All Surface Micromachined Microphone

Flavio Pardo

Bell Labs Lucent Technologies
Murray Hill, NJ

collaborators
D.J.Bishop, P.Gammel, D. López, B.Boie, G. Elko,
R. Sarpeshkar

All Surface Micromachined Microphone

Advantages

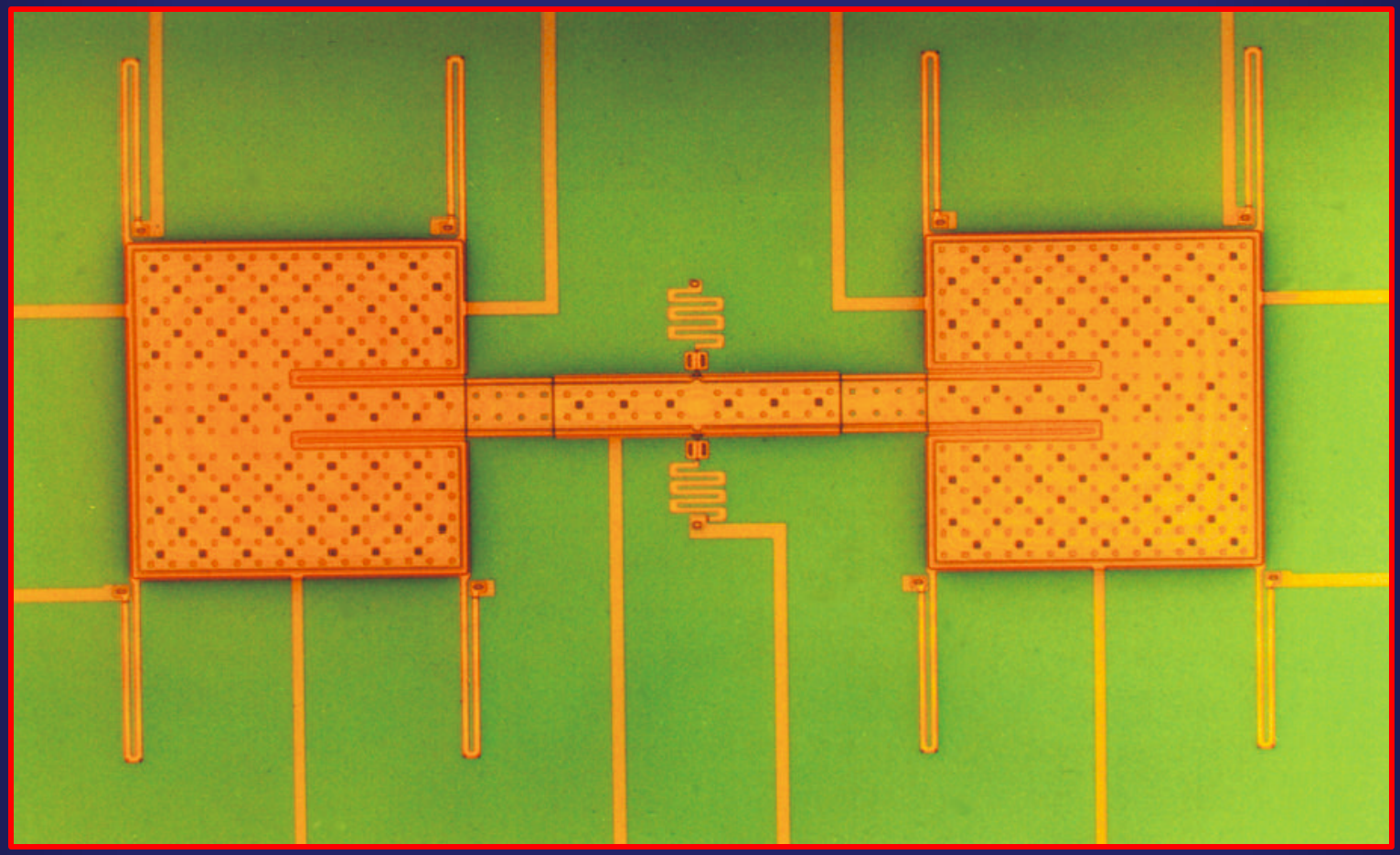
- **Freedom of Design → more functionality**
- **Very Suitable for Integration with electronics**
- **Well-established Commercial Process**
- **Foundries**

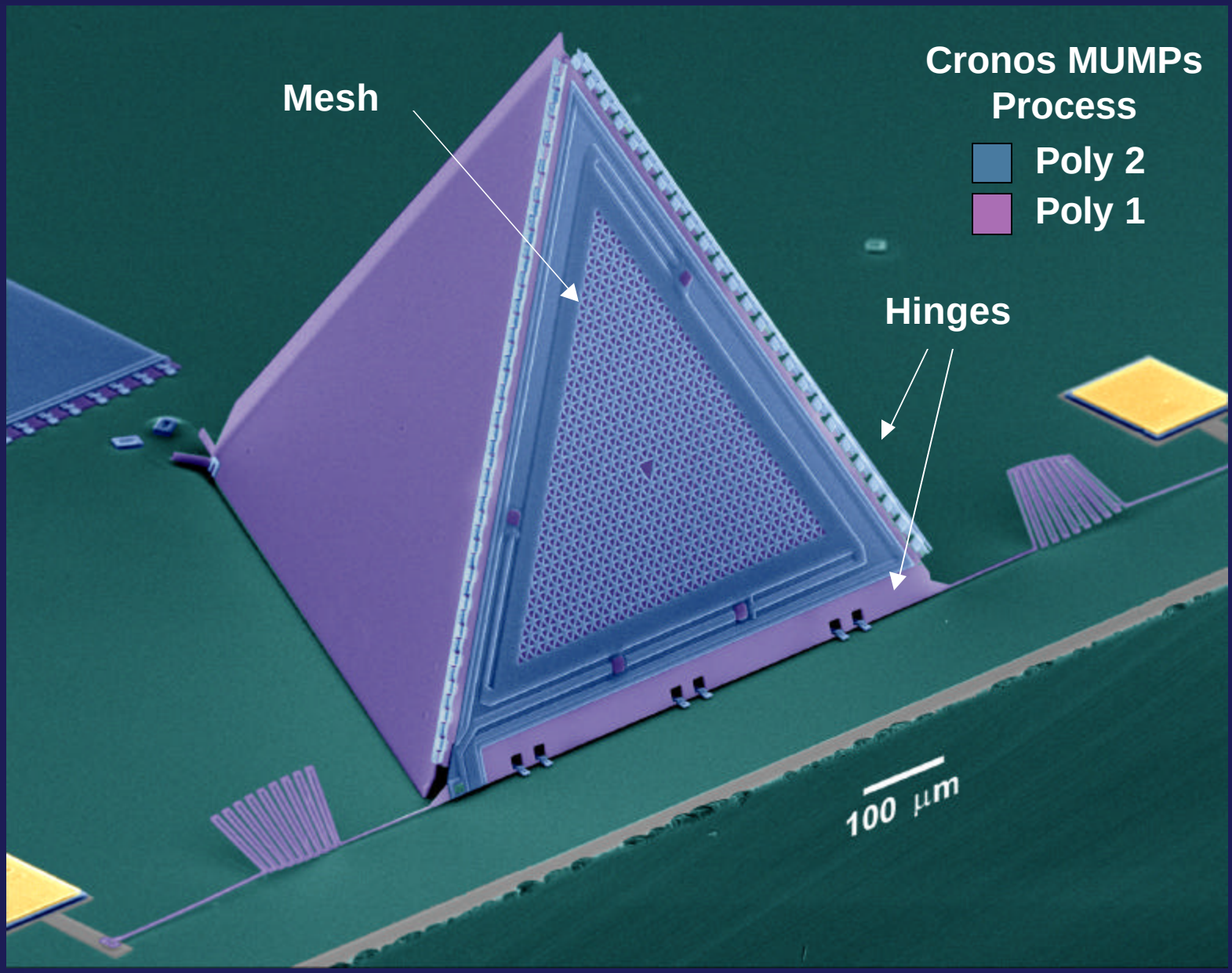
Disadvantages

Solution

- **Small Gaps → damping** Out of Plane Structures
- **Some Assembly Required** Self Assembling

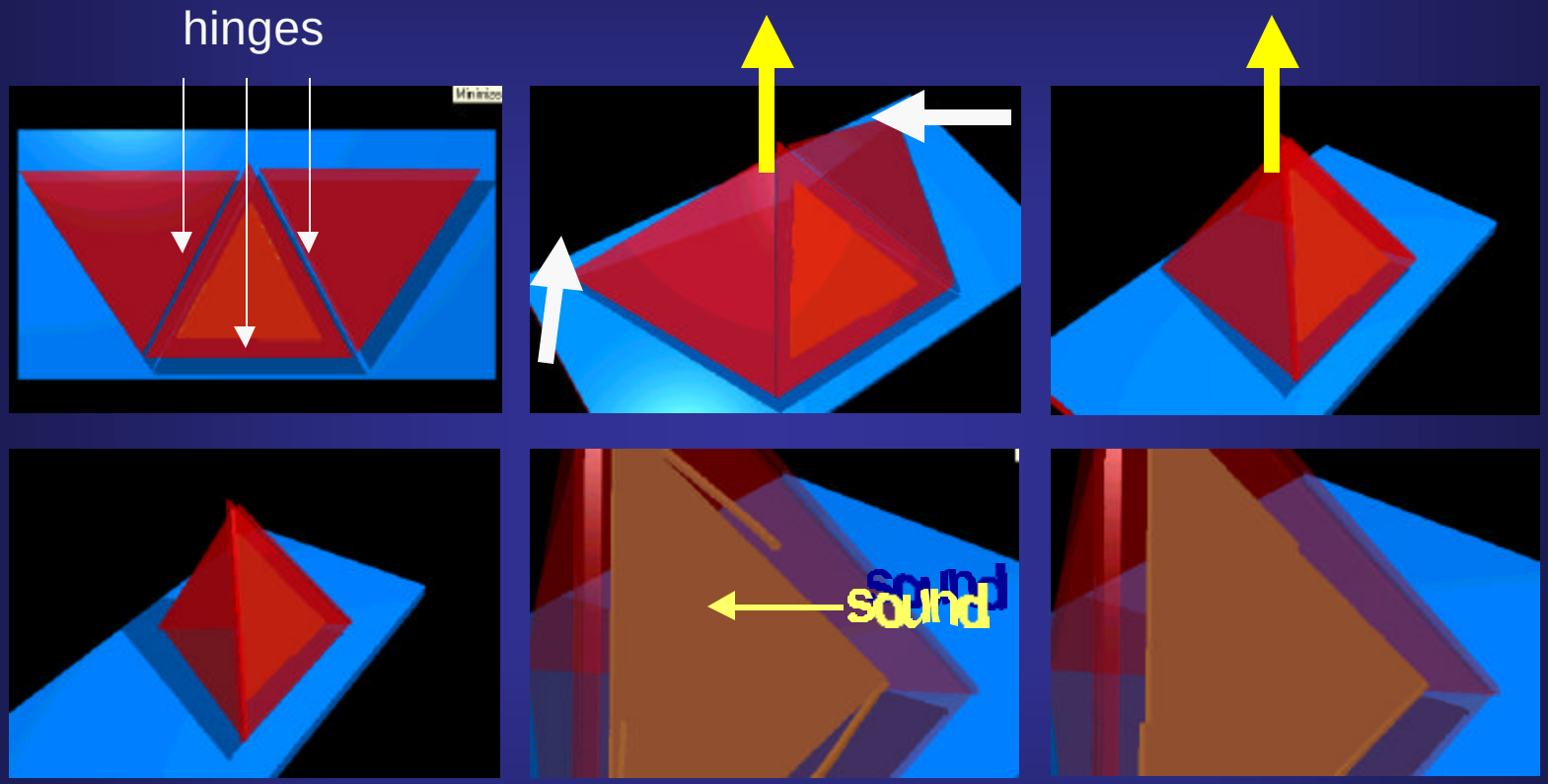
Early Surface Microphone

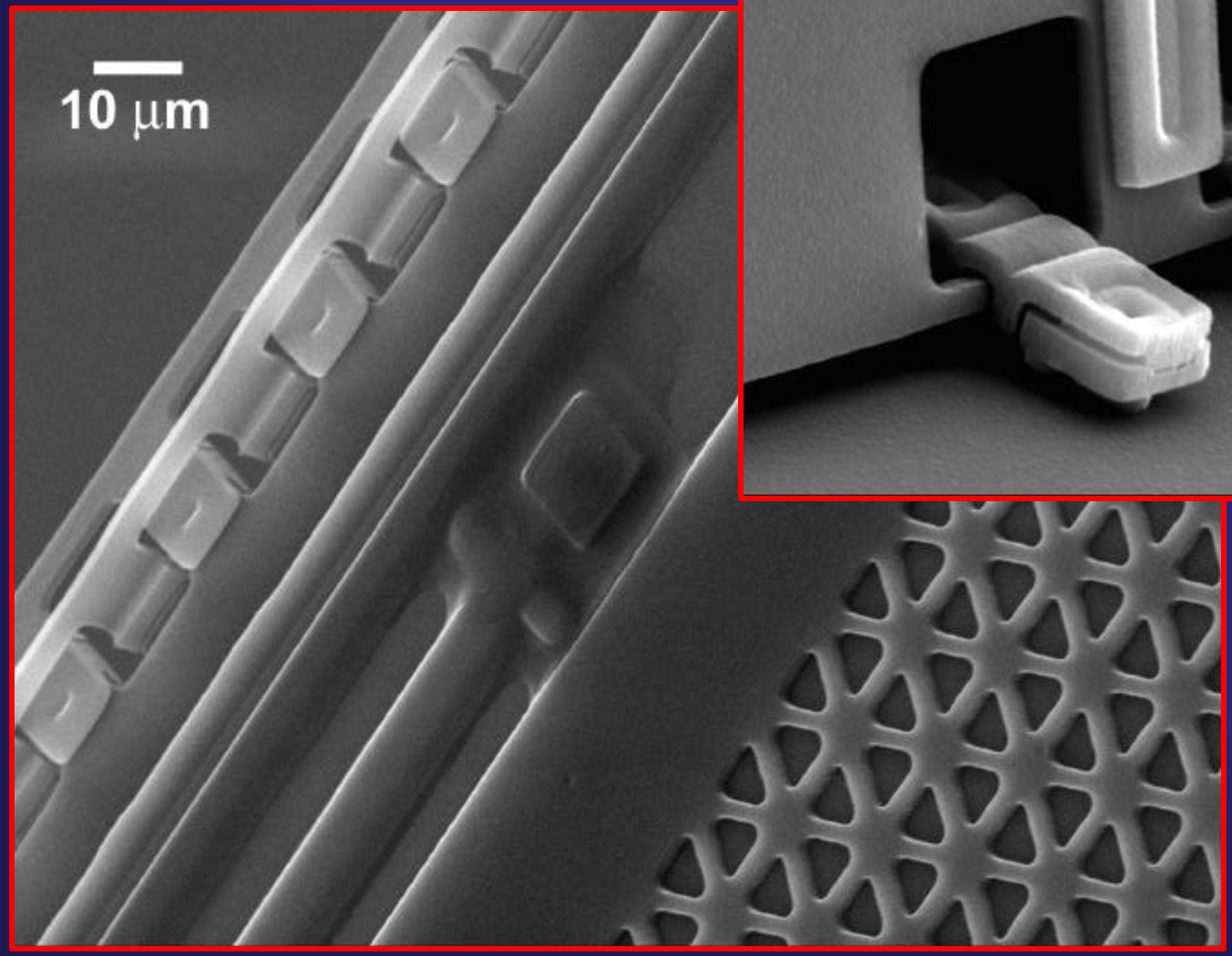


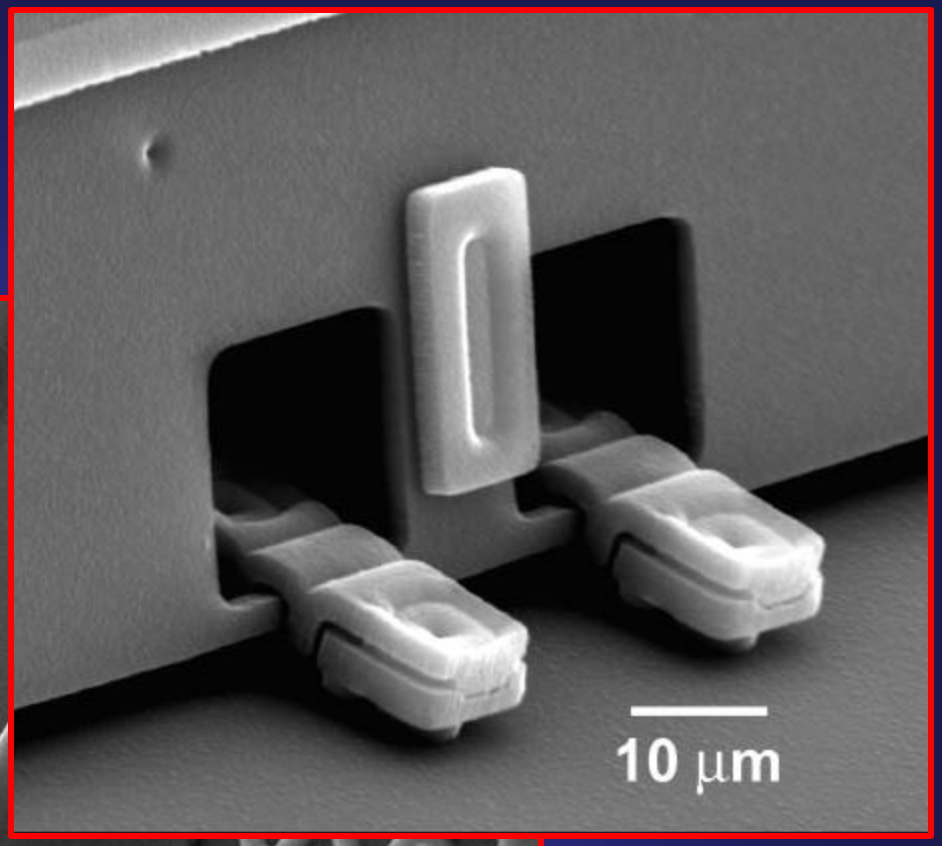


SEM Photograph

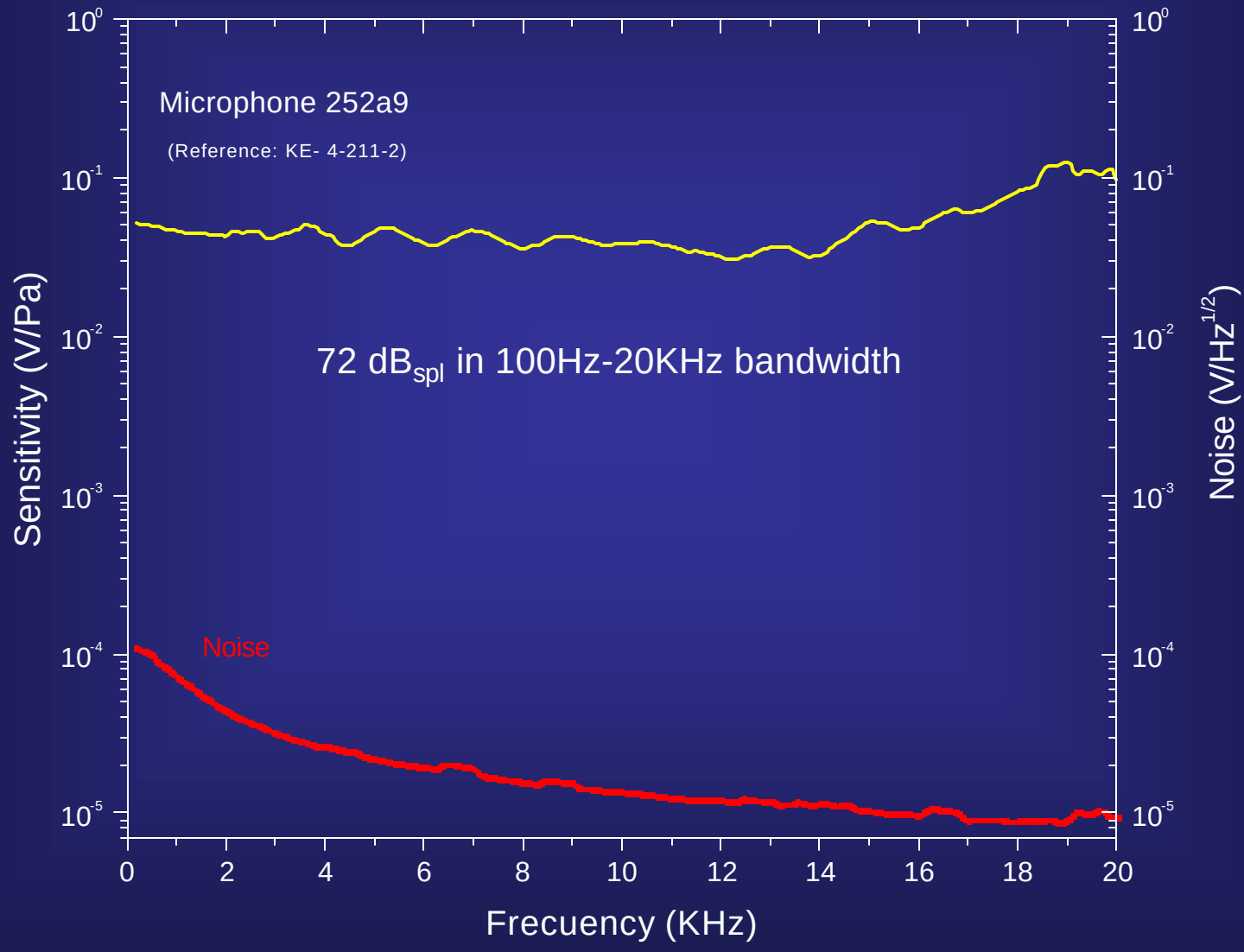
Tent Assembly and Working Principle




10 μm

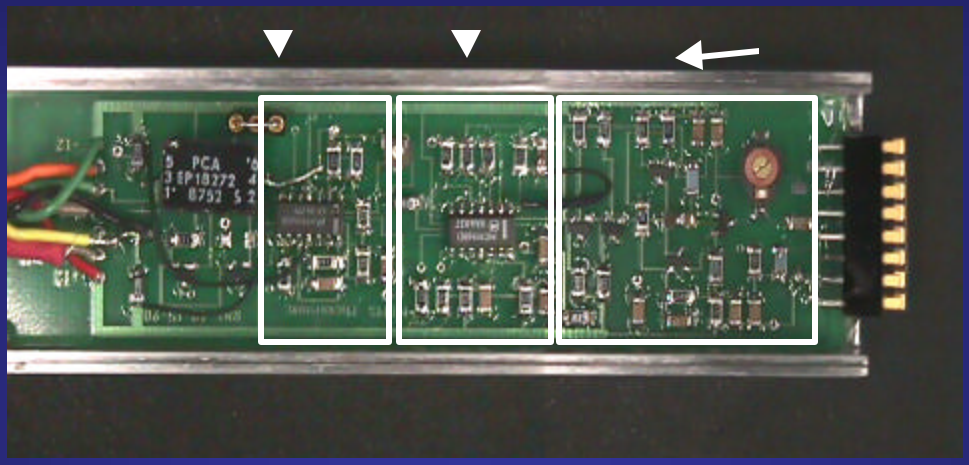

10 μm

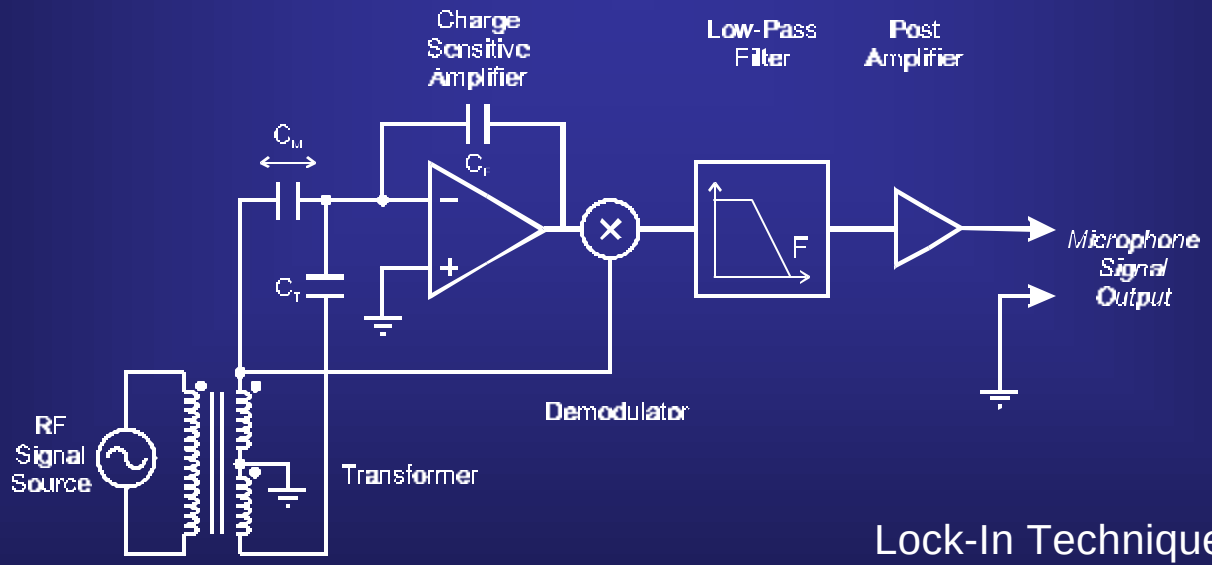
Frequency Response



Detection Circuit

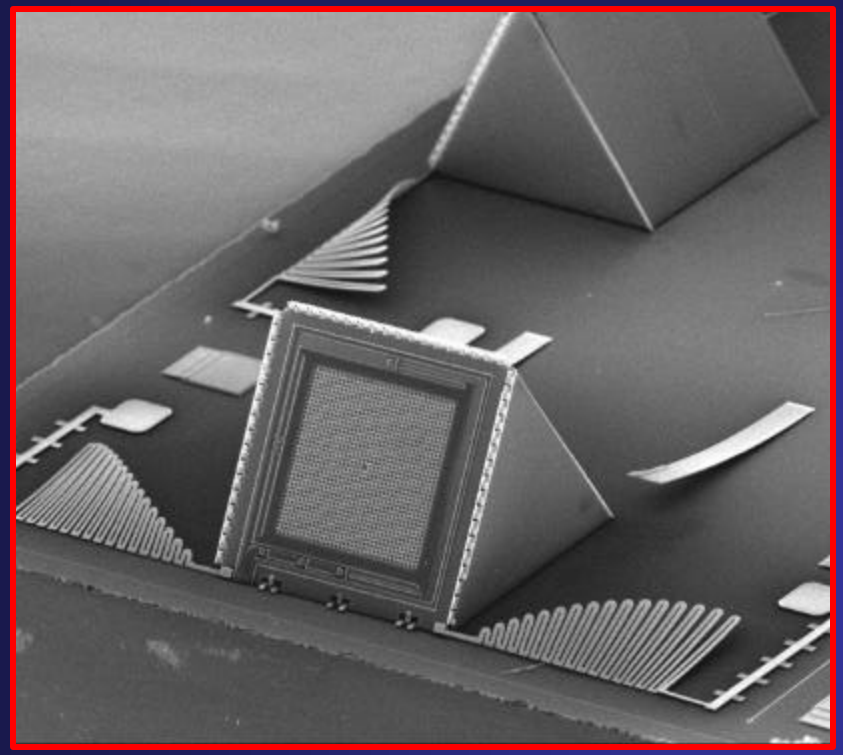
gain and filtering demodulator charge amplifier

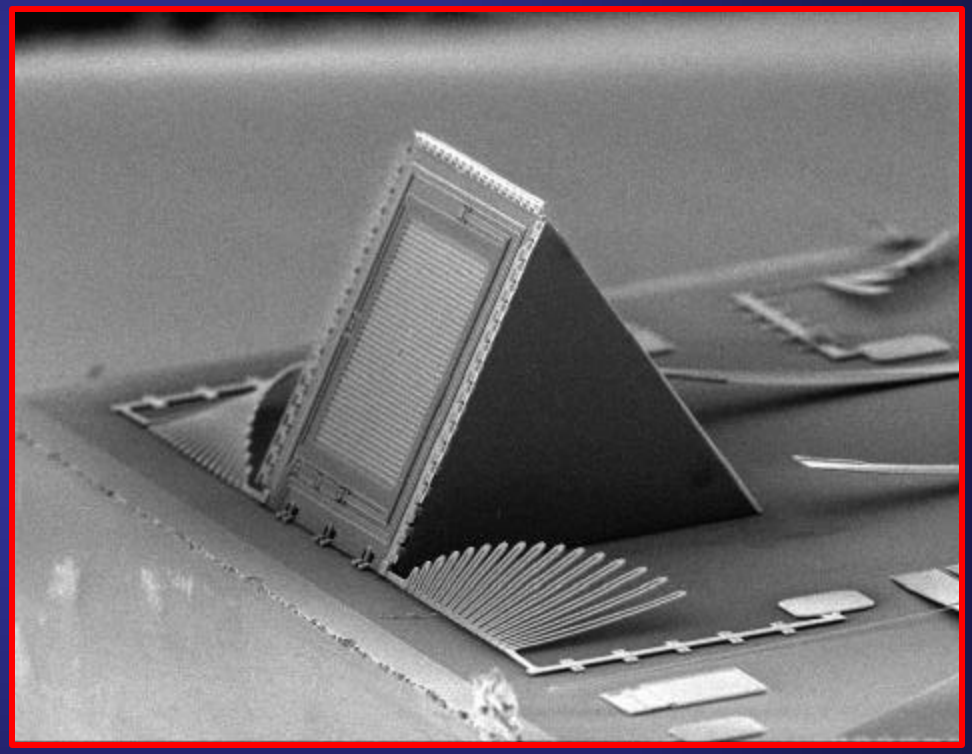




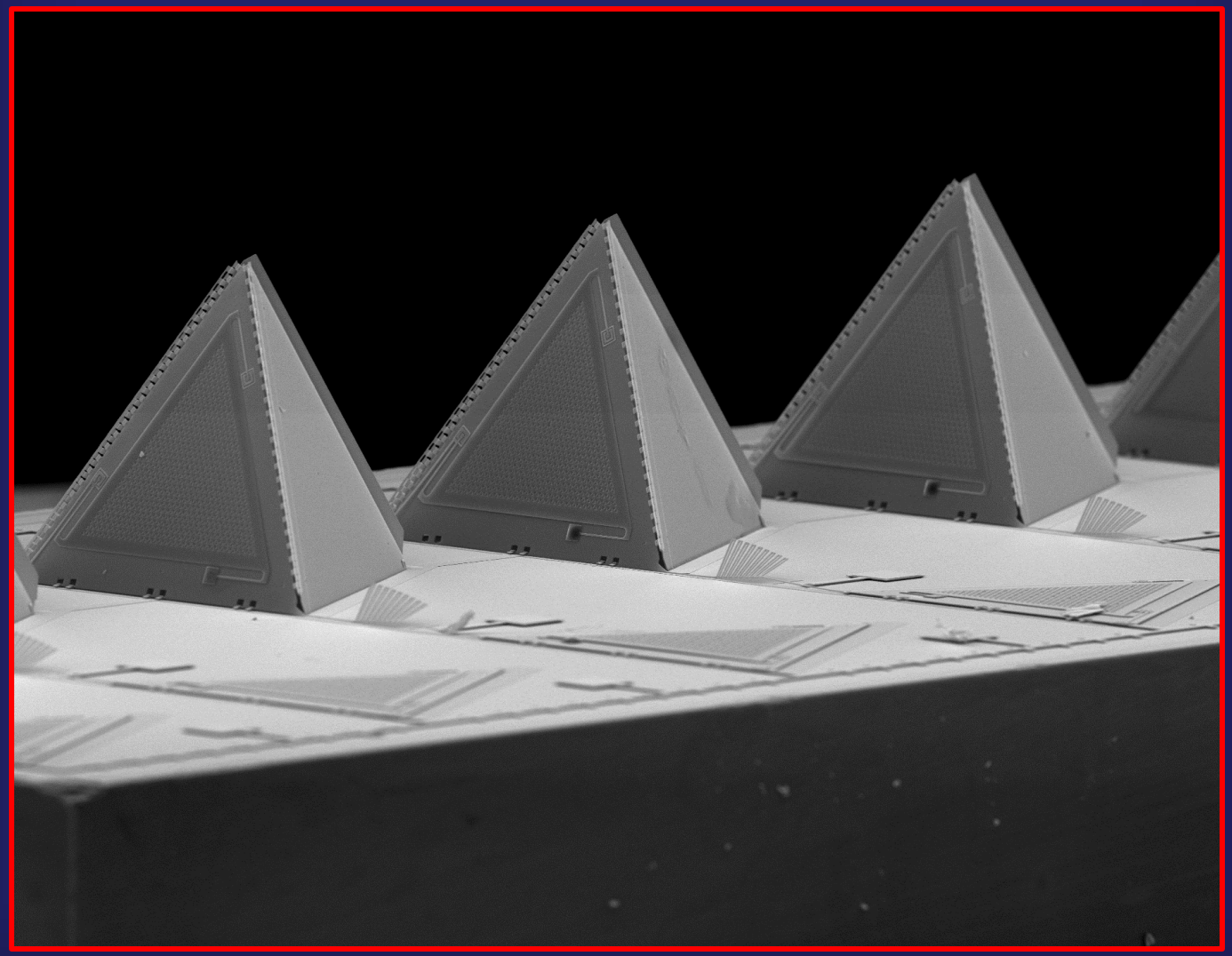
Lock-In Technique

1.5MHz, $1V_{RMS}$ carrier

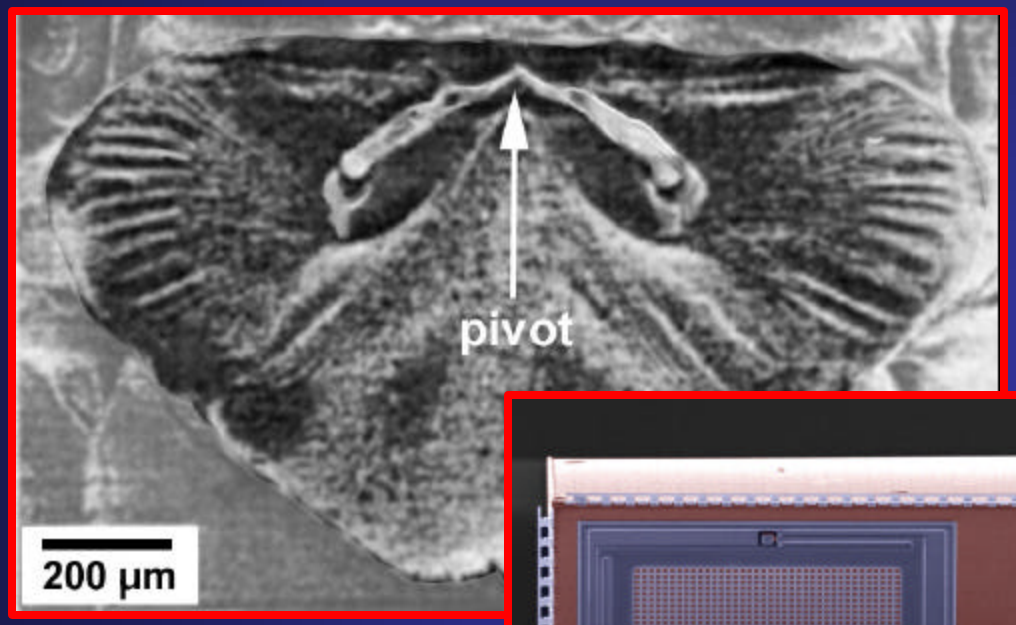


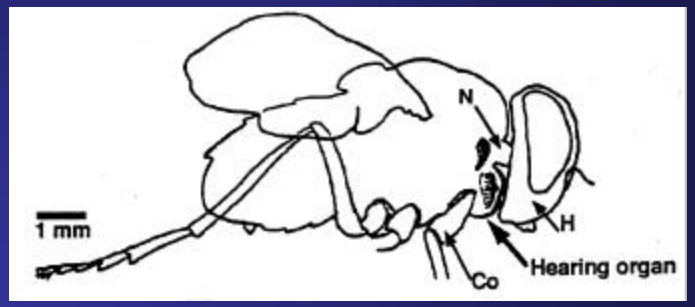


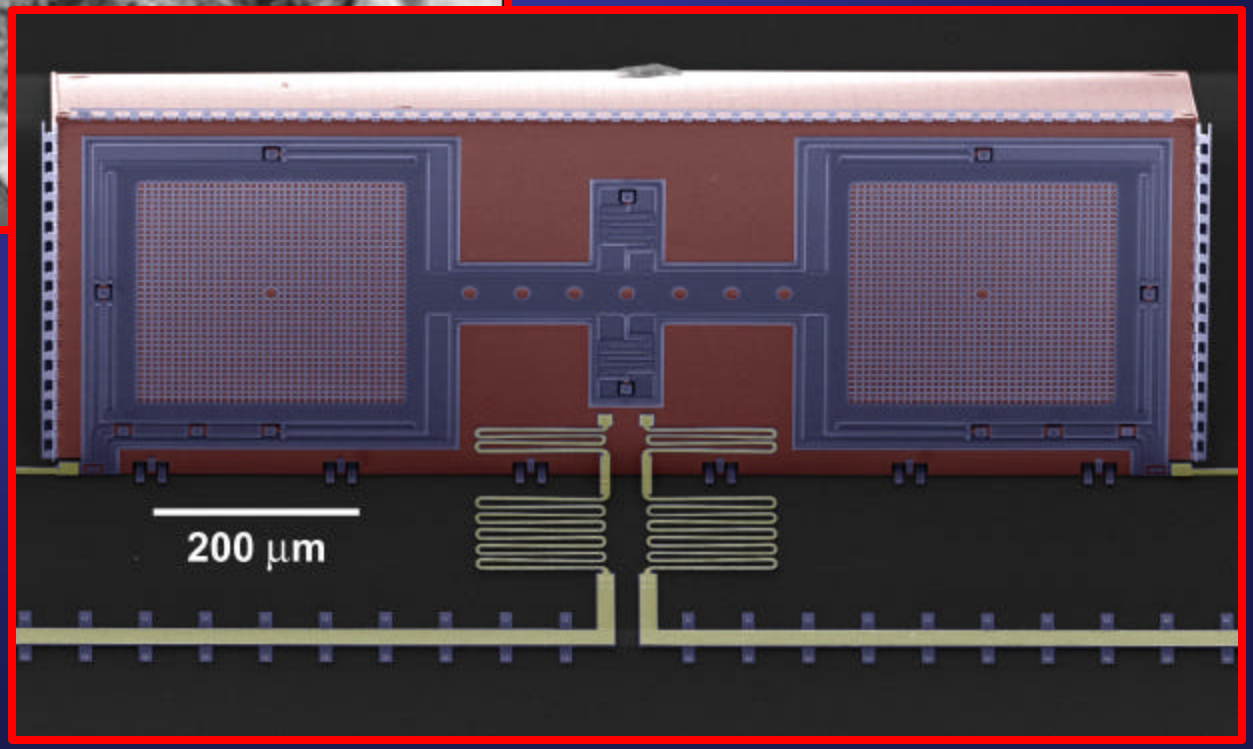
Microphone Arrays



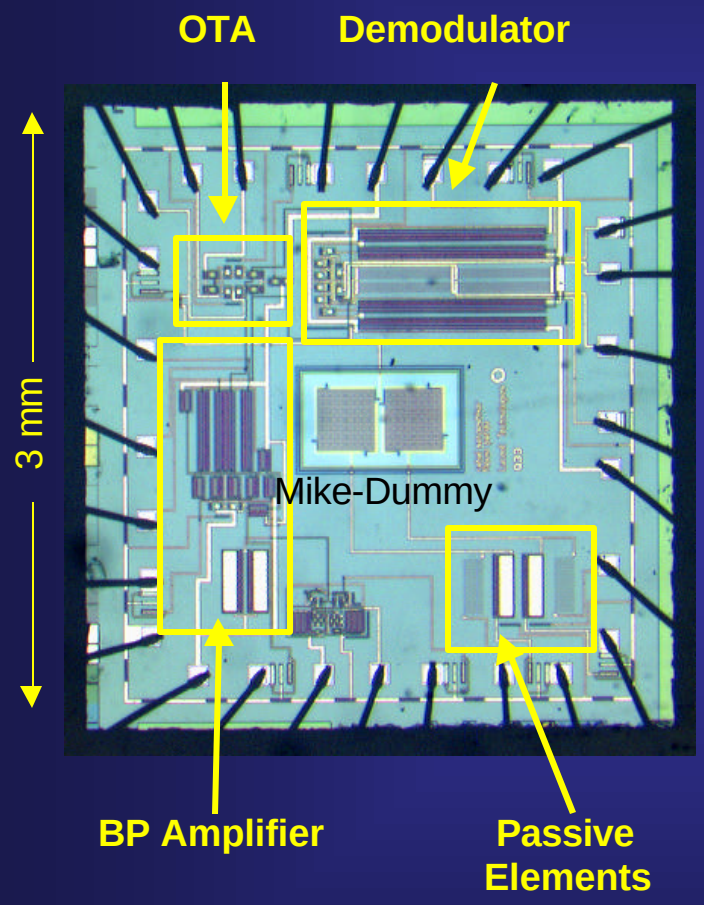
Biologically Inspired Directional Si Microphone

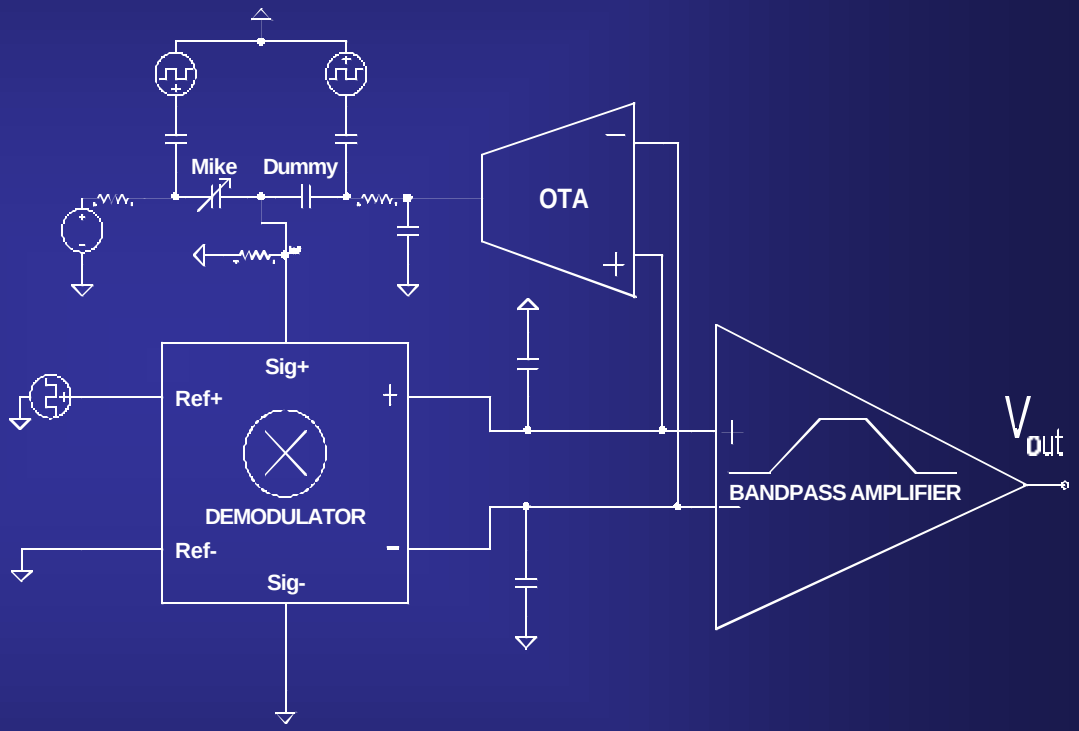




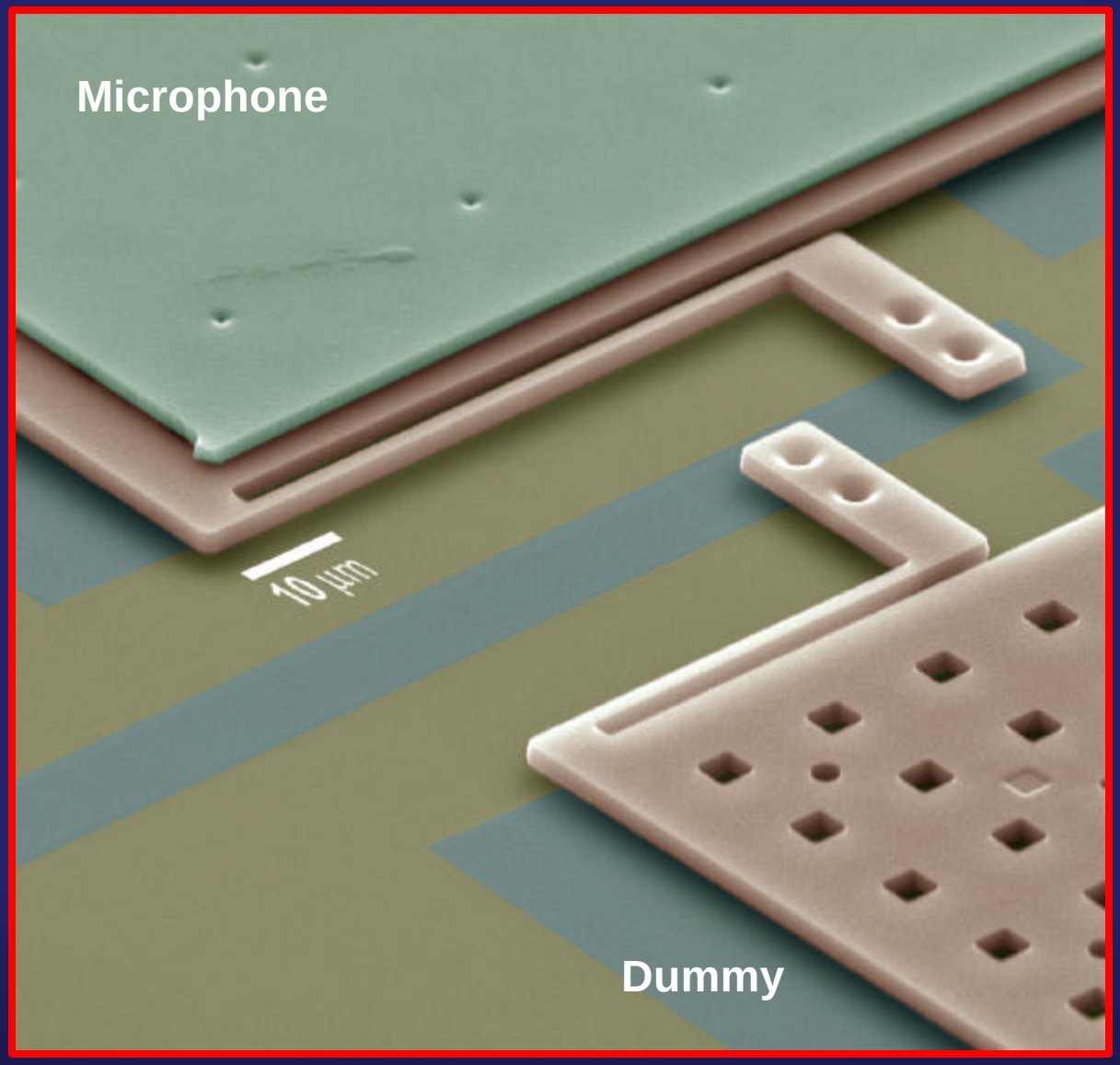


iMEMS sensor

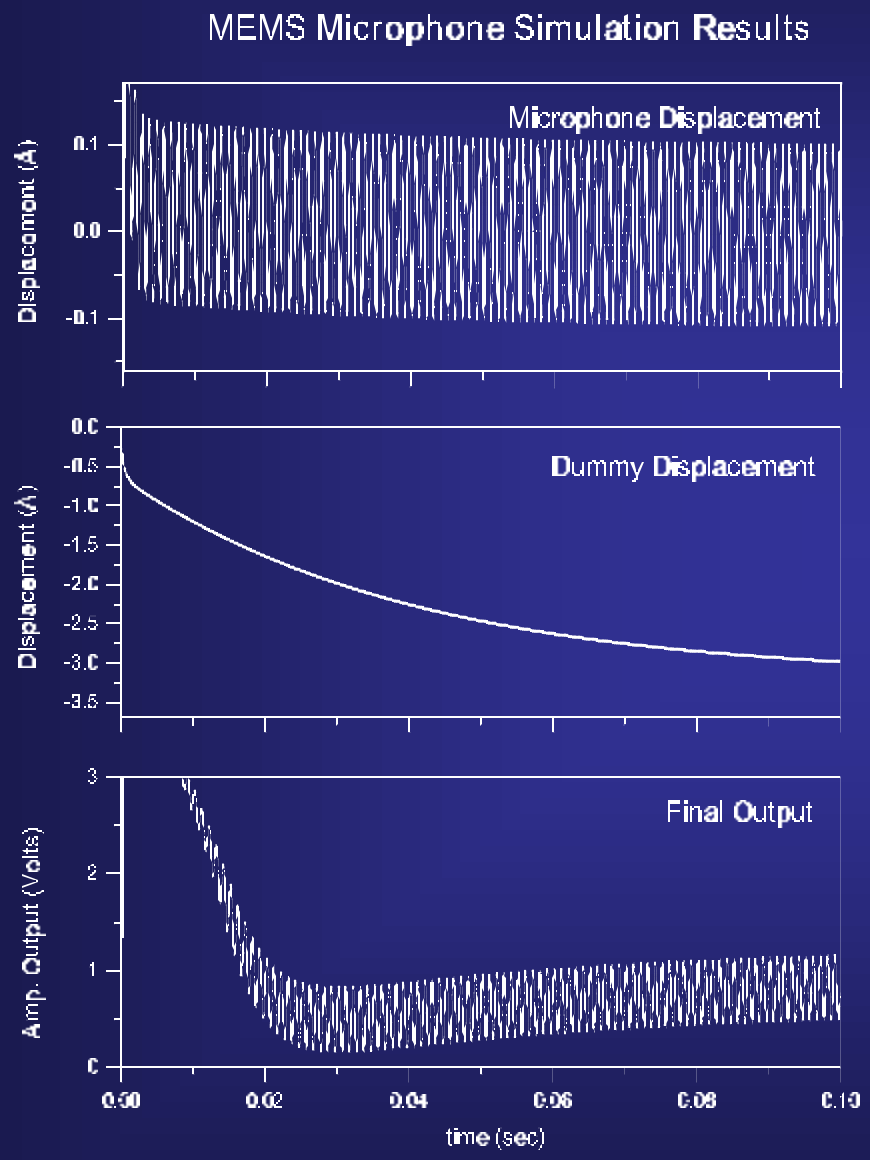
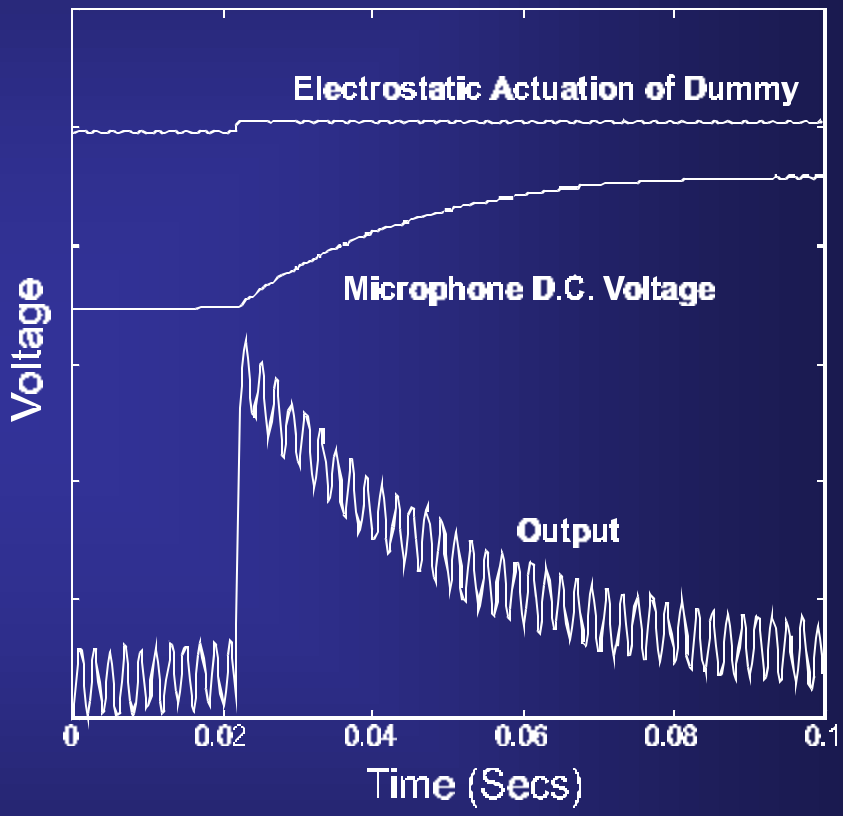




iMEMS sensor detail



SPICE simulations and experiments



Experimental Data