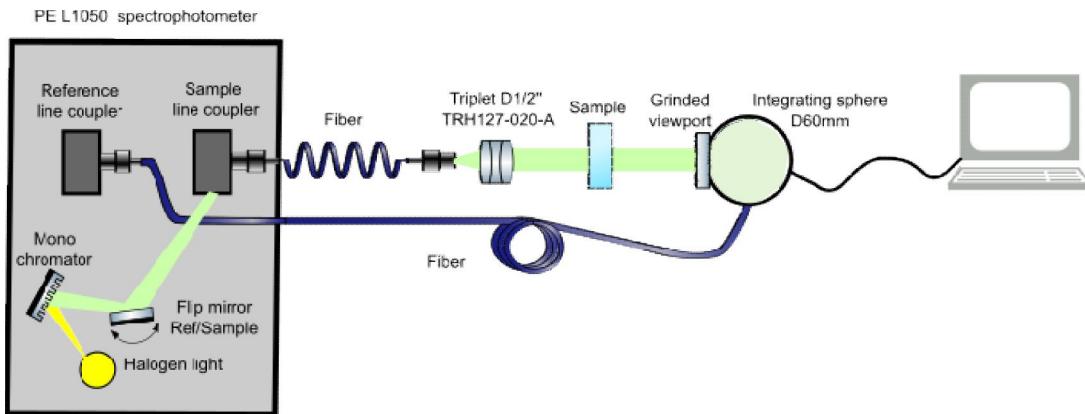


Mesure des filtres MegaCam au LMA

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Laboratoire des Matériaux Avancés – Villeurbanne

Experimental setups

▪ Perkin-Elmer L1050 setup



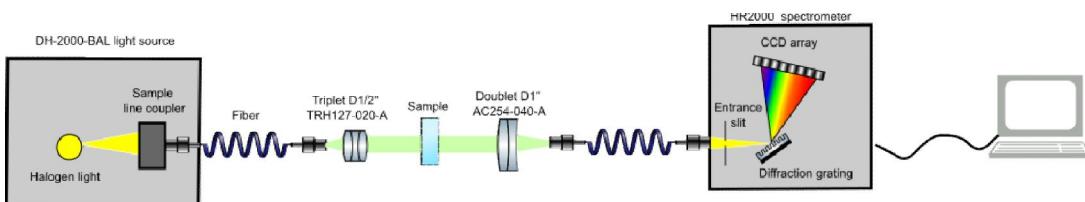
Pros :

- High reliability
- 0.1 nm spectral resolution
- Wide spectral range (175-3300nm)
- Oblique incidence (integrating sphere)
- Wavelength calibration

Cons :

- Slow
- Low sensitivity (integrating sphere)

▪ Ocean Optics HR2000+ setup



Pros :

- Fast
- Compact
- Spectral range (300-1000nm)

Cons :

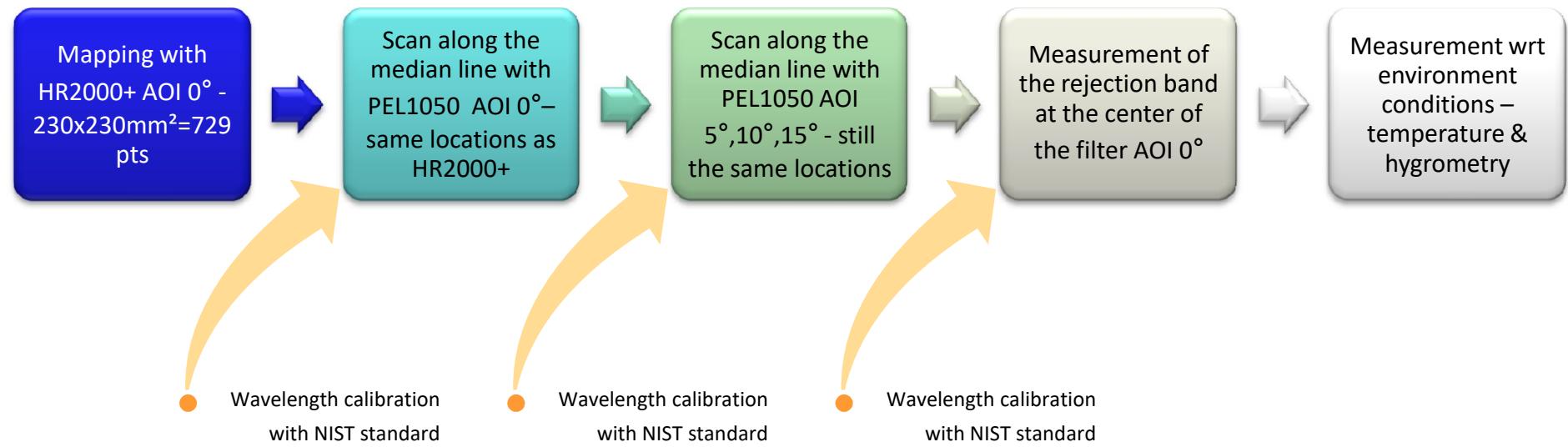
- Low SNR
- Normal incidence only (fibers alignment issue)
- Low spectral resolution

- Same illumination conditions in both setups (pencil beam Ø 6mm)
- Different characteristics but consistent results

→ In order to scan 5 filters over a 260x260mm² area we have to define a protocol using both configurations with some **trade-off between time, accuracy, relevance**.

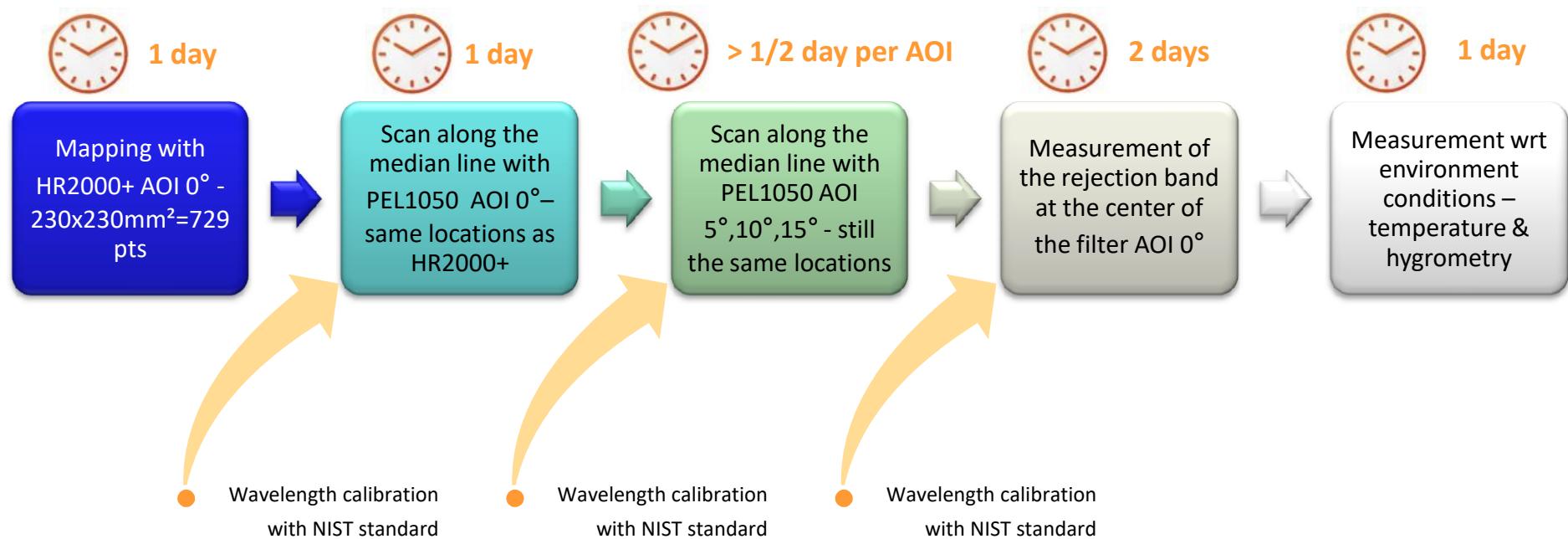
Measurement protocol outline

Several measurements per filter



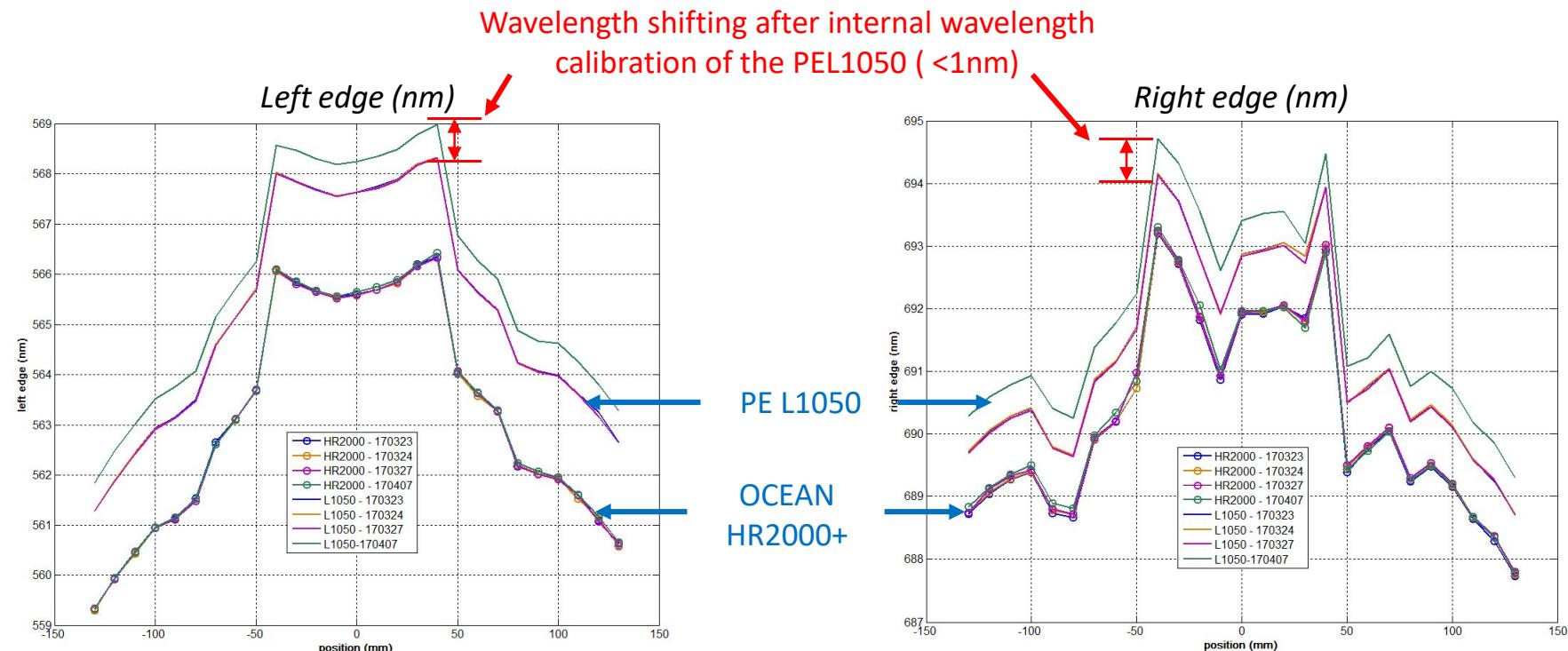
Measurement protocol outline

Time scale considerations



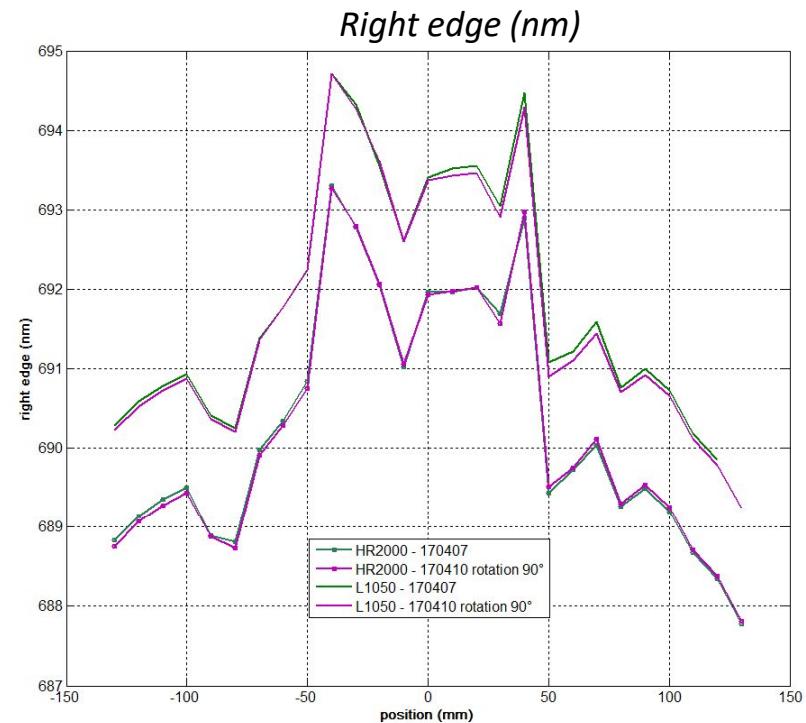
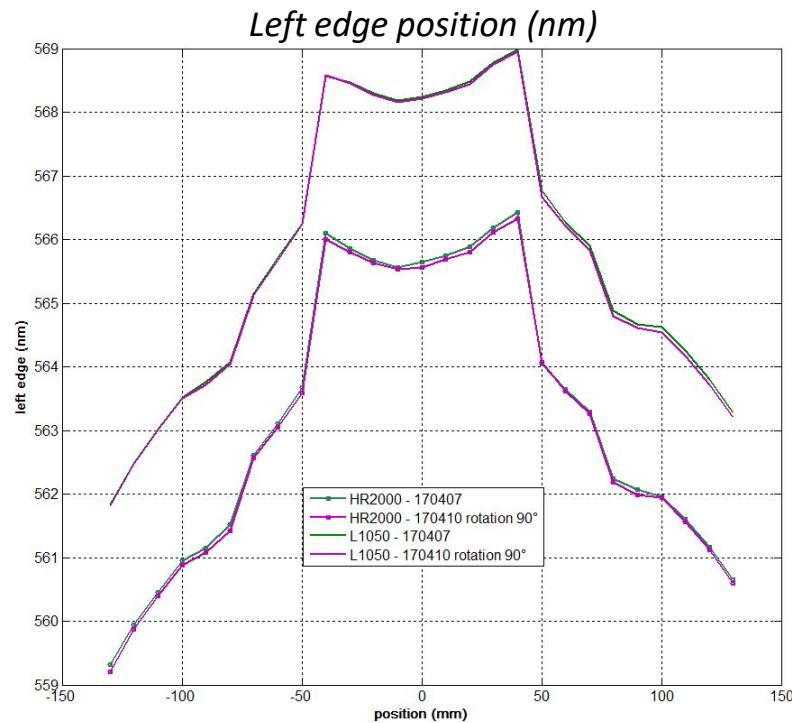
Total : ~7 working days per filter

Comparison btw OCEAN HR2000+ and PE L1050 setups at AOI 0°



- R-Filter measured at 4 different days with both setups
- Installation and alignment on the first day only
- Still some differences between both setups : probably poor wavelength calibration for the HR2000+
- Reproducibility < +/-1 Å and < +/-0.5 Å for OCEAN HR2000+ and PE L1050 setups respectively
- Wavelength calibration with a standard is mandatory to achieve sub-nanometer wavelength accuracy and reproducibility and prevent error due to automatic calibration

Alignment and positioning procedure reliability

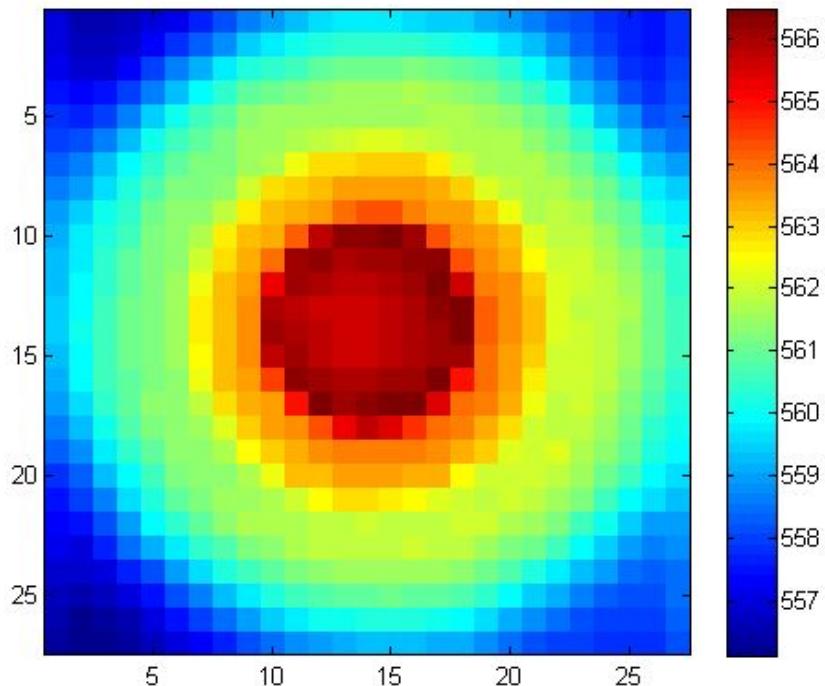


- R-filter same median measured twice (before and after 90° rotation) at normal incidence
- Alignment performed for each filter installation
- Reproducibility < +/-1Å for OCEAN HR2000+ and PE L1050 setups

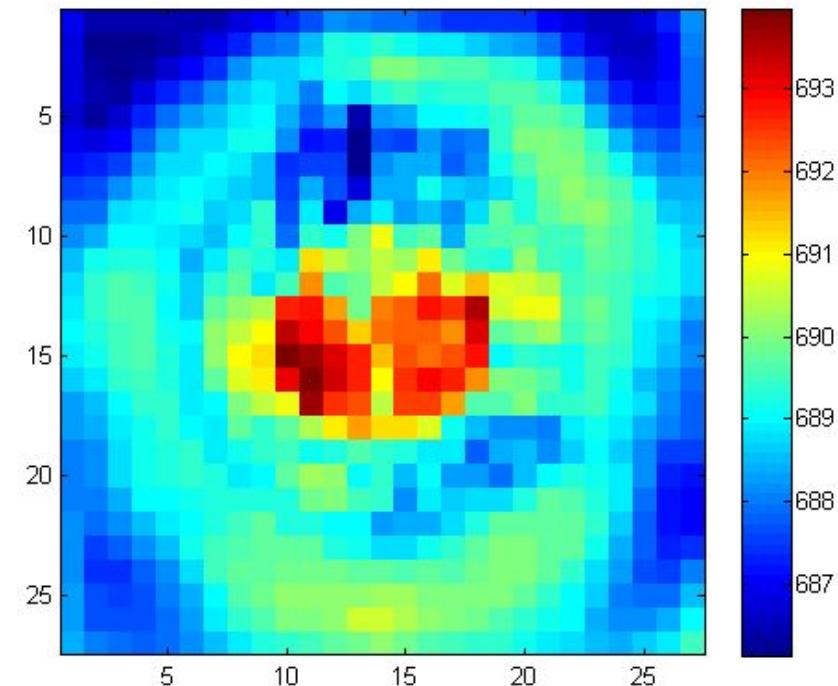
R-filter measurements

Map over 260x260 mm² performed with the Ocean Optics HR2000+ setup (AOI 0°)

Left edge position (nm)



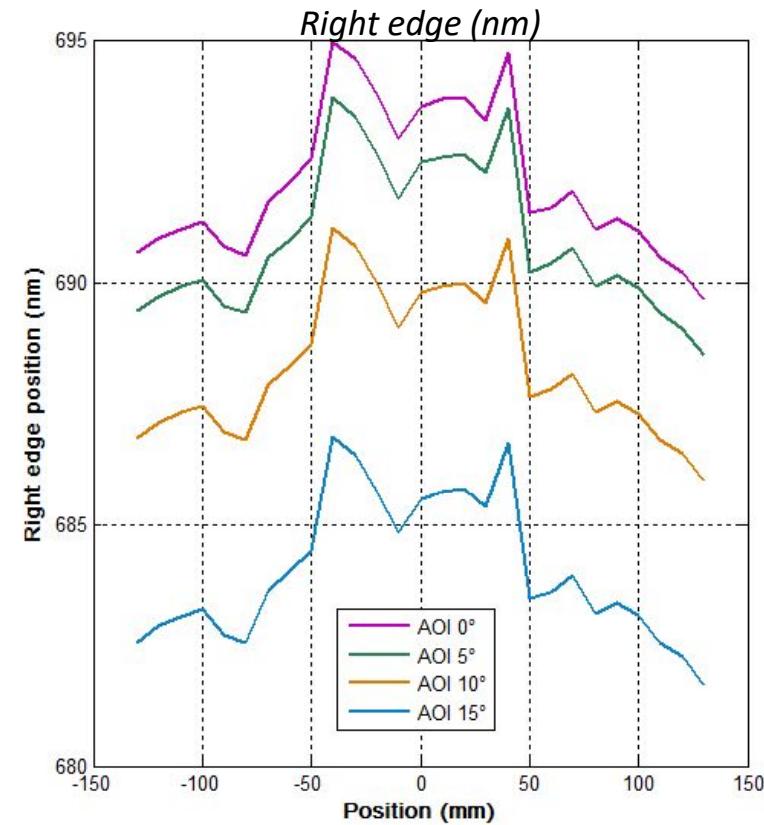
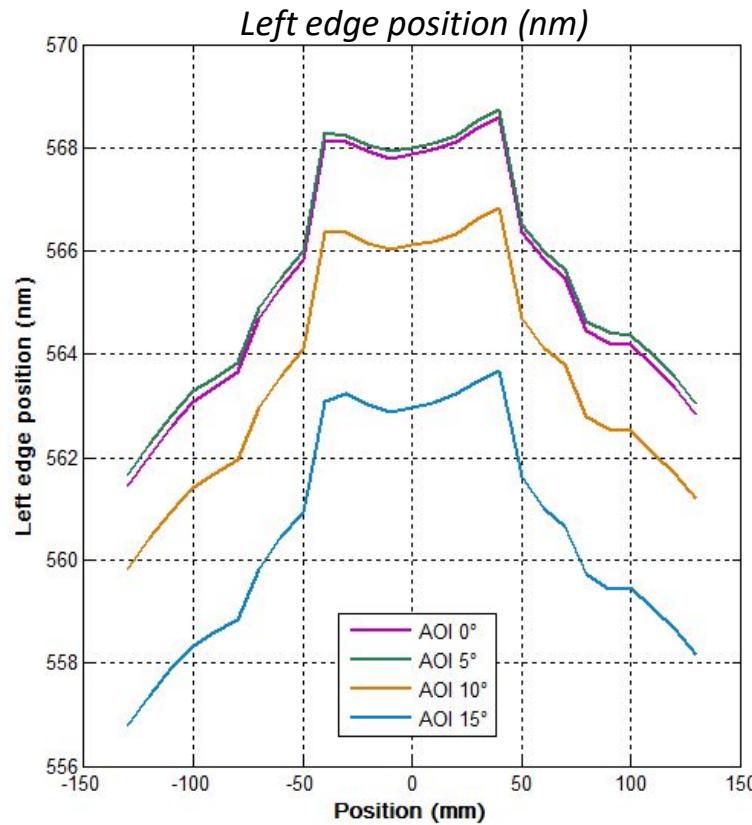
Right edge (nm)



- P-V variations for the left and right edges are ~10 nm and ~8nm respectively
- Dependence mainly radial
- System able to highlight small deviation from radial symmetry

R-filter measurements

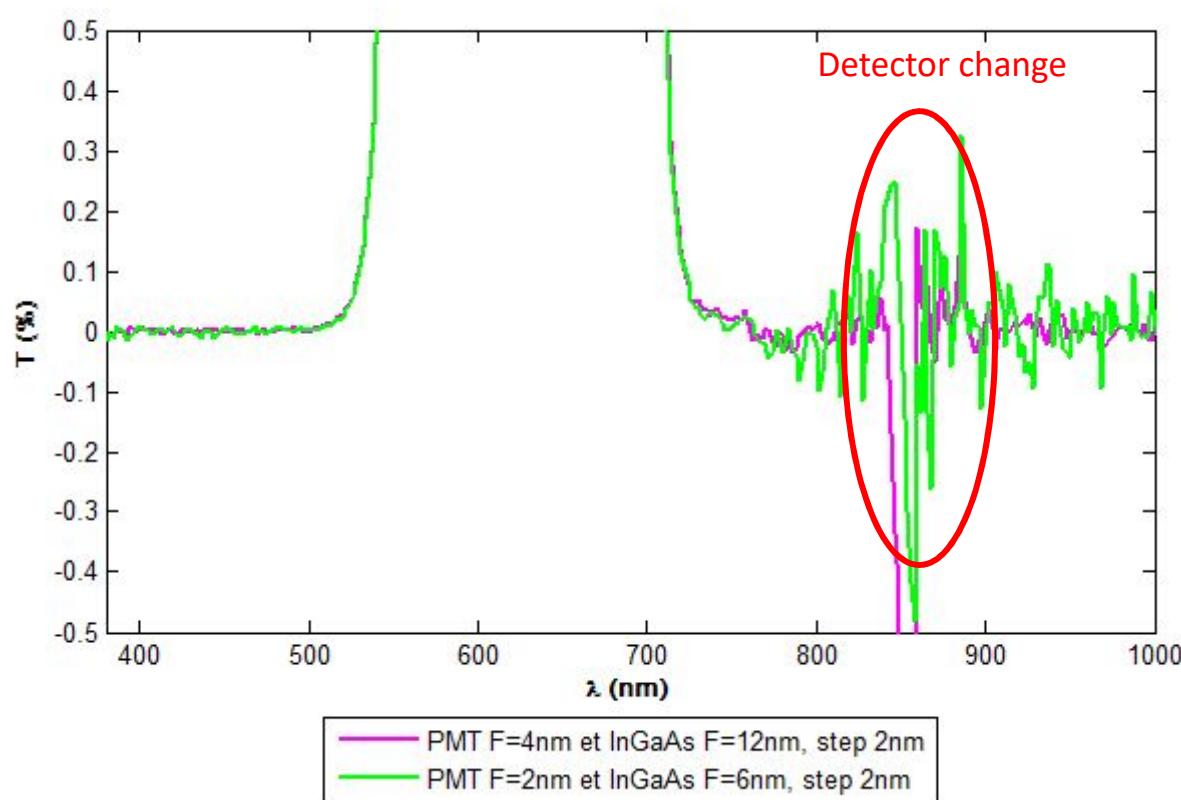
Band pass variations wrt AOI



- Blue-shift wrt increasing AOI
- Different behavior for both edges
- - 5nm and -8nm for the left and right edges respectively

R-filter measurements

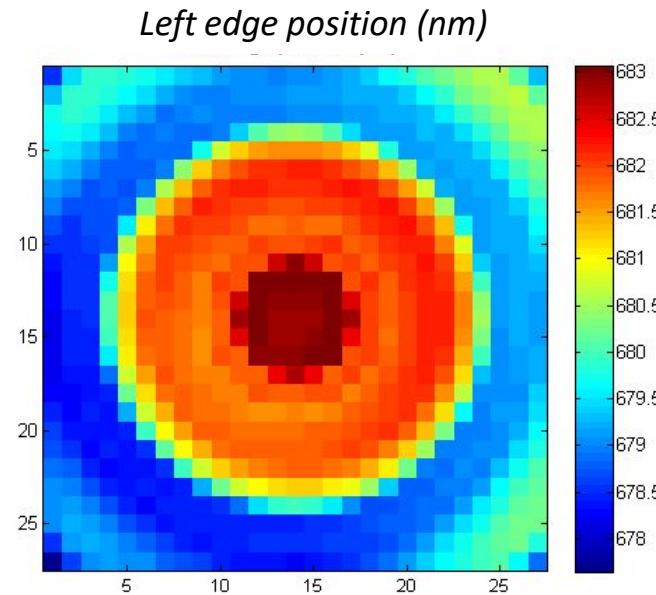
Search for leaks



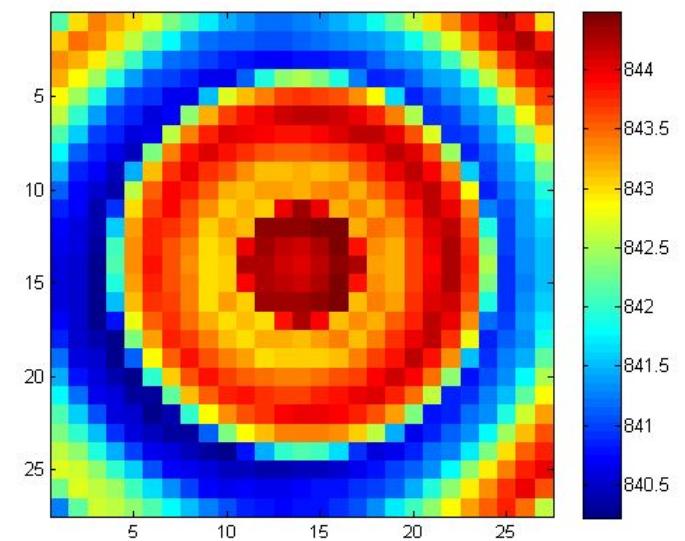
- Leaks measurements in the 380-500nm range is straightforward
- Some issue near 860 nm due to low signal (low efficiency) of the PMT
- Method to be optimized

What's up about the others filters ?

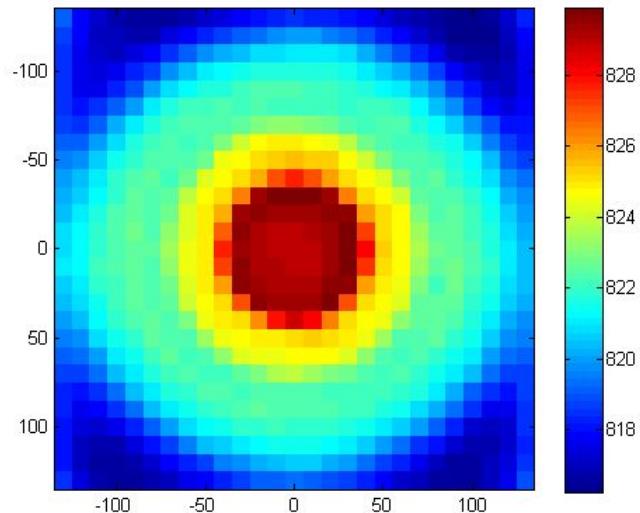
I-filter



Right edge (nm)



Z-filter
(high pass filter not
a bandpass)

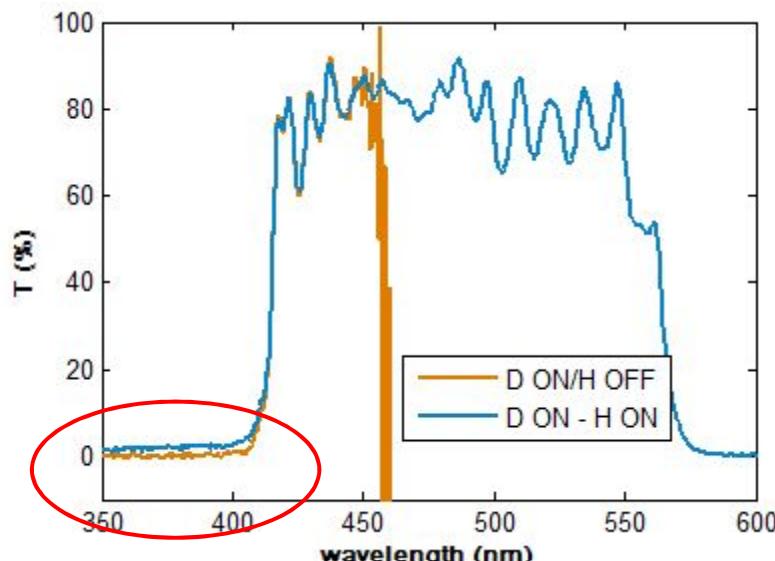


Maps over 260x260 mm² performed with
the Ocean Optics HR2000+ setup (AOI 0°)

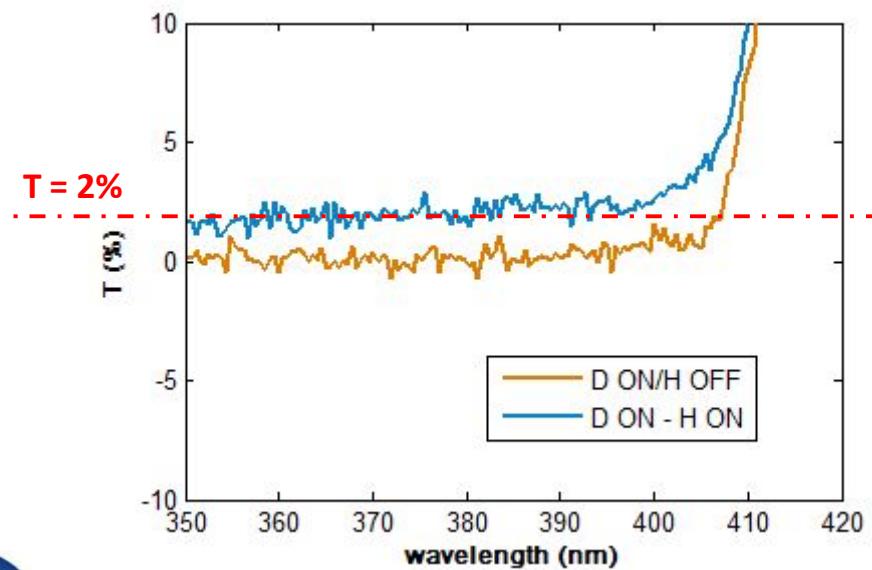
What's up about the others filters ?

Filter	Map with Ocean HR2000+	PE L1050 at AOI 0° , 5° , 10° , 15°	Rejection	Hygrometry
U	NO	NO	NO	NO
G	NO	NO	NO	NO
R	YES	YES	NO	NO
I	YES	YES	NO	NO
Z	YES	YES	NO	NO

The G-filter issue



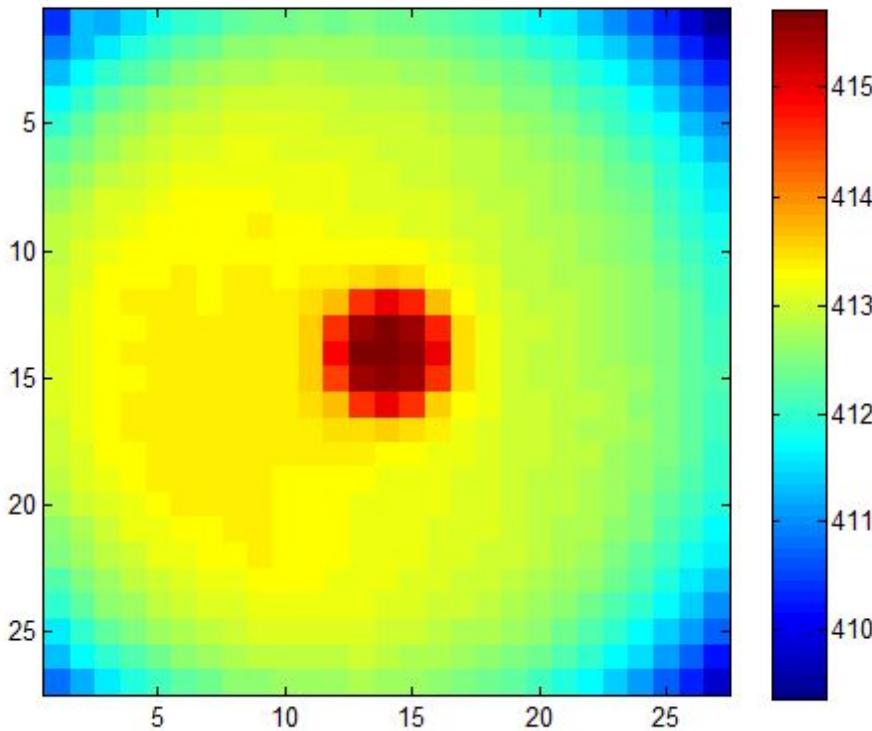
- G-filter works from really close to the UV range up to the visible.
- Require UV lamp (Deuterium) and visible (halogen)



- Stray light issue due to Halogen lamp
- Common issue with spectrometer (like HR2000+)
- Methods were already developed to correct it but require tunable laser, or many long-pass filters
- In the short term, the only solution is to switch off the halogen lamp to prevent stray light below 400nm

The G-filter issue

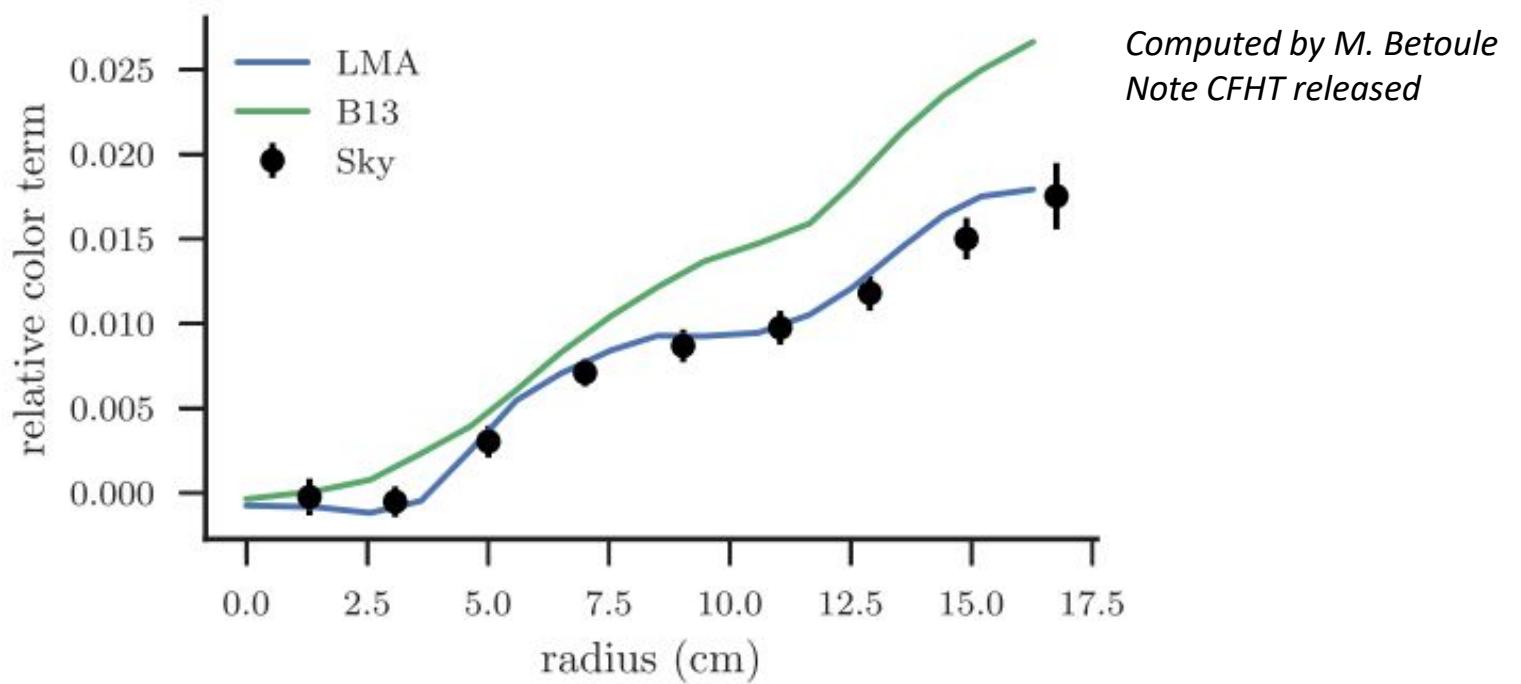
(very) Preliminary results



For the map, we decided to measure the filter twice :

- Only with the deuterium lamp (shown above)
- Only with the halogen lamp for the right edge (measurements in progress)

A relevant result for the Science



- Color terms between stellar measurements computed at the center of the MegaPrime focal plane and a circular average of stellar measurements at other radii
- Comparison between the actual on sky measurements and expectations synthesized the new R-filter measurement set (blue) or the previously published transmission curves (green)



High consistency of the new model with respect to the observations

To do list

1. G-filter and U-filter : map and oblique incidence measurements (in progress for the G-filter)
2. Improve leaks measurement near 860 nm.
 Tricky due to low signal in this wavelength range.
3. Find a way to modify the hygrometry to analyze the impact on the optical response
 Not so easy because filters are not small samples (!)
4. Evaluate the performances of the facilities and cross-check with LSST requirements (SN, PhotoZ, ...)
5. Improve the present facilities or design a new one

END