Tópicos Especiais em Hidráulica e Saneamento: Sensores e Novas Tecnologias para a Melhoria da Qualidade de Água com Monitoramento em Tempo Real

SHS5964

Prof. Dr. Filippo Ghiglieno
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(DF/UFSCar)

Topics

1st day:

- the sensors, the signals and the detection systems;
- the sensor classification;
- the unit of measurements;
- the transfer functions (mathematical models, calibration, computational of a stimulus);
- the sensor characteristics (span, accuracy, calibration error, nonlinearity, saturation,
- repeatability, resolution, uncertainty, output format, environmental factors).

2nd day:

- the physical principles of sensing (electrical charges and fields, capacitance, magnetism, induction, resistance, piezoelectric effect, hall effect, electro-optical effect, thermoelectric effects, sound waves, temperature and thermal properties of materials, heat transfer).

3rd day:

- the optical components of sensors (light, polarization, radiometry, photometry, windows, prisms, mirrors, lenses, fiber optics and waveguides);
- the interface electronic circuits (signal conditioners, sensor connections, excitation circuits, analog to digital converters, data transmission, noise in sensors and circuits, batteries for low power sensors).

4th day: case study: turbidity with a smartphone camera.

5th day: case study: digital holography and particle detection in water with a low cost real time test bench.

Bibliography

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- P. Picart, J.-C. Li. *Digital holography*. Ed. ISTE- Wiley (2012).
- F. Ghiglieno, L. F. Baldasso, C. G. Gonçalos, N. de Aquino, R. M. Lopes. *Ergonomic digital holography for oceanographic applications*. Proc. Blue Photonics 3, Texel Netherlands, 18-20 March 2013 (2013).
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- L. Yeqi, C. Yingyi, F. A Xiaomin. *Review of turbidity detection based on computer vision*. IEEE Access **6** (2018).
- F. Ghiglieno: Agua 4.0 Novas Tecnologias para um Monitoramento e Gerenciamento Inteligente de Recursos Hídricos no dia Mundial da Agua 22/3/2019 (**slides**).
- F. Ghiglieno, E. M. Mendiondo, A. C. B. Delbem, J. C. Estrella, H. L. Carvalho; J. F. Nascimento, K. P. Melo ; A. Firmino: *Put the lab in your pocket: a smart, low-cost, mobile phone system for a real-time prescreening water quality measurements.* Montréal, Canadá International Union of Geodesy and Geophysics (2019).
- H. Ceylan Koydemir; S. Rajpal; Gumustekin, E.; Doruk, K.; Liang, K.; Zoltan, G.; Derek, T.; Aydogan, O. *Smartphone-based turbidity reader*. Sci Rep **9**, 19901 (2019).
- Ascaneo, J. S. *Processamento de imagens de holografia digital para o estudo de organismos planctônicos*. USP Thesis.

Timetable

dicembre 2020
lun 7
mar 8
mer 9
gio 10
ven 11
tutto il g.
Immacolata Concez...
09:00
10:00
11:00
12:00
13:00
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17:00
18:00
19:00
20:00

Timetable

dicembre 2020
lun 14
mar 15
mer 16
gio 17
ven 18
tutto il g.
09:00
10:00
11:00
12:00
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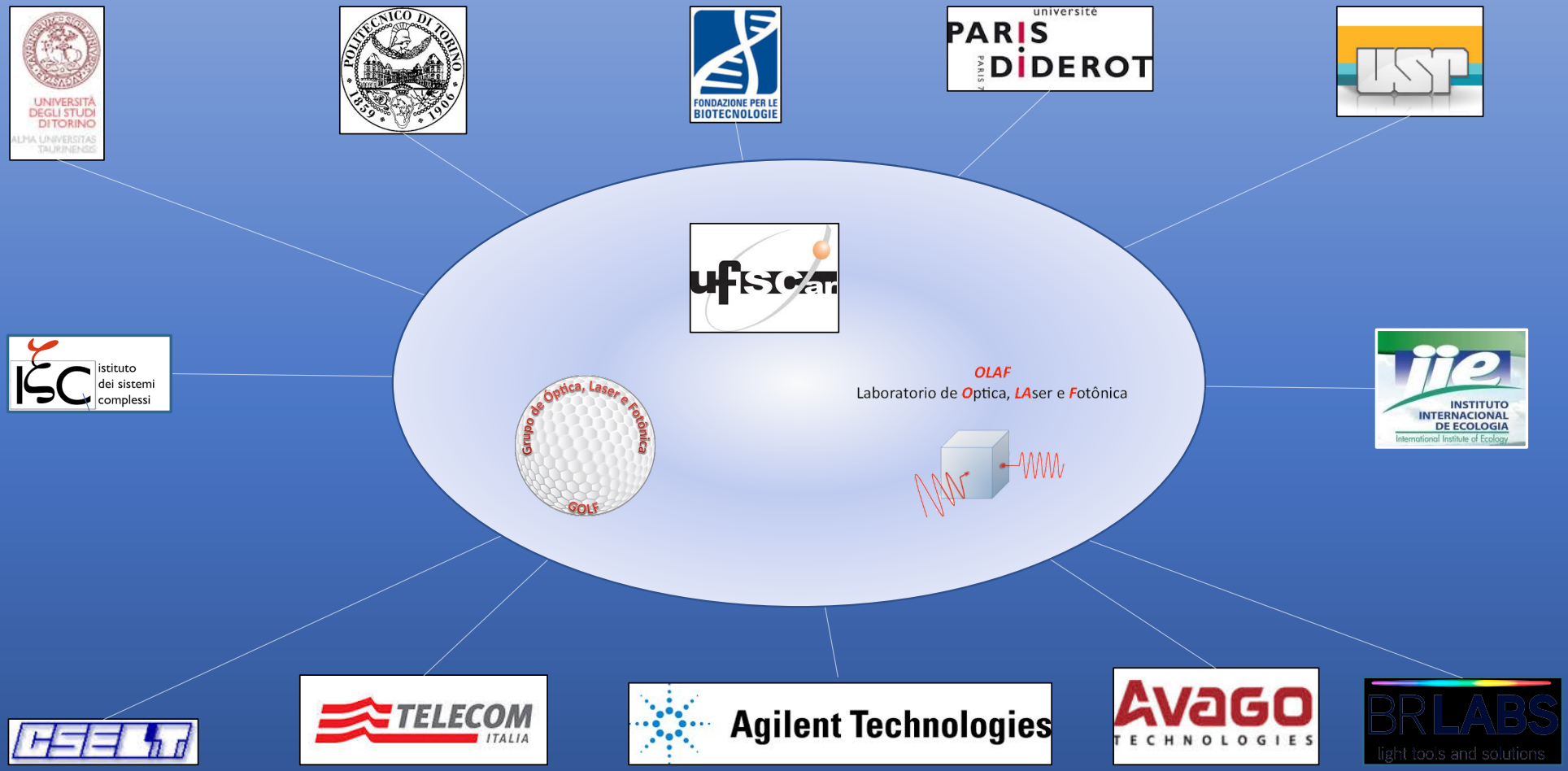
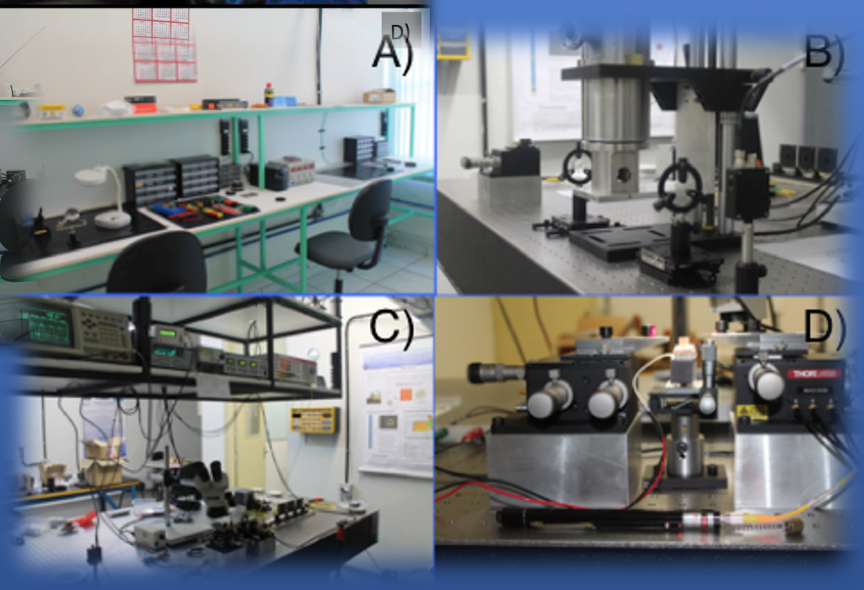
FILIPPO GHIGLIENO: A SHORT CURRICULUM VITAE



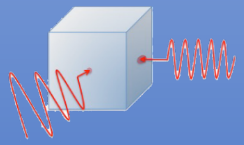
BUILDING THE ÓLAF LABORATORY

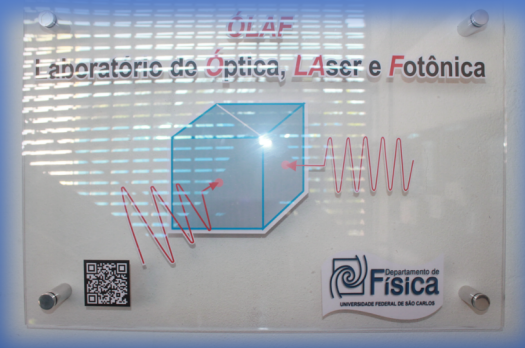
April 2015

April 2017

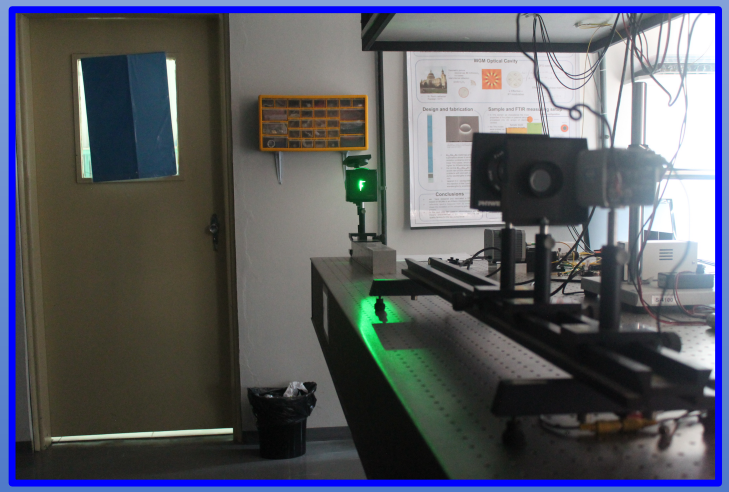


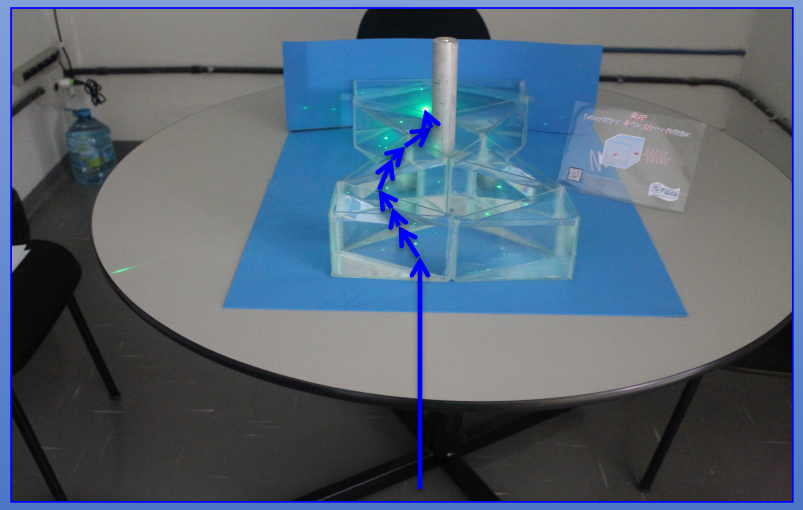
OLAF
Laboratorio de Optica, LAser e Fotônica

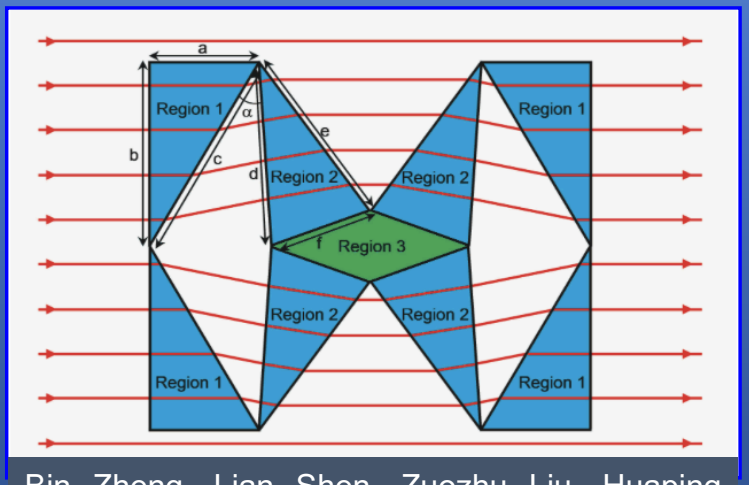




OPTICAL MODELING AT THE ÓLAF LABORATORY

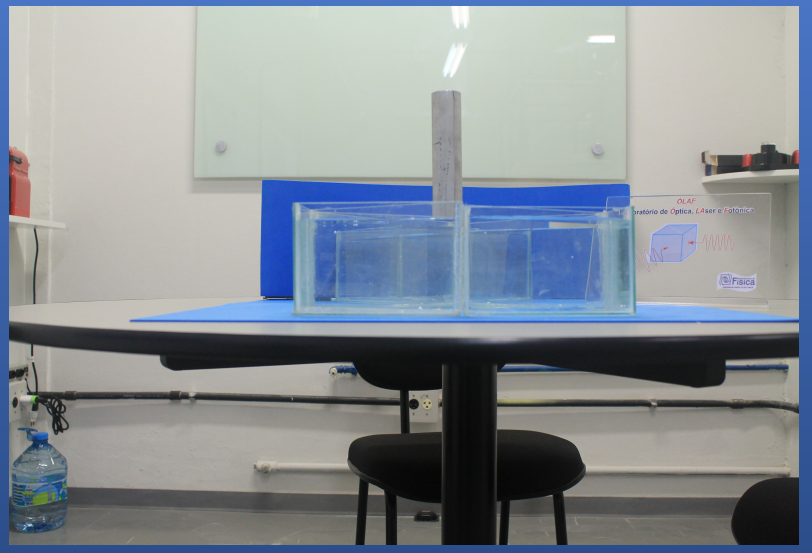






Bin Zheng, Lian Shen, Zuozhu Liu, Huaping Wang, Xianmin Zhang, Hongsheng Chen
Progress In Electromagnetics Research, Vol. **146** (1–5), 2014

DF/UFSCar SEFIs 2016



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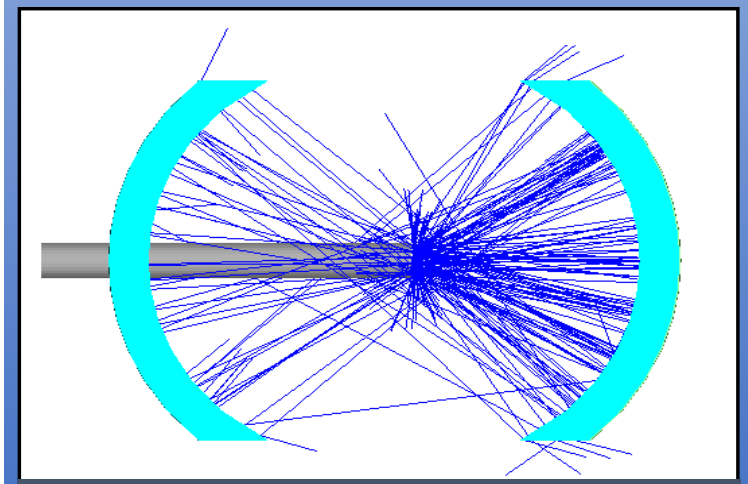
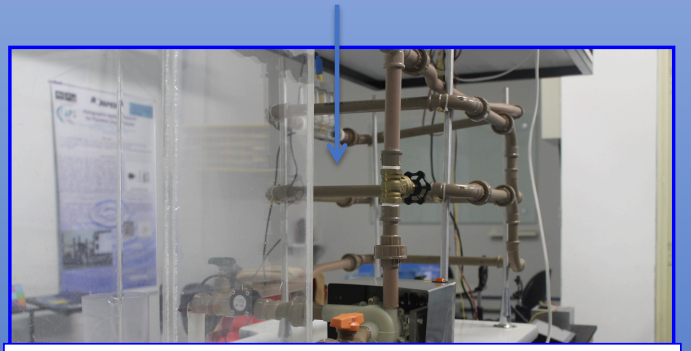


Zeemax optical design
courtesy of PhD Lucimara Scaduto (ÓLAF Lab)



4 ÷ 6%

1.5 ÷ 4%

FAPESP PIPE project 14/50284-8

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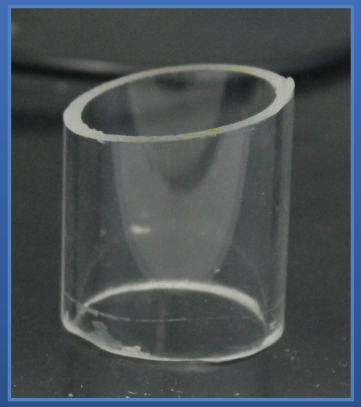

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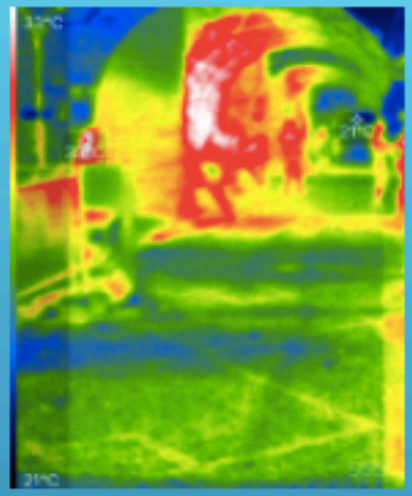

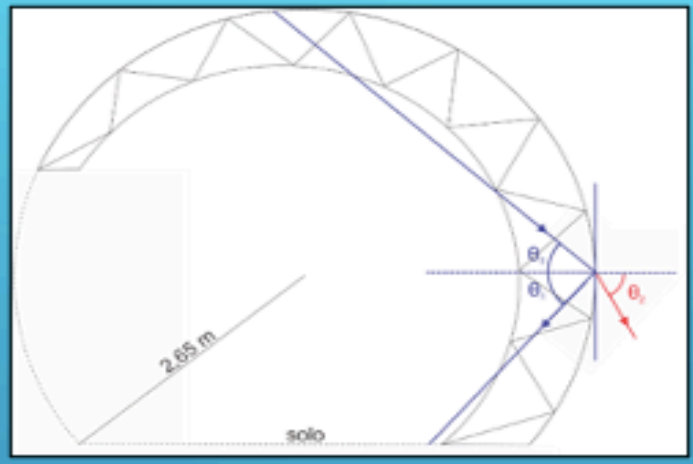

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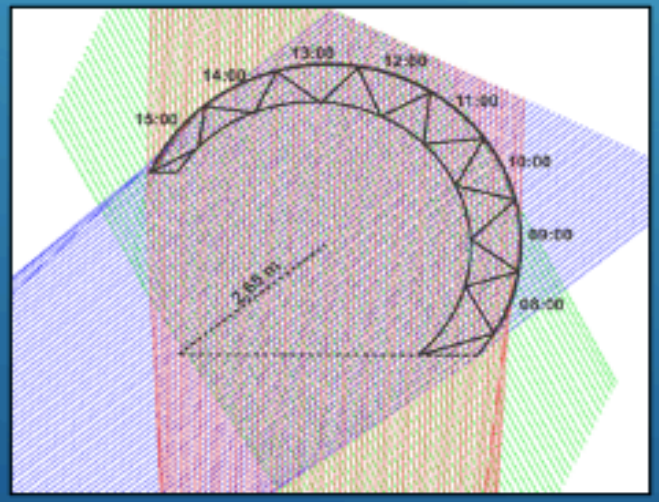
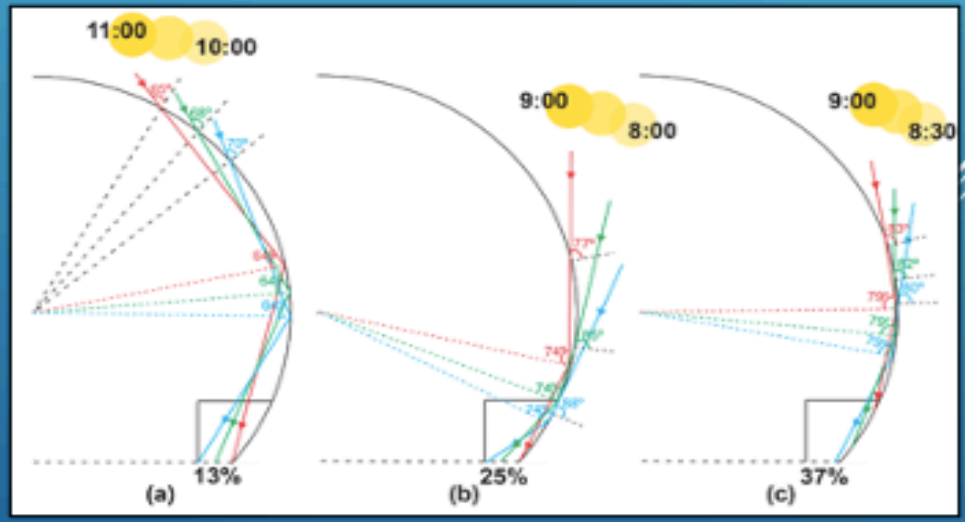
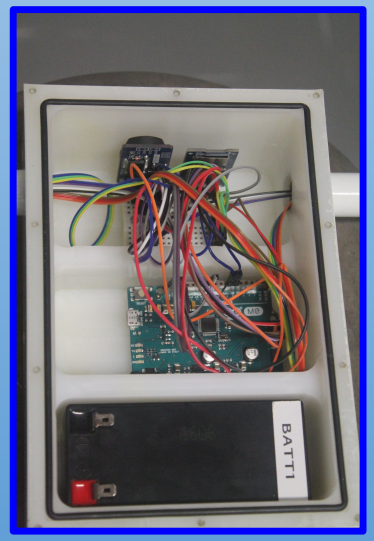




MONITORING STATION FABRICATION AND TEST AT THE ÓLAF LABORATORY



SINGEURB 2017
I Simpósio Nacional de Gestão e Engenharia Urbana

Área: Gestão e Planejamento Urbano

Calvi, F. A., Ramos, G. P., Ghiglieno F.

MONITORAMENTO DA TEMPERATURA EM TEMPO REAL EM PONTOS DE ÔNIBUS NA CIDADE DE SÃO CARLOS

SINGEURB 25-27/10/2017 São Carlos (SP-Brazil)

G1 SÃO CARLOS E ARARAQUARA EPTV

Temperatura em ponto de ônibus coberto sobe até 10 graus, diz estudo da UFSCar

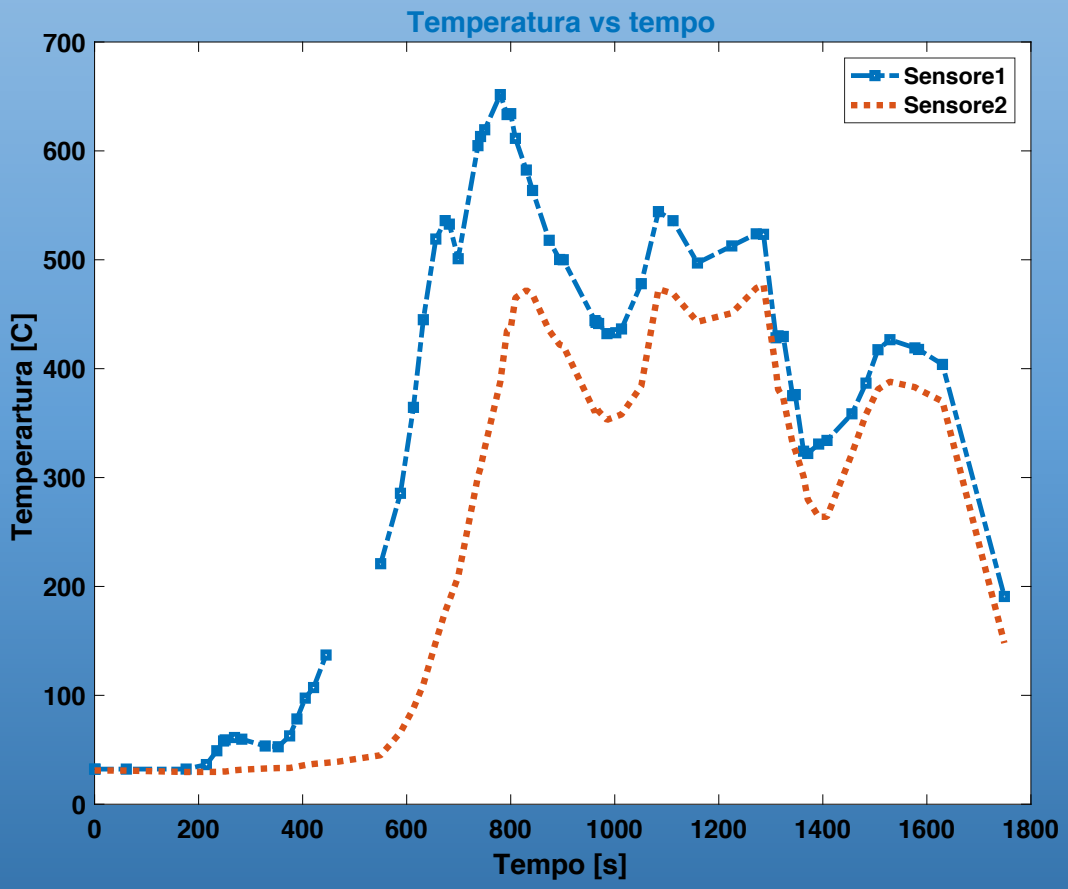
Pesquisadores compararam números dentro e fora dos locais em São Carlos, SP. Formato e cor contribuem para reter o calor. 'Sensação de forno', afirma físico.

Por G1 São Carlos e Araraquara

24/09/2017 17h25 · Atualizado há 3 anos

MONITORING STATION FABRICATION AND TEST AT THE ÓLAF LABORATORY

Test 30/5/2019

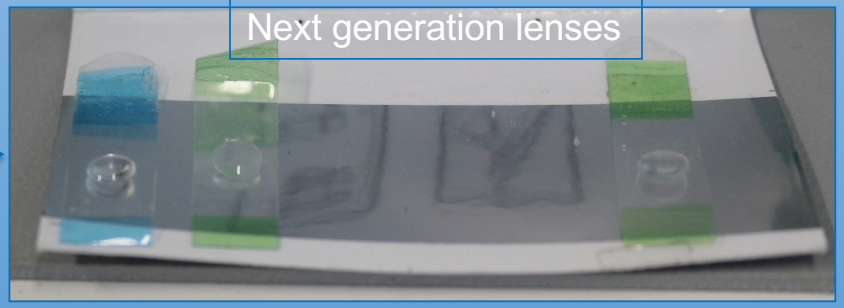


OPTICAL DESIGN AND DEVELOPMENT AT THE ÓLAF LABORATORY

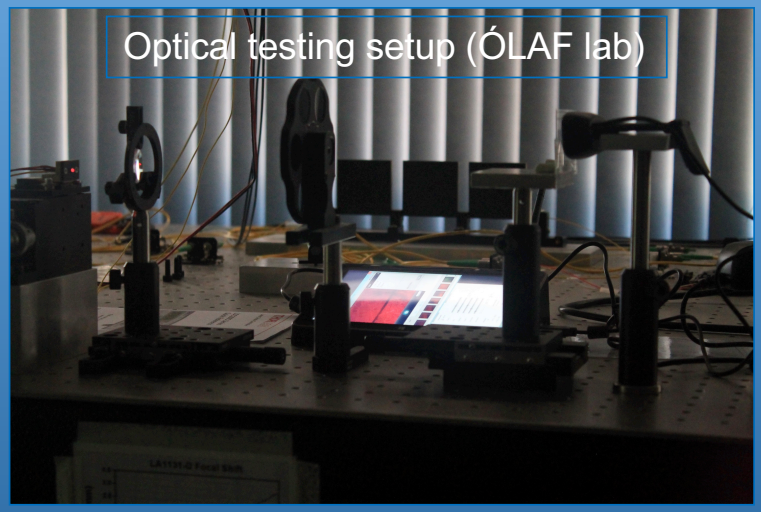
Lens maker equation

$$\frac{1}{f} = (n-1)\left[\frac{1}{R_1} - \frac{1}{R_2} + \frac{(n-1)d}{nR_1R_2}\right]$$

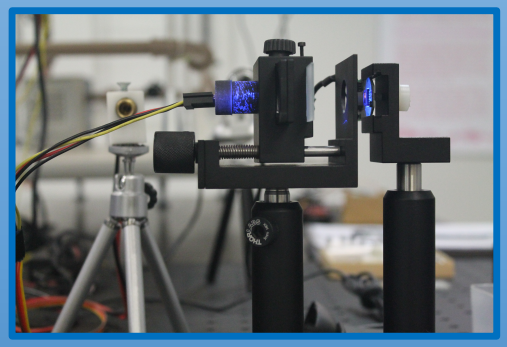
Next generation lenses



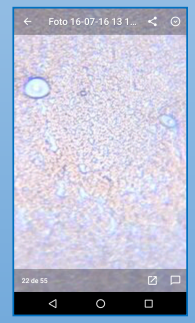
Optical testing setup (ÓLAF lab)

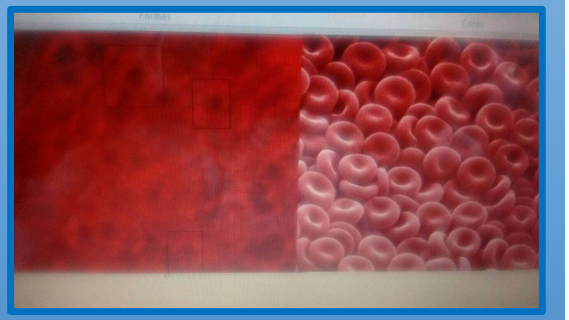


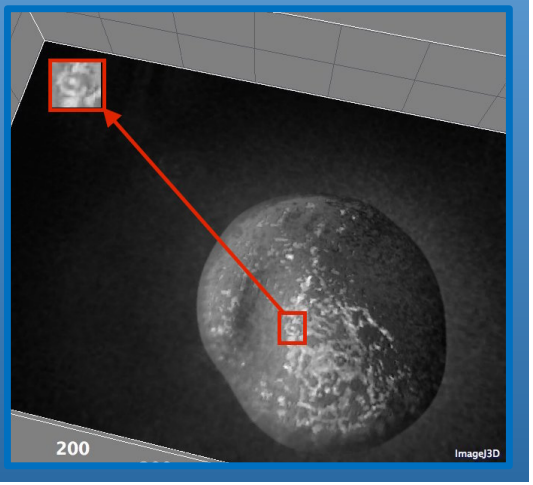
Mobile phone based blood test



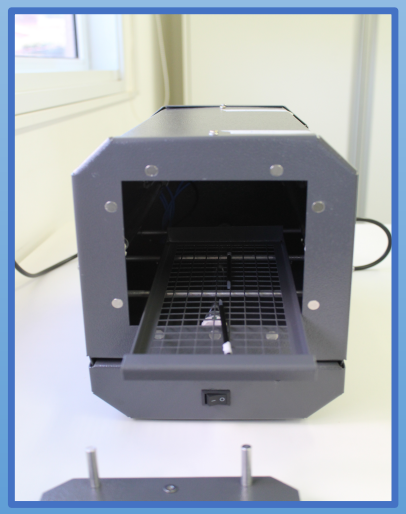
Patent number
BR 1020160237457-2
EPO WO2018068112A1
inventors
Patricia Guedes Braguine
Filippo Ghiglieno



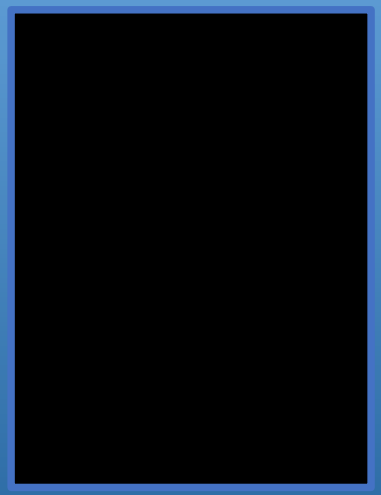


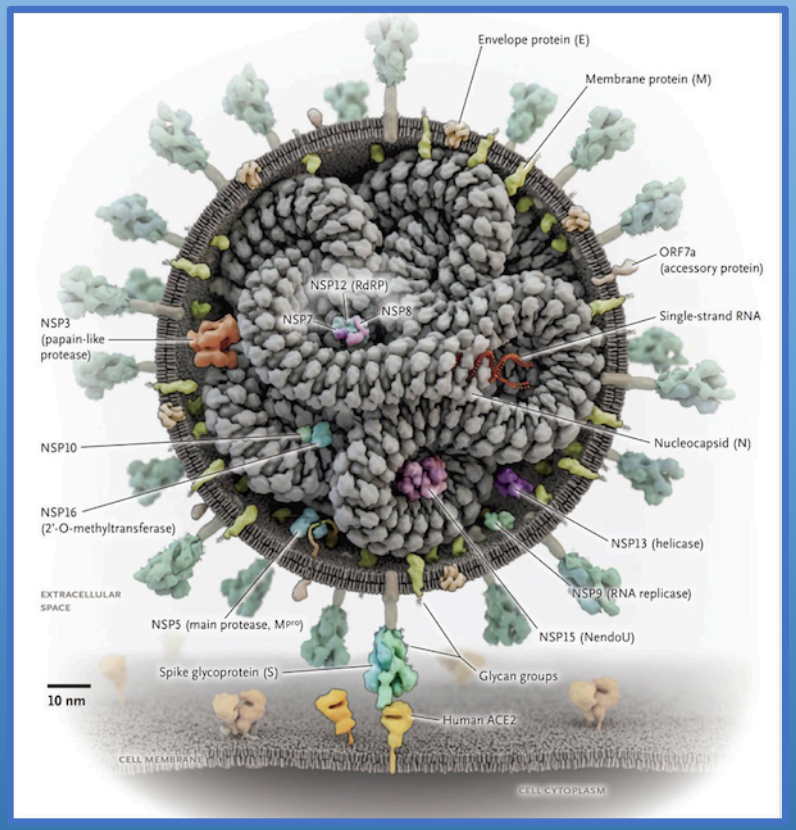


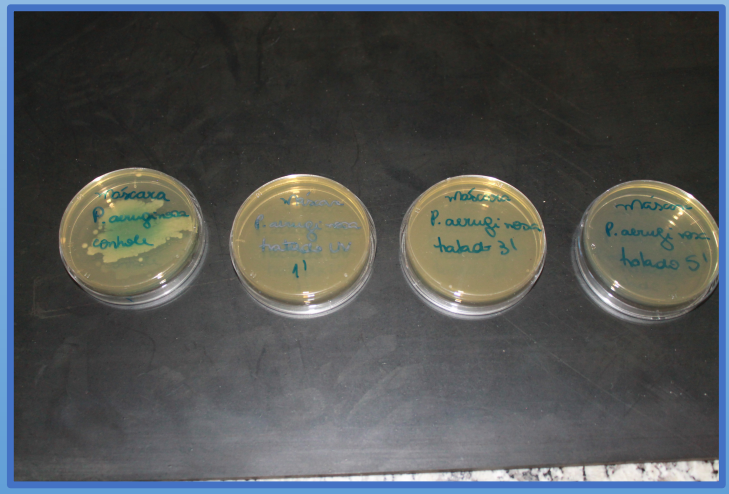
SARS – COV2

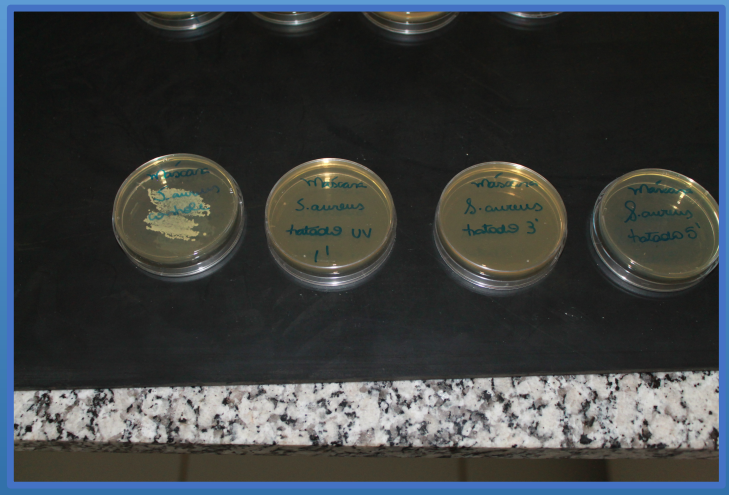


ASEPSIS KIT





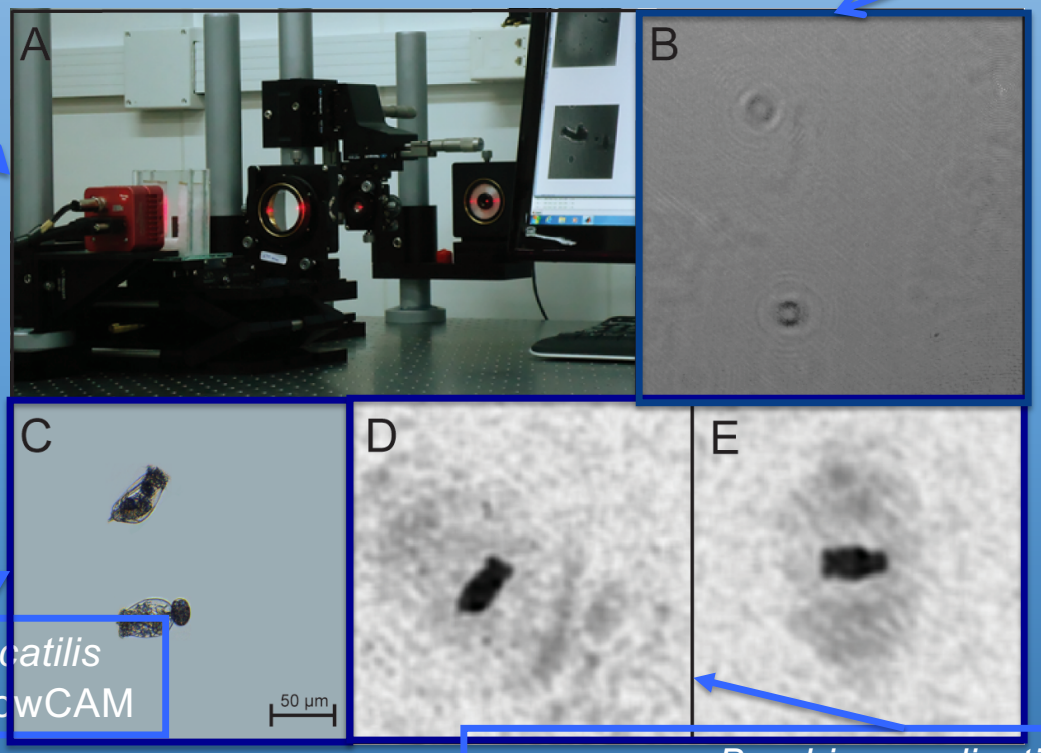




HOLOGRAPHY AND HOLOGRAPHIC MICROSCOPY AT THE ÓLAF LABORATORY

Experimental setup

Hologram



Brachionus plicatilis
image from a FlowCAM

Brachionus plicatilis
2 processed hologram images 3x digital zoom

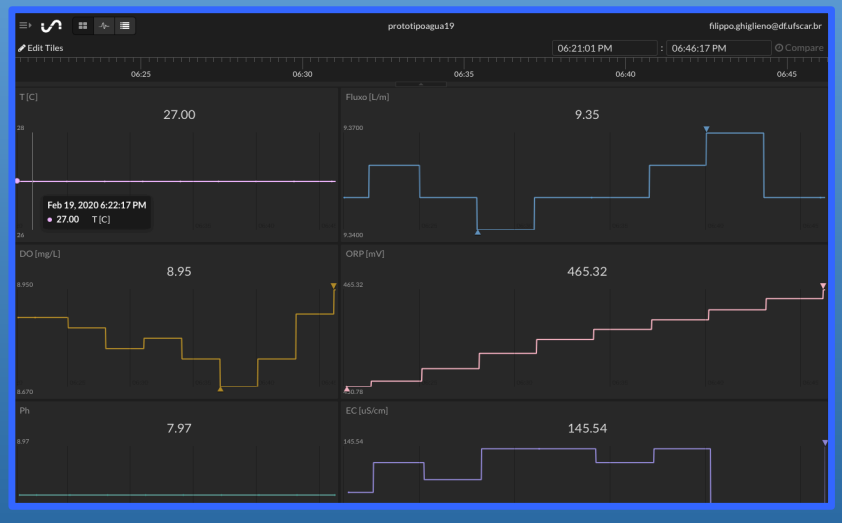
FAPESP HARPIA project
2011/20994-5

F. Ghiglieno, L. F. Baldasso, C. G. Goçalo, N. de Aquino, and R. M. Lopes. *Ergonomic digital holography for oceanographic applications.* 3rd Topical Meeting on Blue Photonics, NIOZ Texel (Oral session), 2013

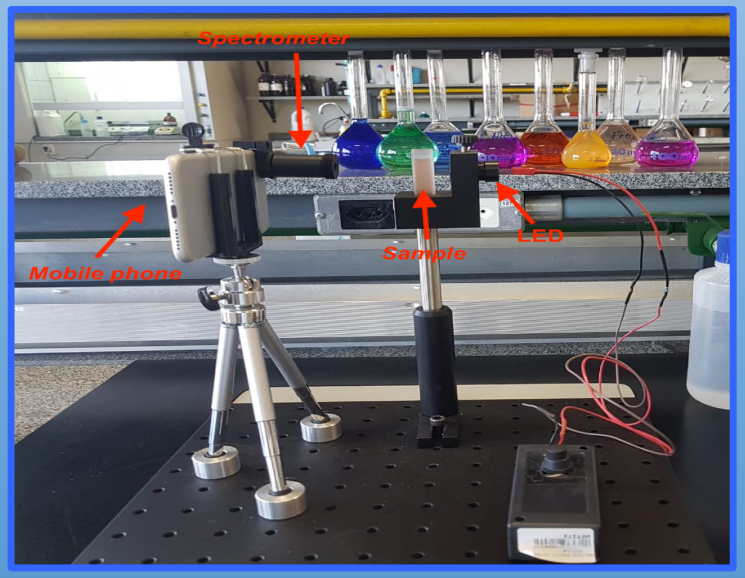
WATER QUALITY MONITORING AT THE ÓLAF LABORATORY

Rea-time pipeline monitoring

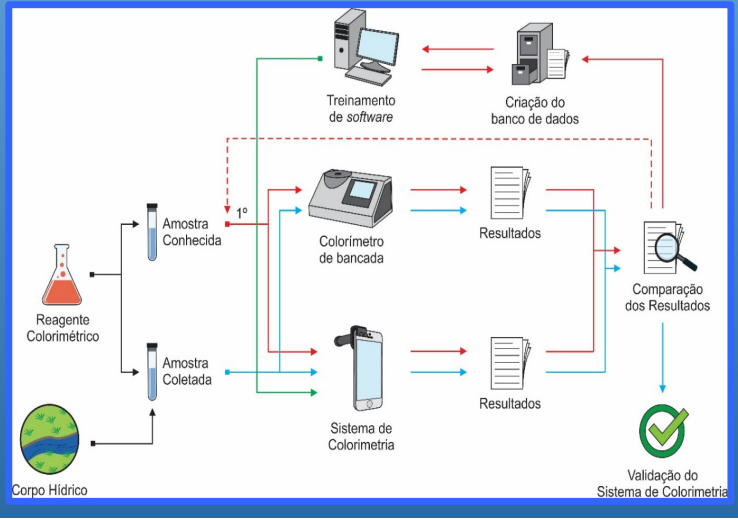
T. M. Tundisi, J. G. Tundisi : Water Resources Management (pag. 181) Editora Scienza (2018)



Colorimetry



Ghiglieno, E. M. Mendiondo, A. C. B. Delbem, J. C. Estrella, H. L. Carvalho; J. F. Nascimento, K. P. Melo ; A. Fimino: *Put the lab in your pocket: a smart, low-cost, mobile phone system for a real-time prescreening water quality measurements.* Montréal, Canadá International Union of Geodesy and Geophysics (2019)

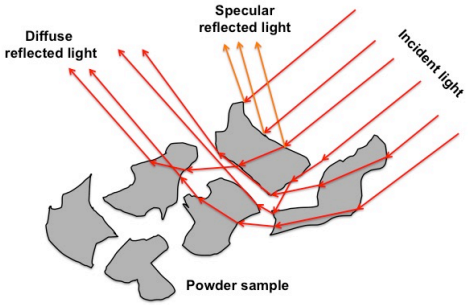


FAPESP PROJECT
2020/10046-1

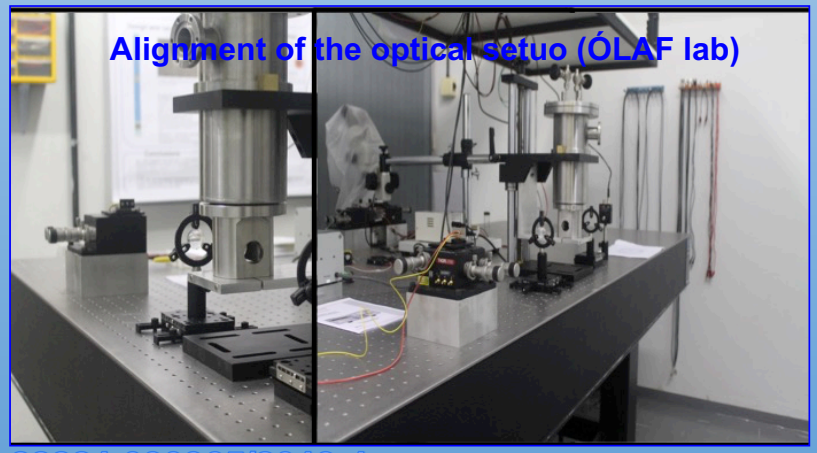
OPTICS FOR LASER SPECTROSCOPY AT THE ÓLAF LABORATORY

- E. Ilisca; F. Ghiglieno Chemical **Phys. Lett**. Vol. 667, (2017)
- E. Ilisca;F. Ghiglieno **Royal Society Open Science** Vol. 3, no. 9, (2016)
- E. Ilisca ; F. Ghiglieno **European Physical Journal. B**, Vol. 87,(2014)

Scattered light from a powder

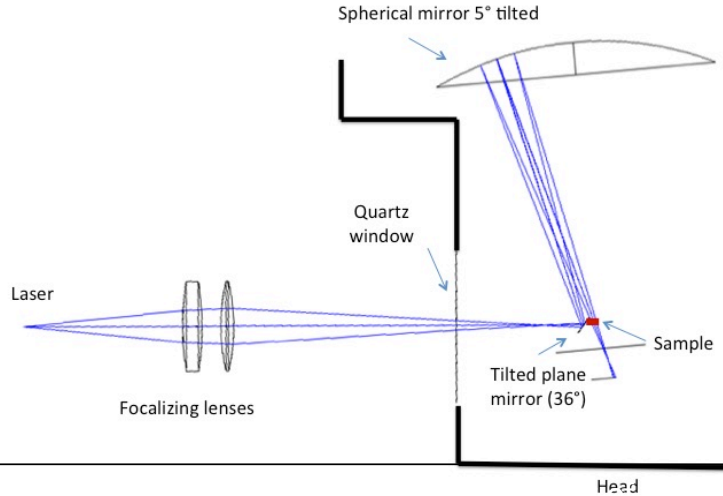


Alignment of the optical setuo (ÓLAF lab)

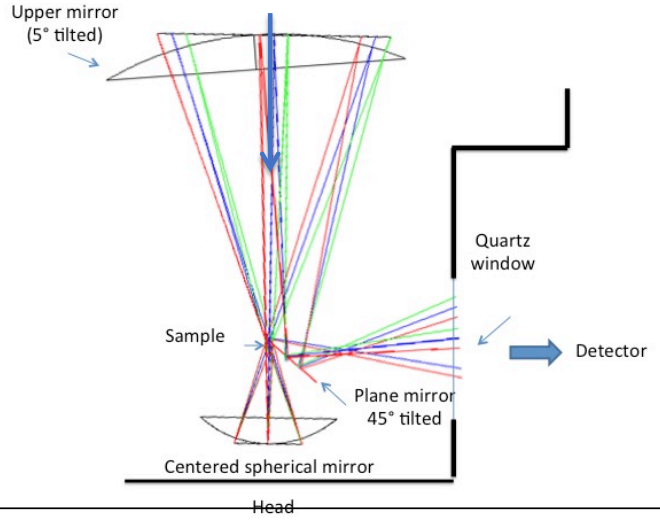


CAPES PVE PROGEMIA 88881.030365/2013-1

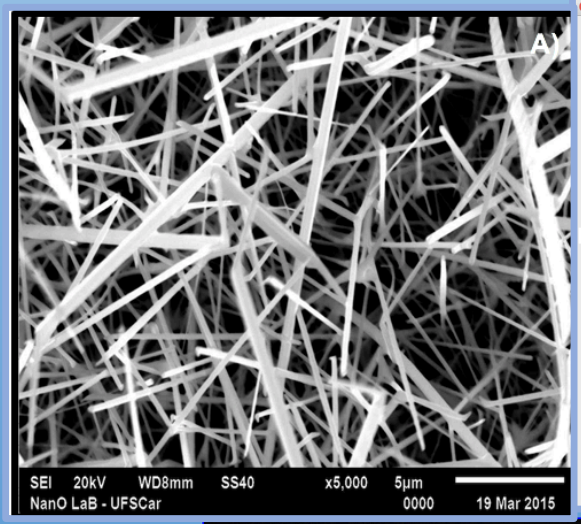
Incoming light path: ray tracing design

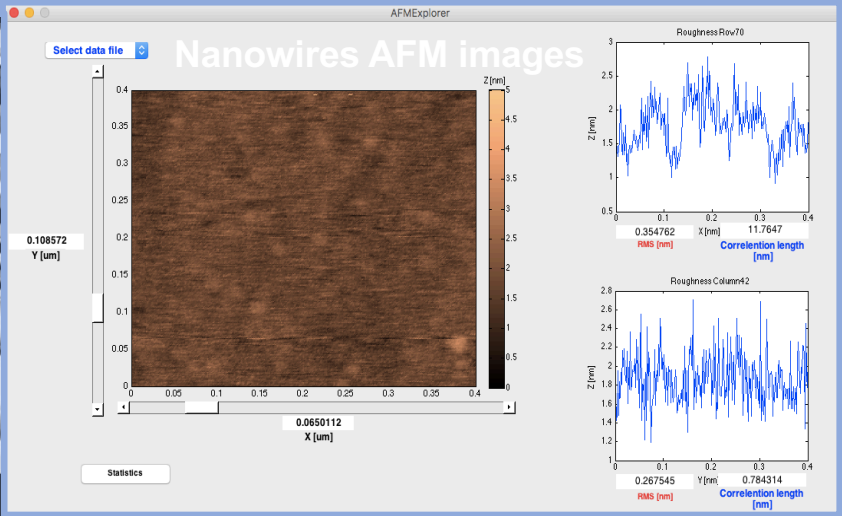


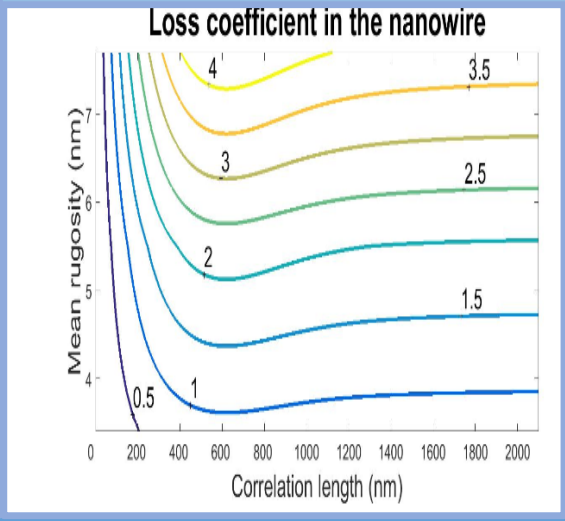
Outcoming light path: ray tracing design

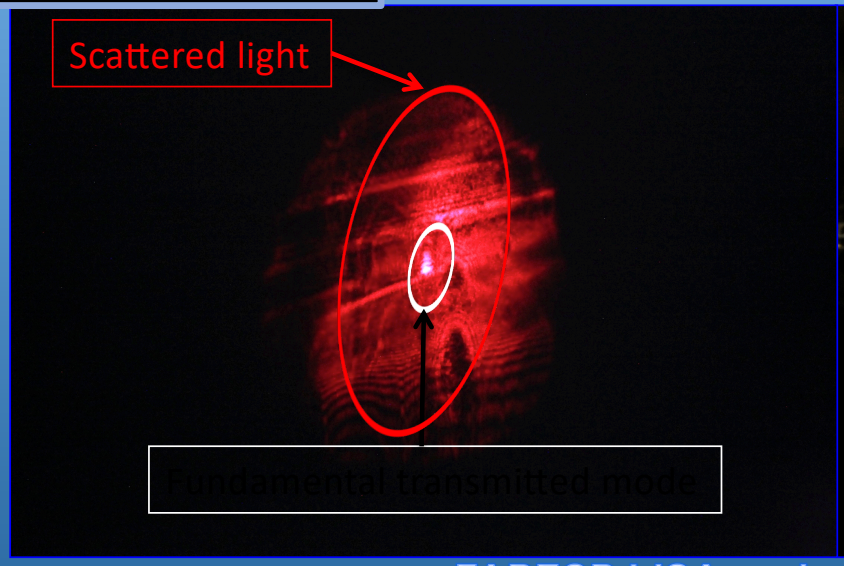


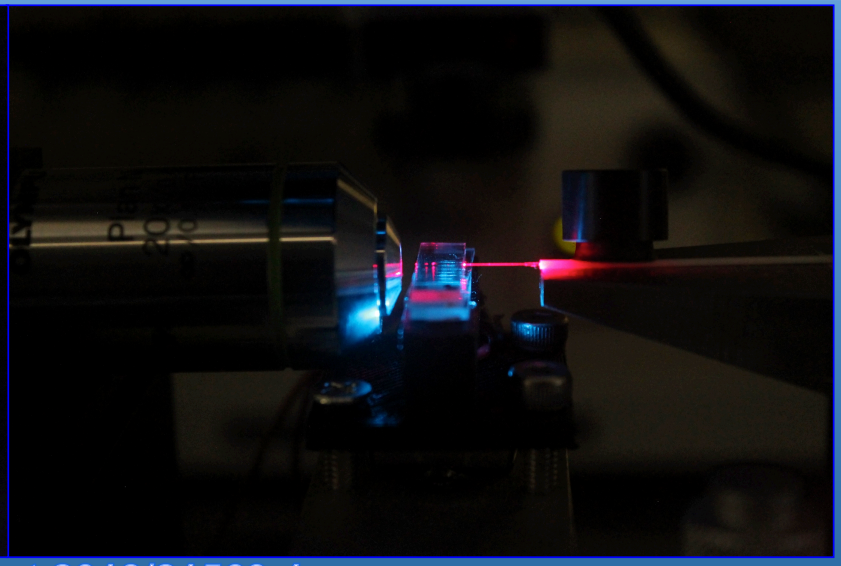
PHOTONICS AT THE ÓLAF LABORATORY











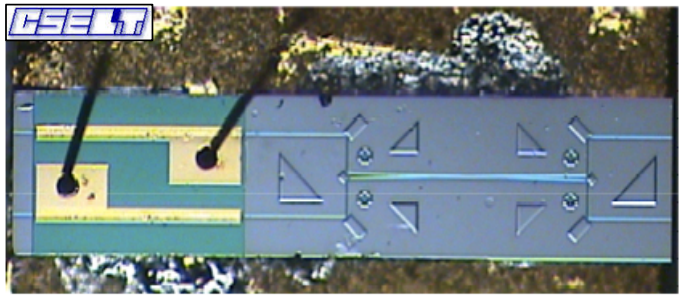
M.Ferreira, F. Ghiglieno et al. 3NANO conference (Brasilia) 2015

FAPESP LISA project 2013/21569-1

I & MY EXPERIENCE WITH THE INTEGRATED OPTICS

1999: Wavelength converter working at 10 Gbit/s

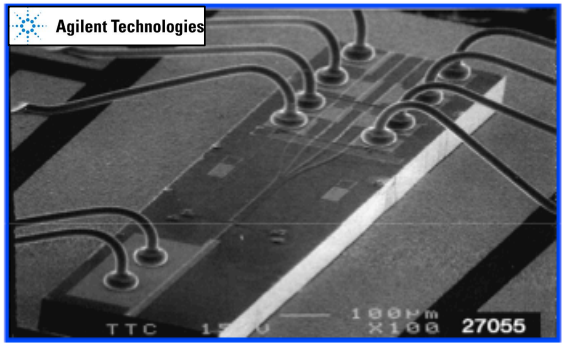
InP/InGaAsP



C. Rigo; C. Coriasso; D. Campi; C. Cacciatore; F. Ghiglieno et al. **Journal of Crystal growth**, Vol 209 (2000)

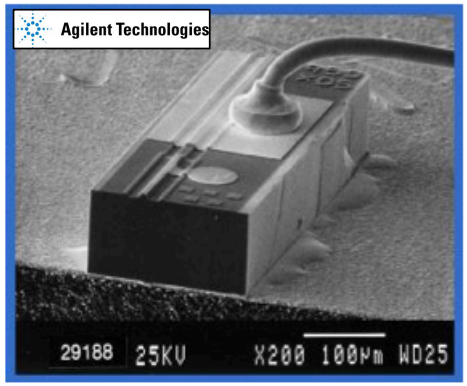
2001: Tunable laser on 70nm range

InP/InGaAsP



2002-2005: DFB laser+EAM

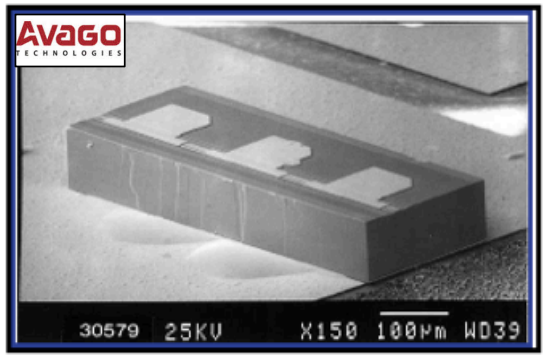
InP/AlGaInIAs



E. Foti; L. Fratta; F. Ghiglieno; C. Coriasso; C.Cacciatore, et al. **Optoelectronics, IEE Proceeding,** Vol. 15(1) (2004)

2005-2008: InAs/GaAs quantum dot laser

GaAS/AlGaAs



M. T. Todaro; A. Salhi; F. Ghiglieno; R. Cingolani, R. et al. **Photonics Technology Letters**, IEEE, Vol. 19, no. 4, (2007)