



**Figure ES.2:** Approximate brightness and flux envelopes for PEP-X and other present and future light sources. Partial lasing in a 50 to 100-m ID may be possible at energies <360 eV, increasing brightness by one or two orders of magnitude. The envelope for the futuristic Cornell ERL [6], presently an experimental R&D project, assumes a 25-m ID operating in either high-flux mode (100 mA) or high-coherence mode (25 mA); its spectrum extends to energies higher than shown. PEP-X brightness may be enhanced by a factor of ~2 with optimized lattice parameters at ID straight sections and using high-performance IDs.

Parameters	SPEAR3 Operational Value	PEP-X Operational Value
Beam energy	3 GeV	4.5 GeV
Injection energy	3 GeV	4.5 GeV
Current	100-500 mA	1.5 A
Fill pattern	280 bunches, 93-bunch gap, camshaft bunch in gap (6-bunch timing mode @ 100 mA available)	3300 bunches, 192-bunch gap other patterns available
Circumference	234.144 m	2199.32 m
Radio frequency	476.315 MHz	476.00 MHz
Bunch spacing	2.1 ns	2.1 ns
Horizontal emittance	9.8 nm-rad	0.094 / 0.14 nm-rad (@ 0A/1.5 A ( $\epsilon_y = 8$ pm-rad))
Vertical emittance	7 pm-rad (0.04% emittance coupling)	8 pm-rad (0.8% emittance coupling)
Critical energy	7.6 keV	6.6 keV
Energy spread	0.097%	0.11%
Lifetime	~50 h @ 100 mA ~14 h @ 500 mA	110/42 min @ 1.5A, $\epsilon = 70/8$ pm-rad
e- size (x, y)	Dipole: 160, 10 $\mu\text{m}$ rms Standard ID: 432, 6 $\mu\text{m}$ rms Chicane ID: 397, 3.4 $\mu\text{m}$ , rms	36 / 8 $\mu\text{m}$ rms @ ID center, I=1.5 A (x/y)
e- divergence (x, y)	Dipole: 236, 2.2 $\mu\text{rad}$ rms Standard ID: 42, 1.22 $\mu\text{rad}$ rms Chicane: 47, 2.14 $\mu\text{rad}$ rms	4 / 1 $\mu\text{rad}$ rms @ ID center, I=1.5 A (x/y)
Bunch length	5.1 mm rms (17 ps rms)	2.5 mm rms (8 ps rms) 5 mm with bunch lengthening cavity
Straight sections for IDs	9 x 2.3 m 4 x 3.7 m 2 x 1.5 m (chicane)	30 x 4.3 m straights in arcs 2 x 120 m long straight