parameter	symbol	nominal	ultimate	25 ns, low beta*	50 ns, long bunches
#bunches	n_b	2808	2808	2808	1404
protons/bunch	N_b [10^{11}]	1.15	1.7	1.7	4.9
bunch spacing	Δt_{sep} [ns]	25	25	25	50
average current	I [A]	0.58	0.86	0.86	1.22
longit. profile		Gaussian	Gaussian	Gaussian	uniform
rms bunch length	σ_z [cm]	7.55	7.55	7.55	14.4
beta at IP1&IP5	β^* [m]	0.55	0.5	0.08	0.25
crossing angle	θ_c [µrad]	285	315	0	381
Piwinski parameter	$\theta_c\sigma_z/(\sigma^* 2)$	0.64	0.75	0.60	2.5
peak luminosity	L [10^{34} cm^{-2}s^{-1}]	1.0	2.3	15.5	8.9
optimum average luminosity for 10 h turn around time	$<L>$ [10^{34} cm^{-2}s^{-1}]	0.46	0.91	2.4	2.3
optimum run length with 10 h turn around	τ_{opt} [h]	21.2	17.0	6.5	10.3
total heat load on beam screen (max SEY=1.4)	dP/ds [W/m]	1.39	1.62	1.62	1.50
events/ crossing		19	44	296	340

Table 1: Parameters for two refined LHC upgrade options compared with the nominal and ultimate LHC design values.