

ABSTRACT

Technological advances have made it possible to integrate, synchronize, and simultaneously display video records, kinematic, kinetic, EMG, and force plate data of human movement. The APASview software is an effective integrated multimedia presentation tool for quantitative and qualitative biomechanical analyses for comparative studies on clinical, sport performance, and industrial applications.

BIOMECHANICAL DATA INTEGRATION AS A METHOD FOR COMPARATIVE STUDIES

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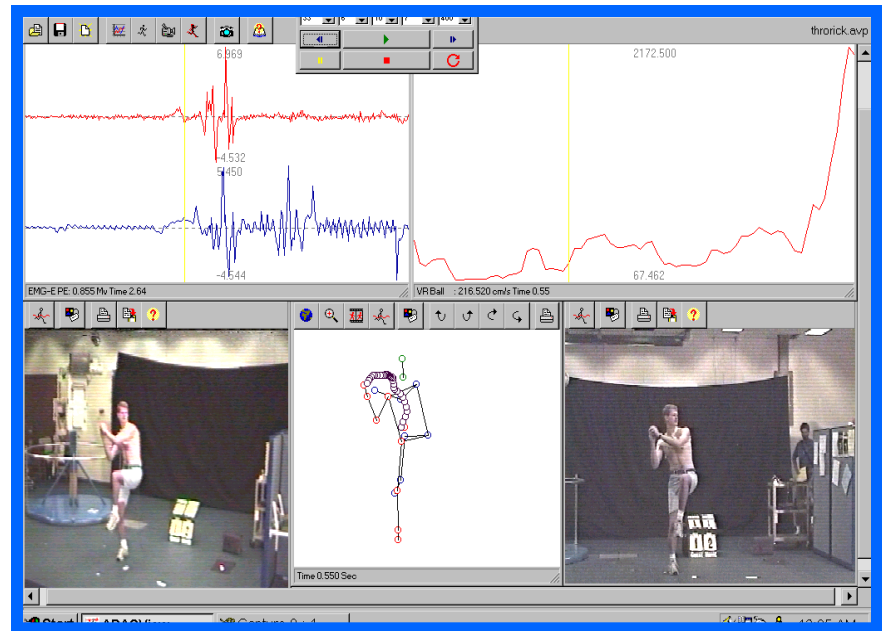
PURPOSE

The purposes of this project were two-fold:

- 1.) develop software that could dynamically integrate video, EMG, force plate, 3-D stick figures, kinematic and kinetic data, and**
- 2.) demonstrate the usefulness of simultaneous data integration in performing qualitative and quantitative biomechanical analyses for ergonomic, sports, and clinical applications.**

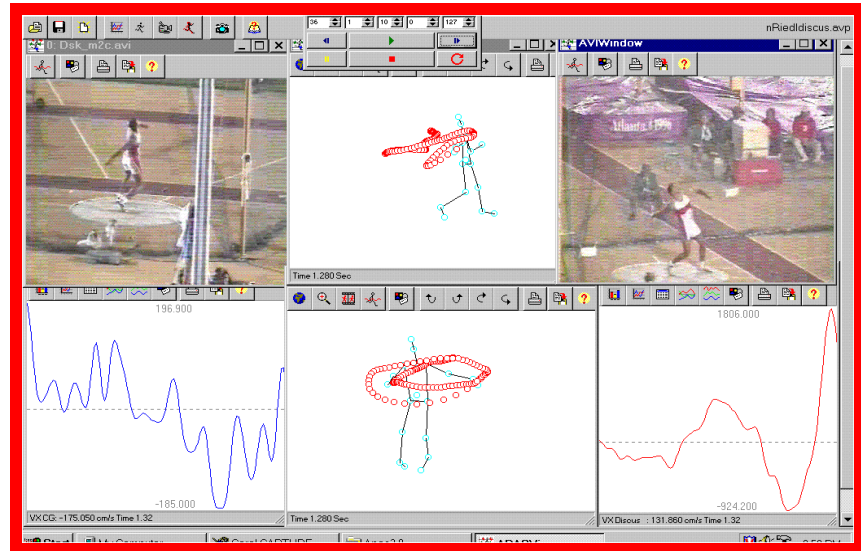
Hardware

- **Main Computer System**
- **Workstations**
- **Capture Card**
- **Network**
 - Intranet
 - Internet



Software Integration

- Capturing
- Digitizing
 - Locally
 - Net Digitizing
- Transformation
- Filtering
- Kinematics Results Display
- Kinetic Results Display
- Analog Display
- Video Display
- Stick Figure Display



Video Recording



VIDEO CAPTURE / DIGITIZING

glift44.1t [lift4c.avi] - good lift

glift42.1t [lift4c.avi] - good lift

glift43.1t [lift4c.avi] - good lift

glift41.1t [lift4c.avi] - good lift

Im: 1/1 T: 0.000 Complete

Im: 4/30 T: 0.483 Complete

Im: 6/50 T: 0.817 Complete

Im: 9/80 T: 1.317 Complete

For Help, press F1

Seq: glift44.cf Data Pts UnLocked AutoD: Off 6881/6947

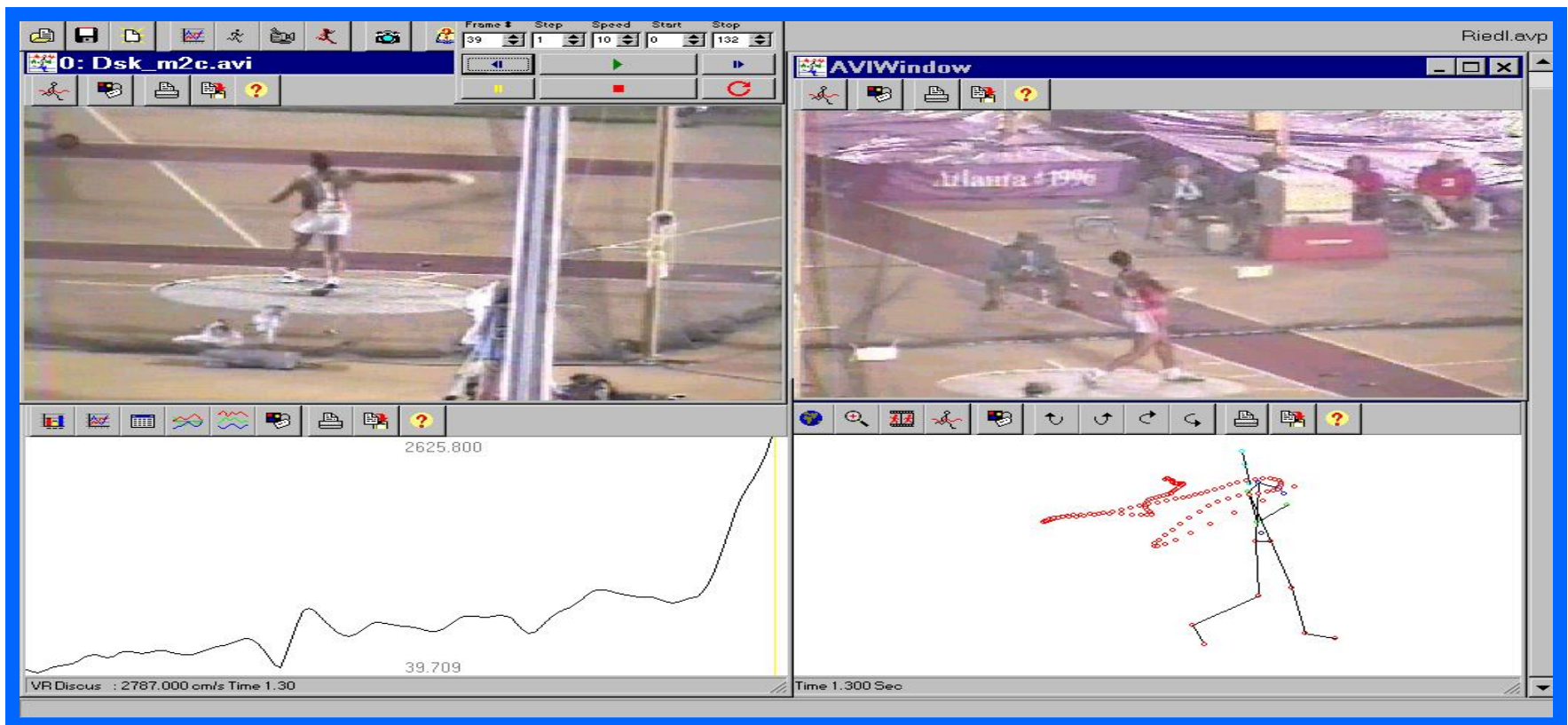
The image displays a software interface for video capture and digitizing, showing four sequential frames of a person performing a lift. Each frame includes a red wireframe overlay representing the person's body and a red box indicating the lift area. The frames are labeled with file names (glift44.1t, glift42.1t, glift43.1t, glift41.1t) and timestamps (T: 0.000, T: 0.483, T: 0.817, T: 1.317). The interface also shows a progress bar (Im: 1/1, Im: 4/30, Im: 6/50, Im: 9/80) and a status bar at the bottom with the text 'For Help, press F1', 'Seq: glift44.cf', 'Data Pts', 'UnLocked', 'AutoD: Off', and '6881/6947'.

TECHNIQUE COMPARISONS USING VIDEO DISPLAY



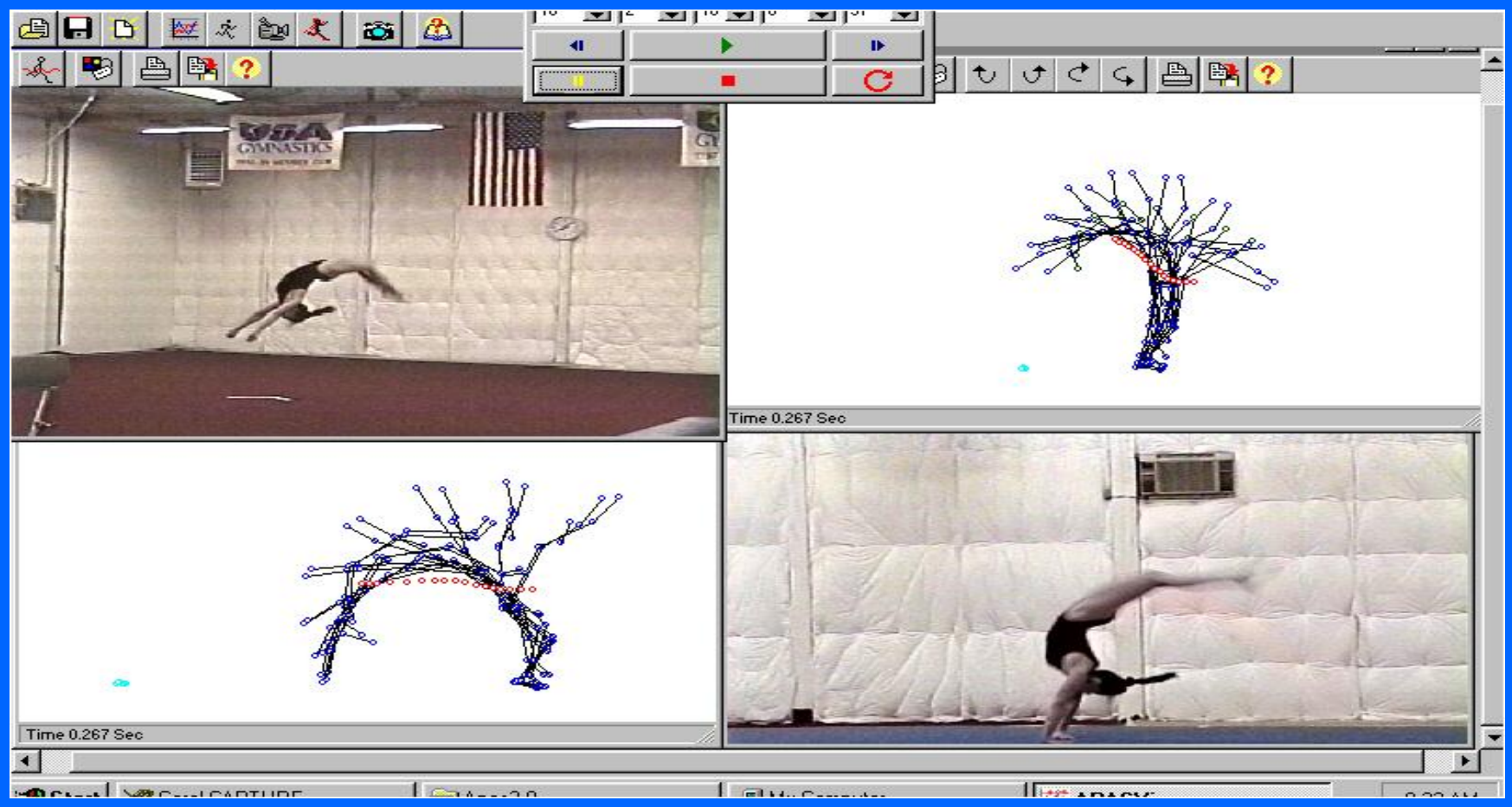
Discus Throwing Analysis Using Video Viewing Option

Video View--The video viewing function permits the biomechanist to observe a sport or functional movement from multiple perspectives, simultaneously. This allows the coach or clinical to perform sport or clinical evaluations at sampling rates that may be 2-10 times faster than visual observations depending on the video cameras transport rate.



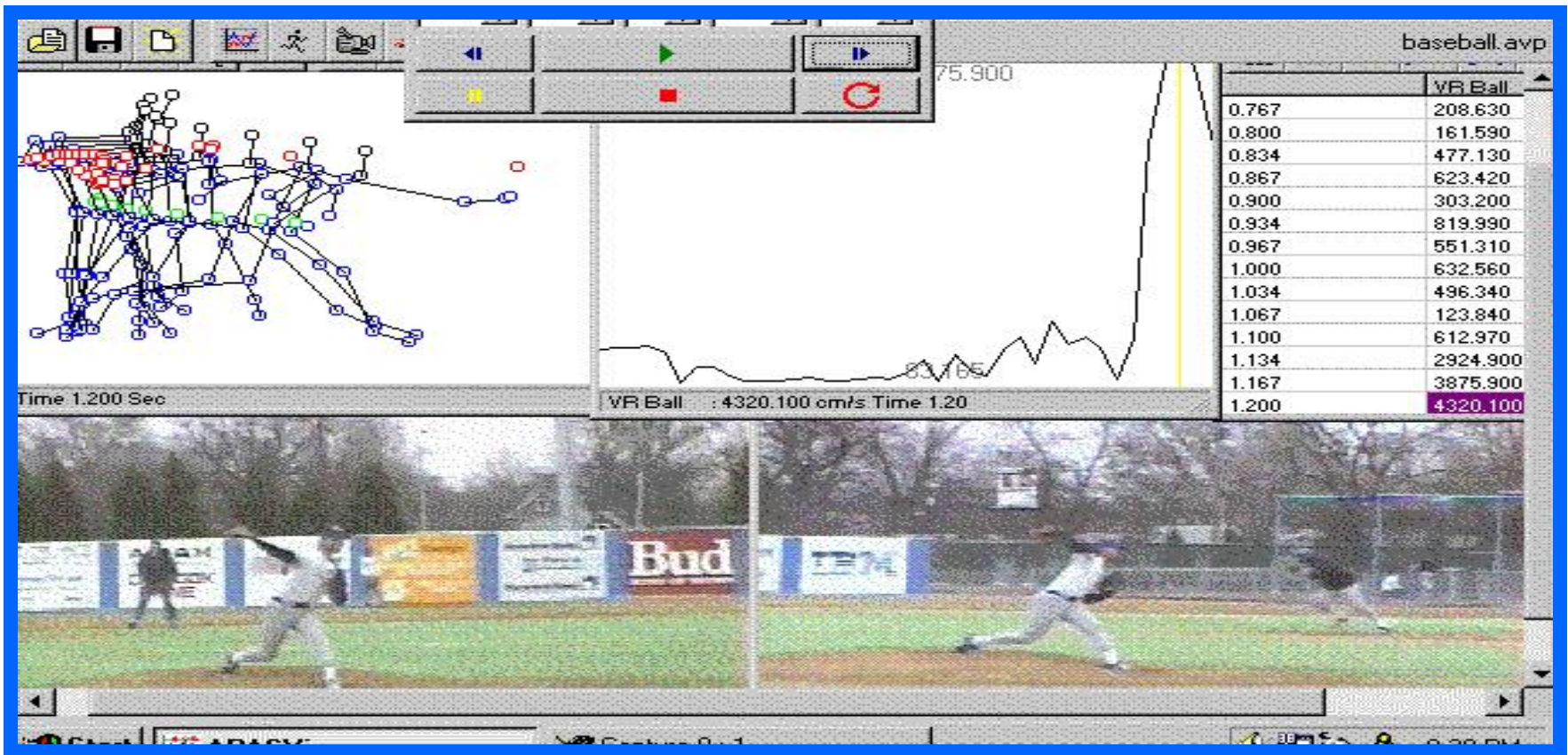
Gymnastics Techniques Comparison of Backhand Spring & Flic-Flac Using Synchronized Views

Sync View--The synchronization function provides the capability of performing a comparative study of two separate trials or different movement techniques in a side – by- side analysis format.



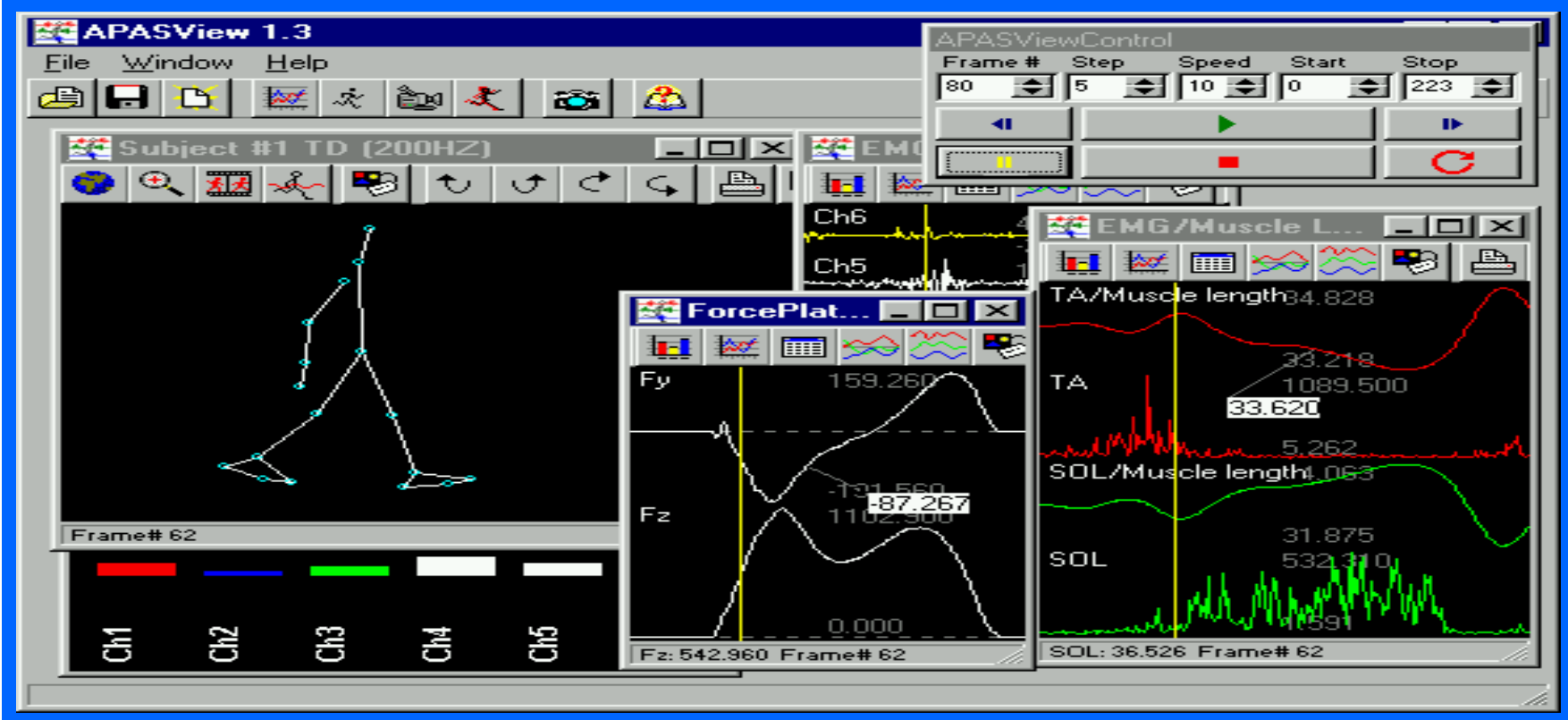
Baseball Pitching Analysis Using Integrated Viewing

Integrated View--The viewing option permits the user to examine the kinematic / kinetic data of the human movement simultaneously with the data point trajectory and the corresponding video frame from multiple cameras). This feature of creating dynamic outputs may be used in performing simultaneously qualitative and quantitative analyses for sport performance.



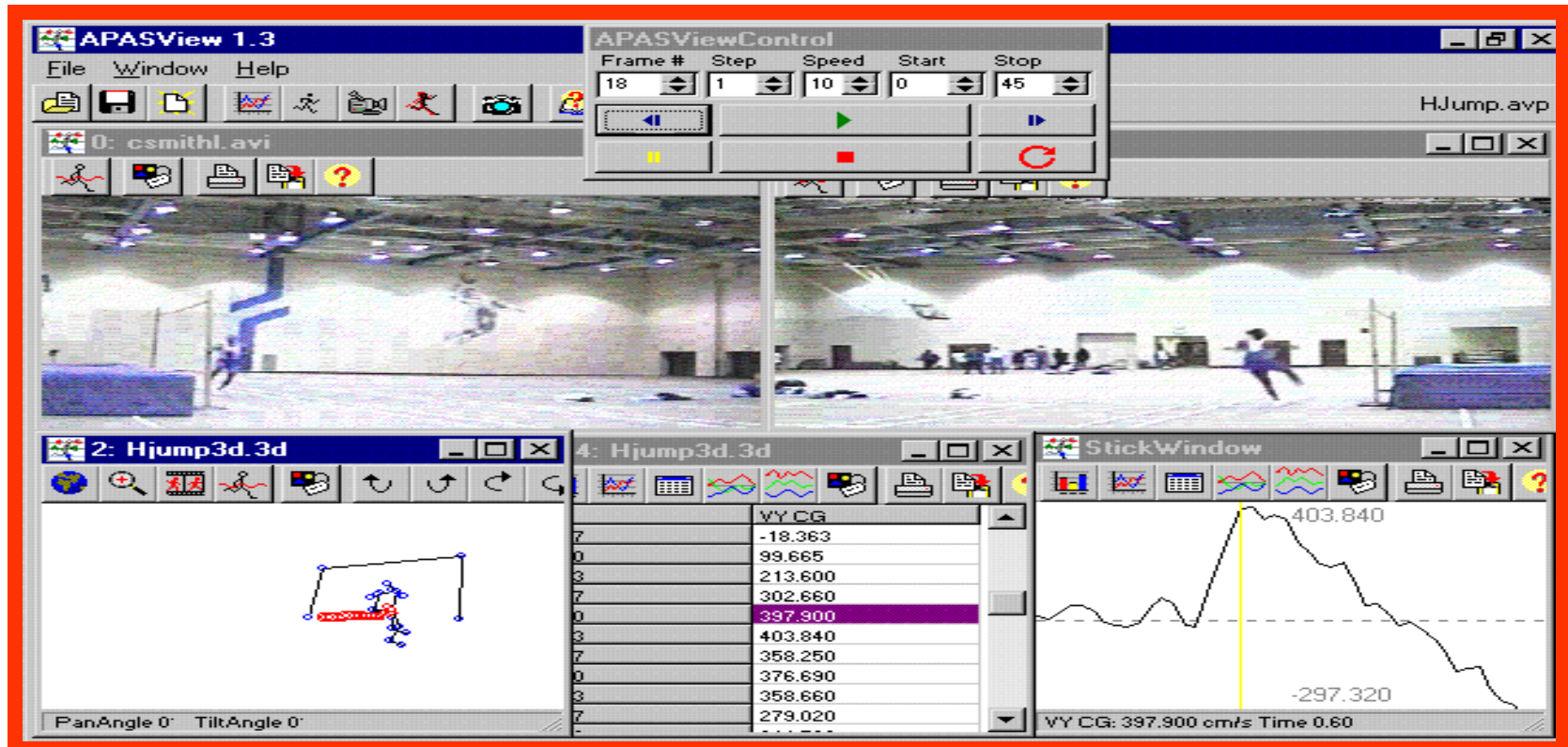
Gait Analysis Using Integrated Data Option

Data View -- The data view is capable of showing many different kinds of numerical data parameters, such as, displacement, velocity, force, EMG and so on. Each channel loaded can be manipulated numerically in order to normalize and modify the data. Each individual data channel can utilize a unique color and a label can be added. The data view can present the data in three different formats, namely, line graphs, bar graphs and numerical table values.



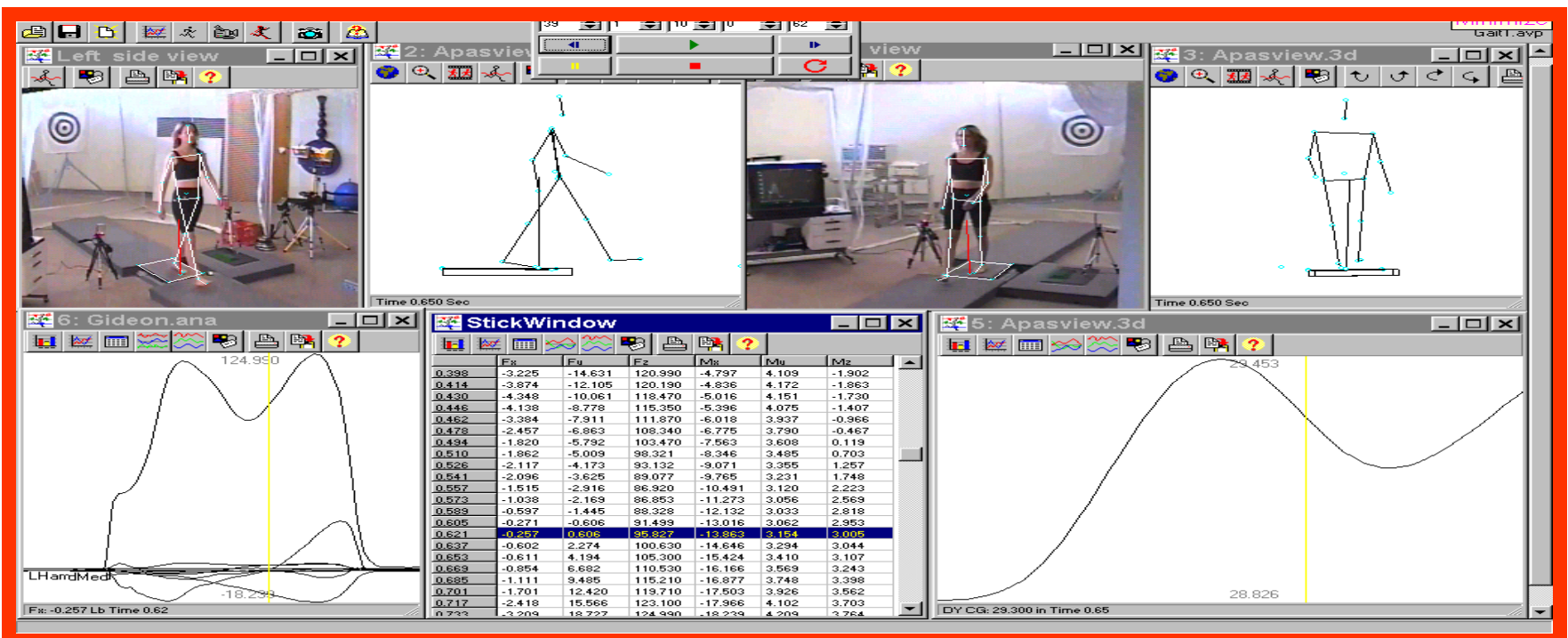
High Jump Analysis Using Integrated Data Option

Data View -- The data view is capable of showing many different kinds of numerical data parameters, such as, displacement, velocity, force, EMG and so on. Each channel loaded can be manipulated numerically in order to normalize and modify the data. Each individual data channel can utilize a unique color and a label can be added. The data view can present the data in three different formats, namely, line graphs, bar graphs and numerical table values.



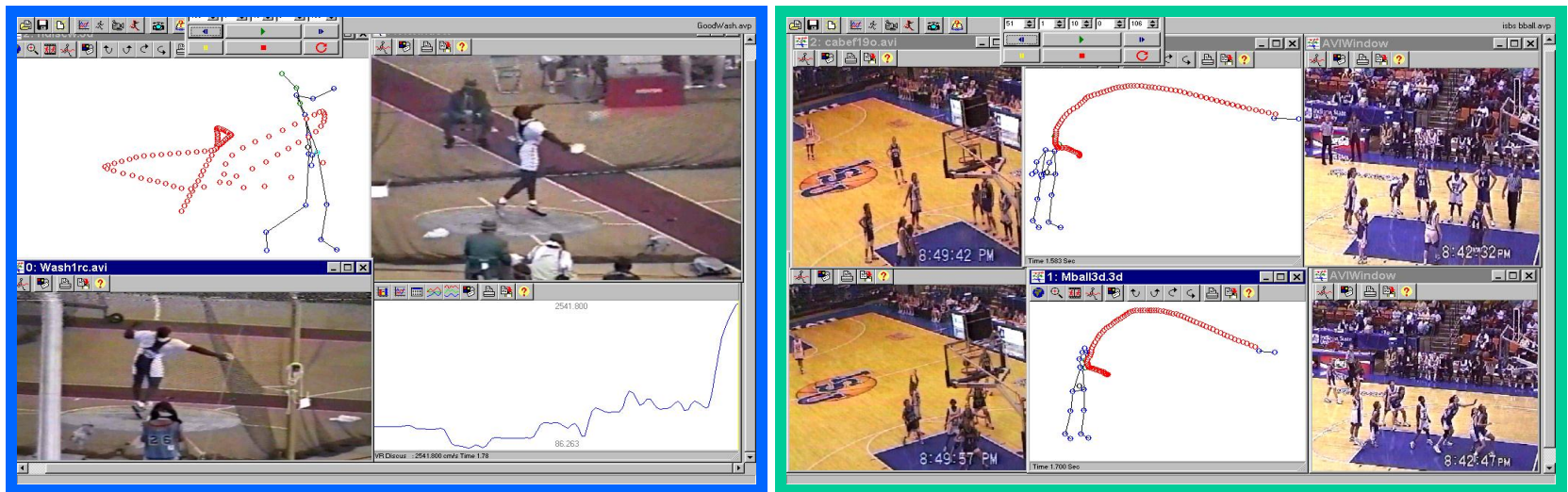
Clinical Gait Analysis with StickFigure Option

Stick Figure View--This function permits the superimposition of the ground reaction force vectors on the digitized video images which may be rotated in 3-D space. A global fiducial point must be digitized in order to define the force plate's referential frame and the numerical data may be dynamically integrated with the matching video images



SUMMARY

- Synchronization of individual views with kinematic, kinetic, and analog data may be accomplished by adjusting the time offset. By synchronizing the separate views or trials, it is possible to produce comparative studies such as the 1996 Atlanta Olympic project conducted by Finch, Ariel & Penny which evaluated discus throwing performance variances observed for best and worst attempts.



- Dynamic integration of video records, kinetic, kinematic, EMG, and force plate data can produce multimedia presentations of human movement that facilitate effective qualitative and quantitative biomechanical analyses.