

The Ariel Performance Analysis System (APAS)



By

Gideon Ariel, Ph.D.

MOVEMENT ANALYSIS CAN BE APPLIED TO:

Athletics

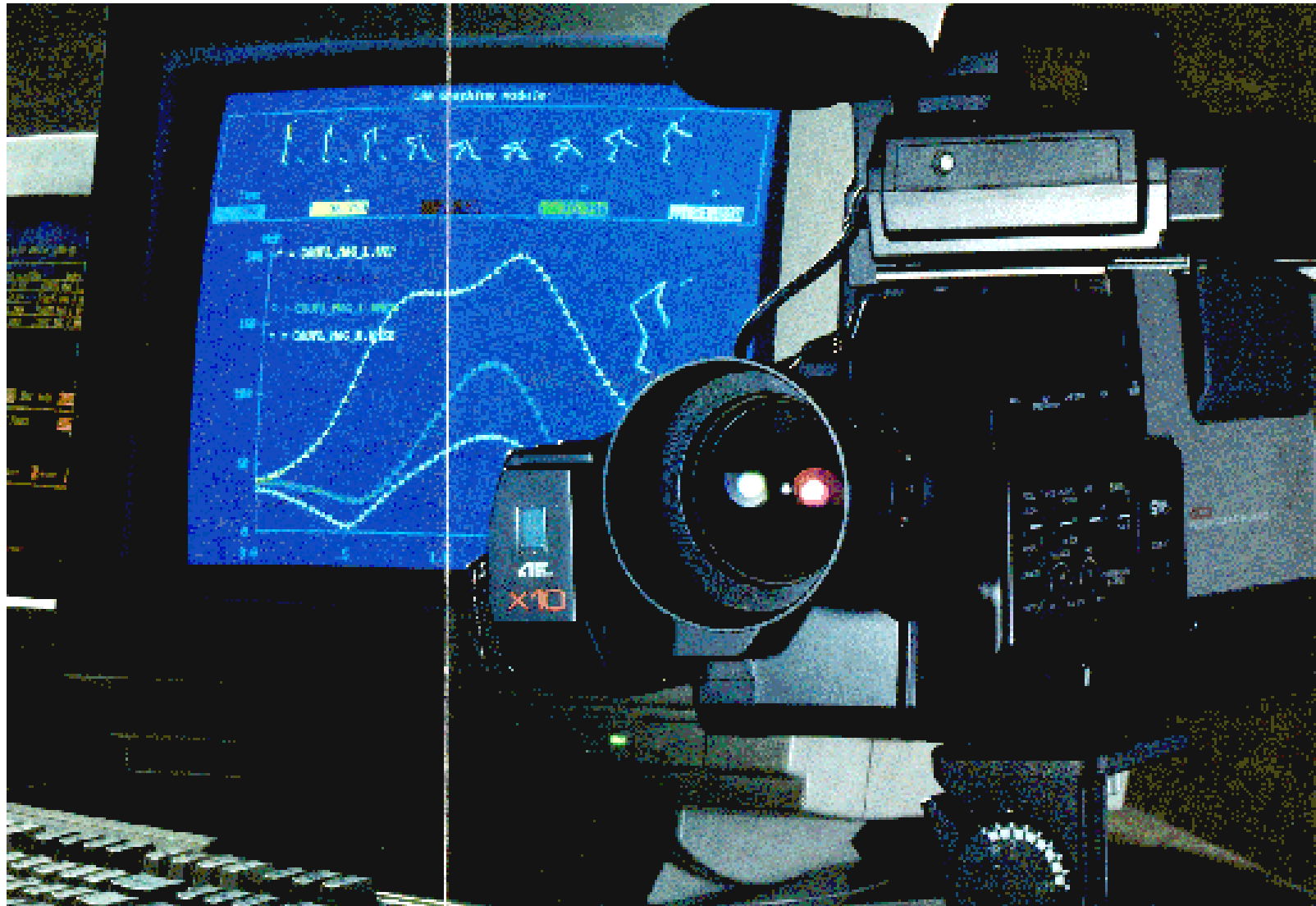
Industry

Medicine

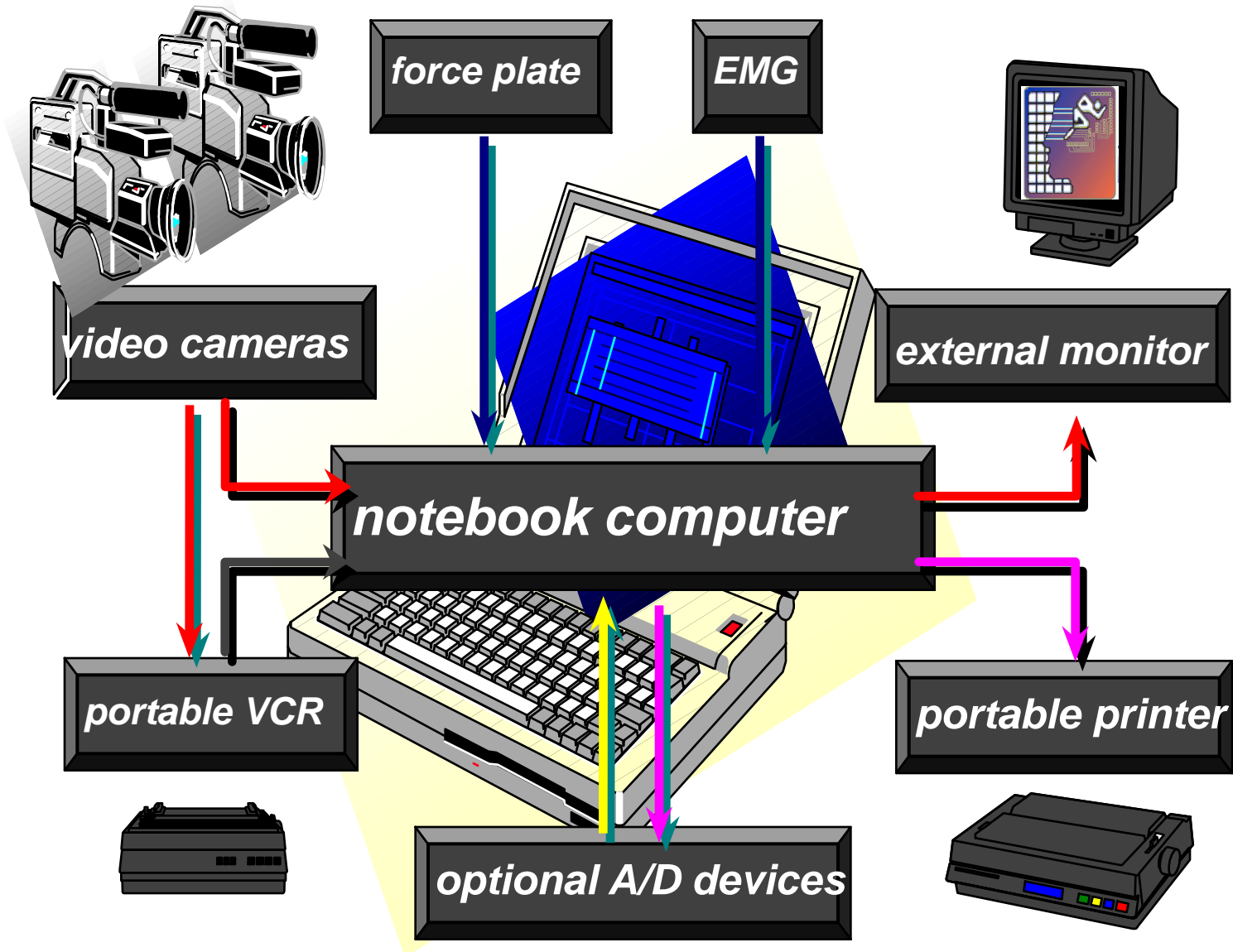
Space



ALL APPLICATIONS UTILIZED SIMILAR QUANTIFICATION TECHNIQUES



Basic Components of Motion Analysis System



Ariel Performance Analysis System

Video Capturing

General Biomechanics
Functional Capacity
Gait Analysis
Jobsite Analysis

Functional Capacity

Sports Analysis
Post Injury Evaluation
Job Qualification Testing

Kinematic Studies

Lifting
Standing
Sitting
Ladder Climbing

Squatting
Backload
Stairclimbing
Hand Evaluation

APAS

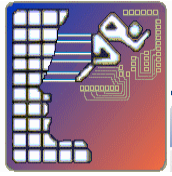
Pre & Post Surgery
Hip Replacements
Knee Replacements
Amputee Gait
Walking Aids
Stroke Patients

Analog A/D Option

Gait Analysis
Balance Analysis
Impact Studies
Prosthetic Design
Neurological Studies

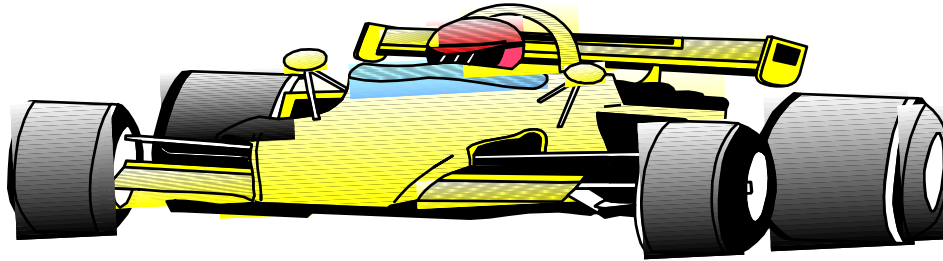
Spine
c.p.
m.d.
m.s.

Carpal Tunnel Syndrome



NEW TECHNOLOGIES

For Your Professional Toolbox



- ① Computerized Video Analysis [Kinematics]
- ① Force Plate [Kinetic Ground Reaction] 3D
- ① Dynamic EMG
- ① Internet Interface

Analysis of Performance Require:

Video Recording

Digitizing the Data

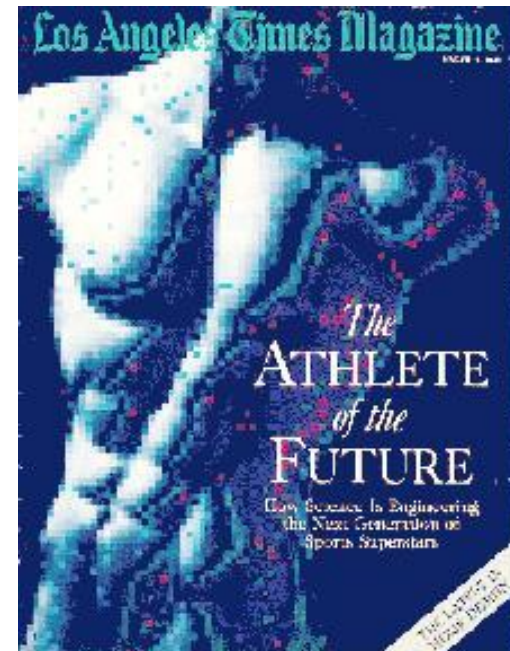
Manual

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





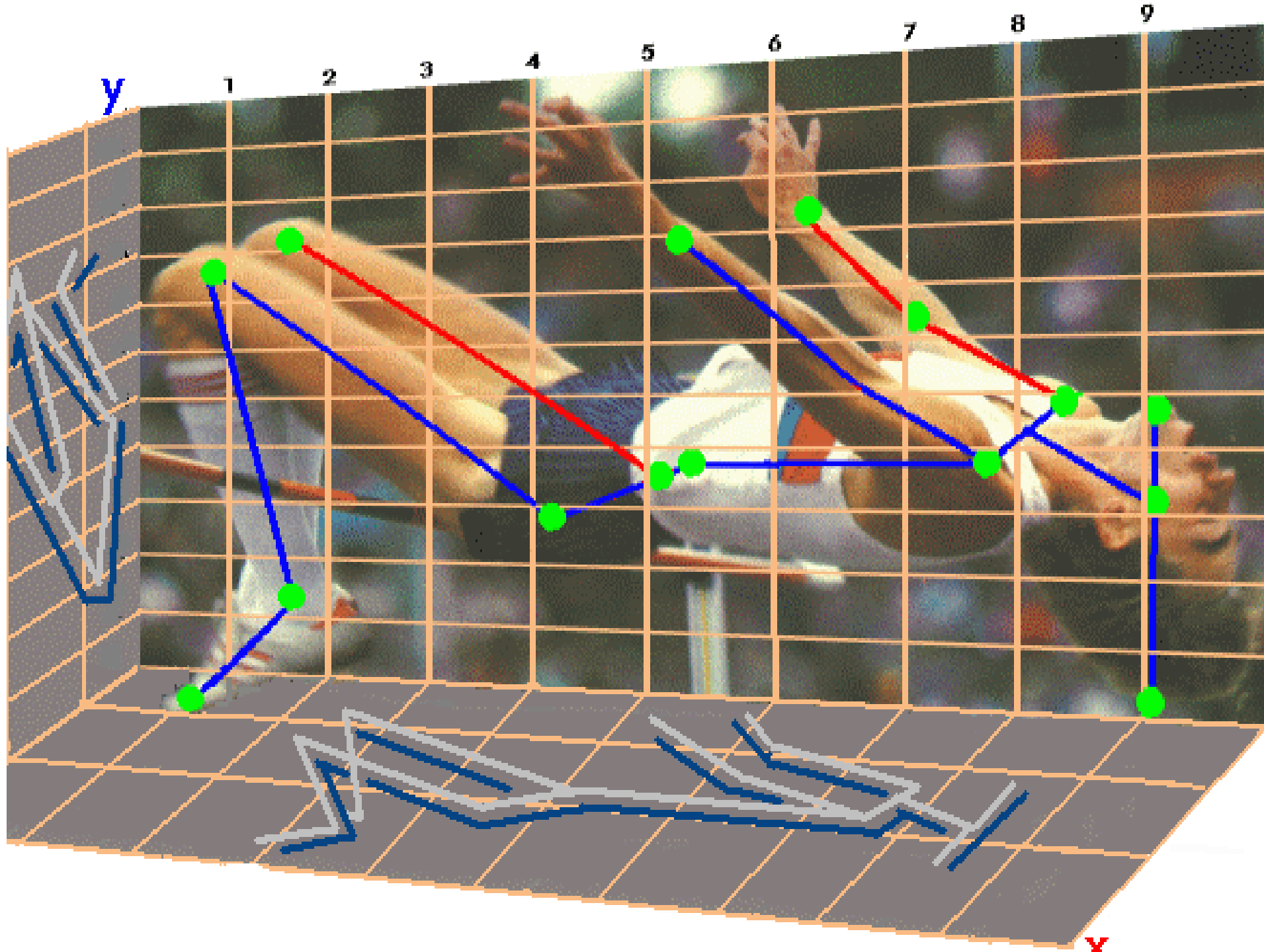
Reidel Gold Medal



Ridel_rear_adi.avi

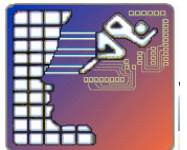
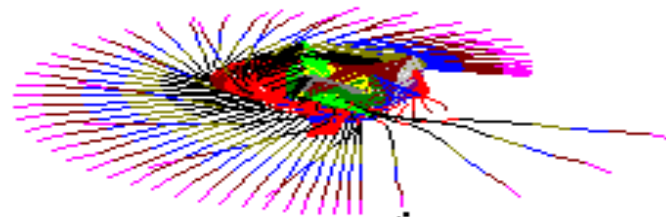
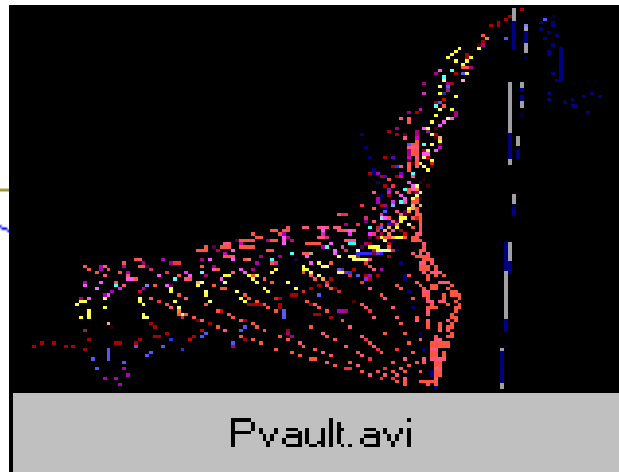
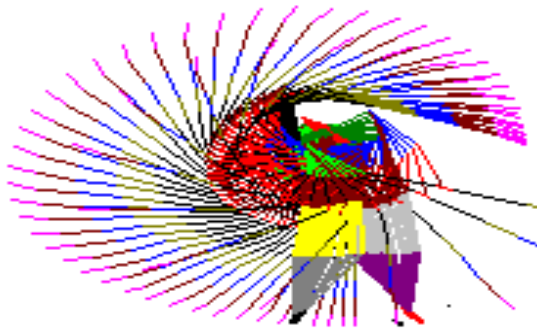


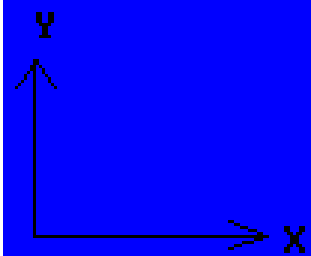
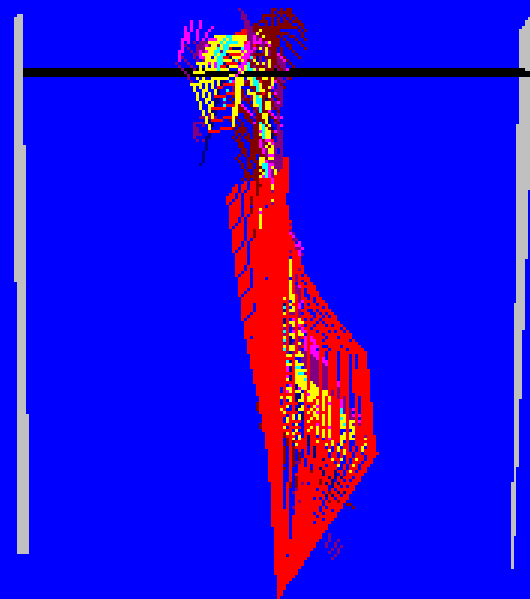
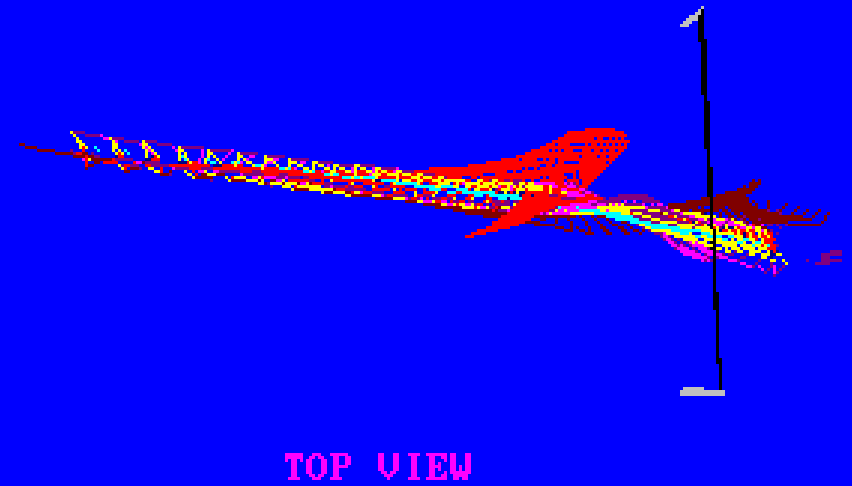
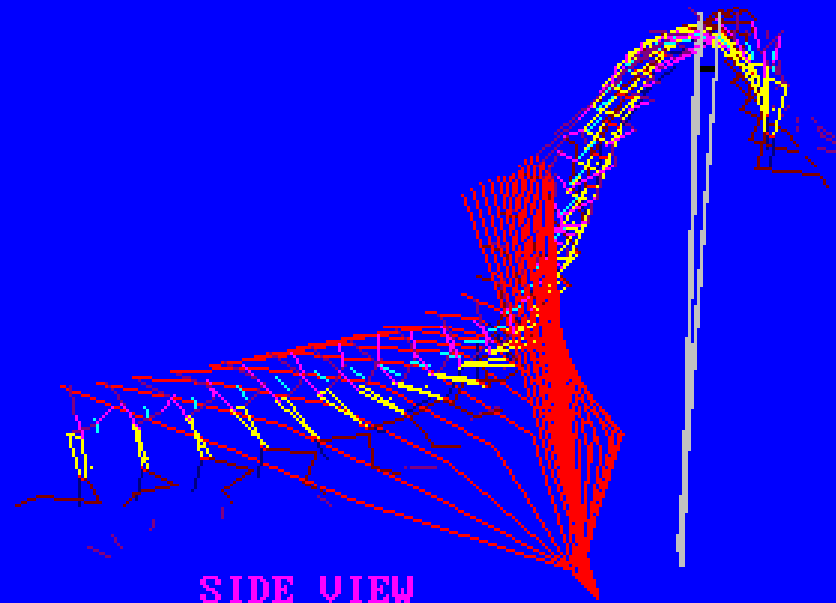
reidelside.avi



Data Transformation

VIEWING Module C.B.A. Inc.





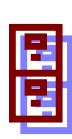
Smoothing of the Data

Filtering Algorithms

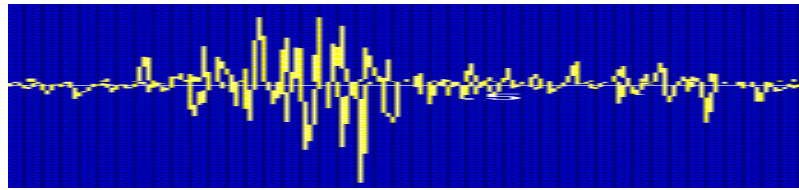
 Cubic Spline

 Digital Filter

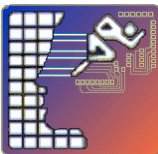
 Quintic Spline

 Fast Fourier Filter

 Segment Constraint



KINETIC FORCE PLATE GROUND REACTION FORCES



Analog Data Input

Force Plates

-  Horizontal force

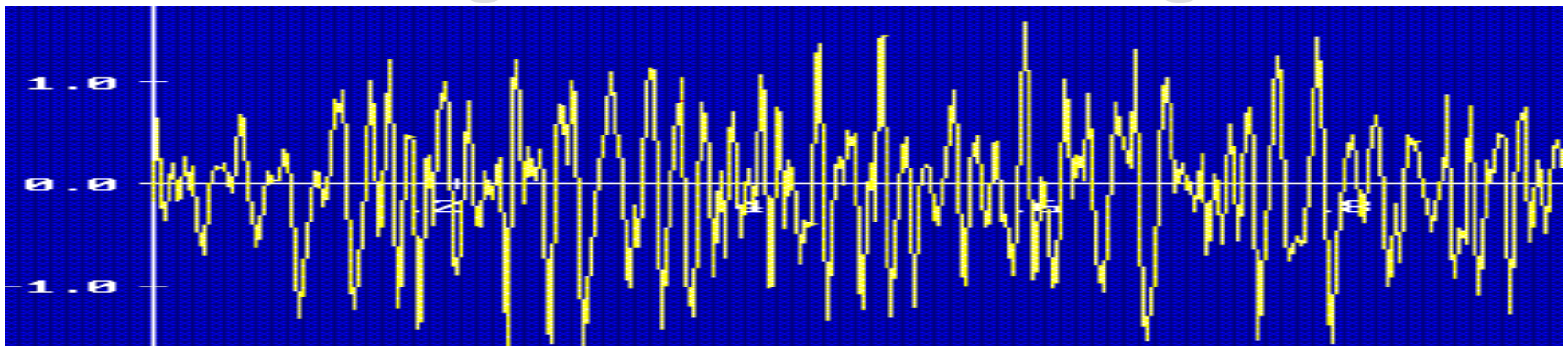
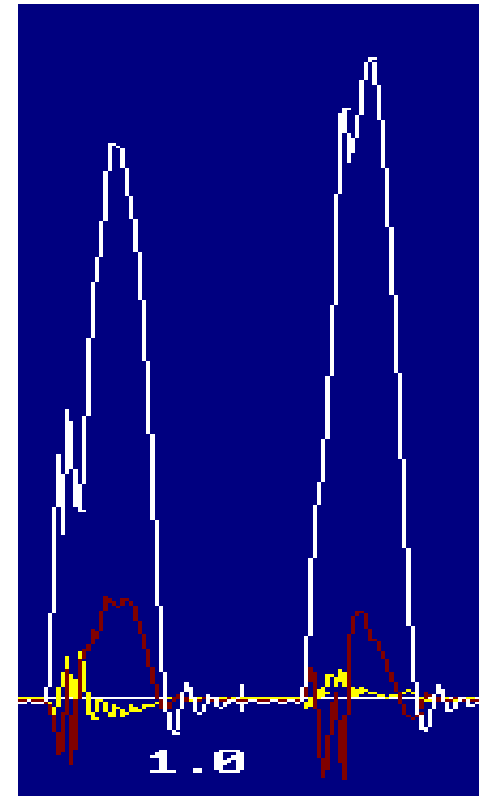
-  Lateral force

-  Vertical force

EMG Data

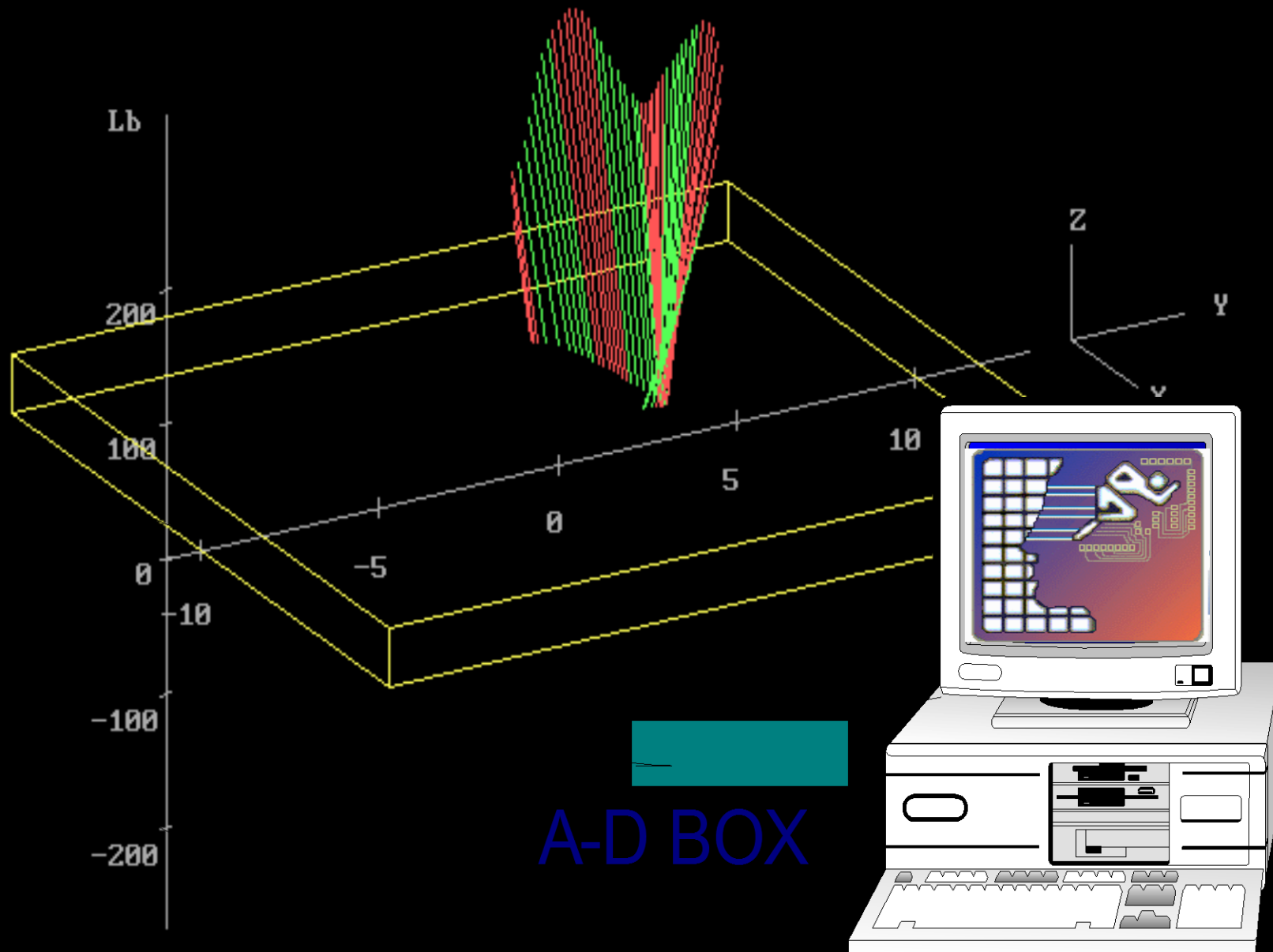
-  Muscle Activity

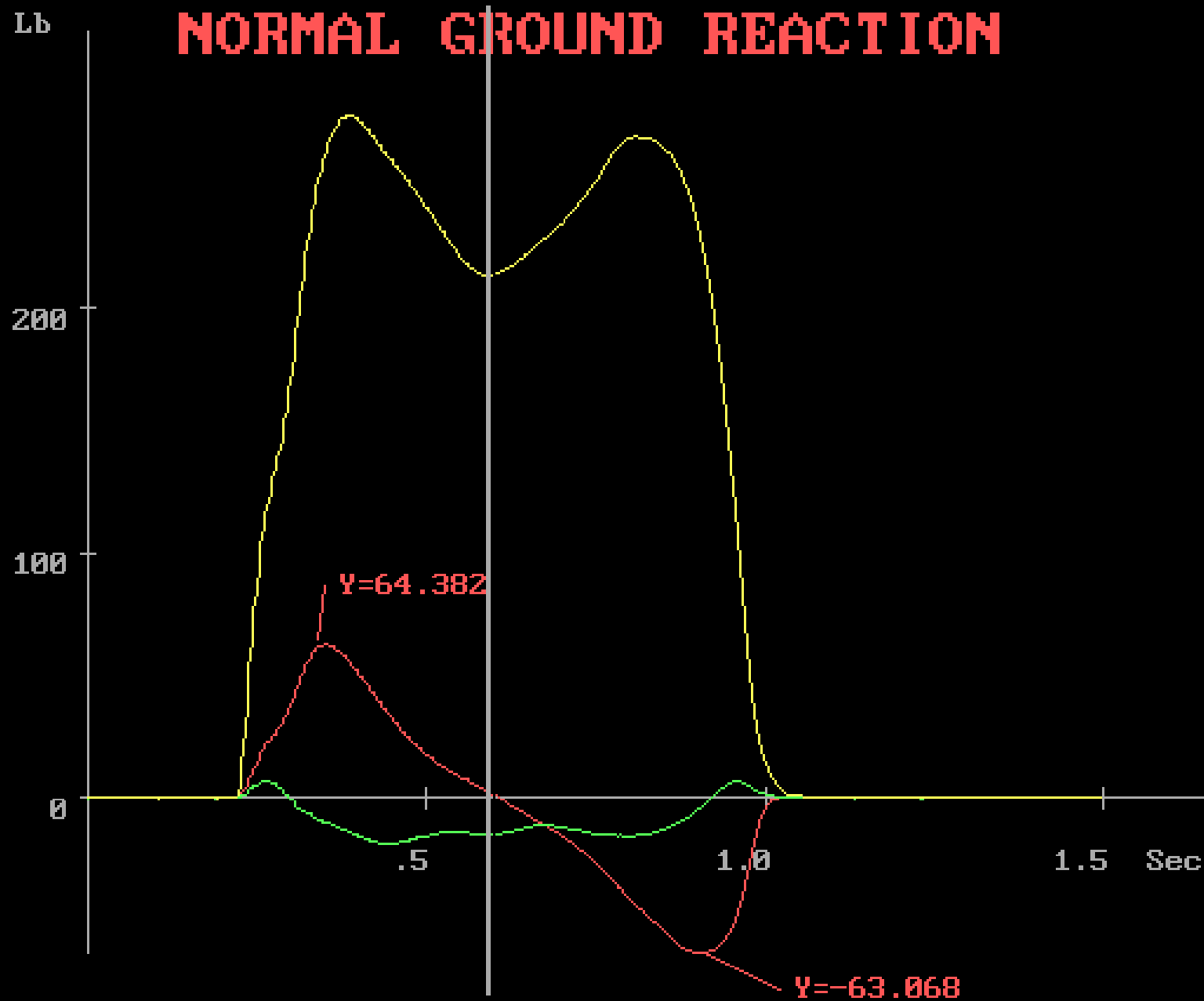
-  Timing of Muscular firing

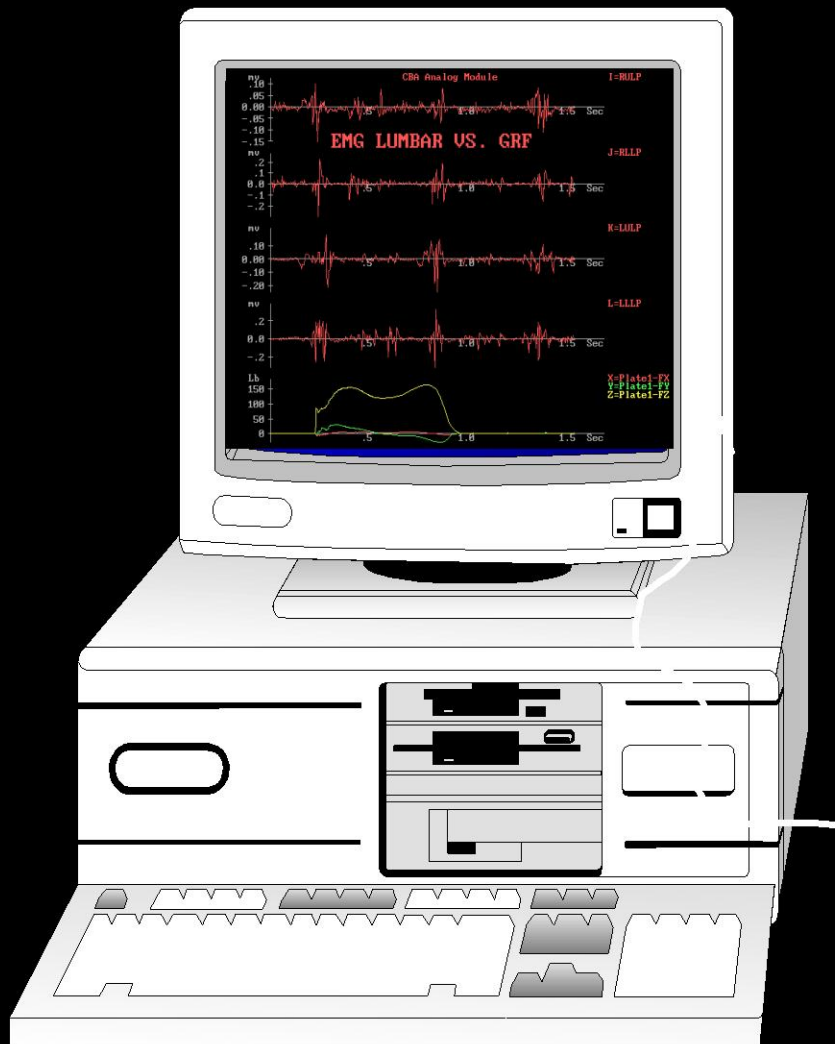


CBA Analog Module

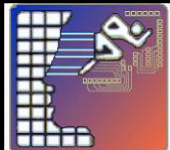
FORCE PLATE







Capability of Monitoring 32 Channels of EMG

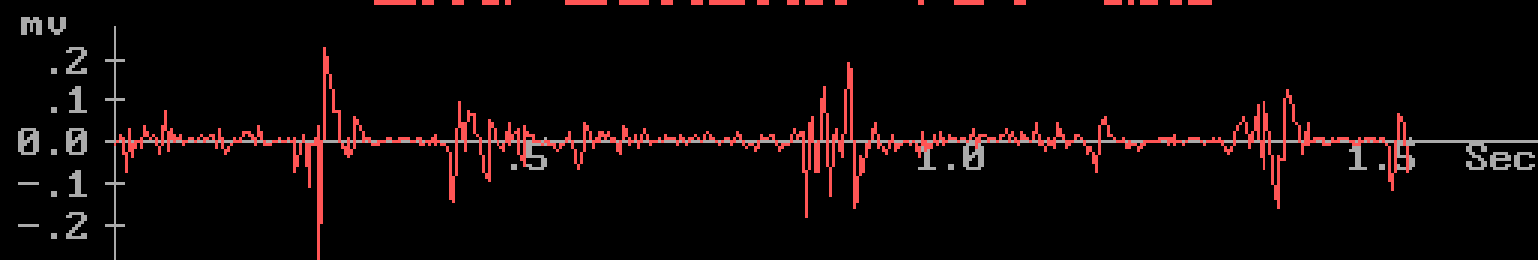


CBA Analog Module

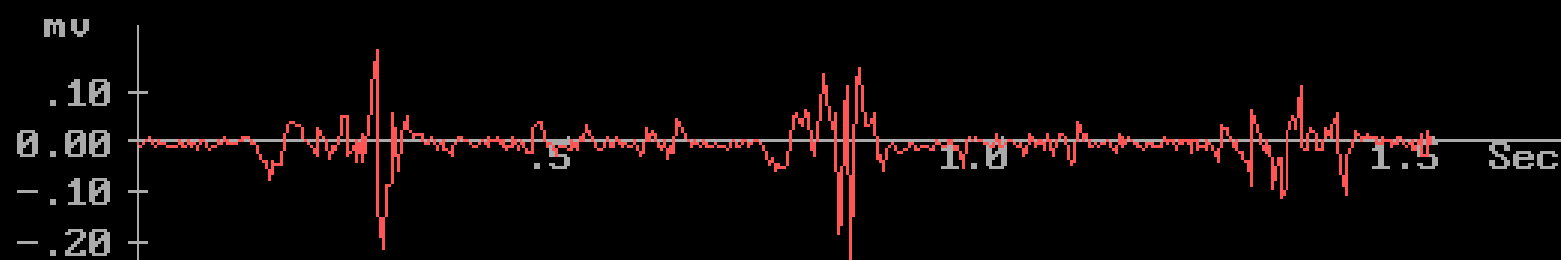
I=RULP



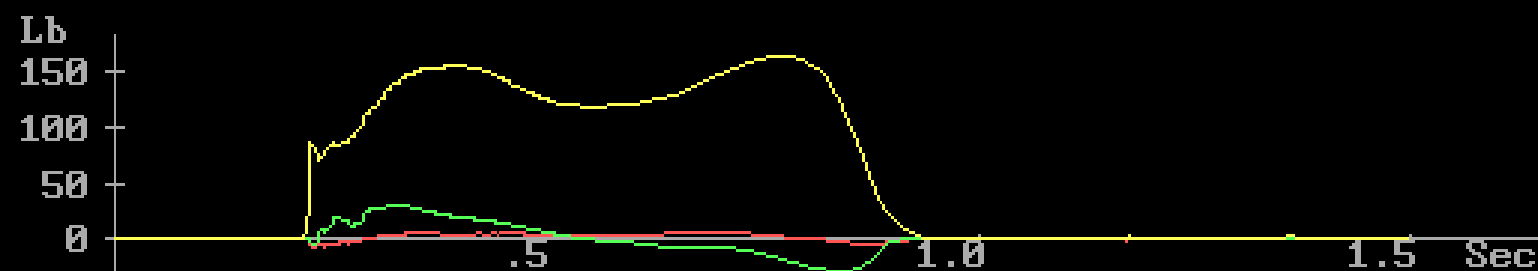
J=RLLP



K=LULP

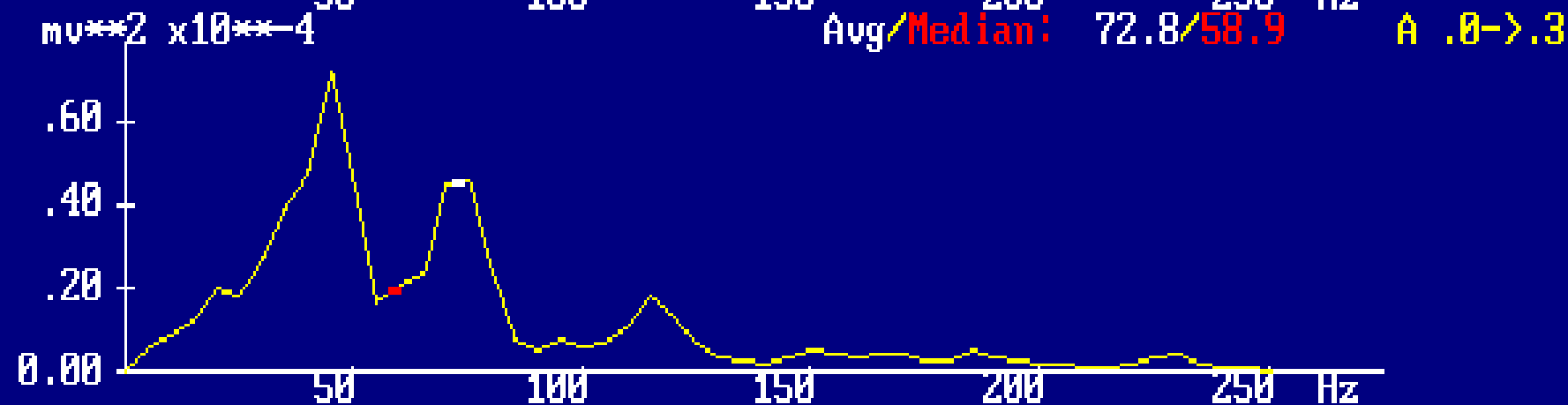
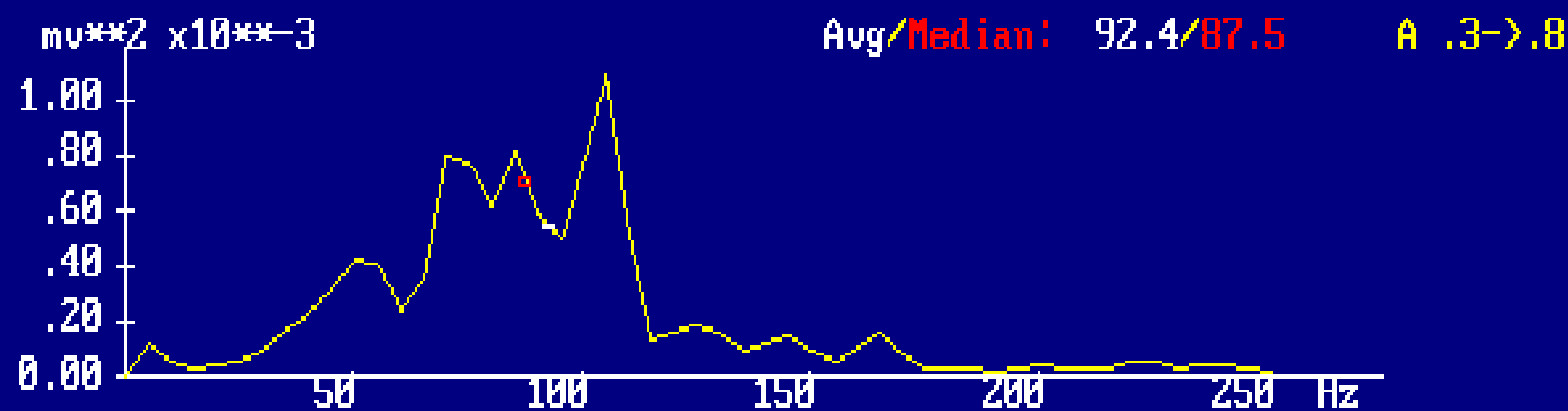
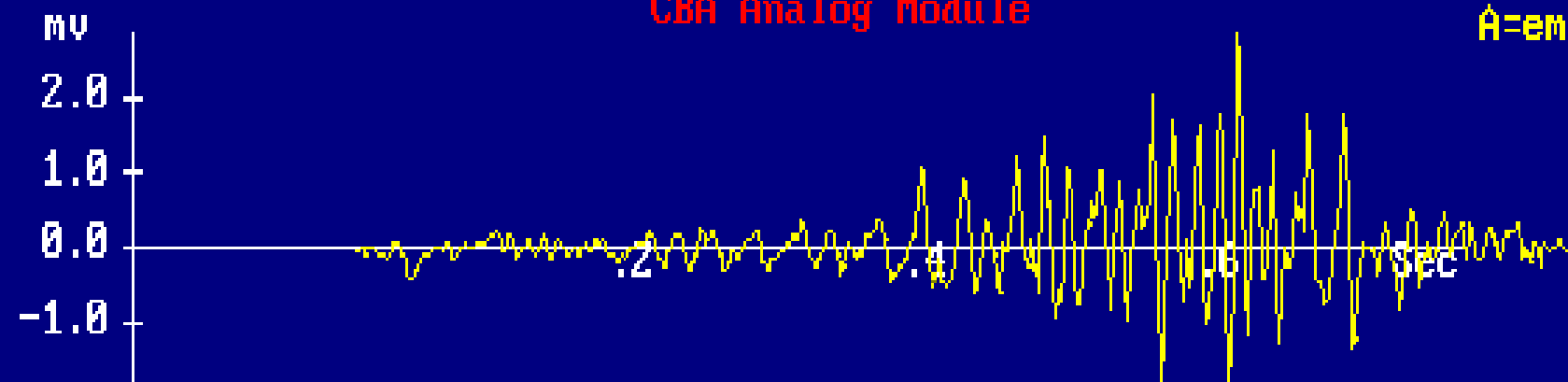


L=LLLP

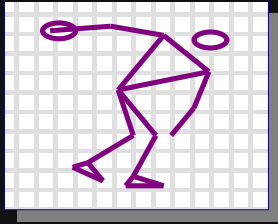


CBA Analog Module

A=emg



AnyKey To Advance

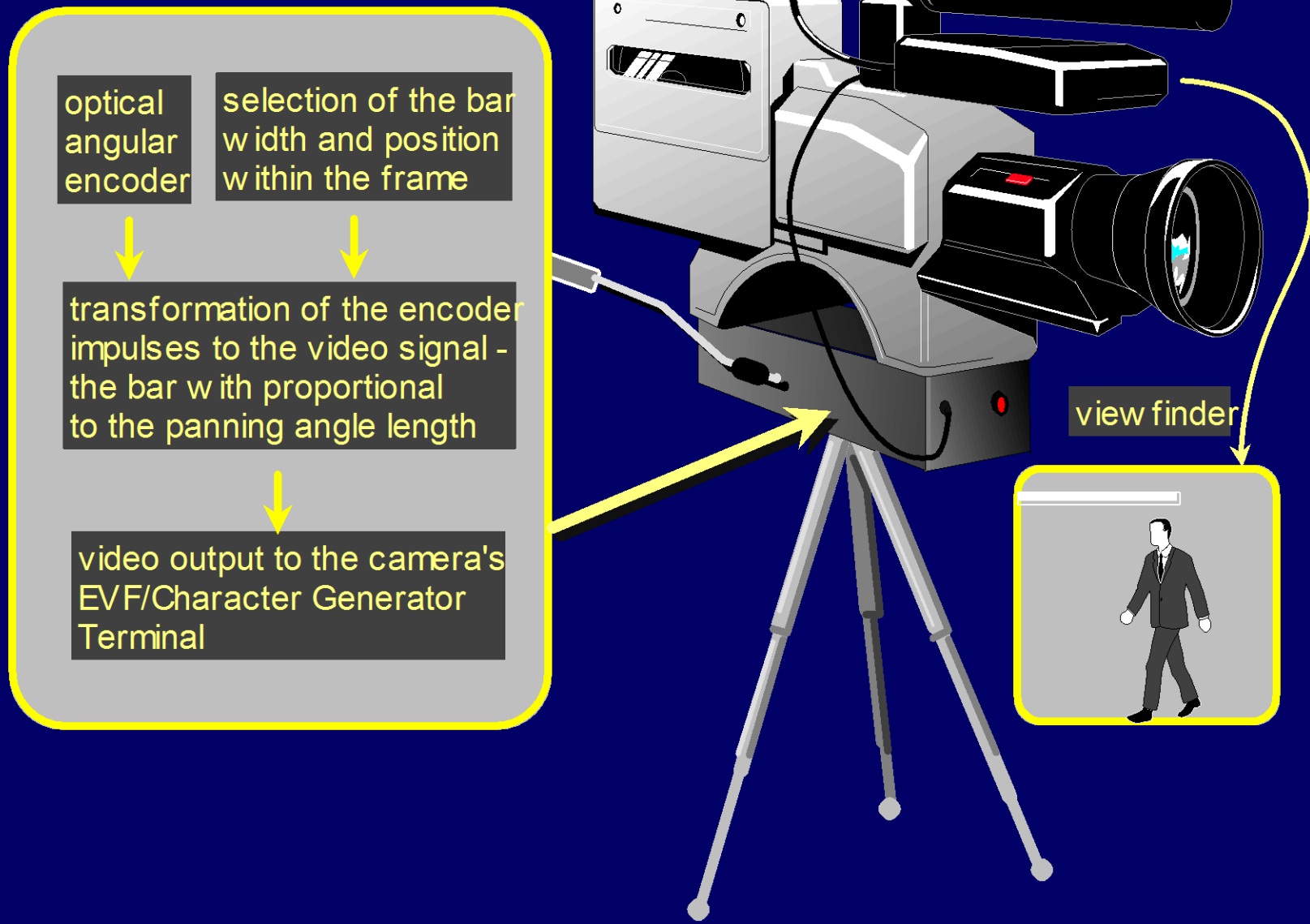


INTERNATIONAL CENTER FOR BIOMECHANICAL RESEARCH

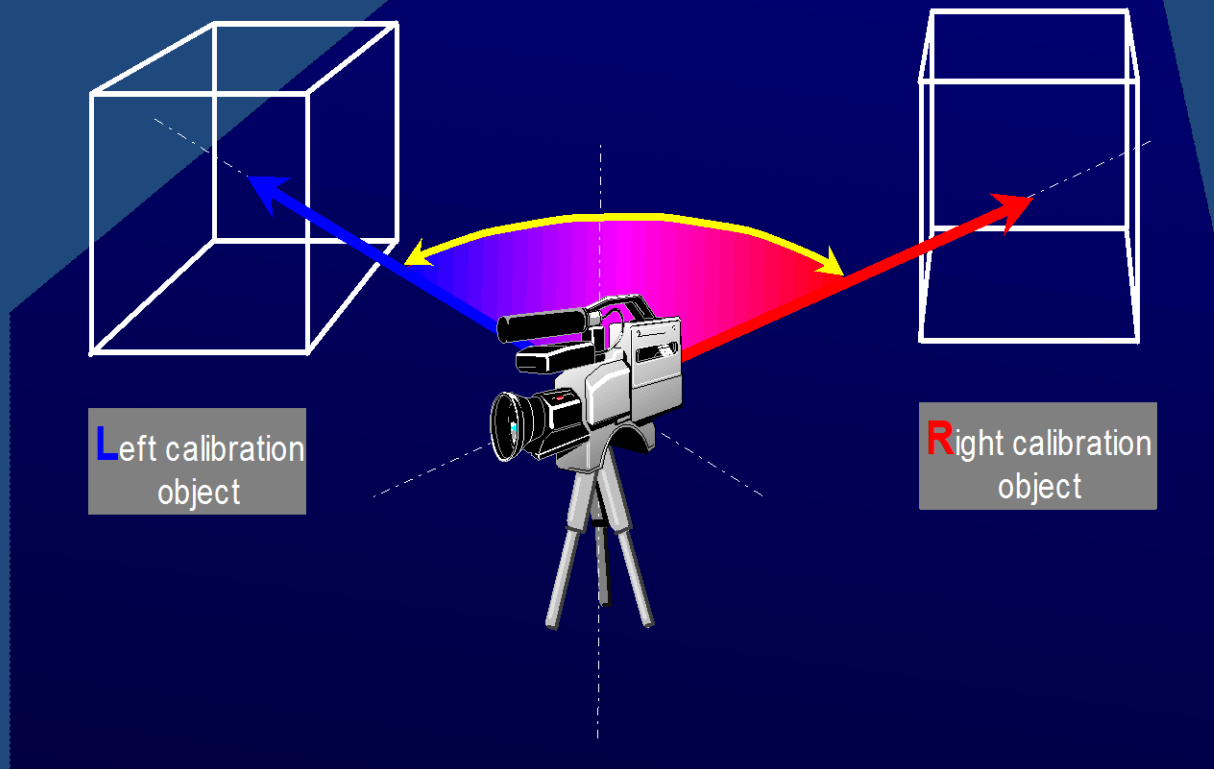
PHOTOGRAMMETRIC TRANSFORMATION WITH PANNING

K.A. Stivers, G.B. Ariel, J. Wise, M.A.
Penny, A. Vorobiev, A. Gouskov, N.
Yakunin

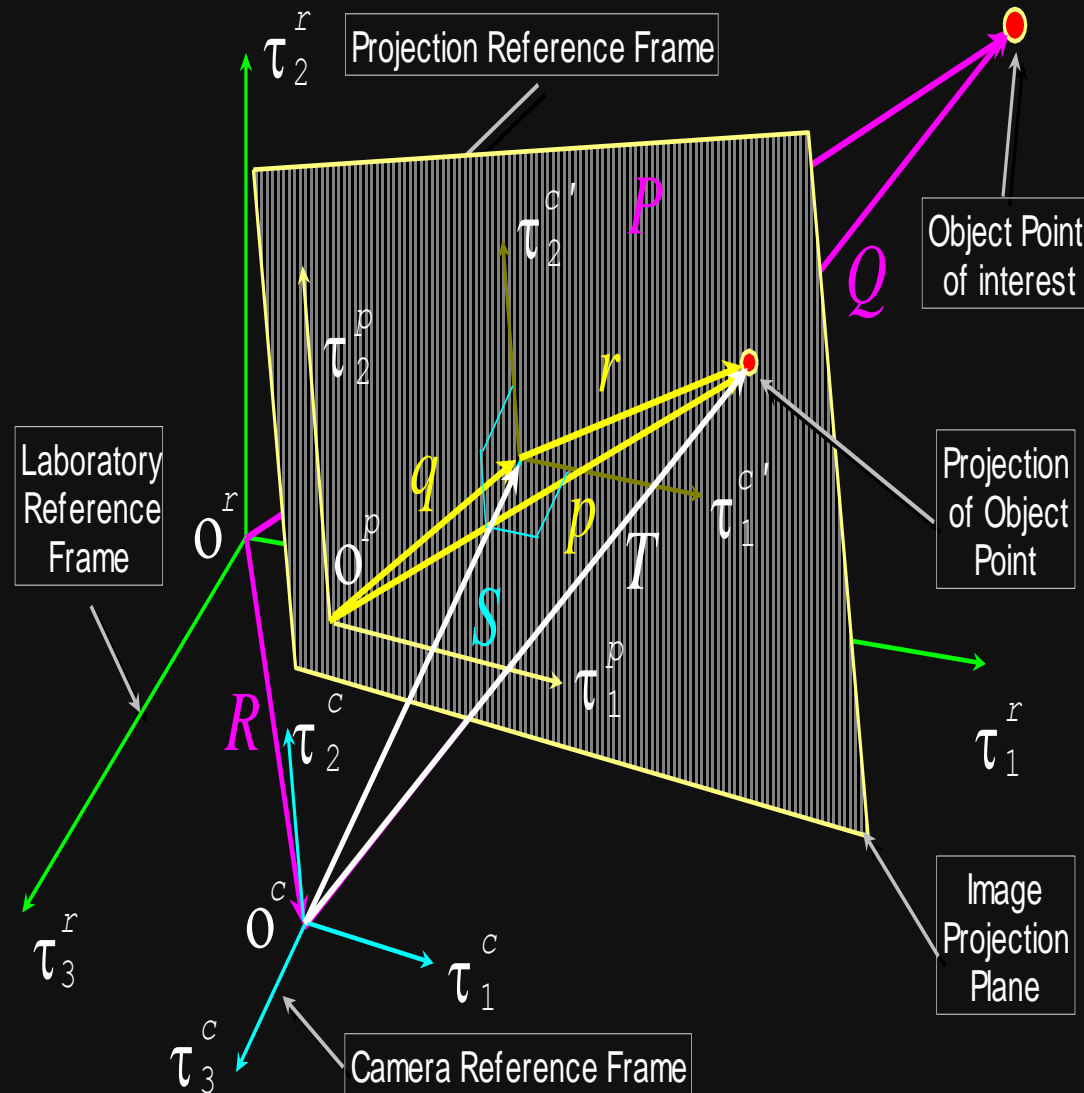
Panning Head



Panning Calibration



Photogrammetric Physical Parameters



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



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

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

The Cyber Coach



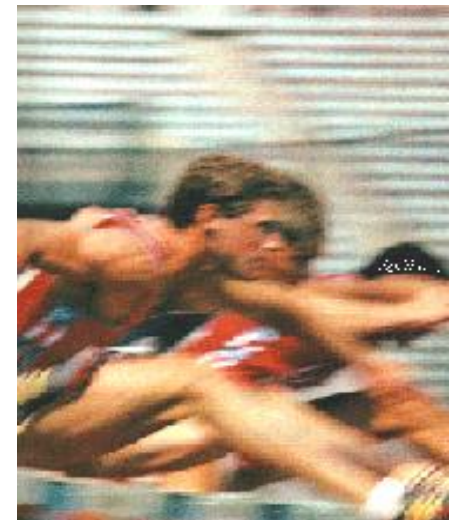
Hammer1.avi

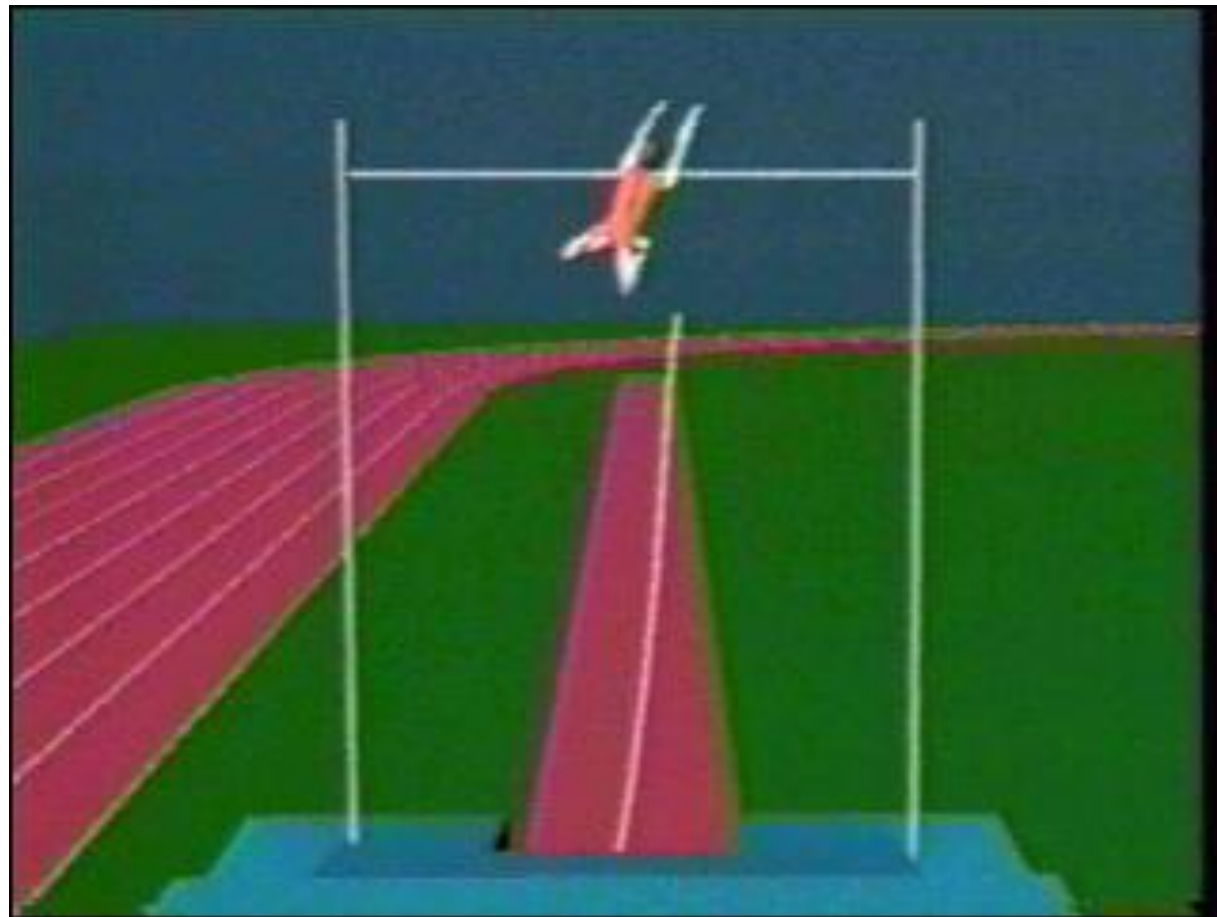


run1.avi



Hurdle1.avi





PV1.avi

LONG JUMP TECHNIQUE: POWER OR SPEED?

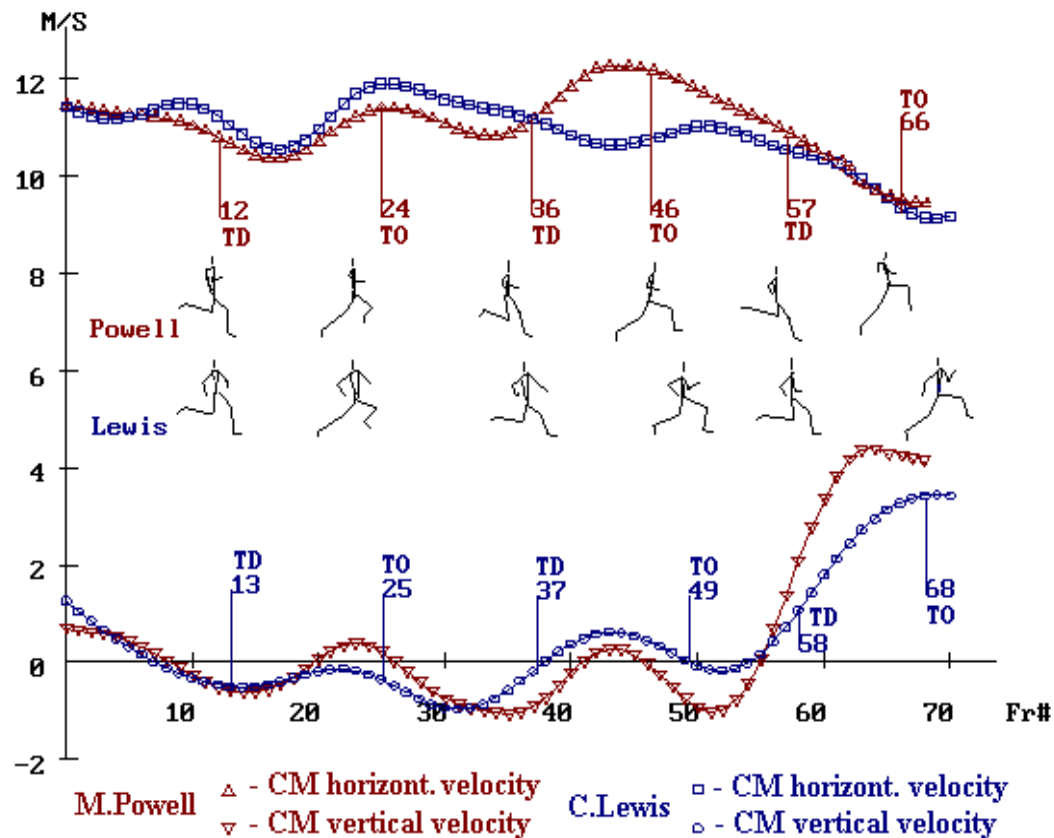
A. VOROBIEV, G.B.ARIEL, I, TER-OVANESSIAN

Comparative Kinematic Characteristics

| Parameters of the Long Jump | M.Powell | C.Lewis |
|--|----------|---------|
| General Information | | |
| Official Distance [m] | 8.95 | 8.91 |
| Effective Distance [m] | 8.98 | 8.91 |
| Favorable Wind Velocity [m/s] | 0.3 | 2.9 |
| The Approach | | |
| Average Speed: 11-6m to the Board [m/s] | 10.79 | 11.23 |
| Average Speed: 6-1m to the Board [m/s] | 10.94 | 11.26 |
| The Length of the Third-Last Stride [m] | 2.4 | 2.23 |
| The Length of the Second-Last Stride [m] | 2.47 | 2.7 |
| The Length of the Last Stride [m] | 2.28 | 1.88 |
| The Take-Off | | |
| CM Horizontal Velocity [m/s] | 9.27 | 9.11 |
| CM Vertical Velocity [m/s] | 4.21 | 3.37 |
| Angle of Projection [deg] | 24.1 | 20.3 |
| Angle of body Lean at Touch-Down [deg] | 71.8 | 77 |
| Angle of body Lean at Take-Off [deg] | 73.9 | 67.5 |

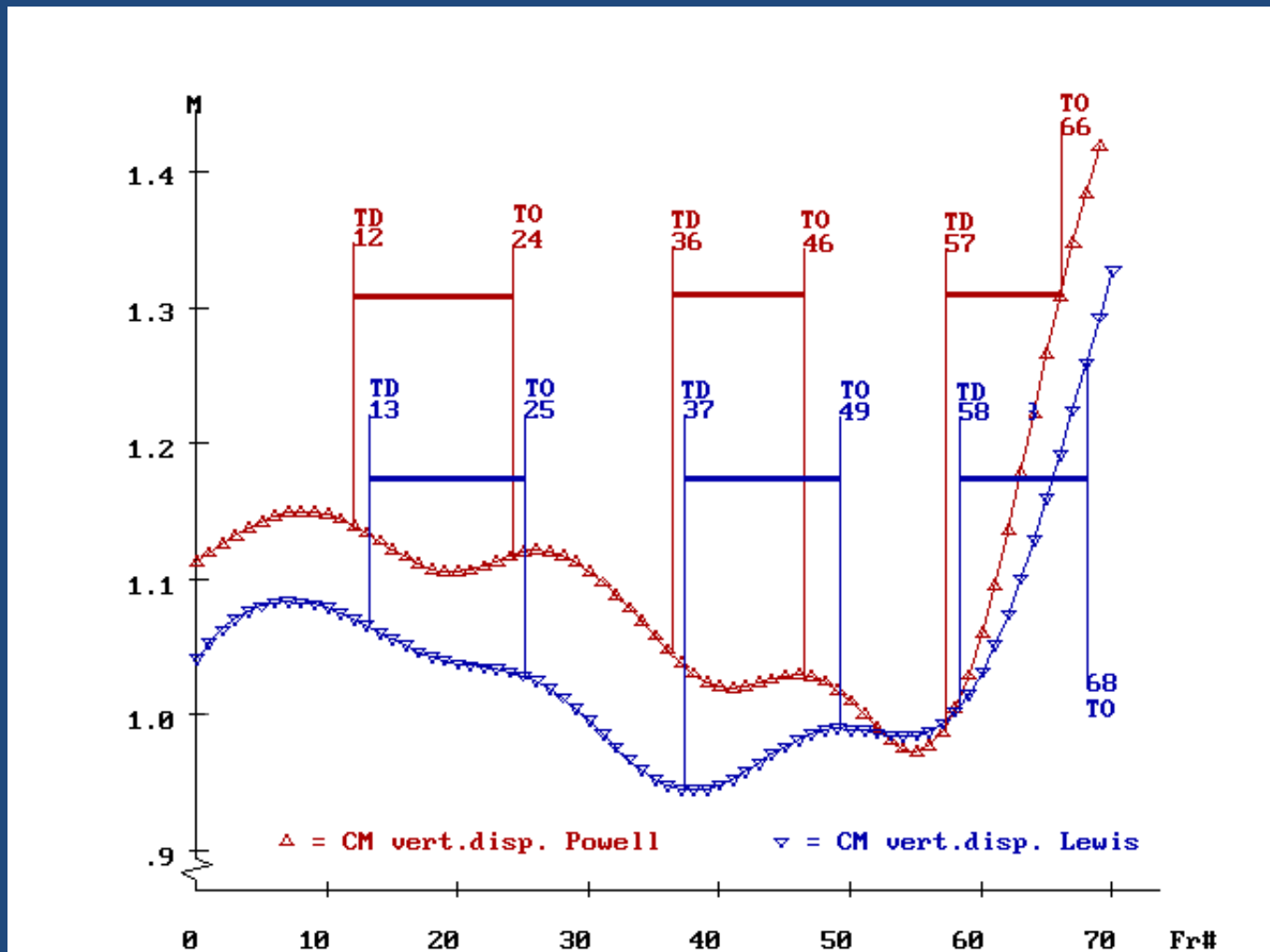
CM Velocities

last strides of the approach



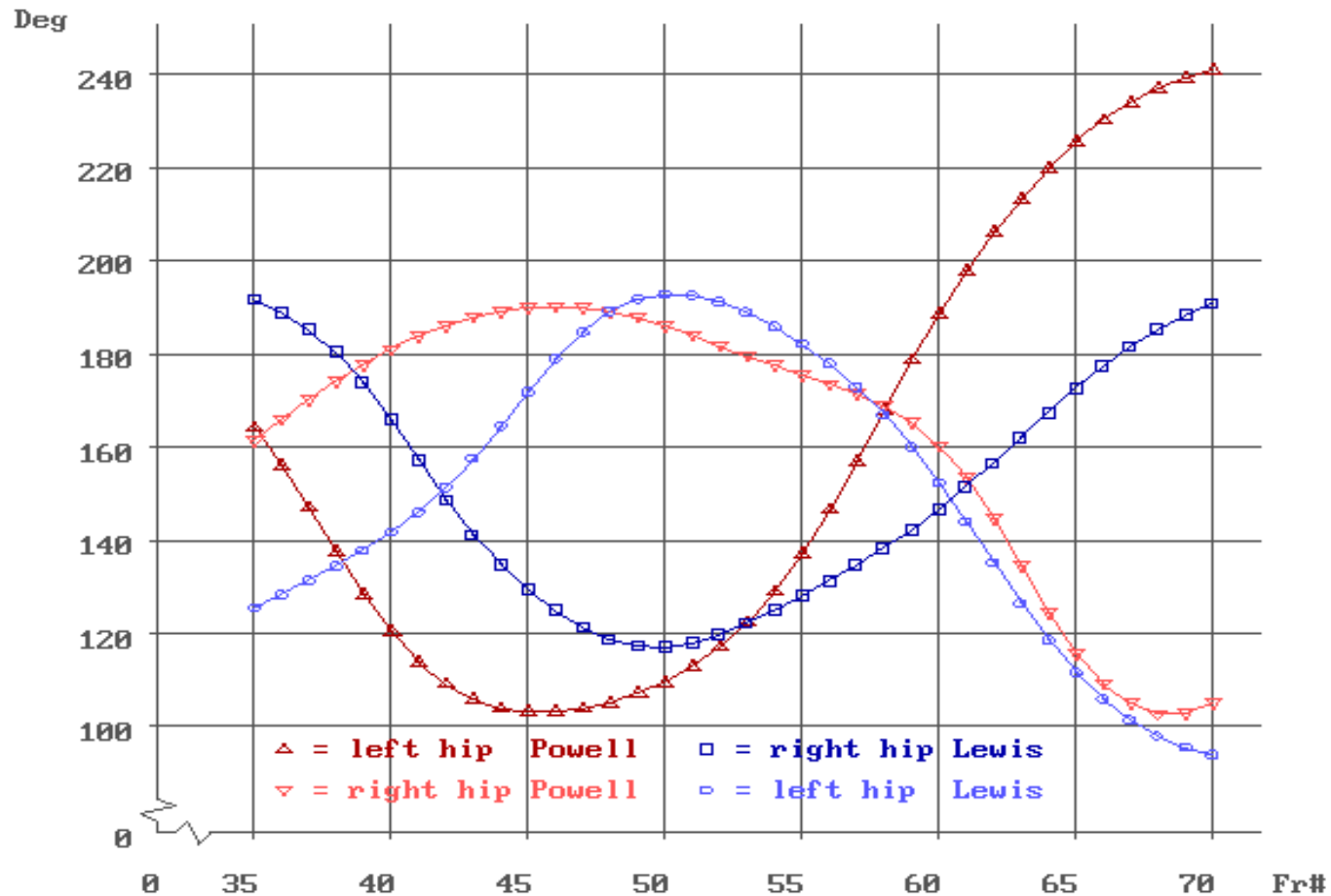
Change of the Height of CM

last strides of the approach



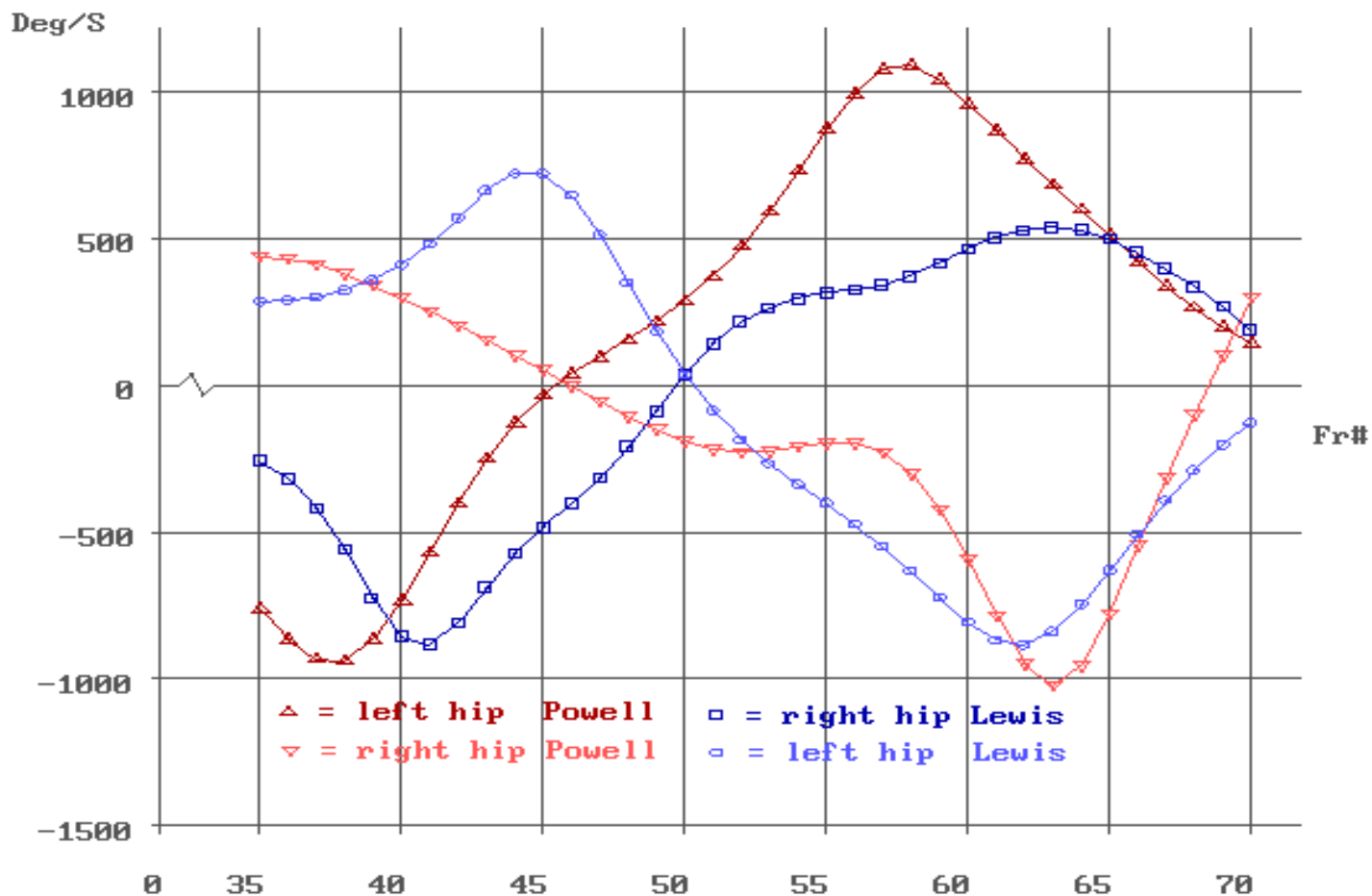
Angular Displacement

hip joint



Angular Velocity

hip joint



Why YOU should select the Ariel Performance Analysis System for YOUR Movement Quantification needs?



THANK YOU

