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I. Measurements

A. Generally

The movement data will be recorded by 200 Hz fixed. The data are already filtered.

The screen will be refreshed by 25 Hz

For using Emylse you are allowed to record 81 seconds. For using MultiCV and Tailor you are restricted to a sweep length of 327 seconds.

The calibration of the sensors and the measurements should only be carried out after the operating temperature has been reached. This is roughly after 15 minutes.

Do not open mc2Cal and mc2Recorder at the same time!

These are the programs for recording the sweeps:



mc2Cal calibrating the sensors



mc2Recorder registering the movement data



ageSoundRec recording sound synchronously by the soundcard of the computer



ageLogger responsible for analyzing malfunctions

B. Start and End of Measurements

First start your control computer and wait until it has completely booted.

Switch on power at the carrier. Please look at the type plate if your system is prepared for 110V or 230V. There is installed an insulating transformer. All components inside the carrier are working with 230V.

The programs inside the carrier computer "Twin..", will start automatically. Please wait about 15 minutes to warm up the system.

To end, please click "shutdown" in the mc2Recorder. Wait one minute and switch off the power at the carrier.

For a new start, you have to wait one more minute before you are allowed to switch on the power again.

C. Creating a log file - ageLogger

The ageLogger will be installed for analyzing malfunctions. The content is not visible. Please send to carstens@articulograph.de in case of any trouble.

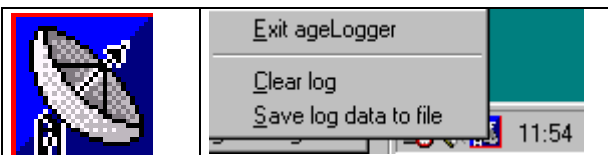


fig. 1: logger menu (left mouse button)

D. Calibrating sensors – mc2Cal

1. Positioning the Helmet at the stand

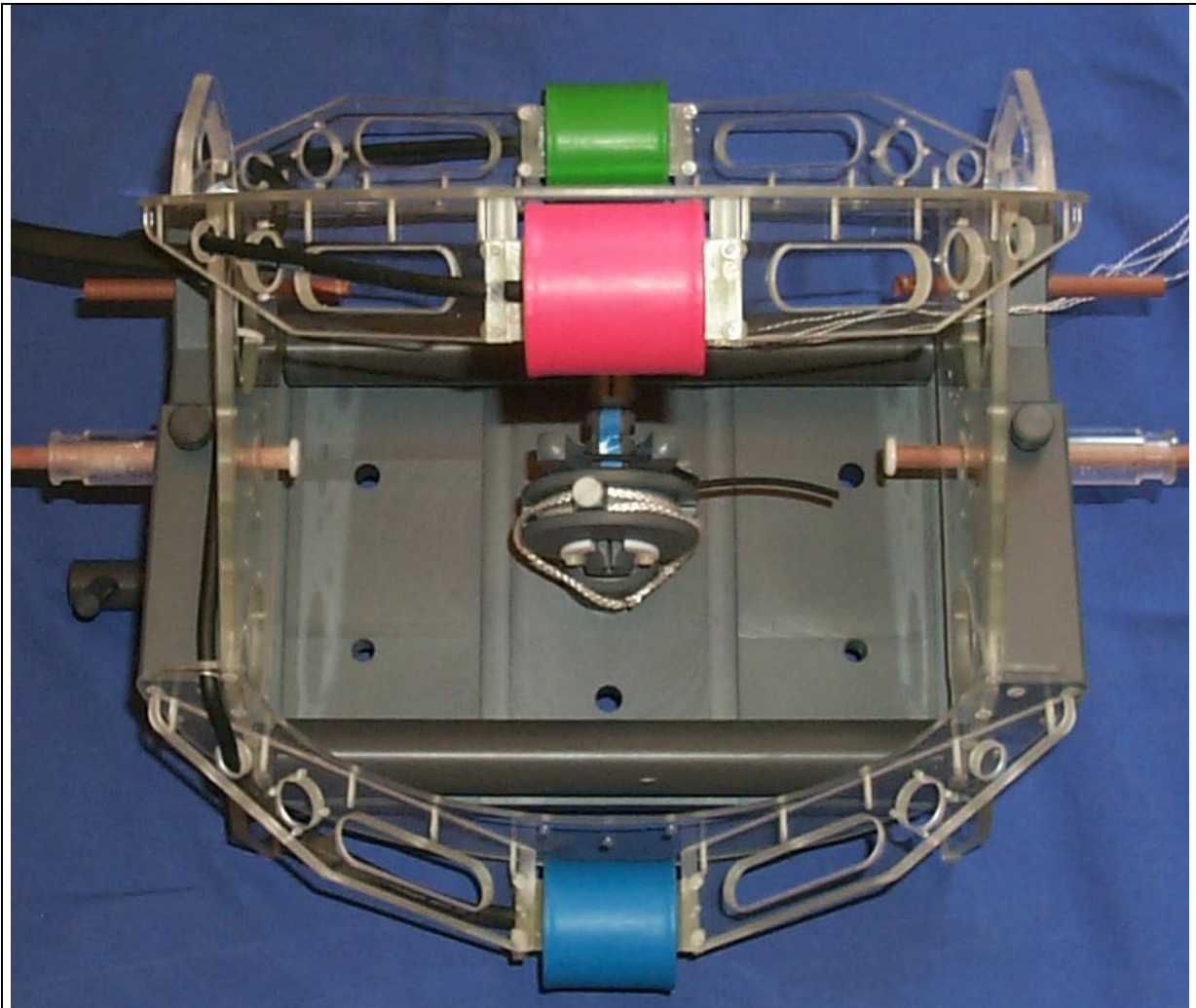


fig. 2: Positioning the Helmet at the stand

Position the helmet on its holder. Make sure that there is no metal nearby to the helmet. Therefore don't use the cover of the carrier !!!

2. Placing the Sensors in the Calibration Magazine

Using the diagram for guidance place the sensors so that they fit snugly into the magazine. Run the wires along the slot in the calibration magazine. Make sure that the channels are arranged in the order shown.

Now place the calibration magazine in the calibration device and fix it in the first position. Make sure that the connecting wires to the sensors are kept as far away from the transmitter coils.

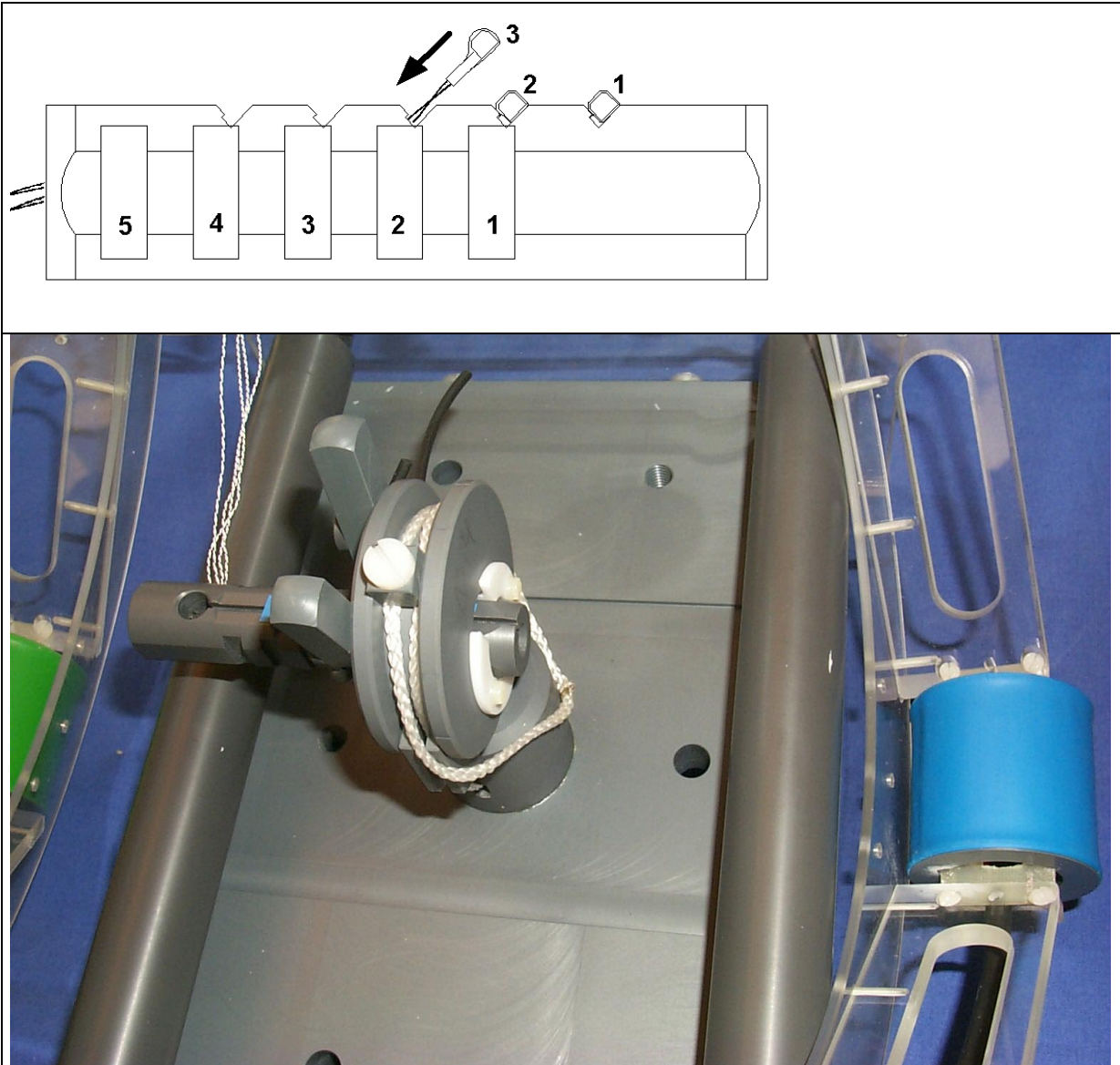


fig. 3: Positioning the sensor in the magazine and the magazine in the calibration stand

3. Calibrating procedure

To calibrate the sensors you open mc2Cal. In the appearing window, the name of the trans-computer has to be seen. Please make sure, that the name is right. If so, press ok, if not please type in the name.

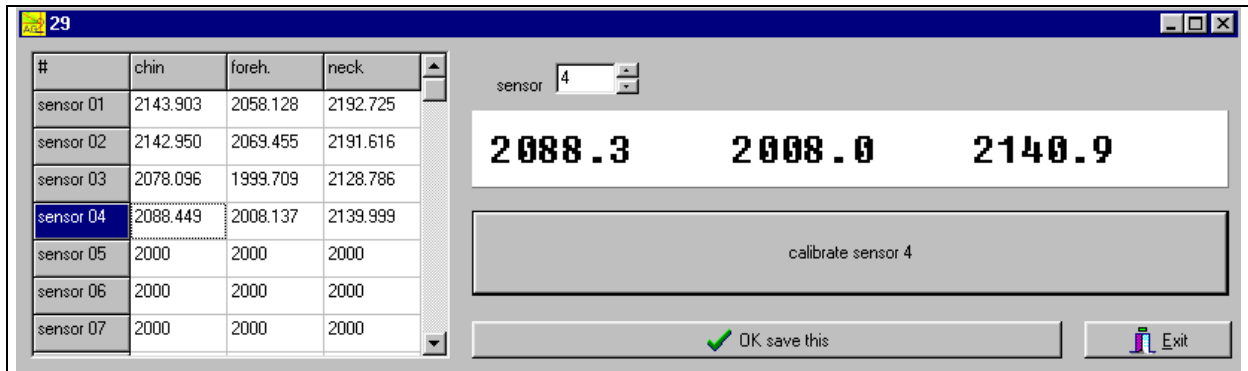


fig. 4: Calibration menu

The window you now see, shows the data of the sensors. On the left hand side there are three columns for chin, forehead and neck. Here, the data of the calibrated sensor will appear. On the right hand side, the actual amplitudes of the sensor you have chosen in the table, can be seen. Please enlarge the window, so that you are able to see the three numbers.

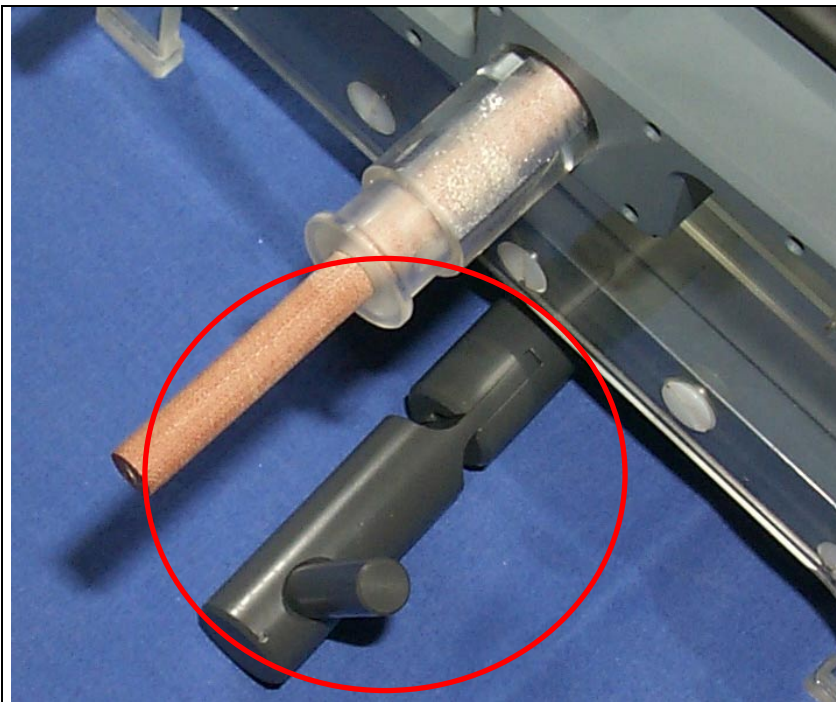


fig. 5: Mechanic to tilt and rotate the calibration magazine

You now have to calibrate the sensors. Adjust by tilting and rotating with the mechanic to find the maximum of the amplitudes.

When the first sensor is well calibrated, press calibrate sensor 1. The data will appear in the table and the data for the second sensor appears automatically in the white field on the right hand side. The same procedure is necessary for every sensor. When all sensors are calibrated, please press ok and save this. The results will be stored into the text file kf.txt.

Please calibrate the sensors in steps of four sensors.

Now you have to exit the program Mc2cal.

E. Accuracy Test

We recommend to record to sweeps with four sensors in the magazine, one at sensor space 1 at the center and a second at sensor space 5 at the center. You should get an absolutely distance of 40 mm (Pythagoras).

Please use MultiCV to convert the data to ASCII.

F. Measurement Session.

1. Acoustic

In case you are working with a soundcard start the program ageSoundRec. The wave form can be seen during measurement if you are sure, that your computer is fast enough.



fig. 6: agSoundRec control window

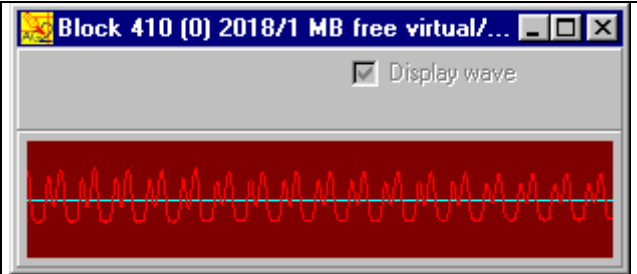


fig. 7: Displaying wave form during sweep recording

2. Sweep recording

Now start the mc2recorder. Again make sure that the name of the trans-computer is right and press ok.

A window appears showing

- a grid with the three transmitter coils
- a circle for the center
- tilt factors
- The position of the sensors
- green frame, if the connection to the AG200 computer is valid, red if not valid

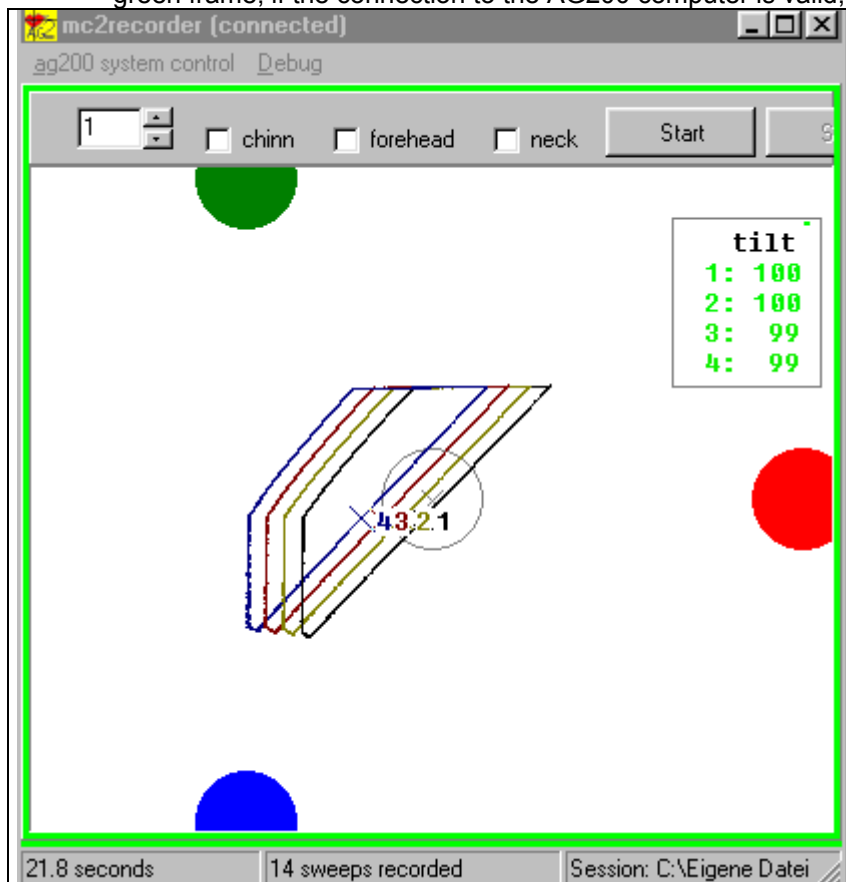
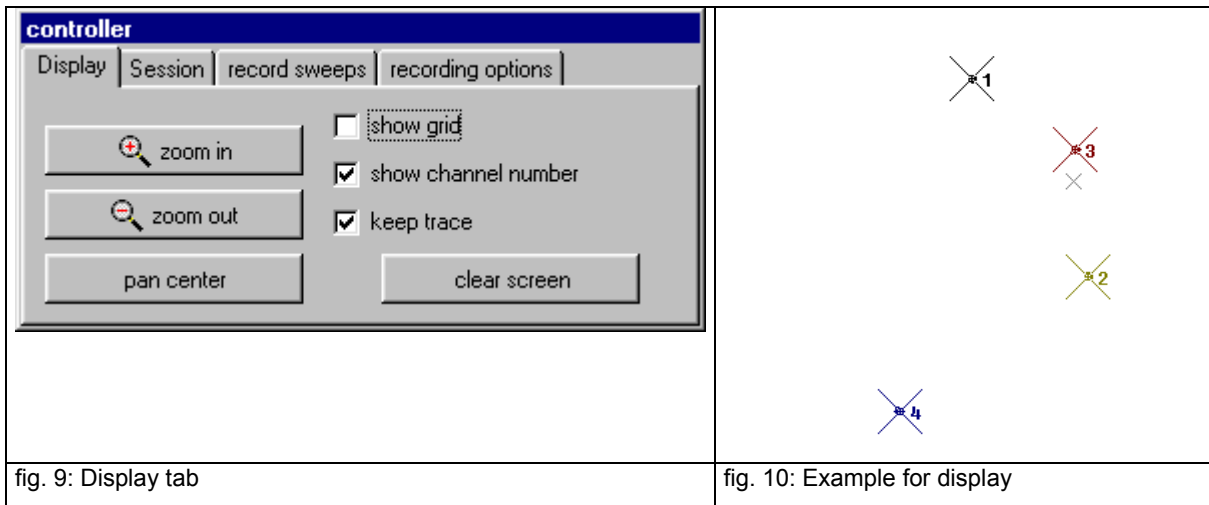


fig. 8: real-time display with showing the actual length (seconds) of recording and the # of the sweep

Please reduce the graphic size, if the display is not in real time !!

a) Controller / Display

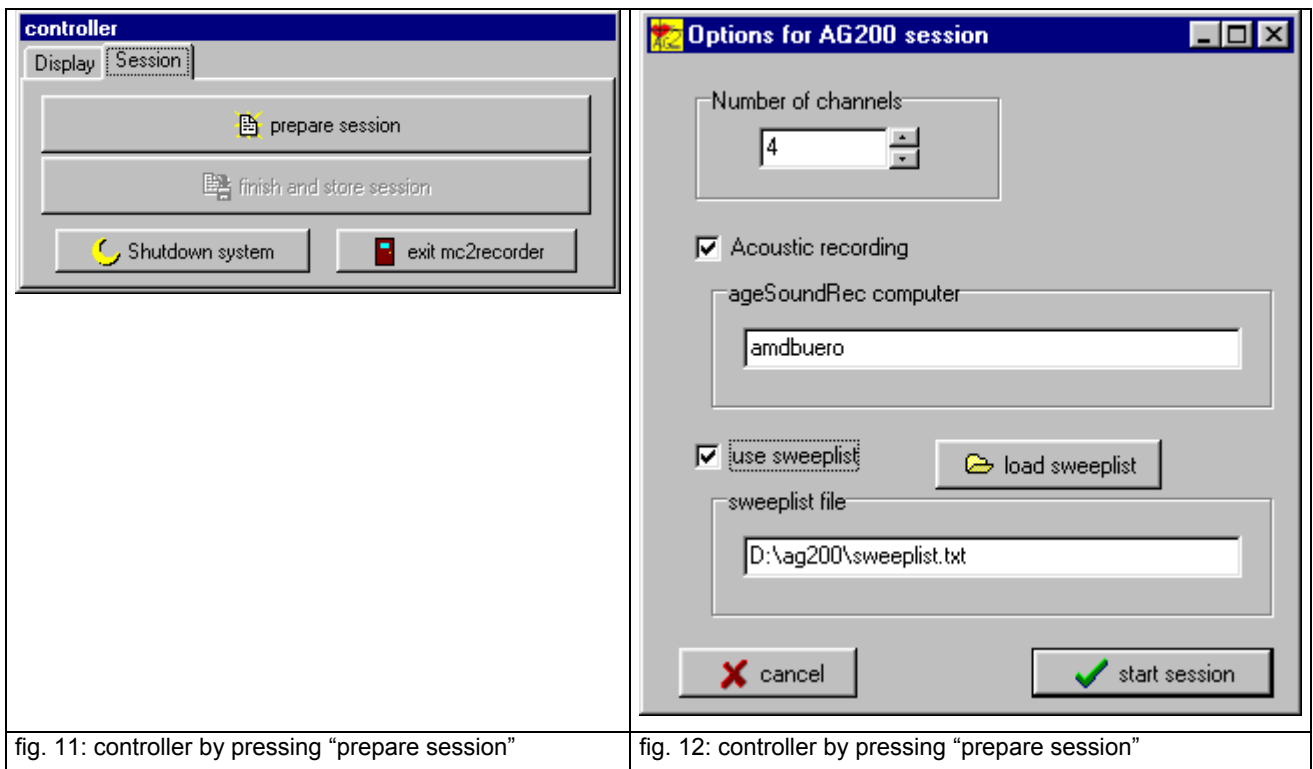
Furthermore, a window called controller will be seen. There you see two tabs: Display and Session



By checking “keep trace”, the whole sweep is shown on the display. Otherwise only the last point is visible. The last point is shown as a cross, while the size of the cross is depending on the tilt factor. The number of channel can be visible.

b) Controller / Prepare session:

For starting the session please press the button saying “prepare session”. A new window will appear:



c) Activate Sound Recording

If you wish to activate the sound recording program, please check Acoustic recording and type in the name of the computer which is responsible for the sound recording. If you use the control computer for sound recording too, please type in: *localhost*. Please make sure, that the program agesoundRec is already running.

d) Check sweep list

Please create a text file that you will use as a sweep list. The comments will appear. You are able to scroll up and down in this list.

Press "start session"

Now you will be offered to create a folder as well as a file name for your study. It is recommended to use a new folder for each session. For the file name use only a maximum **of 6 characters**. Do not use folder with blanks like "my document or my computer", in case you would like to use the program "Emalyse".

For using Emalyse, Tailor or MultiCV to analyze the data, the folder name should not contain more than 8 characters and no blanks.

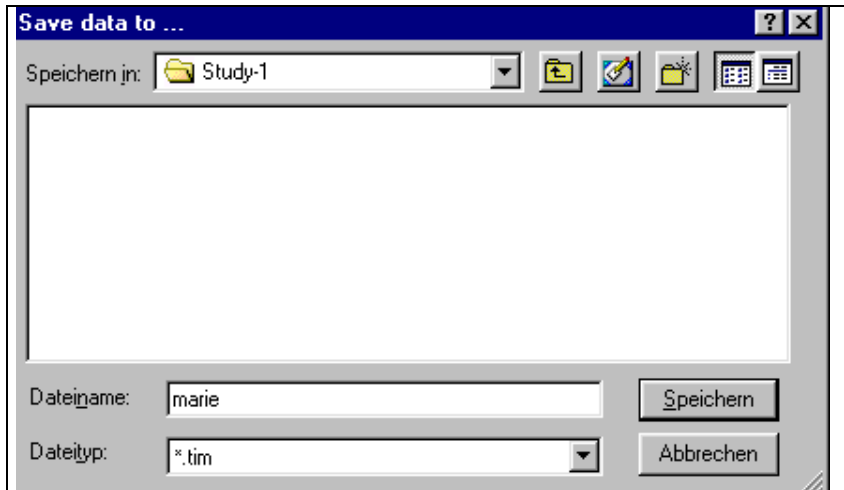


fig. 13: select folder and filename for study

e) Record sweeps

In the controller appears a third tab : "record sweep" - please select.

f) Start recording



fig. 14: record sweeps

Press "start" to start the sweep recording and "stop" to end.

For details to use the sweep list please look at: 3. Sweep list.

Please notice:.. The recording has started when the color of the button has changed to dark red. This may take up to two seconds. Maybe that's not immediately by pressing the start button. By pressing the "stop" button, the recording is stopped immediately even if the button stays red while storing the data.

After 99 sweeps (maximum for one session) the sweep 99 as well as the whole session will be stored automatically.

The data, more the allowed length will be cut and the first 65000 measurements points will be stored

g) End of session and shutdown system

To finish the study please select the tab “Session” and press “finish and store session”

“Shutdown system” to shutdown the Computer inside the system. Don't forget to switch off the power at the Articulograph (carrier).

press “exit mc2recorder” to finish the program

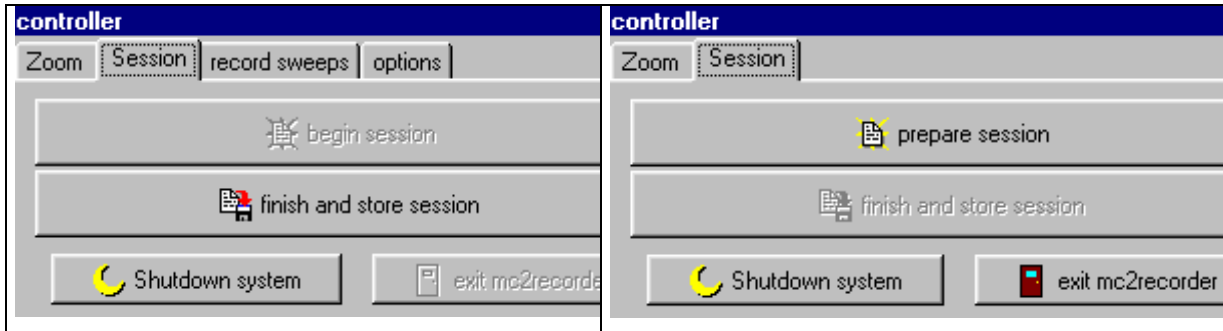


fig. 15: end session:

3. Sweep list

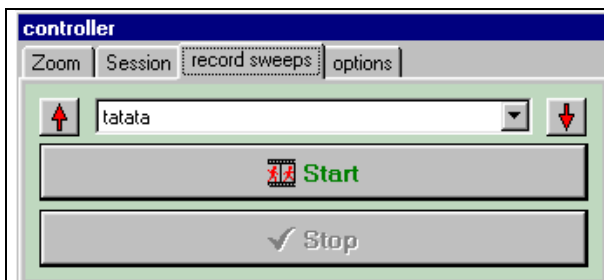


fig. 16: Displaying the sweep list

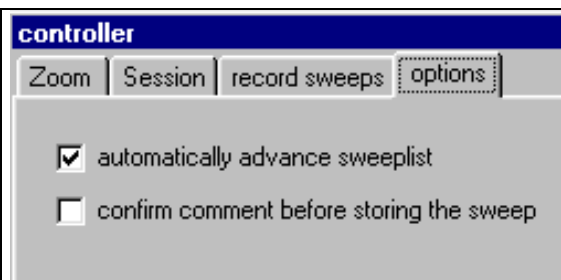


fig. 17: Option for using the sweep list

Please create a text file that you will use as a sweep list. The comments will appear. You are able to scroll up and down in this list.

By checking “confirm comment before storing the sweep” you have the chance to skip the last sweep or to change the comment .

There is a hint, if the sweep list is ending. If you will go on with your study remove check for automatically and type in your comments

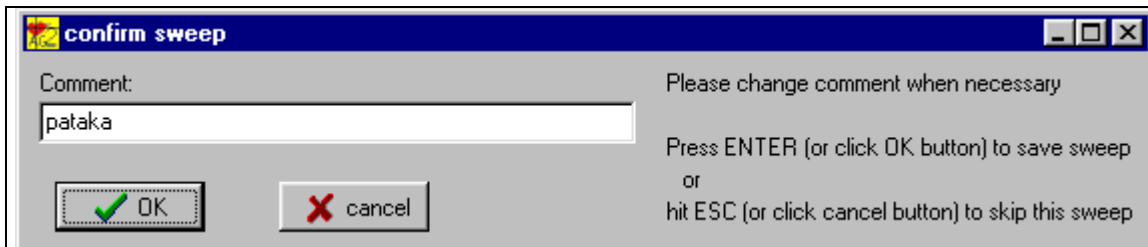


fig. 18: Changing or confirming comments, skipping sweeps

If you do not like to use a sweep list please add the comment before starting the sweep. These comments will be stored within a protocol file and it is necessary for using Emylyse, Tailor or MultiCV.

4. Tilt factor

a) Controlling the tilt factor during the study

<pre> tilt 1: 83 2: 99 3: 100 4: 100 </pre>	<p>At the screen you can control the tilt factors during the measurement. There are shown the numbers running from green to red.</p> <p>If they become red please check the sensor or the sensor orientation.</p>
---	---

The tilt factor is displayed and shows the tilt or misalignment of the sensor at the actual cursor position.

b) Explaining of the tilt factor

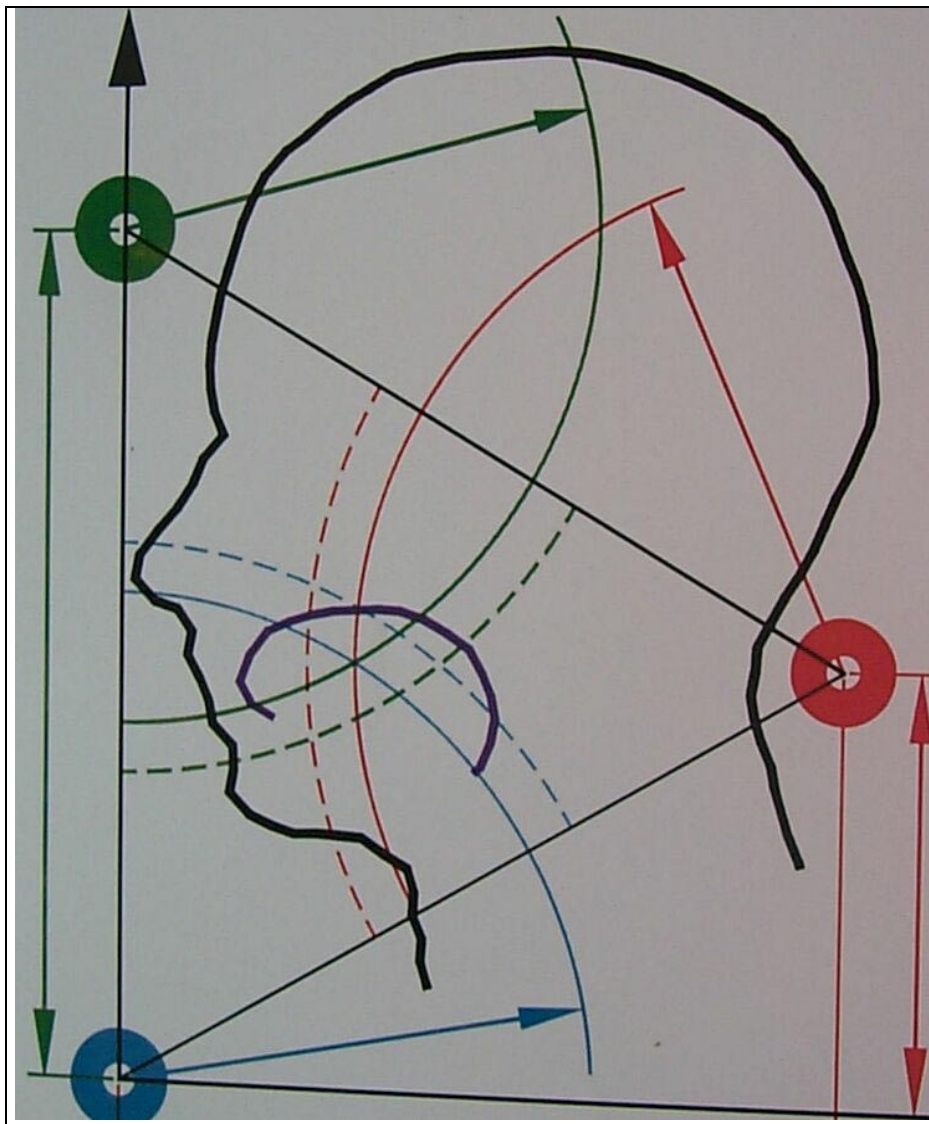


fig. 19: radian of distance

If the tilt factor is higher than 100 your sensor calibration is not well done.

If the alignment and rotation of the sensors would be perfect, all three distance radian would match. The tilt factor is the correction factor. In case the sensor is in the midsagittal plane and tilted or rotated you will get a tilt factor less 100. This correction will be done well and your data are okay even by the tilt factor less than 100. The same happens, if you are a little bit outside of the plane without rotated or tilted sensors. Only if you are outside of the midsagittal plane and the sensors are rotated or tilted you will get an tilt factor less than 100 and an position error.

So, if the tilt factor is much less than 100 the data could be bad however it is not necessary.

G. Data and Filestructure

The data are ready for using Emalyse. (Same file structure as the AG100)

With MultiCV you can create an ASCII file of the movement and sound data.

1. Results of your measurements with the mc2Recorder program

Every study creates 3 files with organisational data and additional 3 files for each sweep. The sweep number is coded in the file extension. The first character of the file extension defines the type of the data (0= co-ordinates; T= tilt factor; A= acoustic) and the last two characters represent the sweep number.

If you name a study for instance "TEST" you get the following files:

a) Files with organisational data

The following files are only once created for one study.

b) TEST.PRT

The protocol file "TEST.PRT" is a normal text file and contains some parameter only valid for the AG100, the protocol data and the commentary to the individual sweeps. You can type, print or edit this file.

c) TEST.CFG

This file contains the adjusted system parameters and calibration information in binary format. This and the following file is used by the evaluation programs. For special analysis you need programmer information. The Type declaration is shown in the chapter "Detailed programming information".

d) TEST.TIM

The timing file contains one data record for each sweep. The record is named Tim_TYPE. It contains the sweep number, the count of measurement points and the starting time in hour, minute, second and hundredth of seconds. The Type declaration is shown in the chapter "Detailed programming information".

e) Files for each sweep

The following three types of data files are created for each sweep in a study. The last two characters of the filename extension represent the sweep number.

(1) TEST.001 .. TEST.099

The movement data of the first sweep are stored in "TEST.001". The XY-co-ordinates are in units of 0.01 mm as integer values.

(2) TEST.T01 .. TEST.T99

For every XY-co-ordinate stored in TEST.001 there is a tilt factor stored in the file TEST.T01.

(3) TEST.A01 .. TEST.A99

Each sweep's acoustic speech information is stored in these files in a compressed format.

f) Additional files when more than 5 channels are used

(1) TEST.101 .. TEST.199

The movement data of the channels 6 - 10 are stored in "TEST.101" in the same manner as the data of channel 1 - 5 are stored in TEST.001".

(2) TEST.U01 .. TEST.U99

For every XY-co-ordinate stored in TEST.001 there is a tilt factor stored in the file TEST.U01.

g) Additional files when more than 10 channels are used

(1) TEST.201 .. TEST.299

The movement data of the first sweep are stored in "TEST.201". The XY-co-ordinates are in units of 0.01 mm as integer values.

(2) TEST.V01 .. TEST.V99

For every XY-co-ordinate stored in TEST.001 there is a tilt factor stored in the file TEST.V01.

2. The data files created by MultiCV

The MultiCV program leaves all measured data unchanged. It creates new files in different formats.

a) Script files to create AutoCad drawings

(1) TEST01.SCR .. TEST99.SCR

TEST01.SCR is a control file for the AutoCad program and will produce an AutoCad drawing file that contains the movement curves of the first sweep.

b) ASCII Files for general data base and evaluation programs

(1) TEST.D01 .. TEST.D99

The file TEST.D01 contains nearly the same information as the TEST.001 file but in an ASCII data format for processing with data base software.

The movement data are converted to an ASCII file which represents a table. Each row shows all data of one sample. You can edit, type or print this file:

tim	Ch1-X	Ch1-Y	Ch1-T	Ch2-X	Ch2-Y	Ch2-T	Ch3-X	Ch3-Y	Ch3-T	Ch4-X	Ch4-Y	Ch4-T	Ch5-X	Ch5-Y	Ch5-T
0	4175	15627	94	5005	16161	94	5861	16898	97	3493	14168	98	2696	15628	99
100	4208	15622	94	5013	16155	94	5856	16891	97	3516	14161	98	2727	15624	100
200	4226	15622	95	4995	16161	94	5856	16891	97	3493	14168	98	2731	15628	99
300	4208	15622	94	5000	16156	94	5865	16893	97	3490	14165	98	2696	15628	99

The first column contains the time in milliseconds. The following columns contain the x and y co-ordinate and the tilt factor of each channel. The XY co-ordinates are in units of 0.01 mm as integer values

c) Acoustic PCM data

(1) TEST.M01 .. TEST.M99

The file TEST.M01 contains the same information as the file TEST.A01 but in a non-compressed integer data format. The acoustic signal is sampled as a 12 Bit word with 16 000 samples per second. The most significant 4 bits are set to zero.

The file is organized as a binary sequence of 16 Bit words (512 Byte block size) and does not contain any header information. The first 16 Bit word represents the first acoustic sample. The least significant byte is stored first.

3. Detailed Programming Information

a) TEST.CFG (This data are only to be compatible to the AG100 data format)

The configuration file contains the following record that keeps the adjusted parameters for the study:

- conf_TYPE = RECORD { Konfigurationsfile }
- ceinstellwerte : array[1..3] of Byte; { Sendeleistung }
- cOffset : array[1..3, 1..5] of Integer;
- crmin : array[1..5, 1..3] of double;
- cMessPeriode, { Meßfrequenz }
- ckanalanzahl, { Anzahl Meßpositionen }
- citt_steps, { Iterationsschritte }
- cF_Shift : Byte; { Mittelwert aus .. }
- cPanX, { X und Y Pos. der }
- cPanY, { graf. Darstellung }
- cScale : Integer; { Vergrößerung }
- cPotenz_K, { R hoch Potenz }
- cR_cen, { Radius zur Mitte }
- cR_max, { größter zugelassener }
- cYS, { Dreieck: Seitenlänge }

- cPotenz_S, { neu genutzt }
- cPotenz_N : double; { neu genutzt }
- cDrv, { Laufwerk für Daten }
- cDatenDir : String [20]; { Directory für Daten }
- cKommentar : Char; { Kommentieren J/N }
- END;

b) TEST.TIM

- The time file contains one "Tim_TYPE" record for each sweep.
- Tim_TYPE = RECORD { Zeitsynchronisationsfile }
- SampleNr,
- Samples,
- Shour,
- SMin,
- SSek,
- SHSek : Word;
- END;

c) TEST.001 .. TEST.099

The file is organized as a binary sequence of "Fi_MessT" records and does not contain any header information. The record "Fi_MessT" is defined as:

Fi_MessT = array[1..5] of word;

The index [1..5] refers to the channel 1-5. The first record contains the X values for all 5 channels of the first sample. The second record contains the Y values for all 5 channels of the first sample. The third record contains the X values for all 5 channels of the second sample.

All odd records contain the X-values and the even records contain the Y-values.

If the study is done with less than 5 channels, the data format is the same. The values at the places of the unused channels are not valid.

d) TEST.T01 .. TEST.T99

The file is organized as a binary sequence of "Fi_TiltT" records and does not contain any header information. The record "Fi_TiltT" is defined as:

Fi_TiltT = array[1..5] of Byte;

For every XY-co-ordinate stored in TEST.001 there is a corresponding tilt factor stored in the file TEST.T01.

e) TEST.A01 .. TEST.A99

The file is organized as a binary sequence of 8 Bit Bytes (128 Byte block size) and does not contain any header information. Each sample is compressed to a 4 Bit value. The first sample is stored in the high nibble of the first byte. The second sample is stored in the low nibble.