Status of HKS(+HES) detectors

Kyoto University

Toshiyuki Gogami

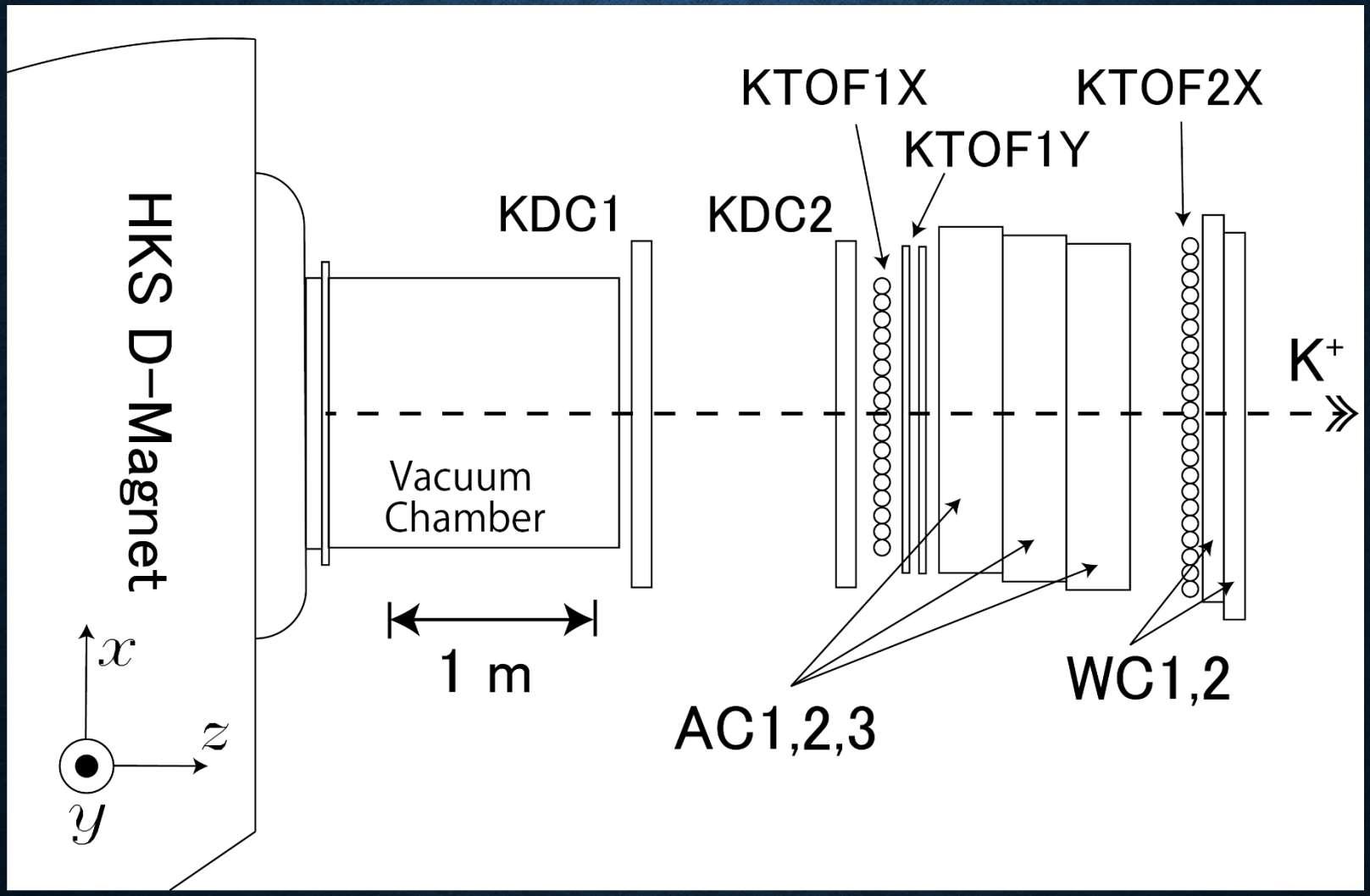
Dec 7, 2021

京都大学　理学研究科・理学部
GRADUATE SCHOOL OF FACULTY OF SCIENCE
KYOTO UNIVERSITY

科研費
KAKENHI

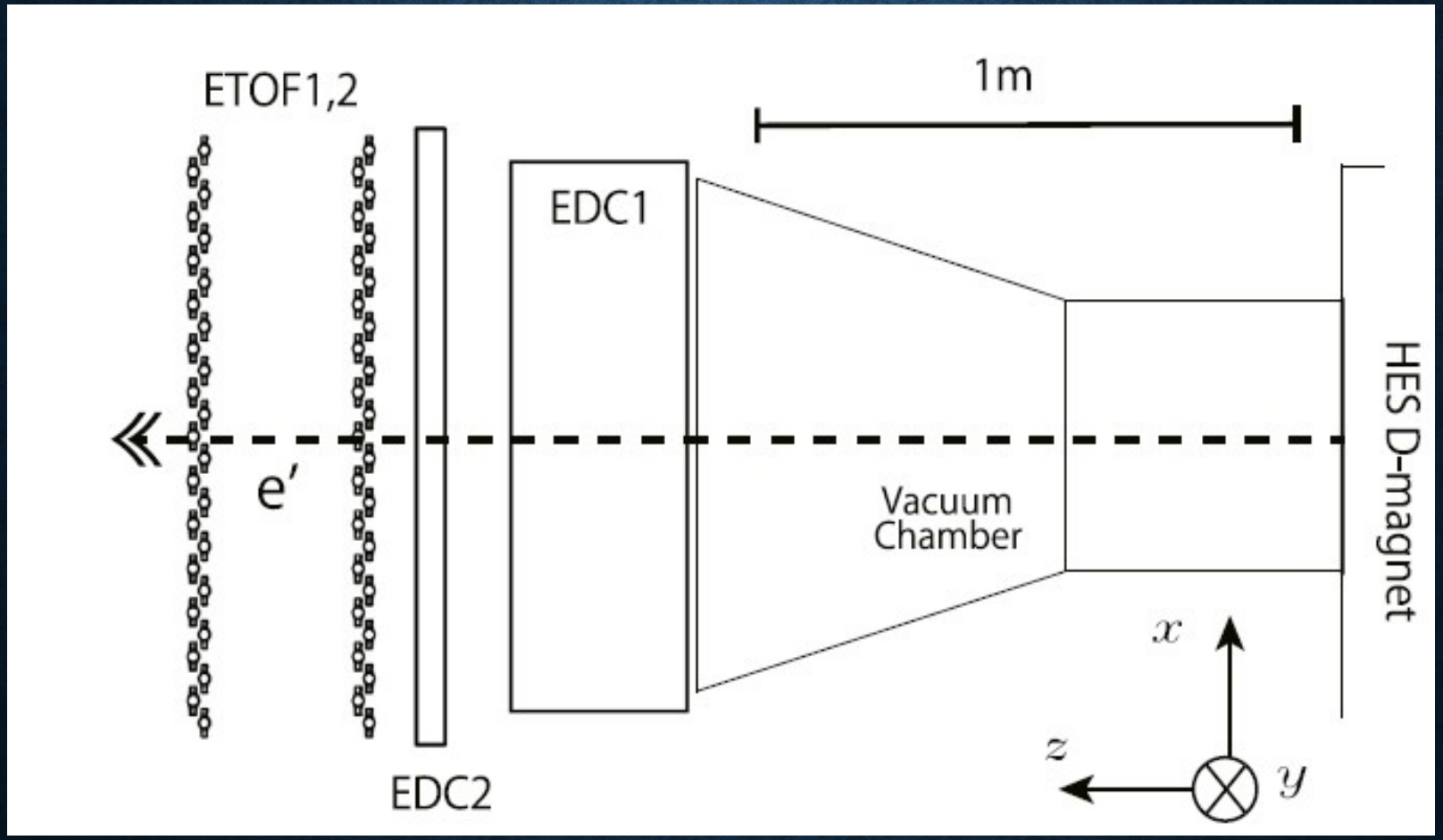
SPIRITS
SUPPORTING PROGRAM FOR INTERACTION-BASED INITIATIVE TEAM STUDIES

HKS DETECTOR SYSTEM



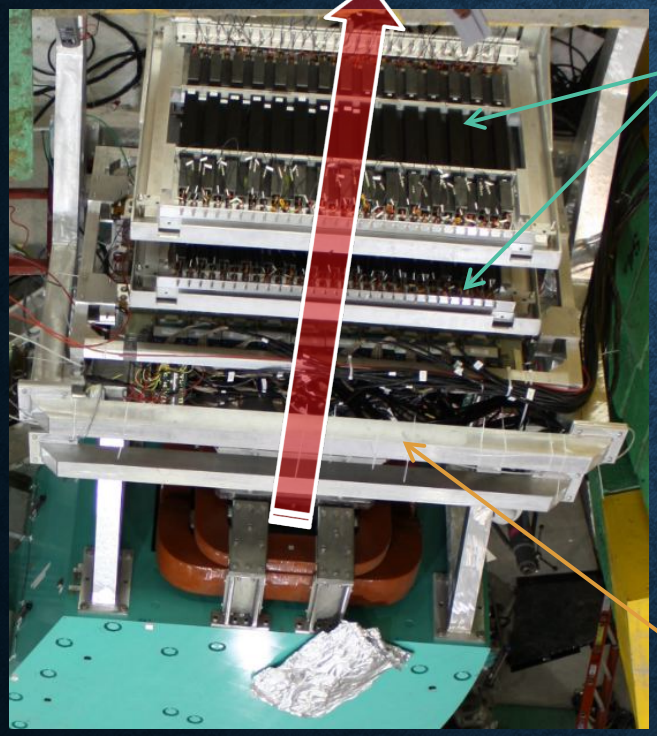
Y. Fujii *et al.*, *Nucl. Instruments Methods, Sect A* **795**, 351—363 (2015).

HES DETECTORS



NIMA 900, 69—83 (2018);
https://doi.org/10.1016/j.nima.2018.05.042

PHOTOS OF HES/HKS DETECTORS



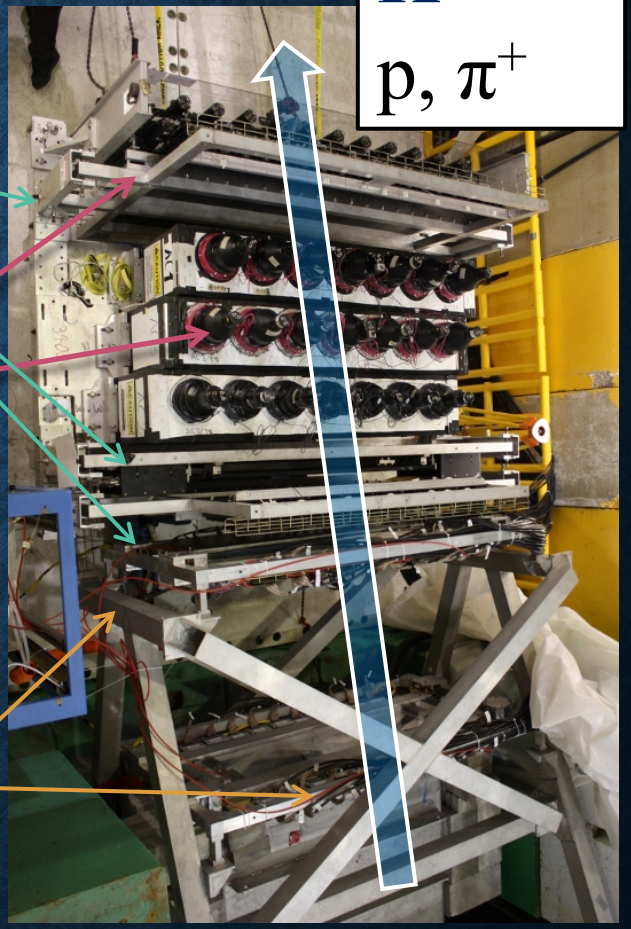
e^-

TOF walls
(Plastic scintillators)

Cherenkov detectors
- Aerogel (n=1.05)
- Water (n=1.33)

Drift chambers

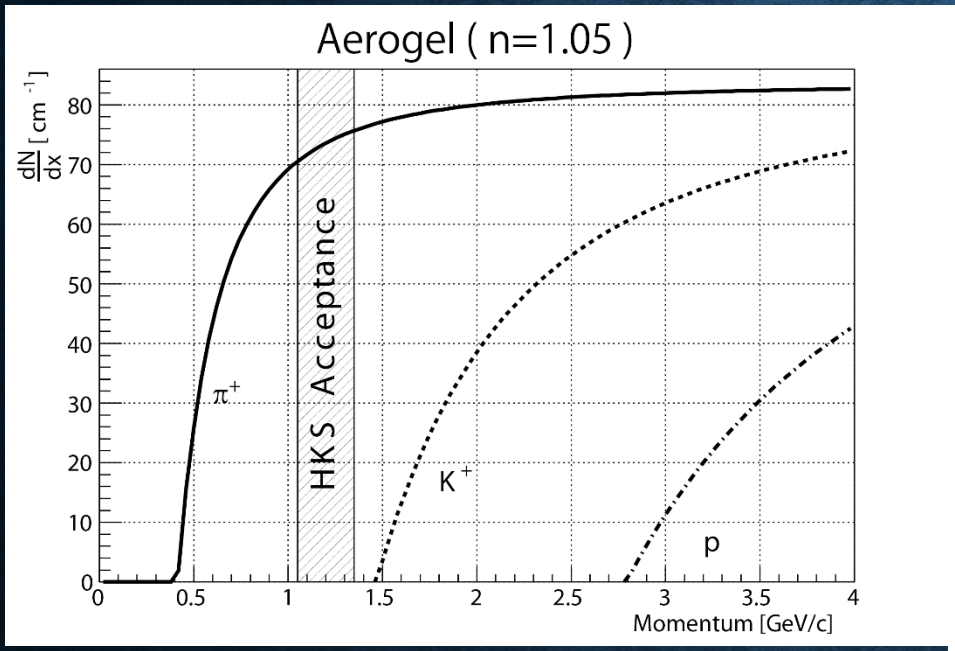
HES

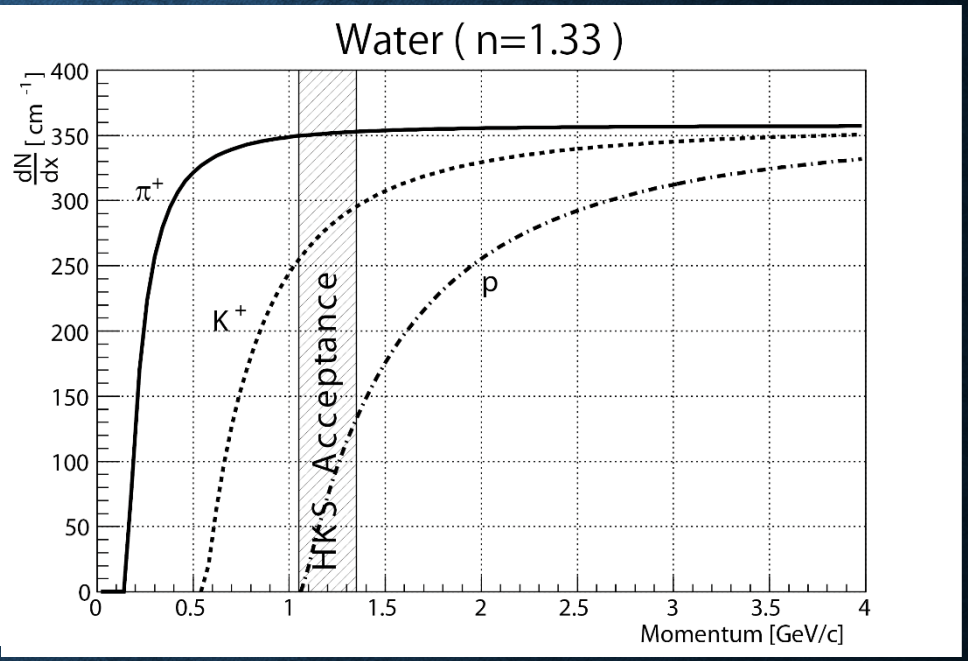


K^+
p, π^+

HKS

ČERENKOV DETECTORS FOR KID

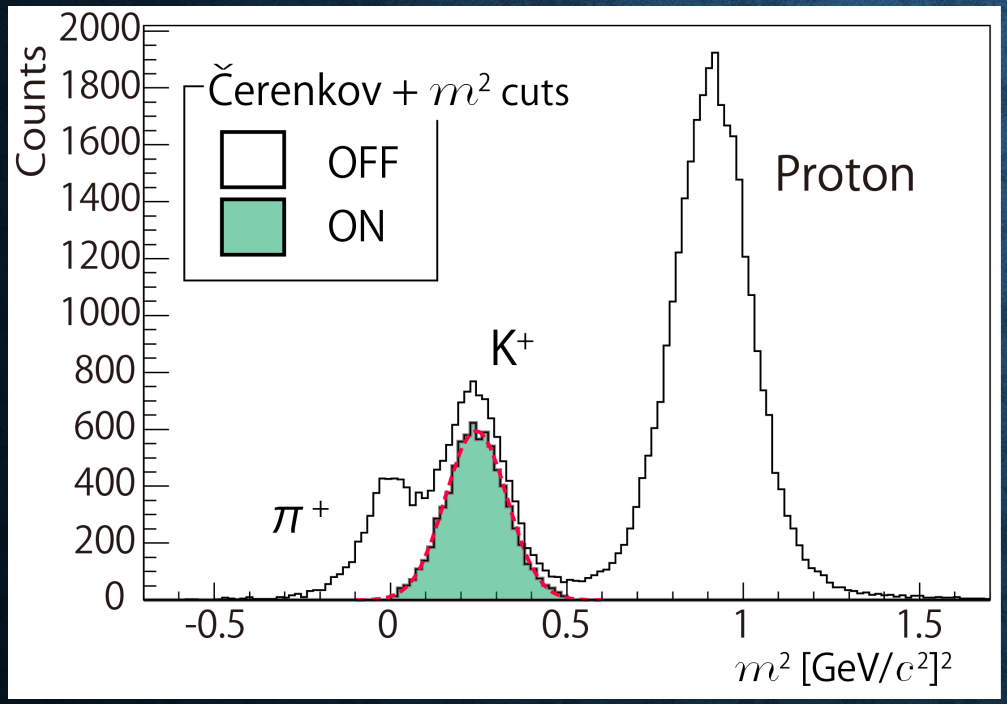




$$\frac{dN}{dx} = 2\pi\alpha z^2 \left(1 - \frac{1}{\beta^2 n^2}\right) \int_{300\ \mathrm{nm}}^{600\ \mathrm{nm}} \frac{1}{\lambda^2} d\lambda$$

KID PERFORMANCE (E05-115)

NIM A **729**, 816–824 (2013)

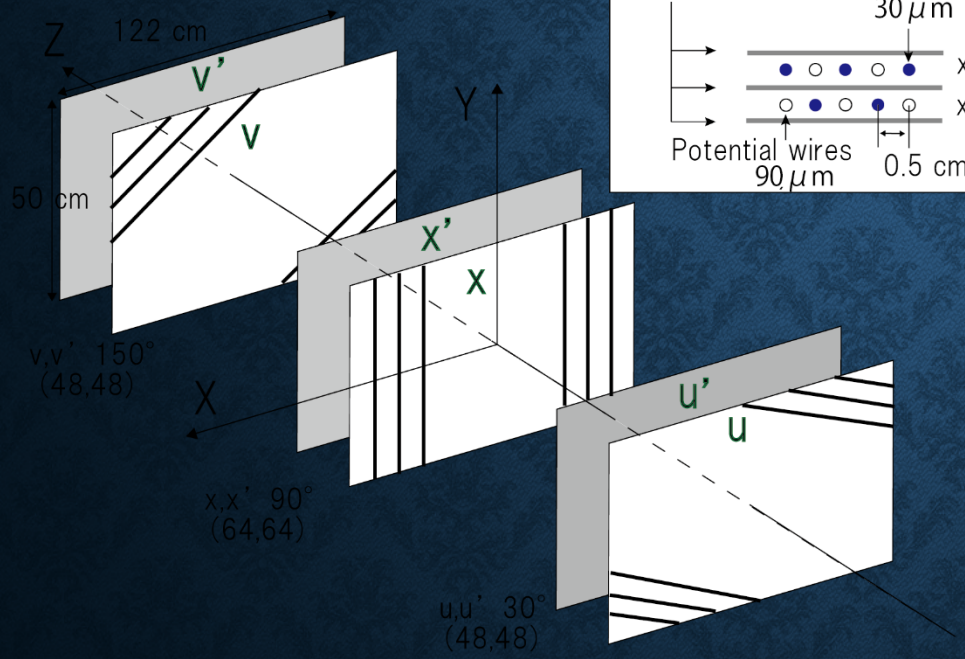


Survival ratios (on- and off-lines)

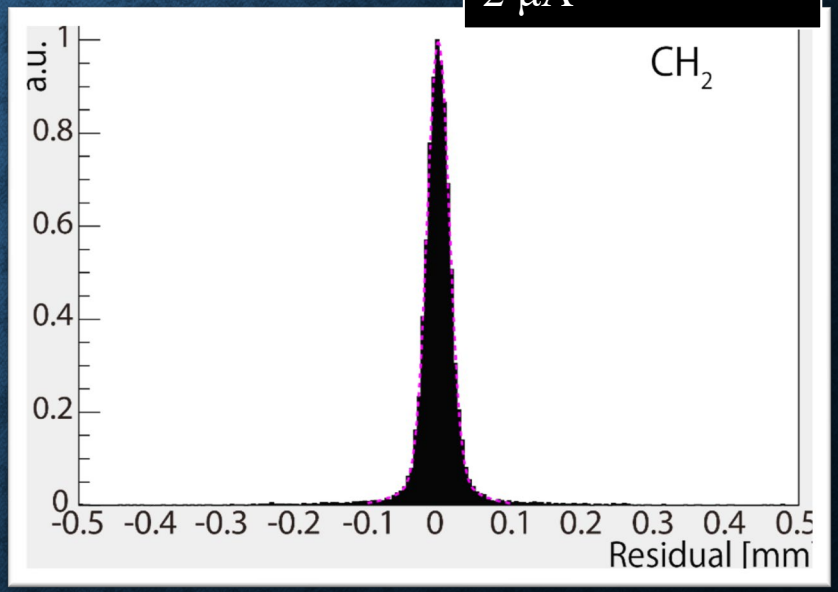
- ✓ K^+ : 83%
- ✓ π^+: 4.7×10^{-4}
- ✓ p : 1.9×10^{-4}

HKS DETECTOR SPECIFICATIONS

PLANER DRIFT CHAMBER; KDC1,2 → HAMPTON GROUP



DATA (E05-115)
CH_2 (0.45 g/cm^2)
2 μA



KDC1, 2
$360 \times 2 = 720$ channels

Typical Tracking Residual

$\sigma = 150$ μm

Three sets of KDC are stored in SBS, JLab

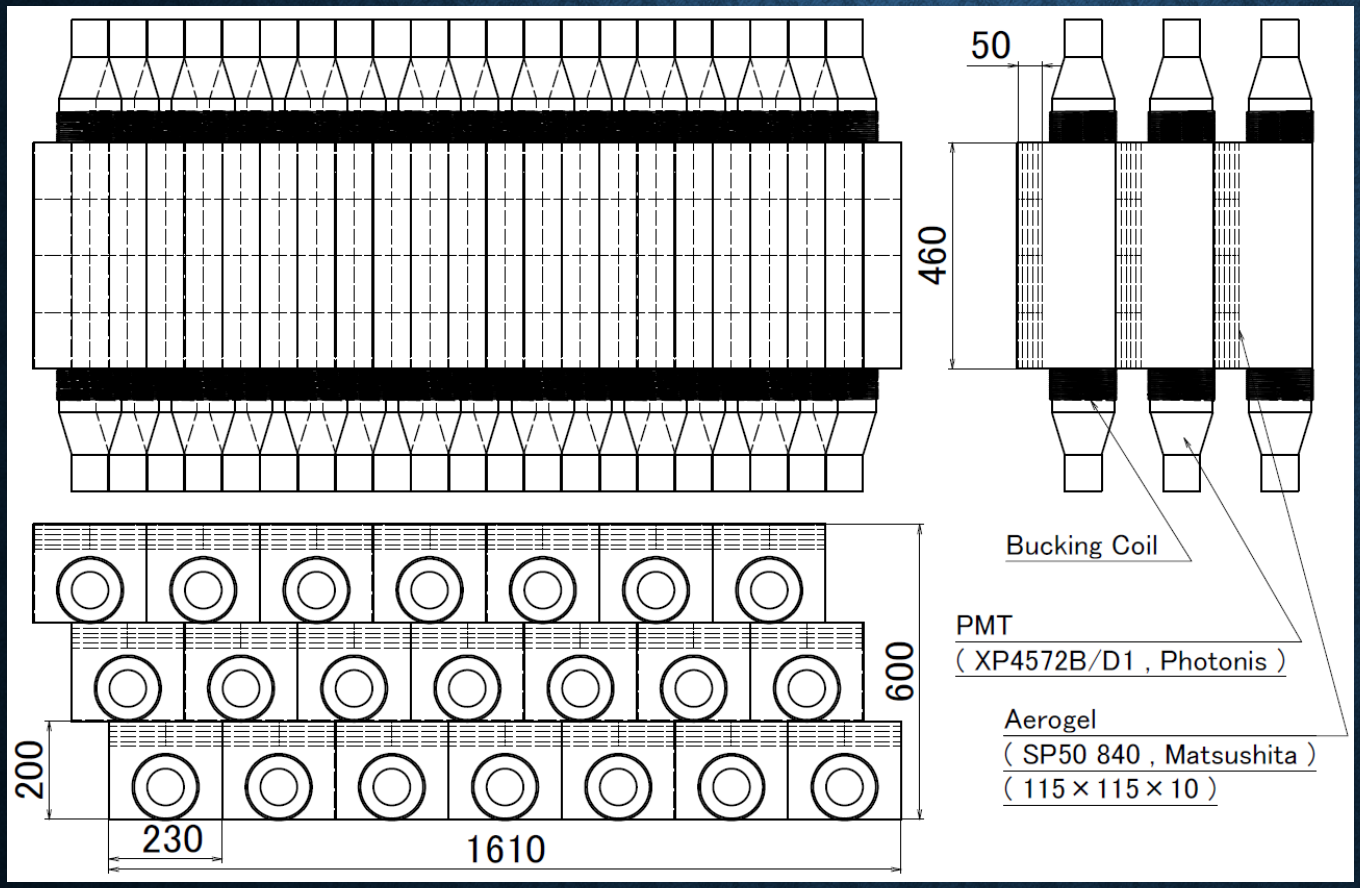
TIME-OF-FLIGHT DETECTOR; KTOF → TOHOKU GROUP (NUE, TG)

ID	Effective Area (mm^2) [1 seg. vol. (mm^3)]	# of channels	σ_t (ps)
1X	1275×300 $(75 \times 300 \times 20^t)$	17×2	60
1Y	1250×275 $(1250 \times 35 \times 20^t)$	9×2	70
2X	1710×350 $(95 \times 350 \times 20^t)$	18×2	60
Total number of channels		88	

PMT check was done for TOF in 2017

Scintillator: Saint Gobain BC-408
PMT: Hamamatsu H1949

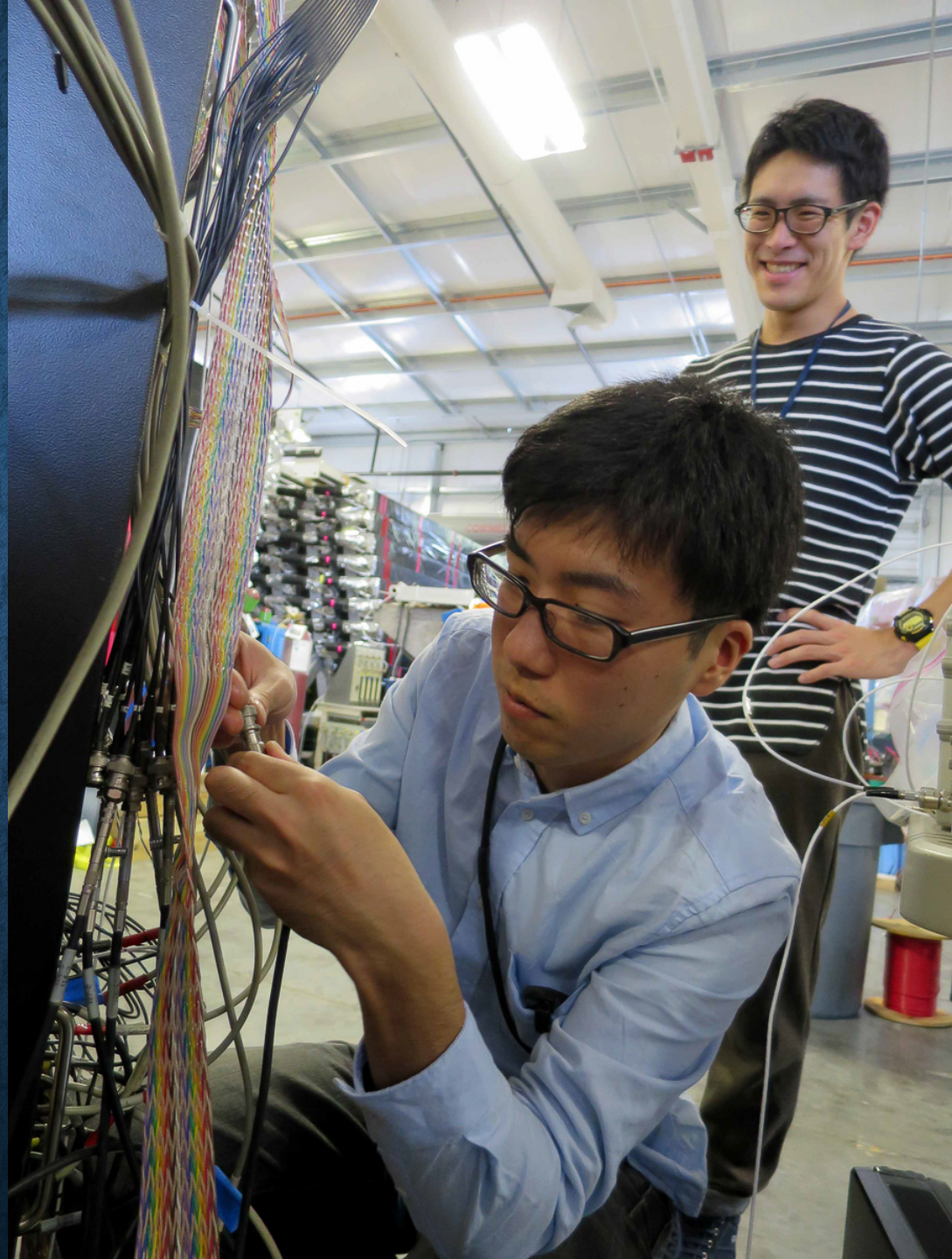
AEROGEL ČERENKOV DETECTOR; AC → FIU GROUP (J. REINHOLD)



$7^{\text{seg}} \times 2 \times 3^{\text{layers}}$
$= 42$ **channels**

Need to check:
- ✓ Radiator
- ✓ PMTs

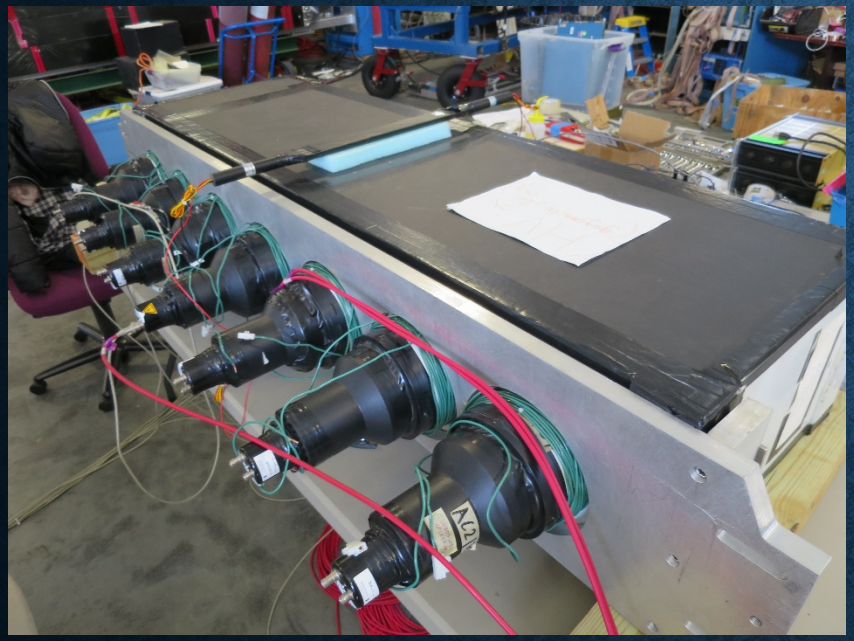

3400#



November, 2017 @ESB, JLab

March 12, 2018 @ESB, JLab

HKS AC TEST CONDITIONS



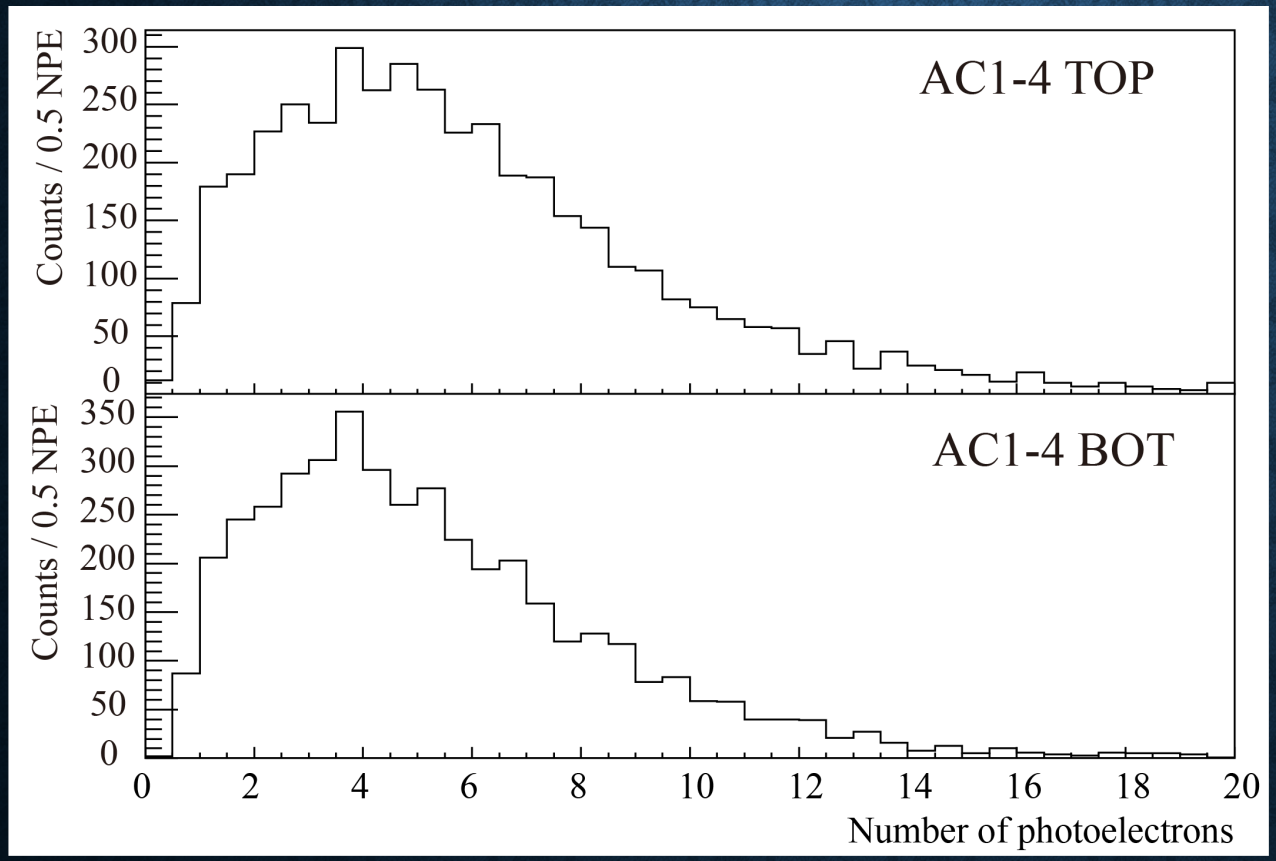
A photograph of AC test at ESB (March 12, 2018)

- ☆AC1-4TOP/BOT was tested
- ☆AC was sandwiched by trigger scintillators (EHODOs)
- ☆HV setting:
  - ✓ Scintillators = -1700 V
  - ✓ AC = +1700 V
- ☆Trigger: Scintillator 1 (bottom one)
- ☆Discriminator threshold: -10 mV
- ☆Trigger rate: 8 Hz
- ☆2018/3/12 – 2018/3/13

THE NUMBER OF PHOTOELECTRONS FOR EACH PMT

hkstest_01349.root

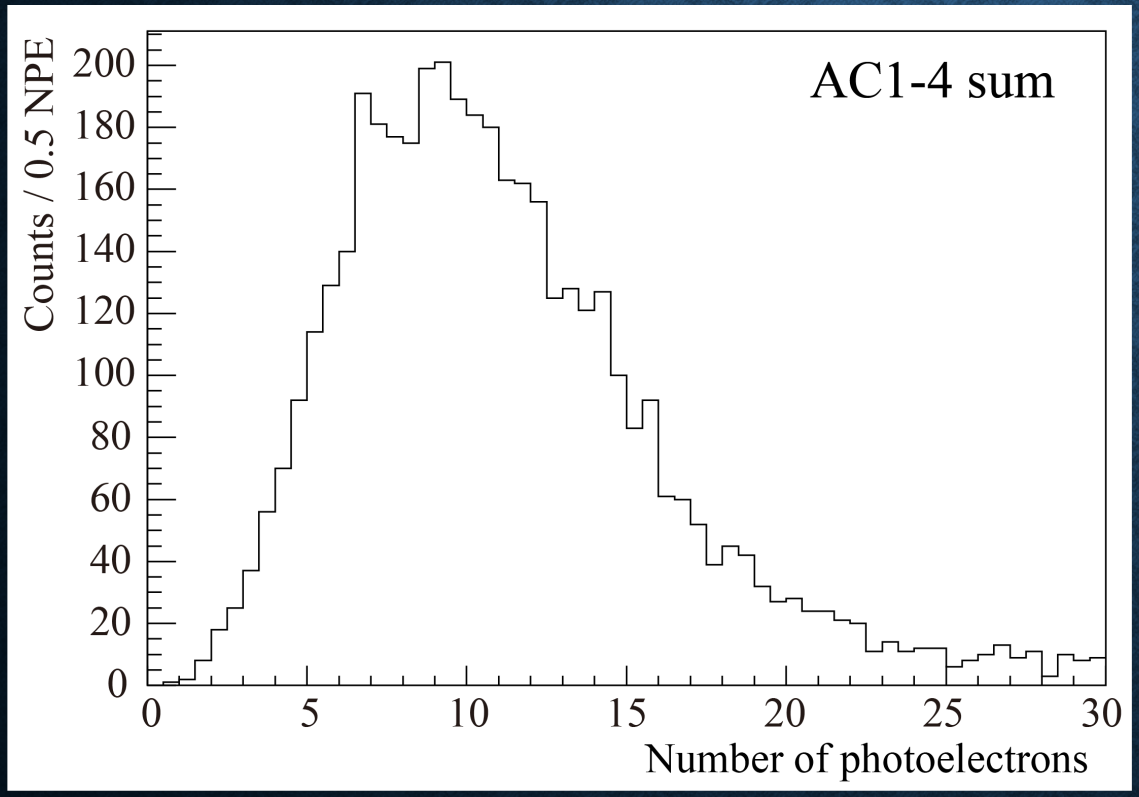
Cosmic ray



It is about **4—5**.

SUMMED NPE (AC1-4)

Cosmic ray

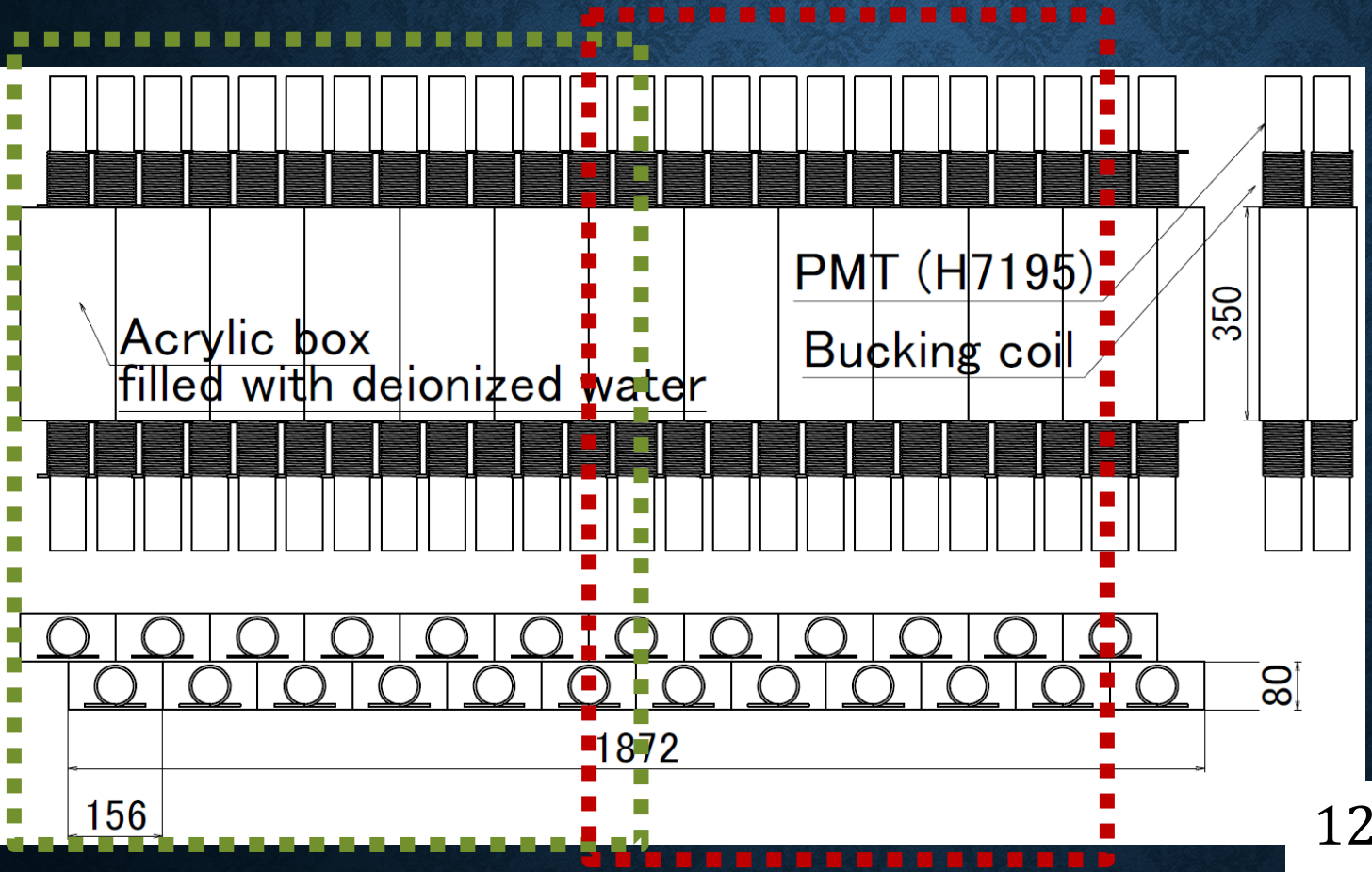


It is about **8—10** which is comparable to that in E05-115.

Great!

Further tests are in progress

WATER ČERENKOV DETECTOR; WC → TOHOKU GROUP



Need to check:
- ✓ Container
- ✓ PMTs

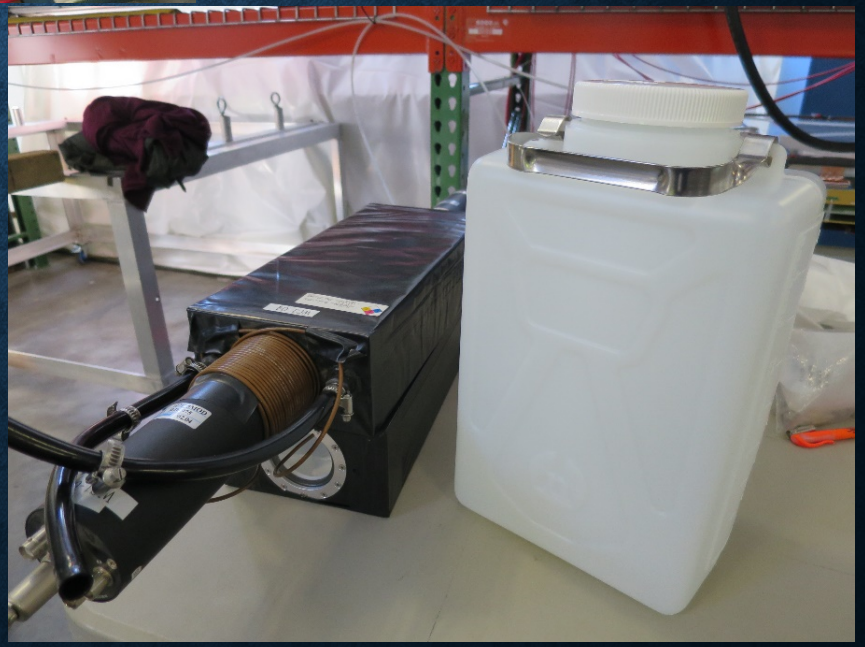
$12^{\text{seg}} \times 2 \times 2^{\text{layers}}$
$= 48$ **channels**

HWC LWC

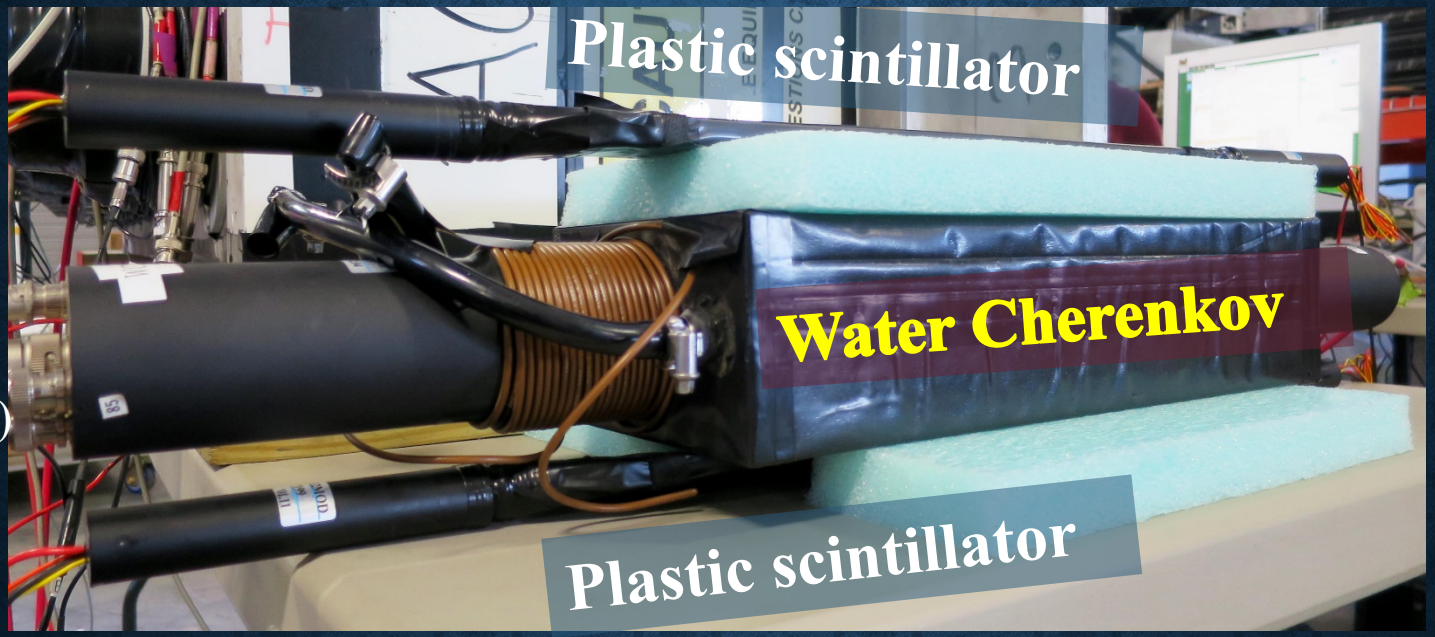
LWC was tested in March 2018

https://www-nh.scphys.kyoto-u.ac.jp/~gogami/e12-15-008/meeting/2018/JLabMeeting_20180315_gogami.pdf

UPW from Phil (denny@jlab.org)

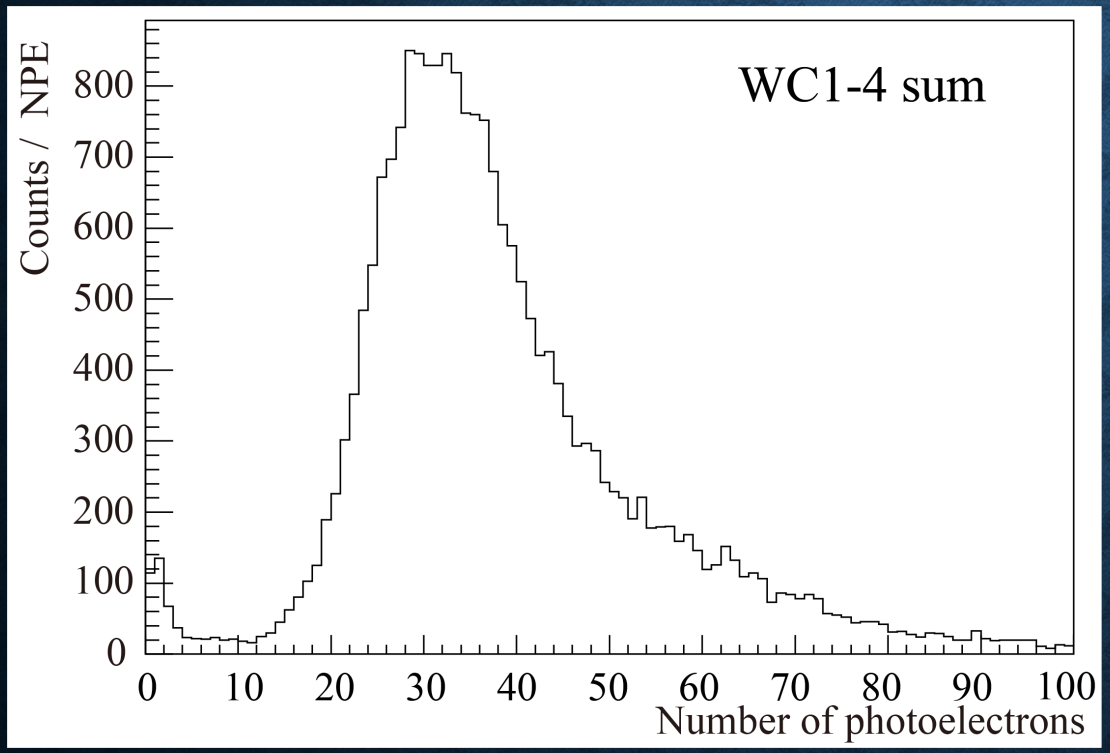


EXPERIMENTAL SETUP AT ESB



- ☆ A WC for lower momentum side (Okayasu-type) was tested (Mar 14—15, 2018)
- ☆ The WC was sandwiched by plastic scintillators (EHODOs)
- ☆ HV (EHODOs, WCs) = $-1700, -2200$ V
- ☆ Cosmic ray trigger: ch0 ⊗ ch1 ⊗ ch2 ⊗ch3 (coincidence of two scintillators)

SUMMED NUMBER OF PHOTOELECTRONS (RUN#1380: HKSTEST_01380.ROOT)

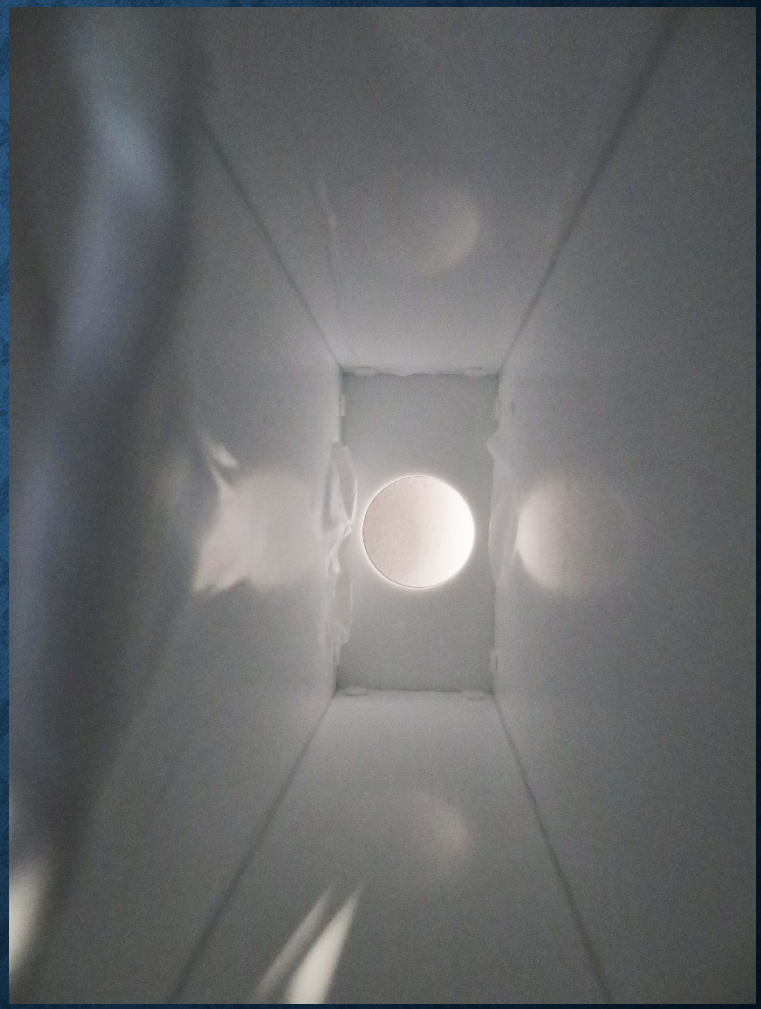


Mean NPE = 30—35

NPE is a little smaller, but not so far from that in E05-115 (It was about 40)

It seems to be usable although further tests will continue

INTERIOR OF HWC BOXES



Reflector is fallen off…

→ New WC → S. Nagano will talk about this tomorrow

NUMBER OF CHANNELS

HKS	ADC	TDC (Counters)	TDC (Trackers)	In charged of
KDC1,2	-	-	720	Hampton
KTOF1X, 1Y, 2X	88	88	-	Tohoku, Kyoto
AC	42	42	-	FIU
WC	48	48	-	Tohoku
Total	178	178	720	-

HES	ADC	TDC (Counters)	TDC (Trackers)	In charged of
EDC1	-	-	1098	Tohoku
EDC2			360	Hampton
EHODO1, 2	116	116	-	Tohoku, Kyoto
Total	116	116	1458	-

PREPARATION SCHEDULE

POSSIBLE SCHEDULE

A = Jan—June
B = July—Dec