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ENHANCE YOUR PERCEPTION

TECHNICAL NOTE TN-0022

Problem	**What is FODIS?**	**Date**	12.9.2012
Author(s)	EHE	Ver	1.1

Background

Many light sources used in reflectance or transmittance measurements are not stable over time. Some common examples are:

- Irradiance of the sun may change rapidly (due to atmosphere or cloud changes)
- Halogen sources may change due to power source instability or aging
- Spectral output and intensity of pulsed Xenon light sources change from pulse to pulse.

For such cases it is necessary to monitor the light source simultaneously with the sample measurement to correct this effect.

NOTE: These changes can sometimes also be eliminated by constantly measuring stable reference sample. For example if the light source changes (or other changes in optical path) are not rapid a reference measurement is preferred method.

FODIS solution

The best method for light source change monitoring is to have the spectrum from the light source at the same image with the sample image. This can be accomplished using so called FODIS (Fiber Optic Downwelling Irradiance Sensor). In this solution a fiber is used to collect the light from the light source (sun, lamp etc…) and transfer it to one end of the input slit of the spectrograph.

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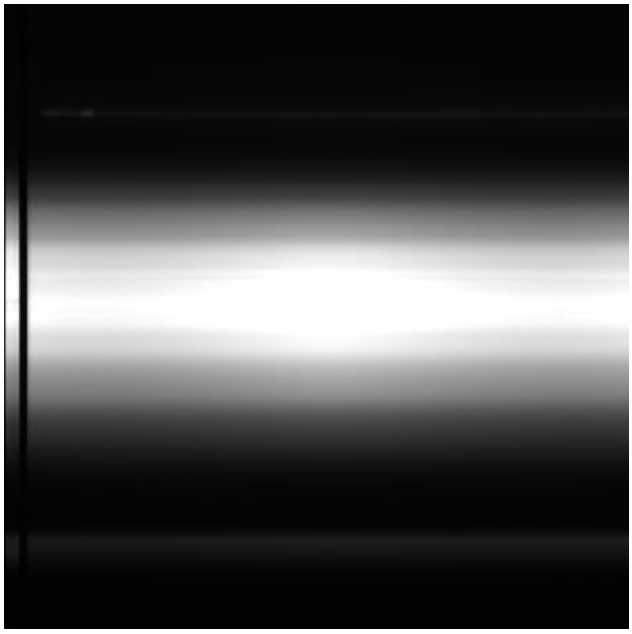

Image 1. An image from the spectral camera using FODIS construction. The signal from the fiber is seen at left side. Spectral axis is vertical and spatial axis horizontal.

Utilization

a. With radiometric calibration: especially in remote sensing applications it is important to quantify the energy reflected and emitted by samples (radiance). To do so, radiometric calibration of the instrument is necessary. Furthermore, radiometric calibration enables the user to link the radiance measured through the FODIS fibers with the other pixels of the detector.
b. Without radiometric calibration: the FODIS devices can be used to monitor relative changes in the illumination. Changes that are detected by the detector on the pixels bound with the FODIS device can be exported to the other pixels of the detector.

Advantages

- Fiber channel has always exactly the same integration time and spectral calibration as the rest of the image.
- Fiber length can be changed according to application need.
- Fiber can be attached to many different adapters (to use diffuser, filter or limit the light using aperture)

Properties to consider

- As the FODIS fiber is attached to input slit it takes about 5-7 % of the spatial pixels from the image narrowing the field of view.
- The signal level is 25-30% slightly lower in FODIS channel (without additional diffuser) than in image area due to losses in connections. This is usually not a

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problem especially in reflectance measurement where the signal from target is much lower than directly from the light source.

- Can be used with Enhanced series ImSpectors and should be ordered as separate option.
- The signal at the FODIS channel consists of 10-20 columns on the detector (depending on pixel size). One should use the spatial average of these columns to reduce the noise while calculating the light source reference spectrum.