

Dichroic filter R&D in Spain

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Overview

- (past) **First iteration:** 7 layers
 - 60 filters of several thicknesses & substrates: **low performance**
- (ongoing) **Second iteration:** >30 layers
 - 5 pre-production filters available: **promising**
 - 55 production filters to be installed in cold box (hopefully)
 - Production offer: 38 €/unit for 30000 units
- (future) **Third iteration:** 42 layers
 - Test batch could be ready in 4-5 weeks. 95€/unit for 60 filters
 - Production offer: 14.5 €/unit for 30000 units

First iteration

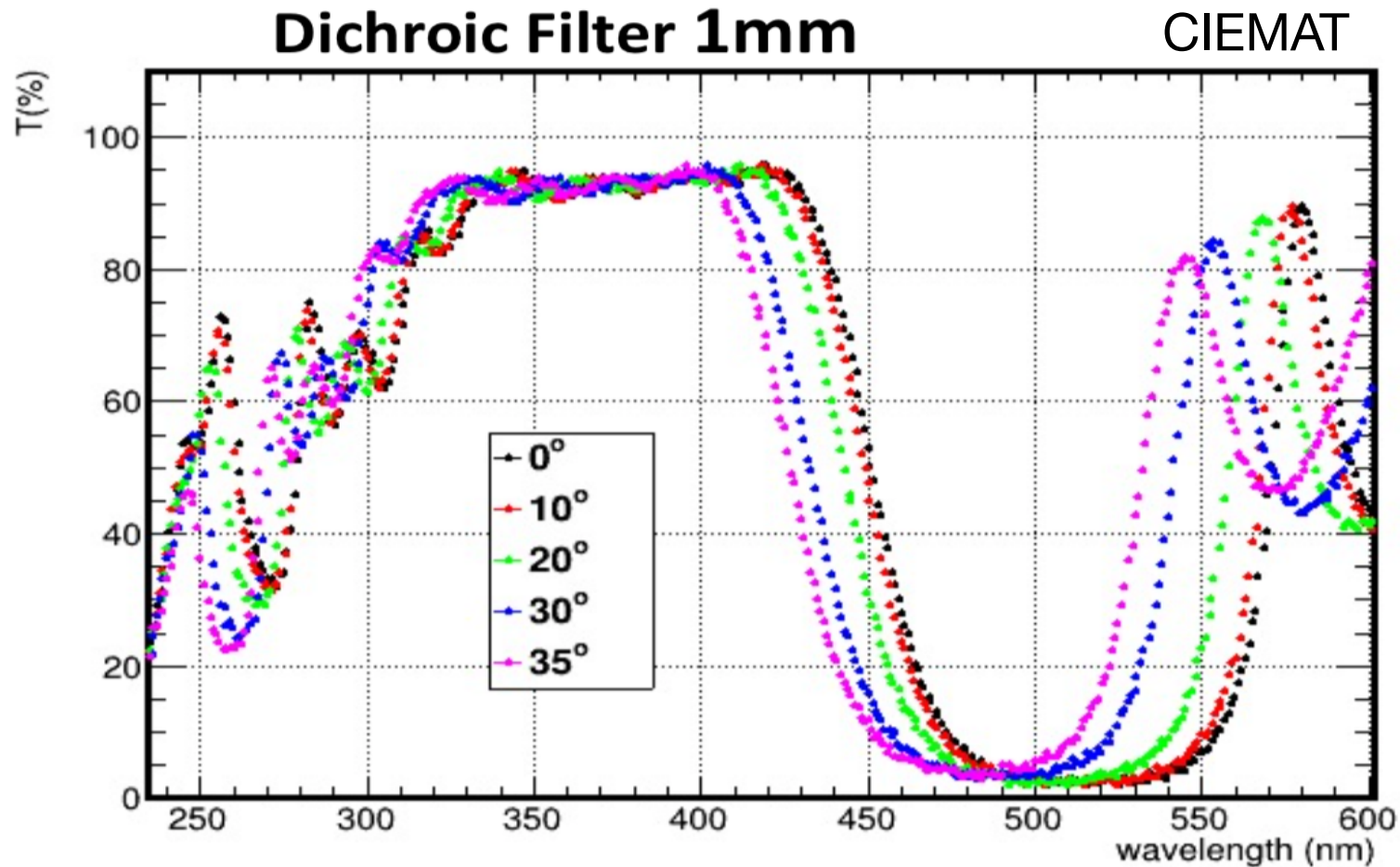
Item	Description	Qty	Unit Price in (€)	Total in (€)
1	Optical Filter Material FUSED SILICA JGS2 Transmission from 300nm- 400 nm > 91,7% Reflection: value above 400 nm as high as possible Surface: S/D 60/40 Incidence angle - 45° Size: 100,0 +0/-0,2mm x 100,0 +0/- 0,2mm Thickness: 1,0 +0/-0,2mm IR grade 1 mm	30,00	29,50	885,00
2	Optical Filter Material FUSED SILICA JGS2 Transmission from 300nm- 400 nm >; 91,7% Reflection: value above 400 nm as high as possible Surface: S/D 60/40 Incidence angle - 45° Size: 100,0 +0/-0,2mm x 100,0 +0/- 0,2mm Thickness: 2,0 +0/-0,2mm IR grade 2 mm	25,00	29,50	737,50
3	Optical Filter Material FUSED SILICA JGS1 Transmission from 300nm- 400 nm > 91,7% Reflection: value above 400 nm as high as possible Surface: S/D 60/40 Incidence angle - 45° Size: 100,0 +0/-0,2mm x 100,0 +0/- 0,2mm Thickness: 1,0 +0/-0,2mm UV grade 1 mm	5,00	190,00	950,00

- Filters received in March
- 7 layers



Results

- Good transmission below cutoff ($>90\%$) but poor reflection above ($<95\%$). We have seen in Julio's talk that reflexion above $\sim 98\%$ is desirable.



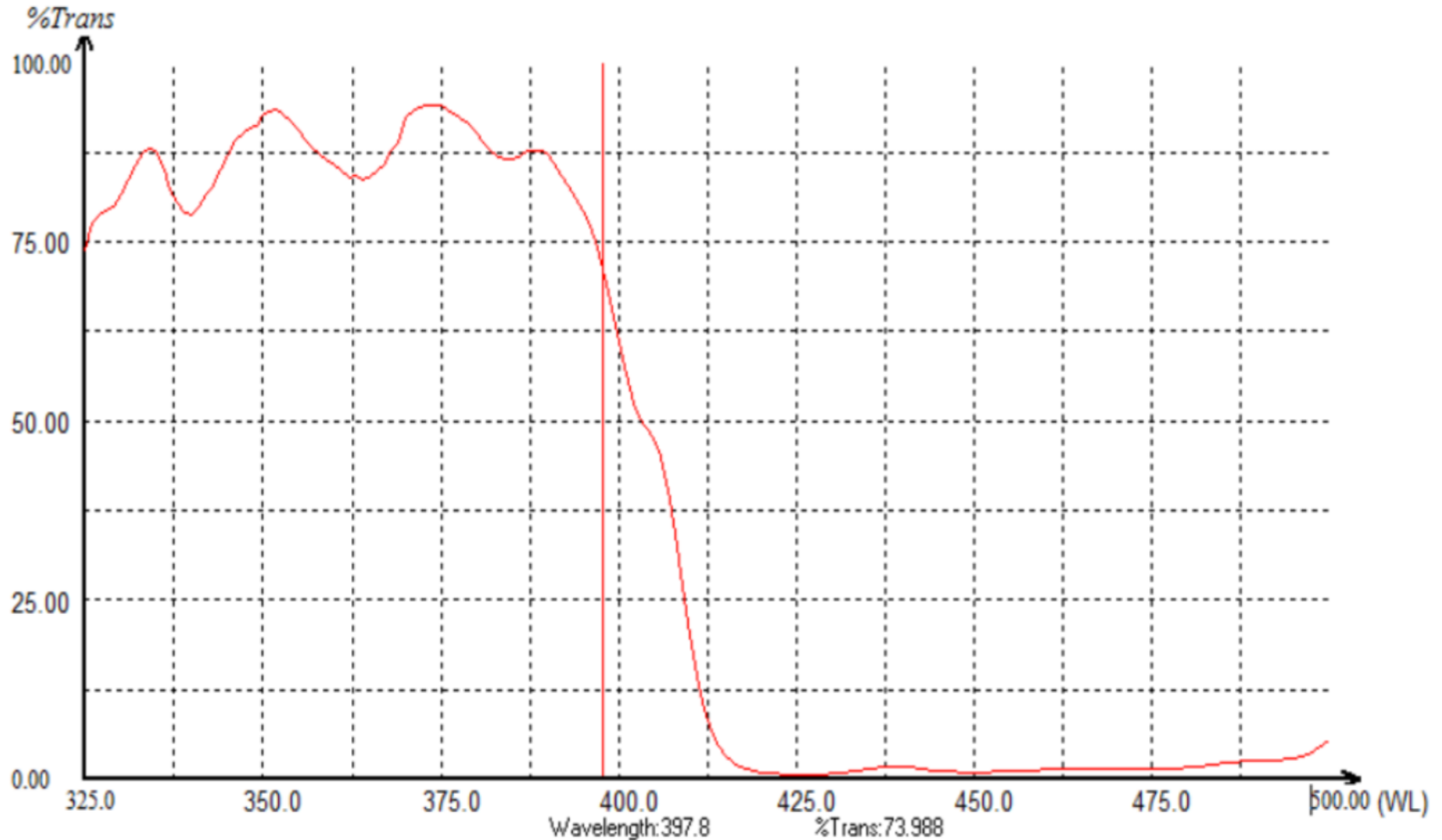
Second iteration

Item	Description	Qty	Unit Price in (€)	Total in (€)
1	Optical Filter Material FUSED SILICA JGS2 Surface: S/D 60/40 size 97 mm x 97 mm x 1 mm (Due to coating homogeneity it might be interesting but more expensive to cut after the coating a from a size of 100 mm x 100 mm x 1 mm) incidence angle 45 ° 300-385nm T>95% (Tolerance: T> 91,7%) 398nm T>80% (Tolerance @385 T > 85%) @415nm T<5% 420-500nm T<1% Values are indicative and can vary +/- 1.5% the objective being to have a cutoff wavelength at 400 nm and the sharpest slope on the wavelength cut.	60,00	85,00	5.100,00
Net Total				5.100,00
Shipping & Handling				29,00
VAT 21%				1.071,00
Shipping & Handling VAT				6,09
Total with Tax				6.206,09

- 5 filters received mid May. Another 55 could be sent in two weeks
- > 30 layers

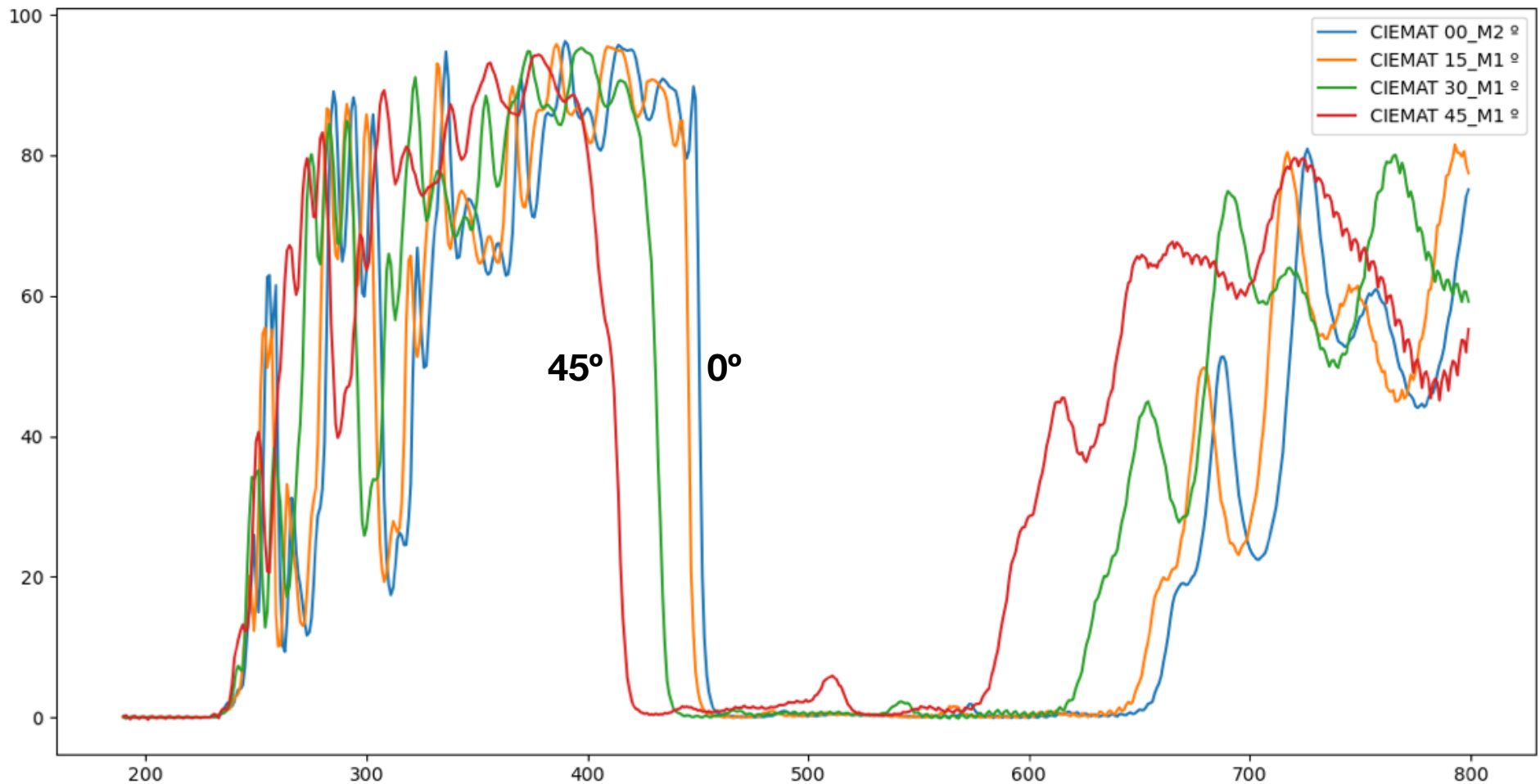
Measurements by Photonexport

- Very good reflection above cut-off



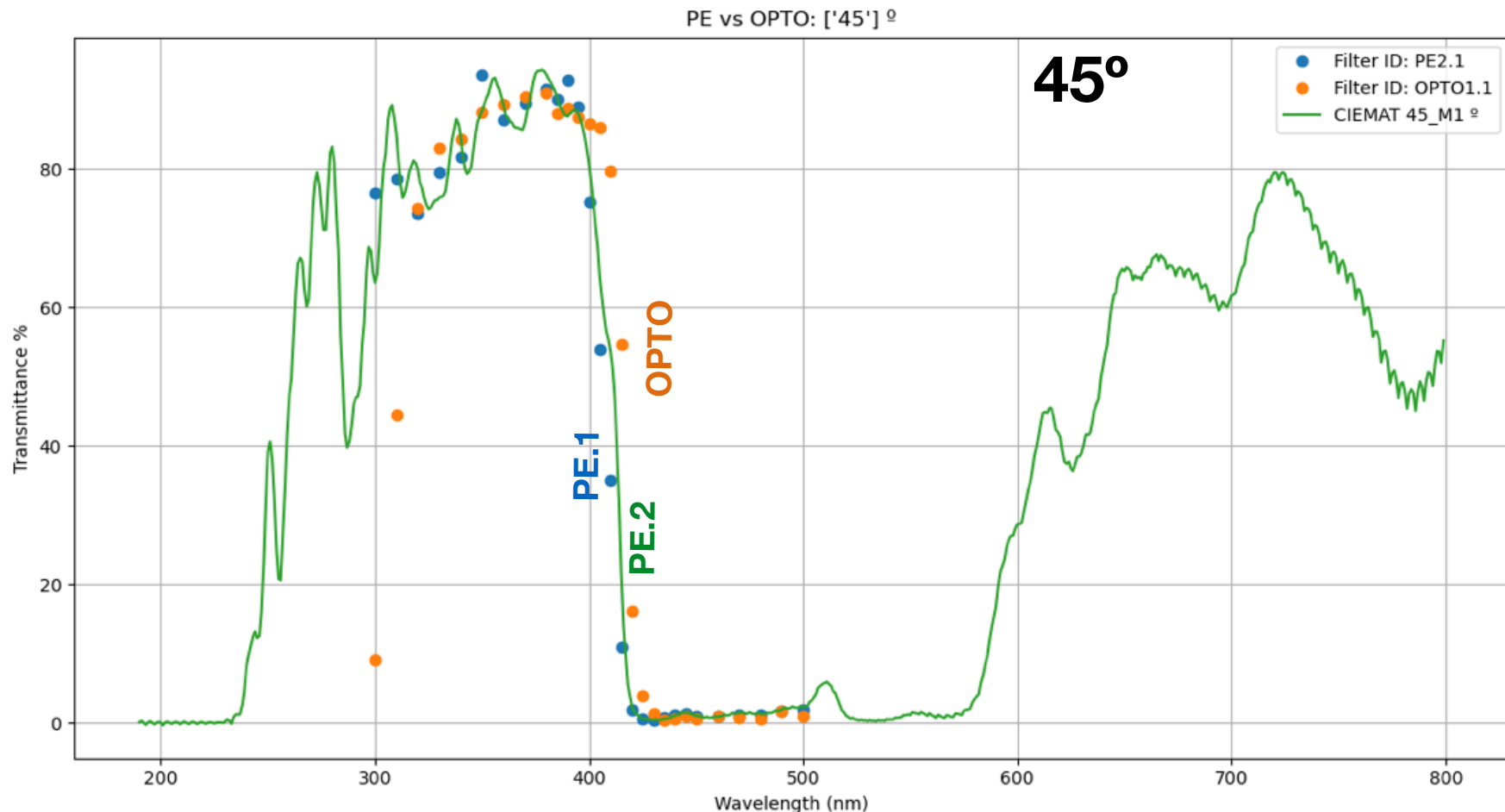
Measurements at CIEMAT

- Varian-Cary 50 Conc UV spectrophotometer
- Different angles



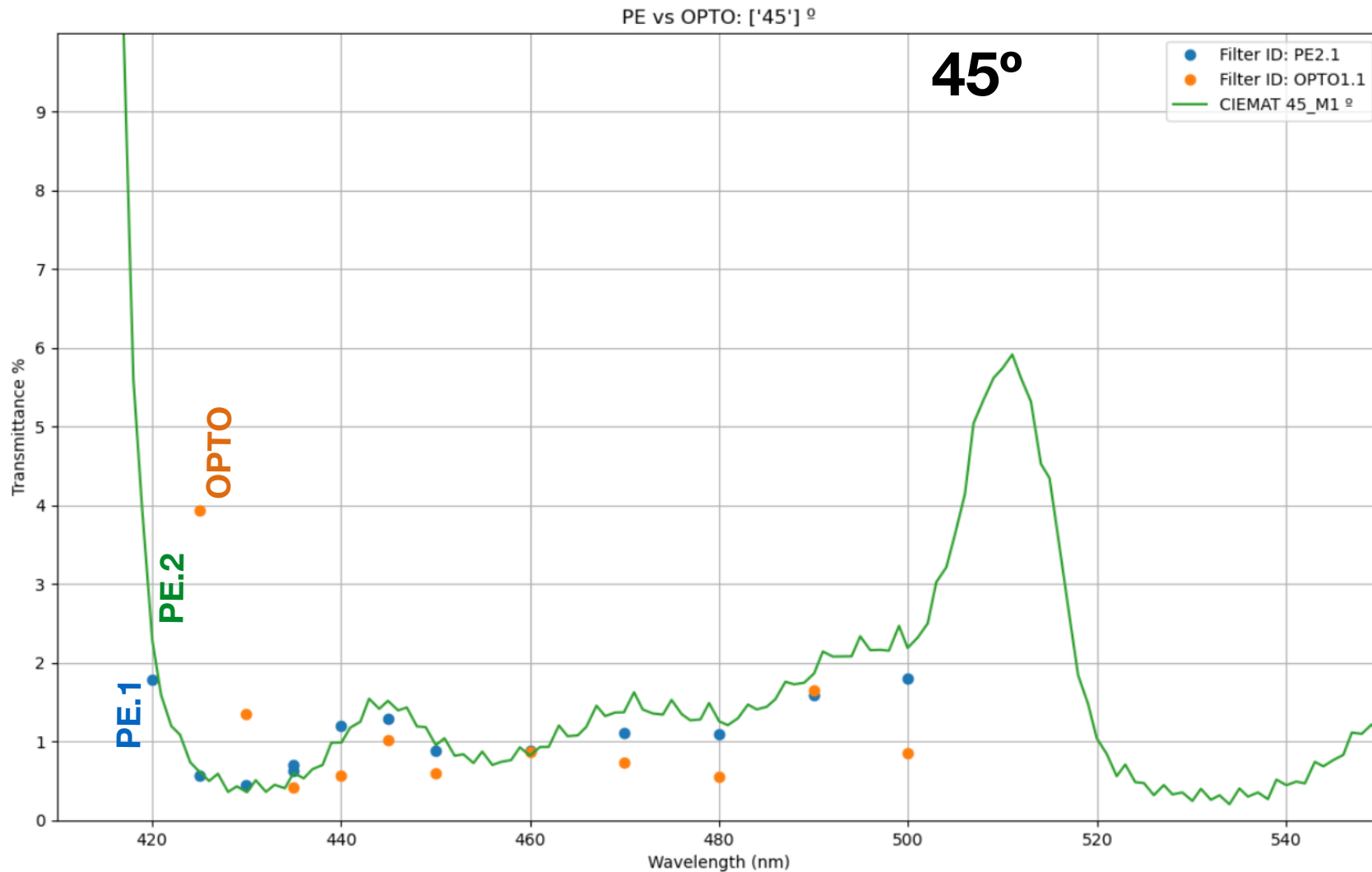
Comparison with OPTO

- Comparison of two different PE filters measured at IFIC and CIEMAT, and an OPTO filter (thanks Ana) measured at IFIC
- Very similar performance. PE slightly better below 330 (fused silica)



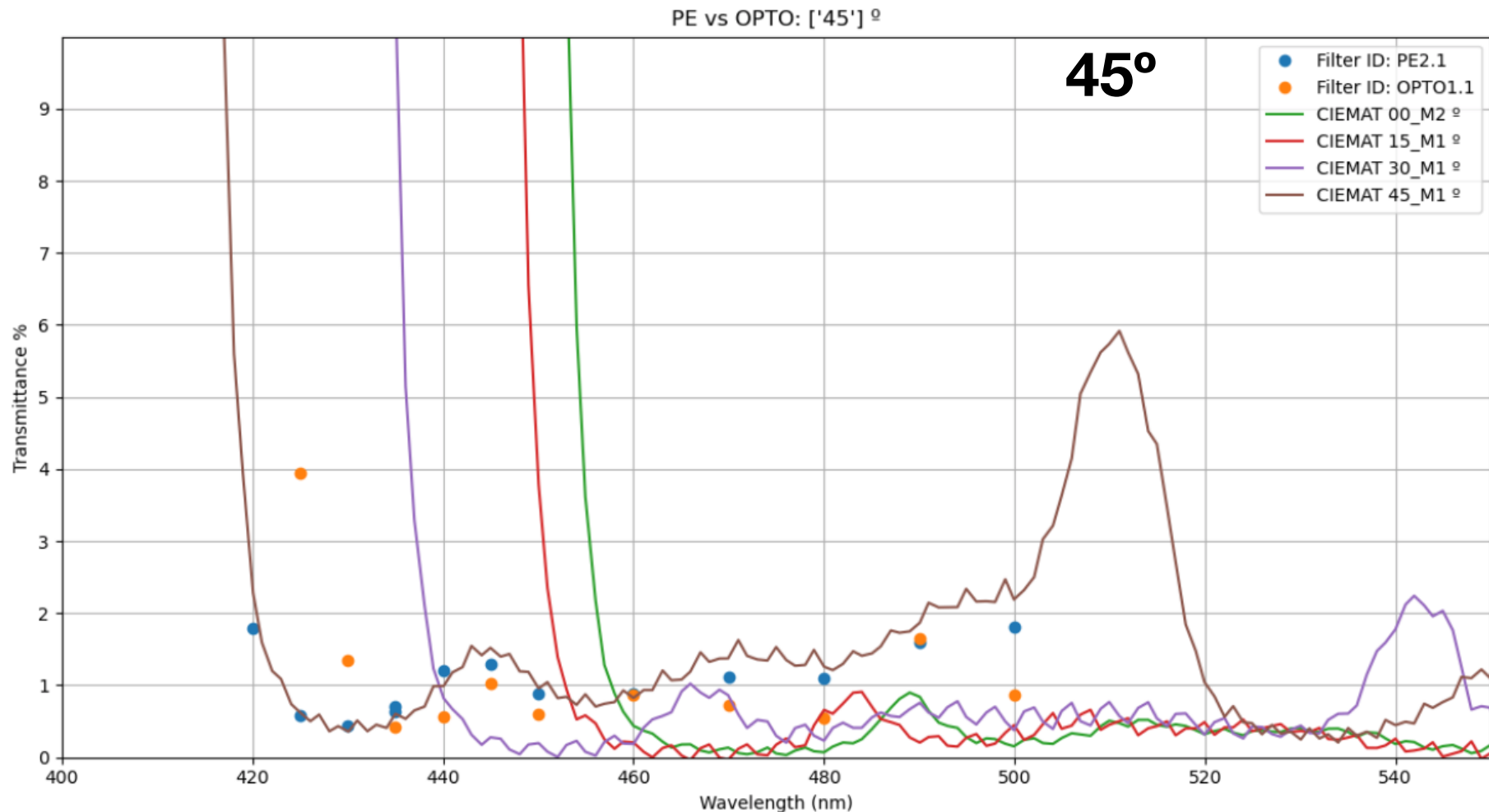
Zoom above the cutoff

- Transmission above cutoff $< 1.5\%$. OPTO filter slightly better



Zoom above the cutoff

- Even better for lower AOI, which goes in the right direction, since the lower the AOI the more reflections photons undergo



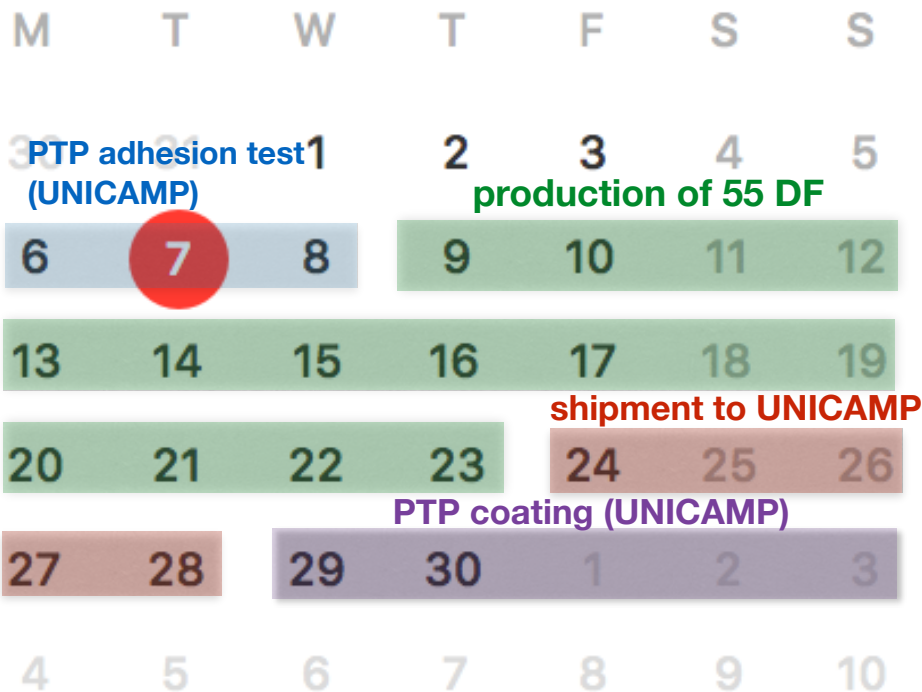
Third iteration

- Test batch could be ready in 4-5 weeks. 95€/unit for 60 filters
- Production offer:
 - 14.5 €/unit for 30000 units
 - 24.5 €/unit for 15000 units
- PE compromise:
 - best effort $T_{avg} > 95\%$ @300-370nm
 - guaranteed $T_{avg} > 80\%$ @300-370nm
 - guaranteed $R > 97\%$ @400-500nm AOI 45 degree
- Negotiating with PE:
 - $R > 99\%$ @400-500nm
 - AOI to be determined based on simulations (see Julio's talk)

Cold box

- We need to know the current schedule for CB in July
- Currently testing PTP adhesion in fused silica at UNICAP
- No time for third iteration. Use second iteration DF
- Very tight schedule. We need to know whether that's possible or not before going ahead with production (6000 €)
 - If not, we go ahead with 3rd iteration, and hopefully test DF in a future CB

June



July



Cold box

- Additional issue: PE produced 100x100 mm² filters instead of 97x97, as specified in the offer
- Cutting them would delay things. Trying to understand how much
- Is it possible to modify the frame ?

backup

Measurements at IFIC

Monochromator

Tungsten lamp

black box

PMT power supply

Keithley pA

computer with
Labview



MC motor controller

Tungsten lamp PS

Inside black box

PMT

PMT

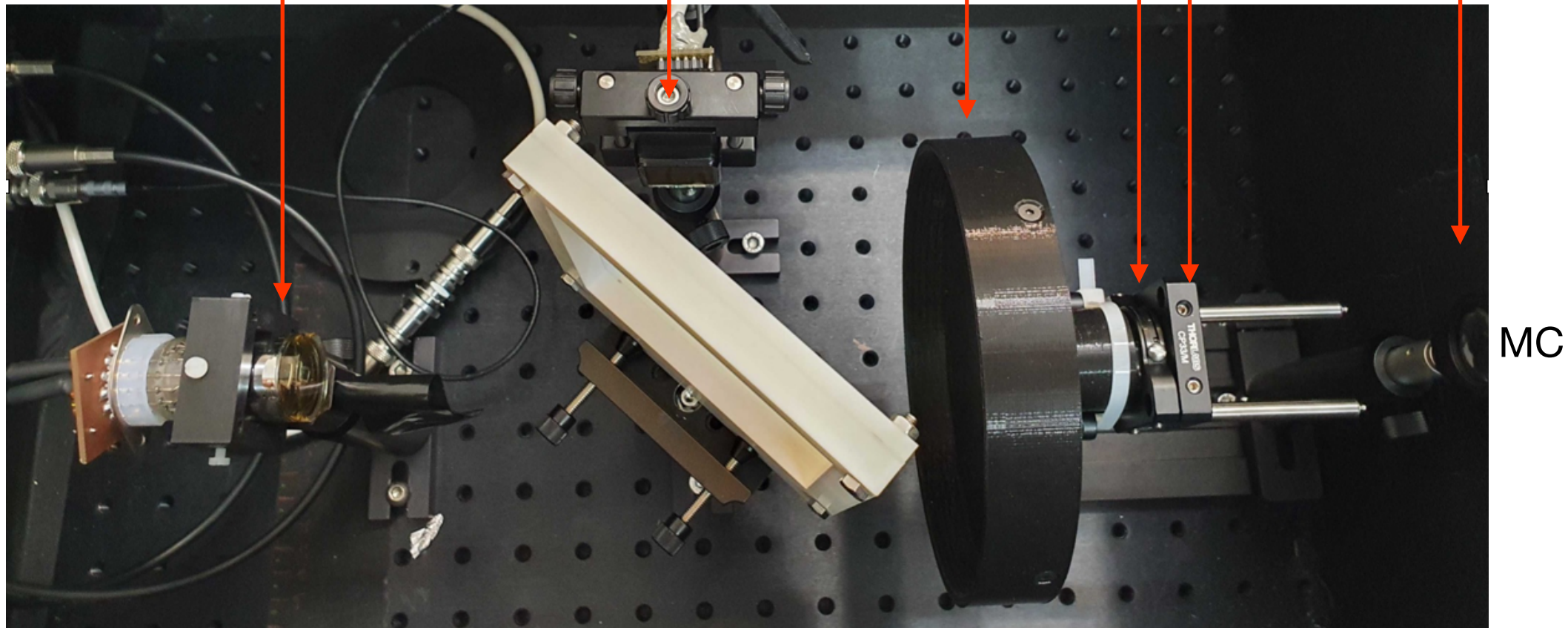
absorber

iris

f=10 cm

f=2.5 cm

filter



MC