

Realization of the Candela and a Robust Dissemination Methodology For Optical Measurements to Replace the FEL at NIST

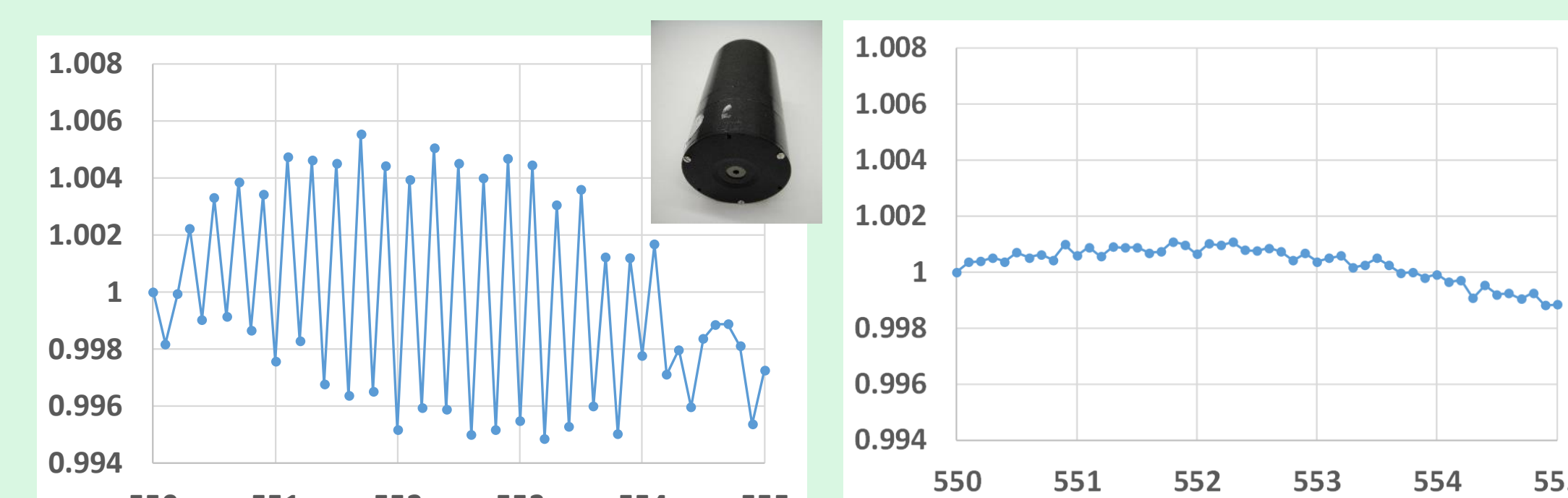
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National Institute of Standards & Technology, USA

NIST Standard Reference Instrument 6013

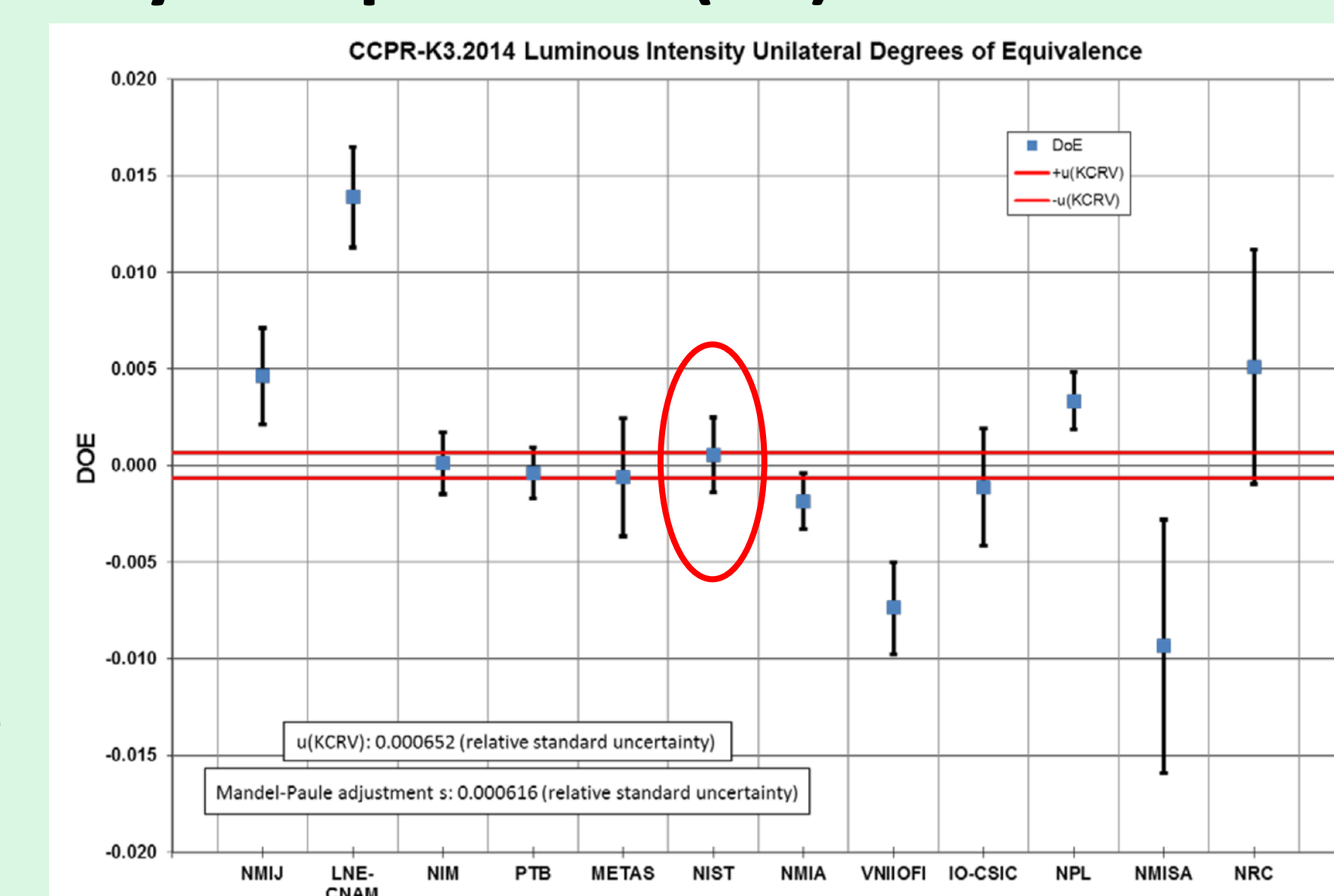


Dissemination of SI unit candela (since 1901)
Illuminance Responsivity, R_{E_V} , 0.20 % ($k=2$)
Luminous Intensity - I_V , 0.25 % ($k=2$)

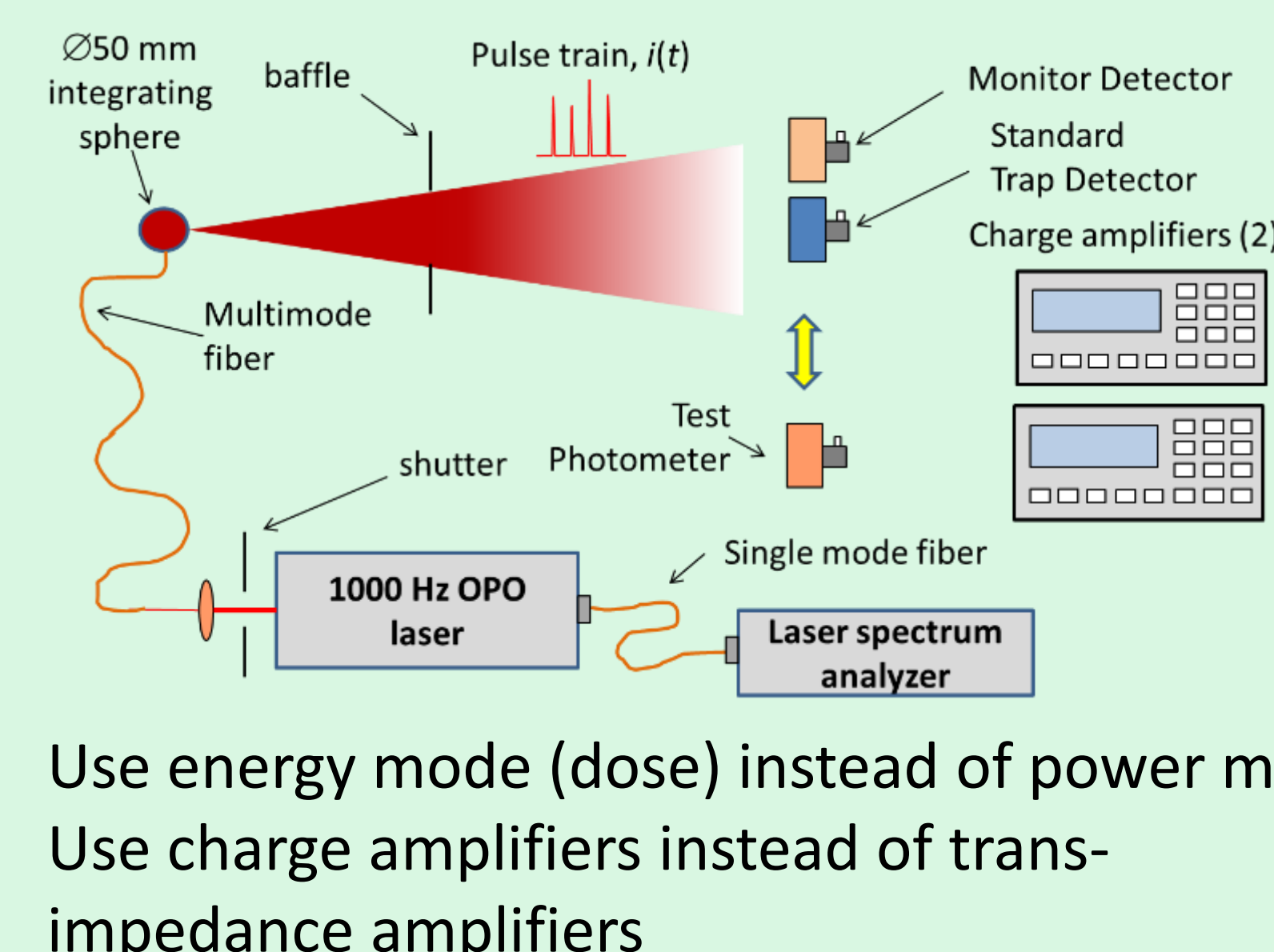


- Scanning interval = 0.1 nm
- Interference fringes reduced by roughing sapphire window inside

Key comparisons (K3)

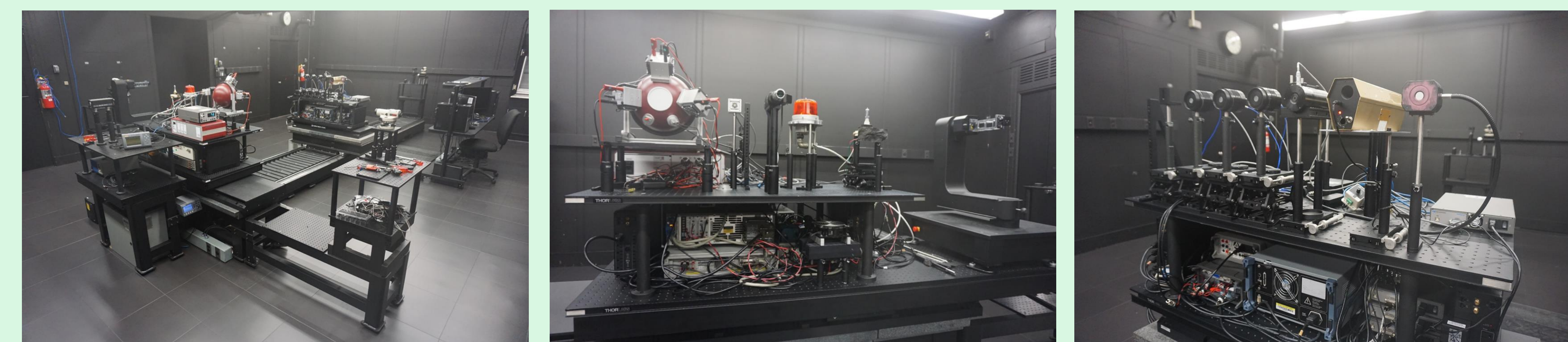


Luminance version

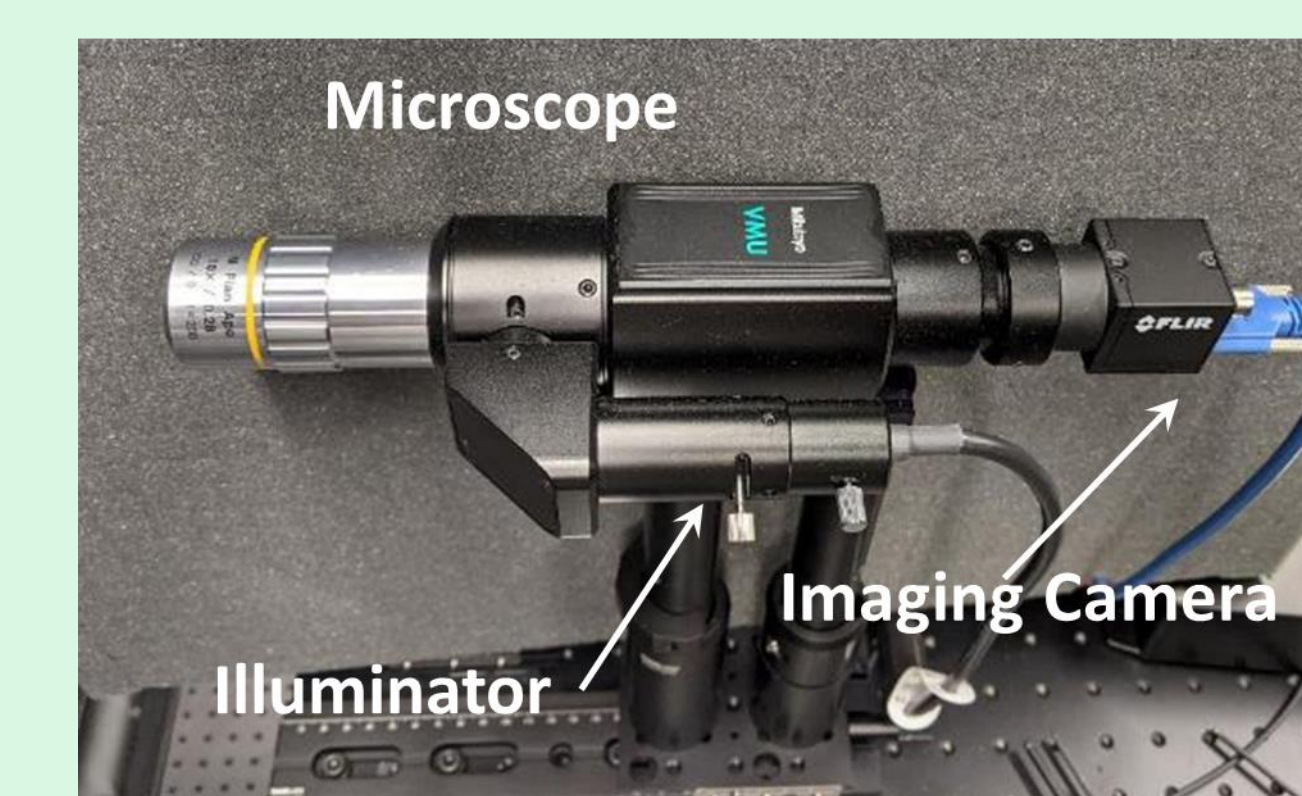


Use energy mode (dose) instead of power mode
Use charge amplifiers instead of trans-impedance amplifiers

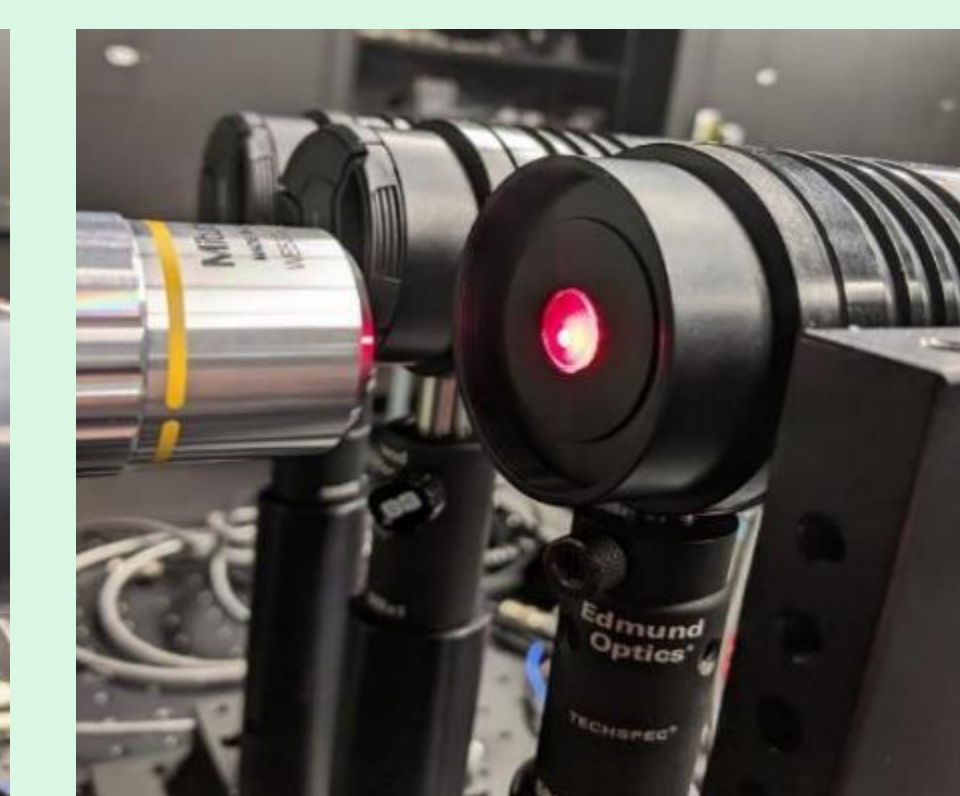
NIST Photometric Bench



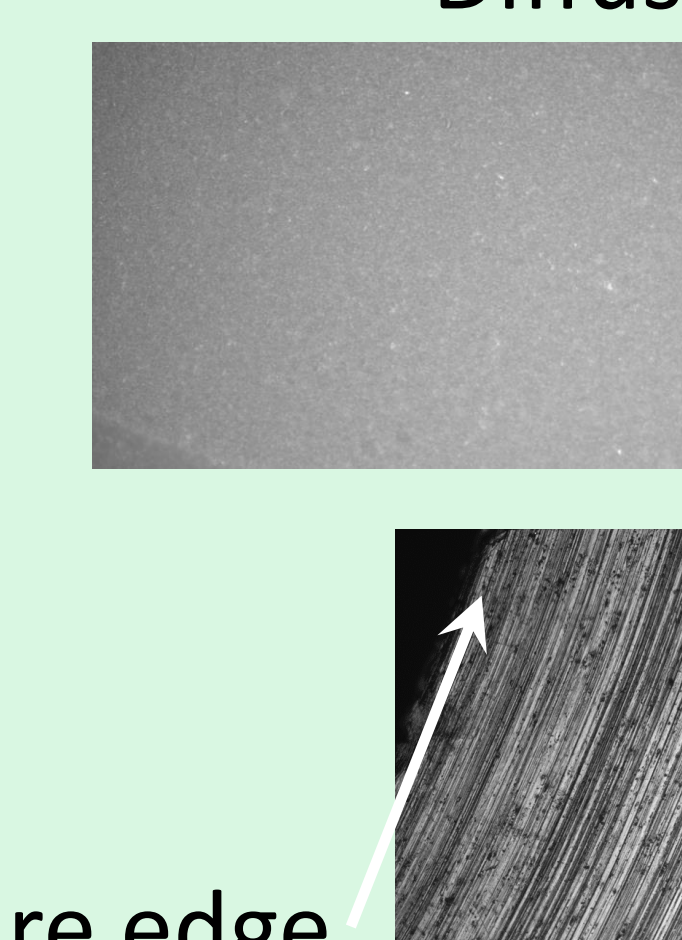
6 m ball screw, 5 m travel, 1.5 m travel source stage
 $\Delta d = 50 \times 10^{-6}$ m



Distance alignment tool

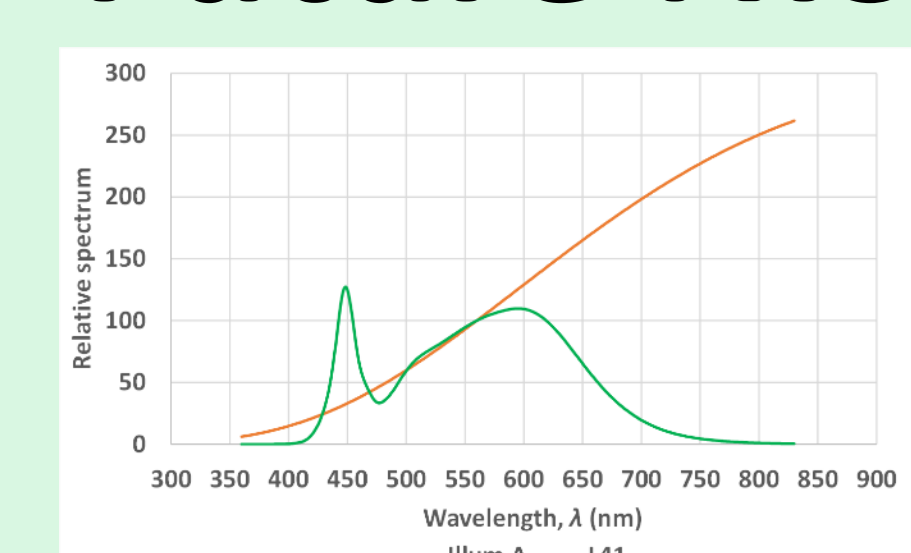


Aperture edge



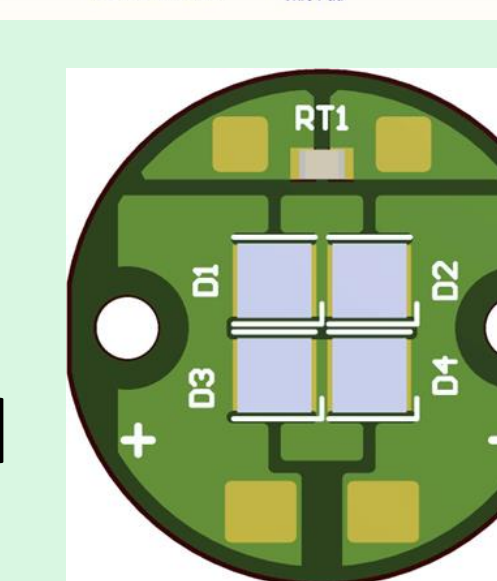
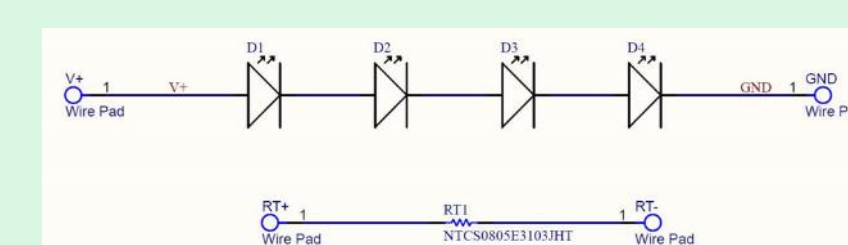
Diffuser surface

Future NIST SRI – Standard Illuminant L



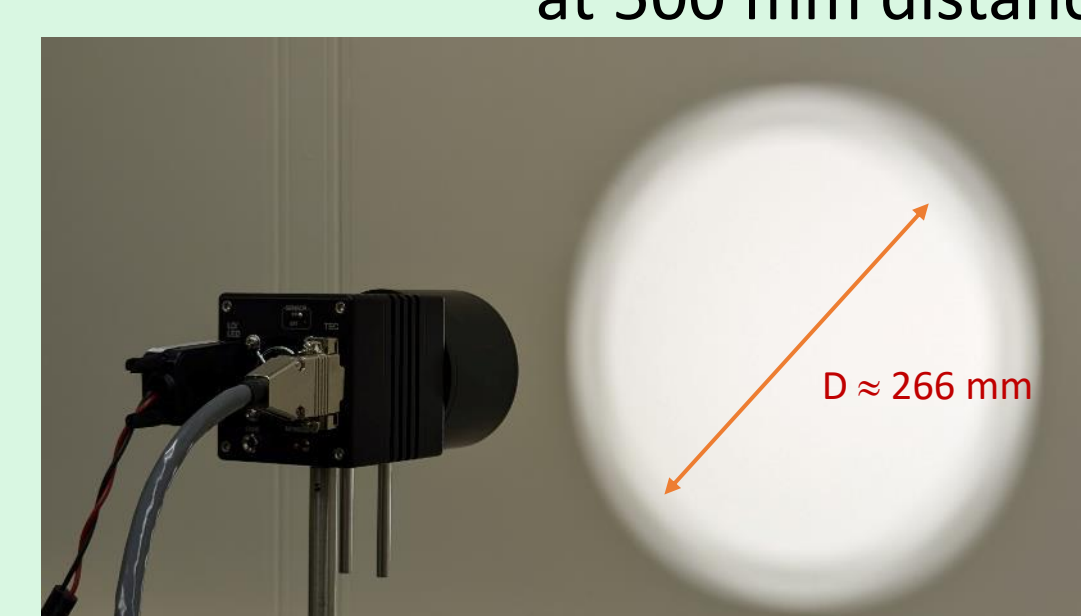
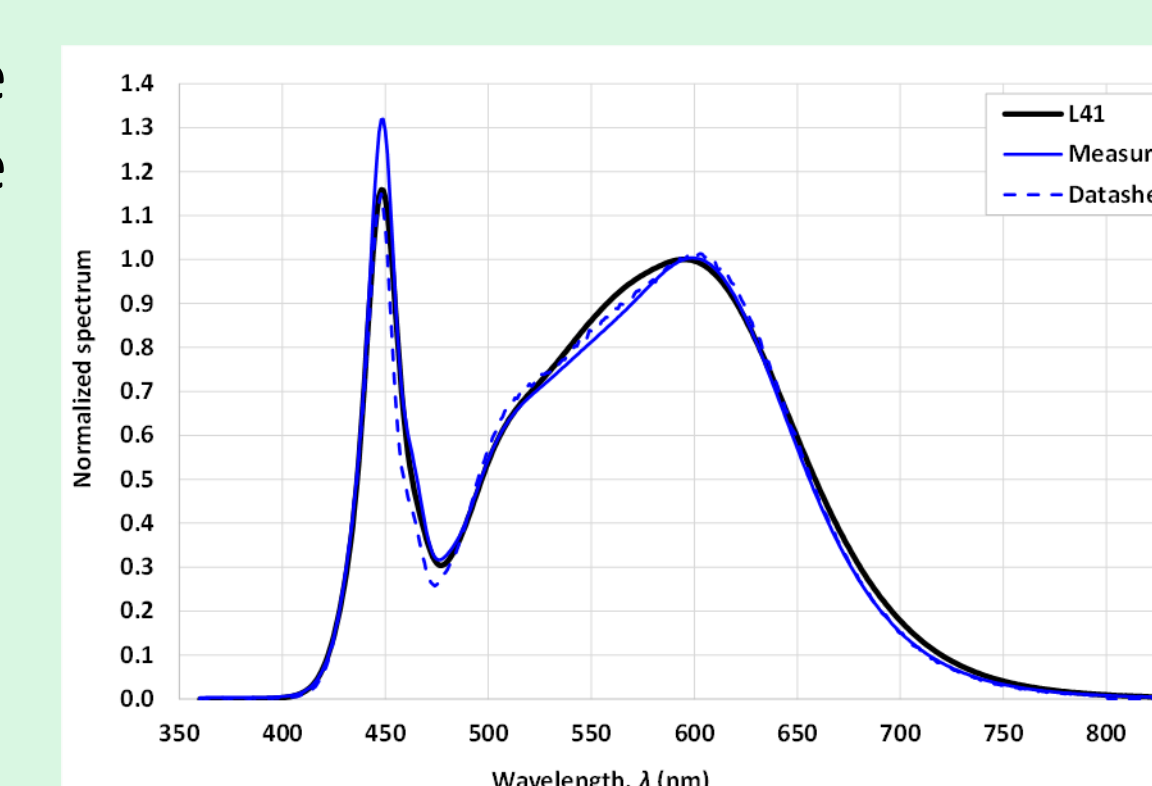
NIST had a need for a stable source that produces Illuminant L and is extremely stable over short and long periods of time

- Source developed based on using four Nichia white LED – Model NV4WB35AM (R8000)-sm405
- A 10K ohm thermistor is on board
- Copper heat transfer plate

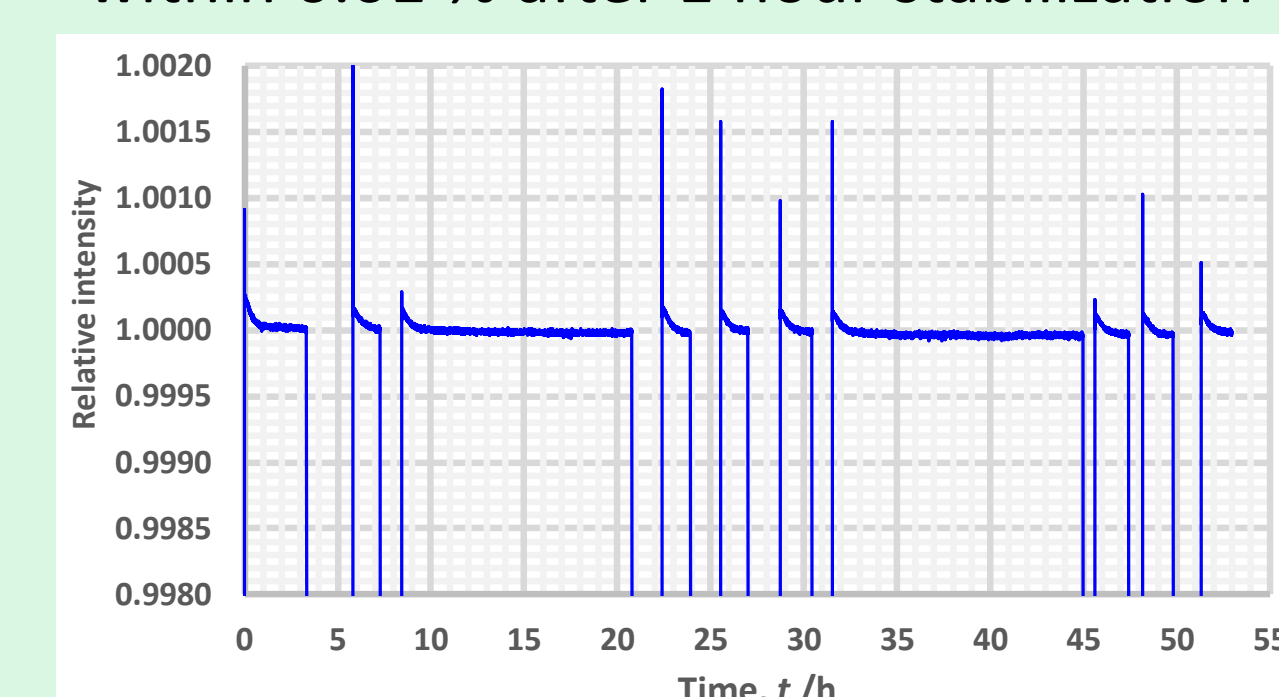


Mounted on TEC
Uniformity <0.1 % over 30 mm spot at 500 mm distance

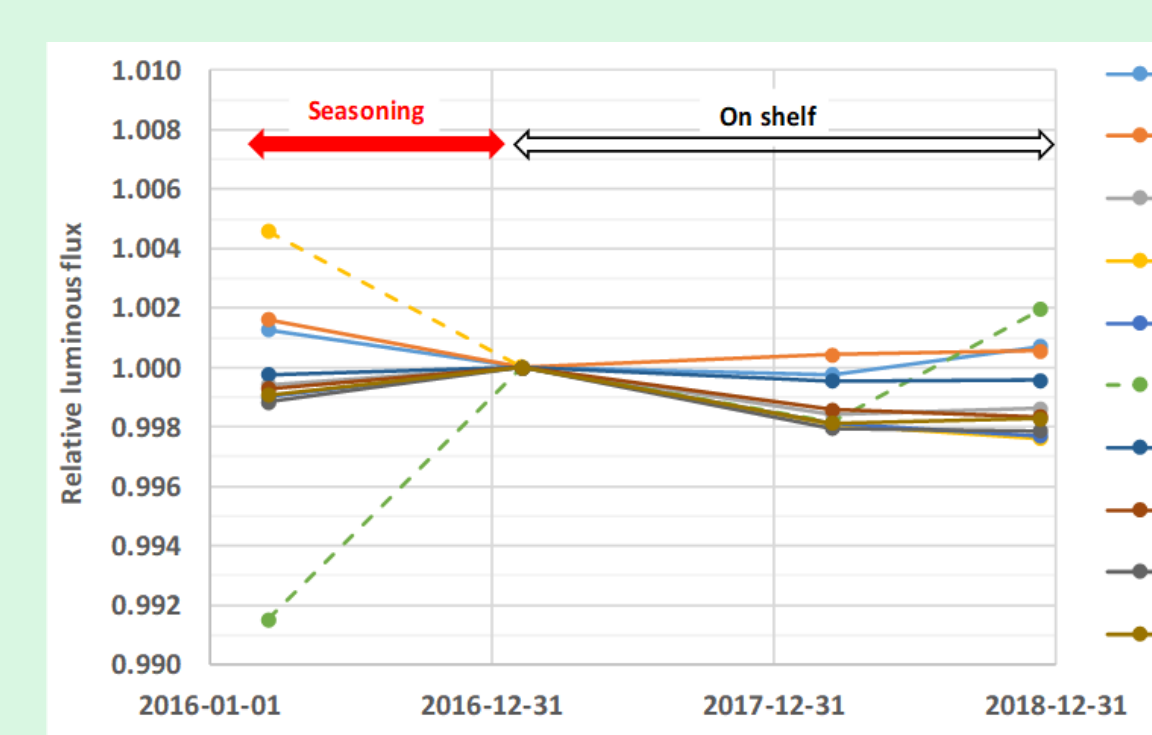
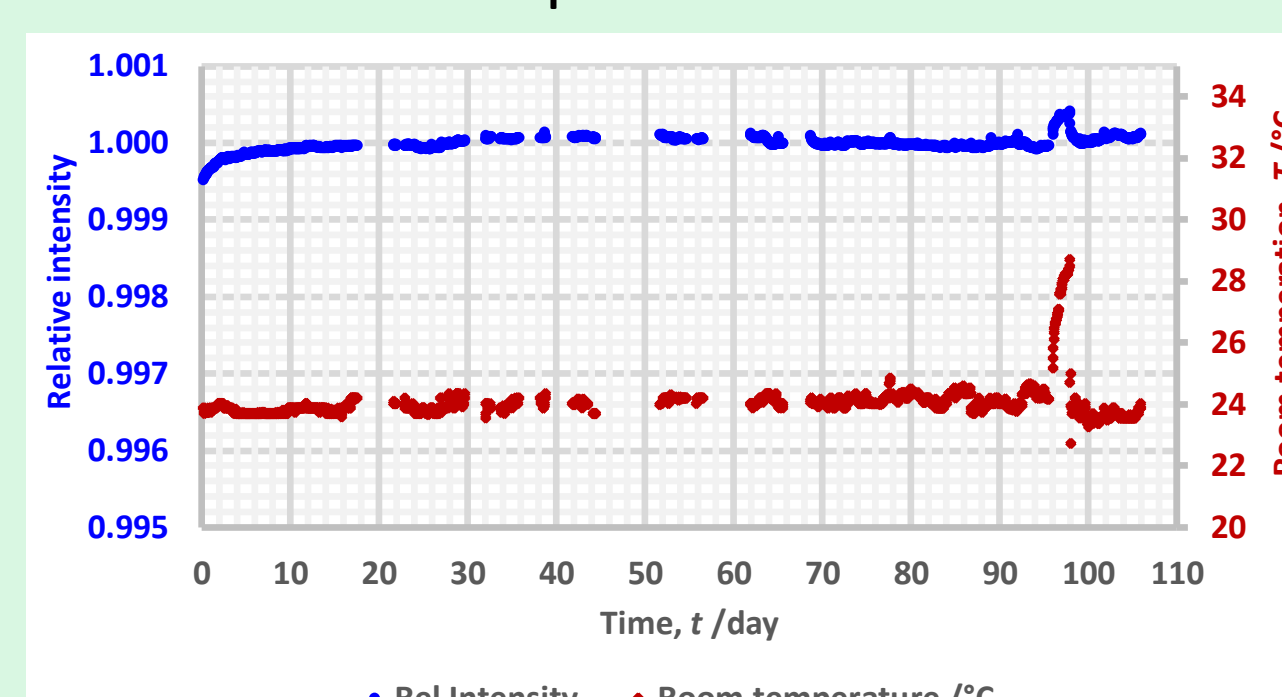
Produces vignetting-free 266 mm spot size at 500 mm distance



Repeatability of luminous intensity is within 0.01 % after 1 hour stabilization

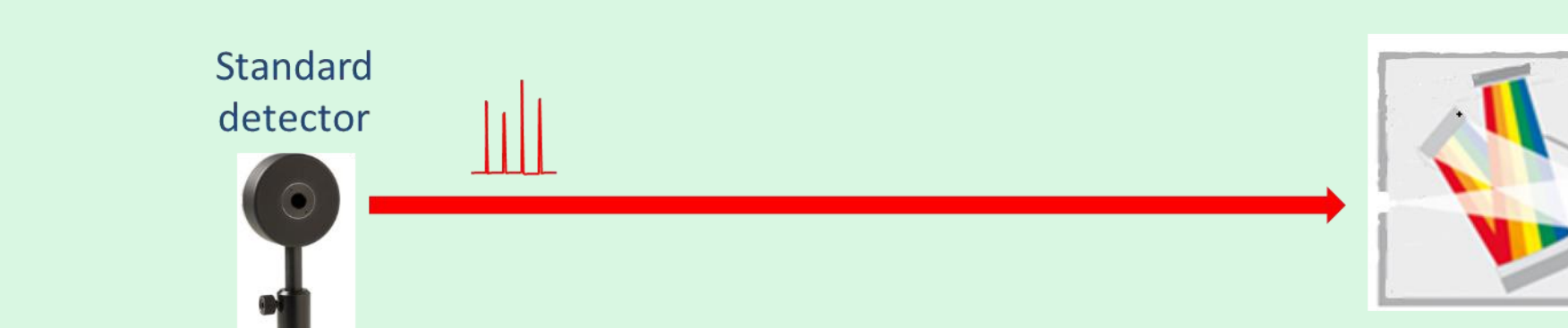
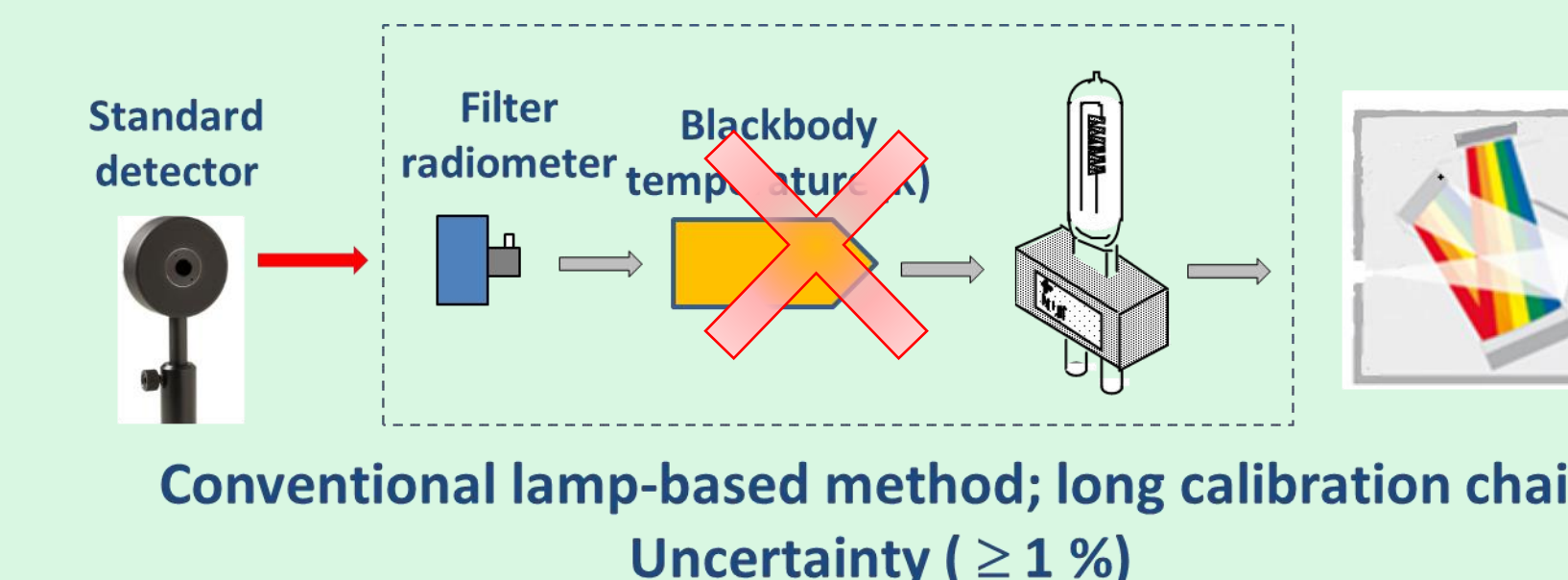


Every hour for luminous intensity over 100 days
Initial change of 0.05 % for the 1st 10 days
Small room-temperature effect is shown on Day 96 to Day 98.

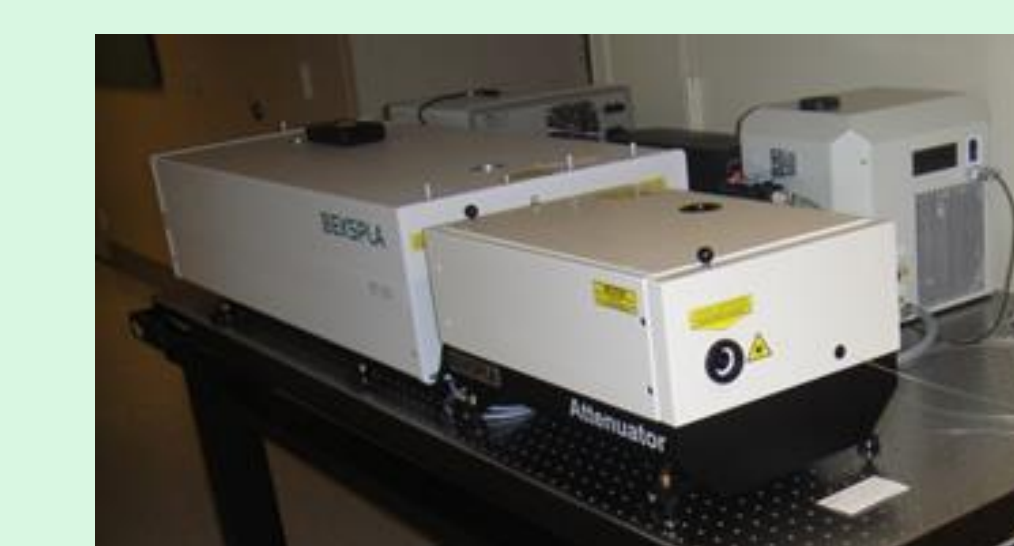


1st year seasoning shows no aging effect
2nd and 3rd years storage no effect
Individual change: 0.2 % (excluding #24 and #26)
Average change among group: <0.1 %

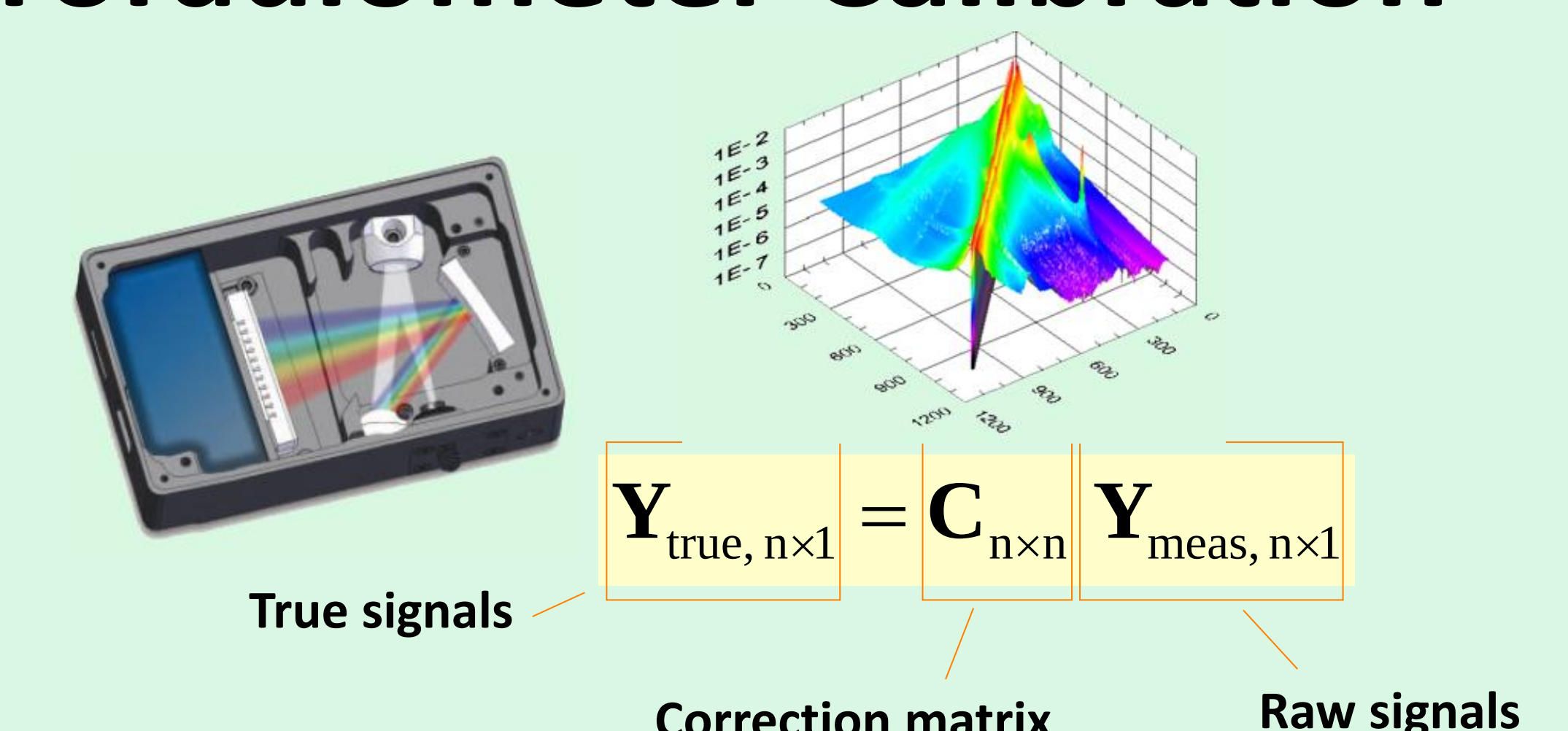
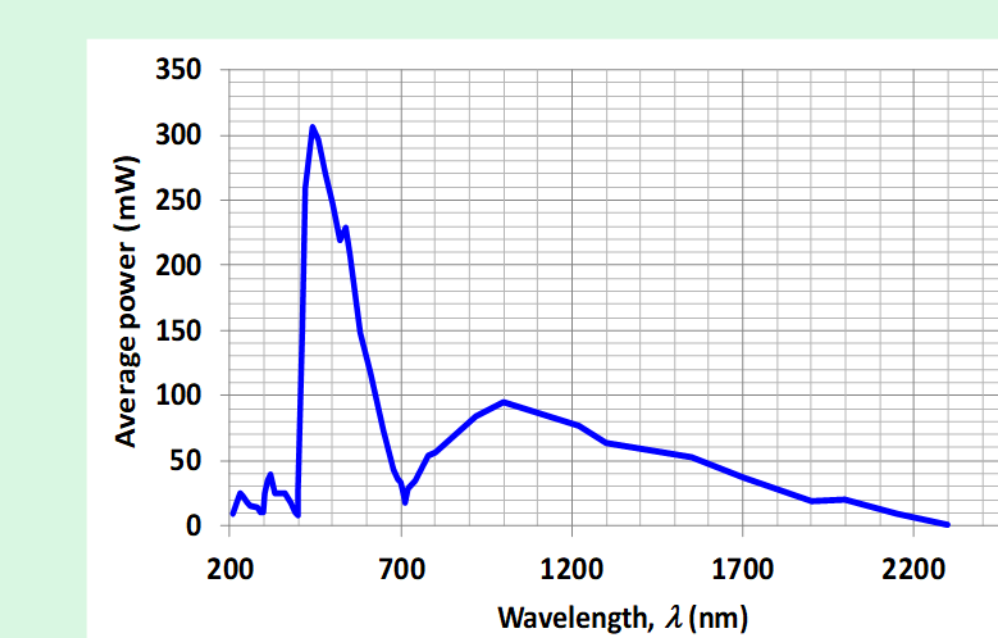
New Detector-based Spectroradiometer Calibration



New detector-based method (0.2 %); enables a new independent way to realize spectral irradiance/radiance scales on spectroradiometers



Automated pulsed laser uniform source (APLUS) laboratory



Simple stray light correction method for array spectroradiometers and imaging systems

Line Spread Function (LSF) and Slit Scattering Function (SSF)

