Joint Development Program with NanoDimensions

Dr.-Ing. Gerd Teepe

CEO and Co-Founder of Celtro GmbH

27th of April 2023

CELTRO Operational Team

Gerd Teepe PhD, Co-Founder, CEO

NEC MOTOROLA AMD GlobalFoundries

Manu Viswambharan M. Sc
IC Design, Principal Engineer

ISRO CYPRESS TECHNISCHE UNIVERSITÄT DRESDEN

Niko Joram PhD
System Design, Principal Engineer

CYPRESS TECHNISCHE UNIVERSITÄT DRESDEN

Thomas Gaspar MD, Co-Founder
Cardiac EP – Pre-Clinical Lead

UNIVERSITÄT LEIPZIG TECHNISCHE UNIVERSITÄT DRESDEN

Judith Piorkowski, MD, Co-Founder
Cardiac EP Lead

UNIVERSITÄT LEIPZIG TECHNISCHE UNIVERSITÄT DRESDEN heart

Jarek Budny, MBA, Co-Founder
Finance & Business Development

MOTOROLA freescale semiconductor
AMD GlobalFoundries

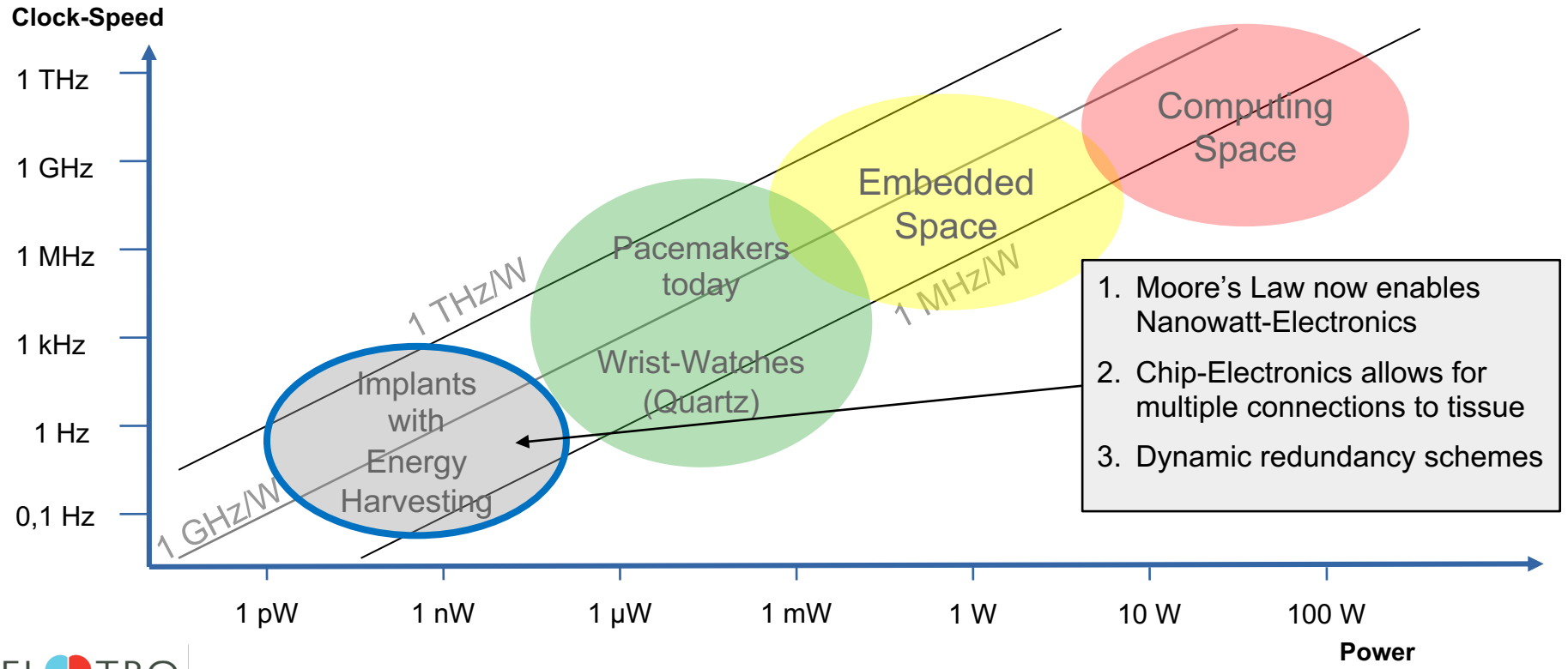
Paul Reidy, Esq.
M&A and Licensing

MOTOROLA freescale semiconductor
RPX RATIONAL PATENT

Tom Drechsel, M.Sc. Bio-Cell
Interface, Principal Engineer

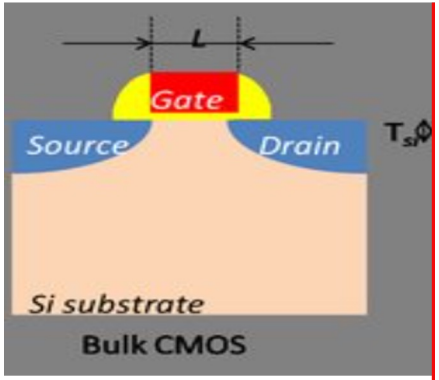
TECHNISCHE UNIVERSITÄT DRESDEN

Moore's Law enables Nanowatt-Electronics



CELTRO

Semiconductor Technology breakthrough in Low Power



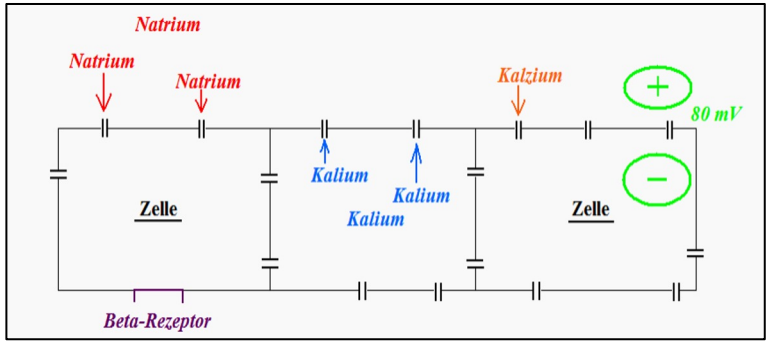
… up to
28 nm

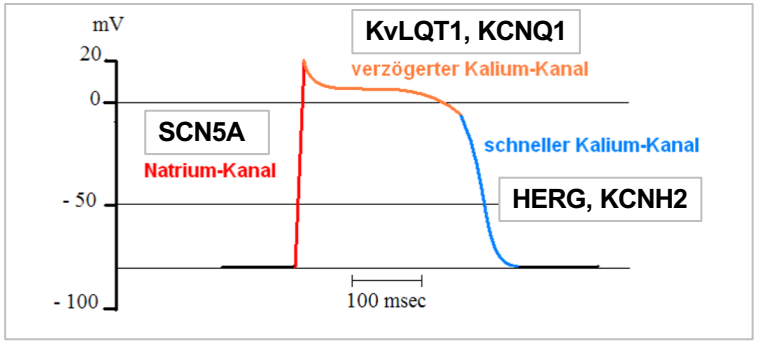
Substrate Diodes

Human Cells are like batteries

continuous exchange of electrical energy

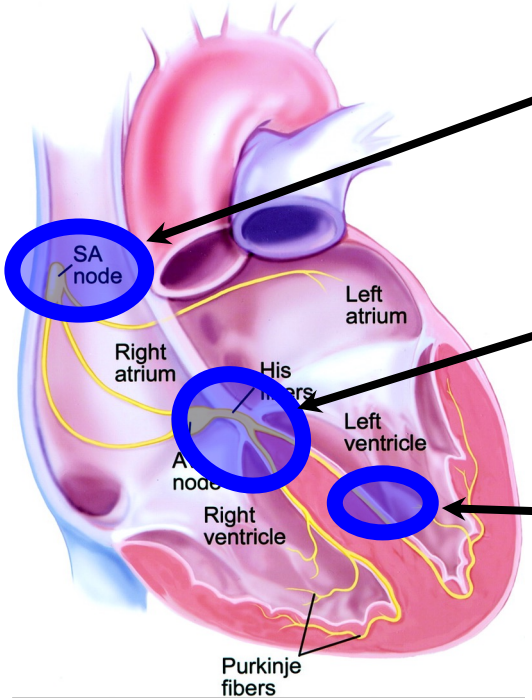
- Every cell is an individual battery
- During each cellular cycle it discharges and recharges once
- Discharge is driven by ion in- and efflux due to potential and concentration gradients
- Recharging needs cellular energy for active ion pumping
- Neighboring cells are activated through electrical field changes and ion channel connections





CELTRO

Medical Indications for Pacemaker Therapy



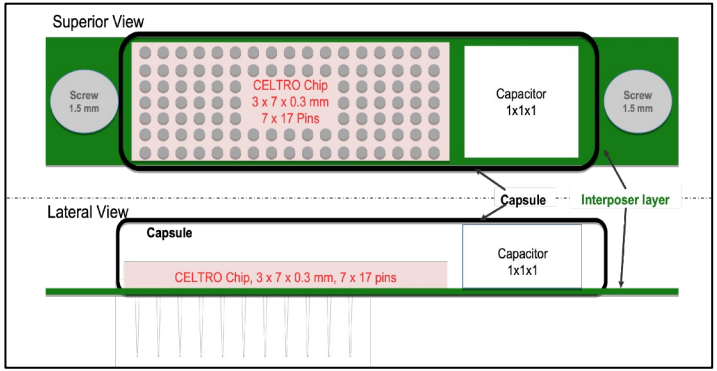
Sinus Node
- Slow pulse
- Cardiac arrest
- Dizziness, loss of contiousness
- Need for pacemaker

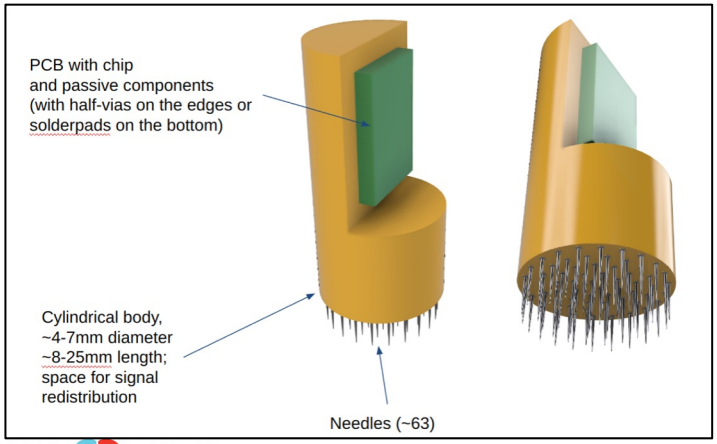
AV-Block
- Slow pulse
- Cardiac arrest
- Dizziness, loss of contiousness
- Need for pacemaker

Left-Bundle-Branch-Block
- Uncoordinated cardiac mechanics
- Heart failure
- Short of breath, poor physical condition
- Bedarf für Schrittmacher

BioChips Harvest Cellular Electrical Energy

Concept Design



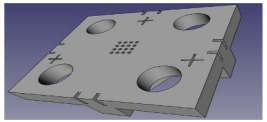


Characteristics

- Nano-Watt Power Footprint
- No Batteries
- No Leads
- pervasively redundant tissue interface
- Katheter deployment

CELTRO

Joint Development Plan with NanoDimensions

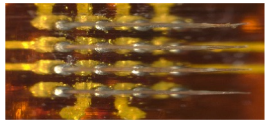


Phase1:
Needle-Holder

Microneedle electrode holder with **16 electrodes**

Feasiility Study for bonding of needle material

Mechanical only design



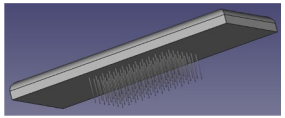
Phase 2:
16-Electrode Array

Microneedle electrode array with 16 electrodes

Print of Alignment structures

Alignment for subsequent prints

Mechanical-electrical co-design



Phase 3:
Pprototype

System-in-package for IC characterization tests

60 - 120 electrodes with connection to IC

Pick & place structures for further addition of devices

Alignment structures & process

Mechanical-electrical co-design

Final Package & Qualification

Phase 4:
Qualifyable Package

Implantable system-in-package prototype

Final Package design

Other componentes like: RF-coil, backside Connection to blood-stream, integration of passives

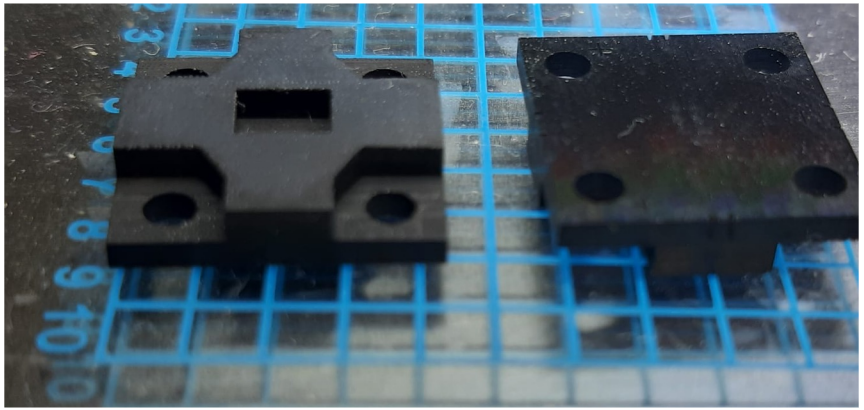
Bio compatibility tests

IPC class 3 compliance (future)

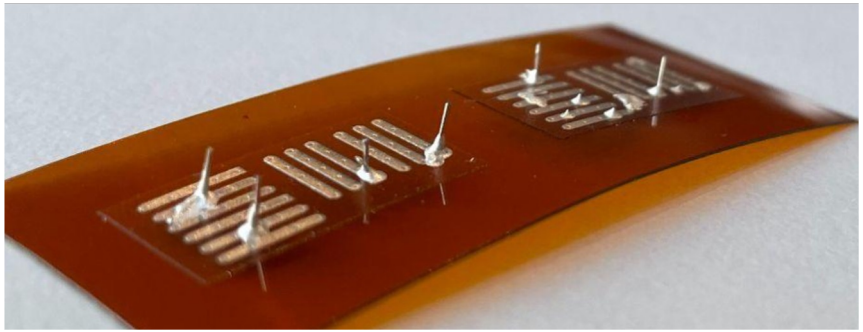
CELTRO

Phase 1

Needle-Holder

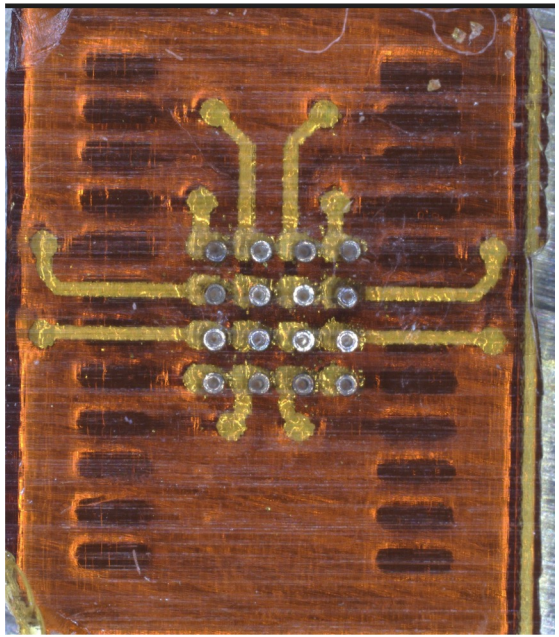


Soldering Tests

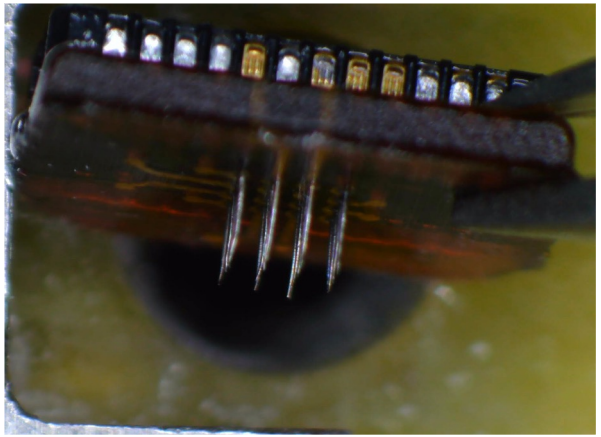


Phase 2 – Mechanical-electrical Co-Design

Top View: Soldering Pads for Connector Attachment



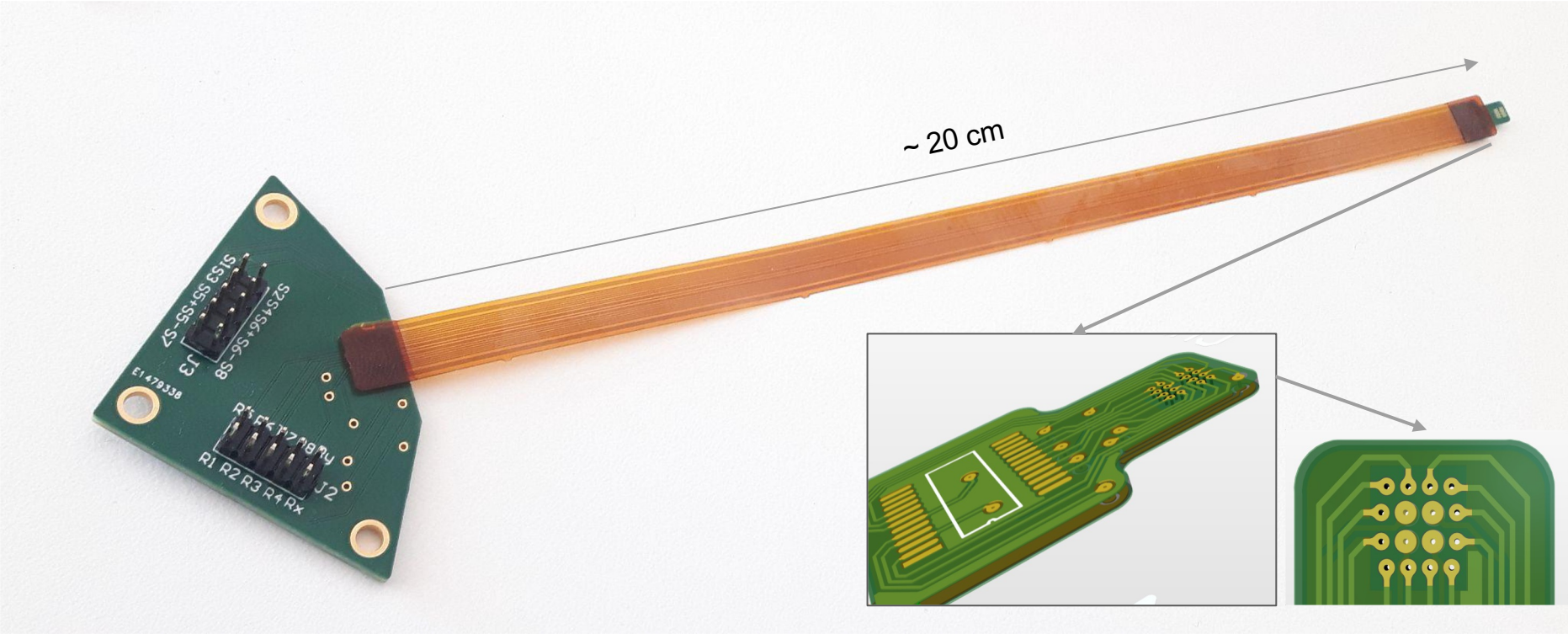
Bottom View with Needles



Side View

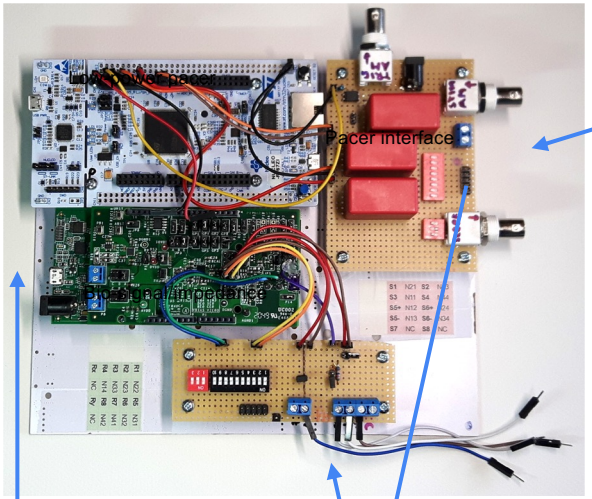
CELTRO

Electrodes for in-vivo-testing



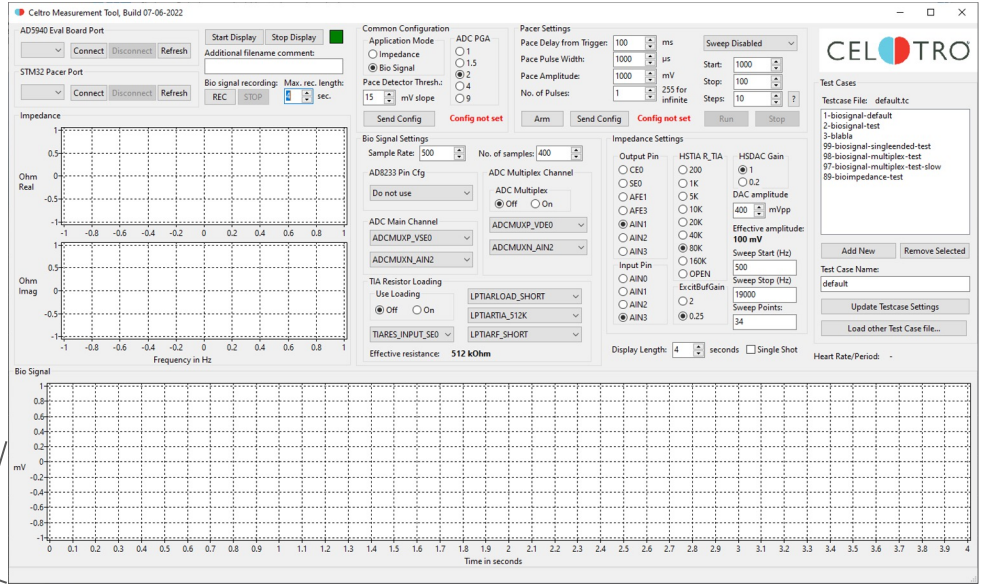
CELTRO

Celtro-EMS (Electrophysiology Measurement System)

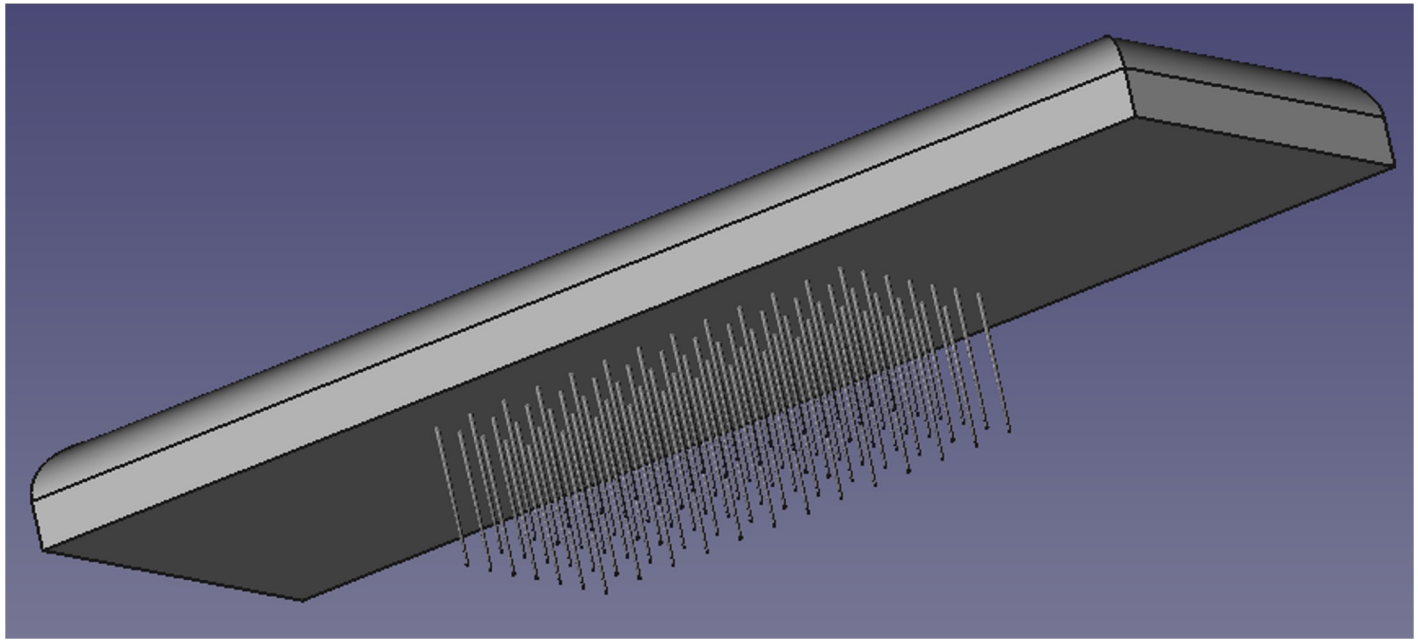


Commercial pulse stimulator (A-M Systems 2100)

Bio-signal/bio-impedance measurement, recording and pacing software



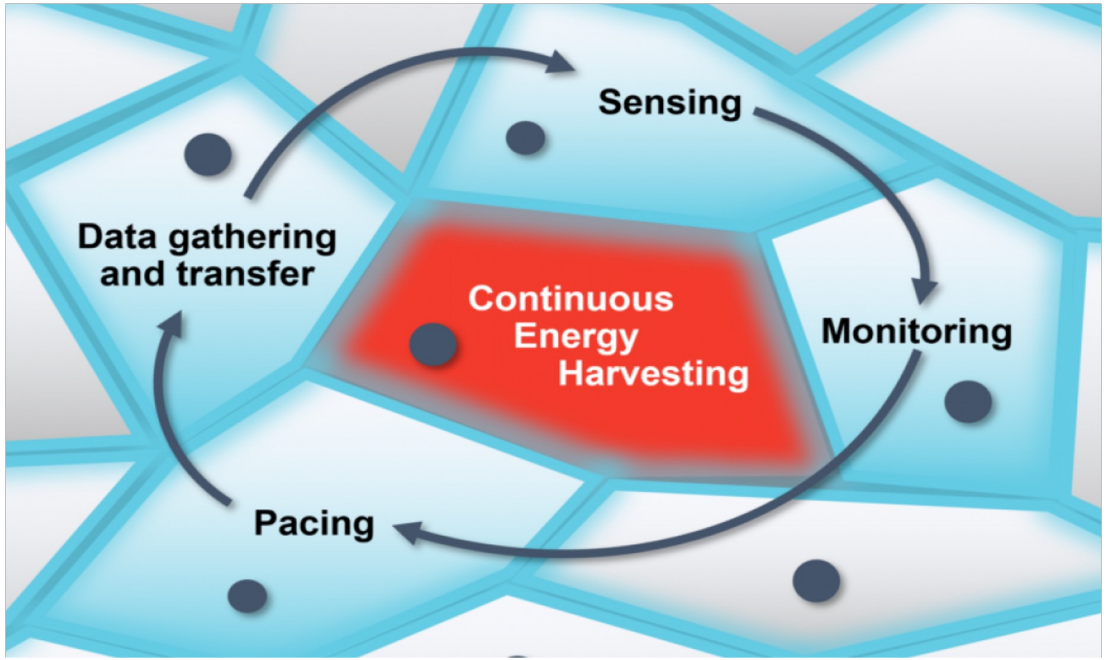
Phase 3 - Conceptual View of Product



CELTRO

Celtro's Energy Harvesting Platform

Basis for further expansion



Celtro Continuous Energy Harvesting Platform

- Nanowatt-Harvesting Range
- Continuous source of energy
- Communication Interface
- Sensing Interface
- Continuous Monitoring
- Alert Function
- Diagnostics Support
- Therapeutic Device Support

It‘s all a matter of team play - Prosit on Success!

CELTRO

Thank You