

# HyperCube™

## HYPERSPECTRAL FILTER

The HyperCube is a hyperspectral filter continuously tunable in the VIS, NIR and SWIR spectral ranges. This filter is designed to fit commercial upright or inverted microscopes and couples with standard cameras and excitation modules. Designed around high-throughput Bragg grating filters, the HyperCube is perfectly suited for luminescence, darkfield, and brightfield hyperspectral imaging.



The HyperCube™ can be used in an upright or in an inverted microscope configuration



### TECHNICAL SPECIFICATIONS

|                              | VIS - SWIR   |             |
|------------------------------|--|-------------|
|                              | 400-1620 nm  |             |
|                              | VIS  | SWIR        |
| Spectral range*              | 400-1000 nm  | 900-1620 nm |
| Spectral resolution (FWHM)   | < 2 nm   | < 4 nm      |
| Spectral channels            | Continuously tunable   |             |
| Spatial resolution           | Sub-micron - limited by microscope objective NA  |             |
| Camera                       | Provided by customer - brand and model must be approved  |             |
| Microscope                   | Provided by customer - brand and model must be approved  |             |
| Wavelength absolute accuracy | FWHM/8   |             |
| Maximum scanning speed       | 150 ms per wavelength  |             |
| Video mode                   | Filtered and non-filtered visualization  |             |
| Preprocessing                | Image stabilization, spatial filtering, statistical tools, spectrum extraction, data normalization, spectral calibration |             |
| Hyperspectral data format    | HDF5, FITS   |             |
| Software                     | PC (Windows10 - 64-bits) with PhySpec™ control and analysis software (computer not included)                             |             |
| Dimensions ( L x W x H )     | 550 mm x 300 mm x 450 mm   |             |
| Weight                       | 8 kg (VIS), 7.2 kg (SWIR)  |             |
| Operating temperature        | 10 to 40 -°C   |             |
| Storage temperature          | 0 to 50 -°C  |             |
| Power requirement            | 120 VAC / 1 A / 60 Hz<br>230 VAC / 1 A / 50 Hz   |             |
|                              | *Other spectral ranges available upon request  |             |
|                              | Objectives, epifluorescence filter and illumination modules provided by customer   |             |

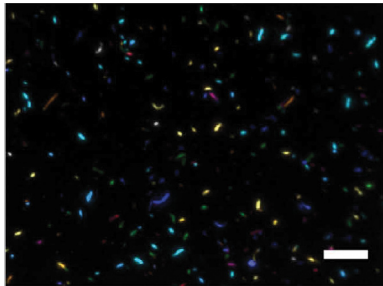
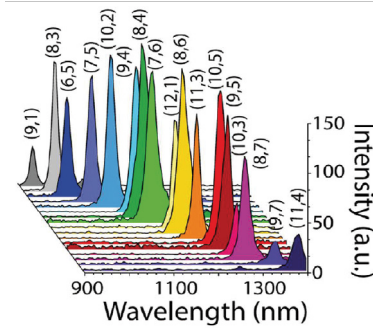
# APPLICATIONS

## 1. MULTIPLEXING

*Spectral and spatial identification of CNT*

False color fluorescence image of SDC-suspended HiPco carbon nanotubes on a glass surface. Each color (17 species) corresponds to a spectrum, as shown below.

REF: Roxbury D. et al. DOI 10.1038/srep14167

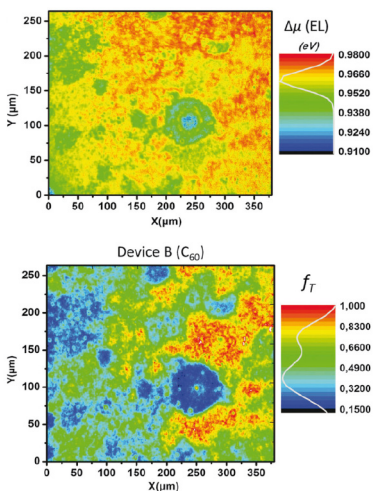


## 2. INHOMOGENEITY – DEFECTS MAPPING

*Luminescence mapping of perovskite devices, absolute calibrated intensity*

The top image represents absolute mapping of the quasi-Fermi level splitting derived from EL, for perovskite cells using  $C_{60}$  as the ETL. The lower image represents mapping of the current transport efficiency  $f_T$ .

REF: El-Hajje G. et al. DOI: 10.1039/c6ee00462h



## KEY POINTS - SPECTRAL AND SPATIAL IMAGING

- » Imaging of multiplexed emitters
- » Study of sample formation, degradation and identification of deficient areas
- » Mapping of spectral heterogeneities
- » Access to the second biological window (900 - 1620 nm)
- » Fast imaging – 1.4 million spectra in minutes
- » Large area – hundreds of  $\mu\text{m}^2$  up to a few  $\text{mm}^2$  with fast stitching

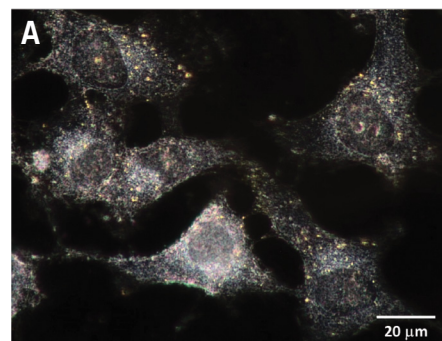
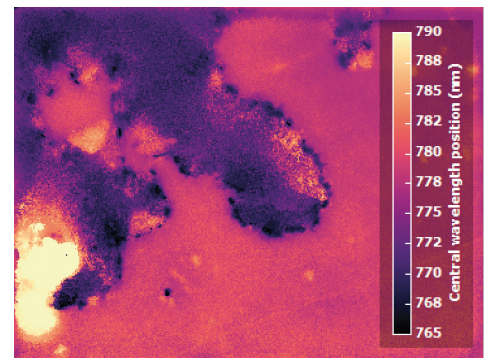
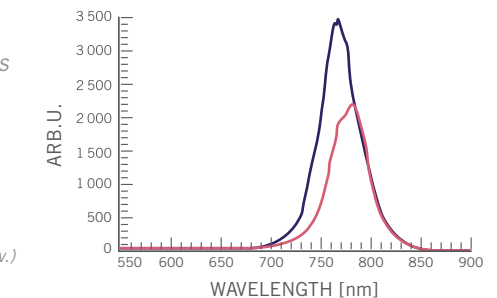
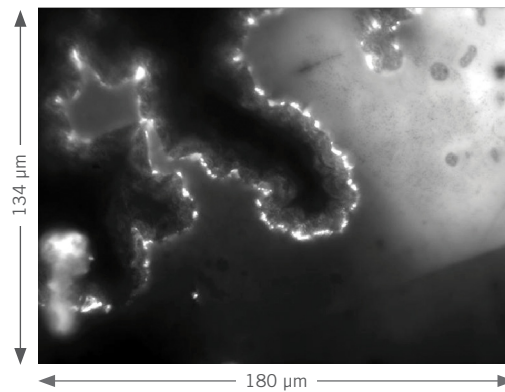
## 3. DEGRADATION - SAMPLE GROWTH

*Photoluminescence mapping of perovskite crystals*

Black and white - PL image extracted at 770 nm, Colored image - false color map of the PL central wavelength,

Side figure - two PL spectra extracted from the hyperspectral data – see corresponding colors.

REF: Samples provided by Mercuri Kanatazidi (Northwestern Univ.) and David Cooke (McGill).



## 4. CELL LABELLING

*Darkfield imaging of gold nanoparticles*

A) Darkfield image of human breast cancer cells tagged with gold nanoparticles (60 nm size), B) monochromatic image at 550 nm. GNPs marked in green after PCA, C) magnification of a breast cancer cell, D) and spectra of GNPs in different areas. Peaks at 550 nm confirm the presence of single 60 nm NPs. The absence of strongly red-shifted peaks confirm the absence of aggregated NPs. The hyperspectral camera did not detect any GNPs in the areas between the cells.

REF: Results kindly provided by: David Rioux, Éric Bergeron and Michel Meunier, at École Polytechnique of Montreal, Quebec, Canada.

