

ILC-Tokushin-Calorimeter



✿ Tohru Takeshita (Shinshu)

✿ Calorimeter activities for 5 years @ Kick Off meeting

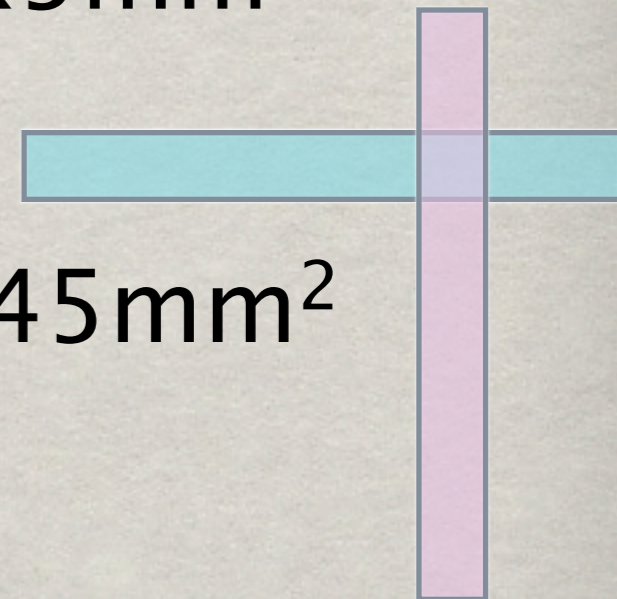
✿ Fine segmented cal. by PFA

✿ ECAL & HCAL <> CALICE

✿ ECAL-silicon (Kyushu) pad $5 \times 5 \text{mm}^2$

✿ ECAL-scintillator (Shinshu) strip $5 \times 45 \text{mm}^2$

✿ HCAL strip $10 \times 180 \text{mm}^2$



5 years plan

Tokushin

✻ 2 years for DBD

✻ 3 years postDBD~TDR

2011 - 2012

2013 - 2014 - 2015

Hybrid ECAL
silicon+scintillator

structure /readout & silicon
sensor

simulation/BT

scintillator sensor
mass production study

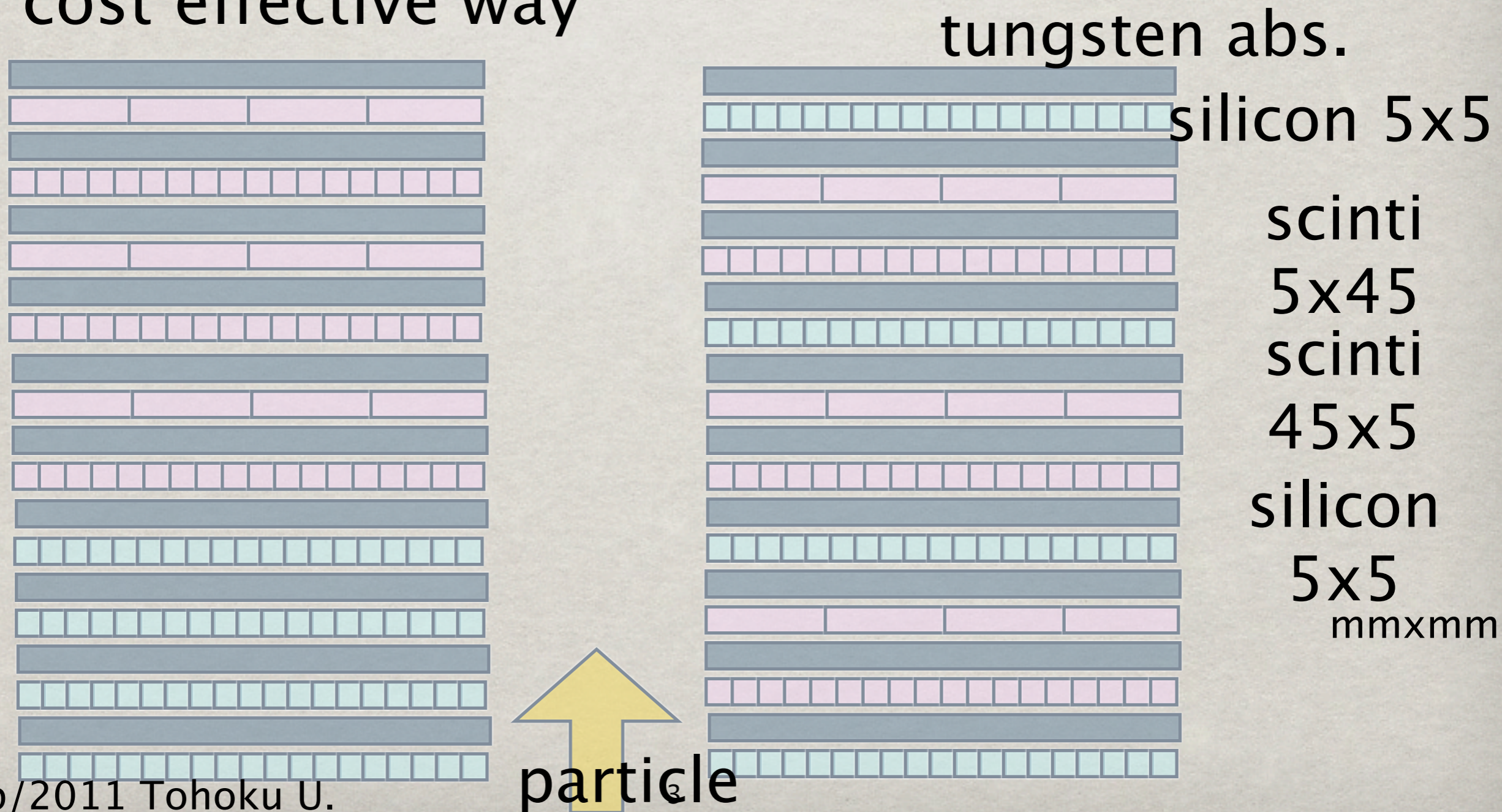
HCAL scintillator
strip + tile
optimization
(simulation)

evaluation by BT

scintillator sensor
mass production study

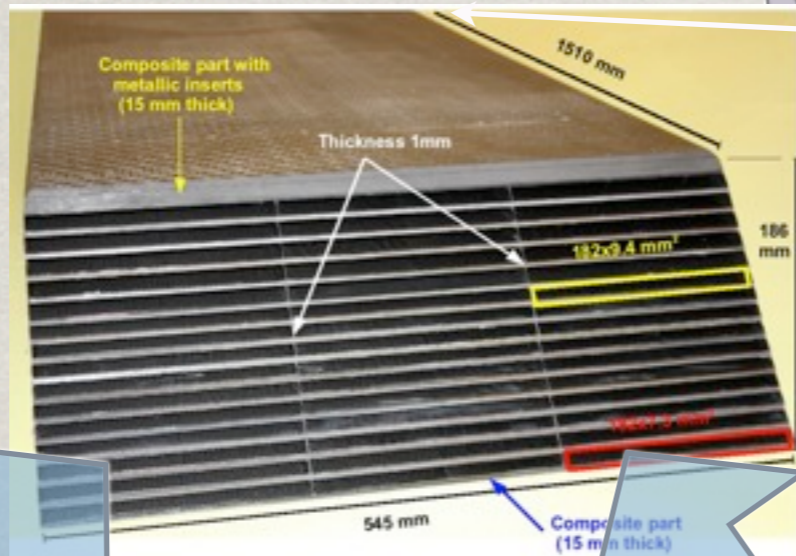
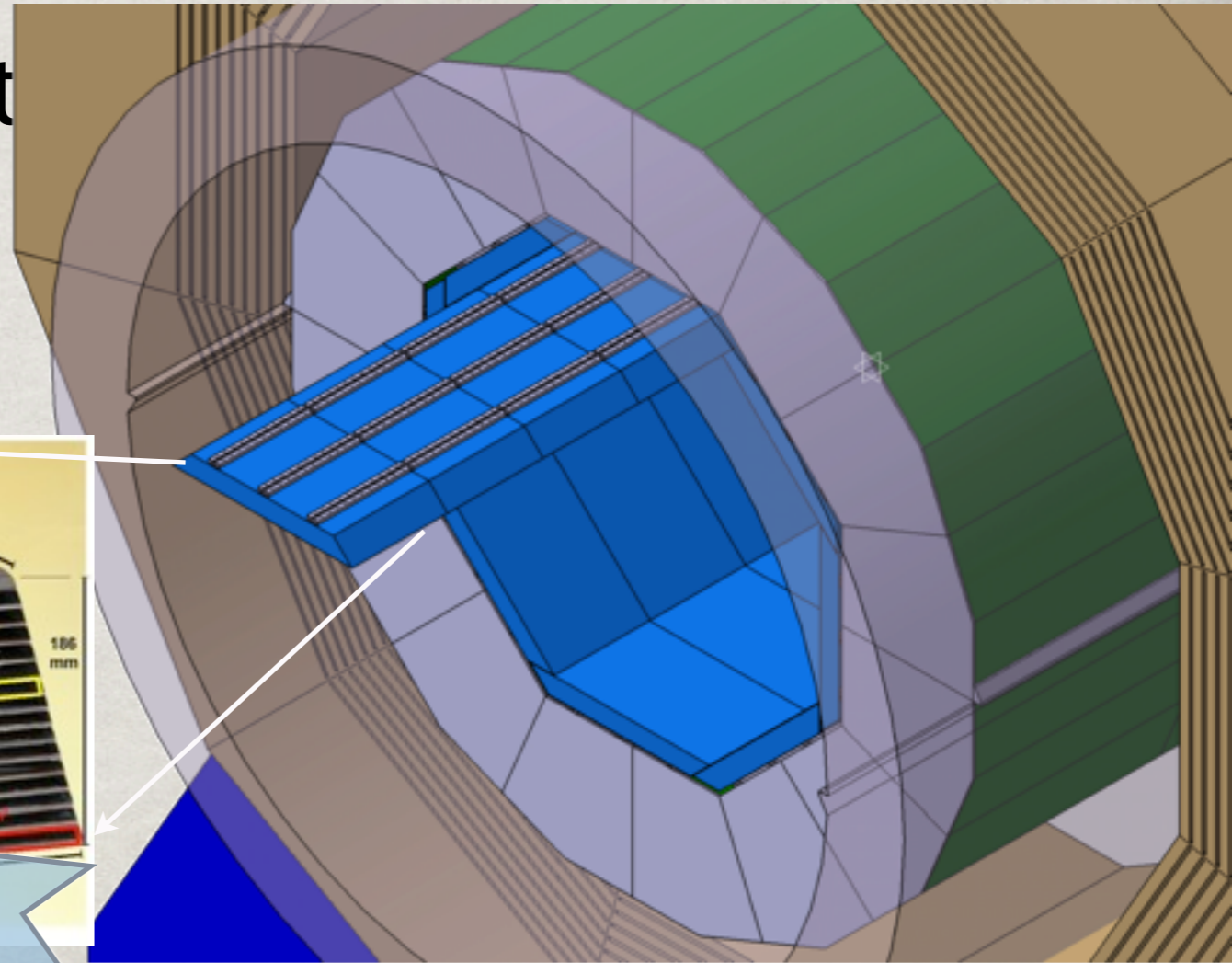
Hybrid ECAL simulation

- ☼ Silicon layers + scintillator layers: Hybrid
- ☼ performance optimization w. PANDORA
- ☼ cost effective way



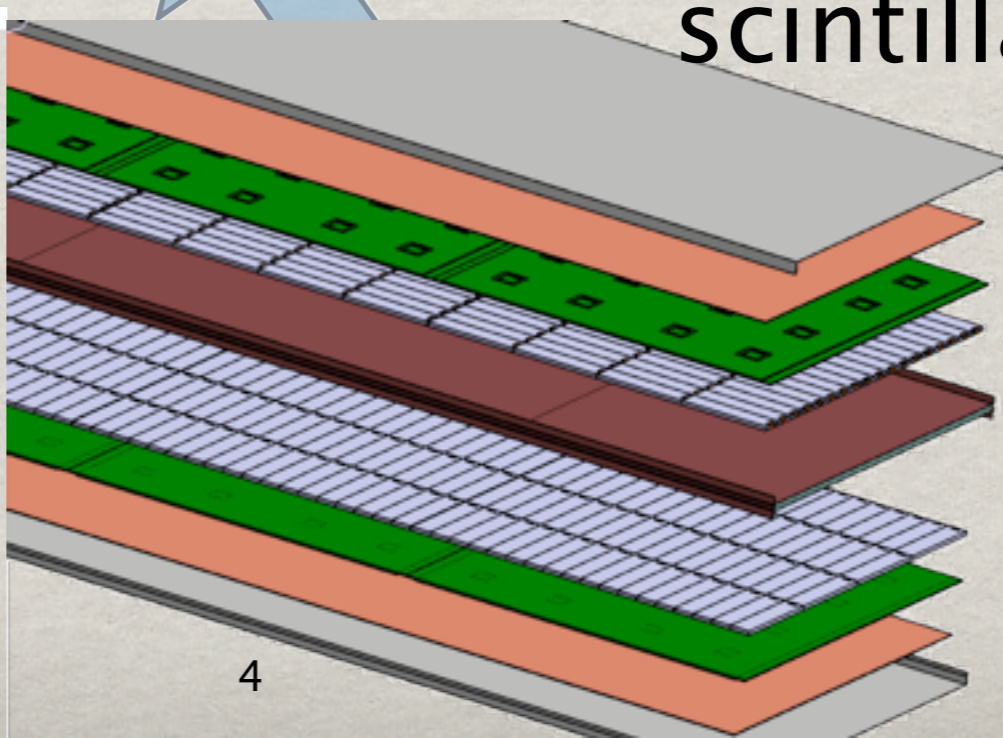
Hybrid ECAL cont. hardware

- ☼ engineering compatibility
- ☼ Beam Test with Hybrid module



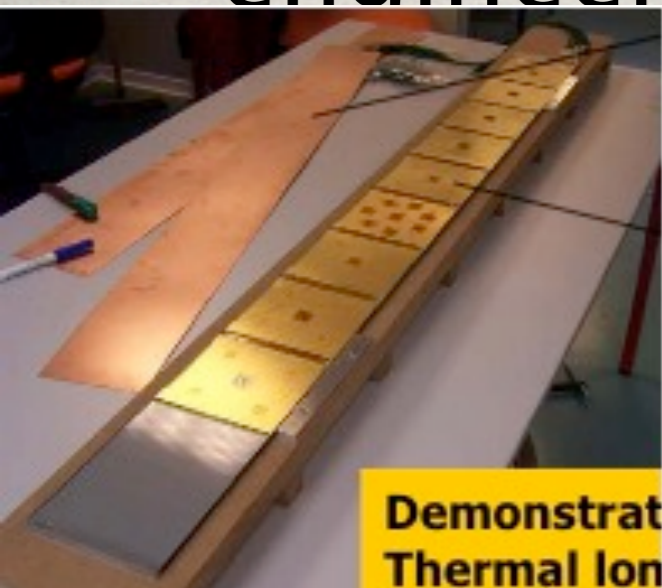
silicon layer

scintillator layer



ECAL-Silicon

- ☼ Kyushu Univ. mostly responsible
- ☼ ++ French Silicon ECAL activities since Jan2010
- ☼ reduce cost by good communication with the manufacturer
- ☼ engineering work



ECAL-scintillator

✻ scintillator production in Korea with extrusion method : 5mm strips

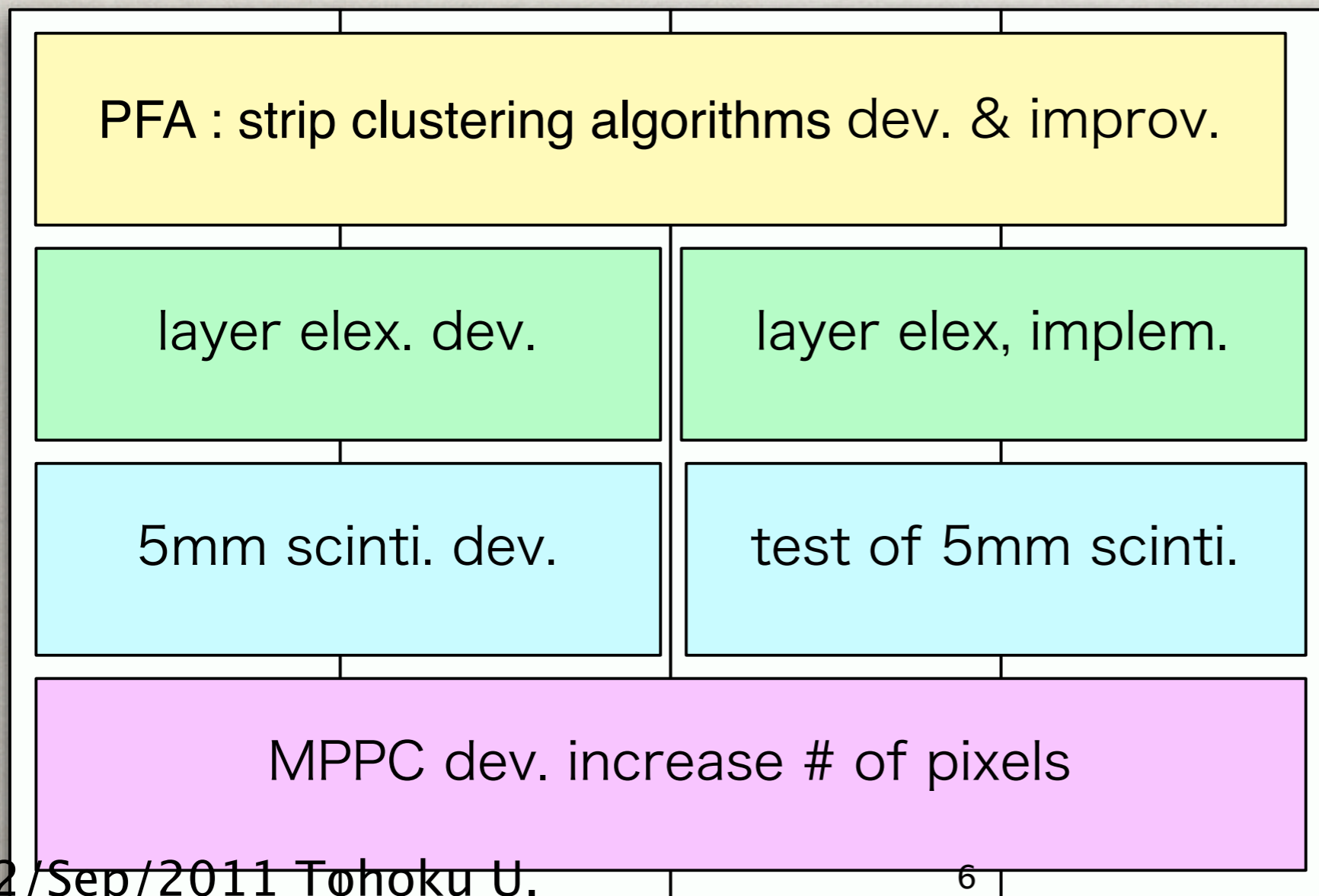
✻ photo sensor : Shinshu

2009

2010

2011

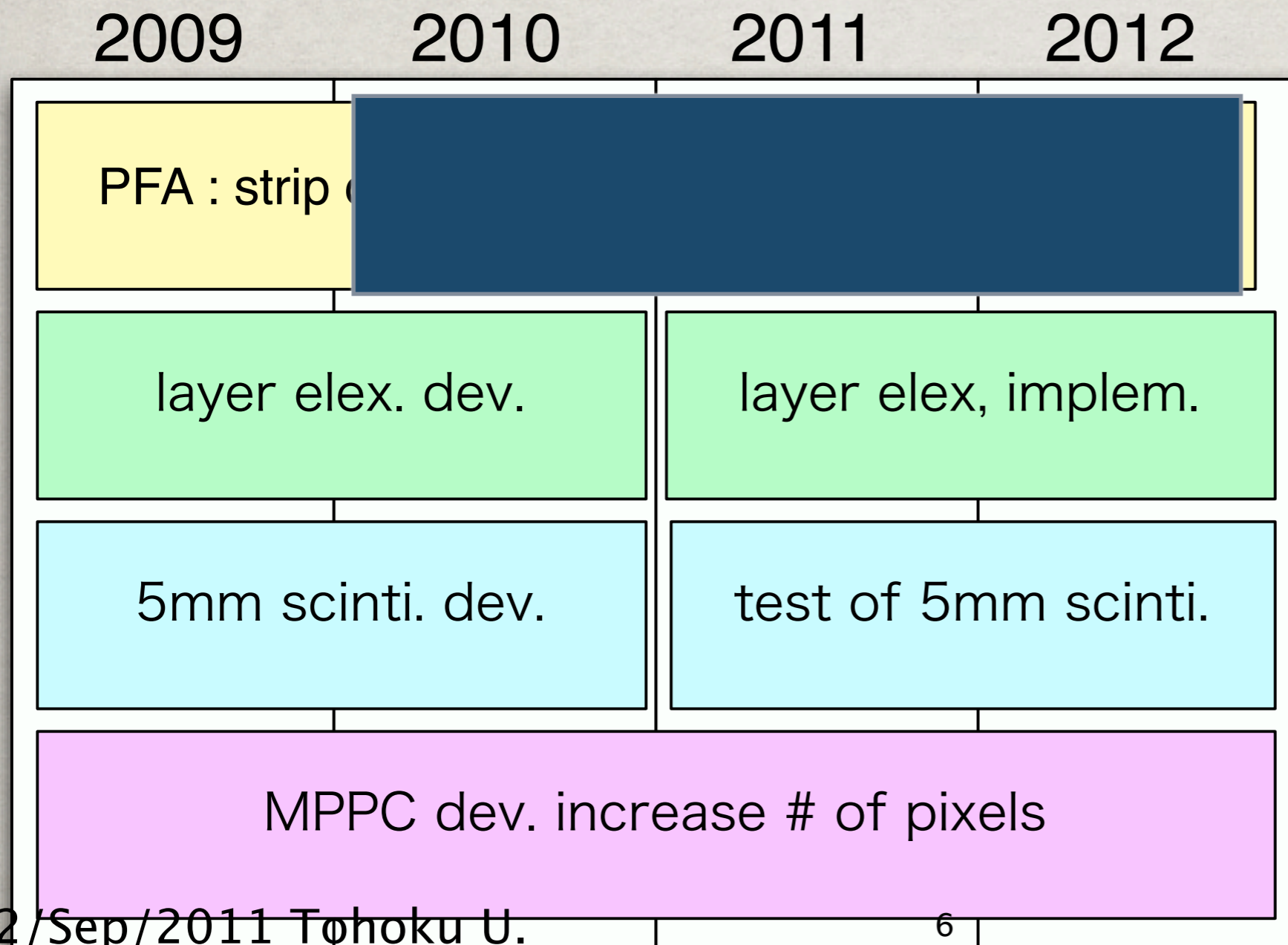
2012



ECAL-scintillator

✻ scintillator production in Korea with extrusion method : 5mm strips

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ECAL-scintillator

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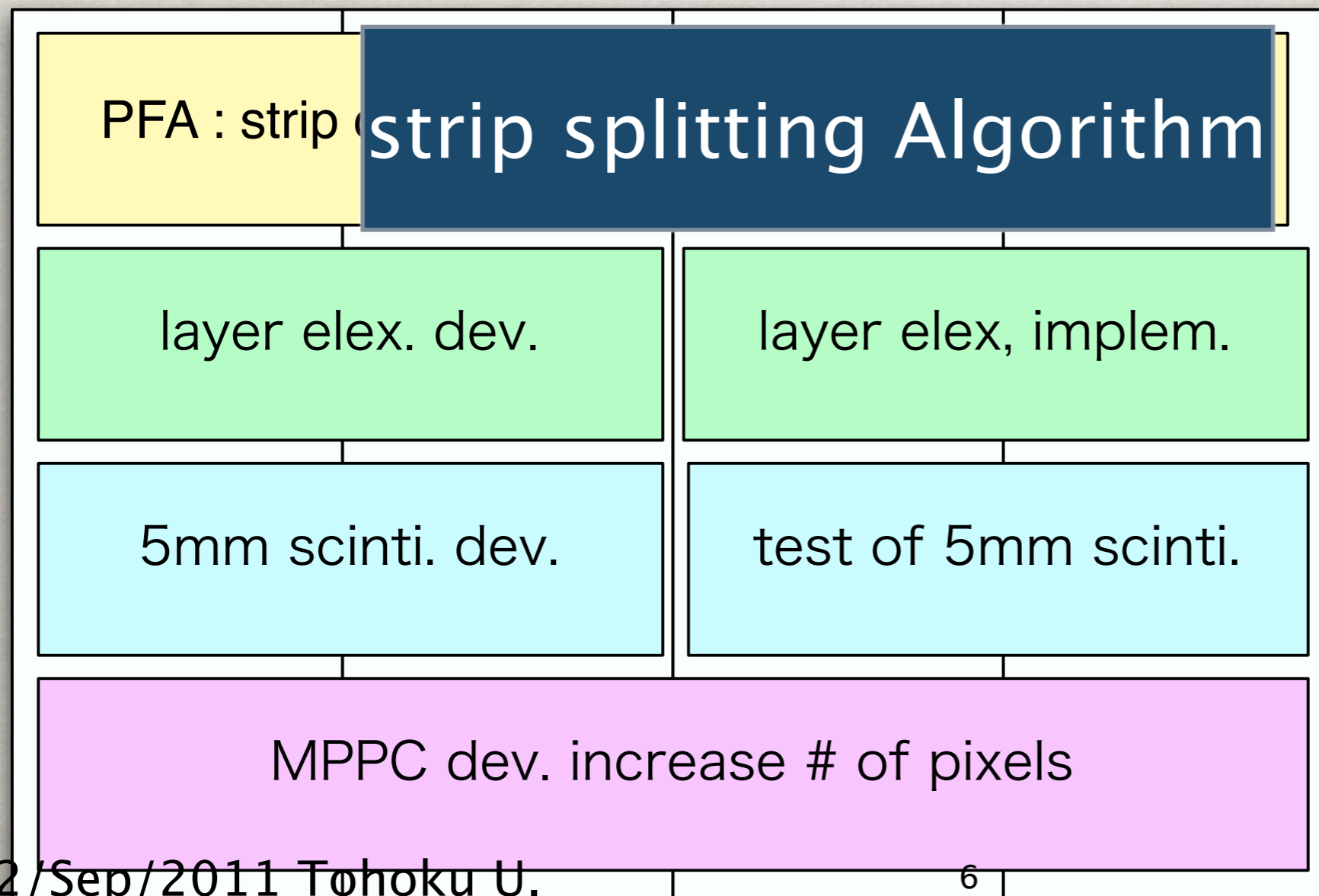
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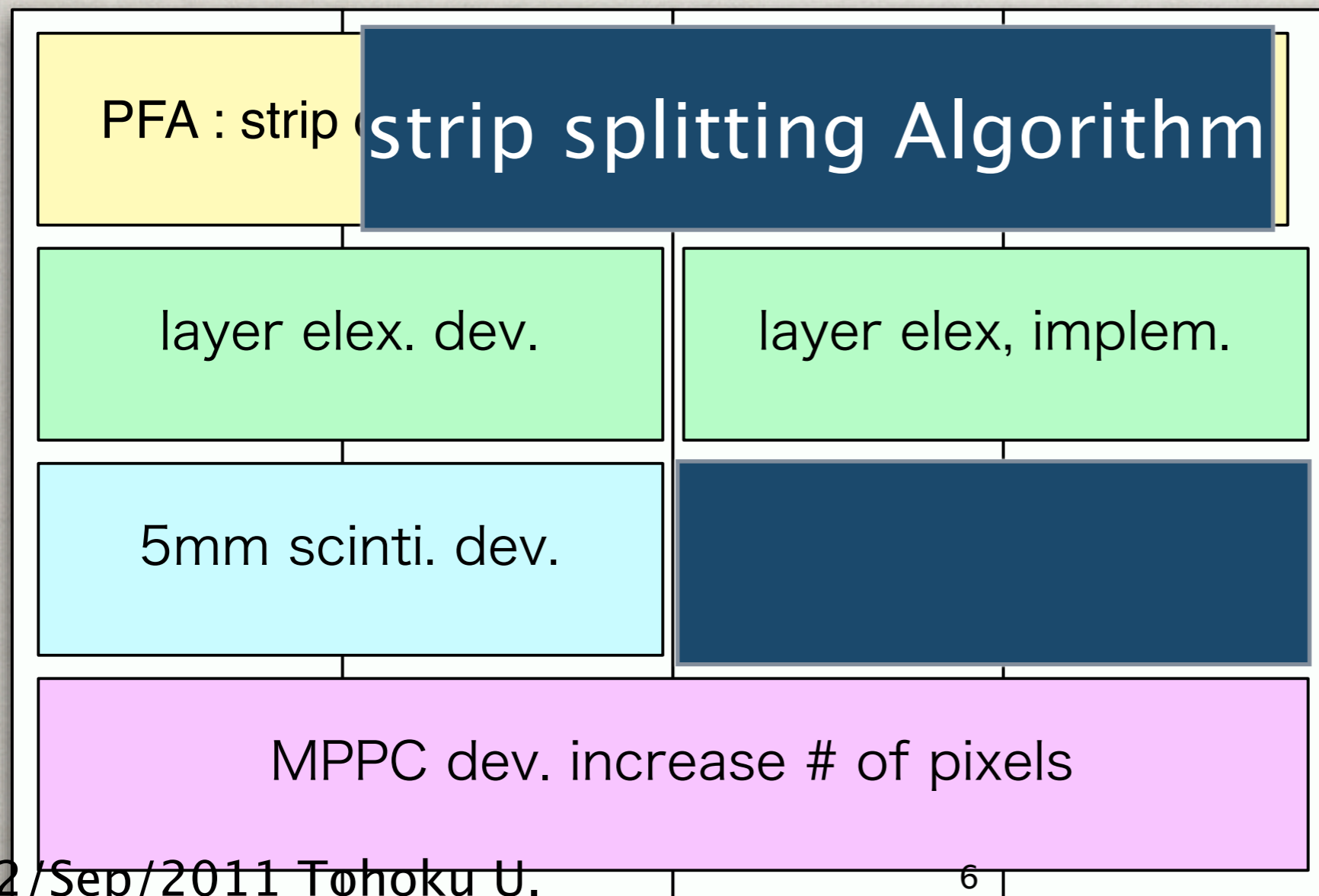
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ECAL-scintillator

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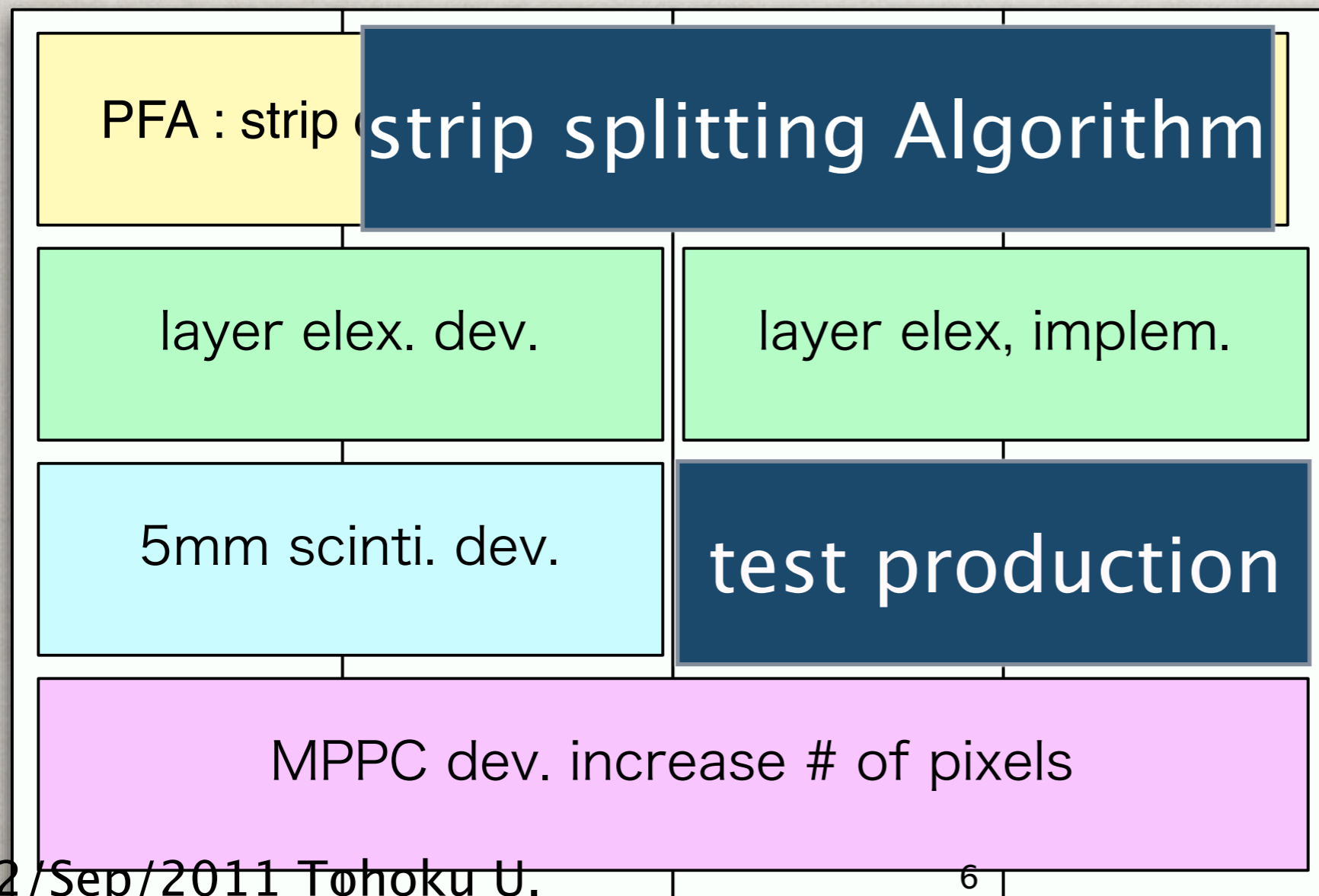
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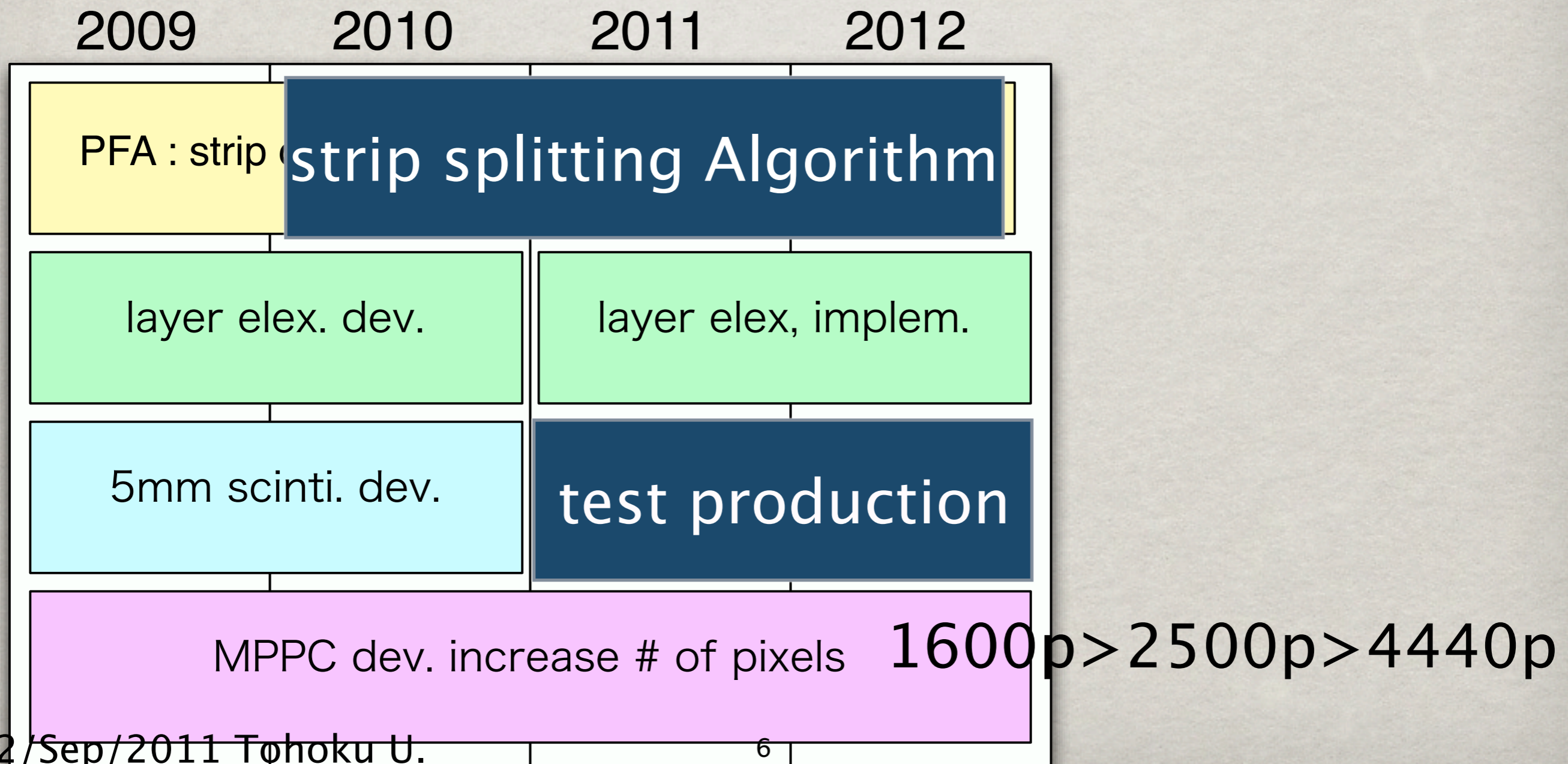
2012



ECAL-scintillator

✻ scintillator production in Korea with extrusion method : 5mm strips

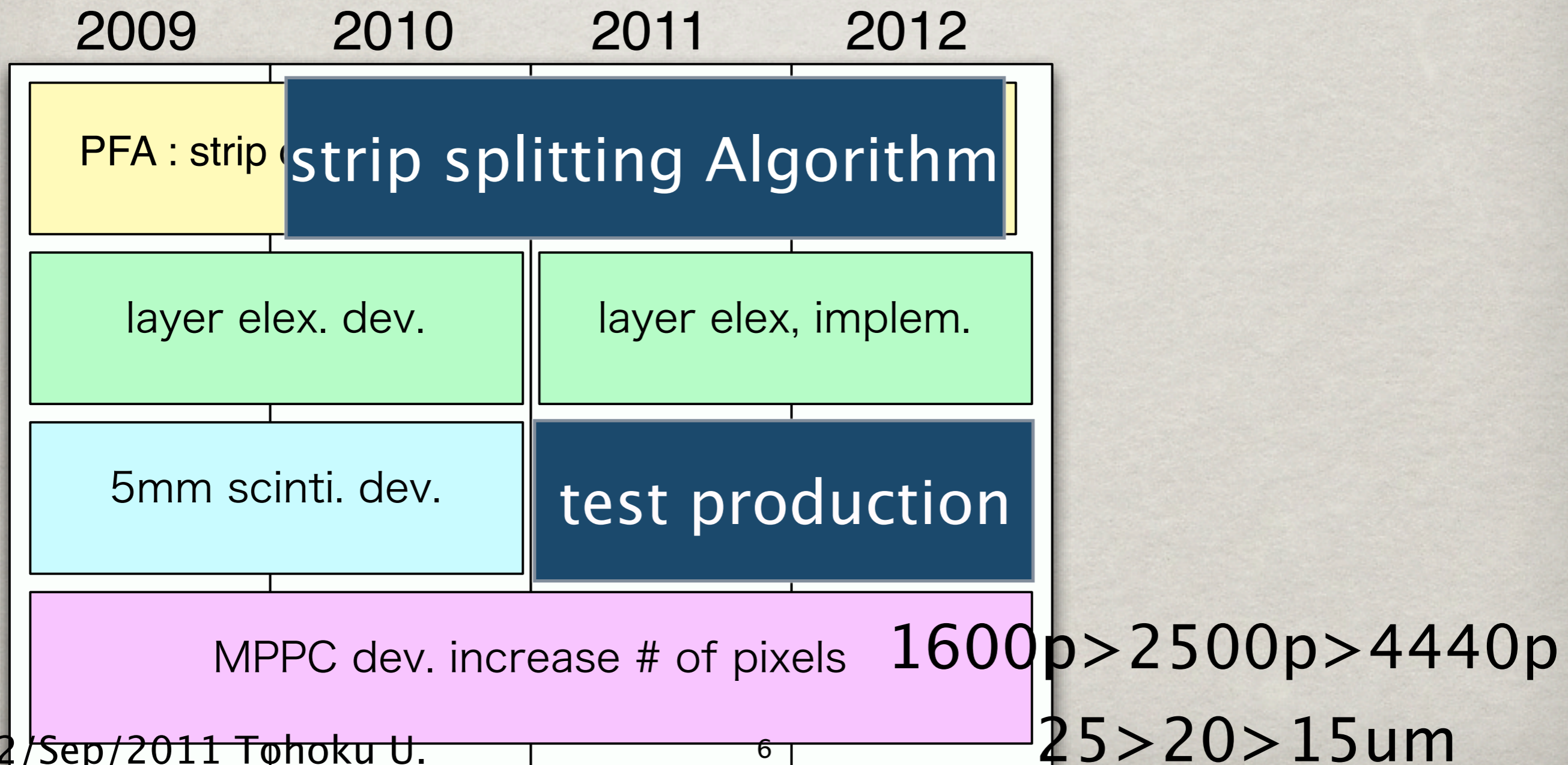
✻ photo sensor : Shinshu



ECAL-scintillator

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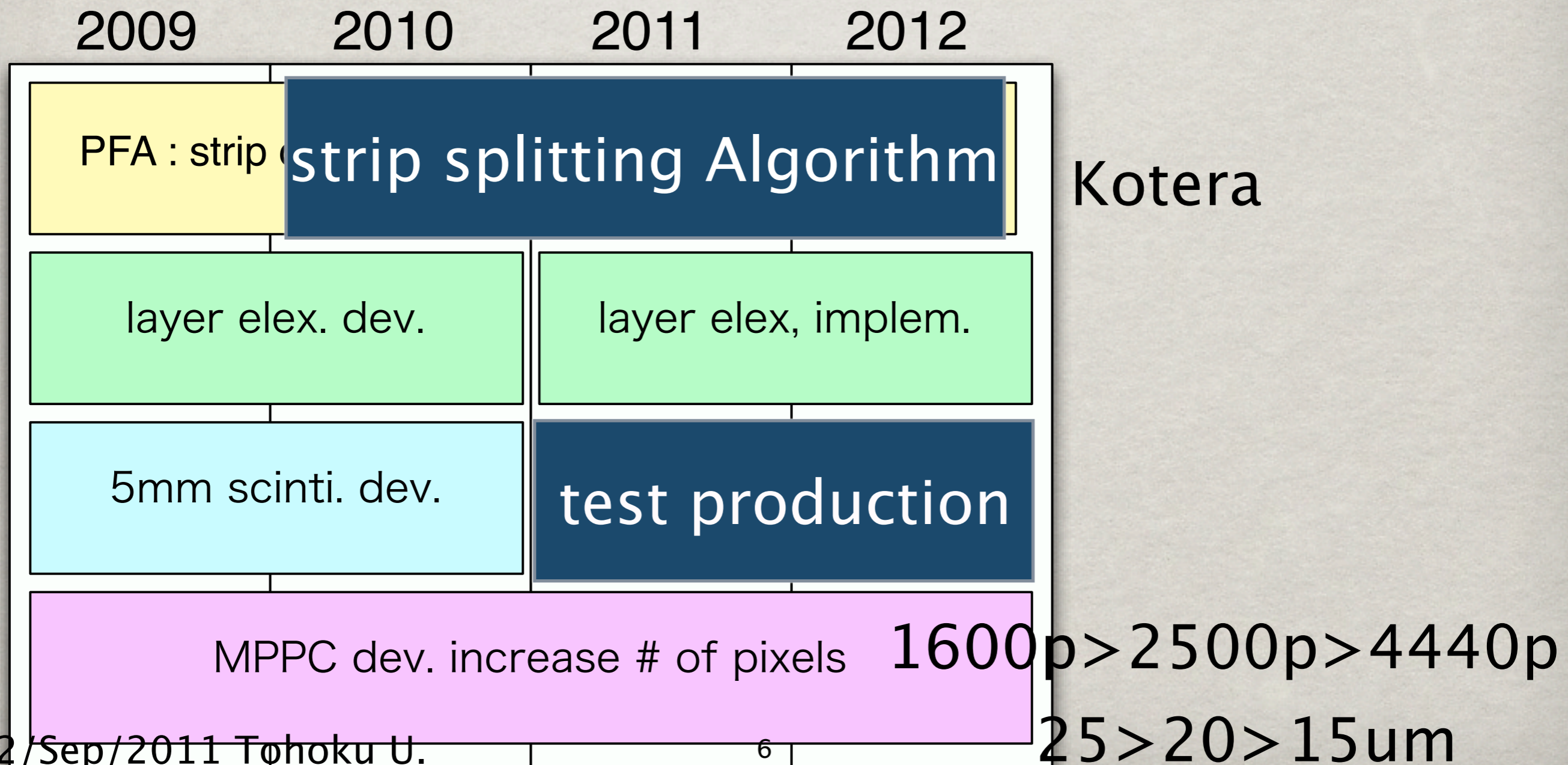
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ECAL-scintillator

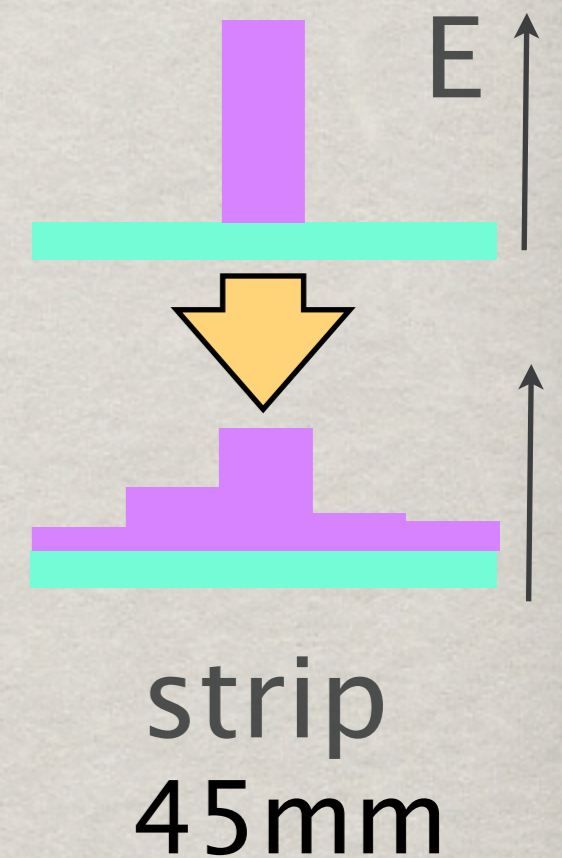
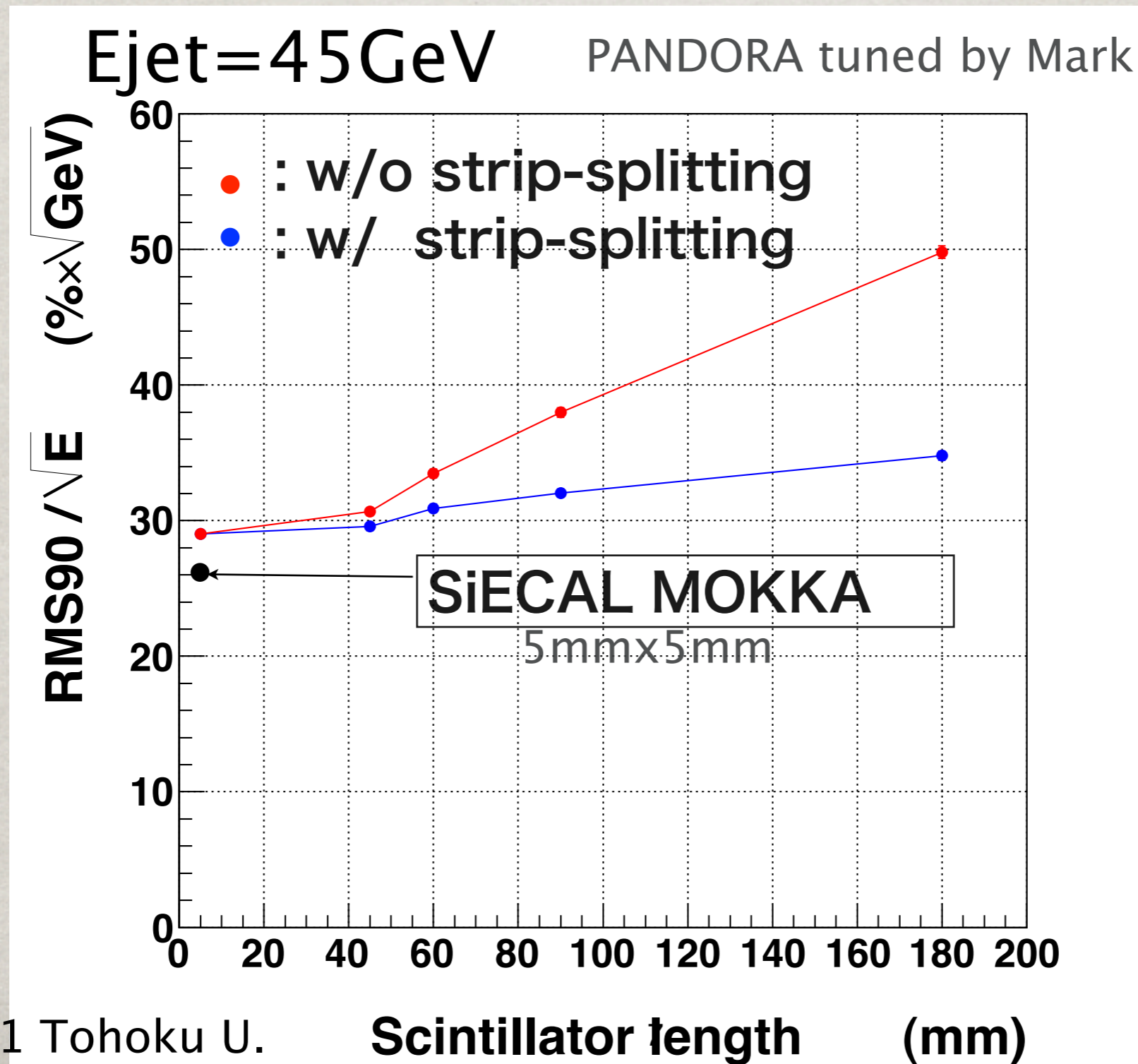
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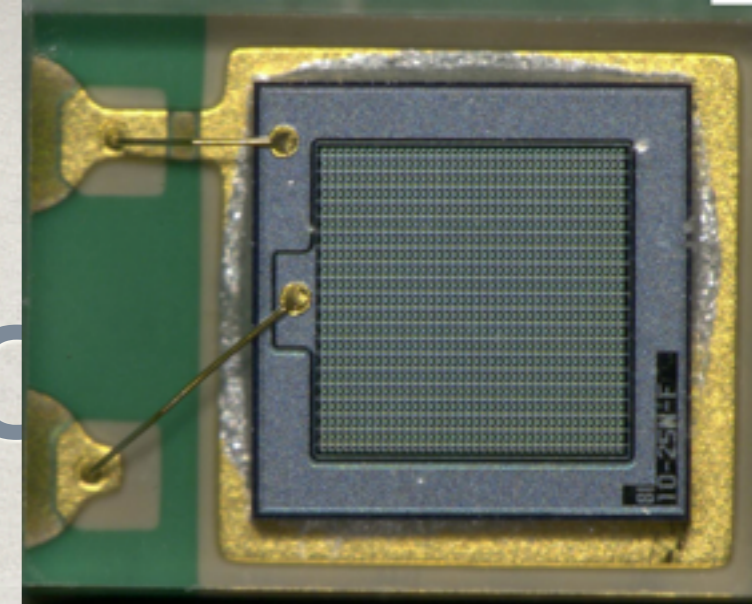


Strip Splitting Algorithm

☼ energy re-sharing into virtual cells of 5mm x 5mm

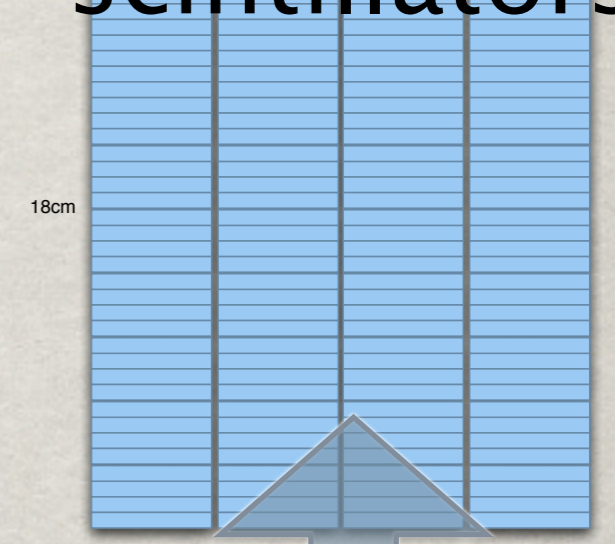


scintillator & electronics integration



- ✱ scintillator layer (Shinshu)
(Korea is pushed)
- ✱ electronics layer (DESY) with SPIROC (F) (precise geom. and design)

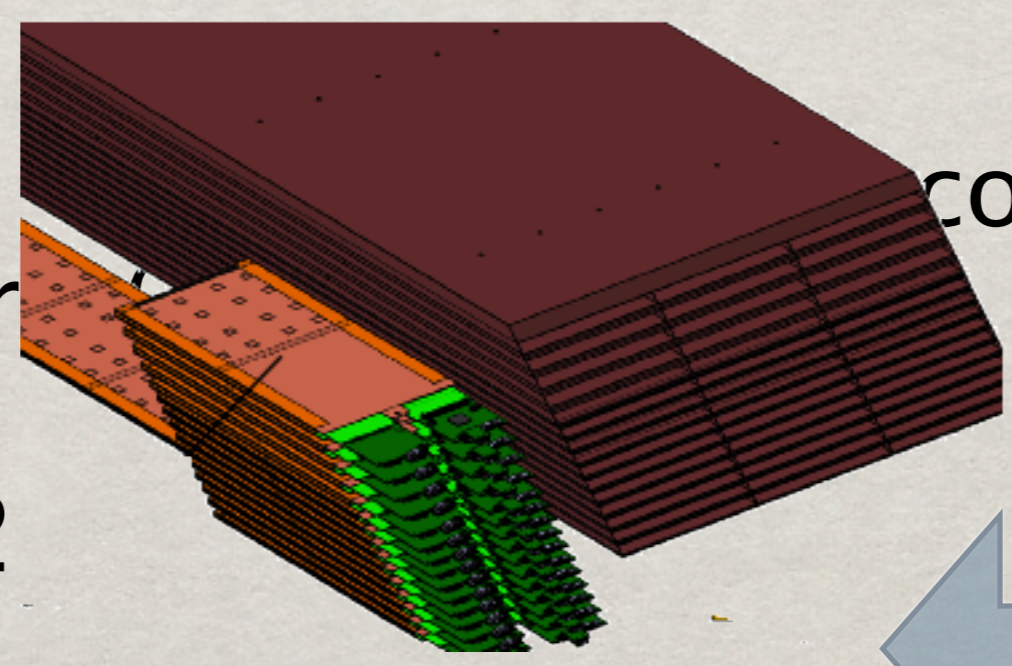
scintillators



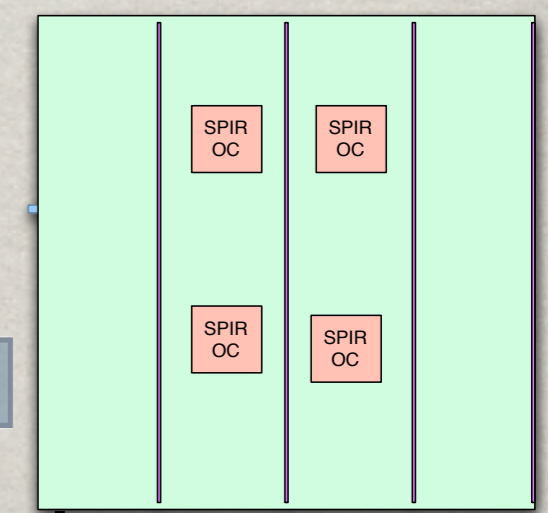
✱ const. & test

✱ integrated layer

✱ Beam test 2012



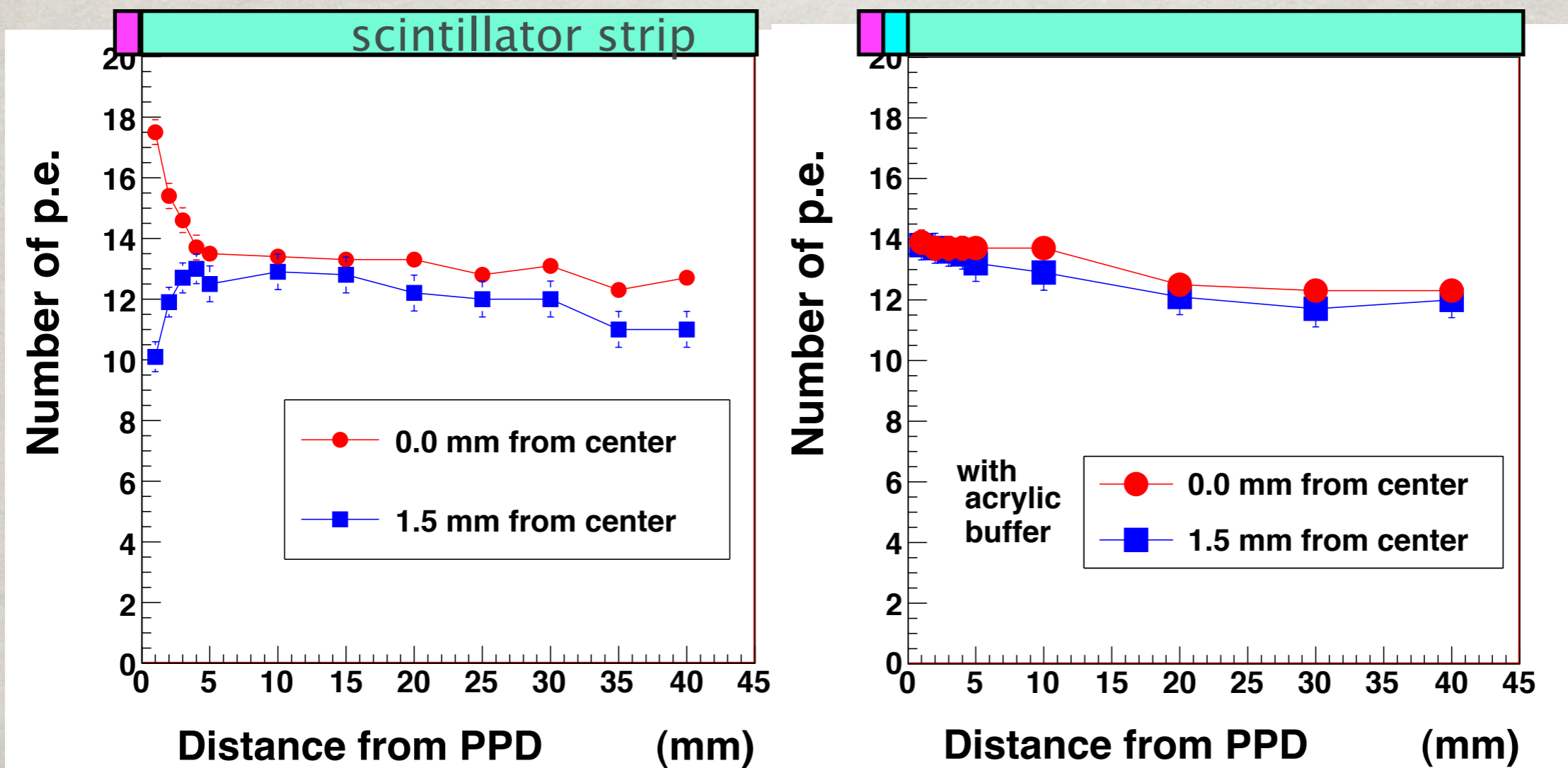
combine



electronics

5mm wide strip

- without WLSF 5mm x 45 mm x 2mm
- direct coupling of a **MPPC** without WLSF
- homogeneous & enough photons for a MIP



MPPC development

25 μ mpitch

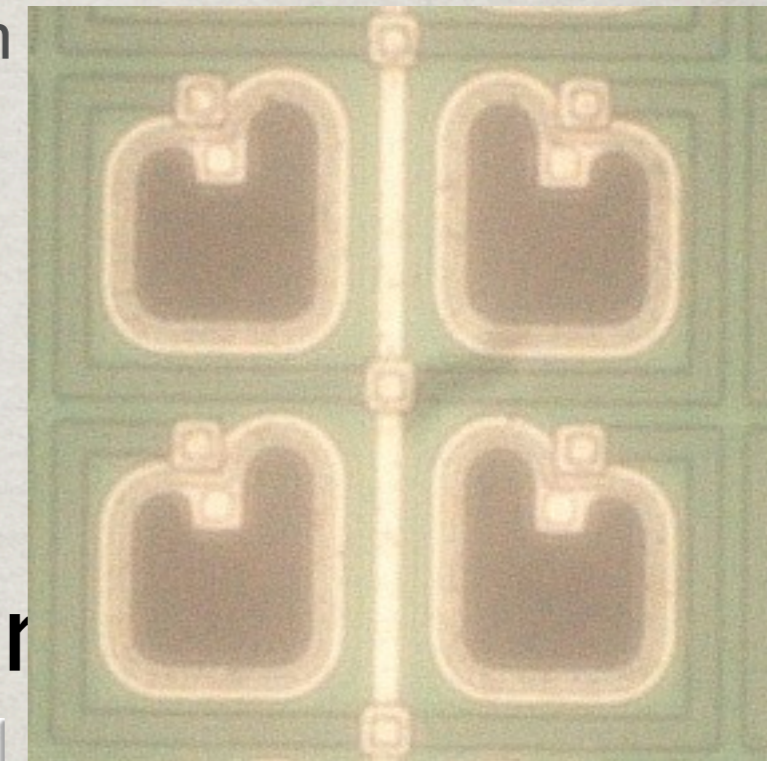
- increase number of pixels

increase dynamic range

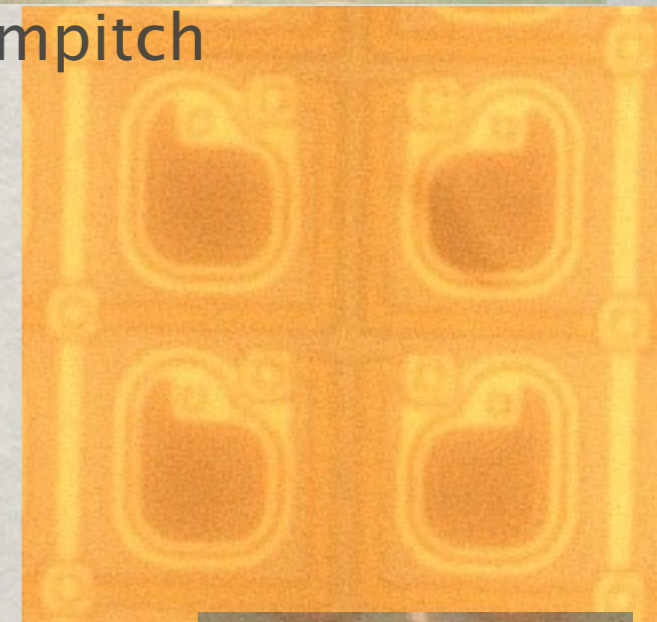
- better linearity by an LED

15ns width

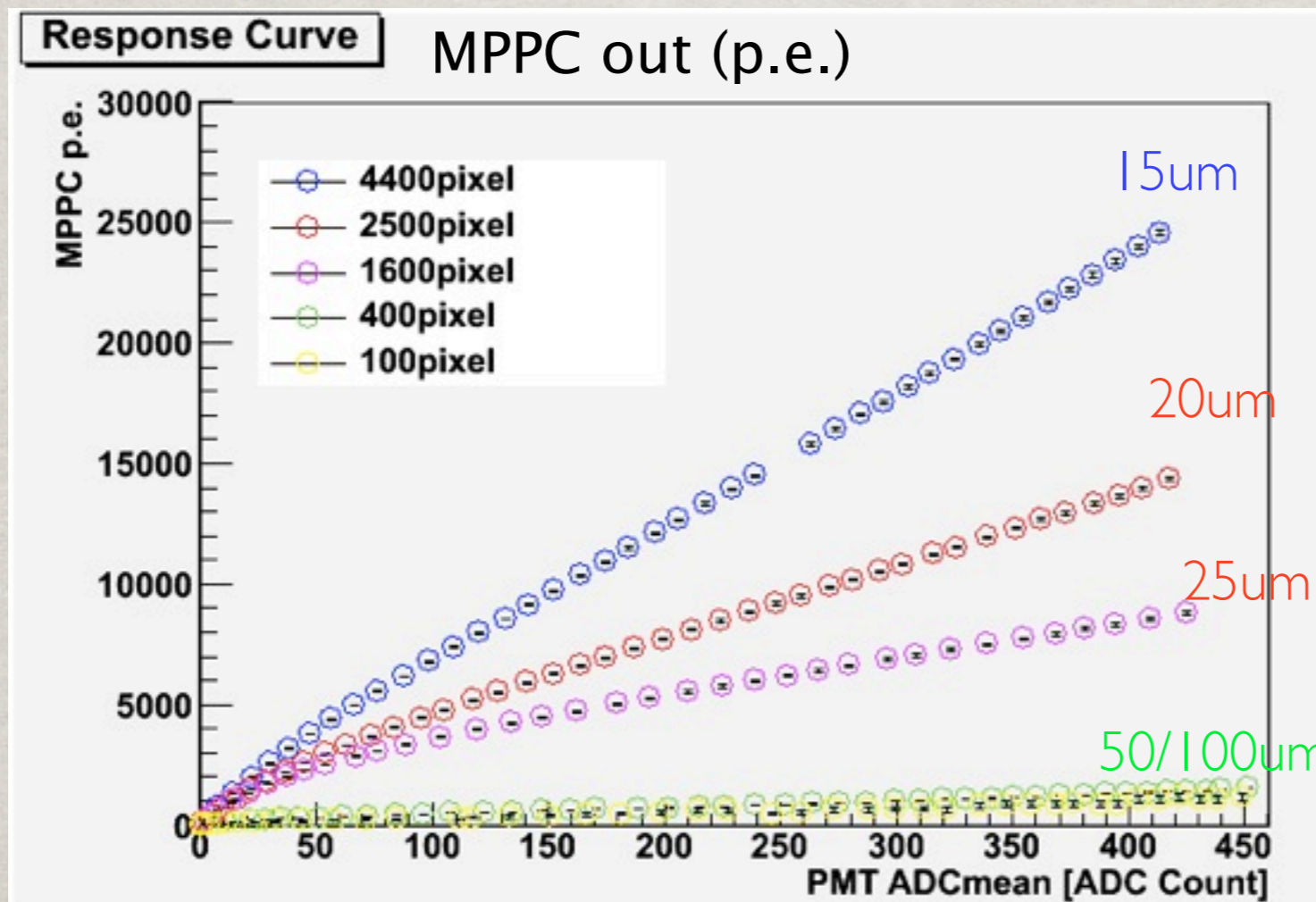
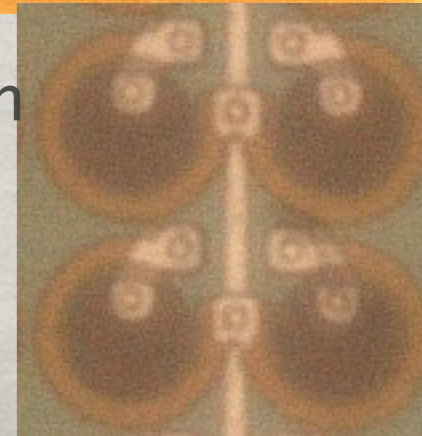
- 25/20/15 μ m pitch in 1mm x 1mm



20 μ mpitch



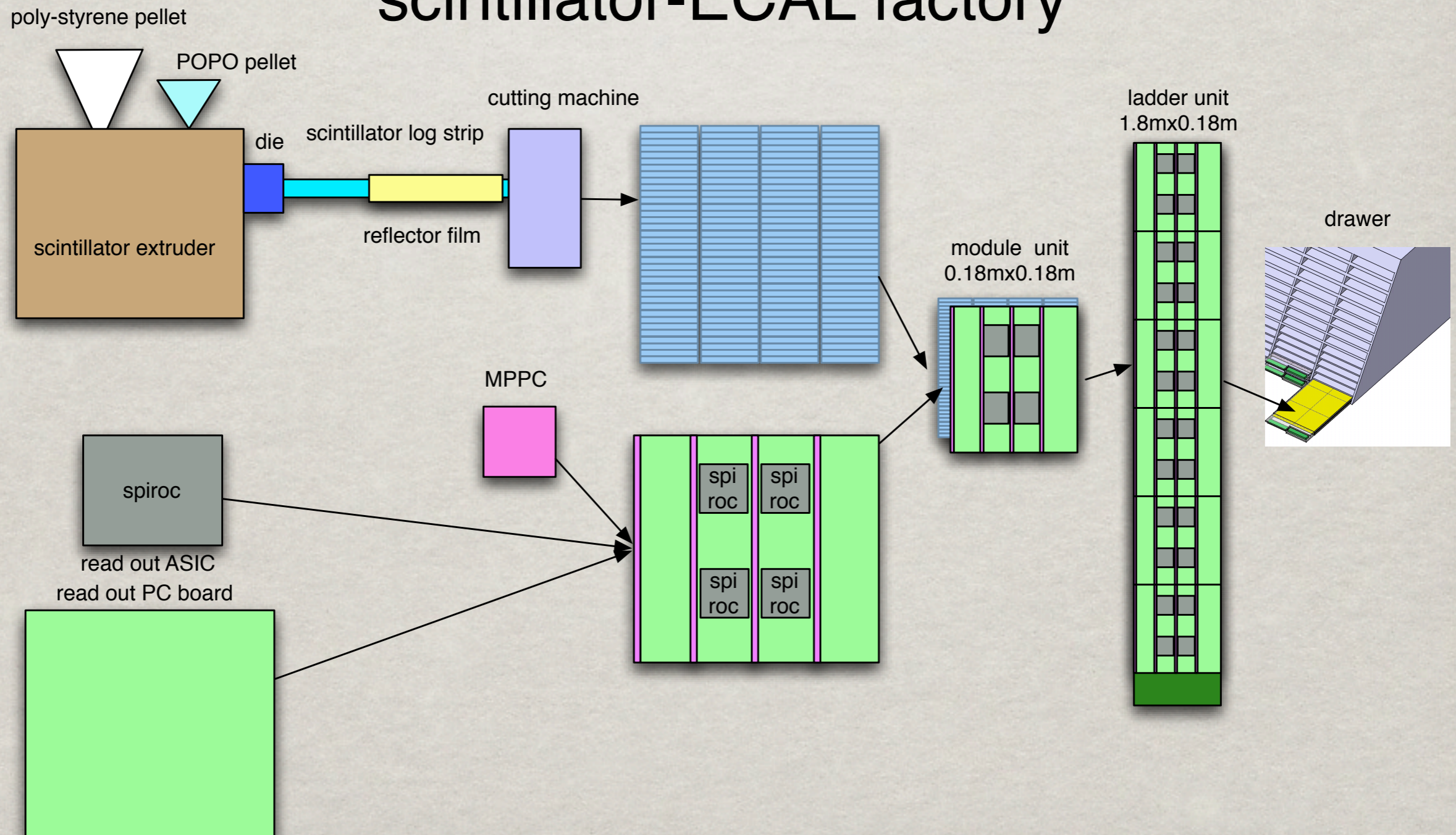
15 μ mpitch



ECAL post-DBD

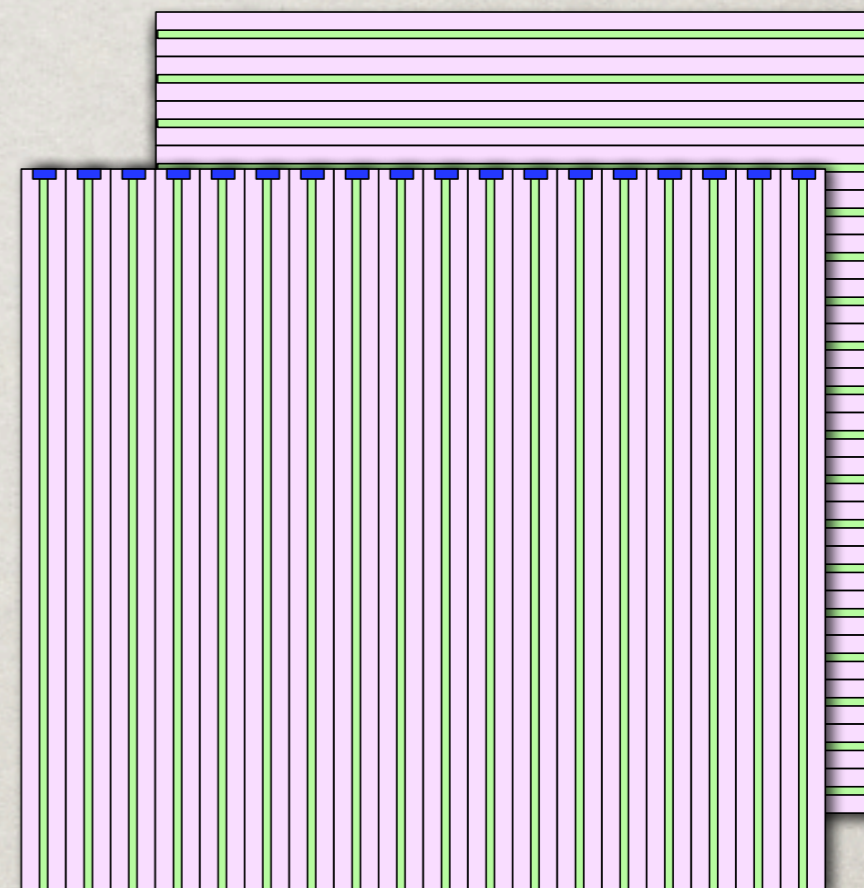
- ✻ establish mass production procedure

scintillator-ECAL factory



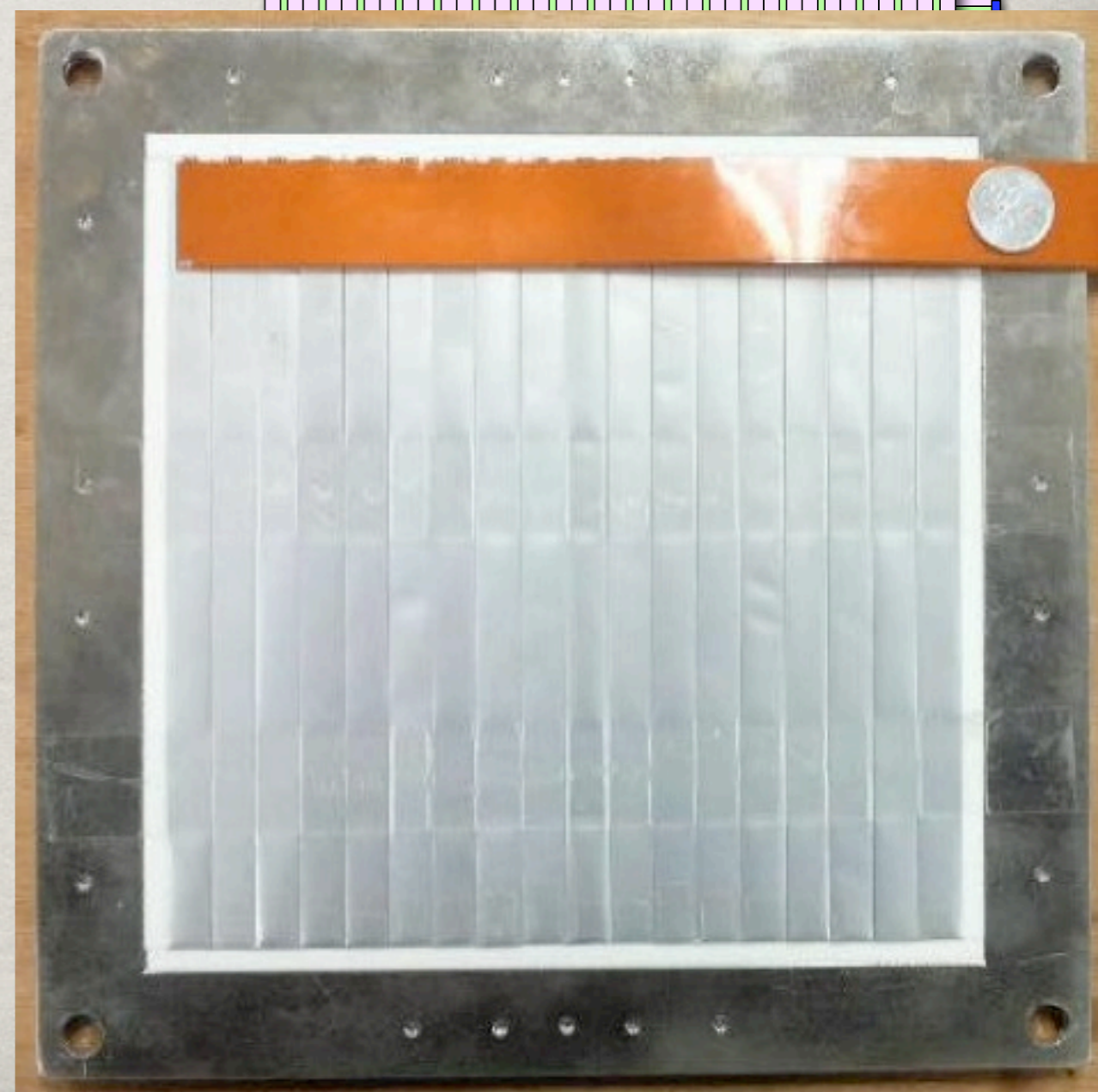
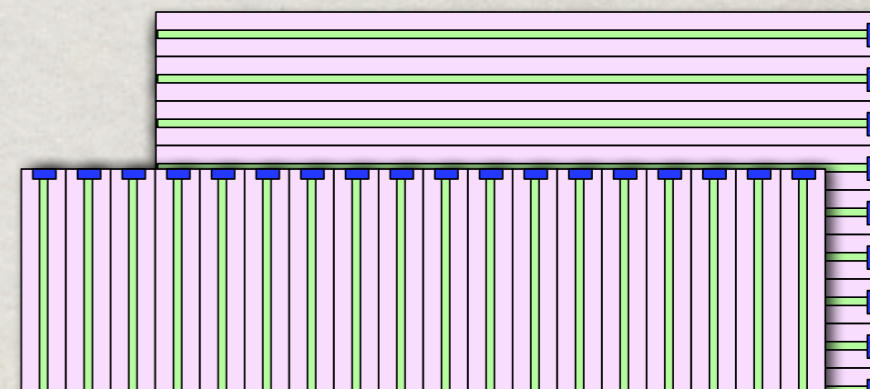
HCAL Strip

- ✱ 1cm x 18cm HCAL strips
- ✱ effective 1x1 cm²
- ✱ WLSF read out by MPPC
- ✱ expertized technique
- ✱ simulation with Strip Splitting Algorithm
- ✱ if OK, Beam test
- ✱ system integration is similar



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summary

- ✿ Tokutei-Calorimeter activities
- ✿ ECAL : silicon + scintillator = hybrid
- ✿ HCAL : scintillator strip cal.
- ✿ engineering & mass production study
- ✿ to be ready for construction in 5 years