

NODE=M014

 $f_0(500)$

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

also known as σ ; was $f_0(600)$, $f_0(400-1200)$

See the related review(s):

Scalar Mesons below 1 GeV

 $f_0(500)$ T-MATRIX POLE $\sqrt{s}$ Note that $\Gamma = -2 \operatorname{Im}(\sqrt{s})$.

NODE=M014PP

NODE=M014PP

NODE=M014PP

→ UNCHECKED ←

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
(400–550)–i(200–350) OUR ESTIMATE (see Fig. 64.3 in the review)			
$(458 \pm 7^{+4}_{-10}) - i(245 \pm 6^{+7}_{-10})$	¹ DANILKIN	21	RVUE Compilation
$(410 \pm 20) - i(240 \pm 15)$	SARANTSEV	21	RVUE $J/\psi(1S) \rightarrow \gamma(\pi\pi, K\bar{K}, \eta\eta, \omega\phi)$
$(512 \pm 15) - i(188 \pm 12)$	² ABLIKIM	17	BES3 $J/\psi \rightarrow \gamma 3\pi$
$(440 \pm 10) - i(238 \pm 10)$	³ ALBALADEJO	12	RVUE Compilation
$(445 \pm 25) - i(278^{+22}_{-18})$	^{4,5} GARCIA-MAR..	11	RVUE Compilation
$(457^{+14}_{-13}) - i(279^{+11}_{-7})$	^{4,6} GARCIA-MAR..	11	RVUE Compilation
$(442^{+5}_{-8}) - i(274^{+6}_{-5})$	⁷ MOUSSALLAM	11	RVUE Compilation
$(452 \pm 13) - i(259 \pm 16)$	⁸ MENNESSIER	10	RVUE Compilation
$(448 \pm 43) - i(266 \pm 43)$	⁹ MENNESSIER	10	RVUE Compilation
$(455 \pm 6^{+31}_{-13}) - i(278 \pm 6^{+34}_{-43})$	¹⁰ CAPRINI	08	RVUE Compilation
$(463 \pm 6^{+31}_{-17}) - i(259 \pm 6^{+33}_{-34})$	¹¹ CAPRINI	08	RVUE Compilation
$(552^{+84}_{-106}) - i(232^{+81}_{-72})$	¹² ABLIKIM	07A	BES2 $\psi(2S) \rightarrow \pi^+\pi^- J/\psi$
$(466 \pm 18) - i(223 \pm 28)$	¹³ BONVICINI	07	CLEO $D^+ \rightarrow \pi^-\pi^+\pi^+$
$(472 \pm 30) - i(271 \pm 30)$	¹⁴ BUGG	07A	RVUE Compilation
$(484 \pm 17) - i(255 \pm 10)$	GARCIA-MAR..	07	RVUE Compilation
$(430) - i(325)$	¹⁵ ANISOVICH	06	RVUE Compilation
$(441^{+16}_{-8}) - i(272^{+9}_{-12.5})$	¹⁶ CAPRINI	06	RVUE $\pi\pi \rightarrow \pi\pi$
$(470 \pm 50) - i(285 \pm 25)$	¹⁷ ZHOU	05	RVUE
$(541 \pm 39) - i(252 \pm 42)$	¹⁸ ABLIKIM	04A	BES2 $J/\psi \rightarrow \omega\pi^+\pi^-$
$(528 \pm 32) - i(207 \pm 23)$	¹⁹ GALLEGOS	04	RVUE Compilation
$(533 \pm 25) - i(249 \pm 25)$	²⁰ BUGG	03	RVUE
$517 - i240$	BLACK	01	RVUE $\pi\pi \rightarrow \pi\pi$
$(470 \pm 30) - i(295 \pm 20)$	¹⁶ COLANGELO	01	RVUE $\pi\pi \rightarrow \pi\pi$
$(535^{+48}_{-36}) - i(155^{+76}_{-53})$	²¹ ISHIDA	01	$\Upsilon(3S) \rightarrow \Upsilon\pi\pi$
$610 \pm 14 - i(310 \pm 13)$	²² SUROVTSEV	01	RVUE $\pi\pi \rightarrow \pi\pi, K\bar{K}$
$(540^{+36}_{-29}) - i(193^{+32}_{-40})$	ISHIDA	00B	$p\bar{p} \rightarrow \pi^0\pi^0\pi^0$
$445 - i235$	HANNAH	99	RVUE π scalar form factor
$(523 \pm 12) - i(259 \pm 7)$	KAMINSKI	99	RVUE $\pi\pi \rightarrow \pi\pi, K\bar{K}, \sigma\sigma$
$442 - i227$	OLLER	99	RVUE $\pi\pi \rightarrow \pi\pi, K\bar{K}$
$469 - i203$	OLLER	99B	RVUE $\pi\pi \rightarrow \pi\pi, K\bar{K}$
$445 - i221$	OLLER	99C	RVUE $\pi\pi \rightarrow \pi\pi, K\bar{K}, \eta\eta$
$420 - i212$	LOCHER	98	RVUE $\pi\pi \rightarrow \pi\pi, K\bar{K}$
$440 - i245$	²³ DOBADO	97	RVUE Compilation
$(602 \pm 26) - i(196 \pm 27)$	²⁴ ISHIDA	97	$\pi\pi \rightarrow \pi\pi$
$(537 \pm 20) - i(250 \pm 17)$	²⁵ KAMINSKI	97B	RVUE $\pi\pi \rightarrow \pi\pi, K\bar{K}, 4\pi$
$470 - i250$	^{26,27} TORNQVIST	96	RVUE $\pi\pi \rightarrow \pi\pi, K\bar{K}, K\pi, \eta\pi$
$387 - i305$	^{27,28} JANSSEN	95	RVUE $\pi\pi \rightarrow \pi\pi, K\bar{K}$
$420 - i370$	²⁹ ACHASOV	94	RVUE $\pi\pi \rightarrow \pi\pi$
$(506 \pm 10) - i(247 \pm 3)$	KAMINSKI	94	RVUE $\pi\pi \rightarrow \pi\pi, K\bar{K}$
$370 - i356$	³⁰ ZOU	94B	RVUE $\pi\pi \rightarrow \pi\pi, K\bar{K}$
$408 - i342$	^{27,30} ZOU	93	RVUE $\pi\pi \rightarrow \pi\pi, K\bar{K}$
$470 - i208$	³¹ VANBEVEREN	86	RVUE $\pi\pi \rightarrow \pi\pi, K\bar{K}, \eta\eta, \dots$
$(750 \pm 50) - i(450 \pm 50)$	³² ESTABROOKS	79	RVUE $\pi\pi \rightarrow \pi\pi, K\bar{K}$
$(660 \pm 100) - i(320 \pm 70)$	PROTOPOP...	73	HBC $\pi\pi \rightarrow \pi\pi, K\bar{K}$
$650 - i370$	³³ BASDEVANT	72	RVUE $\pi\pi \rightarrow \pi\pi$

OCCUR=2

OCCUR=2

OCCUR=2

- 1 Data driven analysis using partial-wave dispersion relations.
- 2 S-matrix pole; 8595 events.
- 3 Applying the chiral unitary approach at NLO to the K_{e4} data of BATLEY 10 and $\pi N \rightarrow \pi\pi N$ data of HYAMS 73, GRAYER 74, and PROTOPODESCU 73.
- 4 Uses the K_{e4} data of BATLEY 10C and the $\pi N \rightarrow \pi\pi N$ data of HYAMS 73, GRAYER 74, and PROTOPODESCU 73.
- 5 Analytic continuation using Roy equations.
- 6 Analytic continuation using GKPY equations.
- 7 Using Roy equations.
- 8 Average of three variants of the analytic K-matrix model. Uses the K_{e4} data of BATLEY 08A and the $\pi N \rightarrow \pi\pi N$ data of HYAMS 73 and GRAYER 74.
- 9 Average of the analyses of three data sets in the K-matrix model. Uses the data of BATLEY 08A, HYAMS 73, and GRAYER 74, partially of COHEN 80 or ETKIN 82B.
- 10 From the K_{e4} data of BATLEY 08A and $\pi N \rightarrow \pi\pi N$ data of HYAMS 73.
- 11 From the K_{e4} data of BATLEY 08A and $\pi N \rightarrow \pi\pi N$ data of PROTOPODESCU 73, GRAYER 74, and ESTABROOKS 74.
- 12 From a mean of three different $f_0(500)$ parametrizations. Uses 40k events.
- 13 From an isobar model using 2.6k events.
- 14 Reanalysis of ABLIKIM 04A, PISLAK 01, and HYAMS 73 data.
- 15 Using the N/D method.
- 16 From the solution of the Roy equation (ROY 71) for the isoscalar S-wave and using a phase-shift analysis of HYAMS 73 and PROTOPODESCU 73 data.
- 17 Reanalysis of the data from PROTOPODESCU 73, ESTABROOKS 74, GRAYER 74, ROSSELET 77, PISLAK 03, and AKHMETSHIN 04.
- 18 From a mean of six different analyses and $f_0(500)$ parameterizations.
- 19 Using data on $\psi(2S) \rightarrow J/\psi \pi\pi$ from BAI 00E and on $\Upsilon(nS) \rightarrow \Upsilon(mS) \pi\pi$ from BUTLER 94B and ALEXANDER 98.
- 20 From a combined analysis of HYAMS 73, AUGUSTIN 89, AITALA 01B, and PISLAK 01.
- 21 A similar analysis (KOMADA 01) finds $(580^{+79}_{-30}) - i(190^{+107}_{-49})$ MeV.
- 22 Coupled channel reanalysis of BATON 70, BENSINGER 71, BAILLON 72, HYAMS 73, HYAMS 75, ROSSELET 77, COHEN 80, and ETKIN 82B using the uniformizing variable.
- 23 Using the inverse amplitude method and data of ESTABROOKS 73, GRAYER 74, and PROTOPODESCU 73.
- 24 Reanalysis of data from HYAMS 73, GRAYER 74, SRINIVASAN 75, and ROSSELET 77 using the interfering amplitude method.
- 25 Average and spread of 4 variants ("up" and "down") of KAMINSKI 97B 3-channel model.
- 26 Uses data from BEIER 72B, OCHS 73, HYAMS 73, GRAYER 74, ROSSELET 77, CASON 83, ASTON 88, and ARMSTRONG 91B. Coupled channel analysis with flavor symmetry and all light two-pseudoscalars systems.
- 27 Demonstrates explicitly that $f_0(500)$ and $f_0(1370)$ are two different poles.
- 28 Analysis of data from FALVARD 88.
- 29 Analysis of data from OCHS 73, ESTABROOKS 75, ROSSELET 77, and MUKHIN 80.
- 30 Analysis of data from OCHS 73, GRAYER 74, and ROSSELET 77.
- 31 Coupled-channel analysis using data from PROTOPODESCU 73, HYAMS 73, HYAMS 75, GRAYER 74, ESTABROOKS 74, ESTABROOKS 75, FROGGATT 77, CORDEN 79, BISWAS 81.
- 32 Analysis of data from APEL 72C, GRAYER 74, CASON 76, PAWLICKI 77. Includes spread and errors of 4 solutions.
- 33 Analysis of data from BATON 70, BENSINGER 71, COLTON 71, BAILLON 72, PROTOPODESCU 73, and WALKER 67.

NODE=M014PP;LINKAGE=P
 NODE=M014PP;LINKAGE=I
 NODE=M014PP;LINKAGE=AD

NODE=M014PP;LINKAGE=GM

NODE=M014PP;LINKAGE=GR
 NODE=M014PP;LINKAGE=GC
 NODE=M014PP;LINKAGE=MO
 NODE=M014PP;LINKAGE=ME

NODE=M014PP;LINKAGE=MN

NODE=M014PP;LINKAGE=CA
 NODE=M014PP;LINKAGE=AP

NODE=M014PP;LINKAGE=AL
 NODE=M014PP;LINKAGE=BO
 NODE=M014PP;LINKAGE=BU
 NODE=M014PP;LINKAGE=AN
 NODE=M014PP;LINKAGE=CL

NODE=M014PP;LINKAGE=ZH

NODE=M014PP;LINKAGE=AB
 NODE=M014PP;LINKAGE=GA

NODE=M014PP;LINKAGE=PS
 NODE=M014PP;LINKAGE=KI
 NODE=M014PP;LINKAGE=SU

NODE=M014PP;LINKAGE=DO

NODE=M014PP;LINKAGE=AA

NODE=M014PP;LINKAGE=E
 NODE=M014PP;LINKAGE=B

NODE=M014PP;LINKAGE=G
 NODE=M014PP;LINKAGE=C
 NODE=M014PP;LINKAGE=D
 NODE=M014PP;LINKAGE=F
 NODE=M014PP;LINKAGE=BV

NODE=M014PP;LINKAGE=A

NODE=M014PP;LINKAGE=J

$f_0(500)$ BREIT-WIGNER MASS

NODE=M014M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
400 to 800 OUR ESTIMATE			
• • • We do not use the following data for averages, fits, limits, etc. • • •			
513 ± 32	34 MURAMATSU 02	CLEO	$e^+e^- \approx 10$ GeV
$478^{+24}_{-23} \pm 17$	AITALA	01B E791	$D^+ \rightarrow \pi^- \pi^+ \pi^+$
563^{+58}_{-29}	35 ISHIDA	01	$\Upsilon(3S) \rightarrow \Upsilon \pi\pi$
555	36 ASNER	00 CLE2	$\tau^- \rightarrow \pi^- \pi^0 \pi^0 \nu_\tau$
540 ± 36	ISHIDA	00B	$p\bar{p} \rightarrow \pi^0 \pi^0 \pi^0$
750 ± 4	ALEKSEEV	99 SPEC	$1.78 \pi^- p_{\text{polar}} \rightarrow \pi^- \pi^+ n$
744 ± 5	ALEKSEEV	98 SPEC	$1.78 \pi^- p_{\text{polar}} \rightarrow \pi^- \pi^+ n$
759 ± 5	37 TROYAN	98	$5.2 np \rightarrow np \pi^+ \pi^-$
780 ± 30	ALDE	97 GAM2	$450 pp \rightarrow pp \pi^0 \pi^0$
585 ± 20	38 ISHIDA	97	$\pi\pi \rightarrow \pi\pi$
761 ± 12	39 SVEC	96 RVUE	$6-17 \pi N_{\text{polar}} \rightarrow \pi^+ \pi^- N$
~ 860	40,41 TORNQVIST	96 RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}, K\pi, \eta\pi$
1165 ± 50	42,43 ANISOVICH	95 RVUE	$\pi^- p \rightarrow \pi^0 \pi^0 n,$ $\bar{p}p \rightarrow \pi^0 \pi^0 \pi^0, \pi^0 \pi^0 \eta, \pi^0 \eta\eta$
414 ± 20	39 AUGUSTIN	89 DM2	

NODE=M014M

→ UNCHECKED ←

- 34 Statistical uncertainty only.
- 35 A similar analysis (KOMADA 01) finds 526^{+48}_{-37} MeV.
- 36 From the best fit of the Dalitz plot.
- 37 6σ effect, no PWA.
- 38 Reanalysis of data from HYAMS 73, GRAYER 74, SRINIVASAN 75, and ROSSELET 77 using the interfering amplitude method.
- 39 Breit-Wigner fit to S-wave intensity measured in $\pi N \rightarrow \pi^- \pi^+ N$ on polarized targets. The fit does not include $f_0(980)$.
- 40 Uses data from ASTON 88, OCHS 73, HYAMS 73, ARMSTRONG 91B, GRAYER 74, CASON 83, ROSSELET 77, and BEIER 72B. Coupled channel analysis with flavor symmetry and all light two-pseudoscalars systems.
- 41 Also observed by ASNER 00 in $\tau^- \rightarrow \pi^- \pi^0 \pi^0 \nu_\tau$ decays.
- 42 Uses $\pi^0 \pi^0$ data from ANISOVICH 94, AMSLER 94D, and ALDE 95B, $\pi^+ \pi^-$ data from OCHS 73, GRAYER 74 and ROSSELET 77, and $\eta\eta$ data from ANISOVICH 94.
- 43 The pole is on Sheet III. Demonstrates explicitly that $f_0(500)$ and $f_0(1370)$ are two different poles.

NODE=M014M;LINKAGE=UT
 NODE=M014M;LINKAGE=KI
 NODE=M014M;LINKAGE=KK
 NODE=M014M;LINKAGE=TN
 NODE=M014M;LINKAGE=AA

NODE=M014M;LINKAGE=E

NODE=M014M;LINKAGE=B

NODE=M014M;LINKAGE=GG
 NODE=M014M;LINKAGE=F

NODE=M014M;LINKAGE=G

$f_0(500)$ BREIT-WIGNER WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
100 to 800 OUR ESTIMATE			
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
335 ± 67	44 MURAMATSU 02	CLEO	$e^+ e^- \approx 10$ GeV
$324^{+42}_{-40} \pm 21$	AITALA	01B E791	$D^+ \rightarrow \pi^- \pi^+ \pi^+$
372^{+229}_{-95}	45 ISHIDA	01	$\Upsilon(3S) \rightarrow \Upsilon \pi \pi$
540	46 ASNER	00 CLE2	$\tau^- \rightarrow \pi^- \pi^0 \pi^0 \nu_\tau$
372 ± 80	ISHIDA	00B	$p \bar{p} \rightarrow \pi^0 \pi^0 \pi^0$
119 ± 13	ALEKSEEV	99 SPEC	$1.78 \pi^- p_{\text{polar}} \rightarrow \pi^- \pi^+ n$
77 ± 22	ALEKSEEV	98 SPEC	$1.78 \pi^- p_{\text{polar}} \rightarrow \pi^- \pi^+ n$
35 ± 12	47 TROYAN	98	$5.2 np \rightarrow np \pi^+ \pi^-$
780 ± 60	ALDE	97 GAM2	$450 pp \rightarrow pp \pi^0 \pi^0$
385 ± 70	48 ISHIDA	97	$\pi \pi \rightarrow \pi \pi$
290 ± 54	49 SVEC	96 RVUE	$6-17 \pi N_{\text{polar}} \rightarrow \pi^+ \pi^- N$
~ 880	50,51 TORNQVIST	96 RVUE	$\pi \pi \rightarrow \pi \pi, K \bar{K}, K \pi, \eta \pi$
460 ± 40	52,53 ANISOVICH	95 RVUE	$\pi^- p \rightarrow \pi^0 \pi^0 n,$ $\bar{p} p \rightarrow \pi^0 \pi^0 \pi^0, \pi^0 \pi^0 \eta, \pi^0 \eta \eta$
494 ± 58	49 AUGUSTIN	89 DM2	

- 44 Statistical uncertainty only.
- 45 A similar analysis (KOMADA 01) finds 301^{+145}_{-100} MeV.
- 46 From the best fit of the Dalitz plot.
- 47 6σ effect, no PWA.
- 48 Reanalysis of data from HYAMS 73, GRAYER 74, SRINIVASAN 75, and ROSSELET 77 using the interfering amplitude method.
- 49 Breit-Wigner fit to S-wave intensity measured in $\pi N \rightarrow \pi^- \pi^+ N$ on polarized targets. The fit does not include $f_0(980)$.
- 50 Uses data from ASTON 88, OCHS 73, HYAMS 73, ARMSTRONG 91B, GRAYER 74, CASON 83, ROSSELET 77, and BEIER 72B. Coupled channel analysis with flavor symmetry and all light two-pseudoscalars systems.
- 51 Also observed by ASNER 00 in $\tau^- \rightarrow \pi^- \pi^0 \pi^0 \nu_\tau$ decays.
- 52 Uses $\pi^0 \pi^0$ data from ANISOVICH 94, AMSLER 94D, and ALDE 95B, $\pi^+ \pi^-$ data from OCHS 73, GRAYER 74 and ROSSELET 77, and $\eta\eta$ data from ANISOVICH 94.
- 53 The pole is on Sheet III. Demonstrates explicitly that $f_0(500)$ and $f_0(1370)$ are two different poles.

NODE=M014W;LINKAGE=UT
 NODE=M014W;LINKAGE=KI
 NODE=M014W;LINKAGE=KK
 NODE=M014W;LINKAGE=TN
 NODE=M014W;LINKAGE=AA

NODE=M014W;LINKAGE=E

NODE=M014W;LINKAGE=B

NODE=M014W;LINKAGE=GG
 NODE=M014W;LINKAGE=F

NODE=M014W;LINKAGE=G

$f_0(500)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \pi \pi$	seen
$\Gamma_2 \quad \gamma \gamma$	seen

NODE=M014215;NODE=M014

DESIG=1;OUR EST;→ UNCHECKED ←
 DESIG=5;OUR EST;→ UNCHECKED ←

$f_0(500)$ PARTIAL WIDTHS **$\Gamma(\gamma\gamma)$** **Γ_2**

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
-------------	-------------	------	---------

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

1.37 ± 13	+0.09 -0.06	54	DANILKIN	21	RVUE	Compilation
2.05 ± 0.21		55	DAI	14A	RVUE	Compilation
1.7 ± 0.4		56	HOFERICHT...	11	RVUE	Compilation
3.08 ± 0.82		57	MENNESSIER	11	RVUE	Compilation
2.08 ± 0.2	+0.07 -0.04	58	MOUSSALLAM	11	RVUE	Compilation
2.08		59	MAO	09	RVUE	Compilation
1.2 ± 0.4		60	BERNABEU	08	RVUE	
3.9 ± 0.6		57	MENNESSIER	08	RVUE	$\gamma\gamma \rightarrow \pi^+\pi^-, \pi^0\pi^0$
1.8 ± 0.4		61	OLLER	08	RVUE	Compilation
1.68 ± 0.15		61,62	OLLER	08A	RVUE	Compilation
3.1 ± 0.5		63,64	PENNINGTON	08	RVUE	Compilation
2.4 ± 0.4		64,65	PENNINGTON	08	RVUE	Compilation
4.1 ± 0.3		66	PENNINGTON	06	RVUE	$\gamma\gamma \rightarrow \pi^0\pi^0$
3.8 ± 1.5		67,68	BOGLIONE	99	RVUE	$\gamma\gamma \rightarrow \pi^+\pi^-, \pi^0\pi^0$
5.4 ± 2.3		67	MORGAN	90	RVUE	$\gamma\gamma \rightarrow \pi^+\pi^-, \pi^0\pi^0$
10 ± 6			COURAU	86	DM1	$e^+e^- \rightarrow \pi^+\pi^- e^+e^-$

54 Using the value of the coupled channel analysis.

55 Using dispersive analysis with phases from GARCIA-MARTIN 11A and BUETTIKER 04 as input.

56 Using Roy-Steiner equations with $\pi\pi$ phase shifts from an update of COLANGELO 01 and from GARCIA-MARTIN 11A.

57 Using an analytic K-matrix model.

58 Using dispersion integral with phase input from Roy equations and data from MARSISKE 90, BOYER 90, BEHREND 92, UEHARA 08A, and MORI 07.

59 Used dispersion theory. The value quoted used the $f_0(500)$ pole position of 457 - i276 MeV.

60 Using p , n polarizabilities from PDG 06 and fitting to $\pi\pi$ phase motion from GARCIA-MARTIN 07 and σ -poles from GARCIA-MARTIN 07 and CAPRINI 06.

61 Using twice-subtracted dispersion integrals.

62 Supersedes OLLER 08.

63 Solution A (preferred solution based on χ^2 -analysis).

64 Dispersion theory based amplitude analysis of BOYER 90, MARSISKE 90, BEHREND 92, and MORI 07.

65 Solution B (worse than solution A; still acceptable when systematic uncertainties are included).

66 Using unitarity and the σ pole position from CAPRINI 06.

67 This width could equally well be assigned to the $f_0(1370)$. The authors analyse data from BOYER 90 and MARSISKE 90 and report strong correlation with $\gamma\gamma$ width of $f_2(1270)$.

68 Supersedes MORGAN 90.

NODE=M014220

NODE=M014W2
NODE=M014W2

OCCUR=2

NODE=M014W2;LINKAGE=C
NODE=M014W2;LINKAGE=B

NODE=M014W2;LINKAGE=HO

NODE=M014W2;LINKAGE=ME
NODE=M014W2;LINKAGE=MO

NODE=M014W2;LINKAGE=MA

NODE=M014W2;LINKAGE=BE

NODE=M014W2;LINKAGE=OL

NODE=M014W2;LINKAGE=LL

NODE=M014W2;LINKAGE=P1

NODE=M014W2;LINKAGE=P3

NODE=M014W2;LINKAGE=P2

NODE=M014W2;LINKAGE=PE

NODE=M014W2;LINKAGE=A

NODE=M014W2;LINKAGE=BL

 $f_0(500)$ REFERENCES

DANILKIN	21	PR D103 114023	I. Danilkin, O. Deineka, M. Vanderhaeghen (MAINZ)
SARANTSEV	21	PL B816 136227	A.V. Sarantsev <i>et al.</i> (BONN, PNPI)
ABLIKIM	17	PRL 118 012001	M. Ablikim <i>et al.</i> (BESIII Collab.)
DAI	14A	PR D90 036004	L.-Y. Dai, M.R. Pennington (CEBAF)
ALBALADEJO	12	PR D86 034003	M. Albaladejo, J.A. Oller (MURC)
GARCIA-MAR...	11	PRL 107 072001	R. Garcia-Martin <i>et al.</i> (MADR, CRAC)
GARCIA-MAR...	11A	PR D83 074004	R. Garcia-Martin <i>et al.</i> (MADR, CRAC)
HOFERICHT...	11	EPJ C71 1743	M. Hoferichter, D.R. Phillips, C. Schat (BONN+)
MENNESSIER	11	PL B696 40	G. Mennessier, S. Narison, X.-G. Wang
MOUSSALLAM	11	EPJ C71 1814	B. Moussallam
BATLEY	10	PL B686 101	J.R. Batley <i>et al.</i> (CERN NA48/2 Collab.)
BATLEY	10C	EPJ C70 635	J.R. Batley <i>et al.</i> (CERN NA48/2 Collab.)
MENNESSIER	10	PL B688 59	G. Mennessier, S. Narison, X.-G. Wang
MAO	09	PR D79 116008	Y. Mao <i>et al.</i>
BATLEY	08A	EPJ C54 411	J.R. Batley <i>et al.</i> (CERN NA48/2 Collab.)
BERNABEU	08	PRL 100 241804	J. Bernabeu, J. Prades (IFIC, GRAN)
CAPRINI	08	PR D77 114019	I. Caprini
MENNESSIER	08	PL B665 205	G. Mennessier, S. Narison, W. Ochs
OLLER	08	PL B659 201	J.A. Oller, L. Roca, C. Schat (MURC, UBA)
OLLER	08A	EPJ A37 15	J.A. Oller, L. Roca (MURC)
PENNINGTON	08	EPJ C56 1	M.R. Pennington <i>et al.</i>
UEHARA	08A	PR D78 052004	S. Uehara <i>et al.</i> (BELLE Collab.)
ABLIKIM	07A	PL B645 19	M. Ablikim <i>et al.</i> (BES Collab.)
BONVICINI	07	PR D76 012001	G. Bonvicini <i>et al.</i> (CLEO Collab.)
BUGG	07A	JP G34 151	D.V. Bugg <i>et al.</i>
GARCIA-MAR...	07	PR D76 074034	R. Garcia-Martin, J.R. Pelaez, F.J. Yndurain
MORI	07	PR D75 051101	T. Mori <i>et al.</i> (BELLE Collab.)
ANISOVICH	06	IJMP A21 3615	V.V. Anisovich
CAPRINI	06	PRL 96 132001	I. Caprini, G. Colangelo, H. Leutwyler (BCIP+)
PDG	06	JP G33 1	W.-M. Yao <i>et al.</i> (PDG Collab.)
PENNINGTON	06	PRL 97 011601	M.R. Pennington
ZHOU	05	JHEP 0502 043	Z.Y. Zhou <i>et al.</i>

NODE=M014

REFID=62088
REFID=61091
REFID=57650
REFID=55923
REFID=54277
REFID=16761
REFID=54121
REFID=53966
REFID=53637
REFID=53975
REFID=53285
REFID=53567
REFID=53657
REFID=52992
REFID=52487
REFID=52271
REFID=52273
REFID=52299
REFID=53976
REFID=53977
REFID=52303
REFID=52309
REFID=51614
REFID=51721
REFID=53252
REFID=51949
REFID=51652
REFID=51137
REFID=51076
REFID=51004
REFID=51184
REFID=50823

ABLIKIM	04A	PL B598 149	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=49740
AKHMETSHIN	04	PL B578 285	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=49609
BUETTIKER	04	EPJ C33 409	P. Buettiker, S. Descotes-Genon, B. Moussallam		REFID=56428:ERROR=1
GALLEGOS	04	PR D69 074033	A. Gallegos <i>et al.</i>		REFID=49769
BUGG	03	PL B572 1	D.V. Bugg		REFID=49586
PISLAK	03	PR D67 072004	S. Pislak <i>et al.</i>	(BNL E865 Collab.)	REFID=49344
Also		PR D81 119903E	S. Pislak <i>et al.</i>	(BNL E865 Collab.)	REFID=53337
MURAMATSU	02	PRL 89 251802	H. Muramatsu <i>et al.</i>	(CLEO Collab.)	REFID=49081
Also		PRL 90 059901 (errat.)	H. Muramatsu <i>et al.</i>	(CLEO Collab.)	REFID=49385
AITALA	01B	PRL 86 770	E.M. Aitala <i>et al.</i>	(FNAL E791 Collab.)	REFID=48005
BLACK	01	PR D64 014031	D. Black <i>et al.</i>		REFID=48314
COLANGELO	01	NP B603 125	G. Colangelo, J. Gasser, H. Leytwyler		REFID=49180
ISHIDA	01	PL B518 47	M. Ishida <i>et al.</i>		REFID=48354
KOMADA	01	PL B508 31	T. Komada <i>et al.</i>		REFID=48541
PISLAK	01	PRL 87 221801	S. Pislak <i>et al.</i>	(BNL E865 Collab.)	REFID=48433
Also		PR D67 072004	S. Pislak <i>et al.</i>	(BNL E865 Collab.)	REFID=49344
Also		PRL 105 019901E	S. Pislak <i>et al.</i>	(BNL E865 Collab.)	REFID=53338
SUROVTSEV	01	PR D63 054024	Y.S. Surovtsev, D. Krupa, M. Nagy		REFID=48310
ASNER	00	PR D61 012002	D.M. Asner <i>et al.</i>	(CLEO Collab.)	REFID=47339
BAI	00E	PR D62 032002	J. Bai <i>et al.</i>	(BES Collab.)	REFID=47955
ISHIDA	00B	PTP 104 203	M. Ishida <i>et al.</i>		REFID=48358
ALEKSEEV	99	NP B541 3	I.G. Alekseev <i>et al.</i>		REFID=46614
BOGLIONE	99	EPJ C9 11	M. Boglione, M.R. Pennington		REFID=46931
HANNAH	99	PR D60 017502	T. Hannah		REFID=46935
KAMINSKI	99	EPJ C9 141	R. Kaminski, L. Lesniak, B. Loiseau	(CRAC, PARIN)	REFID=46927
OLLER	99	PR D60 099906 (errat.)	J.A. Oller <i>et al.</i>		REFID=46899
OLLER	99B	NP A652 407 (errat.)	J.A. Oller, E. Oset		REFID=46924
OLLER	99C	PR D60 074023	J.A. Oller, E. Oset		REFID=47386
ALEKSEEV	98	PAN 61 174	I.G. Alekseev <i>et al.</i>		REFID=46328
ALEXANDER	98	PR D58 052004	J.P. Alexander <i>et al.</i>	(CLEO Collab.)	REFID=46329
LOCHER	98	EPJ C4 317	M.P. Locher <i>et al.</i>	(PSI)	REFID=46372
TROYAN	98	JINRRC 5-91 33	Yu. Troyan <i>et al.</i>		REFID=46615
ALDE	97	PL B397 350	D.M. Alde <i>et al.</i>	(GAMS Collab.)	REFID=45392
DOBADO	97	PR D56 3057	A. Dobado, J.R. Pelaez		REFID=53964
ISHIDA	97	PTP 98 1005	S. Ishida <i>et al.</i>	(TOKY, MIYA, KEK)	REFID=45998
KAMINSKI	97B	PL B413 130	R. Kaminski, L. Lesniak, B. Loiseau	(CRAC, IPN)	REFID=45778
Also		PTP 95 745	S. Ishida <i>et al.</i>	(TOKY, MIYA, KEK)	REFID=45770
SVEC	96	PR D53 2343	M. Svec	(MCGI)	REFID=44509
TORNQVIST	96	PRL 76 1575	N.A. Tornqvist, M. Roos	(HELS)	REFID=44507
ALDE	95B	ZPHY C66 375	D.M. Alde <i>et al.</i>	(GAMS Collab.)	REFID=44375
ANISOVICH	95	PL B355 363	V.V. Anisovich <i>et al.</i>	(PNPI, SERP)	REFID=44442
JANSSSEN	95	PR D52 2690	G. Janssen <i>et al.</i>	(STON, ADLD, JULI)	REFID=44508
ACHASOV	94	PR D49 5779	N.N. Achasov, G.N. Shestakov	(NOVM)	REFID=44087
AMSLER	94D	PL B333 277	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=44093
ANISOVICH	94	PL B323 233	V.V. Anisovich <i>et al.</i>	(Crystal Barrel Collab.)	REFID=43659
BUTLER	94B	PR D49 40	F. Butler <i>et al.</i>	(CLEO Collab.)	REFID=43799
KAMINSKI	94	PR D50 3145	R. Kaminski, L. Lesniak, J.P. Maillet	(CRAC+)	REFID=45771
ZOU	94B	PR D50 591	B.S. Zou, D.V. Bugg	(LOQM)	REFID=44072
ZOU	93	PR D48 3948	B.S. Zou, D.V. Bugg	(LOQM)	REFID=43672
BEHREND	92	ZPHY C56 381	H.J. Behrend	(CELLO Collab.)	REFID=43172
ARMSTRONG	91B	ZPHY C52 389	T.A. Armstrong <i>et al.</i>	(ATHU, BARI, BIRM+)	REFID=41862
BOYER	90	PR D42 1350	J. Boyer <i>et al.</i>	(Mark II Collab.)	REFID=41362
MARSISKE	90	PR D41 3324	H. Marsiske <i>et al.</i>	(Crystal Ball Collab.)	REFID=41351
MORGAN	90	ZPHY C48 623	D. Morgan, M.R. Pennington	(RAL, DURH)	REFID=41583
AUGUSTIN	89	NP B320 1	J.E. Augustin, G. Cosme	(DM2 Collab.)	REFID=41004
ASTON	88	NP B296 493	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)	REFID=40262
FALVARD	88	PR D38 2706	A. Falvard <i>et al.</i>	(CLER, FRAS, LALO+)	REFID=40576
COURAU	86	NP B271 1	A. Courau <i>et al.</i>	(CLER, LALO)	REFID=44510
VANBEVEREN	86	ZPHY C30 615	E. van Beveren <i>et al.</i>	(NIJM, BIEL)	REFID=45769
CASON	83	PR D28 1586	N.M. Cason <i>et al.</i>	(NDAM, ANL)	REFID=20752
ETKIN	82B	PR D25 1786	A. Etkin <i>et al.</i>	(BNL, CUNY, TUFTS, VAND)	REFID=20390
BISWAS	81	PRL 47 1378	N.N. Biswas <i>et al.</i>	(NDAM, ANL)	REFID=21106
COHEN	80	PR D22 2595	D. Cohen <i>et al.</i>	(ANL) IJP	REFID=20381
MUKHIN	80	JETPL 32 601	K.N. Mukhin <i>et al.</i>	(KIAE)	REFID=44528
Translated from		ZETFP 32 616.			
CORDEN	79	NP B157 250	M.J. Corden <i>et al.</i>	(BIRM, RHEL, TELA+) JP	REFID=20374
ESTABROOKS	79	PR D19 2678	P. Estabrooks	(CARL)	REFID=20375
FROGGATT	77	NP B129 89	C.D. Froggatt, J.L. Petersen	(GLAS, NORD)	REFID=21072
PAWLICKI	77	PR D15 3196	A.J. Pawlicki <i>et al.</i>	(ANL) IJ	REFID=20367
ROSSELET	77	PR D15 574	L. Rosselet <i>et al.</i>	(GEVA, SACL)	REFID=11004
CASON	76	PRL 36 1485	N.M. Cason <i>et al.</i>	(NDAM, ANL) IJ	REFID=21064
ESTABROOKS	75	NP B95 322	P.G. Estabrooks, A.D. Martin	(DURH)	REFID=20642
HYAMS	75	NP B100 205	B.D. Hyams <i>et al.</i>	(CERN, MPIM)	REFID=20355
SRINIVASAN	75	PR D12 681	V. Srinivasan <i>et al.</i>	(NDAM, ANL)	REFID=21062
ESTABROOKS	74	NP B79 301	P.G. Estabrooks, A.D. Martin	(DURH)	REFID=20111
GRAYER	74	NP B75 189	G. Grayer <i>et al.</i>	(CERN, MPIM)	REFID=20113
ESTABROOKS	73	Tallahassee	P.G. Estabrooks <i>et al.</i>	(CERN, MPIM)	REFID=20345
HYAMS	73	NP B64 134	B.D. Hyams <i>et al.</i>	(CERN, MPIM)	REFID=20107
OCHS	73	Thesis	W. Ochs	(MPIM, MUNI)	REFID=20349
PROTOPOP...	73	PR D7 1279	S.D. Protopopescu <i>et al.</i>	(LBL)	REFID=20108
APEL	72C	PL 41B 542	W.D. Apel <i>et al.</i>	(KARLK, KARLE, PISA)	REFID=21013
BAILLON	72	PL 38B 555	P.H. Baillon <i>et al.</i>	(SLAC)	REFID=20093
BASDEVANT	72	PL 41B 178	J.L. Basdevant, C.D. Froggatt, J.L. Petersen	(CERN)	REFID=20095
BEIER	72B	PRL 29 511	E.W. Beier <i>et al.</i>	(PENN)	REFID=44530
BENSINGER	71	PL 36B 134	J.R. Bensinger <i>et al.</i>	(WISC)	REFID=21006
COLTON	71	PR D3 2028	E.P. Colton <i>et al.</i>	(LBL, FNAL, UCLA+)	REFID=44533
ROY	71	PL 36B 353	S.M. Roy		REFID=51107
BATON	70	PL 33B 528	J.P. Baton, G. Laurens, J. Reigner	(SACL)	REFID=20086
WALKER	67	RMP 39 695	W.D. Walker	(WISC)	REFID=20960