$\Sigma_c(2455)$

$I(J^P) = 1(\frac{1}{2}^+)$ 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	γ Be, $\overline{E}_\gamma \approx$ 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 $\Upsilon(nS)$
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 $\pm$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$\pm$0.017 OUR FIT					
167.290$\pm$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	$\pi^- N$, 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	γ Be, $\overline{E}_\gamma \approx$ 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	γ Be 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 $\pm$2	1	AMMAR	86	EMUL	ν A

[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.

$\Sigma_c(2455)$ MASS DIFFERENCES

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

VALUE (MeV)	DOCUMENT ID		TECN	COMMENT
0.220$\pm$0.013 OUR FIT				
0.221$\pm$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	$\pi^- N$, 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
$-1.10^{+0.16}_{-0.08}$ **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
$1.89^{+0.09}_{-0.18}$ **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 $\Upsilon(nS)$

• • • 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
$1.83^{+0.11}_{-0.19}$ **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)