D and D_s Decays and Dalitz Analyses

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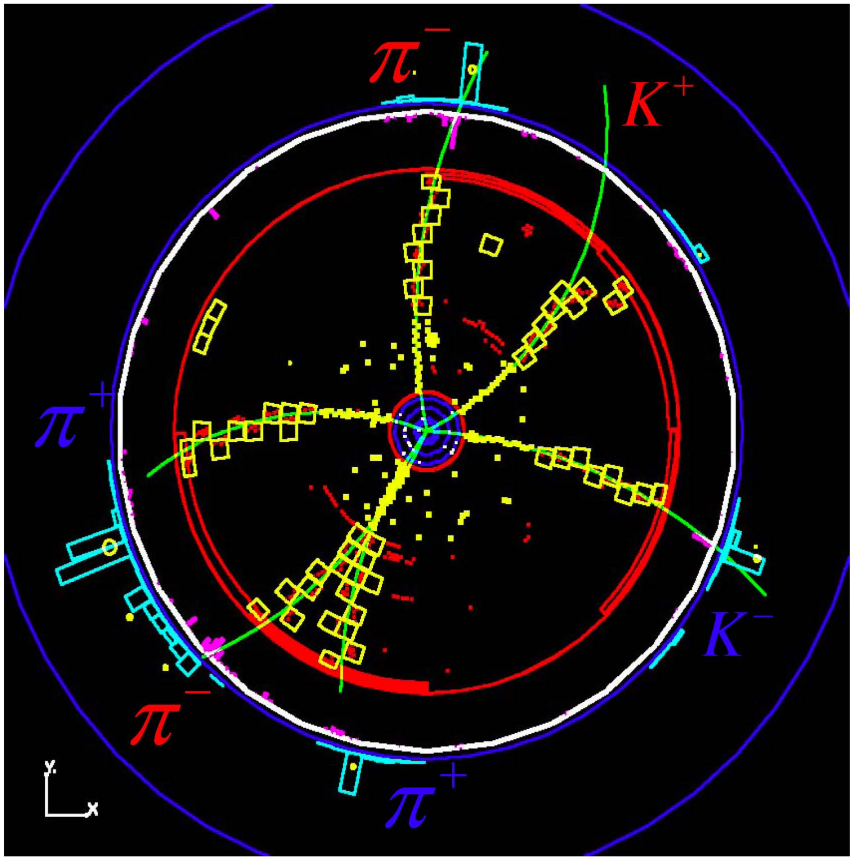
- Absolute D^0 and D^+ Branching Fractions
- Cabibbo Suppressed D^0 and D^+ Decays
- Doubly Cabibbo Suppressed D^0 and D^+ Decays
- Absolute D_s Branching Fractions
- Inclusive D^0, D^+, and D_s decays to $s\bar{s}$
- Dalitz Analyses
- Summary and Conclusions

Heavy Quarks and Leptons 2006
München October 18, 2006

$e^+e^- \to \psi(3770) \to D\bar{D}$ Events and Analyses

$e^+e^- \to \psi(3770) \to D^+D^-$

$D^+ \to K^-\pi^+\pi^+$ and $D^- \to K^+\pi^-\pi^-$



- CLEO-c uses D^+ and D^0 decays from $e^+e^- \to \psi(3770) \to D^+D^-$ or $D^0\bar{D}^0$
  - No additional pions produced
  - Extremely clean events
- Leptonic, semileptonic, and key hadronic branching fractions measured with a double tagging technique
  - Other branching fractions measured relative to a reference mode, usually $D^0 \to K^-\pi^+$ or $D^+ \to K^-\pi^+\pi^+$
- Absolute branching fractions for key Cabibbo Favored hadronic modes were published with 56 $\text{pb}^{-1}$of data.
  - Preliminary update with 281 pb^{-1} reported for the first time here
- Some other branching ratios utilizing 281 pb^{-1} already published or submitted for publication

Absolute D^0 and D^+ Hadronic Branching Fractions

Utilize technique pioneered by MARK III

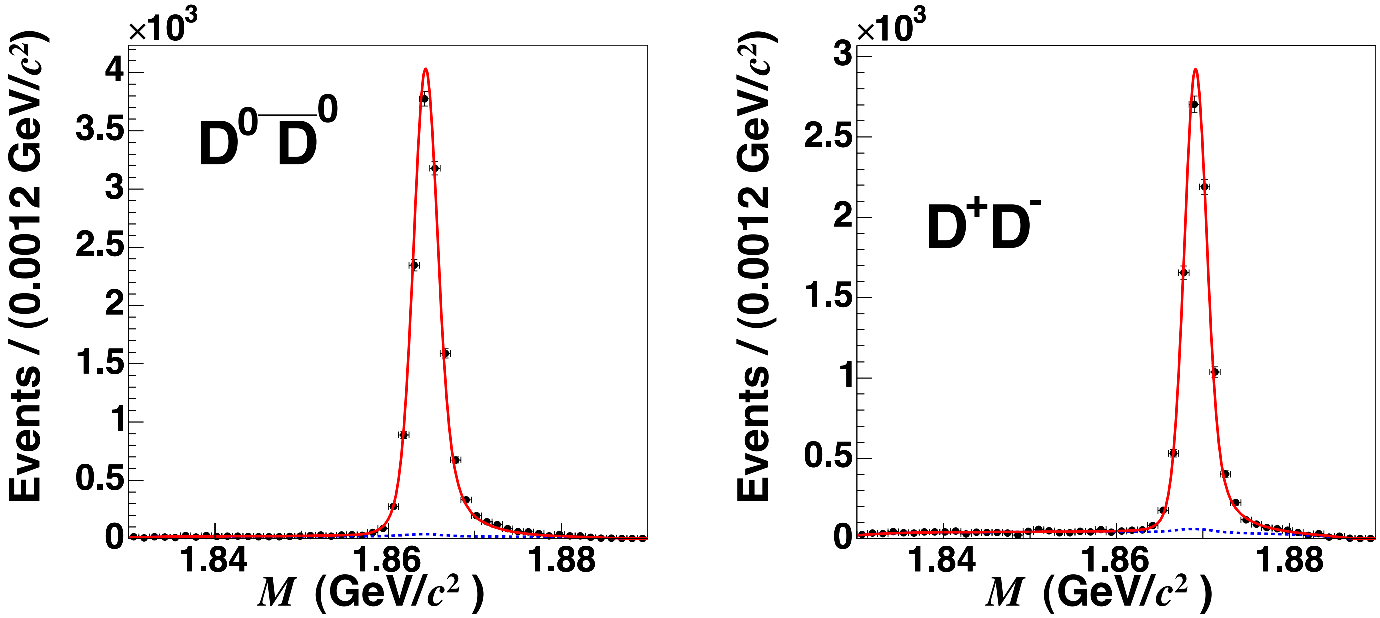
- Single Tag (ST) Yields $D \to i$ and $\bar{D} \to X$ $N_i = N_{D\bar{D}}\, \mathcal{B}_i\, \epsilon_i$
- Double Tag (DT) Yields $D \to i$ and $\bar{D} \to \bar{j}$ $N_{i\bar{j}} = N_{D\bar{D}}\, \mathcal{B}_i\, \mathcal{B}_{\bar{j}}\, \epsilon_{i\bar{j}}$
  - Obtain ST and DT yields from fits to beam constrained mass distributions
  - Compute branching fractions and $N_{D\bar{D}}$

    $$\mathcal{B}_i = \frac{N_{i\bar{j}}}{N_{\bar{j}}}\,\frac{\epsilon_{\bar{j}}}{\epsilon_{i\bar{j}}} \quad \text{and} \quad N_{D\bar{D}} = \frac{N_i N_{\bar{j}}}{N_{i\bar{j}}}\,\frac{\epsilon_{i\bar{j}}}{\epsilon_i \epsilon_{\bar{j}}}$$

  - Do a χ^2 fit including all yields and all errors – correlated and uncorrelated.

Yields from 281 pb^{-1}

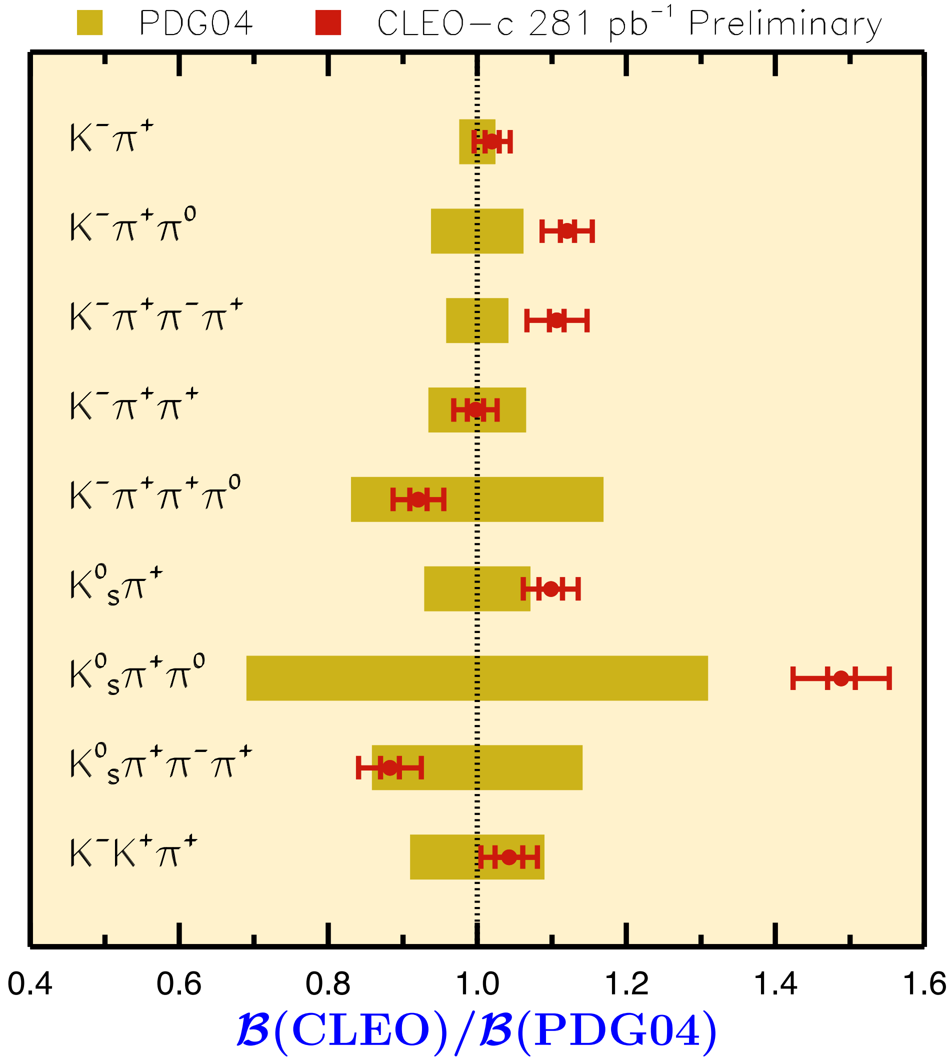
- ST all modes: 230,225 $D^0/\bar{D}^0$ 167,086 D^+/D^-
- DT all modes: $13,575 \pm 120$ $D^0\bar{D}^0$ $8,867 \pm 97$ D^+D^-



Absolute Hadronic D^0 and D^+ Branching Fractions

CLEO-c 281 pb^{-1} Preliminary

Mode	$\mathcal{B}$ (%)
$D^0 \to K^-\pi^+$	$3.87 \pm 0.04 \pm 0.08$
$D^0 \to K^-\pi^+\pi^0$	$14.6 \pm 0.1 \pm 0.4$
$D^0 \to K^-\pi^+\pi^+\pi^-$	$8.3 \pm 0.1 \pm 0.3$
$D^+ \to K^-\pi^+\pi^+$	$9.2 \pm 0.1 \pm 0.2$
$D^+ \to K^-\pi^+\pi^+\pi^0$	$6.0 \pm 0.1 \pm 0.2$
$D^+ \to K^0_S\pi^+$	$1.55 \pm 0.02 \pm 0.05$
$D^+ \to K^0_S\pi^+\pi^0$	$7.2 \pm 0.1 \pm 0.3$
$D^+ \to K^0_S\pi^+\pi^+\pi^-$	$3.13 \pm 0.05 \pm 0.14$
$D^+ \to K^+K^-\pi^+$	$0.93 \pm 0.02 \pm 0.03$

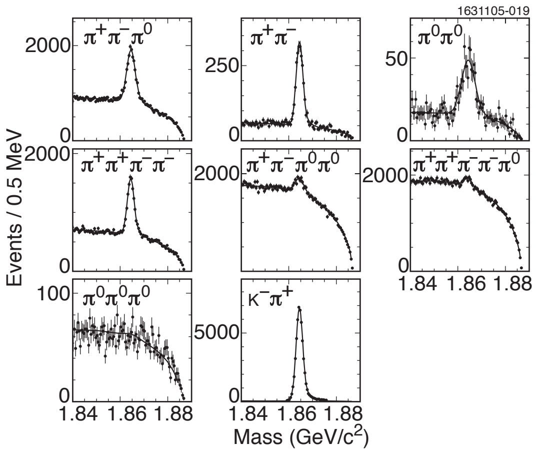


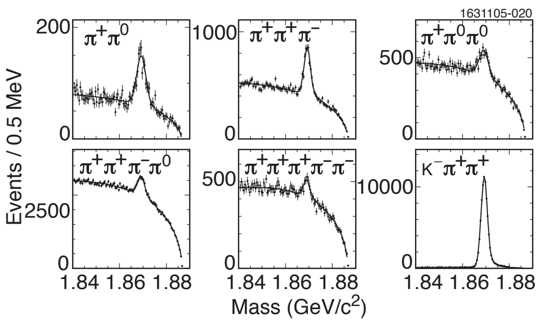
Compare to PDG04 because PDG06 includes CLEO-c 56 pb^{-1} in averages

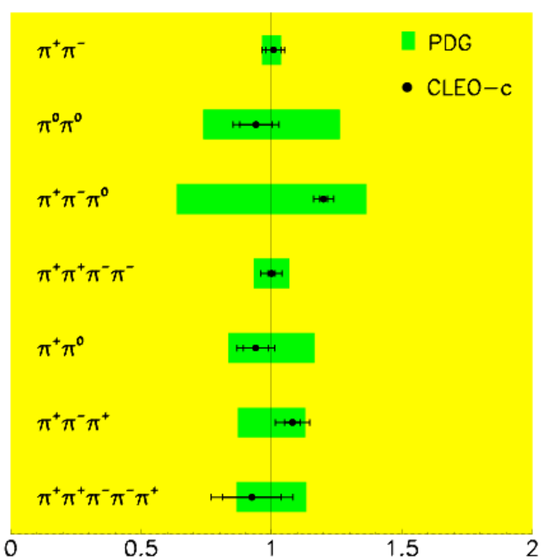
- Systematic errors dominate!
  - Conservative now – little change from 56 pb^{-1} results
  - Expect some improvement
- Final State Radiation included in efficiency MC
  - Without FSR in MC $\mathcal{B}$'s would decrease by $\lesssim 2\%$

2% for $\mathcal{B}(D^0 \to K^-\pi^+)$

Singly-Cabibbo-Suppressed D^0 and D^+ Decays to Pions







CLEO-c 281 pb^{-1}

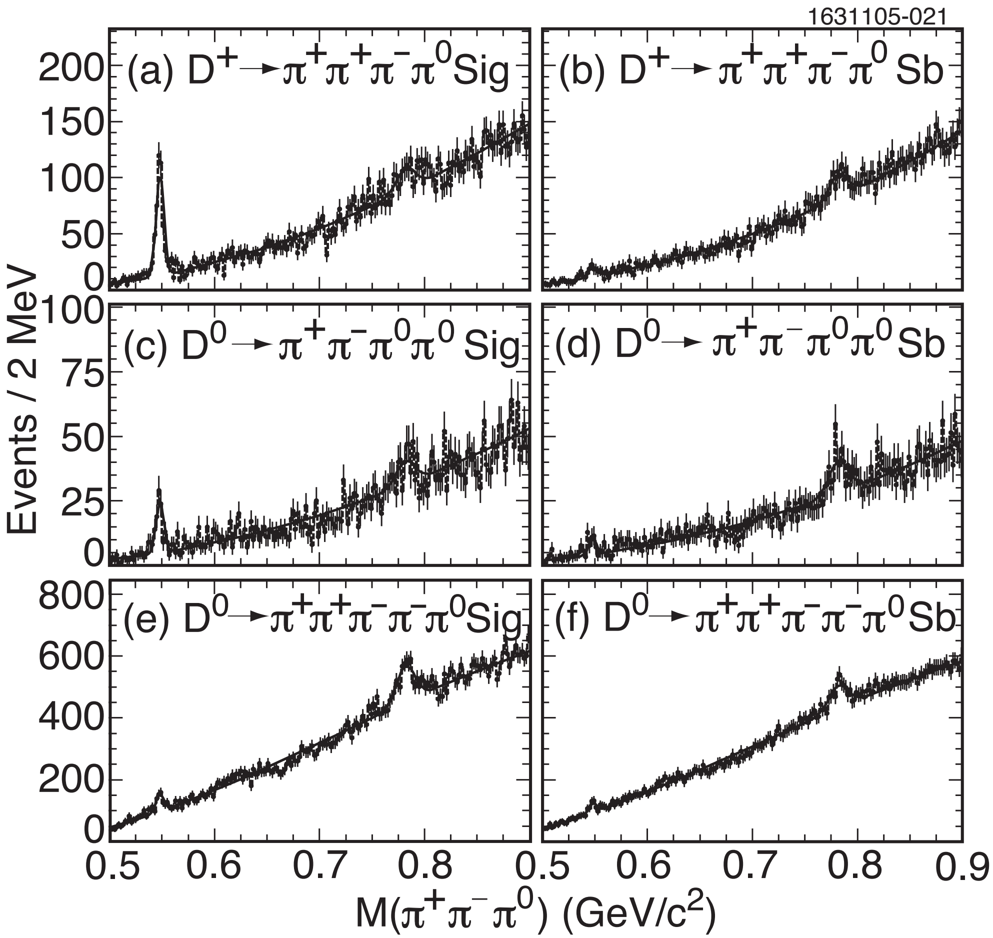
Mode	CLEO-c $\mathcal{B}$ (10^{-3})	PDG04 $\mathcal{B}$ (10^{-3})
$\pi^+\pi^-$	$1.39 \pm 0.04 \pm 0.03$	1.38 ± 0.05
$\pi^0\pi^0$	$0.79 \pm 0.05 \pm 0.04$	0.84 ± 0.22
$\pi^+\pi^-\pi^0$	$13.2 \pm 0.2 \pm 0.5$	11 ± 4
$\pi^+\pi^-\pi^+\pi^-$	$7.3 \pm 0.1 \pm 0.3$	7.3 ± 0.5
$\pi^+\pi^-\pi^0\pi^0$	$9.9 \pm 0.6 \pm 0.7$	—
$\pi^+\pi^-\pi^+\pi^-\pi^0$	$4.1 \pm 0.5 \pm 0.2$	—
$\pi^+\pi^0$	$1.25 \pm 0.06 \pm 0.08$	1.33 ± 0.22
$\pi^+\pi^+\pi^-$	$3.35 \pm 0.10 \pm 0.20$	3.1 ± 0.4
$\pi^+\pi^0\pi^0$	$4.8 \pm 0.3 \pm 0.4$	—
$\pi^+\pi^+\pi^-\pi^0$	$11.6 \pm 0.4 \pm 0.7$	—
$\pi^+\pi^-\pi^+\pi^-\pi^+$	$1.60 \pm 0.18 \pm 0.17$	1.82 ± 0.25

- Reference branching fractions used (CLEO-c and PDG 2004 averages)
  - $\mathcal{B}(D^0 \to K^-\pi^+) = (3.84 \pm 0.07)\%$
  - $\mathcal{B}(D^+ \to K^-\pi^+\pi^+) = (9.4 \pm 0.3)\%$

BaBar $\mathcal{B}(D^+ \to \pi^+\pi^0)$ with DCSD $\mathcal{B}(D^+ \to K^+\pi^0)$

Singly-Cabibbo-Suppressed D^0 and D^+ Decays to Pions

Searches for η and ω in multipion D^0 and D^+ decays



Look for net $M(\pi^+\pi^-\pi^0)$ signals in signal and sideband regions of $\Delta E \equiv E(D) - E_{beam}$

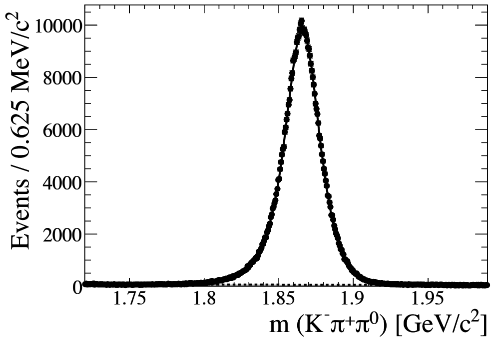
Mode	$\mathcal{B}$ (10^{-3})
$\eta\pi^0$	$0.62 \pm 0.14 \pm 0.05$
$\eta\pi^+$	$3.61 \pm 0.25 \pm 0.26$
$\eta\pi^+\pi^-$	< 1.9 (90% CL)
$\omega\pi^0$	< 0.26 (90% CL)
$\omega\pi^+$	< 0.34 (90% CL)
$\omega\pi^+\pi^-$	$1.7 \pm 0.5 \pm 0.2$

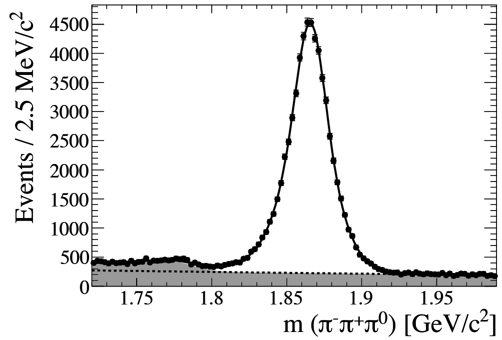
Isospin Amplitudes in $D \to \pi\pi$ decay

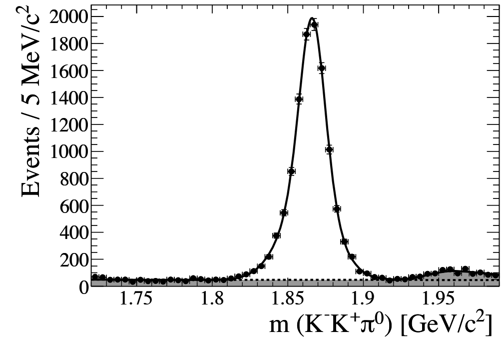
- Amplitudes A_0 and A_2 for $D \to \pi\pi$ to $I = 0, 2$ states
- Determine $A_2/A_0 = 0.420 \pm 0.014 \pm 0.001$ and $\delta = (86.4 \pm 2.8 \pm 3.3)^\circ$ (relative phase) from $\mathcal{B}(\pi^+\pi^-)$, $\mathcal{B}(\pi^0\pi^0)$, and $\mathcal{B}(\pi^+\pi^0)$
  - Indicates that final state interactions are important in $D \to \pi\pi$ decay

Singly-Cabibbo-Suppressed D^0 Decays

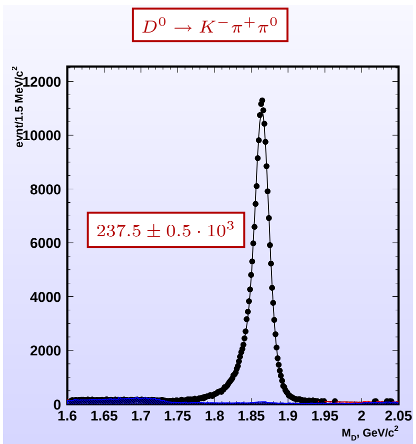
BaBar

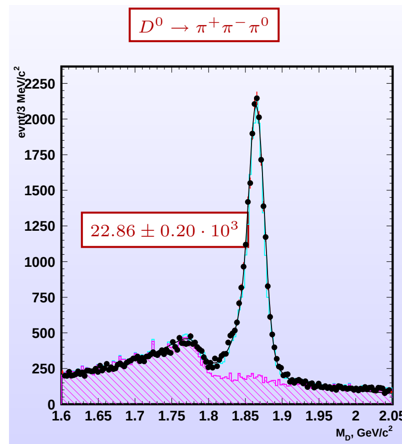






Belle

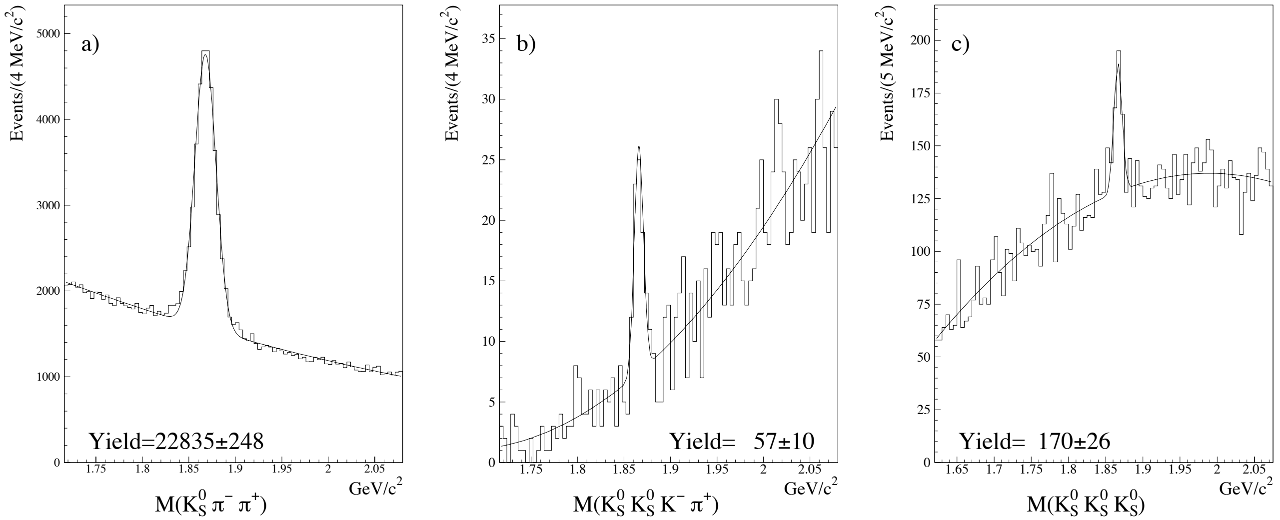




- Note: different x-axes
- BaBar: $D^{*+} \to D^0\pi^+$ tag
- Belle: Uglov ICHEP06
- Used $\mathcal{B}(D^0 \to K^-\pi^+\pi^0)$ from PDG 2006

	$\mathcal{B}(D^0 \to \pi^+\pi^-\pi^0)$	Luminosity
BaBar	$(1.493 \pm 0.008 \pm 0.018 \pm 0.053) \times 10^{-2}$	232 fb^{-1}
CLEO-c	$(1.32 \pm 0.02 \pm 0.05 \pm 0.02) \times 10^{-2}$	281 pb^{-1}
Belle Preliminary	$(1.40 \pm 0.01 \pm 0.04 \pm 0.05) \times 10^{-2}$	
	$\mathcal{B}(D^0 \to K^-K^+\pi^0)$	
BaBar	$(0.334 \pm 0.004 \pm 0.006 \pm 0.012) \times 10^{-2}$	
PDG 2006	$(0.13 \pm 0.04) \times 10^{-2}$	

FOCUS Multi-Kaon Modes



Mode	FOCUS $\mathcal{B}$ (10^{-3})	
$D^0 \to K^0 \bar{K}^0$	$0.86 \pm 0.19 \pm 0.10 \pm 0.05$	SCSD
$D^0 \to K^- K^+ \pi^+ \pi^-$	$2.20 \pm 0.08 \pm 0.06 \pm 0.09$	SCSD
$D^0 \to K^0_S K^0_S \pi^+ \pi^-$	$1.24 \pm 0.21 \pm 0.13 \pm 0.07$	SCSD
$D^0 \to K^0_S K^0_S K^\pm \pi^\mp$	$0.63 \pm 0.11 \pm 0.06 \pm 0.04$	CF
$D^0 \to K^0_S K^0_S K^0_S$	$1.07 \pm 0.16 \pm 0.16 \pm 0.06$	CF

Used reference branching fractions from PDG 06

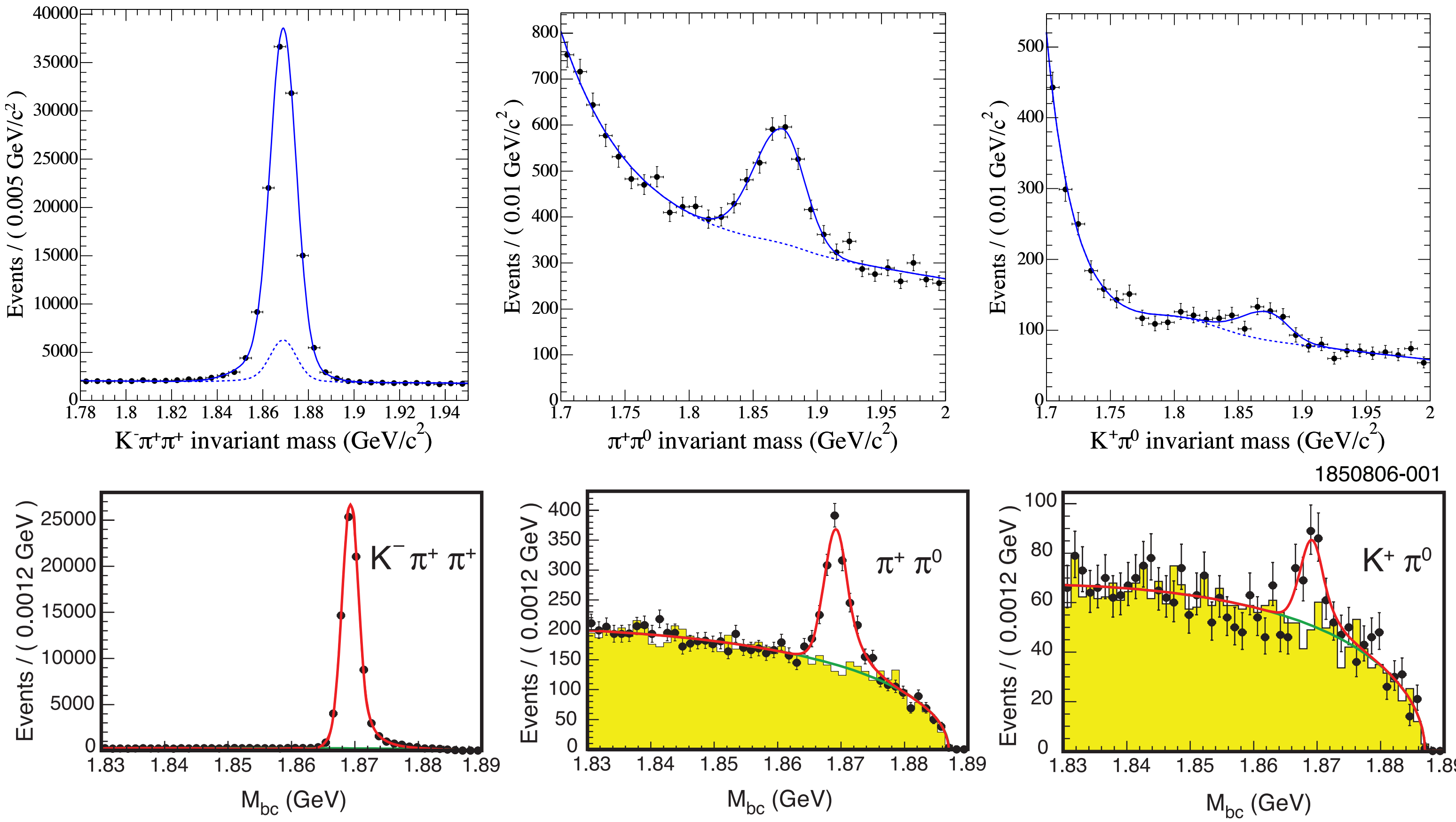
- $\mathcal{B}(D^0 \to K^- \pi^+ \pi^+ \pi^-)$ for $D^0 \to K^- K^+ \pi^+ \pi^-$ decay
- $\mathcal{B}(D^0 \to \bar{K}^0 \pi^+ \pi^-)$ for all other modes

Dalitz Analysis of $D^0 \to K^- K^+ \pi^+ \pi^-$ later

Doubly-Cabibbo-Suppressed D Decays

BaBar
$K^+\pi^0$ First Observation

CLEO-c



	$D^+ \to \pi^+\pi^0$ (SCSD)	$D^+ \to K^+\pi^0$ (DCSD)
Collaboration	$\mathcal{B}_{\rm mode}/\mathcal{B}_{\rm ref}$	$\mathcal{B}_{\rm mode}/\mathcal{B}_{\rm ref}$
BaBar	$(1.33 \pm 0.11 \pm 0.09) \times 10^{-2}$	$(2.68 \pm 0.50 \pm 0.26) \times 10^{-3}$
CLEO-c	$(1.33 \pm 0.07 \pm 0.06) \times 10^{-2}$	$(2.40 \pm 0.38 \pm 0.16) \times 10^{-3}$

(The CLEO-c result for $D^+ \to \pi^+\pi^0$ is from the SCSD analysis.)

Comparison of $D \to K^0_S\pi$ and $D \to K^0_L\pi$ Decay Rates

Cabibbo-Favored and Doubly-Cabibbo-Suppressed amplitudes for $D \to K^0\pi$.

- Observed final states are K^0_S and K^0_L
- Interference between CF and DCS amplitudes can lead to different rates for $D \to K^0_S\pi$ and $D \to K^0_L\pi$
  (Bigi and Yamamoto)
- Reconstruct $D \to K^0_L\pi$ from missing mass

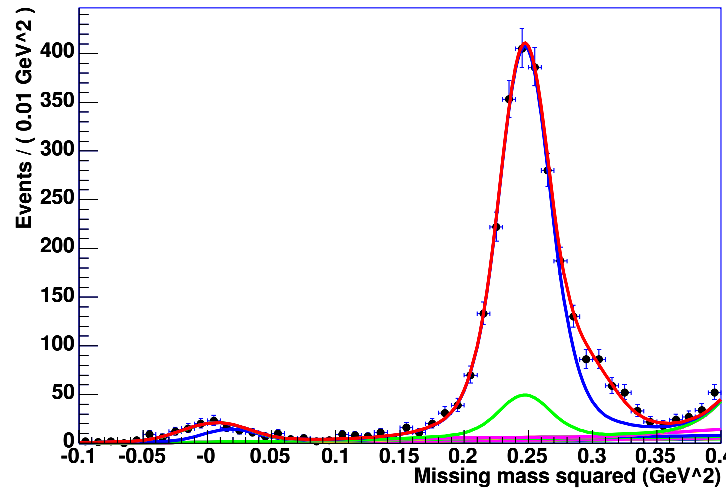
$$R(D) \equiv \frac{\mathcal{B}(D \to K^0_S\pi) - \mathcal{B}(D \to K^0_L\pi)}{\mathcal{B}(D \to K^0_S\pi) + \mathcal{B}(D \to K^0_L\pi)}$$

CLEO-c Preliminary

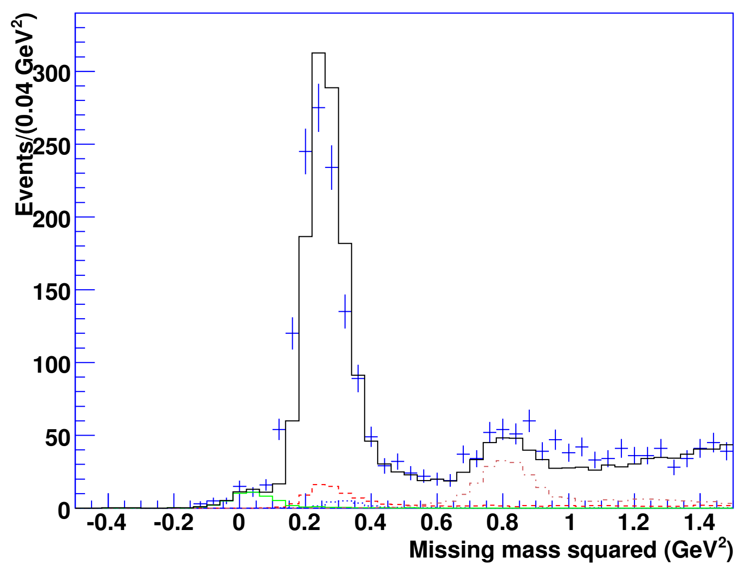
$R(D^+)$	$0.030 \pm 0.023 \pm 0.025$
$R(D^0)$	$0.122 \pm 0.024 \pm 0.030$

- U-spin and SU(3) predict
  $R(D^0) = 2\tan^2(\theta_c)$ which gives
  $R(D^0) = 0.109 \pm 0.001$
- $R(D^+)$ not so simple:
  $D^+ \to \bar{K}^0\pi^+$ external & internal spectator
  $D^+ \to K^0\pi^+$ external spectator & annihilation

$D^+ \to X\pi^+$

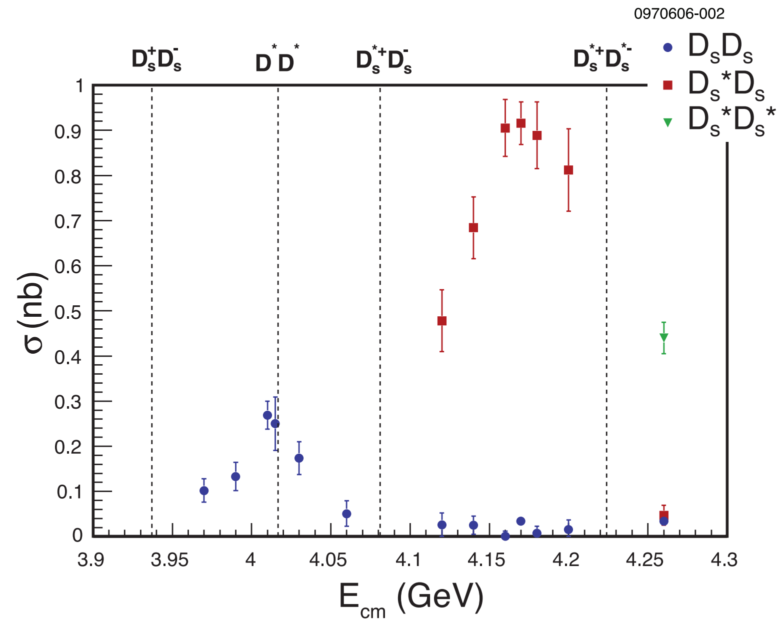


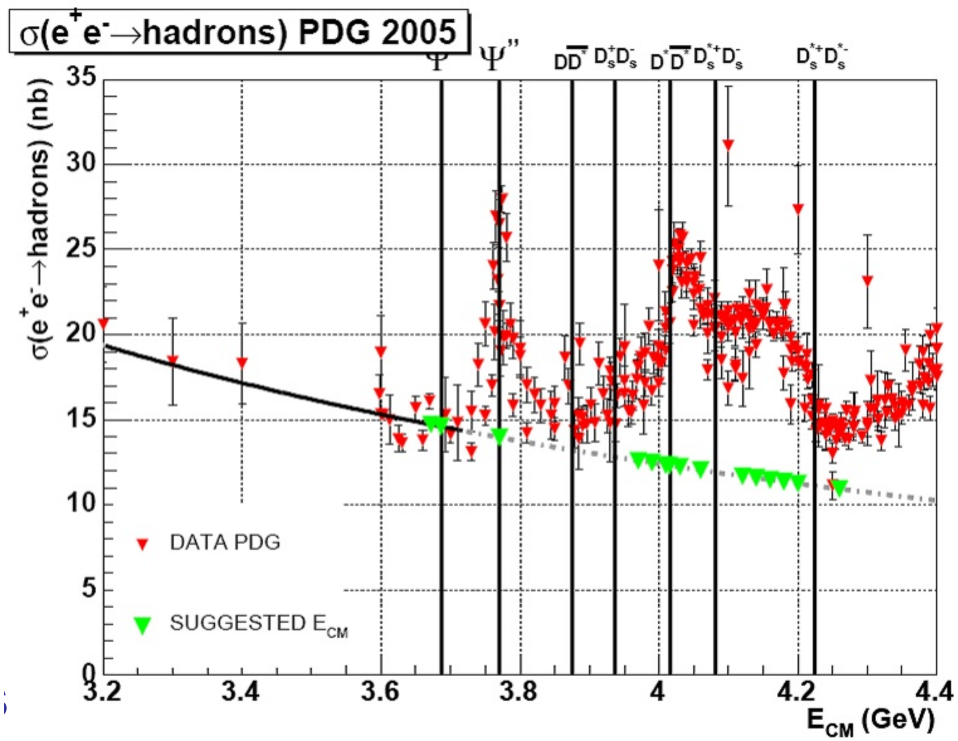
$D^0 \to X\pi^0$

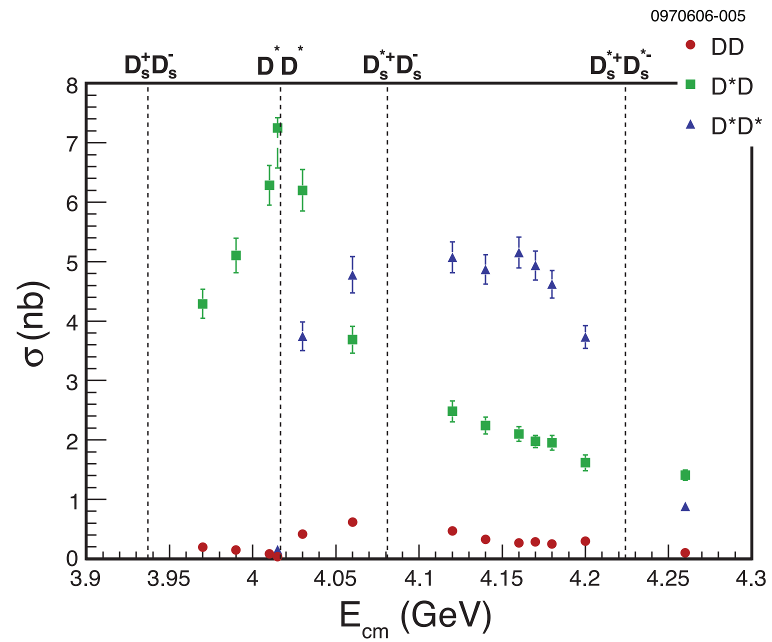


D_s Production Cross Section

- Little was know about the composition of $\sigma(e^+e^-)$ above $E_{cm} = 3.8$ GeV.
- CLEO scan with ~ 5 pb^{-1} per point with fast turnaround and feedback
- More luminosity in the region around $E_{cm} = 4.17$ GeV where $D_s^\pm D_s^{*\mp}$ peaks
  - $\sigma(e^+e^- \rightarrow D_s^\pm D_s^{*\mp}) \approx 0.9$ nb

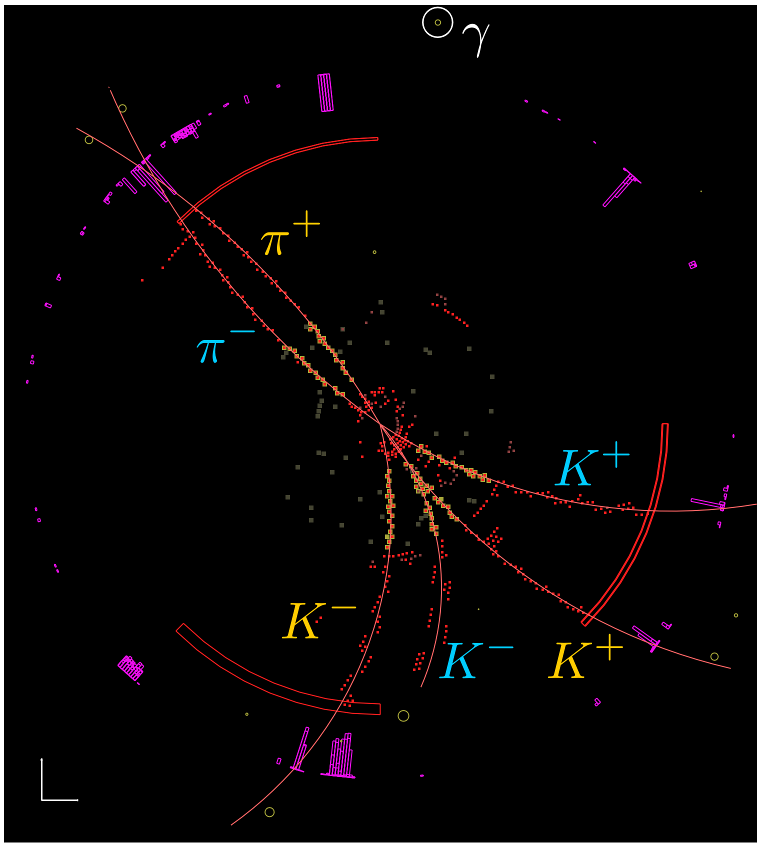






Selecting $D_s^{\pm} D_s^{*\mp}$ Events

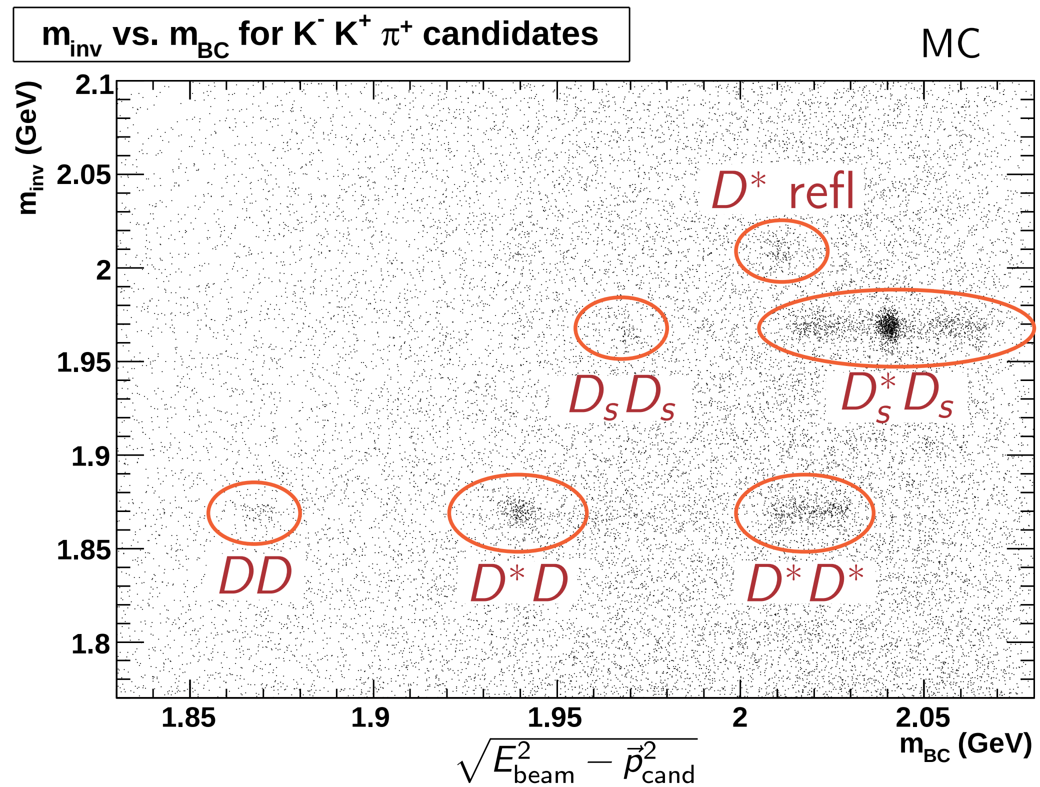
$e^+e^- \longrightarrow D_s^* \, D_s \longrightarrow D_s^+ \, D_s^- \, \gamma$



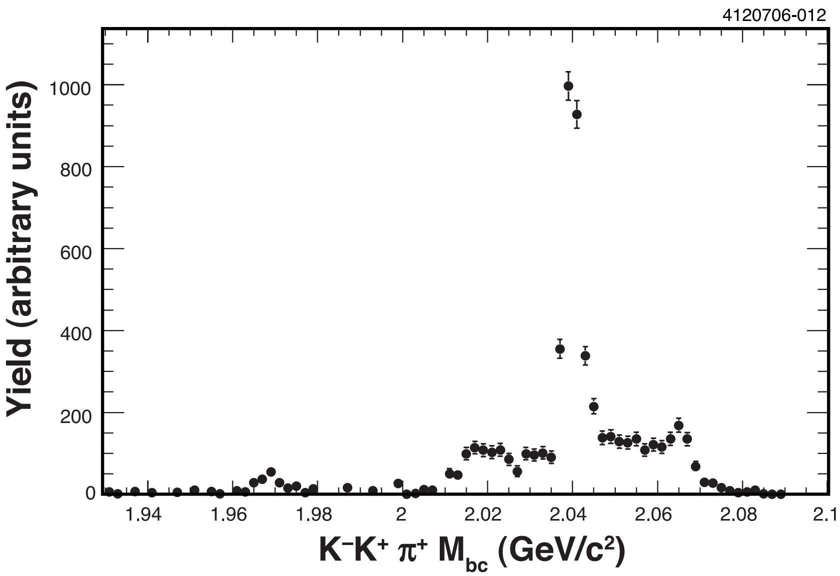
Ignore the γ or π^0 from D_s^* decay

Select $D_s^{\pm} D_s^{*\mp}$ events using:

- Candidate invariant mass m_{inv}
- Candidate m_{BC} (a proxy for momentum)

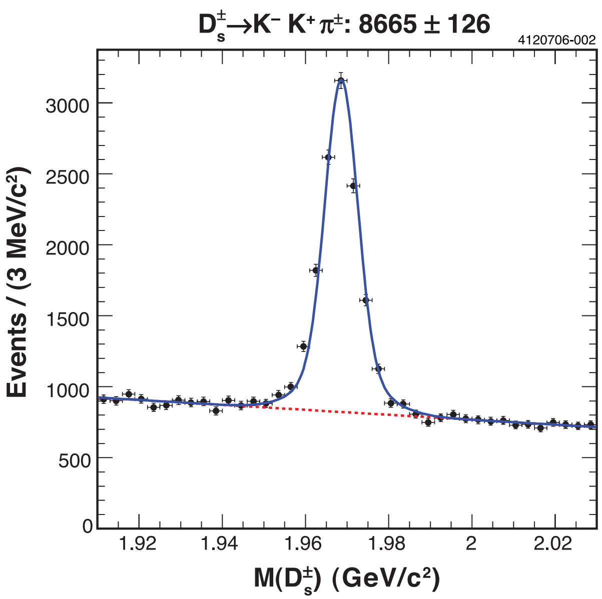


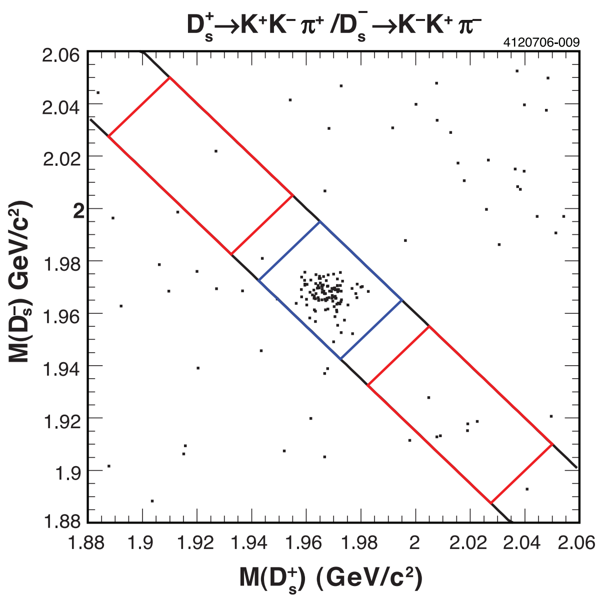
Analyzing $D_s^{\pm} D_s^{*\mp}$ Events

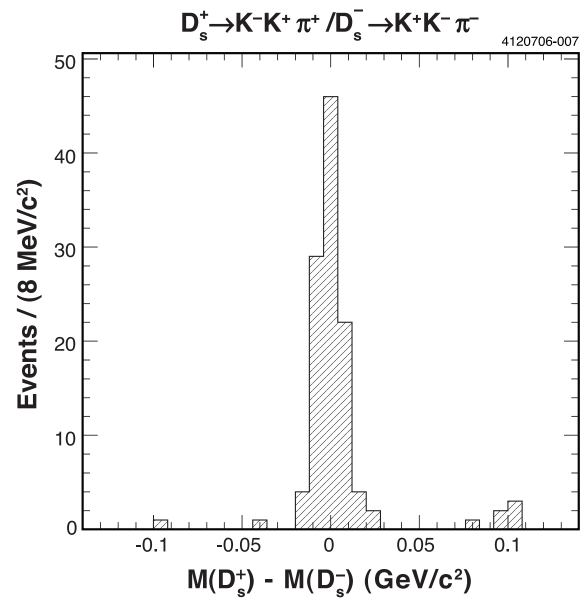


Measuring ST and DT events:

- Require $M_{bc} > 2.01$ GeV
- Fit ST $M(D_s)$ candidate invariant mass distribution
- Cut DT in $M(D_s^-)$ vs $M(D_s^+)$ plane
  - Blue box signal
  - Red boxes sidebands







Absolute Hadronic D_s Branching Fractions

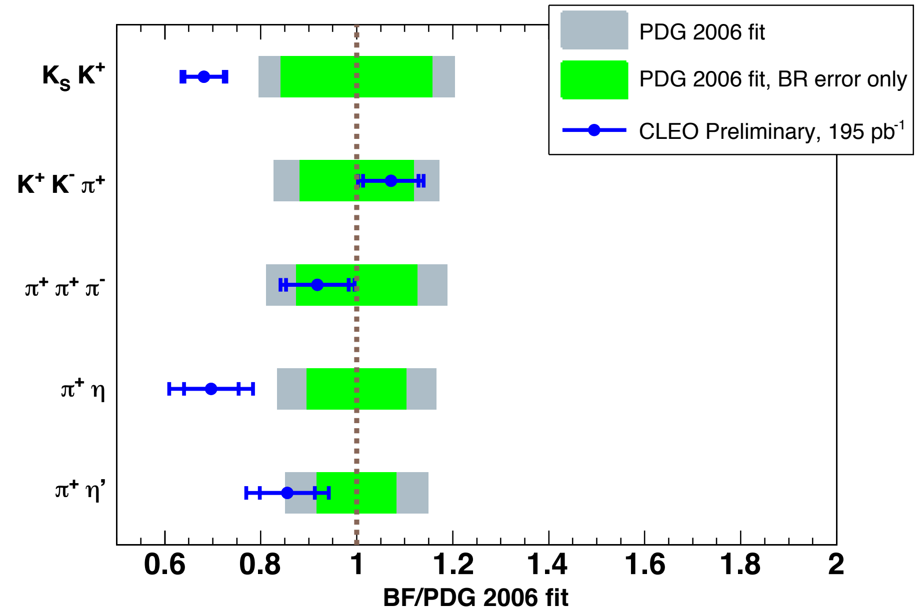
CLEO-c Preliminary

195 pb^{-1} of data

D_s^+ Mode	$\mathcal{B}$ (%)
$K_S K^+$	$1.50 \pm 0.09 \pm 0.05$
$K^- K^+ \pi^+$	$5.57 \pm 0.30 \pm 0.19$
$K^- K^+ \pi^+ \pi^0$	$5.62 \pm 0.33 \pm 0.51$
$\pi^+ \pi^+ \pi^-$	$1.12 \pm 0.08 \pm 0.05$
$\pi^+ \eta$	$1.47 \pm 0.12 \pm 0.14$
$\pi^+ \eta'$	$4.02 \pm 0.27 \pm 0.30$

Additional 130 pb^{-1} to be analyzed

Comparison with PDG 2006



Belle measures $\mathcal{B}(D_s^+ \to K^- K^+ \pi^+)$ utilizing a partial reconstruction technique for $e^+e^- \to D_{s1} D_s^*$ events (R. Uglov ICHEP06)

	$\mathcal{B}(D_s^+ \to K^- K^+ \pi^+)$ (%)
CLEO Preliminary	$5.57 \pm 0.30 \pm 0.19$
Belle Preliminary	$4.1 \pm 0.4 \pm 0.4$

Partial $D_s^+ \to K^- K^+ \pi^+$ Branching Fractions

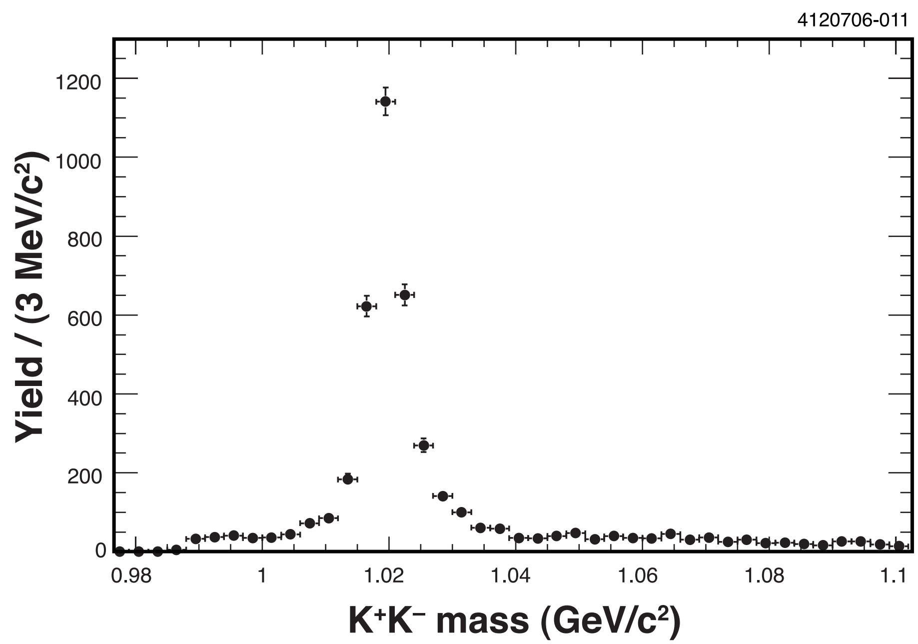
$\mathcal{B}(D_s^+ \to \phi\pi^+ \to K^- K^+ \pi^+)$ is one of the largest D_s branching fractions

- A branching fraction called $\mathcal{B}(D_s^+ \to \phi\pi^+)$ has often been used as a reference branching fraction for D_s decays.
  - Derived from a narrow mass cut around the ϕ peak in the $M(K^+K^-)$ distribution in $D_s^+ \to K^- K^+ \pi^+$ events.
- E687 has published and FOCUS has reported significant contributions from $f_0(980)$ (or $a_0(980)$) in the $\phi\pi$ region of the $D_s^+ \to K^- K^+ \pi^+$ Dalitz plot.
  - These scalar contributions $(\sim 5)\%$ under the ϕ peak in $M(K^+K^-)$ are comparable to current CLEO-c errors for $\mathcal{B}_{\Delta M} \equiv \mathcal{B}(D_s^+ \to K^- K^+ \pi^+)$ with $|M(K^-K^+) - M_\phi| < \Delta M$ MeV/c^2.
- PDG and HEP community need to decide how to deal with this in the future

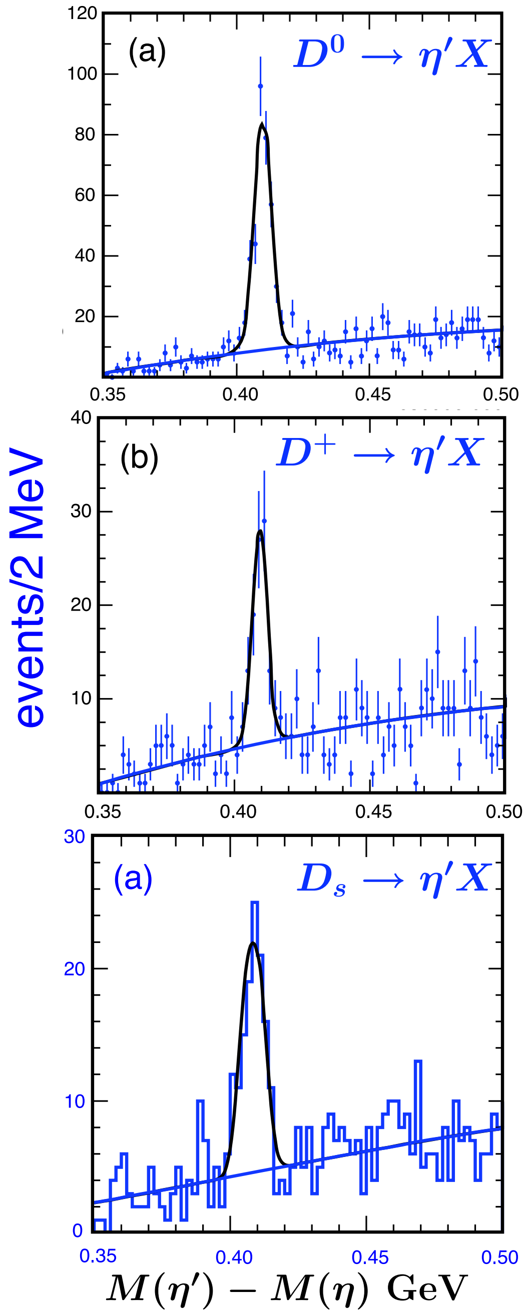
CLEO-c Preliminary

	$\mathcal{B}_{\Delta M}$ (%)
$\mathcal{B}_{10}$	$1.98 \pm 0.12 \pm 0.09$
$\mathcal{B}_{20}$	$2.25 \pm 0.13 \pm 0.12$
PDG 06	1.77 ± 0.44

PDG 06 unfolded from $\mathcal{B}(\phi \to K^- K^+)$ and reported $\mathcal{B}(D_s^+ \to \phi\pi^+)$



CLEO-c Inclusive D^0, D^+, and D_s decays to $s\bar{s}$



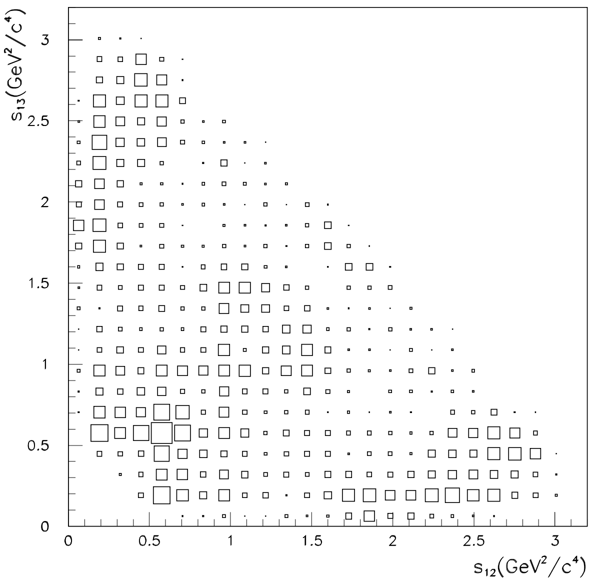
Inclusive D^0, D^+, and D_s decays to ηX, $\eta' X$, and ϕX

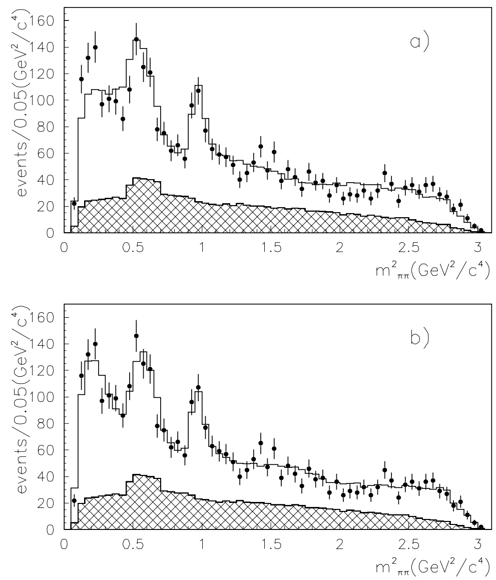
- For these $s\bar{s}$ states larger branching fractions for D_s than for D^0 and D^+
- Fully reconstruct one D and then search for η, η' and ϕ from the other D.
- CLEO utilizes
  281 pb^{-1} of $\psi(3770)$ data for D^0 and D^+
  195 pb^{-1} of $E_{cm} \approx 4.17$ GeV data for D_s

Mode	$\mathcal{B}(D^0)$ (%)	$\mathcal{B}(D^+)$ (%)	$\mathcal{B}(D_s^+)$ (%)
ηX	$9.5 \pm 0.4 \pm 0.8$	$6.3 \pm 0.5 \pm 0.5$	$23.5 \pm 3.1 \pm 2.0$
$\eta' X$	$2.48 \pm 0.17 \pm 0.21$	$1.04 \pm 0.16 \pm 0.09$	$8.7 \pm 1.9 \pm 0.8$
ϕX	$1.05 \pm 0.08 \pm 0.07$	$1.03 \pm 0.10 \pm 0.07$	$16.1 \pm 1.2 \pm 1.1$

- Qualitative observations:
  - η' and ϕ relatively rare in D^0 and D^+ decay
  - η with lower mass and larger light quark content is produced at substantially higher rates in D^0 & D^+
  - ϕ rate higher in D_s decay than in D^0 and D^+ decay
  - can utilize higher ϕ rates to separate D_s from D^0 and D^+ at $\Upsilon(5S)$ and hadron colliders

E791 and FOCUS Dalitz Analyses of $D^+ \to \pi^+\pi^+\pi^-$ Decays

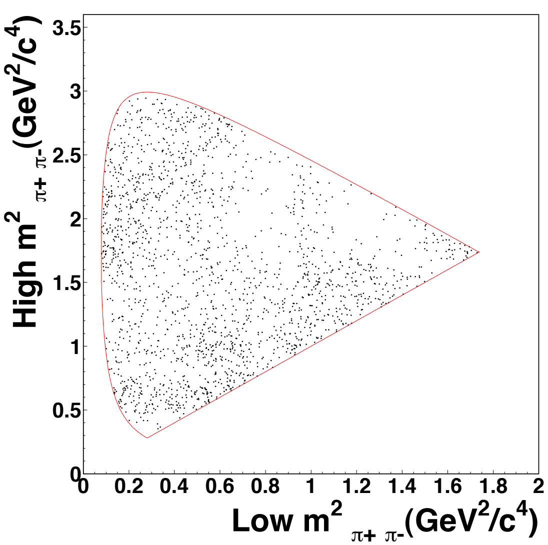


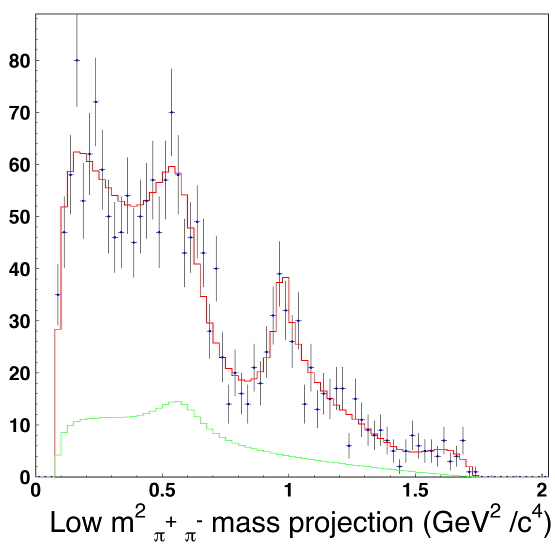


$m^2_{\pi^+\pi^-}$ (GeV^2/c^4)

E791 Dalitz Analysis

- s_{12} and s_{13} are $m_{\pi^+\pi^-}$
- Dalitz plot symmetrized about the line $s_{12} = s_{13}$
- $\sigma^0\pi^+$ for low $m_{\pi^+\pi^-}$ peak
  - (a) without $\sigma^0\pi^+$
  - (b) with $\sigma^0\pi^+$
- Also $\rho^0\pi^+$, $f_2(1270)\pi^+$, ...

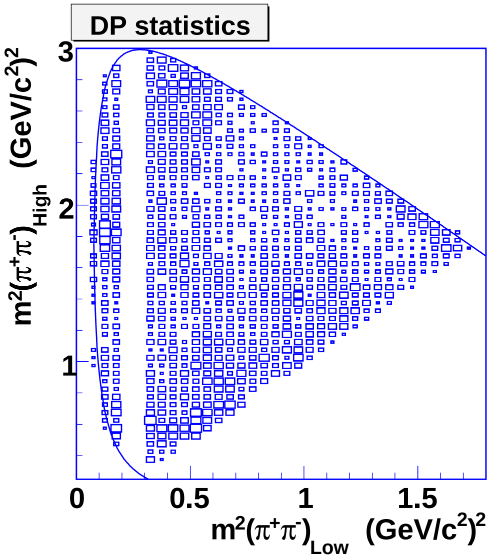


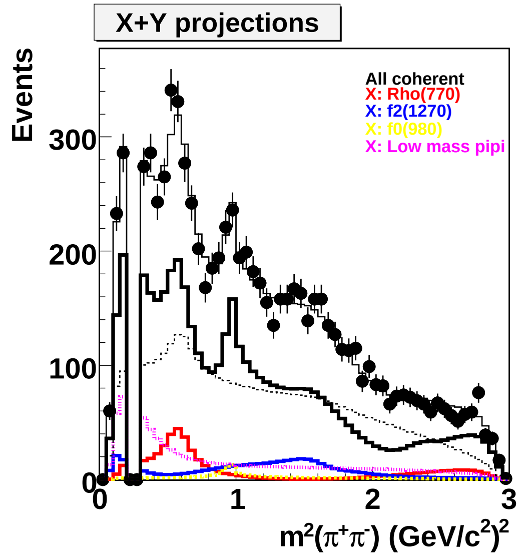


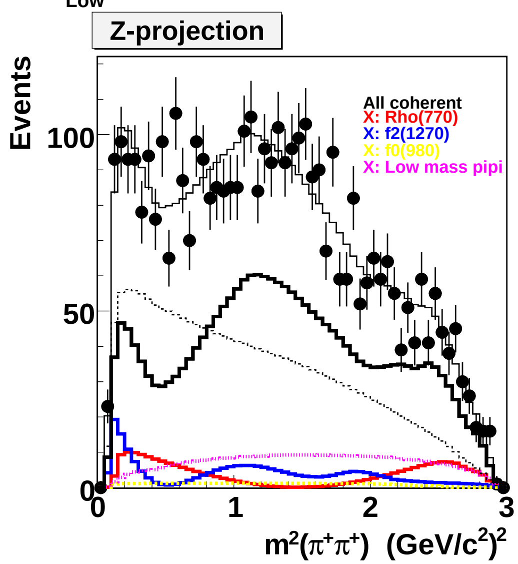
FOCUS Dalitz Analysis

- Used K Matrix formalism
  - Low $m_{\pi^+\pi^-}$ peak from combination of resonances, $f_0(980)$, ...
- Also $\rho^0\pi^+$ and $f_2(1270)\pi^+$

CLEO-c Dalitz Analysis of $D^+ \to \pi^+\pi^+\pi^-$ Decays







Z axis is $m_{\pi^+\pi^+}$

CLEO-c Preliminary

Isobar model like E791

- Removed K^0_S mass region
  - $\sigma^0\pi^+$ for low $m_{\pi^+\pi^-}$ peak
- **Preliminary** Fit Fraction results

	CLEO (%)	E791 (%)
$\rho^0\pi^+$	20.0 ± 2.5	33.6 ± 3.9
$\sigma^0\pi^+$	41.8 ± 2.9	46.3 ± 9.2
$f_2(1270)\pi^+$	18.2 ± 2.7	19.4 ± 2.5
$f_0(908)\pi^+$	4.1 ± 0.9	6.1 ± 1.4
$f_0(1370)\pi^+$	2.6 ± 1.9	2.3 ± 1.7
$f_0(1500)\pi^+$	3.4 ± 1.3	—
Non Res	< 3.5	7.8 ± 6.6
$\rho(1450)\pi^+$	< 2.4	7.8 ± 0.6

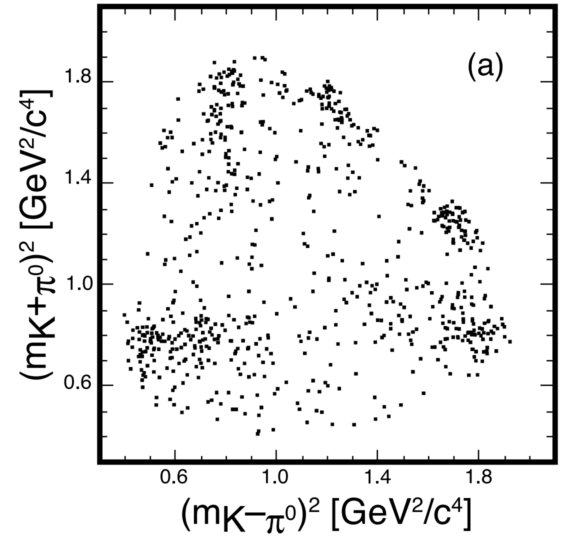
E791 & CLEO-c general agreement

Future: K-Matrix fit like FOCUS

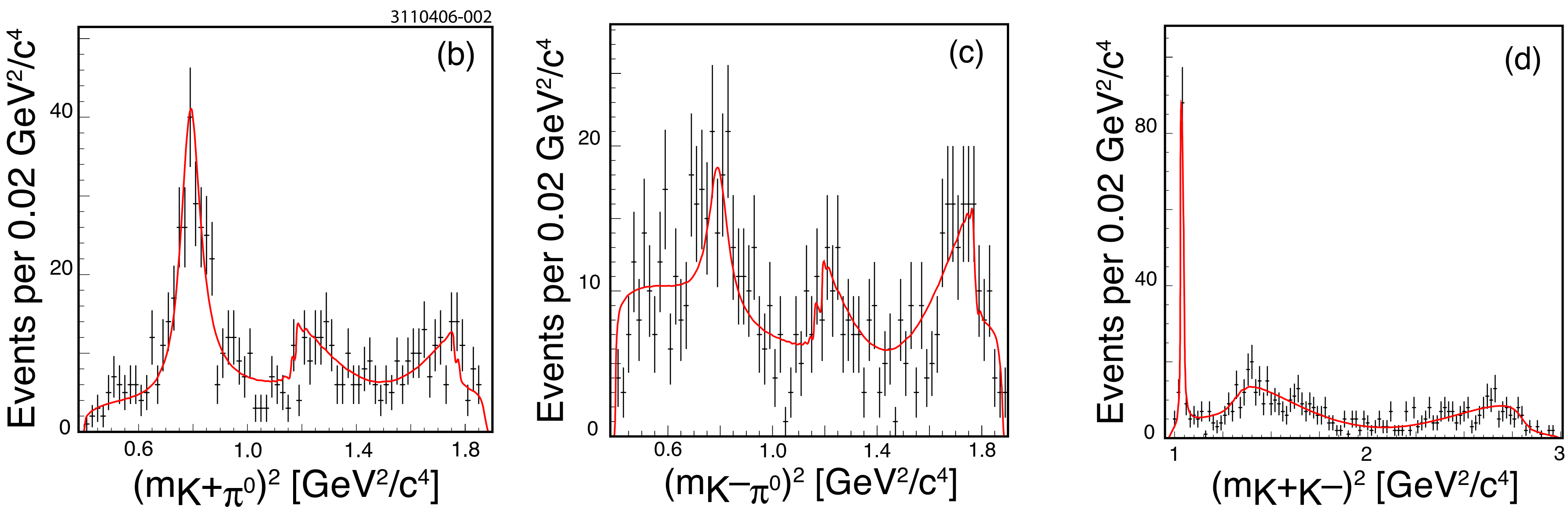
CLEO-III Dalitz Analysis of $D^0 \to K^+K^-\pi^0$ Decays

CKM angle γ (ϕ_3) can be measured in $B^\pm \to D^0(\bar{D}^0)K^\pm$ with $D^0/\bar{D}^0$ decaying to $K^{*+}K^-$ or $K^{*-}K^+$

- Need relative complex amplitude for $\bar{D}^0 \to K^{*+}K^-$ and $D^0 \to K^{*+}K^-$
- Same as relative complex amplitude $r_D e^{i\phi_D}$ for $D^0 \to K^{*-}K^+$ and $D^0 \to K^{*+}K^-$ (assuming CP conservation in these decays)
- CLEO finds:
  - $r_D = 0.52 \pm 0.05 \pm 0.04$
  - $\phi_D = 332^\circ \pm 8^\circ \pm 11^\circ$

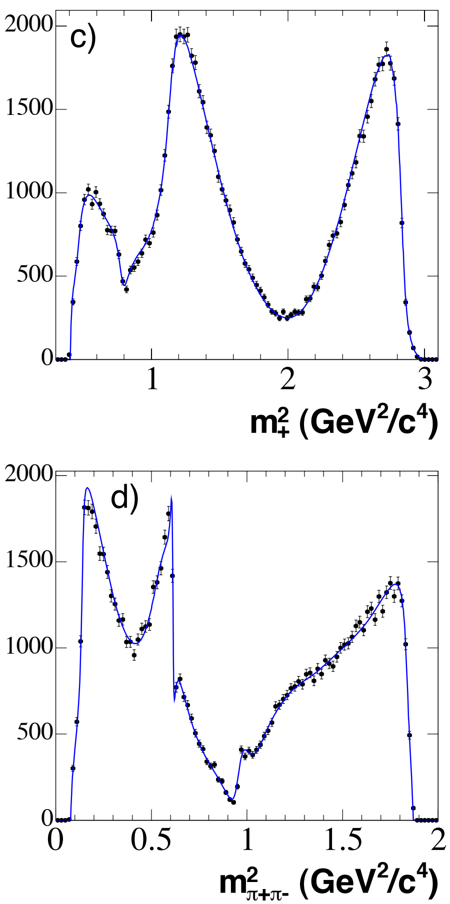


Projected fits

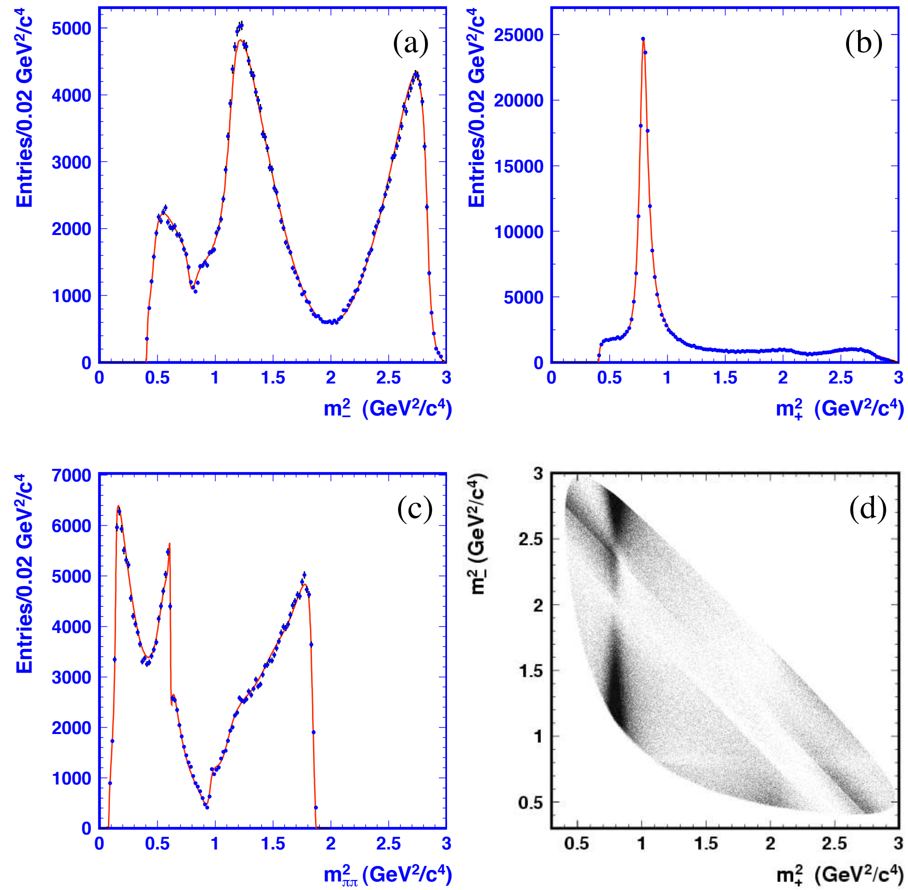


Dalitz Analyses of $D \to K_S^0\pi^+\pi^-$ to Measure γ or ϕ_3

BaBar



Belle



$D^0 \to K_S^0\pi^+\pi^-$ & $\bar{D}^0 \to K_S^0\pi^+\pi^-$

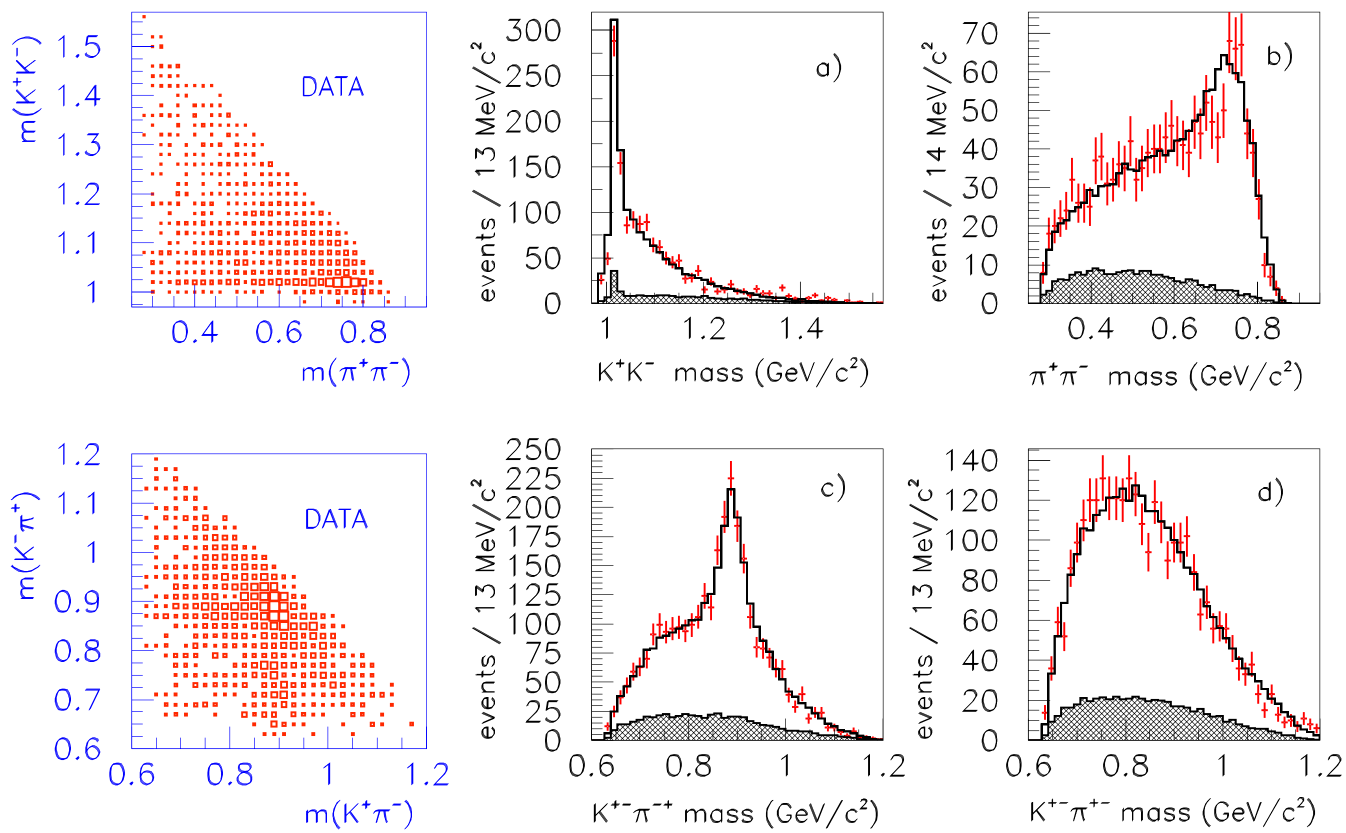
- Both fit data with isobar models
  - BaBar fit 17 two-body states
  - Belle fit 18 two-body states

Four states with Fit Fraction $\gtrsim 10\%$

State	BaBar (%)	Belle (%)
$K^*(892)^+\pi^-$	58.6	61.2
$K_S^0\rho^0$	22.4	21.6
$K_S^0\sigma$	9.3	9.8
Non Res	7.3	9.7

FOCUS Dalitz Analysis of $D^0 \to K^+K^-\pi^+\pi^-$ Decays

Multiple Dalitz Plots from four-body decay



Mode	Fit Fraction (%)
$K_1(1270)^+K^-$	$33 \pm 6 \pm 4$
$K_1(1400)^+K^-$	$22 \pm 3 \pm 4$
$\phi\rho^0$	$29 \pm 2 \pm 1$
$K^*(1400)^0K^+\pi^-$	$11 \pm 1 \pm 1$
$f_0(980)\pi^+\pi^-$	$15 \pm 3 \pm 2$

Summary and Conclusions

Advances in precision and discovery reach with BaBar, Belle, and CLEO-c

- Absolute D hadronic branching fractions from charm threshold CLEO-c
  - 281 pb^{-1} Preliminary results for D^0 and D^+ limited by systematic errors
    - CF decay errors as low as $\lesssim 3\%$
    - Now Final State Radiation must be considered; effects $\lesssim 2\%$
      - Interesting problem for the PDG
  - 195 pb^{-1} Preliminary results for D_s limited by statistics
    - CF decay errors as low as $\lesssim 10\%$
    - Scalar K^+K^- contribution becoming significant in measurements of $\mathcal{B}(D_s \to K^-K^+\pi^+)$ with $M(K^+K^-)$ cut around the ϕ peak
      - Need to define new reference branching fraction for D_s decays
- Many accurate branching ratio measurements from BaBar, Belle, and CLEO-c
  - BaBar and Belle are starting to dominate branching ratio measurements
- Dalitz analyses of $D^+ \to \pi^+\pi^+\pi^-$, $D^0 \to K^+K^-\pi^0$, and $D \to K^0_S\pi^+\pi^-$ decays, and three-body sub-modes from $D^0 \to K^+K^-\pi^+\pi^-$ decays
  - Dalitz analyses of $D \to K^0_S\pi^+\pi^-$ with huge statistics are byproducts of BaBar and Belle measurements of γ or ϕ_3
    - Expect BaBar and Belle to dominate future Dalitz D decay analyses
- Renaissance of hadronic D physics coming from CLEO-c at the charm threshold and BaBar and Belle at the beauty threshold!