

- 1 Close-up view of medical array.
- 2 20 MHz linear piezoceramic array with sandwiched PVDF receiving-array.
- 3 5 MHz dual-plane imaging-array.



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## MEDICAL TRANSDUCER TECHNOLOGY

### Medical Ultrasound

Medicine is a very important field in the application of ultrasound. Close to the patient, ultrasound allows a non-invasive method for diagnosis with direct expressiveness as well as for therapy.

The probe of an ultrasound system is very important for the overall system performance. In most cases, it is necessary to adjust working frequency, beam pattern and sensitivity for the needs of an application.

Especially for medical probes, new transducer designs as well as special housings, predefined by new applications, are demanded by the market.

However, before a new idea or product can be placed on the market, a development of appropriate sensors or the modification of an existing sensor is necessary.

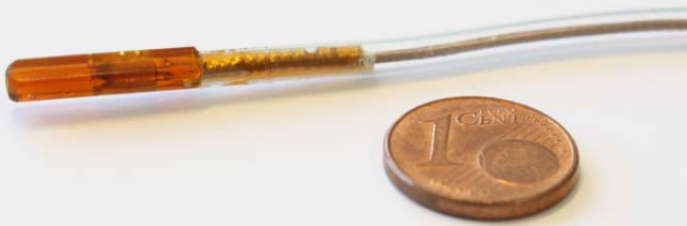
The group Piezosystems and Manufacturing Technology assists you during the complete way of product development from the idea to the production with following services:

- sensor development/optimization
- consulting services
- feasibility studies
- ultrasonic measurements
- sensor production technology

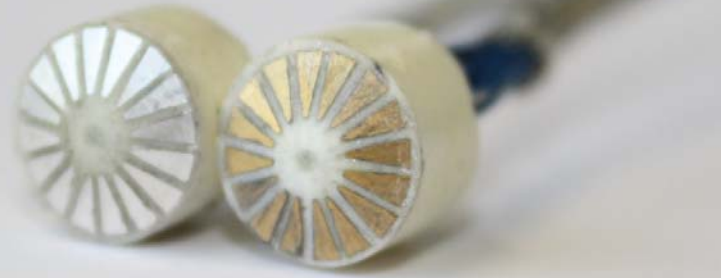
### Scope of applications

We offer development services and production technologies for custom-designed medical sensors with frequencies up to 50 MHz. For example:

- linear, curved and phased-arrays for 2D/planar-imaging
- matrix arrays (3D-/volumetric-imaging)
- Doppler sonographie
- catheter-based or intravascular probes
- therapeutical applicators
- medical cleaning devices
- assistance devices for drug delivery



1

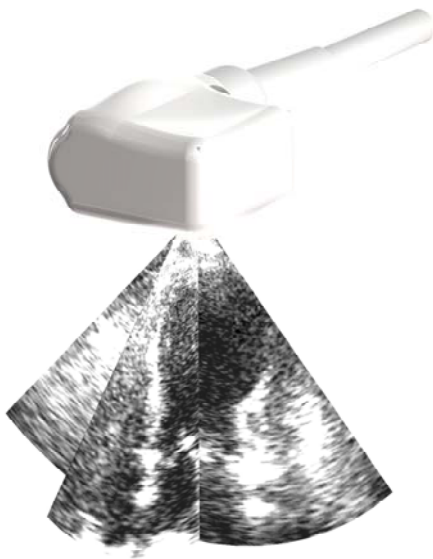


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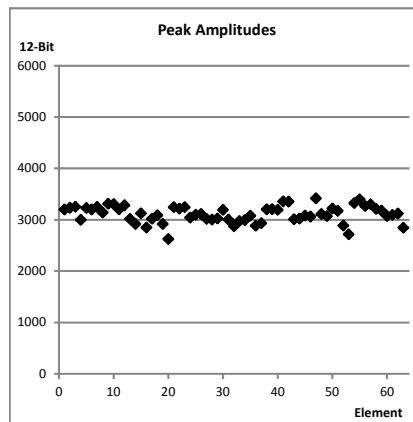
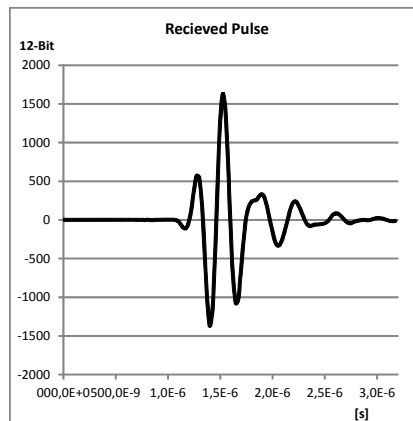
### Transducer Example "T-Array"

For the control of radiotherapy a customized ultrasound probe was needed. To fulfill the requirements, a special imaging probe with 2 phased-arrays was developed. The arrays were arranged perpendicular that information of two perpendicular planes from inside the human body was available.

The center frequency is 5 MHz and the dimension of the array was chosen to transmit and receive sound between two ribs. The elements of the arrays were spaced  $\Lambda/2$  ( $150 \mu\text{m}$ ) which allows a wide opening angle of up to  $120^\circ$  (see also front-page, image 3).



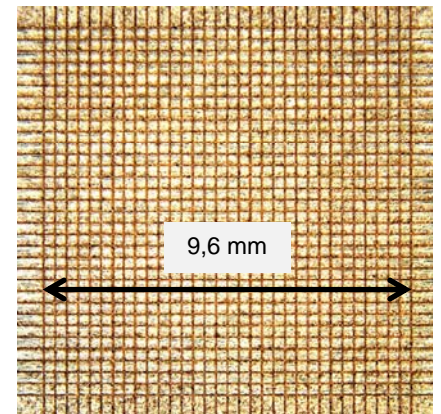
*Biplanar 5 MHz phased-array, developed for real time positioning in radiotherapies.*



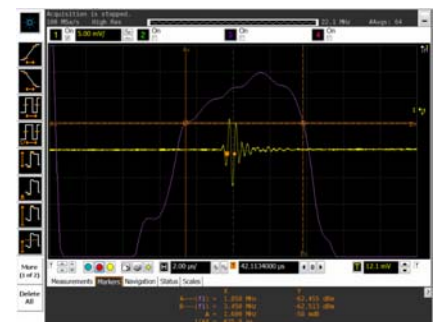
### Transducer Example "2D-Matrix-Array"

For measuring volumes of interest without moving parts it is necessary to fully control the soundbeam within this volume. For steering and focusing the soundbeam a special matrix-array – a planar distribution of tiny transducer elements – is necessary. For this application a  $32 \times 32$  element 2D-matrix-array with a center-frequency of 2,5 MHz and a pitch of  $300 \mu\text{m}$  was developed. To increase bandwidth a 2-layer

matching system was applied on the front. The scalable concept of the acoustic block allows to varying the number of elements and pitch nearly free. So other sizes, frequencies and opening angles are easily realizable.



*2D-matrix-array for volumetric measurements (1024 elements, pitch  $300 \mu\text{m}$ ):*



*Pulse-Echo measurement of a single element of 2D-matrix-array ( $f_c = 2,5 \text{ MHz}$ ).*

- 1 16 MHz transducer for flow measurement in vessels by catheter.
- 2 10 MHz (left) and 20 MHz (right) 16 element doppler-probe for blood flow measurement.