$\Sigma_c(2455)$

$I(J^P) = 1(\frac{1}{2}^+)$ Status: ∗∗∗∗

The angular distribution of $B^- \to \Sigma_c(2455)^0 \overline{p}$ favors $J = 1/2$ (as the quark model predicts). $J = 3/2$ is excluded by more than four standard deviations; see AUBERT 08BN.

$\Sigma_c(2455)$ MASSES

The masses are obtained from the mass-difference measurements that follow.

$\Sigma_c(2455)^{++}$ MASS

VALUE (MeV)	*DOCUMENT ID*
2453.97±0.14 OUR FIT	

$\Sigma_c(2455)^{+}$ MASS

VALUE (MeV)	*DOCUMENT ID*
$2452.65^{+0.22}_{-0.16}$ OUR FIT	

$\Sigma_c(2455)^{0}$ MASS

VALUE (MeV)	*DOCUMENT ID*
2453.75±0.14 OUR FIT	

$\Sigma_c(2455) - \Lambda_c^+$ MASS DIFFERENCES

$m_{\Sigma_c(2455)^{++}} - m_{\Lambda_c^+}$

VALUE (MeV)	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
167.510± 0.017 OUR FIT					
167.510± 0.022 OUR AVERAGE					
167.51 ± 0.01 ±0.02	36k	LEE	14	BELL	e^+e^- at $\Upsilon(4S)$
167.44 ± 0.04 ±0.12	13.8k	AALTONEN	11H	CDF	$p\overline{p}$ at 1.96 TeV
167.4 ± 0.1 ±0.2	2k	ARTUSO	02	CLE2	$e^+e^- \approx \Upsilon(4S)$
167.35 ± 0.19 ±0.12	461	LINK	00C	FOCS	γ A, $\overline{E}_\gamma$ 180 GeV
167.76 ± 0.29 ±0.15	122	AITALA	96B	E791	$\pi^- N$, 500 GeV
167.6 ± 0.6 ±0.6	56	FRABETTI	96	E687	γBe, $\overline{E}_\gamma \approx$ 220 GeV
168.2 ± 0.3 ±0.2	126	CRAWFORD	93	CLE2	$e^+e^- \approx \Upsilon(4S)$
167.8 ± 0.4 ±0.3	54	BOWCOCK	89	CLEO	e^+e^- 10 GeV
168.2 ± 0.5 ±1.6	92	ALBRECHT	88D	ARG	e^+e^- 10 GeV
167.4 ± 0.5 ±2.0	46	DIESBURG	87	SPEC	nA $\sim$ 600 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
167 ± 1	2	JONES	87	HBC	νp in BEBC
166 ± 1	1	BOSETTI	82	HBC	See JONES 87
168 ± 3	6	BALTAY	79	HLBC	ν Ne-H in 15-ft
166 ±15	1	CAZZOLI	75	HBC	νp in BNL 7-ft

$m_{\Sigma_c(2455)^+} - m_{\Lambda_c^+}$

VALUE (MeV)	EVTS	DOCUMENT ID		TECN	COMMENT
$166.19^{+0.16}_{-0.08}$ OUR FIT					
$166.19^{+0.15}_{-0.08}$ OUR AVERAGE					
$166.17 \pm 0.05 {}^{+0.16}_{-0.07}$		YELTON	21	BELL	e^+e^- at Υ(nS)
$166.4 \pm 0.2 \pm 0.3$	661	AMMAR	01	CLE2	$e^+e^- \approx \Upsilon(4S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$168.5 \pm 0.4 \pm 0.2$	111	CRAWFORD	93	CLE2	See AMMAR 01
168 ± 3	1	CALICCHIO	80	HBC	νp in BEBC-TST

$m_{\Sigma_c(2455)^0} - m_{\Lambda_c^+}$

VALUE (MeV)	EVTS	DOCUMENT ID		TECN	COMMENT
167.290±0.017 OUR FIT					
167.290±0.022 OUR AVERAGE					
$167.29 \pm 0.01 \pm 0.02$	32k	LEE	14	BELL	e^+e^- at $\Upsilon(4S)$
$167.28 \pm 0.03 \pm 0.12$	15.9k	AALTONEN	11H	CDF	$p\overline{p}$ at 1.96 TeV
$167.2 \pm 0.1 \pm 0.2$	2k	ARTUSO	02	CLE2	$e^+e^- \approx \Upsilon(4S)$
$167.38 \pm 0.21 \pm 0.13$	362	LINK	00C	FOCS	γ A, $\overline{E}_\gamma$ 180 GeV
$167.38 \pm 0.29 \pm 0.15$	143	AITALA	96B	E791	π^- N, 500 GeV
$167.8 \pm 0.6 \pm 0.2$		ALEEV	96	SPEC	n nucleus, 50 GeV/c
$166.6 \pm 0.5 \pm 0.6$	69	FRABETTI	96	E687	γBe, $\overline{E}_\gamma \approx$ 220 GeV
$167.1 \pm 0.3 \pm 0.2$	124	CRAWFORD	93	CLE2	$e^+e^- \approx \Upsilon(4S)$
$168.4 \pm 1.0 \pm 0.3$	14	ANJOS	89D	E691	γBe 90–260 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$167.9 \pm 0.5 \pm 0.3$	48	[1] BOWCOCK	89	CLEO	e^+e^- 10 GeV
$167.0 \pm 0.5 \pm 1.6$	70	[1] ALBRECHT	88D	ARG	e^+e^- 10 GeV
$178.2 \pm 0.4 \pm 2.0$	85	[2] DIESBURG	87	SPEC	nA $\sim$ 600 GeV
163 ± 2	1	AMMAR	86	EMUL	νA

[1] This result enters the fit through $m_{\Sigma_c^{++}} - m_{\Sigma_c^0}$ given below.

[2] See the note on DIESBURG 87 in the $m_{\Sigma_c^{++}} - m_{\Sigma_c^0}$ section below.

Σ_c(2455) MASS DIFFERENCES

$m_{\Sigma_c(2455)^{++}} - m_{\Sigma_c(2455)^0}$

VALUE (MeV)	DOCUMENT ID		TECN	COMMENT
0.220±0.013 OUR FIT				
0.221±0.014 OUR AVERAGE				
$0.22 \pm 0.01 \pm 0.01$	LEE	14	BELL	e^+e^- at $\Upsilon(4S)$
$0.2 \pm 0.1 \pm 0.1$	ARTUSO	02	CLE2	$e^+e^- \approx \Upsilon(4S)$
$-0.03 \pm 0.28 \pm 0.11$	LINK	00C	FOCS	γ A, $\overline{E}_\gamma$ 180 GeV
$0.38 \pm 0.40 \pm 0.15$	AITALA	96B	E791	π^- N, 500 GeV
$1.1 \pm 0.4 \pm 0.1$	CRAWFORD	93	CLE2	$e^+e^- \approx \Upsilon(4S)$
$-0.1 \pm 0.6 \pm 0.1$	BOWCOCK	89	CLEO	e^+e^- 10 GeV
$1.2 \pm 0.7 \pm 0.3$	ALBRECHT	88D	ARG	$e^+e^- \sim$ 10 GeV

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

-10.8 ± 2.9	[3] DIESBURG	87	SPEC	nA $\sim$ 600 GeV

[3] DIESBURG 87 is completely incompatible with the other experiments, which is surprising since it agrees with them about $m_{\Sigma_c(2455)^{++}} - m_{\Lambda_c^+}$. We go with the majority here.

$m_{\Sigma_c(2455)^+} - m_{\Sigma_c(2455)^0}$

VALUE (MeV)	DOCUMENT ID		TECN	COMMENT
$\mathbf{-1.10^{+0.16}_{-0.08}}$ **OUR FIT**				
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$1.4 \pm 0.5 \pm 0.3$	CRAWFORD	93	CLE2	See AMMAR 01

$\Sigma_c(2455)$ WIDTHS

$\Sigma_c(2455)^{++}$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID		TECN	COMMENT
$\mathbf{1.89^{+0.09}_{-0.18}}$ **OUR AVERAGE**	Error includes scale factor of 1.1.				
$1.84 \pm 0.04 ^{+0.07}_{-0.20}$	36k	LEE	14	BELL	$e^+ e^-$ at $\Upsilon(4S)$
$2.34 \pm 0.13 \pm 0.45$	13.8k	AALTONEN	11H	CDF	$p \overline{p}$ at 1.96 TeV
$2.3 \pm 0.2 \pm 0.3$	2k	ARTUSO	02	CLE2	$e^+ e^- \approx \Upsilon(4S)$
$2.05 ^{+0.41}_{-0.38} \pm 0.38$	1110	LINK	02	FOCS	γ A, $\overline{E}_\gamma \approx 180$ GeV

$\Sigma_c(2455)^{+}$ WIDTH

VALUE (MeV)	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
$2.3 \pm 0.3 \pm 0.3$			YELTON	21	BELL	$e^+ e^-$ at Υ(nS)
• • • We do not use the following data for averages, fits, limits, etc. • • •						
<4.6	90	661	AMMAR	01	CLE2	$e^+ e^- \approx \Upsilon(4S)$

$\Sigma_c(2455)^{0}$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID		TECN	COMMENT
$\mathbf{1.83^{+0.11}_{-0.19}}$ **OUR AVERAGE**	Error includes scale factor of 1.2.				
$1.76 \pm 0.04 ^{+0.09}_{-0.21}$	32k	LEE	14	BELL	$e^+ e^-$ at $\Upsilon(4S)$
$1.65 \pm 0.11 \pm 0.49$	15.9k	AALTONEN	11H	CDF	$p \overline{p}$ at 1.96 TeV
$2.6 \pm 0.5 \pm 0.3$		AUBERT	08BN	BABR	$B^- \to \overline{p} \Lambda_c^+ \pi^-$
$2.5 \pm 0.2 \pm 0.3$	2k	ARTUSO	02	CLE2	$e^+ e^- \approx \Upsilon(4S)$
$1.55 ^{+0.41}_{-0.37} \pm 0.38$	913	LINK	02	FOCS	γ A, $\overline{E}_\gamma \approx 180$ GeV

$\Sigma_c(2455)$ DECAY MODES

$\Lambda_c^+ \pi$ is the only strong decay allowed to a Σ_c having this mass.

	Mode	Fraction (Γ_i/Γ)
Γ_1	$\Lambda_c^+ \pi$	≈ 100 %

$\Sigma_c(2455)$ REFERENCES

YELTON	21	PR D104 052003	J. Yelton *et al.*	(BELLE Collab.)
LEE	14	PR D89 091102	S.-H. Lee *et al.*	(BELLE Collab.)
AALTONEN	11H	PR D84 012003	T. Aaltonen *et al.*	(CDF Collab.)
AUBERT	08BN	PR D78 112003	B. Aubert *et al.*	(BABAR Collab.)
ARTUSO	02	PR D65 071101	M. Artuso *et al.*	(CLEO Collab.)
LINK	02	PL B525 205	J.M. Link *et al.*	(FNAL FOCUS Collab.)
AMMAR	01	PRL 86 1167	R. Ammar *et al.*	(CLEO Collab.)
LINK	00C	PL B488 218	J.M. Link *et al.*	(FNAL FOCUS Collab.)
AITALA	96B	PL B379 292	E.M. Aitala *et al.*	(FNAL E791 Collab.)
ALEEV	96	JINRRC 3-77 31	A.N. Aleev *et al.*	(Serpukhov EXCHARM Collab.)
FRABETTI	96	PL B365 461	P.L. Frabetti *et al.*	(FNAL E687 Collab.)
CRAWFORD	93	PRL 71 3259	G. Crawford *et al.*	(CLEO Collab.)
ANJOS	89D	PRL 62 1721	J.C. Anjos *et al.*	(FNAL E691 Collab.)
BOWCOCK	89	PRL 62 1240	T.J.V. Bowcock *et al.*	(CLEO Collab.)
ALBRECHT	88D	PL B211 489	H. Albrecht *et al.*	(ARGUS Collab.)
DIESBURG	87	PRL 59 2711	M. Diesburg *et al.*	(FNAL E400 Collab.)
JONES	87	ZPHY C36 593	G.T. Jones *et al.*	(CERN WA21 Collab.)
AMMAR	86	JETPL 43 515	R. Ammar *et al.*	(ITEP)
		Translated from ZETFP 43 401.		
BOSETTI	82	PL 109B 234	P.C. Bosetti *et al.*	(AACH3, BONN, CERN+)
CALICCHIO	80	PL 93B 521	M. Calicchio *et al.*	(BARI, BIRM, BRUX+)
BALTAY	79	PRL 42 1721	C. Baltay *et al.*	(COLU, BNL) I
CAZZOLI	75	PRL 34 1125	E.G. Cazzoli *et al.*	(BNL)