

Chiroptera-Inspired **R**obotic **C**Ephaloid: a Novel Tool for Experiments in Synthetic Biology

Period:

May 1, 2002 - April 30, 2003

Partners:

Universiteit Antwerpen

Universität Erlangen-Nürnberg

Katholieke Universiteit Leuven

Bath University

University of Edinburgh

Universität Tübingen



Project Goals

- to reproduce, at a functional level, the echolocation system of bats, i.e. to construct a bionic bat head
- to use this bionic bat head to gain more insight into neural encoding of sensory data in an active sensing context



Challenges: Bionic Bathead

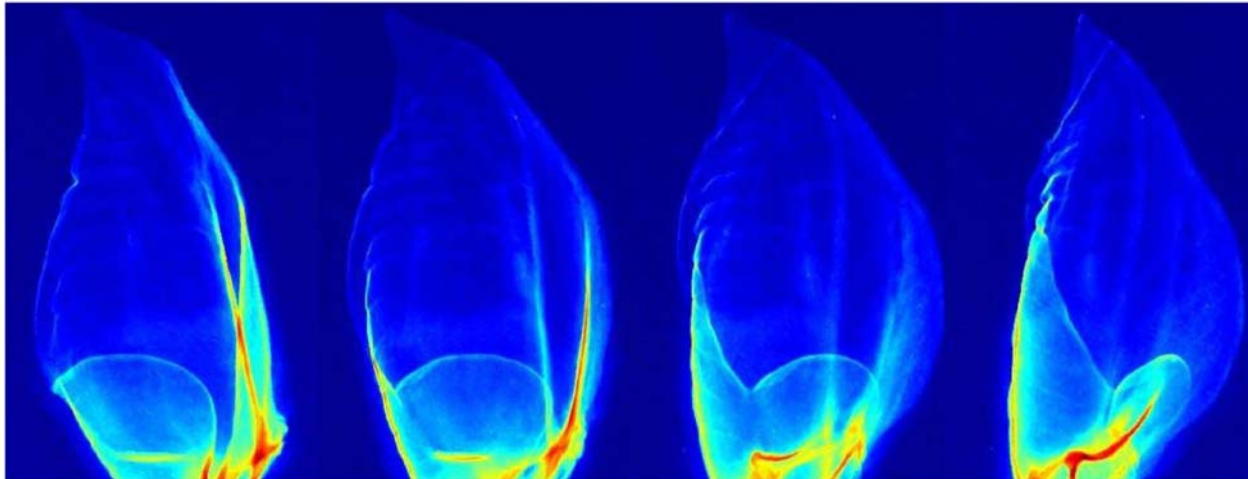
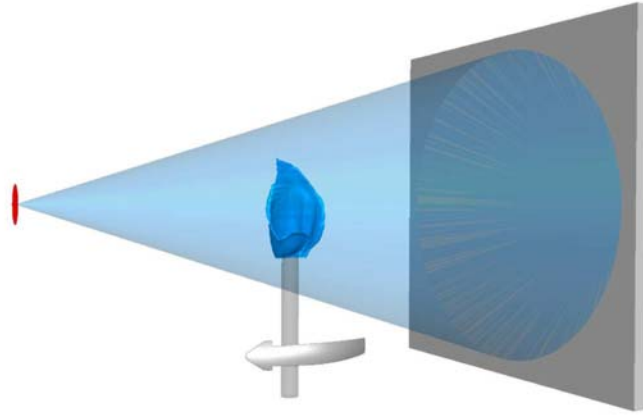
- beamforming shapes to model the bat's mouth/nose & pinnae
- ‘micro’-mechanical system for pinna/emitter movement & shape control
- transducers & efficient drivers for emission/reception of ultrasonic sound waves
- neuromimetic hardware to realise realtime signal processing

Challenges: Realistic Biosonar Tasks

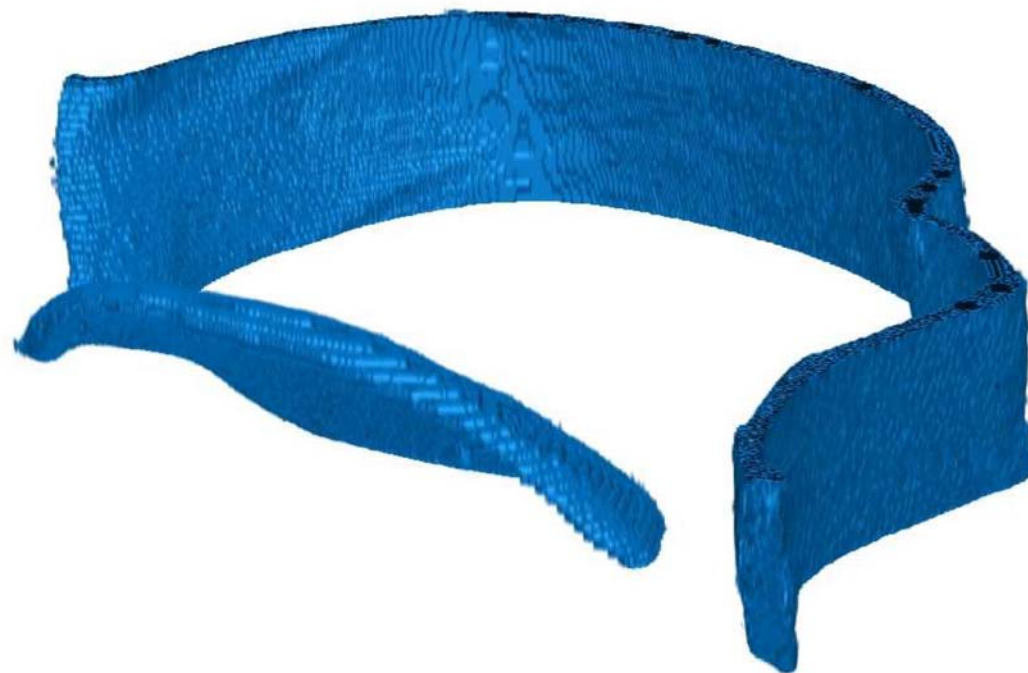
- classifying natural landmarks based on spike coding of the relevant echo features
- navigation in natural environments
- make use of head configuration and body movement to facilitate extraction of echo features



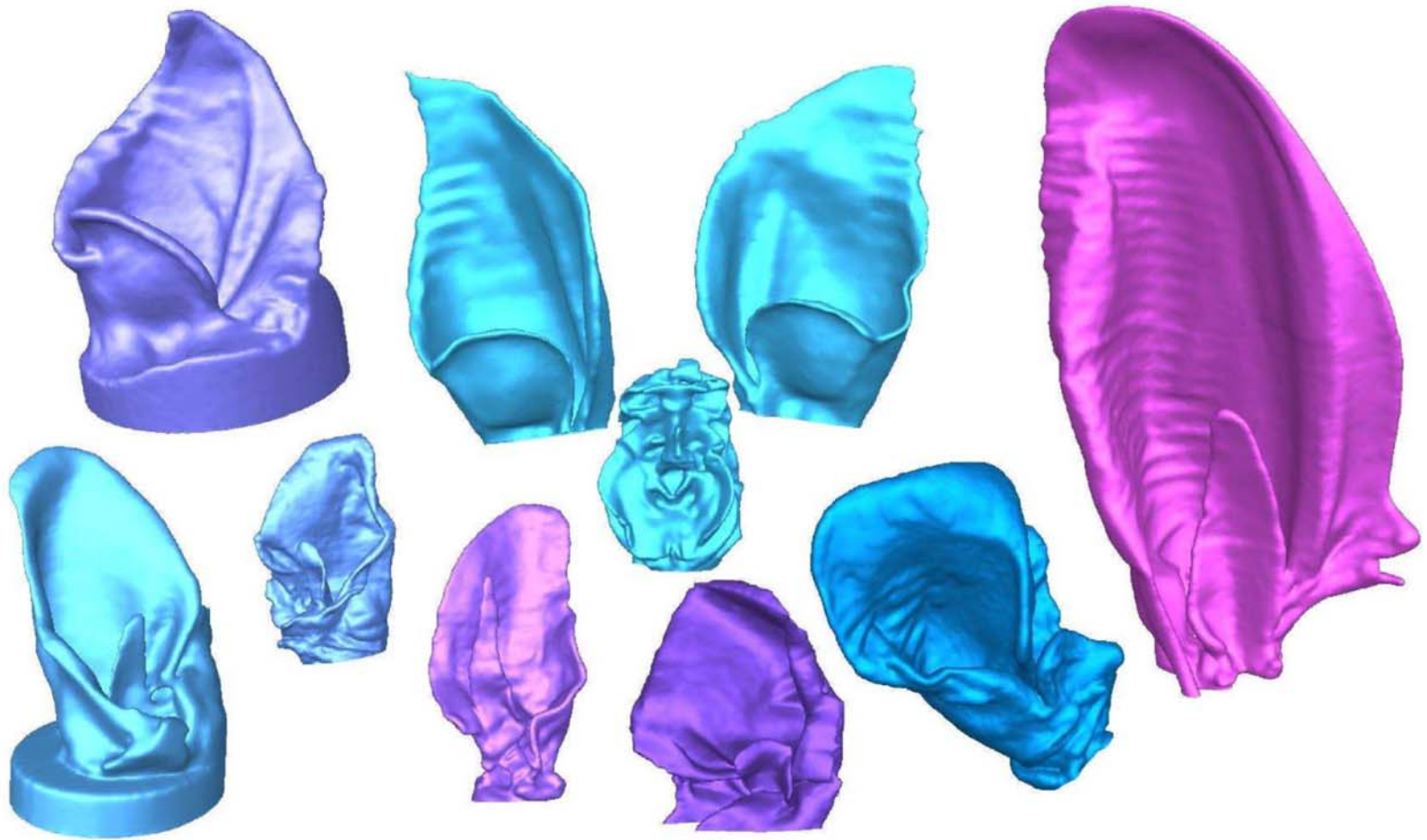
Tomography: Shadow Images



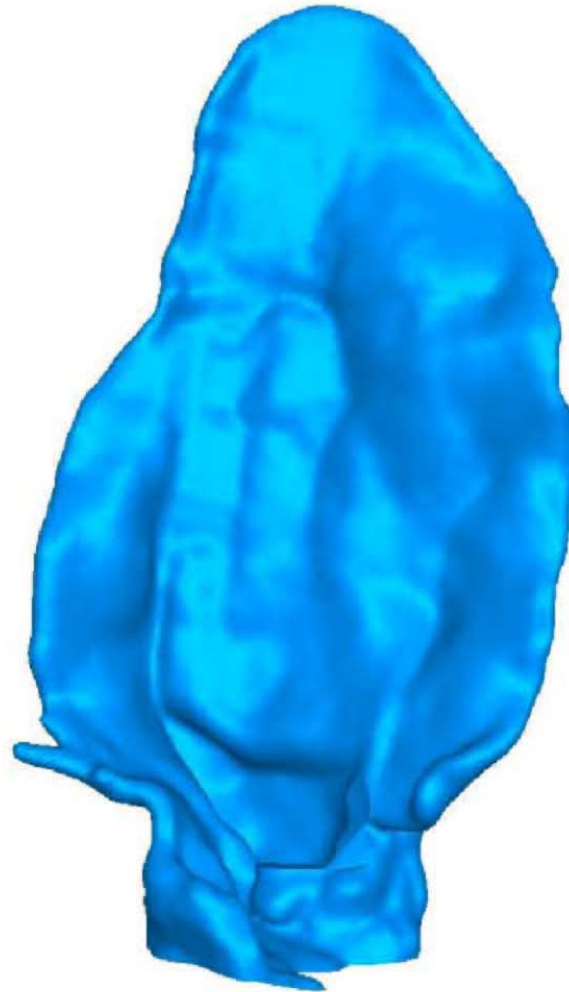
Tomography: Image Segmentation



Results: Ear Zoo

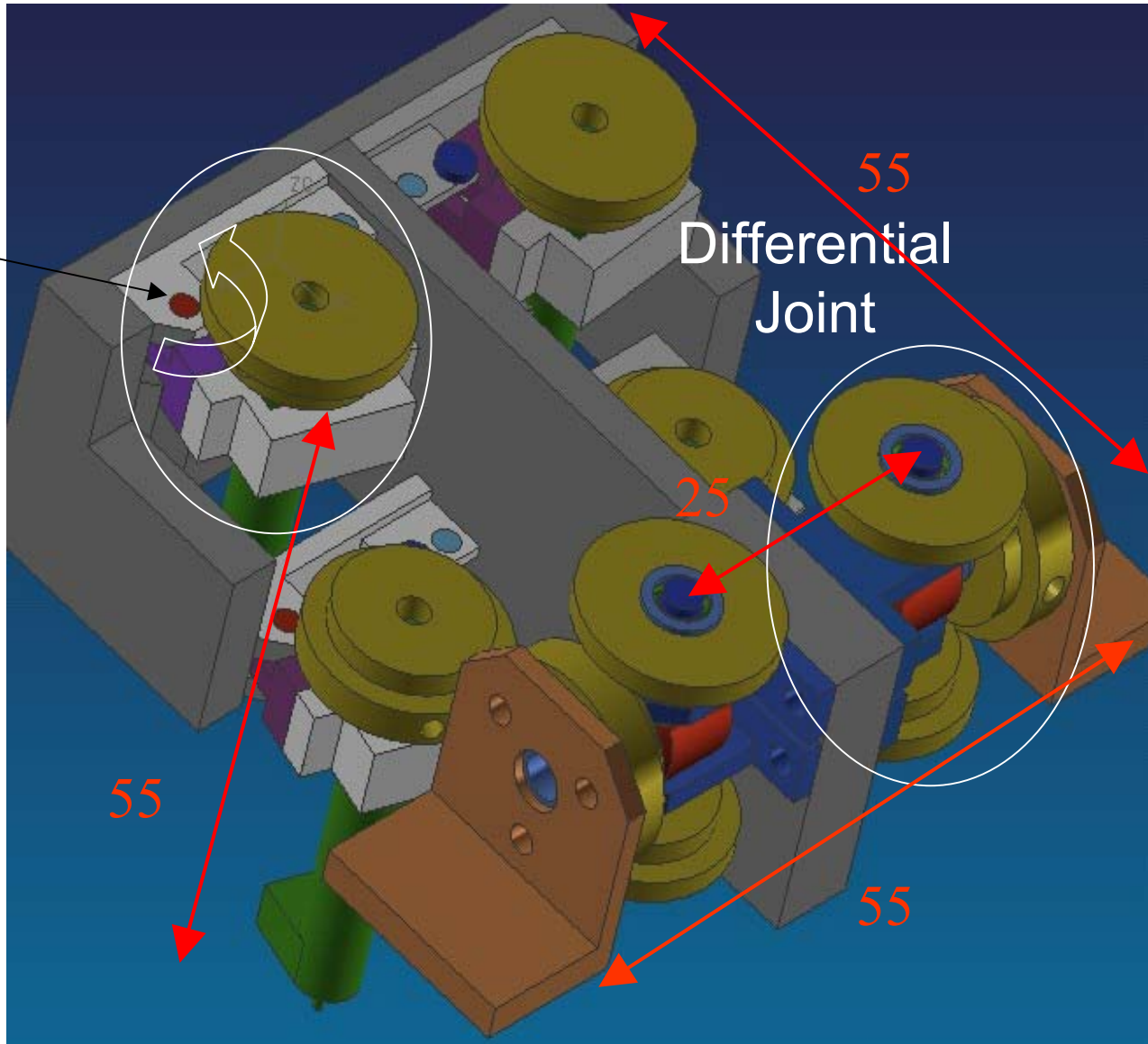


Experiments: Boolean Surgery



Mechanical Design: Overview

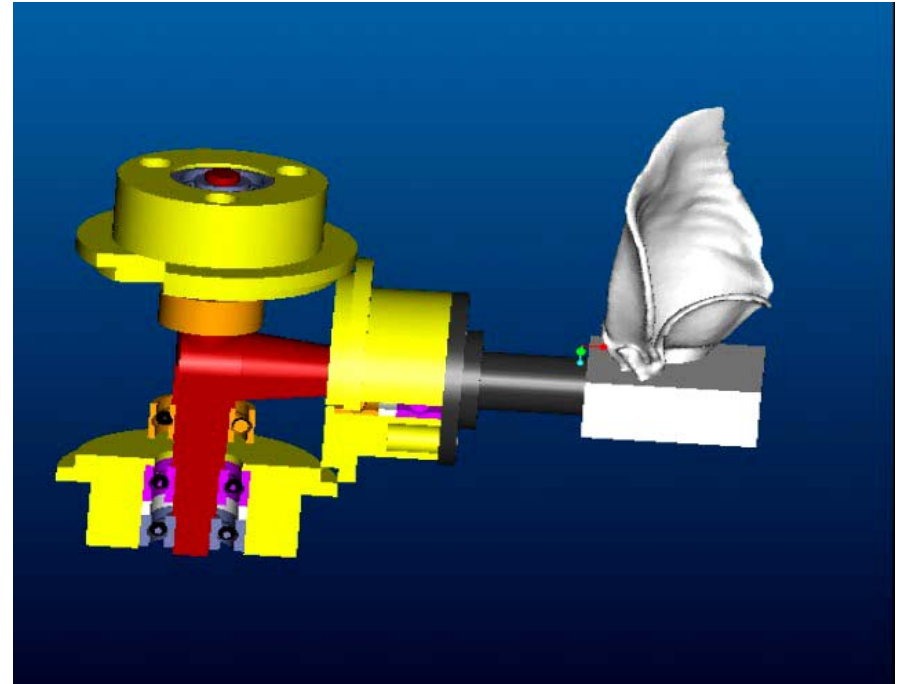
Motor
Suspension



Mechanical Design: Differential Joint

Differential Cable System

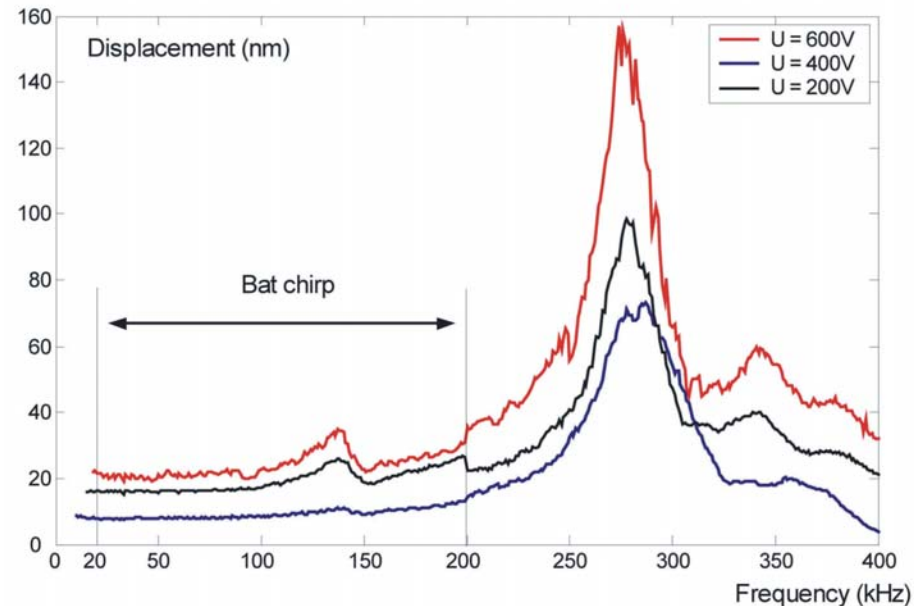
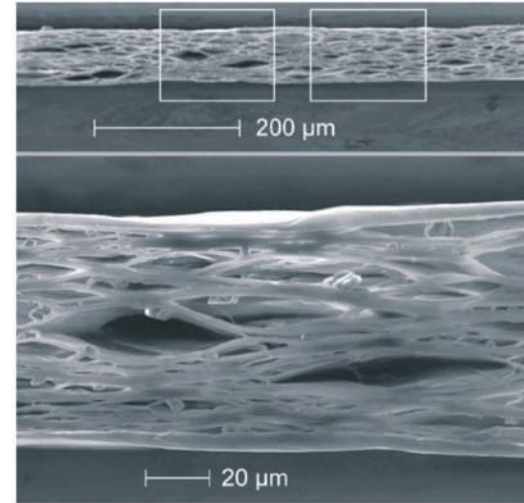
- Pan movement:
Both drive pulleys rotate in the same direction
- Tilt movement:
Drive pulleys move in different directions



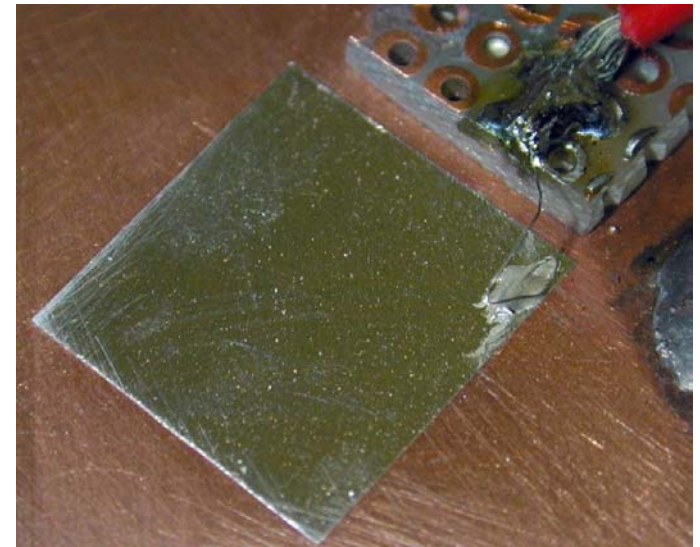
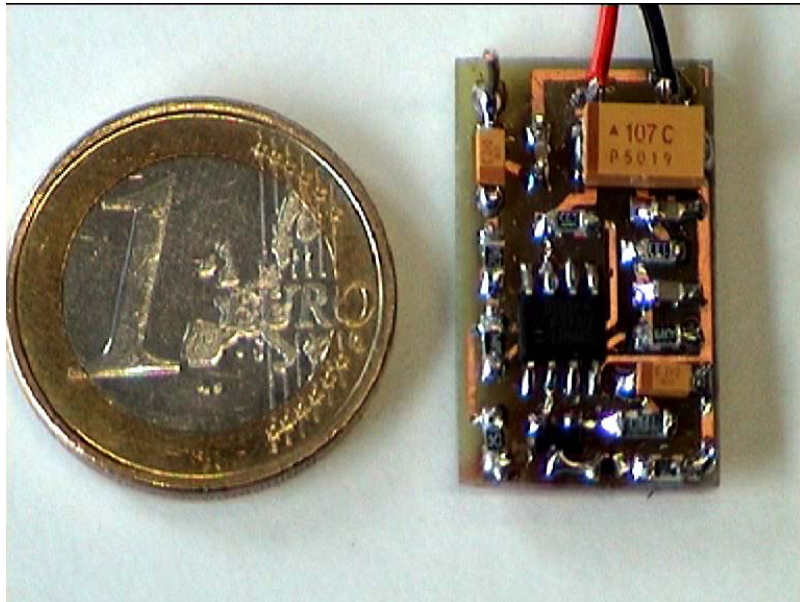
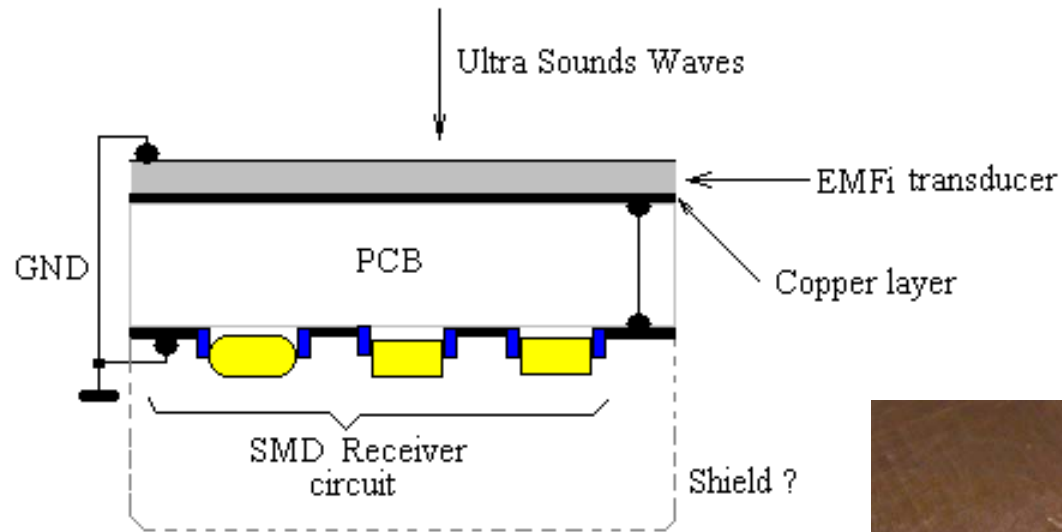
Transducer Technology

ElectroMechanical Film EMFi:

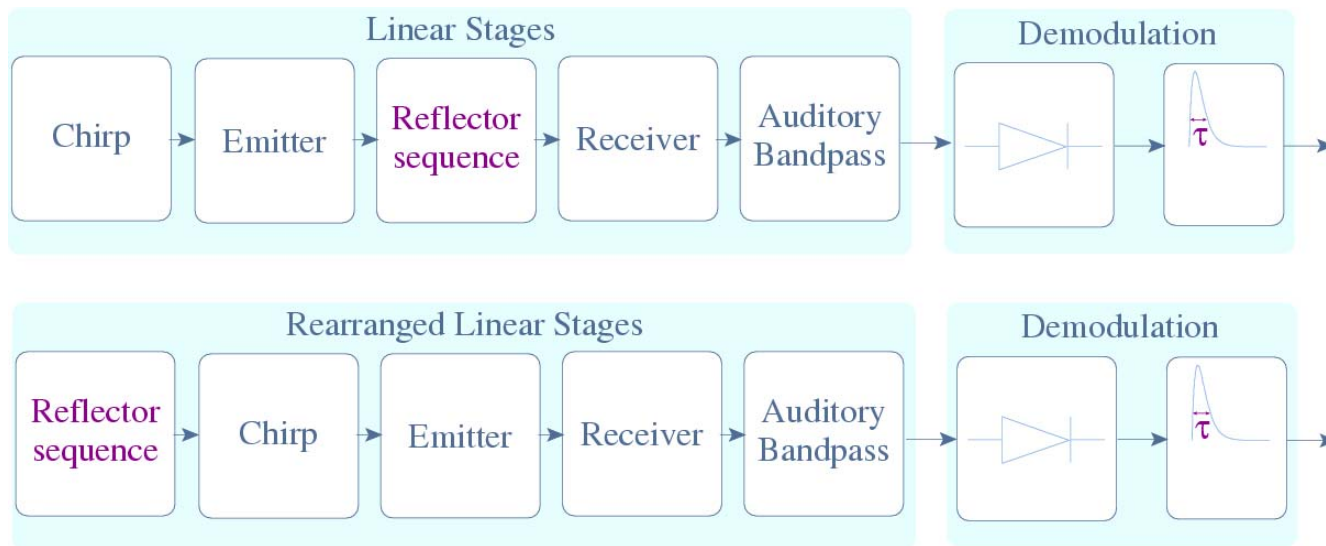
- Electret material with cellular structure
- Light, thin, flexible and easy to process
- Bandwidth: 20-200kHz
- Good impedance match to air
- Low power consumption



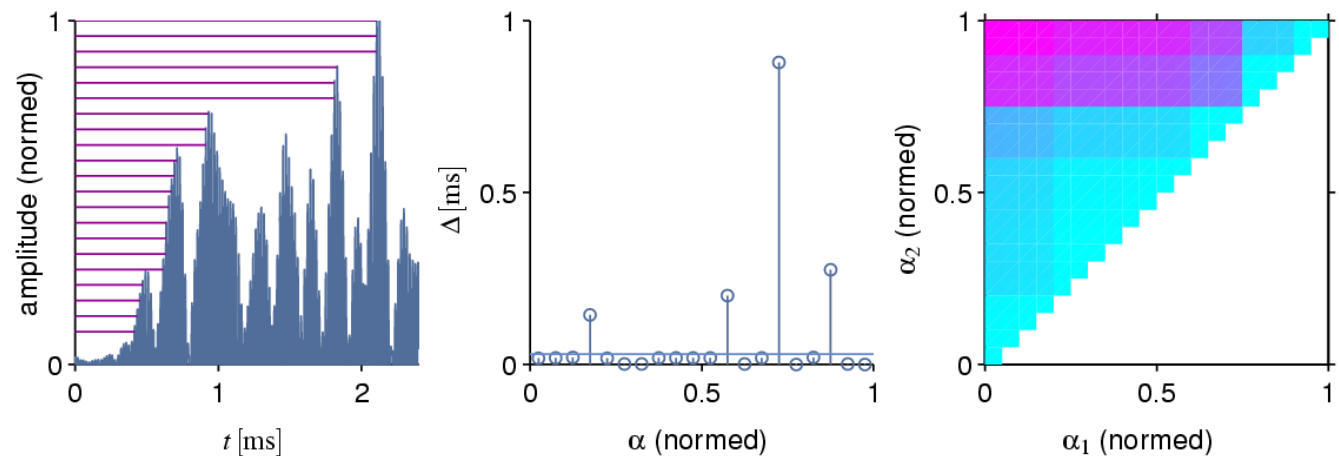
EMFi-based Receiver



Spike Coding of Echo Features



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Block diagram of Binaural, Digital, Silicon Cochlea

