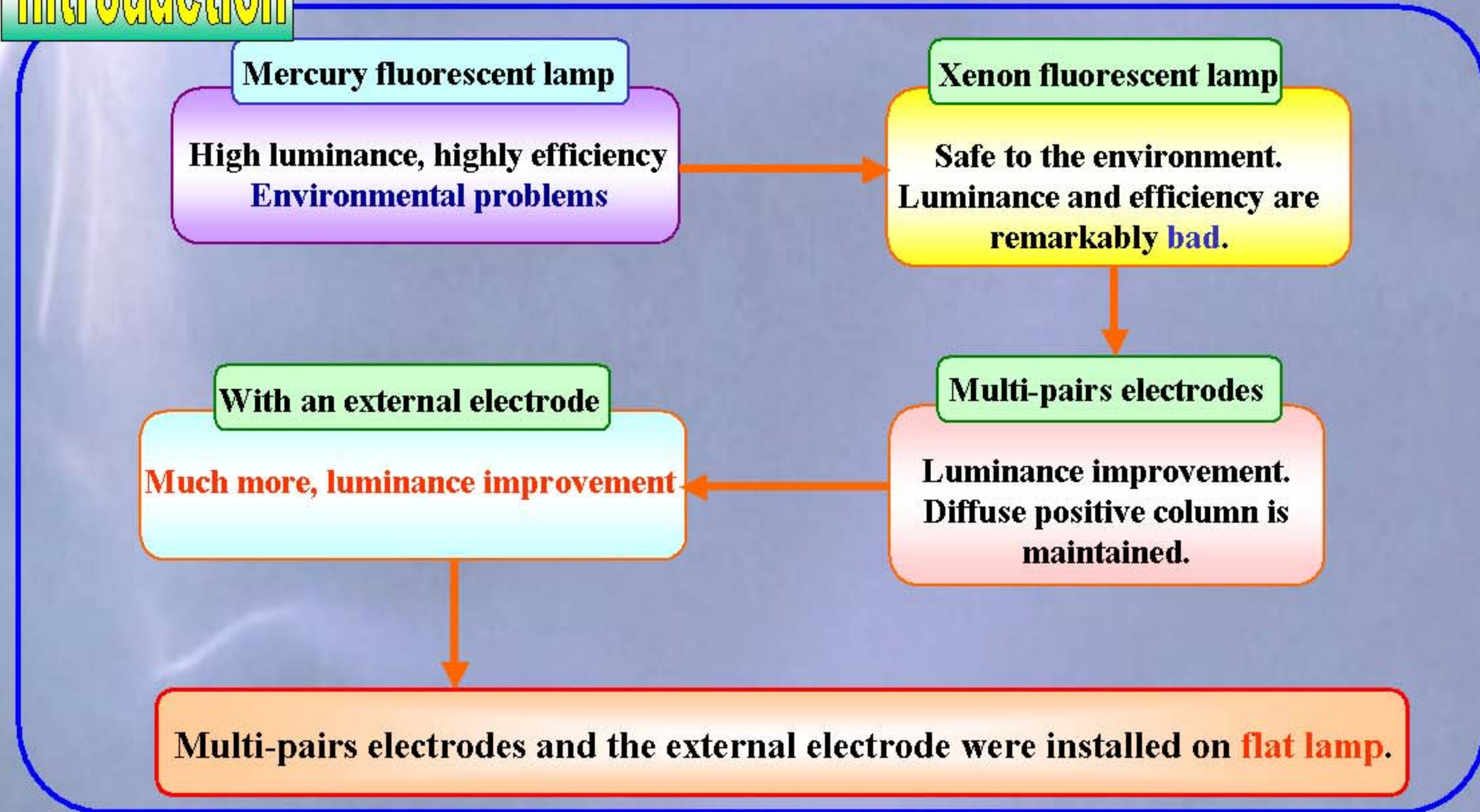


## Introduction



## Experimental setup

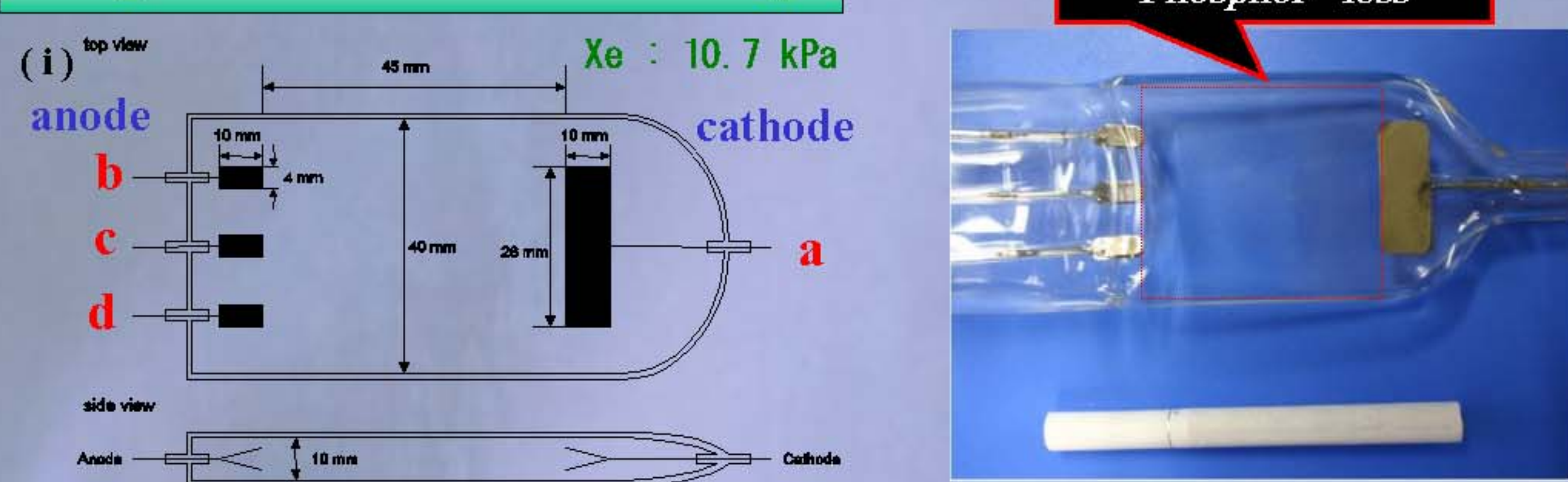


Fig. 1 : Flat lamp with multi electrodes

Fig. 2 : Lamp used to experiment

Three discharge roads of a-b, a-c and a-d

### Condition

Frequency : 25 kHz  
 Pulse width : 2  $\mu$ s

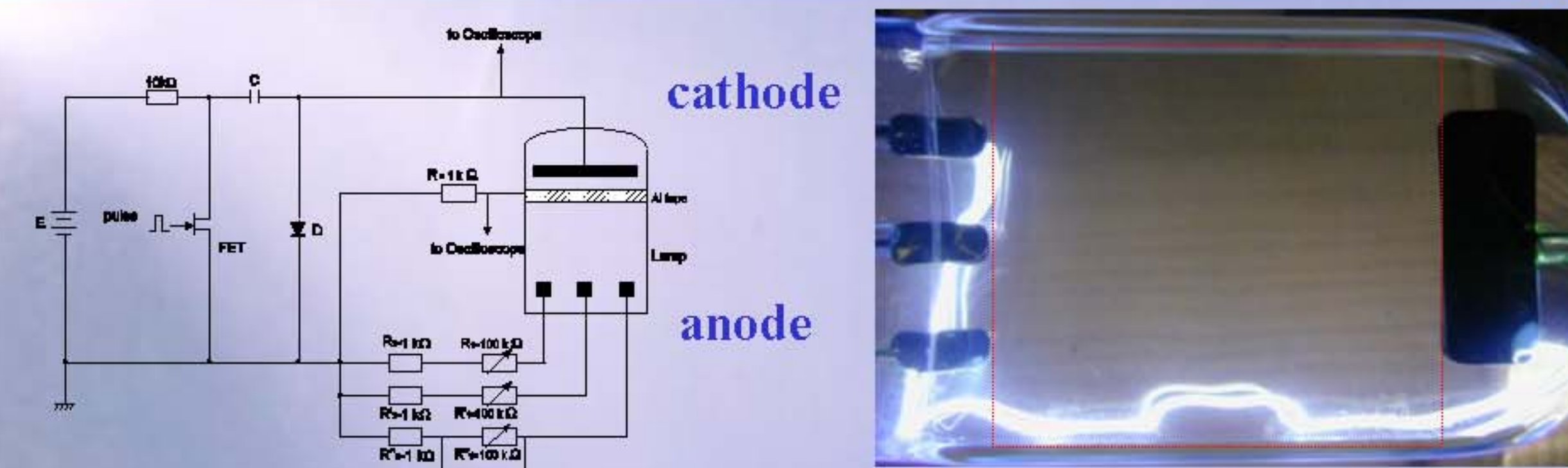


Fig. 3 : Pulsed discharge circuit

Fig. 4: The contracted positive column

The peak currents flowing through three anodes were maintained at the same value of 5 mA to maintain the positive column at diffuse stat. Pictures of the discharge were taken with the digital camera.

- Luminance distribution
- Average intensity
- Standard deviation
- Coefficient of deviation (Standard deviation / Average intensity)

The current increases  $\rightarrow$  The contracted positive column  
 To get a diffuse positive column  $\rightarrow$  The peak current of each discharge paths are set at same value.

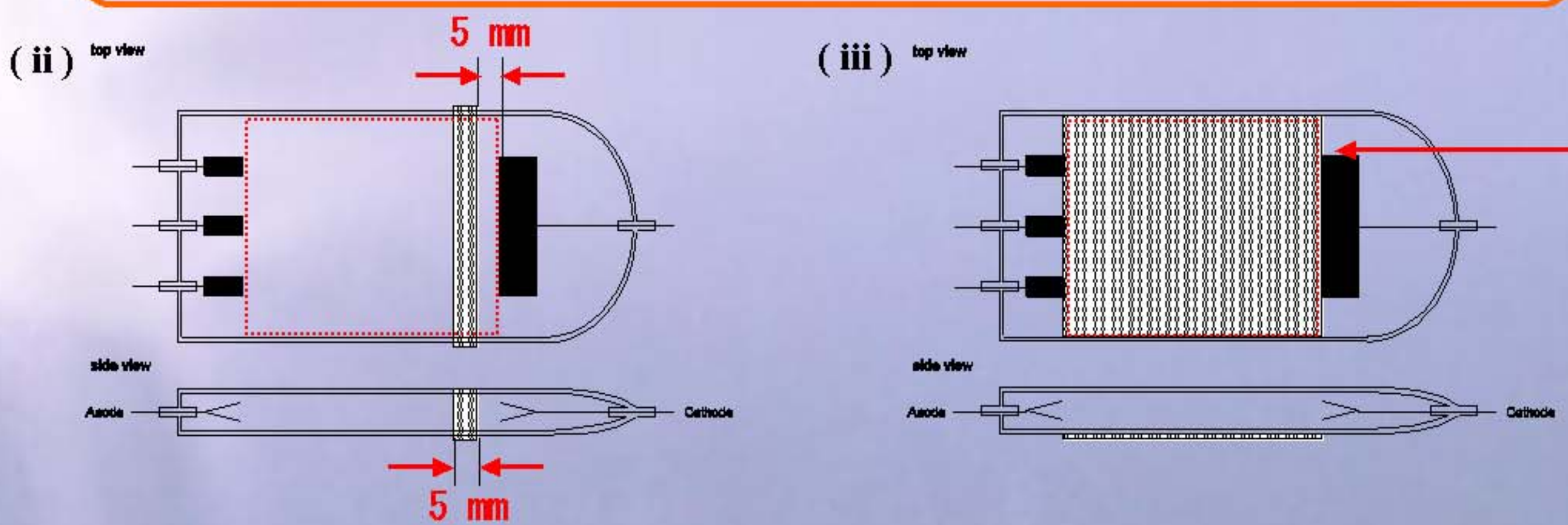


Fig. 5: With an external electrode of 5 mm wide on the side and bottom

Fig. 6: With an external electrode on the bottom

The area taken by the camera is shown as a red dotted line in Figures 5 and 6.

## Results

### Without external electrode

The discharge paths from three anodes attracted each other and shrank to a narrow positive column in front of the cathode.

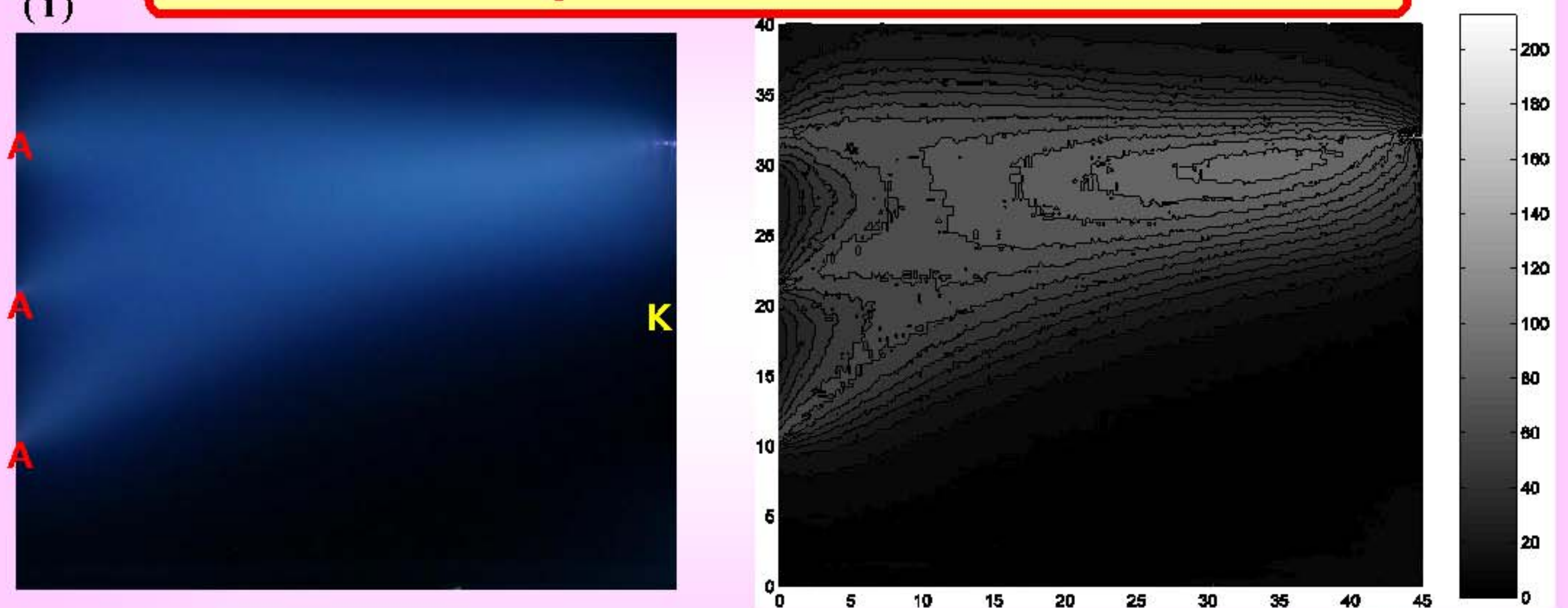


Fig. 7 : Picture and luminance distribution of diffused positive column

Average intensity 33.4, Standard deviation 27.6, and Coefficient of deviation 0.824

### With an external electrode of 5 mm wide on the side and bottom

Luminescence has weakened in a center part and a top and bottom.

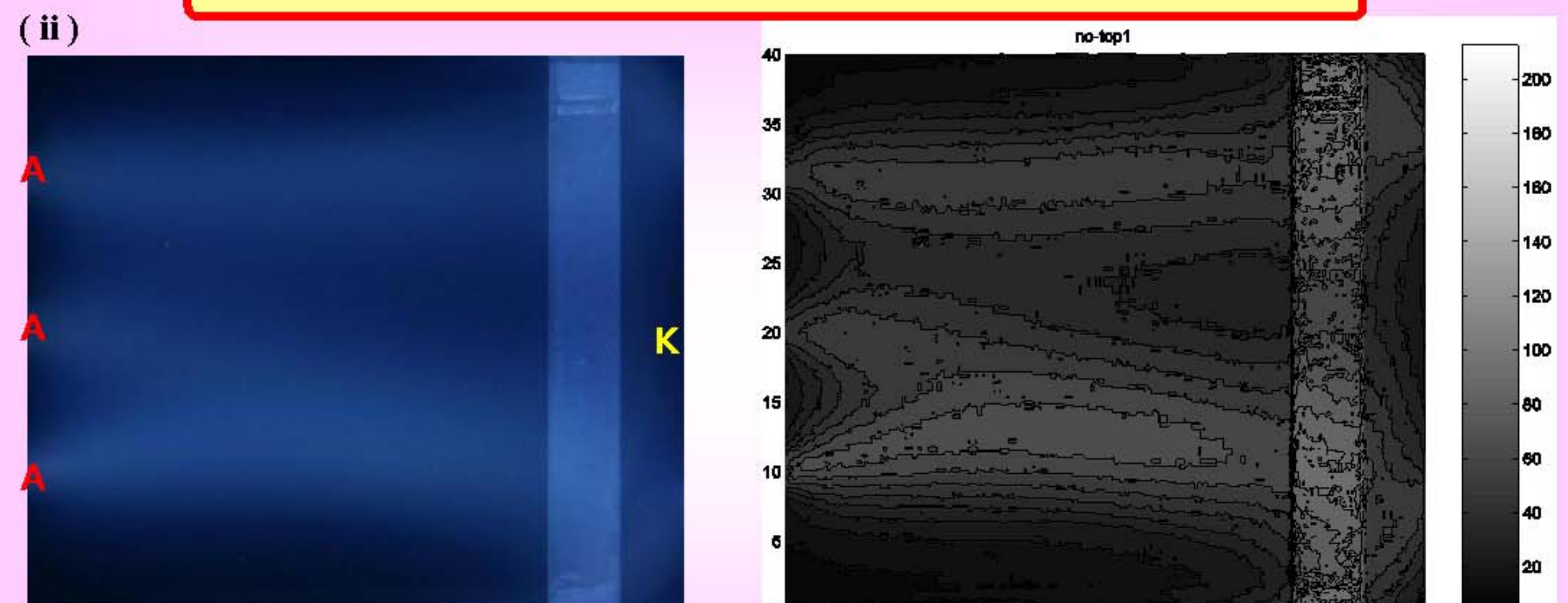


Fig. 8 : Picture and luminance distribution of diffused positive column

Average intensity 44.8, Standard deviation 19.3, and Coefficient of deviation 0.429

### With an external electrode on the bottom

The positive column has expanded uniformly.

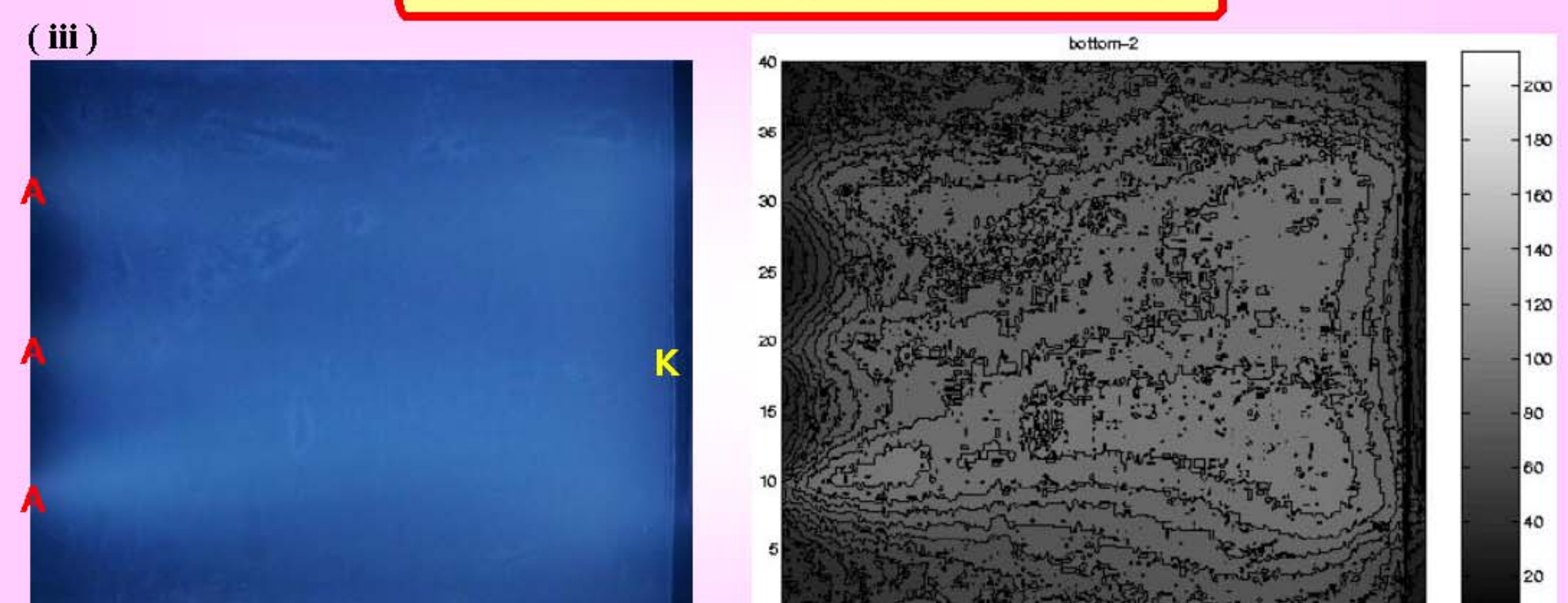


Fig. 9 : Picture and luminance distribution of diffused positive column

Average intensity 79.1, Standard deviation 18.2, and Coefficient of deviation 0.230

Reflection with aluminum tape

A : Anode  
 K : Cathode

## Discussion

	Installation method of external electrode		
	(i) Nothing	(ii) Zonation	(iii) Plane
Luminance	Low	$\nearrow$	High
Uniformity	Low	$\nearrow$	High

The current paths from the three cathodes tend to shrink because of the attractive force, however by putting an external electrode on the bottom surface the electric field is distorted and the current is attracted to the wide area of the external electrode, and then the concentration of the current to a certain point is prevented. Moreover, reflection of the emitted light on the external electrode contributes the improvement of the averaged luminance.

## Reference

T. Murakami, K. Toryu, H. Motomura, M. Jinno, and M. Aono, "Improvement of luminance and efficacy by using multi-pairs of electrodes" Proceedings of Annual Conference of Fundamentals and Materials Society IEE Japan, pp 226-231, (2004)