GPS technology

Applicazioni nello sprint

gpexe
the power tracker

Ivan Zadro
Allenatore FIDAL
Dottore di Ricerca
Università degli Studi di Udine
Corso di Laurea in Scienza dello Sport
Cell. +39 347 0738566
e-mail: ivan.zadro@uniud.it

GPS technology

Applicazioni nello sprint

Di cosa parleremo?

- ***Introduzione teorica sulla relazione Acc-Vel: utilità e come ottenerla***
- ***Vantaggi della tecnologia GPS***
- ***Cenni tecnologici sul dispositivo***
- ***Quali informazioni utili per lo sprinter?***
- ***Possibili sviluppi***

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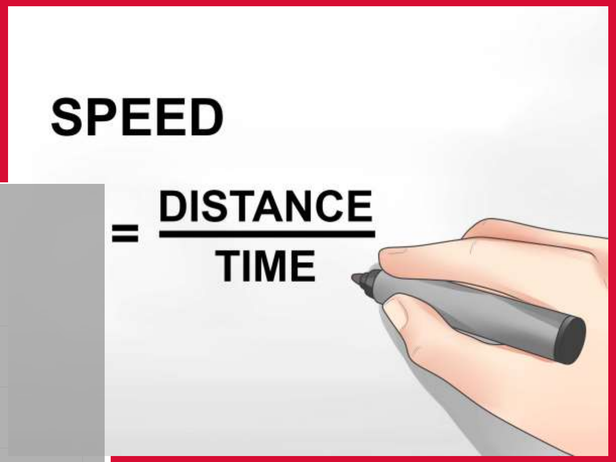
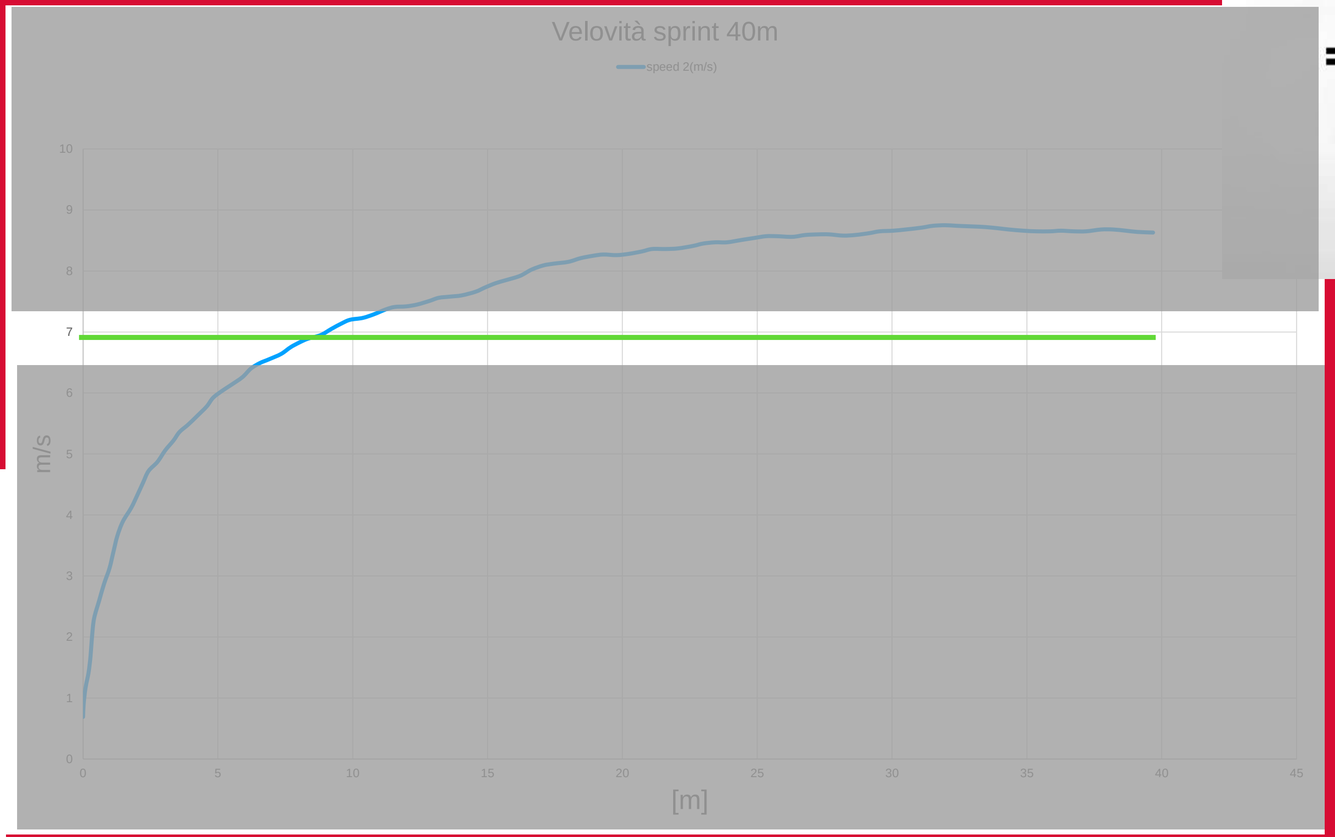
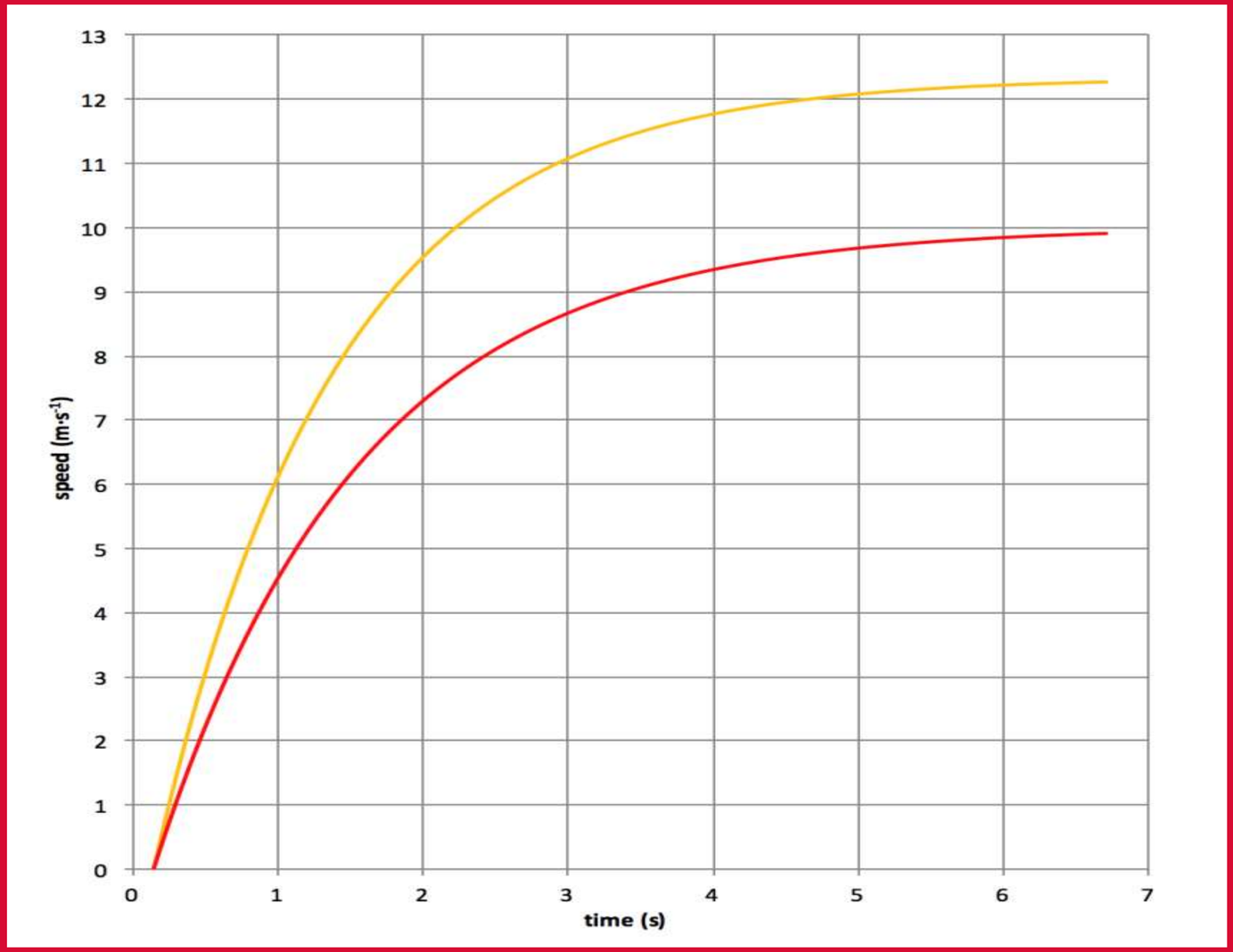




Come lo misuriamo solitamente uno sprint?

La relazione Acc-V

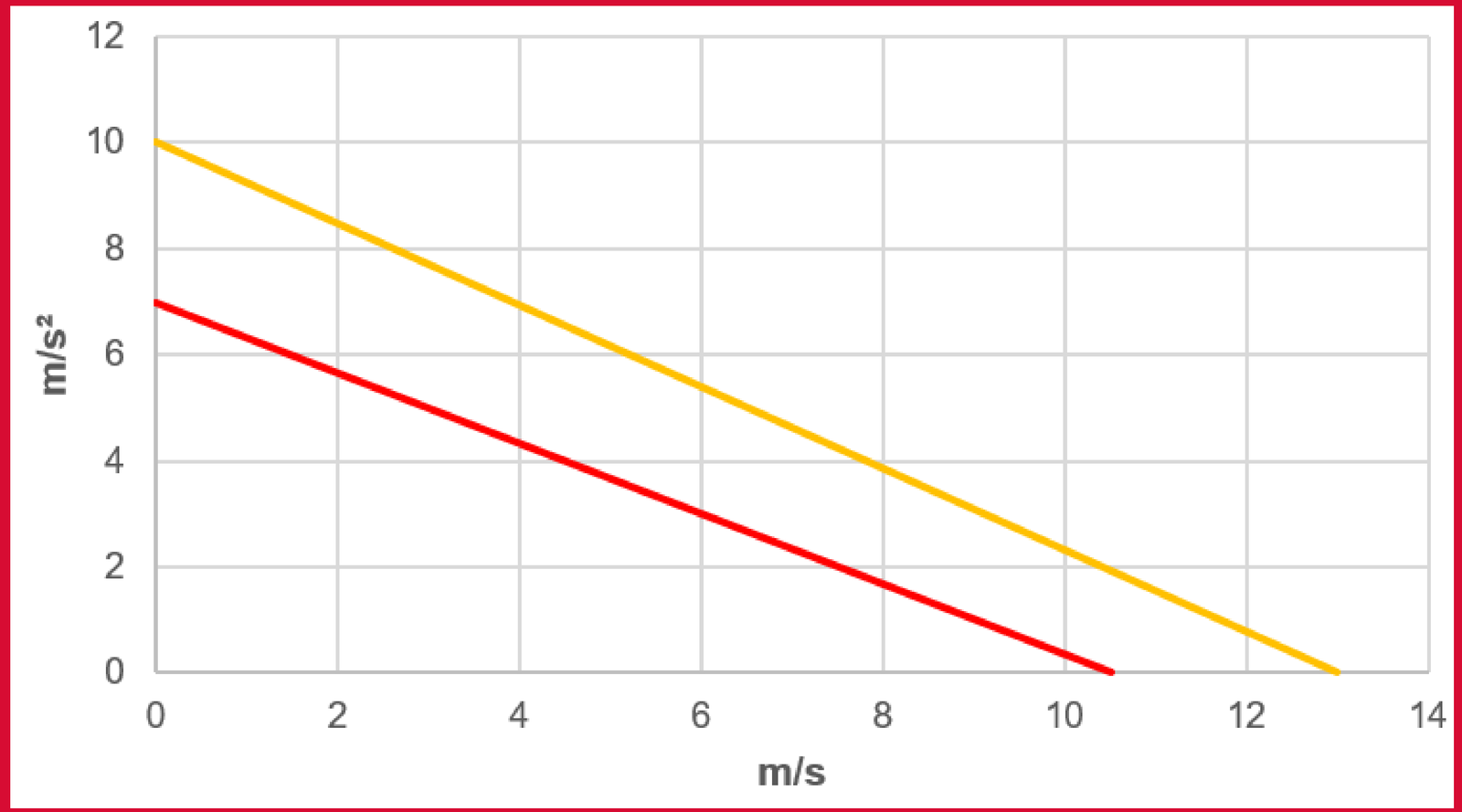


La capacità di produrre velocità in funzione del tempo dipende dalle potenzialità di un atleta.
In giallo Bolt in rosso un atleta di media qualificazione

La relazione Acc-V

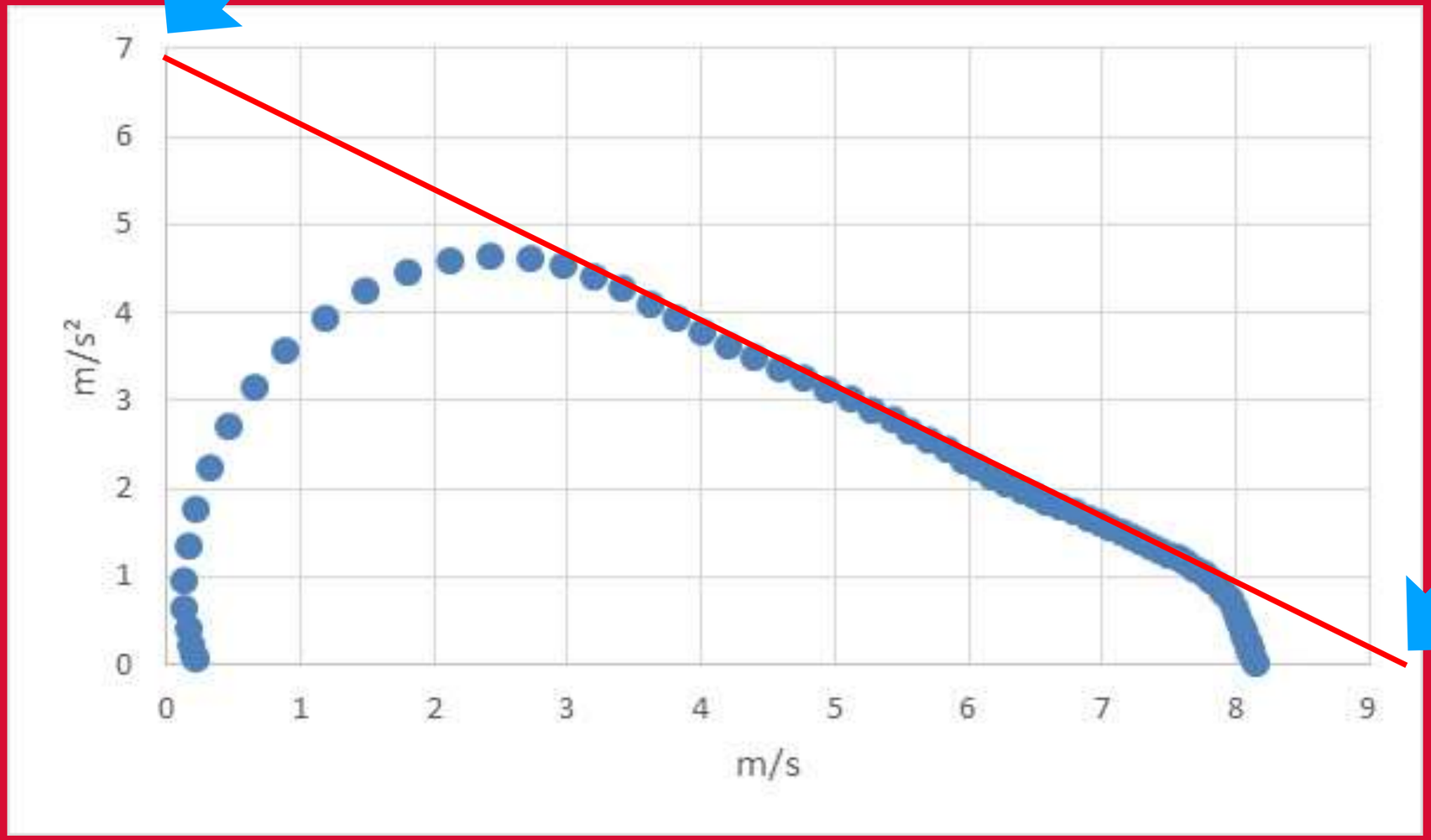
Un altro modo per mettere in evidenza la differenza tra i due atleti è osservarne la capacità di accelerazione

La relazione Acc-V *(Morin JB et al.)*



- *Questa relazione è facilemente ottenibile attraverso la combinazione dei due precedenti grafici*
- *Molti studi hanno messo in evidenza come la relazione tra forza e velocità sia ben rappresentata da una funzione lineare decrescente (Morin et al.)*
- *Per i due atleti precedenti questa relazione è quella rappresentata qui a fianco*

La relazione Acc-V: «dietro le quinte»

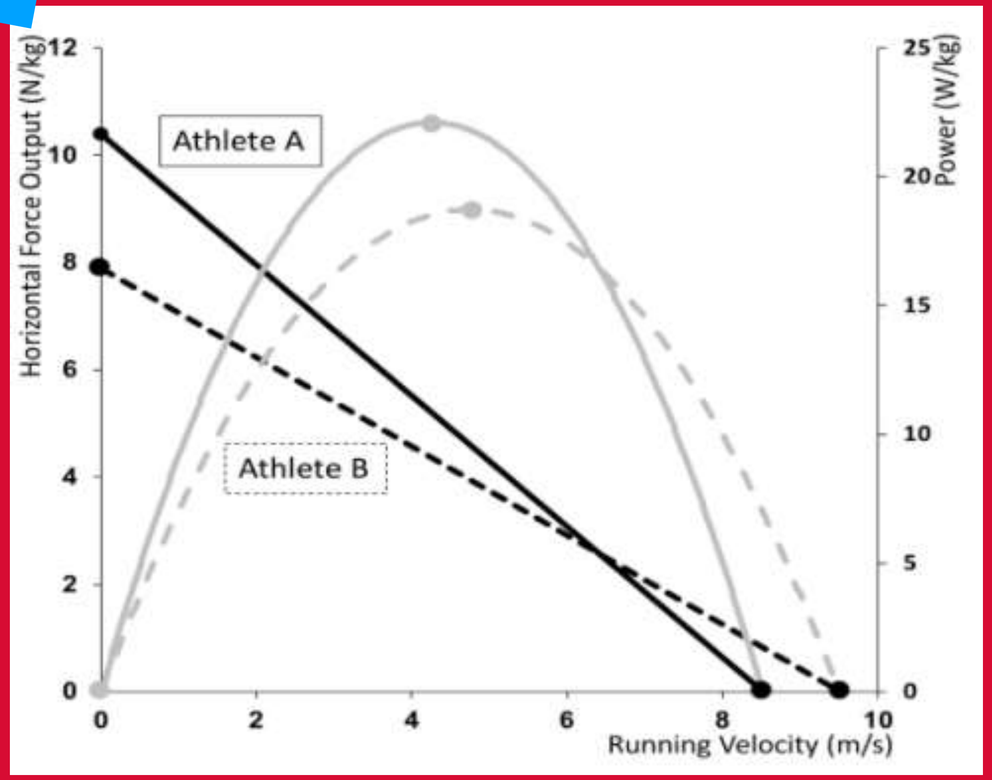


La relazione reale di un atleta

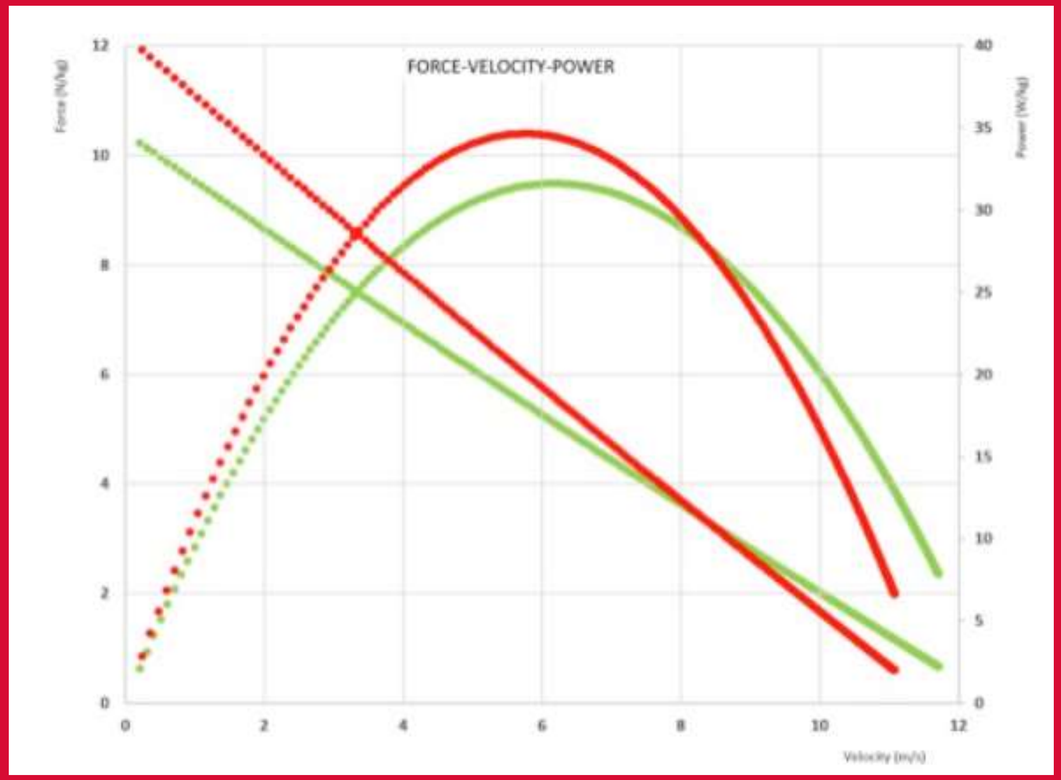
Acc 0 = Accelerazione massima teorica

V0 = velocità massima teorica

Same 30m time, different FVP profiles

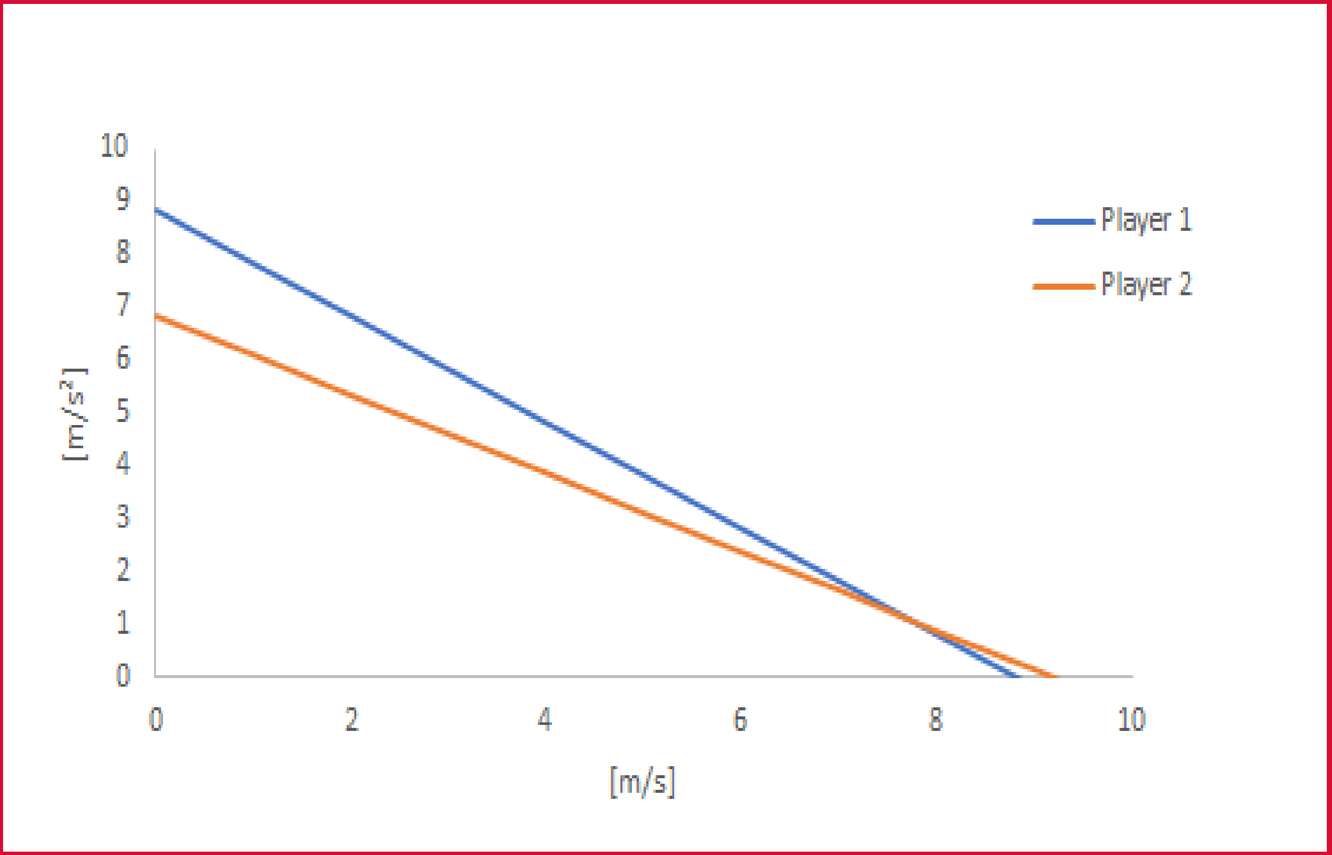


Morin JB; Samozino P. International Journal of Sports Physiology and Performance. 2015



*Horizontal force output (N/kg, straight line) and Power (W/kg, curved line) for the best acceleration (**Su Bingtian**, red) and best top speed (**Usain Bolt**, green) of all time as calculated in 100m races (graph using JB Morin excel sheet). https://www.hmmrmedia.com/2021/10/tokyo-sprint-analysis/*

REL Acc-V: CASE REPORT



- *Rel Acc-V di uno sprint di 30m di due atleti con tempi molto simili (4,56 sec. e 4,61 sec.)*

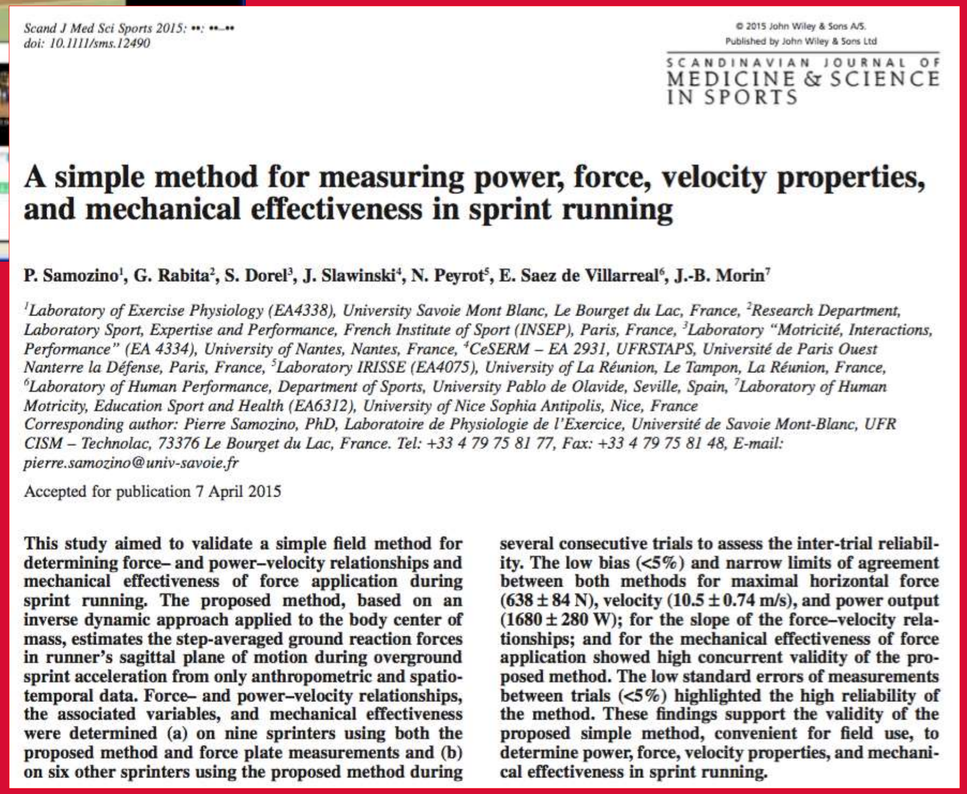
- *Il sogg. 1 infatti presenta valori di accelerazione, e quindi di forza orizzontale (F0), maggiori rispetto al sogg. 2 nella prima parte dello sprint, mentre ha meno capacità di produrre accelerazione alle velocità più alte*

La relazione Acc-V

Avere la possibilità di conoscere come un atleta sviluppa la sua accelerazione in funzione della velocità può certamente rappresentare un’utile informazione per l’allenatore al fine di migliorare le capacità di sprint dei propri atleti, personalizzare l’allenamento e monitorare le loro caratteristiche durante la stagione competitiva

Come ottenere la relazione Acc-Vel con

- ***Videonalisi***
- ***[Applicazione telefonica per IOS]***
- ***GPS***



Scand J Med Sci Sports 2015: ••; ••–••
doi: 10.1111/sms.12490

SCANDINAVIAN JOURNAL OF MEDICINE & SCIENCE IN SPORTS

A simple method for measuring power, force, velocity properties, and mechanical effectiveness in sprint running

P. Samozino[1], G. Rabita[2], S. Dorel[3], J. Slawinski[4], N. Peyrot[5], E. Saez de Villarreal[6], J.-B. Morin[7]

[1]Laboratory of Exercise Physiology (EA4338), University Savoie Mont Blanc, Le Bourget du Lac, France, [2]Research Department, Laboratory Sport, Expertise and Performance, French Institute of Sport (INSEP), Paris, France, [3]Laboratory "Motricité, Interactions, Performance" (EA 4334), University of Nantes, Nantes, France, [4]CeSERM – EA 2931, UFRSTAPS, Université de Paris Ouest Nanterre la Défense, Paris, France, [5]Laboratory IRISSE (EA4075), University of La Réunion, Le Tampon, La Réunion, France, [6]Laboratory of Human Performance, Department of Sports, University Pablo de Olavide, Seville, Spain, [7]Laboratory of Human Motricity, Education Sport and Health (EA6312), University of Nice Sophia Antipolis, Nice, France
Corresponding author: Pierre Samozino, PhD, Laboratoire de Physiologie de l'Exercice, Université de Savoie Mont-Blanc, UFR CISM – Technolac, 73376 Le Bourget du Lac, France. Tel: +33 4 79 75 81 77, Fax: +33 4 79 75 81 48, E-mail: pierre.samozino@univ-savoie.fr

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This study aimed to validate a simple field method for determining force– and power–velocity relationships and mechanical effectiveness of force application during sprint running. The proposed method, based on an inverse dynamic approach applied to the body center of mass, estimates the step-averaged ground reaction forces in runner's sagittal plane of motion during overground sprint acceleration from only anthropometric and spatio-temporal data. Force– and power–velocity relationships, the associated variables, and mechanical effectiveness were determined (a) on nine sprinters using both the proposed method and force plate measurements and (b) on six other sprinters using the proposed method during several consecutive trials to assess the inter-trial reliability. The low bias (<5%) and narrow limits of agreement between both methods for maximal horizontal force (638 ± 84 N), velocity (10.5 ± 0.74 m/s), and power output (1680 ± 280 W); for the slope of the force–velocity relationships; and for the mechanical effectiveness of force application showed high concurrent validity of the proposed method. The low standard errors of measurements between trials (<5%) highlighted the high reliability of the method. These findings support the validity of the proposed simple method, convenient for field use, to determine power, force, velocity properties, and mechanical effectiveness in sprint running.

gpexe / pro²

Con il gpexe pro², attraverso un ricevitore GPS ad alta frequenza (18,18 Hz), è possibile tracciare la posizione e la velocità dell’atleta. Tutti i dati vengono memorizzati e utilizzati per calcolare una serie di parametri utili per valutare il volume e l'intensità della performance

Ma siamo sicuri della sua accuratezza?

2015 This preliminary study aimed to analyze the accuracy of the GPEXE system by comparing five different straight line protocols with a reference laser device (LAVEG Sport, 100 Hz, Jenoptik, Jena, Germany). The results demonstrated an average deviation (RMSE) of 0.45 $m \cdot s^{-1}$ between GPEXE and LAVEG. Furthermore, the results showed that GPEXE tends to overestimate the low velocities and to slightly underestimated the high velocities.

2015 The aim of this study was to evaluate the accuracy and reliability of a GPS device with a sampling frequency of 20 Hz for measuring distance and speed of shuttle runs. A high frequency video system was utilized as a criterion measure. Moreover, total distance and peak speed recorded by 20 Hz GPS device were compared to the same data obtained by a 10 Hz GPS device. The main finding of this study was that the 20 Hz GPS device was generally more accurate than the 10 Hz GPS device for measuring total distance and running speed in shuttle sprints. It should be pointed out, however, that a high frequency camera isn't as good as laser or radar to verify the accuracy and reliability of GPS technology during sprint o shuttle runs.

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2016 This study aimed to evaluate established 10 Hz GPS (MinimaxX S4, Catapult Innovations), latest commercial available 18.18 Hz GPS (GPEXE PRO, EXELIO srl) and 20 Hz LPS (KINEXON precision technologies) for determining movement patterns in soccer. The 18.18 Hz GPS had better validity and reliability for determining distances covered and sprint mechanical properties than the 10 Hz GPS. However, of all evaluated systems, the 20 Hz LPS showed the best overall validity and reliability. The related manuscript is actually accepted for the publication on Plos ONE.

2017 The purpose of this study was to test the concurrent validity of data from two different global positioning system (GPS) units for obtaining mechanical properties during sprint acceleration using a field method recently validated by Samozino et al. The concurrent validity for all variables derived from 20 Hz GPS measurements was better than that obtained from the 5 Hz GPS units. However, in the current state of GPS devices accuracy for speed-time measurements over a maximal sprint acceleration, we recommend that radar, laser devices and timing gates remain the reference methods for implementing Samozino et al.'s computations. The paper was published in January 2017 on International Journal of Sports Physiology and Performance.

…ed altri 4 articoli scientifici di validazione dello strumento. E' stato anche utilizzato per la misura in molti altri studi scientifici

Pratico da indossare durante l’attività sportiva. Non necessita di alcuna preparazione sul campo

Per ora è prevalentemente utilizzato nel mondo del calcio


RONGDA
2015
FSHF
1930
AS MONACO FC
S.S.LAZIO
ATLANTIQUE
STADE ROCHELAIS
LAUSANNE SPORT
Ticino TEAM
TORINO
1906
FC
WATFORD
ITALIA
FIGC
ACM
1899
UDINESE CALCIO
EMPOLI F.C.
1920
PESCARA CALCIO
1936
1971
D.R.B.T
TADJENANET
PARMA CALCIO
1913
Université
de Toulouse

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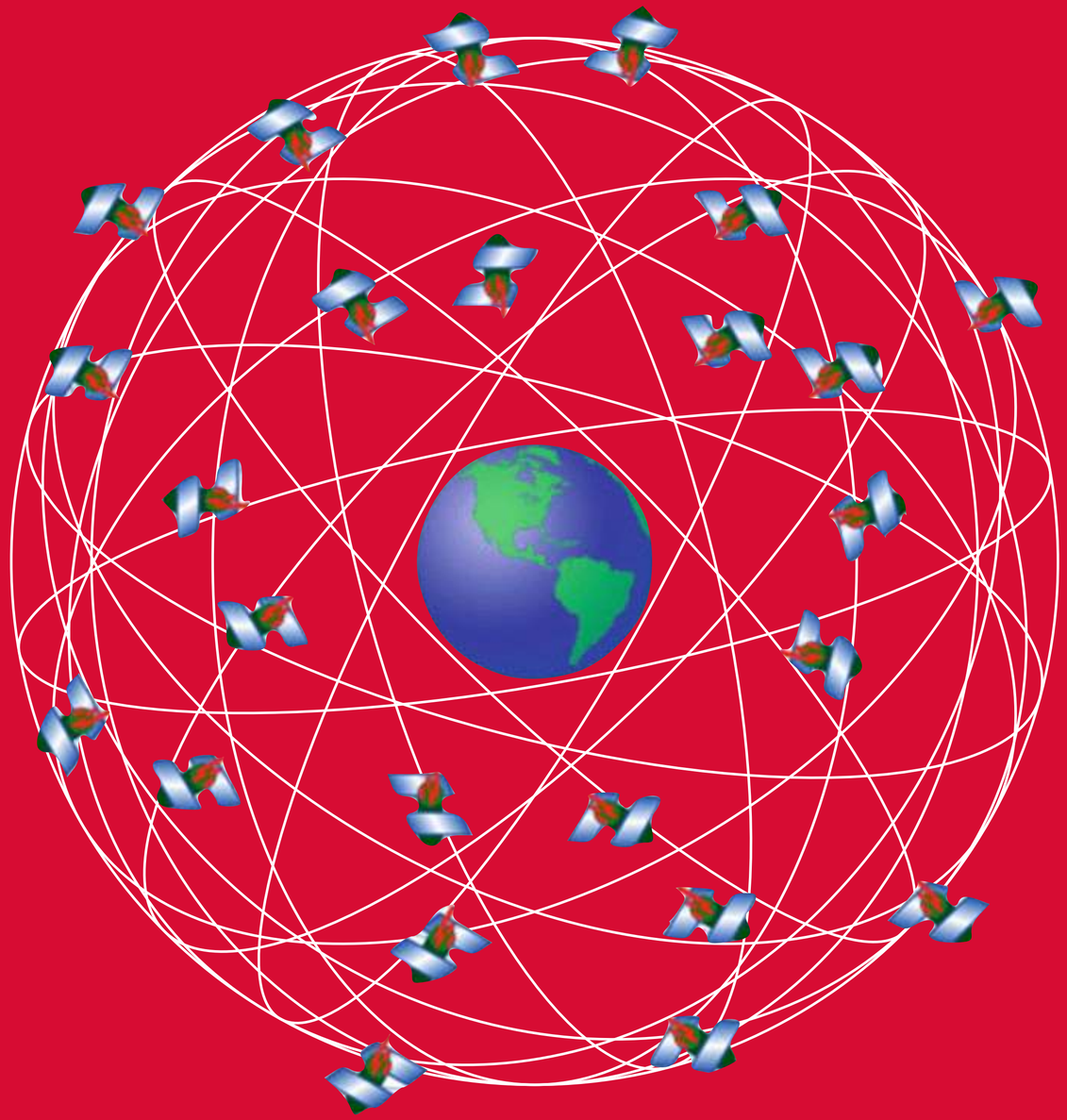
GPS satellites number

31



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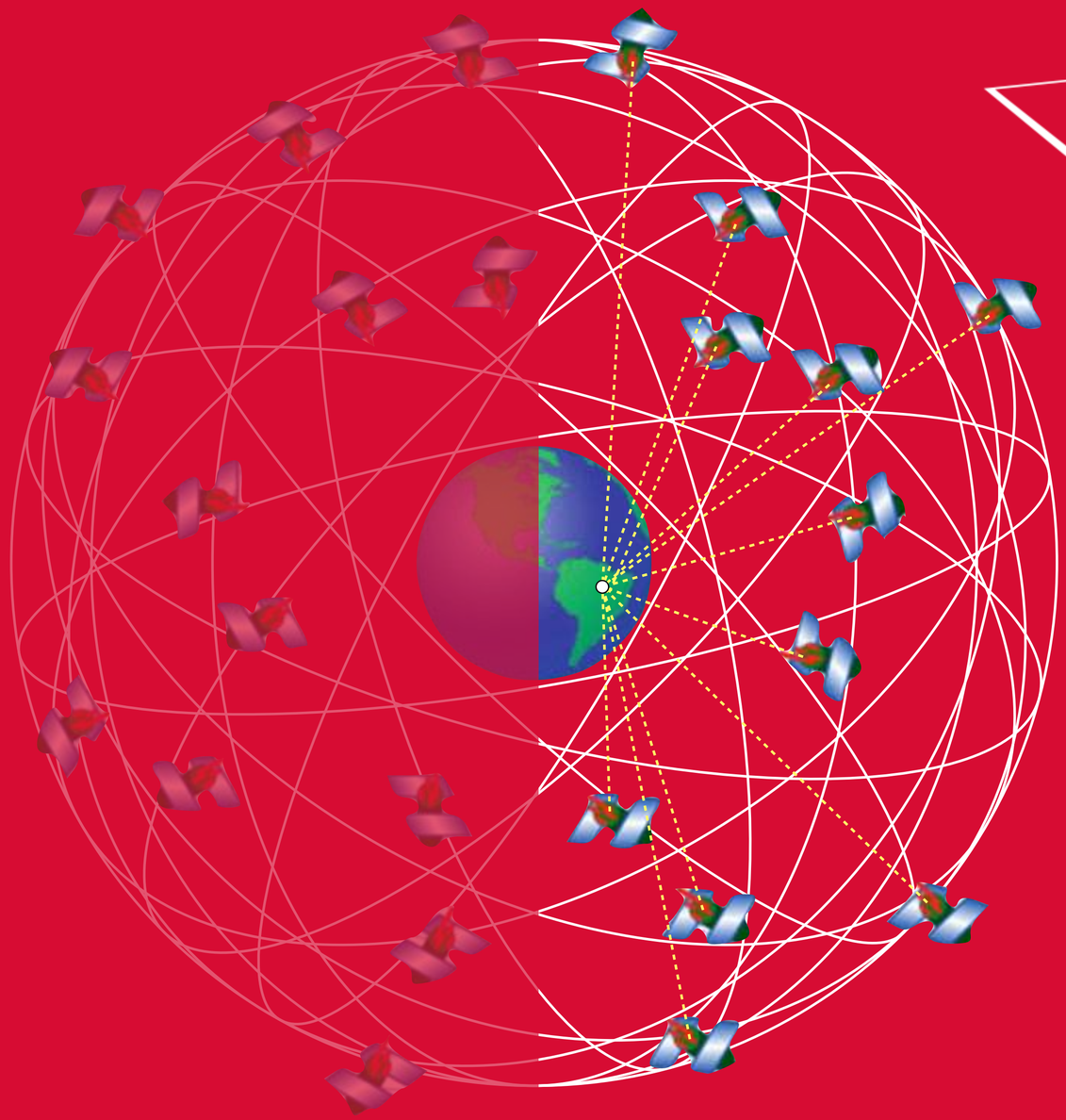
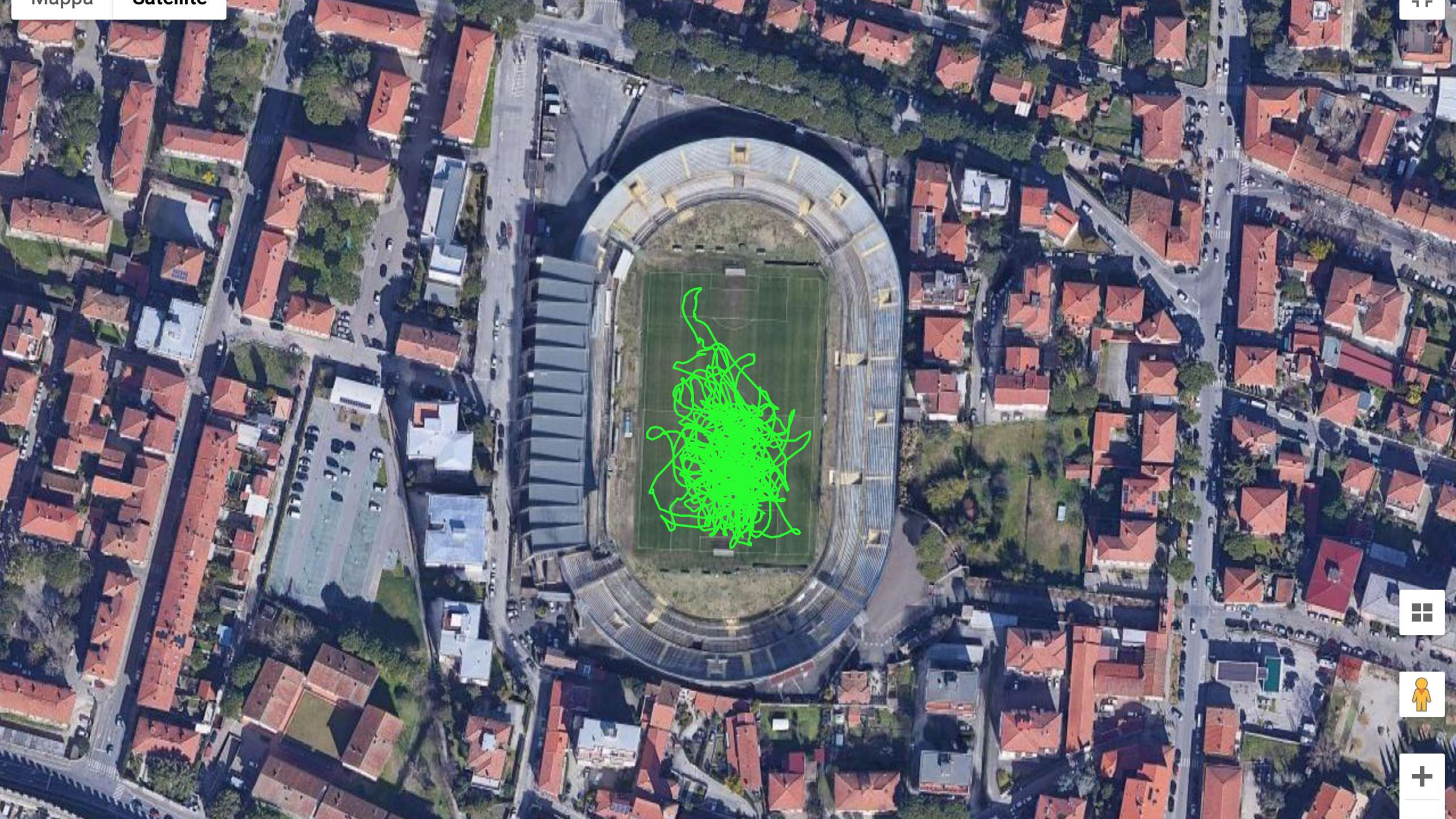
GPS satellites number

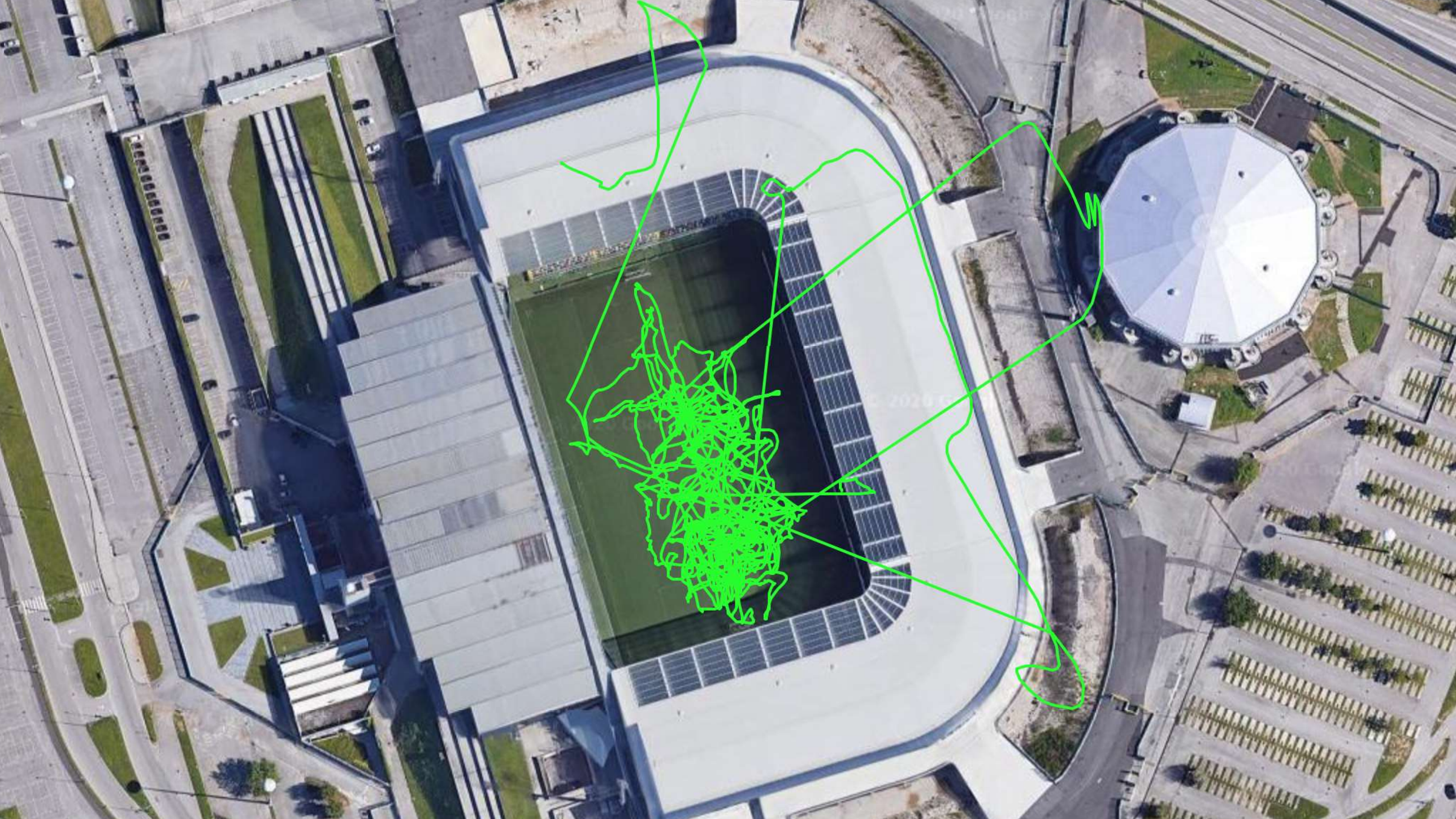
31



GPS satellites connected

9


Mappa
Satellite




AT&T STADIUM

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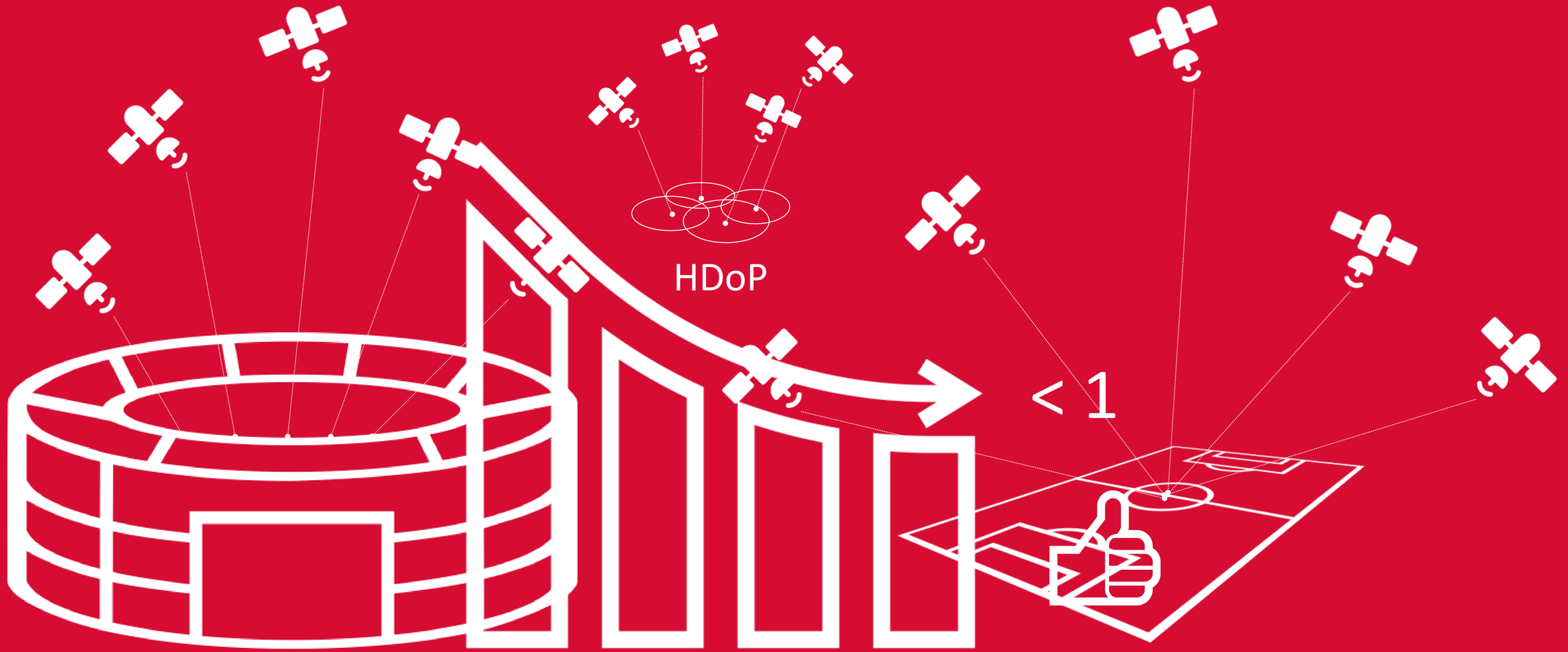
sat number

obstacles

receiver



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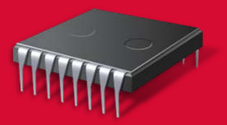
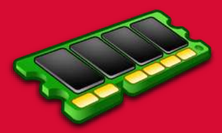


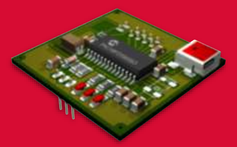
chip

battery

antenna



memory



circuit

case

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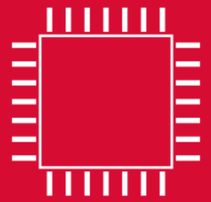


GNSS receiver

IMU

time

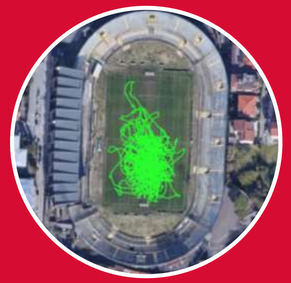
position

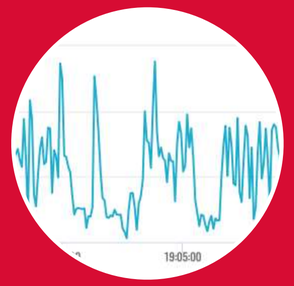
speed

accelerometer

gyroscope

magnetometer





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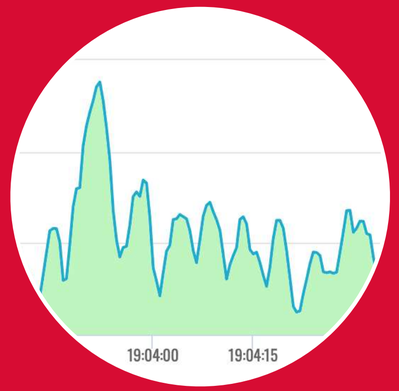
$\int f(x)\,dt$

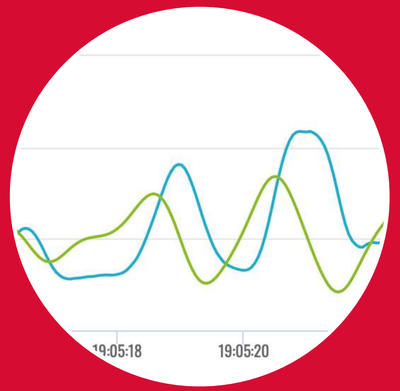
speed

$\frac{df(x)}{dt}$

distance



acceleration



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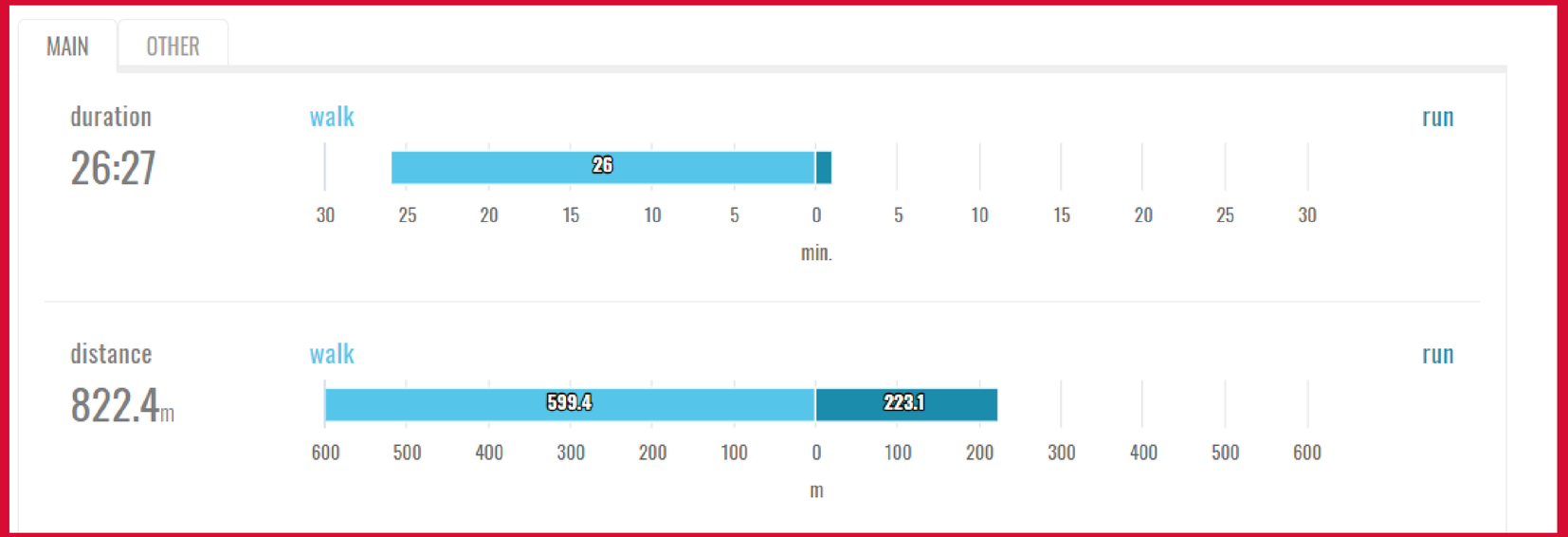
filtering

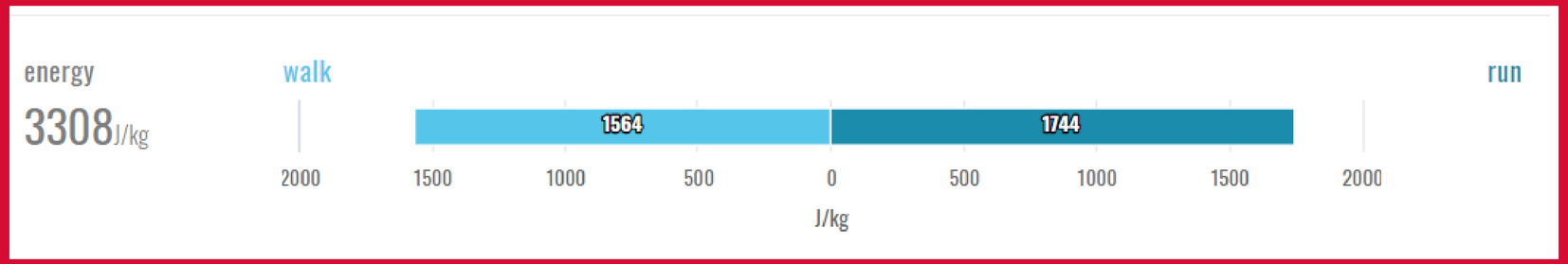
Principali informazioni sulla seduta di allenamento ottenibili dalla web app

1. Distanza percorsa e durata totale, con distinzione tra cammino e corsa;
2. Stima della spesa energetica;
3. Accelerazione e velocità massime ottenute;
4. Tempo trascorso e distanza percorsa oltre soglie che è possibile impostare a piacimento. Ad es. 9 m/s e 4 m/s^2;
5. La relazione Accelerazione-Velocità dell'atleta;
6. Numero di salti/balzi effettuati.

1. Distanza percorsa e durata totale, con distinzione tra cammino e corsa;



2. Stima della spesa energetica;



3. Accelerazione e velocità massime ottenute

MAIN | OTHER

max values

max speed m/s	max acc m/s^2	max dec m/s^2	max HR b/min	max met power W/kg
8.14	4.32	-2.15	-	100.04

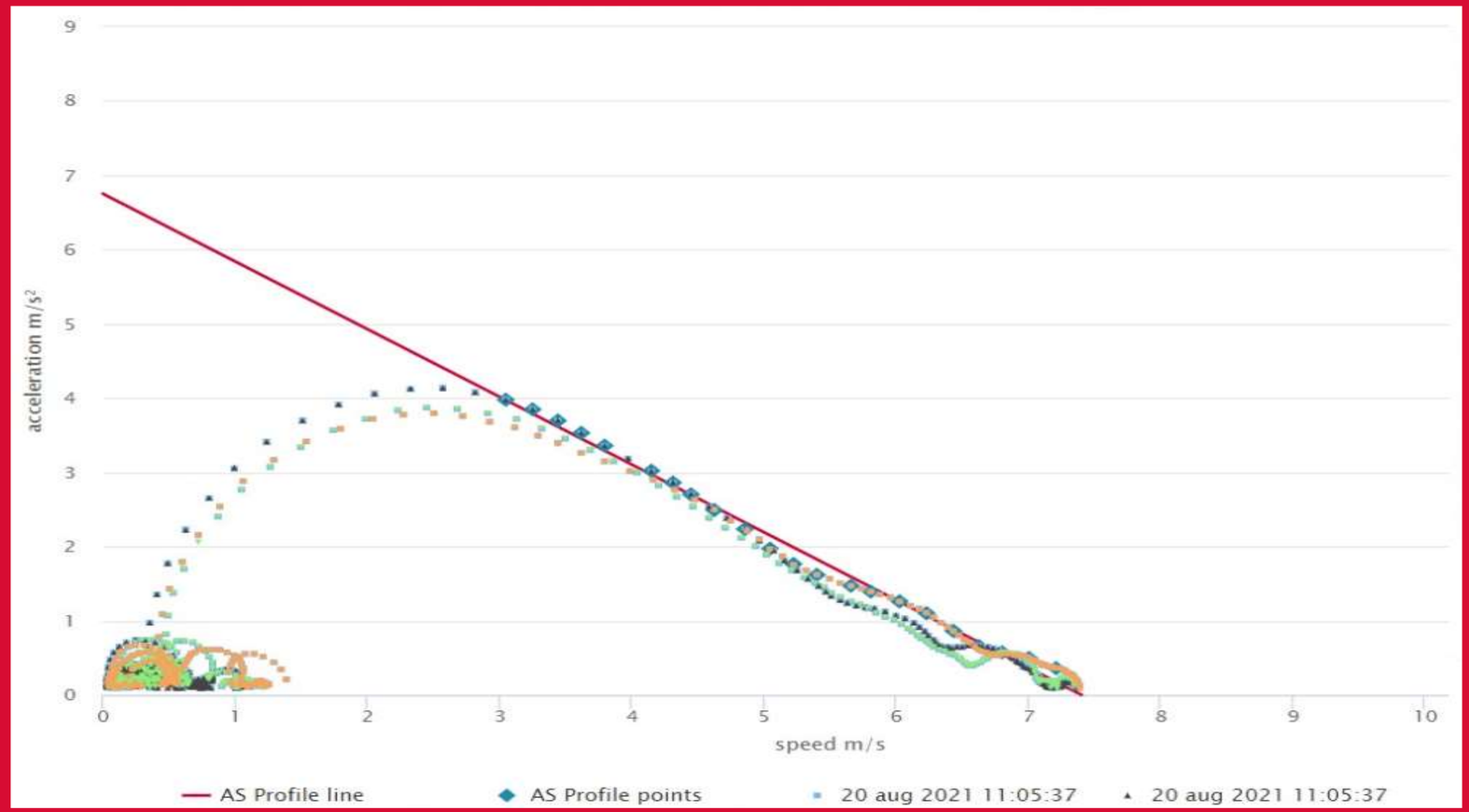
4. Tempo trascorso e distanza percorsa oltre soglie che è possibile impostare a piacimento

speed zones

	speed events	time mm:ss	distance m
Z1 (0.00 – 5.50 m/s)		26:05	679.0
Z2 (5.50 – 7.00 m/s)		00:15	100.1
Z3 (over 7.00 m/s)	8 *	00:06	43.3

(*) over 7.00 m/s

5. La relazione Acc-Vel…



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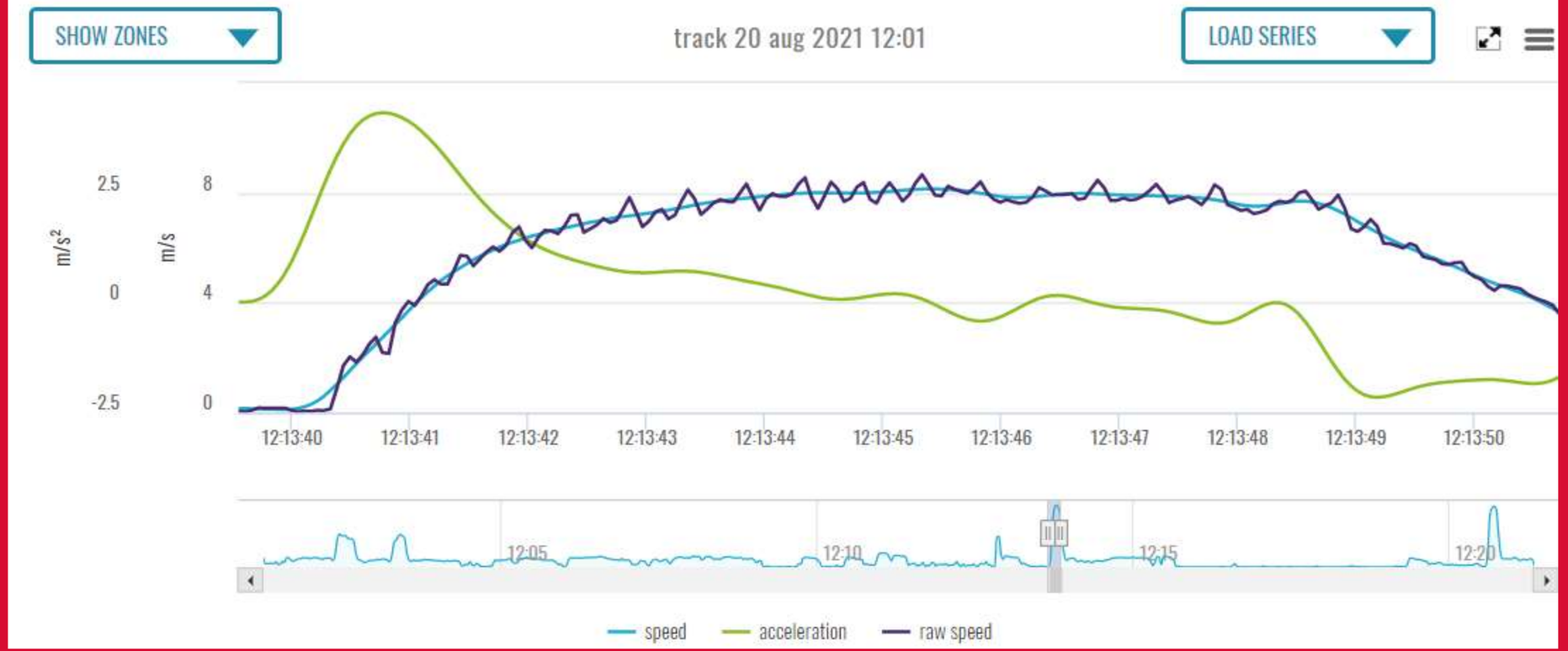
VELOCITA’ E ACCELERAZIONE

	time	duration	dist m	EDI %	dist / sp Z2 m	dist / sp Z3 m	MPE	MPE rec av t s
full track	12:01:13 — 12:21:19	20:05	1023.5	6.9	27.1	99.8	5	194.3
selection	12:13:39 — 12:13:50	0:11	69.8	39.1	-	-	1	1.2



Dalla web app si possono ottenere vel max e acc max

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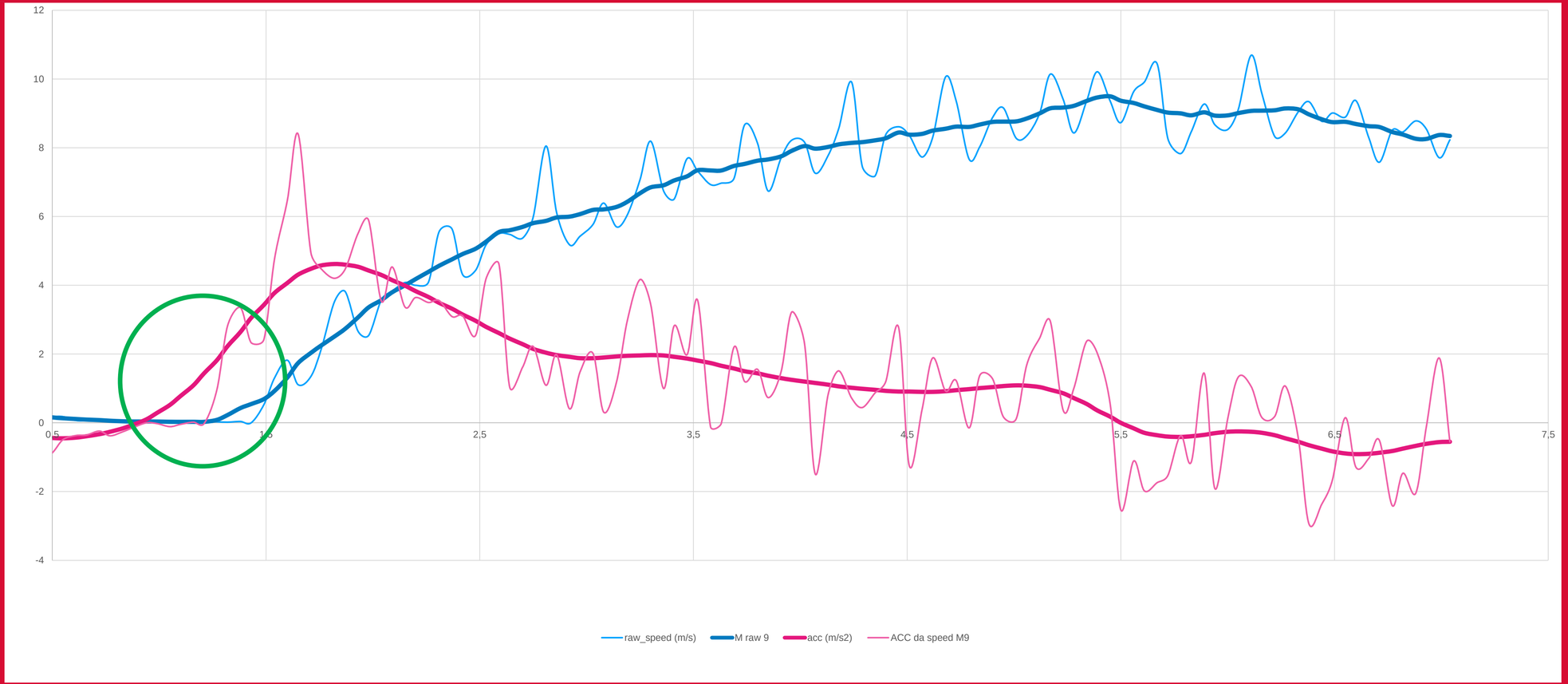
speed

df(x) /dt

acceleration

I FILTRI



Informazioni derivate

Non essendo la webapp pensata specificatamente per l’utilizzo in atletica leggera, è possibile ottenere ulteriori interessanti informazioni scaricando il file excel dell’allenamento, ottenendo così ad es.

1. Sovrapporre tracce di velocità per confrontare diversi sprin svolti sulla stessa distanza
2. La relazione Acc-Vel di diversi periodi

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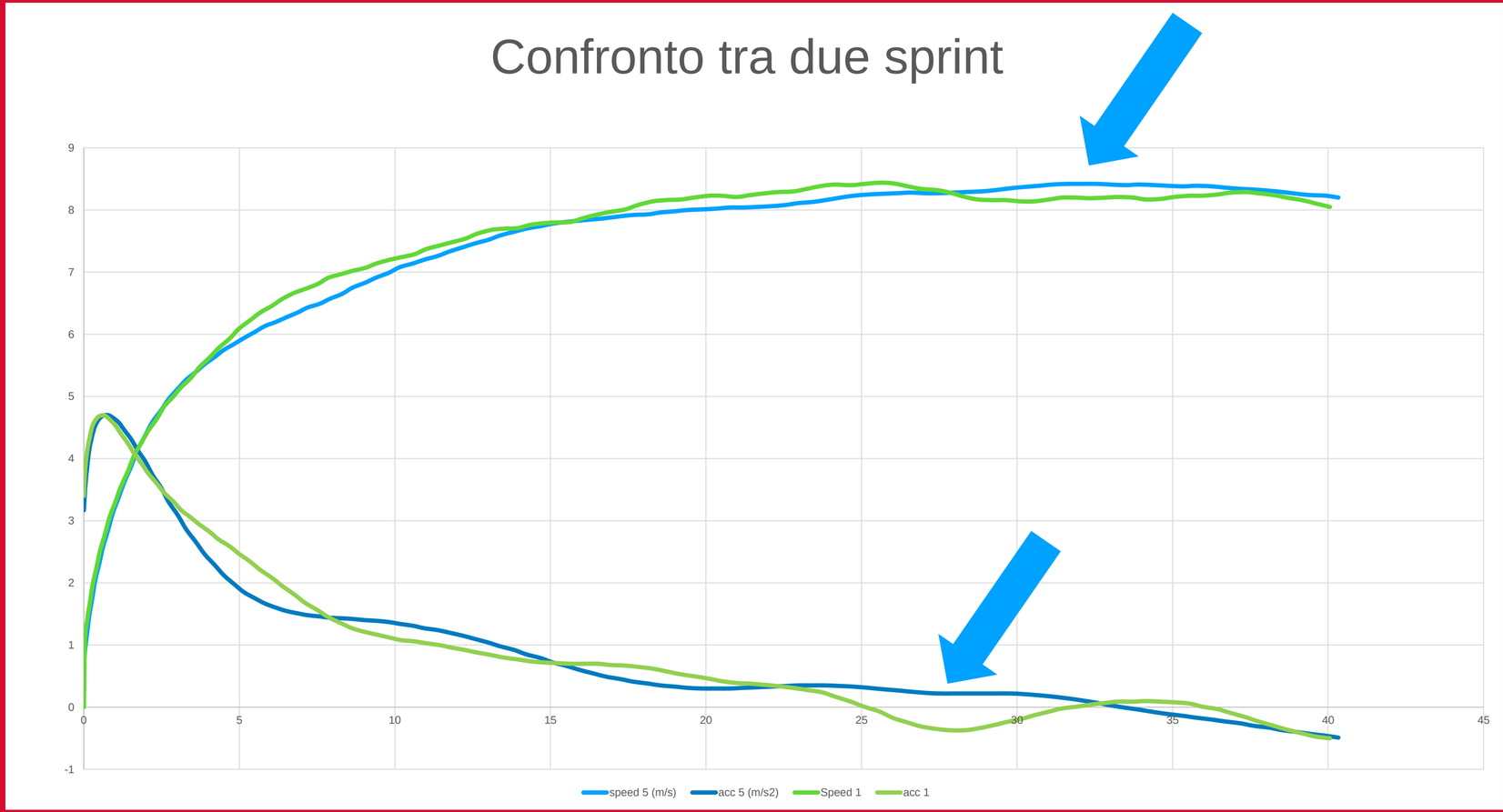
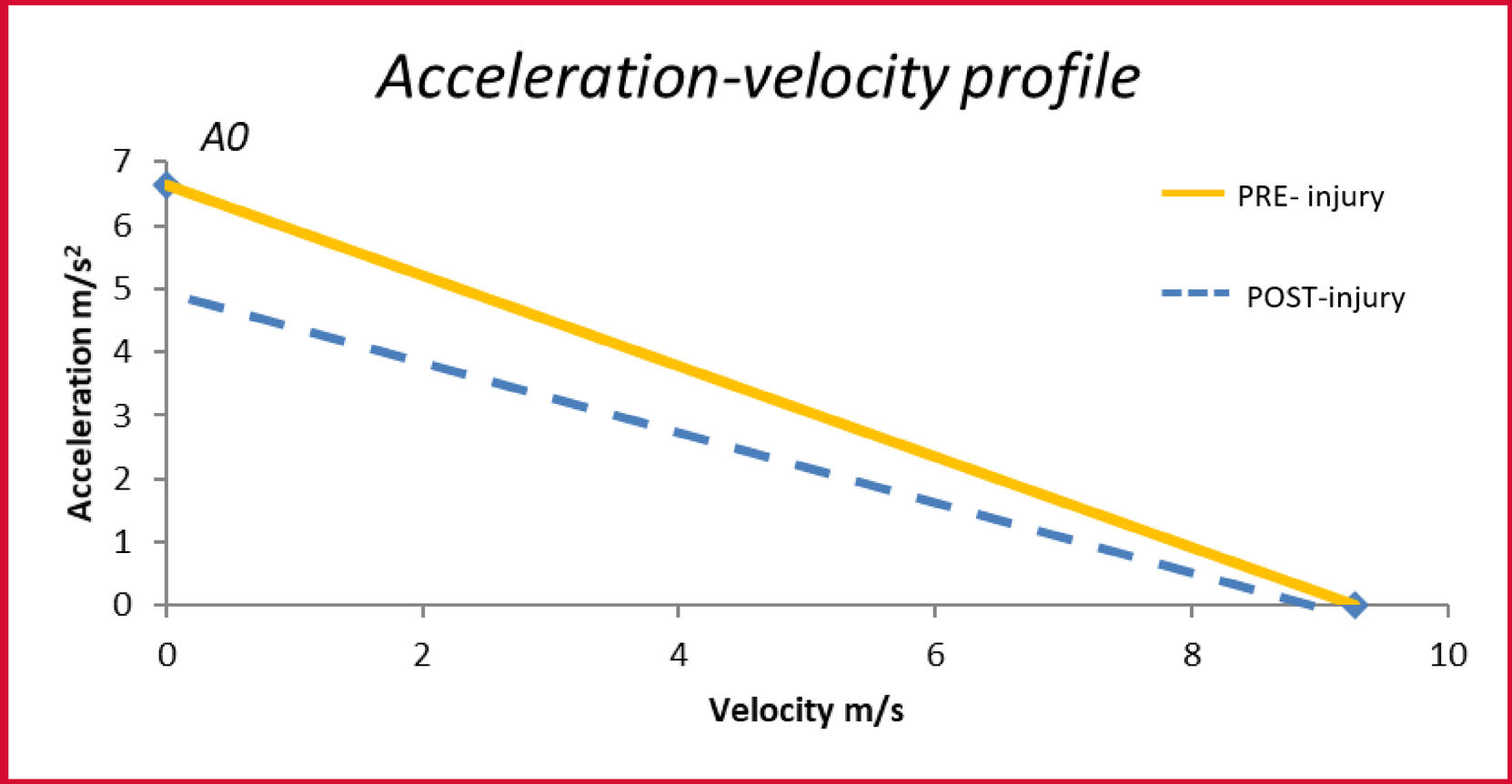
1. Sovrapporre tracce di velocità….



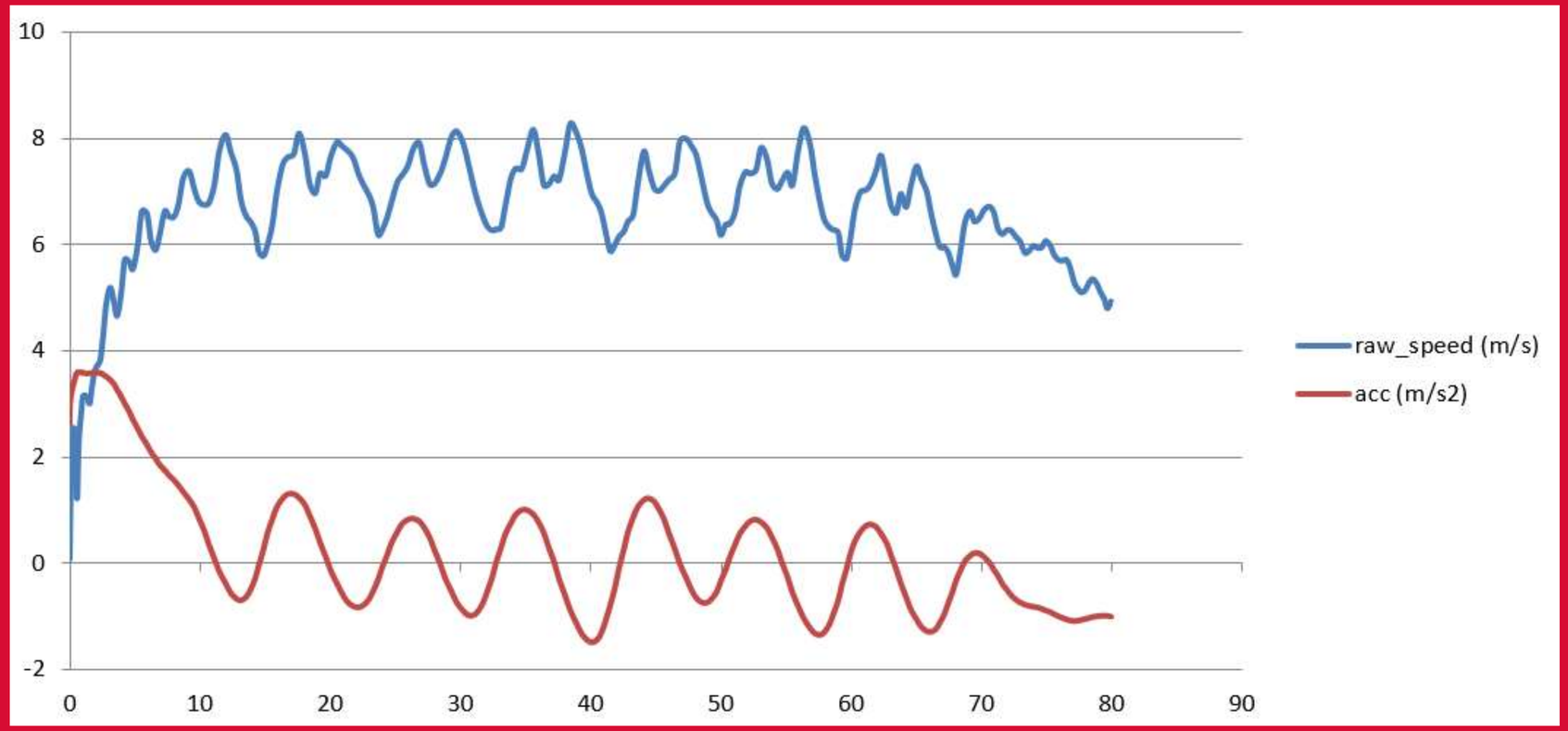
1. La relazione Acc-Vel di diversi periodi



Possibili sviluppi…

1. L’andamento della velocità negli bassi ed alti…
2. Velocità di ingresso e rincorsa nel salto in lungo…

3. Sviluppi: la velocità negli ostacoli



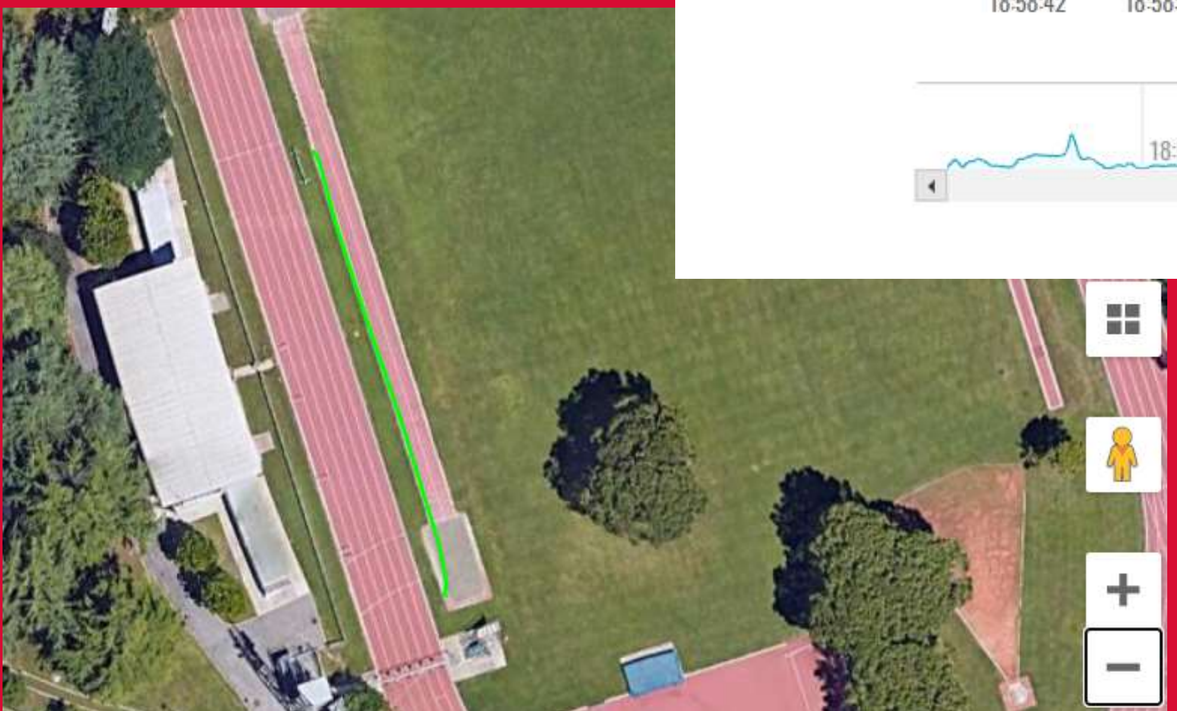
Primi 7 ostacoli dei 110hs

3. Sviluppi: la velocità negli ostacoli

I primi 5 ostacoli dei 400hs

2. Velocità di ingresso e rincorsa salto in lungo?

[Salto in lungo]



Conclusioni

- Il dispositivo GPS a 20Hz rappresenta certamente un valido strumento per misurare la velocità istantanea nelle diverse distanze nello sprint
- E’ pratico da utilizzare poiché non necessita di praparazione sul campo
- Attraverso la web si hanno interessanti dati di sintesi, come la vel e acc massime raggiunte e tempo e distanza oltre a velocità e acc di soglia impostate
- Permette di ottenere velocemente la relazione Acc-Vel dell’atleta
- Potrebbe avere applicazioni anche in altri ambiti (ostacoli, salto in lungo…)
- E’ necessario verificare la qualità della ricezione


GRAZIE