THE DEPENDENCE OF THE CHANGE IN THE SCATTERING PATTERN OF LIGHT ON THE BRIGHTNESS OF THE LEDS DURING THE DIGITAL DIAPHANOSCOPY

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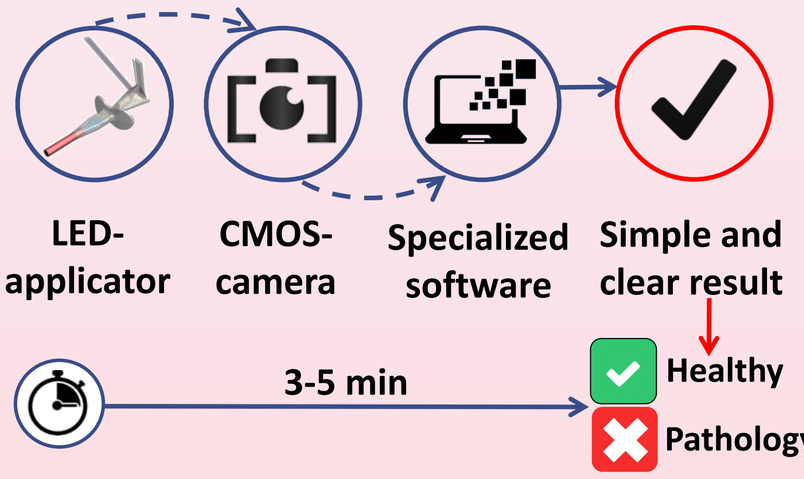
INTRODUCTION

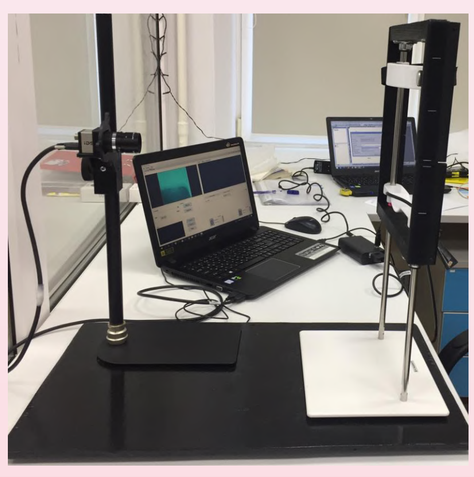
20% of people in the world suffer from diseases of the paranasal sinuses
The diagnostic methods used today have disadvantages that the digital diaphanoscopy method haven't.
Advantages of digital diaphanoscopy: simplicity, quick analysis, safety (no radiation), portability, non-invasive, painlessness

THE AIM OF RESEARCH

- ✓ To identify factors that influence on the diagnostics result;
- ✓ to justify the medical and technical requirements for the instrument by a signal simulation;
- ✓ to adjust the parameters of the LED-applicator in order to obtain similar scattering patterns of light in the study of patients' sinuses with different anatomical features.

EXPERIMENTAL METHOD AND EQUIPMENT





Diagnostics methods: digital diaphanoscopy and magnetic resonance imaging (MRI)
20 healthy volunteers; 15 patients with pathologies of the paranasal sinuses

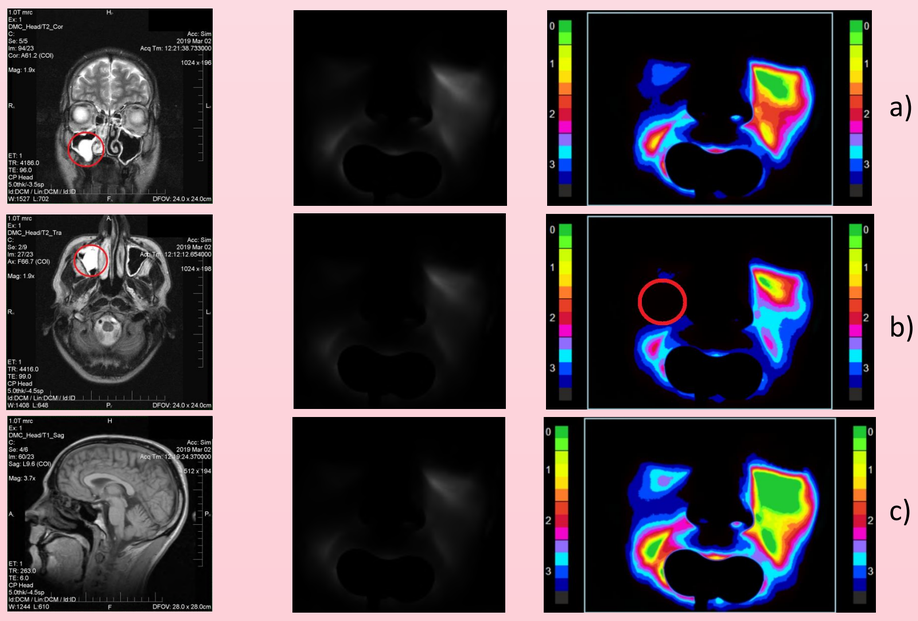
Wavelengths of LED-applicator:
- ✓ 650 nm
- ✓ 850 nm

Camera: UI-3240CP Rev.2
Quantum efficiency:
- ✓ 75% (650 nm)
- ✓ 45% (850 nm)

1T MRI Scanner of the Magnetom series (Siemens)

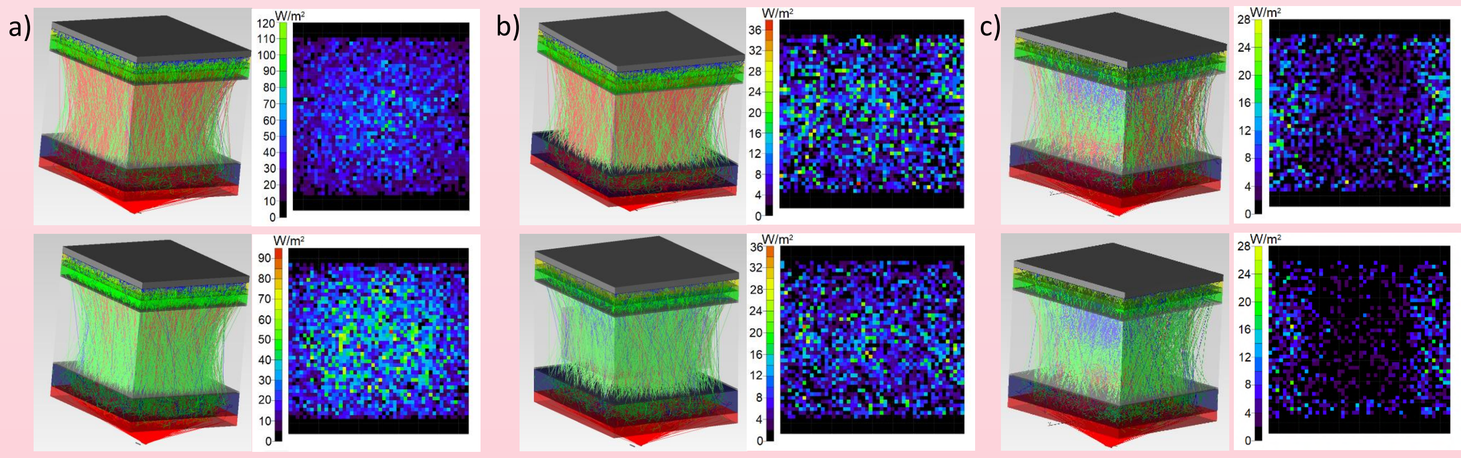
RESULTS AND DISCUSSION

MRI study examples (left side) and examples of registered and processed images (right side) at exposure time 20.7 ms for 650 nm (a), 850 nm (b) and combination 650 and 860 nm (c) radiation sources

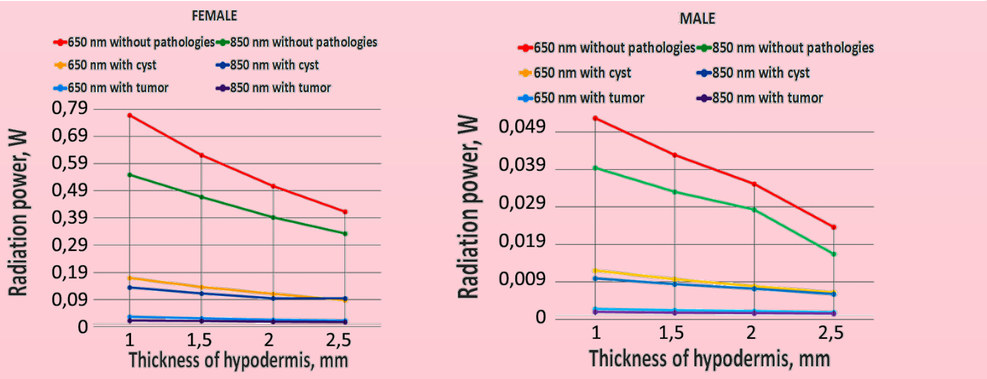


- ✓ In 4 patients out of 15, cysts were found in the right sinuses in two studies.

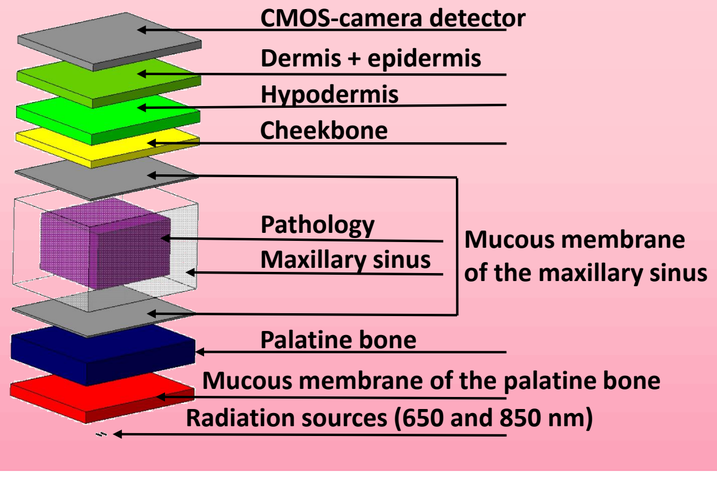
The simulation results of probing signal passing through the maxillary sinus of a male without pathology (a), with a cyst (b) and with tumor (c) for 650 nm (top) and 850 nm (bottom)



The dependence of the power on the camera detector for different wavelengths on the hypoderm thicknesses and the presence of pathologies in the sinuses



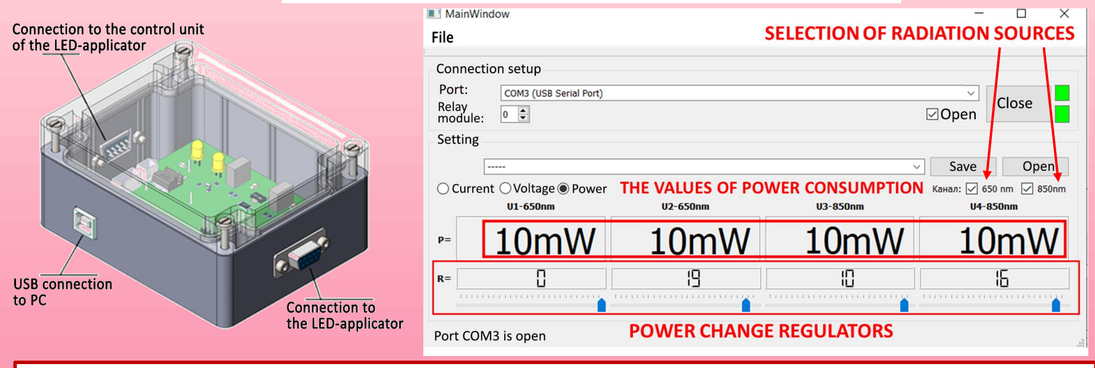
Head tissue layers for Monte Carlo model (TracePro software)



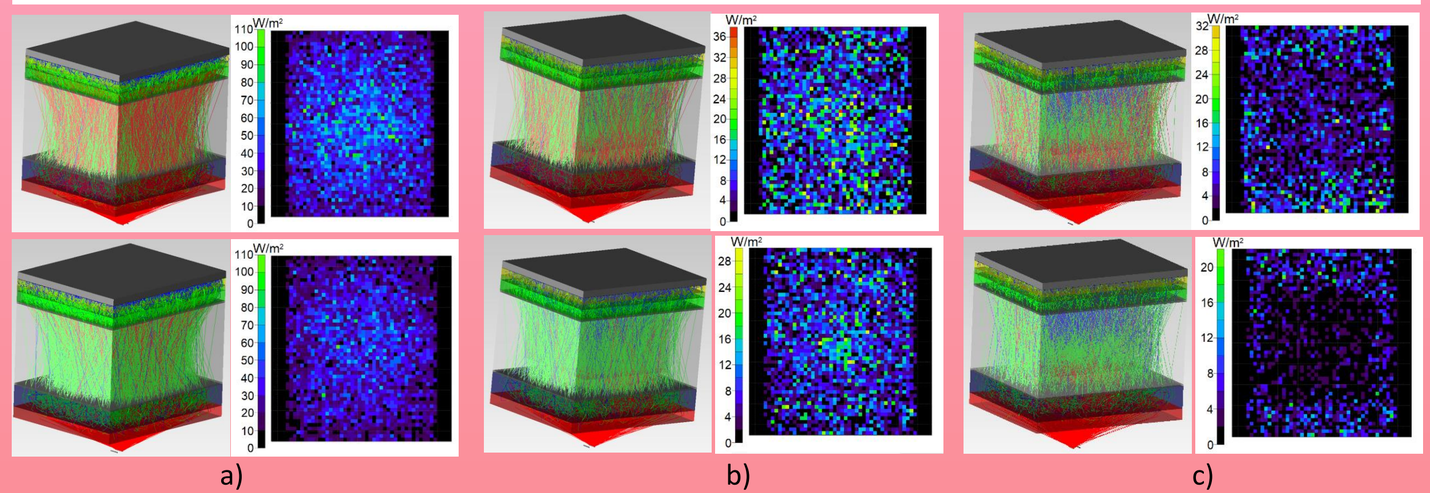
Radiation sources:
- ✓ 650 nm (4 mW) – 200 000 rays;
- ✓ 850 nm (4 mW) – 200 000 rays

Parameters of the simulated environment:
- ✓ Layer thickness **L**
- ✓ Scattering coefficient μ_s
- ✓ Absorption coefficient μ_a
- ✓ Refractive index **n**
- ✓ Anisotropy **g**

The controller of the LED-applicator brightness



The simulation results of probing signal passing through the maxillary sinus of a female without pathology (a), with a cyst (b) and with tumor (c) for 650 nm (top) and 850 nm (bottom)



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CONCLUSION

It is planned to conduct experimental studies with the participation of conditionally healthy volunteers and patients with suspected pathology of the maxillary sinuses, taking into account the detected values of power consumption by LED-applicator.