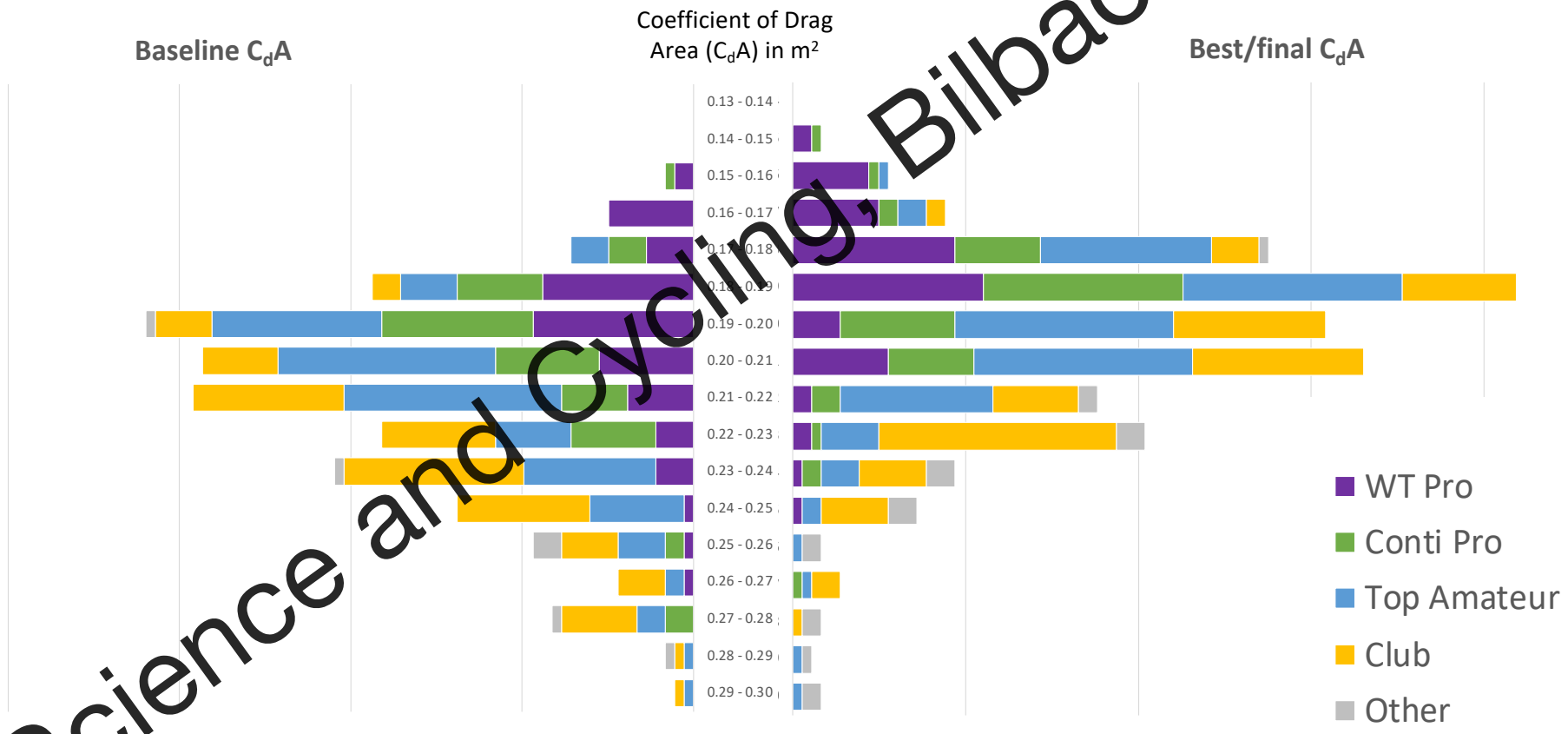
Club level (123)

10.7% change in C_dA | 27 W saving

Note: Coefficient of Drag Area (C_dA) corrected for 'stanchion tares'

Coefficient of Drag Area (C_dA)

8.9% average improvement across all groups



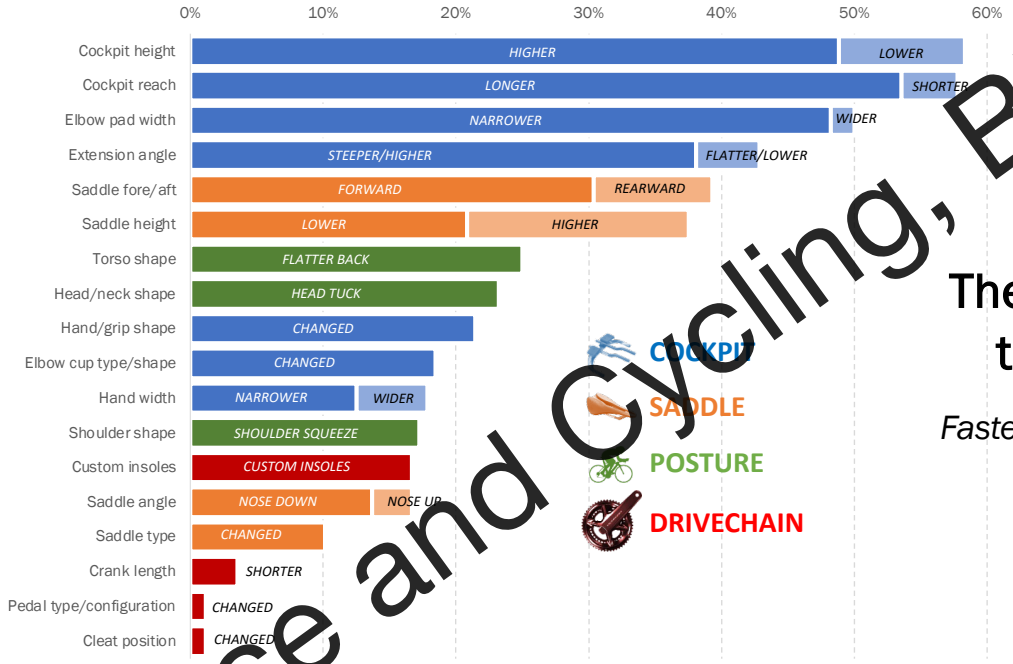
Note: Coefficient of Drag Area (C_dA) corrected for 'stanchion tares'

Designing the solution

Consistent and reliable method allows for more confident decisions

Ergonomic changes or cues

Where an ergonomic change has resulted in better function and better aerodynamics



The importance of having solutions that work in multiple scenarios

Faster, for more of the time, for more events, for more circumstances, for more people

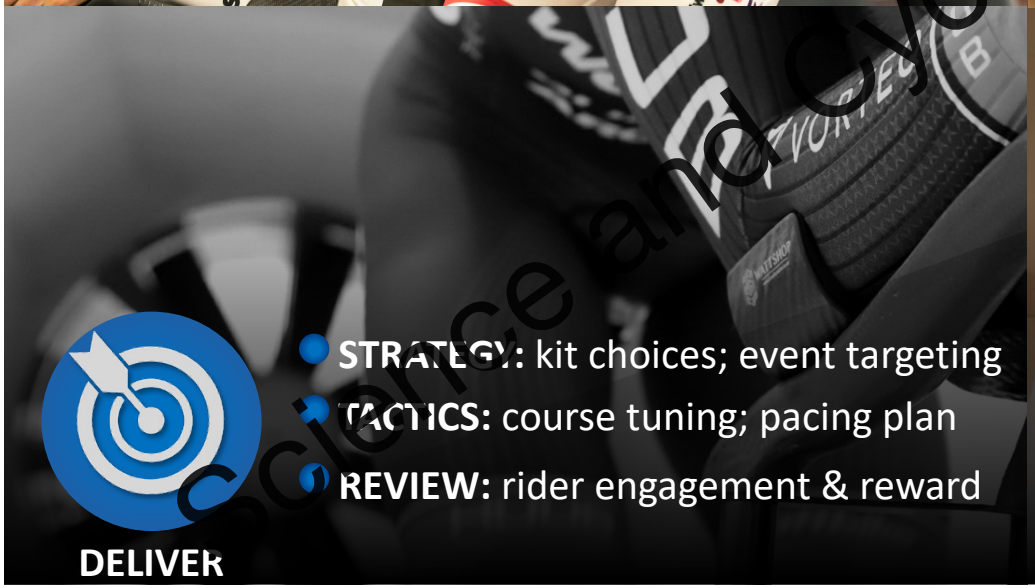
- **HEADROOM:** breadth of function not singular solution
- **PRAGMATIC:** simple, achievable, flexible
- **ROBUST:** risk reduced; pressure checked

Delivery

Consistent and reliable method allows for better decisions

Position optimization

Confidence that the position works

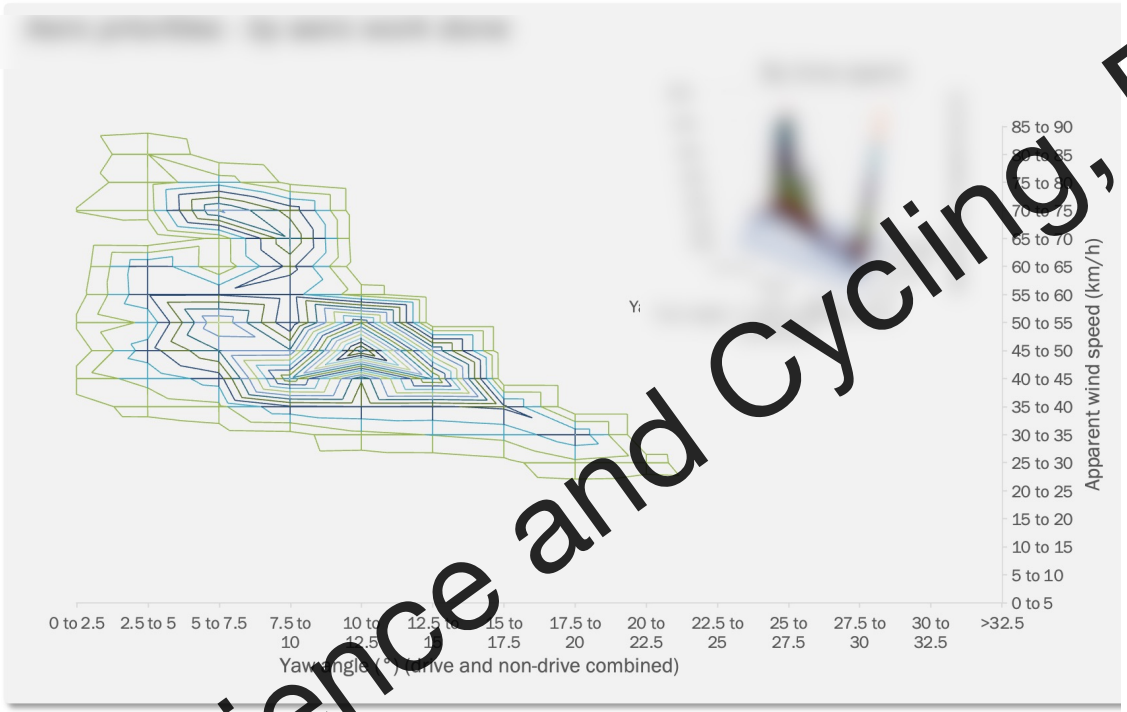


- **STRATEGY:** kit choices; event targeting
- **TACTICS:** course tuning; pacing plan
- **REVIEW:** rider engagement & reward

DELIVER

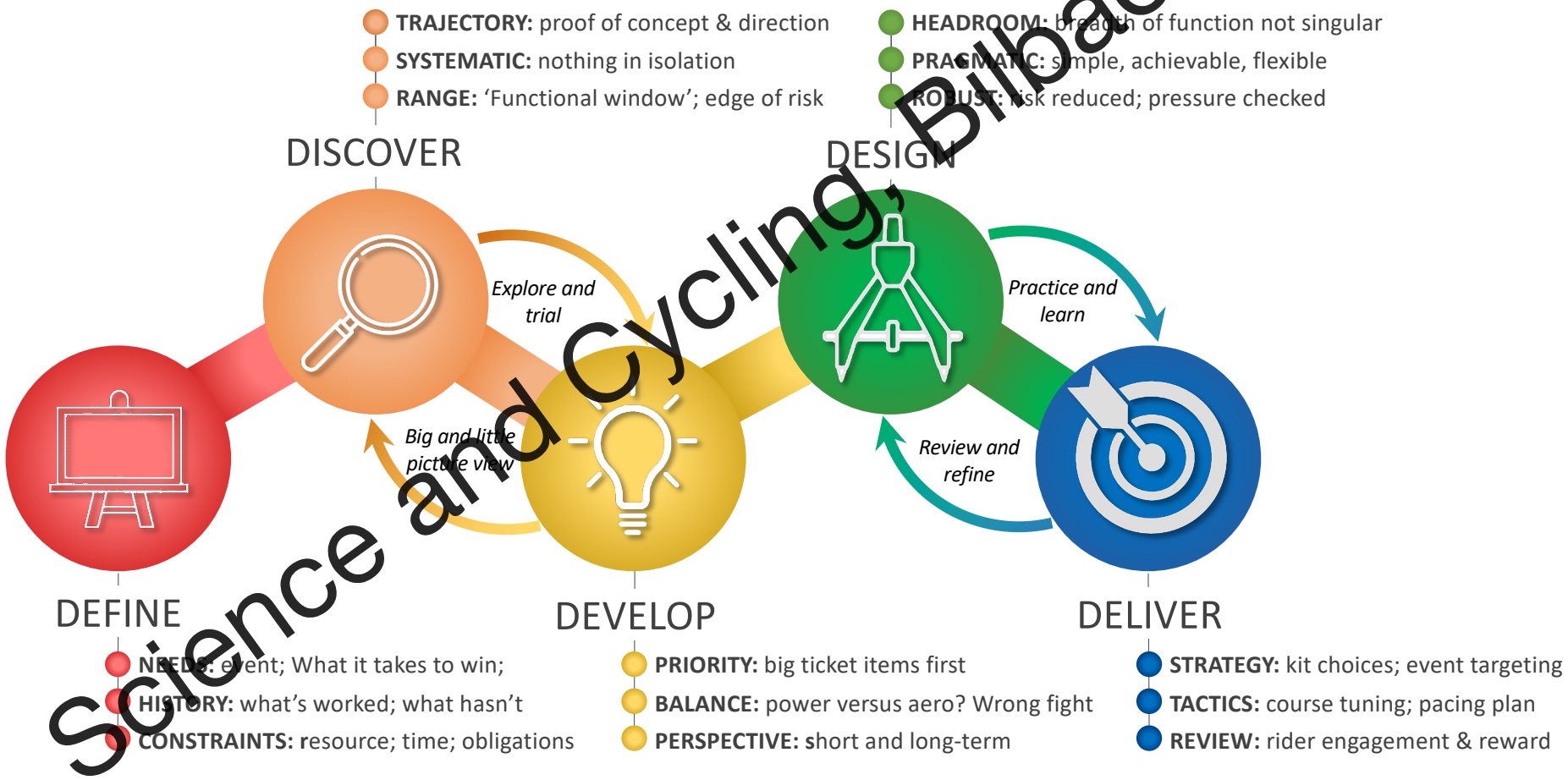
Delivery: performance modelling

Physics and physiology: aero, yaw and speed, and critical power



Trust the method

Systematic and logical; confidence in outcomes



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