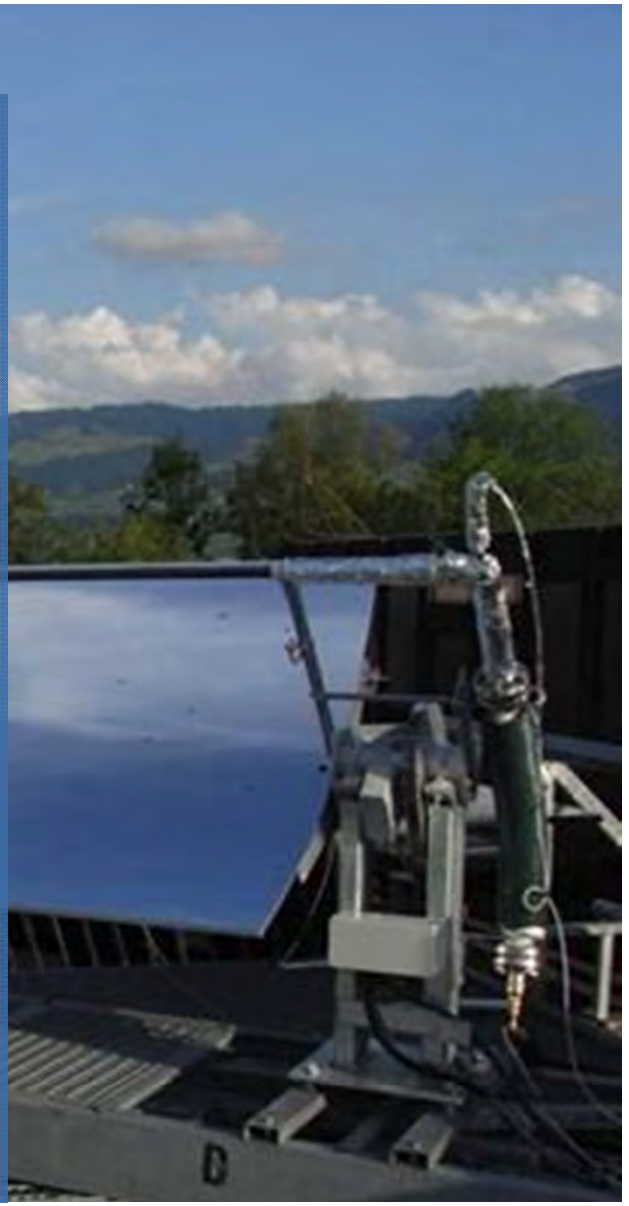
Material Characterization
-
Mirrors

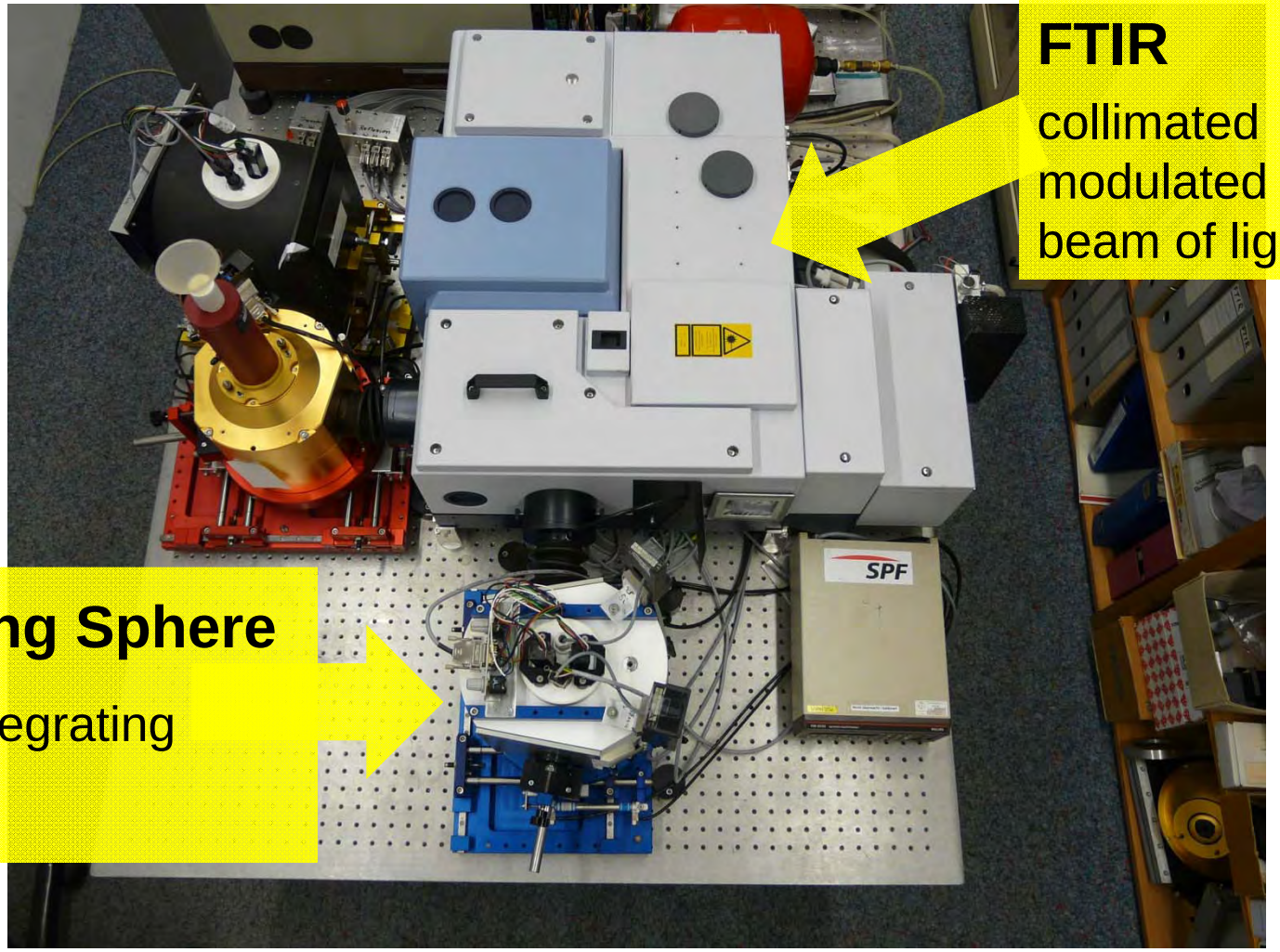


Stefan Brunold
Institutsleiter Stv. SPF - Institut für Solartechnik
Rapperswil

HSR
HOCHSCHULE FÜR TECHNIK
RAPPERSWIL
FHO Fachhochschule Ostschweiz

SPF INSTITUT FÜR SOLARTECHNIK

FTIR Spectroscopy using Integrating Spheres



FTIR

collimated
modulated
beam of light

Integrating Sphere

spatially integrating

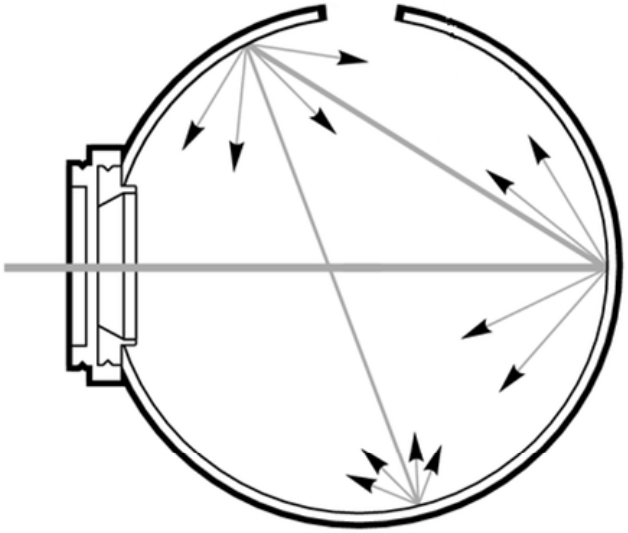
detector

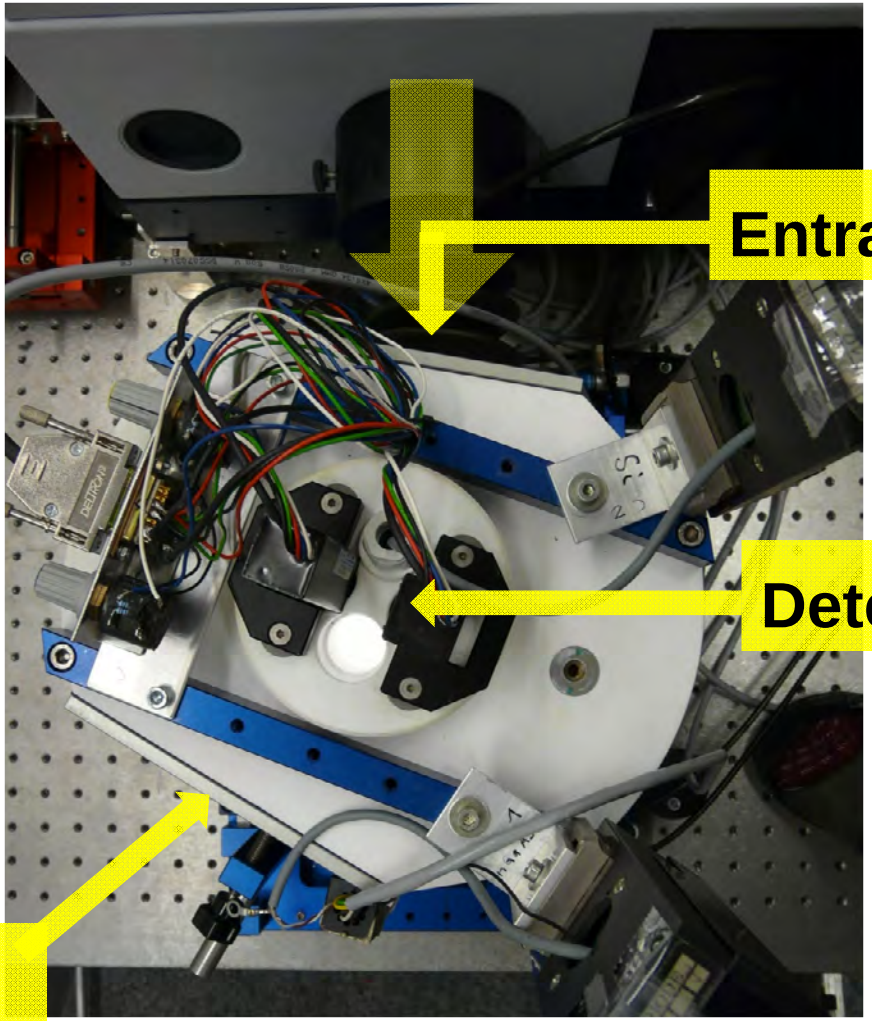
FTIR Spectroscopy using Integrating Spheres

Surface:

- high reflectance
- diffuse characteristics

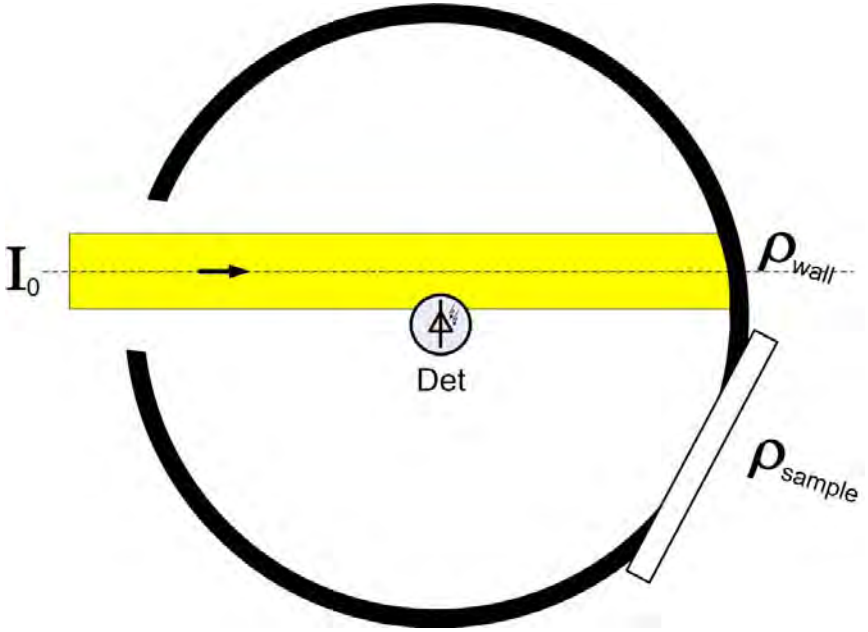
= homogenous illumination



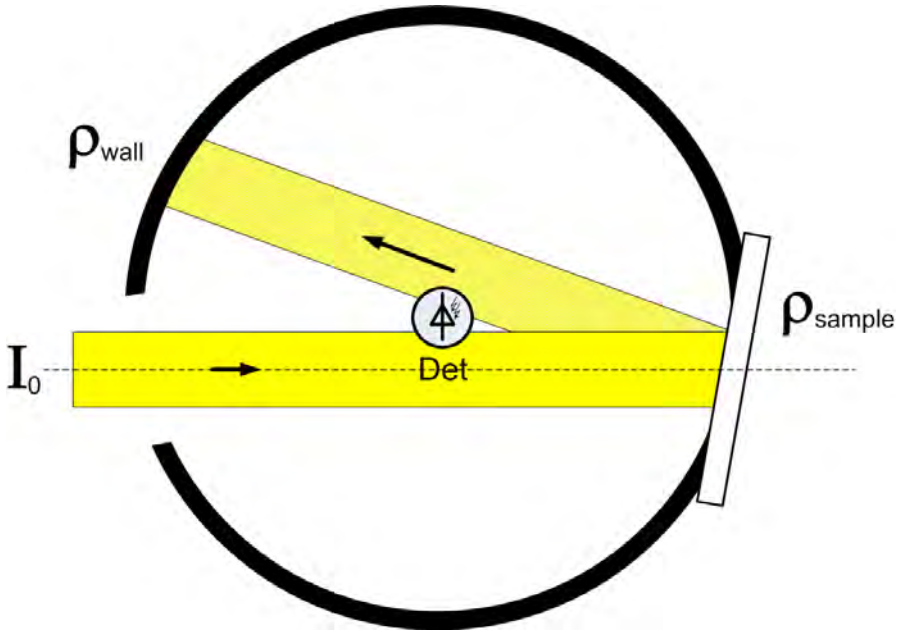


Reference Measurement

$$S_{det,ref} = I_0 \cdot \rho_{wall} \cdot f_{sphere}$$



Sample Measurement

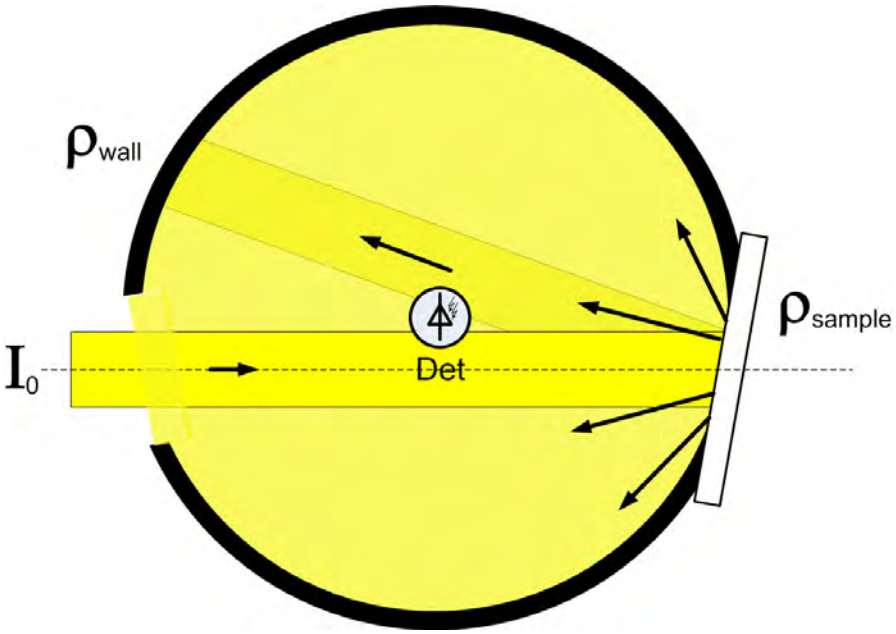


$$S_{det,ref} = I_0 \cdot \rho_{wall} \cdot f_{sphere}$$

$$S_{det,spl} = I_0 \cdot \rho_{sample} \cdot \rho_{wall} \cdot f_{sphere}$$

$$\rho_{sample} = S_{det,spl} / S_{det,ref}$$

Sample Measurement



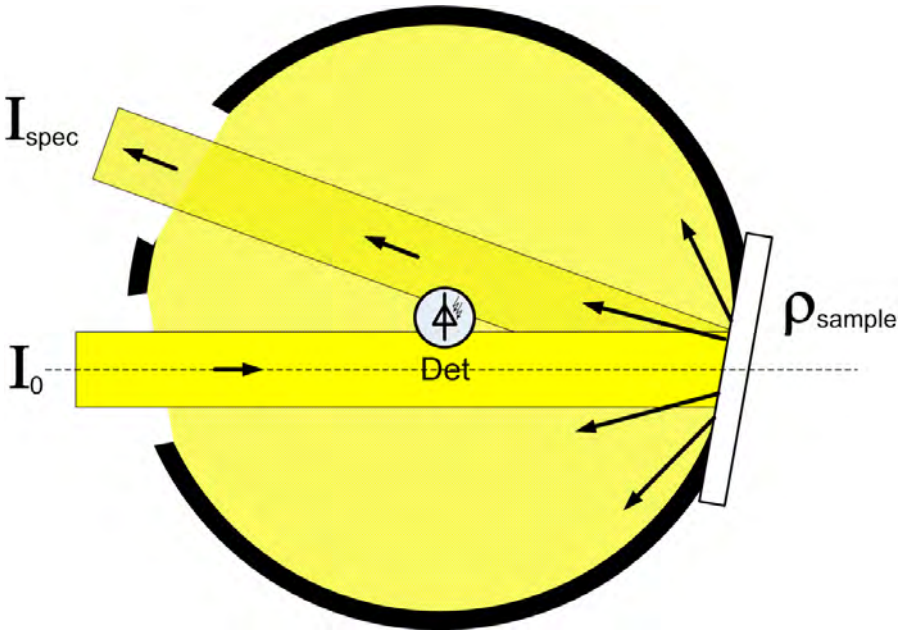
$$S_{det,ref} = I_0 \cdot \rho_{wall} \cdot f_{sphere}$$

$$S_{det,spl} = I_0 \cdot \rho_{sample} \cdot \rho_{wall} \cdot f_{sphere}$$

$$\rho_{sample} = S_{det,spl} / S_{det,ref}$$

Hemispherical Reflectance: $\rho_{hem} = \rho_{dif} + \rho_{spec}$

Sample Measurement



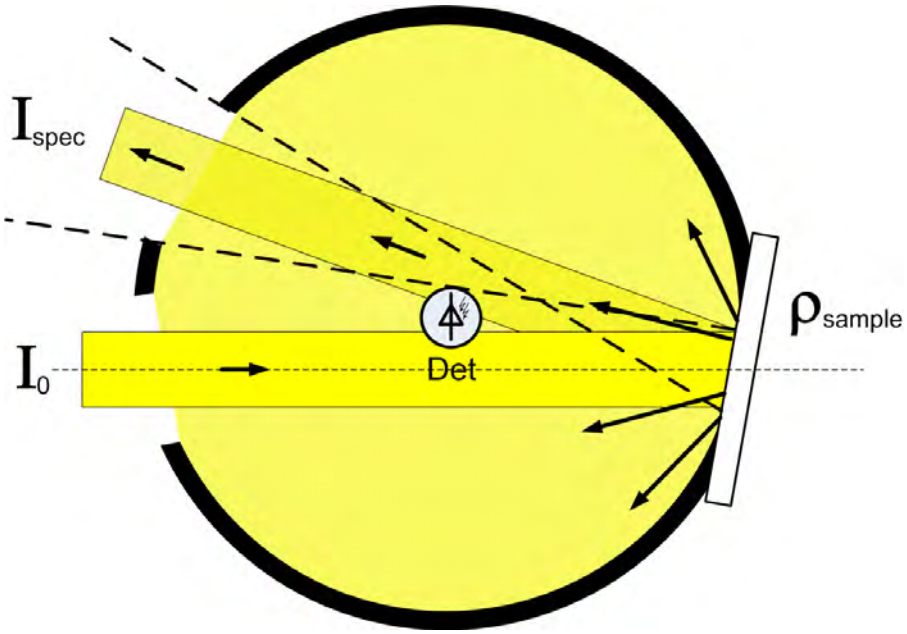
$$S_{det,ref} = I_0 \cdot \rho_{wall} \cdot f_{sphere}$$

$$S_{det,spl} = I_0 \cdot \rho_{sample} \cdot \rho_{wall} \cdot f_{sphere}$$

$$\rho_{sample} = S_{det,spl} / S_{det,ref}$$

Diffuse Reflectance: $\rho_{dif} \Rightarrow \rho_{spec} = \rho_{hem} - \rho_{dif}$

Sample Measurement



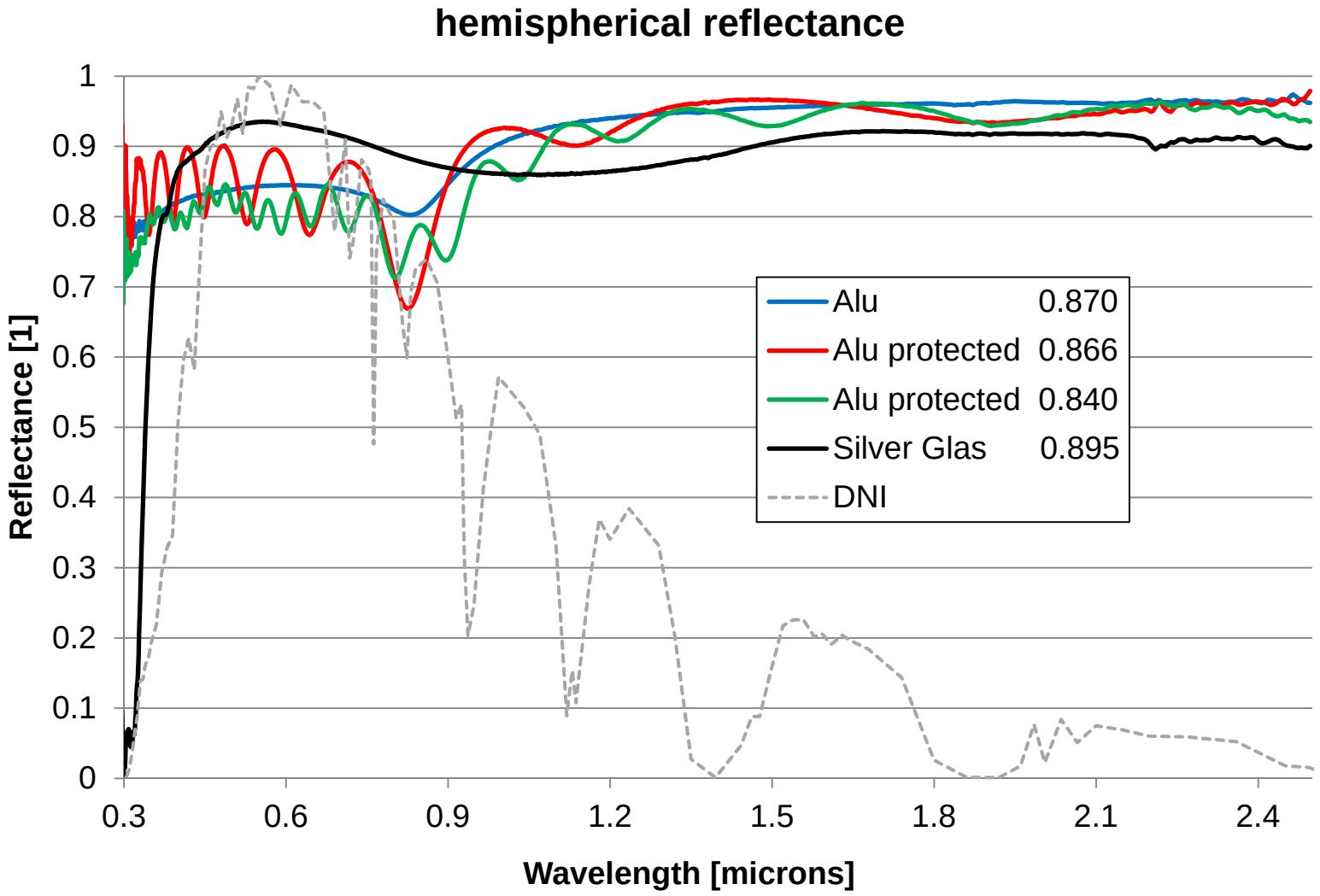
$$S_{det,ref} = I_0 \cdot \rho_{wall} \cdot f_{sphere}$$

$$S_{det,spl} = I_0 \cdot \rho_{sample} \cdot \rho_{wall} \cdot f_{sphere}$$

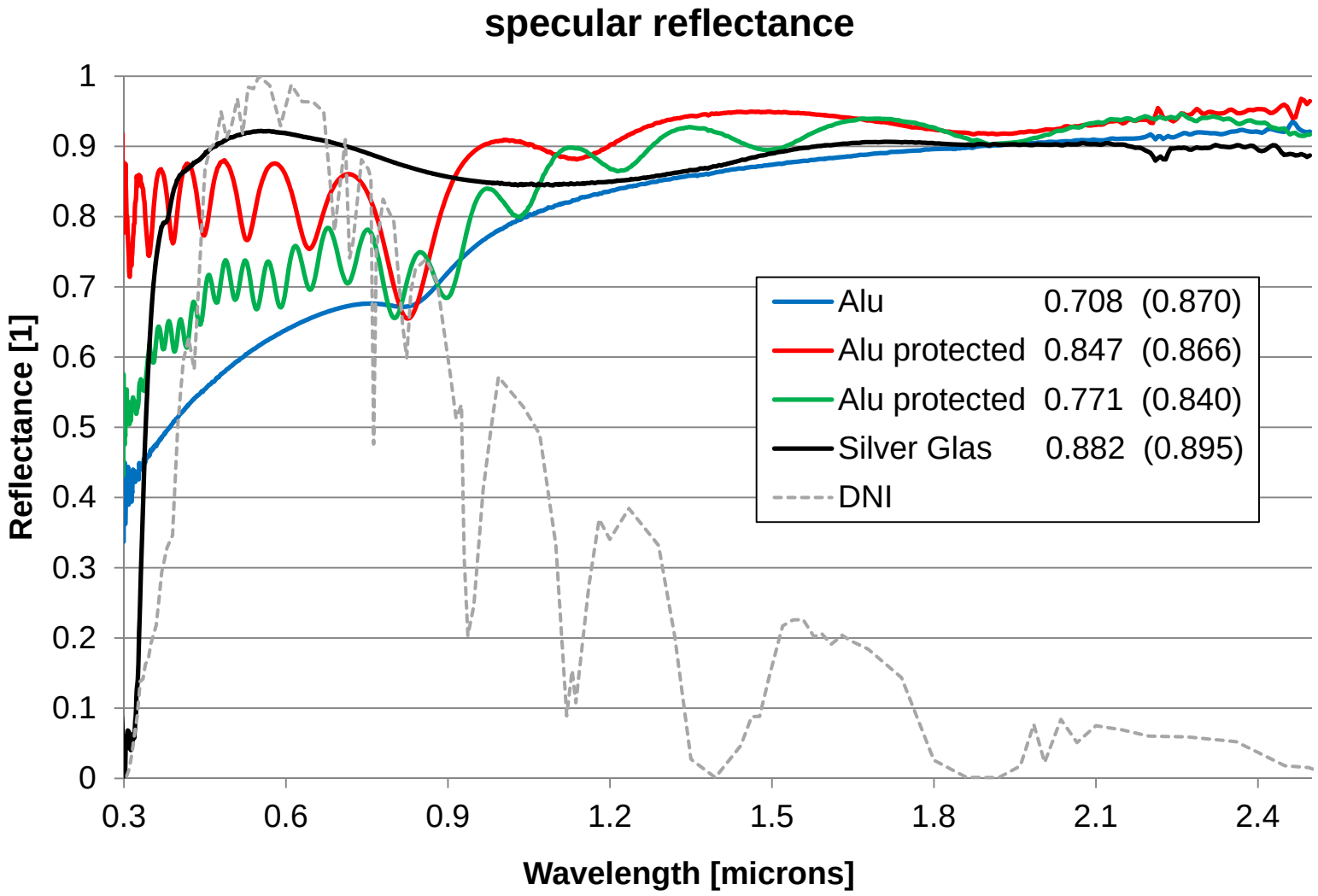
$$\rho_{sample} = S_{det,spl} / S_{det,ref}$$

Diffuse Reflectance: $\rho_{dif} \Rightarrow \rho_{spec} = \rho_{hem} - \rho_{dif}$

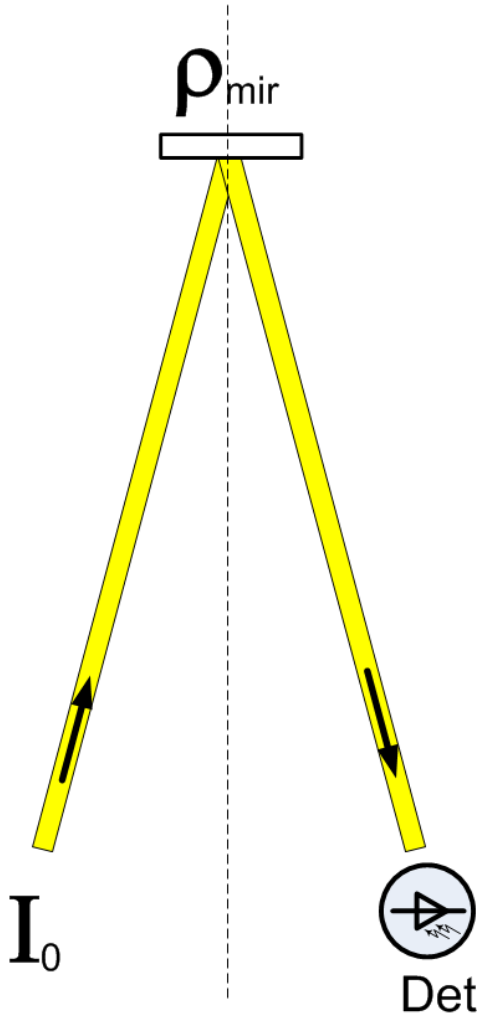
FTIR Spectroscopy using Integrating Spheres



FTIR Spectroscopy using Integrating Spheres

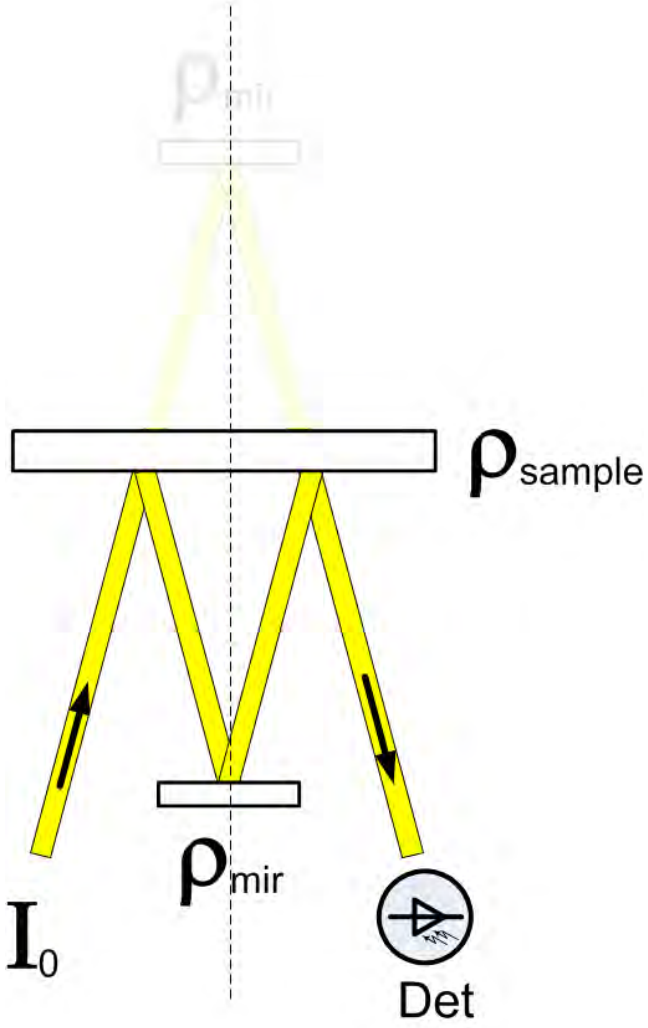


FTIR Spectroscopy using V-W-Optics



$$s_{det,ref} = I_0 \cdot \rho_{mir} \cdot f_{VW}$$

FTIR Spectroscopy using V-W-Optics



$$S_{det,ref} = I_0 \cdot \rho_{mir} \cdot f_{VW}$$

$$S_{det,spl} = I_0 \cdot \rho_{sample} \cdot \rho_{mir} \cdot \rho_{sample} \cdot f_{VW}$$

Specular Reflectance:

$$\rho_{spec} = (S_{det,spl} / S_{det,ref})^{1/2}$$

Thank you for your attention!

HSR
HOCHSCHULE FÜR TECHNIK
RAPPERSWIL
FHO Fachhochschule Ostschweiz

SPF INSTITUT FÜR SOLARTECHNIK