

# A portable, modular, and low cost auditory brainstem response recording system including an algorithm for automatic identification of responses suitable for hearing screening

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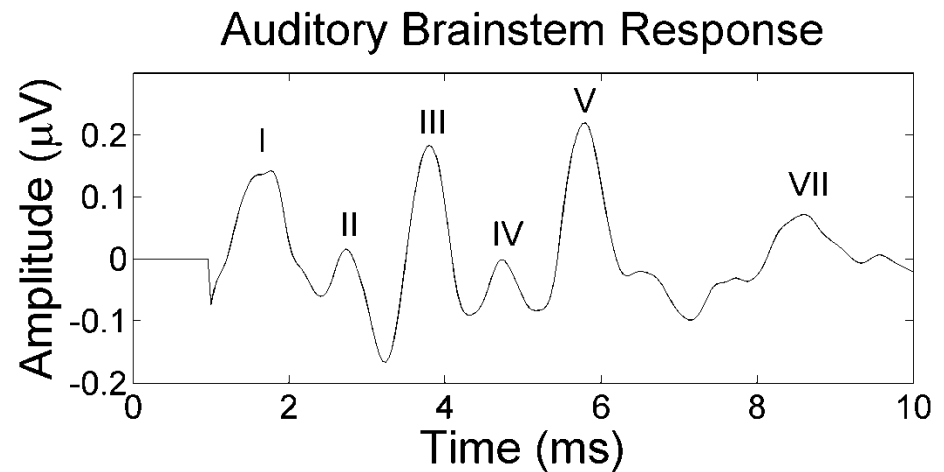
IEEE EMBS Special Topic Conference on Point-of-Care Healthcare Technologies

# Introduction. ABR signals

- The human auditory system



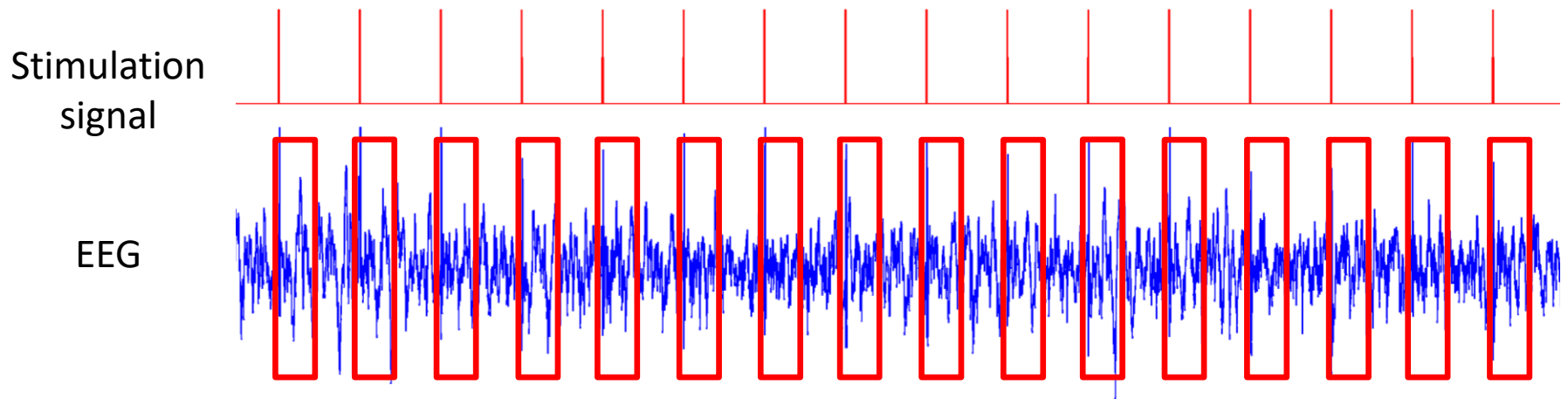
Source: SPD Australia



- Clinical application

# Introduction. ABR recording process

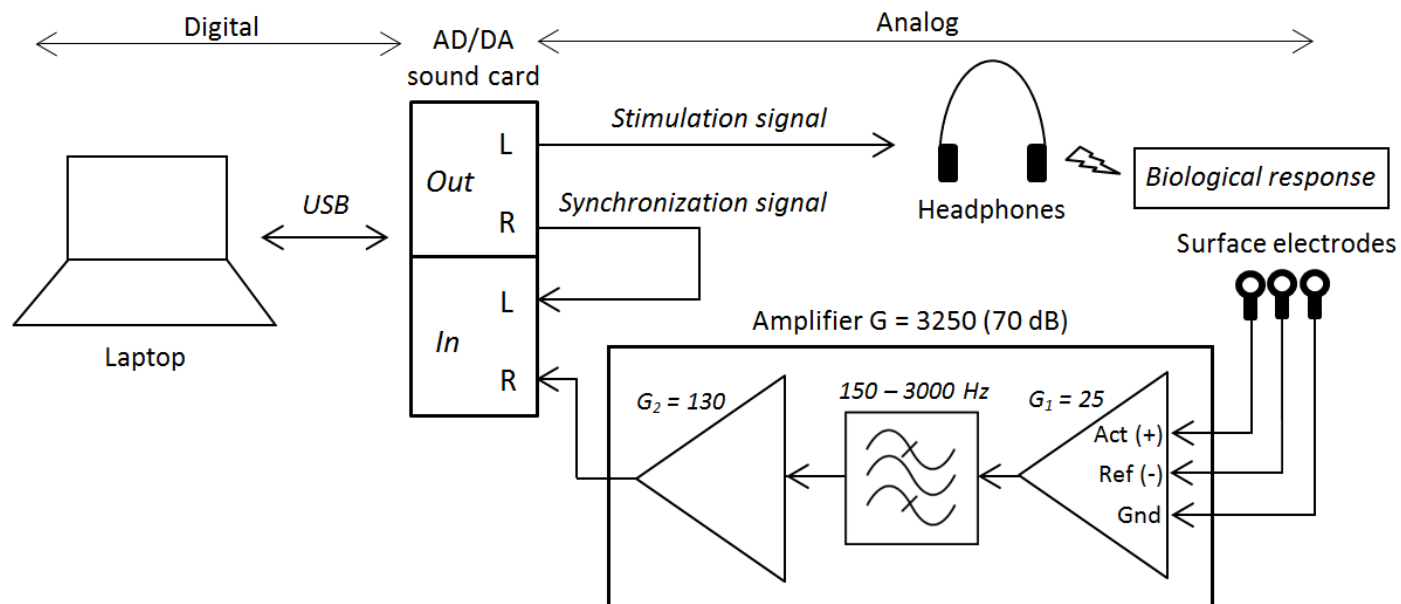
- Recording problems
  - Amplitude  $< 1 \mu\text{V}$
  - SNR  $< -30 \text{ dB}$



$$SNR_N = SNR_1 + \sqrt{N}$$

# ABR recording system. Description

- General scheme of the system



*Valderrama et al. (2011)*

# ABR recording system. Advantages

- Flexibility

- ✓ Intensity of stimulation
- ✓ Stimulation polarity
- ✓ Number of averaged responses
- ✓ Artefact rejection techniques
- ✓ Stimulation frequency
- ✓ Digital filter
- ✓ A/D sample frequency
- ✓ Total Access to RAW recording data

- Portability

- ✓ Battery powered

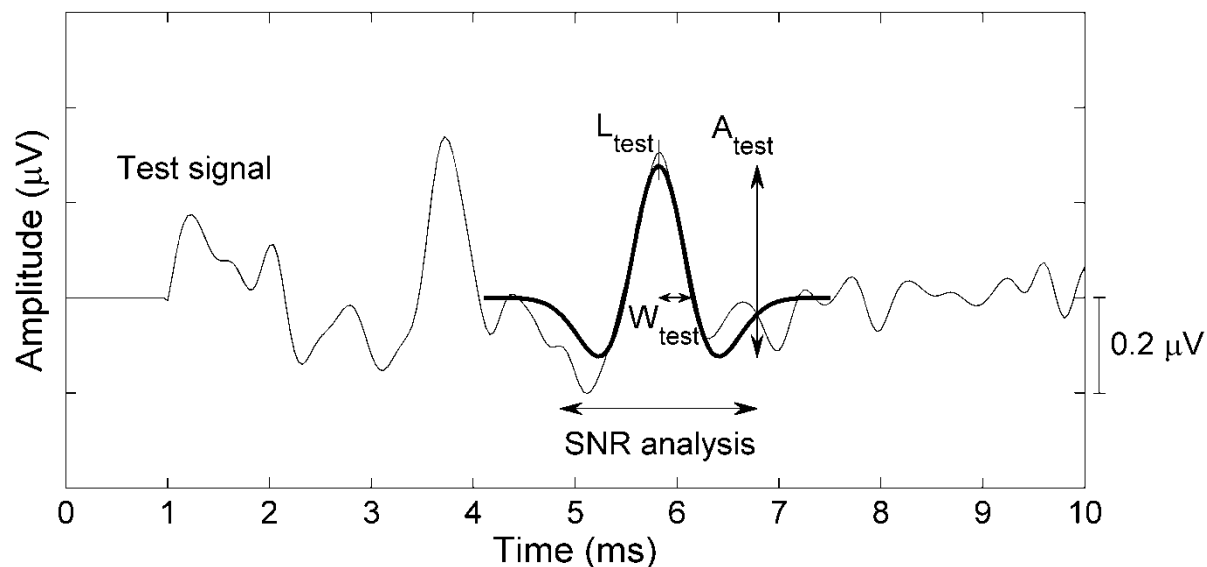
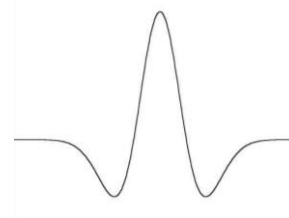
- Price

- ✓ Rough cost of the system (laptop not included) below 500 \$

# Fitted Parametric Peaks. Description

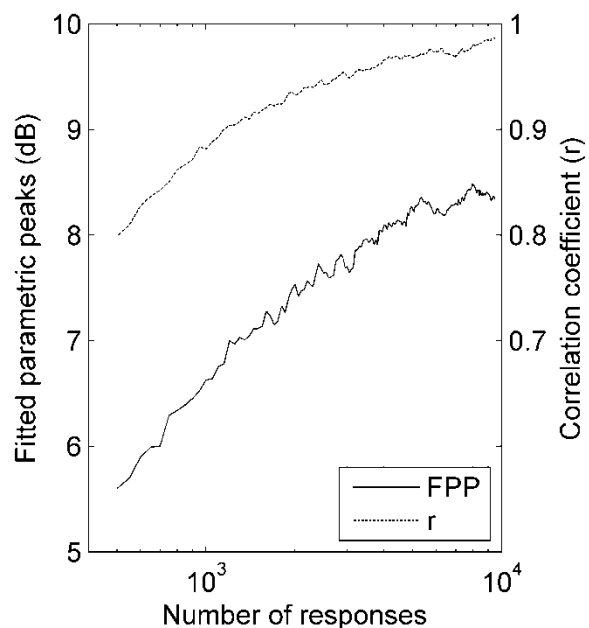
- Quality assessment method based on the use of templates

$$x(t, A, L, W) = A \cdot \left(1 - \frac{(t-L)^2}{W^2}\right) \cdot e^{-\frac{(t-L)^2}{2 \cdot W^2}}$$



# Fitted Parametric Peaks. Assessment

- The FPP method is compared with the correlation coefficient ( $r$ )
- Both techniques present in average a similar tendency ( $r=0.88$ )



# Conclusions

- The proposed ABR recording system can be used to obtain reliable and high-quality ABR recordings.
  - Its portability could spread a hearing screening protocol to rural and other difficult access areas.
  - Its high-performance and low cost could make its use appropriate in low-budget institutions and medical centres from developing countries.
  - Its open nature is appropriate for research purposes.
- The *Fitted Parametric Peaks* methodology included in this system can be considered a valid procedure to provide an automatic assessment of the quality of ABR recordings and identification of the peaks.