Dokumentenname:	ATLAS_SOP_Linearity.doc	
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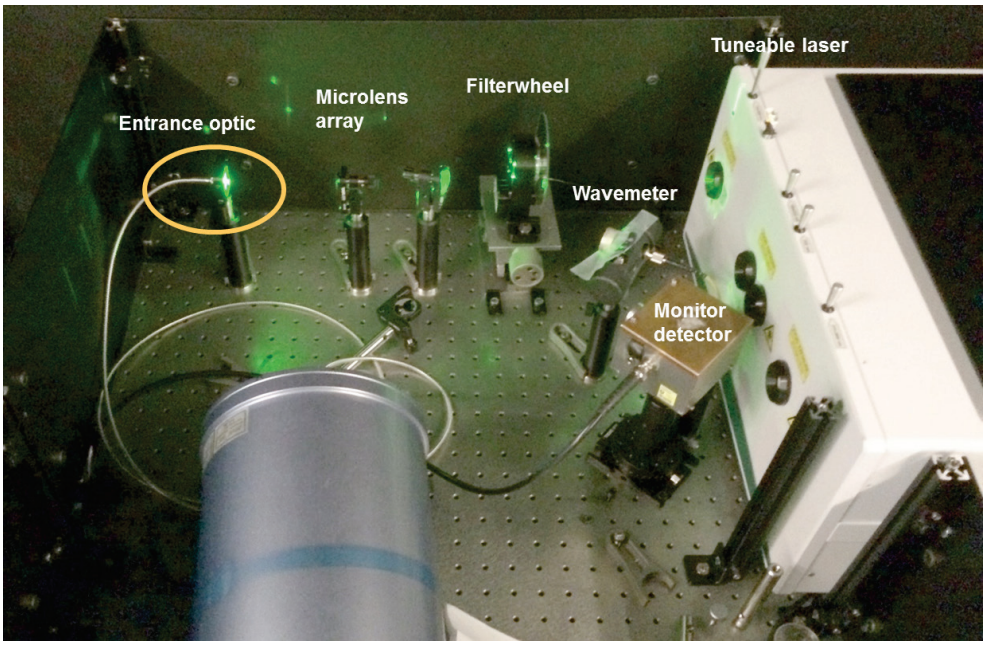
Standard Operating Procedure for measuring the linearity of an array spectroradiometer

1 Introduction

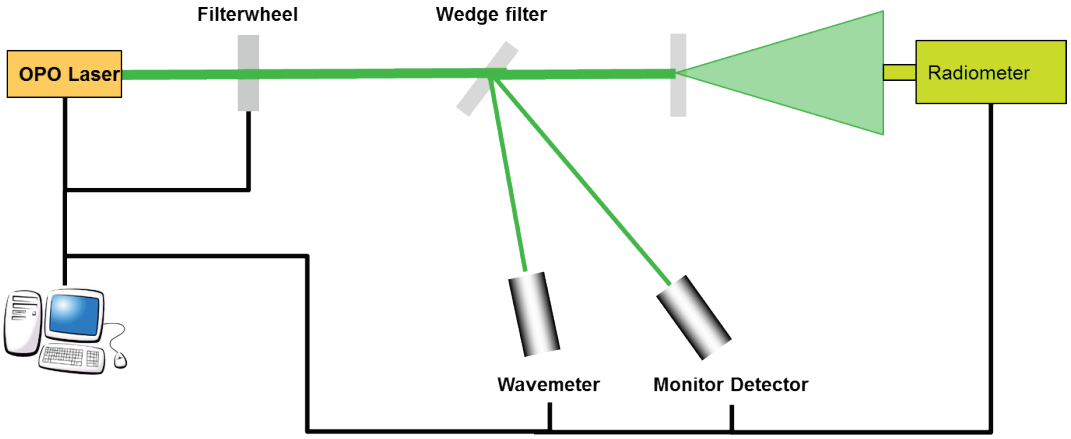
The following instructions describe how the linearity is measured with the tuneable laser facility ATLAS in the optical laboratory of PMOD/WRC.

2 Instrument installation

The optical setup of ATLAS is the following:



The Schematic of the measurement setup is shown below:



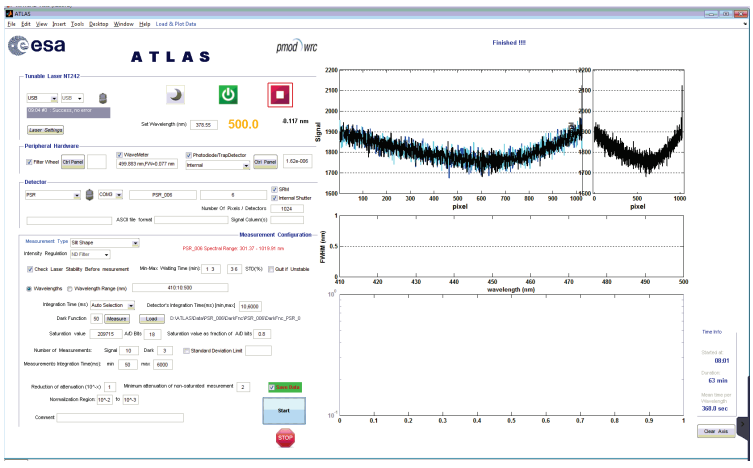
The Spectroradiometer entrance optic is placed in the center of the homogeneous radiation field produced by the microlens array, at a distance of about 20 cm to 30 cm. To select the best position, it is best to turn on the laser, set it a visible wavelength, e.g. 550 nm, and adjust the entrance optic of the Device Under Test (DUT) until it is fully illuminated.

The DUT, the filterwheel, the wavemeter and the monitor detector are controlled with the ATLAS software described in the next section.

1) The current of the monitor detector is either measured with an electrometer Keithley 6517, or a current meter Keithley 6485. The choice depends on the type of diode which is used: In case of the PMOD trap detector (default), the current meter is used. For all other diodes the use of either electrometer or current meter needs to be selected based on a comparison to the trap detector. This selection procedure is described in another document.
2) The wavemeter LSA UV 2L from High Finesse is connected to the PC using a USB cable. The use of the wavemeter is fully controlled by the ATLAS software and is not described here. Please see the manual for further information.
3) Please refer to the operation manual of the NT242 Laser on the correct use of the system: First turn on the water circulation, then the laser power supply. Please verify the correct operation of the laser before starting the measurements.

3 ATLAS gui

The system is controlled through a software interface written in matlab. The use of the ATLAS gui is reserved to trained operators!



4 Measurement principle

The linearity measurements are done at representative wavelengths of the DUT to cover its usual operating range. The possible wavelength range covered can be from 200 nm to 1100 nm, limited by the sensitivity range of the silicon photodiode used as monitor detector, and the wavemeter (200 nm to 1100 nm). The measurements are performed by measuring the laser lines at different integration times and different intensity levels without saturating the instrument to retrieve the nonlinearity component with respect to integration times (Method A) and the nonlinearity component with respect to photons per second (Method B) respectively. A third method (method C) can be used which combines method A and B.

Method A (electronic nonlinearity)

1. The wavelength of the laser is set.
2. The attenuation of the filter wheel is selected (either low, middle, and high)
3. The highest possible integration time is selected to reach about 90% of the saturated signal level.
4. Measurements are taken with the DUT from the highest possible integration time found in step 3 to the shortest possible.
5. If the DUT has a shutter it is closed and the laser output is turned off. Measurements of dark counts are taken at the same integration times as for the measurements.
6. The wavelength reading of the wavemeter is measured.

The above sequence is repeated for three different attenuations and for as many wavelengths as necessary.

Method B (photons/second)

1. The wavelength of the laser is set.
2. The lowest possible attenuation of the filter wheel is selected to keep the monitor detector in its appropriate linear measurement regime.
3. The highest possible integration time is selected to reach about 90% of the saturated signal level.
4. Measurements are taken with the DUT at the fixed integration time found in step 3 and the attenuation is varied from its lowest attenuation to the largest possible attenuation where the signal to noise of both the monitor detector and the DUT is still valid.
5. If the DUT has a shutter it is closed and the laser output is turned off. Measurements of dark counts are taken at the same integration time as for the measurements.
6. The wavelength reading of the wavemeter is measured.

The above sequence is repeated for as many wavelengths as necessary.

Method C (photons/second and optimized IT). The only difference to method B is that at every change of the attenuation level in 4, the integration time of the DUT is optimized to reach a signal level at 90% of the saturation level.

1. The wavelength of the laser is set.
2. The lowest possible attenuation of the filter wheel is selected to keep the monitor detector in its appropriate linear measurement regime.
3. At every step of the sequence, the attenuation of the filter wheel is increased from its lowest attenuation found in step 2 to the largest possible attenuation. At each position of the filter wheel, the highest possible integration time is selected to reach about 90% of the saturated signal level.
4. Measurements of the DUT are taken for the selected attenuation and the selected integration time.
5. If the DUT has a shutter it is closed and the laser output is turned off. Measurements of dark counts are taken at the same integration time as for the measurements.
6. The wavelength reading of the wavemeter is measured.

The above sequence is repeated for different attenuation levels and for as many wavelengths as necessary.

5 Data archive

The measured data is archived on the PMOD/WRC server, at
\\ad.pmodwrc.ch\Institute\Projects\ATLAS\characterisations
In the appropriate directory for the DUT.

The Dokumenten History

Version	Freigabedatum	Freigabe	Änderungen
1.0	20.6.2016	JG	First Version of document