

HKS DAQ meeting

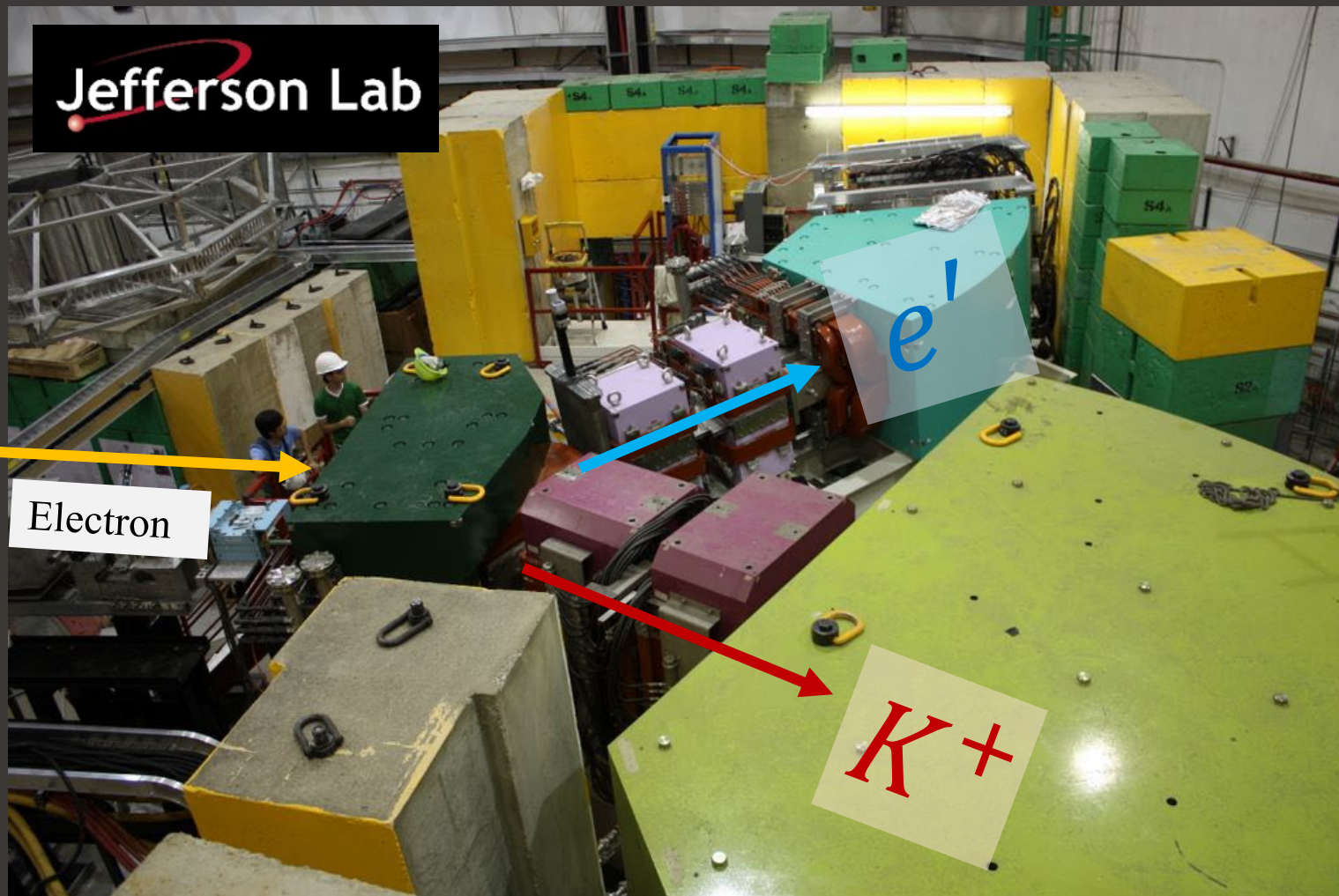
Graduate School of Science, Kyoto University

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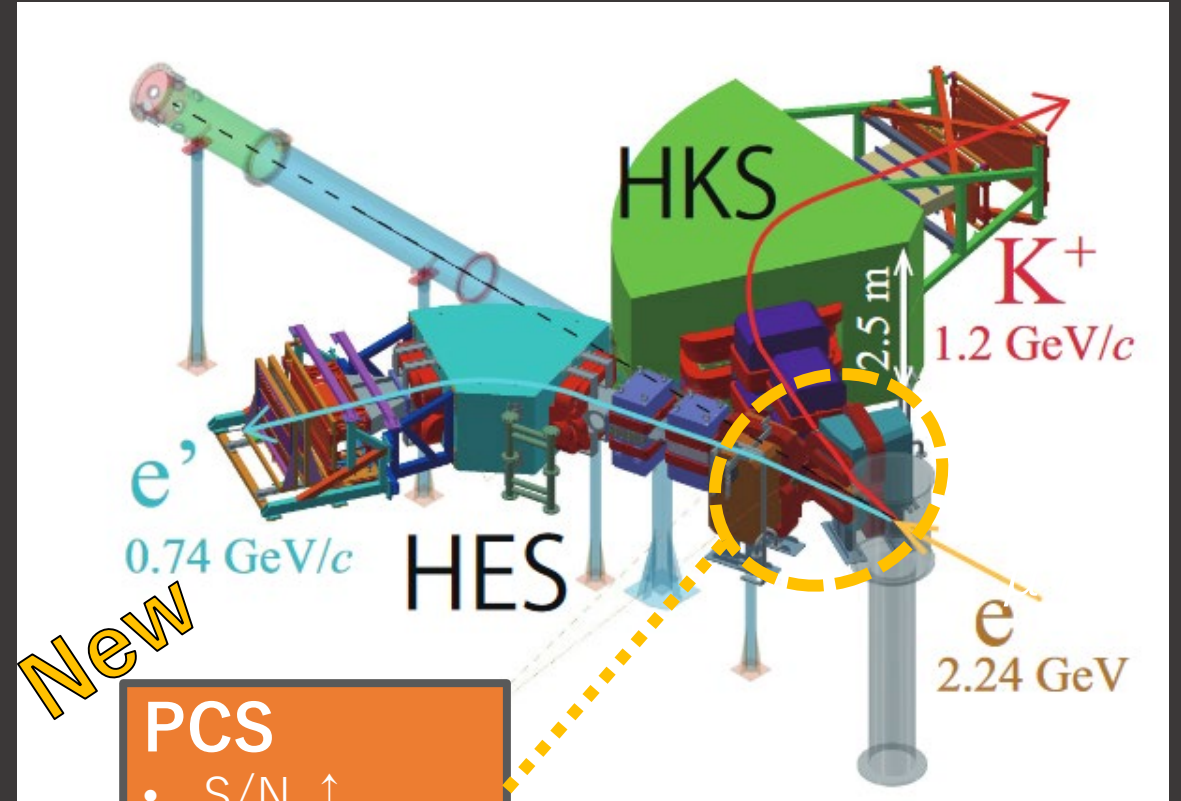
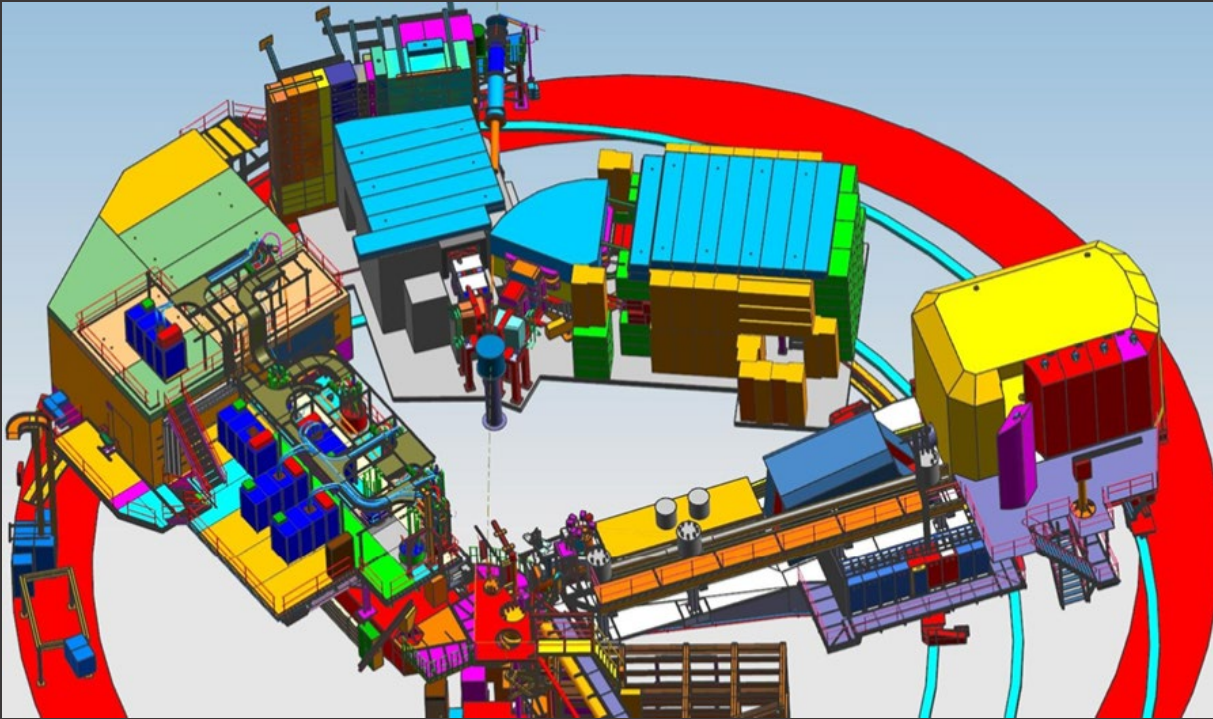
Approved: E12-15-008, (E12-19-002), E12-20-013

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

Hall A (original proposal) → Hall C



PCS

- S/N ↑
- Flexibility ↑

Existing spectrometers HES and HKS are going to be used

Particle Detectors in HES and HKS

HES e^-

HKS K^+
 p, π^+

TOF walls (Plastic scintillators)

Cherenkov detectors

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

Drift chambers

The image shows two detector setups side-by-side. The left setup, labeled HES, is for electrons (e^-) and features a red arrow pointing upwards through a stack of detector layers. The right setup, labeled HKS, is for kaons (K^+), protons (p), and pions (π^+) and features a blue arrow pointing upwards through a similar stack of detector layers. Labels with arrows point to specific components: TOF walls (plastic scintillators) at the top, Cherenkov detectors (aerogel and water) in the middle, and drift chambers at the bottom.

c.f.) https://wiki.jlab.org/tegwiki/index.php/Hypernuclear_CollaborationMeeting_2021Dec

Particle Detectors in HES and HKS

HES

e^-

K^+

p, π^+

HKS

	Detector	Current status	No. of channels		Ready?
			ADC	TDC	
HKS	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	
HES	Drift Chambers	To be tested	N/A	1098+360	
	TOF counters	To be tested	116	116	

Drift chambers

The number of ADC/TDC

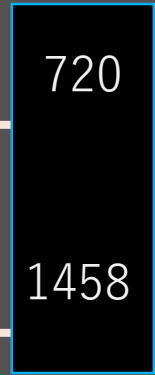
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ex.) FB 1877

Low resolution TDC

ex.) FB 1875

High resolution TDC

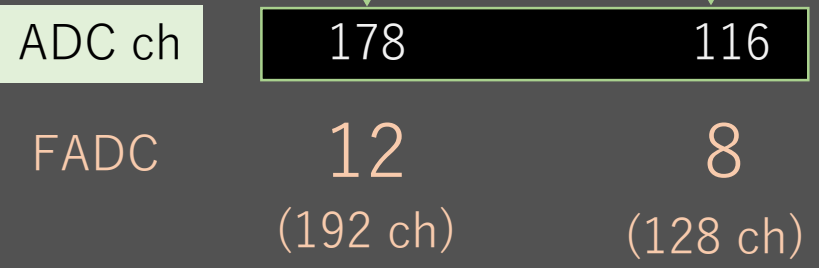


8 (768 ch)

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
Total		20	24	4

Trigger condition

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

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

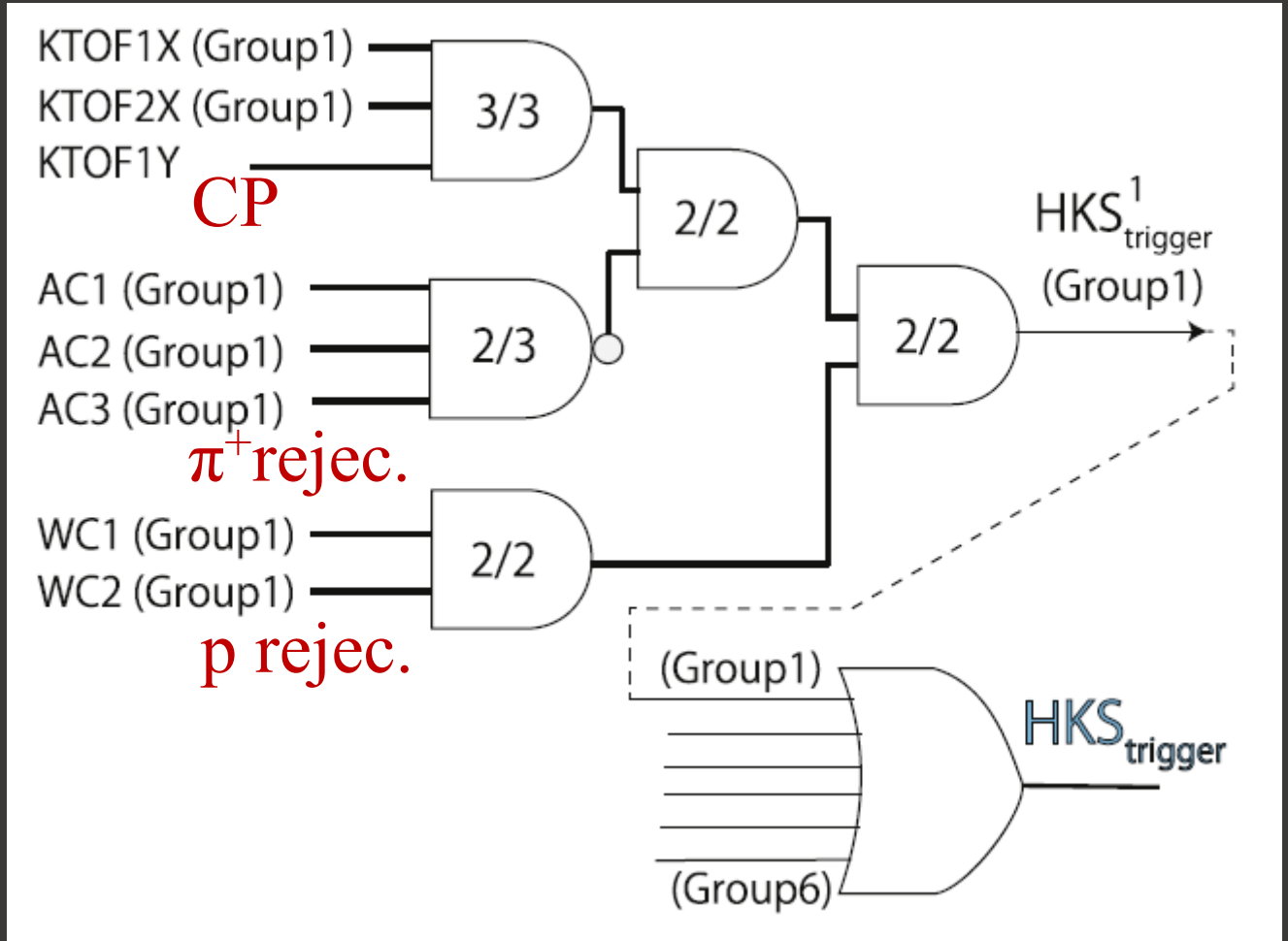
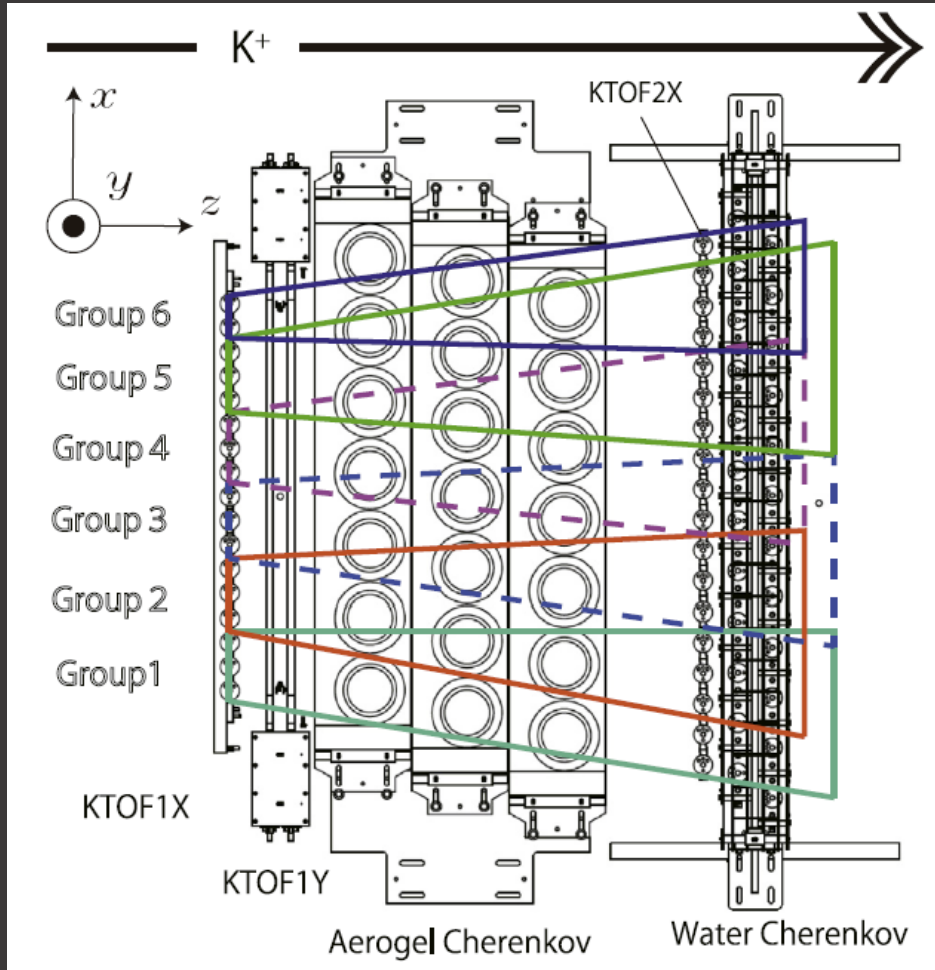
Expected charged particle rates

{ 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^+	π^+	p	
50	^6Li	120	0.27	22	28	1.0
	^9Be (100)	140	0.26	21	27	1.8
	^{10}B	170	0.25	21	26	2.1
30	^6Li	73	0.16	13	17	0.5
	^9Be (100)	81	0.15	13	16	0.5
	^{10}B	100	0.15	12	16	0.3

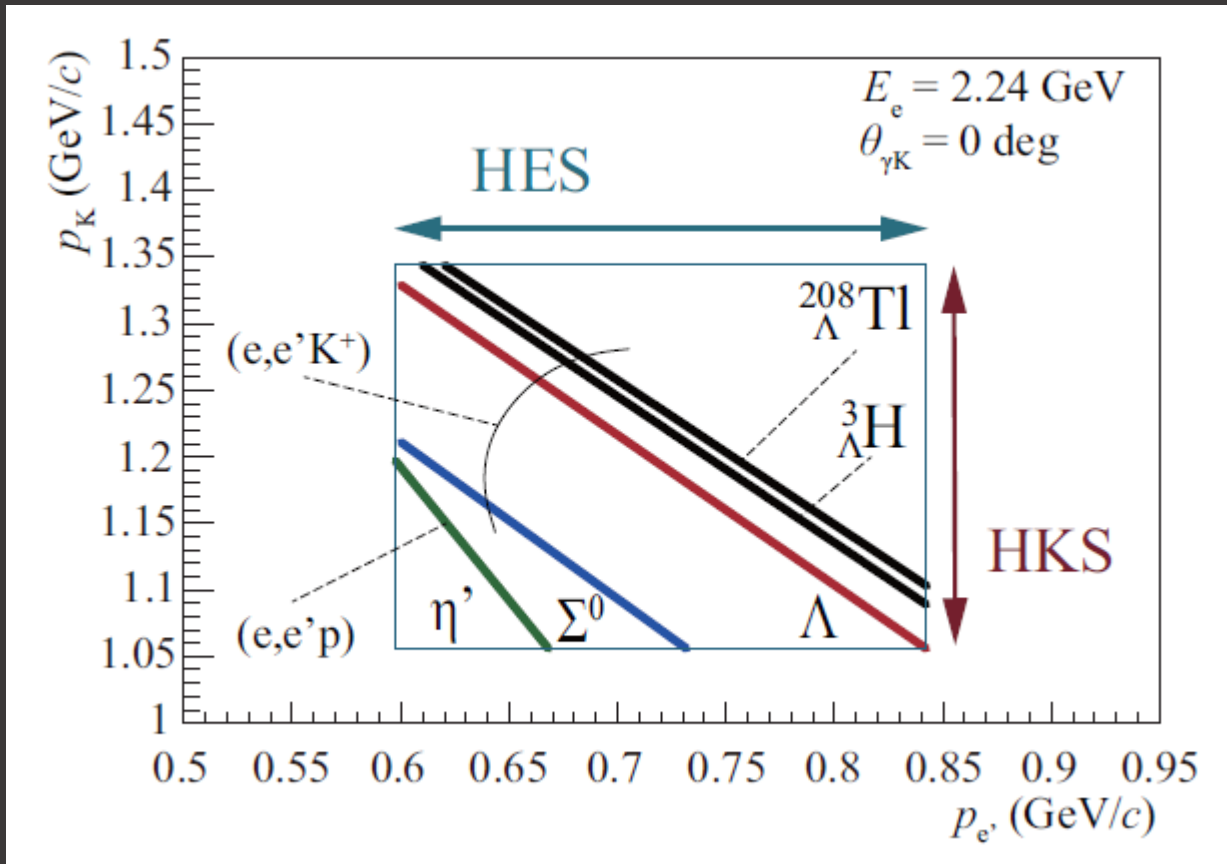
Cherenkov counters may not need to be included in the trigger

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 / information

- Availability of resources
 - FADC, TDC (available VME TDCs?) and crates
 - VETROC + Mezz. cards → asked a quote/invoice → any updates?
- Trigger by FADC
 - Possible?
 - if so, any sample code? → Iwamoto (student at Kyoto Univ.)
 - if not, other options? VETROC or HUL
- 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/>
 - We are staying at JLab from Nov 13 (Mon) to Nov 17 (Fri)

Backup

J-PARC E63

J-PARC E94

JLab LOI12-23-013

- YN scat. exp.
- Femotoscropy

CSB

${}^3\Lambda\text{H}$ 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