Heavy Flavor Averaging Group
August 2014

Compilation of B^+ Semi-leptonic and Radiative Branching Fractions
All branching fractions are in units of 10^{-6}

In PDG2014   New since PDG2014 (preliminary)   New since PDG2014 (published)

RPP#	Mode	PDG2014 Avg.	BABAR	Belle	CLEO	CDF	LHCb	New Avg.
363	$K^{*+}\gamma$	42.1 ± 1.8	$42.2 \pm 1.4 \pm 1.6$	$42.5 \pm 3.1 \pm 2.4$	$37.6^{+8.9}_{-8.3} \pm 2.8$			42.1 ± 1.8
364	$K_1^+(1270)\gamma$	43 ± 13	$44.0^{+6.0+5.8}_{-4.0-5.9}$ †	$43 \pm 9 \pm 9$				$43.7^{+7.0}_{-6.2}$
365	$K^+\eta\gamma$	7.9 ± 0.9	$7.7 \pm 1.0 \pm 0.4$	$8.4^{+1.5}_{-1.2} \pm 0.9$				7.9 ± 0.9
366	$K^+\eta'\gamma$	$2.9^{+1.0}_{-0.9}$	$1.9^{+1.5}_{-1.2} \pm 0.1$	$3.6 \pm 1.2 \pm 0.4$				$2.9^{+1.0}_{-0.9}$
367	$K^+\phi\gamma$	2.7 ± 0.4	$3.5 \pm 0.6 \pm 0.4$	$2.48 \pm 0.30 \pm 0.24$				2.71 ± 0.34
368	$K^+\pi^-\pi^+\gamma$	27.6 ± 2.2	$27.2 \pm 1.0^{+1.1}_{-1.3}$ †	$25.0 \pm 1.8 \pm 2.2$ ‡				26.7 ± 1.4
369	$K^{*0}\pi^+\gamma$ §	20^{+7}_{-6}	$26.0^{+1.4}_{-1.3} \pm 1.8$ †	$20^{+7}_{-6} \pm 2$				$25.5^{+2.2}_{-2.1}$
370	$K^+\rho^0\gamma$ §	< 20	$9.2^{+0.8}_{-0.7} \pm 1.3$ †	< 20				9.2 ± 1.5
–	$(K\pi)_0^{*0}\pi^+\gamma$	New	$11.3 \pm 1.5^{+2.0}_{-2.6}$ †					$11.3^{+2.5}_{-3.0}$
371	$K^+\pi^-\pi^+\gamma$(N.R.)§	< 9.2	$10.8^{+1.4+1.9}_{-1.5-2.5}$ †	< 9.2				$10.8^{+2.4}_{-2.9}$
–	$K_0^*(1430)\pi^+\gamma$	New	$0.82 \pm 0.11^{+0.17}_{-0.21}$ †					$0.82^{+0.20}_{-0.24}$
372	$K^0\pi^+\pi^0\gamma$	46 ± 5	$45.6 \pm 4.2 \pm 3.1$ †					45.6 ± 5.2
373	$K_1^+(1400)\gamma$	< 15	$9.7^{+4.6+3.2}_{-2.9-1.9}$ †	< 15				$9.7^{+5.6}_{-3.5}$
–	$K^{*+}(1410)\gamma$	New	$23.8^{+5.2+6.4}_{-4.6-2.8}$ †					$23.8^{+8.2}_{-5.4}$
374	$K_2^*(1430)^+\gamma$	14 ± 4	$10.4^{+8.7+6.3}_{-7.0-9.9}$ †					$10.4^{+10.7}_{-12.1}$
375	$K^{*+}(1680)\gamma$	< 1900	72^{+7+16}_{-6-14} †					72^{+17}_{-15}
376	$K_3^*(1780)^+\gamma$	< 39		< 39				< 39
378	$\rho^+\gamma$	0.98 ± 0.25	$1.20^{+0.42}_{-0.37} \pm 0.20$	$0.87^{+0.29+0.09}_{-0.27-0.11}$	< 13			$0.98^{+0.25}_{-0.24}$
428	$p\overline{\Lambda}\gamma$	$2.4^{+0.5}_{-0.4}$		$2.45^{+0.44}_{-0.38} \pm 0.22$				$2.45^{+0.49}_{-0.44}$
432	$p\overline{\Sigma^0}\gamma$	< 4.6		< 4.6				< 4.6
467	$\pi^+\ell^+\ell^-$	< 0.049	< 0.066	< 0.049				< 0.049
468	$\pi^+e^+e^-$	< 0.080	< 0.125	< 0.080				< 0.080
469	$\pi^+\mu^+\mu^-$	< 0.055	< 0.055	< 0.069			$0.023 \pm 0.006 \pm 0.001$ ¶ [1]	0.023 ± 0.006
470	$\pi^+\nu\overline{\nu}$	< 100		< 98				< 98
471	$K^+\ell^+\ell^-$	0.451 ± 0.023	$0.48 \pm 0.09 \pm 0.02$	$0.53^{+0.06}_{-0.05} \pm 0.03$			[4]	0.51 ± 0.05
472	$K^+e^+e^-$	0.55 ± 0.07	$0.51^{+0.12}_{-0.11} \pm 0.02$	$0.57^{+0.09}_{-0.08} \pm 0.03$	< 2.4			0.55 ± 0.07
473	$K^+\mu^+\mu^-$	0.449 ± 0.023	$0.41^{+0.16}_{-0.15} \pm 0.02$	$0.53 \pm 0.08^{+0.07}_{-0.03}$	< 3.68	$0.45 \pm 0.03 \pm 0.02$	$0.429 \pm 0.007 \pm 0.021$	0.439 ± 0.018
476	$K^+\nu\overline{\nu}$	< 16	< 16	< 55	< 240			< 16
477	$\rho^+\nu\overline{\nu}$	< 213		< 213				< 213
478	$K^{*+}\ell^+\ell^-$	1.29 ± 0.21	$1.40^{+0.40}_{-0.37} \pm 0.09$	$1.24^{+0.23}_{-0.21} \pm 0.13$				$1.29^{+0.22}_{-0.21}$
479	$K^{*+}e^+e^-$	$1.55^{+0.40}_{-0.31}$	$1.38^{+0.47}_{-0.42} \pm 0.08$	$1.73^{+0.50}_{-0.42} \pm 0.20$				$1.55^{+0.35}_{-0.32}$
480	$K^{*+}\mu^+\mu^-$	1.12 ± 0.15	$1.46^{+0.79}_{-0.75} \pm 0.12$	$1.11^{+0.32}_{-0.27} \pm 0.10$		$0.89 \pm 0.25 \pm 0.09$	$0.924 \pm 0.093 \pm 0.067$	$0.949^{+0.099}_{-0.097}$
481	$K^{*+}\nu\overline{\nu}$	< 40	< 64	< 40				< 40
–	$K^+\pi^+\pi^-\mu^+\mu^-$	New					$0.436^{+0.029}_{-0.027} \pm 0.028$ ¶ [2]	$0.436^{+0.040}_{-0.039}$
–	$K^+\phi\mu^+\mu^-$	New					$0.082^{+0.019+0.029}_{-0.017-0.027}$ ¶	$0.082^{+0.035}_{-0.032}$
484	$\pi^+e^\pm\mu^\mp$	< 0.17	< 0.17					< 0.17
485	$\pi^+e^+\tau^-$	< 74	< 74					< 74
486	$\pi^+e^-\tau^+$	< 20	< 20					< 20
487	$\pi^+e^\pm\tau^\mp$	< 75	< 75					< 75
488	$\pi^+\mu^+\tau^-$	< 62	< 62					< 62
489	$\pi^+\mu^-\tau^+$	< 45	< 45					< 45
490	$\pi^+\mu^\pm\tau^\mp$	< 72	< 72					< 72
491	$K^+e^+\mu^-$	< 0.091	< 0.091					< 0.091
492	$K^+e^-\mu^+$	< 0.13	< 0.13					< 0.13
493	$K^+e^\pm\mu^\mp$	< 0.091	< 0.091					< 0.091
494	$K^+e^+\tau^-$	< 43	< 43					< 43
495	$K^+e^-\tau^+$	< 15	< 15					< 15
496	$K^+e^\pm\tau^\mp$	< 30	< 30					< 30
497	$K^+\mu^+\tau^-$	< 45	< 45					< 45
498	$K^+\mu^-\tau^+$	< 28	< 28					< 28
499	$K^+\mu^\pm\tau^\mp$	< 48	< 48					< 48
500	$K^{*+}e^+\mu^-$	< 1.3	< 1.3					< 1.3
501	$K^{*+}e^-\mu^+$	< 0.99	< 0.99					< 0.99
502	$K^{*+}e^\pm\mu^\mp$	< 1.4	< 1.4					< 1.4
503	$\pi^-e^+e^+$	< 0.023	< 0.023		< 1.6			< 0.023
504	$\pi^-\mu^+\mu^+$	< 0.013	< 0.107		< 1.4		< 0.004 [3]	< 0.004 [3]
505	$\pi^-e^+\mu^+$	< 0.15	< 0.15		< 1.3			< 0.15
506	$\rho^-e^+e^+$	< 0.17	< 0.17		< 2.6			< 0.17
507	$\rho^-\mu^+\mu^+$	< 0.42	< 0.42		< 5.0			< 0.42
508	$\rho^-e^+\mu^+$	< 0.47	< 0.47		< 3.3			< 0.47
509	$K^-e^+e^+$	< 0.03	< 0.03		< 1.0			< 0.03
510	$K^-\mu^+\mu^+$	< 0.041	< 0.067		< 1.8		< 0.041	< 0.041
511	$K^-e^+\mu^+$	< 0.16	< 0.16		< 2.0			< 0.16
512	$K^{*-}e^+e^+$	< 0.40	< 0.40		< 2.8			< 0.40
513	$K^{*-}\mu^+\mu^+$	< 0.59	< 0.59		< 8.3			< 0.59
514	$K^{*-}e^+\mu^+$	< 0.30	< 0.30		< 4.4			< 0.30

† $M_{K\pi\pi} < 1.8$ GeV/c^2; ‡ $1.0 < M_{K\pi\pi} < 2.0$ GeV/c^2; § $M_{K\pi\pi} < 2.4$ GeV/c^2.
¶ Relative BF converted to absolute BF.
[1] PDG2014 cites only the measurement: $\mathcal{B}(\pi^+\mu^+\mu^-)/\mathcal{B}(K^+\mu^+\mu^-) = 0.053 \pm 0.014 \pm 0.01$.
[2] Differential BF in bins of $m(\mu\mu)$ is also available.
[3] At 95% C.L.
[4] PDG considers here the BF measured in $B^+ \to K^+\mu^+\mu^-$.

Heavy Flavor Averaging Group
August 2014

Compilation of B^0 Semi-leptonic and Radiative Branching Fractions
All branching fractions are in units of 10^{-6}

In PDG2014   New since PDG2014 (preliminary)   New since PDG2014 (published)

RPP#	Mode	PDG2014 Avg.	BABAR	Belle	CLEO	CDF	LHCb	New Avg.
336	$K^0\eta\gamma$	7.6 ± 1.8	$7.1^{+2.1}_{-2.0} \pm 0.4$	$8.7^{+3.1+1.9}_{-2.7-1.6}$				$7.6^{+1.8}_{-1.7}$
337	$K^0\eta'\gamma$	< 6.4	< 6.6	< 6.4				< 6.4
338	$K^0\phi\gamma$	2.7 ± 0.7	< 2.7	$2.74 \pm 0.60 \pm 0.32$				2.74 ± 0.68
339	$K^+\pi^-\gamma$ §	4.6 ± 1.4		$4.6^{+1.3+0.5}_{-1.2-0.7}$				4.6 ± 1.4
340	$K^{*0}\gamma$	43.3 ± 1.5	$44.7 \pm 1.0 \pm 1.6$	$40.1 \pm 2.1 \pm 1.7$	$45.5^{+7.2}_{-6.8} \pm 3.4$			43.3 ± 1.5
341	$K^*(1410)^0\gamma$	< 130		< 130				< 130
342	$K^+\pi^-\gamma$ (N.R.) §	< 2.6		< 2.6				< 2.6
344	$K^0\pi^+\pi^-\gamma$	19.5 ± 2.2	$18.5 \pm 2.1 \pm 1.2$ †	$24 \pm 4 \pm 3$ ‡				19.5 ± 2.2
345	$K^+\pi^-\pi^0\gamma$	41 ± 4	$40.7 \pm 2.2 \pm 3.1$ †					40.7 ± 3.8
346	$K^0_1(1270)\gamma$	< 58		< 58				< 58
347	$K^0_1(1400)\gamma$	< 12		< 12				< 12
348	$K^*_2(1430)^0\gamma$	12.4 ± 2.4	$12.2 \pm 2.5 \pm 1.0$	$13 \pm 5 \pm 1$				12.4 ± 2.4
350	$K^*_3(1780)^0\gamma$	< 83		< 83				< 83
352	$\rho^0\gamma$	0.86 ± 0.15	$0.97^{+0.24}_{-0.22} \pm 0.06$	$0.78^{+0.17+0.09}_{-0.16-0.10}$	< 17			$0.86^{+0.15}_{-0.14}$
354	$\omega\gamma$	$0.44^{+0.18}_{-0.16}$	$0.50^{+0.27}_{-0.23} \pm 0.09$	$0.40^{+0.19}_{-0.17} \pm 0.13$	< 9.2			$0.44^{+0.18}_{-0.16}$
355	$\phi\gamma$	< 0.85	< 0.85		< 3.3			< 0.85
–	$p\overline{\Lambda}\pi^-\gamma$	New		< 0.65				< 0.65
465	$\pi^0\ell^+\ell^-$	< 0.053	< 0.053	< 0.154				< 0.053
466	$\pi^0 e^+ e^-$	< 0.084	< 0.084	< 0.227				< 0.084
467	$\pi^0\mu^+\mu^-$	< 0.069	< 0.069	< 0.184				< 0.069
468	$\eta\ell^+\ell^-$	< 0.064	< 0.064					< 0.064
469	$\eta e^+ e^-$	< 0.108	< 0.108					< 0.108
470	$\eta\mu^+\mu^-$	< 0.112	< 0.112					< 0.112
471	$\pi^0\nu\overline{\nu}$	< 69		< 69				< 69
472	$K^0\ell^+\ell^-$	$0.31^{+0.08}_{-0.07}$	$0.21^{+0.15}_{-0.13} \pm 0.02$	$0.34^{+0.09}_{-0.08} \pm 0.02$				$0.31^{+0.08}_{-0.07}$
473	$K^0 e^+ e^-$	$0.16^{+0.10}_{-0.08}$	$0.08^{+0.15}_{-0.12} \pm 0.01$	$0.20^{+0.14}_{-0.10} \pm 0.01$	< 8.45			$0.16^{+0.10}_{-0.08}$
474	$K^0\mu^+\mu^-$	0.34 ± 0.05	$0.49^{+0.29}_{-0.25} \pm 0.03$	$0.44^{+0.13}_{-0.10} \pm 0.03$	< 6.64	$0.33 \pm 0.08 \pm 0.03$	$0.327 \pm 0.034 \pm 0.017$	$0.341^{+0.033}_{-0.032}$
475	$K^0\nu\overline{\nu}$	< 49	< 49	< 194				< 49
476	$\rho^0\nu\overline{\nu}$	< 208		< 208				< 208
477	$K^{*0}\ell^+\ell^-$	$0.99^{+0.12}_{-0.11}$	$1.03^{+0.22}_{-0.21} \pm 0.07$	$0.97^{+0.13}_{-0.11} \pm 0.07$				$0.99^{+0.13}_{-0.11}$
478	$K^{*0} e^+ e^-$	$1.03^{+0.19}_{-0.17}$	$0.86^{+0.26}_{-0.24} \pm 0.05$	$1.18^{+0.27}_{-0.22} \pm 0.09$				$1.03^{+0.19}_{-0.17}$
479	$K^{*0}\mu^+\mu^-$	1.05 ± 0.10	$1.35^{+0.40}_{-0.37} \pm 0.10$	$1.06^{+0.19}_{-0.14} \pm 0.07$			$1.14 \pm 0.09 \pm 0.06$	$1.13^{+0.10}_{-0.09}$
480	$K^{*0}\nu\overline{\nu}$	< 55	< 120	< 55				< 55
481	$\phi\nu\overline{\nu}$	< 127		< 127				< 127
483	$\pi^0 e^\pm\mu^\mp$	< 0.14	< 0.14					< 0.14
484	$K^0 e^\pm\mu^\mp$	< 0.27	< 0.27					< 0.27
485	$K^{*0} e^\pm\mu^\mp$	< 0.53	< 0.53					< 0.53

†$M_{K\pi\pi} < 1.8$ GeV/c^2; ‡ $1.0 < M_{K\pi\pi} < 2.0$ GeV/c^2; § 1.25 GeV/$c^2 < M_{K\pi} < 1.6$ GeV/c^2

Heavy Flavor Averaging Group
August 2014

Compilation of B Semi-leptonic and Radiative Branching Fractions
All branching fractions are in units of 10^{-6}

In PDG2014   New since PDG2014 (preliminary)   New since PDG2014 (published)

RPP#	Mode	PDG2014 Avg.	BABAR	Belle	CLEO	CDF	New Avg.
66	$K\eta\gamma$	$8.5^{+1.8}_{-1.6}$		$8.5^{+1.3}_{-1.2} \pm 0.9$			$8.5^{+1.6}_{-1.5}$
68	$K_2^*(1430)\gamma$	17^{+6}_{-5}			$17 \pm 6 \pm 1$		17 ± 6
70	$K_3^*(1780)\gamma$	< 37		< 2.8 §			< 2.8 §
77	$s\gamma$	360 ± 23	$300 \pm 14 \pm 20$	$345 \pm 15 \pm 40$	$321 \pm 43^{+32}_{-29}$		$343 \pm 21 \pm 7$
78	$d\gamma$	9.2 ± 3.0	$9.2 \pm 2.0 \pm 2.3$				9.2 ± 3.0
84	$\rho\gamma$	1.39 ± 0.25	$1.73^{+0.34}_{-0.32} \pm 0.17$	$1.21^{+0.24}_{-0.22} \pm 0.12$	< 14		$1.39^{+0.22}_{-0.21}$
85	$\rho/\omega\gamma$	1.30 ± 0.23	$1.63^{+0.30}_{-0.28} \pm 0.16$	$1.14 \pm 0.20^{+0.10}_{-0.12}$	< 14		$1.30^{+0.18}_{-0.19}$
119	se^+e^- ‡	4.7 ± 1.3	$7.69^{+0.82+0.71}_{-0.77-0.60}$	$4.56 \pm 1.15^{+0.33}_{-0.40}$	< 57		6.44 ± 0.76
120	$s\mu^+\mu^-$ ‡	4.3 ± 1.2	$4.41^{+1.31+0.63}_{-1.17-0.50}$	$1.91 \pm 1.02^{+0.16}_{-0.18}$	< 58		2.90 ± 0.80
121	$s\ell^+\ell^-$ ‡	4.5 ± 1.0	$6.73^{+0.70+0.60}_{-0.64-0.56}$	$3.33 \pm 0.80^{+0.19}_{-0.24}$	< 42		4.97 ± 0.59
122	$\pi\ell^+\ell^-$	< 0.059	< 0.059	< 0.062			< 0.059
123	πe^+e^-	< 0.110	< 0.110				< 0.110
124	$\pi\mu^+\mu^-$	< 0.050	< 0.050				< 0.050
125	Ke^+e^-	0.44 ± 0.06	$0.39^{+0.09}_{-0.08} \pm 0.02$	$0.48^{+0.08}_{-0.07} \pm 0.03$			0.44 ± 0.06
126	$K^*e^+e^-$	1.19 ± 0.20	$0.99^{+0.23}_{-0.21} \pm 0.06$	$1.39^{+0.23}_{-0.20} \pm 0.12$			$1.19^{+0.17}_{-0.16}$
127	$K\mu^+\mu^-$	0.44 ± 0.04	$0.41^{+0.13}_{-0.12} \pm 0.02$	$0.50 \pm 0.06 \pm 0.03$		$4.2 \pm 0.4 \pm 0.2$	0.55 ± 0.06
128	$K^*\mu^+\mu^-$	1.06 ± 0.09	$1.35^{+0.35}_{-0.33} \pm 0.10$	$1.10^{+0.16}_{-0.14} \pm 0.08$		$10.1 \pm 1.0 \pm 0.5$	1.33 ± 0.16
129	$K\ell^+\ell^-$	0.48 ± 0.04	$0.47 \pm 0.06 \pm 0.02$	$0.48^{+0.05}_{-0.04} \pm 0.03$	< 1.7		0.48 ± 0.04
130	$K^*\ell^+\ell^-$	1.05 ± 0.10	$1.02^{+0.14}_{-0.13} \pm 0.05$	$1.07^{+0.11}_{-0.10} \pm 0.09$	< 3.3		1.05 ± 0.10
131	$K\nu\bar{\nu}$	< 17	< 17				< 17
132	$K^*\nu\bar{\nu}$	< 76	< 76				< 76
134	$\pi e^{\pm}\mu^{\mp}$	< 0.092	< 0.092		< 1.6		< 0.092
135	$\rho e^{\pm}\mu^{\mp}$	< 3.2			< 3.2		< 3.2
136	$Ke^{\pm}\mu^{\mp}$	< 0.038	< 0.038		< 1.6		< 0.038
137	$K^*e^{\pm}\mu^{\mp}$	< 0.51	< 0.51		< 6.2		< 0.51
−	$s\gamma$ with baryons	−			< 38 †		< 38 †

† $E_\gamma > 2.0$ GeV.

‡ Belle: $M(\ell^+\ell^-) > 0.2$ GeV/c^2, BABAR: $M^2(\ell^+\ell^-) > 0.1$ GeV^2/c^4.

§ Product BF ($\times\mathcal{B}(K_3^* \to K\eta)$). PDG gives the BF assuming $\mathcal{B}(K_3^* \to K\eta) = 11^{+5}_{-4}$.

Heavy Flavor Averaging Group
August 2014
Compilation of B^+ and B^0 Leptonic Branching Fractions
All branching fractions are in units of 10^{-6}

In PDG2014   New since PDG2014 (preliminary)   New since PDG2014 (published)

RPP#	Mode	PDG2014 Avg.	BABAR	Belle	CDF	LHCb	CMS	New Avg.
29	$e^+\nu$	< 0.98	< 1.9	< 0.98 †				< 0.98 †
30	$\mu^+\nu$	< 1.0	< 1.0	< 1.7 †				< 1.0
31	$\tau^+\nu$	114 ± 27	179 ± 48 ‡	96 ± 26 ‡				114 ± 22
32	$\ell^+\nu_\ell\gamma$	< 15.6	< 15.6					< 15.6
33	$e^+\nu_e\gamma$	< 17	< 17					< 17
34	$\mu^+\nu_\mu\gamma$	< 24	< 24					< 24
457	$\gamma\gamma$	< 0.32	< 0.32	< 0.62				< 0.32
458	e^+e^-	< 0.083	< 0.113	< 0.19	< 0.083			< 0.083
459	$e^+e^-\gamma$	< 0.12	< 0.12					< 0.12
460	$\mu^+\mu^-$	< 0.00063	< 0.052	< 0.16	< 0.0038	< 0.00063	< 0.00092	< 0.00063
460	$\mu^+\mu^-$	CMS-LHCb comb.				$0.00039^{+0.00016}_{-0.00014}$ §	$0.00039^{+0.00016}_{-0.00014}$ §	
461	$\mu^+\mu^-\gamma$	< 0.16	< 0.16					< 0.16
462	$\mu^+\mu^-\mu^+\mu^-$	< 0.0053				< 0.0053		< 0.0053
464	$\tau^+\tau^-$	< 4100	< 4100					< 4100
482	$e^\pm\mu^\mp$	< 0.0028	< 0.092	< 0.17	< 0.064	< 0.0028		< 0.0028
488	$e^\pm\tau^\mp$	< 28	< 28					< 28
489	$\mu^\pm\tau^\mp$	< 22	< 22					< 22
490	$\nu\bar\nu$	< 24	< 24	< 130				< 24
491	$\nu\bar\nu\gamma$	< 17	< 17					< 17

† More recent results exist, with hadronic tagging (Ref. [39]). It does not improve the limits (< 3.4 and < 2.7 for $e^+\nu$ and $\mu^+\nu$, respectively).
‡ The authors average their results with the earlier PRD 81 051101 (BABAR) and PRD 82, 071101 (Belle).
§ Relative BF converted to absolute BF.

Heavy Flavor Averaging Group
August 2014

Compilation of B^+ Relative Semi-leptonic and Radiative Branching Fractions (UL 90% CL)

In PDG2014 New since PDG2014 (preliminary) New since PDG2014 (published)

RPP#	Mode	PDG2012 Avg.	CDF	DØ	LHCb	New avg.
–	$10^4 \times \mathcal{B}(B^+ \to K^+\pi^+\pi^-\mu^+\mu^-)/\mathcal{B}(B^+ \to \psi(2S)K^+)$	New			$6.95^{+0.46}_{-0.43} \pm 0.34$	$6.95^{+0.57}_{-0.55}$
–	$10^4 \times \mathcal{B}(B^+ \to K^+\phi\mu^+\mu^-)/\mathcal{B}(B^+ \to \psi(2S)K^+)$	New			$1.58^{+0.36+0.19}_{-0.32-0.07}$	$1.58^{+0.41}_{-0.33}$

Heavy Flavor Averaging Group
August 2014
Compilation of $B \to \bar{b} \to \bar{q}$ gluon Branching Fractions
All branching fractions are in units of 10^{-6}

In PDG2014   New since PDG2014 (preliminary)   New since PDG2014 (published)

RPP#	Mode	PDG2014 Avg.	BABAR	Belle	CLEO	New Avg.
80	ηX	260^{+50}_{-80}		$261 \pm 30^{+44}_{-74}$ §	< 440	261^{+53}_{-79}
81	$\eta' X$	420 ± 90	$390 \pm 80 \pm 90$ †		$460 \pm 110 \pm 60$ †	423 ± 86
82	$K^+ X$	< 187	< 187 ‡			< 187 ‡
83	$K^0 X$	195^{+71}_{-67}	$195^{+51}_{-45} \pm 50$ ‡			195^{+71}_{-67}
94	$\pi^+ X$	370 ± 80	$372^{+50}_{-47} \pm 59$ ¶			372^{+77}_{-75}

§ $0.4 < m_X < 2.6 \mathrm{GeV}/c$;   † $2.0 < p^*(\eta') < 2.7 \mathrm{GeV}/c$.

‡ $m_X < 1.69 \mathrm{GeV}/c$;   ¶ $m_X < 1.71 \mathrm{GeV}/c$.

Heavy Flavor Averaging Group
August 2014
Isospin Asymmetry

Parameter	PDG2014 Avg.	BABAR	Belle	LHCb	New Avg.
$\Delta_{0^-}(X_s\gamma)$	-0.01 ± 0.06	-0.01 ± 0.06 §			-0.01 ± 0.06
$\Delta_{0^+}(K^*\gamma)$	0.052 ± 0.026	$0.066 \pm 0.021 \pm 0.022$	$0.012 \pm 0.044 \pm 0.026$		0.012 ± 0.051
$\Delta_{\rho\gamma}$	-0.46 ± 0.17	$-0.43^{+0.25}_{-0.22} \pm 0.10$	$-0.48^{+0.21+0.08}_{-0.19-0.09}$		$-0.48^{+0.23}_{-0.21}$
$\Delta_{0^-}(K\ell\ell)$ †	-0.37 ± 0.13	$-0.58^{+0.29}_{-0.37} \pm 0.02$	$-0.31^{+0.17}_{-0.14} \pm 0.08$	$-0.35^{+0.23}_{-0.27}$	-0.32 ± 0.14
$\Delta_{0^-}(K^*\ell\ell)$ †	-0.22 ± 0.10	$-0.25^{+0.20}_{-0.17} \pm 0.03$	$-0.29 \pm 0.16 \pm 0.09$	-0.15 ± 0.16	-0.21 ± 0.12
$\Delta_{0^-}(K^{(*)}\ell\ell)$ †	-0.45 ± 0.17	$-0.64^{+0.15}_{-0.14} \pm 0.03$	$-0.30^{+0.12}_{-0.11} \pm 0.08$		-0.30 ± 0.14

† See the references for precise $q^2 = m_{\ell\ell}^2$ region. In all measurements $m_{\ell\ell} < m_{J/\psi}$

§ Average of two independent measurements from BABAR.

Isospin Asymmetry (A_{I}) for $K^{(*)}\ell^+\ell^-$ modes in bins of $q^2 = m_{\ell\ell}^2$

In PDG2014   New since PDG2014 (preliminary)   New since PDG2014 (published)

Mode	q^2 [(GeV/c^2)²] †	PDG2014 Avg.	BABAR	Belle	CDF ‡	LHCb ‡	New Avg.
$K\ell^+\ell^-$	< 2.0		$-0.51^{+0.49}_{-0.95}$	$-0.33^{+0.34}_{-0.26}$	$0.19 \pm 0.34 \pm 0.05$	$-0.55^{+0.40}_{-0.56}$	$-0.24^{+0.18}_{-0.19}$
	[2.0, 4.3]		$-0.73^{+0.48}_{-0.55}$	$-0.47^{+0.50}_{-0.39}$	$-0.07 \pm 0.34 \pm 0.07$	$-0.76^{+0.45}_{-0.79}$	$-0.42^{+0.20}_{-0.22}$
	[4.3, 8.68]		$-0.32^{+0.27}_{-0.30}$	$-0.19^{+0.26}_{-0.22}$	$-0.20 \pm 0.26 \pm 0.08$	$0.00^{+0.14}_{-0.15}$	-0.11 ± 0.11
	[10.09, 12.86]		$-0.05^{+0.25}_{-0.29}$	$-0.29^{+0.37}_{-0.29}$	$-0.27 \pm 0.37 \pm 0.08$	$-0.15^{+0.19}_{-0.22}$	$-0.16^{+0.14}_{-0.15}$
	[14.18, 16.00]		$0.05^{+0.32}_{-0.43}$	$-0.40^{+0.61}_{-0.69}$	$0.04 \pm 0.23 \pm 0.05$	-0.40 ± 0.22	$-0.17^{+0.14}_{-0.15}$
	> 16.00		$-0.93^{+0.83}_{-4.99}$	$0.11^{+0.25}_{-0.22}$	$-0.29 \pm 0.28 \pm 0.06$	$-0.52^{+0.18}_{-0.22}$	$-0.28^{+0.12}_{-0.13}$
	[1.00, 6.00]		$-0.41^{+0.25}_{-0.01}$	$-0.41^{+0.26}_{-0.21}$	$-0.06 \pm 0.24 \pm 0.07$	$-0.35^{+0.23}_{-0.27}$	-0.30 ± 0.12
$K\ell^+\ell^-$ §	$0.1 - 2.0$					$-0.37^{+0.18}_{-0.21} \pm 0.02$	$-0.37^{+0.18}_{-0.21}$
	$2.0 - 4.0$					$-0.15^{+0.13}_{-0.15} \pm 0.02$	$-0.15^{+0.13}_{-0.15}$
	$4.0 - 6.0$					$-0.10^{+0.13}_{-0.16} \pm 0.02$	$-0.10^{+0.13}_{-0.16}$
	$6.0 - 8.0$					$0.09^{+0.10}_{-0.11} \pm 0.02$	$0.09^{+0.10}_{-0.11}$
	$11.0 - 12.5$					$-0.16^{+0.15}_{-0.18} \pm 0.03$	$-0.16^{+0.15}_{-0.18}$
	$15.0 - 17.0$					$-0.04^{+0.11}_{-0.13} \pm 0.02$	$-0.04^{+0.11}_{-0.13}$
	$17.0 - 22.0$					$-0.12^{+0.10}_{-0.11} \pm 0.02$	$-0.12^{+0.10}_{-0.11}$
	$1.1 - 6.0$					$-0.10^{+0.08}_{-0.09} \pm 0.02$	$-0.10^{+0.08}_{-0.09}$
	$15.0 - 22.0$					$-0.09^{+0.08}_{-0.08} \pm 0.02$	-0.09 ± 0.08
$K^*\ell^+\ell^-$	< 2.0		$-0.17^{+0.29}_{-0.24}$	$-0.67^{+0.19}_{-0.17}$	$0.15 \pm 0.32 \pm 0.06$	$0.05^{+0.27}_{-0.21}$	$-0.25^{+0.12}_{-0.11}$
	[2.0, 4.3]		$-0.06^{+0.56}_{-0.36}$	$1.45^{+1.04}_{-1.15}$	$0.00 \pm 0.39 \pm 0.07$	$-0.27^{+0.29}_{-0.18}$	$-0.12^{+0.23}_{-0.17}$
	[4.3, 8.68]		$0.03^{+0.43}_{-0.32}$	$-0.34^{+0.32}_{-0.30}$	$0.29 \pm 0.41 \pm 0.13$	$-0.06^{+0.19}_{-0.14}$	$-0.06^{+0.14}_{-0.11}$
	[10.09, 12.86]		$-0.48^{+0.23}_{-0.19}$	$0.00^{+0.22}_{-0.23}$	$0.43 \pm 0.35 \pm 0.10$	$-0.16^{+0.17}_{-0.16}$	-0.14 ± 0.11
	[14.18, 16.00]		$0.24^{+0.61}_{-0.39}$	$0.16^{+0.31}_{-0.36}$	$0.17 \pm 0.29 \pm 0.07$	$0.02^{+0.23}_{-0.21}$	$0.11^{+0.15}_{-0.14}$
	> 16.00		$1.07^{+4.28}_{-1.01}$	$-0.02^{+0.22}_{-0.23}$	$-0.23 \pm 0.23 \pm 0.06$	$0.02^{+0.21}_{-0.20}$	-0.05 ± 0.13
	[1.00, 6.00]		$-0.20^{+0.30}_{-0.23}$	$0.33^{+0.38}_{-0.44}$	$-0.26 \pm 0.21 \pm 0.07$	-0.15 ± 0.16	$-0.16^{+0.12}_{-0.11}$
$K^*\ell^+\ell^-$ §	$0.1 - 2.0$					$0.11^{+0.12}_{-0.11} \pm 0.02$	$0.11^{+0.12}_{-0.11}$
	$2.0 - 4.0$					$-0.20^{+0.15}_{-0.12} \pm 0.03$	$-0.20^{+0.15}_{-0.12}$
	$4.0 - 6.0$					$0.23^{+0.21}_{-0.18} \pm 0.02$	$0.23^{+0.21}_{-0.18}$
	$6.0 - 8.0$					$0.19^{+0.17}_{-0.15} \pm 0.02$	$0.19^{+0.17}_{-0.15}$
	$11.0 - 12.5$					$-0.25^{+0.09}_{-0.08} \pm 0.03$	$-0.25^{+0.10}_{-0.09}$
	$15.0 - 17.0$					$-0.10^{+0.10}_{-0.09} \pm 0.03$	-0.10 ± 0.10
	$17.0 - 19.0$					$0.51^{+0.29}_{-0.24} \pm 0.02$	$0.51^{+0.29}_{-0.24}$
	$1.1 - 6.0$					$0.00^{+0.12}_{-0.10} \pm 0.02$	$0.00^{+0.12}_{-0.10}$
	$15.0 - 19.0$					$0.06^{+0.10}_{-0.09} \pm 0.02$	$0.06^{+0.10}_{-0.09}$

† See the papers for the exact $q^2 = M^2(\mu^+\mu^-)$ selection.   ‡ Muon mode only $(\ell = \mu)$.
§ Results in two different sets of q^2 bins are available.

Heavy Flavor Averaging Group

August 2014

Forward-backward Asymmetry (A_{FB})

In PDG2014   New since PDG2014 (preliminary)   New since PDG2014 (published)

Mode	q^2 [(GeV/c^2)^2] †	PDG2014 Avg.	Belle	CDF ‡	LHCb ‡	CMS ‡	ATLAS ‡	New Avg.
$K\ell^+\ell^-$	< 2.0	$0.00^{+0.06}_{-0.06}$	$0.06^{+0.32}_{-0.35}\pm0.02$	$-0.19^{+0.37}_{-0.45}\pm0.09$	$0.00^{+0.06}_{-0.05}{}^{+0.03}_{-0.01}$			$-0.00^{+0.06}_{-0.05}$
	[2.0, 4.3]	$0.09^{+0.10}_{-0.07}$	$-0.43^{+0.38}_{-0.40}\pm0.09$	$0.32^{+0.17}_{-0.13}\pm0.10$	$0.07^{+0.08}_{-0.05}{}^{+0.02}_{-0.01}$			$0.09^{+0.08}_{-0.06}$
	[4.3, 8.68]	$-0.04^{+0.04}_{-0.05}$	$-0.20^{+0.12}_{-0.14}\pm0.03$	$0.08^{+0.08}_{-0.09}\pm0.01$	$-0.02^{+0.03}_{-0.05}\pm0.03$			$-0.02^{+0.04}_{-0.05}$
	[10.09, 12.86]	-0.05 ± 0.06	$-0.21^{+0.17}_{-0.15}\pm0.06$	$-0.04^{+0.12}_{-0.10}\pm0.03$	$-0.03\pm0.07\pm0.01$			-0.05 ± 0.06
	[14.18, 16.00]	$-0.02^{+0.07}_{-0.05}$	$0.04^{+0.13}_{-0.16}\pm0.05$	$-0.07^{+0.08}_{-0.08}\pm0.01$	$-0.01^{+0.12}_{-0.06}{}\pm0.01$			$-0.03^{+0.06}_{-0.04}$
	[16.0, 18.0]	$-0.09^{+0.07}_{-0.09}$			$-0.09^{+0.07}_{-0.09}{}^{+0.02}_{-0.01}$			$-0.09^{+0.07}_{-0.09}$
	[18.0, 22.0]	0.02 ± 0.11			$0.02\pm0.11\pm0.01$			0.02 ± 0.11
	> 16.00	$0.04^{+0.09}_{-0.07}$	$0.02^{+0.11}_{-0.08}\pm0.02$	$0.05^{+0.18}_{-0.10}\pm0.05$				$0.03^{+0.09}_{-0.07}$
	[1.00, 6.00]	$0.034^{+0.040}_{-0.029}$	$-0.04^{+0.13}_{-0.16}\pm0.05$	$0.13^{+0.11}_{-0.10}\pm0.02$	$0.02^{+0.05}_{-0.03}{}^{+0.02}_{-0.01}$			$0.03^{+0.05}_{-0.03}$
$K^*\ell^+\ell^-$	< 2.0	-0.01 ± 0.14	$0.47^{+0.26}_{-0.32}\pm0.03$	$0.05^{+0.28}_{-0.27}\pm0.10$	$-0.02\pm0.12\pm0.01$	$-0.29^{+0.37}_{-0.00}\pm0.18$		0.04 ± 0.11
	[1.0, 2.0]	$0.45^{+0.26}_{-0.30}$				$-0.29^{+0.41}_{-0.18}$		$-0.29^{+0.41}_{-0.18}$
	[2.0, 4.3]	-0.15 ± 0.07	$0.11^{+0.31}_{-0.36}\pm0.07$	$0.09^{+0.14}_{-0.12}\pm0.04$	$-0.20\pm0.08\pm0.01$	$-0.07\pm0.20\pm0.02$	$0.22\pm0.28\pm0.14$	-0.15 ± 0.07
	[4.3, 8.68]	$0.13^{+0.05}_{-0.06}$	$0.45^{+0.21}_{-0.18}\pm0.15$	$0.44^{+0.13}_{-0.12}\pm0.08$	$0.16^{+0.06}_{-0.05}\pm0.01$	$-0.01\pm0.11\pm0.03$	$0.24\pm0.13\pm0.01$	0.15 ± 0.04
	[10.09, 12.86]	0.34 ± 0.05	$0.43^{+0.20}_{-0.18}\pm0.03$	$0.53^{+0.09}_{-0.09}\pm0.07$	$0.28^{+0.07}_{-0.06}\pm0.02$	$0.40\pm0.08\pm0.05$	$0.09\pm0.09\pm0.03$	$0.29^{+0.05}_{-0.04}$
	[14.18, 16.00]	$0.47^{+0.07}_{-0.06}$	$0.70^{+0.16}_{-0.22}\pm0.10$	$0.35^{+0.17}_{-0.19}\pm0.06$	$0.51^{+0.07}_{-0.05}\pm0.02$	$0.29\pm0.09\pm0.05$	$0.48\pm0.19\pm0.05$	0.48 ± 0.04
	[16.0, 19.0]	0.40 ± 0.06	$0.66^{+0.11}_{-0.16}\pm0.04$	$0.19^{+0.17}_{-0.21}\pm0.05$	$0.30^{+0.08}_{-0.08}{}^{+0.01}_{-0.02}$	$0.41\pm0.05\pm0.03$	$0.16\pm0.10\pm0.03$	0.36 ± 0.04
	[1.00, 6.00]	-0.12 ± 0.07	$0.26^{+0.27}_{-0.30}\pm0.07$		$-0.17\pm0.06\pm0.01$	$-0.07\pm0.12\pm0.01$	$0.07\pm0.20\pm0.07$	-0.11 ± 0.05

† see the original paper for the exact q^2 selection.   ‡ muon mode only ($\ell = \mu$).

Heavy Flavor Averaging Group

August 2014

Fraction of the Longitudinal Polarization (F_L)

In PDG2014   New since PDG2014 (preliminary)   New since PDG2014 (published)

Mode	q^2 [(GeV/c^2)^2] †	PDG2014 Avg.	Belle	CDF ‡	LHCb ‡	CMS ‡	ATLAS ‡	New Avg.
$K^*\ell^+\ell^-$	< 2.0	$0.34^{+0.08}_{-0.07}$	$0.29^{+0.21}_{-0.18} \pm 0.02$	$0.25^{+0.14}_{-0.13} \pm 0.04$	$0.37^{+0.11}_{-0.09}$			$0.33^{+0.08}_{-0.07}$
	[1.0, 2.0]	$0.60^{+0.00}_{-0.28} \pm 0.19$				$0.60^{+0.00}_{-0.28} \pm 0.19$		$0.60^{+0.19}_{-0.34}$
	[2.0, 4.3]	0.69 ± 0.08	$0.71 \pm 0.24 \pm 0.05$	$0.71^{+0.15}_{-0.17} \pm 0.07$	$0.74^{+0.10}_{-0.09}$	$0.65 \pm 0.17 \pm 0.03$	$0.26 \pm 0.18 \pm 0.06$	0.66 ± 0.07
	[4.3, 8.68]	0.64 ± 0.06	$0.64^{+0.23}_{-0.24} \pm 0.07$	$0.72^{+0.12}_{-0.13} \pm 0.05$	$0.57 \pm 0.07 \pm 0.03$	$0.81^{+0.13}_{-0.12} \pm 0.05$	$0.37 \pm 0.11 \pm 0.02$	0.59 ± 0.05
	[10.09, 12.86]	0.43 ± 0.06	$0.17^{+0.17}_{-0.15} \pm 0.03$	$0.38^{+0.11}_{-0.11} \pm 0.04$	$0.48^{+0.08}_{-0.09} \pm 0.03$	$0.45^{+0.10}_{-0.11} \pm 0.04$	$0.50 \pm 0.09 \pm 0.04$	0.44 ± 0.05
	[14.18, 16.00]	0.35 ± 0.08	$-0.15^{+0.27}_{-0.23} \pm 0.07$	$0.40^{+0.11}_{-0.11} \pm 0.04$	$0.33^{+0.08}_{-0.07} \pm 0.02$	$0.53 \pm 0.12 \pm 0.03$	$0.28 \pm 0.16 \pm 0.03$	$0.36^{+0.06}_{-0.05}$
	[16.0, 19.0]	0.37 ± 0.06	$0.12^{+0.15}_{-0.13} \pm 0.02$	$0.19^{+0.12}_{-0.12} \pm 0.07$	$0.38^{+0.09}_{-0.08} \pm 0.03$	$0.44 \pm 0.07 \pm 0.03$	$0.35 \pm 0.08 \pm 0.02$	0.35 ± 0.04
	[1.00, 6.00]	0.66 ± 0.06	$0.67 \pm 0.23 \pm 0.05$	$0.76^{+0.12}_{-0.14} \pm 0.07$	$0.65^{+0.08}_{-0.07} \pm 0.03$	$0.68 \pm 0.10 \pm 0.02$	$0.18 \pm 0.15 \pm 0.03$	0.62 ± 0.05

† see the original paper for the exact q^2 selection.   ‡ muon mode only ($\ell = \mu$).

Heavy Flavor Averaging Group
August 2014
Up-down Asymmetry in $B^+ \to K^+\pi^-\pi^+\gamma$

In PDG2014   New since PDG2014 (preliminary)   New since PDG2014 (published)

Mode	$m_{K^+\pi^-\pi^+}$ [(GeV/c^2)^2]	PDG2014 Avg.	LHCb	New Avg.
$K^+\pi^-\pi^+\gamma$	1.1-1.3		6.9 ± 1.7	6.9 ± 1.7
	1.3-1.4		4.9 ± 2.0	4.9 ± 2.0
	1.4-1.6		5.6 ± 1.8	5.6 ± 1.8
	1.6-1.9		-4.5 ± 1.9	-4.5 ± 1.9
	1.1-1.3		-1.1 ± 1.7	-1.1 ± 1.7
	1.3-1.4		7.2 ± 2.0	7.2 ± 2.0
	1.4-1.6		6.4 ± 1.8	6.4 ± 1.8
	1.6-1.9		-3.9 ± 1.9	-3.9 ± 1.9

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