Measurement Standards Laboratory of New Zealand

BxDiff
JRP 18SIB03

Transmittance Haze

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haze

cloudy appearance due to contrast reduction, usually attributable to light scattering

Note 1 to entry: Correlated measures in reflection are:
a) scattering of light at the glossy surface of a specimen responsible for the apparent reduction in contrast of objects viewed by reflection at the surface;
b) percentage of reflected light scattered by a specimen having a glossy surface so that its direction deviates more than a specified angle from the direction of specular reflection.

Note 2 to entry: Correlated measures in transmission are:
a) scattering of light by a specimen responsible for the apparent reduction in contrast of objects viewed through it;
b) percentage of transmitted light that is scattered so that its direction deviates more than a specified angle from the direction of the incident beam.

"Canopy of greenhouse" by allispossible.org.uk is marked with CC BY-NC-SA 2.0.

"The LSST Camera Lens is here!" by SLAC National Accelerator Laboratory is marked with CC BY-NC-SA 2.0.

"Chelsea Modern" by Lauren Manning is marked with CC BY 2.0.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *haze, n*—in transmission, the scattering of light by a specimen responsible for the reduction in contrast of objects viewed through it. The percent of transmitted light that is scattered so that its direction deviates more than a specified angle from the direction of the incident beam.

3.2.1.1 *Discussion*—In this test method, the specified angle is 0.044 rad (2.5°).

2.2 Haze

That percentage of transmitted light which in passing through the specimen, deviates from the incident beam by more than 2.5° on average, by forward scattering.

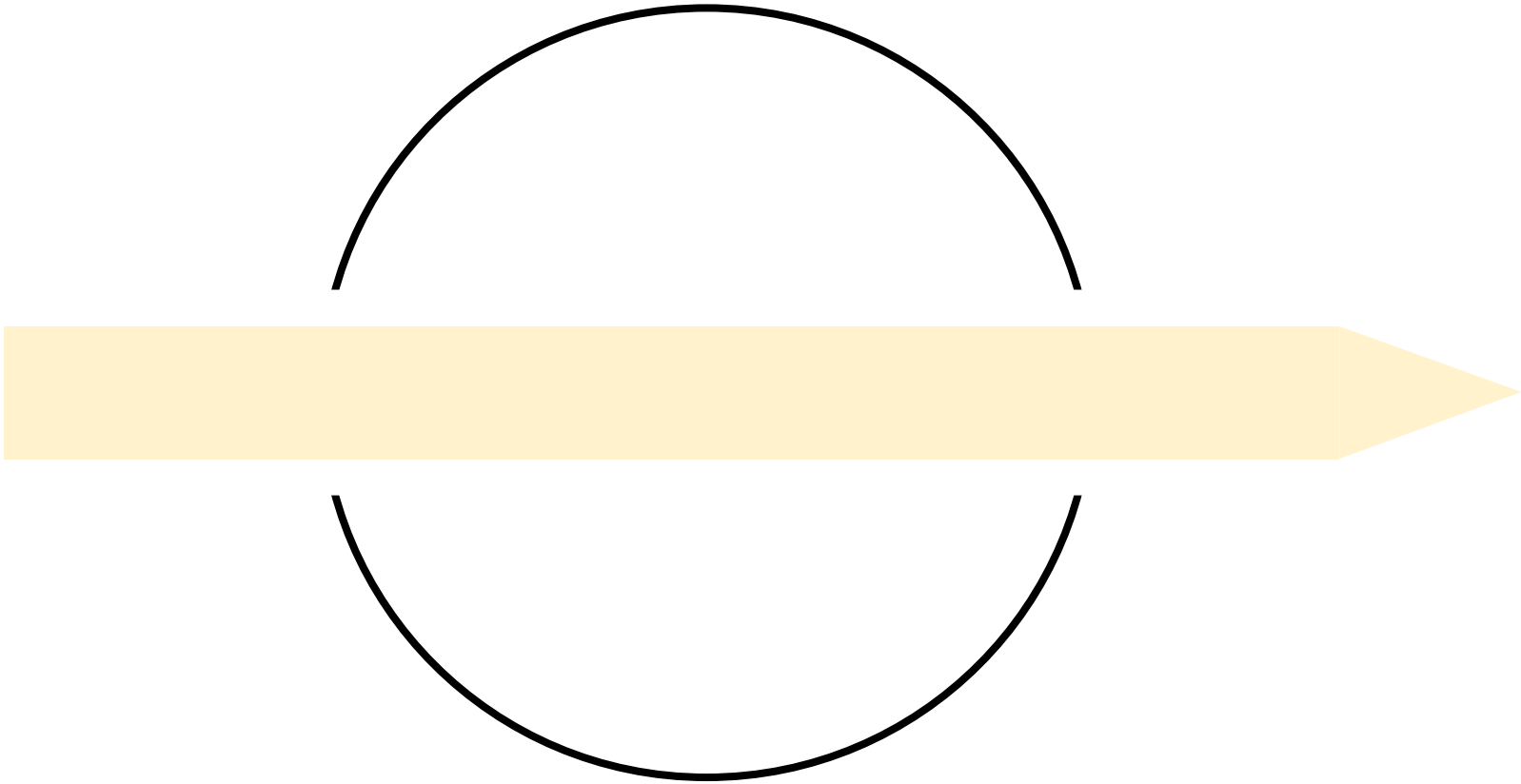
2.454

haze

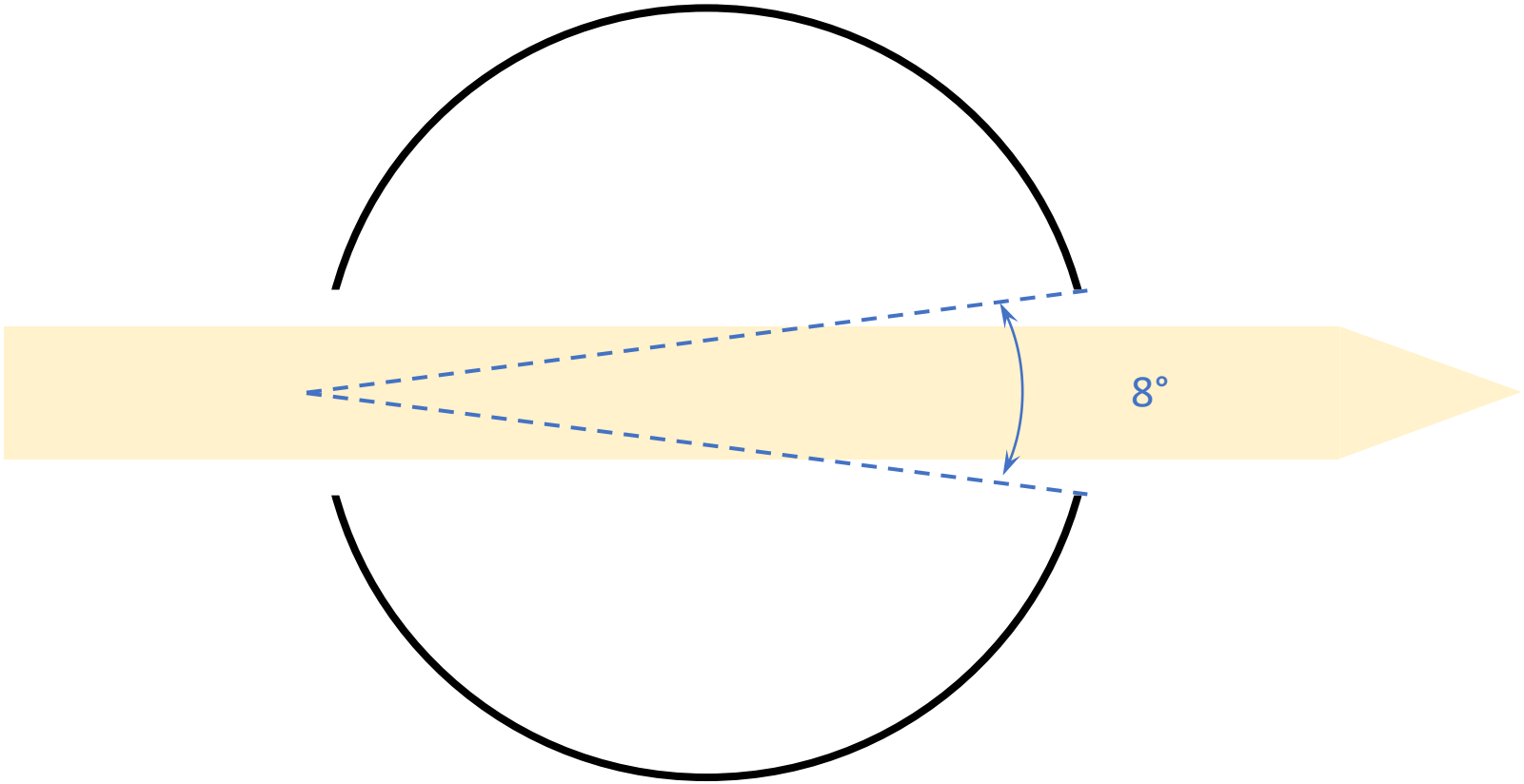
percentage of transmitted light, passing through a plastic, which deviates from the incident light by no more than 0,044 rad (2,5°) by forward scattering

Note 1 to entry: This phenomenon gives the plastic a cloudy appearance.

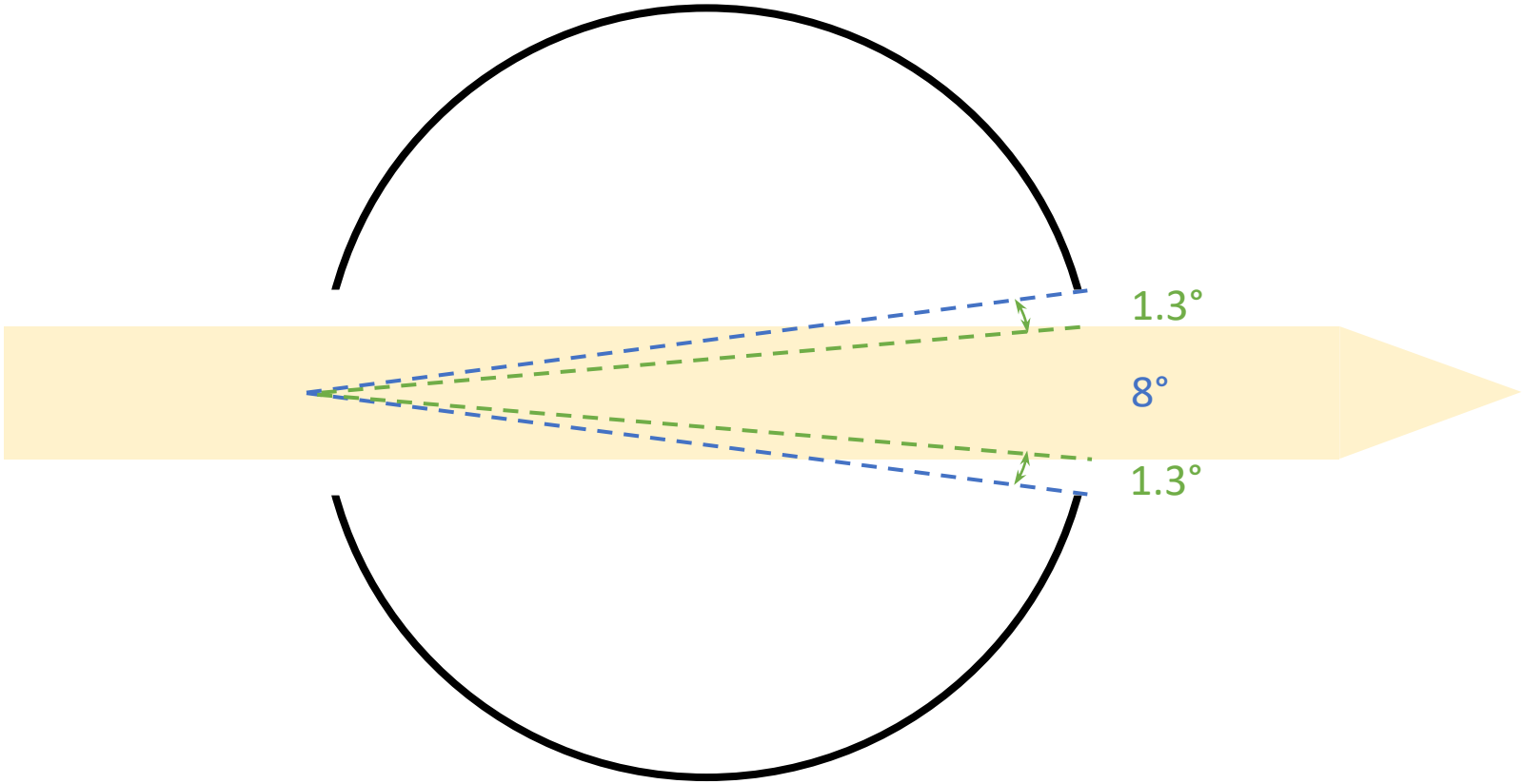
Sphere Measurement



Sphere Measurement



Sphere Measurement



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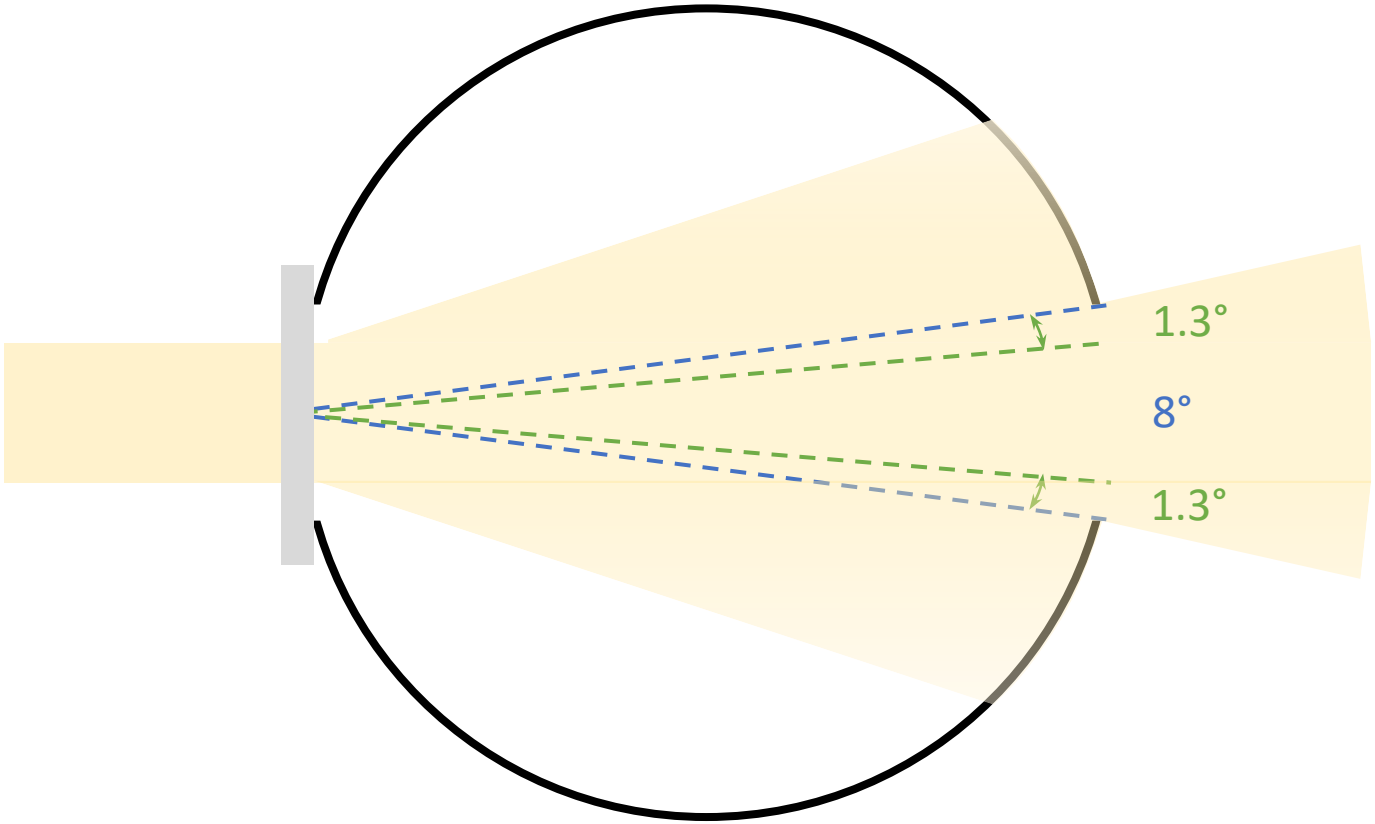
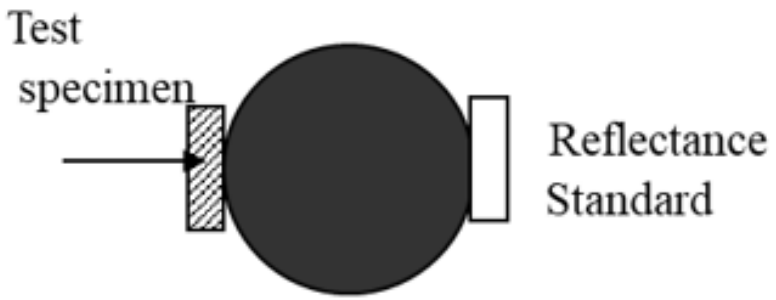
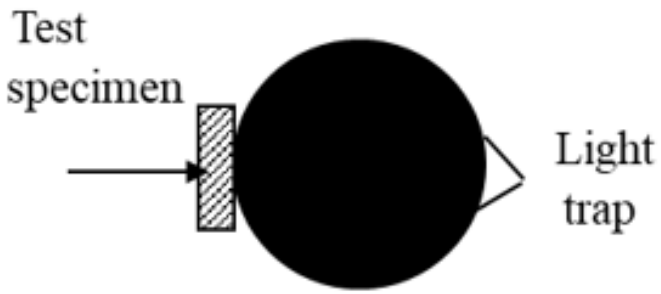


Sphere Measurement



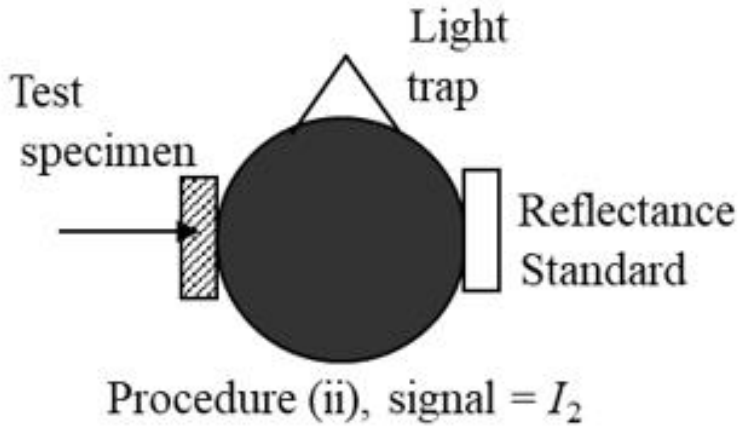
Procedure (ii), signal = I_2



Procedure (iv), signal = I_4

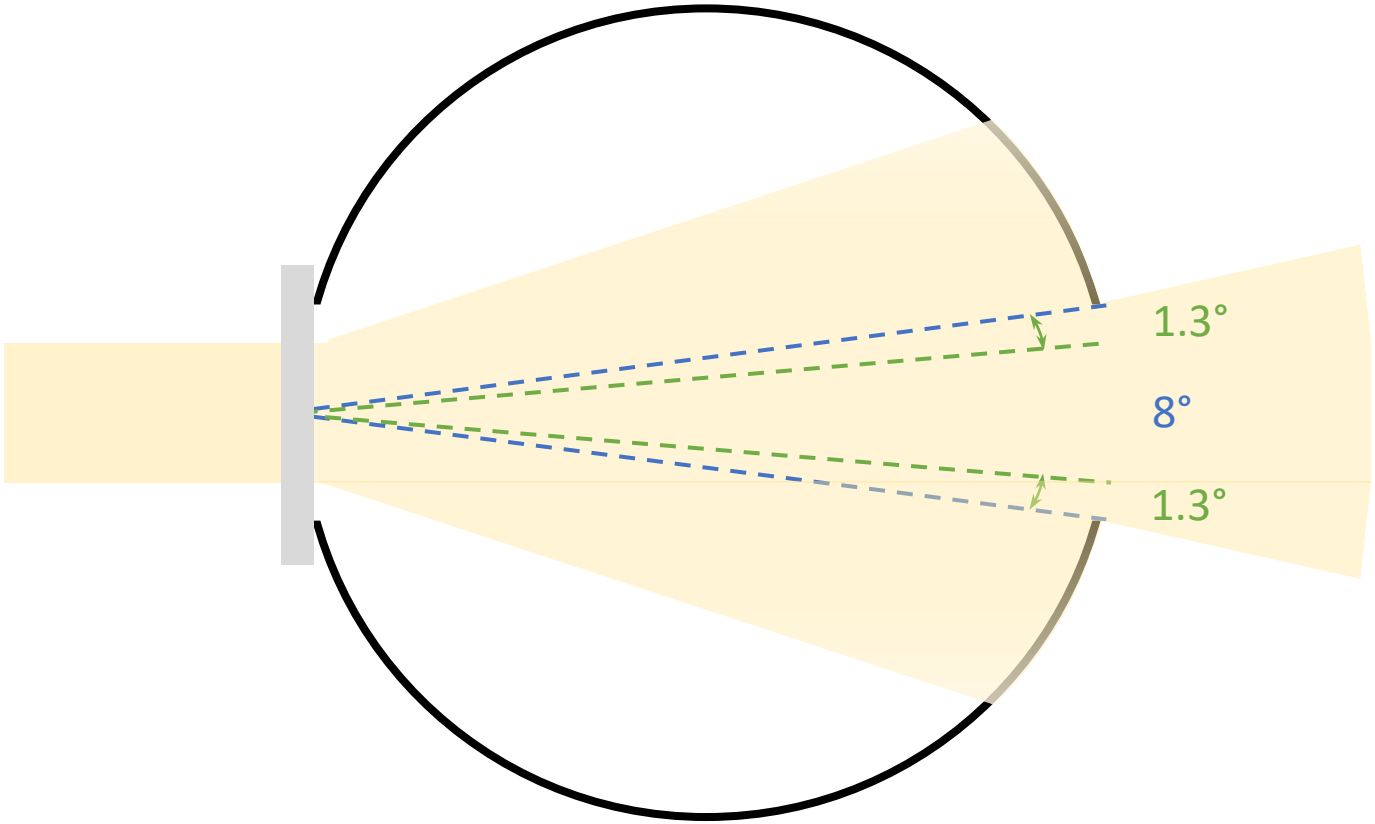
ASTM D1003 – sphere throughput is different for I2 and I4, so measured haze value may be different by up to 15% between two spheres which both compy with the standard.

Sphere Measurement

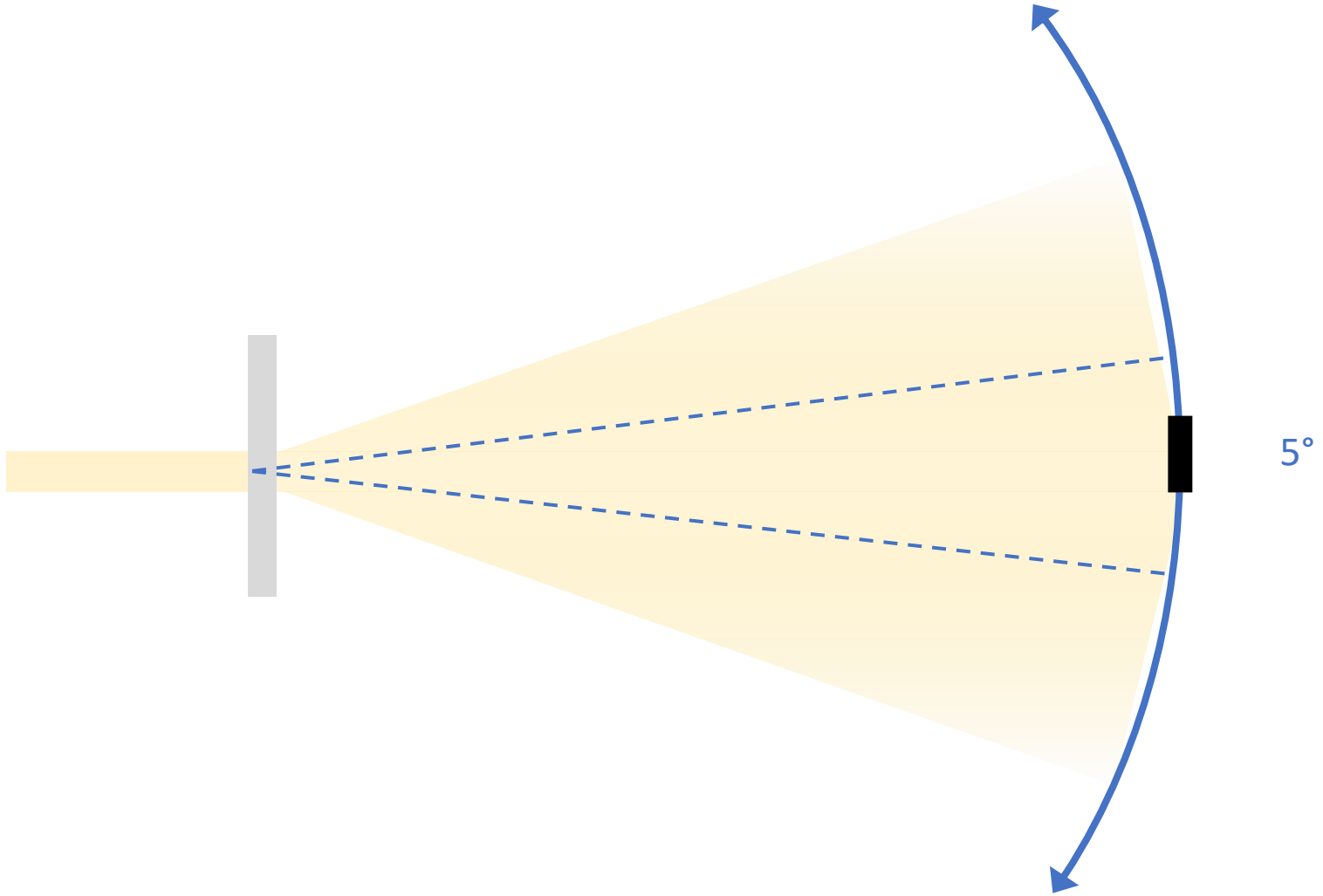


ISO14782 – Use of compensation port keeps sphere throughput consistent for ratioed measurements.

Sphere Measurement



Goniospectrophotometer Measurement



Issues of Interest

Using BTDF as a traceability route for integrating sphere measurements

- Can we calibrate standards on a gonio?
- Different BTDF shapes, different haze values

Use gonio to evaluate sensitivity and therefore uncertainties for sphere measurements

- sensitivity to geometrical tolerances of spheres, beam diameter and divergence etc

Also evaluate difference between definition of haze, and haze as measured by a sphere based haze meter

- integration of high resolution BTDF over 2.5° versus simulating sphere geometry

BxDiff Activity

The performance of the two measurement scenarios, goniospectrophotometric measurements for the entire hemisphere vs measurement in predefined geometry as reported in ISO 14782 will be compared by CI, CNAM and Innventia. For this purpose, measurements will be performed by CI, CNAM and Innventia on 2 classes of films (from A5.2.5), one being quasi-Lambertian and a second exhibiting a strong angular dependence within an angle of 5 degrees from specular, which is the approximate angle subtended by the exit port on a hazemeter.

Plan

Sample1: BTDF Study ‘Quasi-Lambertian’ SiO2 Sample

Sample2: - BTDF Study FWHM 16° (but still not much structure at 2.5°)

- Type 1 FWHM ~ 0.4°
- Type 2 Nanocellulose: FWHM 0.4° - 5°

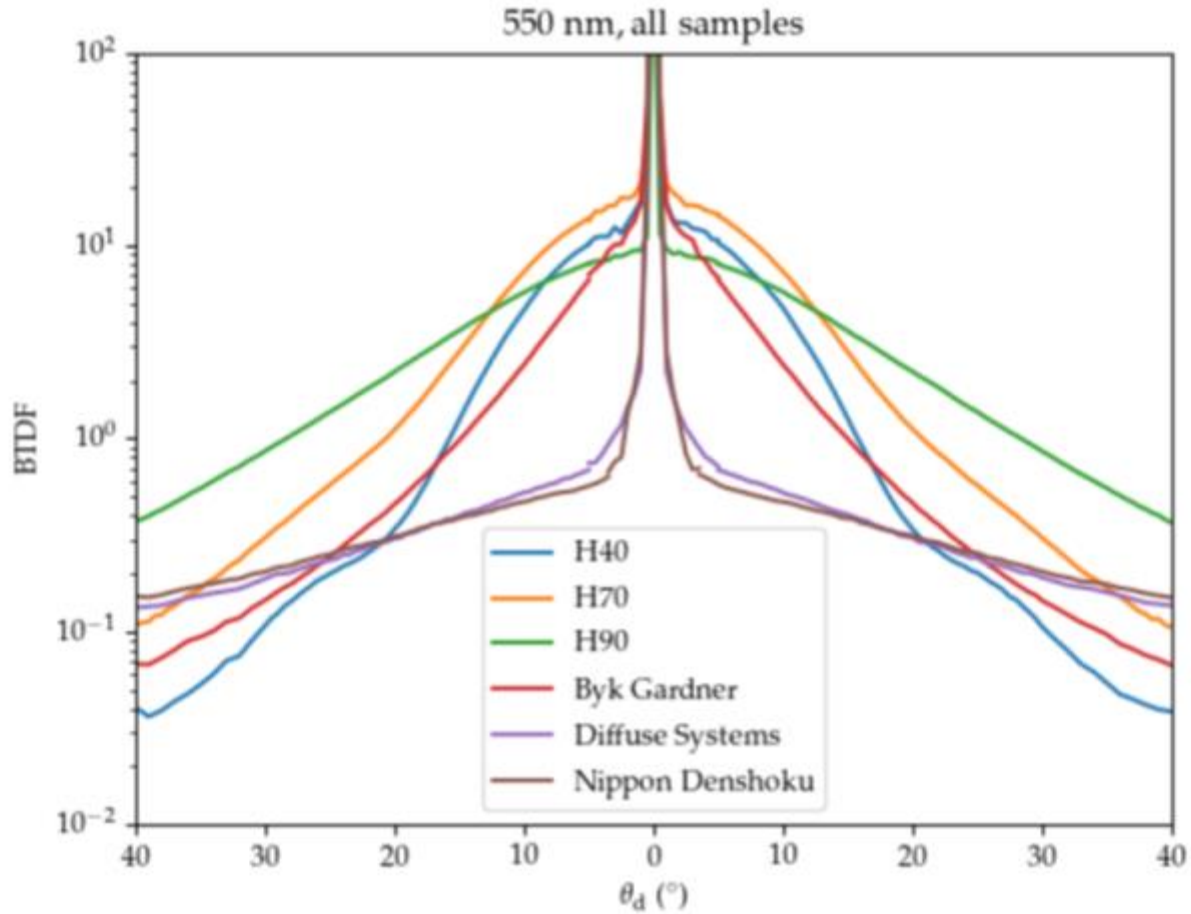


Figure 1: BTDF data for all six samples with 550 nm light. The y-axis has been plotted on a logarithmic scale and the x-axis has been plotted with $\phi_d = 0°$ on the left half and $\phi_d = 180°$ on the right half.