



# LHC Injectors Upgrade





# LIU target beam parameters

		PSB						
		$N$ ( $10^{11}$ p)	$\epsilon_{x,y}$ ( $\mu\text{m}$ )	$E$ (GeV)	$\epsilon_z$ (eVs)	$B_l$ (ns)	$\delta p/p_0$	$\Delta Q_{x,y}$
LIU	Standard	29.55	1.55	0.16	1.4	650	$1.8 \cdot 10^{-3}$	(0.55, 0.66)
	BCMS	14.77	1.13	0.16	1.4	650	$1.8 \cdot 10^{-3}$	(0.35, 0.44)
	HL-LHC	34.21	1.72	0.16	1.4	650	$1.8 \cdot 10^{-3}$	(0.58, 0.69)

  

		PS (double injection)						
		$N$ ( $10^{11}$ p/b)	$\epsilon_{x,y}$ ( $\mu\text{m}$ )	$E$ (GeV)	$\epsilon_z$ (eVs/b)	$B_l$ (ns)	$\delta p/p_0$	$\Delta Q_{x,y}$
LIU	Standard	28.07	1.63	2.0	3.00	205	$1.5 \cdot 10^{-3}$	(0.16, 0.28)
	BCMS	14.04	1.19	2.0	1.48	135	$1.1 \cdot 10^{-3}$	(0.19, 0.31)
	HL-LHC	32.50	1.80	2.0	3.00	205	$1.5 \cdot 10^{-3}$	(0.18, 0.30)

  

		SPS (several injections)						
		$N$ ( $10^{11}$ p/b)	$\epsilon_{x,y}$ ( $\mu\text{m}$ )	$p$ (GeV/c)	$\epsilon_z$ (eVs/b)	$B_l$ (ns)	$\delta p/p_0$	$\Delta Q_{x,y}$
LIU	Standard	2.22	1.71	26	0.37	3.0	$1.5 \cdot 10^{-3}$	(0.09, 0.16)
	BCMS	2.22	1.25	26	0.37	3.0	$1.5 \cdot 10^{-3}$	(0.12, 0.21)
	HL-LHC	2.57	1.89	26	0.37	3.0	$1.5 \cdot 10^{-3}$	(0.10, 0.17)

  

		LHC					
		$N$ ( $10^{11}$ p/b)	$\epsilon_{x,y}$ ( $\mu\text{m}$ )	$p$ (GeV/c)	$\epsilon_z$ (eVs/b)	$B_l$ (ns)	bunches/train
LIU	Standard	2.00	1.88	450	0.60	1.65	72
	BCMS	2.00	1.37	450	0.60	1.65	48
	HL-LHC	2.32	2.08	450	0.65	1.65	72





# LIU beams

- Longitudinal parameters at PSB injection (LIU beams)
  - Parameters should be considered after RF capture
  - 1.4 eVs corresponds to about 80% of the bucket area
  - For standard production scheme, this value can also be larger, anyway the extracted long. emittance needs to be 3 eVs
  - Can't be much larger for BCMS beams (extracted 1.48 eVs)
- Transverse parameters at PSB injection (LIU beams)
  - Are derived from the assumption of double brightness (compared to the present performance) at the PSB extraction
  - Ideally, we would need to have a brightness curve covering the full range from  $8e11$  to  $3.4e12$  (25 and 50 ns from “old” nominal intensities to HL-LHC values)



# ISOLDE beams

- HIE ISOLDE beams:
  - Spec on beam intensity delivered to ISOLDE after intensity/energy upgrade to be fully clarified yet (IEFC?)
    - Original target → doubling the present intensity, i.e. at least  $1.8 \times 10^{13}$  p/ring extracted
    - Limited to  $1.4 \times 10^{13}$  p/ring if C02+C04 upgrade only (no Finemet)
    - Other limitation if distributor pulse length changes from from 600 to 450  $\mu\text{s}$  (depending on intensity from Linac4) → Request to study scenarios with 100, 120 and 150 turns injected and 30, 50, 80 mA source currents
  - Transverse emittance here is not an issue, only limit is PSB acceptance @injection