Average Hadron Multiplicities in Hadronic e^+e^- Annihilation Events

Table 36.1: Average hadronic multiplicities per hadronic e^+e^- annihilation event at $\sqrt{s} \approx 10$, 29–35, and 91 GeV. The rates given include decay products from resonances with $c\tau < 10$ cm, and include charge conjugated states. (Updated September 1997 by O. Biebel.)

Particle	$\sqrt{s} \approx 10$ GeV		$\sqrt{s} = 29$–35 GeV		$\sqrt{s} = 91$ GeV	
Pseudoscalar mesons:						
π^+	6.6	$\pm$ 0.2	10.3	$\pm$ 0.4	17.1	$\pm$ 0.4
π^0	3.2	$\pm$ 0.3	5.83	$\pm$ 0.28	9.42	$\pm$ 0.56
K^+	0.90	$\pm$ 0.04	1.48	$\pm$ 0.09	2.39	$\pm$ 0.12
K^0	0.91	$\pm$ 0.05	1.48	$\pm$ 0.07	2.013	$\pm$ 0.033
η	0.20	$\pm$ 0.04	0.61	$\pm$ 0.07	0.97	$\pm$ 0.10
$\eta'(958)$	0.03	$\pm$ 0.01	0.26	$\pm$ 0.10	0.222	$\pm$ 0.040
D^+	0.16	$\pm$ 0.03	0.17	$\pm$ 0.03	0.175	$\pm$ 0.016
D^0	0.37	$\pm$ 0.06	0.45	$\pm$ 0.07	0.454	$\pm$ 0.030
D_s^+	0.13	$\pm$ 0.02	0.45	$\pm$ 0.20$^{(a)}$	0.131	$\pm$ 0.021
B^+, B_d^0		—		—	0.165	$\pm$ 0.026$^{(b)}$
B_s^0		—		—	0.057	$\pm$ 0.013$^{(b)}$
Scalar mesons:						
$f_0(980)$	0.024	$\pm$ 0.006	0.05	$\pm$ 0.02$^{(c)}$	0.14	$\pm$ 0.06$^{(d)}$
Vector mesons:						
$\rho(770)^0$	0.35	$\pm$ 0.04	0.81	$\pm$ 0.08	1.28	$\pm$ 0.14
$\omega(782)$	0.30	$\pm$ 0.08		—	1.10	$\pm$ 0.13
$K^*(892)^+$	0.27	$\pm$ 0.03	0.64	$\pm$ 0.05	0.715	$\pm$ 0.059
$K^*(892)^0$	0.29	$\pm$ 0.03	0.56	$\pm$ 0.06	0.747	$\pm$ 0.028
$\phi(1020)$	0.044	$\pm$ 0.003	0.085	$\pm$ 0.011	0.109	$\pm$ 0.007
$D^*(2010)^+$	0.22	$\pm$ 0.04	0.43	$\pm$ 0.07	0.183	$\pm$ 0.010
$D^*(2007)^0$	0.23	$\pm$ 0.06	0.27	$\pm$ 0.11		—
B^* $^{(e)}$		—		—	0.288	$\pm$ 0.026
$J/\psi(1S)$		—		—	0.0053	$\pm$ 0.0004$^{(f)}$
$\psi(2S)$		—		—	0.0023	$\pm$ 0.0004$^{(f)}$
$\Upsilon(1S)$		—		—	0.00014	$\pm$ 0.00007$^{(f)}$
Pseudovector mesons:						
$\chi_{c1}(1P)$		—		—	0.0041	$\pm$ 0.0011$^{(f)}$
Tensor mesons:						
$f_2(1270)$	0.09	$\pm$ 0.02	0.14	$\pm$ 0.04	0.31	$\pm$ 0.12
$f_2'(1525)$		—		—	0.020	$\pm$ 0.008
$K_2^*(1430)^+$		—	0.09	$\pm$ 0.03		—
$K_2^*(1430)^0$		—	0.12	$\pm$ 0.06	0.19	$\pm$ 0.07$^{(g)}$
B^{**} $^{(h)}$		—		—	0.118	$\pm$ 0.024
Baryons:						
p	0.253	$\pm$ 0.016	0.640	$\pm$ 0.050	0.964	$\pm$ 0.102
Λ	0.080	$\pm$ 0.007	0.205	$\pm$ 0.010	0.372	$\pm$ 0.009
Σ^0	0.023	$\pm$ 0.008		—	0.070	$\pm$ 0.012
Σ^-		—		—	0.071	$\pm$ 0.018
Σ^+		—		—	0.099	$\pm$ 0.015
$\Sigma^\pm$		—		—	0.174	$\pm$ 0.009
Ξ^-	0.0059	$\pm$ 0.0007	0.0176	$\pm$ 0.0027	0.0258	$\pm$ 0.0010
$\Delta(1232)^{++}$	0.040	$\pm$ 0.010		—	0.085	$\pm$ 0.014
$\Sigma(1385)^-$	0.006	$\pm$ 0.002	0.017	$\pm$ 0.004	0.0240	$\pm$ 0.0017
$\Sigma(1385)^+$	0.005	$\pm$ 0.001	0.017	$\pm$ 0.004	0.0239	$\pm$ 0.0015
$\Sigma(1385)^\pm$	0.0106	$\pm$ 0.0020	0.033	$\pm$ 0.008	0.0462	$\pm$ 0.0028
$\Xi(1530)^0$	0.0015	$\pm$ 0.0006		—	0.0055	$\pm$ 0.0005
Ω^-	0.0007	$\pm$ 0.0004	0.014	$\pm$ 0.007	0.0016	$\pm$ 0.0003
Λ_c^+	0.100	$\pm$ 0.030$^{(i)}$	0.110	$\pm$ 0.050	0.078	$\pm$ 0.017
Λ_b^0		—		—	0.031	$\pm$ 0.016
$\Sigma_c^{++}, \Sigma_c^0$	0.014	$\pm$ 0.007		—		—
$\Lambda(1520)$	0.008	$\pm$ 0.002		—		—

All average multiplicites are per hadronic e^+e^- annihilation event.

(a) B($D_s \to \eta\pi,\ \eta'\pi$) has been used (RPP 1994).
(b) The Standard Model B($Z \to b\bar{b}$) = 0.217 was used.
(c) $x_p = p/p_{\text{beam}} > 0.1$ only.
(d) Extrapolation to the unobserved region using the shape predicted by JETSET.
(e) Any charge state (*i.e.*, B_d^*, B_u^*, or B_s^*).
(f) B($Z \to$ hadrons) = 0.699 has been used (RPP 1994).
(g) $x_E = E[K_2^*(1430)^0]/E_{\text{beam}} < 0.3$ only.
(h) Any charge state (*i.e.*, B_d^{**}, B_u^{**}, or B_s^{**}).
(i) The value was taken from the cross section of the $\Lambda_c^+ \to p\pi K$, assuming the branching fraction to be (3.2 ± 0.7)% (RPP 1992).

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