Grace,

As you'll note in my reply to Andy, the integrating sphere is still open to research, however I'm coming down in favor of a bit of different solution based on your experience with light sources. Thank you for those insights.

You mentioned you flash the LEDs. Do you use intermittent movement on the film and a relatively long flash or ??? I'd appreciate length of flash in particular as I try to understand how much light to generate.

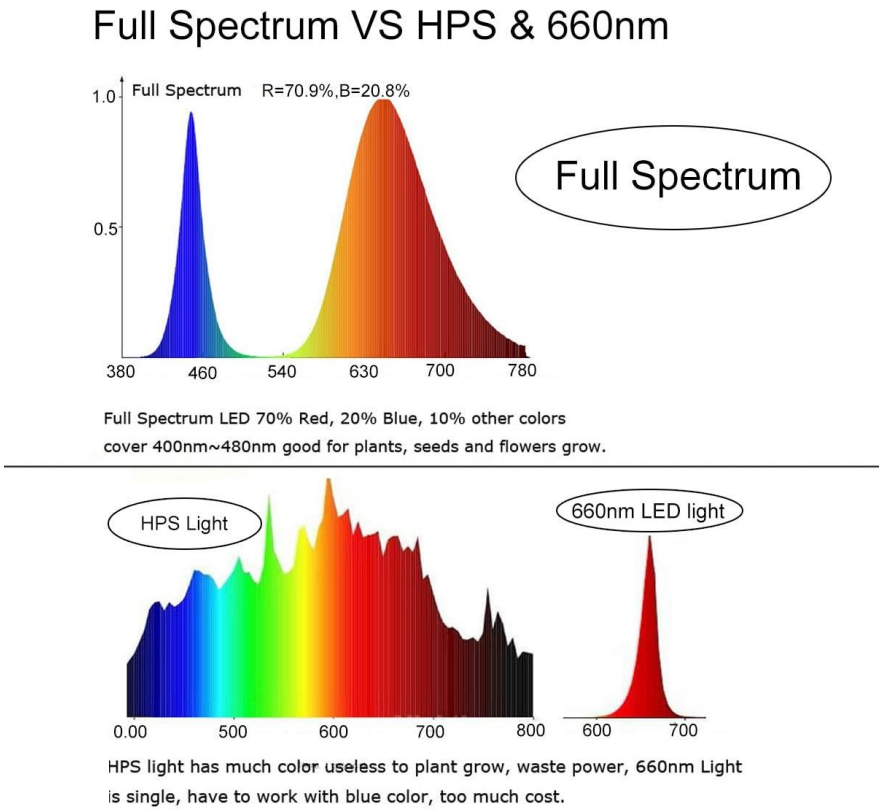
Searching for hi power LEDs with good CRI was instructive.

1] A YouTube video: https://www.youtube.com/watch?v=L3LWXznJx_0
Can this LED mimic daylight? (Yuji LED review - super high CRI)
A bit of checking says a 100 Yuji is in the $100 class.

2] Ebay seller CH_TOWN selling 100 W 'full spectrum" LEDs
https://www.ebay.com/itm/Full-Spectrum-380-840nm-1w-3w-5w-10w-20w-30w-50w-100w-High-Power-LED-Chip-Lights/122022086959
$19.99 each seemed like a better deal.

But then realized many hi power 100W LEDs for sale on Ebay and Amazon labeled 'wide spectrum' are 'grow' lamps and furthermore may even have holes in their spectrum. In particular the Amazon ($17.38 price looked pretty good) but then the URL has some good information:

https://www.amazon.com/Chanzon-Spectrum-380nm-840nm-Components-Hydroponic/dp/B01DBZI8RC/ref=pd_rhf_dp_p_img_1

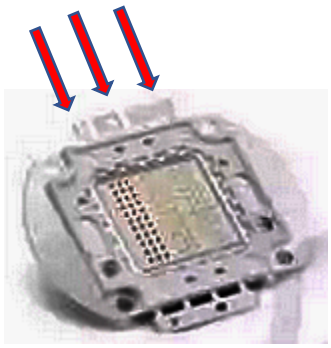


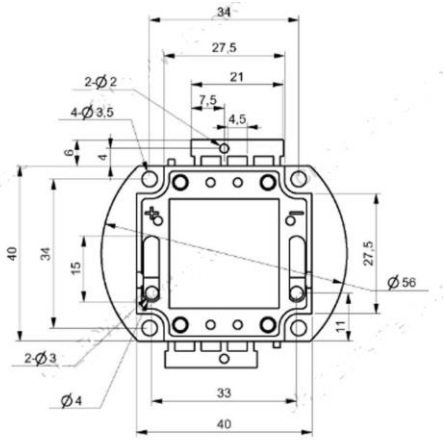
A huge hole in the green, so totally unacceptable for film scanner illumination. From this we need another approach. Dug around and found the Chanzon LEDs on Alibaba. https://chanzon.en.alibaba.com/product/1600132638693-822149600/1W_3W_5W_10W_20W_30W_50W_100W_150W_Warm_Natural_White_Red_Green_Blue_RGB_UV_IR_Infrared_High_Power_Flood_Light_Grow_COB_LED_Chip.html

And this is where it gets interesting. Go near the bottom and a big list of available 100W LEDs are listed. In particular are 4 that are particularly interesting.

		AA0488	100W	Red	620-625NM	6000-6500LM	20V-24V	3000mA
		AA0489	100W	Blue	460-470NM	3000-4000LM	30V-34V	3000mA
		AA0491	100W	Green	520-525NM	7000-8000LM	30V-34V	3000mA
		AA0510	100W	RGB	R:620-630NM G:520-525NM B:460-465NM	R:1300-1500LM G:2300-2500LM B:650-800LM	R:22V-26V G:33V-37V B:33V-37V	900mA / Color

And a blow up of the RGB shows that there are 3 tabs so the unit has separate sets of LEDs than can be individually turned on.





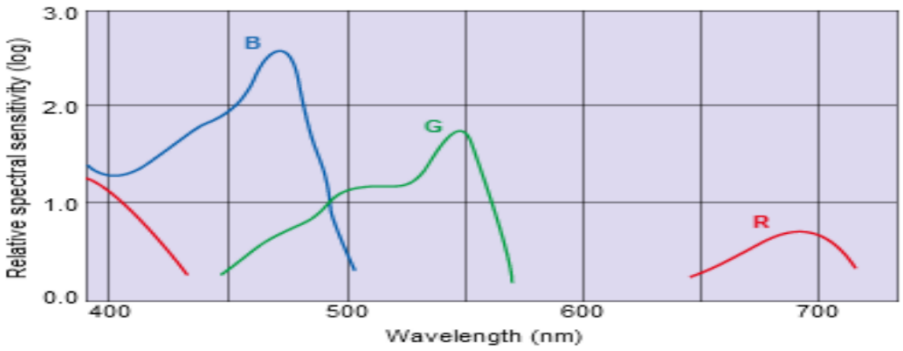
Some scaling measurements says that the LED window is 24.7 mm.

PROPOSAL:
Now the question. By definition movie film is essentially only 3 dye colors.

For instance A Fuji movie stock curve:

https://www.fujifilm.com/products/motion_picture/lineup/eterna_cp_3521xd/index.html

Spectral sensitivity curves



Processing : Specified standardized conditions
Densitometry : Arbitrary three color densities
Density : 1.0 above minimum density
Sensitivity : Reciprocal of exposure (ergs/cm²) required to produce specified density

So CRI is irrelevant for a film scanner. The important point is to be sensitive to the individual dye colors. Hence adjust the laser colors to the center of the dye absorption peak which in the case above is about 470, 550 and 690 nm. The magic happens later when these peaks are ‘reproduced’ with some color source spectrum present in the monitor. Please let me know if this is a wrong way to view it.

If the assumption is correct, then now the problem is reduced to using RGB and whether to choose one unit 100W or combining 3 units of R,G,and B for a 300 W unit. Combining can be done with an integrating sphere (light efficiency/absorption?) or with a dichroic X-cube prism. Some interesting questions about that, too. It would have to be fairly big because of the LED size, but having just tested some cheap 0.8” ones (~$7 each

from Amazon) I'm pretty sure they're rejects for LED projectors. The colors of the beam don't look correctly centered to my eye and significant leakage when tested with laser pens. Fun to play with for decoration but probably unsuited for this application. Be that as it may, I'm sure good ones are available – just don't know how much.

So another technique that comes to mind – the Kohler Illumination concept. https://www.suss-microoptics.com/suss-microoptics/technical-publications/SPIE_7102_19-%20Optical%20Design%20Conf.-%20Laser%20Beam%20Homogenizing-%20Glasgow%202008.pdf

This will require more optics but should be quite possible and if I understand correctly it provides a method to reduce the source size to meet the film image size so the effective illumination is going up and not wasted by the extreme wide angle of the source 100W LED. More to think about on this subject.

I certainly agree with you about runout. I just haven't gotten around to thinking a lot about it yet. However I'm sure runout will be way below concern in regard to focus, but jitter is a different question. However if the sprocket position detection is as good as I calculated and be situated so it's sensitive to the runout, then I think it will take care of easily obtained machining runout figures.

Comments welcome.
Charles R. Patton