

Bunch Length and “Lebedev’s Criterion”

Collider	Tevatron ¹⁾	RHIC ¹⁾		LHC ²⁾		NICA ²⁾
Particles	p, p-bar	p	¹⁹⁷ Au ⁷⁹⁺	p	²⁰⁸ Pb ⁸²⁺	¹⁹⁷ Au ⁷⁹⁺
Circumference, m	6275	3833.845		26658.883		503
RF harmonics, h	1113	120, 360, 2520	360, 2520	35640		66
RMS bunch length, cm	45 =>62 (pbar) 50 => 75 (prots)	52	22	7.55	7.94	60
<i>k_s</i> -factor	1.2 – 1.5	61 – 2.9	48 – 6.9	9.9	9.4	12.7
Bucket half height, Δp/p, 10 ⁻⁴	4.6	12	20	3.6	3.56	19
RMS Δp/p, 10 ⁻⁴	1.2 – 1.5	1.8	5.0	1.1	-	1.1
<i>k_{Δp}</i> -factor	3.8 – 3.0	6.7	4.0	3.2	-	17

1) Operation parameters 2) Project parameters

$$k_s = \frac{C_{Ring}}{h\sigma_{rms}} \quad k_{\Delta p} = \frac{\delta p_{bucket_half}}{\delta p_{rms}}$$