



Deutsche  
Sporthochschule Köln  
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## „Influence of non-circular chainrings on physiological parameters in handcycling“

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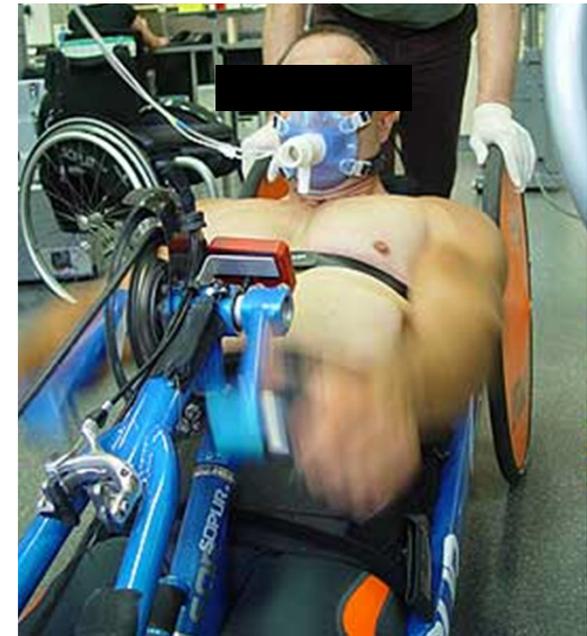
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## Manufacturing

## Aerodynamics



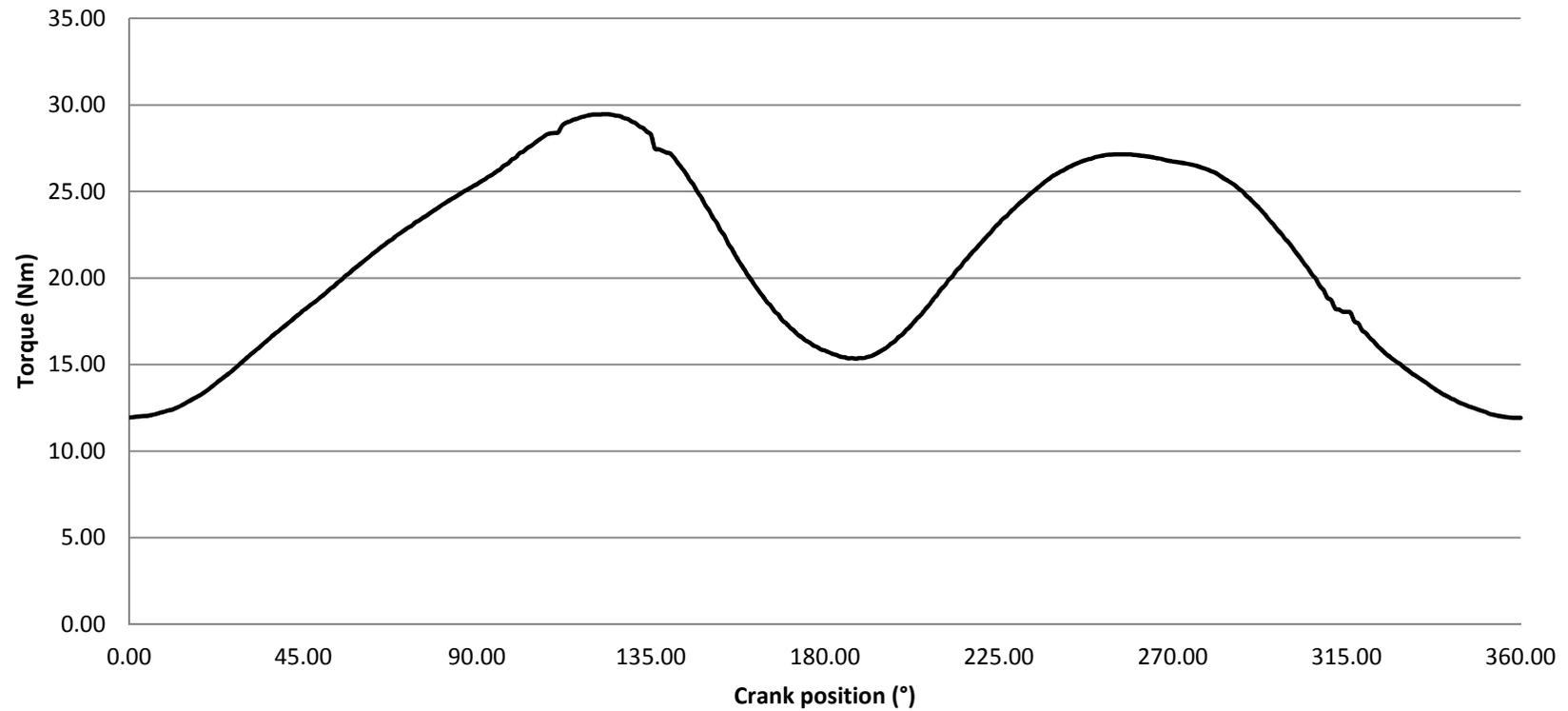
## Propulsion





# Propulsion

## Torque Distribution

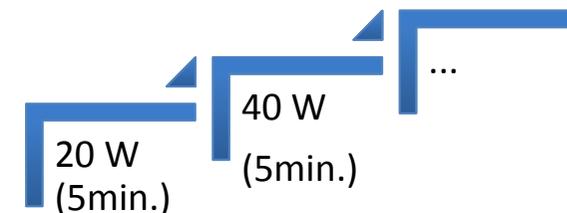






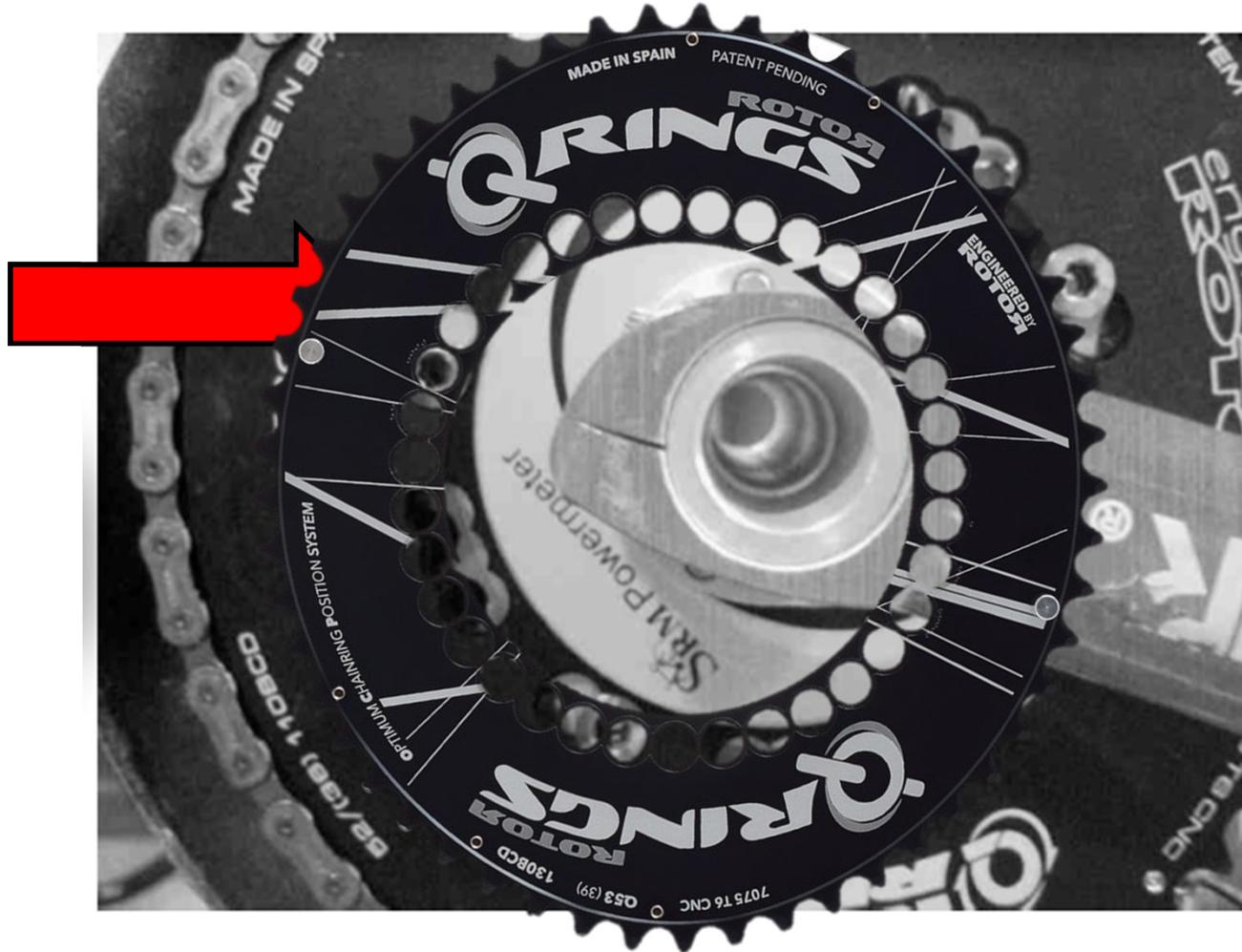
## Methods:

- subjects: twelve male able bodied persons with good performance level of the upper extremities (age:  $24,5 \pm 2,43$  years, size:  $184.08 \pm 3.99$  cm, weight:  $77.13 \pm 7.02$  kg)
- incremental stage test (calculation of power analog to 4 mmol/l lactate concentration)
- main-test: 2x20s isokinetic Sprint-test, 20min. Endurance-test (power analog to 4 mmol/l), 2x20s isokinetic Sprint-test; non-circular chainrings (NCC) and circular chainrings (CC) were used randomly
- heart rate, oxygen uptake, carbon dioxide output, respiratory exchange ratio and the subjects' perceived exertion was measured



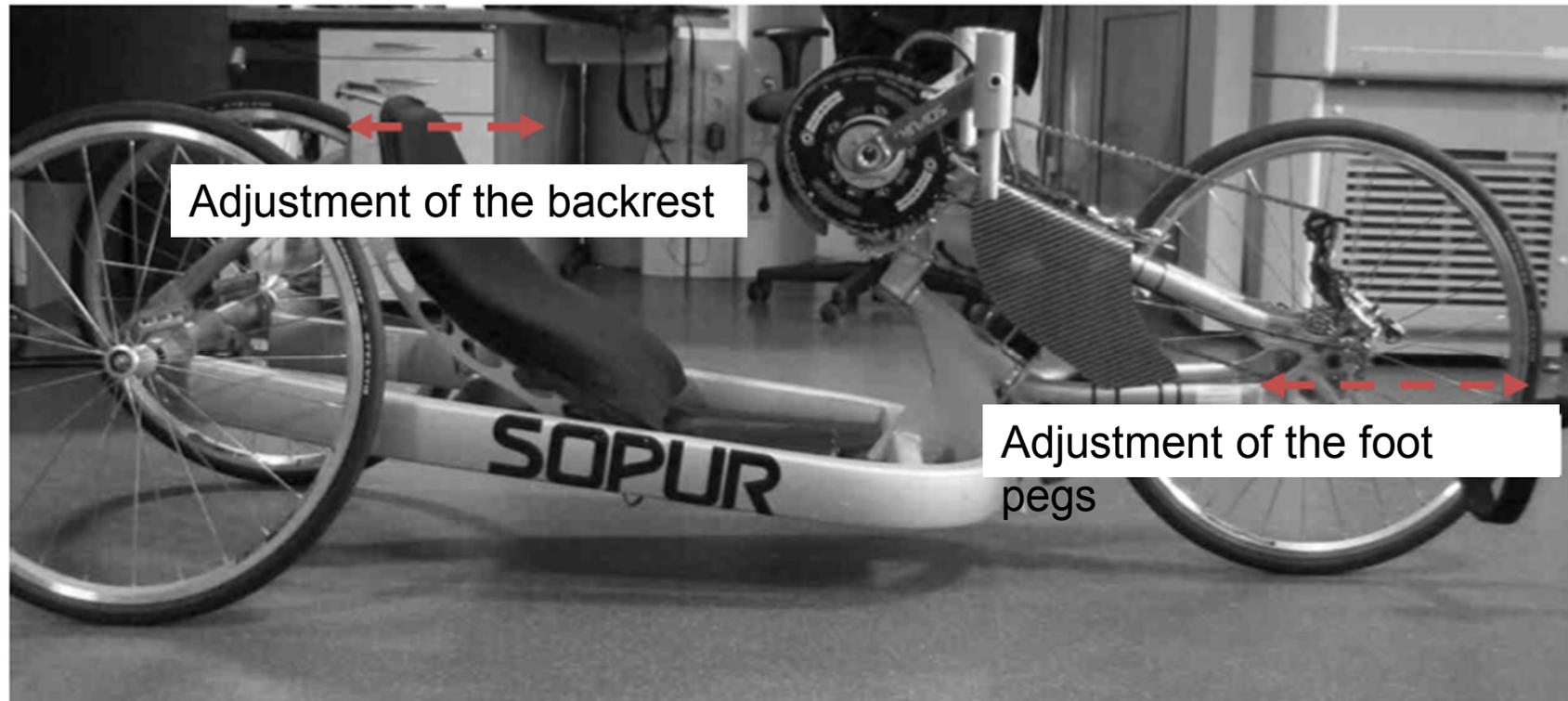


# NCC adjustment



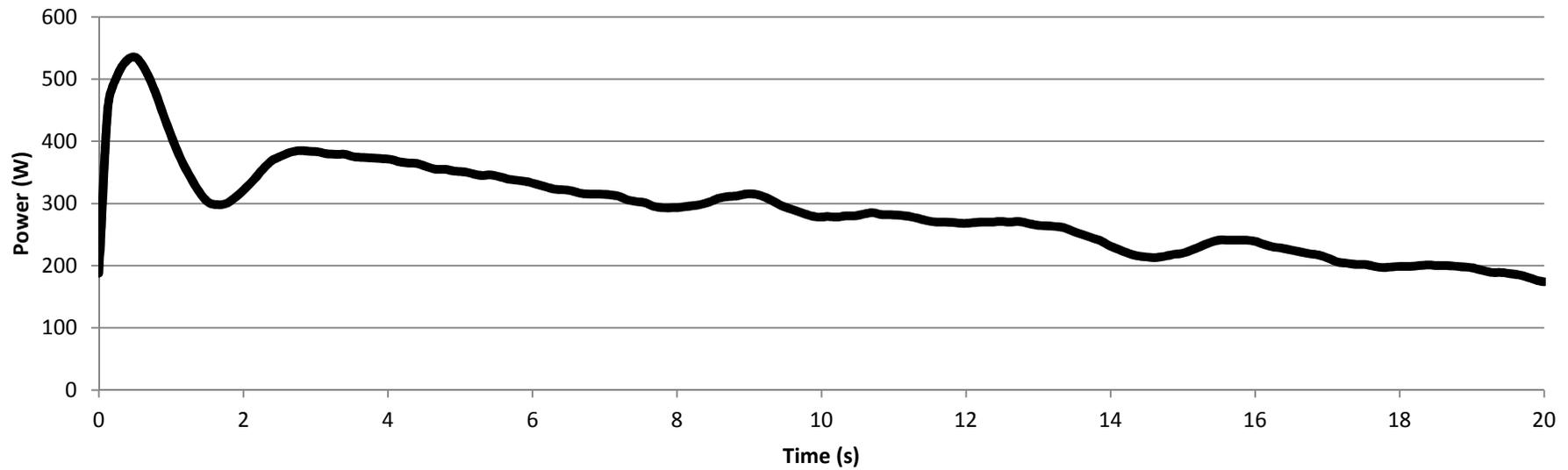


## Handcycle positioning



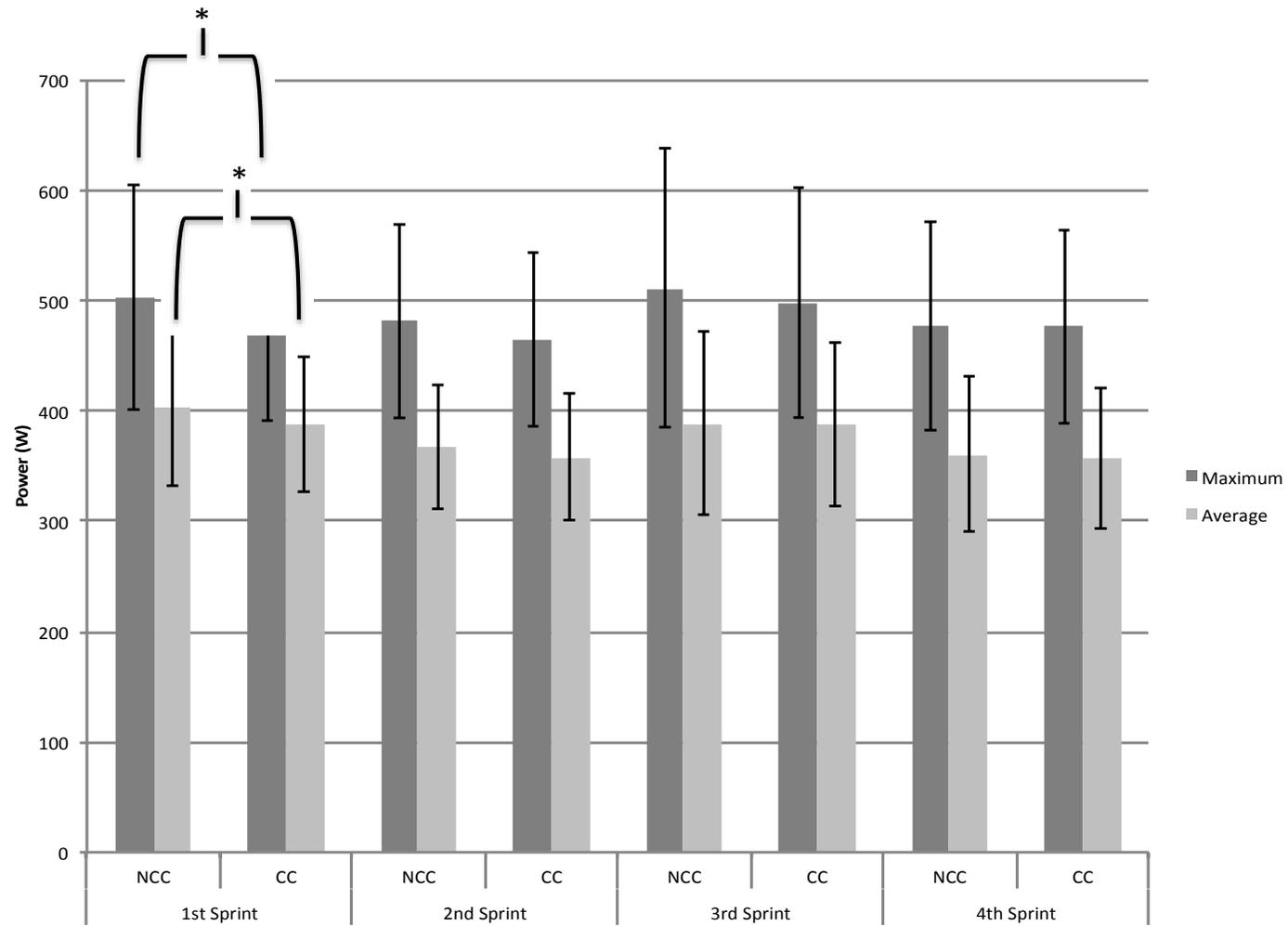


## Sprint-tests (results)





## Sprint-tests (results)





# Endurance-tests (results)

Chainring <sup>16</sup>	NCC				CC			
	10min		20min		10min		20min	
	Mean	SE	Mean	SE	Mean	SE	Mean	SE
VO <sub>2</sub> (ml/min) <sup>12</sup>	1826.8	90.31	1853.9	97.47	1823.6	89.8	1858.3	99.96
rel VO <sub>2</sub> (ml/min/kg) <sup>10</sup>	23.9	1.36	24.2	1.44	23.6	0.98	24.1	1.26
HR (bpm) <sup>8</sup>	120.6	4.06	121.1	4.53	124.6	5.12	125.1	5.23
VCO <sub>2</sub> (ml/min) <sup>10</sup>	1679.9	100.88	1718.8	103.36	1691.3	84.46	1694.1	96.17
RER (CO <sub>2</sub> /O <sub>2</sub> ) <sup>6</sup>	0.91	0.02	0.90	0.01	0.90	0.01	0.9	0.01
La (mmol/l) <sup>4</sup>	6.3	0.38	5.7	0.58	6.3	0.48	5.1	0.46

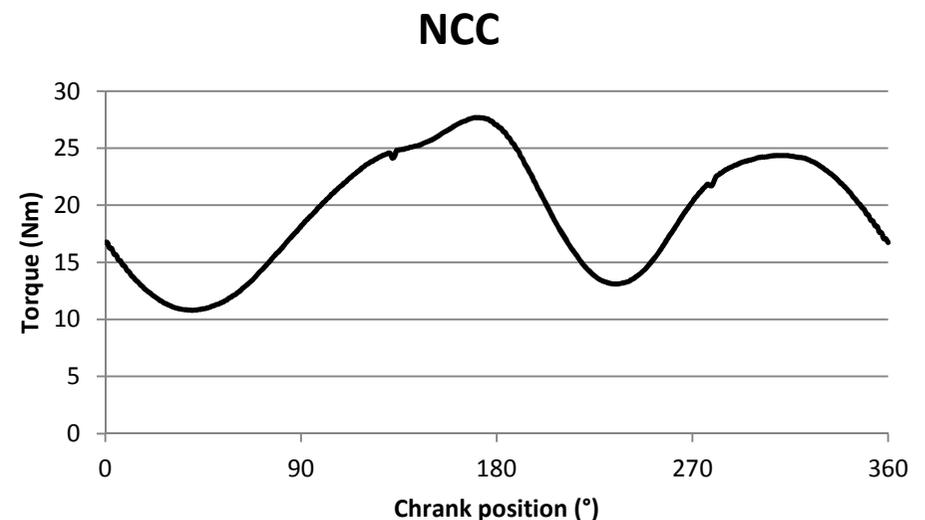
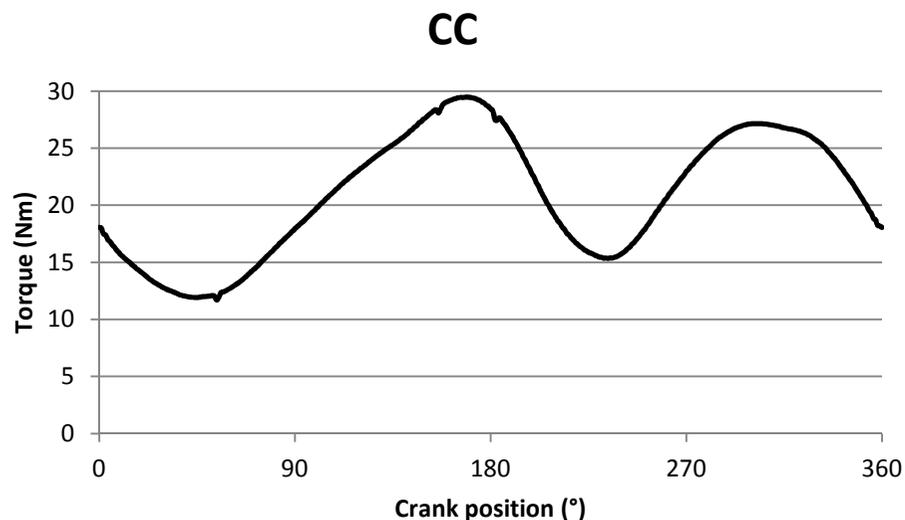
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No significant physiological differences



## Discussion

Theoretical approach of shortening the phases of low forces and lengthen the phases of high forces, while the range between highs and lows should be as small as possible, seems not effective enough for physiological optimization while using a NCC during an endurance test in handcycling.





## Conclusion

Focussing on physiological parameters a performance optimization using NCC in a handcycle was demonstrated for sprint performance (lower RPE might be beneficial for performances).

### **Practical advice:**

- individual analysis of torque distribution and fitting of the NCC**
- control of the physiological responding / improvement**
- athletes-choice („feeling“)**



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