Estimating source output

Example 1
Find for the output from 400 - 600 nm in the collimated beam of a 150 W Xe-lamp with F/1.5 condensing optics.

The curve for the 150 W Xe lamp shows a value of approx. 15 mWm-2nm-1 for the range of 400 - 600 nm. The F/1.5 condenser has a conversion factor of 0.05.

The spectral bandwidth is 200 nm. Multiplication of 15 with 0.05 gives a result of 0.75 mW/nm^{-1} for the average output in the collimated beam (under consideration of the changed units). The rear reflector in the lamp housing increases the output by approx. 50%.
So the final output is:

0.75 x 200 x 1.5 = 225 mW

Example 2
Find the output of a Hg line (365 nm) with 5 nm bandwidth in a collimated beam of a 1 kW Hg(Xe) lamp in a lamp housing with F/1 condensing optics.

The curve shows a value of approx. 3 x $10^3 mWm^{-2}nm^{-1}$ resp. a value of approx. 1 x 10^3 $mWm^{-2}nm^{-1}$ for 365 ± 2.5 nm. The calculation of the area (triangle) with a 5 nm bandwidth gives a value of 5.000 mWm^{-2}.

The conversion factor of the F/1 condenser is 0.12. Therefore the output will be 5.000 x 0.12 = 600 mW. The rear reflector adds 50%, so the total output is:

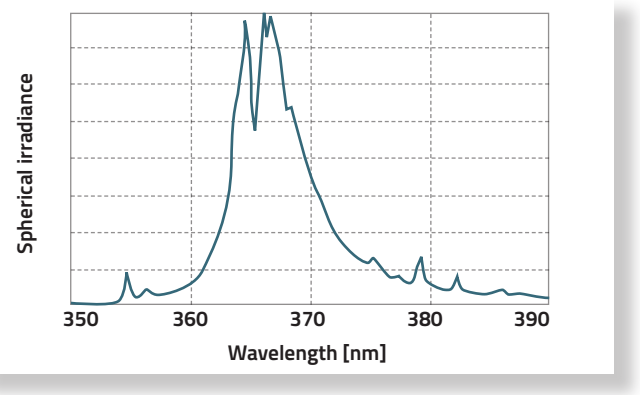
0.6 x 1.5 = 0.9 W

Approximation only
Please keep in mind that this is always just an approximation. The conversion factor depends on the lamp and does not consider the additional gain by the rear reflector in the lamp housing. Furthermore, all of the above refers to data of a condenser adjusted in a way that a collimated beam in the visible is produced. The total intensity may be increased by producing a diverging beam and by moving the condenser closer to the lamp and vice versa.

With a rear reflector you get up to 50% more output for arc lamps. Under 350 nm it reflects less (approx. 20% at 250 nm). For halogen lamps the reflector also provides more output. But for lamps with close-packed planar filaments the image of the filament produced by the reflector has to be placed next to the direct image. This can reduce the usefulness of the reflector. When the image of the reflector is directly placed on the filament, it will be overstrained. The power balance of the light source changes which leads to an intensity drift.

Hg lines
The Hg lines of high-pressure arc lamps are substantially broadened and show line shifting from the tabulated line values. The light emitted from the inner part of the plasma arc is absorbed in the cold outer part of the arc which leads to self-absorption of the Hg lines. The figure below shows the 365 Hg line.

This is important for selecting an interference filter peaking at Hg lines.



Self adsorption of 365 nm Hg line

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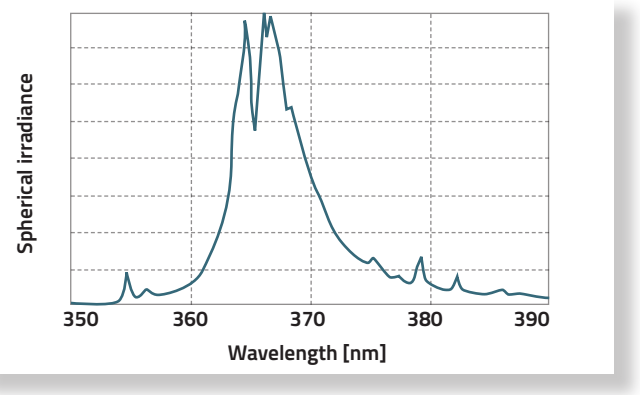

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