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## II. Recording a session

### A. Starting Cs5recorder

#### 1. Start the program

To start the program select cs5recorder from the menu (Figure 1).



Figure 1: Click Application → AG501 → cs5recorder to start the program

In order to record data, it is necessary to have at least one set of sensors calibrated. When the program opens, it asks for the directory of the corresponding calibration set (Figure 2).

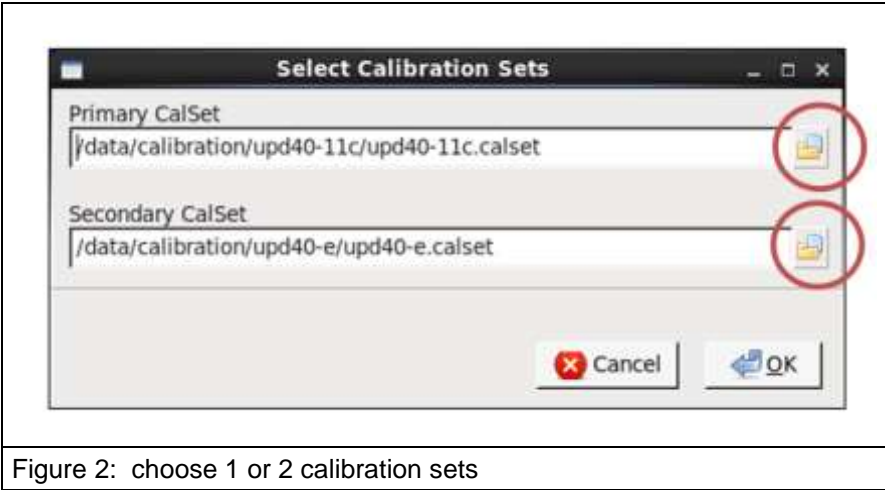


Figure 2: choose 1 or 2 calibration sets

The primary calibration set (calset) is intended to be used for the study. The secondary calset should have spare sensors in case a broken sensor needs to be replaced.

The calsets usually can be found under `/data/calibration/`.

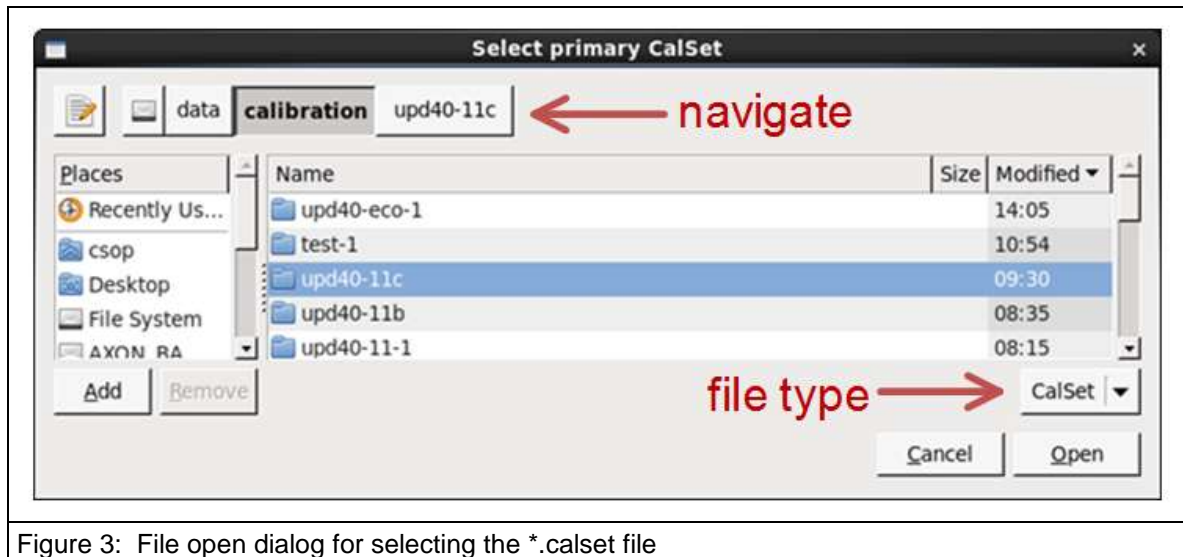


Figure 3: File open dialog for selecting the \*.calset file

The 'Select primary Calset' dialog allows you to navigate to the desired \*.calset file (Figure 3). Select it and click open.

## 2. Possible Error Message



### 3. Start data transfer

To start the data transfer click the start button in the upper right corner of the user interface (Figure 5).

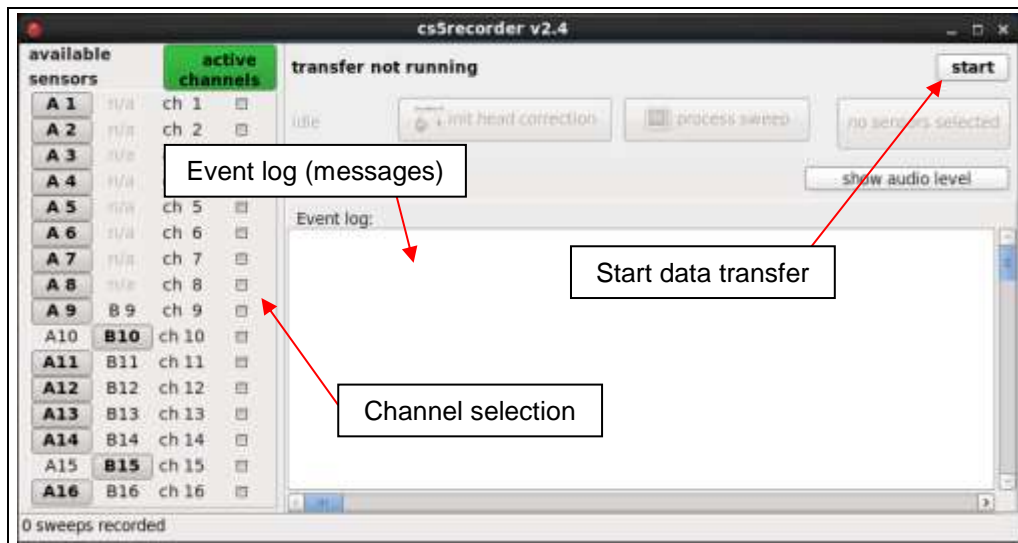


Figure 5: The cs5recorder user interface at startup

When the data transfer is started, an activity log (green panel) appears. It counts the time and shows the amount of samples received. At this time, a real time display (see chapter C, Figure 17) will show the sensor positions but no data will be saved.

### 4. Select channels for recording

Select the channels for recording by clicking the channels beneath the *active channels* headline (Figure 6). At program startup all channels are deselected by default. To toggle all channels (select deselected channels and deselect selected channels) click the *active channels* button.

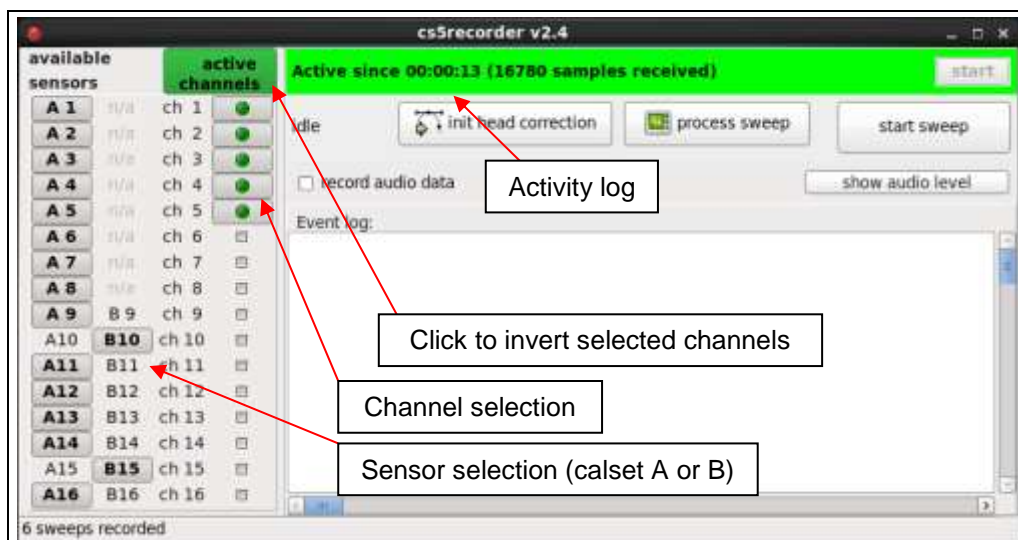


Figure 6: Channel and sensor selection

If a calset contains broken sensors, they are marked as unavailable (n/a) and, if available, the sensor of the secondary calset are selected (B10 and B15 in Figure 6). Sensors of the secondary calset can also be selected manually by clicking the desired sensors (B1 to B4 in Figure 7).

It is **important** to **deselect** channels which are not used, not connected, or not in the measurement area. Otherwise, the program will still calculate their position from the noises they produce.

## 5. Session with sound recording

To activate sound recording select the *record audio data*-option (Figure 7-1).

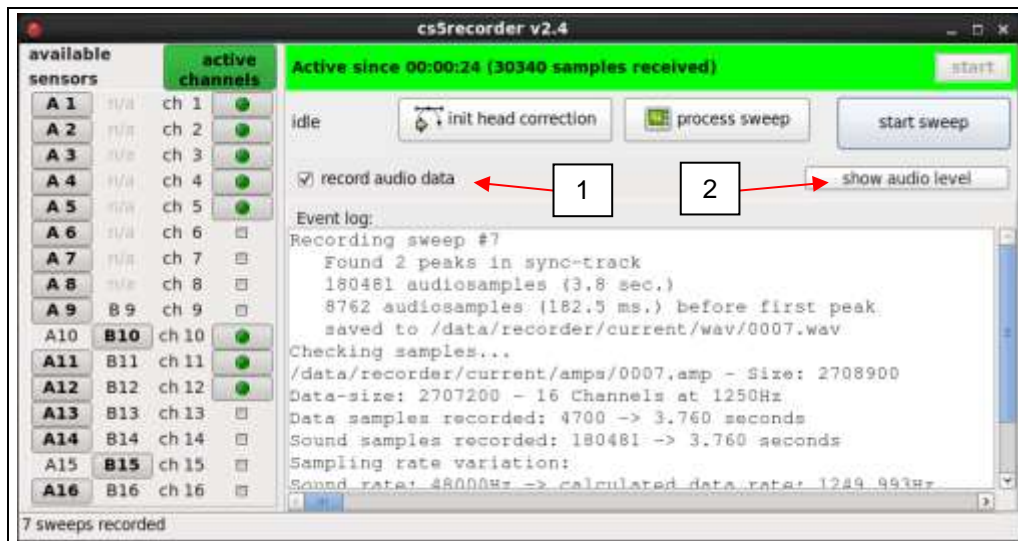


Figure 7: Click the audio-checkbox for recording audio data

Figure 7 shows a successful sound recording. The message 'Found 2 peaks . . .' indicates that the starting and trailing edge from the sweep-synchronization signal was successfully detected.

These are the synchronization markers in the left channel of the audio recording. The audio recording will be cut to be synchronized and stored as 0006.wav for sweep 6.

[ag501\\_sound.pdf](#)

With the *show audio level*-button (Figure 7-2), it is possible to show the audio level (see Figure 8). Please note: *The window must be closed before the recording of data is started. Otherwise, the sound recording will fail. Please close the window pressing Ctrl-C on the keyboard.*

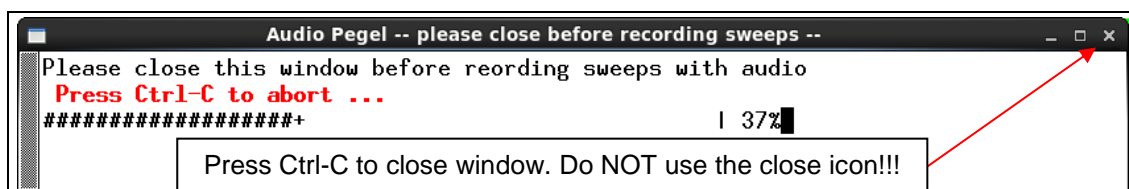


Figure 8: Show audio level to control the output

## B. Recording sweeps

### 1. Documentation

The data will be stored within the folder `/data/recorder/current/`  
It is not possible to select another directory for the data.

### 2. Start recording

You can use the start (Figure 9) and stop button for the recording of sweeps with different lengths. Each selected channel will be recorded. These settings can be changed for every sweep. It is necessary to deselect unused channels to avoid straining the position calculation with invalid data.

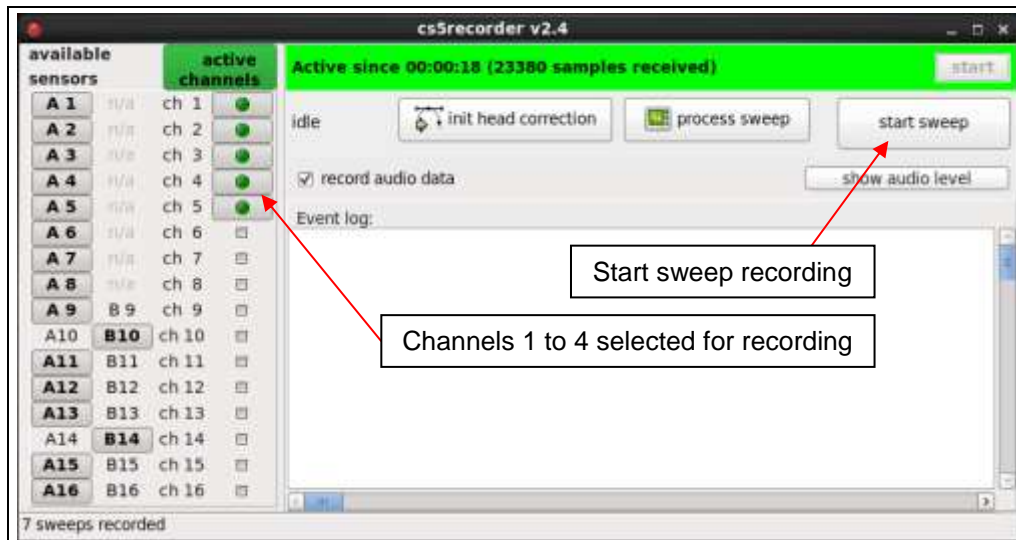


Figure 9: Click start sweep to start recording (channels 1 to 4 selected)

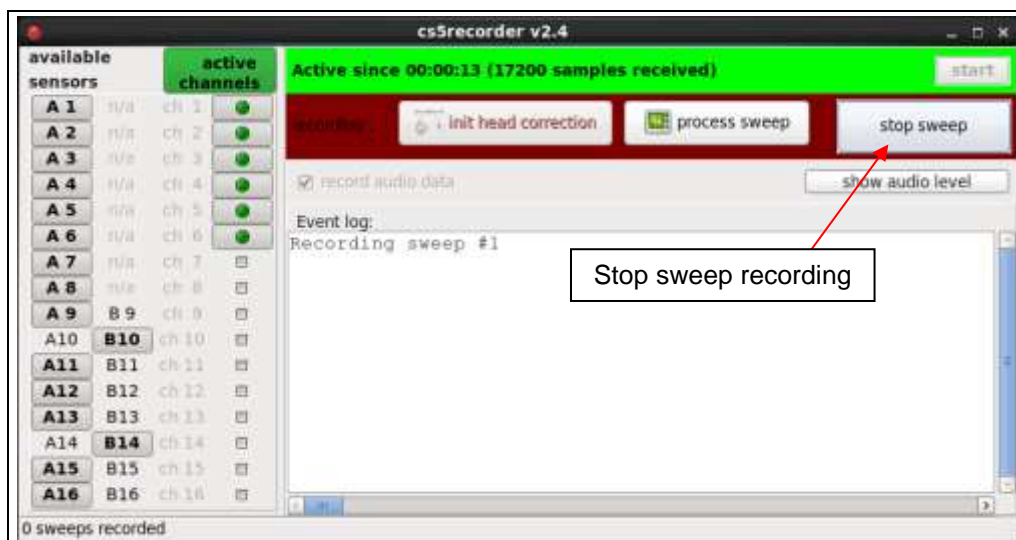


Figure 10: cs5recorder during sweep recording

To use a fixed length use the command line `setsweep len 10`. When this command is used, each sweep recording will stop after 10 seconds. It is still possible to stop the sweep earlier.

To enable the maximum sweep length, use the command `setsweep len 0`

During sweep recording only the amplitudes will be stored. You have to run `cs5calcp` to get the rawpos folder with the calculated positions and `cs5normpos` to generate the final position data. Alternatively you can use the *init head correction*- and *process sweep*-buttons (see section 3 and 4).



### 3. Initializing head correction for the realtime display

To use head corrected data in the realtime display of cs5view (see *Recording with realtime display*) it is necessary to create a reference object from the reference sensors (at least two sensors that are not effected by speech movement – any quasi-stationary location on the head could in principle serve as gluing location; in practice, the most common locations are the upper incisors, the nasion, and behind left and right ear).

After recording a sweep including at least all of the reference sensors, click the *init head correction*-button (Figure 11).

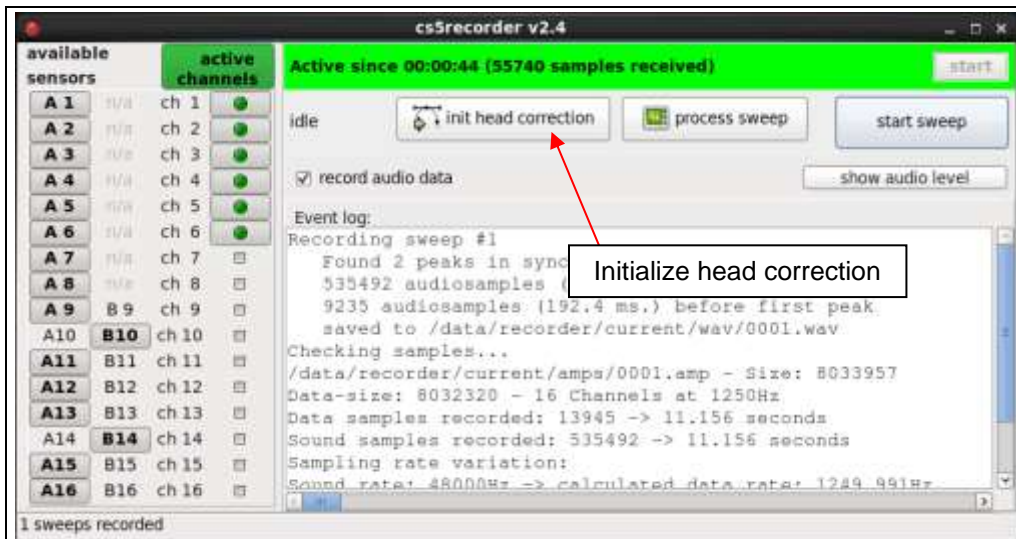


Figure 11: Initializing head correction

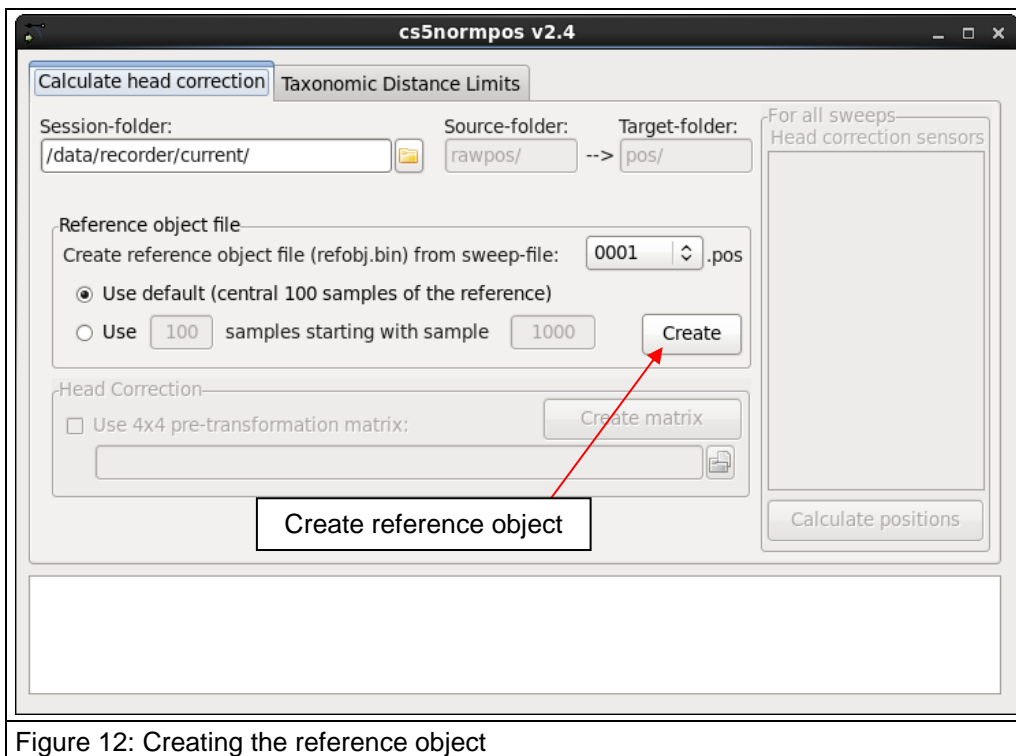


Figure 12: Creating the reference object

This will run calcpso to calculate the rawpos-data (raw position data) of the sweep and subsequently start the program cs5normpos that will create a reference object file from the recorded sweep (Figure 12). After creating the reference object, choose the reference sensors and click *Calculate positions* to perform head correction (Figure 13). The program will close once the head correction is done. It is now possible to use the realtime view in cs5view with head corrected data.

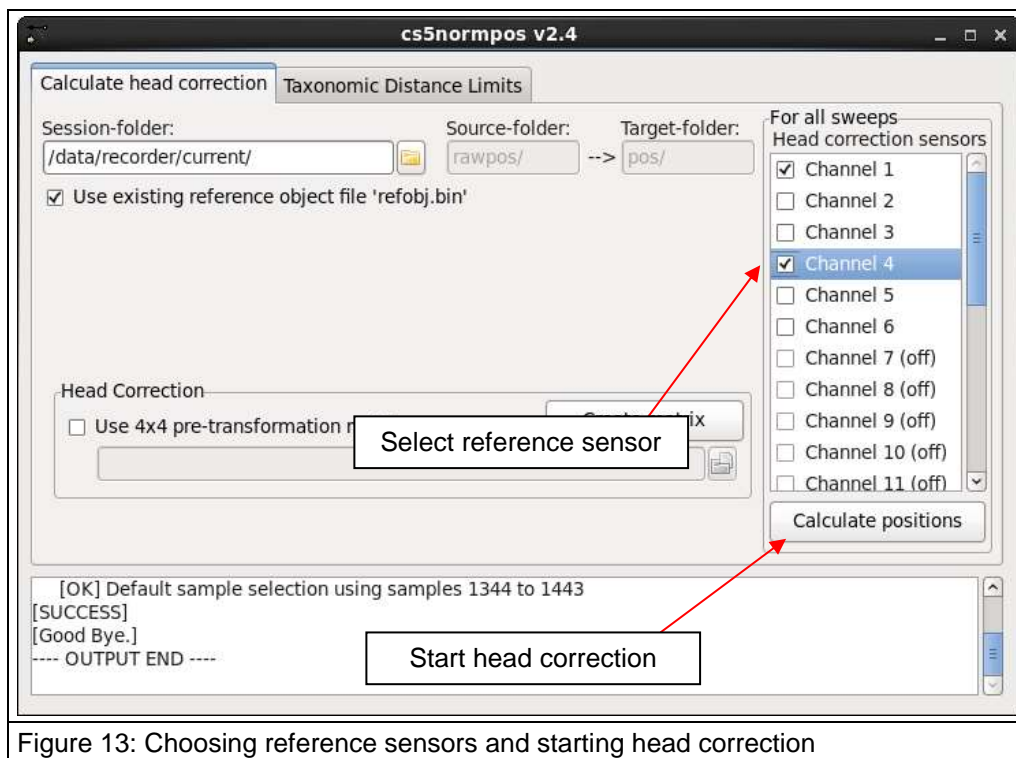


Figure 13: Choosing reference sensors and starting head correction

**Please note:** The initialization of head correction only has to be done once per session. Since all position data of later sweeps will be normalized to the reference object (reference sensors of the initial sweep), it is recommended to perform the head correction initialization on a sweep with minimum head movement and the head being positioned well aligned in the measurement area of the AG501. However, the initialization can be repeated at any time with sweeps that seem to be better suited for the purpose. Where necessary, head correction of already calculated sweeps has to be repeated using cs5normpos (see *Head correction*).

#### 4. Processing sweeps

After the initialization of head correction, for any subsequently recorded sweep calculation of raw and head corrected position data can be produced by clicking the *process sweep*-button (Figure 14). This is useful for a quick check of sweep results or for defining contours in cs5view.

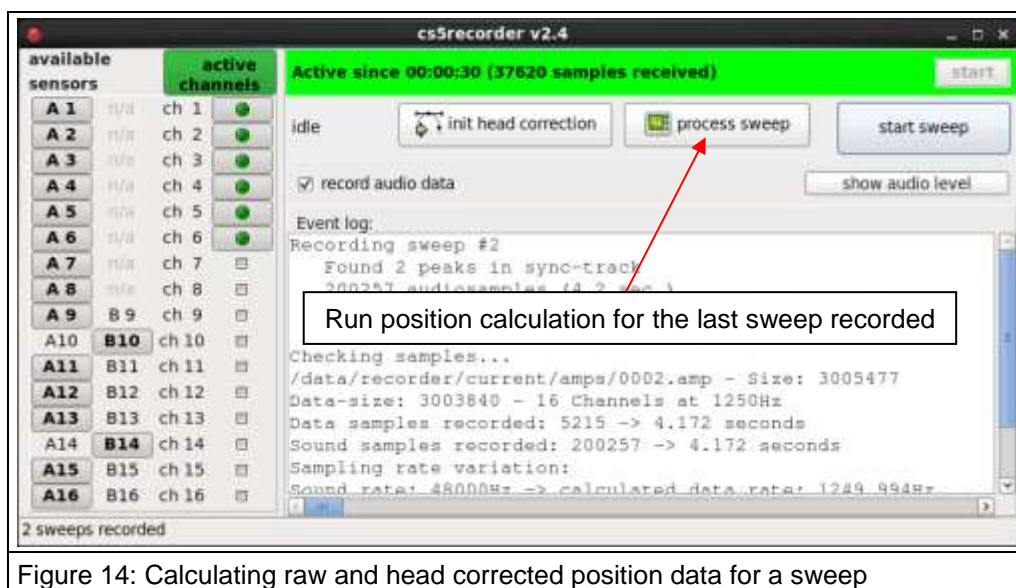


Figure 14: Calculating raw and head corrected position data for a sweep



Please make sure that all reference sensors used for the creation of the reference object are active while recording, since the calculation of the head corrected position will fail, if reference sensors are missing (Figure 15).

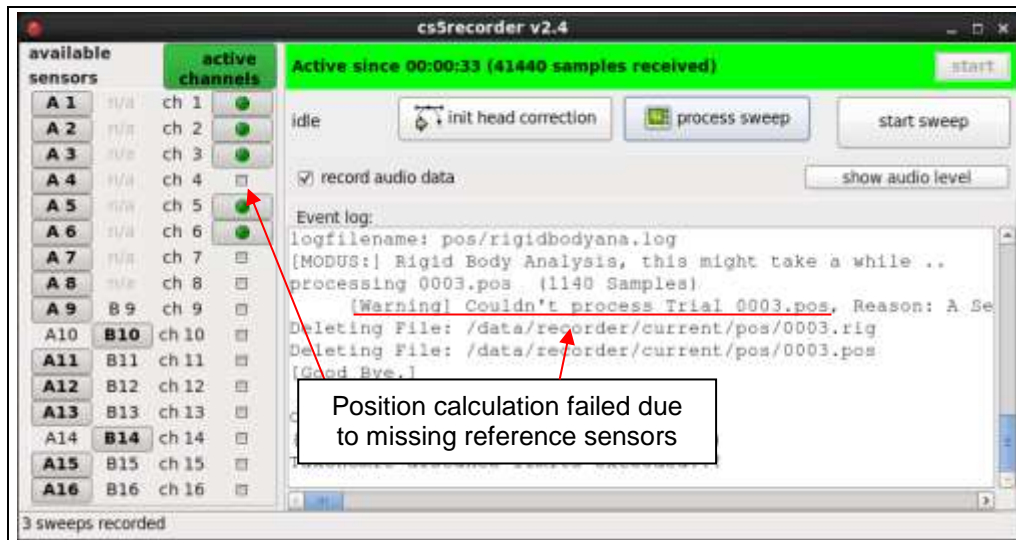


Figure 15: Calculation of head corrected position data failed, because reference sensors used for the reference object were not active during recording

If during head correction the limits for the taxonomic distances (Mean or StdDev) are exceeded, a warning is displayed (Figure 16). For further information on taxonomic distances check the [cs5normpos-manual](#).

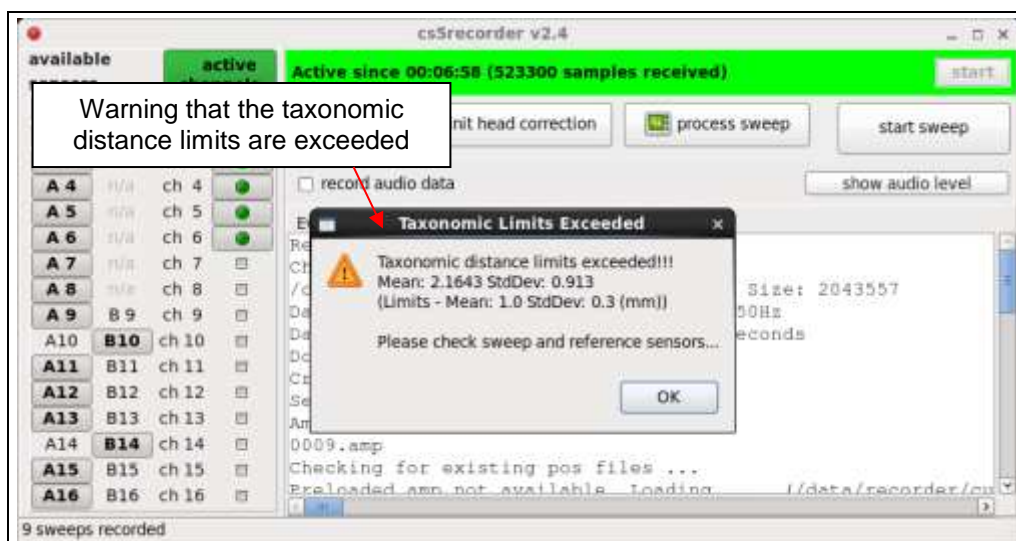


Figure 16: Taxonomic distance limits were exceeded during head correction

## C. Recording with realtime display

Open the program Cs5view (in addition to cs5recorder) and click realtime display (Figure 17-1). Please check the [cs5view](#) documentation for detailed program description.

### 1. Absolute positions

The absolute sensor positions (Figure 17-2) will be shown and by starting the sweep recording you will see the traces (Figure 17-3).

This helps to place the subject within the measurement area and to control the sensors during the session. The position data is displayed but not stored.

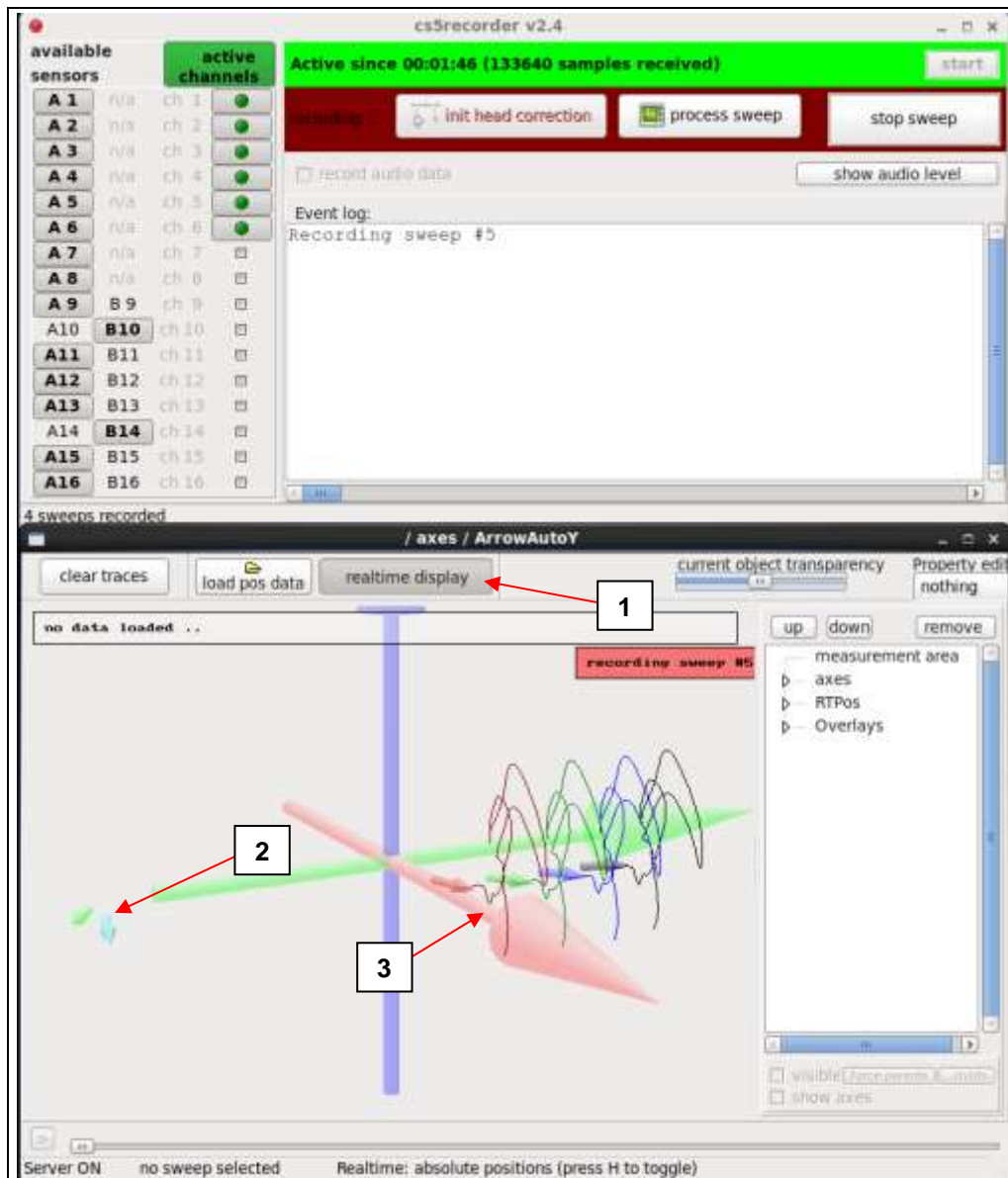


Figure 17: Recording with real time display (absolute positions)

## 2. Normalized positions

If you initialized head correction for the realtime display (section II.B.3) you can type **H** on the keyboard to toggle the realtime view between absolute positions and normalized positions.

While in realtime view with absolute positions all sensors show movement relative to the measurement area, with normalized positions all movement is shown relative to the reference sensors. The reference sensors remain static (Figure 18-1) and only dynamic sensors show traces (Figure 18-2).

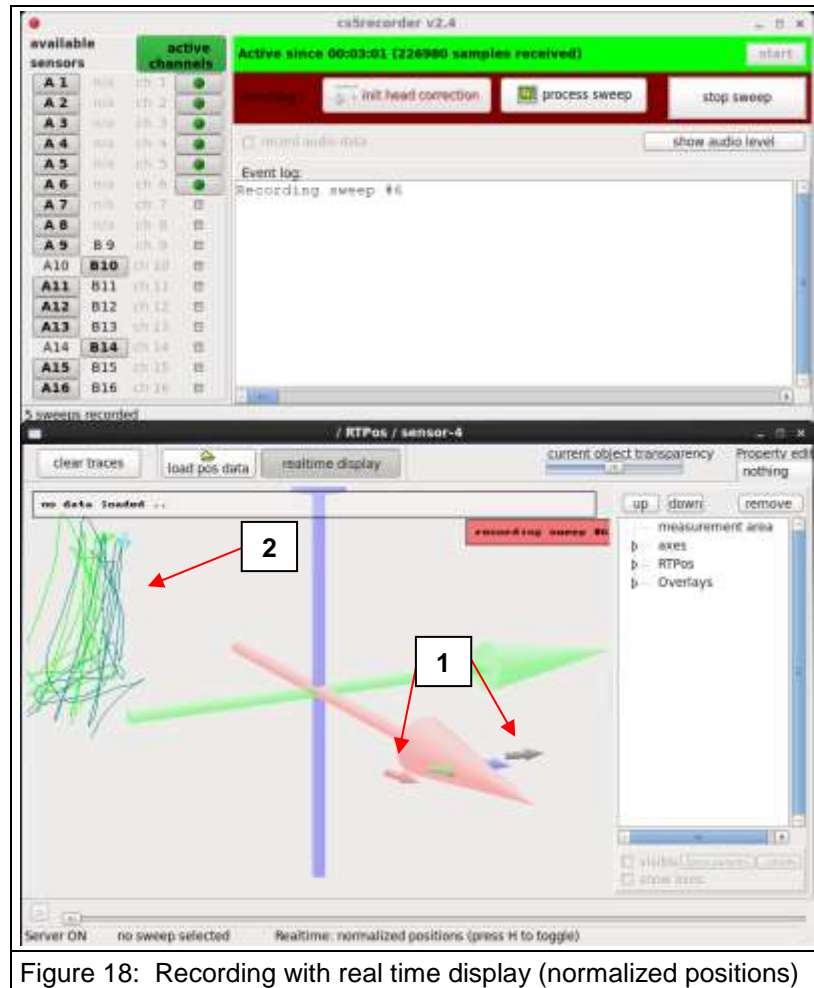


Figure 18: Recording with real time display (normalized positions)

It is also possible to build up contours (for example palate or head) to serve as a visual reference (Figure 19). Please check the [cs5view-howtos](#) for details.

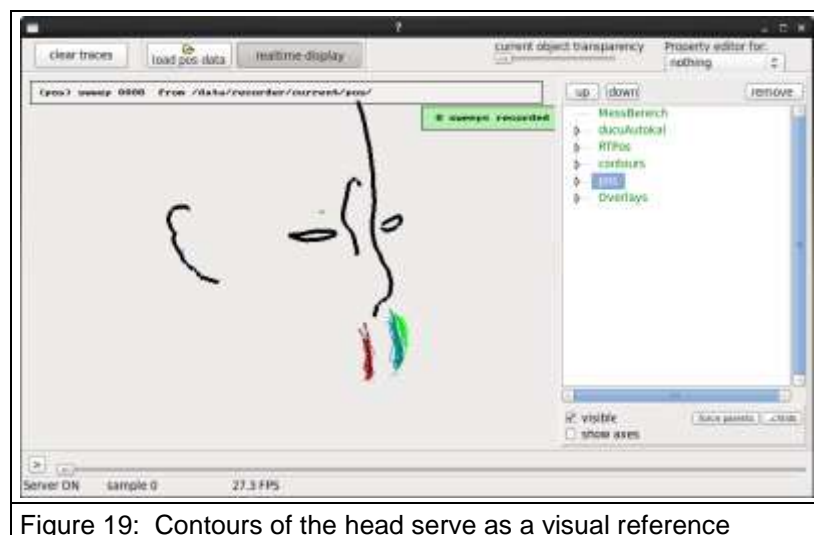


Figure 19: Contours of the head serve as a visual reference

### 3. Sweep start and stop with cs5view

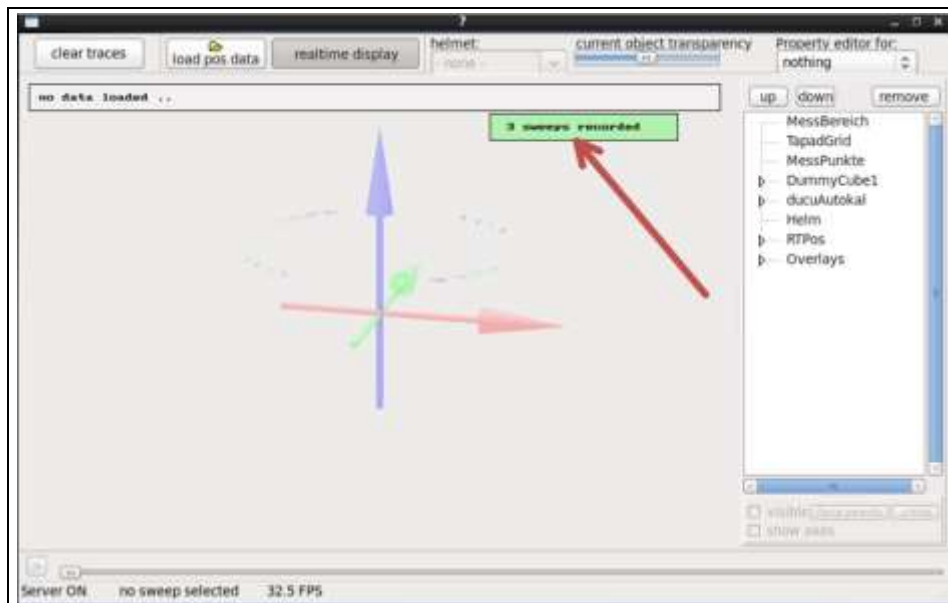


Figure 20: Start sweep recording in the realtime display environment

You can start and stop the sweeps from within cs5view by clicking the green 'recording' panel.

#### 4. Confirm data quality

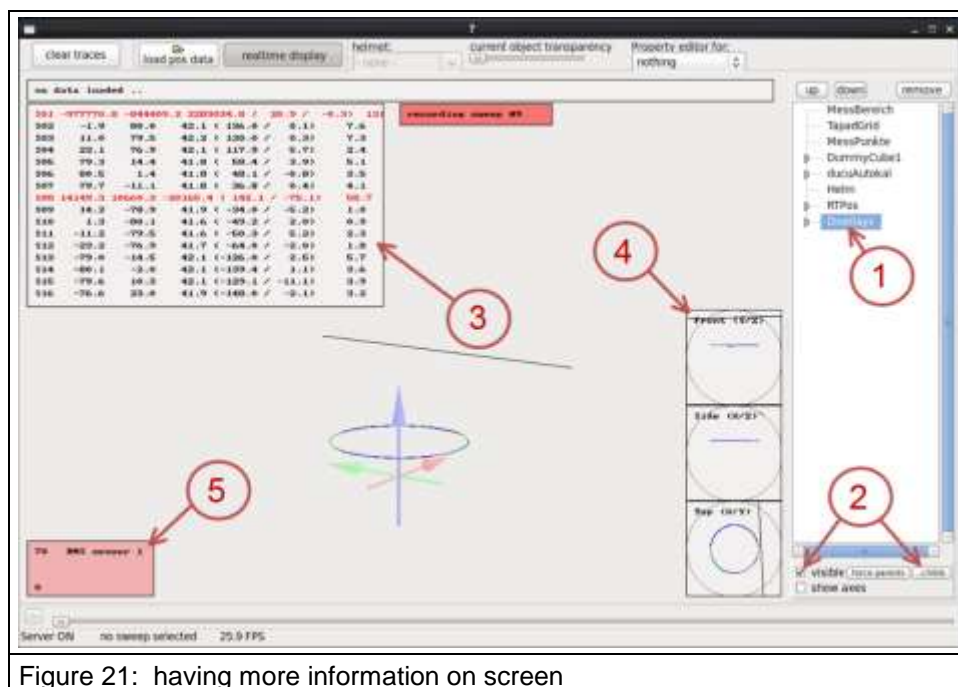


Figure 21: having more information on screen

To get more information on the data recording procedure, click 'Overlays' (1), 'childs (2), and check the 'visible' box (2).

The upper left table (3) shows the 'Sample' information from all channels (sensors). After the channel number (s01), the data is shown in the same format as in the 'pos' file: x, y, z,  $\phi$ ,  $\theta$ , and rms.

In Figure 21, the sensors 1 and 8 are marked red because their rms value is too high.

## D. Audio errors

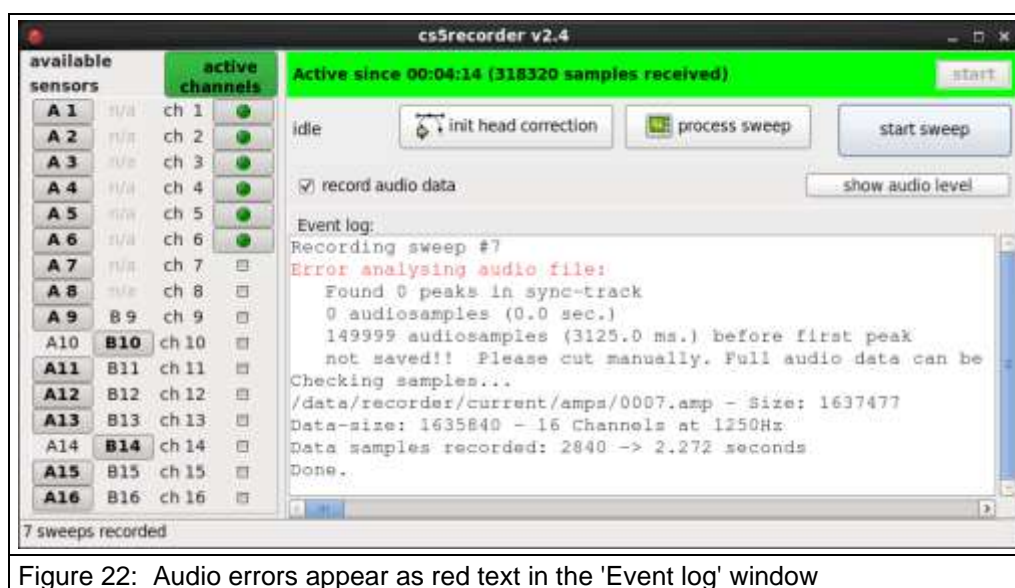


Figure 22: Audio errors appear as red text in the 'Event log' window

If an audio error occurs, a corresponding message appears. Just a \*.wav.all will be stored. This is the whole, uncut sound recording. It needs to be cut by hand. Please control the audio setting as described in the AG501-sound.pdf

## E. Position calculation

### 1. Starting cs5calcpus

Execute the program 'cs5calcpus' (Figure 23) to do the position calculation and select the amps-folder of your session (Figure 24).

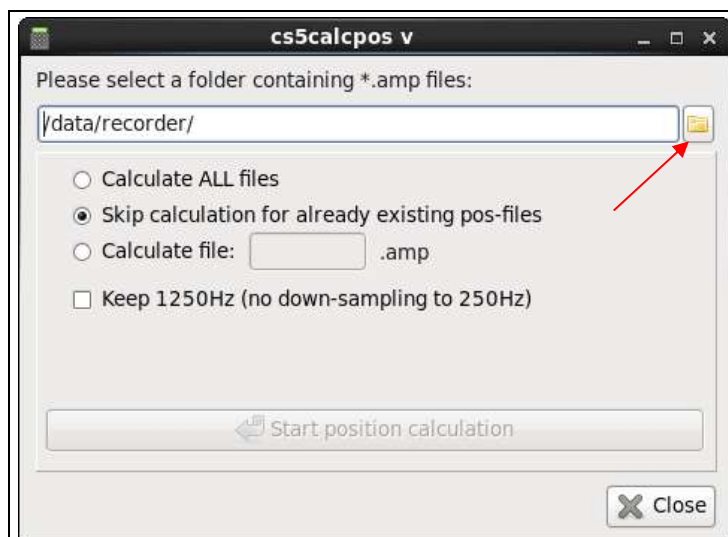


Figure 23: First select the desired folder of the study

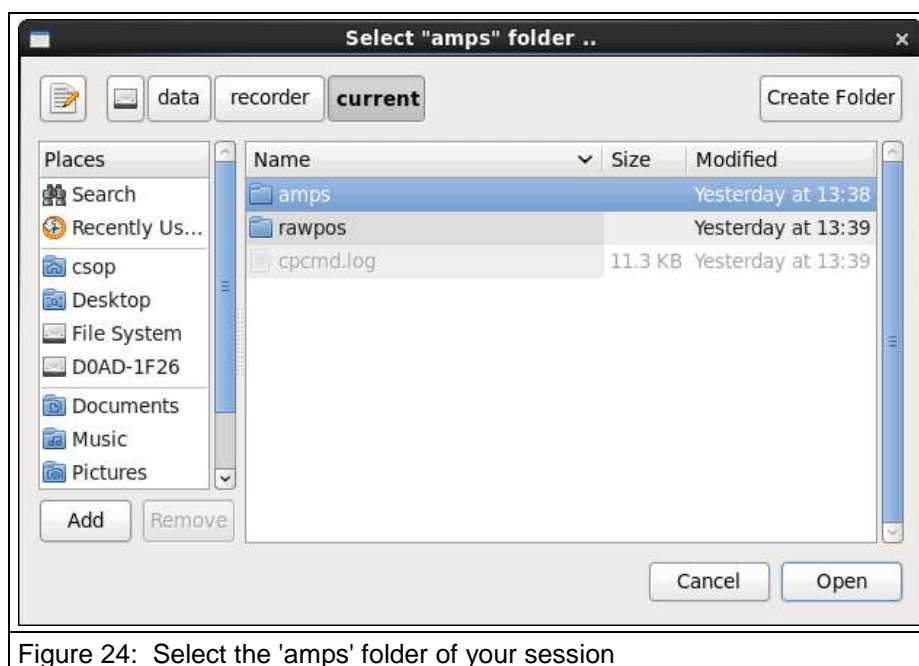


Figure 24: Select the 'amps' folder of your session



The cs5calcpus program will display the number of sweeps in the selected folder (Figure 25-1) and the 'Start position calculation' (Figure 25-2) button is activated.

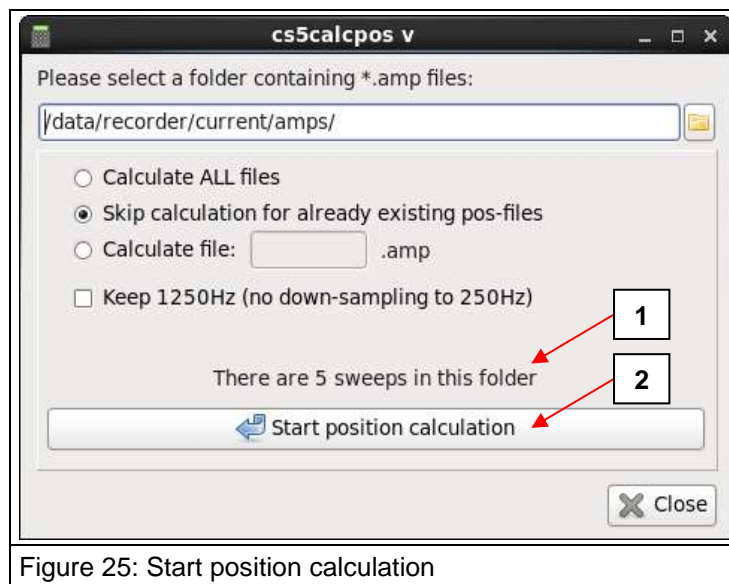


Figure 25: Start position calculation

The position calculation may take a while. During calculation a dialog shows information on file processing status and enables you to cancel the operation (Figure 26).

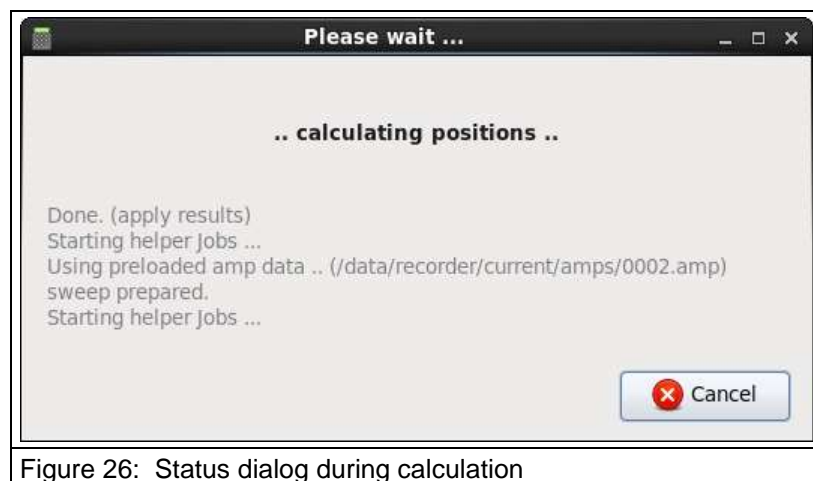


Figure 26: Status dialog during calculation

When the calculation is finished, you will find the folder 'rawpos' within your session-folder.

## 2. Calculation options

**Calculate ALL files** (Figure 27-1): For all amp-files in the selected folder rawpos-data will be created. Already existing pos-data from previous calculations will be overwritten. This option is useful for recalculating all amp-files after changing the down-sampling option.

**Skip calculation...** (Figure 27-1): Rawpos-data will only be created for amp-files that have not been processed yet.

**Calculate file** (Figure 27-1): Rawpos-data will only be created for the amp-file(s) matching the specified file pattern (use \* as wildcard: 003\* will match sweeps 0030 to 0039).

**Keep 1250Hz** (Figure 27-2): Per default the 1250Hz amp data will be sampled down to 250Hz position data. Check this option if you want to keep 1250Hz resolution in the position data.

**Do not filter data** (Figure 27-3): This option is only available, when the *Keep 1250Hz*-option is selected. The position data will be processed in full resolution without applying any filter.

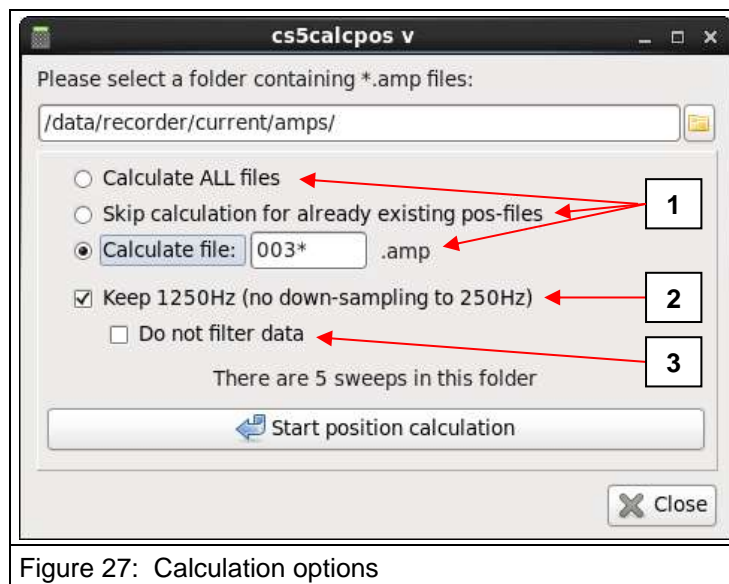


Figure 27: Calculation options

## F. Head correction

See [ag501-cs5normpos.pdf](#)

## G. Converting the results to ASCII format

See [ag501-cs5bin2ascii.pdf](#)

## H. Finishing a recording

After finishing the recording, close the cs5recorder software. Then, rename the folder 'current' (any name will do). By starting cs5recorder, a new 'current' folder will be created. Otherwise, the sweeps will be added to your last session

## I. Folder structure

### 1. Session folder

#### a) "amps" subfolder

This folder is always present. It contains the sweep files (\*.amp) and the corresponding .ini files.

#### b) "wav" subfolder

This folder is only created if sound is used. In this case, it contains the sound files in wav format.

- for detailed information on data formats refer to

[ag501-data-format.pdf](#)

2. Folder structure example:

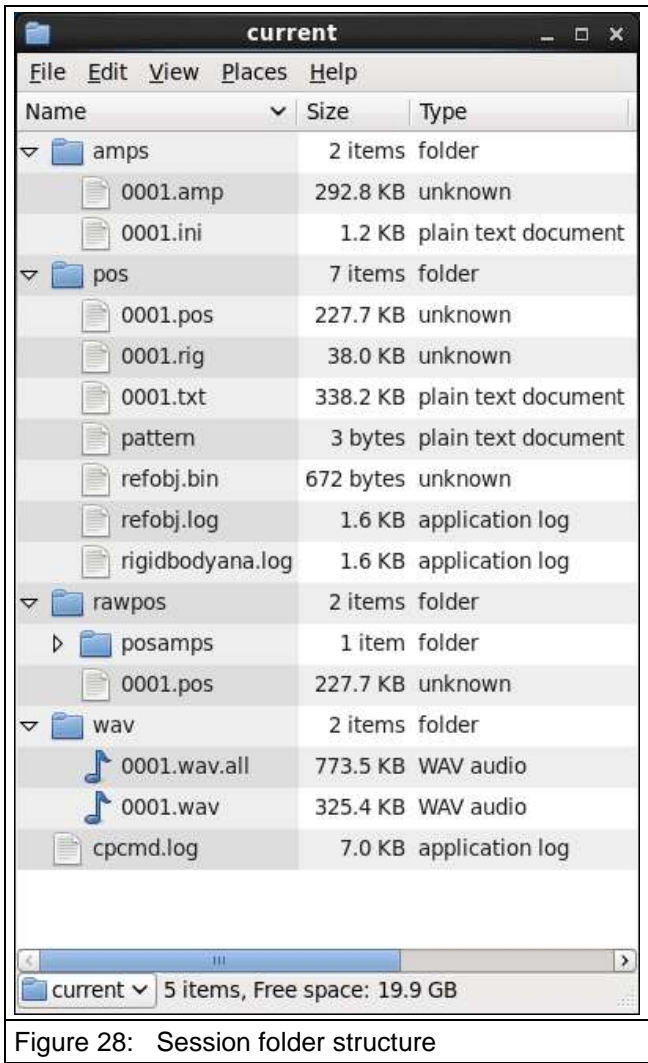


Figure 28: Session folder structure

III. Revision history - cs5recorder

Date	Revision	Annotation
June 12 <sup>th</sup> , 2012	1	
November 6 <sup>th</sup> , 2012	2	General revision
February 7 <sup>th</sup> , 2013	3	Grammar & spelling
February 26 <sup>th</sup> , 2014	4	Position calculation, head correction, ASCII conversion updated
November 16 <sup>th</sup> , 2015	5	Updated screenshots, taxonomic limits