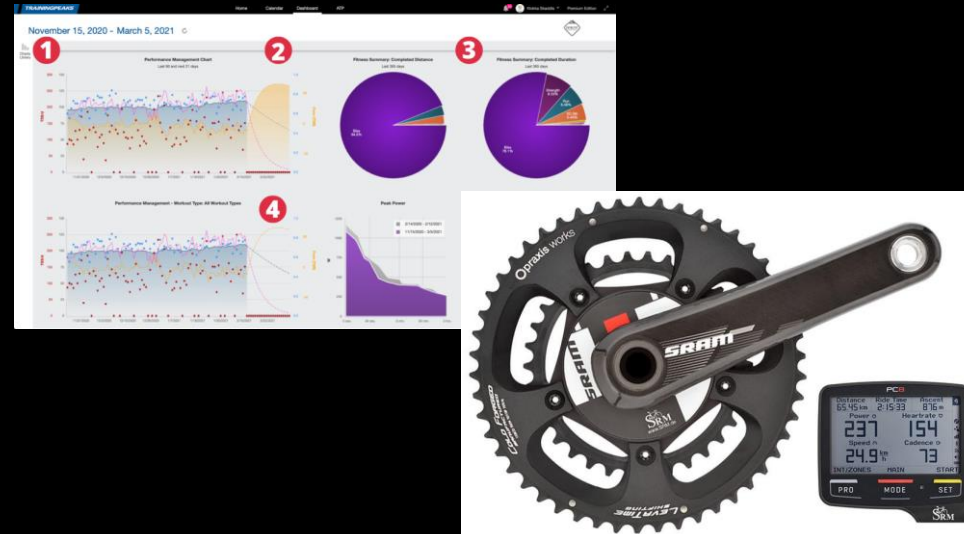


Learning from field data of professional cyclists; from winning bunch sprints to the effect of accumulating fatigue on performance



Stellenbosch

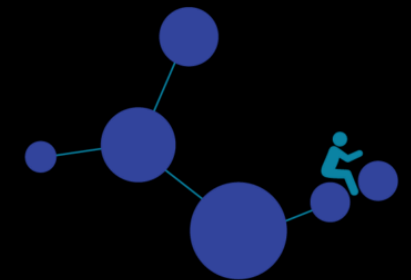
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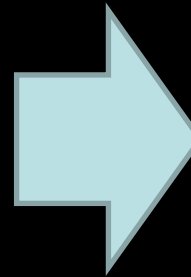
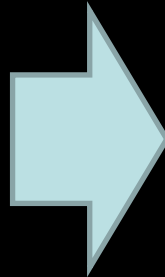


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Introduction



Introduction



Introduction

Laboratory data



Field data

International Journal of Sports Physiology and Performance, 2021, 16, 3-12
<https://doi.org/10.1123/ijsp.2020-0106>
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The Physical Demands and Power Profile of Professional Men's Cycling Races: An Updated Review
Dajo Sanders and Teun van Erp

International Journal of Sports Physiology and Performance, 2021, 16, 1089-1095
<https://doi.org/10.1123/ijsp.2020-0281>
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Physical Demands and Performance Indicators in Male Professional Cyclists During a Grand Tour: WorldTour Versus ProTeam Category
Xabier Muriel, Pedro L. Valenzuela, Manuel Mateo-March, Jesús G. Pallarés, Alejandro Lucia, and David Barranco-Gil

International Journal of Sports Physiology and Performance, 2020, 15, 534-540
<https://doi.org/10.1123/ijsp.2019-0320>
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Training Characteristics of Male and Female Professional Road Cyclists: A 4-Year Retrospective Analysis
Teun van Erp, Dajo Sanders, and Jos J. de Koning

International Journal of Sports Physiology and Performance, 2021, 16, 881-889
<https://doi.org/10.1123/ijsp.2020-0200>
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Power Profiling in U23 Professional Cyclists During a Competitive Season
Peter Leo, James Spragg, Iñigo Mujika, Verena Menz, and Justin S. Lawley

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Power Profiling, Workload Characteristics, and Race Performance of U23 and Professional Cyclists During the Multistage Race Tour of the Alps
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Maintaining Power Output with Accumulating Levels of Work Done Is a Key Determinant for Success in Professional Cycling
TEUN VAN ERP¹, DAJO SANDERS¹, and ROBERT P. LAMBERTS¹

Power Profile of Top 5 Results in World Tour Cycling Races
Teun van Erp, Robert P. Lamberts, and Dajo Sanders

International Journal of Sports Physiology and Performance, (Ahead of Print)
<https://doi.org/10.1123/ijsp.2020-0751>
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Sprint Tactics in the Tour de France: A Case Study of a World-Class Sprinter (Part II)
Teun van Erp, Marcel Kittel, and Robert P. Lamberts

International Journal of Sports Physiology and Performance, (Ahead of Print)
<https://doi.org/10.1123/ijsp.2020-0700>
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Demands of the Tour de France: A Case Study of a World-Class Sprinter (Part I)
Teun van Erp, Marcel Kittel, and Robert P. Lamberts

Physical demands and power profile of different stage types within a cycling grand tour
DAJO SANDERS^{1,2} & MATHIEU HEIJBOER³
¹Physiology, Exercise and Nutrition Research Group, University of Stirling, Stirling, UK; ²Sport, Exercise and Health Research Centre, Nanyang University, Birmingham, UK & ³Team LottoNL-Jumbo Professional Cycling Team, Amsterdam,

WHAT CAN WE LEARN FROM FIELD DATA IN ELITE CYCLISTS



Sprint tactics in the TDF
Case-study of a world-class sprinter

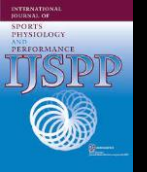


Power Profile of Top 5 Results
in World Tour Cycling Races
Effects of different stage type



Changes in Power output
with accumulating level
of work completed

Sprint tactics in the Tour de France



International Journal of Sports Physiology and Performance, (Ahead of Print)
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BRIEF REPORT

Sprint Tactics in the Tour de France: A Case Study of a World-Class Sprinter (Part II)

Teun van Erp, Marcel Kittel, and Robert P. Lamberts



Sprinting tactics and characteristics

Highly successful sprinter shared his PO data from 4 TDF editions (2013, 2014, 2016 and 2017)

	All sprints	Min	Max
Duration (s)	13 ± 3	7	17
PO (W)	1411 ± 117	1026	1576
Speed (km/h)	66 ± 6	52	73
Cadence (rpm)	112 ± 5	103	121

Riding for 2 teams, namely:

Giant-Shimano (2013, 2014)



and

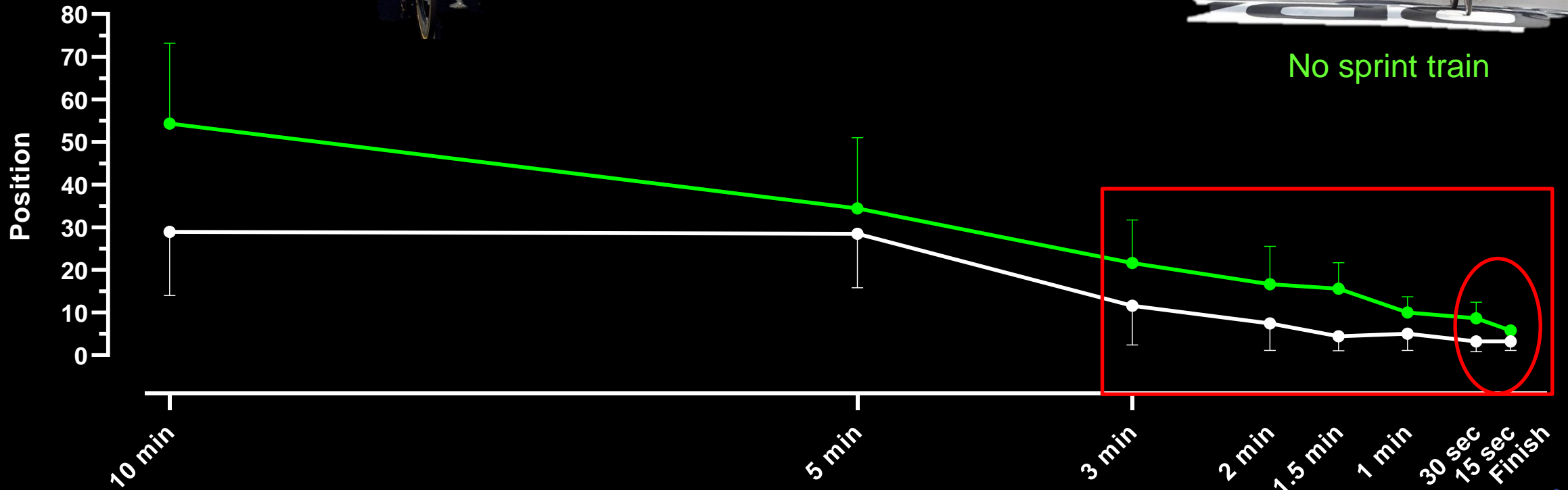
Etixx-Quick step (2016,2017)



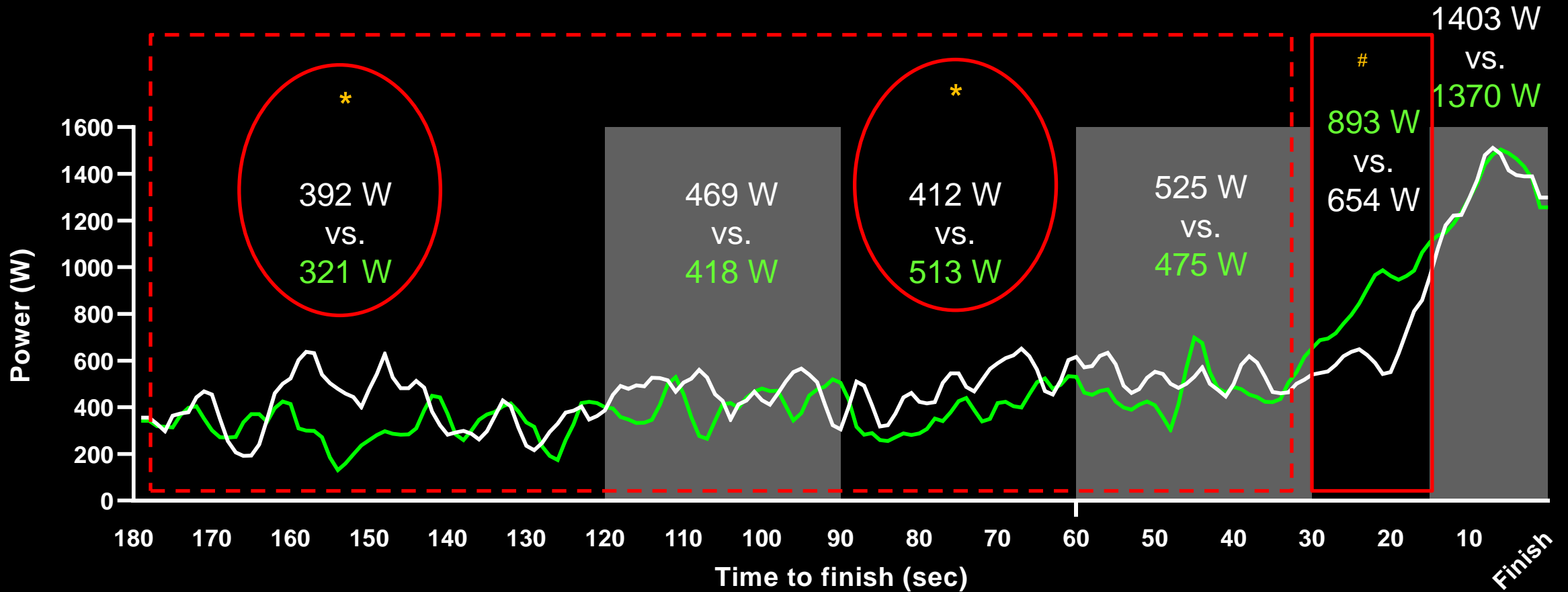
Sprint tactics



- team Quick-step
- team Shimano



Sprinting tactics – last 3 minutes



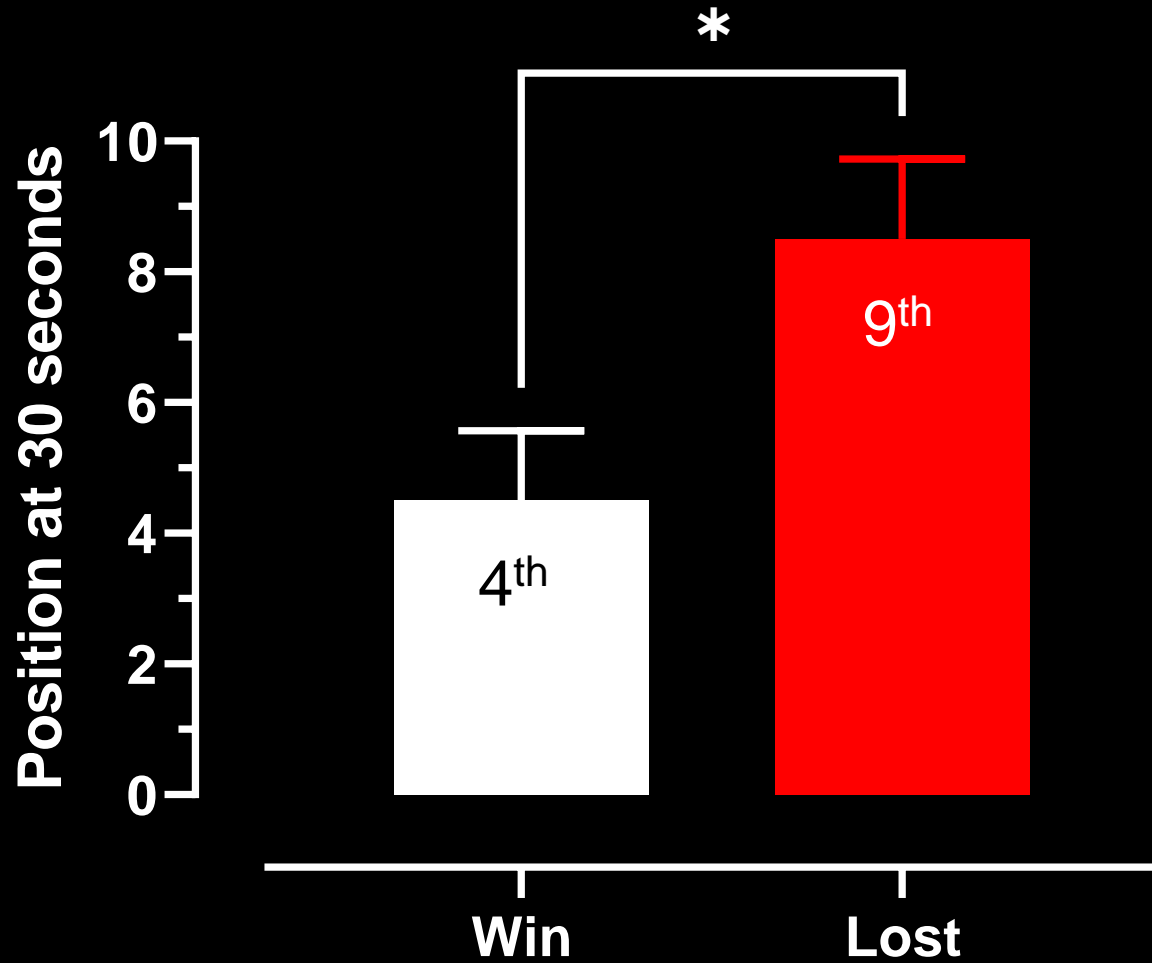
8 out of 10 sprint resulted in a win



6 out of 11 sprint resulted in a win

— team Quick-step
— team Shimano

Won versus lost



Sprinting tactics and characteristics

Take home messages

High-power outputs are needed to win sprint stages in the TDF

Sprint tactics and demands differ based on team tactics

Sprint tactics have **pro's** and **con's** at different time points

Position at 30 seconds before the finish is important to win a sprint

Based team tactics - **sprint training** might need to differ



Power Profile of Top 5 Results in World Tour Cycling Races

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<https://doi.org/10.1123/ijssp.2021-0081>
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ORIGINAL INVESTIGATION



Power Profile of Top 5 Results in World Tour Cycling Races

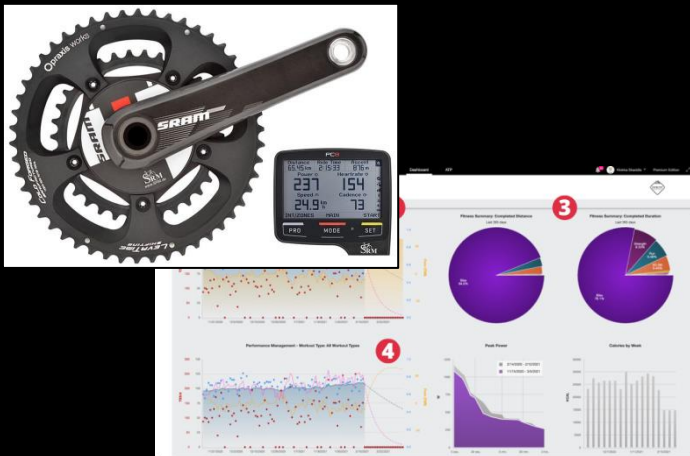
Teun van Erp, Robert P. Lamberts, and Dajo Sanders



Power Profile of Top 5 Results in World Tour Cycling Races

Top 5 results of **18 WT cyclists** during 177 races (2012-2019)

Flat: n=84
 Sm_{sprint}: n=49
 Sm_{uphill}: n=19
 Mountain: n=25



	FLAT	SM _{sprint}	SM _{mountain}	Mountain
Body mass (kg)	80 ± 7	76 ± 10	66 ± 5	65 ± 5
10 sec MMP	1611 ± 182	1376 ± 258	1048 ± 90	1038 ± 74
60 sec MMP	785 ± 67	762 ± 99	666 ± 39	670 ± 30
5 min MMP	494 ± 47	490 ± 35	461 ± 25	466 ± 28
20 min MMP	423 ± 27	427 ± 31	408 ± 25	409 ± 32
CP (W)	399 ± 25	405 ± 32	389 ± 25	389 ± 33
W' (kJ)	30 ± 8	26 ± 4	23 ± 2	24 ± 3

CP and W' calculated from linear work time model using MMP – 3,5,10 and 20 min MMP

Power Profile of Top 5 Results in World Tour Cycling Races

Flat



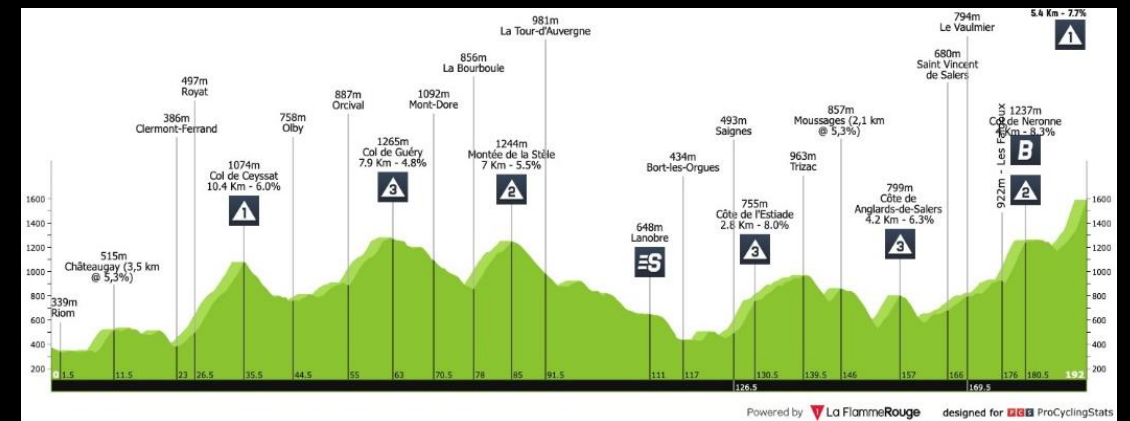
Semi-mountain – uphill finish



Semi-mountain – flat finish



Mountain



Power Profile of Top 5 Results in World Tour Cycling Races

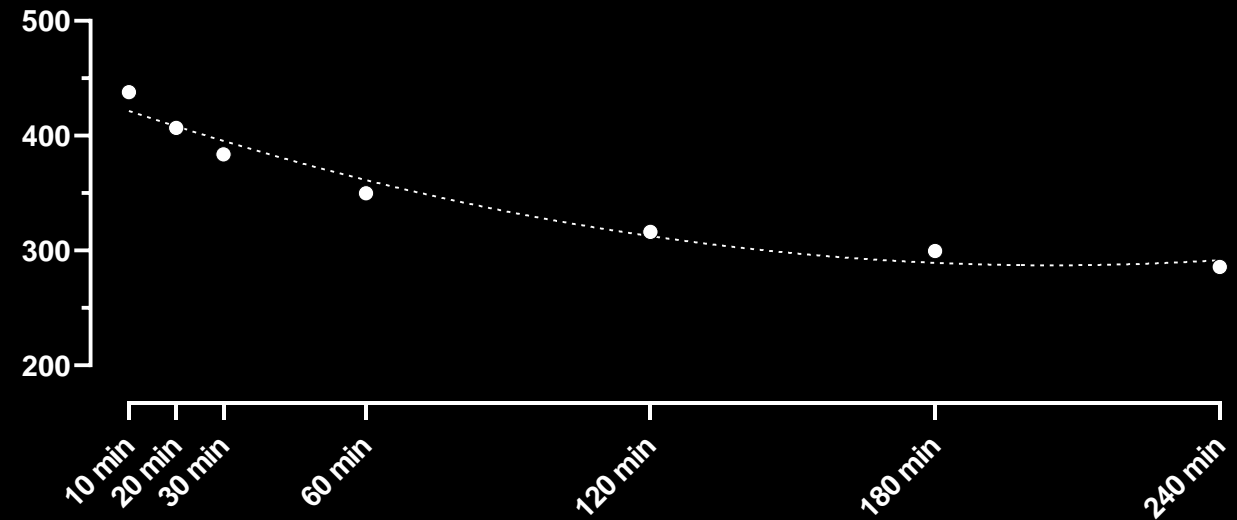
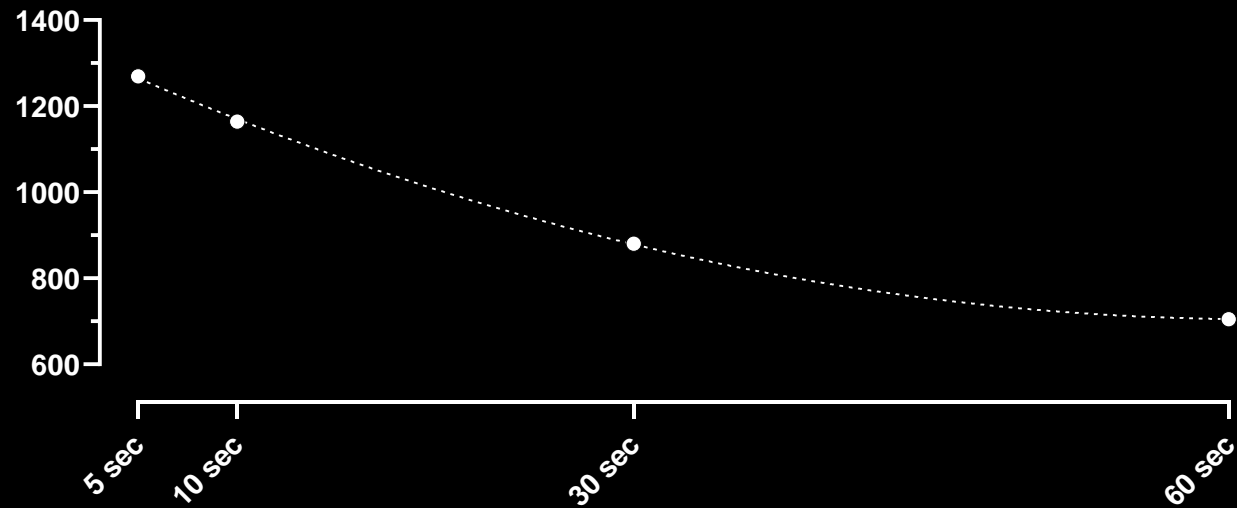
Power profile

Mean Maximum Power output (MMP) over different time frames



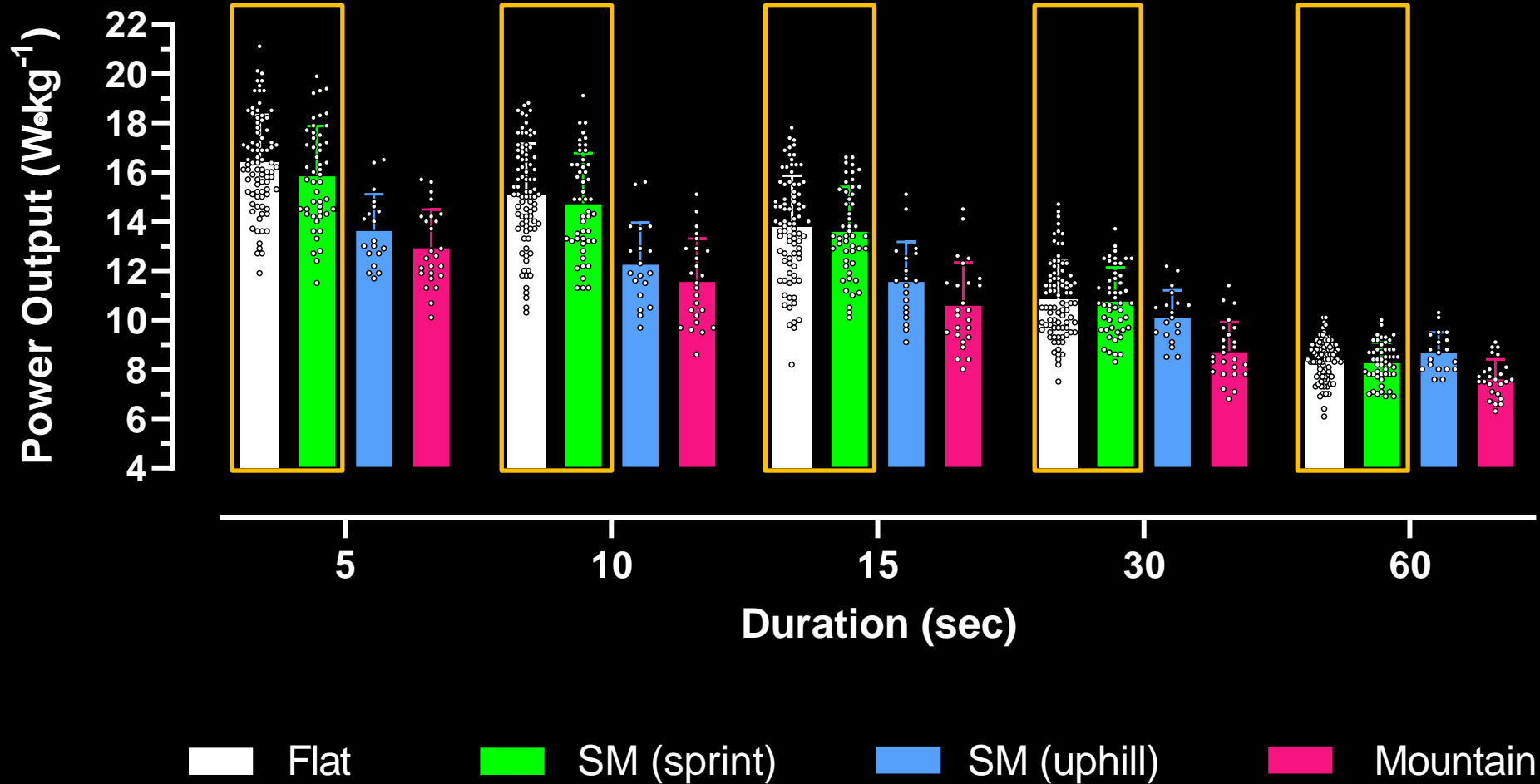
Short duration

Long duration



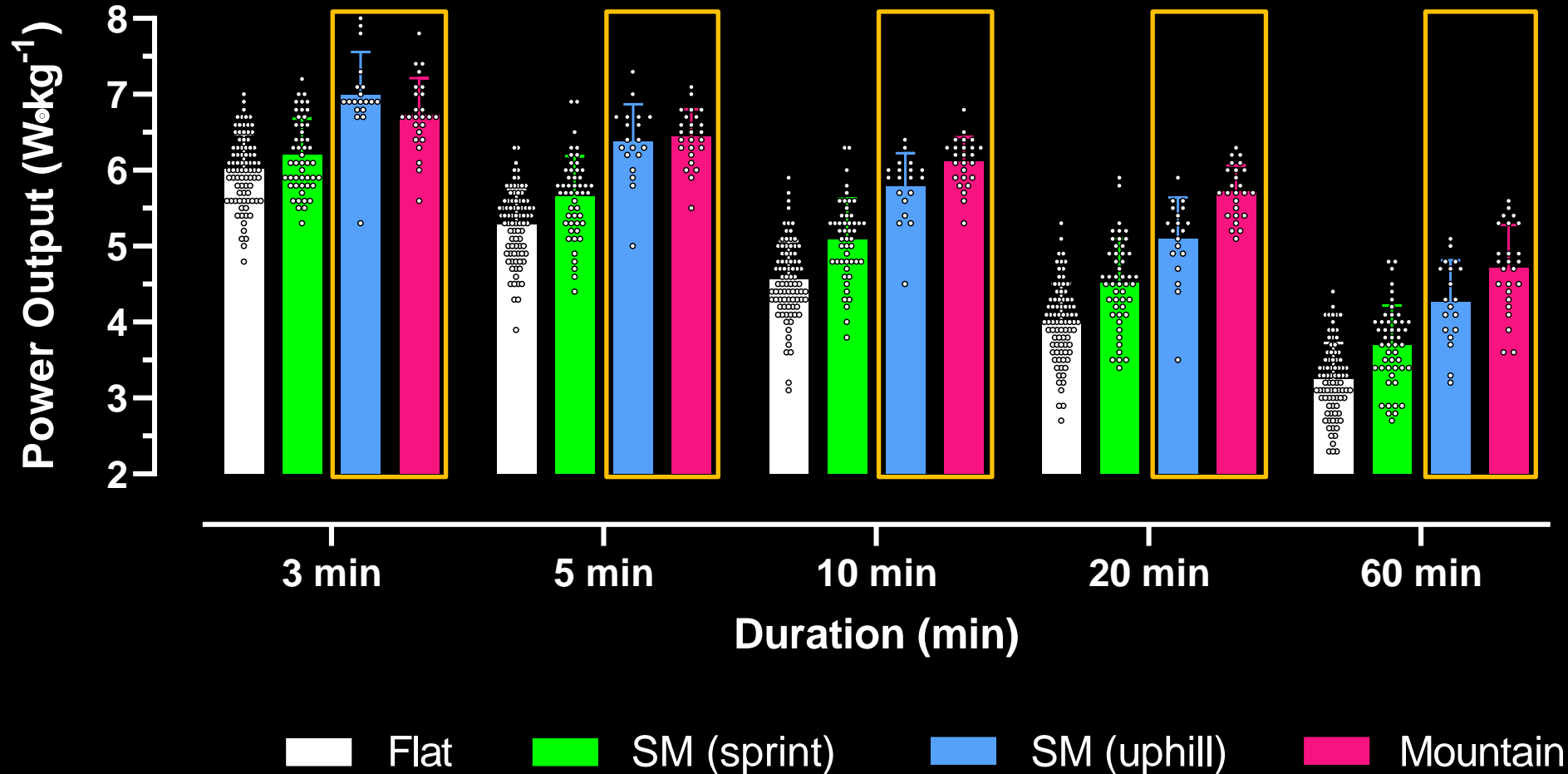
Power Profile of Top 5 Results in World Tour Cycling Races

Short duration MMP's (≤ 60 seconds)



Power Profile of Top 5 Results in World Tour Cycling Races

Long duration MMP's (≥ 3 minutes)



Power Profile of Top 5 Results in World Tour Cycling Races

Take home messages:

Top-5 **Flat** and **SM_{sprint}** : **short duration MMP's** (especially 5, 10 and 15 sec) are important

Reference values for successful sprints:

	Flat	SM _{sprint}
5 sec	1370 ± 211	1238 ± 205
10 sec	1259 ± 216	1152 ± 2206
15 sec	1150 ± 209	1064 ± 181
30 sec	906 ± 154	841 ± 130
60 sec	701 ± 80	646 ± 80



Top-5 **SM_{uphill}** and **MT** races : long duration MMP's (especially ≥10 min) are important

Reference values for successful sprints:

	Flat	SM _{sprint}
3 min	7.0 ± 0.6	6.7 ± 0.5
5 min	6.4 ± 0.5	6.4 ± 0.4
10 min	5.8 ± 0.4	6.1 ± 0.3
20 min	5.1 ± 0.5	5.7 ± 0.3
60 min	4.3 ± 0.5	4.7 ± 0.6



Changes in Power output with accumulating level of work completed



Maintaining Power Output with Accumulating Levels of Work Done Is a Key Determinant for Success in Professional Cycling

TEUN VAN ERP¹, DAJO SANDERS², and ROBERT P. LAMBERTS¹

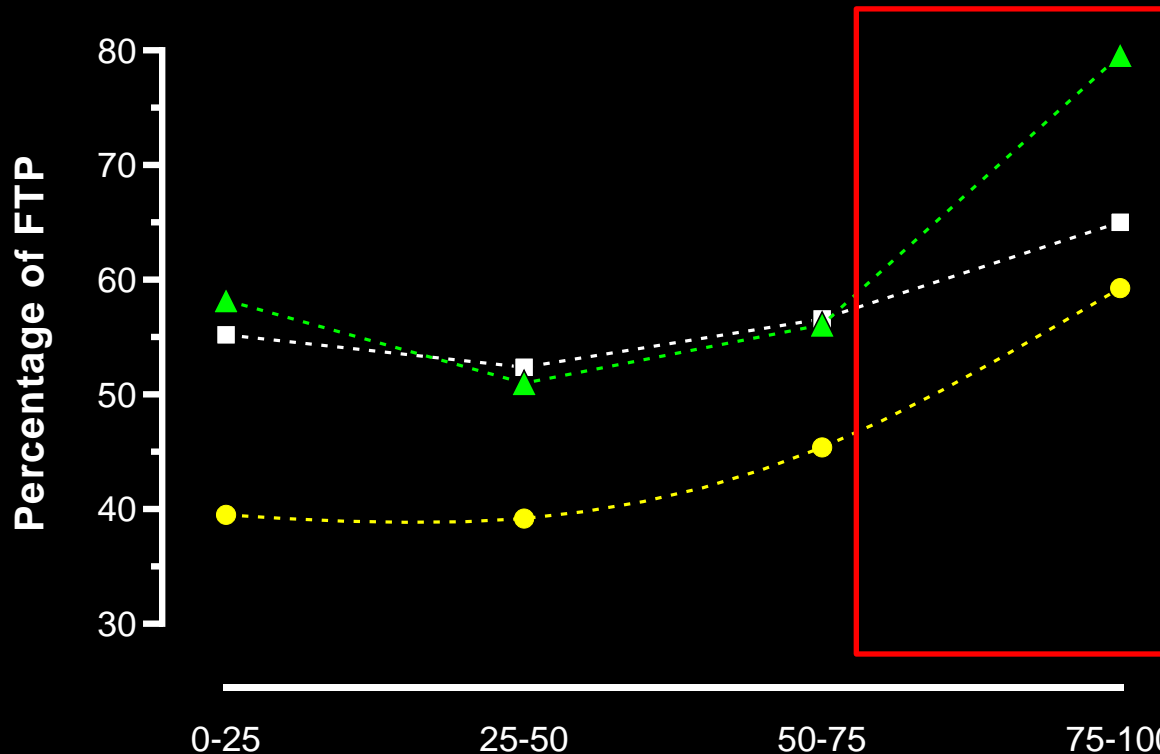


Changes in Power output with accumulating level of work completed

Professional cycling races in male cyclists

Duration: 4 to 7 hours

Energy expenditures: ~3700 kJ (up to > 5700 kJ)



- ▲--- Mountain stages
- Semi Mountain TD
- Flat stages



Changes in Power output with accumulating level of work completed

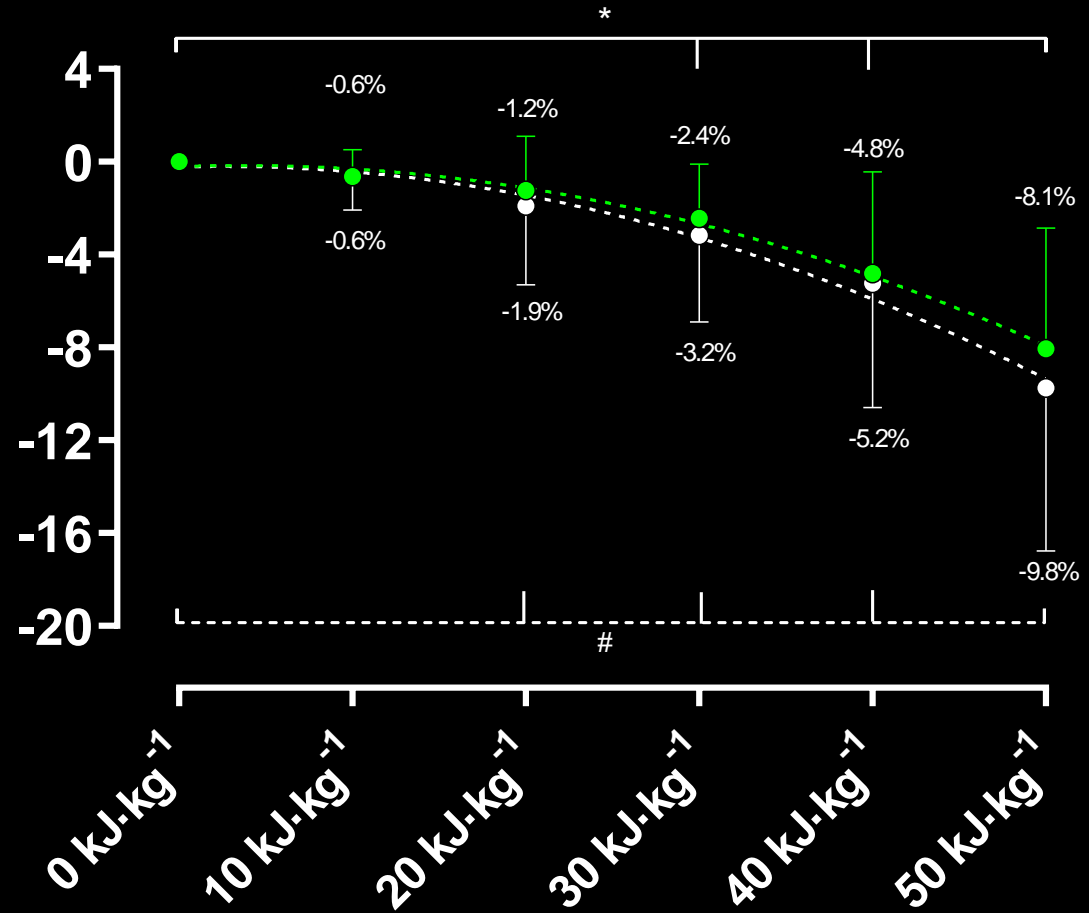
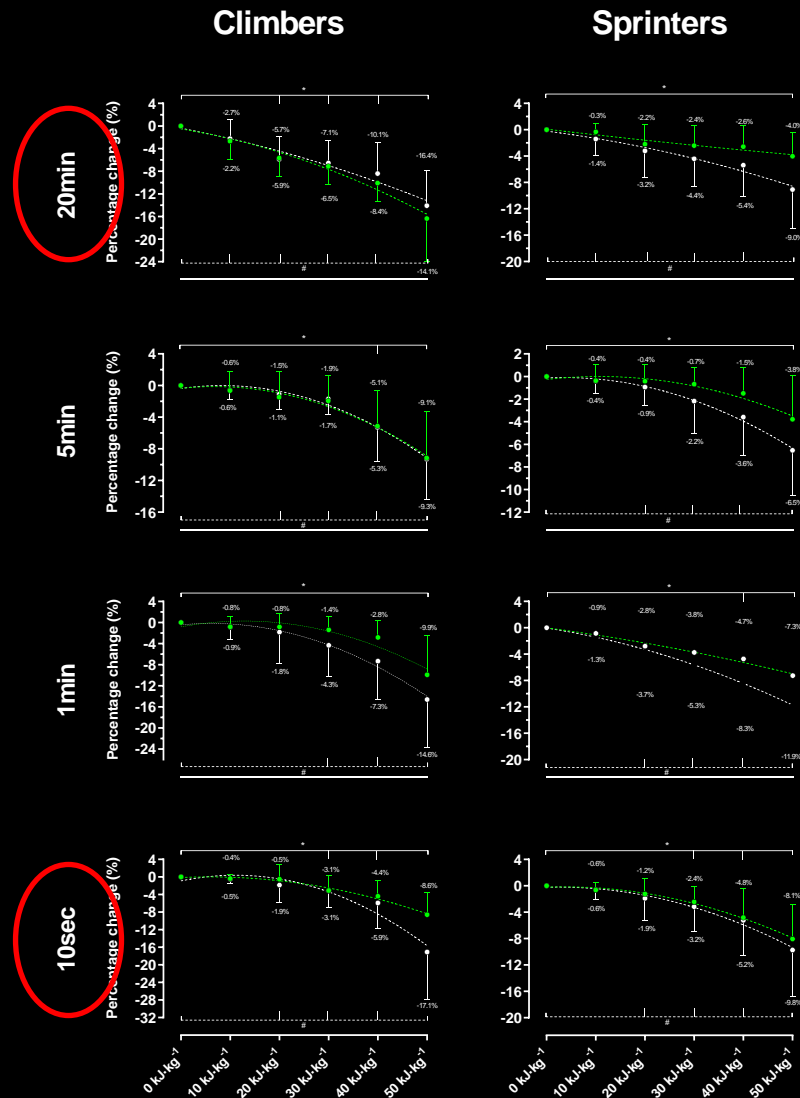
26 professional cyclists
17,900 power files
85 seasons



	Climbers		Sprinters	
	Highly successful	Less successful	Highly successful	Less successful
Seasons	15	30	16	24
Riders	5	13	7	8
PCS points	949 ± 477	154 ± 98	936 ± 480	173 ± 54
Top-10 classifications	9 ± 2	2 ± 2	19 ± 2	7 ± 4

* >400 PCS – highly successful

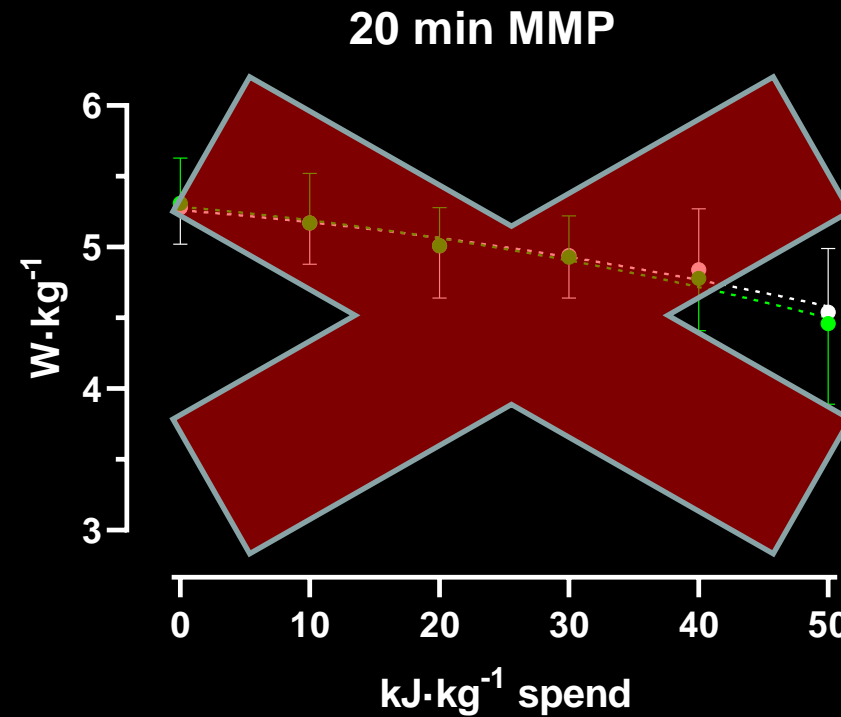
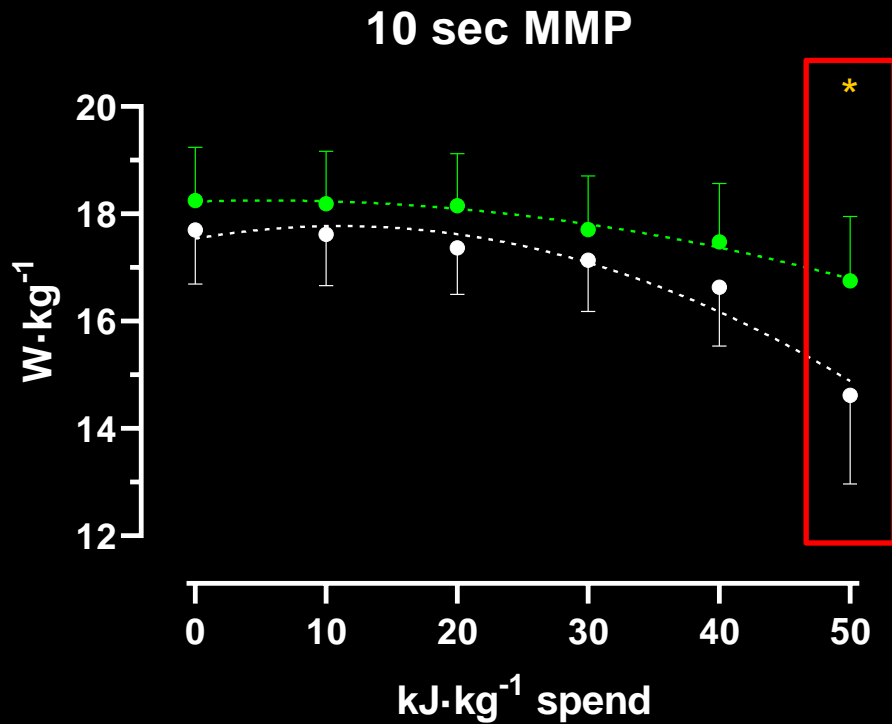
Changes in Power output with accumulating level of work completed



Changes in Power output with accumulating level of work completed

MMP profiles with accumulating levels of work completed

ABSOLUTE CHANGES IN PO

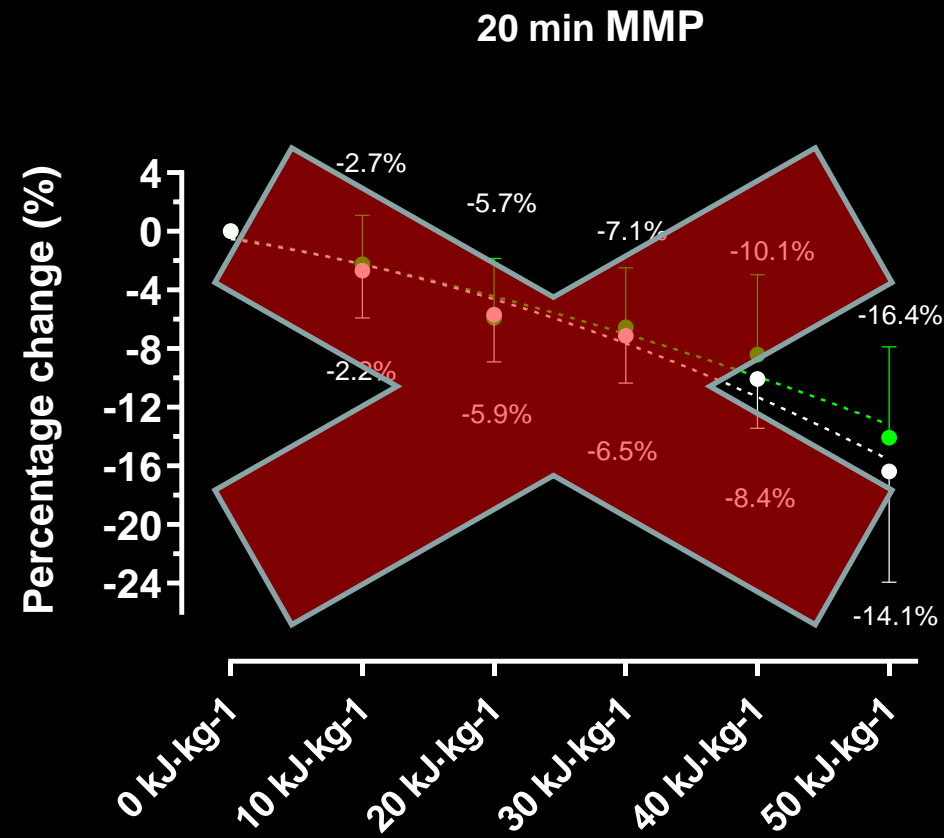
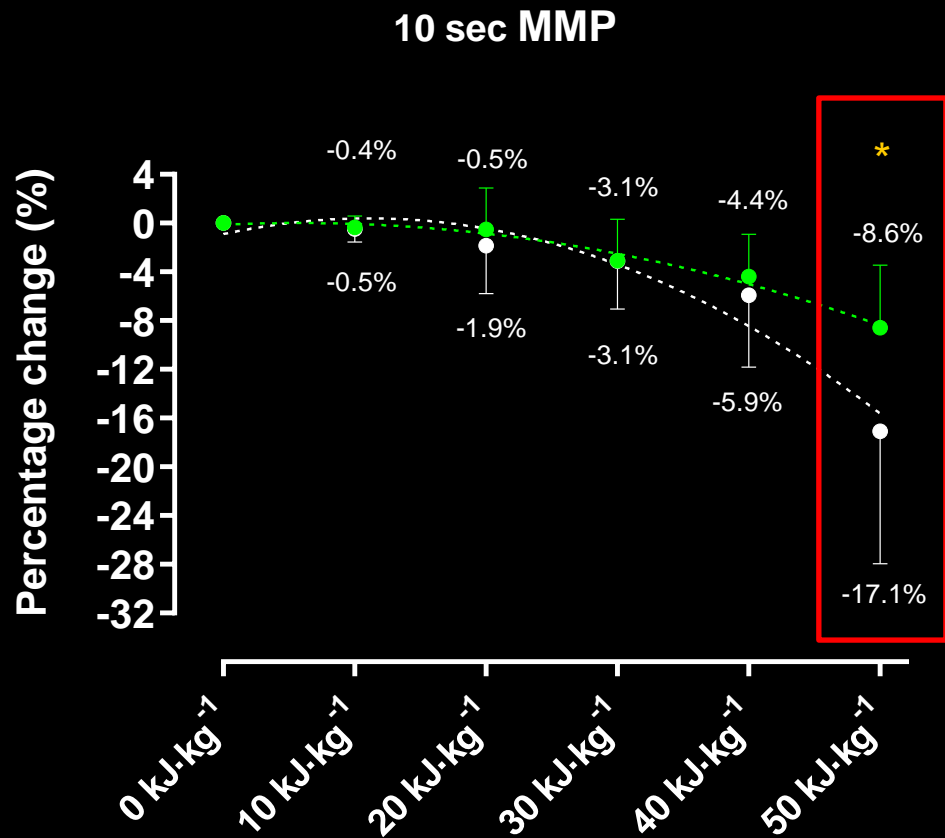


Sprinters

Changes in Power output with accumulating level of work completed

MMP profiles with accumulating levels of work completed

RELATIVE CHANGES IN PO

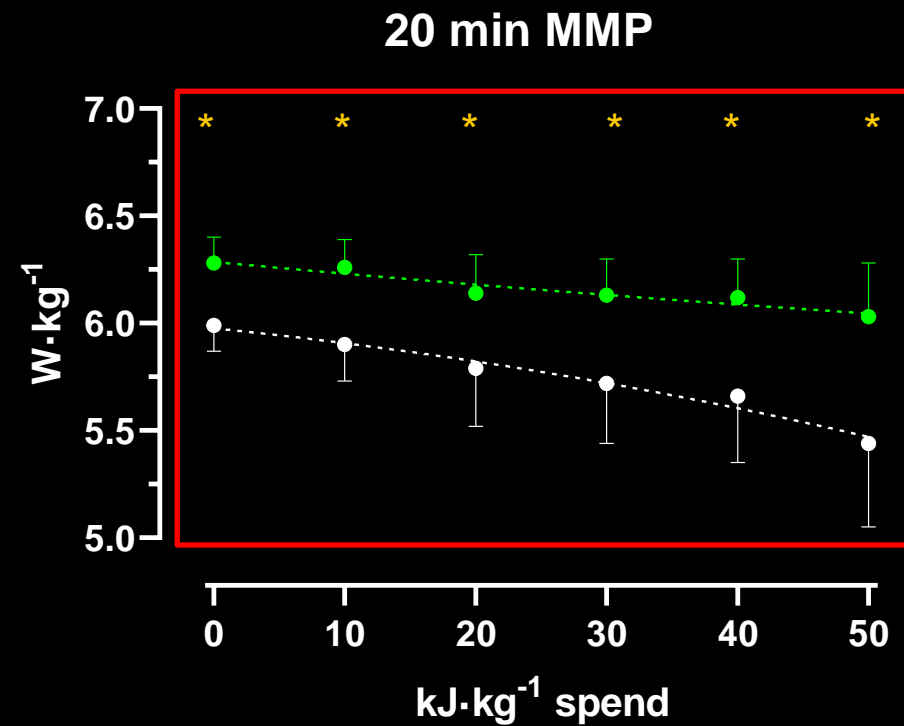
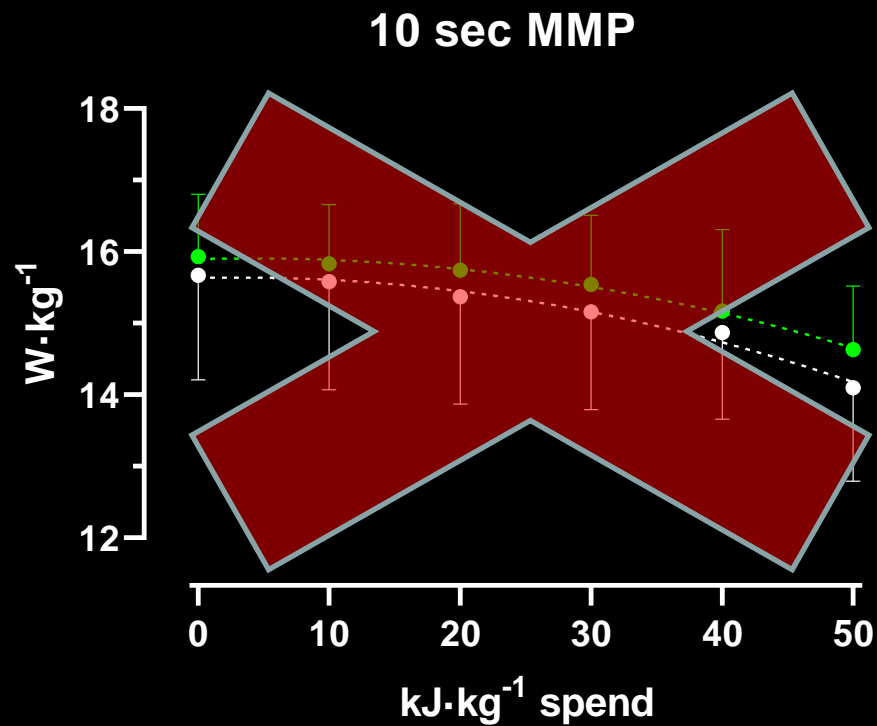


Sprinters

Changes in Power output with accumulating level of work completed

MMP profiles with accumulating levels of work completed

ABSOLUTE CHANGES IN PO

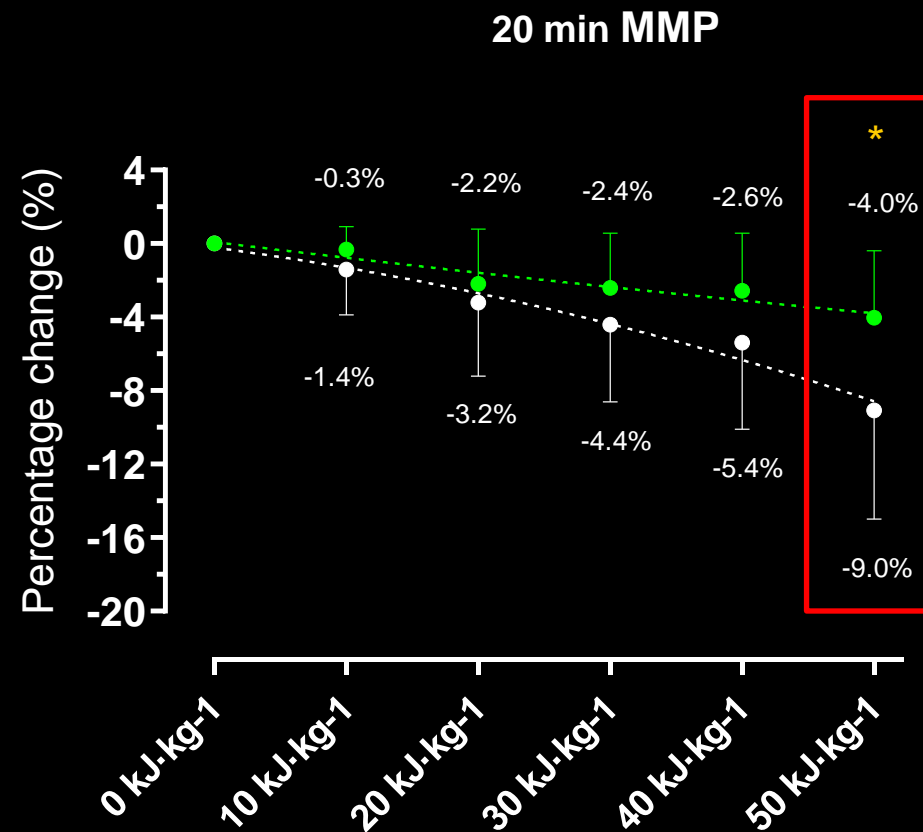
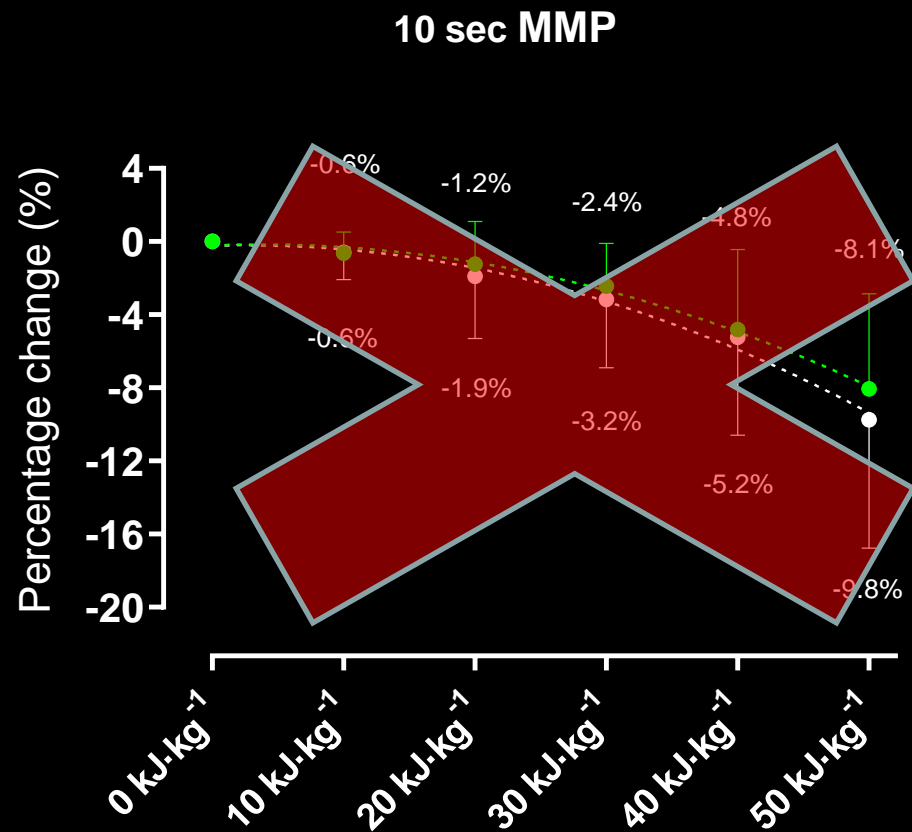


CLIMBERS

Changes in Power output with accumulating level of work completed

MMP profiles with accumulating levels of work completed

RELATIVE CHANGES IN PO



CLIMBERS

Changes in Power output with accumulating level of work completed

Take home messages:

Successful sprinters can maintain **short duration MMP's** (esp. 10 sec) better with accumulating level of kJ burnt

Changes in **10 sec MMP's**

	Highly successful	Less successful
10 kJ/kg	- 0.4	- 0.5
20 kJ/kg	- 0.5	- 1.9
30 kJ/kg	- 3.1	- 3.1
40 kJ/kg	- 4.4	- 5.9
50 kJ/kg	- 8.6	- 17.1



Successful climbers can maintain **long duration MMP's** (esp. 20 min) better with accumulating level of kJ burnt.

Changes in **20 min MMP's**

	Highly successful	Less successful
10 kJ/kg	- 0.3	- 1.4
20 kJ/kg	- 2.2	- 3.2
30 kJ/kg	- 2.4	- 4.4
40 kJ/kg	- 2.6	- 5.4
50 kJ/kg	- 4.0	- 9.0



Learning from field data in professional cyclists

Provide novel insight into **cycling demands in the field** (specific races / team tactics)

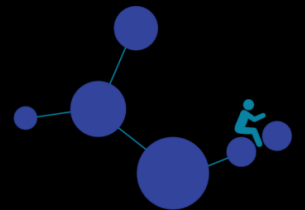
Field data can assist with assessing '**strength**' and '**weaknesses**' of a rider

Field data can assist with **monitoring & optimizing training programs**

Field data allows to gain **insights** into **changes in performance** with **accumulating levels of work done** ('fatigue').

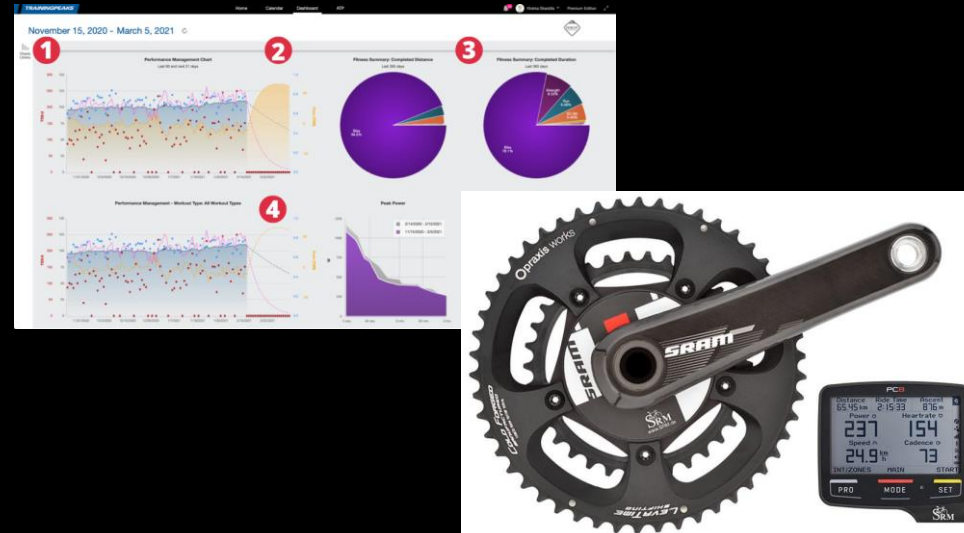
Field data can provide **insights into the best role** for a cyclist **within a team**.

Field data can play a role in **talent identification** and **development** (specialisation)



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Learning from field data of professional cyclists; from winning bunch sprints to the effect of accumulating fatigue on performance



Stellenbosch

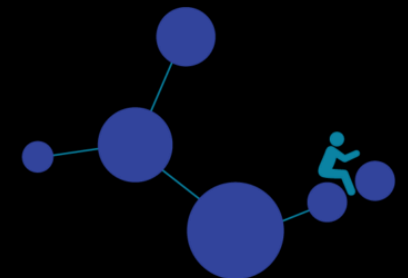
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