



# Si Sensor Study for ILD Calorimeter

28/05/2013 at ECFA LC2013

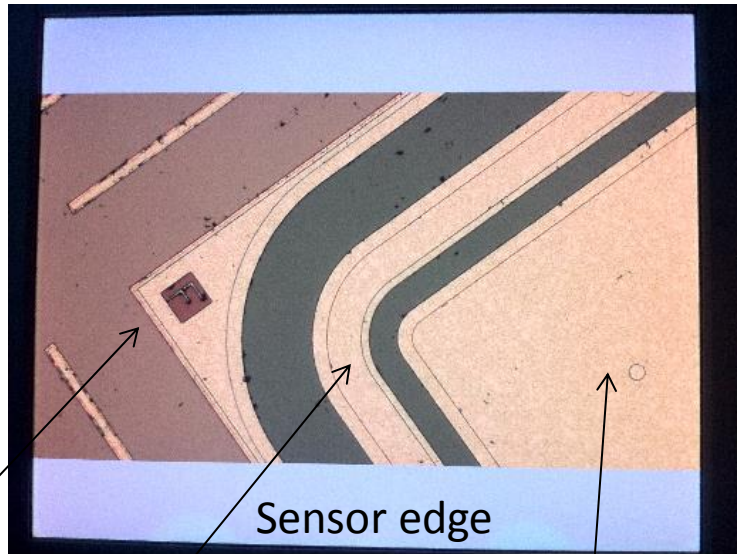
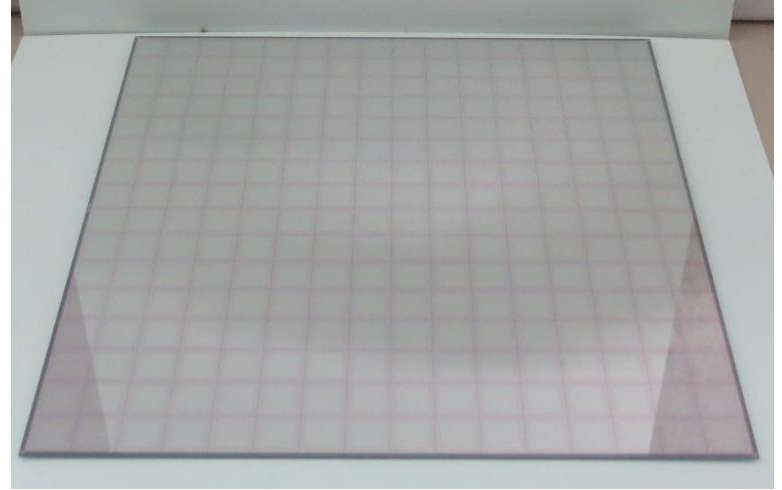
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# Motivation

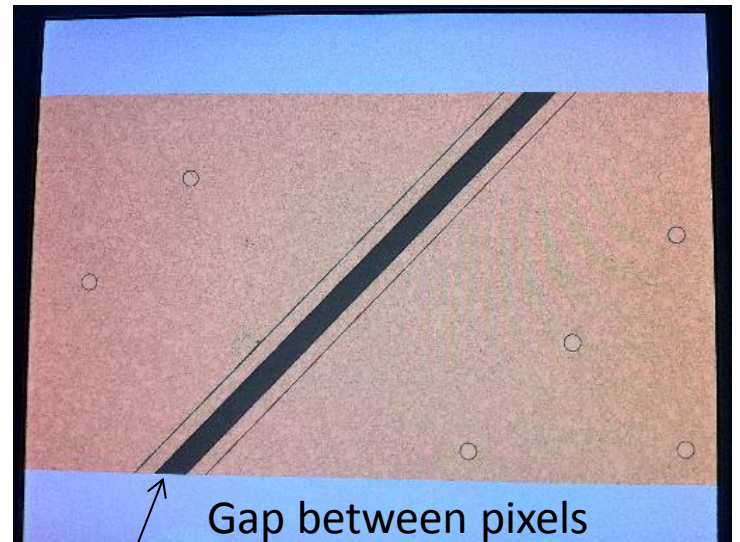
- We have to understand cross talk and signal behavior when particle hit a pixel, edge of sensor, gap between two pixels
- We are setting up Infrared laser system to study those issues.



edge

Guard ring

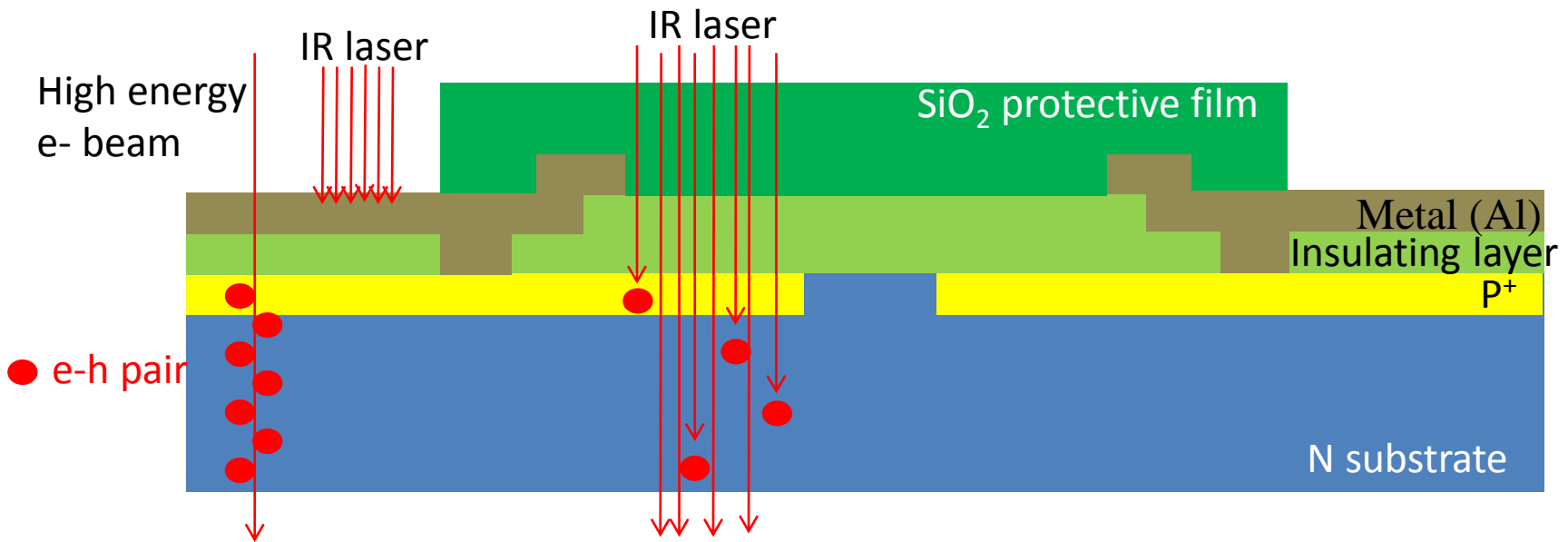
pixel



gap

# Infrared Laser Signal

- Wave length **1064 nm = 1.16 eV**
- Energy gap of Si = 1.12 eV
- **Average** production energy of **e-h pair = 3.6 eV**
- Almost all laser light go through a Si sensor, but they can make e-h pair a certain probability.  
→ We can make e-h pair uniformly in a sensitive area.



# Laser System

CRYLAS GmbH

DSS1064-Q2(Class 3B)

Wave length : 1064 nm

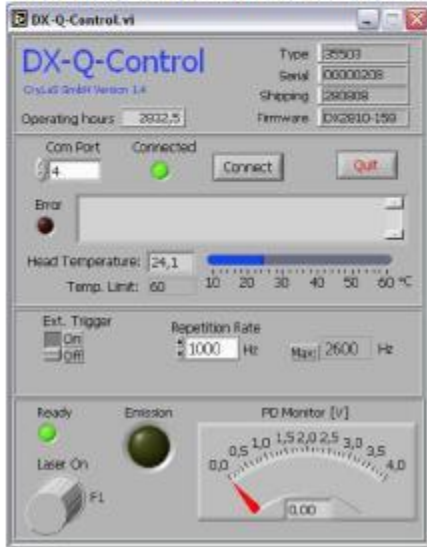
Pulse width : ~1.5 ns

Pulse energy : > 20  $\mu\text{J}/\text{pulse}$   
~  $10^{14}$  photons/pulse

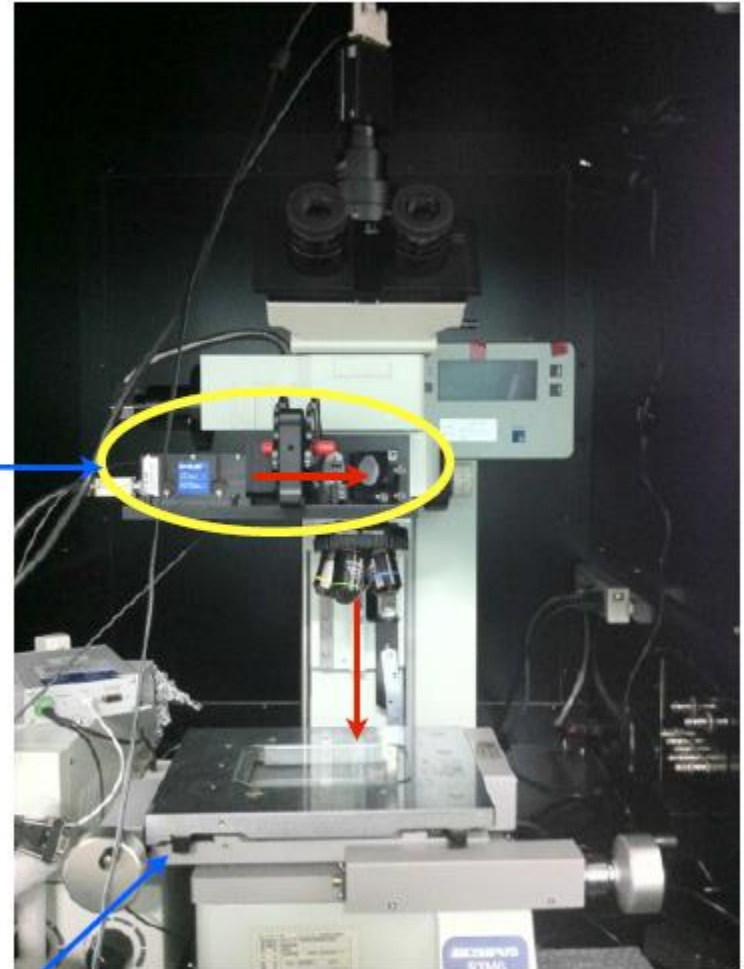
Peak power : > 13 kW

Repetition rate : 1 ~ 10k Hz

Interface of the control software



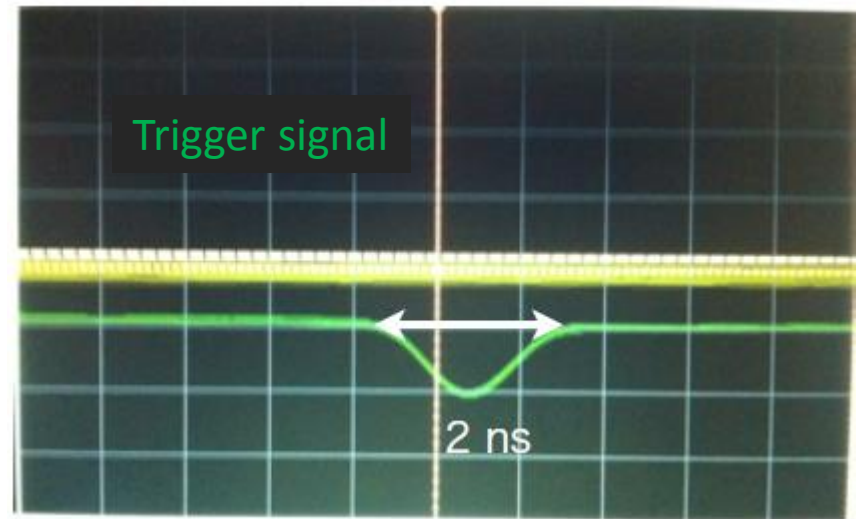
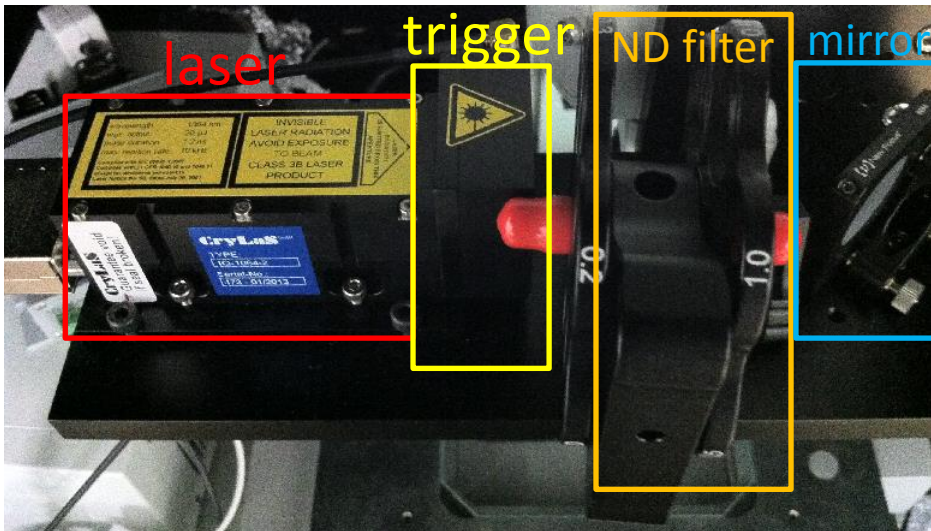
Laser  
Trigger  
ND filters  
mirror



x-y stage

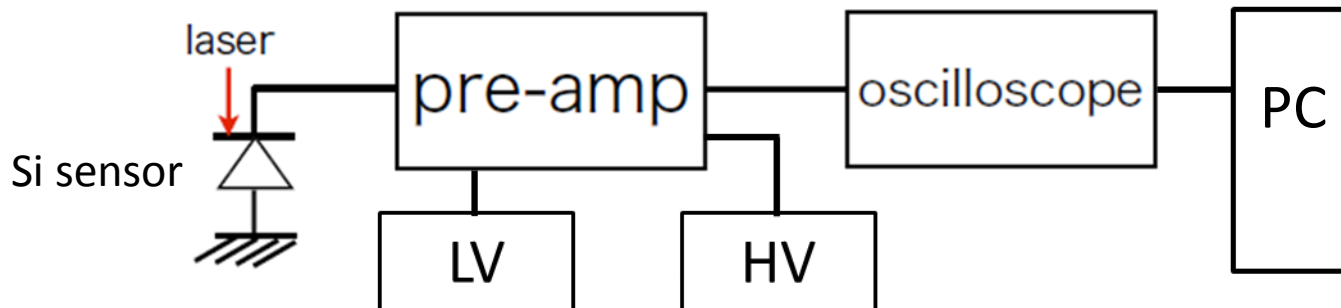
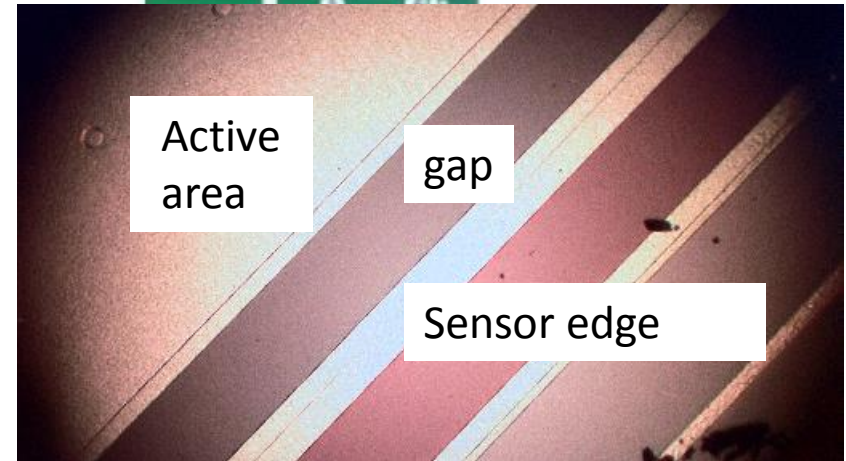
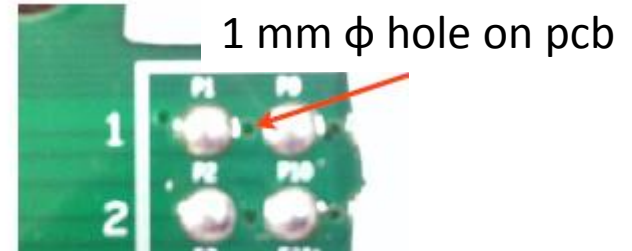
# Laser System contd.

- Trigger module attached just after laser module.
- We can reduced and control laser power with ND filters



# setup

- Bias  $V$  ranging 0 to 130 V
- Laser light is focused on gap between cell edge and sensor edge
- Read out signal from only one channel for now.  
(one of the corner edge)

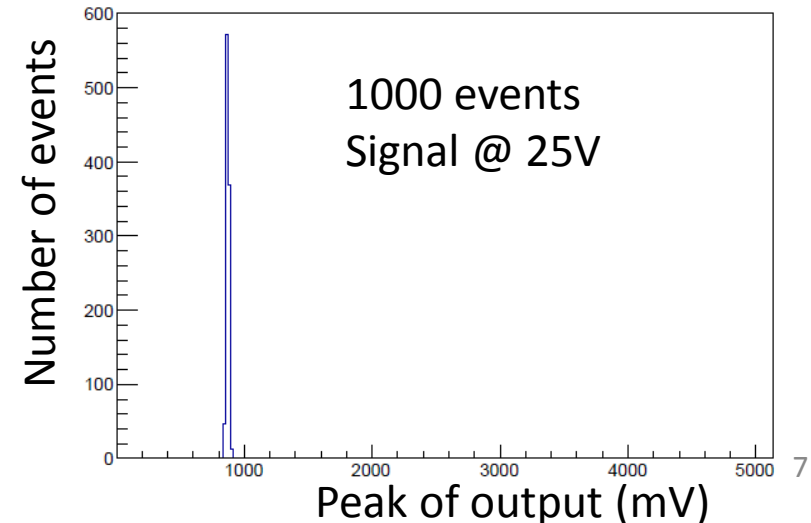
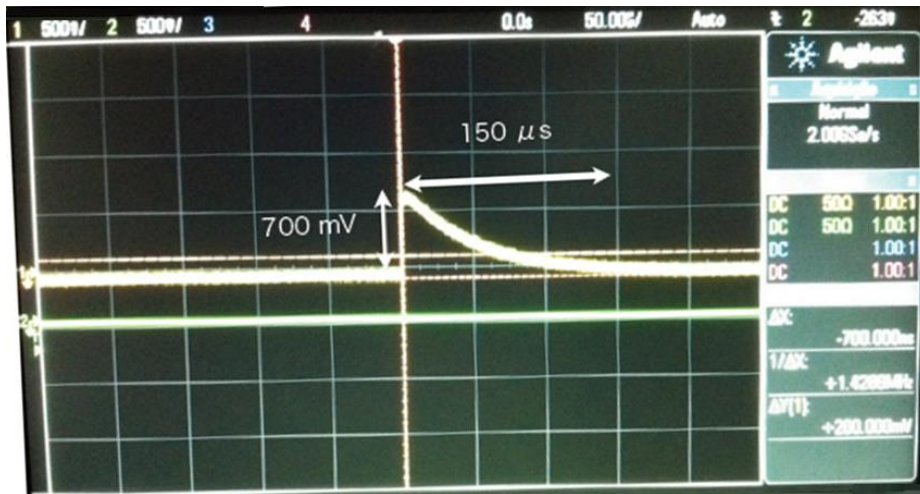


# Laser Signal

- We measured laser signal with oscilloscope
- Get peak value from each event
- Fit with gaussian
- Fluctuation of Peak value  $\sim 1\%$

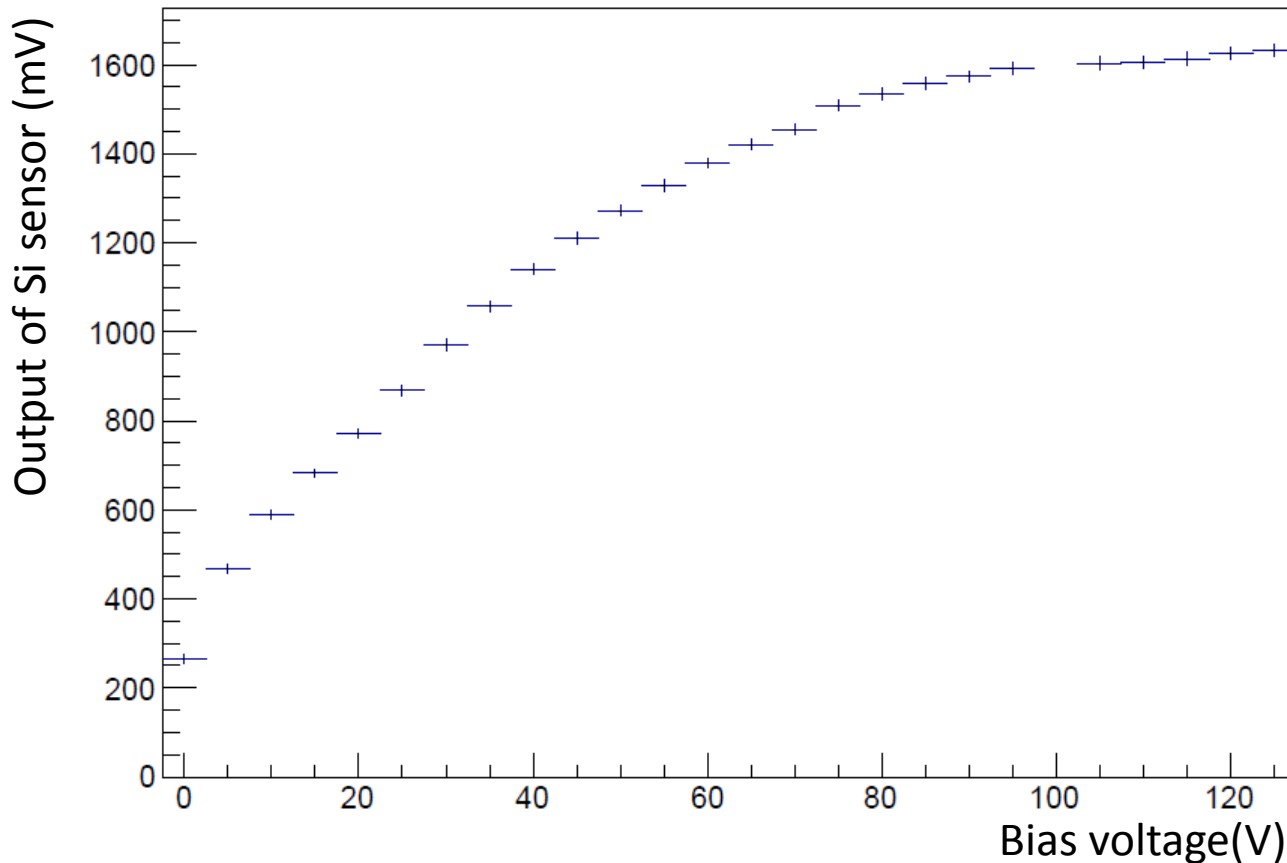


Active area      gap      Sensor edge



# result

- first result of our IR laser measurement system.  
(the system is still in preparation)
- Bias V scan ranging from 0 to 130 V
- 4x4 cell baby chip with no guard ring





## Summary

- We started Si sensor measurement with IR laser
- We can see IR laser signal from Si sensor
- Signal is saturated related to depth of depletion layer

## Plan

- Develop measurement system
- Multi pixel readout
- Design new PCB and circuit for IR laser measurement