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APPLICATION NOTES

Fiber Coupling

AN 470004-00

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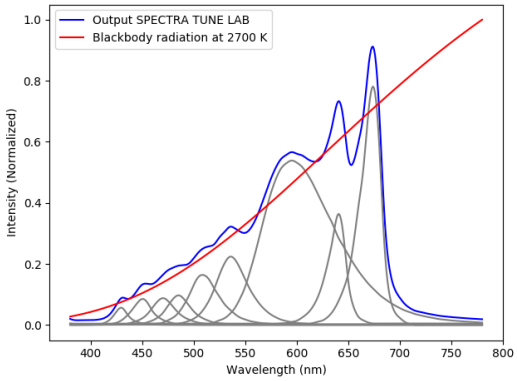
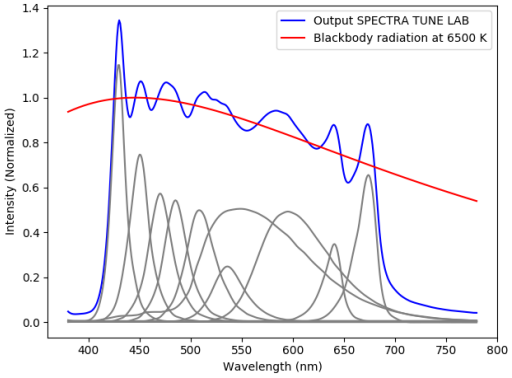
BUTT-COUPLING TO AN OPTICAL LIGHT GUIDE OR FIBER



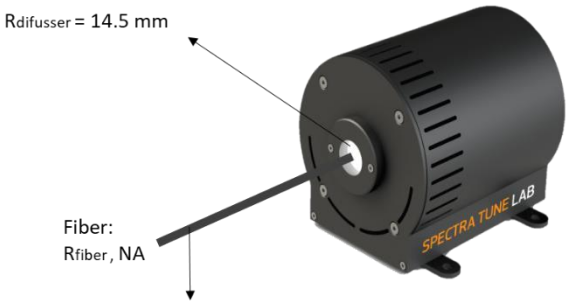


For some applications, it is interesting to couple the light being mixed at the diffuser into an optical guide such a Liquid Light Guide (LLG) or Optical Fiber (OF). For illumination or high throughput applications a LLG is preferred. On the other hand, when spatial precision is required to illuminate a sample, an OF butt-coupled to the diffuser may be used. In both options, the irradiance at the end of the fiber will be similar when equal Numerical Apertures (NA) are used.

When coupling light from a diffuse light source, there is no gain in using an intermediate optical lens system between the diffuser and the fiber because a physical limitation given by the Lagrange invariant of the system or its *étendue* limitation, so butt-coupling is always the easiest solution.

A LLG or fiber bundle is always a good solution if the application requires gathering as much light as possible.

Channel	Nº of LEDs	Color	Peak Emission (nm)	radiometric value (W)	Photometric Value(lm)	FWHM (nm)
CH 1	2	UV	430	0.78	10.5	16
CH 2	2	Royal Blue	450	1	32.9	22
CH 3	3	Dark Blue	470	0.65	55.5	27
CH 4	3	Blue	480	0.89	111.7	27
CH 5	5	Cyan	510	0.9	334.5	34
CH 6	5	Green	535	0.73	426.1	37
CH 7	10	Lime	550	2.75	1214.9	115
CH 8	12	PC Amber	595	2.61	933.9	81
CH 9	2	Red	640	0.5	74.7	21
CH 10	4	Deep Red	675	1.21	52.9	23



As an example, we provide here coupling efficiency values of two typical configurations (LLG and OF):

FIBER BUTT-COUPLING

$D_{difusser}$ (mm)	29
$R_{difusser}$ (mm):	14,5
$A_{difusser}$ (cm^2):	6,6052

R_{fiber}^2 / $R_{difusser}^2$ * NA^2	R_{LLG}^2 / $R_{difusser}^2$ * NA^2
1,0702E-04	7,40E-03

Channel #	Channel Power (W)	Irradiance at difusser (W/cm^2)	Example 1. Multimode Fiber. Dfiber = 600um, NA=0.5 $P_{coupled} = P_{difusser} * R_{fiber}^2 / R_{difusser}^2 * NA^2$ (in Watts)	Example 2: Liquid Light Guide. Dllg = 5mm NA=0.5 $P_{coupled} = P_{difusser} * R_{LLG}^2 / R_{difusser}^2 * NA^2$ (in Watts)
CH1	0.78	1.18E-01	8.35E-05	5.77E-03
CH2	1.00	1,51E-01	1.07E-04	7.40E-03
CH3	0.65	9.84E-02	6.96E-05	4.81E-03
CH4	0.89	1.34E-01	9.52E-05	6.59E-03
CH5	0.9	1.36E-01	9.63E-05	6.66E-03
CH6	0.73	1.10E-01	7.81E-05	5.4E-03
CH7	2.75	4.16E-01	2.94E-04	2.04E-02
CH8	2.61	3.95E-01	2.79E-04	1.93E-02
CH9	0.5	7.56E-02	5.35E-05	3.70E-03
CH10	1.21	1.83E-01	1.29E-04	8.95E-03
TOTAL	**12.0E00**	**1.822E+00**	**1.29E-03**	**8.89E-02**

TOTAL FIBER IRRADIANCE (W/cm^2)	**4.55E-01**	**4.53E-01**

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