

*School of Natural Sciences and Mathematics*

***Precision Study of  $\eta' \rightarrow \gamma\pi^+\pi^-$  Decay Dynamics—Supplement***

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# Supplemental Material

The systematic uncertainties in the model dependent and independent approaches are summarized in the following Table II.

TABLE II. Impact of the systematic uncertainties on the model-dependent fits and on the model-independent fit. All the values for the model-dependent fits are the absolute differences, while those for the independent fit are the relative differences in %.

Systematic sources	$\rho^0$ - $\omega$ - $\rho'$						$\rho^0$ - $\omega$ -box anomaly					model-independent fit		
	$M(\rho^0)\Gamma(\rho^0)$	$\arg \delta$ [ $10^{-2}$ ]	$ \delta $ [ $10^{-3}$ ]	$\arg \beta$ [ $10^{-2}$ ]	$ \beta $ [ $10^{-3}$ ]		$M(\rho^0)\Gamma(\rho^0)$	$\arg \delta$ [ $10^{-2}$ ]	$ \delta $ [ $10^{-3}$ ]	$\alpha$		$\kappa$	$\lambda$	$\xi$
4C kinematic fit	0.20	0.37	0.52	0.09	0.19	0.96	0.22	0.38	0.75	0.10	0.05	1.82	3.62	3.89
MDC tracking	0.04	0.08	0.21	0.00	0.23	1.20	0.05	0.12	0.17	0.00	0.06	0.10	0.85	0.44
Photon detection	0.08	0.04	0.20	0.00	0.21	1.39	0.09	0.03	0.24	0.00	0.07	1.32	3.86	0.20
$\eta'$ mass window	0.21	0.10	1.32	0.00	0.53	3.16	0.20	0.08	1.32	0.01	0.15	0.03	0.05	0.01
Binning	0.06	0.14	1.37	0.05	0.14	0.65	0.07	0.15	1.25	0.06	0.04	0.44	0.86	3.09
Fit range	0.07	0.43	0.38	0.02	0.32	3.09	0.10	0.44	0.42	0.02	0.15	3.82	7.82	0.18
Background uncertainty	0.11	0.23	0.54	0.01	0.50	3.88	0.09	0.25	0.52	0.01	0.21	5.13	8.15	0.55
Mass resolution	0.03	0.06	0.55	0.04	0.09	0.23	0.03	0.06	0.64	0.04	0.01	0.04	0.08	2.45
Resonances	0.06	0.08	1.47	0.01	3.57	4.41	0.02	0.04	1.44	0.01	0.01	-	-	-
Total	0.34	0.65	2.62	0.11	3.68	7.67	0.35	0.67	2.62	0.13	0.32	6.79	12.53	5.59
Form Factor	-	-	-	-	-	-	-	-	-	-	-	16.40	34.70	3.40