BES RESULTS ON INCLUSIVE D MESON DECAYS

XINCHOU LOU

University of Texas at Dallas
U.S.A.

Representing the BES Collaboration

- Brief Introduction

- The Analysis and Results on

$$D^{+,0} \rightarrow \phi X, \overline{K}^{*}(892)^{0} X, K^{*}(892)^{0} X$$

- Results and Comparison to Measured Exclusive D Decays

- Summary

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INTRODUCTION

Limited knowledge on inclusive D decays

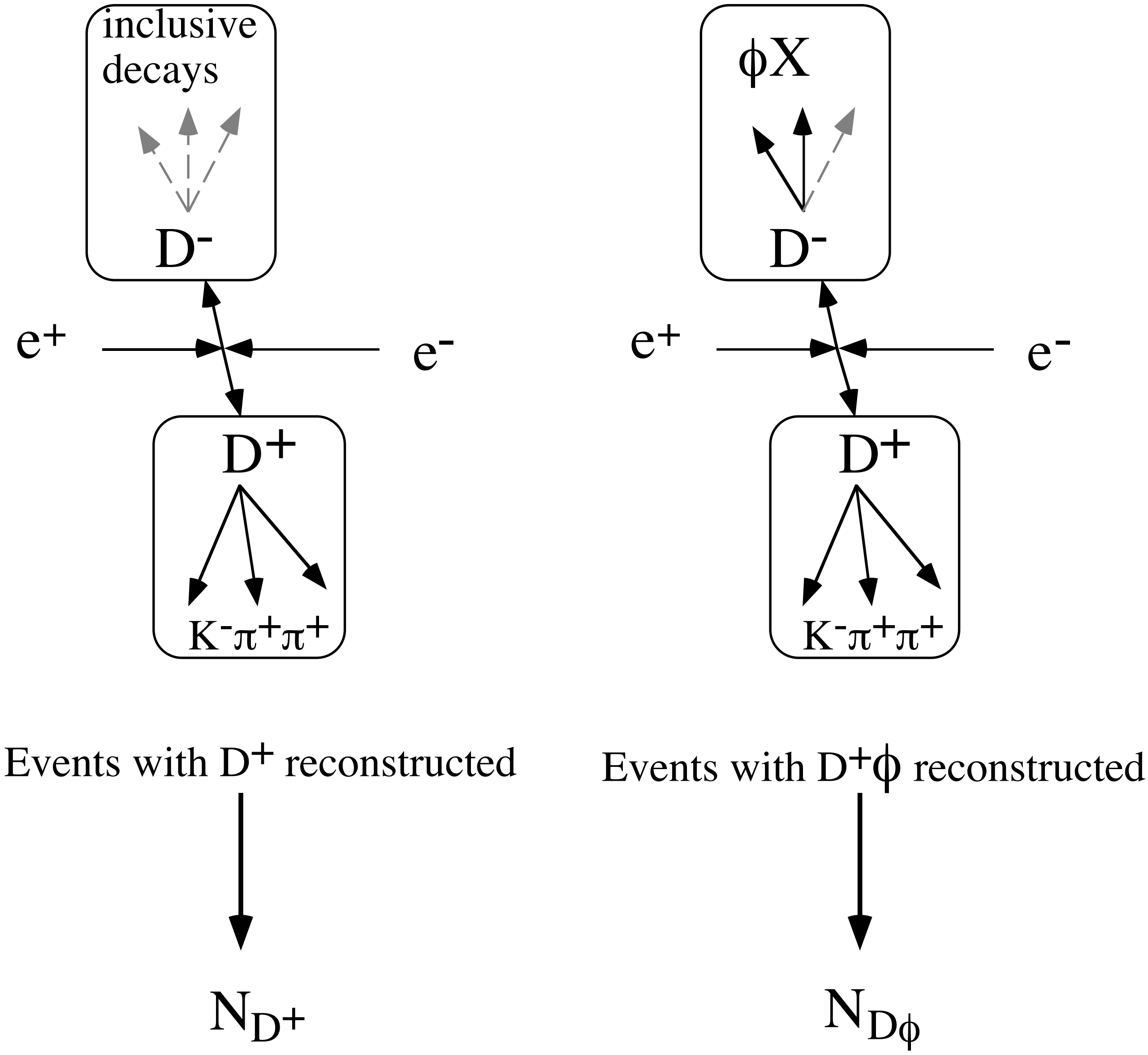
Inclusive Modes	D^0 (%)	D^+ (%)
e^+	6.75±0.29	17.2±1.9
μ^+	6.6±0.8	**N/A**
K^-	53±4	24.2±2.8
K^+	$3.4^{+0.6}_{-0.4}$	5.8±1.4
$\overline{K}^*(892)^0$	**N/A**	**N/A**
$K^*(892)^0$	**N/A**	**N/A**
$\overline{K^0}$ or K^0	42±5	59±7
ϕ	**N/A**	**N/A**
η	<13	<13
Source:	PDG98	PDG98

- First measurements and a check on the exclusive D decay modes containing a ϕ, $\overline{K}^*(892)^0$ or $K^*(892)^0$

  CK allowed CK suppressed

- Engineering measurement for better D and B simulations for high precision B-factory experiments

- Help background estimates for $B_s^0 \leftrightarrow \overline{B_s^0}$ oscillation study (SLD, LEP, CDF: which can use $\phi\ell$ to tag B_s)



$$B(D^{+} \rightarrow \phi X) = \frac{N_{D^{+}\phi}}{\varepsilon_{\phi} \cdot N_{D^{+}} \cdot \varepsilon_{charge} \cdot \omega_{DD}}$$

THE ANALYSIS

- Particle Identification

—$K^{\pm}$, $\pi^{\pm}$ are selected based on confidence level calculated
with dE/dx and TOF measurements

—$K^{\pm}$ must be more likely to be a kaon than a pion
$\pi^{\pm}$ must past consistency requirement

- Reconstruction of D^0, D^+ Mesons

—Decay Modes:

$D^0 \longrightarrow K^- \pi^+$ π^+ must not be identified as a K^+

$D^0 \longrightarrow K^- \pi^- \pi^+ \pi^+$ $\pi^+ \pi^-$ must be consistent with $\rho(770)$

$D^+ \longrightarrow K^- \pi^+ \pi^+$

—Only D^0, D^+ from $e^+ e^- \longrightarrow D^* \overline{D^*}, D^* \overline{D}$ are selected

- Reconstruction of ϕ, $K^*(892)^0$

— $\phi \longrightarrow K^+ K^+$, $\overline{K}^*(892)^0 \rightarrow K^- \pi^+$

Type Identification of Recoiling *D* Mesons

— At 4.03 GeV (C.M.) $e^+e^- \to D^{*(+,0)}\overline{D^*}^{(-,0)}, D^{*(+,0)}\overline{D}^{(-,0)}$

— To Determine D^0, D^+ B. F. Separately, We Need to Know:
(1) number of tagged $D^{+,0}$ events ?
(2) how many D^0 and D^+ are in the recoil ?
(3) is the ϕ, or $\overline{K}^*(892)^0$ from D^0 or D^+ ?

- Recoil D Charge Method

— For $e^+e^- \to D^{*(+,0)}\overline{D^*}^{(-,0)}, D^{*(+,0)}\overline{D}^{(-,0)}$ events:
(1) π^+ from D^{*+} are too slow to be well detected by BES
(2) only weakly decaying D^0, D^+ are 'seen' in the detector
(3) total electric charge recoiling against the fully reconstructed D is that of the $\overline{D}$

- Double Tag Method

$$N(D^+\phi) = \varepsilon \cdot [\ N_{D+}^{D-} \cdot B(D^- \to \phi X) + N_{D+}^{\overline{D}^0} \cdot B(\overline{D}^0 \to \phi X)\ ] \qquad (1)$$

$$N(D^0\phi) = \varepsilon \cdot [\ N_{D0}^{D-} \cdot B(D^- \to \phi X) + N_{D0}^{\overline{D}^0} \cdot B(\overline{D}^0 \to \phi X)\ ] \qquad (2)$$

— Of a total of 9,054±308 *D* Mesons in the Recoil,
D^0 events: **6,803 ± 303 ± 77**
D^+ events: **2,251 ± 77 ± 43**

RESULTS

- Based on 10 $D\phi$ Events Observed, We Determine

$$B(D^0 \to \phi X)=1.17\pm0.79\pm0.10$$
$$B(D^+ \to \phi X)=1.85\pm1.90\pm0.14$$
$$B(D^+ \to \phi e^+ \nu)<1.6\%$$

- Based on 247±29 $DK^*(892)^0$ Events Observed, We Determine

$$B(D^0 \to \overline{K^*}(892)^0 X) \quad = (11.1\pm\ 5.1\pm3.2)\%$$
$$B(D^+ \to \overline{K^*}(892)^0 X) \quad = (27.7\pm14.1\pm4.4)\%$$

averaged for BES mixture of D^0, D^+ mesons

$$B(D^{0,+} \to \overline{K^*}(892)^0 X) = (15.7\pm1.9\pm1.4)$$

$$B(D^{0,+} \to K^*(892)^0 X) = (2.6\pm1.1\pm0.2)\%$$

Exclusive D Decays Modes Containing a ϕ

D Meson	Mode	B.R. (%)	Exp.
$D^+ \to$	$\phi\pi^+\pi^+\pi^-$	<0.2	E691
	ϕK^+	<0.013	E687
	$\phi\pi^+$	0.61±0.06	CLEO *etal*
	$\phi\pi^+\pi^0$	2.3±1.0	ACCMOR
	$\phi e^+\nu$	<2.09	MK3
	$\phi\mu^+\nu$	<3.72	MK3
	$\phi e^+\nu$	**<1.6**	**BES**
	ϕX	**1.85±1.90±0.14**	**BES**
$D^0 \to$	$\phi\overline{K^0}$	0.86±0.10	ARGUS *etal*
	$\phi\pi^+\pi^-$	0.108±0.029	ARGUS *etal*
	$\phi\omega$	<0.21	ARGUS
	$\phi\eta$	<0.28	ARGUS
	$\phi\pi^0$	<0.14	ARGUS
	ϕX	**1.17±0.79±0.10**	**BES**
Average	ϕX	**1.29±0.51±0.10**	**BES**

Exclusive D Decays Modes Containing a $K^*(892)^0$

D Meson	Mode	B.R. (%)	Exp.
$D^+ \to$	$\overline{K^*}^0 e^+\nu$	4.8±0.5	PDG98
	$\overline{K^*}^0 \mu^+\nu$ $\overline{K^*}^0 \pi^+$ $\overline{K^*}^0 \pi^+\pi^0$ $\overline{K^*}^0 \pi^+\pi^+\pi^-$ $\overline{K^*}^0 K^+$ $\overline{K^*}^0 K^{*+}$ SUM	4.4±0.6 1.90±0.19 6.7±1.4 0.81±0.34 0.42±0.05 2.6±1.1 21.6±2.0	PDG98 PDG98 PDG98 PDG98 PDG98 PDG98
	$\overline{K^*}^0 X$	**27.2±14.1±4.4**	**BES**
$D^0 \to$	$\overline{K^*}^0 \pi^0$	3.2±0.4	PDG98
	$\overline{K^*}^0 \pi^+\pi^+$ $\overline{K^*}^0 \pi^+\pi^-\pi^0$ $\overline{K^*}^0 K^+\pi^+$ SUM	2.3±0.5 1.8±0.9 0.17±0.12 7.5±1.1	PDG98 PDG98 PDG98
	$\overline{K^*}^0 X$	**11.1±5.1±3.2**	**BES**
Average	$\overline{K^*}^0 X$	**15.7±1.9±1.4**	**BES**

SUMMARY

- We report on first measurement of inclusive D^0, D^+ decays into ϕ, $K^*(892)^0$ using the BES detector
- Within errors the BES branching fractions are consistent with published exclusive D decays.
- Little room for unaccounted for D decays into ϕ, $K^*(892)^0$ containing states.
- Expect to have results on other inclusive decays of D^0, D^+ mesons