The Biomechanical Project at the Atlanta Olympic Games 1996

Sponsored by the International Track and Field Coaches Association

by Gideon Ariel, Ph.D. Wingate Institute, December, 1996

History was made at the Atlanta Games by utilizing the Internet to provide Biomechanical data immediately for use at remote sites

The purpose of the research conducted at the XXVI Olympiad in Atlanta was to expand the biomechanical applications and the interactive capabilities of the Internet to make sport performances rapidly available to everyone

Under the auspices of the International Track and Field Coaches Association, the track and field events which were performed at the Atlanta Olympics in 1996, were selected to illustrate these procedures because these activities uniquely captivate an enthusiastic world-wide audience

- **Because of the strict accessibility to the field for security reasons, special locations had to be chosen and guarantee for setting video cameras.**
- **The main goal in the present study was to be able to load the data in to the Internet at the fastest time, so scientists, students and any interest group will be able to download the video and other data immediately from the Internet.**

- **The purpose of the present study was to analyze Track and Field performances in the Atlanta 1996 Olympic Games.**

- **This was a new and innovative procedure that allows immediate sending of video information all around the world for immediate analysis at different locations**

A BIOMECHANICAL STEP ONTO THE INTERNET

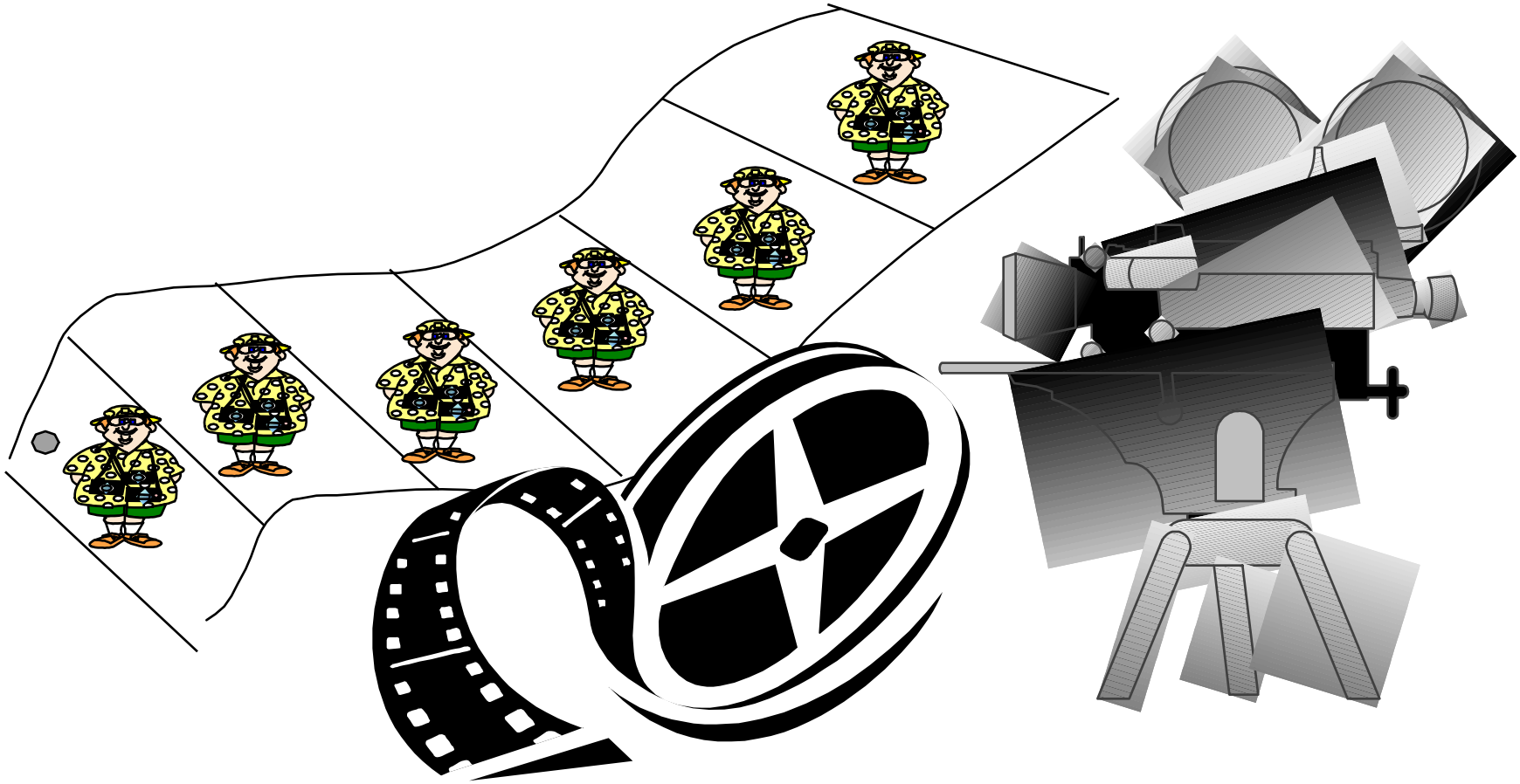
It is a window on the ever-expanding world of on-line information. The new communication links afforded by rapid satellite/computer exchanges bringing together hypertext multimedia and global networking. The Web is growing at an astounding rate and is changing the scientific world by making it possible for anyone to transmit and receive information around the world.

hj1.avi

disk1.avi

The Early 70's

use of high speed cinematography



American Medical
NEWS

An Informed Membership
Is Our Greatest Strength

AUGUST 1, 1977

MD aims to improve nation's health using Olympic athletes as 'walking fitness labs'

Vascular surgeon Bardik (left) and computer scientist Ariel are collaborating at the Squaw Valley Sports Medicine Center to learn more about physical fitness using unique specimens—Olympic athletes.

By Patty Ann

the three of them won the AMA's Hektoen Gold Medal last year.

Squaw Valley, with two goals in mind: to help Olympic-caliber athletes learn more about their bodies and improve the physical fitness of the nation.

"People ask me, why do you do this thing? As a vascular surgeon, how do you fit? An orthopod, yes, but a vascular surgeon?

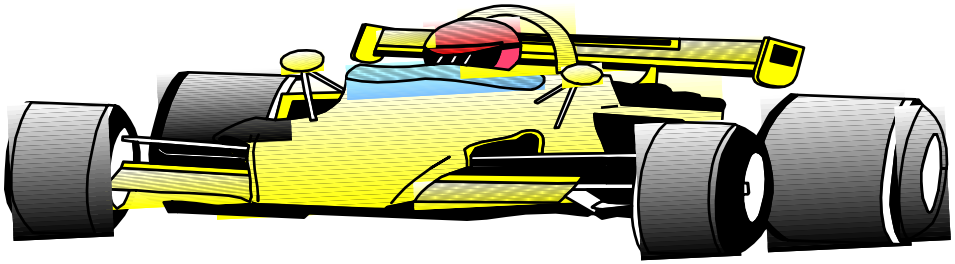
"I treat people with coronary disease, and I work with bypass patients, which is sort of seeing the end of the spectrum of physical fitness. And here are these athletes, who are the best physiological specimens we can produce in this country, and I think somehow we can evaluate the process in physical fitness and use it to our advantage.

"THESE OLYMPIC athletes, these are ordinary people. Ordinary people who have talent. And they need to train and learn to live with that talent. We can learn so much from them."

Housed in the ghost town of dormitories and offices left over from the 1960 Winter Olympics at Squaw Valley, the Olympic Training Center is a busy and

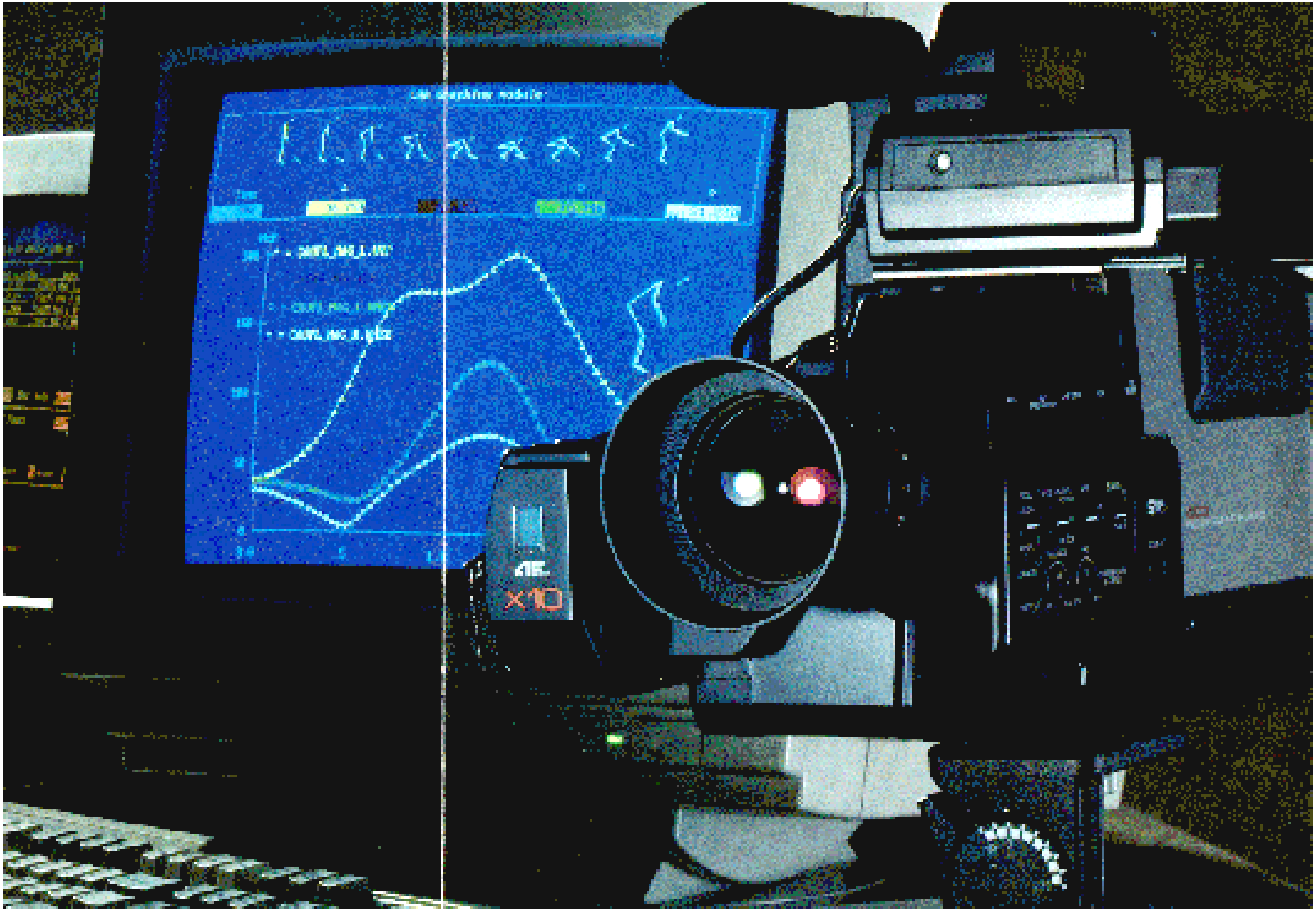
NEW TECHNOLOGIES

For Your Professional Toolbox

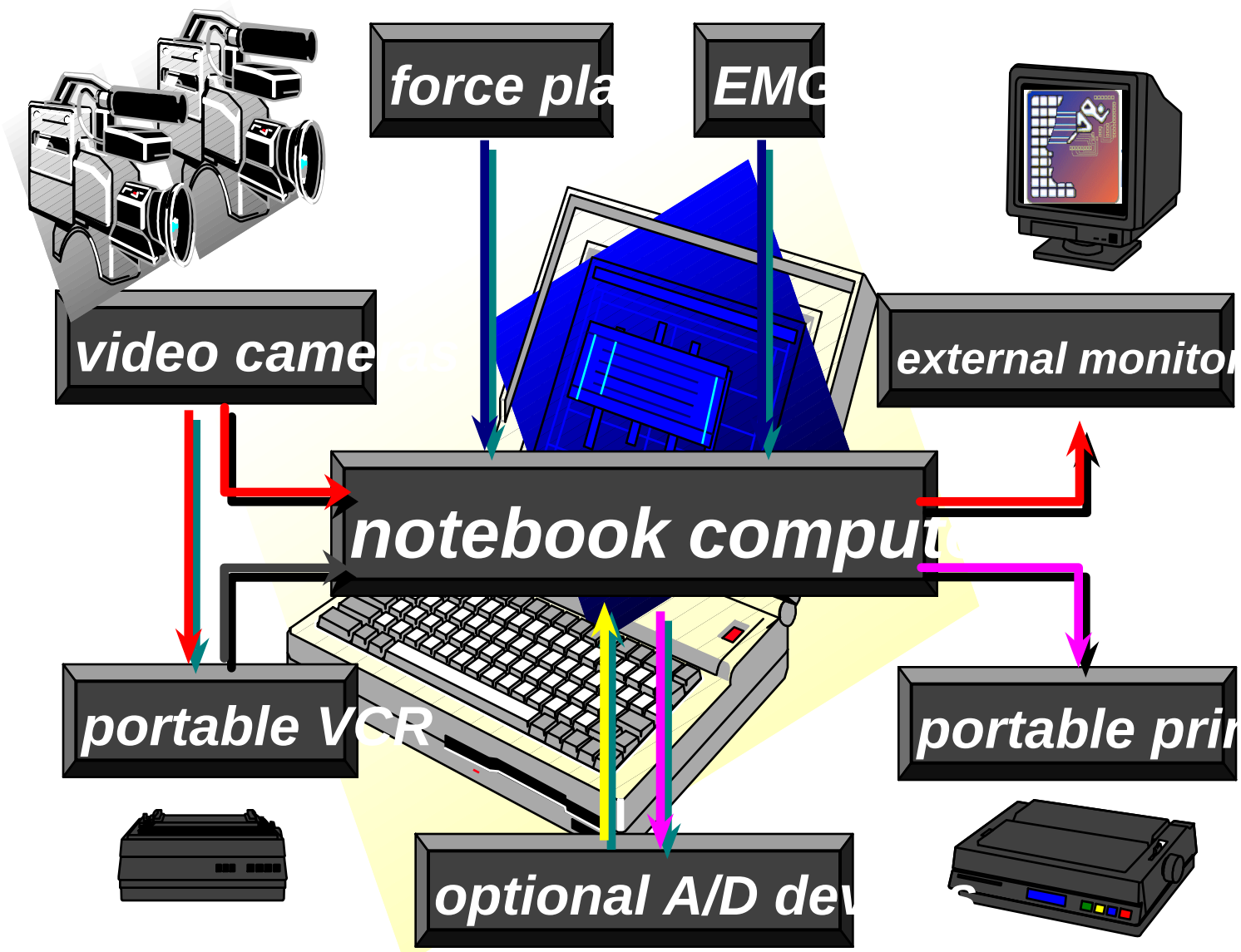


- Computerized Video Analysis [Kinematics]
- Force Plate [Kinetic Ground Reaction] 3D
- Dynamic EMG
- Internet Interface

ALL APPLICATIONS UTILIZED SIMILAR QUANTIFICATION TECHNIQUES

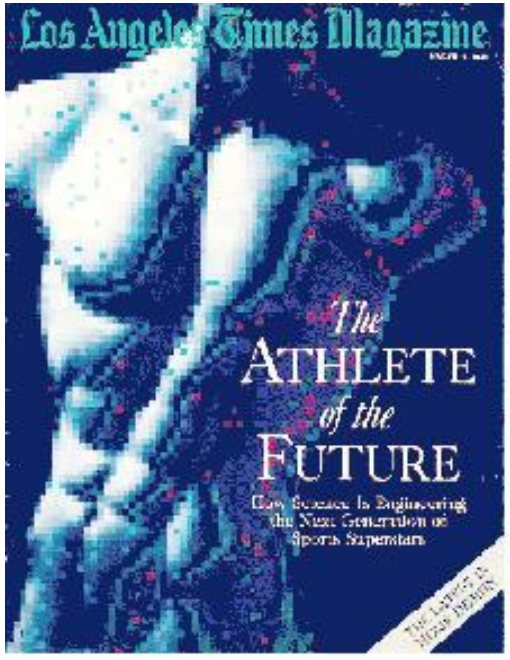


Basic Components of Motion Analysis System



Analysis of Performance Require:

- **Video Recording**
- **Digitizing the Data**
  - **Manual**
  - **Automatic**
- **Transformation of the Data**
  - **2D - Two Dimensional**
  - **3D - Three Dimensional**



KINEMATIC PROCESSING STEPS

- DATA ACQUISITION
- FRAME GRABBING
- TRANSFORMATION
- SMOOTHING
- DATA ANALYSIS

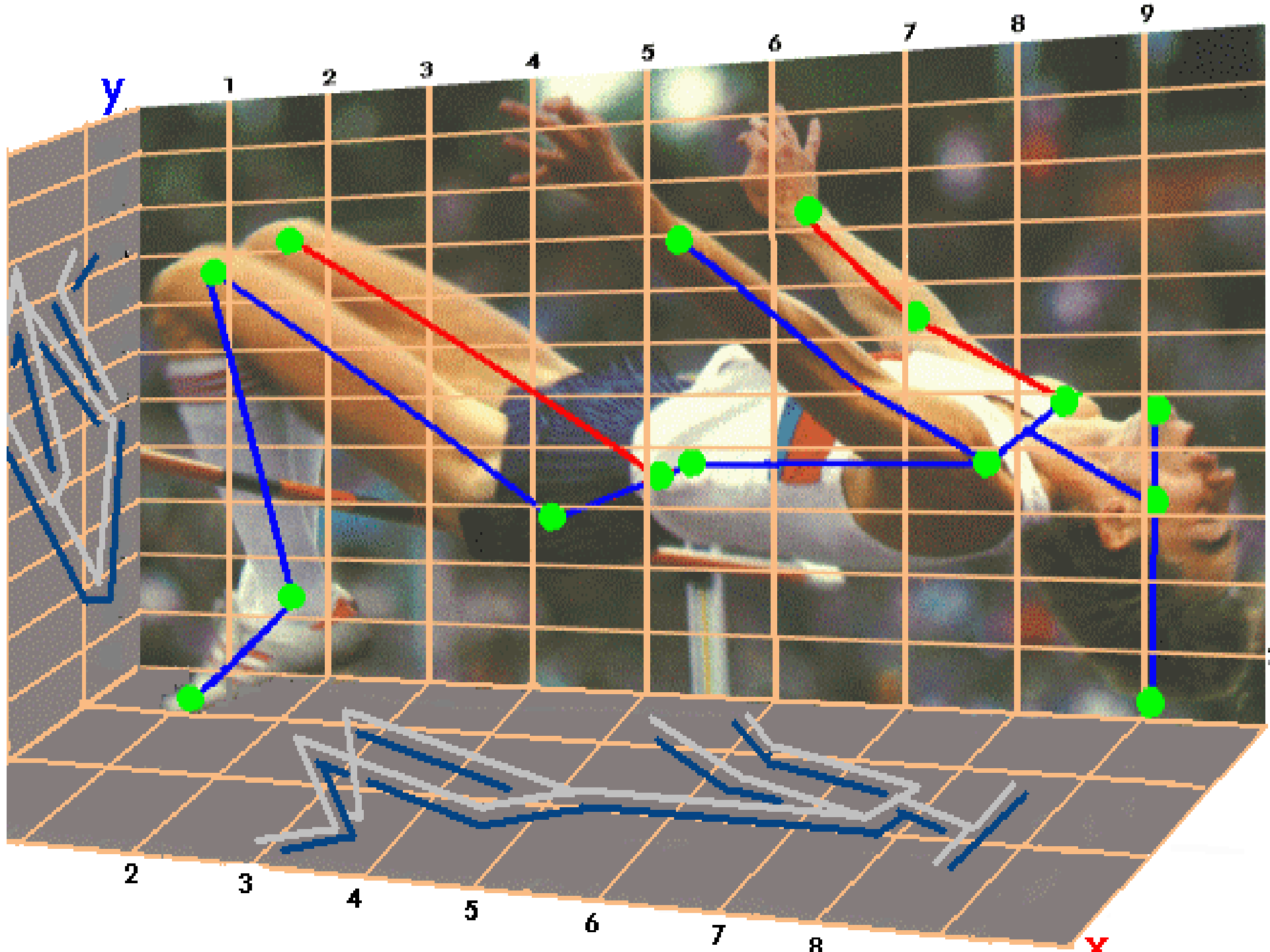
Video Recording
and
Digitizing the Data

Louis1.avi

Reidel Gold Medal

Ridel_rear_adi.avi

reidelside.avi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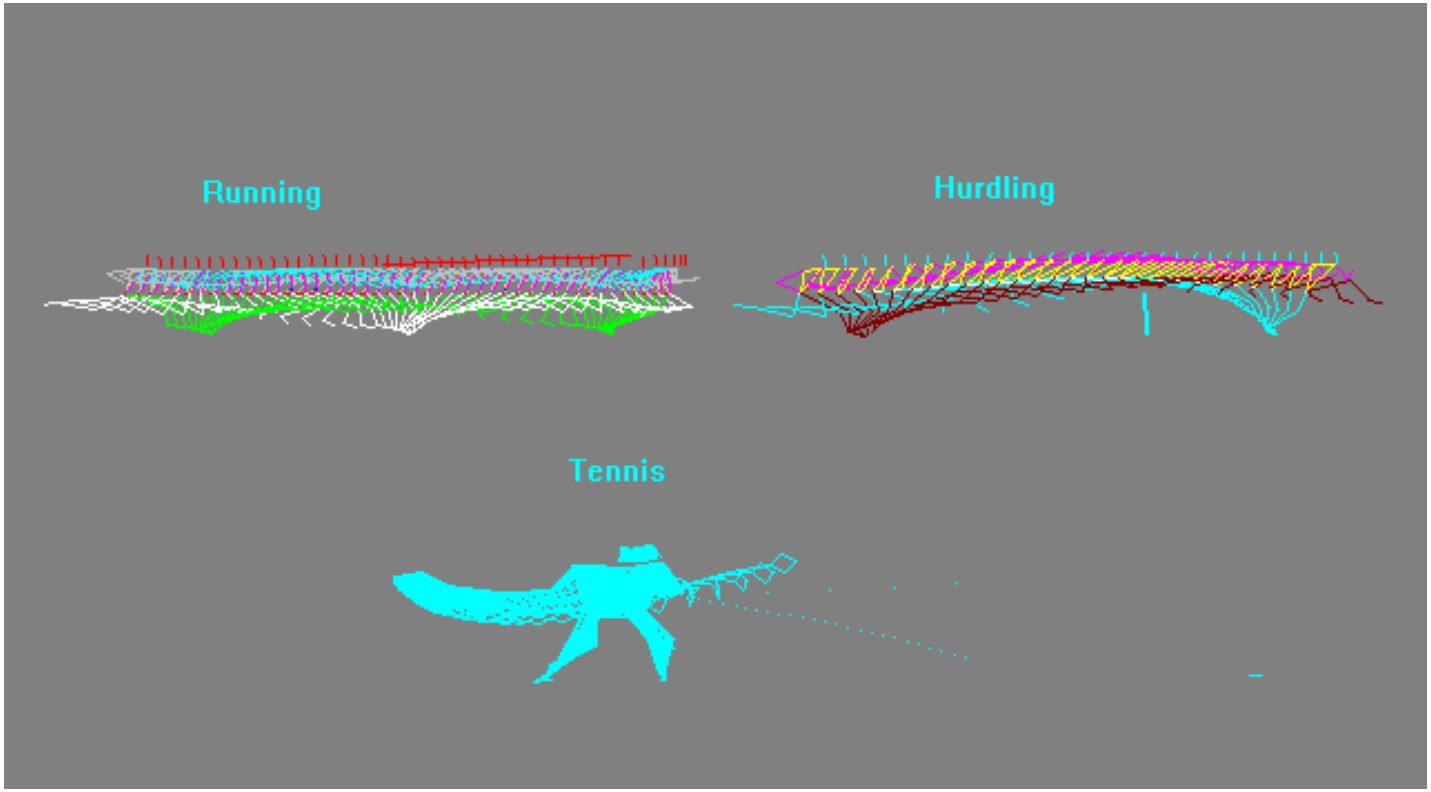
Athletic performances can be divided into a wide spectrum of activities.

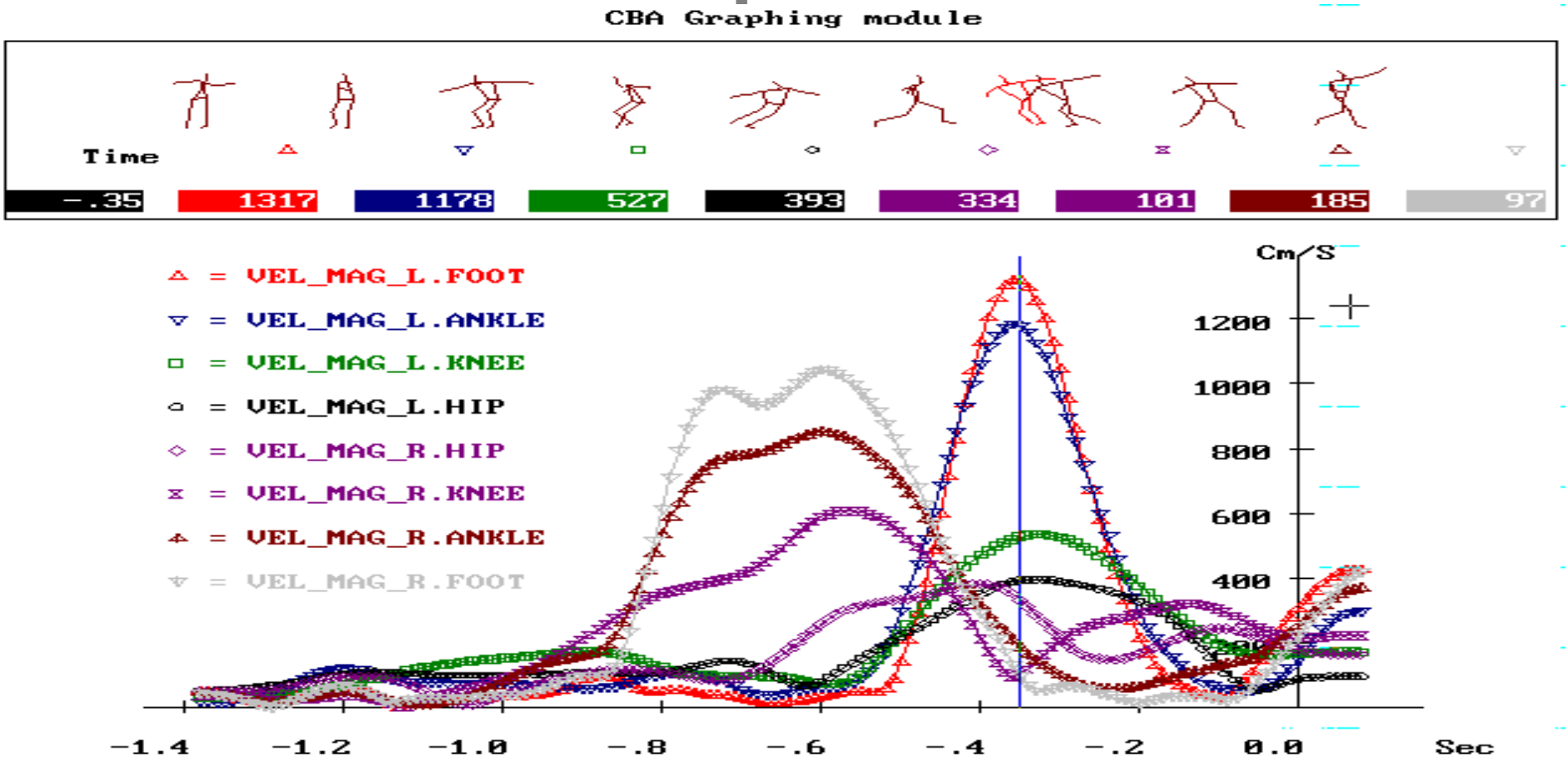


Video of Activities

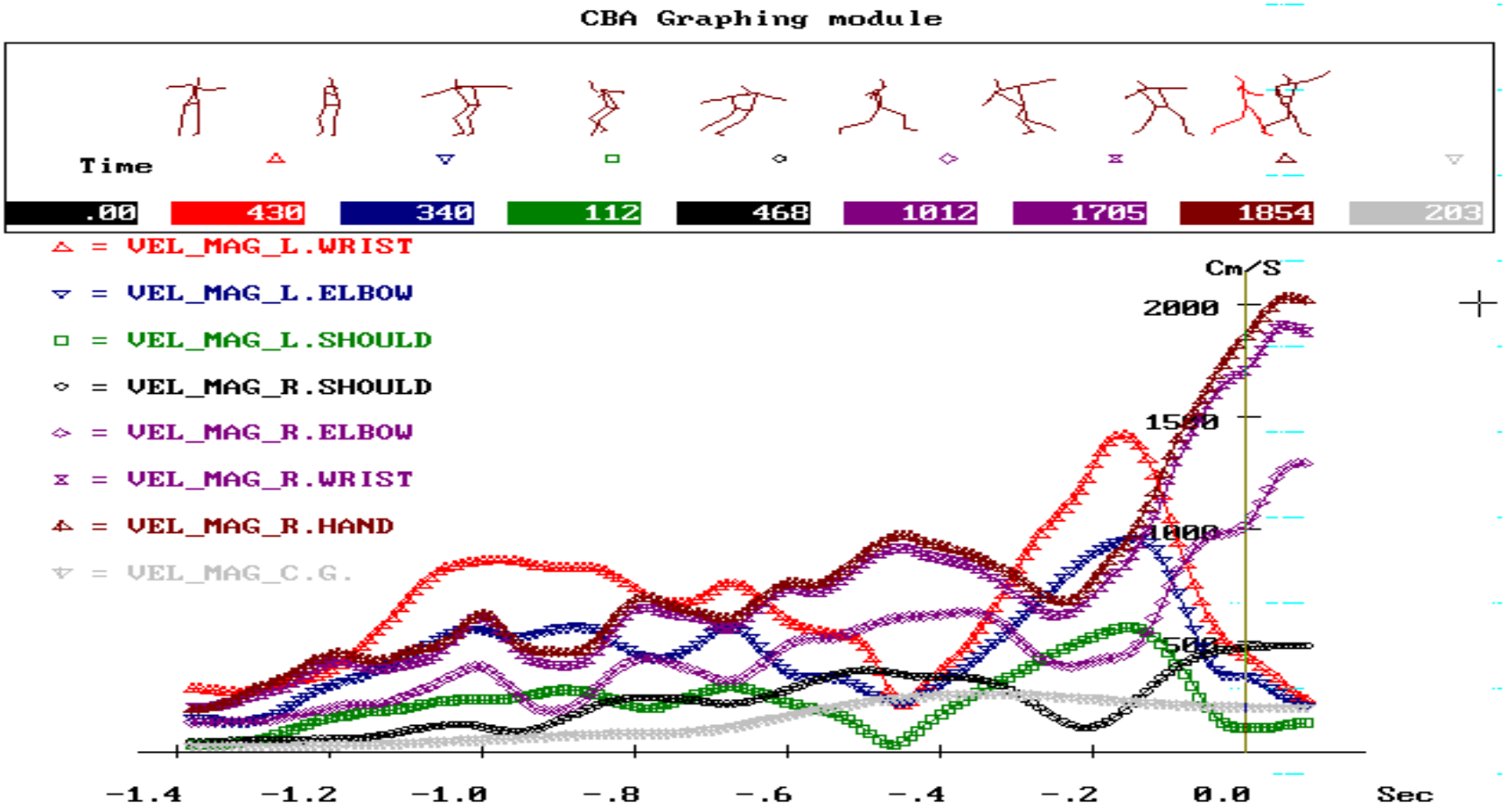
- Explosive Events
  - Throwing
  - Sprinting
  - Jumping
- Endurance Events
  - Long Distance Running
  - Swimming
  - Cycling

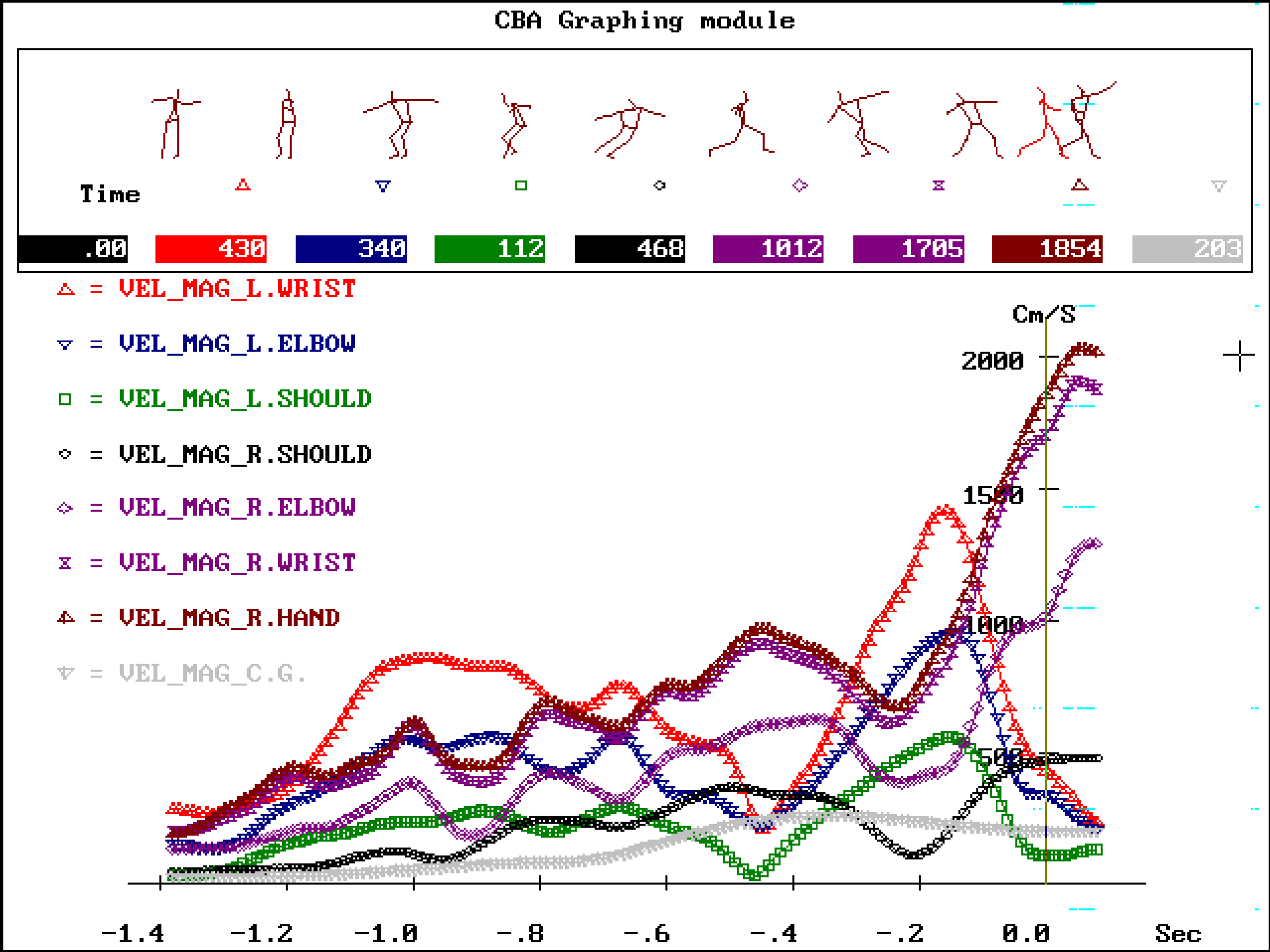
- Esthetic Events
  - Figure Skating
  - Diving
- Team Sports
  - Soccer
  - Basketball
  - Ice Hockey
- Accuracy Events
  - Archery
  - Shooting
  - Golf

Calculating the Velocities of the lower limb revealed acceleration and deceleration patterns in a unique sequence



Observing the upper extremities reveals a pattern as well.




CBA Graphing module
Time
.00
430
340
112
468
1012
1705
1854
203
△ = VEL_MAG_L.WRIST
▽ = VEL_MAG_L.ELBOW
□ = VEL_MAG_L.SHOULD
◇ = VEL_MAG_R.SHOULD
◇ = VEL_MAG_R.ELBOW
⧖ = VEL_MAG_R.WRIST
△ = VEL_MAG_R.HAND
▽ = VEL_MAG_C.G.
Cm/S
2000
1500
1000
500
-1.4
-1.2
-1.0
-.8
-.6
-.4
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0.0
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Enter Root Filename [8 Chars]

Filename: dub2vel

Enter-Select

CBA Graphing module

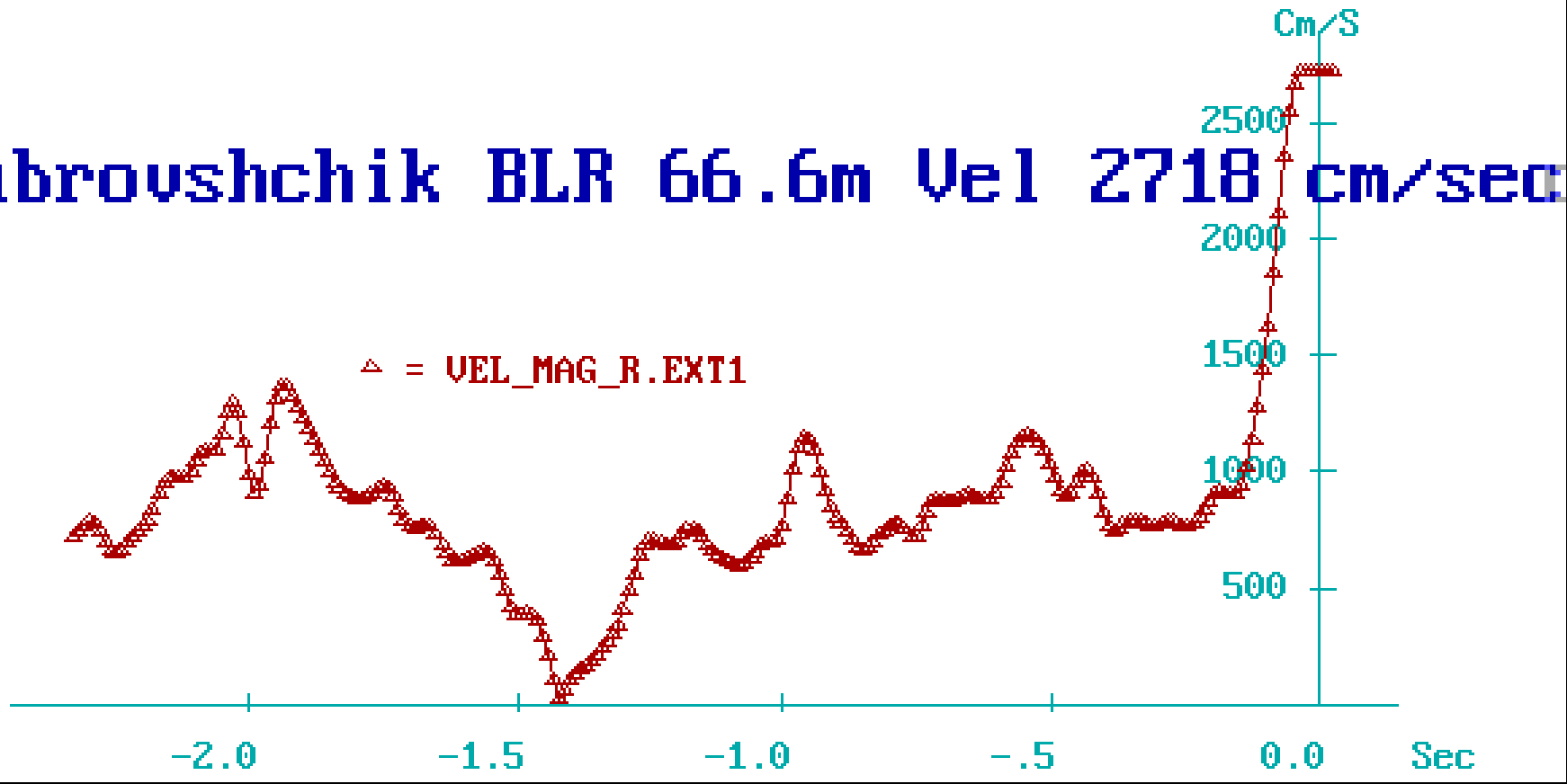
Time

-.003

△

2718.419

Dubrovshchik BLR 66.6m Vel 2718 cm/sec



File Exists

Replace Keep

F10-Quit

CBA Graphing module

Time

-.046

△

2126.684

2484.85

Cm/S

△ = VEL_MAG_R.EXT1

Washington 65.42m

2500

2000

1500

1000

500

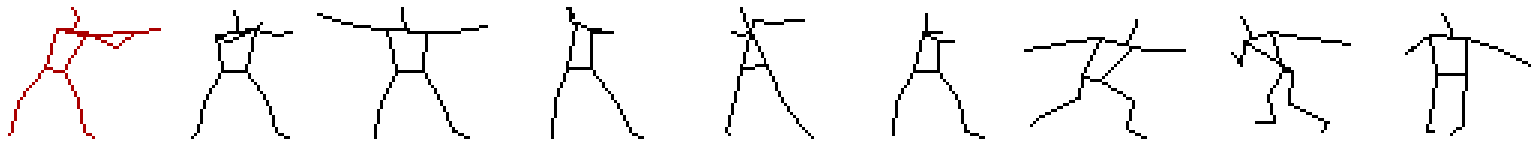
-1.8 -1.6 -1.4 -1.2 -1.0 -.8 -.6 -.4 -.2 0.0 Sec

Enter Root Filename [8 Chars]

Filename: r_momnt

Enter-Select

CBA Graphing module



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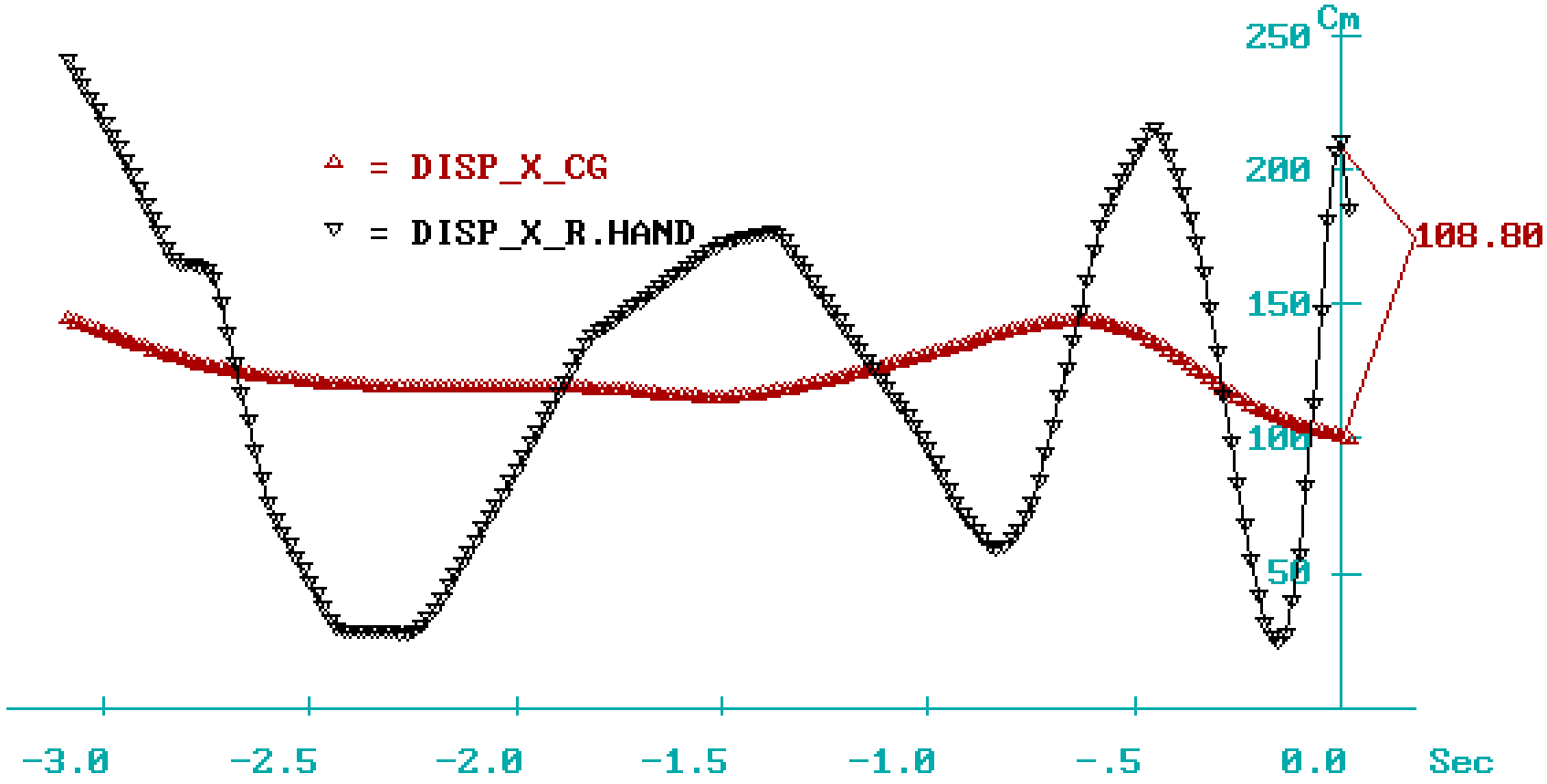
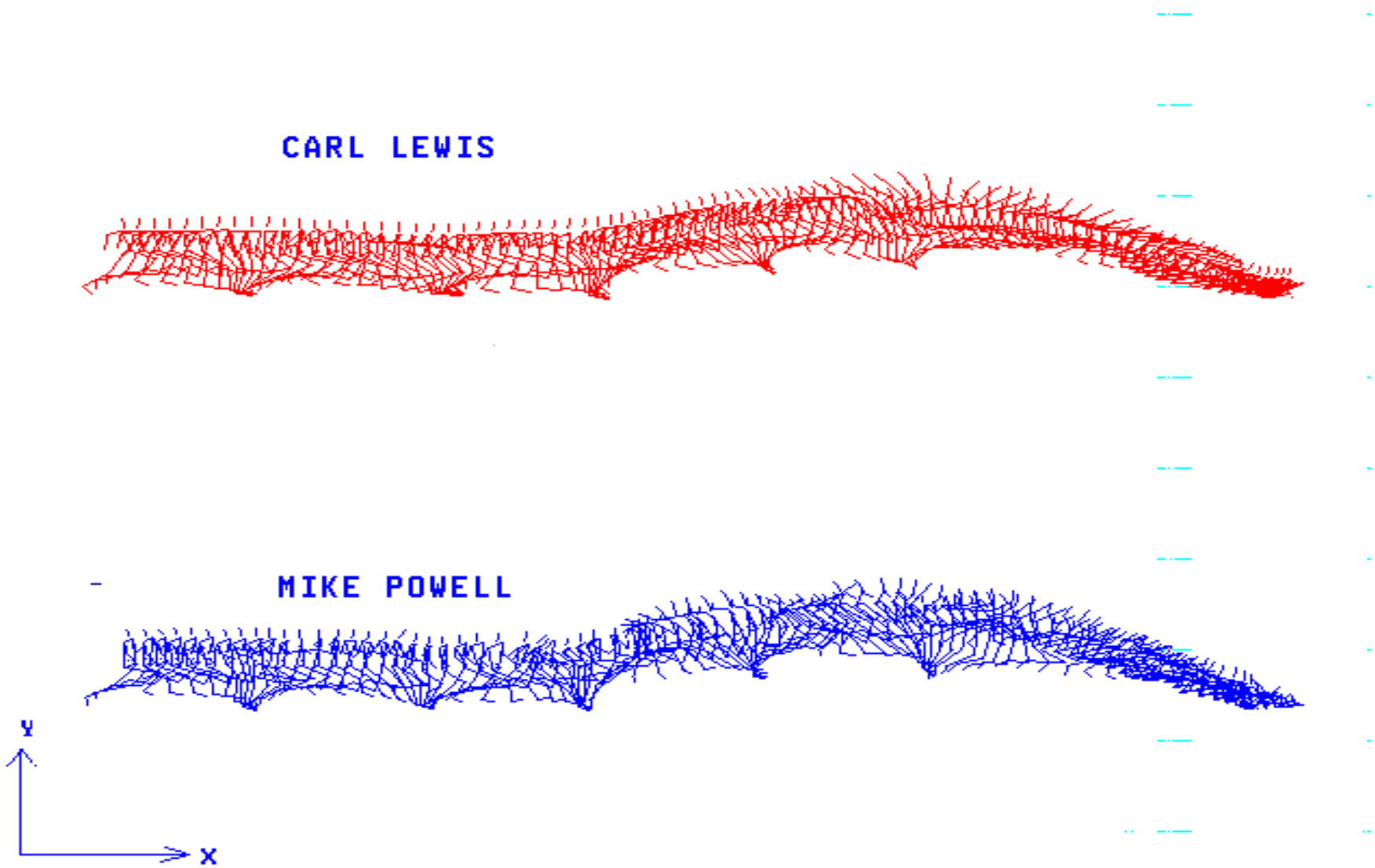
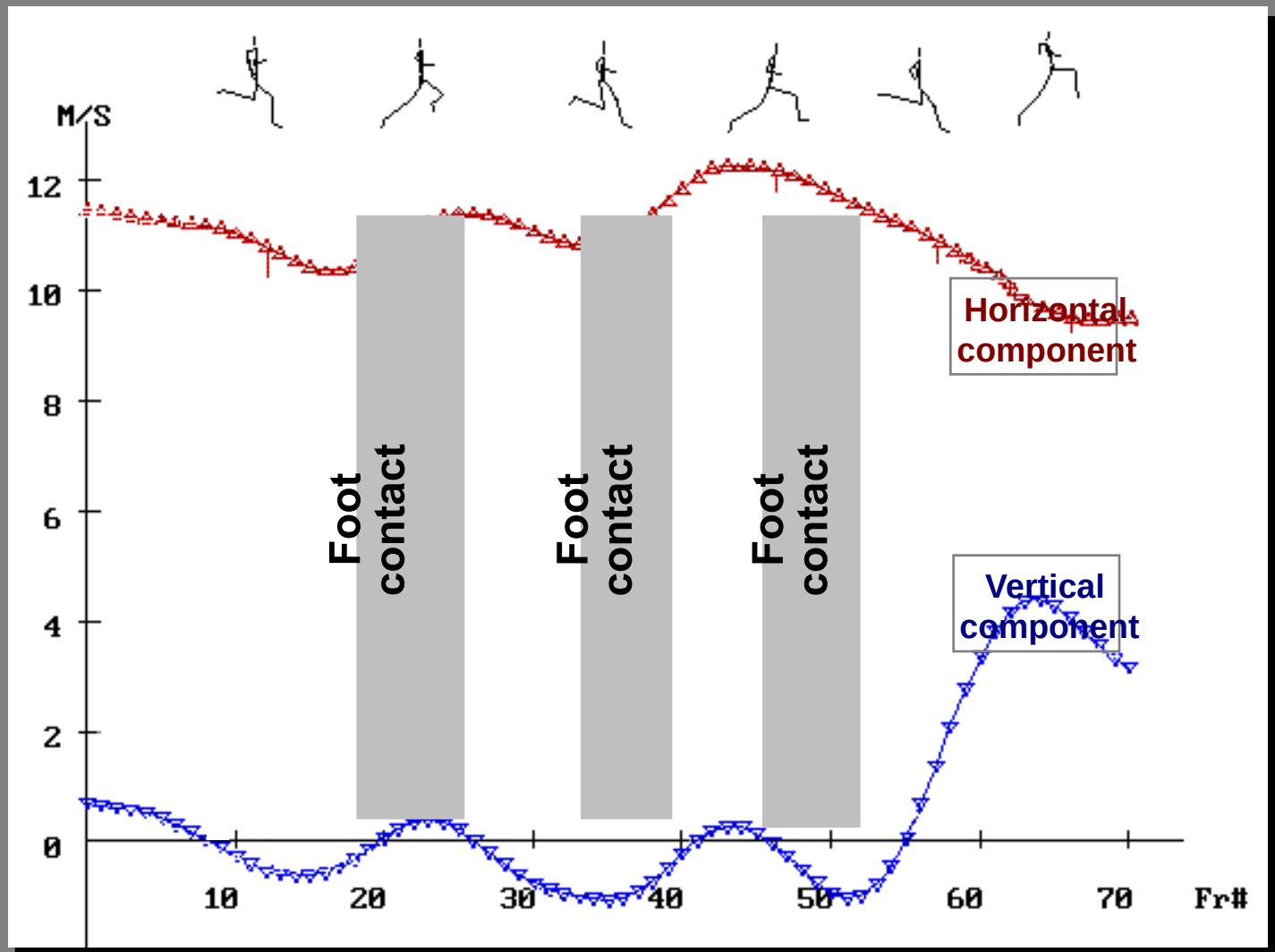


THE CASE OF THE LONG JUMP:

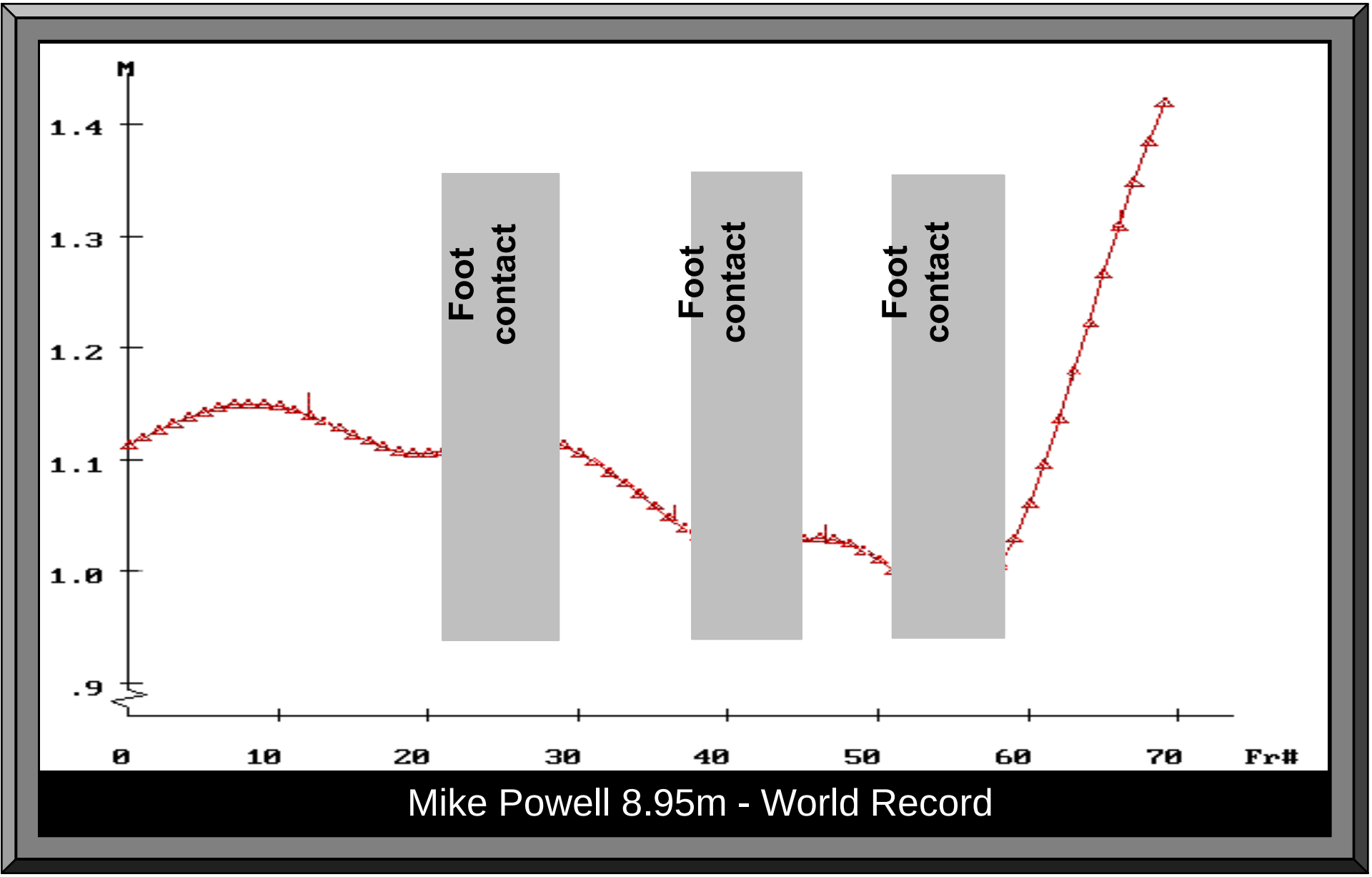


Velocity of the Center of Mass



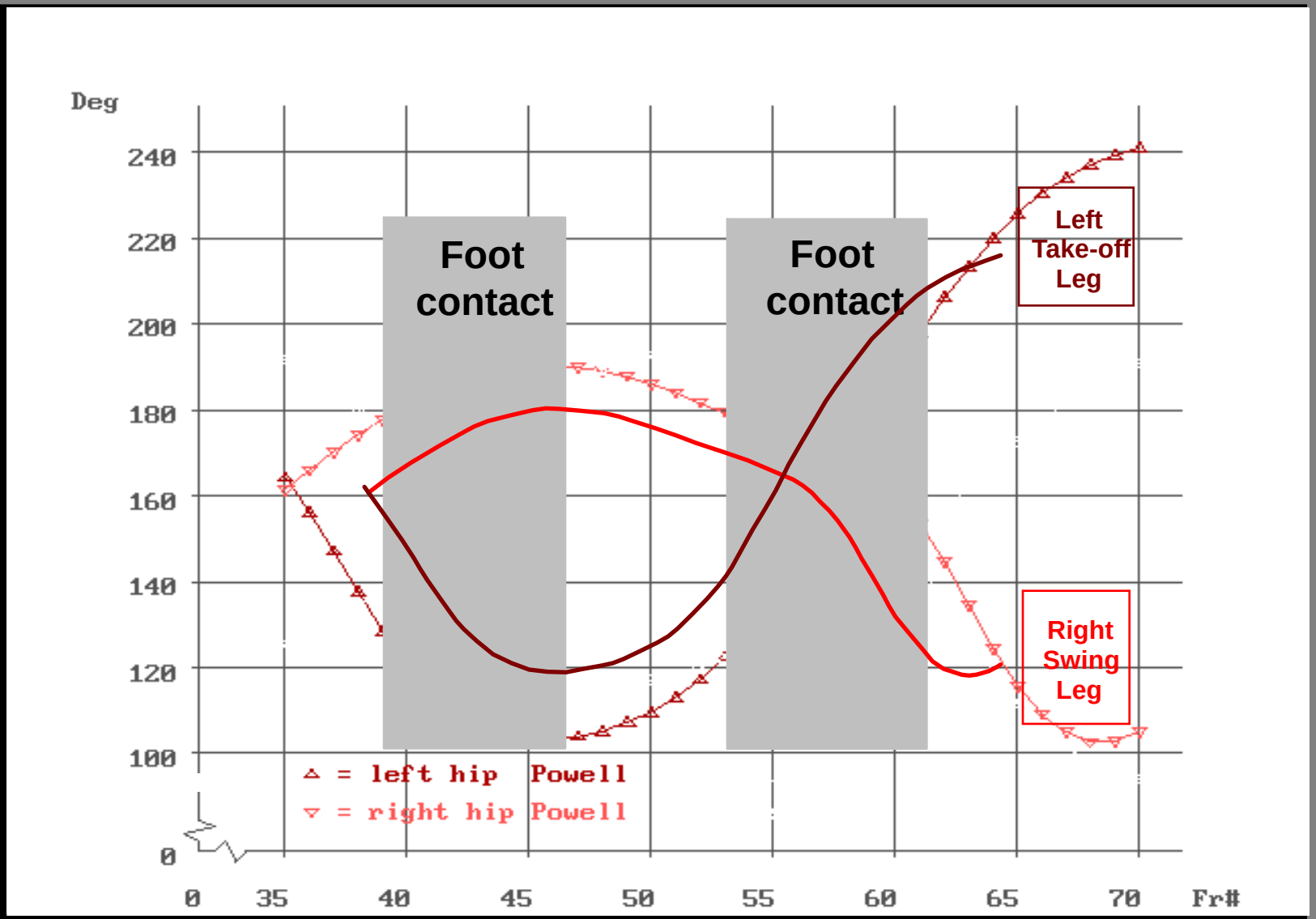
Mike Powell 8.95m - World Record

Height of the Center of Mass



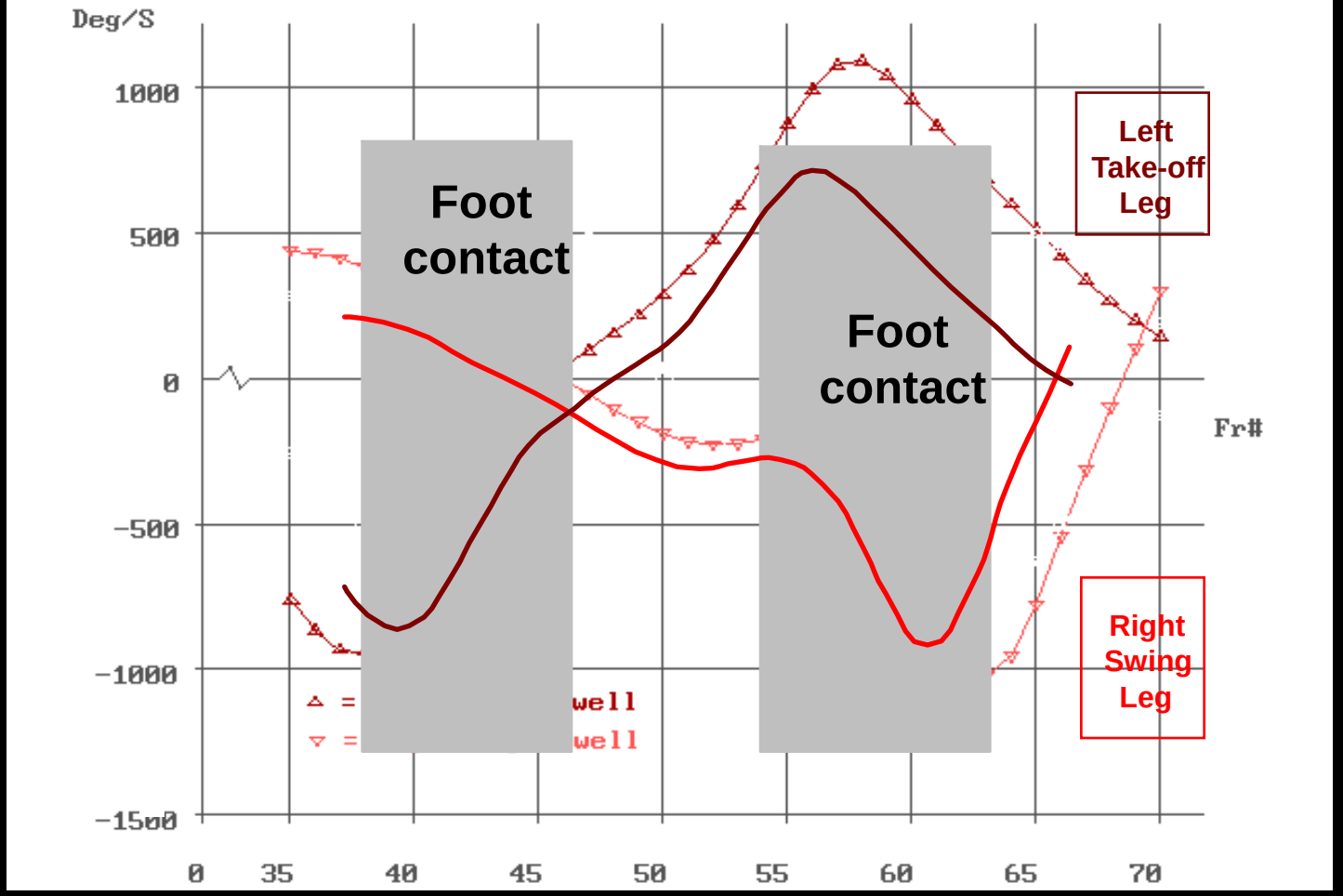
Mike Powell 8.95m - World Record

Angular Displacement in Hip Joints



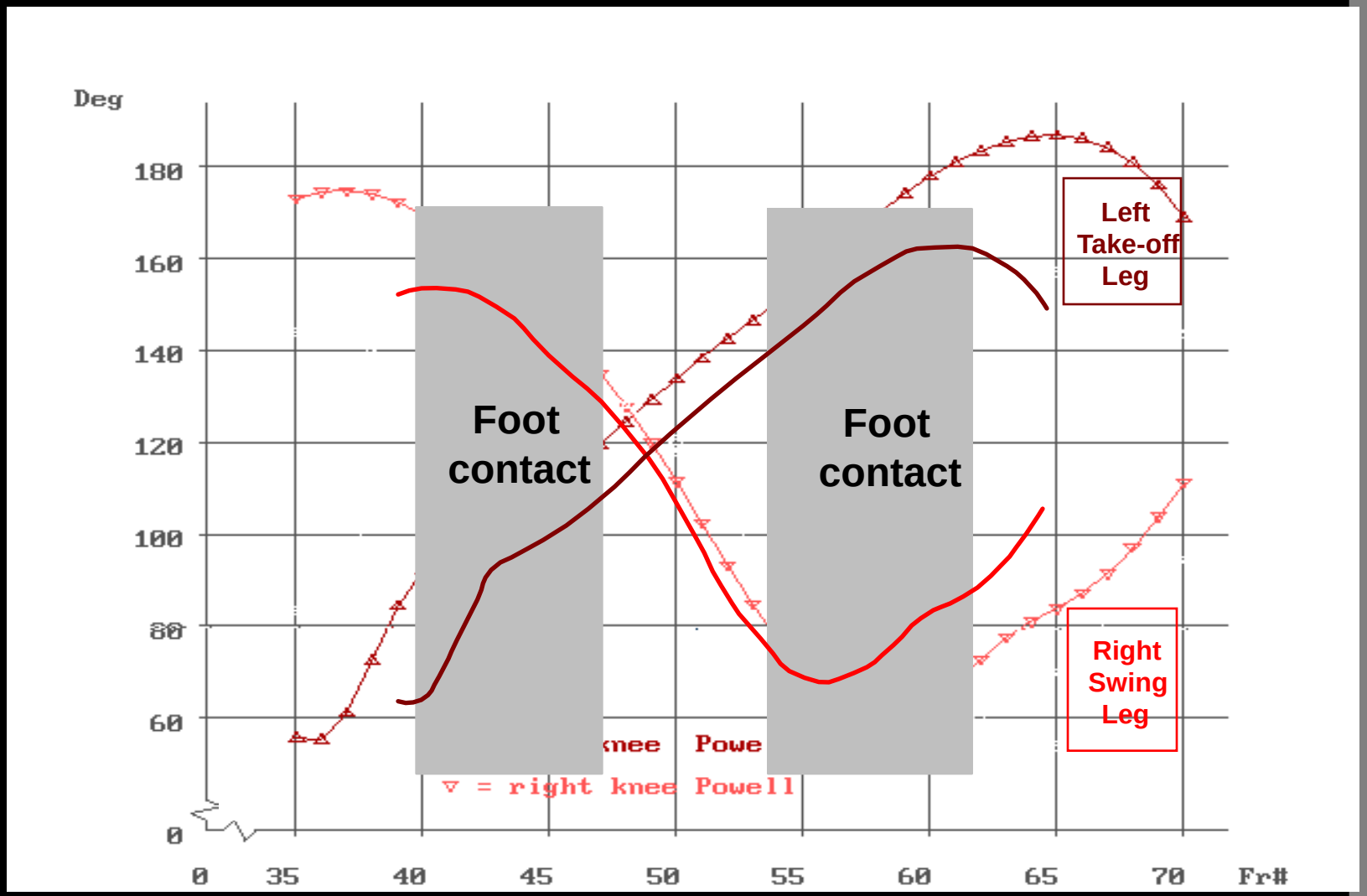
Mike Powell 8.95m - World Record

Angular Velocity in Hip Joints



Mike Powell 8.95m - World Record

Angular Displacement in Knee Joints



Mike Powell 8.95m - World Record

The Internet has opened a new frontier for research and international cooperation on multifaceted studies.

Essentially, in Internet terms, the entire process consists of the following steps:

- Analog video data is captured off-site and off-line through the use of a frame-by-frame advance VCR.
- Analog video data is converted off-site and off-line to digital video data in AVI format.
- Digital video data in AVI format is transmitted via FTP from a remote PC (browser) to a web server.

- **The web server, converts the AVI frames into individual GIF files.**
- **The web server, through CGI, super-imposes the x,y,z coordinates on the video images.**
- **The web server sends back the processed (digitized) image frames back to the remote PC (browser) with all pertinent mathematical and physical observations, analysis, and conclusions.**

Utilizing the tools available in Cyberspace, the Biomechanist, The Coach and the Sport Scientist can retrieve and display data as well as documents from virtually anywhere on the planet. Studies can be conducted at multiple locations and data rapidly exchanged among these sites.

The Cyber Coach

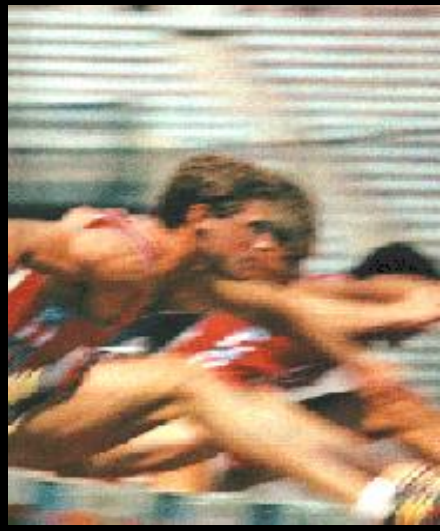
Hammer1.avi

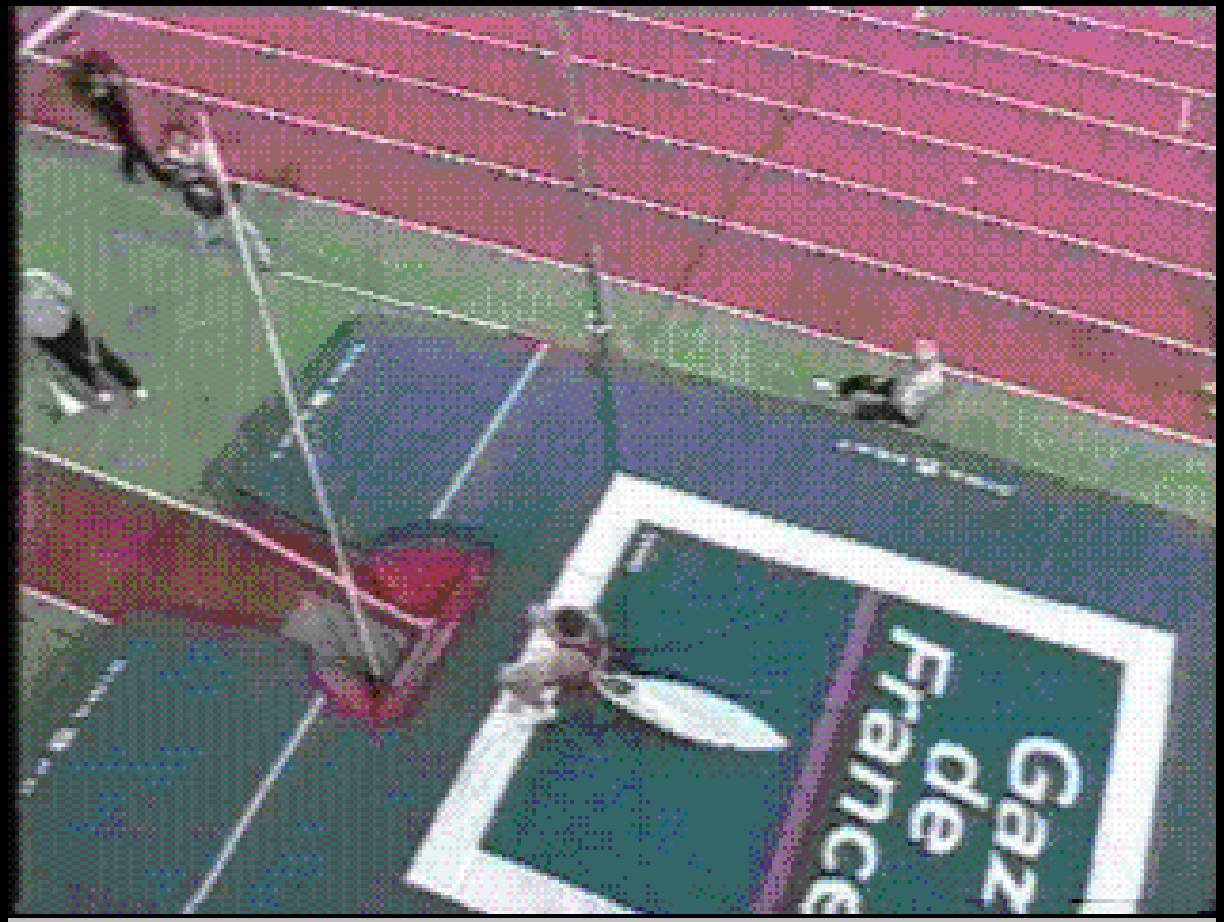

200 m
19.32
USA
2370
MIKE BLAKE/REUTTERS


3478
3298
Ross Kinnaird/Allsport

run1.avi

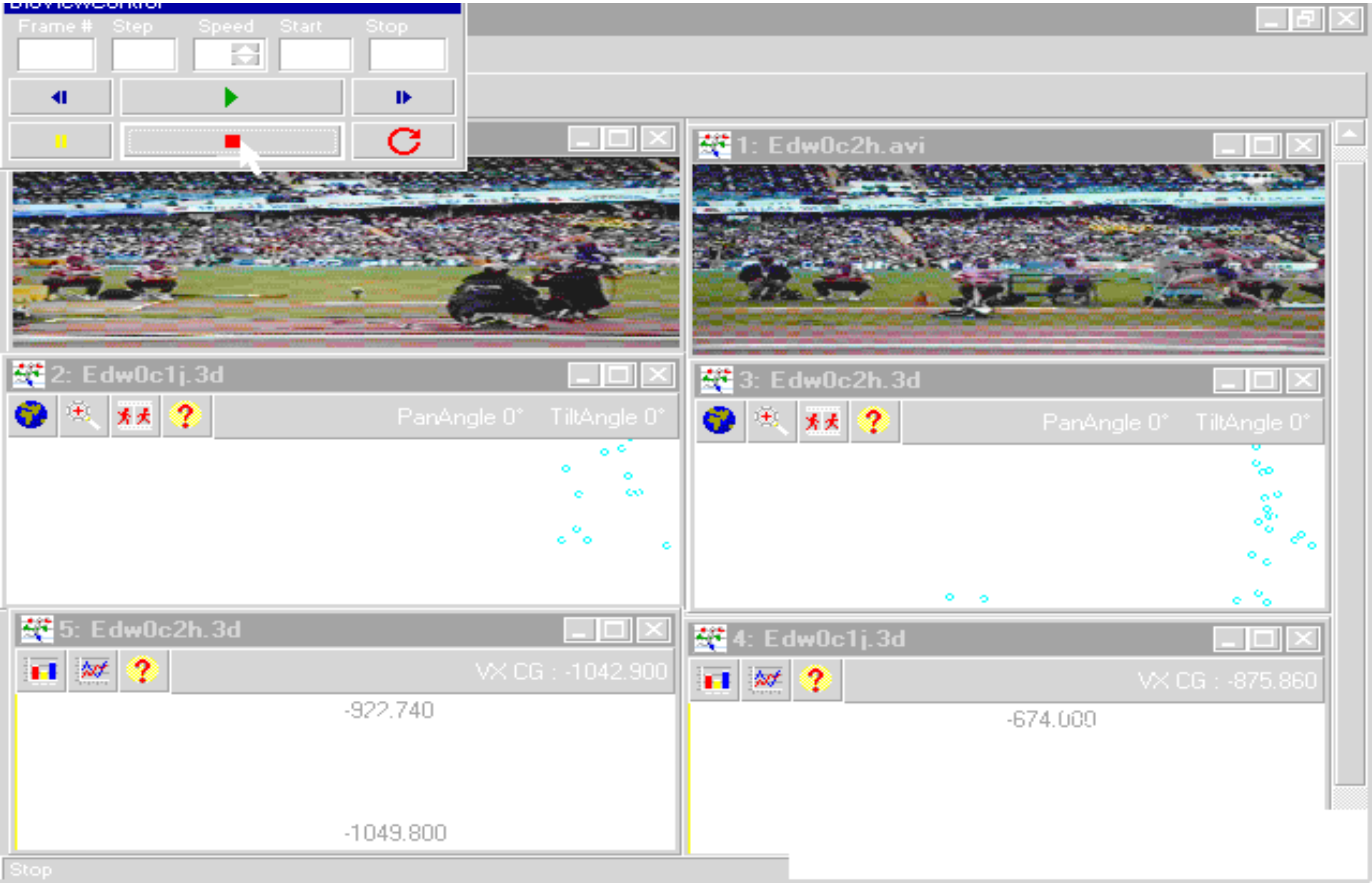
hrdle1.avi





PV1.avi

Bioview


Frame #
Step
Speed
Start
Stop
1: Edw0c2h.avi
2: Edw0c1j.3d
PanAngle 0°
TiltAngle 0°
3: Edw0c2h.3d
PanAngle 0°
TiltAngle 0°
5: Edw0c2h.3d
VX CG : -1042.900
-922.740
-1049.800
4: Edw0c1j.3d
VX CG : -875.860
-674.000
Stop

MISSION IMPOSSIBLE:

The Biomechanical Project of the XXVI Olympics at Atlanta in 1996

http://www.sportscience.com

THANK YOU