

# Status of HES(+HES) detectors

Kyoto University

Toshiyuki Gogami

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京都大学 理学研究科・理学部

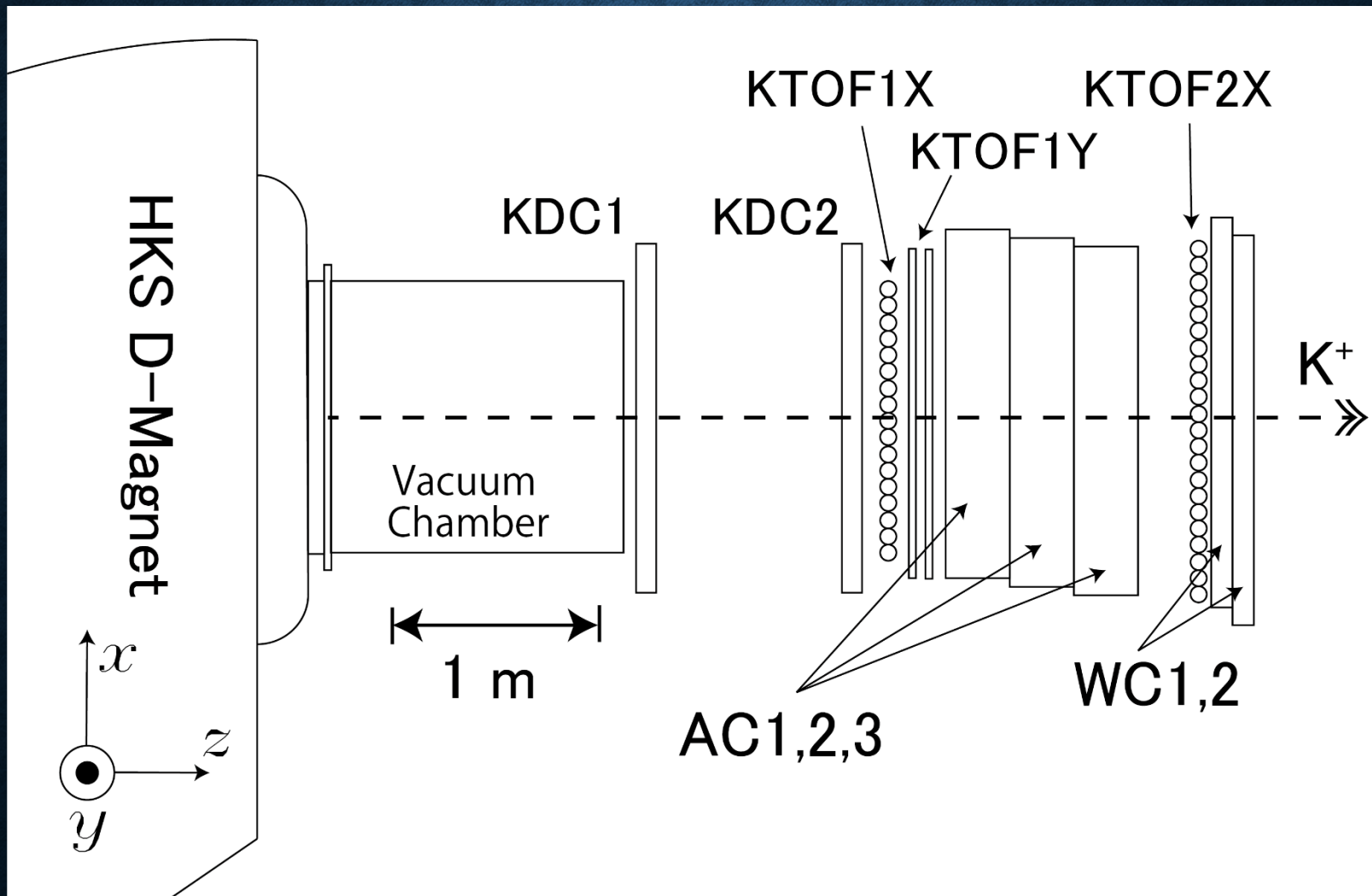
GRADUATE  
SCHOOL OF  
FACULTY OF **SCIENCE**  
KYOTO UNIVERSITY

科研費  
KAKENHI

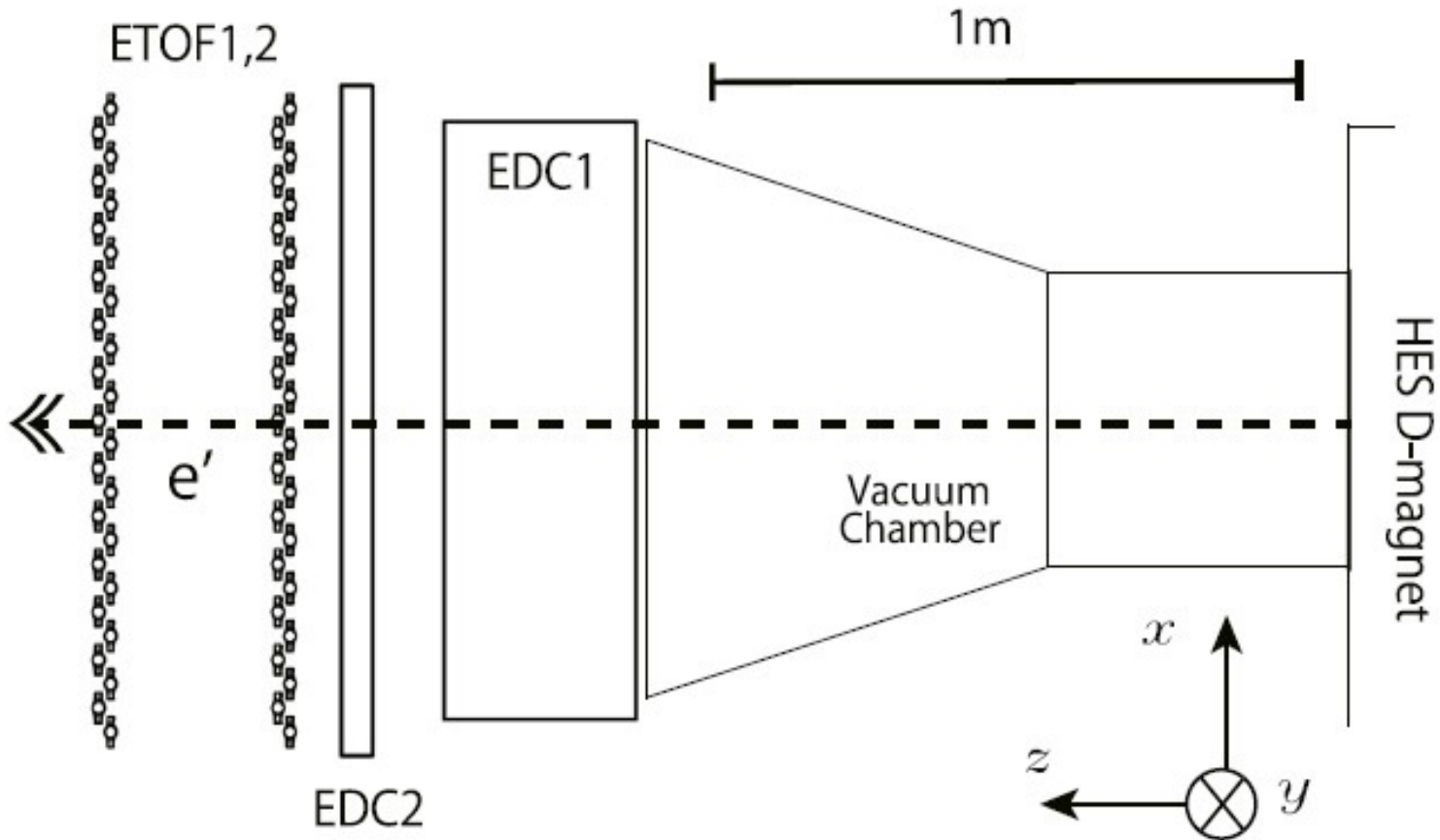
**SPIRITS**  
SUPPORTING PROGRAM FOR INTERACTION-BASED  
INITIATIVE TEAM STUDIES



# HKS DETECTOR SYSTEM



# HES DETECTORS



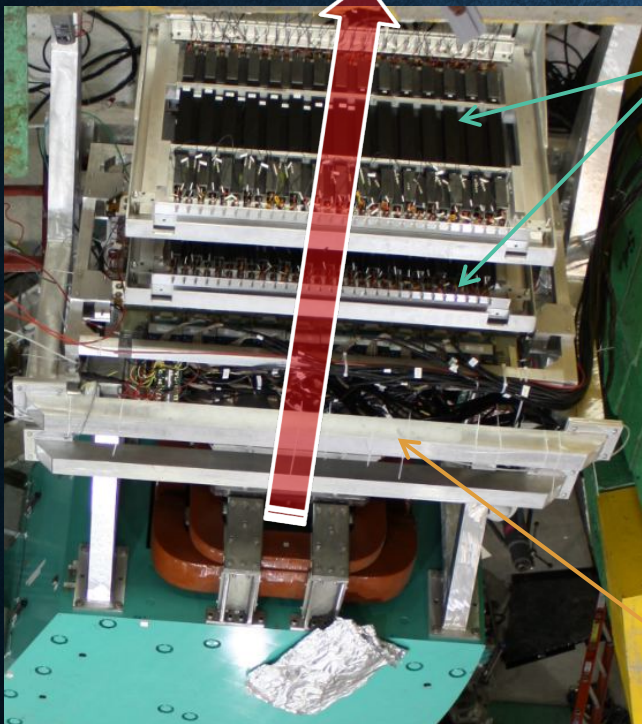
NIMA 900, 69—83 (2018);

<https://doi.org/10.1016/j.nima.2018.05.042>



# PHOTOS OF HES/HKS DETECTORS

$e^-$



TOF walls  
(Plastic scintillators)

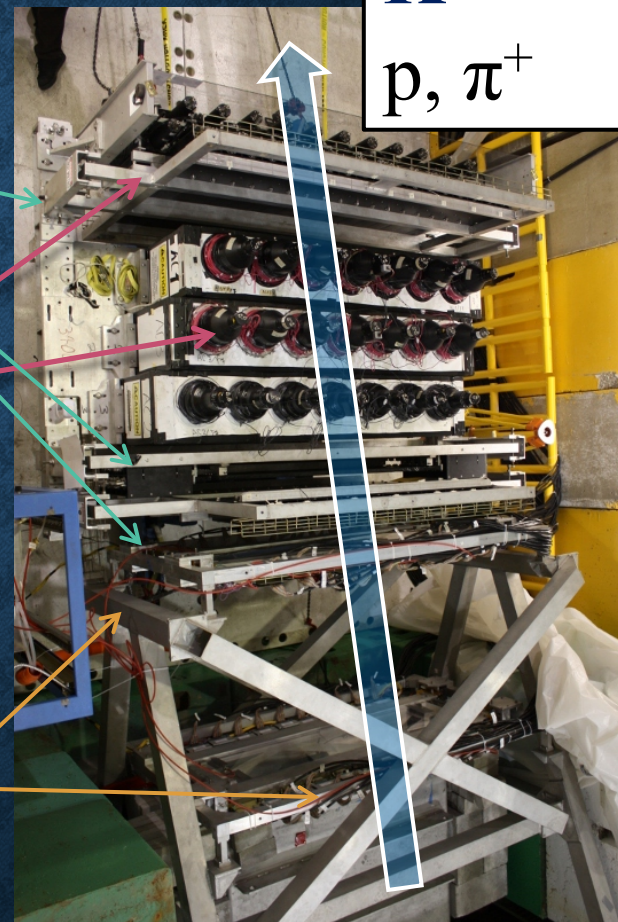
Cherenkov detectors  
• Aerogel ( $n=1.05$ )  
• Water ( $n=1.33$ )

Drift chambers

**HES**

$K^+$

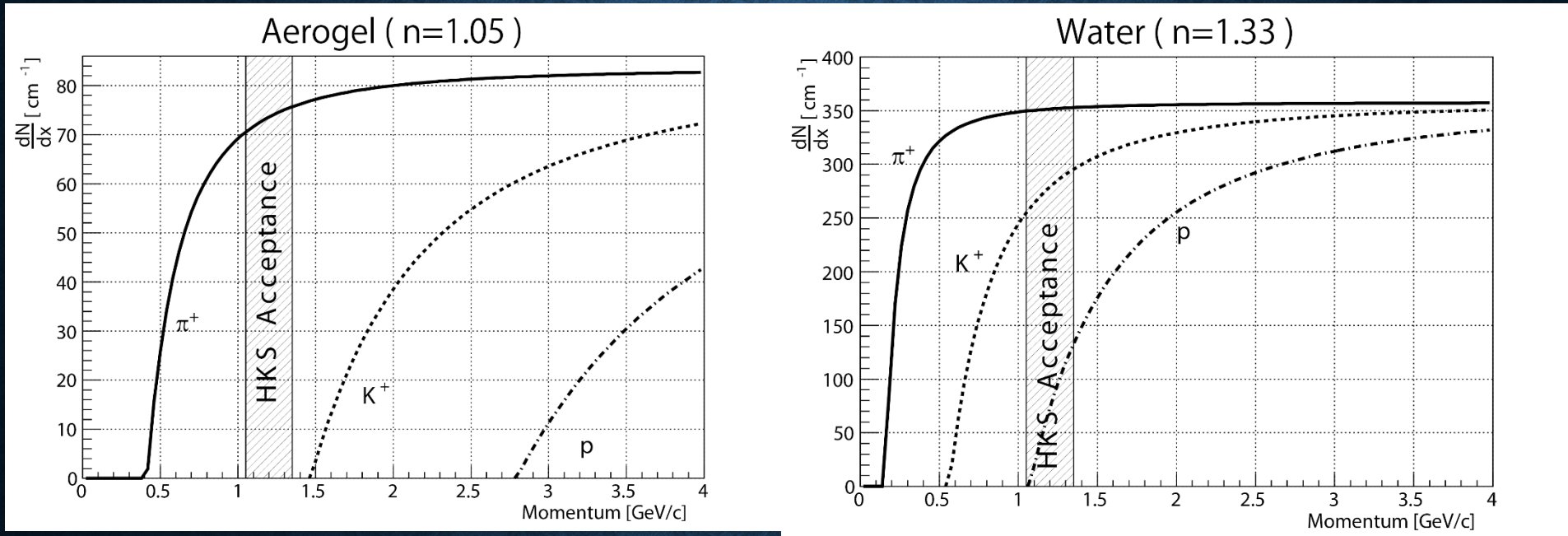
$p, \pi^+$



**HKS**



# ČERENKOV DETECTORS FOR KID

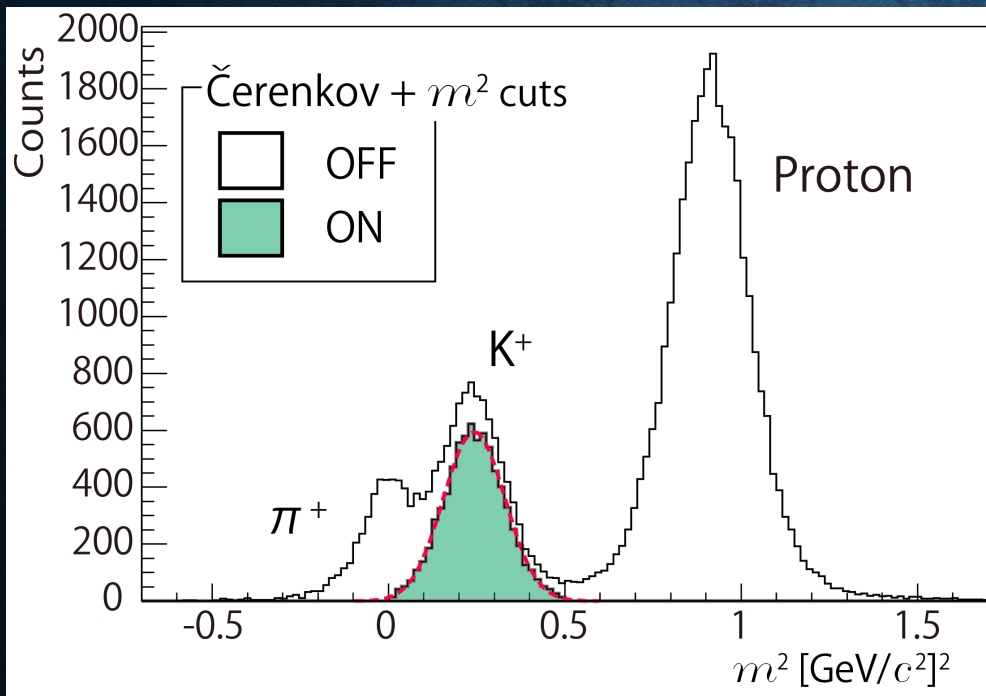


$$\frac{dN}{dx} = 2\pi\alpha z^2 \left( 1 - \frac{1}{\beta^2 n^2} \right) \int_{300 \text{ nm}}^{600 \text{ nm}} \frac{1}{\lambda^2} d\lambda$$



# KID PERFORMANCE (E05-115)

NIM A 729, 816–824 (2013)



## Survival ratios (on- and off-lines)

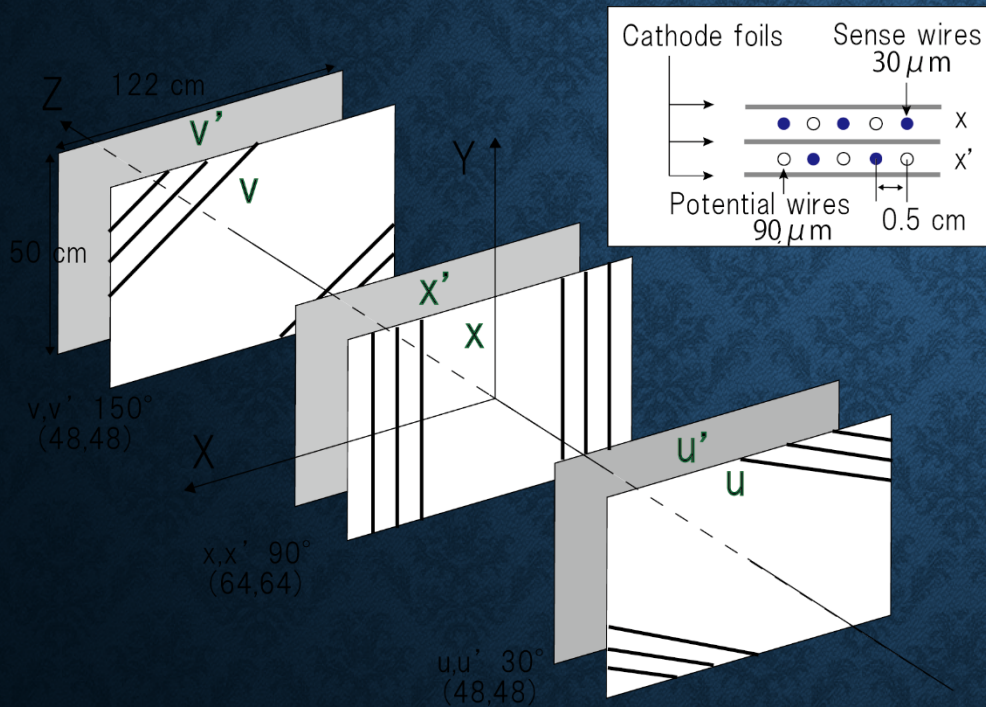
- ✓  $K^+$  : 83%
- ✓  $\pi^+$  :  $4.7 \times 10^{-4}$
- ✓  $p$  :  $1.9 \times 10^{-4}$



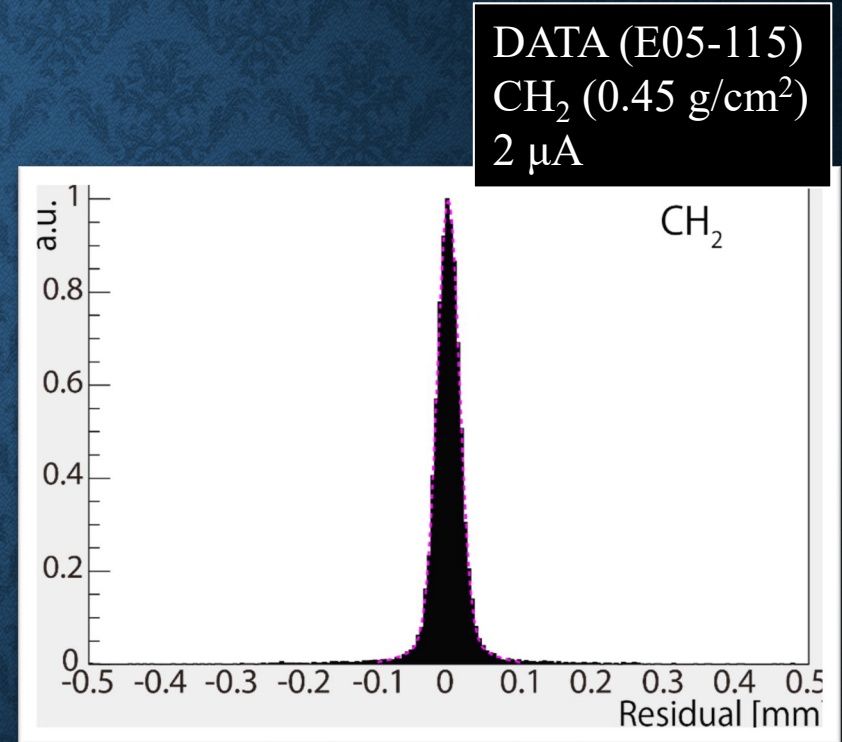
# **HKS DETECTOR SPECIFICATIONS**



# PLANER DRIFT CHAMBER; KDC1,2 → HAMPTON GROUP



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



Three sets of KDC are stored in SBS, JLab



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



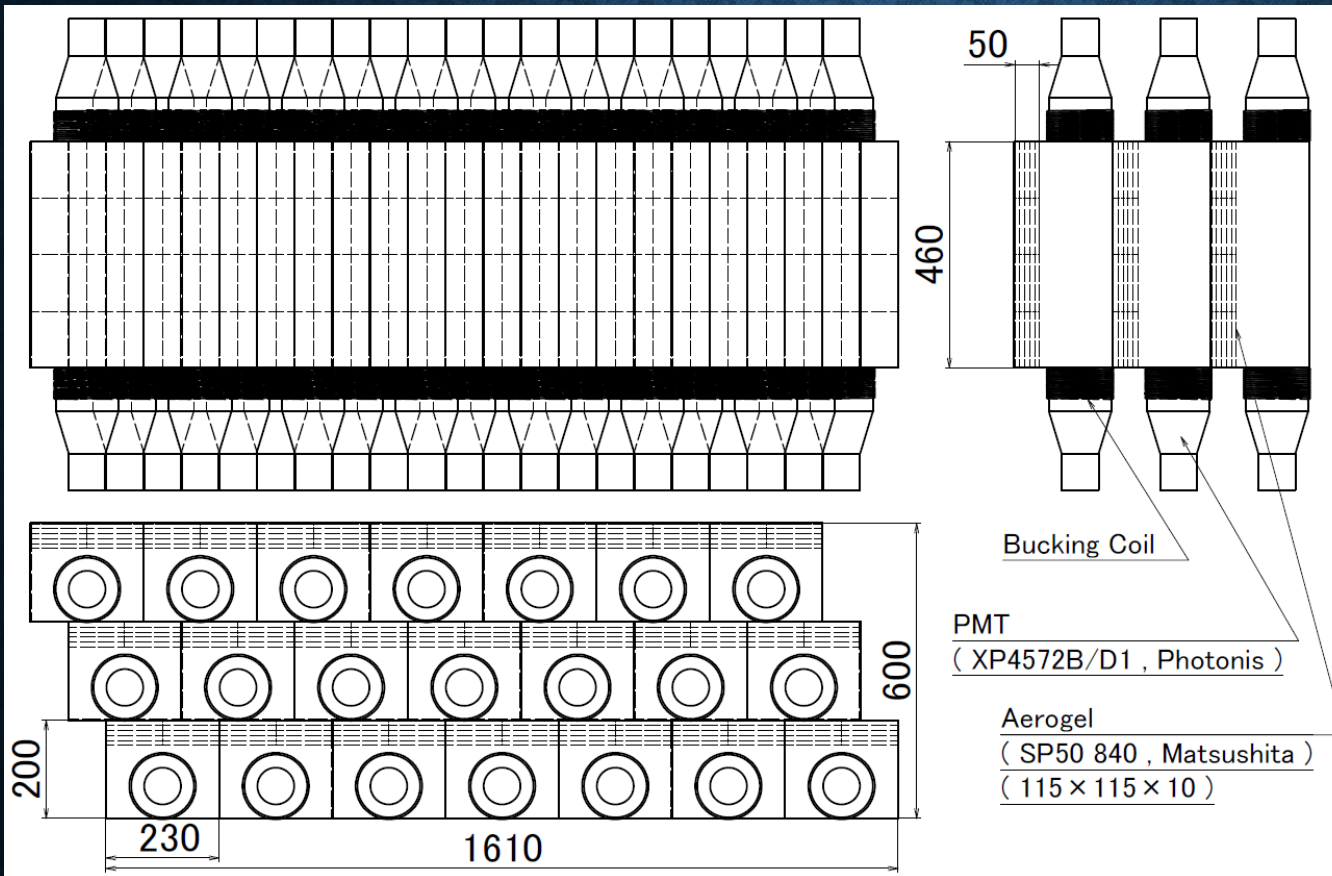
ID	Effective Area (mm <sup>2</sup> ) [1 seg. vol. (mm <sup>3</sup> )]	# of channels	$\sigma_t$ (ps)
1X	1275 × 300 (75 × 300 × 20 <sup>t</sup> )	17 × 2	60
1Y	1250 × 275 (1250 × 35 × 20 <sup>t</sup> )	9 × 2	70
2X	1710 × 350 (95 × 350 × 20 <sup>t</sup> )	18 × 2	60
Total number of channels		88	

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





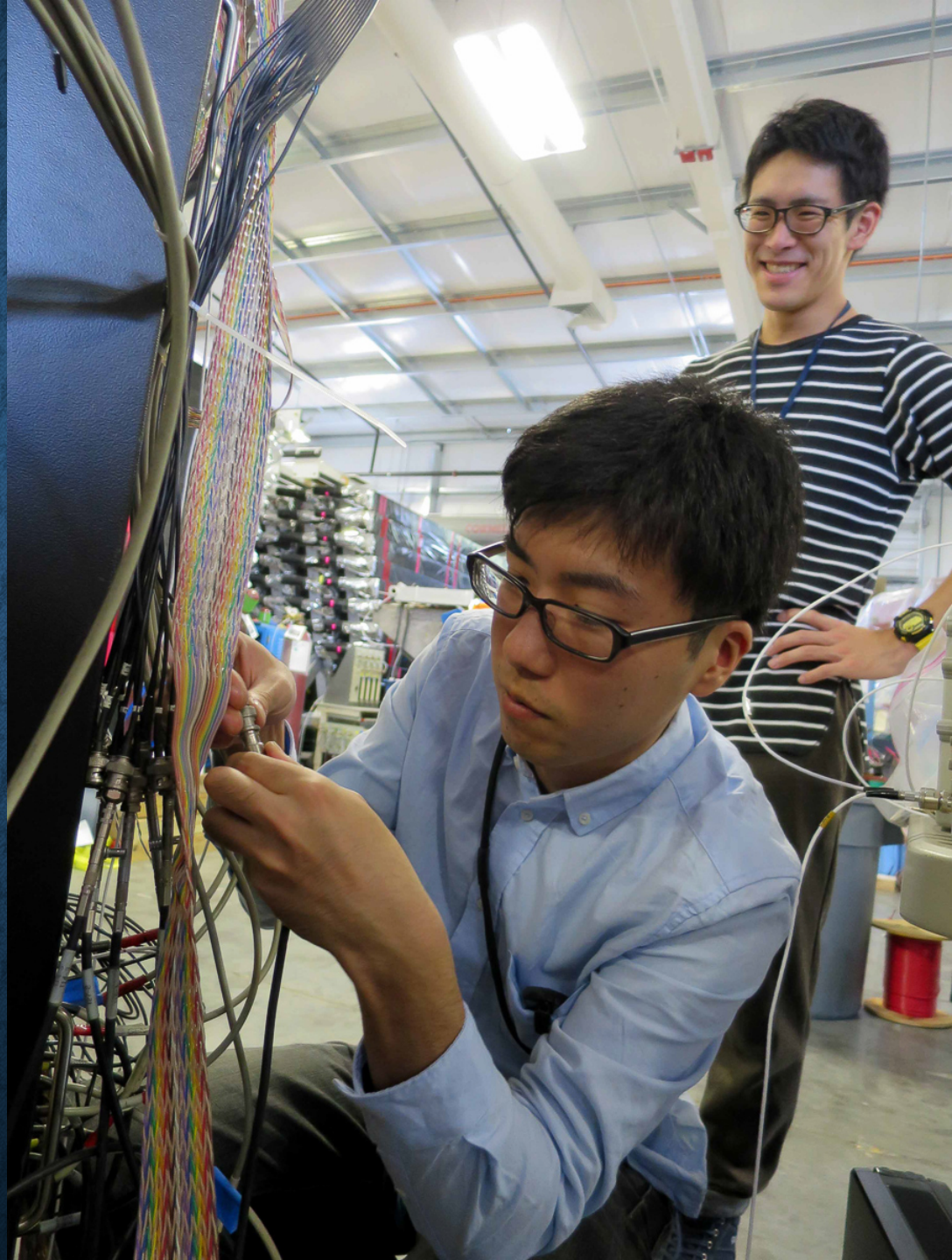
3400#

X  
RC3

CAUTION  
FRAGILE



*November, 2017 @ESB, JLab*



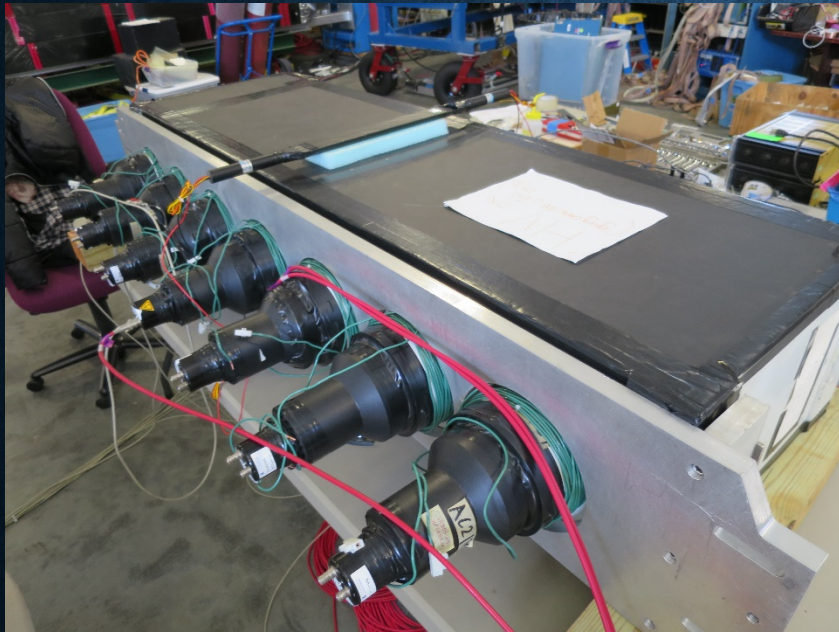




*March 12, 2018 @ESB, JLab*



# HKS AC TEST CONDITIONS



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

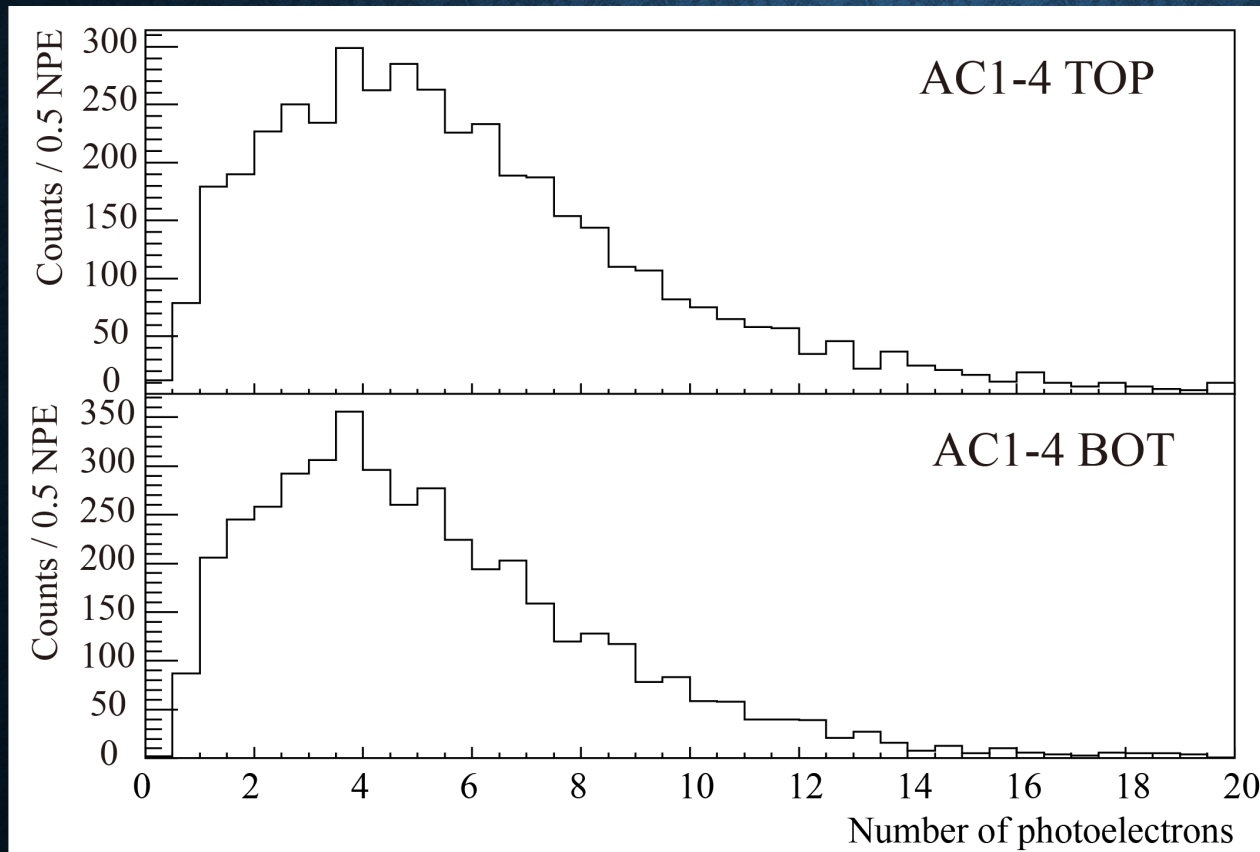
- ☆ AC1-4TOP/BOT was tested
- ☆ AC was sandwiched by trigger scintillators (EHODOs)
- ☆ HV setting:
  - ✓ Scintillators = -1700 V
  - ✓ AC = +1700 V
- ☆ Trigger: Scintillator 1 (bottom one)
- ☆ Discriminator threshold: -10 mV
- ☆ Trigger rate: 8 Hz
- ☆ 2018/3/12 – 2018/3/13



# THE NUMBER OF PHOTOELECTRONS FOR EACH PMT

*hkstest\_01349.root*

*Cosmic ray*



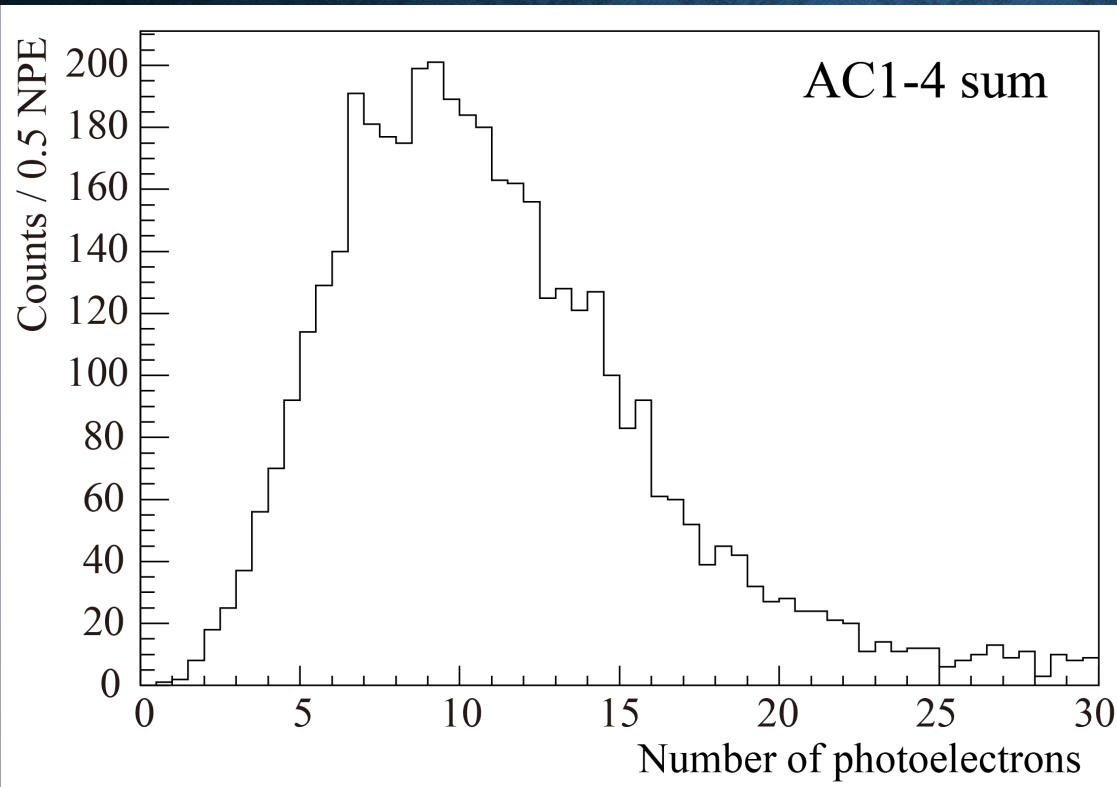
It is about **4—5**.



# SUMMED NPE (AC1-4)

*hkstest*

*Cosmic ray*



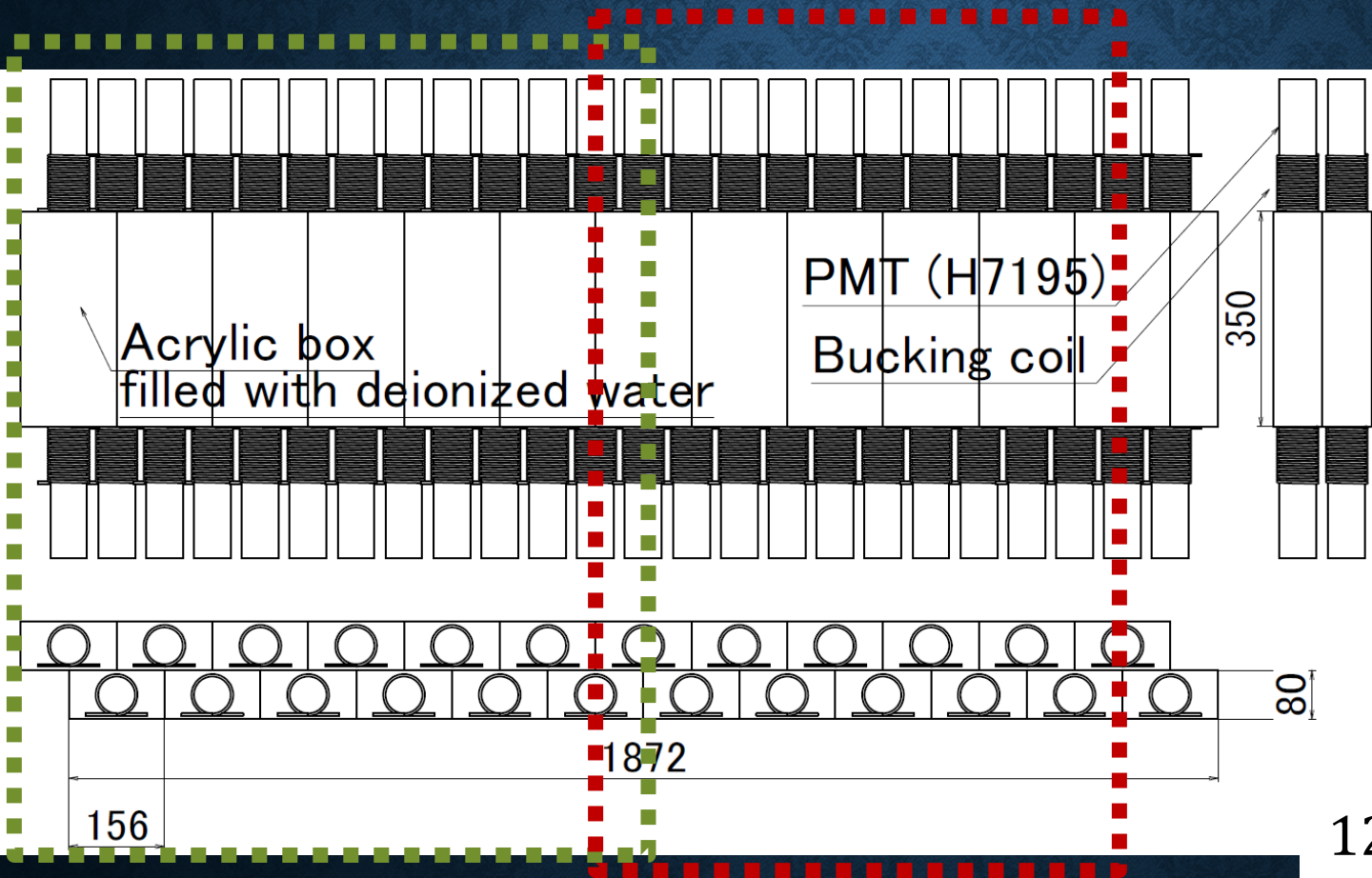
It is about **8—10** which is comparable to that in E05-115.

Great!

Further tests are in progress



# WATER ČERENKOV DETECTOR; WC → TOHOKU GROUP



Need to check:

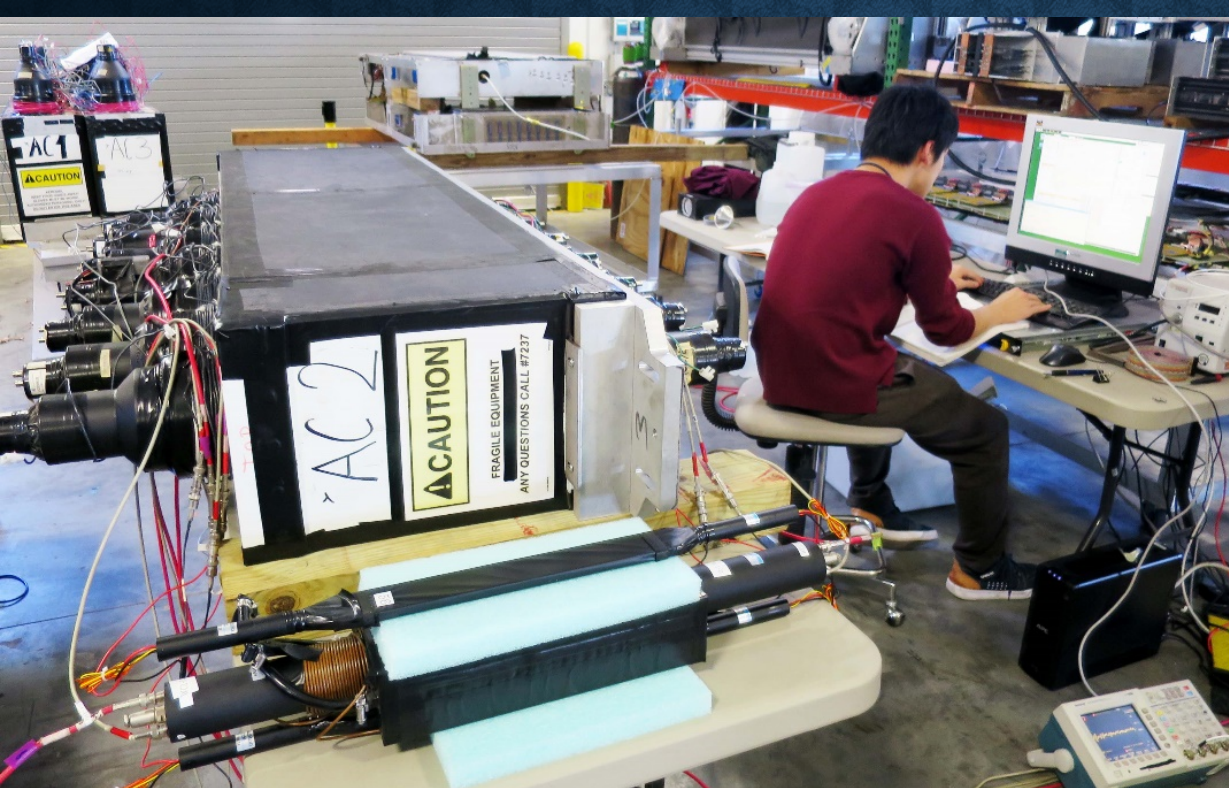
- ✓ Container
- ✓ PMTs

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

HWC

LWC

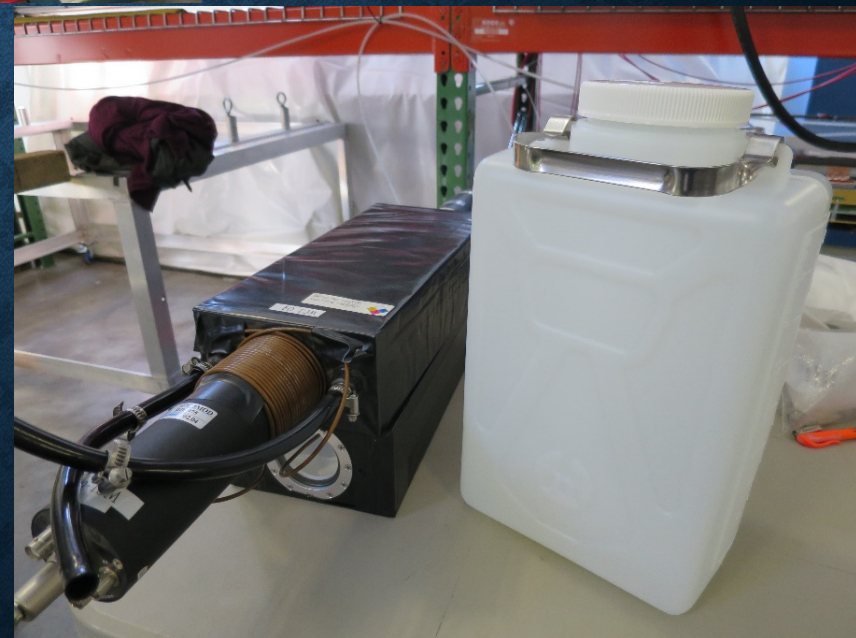




LWC was tested  
in March 2018

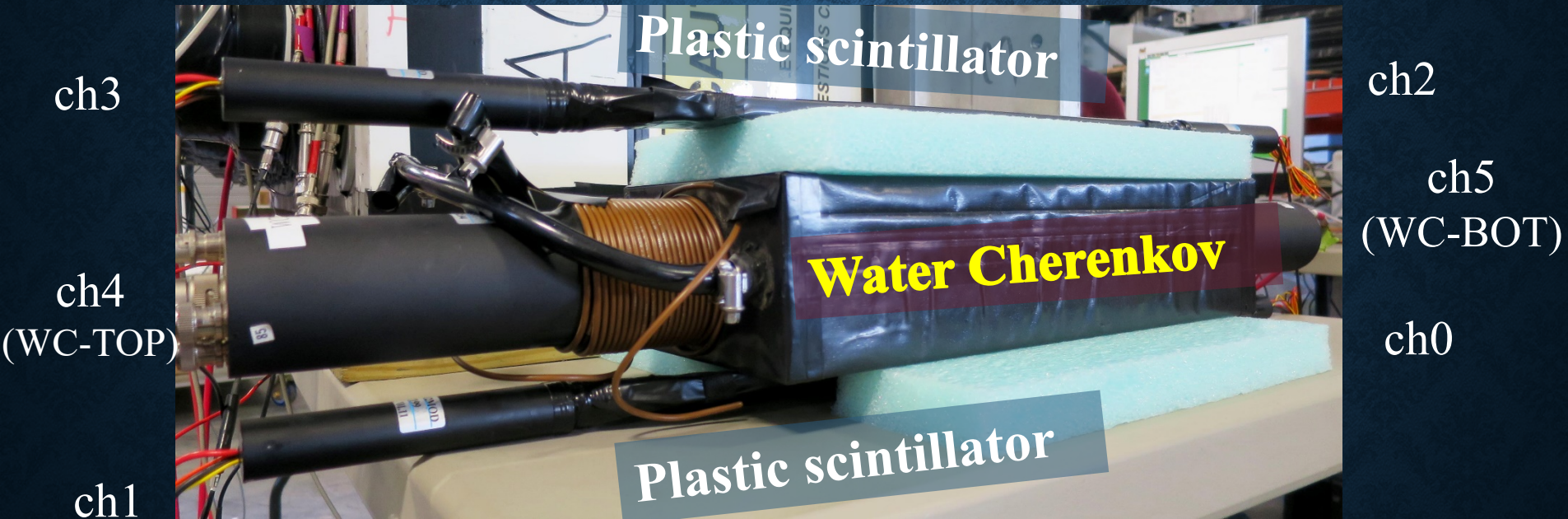
[https://www-nh.scphys.kyoto-u.ac.jp/~gogami/e12-15-008/meeting/2018/JLabMeeting\\_20180315\\_gogami.pdf](https://www-nh.scphys.kyoto-u.ac.jp/~gogami/e12-15-008/meeting/2018/JLabMeeting_20180315_gogami.pdf)

UPW from Phil  
([denny@jlab.org](mailto:denny@jlab.org))





# EXPERIMENTAL SETUP AT ESB

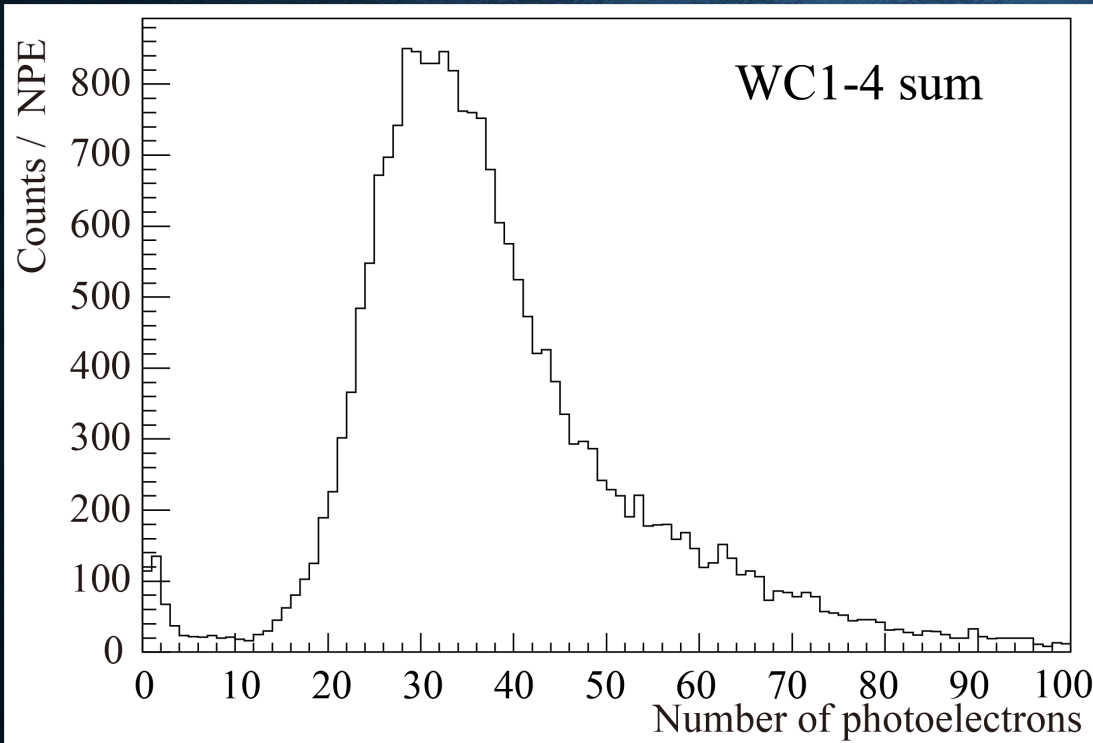


- ☆ A WC for lower momentum side (Okayasu-type) was tested (Mar 14—15, 2018)
- ☆ The WC was sandwiched by plastic scintillators (EHODOs)
- ☆ HV (EHODOs, WCs) =  $-1700, -2200$  V
- ☆ Cosmic ray trigger: ch0  $\otimes$  ch1  $\otimes$  ch2  $\otimes$  ch3 (coincidence of two scintillators)



# SUMMED NUMBER OF PHOTOELECTRONS (RUN#1380: HKSTEST\_01380.ROOT)

*Cosmic ray*



Mean NPE = 30—35

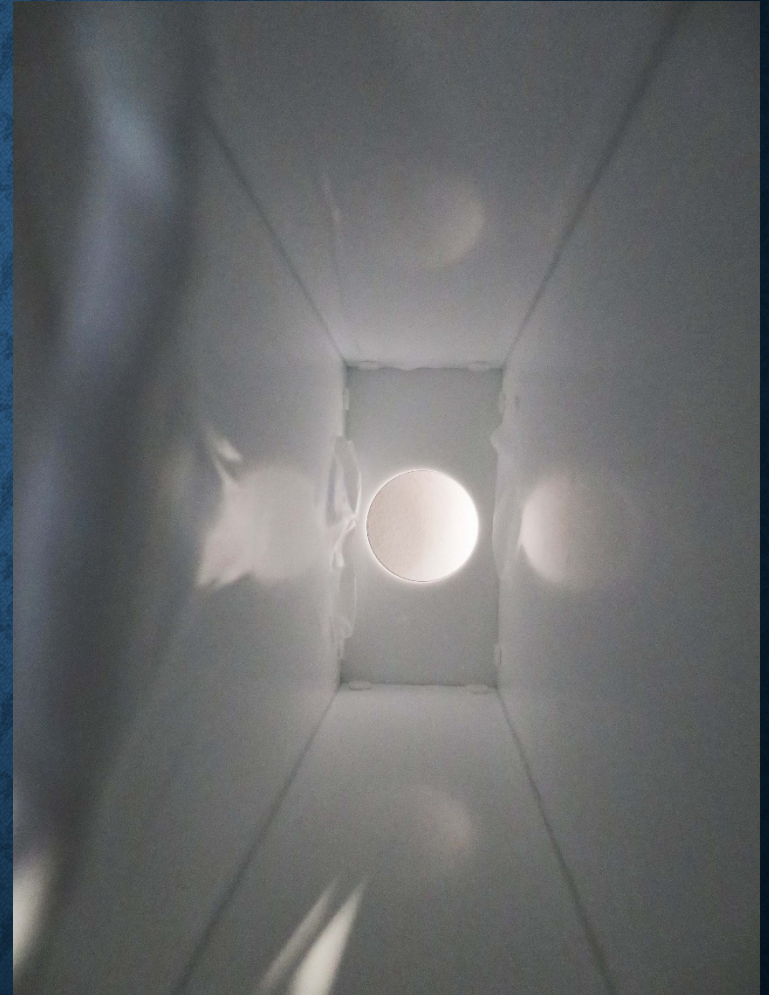


NPE is a little smaller, but  
not so far from that in E05-115  
(It was about 40)

*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
<b>Total</b>	<b>178</b>	<b>178</b>	<b>720</b>	-

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



# **PREPARATION SCHEDULE**



# POSSIBLE SCHEDULE

A = Jan—June

B = July—Dec

