WORKSHOP/TRAINING SESSION FOR STAKEHOLDERS AND END-USERS FROM INDUSTRY - 26TH NOVEMBER 2018

FOILS SELECTED FOR THE PROJECT; ANALYSIS OF ANGULAR DISTRIBUTION OF REFLECTION

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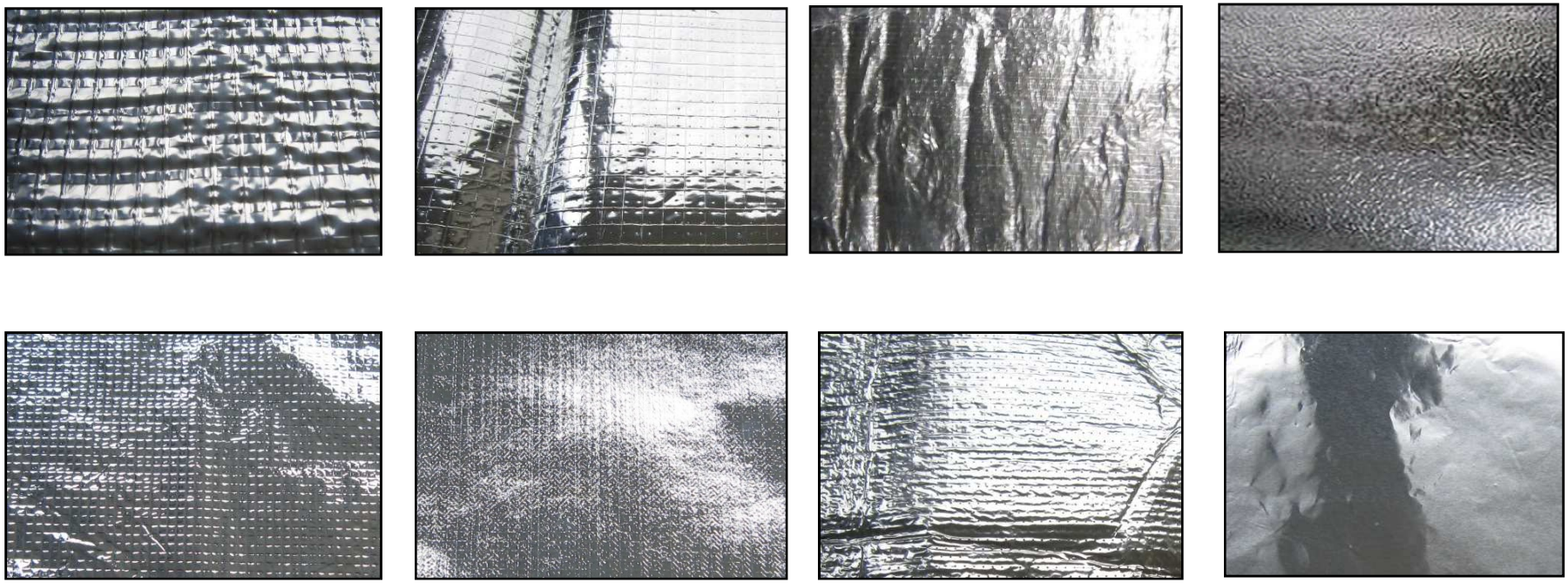
Foils selected for the project; analysis of angular distribution of reflection

Response of an emissometer is a combination of :

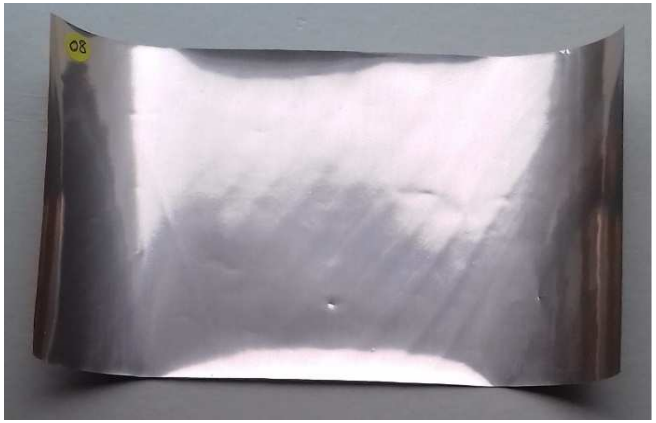
- Sensitivity of the instrument to the angular diffusion of the sample,
- Spectral sensitivity of the instrument or of the technique of calculation,
- Level of emissivity / reflectance (emissvity level(s) used for calibration , emissivity level of the sample, linearity of response of the instrument),
- Spectral distribution of reflectivity ,
- Temperature conditions when measuring (temperature of the sample, temperature of the radiation source for “total measurements”).

- Evaluation of the uncertainty of measurements requires :
  - angular diffusion of the sample,
  - level of emissivity/reflectance,
  - spectral distribution of emissivity/reflectance,
  - Uniformity of emissivity/reflectance,
  - Reproducibility of the local orientation of the surface of the samples (loose foils, solid samples).
  - Radiation absorption and thermal inertia of the sample material (evolution of sample temperature when measuring).

High diversity of morphologies of surfaces for commercial low E insulation products

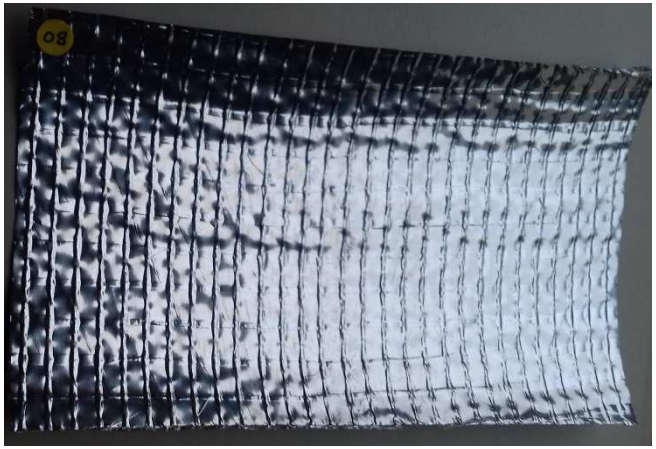


First foils selected for first tests in the project



PE80 µm Copper – Front

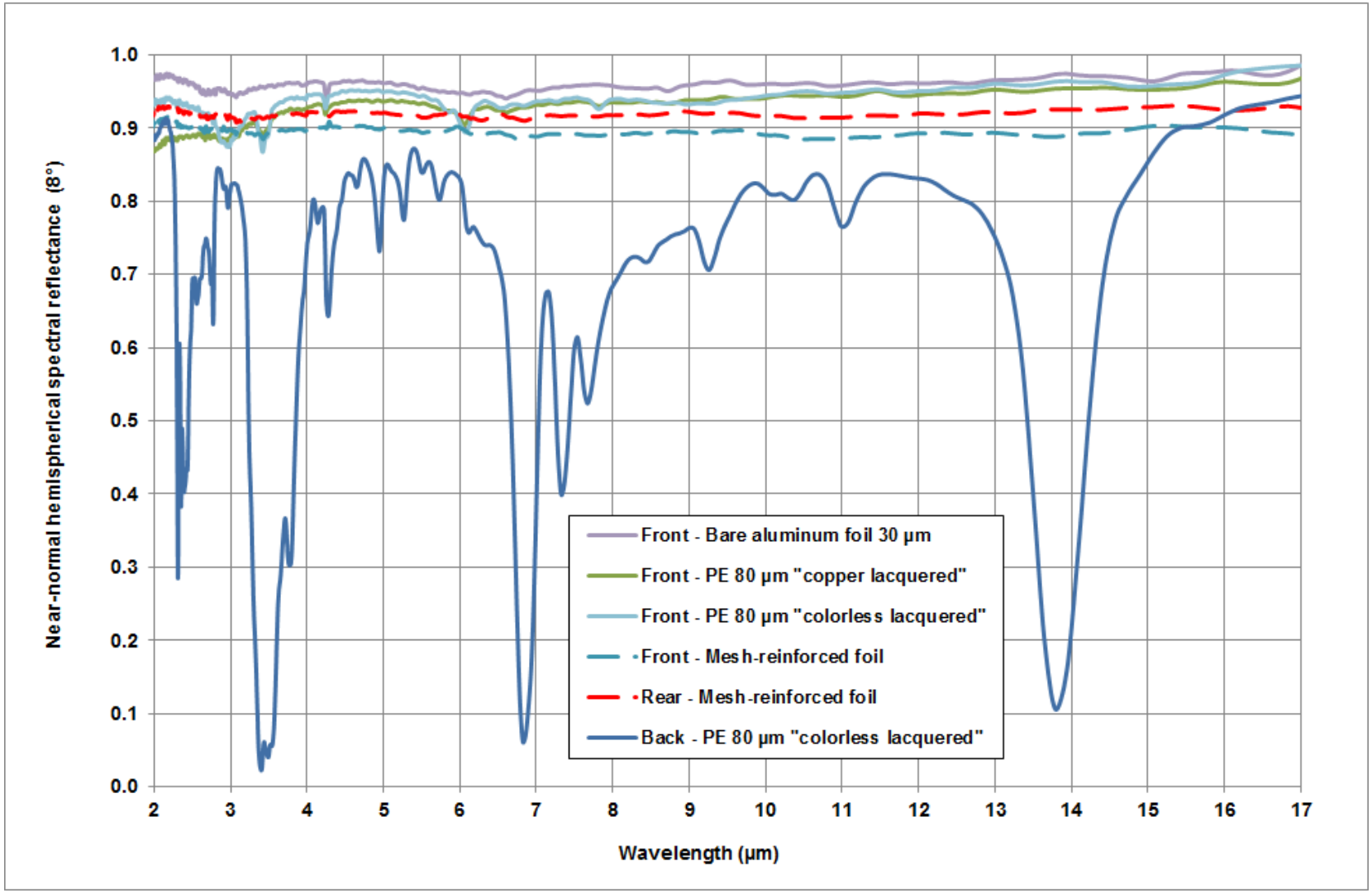
PE80 µm colorless- Front



Mesh reinforced foil - Front

Bare aluminium foil - Front

Foils selected for the project : spectral reflectance curves



Spectral curves, emissivities :

- Front sides of the foils :
  - low emissivity,
  - Smooth spectral curves (low spectral variations),

- Front sides of the foils :
  - High influence of the polyethylene foil → typical spectral curve with strong absorption peaks.

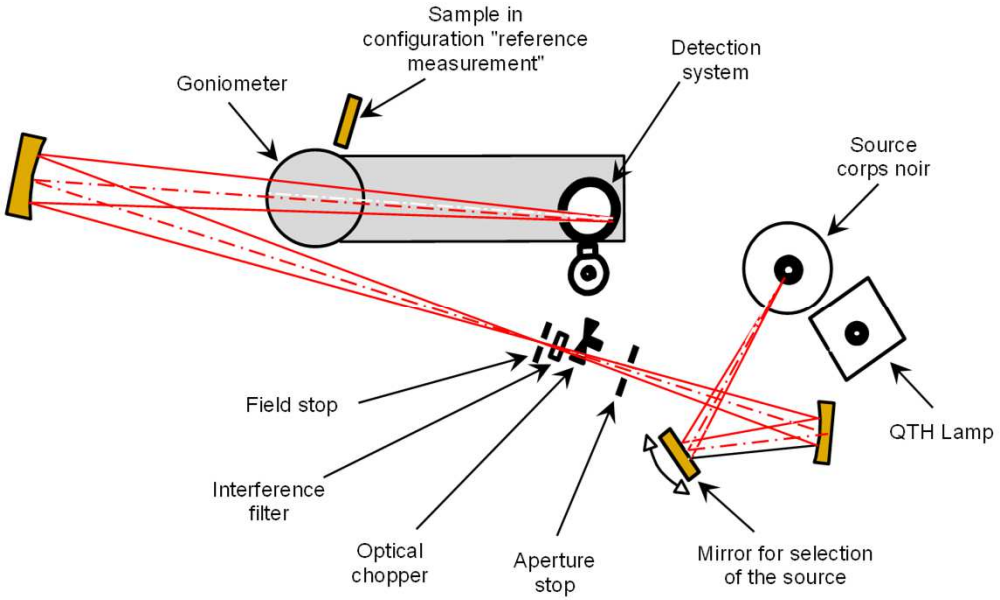
- Total hemispherical emissivities of the selected foils (first results for selection)

Description	Total hemispherical emissivity (TIR100-2)		Flatness of the surfaces	Homogeneity (30 samples) front side		Manufacturer
	Front side	Back side		SD	Max - min	
Foil PE 80 µm "copper lacquered"	0.050	0.21	smooth	0.004	0.013	ACTIS
Foil PE 80 µm "colorless lacquered"	0.043	0.21	smooth	0.005	0.018	ACTIS
Bare aluminum foil 30 µm	0.034	0.039	smooth	0.002	0.007	Eurofoil
Mesh-reinforced (not perorated)	0.100	0.077	Not smooth	0.011	0.049	ACTIS

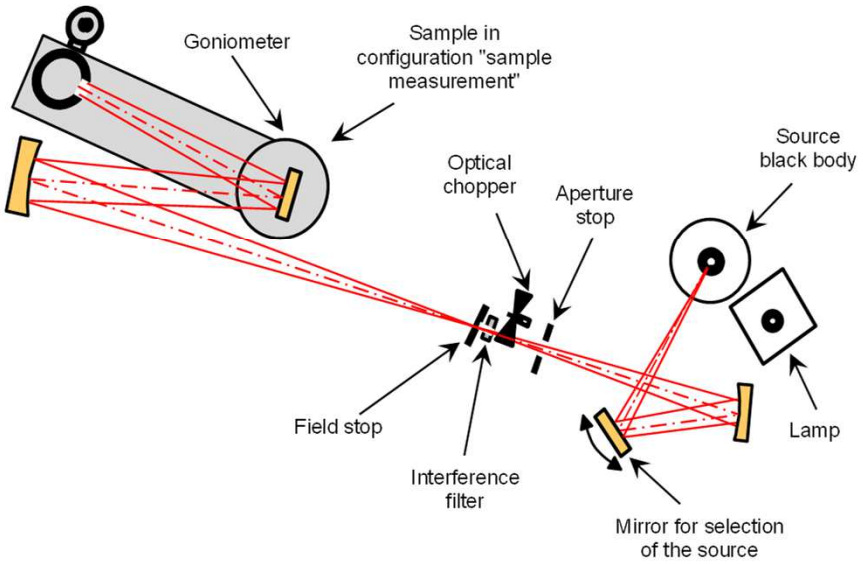
Angular distribution of a near-normal incident beam :

Instrument used for analysis : goniometer developed for specular reflectance measurements in IR.

Configurations used for a typical specular reflectance measurement



Reference configuration

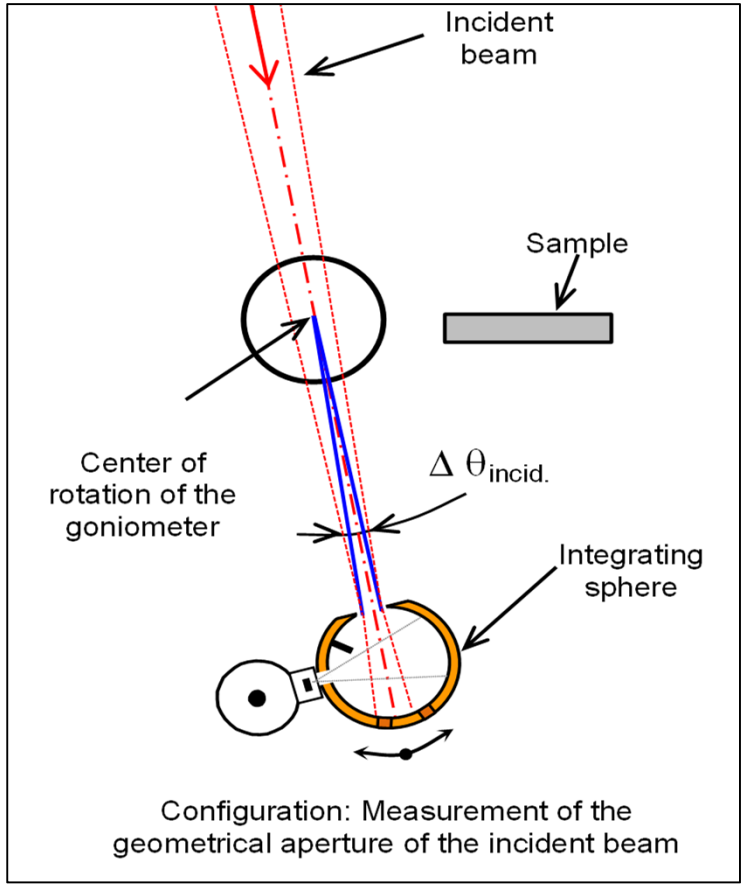


Sample configuration

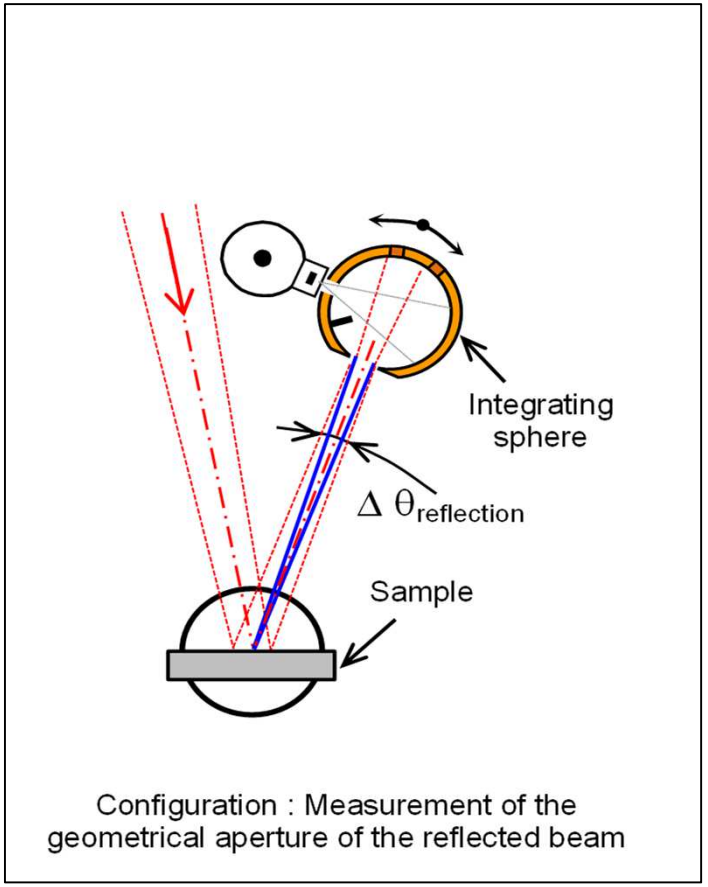
Angular distribution of a near-normal incident beam :

Principle : Displacement of the detection system with the goniometer and analysis of the measured signal in function of angle.

Configurations used for analysis of the angular distribution of reflection in the plane of incidence



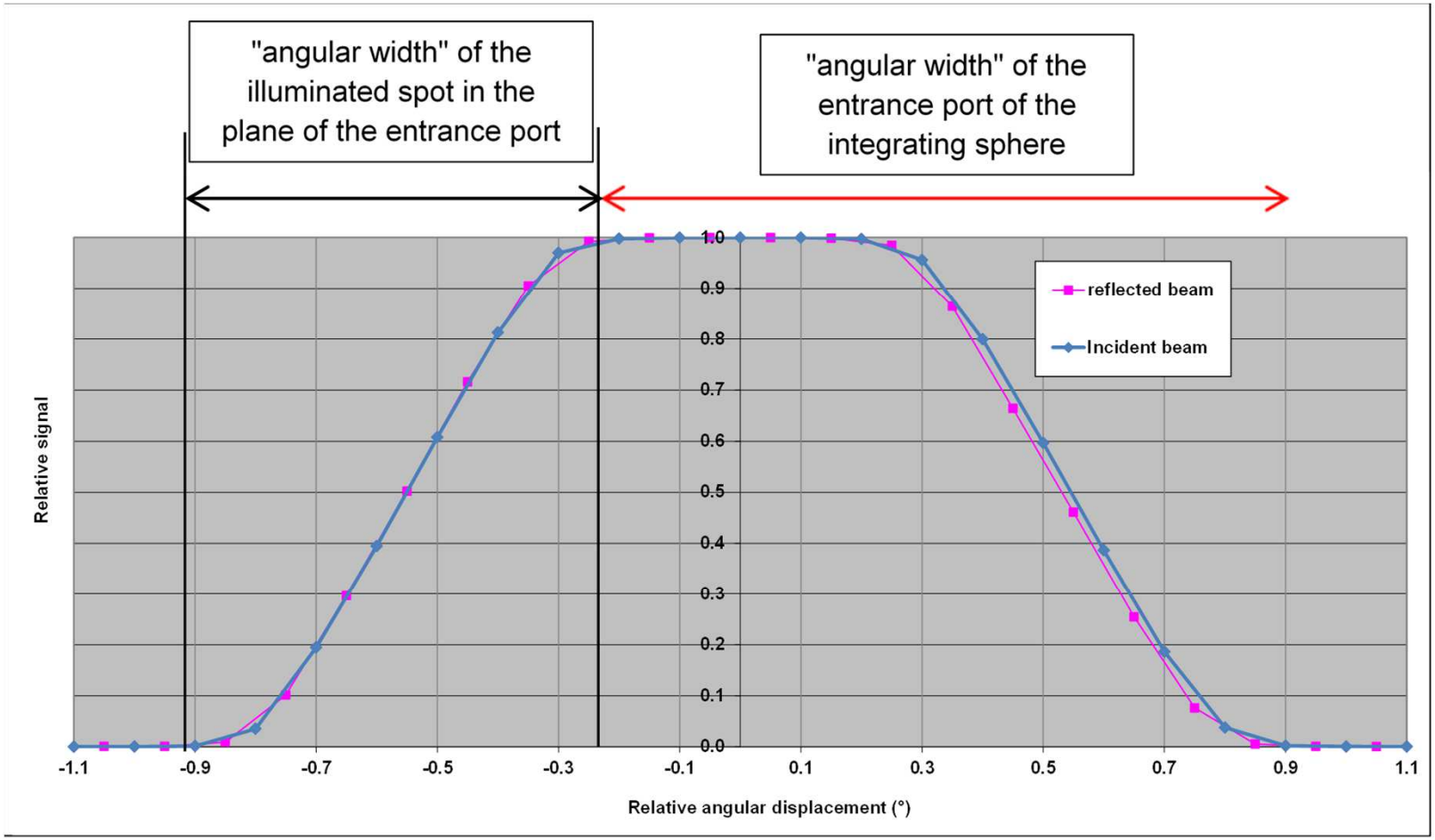
Reference configuration



Sample configuration

Angular distribution of a near-normal incident beam :

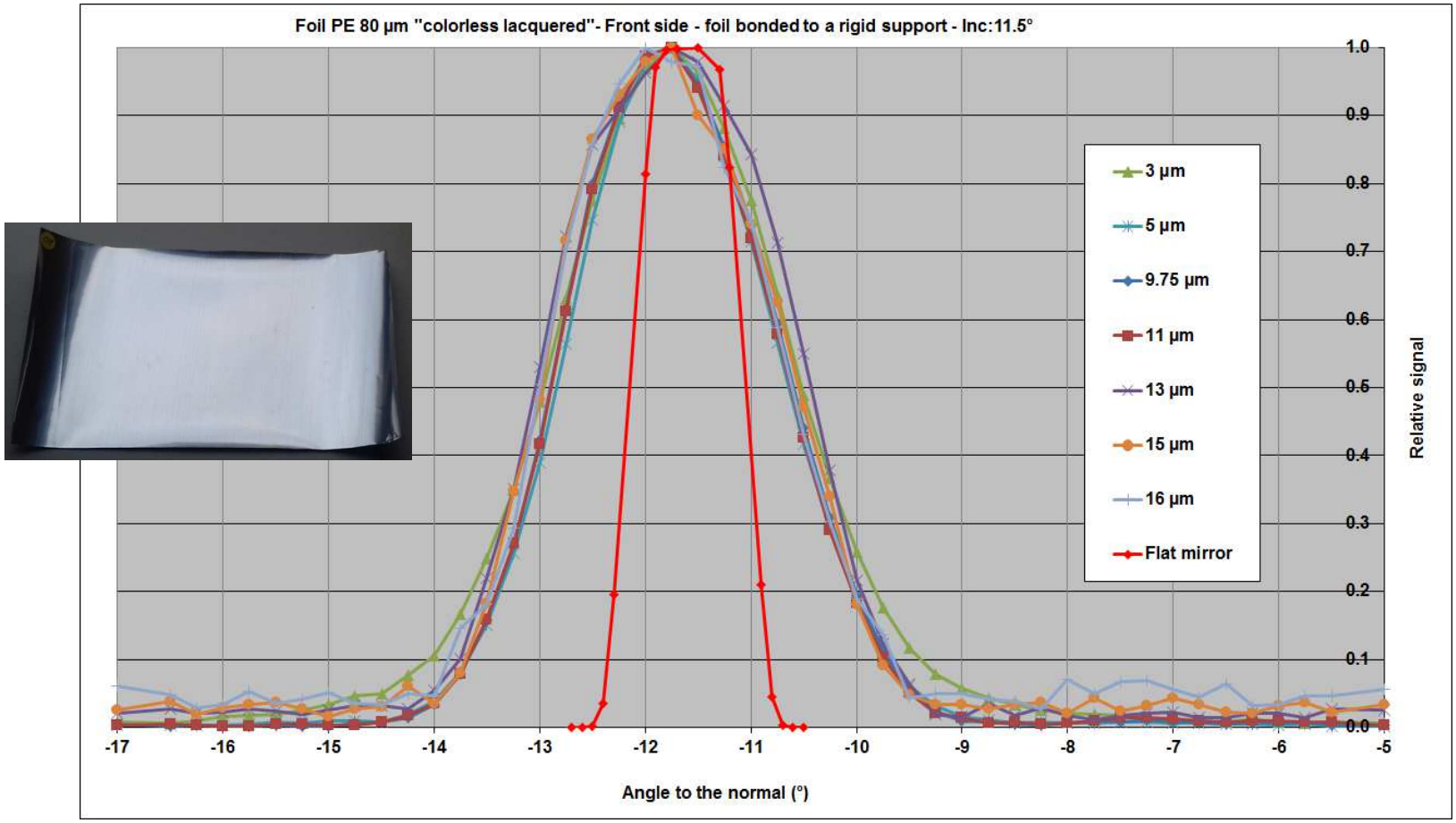
« Angular calibration » of the system by angular analysis of the angular distribution of the incident beam or of the beam reflected by a non diffusing mirror.



Sample = Gold mirror

Results on selected foils :

Influence of wavelength :

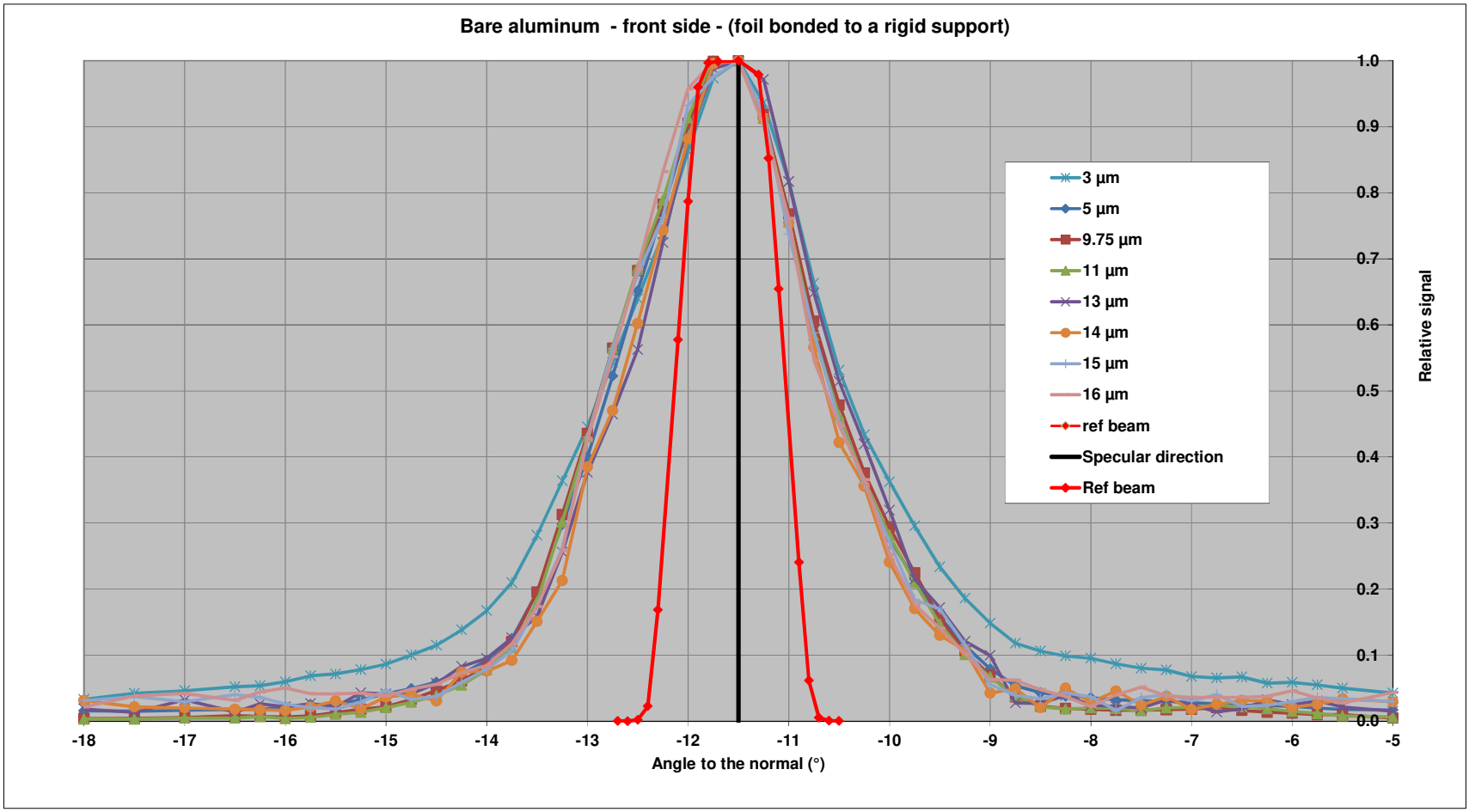


No effect of wavelength → dispersion mostly due to morphology of the surface

Same type of curves obtained on others smooth foils

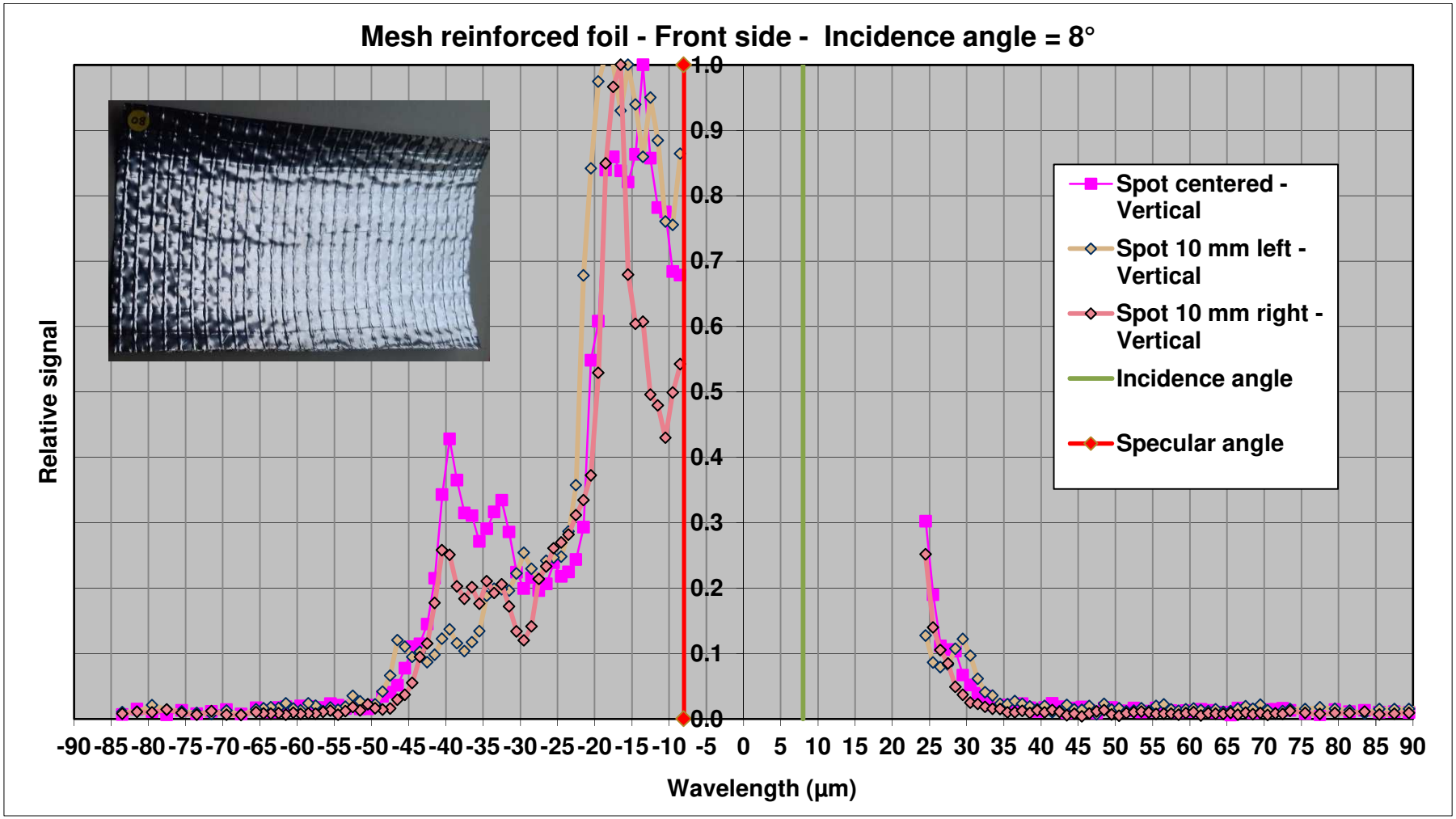
Results on selected foils :

Influence of wavelength :



Low effect of wavelength (a bit more more spreading for 3 µm)

Results on selected foils :



Reflected radiation strongly scattered angularly : non-flatness of the surface.

Conclusion from first measurements :

Front sides of the foils selected : low emissivity; no spectral variations.

Angular diffusion : Smooth foils are not specular, cone of reflection around specular direction.

Highly non flat foil : → large angular spreading.

Other types of foils could be used in the project when validating techniques of measurement or testing improved procedures for measurement.

Questions ?