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A Performance Passport in Cycling
Facts & Fancy

Dr. Raphael Faiss, University of Lausanne, Switzerland
Prof. Louis Passfield, University of Kent, U.K.

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Power output (watts) + Longitudinal approach

A Performance Passport in Cycling

Cycling data collection & analysis for performance modeling

Reliability   Accuracy   Anonymity   Validity

An international collaborative project of scientific experts

Independence
Transparency

Expertise
Added Value

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Cycling performance and related variables

Training → Performance
- Acute load
- Chronic load
- Intensity
- Recovery
- Environment
- Motivation
Doping

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How accurate, precise and reliable are cycling performance data?

Accuracy and reliability of powermeter recordings in pro cycling is unknown

Analysis of data recording would allow to determine current validity of calibration procedures in teams and data reliability

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How accurate, precise and reliable are cycling performance data?

High Accuracy
High Precision
Low Bias

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How good are current cycling power meters?

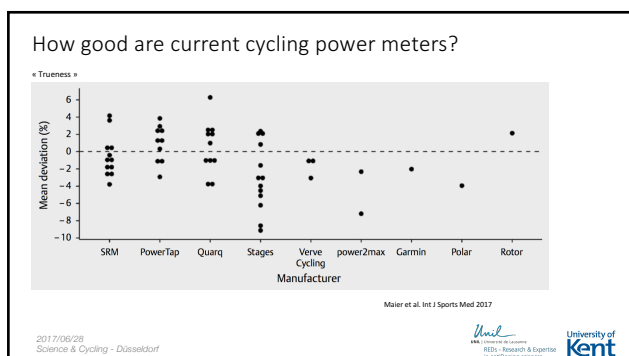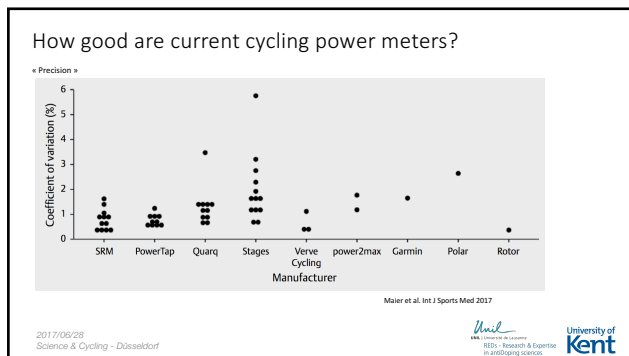| n	Manufacturer	Mean deviation (%)	Coefficient of variation (%)	Cadence (RPM)
12	SRM	−0.5 ± 2.4	0.8 ± 0.4	83 ± 14
10	PowerTap	0.9 ± 2.1	0.8 ± 0.2	87 ± 5
11	Quarq	0.5 ± 3.0	1.3 ± 0.8	87 ± 6
13	Stages Cycling	−2.9 ± 3.9	2.0 ± 1.4 *	89 ± 6
3	Verve Cycling	−1.7 ± 1.1	0.6 ± 0.4	88 ± 3
2	power2max	−4.8 ± 3.4	1.5 ± 0.4	87 ± 16
1	Garmin	−2.0	1.6	86
1	Polar	−3.9	2.6	93
1	Rotor	2.1	0.4	84
54	All	−0.9 ± 3.2	1.2 ± 0.9	87 ± 8

Trueness & Precision

Values are presented as mean ± standard deviation (if $n > 1$).
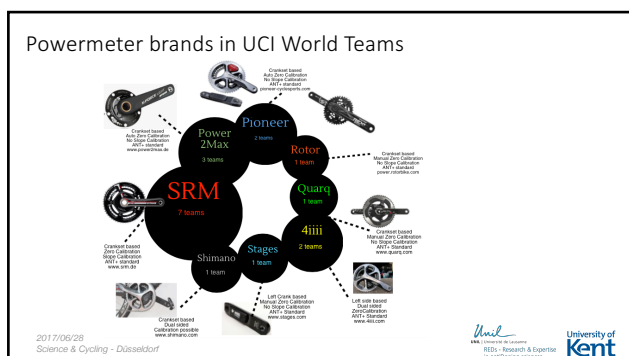* Different from SRM and PowerTap $p < 0.05$
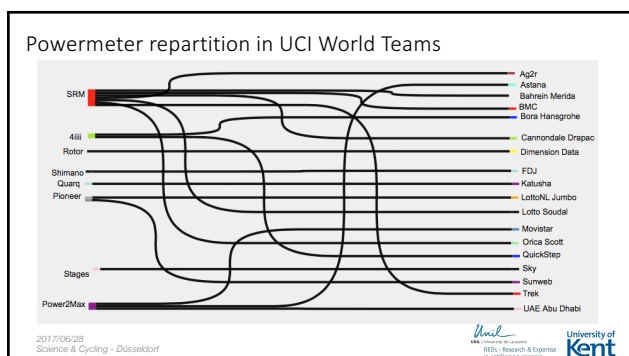
Maier et al. Int J Sports Med 2017
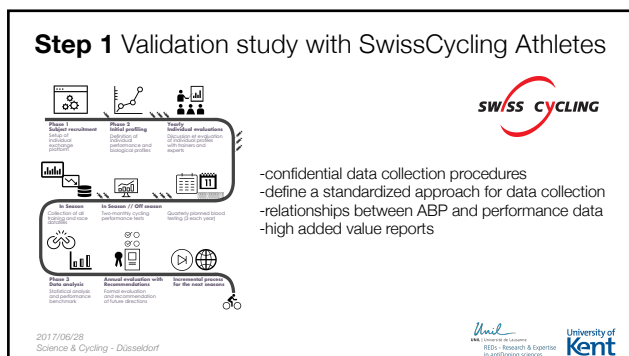
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How good are current cycling power meters?

« Trueness »

Maier et al. Int J Sports Med 2017

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How good are current cycling power meters?

« Precision »

Maier et al. Int J Sports Med 2017

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Powermeter brands in UCI World Teams

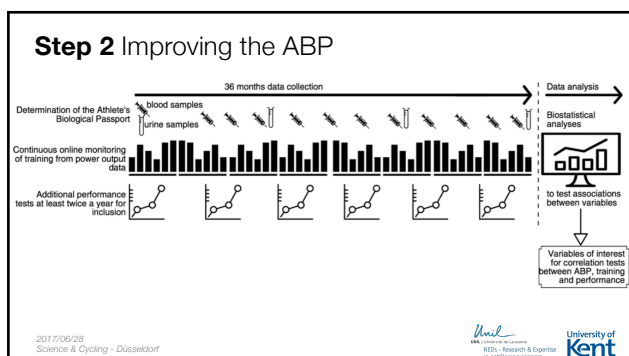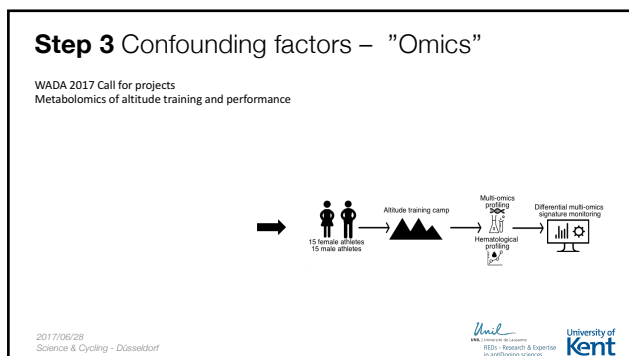Powermeter repartition in UCI World Teams

Step 1 Validation study with SwissCycling Athletes

-confidential data collection procedures
-define a standardized approach for data collection
-relationships between ABP and performance data
-high added value reports

**Phase 3
Data analysis**
Statistical analysis
and performance
benchmark

**Annual evaluation with
Recommendations**
Formal evaluation and
recommendation of
future directions

**Incremental process
for the next seasons**

In Season
Collection of all
training and race
datafiles

In Season // Off season
Two-monthly cycling
performance tests

Quarterly planned blood
testing (3 each year)

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Step 2 Improving the ABP

36 months data collection   Data analysis

Determination of the Athlete's
Biological Passport

blood samples
urine samples

Biostatistical
analyses

Continuous online monitoring
of training from power output
data

Additional performance
tests at least twice a year for
inclusion

to test associations
between variables

Variables of interest
for correlation tests
between ABP, training
and performance

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Step 3 Confounding factors – "Omics"

WADA 2017 Call for projects
Metabolomics of altitude training and performance

15 female athletes
15 male athletes

Altitude training camp

Multi-omics
profiling

Hematological
profiling

Differential multi-omics
signature monitoring

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Step 3 Confounding factors

WADA Special Call Project
Markers of erythropoiesis stimulating agents (ESAs) use and hypoxia
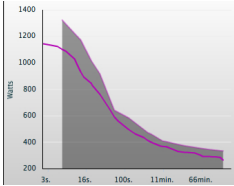
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Step 3 Confounding factors

WADA Special Call Project
Markers of erythropoiesis stimulating agents (ESAs) use and hypoxia

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Power is a safety net for the riders !

Help prevent false positive?
　-doping = unethical benefits from training
　-thresholds are not thresholds

Race vs. Training performance
　-protects racers reputation

Added value
　-what is effective training?
　-societal benefit

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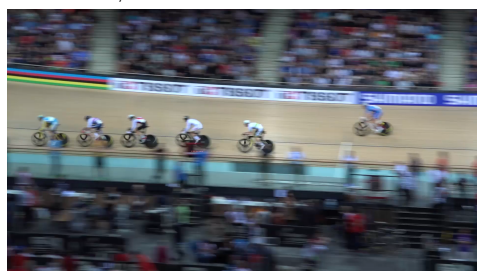
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Thank you for your attention !

« Scientific » analyses & skills

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