Heavy FLavor AVeraging group (HFLAV) - November 2016

B^+ Branching Fractions (decays with kaons part 1) ($\times 10^{-6}$) - UL at 90% CL

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

RPP#	Mode	PDG2014 Avg.	BABAR		Belle		CLEO		CDF	LHCb	Our Avg.
262	$K^0\pi^+$	23.7 ± 0.8	$23.9 \pm 1.1 \pm 1.0$	[1]	$23.97 \pm 0.53 \pm 0.71$	[2]	$18.8^{+3.7+2.1}_{-3.3-1.8}$	[3]			23.79 ± 0.75
263	$K^+\pi^0$	12.9 ± 0.5	$13.6 \pm 0.6 \pm 0.7$	[4]	$12.62 \pm 0.31 \pm 0.56$	[2]	$12.9^{+2.4+1.2}_{-2.2-1.1}$	[3]			$12.94^{+0.52}_{-0.51}$
264	$\eta' K^+$	70.6 ± 2.5	$71.5 \pm 1.3 \pm 3.2$	[5]	$69.2 \pm 2.2 \pm 3.7$	[6]					70.6 ± 2.7
265	$\eta' K^{*+}$	$4.8^{+1.8}_{-1.6}$	$4.8^{+1.6}_{-1.4} \pm 0.8$	[7]	< 2.9	[8]					$4.8^{+1.8}_{-1.6}$
266	$\eta' K_0^*(1430)^+$	5.2 ± 2.1	$5.2 \pm 1.9 \pm 1.0$	[7]							5.2 ± 2.1
267	$\eta' K_2^*(1430)^+$	28 ± 5	$28.0^{+4.6}_{-4.3} \pm 2.6$	[7]							$28.0^{+5.3}_{-5.0}$
268	ηK^+	2.4 ± 0.4	$2.94^{+0.39}_{-0.34} \pm 0.21$	[5]	$2.12 \pm 0.23 \pm 0.11$	[9]	$2.2^{+2.8}_{-2.2}$	[10]			$2.36^{+0.22}_{-0.21}$
269	ηK^{*+}	19.3 ± 1.6	$18.9 \pm 1.8 \pm 1.3$	[11]	$19.3^{+2.0}_{-1.9} \pm 1.5$	[12]	$26.4^{+9.6}_{-8.2} \pm 3.3$	[10]			19.3 ± 1.6
270	$\eta K_0^*(1430)^+$	18 ± 4	$18.2 \pm 2.6 \pm 2.6$	[11]							18.2 ± 3.7
271	$\eta K_2^*(1430)^+$	9.1 ± 3.0	$9.1 \pm 2.7 \pm 1.4$	[11]							9.1 ± 3.0
272	$\eta(1295) K^+$ †	$2.9^{+0.8}_{-0.7}$	$2.9^{+0.8}_{-0.7} \pm 0.2$ ‡	[13]							$2.9^{+0.8}_{-0.7}$
274	$\eta(1405) K^+$ †	< 1.2	< 1.2	[13]							< 1.2
275	$\eta(1475) K^+$ †	$13.8^{+2.1}_{-1.8}$	$13.8^{+1.8+1.0}_{-1.7-0.6}$	[13]							$13.8^{+2.1}_{-1.8}$
276	$f_1(1285) K^+$	< 2.0	< 2.0	[13]							< 2.0
277	$f_1(1420) K^+$ †	< 2.9	< 2.9	[13]							< 2.9
279	$\phi(1680) K^+$ †	< 3.4	< 3.4	[13]							< 3.4
280	$f_0(1500) K^+$	3.7 ± 2.2	3.7 ± 2.2 §	[14, 15]							3.7 ± 2.2
281	ωK^+	6.7 ± 0.8	$6.3 \pm 0.5 \pm 0.3$	[16]	$6.8 \pm 0.4 \pm 0.4$	[17]	$3.2^{+2.4}_{-1.9} \pm 0.8$	[18]			6.5 ± 0.4
282	ωK^{*+}	< 7.4	< 7.4	[19]							< 7.4
283	$\omega (K\pi)_0^{*+}$	28 ± 4	$27.5^{+3.0}_{-2.6}$	[19]							$27.5^{+3.0}_{-2.6}$
284	$\omega K_0^*(1430)^+$	24 ± 5	$24.0 \pm 2.6 \pm 4.4$	[19]							24.0 ± 5.1
285	$\omega K_2^*(1430)^+$	21 ± 4	$21.5 \pm 3.6 \pm 2.4$	[19]							21.5 ± 4.3
286	$a_0(980)^+ K^0$ †	< 3.9	< 3.9	[20]							< 3.9
287	$a_0(980)^0 K^+$ †	< 2.5	< 2.5	[20]							< 2.5
288	$K^{*0}\pi^+$	10.1 ± 0.9	$10.8 \pm 0.6^{+1.2}_{-1.4}$	[14]	$9.7 \pm 0.6^{+0.8}_{-0.9}$	[21]					$10.1^{+0.8}_{-0.9}$
289	$K^{*+}\pi^0$	8.2 ± 1.9	$8.2 \pm 1.5 \pm 1.1$	[22]			$7.1^{+11.4}_{-7.1} \pm 1.0$	[18]			8.2 ± 1.8
290	$K^+\pi^+\pi^-$	51 ± 2.9	$54.4 \pm 1.1 \pm 4.6$	[14]	$48.8 \pm 1.1 \pm 3.6$	[21]					51.0 ± 3.0
291	$K^+\pi^+\pi^-$ (NR)	$16.3^{+2.1}_{-1.5}$	$9.3 \pm 1.0^{+6.9}_{-1.7}$	[14]	$16.9 \pm 1.3^{+1.7}_{-1.6}$	[21]					16.3 ± 2.0
292	$\omega(782) K^+$ $(K^+\pi^+\pi^-)$	6 ± 9	$5.9^{+8.8+0.5}_{-9.0-0.4}$	[14]							$5.9^{+8.8}_{-9.0}$
293	$f_0(980) K^+$ $(K^+\pi^+\pi^-)$ †	$9.4^{+1.0}_{-1.2}$	$10.3 \pm 0.5^{+2.0}_{-1.4}$	[14]	$8.8 \pm 0.8^{+0.9}_{-1.8}$	[21]					$9.4^{+0.9}_{-1.0}$
294	$f_2(1270)^0 K^+$ $(K^+\pi^+\pi^-)$	1.07 ± 0.27	$0.88^{+0.38+0.01}_{-0.33-0.03}$	[14]	$1.33 \pm 0.30^{+0.23}_{-0.34}$	[21]					1.07 ± 0.29
295	$f_0(1370)^0 K^+$ $(K^+\pi^+\pi^-)$ †	< 10.7	< 10.7	[23]							< 10.7
296	$\rho(1450)^0 K^+$ $(K^+\pi^+\pi^-)$	< 11.7	< 11.7	[23]							< 11.7
297	$f_2'(1525) K^+$ $(K^+\pi^+\pi^-)$	< 3.4	< 3.4	[23]							< 3.4
298	$\rho^0 K^+$ $(K^+\pi^+\pi^-)$	3.7 ± 0.5	$3.56 \pm 0.45^{+0.57}_{-0.46}$	[14]	$3.89 \pm 0.47^{+0.43}_{-0.41}$	[21]					$3.74^{+0.49}_{-0.45}$
299	$K_0^*(1430)^0\pi^+$ $(K^+\pi^+\pi^-)$	45^{+9}_{-7}	$32.0 \pm 1.2^{+10.8}_{-6.0}$	[14]	$51.6 \pm 1.7^{+7.0}_{-7.5}$	[21]					45.1 ± 6.3
300	$K_2^*(1430)^0\pi^+$ $(K^+\pi^+\pi^-)$	$5.6^{+2.2}_{-1.5}$	$5.6 \pm 1.2^{+1.8}_{-0.8}$	[14]	< 6.9	[24]					$5.6^{+2.2}_{-1.4}$
301	$K^*(1410)^0\pi^+$ $(K^+\pi^+\pi^-)$	< 45			< 45	[24]					< 45
302	$K^*(1680)^0\pi^+$ $(K^+\pi^+\pi^-)$	< 12	< 15	[23]	< 12	[24]					< 12
303	$K^+\pi^0\pi^0$	16.2 ± 1.9	$16.2 \pm 1.2 \pm 1.5$	[22]							16.2 ± 1.9
304	$f_0(980) K^+$ $(K^+\pi^0\pi^0)$	2.8 ± 0.8	$2.8 \pm 0.6 \pm 0.5$	[22]							2.8 ± 0.8
305	$K^-\pi^+\pi^+$	< 0.95	< 0.95	[25]	< 4.5	[26]				< 0.046	[27] < 0.046
306	$K^-\pi^+\pi^+$ (NR)	< 56					< 56	[28]			< 56
307	$K_1(1270)^0\pi^+$	< 40	< 40	[29]							< 40
308	$K_1(1400)^0\pi^+$	< 39	< 39	[29]							< 39
309	$K^0\pi^+\pi^0$	< 66					< 66	[30]			< 66
310	$\rho^+ K^0 (K^0\pi^+\pi^0)$	8.0 ± 1.5	$8.0^{+1.4}_{-1.3} \pm 0.6$	[31]							$8.0^{+1.5}_{-1.4}$
311	$K^{*+}\pi^+\pi^-$	75 ± 10	$75.3 \pm 6.0 \pm 8.1$	[32]							75.3 ± 10.1
312	$K^{*+}\rho^0$	4.6 ± 1.1	$4.6 \pm 1.0 \pm 0.4$	[33]							4.6 ± 1.1
313	$f_0(980) K^{*+}$ †	4.2 ± 0.7	$4.2 \pm 0.6 \pm 0.3$	[33]							4.2 ± 0.7

Results for LHCb are relative BFs converted to absolute BFs.
CLEO upper limits that have been greatly superseded are not shown.
† In this product of BFs, all daughter BFs not shown are set to 100%.
‡ The value quoted is $\mathcal{B}(B^+ \to \eta(1295)K^+) \times \mathcal{B}(\eta(1295) \to \eta\pi\pi)$.
§ Average of results in $K_S^0 K^+ K^-$, $K_S^0 K_S^0 K^+$ [15] and $K^+\pi^+\pi^-$ [14]. Includes an f_X resonance with parameters that are compatible with $f_0(1500)$.

Heavy FLavor AVeraging group (HFLAV) - November 2016

B^+ Branching Fractions (decays with kaons part 2) ($\times 10^{-6}$) - UL at 90% CL

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

RPP#	Mode	PDG2014 Avg.	BABAR	Belle	CLEO	CDF	LHCb	Our Avg.
314	$a_1^+ K^0$	35 ± 7	$34.9 \pm 5.0 \pm 4.4$ [34]					34.9 ± 6.7
315	$b_1^+ K^0$ †	9.6 ± 1.9	$9.6 \pm 1.7 \pm 0.9$ [35]					9.6 ± 1.9
317	$K_1(1400)^+ \rho^0$	< 780	< 780 ¶ [36]					< 780 ¶
318	$K_2(1430)^+ \rho^0$	< 1500	< 1500 ¶ [36]					< 1500 ¶
319	$b_1^0 K^+$ †	9.1 ± 2.0	$9.1 \pm 1.7 \pm 1.0$ [37]					9.1 ± 2.0
320	$b_1^+ K^{*0}$ †	< 5.9	< 5.9 [38]					< 5.9
321	$b_1^0 K^{*+}$ †	< 6.7	< 6.7 [38]					< 6.7
322	$K^+ \overline{K}^0$	1.31 ± 0.17	$1.61 \pm 0.44 \pm 0.09$ [1]	$1.11 \pm 0.19 \pm 0.05$ [2]			$1.52 \pm 0.21 \pm 0.05$ [39]	1.32 ± 0.14
323	$\overline{K}^0 K^+ \pi^0$	< 24			< 24 [30]			< 24
324	$K^+ K_S K_S$	10.8 ± 0.6	$10.6 \pm 0.5 \pm 0.3$ [15]	$13.4 \pm 1.9 \pm 1.5$ [26]				10.8 ± 0.6
325	$f_0(980) K^+ \ (K^+ K_S K_S)$	14.7 ± 3.3	$14.7 \pm 2.8 \pm 1.8$ [15]					14.7 ± 3.3
326	$f_0(1710) K^+ \ (K^+ K_S K_S)$	$0.48^{+0.40}_{-0.26}$	$0.48^{+0.40}_{-0.24} \pm 0.11$ [15]					$0.48^{+0.41}_{-0.26}$
327	$K^+ K_S K_S \ (NR)$	20 ± 4	$19.8 \pm 3.7 \pm 2.5$ [15]					19.8 ± 4.5
328	$K_S K_S \pi^+$	< 0.51	< 0.51 [40]	< 3.2 [26]				< 0.51
329	$K^+ K^- \pi^+$	5.0 ± 0.7	$5.0 \pm 0.5 \pm 0.5$ [41]	< 13 [26]				5.0 ± 0.7
330	$K^+ K^- \pi^+ \ (NR)$	< 75			< 75 [28]			< 75
331	$\overline{K}^{*0} K^+ \ (K^+ K^- \pi^+)$	< 1.1	< 1.1 [42]					< 1.1
332	$\overline{K}_0^*(1430)^0 K^+ \ (K^+ K^- \pi^+)$	< 2.2	< 2.2 [42]					< 2.2
333	$K^+ K^+ \pi^-$	< 0.16	< 0.16 [25]	< 2.4 [26]			< 0.011 [27]	< 0.011
334	$K^+ K^+ \pi^- \ (NR)$	< 87.9						< 87.9
335	$f_2'(1525) K^+$	1.8 ± 0.5	1.8 ± 0.5 ‡ [15]	< 8 [24]				1.8 ± 0.5
336	$f_J(2220) K^+$	< 1.2		< 1.2 [43]				< 1.2
337	$K^{*+} \pi^+ K^-$	< 11.8	< 11.8 [32]					< 11.8
338	$K^{*+} \overline{K}^{*0}$	1.2 ± 0.5	$1.2 \pm 0.5 \pm 0.1$ [44]	< 1.31 [45]				1.2 ± 0.5
339	$K^{*+} K^+ \pi^-$	< 6.1	< 6.1 [32]					< 6.1
340	$K^+ K^- K^+$	34.0 ± 1.4	$34.6 \pm 0.6 \pm 0.9$ [15]	$30.6 \pm 1.2 \pm 2.3$ [24]				34.0 ± 1.0
341	$\phi K^+ \ (K^+ K^- K^+)$	$8.8^{+0.7}_{-0.6}$	$9.2 \pm 0.4^{+0.7}_{-0.5}$ [15]	$9.6 \pm 0.9^{+1.1}_{-0.8}$ [24]	$5.5^{+2.1}_{-1.8} \pm 0.6$ [46]	$7.6 \pm 1.3 \pm 0.6$ [47]		8.8 ± 0.5
342	$f_0(980) K^+ \ (K^+ K^- K^+)$	9.4 ± 3.2	$9.4^{+1.6}_{-2.8}$ [15]					$9.4^{+1.6}_{-2.8}$
343	$a_2(1320) K^+ \ (K^+ K^- K^+)$ †	< 1.1		< 1.1 [24]				< 1.1
344	$X_0(1550) K^+ \ (K^+ K^- K^+)$	4.3 ± 0.7	$4.3 \pm 0.60 \pm 0.30$ [48]					4.30 ± 0.67
345	$\phi(1680) K^+ \ (K^+ K^- K^+)$ †	< 0.8		< 0.8 [24]				< 0.8
346	$f_0(1710) K^+ \ (K^+ K^- K^+)$ †	1.1 ± 0.6	$1.12 \pm 0.25 \pm 0.50$ [15]					1.12 ± 0.56
347	$K^+ K^- K^+ \ (NR)$	$23.8^{+2.8}_{-5.0}$	$22.8 \pm 2.7 \pm 7.6$ [15]	$24.0 \pm 1.5^{+2.6}_{-6.0}$ [24]				$23.8^{+2.9}_{-5.1}$
348	$K^{*+} K^+ K^-$	36 ± 5	$36.2 \pm 3.3 \pm 3.6$ [32]					36.2 ± 4.9
349	ϕK^{*+}	10.0 ± 2.0	$11.2 \pm 1.0 \pm 0.9$ [49]	$6.7^{+2.1+0.7}_{-1.9-1.0}$ [50]	$10.6^{+6.4+1.8}_{-4.9-1.6}$ [46]			10.0 ± 1.1
350	$\phi(K\pi)_0^{*+}$	8.3 ± 1.6	$8.3^{+1.4}_{-0.8}$ [51]					$8.3^{+1.4}_{-0.8}$
351	$\phi K_1(1270)^+$	6.1 ± 1.9	$6.1 \pm 1.6 \pm 1.1$ [51]					6.1 ± 1.9
352	$\phi K_1(1400)^+$	< 3.2	< 3.2 [51]					< 3.2
353	$\phi K^*(1410)^+$	< 4.3	< 4.3 [51]					< 4.3
354	$\phi K_0^*(1430)^+$	7.0 ± 1.6	$7.0 \pm 1.3 \pm 0.9$ [51]					7.0 ± 1.6
355	$\phi K_2^*(1430)^+$	8.4 ± 2.1	$8.4 \pm 1.8 \pm 1.0$ [51]					8.4 ± 2.1
356	$\phi K_2(1770)^+$	< 15	< 15 [51]					< 15
357	$\phi K_2(1820)^+$	< 16.3	< 16.3 [51]					< 16.3
358	$a_1^+ K^{*0}$	< 3.6	< 3.6 [52]					< 3.6
359	$\phi\phi K^+$ §	5.0 ± 1.2	$5.6 \pm 0.5 \pm 0.3$ [53]	$2.6^{+1.1}_{-0.9} \pm 0.3$ [43]				5.0 ± 0.5
360	$\eta'\eta' K^+$	< 25	< 25 [54]					< 25
361	$K^+ \omega\phi$	< 1.9		< 1.9 [55]				< 1.9
362	$K^+ X(1812)$ †	< 0.32		< 0.32 [55]				< 0.32

Results for CDF and LHCb are relative BFs converted to absolute BFs.
CLEO upper limits that have been greatly superseded are not shown.
† In this product of BFs, all daughter BFs not shown are set to 100%.
‡ Average of results in $K_S^0 K^+ K^-$, $K_S^0 K_S^0 K^+$ [15].
§ $M_{\phi\phi} < 2.85$ GeV/c^2.
¶ Result from ARGUS. Cited in the *BABAR* column to avoid adding a column to the table.

Heavy FLavor AVeraging group (HFLAV) - November 2016

B^+ Branching Fractions (decays without kaons) ($\times 10^{-6}$) - UL at 90% CL

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

RPP#	Mode	PDG2014 Avg.	BABAR	Belle	CLEO	CDF	LHCb	Our Avg.
379	$\pi^+\pi^0$	5.5 ± 0.4	$5.02 \pm 0.46 \pm 0.29$ [4]	$5.86 \pm 0.26 \pm 0.38$ [2]	$4.6^{+1.8+0.6}_{-1.6-0.7}$ [3]			$5.48^{+0.35}_{-0.34}$
380	$\pi^+\pi^+\pi^-$	15.2 ± 1.4	$15.2 \pm 0.6 \pm 1.3$ [56]					15.2 ± 1.4
381	$\rho^0\pi^+$	8.3 ± 1.2	$8.1 \pm 0.7^{+1.3}_{-1.6}$ [56]	$8.0^{+2.3}_{-2.0} \pm 0.7$ [57]	$10.4^{+3.3}_{-3.4} \pm 2.1$ [18]			$8.3^{+1.2}_{-1.3}$
382	$f_0(980)\pi^+$ †	< 1.5	< 1.5 [56]					< 1.5
383	$f_2(1270)\pi^+$	$1.6^{+0.7}_{-0.4}$	$1.57 \pm 0.42^{+0.55}_{-0.25}$ [56]					$1.57^{+0.69}_{-0.49}$
384	$\rho(1450)^0\pi^+$ †	$1.4^{+0.6}_{-0.9}$	$1.4 \pm 0.4^{+0.5}_{-0.8}$ [56]					$1.4^{+0.6}_{-0.9}$
385	$f_0(1370)\pi^+$ †	< 4.0	< 4.0 [56]					< 4.0
387	$\pi^+\pi^-\pi^+(NR)$	$5.3^{+1.5}_{-1.1}$	$5.3 \pm 0.7^{+1.3}_{-0.8}$ [56]					$5.3^{+1.5}_{-1.1}$
388	$\pi^+\pi^0\pi^0$	< 890	< 890 ‡ [58]					< 890 ‡
389	$\rho^+\pi^0$	10.9 ± 1.4	$10.2 \pm 1.4 \pm 0.9$ [59]	$13.2 \pm 2.3^{+1.4}_{-1.9}$ [60]				$10.9^{+1.4}_{-1.5}$
391	$\rho^+\rho^0$	24.0 ± 1.9	$23.7 \pm 1.4 \pm 1.4$ [61]	$31.7 \pm 7.1^{+3.8}_{-6.7}$ [62]				$24.0^{+1.9}_{-2.0}$
392	$f_0(980)\rho^+$ †	< 2.0	< 2.0 [61]					< 2.0
393	$a_1^+\pi^0$	26 ± 7	$26.4 \pm 5.4 \pm 4.1$ [63]					26.4 ± 6.8
394	$a_1^0\pi^+$	20 ± 6	$20.4 \pm 4.7 \pm 3.4$ [63]					20.4 ± 5.8
395	$\omega\pi^+$	6.9 ± 0.5	$6.7 \pm 0.5 \pm 0.4$ [16]	$6.9 \pm 0.6 \pm 0.5$ [64]	$11.3^{+3.3}_{-2.9} \pm 1.4$ [18]			6.9 ± 0.5
396	$\omega\rho^+$	15.9 ± 2.1	$15.9 \pm 1.6 \pm 1.4$ [19]					15.9 ± 2.1
397	$\eta\pi^+$	4.02 ± 0.27	$4.00 \pm 0.40 \pm 0.24$ [5]	$4.07 \pm 0.26 \pm 0.21$ [9]	$1.2^{+2.8}_{-1.2}$ [10]			4.02 ± 0.27
398	$\eta\rho^+$	7.0 ± 2.9	$9.9 \pm 1.2 \pm 0.8$ [65]	$4.1^{+1.4}_{-1.3} \pm 0.4$ [12]	$4.8^{+5.2}_{-3.8}$ [10]			6.9 ± 1.0
399	$\eta'\pi^+$	2.7 ± 0.9	$3.5 \pm 0.6 \pm 0.2$ [5]	$1.8^{+0.7}_{-0.6} \pm 0.1$ [6]	$1.0^{+5.8}_{-1.0}$ [10]			$2.7^{+0.5}_{-0.4}$
400	$\eta'\rho^+$	9.7 ± 2.2	$9.7^{+1.9}_{-1.8} \pm 1.1$ [7]	< 5.8 [8]				$9.7^{+2.2}_{-2.1}$
401	$\phi\pi^+$	< 0.15	< 0.24 [66]	< 0.33 [67]			< 0.15 [68]	< 0.15
402	$\phi\rho^+$	< 3.0	< 3.0 [69]					< 3.0
403	$a_0(980)^0\pi^+$ †	< 5.8	< 5.8 [20]					< 5.8
404	$a_0(980)^+\pi^0$ †	< 1.4	< 1.4 [70]					< 1.4
405	$\pi^+\pi^+\pi^+\pi^-\pi^-$	< 860	< 860 ‡ [58]					< 860 ‡
406	$\rho^0 a_1(1260)^+$	< 620			< 620 [71]			< 620
407	$\rho^0 a_2(1320)^+$	< 720			< 720 [71]			< 720
408	$b_1^0\pi^+$ †	6.7 ± 2.0	$6.7 \pm 1.7 \pm 1.0$ [37]					6.7 ± 2.0
409	$b_1^+\pi^0$ †	< 3.3	< 3.3 [35]					< 3.3
410	$\pi^+\pi^+\pi^+\pi^-\pi^-\pi^0$	< 6300	< 6300 ‡ [58]					< 6300 ‡
411	$b_1^+\rho^0$ †	< 5.2	< 5.2 [38]					< 5.2
413	$b_1^0\rho^+$ †	< 3.3	< 3.3 [38]					< 3.3

Results for LHCb are relative BFs converted to absolute BFs.
CLEO upper limits that have been greatly superseded are not shown.
† In this product of BFs, all daughter BFs not shown are set to 100%.
‡ Result from ARGUS. Cited in the *BABAR* column to avoid adding a column to the table.

Heavy FLavor AVeraging group (HFLAV) - November 2016

B^0 Branching Fractions (decays with kaons part 1) ($\times 10^{-6}$) - UL at 90% CL

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

RPP#	Mode	PDG2014 Avg.	BABAR		Belle		CLEO		CDF	LHCb	Our Avg.
227	$K^+\pi^-$	19.6 ± 0.5	$19.1 \pm 0.6 \pm 0.6$	[72]	$20.0 \pm 0.34 \pm 0.60$	[2]	$18.0^{+2.3+1.2}_{-2.1-0.9}$	[3]			$19.57^{+0.53}_{-0.52}$
228	$K^0\pi^0$	9.9 ± 0.5	$10.1 \pm 0.6 \pm 0.4$	[73]	$9.68 \pm 0.46 \pm 0.50$	[2]	$12.8^{+4.0+1.7}_{-3.3-1.4}$	[3]			9.93 ± 0.49
229	$\eta' K^0$	66 ± 4	$68.5 \pm 2.2 \pm 3.1$	[5]	$58.9^{+3.6}_{-3.5} \pm 4.3$	[6]	$89^{+18}_{-16} \pm 9$	[10]			66.1 ± 3.1
230	$\eta' K^{*0}$	3.1 ± 0.9	$3.1^{+0.9}_{-0.8} \pm 0.3$	[7]	$2.6 \pm 0.7 \pm 0.2$	[74]	$7.8^{+7.7}_{-5.7}$	[10]			$2.8^{+0.6}_{-0.5}$
231	$\eta' K_0^*(1430)^0$	6.3 ± 1.6	$6.3 \pm 1.3 \pm 0.9$	[7]							6.3 ± 1.6
232	$\eta' K_2^*(1430)^0$	13.7 ± 3.2	$13.7^{+3.0}_{-1.9} \pm 1.2$	[7]							$13.7^{+3.2}_{-2.2}$
233	ηK^0	$1.23^{+0.27}_{-0.24}$	$1.15^{+0.43}_{-0.38} \pm 0.09$	[5]	$1.27^{+0.33}_{-0.29} \pm 0.08$	[9]	$0.0^{+3.0}_{-0.0}$	[10]			$1.23^{+0.27}_{-0.24}$
234	ηK^{*0}	15.9 ± 1.0	$16.5 \pm 1.1 \pm 0.8$	[11]	$15.2 \pm 1.2 \pm 1.0$	[12]	$13.8^{+5.5}_{-4.6} \pm 1.6$	[10]			15.9 ± 1.0
235	$\eta K_0^*(1430)^0$	11.0 ± 2.2	$11.0 \pm 1.6 \pm 1.5$	[11]							11.0 ± 2.2
236	$\eta K_2^*(1430)^0$	9.6 ± 2.1	$9.6 \pm 1.8 \pm 1.1$	[11]							9.6 ± 2.1
237	ωK^0	5.0 ± 0.6	$5.4 \pm 0.8 \pm 0.3$	[16]	$4.5 \pm 0.4 \pm 0.3$	[17]	$10.0^{+5.4}_{-4.2} \pm 1.4$	[18]			4.8 ± 0.4
238	$a_0(980)^0 K^0$ †	< 7.8	< 7.8	[20]							< 7.8
239	$b_1^0 K^0$ †	< 7.8	< 7.8	[35]							< 7.8
240	$a_0(980)^- K^+$ †	< 1.9	< 1.9	[75]							< 1.9
241	$b_1^- K^+$ †	7.4 ± 1.4	$7.4 \pm 1.0 \pm 1.0$	[37]							7.4 ± 1.4
242	$b_1^0 K^{*0}$ †	< 8.0	< 8.0	[38]							< 8.0
243	$b_1^- K^{*+}$ †	< 5.0	< 5.0	[38]							< 5.0
244	$a_0(1450)^- K^+$ †	< 3.1	< 3.1	[75]							< 3.1
245	$K_S X^0$(Familon) †	< 53					< 53	[76]			< 53
246	ωK^{*0}	2.0 ± 0.5	$2.2 \pm 0.6 \pm 0.2$	[19]	$1.8 \pm 0.7^{+0.3}_{-0.2}$	[77]					2.0 ± 0.5
247	ωK^{*0}	18.4 ± 2.5	$18.4^{+1.8}_{-1.7}$	[19]							$18.4^{+1.8}_{-1.7}$
248	$\omega K_0^*(1430)^0$	16.0 ± 3.4	$16.0 \pm 1.6 \pm 3.0$	[19]							16.0 ± 3.4
249	$\omega K_2^*(1430)^0$	10.1 ± 2.3	$10.1 \pm 2.0 \pm 1.1$	[19]							10.1 ± 2.3
250	$\omega K^+\pi^-$ (NR) [1]	5.1 ± 1.0			$5.1 \pm 0.7 \pm 0.7$	[77]					5.1 ± 1.0
251	$K^+\pi^-\pi^0$	37.8 ± 3.2	$38.5 \pm 1.0 \pm 3.9$	[78]	$36.6^{+4.2}_{-4.3} \pm 3.0$	[79]					37.8 ± 3.2
252	$\rho^- K^+$	7.0 ± 0.9	$6.6 \pm 0.5 \pm 0.8$	[78]	$15.1^{+3.4+2.4}_{-3.3-2.6}$	[79]					7.0 ± 0.9
253	$\rho(1450)^- K^+$	2.4 ± 1.2	$2.4 \pm 1.0 \pm 0.6$	[78]							2.4 ± 1.2
254	$\rho(1700)^- K^+$	0.6 ± 0.7	$0.6 \pm 0.6 \pm 0.4$	[78]							0.6 ± 0.7
255	$K^+\pi^-\pi^0$ (NR)	2.8 ± 0.6	$2.8 \pm 0.5 \pm 0.4$	[78]	< 9.4	[79]					2.8 ± 0.6
256	$(K\pi)_0^{*+}\pi^-$	34 ± 5	$34.2 \pm 2.4 \pm 4.1$	[78]							34.2 ± 4.8
257	$(K\pi)_0^{*+}\pi^0$	8.5 ± 1.7	$8.6^{+1.1}_{-1.3}$	[78]							$8.6^{+1.1}_{-1.3}$
258	$K_2^*(1430)^0\pi^0$	< 4.0	< 4.0	[80]							< 4.0
259	$K^*(1680)^0\pi^0$	< 7.5	< 7.5	[80]							< 7.5
260	$K_x^{*0}\pi^0$ [2]	6.1 ± 1.6			$6.1^{+1.6+0.5}_{-1.5-0.6}$	[79]					$6.1^{+1.7}_{-1.6}$
261	$K^0\pi^+\pi^-$	65 ± 8	$50.2 \pm 1.5 \pm 1.8$	[81]	$47.5 \pm 2.4 \pm 3.7$	[82]	$50^{+10}_{-9} \pm 7$	[30]		$65.2^{+6.0}_{-5.1}$ ‡	[83] 51.8 ± 1.9
262	$K^0\pi^+\pi^-$ (NR)	$14.7^{+4.0}_{-2.6}$	$11.1^{+2.5}_{-1.0} \pm 0.9$	[81]	$19.9 \pm 2.5^{+1.7}_{-2.0}$	[82]					14.7 ± 2.0
263	$\rho^0 K^0$	4.7 ± 0.6	$4.4 \pm 0.7 \pm 0.3$	[81]	$6.1 \pm 1.0^{+1.1}_{-1.2}$	[82]					4.7 ± 0.7
264	$K^{*+}\pi^-$	8.4 ± 0.8	8.2 ± 0.9 [3]	[78, 81]	$8.4 \pm 1.1^{+1.0}_{-0.9}$	[82]	$16^{+6}_{-5} \pm 2$	[30]			8.4 ± 0.8
265	$K_0^*(1430)^+\pi^-$	33 ± 7	$29.9^{+2.3}_{-1.7} \pm 3.6$	[81]	$49.7 \pm 3.8^{+6.8}_{-8.2}$	[82]					$33.5^{+3.9}_{-3.8}$
266	$K_x^{*+}\pi^-$ [2]	5.1 ± 1.6			$5.1^{+1.5+0.6}_{-1.5-0.7}$	[79]					$5.1^{+1.6}_{-1.7}$
267	$K^*(1410)^+\pi^-$ †	< 3.8			< 3.8	[82]					< 3.8
268	$f_0(980)K^0$ †	7.0 ± 0.9	$6.9 \pm 0.8 \pm 0.6$	[81]	$7.6 \pm 1.7^{+0.9}_{-1.3}$	[82]					7.0 ± 0.9
269	$f_2(1270)^0 K^0$	$2.7^{+1.3}_{-1.2}$	$2.7^{+1.0}_{-0.8} \pm 0.9$	[81]	< 2.5 †	[82]					$2.7^{+1.3}_{-1.2}$
270	$f_x(1300)^0 K^0$	1.8 ± 0.7	$1.81^{+0.55}_{-0.45} \pm 0.48$	[81]							$1.81^{+0.73}_{-0.66}$

Results for LHCb are relative BFs converted to absolute BFs.
CLEO upper limits that have been greatly superseded are not shown.
† In this product of BFs, all daughter BFs not shown are set to 100%.
‡ Obtained from a fit to the ratios of BFs measured by LHCb (Ref. [83]) and to the averages of the BFs in their numerators, as measured by other experiments (RPP 292 and 298).
[1] $0.755 < M(K\pi) < 1.250$ GeV/c^2. [2] K_x^{*0} stands for the possible candidates for $K^*(1410), K_0^*(1430), K_2^*(1430)$.
[3] Average of *BABAR* results from $B^0 \to K^+\pi^-\pi^0$ [78] and $B^0 \to K^0\pi^+\pi^-$ [81].

Heavy FLavor AVeraging group (HFLAV) - November 2016

B^0 Branching Fractions (decays with kaons part 2) ($\times 10^{-6}$) - UL at 90% CL

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

RPP#	Mode	PDG2014 Avg.	BABAR		Belle		CLEO	CDF	LHCb		Our Avg.
271	$K^{*0}\pi^0$	3.3 ± 0.6	$3.3 \pm 0.5 \pm 0.4$	[78]	< 3.5	[79]					3.3 ± 0.6
272	$K_2^*(1430)^+\pi^-$	< 6	< 16.2	[80]	< 6.3	[82]					< 6.3
273	$K^*(1680)^+\pi^-$	< 10	< 25	[80]	< 10.1	[82]					< 10.1
275	$\rho^0 K^+\pi^-$	2.8 ± 0.7			$2.8 \pm 0.5 \pm 0.5$ [2]	[84]					2.8 ± 0.7
276	$f_0(980)K^+\pi^-$	$1.4^{+0.5}_{-0.6}$			$1.4 \pm 0.4^{+0.3}_{-0.4}$ [2]	[84]					$1.4^{+0.5}_{-0.6}$
277	$K^+\pi^-\pi^+\pi^-$	< 2.1			< 2.1	[84]					< 2.1
278	$K^{*0}\pi^+\pi^-$	55 ± 5	$54.5 \pm 2.9 \pm 4.3$	[85]							54.5 ± 5.2
279	$K^{*0}\rho^0$	3.9 ± 1.3	$5.1 \pm 0.6^{+0.6}_{-0.8}$	[86]	$2.1^{+0.8+0.9}_{-0.7-0.5}$	[84]					3.9 ± 0.8
280	$f_0(980)K^{*0}$ †	$3.9^{+2.1}_{-1.8}$	$5.7 \pm 0.6 \pm 0.4$	[86]	$1.4^{+0.6+0.6}_{-0.5-0.4}$	[84]					3.9 ± 0.5
281	$K_1(1270)^+\pi^-$	< 30	17^{+6}_{-25}	[29]							17^{+6}_{-25}
282	$K_1(1400)^+\pi^-$	< 27	16^{+8}_{-24}	[29]							16^{+8}_{-24}
283	$a_1^- K^+$	16 ± 4	$16.3 \pm 2.9 \pm 2.3$	[34]							16.3 ± 3.7
284	$K^{*+}\rho^-$	10.3 ± 0.26	$10.3 \pm 2.3 \pm 1.3$	[86]							10.3 ± 2.6
285	$K_0(1430)^+\rho^-$	28 ± 12	$28 \pm 10 \pm 6$	[86]							28 ± 11
287	$K_0^*(1430)^0\rho^0$	27 ± 6	$27 \pm 4 \pm 4$	[86]							27 ± 5
288	$K_0^*(1430)^0 f_0(980)$	2.7 ± 0.9	$2.7 \pm 0.7 \pm 0.6$	[86]							2.7 ± 0.9
289	$K_2^*(1430)^0 f_0(980)$	8.6 ± 2.0	$8.6 \pm 1.7 \pm 1.0$	[86]							8.6 ± 2.0
290	K^+K^-	0.13 ± 0.05	< 0.5	[72]	$0.10 \pm 0.08 \pm 0.04$	[2]		$0.23 \pm 0.10 \pm 0.10$	$0.0780 \pm 0.0127 \pm 0.0084$	[88]	0.0803 ± 0.0147
291	$K^0\overline{K}^0$	1.21 ± 0.16	$1.08 \pm 0.28 \pm 0.11$	[1]	$1.26 \pm 0.19 \pm 0.05$	[2]					1.21 ± 0.16
292	$K^0K^-\pi^+$	7.3 ± 1.1	$6.4 \pm 1.0 \pm 0.6$	[89]	< 18	[26]			6.64 ± 0.99 [1]	[83]	6.54 ± 0.75
293	$K^{*0}\overline{K}^0$ ‡	< 1.9	< 1.9	[90]					< 0.96	[91]	< 0.96
	$K^{*\mp}K^{\pm}$								< 0.4	[92]	< 0.4
294	$K^+K^-\pi^0$	2.2 ± 0.6			$2.17 \pm 0.60 \pm 0.24$	[93]					2.17 ± 0.65
295	$K_S K_S \pi^0$	< 0.9	< 0.9	[94]							< 0.9
296	$K_S K_S \eta$	< 1.0	< 1.0	[94]							< 1.0
297	$K_S K_S \eta'$	< 2.0	< 2.0	[94]							< 2.0
298	$K^+K^-K^0$	26.3 ± 1.5	$26.5 \pm 0.9 \pm 0.8$	[15]	$28.3 \pm 3.3 \pm 4.0$	[26]			19.1 ± 1.9 [1]	[83]	24.5 ± 1.0
299	ϕK^0	7.3 ± 0.7	$7.1 \pm 0.6^{+0.4}_{-0.3}$	[15]	$9.0^{+2.2}_{-1.8} \pm 0.7$	[50]	$5.4^{+3.7}_{-2.7} \pm 0.7$				$7.3^{+0.7}_{-0.6}$
300	$f_0(980)K^0$ †	$7.0^{+3.5}_{-3.0}$	$7.0^{+2.6}_{-1.8} \pm 2.4$	[15]							$7.0^{+3.5}_{-3.0}$
301	$f_0(1500)K^0$ †	13^{+7}_{-5}	$13.3^{+5.8}_{-4.4} \pm 3.2$	[15]							$13.3^{+6.6}_{-5.4}$
302	$f_2'(1525)K^0$	$0.3^{+0.5}_{-0.4}$	$0.29^{+0.27}_{-0.18} \pm 0.36$	[15]							$0.29^{+0.45}_{-0.40}$
303	$f_0(1710)K^0$ †	4.4 ± 0.9	$4.4 \pm 0.7 \pm 0.5$	[15]							4.4 ± 0.9
304	$K^0K^+K^-$ (NR)	33 ± 10	$33 \pm 5 \pm 9$	[15]							33 ± 10
305	$K_S K_S K_S$	$6.2^{+1.2}_{-1.1}$	$6.19 \pm 0.48 \pm 0.19$	[95]	$4.2^{+1.6}_{-1.3} \pm 0.8$	[26]					6.04 ± 0.50
306	$f_0(980)K_S$ †	2.7 ± 1.8	$2.7^{+1.3}_{-1.2} \pm 1.3$ †	[95]							2.7 ± 1.8
307	$f_0(1710)K_S$ †	$0.50^{+0.050}_{-0.026}$	$0.50^{+0.46}_{-0.24} \pm 0.11$ †	[95]							$0.50^{+0.47}_{-0.26}$
308	$f_0(2010)K_S$ †	0.5 ± 0.6	$0.54^{+0.21}_{-0.20} \pm 0.52$ †	[95]							0.54 ± 0.56
309	$K_S K_S K_S (NR)$	13.3 ± 3.1	$13.3^{+2.2}_{-2.3} \pm 2.2$	[95]							$13.3^{+3.1}_{-3.2}$
310	$K_S K_S K_L$	< 16	< 16 [2]	[96]							< 16 [2]
311	$K^{*0}K^+K^-$	27.5 ± 2.6	$27.5 \pm 1.3 \pm 2.2$	[85]							27.5 ± 2.6
312	ϕK^{*0}	10.0 ± 0.5	$9.7 \pm 0.5 \pm 0.6$	[97]	$10.4 \pm 0.5 \pm 0.6$	[98]	$11.5^{+4.5+1.8}_{-3.7-1.7}$				$10.1^{+0.6}_{-0.5}$
313	$K^+\pi^-\pi^+K^-$	< 72			< 72 [3]	[99]					< 72 [3]
314	$K^{*0}\pi^+K^-$	4.5 ± 1.3	$4.6 \pm 1.1 \pm 0.8$	[85]	< 13.9 [3]	[99]					4.6 ± 1.4
315	$K^{*0}\overline{K}^{*0}$	0.8 ± 0.5	$1.28^{+0.35}_{-0.30} \pm 0.11$	[100]	$0.26^{+0.33+0.10}_{-0.29-0.08}$	[99]					0.81 ± 0.23
316	$K^+\pi^-K^+\pi^-(NR)$	< 6.0			< 6.0 [3]	[99]					< 6.0 [3]
317	$K^{*0}K^+\pi^-$	< 2.2	< 2.2	[85]	< 7.6 [3]	[99]					< 2.2
318	$K^{*0}K^{*0}$	< 0.2	< 0.41	[100]	< 0.2	[99]					< 0.2
319	$K^{*+}K^{*-}$	< 2.0	< 2.0	[101]							< 2.0
320	$K_1^*(1400)^0\phi$	< 5000	< 5000 [5]	[36]							< 5000 [5]
321	$(K\pi)_0^{*0}\phi$	4.3 ± 0.4	$4.3 \pm 0.4 \pm 0.4$	[97]	$4.3 \pm 0.4 \pm 0.4$	[98]					4.3 ± 0.4
322	$(K\pi)_0^{*0}\phi$ [4]	< 1.7	< 1.7	[102]							< 1.7
323	$K_0^*(1430)^0\pi^+K^-$	< 31.8			< 31.8 [3]	[99]					< 31.8 [3]
324	$K_0^*(1430)^0\overline{K}^{*0}$	< 3.3			< 3.3	[99]					< 3.3

Results for CDF and LHCb are relative BFs converted to absolute BFs.
CLEO upper limits that have been greatly superseded are not shown.
† In this product of BFs, all daughter BFs not shown are set to 100%. ‡ Includes two distinct decay processes: $\mathcal{B}(B^0 \to f) + \mathcal{B}(B^0 \to \bar{f})$.
[1] Obtained from a fit to the ratios of BFs measured by LHCb (Ref. [83]) and to the averages of the BFs therein, as measured by other experiments (excluding the present line).
[2] $0.75 < M(K\pi) < 1.20$ GeV/c^2. [3] $0.70 < M(K\pi) < 1.70$ GeV/c^2. [4] $1.60 < M(K\pi) < 2.15$ GeV/c^2.
[5] Result from ARGUS. Cited in the *BABAR* column to avoid adding a column to the table.

Heavy FLavor AVeraging group (HFLAV) - November 2016

B^0 Branching Fractions (decays with kaons part 3) ($\times 10^{-6}$) - UL at 90% CL

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

RPP#	Mode	PDG2014 Avg.	BABAR	Belle	CLEO	CDF	LHCb	Our Avg.
325	$K_0^*(1430)^0\overline{K}_0^*(1430)^0$	< 8.4		< 8.4 [99]				< 8.4
326	$\phi K_0^*(1430)^0$	3.9 ± 0.8	$3.9 \pm 0.5 \pm 0.6$ [97]	$4.3 \pm 0.4 \pm 0.4$ [98]				4.2 ± 0.5
327	$K_0^*(1430)^0 K^{*0}$	< 1.7		< 1.7 [99]				< 1.7
328	$K_0^*(1430)^0 K_0^*(1430)^0$	< 4.7		< 4.7 [99]				< 4.7
329	$\phi K^*(1680)^0$	< 3.5	< 3.5 [102]					< 3.5
330	$\phi K_3^*(1780)^0$	< 2.7	< 2.7 [102]					< 2.7
331	$\phi K_4^*(2045)^0$	< 15.3	< 15.3 [102]					< 15.3
332	$\rho^0 K_2^*(1430)^0$	< 1100	< 1100 ‡ [36]					< 1100 ‡
333	$\phi K_2^*(1430)^0$	6.8 ± 0.9	$7.5 \pm 0.9 \pm 0.5$ [97]	$5.5^{+0.9}_{-0.7} \pm 1.0$ [98]				6.8 ± 0.8
334	$\phi\phi K^0$ †	4.5 ± 0.9	$4.5 \pm 0.8 \pm 0.3$ [53]					4.5 ± 0.9
335	$\eta'\eta' K^0$	< 31	< 31 [54]					< 31

† $M_{\phi\phi} < 2.85$ GeV/c^2.

‡ Result from ARGUS. Cited in the *BABAR* column to avoid adding a column to the table.

Heavy FLavor AVeraging group (HFLAV) - November 2016

B^0 Branching Fractions (decays without kaons) ($\times 10^{-6}$) - UL at 90% CL

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

RPP#	Mode	PDG2014 Avg.	BABAR		Belle		CLEO		CDF	LHCb		Our Avg.
356	$\pi^+\pi^-$	5.15 ± 0.19	$5.5 \pm 0.4 \pm 0.3$	[72]	$5.04 \pm 0.21 \pm 0.18$	[2]	$4.5^{+1.4+0.5}_{-1.2-0.4}$	[3]	$5.02 \pm 0.33 \pm 0.35$ ‡ [103]	$5.08 \pm 0.17 \pm 0.37$	[104]	5.10 ± 0.19
357	$\pi^0\pi^0$	1.91 ± 0.22	$1.83 \pm 0.21 \pm 0.13$	[73]	$2.3^{+0.4+0.2}_{-0.5-0.3}$	[105]						$1.91^{+0.22}_{-0.23}$
358	$\eta\pi^0$	< 1.5	< 1.5	[65]	$4.1^{+1.7+0.5}_{-1.5-0.7}$	[106]	< 2.9	[10]				$4.1^{+1.8}_{-1.7}$
359	$\eta\eta$	< 1.0	< 1.0	[5]	$0.76^{+0.27+0.14}_{-0.23-0.16}$	[107]						$0.76^{+0.30}_{-0.28}$
360	$\eta'\pi^0$	1.2 ± 0.6	$0.9 \pm 0.4 \pm 0.1$	[65]	$2.8 \pm 1.0 \pm 0.3$	[6]	$0.0^{+1.8}_{-0.0}$	[10]				1.2 ± 0.4
361	$\eta'\eta'$	< 1.7	< 1.7	[5]	< 6.5	[8]						< 1.7
362	$\eta'\eta$	< 1.2	< 1.2	[65]	< 4.5	[8]						< 1.2
363	$\eta'\rho^0$	< 1.3	< 2.8	[7]	< 1.3	[8]						< 1.3
364	$f_0(980)\eta'$ †	< 0.9	< 0.9	[7]								< 0.9
365	$\eta\rho^0$	< 1.5	< 1.5	[75]	< 1.9	[12]						< 1.5
366	$f_0(980)\eta$ †	< 0.4	< 0.4	[75]								< 0.4
367	$\omega\eta$	$0.94^{+0.40}_{-0.31}$	$0.94^{+0.35}_{-0.30} \pm 0.09$	[5]								$0.94^{+0.36}_{-0.31}$
368	$\omega\eta'$	$1.0^{+0.5}_{-0.4}$	$1.01^{+0.46}_{-0.38} \pm 0.09$	[5]	< 2.2	[8]						$1.01^{+0.47}_{-0.39}$
369	$\omega\rho^0$	< 1.6	< 1.6	[19]								< 1.6
370	$f_0(980)\omega$ †	< 1.5	< 1.5	[19]								< 1.5
371	$\omega\omega$	1.2 ± 0.4	$1.2 \pm 0.3^{+0.3}_{-0.2}$	[108]								1.2 ± 0.4
372	$\phi\pi^0$	< 0.15	< 0.28	[66]	< 0.15	[67]						< 0.15
373	$\phi\eta$	< 0.5	< 0.5	[5]								< 0.5
374	$\phi\eta'$	< 0.5	< 1.1	[5]	< 0.5	[8]						< 0.5
375	$\phi\rho^0$	< 0.33	< 0.33	[69]								< 0.33
376	$f_0(980)\phi$ †	< 0.38	< 0.38	[69]								< 0.38
377	$\omega\phi$	< 0.7	< 0.7	[108]								< 0.7
378	$\phi\phi$	< 0.2	< 0.2	[69]						< 0.028	[109]	< 0.028
379	$a_0^{\mp}(980)\pi^{\pm}$ †	< 3.1	< 3.1	[75]								< 3.1
379	$a_0^{\mp}(1450)\pi^{\pm}$	< 2.3	< 2.3	[75]								< 2.3
380	$a_0^{\mp}(1450)\pi^{\pm}$ †	< 2.3	< 2.3	[75]								< 2.3
382	$\rho^0\pi^0$	2.0 ± 0.5	$1.4 \pm 0.6 \pm 0.3$	[110]	$3.0 \pm 0.5 \pm 0.7$	[111]	$1.6^{+2.0}_{-1.4} \pm 0.8$	[18]				2.0 ± 0.5
383	$\rho^{\mp}\pi^{\pm}$	23.0 ± 2.3	$22.6 \pm 1.8 \pm 2.2$	[112]	$22.6 \pm 1.1 \pm 4.4$	[111]	$27.6^{+8.4}_{-7.4} \pm 4.2$	[18]				23.0 ± 2.3
384	$\pi^+\pi^-\pi^+\pi^-$	< 19.3	< 23.1	[113]	< 11.2	[114]						< 11.2
385	$\rho^0\pi^+\pi^-(NR)$	< 8.8	< 8.8	[113]	< 12	[114]						< 8.8
386	$\rho^0\rho^0$	0.73 ± 0.28	$0.92 \pm 0.32 \pm 0.14$	[113]	$1.02 \pm 0.30 \pm 0.15$	[114]				$0.94 \pm 0.17 \pm 0.11$ ‡	[115]	0.95 ± 0.16
387	$f_0(980)\pi^+\pi^-(NR)$ †	< 3.8			< 3.0	[114]						< 3.0
388	$f_0(980)\rho^0$ †	< 0.3	< 0.40	[113]	$0.78 \pm 0.22 \pm 0.11$	[114]						0.78 ± 0.25
389	$f_0(980)f_0(980)$ †	< 0.1	< 0.19	[113]	< 0.2	[114]						< 0.19
391	$a_1^{\mp}\pi^{\pm}$	26 ± 5	$33.2 \pm 3.8 \pm 3.0$	[116]	$22.2 \pm 2.0 \pm 2.8$	[117]						25.9 ± 2.8
392	$a_2^{\mp}\pi^{\pm}$	< 6.3			< 6.3	[117]						< 6.3
393	$\pi^+\pi^-\pi^0\pi^0$	< 3100	< 3100 ¶	[58]								< 3100 ¶
394	$\rho^+\rho^-$	24.2 ± 3.1	$25.5 \pm 2.1^{+3.6}_{-3.9}$	[118]	$22.8 \pm 3.8^{+2.3}_{-2.6}$	[119]						$24.2^{+3.1}_{-3.2}$
395	$a_1(1260)^0\pi^0$	< 1100	< 1100 ¶	[58]								< 1100 ¶
396	$\omega\pi^0$	< 0.5	< 0.5	[65]	< 2.0	[64]						< 0.5
397	$\pi + \pi^+\pi^-\pi^-\pi^0$	< 9000	< 9000 ¶	[58]								< 9000 ¶
398	$a_1^{\pm}\rho^{\mp}$	< 61	< 61	[120]								< 61
399	$a_1^{\pm}\rho^0$	< 600	< 6000 ¶	[58]								< 6000 ¶
400	$b_1^{\mp}\pi^{\pm}$ †	10.9 ± 1.5	$10.9 \pm 1.2 \pm 0.9$	[37]								10.9 ± 1.5
401	$b_1^0\pi^0$ †	< 1.9	< 1.9	[35]								< 1.9
402	$b_1^{\pm}\rho^{\mp}$ †	< 1.4	< 1.4	[38]								< 1.4
403	$b_1^0\rho^0$ †	< 3.4	< 3.4	[38]								< 3.4
404	$\pi^+\pi^+\pi^+\pi^-\pi^-\pi^-$	< 3000	< 3000 ¶	[58]								< 3000 ¶
405	$a_1^{\pm}a_1^{\mp}$	11.8 ± 2.6	11.8 ± 2.6	[121]								11.8 ± 2.6
406	$\pi + \pi^+\pi^+\pi^-\pi^-\pi^-\pi^0$	< 11000	< 11000 ¶	[58]								< 11000 ¶
	$\phi\pi^+\pi^-$									$0.182 \pm 0.048 \pm 0.014$ §	[122]	0.182 ± 0.050

Results for CDF and LHCb are relative BFs converted to absolute BFs.
CLEO upper limits that have been greatly superseded are not shown.
† In this product of BFs, all daughter BFs not shown are set to 100%.
‡ Result given as $0.94 \pm 0.17 \pm 0.09 \pm 0.06$ where last error is from $\mathcal{B}(B^0 \to \phi K^{*0})$.
§ In the mass range $400 < m(\pi^+\pi^-) < 1600$ GeV/c^2.
¶ Result from ARGUS. Cited in the *BABAR* column to avoid adding a column to the table.

Heavy FLavor AVeraging group (HFLAV) - November 2016

Compilation of B^0 relative Branching Fractions - UL at 90% CL

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

RPP#	Mode	PDG2014 Avg.	CDF	LHCb	Our Avg.
273	$\mathcal{B}(B^0 \to K^+K^-)/\mathcal{B}(B^0 \to K^+\pi^-)$		$0.012 \pm 0.005 \pm 0.005$ [87]	$0.00398 \pm 0.00065 \pm 0.00042$ [88]	0.00416 ± 0.00099
356	$\mathcal{B}(B^0 \to \pi^+\pi^-)/\mathcal{B}(B^0 \to K^+\pi^-)$	0.261 ± 0.010	$0.259 \pm 0.017 \pm 0.016$[103]	$0.262 \pm 0.009 \pm 0.017$ [104]	0.261 ± 0.015
	$\mathcal{B}(B^0 \to K^{*\mp}K^{\pm})/\mathcal{B}(B^0 \to K^{*+}\pi^-)$			< 0.05 [92]	< 0.05
	$\mathcal{B}(B^0 \to K^0_S K^{*0})/\mathcal{B}(B^0 \to K^0_S\pi^+\pi^-)$ †			< 0.020 [91]	< 0.020

† Numerator includes two distinct decay processes: $\mathcal{B}(B^0 \to f) + \mathcal{B}(B^0 \to \bar{f})$.

References

[1] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. Lett. **97**, 171805, (2006), `arXiv:hep-ex/0608036 [hep-ex]`.

[2] Y. T. Duh *et al.*, (Belle collaboration), Phys. Rev. **D87**, 031103, (2013), `arXiv:1210.1348 [hep-ex]`.

[3] A. Bornheim *et al.*, (CLEO collaboration), Phys. Rev. **D68**, 052002, (2003), `arXiv:hep-ex/0302026 [hep-ex]`, Erratum ibid. **D75**, 119907, (2007).

[4] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. **D76**, 091102, (2007), `arXiv:0707.2798 [hep-ex]`.

[5] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. **D80**, 112002, (2009), `arXiv:0907.1743 [hep-ex]`.

[6] J. Schumann *et al.*, (Belle collaboration), Phys. Rev. Lett. **97**, 061802, (2006), `arXiv:hep-ex/0603001 [hep-ex]`.

[7] P. del Amo Sanchez *et al.*, (*BABAR* collaboration), Phys. Rev. **D82**, 011502, (2010), `arXiv:1004.0240 [hep-ex]`.

[8] J. Schumann *et al.*, (Belle collaboration), Phys. Rev. **D75**, 092002, (2007), `arXiv:hep-ex/0701046 [hep-ex]`.

[9] C. T. Hoi *et al.*, (Belle collaboration), Phys. Rev. Lett. **108**, 031801, (2012), `arXiv:1110.2000 [hep-ex]`.

[10] S. J. Richichi *et al.*, (CLEO collaboration), Phys. Rev. Lett. **85**, 520, (2000), `arXiv:hep-ex/9912059 [hep-ex]`.

[11] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. Lett. **97**, 201802, (2006), `arXiv:hep-ex/0608005 [hep-ex]`.

[12] C. H. Wang *et al.*, (Belle collaboration), Phys. Rev. **D75**, 092005, (2007), `arXiv:hep-ex/0701057 [hep-ex]`.

[13] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. Lett. **101**, 091801, (2008), `arXiv:0804.0411 [hep-ex]`.

[14] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. **D78**, 012004, (2008), `arXiv:0803.4451 [hep-ex]`.

[15] J. P. Lees *et al.*, (*BABAR* collaboration), Phys. Rev. **D85**, 112010, (2012), `arXiv:1201.5897 [hep-ex]`.

[16] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. **D76**, 031103, (2007), `arXiv:0706.3893 [hep-ex]`.

[17] V. Chobanova *et al.*, (Belle collaboration), Phys. Rev. **D90**, 012002, (2014), `arXiv:1311.6666 [hep-ex]`.

[18] C. P. Jessop *et al.*, (CLEO collaboration), Phys. Rev. Lett. **85**, 2881, (2000), `arXiv:hep-ex/0006008 [hep-ex]`.

[19] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. **D79**, 052005, (2009), `arXiv:0901.3703 [hep-ex]`.

[20] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. **D70**, 111102, (2004), `arXiv:hep-ex/0407013 [hep-ex]`.

[21] A. Garmash *et al.*, (Belle collaboration), Phys. Rev. Lett. **96**, 251803, (2006), `arXiv:hep-ex/0512066 [hep-ex]`.

[22] J. P. Lees *et al.*, (*BABAR* collaboration), Phys. Rev. **D84**, 092007, (2011), `arXiv:1109.0143 [hep-ex]`.

[23] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. **D72**, 072003, (2005), `arXiv:hep-ex/0507004 [hep-ex]`, Erratum ibid. **D74**, 099903, (2006).

[24] A. Garmash *et al.*, (Belle collaboration), Phys. Rev. **D71**, 092003, (2005), `arXiv:hep-ex/0412066 [hep-ex]`.

[25] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. **D78**, 091102, (2008), `arXiv:0808.0900 [hep-ex]`.

[26] A. Garmash *et al.*, (Belle collaboration), Phys. Rev. **D69**, 012001, (2004), `arXiv:hep-ex/0307082 [hep-ex]`.

[27] R. Aaij *et al.*, (LHCb collaboration), Phys. Lett. **B765**, 307, (2017), `arXiv:1608.01478 [hep-ex]`.

[28] T. Bergfeld *et al.*, (CLEO collaboration), Phys. Rev. Lett. **77**, 4503, (1996).

[29] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. **D81**, 052009, (2010), `arXiv:0909.2171 [hep-ex]`.

[30] E. Eckhart *et al.*, (CLEO collaboration), Phys. Rev. Lett. **89**, 251801, (2002), `arXiv:hep-ex/0206024 [hep-ex]`.

[31] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. **D76**, 011103, (2007), `arXiv:hep-ex/0702043 [hep-ex]`.

[32] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. **D74**, 051104, (2006), `arXiv:hep-ex/0607113 [hep-ex]`.

[33] P. del Amo Sanchez *et al.*, (*BABAR* collaboration), Phys. Rev. **D83**, 051101, (2011), `arXiv:1012.4044 [hep-ex]`.

[34] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. Lett. **100**, 051803, (2008), `arXiv:0709.4165 [hep-ex]`.

[35] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. **D78**, 011104, (2008), arXiv:0805.1217 [hep-ex].

[36] H. Albrecht *et al.*, (ARGUS collaboration), Phys. Lett. **B254**, 288, (1991).

[37] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. Lett. **99**, 241803, (2007), arXiv:0707.4561 [hep-ex].

[38] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. **D80**, 051101, (2009), arXiv:0907.3485 [hep-ex].

[39] R. Aaij *et al.*, (LHCb collaboration), Phys. Lett. **B726**, 646, (2013), arXiv:1308.1277 [hep-ex].

[40] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. **D79**, 051101, (2009), arXiv:0811.1979 [hep-ex].

[41] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. Lett. **99**, 221801, (2007), arXiv:0708.0376 [hep-ex].

[42] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. **D76**, 071103, (2007), arXiv:0706.1059 [hep-ex].

[43] H. C. Huang *et al.*, (Belle collaboration), Phys. Rev. Lett. **91**, 241802, (2003), arXiv:hep-ex/0305068 [hep-ex].

[44] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. **D79**, 051102, (2009), arXiv:0901.1223 [hep-ex].

[45] Y. M. Goh *et al.*, (Belle collaboration), Phys. Rev. **D91**, 071101, (2015), arXiv:1502.00381 [hep-ex].

[46] R. A. Briere *et al.*, (CLEO collaboration), Phys. Rev. Lett. **86**, 3718, (2001), arXiv:hep-ex/0101032 [hep-ex].

[47] D. Acosta *et al.*, (CDF collaboration), Phys. Rev. Lett. **95**, 031801, (2005), arXiv:hep-ex/0502044 [hep-ex].

[48] A. Abulencia *et al.*, (CDF collaboration), Phys. Rev. **D73**, 032003, (2006), arXiv:hep-ex/0510048 [hep-ex].

[49] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. Lett. **99**, 201802, (2007), arXiv:0705.1798 [hep-ex].

[50] K. F. Chen *et al.*, (Belle collaboration), Phys. Rev. Lett. **91**, 201801, (2003), arXiv:hep-ex/0307014 [hep-ex].

[51] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. Lett. **101**, 161801, (2008), arXiv:0806.4419 [hep-ex].

[52] P. del Amo Sanchez *et al.*, (*BABAR* collaboration), Phys. Rev. **D82**, 091101, (2010), arXiv:1007.2732 [hep-ex].

[53] J. P. Lees *et al.*, (*BABAR* collaboration), Phys. Rev. **D84**, 012001, (2011), arXiv:1105.5159 [hep-ex].

[54] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. **D74**, 031105, (2006), arXiv:hep-ex/0605008 [hep-ex].

[55] C. Liu *et al.*, (Belle collaboration), Phys. Rev. **D79**, 071102, (2009), arXiv:0902.4757 [hep-ex].

[56] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. **D79**, 072006, (2009), arXiv:0902.2051 [hep-ex].

[57] A. Gordon *et al.*, (Belle collaboration), Phys. Lett. **B542**, 183, (2002), arXiv:hep-ex/0207007 [hep-ex].

[58] H. Albrecht *et al.*, (ARGUS collaboration), Phys. Lett. **B241**, 278, (1990).

[59] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. **D75**, 091103, (2007), arXiv:hep-ex/0701035 [hep-ex].

[60] J. Zhang *et al.*, (Belle collaboration), Phys. Rev. Lett. **94**, 031801, (2005), arXiv:hep-ex/0406006 [hep-ex].

[61] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. Lett. **102**, 141802, (2009), arXiv:0901.3522 [hep-ex].

[62] J. Zhang *et al.*, (Belle collaboration), Phys. Rev. Lett. **91**, 221801, (2003), arXiv:hep-ex/0306007 [hep-ex].

[63] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. Lett. **99**, 261801, (2007), arXiv:0708.0050 [hep-ex].

[64] C. M. Jen *et al.*, (Belle collaboration), Phys. Rev. **D74**, 111101, (2006), arXiv:hep-ex/0609022 [hep-ex].

[65] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. **D78**, 011107, (2008), arXiv:0804.2422 [hep-ex].

[66] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. **D74**, 011102, (2006), arXiv:hep-ex/0605037 [hep-ex].

[67] J. H. Kim *et al.*, (Belle collaboration), Phys. Rev. **D86**, 031101, (2012), arXiv:1206.4760 [hep-ex].

[68] R. Aaij *et al.*, (LHCb collaboration), Phys. Lett. **B728**, 85, (2014), arXiv:1309.3742 [hep-ex].

[69] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. Lett. **101**, 201801, (2008), arXiv:0807.3935 [hep-ex].

[70] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. **D77**, 011101, (2008), arXiv:0708.0963 [hep-ex].

[71] D. Bortoletto *et al.*, (CLEO collaboration), Phys. Rev. Lett. **62**, 2436, (1989).

[72] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. **D75**, 012008, (2007), arXiv:hep-ex/0608003 [hep-ex].

[73] J. P. Lees *et al.*, (*BABAR* collaboration), Phys. Rev. **D87**, 052009, (2013), arXiv:1206.3525 [hep-ex].

[74] S. Sato *et al.*, (Belle collaboration), Phys. Rev. **D90**, 072009, (2014), arXiv:1408.6343 [hep-ex].

[75] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. **D75**, 111102, (2007), arXiv:hep-ex/0703038 [hep-ex].

[76] R. Ammar *et al.*, (CLEO collaboration), Phys. Rev. Lett. **87**, 271801, (2001), arXiv:hep-ex/0106038 [hep-ex].

[77] P. Goldenzweig *et al.*, (Belle collaboration), Phys. Rev. Lett. **101**, 231801, (2008), arXiv:0807.4271 [hep-ex].

[78] J. P. Lees *et al.*, (*BABAR* collaboration), Phys. Rev. **D83**, 112010, (2011), arXiv:1105.0125 [hep-ex].

[79] P. Chang *et al.*, (Belle collaboration), Phys. Lett. **B599**, 148, (2004), arXiv:hep-ex/0406075 [hep-ex].

[80] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. **D78**, 052005, (2008), arXiv:0711.4417 [hep-ex].

[81] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. **D80**, 112001, (2009), arXiv:0905.3615 [hep-ex].

[82] A. Garmash *et al.*, (Belle collaboration), Phys. Rev. **D75**, 012006, (2007), arXiv:hep-ex/0610081 [hep-ex].

[83] R. Aaij *et al.*, (LHCb collaboration), JHEP **10**, 143, (2013), arXiv:1307.7648 [hep-ex].

[84] S. H. Kyeong *et al.*, (Belle collaboration), Phys. Rev. **D80**, 051103, (2009), arXiv:0905.0763 [hep-ex].

[85] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. **D76**, 071104, (2007), arXiv:0708.2543 [hep-ex].

[86] J. P. Lees *et al.*, (*BABAR* collaboration), Phys. Rev. **D85**, 072005, (2012), arXiv:1112.3896 [hep-ex].

[87] T. Aaltonen *et al.*, (CDF collaboration), Phys. Rev. Lett. **108**, 211803, (2012), arXiv:1111.0485 [hep-ex].

[88] R. Aaij *et al.*, (LHCb collaboration), Phys. Rev. Lett. **118**, 081801, (2017), arXiv:1610.08288 [hep-ex].

[89] P. del Amo Sanchez *et al.*, (*BABAR* collaboration), Phys. Rev. **D82**, 031101, (2010), arXiv:1003.0640 [hep-ex].

[90] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. **D74**, 072008, (2006), arXiv:hep-ex/0606050 [hep-ex].

[91] R. Aaij *et al.*, (LHCb collaboration), JHEP **01**, 012, (2016), arXiv:1506.08634 [hep-ex].

[92] R. Aaij *et al.*, (LHCb collaboration), New J. Phys. **16**, 123001, (2014), arXiv:1407.7704 [hep-ex].

[93] V. Gaur *et al.*, (Belle collaboration), Phys. Rev. **D87**, 091101, (2013), arXiv:1304.5312 [hep-ex].

[94] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. **D80**, 011101, (2009), arXiv:0905.0868 [hep-ex].

[95] J. P. Lees *et al.*, (*BABAR* collaboration), Phys. Rev. **D85**, 054023, (2012), arXiv:1111.3636 [hep-ex].

[96] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. **D74**, 032005, (2006), arXiv:hep-ex/0606031 [hep-ex].

[97] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. **D78**, 092008, (2008), arXiv:0808.3586 [hep-ex].

[98] M. Prim *et al.*, (Belle collaboration), Phys. Rev. **D88**, 072004, (2013), arXiv:1308.1830 [hep-ex].

[99] C. C. Chiang *et al.*, (Belle collaboration), Phys. Rev. **D81**, 071101, (2010), arXiv:1001.4595 [hep-ex].

[100] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. Lett. **100**, 081801, (2008), arXiv:0708.2248 [hep-ex].

[101] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. **D78**, 051103, (2008), arXiv:0806.4467 [hep-ex].

[102] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. **D76**, 051103, (2007), arXiv:0705.0398 [hep-ex].

[103] T. Aaltonen *et al.*, (CDF collaboration), Phys. Rev. Lett. **106**, 181802, (2011), arXiv:1103.5762 [hep-ex].

[104] R. Aaij *et al.*, (LHCb collaboration), JHEP **10**, 037, (2012), arXiv:1206.2794 [hep-ex].

[105] K. Abe *et al.*, (Belle collaboration), Phys. Rev. Lett. **94**, 181803, (2005), arXiv:hep-ex/0408101 [hep-ex].

[106] B. Pal *et al.*, (Belle collaboration), Phys. Rev. **D92**, 011101, (2015), arXiv:1504.00957 [hep-ex].

[107] A. Abdesselam *et al.*, (Belle collaboration), arXiv:1609.03267 [hep-ex], (2016).

[108] J. P. Lees *et al.*, (*BABAR* collaboration), Phys. Rev. **D89**, 051101, (2014), arXiv:1312.0056 [hep-ex].

[109] R. Aaij *et al.*, (LHCb collaboration), JHEP **10**, 053, (2015), arXiv:1508.00788 [hep-ex].

[110] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. Lett. **93**, 051802, (2004), arXiv:hep-ex/0311049 [hep-ex].

[111] A. Kusaka *et al.*, (Belle collaboration), Phys. Rev. **D77**, 072001, (2008), arXiv:0710.4974 [hep-ex].

[112] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. Lett. **91**, 201802, (2003), arXiv:hep-ex/0306030 [hep-ex].

[113] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. **D78**, 071104, (2008), arXiv:0807.4977 [hep-ex].

[114] I. Adachi *et al.*, (Belle collaboration), Phys. Rev. **D89**, 072008, (2014), arXiv:1212.4015 [hep-ex], Addendum ibid. **D89**, 119903, (2014).

[115] R. Aaij *et al.*, (LHCb collaboration), Phys. Lett. **B747**, 468, (2015), arXiv:1503.07770 [hep-ex].

[116] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. Lett. **97**, 051802, (2006), arXiv:hep-ex/0603050 [hep-ex].

[117] J. Dalseno *et al.*, (Belle collaboration), Phys. Rev. **D86**, 092012, (2012), arXiv:1205.5957 [hep-ex].

[118] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. **D76**, 052007, (2007), arXiv:0705.2157 [hep-ex].

[119] A. Somov *et al.*, (Belle collaboration), Phys. Rev. Lett. **96**, 171801, (2006), arXiv:hep-ex/0601024 [hep-ex].

[120] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. **D74**, 031104, (2006), arXiv:hep-ex/0605024 [hep-ex].

[121] B. Aubert *et al.*, (*BABAR* collaboration), Phys. Rev. **D80**, 092007, (2009), arXiv:0907.1776 [hep-ex].

[122] R. Aaij *et al.*, (LHCb collaboration), Phys. Rev. **D95**, 012006, (2017), arXiv:1610.05187 [hep-ex].