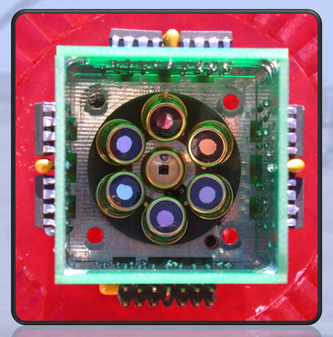
# Re-establishment of the MFRSR Calibration Facility at the SGP

**Dan Nelson[1], Craig Webb[1], Joseph Michalsky[2], Gary Hodges[2], Piotr Kiedron[2], Patrick Disterhoft[2], John Schmelzer[3], Jerry Berndt[4]**

[1]ACRF/SGP, Cherokee Nation Distributors, Stilwell, OK
[2]National Oceanographic and Atmospheric Administration, Boulder, CO
[3]Pacific Northwest National Laboratory, Richland, WA
[4]Consultant to NOAA, Everett, WA

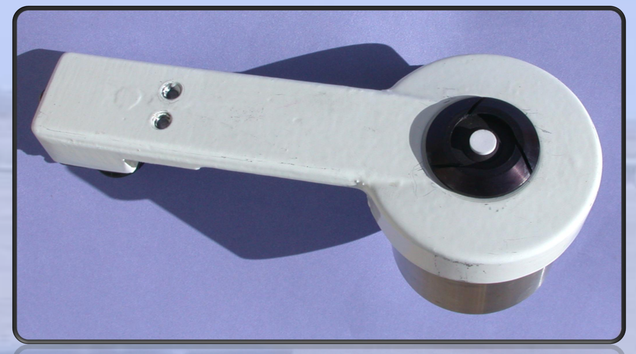
**Instrument Calibration** is an important activity at the SGP (Southern Great Plains), a fact known to most ARM personnel. In 2007, the calibration activity for ARM MFRSRs (Multi-Filter Rotating Shadowband Radiometers) and similar spectrally selective radiometers was transferred from PNNL to the SGP RCF (Radiometer Calibration Facility). This poster will detail the methodology for this activity at the SGP, including the testing of the systems and how they are used for *Cosine Response*, *Spectral Response*, and *Absolute Response* characterizations and calibrations.

- The Cosine Calibration bench shown below was dismantled at PNNL, and shipped to SGP for reinstallation.
- Spectral Calibration will be accomplished with an automated monochromator system, which is currently being assembled and tested by NOAA ESRL in Boulder, Colorado, and will be deployed at SGP in the first half of 2008.
- The existing SGP Absolute Calibration system has been refreshed with new NIST-traceable standard lamps and CR-1000 datalogger.



**MFR Filter-Detector Cube**

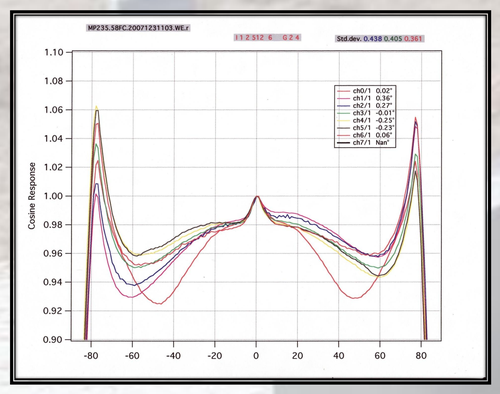
Six Narrow-Band, Optically-Filtered, Silicon Photodiodes Surround an Unfiltered, Precision Reference Photodiode



**MFR Filter-Detector Head**

Notice the Small, Round, **Spectralon**® Optical Receiver Centered Within the Black Artificial Horizon

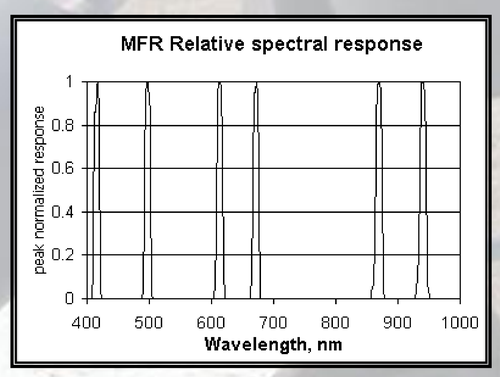
## Cosine Response




All radiometers exhibit sensitivity to the angle between incoming radiation and the sensing surface. Visualize this calibration as a correction for variations in signal output caused by the ever changing solar angle presented to each of the seven photodiodes.

During this calibration step, the MFRSR detector-head is mounted on a motorized stage and incrementally rotated in front of a collimated white light source, first about its east-west axis, and then about its north-south axis, while a datalogger records the output from each of the seven detectors.

## Spectral Response

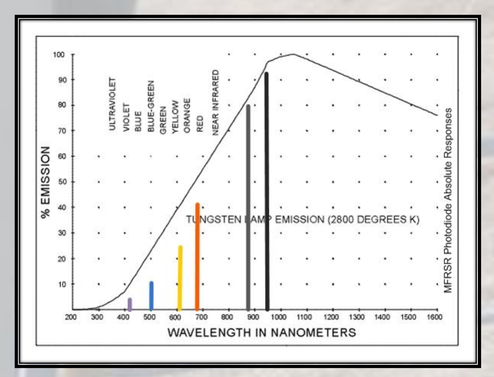




Narrow-band optical filters, such as those situated in front of the MFRSR photodiodes, do not exhibit the qualities of a perfect optical filter. Real-world filters roll off gradually on both sides of their center wavelength. Visualize this calibration as a characterization for each of the seven photodiodes as they respond to the various wavelengths of incoming solar radiation.

During this calibration step, the MFRSR detector-head is mounted at the exit port of an automated, scanning monochromator, which is capable of illuminating the MFRSR optical receiver with a range of narrow band of optical radiation, while a datalogger records the output from each of the seven detectors.

## Absolute Response




Radiometers must be calibrated against established standards before their response to solar radiation becomes meaningful. Visualize this calibration as providing a NIST-traceable response in MFRSR signal output for each of the seven photodiodes. This type of calibration provides us with unique voltage representations for absolute detector responsivities.

During this calibration step, the MFRSR detector-head is mounted at the exit port of a LI-COR LI-1800-02 Optical Radiation Calibrator, which utilizes a NIST-traceable lamp for illumination, while a datalogger records the output from each of the seven detectors.

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