File specifications for a device independent TCD playback platform

In this paper we describe a simplified approach to an open format that may be adopted by any of the device manufacturers.

These new files can be read on a modified and simplified version of the TCD Simulator (the educational TCD program), and the embolic signals can be played back with both spectral analysis and audio in qualities optimized for emboli detection. In the files in the subfolder "\clips", there are examples of the header/binary format. The header is, as its name suggests, the first part of the file in and in UTF-8 format. Its length must be a multiple of 0x1000, maximum 0x10000. (The size of the header in the example is 8 kB (hex 0x2000).

The first number in each line refers to the sample number in the data – each sample consisting of 2 numbers for 1 channel recording and 4 numbers for 2 channel recordings. – The sample number is of course is 0 for the state of the device parameters at the beginning of monitoring; the further (nonzero) numbers designate when changes are made in instrument settings – such as depth, sample volume size, prf and gain.

The number is followed by a tab character (\t) and then by the keyword (lower case) that tells the system which numerical parameter or text follows after the colon. The line entries in the header string are terminated by CRLF (\r\n) character pair and as usual, the NULL TERMINATOR character denotes the end of the header string. Note that for single channel recordings, keywords without the channel number (e.g. depth: instead of depth1:) are permitted.

After the fixed size header (only partly filled by the header string) follows the binary data in either 16-bit short integers or 32-bit float format. Each sample contains 2 (quadrature) binary numbers (1 channel recording); for 2 channel recording followed by another pair of binary numbers representing the second channel. The binary section of the file must be uninterrupted by other content.

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Example of Header Entries (those with no asterisk(s) are not mandatory)

0	`doppler:xxxx`	(The manufacturers Doppler instrument name)
0	`version:xxxx`	(The manufacturers Software Version)
0	`clinic: xxxx`	(The clinic or physician providing the data)
0	`patient:anonymous`	(Evt. Patient name – omitted in files made public)
0	`file:example.binx`	(Original file name – can be omitted in files made public)
0	`caseid:11072141`	(Evt. Patient id string – can be omitted in files made public)
0	`birthday:01-01-2001`	(Evt. Patient DOB)
0	`recdate:14-04-2021`	(Date of original recording)
0	`usfreq:2 MHz`	(** Ultrasound frequency used in recording)
0	`encoding:float`	(**specify either `float` (32bit) or `short` (16 bit)
0	`label1:MCA_L`	(**Label of recording site)
0	`label2:MCA_R`	(* Label of evt. 2nd recording site)
0	`starttime:12:46:48`	(** Start of recording in standard format (hh:mm:ss)
0	`binofs:8192`	(** Size allocated for header)
0	`gates:2`	(** Number of gates used – either 1 or 2)
0	`prf:7042`	(** Pulse repetition frequency in Hz)
0	`depth1:43`	(** Depth of sample volume in mm)
0	`sv1:8`	(** Sample volume length in mm)
0	`gain1:31`	(Gain setting of Doppler)
0	`hipass1:100`	(High Pass Filter Setting - Hz)
0	`depth2:43`	(* Depth of evt. 2nd gate – mm)
0	`sv2:8`	(* Length of evt. 2nd gate – mm)
0	`gain2:31`	(Gain of evt. 2nd chan)
0	`hipass2:100`	(Evt. 2nd channel High Pass Filter - Hz)
34085	`currtime:12:46:52`	(Current time at this sample number)
34085	`depth1:50`	(** Changes in parameter: prf – depth – sv - gain)
249415	`stoptime:12:47:22`	(End of recording at this time)

(Non-essential header entries – without asterisk)

(* Mandatory only for 2 channel recordings)

(** Mandatory for 1 and 2 channel recordings)