

Comparison of commercial UV LED sources and radiometers

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NIST calibration services in the ultraviolet

Detectors: Spectral radiant power responsivity

- Photodiode calibrations

- Photomultiplier calibrations

- Irradiance meter calibrations

- Special tests

Source calibration

- Deuterium lamp calibrations

- Special tests

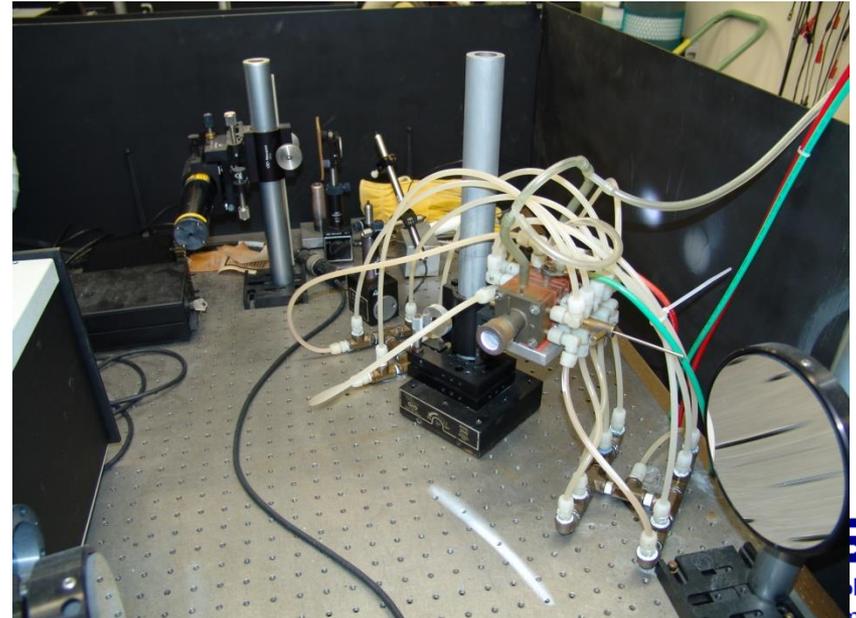
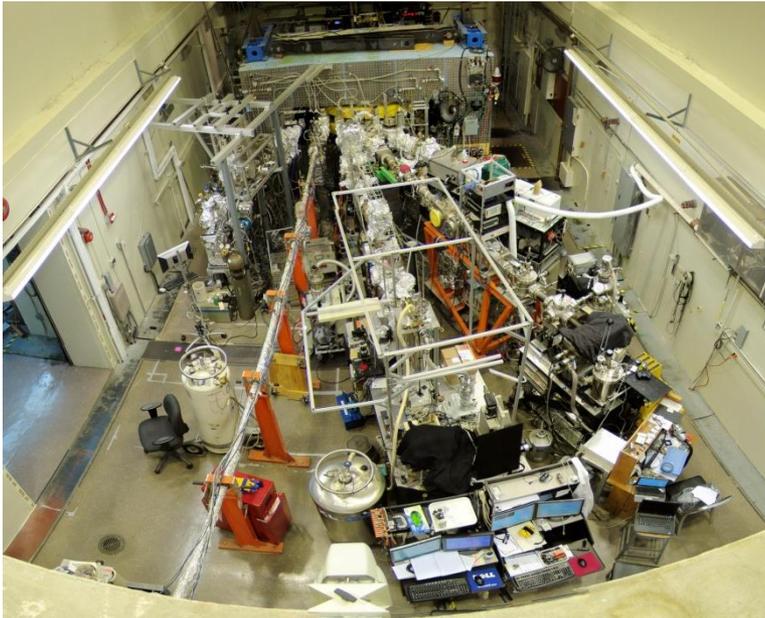
NIST sources of ultraviolet

Synchrotron radiation

- Relativistic electrons
- Broadband output
- Absolute source

Plasma sources

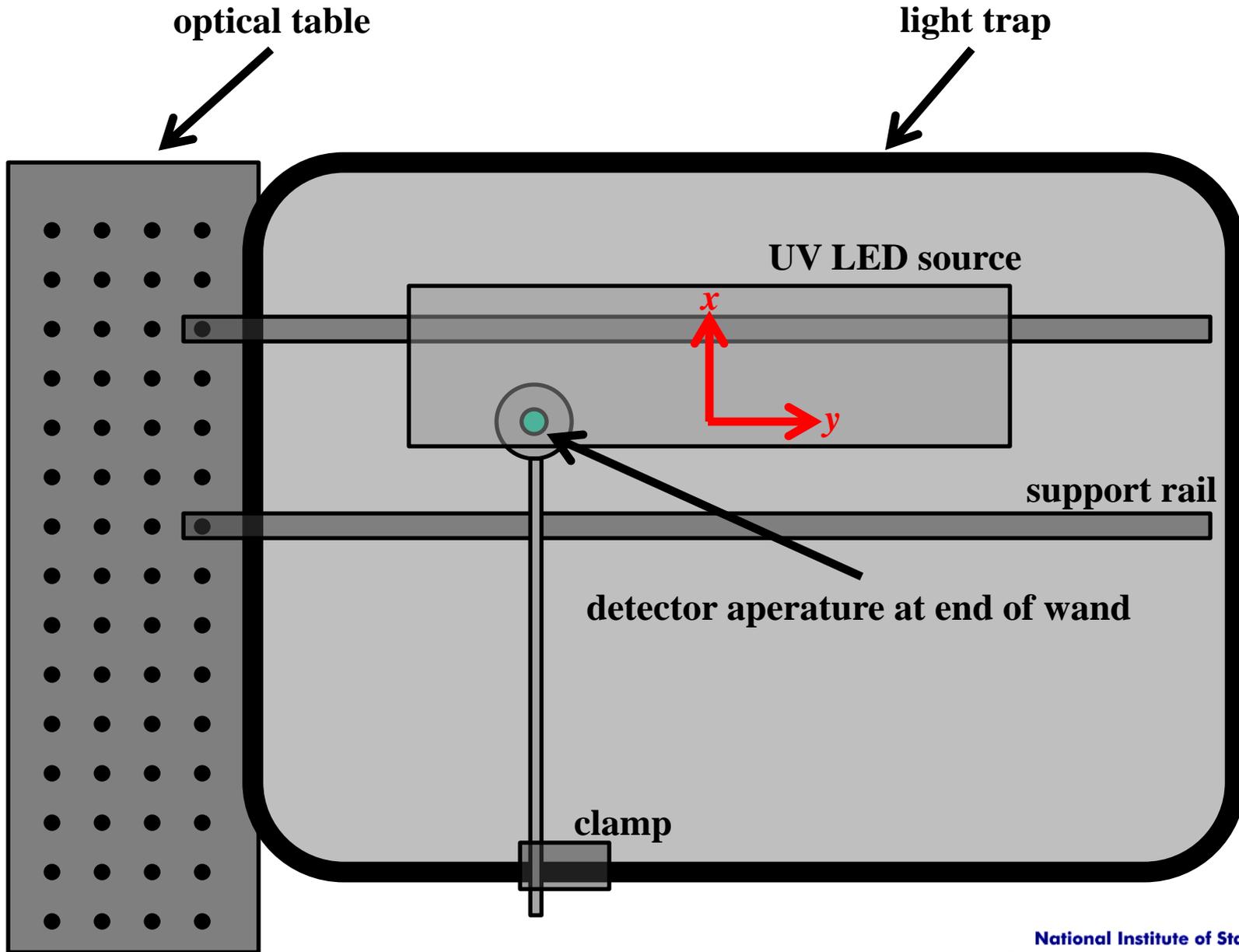
- Argon arc
- Laser-driven sources



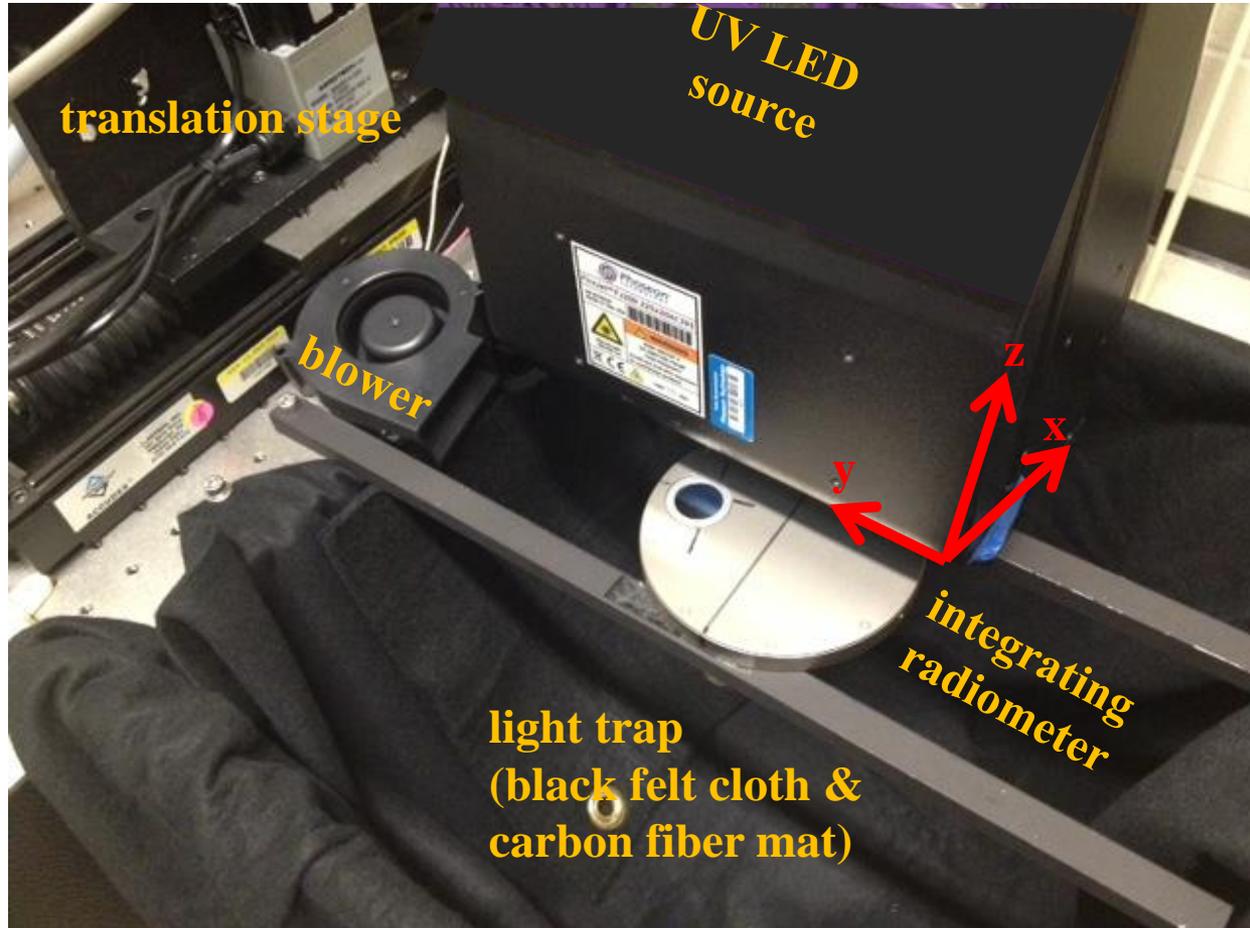
Two commercial sources and two detectors

	device	area (cm²)	λ (nm)	max (W cm⁻²)
A	source,	22.5 × 2.0	380 - 420	12
B1	source, lens	22.5 × 2.5	390 - 400	7
B2	source	22.5 × 2.5	390 - 400	7
A	power meter, wand or spot	0.64	320 - 460	40
C	power meter, integrating	0.03 ?	375 - 415	10

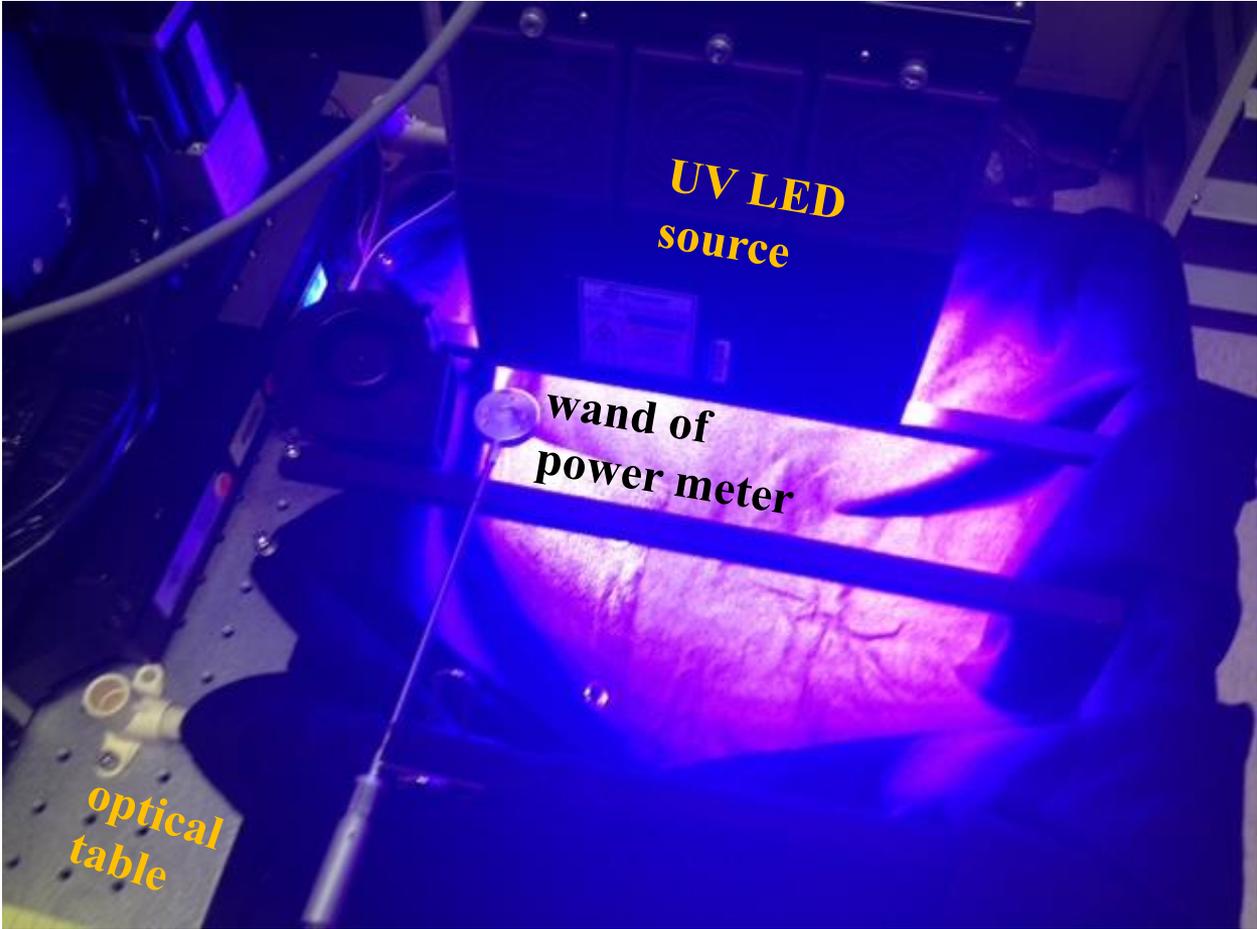
Schematic of layout (looking down)



Setup with the integrating power meter

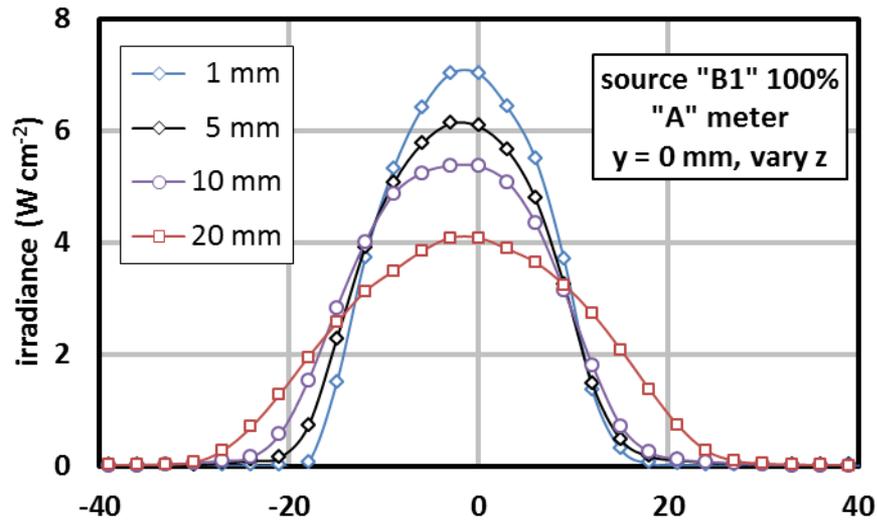


Operation with the wand power meter

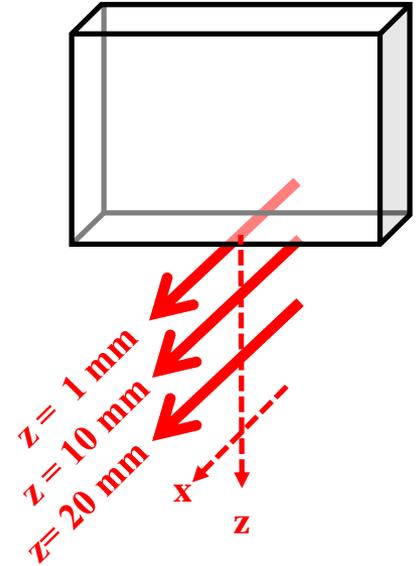
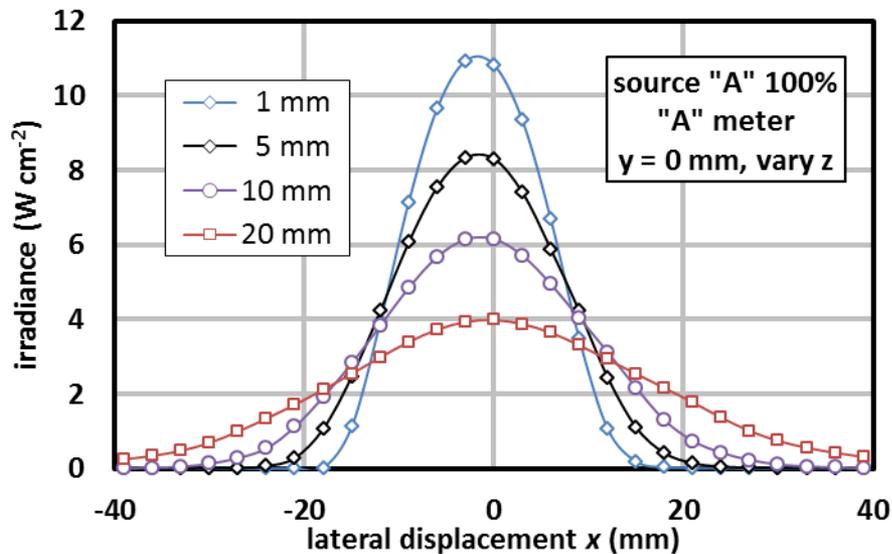


Height of source above detector

source "B1"
(focused)

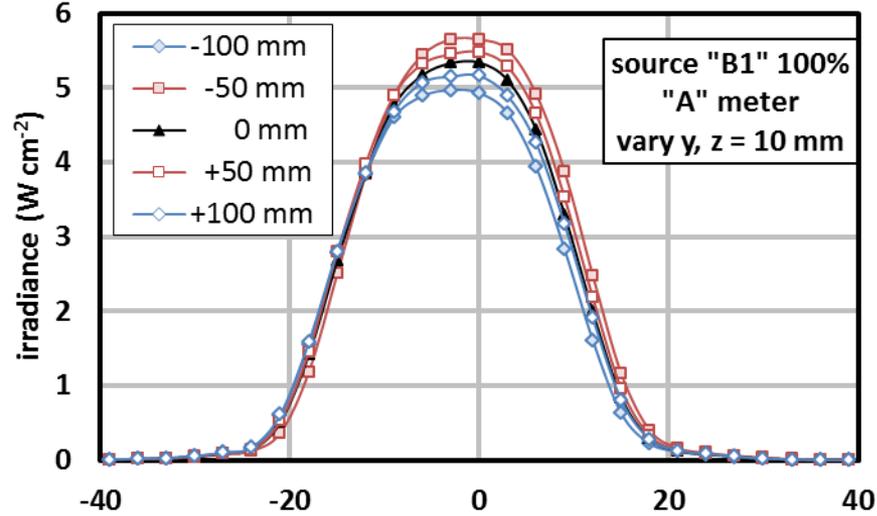


source "A"
(not focused)

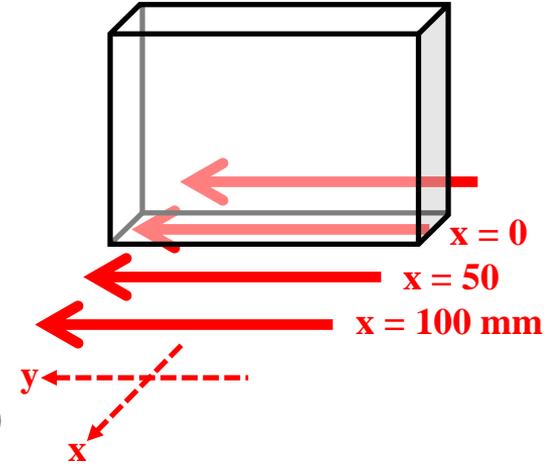
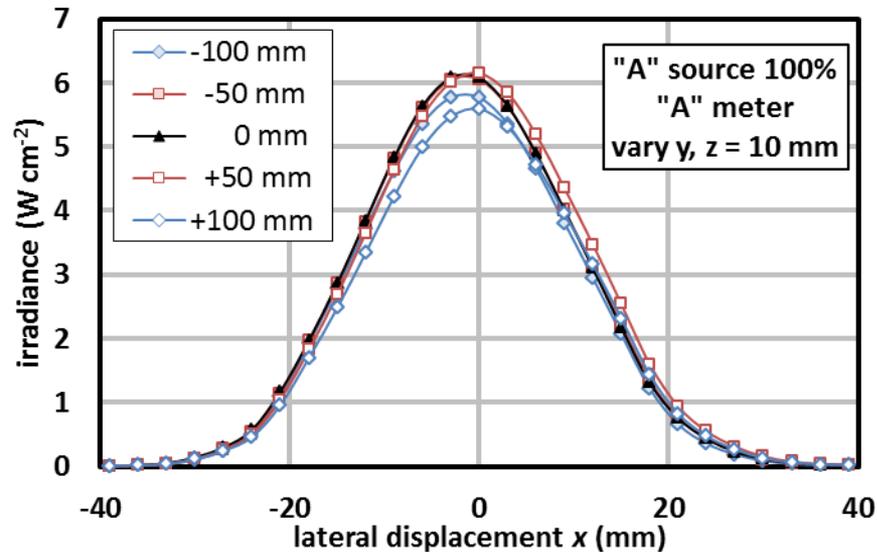


Lateral position, fixed height

source "B1"
(focused)

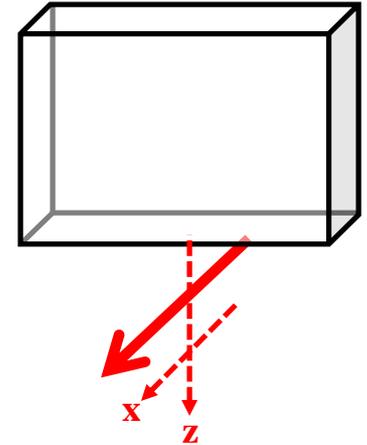
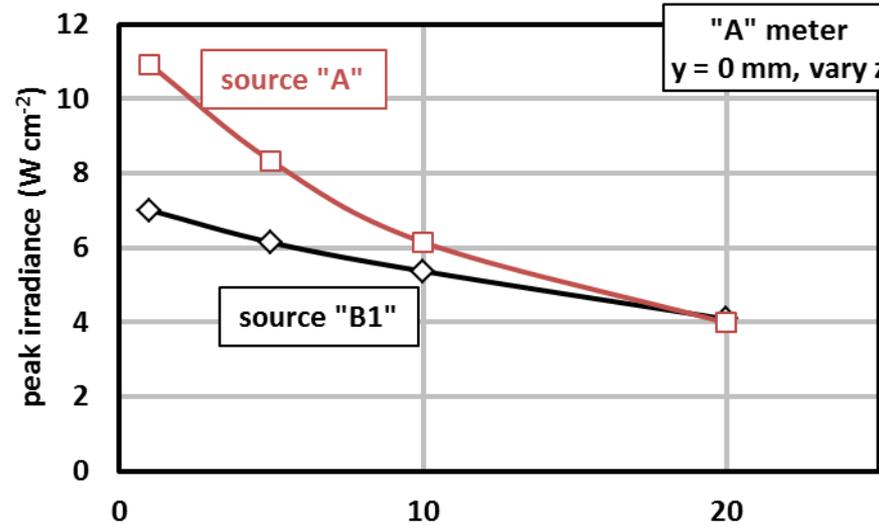


source "A"
(not focused)



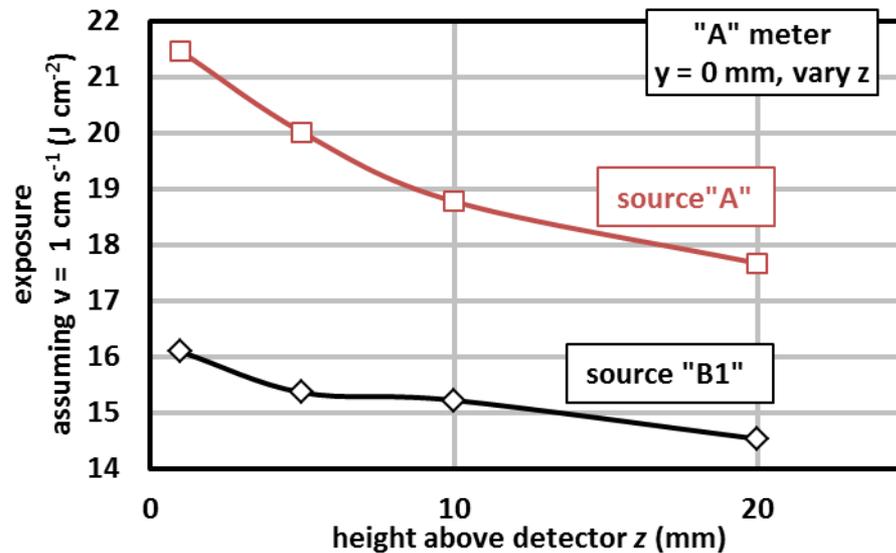
Peak irradiance and integrated exposure

peak irradiance

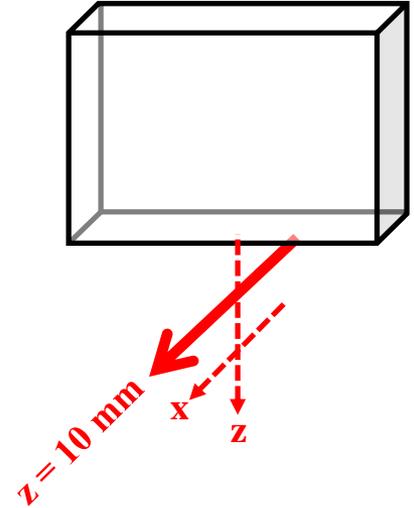
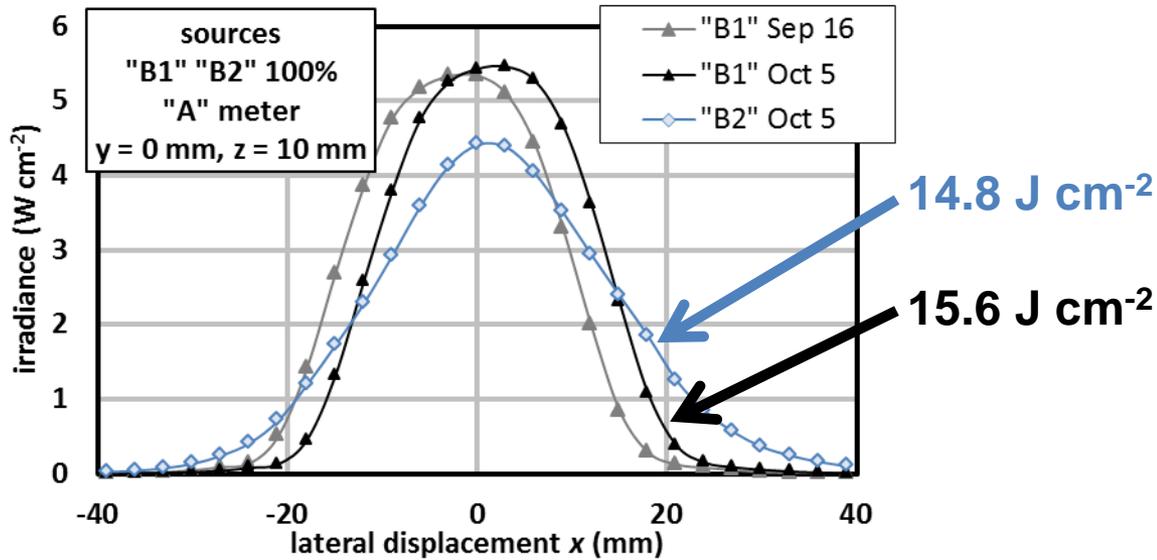


$$I(z) = \int_{x_1}^{x_2} i(x, z) dx$$

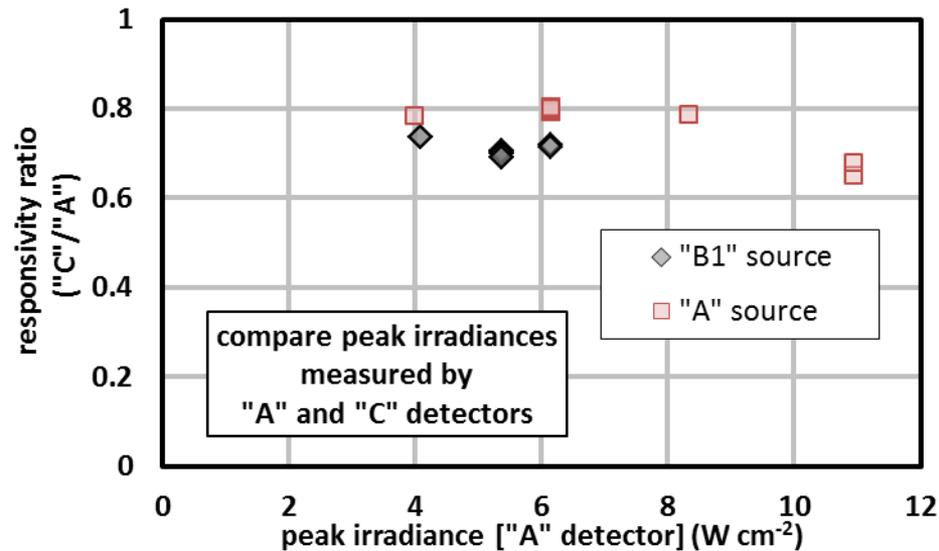
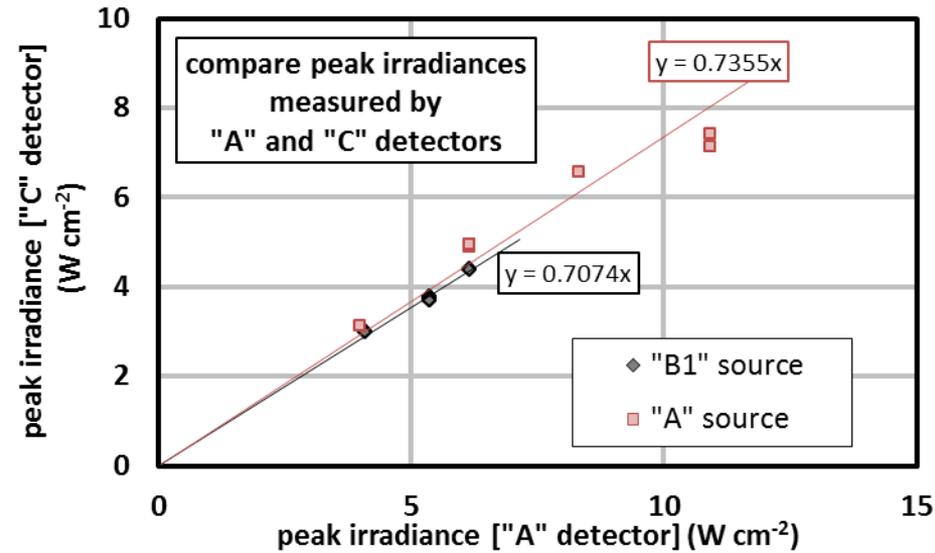
integrated exposure



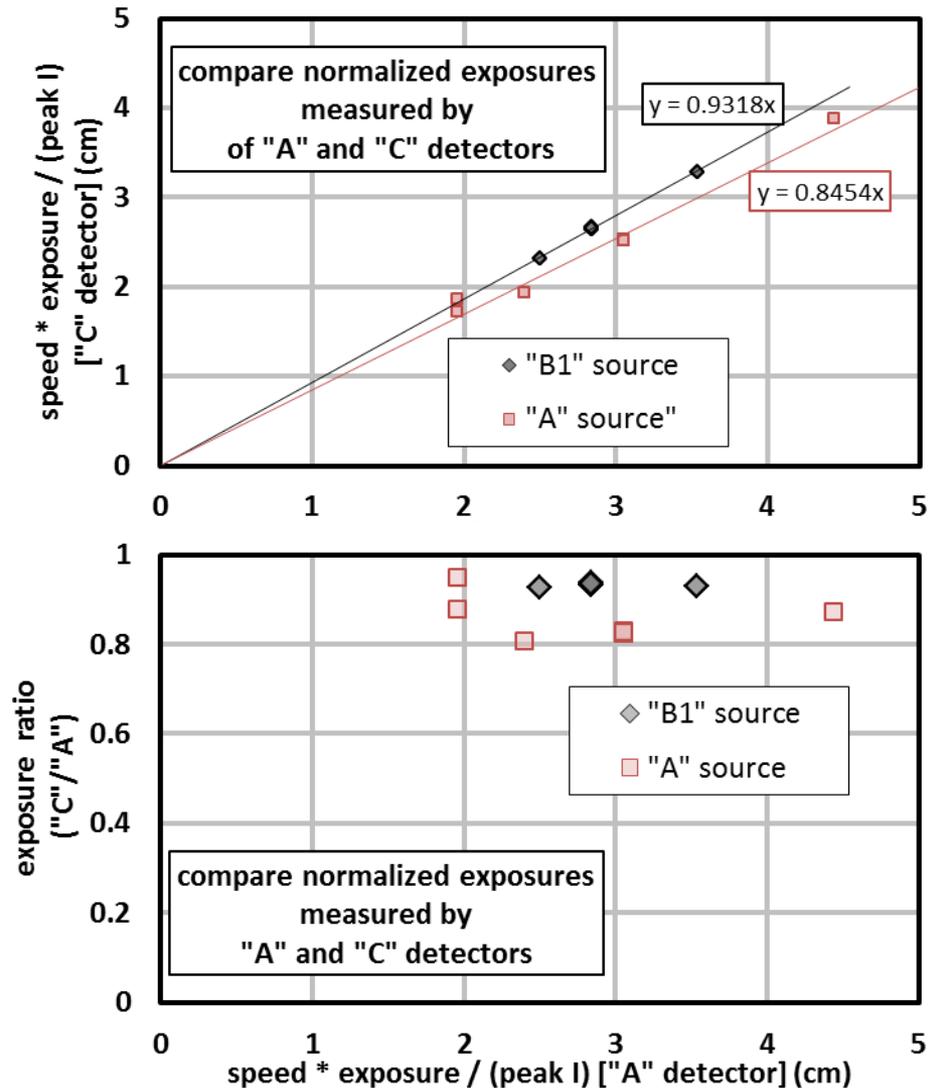
Affect of lens on exposure curve



Peak irradiance measured by two detectors



Integrated exposure measured by two detectors



Summary

Measurement issues

Polycarbonate safety glasses don't protect at 395 nm.

Heating...

- An exposed black cloth reached 200 °C. The IR camera was helpful.
- The integrating radiometer should not move too slowly.

The cylindrical lens...

- affected the dependence of irradiance on height.
- did not change the integrated exposure.

Source performance

Peak irradiance agreed (?) with spec at $z = 0$ mm.

Lateral irradiance constant within ± 10 %.

Detector performance

Detector "C" was 0.7 times as sensitive as "A".

After adjusting for sensitivity, the integrated exposures agreed.

Standards

State the uncertainties in the specifications.

Height at which the source irradiance is specified.

Procedure to characterize integrating radiometer.

Traceability.