Scintillator strip study for SCECAL

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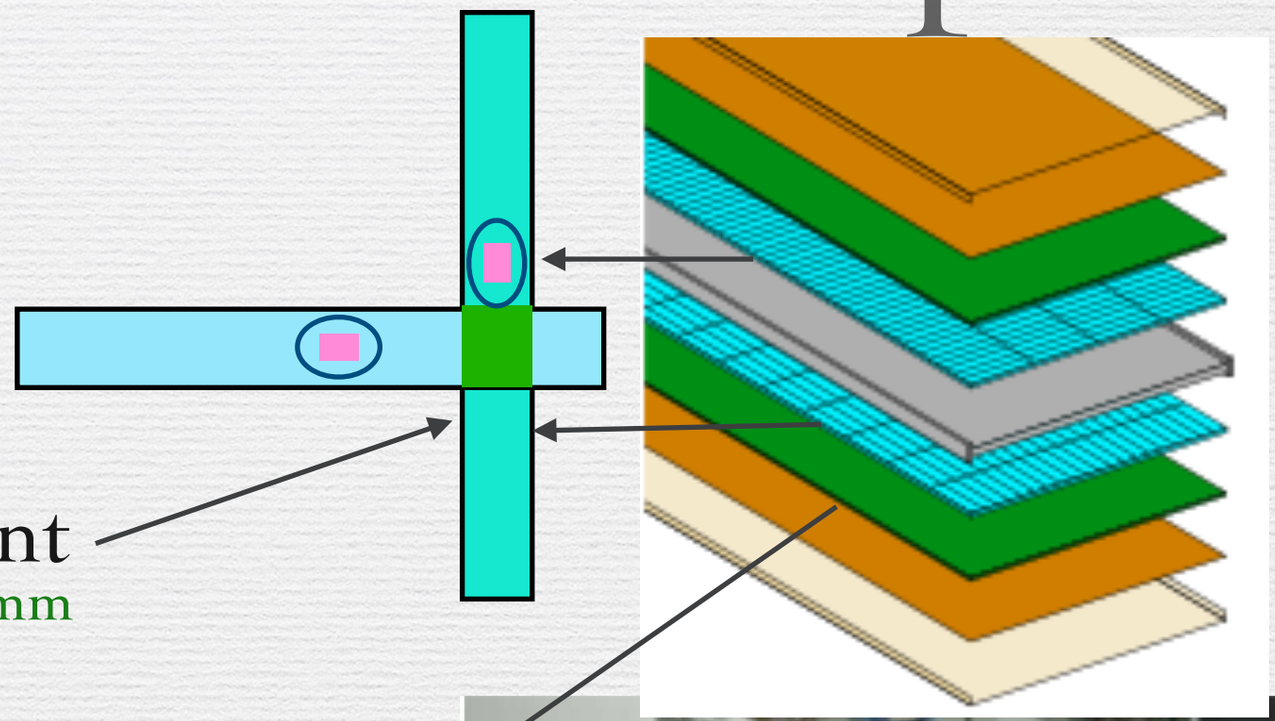
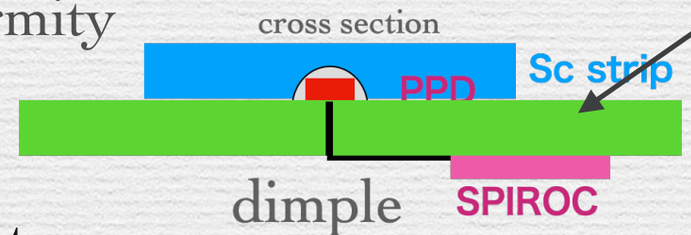
ILC-JP annual meeting 9March2022

- Current situation of SC-ECAL
- Scintillator Activities
- Strip stability

SCECAL and SC-strip

- As an EM calorimeter
- Scintillator strip with tungsten absorber
  - Orthogonal arrangement
    5mmx5mm
  - With a dimple read by a MPPC
- Embedded read out electronics
- A prototype is ready for beam test with Chines contribution





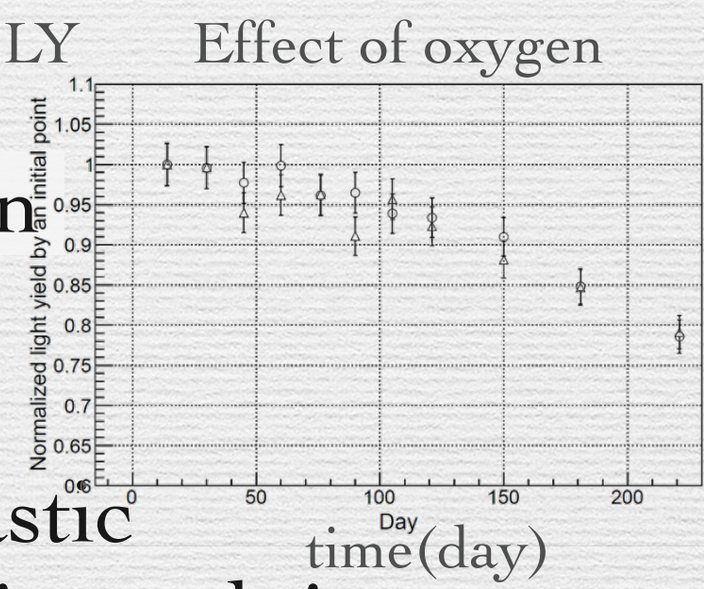
Sc-ECAL activities

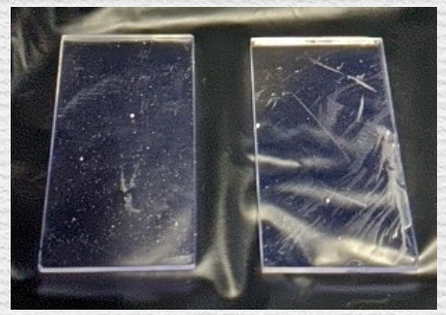
Tokyo University : W.Ootani
SC-ECAL prototype, injection molding prod. and more
Ryunosuke

Shinshu University: T.Takeshita
strip stability test

Nippon Dental University: H. Ono
Room temperature curing scintillator production

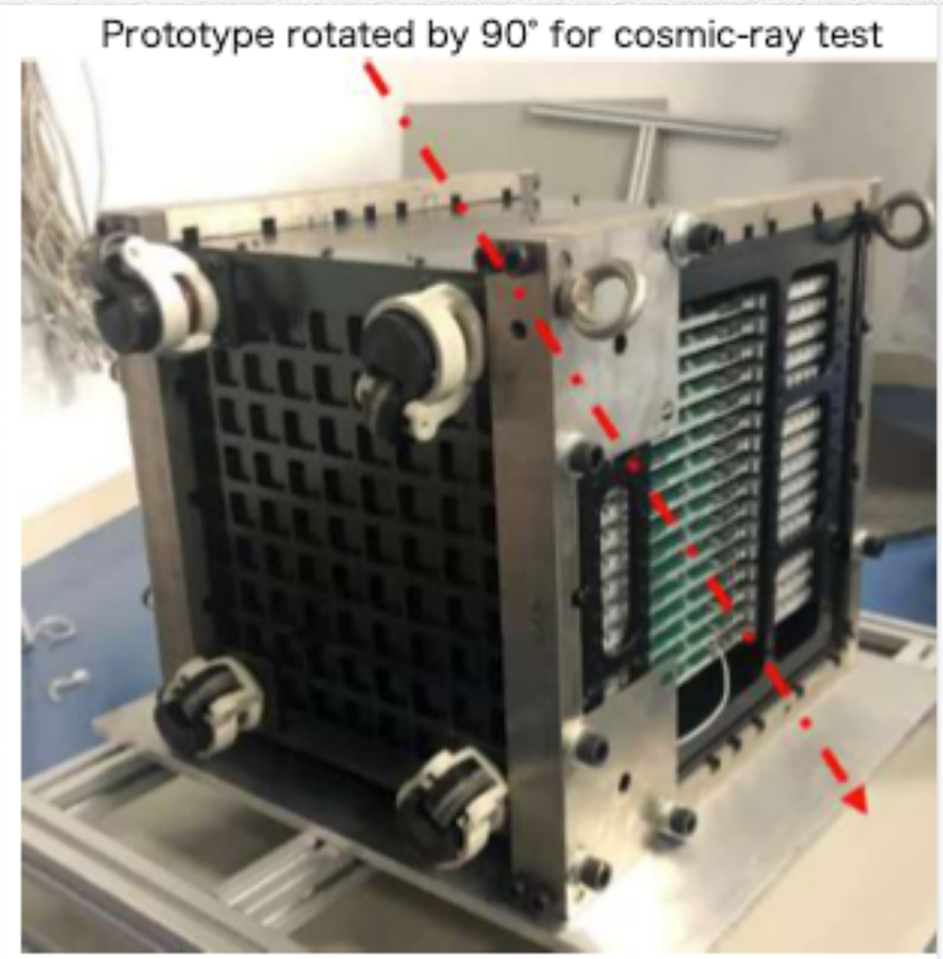
Nagano College (KOSEN) : E.Saito
development of a room-temperature-curable plastic scintillator, especially improvement of the stability and time resolution.



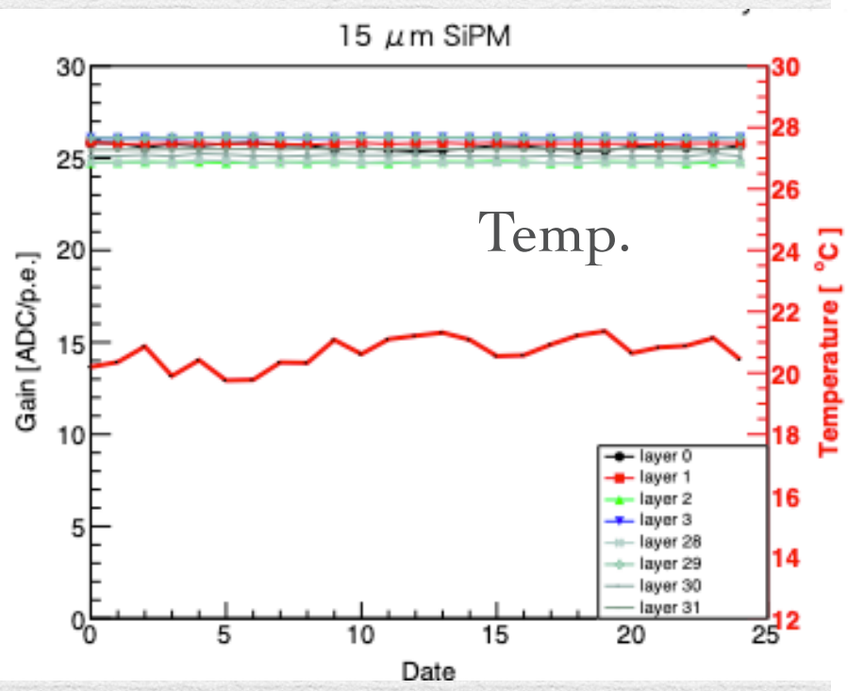


Strip stability

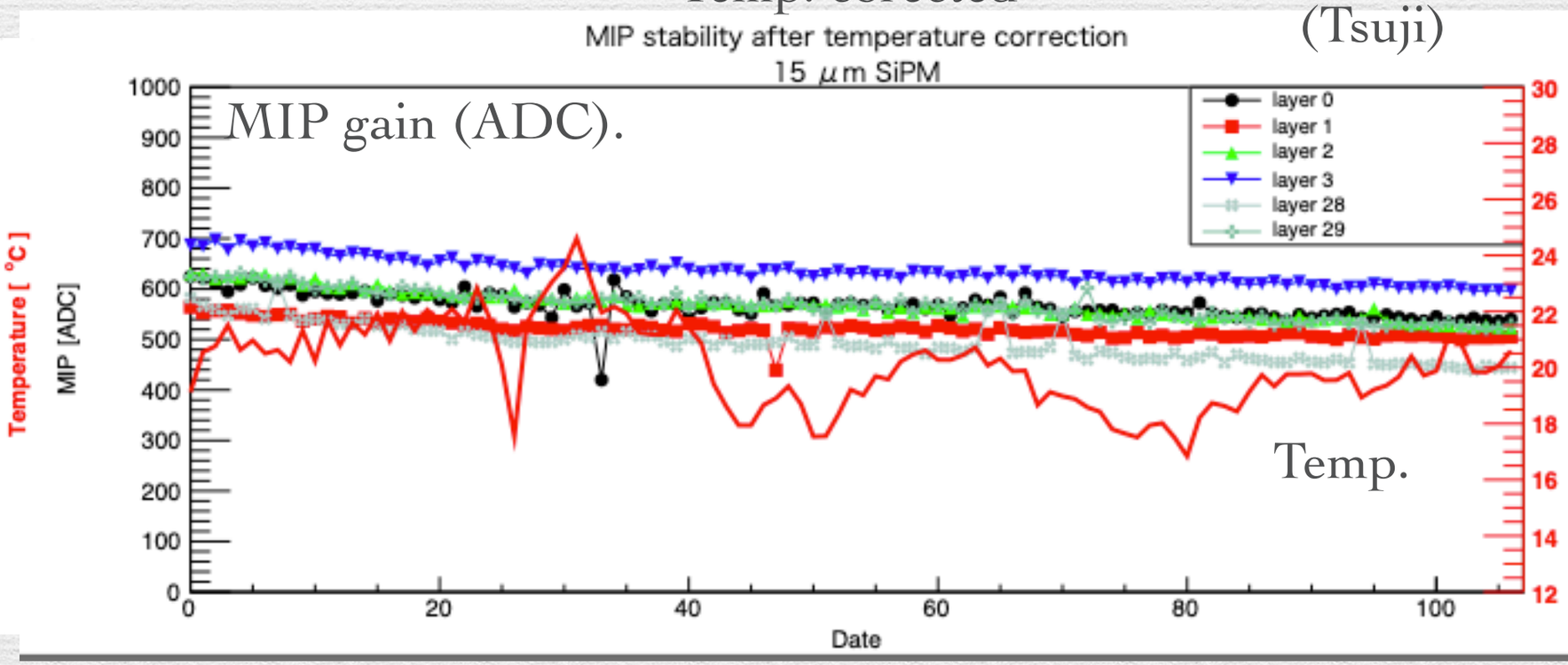
- prototype showed 5-13% decrease over 3 months depending on layers with CR (20-52%/year)
- While stable with LED data (one month)
- Includes many contributions,
  - Scintillator, MPPC,,,



- To understand …



Temp. corected (Tsuji)



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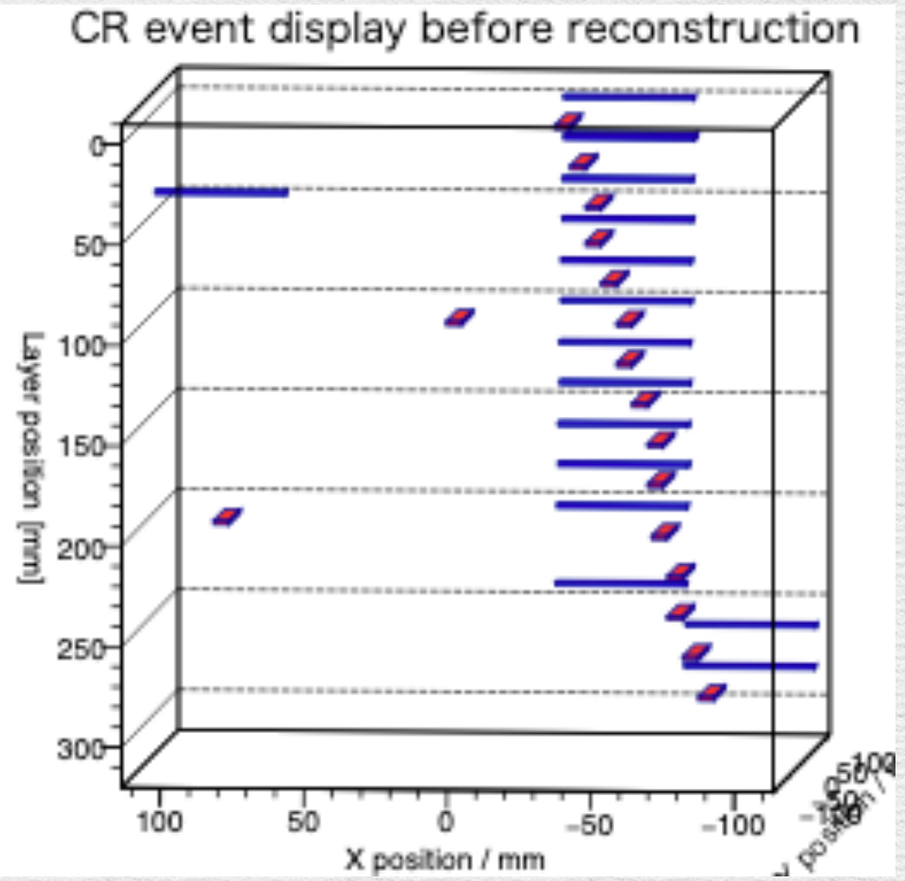

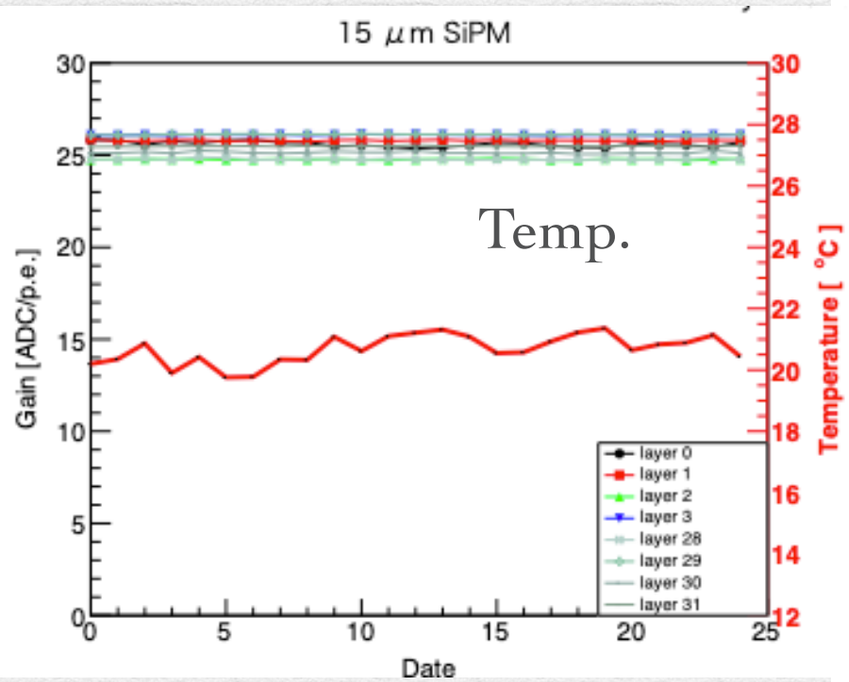

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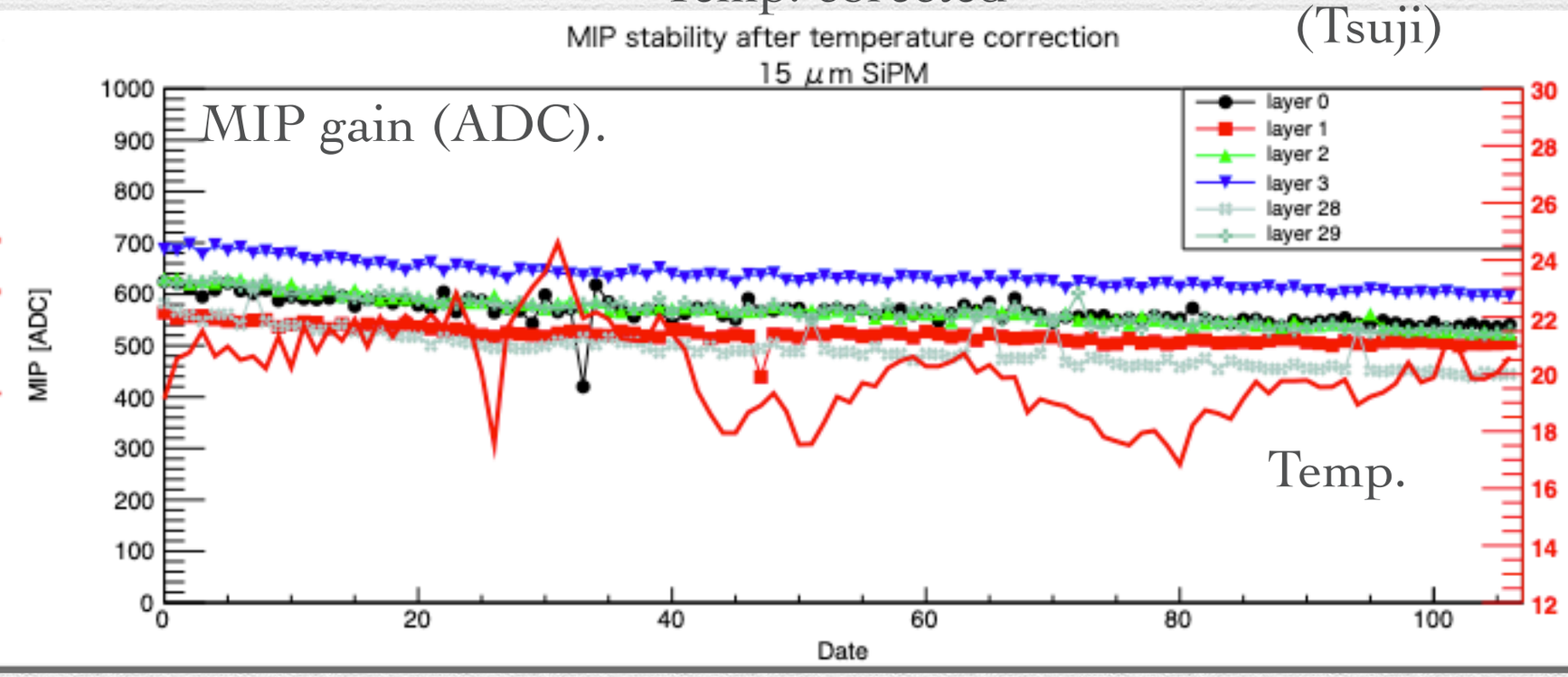
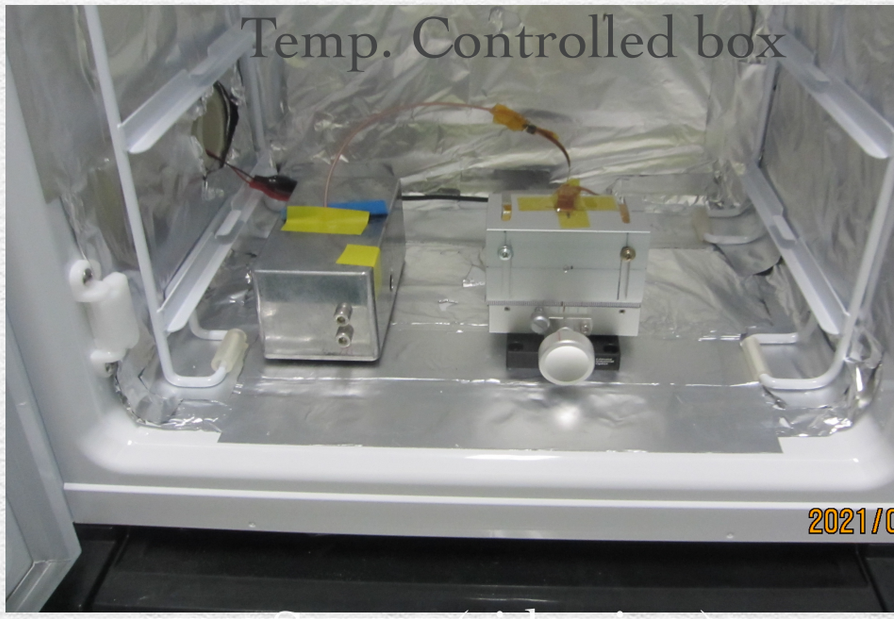
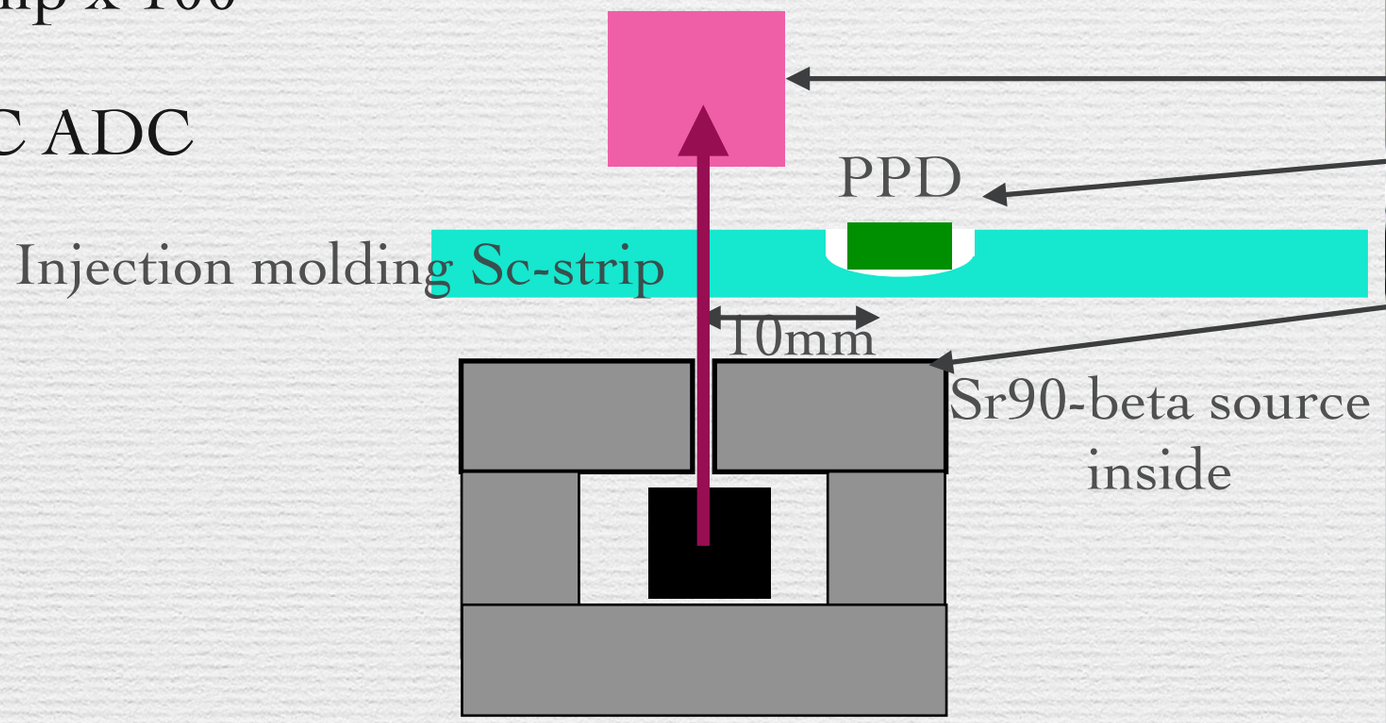
(Tsuji)

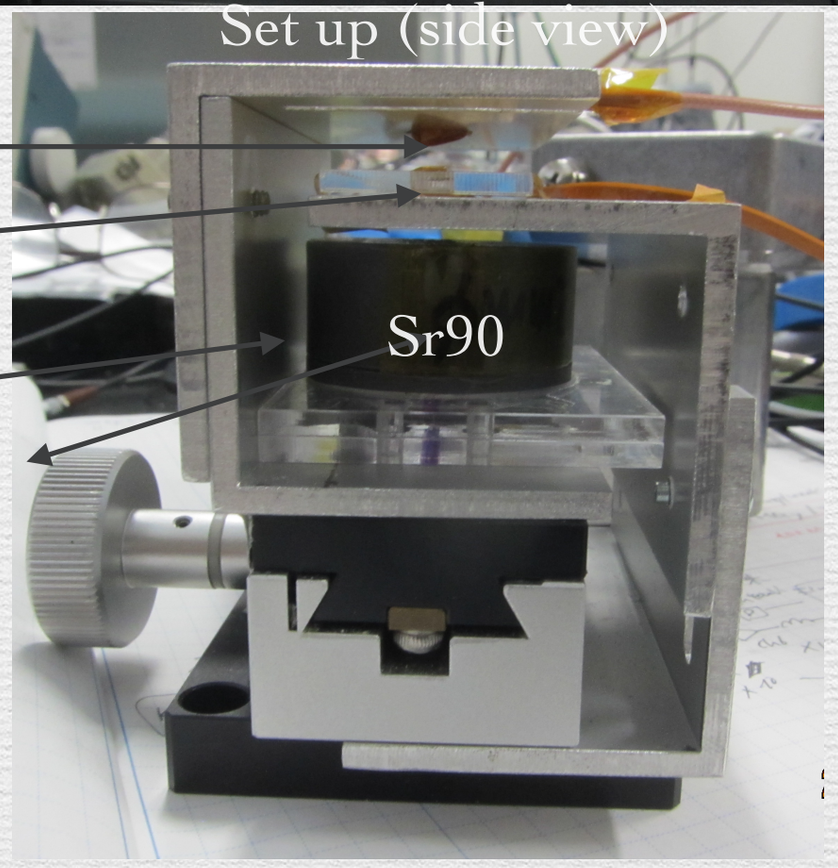


Strip stability test at Shinshu with beta rays

- In a temperature controlled box of 20.5+-0.1C
- intensity of beta rays from Sr90 ~ 100Hz /1mmϕ
- Scintillator strip = injection molding strip
- PPD= MPPC S14160-1315PS : 15um pitch , 1.3mmx1.3mm
- NIM Amp x 100
- CAMAC ADC



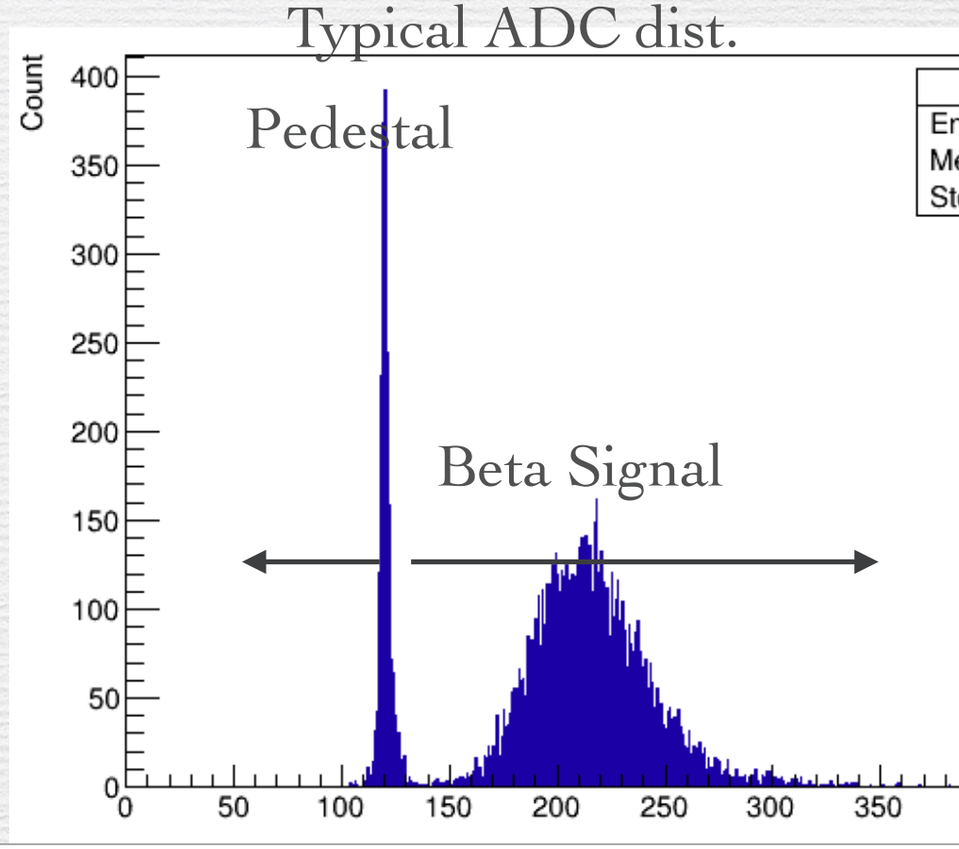




Result with continuous beta

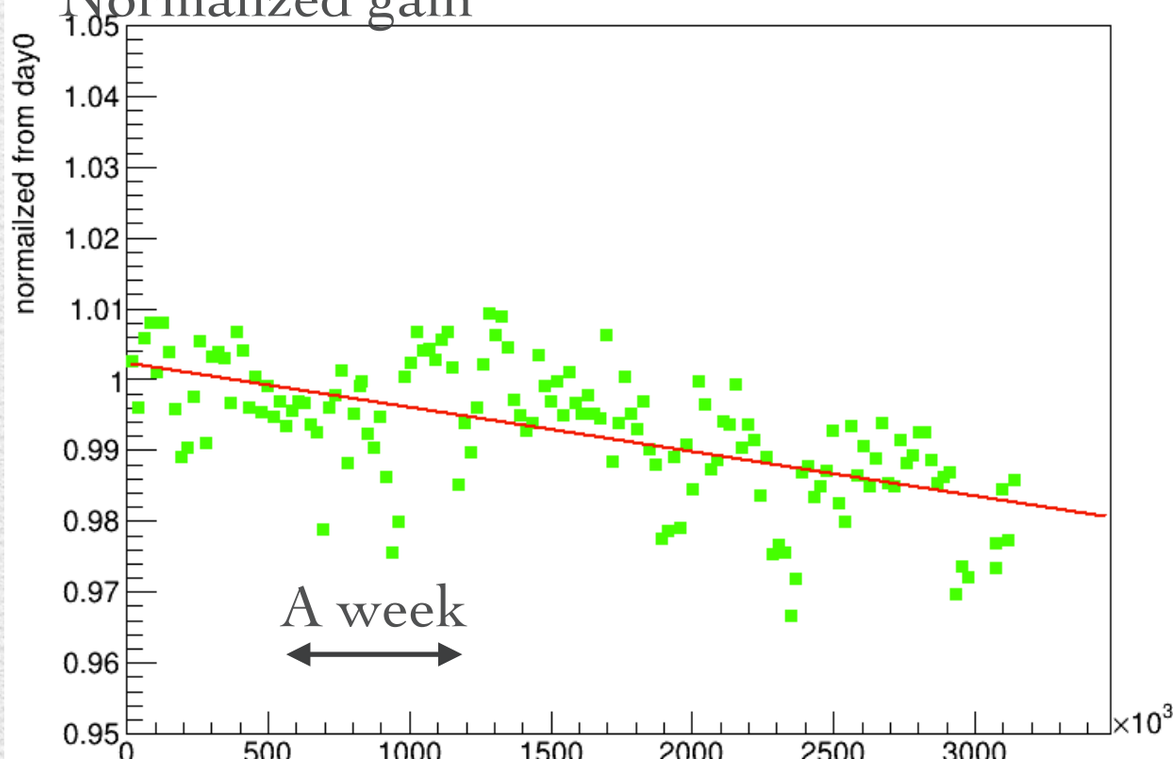
- Continuous beta ray irradiation for 5 weeks
- -0.05%/day ~ -18%/year including radiation effect, aging of scintillator and PPD and …

Typical ADC dist.



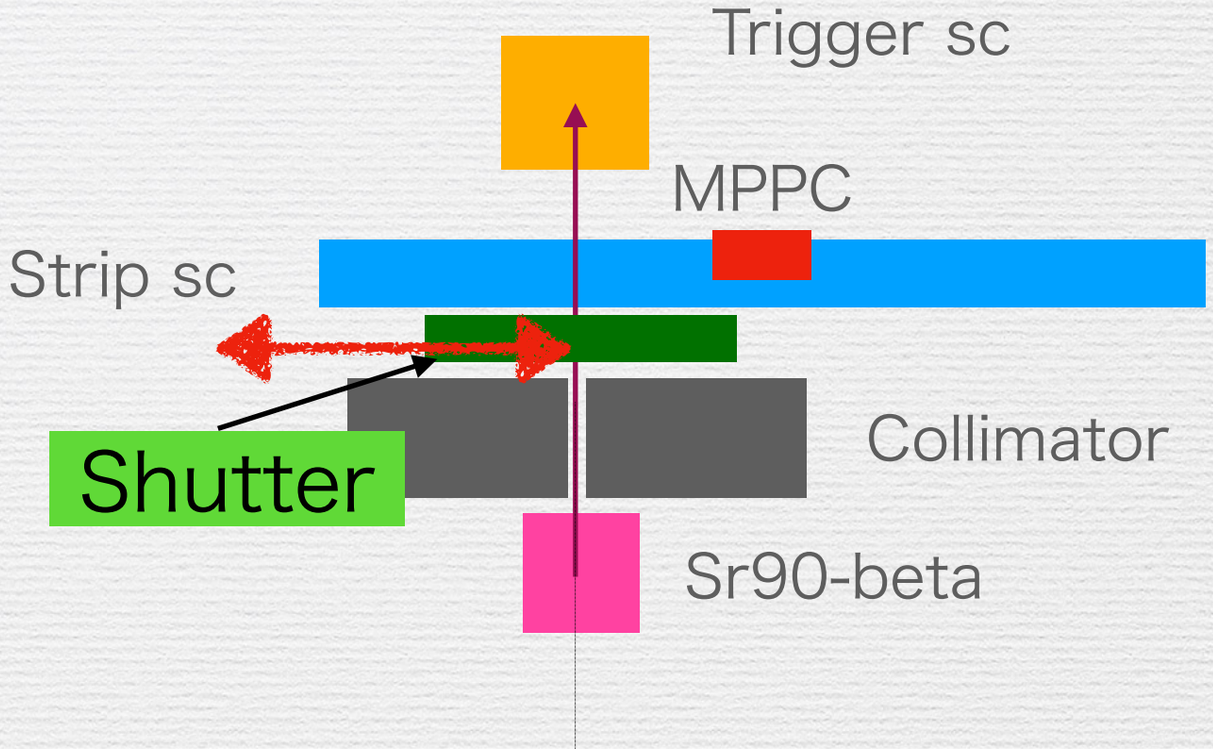
stability

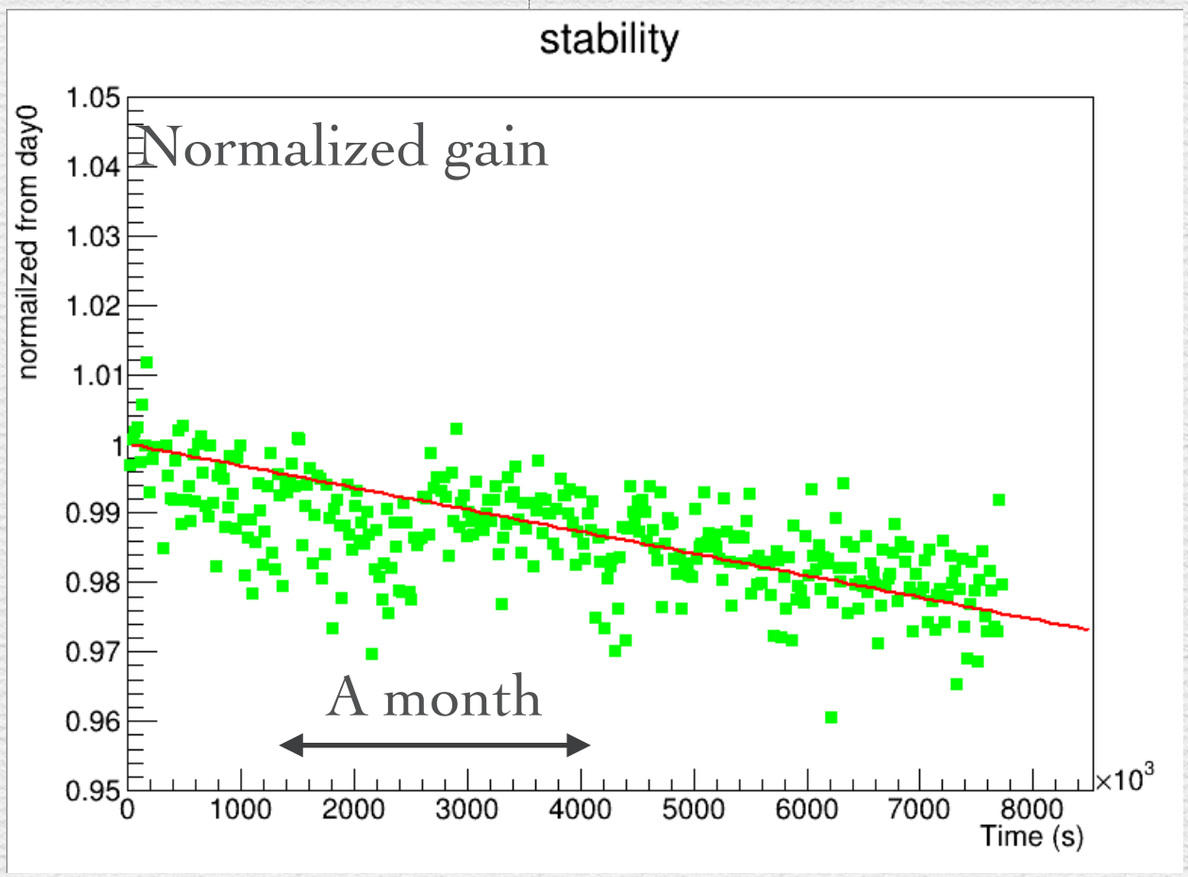
Normalized gain



Result with intermittent beta

- Intermittent bombardment for 3 months, during DAQ ~ 4min every 6hs
- Installed a lead shutter
- -0.027%/day ~10%/year : including aging of PPD and scintillator, radiation effect and others
- Investigate the reasons
- gain = LY(scintillator)*G(PPD)
  - G(PPD) can be monitored by measuring photo-electron gain

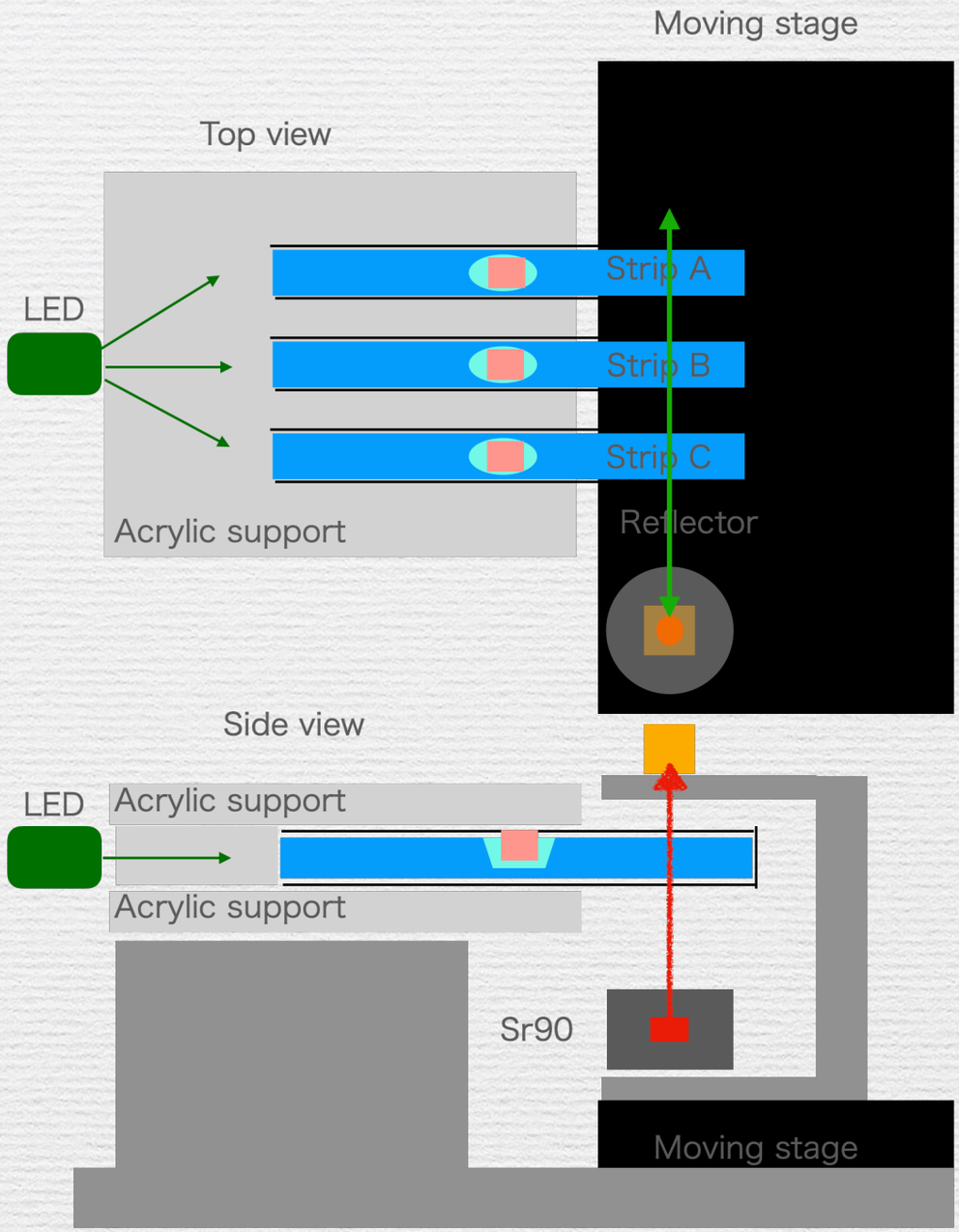




Setup with intermittent betaII

- Intermittent bombardment for three scintillator strips
- LED light from side of strips to monitor PPD gains
- Strip A: injection molding
- Strip B: Kuraray SCSN38
- Strip C: Eljen EJ204
- PPD=MPPC: S14160-1315CS
- trigger=LED or beta ray

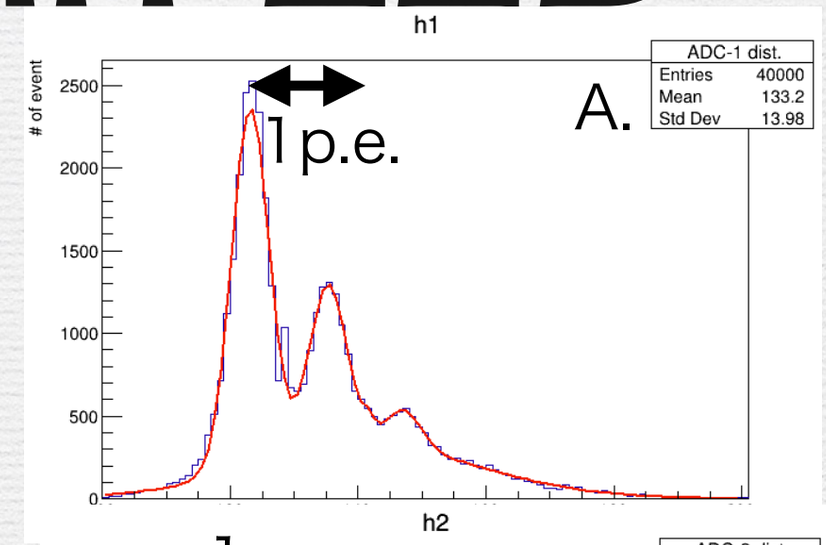
  Continuous with 10Hz

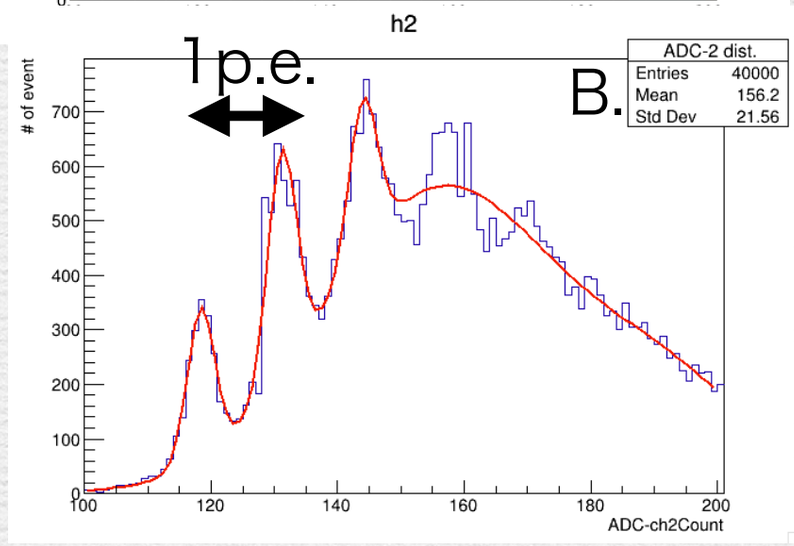


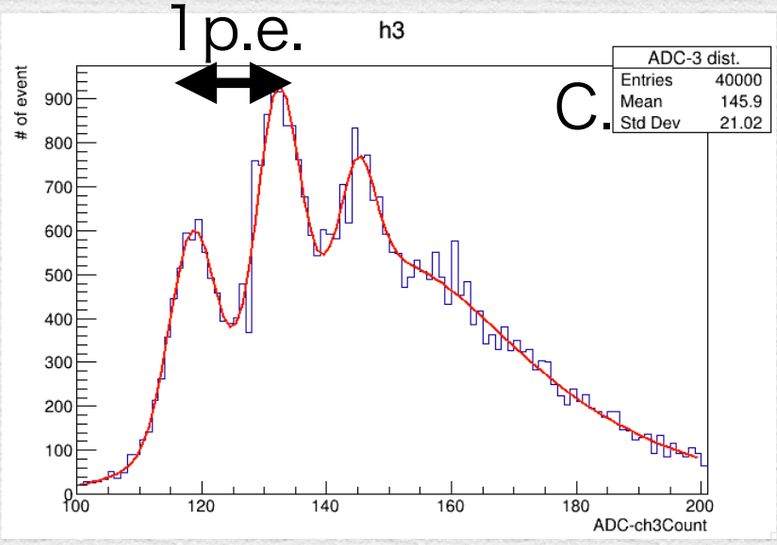
p.e. peaks by an LED

Photo-electron

- An LED is flickering
- Histograms show ADC dist's at beginning
- Fitting with sum of five gauss functions between 100 and 200 ADC counts
- P.e.'s are calculated from the first(0p.e.) and second(1p.e.) peaks





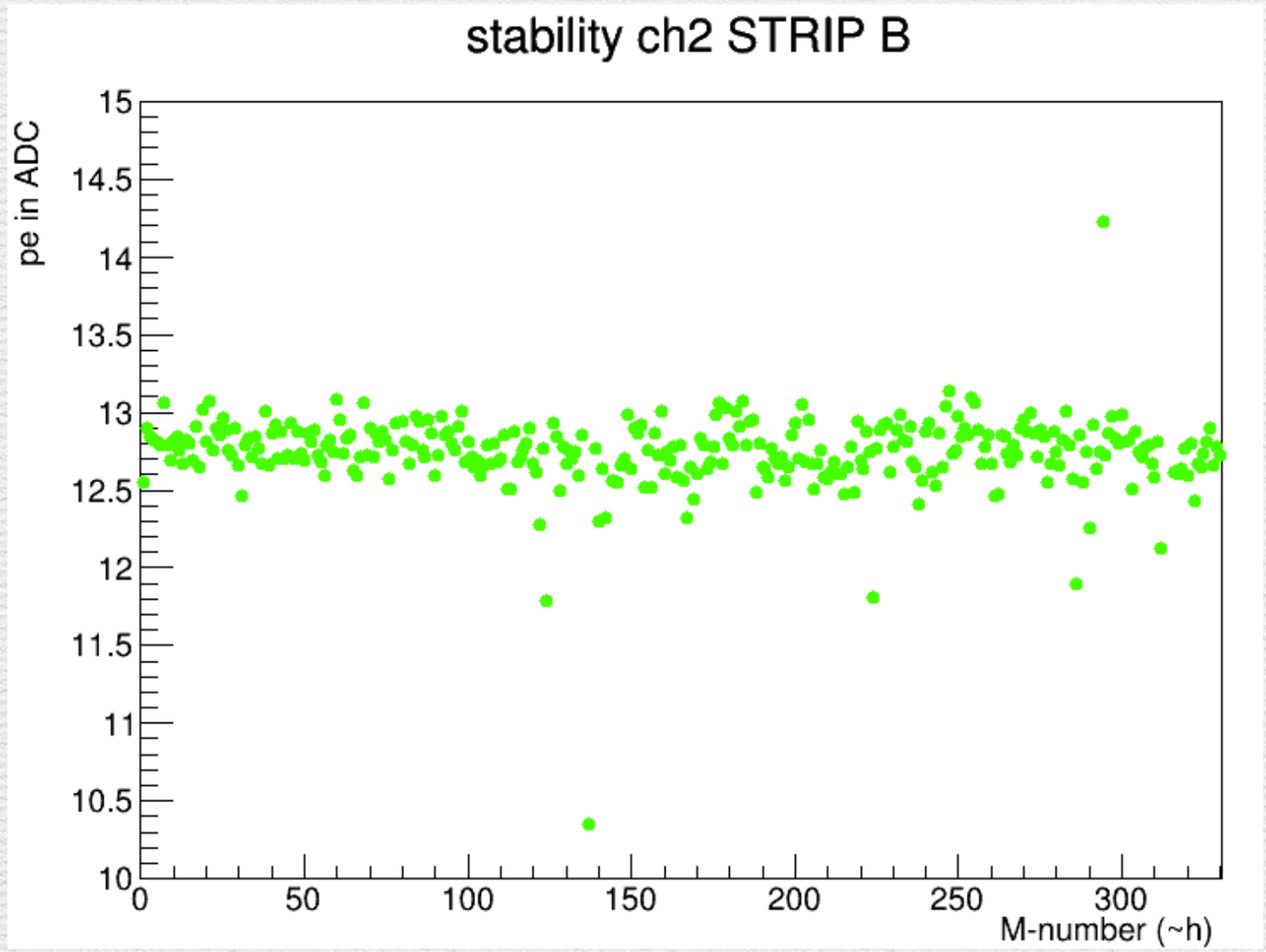


p.e. stability for 14d

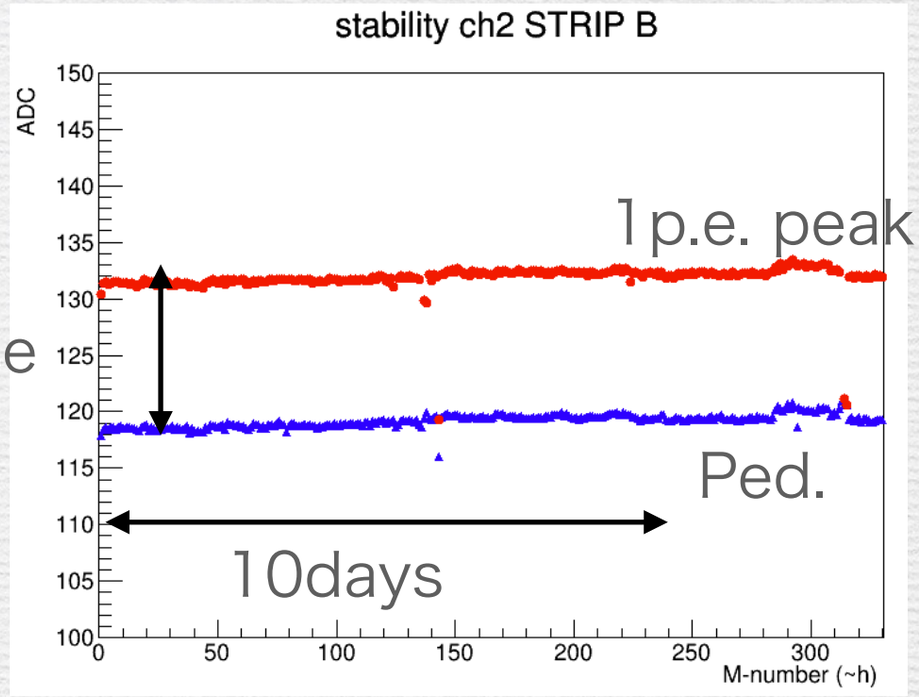
Strip B:

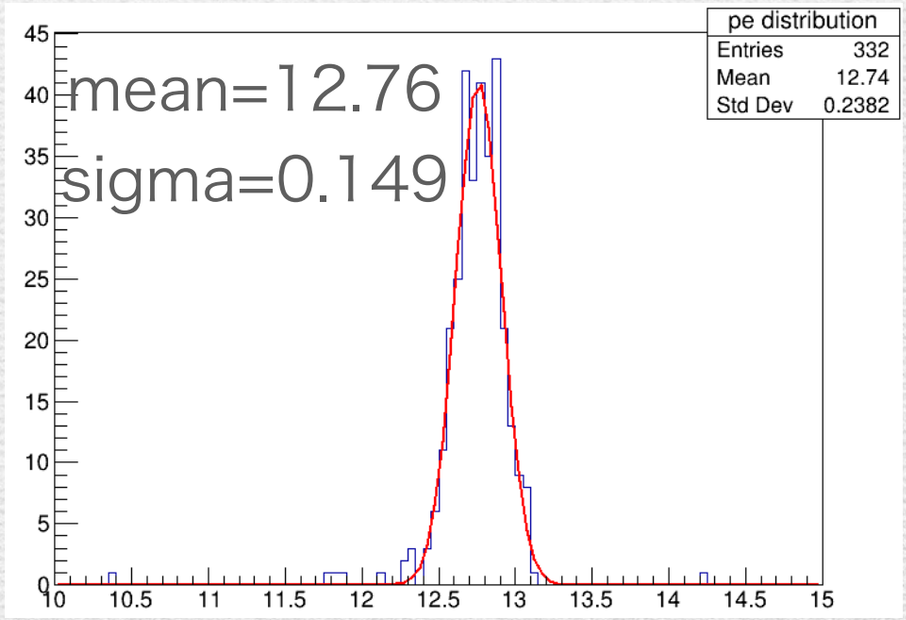
Kuraray SCSN38

Good stability~1%



1p.e. response

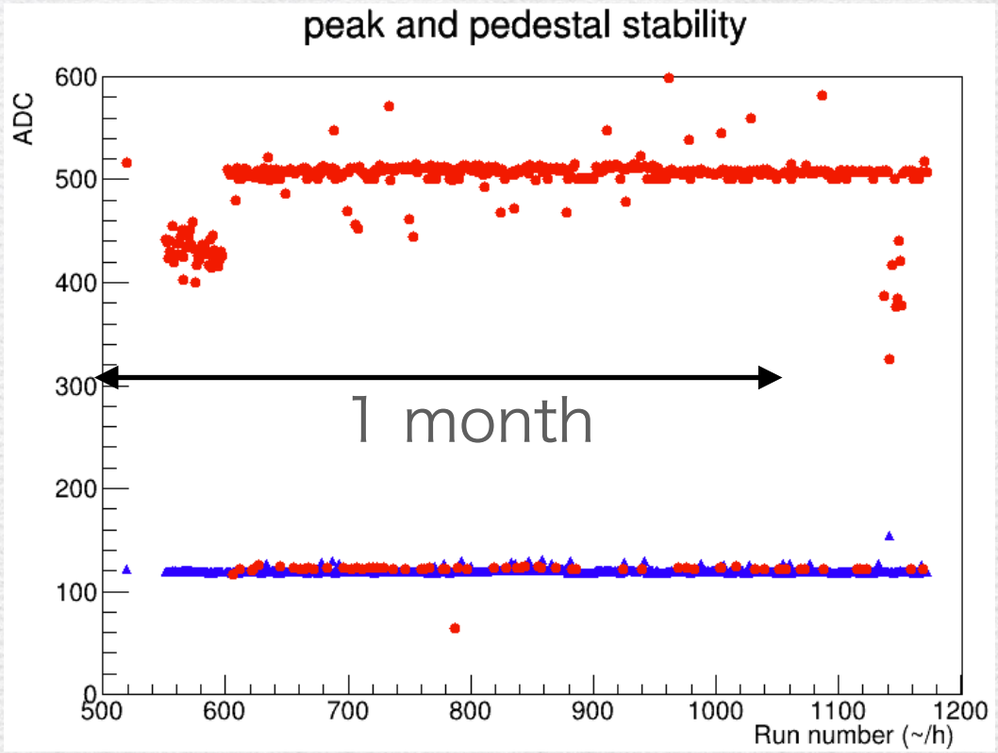


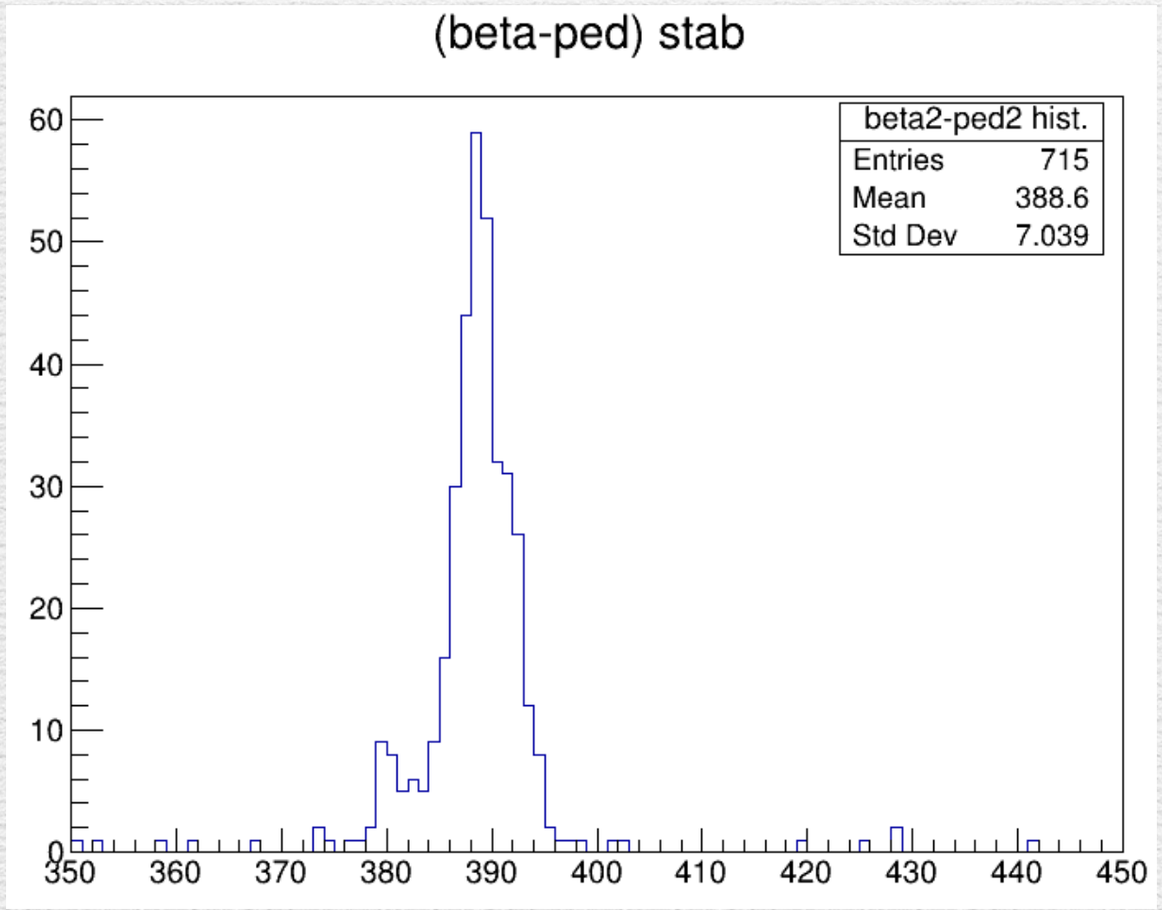


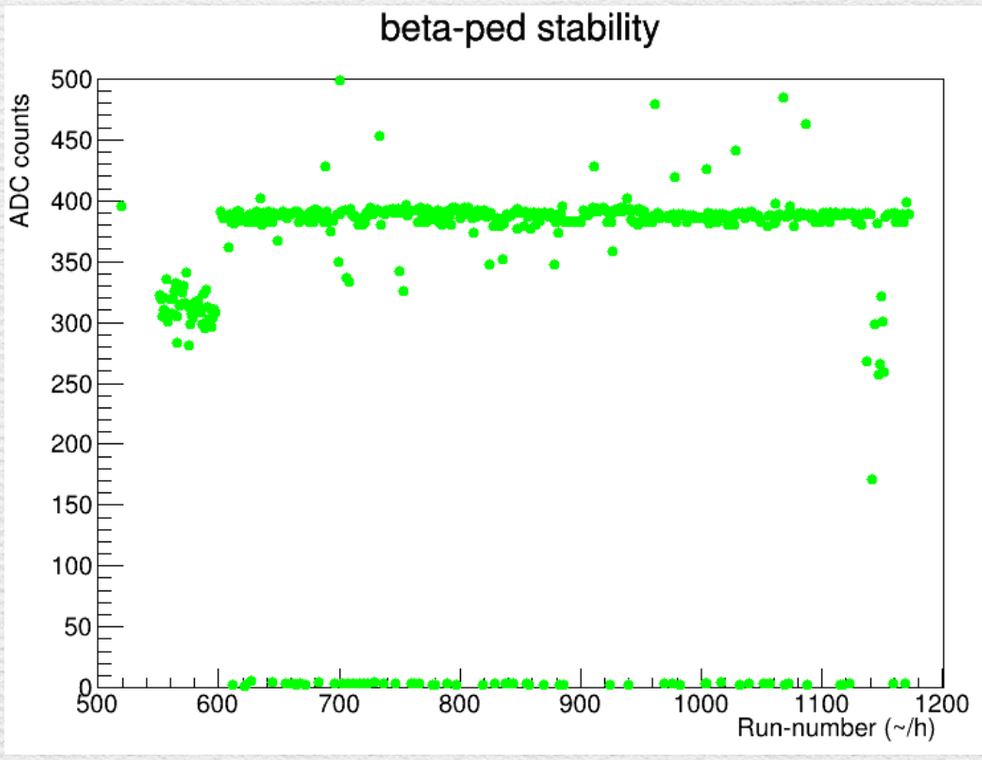
Stability : beta rays

Beta responce: strip B: Kuraray strip

- More than a month
- Good beta peak stability ~ 0.5%







Summary and outlook

- Strip stability test by beta response with simultaneous photo-electron detection is running
- DAQ continues at least 3 months
- stable both beta and p.e. responses for two weeks at least

- Need to analyze p.e. response and beta ray combined
- Investigate and identify the reason of decreasing results owith cosmic ray test at China