

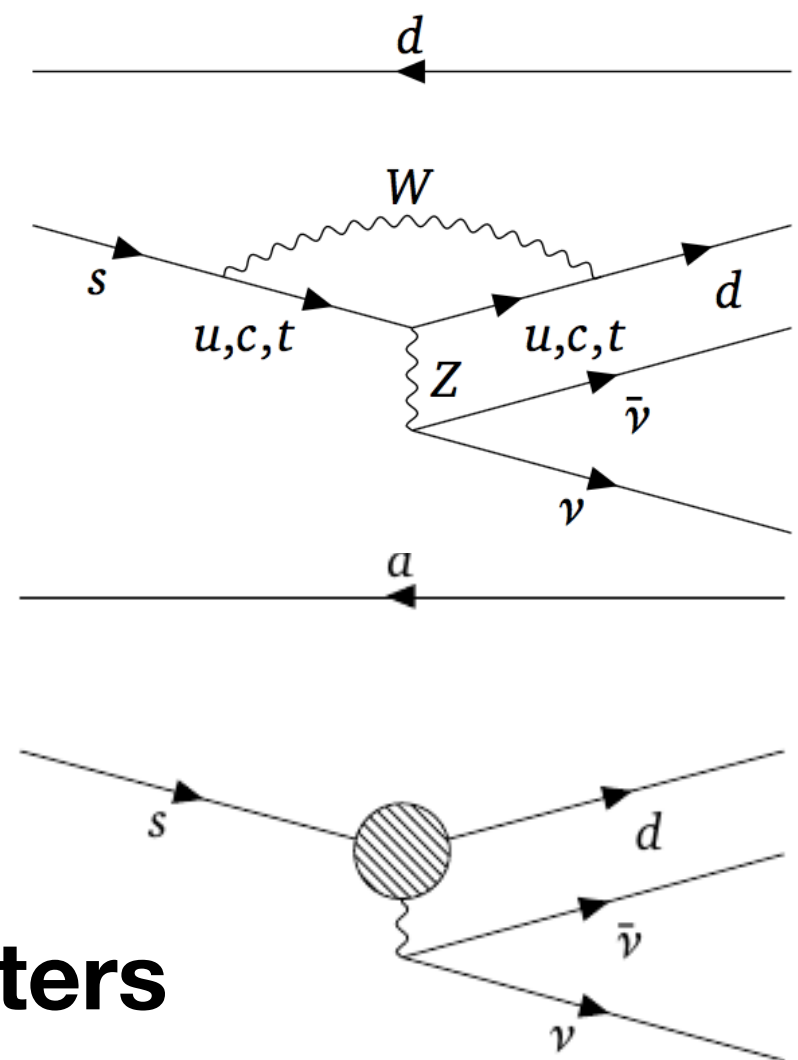
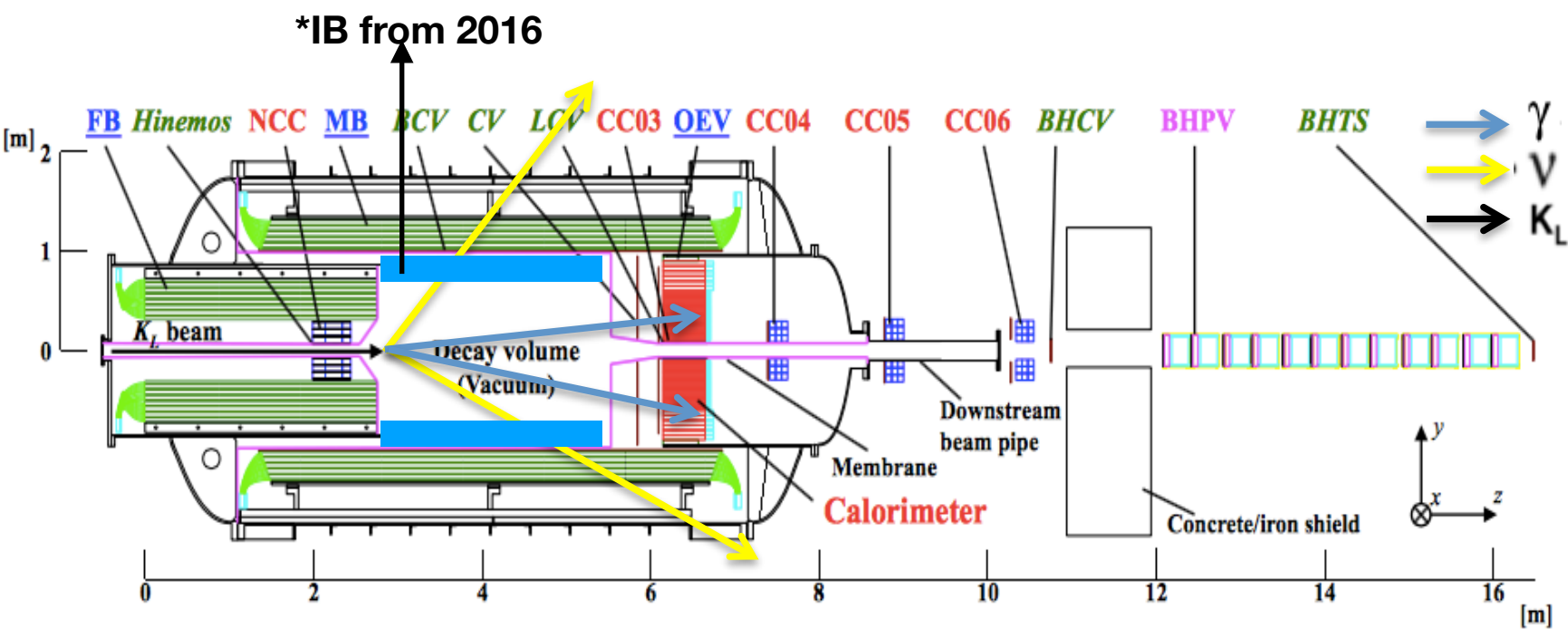
# Present Status of KOTO

김준이, 김은주(전북대), 임계엽(KEK), 안정근(고려대)  
for the KOTO Collaboration  
2018 KPS Spring Meeting

# J-PARC KOTO Experiment

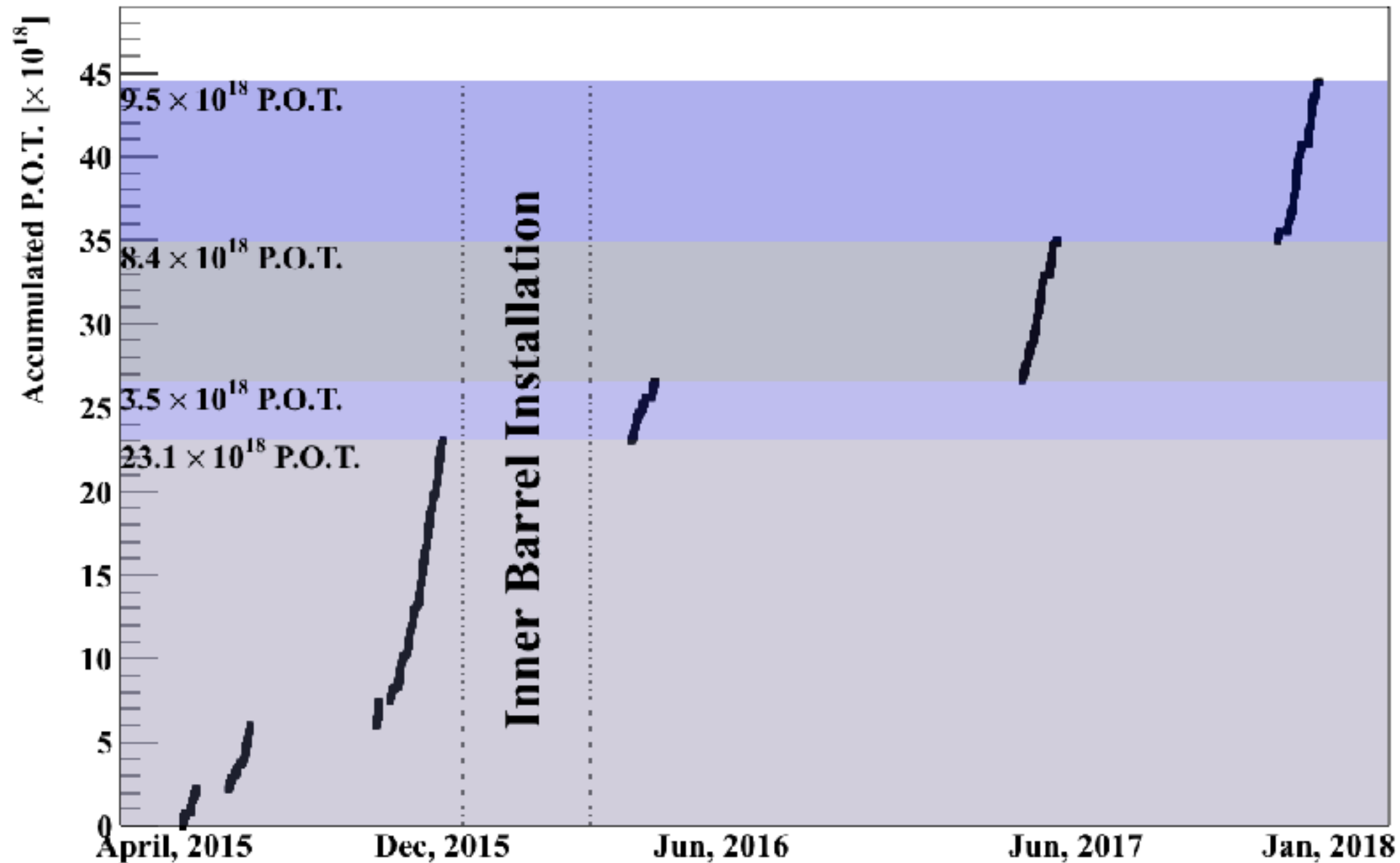
$Br(K_L \rightarrow \pi^0 \nu \bar{\nu}) = (3.0 \pm 0.3) \times 10^{-11}$  predicted by S.M.

Clean mode to explore the New Physics



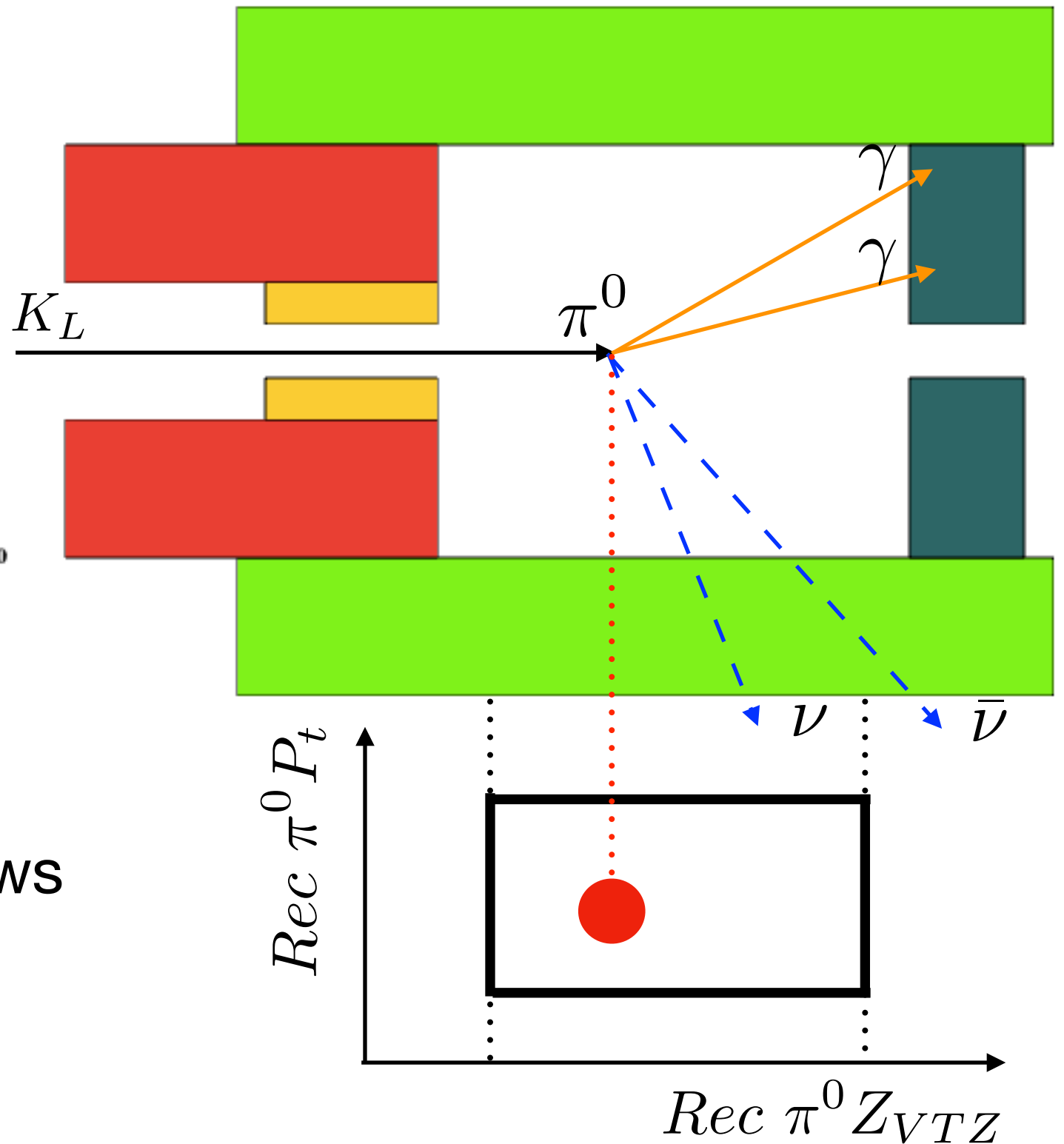
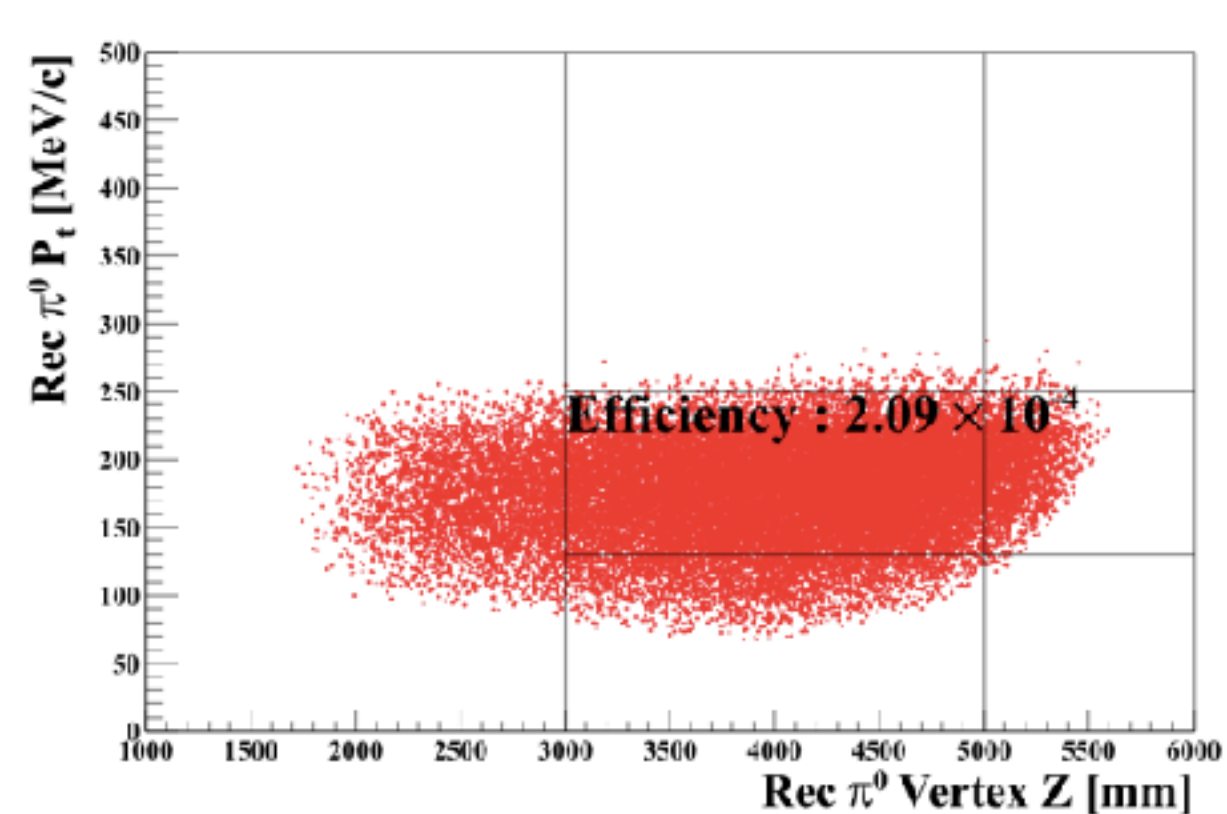
CsI Calorimeter and Hermetic Veto Counters

# Accumulated Data



- P.O.T.(Proton On Target)  $\propto$  number of incident kaons
- Total statistics will allow us to break Grossman-Nir bound

# Definition of Signal



- A pair of neutrinos with transverse momentum allows the neutral pion to have transverse momentum.



# Background Estimation of 2015 Data

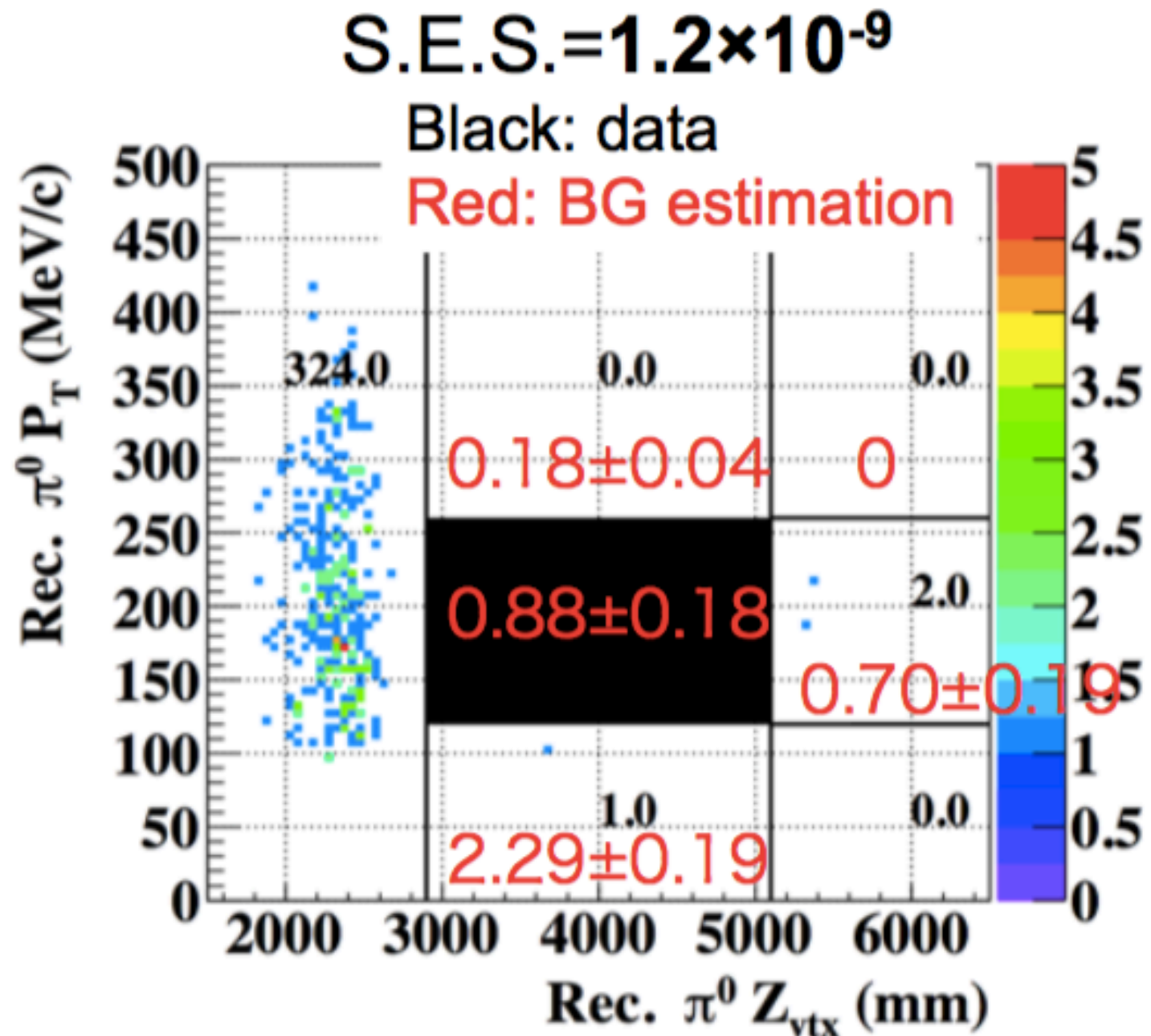
2018 PAC meeting

	New	
KL->2pi0	0.07±0.07	●
KL->pi+pi-pi0	0.18±0.05	●
NCC	0.13±0.07	●
Hadron cluster	0.26±0.08	●
CV-pi0	<0.14	●
CV-eta	0.05	●
KL->2gamma	0.02±0.02	●
KL->3pi0 fast	<0.01	●
Masking Ke3	<0.094	●
Masking K3pi0	0.17±0.12	●
Sum	0.88±0.18	

Orange : M.C. simulation

Orange+Blue : M.C. simulation with data-based normalization

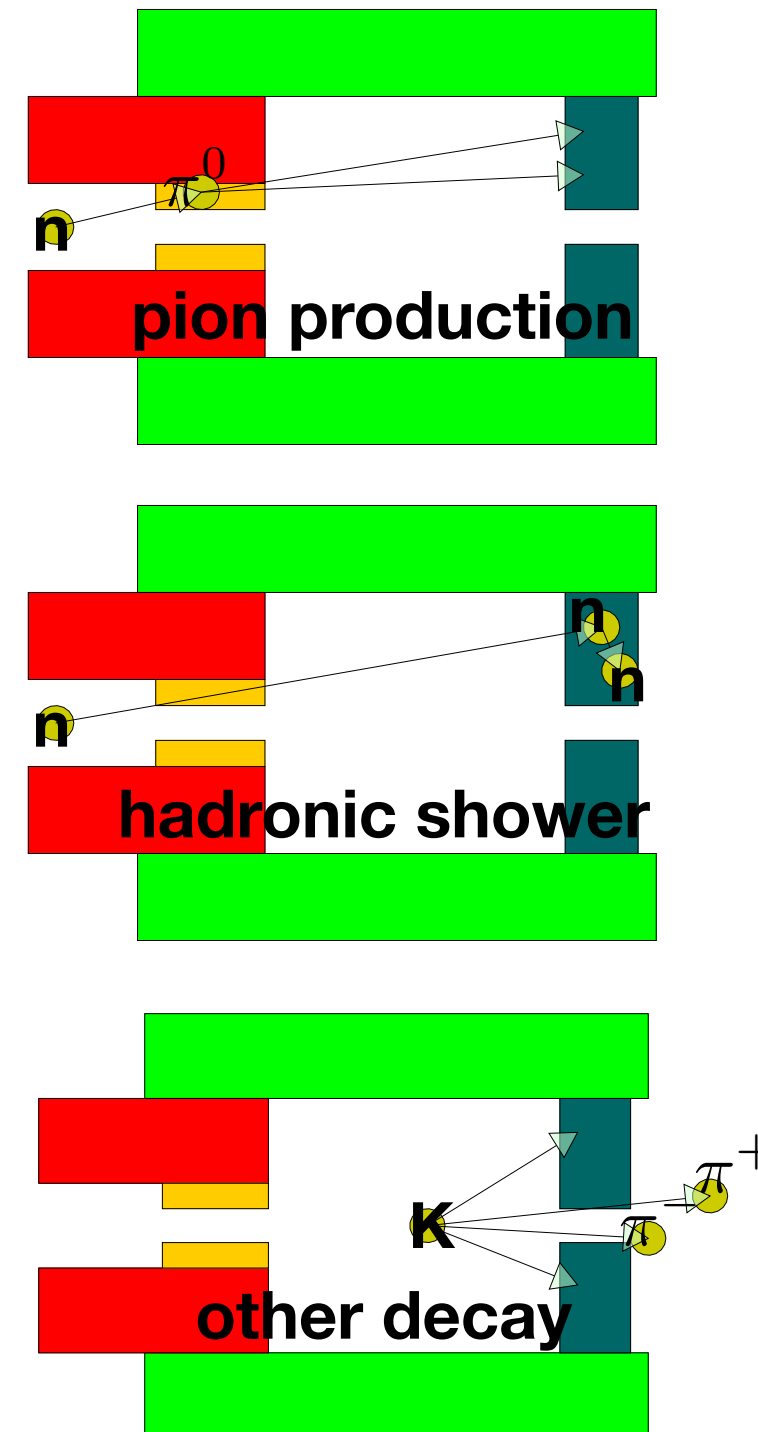
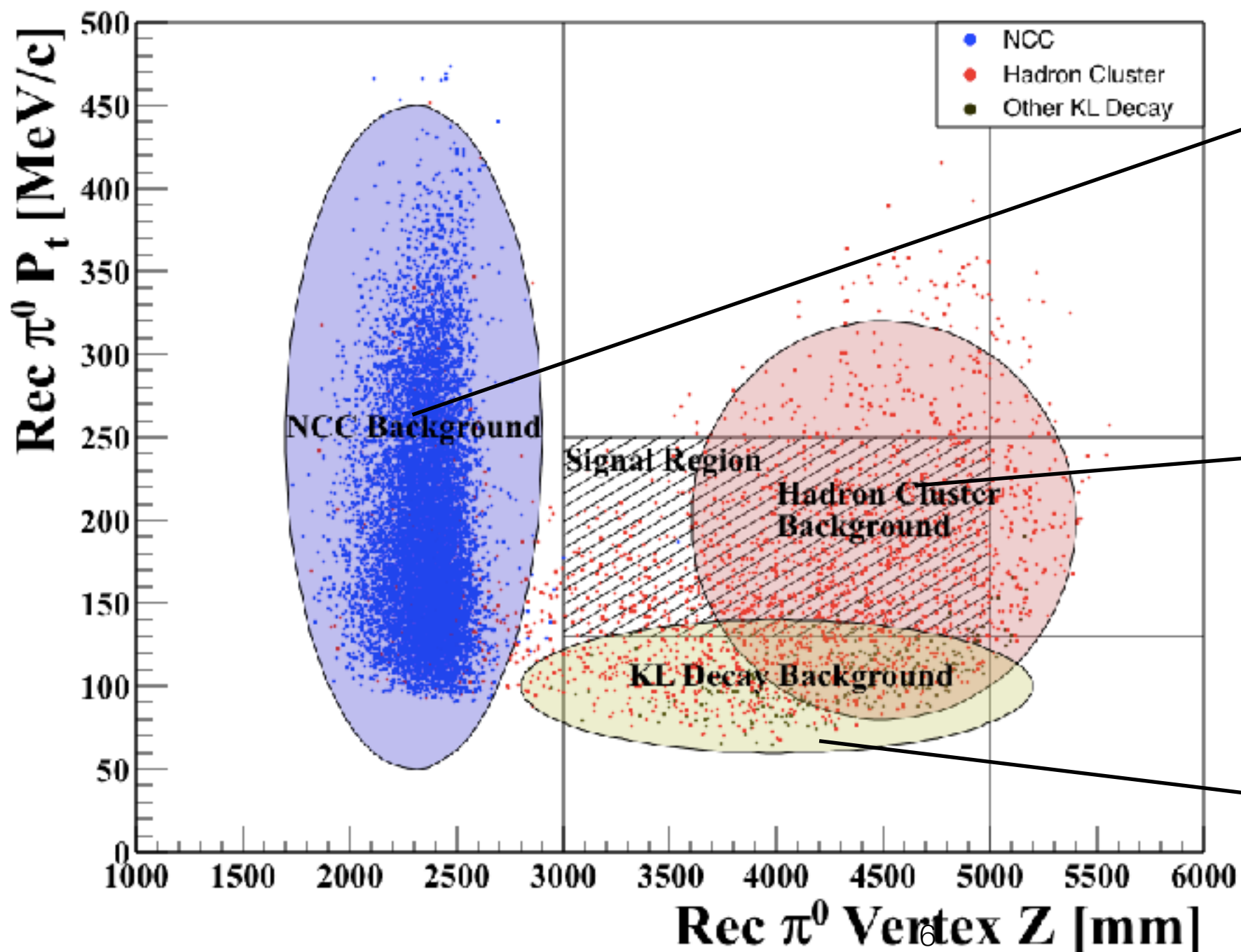
Blue : Background estimation using special data



- Signal box will be open in this June.

# Sources of Backgrounds

- Background estimation for understanding remaining events around signal box.



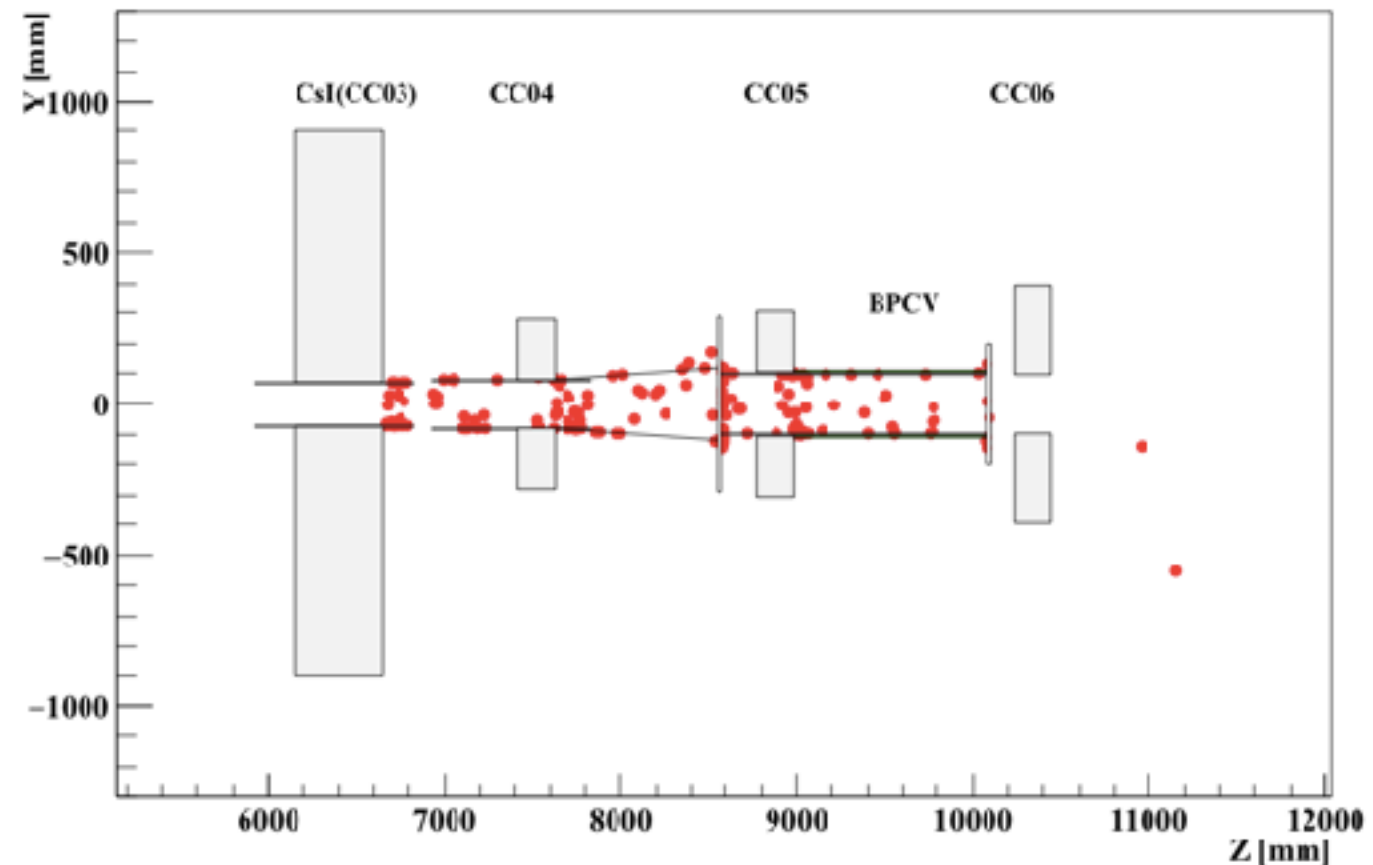
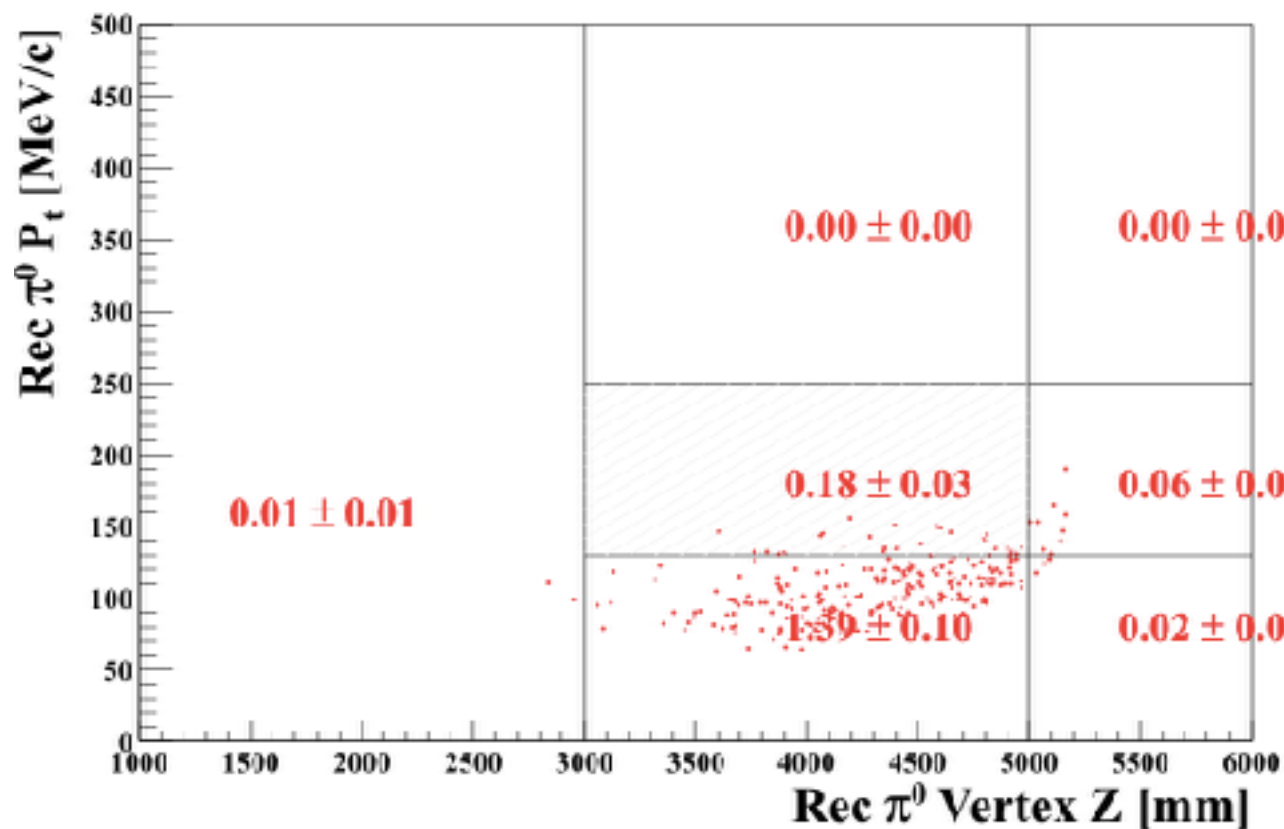
# Current Issues of KOTO

- Background from  $K_L \rightarrow \pi^+ \pi^- \pi^0$  decay mode
  - Installation of new detector at downstream
- Hadron cluster in CsI Calorimeter
  - Installation of front-end readout for CsI Calorimeter
- Pion production at NCC
  - Special data collections for the study.

# $K_L \rightarrow \pi^+ \pi^- \pi^0$ Background

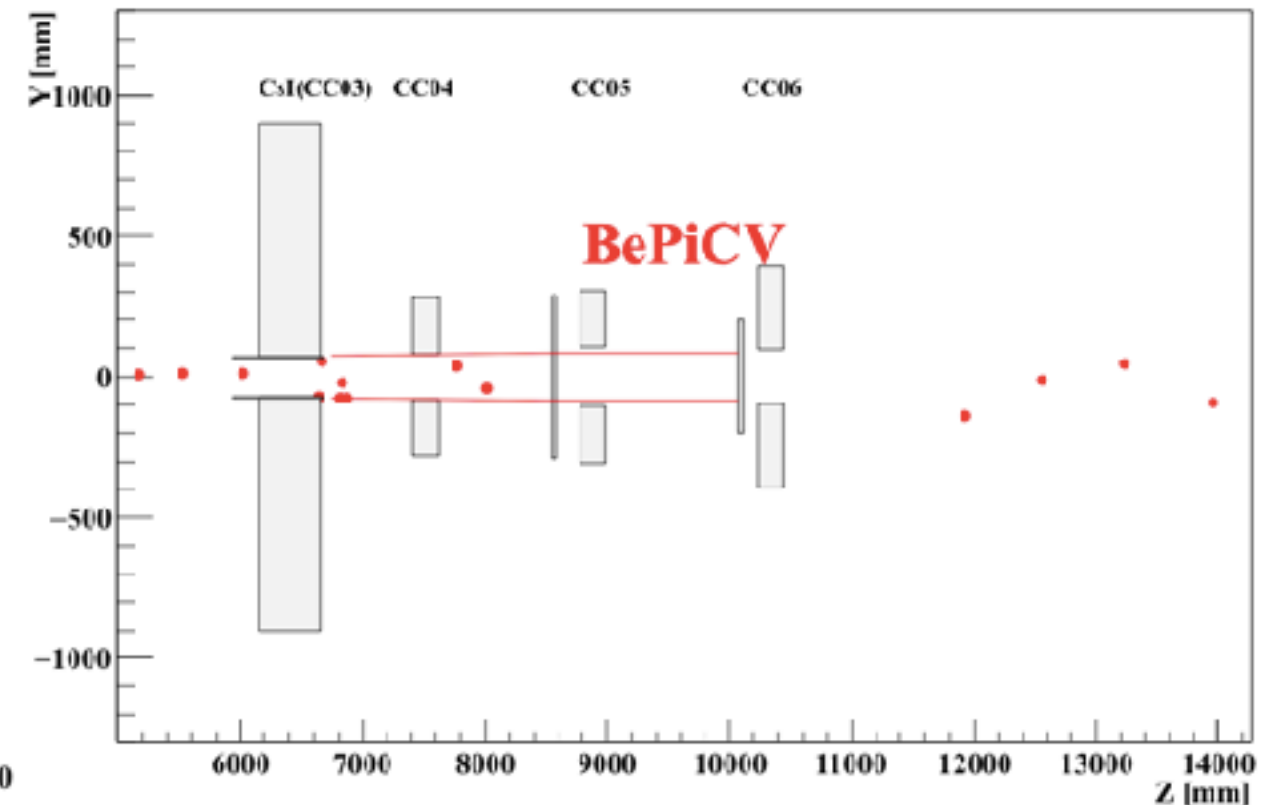
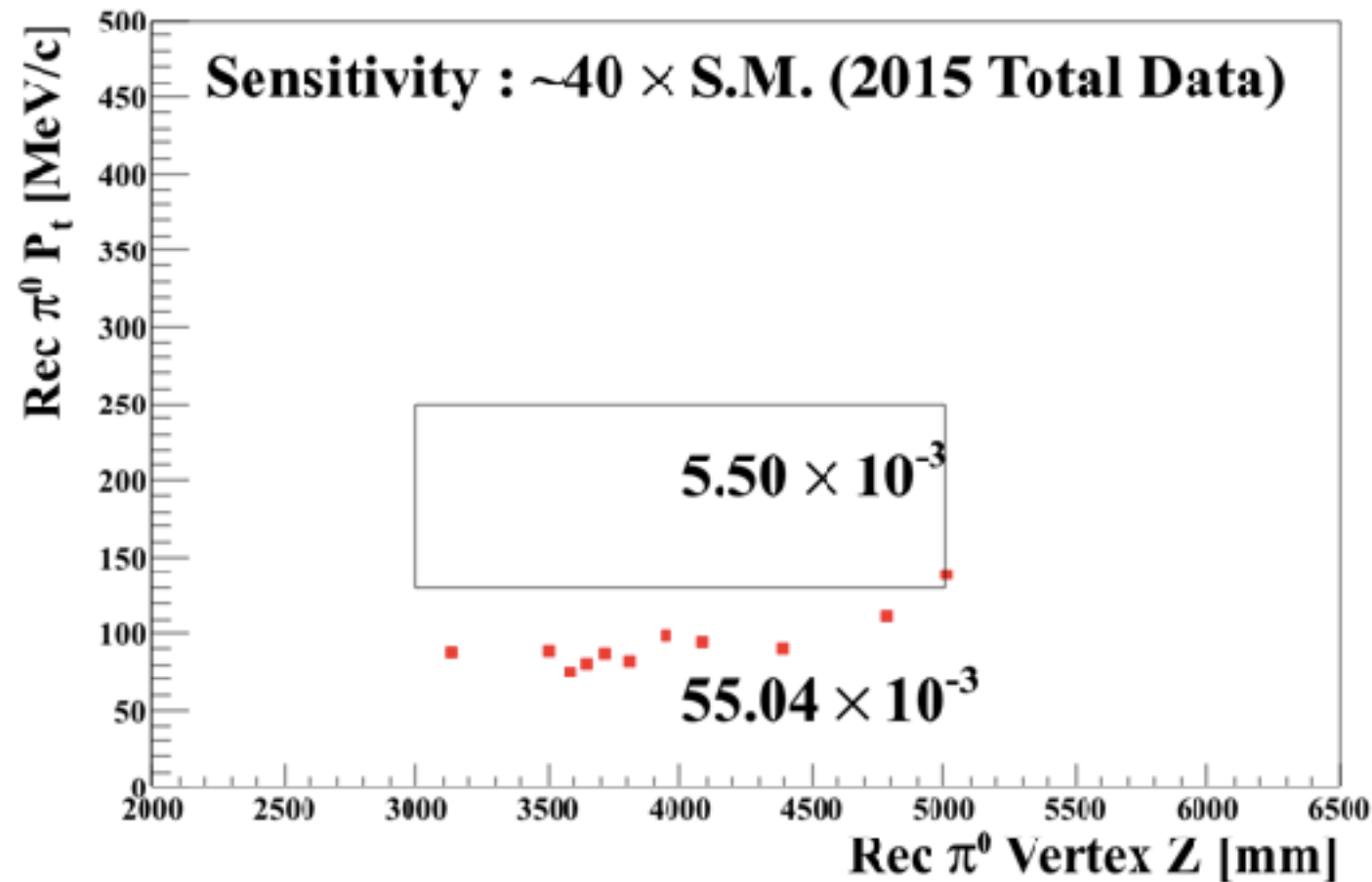
Normalized to 2015 Data

Interaction Points of charged pions



- Backgrounds come from dead material at downstream.
- Beam pipe with active material will be installed(BePiCV)

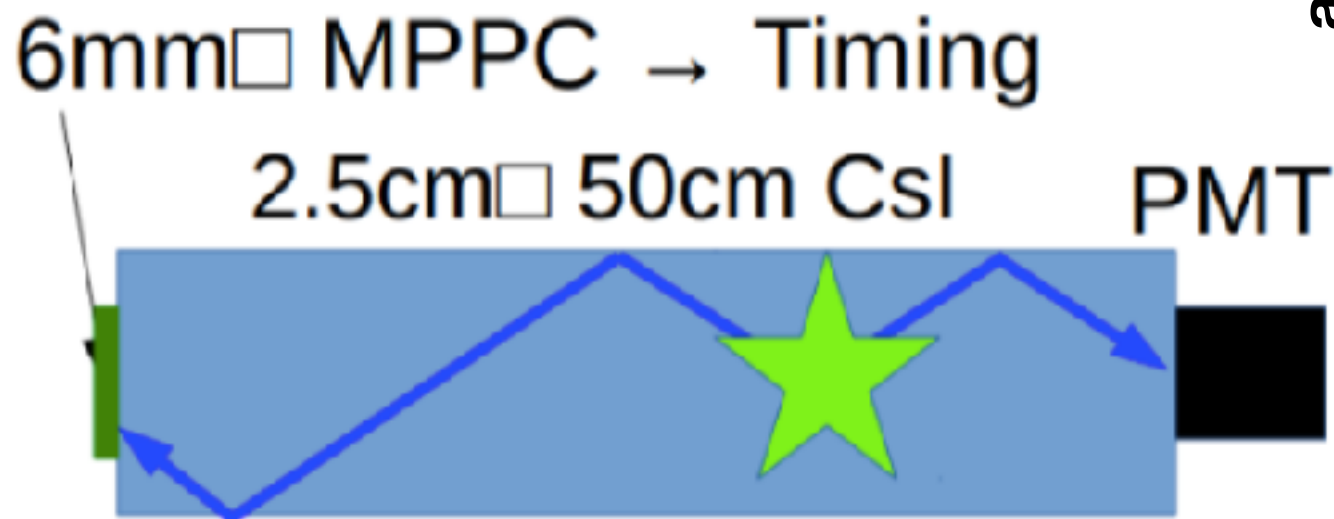
# Status of BePiCV (Beam Pipe Charged Veto)



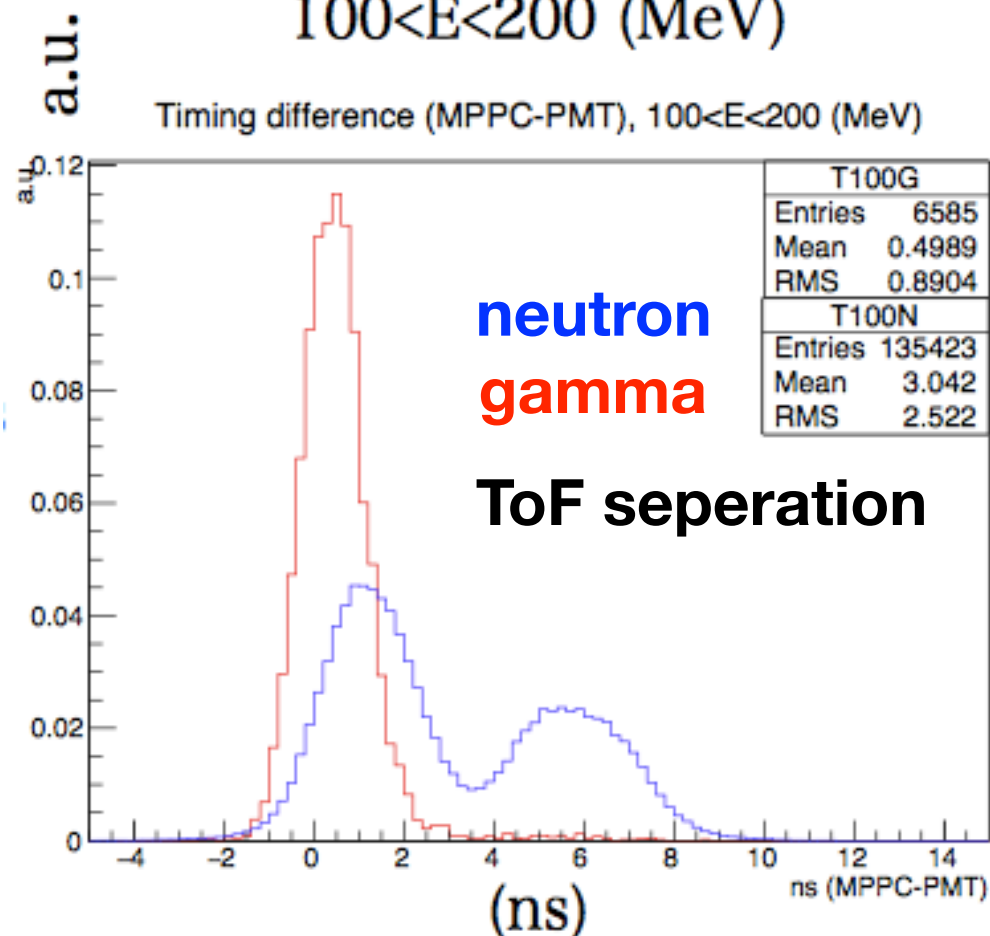
- 5 mm thick and 3.2 m-long scintillator.
- 30 times larger background rejection.



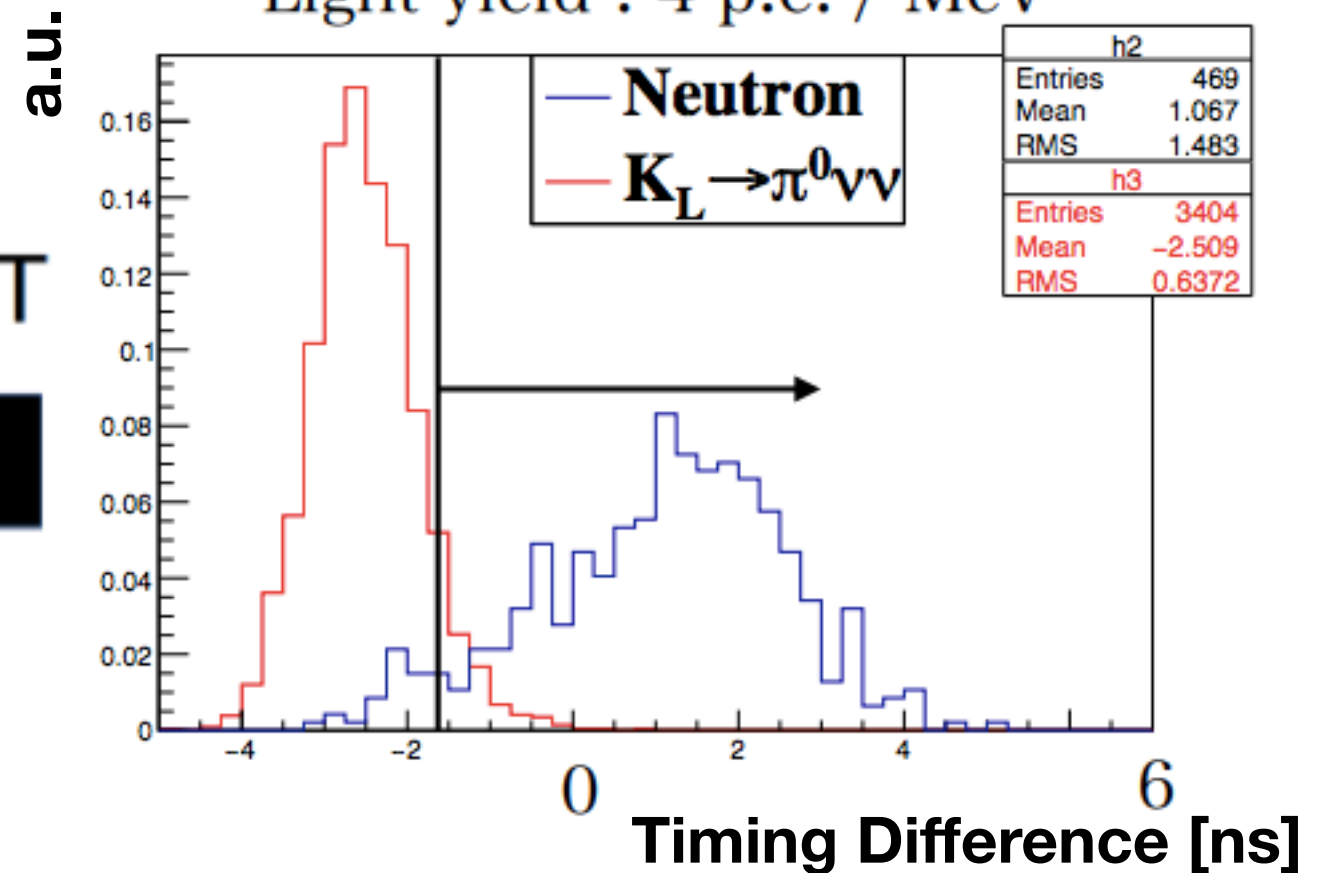
# Front Readout of CsI Calorimeter



100 < E < 200 (MeV)



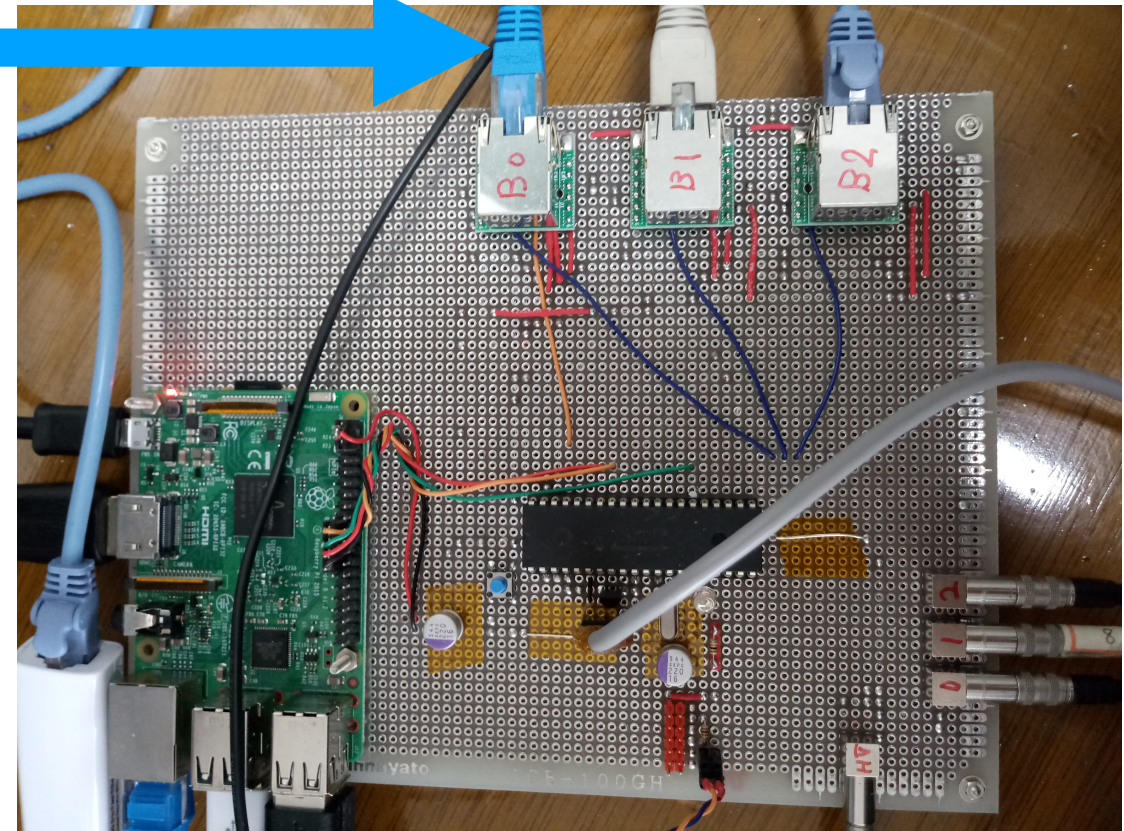
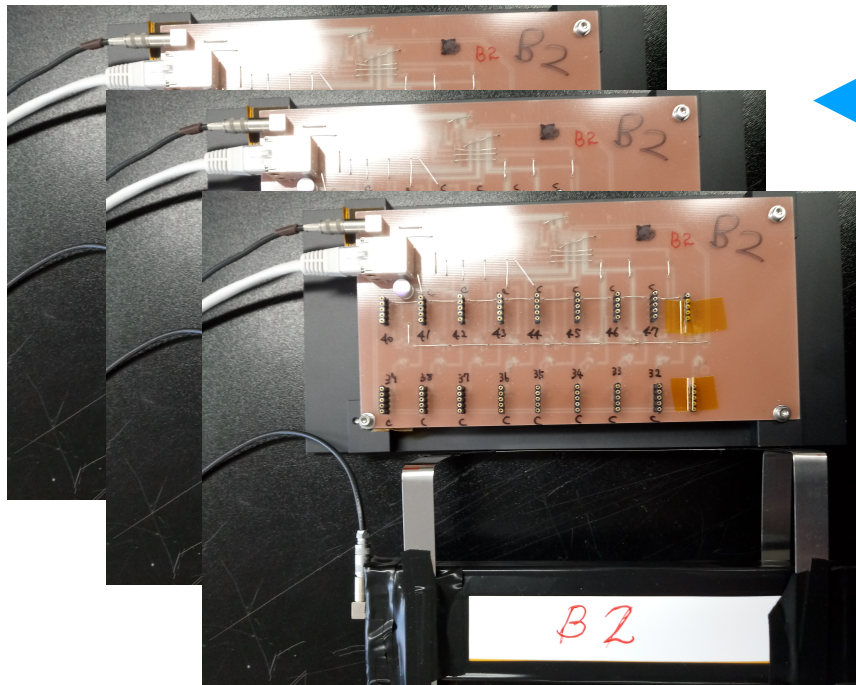
Light yield : 4 p.e. / MeV



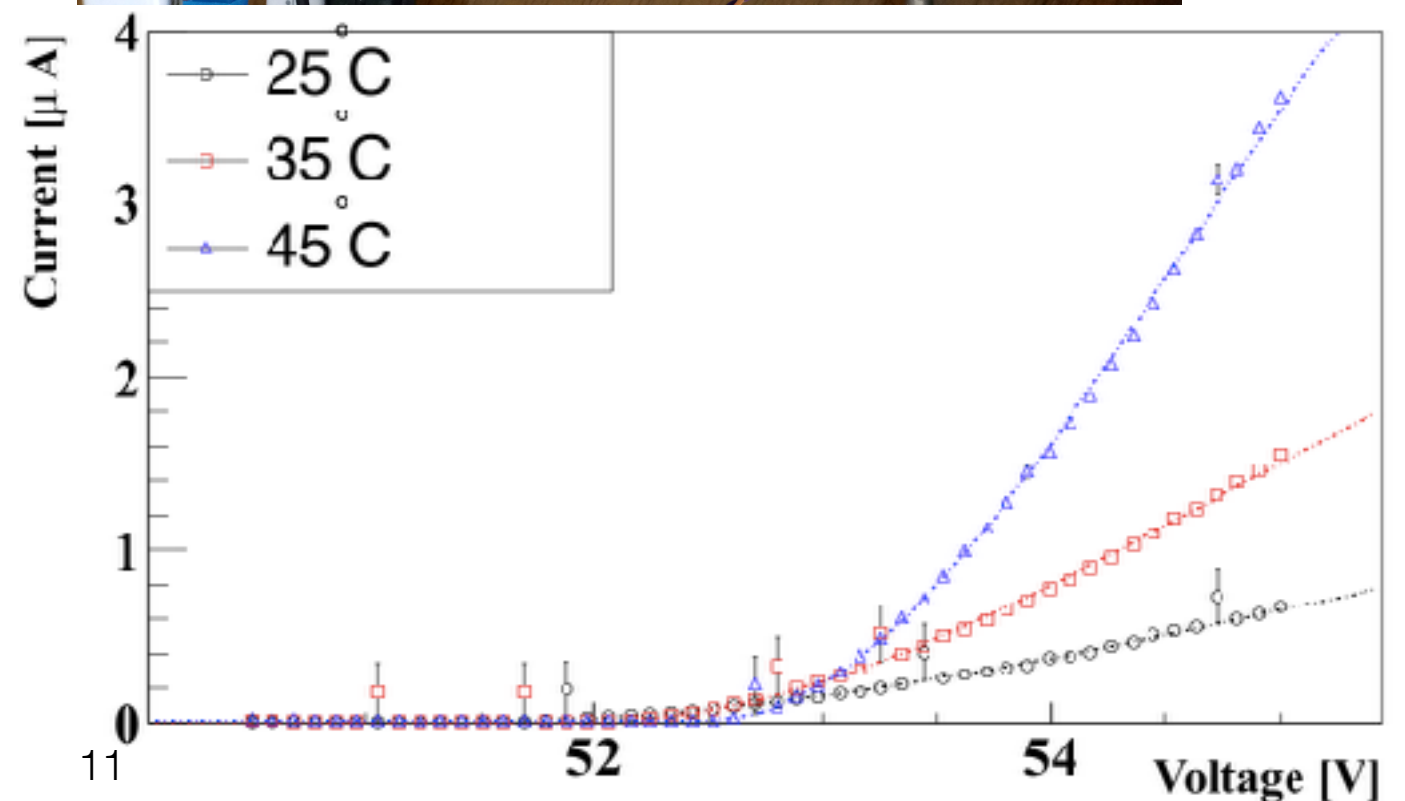
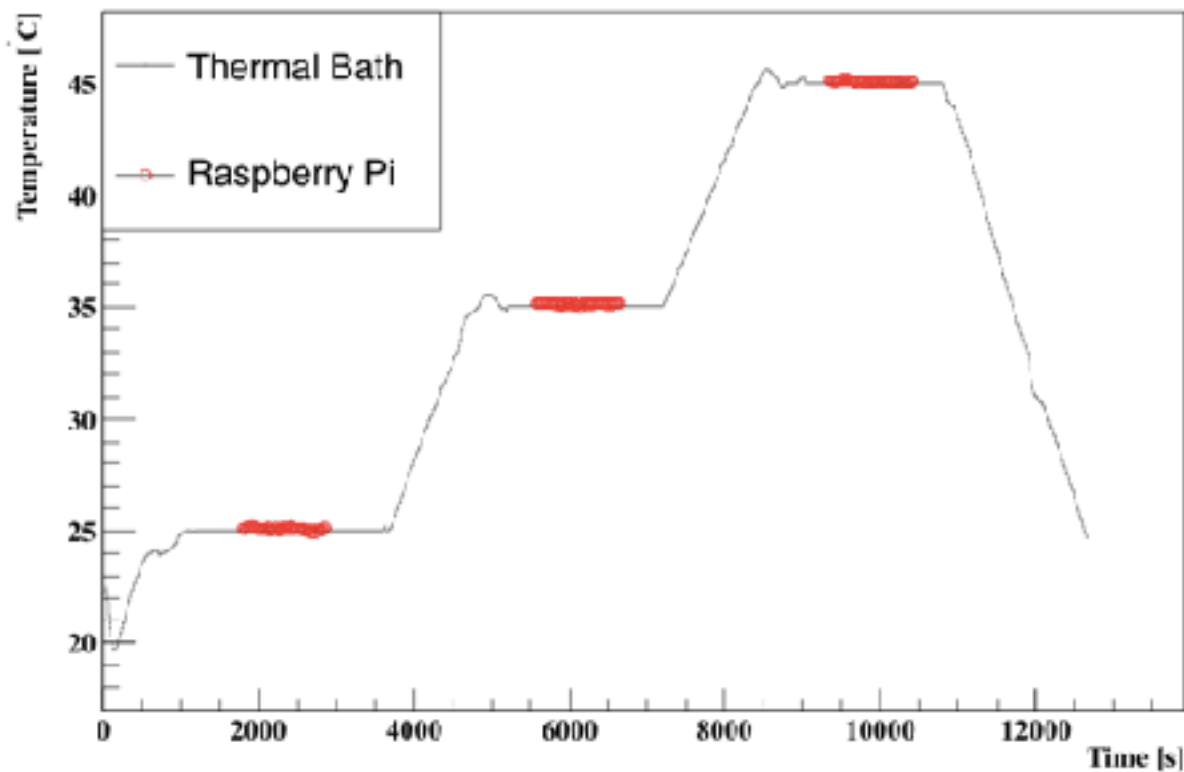
- S13360-6050CS Model
  - 14400 pixels
  - up to +3V
- 4000 MPPCs
- 8 p.e. / MeV with undoped CsI

# I-V Curve Measurement of MPPCs

@ CBNU



## Temperature Measurement



# Summary

- With 2015 data,  $1.2e-9$  single event sensitivity is achieved
  - Signal box will be open in this June.
- R&D for upgrade of subsystems is ongoing and the upgrade will be implemented in this year.
  - The background of  $K_L \rightarrow \pi^+ \pi^- \pi^0$  is estimated to reject up to S.M. level using M.C. simulation
  - Designing for optimization is in progress @ CBNU.
  - IV curve measurement is ongoing for  $\sim 500$  MPPCs @ CBNU.