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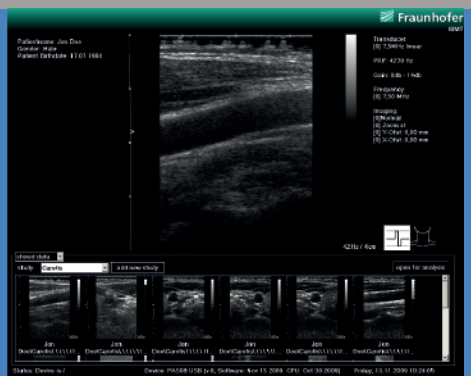
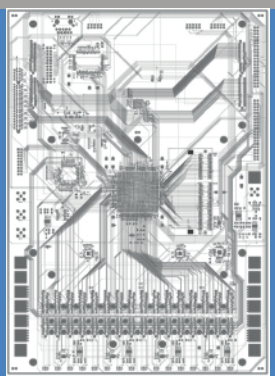
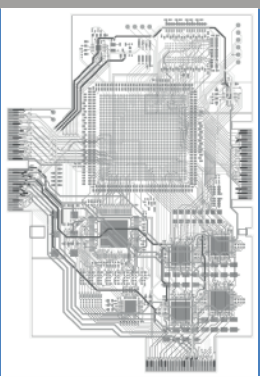
2 

3 



1 *DiPhAS research system cart.*
2 *Clinical user interface example.*
3 *FPGA powered electronics.*

ULTRASOUND BEAMFORMER PLATFORM

System Description

Diagnostic imaging quality of ultrasound systems is defined by the beamforming characteristics of the ultrasonic device. Modern plane wave imaging, dynamic focusing, steering, amplitude weighting, pulse coding and controlling the size of the aperture of an array probe are the techniques which are used to form the acoustic beam. Especially for research and development it is needed to have complete control possibilities over the parameters that determine the geometry, the direction, the number and the acoustical properties of the sound beams. The ultrasound research system «DiPhAS», which is in its ninth generation of development, provides full control over all beamforming and imaging parameters. DiPhAS is controlled and programmed by a standard PC. Beyond basic routines provided by its operating system additional extended functions for control and processing are implemented.

RF- or Channel-Data Acquisition

Research in the field of ultrasonic diagnostics includes the development and use of advanced methods of processing high-frequency data (RF-data) and single-channel data (RAW-data).
DiPhAS allows full access to the high-frequency signals coming from each single receiving element of the array probe. Amplifying as well as amplitude weighting, pulse forms and the delays can be programmed individually. This includes a code generator for creation of standard transmission patterns and the possibility to use any custom excitation pattern for pulse sequencing.
The system includes a high-performance PC but it is also possible to connect any PC via modern and fast interfaces (Gigabit Ethernet and PCI express). The complete RF-data can be transferred to the PC for online processing, imaging or storage to be used in offline signal processing.

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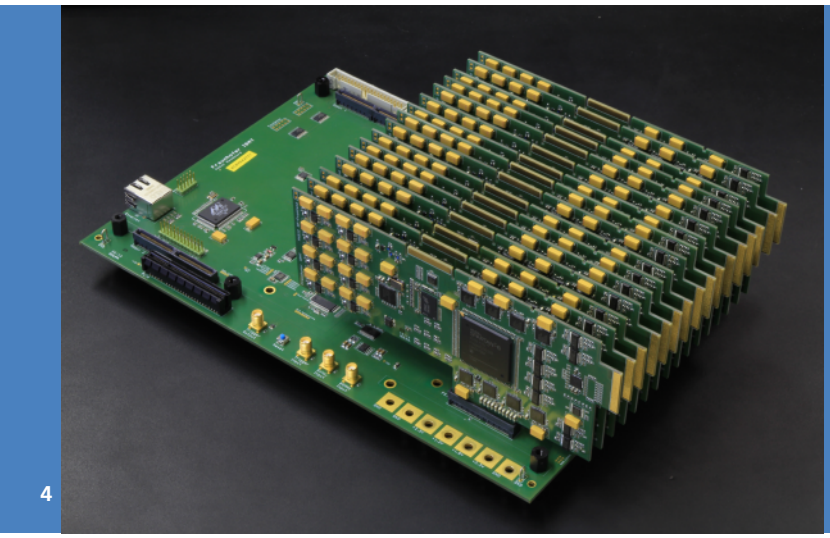
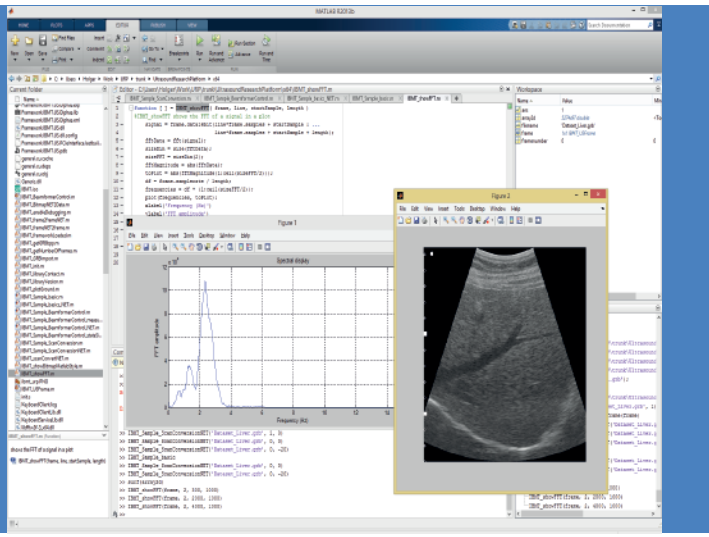




Modular and Scalable

DiPhAS is structured modularly and can be scaled in channel count and can adapt any commercially available or self-developed linear, curved, phased and 2D-array probes.

-Basis module:
mainboard, power supply, system software

-Application-specific modules:
front ends, transducers, signal processing, visualization

- Software modules:
framework for ultrasound integration in 3rd party applications, closed-loop filter integration for online evaluation

Applications

The system is available in application-specific configurations:

High-frequency: transducers 20–100 MHz (Material testing, industrial process- and quality control, biotechnology)

Traditional clinical: transducers 1–20 MHz (Special versions: MRI compatible, therapy control, optoacustic, VVI, ultrafast-imaging) medical certification option

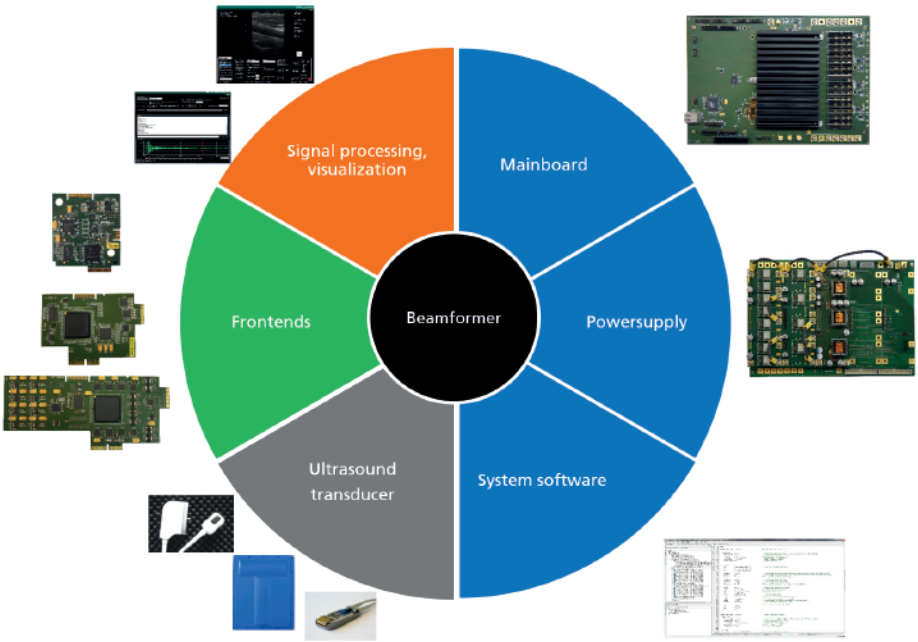
Low-frequency: transducers 0,1 - 10 MHz (Sonar systems like MBES or 3D-Camera, therapy systems)

Features

Basis module:
-Xilinx FPGAs for operation control, data transmission and signal processing
-Data transfer to PC using modern fast interfaces (PCI express, Gigabit Ethernet)
-Custom power supply that can operate on battery power as option and generates various voltages for FPGA, ICs, transmitter, ATX voltage for integrated PC

Frontend boards:
implement transmit pulse sequencing, data transfer management and pre-processing, include large DDR3 memory for buffering of receive data
-high-frequency digitalization
-high-voltage pulser or operational amplifier

Ultrasound technologies:
-channel data acquisition
-ultrafast ultrasound imaging



4 *Beamformer electronics.*
5 *Research platform software interface example.*