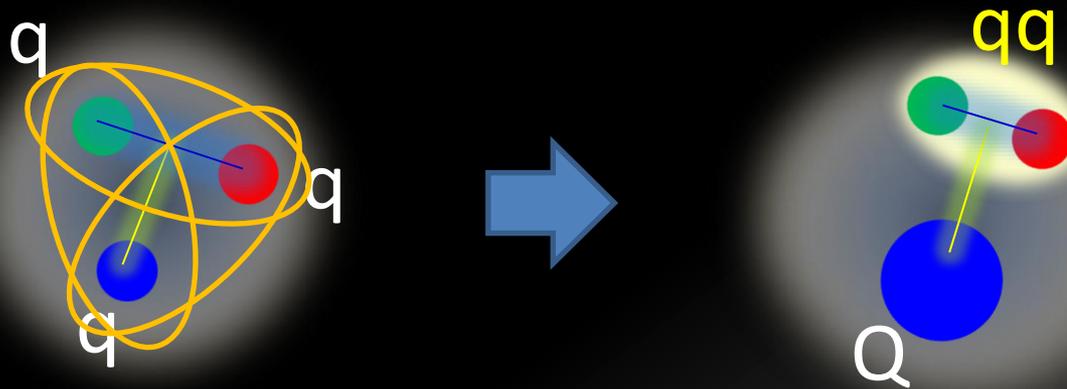


Baryon spectroscopy with heavy flavors at J-PARC

H. Noumi (RCNP, Osaka University)
11 October, 2014

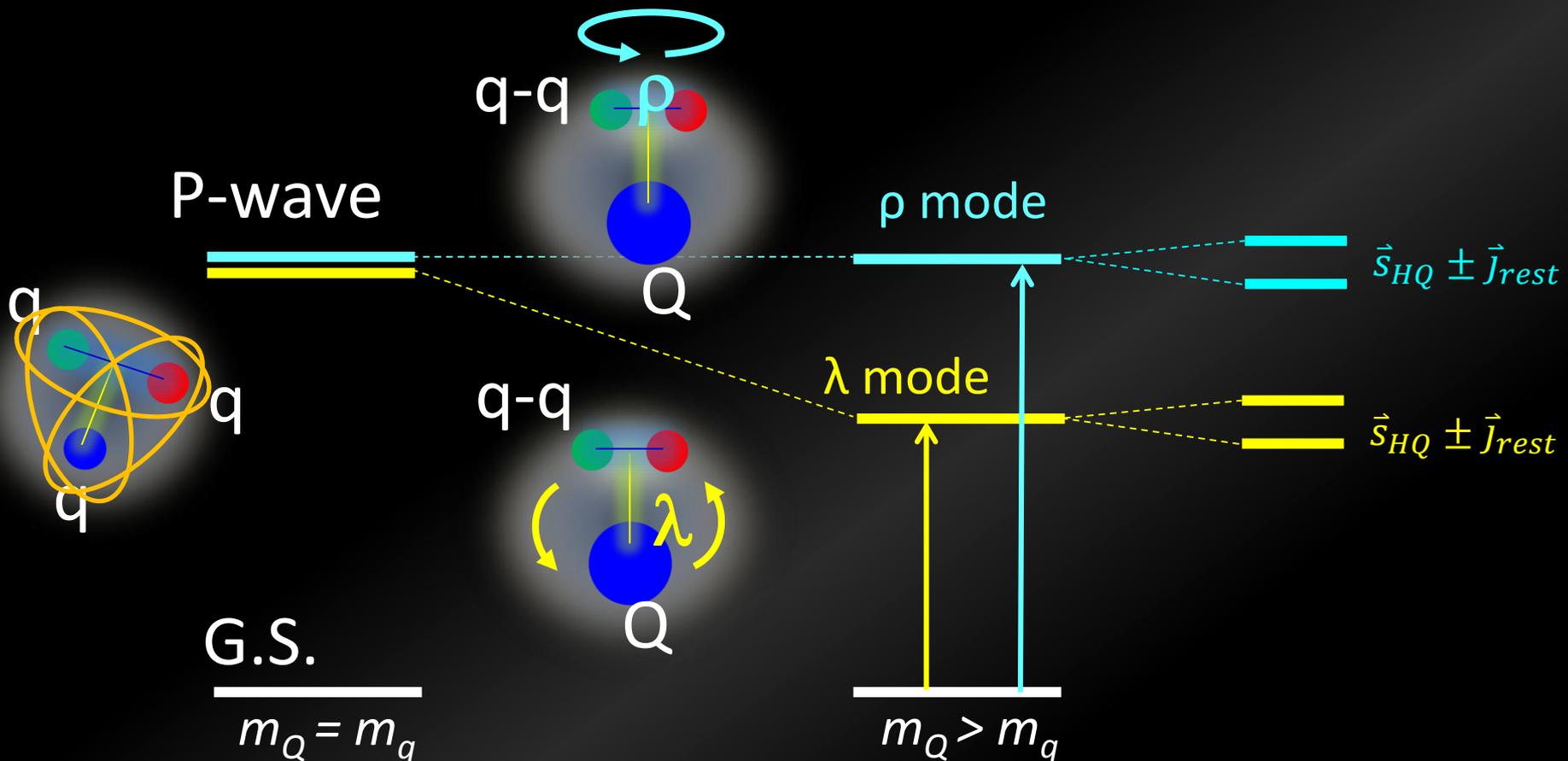
What we can learn from baryons with heavy flavors



- Quark motion of “ qq ” is singled out by a heavy Q
 - Diquark correlation
- Level structure, Production rate, Decay properties
- Properties are expected to depend on a Q mass.

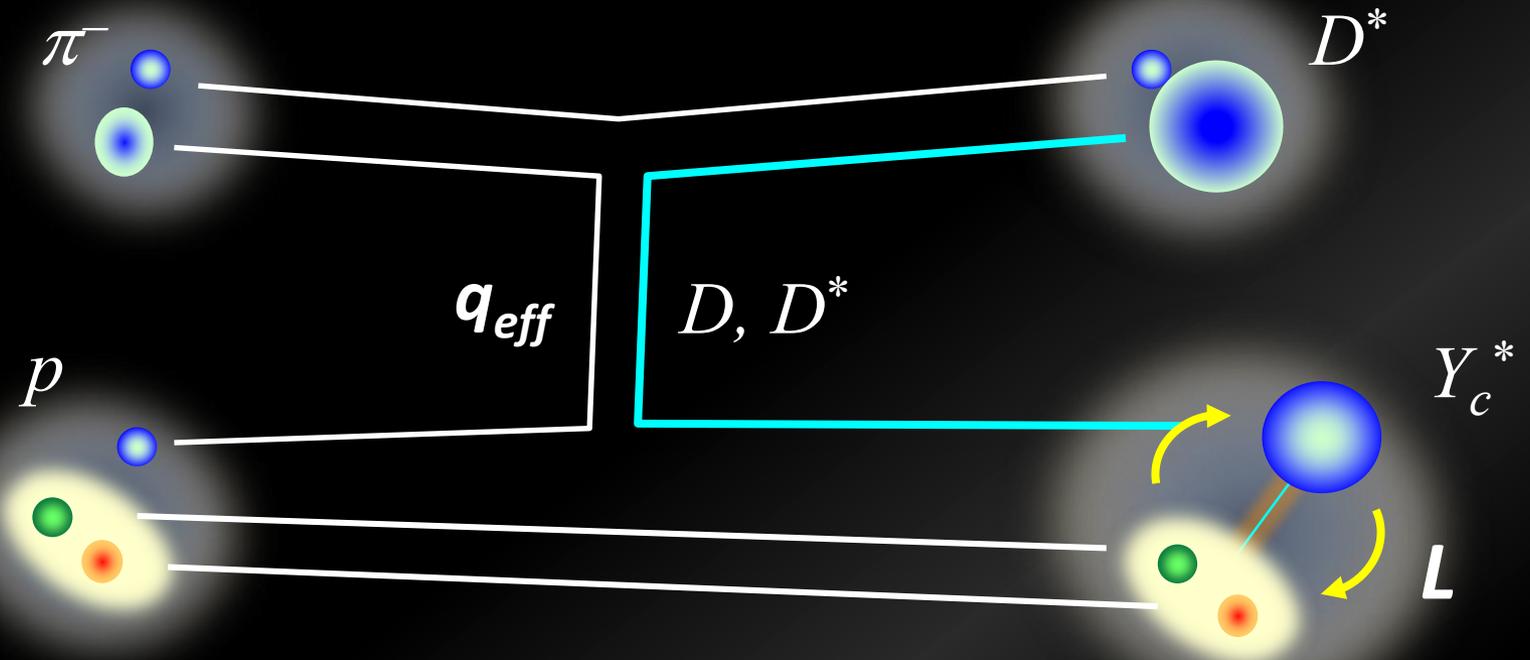
Schematic Level Structure of Heavy Baryons

- λ and ρ motions split (Isotope Shift)
- HQ spin multiplet ($\vec{s}_{HQ} \pm \vec{J}_{rest}$)



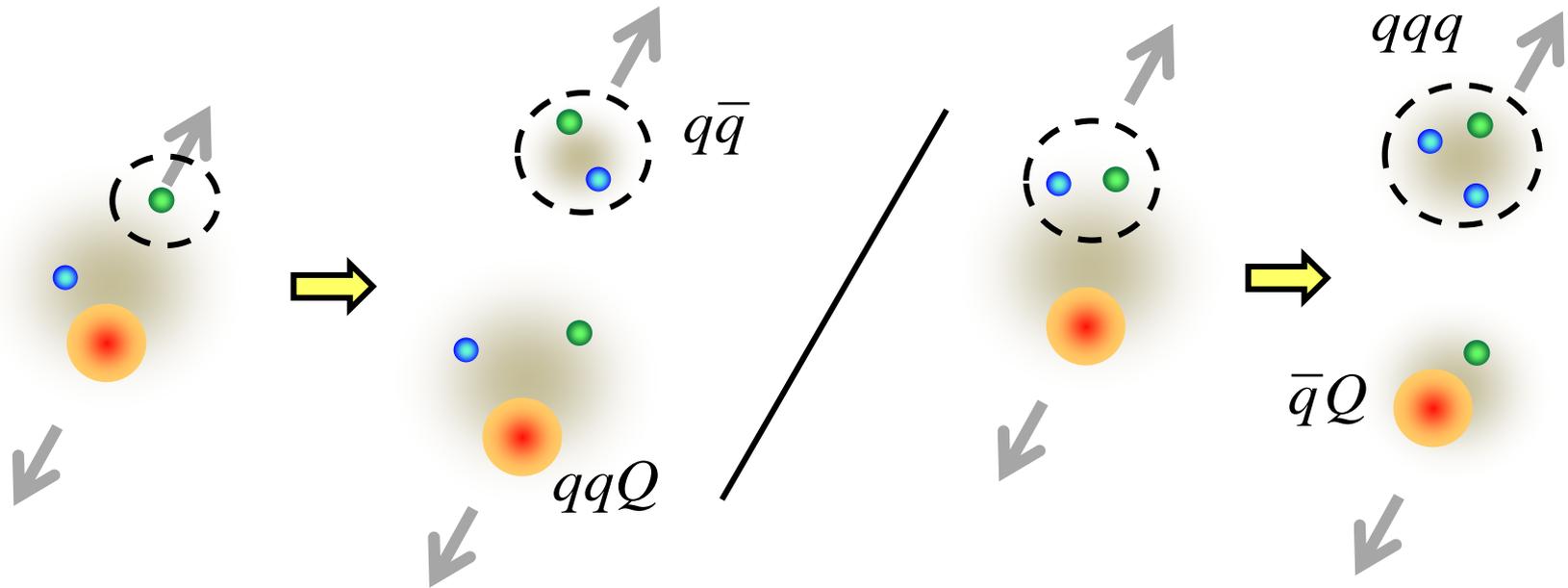
Production Rate

S.H. Kim, A. Hosaka, H.C. Kim, HN, K. Shirotori, PTEP, 103D01, 2014.



- ✓ C.S. DOES NOT go down at higher L when $q_{eff} > 1 \text{ GeV}/c$
- ✓ λ modes are excited by a simple mechanism

Decay Properties



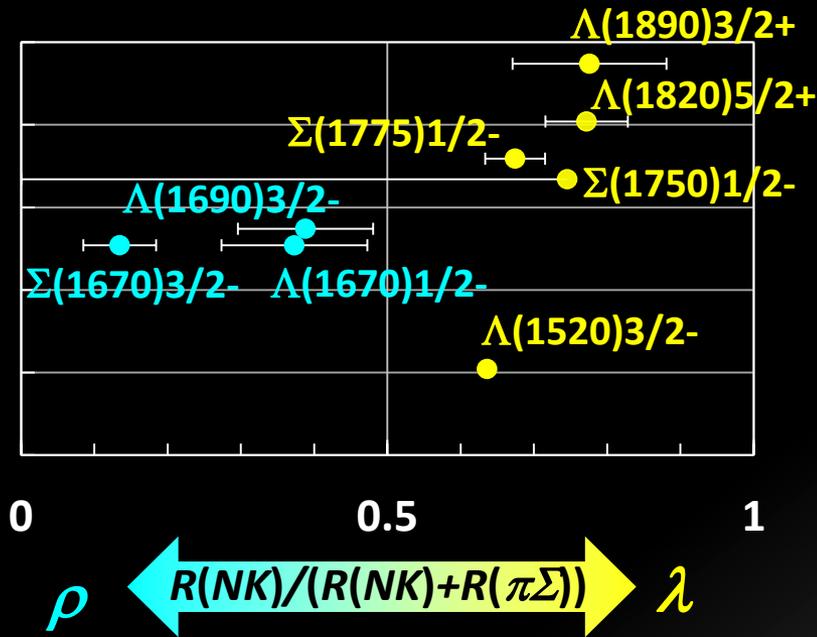
ρ mode (qq)

$$\Gamma(\Sigma_c \pi) > \Gamma(pD)$$

λ mode [qq]

$$\Gamma(\Sigma_c \pi) < \Gamma(pD)$$

Hint in $R(NK)/R(\pi\Sigma)$



ates

- Decay ratios in known hyperons **SUGGEST** the λ/ρ mode states
- λ/ρ mode ID by Prod. Rates correlate w/ Decay Ratios
→ to be established

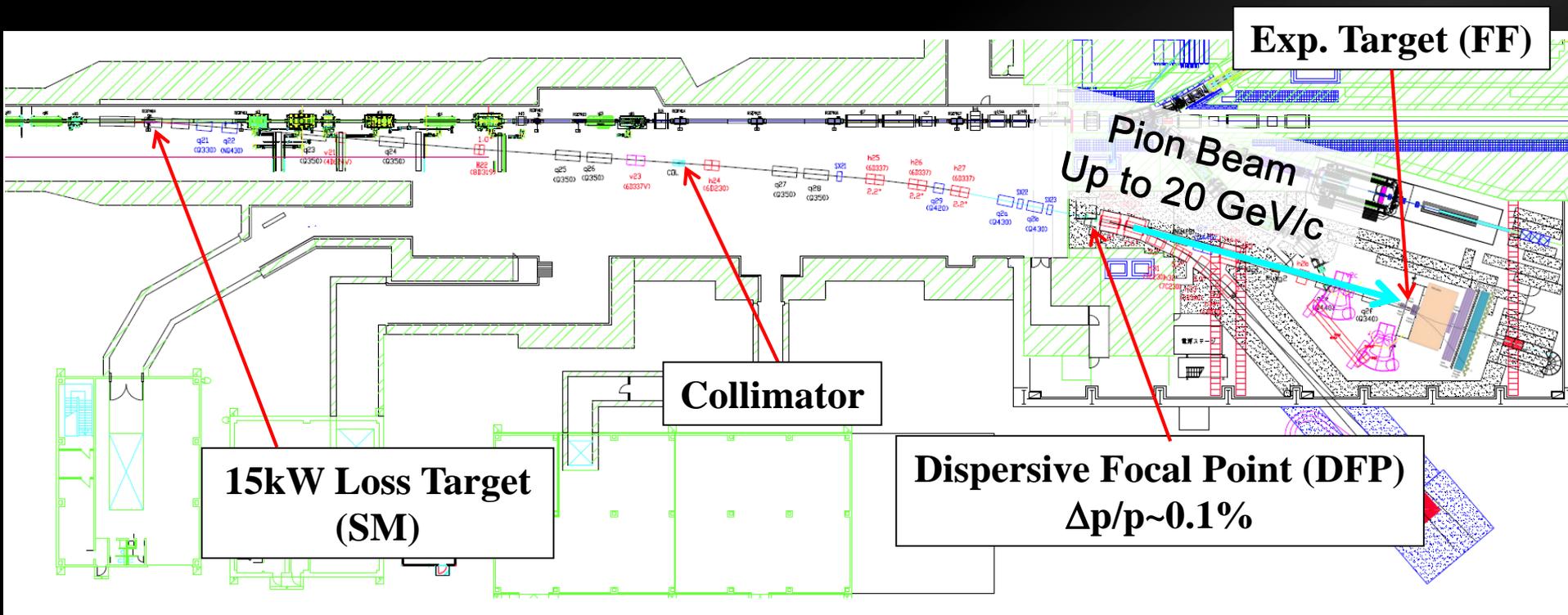
* Phase space factor: p^{2L+1} corrected

More clearly identified in charmed baryons

High-res., High-momentum Beam Line

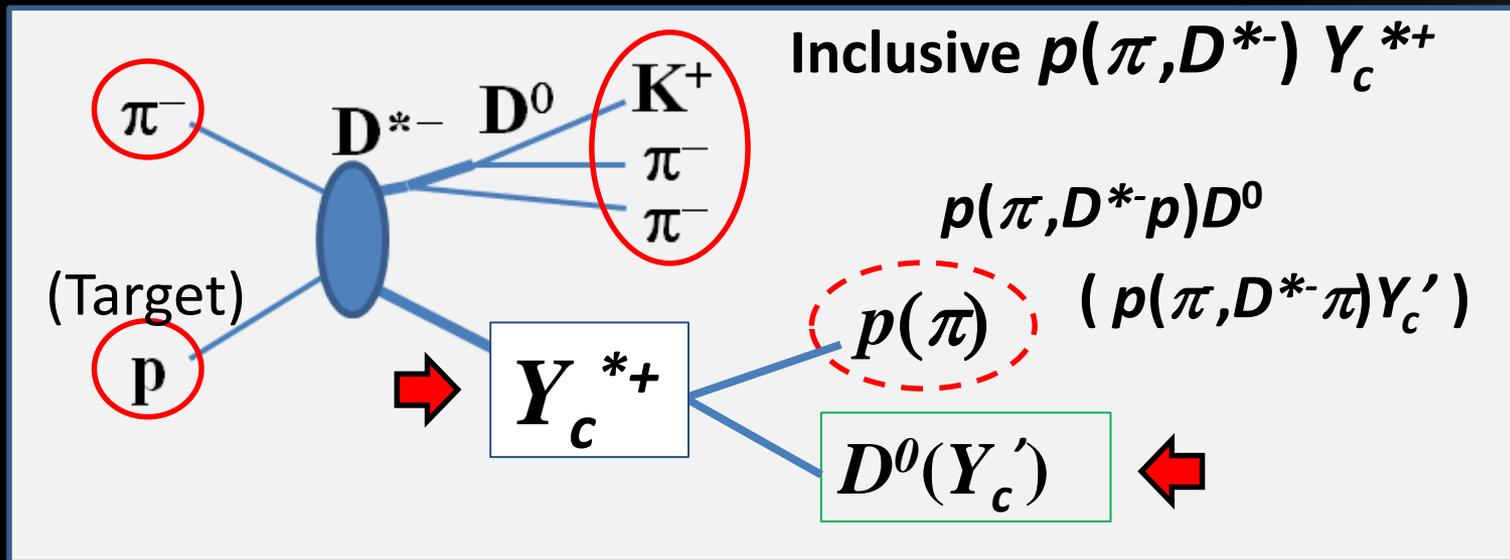
- High-intensity secondary Pion beam
– $>1.0 \times 10^7$ pions/sec @ 20GeV/c
- High-resolution beam: $\Delta p/p \sim 0.1\%$

Open a new platform for hadron physics



Charmed Baryon Spectroscopy

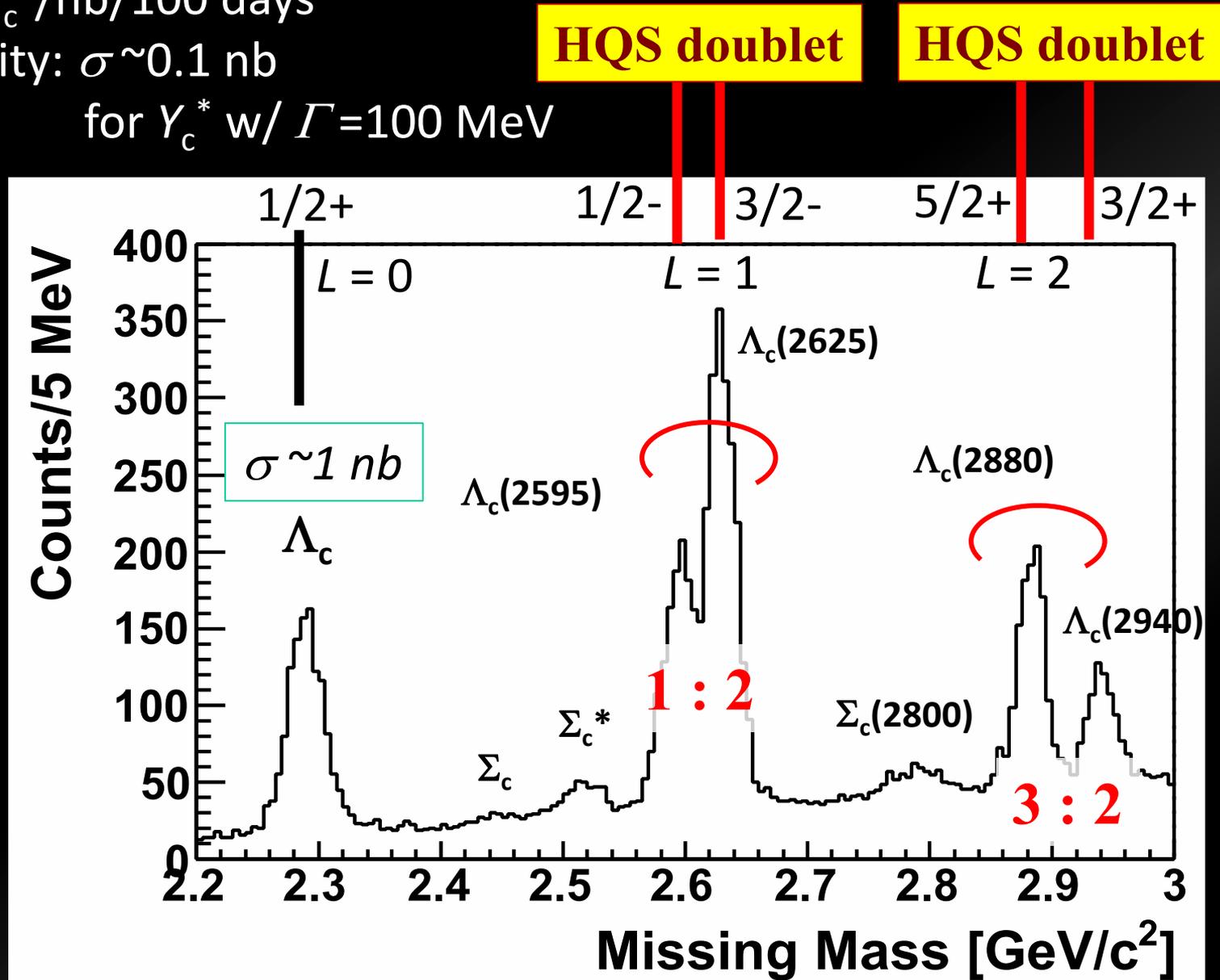
Using Missing Mass Techniques



Conducted by the **E50** experiment at J-PARC

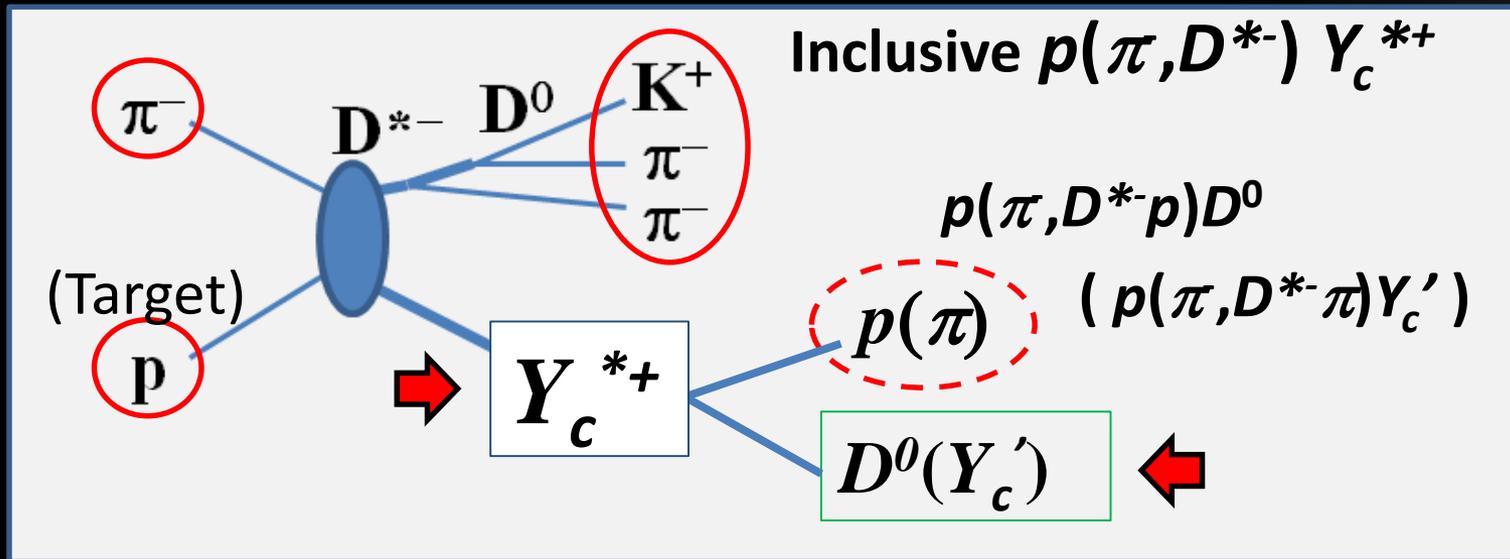
Missing Mass Spectrum (Sim.)

- $\sim 1000 Y_c^*/\text{nb}/100 \text{ days}$
- Sensitivity: $\sigma \sim 0.1 \text{ nb}$
for Y_c^* w/ $\Gamma = 100 \text{ MeV}$



Charmed Baryon Spectroscopy

Using Missing Mass Techniques

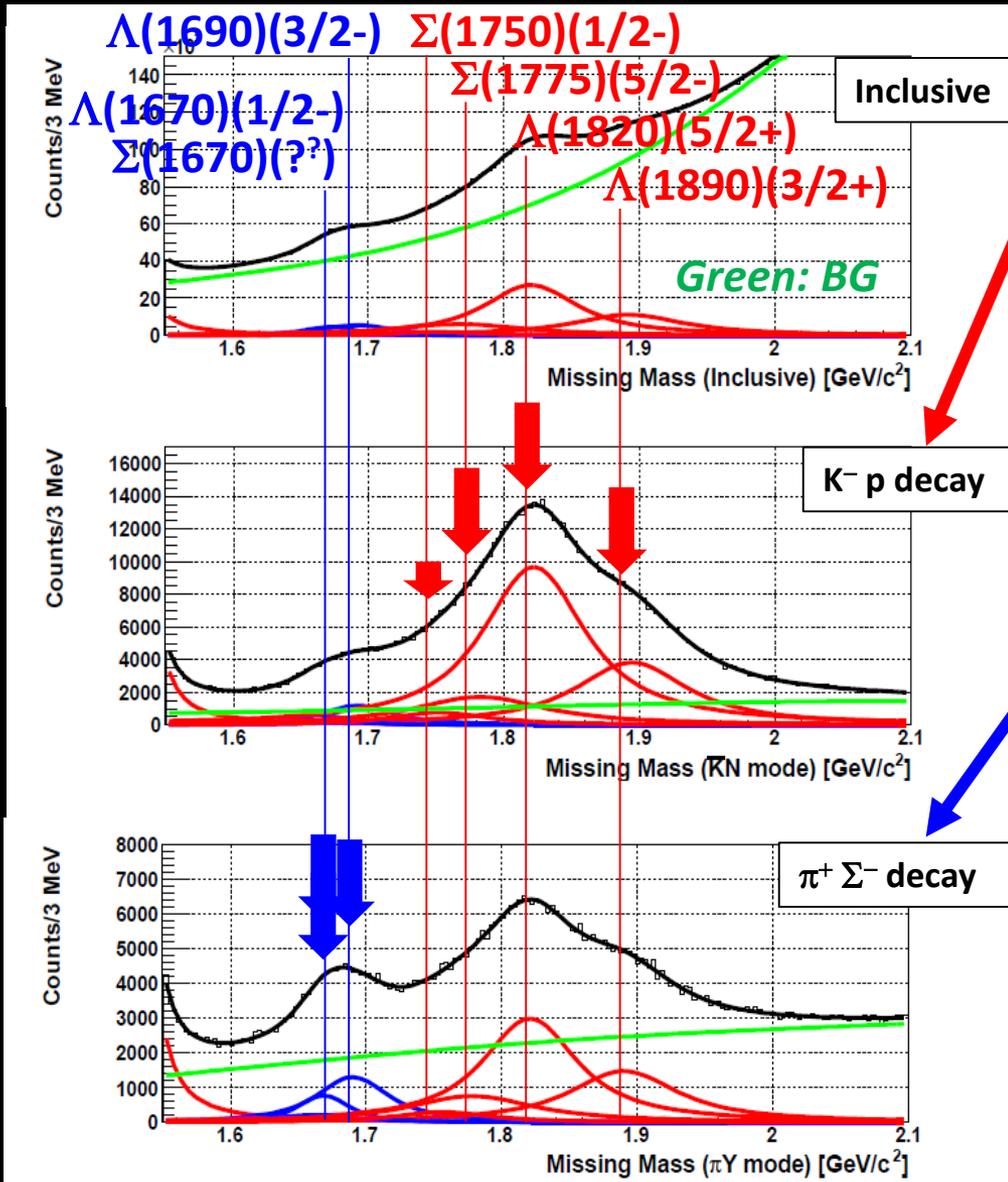


- S=-1 Hyperon by $p(\pi^-, K^*)$, $Y^* \rightarrow pK$, πY
- S=-2 Hyperon by $p(K^-, K^*)$, (K^-, K) , (π, KK^*) , $\Xi^* \rightarrow YK$, $\pi \Xi$

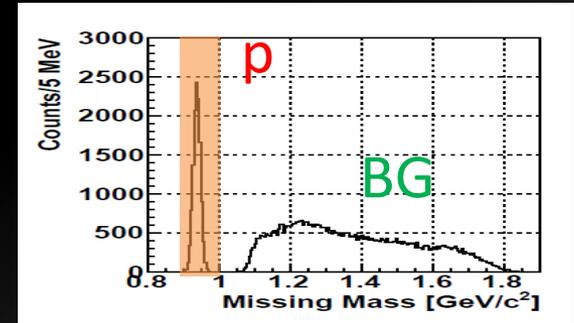
x1000~10000 better statistics than Y_c^*

Hyperon production via $p(\pi^-, K^{*0})X$

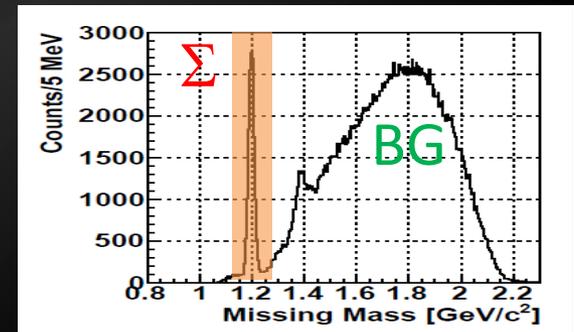
Simulation w/ 4×10^{11} pions (3 days)



- $X \rightarrow K^- p$ decay
- K^- tagged, Missing “p” gated



- $X \rightarrow \pi^+ \Sigma^-$ decay
- π^+ tagged, Missing “ Σ ” gated



A New Platform for Hadron physics at the High-p Beam Line

- To be a Cooperative Project of RCNP, IPNS/KEK, and the J-PARC Center under Agreement btwn Osaka U. and KEK
 - enhance the High-p BL Facility
 - High-resolution, high-p Secondary Beam Line
 - Multi-particle Spectrometer
 - Conduct hadron nuclear physics at High-p BL
 - E50: “Charmed Baryon Spectroscopy via the (π^-, D^{*-}) reaction”

We welcome your join!

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Thank you for your attention.