Reference = LEES 13F; PR D87 052010
Verifier code = BABAR

Normally we send all verifications for one experiment to one person, usually the spokesperson or data-analysis coordinator, who then distributes them to the appropriate people. Please tell us if we should send the verifications for your experiment to someone else.

PLEASE READ NOW

PLEASE REPLY WITHIN ONE WEEK

Fabio Anulli

EMAIL: anulli@slac.stanford.edu

July 21, 2016

Dear Colleague,

(1) Please check the results of your experiment carefully. They are marked.

(2) Please reply within one week.

(3) Please reply even if everything is correct.

(4) IMPORTANT!! Please tell WHICH papers you are verifying. We have lots of requests out.

(5) Feel free to make comments on our treatment of any of the results (not just yours) you see.

Thank you for helping us make the Review accurate and useful.

Sincerely,

Simon Eidelman
BINP, Budker Inst. of Nuclear Physics
Prospekt Lavrent'eva 11
RU-630090 Novosibirsk
Russian Federation

EMAIL: simon.eidelman@cern.ch

LIGHT UNFLAVORED MESONS ($S = C = B = 0$)

For $I = 1$ (π, b, ρ, a): $u\overline{d}$, $(u\overline{u}-d\overline{d})/\sqrt{2}$, $d\overline{u}$;
for $I = 0$ (η, η', h, h', ω, ϕ, f, f'): $c_1(u\overline{u} + d\overline{d}) + c_2(s\overline{s})$

NODE=MXXX005

NODE=MXXX005

NODE=M004

$\phi(1020)$

$I^G(J^{PC}) = 0^-(1^{--})$

$\phi(1020)$ MASS

NODE=M004M

NODE=M004M

VALUE (MeV)	EVTS	DOCUMENT ID		TECN	COMMENT
1019.461±0.019 OUR AVERAGE		Error includes scale factor of 1.1.			
1019.51 ±0.02 ±0.05		[1] LEES	13Q	BABR	$e^+e^- \to K^+K^-\gamma$
1019.30 ±0.02 ±0.10	105k	AKHMETSHIN	06	CMD2	0.98–1.06 $e^+e^- \to \pi^+\pi^-\pi^0$
1019.52 ±0.05 ±0.05	17.4k	AKHMETSHIN	05	CMD2	0.60-1.38 $e^+e^- \to \eta\gamma$
1019.483±0.011±0.025	272k	[2] AKHMETSHIN	04	CMD2	$e^+e^- \to K^0_L K^0_S$
1019.42 ±0.05	1900k	[3] ACHASOV	01E	SND	$e^+e^- \to K^+K^-$, $K_S K_L$, $\pi^+\pi^-\pi^0$
1019.40 ±0.04 ±0.05	23k	AKHMETSHIN	01B	CMD2	$e^+e^- \to \eta\gamma$
1019.36 ±0.12		[4] ACHASOV	00B	SND	$e^+e^- \to \eta\gamma$
1019.38 ±0.07 ±0.08	2200	[5] AKHMETSHIN	99F	CMD2	$e^+e^- \to \pi^+\pi^- \geq 2\gamma$
1019.51 ±0.07 ±0.10	11169	AKHMETSHIN	98	CMD2	$e^+e^- \to \pi^+\pi^-\pi^0$
1019.5 ±0.4		BARBERIS	98	OMEG	450 $pp \to pp2K^+2K^-$
1019.42 ±0.06	55600	AKHMETSHIN	95	CMD2	$e^+e^- \to$ hadrons
1019.7 ±0.3	2012	DAVENPORT	86	MPSF	400 pA $\to$ 4KX
1019.7 ±0.1 ±0.1	5079	ALBRECHT	85D	ARG	10 $e^+e^- \to K^+K^-$X
1019.3 ±0.1	1500	ARENTON	82	AEMS	11.8 polar. $pp \to KK$
1019.67 ±0.17	25080	[6] PELLINEN	82	RVUE	
1019.52 ±0.13	3681	BUKIN	78C	OLYA	$e^+e^- \to$ hadrons
• • • We do not use the following data for averages, fits, limits, etc. • • •					
YOUR DATA 1019.48 ±0.01		LEES	13F	BABR	$D^+ \to K^+K^-\pi^+$
1019.441±0.008±0.080	542k	[7] AKHMETSHIN	08	CMD2	1.02 $e^+e^- \to K^+K^-$
1019.63 ±0.07	12540	[8] AUBERT,B	05J	BABR	$D^0 \to \overline{K}^0 K^+K^-$
1019.8 ±0.7		ARMSTRONG	86	OMEG	85 $\pi^+/pp \to \pi^+/p4Kp$
1020.1 ±0.11	5526	[8] ATKINSON	86	OMEG	20–70 γp
1019.7 ±1.0		BEBEK	86	CLEO	$e^+e^- \to \Upsilon(4S)$
1019.411±0.008	642k	[9] DIJKSTRA	86	SPEC	100–200 $\pi^\pm$, $\overline{p}$, p, $K^\pm$, on Be
1020.9 ±0.2		[8] FRAME	86	OMEG	13 $K^+p \to \phi K^+p$
1021.0 ±0.2		[8] ARMSTRONG	83B	OMEG	18.5 $K^-p \to K^-K^+\Lambda$
1020.0 ±0.5		[8] ARMSTRONG	83B	OMEG	18.5 $K^-p \to K^-K^+\Lambda$
1019.7 ±0.3		[8] BARATE	83	GOLI	190 π^-Be $\to 2\mu$X
1019.8 ±0.2 ±0.5	766	IVANOV	81	OLYA	1–1.4 $e^+e^- \to K^+K^-$
1019.4 ±0.5	337	COOPER	78B	HBC	0.7–0.8 $\overline{p}p \to K^0_S K^0_L \pi^+\pi^-$
1020 ±1	383	[8] BALDI	77	CNTR	10 $\pi^-p \to \pi^-\phi p$
1018.9 ±0.6	800	COHEN	77	ASPK	6 $\pi^\pm N \to K^+K^-N$
1019.7 ±0.5	454	KALBFLEISCH	76	HBC	2.18 $K^-p \to \Lambda K\overline{K}$
1019.4 ±0.8	984	BESCH	74	CNTR	2 $\gamma p \to pK^+K^-$
1020.3 ±0.4	100	BALLAM	73	HBC	2.8–9.3 γp
1019.4 ±0.7		BINNIE	73B	CNTR	$\pi^-p \to \phi n$
1019.6 ±0.5	120	[10] AGUILAR-...	72B	HBC	3.9,4.6 $K^-p \to \Lambda K^+K^-$

OCCUR=2

OCCUR=2

1019.9	±0.5	100	[10] AGUILAR-...	72B	HBC	3.9,4.6 $K^- p \to K^- p K^+ K^-$	OCCUR=2
1020.4	±0.5	131	COLLEY	72	HBC	10 $K^+ p \to K^+ p \phi$	
1019.9	±0.3	410	STOTTLE...	71	HBC	2.9 $K^- p \to \Sigma / \Lambda K \overline{K}$	

[1] Using a phenomenological model based on KUHN 90 with a sum of Breit-Wigner resonances for $\rho(770)$, $\omega(782)$, $\phi(1020)$ and their higher mass excitations. NODE=M004M;LINKAGE=C

[2] Update of AKHMETSHIN 99D NODE=M004M;LINKAGE=GS

[3] From the combined fit assuming that the total $\phi(1020)$ production cross section is saturated by those of $K^+ K^-$, $K_S K_L$, $\pi^+ \pi^- \pi^0$, and $\eta\gamma$ decays modes and using ACHASOV 00B for the $\eta\gamma$ decay mode. NODE=M004M;LINKAGE=AE

[4] Using a total width of 4.43 ± 0.05 MeV. Systematic uncertainty included. NODE=M004M;LINKAGE=G2

[5] Using a total width of 4.43 ± 0.05 MeV. NODE=M004M;LINKAGE=F2

[6] PELLINEN 82 review includes AKERLOF 77, DAUM 81, BALDI 77, AYRES 74, DEGROOT 74. NODE=M004M;LINKAGE=R

[7] Strongly correlated with AKHMETSHIN 04. NODE=M004M;LINKAGE=AH

[8] Systematic errors not evaluated. NODE=M004M;LINKAGE=A

[9] Weighted and scaled average of 12 measurements of DIJKSTRA 86. NODE=M004M;LINKAGE=B

[10] Mass errors enlarged by us to $\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass. NODE=M004M;LINKAGE=D

ϕ(1020) WIDTH

NODE=M004W

NODE=M004W

	VALUE (MeV)	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
	4.266±0.031 OUR AVERAGE		Error includes scale factor of 1.2.			
	4.29 ±0.04 ±0.07		[1] LEES	13Q	BABR	$e^+ e^- \to K^+ K^- \gamma$
	4.30 ±0.06 ±0.17	105k	AKHMETSHIN	06	CMD2	0.98–1.06 $e^+ e^- \to \pi^+ \pi^- \pi^0$
	4.280±0.033±0.025	272k	[2] AKHMETSHIN	04	CMD2	$e^+ e^- \to K^0_L K^0_S$
	4.21 ±0.04	1900k	[3] ACHASOV	01E	SND	$e^+ e^- \to K^+ K^-$, $K_S K_L$, $\pi^+ \pi^- \pi^0$
	4.44 ±0.09	55600	AKHMETSHIN	95	CMD2	$e^+ e^- \to$ hadrons
	4.5 ±0.7	1500	ARENTON	82	AEMS	11.8 polar. $p p \to K K$
	4.2 ±0.6	766	[4] IVANOV	81	OLYA	1–1.4 $e^+ e^- \to K^+ K^-$
	4.3 ±0.6		[4] CORDIER	80	DM1	$e^+ e^- \to \pi^+ \pi^- \pi^0$
	4.36 ±0.29	3681	[4] BUKIN	78C	OLYA	$e^+ e^- \to$ hadrons
	4.4 ±0.6	984	[4] BESCH	74	CNTR	2 $\gamma p \to p K^+ K^-$
	4.67 ±0.72	681	[4] BALAKIN	71	OSPK	$e^+ e^- \to$ hadrons
	4.09 ±0.29		BIZOT	70	OSPK	$e^+ e^- \to$ hadrons
	• • • We do not use the following data for averages, fits, limits, etc. • • •					
YOUR DATA	4.37 ±0.02		LEES	13F	BABR	$D^+ \to K^+ K^- \pi^+$
	4.24 ±0.02 ±0.03	542k	[5] AKHMETSHIN	08	CMD2	1.02 $e^+ e^- \to K^+ K^-$
	4.28 ±0.13	12540	[6] AUBERT,B	05J	BABR	$D^0 \to \overline{K}^0 K^+ K^-$
	4.45 ±0.06	271k	DIJKSTRA	86	SPEC	100 π^- Be
	3.6 ±0.8	337	[4] COOPER	78B	HBC	0.7–0.8 $\overline{p} p \to K^0_S K^0_L \pi^+ \pi^-$
	4.5 ±0.50	1300	[4,6] AKERLOF	77	SPEC	400 pA $\to K^+ K^-$ X
	4.5 ±0.8	500	[4,6] AYRES	74	ASPK	3–6 $\pi^- p \to K^+ K^- n$, $K^- p \to K^+ K^- \Lambda / \Sigma^0$
	3.81 ±0.37		COSME	74B	OSPK	$e^+ e^- \to K^0_L K^0_S$
	3.8 ±0.7	454	[4] BORENSTEIN	72	HBC	2.18 $K^- p \to K \overline{K} n$

[1] Using a phenomenological model based on KUHN 90 with a sum of Breit-Wigner resonances for $\rho(770)$, $\omega(782)$, $\phi(1020)$ and their higher mass excitations. NODE=M004W;LINKAGE=C

[2] Update of AKHMETSHIN 99D NODE=M004W;LINKAGE=GS

[3] From the combined fit assuming that the total $\phi(1020)$ production cross section is saturated by those of $K^+ K^-$, $K_S K_L$, $\pi^+ \pi^- \pi^0$, and $\eta\gamma$ decays modes and using ACHASOV 00B for the $\eta\gamma$ decay mode. NODE=M004W;LINKAGE=AE

[4] Width errors enlarged by us to $4\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass. NODE=M004W;LINKAGE=D

[5] Strongly correlated with AKHMETSHIN 04. NODE=M004W;LINKAGE=AH

[6] Systematic errors not evaluated. NODE=M004W;LINKAGE=A

$\phi(1020)$ REFERENCES

NODE=M004

YOUR PAPER	LEES	13F	PR D87 052010	J.P. Lees *et al.*	(BABAR Collab.)	REFID=55127
	LEES	13Q	PR D88 032013	J.P. Lees *et al.*	(BABAR Collab.)	REFID=55404
	AKHMETSHIN	08	PL B669 217	R.R. Akhmetshin *et al.*	(CMD-2 Collab.)	REFID=52572
	AKHMETSHIN	06	PL B642 203	R.R. Akhmetshin *et al.*	(CMD-2 Collab.)	REFID=51465
	AKHMETSHIN	05	PL B605 26	R.R. Akhmetshin *et al.*	(Novosibirsk CMD-2 Collab.)	REFID=50330
	AUBERT,B	05J	PR D72 052008	B. Aubert *et al.*	(BABAR Collab.)	REFID=50824
	AKHMETSHIN	04	PL B578 285	R.R. Akhmetshin *et al.*	(Novosibirsk CMD-2 Collab.)	REFID=49609
	ACHASOV	01E	PR D63 072002	M.N. Achasov *et al.*	(Novosibirsk SND Collab.)	REFID=48311
	AKHMETSHIN	01B	PL B509 217	R.R. Akhmetshin *et al.*	(Novosibirsk CMD-2 Collab.)	REFID=48167
	ACHASOV	00B	JETP 90 17	M.N. Achasov *et al.*	(Novosibirsk SND Collab.)	REFID=47425
			Translated from ZETF 117 22.			
	AKHMETSHIN	99D	PL B466 385	R.R. Akhmetshin *et al.*		REFID=47397
	Also		PL B508 217 (errat.)	R.R. Akhmetshin *et al.*	(Novosibirsk CMD-2 Collab.)	REFID=48328
	AKHMETSHIN	99F	PL B460 242	R.R. Akhmetshin *et al.*	(Novosibirsk CMD-2 Collab.)	REFID=47473
	AKHMETSHIN	98	PL B434 426	R.R. Akhmetshin *et al.*	(CMD-2 Collab.)	REFID=46325
	BARBERIS	98	PL B432 436	D. Barberis *et al.*	(Omega Expt.)	REFID=46344
	AKHMETSHIN	95	PL B364 199	R.R. Akhmetshin *et al.*	(Novosibirsk CMD-2 Collab.)	REFID=44617
	KUHN	90	ZPHY C48 445	J.H. Kuhn *et al.*	(MPIM)	REFID=45862
	ARMSTRONG	86	PL 166B 245	T.A. Armstrong *et al.*	(ATHU, BARI, BIRM+)	REFID=20563
	ATKINSON	86	ZPHY C30 521	M. Atkinson *et al.*	(BONN, CERN, GLAS+)	REFID=20564
	BEBEK	86	PRL 56 1893	C. Bebek *et al.*	(CLEO Collab.)	REFID=11540
	DAVENPORT	86	PR D33 2519	T.F. Davenport	(TUFTS, ARIZ, FNAL, FSU, NDAM+)	REFID=20567
	DIJKSTRA	86	ZPHY C31 375	H. Dijkstra *et al.*	(ANIK, BRIS, CERN+)	REFID=20568
	FRAME	86	NP B276 667	D. Frame *et al.*	(GLAS)	REFID=20569
	ALBRECHT	85D	PL 153B 343	H. Albrecht *et al.*	(ARGUS Collab.)	REFID=20562
	ARMSTRONG	83B	NP B224 193	T.A. Armstrong *et al.*	(BARI, BIRM, CERN+)	REFID=20558
	BARATE	83	PL 121B 449	R. Barate *et al.*	(SACL, LOIC, SHMP, IND)	REFID=12177
	ARENTON	82	PR D25 2241	M.W. Arenton *et al.*	(ANL, ILL)	REFID=20556
	PELLINEN	82	PS 25 599	A. Pellinen, M. Roos	(HELS)	REFID=20557
	DAUM	81	PL 100B 439	C. Daum *et al.*	(AMST, BRIS, CERN, CRAC+)	REFID=20552
	IVANOV	81	PL 107B 297	P.M. Ivanov *et al.*	(NOVO)	REFID=20553
	Also		Private Comm.	S.I. Eidelman	(NOVO)	REFID=20554
	CORDIER	80	NP B172 13	A. Cordier *et al.*	(LALO)	REFID=20240
	BUKIN	78C	SJNP 27 516	A.D. Bukin *et al.*	(NOVO)	REFID=20544
			Translated from YAF 27 976.			
	COOPER	78B	NP B146 1	A.M. Cooper *et al.*	(TATA, CERN, CDEF+)	REFID=20235
	AKERLOF	77	PRL 39 861	C.W. Akerlof *et al.*	(FNAL, MICH, PURD)	REFID=20534
	BALDI	77	PL 68B 381	R. Baldi *et al.*	(GEVA)	REFID=20536
	COHEN	77	PRL 38 269	D. Cohen *et al.*	(ANL)	REFID=20538
	KALBFLEISCH	76	PR D13 22	G.R. Kalbfleisch, R.C. Strand, J.W. Chapman	(BNL+)	REFID=20531
	AYRES	74	PRL 32 1463	D.S. Ayres *et al.*	(ANL)	REFID=20522
	BESCH	74	NP B70 257	H.J. Besch *et al.*	(BONN)	REFID=20523
	COSME	74B	PL 48B 159	G. Cosme *et al.*	(ORSAY)	REFID=20526
	DEGROOT	74	NP B74 77	A.J. de Groot *et al.*	(AMST, NIJM)	REFID=20527
	BALLAM	73	PR D7 3150	J. Ballam *et al.*	(SLAC, LBL)	REFID=20520
	BINNIE	73B	PR D8 2789	D.M. Binnie *et al.*	(LOIC, SHMP)	REFID=20216
	AGUILAR-...	72B	PR D6 29	M. Aguilar-Benitez *et al.*	(BNL)	REFID=20205
	BORENSTEIN	72	PR D5 1559	S.R. Borenstein *et al.*	(BNL, MICH)	REFID=20215
	COLLEY	72	NP B50 1	D.C. Colley *et al.*	(BIRM, GLAS)	REFID=20519
	BALAKIN	71	PL 34B 328	V.E. Balakin *et al.*	(NOVO)	REFID=20507
	STOTTLE...	71	Thesis ORO 2504 170	A.R. Stottlemyer	(UMD)	REFID=20512
	BIZOT	70	PL 32B 416	J.C. Bizot *et al.*	(ORSAY)	REFID=20501
	Also		Liverpool Sym. 69	J.P. Perez-y-Jorba		REFID=20502

STRANGE MESONS
$(S = \pm1,\ C = B = 0)$

NODE=MXXX020

$K^+ = u\overline{s}$, $K^0 = d\overline{s}$, $\overline{K}^0 = \overline{d}\,s$, $K^- = \overline{u}\,s$, similarly for K^*'s

NODE=MXXX020

NODE=M018

$K^*(892)$

$I(J^P) = \frac{1}{2}(1^-)$

$K^*(892)$ MASS

NODE=M018205

NEUTRAL ONLY

NODE=M018M2

NODE=M018M2

VALUE (MeV)	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
895.81±0.19 OUR AVERAGE		Error includes scale factor of 1.4. See the ideogram below.			
895.4 ±0.2 ±0.2	243k	[13] DEL-AMO-SA..11I		BABR	$D^+ \to K^-\pi^+ e^+ \nu_e$
895.7 ±0.2 ±0.3	141k	[14] BONVICINI	08A	CLEO	$D^+ \to K^-\pi^+\pi^+$
$895.41 \pm 0.32^{+0.35}_{-0.43}$	18k	[15] LINK	05I	FOCS	$D^+ \to K^-\pi^+\mu^+\nu_\mu$
896 ±2		BARBERIS	98E	OMEG	450 $p p \to p_f p_s K^* \overline{K}^*$
895.9 ±0.5 ±0.2		ASTON	88	LASS	11 $K^- p \to K^-\pi^+ n$
894.52±0.63	25k	[1] ATKINSON	86	OMEG	20–70 γp

	VALUE (MeV)	EVTS	DOCUMENT ID		TECN	COMMENT	
	894.63±0.76	20k	[1] ATKINSON	86	OMEG	20–70 γp	OCCUR=2
	897 ±1	28k	EVANGELIS...	80	OMEG	10 $\pi^- p \rightarrow K^+ \pi^- (\Lambda, \Sigma)$	
	898.4 ±1.4	1180	AGUILAR-...	78B	HBC	0.76 $\overline{p} p \rightarrow K^\mp K^0_S \pi^\pm$	
	894.9 ±1.6		WICKLUND	78	ASPK	3,4,6 $K^\pm N \rightarrow (K\pi)^0 N$	
	897.6 ±0.9		BOWLER	77	DBC	5.4 $K^+ d \rightarrow K^+ \pi^- p p$	
	895.5 ±1.0	3600	MCCUBBIN	75	HBC	3.6 $K^- p \rightarrow K^- \pi^+ n$	
	897.1 ±0.7	22k	[1] PALER	75	HBC	14.3 $K^- p \rightarrow (K\pi)^0$ X	
	896.0 ±0.6	10k	FOX	74	RVUE	2 $K^- p \rightarrow K^- \pi^+ n$	
	896.0 ±0.6		FOX	74	RVUE	2 $K^+ n \rightarrow K^+ \pi^- p$	OCCUR=2
	896 ±2		[16] MATISON	74	HBC	12 $K^+ p \rightarrow K^+ \pi^- \Delta$	
	896 ±1	3186	LEWIS	73	HBC	2.1–2.7 $K^+ p \rightarrow K \pi \pi p$	
	894.0 ±1.3		[16] LINGLIN	73	HBC	2–13 $K^+ p \rightarrow K^+ \pi^- \pi^+ p$	
	898.4 ±1.3	1700	[2] BUCHNER	72	DBC	4.6 $K^+ n \rightarrow K^+ \pi^- p$	
	897.9 ±1.1	2934	[2] AGUILAR-...	71B	HBC	3.9,4.6 $K^- p \rightarrow K^- \pi^+ n$	
	898.0 ±0.7	5362	[2] AGUILAR-...	71B	HBC	3.9,4.6 $K^- p \rightarrow K^- \pi^+ \pi^- p$	OCCUR=2
	895 ±1	4300	[3] HABER	70	DBC	3 $K^- N \rightarrow K^- \pi^+$ X	
	893.7 ±2.0	10k	DAVIS	69	HBC	12 $K^+ p \rightarrow K^+ \pi^- \pi^+ p$	
	894.7 ±1.4	1040	[2] DAUBER	67B	HBC	2.0 $K^- p \rightarrow K^- \pi^+ \pi^- p$	
	• • • We do not use the following data for averages, fits, limits, etc. • • •						
YOUR DATA	895.53±0.17		LEES	13F	BABR	$D^+ \rightarrow K^+ K^- \pi^+$	
	894.9 ±0.5 ±0.7	14.4k	[17] MITCHELL	09A	CLEO	$D^+_s \rightarrow K^+ K^- \pi^+$	
	896.2 ±0.3	20k	[8] AUBERT	07AK	BABR	10.6 $e^+ e^- \rightarrow K^{*0} K^\pm \pi^\mp \gamma$	
	900.7 ±1.1	5900	BARTH	83	HBC	70 $K^+ p \rightarrow K^+ \pi^-$ X	

[1] Inclusive reaction. Complicated background and phase-space effects. NODE=M018M;LINKAGE=I
[2] Mass errors enlarged by us to $\Gamma/\sqrt{N}$. See note. NODE=M018M;LINKAGE=D
[3] Number of events in peak reevaluated by us. NODE=M018M;LINKAGE=W
[8] Systematic uncertainties not estimated. NODE=M018M2;LINKAGE=NS
[13] Taking into account the $K^*(892)^0$, S-wave and P-wave ($K^*(1410)^0$). NODE=M018M2;LINKAGE=DE
[14] From the isobar model with a complex pole for the κ. NODE=M018M2;LINKAGE=BO
[15] Fit to $K\pi$ mass spectrum includes a non-resonant scalar component. NODE=M018W2;LINKAGE=LI
[16] From pole extrapolation. NODE=M018M;LINKAGE=C
[17] This value comes from a fit with χ^2 of 178/117. NODE=M018M2;LINKAGE=MI

*K**(892) WIDTH

NODE=M018215

NEUTRAL ONLY

NODE=M018W2
NODE=M018W2

VALUE (MeV)	EVTS	DOCUMENT ID		TECN	COMMENT	
47.4 ±0.6 OUR AVERAGE		Error includes scale factor of 2.0. See the ideogram below.				
46.5 ±0.3 ±0.2	243k	[32] DEL-AMO-SA...	11I	BABR	$D^+ \rightarrow K^- \pi^+ e^+ \nu_e$	
45.3 ±0.5 ±0.6	141k	[33] BONVICINI	08A	CLEO	$D^+ \rightarrow K^- \pi^+ \pi^+$	
47.79±0.86$^{+1.32}_{-1.06}$	18k	[34] LINK	05I	FOCS	$D^+ \rightarrow K^- \pi^+ \mu^+ \nu_\mu$	
54 ±3		BARBERIS	98E	OMEG	450 $p p \rightarrow p_f p_s K^* \overline{K}^*$	
50.8 ±0.8 ±0.9		ASTON	88	LASS	11 $K^- p \rightarrow K^- \pi^+ n$	
46.5 ±4.3	5900	BARTH	83	HBC	70 $K^+ p \rightarrow K^+ \pi^-$ X	
54 ±2	28k	EVANGELIS...	80	OMEG	10 $\pi^- p \rightarrow K^+ \pi^- (\Lambda, \Sigma)$	
45.9 ±4.8	1180	AGUILAR-...	78B	HBC	0.76 $\overline{p} p \rightarrow K^\mp K^0_S \pi^\pm$	
51.2 ±1.7		WICKLUND	78	ASPK	3,4,6 $K^\pm N \rightarrow (K\pi)^0 N$	
48.9 ±2.5		BOWLER	77	DBC	5.4 $K^+ d \rightarrow K^+ \pi^- p p$	
48 $^{+3}_{-2}$	3600	MCCUBBIN	75	HBC	3.6 $K^- p \rightarrow K^- \pi^+ n$	
50.6 ±2.5	22k	[22] PALER	75	HBC	14.3 $K^- p \rightarrow (K\pi)^0$ X	
47 ±2	10k	FOX	74	RVUE	2 $K^- p \rightarrow K^- \pi^+ n$	
51 ±2		FOX	74	RVUE	2 $K^+ n \rightarrow K^+ \pi^- p$	OCCUR=2
46.0 ±3.3	3186	[21] LEWIS	73	HBC	2.1–2.7 $K^+ p \rightarrow K \pi \pi p$	
51.4 ±5.0	1700	[21] BUCHNER	72	DBC	4.6 $K^+ n \rightarrow K^+ \pi^- p$	
55.8 $^{+4.2}_{-3.4}$	2934	[21] AGUILAR-...	71B	HBC	3.9,4.6 $K^- p \rightarrow K^- \pi^+ n$	
48.5 ±2.7	5362	AGUILAR-...	71B	HBC	3.9,4.6 $K^- p \rightarrow K^- \pi^+ \pi^- p$	OCCUR=2
54.0 ±3.3	4300	[21,23] HABER	70	DBC	3 $K^- N \rightarrow K^- \pi^+$ X	
53.2 ±2.1	10k	[21] DAVIS	69	HBC	12 $K^+ p \rightarrow K^+ \pi^- \pi^+ p$	
44 ±5.5	1040	[21] DAUBER	67B	HBC	2.0 $K^- p \rightarrow K^- \pi^+ \pi^- p$	

• • • We do not use the following data for averages, fits, limits, etc. • • •

YOUR DATA	44.90±0.30		LEES	13F	BABR	$D^+ \to K^+ K^- \pi^+$
	45.7 ±1.1 ±0.5	14.4k	[35] MITCHELL	09A	CLEO	$D_s^+ \to K^+ K^- \pi^+$
	50.6 ±0.9	20k	[28] AUBERT	07AK	BABR	10.6 $e^+ e^- \to K^{*0} K^\pm \pi^\mp \gamma$

[21] Width errors enlarged by us to $4 \times \Gamma/\sqrt{N}$; see note. NODE=M018W;LINKAGE=D
[22] Inclusive reaction. Complicated background and phase-space effects. NODE=M018W;LINKAGE=I
[23] Number of events in peak reevaluated by us. NODE=M018W;LINKAGE=W
[28] Systematic uncertainties not estimated. NODE=M018W2;LINKAGE=NS
[32] Taking into account the $K^*(892)^0$, S-wave and P-wave ($K^*(1410)^0$). NODE=M018W2;LINKAGE=DE
[33] From the isobar model with a complex pole for the κ. NODE=M018W2;LINKAGE=BO
[34] Fit to $K\pi$ mass spectrum includes a non-resonant scalar component. NODE=M018M2;LINKAGE=LI
[35] This value comes from a fit with χ^2 of 178/117. NODE=M018W2;LINKAGE=MI

$K^*(892)$ REFERENCES

NODE=M018

YOUR PAPER	LEES	13F	PR D87 052010	J.P. Lees *et al.*	(BABAR Collab.)	REFID=55127
	DEL-AMO-SA...	11I	PR D83 072001	P. del Amo Sanchez *et al.*	(BABAR Collab.)	REFID=16493
	MITCHELL	09A	PR D79 072008	R.E. Mitchell *et al.*	(CLEO Collab.)	REFID=52756
	BONVICINI	08A	PR D78 052001	G. Bonvicini *et al.*	(CLEO Collab.)	REFID=52426
	AUBERT	07AK	PR D76 012008	B. Aubert *et al.*	(BABAR Collab.)	REFID=51908
	LINK	05I	PL B621 72	J.M. Link *et al.*	(FNAL FOCUS Collab.)	REFID=50679
	BARBERIS	98E	PL B436 204	D. Barberis *et al.*	(Omega Expt.)	REFID=46348
	ASTON	88	NP B296 493	D. Aston *et al.*	(SLAC, NAGO, CINC, INUS)	REFID=40262
	ATKINSON	86	ZPHY C30 521	M. Atkinson *et al.*	(BONN, CERN, GLAS+)	REFID=20564
	BARTH	83	NP B223 296	M. Barth *et al.*	(BRUX, CERN, GENO, MONS+)	REFID=22456
	EVANGELIS...	80	NP B165 383	C. Evangelista *et al.*	(BARI, BONN, CERN+)	REFID=22450
	AGUILAR-...	78B	NP B141 101	M. Aguilar-Benitez *et al.*	(MADR, TATA+)	REFID=22438
	WICKLUND	78	PR D17 1197	A.B. Wicklund *et al.*	(ANL)	REFID=20124
	BOWLER	77	NP B126 31	M.G. Bowler *et al.*	(OXF)	REFID=22437
	MCCUBBIN	75	NP B86 13	N.A. McCubbin, L. Lyons	(OXF)	REFID=22434
	PALER	75	NP B96 1	K. Paler *et al.*	(RHEL, SACL, EPOL)	REFID=22435
	FOX	74	NP B80 403	G.C. Fox, M.L. Griss	(CIT)	REFID=22430
	MATISON	74	PR D9 1872	M.J. Matison *et al.*	(LBL)	REFID=22431
	LEWIS	73	NP B60 283	P.H. Lewis *et al.*	(LOWC, LOIC, CDEF)	REFID=22427
	LINGLIN	73	NP B55 408	D. Linglin	(CERN)	REFID=22428
	BUCHNER	72	NP B45 333	K. Buchner *et al.*	(MPIM, CERN, BRUX)	REFID=22418
	AGUILAR-...	71B	PR D4 2583	M. Aguilar-Benitez, R.L. Eisner, J.B. Kinson	(BNL)	REFID=22408
	HABER	70	NP B17 289	B. Haber *et al.*	(REHO, SACL, BGNA, EPOL)	REFID=22406
	DAVIS	69	PRL 23 1071	P.J. Davis *et al.*	(LRL)	REFID=22400
	DAUBER	67B	PR 153 1403	P.M. Dauber *et al.*	(UCLA)	REFID=22389

Reference = LEES 14G; PR D89 111102
Verifier code = BABAR

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PLEASE READ NOW

PLEASE REPLY WITHIN ONE WEEK

Fabio Anulli

EMAIL: anulli@slac.stanford.edu

July 21, 2016

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(2) Please reply within one week.

(3) Please reply even if everything is correct.

(4) IMPORTANT!! Please tell WHICH papers you are verifying. We have lots of requests out.

(5) Feel free to make comments on our treatment of any of the results (not just yours) you see.

Thank you for helping us make the Review accurate and useful.

Sincerely,

Simon Eidelman
BINP, Budker Inst. of Nuclear Physics
Prospekt Lavrent'eva 11
RU-630090 Novosibirsk
Russian Federation

EMAIL: simon.eidelman@cern.ch

$b\overline{b}$ MESONS

NODE=MXXX030

NODE=M049

$\Upsilon(1S)$

$I^G(J^{PC}) = 0^-(1^{--})$

$\Upsilon(1S)$ BRANCHING RATIOS

NODE=M049225

$\Gamma(\overline{^2H}$ anything$)/\Gamma_{total}$ Γ_{47}/Γ

NODE=M049R33
NODE=M049R33

VALUE (units 10^{-5})	EVTS	DOCUMENT ID		TECN	COMMENT
2.85±0.25 OUR AVERAGE					
YOUR DATA $2.81\pm0.49^{+0.20}_{-0.24}$		LEES	14G	BABR	$e^+e^- \to \overline{^2H}\,X$
$2.86\pm0.19\pm0.21$	455	ASNER	07	CLEO	$e^+e^- \to \overline{^2H}\,X$

OCCUR=2

$\Upsilon(1S)$ REFERENCES

NODE=M049

YOUR PAPER LEES 14G PR D89 111102 J.P. Lees *et al.* (BABAR Collab.) REFID=55939
ASNER 07 PR D75 012009 D.M. Asner *et al.* (CLEO Collab.) REFID=51617

NODE=M052

$\Upsilon(2S)$

$I^G(J^{PC}) = 0^-(1^{--})$

$\Upsilon(2S)$ BRANCHING RATIOS

NODE=M052225

$\Gamma(\overline{^2H}$ anything$)/\Gamma_{total}$ Γ_{23}/Γ

NODE=M052R18
NODE=M052R18

VALUE (units 10^{-5})	EVTS	DOCUMENT ID		TECN	COMMENT
$2.78^{+0.30}_{-0.26}$ OUR AVERAGE Error includes scale factor of 1.2.					
YOUR DATA $2.64\pm0.11^{+0.26}_{-0.21}$		LEES	14G	BABR	$e^+e^- \to \overline{^2H}\,X$
$3.37\pm0.50\pm0.25$	58	ASNER	07	CLEO	$e^+e^- \to \overline{^2H}\,X$

$\Upsilon(2S)$ REFERENCES

NODE=M052

YOUR PAPER LEES 14G PR D89 111102 J.P. Lees *et al.* (BABAR Collab.) REFID=55939
ASNER 07 PR D75 012009 D.M. Asner *et al.* (CLEO Collab.) REFID=51617

NODE=M048

$\Upsilon(3S)$

$I^G(J^{PC}) = 0^-(1^{--})$

$\Upsilon(3S)$ BRANCHING RATIOS

NODE=M048225

$\Gamma(\overline{^2H}$ anything$)/\Gamma_{total}$ Γ_{19}/Γ

NODE=M048R00
NODE=M048R00

VALUE (units 10^{-5})	DOCUMENT ID		TECN	COMMENT
YOUR DATA **$2.33\pm0.15^{+0.31}_{-0.28}$**	LEES	14G	BABR	$e^+e^- \to \overline{^2H}\,X$

$\Upsilon(3S)$ REFERENCES

NODE=M048

YOUR PAPER LEES 14G PR D89 111102 J.P. Lees *et al.* (BABAR Collab.) REFID=55939

Reference = LEES 14F; PR D89 111103
Verifier code = BABAR

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$c\overline{c}$ MESONS

NODE=MXXX025

NODE=M181

$X(4360)$

$I^G(J^{PC}) = ?^?(1^{--})$

Seen in radiative return from e^+e^- collisions at $\sqrt{s} = 9.54$–10.58 GeV by AUBERT 07S, WANG 07D, and LEES 14F. See also the review under the $X(3872)$ particle listings. (See the index for the page number.)

NODE=M181

$X(4360)$ MASS

NODE=M181M

NODE=M181M

	VALUE (MeV)	EVTS	DOCUMENT ID		TECN	COMMENT
	4346± 6 OUR AVERAGE					
	4347± 6±3	279	[1] WANG	15A	BELL	10.58 $e^+e^- \to \gamma\pi^+\pi^-\psi(2S)$
YOUR DATA	4340±16±9	37	[2] LEES	14F	BABR	10.58 $e^+e^- \to \gamma\pi^+\pi^-\psi(2S)$
	• • • We do not use the following data for averages, fits, limits, etc. • • •					
	$4355^{+9}_{-10}\pm9$	74	[3] LIU	08H	RVUE	10.58 $e^+e^- \to \gamma\pi^+\pi^-\psi(2S)$
	4324±24		[4] AUBERT	07S	BABR	10.58 $e^+e^- \to \gamma\pi^+\pi^-\psi(2S)$
	4361± 9±9	47	[2] WANG	07D	BELL	10.58 $e^+e^- \to \gamma\pi^+\pi^-\psi(2S)$

[1] From a two-resonance fit. Supersedes WANG 07D. NODE=M181M;LINKAGE=A
YOUR NOTE [2] From a two-resonance fit. NODE=M181M;LINKAGE=WA
[3] From a combined fit of AUBERT 07S and WANG 07D data with two resonances. NODE=M181M;LINKAGE=LI
[4] From a single-resonance fit. Systematic errors not estimated. NODE=M181M;LINKAGE=AU

$X(4360)$ WIDTH

NODE=M181W

NODE=M181W

	VALUE (MeV)	EVTS	DOCUMENT ID		TECN	COMMENT
	102±10 OUR AVERAGE					
	103± 9± 5	279	[1] WANG	15A	BELL	10.58 $e^+e^- \to \gamma\pi^+\pi^-\psi(2S)$
YOUR DATA	94±32±13	37	[2] LEES	14F	BABR	10.58 $e^+e^- \to \gamma\pi^+\pi^-\psi(2S)$
	• • • We do not use the following data for averages, fits, limits, etc. • • •					
	$103^{+17}_{-15}\pm11$	74	[3] LIU	08H	RVUE	10.58 $e^+e^- \to \gamma\pi^+\pi^-\psi(2S)$
	172±33		[4] AUBERT	07S	BABR	10.58 $e^+e^- \to \gamma\pi^+\pi^-\psi(2S)$
	74±15±10	47	[2] WANG	07D	BELL	10.58 $e^+e^- \to \gamma\pi^+\pi^-\psi(2S)$

[1] From a two-resonance fit. Supersedes WANG 07D. NODE=M181W;LINKAGE=A
YOUR NOTE [2] From a two-resonance fit. NODE=M181W;LINKAGE=WA
[3] From a combined fit of AUBERT 07S and WANG 07D data with two resonances. NODE=M181W;LINKAGE=LI
[4] From a single-resonance fit. Systematic errors not estimated. NODE=M181W;LINKAGE=AU

$X(4360)$ $\Gamma(i) \times \Gamma(e^+e^-)/\Gamma(\text{total})$

NODE=M181230

$\Gamma(\psi(2S)\pi^+\pi^-) \times \Gamma(e^+e^-)/\Gamma_{total}$ — $\Gamma_2\Gamma_1/\Gamma$

NODE=M181G1
NODE=M181G1

	VALUE (eV)	EVTS	DOCUMENT ID		TECN	COMMENT	
	• • • We do not use the following data for averages, fits, limits, etc. • • •						
	9.2±0.6±0.6	279	[1] WANG	15A	BELL	10.58 $e^+e^- \to \gamma\pi^+\pi^-\psi(2S)$	
	10.9±0.6±0.7	279	[2] WANG	15A	BELL	10.58 $e^+e^- \to \gamma\pi^+\pi^-\psi(2S)$	OCCUR=2
YOUR DATA	6.0±1.0±0.5	37	[3] LEES	14F	BABR	10.58 $e^+e^- \to \gamma\pi^+\pi^-\psi(2S)$	
YOUR DATA	7.2±1.0±0.6	37	[4] LEES	14F	BABR	10.58 $e^+e^- \to \gamma\pi^+\pi^-\psi(2S)$	OCCUR=2
	$11.1^{+1.3}_{-1.2}$	74	[5] LIU	08H	RVUE	10.58 $e^+e^- \to \gamma\pi^+\pi^-\psi(2S)$	
	12.3±1.2	74	[6] LIU	08H	RVUE	10.58 $e^+e^- \to \gamma\pi^+\pi^-\psi(2S)$	OCCUR=2
	10.4±1.7±1.5	47	[3] WANG	07D	BELL	10.58 $e^+e^- \to \gamma\pi^+\pi^-\psi(2S)$	
	11.8±1.8±1.4	47	[4] WANG	07D	BELL	10.58 $e^+e^- \to \gamma\pi^+\pi^-\psi(2S)$	OCCUR=2

[1] Solution I of two equivalent solutions from a fit using two interfering resonances. Supersedes WANG 07D. NODE=M181G1;LINKAGE=A
[2] Solution II of two equivalent solutions from a fit using two interfering resonances. Supersedes WANG 07D. NODE=M181G1;LINKAGE=B
YOUR NOTE [3] Solution I of two equivalent solutions in a fit using two interfering resonances. NODE=M181G1;LINKAGE=WA
YOUR NOTE [4] Solution II of two equivalent solutions in a fit using two interfering resonances. NODE=M181G1;LINKAGE=WN
[5] Solution I in a combined fit of AUBERT 07S and WANG 07D data with two resonances. NODE=M181G1;LINKAGE=LI
[6] Solution II in a combined fit of AUBERT 07S and WANG 07D data with two resonances. NODE=M181G1;LINKAGE=LU

$X(4360)$ REFERENCES

NODE=M181

	WANG	15A	PR D91 112007	X.L. Wang *et al.*	(BELLE Collab.)	REFID=56839
YOUR PAPER	LEES	14F	PR D89 111103	J.P. Lees *et al.*	(BABAR Collab.)	REFID=55938
	LIU	08H	PR D78 014032	Z.Q. Liu, X.S. Qin, C.Z. Yuan		REFID=52296
	AUBERT	07S	PRL 98 212001	B. Aubert *et al.*	(BABAR Collab.)	REFID=51724
	WANG	07D	PRL 99 142002	X.L. Wang *et al.*	(BELLE Collab.)	REFID=51959

NODE=M189

$X(4660)$

$I^G(J^{PC}) = ?^?(1^{--})$

Seen in radiative return from e^+e^- collisions at $\sqrt{s}$ = 9.54–10.58 GeV by WANG 07D. Also obtained in a combined fit of WANG 07D, AUBERT 07S, and LEES 14F. See also the review under the $X(3872)$ particle listings. (See the index for the page number.)

NODE=M189

$X(4660)$ MASS

NODE=M189M

NODE=M189M

	VALUE (MeV)	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*	
	4643± 9 OUR AVERAGE		Error includes scale factor of 1.2.				
	4652±10±11	279	[1] WANG	15A	BELL	10.58 $e^+e^- \to \gamma\pi^+\pi^-\psi(2S)$	
YOUR DATA	4669±21± 3	37	[2] LEES	14F	BABR	10.58 $e^+e^- \to \gamma\pi^+\pi^-\psi(2S)$	
	$4634^{+8}_{-7}{}^{+5}_{-8}$	142	[3] PAKHLOVA	08B	BELL	$e^+e^- \to \Lambda_c^+\Lambda_c^-$	
	• • • We do not use the following data for averages, fits, limits, etc. • • •						
	$4661^{+9}_{-8}\pm 6$	44	[4] LIU	08H	RVUE	10.58 $e^+e^- \to \gamma\pi^+\pi^-\psi(2S)$	
	4664±11± 5	44	WANG	07D	BELL	10.58 $e^+e^- \to \gamma\pi^+\pi^-\psi(2S)$	

YOUR NOTE

[1] From a two-resonance fit. Supersedes WANG 07D. NODE=M189M;LINKAGE=A

[2] From a two-resonance fit. NODE=M189M;LINKAGE=LE

[3] The $\pi^+\pi^-\psi(2S)$ and $\Lambda_c^+\Lambda_c^-$ states are not necessarily the same. NODE=M189M;LINKAGE=PA

[4] From a combined fit of AUBERT 07S and WANG 07D data with two resonances. NODE=M189M;LINKAGE=LI

$X(4660)$ WIDTH

NODE=M189W

NODE=M189W

	VALUE (MeV)	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
	72±11 OUR AVERAGE					
	68±11± 5	279	[1] WANG	15A	BELL	10.58 $e^+e^- \to \gamma\pi^+\pi^-\psi(2S)$
YOUR DATA	104±48±10	37	[2] LEES	14F	BABR	10.58 $e^+e^- \to \gamma\pi^+\pi^-\psi(2S)$
	$92^{+40}_{-24}{}^{+10}_{-21}$	142	[3] PAKHLOVA	08B	BELL	$e^+e^- \to \Lambda_c^+\Lambda_c^-$
	• • • We do not use the following data for averages, fits, limits, etc. • • •					
	$42^{+17}_{-12}\pm 6$	44	[4] LIU	08H	RVUE	10.58 $e^+e^- \to \gamma\pi^+\pi^-\psi(2S)$
	48±15± 3	44	WANG	07D	BELL	10.58 $e^+e^- \to \gamma\pi^+\pi^-\psi(2S)$

YOUR NOTE

[1] From a two-resonance fit. Supersedes WANG 07D. NODE=M189W;LINKAGE=A

[2] From a two-resonance fit. NODE=M189W;LINKAGE=LE

[3] The $\pi^+\pi^-\psi(2S)$ and $\Lambda_c^+\Lambda_c^-$ states are not necessarily the same. NODE=M189W;LINKAGE=B

[4] From a combined fit of AUBERT 07S and WANG 07D data with two resonances. NODE=M189W;LINKAGE=LI

$X(4660)$ $\Gamma(i) \times \Gamma(e^+e^-)/\Gamma(\text{total})$

NODE=M189230

$\Gamma(\psi(2S)\pi^+\pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ — $\Gamma_2\Gamma_1/\Gamma$

NODE=M189G1

NODE=M189G1

	VALUE (eV)	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*	
	• • • We do not use the following data for averages, fits, limits, etc. • • •						
	2.0±0.3±0.2	279	[1] WANG	15A	BELL	10.58 $e^+e^- \to \gamma\pi^+\pi^-\psi(2S)$	
	8.1±1.1±1.0	279	[2] WANG	15A	BELL	10.58 $e^+e^- \to \gamma\pi^+\pi^-\psi(2S)$	OCCUR=2
YOUR DATA	2.7±1.3±0.5	37	[3] LEES	14F	BABR	10.58 $e^+e^- \to \gamma\pi^+\pi^-\psi(2S)$	
YOUR DATA	7.5±1.7±0.7	37	[4] LEES	14F	BABR	10.58 $e^+e^- \to \gamma\pi^+\pi^-\psi(2S)$	OCCUR=2
	$2.2^{+0.7}_{-0.6}$	44	[5] LIU	08H	RVUE	10.58 $e^+e^- \to \gamma\pi^+\pi^-\psi(2S)$	
	5.9±1.6	44	[6] LIU	08H	RVUE	10.58 $e^+e^- \to \gamma\pi^+\pi^-\psi(2S)$	OCCUR=2
	3.0±0.9±0.3	44	[3] WANG	07D	BELL	10.58 $e^+e^- \to \gamma\pi^+\pi^-\psi(2S)$	
	7.6±1.8±0.8	44	[4] WANG	07D	BELL	10.58 $e^+e^- \to \gamma\pi^+\pi^-\psi(2S)$	OCCUR=2

[1] Solution I of two equivalent solutions from a fit using two interfering resonances. Supersedes WANG 07D. NODE=M189G1;LINKAGE=A

[2] Solution II of two equivalent solutions from a fit using two interfering resonances. Supersedes WANG 07D. NODE=M189G1;LINKAGE=B

YOUR NOTE [3] Solution I of two equivalent solutions in a fit using two interfering resonances. NODE=M189G1;LINKAGE=WA

YOUR NOTE [4] Solution II of two equivalent solutions in a fit using two interfering resonances. NODE=M189G1;LINKAGE=WN

[5] Solution I in a combined fit of AUBERT 07S and WANG 07D data with two resonances. NODE=M189G1;LINKAGE=LI

[6] Solution II in a combined fit of AUBERT 07S and WANG 07D data with two resonances. NODE=M189G1;LINKAGE=LU

X(4660) REFERENCES

NODE=M189

	WANG	15A	PR D91 112007	X.L. Wang *et al.*	(BELLE Collab.)	REFID=56839
YOUR PAPER	LEES	14F	PR D89 111103	J.P. Lees *et al.*	(BABAR Collab.)	REFID=55938
	LIU	08H	PR D78 014032	Z.Q. Liu, X.S. Qin, C.Z. Yuan		REFID=52296
	PAKHLOVA	08B	PRL 101 172001	C. Pakhlova *et al.*	(BELLE Collab.)	REFID=52596
	AUBERT	07S	PRL 98 212001	B. Aubert *et al.*	(BABAR Collab.)	REFID=51724
	WANG	07D	PRL 99 142002	X.L. Wang *et al.*	(BELLE Collab.)	REFID=51959

Reference = LEES 14E; PR D89 112004
Verifier code = BABAR

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$c\overline{c}$ MESONS

NODE=MXXX025

NODE=M026

$\eta_c(1S)$

$I^G(J^{PC}) = 0^+(0^{-+})$

$\eta_c(1S)$ MASS

NODE=M026M

NODE=M026M

	VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT	
	2983.4 ± 0.5 OUR AVERAGE		Error includes scale factor of 1.2.			
	2982.2 ± 1.5 ± 0.1	2.0k	[1] AAIJ 15BI	LHCB	$p p \to \eta_c(1S) X$	
	2983.5 ± 1.4 $^{+1.6}_{-3.6}$		[2] ANASHIN 14	KEDR	$J/\psi \to \gamma \eta_c$	
YOUR DATA	2979.8 ± 0.8 ± 3.5	4.5k	[3,4] LEES 14E	BABR	$\gamma\gamma \to K^+ K^- \pi^0$	
YOUR DATA	2984.1 ± 1.1 ± 2.1	900	[3,4,5] LEES 14E	BABR	$\gamma\gamma \to K^+ K^- \eta$	OCCUR=2
	2984.3 ± 0.6 ± 0.6		[6,7] ABLIKIM 12F	BES3	$\psi(2S) \to \gamma \eta_c$	
	2984.49 ± 1.16 ± 0.52	832	[3] ABLIKIM 12N	BES3	$\psi(2S) \to \pi^0 \gamma$ hadrons	
	2982.7 ± 1.8 ± 2.2	486	ZHANG 12A	BELL	$e^+ e^- \to e^+ e^- \eta' \pi^+ \pi^-$	
	2984.5 ± 0.8 ± 3.1	11k	DEL-AMO-SA...11M	BABR	$\gamma\gamma \to K^+ K^- \pi^+ \pi^- \pi^0$	
	2985.4 ± 1.5 $^{+0.5}_{-2.0}$	920	[7] VINOKUROVA 11	BELL	$B^\pm \to K^\pm (K^0_S K^\pm \pi^\mp)$	
	2982.2 ± 0.4 ± 1.6	14k	[8] LEES 10	BABR	10.6 $e^+ e^- \to e^+ e^- K^0_S K^\pm \pi^\mp$	
	2985.8 ± 1.5 ± 3.1	0.9k	AUBERT 08AB	BABR	$B \to \eta_c(1S) K^{(*)} \to K \overline{K} \pi K^{(*)}$	
	2986.1 ± 1.0 ± 2.5	7.5k	UEHARA 08	BELL	$\gamma\gamma \to \eta_c \to$ hadrons	
	2970 ± 5 ± 6	501	[9] ABE 07	BELL	$e^+ e^- \to J/\psi(c\overline{c})$	
	2971 ± 3 $^{+2}_{-1}$	195	WU 06	BELL	$B^+ \to p \overline{p} K^+$	
	2974 ± 7 $^{+2}_{-1}$	20	WU 06	BELL	$B^+ \to \Lambda \overline{\Lambda} K^+$	OCCUR=2
	2981.8 ± 1.3 ± 1.5	592	ASNER 04	CLEO	$\gamma\gamma \to \eta_c \to K^0_S K^\pm \pi^\mp$	
	2984.1 ± 2.1 ± 1.0	190	[10] AMBROGIANI 03	E835	$\overline{p} p \to \eta_c \to \gamma\gamma$	
	• • • We do not use the following data for averages, fits, limits, etc. • • •					
	2982.5 ± 0.4 ± 1.4	12k	[11] DEL-AMO-SA...11M	BABR	$\gamma\gamma \to K^0_S K^\pm \pi^\mp$	OCCUR=2
	2982.2 ± 0.6		[12] MITCHELL 09	CLEO	$e^+ e^- \to \gamma X$	
	2982 ± 5	270	[13] AUBERT 06E	BABR	$B^\pm \to K^\pm X_{c\overline{c}}$	
	2982.5 ± 1.1 ± 0.9	2.5k	[14] AUBERT 04D	BABR	$\gamma\gamma \to \eta_c(1S) \to K \overline{K} \pi$	
	2977.5 ± 1.0 ± 1.2		[12,15] BAI 03	BES	$J/\psi \to \gamma \eta_c$	
	2979.6 ± 2.3 ± 1.6	180	[16] FANG 03	BELL	$B \to \eta_c K$	
	2976.3 ± 2.3 ± 1.2		[12,17] BAI 00F	BES	J/ψ, $\psi(2S) \to \gamma \eta_c$	
	2976.6 ± 2.9 ± 1.3	140	[12,18] BAI 00F	BES	$J/\psi \to \gamma \eta_c$	OCCUR=2
	2980.4 ± 2.3 ± 0.6		[19] BRANDENB... 00B	CLE2	$\gamma\gamma \to \eta_c \to K^\pm K^0_S \pi^\mp$	
	2975.8 ± 3.9 ± 1.2		[18] BAI 99B	BES	Sup. by BAI 00F	
	2999 ± 8	25	ABREU 98O	DLPH	$e^+ e^- \to e^+ e^-$ +hadrons	
	2988.3 $^{+3.3}_{-3.1}$		ARMSTRONG 95F	E760	$\overline{p} p \to \gamma\gamma$	
	2974.4 ± 1.9		[12,20] BISELLO 91	DM2	$J/\psi \to \eta_c \gamma$	
	2969 ± 4 ± 4	80	[12] BAI 90B	MRK3	$J/\psi \to \gamma K^+ K^- K^+ K^-$	
	2956 ±12 ±12		[12] BAI 90B	MRK3	$J/\psi \to \gamma K^+ K^- K^0_S K^0_L$	OCCUR=3
	2982.6 $^{+2.7}_{-2.3}$	12	BAGLIN 87B	SPEC	$\overline{p} p \to \gamma\gamma$	
	2980.2 ± 1.6		[12,20] BALTRUSAIT...86	MRK3	$J/\psi \to \eta_c \gamma$	
	2984 ± 2.3 ± 4.0		[12] GAISER 86	CBAL	$J/\psi \to \gamma X$, $\psi(2S) \to \gamma X$	
	2976 ± 8		[12,21] BALTRUSAIT...84	MRK3	$J/\psi \to 2\phi\gamma$	
	2982 ± 8	18	[22] HIMEL 80B	MRK2	$e^+ e^-$	
	2980 ± 9		[22] PARTRIDGE 80B	CBAL	$e^+ e^-$	

[1] AAIJ 15BI reports $m_{J/\psi} - m_{\eta_c(1S)}$ = 114.7 ± 1.5 ± 0.1 MeV from a sample of $\eta_c(1S)$ and J/ψ produced in b-hadron decays. We have used current value of $m_{J/\psi}$ = 3096.900 ± 0.006 MeV to arrive at the quoted $m_{\eta_c(1S)}$ result. NODE=M026M;LINKAGE=D
[2] Taking into account an asymmetric photon lineshape. NODE=M026M;LINKAGE=E
YOUR NOTE [3] With floating width. NODE=M026M;LINKAGE=AL
YOUR NOTE [4] Ignoring possible interference with the non-resonant 0^- amplitude. NODE=M026M;LINKAGE=LS
YOUR NOTE [5] Using both, $\eta \rightarrow \gamma\gamma$ and $\eta \rightarrow \pi^+\pi^-\pi^0$ decays. NODE=M026M;LINKAGE=EL
[6] From a simultaneous fit to six decay modes of the η_c. NODE=M026M;LINKAGE=BL
[7] Accounts for interference with non-resonant continuum. NODE=M026M;LINKAGE=VA
[8] Taking into account interference with the non-resonant $J^P = 0^-$ amplitude. NODE=M026M;LINKAGE=LE
[9] From a fit of the J/ψ recoil mass spectrum. Supersedes ABE,K 02 and ABE 04G. NODE=M026M;LINKAGE=EB
[10] Using mass of $\psi(2S)$ = 3686.00 MeV. NODE=M026M;LINKAGE=BG
[11] Not independent from the measurements reported by LEES 10. NODE=M026M;LINKAGE=DE
[12] MITCHELL 09 observes a significant asymmetry in the lineshapes of $\psi(2S) \rightarrow \gamma\eta_c$ and $J/\psi \rightarrow \gamma\eta_c$ transitions. If ignored, this asymmetry could lead to significant bias whenever the mass and width are measured in $\psi(2S)$ or J/ψ radiative decays. NODE=M026M;LINKAGE=MI
[13] From the fit of the kaon momentum spectrum. Systematic errors not evaluated. NODE=M026M;LINKAGE=AU
[14] Superseded by LEES 10. NODE=M026M;LINKAGE=UB
[15] From a simultaneous fit of five decay modes of the η_c. NODE=M026M;LINKAGE=AK
[16] Superseded by VINOKUROVA 11. NODE=M026M;LINKAGE=FA
[17] Weighted average of the $\psi(2S)$ and $J/\psi(1S)$ samples. Using an η_c width of 13.2 MeV. NODE=M026M;LINKAGE=KZ
[18] Average of several decay modes. Using an η_c width of 13.2 MeV. NODE=M026M;LINKAGE=C1
[19] Superseded by ASNER 04. NODE=M026M;LINKAGE=NN
[20] Average of several decay modes. NODE=M026M;LINKAGE=A
[21] $\eta_c \rightarrow \phi\phi$. NODE=M026M;LINKAGE=B
[22] Mass adjusted by us to correspond to $J/\psi(1S)$ mass = 3097 MeV. NODE=M026M;LINKAGE=M

$\eta_c(1S)$ WIDTH

NODE=M026W

NODE=M026W

	VALUE (MeV)	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*	
	31.9± 1.0 OUR AVERAGE		Error includes scale factor of 1.2.				
	$27.2 \pm 3.1^{+5.4}_{-2.6}$		[1] ANASHIN	14	KEDR	$J/\psi \rightarrow \gamma\eta_c$	
YOUR DATA	$25.2 \pm 2.6 \pm 2.4$	4.5k	[2,3] LEES	14E	BABR	$\gamma\gamma \rightarrow K^+K^-\pi^0$	
YOUR DATA	$34.8 \pm 3.1 \pm 4.0$	900	[2,3,4] LEES	14E	BABR	$\gamma\gamma \rightarrow K^+K^-\eta$	OCCUR=2
	$32.0 \pm 1.2 \pm 1.0$		[5,6] ABLIKIM	12F	BES3	$\psi(2S) \rightarrow \gamma\eta_c$	
	$36.4 \pm 3.2 \pm 1.7$	832	[2] ABLIKIM	12N	BES3	$\psi(2S) \rightarrow \pi^0\gamma$ hadrons	
	$37.8^{+5.8}_{-5.3} \pm 3.1$	486	ZHANG	12A	BELL	$e^+e^- \rightarrow e^+e^-\eta'\pi^+\pi^-$	
	$36.2 \pm 2.8 \pm 3.0$	11k	DEL-AMO-SA...	11M	BABR	$\gamma\gamma \rightarrow K^+K^-\pi^+\pi^-\pi^0$	
	$35.1 \pm 3.1^{+1.0}_{-1.6}$	920	[6] VINOKUROVA	11	BELL	$B^\pm \rightarrow K^\pm(K^0_S K^\pm\pi^\mp)$	
	$31.7 \pm 1.2 \pm 0.8$	14k	[7] LEES	10	BABR	10.6 $e^+e^- \rightarrow e^+e^-K^0_S K^\pm\pi^\mp$	
	$36.3^{+3.7}_{-3.6} \pm 4.4$	0.9k	AUBERT	08AB	BABR	$B \rightarrow \eta_c(1S)K^{(*)} \rightarrow K\overline{K}\pi K^{(*)}$	
	$28.1 \pm 3.2 \pm 2.2$	7.5k	UEHARA	08	BELL	$\gamma\gamma \rightarrow \eta_c \rightarrow$ hadrons	
	$48\ ^{+8}_{-7} \pm 5$	195	WU	06	BELL	$B^+ \rightarrow p\overline{p}K^+$	
	$40 \pm 19 \pm 5$	20	WU	06	BELL	$B^+ \rightarrow \Lambda\overline{\Lambda}K^+$	OCCUR=2
	$24.8 \pm 3.4 \pm 3.5$	592	ASNER	04	CLEO	$\gamma\gamma \rightarrow \eta_c \rightarrow K^0_S K^\pm\pi^\mp$	
	$20.4^{+7.7}_{-6.7} \pm 2.0$	190	AMBROGIANI	03	E835	$\overline{p}p \rightarrow \eta_c \rightarrow \gamma\gamma$	
	$23.9^{+12.6}_{-7.1}$		ARMSTRONG	95F	E760	$\overline{p}p \rightarrow \gamma\gamma$	
	• • • We do not use the following data for averages, fits, limits, etc. • • •						
	$32.1 \pm 1.1 \pm 1.3$	12k	[8] DEL-AMO-SA...	11M	BABR	$\gamma\gamma \rightarrow K^0_S K^\pm\pi^\mp$	OCCUR=2
	$34.3 \pm 2.3 \pm 0.9$	2.5k	[9] AUBERT	04D	BABR	$\gamma\gamma \rightarrow \eta_c(1S) \rightarrow K\overline{K}\pi$	
	$17.0 \pm 3.7 \pm 7.4$		[10] BAI	03	BES	$J/\psi \rightarrow \gamma\eta_c$	
	$29 \pm 8 \pm 6$	180	[11] FANG	03	BELL	$B \rightarrow \eta_c K$	
	$11.0 \pm 8.1 \pm 4.1$		[12] BAI	00F	BES	$J/\psi \rightarrow \gamma\eta_c$ and $\psi(2S) \rightarrow \gamma\eta_c$	
	$27.0 \pm 5.8 \pm 1.4$		[13] BRANDENB...	00B	CLE2	$\gamma\gamma \rightarrow \eta_c \rightarrow K^\pm K^0_S\pi^\mp$	
	$7.0^{+7.5}_{-7.0}$	12	BAGLIN	87B	SPEC	$\overline{p}p \rightarrow \gamma\gamma$	
	$10.1^{+33.0}_{-8.2}$	23	[14] BALTRUSAIT...	86	MRK3	$J/\psi \rightarrow \gamma p\overline{p}$	

11.5 ± 4.5			GAISER	86	CBAL	$J/\psi \to \gamma X$, $\psi(2S) \to \gamma X$
< 40	90% CL	18	HIMEL	80B	MRK2	$e^+ e^-$
< 20	90% CL		PARTRIDGE	80B	CBAL	$e^+ e^-$

[1] Taking into account an asymmetric photon lineshape. NODE=M026W;LINKAGE=A

YOUR NOTE [2] With floating mass. NODE=M026W;LINKAGE=AL

YOUR NOTE [3] Ignoring possible interference with the non-resonant 0^- amplitude. NODE=M026W;LINKAGE=LS

YOUR NOTE [4] Using both, $\eta \to \gamma\gamma$ and $\eta \to \pi^+\pi^-\pi^0$ decays. NODE=M026W;LINKAGE=EL

[5] From a simultaneous fit to six decay modes of the η_c. NODE=M026W;LINKAGE=BL

[6] Accounts for interference with non-resonant continuum. NODE=M026W;LINKAGE=VA

[7] Taking into account interference with the non-resonant $J^P = 0^-$ amplitude. NODE=M026W;LINKAGE=LE

[8] Not independent from the measurements reported by LEES 10. NODE=M026W;LINKAGE=DE

[9] Superseded by LEES 10. NODE=M026W;LINKAGE=UB

[10] From a simultaneous fit of five decay modes of the η_c. NODE=M026W;LINKAGE=AK

[11] Superseded by VINOKUROVA 11. NODE=M026W;LINKAGE=FA

[12] From a fit to the 4-prong invariant mass in $\psi(2S) \to \gamma\eta_c$ and $J/\psi(1S) \to \gamma\eta_c$ decays. NODE=M026W;LINKAGE=KZ

[13] Superseded by ASNER 04. NODE=M026W;LINKAGE=NN

[14] Positive and negative errors correspond to 90% confidence level. NODE=M026W;LINKAGE=L

$\eta_c(1S)$ BRANCHING RATIOS

NODE=M026225

HADRONIC DECAYS

NODE=M026305

$\Gamma(f_0(980)\eta)/\Gamma_{total}$ Γ_{17}/Γ

NODE=M026R41

	VALUE	DOCUMENT ID		TECN	COMMENT
YOUR DATA	**seen**	LEES	14E	BABR	Dalitz anal. of $\eta_c \to K^+K^-\eta$

$\Gamma(f_0(1500)\eta)/\Gamma_{total}$ Γ_{18}/Γ

NODE=M026R42

	VALUE	DOCUMENT ID		TECN	COMMENT
YOUR DATA	**seen**	LEES	14E	BABR	Dalitz anal. of $\eta_c \to K^+K^-\eta$

$\Gamma(f_0(2200)\eta)/\Gamma_{total}$ Γ_{19}/Γ

NODE=M026R43

	VALUE	DOCUMENT ID		TECN	COMMENT
YOUR DATA	**seen**	LEES	14E	BABR	Dalitz anal. of $\eta_c \to K^+K^-\eta$

$\Gamma(a_0(980)\pi)/\Gamma_{total}$ Γ_{20}/Γ

NODE=M026R44

	VALUE	DOCUMENT ID		TECN	COMMENT
YOUR DATA	**seen**	LEES	14E	BABR	Dalitz anal. of $\eta_c \to K^+K^-\pi^0$

$\Gamma(a_0(1320)\pi)/\Gamma_{total}$ Γ_{21}/Γ

NODE=M026R45

	VALUE	DOCUMENT ID		TECN	COMMENT
YOUR DATA	**seen**	LEES	14E	BABR	Dalitz anal. of $\eta_c \to K^+K^-\pi^0$

$\Gamma(a_0(1450)\pi)/\Gamma_{total}$ Γ_{22}/Γ

NODE=M026R46

	VALUE	DOCUMENT ID		TECN	COMMENT
YOUR DATA	**seen**	LEES	14E	BABR	Dalitz anal. of $\eta_c \to K^+K^-\pi^0$

$\Gamma(K_0^*(1430)\overline{K})/\Gamma_{total}$ Γ_{25}/Γ

NODE=M026R47

	VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
	seen	12k	[1] LEES	16A	BABR	$\gamma\gamma \to \eta_c(1S) \to K\overline{K}\pi$
YOUR DATA	**seen**		LEES	14E	BABR	Dalitz anal. of $\eta_c \to K^+K^-\eta/\pi^0$

[1] From a model-independant partial wave analysis. NODE=M026R47;LINKAGE=A

$\Gamma(K_2^*(1430)\overline{K})/\Gamma_{total}$ Γ_{26}/Γ

NODE=M026R48

	VALUE	DOCUMENT ID		TECN	COMMENT
YOUR DATA	**seen**	LEES	14E	BABR	Dalitz anal. of $\eta_c \to K^+K^-\pi^0$

$\Gamma(K_0^*(1950)\overline{K})/\Gamma_{total}$ Γ_{27}/Γ

NODE=M026R49

	VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
	seen	12K	[1] LEES	16A	BABR	$\gamma\gamma \to \eta_c(1S) \to K\overline{K}\pi$
YOUR DATA	**seen**		LEES	14E	BABR	Dalitz anal. of $\eta_c \to K^+K^-\eta/\pi^0$

[1] From a Dalitz plot analysis using an isobar model. NODE=M026R49;LINKAGE=A

$\Gamma(K\overline{K}\eta)/\Gamma(K\overline{K}\pi)$ Γ_{29}/Γ_{28}

NODE=M026R40

	VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
YOUR DATA	**0.190±0.008±0.017**	5.4k	[1] LEES 14E	BABR	$\gamma\gamma \to K^+K^-\eta/\pi^0$	NODE=M026R40

YOUR NOTE [1] LEES 14E reports $B(\eta_c(1S) \to K^+K^-\eta)/B(\eta_c(1S) \to K^+K^-\pi^0) = 0.571\pm0.025\pm0.051$, which we divide by 3 to account for isospin symmetry. It uses both $\eta \to \gamma\gamma$ and $\eta \to \pi^+\pi^-\pi^0$ decays. NODE=M026R40;LINKAGE=LE

$\eta_c(1S)$ REFERENCES

NODE=M026

	LEES	16A	PR D93 012005	J.P. Lees *et al.*	(BABAR Collab.)	REFID=57125
	AAIJ	15BI	EPJ C75 311	R. Aaij *et al.*	(LHCb Collab.)	REFID=57147
	ANASHIN	14	PL B738 391	V.V. Anashin *et al.*	(KEDR Collab.)	REFID=56130
YOUR PAPER	LEES	14E	PR D89 112004	J.P. Lees *et al.*	(BABAR Collab.)	REFID=55937
	ABLIKIM	12F	PRL 108 222002	M. Ablikim *et al.*	(BES III Collab.)	REFID=54271
	ABLIKIM	12N	PR D86 092009	M. Ablikim *et al.*	(BES III Collab.)	REFID=54741
	ZHANG	12A	PR D86 052002	C.C. Zhang *et al.*	(BELLE Collab.)	REFID=54763
	DEL-AMO-SA...	11M	PR D84 012004	P. del Amo Sanchez *et al.*	(BABAR Collab.)	REFID=16751
	VINOKUROVA	11	PL B706 139	A. Vinokurova *et al.*	(BELLE Collab.)	REFID=53927
	LEES	10	PR D81 052010	J.P. Lees *et al.*	(BABAR Collab.)	REFID=53236
	MITCHELL	09	PRL 102 011801	R.E. Mitchell *et al.*	(CLEO Collab.)	REFID=52676
	AUBERT	08AB	PR D78 012006	B. Aubert *et al.*	(BABAR Collab.)	REFID=52267
	UEHARA	08	EPJ C53 1	S. Uehara *et al.*	(BELLE Collab.)	REFID=52064
	ABE	07	PRL 98 082001	K. Abe *et al.*	(BELLE Collab.)	REFID=51627
	AUBERT	06E	PRL 96 052002	B. Aubert *et al.*	(BABAR Collab.)	REFID=51059
	WU	06	PRL 97 162003	C.-H. Wu *et al.*	(BELLE Collab.)	REFID=51472
	ABE	04G	PR D70 071102	K. Abe *et al.*	(BELLE Collab.)	REFID=50182
	ASNER	04	PRL 92 142001	D.M. Asner *et al.*	(CLEO Collab.)	REFID=49745
	AUBERT	04D	PRL 92 142002	B. Aubert *et al.*	(BABAR Collab.)	REFID=49746
	AMBROGIANI	03	PL B566 45	M. Ambrogiani *et al.*	(FNAL E835 Collab.)	REFID=49465
	BAI	03	PL B555 174	J.Z. Bai *et al.*	(BES Collab.)	REFID=49185
	FANG	03	PRL 90 071801	F. Fang *et al.*	(BELLE Collab.)	REFID=49206
	ABE,K	02	PRL 89 142001	K. Abe *et al.*	(BELLE Collab.)	REFID=49188
	BAI	00F	PR D62 072001	J.Z. Bai *et al.*	(BES Collab.)	REFID=48546
	BRANDENB...	00B	PRL 85 3095	G. Brandenburg *et al.*	(CLEO Collab.)	REFID=48553
	BAI	99B	PR D60 072001	J.Z. Bai *et al.*	(BES Collab.)	REFID=47385
	ABREU	98O	PL B441 479	P. Abreu *et al.*	(DELPHI Collab.)	REFID=46553
	ARMSTRONG	95F	PR D52 4839	T.A. Armstrong *et al.*	(FNAL, FERR, GENO+)	REFID=44623
	BISELLO	91	NP B350 1	D. Bisello *et al.*	(DM2 Collab.)	REFID=41668
	BAI	90B	PRL 65 1309	Z. Bai *et al.*	(Mark III Collab.)	REFID=41354
	BAGLIN	87B	PL B187 191	C. Baglin *et al.*	(R704 Collab.)	REFID=40018
	BALTRUSAIT...	86	PR D33 629	R.M. Baltrusaitis *et al.*	(Mark III Collab.)	REFID=22009
	GAISER	86	PR D34 711	J. Gaiser *et al.*	(Crystal Ball Collab.)	REFID=22012
	BALTRUSAIT...	84	PRL 52 2126	R.M. Baltrusaitis *et al.*	(CIT, UCSC+) JP	REFID=22006
	HIMEL	80B	PRL 45 1146	T.M. Himel *et al.*	(SLAC, LBL, UCB)	REFID=22003
	PARTRIDGE	80B	PRL 45 1150	R. Partridge *et al.*	(CIT, HARV, PRIN+)	REFID=22004

NODE=M059

$\eta_c(2S)$

$I^G(J^{PC}) = 0^+(0^{-+})$

Quantum numbers are quark model predictions. NODE=M059

$\eta_c(2S)$ MASS

NODE=M059M

	VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT	
	3639.2±1.2 OUR AVERAGE					NODE=M059M
YOUR DATA	3637.0±5.7±3.4	178	[1,2] LEES 14E	BABR	$\gamma\gamma \to K^+K^-\pi^0$	
YOUR DATA	3635.1±5.8±2.1	47	[1,3] LEES 14E	BABR	$\gamma\gamma \to K^+K^-\eta$	OCCUR=2
	3646.9±1.6±3.6	57 ± 17	ABLIKIM 13K	BES3	$\psi(2S) \to \gamma K^0_S K^\pm\pi^\mp\pi^+\pi^-$	
	3637.6±2.9±1.6	127 ± 18	[4] ABLIKIM 12G	BES3	$\psi(2S) \to \gamma K^0 K\pi, K K\pi^0$	
	3638.5±1.5±0.8	624	[1] DEL-AMO-SA..11M	BABR	$\gamma\gamma \to K^0_S K^\pm\pi^\mp$	
	3640.5±3.2±2.5	1201	[1] DEL-AMO-SA..11M	BABR	$\gamma\gamma \to K^+K^-\pi^+\pi^-\pi^0$	OCCUR=2
	$3636.1^{+3.9}_{-4.2}{}^{+0.7}_{-2.0}$	128	[5] VINOKUROVA 11	BELL	$B^\pm \to K^\pm(K^0_S K^\pm\pi^\mp)$	
	3626 ±5 ±6	311	[6] ABE 07	BELL	$e^+e^- \to J/\psi(c\overline{c})$	
	$3645.0\pm5.5^{+4.9}_{-7.8}$	121 ± 27	AUBERT 05C	BABR	$e^+e^- \to J/\psi c\overline{c}$	
	3642.9±3.1±1.5	61	ASNER 04	CLEO	$\gamma\gamma \to \eta_c \to K^0_S K^\pm\pi^\mp$	
	• • • We do not use the following data for averages, fits, limits, etc. • • •					
	3639 ±7	98 ± 52	[7] AUBERT 06E	BABR	$B^\pm \to K^\pm X_{c\overline{c}}$	
	3630.8±3.4±1.0	112 ± 24	[8] AUBERT 04D	BABR	$\gamma\gamma \to \eta_c(2S) \to K\overline{K}\pi$	
	3654 ±6 ±8	39 ± 11	[9] CHOI 02	BELL	$B \to K K_S K^-\pi^+$	
	3594 ±5		[10] EDWARDS 82C	CBAL	$e^+e^- \to \gamma X$	

YOUR NOTE [1] Ignoring possible interference with continuum. NODE=M059M;LINKAGE=DE

YOUR NOTE [2] With a width fixed to 11.3 MeV. NODE=M059M;LINKAGE=LE

YOUR NOTE [3] With a width fixed to 11.3 MeV. Using both $\eta \to \gamma\gamma$ and $\eta \to \pi^+\pi^-\pi^0$ decays. NODE=M059M;LINKAGE=LS

[4] From a simultaneous fit to $K^0_S K^\pm \pi^\mp$ and $K^+ K^- \pi^0$ decay modes. NODE=M059M;LINKAGE=AB

[5] Accounts for interference with non-resonant continuum. NODE=M059M;LINKAGE=VA

[6] From a fit of the J/ψ recoil mass spectrum. Supersedes ABE,K 02 and ABE 04G. NODE=M059M;LINKAGE=EB

[7] From the fit of the kaon momentum spectrum. Systematic errors not evaluated. NODE=M059M;LINKAGE=AU

[8] Superseded by DEL-AMO-SANCHEZ 11M. NODE=M059M;LINKAGE=AR

[9] Superseded by VINOKUROVA 11. NODE=M059M;LINKAGE=CH

[10] Assuming mass of $\psi(2S)$ = 3686 MeV. NODE=M059M;LINKAGE=A

$\eta_c(2S)$ BRANCHING RATIOS

NODE=M059220

$\Gamma(K\overline{K}\eta)/\Gamma(K\overline{K}\pi)$ Γ_3/Γ_2

NODE=M059R26

NODE=M059R26

	VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
YOUR DATA	**27.3±7.0±5.7**	225	[28] LEES	14E	BABR	$\gamma\gamma \to K^+ K^- \gamma\gamma$

YOUR NOTE [28] LEES 14E reports $B(\eta_c(2S) \to K^+ K^- \eta)/B(\eta_c(2S) \to K^+ K^- \pi^0) = 0.82 \pm 0.21 \pm 0.17$, which we divide by 3 to account for isospin symmetry. NODE=M059R26;LINKAGE=LE

$\eta_c(2S)$ REFERENCES

NODE=M059

YOUR PAPER	LEES	14E	PR D89 112004	J.P. Lees *et al.*	(BABAR Collab.)	REFID=55937
	ABLIKIM	13K	PR D87 052005	M. Ablikim *et al.*	(BES III Collab.)	REFID=54956
	ABLIKIM	12G	PRL 109 042003	M. Ablikim *et al.*	(BES III Collab.)	REFID=54272
	DEL-AMO-SA...	11M	PR D84 012004	P. del Amo Sanchez *et al.*	(BABAR Collab.)	REFID=16751
	VINOKUROVA	11	PL B706 139	A. Vinokurova *et al.*	(BELLE Collab.)	REFID=53927
	ABE	07	PRL 98 082001	K. Abe *et al.*	(BELLE Collab.)	REFID=51627
	AUBERT	06E	PRL 96 052002	B. Aubert *et al.*	(BABAR Collab.)	REFID=51059
	AUBERT	05C	PR D72 031101	B. Aubert *et al.*	(BABAR Collab.)	REFID=50773
	ABE	04G	PR D70 071102	K. Abe *et al.*	(BELLE Collab.)	REFID=50182
	ASNER	04	PRL 92 142001	D.M. Asner *et al.*	(CLEO Collab.)	REFID=49745
	AUBERT	04D	PRL 92 142002	B. Aubert *et al.*	(BABAR Collab.)	REFID=49746
	ABE,K	02	PRL 89 142001	K. Abe *et al.*	(BELLE Collab.)	REFID=49188
	CHOI	02	PRL 89 102001	S.-K. Choi *et al.*	(BELLE Collab.)	REFID=48760
	EDWARDS	82C	PRL 48 70	C. Edwards *et al.*	(CIT, HARV, PRIN+)	REFID=22173

Reference = LEES 15C; PR D91 052002
Verifier code = BABAR

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PLEASE READ NOW

PLEASE REPLY WITHIN ONE WEEK

Fabio Anulli

EMAIL: anulli@slac.stanford.edu

July 21, 2016

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(5) Feel free to make comments on our treatment of any of the results (not just yours) you see.

Thank you for helping us make the Review accurate and useful.

Sincerely,

Simon Eidelman
BINP, Budker Inst. of Nuclear Physics
Prospekt Lavrent'eva 11
RU-630090 Novosibirsk
Russian Federation

EMAIL: simon.eidelman@cern.ch

CHARMED, STRANGE MESONS ($C = S = \pm1$)

$D_s^+ = c\overline{s}$, $D_s^- = \overline{c}\,s$, similarly for D_s^*'s

NODE=MXXX040

NODE=MXXX040

NODE=M182

$D_{s1}^*(2700)^\pm$

$I(J^P) = 0(1^-)$

$D_{s1}^*(2700)^+$ MASS

NODE=M182M

NODE=M182M

	VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT	
	$2708.3^{+4.0}_{-3.4}$ OUR AVERAGE					
YOUR DATA	$2699\ ^{+14}_{-7}$		[1] LEES 15C	BABR	$B \to D D^0 K^+$	
	$2709.2 \pm 1.9 \pm 4.5$	52k	[2] AAIJ 12AU	LHCB	$pp \to (DK)^+ X$ at 7 TeV	
	$2710 \pm 2\ ^{+12}_{-7}$	10.4k	[3] AUBERT 09AR	BABR	$e^+e^- \to D^{(*)} K X$	
	$2708 \pm 9\ ^{+11}_{-10}$	182	BRODZICKA 08	BELL	$B^+ \to D^0 \overline{D}^0 K^+$	
	• • • We do not use the following data for averages, fits, limits, etc. • • •					
YOUR DATA	$2694 \pm 8\ ^{+13}_{-3}$		LEES 15C	BABR	$B^0 \to D^- D^0 K^+$	OCCUR=2
YOUR DATA	$2707 \pm 8 \pm 8$		LEES 15C	BABR	$B^+ \to \overline{D}^0 D^0 K^+$	OCCUR=3
	$2688 \pm 4 \pm 3$		[4] AUBERT,BE 06E	BABR	$10.6\ e^+e^- \to DKX$	

YOUR NOTE

[1] From a combined analysis of $B^0 \to D^- D^0 K^+$ and $B^+ \to \overline{D}^0 D^0 K^+$. NODE=M182M;LINKAGE=B

[2] From the combined fit of the $D^+ K^0_S$ and $D^0 K^+$ modes in the model including the $D_{s2}^*(2573)^+$, $D_{s1}^*(2700)^+$ and spin-0 $D_{sJ}^*(2860)^+$. NODE=M182M;LINKAGE=AA

[3] From simultaneous fits to the two DK mass spectra and to the total D^*K mass spectrum. NODE=M182M;LINKAGE=AB

[4] Superseded by AUBERT 09AR. NODE=M182M;LINKAGE=AU

$D_{s1}^*(2700)^+$ WIDTH

NODE=M182W

NODE=M182W

	VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT	
	$122\ ^{+11}_{-8}$ OUR AVERAGE					
YOUR DATA	$127\ ^{+24}_{-10}$		[5] LEES 15C	BABR	$B \to D D^0 K^+$	
	$115.8 \pm 7.3 \pm 12.1$	52k	[6] AAIJ 12AU	LHCB	$pp \to (DK)^+ X$ at 7 TeV	
	$149 \pm 7\ ^{+39}_{-52}$	10.4k	[7] AUBERT 09AR	BABR	$e^+e^- \to D^{(*)} K X$	
	$108 \pm 23\ ^{+36}_{-31}$	182	BRODZICKA 08	BELL	$B^+ \to D^0 \overline{D}^0 K^+$	
	• • • We do not use the following data for averages, fits, limits, etc. • • •					
YOUR DATA	$145 \pm 24\ ^{+22}_{-14}$		LEES 15C	BABR	$B^0 \to D^- D^0 K^+$	OCCUR=2
YOUR DATA	$113 \pm 21\ ^{+20}_{-16}$		LEES 15C	BABR	$B^+ \to \overline{D}^0 D^0 K^+$	OCCUR=3
	$112 \pm 7 \pm 36$		[8] AUBERT,BE 06E	BABR	$10.6\ e^+e^- \to DKX$	

YOUR NOTE

[5] From a combined analysis of $B^0 \to D^- D^0 K^+$ and $B^+ \to \overline{D}^0 D^0 K^+$. NODE=M182W;LINKAGE=A

[6] From the combined fit of the $D^+ K^0_S$ and $D^0 K^+$ modes in the model including the $D_{s2}^*(2573)^+$, $D_{s1}^*(2700)^+$ and spin-0 $D_{sJ}^*(2860)^+$. NODE=M182W;LINKAGE=AA

[7] From simultaneous fits to the two DK mass spectra and to the total D^*K mass spectrum. NODE=M182W;LINKAGE=AB

[8] Superseded by AUBERT 09AR. NODE=M182W;LINKAGE=AU

$D_{s1}^*(2700)^\pm$ REFERENCES

NODE=M182

YOUR PAPER

LEES	15C	PR D91 052002	J.P. Lees *et al.*	(BABAR Collab.)	REFID=56412
AAIJ	12AU	JHEP 1210 151	R. Aaij *et al.*	(LHCb Collab.)	REFID=54735
AUBERT	09AR	PR D80 092003	B. Aubert *et al.*	(BABAR Collab.)	REFID=53135
BRODZICKA	08	PRL 100 092001	J. Brodzicka *et al.*	(BELLE Collab.)	REFID=52144
AUBERT,BE	06E	PRL 97 222001	B. Aubert *et al.*	(BABAR Collab.)	REFID=51512

Reference = LEES 16A; PR D93 012005
Verifier code = BABAR

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RU-630090 Novosibirsk
Russian Federation

EMAIL: simon.eidelman@cern.ch

LIGHT UNFLAVORED MESONS ($S = C = B = 0$)

For $I = 1$ (π, b, ρ, a): $u\overline{d}$, $(u\overline{u} - d\overline{d})/\sqrt{2}$, $d\overline{u}$;
for $I = 0$ (η, η', h, h', ω, ϕ, f, f'): $c_1(u\overline{u} + d\overline{d}) + c_2(s\overline{s})$

NODE=MXXX005

NODE=MXXX005

NODE=M227

$a_0(1950)$

$I^G(J^{PC}) = 1^-(0^{++})$

OMITTED FROM SUMMARY TABLE

Needs confirmation. Seen in $\gamma\gamma \rightarrow \eta_c(1S) \rightarrow K\overline{K}\pi$ by LEES 16A with significance 2.5 σ in $K^0_S K^\pm \pi^\mp$ and 4.2 σ in $K^+ K^- \pi^0$. Spin-2 explanation ($a_2(1950)$) is not compatible with data.

NODE=M227

$a_0(1950)$ MASS

NODE=M227M

	VALUE (MeV)	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*	
							NODE=M227M
YOUR DATA	**1931±14±22**	12k	[1,2] LEES	16A	BABR	$\gamma\gamma \rightarrow \eta_c(1S) \rightarrow K\overline{K}\pi$	OCCUR=3
	• • • We do not use the following data for averages, fits, limits, etc. • • •						
YOUR DATA	1949±32±76	8k	[1] LEES	16A	BABR	$\gamma\gamma \rightarrow \eta_c(1S) \rightarrow K^0_S K^\pm \pi^\mp$	
YOUR DATA	1927±15±23	4k	[1] LEES	16A	BABR	$\gamma\gamma \rightarrow \eta_c(1S) \rightarrow K^+ K^- \pi^0$	OCCUR=2

YOUR NOTE [1] From a model-independent partial wave analysis fit to a relativistic Breit-Wigner function with a floating width. NODE=M227M;LINKAGE=A

YOUR NOTE [2] WEighted average of the $K^0_S K^\pm$ and $K^+ K^-$ decay modes. NODE=M227M;LINKAGE=B

$a_0(1950)$ WIDTH

NODE=M227W

	VALUE (MeV)	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*	
							NODE=M227W
YOUR DATA	**271±22± 29**	12k	[1,2] LEES	16A	BABR	$\gamma\gamma \rightarrow \eta_c(1S) \rightarrow K\overline{K}\pi$	OCCUR=3
	• • • We do not use the following data for averages, fits, limits, etc. • • •						
YOUR DATA	265±36±110	8k	[1] LEES	16A	BABR	$\gamma\gamma \rightarrow \eta_c(1S) \rightarrow K^0_S K^\pm \pi^\mp$	
YOUR DATA	274±28± 30	4k	[1] LEES	16A	BABR	$\gamma\gamma \rightarrow \eta_c(1S) \rightarrow K^+ K^- \pi^0$	OCCUR=2

YOUR NOTE [1] From a model-independent partial wave analysis fit to a relativistic Breit-Wigner function with a floating mass. NODE=M227W;LINKAGE=A

YOUR NOTE [2] Weighted average of the $K^0_S K^\pm$ and $K^+ K^-$ decay modes. NODE=M227W;LINKAGE=B

$a_0(1950)$ BRANCHING RATIOS

NODE=M227225

$\Gamma(K\overline{K})/\Gamma_{total}$ **Γ_1/Γ**

NODE=M227R01

	VALUE	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*	
							NODE=M227R01
YOUR DATA	**seen**	12k	[1] LEES	16A	BABR	$\gamma\gamma \rightarrow \eta_c(1S) \rightarrow K\overline{K}\pi$	

YOUR NOTE [1] From a model-independent partial wave analysis. NODE=M227R01;LINKAGE=A

$a_0(1950)$ REFERENCES

NODE=M227

YOUR PAPER LEES 16A PR D93 012005 J.P. Lees *et al.* (BABAR Collab.) REFID=57125

$c\overline{c}$ MESONS

NODE=MXXX025

NODE=M026

$\eta_c(1S)$

$I^G(J^{PC}) = 0^+(0^{-+})$

$\eta_c(1S)$ BRANCHING RATIOS

NODE=M026225

HADRONIC DECAYS

NODE=M026305

NODE=M026R00
NODE=M026R00

$\Gamma(a_0(1950)\pi)/\Gamma_{total}$ — Γ_{23}/Γ

	VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
YOUR DATA	**seen**	12k	[1] LEES	16A	BABR	$\gamma\gamma \to \eta_c(1S) \to K\overline{K}\pi$

YOUR NOTE [1] From a model-independant partial wave analysis.

NODE=M026R00;LINKAGE=A

NODE=M026R50
NODE=M026R50

$\Gamma(a_2(1950)\pi)/\Gamma_{total}$ — Γ_{24}/Γ

	VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
YOUR DATA	**not seen**	12k	[1] LEES	16A	BABR	$\gamma\gamma \to \eta_c(1S) \to K\overline{K}\pi$

YOUR NOTE [1] From a model-independent partial wave analysis assuming the existence of a hypothetical tensor isovector $a_2(1950)$.

NODE=M026R50;LINKAGE=A

NODE=M026R47
NODE=M026R47

$\Gamma(K_0^*(1430)\overline{K})/\Gamma_{total}$ — Γ_{25}/Γ

	VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
YOUR DATA	seen	12k	[1] LEES	16A	BABR	$\gamma\gamma \to \eta_c(1S) \to K\overline{K}\pi$
	seen		LEES	14E	BABR	Dalitz anal. of $\eta_c \to K^+K^-\eta/\pi^0$

YOUR NOTE [1] From a model-independant partial wave analysis.

NODE=M026R47;LINKAGE=A

NODE=M026R49
NODE=M026R49

$\Gamma(K_0^*(1950)\overline{K})/\Gamma_{total}$ — Γ_{27}/Γ

	VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
YOUR DATA	seen	12K	[1] LEES	16A	BABR	$\gamma\gamma \to \eta_c(1S) \to K\overline{K}\pi$
	seen		LEES	14E	BABR	Dalitz anal. of $\eta_c \to K^+K^-\eta/\pi^0$

YOUR NOTE [1] From a Dalitz plot analysis using an isobar model.

NODE=M026R49;LINKAGE=A

$\eta_c(1S)$ REFERENCES

NODE=M026

YOUR PAPER LEES 16A PR D93 012005 J.P. Lees *et al.* (BABAR Collab.) REFID=57125
LEES 14E PR D89 112004 J.P. Lees *et al.* (BABAR Collab.) REFID=55937