

Biomech Planar Motion Analysis System Quick Reference Guide

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This Guide is intended to assist users through the series of programs collectively known as the Biomech Planar Motion Analysis System. This system consists of stand-alone programs that can run from DOS, Windows 3.1 or Windows 95/NT. Two programs are provided for the execution of the programs in a Windows environment. One program is for use with Windows 3.1 (BMWIN.EXE) and another is for execution under Windows 95 or NT (BMWIN95.EXE). For DOS execution a batch file is provided (BIOMECH.BAT).

It is assumed that you have already digitized a sequence of motion pictures using the Ariel Performance Analysis System (APAS) and that your digitized data is present in a directory used by the APAS. If you have previously digitized data skip the following two sections and start at the section labelled: Starting the Biomech Planar Motion Analysis System.

Transferring files from the APAS to another computer

To use the Biomech software you must put your data files in subdirectory on your data processing computer. Two files should have been created by the APAS, trial.CF (Common File) and trial.#T (where # can be 1 through 9). These files must be written onto a floppy diskette and then transferred to another computer for processing. For example, if your files are in the default APAS data directory perform the following commands from the DOS command prompt to copy your files to your diskette.

```
D:  
CD \pasdata  
COPY trial.* A:
```

where, **trial**, is the name that you gave your digitized “sequence”.

To run the Biomech software you will need to create a “control file”. This file has the same filename as your data file but has the file extension, .CFB. It will contain information about how to construct your linked-segment model and what data processing is to be performed. A copy of this file should be included with your data files. Enter, for example:

```
XCOPY c:\biomech\walk.cfb a:\trial.cfb
```

Remove the diskette and insert into your data processing computer. From the DOS prompt, you must create a data directory for your files. Create a subdirectory with the same name as your data file. E.g., from the command line enter:

```
C:
```

CD \data\walking

MD trial

Next, copy your data files to this directory. Enter, for example:

A:

COPY trial.* c:\data\walking\trial

Converting from APAS to Biomech

To edit your data and convert it to a format suitable to Biomech run the Imager program and save your corrections before exiting the program. You must also add “event codes” to your data file to assist in the determination of various gait parameters.

IMAGER trial.1T (you may have to use .2T, .3T,9T instead)

Alternately run Biomech for Windows and after opening the data directory select the appropriate file from the **Data|Select data** item. Then choose **Data|Convert data|Ariel Dynamics|1T**. After editing the data, save the modified file by pressing “W”(write), entering -5 to renumber your data for the Biomech system and pressing “Q”(quit) to exit.

Starting the Biomech Planar Motion Analysis System

The following pages are arranged in the order that the various programs must be executed. For kinematic analyses, only the first group needs to be executed. For kinetic analyses, the kinematics program must be run first then either the Energy, Force or Momentum programs. The Power program can only be executed if the Force program has already been run. The Graph program can be used to display data from any of the programs but users will probably want to use Excel or Quattro Pro to produce graphical output. A separate manual is available to describe how the Graph program works (i.e., GRAPH User’s Manual).

Where the text is presented in two columns, the left column, describes how to run the programs from DOS using the batch file, BIOMECH.BAT. The right column shows the equivalent commands for the Windows programs (BMWIN.EXE or BMWIN95.EXE). To start the Windows programs click on the appropriate icons. To start the DOS version change to the appropriate data directory then enter:

%BIOMECH%\BIOMECH

If the software has been installed properly a program menu should appear. If not refer to the README.TXT file that was included with the installation software.

CINEDATA, ERRCHECK & KINEMATICS

Starting the DOS Biomech system

Use the CINEDATA program to convert your data from digitizer units to real (metric) dimensions. This program will also refine or “straighten” your data by correcting for camera misalignments. Use the batch file, BIOMECH.BAT:

BIOMECH trial

This shell will present you with a menu of program options. First, you will need to renumber your data since the Biomech software expects at least four, preferably six, frames to permit filtering and differentiation. Second, choose the option [C] to start the CINEDATA program. You may view its printed output by answering the following question positively.

To customize your control file (.CFB) select the menu option [2]. This program will copy various details from your digitized data file (.DG) to your control file. Now edit the control file to configure it for your data file. Follow the instructions in the document, **Example of a Biomech Control File**. Use the document, **Biomech User’s Manual** to make any required modifications.

Next, select the options [E] for ERRCHECK and [K] for KINEMATICS. The ERRCHECK program compares the measured segment lengths against the lengths of the segments obtained from the frame-by-frame digitized coordinates. KINEMATICS filters the data and computes marker, segment and total body kinematics.

Note, the listing (output) from each program is contained in your data directory. You may view them with the option [V] and then selecting the appropriate file. The output files have the extension, .OUT, and the filename of the program that created them. For example, the kinematics are stored in the file, KINEMATI.OUT.

Using Biomech for Windows

Below are the equivalent commands for using Biomech for Windows instead of DOS commands.

Model|Select model (.CFB)

Data|Refine/scale data (Cinedata)

Model|Copy data to model

Manuals|Control file example

Manuals|Biomech User’s Manual

Programs|Errcheck

Programs|Kinematics

Look in file list labelled “Output files”

Click on “kinemati.out”

ENERGY and FORCE

Biomech for DOS

Mechanical work and energy

To compute work and energy you will need to edit the control file (.CFB) and identify the number of frames in your movement cycle (9th number on card 2) and the starting frame number (11th number on card 2). Refer to the Biomech User's Manual by running the Biomech menu.

BIOMECH trial

Then select [H]elp and [O]pen to edit the control file. Finally, select [W]ork to run the work/energy program and view the listing.

Forces and moments

To perform an inverse dynamics analysis merge the force platform data with your control file (.CFB). First move a copy of the raw force (.RF) file to your data directory. For example:

COPY a:\trial.rf c:\data\walking\trial

If you collected your force data with BioWare or APAS use the BioProc program to process the data and save the "reduced data" with in the .RF file format. You will need to determine the frame numbers corresponding with ipsilateral foot-strike (IFS) and ipsilateral toe-off (ITO). This can be done by viewing your .DG file with the Imager program.

IMAGER trial.dg

Then choose the [2] option from the Biomech menu and answer the questions, appropriately.

BIOMECH trial

Finally, select the [F]orces option and view the listing produced by the FORCE program.

Biomech for Windows

First, select your data file then edit the .CFB file with:

Manuals|Biomech User's Manual

**Model|Edit/view model in ASCII
Programs|Work-energy**

Aimate|Digitized data (.DG)

Model|Add forces to model

Programs|Force

POWERS and GRAPH

Biomech for DOS

Start MS-DOS and move to the directory that contains your data files. Start the Biomech software.

BIOMECH trial

Run the Powers program to perform the power analyses. View the listing produced.

Press **[P]**

To graph and print the results of the power analysis.

Press **[J]**oint (to graph the joint powers)
walk or **run** (enter name of the GRAPH control file)
 Press **[N]**ext (to view graph of knee powers)
 Press **[N]**ext (to view graph of hip powers)
 Press **Y** (to replot the graphs)
 Press **N** (for black and white graphs)
 Press **J** (for LaserJet III printer)
 [Press **Y** (optional if printer was not already online)]
 Press **N** (to rotate the figure)

Repeat until all three figures have been printed. Then press **[Q]**uit to exit the GRAPH program.

Biomech for Windows

Start Biomech for Windows and open the directory containing your data files. Select the appropriate .CFB file from the Models list.

Programs|Powers

To graph the results open the **Graph** menu and use **Select binary file** to select the file with extension .PJ. Then select the WALK.GRA or RUN.GRA file from the **Select type of graph** list-box. Next, use the **Create the graph(s)** item to generate the graphics file (HPGL format). This file has a .PLT extension and can be viewed by clicking the file listed in the **Graphs** list-box. The last item under the Graph menu, **Print graph(s)**, is for sending the graphics output to a Laserjet or HP compatible printer.