GLD-MUON R/D
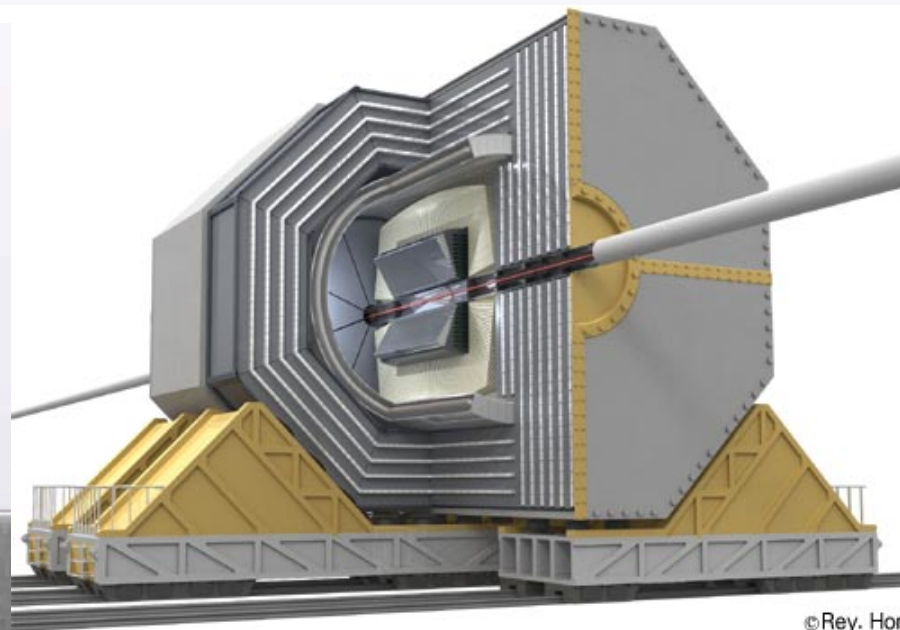
T.Takeshita for GLD @Snowmass 05

GLD-MUON system
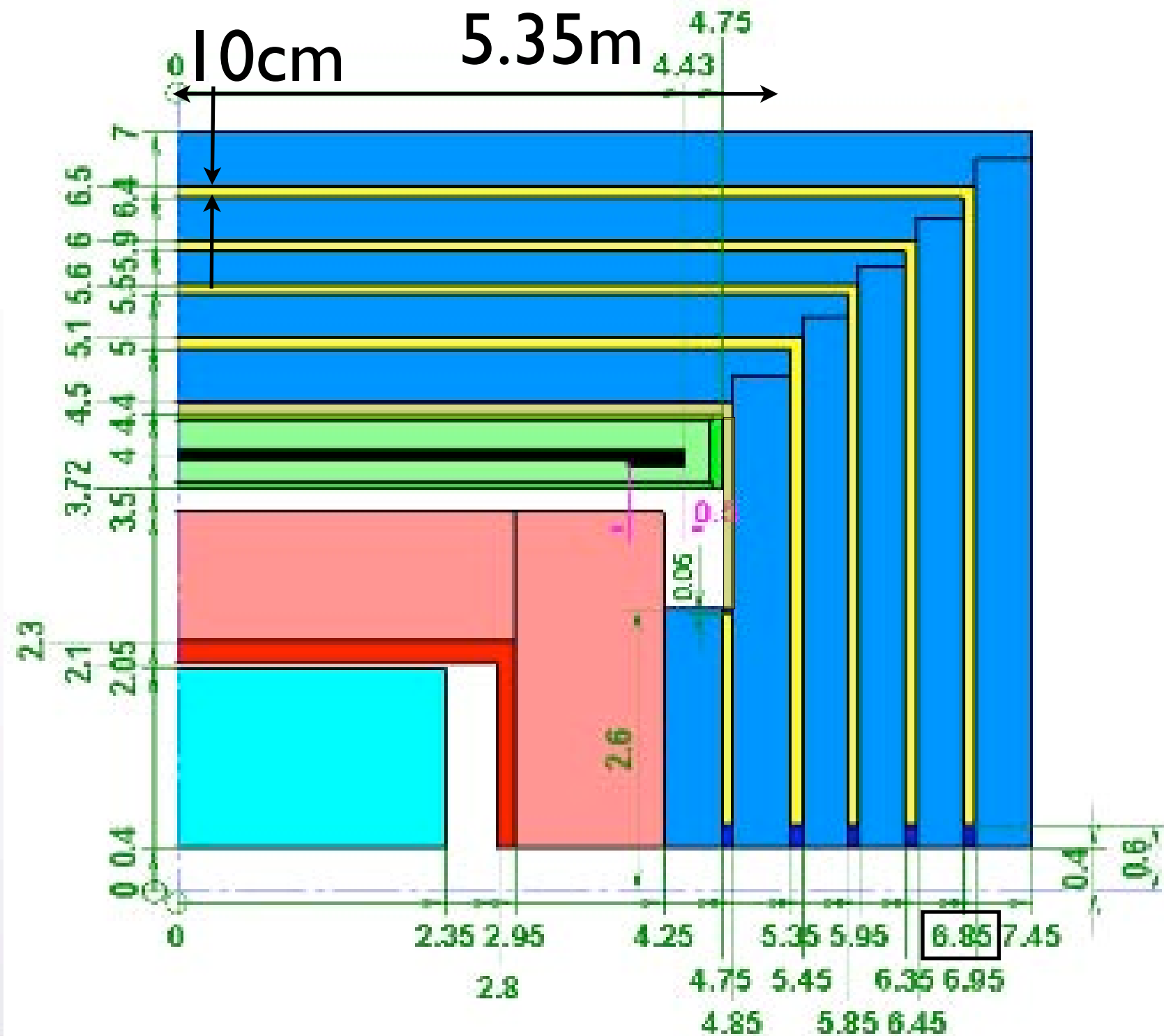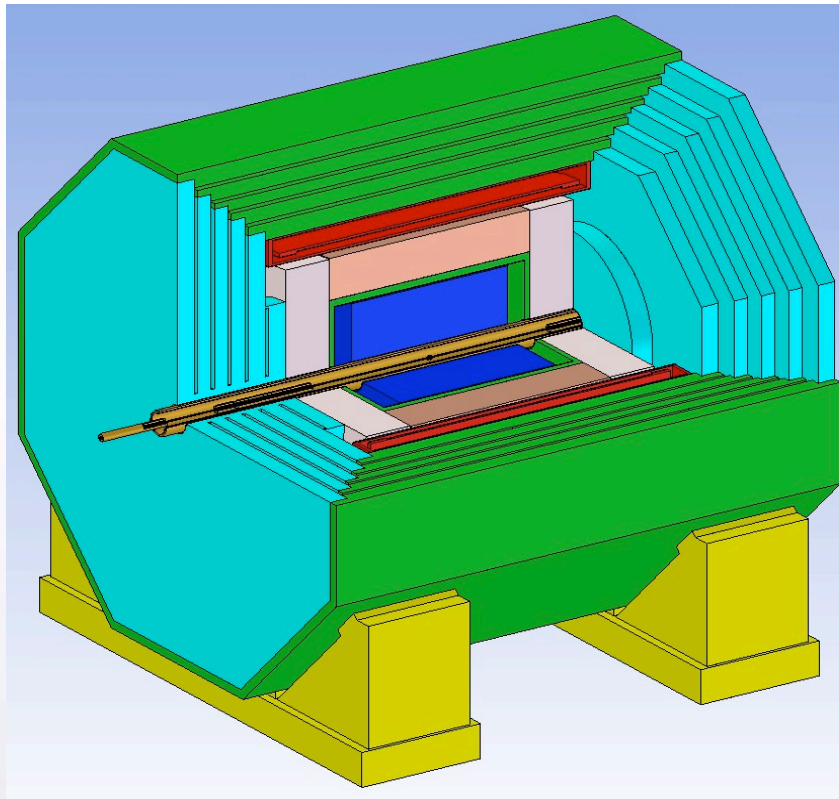## R/D results
scintillator and photon sensor
R/D needed

©Rey. Hori

GLD detector

10cm   5.35m

GLD-MUON : system

scintillator bars + MPC

barrel module

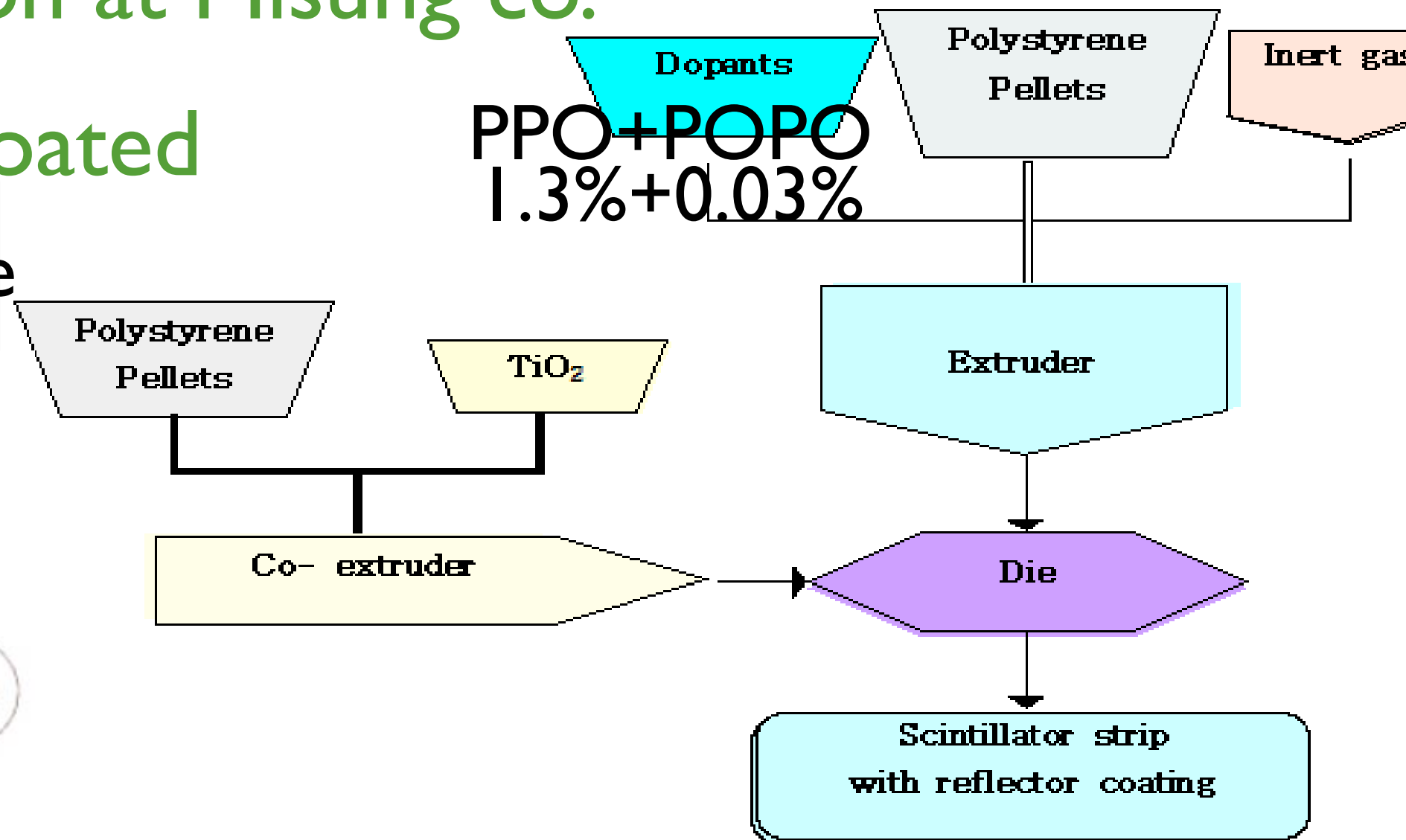endcap module

10cm>X

~5cm

5.6k bars

4.5 ~ 6.5m

4.5 ~ 7m

3.2k bars
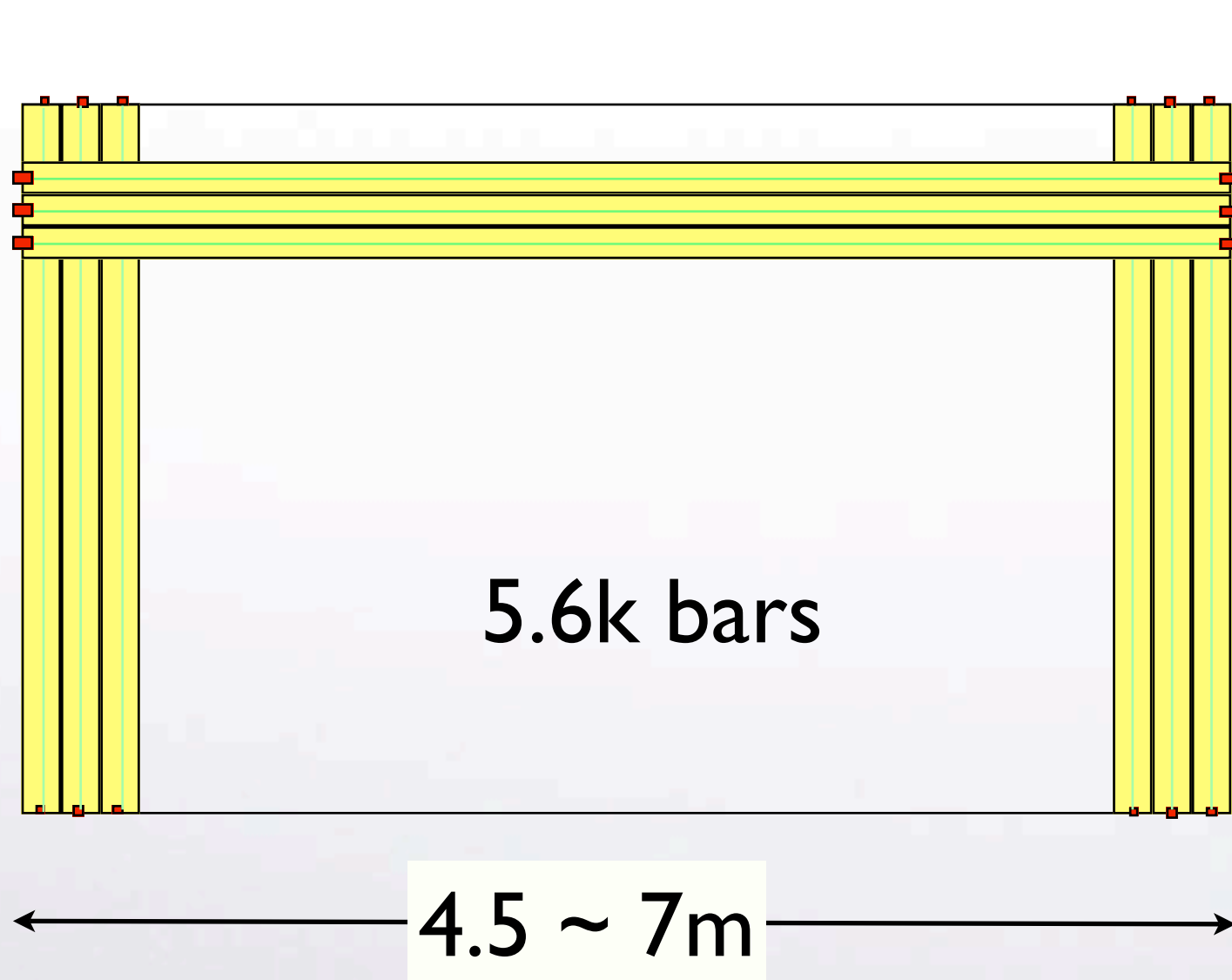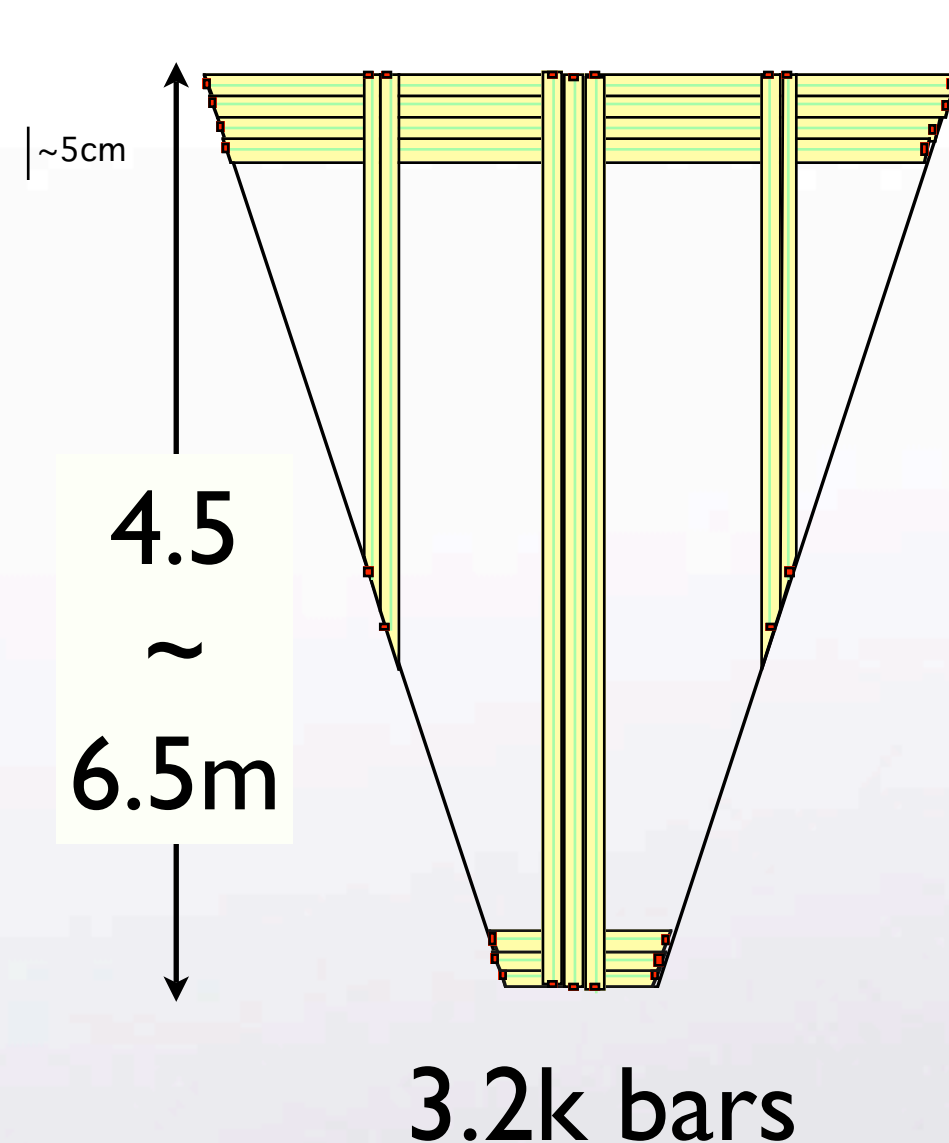
GLD-MUON : scintillator R/D

- scintillator bar R/D at Kyungpook N. U.

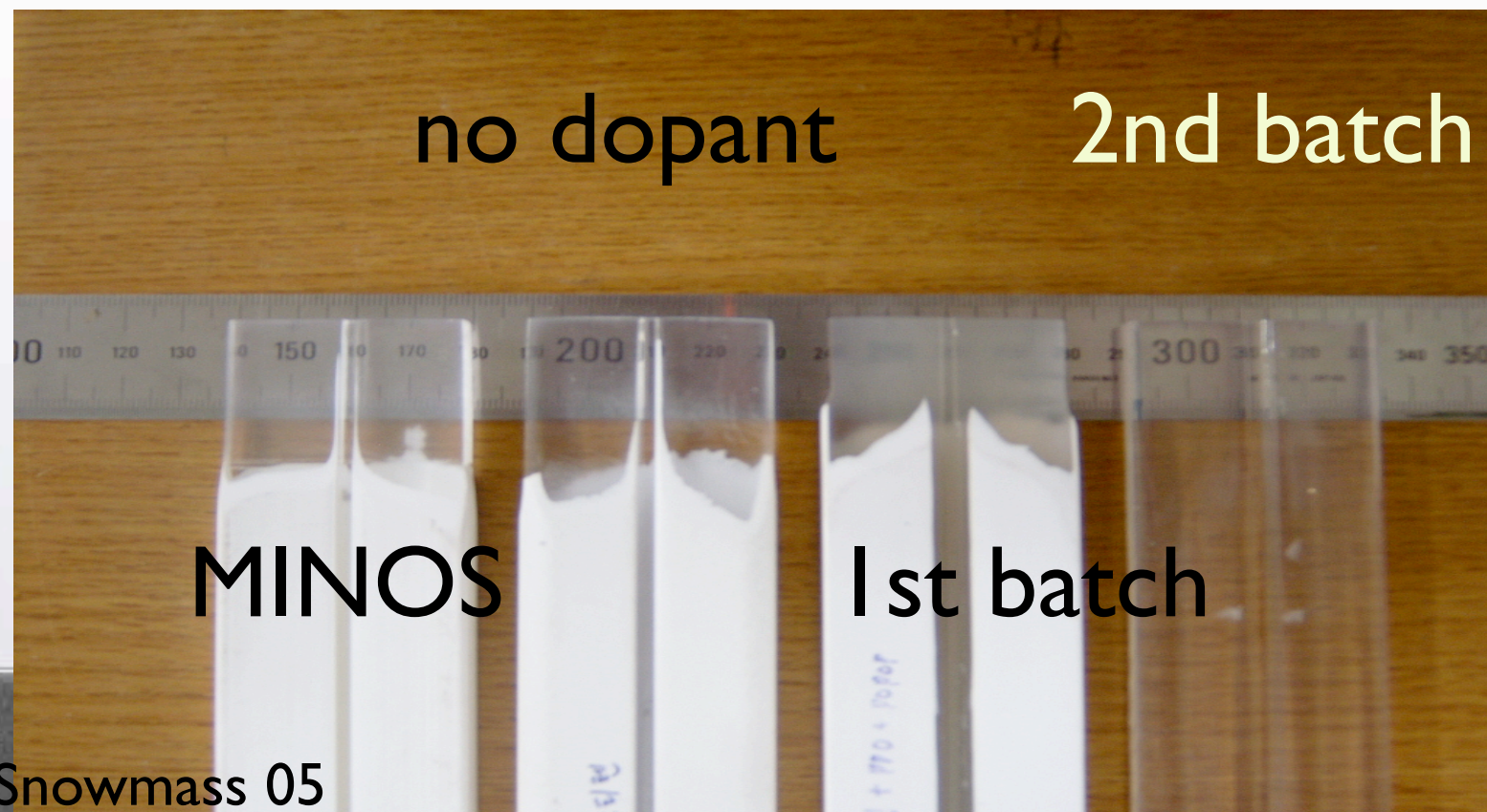- production at Misung co.

  - TiO2 coated

extrusion machine

PPO+POPO
1.3%+0.03%

Dopants

Polystyrene
Pellets

Inert gas

Polystyrene
Pellets

TiO$_2$

Extruder

Co- extruder

Die

Scintillator strip
with reflector coating

- Progress

Evolution

no dopant   2nd batch
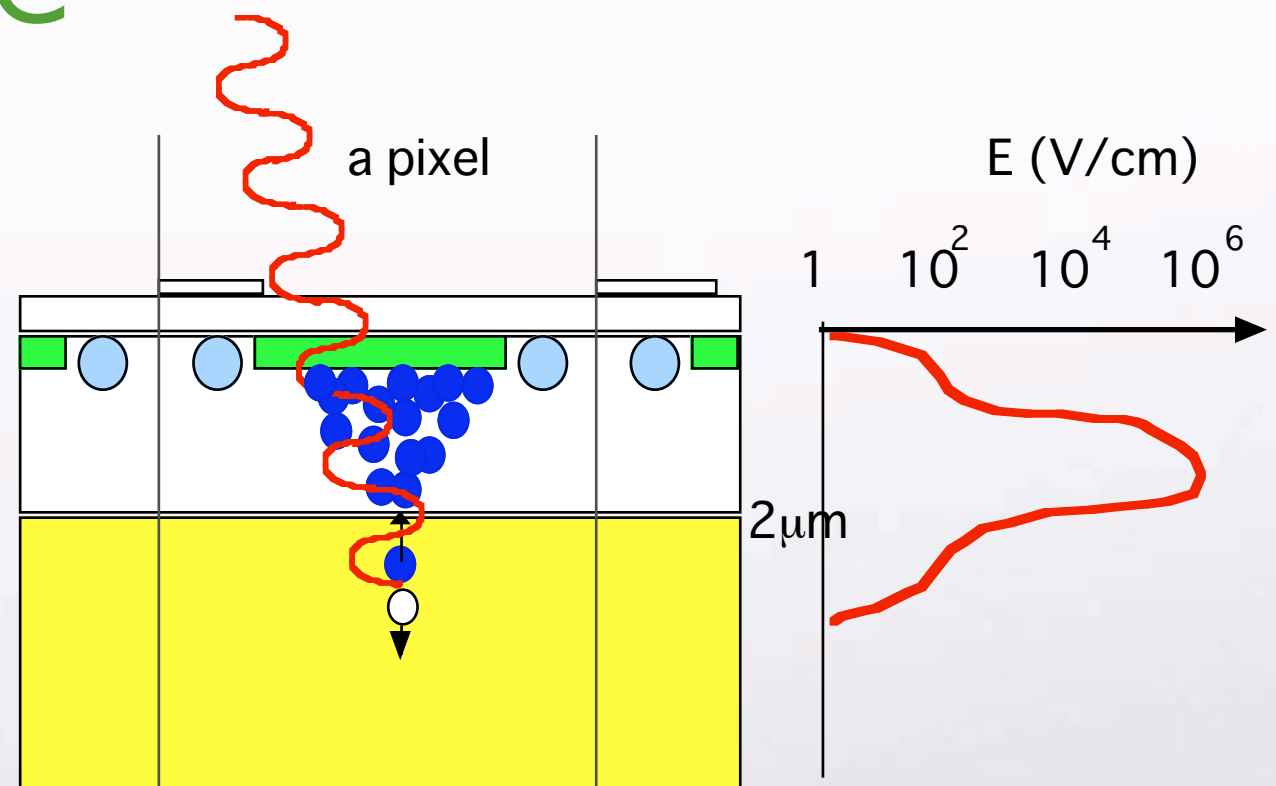
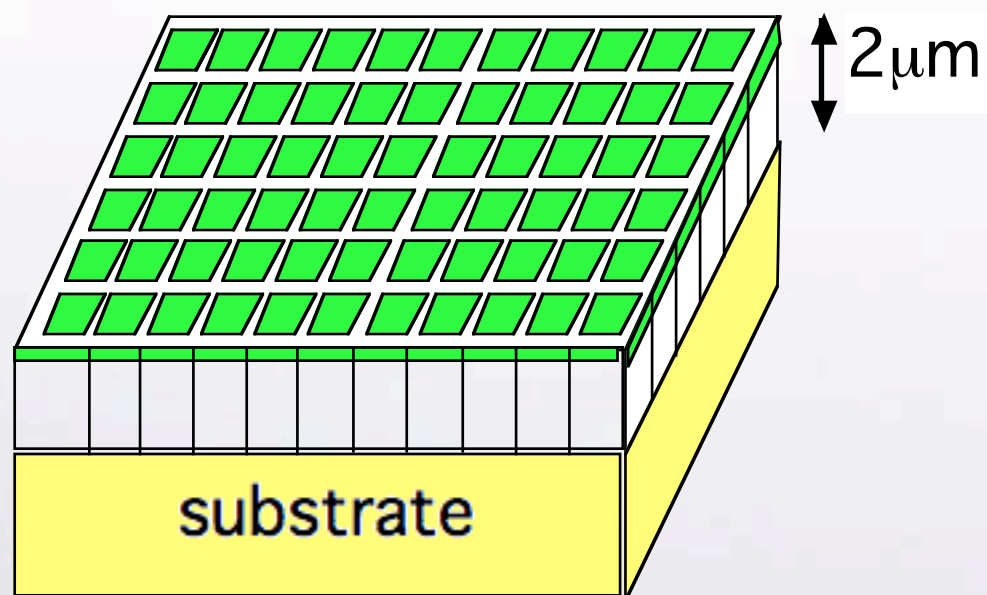MINOS   1st batch

- ## Progress and study

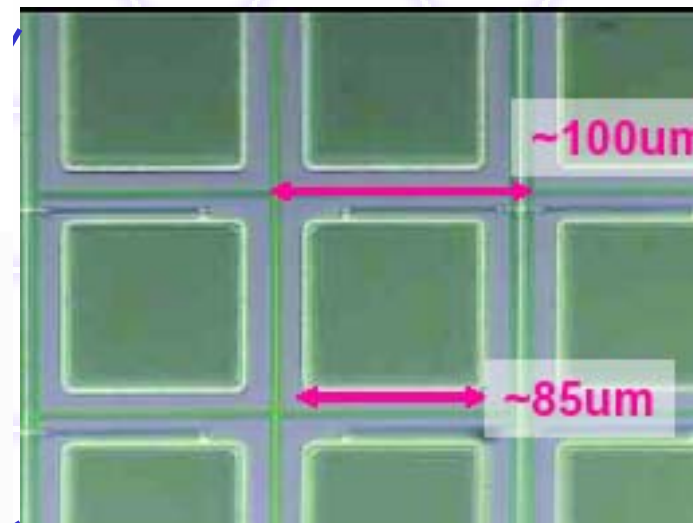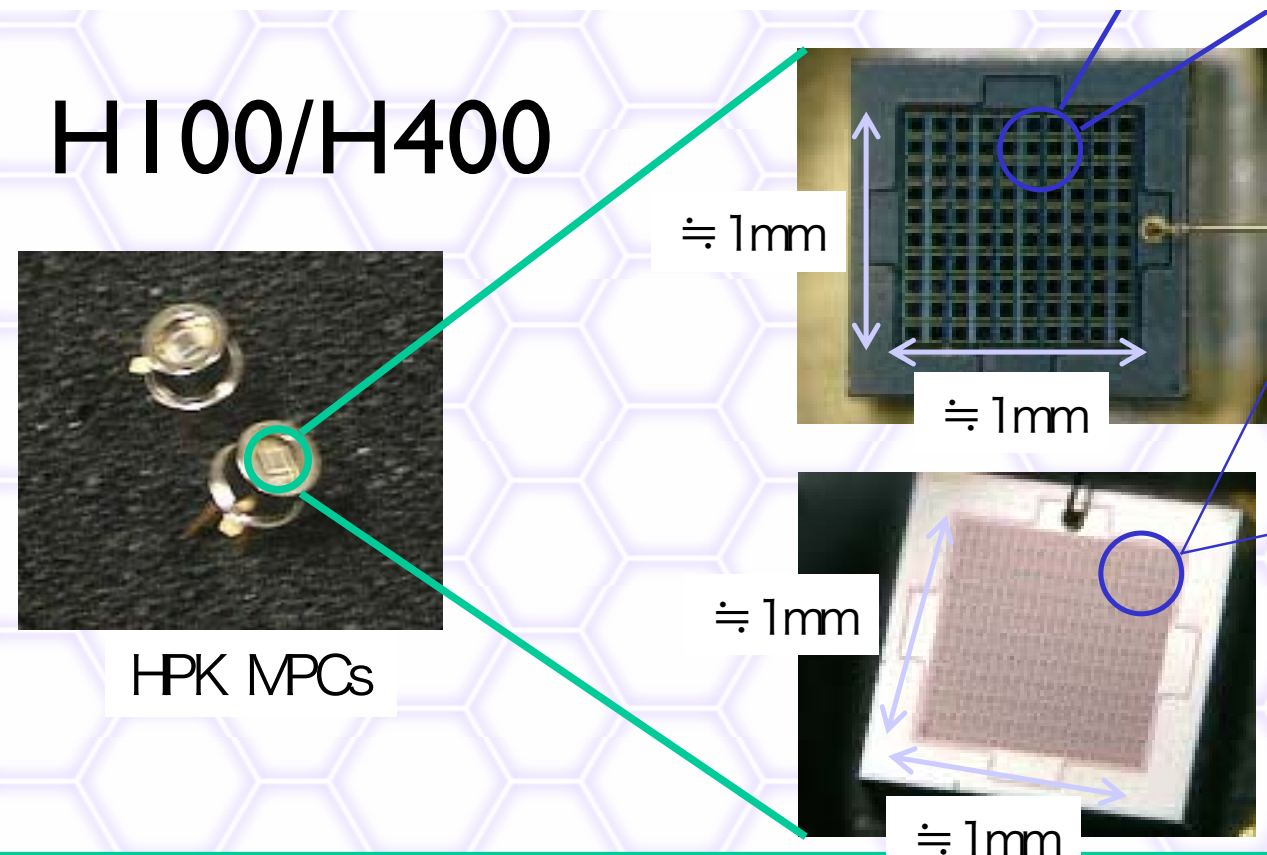relative light yield
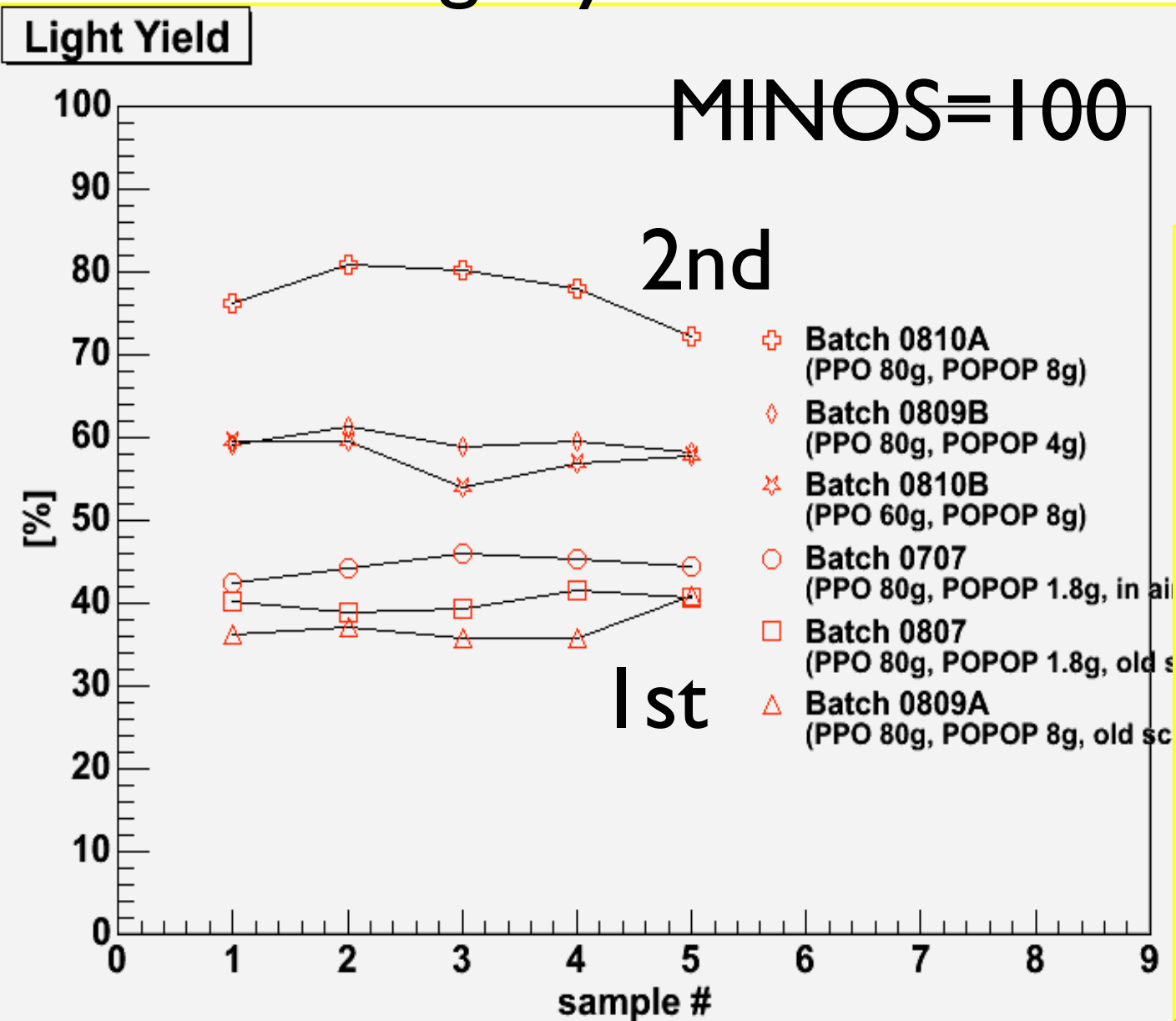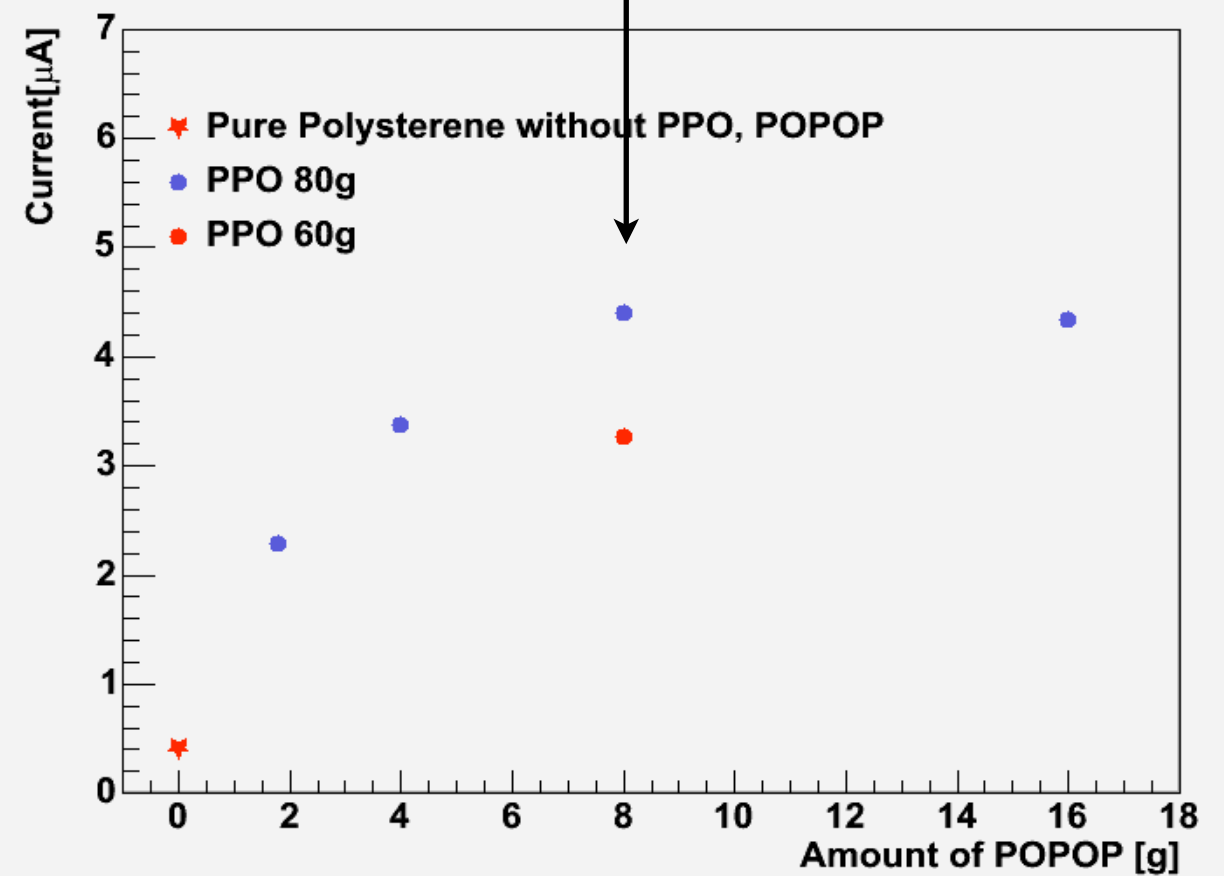
GLD-MUON : photon sensor R/D

- detector is in the magnetic filed of 3T

- photon sensor at the both ends of scintillator

- we need small and semi-conductor photon sensor
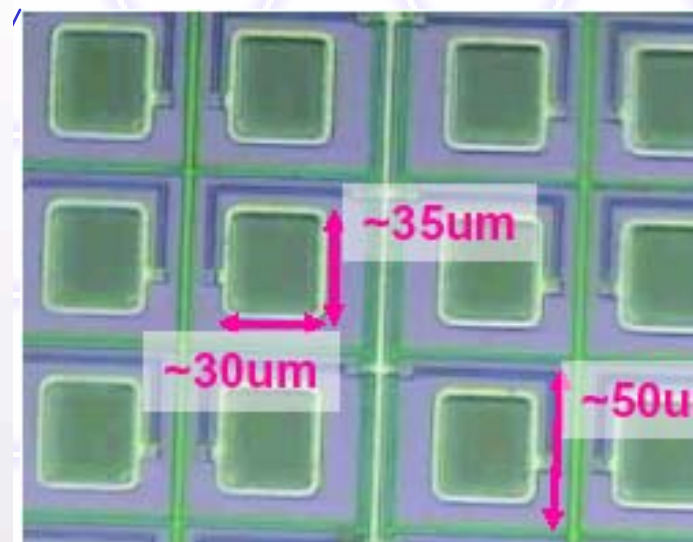
- candidate is SiPM or MPC

GLD-MUON : photon sensor R/D

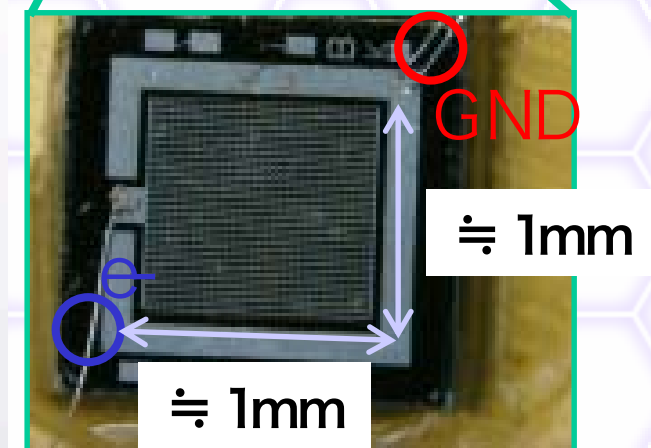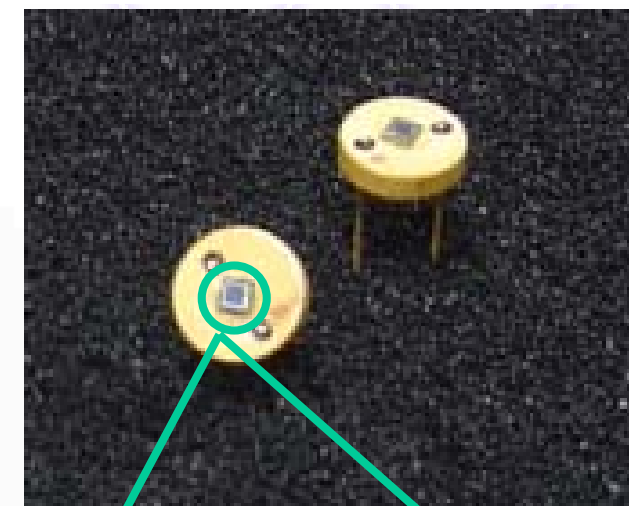- test samples : MPC(H100,H400) Multipixel Photon Counter   and SiPM(R1156)

R1156

H100/H400

HPK MPCs

≒1mm
≒1mm
≒1mm
≒1mm

~100um
~85um

100pix <100μm>

~35um
~30um
~50um

400pix <50μm>

GND
e⁻
≒1mm
≒1mm

Pictures of Russian SiPM

GLD-MUON : photon sensor R/D

- Photon Counting capability
  - at room temperature

R1156_63.2V

R1156
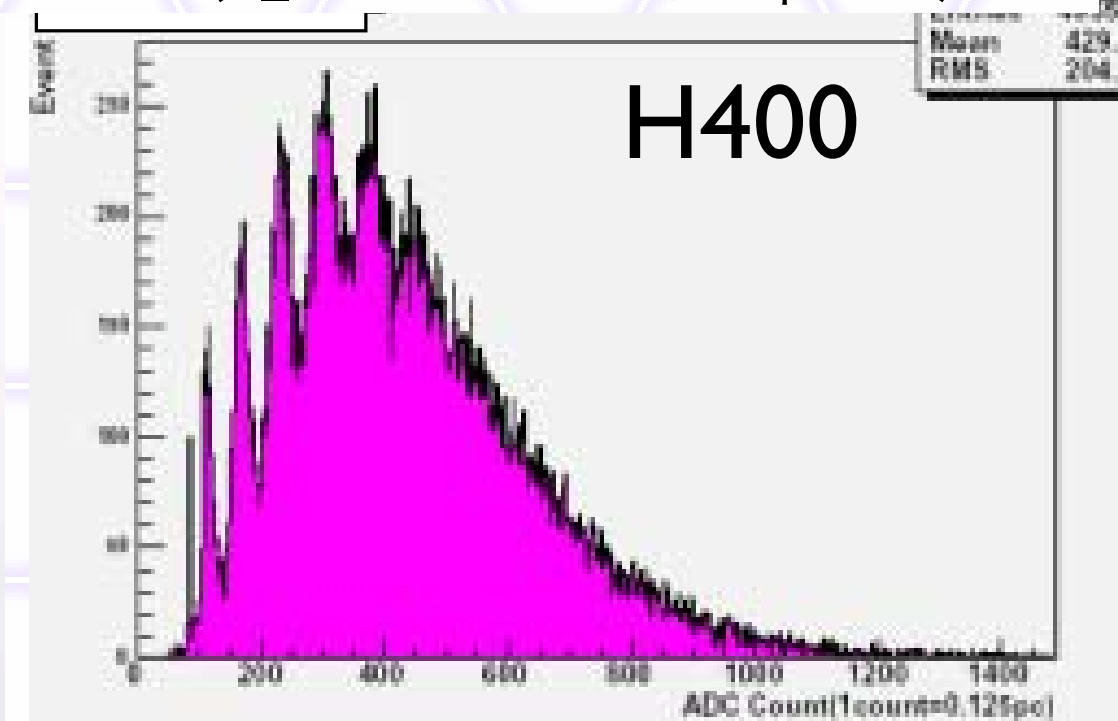
H100_49.1V

H100

ADC-dist.
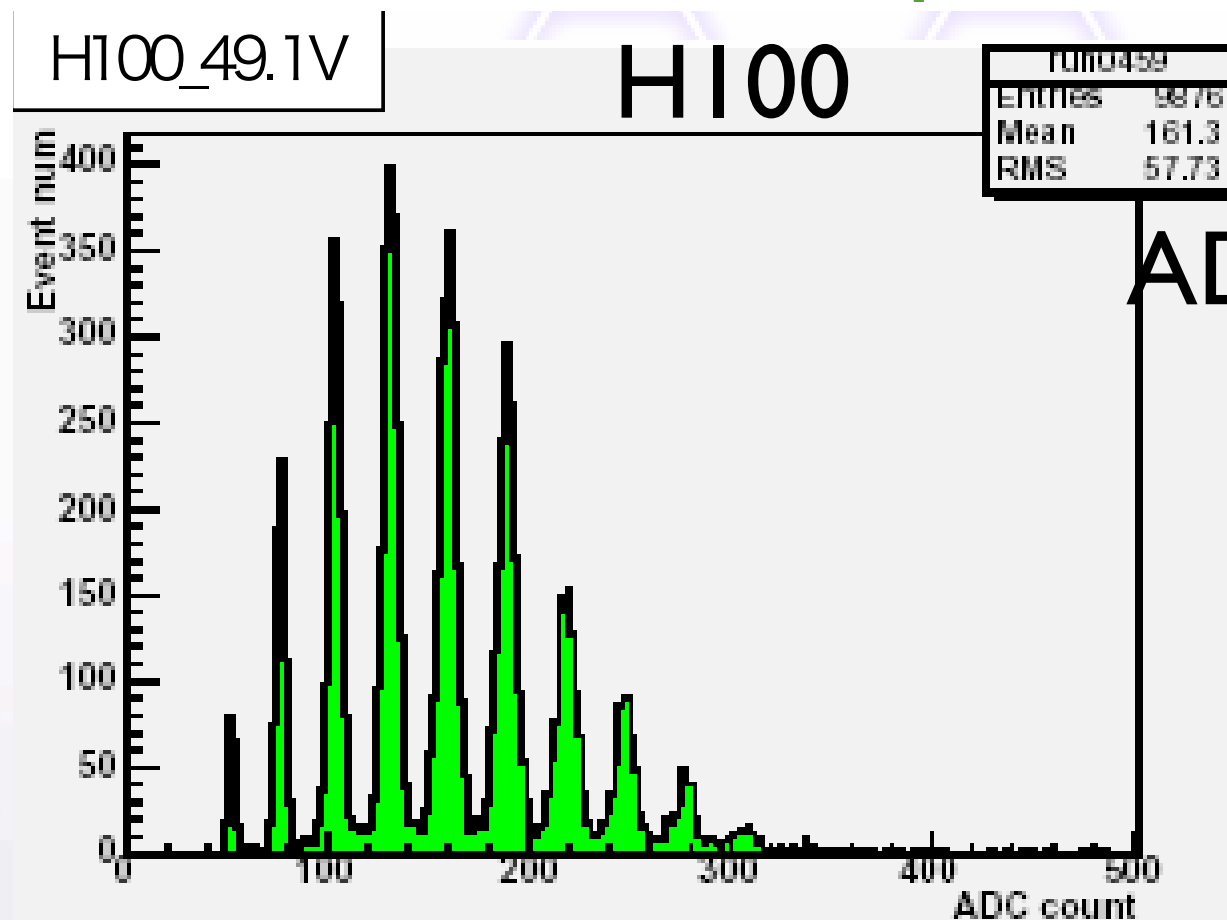
H100 (V_B=49.1V, T=20C, no AMP)

H100 is excellent
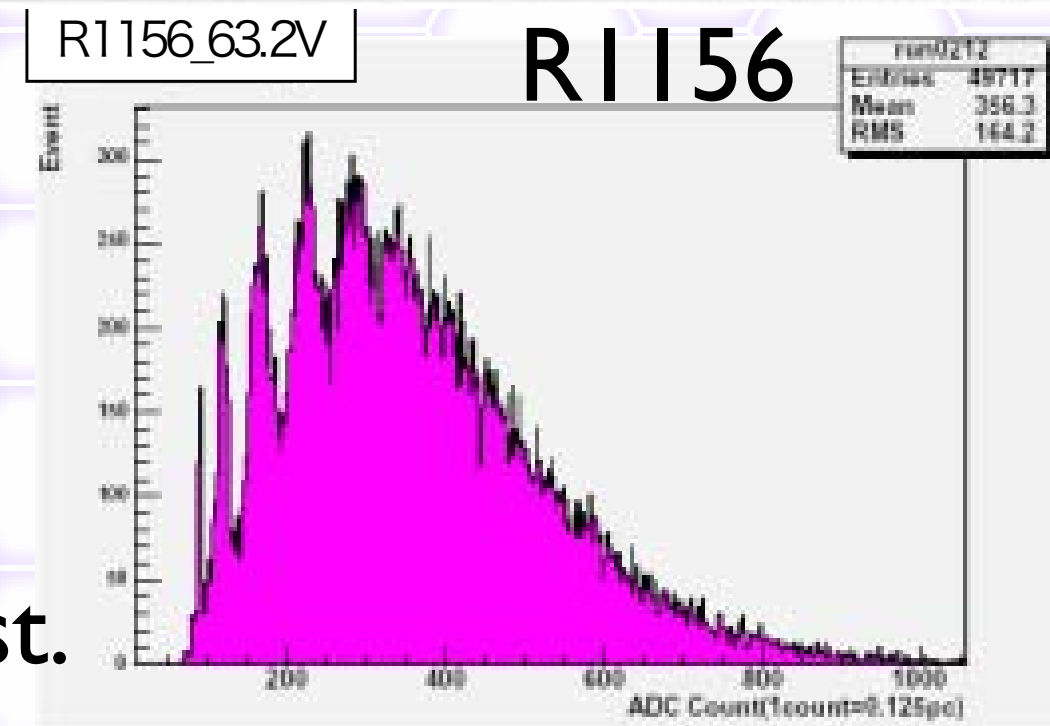
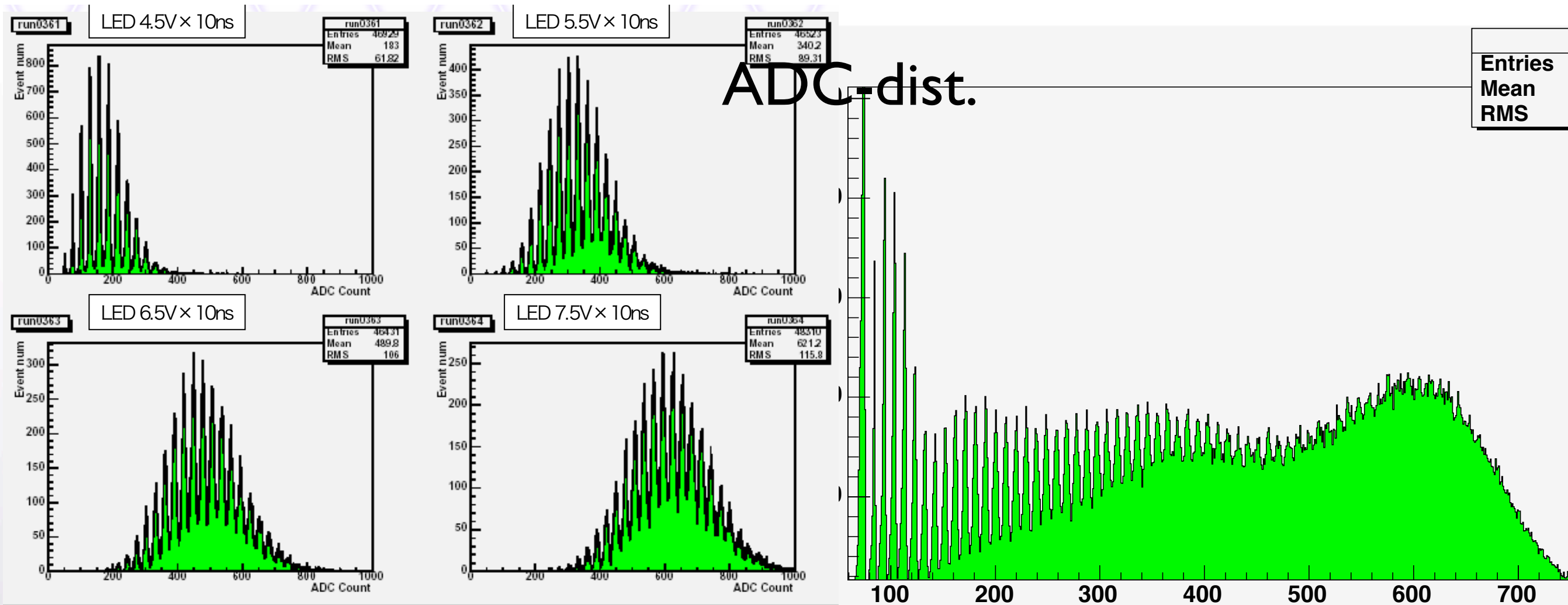R1156 (V_B=63.2V, T=20C, Amp Used)

H400

H400 (V_B=48.8V T=20C, Amp Used)

GLD-MUON : photon sensor R/D

- MPC H100 photon counting capability

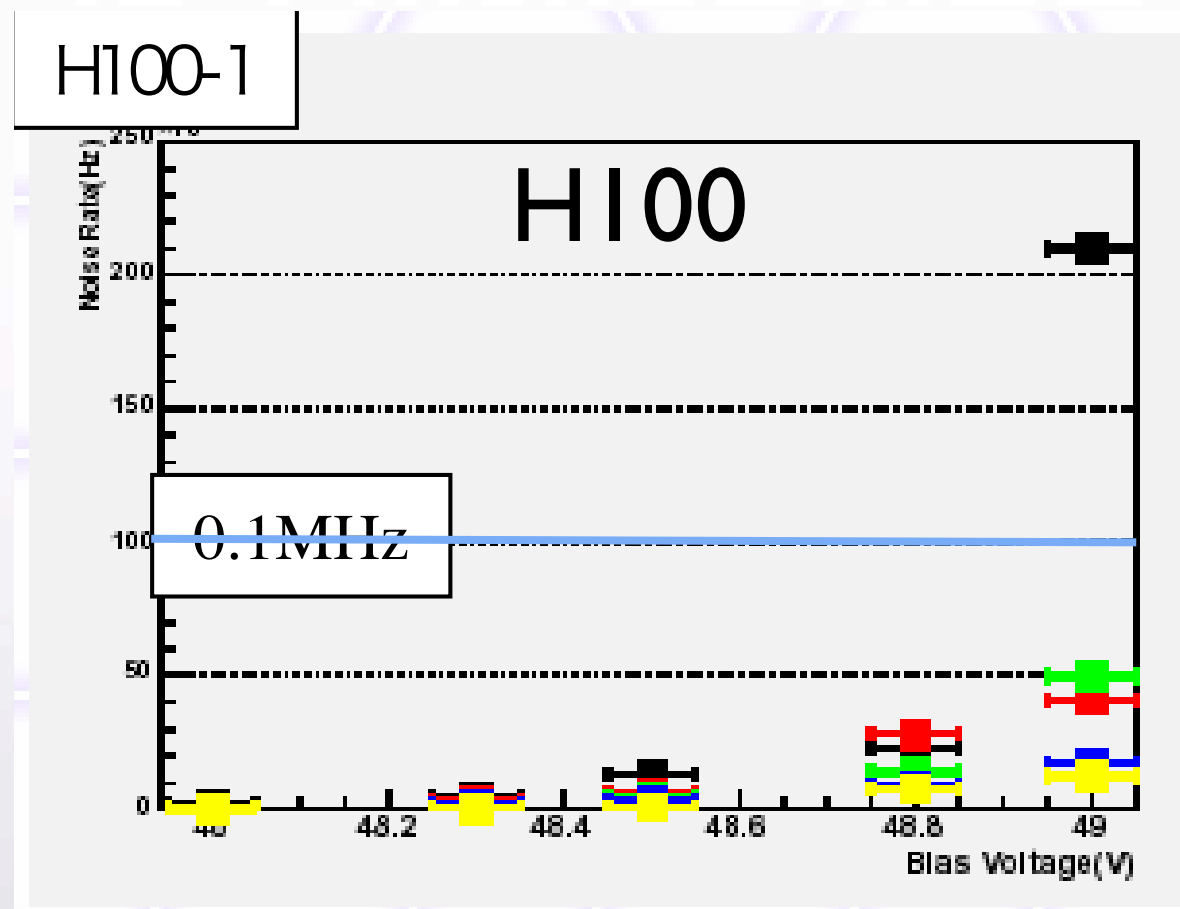different led drive voltages   changing led pulse width
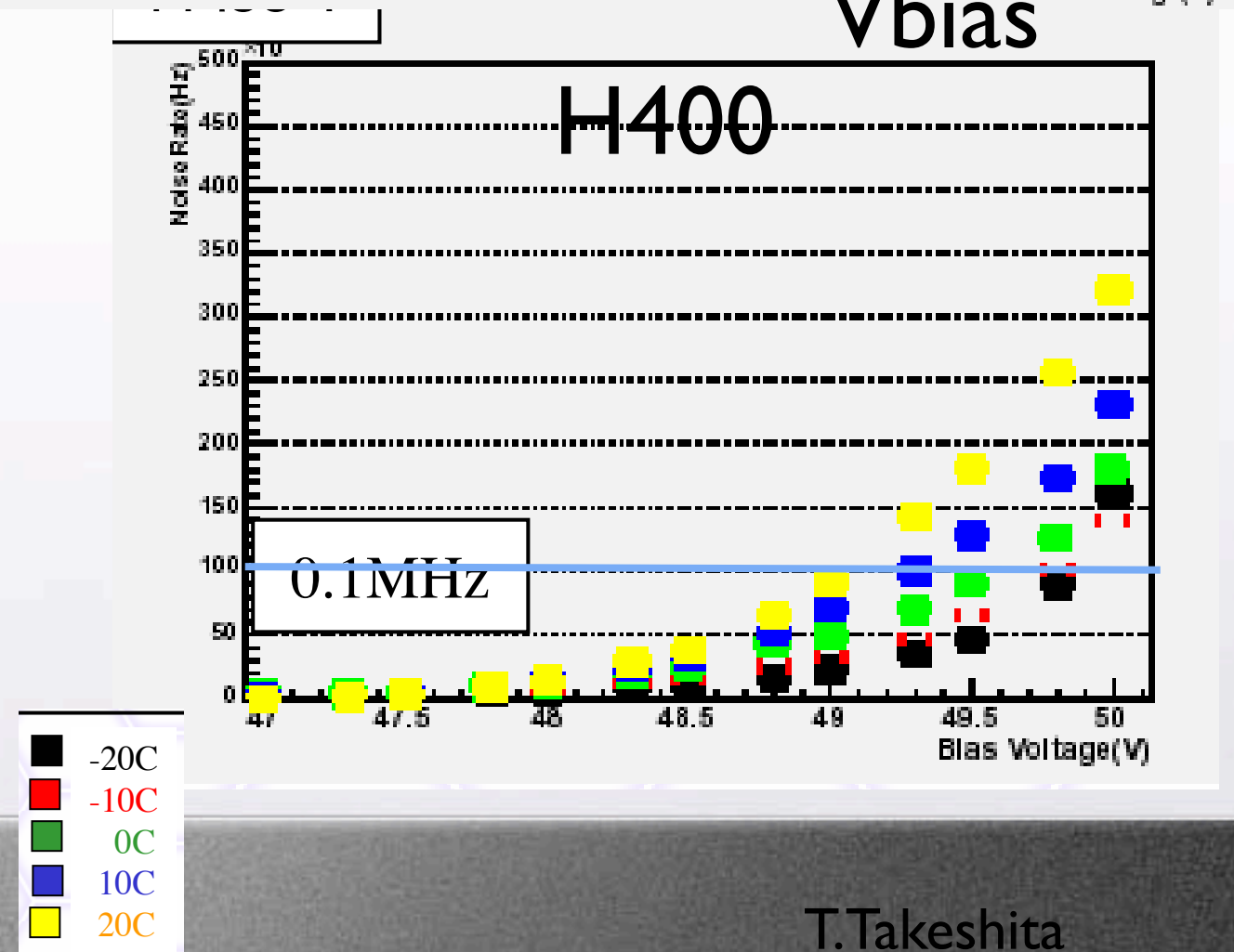

up to ~40 photons or pixels   up to ~60

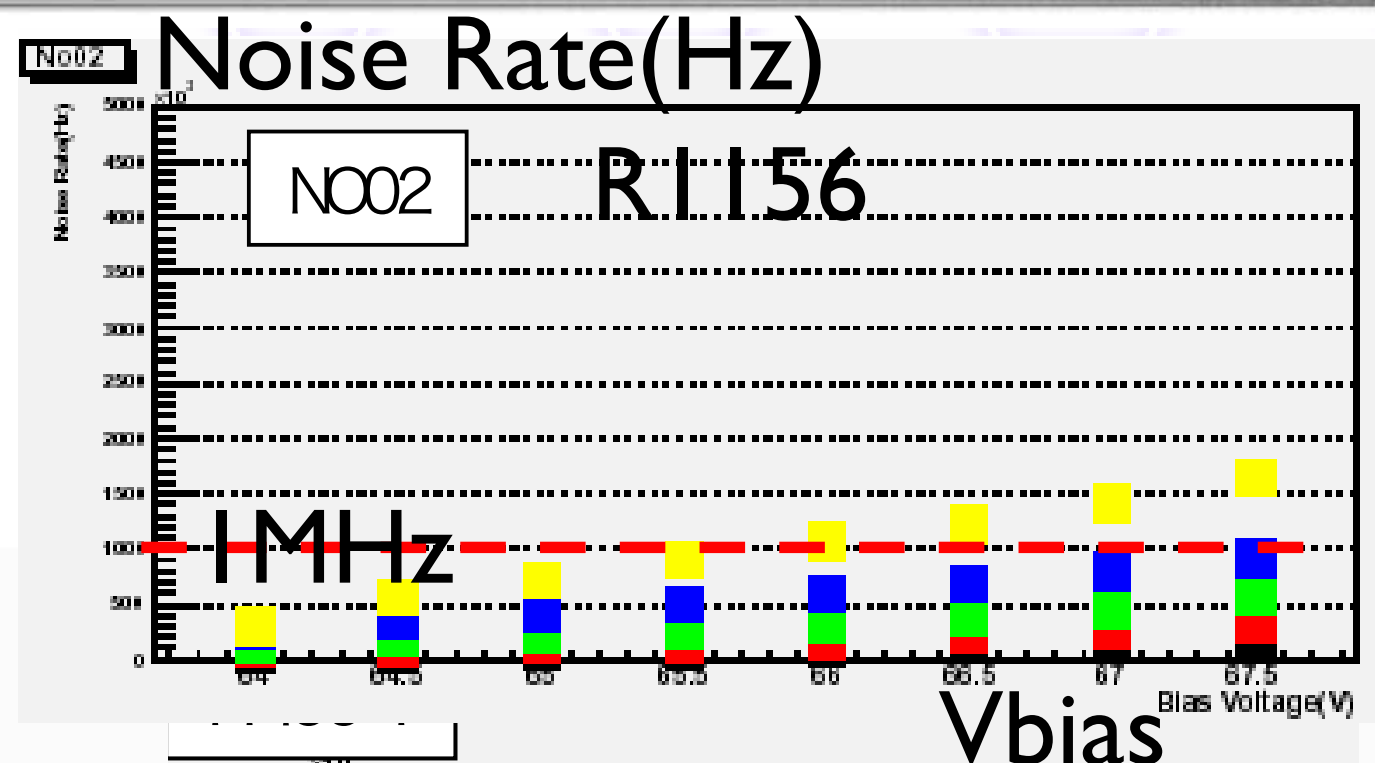# GLD-MUON : photon sensor R/D

- Noise rate

  - -30mV threshold

  - with amp (x200)

Noise Rate(Hz)
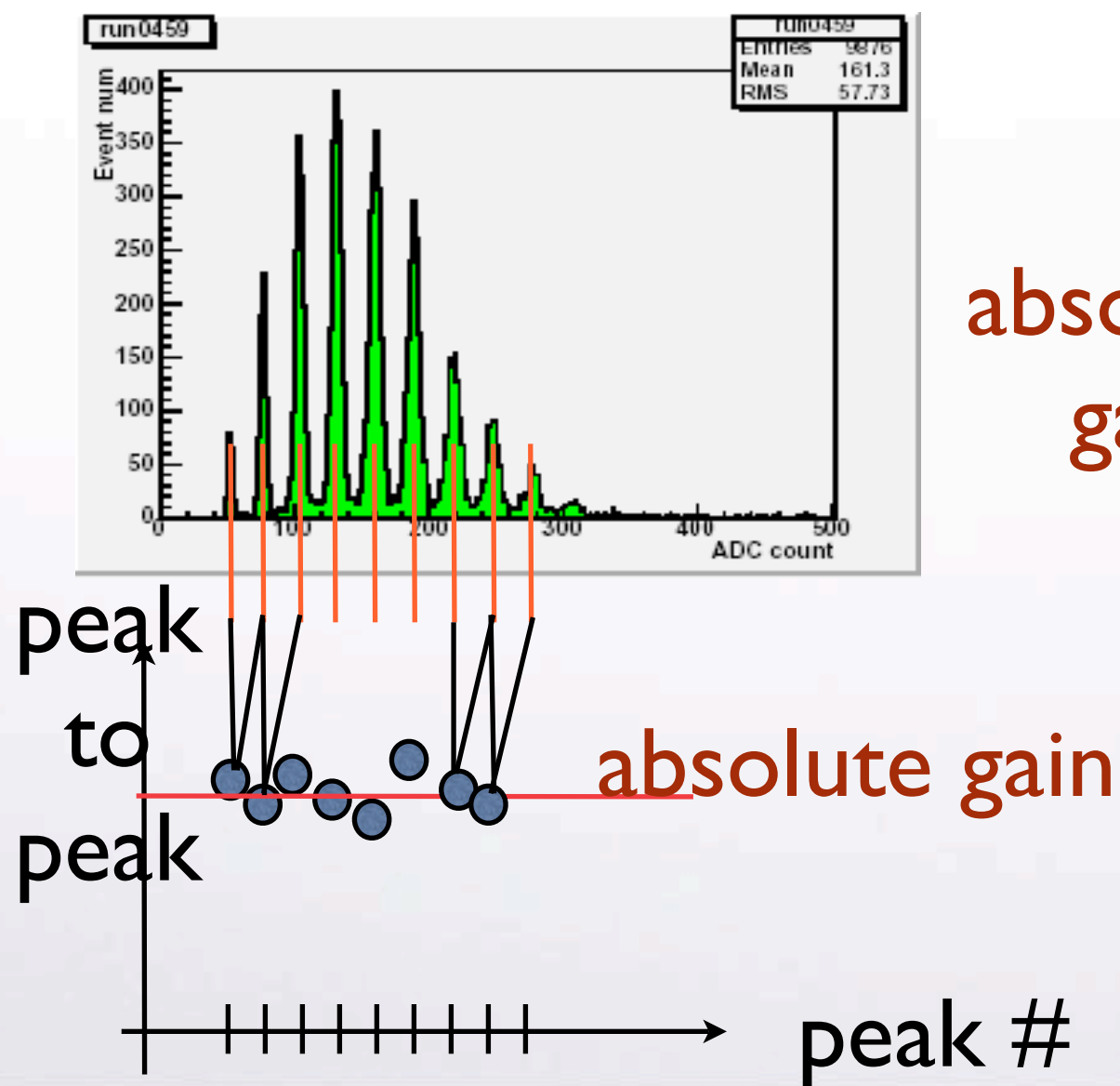
R1156

1MHz

Vbias

H100-1

H100

0.1MHz

MPC's are calm

H400

0.1MHz

■	-20C
■	-10C
■	0C
■	10C
■	20C

photon sensor R/D cont.

- absolute gain for H100   gain~2 x 10^7

ADC dist.

peak to peak

absolute gain

peak #
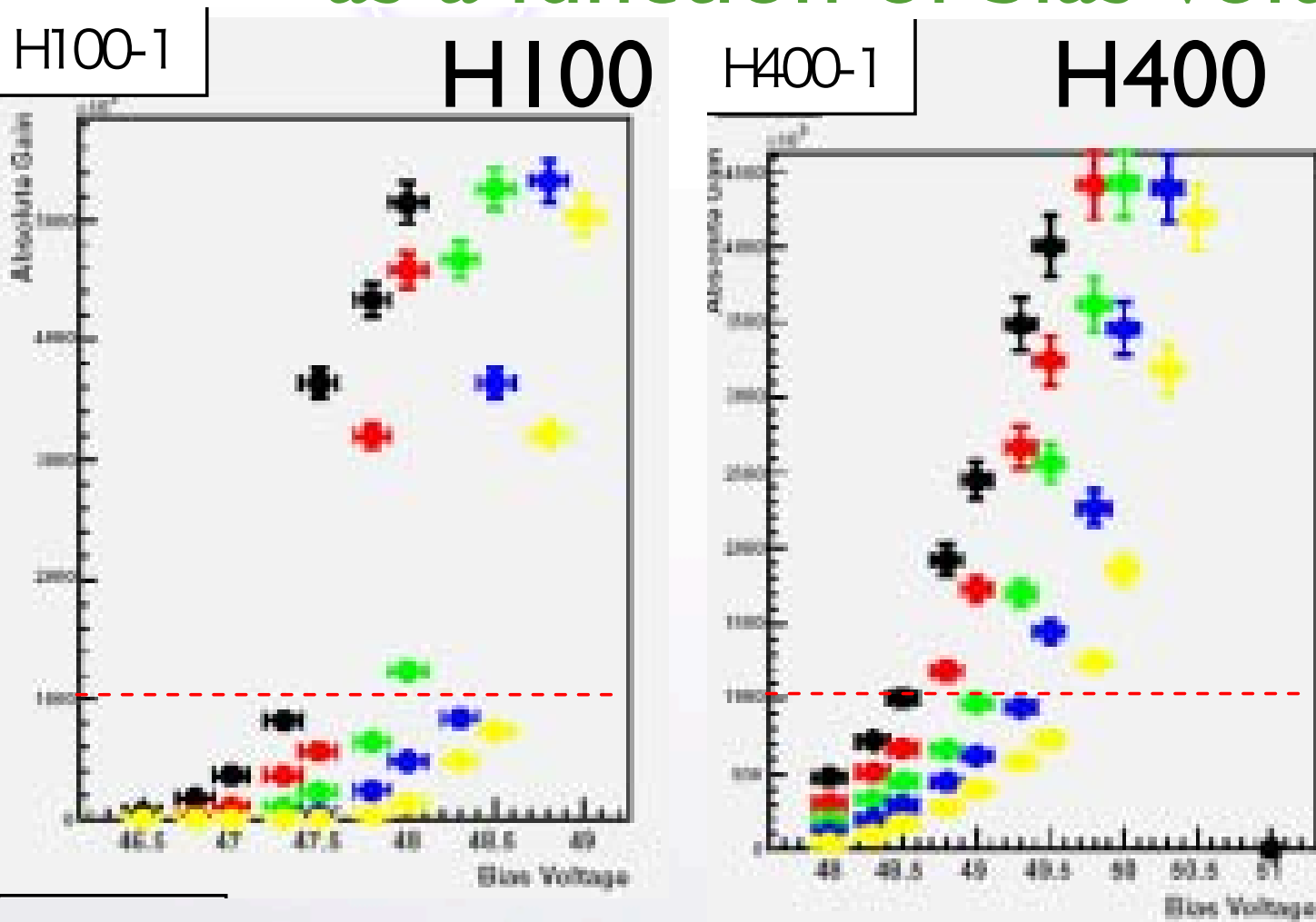

absolute gain
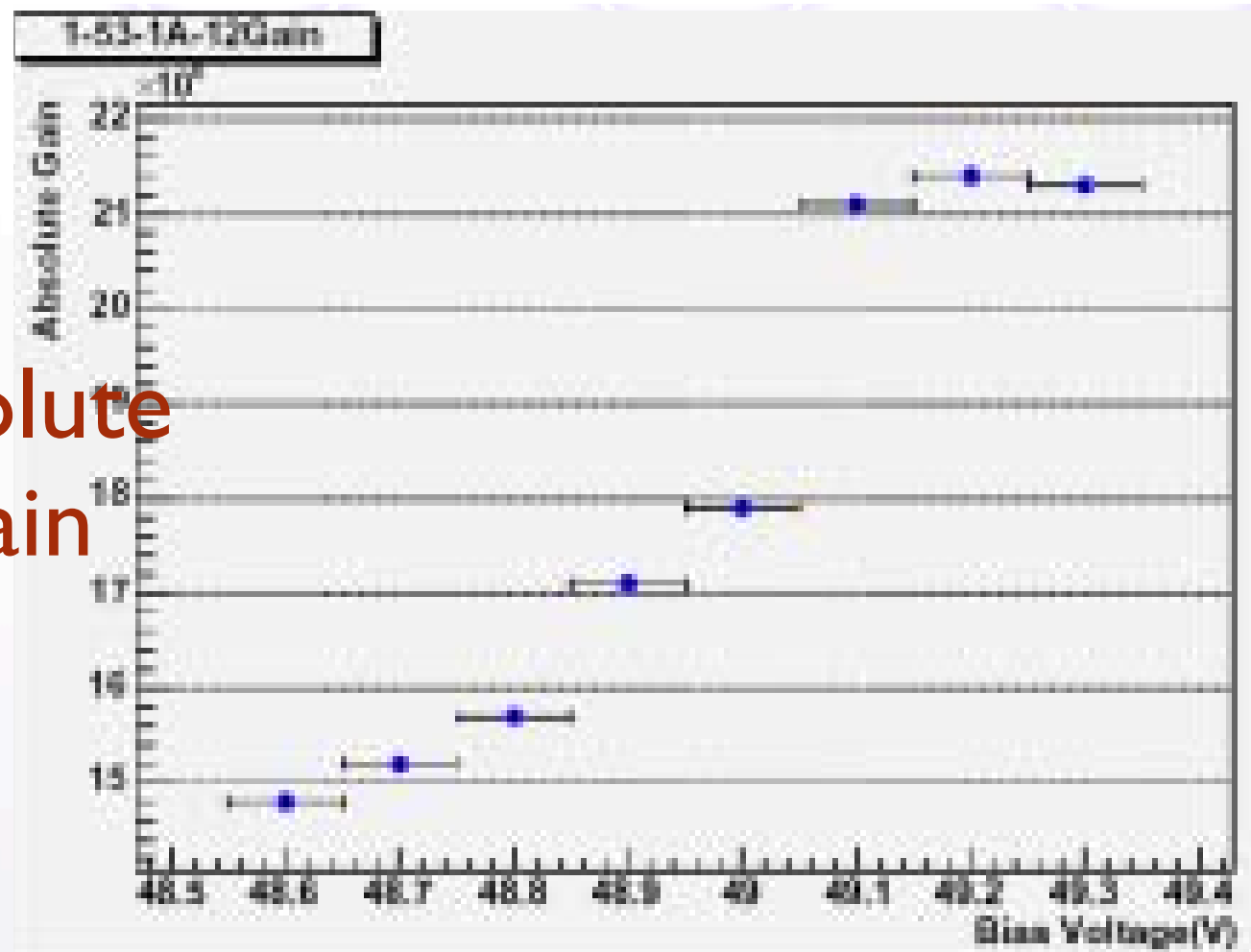
Gain vs Bias Voltage (Temperature 20C)

Vbias

photon sensor R/D cont.

- gain vs temperature

  - as a function of bias voltage

H100-1 **H100** H400-1 **H400** **R1154**

gain

10^6

■	-20C
■	-10C
■	0C
■	10C
■	20C

higher gain at lower temp.
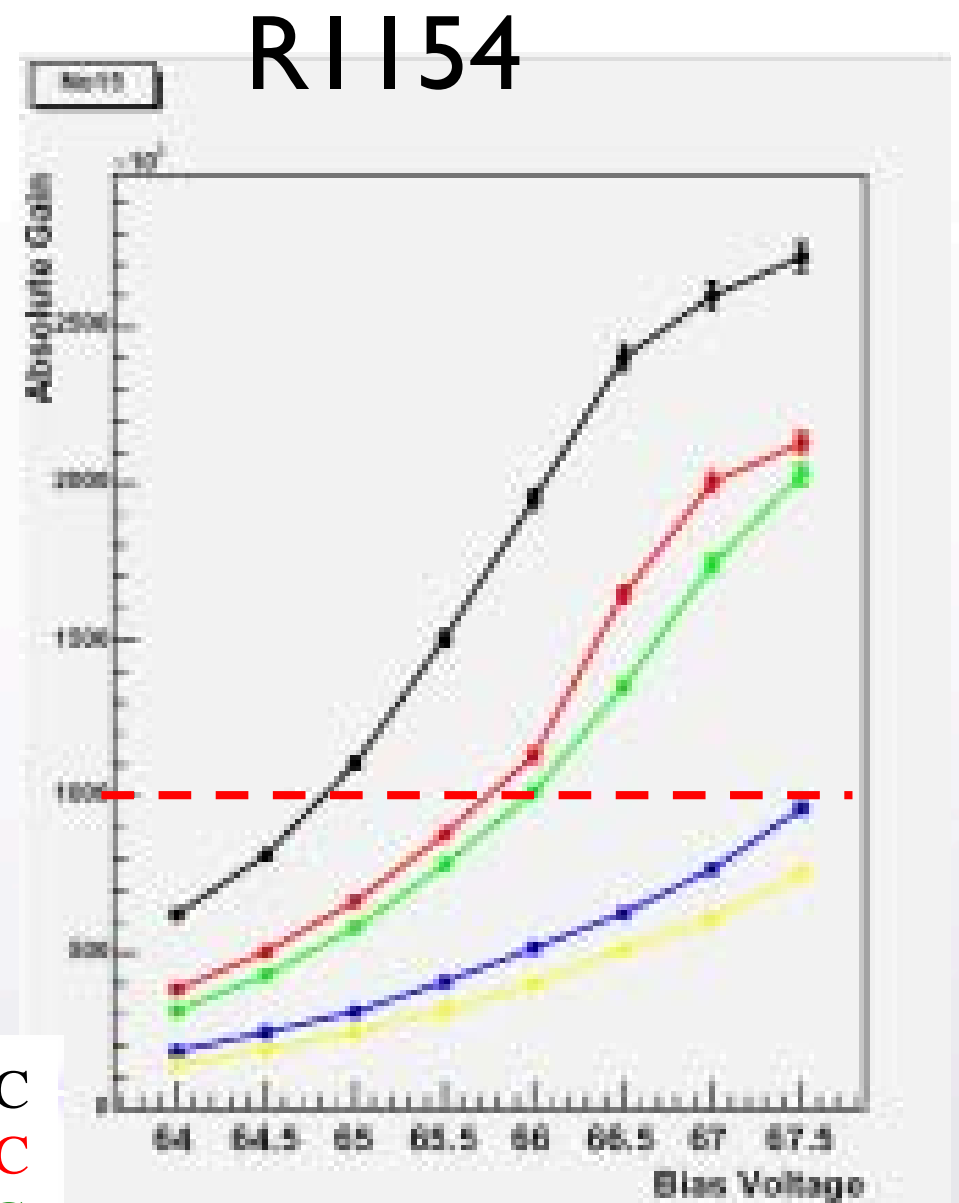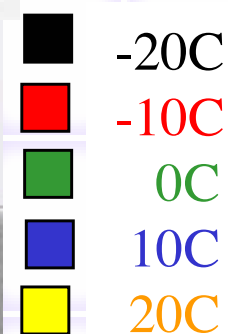
photon sensor R/D cont.

- pixel to pixel test by laser photon 532nm

YAG Laser

Position distribution(HPK 100pixel No.1)
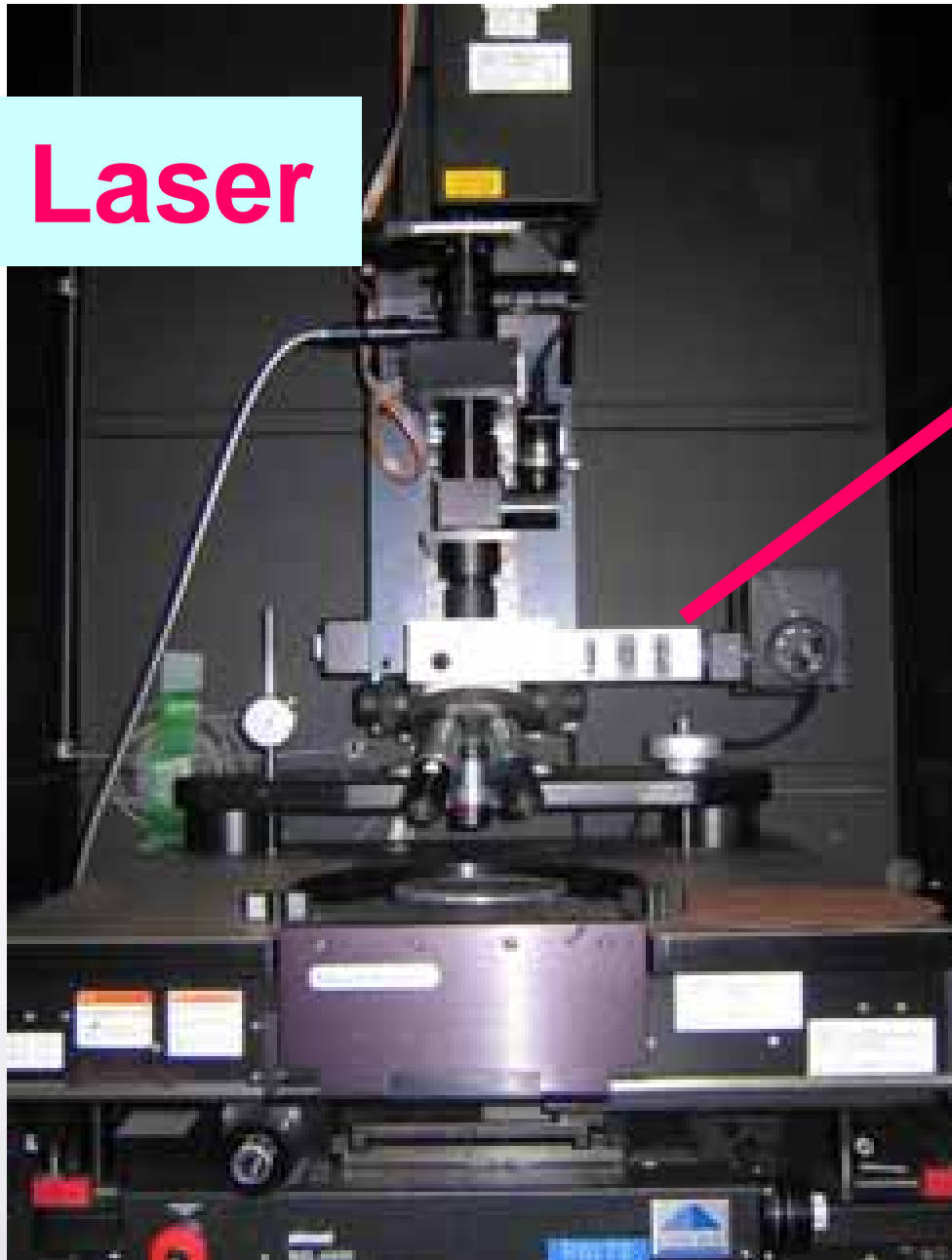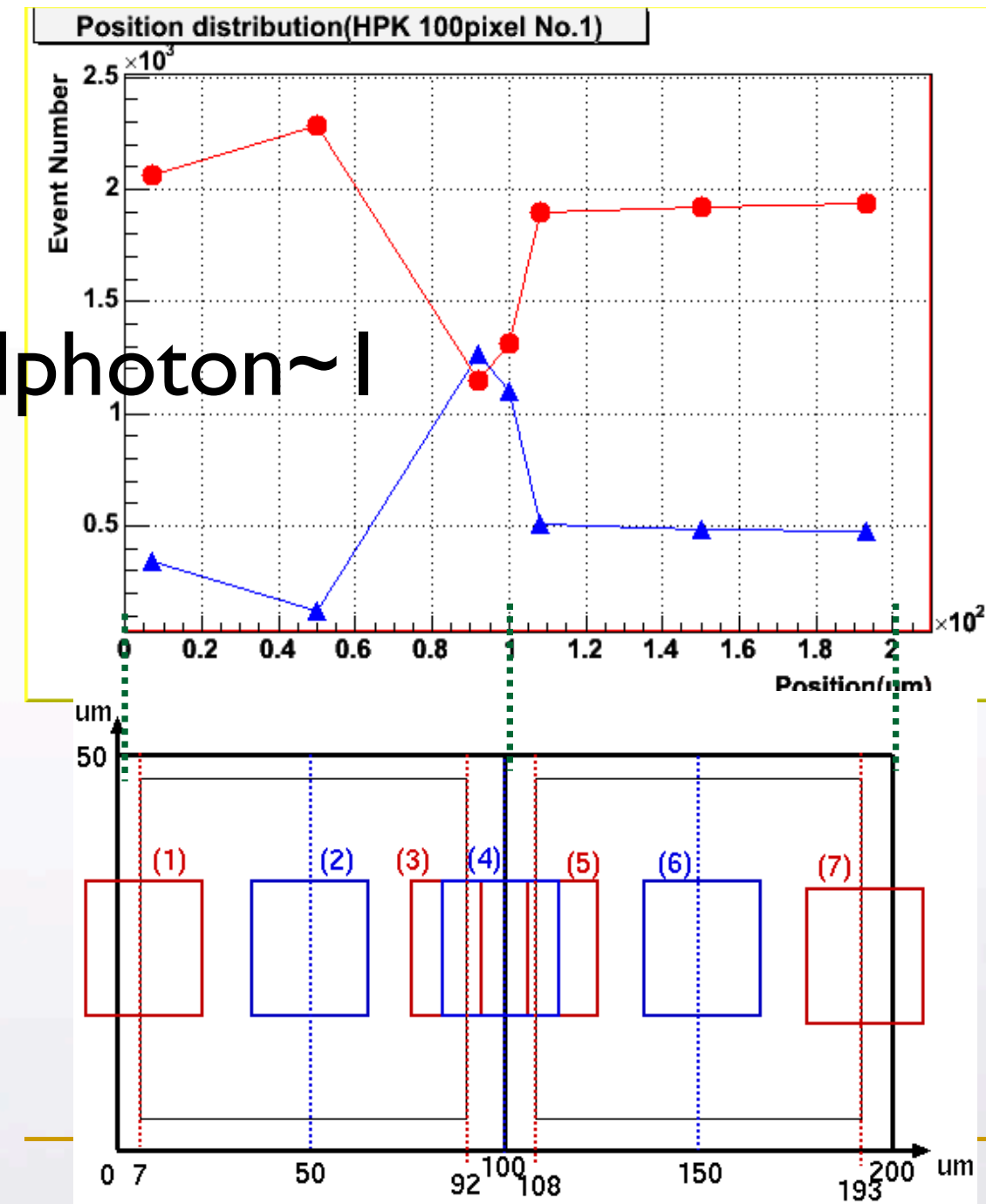
Nphoton~1

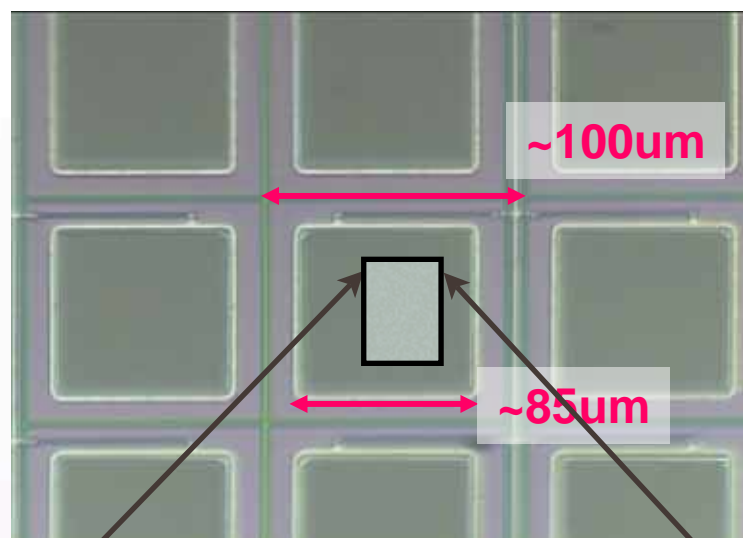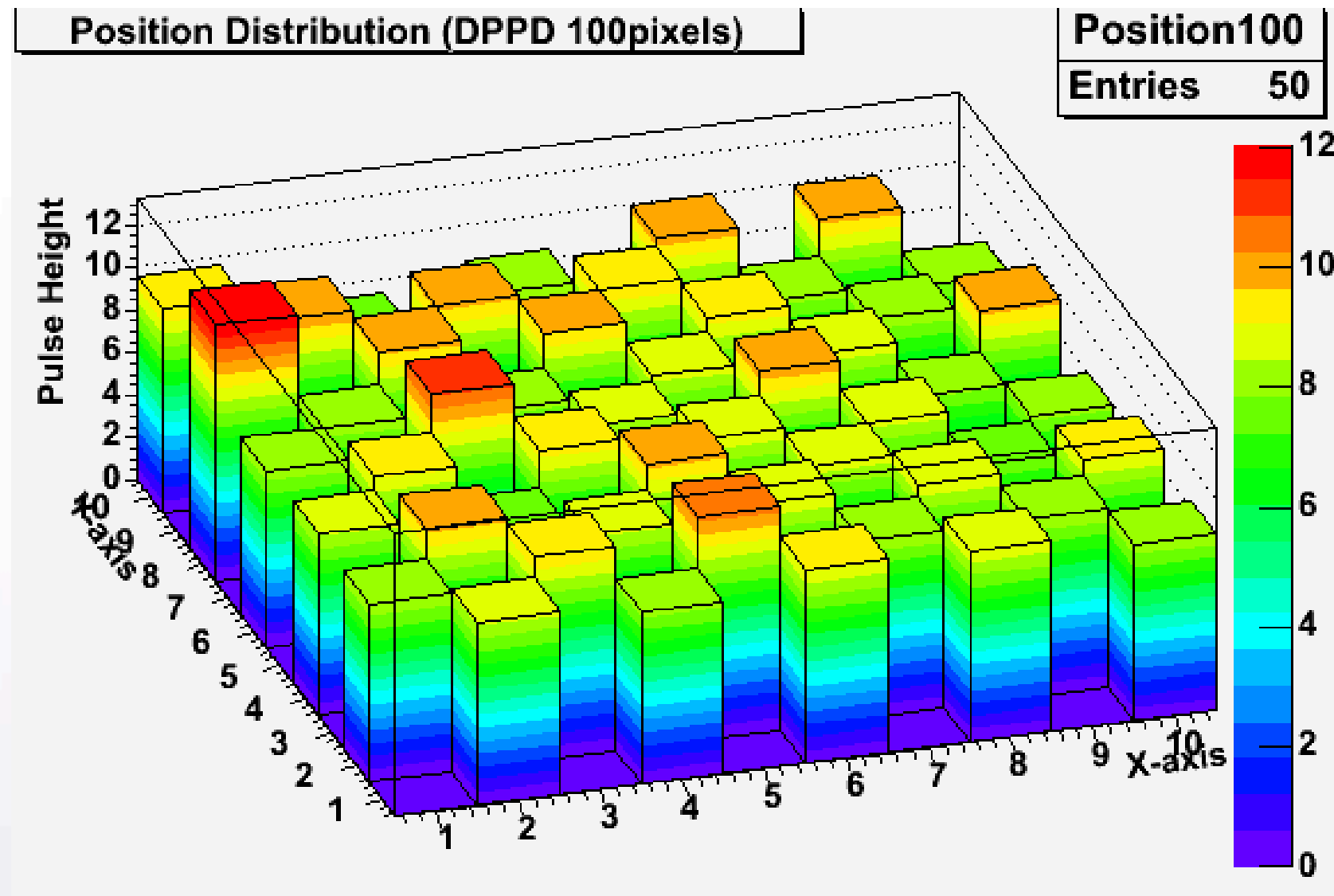# photon sensor R/D cont.

- ## pixel test by laser photon

H100-0

photon sensor R/D cont.

- to do list

  - linearity (saturation)

  - efficiency (overall and pixel)

  - X talk ? (pixel to pixel)

  - device to device difference

- improve MPC with Hamamatsu PK.

GLD-muon R/D

- scintillator production is in progress

- photon sensor R/D is on going

- beam test a bar+2MPC's this fall

- simulation effort is needed for realistic muon detector

  - efficiency for muon/ misidentification

  - optimum number of layers

  - thickness of the bar

T.Takeshita