Multivariate discrimination analysis of multispectral fiber sensor data for kidney cancer diagnostics *in-vivo*

Valeria Belikova[1], Urszula Zabarylo[2], Viacheslav Artyushenko[2], Franziska Schulte[2], Iskander Usenov[3], Vladislav Galyanin[1], Andrey Bogomolov[1,2,4]

[1] Samara State Technical University, Samara, Russia

[2] art photonics GmbH, Berlin, Germany

[3]TU Berlin, Institute for Optics & Atomic Physics, Berlin, Germany

[4] Global Modelling, Aalen, Germany

According to the statistics, cancer remains one of the most common causes of death throughout the world. Surgical intervention is still the main method of medical treatment of the disease. Operation success strongly depends on the doctor's ability to distinguish tumor from healthy tissues. Visual assessment of tissue sections and biopsy are the common methods of histopathological analysis. Its main disadvantages are the high costs and considerable time that is needed to obtain results. During a surgical treatment this puts the patient at greater risk due to prolonged exposure to general anesthesia.

Over the past two decades, the use of optical spectroscopy for biomedical applications has grown significantly. Its attractiveness comes from its ability to provide quantitative information about the biochemical and morphological states of the tissue in a minimally invasive or noninvasive manner. In accordance with the literature, different fiber-optic probes and spectroscopic techniques are used in tissue analysis of skin, breast, lungs, brain, gastric and some other types of tumor.

In this work we have investigated *ex*- and *in-vivo* samples of malignant and healthy kidney tissues of eleven patients using four spectroscopic techniques simultaneously: mid-Infrared, near infrared, fluorescence and Raman spectroscopy. The measurements were performed with various fiber-based probes transmitting the light in the respective spectral range. Here we report on the development of diagnostic multivariate algorithms capable of cancer of the human kidney using this multispectral data.