



21 September 2026. 15:00 - 17:00 CEST

EPIC Online Technology Meeting on
Fibers for Medical Applications



ArtFiberSystems

FLEXIBLE. LIGHT. SOLUTIONS.

Advanced Fiber Solutions for Life Science Applications

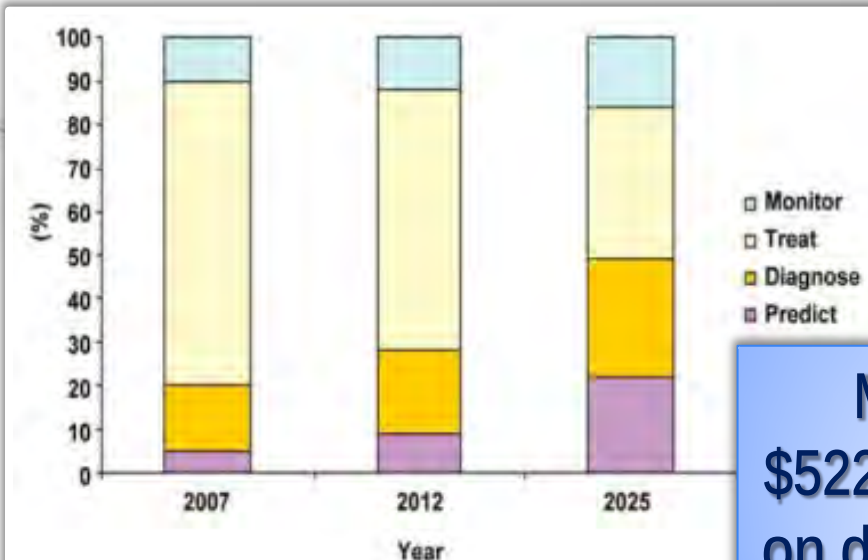
Slava Artyushenko, Martin Warman, Polina Fomina, Alex Novikov, Boris Mizaikoff



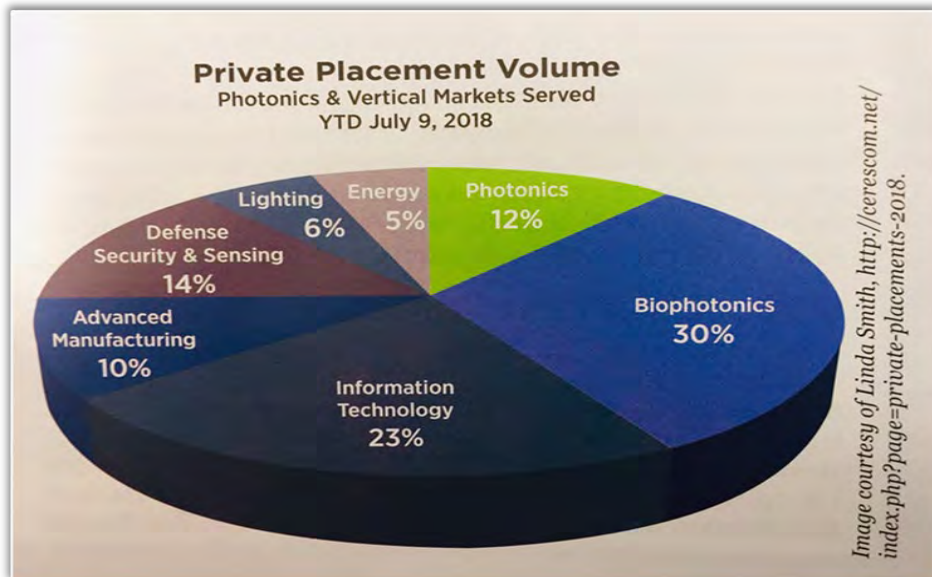
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Recent Trends of Medical / Biophotonics Market

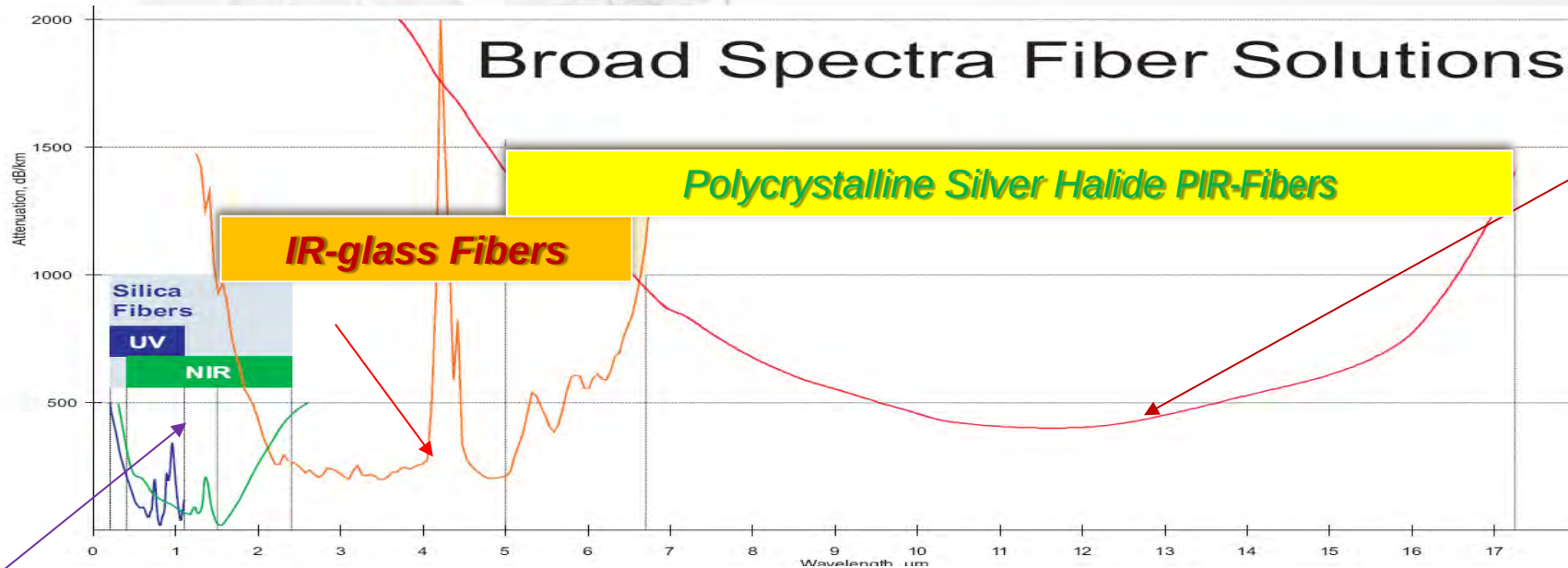
<i>Market trends (\$B)</i>	2016	2021
Process Spec-py	13,01	22,04
Medical Sensors	8,49	15,01
Endoscopy	23,8	33,6
POC Diagnostics	21,1	37
Healthcare IT	107,5	228,8
IoT	157,05	661,74
Life Science	43,5	64,52
TOTAL	374,45	1062,71



Medtech sales up to \$522bn in 2022 - with focus on diagnostics & screening



Silica, CIR & PIR-Fibers + Hollow WaveGuides for 0.3-16 μ m



Polycrystalline InfraRed PIR-Fiber



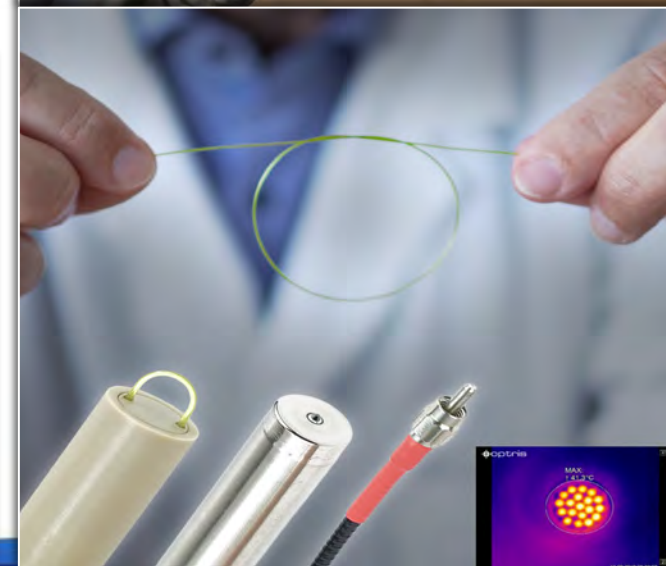
Silica Fibers UV-Vis & Vis-NIR



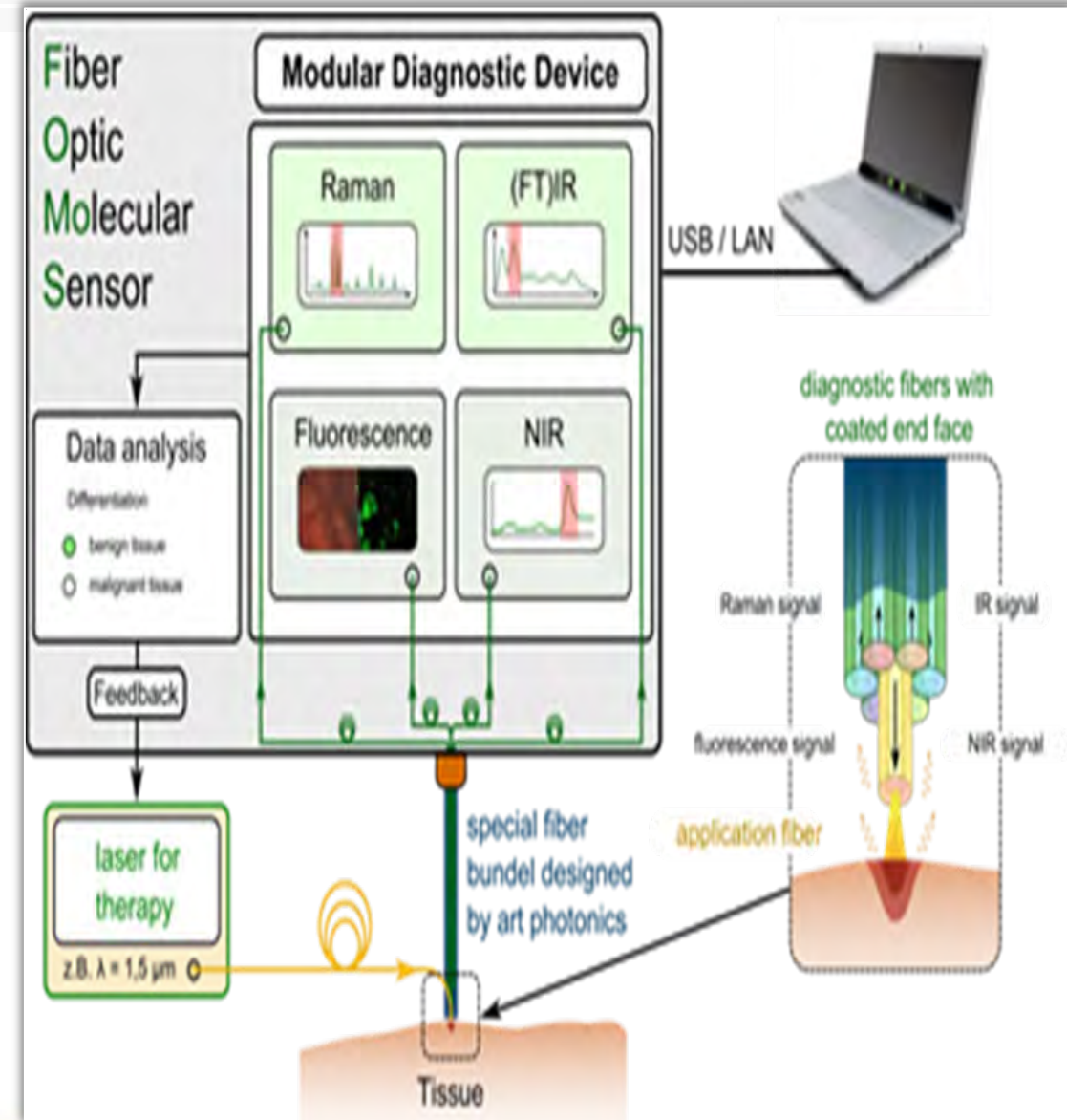
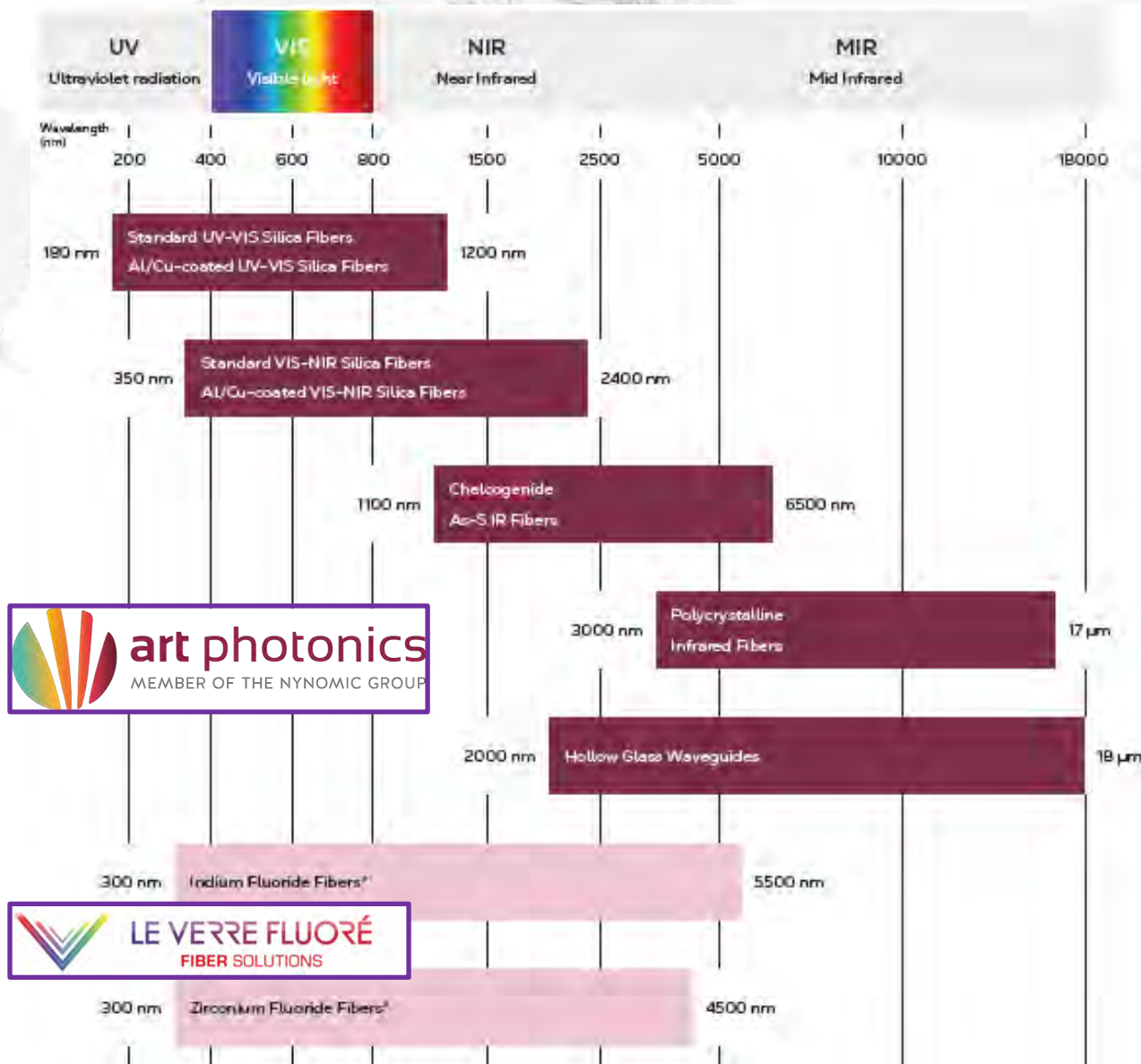
Tiny fiber probes enables spectral analysis of tissue inside human body *in-vivo* – vs common biopsy.

Single fiber Raman probe with $OD < 160 \mu$ m enables to detect tumor margin $< 0,1s$

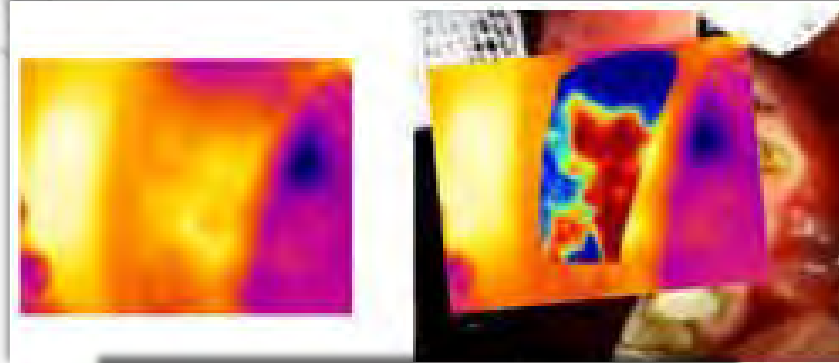
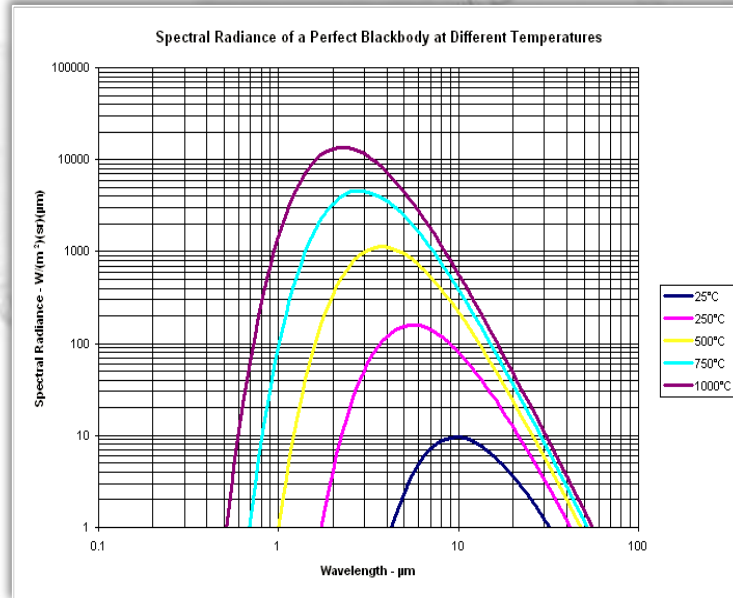
RIVERD
INTERNATIONAL BV



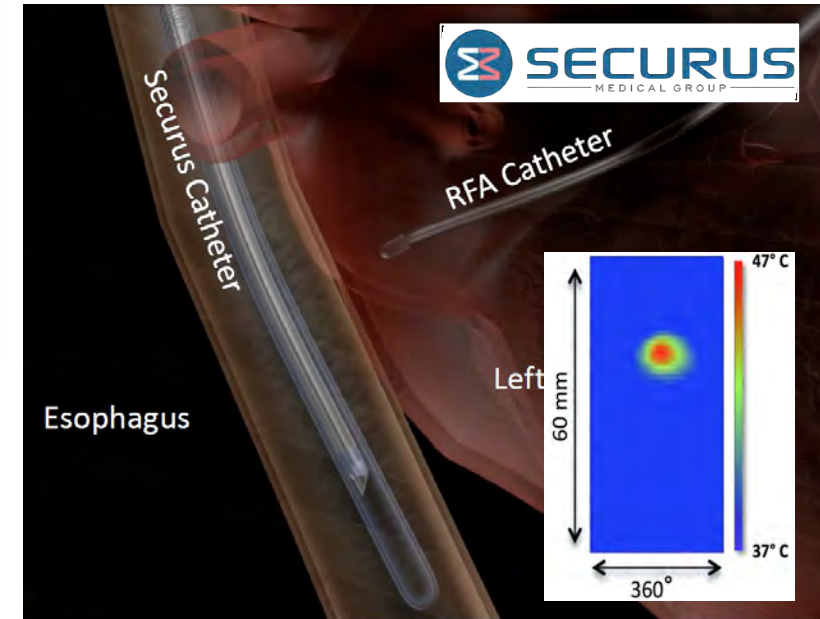
Transmission for Different Fibers in 0.2-18 μ m - used for Fiber Probes



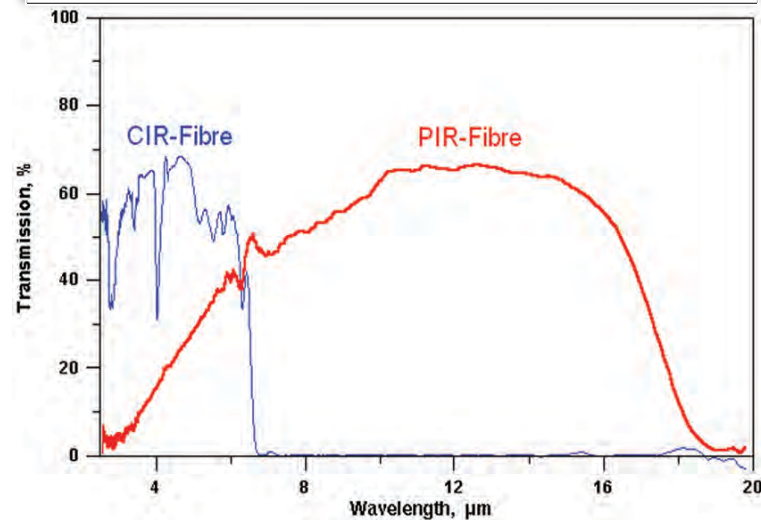
PIR-Fibers for IR-Imaging Endoscopy in Mid IR-Range



Classic thermography (left) vs
HTB's HDI used in HDIntra (right)
www.htbioimaging.com



PIR-Fiber IR-imaging Endoscope



19xPIR-fiber IR-image bundle

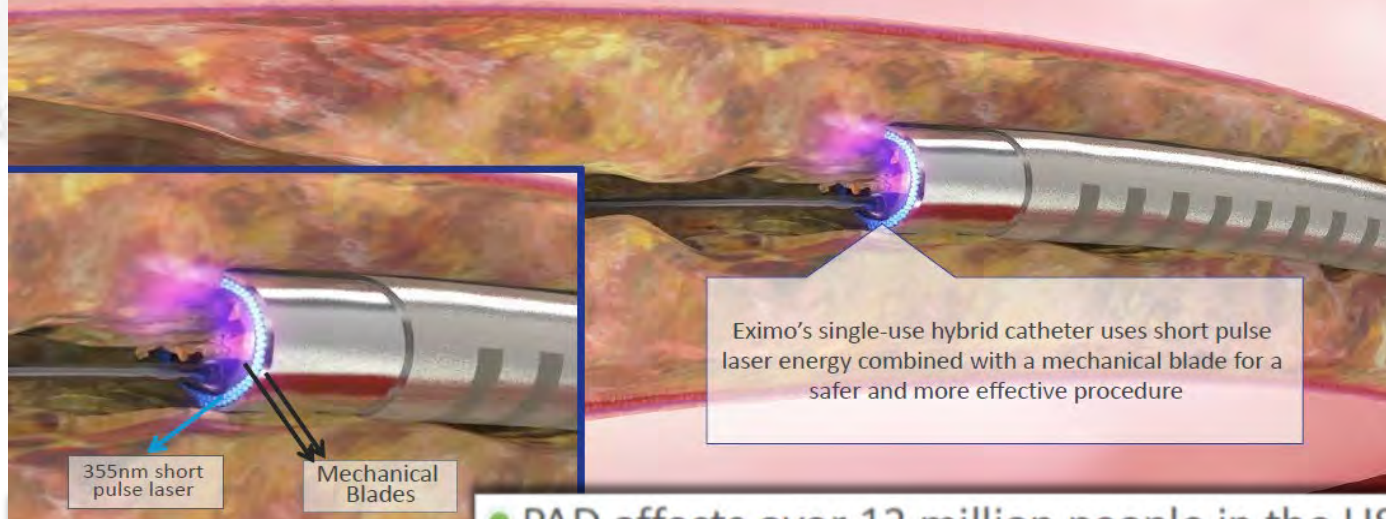


Laser Angioplasty with Atherocatheters at 308nm and 355nm

EXIMO
Hybrid Medical Technologies

B-Laser Hybrid Catheter™ - Smart Duo Work

EXIMO's novel combination of a transformational laser technology and a mechanical blade on a single catheter is poised to disrupt the PAD market



- PAD affects over 12 million people in the US
- Annual hospital costs associated with PAD amputations \$5.5B
- Approximately 185,000 amputations occur yearly, 122,000 (66%) caused by PAD



Atherectomy with 355nm Laser

Journal of

10/17

BIOPHOTONICS

www.biophotonics-journal.org



EXIMO
EXIMO MEDICAL LTD.

- was acquired in 2019
by AngioDynamics

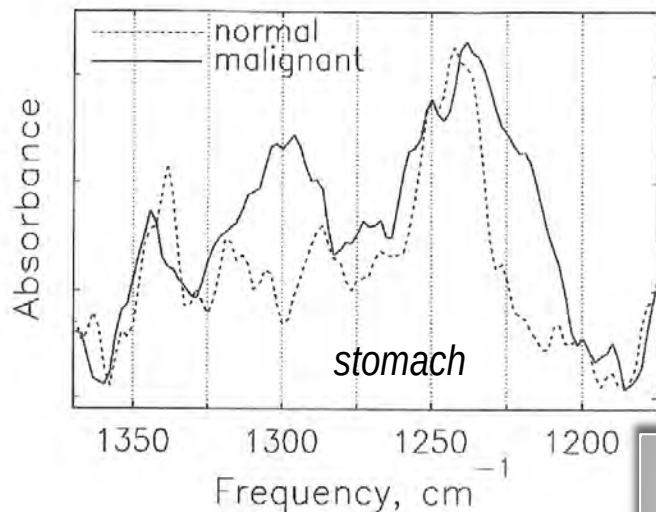
Использование эксимерного лазера для удаления атеросклеротической бляшки /
В.Г.Артюшенко, В.С.Букреев, С.К.Вартапетов // Грудная Хирургия, 1986, № 5, с.16-20

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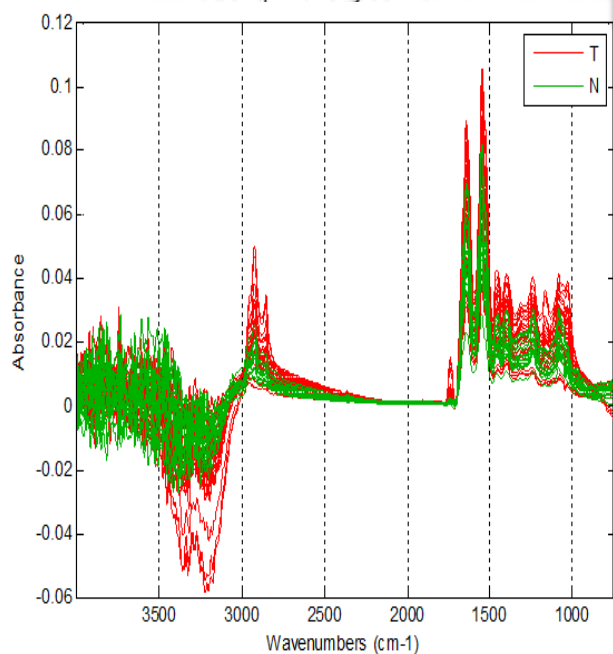
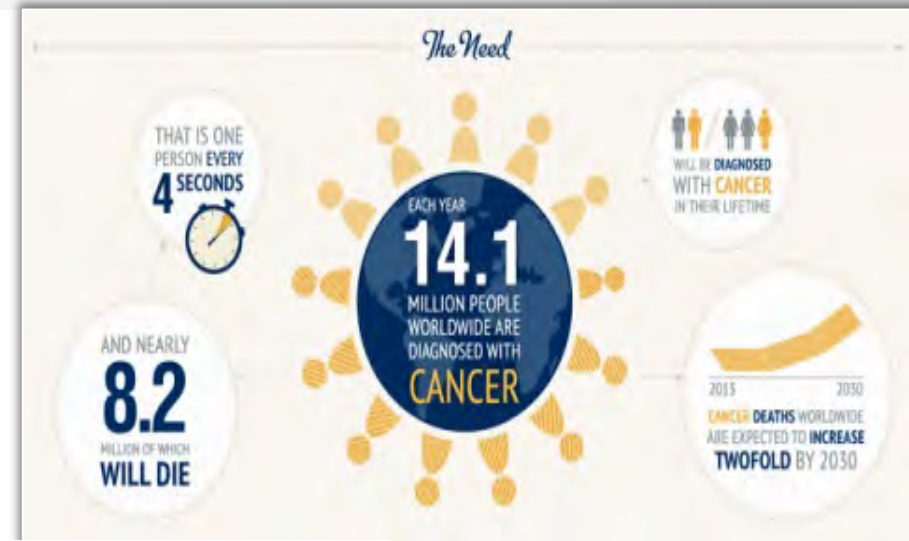
Source: Lux Research, Inc.
www.luxresearchinc.com



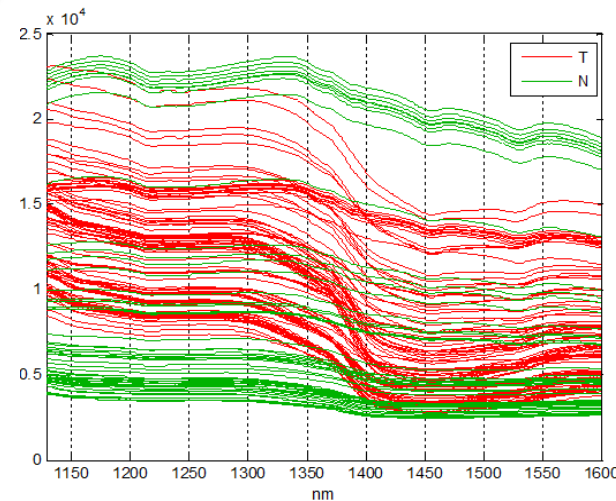
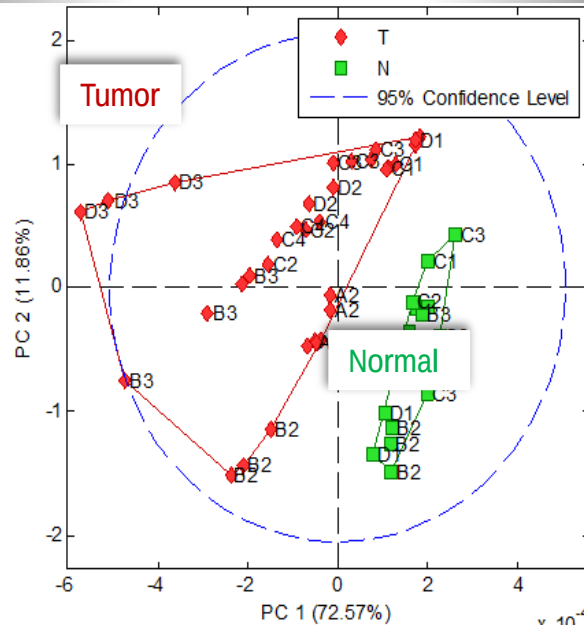
Cancer Diagnostics with ATR-MIR & DRS-NIR fiber-probes



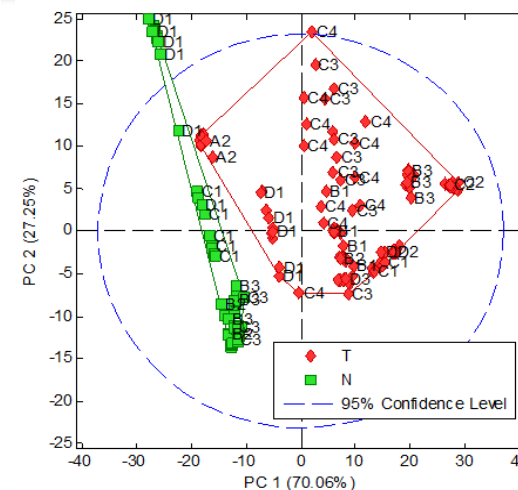
Our ATR-probes coupled to FTIR-spectrometer enable to detect stomach cancer *ex-vivo* 30 years ago (see spectra at the left) - with the 1st data published in Proc. SPIE v.2328, 76-81, v.2631, 1994. Our tests in Berlin made on 2015-2016 for kidney RC-carcinoma have confirmed glucose role as this tumor biomarker together with the lipid/ water ratio



Mid IR-absorption Spectra of *normal* & *tumor* kidney with PCA spectra analysis



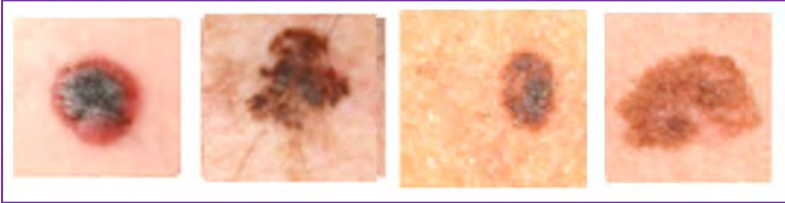
NIR-Spectra for normal and tumor of kidney (1129-1600nm) with PCA



Skin Cancer Detection with ATR-IR-Fiber probes at Tel Aviv University

Melanoma

This is a malignant skin cancer that is responsible for almost ~10000 deaths, out of 100000 new cases in the US, annually.



Basal Cell Carcinoma (BCC) & Squamous Cell Carcinoma (SCC)

Much more common than melanoma.

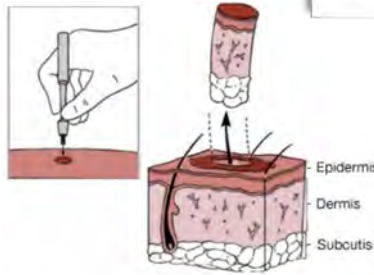
Much less malignant than melanoma. Rarely metastasizes beyond the original tumor site.



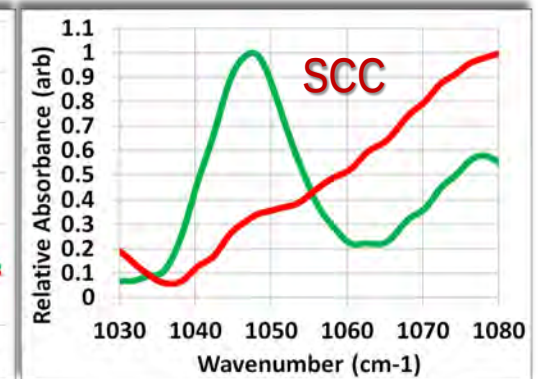
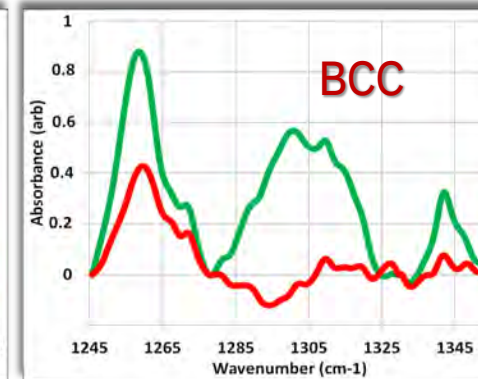
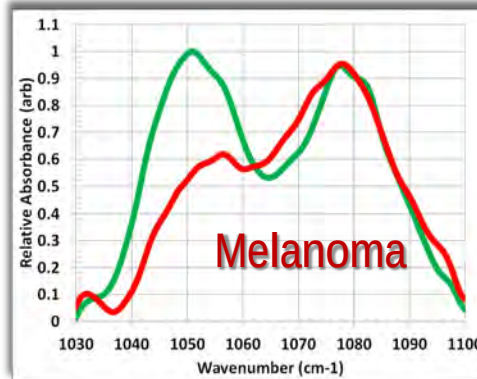
Dermoscopes:



Biopsy:

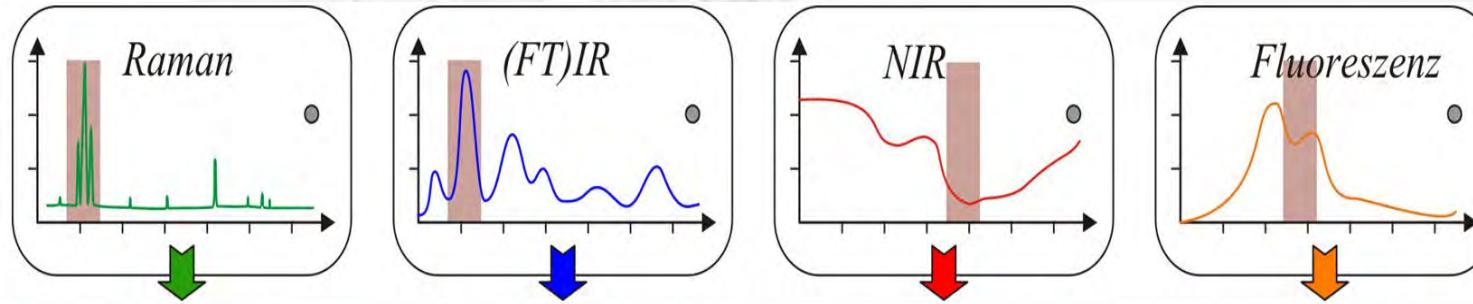


Prof. Abraham Katzir doing the tests of skin lesion with AgHal-fiber probe coupled to FTIR-spectrometer with one of 90 patients used for clinical studies. This non-invasive test enables to detect 5 melanoma, 7 BCC & 3 SCC (with a special algorithm)

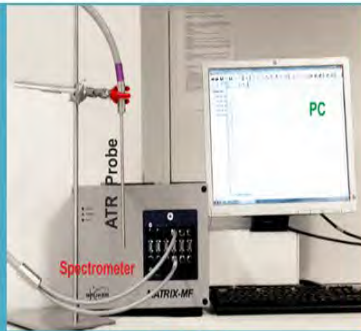


ATR-fiber spectroscopy may enable non-invasive, rapid, and easy diagnostic tool for fast melanoma detection – with its differentiation from BCC or SCC

Tumor Detection with 4 Label Free Spectroscopy Methods



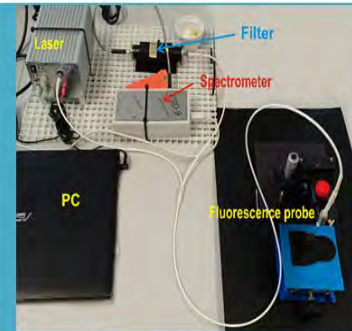
Raman @690nm & @785nm



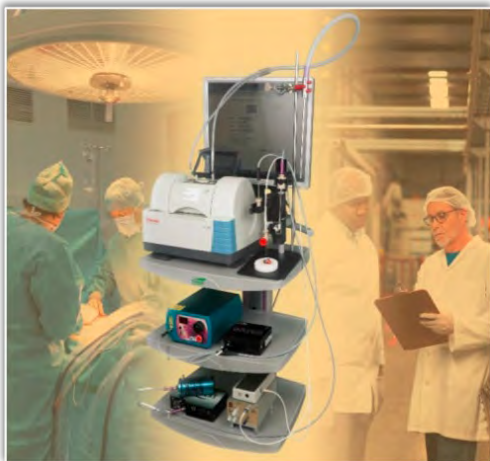
FTIR (MIR)



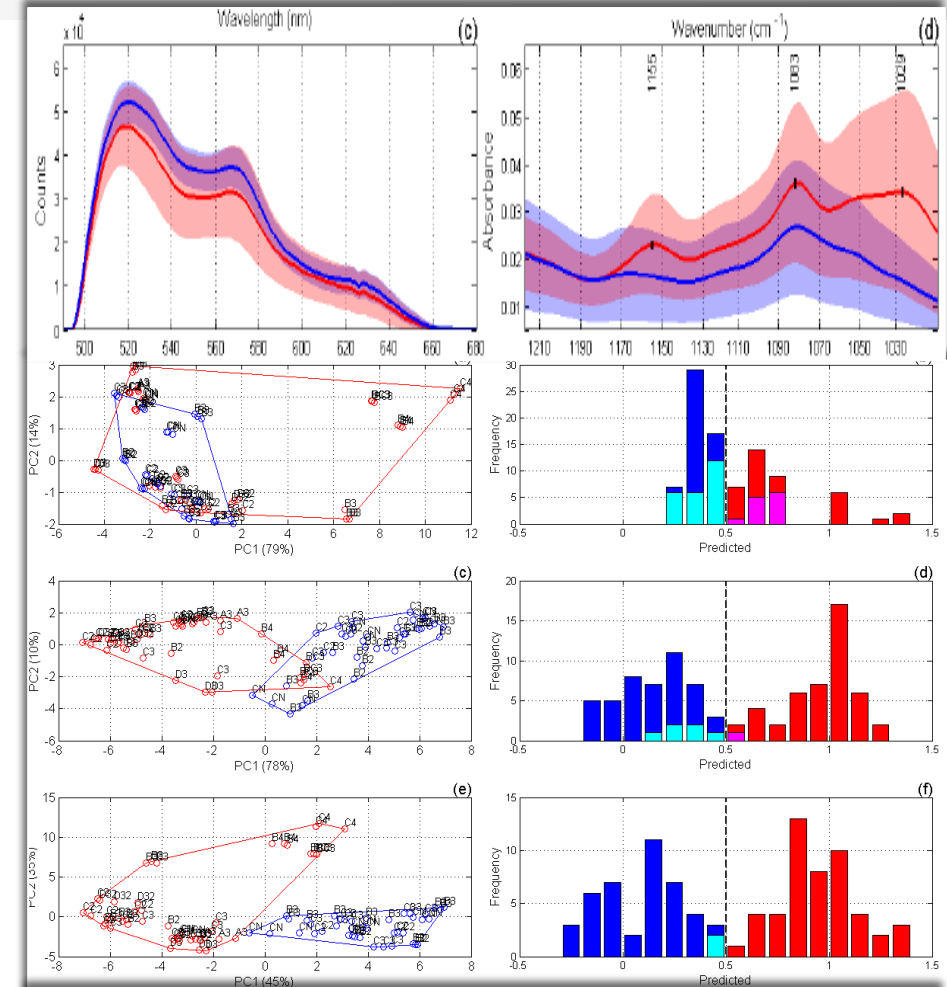
DRS NIR



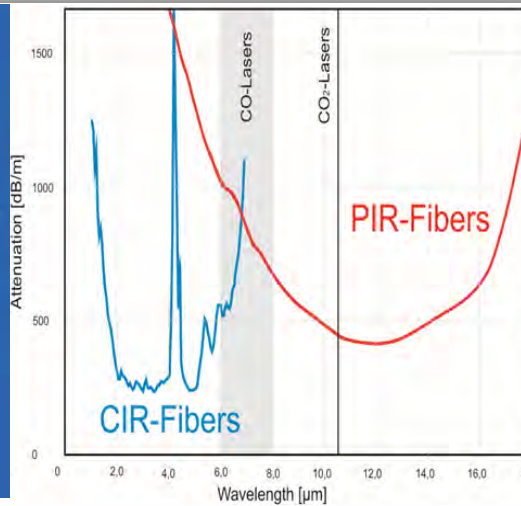
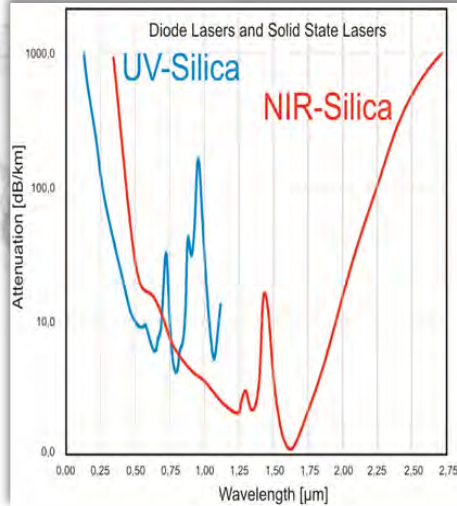
Fluoreszenz @ 473nm



Comparison of all 4 key spectroscopy methods made for the same tissue spots enables to select the best one (or their best combination) for the most sensitive, specific and accurate detection of tumor margins. This selection depends on organ & type of cancer, while spectra fusion from different methods leads to much higher accuracy in real time tumor detection



Innovative Fiber Probes for all key Spectroscopy Methods



Demands to Medical Fiber Probes:

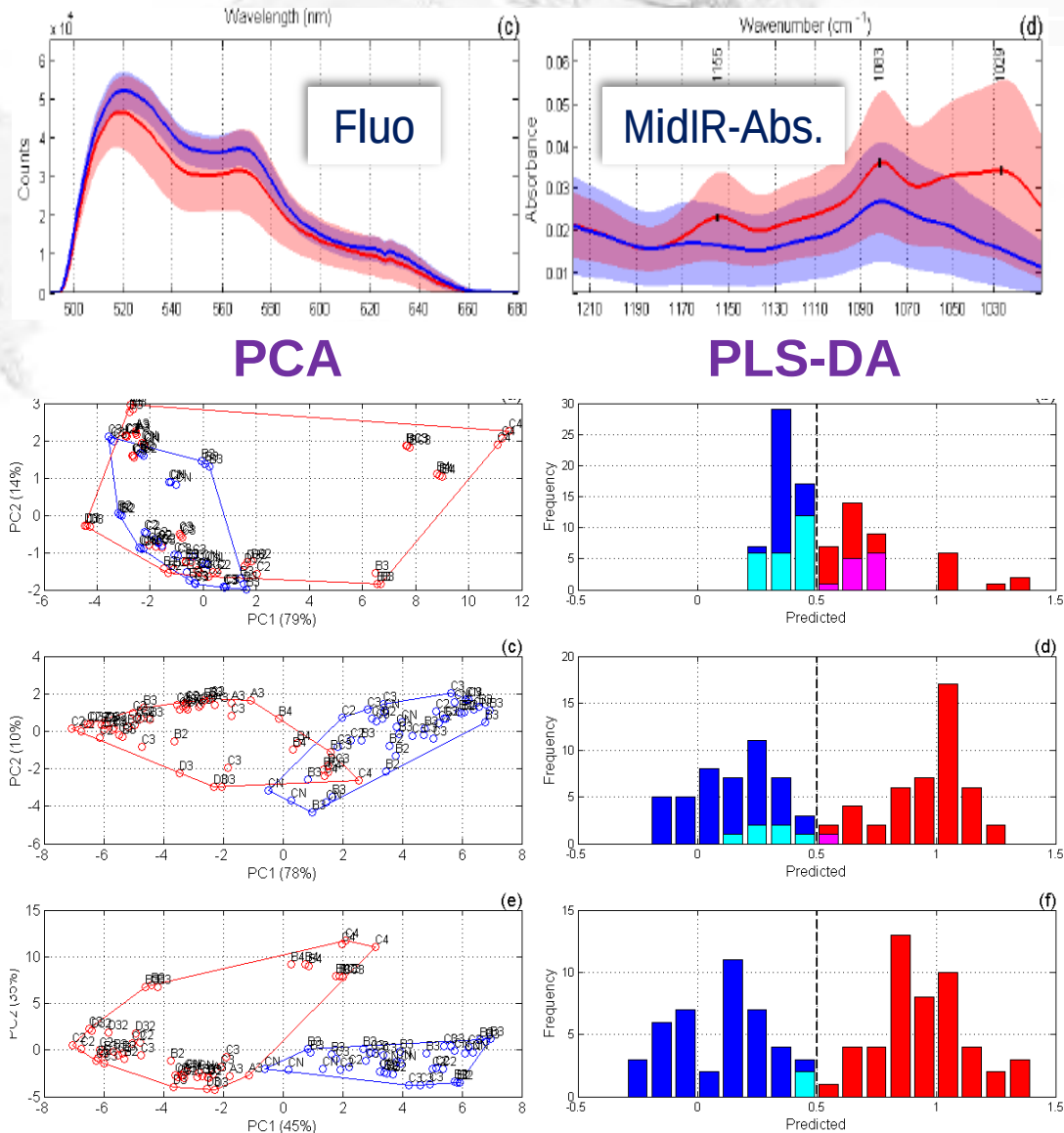
- small diameter
- highly flexible
- biocompatible
- sterilizable or
- disposable
- easy detachable
- compatible with endoscopes or catheters
- of stable & high transmission under bending
- of low cost



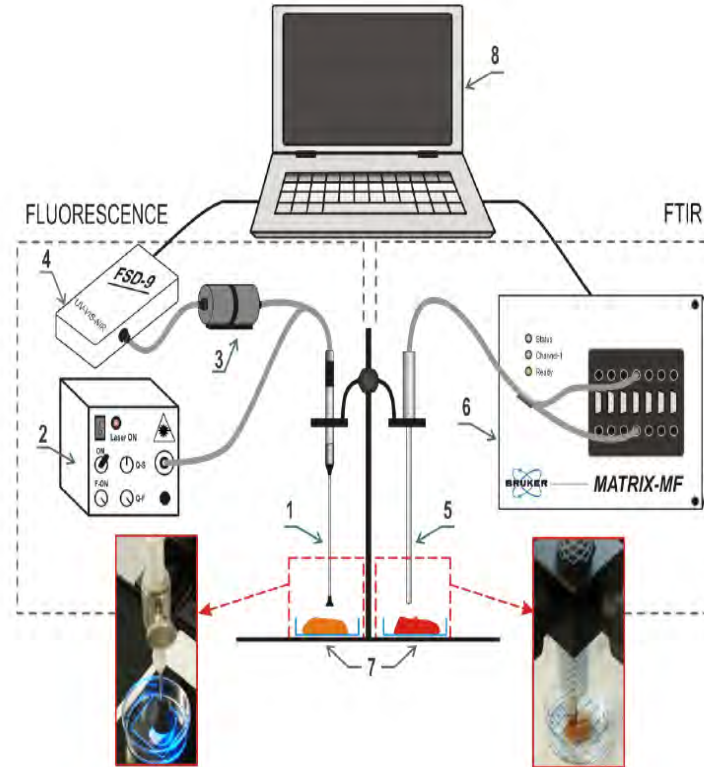
Broad Spectra Fiber solutions for various Fiber probes for 0.3-16μm range



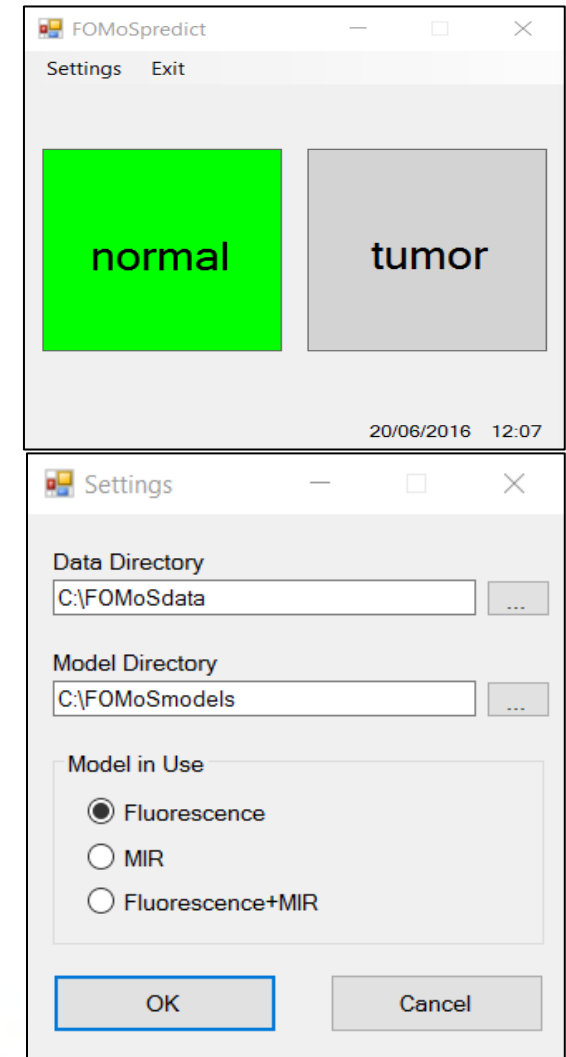
Fusion of Fluo- + Mid IR-absorption spectra for Kidney RCC



Renal Cell Carcinoma of kidney (*in-vitro*)



Sensors 2017, 17, 2548;



Needle Fiber Probe for HW-Raman Spectroscopy Guided Cancer Surgery

Eurostars-project: Ra-Sure (ESTAR18101)

300.000 new oral cancer patients/year

Surgery to remove tumour successful in only 15% of cases

Technology needed to support surgeon



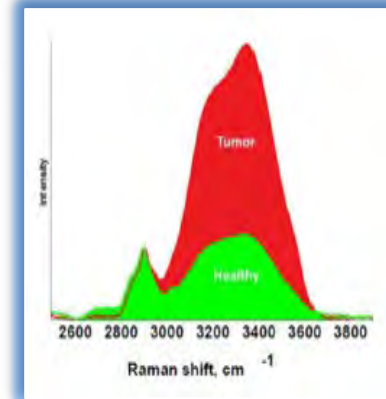
Single fiber Raman Needle Probe (OD<180µm)

penetrates in resected tissue for 1cm to detect *ex-vivo* oral cancer (SCC) margins in 1s – providing HW-Raman spectrum each 100ms (i.e. with 1mm accuracy)

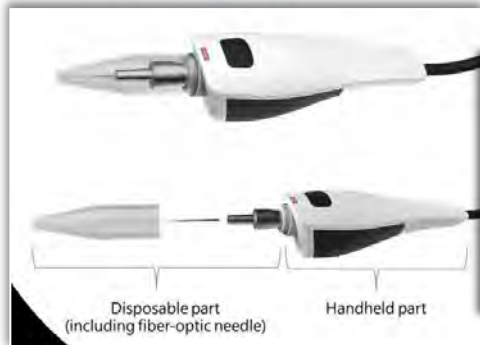


Erasmus MC

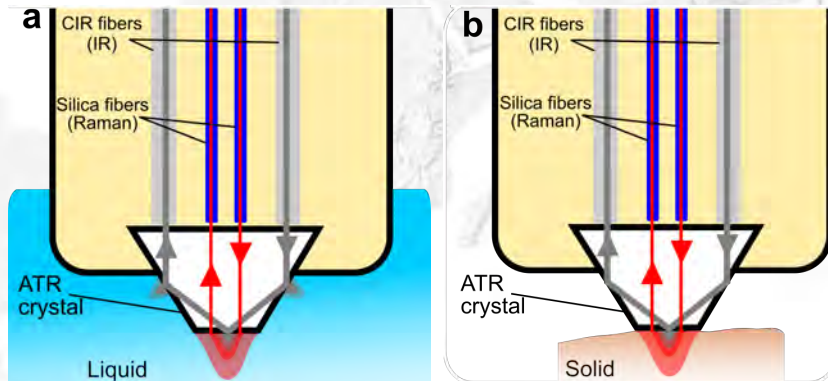
Erasmus Medical Center



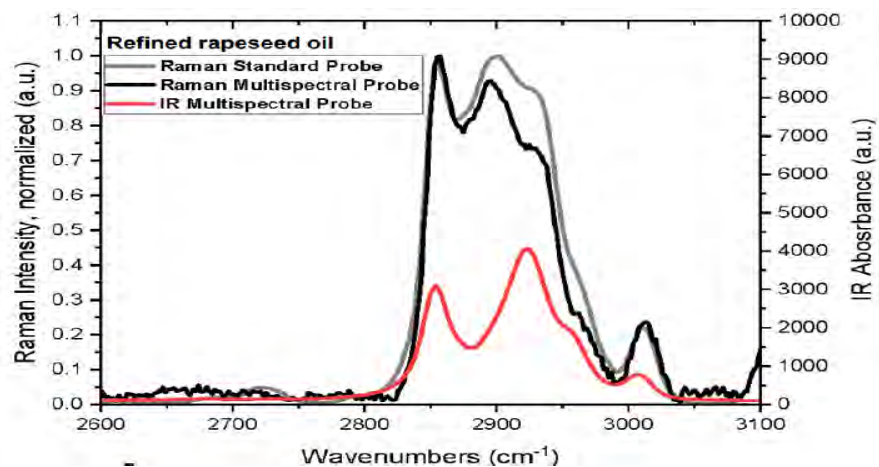
Water content is higher in Oral cancer - compared to the surrounding healthy tissue, and can be used as spectral biomarker to detect tumor margins



Combi-Fiber Systems for ATR+Fluo/ Raman spectroscopy



Combi probe with 2 IR-fibers coupled to FTIR-spectrometer and 2 Silica fibers coupled to Fluo or Raman spectrometers to work with 680nm & 785nm laser



Raman & MIR spectra for refined rapeseed oil

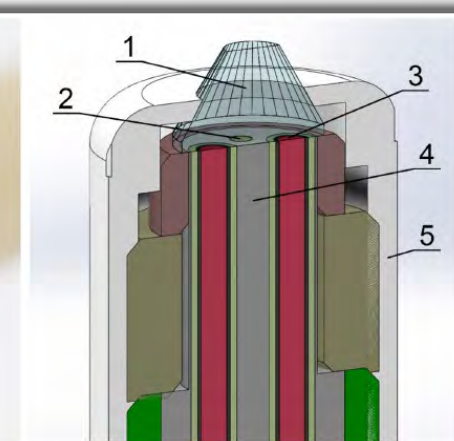
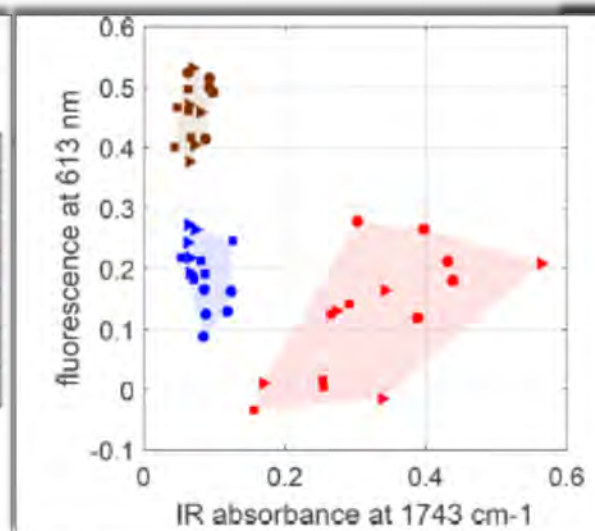
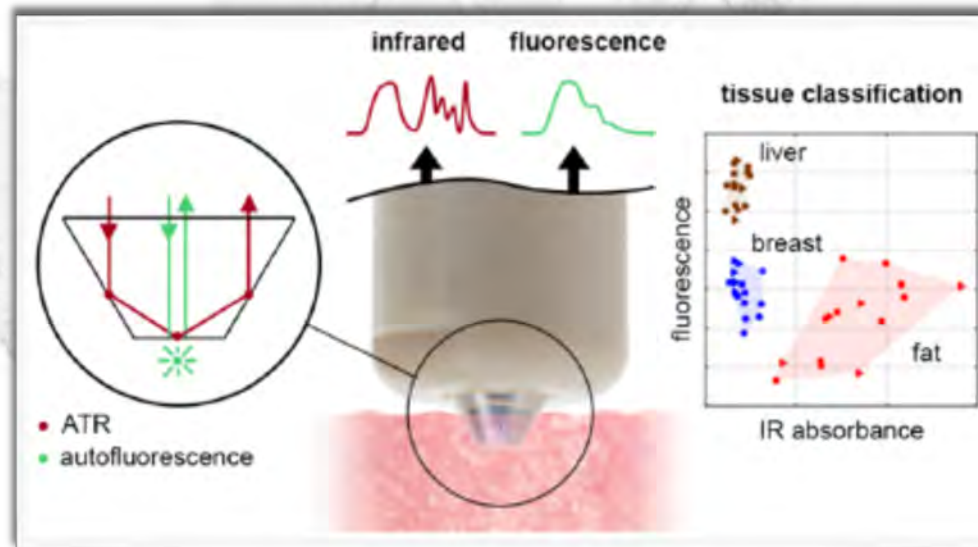


Combi-ATR/ Fluo&Raman Fiber System with Bruker ALPHA, NLIR & Wasatch spectrometers

[Nature Sci. Rep. 14, 7430 \(2024\)](https://www.nature.com/articles/s41598-024-57539-4) <https://www.nature.com/articles/s41598-024-57539-4>
Multimodal fiber probe for simultaneous mid-infrared and Raman spectroscopy

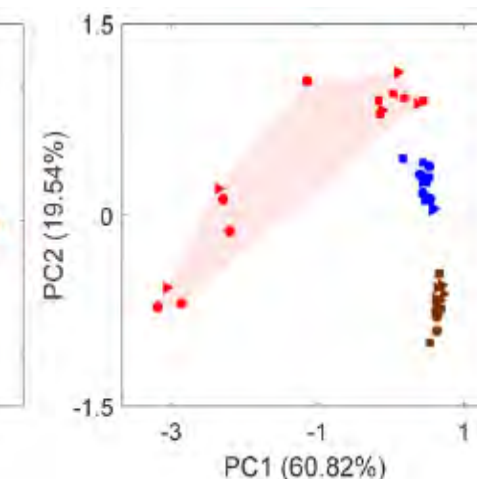
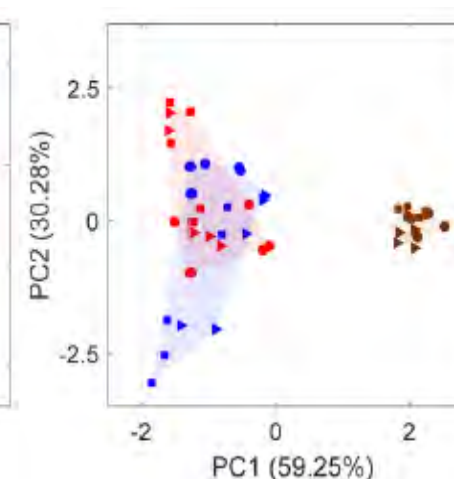
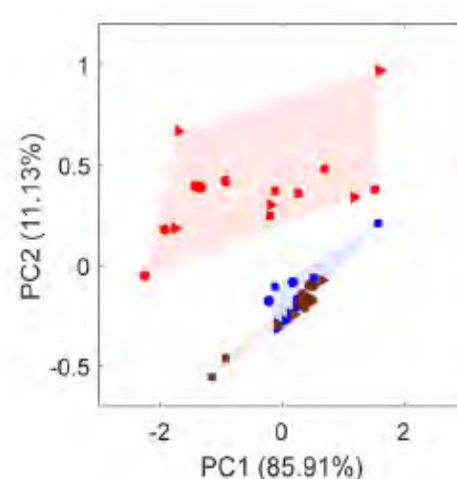
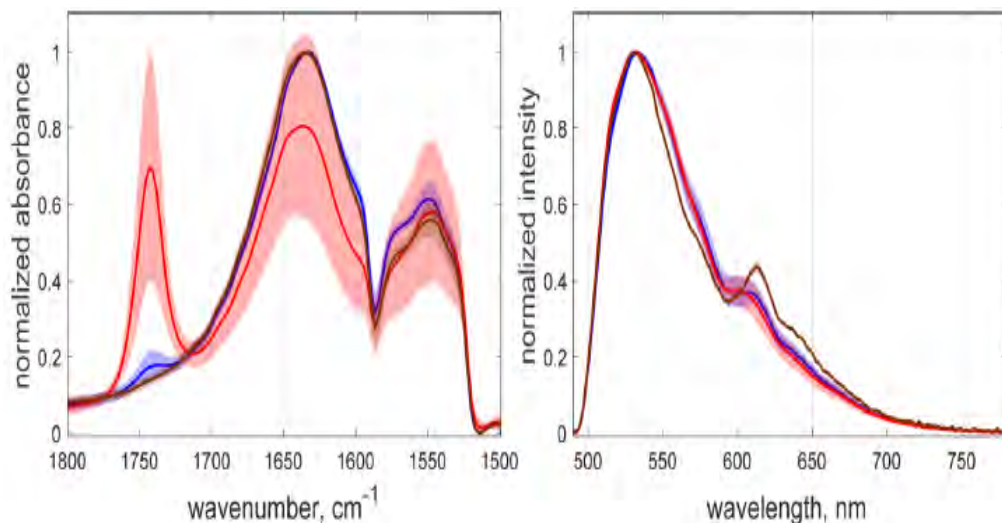
Alexander Novikov,^{1,2*} Stanislav Perevoschikov,^{1,3} Iskander Usenov,^{1,2}
Tatiana Sakharova,¹ Viacheslav Artyushenko,¹ Andrey Bogomolov⁴

Combi-Fiber Probe for Mid-IR/Fluo-Spectra Fusion Sensors

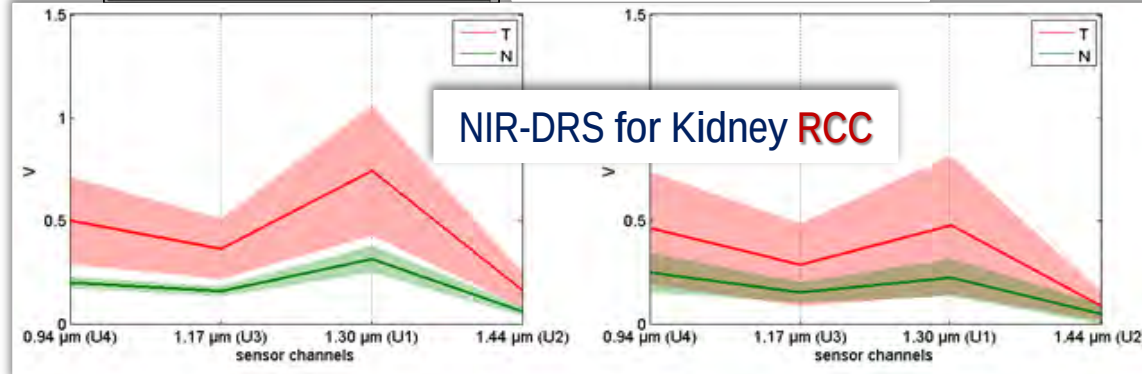
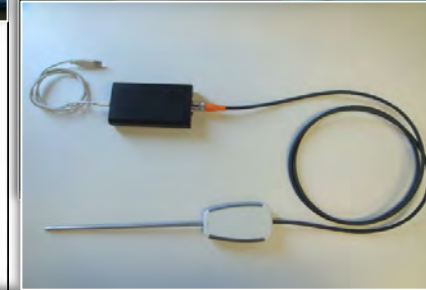
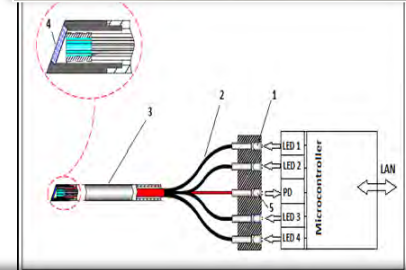
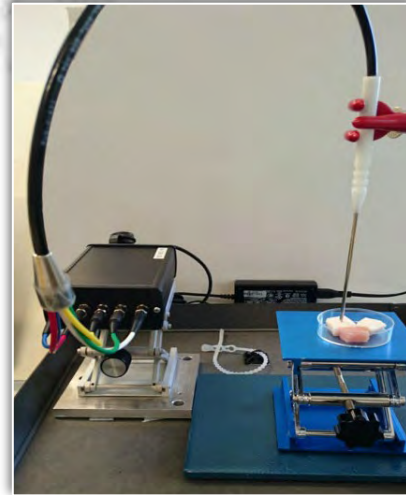
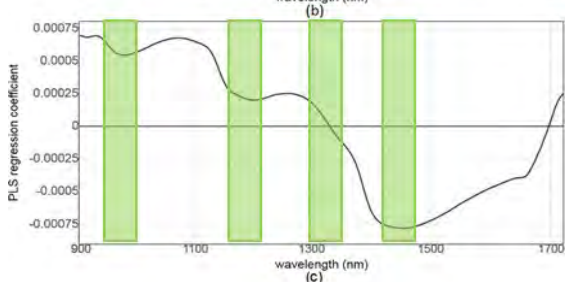
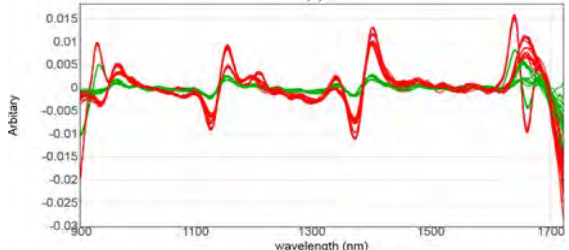
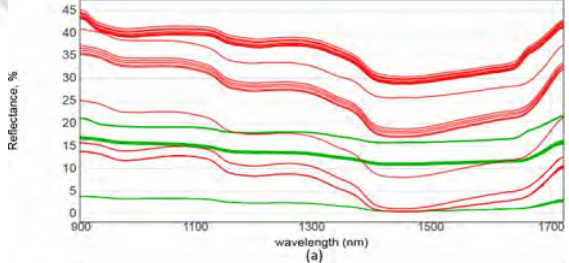


<https://doi.org/10.1021/acs.analchem.1c00080>

analytical
chemistry

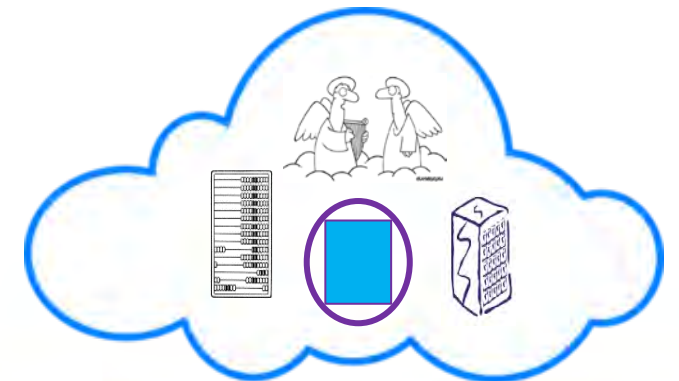


Spectral Fiber NIR-LED-Margin Sensor for Onco-Surgery

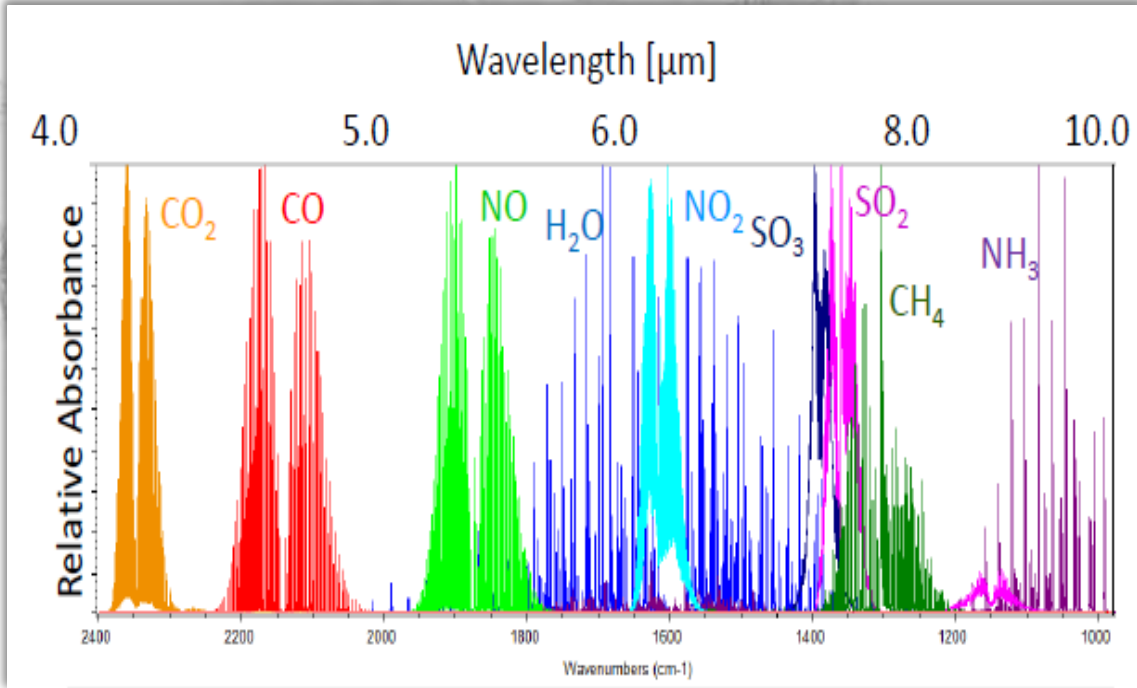


The global market for IoT networking solutions will grow from \$392.1 billion in 2017 to \$1.0 trillion by 2022 with a CAGR of 21.6% for this period

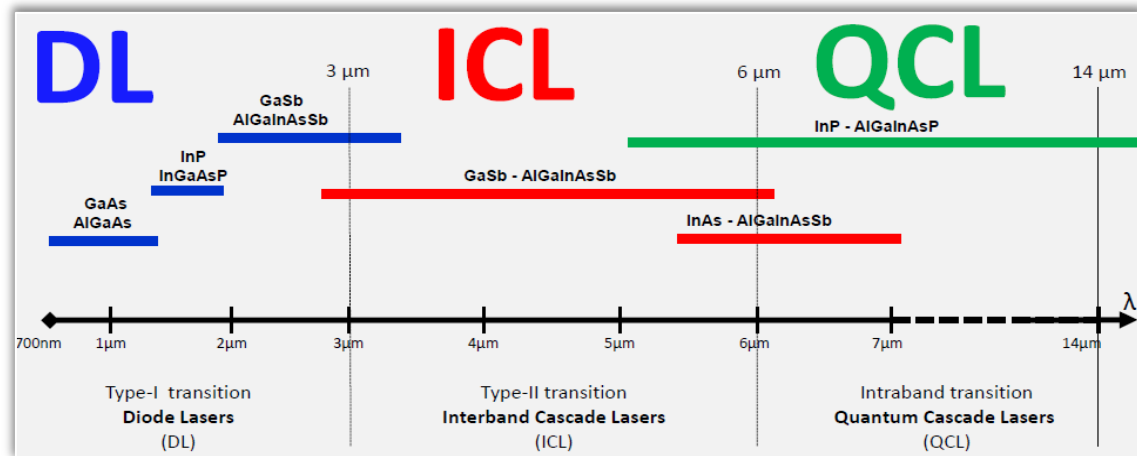
Medical Fiber Sensors – should be developed as a big part for this Dream Future!



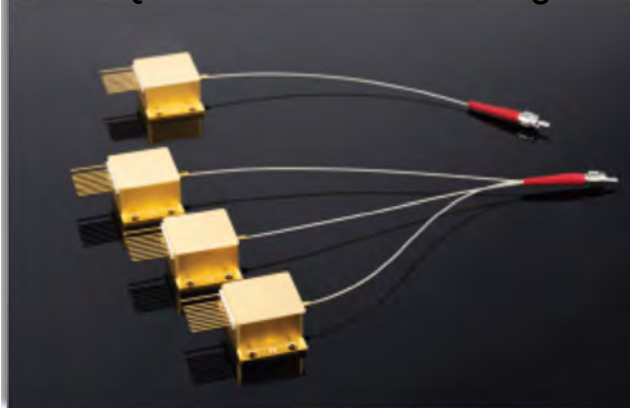
IR-Fiber coupled IC & QC-Lasers for Biomedical Diagnostics



PIR-fiber bundle combines radiation of 7 QC-Lasers into Arthro-Probe



IR-fiber bundle combiner for any ICL or QCL of selected wavelength



QCL with detachable IR-fiber cable



Laser-irradiating infrared attenuated total reflection spectroscopy of articular cartilage: Potential and challenges for diagnosing osteoarthritis

P. Krebs^a, M. Nägele^b, P. Fomina^a, V. Virtanen^c, E. Nippolainen^d, R. Shaikh^d, I.O. Afara^d, J. Töyräs^{d,e,f}, I. Usenov^g, T. Sakharova^g, V. Artyushenko^g, V. Tafintseva^h, J.H. Solheim^h, B. Zimmermann^h, A. Kohler^h, O. Königⁱ, S. Saarakkala^{c,j}, B. Mizaiakoff^{a,k,*}

Osteoarthritis and Cartilage Open 6 (2024) 100466

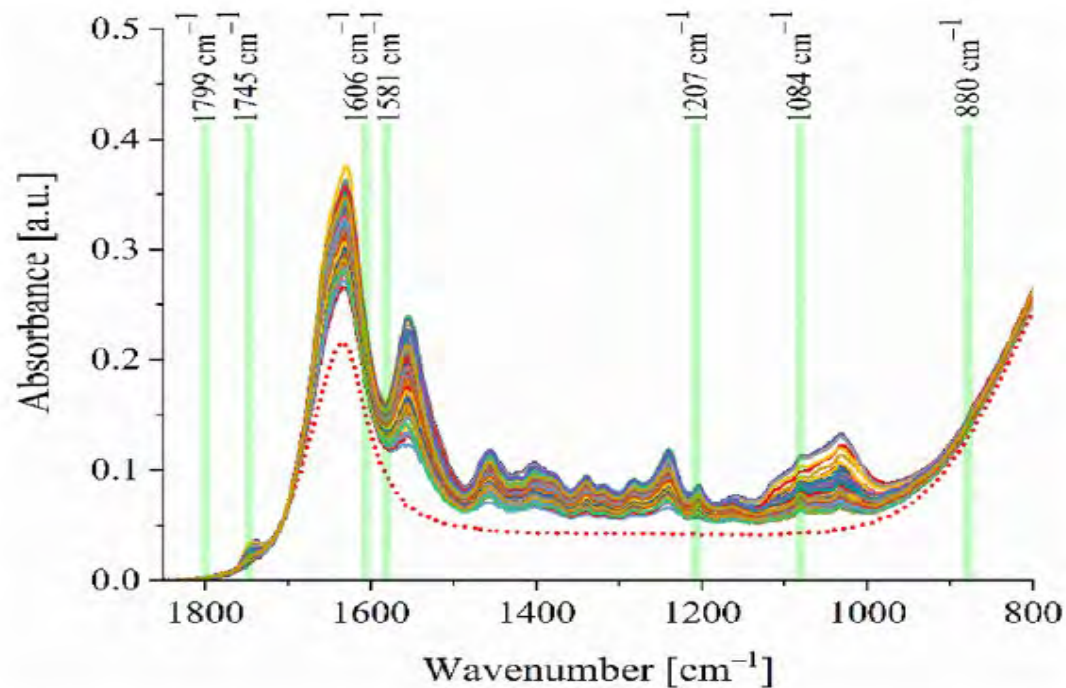
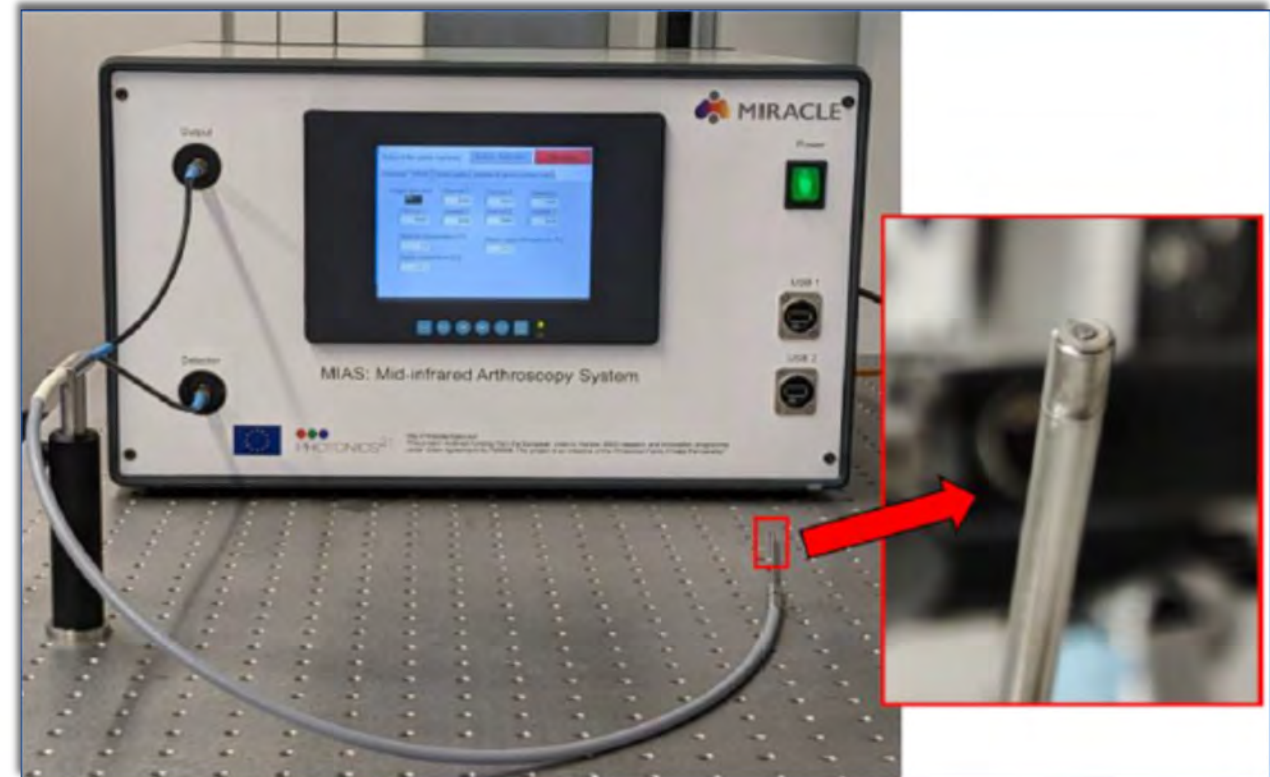


Fig. 2. Selected laser wavelengths of the AO scanner shown on FTIR spectra of human AC tissue. The red dotted line shows a water spectrum indicating the spectral regions where water overlaps with the amide features. (Lipid: 1745 cm^{-1} ; amide I/water: 1606 cm^{-1} ; amide II/water: 1581 cm^{-1} ; amide III: 1207 cm^{-1} ; carbohydrate: 1084 cm^{-1} ; background/baseline: 1799 cm^{-1} , 880 cm^{-1}).



Main Trends of Fiber Diagnostic Solutions:

- ➡ Fiber spectroscopy can be used in a broad spectral range and can combine spectral methods to enhance sensitivity, specificity and accuracy of molecular analysis for any media at remote distance in real time, including medical diagnostics *in-vivo* – *for point of care & telemedicine*
- ➡ Most of pragmatic applications could not accept too high cost, bulky and complicated spectral systems, but require a variety of customized fiber sensors – with small size, low cost, friendly software, compatibility with smart-phones and upgradable via iCloud to the enhanced databanks
- ➡ Spectral fiber sensors to be developed for their use in clinics - to enable detection of tumor margins *in-vivo* and diagnostics of various diseases by tissues & bioliquids analysis with WiFi data transfer to AI in iClouds for real time and even remote diagnostics (telemedicine)

Market forecasts for Diagnostics, including Cancer



The report "**Cancer Biomarkers Market**" by Profiling Technology (Omics, Imaging), Cancer (Lung, Breast, Leukemia, Melanoma, Colorectal), Product (Instruments, Consumables), Application (Diagnostics, R&D, Prognostics), Enduser, and Region - Global Forecast to 2029", **is projected to reach USD 42.0 billion by 2029 from USD 24.5 billion in 2024, at a CAGR of 11.3%** during the forecast period.

The report "**Molecular Diagnostics Market**" by Product & Services (Kits, Instruments, Software), Test Type (Lab, PoC), Sample (Blood, Urine), Technology (PCR, NGS, ISH, INAAT), Application (Infectious (Hepatitis, HIV, HAI, TB, HPV), Oncology) - Global Forecast to 2029", **is valued at an estimated USD 17.3 billion in 2024 and is projected to reach USD 32.7 billion by 2029 at a CAGR of 13.5%** during the forecast period.

The report "**Liquid Biopsy Market**" by Product & Service (Kits, Instruments), Circulating Biomarker (CTC, ctDNA, cfDNA), Technology (NGS, PCR), Application (Cancer (Lung, Breast, Prostate), Non-cancer (NIPT, Infectious)), Sample Type (Blood) - Global Forecast to 2029", **is valued at an estimated USD 6.4 billion in 2024 and is projected to reach USD 11.3 billion by 2029 at a CAGR of 11.9%** during the forecast period.

The report "**Tissue Diagnostics Market**" by Product (Consumables (Antibodies, Reagents, Tissue, Probes), Instrument (Processing System, Scanner)), Technology (ISH, IHC, Slide Staining), Disease Type (Breast Cancer, Lymphoma, Prostate Cancer) - Global Forecast to 2028", **is projected to reach USD 8.4 billion by 2028 from USD 5.6 billion in 2023, at a CAGR of 8.4%** during the forecast period.

Welcome to contact at info@afs.art & Slava@afs.art

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