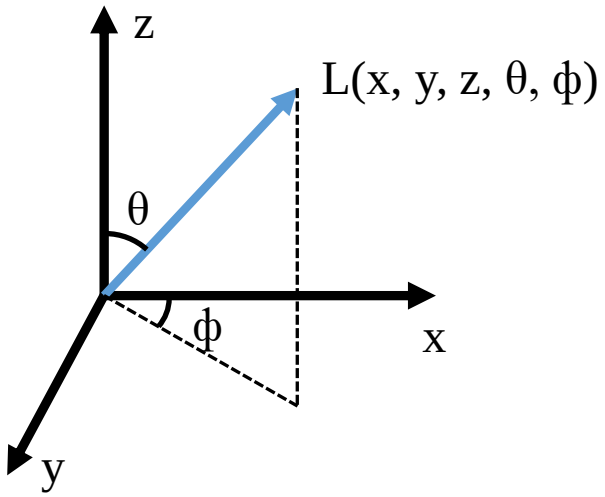
Light field

Information of ray (incoherent light)

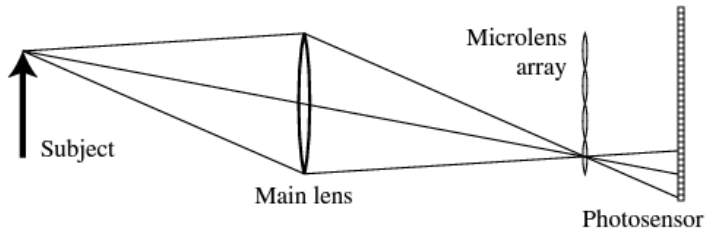
- Three coordination (x, y, z)
- Two angle (θ, ϕ)
- Time (t)
- Radiance ($W/m^2/sr$)
- Polarization, color



	Holography	Light field
Light source	coherent	Incoherent
View	continuous	Discrete (multi-view)
information	5D (Angle + position)	
Measurement	Interference measurement	MLA (micro lens array) or Multiple camera array
Noise	*technical noise + Speckle noise	*technical noise
*(photon and electronic noise from the recording sensor)		

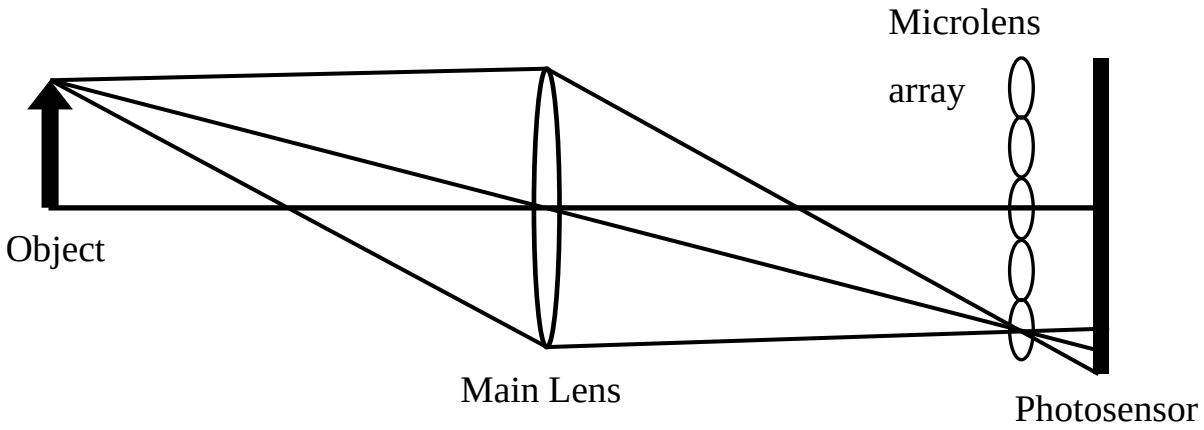
1)

2)



1) ACM Trans. Graph. 24, 3 (July 2005), 765–776
2) Stanford University Computer Science Tech Report CSTR 2005-02

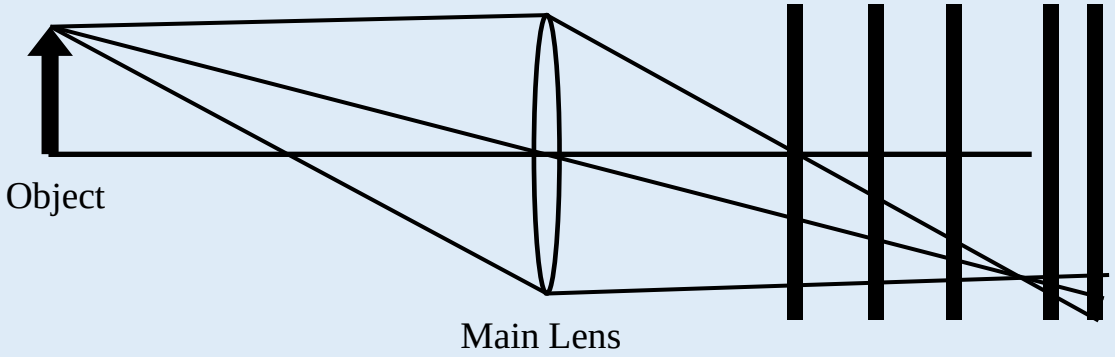
Multi-focus measurement



Sensor resolution = M x M = M^2

Micro lens array resolution
= Spatial resolution = N x N = N^2

Angular resolution = Sensor resolution / Spatial resolution = M^2 / N^2



Transparent photosensor

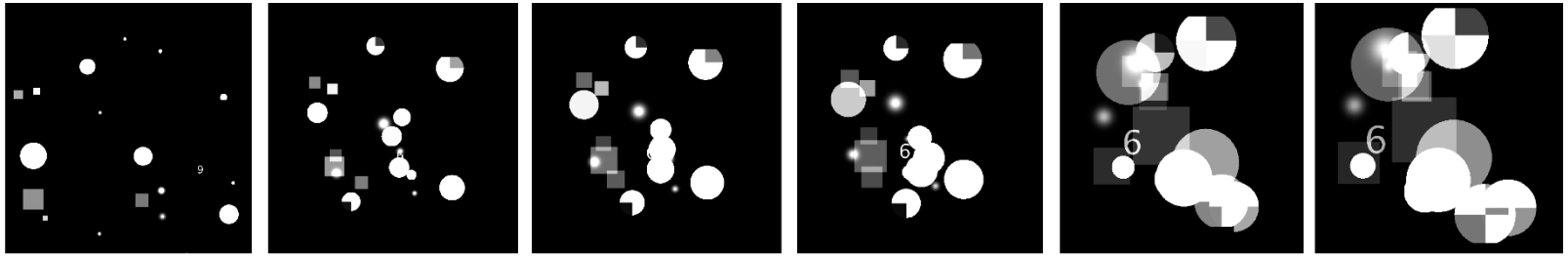
or multi-focus measurement

Sensor resolution = Spatial resolution
=M x M = M^2

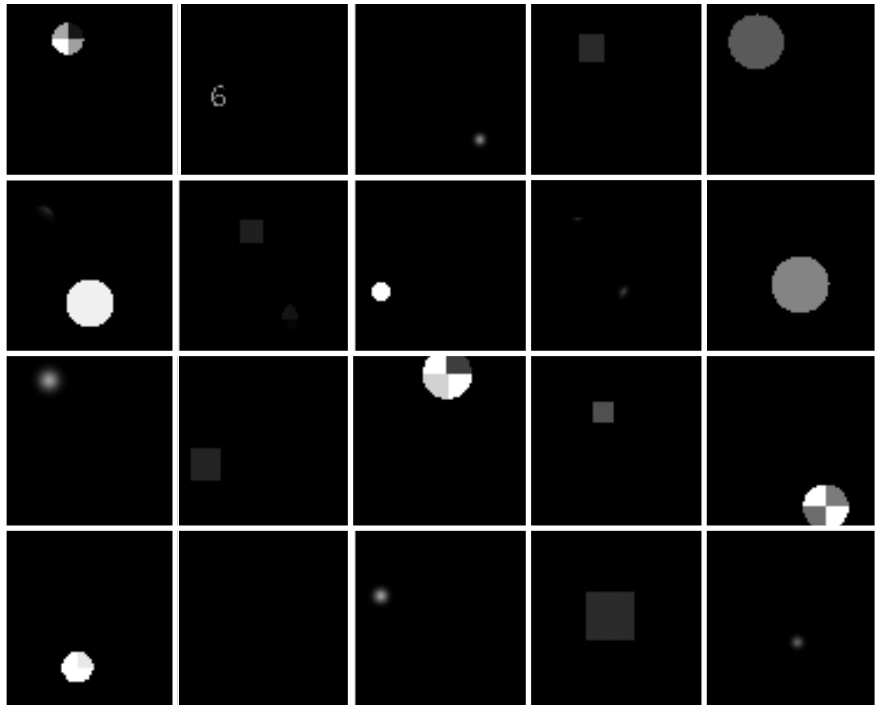
Angular resolution = 1 ~ M^2

Extraction algorithm of light field information from multi-plane images

Transparent sensors or multi-plane images



Deconvolution (multi-PSF, blind)

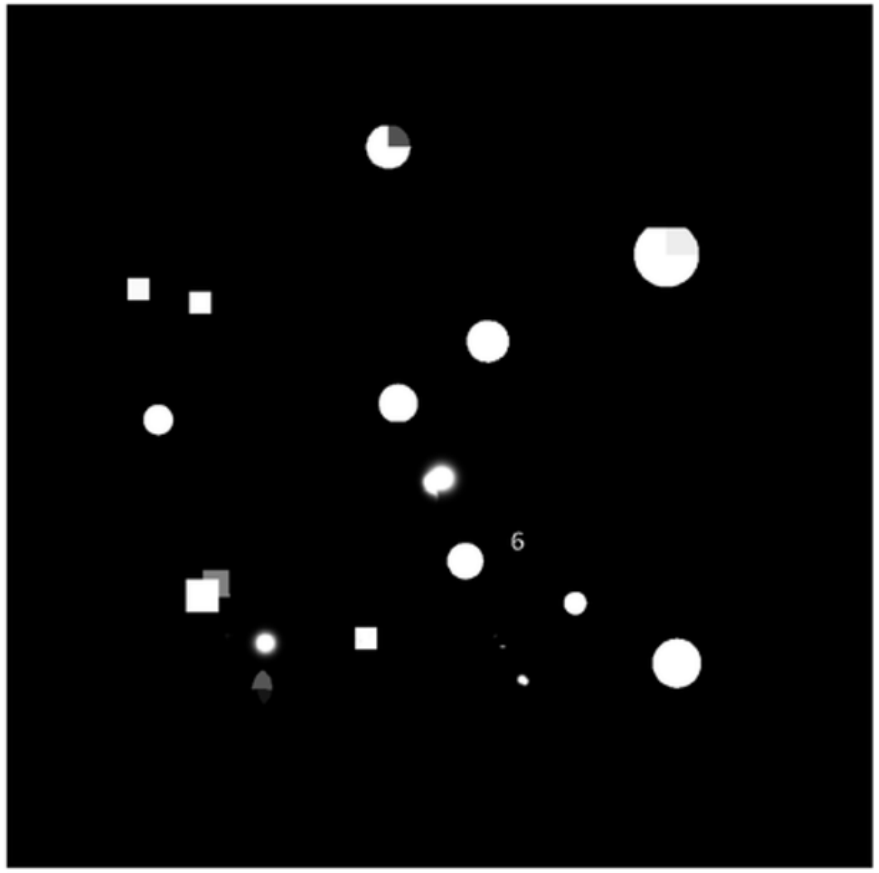


Coordination Transformation

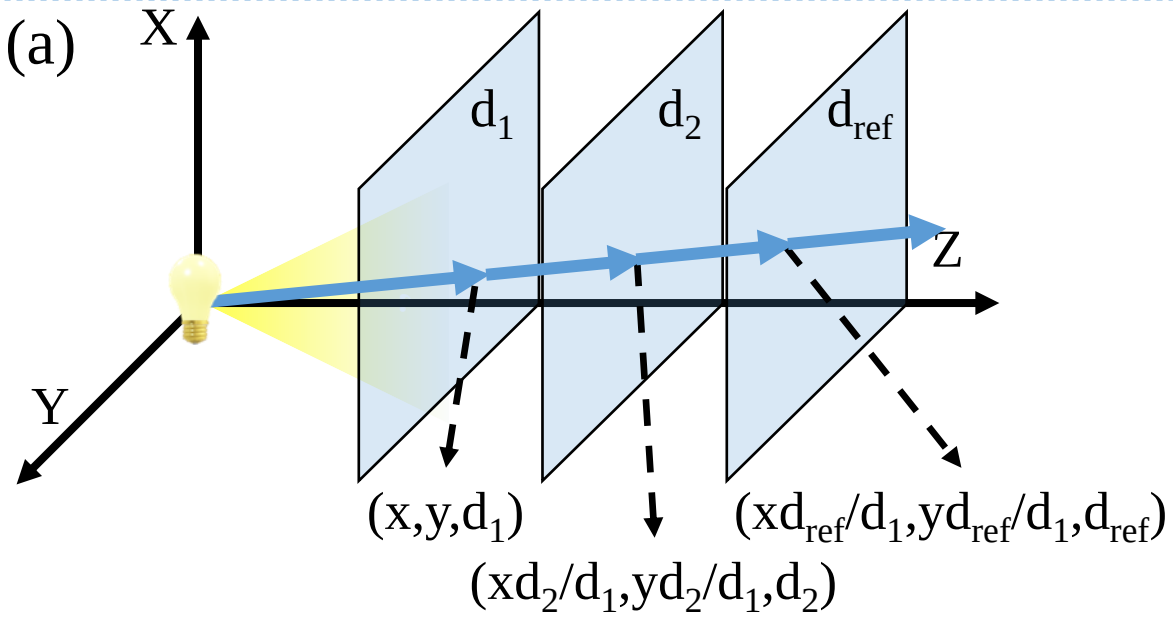
Re-combination

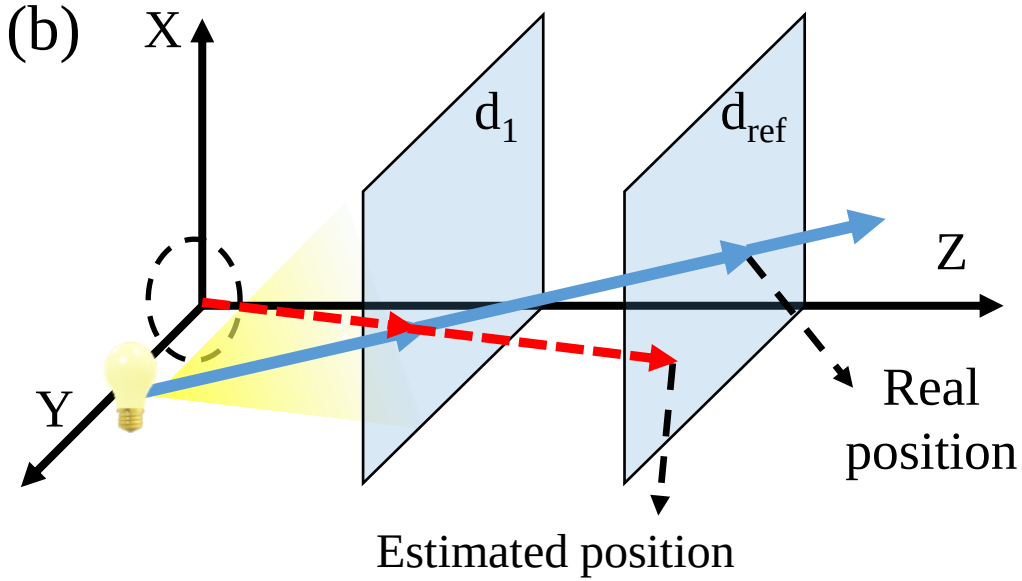
Refocusing

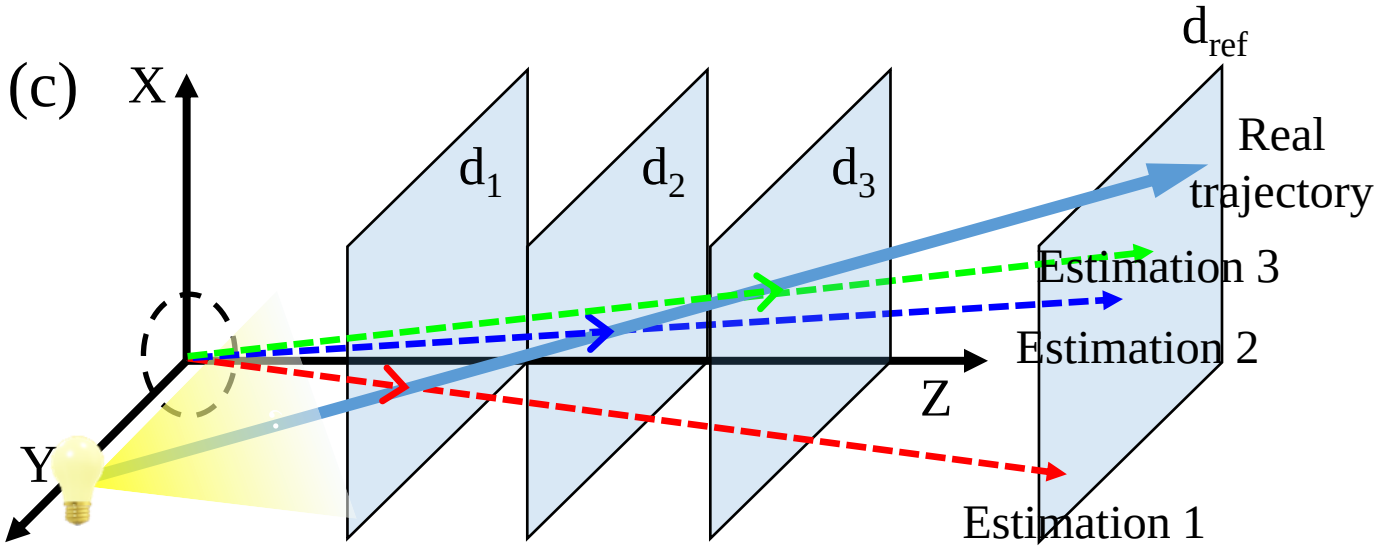
Refocusing



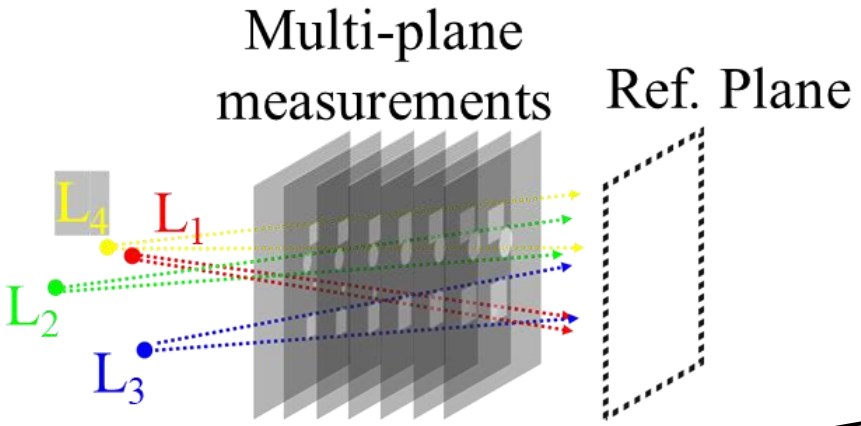
Measurements and predictions depending on the position of the light source



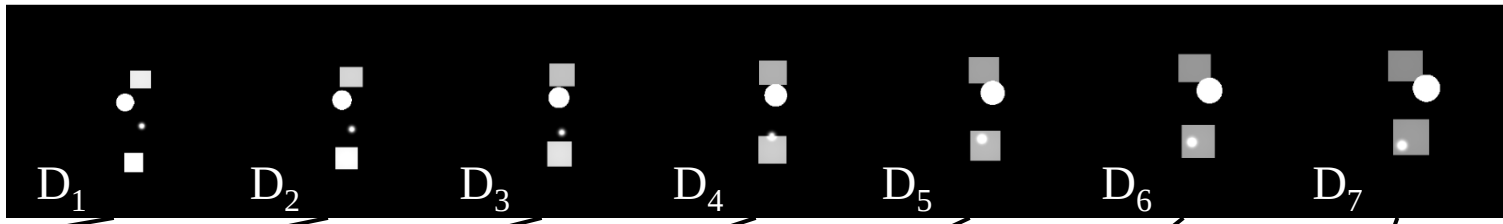




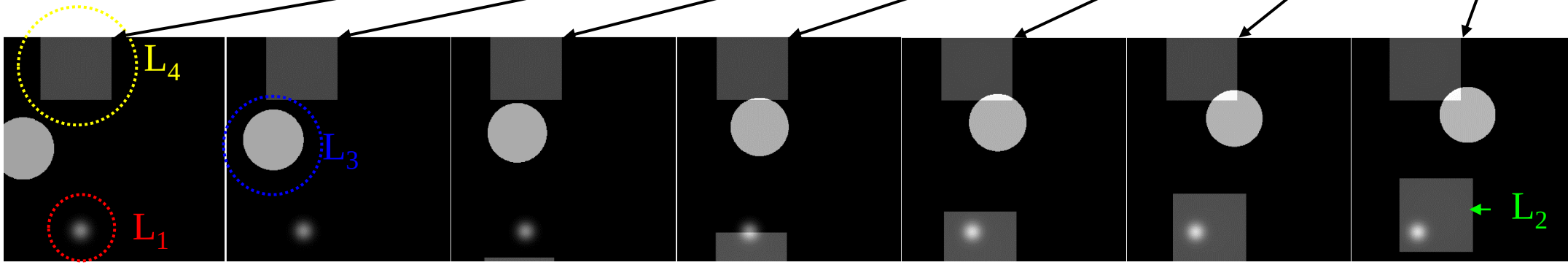
Measurements and predictions depending on the position of the light source



Multi-plane measurements



Estimations for L4



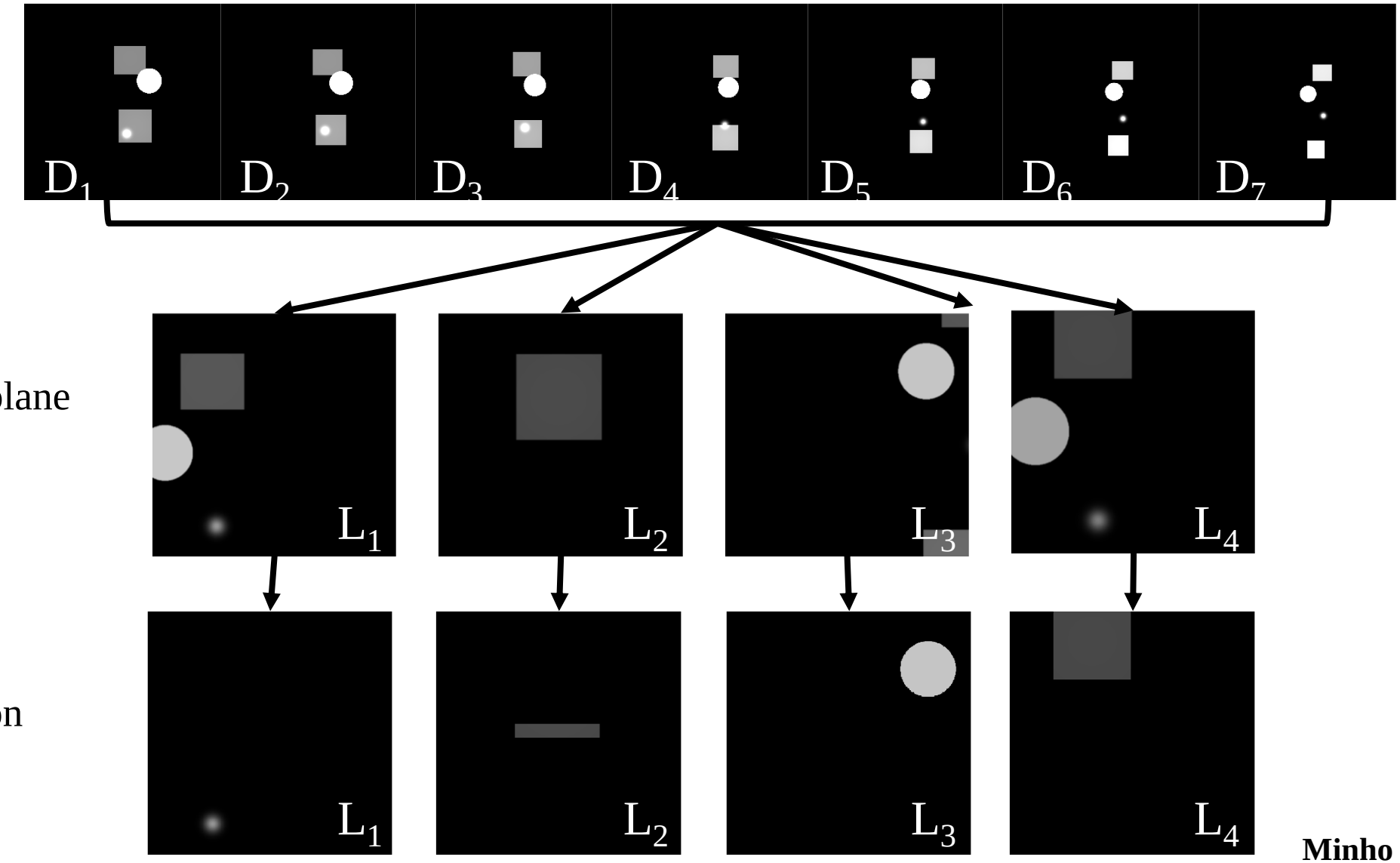
Light pattern of L4 predicted at reference plane

Measurements and predictions depending on the position of the light source

Multi-plane measurements

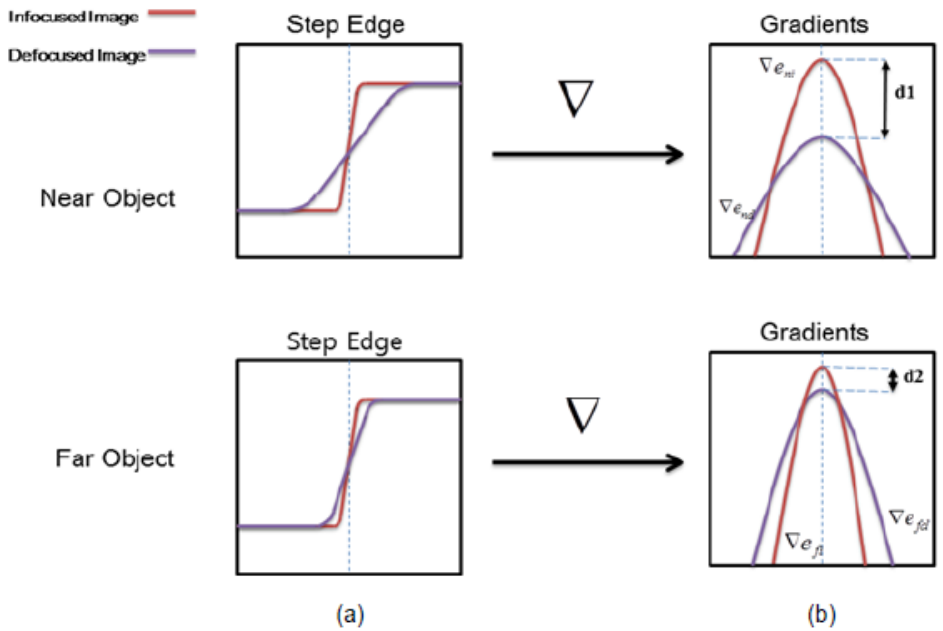
Estimations at reference plane for each light source

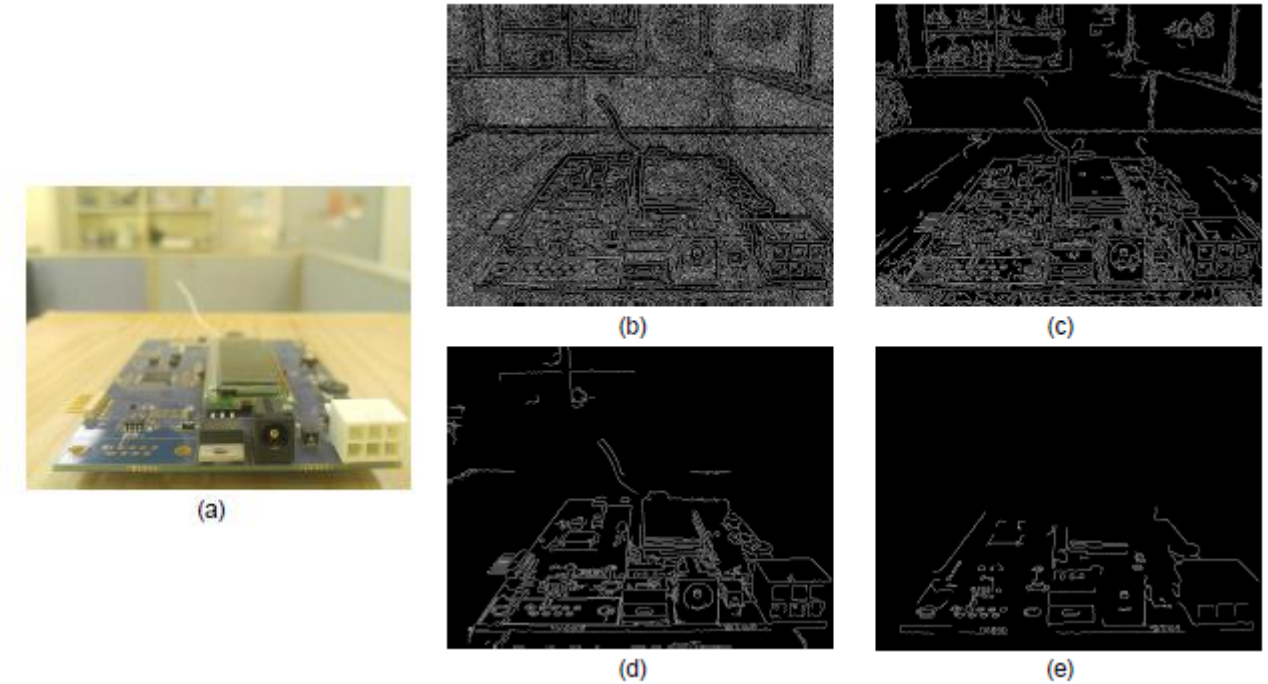
Extracted light information



Computation reduction through depth estimation

If no light source is present, no static component is present in estimated images
-> Volume scanning (like confocal microscope) or depth estimation is needed





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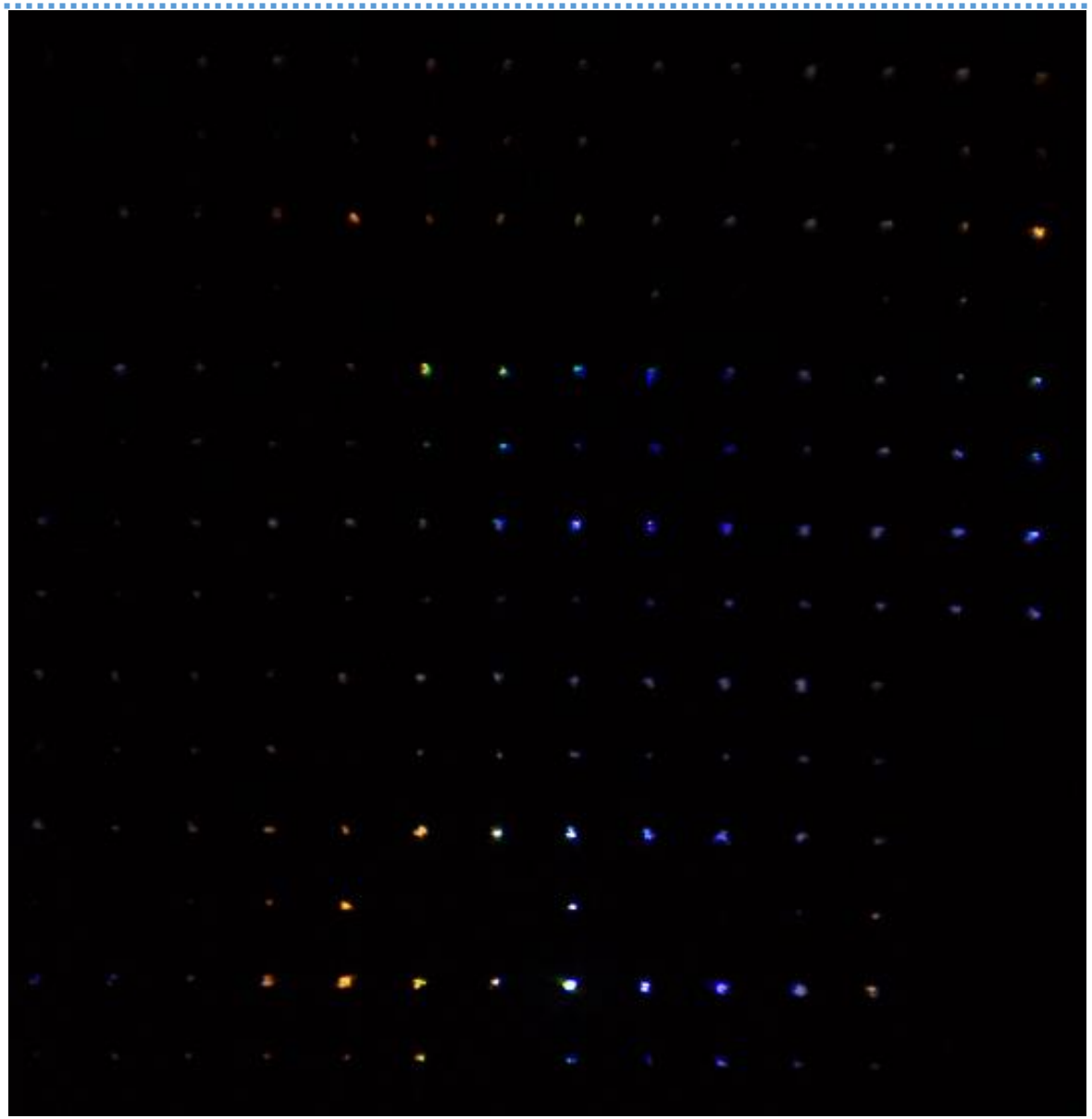
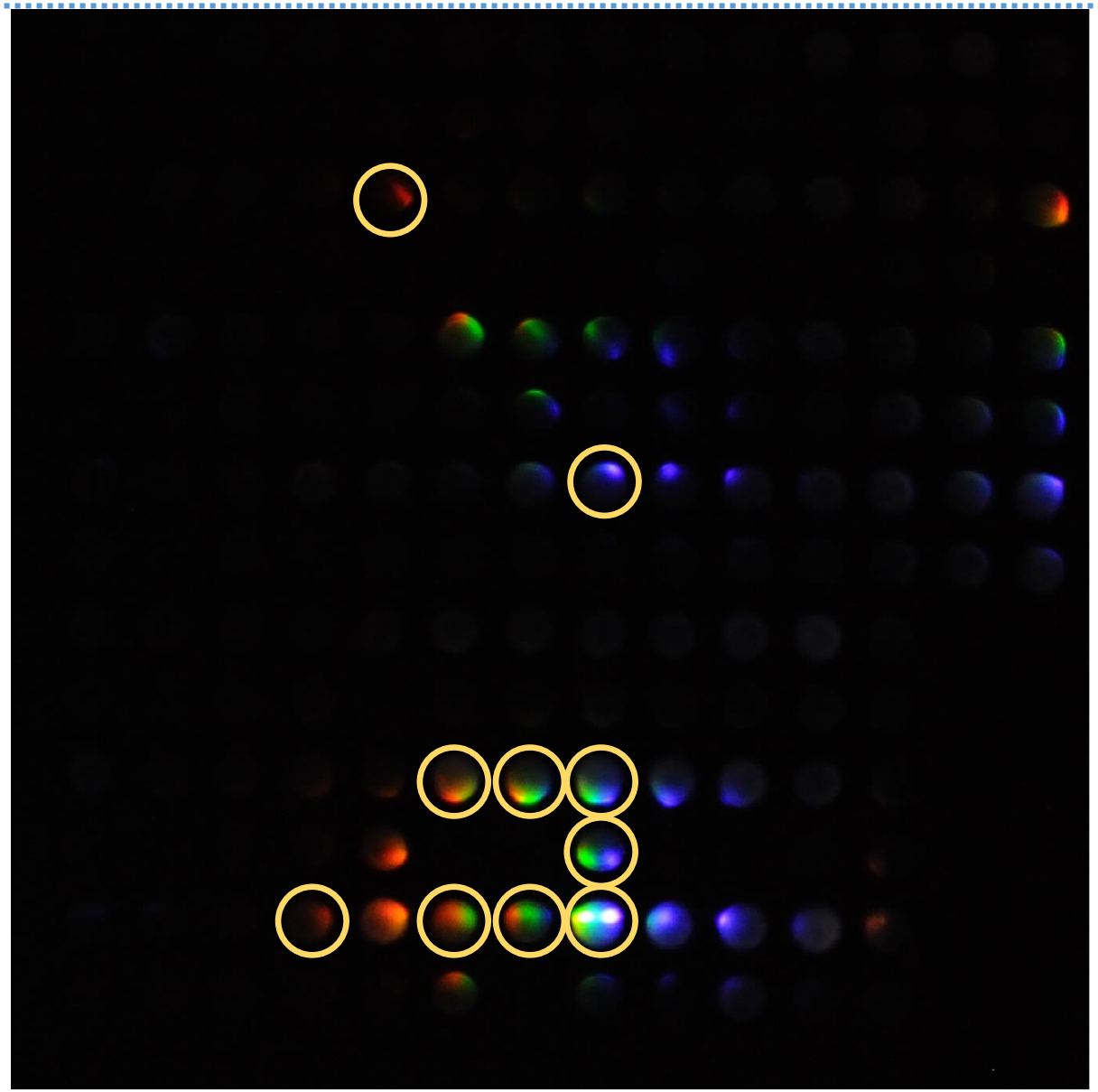
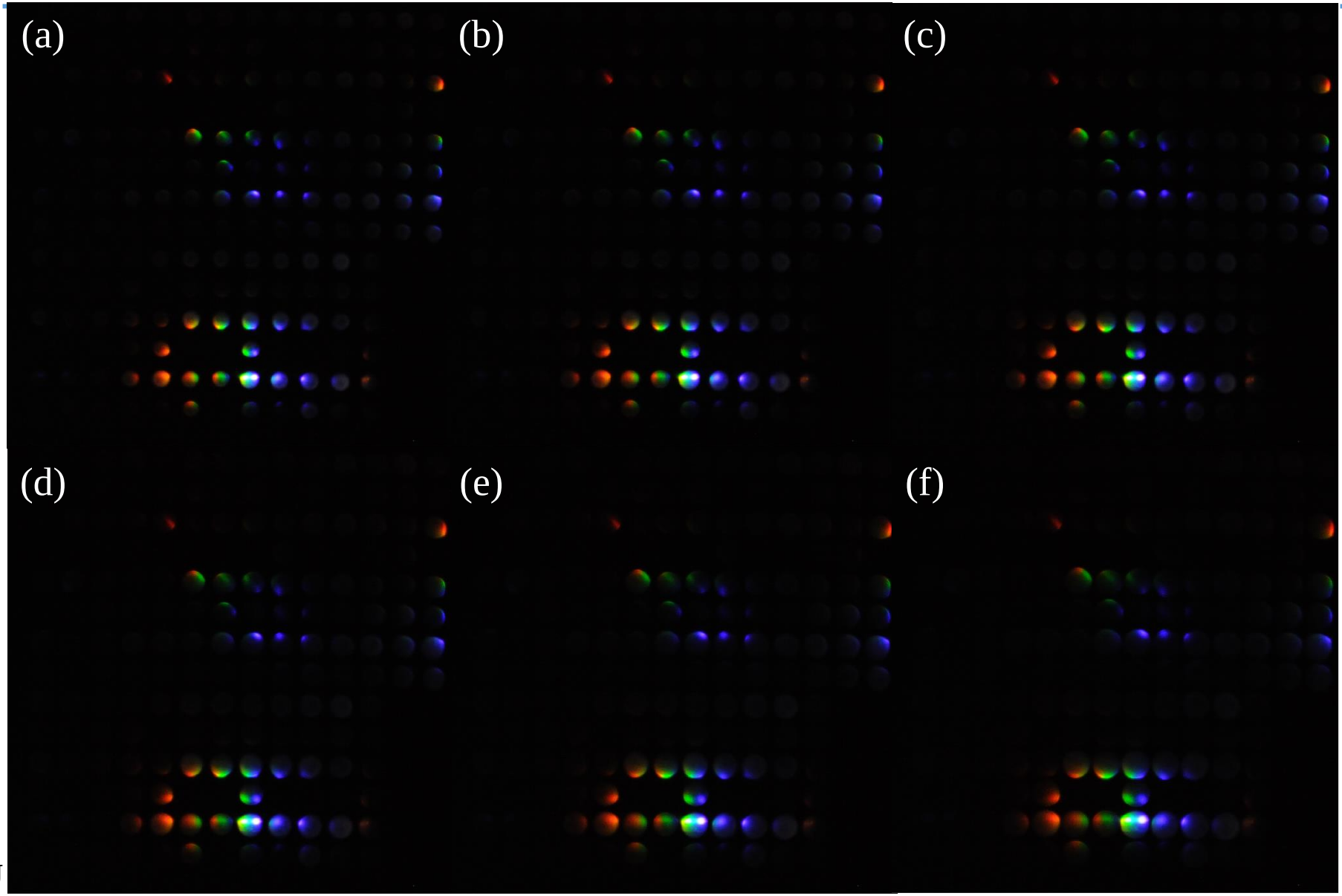
Extraction of light field information through multi-focus measurements



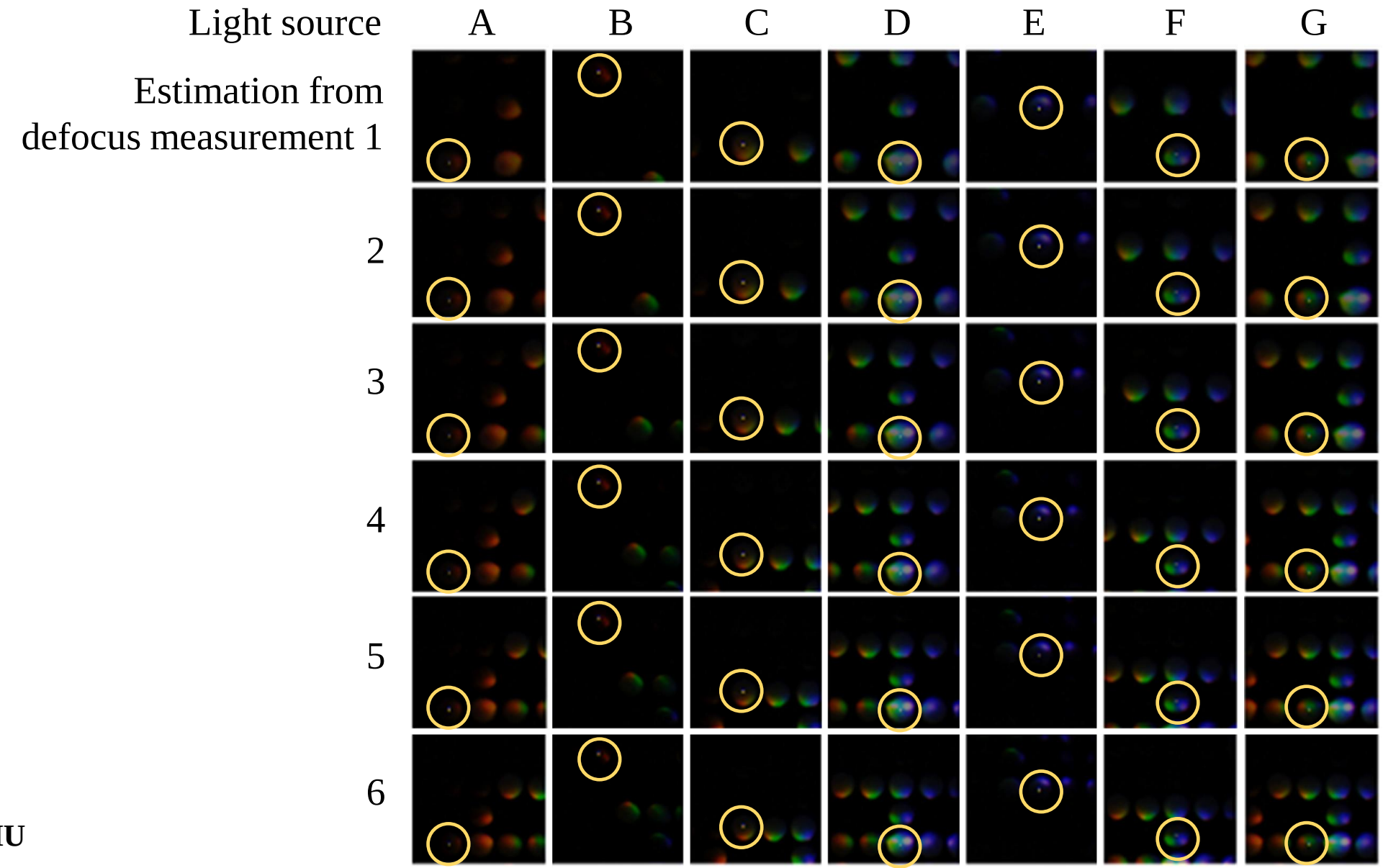


Extraction of light field information through multi-focus measurements

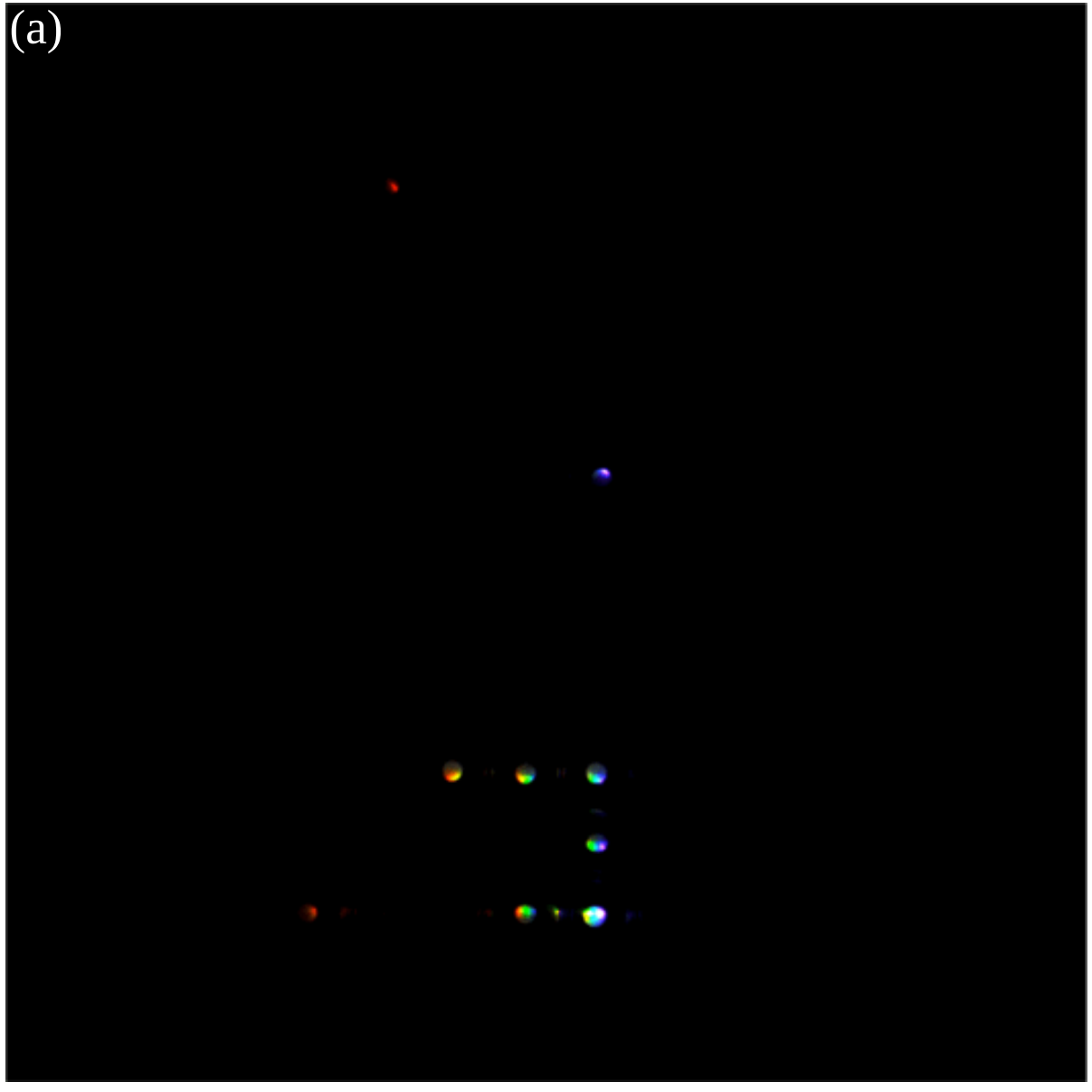


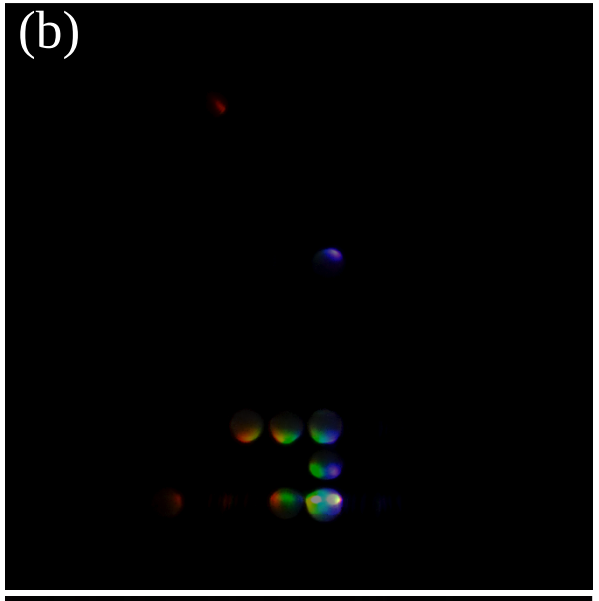
Defocus
Measurement 1 ~6
+
Camera
information
+
(Location of
Interest)

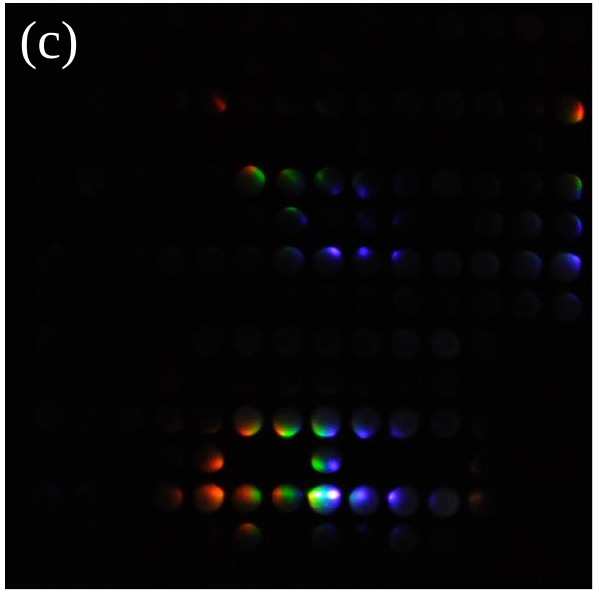
Extraction of light field information through multi-focus measurements



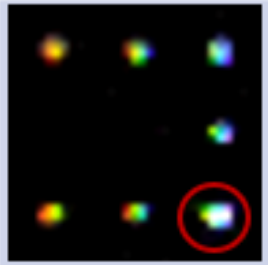
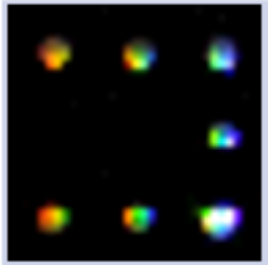
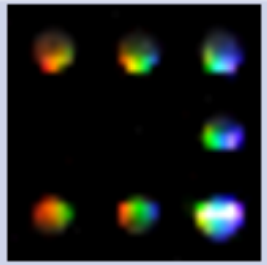
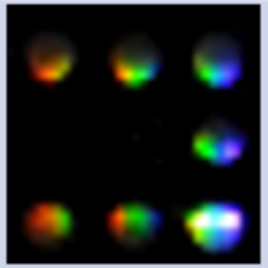
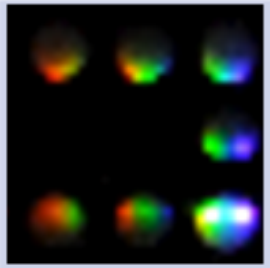
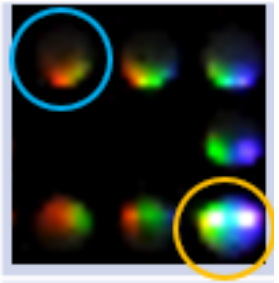
Extraction of light field information through multi-focus measurements







Extraction of light field information through multi-focus measurements

상대 거리 (A.U.)	36	48	56	64	74	82	90
실제 측정							
Re-focusing