

Bike fitting (body & floor)

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Lower Limb Kinematics – Feet & Ankles

FOOT ROTATION



Left foot external rotation
(min angle with bike)

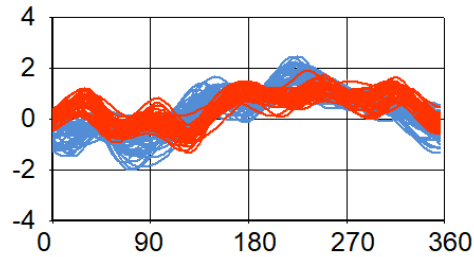
0°

Left foot internal rotation
(max angle with bike)

1°

Total rotation range

1°



Right foot external rotation
(min angle with bike)

-1°

Right foot internal rotation
(max angle with bike)

2°

Total rotation range

3°

FOOT ANGLE TO HORIZONTAL



Left foot min/max angle
to horizontal

8° / 48°

Crank @ left min/max
angle to horizontal

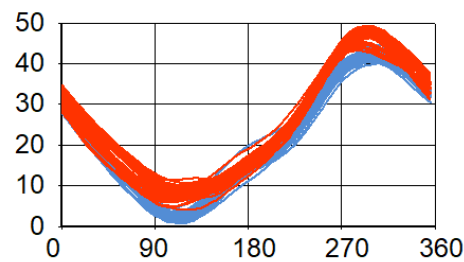
113° / 295°

Left foot angle to
horizontal range

40°

Left foot angle to
horizontal - Crank @90°/
@270°

9° / 45°



Right foot min/max
angle to horizontal

2° / 42°

Crank @ right min/max
angle to horizontal

111° / 291°

Right foot angle to
horizontal range

40°

Right foot angle to
horizontal - Crank
@90°/@270°

4° / 40°

ANKLE FLEXION



Left ankle flexion

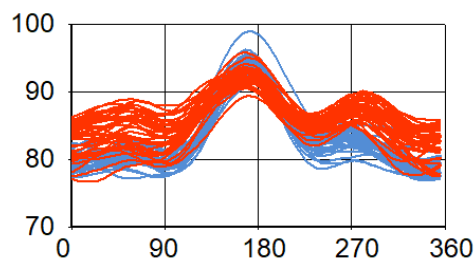
84°

Left ankle extension

91°

Range of motion

7°



Right ankle flexion

78°

Right ankle extension

94°

Range of motion

16°

ANKLE LATERAL OSCILLATION

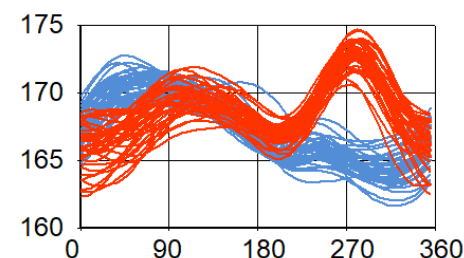


Left ankle position in
relation to bike (mean)

169 mm

Total swing range

7 mm



Right ankle position in
relation to bike (mean)

167 mm

Total swing range

11 mm

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Lower Limb Kinematics – Knees

KNEE FLEXION



Left knee flex/extension

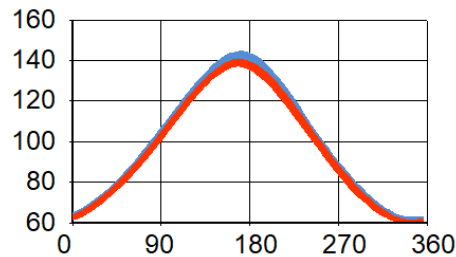
61° / 139°

Crank @ left knee flexion/
extension

340° / 169°

Range of motion

78°



Right knee flex/ext

62° / 142°

Crank @ right knee
flexion/extension

342° / 167°

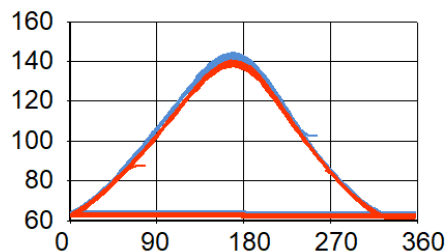
Range of motion

80°

KNEE ANGLE IN RELATION TO CRANK ANGLE



This graph is used for
symmetry assessment.
The relationship
between knee and
crank angle would
ideally describe
overlapped curves.



KNEE LATERAL OSCILLATION

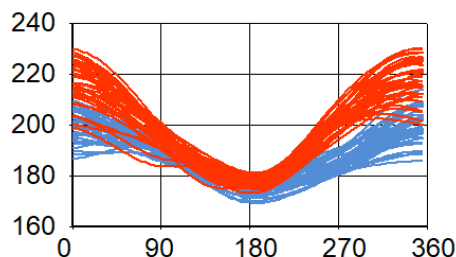


Left knee position in
relation to bike (mean)

199 mm

Total swing range

43 mm



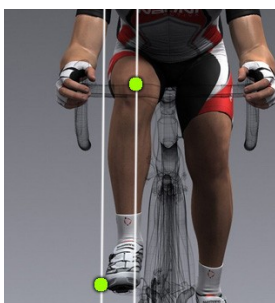
Right knee position in
relation to bike (mean)

188 mm

Total swing range

25 mm

KNEE TO M5 LATERAL OSCILLATION

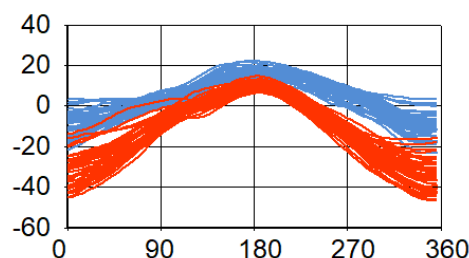


Mean left foot position
in relation to left knee

-12 mm

Total distance range

61 mm



Mean right foot position
in relation to right knee

4 mm

Total distance range

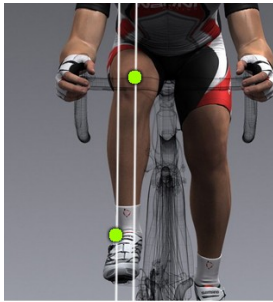
46 mm

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ANKLE TO KNEE LATERAL DISTANCE

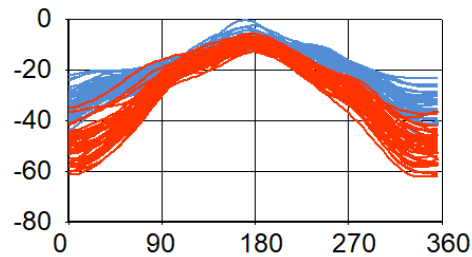


Mean left ankle position
in relation to knee

-30 mm

Total distance range

43 mm



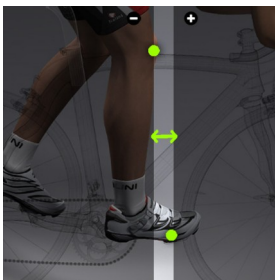
Mean right ankle
position in relation to
knee

-21 mm

Total distance range

27 mm

KOPS (KNEE OVER PEDAL SPINDLE) DISTANCE



Mean left KOPS

-10 mm

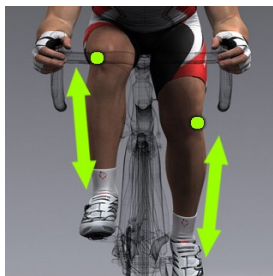
KOPS is defined as the average distance between the tibial tuberosity and the pedal axle in the antero-posterior direction, with a crank angle of 90°. As for the interpretation of the sign (positive or negative):

- ✓ When the knee is ahead of the pedal axle, the KOPS is positive.
- ✓ When the knee is behind the pedal axle, the KOPS is negative.

Mean right KOPS

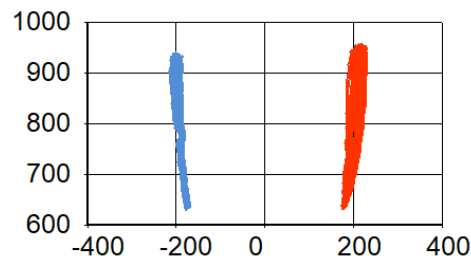
-25 mm

KNEE TRAJECTORIES (FRONT VIEW)



Left knee angle with
vertical

7 °



Right knee angle with
vertical

5 °

■ Left ■ Right

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Lower Limb Kinematics – Thighs

THIGH TILT



■ Left ■ Right

Left thigh min angle

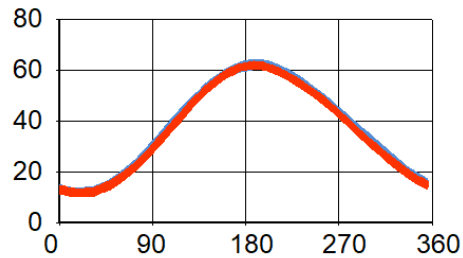
11°

Left thigh max angle

62°

Range of motion

51°



Right thigh min angle

13°

Right thigh max angle

63°

Range of motion

50°

Lower Limb Kinematics – Hips & Pelvis

HIP FLEXION



Left hip flex/extension

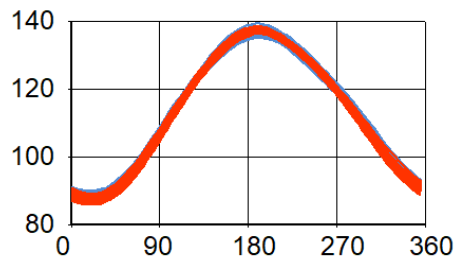
88° / 137°

Crank @ left hip
flexion/extension

17° / 187°

Range of motion

49°



Right hip flex/extension

89° / 137°

Crank @ left hip flexion/
extension

18° / 187°

Range of motion

48°

HIPS CENTER TO BOTTOM BRACKET AP DISTANCE

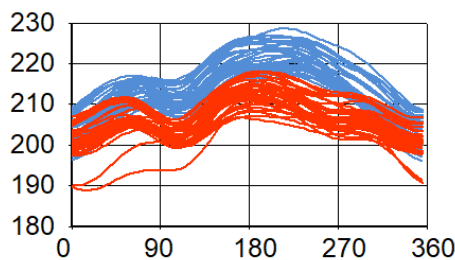


Left minimum distance

201 mm

Left maximum distance

211 mm



Right minimum distance

203 mm

Right maximum distance

222 mm

ANKLE TO HIP LATERAL DISTANCE

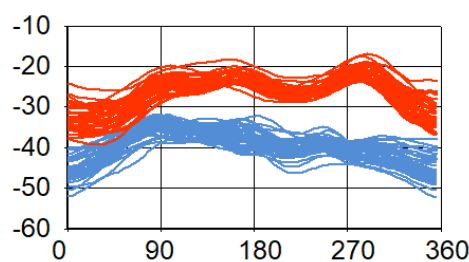


Mean left ankle position
in relation to left hip

-26 mm

Total distance range

8 mm



Mean right ankle position
in relation to right hip

-40 mm

Total distance range

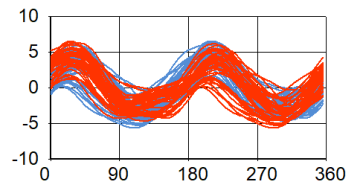
8 mm

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HIPS CENTER VERTICAL TRAVEL



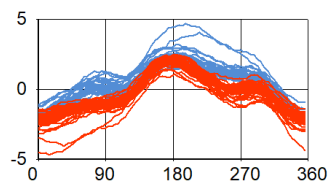
Total vertical travel (range of motion)
8 mm

HIP SETBACK



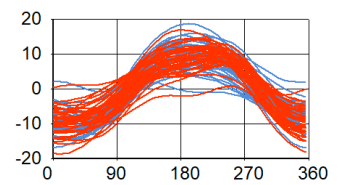
Mean hips center setback
73 °

PELVIS ROTATION



Left/right rotation (mean)
-2 ° / 2 °
Total rotation (range of motion)
4 °

PELVIS LATERAL OSCILLATION



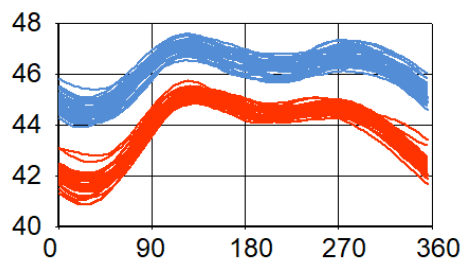
Left swing (mean)
-10 mm
Right swing (mean)
10 mm
Total swing (range of motion)
20 mm
Pelvis position in relation to bike
0 mm

Trunk Kinematics

HIP TO SHOULDER TILT



Minimum left hip-shoulder angle
42 °
Maximum left hip-shoulder angle
45 °
Range of motion
3 °

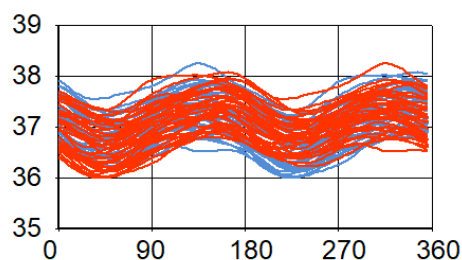


Minimum right hip-shoulder angle
45 °
Maximum right hip-shoulder angle
47 °
Range of motion
2 °

TRUNK TILT (SACRUM-NECK)



Average trunk angle to horizontal (Sacrum to neck segment)
37 °
Range of motion
7 °



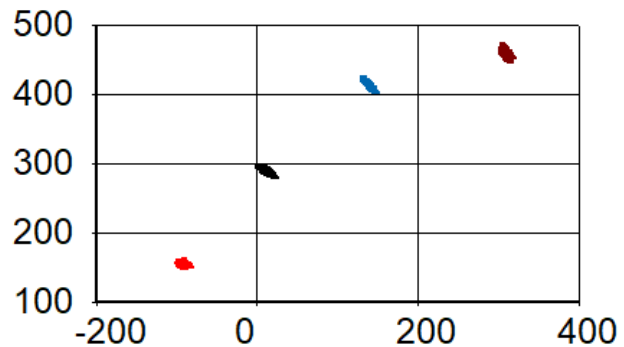
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Back & Shoulders Kinematics

BACK VERTICAL OSCILLATION



HIP - SHOULDER - ELBOW



Minimum left hip-shoulder-elbow

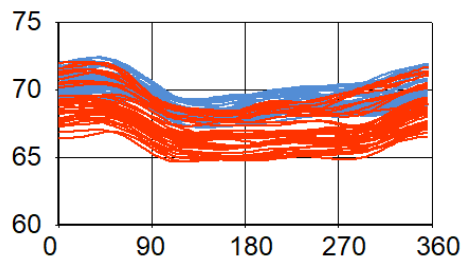
66°

Maximum left hip-shoulder-elbow

69°

Range of motion

3°



Minimum right hip-shoulder-elbow

68°

Maximum right hip-shoulder-elbow

70°

Range of motion

2°

SHOULDER LATERAL OSCILLATION



Left swing (mean)

-18 mm

Right swing (mean)

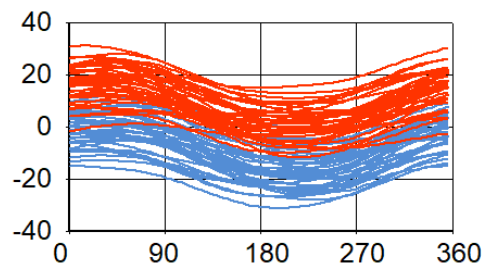
-1 mm

Total swing (range of motion)

17 mm

Average shoulder position in relation to bike

-9 mm



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Arms Kinematics

ELBOW FLEXION

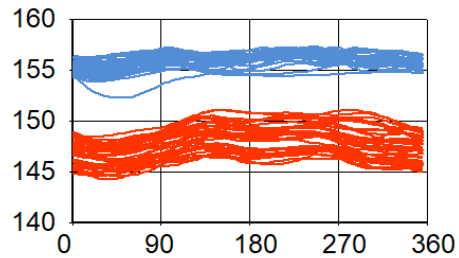


Average left elbow flexion

145°

Range of motion

7°



Average right elbow flexion

157°

Range of motion

5°

FOREARM TILT



Min left forearm angle to horizontal

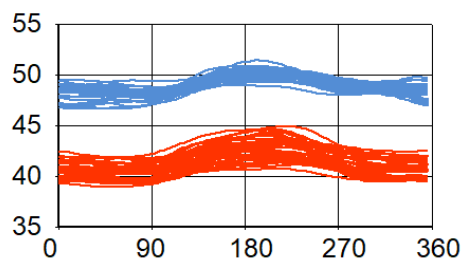
40°

Max left forearm angle to horizontal

43°

Range of motion

3°



Min right forearm angle to horizontal

48°

Max right forearm angle to horizontal

50°

Range of motion

2°

SHOULDER TO WRIST LATERAL DISTANCE

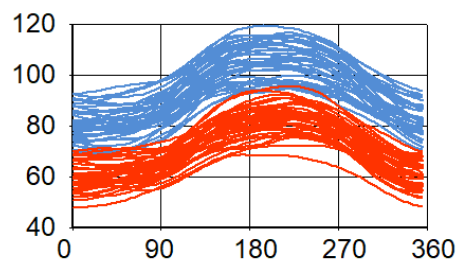


Mean lateral distance between left shoulder and wrist

71 mm

Range of motion

48 mm



Mean lateral distance between right shoulder and wrist

93 mm

Range of motion

50 mm

Automated anthropometry measures



Upper arm length

(Shoulder to elbow segment)

320 mm 346 mm

Forearm length

(Elbow to wrist segment)

274mm 260mm

Spine length

(Sacrum to neck segment)

526 mm

Shoulder distance

(Right shoulder to left shoulder segment)

306 mm

Thigh length

(Hip to knee segment)

422 mm 415 mm

Tibia length

(Knee to ankle segment)

394 mm 390 mm

Hip to wrist - vertical

(Mean distance from hip to wrist)

89 mm 73 mm

Hip to wrist - horizontal

(Mean distance from hip to wrist)

710 mm 715 mm

Notes: