

SpectrAIR™



*Portable UV-VIS-NIR spectroradiometer
for environmental monitoring applications*

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Why SpectrAIR

SpectrAIR is an innovative spectroradiometric system designed to perform precise measurements of different environmental, atmospherical and bio-meteorological parameters.

SpectrAIR has been developed in close collaboration with the Applied Physics Institute of the National Council of Research. It has been conceived as a portable and adaptable device capable of taking measurements of solar spectral irradiance in the range UV-VIS-NIR, and providing direct environmental information for applications in air quality, photobiology, solar photovoltaic energy, biometeorology and agro-meteorology.



Mobile station used by Environmental Protection Agency of Tuscany Region (ARPAT) in Livorno for solar radiation and ozone measurement campaign in 2006



SpectrAIR is capable to provide, together with the solar global spectral irradiance, the following main measurements :

- *Total column ozone*
- *Atmospheric turbidity*
- *Direct to diffuse irradiance ratio*
- *Ground spectral albedo*
- *Photosynthetically active radiation*
- *UV index (WHO standard for erythemally weighted UV radiation measurement)*

How SpectrAIR works

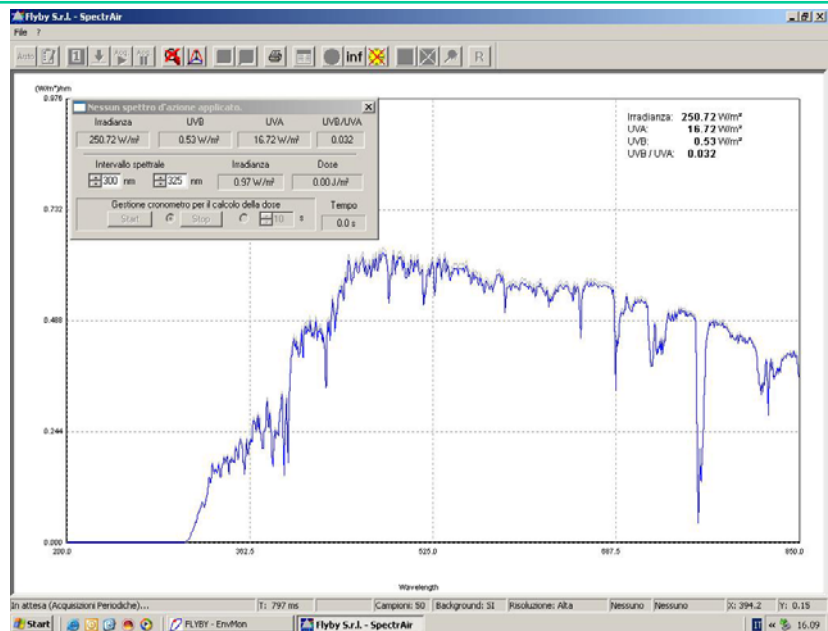
SpectrAIR system consists of a portable fiber optic spectroradiometer. The fiber is ended with a cosine response diffuser with a quartz dome for open door measurements.

SpectrAIR works with any Personal Computer equipped with Microsoft Windows XP and two USB2 ports.

A smart software package is provided to allow the user to easy control the instrument and to perform immediate data analysis.

An action spectra database can easily be accessed allowing for on-line spectral weighting of spectral measurements for effective irradiance determination (e.g. photobiology, solar photovoltaic effective radiation, ...).

Example of solar spectrum measured by SpectrAIR periodically. The grey line shows the old spectrum, the blue line the last measured one.



SpectrAIR software has the following features :

- **management of integral and spectral irradiance measurements using different measurement units**
- **spectral dosimetry function**
- **management of the spectroradiometer and of the photo-biological action spectra database**
- **acquisition programming for automatic periodic measurements**
- **automatic dark noise compensation by means of optical shutter**
- **user interface to measure the spectral albedo of the ground surface**
- **data saved in ASCII text format, compatible with the most common programs of data analysis (Excel, Origin, etc.)**



Technical features

Characteristics

SpectrAIR exploits a concave holographic aberration-corrected grating and a CCD detector optimized for UV-VIS-NIR solar irradiance detection

<i>Entrance slit size :</i>	<i>25 μm</i>
<i>Diffuser :</i>	<i>UV high efficiency cosine response diffuser with quartz dome</i>
<i>CCD :</i>	<i>UV enhanced - 12 bit ADC</i>
<i>Fiber optic :</i>	<i>special UV-VIS anti-solarization quartz fiber (2-5-10m lengths available)</i>
<i>Interfaces :</i>	<i>serial port RS232 (optical shutter command) parallel port (control and data)</i>
<i>Power supply :</i>	<i>12 VDC</i>
<i>Consumption :</i>	<i>2 W (typical)</i>
<i>Dimensions :</i>	<i>270 x 270 x 100 mm</i>
<i>Weight :</i>	<i>2 kg</i>

Performances

<i>Wavelength range :</i>	<i>290-850 nm</i>
<i>Spectral resolution :</i>	<i>optical 1 nm (FWHM) spatial 0.5 nm</i>
<i>Angular response :</i>	<i>lambertian (cosine error < 3%)</i>
<i>Irradiance accuracy :</i>	<i>8% @ UV 3% @ VIS-NIR (NIST traceable)</i>
<i>Spectral accuracy :</i>	<i>0.2 nm</i>

Optics can be customized at the order, to match specific application needs .

SpectrAIR and its accessories (1 fiber optic, 1 diffuser, 1 serial/USB2 cable, 1 parallel/USB2 cable) come in a portable hard suitcase.



References

SpectrAIR has been tested and adopted by many international Research Institutes and industries.

The research institutes and companies that use SpectrAIR are:

- ***ARPAT - Environmental Protection Agency - Tuscany Region***
- ***CNR-IFAC – air quality in industrial environment – SERQUA project (funded by Regione Toscana)***
- ***University of Pisa – Agricultural Science Department - Photobiology***
- ***Frescobaldi S.p.A. – global VIS-NIR irradiance measurements and spectral albedo characterization in the vineyards of Chianti (Tuscany) – Agro-meteorology***
- ***University of Napoli “Federico II” – Clinical Dermatology – Phototherapy***
- ***University of Firenze – Department of Chemistry (CSGI) – Photochemistry***

SpectrAIR is currently used for solar photovoltaic field efficiency monitoring in the framework of a R&D project in collaboration with ENEL Produzione – Solar Energy Plant of Serre (Italy)

The U.S. National Cancer Institute (NCI) used the SpectrAIR biomedical version (SpectraMED) for the characterization of an UV source for an epidemiological study in which the minimal erythemal dose (MED) of patients was assessed with high accuracy

Publications regarding SpectrAIR:

G.Licitra, F.Flore et al., “MEDSUN: un sistema innovativo di fotoprotezione e monitoraggio su larga scala dell'esposizione ai raggi UV solari”, 3° Convegno Nazionale sul Controllo Ambientale degli Agenti Fisici, ARPA Piemonte, Biella, 7-9 Giugno 2006

F.Flore, G.Licitra et al., “Validation of UV and Ozone EO based data used in PROMOTE/MEDSUN service, by means of on ground measurements”, ESA/ESRIN Atmospheric Science Conference, Frascati, 8-12 May 2006

E.Simeone, G.Licitra et al., “Sistema di fotoprotezione solare mediante elaborazione di immagini ottiche satellitari”, Atti della 9ª Conferenza Nazionale ASITA, vol.2°, Catania, 15-18 Novembre 2005

E.Simeone, G.Licitra et al., “A new web & SMS based real-time photoprotection service”, World Congress for “New technologies in preventing photoinduced skin cancer and photoageing”, Siena, 19-21 October 2005

A.V.Brenner et al., “Instrumental Measurement of Skin Color and Skin Ultraviolet Sensitivity and Risk of Cutaneous Malignant Melanoma: a Case-Control Study in an Italian Population”, Am. Journ. of Epidemiol. – Vol 156, no 4 – 2002).

E.Simeone, F.Ghetti et al., “Spectral irradiance dependence on vineyards soil covering and geographic altitude in Chianti Rufina (Firenze, Italy)”, 10th Congress of the European Society for Photobiology, Vienna, 6-11 Sept. 2003