9. HIGH-ENERGY COLLIDER PARAMETERS: e^+e^- Colliders (I)

The numbers here were received from representatives of the colliders in 1993 or early 1994. Quantities are, where appropriate, r.m.s. H and V indicate horizontal and vertical directions. Many of the numbers of course change over the lifetime of a collider; only the latest values are given here.

	SPEAR (SLAC)	DORIS (DESY)	CESR [CESR+ (phase2)] (Cornell)	PETRA (DESY)	PEP (SLAC)
Physics start date	1972	1973	1979 [1995]	1978	1980
Physics end date	1990	—	—	1986	1990
Maximum beam energy (GeV)	4	5.6	6	23.4	15
Luminosity (10^{30}cm^{-2}s^{-1})	10 at 3 GeV	33 at 5.3 GeV	290 at 5.3 GeV [600 in 1995]	24 at 17.5 GeV	60
Time between collisions (μs)	0.75	0.965	0.36 [0.028 in 1995]	3.8	2.44
Crossing half angle (μ rad)	0	0	0 [2500 in 1995]	0	0
Energy spread (units 10^{-3})	1	1.2 at 5 GeV	0.6 at 5.3 GeV	1.1 at 17.5 GeV	1
Bunch length (cm)	$\sigma_z \approx 4$	$\sigma \sim 2$ at 5 GeV	1.7	$\sigma \sim 1.3$ at 17.5 GeV	$\sigma_z = 2$
Beam radius (10^{-6} m)	H: 700 V: 50	H: 740 V: ~ 30 } at 5 GeV	H: 500 V: 11	H: 430 V: 13 } at 17.5 GeV	H: 340 V: 14
Free space at interaction point (m)	±2.5	±1.2	±2.2 (±0.6 to REC quads)	±4.5	±3.7
Luminosity lifetime (hr)	≈ 3	1.0–1.5	3–4	4 at 17.5 GeV	4
Filling time (min)	15	≈ 15	10	20	15
Acceleration period (s)	≤ 100	—	—	—	≤ 100
Injection energy (GeV)	2.5	up to 5.6	6	7	15
Transverse emittance ($10^{-9}\pi$ rad-m)	$H \approx 430$	H: 500 V: 5–50 } at 5 GeV	H: 240 V: 8	H: 140 V: 2	$H \approx 120$
β^*, amplitude function at interaction point (m)	H: 1.2 V: 0.08	H: 0.59/12.3 V: 0.04/0.79	H: 1.0 V: 0.018	H: 1.3 V: 0.08	H: 1.0 V: 0.05
Beam-beam tune shift per crossing (units 10^{-4})	300	≤ 280 (space charge limit at 5.3 GeV)	420 [300 in 1995]	H: 160 V: 400 } at 17.5 GeV	550
RF frequency (MHz)	358	500	500	500	352
Particles per bunch (units 10^{10})	15	27	24 [17 in 1995]	26	35
Bunches per ring per species	1	1	7 [27 in 1995]	2	3
Average beam current per species (mA)	30	45 at 5.3 GeV	110 [300 in 1995]	11 at 17.5 GeV	21
Circumference (km)	0.234	0.2892	0.768	2.304	2.2
Interaction regions	2	2	1	4	1
Utility insertions	18	10	2	4	5
Magnetic length of dipole (m)	2.35	3.2/1.1	1.6–6.6	5.38	5.4
Length of standard cell (m)	11.4	13.2	16	14.4	14.35
Phase advance per cell (deg)	H: 79 V: 90	H: 140 V: 50	45–90 (no standard cell)	H: 47 V: 40	H: 56 V: 33
Dipoles in ring	36	H: 28 V: 6	86	224	192
Quadrupoles in ring	46	68	106	360	248
Peak magnetic field (T)	1.1	1.5	0.3 normal 0.8 high field } at 8 GeV	0.4 at 23 GeV	0.36