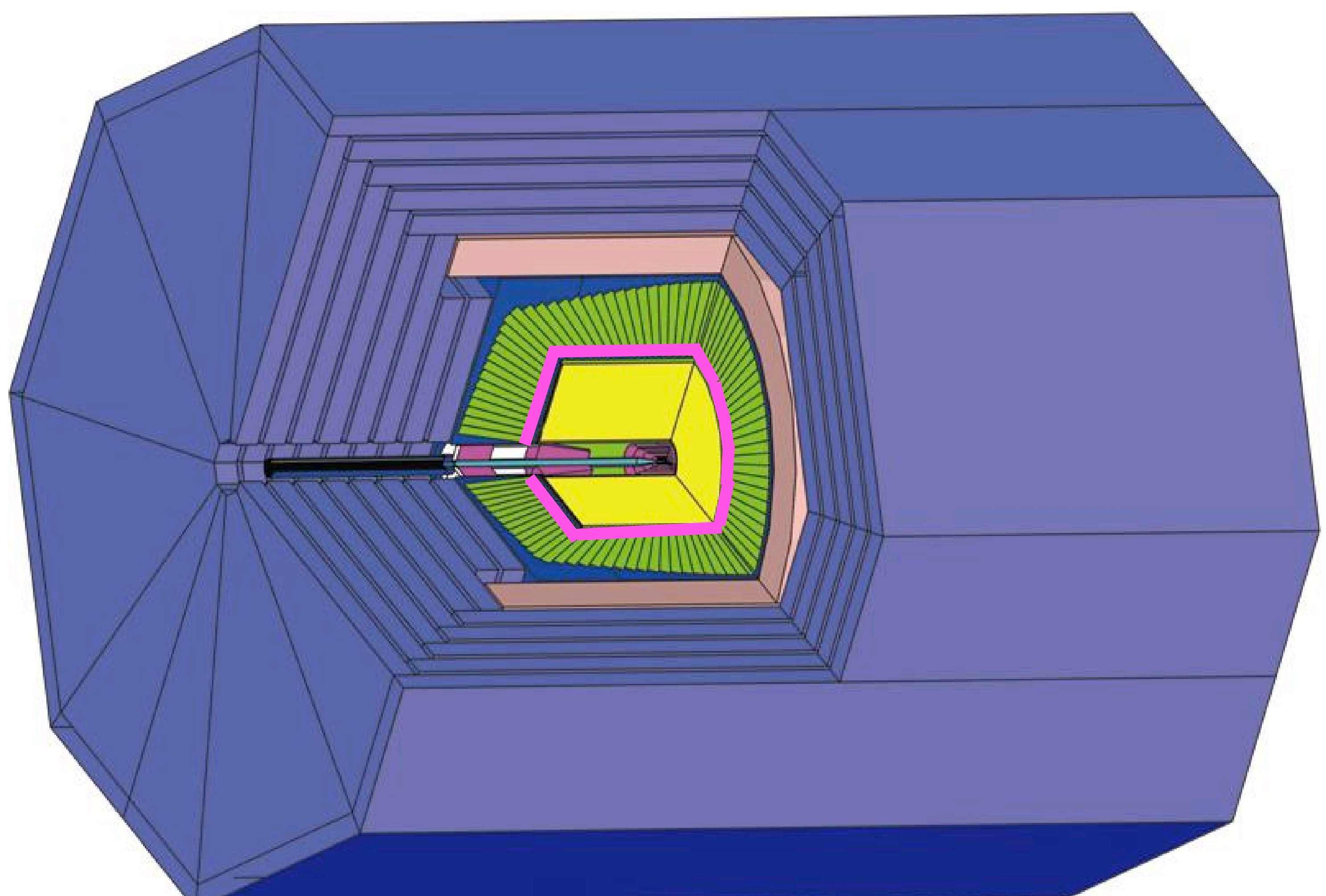
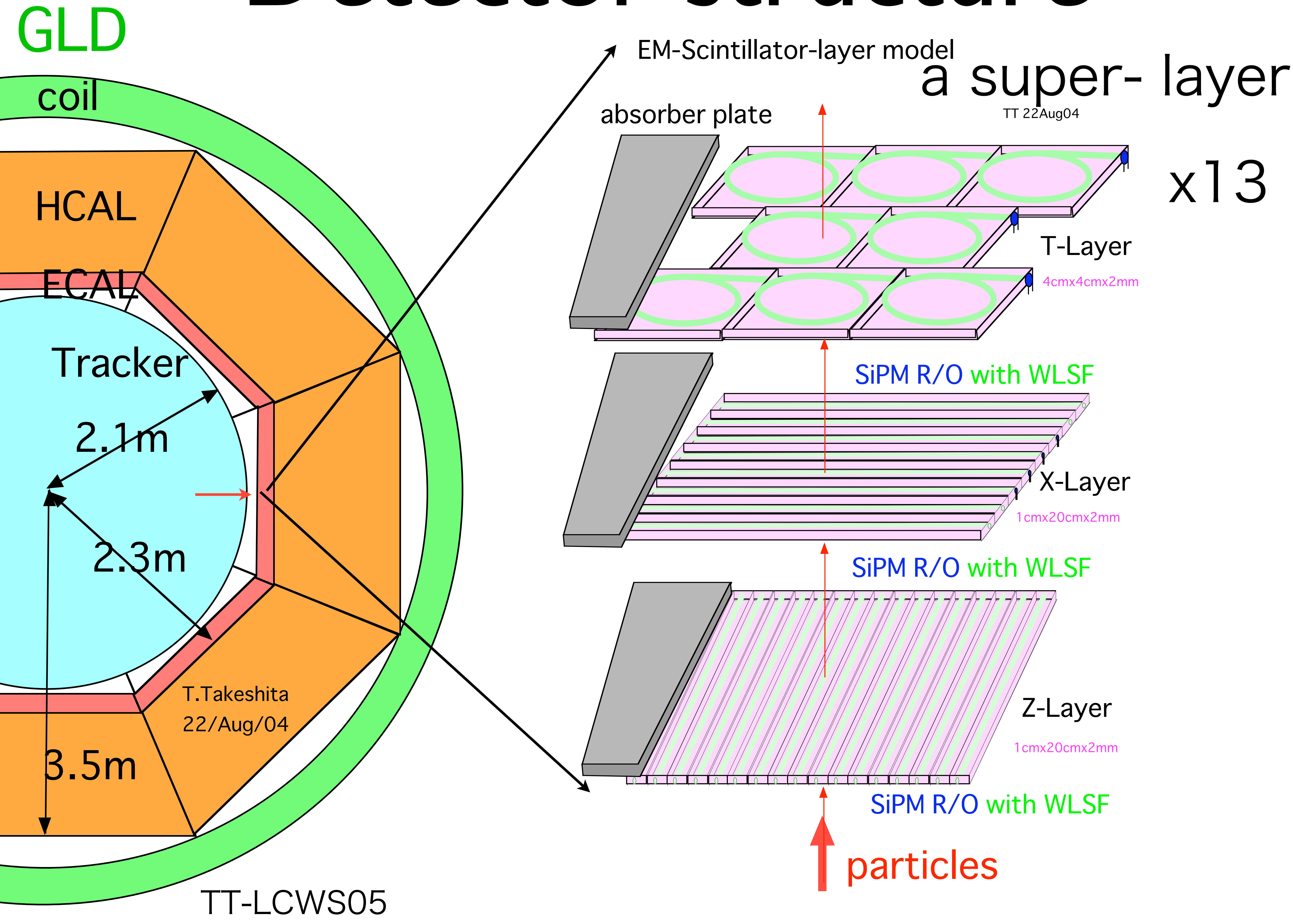
Design considerations for the scintillator-strip ECAL electronics

M.Tanaka (KEK) and T.Takeshita (Shinshu) for GLD-CAL

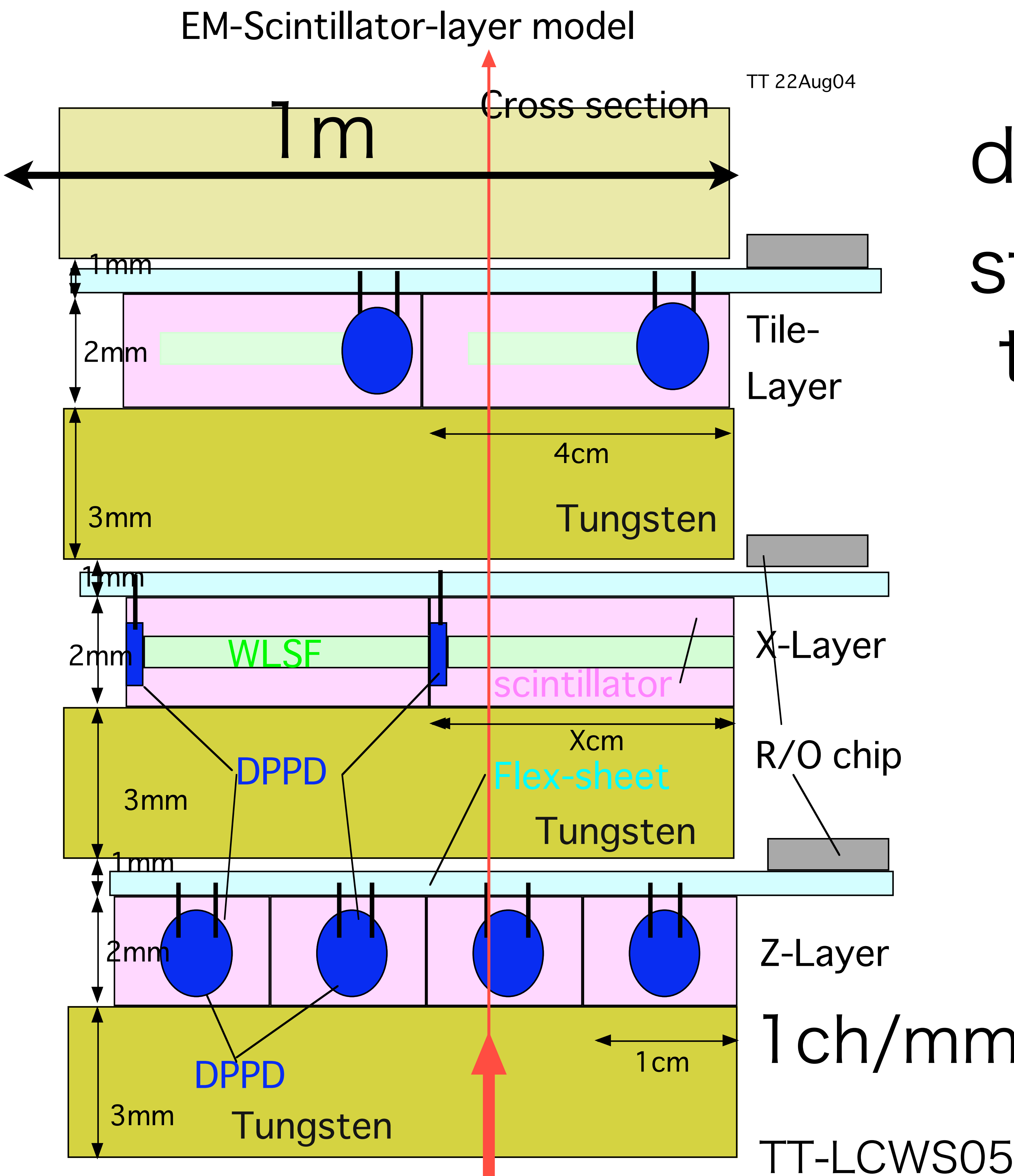


TT-LCWS05

Detector structure



Detector structure cont'd



density/super-layer

strip: $1 \times 10 \times 0.2\ cm^3$

tile : $4 \times 4 \times 0.2\ cm^3$

$625 ch/m^2$

$1000 ch/m^2$

$1000 ch/m^2$

$2625 ch/m^2$

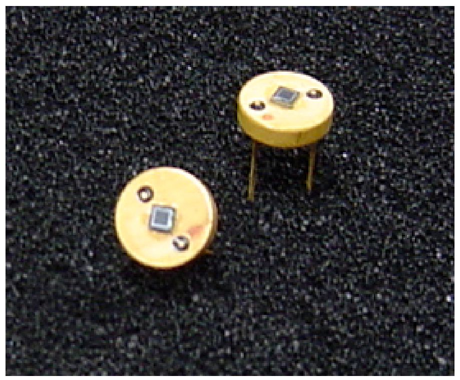
13x53kch/oct

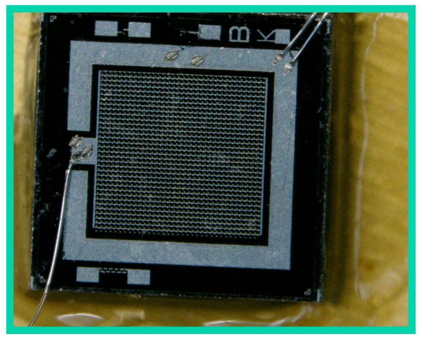
690kch/oct

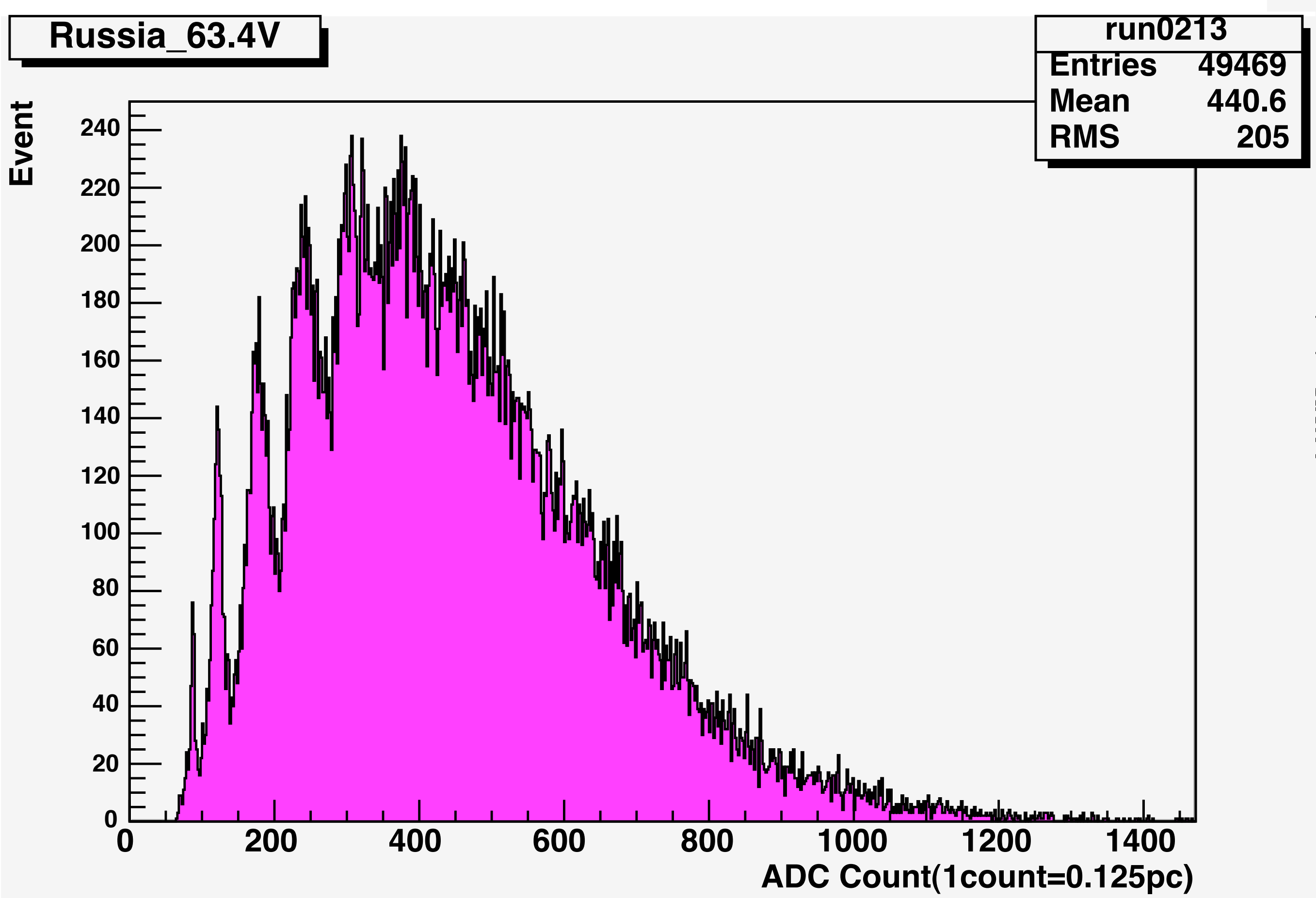
photon sensor

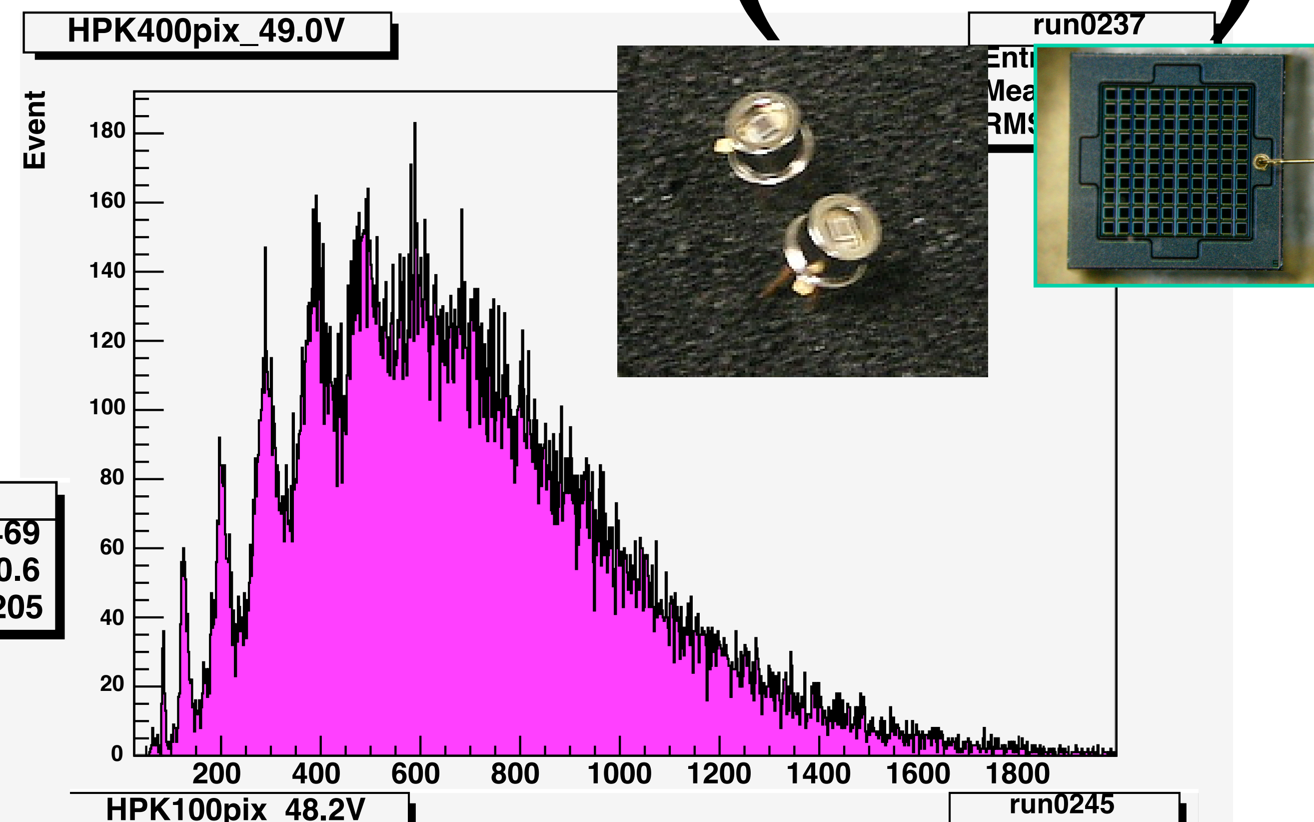
room temp.

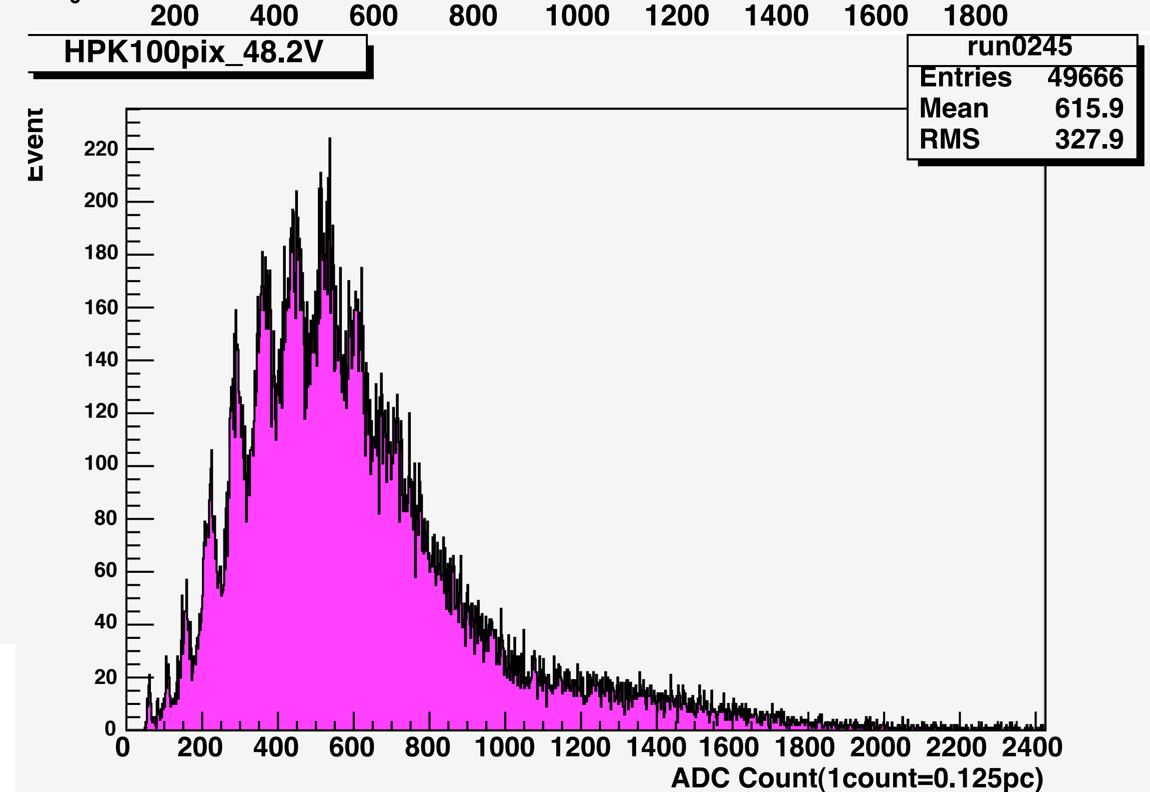
SiPM (Russia) MPPC (HPK)







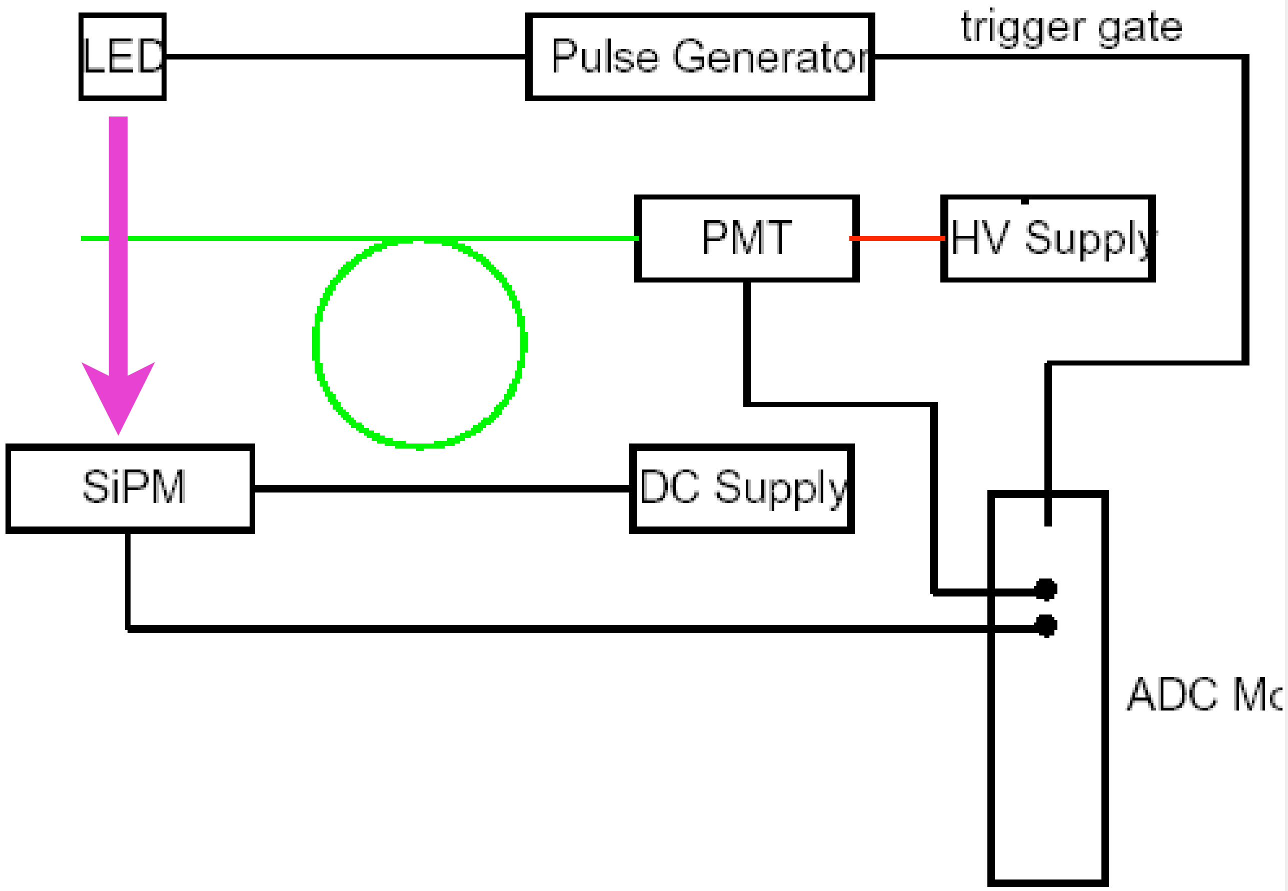




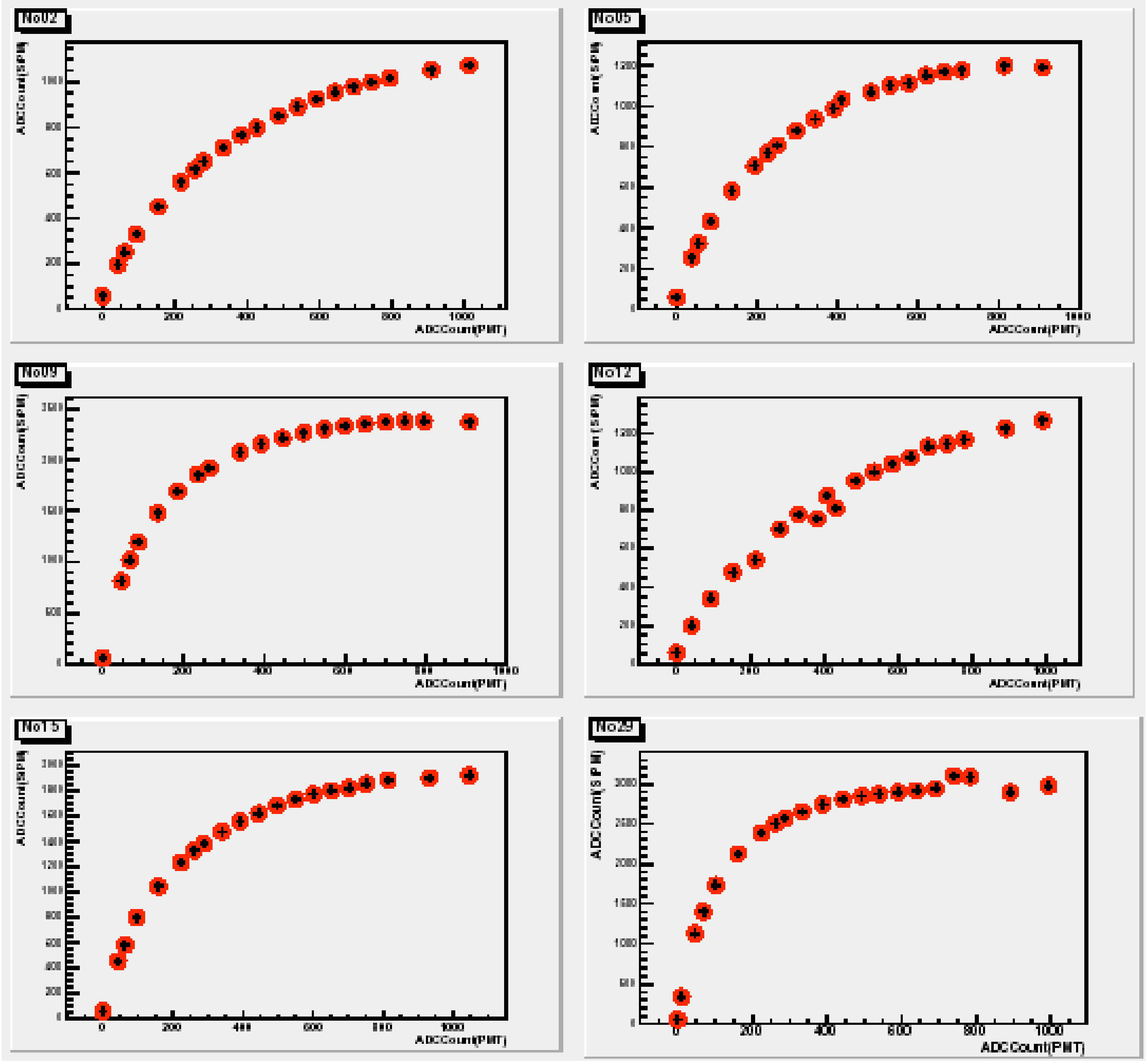
TT-LCWS05

photon sensor cont'd

linearity



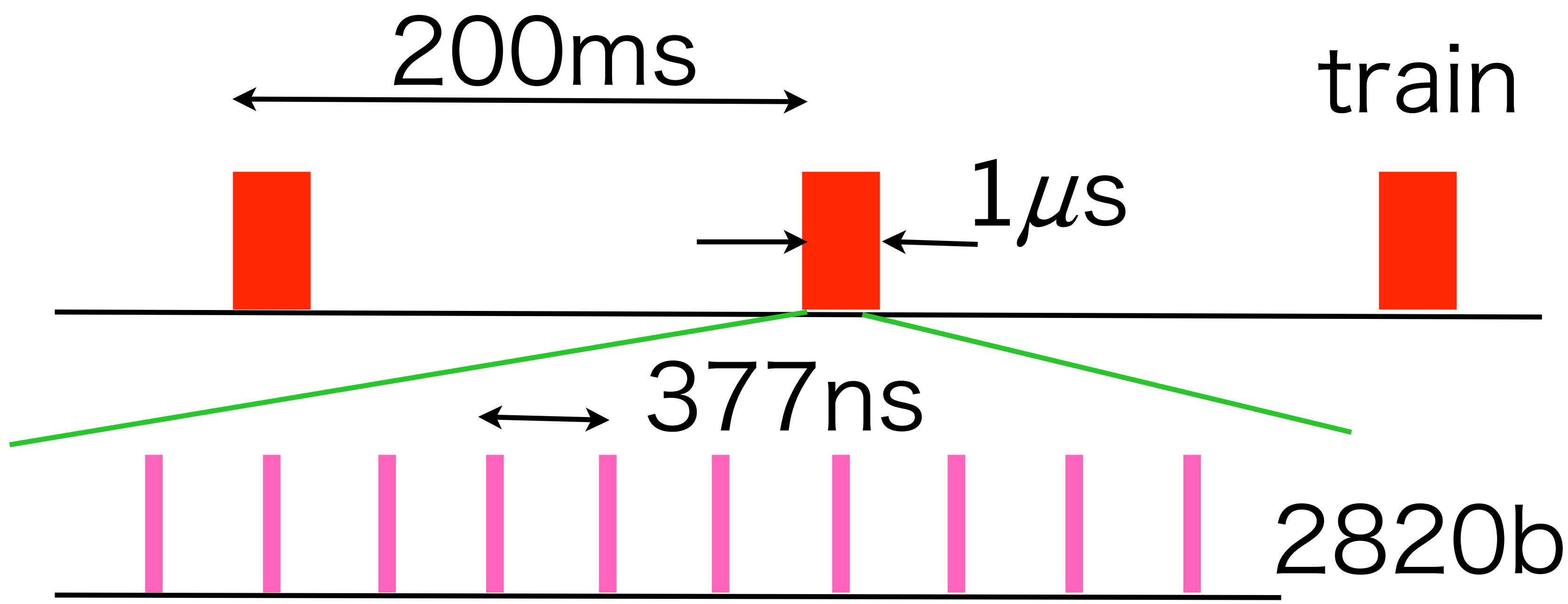
SiPM(1100pix)



PMT

Requirement I

Accelerator



Data transfer during train gap (200ms)

1Gbps transfer rate ～ 25MByte trans. Max

1000ch/trans. data ～25kByte/ch

4Byte/event ⟶ 6k event/ch >

3k bunches/train.

Good enough

Requirement 1 cont'd

Data transfer during train gap

Max occupancy for a train

depends on SiPM dark hit-rate

~1MHz >> physics event incl. BBG

Low power consumption

20mW/ch ==> 0.2kW/oct

power loss in power cable

Requirement 2

Detector

channel density ~ 1mm/ch

photon sensor

dynamic range 1000 ~ >10-12bit

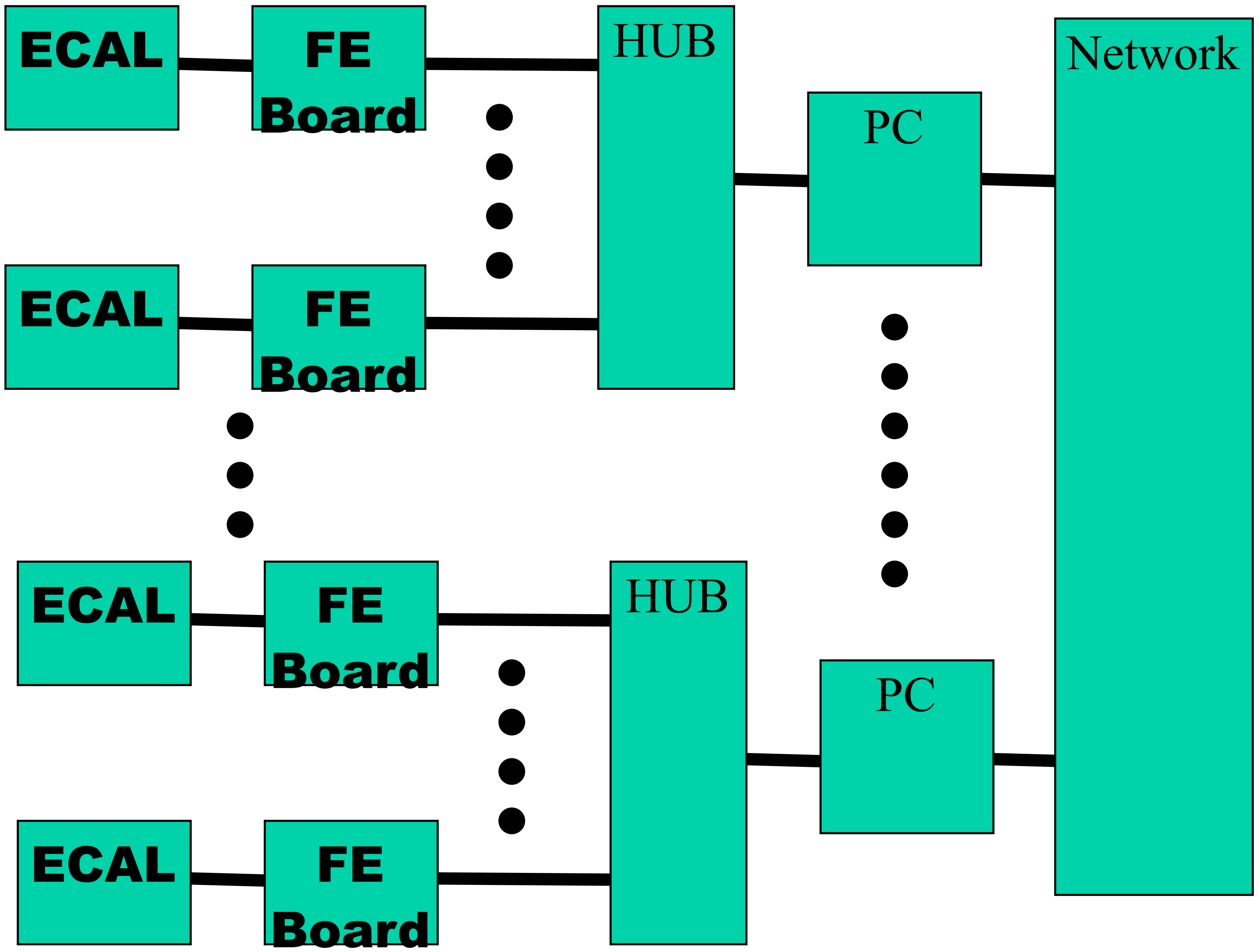
gain variation : need fine adjustment

Overview

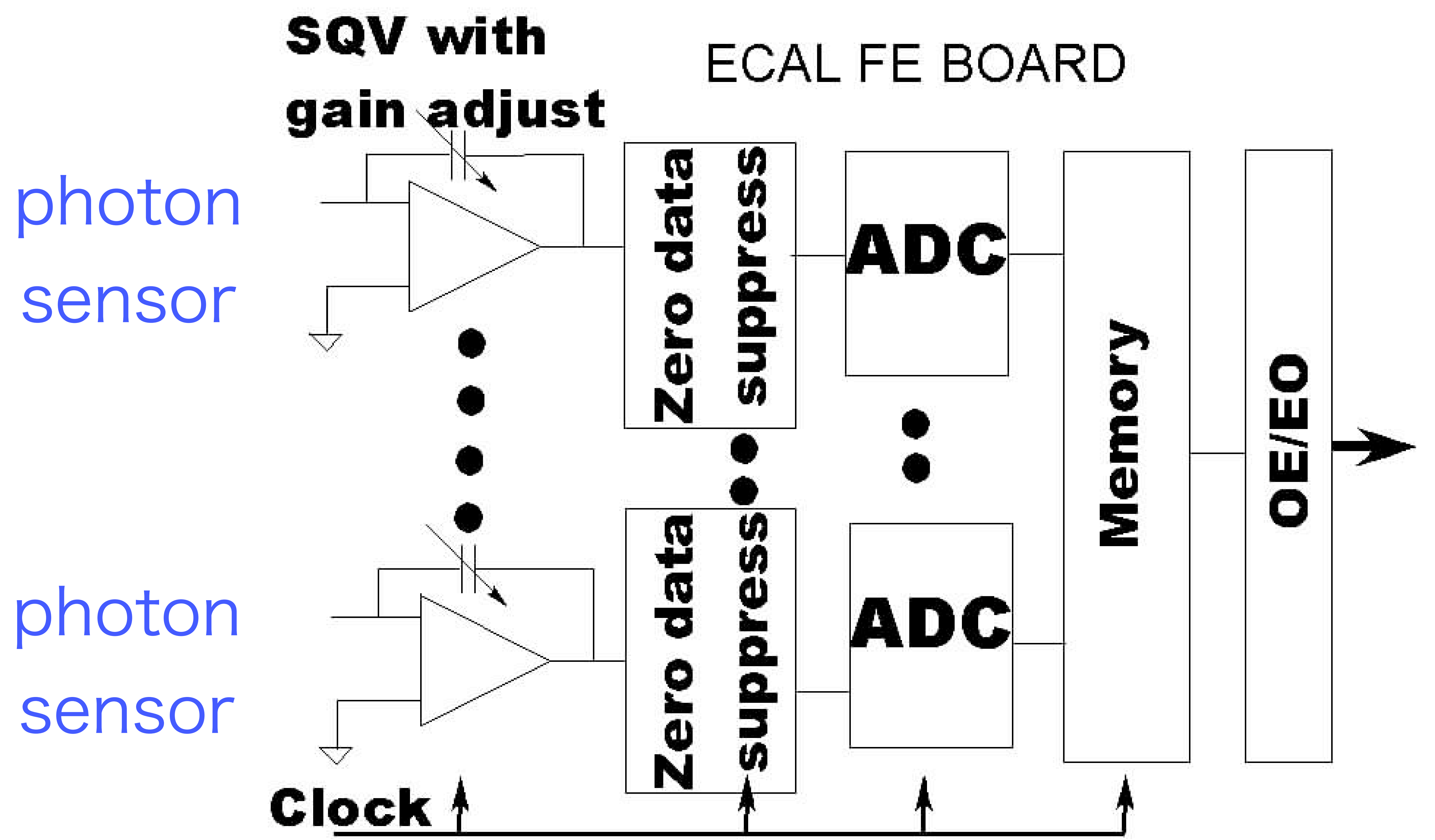
- **Data transfer during train gap : OK**
- **Synchronous Current Integrator for Q-to-V conversion (SQV)**
- **Zero suppression mechanism near detector**
- **Optical data transfer for GND isolation**
- **Ethernet based Event building**

Block diagram

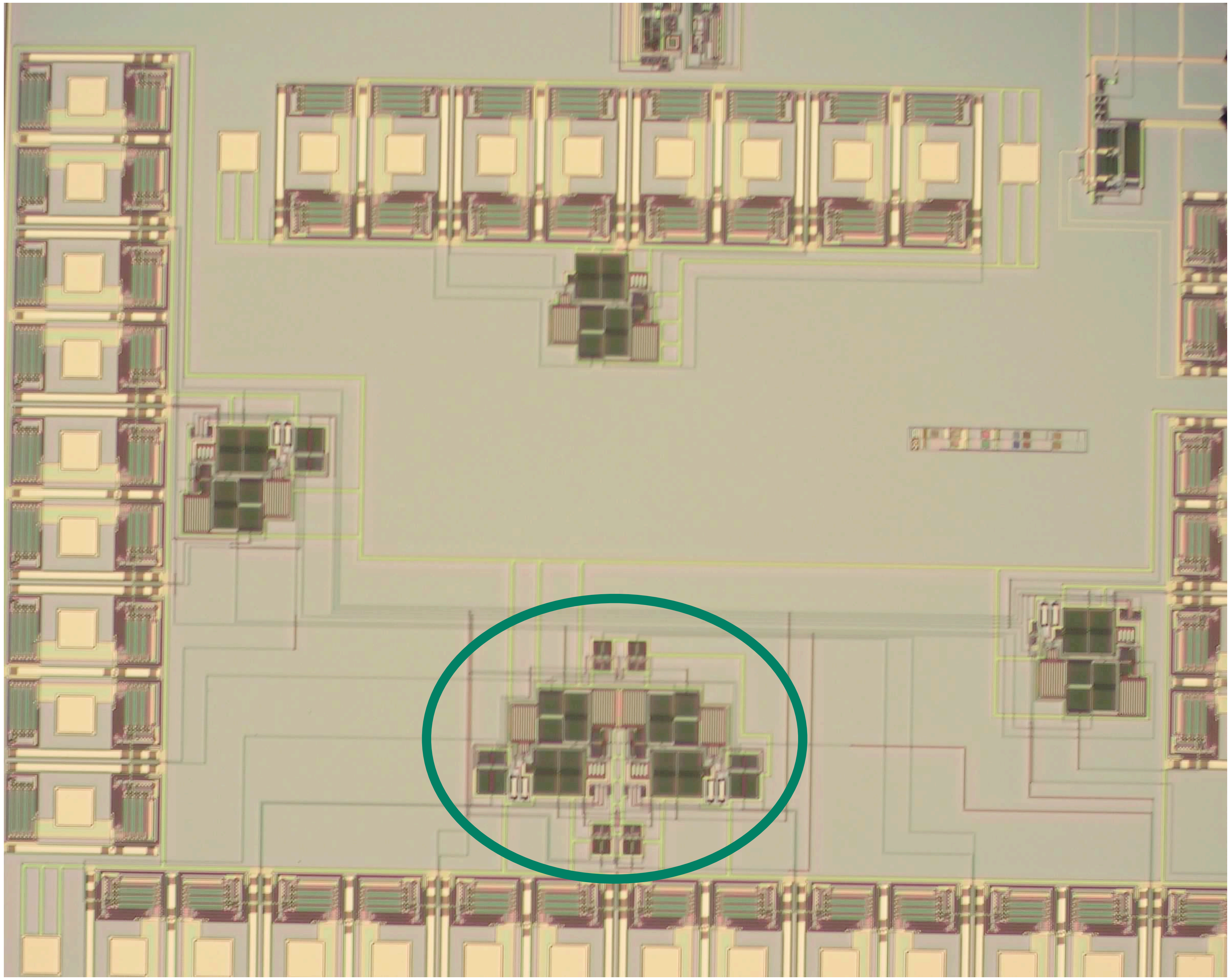
on det.



FE board

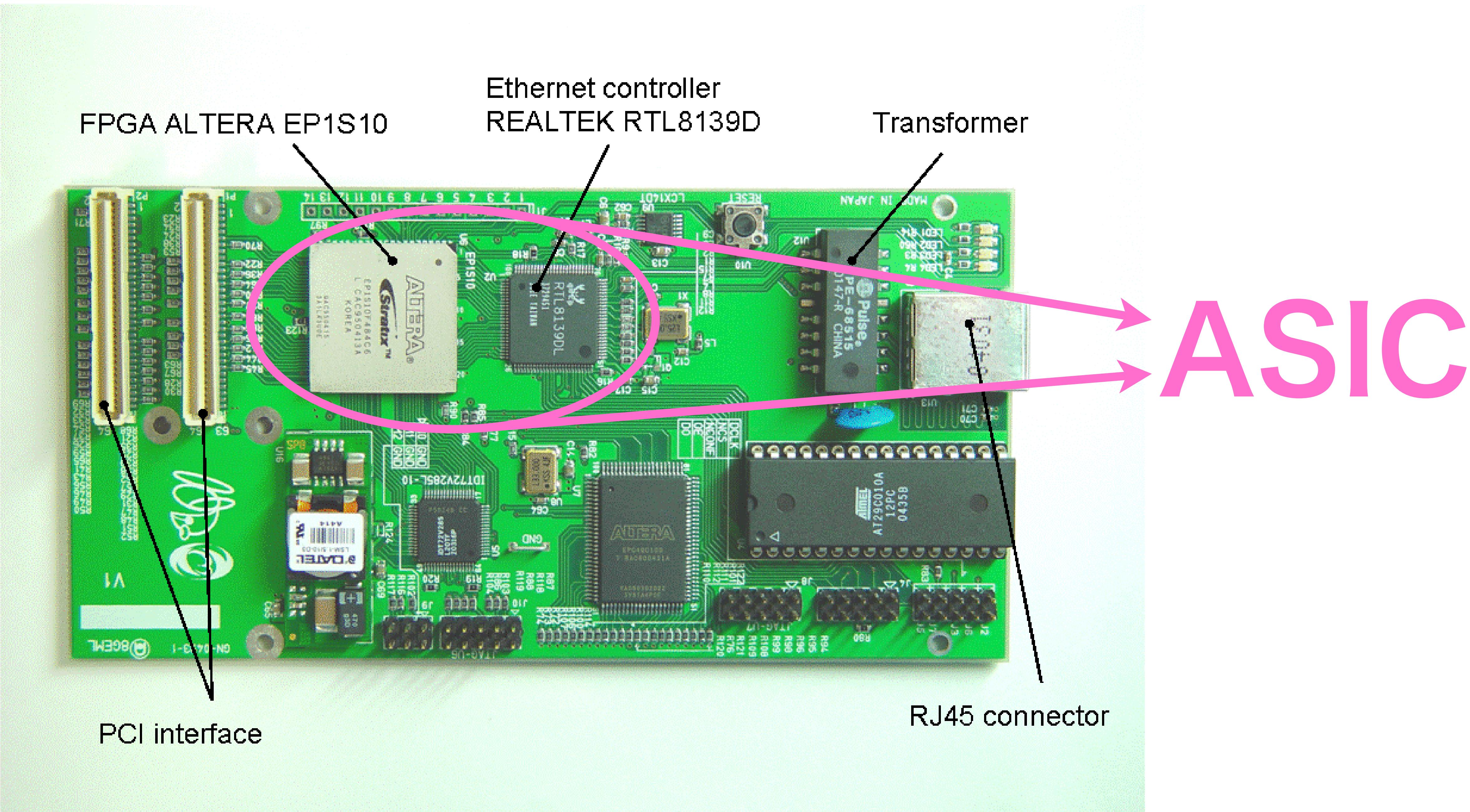

SQV with
gain adjust
ECAL FE BOARD
photon
sensor
Zero data
suppress
ADC
Memory
OE/EO
photon
sensor
Zero data
suppress
ADC
Clock

SQV-TEG



Ethernet Data transfer

Proto. Board



Summary

- scintillator strip ECAL electronics for ILC
- photon sensor ,ADC and DAQ
- ASIC production
- need gain adjustment scheme