

## The improvement of contrast on LCOS system

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### Abstract

The discussion of this study is that we proposed a new construction to improve the potency of LCOS projection monitor. We suggest a new construction that uses special optics coating to reduce the green channel and obtains a purer white field. Compared with the voltage method to adjust on the monitor, we can get higher contrast gradient.

### Keywords:

Contrast, En-contrast Filter

### 1. Introduction

Almost all the common micro monitor projection systems use the high-pressured mercury lamp to project the photo source. The characteristics of Green channel of this mercury lamp will be stronger than Blue and Red channel like Fig1 because that green light spectrum is higher than the red and the blue light [1], and this situation results in green-shifted phenomenon while mixing white light. In general, in order to improve this condition and make white-valve more pure, we will adjust the voltage on the micro monitor [2] to reduce the green light and match the energy of R, G, and B and obtain more vivid color with standard white-valve as well as higher contrast gradient. In spite of using the electric circuit, we can use optical method to achieve more saturated white.

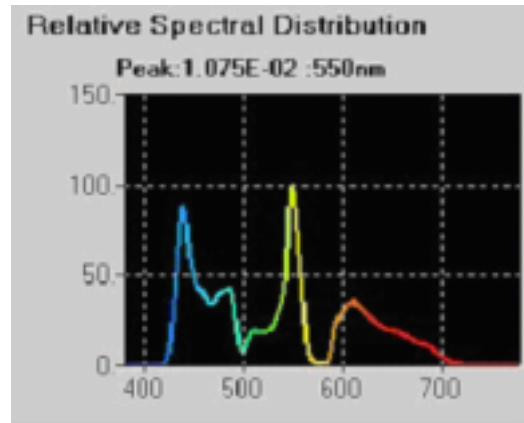


Fig.1 The spectrum of the lamp

In order to improve this situation, this research proposes a new construction to improve the potency of the LCOS projection monitor. The main idea uses optical method to achieve. By using an En-contrast filter to reduce the green light, a whiter valve is able to be obtained. It has been actively applied to the LCOS projection monitor optical system. Fig.2 will be our new light engine [3][4] and the originally Mirror is substituted by our en-contrast filter.

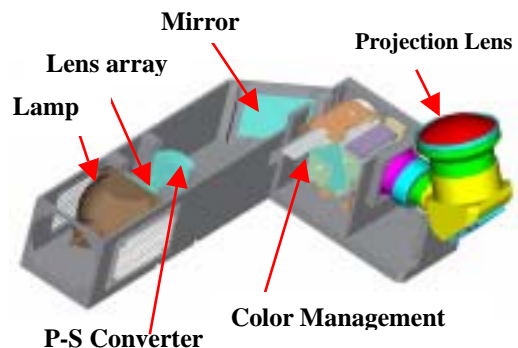


Fig.2 Structure of new light engine

This usage of the research above utilizes light filter dispersion of light principle and unifies the coating method that reduces light transmission 20% by using an en-contrast filter and achieved the same goal by using the voltage method. The principle of En-contrast Filter fabrication like Fig. 3,4,5,6 shows, combined with low pass filter with long pass filter and then using coating method to invert the filter from transmission to reflection, we can finally get an en-contrast filter. Compares to the general voltage liquid crystal characteristic that is unable to reduce its dark field brightness, this kind of situation can make the gray scale adjustment more flexible cause the usable range of voltage is larger than convention method, and hence results in a wider CIE distribution. Also contrast can be promoted because the reduction of dark field intensity. This research develops a penetration type light filter by using optical coating technology to reduce the green light transmission rate.

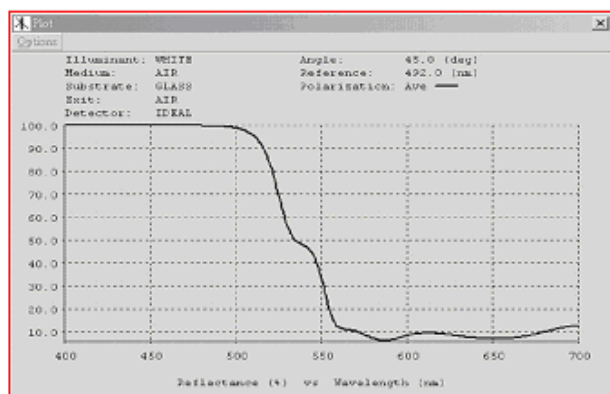


Fig.3 Low pass filter

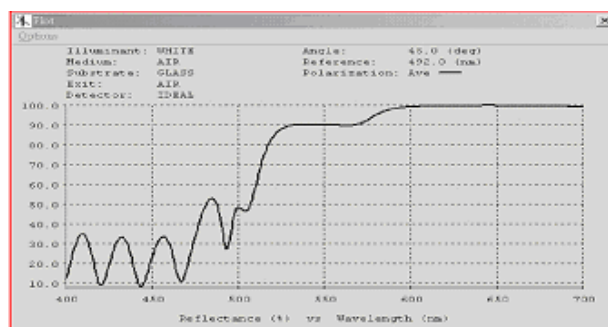


Fig.4 Long pass filter

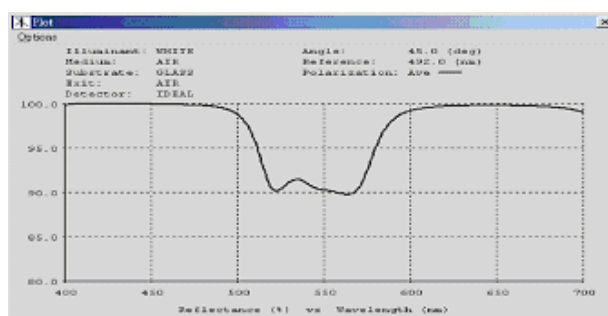


Fig.5 Combine Low and Long pass filter

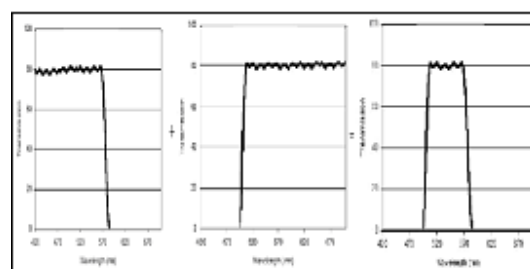


Fig.6 En-contrast Filter system regulation principle

## 2. Optical Measurement Result



Fig.7 Laboratory intention

Our laboratory intention is like Fig.7. The result of the reflector optics efficiency is shown in Table 1,2,3. Compared with the reflector our en-contrast optics efficiency is shown in Table 4,5,6.

**2.1 Reflector under GAMMA ON optics efficiency**

Table1.White field

Unit : Nits					
0.2826	0.3087	0.2868	0.2956	0.2847	0.3025
315.4		370.2		317.5	
0.2858	0.3100	0.2901	0.2991	0.2880	0.3071
356.9		411.1		340.0	
0.2819	0.3060	0.2871	0.2962	0.2880	0.3065
339.2		384.0		347.9	

Color temperature 8600, duv0.0001

Table 2. R.G.B field

Unit : Nits					
Red		Green		Blue	
0.6436	0.3458	0.3007	0.6436	0.3458	0.3007
101.9		267.5		44.62	

Table 3. Darkness field

Unit : Nits					
0.2794	0.2563	0.2595	0.2362	0.2406	0.2175
0.56		0.70		0.52	
0.2722	0.2534	0.2588	0.2358	0.2546	0.2350
0.58		0.75		0.60	
0.2543	0.2325	0.2574	0.2340	0.2549	0.2344
0.55		0.73		0.58	

**2.2 Encontrast Filter under GAMMA ON optics efficiency**

Table 4. White field

Unit : Nits					
0.2838	0.3084	0.2857	0.2963	0.2827	0.3036
324.8		362.1		317.5	
0.2846	0.3083	0.2898	0.2999	0.2867	0.3099
344.8		412.3		336.5	
0.2790	0.3023	0.2867	0.2977	0.2873	0.3082
311.3		376.2		345.0	

Color temperature 8590, duv0.0007

Table 5. R.G.B field

Unit : Nits					
Red		Green		Blue	
0.6444	0.3451	0.2936	0.6679	0.1355	0.0643
101.4		264.2		44.12	

Table 6. Darkness field

Unit : Nits					
0.2838	0.3084	0.2857	0.2963	0.2827	0.3036
324.8		362.1		317.5	
0.2846	0.3083	0.2898	0.2999	0.2867	0.3099
344.8		412.3		336.5	
0.2790	0.3023	0.2867	0.2977	0.2873	0.3082
311.3		376.2		345.0	

Table7.The result of this En-contrast Filter system regulation unusual simplicity

	Reflector	En-contrast Filter
Brightness	353.57	347.83 (Lower2%)
Contrast	572.1	680.68 (Enhence19%)

**3. Conclusions**

In order to improve the phenomenon that green light spectrum is higher than the red and the blue light, this research is proposed one new method to reduce the intensity of green light by developing a piece of En-contrast Filter that uses the coating principle. The reduction of green light intensity is achieved by optical method. We practically applied the experimental result to a LCOS rear projection monitor, demonstrated like Table7, that the dark field contrast is promoted from 572.1 to 680.68, and also avoids the voltage waste by using traditional voltage method. Our method makes the whole color even more lifelike and more saturate. The fabrication of En-contrast Filter is simple and the cost is certainly cheap, therefore it can be used in our future products that have the quite big commercial value.

**4. References**

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