National Research Tomsk State University

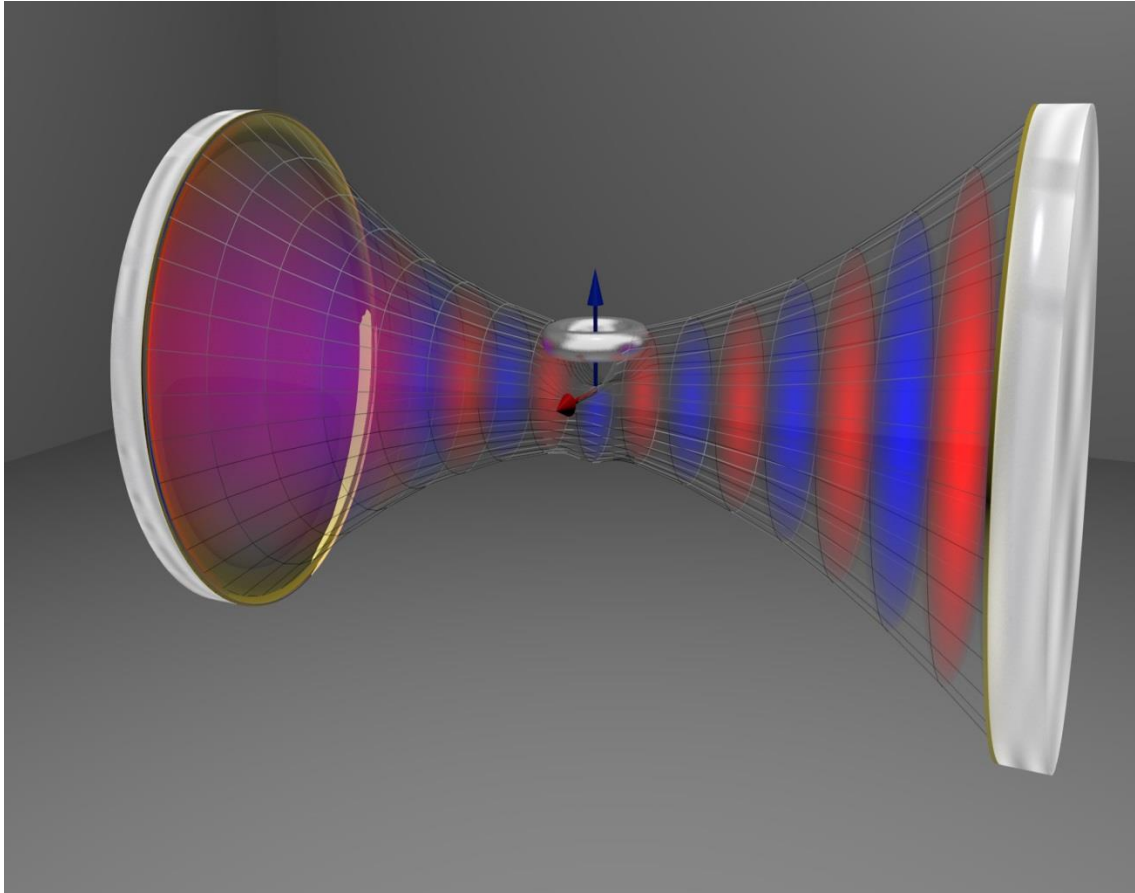# RADIOWAVE TOMOGRAPHY OF HIDDEN OBJECTS

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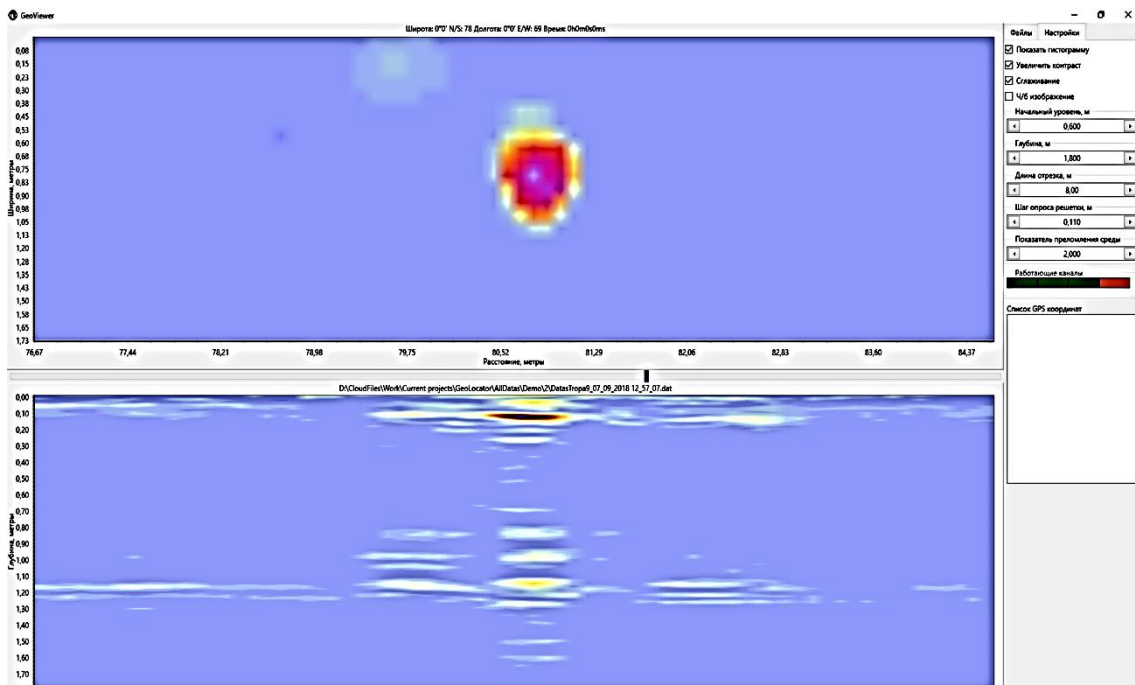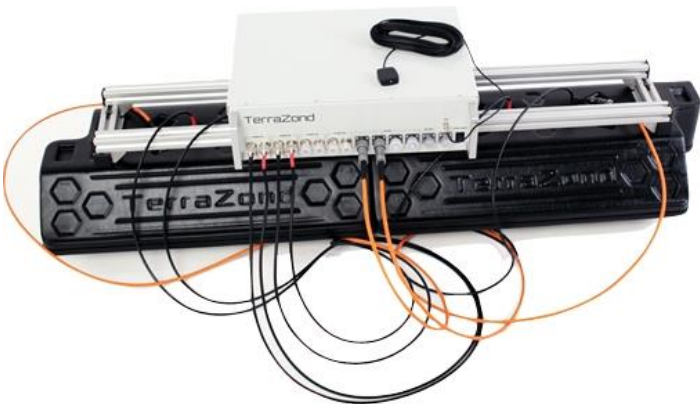e-mail: yvlp@mail.tsu.ru

Introduction

- Technology:
  Radiowave focusing on the point of space

- Advantages :
  real-time radio image acquisition
  high resolution radio tomography image

- Result:
  Several devices for different purposes

- Use for:
  3D visualization of hidden objects

Applications

- Quality control of a road surface:
  - Radiowave multichannel geolocator for road «**TerraZond**»
  - 3D radio tomograph for engineer communications «**3D RadioScan**»

- Security:
  - TWR radar for detecting humans through barriers «**Radar Dozor**»
  - Compact multichannel geolocator «**MiniGeoScan**»
  - Portal for detecting of prohibited Items

- Measurement of material parameters:
  - Measurer of electro-physical parameters for flat objects «**WaveCube**»
  - Radiowave mammography «**WaveScan**»

GEORADIOTOMOGRAPH

Use for:
operational examination of the roadways without invasion.

Advantages:
working with road width up to 2,4 meters;
speed up to 80 km/h.

Characteristics :
probing deep 2 m;
resolution 5 cm

3D RadioScan
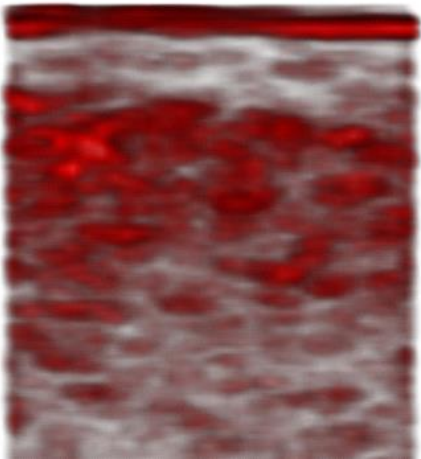

2D visualization

3D visualization

Use for:
Detection and visualization of optical cables, plastic and metal tubes, voids under ground, into blocks ands concrete walls, road layers
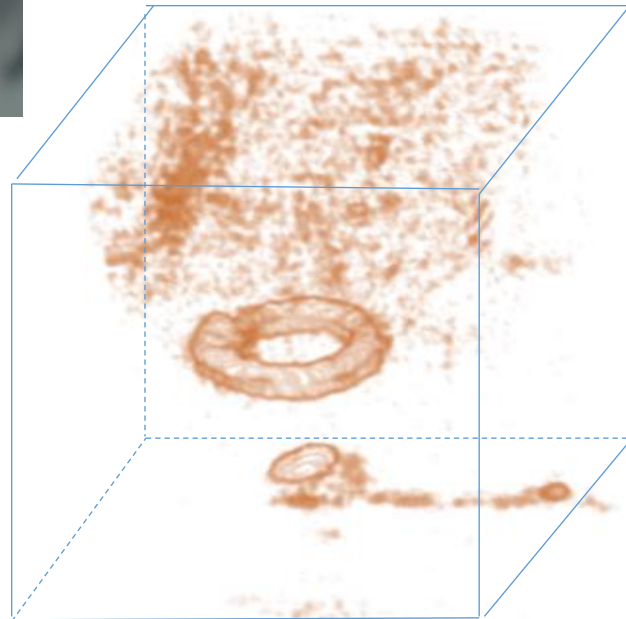
Advantages:
Mobility;
High resolution .

Characteristics :
probing deep 1 m;
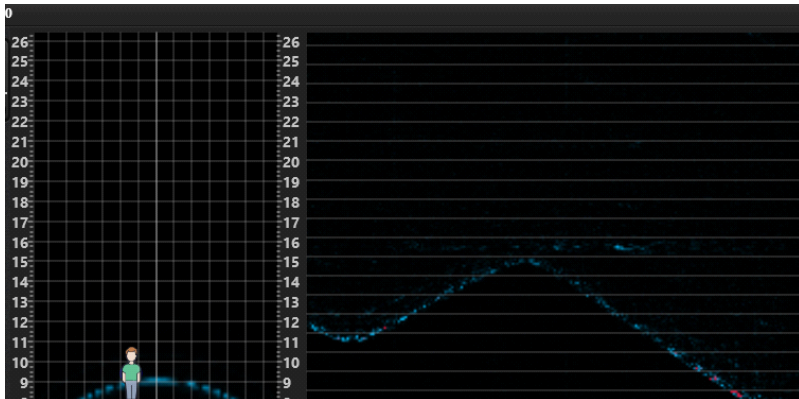resolution 1 cm;
working area 0,7×0,7 m.

RADAR DOZOR 400

Use for:
detecting moving or motionless humans behind barriers.

Advantages:
scanning through block and reinforcement walls;
scanning multilayered building constructions;
scanning through a snow or smoke.

Characteristics :

range 25 m;
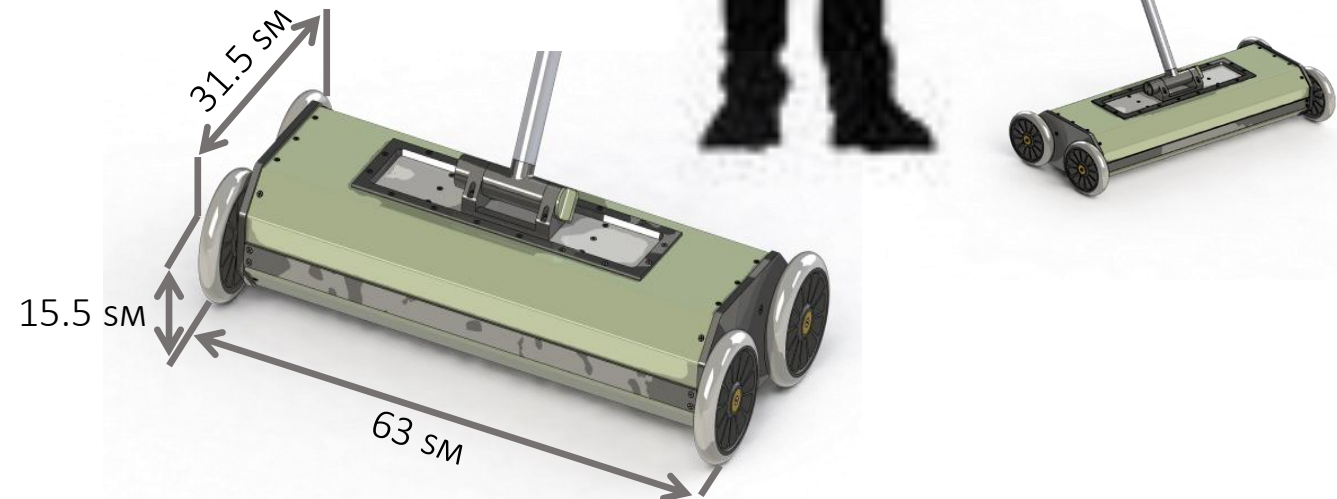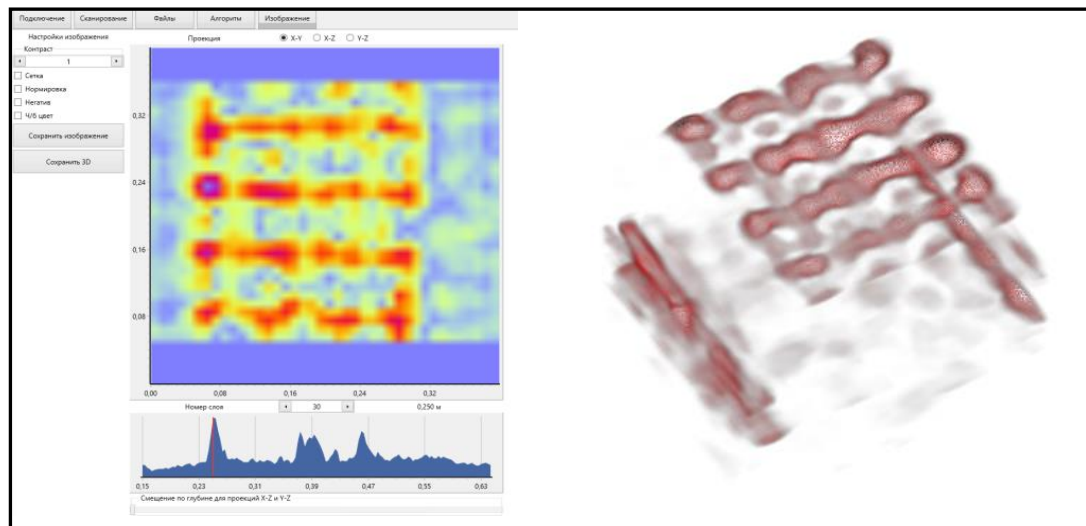real-time proccesing 10 fps.

MiniGeoScan

Use for:
Detection and visualization of hidden metallic and dielectric objects under ground

Advantages:
• Mobile and ergonomic construction;
• Scanning of surface types (a floor, walls, a ceiling, road layers);
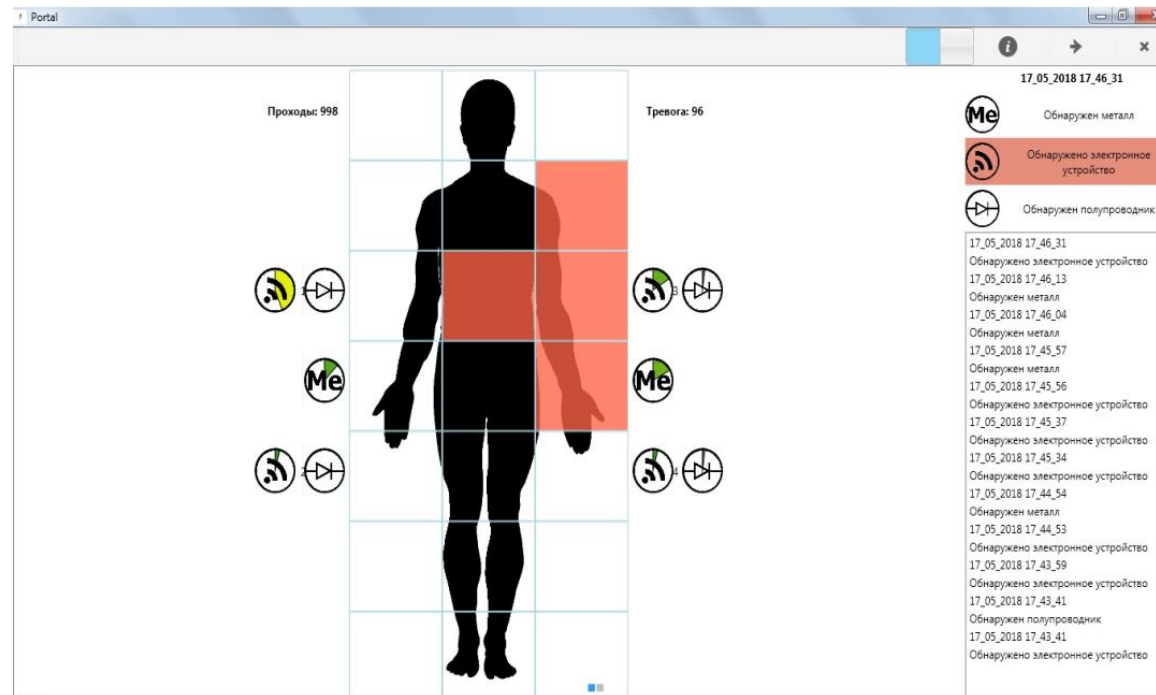• Real-time visualization on a remote screen.

Characteristics :
• Frequency band of sounding signal: 1.5 – 8 GHz;
• Penetration depth: 1 m;
• Resolution: 2 cm;
• Width of 16 elements antenna array;
• Scanning speed: 0,1 m/sec

31.5 sm

15.5 sm

63 sm

Portal for detecting of prohibited Items

- **1. System for detection of radio-electronic devices**
  - Detection of hidden electronic devices - cell phones, fuze, transmitters, video cameras, listening devices
  - Detection of damaging elements in the form of a large number of bolts,, cut rebars, etc., which enhance damaging effect of the explosion of suicide belts
- **2. System for detection of all classes metallic objects**
  - Detection ferrous metals
  - Detection non-ferrous metals
- **3. Software**
  - Processing
  - Analysis
  - Visualization
  - Archiving

WaveCube

Use for:
High-speed measurement of complex reflection and transmission coefficients, dielectric and magnetic permeability coefficients of flat absorbers and dielectrics.
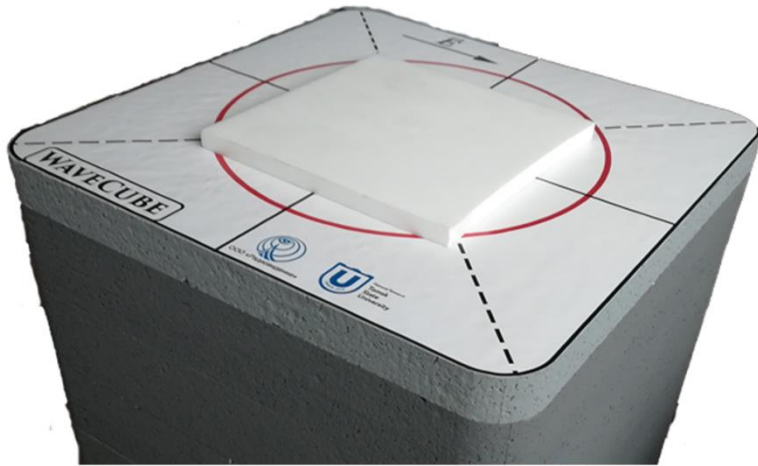
Advantages:
- Wideband measurement;
- Real-time processing;
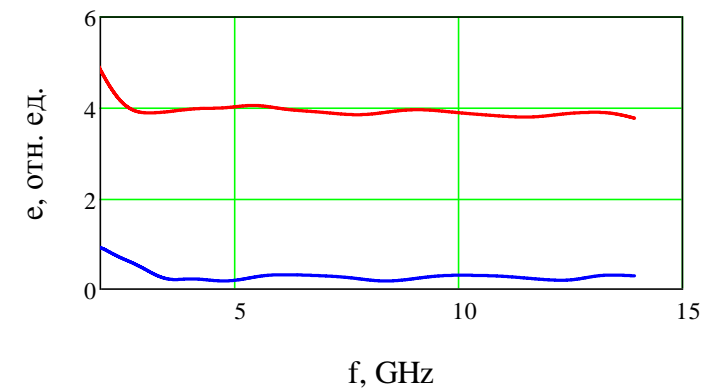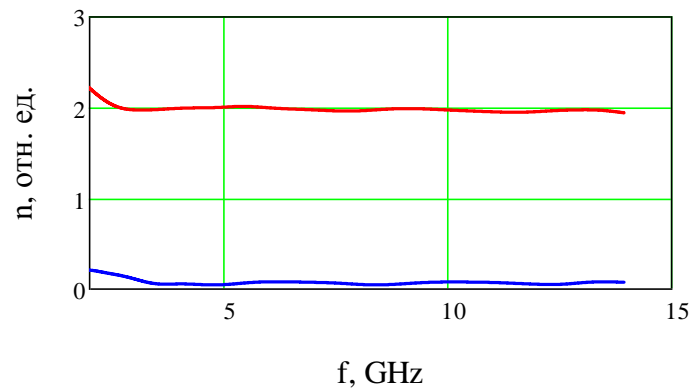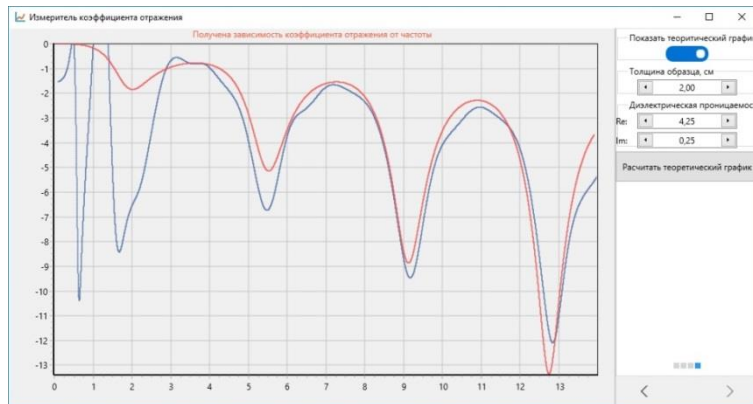- Measurements not require no anechoic chamber.

Characteristics:
- Wideband: 1.5 – 18 GHz;
- Dynamical range of measurements: not less 94 dB;
- Size: height 70 cm, width 60 cm, length 60 cm;
- Linear size of object under research: not less 15 cm.
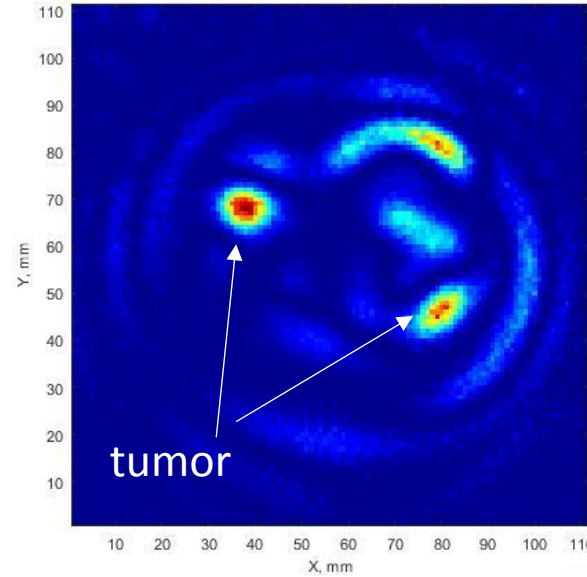
WaveCube

Software:

- High-speed processing of object's complex parameters
- Presentation and storage of measurement data and comments on them;
- Analysis of data after series of measurements;
- Calculate theoretical reflection and transmittance coefficients for verification of measurement methods;
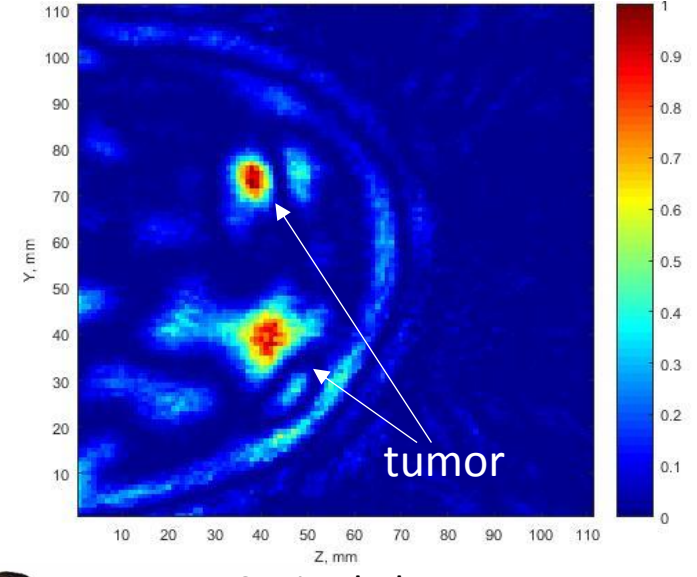- data export in XLS, ASCII, JPG, BMP.

Radiowave mammography

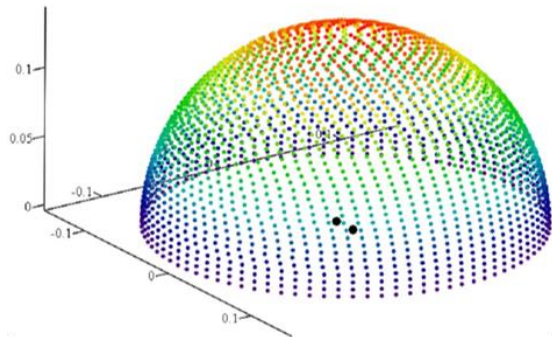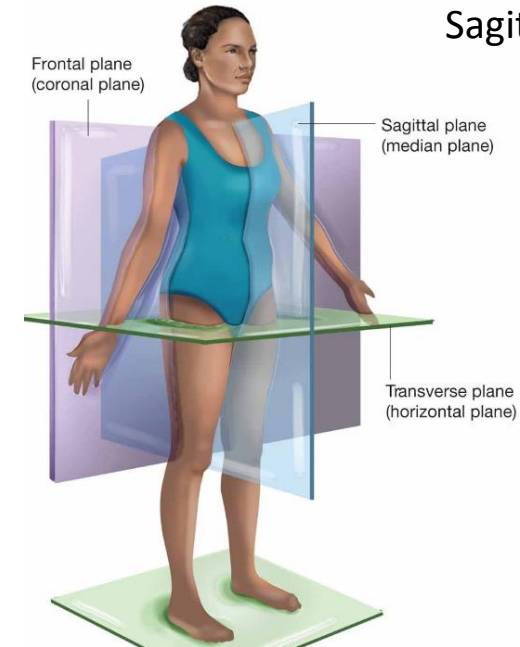Components and construction of a complex breast imaging phantom

1194 points of scan

Coronal plane

Sagittal plane
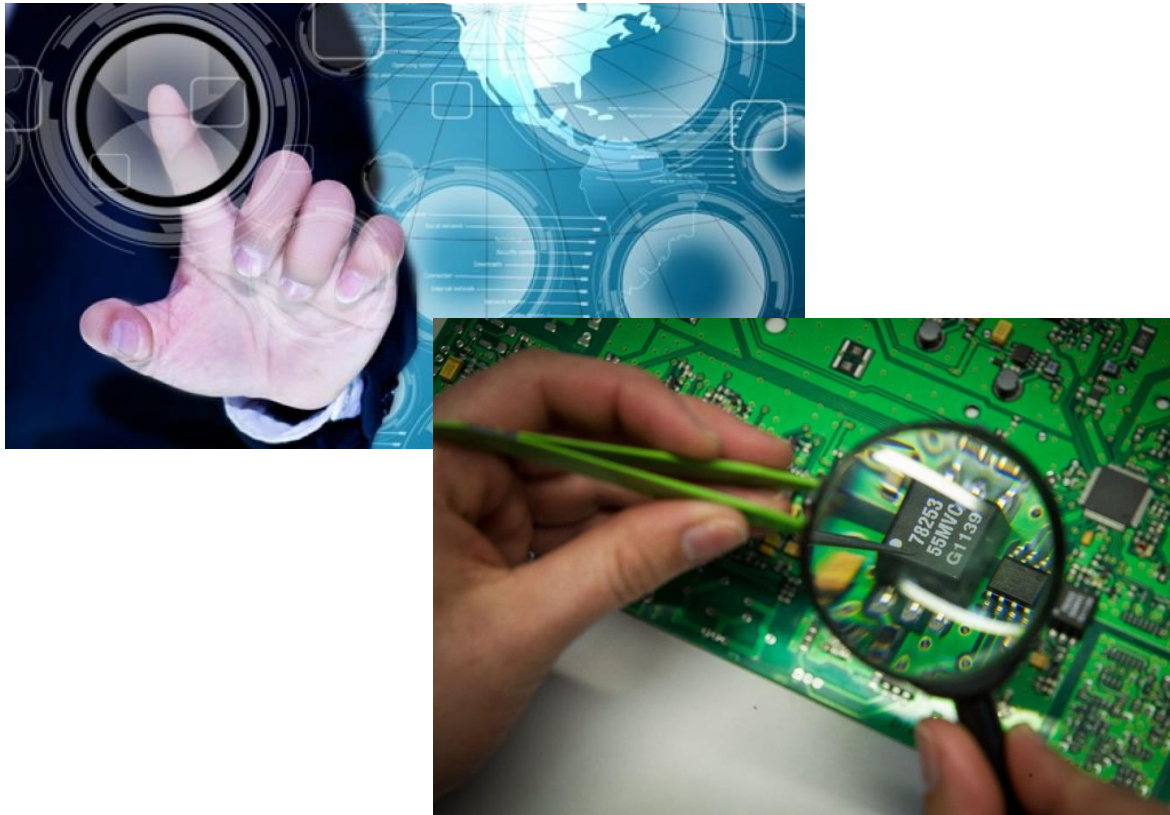
Experiments with the female breast imaging phantom

R & D

Use for:
developing of prototypes according to the terms of reference;
developing of software for control and data processing.

Advantages:
hight qualified team;
experience;
full cycle (from modeling to producing).