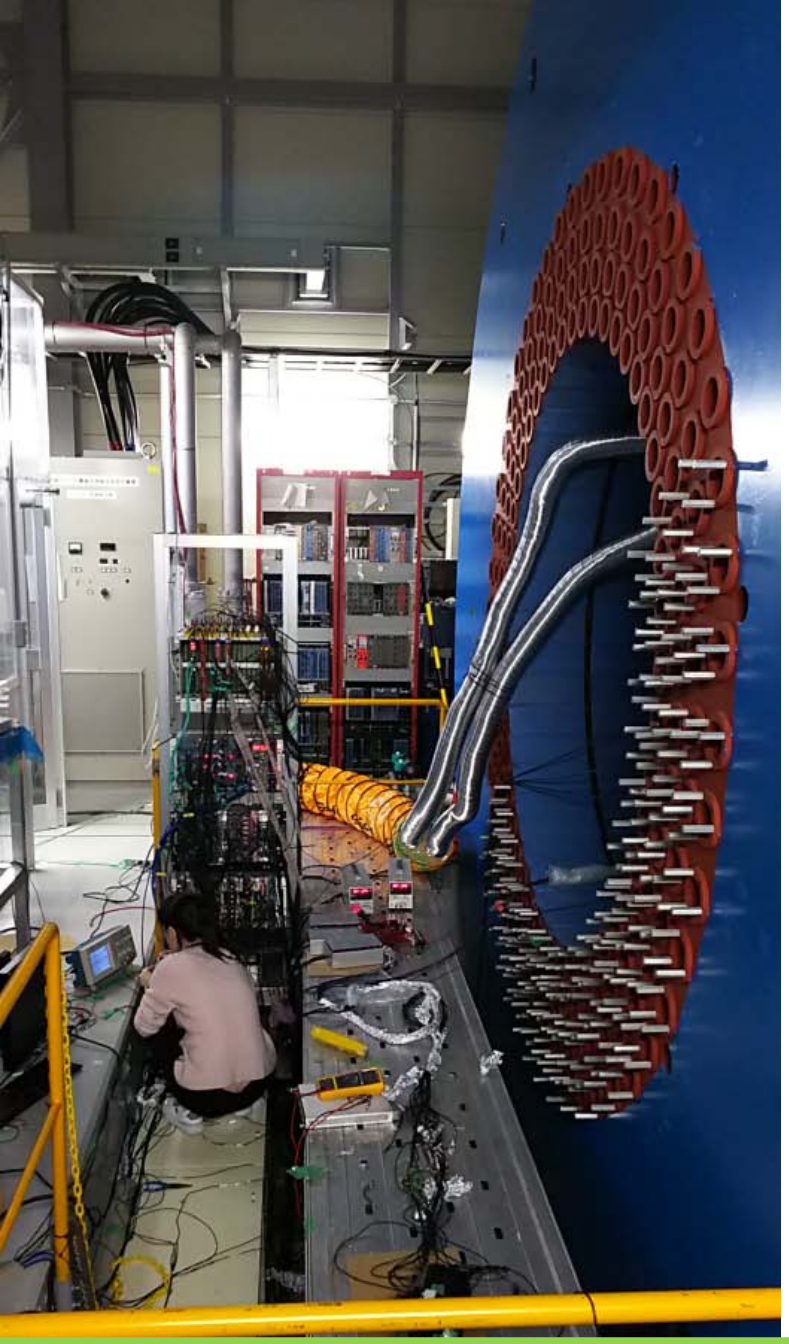

Exotic Baryon Systems from Photoproduction

and

Beam Commissioning of the LEPS2 Solenoid Spectrometer

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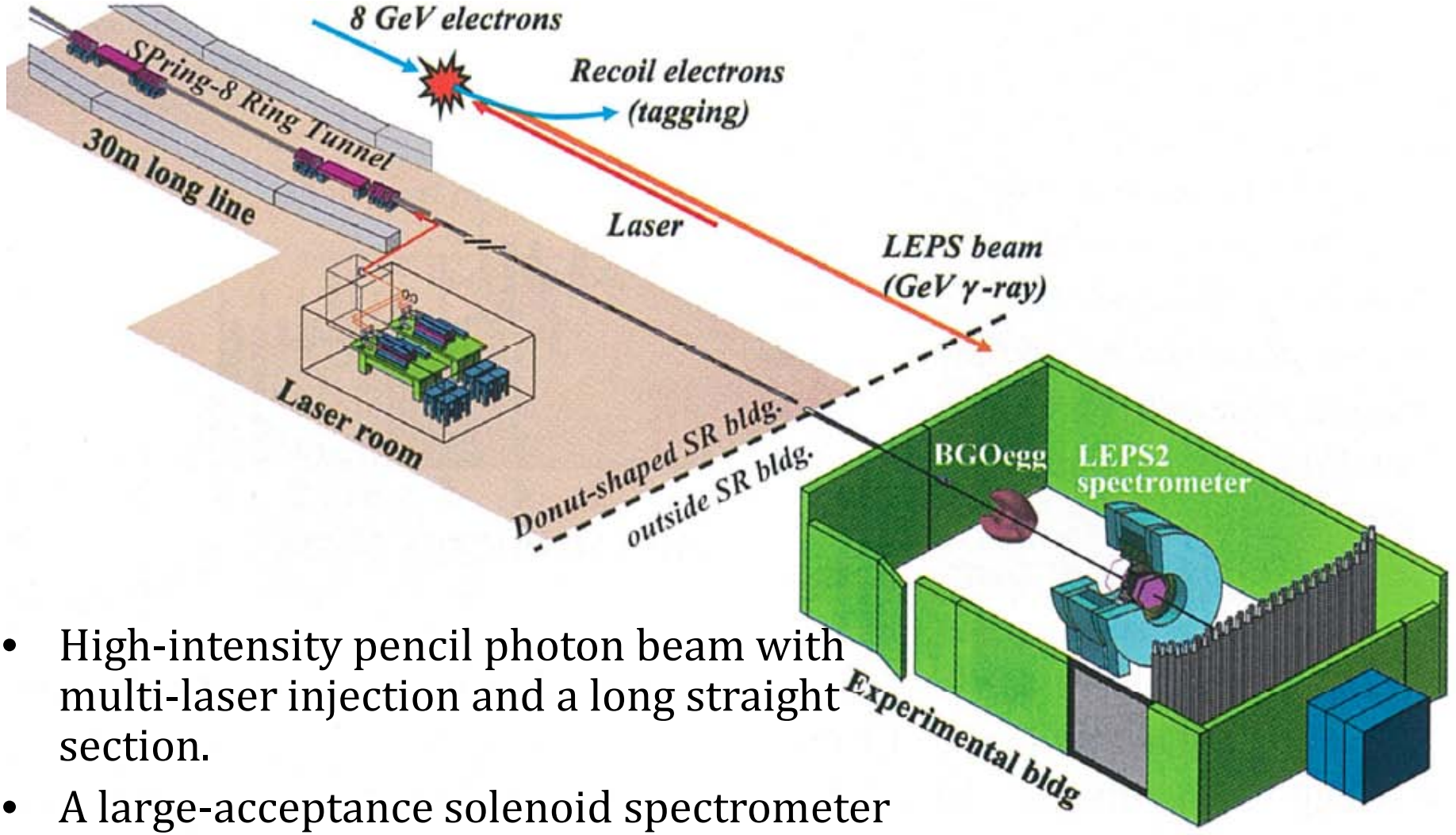
for the LEPS2 Collaboration

APFB 2017, Aug 26 – 30, 2017, Guilin

Outline

- **Linearly polarized Compton-backscattered photons come to the LEPS2 solenoid spectrometer at SPring-8.**
- **High-intensity photon beam in the range of 1.3-2.9 GeV and a large angular acceptance will open new opportunities to explore exotic baryon systems from photo-production, such as Θ+, K-pp, and Λ(1405).**
- **A new data acquisition system has been built for the LEPS2 experiment, based on the network-based DAQ-middleware framework.**
- **Second beam commissioning of the LEPS spectrometer system was performed last July, 2017.**

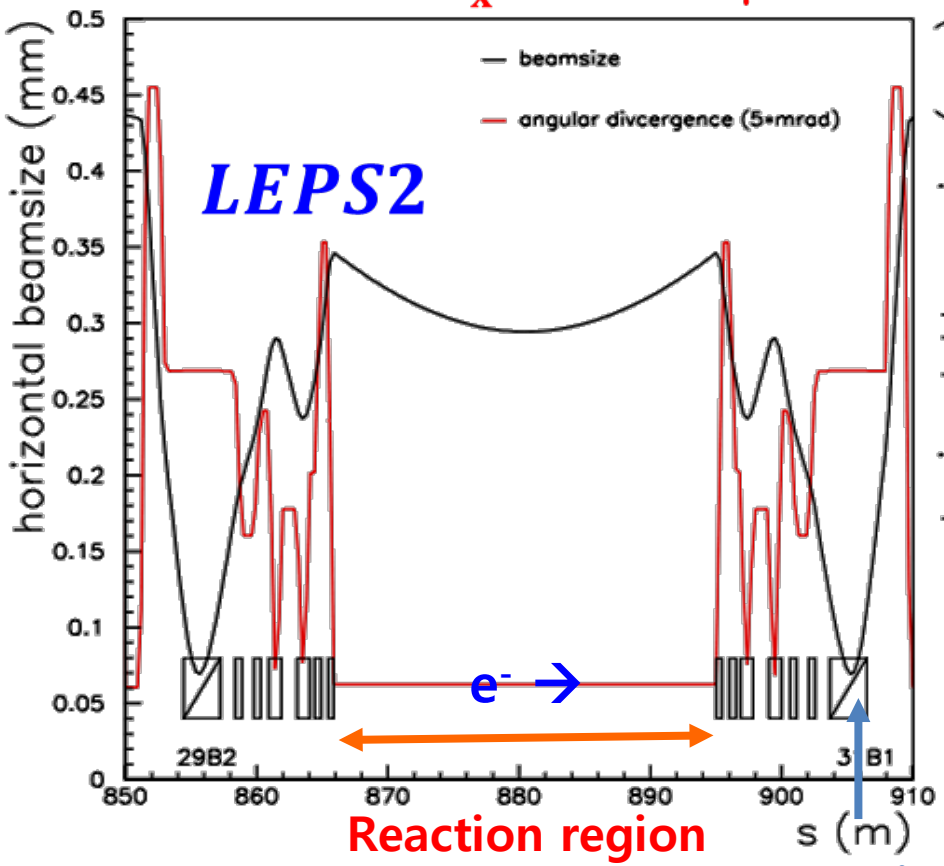
LEPS2 Experiment at SPring-8



- High-intensity pencil photon beam with multi-laser injection and a long straight section.
- A large-acceptance solenoid spectrometer

Divergence of Compton backscattered Beam

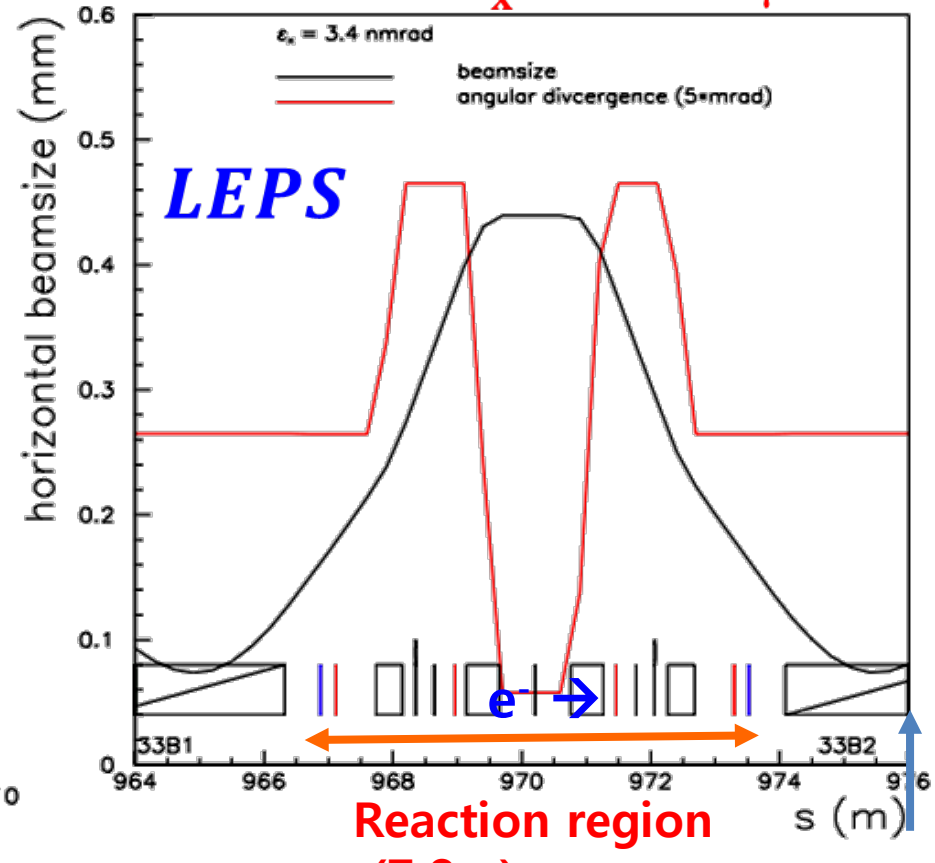
BL31 $< \sigma_{x'} >= 14$ μrad.



Reaction region (30m)

Tagging point

BL33 $< \sigma_{x'} >= 58$ μrad.



Reaction region (7.8m)

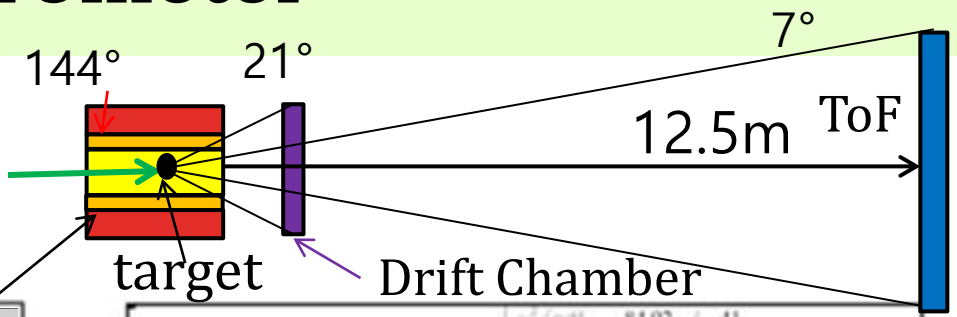
Tagging point

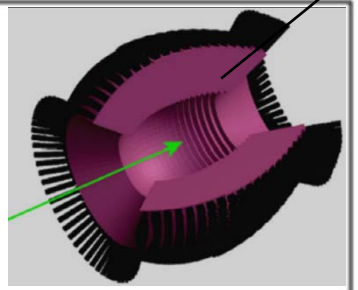
Better divergence → Better tagging resolution

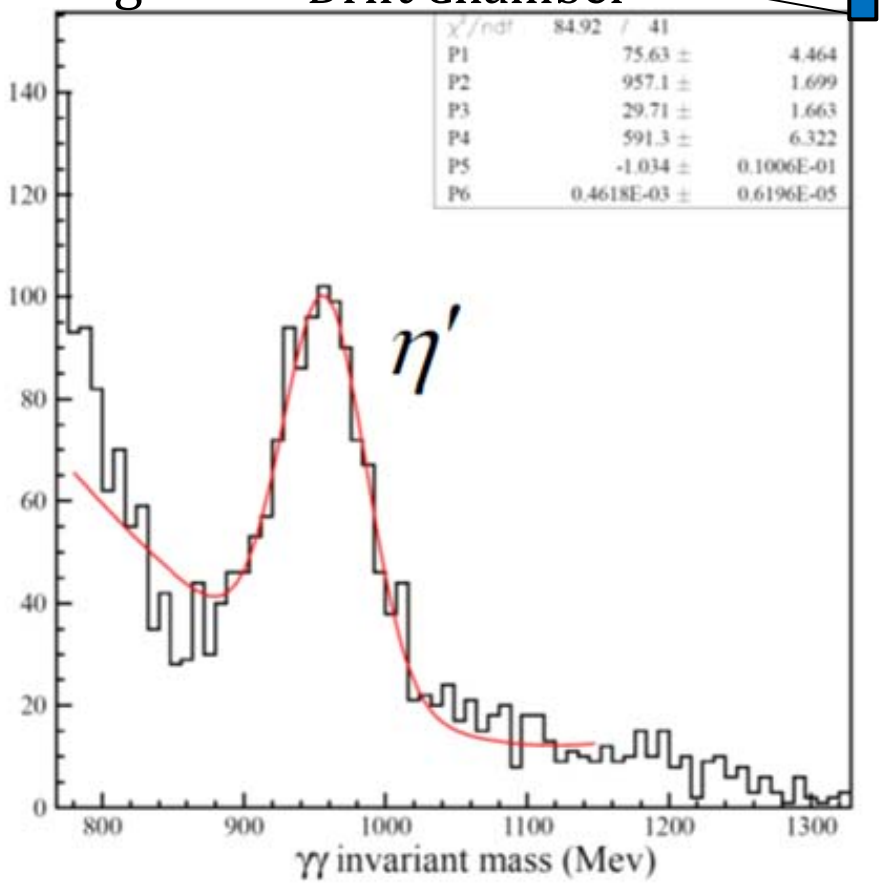
Smaller beam size at a long distance

LEPS2 BGOegg Spectrometer

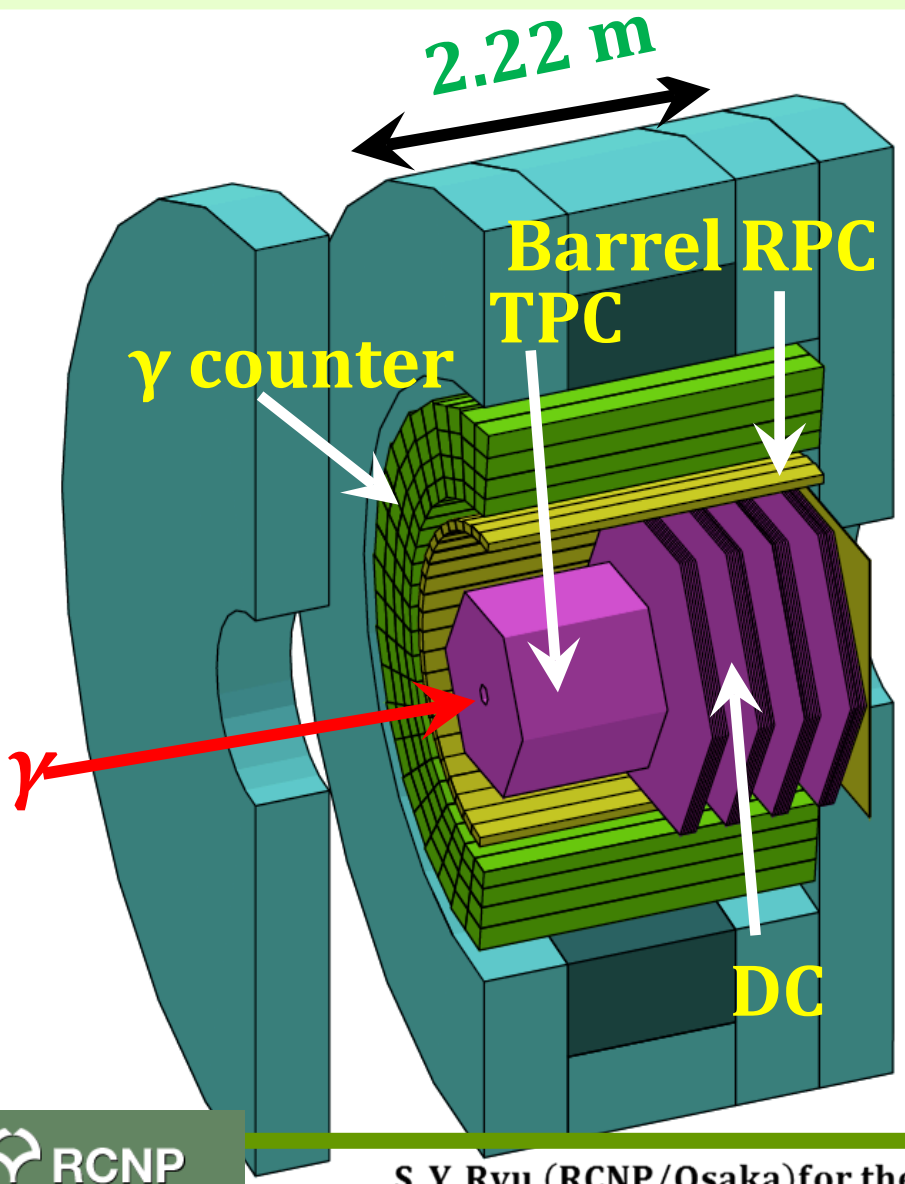
$\gamma + {}^{12}C \rightarrow \eta' \otimes {}^{11}B + p$

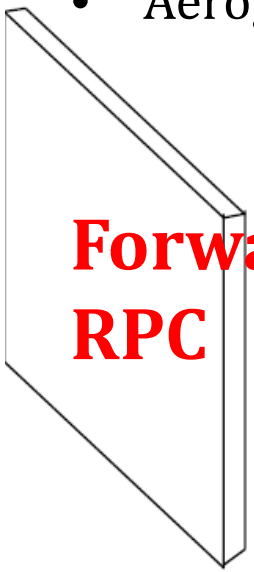






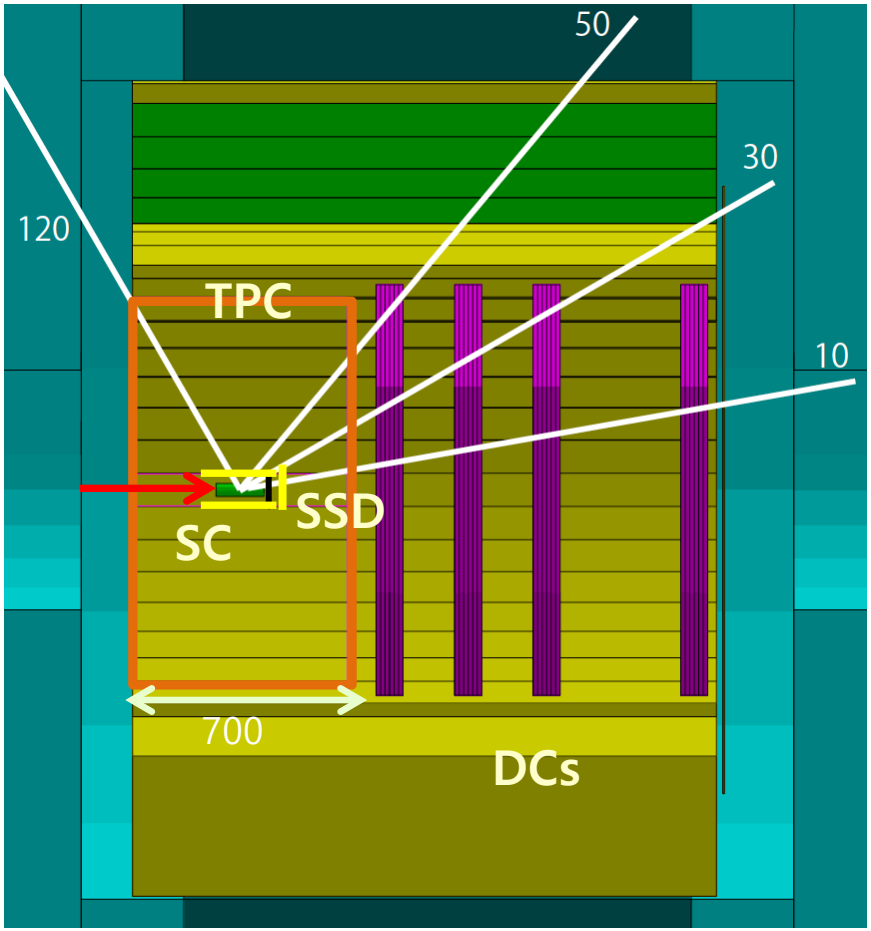
LEPS2 Solenoid Spectrometer





- Time Projection Chamber (TPC)
- Forward Drift Chambers (DCs)
- Resistive Plate Chamber (RPC) for the time-of-flight measurement
- Aerogel Cherenkov Counters
- Barrel Lead/Scintillator Calorimeter (14.3 X0)

LEPS2 Solenoid Spectrometer



Tracking System

Drift Chamber

σ ~ 150 μm

wires → x, x′, u, u′, v, v′

Time Projection Chamber(TPC)

σ ~ 400 μm, ~20 layers

DSSD

σ ~ 35 μm

PID System

RPC

Δt ~ 50 ps

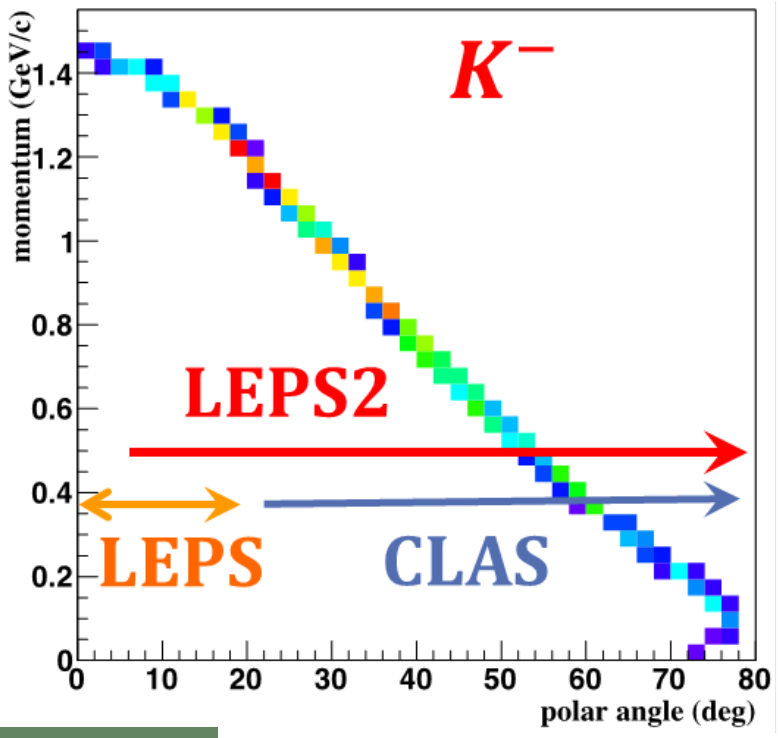
AC

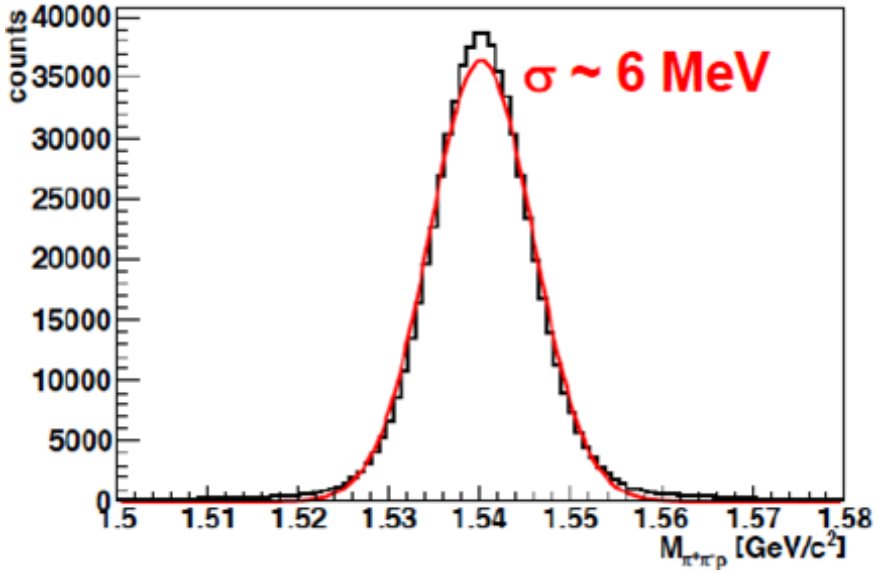
n = 1.03 (30°~ 40°)

n = 1.05 (40° ~50°)

Search for Θ^+ at LEPS2

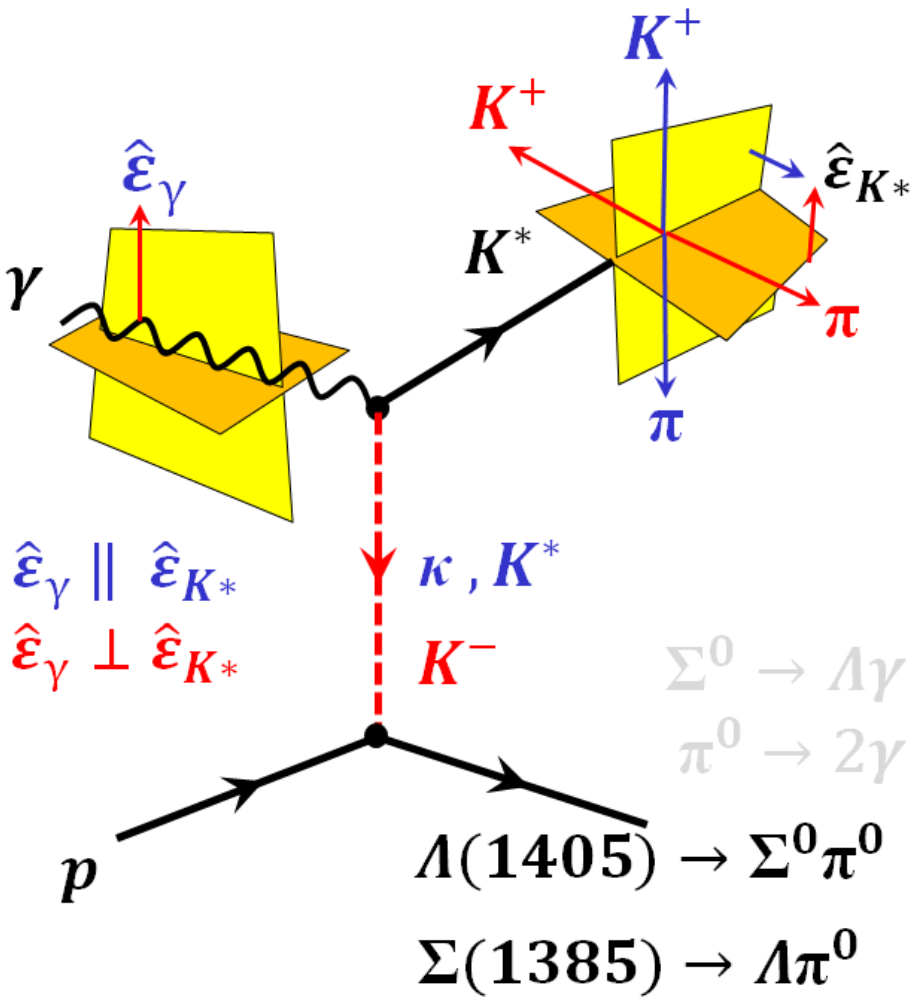
- $\gamma n \to K^- \Theta^+$ $(\Theta^+ \to K^0_S p;\ K^0_S \to \pi^-\pi^+)$
- $\gamma p \to \bar{K}^{*0} \Theta^+$ $(\bar{K}^{*0} \to K^- \pi^+)$
- No Fermi-motion correction is needed in both modes.
- Detection of K^- ensures a production of S=+1 baryon





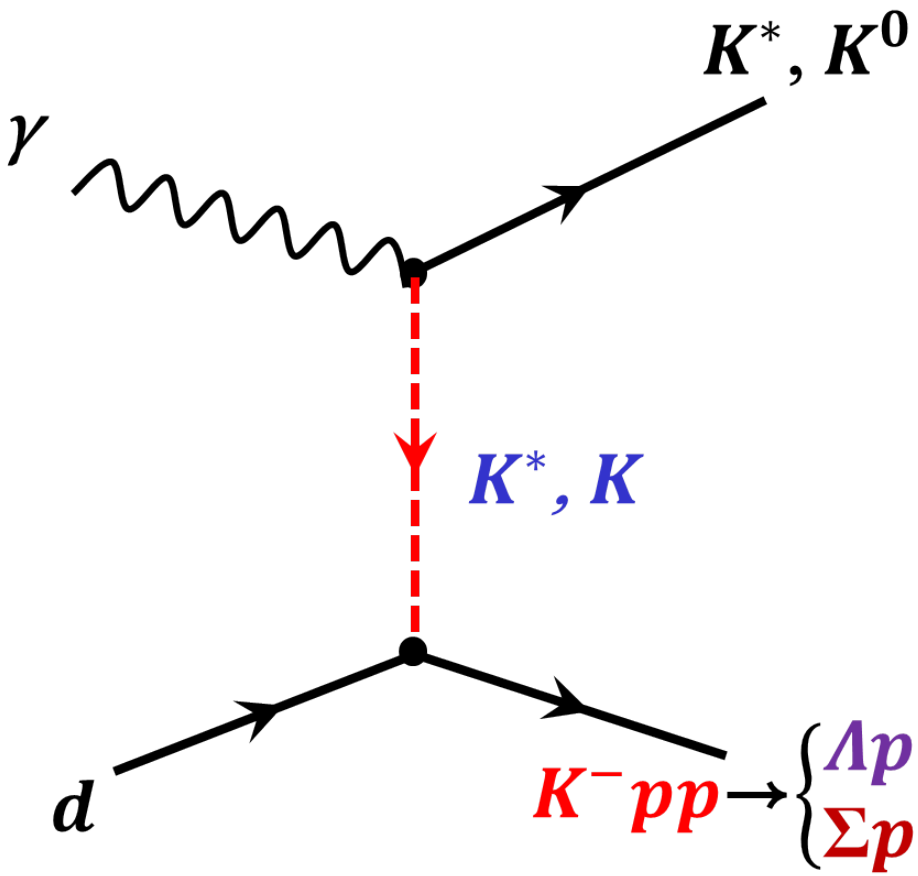
Unveiling the Two-Pole Structure of Λ(1405)

Photoproduction of $\Lambda(1405)$ with $K(892)^+$



- K decay plane ⊥ (∥) the photon beam polarization ($\hat{\varepsilon}$) for unnatural-parity exchange (natural-parity exchange).
- I=0 channel $\Lambda(1405) \to \Sigma^0\pi^0$ detection.

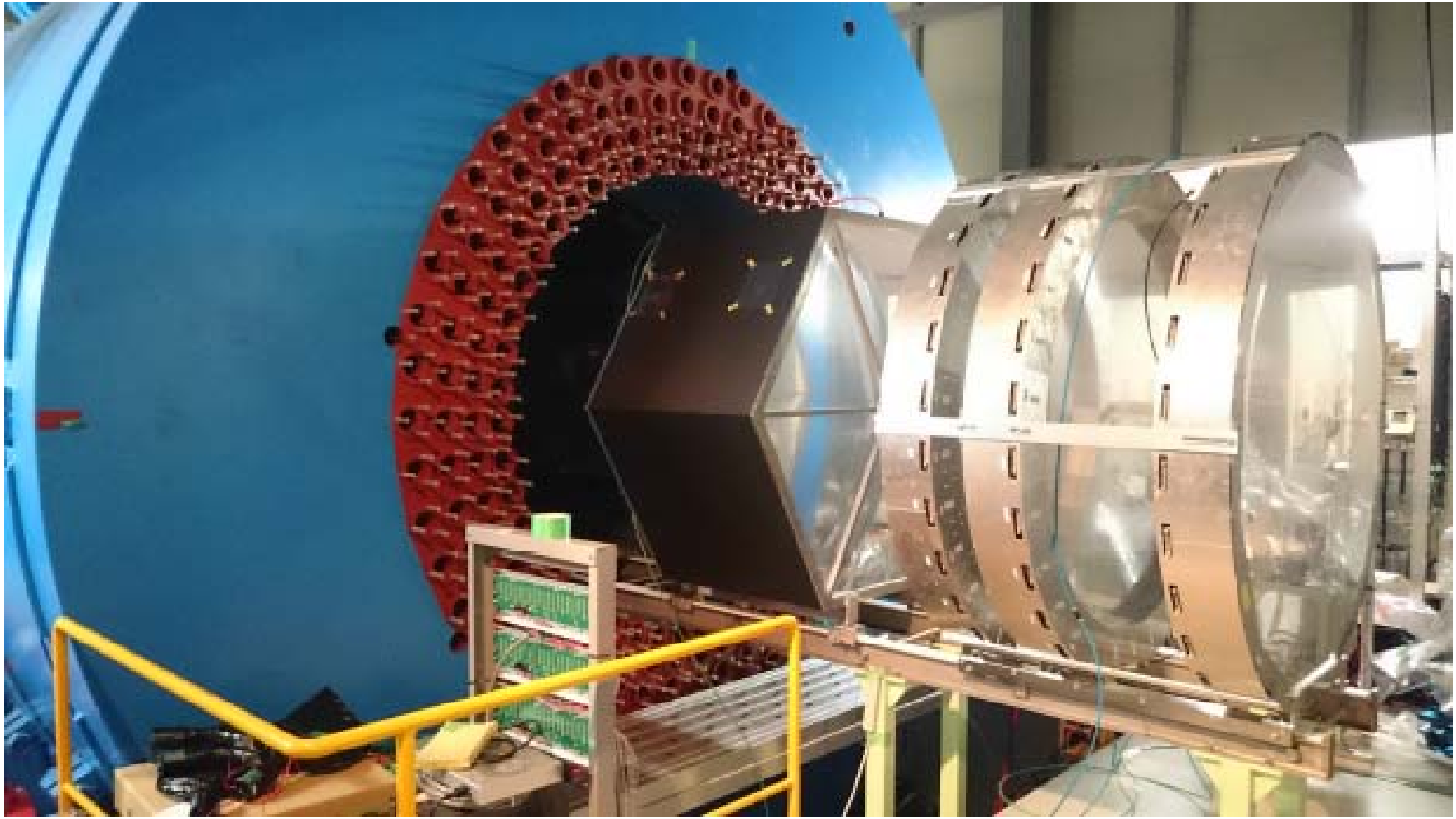
Search for K^-pp nuclei at LEPS2



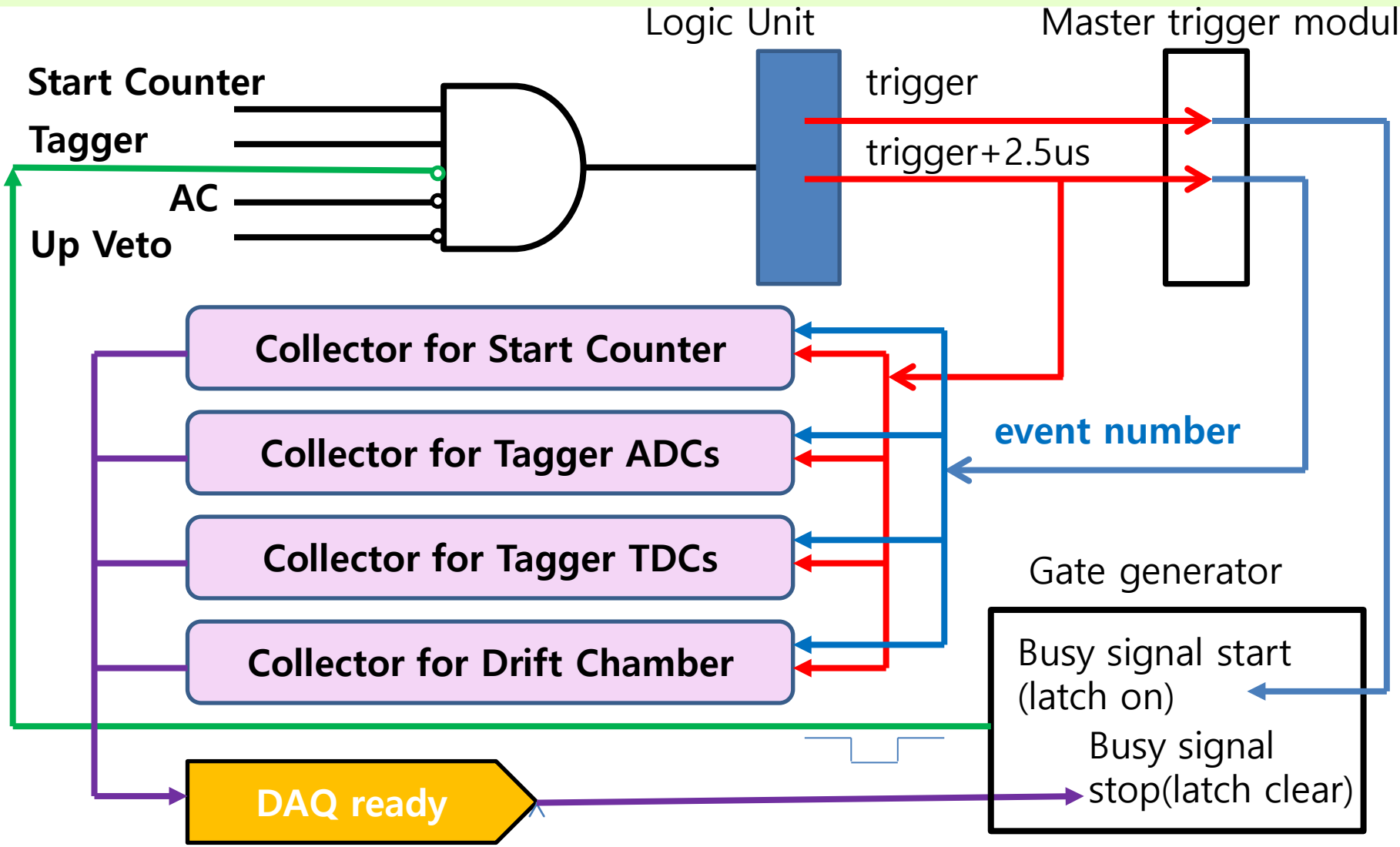
- K^-pp search in $\gamma d \rightarrow K^+\pi^- X$, $K^0_S X$, and $K^{*0} X$ reactions at LEPS2.
- Complete kinematics with a detection of K/K^* and decay products from K^-pp.

Overview of the LEPS2 Facility

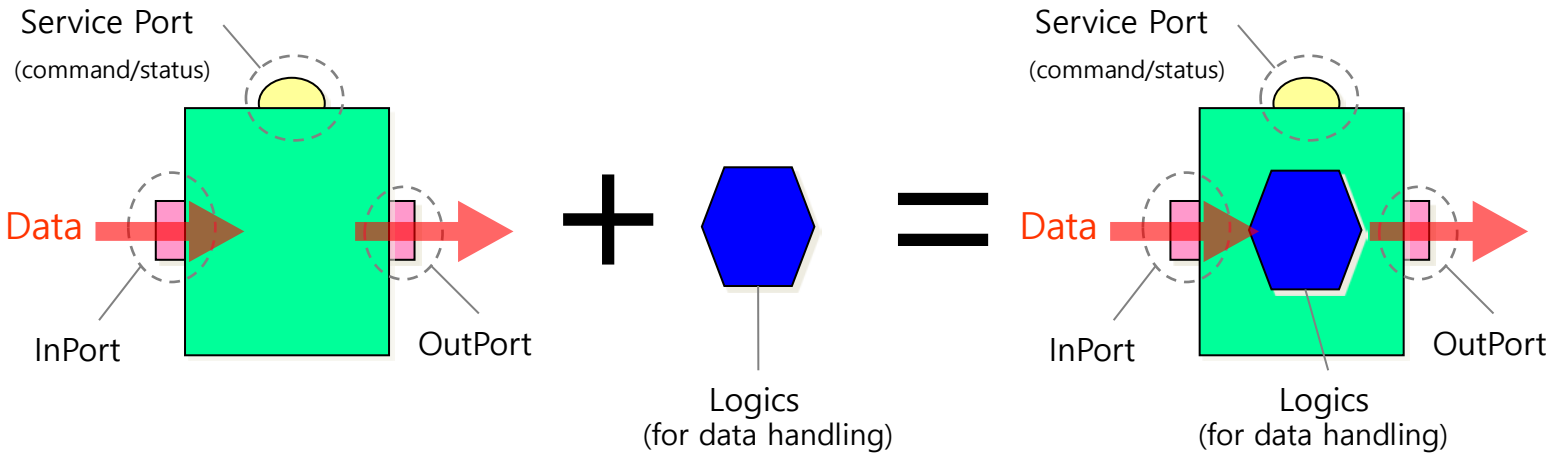
LEPS2 Detectors



Trigger System for Beam Commissioning



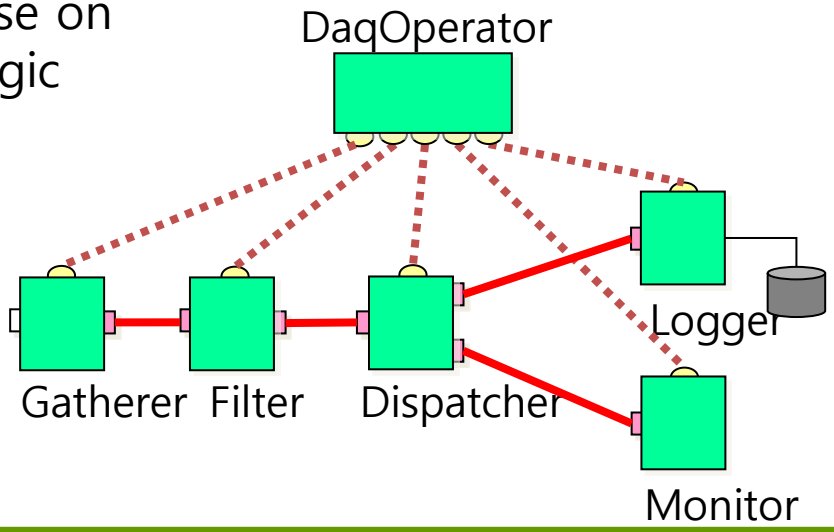
DAQ Components with DAQ-middleware



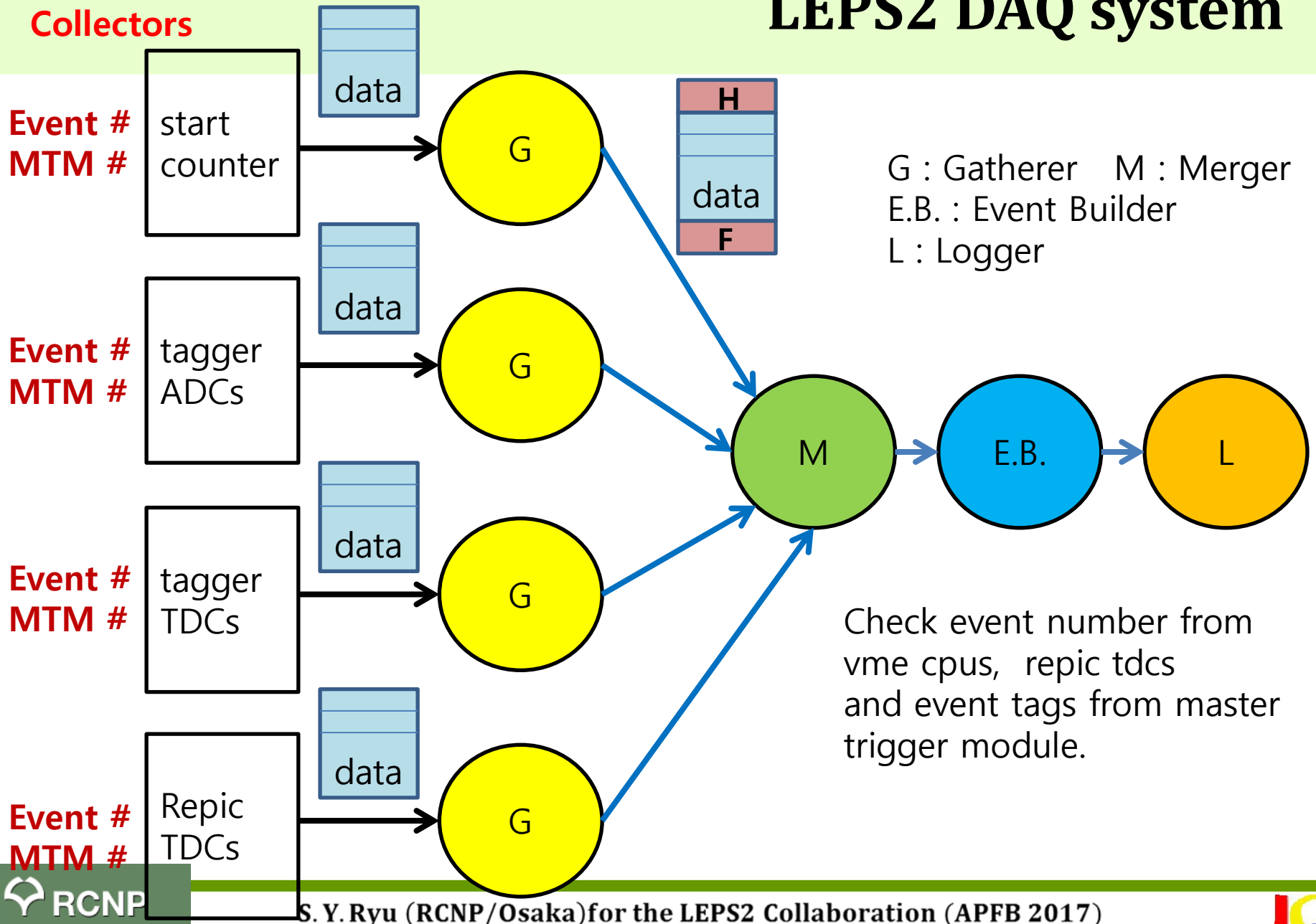
Example of component configuration

- User can create new DAQ components base on implemented core logics such as readout logic and histogramming logic.

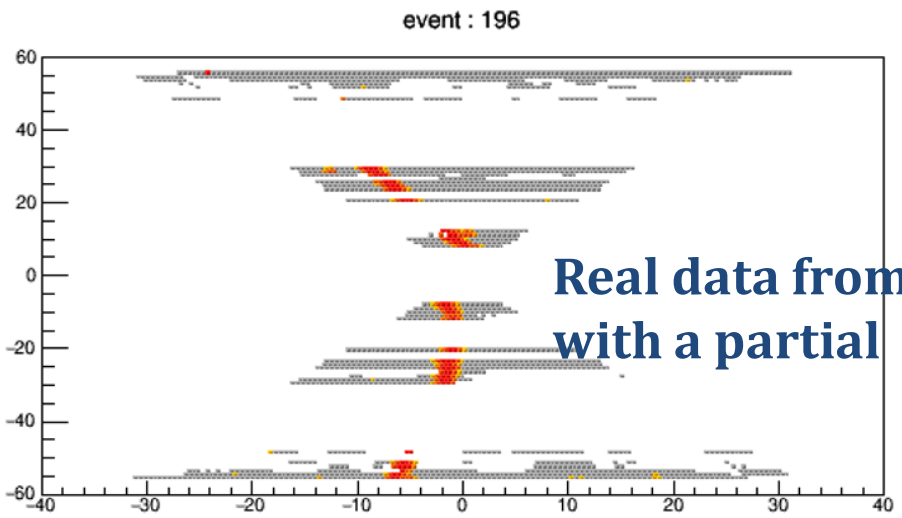
- DAQ-Middleware provides data transfer beween DAQ components.

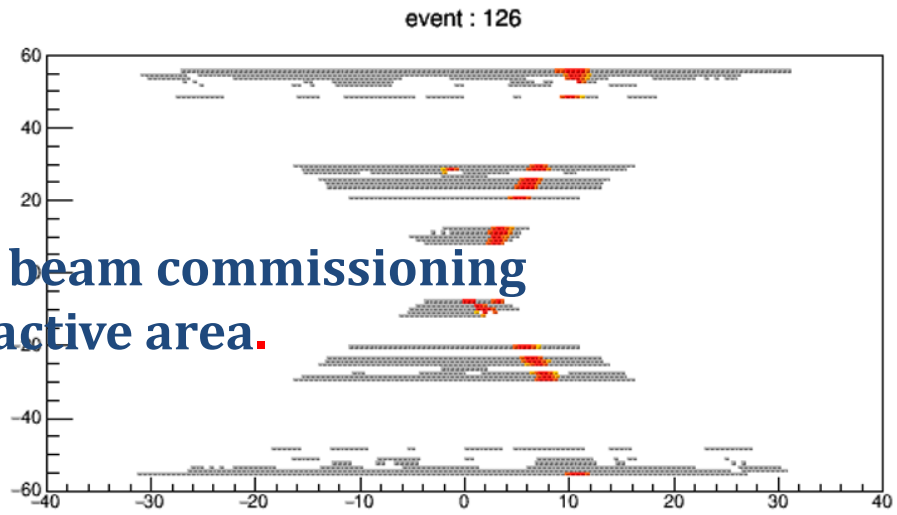


LEPS2 DAQ system

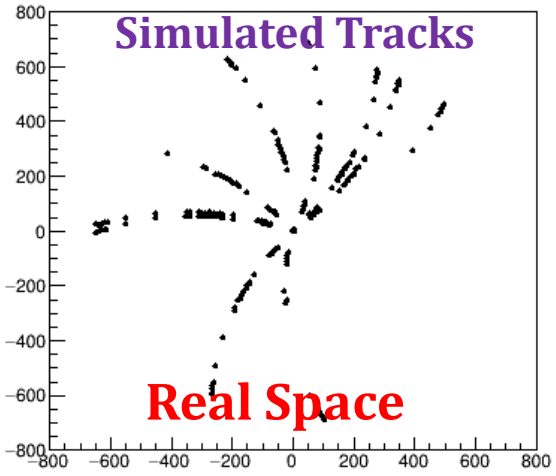


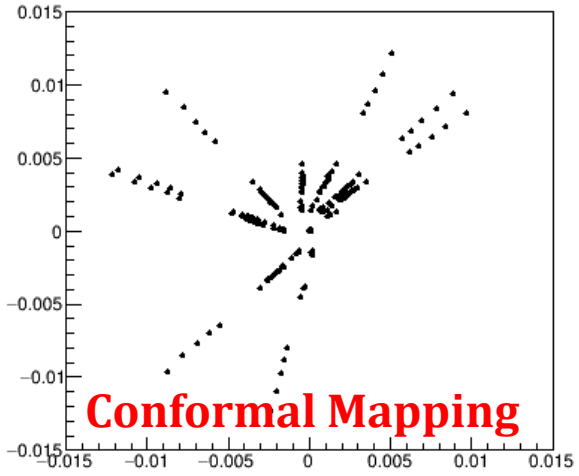
TPC Track Reconstruction

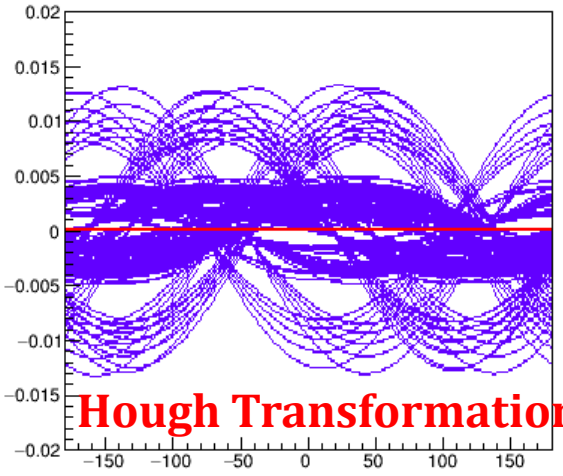




Real data from beam commissioning with a partial active area.







Summary

- **A new linearly-polarized photon beam facility is about to start physics runs with the LEPS2 solenoid spectrometer at SPring-8.**

- **DAQ performance will also be tested in coming physics runs.**

- **High-intensity photon beam in the range of 1.3-2.9 GeV and a large angular acceptance will open new opportunities to explore exotic baryon systems from photo-production, such as Θ+, K-pp, and Λ(1405).**