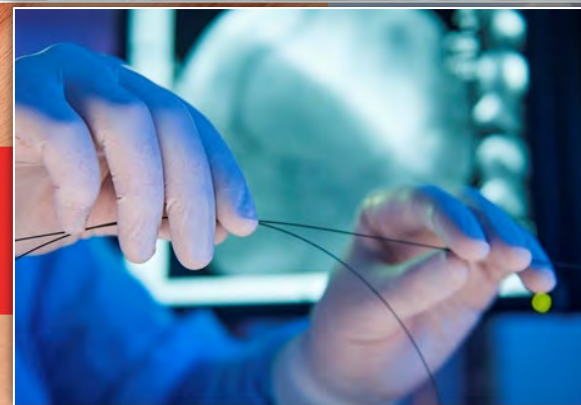




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Fiber optics of 0.3-16 μ m range for the future endoscopy



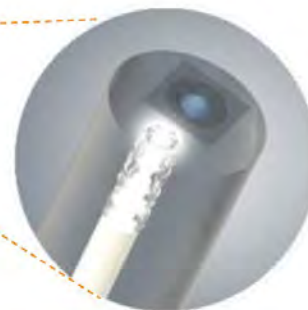
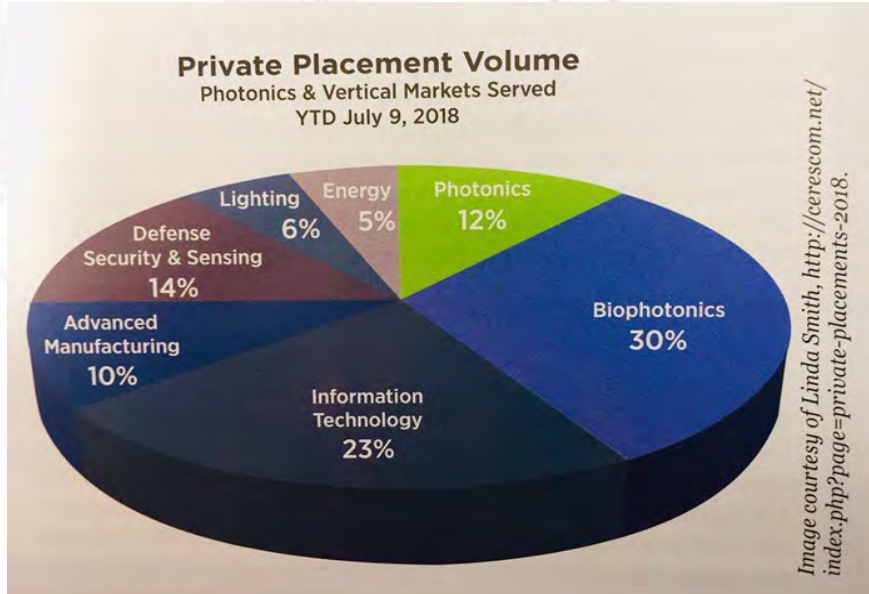
Wednesday, 17 June 2020, 15:00 CEST
EPIC Online Technology Meeting on Endoscopy

Dr. Slava Artyushenko

www.artphotonics.com

Fiber Optics Drive Innovation in the Operating Room

Source: SCHOTT North America, Inc. - Lighting and Imaging

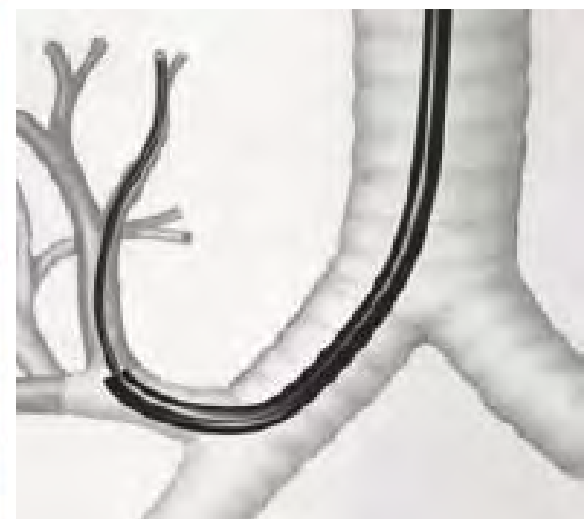
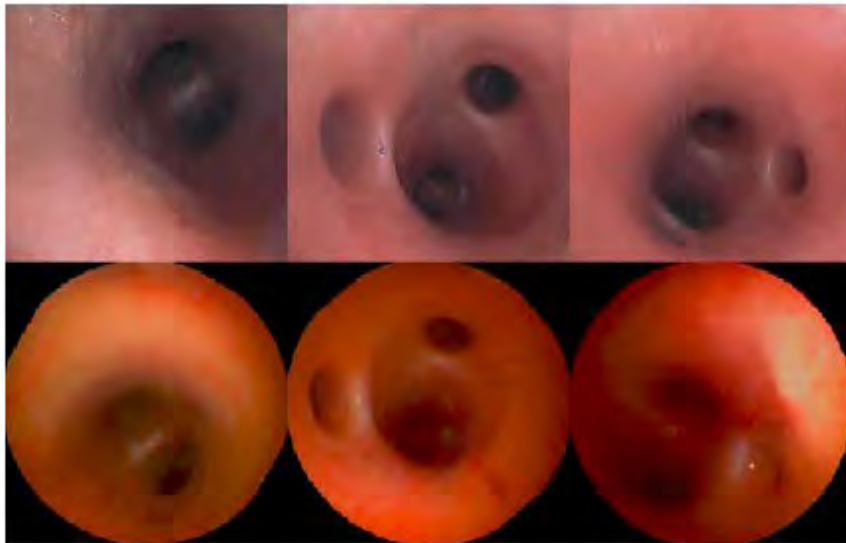
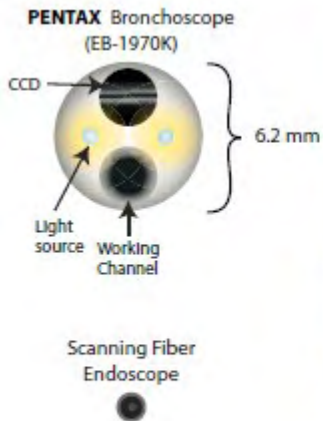
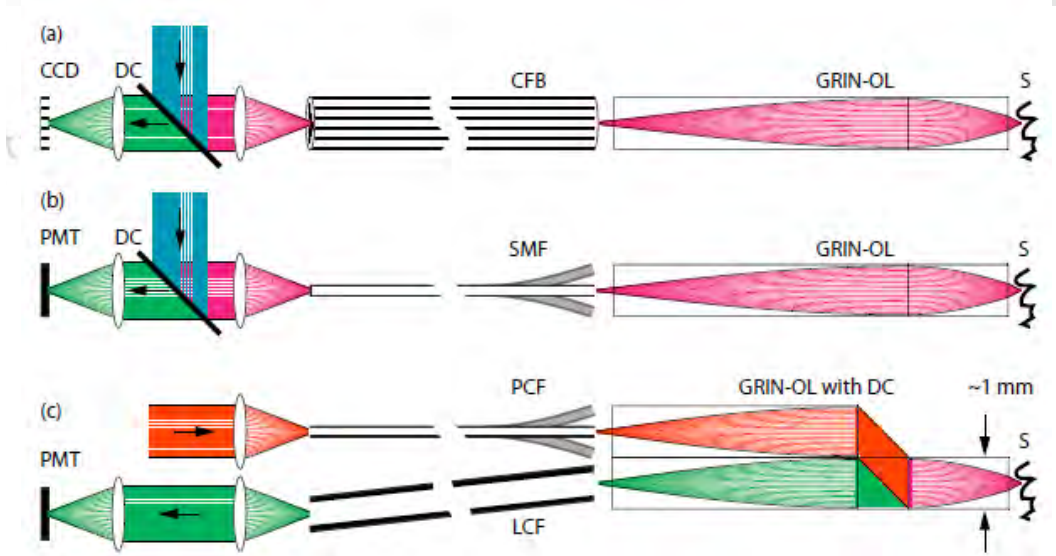


SingleEZ Guide – glass fiber illumination made easy



Advantages of Scanning Fiber Endoscopes

Fluorescence Imaging
obtained with CBF vs
SMF SFE or PCF/LCF
ultrathin SFE using
single- or two-photon
excitation



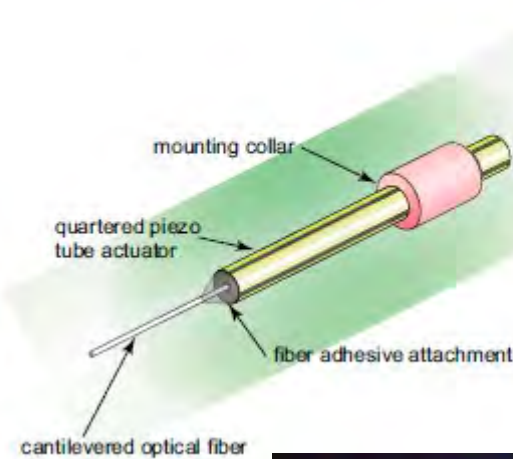
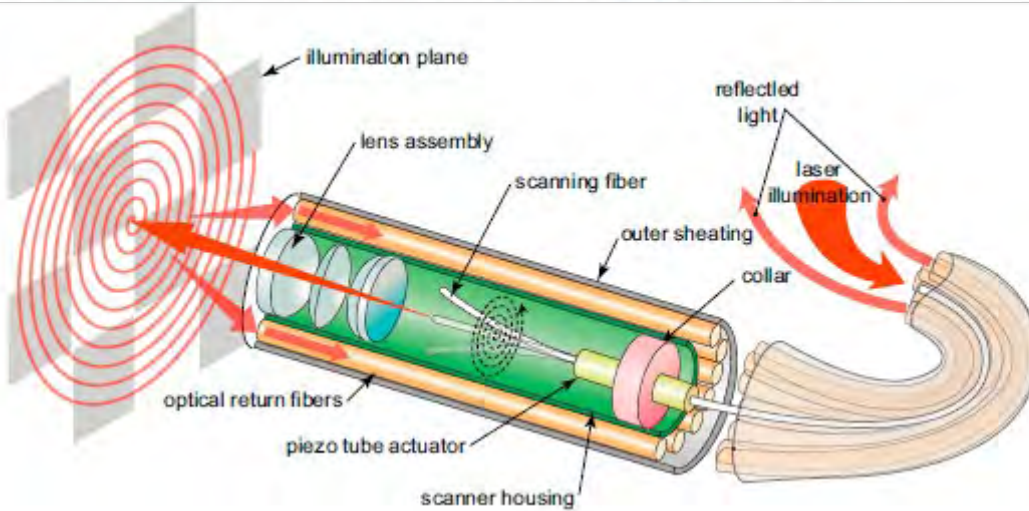
Scanning fiber endoscopy with highly flexible, 1 mm catheterscopes for wide-field, full-color imaging

Cameron M. Lee¹, Christoph J. Engelbrecht², Timothy D. Soper¹, Fritjof Helmchen², and Eric J. Seibel^{*,1}

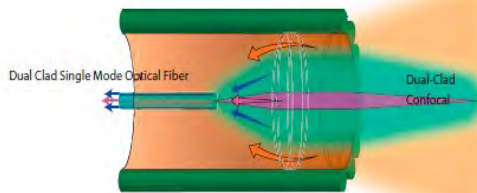
J. Biophoton. 3, No. 5–6, 385–407 (2010)

¹ University of Washington, Dept. of Mechanical Engineering, Stevens Way Box 352600, Seattle Washington 98195, USA

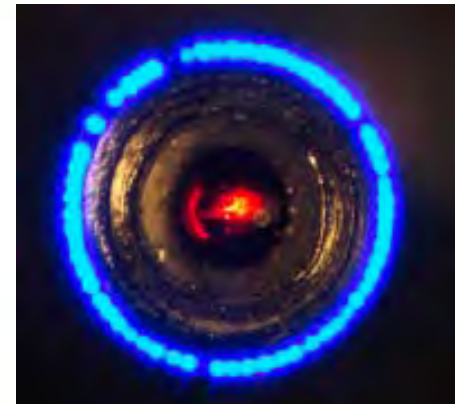
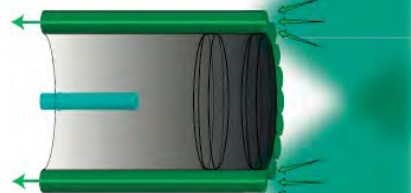
² University of Zurich, Dept. of Neurophysiology, Brain Research Institute, Switzerland



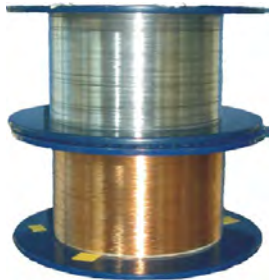
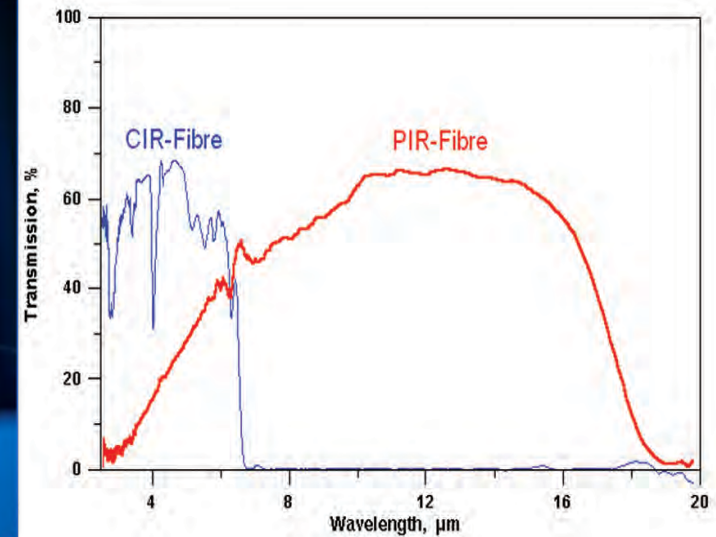
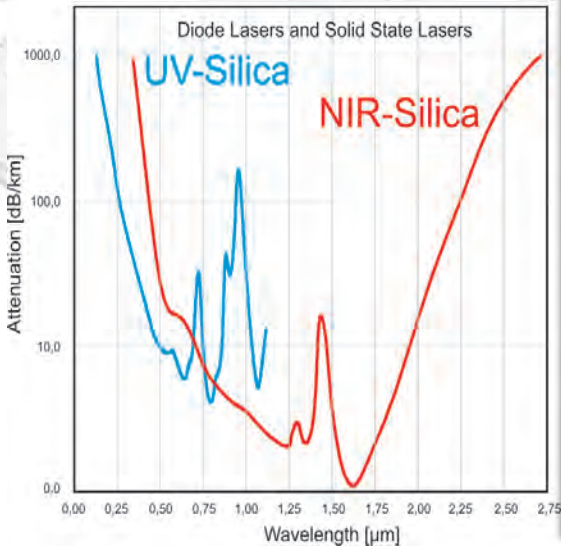
Confocal and Dual Clad Fiber Collection



External Large Core Fiber Collection



Metal coated Silica and CIR- & PIR-fibres



Alu- or Copper coated Silica fibers enables to use them in 0.3-2.2μm range for enhanced probes

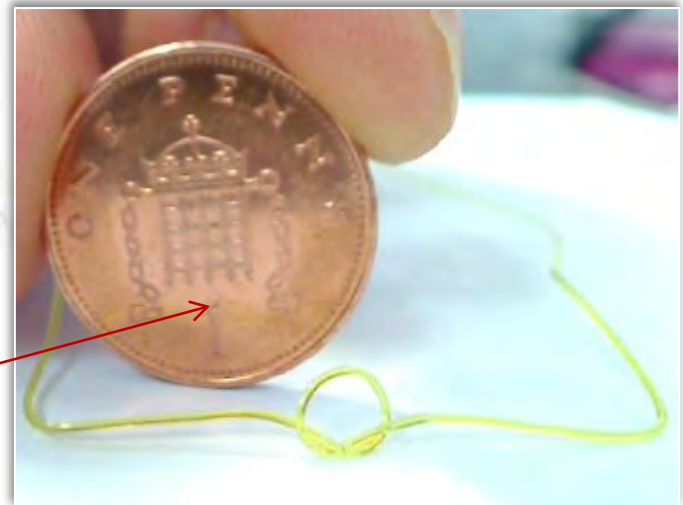
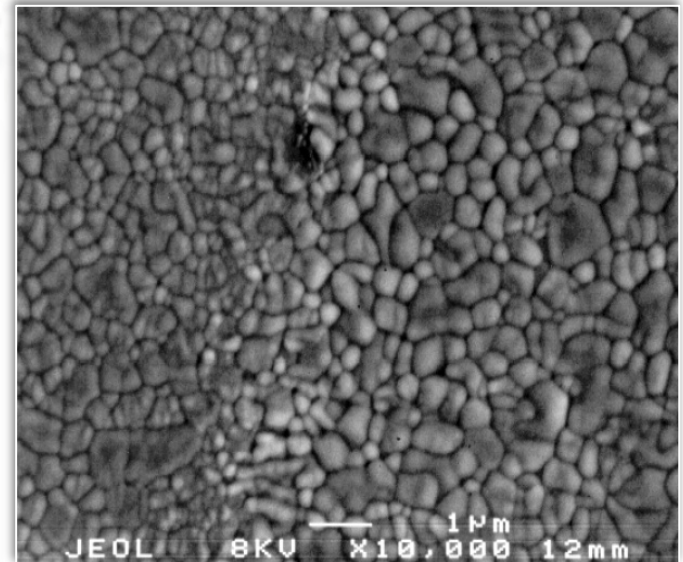
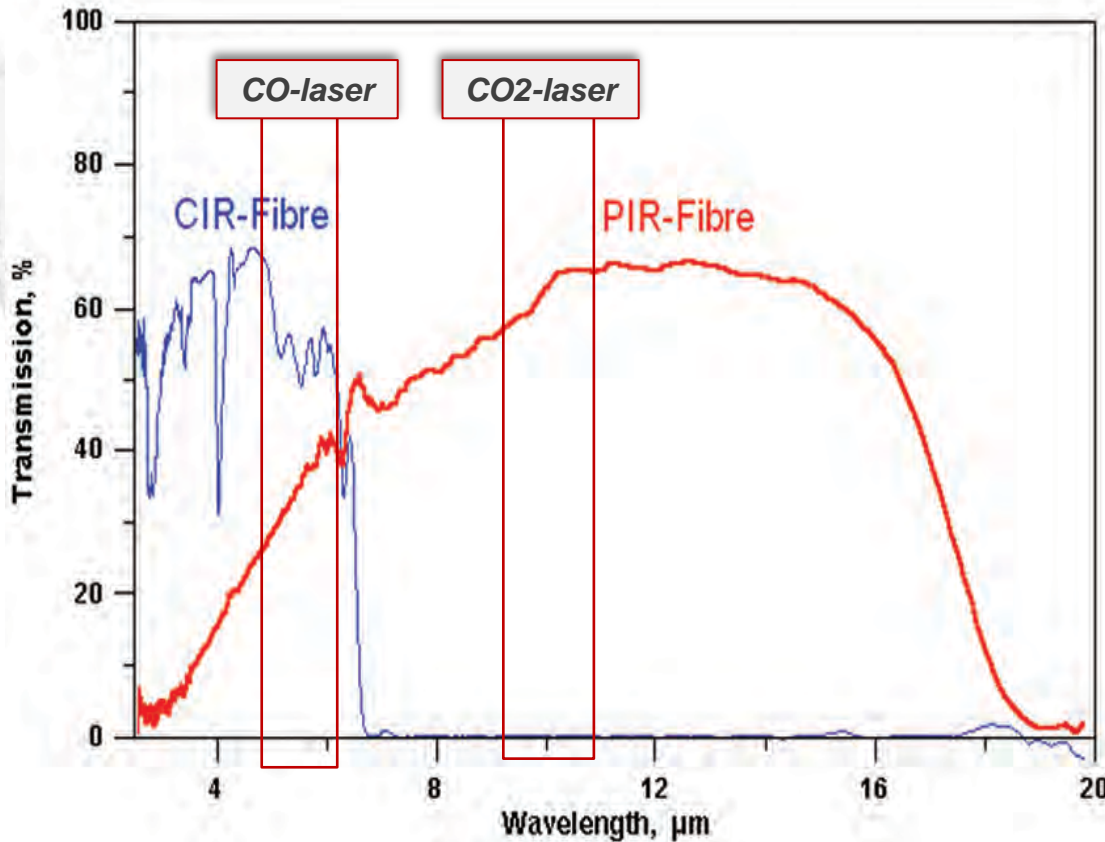


Polycrystalline PIR-fibres produced by extrusion from AgCl:AgBr crystals – the best for transmission in Mid IR-range: 3-16μm



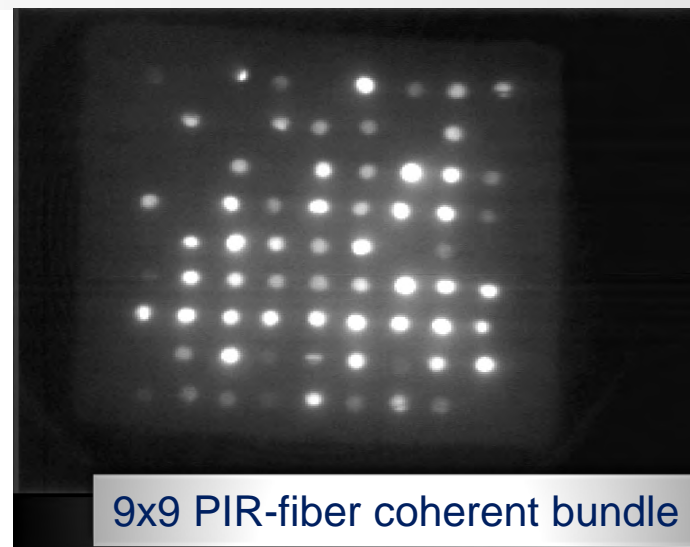
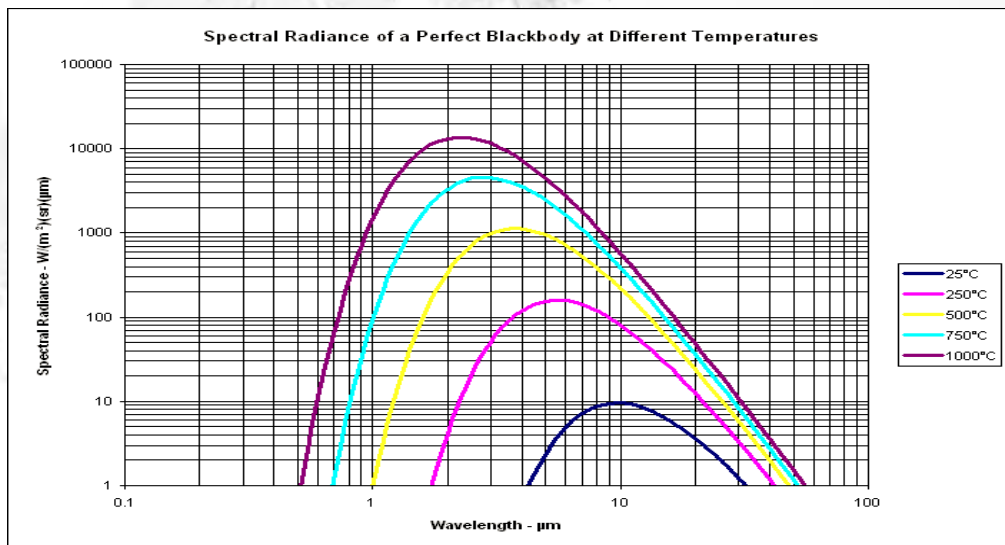
Chalcogenide CIR-fibers drawn from As-S glasses enable high transmission in 1-6μm range

CIR- and Silver Halide PIR-fibers for 1-18 μ m Range



Polycrystalline IR-fibers (PIR-fibers) extruded from AgCl:AgBr crystals with sub-micron structure are the best for 3-17 μ m. They are non-toxic, non-hygroscopic, and very flexible

Mid IR-Fiber Pyrometry

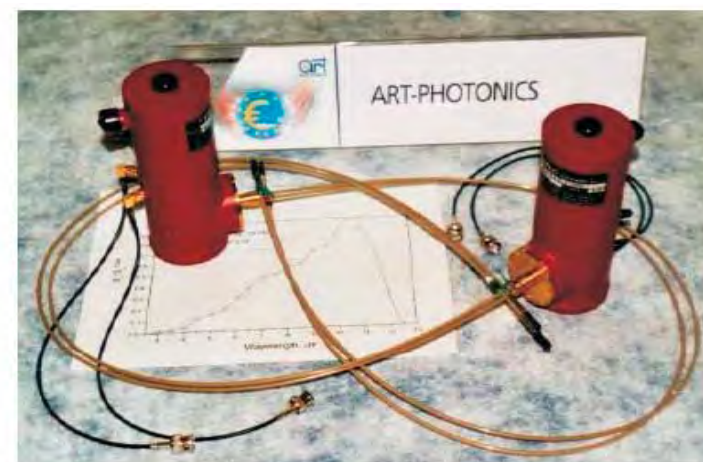


FIBRE-COUPLED
THERMOPILE INFRARED
RADIATION SENSOR

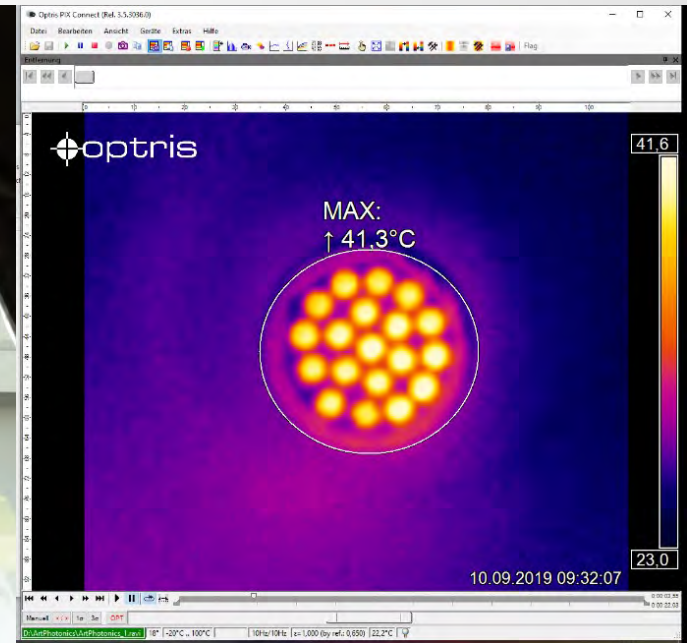
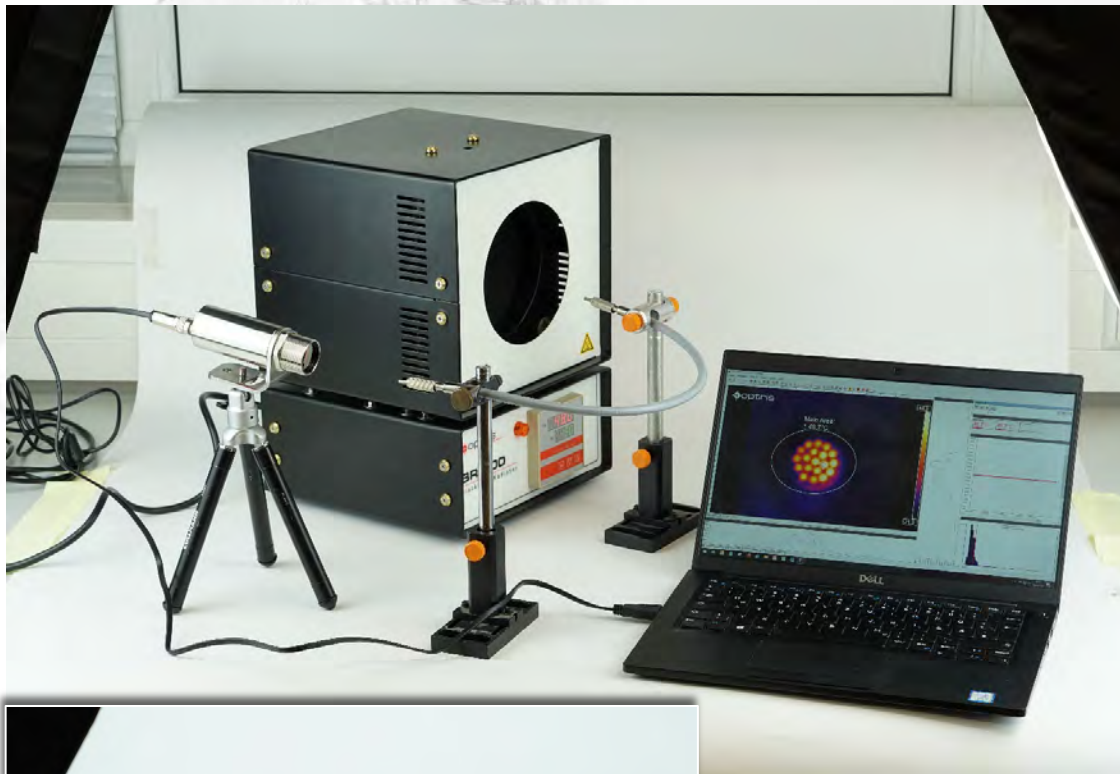
TS-100-PIR-fiber Sensor

FEATURES:

- * Ambient Temperature Operation
- * 4 – 18 µm Spectral Response
- * Rugged Construction
- * Flexible PIR-Fiber with 0.1-10m length
- * Hermetically Sealed
- * Excellent Long-Term Stability
- * High Reliability
- * Self-Generating Voltage
 - No Bias Required
 - No 1/f Noise



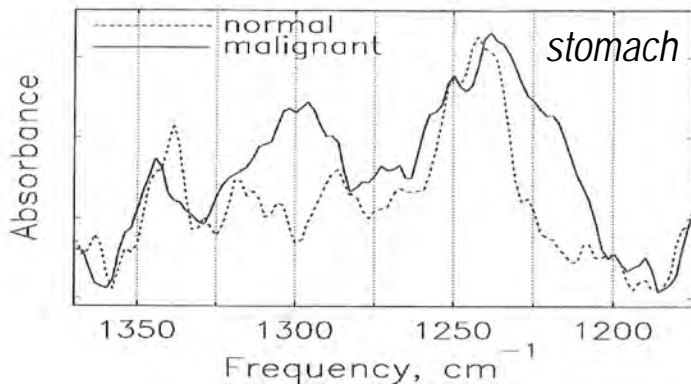
IR-Vision Camera with 19xPIR-fiber Bundle



Perfect match of PIR-fiber transmission in 4-16 μ m range to IR-emissivity of blackbody from -100° to +200°C opens the new horizon of flexible Mid IR endoscopy applications



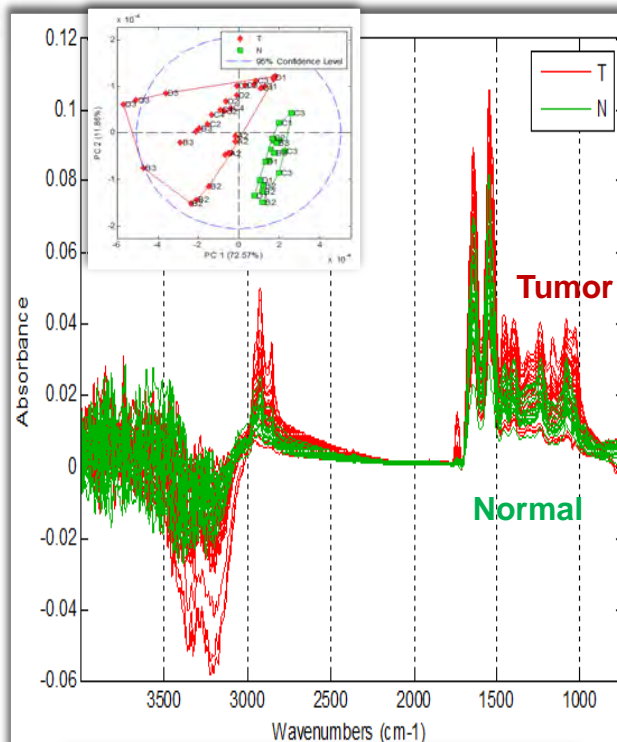
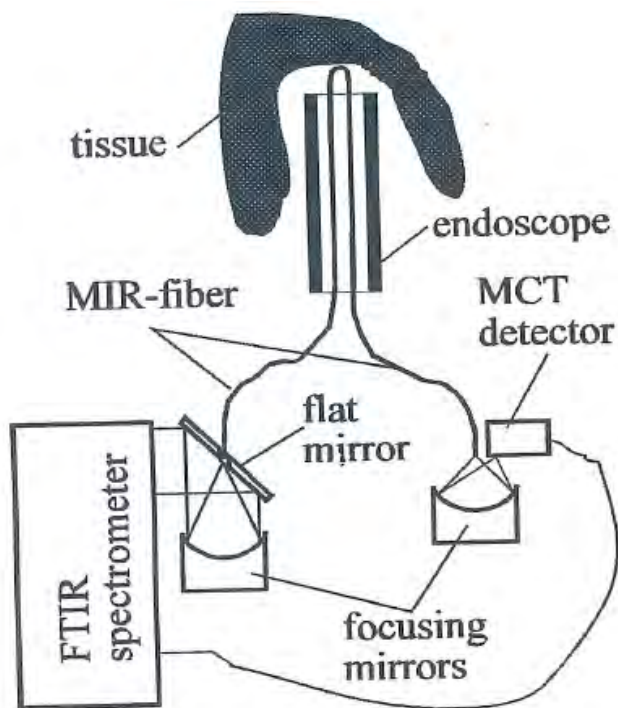
Cancer Diagnostics with ATR-fiber Coupled FTIR



Our spectroscopy detection of stomach cancer *ex-vivo* by FTIR-fiber spectroscopy have been started in 1992-1993 (see spectra at right) - with the 1st data published in 1994 (Proc. SPIE v.2328).

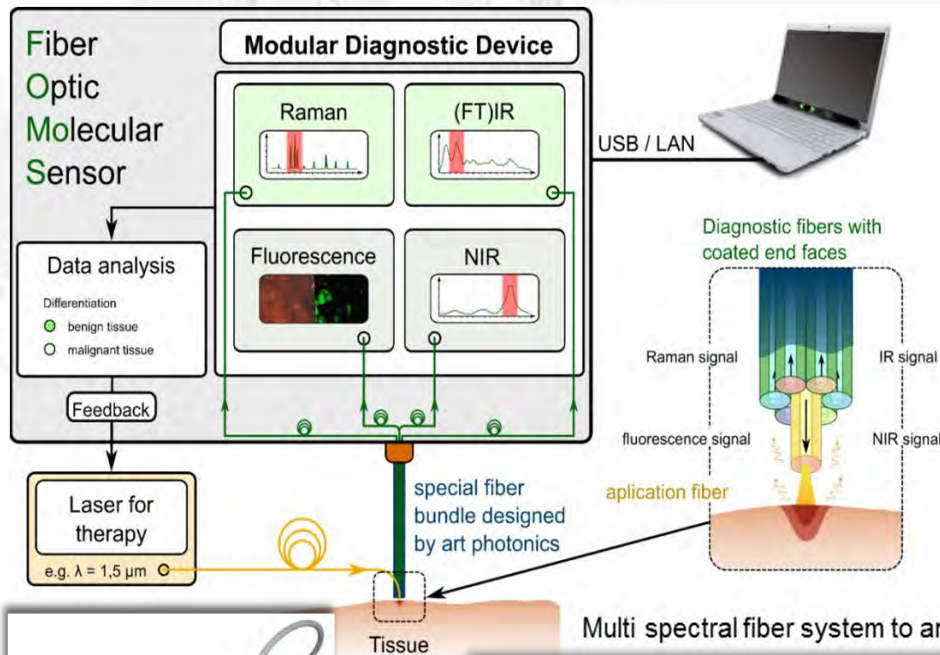
Demands to Medical Fiber Probes:

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



Spectra of normal & tumor kidney tissue with PCA spectra analysis

Multi-Spectral Fiber System for *in-vivo* Diagnostics



National University of Singapore

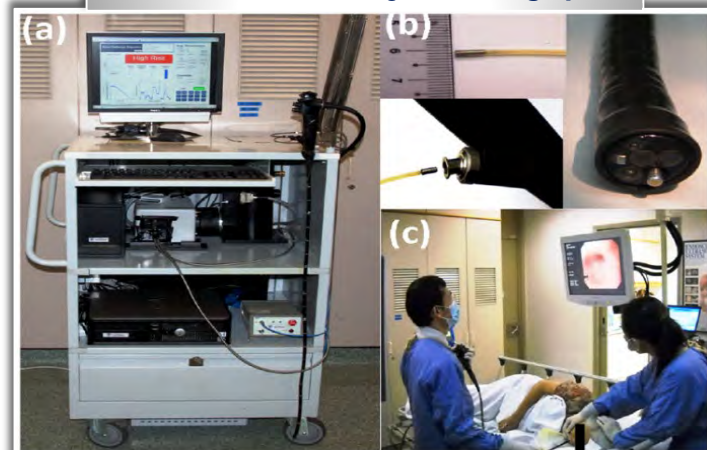
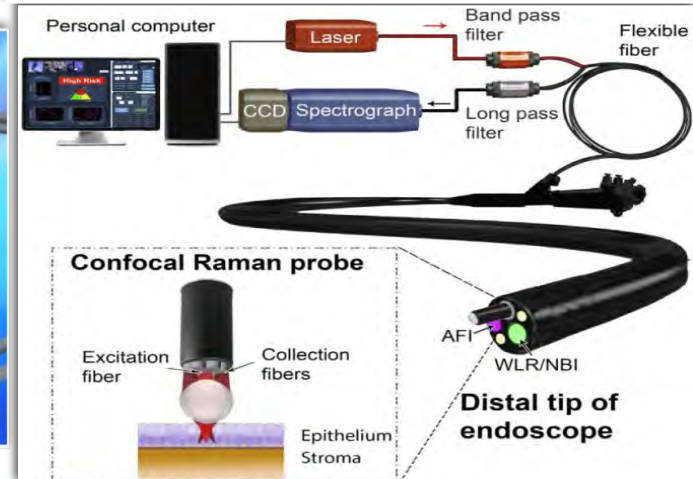


Fig. 1 (a) Photograph of Raman endoscopy system in clinic; (b) insertion of the 1.8 mm Raman endoscopic probe into the working channel of an endoscope during gastroscopy; and (c) routine Raman endoscopy procedure in clinic.



Do you need unique fiber solution in 0.3-16 μ m range?



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EPIC Online Meeting on Endoscopy

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