Reference = ABAZOV 15M; PRL 115 232001
Verifier code = D0

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*

Dmitri Denisov

EMAIL: denisovd@fnal.gov

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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
Russian Federation

EMAIL: simon.eidelman@cern.ch

# $c\bar{c}$ MESONS

NODE=MXXX025

NODE=M193

## $X(4140)$

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

Seen by AALTONEN 09AH, ABAZOV 14A, CHATRCHYAN 14M in $B^+ \to X K^+$, $X \to J/\psi\phi$, and by ABAZOV 15M separately in both prompt (4.7 $\sigma$) and non-prompt (5.6 $\sigma$) production in $p\bar{p} \to J/\psi\phi +$ anything. Not seen by SHEN 10 in $\gamma\gamma \to J/\psi\phi$, AAIJ 12AA in $B^+ \to J/\psi\phi K^+$, and ABLIKIM 15 in $e^+e^- \to \gamma J/\psi\phi$ at $\sqrt{s} = 4.23$, 4.26, 4.36 GeV.

NODE=M193

### $X(4140)$ MASS

NODE=M193M

| VALUE (MeV) | EVTS | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|---|
| **4146.9±3.1 OUR AVERAGE** | | Error includes scale factor of 1.3. See the ideogram below. | | | |
| YOUR DATA 4152.5±1.7$^{+6.2}_{-5.4}$ | 1.4k | [1] ABAZOV | 15M | D0 | $p\bar{p} \to J/\psi\phi +$ anything |
| 4159.0±4.3±6.6 | 52 | [2] ABAZOV | 14A | D0 | $B^+ \to J/\psi\phi K^+$ |
| 4148.0±2.4±6.3 | 0.3k | [3] CHATRCHYAN | 14M | CMS | $B^+ \to J/\psi\phi K^+$ |
| 4143.0±2.9±1.2 | 14 | [4] AALTONEN | 09AH | CDF | $B^+ \to J/\psi\phi K^+$ |

NODE=M193M

YOUR NOTE
[1] Statistical significance of more than 6 $\sigma$. NODE=M193M;LINKAGE=C
[2] Statistical significance of 3.1 $\sigma$. NODE=M193M;LINKAGE=A
[3] From a fit assuming an $S$-wave relativistic Breit-Wigner shape above a three-body phase-space non-resonant component with statistical significance of more than 5 $\sigma$. NODE=M193M;LINKAGE=B
[4] Statistical significance of 3.8 $\sigma$. NODE=M193M;LINKAGE=AA

### $X(4140)$ WIDTH

NODE=M193W

| VALUE (MeV) | EVTS | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|---|
| **15 $^{+6}_{-5}$ OUR AVERAGE** | | | | | |
| YOUR DATA 16.3± 5.6±11.4 | 1.4k | [1] ABAZOV | 15M | D0 | $p\bar{p} \to J/\psi\phi +$ anything |
| 20 ±13 $^{+3}_{-8}$ | 52 | [2] ABAZOV | 14A | D0 | $B^+ \to J/\psi\phi K^+$ |
| 28 $^{+15}_{-11}$ ±19 | 0.3k | [3] CHATRCHYAN | 14M | CMS | $B^+ \to J/\psi\phi K^+$ |
| 11.7$^{+8.3}_{-5.0}$± 3.7 | 14 | [4] AALTONEN | 09AH | CDF | $B^+ \to J/\psi\phi K^+$ |

NODE=M193W

YOUR NOTE
[1] Statistical significance of more than 6 $\sigma$. NODE=M193W;LINKAGE=C
[2] Statistical significance of 3.1 $\sigma$. NODE=M193W;LINKAGE=A
[3] From a fit assuming an $S$-wave relativistic Breit-Wigner shape above a three-body phase-space non-resonant component with statistical significance of more than 5 $\sigma$. NODE=M193W;LINKAGE=B
[4] Statistical significance of 3.8 $\sigma$. NODE=M193W;LINKAGE=AA

### $X(4140)$ BRANCHING RATIOS

NODE=M193225

**$\Gamma(J/\psi\phi)/\Gamma_{total}$** **$\Gamma_1/\Gamma$**

NODE=M193R01

| VALUE | EVTS | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|---|
| YOUR DATA seen | 1.9k | [1] ABAZOV | 15M | D0 | $p\bar{p} \to J/\psi\phi +$ anything |
| **seen** | 52 | [2] ABAZOV | 14A | D0 | $B^+ \to J/\psi\phi K^+$ |
| **seen** | 0.3k | [3] CHATRCHYAN | 14M | CMS | $B^+ \to J/\psi\phi K^+$ |
| **seen** | 14 | [4] AALTONEN | 09AH | CDF | $B^+ \to J/\psi\phi K^+$ |
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | | |
| not seen | | [5] ABLIKIM | 15 | BES3 | $e^+e^- \to \gamma\phi J/\psi$ |
| not seen | | [6] AAIJ | 12AA | LHCB | $pp \to B^+ X$ at 7 TeV |

NODE=M193R01

YOUR NOTE
[1] Statistical significance of more than 6 $\sigma$. NODE=M193R01;LINKAGE=D
[2] ABAZOV 14A reports $B(B^+ \to X(4140)K^+ \to J/\psi\phi K^+)/B(B^+ \to J/\psi\phi K^+) = (19 \pm 7 \pm 4)\%$ with 3.1 $\sigma$ signficance. NODE=M193R01;LINKAGE=A
[3] From a fit assuming an $S$-wave relativistic Breit-Wigner shape above a three-body phase-space non-resonant component with statistical significance of more than 5 $\sigma$. NODE=M193R01;LINKAGE=C
[4] Statistical significance of 3.8 $\sigma$. NODE=M193R01;LINKAGE=AA
[5] Reported $\sigma(e^+e^- \to \gamma X(4140))\cdot B(X(4140) \to J/\psi\phi) < 0.35$, 0.28, and 0.33 pb at 4.23, 4.26, and 4.36 GeV, respectively, at 90% CL. NODE=M193R01;LINKAGE=B

[6] Reported B($B^+ \to X(4140)K^+$)·B($X(4140) \to J/\psi\phi$)/B($B^+ \to J/\psi\phi K^+$) $< 0.07$ at 90% CL. NODE=M193R01;LINKAGE=AI

## $X(4140)$ REFERENCES

NODE=M193


| | | | | | | |
|---|---|---|---|---|---|---|
| YOUR PAPER | ABAZOV | 15M | PRL 115 232001 | V.M. Abazov *et al.* | (D0 Collab.) | REFID=56957 |
| | ABLIKIM | 15 | PR D91 032002 | M. Ablikim *et al.* | (BES III Collab.) | REFID=56368 |
| | ABAZOV | 14A | PR D89 012004 | V.M. Abazov *et al.* | (D0 Collab.) | REFID=55650 |
| | CHATRCHYAN | 14M | PL B734 261 | S. Chatrchyan *et al.* | (CMS Collab.) | REFID=55753 |
| | AAIJ | 12AA | PR D85 091103 | R. Aaij *et al.* | (LHCb Collab.) | REFID=54263 |
| | SHEN | 10 | PRL 104 112004 | C.P. Shen *et al.* | (BELLE Collab.) | REFID=53235 |
| | AALTONEN | 09AH | PRL 102 242002 | T. Aaltonen *et al.* | (CDF Collab.) | REFID=52968 |