

# TOWARDS AN ON-CHIP OPTICAL MICROSYSTEM FOR SPECTROSCOPIC DETECTION OF GASTROINTESTINAL DYSPLASIA

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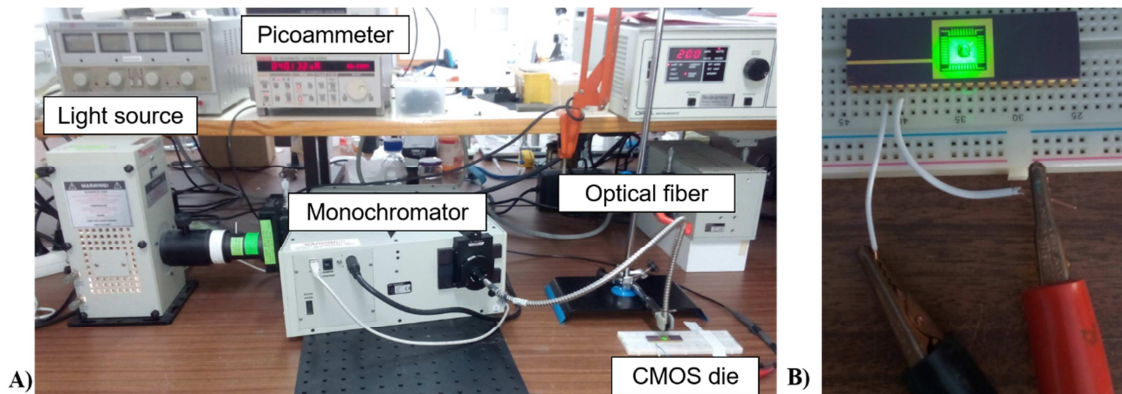
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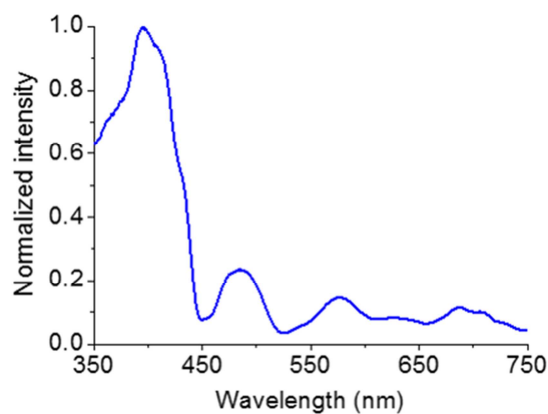
## Supplementary Information

### A1. Optical setup used for the CMOS photodiode characterization



**Figure S1.** A) Optical setup used for the CMOS photodiode spectral characterization. B) CMOS die mounted in the chip-carrier and with the picoammeter cables to measure the photodiode current.

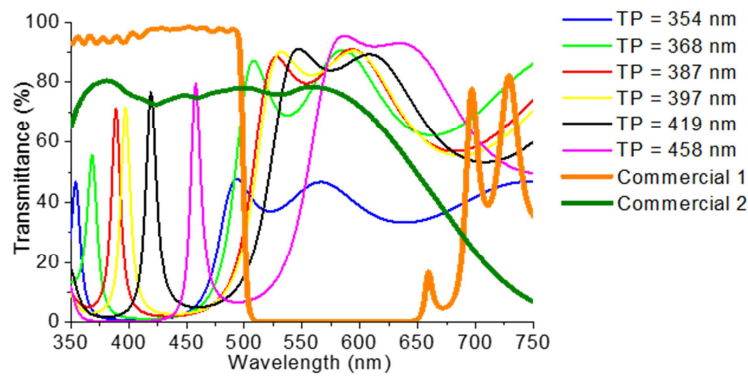
### A2. Intensity curve of the light source used for the experimental measurements



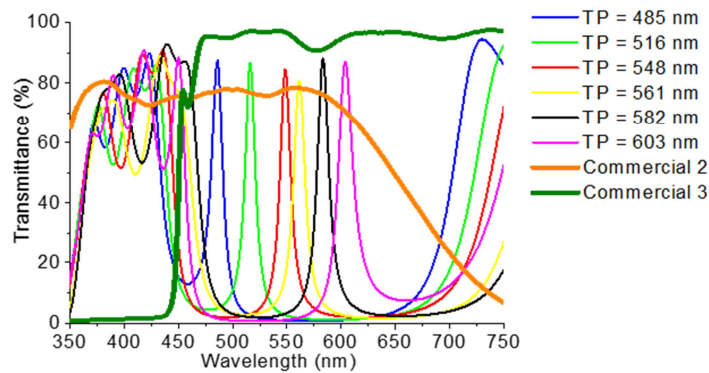
**Figure S2.** Normalized intensity curve of the light source used for experimental measurements.

### A3. Intensity curves of the fabricated optical filters with commercial optical filters to remove second order effects

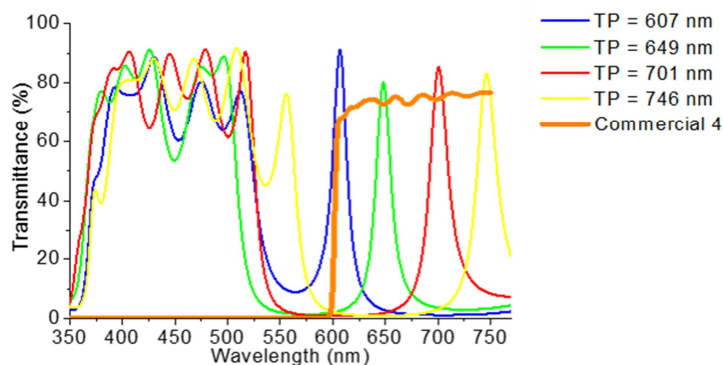
For the fabricated optical filters in the UV/Vis (Ultraviolet/Visible) region, it is necessary to use two commercial optical filters: commercial 1 (from *Edmund Optics*) and commercial 2 (*FSQ-KG5* from *Newport*) – Figure S3. For the optical filters in the Visible region, it is also necessary to use two commercial optical filters: commercial 2 (*FSQ-KG5* from *Newport*) and commercial 3 (from *Edmund Optics*) – Figure S4. Finally, for the optical filters in the Vis/IR (Visible/Infrared) region, it is necessary to consider one commercial optical filter: commercial 4 (*FEL0600* from *Thorlabs*) – Figure S5.



**Figure S3.** Transmittance spectra of the fabricated optical filters in the UV/Vis region and commercial optical filters used to eliminate second order effects. TP: filter maximum transmittance peak wavelength.

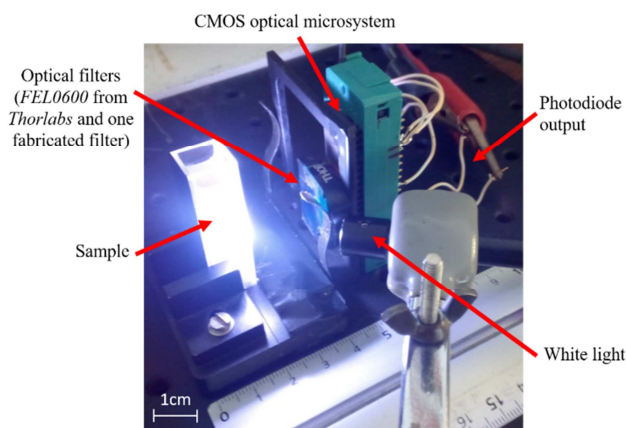


**Figure S4.** Transmittance spectra of the fabricated optical filters in the Vis region and commercial optical filters used to eliminate second order effects. TP: filter maximum transmittance peak wavelength.



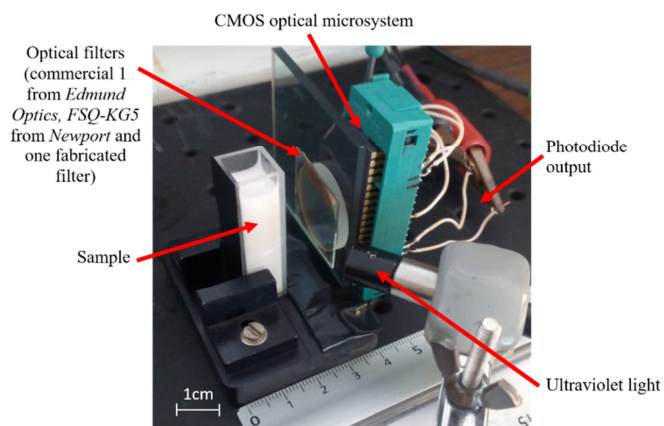
**Figure S5.** Transmittance spectra of the fabricated optical filters in the Vis/IR region and commercial optical filter used to eliminate second order effects. TP: filter maximum transmittance peak wavelength.

#### A4. Optical setup used for the diffuse reflectance experimental measurements



**Figure S6.** Optical setup implemented for the diffuse reflectance experimental measurements.

#### A5. Optical setup used for the fluorescence experimental measurements

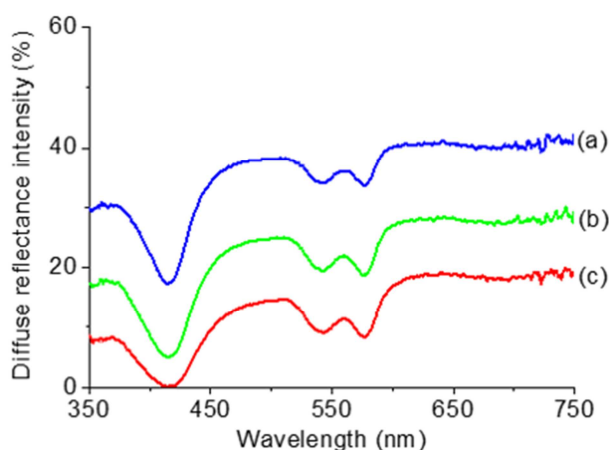


**Figure S7.** Optical setup implemented for the fluorescence experimental measurements.

## A6. Diffuse reflectance measurements using a group of phantoms with a commercial spectrophotometer (*Shimadzu UV-3101PC*)

**Table S1.** Phantoms prepared for diffuse reflectance experimental measurements with a commercial spectrophotometer.

Phantom	Hemoglobin concentration (mg/mL)	Polystyrene beads concentration (%)	NADH concentration ( $\mu\text{g/mL}$ )	Carbostyryl concentration ( $\mu\text{g/mL}$ )
(a)	0.25	0.50	0.50	1.50
(b)	0.50	0.25	1.00	1.00
(c)	1.00	0.15	1.50	0.50



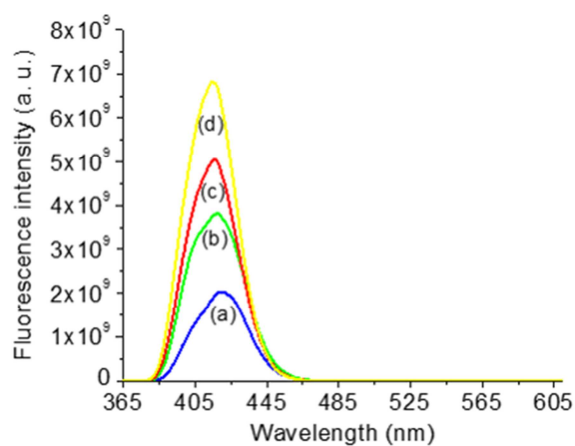
**Figure S8.** Diffuse reflectance spectra of the phantoms presented on Table S1.

## A7. Fluorescence measurements using a group of phantoms with a commercial spectrofluorometer (*SPEX® FluoroLog® 2*)

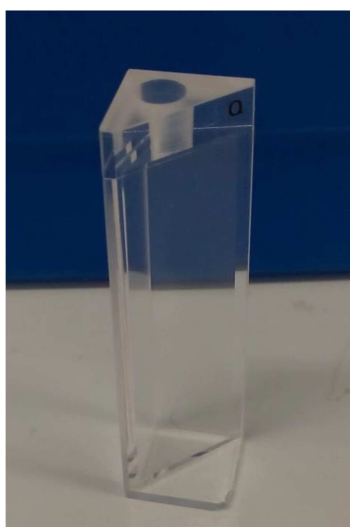
In the experimental measurements, it was used a front-face geometry, where it is detected the light emitted from the same surface of the excitation light incidence, and triangular quartz cuvettes (with 3 windows, see Figure S10), since on the optical setup of Figure S7, the angle between illumination and detection is approximately  $45^\circ$ . Moreover, the equipment excitation and emission slits were opened and the tension of the photomultiplier was lowered, to avoid saturation.

**Table S2.** Phantoms prepared for fluorescence experimental measurements with a commercial spectrofluorometer.

Phantom	Hemoglobin concentration (mg/mL)	Polystyrene beads concentration (%)	NADH concentration ( $\mu\text{g/mL}$ )	Carbostyryl concentration ( $\mu\text{g/mL}$ )
(a)	0.25	0.50	25	75
(b)	0.25	0.50	50	150
(c)	0.25	0.50	75	225
(d)	0.25	0.50	100	300



**Figure S9.** Fluorescence spectra (excitation at 350 nm) of the phantoms presented on Table S2.



**Figure S10.** Triangular quartz cuvette used for fluorescence measurements on the spectrofluorometer (SPEX® FluoroLog® 2).