

FCC-ee parameter update, October 2017

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many thanks to Erk Jensen for continuous encouragement

D. Shatilov, K. Oide, August 2017

parameter	W	H (ZH)	ttbar	
beam energy [GeV]	45.6	80	120	175
arc cell optics	60/60	90/90	90/90	90/90
momentum compaction [10^{-5}]	1.48	0.73	0.73	0.73
horizontal emittance [nm]	0.27	0.28	0.63	1.34
vertical emittance [pm]	1.0	1.0	1.3	2.7
horizontal beta* [m]	0.15	0.2	0.3	1
vertical beta* [mm]	0.8	1	1	2
length of interaction area [mm]	0.42	0.5	0.9	1.95
tunes, half-ring (x, y, s)	(0.569, 0.61, 0.0125)	(0.577, 0.61, 0.0115)	(0.565, 0.60, 0.0180)	(0.553, 0.59, 0.0343)
longitudinal damping time [ms]	414	77	23	7.5
SR energy loss / turn [GeV]	0.036	0.34	1.72	7.8
total RF voltage [GV]	0.10	0.44	2.0	9.5
RF acceptance [%]	0.9	1.9	2.5	5.0
energy acceptance [%]	1.3	1.3	1.5	2.5
energy spread (SR / BS) [%]	0.038 / 0.132	0.066 / 0.153	0.099 / 0.151	0.147 / 0.192
bunch length (SR / BS) [mm]	3.5 / 12.1	3.3 / 7.65	3.15 / 4.9	2.45 / 3.25
Piwinski angle (SR / BS)	8.2 / 28.5	6.6 / 15.3	3.4 / 5.3	1.0 / 1.33
bunch intensity [10^{11}]	1.7	1.5	1.5	2.7
no. of bunches / beam	16640	2000	393	48
beam current [mA]	1390	147	29	6.4
luminosity [$10^{34} \text{ cm}^{-2}\text{s}^{-1}$]	>200	>30	>7	>1.6
beam-beam parameter (x / y)	0.004 / 0.133	0.0065 / 0.118	0.016 / 0.108	0.095 / 0.157
luminosity lifetime [min]	70	50	42	39
time between injections [sec]	122	44	31	32
allowable asymmetry [%]	± 5	± 3	± 3	± 3
required lifetime by BS [min]	29	16	11	12
actual lifetime by BS ("weak") [min]	> 200	20	20	24

“reduced luminosity target (~-10%)”

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longitudinal damping time [ms]	414	77	23	6.6
SR energy loss / turn [GeV]	0.036	0.34	1.72	9.21
total RF voltage [GV]	0.10	0.44	2.0	10.93
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energy spread (SR / BS) [%]	0.038 / 0.132	0.066 / 0.153	0.099 / 0.151	0.15 / 0.20
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luminosity lifetime [min]	70	50	42	44
time between injections [sec]	122	44	31	32
allowable asymmetry [%]	± 5	± 3	± 3	± 3
required lifetime by BS [min]	29	16	11	10
actual lifetime by BS ("weak") [min]	> 200	20	20	25

“reduced luminosity target (~-10%)”

conservative revised operation model

working point	luminosity/IP [$10^{34} \text{ cm}^{-2}\text{s}^{-1}$]	total luminosity (2 IPs)/ year	physics goal	run time [years]
Z first 2 years	100	26 $\text{ab}^{-1}/\text{year}$	150 ab^{-1}	4
Z later	200	52 $\text{ab}^{-1}/\text{year}$		
<i>W</i>	30	7.8 $\text{ab}^{-1}/\text{year}$	10 ab^{-1}	~1
<i>H</i>	7.0	1.8 $\text{ab}^{-1}/\text{year}$	5 ab^{-1}	3
top	1.3	0.34 $\text{ab}^{-1}/\text{year}$	1.5 ab^{-1}	4-5

total run time: 12-13 years