**Auditory Research**

**Dosimetric HPD**

- Int. MIC
- Pre-Amp
- Exponential Averaging (slow, bypass)
- ADC
- Squaring
- Normalizer (coefficients in)
- Weighting Filters (A, C, FLAT)
- Dose Calculation

\[ D = \frac{100}{T} \sum_{i=1}^{N} 10^{5\text{dB}_i} \]

- Ensure adequate protection levels
- Monitor noise dose under HPD and provide feedback
- Maximize communication and perception of warning signals

**In-Ear Acoustics**

- Microphones
- MEMS
- Speakers
- Moving Coils (Dynamic)
- Balanced Armature

**In-Ear Platform**

- Microprocessor
- Audio Codec
- Memory
- DSP

**Methodology**

- Review literature on NIH, dosimetry, in-ear SPL measurement, HPD attenuation
- Select transducers and electronics based on pre-defined criteria
- Embed electro-acoustical components inside Sonomax instant custom earpiece
- Validate functionality of pre-production units in lab environment (ATP, test subjects)
- Perform group studies by taking advantage of rapid deployment of custom earpieces

**Motivation**

- Lack of appropriate data collection methods and tools for individual measurement of several known NIHL causes (exposure levels, HPD attenuation, susceptibility to NIHL, ...) and early symptoms (hearing threshold shift, OAE, ...)
- Demand for versatile auditory research platform providing individuals with a controlled acoustic environment and live digital signal processing capabilities
- Need for further refinement in the understanding of variability in inter-individual factors related to NIHL (auditory fatigue, recovery rate, effective silence values)

**Goals**

- Develop a measurement device for individual auditory data collection
- Design a versatile programmable audio framework for live signal processing
- Enable further fundamental research on NIHL and its prevention

**Digital Earplug for Brain Plasticity Research**

- Current collaboration with Brain Music and Sound Research (BRAMS)
- Current collaboration with Faculty of Medicine and Health Sciences, Genk University
- Daily Tracking of Individual Otoacoustic Emissions (OAE)

**In-Ear Auditory Research Platform and Application for a Smart Dosimetric Hearing Protection Device**

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