Assessment of the Accuracy of the MOBY Spectral Radiance Calibration Sources Using the SXR and the VXR

B. Carol Johnson and Howard W. Yoon
Optical Technology Division

Mike Feinholz
Moss Landing Marine Laboratories

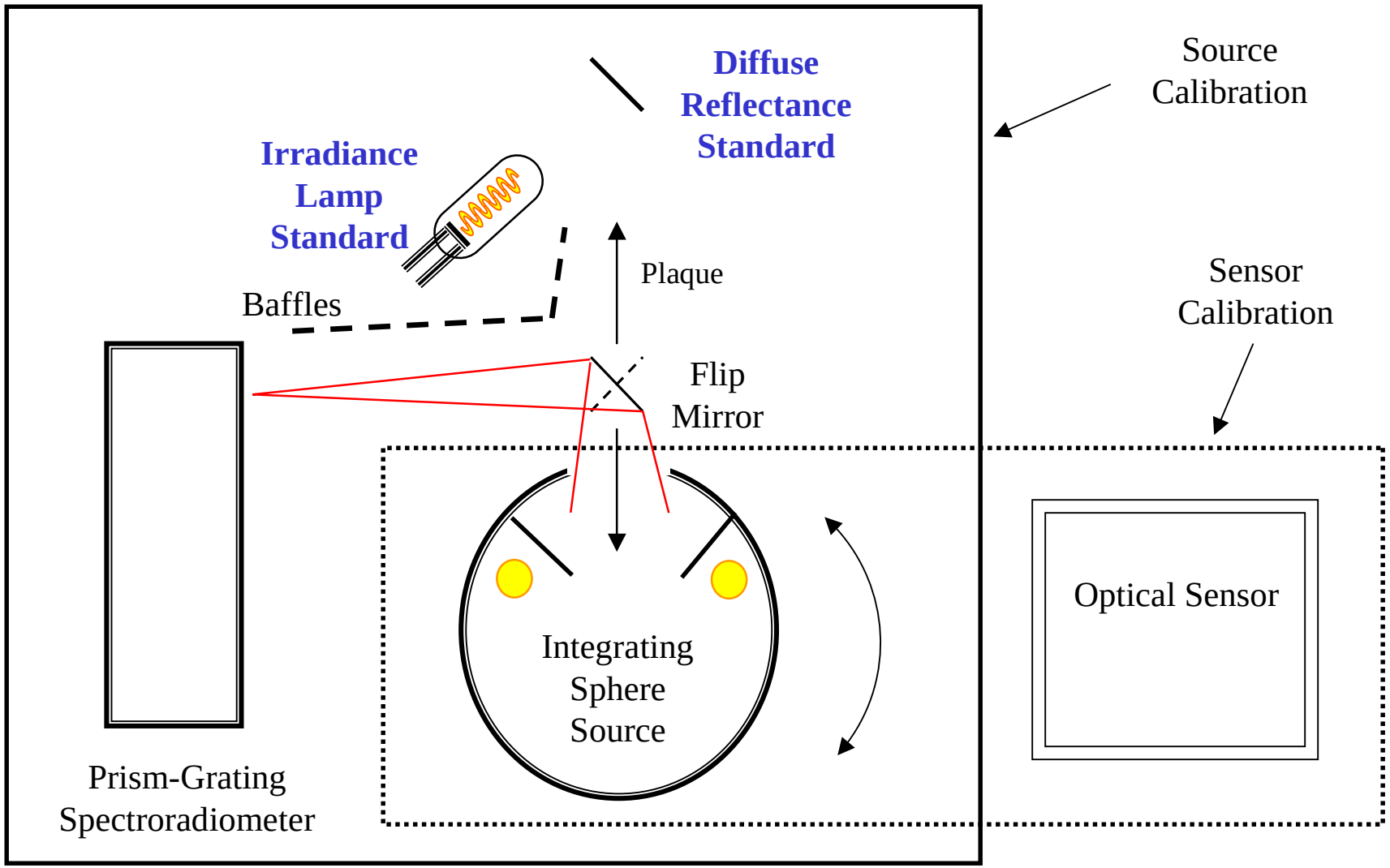
Dennis K. Clark
National Oceanic and Atmospheric Administration
National Environmental Satellite, Data, and Information Services

Poster Presentation
Oceans from Space, Venice, Italy
October 9 – 13, 2000

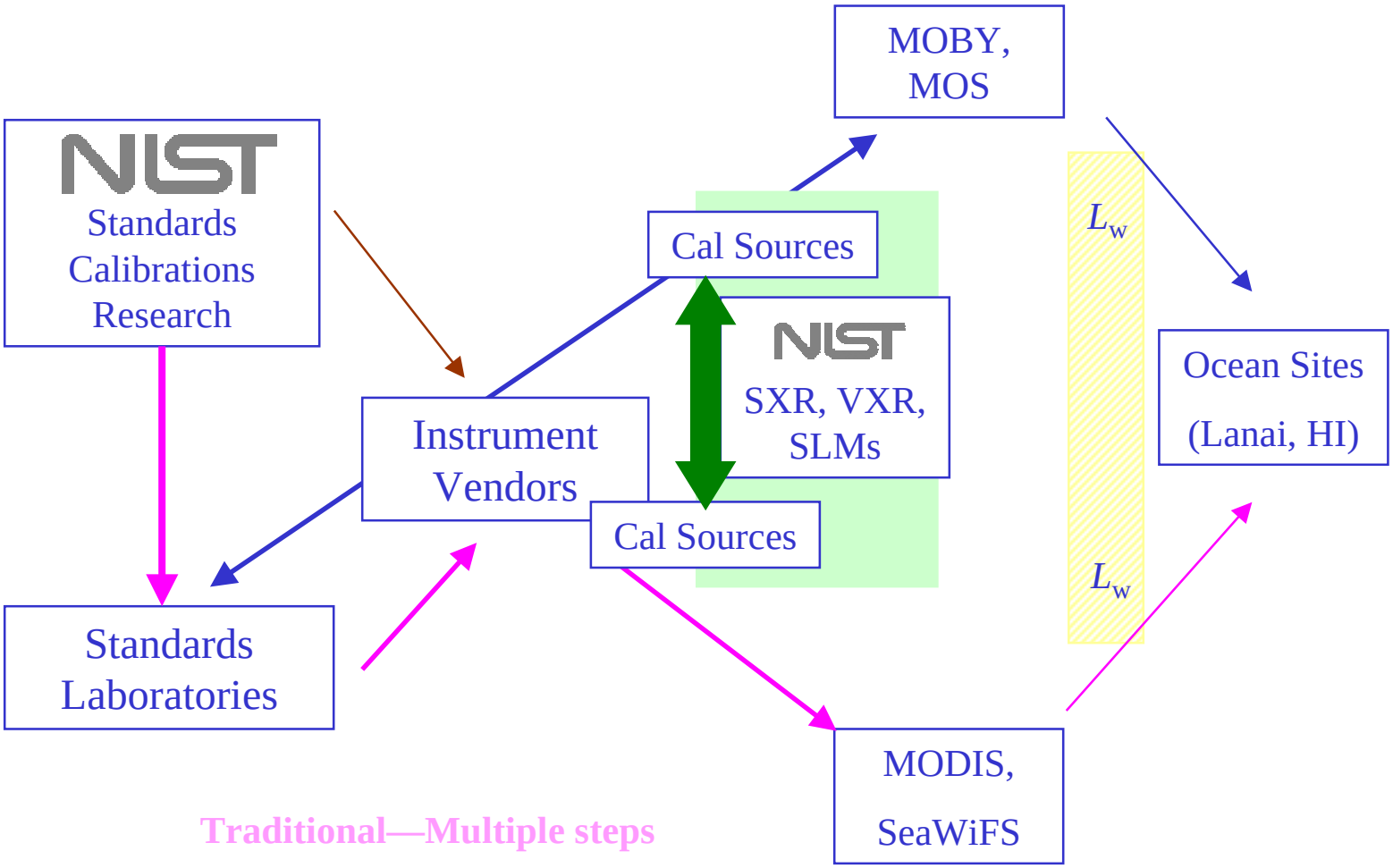
Motivation

- Measurements of Radiant Flux → *Physical Properties of Complex Systems*
- Required Scientific Accuracy → *State of the Art Measurements*
- International, Multi-platform, Multi-instrument → *Long Time Series Data*
- Manufacturer or PI Responsible for Characterization and Calibration of Sensor → *Verification Program*

Spectral Radiance from NIST Standards



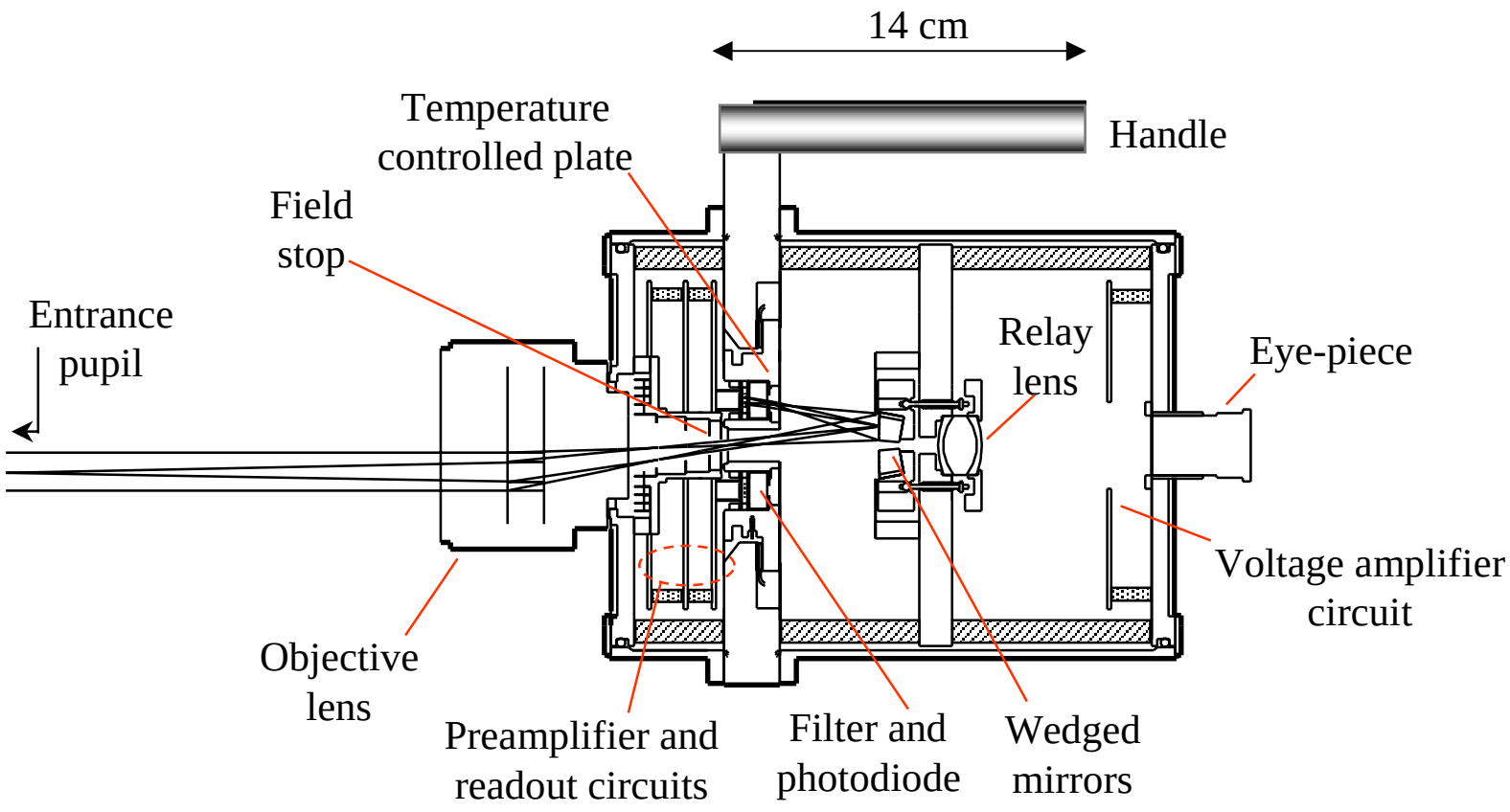
Measurement Chains



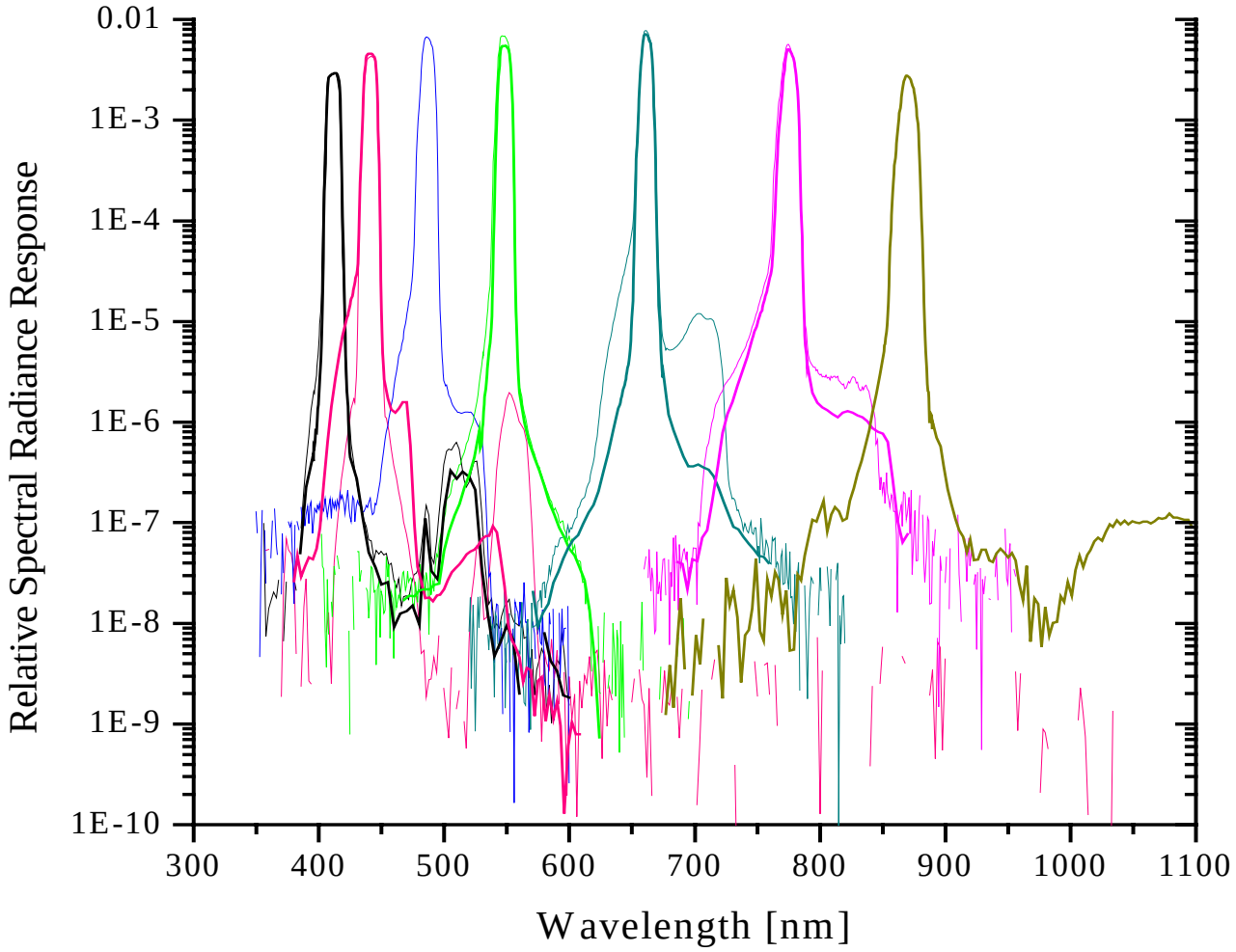
Traditional—Multiple steps

NIST/OA Programs—Direct verification in the field

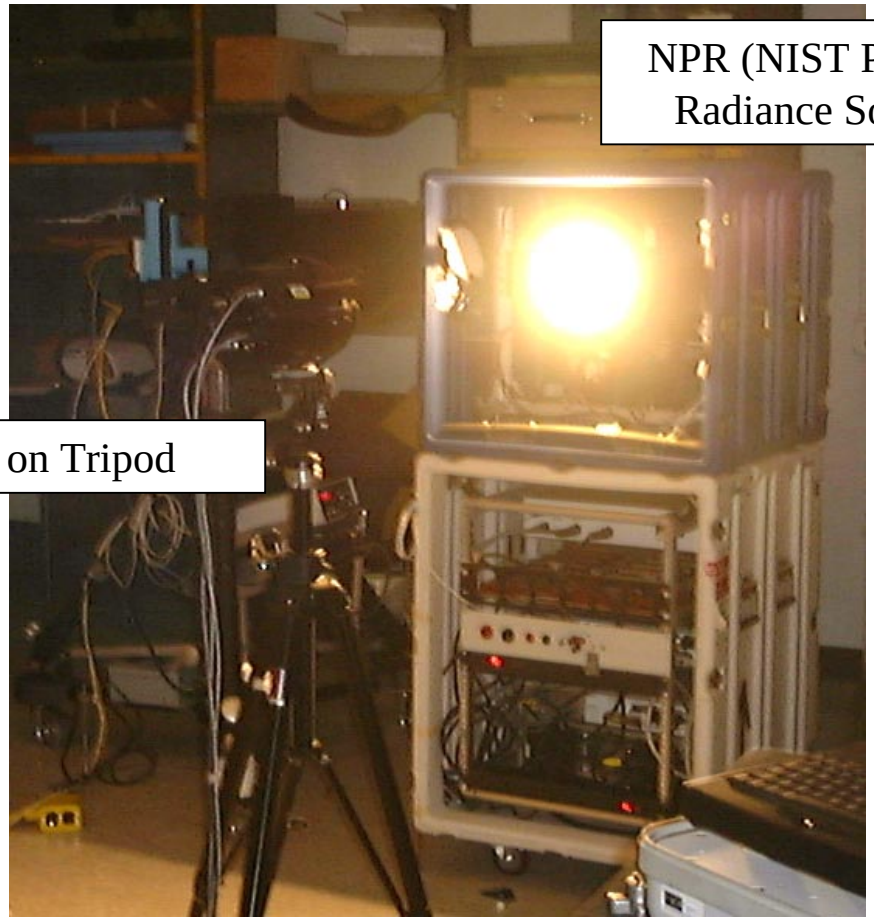
Visible Transfer Radiometer (VXR)



VXR and SXR Channels



VXR and NPR in the Field



- VXR (or SXR or SLMs) transfer NIST radiance scales to the field
- NPR is a stable, portable, calibrated source, with monitor photodiodes, for verifying VXR in the field

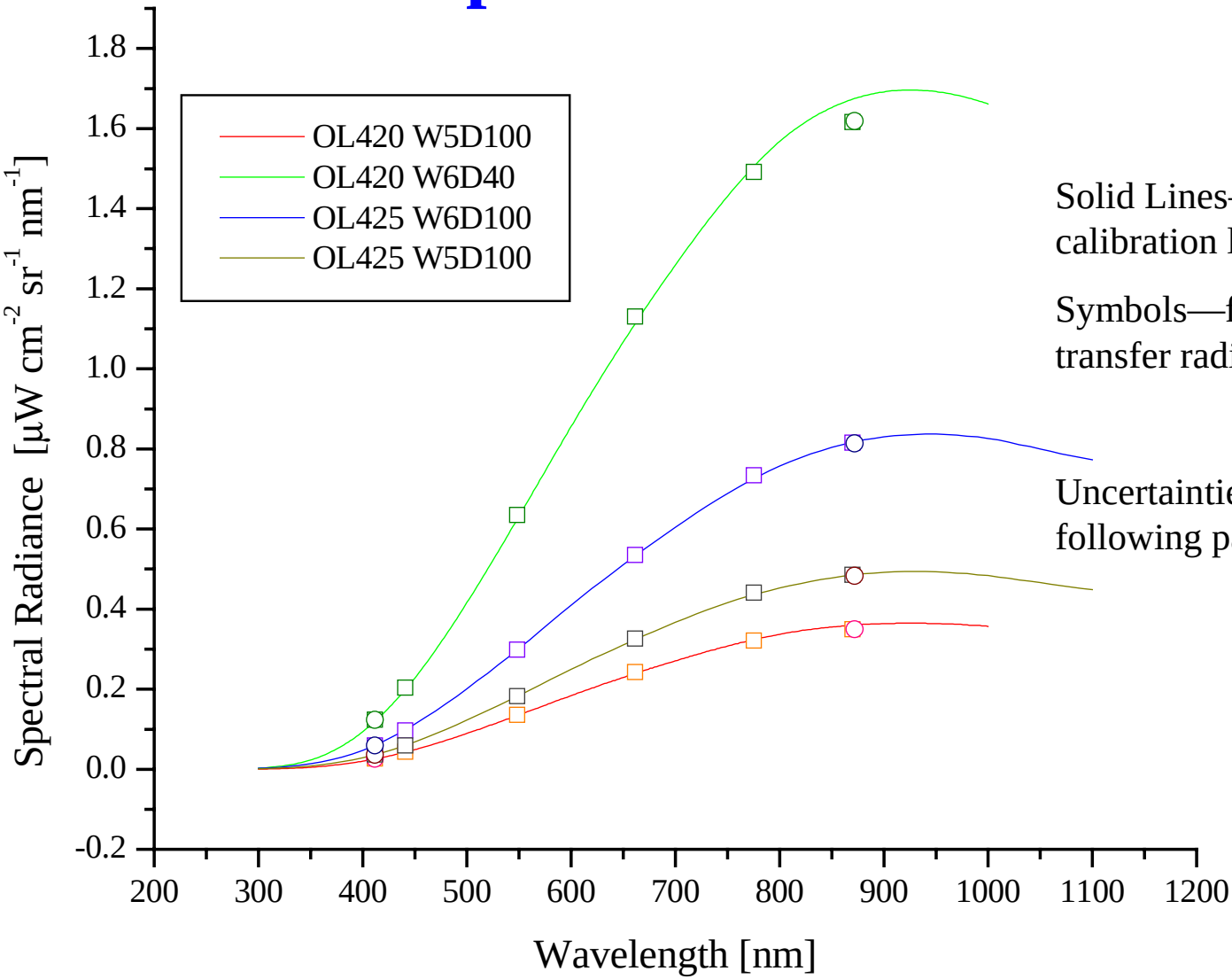
Comparisons at Snug Harbor

- September 1996
  - NIST & SXR
  - SLMs, MOBY, MOS, OL420
- January 1999
  - NIST & VXR, NPR
  - SLMs, MOBY, MOS, MD5, Diver's Lamps, OL420, OL425
- February 2000
  - NIST & VXR, NPR
  - SLMs, MOBY, MOS, OL425

MOBY Spheres

- OL420
  - Calibrated in terms of spectral radiance, $L(\lambda)$
  - External lamp (90° to exit aperture)
  - Continuously variable (translate lamp or change throughput between lamp and the sphere)
  - No monitor photodiode
- OL425
  - Calibrated in terms of the relative spectral shape and the output of the monitor photometer
  - External lamp and interior baffle plate (lamp is on-axis)
  - Continuously variable (change throughput between lamp and the sphere)

Sphere Radiance

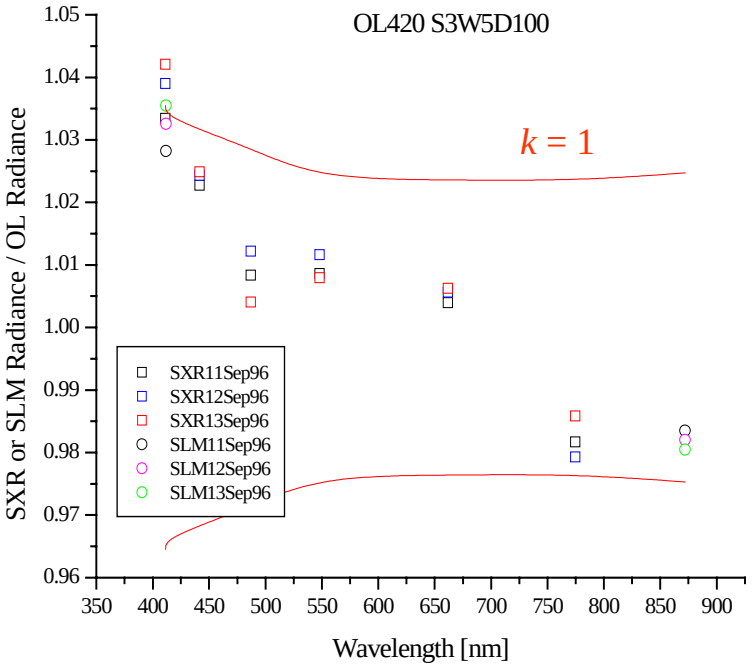


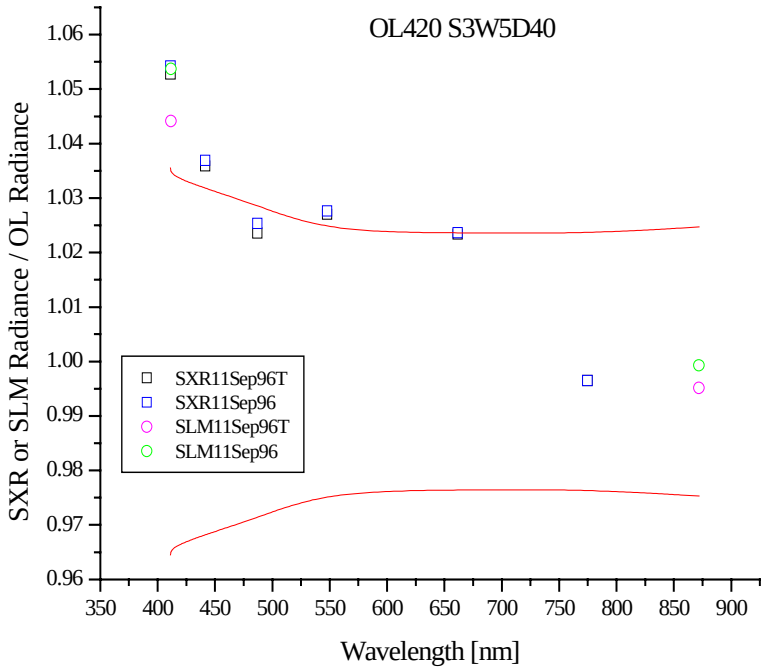
Solid Lines—from calibration laboratory

Symbols—from NIST transfer radiometers

Uncertainties—see following pages

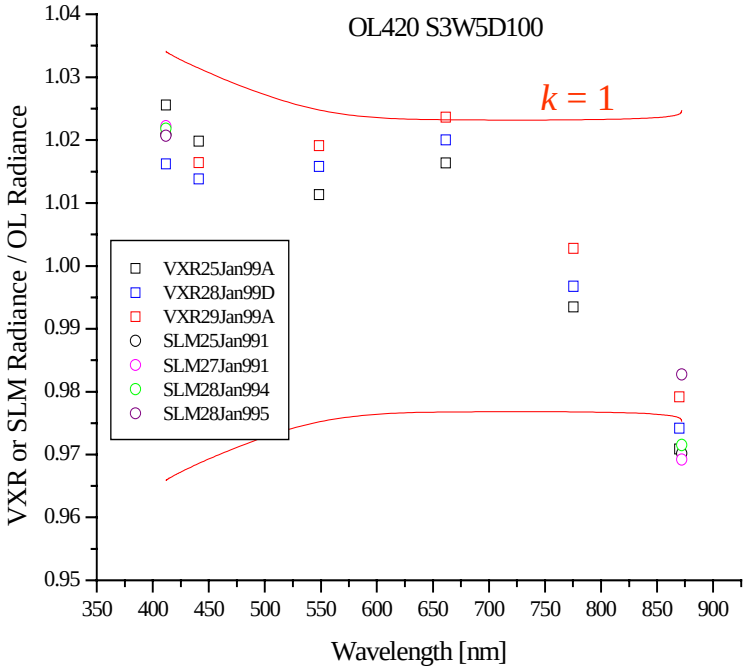
OL420 in 1996

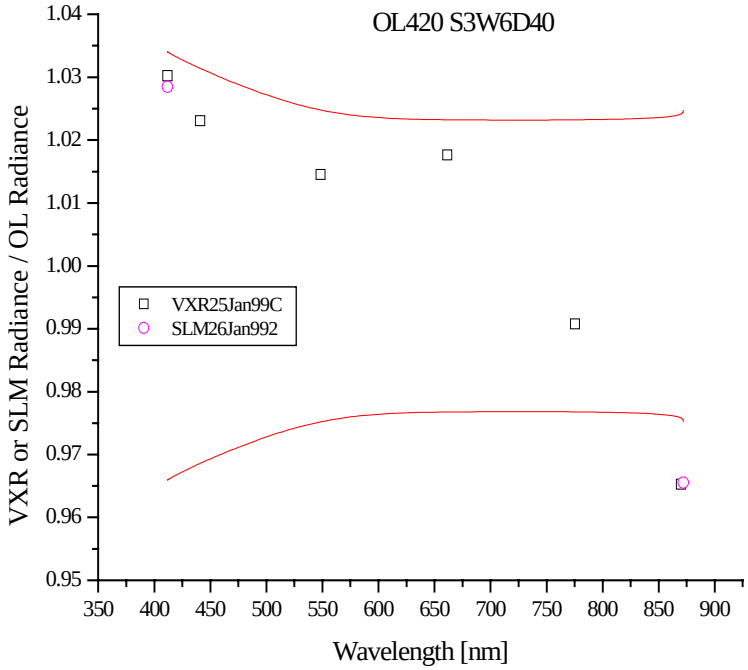




OL420 is calibrated by Optronic Laboratories at the S3W5D100 setting; numeric ratios are provided for all other settings: W5D40 = 1.5 * W5D100. The SXR-SLM results give 1.52.

OL420 in 1999

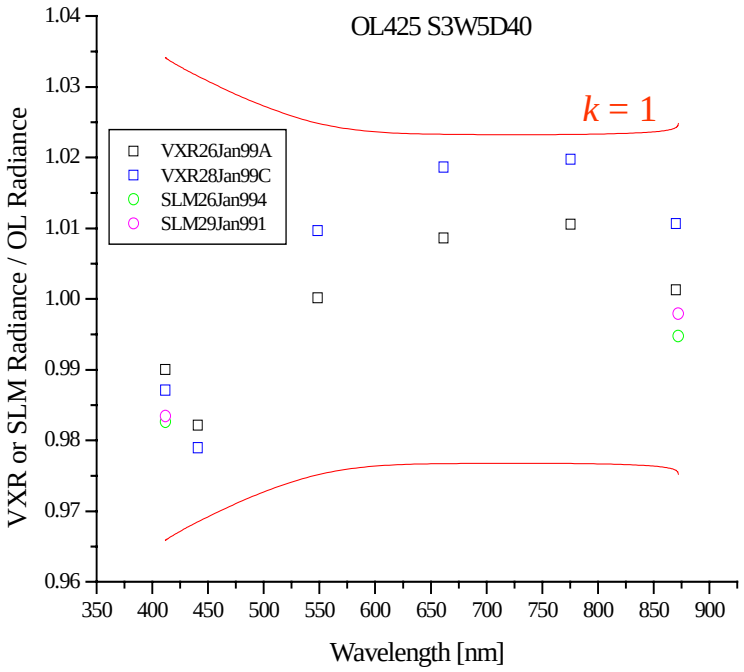


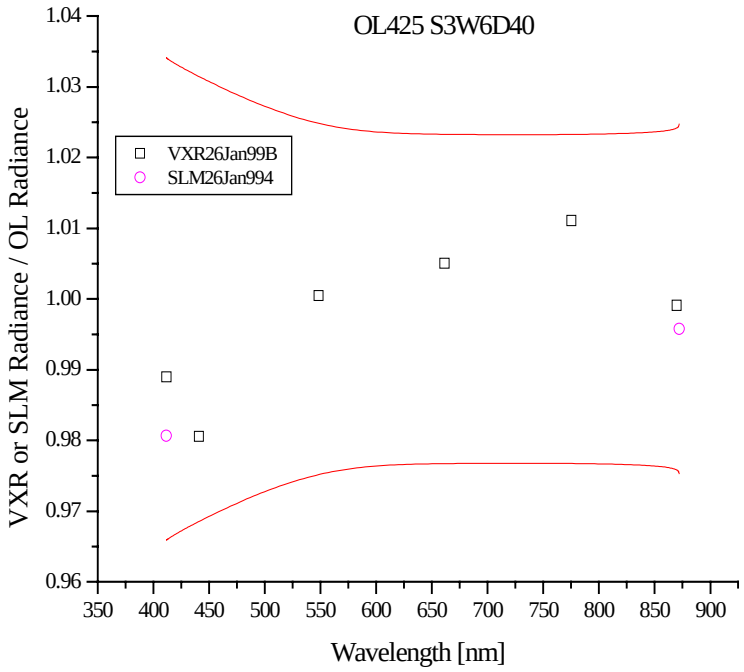


Calibrated at S3W5D100

Relate to S3W5D100 using OL numeric factors: S3W6D40 = 1.5*3.1 S3W5D100

OL425 in 1999

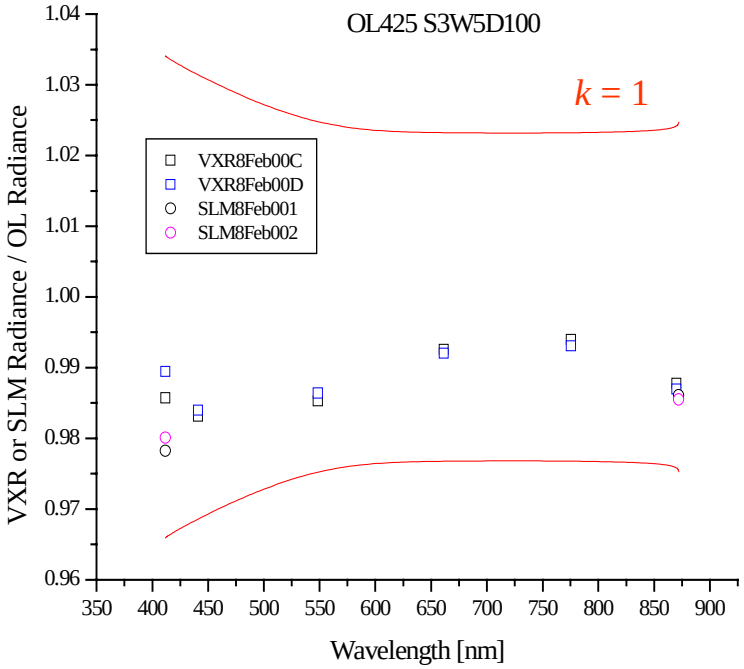




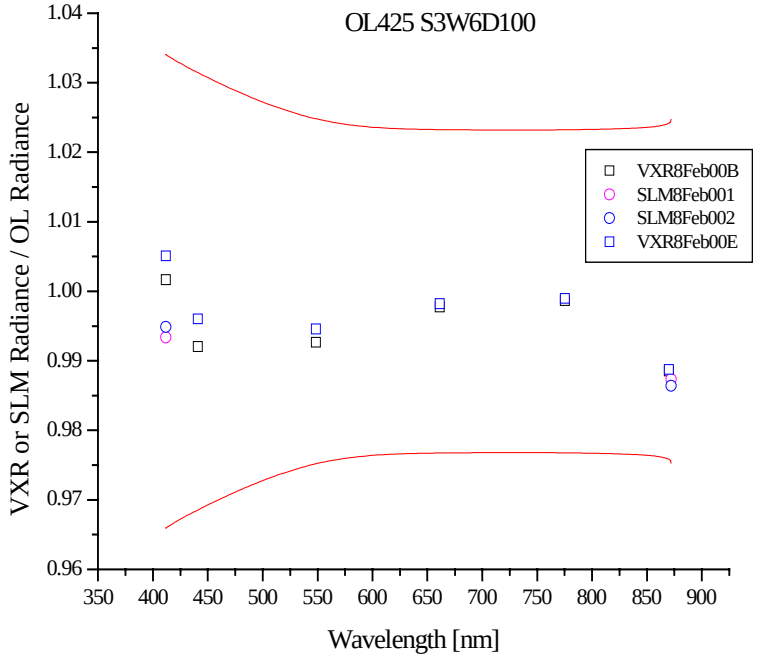
Calibrated at S3W5D100; scaled using OL425 Photometer

Calibrated at S3W6D100; scaled using OL425 Photometer

OL425 in 2000



Calibrated at S3W5D100



Calibrated at S3W6D100

Conclusions

- Spectral radiances of MOBY calibration sources are accurate to within +/- 3% from 410 nm to 870 nm
- Commercial calibration laboratory is providing standards that are within their stated expanded (k = 2) uncertainties
- OL420 appears to have a spectral component compared to NIST; the OL425 does not, but the variations are within the uncertainties
- Periodic comparisons with EOS/NIST should continue