

# HKS DAQ meeting

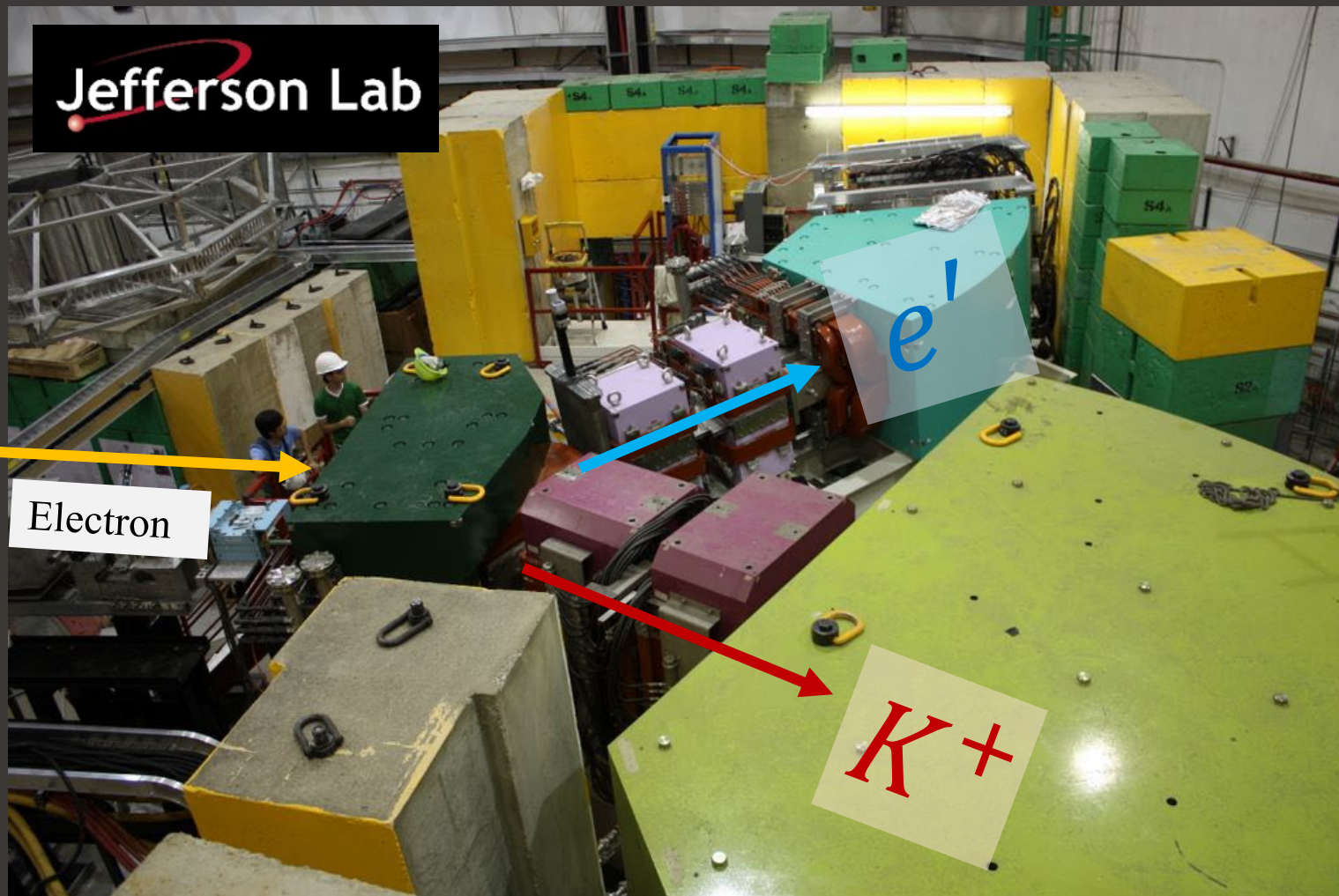
Graduate School of Science, Kyoto University

Toshiyuki Gogami

Oct 24, 2023



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



Approved: E12-15-008, (E12-19-002), E12-20-013

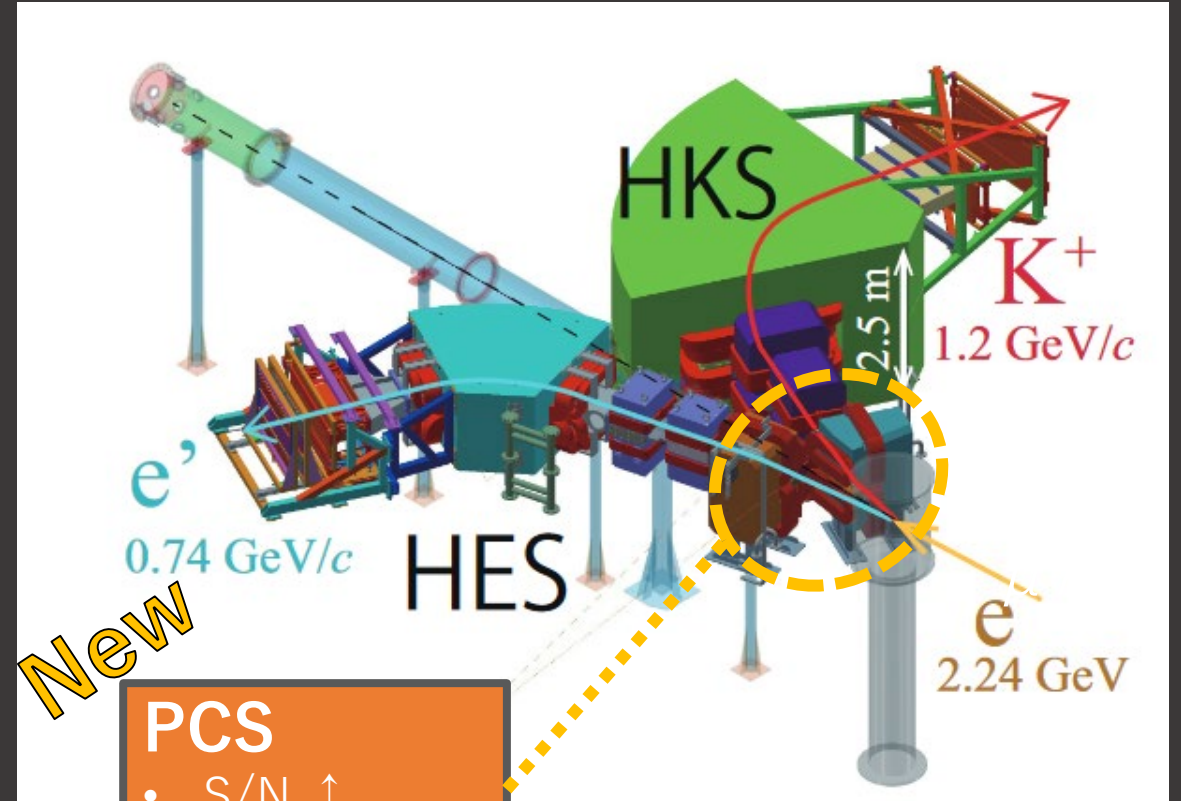
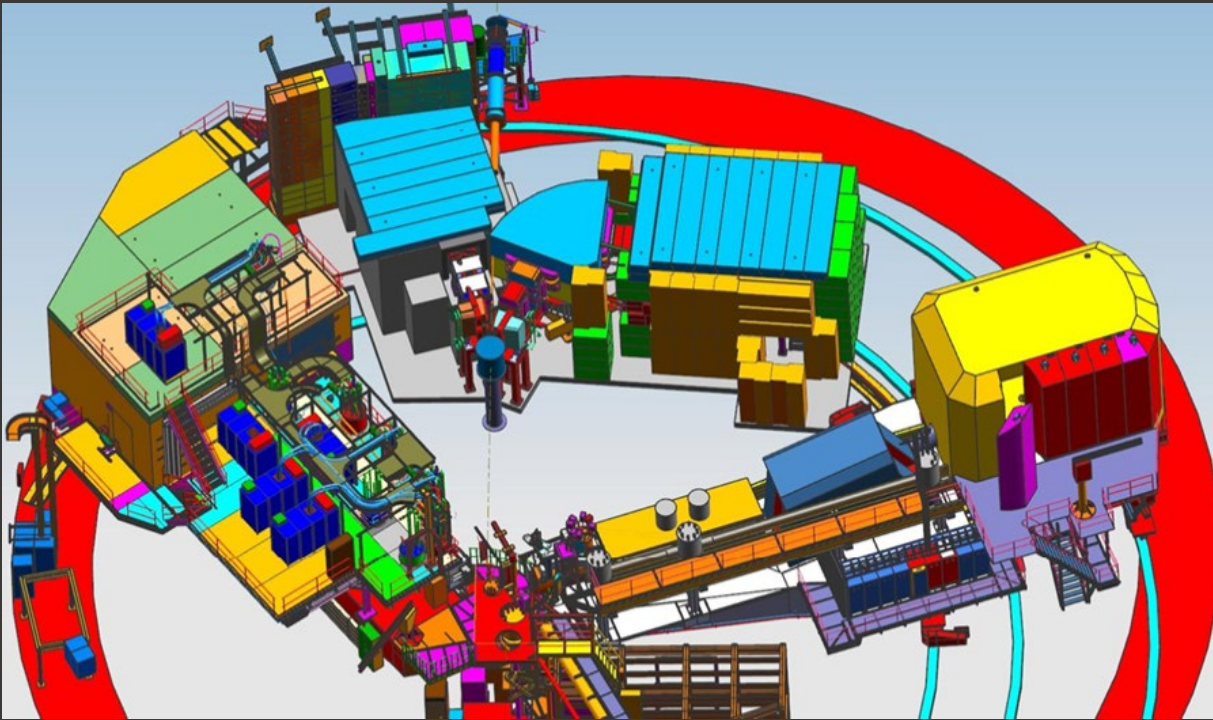
Proposing next year: LO12-23-011, LO12-23-013, LO12-23-016

# Next experiment at JLab Hall C (FY2026~)

Schematic from LO12-23-013 (TG et al., Lol to PAC51):

[https://researchmap.jp/gogami/published\\_papers/42361620/attachment\\_file.pdf](https://researchmap.jp/gogami/published_papers/42361620/attachment_file.pdf)

Hall A (original proposal) → Hall C



PCS

- S/N  $\uparrow$
- Flexibility  $\uparrow$

Existing spectrometers HES and HKS are going to be used

# Particle Detectors in HES and HKS

**HES**  $e^-$

**HKS**  $K^+$   
 $p, \pi^+$

**TOF walls**  
(Plastic scintillators)

**Cherenkov detectors**

- Aerogel ( $n=1.05$ )
- Water ( $n=1.33$ )

**Drift chambers**

c.f.) [https://wiki.jlab.org/tegwiki/index.php/Hypernuclear\\_CollaborationMeeting\\_2021Dec](https://wiki.jlab.org/tegwiki/index.php/Hypernuclear_CollaborationMeeting_2021Dec)

# Particle Detectors in HES and HKS

HES

$e^-$

$K^+$

$p, \pi^+$

HKS

	Detector	Current status	No. of channels		Ready?
			ADC	TDC	
<b>HKS</b>	Drift Chambers	To be tested	N/A	360 + 360	Yes
	TOF counters	All PMTs were checked	88	88	
	Aerogel Cherenkov	Test done	42	42	
	Water Cherenkov	New boxes under construction	48	48	
<b>HES</b>	Drift Chambers	To be tested	N/A	1098+360	
	TOF counters	To be tested	116	116	

Drift chambers

# The number of ADC/TDC

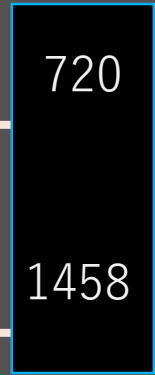
	Detector	Current status	No. of channels		Ready?
			ADC	TDC	
<b>HKS</b>	Drift Chambers	To be tested	N/A	360 + 360	Yes
	TOF counters	All PMTs were checked	88	88	
	Aerogel Cherenkov	Test done	42	42	
	Water Cherenkov	New boxes under construction	48	48	
<b>HES</b>	Drift Chambers	To be tested	N/A	1098+360	
	TOF counters	To be tested	116	116	

ex.) FB 1877

Low resolution TDC

ex.) FB 1875

High resolution TDC

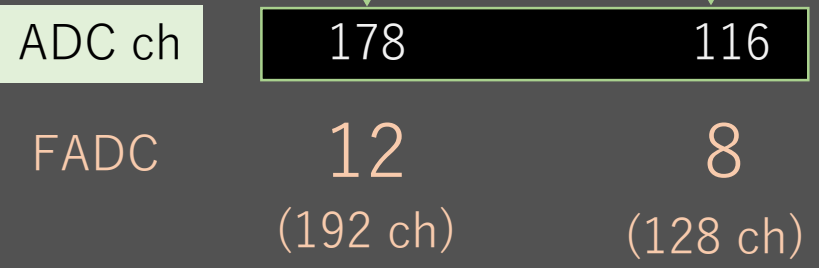


8 (768 ch)

88 2 (128 ch)

16 (1536 ch)

116 2 (128 ch)



	96 ch/mod.		64 ch/mod.	
	Spect.	FADC	LR TDC	HR TDC
HES		12	8	2
HKS		8	16	2
<b>Total</b>		<b>20</b>	<b>24</b>	<b>4</b>

# Trigger condition

$$\text{COIN} = \text{HKS} \otimes \text{HES}$$

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

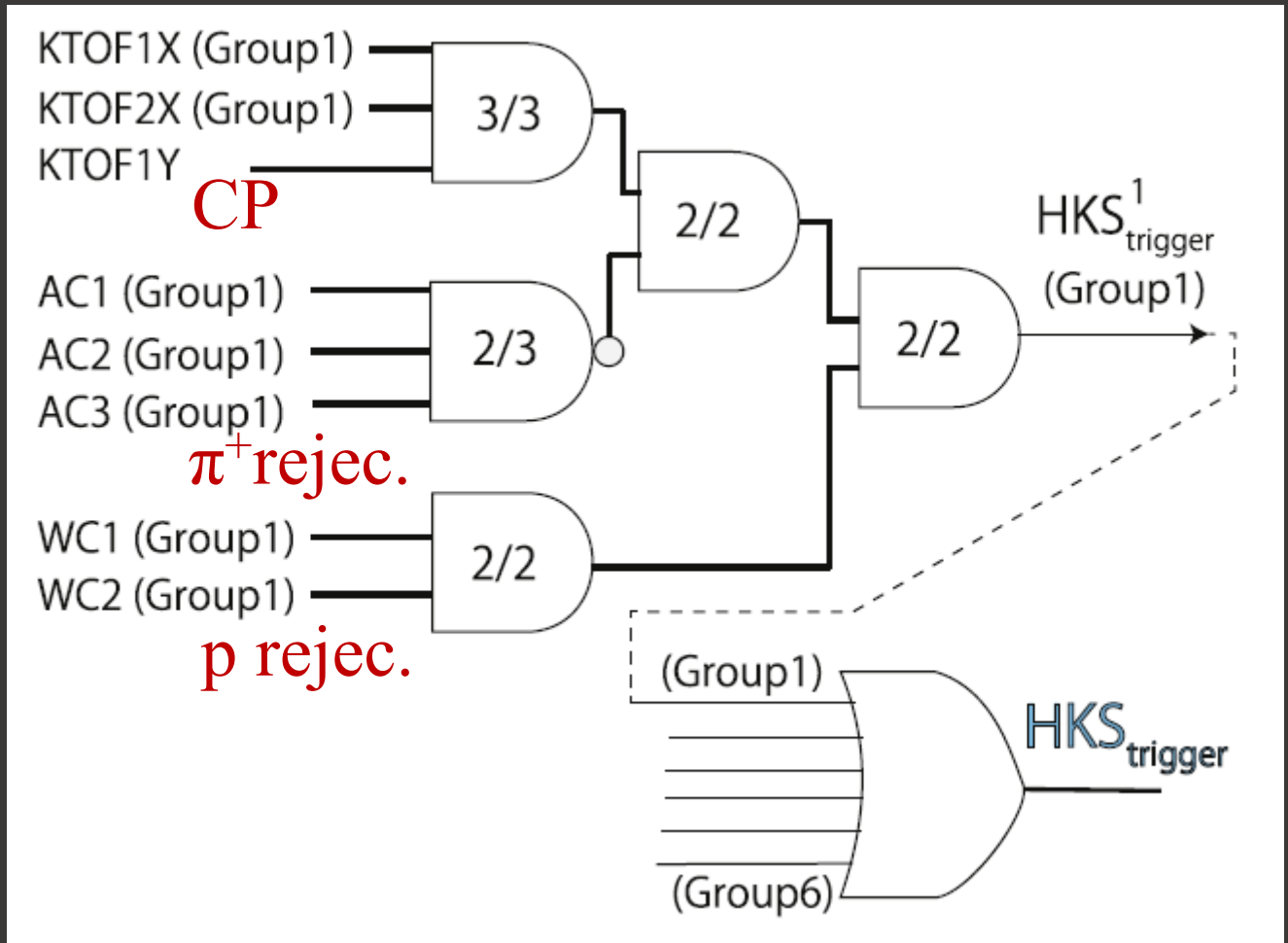
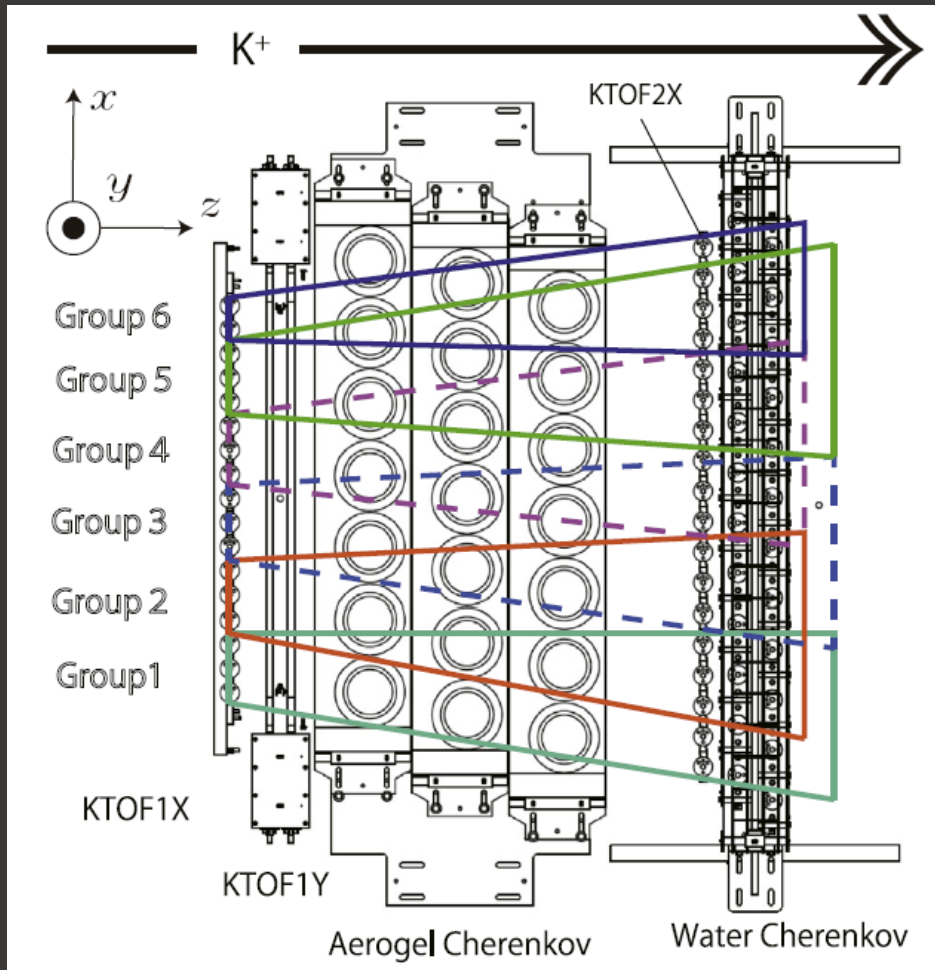
# Expected charged particle rates

{ HES: 30 ns width  
 HKS: 200 ns width

Beam current ( $/\mu\text{A}$ )	Target [ $/(\text{mg}/\text{cm}^2)$ ]	Rate ( $/\text{kHz}$ )				Coincidence btw HES and HKS
		HES	HKS			
		$e'$	$K^+$	$\pi^+$	p	
50	$^6\text{Li}$	120	0.27	22	28	1.0
	$^9\text{Be}$ (100)	140	0.26	21	27	1.8
	$^{10}\text{B}$	170	0.25	21	26	2.1
30	$^6\text{Li}$	73	0.16	13	17	0.5
	$^9\text{Be}$ (100)	81	0.15	13	16	0.5
	$^{10}\text{B}$	100	0.15	12	16	0.3

Cherenkov counters may not need to be included in the trigger

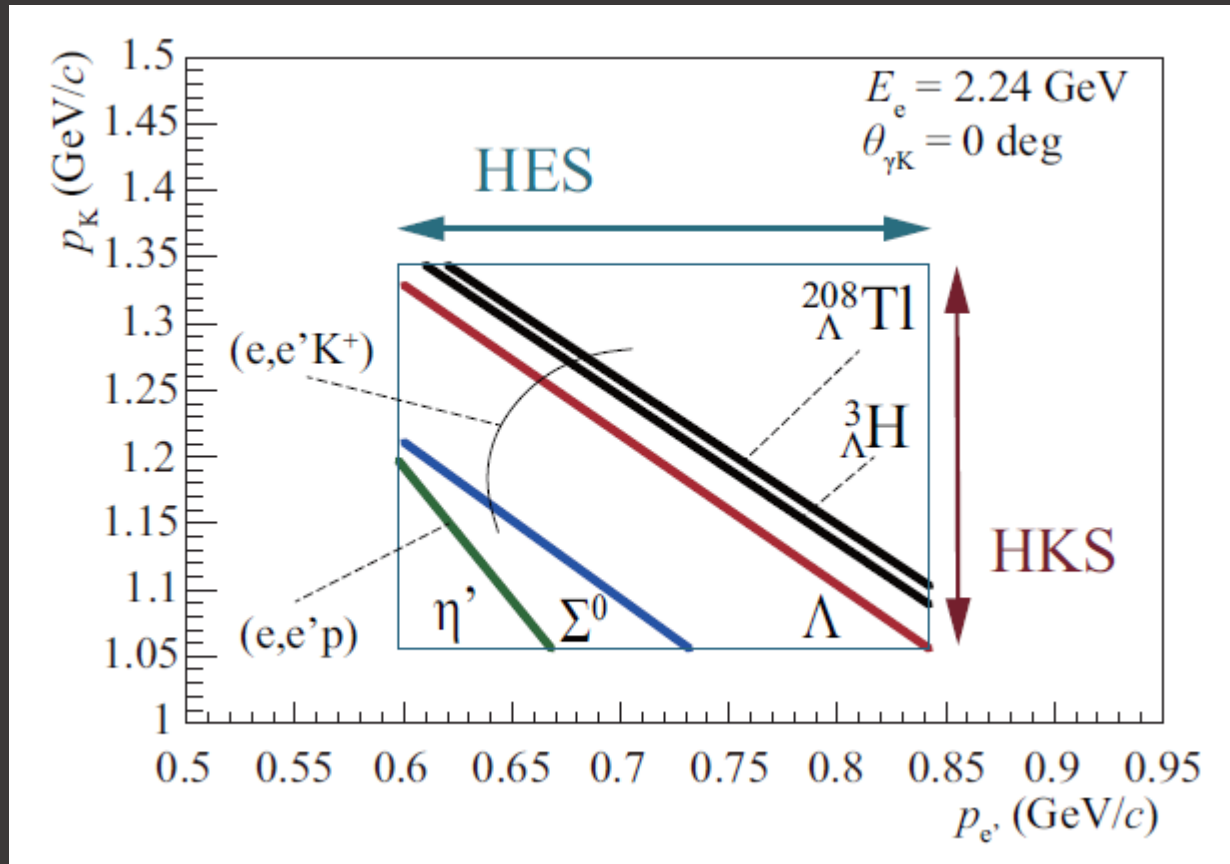
# Grouping trigger (in the case of HKS)



➡ Can FADC handle with this purpose?



# Unbiased trigger



Unbiased trigger (such as CP trig.)  
- prescale  $\rightarrow$  accumulate in data

# To be checked

- Availability of resources
  - FADC, TDC and crates
- Trigger by FADC
  - Possible? → (if so) any sample code? → Iwamoto (student at Kyoto Univ.)
- Meeting at JLab on Nov 14, 2023
  - To discuss what needs to be prepared for ERR, aiming to have the ERR in the beginning of 2024
  - <https://indico.jlab.org/event/742/>

# Backup

J-PARC E63

J-PARC E94

JLab LOI12-23-013

- YN scat. exp.
- Femotoscropy

CSB

${}^3\Lambda$  lifetime puzzle

$nn\Lambda$  bound puzzle

JLab E12-19-002

JLab LOI12-23-011

Invariant mass spectroscopy by RHI beam @LHC, RHIC, GSI

JLab C12-20-013 (C2)

JLab LOI12-23-016

Many Body effect (Cluster, deformation)

- Space observation
- Graviton wave meas.

Neutron star puzzle

Strangeness	2B	Coupled channel	3B
-1		$\Lambda N - \Sigma N$	
-2		$\Xi N - \Lambda \Lambda$	

J-PARC E70

J-PARC E75

J-PARC E96

JLab E12-15-008

JLab E12-20-013