XIOPM

Performance of an Imager Intensifer for IsCMOS Readout System of HERD

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Outline

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- System Concept and requirements
- Design and Results
- Summary

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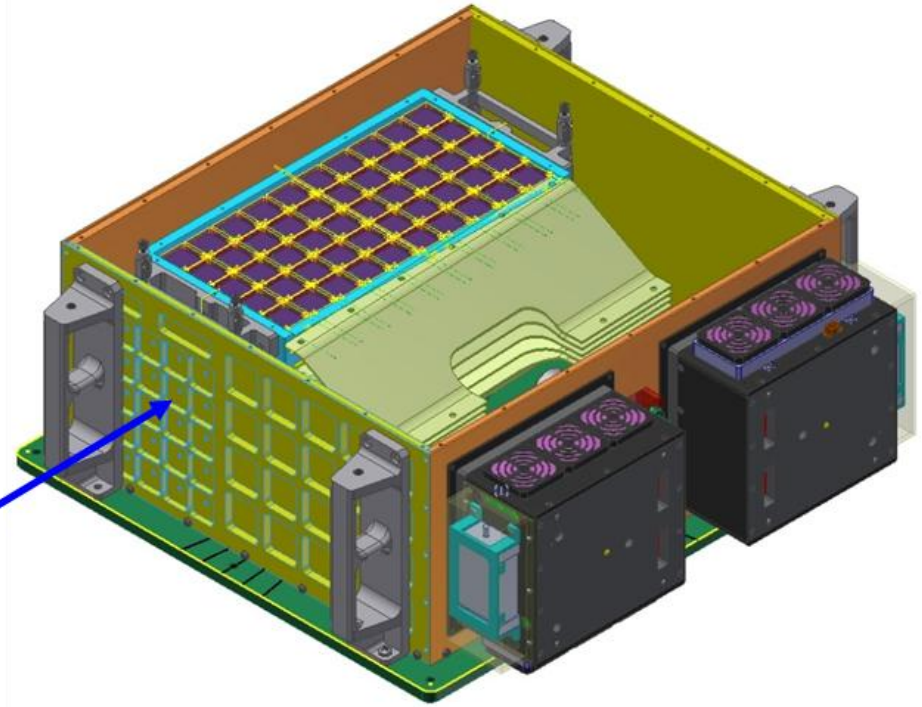
Specifying Instrument requirements

- spectral response range: 450nm-600nm
- sensitivity: 0.3MIP/channel
- trigger off/on delay time:＜1us
- max frame rate: 500fps
- dynamic range:＞1000

- 1 LYSO array
  - 5×5×10 crystals
  - **2 IsCMOS systems**



Optimize performance for finalizing IsCMOS design

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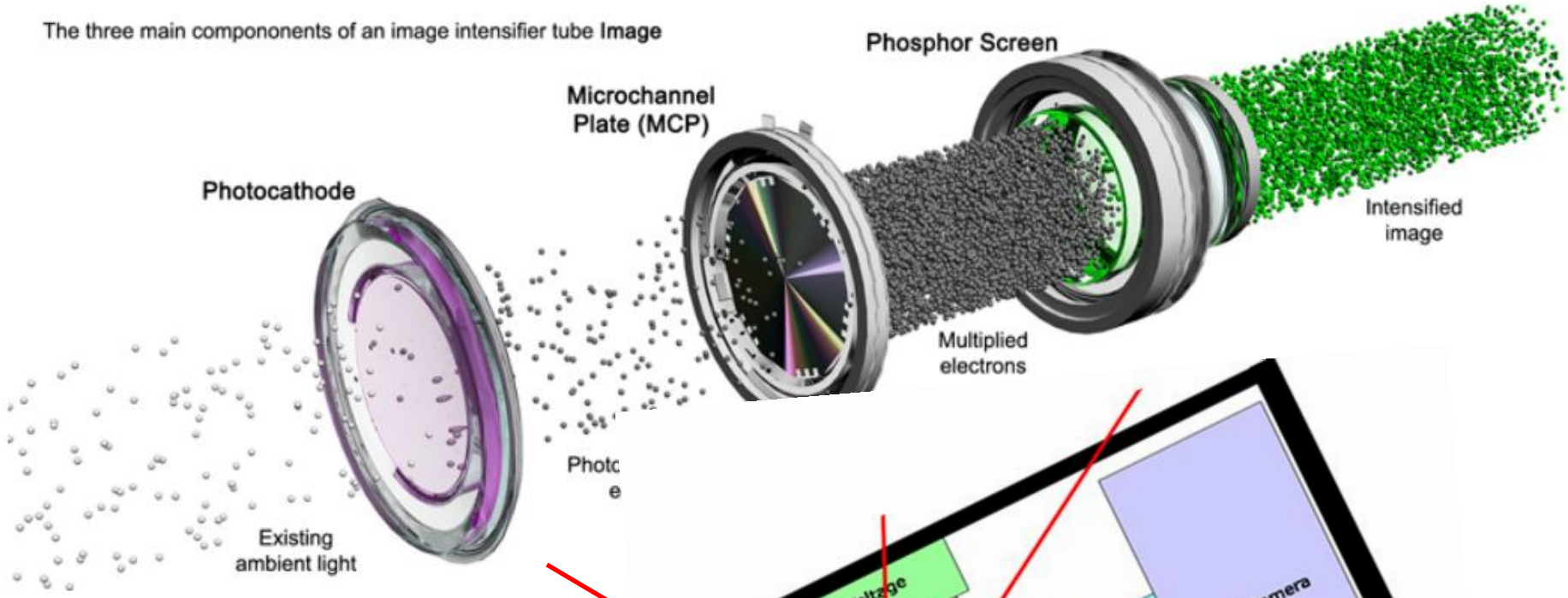

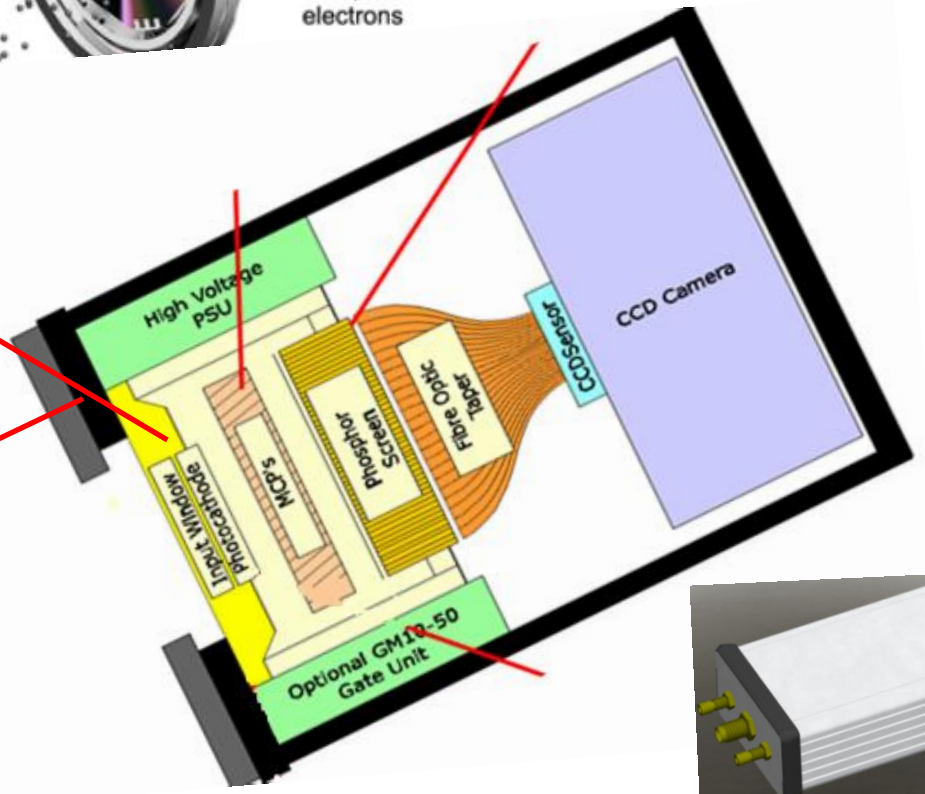

Nonuniformity

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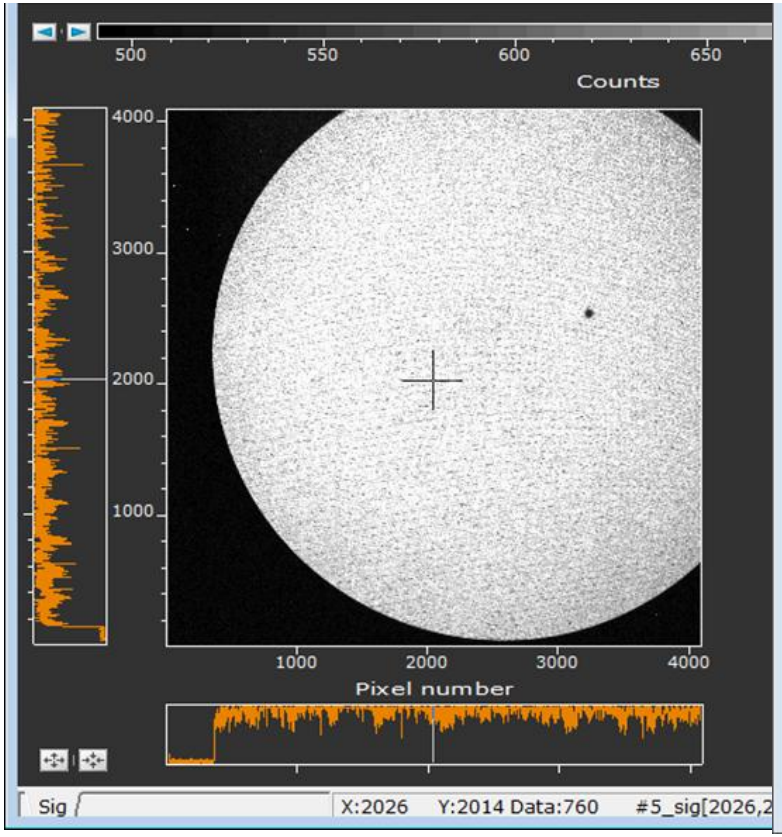
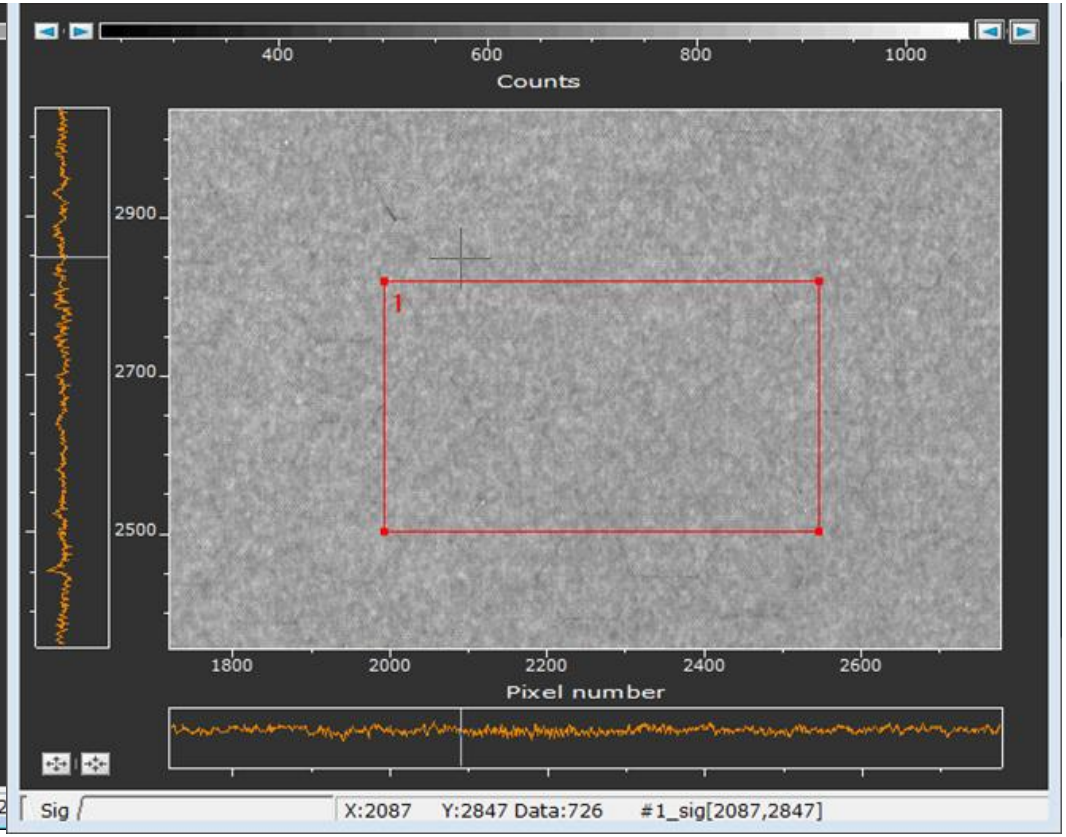
Nonuniformity:2.1%-5.2%



Overall picture



Partial magnification picture

Phosphor screen: decay time

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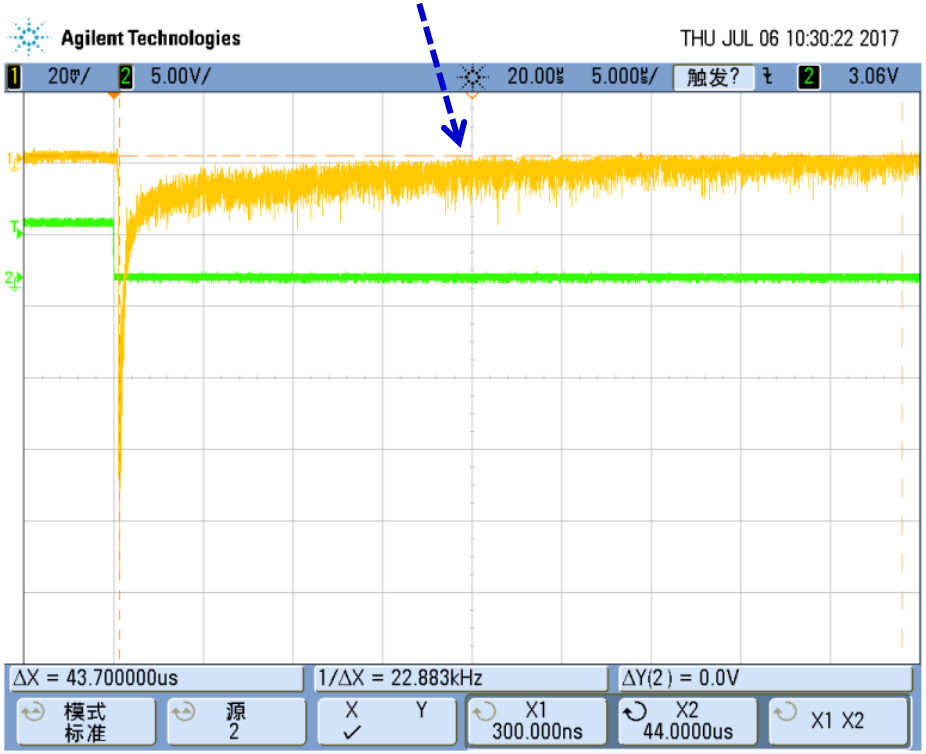
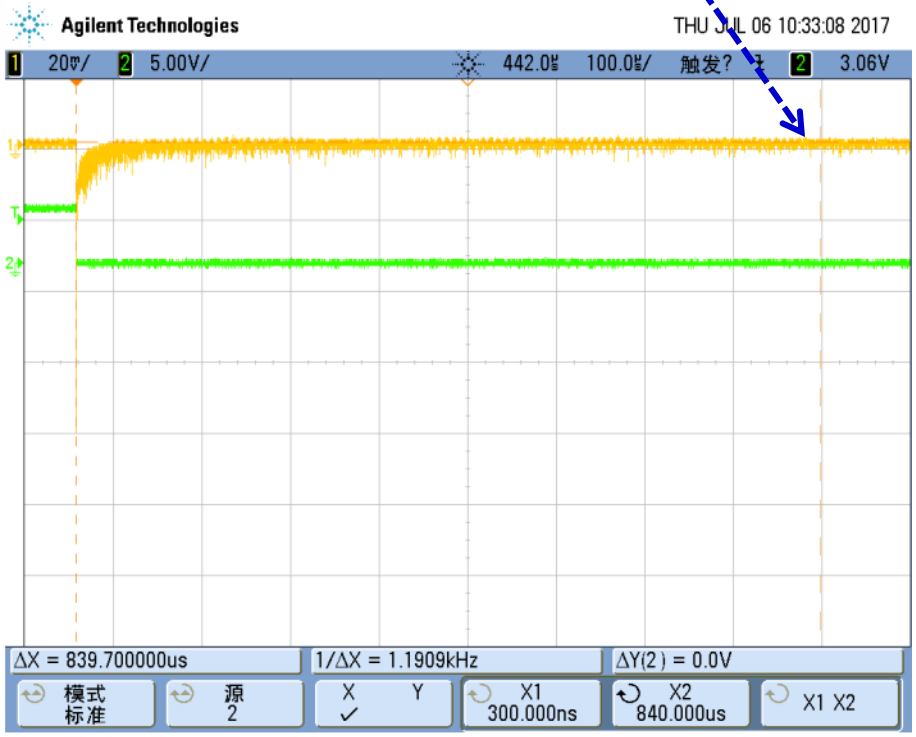
95% Energy is concentrated in 100us, and the 840us decay time match with sCMOS frame rate(500fps)

~100us



decay time ~840us



High Voltage PSU: MCP gain

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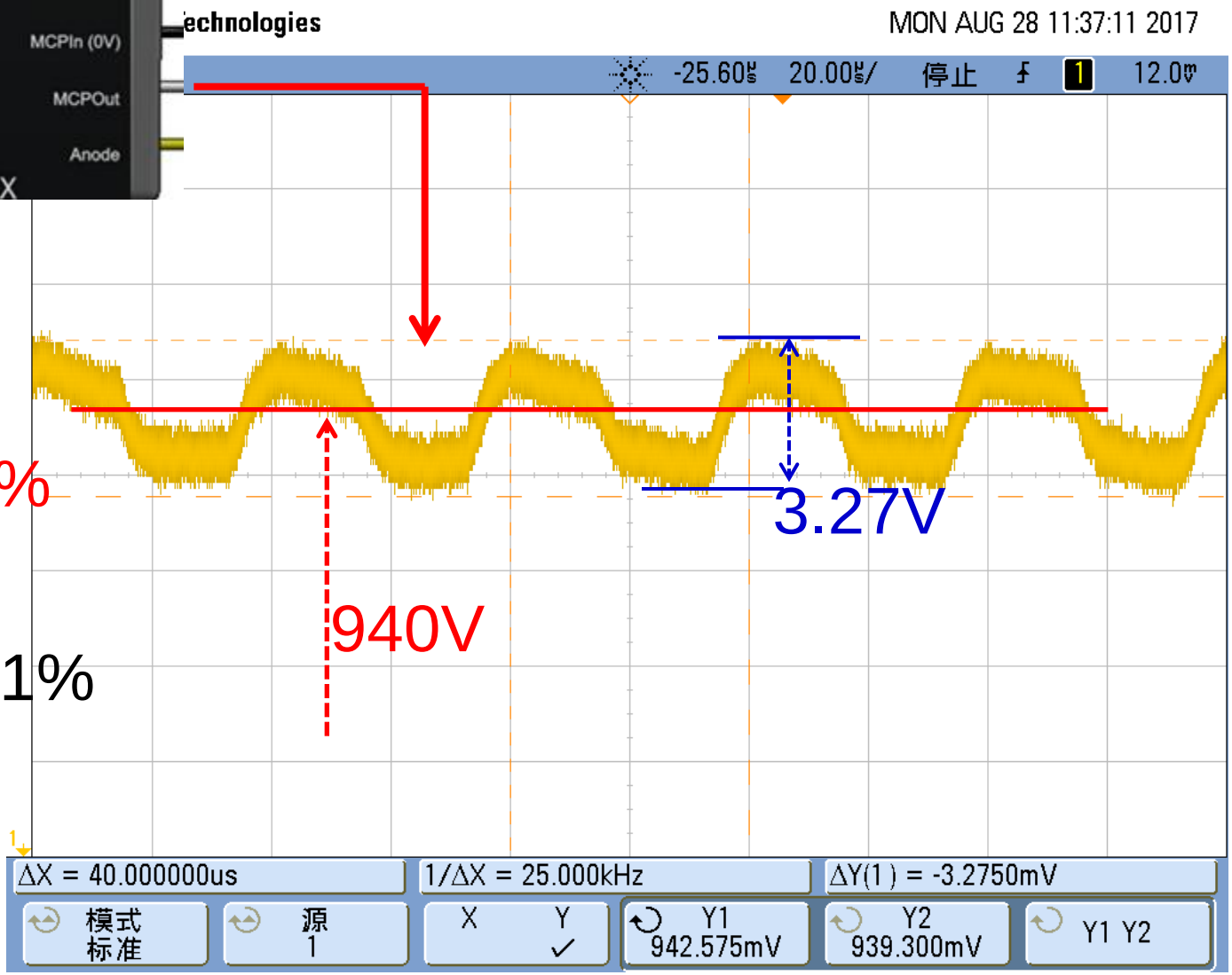

3.27/940=0.35%

Gain change:~1%

High Voltage PSU: phosphor screen voltage

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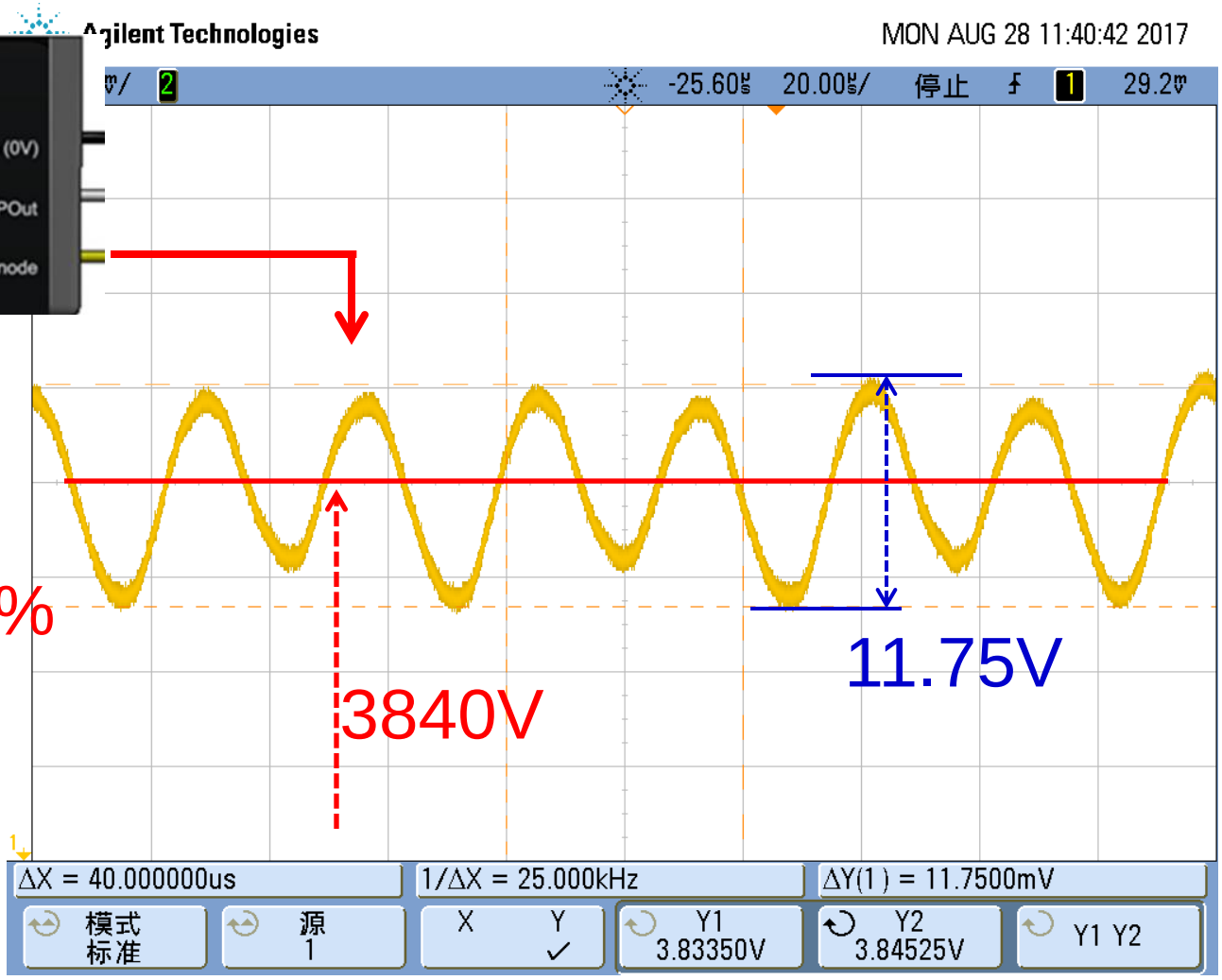
The effect on the brightness of the screen can be ignored



11.75/3840=0.31%

Gated Unite for photocathode

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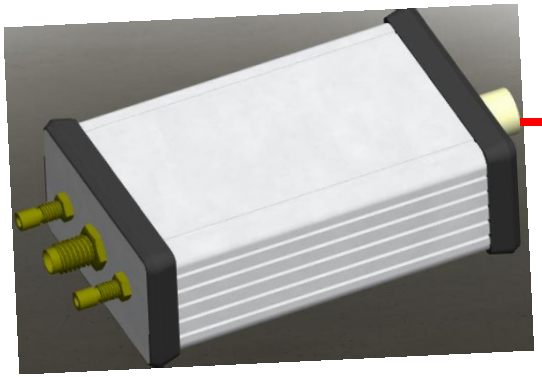

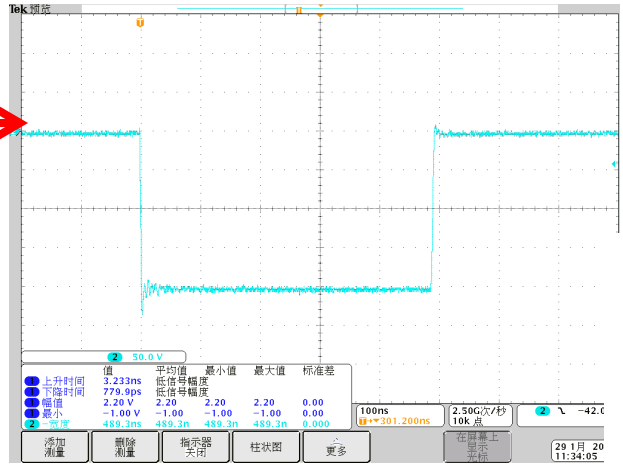

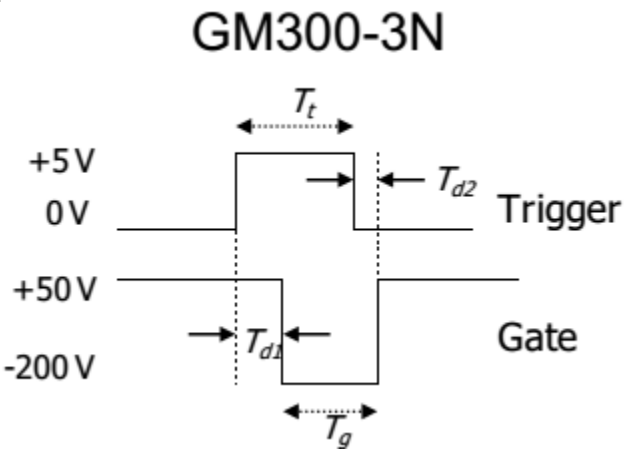

Typical Timing Parameters

Leading Edge Propagation Delay	T_{d1}	50 ns
Trailing Edge Propagation Delay	T_{d2}	40 ns
Trigger / Gate Offset Time Tt - Tg	T_{d1} - T_{d2}	10 ns
Minimum Gate Width in Inverted Mode	T_g	50 ns
Propagation Delay Temperature Co-efficient		40 (± 5) ps / °C
Gate Width Temperature Co-efficient		± 10 ps / °C

Gated Unite for photocathode

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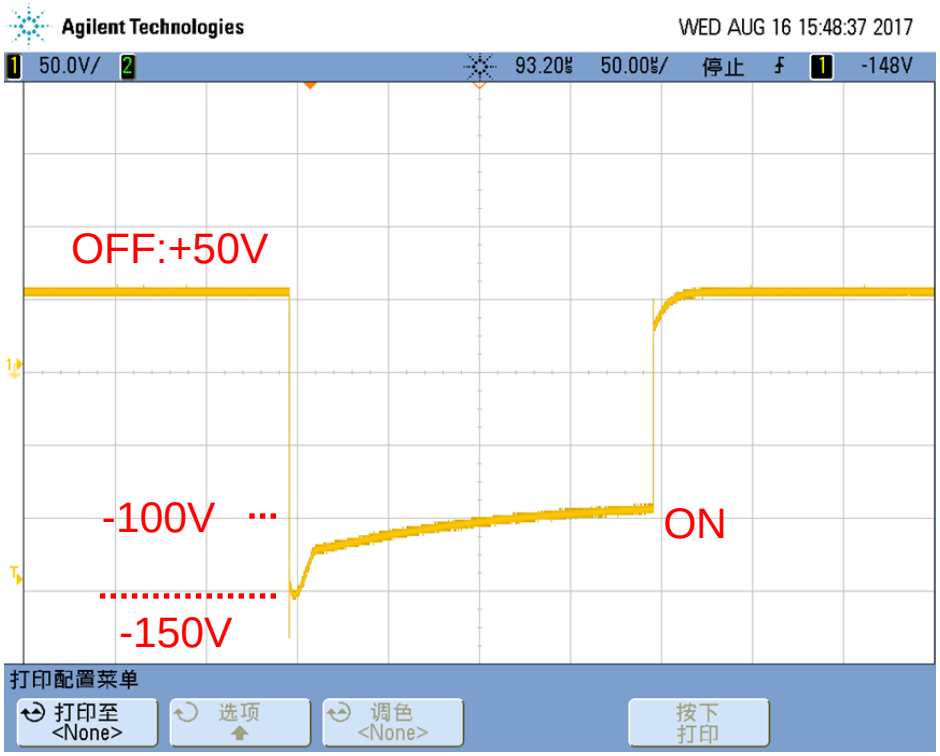
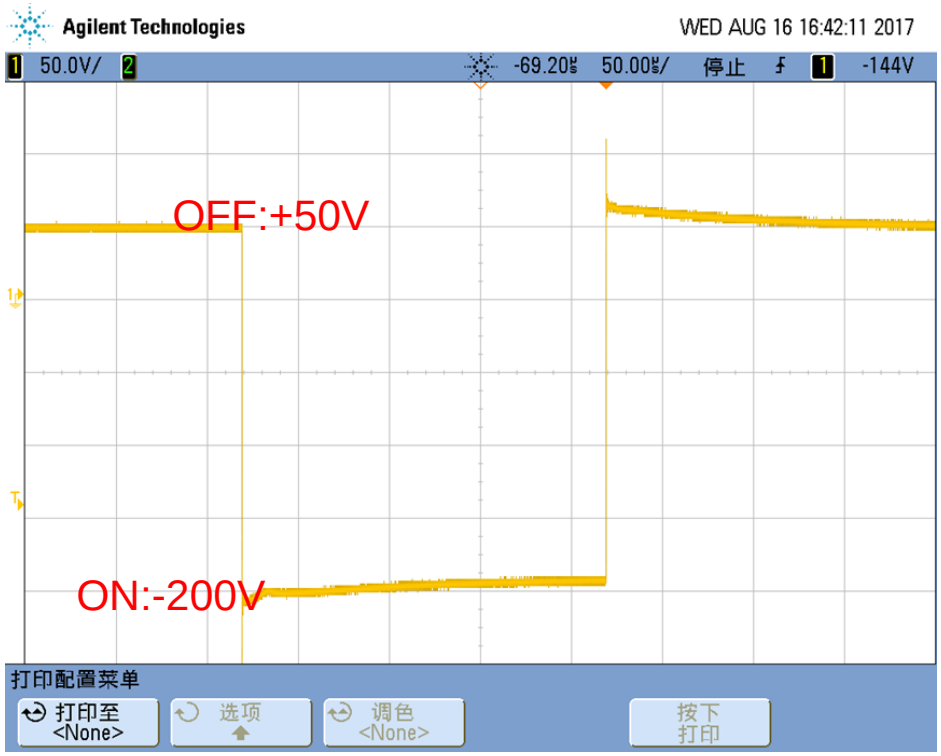


Impedance mismatching



Impedance matching

Spot Diffusion

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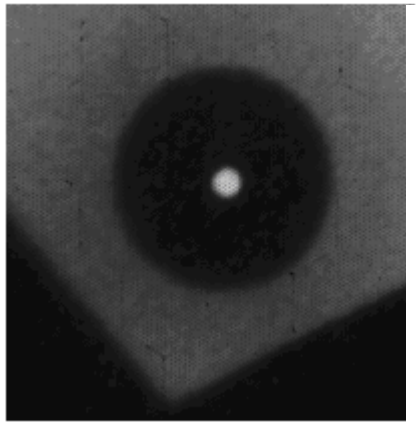
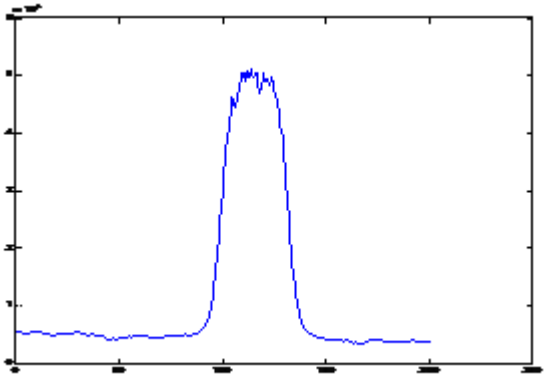
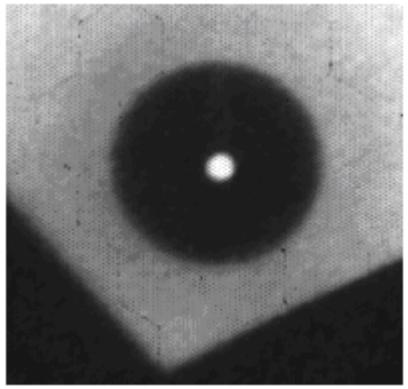
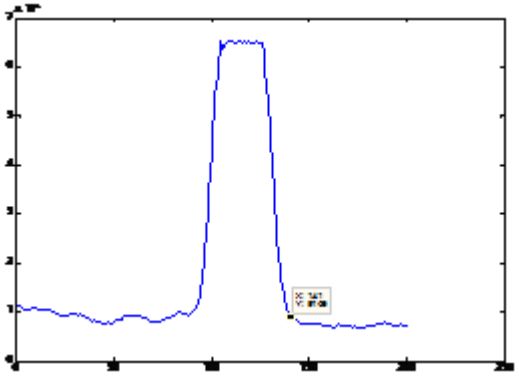
Test spot diffusion caused by different light intensity

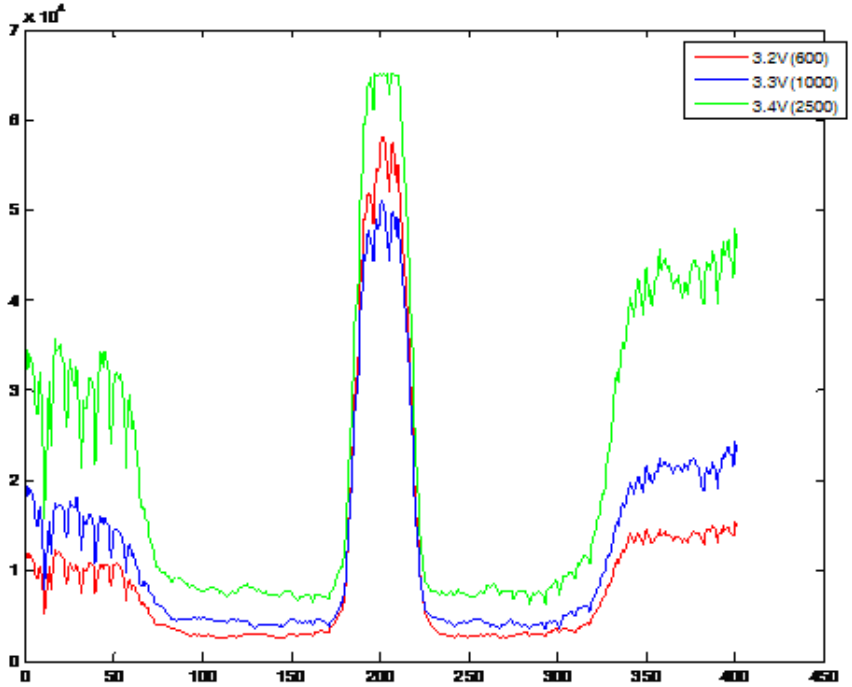








spot diffusion caused by I.I. is 1.5 times in different light intensity



spot diffusion caused by different gains of I.I.

Dynamic range

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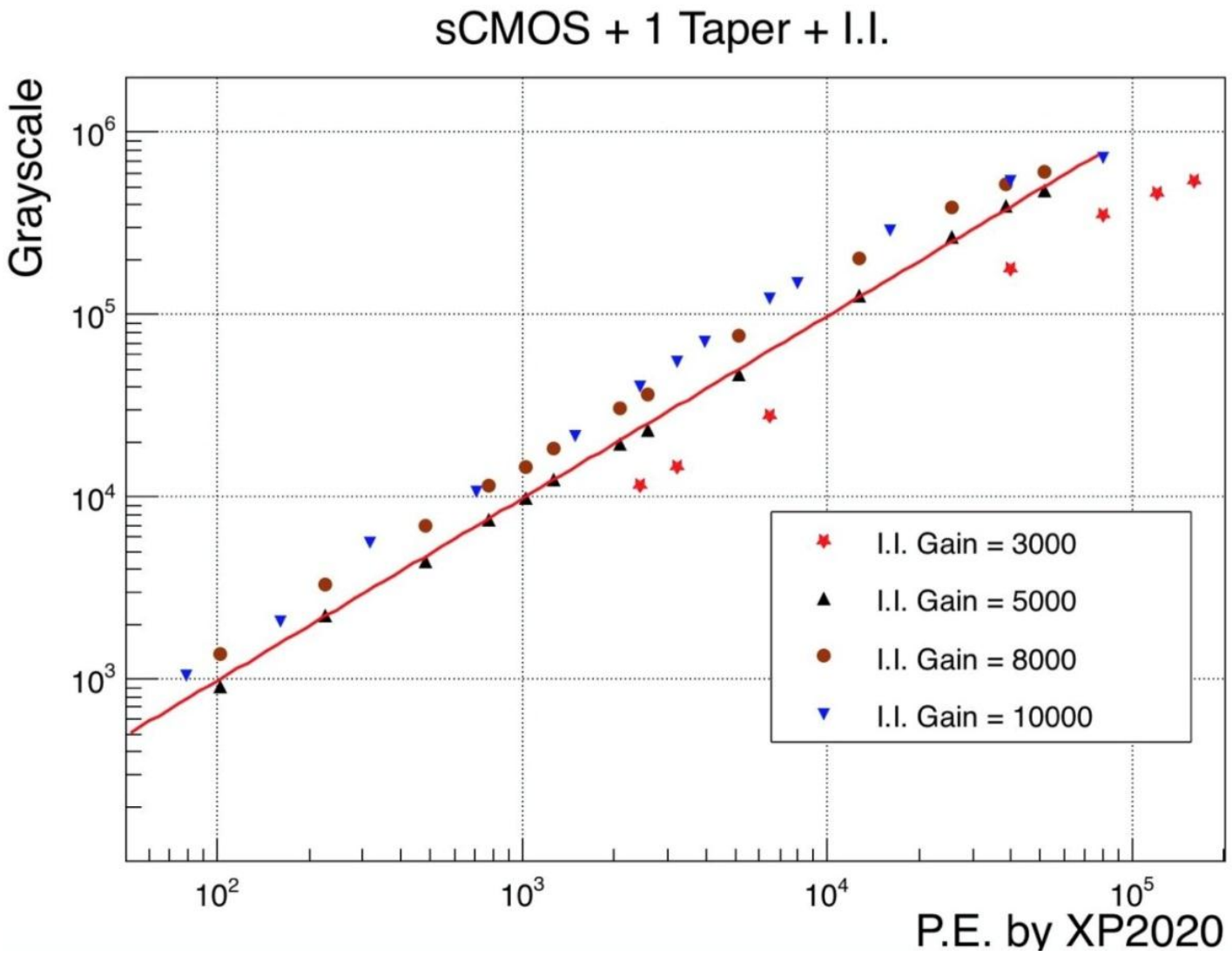

Dynamic range: 1000:1

Summary

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We have developed I.I. which satisfies most of our requirements

- sensitivity & trigger off/on delay time
- decay time

R&D is now focused on :Atomic layer deposition

- low noise photocathode
- lifetime and dynamic range improvement
- larger area detector

Thanks for your attention!

Atomic layer deposition (ALD)

Allows engineering of surfaces after MCP is fabricated-**high dynamic range & long lifetime**

- Optimize secondary electron coefficient for gain
- Optimize resistivity

Separates microchannel fabrication from surface preparation-**larger area detector**

- MCPs can be made from any glass, alumina, plastic
- Lithographic techniques for larger arrays of pores