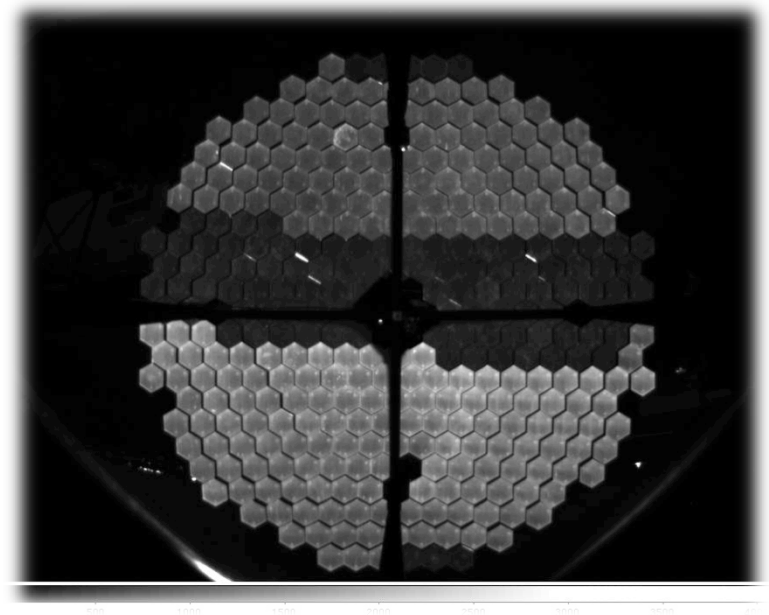


VERITAS Mirrors: coating degradation study

Julien Rousselle, UCLA
Timothy Arlen, UCLA
Vladimir Vassiliev, UCLA

- ✓ Mirrors time line
- ✓ Instrument set-up
- ✓ Mirror topography
- ✓ Mirror reflectivity
- ✓ Perspectives



Compare the mirror aging for different over-coating

- ✓ Measure reflectivity / micro-roughness just after coating
- ✓ Mount the mirrors on T3 in the same time
- ✓ Remove the mirrors after few months and repeat the measurements
- ✓ Mount the mirrors again
-
-
-

Substrate

Doti glass (VERITAS)

VERITAS mirrors

coating: Aluminum (Emmet)

overcoating: Anodization (Emmet)

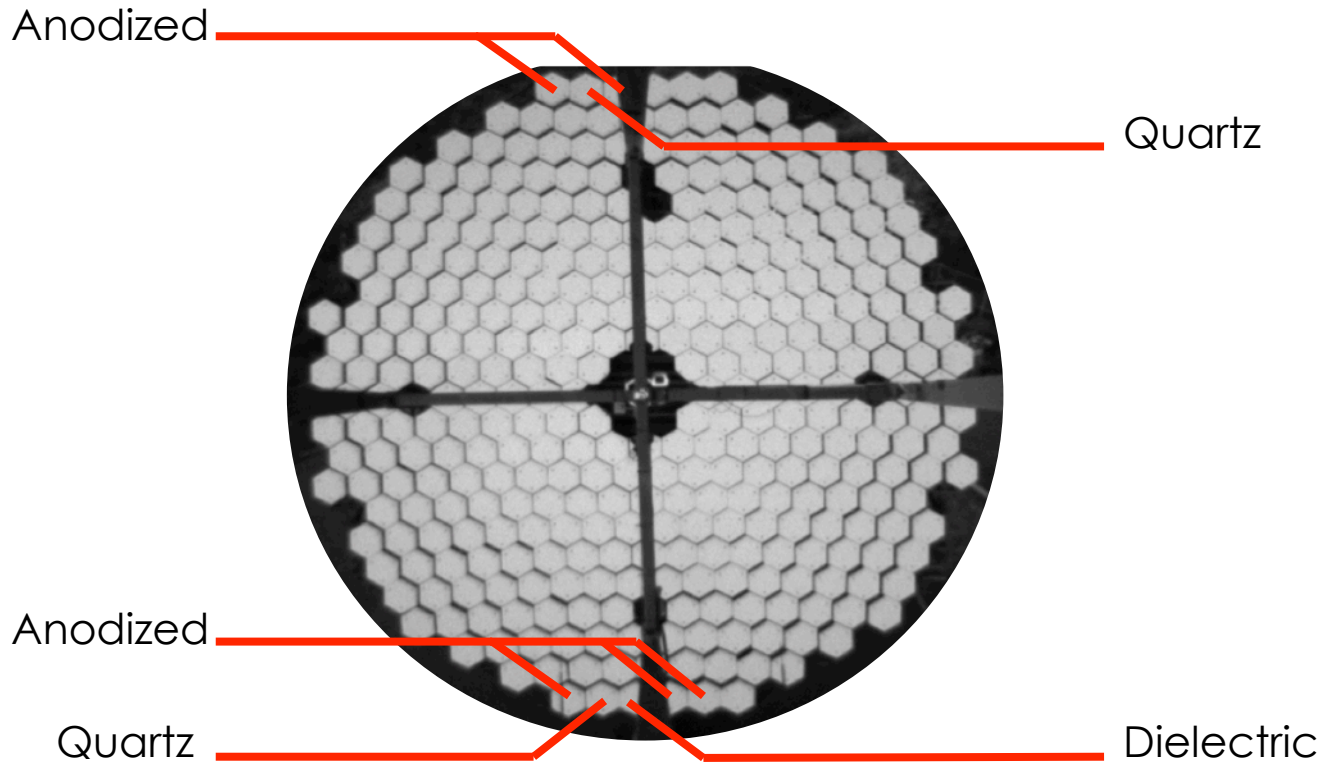
BTE mirrors

coating: Aluminum

overcoating: quartz ($\text{SiO}_2/\text{SiO}_2$)

+ pure dielectric mirror

8 mirrors on T3



Impact of the mirror position on its performance ?

Mirror history



Mounted for the first time in March 2010

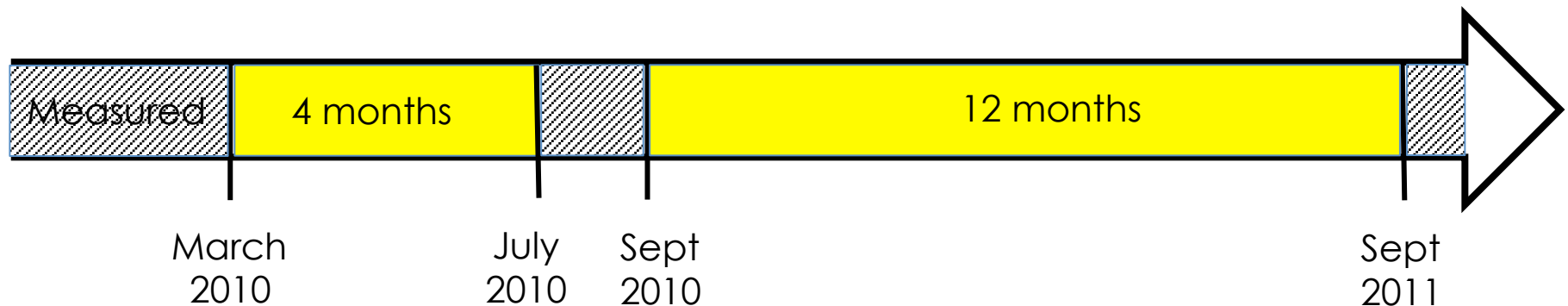
3 measurements :

- ✓ after coating
- ✓ after 4 months on T3
- ✓ after 12 months on T3

A total of **16 months on T3**

Including around **1.5 monsoons**

Dielectric mirror permanently removed after 4 months



Mirror topography



Veeco Wyko NT9300 Optical Profiler

In the California NanoSystems Institute in UCLA

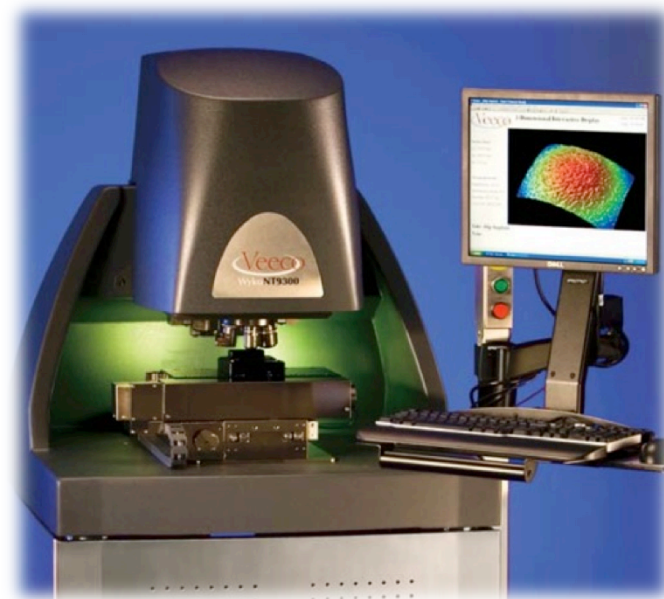
Phase Shifting Interferometry (PSI)

No contact with the mirror

Vertical resolution : 0.1 nm

5x magnification : FoW 1x1 mm
pixel size 2x2 μm

20x magnification : FoW 250x250 μm
pixel size 500 nm



Veeco 3-Dimensional Interactive Display

Date: 01/09/2012

Time: 14:26:35

Surface Stats:

Ra: 2.08 nm

Rq: 2.74 nm

Rt: 28.26 nm

Measurement Info:

Magnification: 20.16

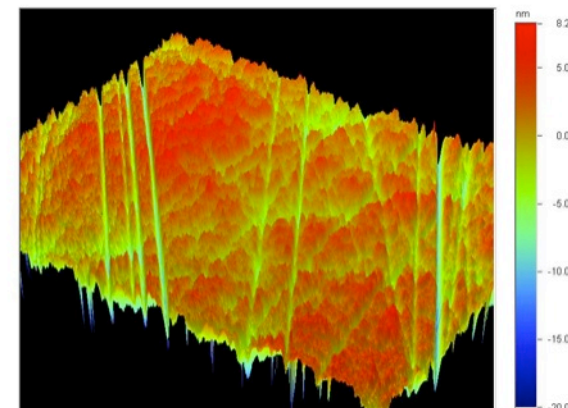
Measurement Mode: PSI

Sampling: 491.03 nm

Array Size: 640 X 480

Title:

Note:



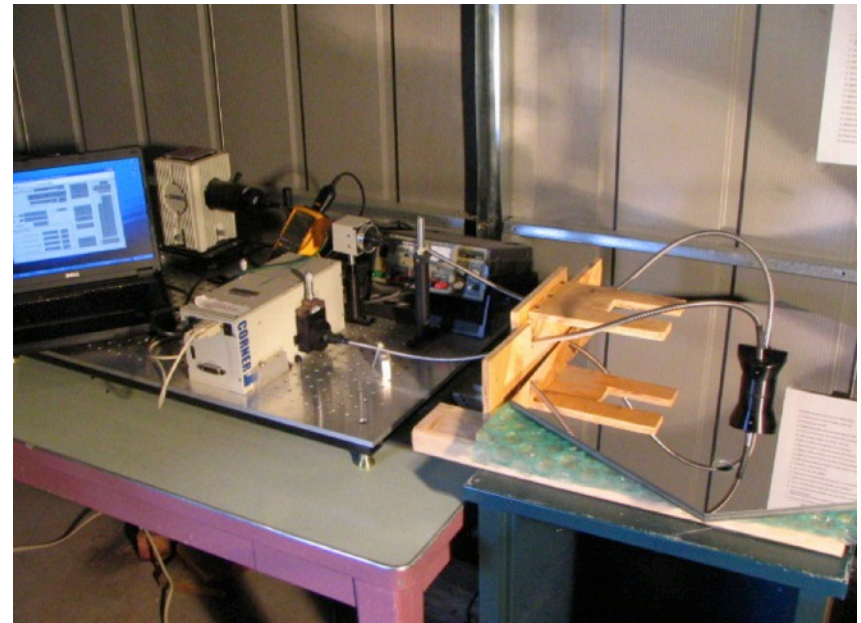
Relative reflectance by Emmet

In Emmet's lab at basecamp

Relative measurement with a bare aluminum reference mirror

Wavelength range : 260-700 nm

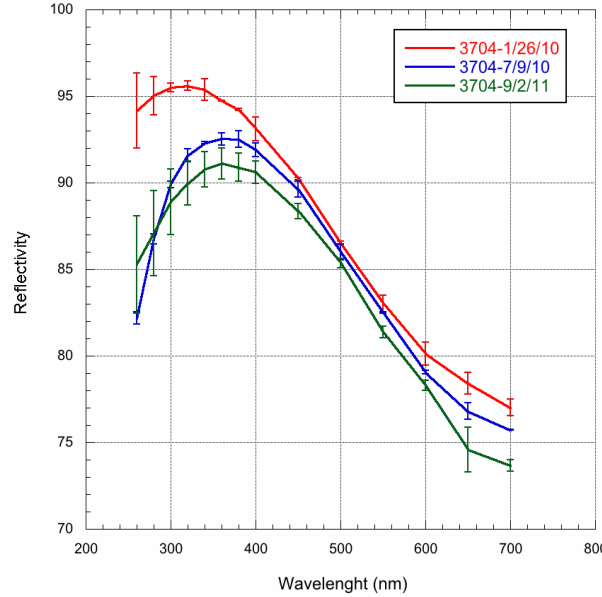
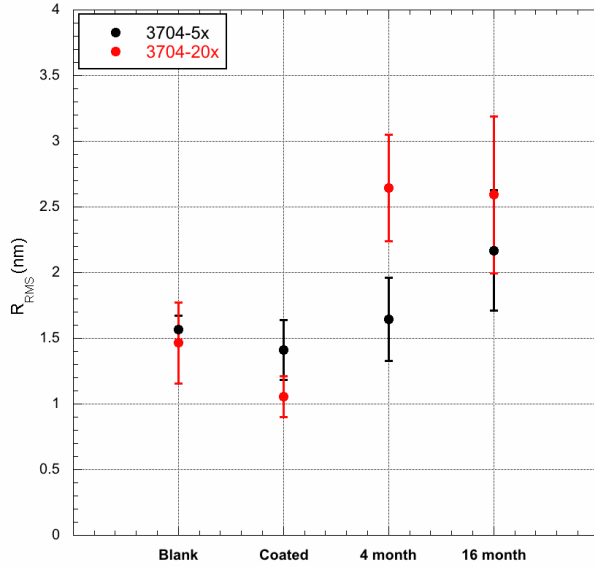
5 point on the mirror



Anodization over-coating



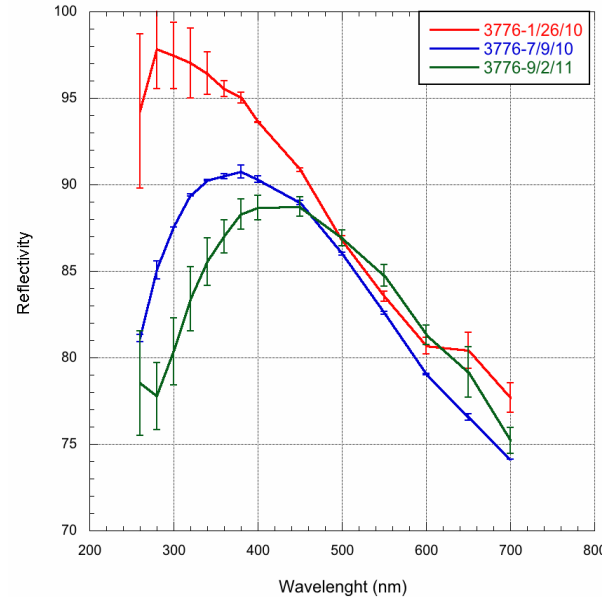
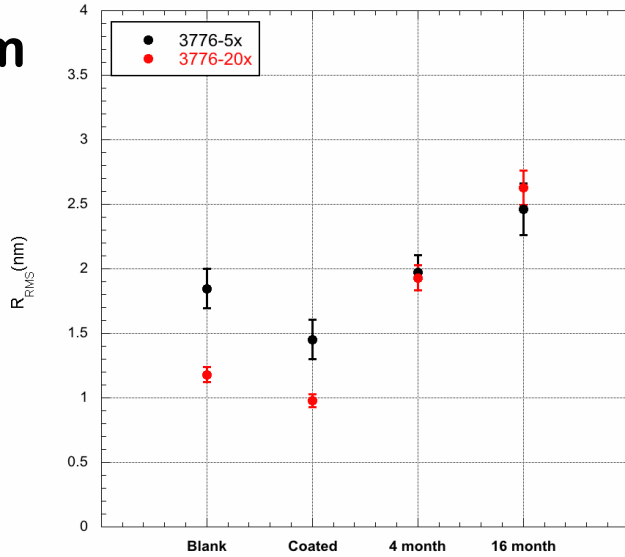
Top



↕ -2.5 %
↕ -1.5 %

-4 % @ 360 nm

Bottom



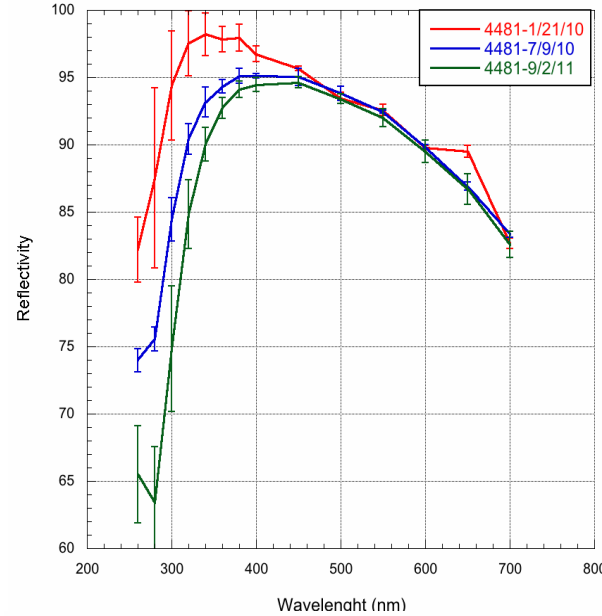
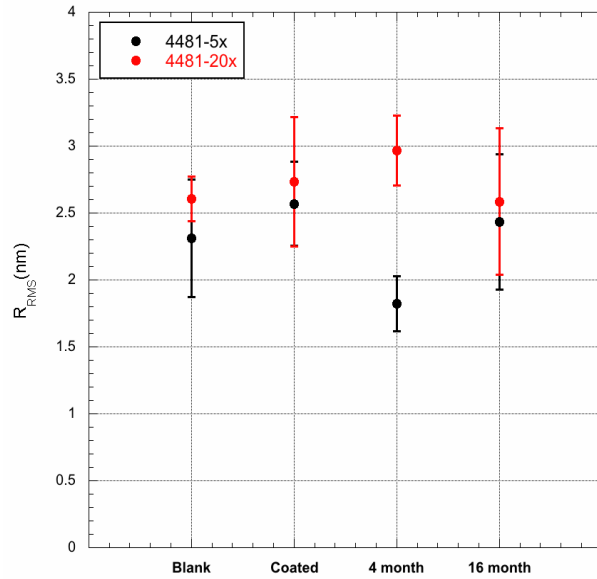
↕ -5 %
↕ -3 %

-8 % @ 360 nm

Quartz over-coating



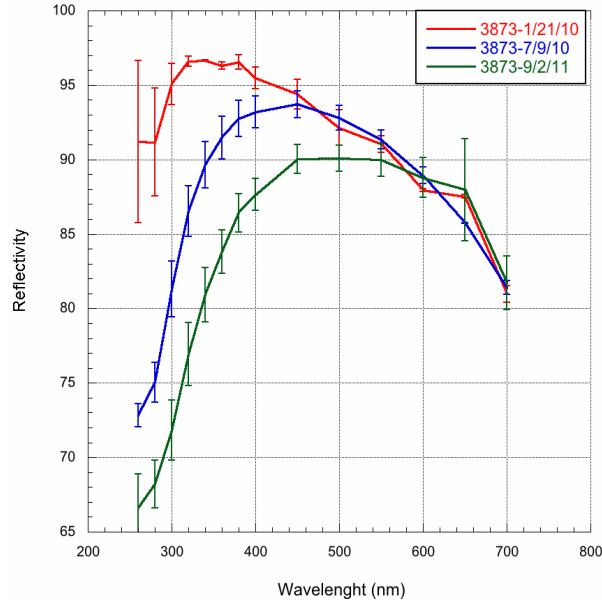
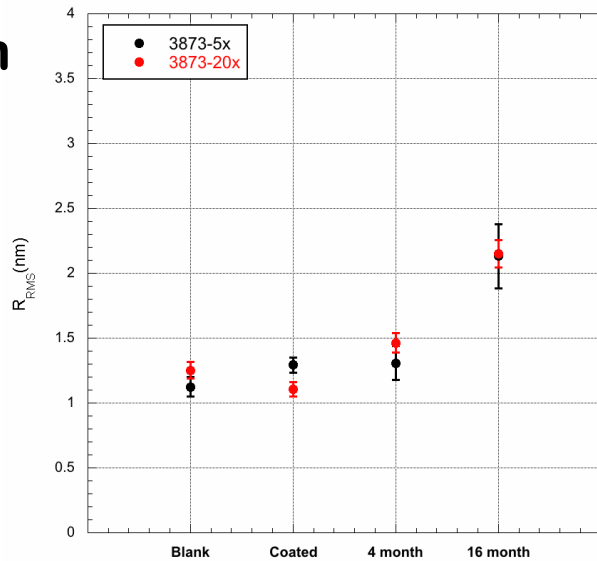
Top



↕ -4 %
↕ -2 %

-6 % @ 360 nm

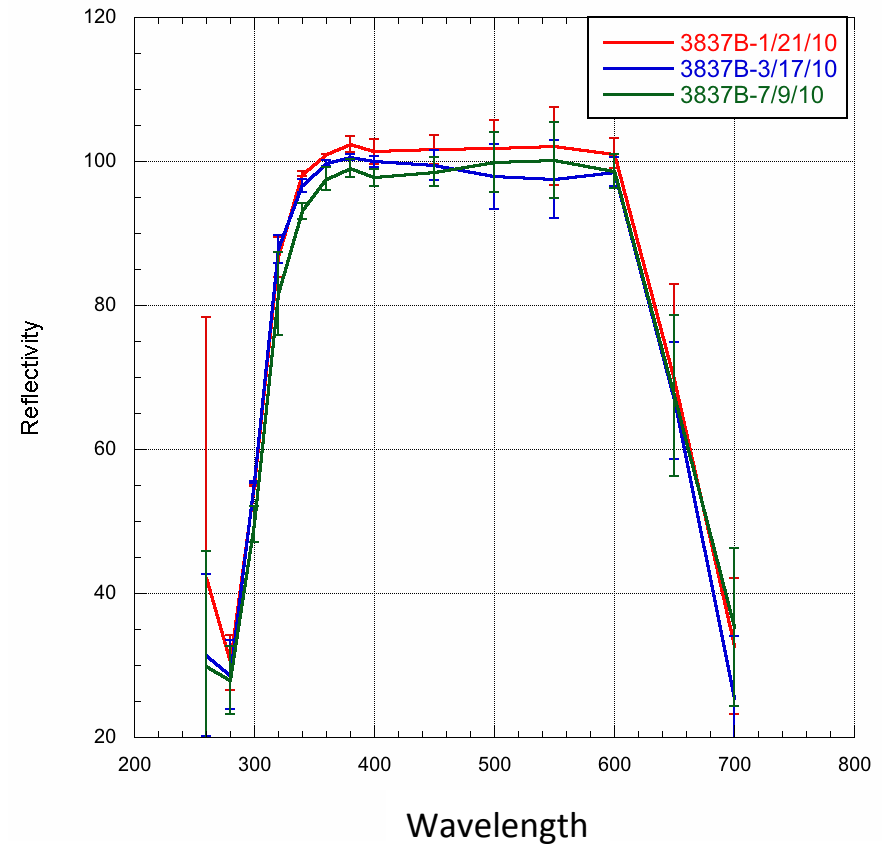
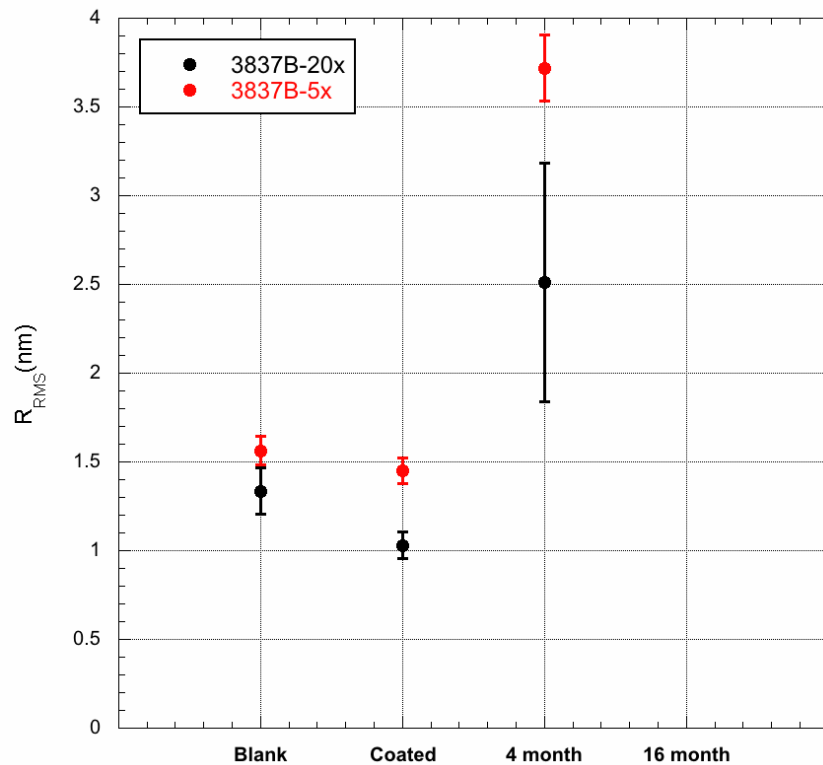
Bottom



↕ -5 %
↕ -8 %

-13 % @ 360 nm

Dielectric coating



Only measured after 4 months on T3
Large variations of micro-roughness but stable reflectance



Portable reflectometer

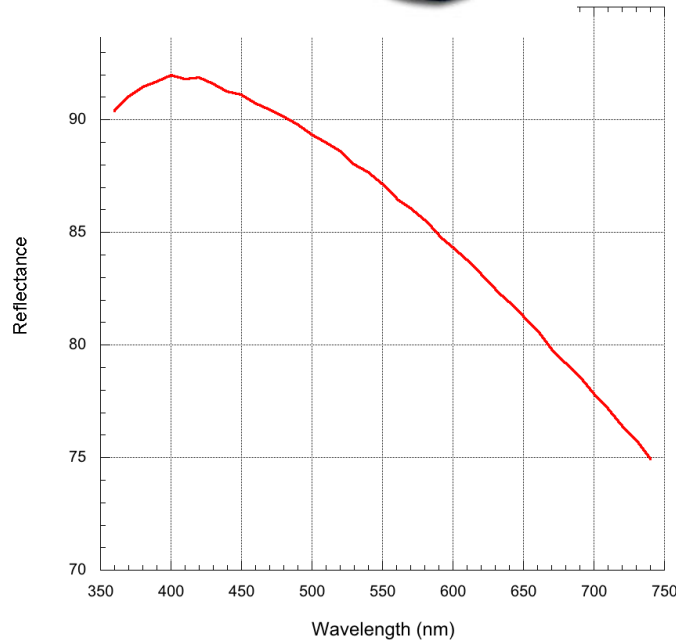
Wavelength range : 360 – 740 nm

Calibrated (with certification)

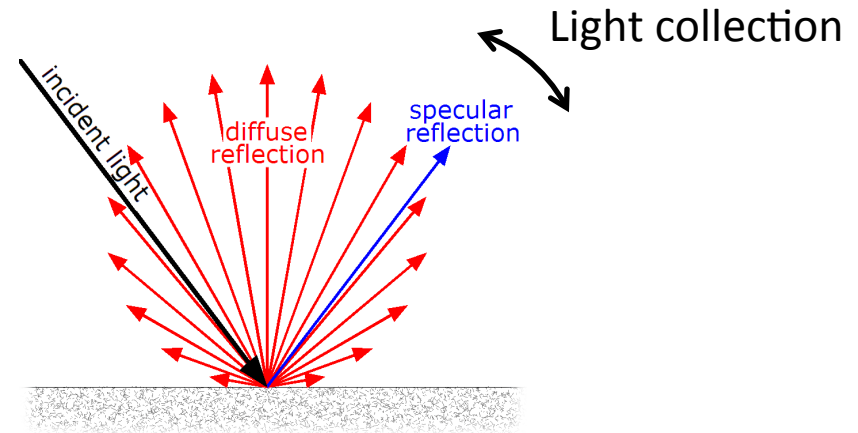
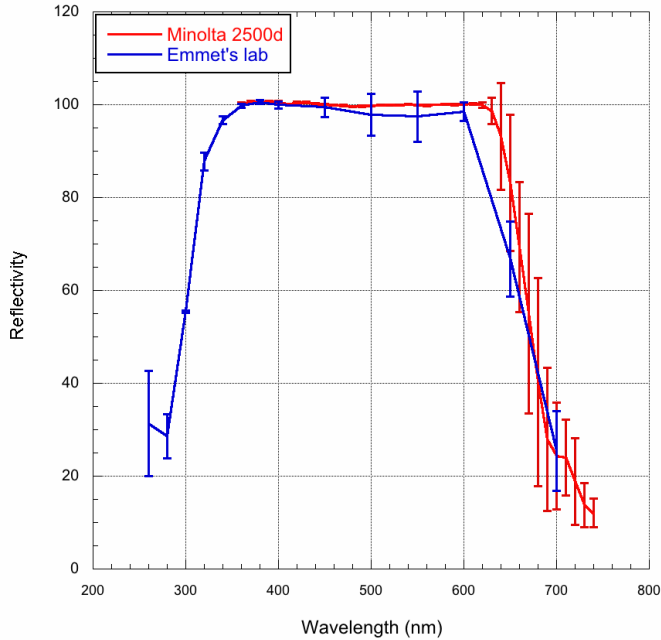
Measurement area : 8 mm

Weight : ~ 700 g

Capable to separate the diffusion and specular reflectance



Cross calibration (in progress)



Good agreement between the 2 instruments for “good” mirrors (low diffusion)

Large difference (up to 10%) for “bad” mirrors (large diffusion)

For the next months :

- ✓ Repeat the last measurement with a newly coated reference mirror
- ✓ Mount again the anodized and quartz mirrors on T3 ASAP
- ✓ Resume the dielectric aging with a new mirror from BTE
- ✓ Try other coating technics ?