Reference = AAIJ 15BI; EPJ C75 311
Verifier code = LHCB

Normally we send all verifications for one experiment to one person, usually the spokesperson or data-analysis co-ordinator, 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

Vincenzo Vagnoni

EMAIL: vincenzo.vagnoni@bo.infn.it

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
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Prospekt Lavrent'eva 11
RU-630090 Novosibirsk
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$c\bar{c}$ 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.				
YOUR DATA	2982.2 ± 1.5 ± 0.1	2.0k	[1] AAIJ	15BI	LHCB	$pp \to \eta_c(1S)X$	
	2983.5 ± 1.4 $^{+1.6}_{-3.6}$		[2] ANASHIN	14	KEDR	$J/\psi \to \gamma\eta_c$	
	2979.8 ± 0.8 ± 3.5	4.5k	[3,4] LEES	14E	BABR	$\gamma\gamma \to K^+K^-\pi^0$	
	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	$e^+e^- \to J/\psi(c\bar{c})$	
	2971 ± 3 $^{+2}_{-1}$	195	WU	06	BELL	$B^+ \to p\bar{p}K^+$	
	2974 ± 7 $^{+2}_{-1}$	20	WU	06	BELL	$B^+ \to \Lambda\bar{\Lambda}K^+$	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	$\bar{p}p \to \eta_c \to \gamma\gamma$	
	• • • 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	$B^\pm \to K^\pm X_{c\bar{c}}$	
	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	$J/\psi,\ \psi(2S) \to \gamma\eta_c$	
	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	$\bar{p}p \to \gamma\gamma$	
	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	$\bar{p}p \to \gamma\gamma$	
	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^-	

YOUR NOTE

[1] AAIJ 15BI reports $m_{J/\psi} - m_{\eta_c(1S)} = 114.7 \pm 1.5 \pm 0.1$ MeV from a sample of $\eta_c(1S)$ and J/ψ produced in b-hadron decays. We have used current value of $m_{J/\psi} = 3096.900 \pm 0.006$ 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

[3] With floating width. NODE=M026M;LINKAGE=AL

[4] Ignoring possible interference with the non-resonant 0^- amplitude. NODE=M026M;LINKAGE=LS

[5] Using both, $\eta \to \gamma\gamma$ and $\eta \to \pi^+\pi^-\pi^0$ 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 $\psi(2S) \to \gamma\eta_c$ and $J/\psi \to \gamma\eta_c$ 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] $\eta_c \to \phi\phi$. NODE=M026M;LINKAGE=B

[22] Mass adjusted by us to correspond to $J/\psi(1S)$ mass = 3097 MeV. NODE=M026M;LINKAGE=M

$\eta_c(1S)$ REFERENCES

NODE=M026

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

REFID=57147 REFID=56130 REFID=55937 REFID=54271 REFID=54741 REFID=54763 REFID=16751 REFID=53927 REFID=53236 REFID=52676 REFID=52267 REFID=52064 REFID=51627 REFID=51059 REFID=51472 REFID=50182 REFID=49745 REFID=49746 REFID=49465 REFID=49185 REFID=49206 REFID=49188 REFID=48546 REFID=48553 REFID=47385 REFID=46553 REFID=44623 REFID=41668 REFID=41354 REFID=40018 REFID=22009 REFID=22012 REFID=22006 REFID=22003 REFID=22004

NODE=M070

$J/\psi(1S)$

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

$J/\psi(1S)$ MASS

NODE=M070M

VALUE (MeV)	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
3096.900±0.006 OUR AVERAGE					
YOUR DATA 3096.66 ±0.19 ±0.02	6.1k	[1] AAIJ	15BI	LHCB	$pp \to J/\psi X$

NODE=M070M

3096.900 ± 0.002 ± 0.006			[2] ANASHIN	15	KEDR	$e^+e^- \to$ hadrons	
3096.89 ± 0.09		502	[3] ARTAMONOV	00	OLYA	$e^+e^- \to$ hadrons	
3096.91 ± 0.03 ± 0.01			[4] ARMSTRONG	93B	E760	$\overline{p}p \to e^+e^-$	
3096.95 ± 0.1 ± 0.3		193	BAGLIN	87	SPEC	$\overline{p}p \to e^+e^-$ X	
• • • We do not use the following data for averages, fits, limits, etc. • • •							
3096.917 ± 0.010 ± 0.007			AULCHENKO	03	KEDR	$e^+e^- \to$ hadrons	
3097.5 ± 0.3			GRIBUSHIN	96	FMPS	515 π^- Be $\to 2\mu X$	
3098.4 ± 2.0		38k	LEMOIGNE	82	GOLI	185 π^- Be $\to \gamma\mu^+\mu^-$ A	
3096.93 ± 0.09		502	[5] ZHOLENTZ	80	REDE	e^+e^-	
3097.0 ± 1			[6] BRANDELIK	79C	DASP	e^+e^-	

YOUR NOTE

[1] From a sample of $\eta_c(1S)$ and J/ψ produced in b-hadron decays. NODE=M070M;LINKAGE=B

[2] Supersedes AULCHENKO 03. NODE=M070M;LINKAGE=A

[3] Reanalysis of ZHOLENTZ 80 using new electron mass (COHEN 87) and radiative corrections (KURAEV 85). NODE=M070M;LINKAGE=AR

[4] Mass central value and systematic error recalculated by us according to Eq. (16) in ARMSTRONG 93B, using the value for the $\psi(2S)$ mass from AULCHENKO 03. NODE=M070M;LINKAGE=NW

[5] Superseded by ARTAMONOV 00. NODE=M070M;LINKAGE=RZ

[6] From a simultaneous fit to e^+e^-, $\mu^+\mu^-$ and hadronic channels assuming $\Gamma(e^+e^-) = \Gamma(\mu^+\mu^-)$. NODE=M070M;LINKAGE=F

$J/\psi(1S)$ REFERENCES

NODE=M070

YOUR PAPER

AAIJ	15BI	EPJ C75 311	R. Aaij *et al.*	(LHCb Collab.)	REFID=57147
ANASHIN	15	PL B749 50	V.V. Anashin *et al.*	(KEDR Collab.)	REFID=56792
AULCHENKO	03	PL B573 63	V.M. Aulchenko *et al.*	(KEDR Collab.)	REFID=49579
ARTAMONOV	00	PL B474 427	A.S. Artamonov *et al.*		REFID=47424
GRIBUSHIN	96	PR D53 4723	A. Gribushin *et al.*	(E672 Collab., E706 Collab.)	REFID=44739
ARMSTRONG	93B	PR D47 772	T.A. Armstrong *et al.*	(FNAL E760 Collab.)	REFID=43307
BAGLIN	87	NP B286 592	C. Baglin *et al.*	(LAPP, CERN, GENO, LYON+)	REFID=40002
COHEN	87	RMP 59 1121	E.R. Cohen, B.N. Taylor	(RISC, NBS)	REFID=11616
KURAEV	85	SJNP 41 466	E.A. Kuraev, V.S. Fadin	(NOVO)	REFID=40033
		Translated from YAF 41 733.			
LEMOIGNE	82	PL 113B 509	Y. Lemoigne *et al.*	(SACL, LOIC, SHMP+)	REFID=22084
ZHOLENTZ	80	PL 96B 214	A.A. Zholents *et al.*	(NOVO)	REFID=10320
Also		SJNP 34 814	A.A. Zholents *et al.*	(NOVO)	REFID=10321
		Translated from YAF 34 1471.			
BRANDELIK	79C	ZPHY C1 233	R. Brandelik *et al.*	(DASP Collab.)	REFID=22114