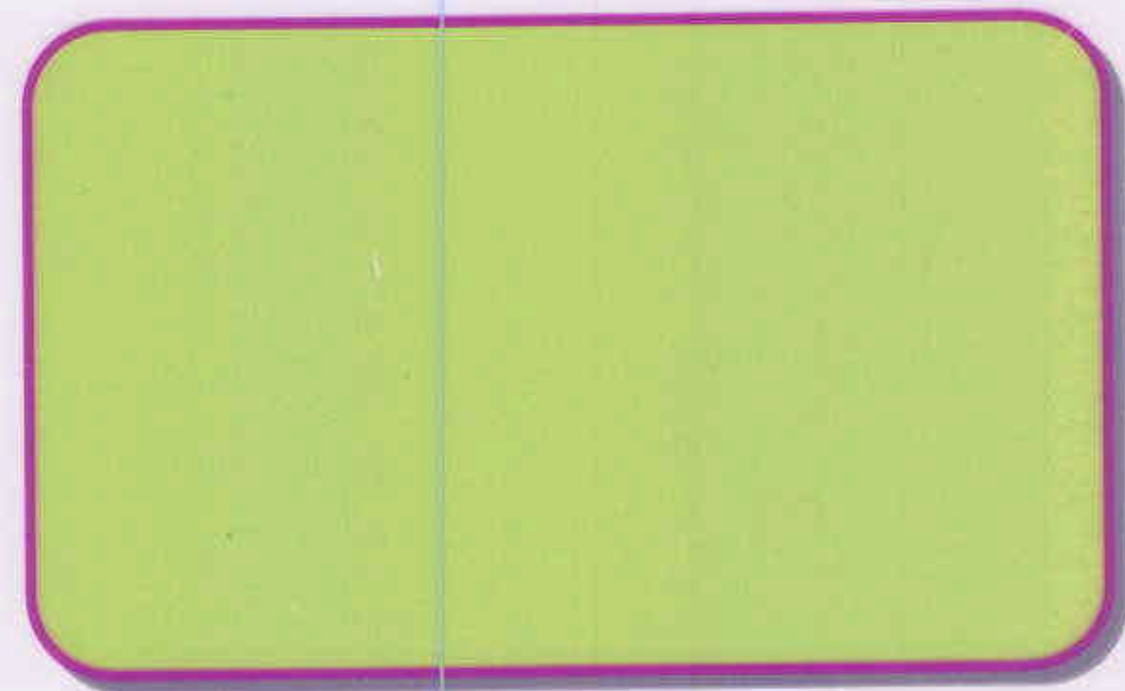




ICHEP2000
Osaka, jul. 27-aug. 2, 2000



PHOTOPRODUCTION OF CHARM BARYONS AT THE TEVATRON IN FOCUS



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★ $\Sigma_c^{+,0}$ ISOSPIN MASS SPLITTING
PRELIMINARY " WIDTHS

★ Σ_c^* STATES

★ { SOME Λ_c^+ DECAY CHANNELS
SOME $\Xi_c^{+,0}$ DECAY CHANNELS

➔ FIRST $\Xi_c^+ \rightarrow \Omega^- K^+ \pi^+$



ISOSPIN DEGENERACY

The unequal quark masses make particle masses in the same isospin multiplet different



Particles **PDG'98** Mass difference (MeV/c²)

n - p 1.293318 ± 0.000009

Δ⁰ - Δ⁺⁺ 2.6 ± 0.4

Σ⁻ - Σ⁺ 8.08 ± 0.08

Ξ⁻ - Ξ⁰ 6.4 ± 0.6

Σ⁰c - Σ⁺⁺c -0.57 ± 0.23

Σ⁰c - Σ⁺c -1.4 ± 0.6

Ξ⁰c - Ξ⁺c 4.7 ± 2.1

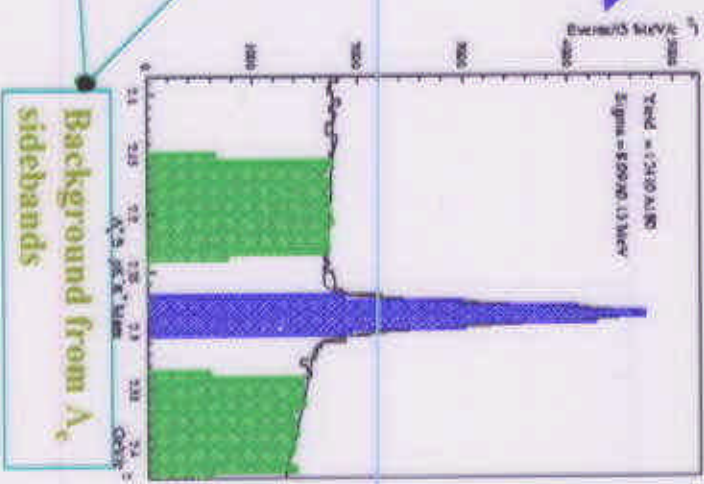
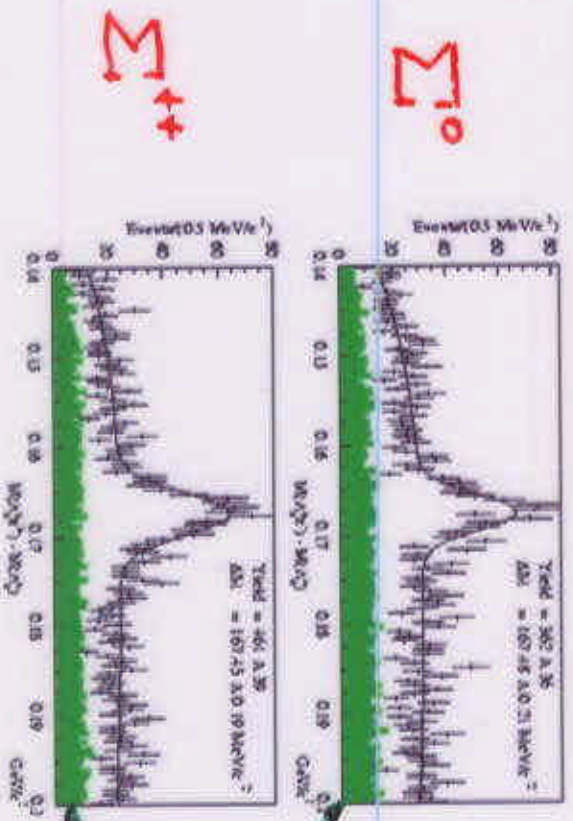
Recent measurements suggest: $M[cud] > M[euu] > M[edd]$



Σ_c isospin mass splitting

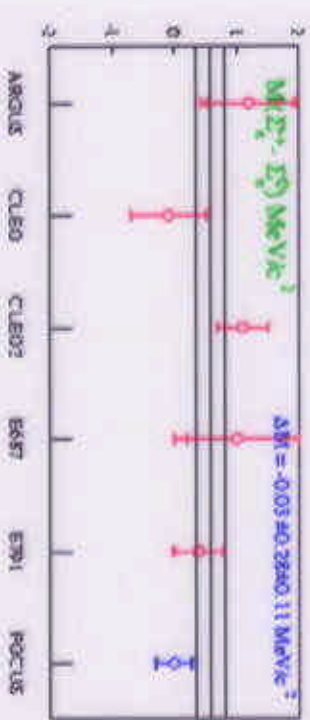
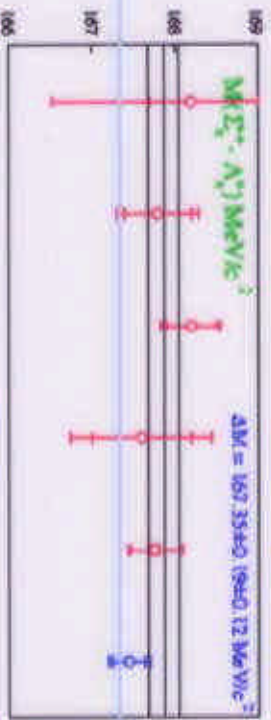
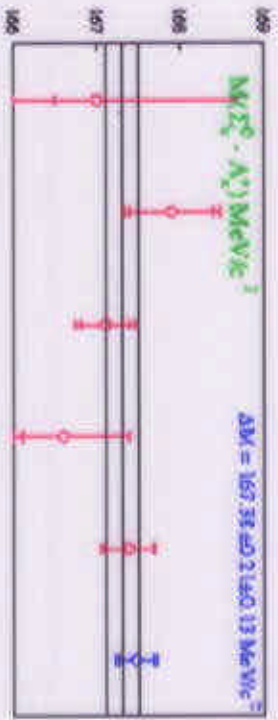
• Decay chain: $\Sigma_c^{++0} \rightarrow \Lambda_c^+ \pi^+$

• Used only a clean $\Lambda_c^+ \rightarrow pK\pi^+$





Final results



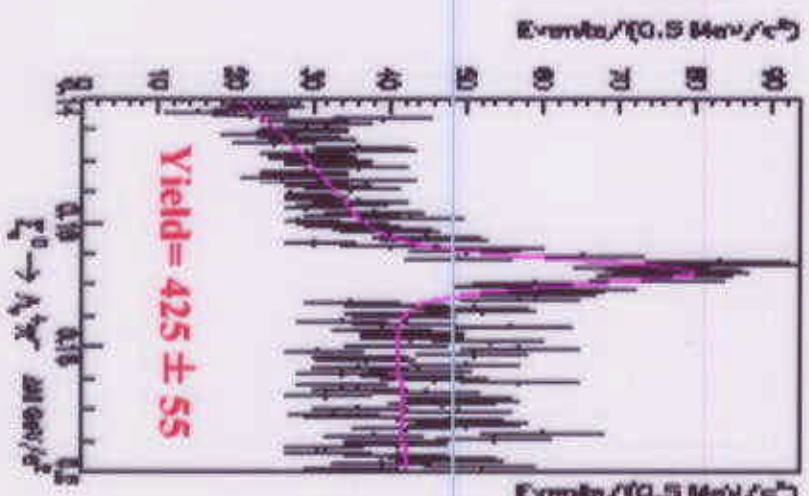
$$\Delta M (M_{\Sigma_c} - M_{\Lambda_c^+})$$

FOCUS **PDG**

- $\Delta M(\Sigma_c^0) = 167.38 \pm .21 \pm .13$
- $\Delta M(\Sigma_c^+) = 167.31 \pm .21$
- $\Delta M(\Sigma_c^{++}) = 167.35 \pm .19 \pm .12$
- $\Delta M(\Sigma_c^{++}) = 167.87 \pm .20$
- $\Delta M(\Sigma_c^{++} - \Sigma_c^0) = -0.03 \pm .28 \pm .11$
- $\Delta M(\Sigma_c^{++} - \Sigma_c^0) = 0.66 \pm .28$



$\Sigma_c^{++}, 0$
Widths



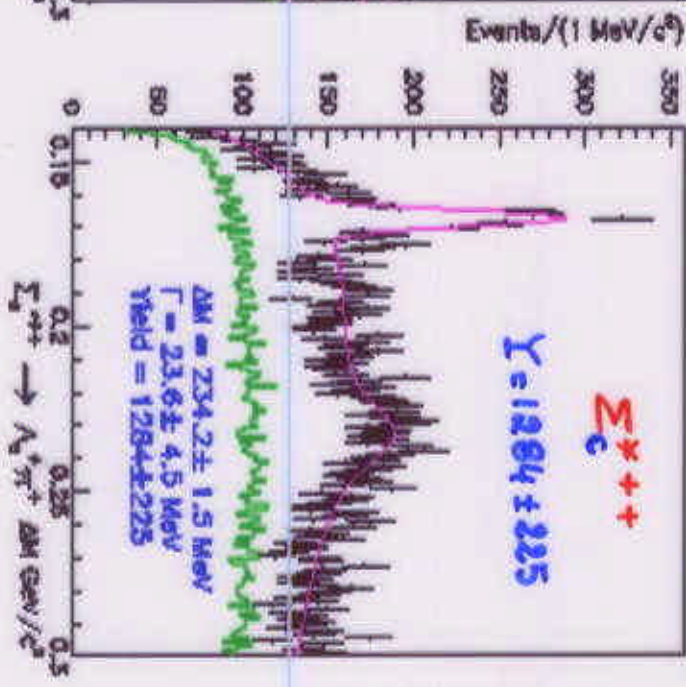
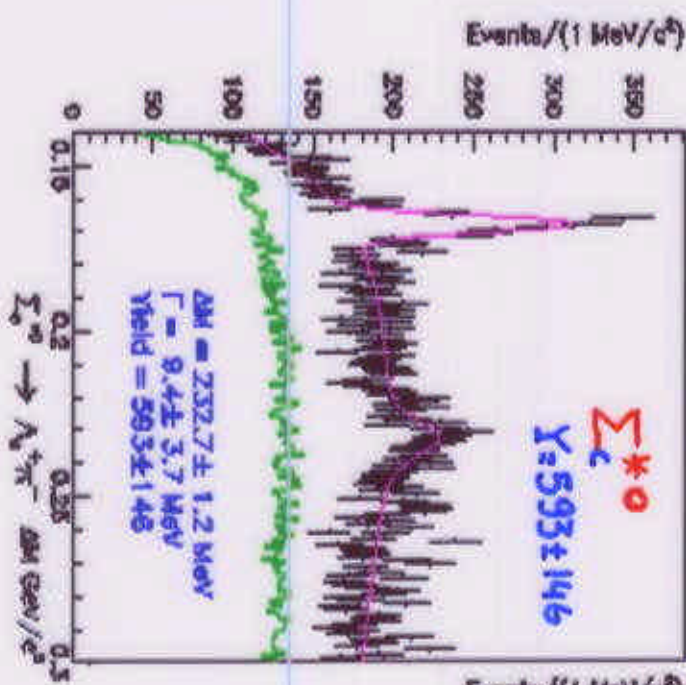
very preliminary

$\Gamma(\Sigma_c^0) = 2.68 \pm .79 \text{ MeV}$
 $\Gamma(\Sigma_c^{++}) = 2.63 \pm .77 \text{ MeV}$
 exp. resolution $\approx 1.5 \text{ MeV}$

consistent with CLEOII
 recent results



Σ_c excited states





Σ_c excited states



E(831) preliminary

Σ_c^{*0} :	$\Delta M = 232.7 \pm 1.2 \text{ MeV}$	593 eV
Σ_c^{*++} :	$\Delta M = 234.2 \pm 1.5 \text{ MeV}$	1284 eV

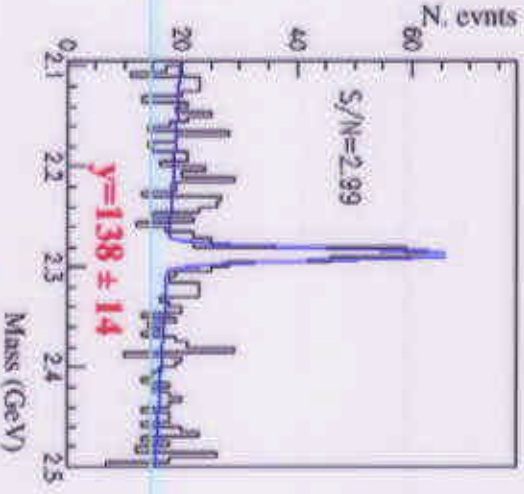
Well compatible with CLEO values reported in PDBook

CLEO

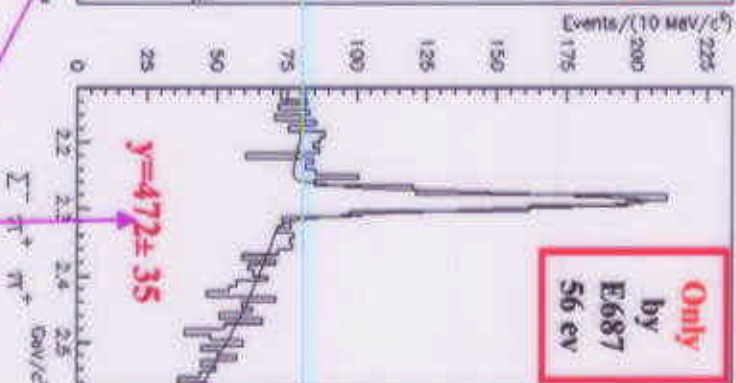
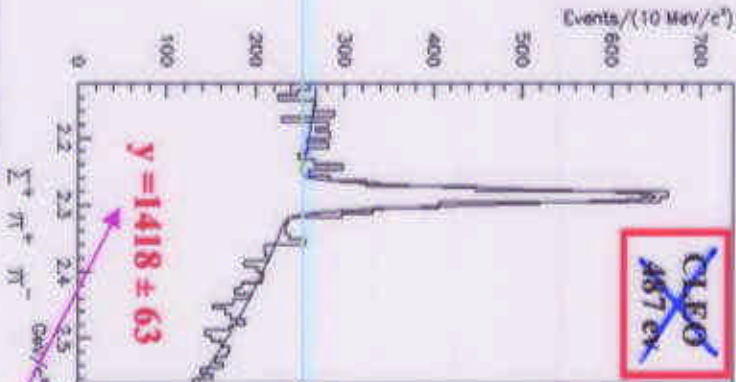
Σ_c^{*0} :	$\Delta M = 232.6 \pm 1.0 \pm 0.8 \text{ MeV}$	504 eV
Σ_c^{*++} :	$\Delta M = 234.5 \pm 1.1 \pm 0.8 \text{ MeV}$	677 eV



other Λ_c^+ decays channels



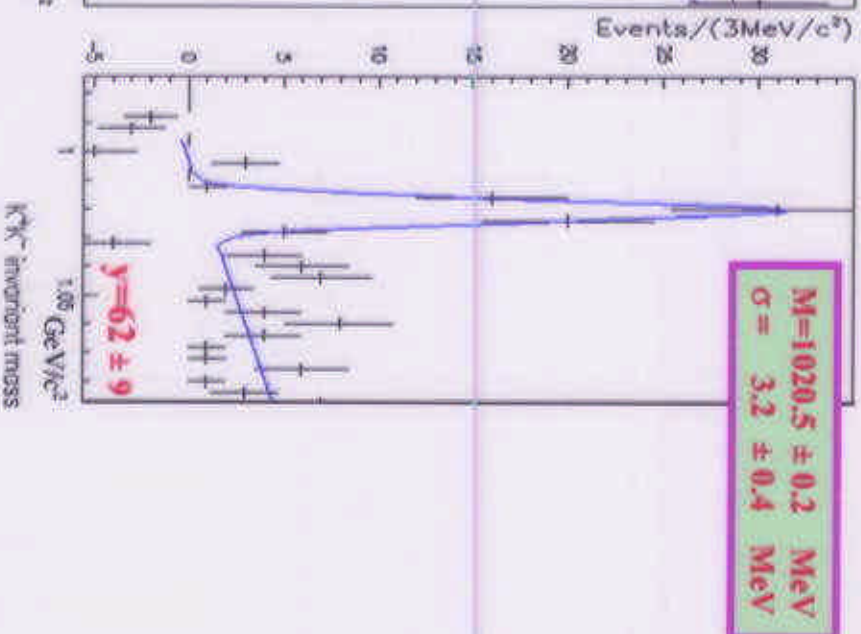
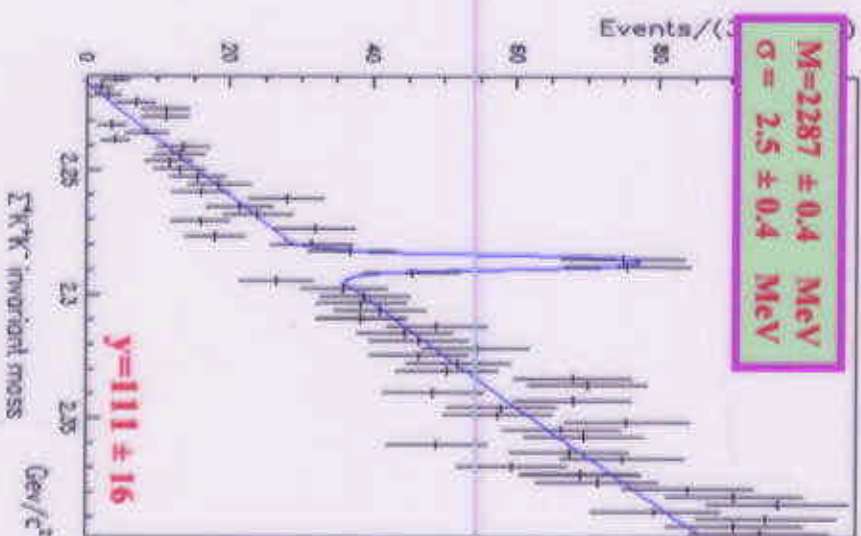
$\Lambda_c^+ \rightarrow \Sigma^- K^+ \pi^+$



More channels under study:

$p\pi^+\pi^-$, pK^+K^- , pK_s^0 , $\Sigma^+ K^+K^-$, $\Lambda^0\pi^+$,

FOCUS



$$R = \frac{N(\Sigma^+ \Phi^0)}{N(\Sigma^+ K^+ K^-)}$$

$R \approx 0.56 \pm 0.11$
 preliminary
 no eff. Corr.



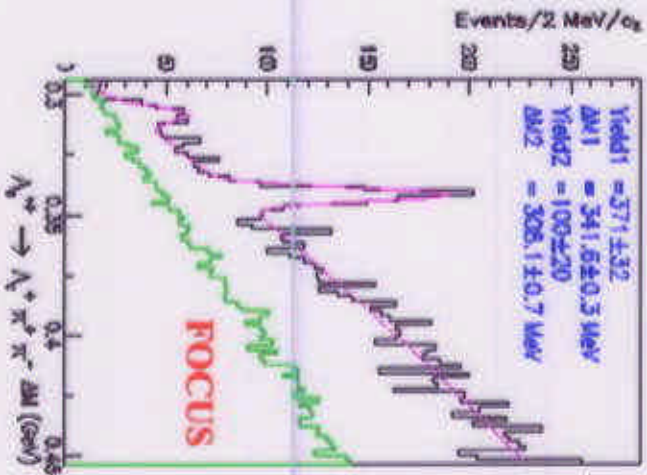


Λ_c^+ excited states

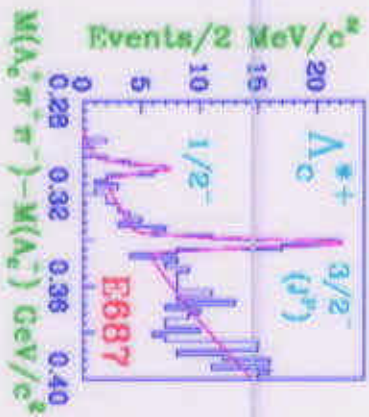


$\Lambda_c^{*+}(2625)$, $\Lambda_c^{*+}(2593)$

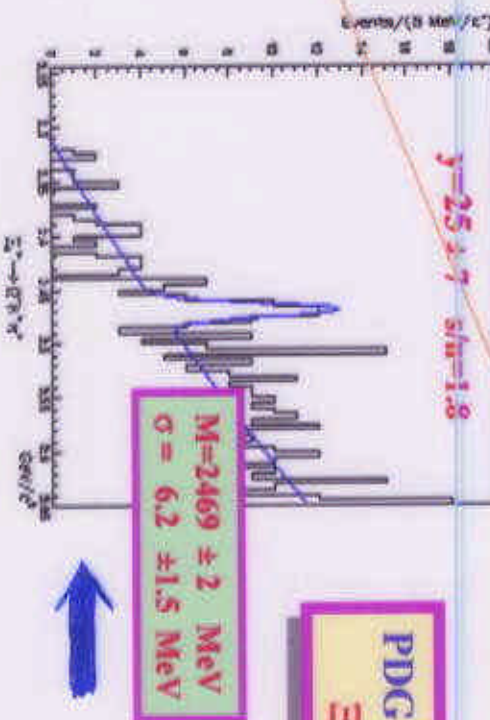
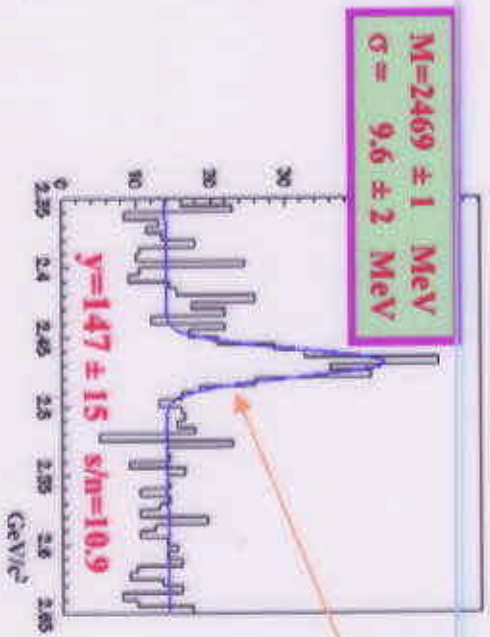
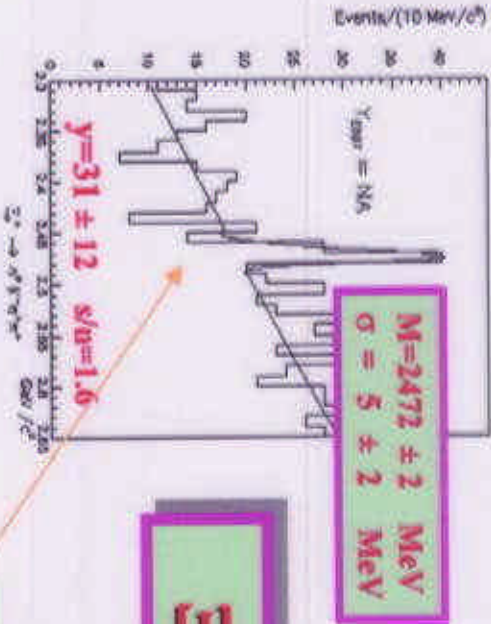
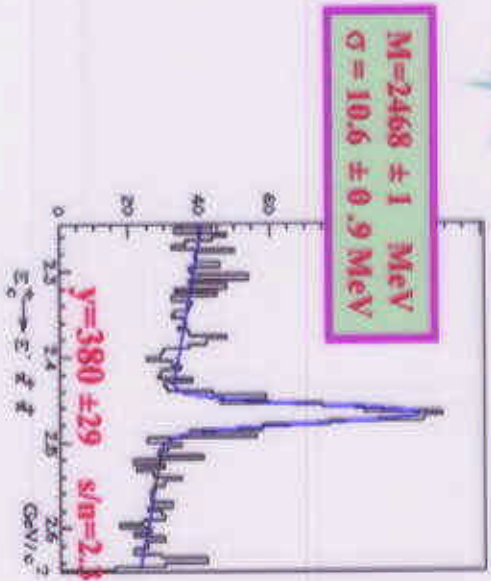
- Exp. results from ARGUS, CLEO, E687



$\Delta M(\Lambda_c^{*+} - \Lambda_c^+)$



- Σ_c resonant components for $\Lambda_c^{*+}(3/2^-)$ state via D wave for $\Lambda_c^{*+}(1/2^-)$ state via S wave



Ξ_c^+ samples

still partial samples

PDG av. mass error:
 Ξ_c^+ : 1.4 MeV

NEW

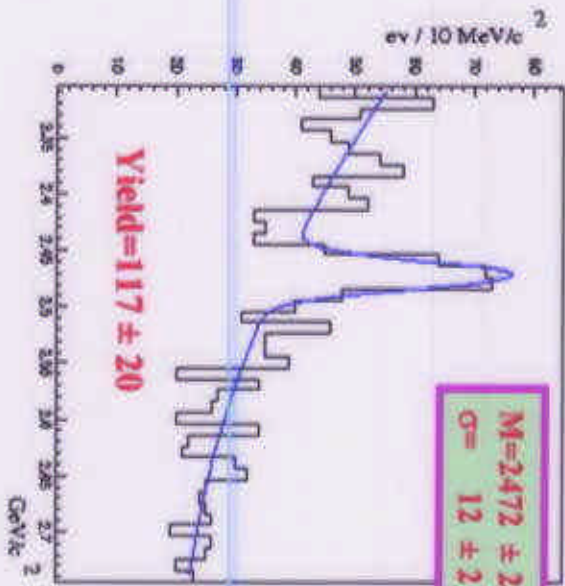




Ξ_c^0 samples



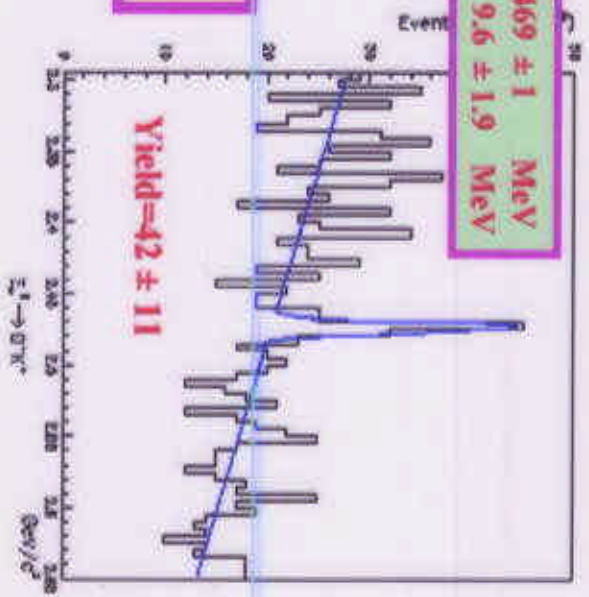
$$\Xi_c^0 \rightarrow \Xi^- \pi^+$$



$M=2472 \pm 2$ MeV
 $\sigma=12 \pm 2$ MeV

PDG av. mass error:
 Ξ_c^0 : 1.8 MeV

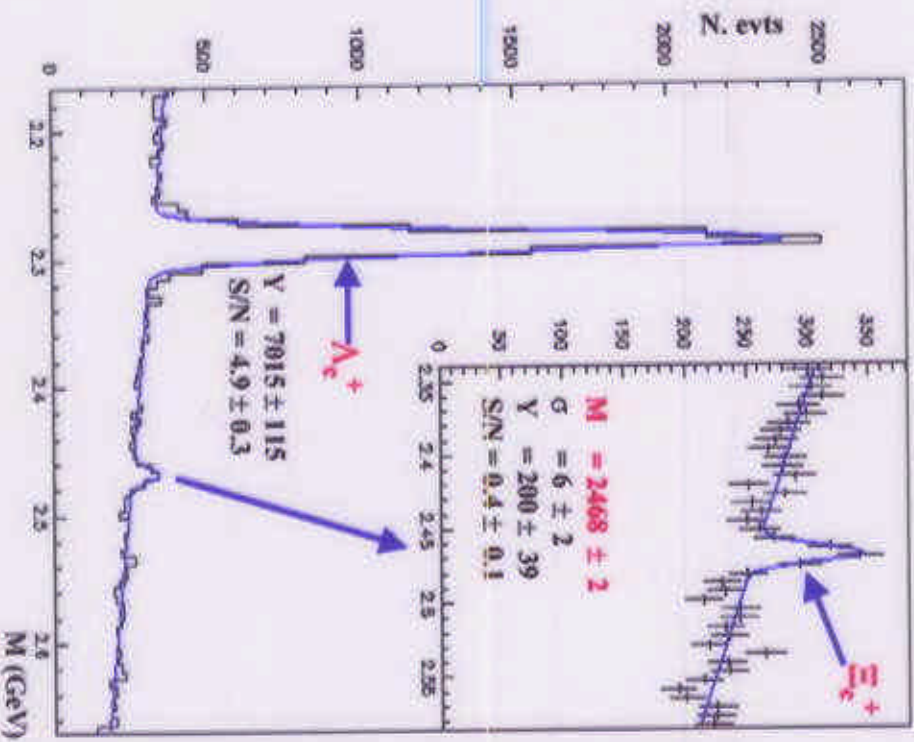
$$\Xi_c^0 \rightarrow \Omega^- K^+$$



$M=2469 \pm 1$ MeV
 $\sigma=9.6 \pm 1.9$ MeV



Cabibbo sup. $\Xi_c^+ \rightarrow p K^- \pi^+$



preliminary

$$\text{B.R.} = \frac{\Xi_c^+ \rightarrow p K^- \pi^+}{\Xi_c^+ \rightarrow \Xi^- \pi^+ \pi^+} = 0.13 \pm 0.03 \pm 0.02$$

First reported by Selex
 $(0.20 \pm 0.04 \pm 0.02)$

Full sample
 Tight selection on p and K
 New BR measurement in progress



Conclusions



- The charmed Σ particles are isospin degenerate at a high level;
- **Masses and widths of charmed baryon states are being consistently measured; observations of CS states are in progress;**
- **Improved lifetime measurements are close. (NOT SHOWN)**
- **Hadron spectroscopy in the charm baryon sector is getting started: **Precise and new measurements** are ready to come.**