

# TITLE OF THE PRESENTATION

Kinematics during Marcialonga ski  
marathon:

gender and fatigue

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# INTRODUCTION

MARCIALONGA science



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Central and peripheral fatigue in knee and elbow extensor muscles  
after a long-distance cross-country ski race

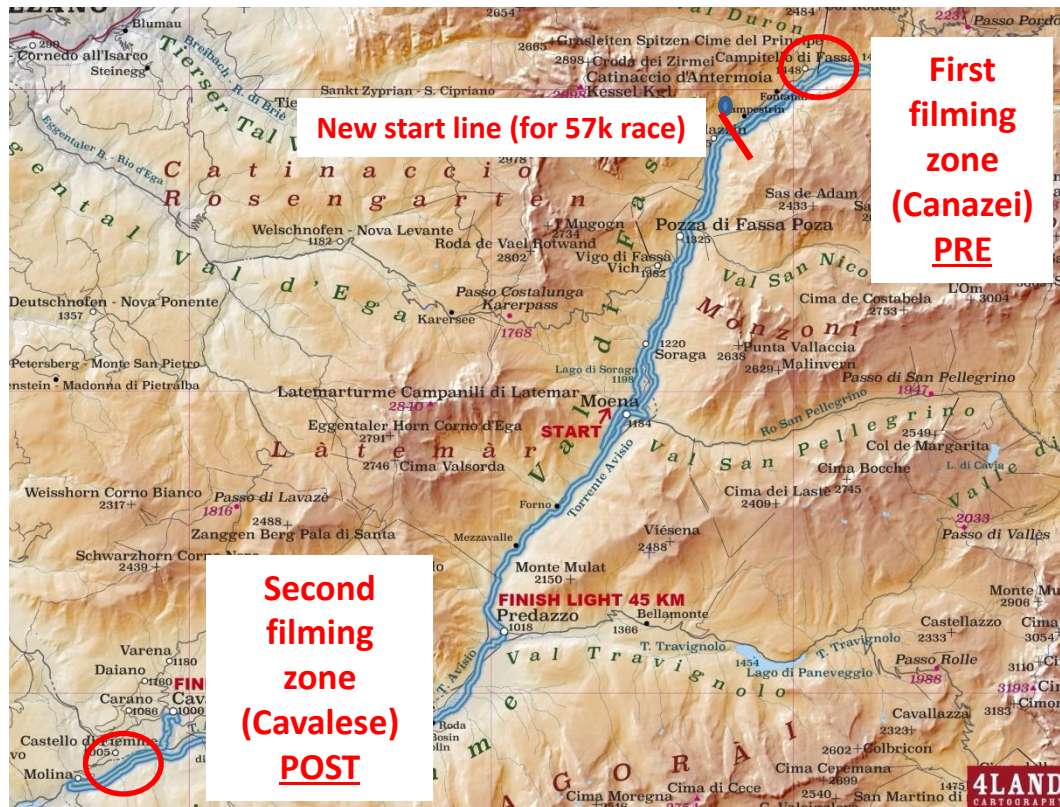
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2015

MARCIALONGA science



2017



First  
filming  
zone  
(Canazei)  
PRE

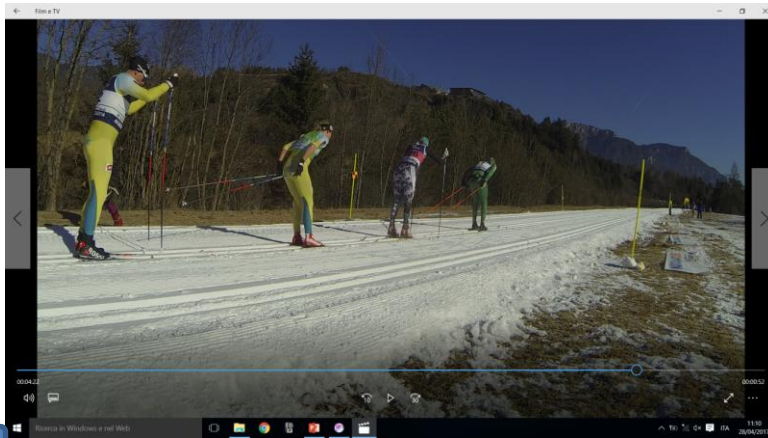
Second  
filming  
zone  
(Cavalese)  
POST

AIM

Evaluate the effect of a  
long term ecological  
fatigue on DP kinematic  
during a real XCS- race

# EXPERIMENTAL SET-UP

# METHODS



GoPRO Hero  
Smartphone App

## Lateral recording

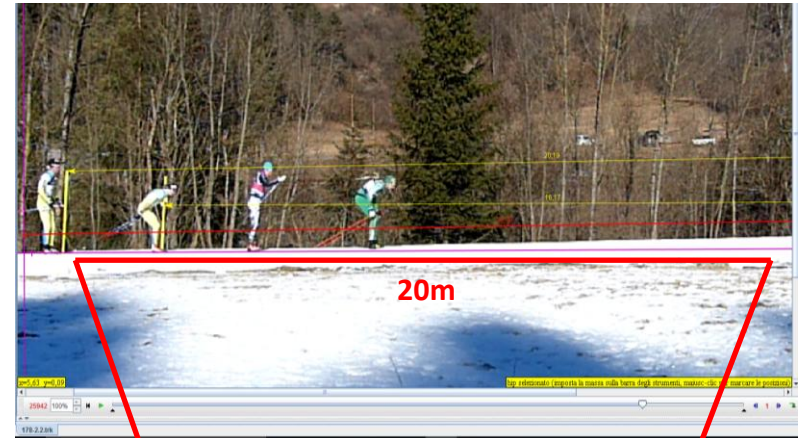
To assign athlete's number

To check the track number

## Frontal recording:

To apply the right calibration according to track number

To track the point of interest of each athlete



40m

20m

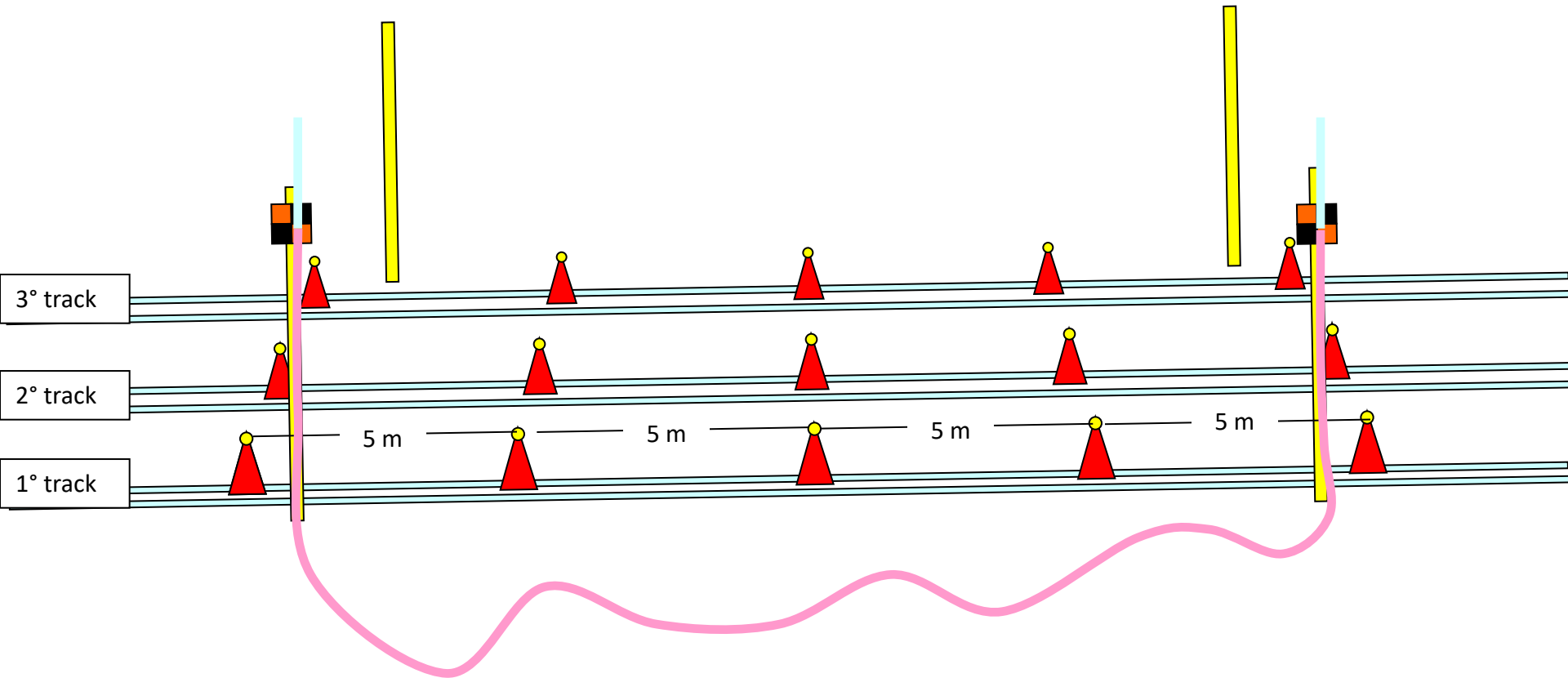
40m



Panasonic FZ 200 LUMIX  
sample frequency: 100Hz

# TRACK CALIBRATION

# METHODS



For each track:

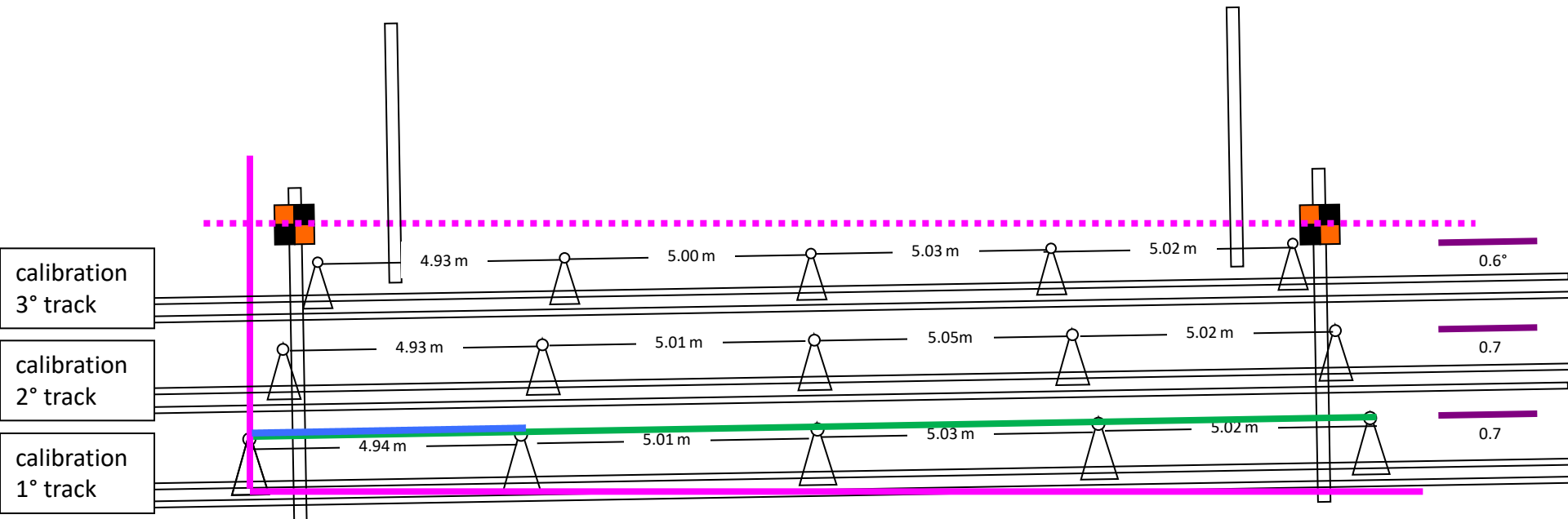
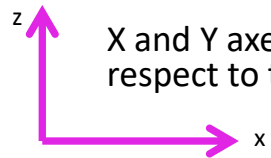
Calibration tool (between 1° and 5° cone) = 2000 cm



Check between the cones ( $500 \pm 7$  cm)



Tracking of the horizontal line





Tracker

File Modifica Video Tracce Coordinate Finestra Aiuto



hip m 1,000

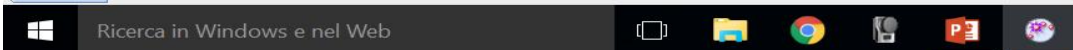


z=15,03 y=4,58

hip selezionato (imposta la massa sulla barra degli strumenti, mausc-click per marcare le posizioni)

29304 100%

178-2.2.trk



First 10 subjects following the final rank that:

- visible for 20 m
- 2 completed DP cycles in the 20 m zone
- no track change
- no back torsions to control the opponenets
- 20 m mean speed  $\pm$  2 km/h from the mean group (pre and post) mean speed on 20 m

## TRACKER SOFTWARE

semi-automatic Tracking of shoulder, elbow, hip, knee, ankle joint centre + specific points (head , hand, tip of the foot, poles)



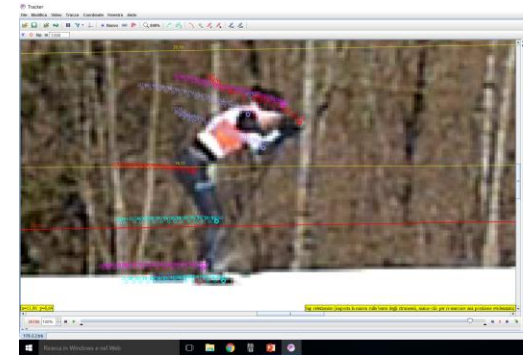
Point of interest

Proximal inclusion zone. Circular zone with a standard radius of about 15 real cm

Larged inclusion zone. Quandrangular zone with standard radius of the inscribed circumference of about 70 real cm

Both the inclusion zones could be re-dimensioned and decentralized respect to the point of interest, to better recognize the point, accordingly to the colors, contrasts and articular range...

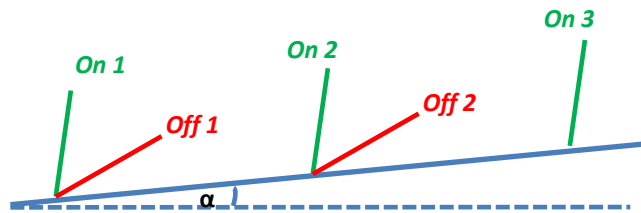
However, the recognition was performed with the default settings for the tracking, in the majority of the cases





# VARIABLES ( from two cycles to the mean...)

# METHODS

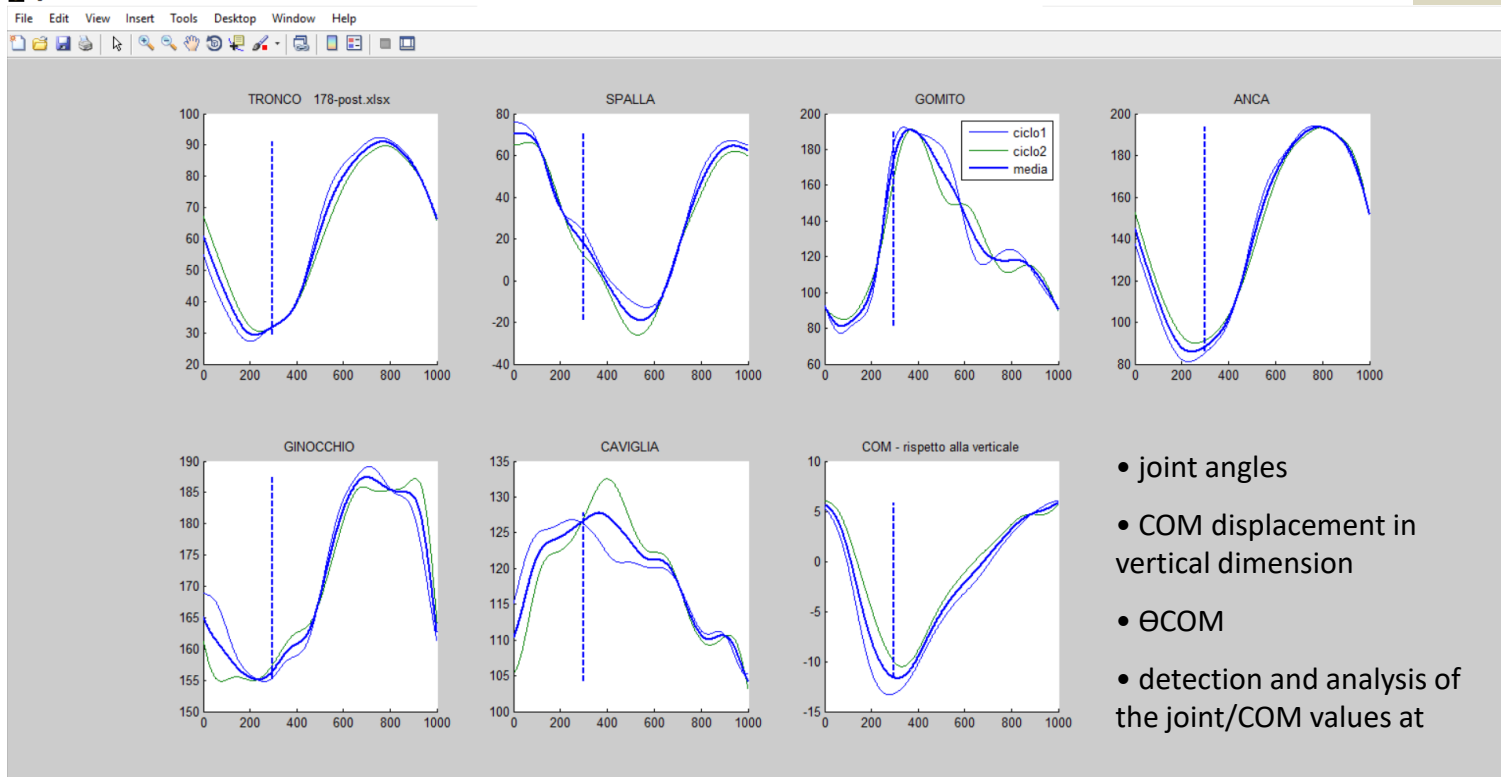


- cycle time **-CT-**  $(\text{on}+1\text{time} - \text{on}\text{time})$
- poling time **-PT-**  $(\text{off}\text{time} - \text{on}\text{time})$
- cycle frequency **-CF-**  $(1/\text{CT})$
- cycle length **-CL-**  $(\text{on}+1x - \text{on}x) \cdot \cos\alpha^{-1}$
- cycle velocity **-CV-**  $(\text{CL}/\text{CT})$

PAIRWISE  
T-TEST di  
STUDENT

## STATISTICAL DESIGN

Figure 1



TWO WAY  
ANOVA for  
RM)

- joint angles
- COM displacement in vertical dimension
- $\theta_{\text{COM}}$
- detection and analysis of the joint/COM values at