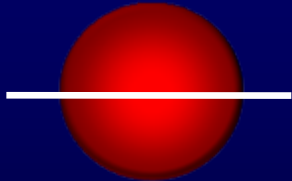


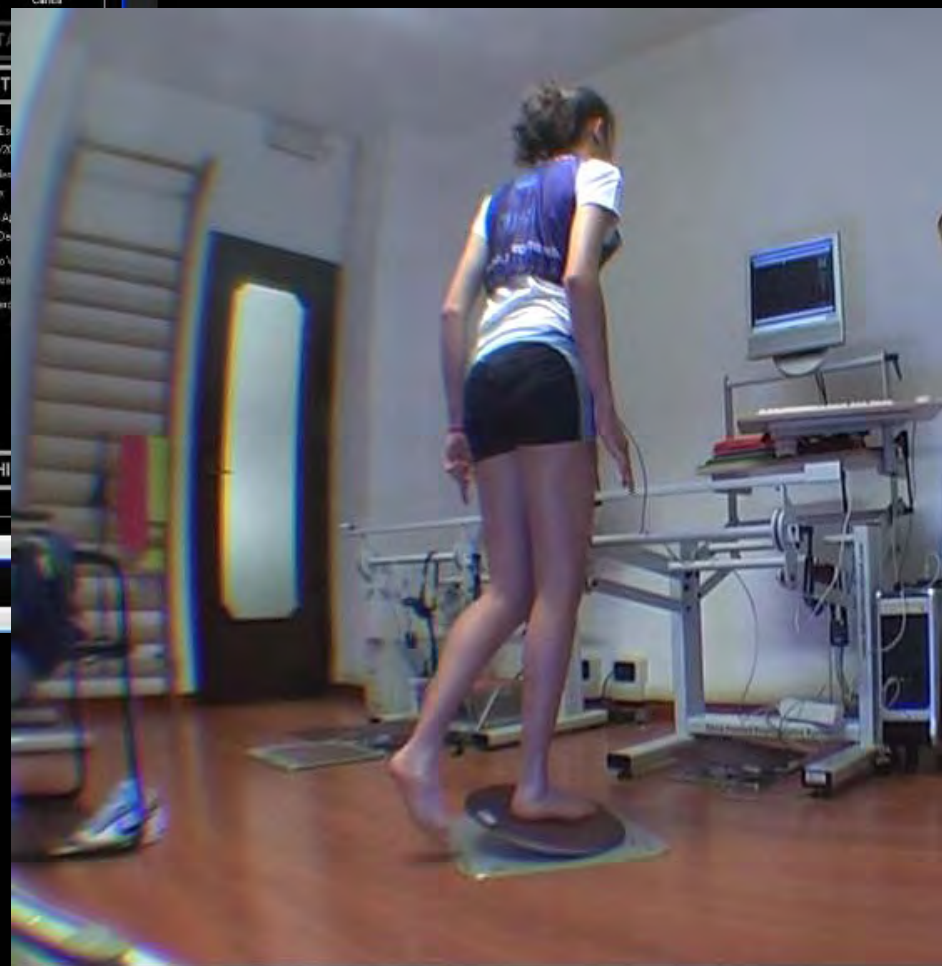
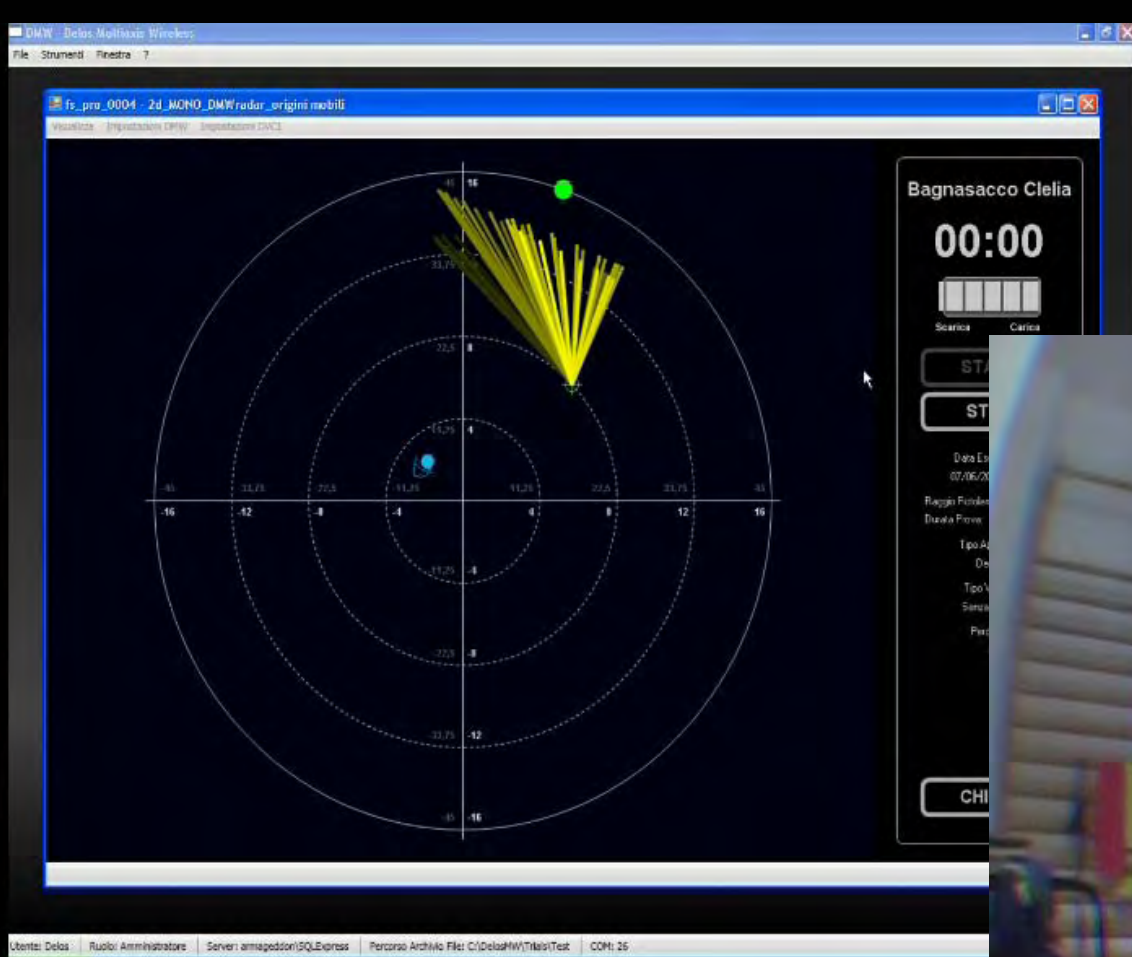
Degrees of freedom



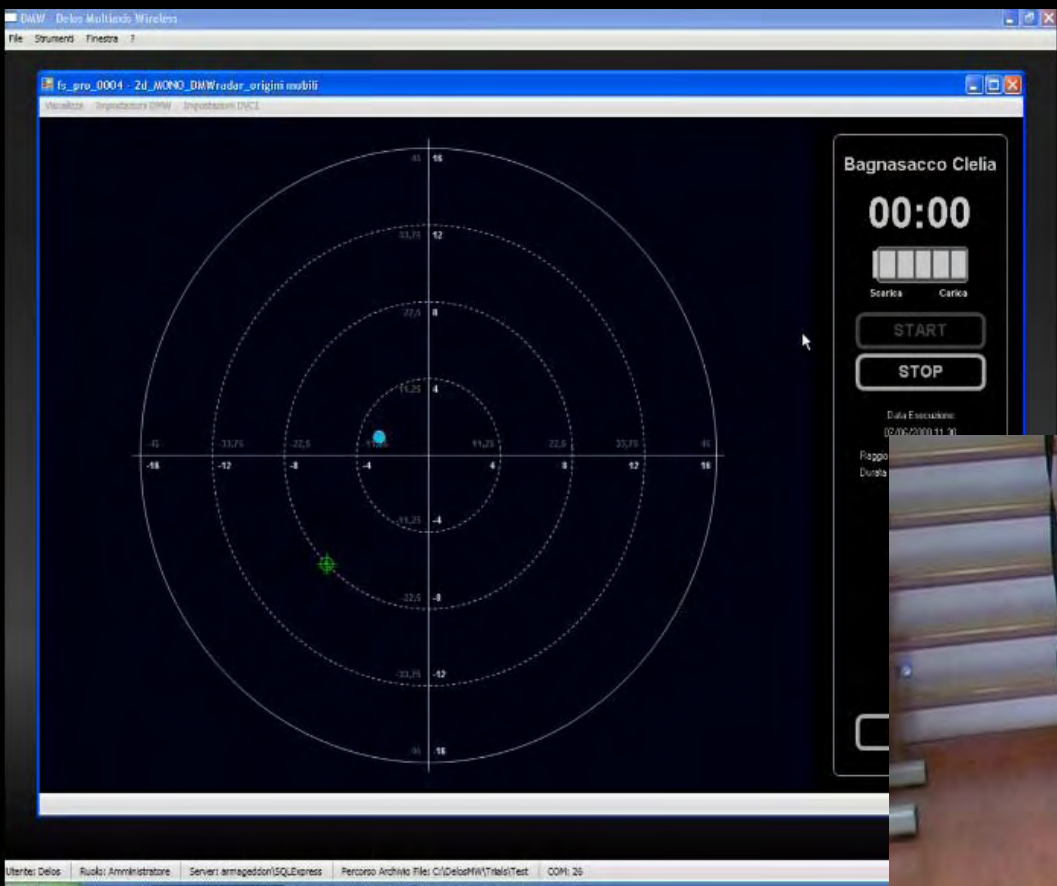
☰ **one** degree of freedom?
(section of cylinder)



☰ **three** degrees of freedom?
(section of sphere)



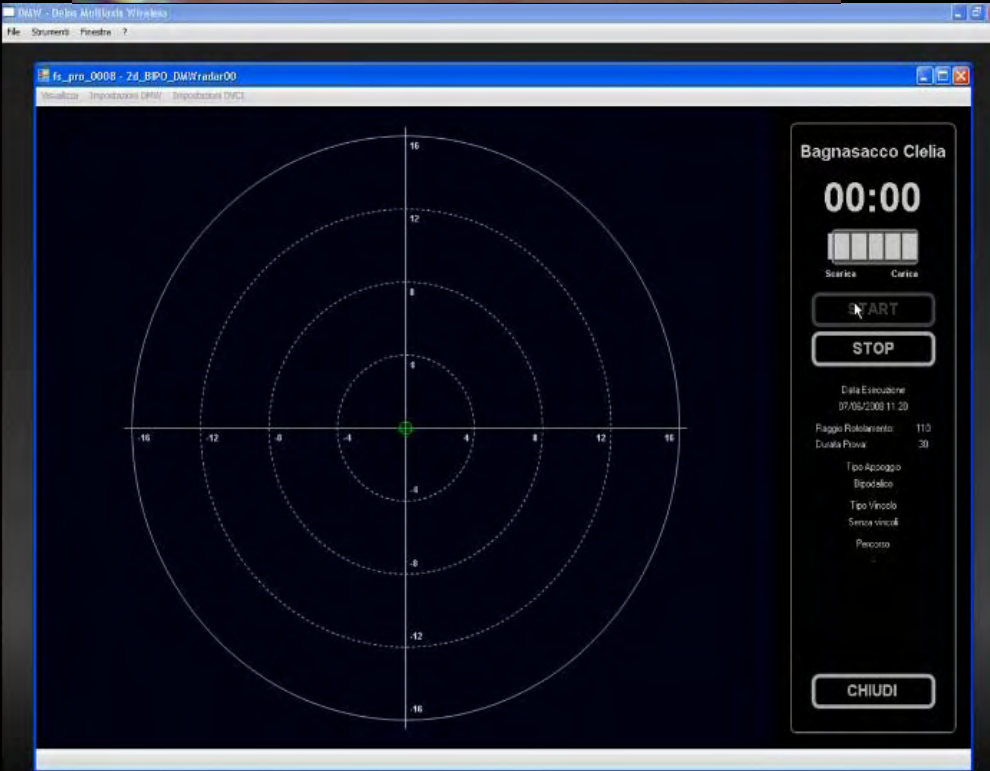
Range exploration
45°, 8°
right



Esplorazione range
225°, 8°
sinistra



**Mezzosquat
ritmo libero
bipodalico**



Even an extreme sport activity as the **marathon** is
unable to develop top postural endurance.



Enduring proprioceptive control

ALTA DENSITA'

Marathon runners: HF proprioceptive training and running performances

Fisioequipe (Roma) – Centro propriocezione (Torino)

PURPOSE

The purpose of this study was to investigate :

- if an endurance proprioceptive training of postural muscles can be applied with short high density training
- its effects on long distance running performances
- its feasibility in microgravity

Methods



12 amateur marathon runners

Aged: $41,2 \pm 8,7$ (range 29-48 years)

Sex: male

BMI: $23,9 \pm 2,0$

Category: subjects with stabilized long distance running performances over the last three years
(range: average time $\pm 5\%$)

PROPRIOCEPTIVE TRAINING

- **High frequency instability**
- **High density**

Two sessions per week for two months of **HF proprioceptive** training were added to their usual training program without increasing total training time

PROPRIOCEPTIVE TRAINING PROTOCOL

Introductory phase (normal density):

- trials lasting 30 seconds
- avoiding hand support
- refining postural control

HIGH FREQUENCY
INSTABILITY

High density phase:

- trials lasting 40 to 90 seconds
- refining postural control
- increasing postural endurance

PROPRIOCEPTIVE TRAINING PROTOCOL

- Two sessions per week for two months
- Constant number of trials (n=12)
- Single trial duration
 - 1st session: 40 seconds
 - 16th session: 90 seconds
- Constant inter-trials recovery: 15 seconds
- 1st session duration (including test): 30 minutes
- 16th session duration (including test): about 50 minutes

Single session



Pre-training test

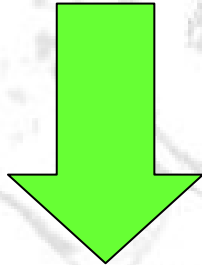
HF visuo-proprioceptive training session

Post-training test (postural decay assessment)

Progression rule

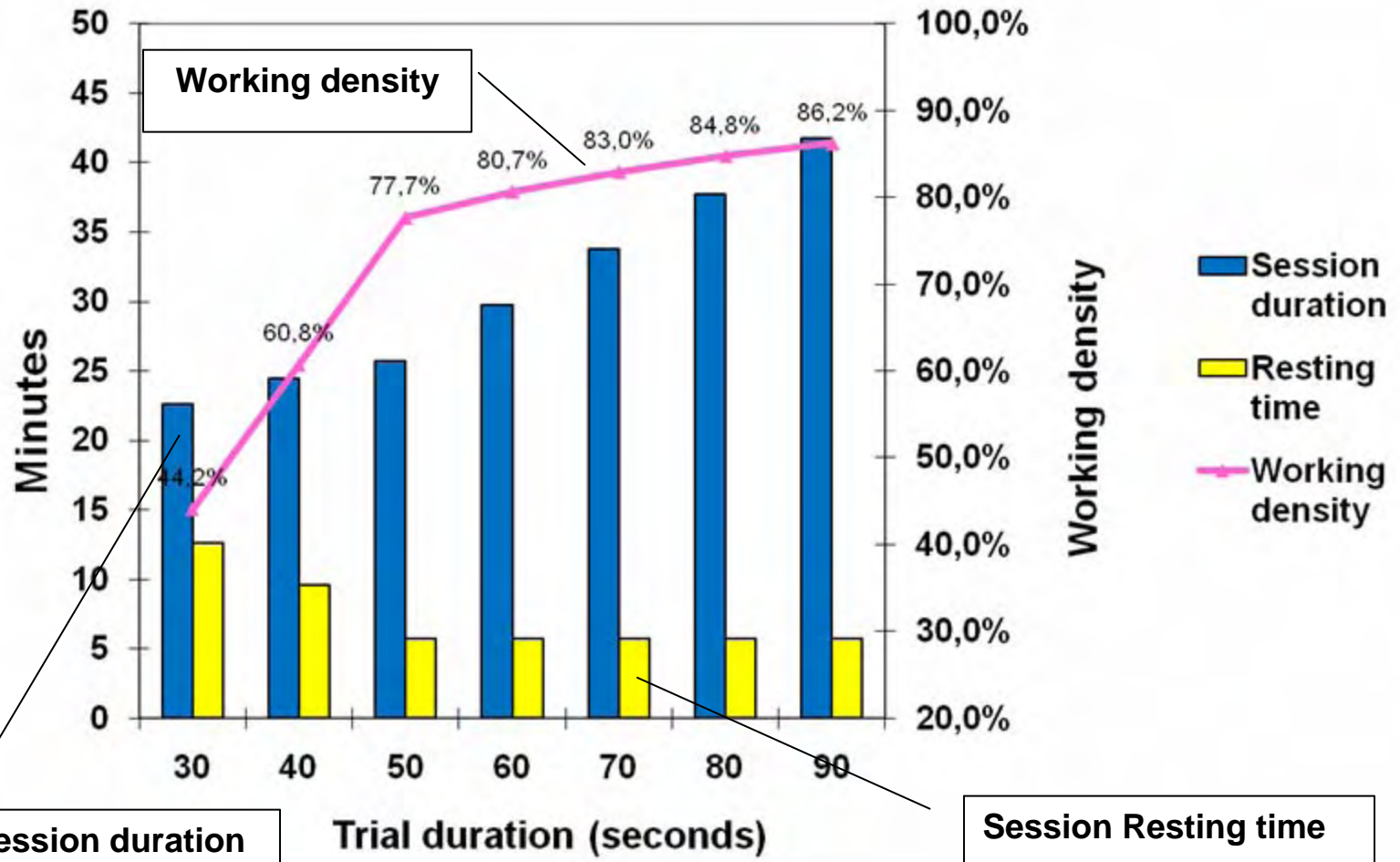
IF

the POST-training test is better than the PRE-training test



In the next session:
each trial lasts 10 seconds more

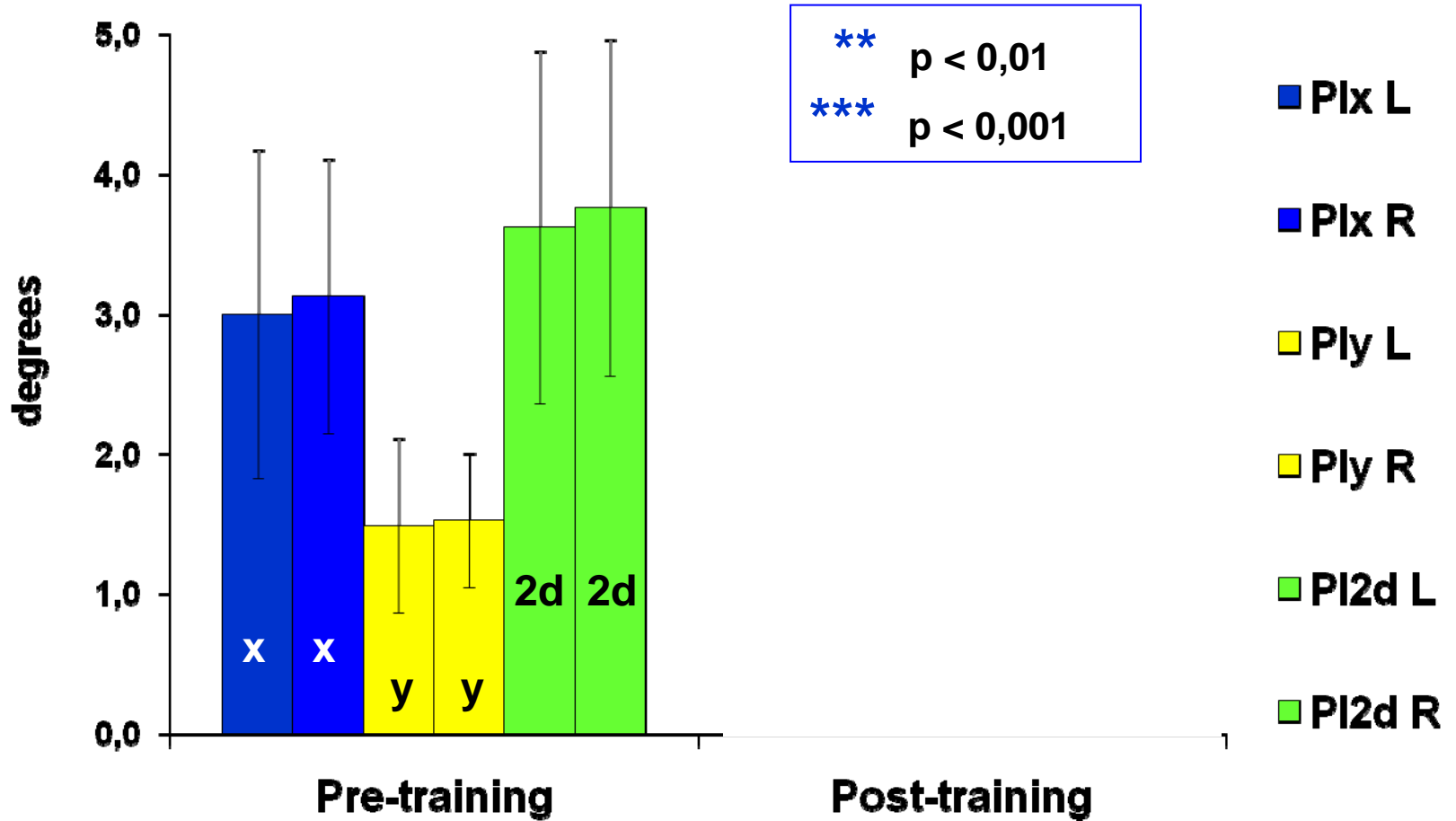
Session duration, resting time, working density



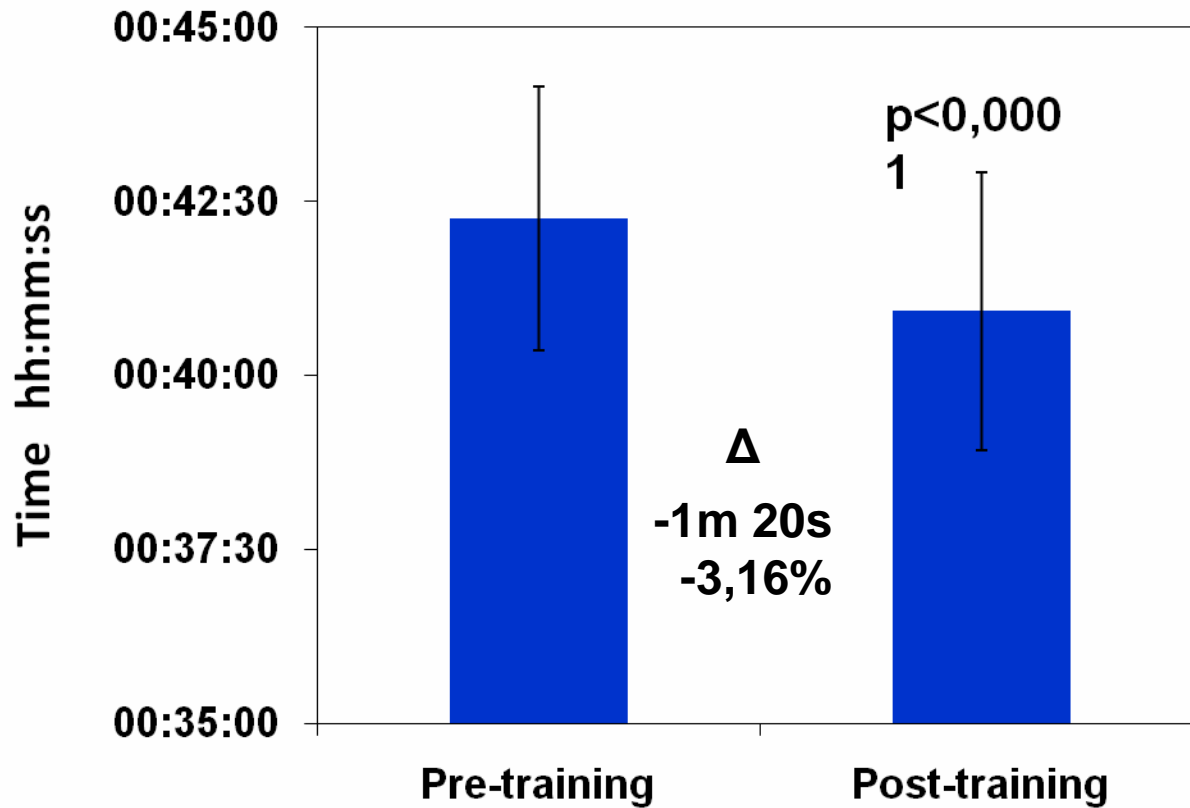


RESULTS

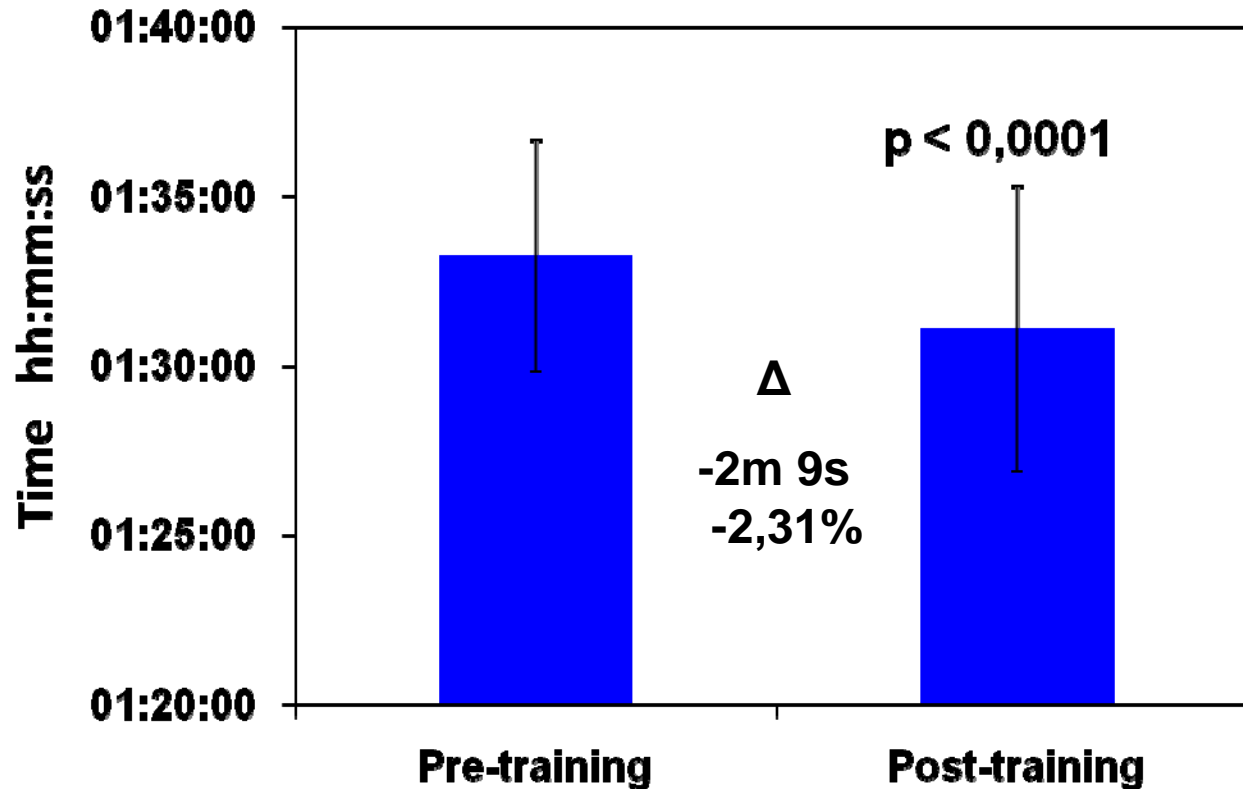
POSTURAL INSTABILITY COMPONENTS

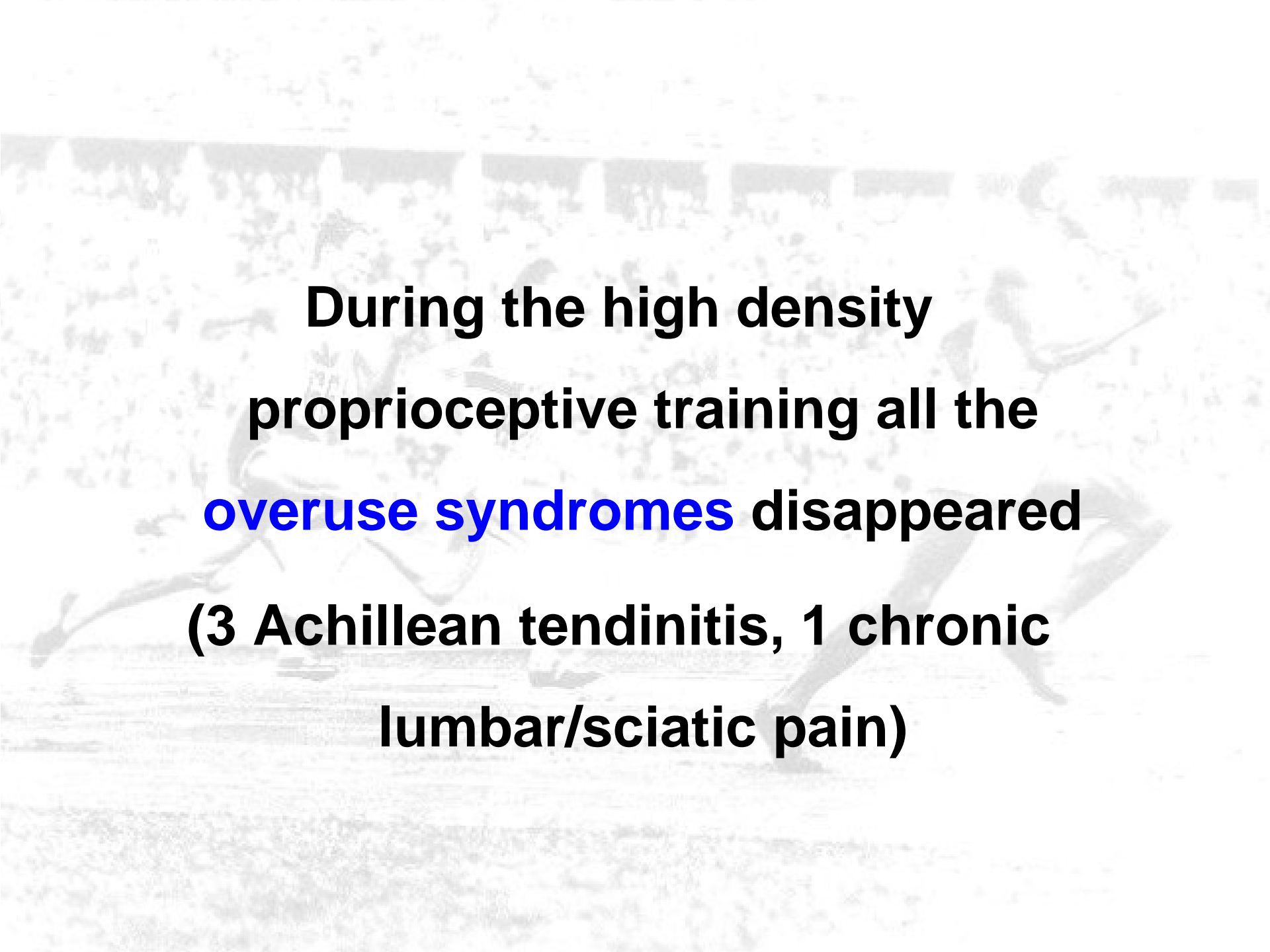


10000 m RUNNING PERFORMANCES



HALF MARATHON PERFORMANCES (21,097 km)





**During the high density
proprioceptive training all the
overuse syndromes disappeared
(3 Achillean tendinitis, 1 chronic
lumbar/sciatic pain)**