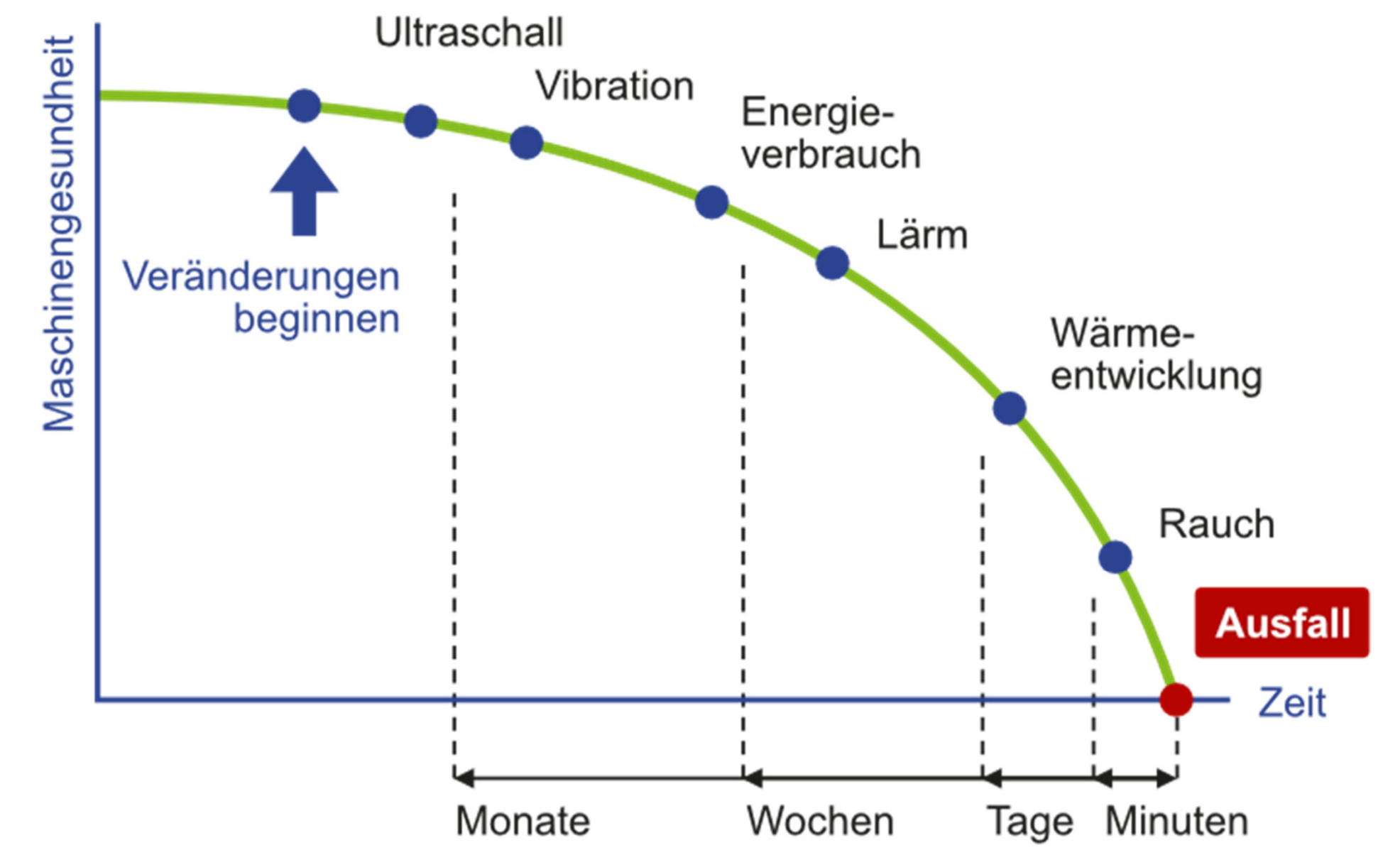


## Predictive Maintenance

Offers high potential to save costs, material and energy

- Requires constant monitoring and analysis of machines and process status
- Anomaly detection: Most of the the data is redundant/irrelevant



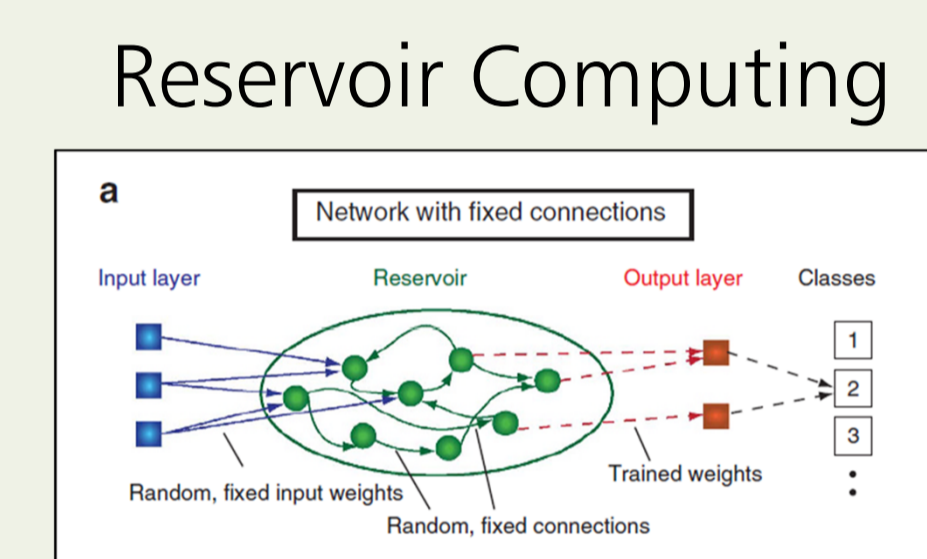
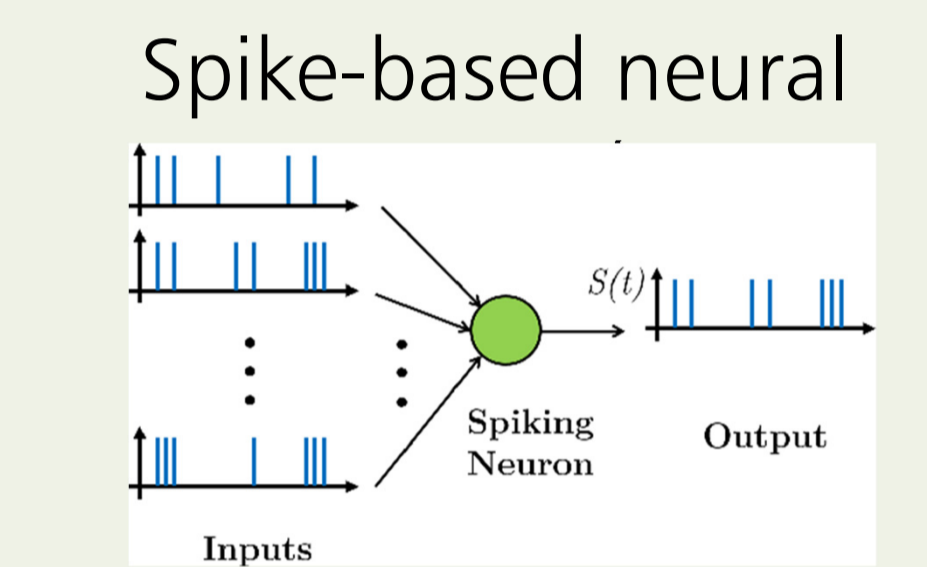
Solution: Energy-efficient, Bio-inspired Acoustic Monitoring

Processing at sensor level → Early stage complexity reduction → Use of small and efficient ML networks

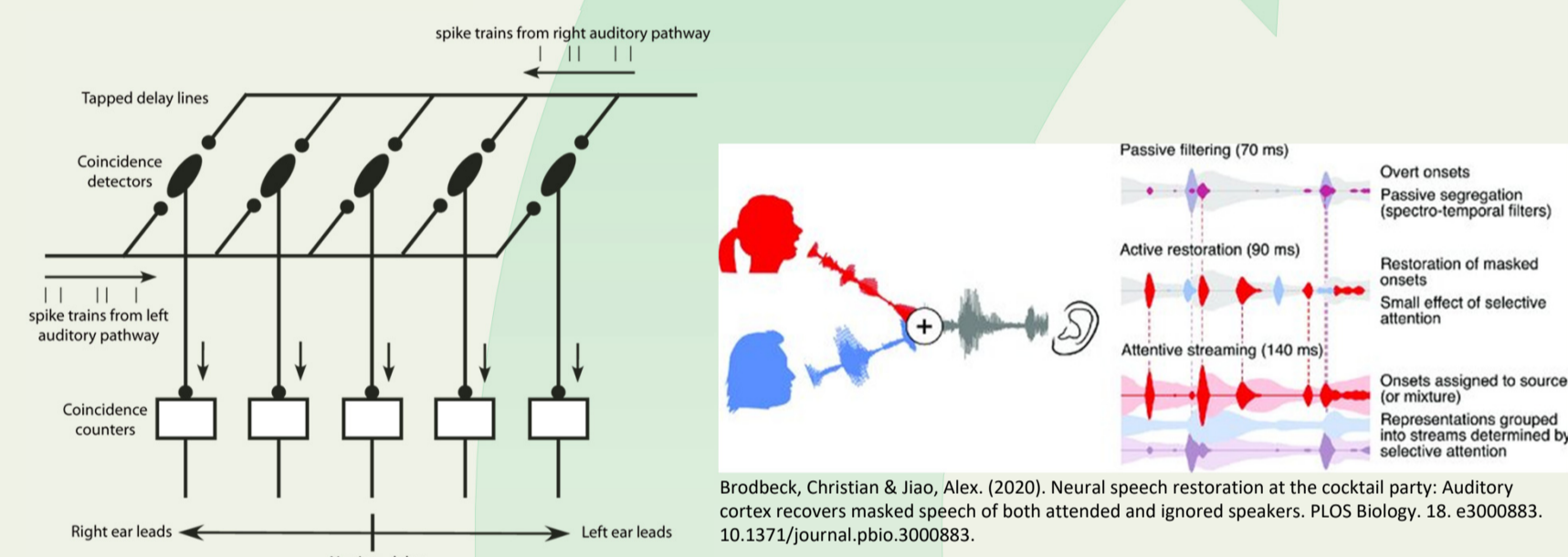
Event-based data streaming → Reduces data traffic and improves data security

## Efficient Computing – Sound Analysis and Event Detection

using small and hardware-based signal analysis e.g.:

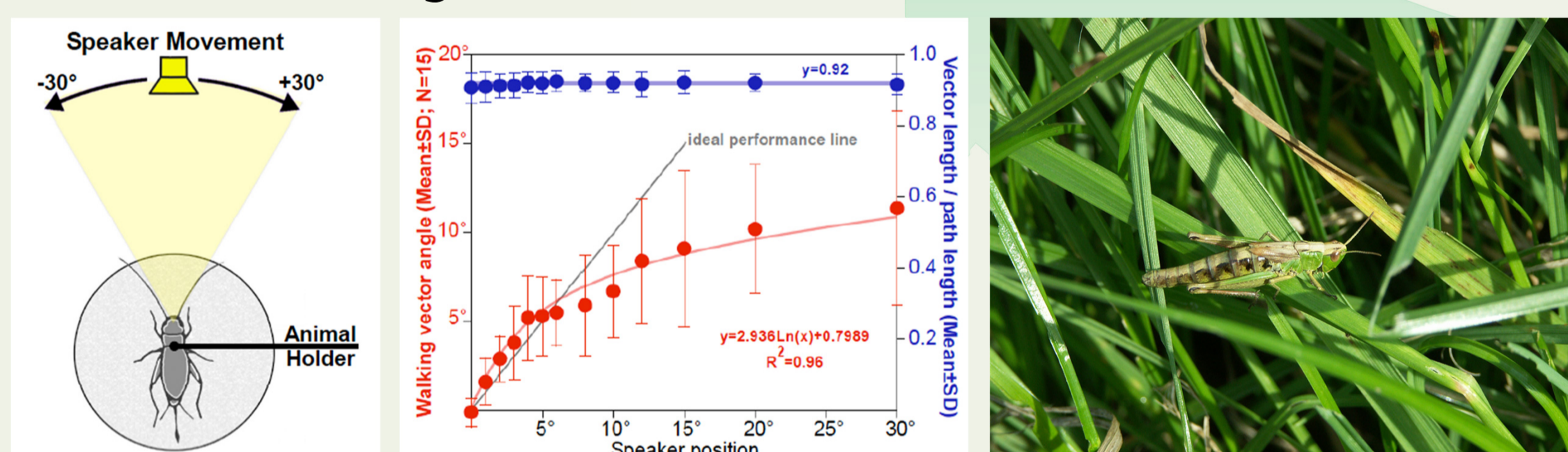


Bio-inspired sound localization and separation e.g. with delay lines



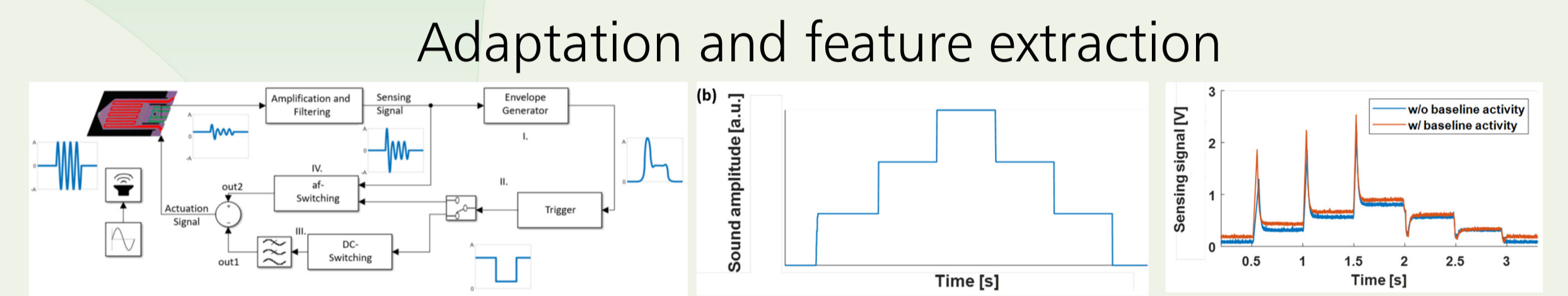
## Smart Technologies – Bio-Inspired Sensor Design and Processing

High resolution for localization (~1°) despite strong distortion of localization cues

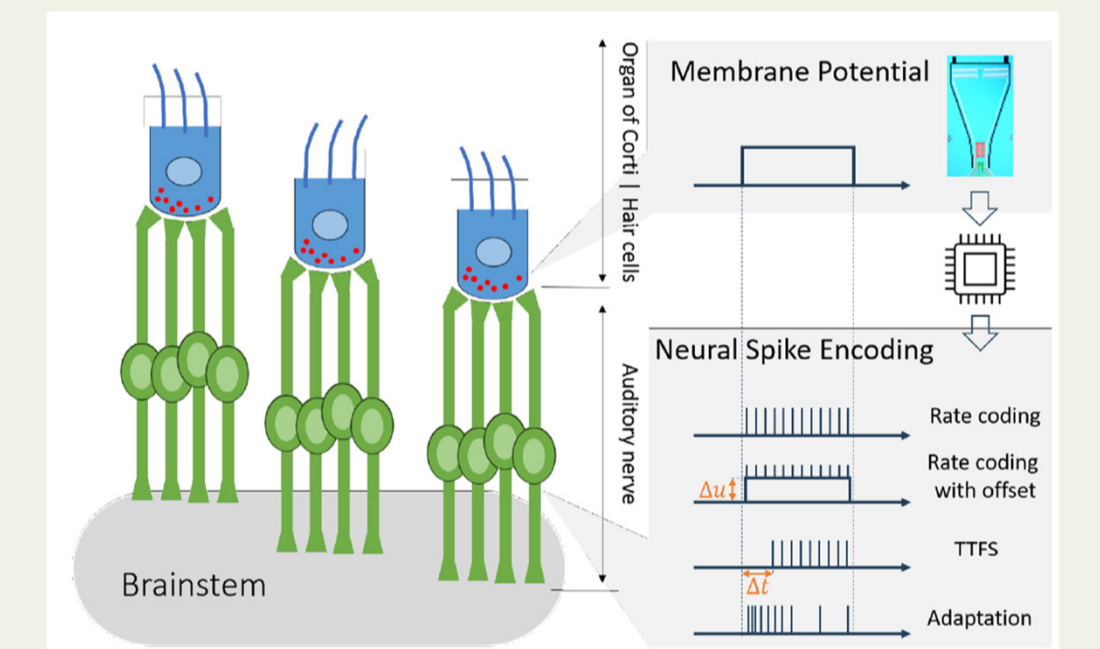


## Bio-Inspired Electronic – Event-Based, Smart Sound Sensing

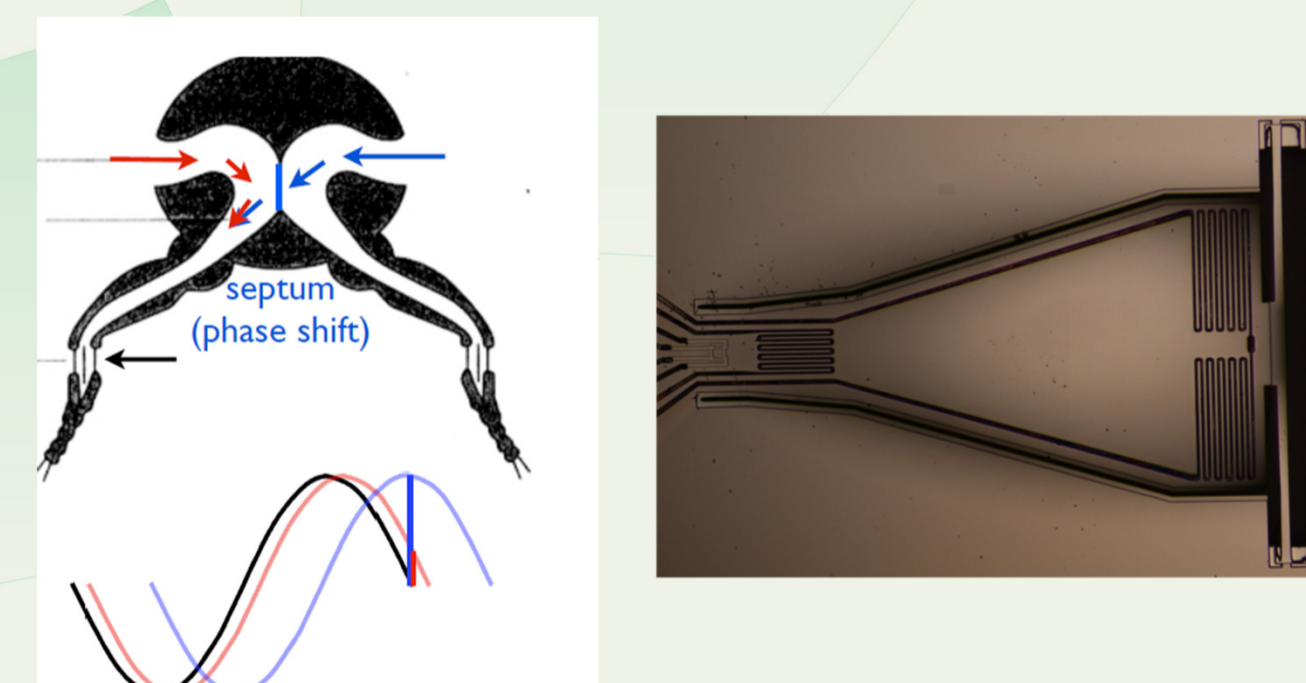
using micro-mechanical (MEMS) sensors with feedback and bio-inspired circuits e.g.:



Bio-inspired sound encoding



Integrate biological principles for improved sensing (e.g. phase shift)



## Work Packages and Time Plan

WP1 – Sensor Design, Development Processing Hardware (MNES group, 1.5 years)

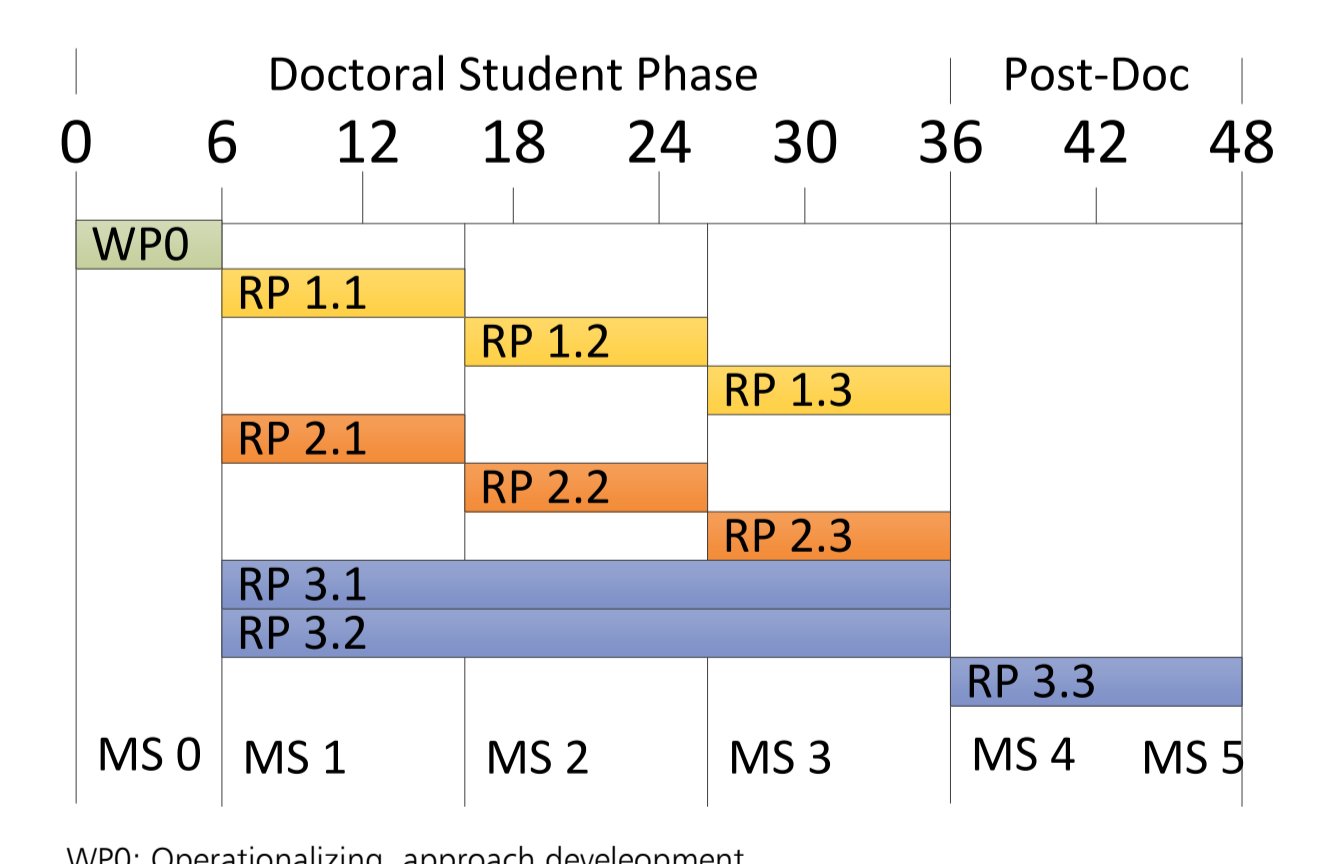
- MEMS design and fabrication
- Neuromorphic circuits for localization and event-detection
- Research stay at U.Ulm (C. Lenk)

WP2 – Audio Measurement, Processing, Acoustic Analysis (EMT group, 1.5 years)

- Event and anomaly detection
- Directional signal analysis, sensor tuning
- Event and stream segregation

WP3 – Evaluation, Application in Industrial Context (MNES + EMT, 1 year)

- Step-wise validation
- Use-case demonstrator
- Real-time, event-driven acoustic monitoring



## Interdisciplinary Expertise and Related Projects

Dr. Tzvetan Ivanov  
- MEMS design for sensing and fabrication  
- bio-inspired circuits and smart sensing

Dr. Stephan Werner  
- mobile acoustic measurements  
- acoustic analysis and classification  
- position-dynamic (6DoF) real-time auralization

NeuroSensEar (CZS) → innovative sensors control and processing for future hearing aids  
Snaice (VW) → Neuromorphic sensing with active efficient coding for edge computing  
SFB1461 (DFG) → biological inspired information processing  
CoHumanics (CZS) → User acceptance of audiovisual Mixed Reality application  
Isoperare (Meta) → Development of auditory prediction models for iso-perceptive areas  
Multiparties (BMBF) → Development of tools for network-based multi-user Mixed Reality