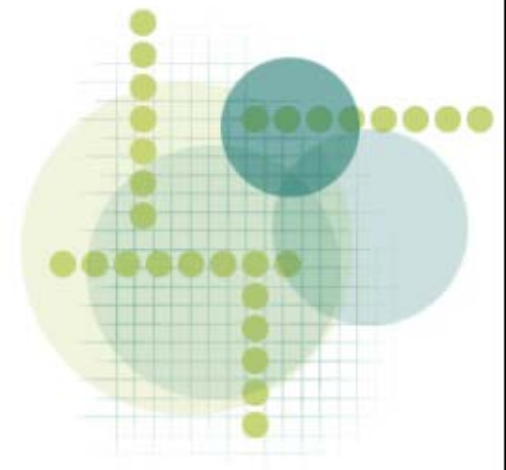


場曲

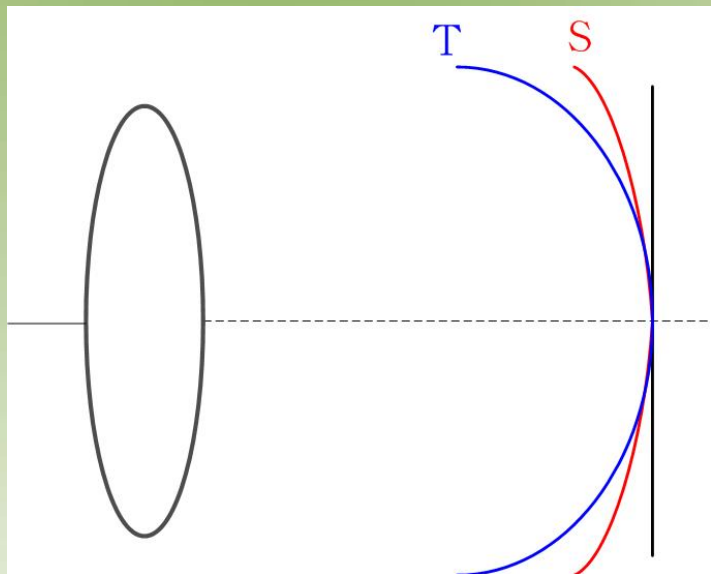
檢測之研究

指導老師：林宸生

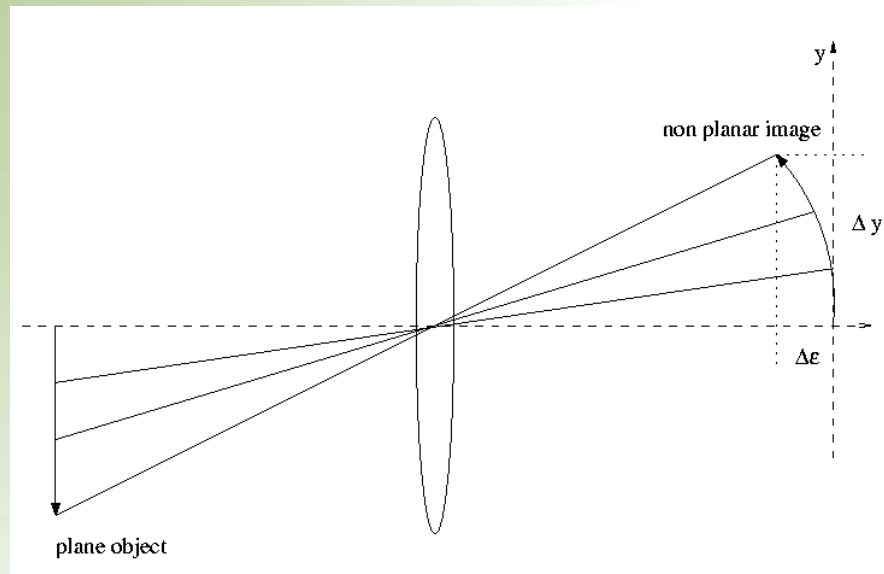
學生：吳俊旻、何振維、韋子祈



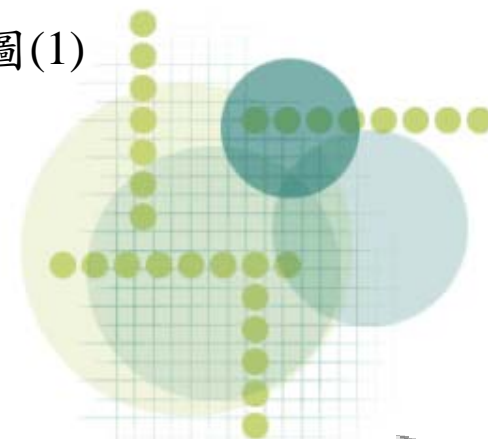
像場彎曲



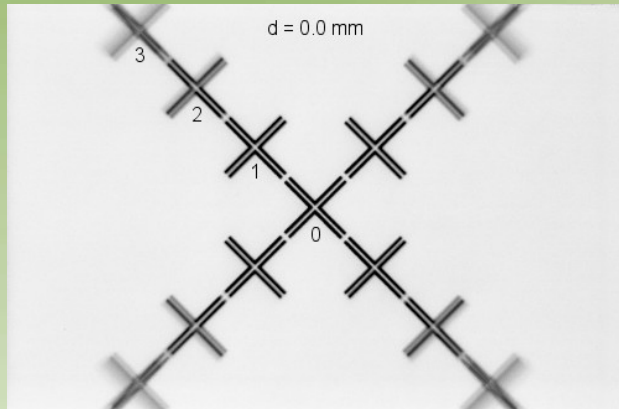
場曲示意圖



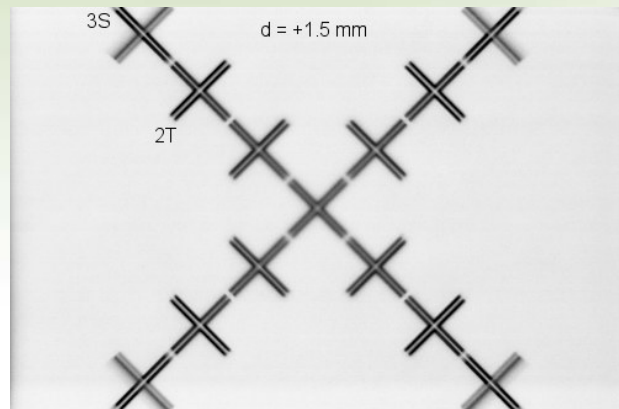
場曲示意圖(1)



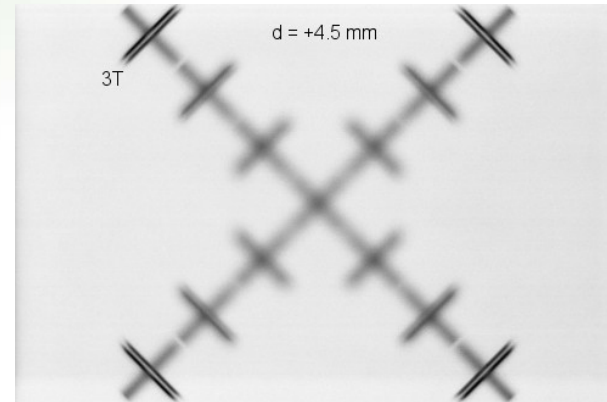
像場彎曲(1)



0.0mm[21]

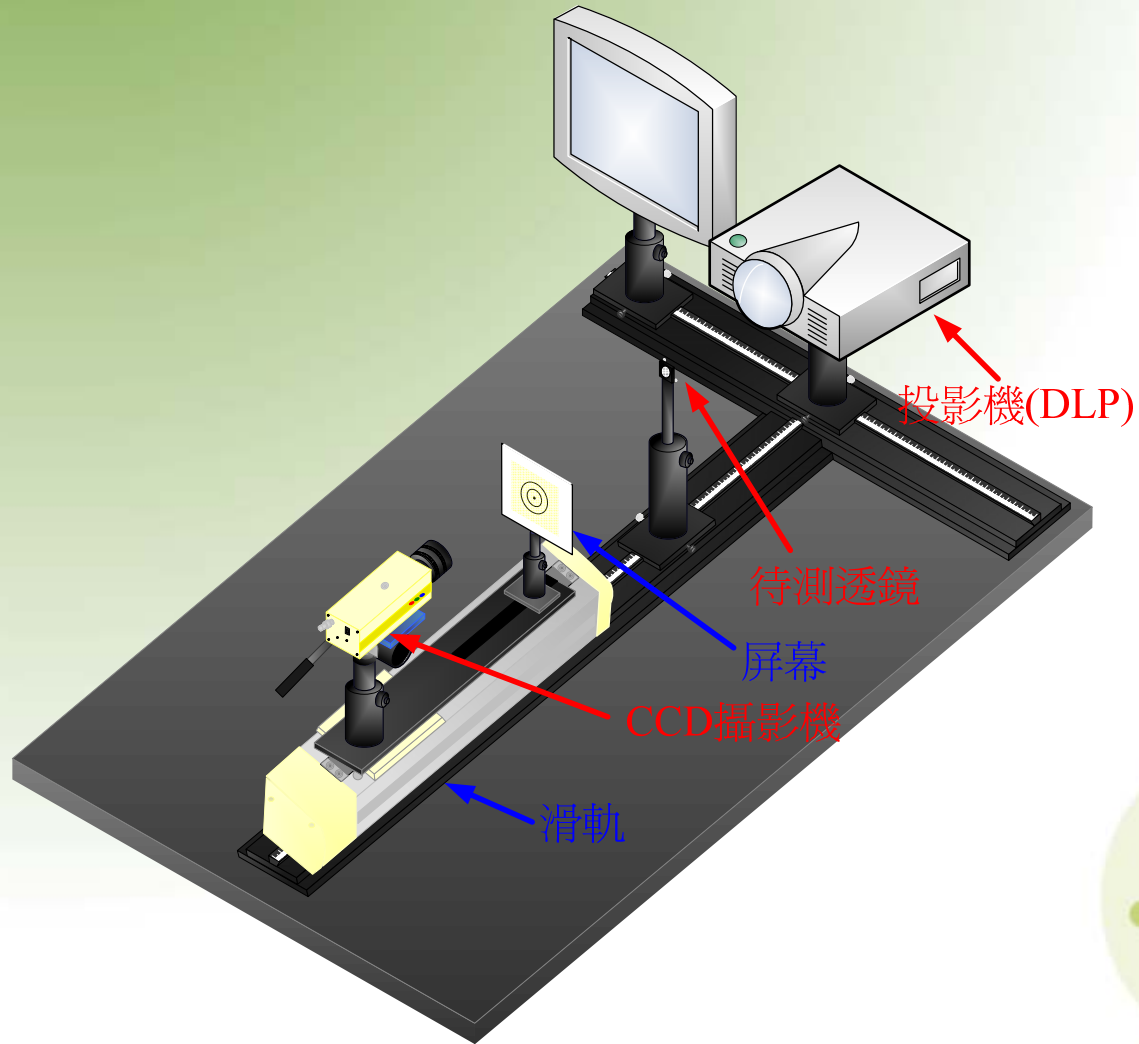


+1.5mm[21]



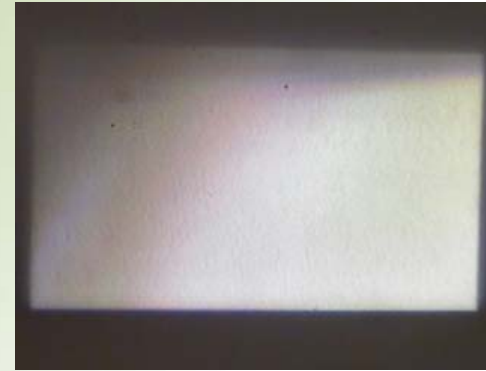
+4.5mm[21]

場曲量測架構



對比分析

$$V_B = \frac{1}{mn} \sum_{x=1}^m \sum_{y=1}^n I(x, y)$$



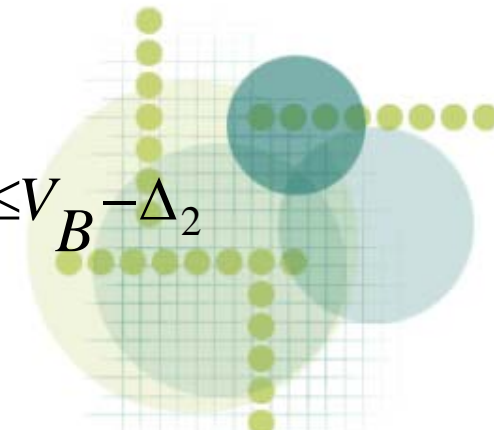
光場不均

$$I_b = \frac{1}{ij} \sum_{x=1}^i \sum_{y=1}^j I(x, y)$$

if $I(x, y) > V_B + \Delta_1$,

$$I_d = \frac{1}{(m-i)(n-j)} \sum_{x=1}^{m-i} \sum_{y=1}^{n-j} I(x, y)$$

if $I(x, y) \leq V_B - \Delta_2$



對比分析(1)

(I)

If $(\forall K_g < I_b) \wedge (P(x, y) < I_b) \quad g=0\sim7$

Then $S_b = P(x, y) + S_b, l_b = l_b + 1$

l_b : 所有核心亮點之點素數目

S_b : 所有核心亮點之點素亮度總合

I_b : 理想亮點

$$I'_b = \frac{S_b}{l_b}$$

(II)

If $(\forall K_g < I_d) \wedge (P(x, y) < I_d) \quad d=0\sim7$

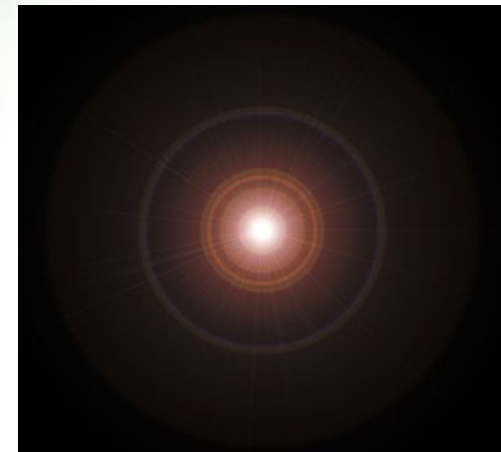
Then $S_d = P(x, y) + S_d, l_d = l_d + 1$

l_d : 所有核心暗點之點素數目

S_d : 所有核心暗點之點素亮度總合

I'_d : 理想暗點

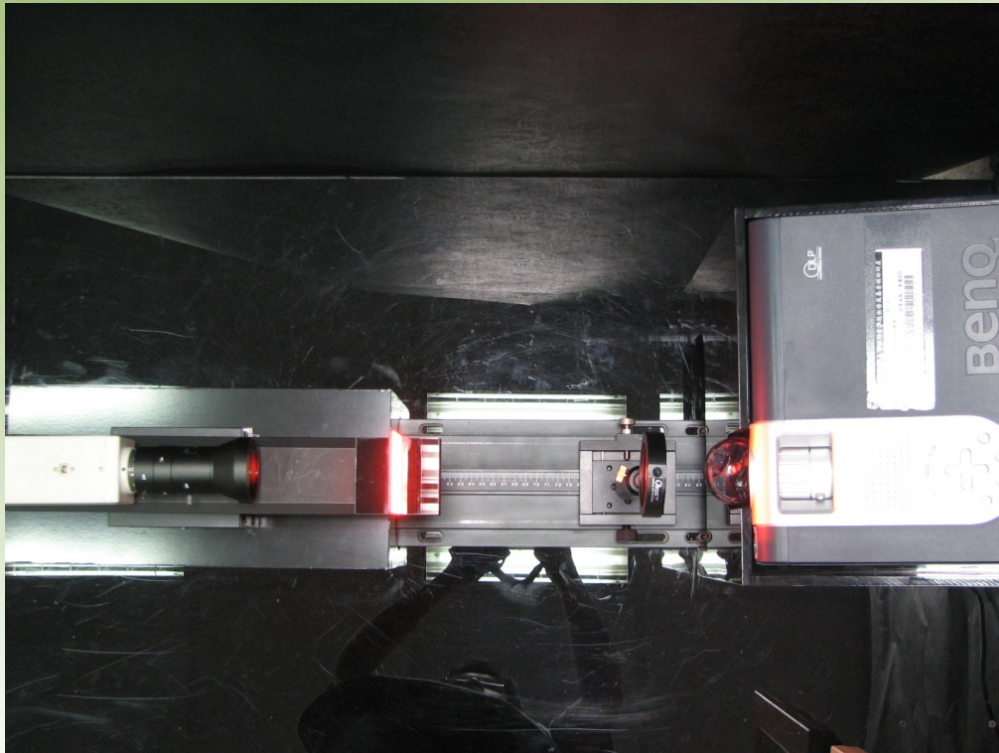
K3	k2	k1
K4	P(x,y)	K0
K5	K6	K7



光暈

$$I'_d = \frac{S_d}{l_d}$$

場曲實體結構與實驗流程

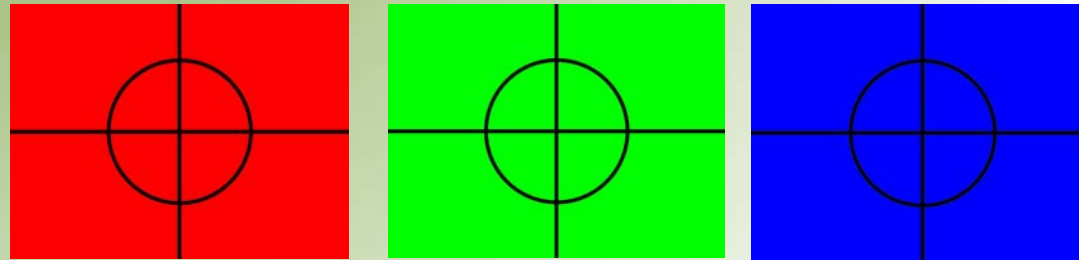


實體架構



流程

待測投影圖片



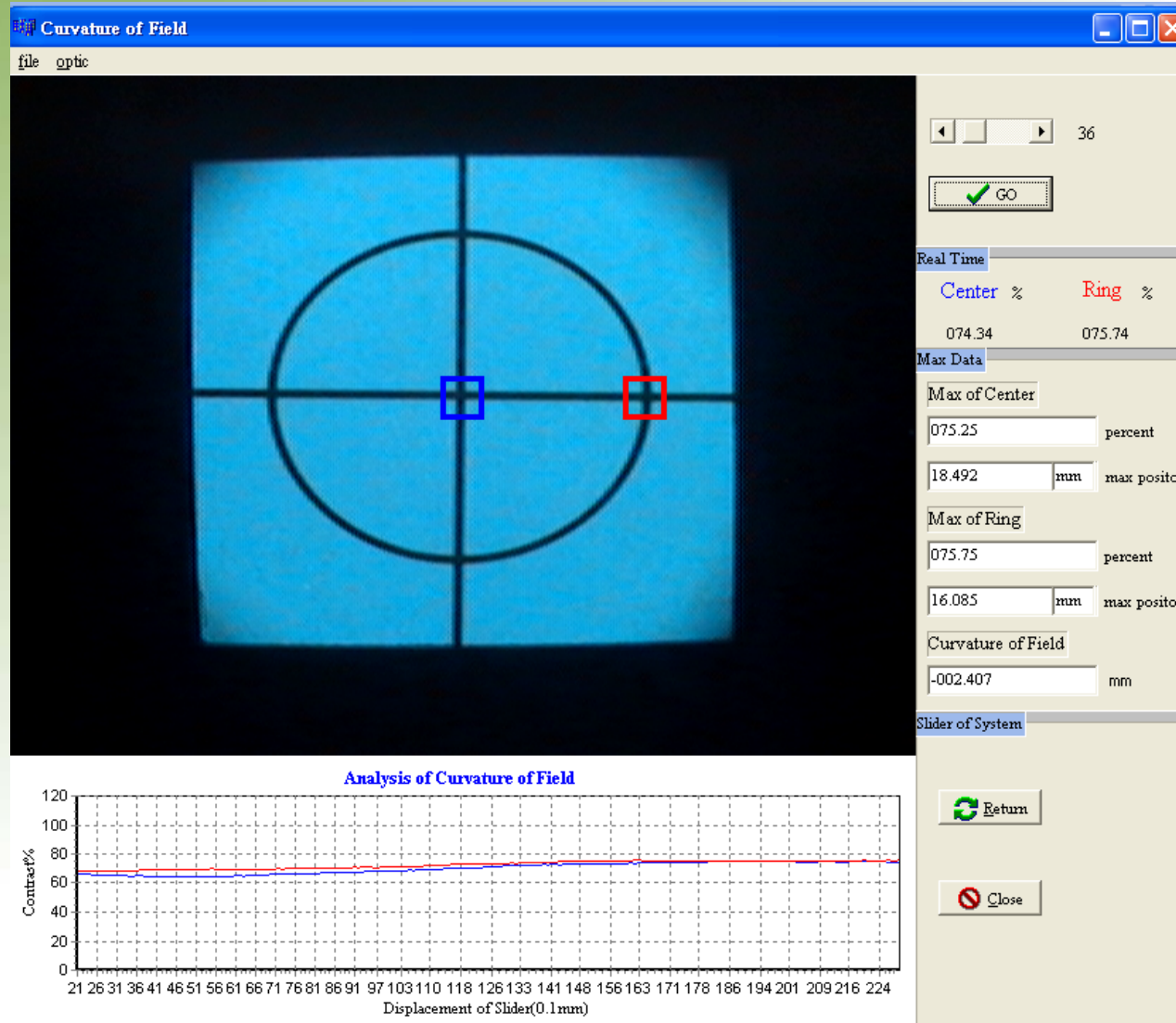
預設投影之圖片(R、G、B)

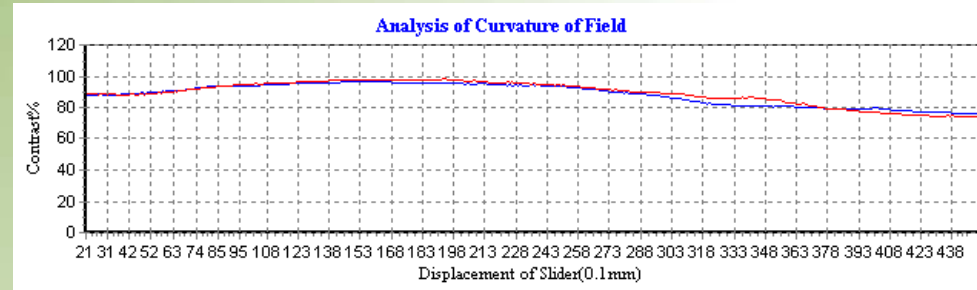
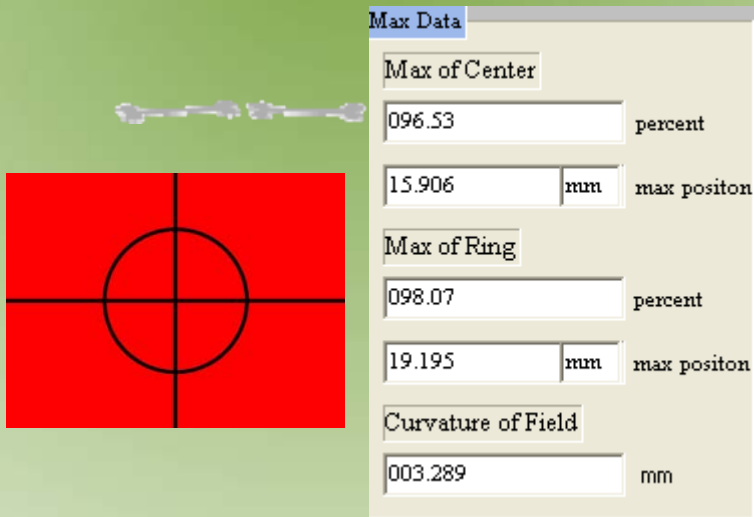
$$C_c = \frac{I_{c \max} - I_{c \min}}{I_{c \max} + I_{c \min}} \quad C_r = \frac{I_{r \max} - I_{r \min}}{I_{r \max} + I_{r \min}}$$

C_c 、 $I_{c \max}$ 、 $I_{c \min}$ 分別為影像中央之亮暗對比值和像素最多和次多之灰度值

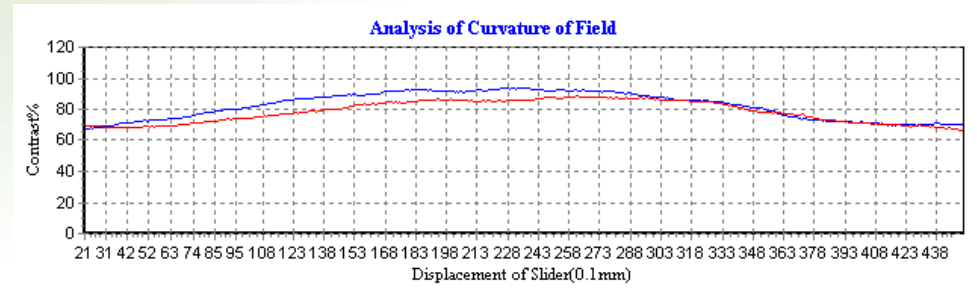
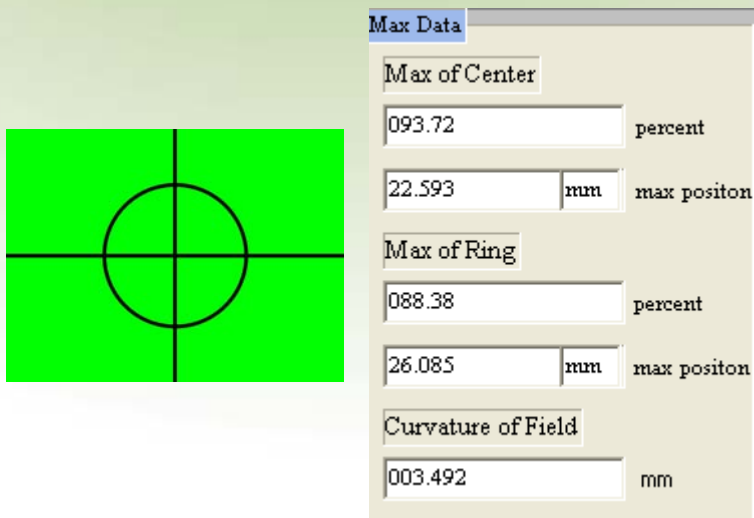
C_r 、 $I_{r \max}$ 、 $I_{r \min}$ 分別為影像右緣之亮暗對比值和像素最多和次多之灰度值

場曲實驗數據



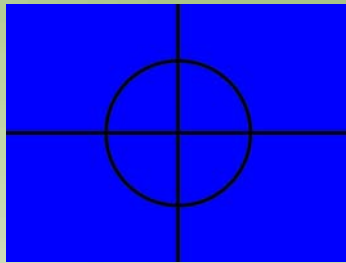


投射紅色波長之場曲分析數據與圖形

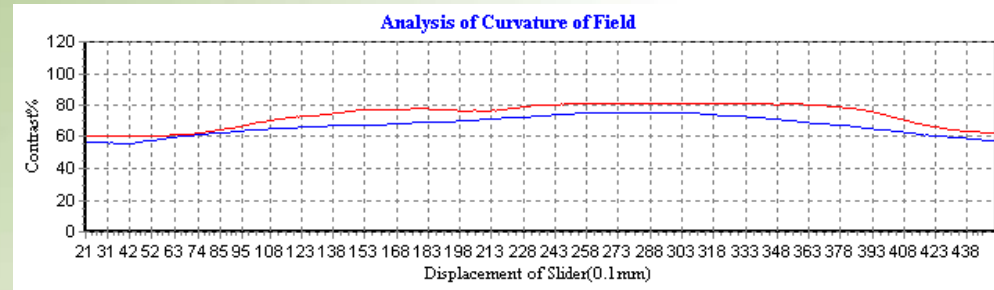


投射綠色波長之場曲分析數據與圖形

場曲實驗數據(1)



Max Data	
Max of Center	
075.54	percent
27.085	mm max positon
Max of Ring	
081.35	percent
30.195	mm max positon
Curvature of Field	
003.110	mm



投射藍色波長之場曲分析數據與圖形



ZEMAX 模擬驗證

場曲像差之自動分析影片

Data for wavelength : 0.486133 microns.

Y angle (deg)	Tan shift	Sag shift	Real Height	Ref. Height	Distortion
0.00000000	-5.06169521	-5.06169521	0.00000000	0.00000000	0.00000000%
4.06000000	-7.21892474	-5.99250292	17.45522244	17.45330068	0.01101086%
5.04000000	-8.37878996	-6.49501720	21.68954353	21.68585315	0.01701748%
5.88000000	-9.56681202	-7.01110389	25.32972175	25.32383845	0.02323226%
6.86000000	-11.17580065	-7.71227784	29.59156800	29.58217531	0.03175118%

Data for wavelength : 0.546100 microns.

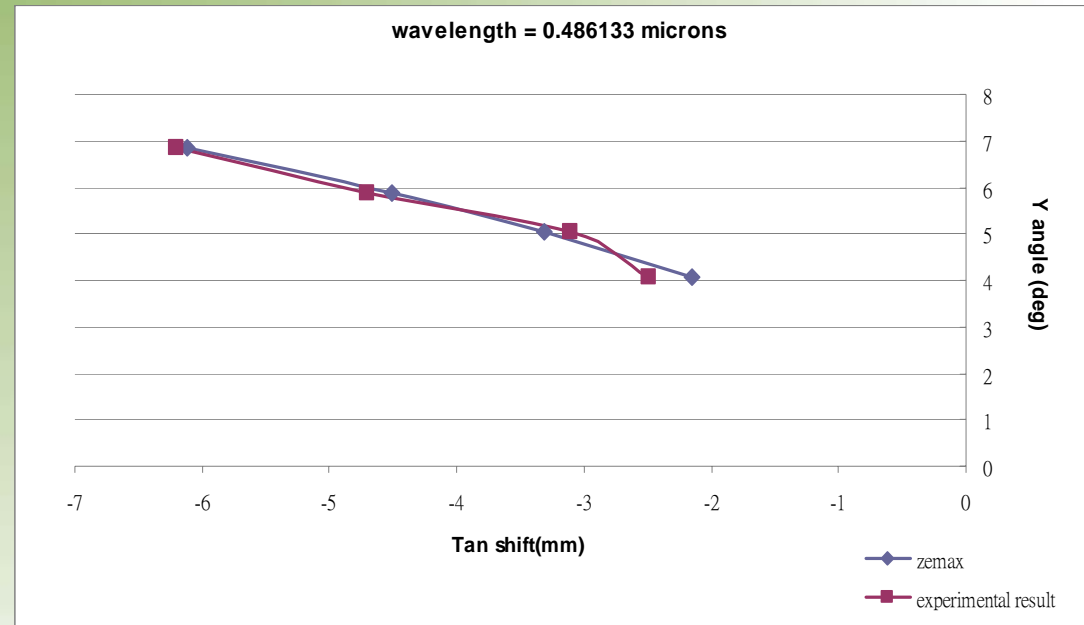
Y angle (deg)	Tan shift	Sag shift	Real Height	Ref. Height	Distortion
0.00000000	-0.00000000	-0.00000000	0.00000000	0.00000000	0.00000000%
4.06000000	-2.20585373	-0.95365441	17.45437489	17.45247295	0.01089780%
5.04000000	-3.39184564	-1.46849789	21.68847705	21.68482469	0.01684295%
5.88000000	-4.60662291	-1.99724341	25.32846021	25.32263745	0.02299426%
6.86000000	-6.25183887	-2.71561064	29.59006854	29.58077236	0.03142643%

Data for wavelength : 0.656273 microns.

Y angle (deg)	Tan shift	Sag shift	Real Height	Ref. Height	Distortion
0.00000000	5.70402936	5.70402936	0.00000000	0.00000000	0.00000000%
4.06000000	3.44338255	4.72458410	17.45344315	17.45156305	0.01077329%
5.04000000	2.22794847	4.19582174	21.68730462	21.68369412	0.01665073%
5.88000000	0.98302080	3.65278523	25.32707331	25.32131723	0.02273214%
6.86000000	-0.70301966	2.91500803	29.58842004	29.57923014	0.03106876%

場曲模擬數據

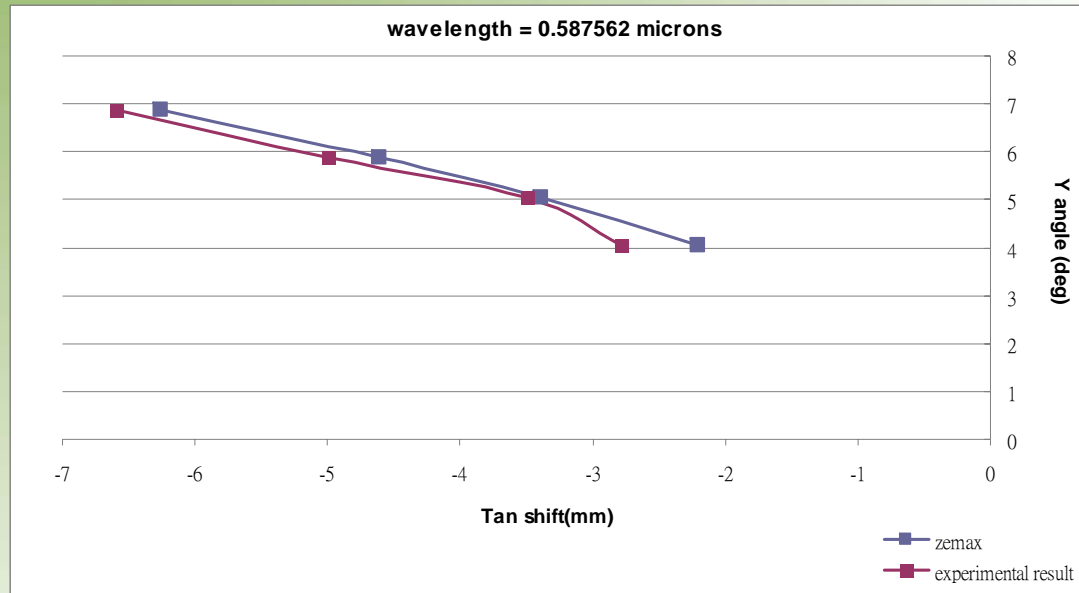
ZEMAX模擬驗證



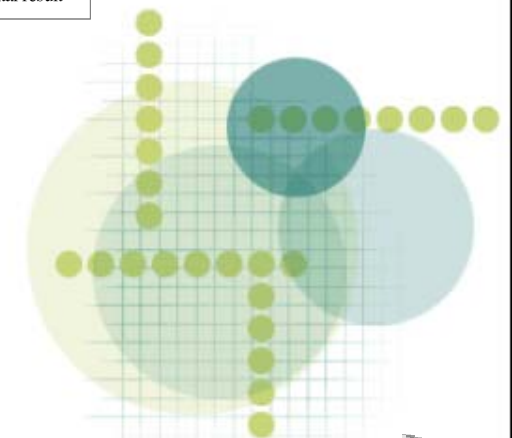
藍色波長之場曲理論值與實際量測比較



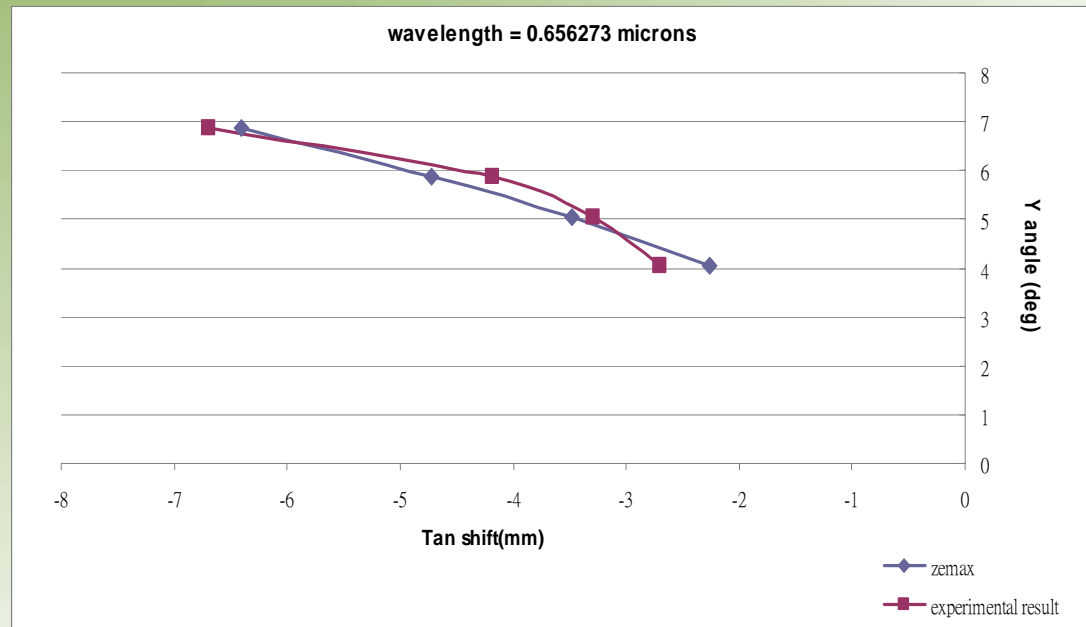
ZEMAX模擬驗證



綠色波長之場曲理論值與實際量測比較



ZEMAX模擬驗證



紅色波長之場曲理論值與實際量測比較

