FRAUNHOFER INSTITUTE FOR BIOMEDICAL ENGINEERING (IBMT)

CUSTOMIZED SOLUTIONS FOR ULTRASOUND BASED CELL THERAPY, SMALL ANIMAL THERAPY AND NEUROSTIMULATION

FROM FEASIBILITY TO CERTIFIED SYSTEMS

TRANSDUCER DEVELOPMENT AND MANUFACTURING

• Different applications: imaging, therapy, NDT
• Single element or array transducers (1D, 2D, special geometries)
• Different technologies (PZT, single crystal, composites)
• Wide frequency range from kHz to GHz
• MR-compatible transducer technology
• Scalable production technology from single prototypes to batches (certified according to ISO 13485)

ULTRASOUND EXPERTISE & STRUCTURE

• 5 groups with expertise in ultrasound simulation, electronics, transducers, signal processing / algorithms and transducer production technologies (ISO 13485 certified)
• More than 30 years of experience in development of customized ultrasound hard- and software solutions
• More than 40 people of highly qualified staff
• More than 50 ultrasound R&D projects per year
• Excellent infrastructure for development & characterization of ultrasound hardware

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TRANSLATIONAL THERAPEUTIC ULTRASOUND

**High-throughput cell therapy applicators:**
- Applicators from 6 to 96 well plates
- Adjustable frequency range
- Defined sequences (PRF, DC, frequency, burst count)
- Different applications: ultrasound hyperthermia, ultrasound induced drug-delivery, BBB opening

**Ultrasound neurostimulation system:**
- Matrix array probes for 3D steering at different frequencies
- 128 channel electronics system, programmable pulse sequence
- Intuitive user interface for free 3D focus positioning
- Certified for clinical use (conformity to IEC 60601, 60601-2-37, 62304)

**Small animal ultrasound therapy system:**
- Integration in small animal PET-MR
- 11x11 matrix array for 3D beam steering, different frequencies
- MR-compatibility for low intermodality interferences

**Small animal applicator with integrated ultrasound matrix array transducer (left) and its pressure distribution using volumetric beam steering**

**HIGH POWER ULTRASOUND BEAMFORMER**
- Scalable ultrasound electronics, up to 1024 channels
- MR-compatible option
- Multi-channel booster option
  - 100% duty cycle
  - up to 100 seconds
  - up to 16W power per channel
  - Transmit amplitude up to 200Vpp

**Ultrasound well applicator**

**MR-compatible ultrasound system**

**Comparing ultrasound B-Mode imaging (left) to ultrasound thermometry (right)**

**SOFTWARE SOLUTIONS**

**Customized solutions for therapy systems**
- Control of ultrasound cell applicator with parametrization on the single well level

**Planning software for small animal therapy (left) and cell therapy (right)**

**Small animal system: definition of focus position (in 3D) and pulse patterns**

**Availability of SDKs (C#, Matlab) for integration of hardware control in existing software structures**

**Algorithms for therapy planning (using MRI and CT scans) and therapy monitoring (using ultrasound thermometry imaging)**