

# NB CE-Chirps<sup>®</sup> LS Latency Norms

## Application

Narrow Band (NB) CE-Chirp<sup>®</sup> LS stimuli are an alternative to tone bursts for frequency specific threshold assessment. Just as there are 500Hz, 1kHz, 2kHz and 4kHz tone burst stimuli, there are 500Hz, 1kHz, 2kHz and 4kHz NB CE-Chirp<sup>®</sup> LS stimuli.

Similar to all other CE-Chirp<sup>®</sup> stimuli, the NB CE-Chirp<sup>®</sup> LS stimulus family utilizes a compensation for the cochlear travel time within the one octave wide stimulation. This improves the neural synchronization and thus provides larger response amplitudes compared to traditional tone bursts.

## EPx5 version 4.4

With version 4.4 of the EPx5 ABR software, a slight modification to the previous implementation of NB CE-Chirp<sup>®</sup> stimuli is introduced. To distinguish between the old implementation (version 4.3 and older) and the new implementation, the name of the NB CE-Chirp<sup>®</sup> have changed to NB CE-Chirp<sup>®</sup> LS in version 4.4. The later stands for Level Specific, and is chosen because it is introduced together with the CE-Chirp<sup>®</sup> LS.

## Differences between NB CE-Chirp<sup>®</sup> and NB CE-Chirps<sup>®</sup> LS

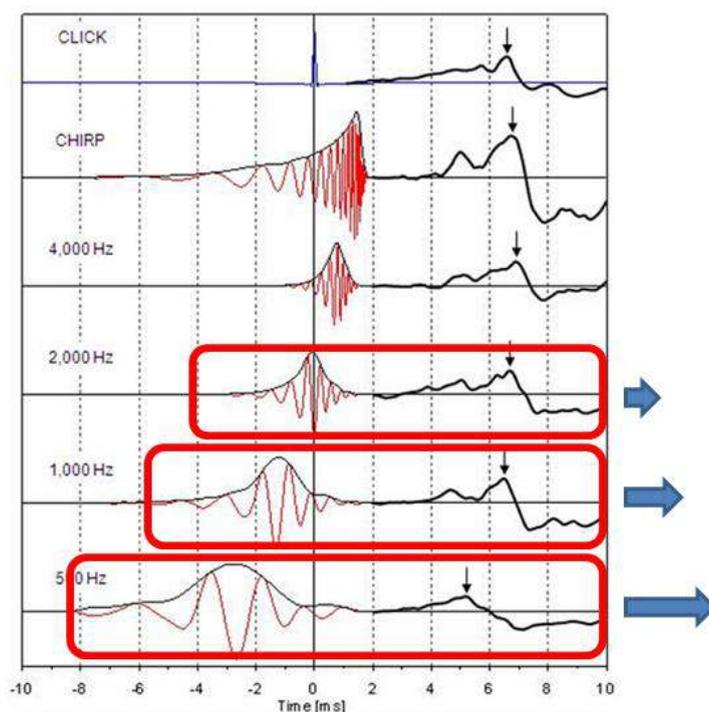
The new NB CE-Chirp<sup>®</sup> LS stimuli frequency components are identical to the previous NB CE-Chirp<sup>®</sup> stimuli. The only difference is the time at which they are presented relative to "0 ms" on the time scale.

It has become a standard in the industry that Clicks are presented at 0 ms, and that Tone Bursts start at 0 ms, albeit the latter makes 500Hz tone burst responses, for example, appear very late on the time scale.

The previous NB CE-Chirp<sup>®</sup> stimuli were positioned according to the timing of their component within the broadband CE-Chirp<sup>®</sup>. There was of course a certain clear logic to that, but the responses appear very early. That has been a confusing issue to some clinicians.

The new CE-Chirp<sup>®</sup> LS stimulus family has been positioned such that its wave V response is similar, irrespectively of which Chirp frequency is being tested.

In order to obtain very similar response latencies at all stimulation levels, the time shifting for these stimuli depends on the stimulation level. Hence the new name NB CE-Chirp<sup>®</sup> LS (= Level Specific).



**Fig 1.** The original NB CE-Chirp<sup>®</sup> at 500Hz, 1kHz and 2kHz are moved to a later position on the time scale, in such a way that their wave V response becomes identical to the original click. The exact amount of change varies slightly in respect to the stimulation level so the identical response latency for all four frequencies is maintained at all stimulation levels.

One benefit of this, is that you can use the same recording window length for all 4 stimuli. Furthermore, identifying a response will be easier to learn, as response latencies will be very similar for all 4 NB CE-Chirp<sup>®</sup> LS frequencies relative to the Click and the broad band CE-Chirp<sup>®</sup> LS. Of course normal variation between patients will occur.

### The Latency Table

With identical settings, the 500Hz, 1kHz, 2kHz an 4kHz NB CE-Chirp<sup>®</sup> LS stimuli, all provide identical response latencies as a consequence of the stimulus positioning discussed. Therefore, the same latency table for wave V applies to all four stimuli (see fig 2, below).

These latency norms are based on data presented in Elberling, C. & Don, M. (2010). A direct approach for the design of chirp stimuli used for the recording of auditory brainstem responses. J. Acoust. Soc. Am. 128, 2955-2964.

### Final note for those interested in comparing new to old latency norms

It is important to stress that the stimuli frequency components are unchanged, which allows for all the wealth of clinical data that has been obtained with these stimuli to remain valid except for the discussed changes in latency.

The old and new latency norms for adults and thus the difference in timing are provided below.

NB CE-Chirp <sup>®</sup> LS			NB CE-Chirp <sup>®</sup> (2009)														
500Hz- 4kHz			4kHz			2kHz			1kHz			500Hz					
Mark V			Mark V			Mark V			Mark V			Mark V					
nHL	Position	Deviation	nHL	Position	Deviation	nHL	Position	Deviation	nHL	Position	Deviation	nHL	Position	Deviation			
-10 dB			-10 dB			-10 dB			-10 dB			-10 dB					
0 dB			0 dB			0 dB			0 dB			0 dB					
10 dB	8.70	0.90	10 dB	8.67	0.54	10 dB	8.57	0.68	10 dB	9.40	0.90	10 dB	9.50	1.33			
20 dB	7.97	0.79	20 dB	7.99	0.51	20 dB	7.86	0.54	20 dB	8.39	0.79	20 dB	7.72	1.23			
30 dB	7.35	0.69	30 dB	7.37	0.47	30 dB	7.19	0.43	30 dB	7.50	0.69	30 dB	6.36	1.13			
40 dB	6.82	0.61	40 dB	6.82	0.42	40 dB	6.55	0.36	40 dB	6.72	0.61	40 dB	5.42	1.01			
50 dB	6.36	0.56	50 dB	6.34	0.37	50 dB	5.96	0.33	50 dB	5.49	0.56	50 dB	3.85	0.89			
60 dB	5.96	0.52	60 dB	5.92	0.31	60 dB	5.40	0.35	60 dB	4.57	0.52	60 dB	2.89	0.75			
70 dB	5.60	0.50	70 dB	5.57	0.24	70 dB	4.88	0.40	70 dB	3.95	0.50	70 dB	2.39	0.59			
80 dB	5.27	0.50	80 dB	5.29	0.16	80 dB	4.39	0.49	80 dB	3.63	0.50	80 dB	2.21	0.43			
90 dB	4.95	0.51	90 dB	5.07	0.08	90 dB	3.94	0.62	90 dB	3.61	0.51	90 dB	2.21	0.25			
100 dB			100 dB			100 dB			100 dB			100 dB					

**Fig 2.** Adult latency tables for NB CE-Chirp<sup>®</sup> and NB CE-Chirp<sup>®</sup> LS for 500 Hz, 1kHz, 2kHz and 4kHz. The above tables can be found in EP x5 software version. 4.4 in System Setup - Latency Template - Stimulus. When showing historic sessions the latency norms will follow the stimuli used.