NEWS FROM DISTO

Ken Suzuki / Stefan-Meyer-Institut, ÖAW

P. Kienle, M. Maggiora, T. Yamazaki
and DISTO collaboration

EXA2011@Vienna 07.09.2011

Experimental principle

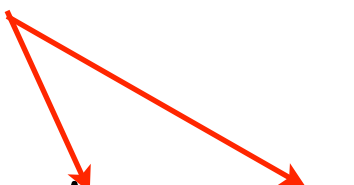
„ordinary process“

$$p + p \rightarrow \quad \Lambda + p \quad + K^+$$

Experimental principle

„exotic process“

$$p + p \rightarrow \underline{\text{"}K^- pp\text{"}} + K^+$$



$$\Lambda + p$$

Experimental principle

„exotic process“

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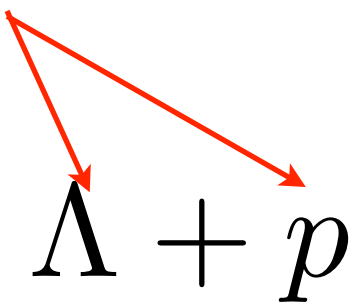
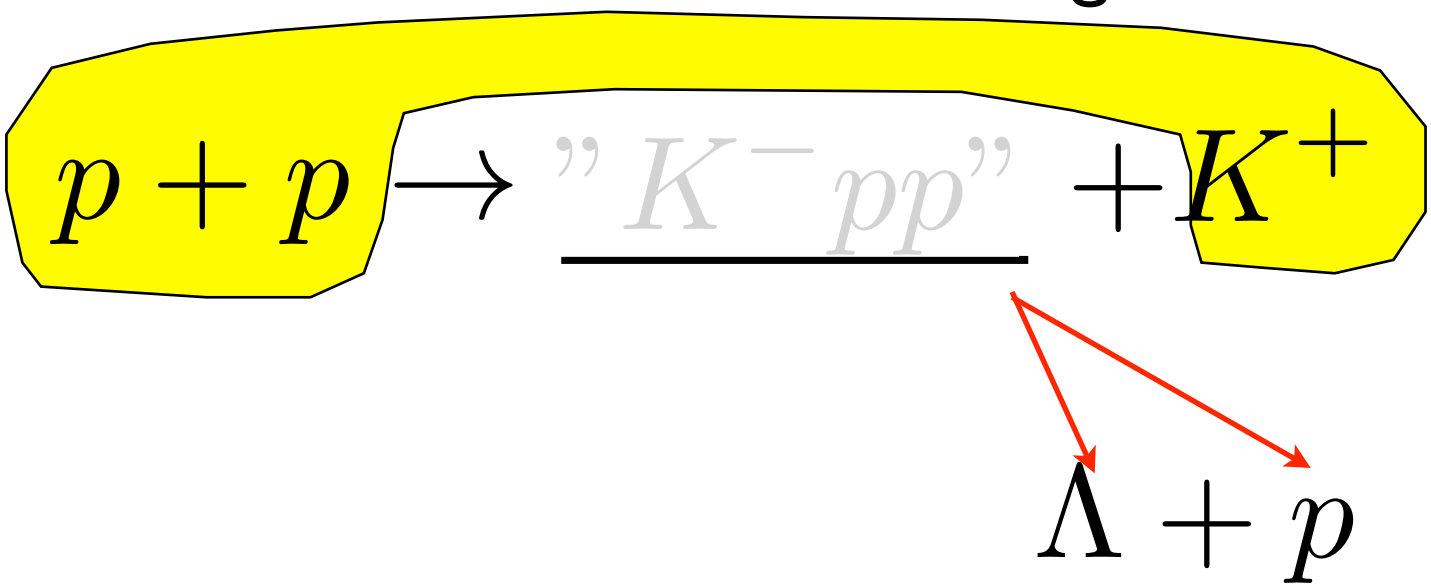


Experimental principle

„exotic process“

Production Channel
Missing Mass: K^+



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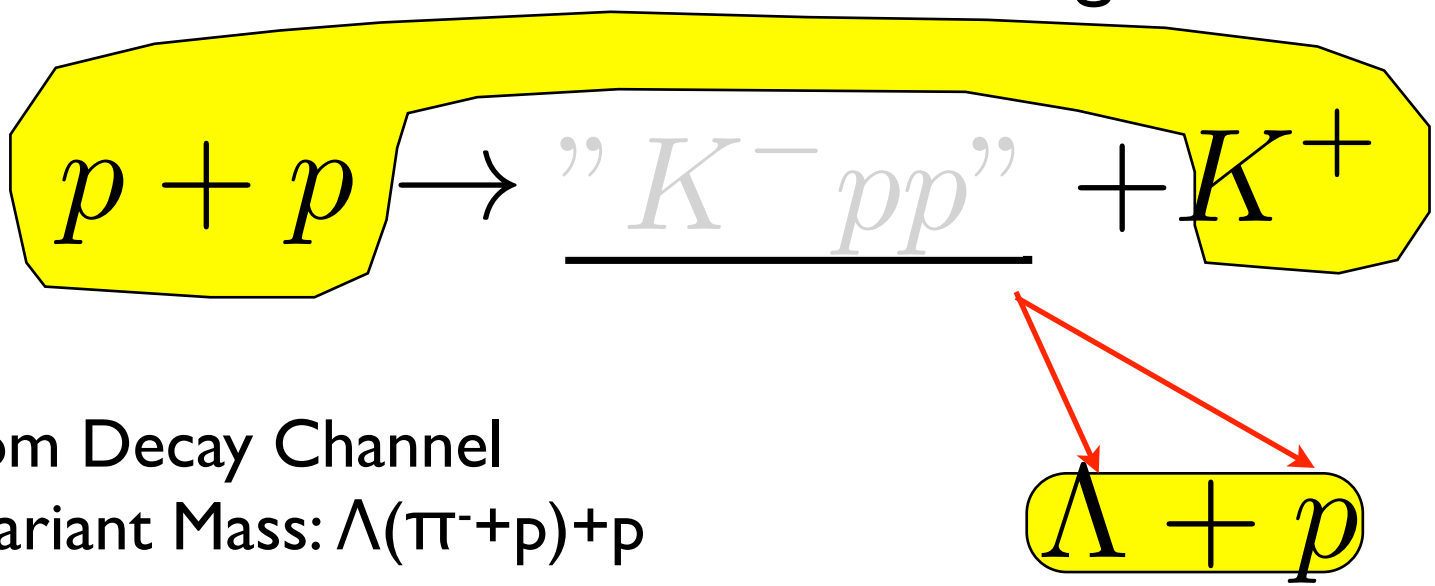

From Decay Channel
Invariant Mass: $\Lambda(\pi^- + p) + p$

Experimental principle

„exotic process“

Production Channel
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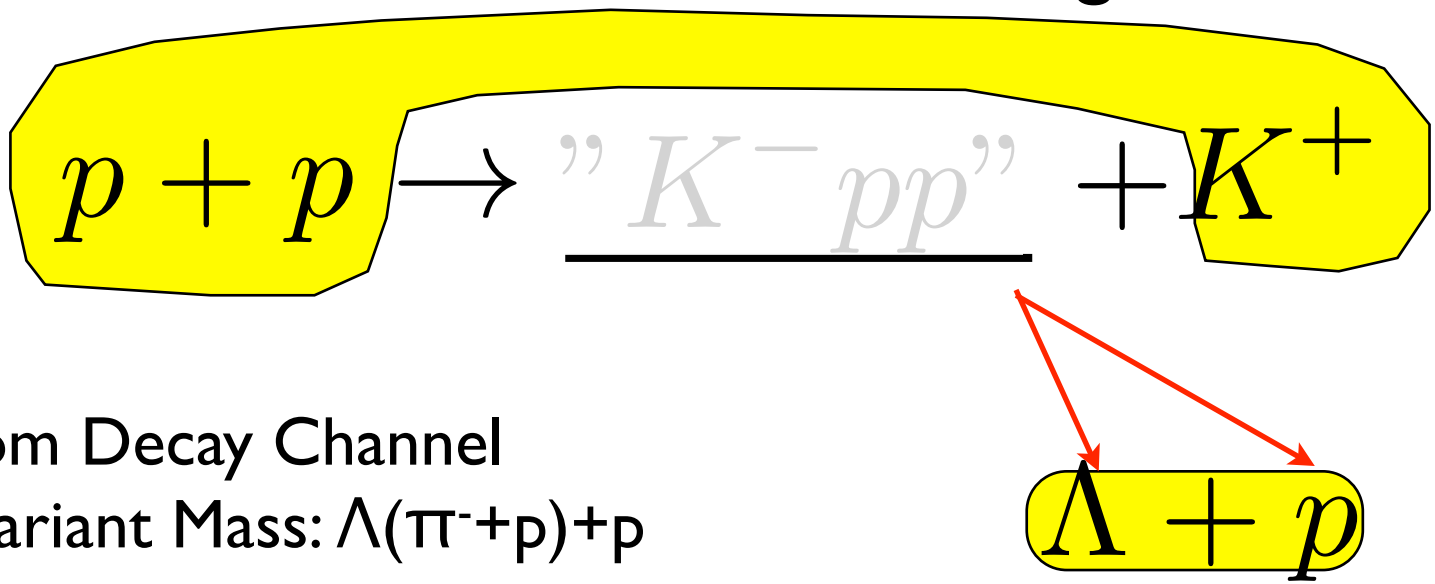

From Decay Channel
Invariant Mass: $\Lambda(\pi^- + p) + p$

Full kinematical information
with a large acceptance detector

Experimental principle

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$$\Lambda + p$$

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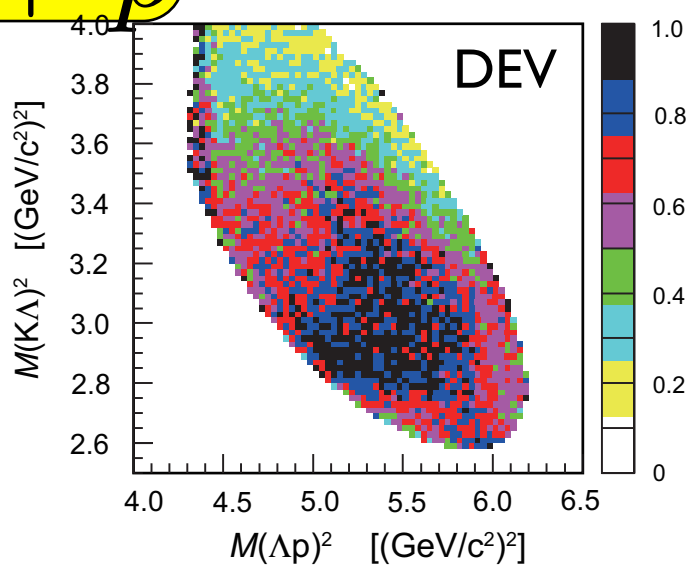

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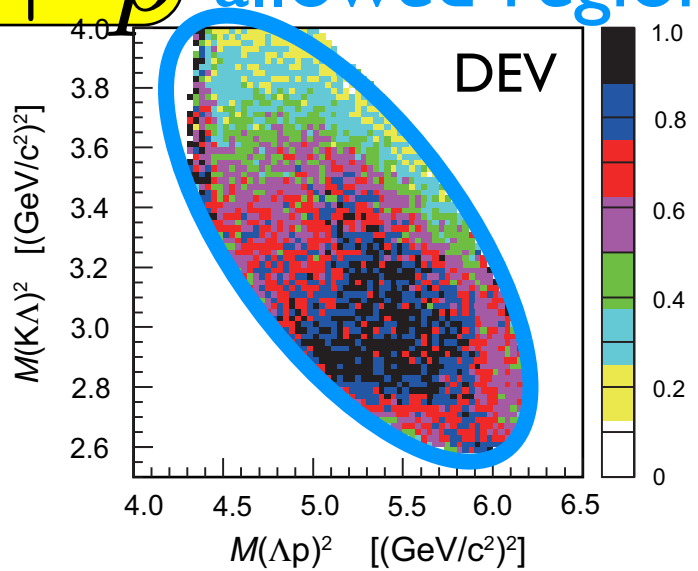
$$\Lambda + p$$

Kinematically allowed region

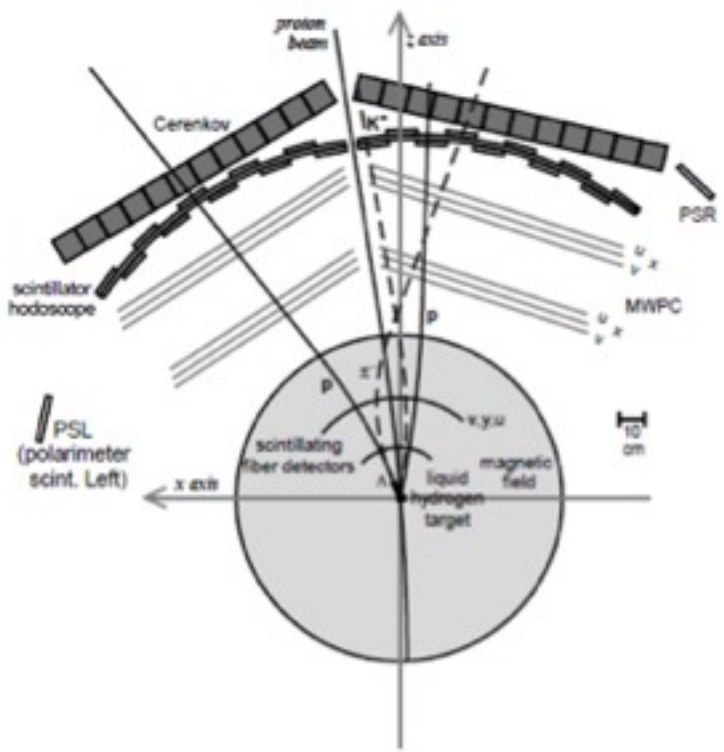


Full kinematical information
with a large acceptance detector

PRL 104, 132502 (2010) PHYSICAL REVIEW LETTERS week ending 2 APRIL 2010

Indication of a Deeply Bound and Compact $K^- pp$ State Formed in the $pp \rightarrow p\Lambda K^+$ Reaction at 2.85 GeV

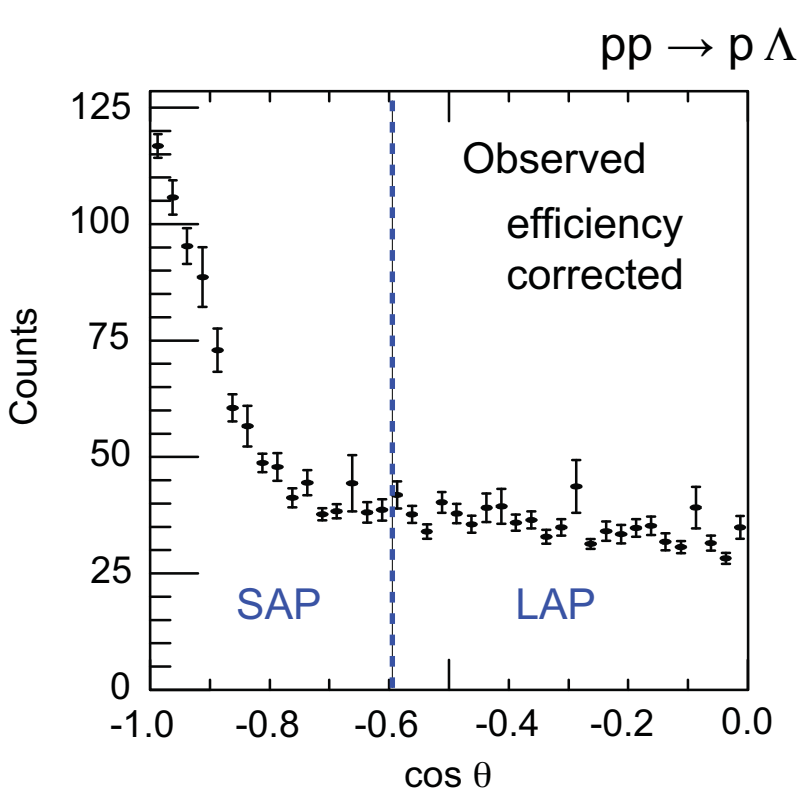
T. Yamazaki, P. Kienle, M. Maggiora, K. Suzuki
and DISTO collaboration

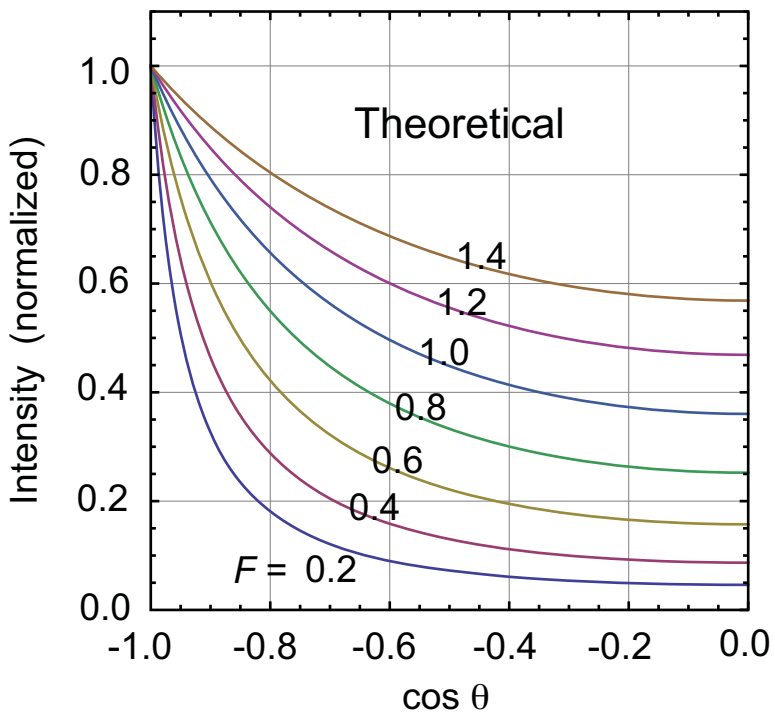


- *177k exclusive $pp \rightarrow p\Lambda K^+$ final state events@2.85 GeV*

2.85 GeV: Proton Angular Distribution

The most essential cut: Large angle proton cut ≡ $|cos\vartheta_{CM,p}|<0.6$





The observed very sharp forward component is well accounted for by postulating F ≈ 0.2 – 0.3, namely, the intermediate boson mass is close to the pion mass.

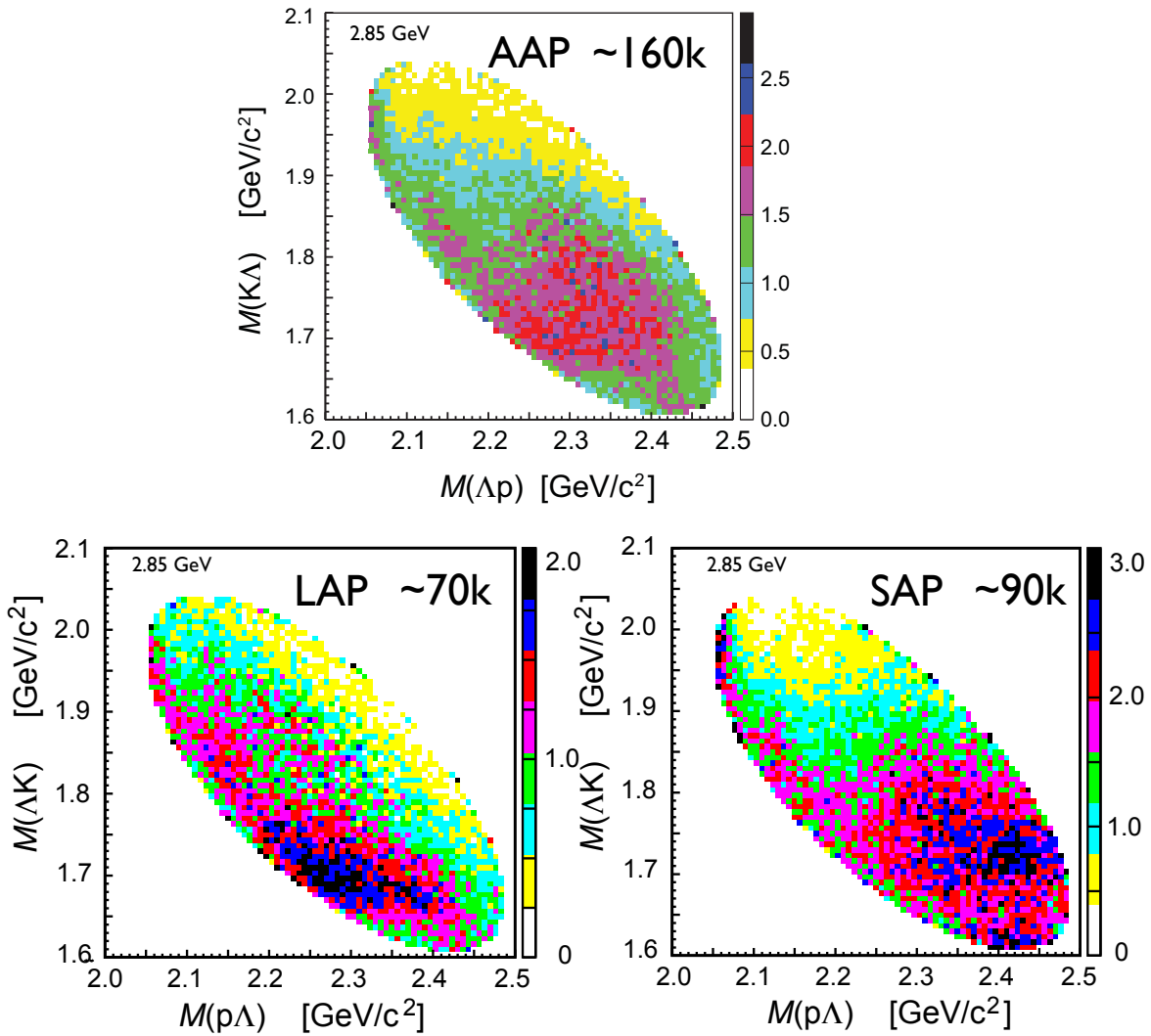
$$T(Q^2) = V_0[\frac{1}{1+b_1^2Q^2} + G\frac{1}{1+b_2^2Q^2}]$$

$$b_1 = \frac{\hbar c}{m_B} = m_p \times F = 0.77 \times F, b_2 = \frac{\hbar c}{m_B}$$

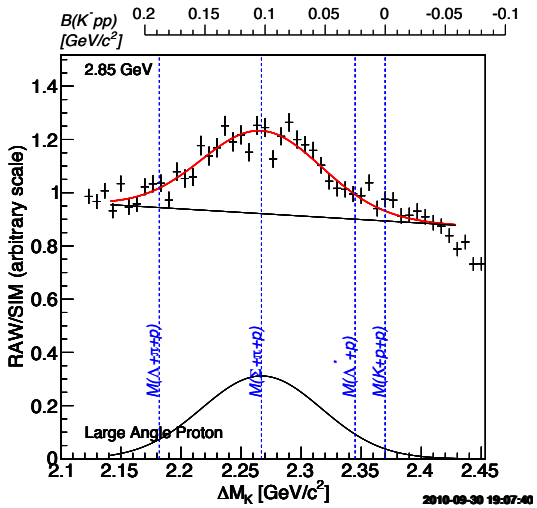
Y. Akaishi and T. Yamazaki, unpublished (2010)

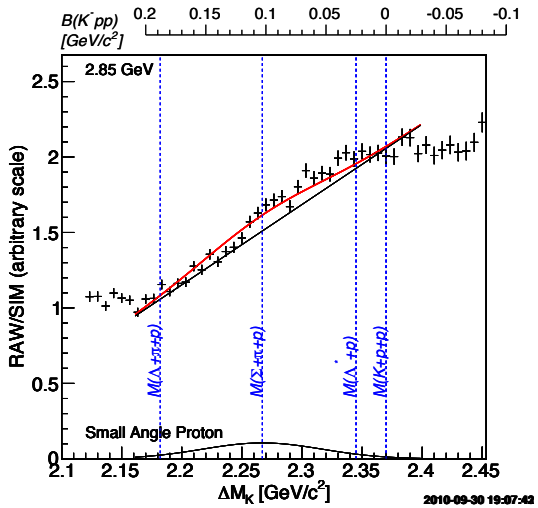
2.85 GeV: Proton Angular Distribution

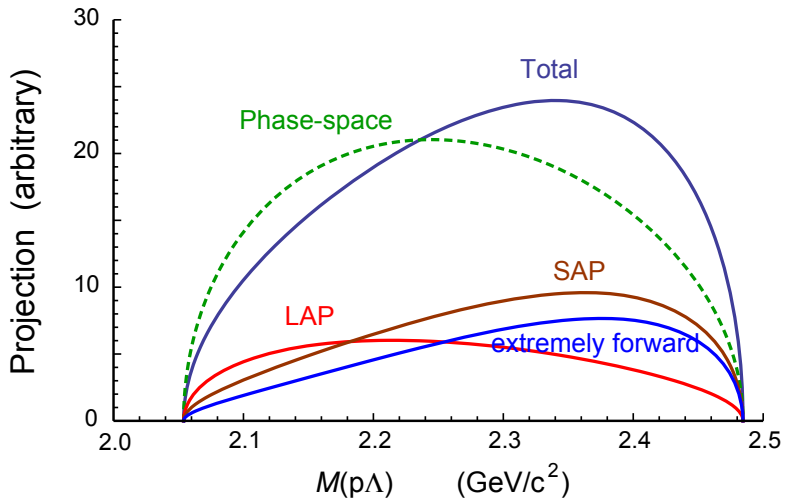
Exclusive data sample of $pp \rightarrow p\Lambda K^+$

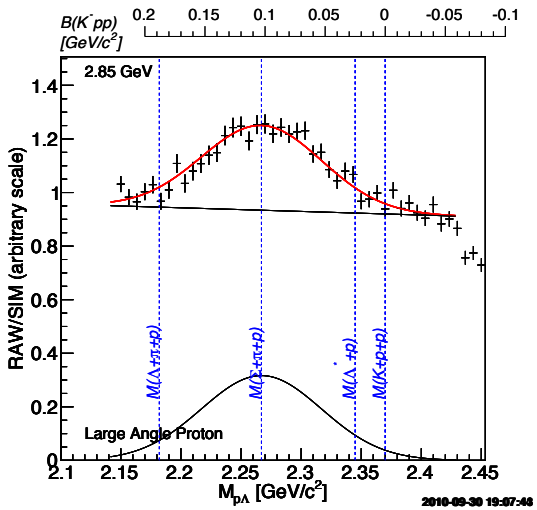


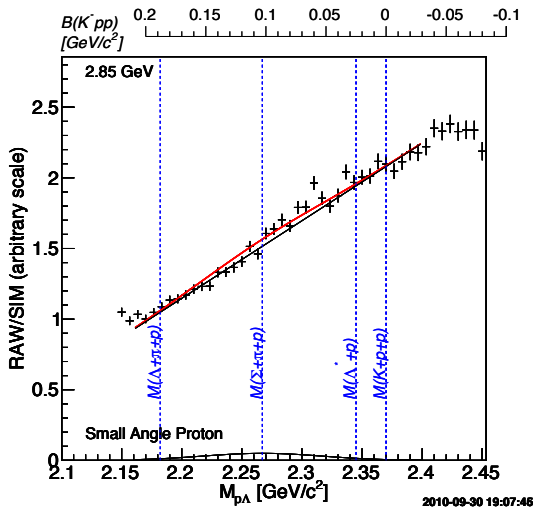
$M(p\Lambda)=\Delta M(K)$ spectra

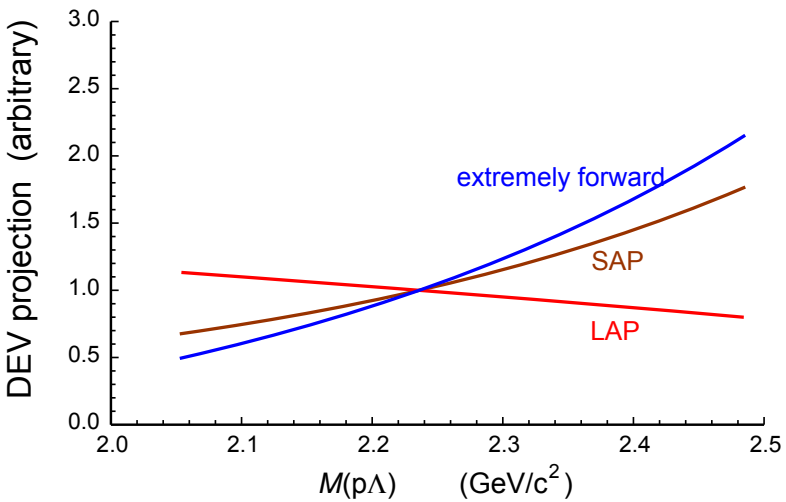












Broad peak with M=2267MeV/c^2 and Γ=118 MeV is shown

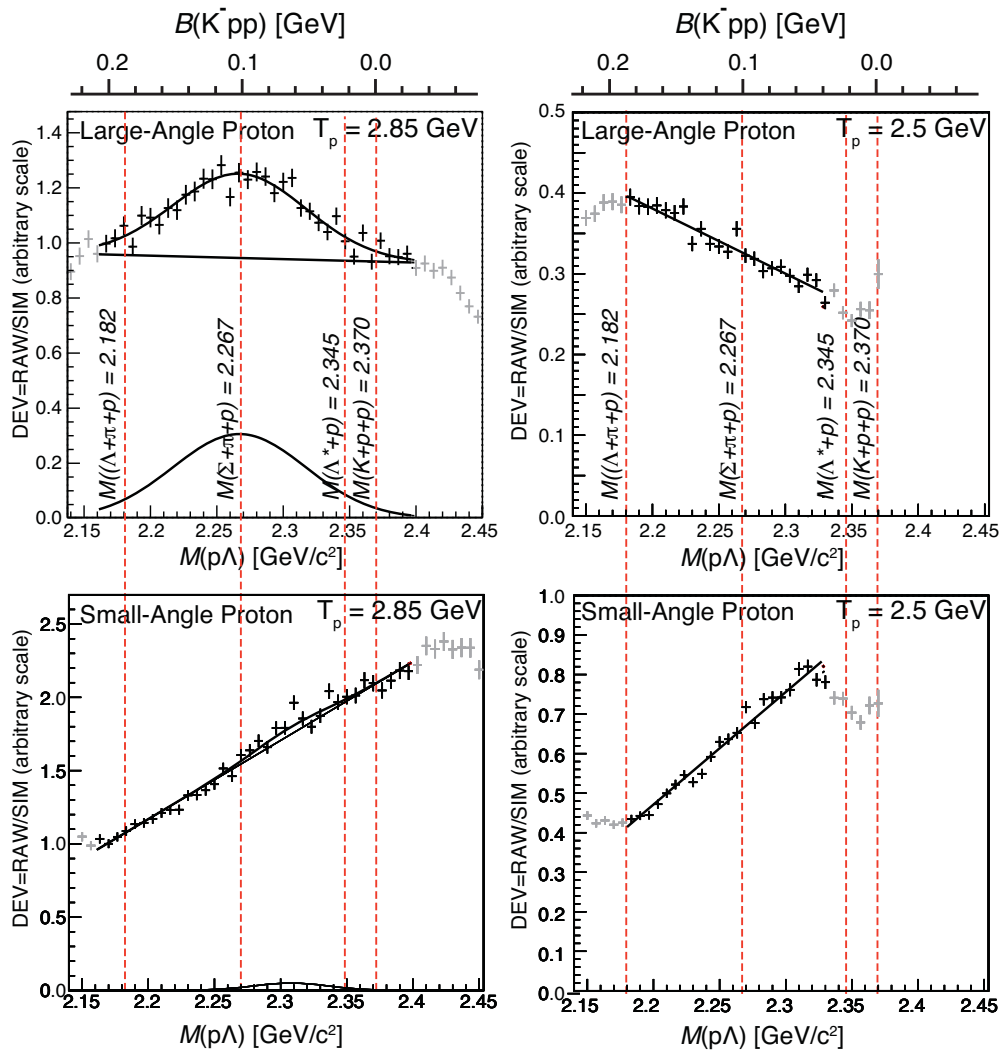
Y. Akaishi and T. Yamazaki, unpublished (2010)

2.5 GeV Data

2.5 GeV Data

2.5 GeV	125k
2.85 GeV	177k

DISTO Data@2.5GeV

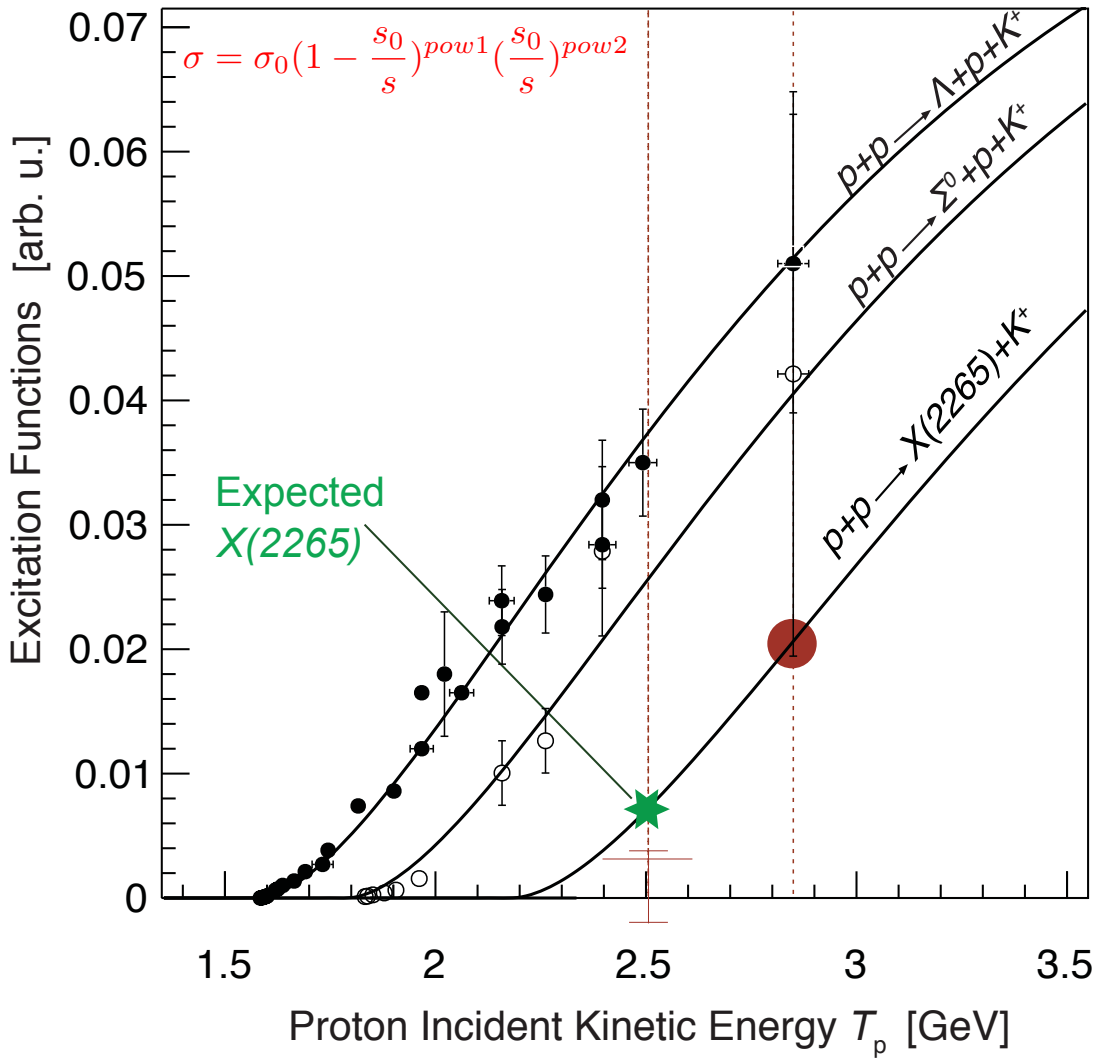


What could this imply?

to be seen or not to be seen?

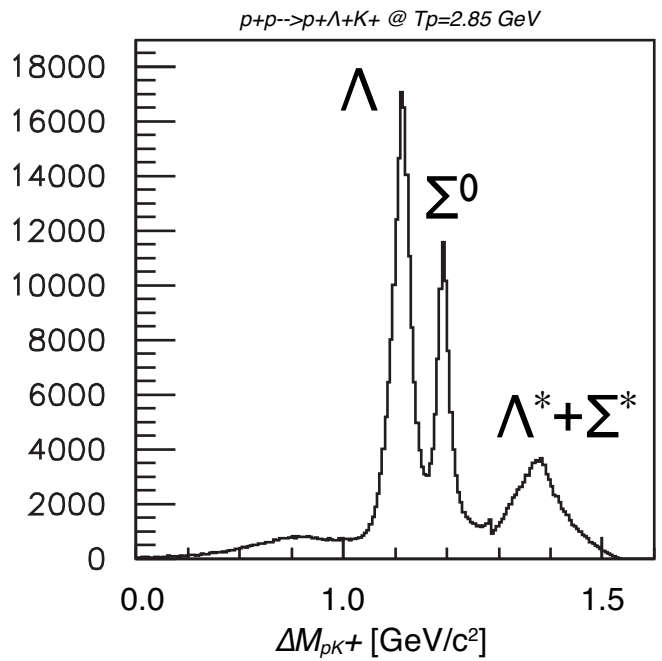
Cross section

Observation of X(2265) pushed down the expected production threshold of K^-pp



½ - ⅓ of X(2265) production comp. 2.85 GeV expected

$p+p \rightarrow p+K^{+}+X(\Lambda, \Sigma, \Lambda^{*}, \Sigma^{0}, ..)$



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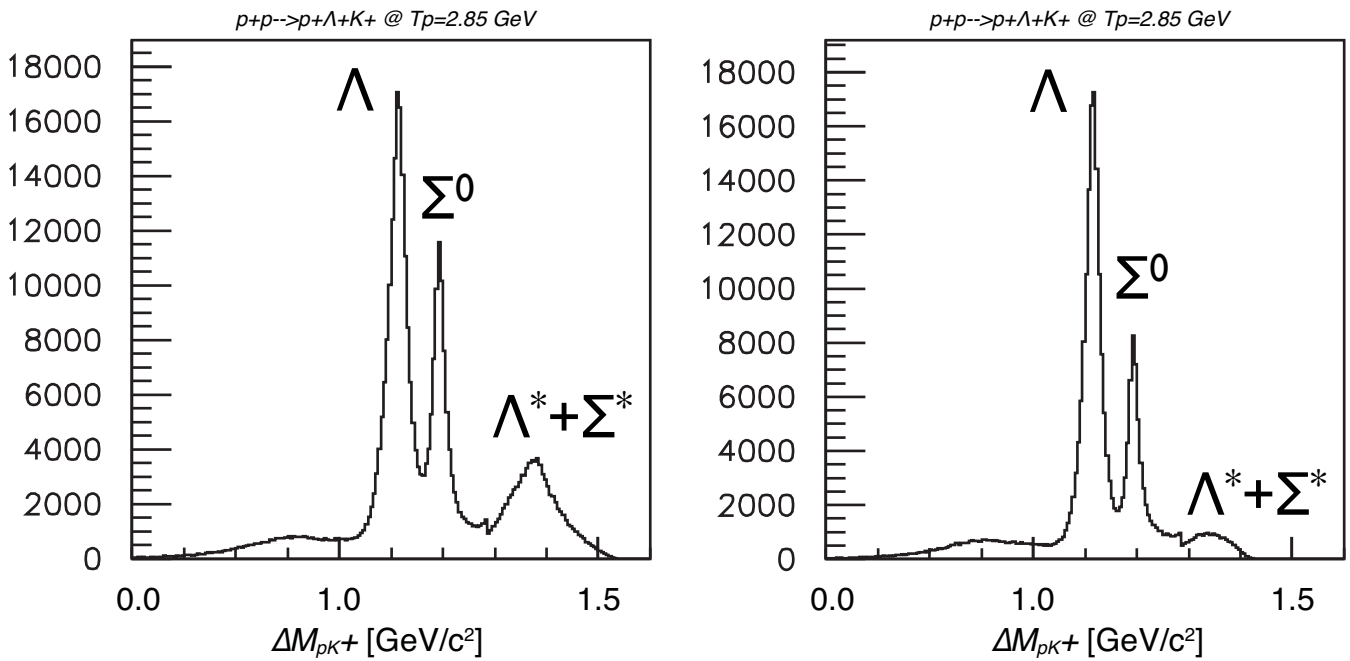
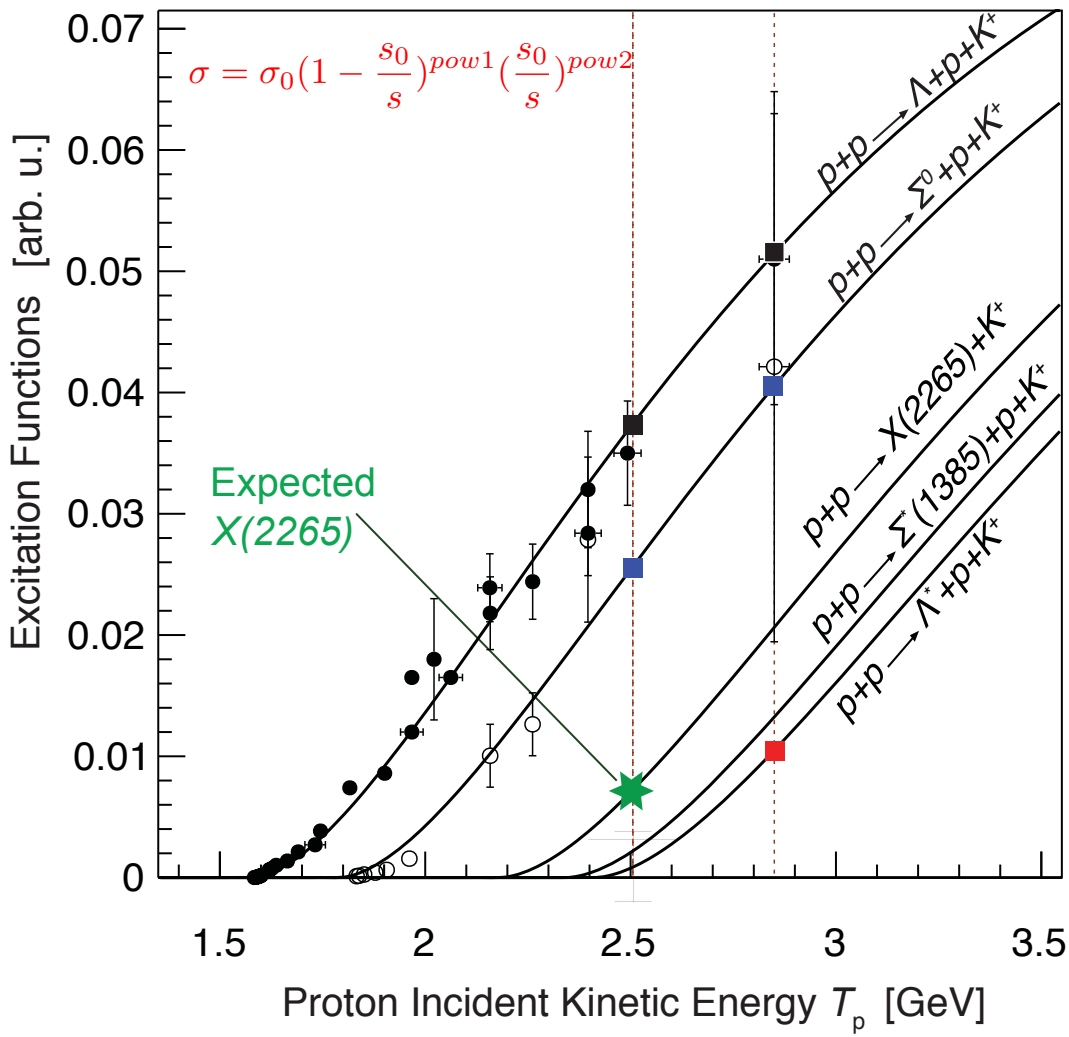


$pp \rightarrow p\Lambda K^+$ data

$$R_X^{\text{obs}} = \frac{\sigma_X(2.50)}{\sigma_X(2.85)} = \frac{Y_X(2.50)}{Y_X(2.85)} \times \frac{\sigma_{p\Lambda K}(2.50)}{\sigma_{p\Lambda K}(2.85)} \qquad R_X^{\text{expected}} = \frac{\sigma_X(2.50)}{\sigma_X(2.85)} \approx 0.5.$$

$= 0.011 \pm 0.106$



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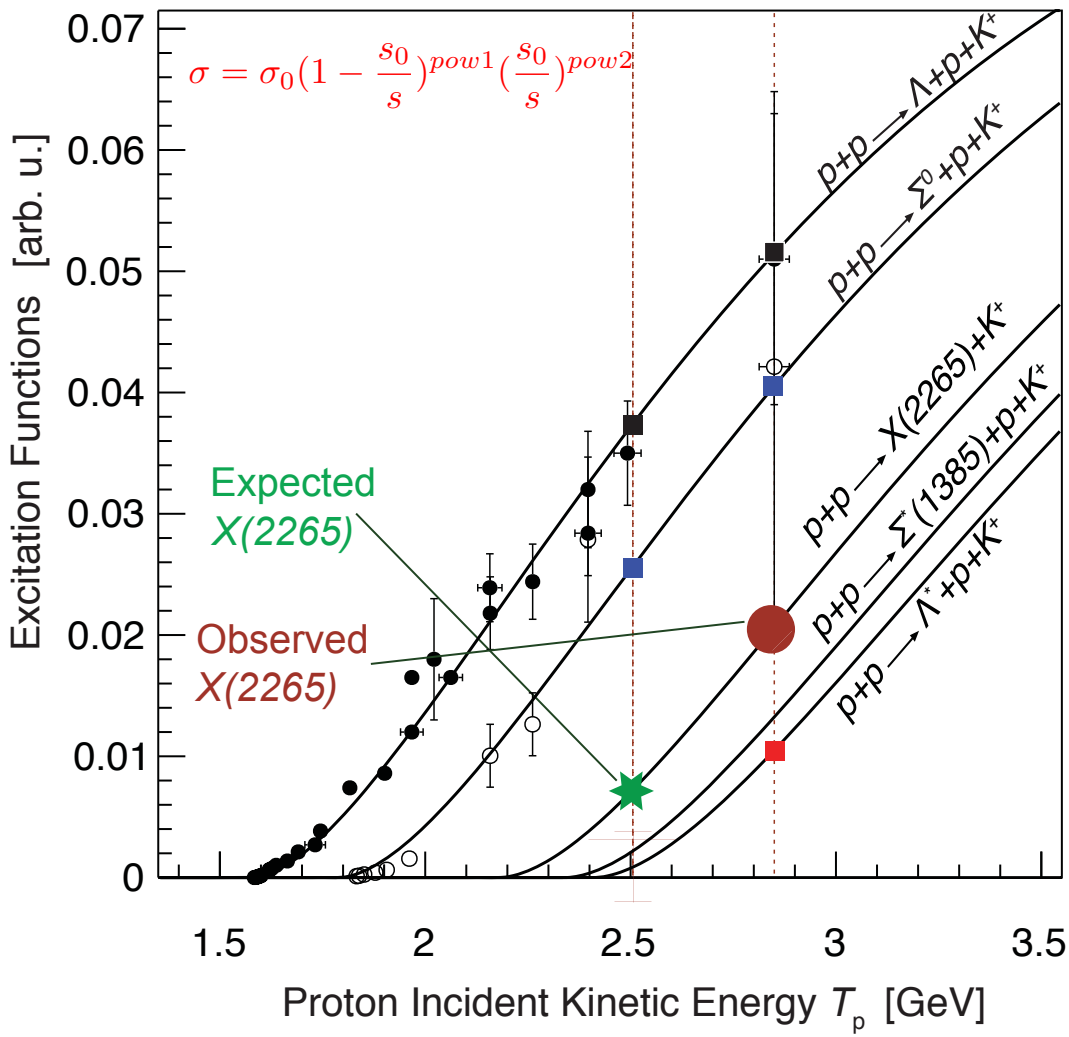

$pp \to p\Lambda K^+$ data

$$R_X^{\text{obs}} = \frac{\sigma_X(2.50)}{\sigma_X(2.85)} = \frac{Y_X(2.50)}{Y_X(2.85)} \times \frac{\sigma_{p\Lambda K}(2.50)}{\sigma_{p\Lambda K}(2.85)} \qquad R_X^{\text{expected}} = \frac{\sigma_X(2.50)}{\sigma_X(2.85)} \approx 0.5.$$

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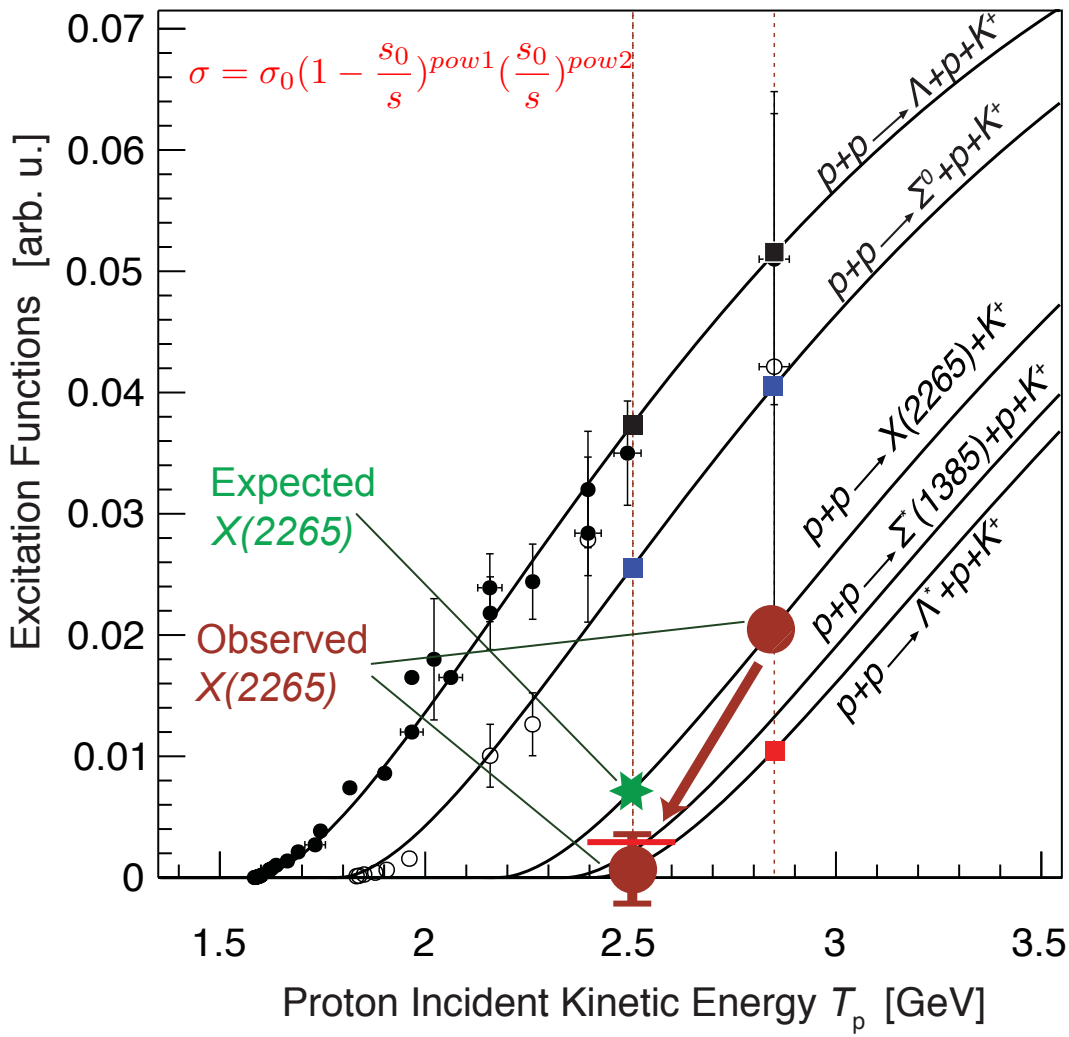
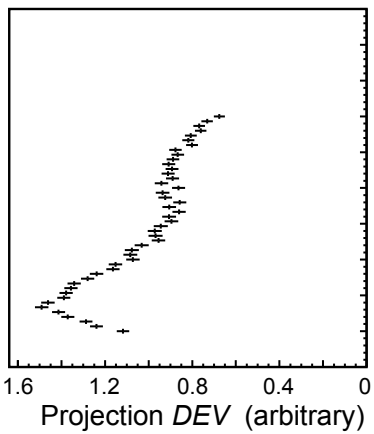
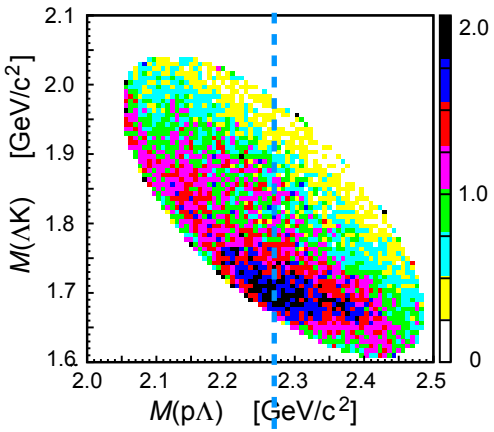


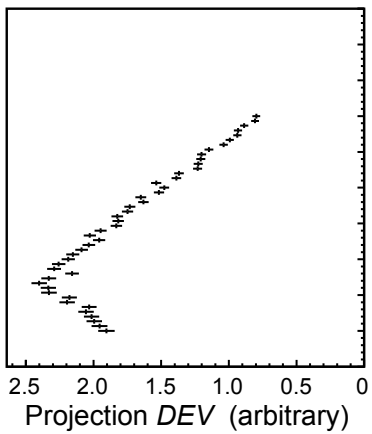
$pp \to p\Lambda K^+$ Dalitz plot, projection @2.85GeV

$\to p+(K^++\Lambda\equiv N^*) \to p+K^++\Lambda$

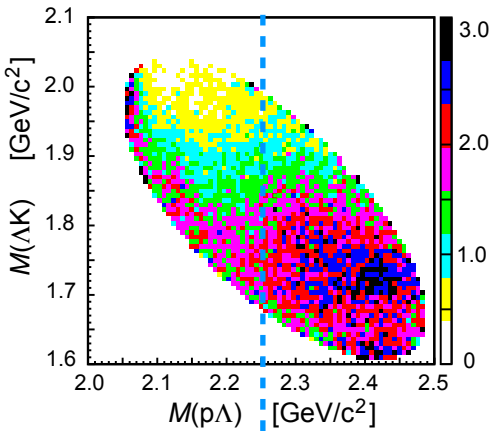
X(2265)

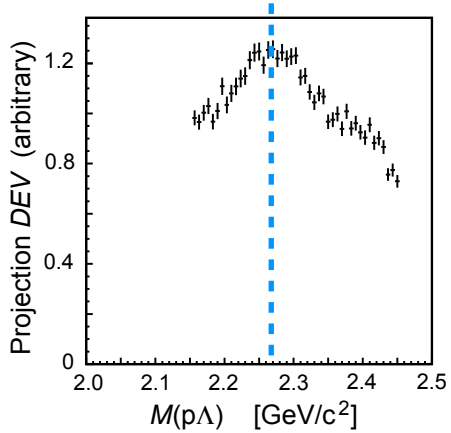


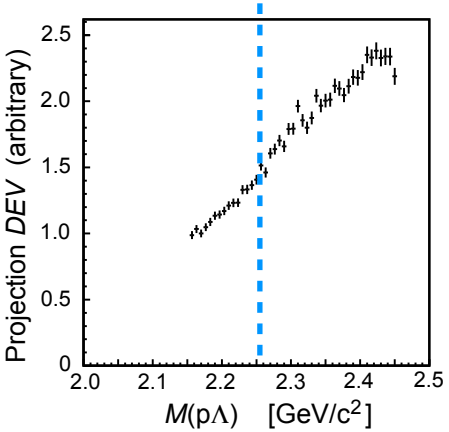




X(2265)



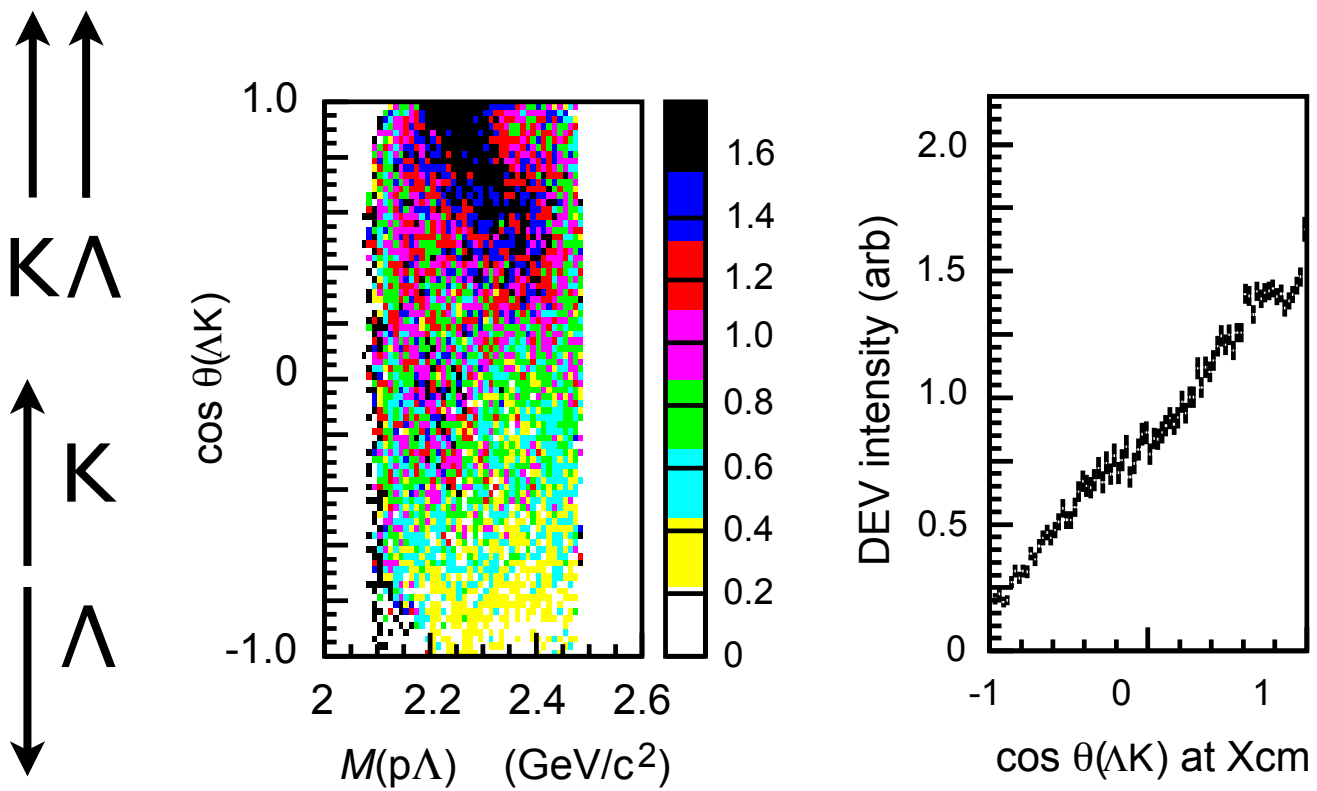




$\to K^+ + X \to K^+ + p + \Lambda$

FSI between K^+ and Λ?

Angular correlation of K^+ and Λ

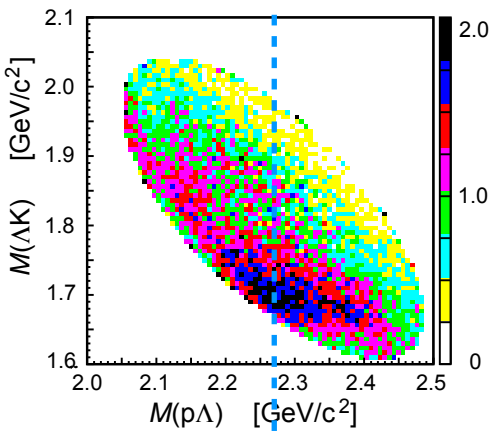


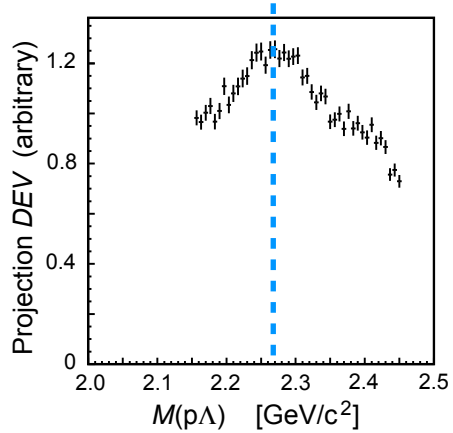
$\cos\vartheta(\Lambda\text{-}K^+)\sim 1$ associated with X(2267) production

Λ and K^+preferentially emitted to same direction

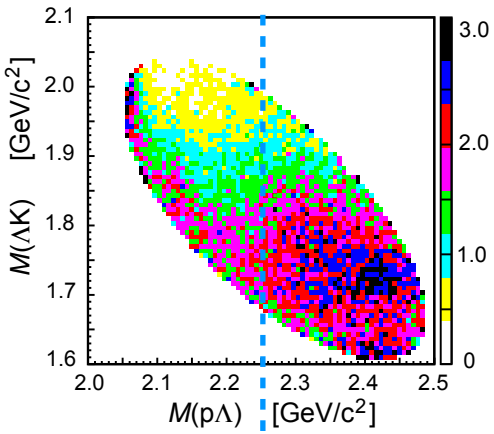
$pp \rightarrow p\Lambda K^+$ Dalitz plot, projection @2.85GeV

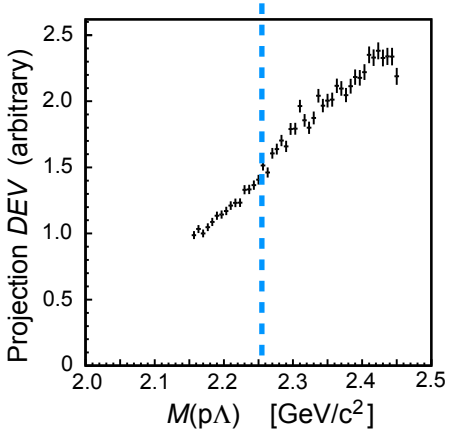
X(2265)





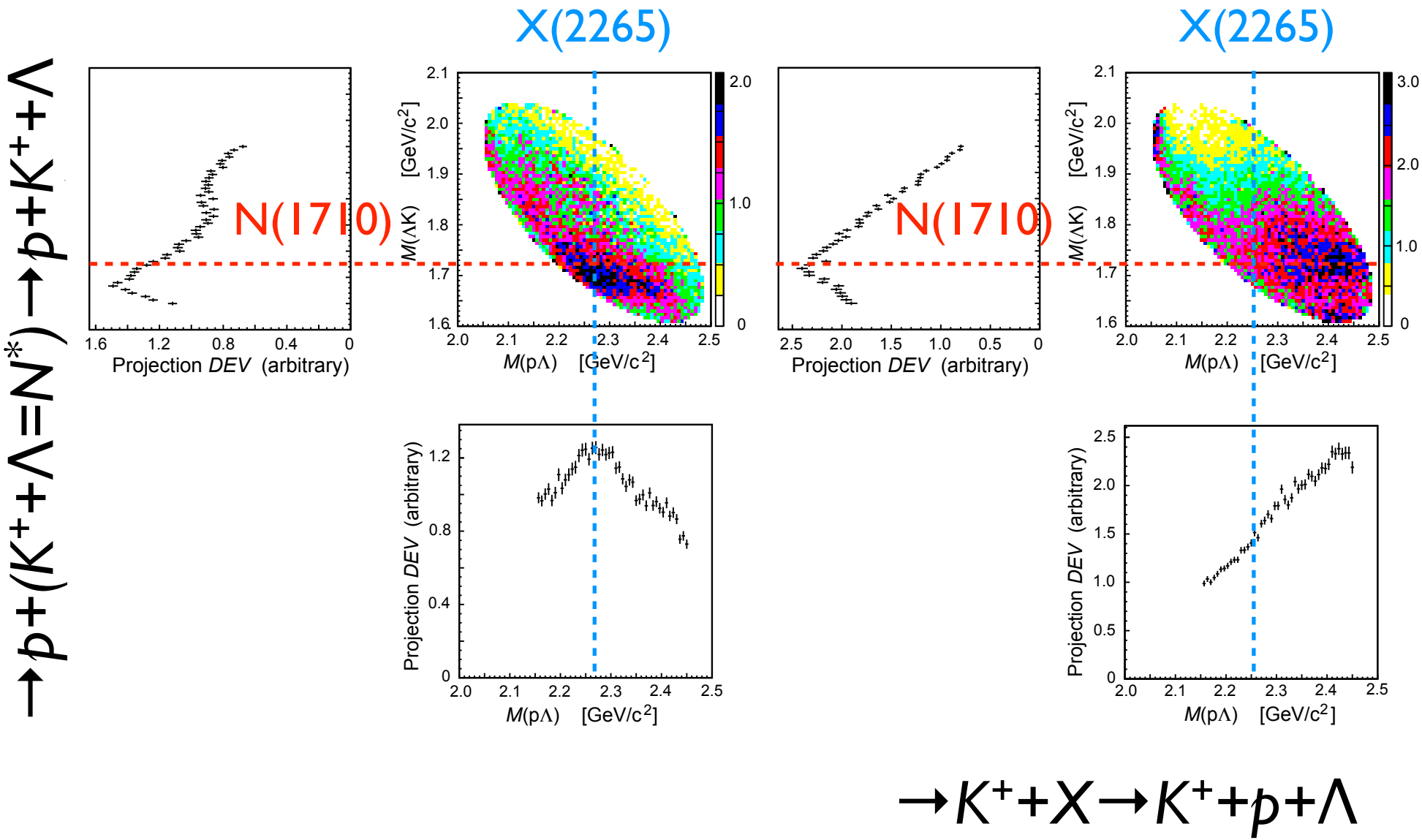
X(2265)





$\rightarrow K^+ + X \rightarrow K^+ + p + \Lambda$

$pp \to p\Lambda K^+$ Dalitz plot, projection @2.85GeV



Conclusion

- *DISTO result of X(2265) first reported@EXA08 (2.85 GeV) => PRL104(2010)132502.*
- *No X(2265) at 2.5 GeV data where Λ* has no cross section. That's consistent with a picture that Λ* plays an important role for a formation of the deeply bound kaonic state*
- *2.85 GeV data being studied more carefully.*
  - *Attractive FSI of ΛK^+*
  - *N* (1710) resonance?*