Supplemental: Measurements of Absolute Branching Fractions of Fourteen Exclusive Hadronic D Decays to η

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Figure 1 shows illustration of the $M_{\rm BC}^{\rm tag}$ vs. $M_{\rm BC}^{\rm sig}$ distribution of the accepted DT candidate events.

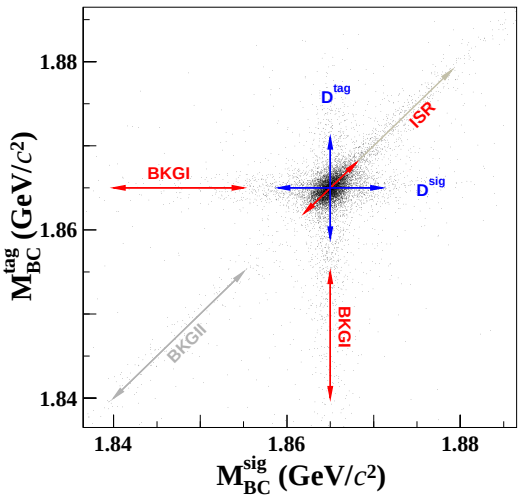

Fig. 1. The $M_{\rm BC}^{\rm tag}$ vs. $M_{\rm BC}^{\rm sig}$ distribution of the accepted DT candidate events.

Figure 2 shows the definitions of 1D and 2D K_S^0 signal and sideband regions.

Table 1 summarizes the ST yields of $CP\pm$ tags from the fits to the $M_{\rm BC}^{\rm tag}$ distributions of the accepted ST candidates, the DT yields tagged by $CP\pm$ tags from the 2D fits to the $M_{\rm BC}^{\rm tag}$ vs. $M_{\rm BC}^{\rm sig}$ distributions of the accepted DT candidates, and the QC factors obtained with the same method as described in Ref. [1] and the necessary parameters quoted from Refs. [2–4]. No DT events are observed from the $D^0 \to K^+K^-\eta$ and $K_S^0K_S^0\eta$ decays. The systematic uncertainties arising from QC effects are directly assigned as the averaged strong-phase factor C_f by the flavor tag yields.

Table 2 summarizes the systematic uncertainties for various sources in the measurements of BFs, which are assigned relative to the measured BFs. For each signal decay, the total uncertainty is obtained by quadratically adding all errors.

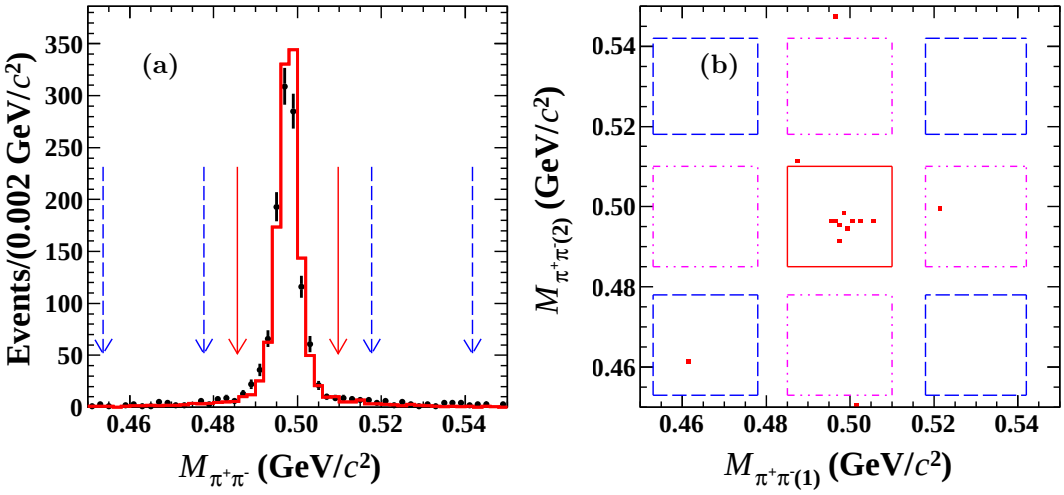

Fig. 2. (a) Comparison of the $M_{\pi^+\pi^-}$ distributions of the $D^0 \to K_S^0\pi^0\eta$ candidate events between data (dots with error bars) and the inclusive MC sample (histogram). Pairs of the solid (dashed) arrows denote the 1D K_S^0 signal (sideband) regions. (b) Distribution of $M_{\pi^+\pi^-(1)}$ vs. $M_{\pi^+\pi^-(2)}$ for the $D^0 \to K_S^0K_S^0\eta$ candidate events in data. Solid box denotes the 2D signal region. Dot-dashed (dashed) boxes indicate the 2D sideband 1 (2) regions.

Table 1. Summary of the ST yields of $CP\pm$ tags ($S^{\pm}_{\rm measured}$), the DT yields tagged by $CP\pm$ tags ($M^{\mp}_{\rm measured}$), and the QC factor ($f_{\rm QC}$). The errors are statistical only.

CP tag	$S^{+}_{\rm measured}$	$S^{-}_{\rm measured}$		
	57779±287	70512±311		
Decay	$M^{-}_{\rm measured}$	$M^{+}_{\rm measured}$	$f_{\rm QC}$	Uncertainty (%)
$D^0 \to K^0_S\pi^0\eta$	$2.4^{+1.6}_{-2.0}$	67.6 ± 8.3	$0.942^{+0.007}_{-0.008}$	0.8
$D^0 \to K^+K^-\eta$	0	0	–	7.4
$D^0 \to K^0_SK^0_S\eta$	0	0	–	7.4
$D^0 \to K^0_S\pi^+\pi^-\eta$	19.8 ± 4.7	$2.0^{+0.9}_{-1.1}$	$1.057^{+0.013}_{-0.013}$	1.3
$D^0 \to K^0_S\pi^0\pi^0\eta$	$5.4^{+2.8}_{-2.4}$	0	$1.073^{+0.065}_{-0.040}$	6.5
$D^0 \to \pi^+\pi^-\pi^0\eta$	13.6 ± 4.8	18.8 ± 4.4	$0.993^{+0.008}_{-0.008}$	0.8

Table 2. Systematic uncertainties (%) in the measurements of the BFs.

Sources	$D^0 \to$								$D^+ \to$					
	$K^-\pi^+\eta$	$K^0_S\pi^0\eta$	$K^+K^-\eta$	$K^0_SK^0_S\eta$	$K^-\pi^+\pi^0\eta$	$K^0_S\pi^+\pi^-\eta$	$K^0_S\pi^0\pi^0\eta$	$\pi^+\pi^-\pi^0\eta$	$K^0_S\pi^+\eta$	$K^0_SK^+\eta$	$\pi^+\pi^+\pi^-\eta$	$K^0_S\pi^+\pi^0\eta$	$K^-\pi^+\pi^+\eta$	$\pi^+\pi^0\pi^0\eta$
$N^{\rm tot}_{\rm ST}$	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
$K^{\pm}/\pi^{\pm}$ tracking	0.7	–	1.0	–	0.9	0.7	–	0.6	0.2	0.5	1.2	0.4	0.9	0.3
$K^{\pm}/\pi^{\pm}$ PID	0.4	–	0.5	–	0.4	0.4	–	0.4	0.2	0.3	0.7	0.2	0.6	0.2
π^0/η reconstruction	0.7	1.5	0.8	0.8	1.4	0.8	2.2	1.5	0.7	0.8	0.7	1.5	0.7	2.2
K^0_S reconstruction	–	1.6	–	3.2	–	1.6	1.6	–	1.6	1.6	–	1.6	–	–
Quoted $\mathcal{B}$	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
2D fit	0.5	1.0	5.3	10.5	2.4	0.7	2.9	2.6	0.9	3.6	1.9	4.5	2.1	3.2
$D\bar{D}$ angle	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
$\Delta E^{\rm sig}$ requirement	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
$K^0_S/\eta/\omega/\eta'$ rejection	–	–	–	–	–	3.7	5.9	2.3	–	–	–	–	1.9	2.9
K^0_S sideband	–	0.5	–	–	–	0.6	–	–	0.2	–	–	–	–	–
MC statistics	0.3	0.5	0.4	0.6	0.5	0.6	1.1	0.5	0.4	0.5	0.4	0.7	0.4	0.7
MC generator	0.5	0.8	0.9	0.9	1.2	1.5	0.9	1.8	0.9	0.9	1.5	0.9	1.2	1.9
Strong phase of neutral D	–	0.8	7.4	7.4	–	1.3	6.5	0.8	–	–	–	–	–	–
Total	1.6	2.9	9.3	13.3	3.4	3.8	8.3	4.4	2.4	4.2	3.0	5.2	3.4	5.3

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