

Measurement of the (γ, K_S) reaction at SPring-8/LEPS

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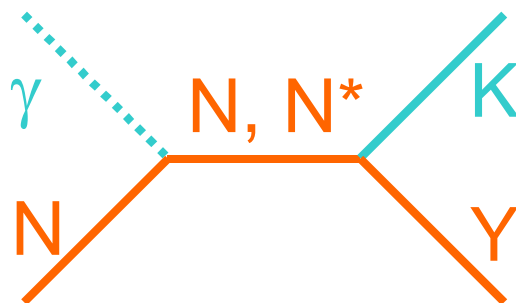
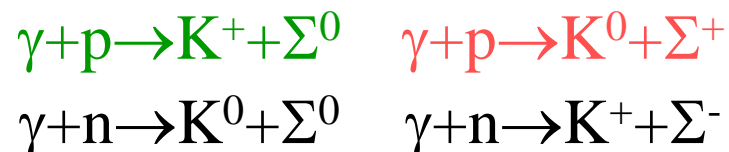
- Kaon photoproduction
- The $p(\gamma, K_S)$ reaction
- Results of test experiment
- Future prospects

Kaon photoproduction

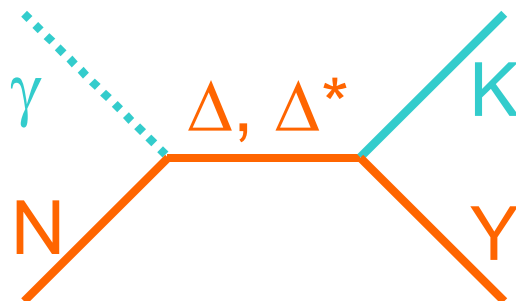
- Physics to be investigated
 - “Missing resonance” search (Baryon spectra)
 - Reaction mechanism in $E_\gamma \approx 2\text{GeV}$ region
 - Between isobar-model and Regge-model
 - Considerable progresses but need more info
- Next directions
 - New observables
 - Polarization and asymmetry are useful
 - New channels
 - The (γ, K^0) reaction --- K^+ well studied
 - Neutron target

Why K^0 channel

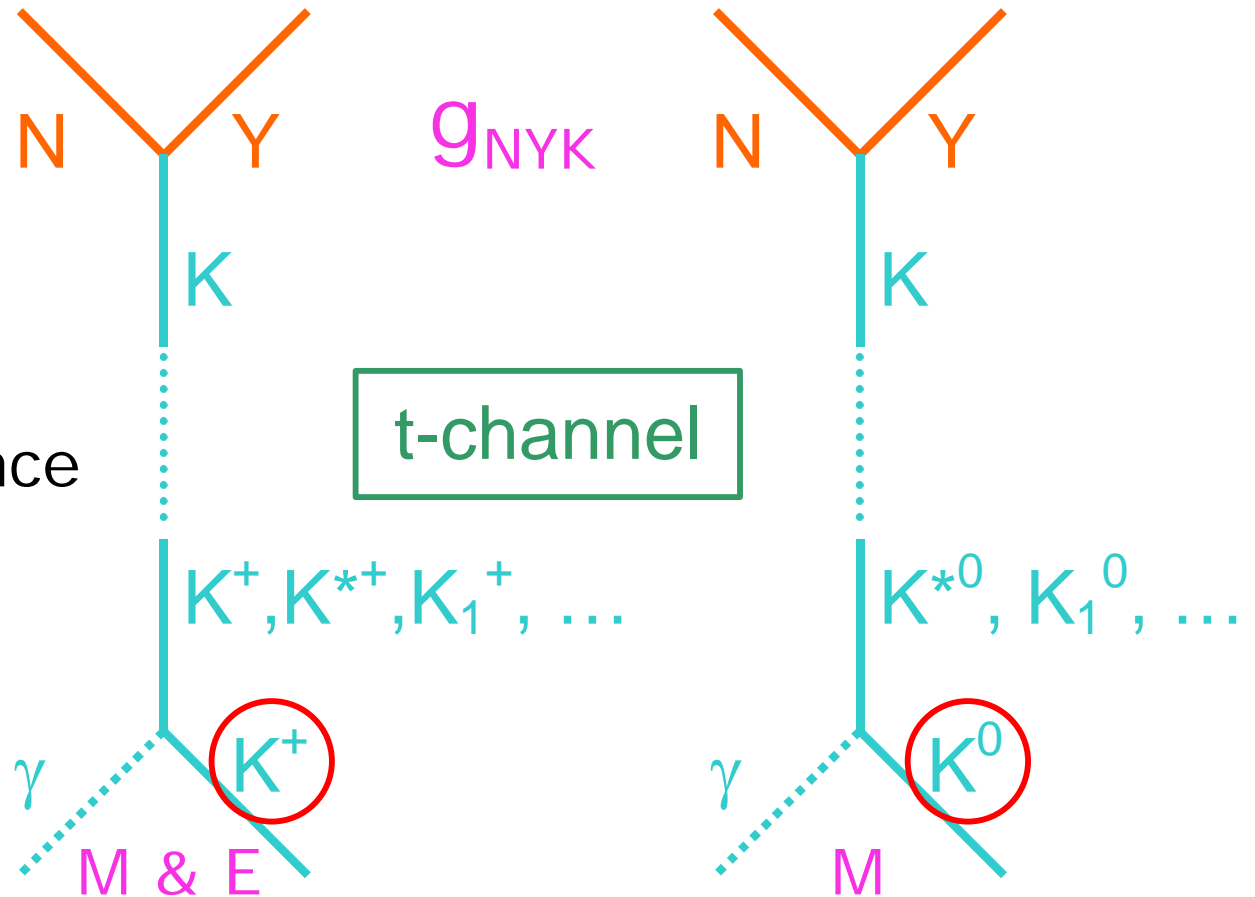
- K^0 and K^+ channels at the same time
 - From isospin symmetry

 σ_1 $2\sigma_1$

s-channel

 $2\sigma_2$ σ_2

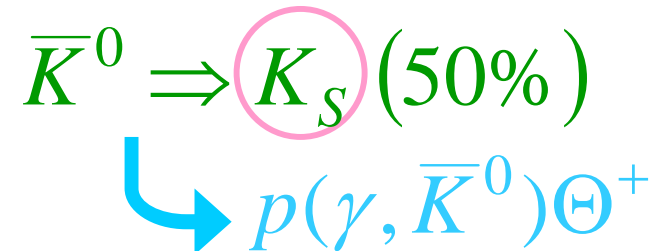
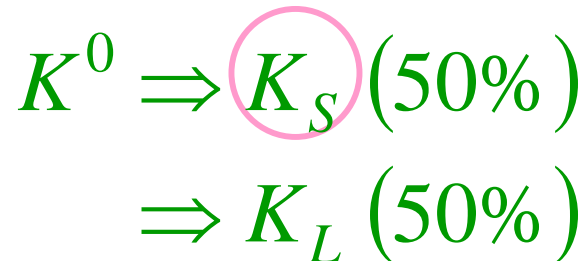
- Similarity and



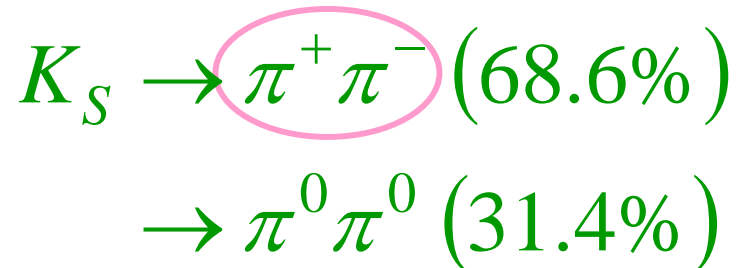
- Difference

K_S measurement at LEPS

- How to measure K^0

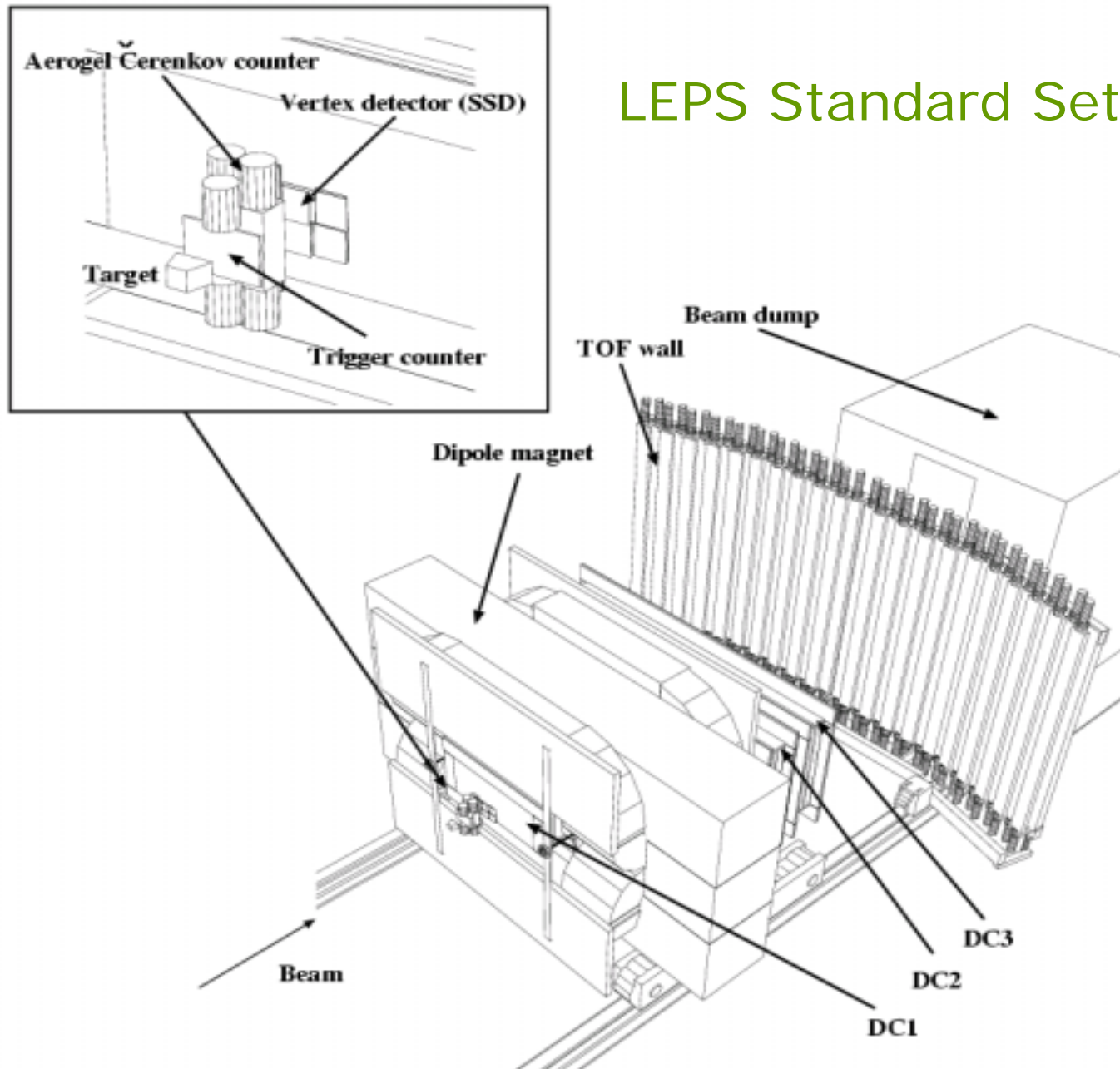


- How to measure K_S



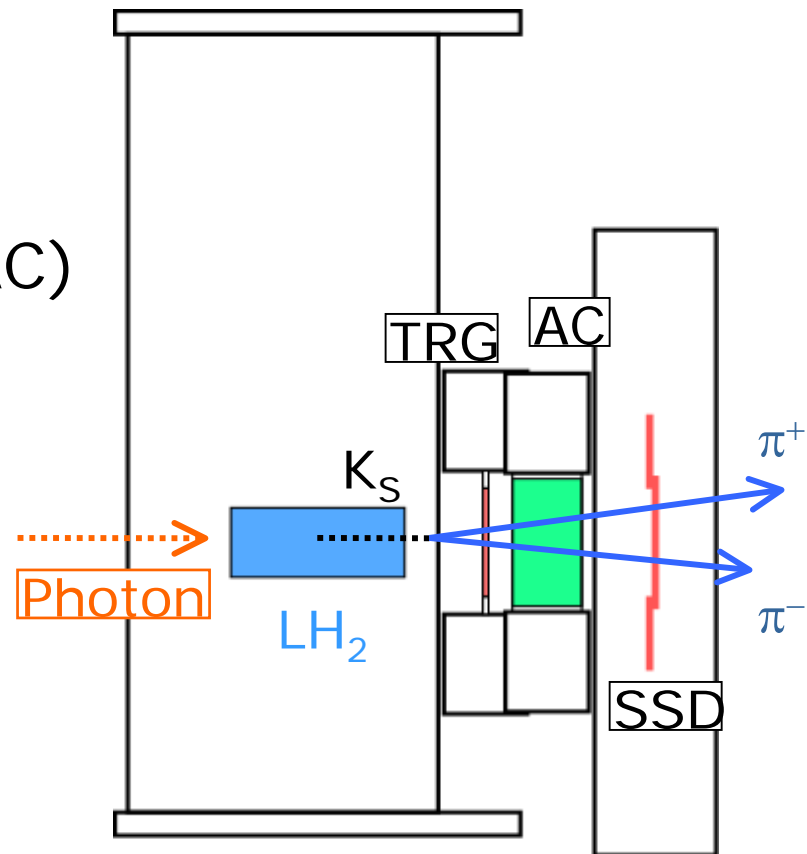
- Measure $\pi^+ \pi^-$ with magnetic spectrometer
- Need clear identification of K_S
 - Huge multi- π photoproduction background

LEPS Standard Setup



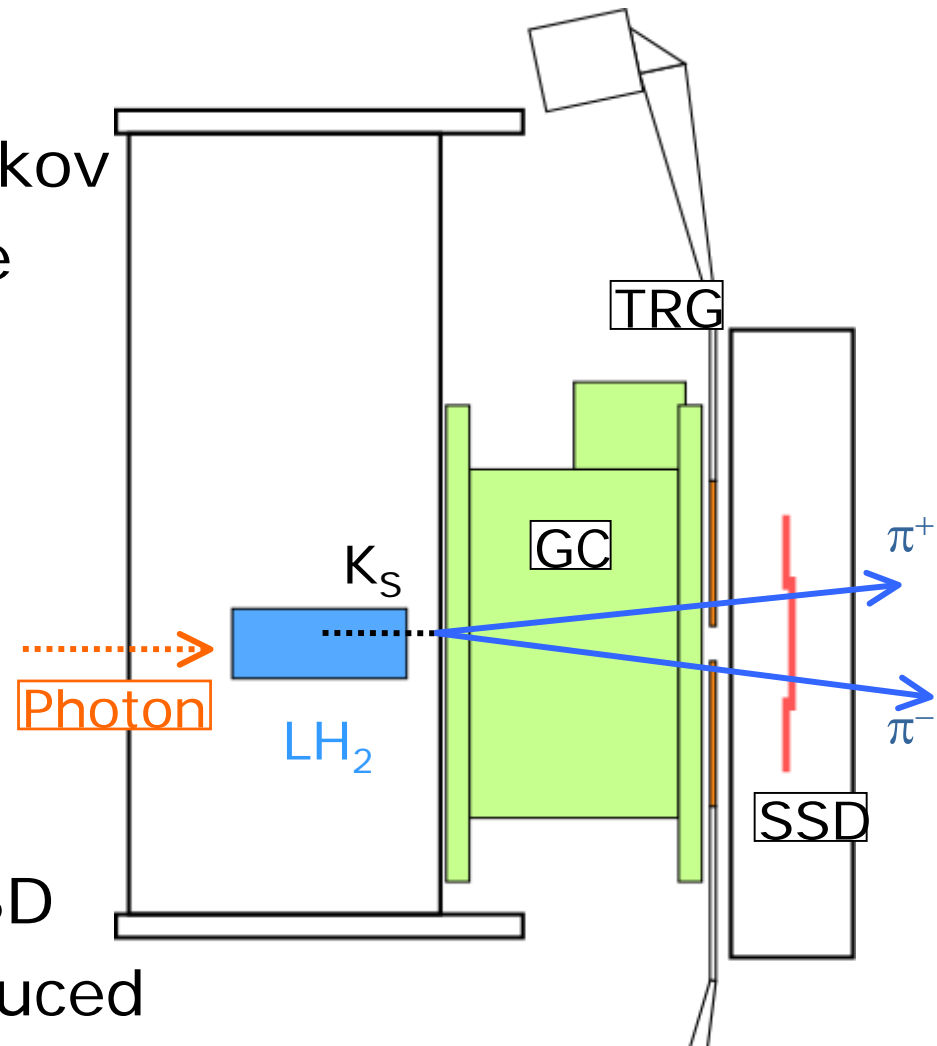
■ LEPS standard setup

- LEPS standard setup
 - Suitable for K^+/K^-
- Aerogel Cherenkov (AC)
 - Veto most of pions
 - $P_{\text{thre}} = 0.6 \text{ GeV}/c$
- Trigger counter (TRG)
 - K_S pass through
 - TRG is BG source



■ K_S setup

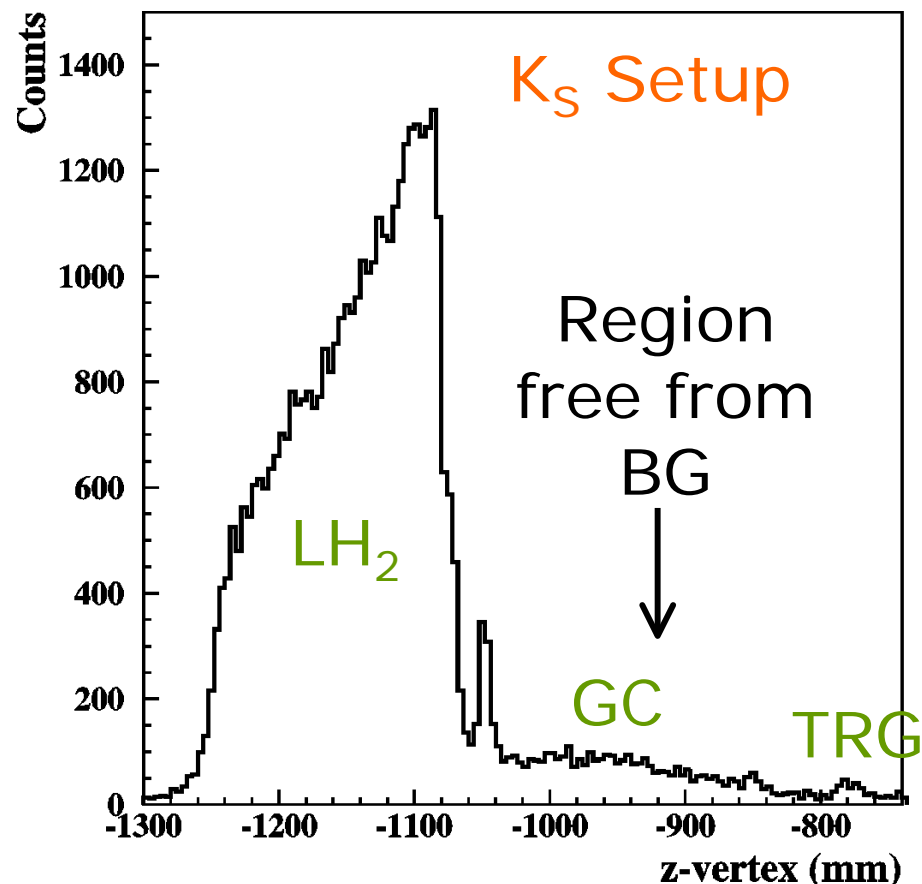
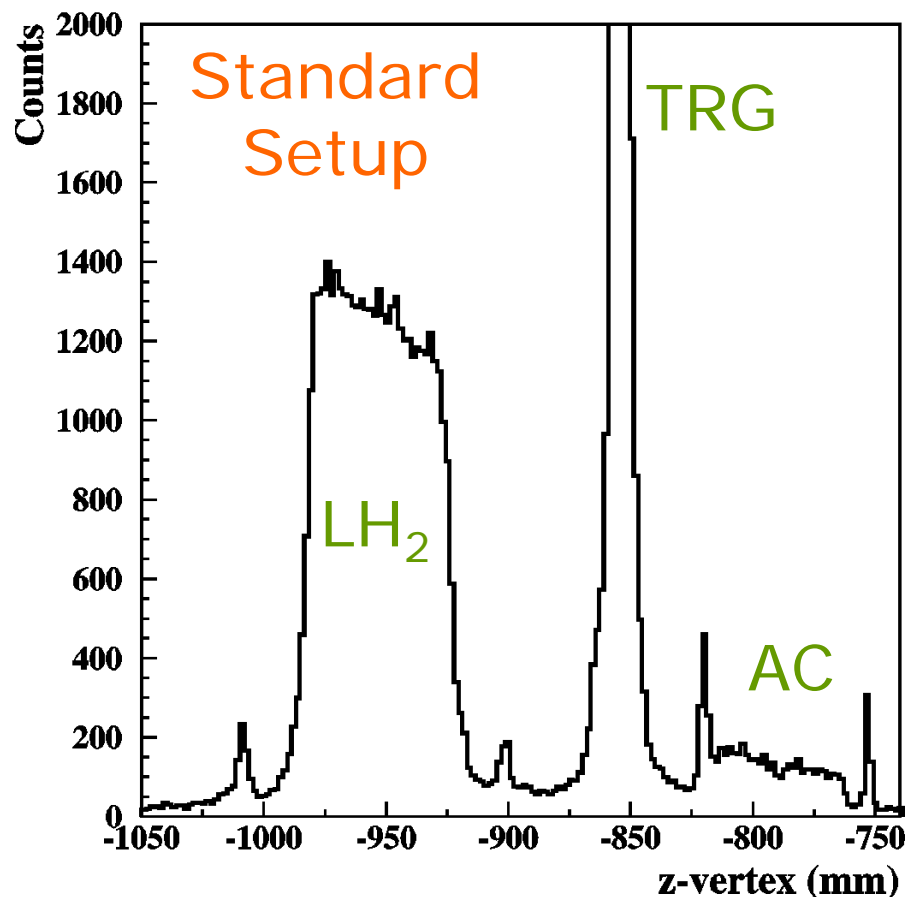
- AC \Rightarrow Gas Cherenkov
 - 1atm isobutane
 - $P_{\text{thre}} > 2\text{GeV}/c$
 - Accept pions
- New TRG
 - 40 \times 30 hole
 - No e^+e^- hit
- No material
 - From LH_2 to SSD
 - BG may be reduced



Results of test experiment

■ Raw spectra

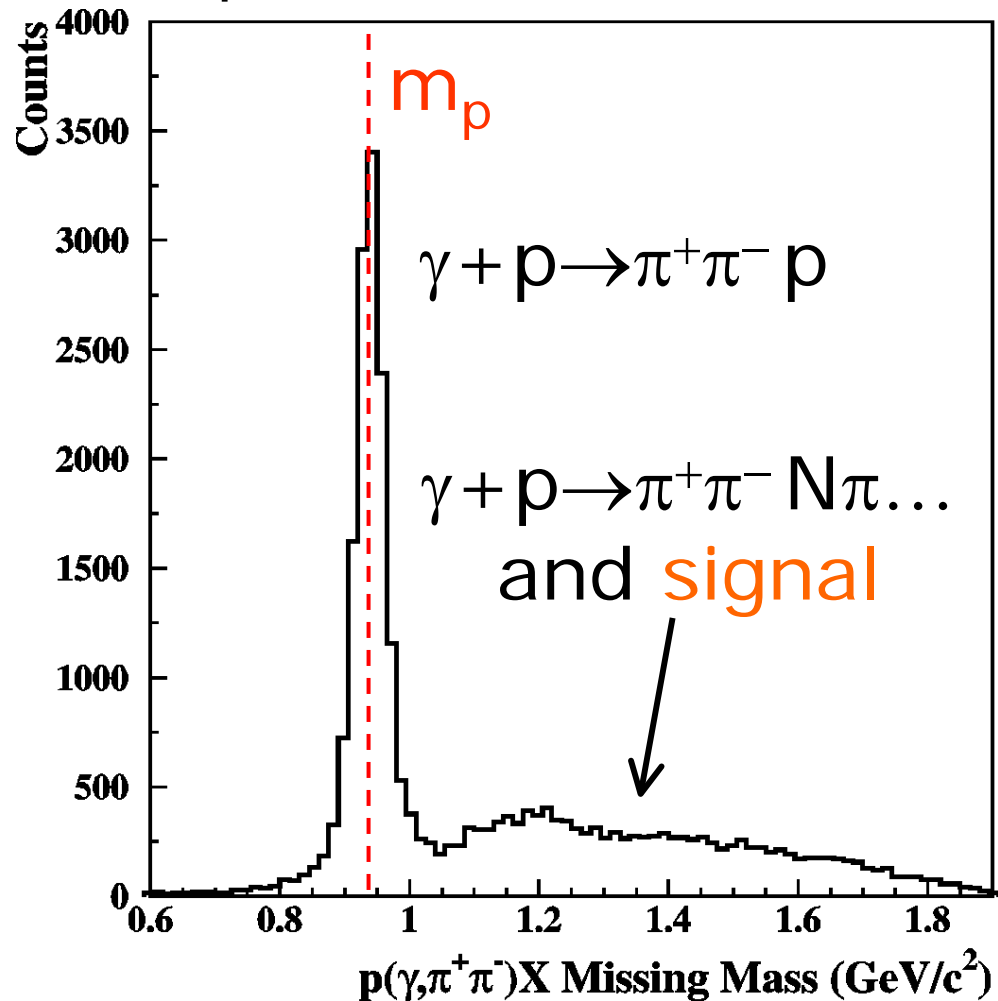
■ $\pi^+\pi^-$ 2 track events selected



- Raw missing mass spectra

Kinematics of
 $\gamma + p \rightarrow \pi^+ \pi^- X$
 assumed

Need additional
 K_S
 Identification !

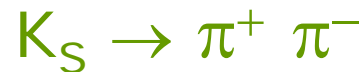


■ Event selections

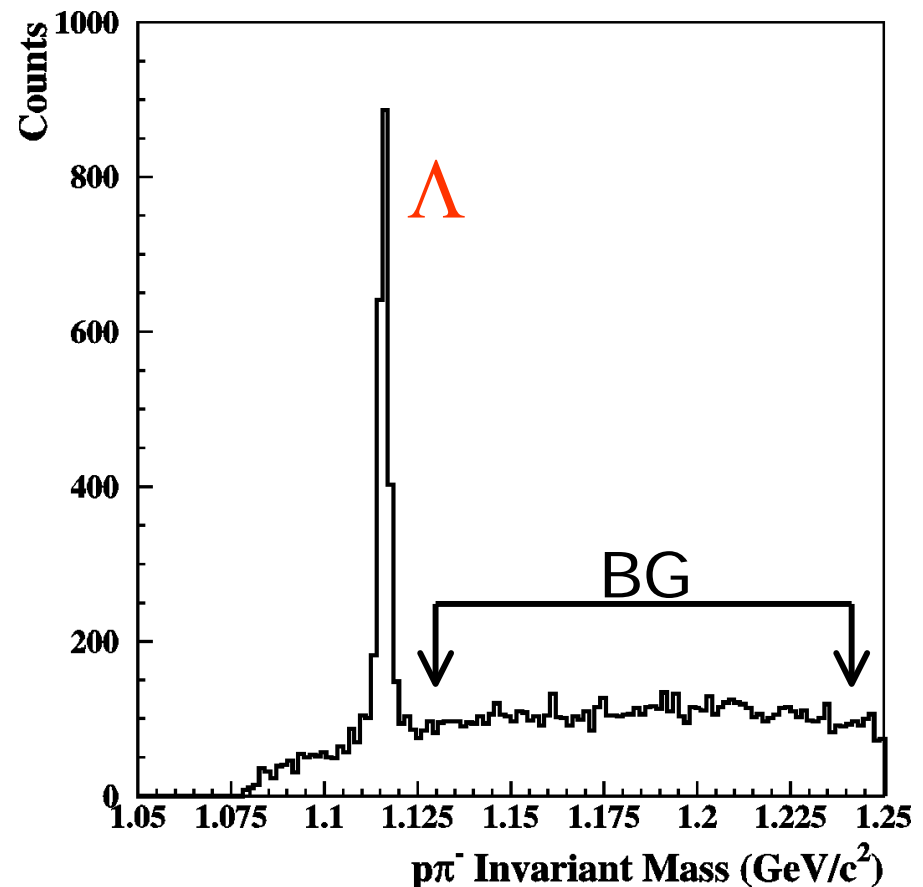
- Possible event selection tested by Λ events



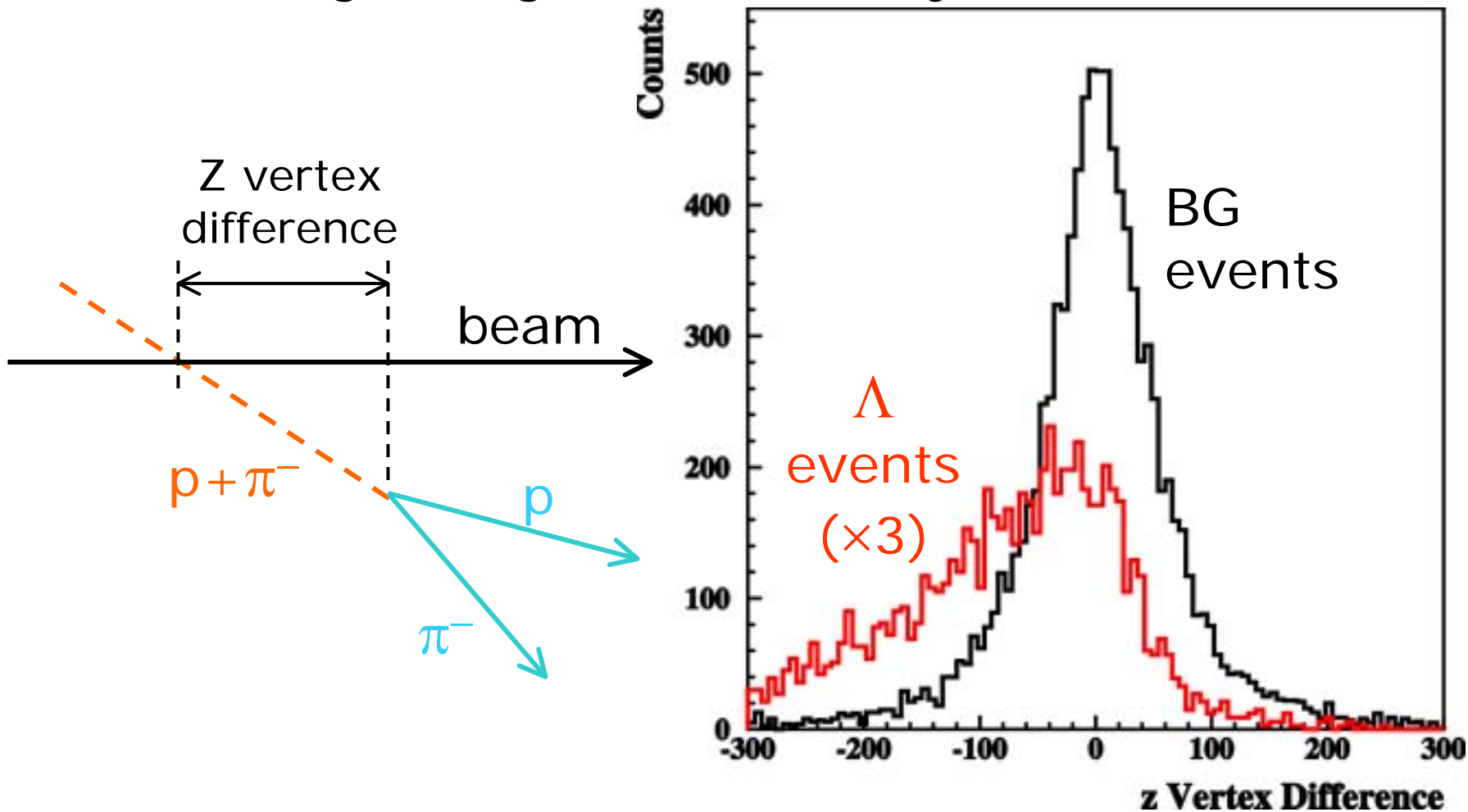
$$\beta\gamma c\tau \approx 150 \text{ mm}$$



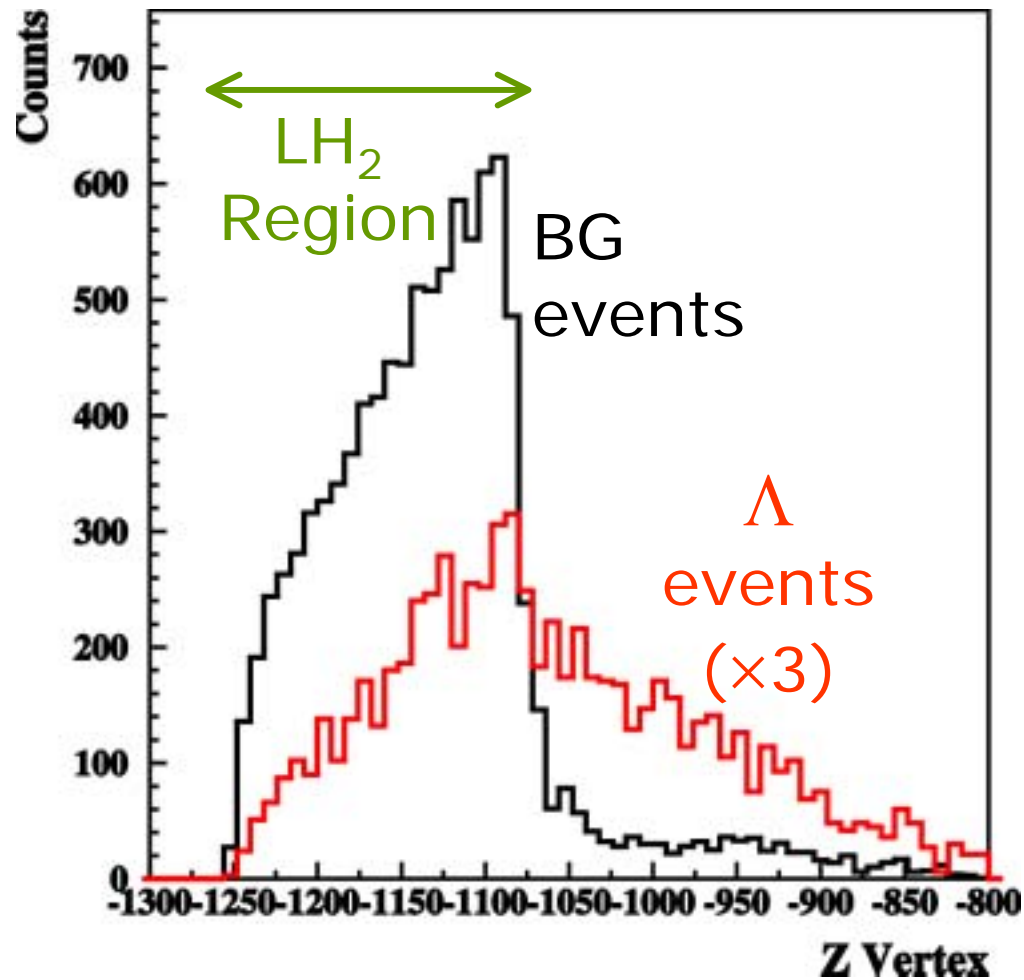
$$\beta\gamma c\tau \approx 100 \text{ mm}$$



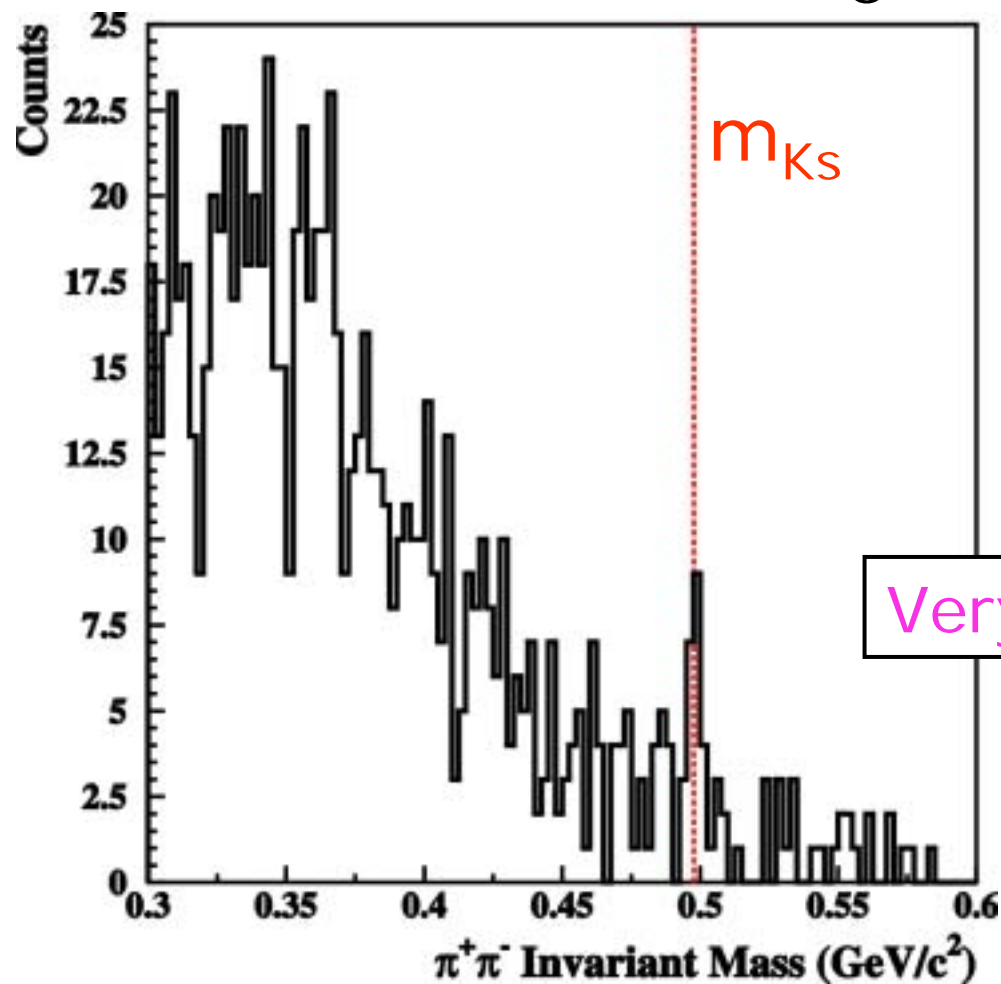
- Flight length before decay



- Z vertex distribution of $\rho\pi^-$ pair



- Selected $\pi^+\pi^-$ events (K_S candidates)



Future prospects

- Next beamtime in November
 - 3-4 weeks beamtime
 - Expected yield
 - About 500 of $\gamma + p \rightarrow K^0 + \Sigma^+$ events
 - Beam polarization asymmetry Σ
 - Θ^+ yield
 - If $\sigma \approx 300 \text{ nb}$, we see a few 10s of Θ^+ .
 - If $\sigma < 20 \text{ nb}$, we see almost no Θ^+ .