Study of Charmed Baryons Decays and $D^0 \to K^0\pi^0$ Decay at Belle

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EPS HEP 2001, Budapest
14.07.2001

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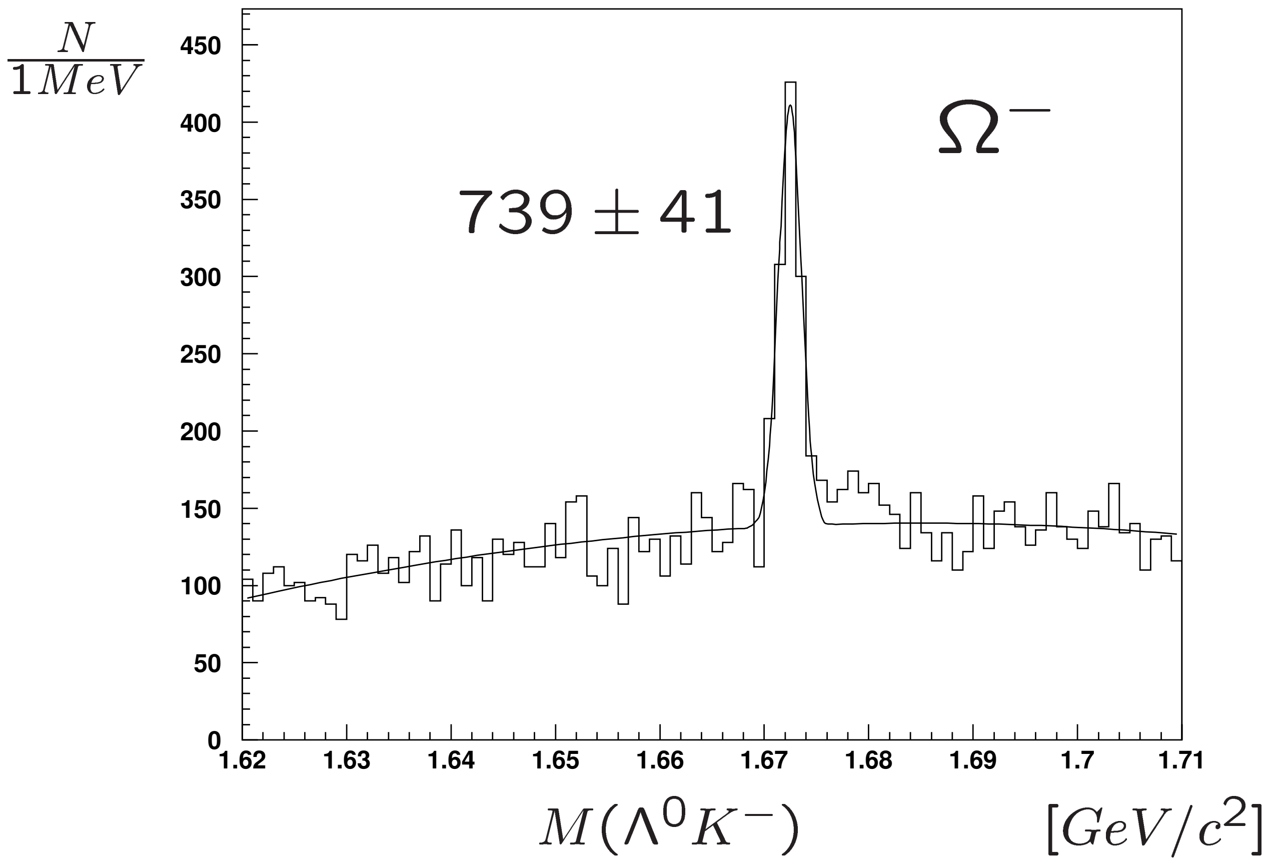
- **Study of Cabibbo-suppressed decay**
  $\Lambda_c^+ \to p K^+ K^-$

23.6 fb^{-1} collected in $\Upsilon(4S)$-resonance and nearby continuum.

Study of $\Omega_C^0 \to \Omega^- \pi^+$

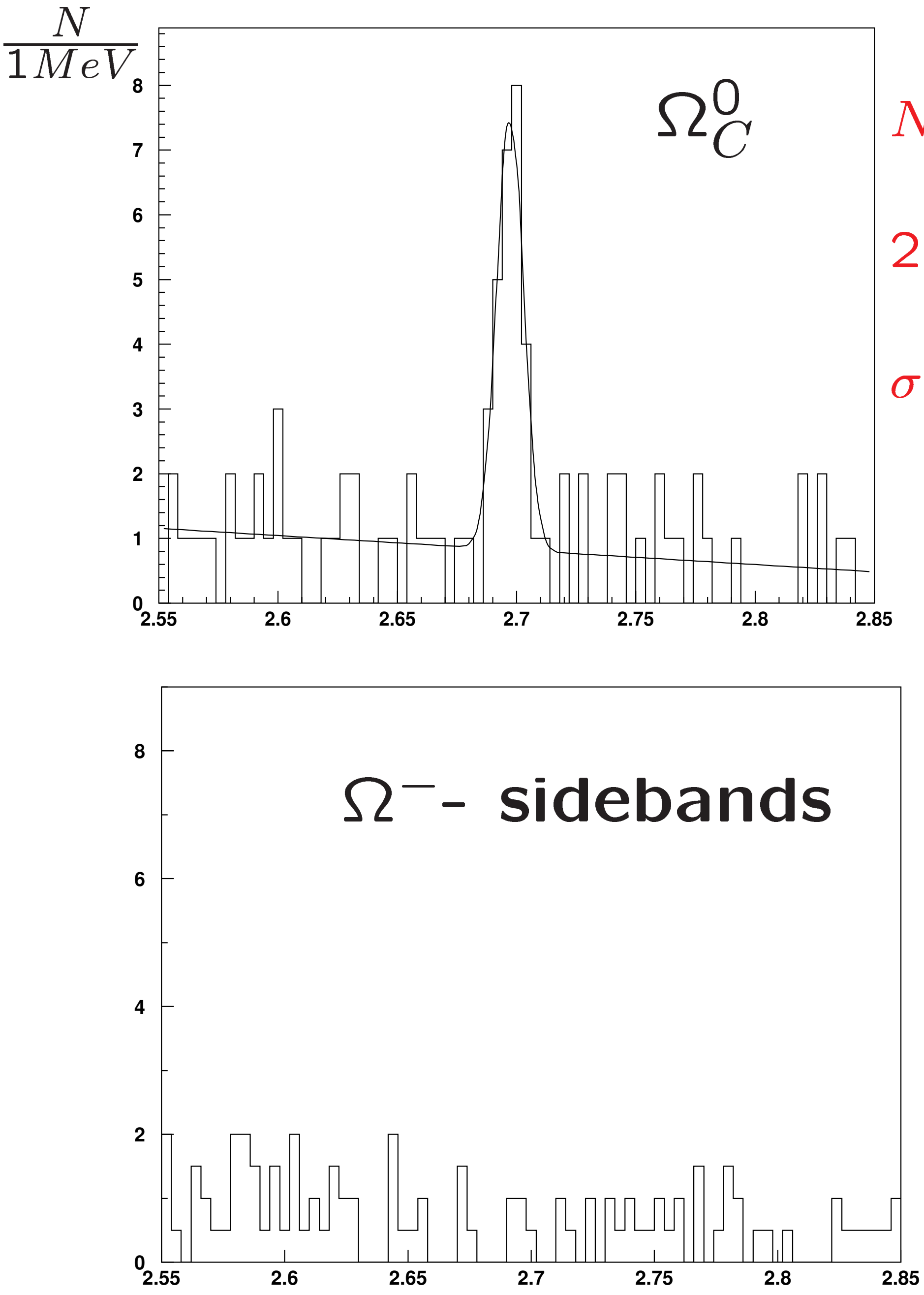
E687(10.3 ± 3.9), $M = 2705.9 \pm 3.9$ MeV$/c^2$
CLEO(13.3 ± 4.1), $M = 2694.6 \pm 3.2$ MeV$/c^2$

- $\Omega^- \to \Lambda^0 K^-$, $\Lambda^0 \to p\pi^-$
  $\sigma = 1.1 \pm 0.1$ MeV, $M = 1672.5 \pm 0.5$ MeV$/c^2$
  - $P(K/\pi) > 0.6$ for K, $P(K/p) < 0.4$ for p



Study of $\Omega_C^0 \to \Omega^- \pi^+$

- $x_p > 0.5$



$N = 23.5 \pm 5.4$

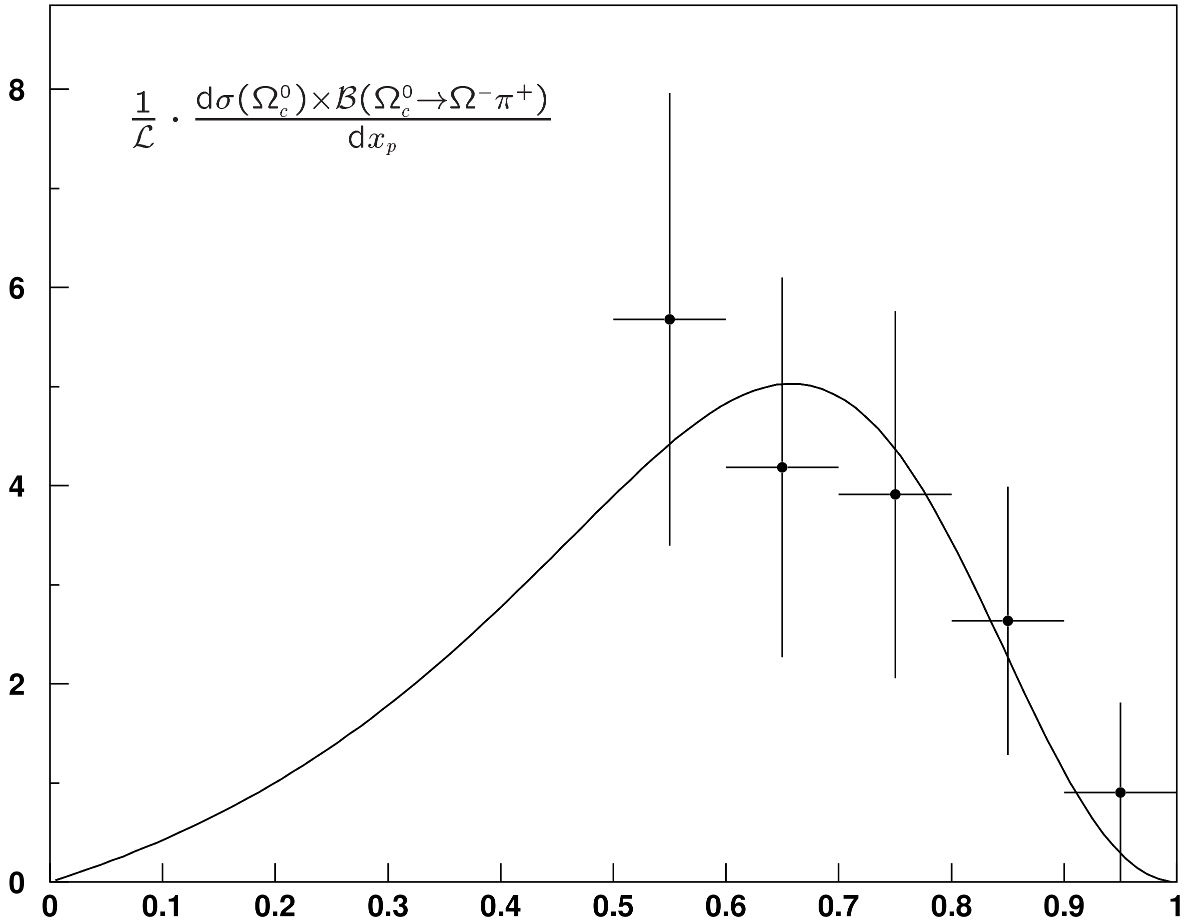
2697.3 ± 1.5 MeV$/c^2$

$\sigma = 5.7$ MeV$/c^2$ (MC)

$M(\Omega^- \pi^+) \qquad [GeV/c^2]$

Study of $\Omega_C^0 \to \Omega^- \pi^+$

x_p -distribution

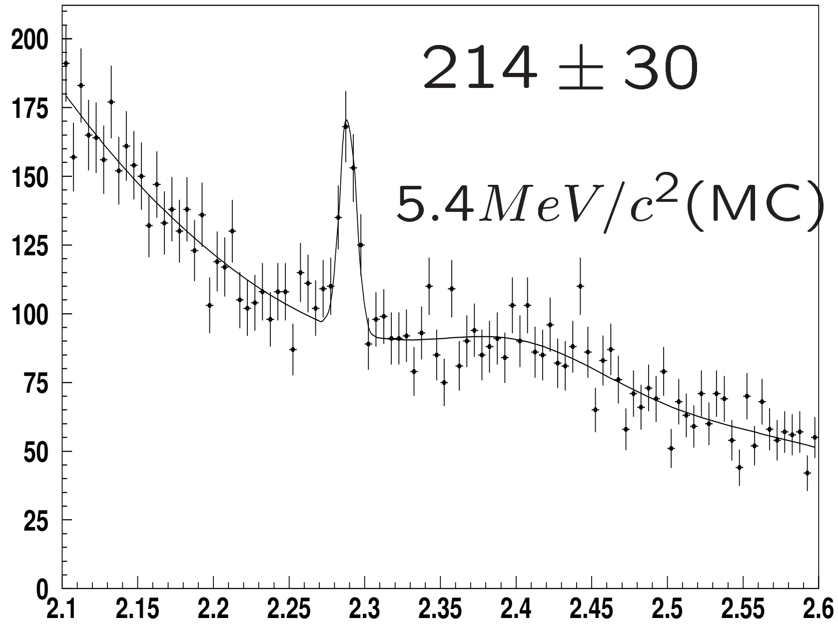


- $\sigma(\Omega_c^0|x_p > 0.5) \times \mathcal{B}(\Omega_c^0 \to \Omega^-\pi^+) = 17.5 \pm 4.0$ fb
- $\sigma(\Omega_c^0|x_p > 0.5)\times\mathcal{B}(\Omega_c^0 \to \Omega^-\pi^+) = 11.3\pm4.3$ fb(CLEO)
- Fit with Peterson *et al.* gives $\epsilon_p = 0.18^{+0.27}_{-0.10}$
- $\sigma(\Omega_c^0) \times \mathcal{B}(\Omega_c^0 \to \Omega^-\pi^+) = 24.2^{+51.4}_{-13.8}$ fb

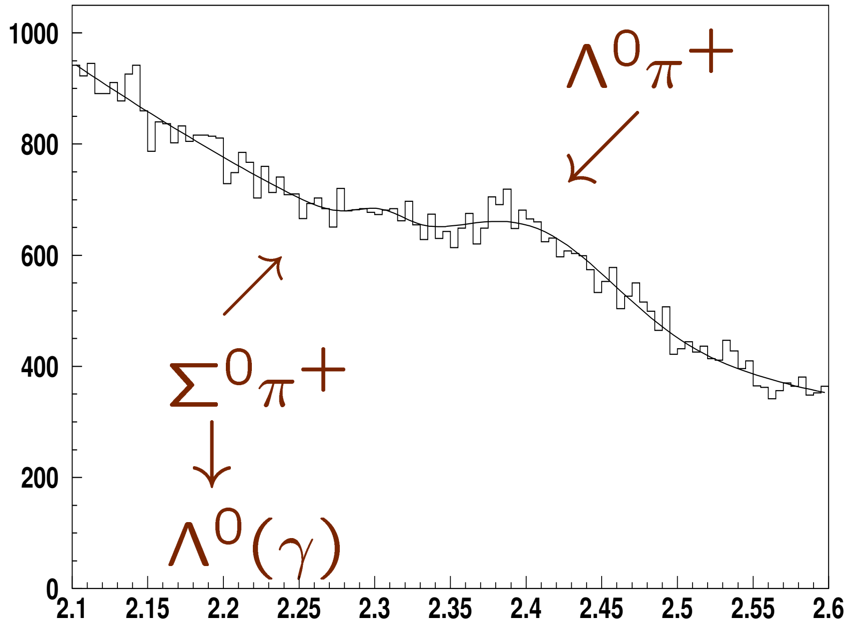
Observation of $\Lambda_C^+ \to \Lambda^0 K^+$

- $x_p > 0.5$

$\frac{N}{5MeV}$



$\mathbf{P(K/\pi)} > 0.6$



$\mathbf{P(K/\pi)} < 0.1$

$\Lambda^0\pi^+(\pi^0)$

$\Sigma^0\pi^+(\pi^0)$

$M(\Lambda^0 K^+) \qquad [GeV/c^2]$

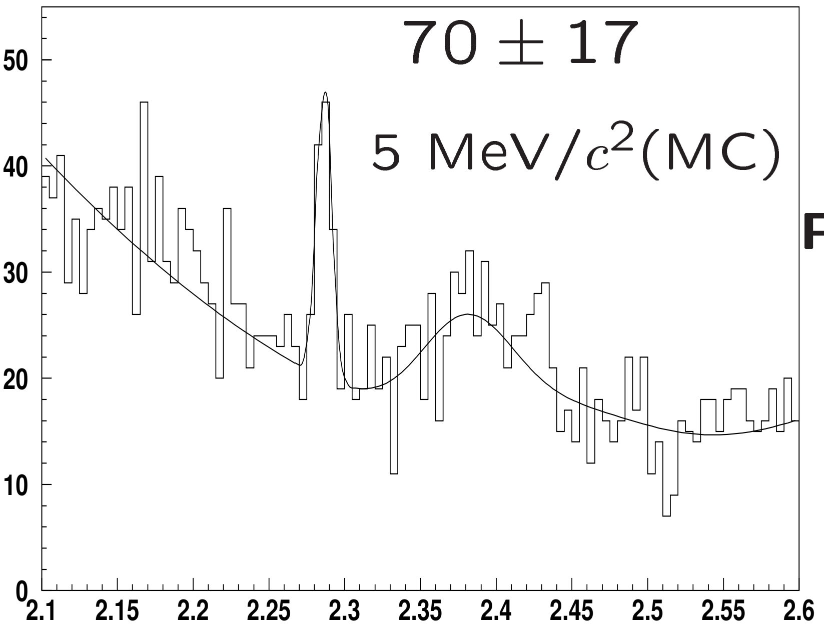
$$\frac{\mathcal{B}(\Lambda_c^+ \to \Lambda^0 K^+)}{\mathcal{B}(\Lambda_c^+ \to \Lambda^0 \pi^+)} = 0.085 \pm 0.012 \pm 0.012.$$

Observation of $\Lambda_C^+ \to \Sigma^0 K^+$

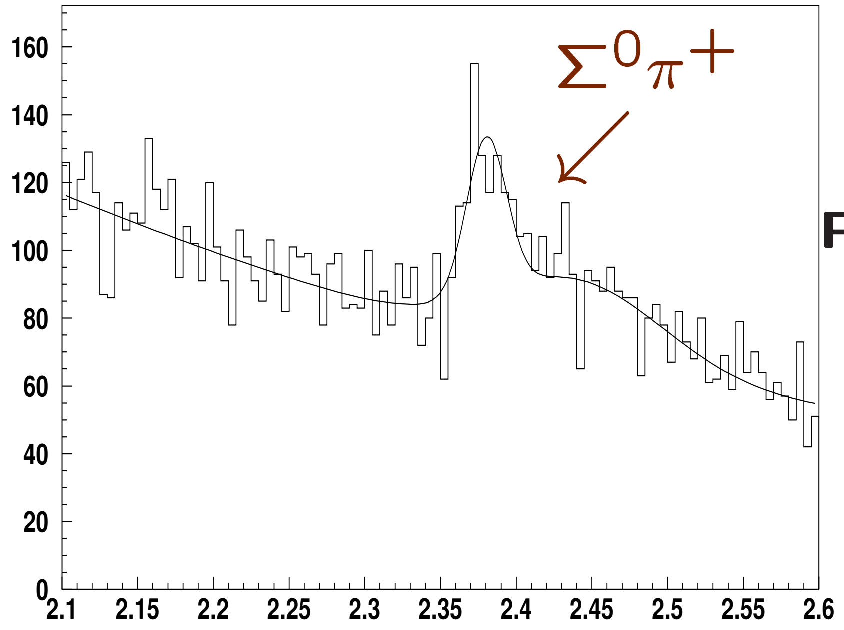
BELLE

- $x_p > 0.6$

$\frac{N}{5MeV}$



P(K/π) > 0.6



P(K/π) < 0.1

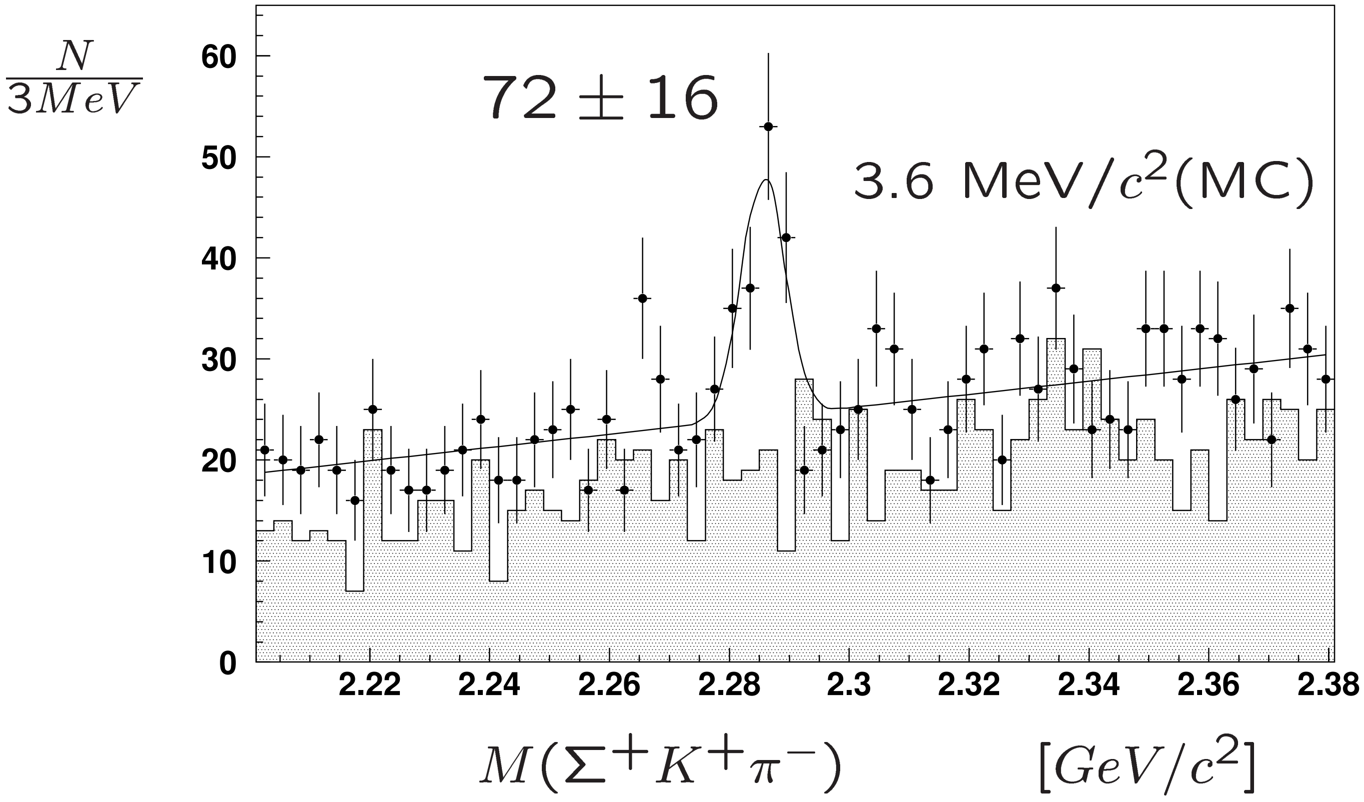
$M(\Sigma^0 K^+) \qquad [GeV/c^2]$

$$\frac{\mathcal{B}(\Lambda_c^+ \to \Sigma^0 K^+)}{\mathcal{B}(\Lambda_c^+ \to \Sigma^0 \pi^+)} = 0.073 \pm 0.018 \pm 0.014.$$

Observation of $\Lambda_C^+ \to \Sigma^+ K^+ \pi^-$

- Only 2 events - NA32 in 1992

- $x_p > 0.6$ • P(K/π) > 0.9 for K

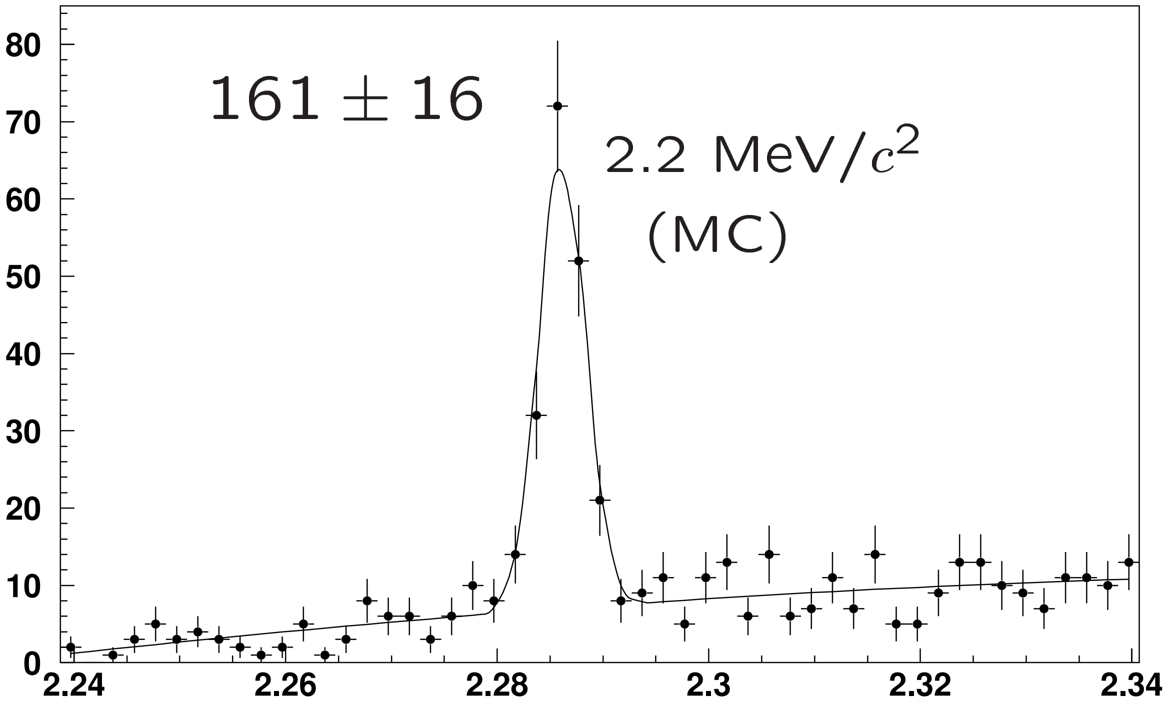


$$\frac{\mathcal{B}(\Lambda_c^+ \to \Sigma^+ K^+ \pi^-)}{\mathcal{B}(\Lambda_c^+ \to \Sigma^+ \pi^+ \pi^-)} = 0.059 \pm 0.014.$$

Study of $\Lambda_C^+ \to \Sigma^+ K^+ K^-$

W-exchange dominantly

- $x_p > 0.5$ • $P(K/\pi) > 0.9$



$$\frac{\mathcal{B}(\Lambda_c^+ \to \Sigma^+ K^+ K^-)}{\mathcal{B}(\Lambda_c^+ \to \Sigma^+ \pi^+ \pi^-)} = 0.075 \pm 0.008.$$

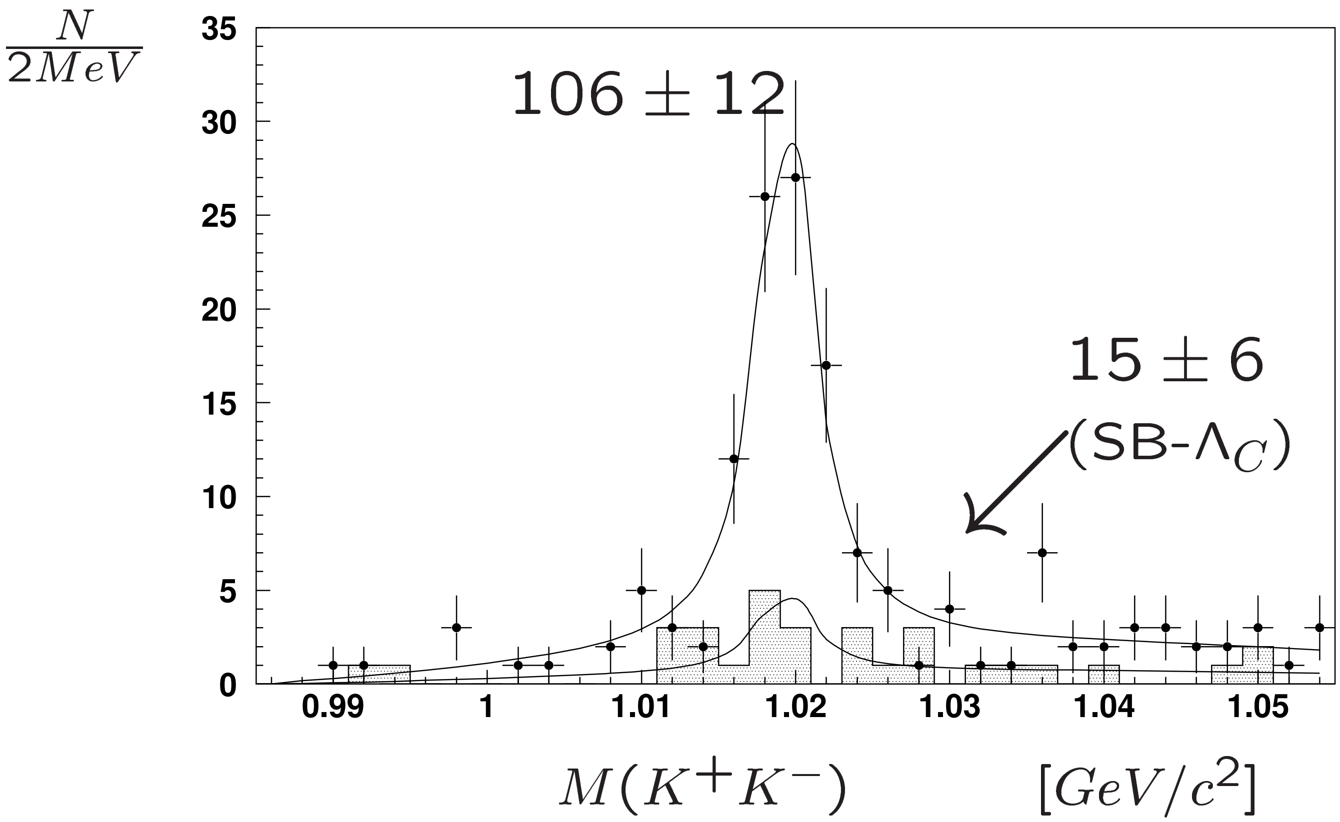
$$\frac{\mathcal{B}(\Lambda_c^+ \to \Sigma^+ K^+ K^-)}{\mathcal{B}(\Lambda_c^+ \to p K^- \pi^+)} = 0.070 \pm 0.012 \pm 0.011.$$

(CLEO)

$$\frac{\mathcal{B}(\Lambda_c^+ \to \Sigma^+ \pi^+ \pi^-)}{\mathcal{B}(\Lambda_c^+ \to p K^- \pi^+)} = 0.69 \pm 0.09. \text{ (PDG)}$$

Study of $\Lambda_C^+ \to \Sigma^+ \phi$

$|M(\Sigma^+ K^+ K^-) - M(\Lambda_c)| < 5$ MeV$/c^2$



$$\frac{\mathcal{B}(\Lambda_c^+ \to \Sigma^+ \phi)}{\mathcal{B}(\Lambda_c^+ \to \Sigma^+ \pi^+ \pi^-)} = 0.091 \pm 0.014.$$

$$\frac{\mathcal{B}(\Lambda_c^+ \to \Sigma^+ \phi)}{\mathcal{B}(\Lambda_c^+ \to p K^- \pi^+)} = 0.069 \pm 0.023 \pm 0.016.$$

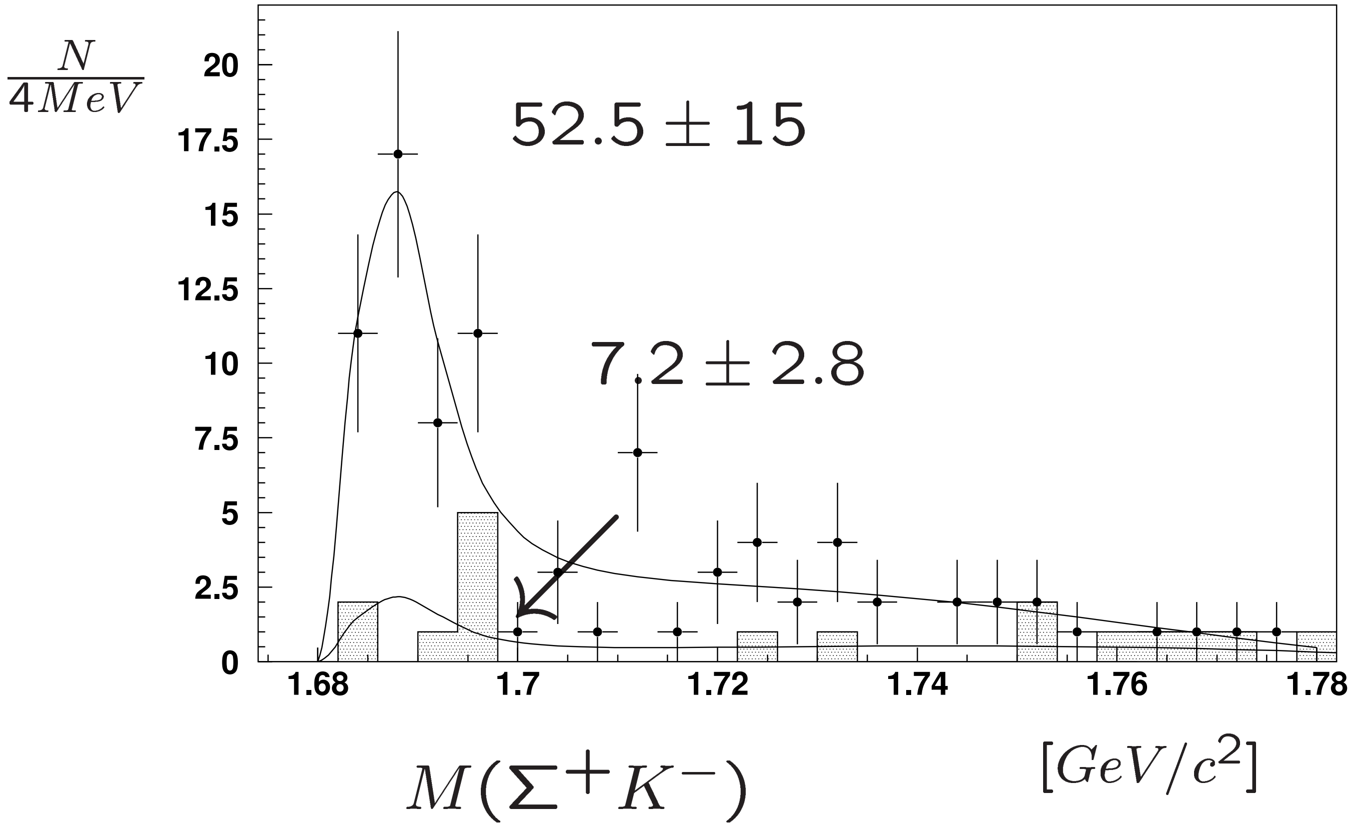
(CLEO)

$$\frac{\mathcal{B}(\Lambda_c^+ \to \Sigma^+ \pi^+ \pi^-)}{\mathcal{B}(\Lambda_c^+ \to p K^- \pi^+)} = 0.69 \pm 0.09. \text{ (PDG)}$$

Evidence for $\Lambda_C^+ \rightarrow \Xi(1690)K^+$

- $\Xi(1690) \rightarrow \Sigma^+ K^-$

- $|M(\Sigma^+ K^+ K^-) - M(\Lambda_c^+)| < 5$ MeV/c^2

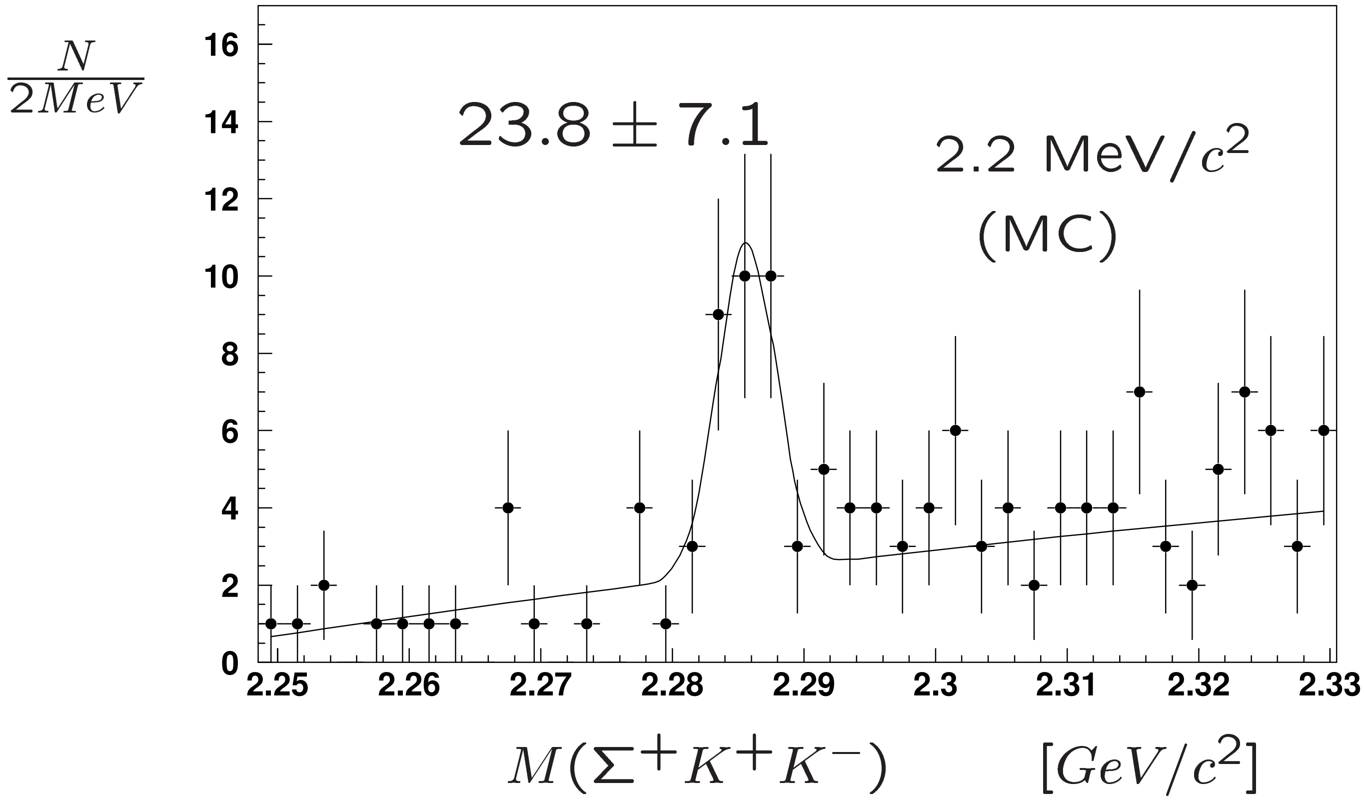


$$\frac{\mathcal{B}(\Lambda_c^+ \rightarrow \Xi(1690)K^+) \times \mathcal{B}(\Xi \rightarrow \Sigma^+ K^-)}{\mathcal{B}(\Lambda_c^+ \rightarrow \Sigma^+ \pi^+ \pi^-)} = 0.021 \pm 0.007.$$

Non-resonant $\Lambda_C^+ \to \Sigma^+ K^+ K^-$

$|M(K^+K^-) - M(\phi)| > 10$ MeV/c^2

$|M(\Sigma^+K^-) - M(\Xi(1690))| > 20$ MeV/c^2

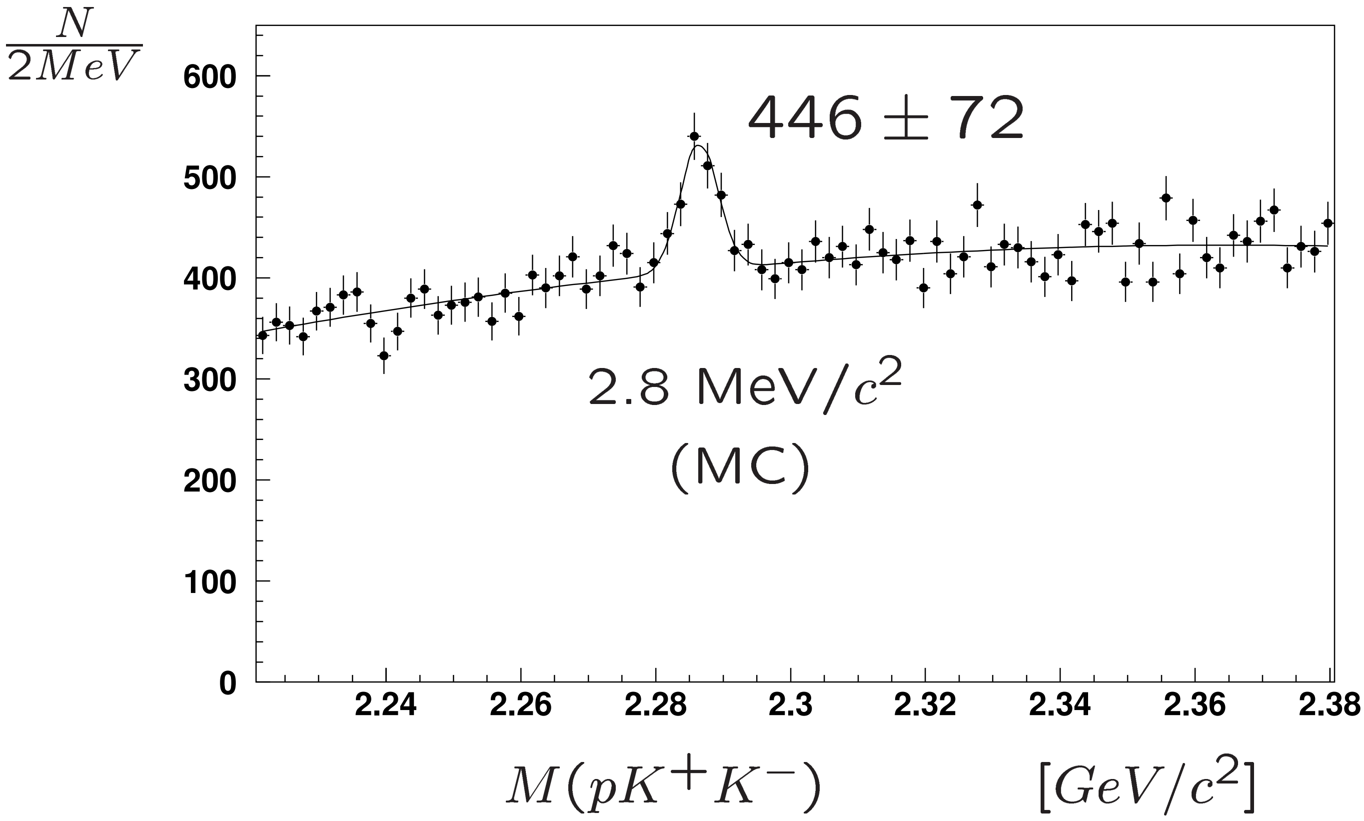


- $N = 12.3 \pm 2.5 \to \phi$-tail

- $N = 5.4 \pm 1.8 \to \Xi(1690)$-tail

Study of $\Lambda_C^+ \to pK^+K^-$

- $x_p > 0.6$ • $P(K/\pi) > 0.9$ for K

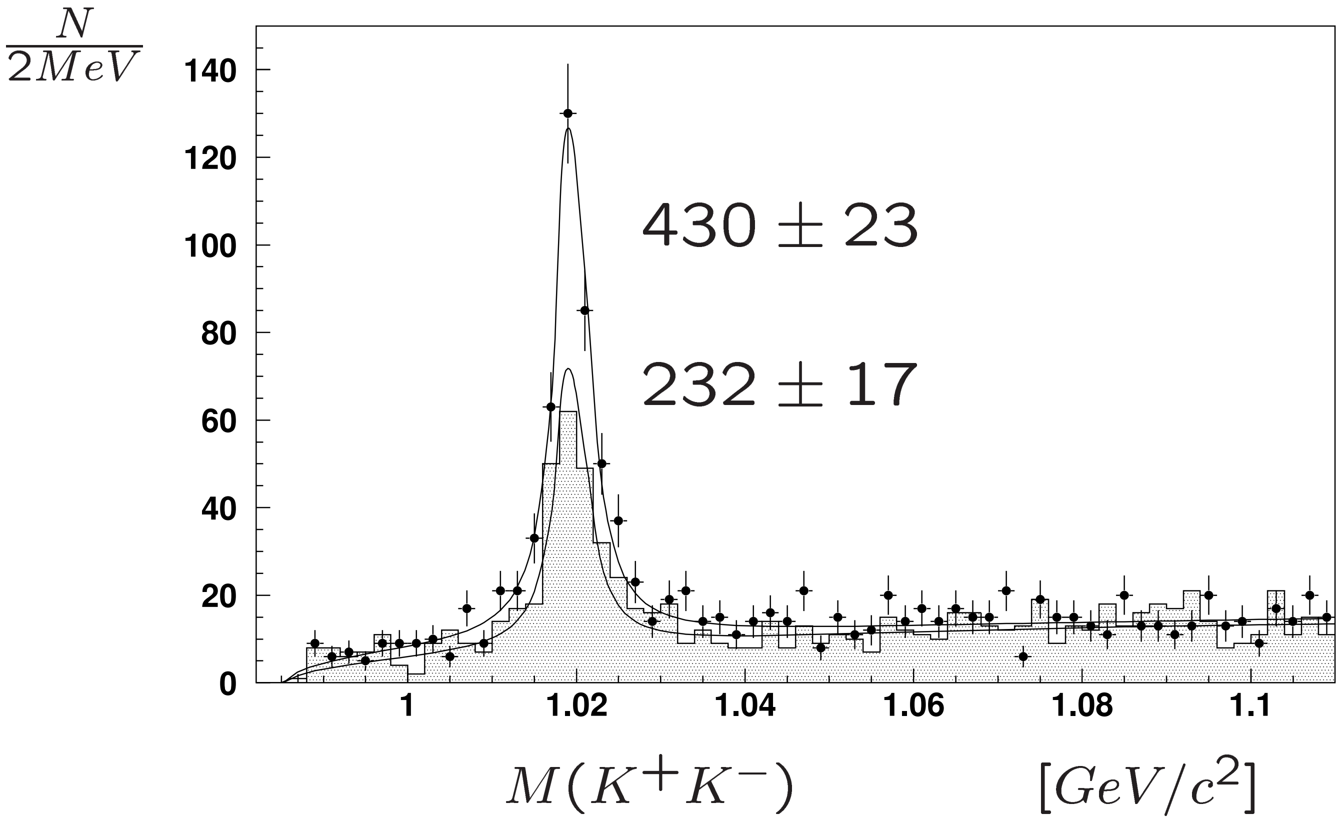


$$\frac{\mathcal{B}(\Lambda_c^+ \to pK^+K^-)}{\mathcal{B}(\Lambda_c^+ \to pK^-\pi^+)} = 0.0150 \pm 0.0025.$$

$$\frac{\mathcal{B}(\Lambda_c^+ \to pK^+K^-)}{\mathcal{B}(\Lambda_c^+ \to pK^-\pi^+)} = 0.039 \pm 0.009 \pm 0.007.$$

(CLEO)

Study of $\Lambda_C^+ \to p\phi$



$$\frac{\mathcal{B}(\Lambda_c^+ \to p\phi)}{\mathcal{B}(\Lambda_c^+ \to pK^-\pi^+)} = 0.0150 \pm 0.0023.$$

$$\frac{\mathcal{B}(\Lambda_c^+ \to p\phi)}{\mathcal{B}(\Lambda_c^+ \to pK^-\pi^+)} = 0.024 \pm 0.006 \pm 0.003.$$

(CLEO)

Conclusions

- **Measurement of $\Omega_c^0 \to \Omega^-\pi^+$ decay**

  23.5±5.4 events; $M = 2697.3 \pm 1.5$ MeV/c^2

  $\sigma(\Omega_c^0 | x_p > 0.5) \times \mathcal{B}(\Omega_c^0 \to \Omega^-\pi^+) = 17.5 \pm 4.0$ fb

- **Observation of Cabibbo-suppressed decays**
  $\Lambda_c^+ \to \Lambda^0 K^+$, $\Lambda_c^+ \to \Sigma^0 K^+$, $\Lambda_c^+ \to \Sigma^+ K^+ \pi^-$

$$\frac{\mathcal{B}(\Lambda_c^+ \to \Lambda^0 K^+)}{\mathcal{B}(\Lambda_c^+ \to \Lambda^0 \pi^+)} = 0.085 \pm 0.012 \pm 0.012.$$

$$\frac{\mathcal{B}(\Lambda_c^+ \to \Sigma^0 K^+)}{\mathcal{B}(\Lambda_c^+ \to \Sigma^0 \pi^+)} = 0.073 \pm 0.018 \pm 0.014.$$

$$\frac{\mathcal{B}(\Lambda_c^+ \to \Sigma^+ K^+ \pi^-)}{\mathcal{B}(\Lambda_c^+ \to \Sigma^+ \pi^+ \pi^-)} = 0.059 \pm 0.014.$$

Conclusions–II

- **Detailed study of $\Lambda_c^+ \to \Sigma^+ K^+ K^-$ decay**

  Evidence for $\Lambda_c \to \Xi(1690) K^+$ decay

  $$\frac{\mathcal{B}(\Lambda_c^+ \to \Xi(1690) K^+) \times \mathcal{B}(\Xi \to \Sigma^+ K^-)}{\mathcal{B}(\Lambda_c^+ \to \Sigma^+ \pi^+ \pi^-)} = 0.021 \pm 0.007.$$

  $$\frac{\mathcal{B}(\Lambda_c^+ \to \Sigma^+ \phi)}{\mathcal{B}(\Lambda_c^+ \to \Sigma^+ \pi^+ \pi^-)} = 0.091 \pm 0.014.$$

  $$\frac{\mathcal{B}(\Lambda_c^+ \to \Sigma^+ K^+ K^-)_{non-res}}{\mathcal{B}(\Lambda_c^+ \to \Sigma^+ \pi^+ \pi^-)} < 0.014 \text{ @ } 90\% \text{ CL}.$$

- **Study of Cabibbo-suppressed decay $\Lambda_c^+ \to p K^+ K^-$ with improved accuracy**

  $$\frac{\mathcal{B}(\Lambda_c^+ \to p K^+ K^-)}{\mathcal{B}(\Lambda_c^+ \to p K^- \pi^+)} = 0.0150 \pm 0.0025.$$

  $$\frac{\mathcal{B}(\Lambda_c^+ \to p \phi)}{\mathcal{B}(\Lambda_c^+ \to p K^- \pi^+)} = 0.0150 \pm 0.0023.$$