

**Is Spectralon,
the Highest Diffuse Reflectivity Material,
a Lambertian Scatterer?**

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What is Spectralon?

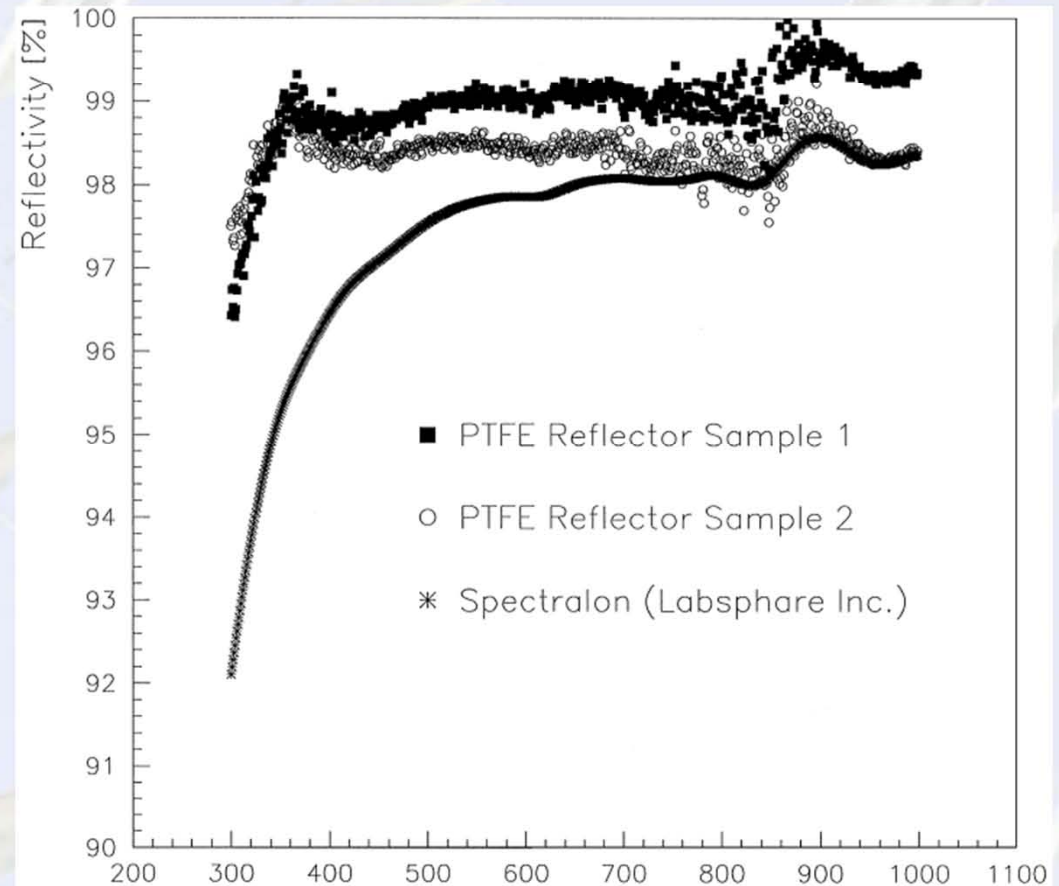
- product name for diffusely reflecting material
- manufactured from PTFE (**P**oly**t**etra**f**luore**e**thylene)
- sintered from PTFE powder
- very high diffuse reflectivity in the wavelength regime from 300-1000nm
- said to be a perfect diffusor (Lambertianen reflector)

PTFE reflector manufactured in MPI

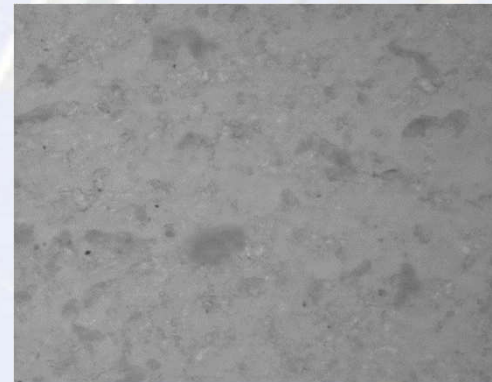
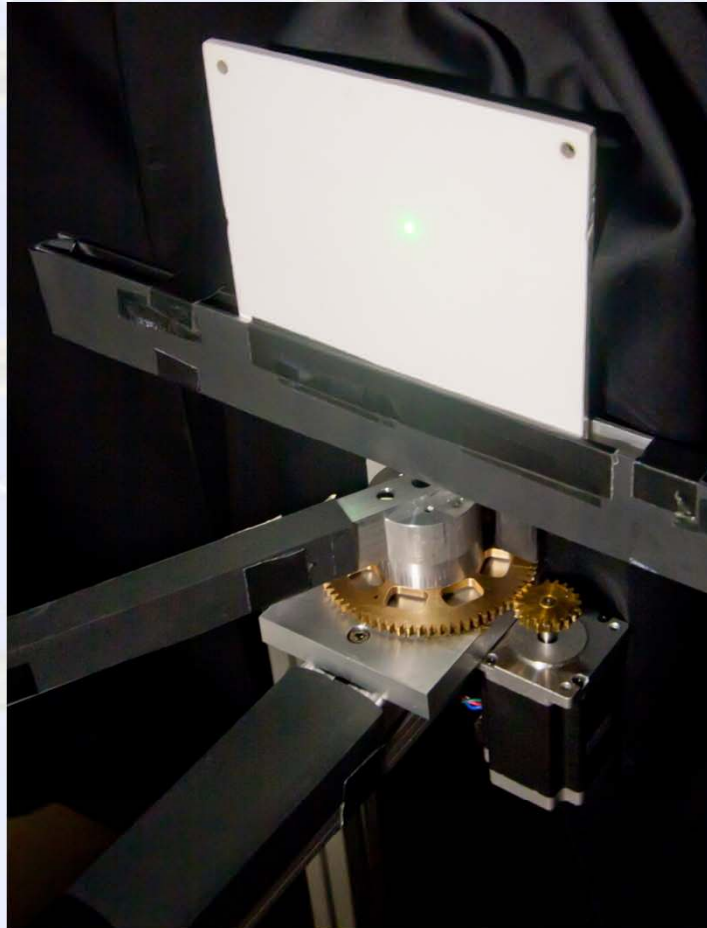
- PTFE powder HOSTAFLON grain size : 20 μ m
- sintered in the oven over 6 h with different temperatures
- cooled down very slowly over 15 h
- can be machined into various shapes

Achieved properties could easily compete with those of the commercially available reflectors

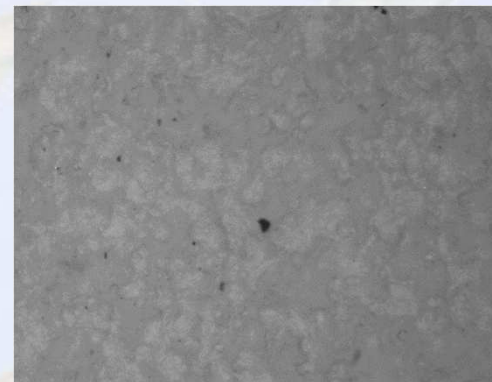
Mirzoyan, et al., 2000



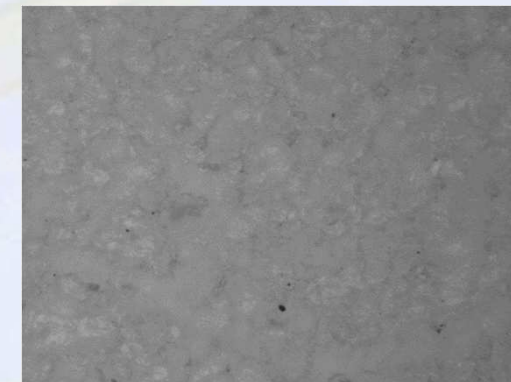
Different reflector samples



6mm



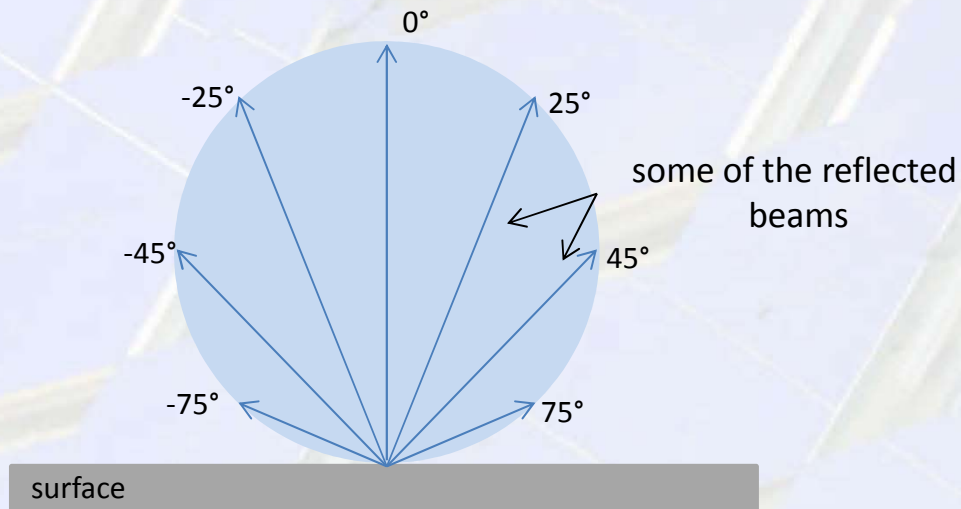
13mm



commercial

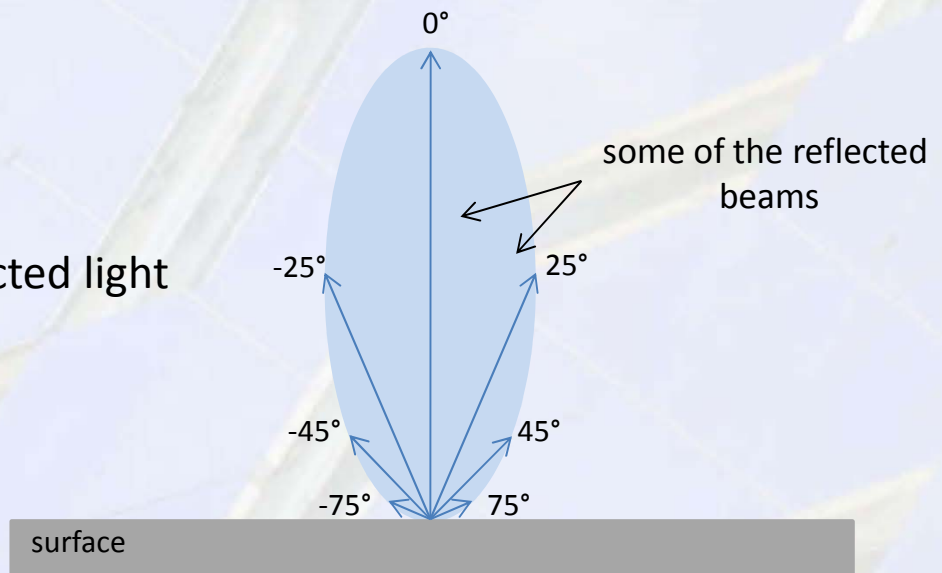
Spectralon surface under the microscope
(magnification: 160-320 times)

Different directional characteristics



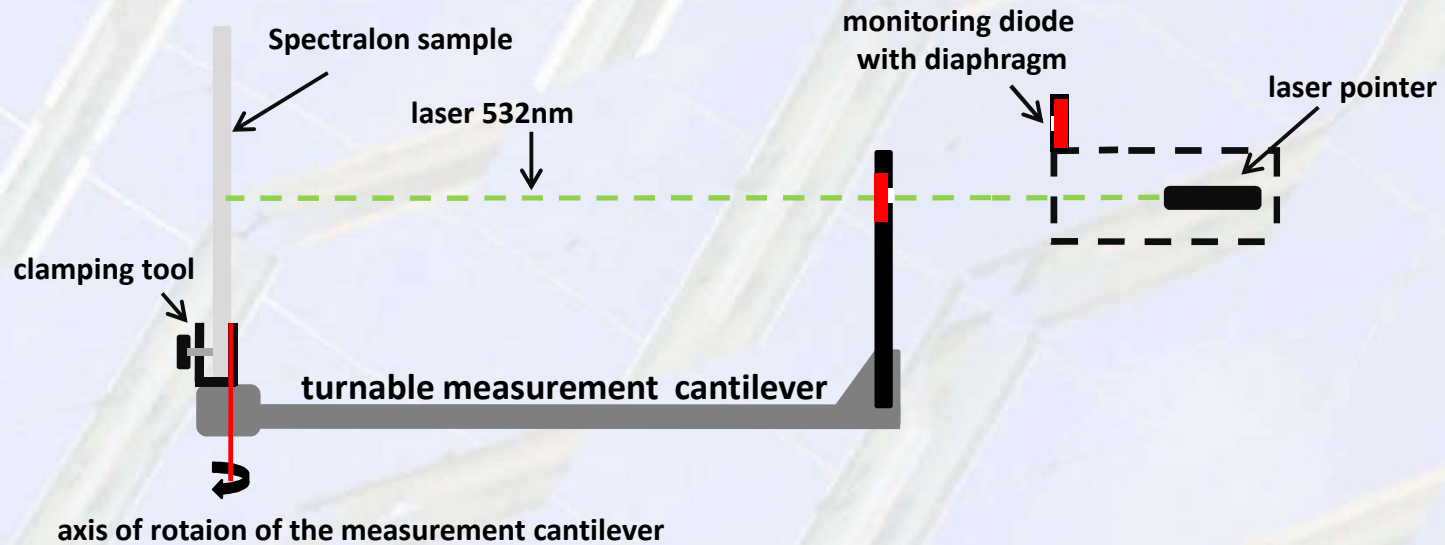
diffusely reflected light

not so diffusely but more specular reflected light for perpendicular incidence

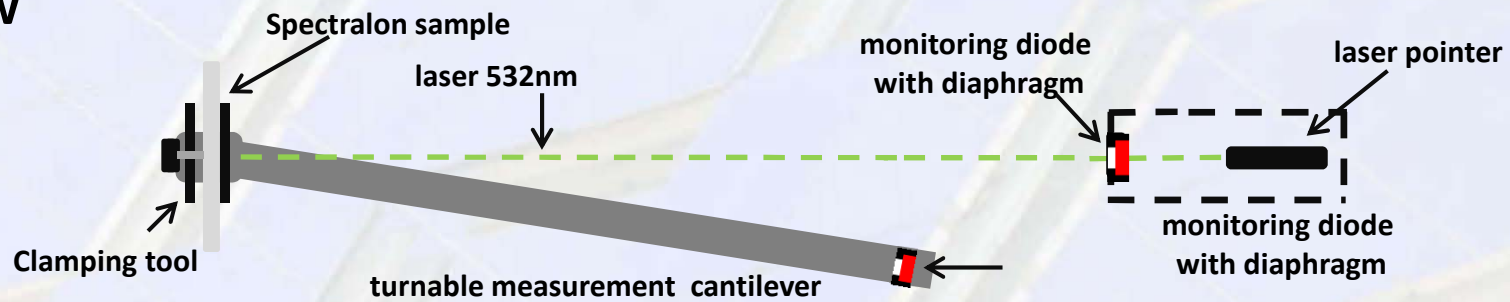


Measurement setup for characterizing the Spectralon samples

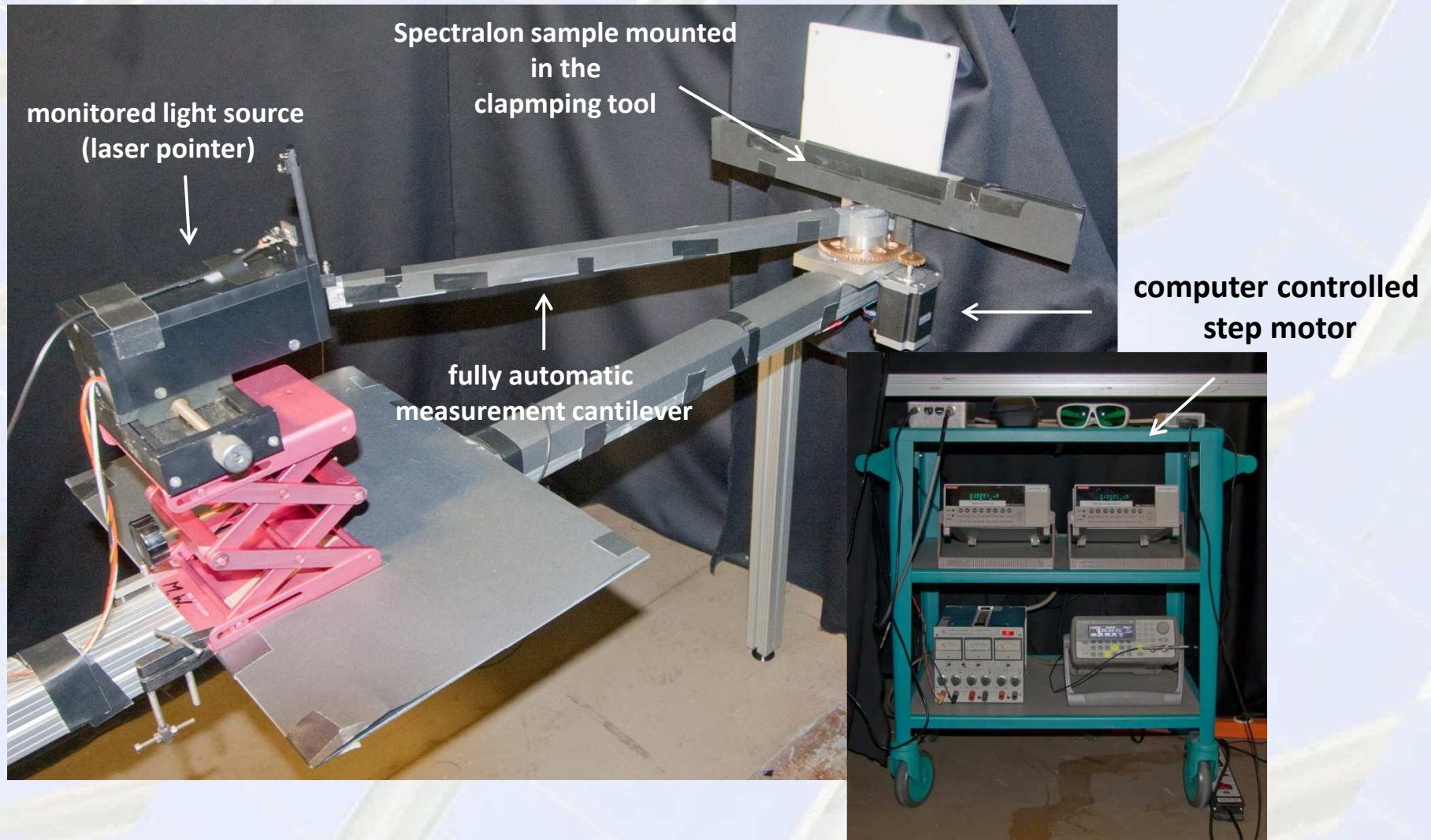
side view



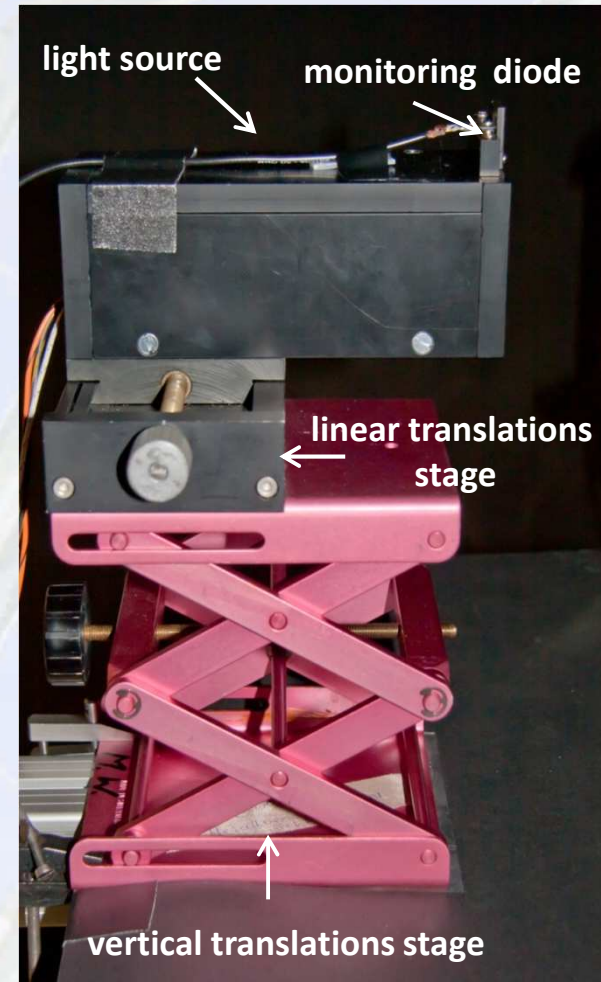
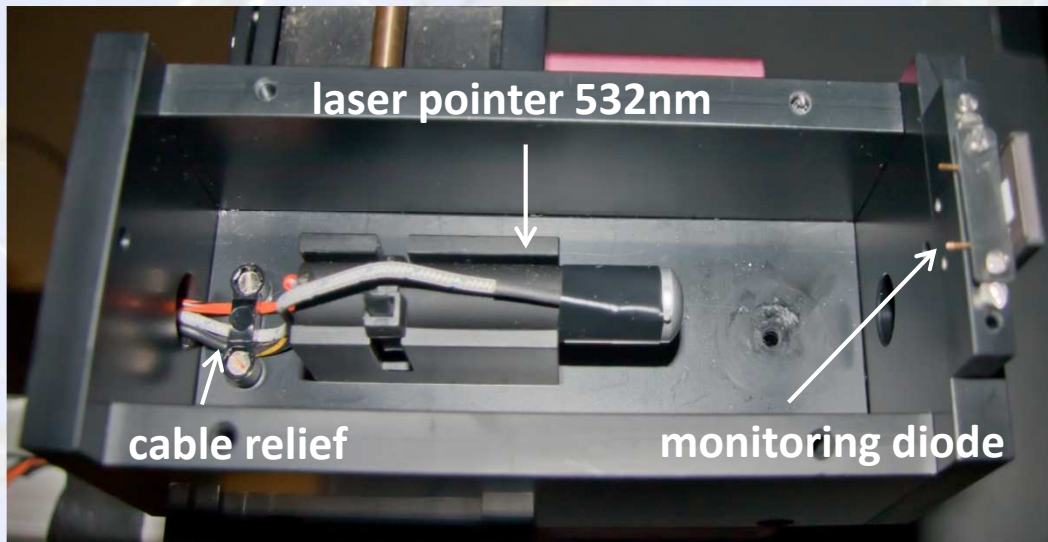
top view



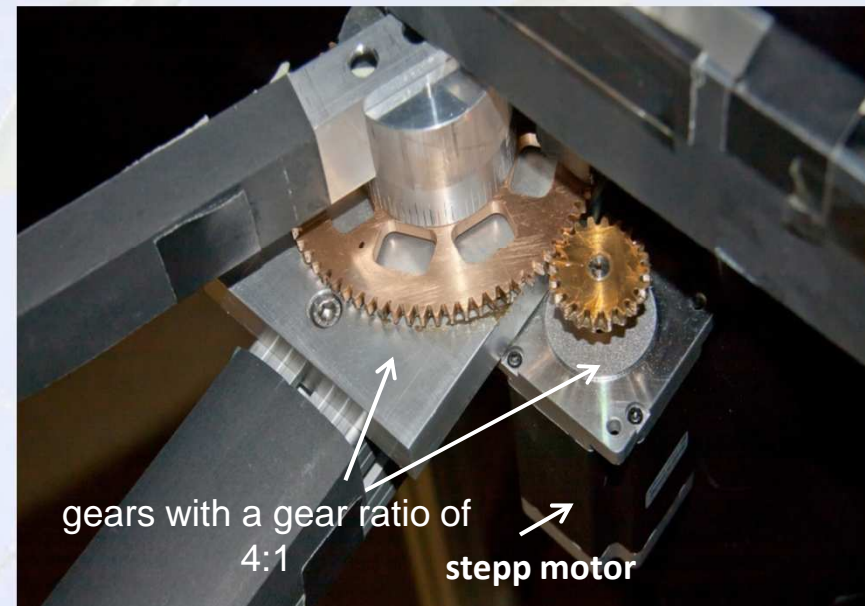
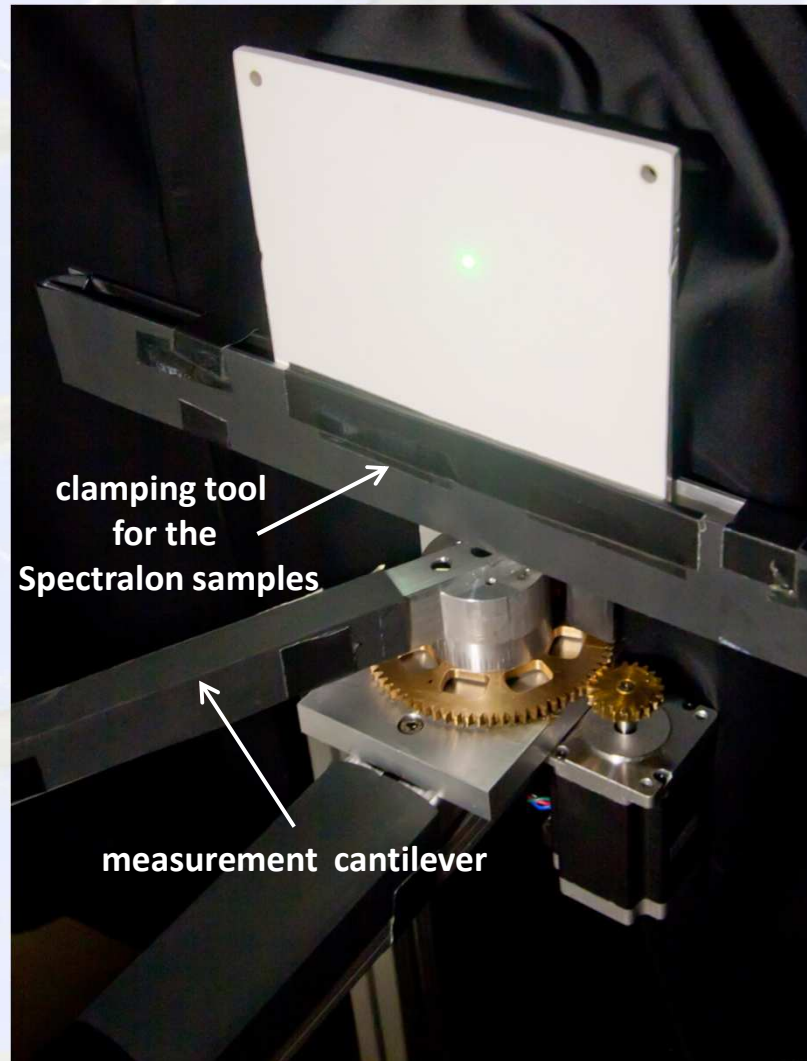
Measurement setup for characterizing the Spectralon samples



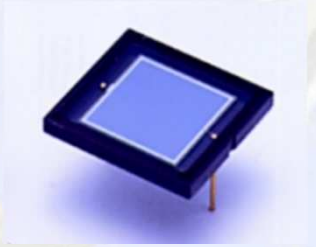
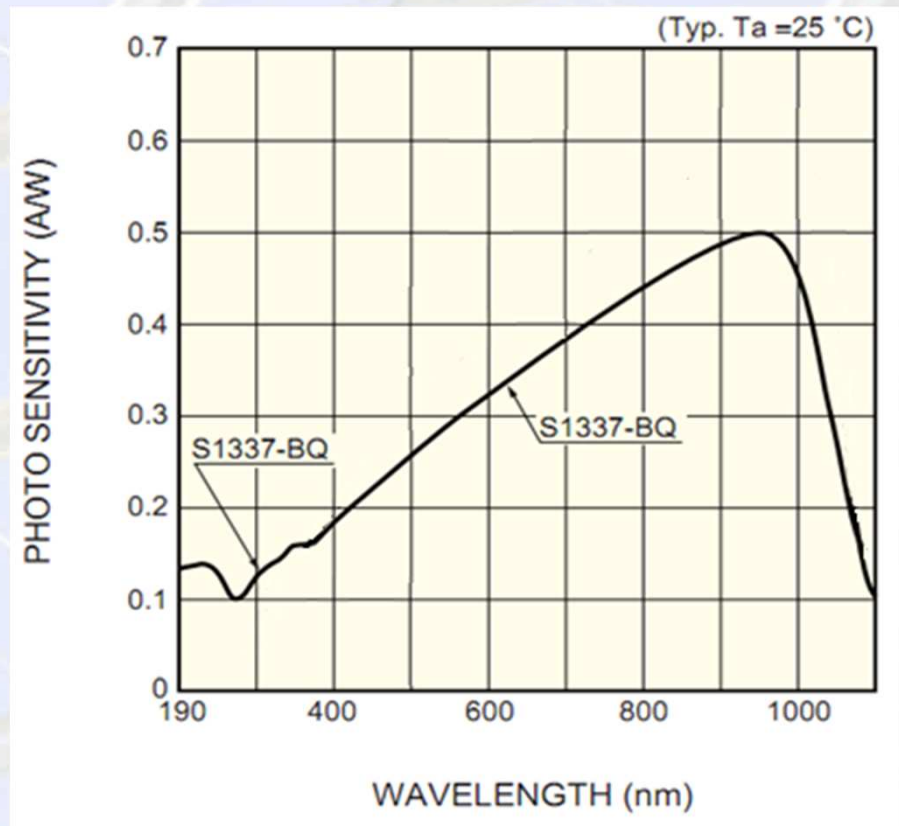
light source



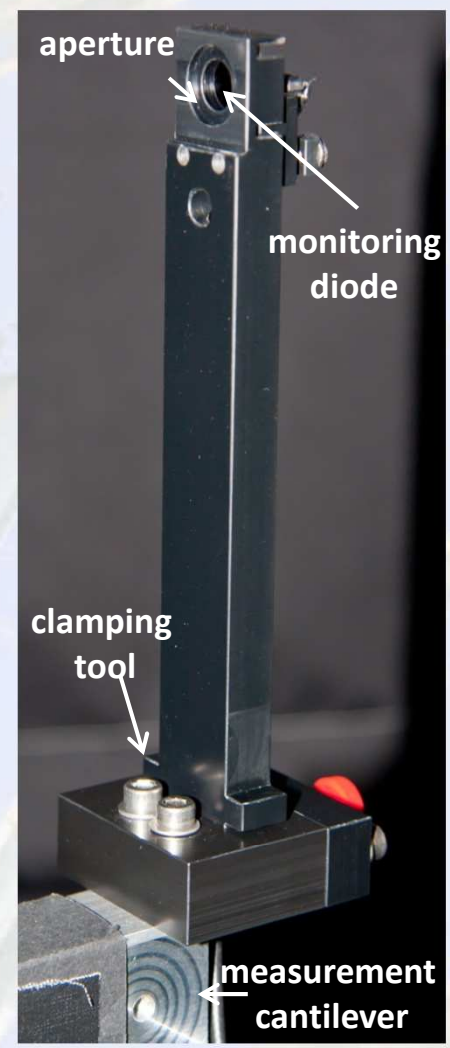
Sample holder and drive system for the cantilever



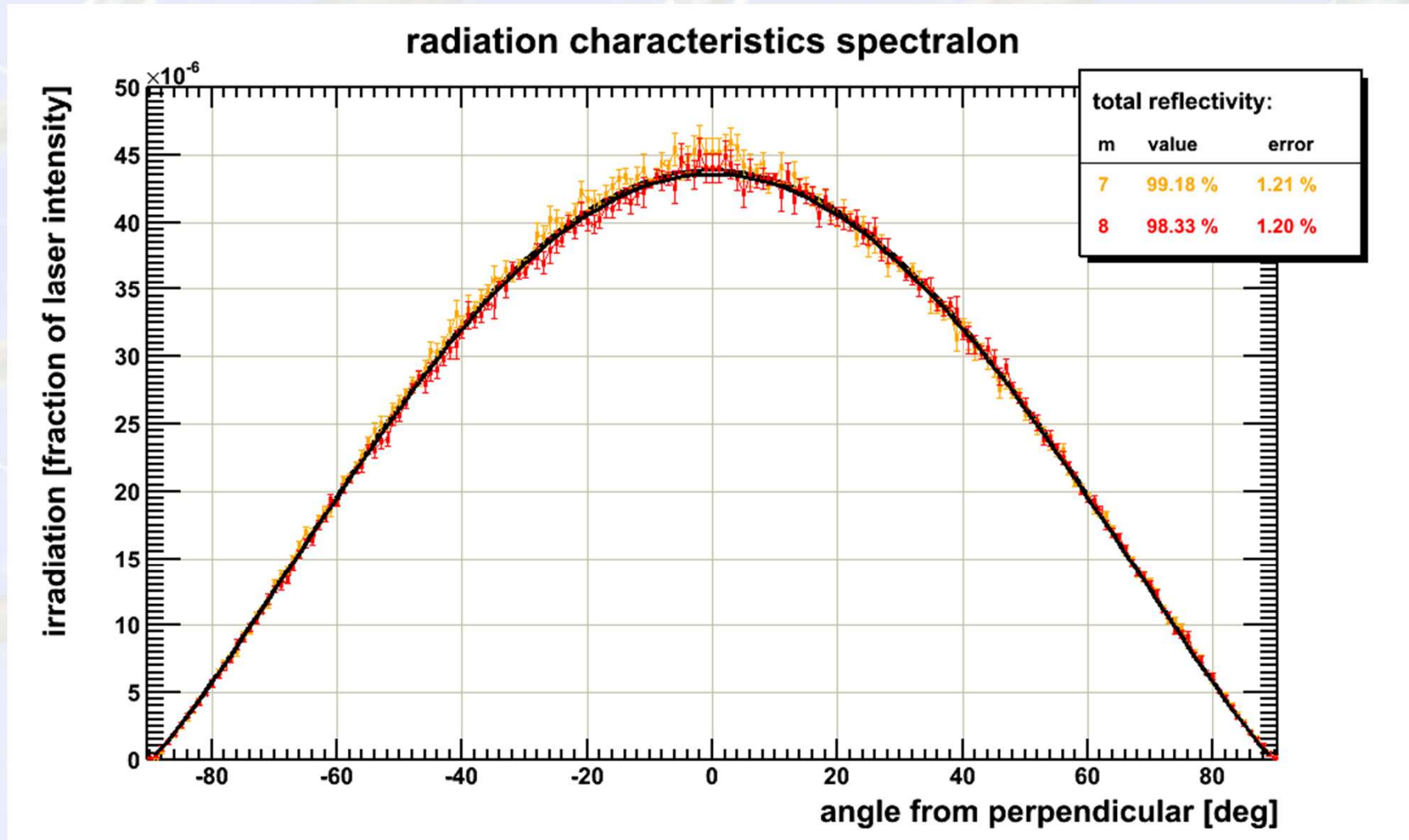
measurement diode



Hamamatsu S1337-BQ

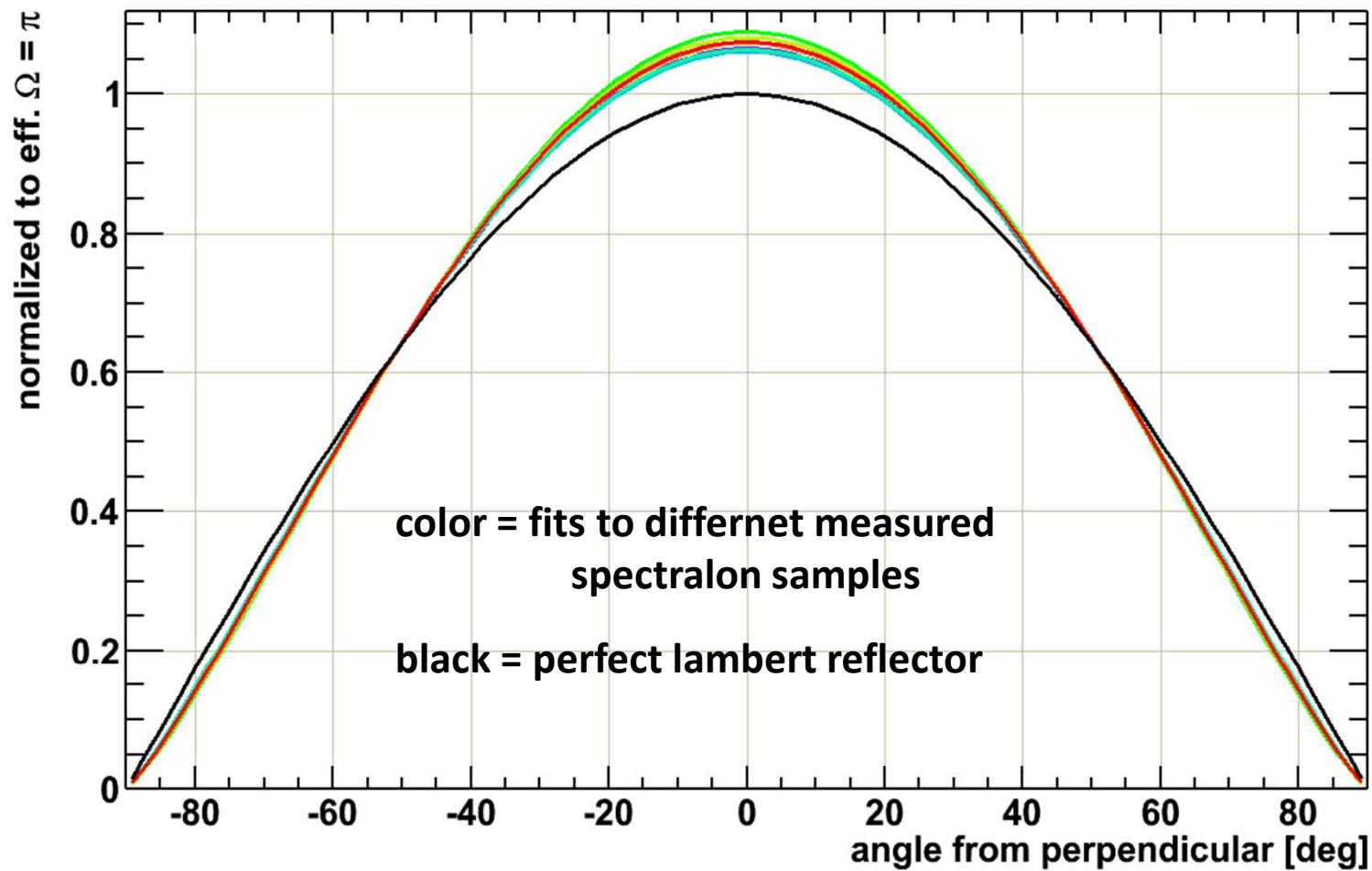


Example of a scattering characteristics of real spectralon sample

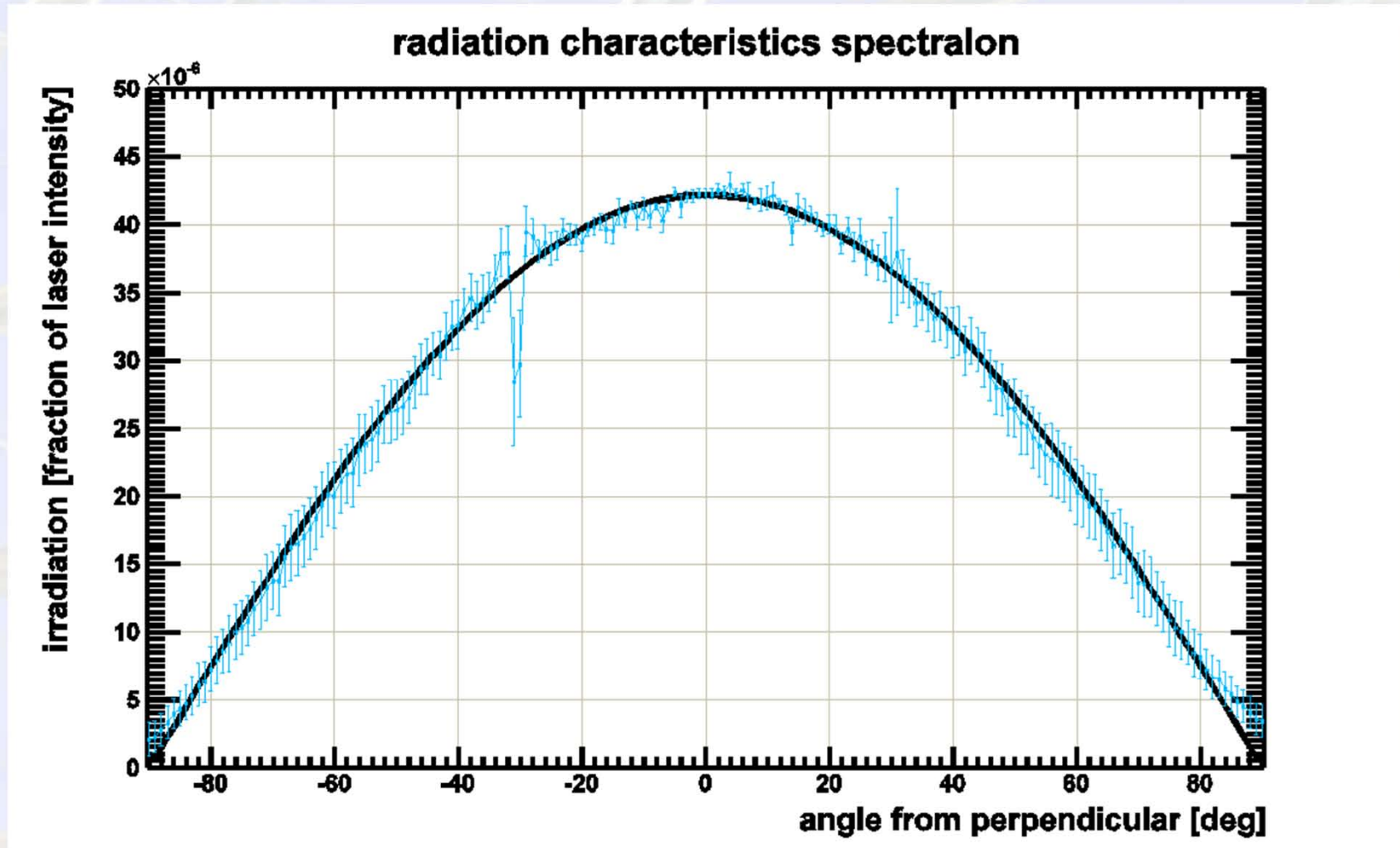


$$f(\varphi) = E_0 \cdot \cos(\varphi)^\alpha \quad \alpha = 1.15 \pm 0.02$$

scattering characteristics of real spectralon samples vs. ideal diffuse (Lambertian) reflector



scattering characteristics spectralon sample Illuminated under -30 deg



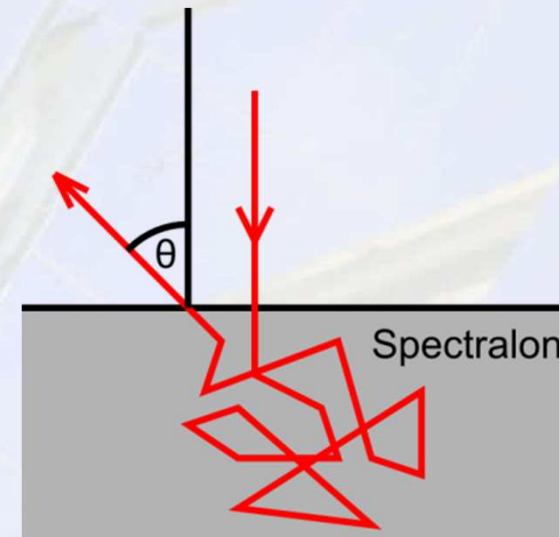
Simulation steps

2 very simple assumptions:

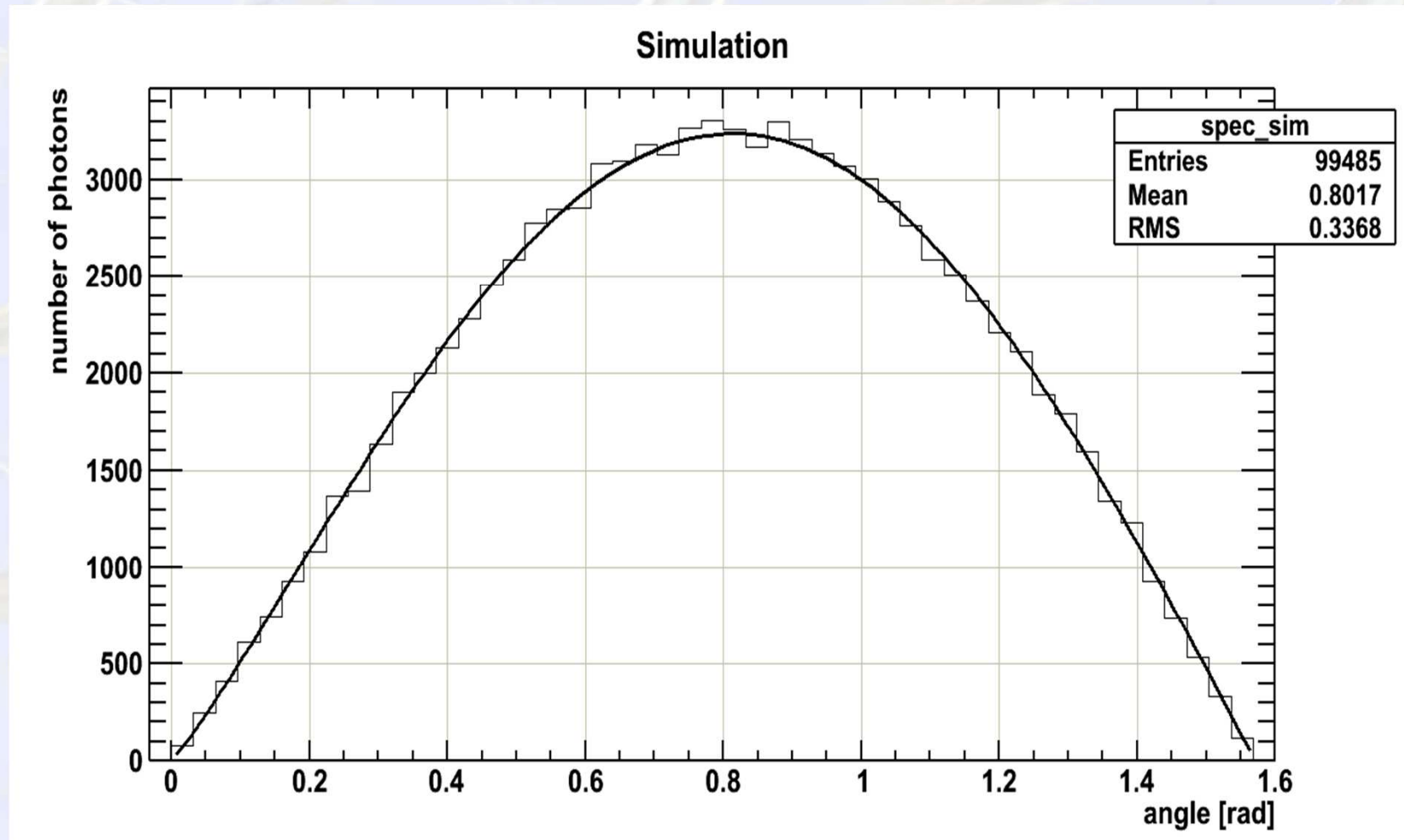
- penetration depth distribution according to an exponential law
- isotropic scattering at interaction point

Not taken into account:

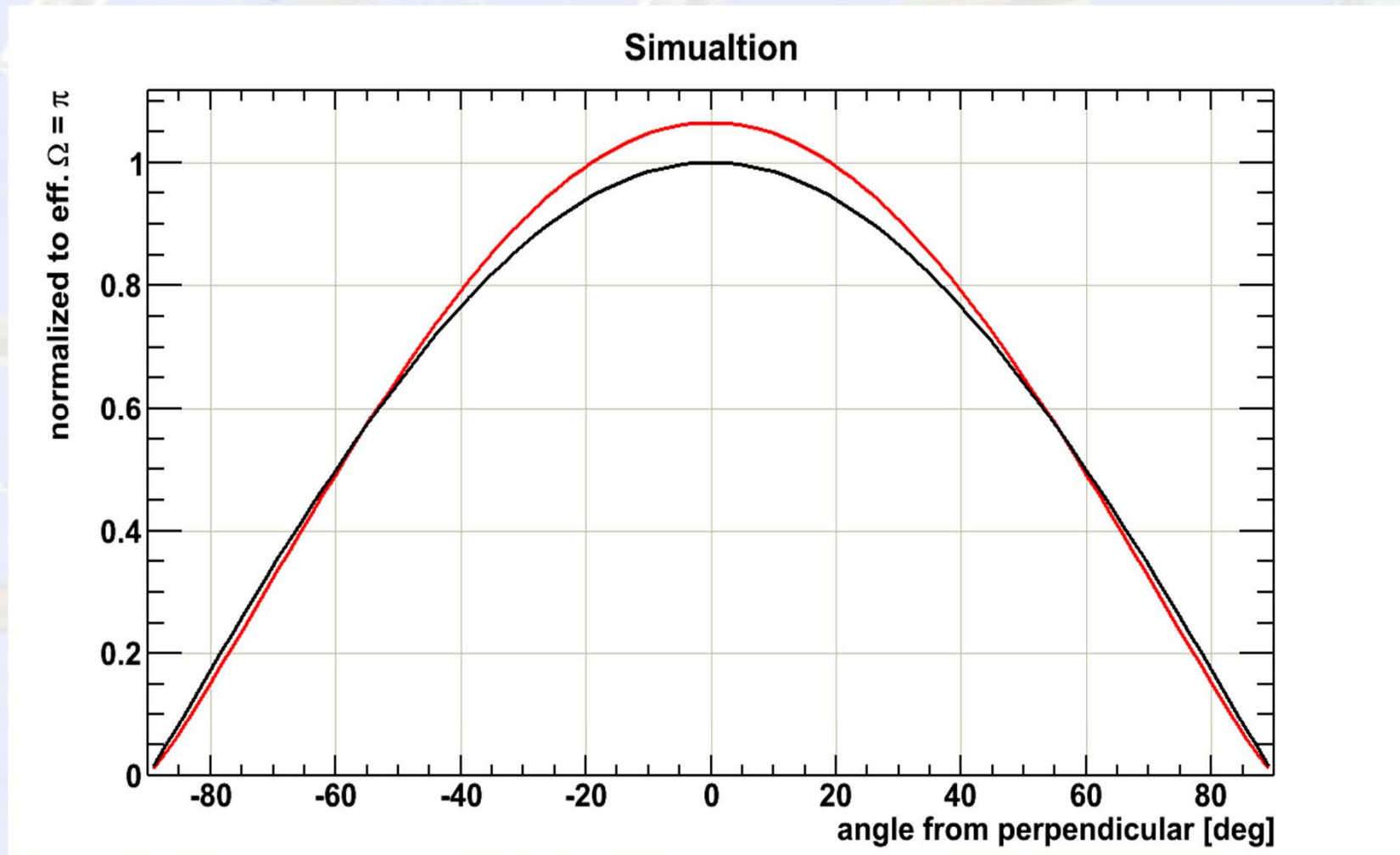
- grain size
- horizontal propagation of the light



Result of the Simulation



scattering characteristics of simulated spectralon vs. ideal diffuse (Lambertian) reflector

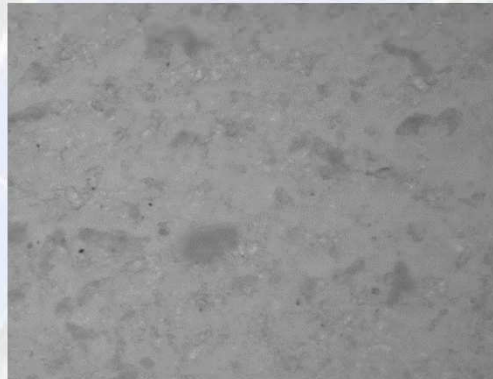


$$f(\varphi) = E_0 \cdot \cos(\varphi)^\alpha \quad \alpha = 1.11$$

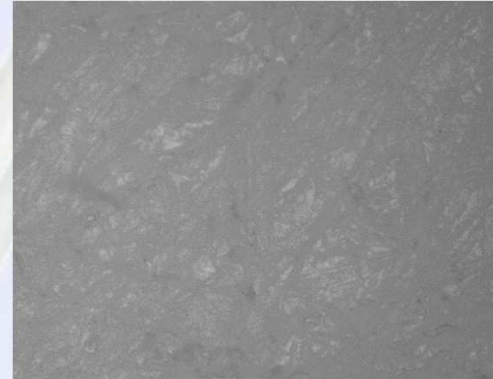
Thank you!

Different reflector samples under the microscope

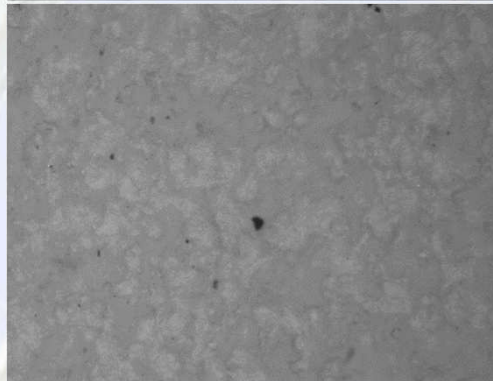
6mm



9mm



13mm



comercial

