



ERL working modes



CLASSE

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Cornell University / CLASSE / SRF group & ERL effort

- a) High Current mode
- b) High Coherence mode
- c) High Buch charge mode
- d) HGHG FEL mode ?
- e) SASE FEL mode ?
- f) XFEL-O mode ?



Beam goals for ERLs



	Energy recovered modes			One pass	
Modes:	(A) Flux	(B) Coherence	(C) Short-Pulse	(D) High charge	Units
Energy	5	5	5	5	GeV
Current	100	25	100	0.1	mA
Bunch charge	77	19	77	1000	pC
Repetition rate	1300	1300	1300	0.1	MHz
Norm. emittance	0.3	0.08	1	5.0	mm mrad
Geom. emittance	31	8.2	103	1022	pm
Rms bunch length	2000	2000	100	50	fs
Relative energy spread	0.2	0.2	1	3	10^{-3}
Beam power	500	125	500	0.5	MW

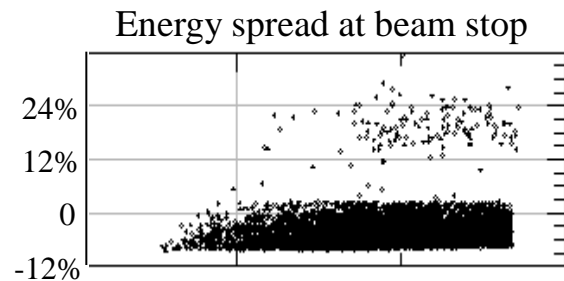
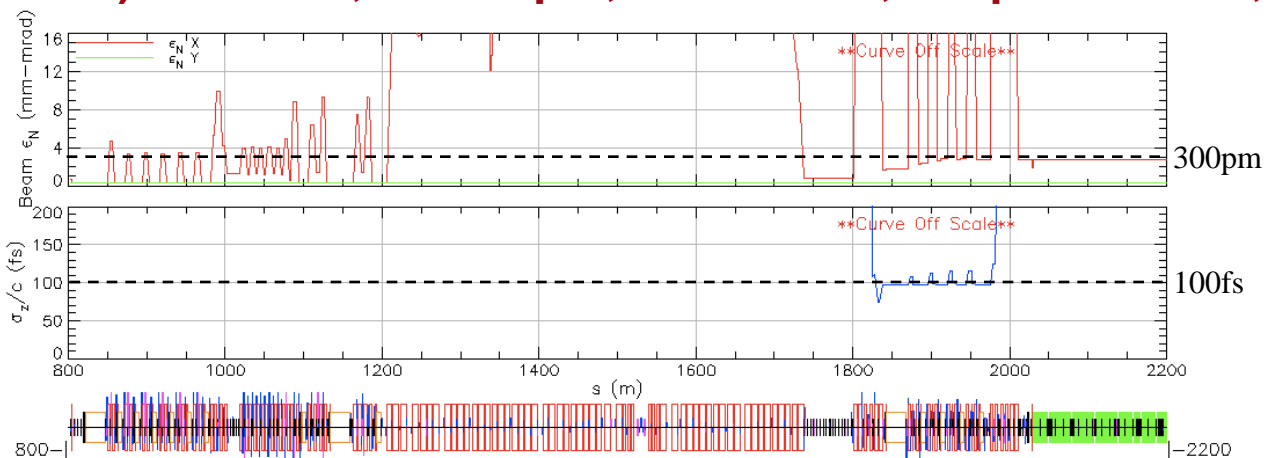


Electron Beam Parameters



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- 1) Hard x-rays: 5GeV, competitive current: up to 100mA
low charge per bunch \longrightarrow low emittance
- 2) Working modes: current, emittances, energy spread, bunch length
 - A) 100mA, 30/30pm, 2.e-4, 2ps
 - B) 25mA, 8/ 8pm, 2.e-4, 2ps
 - C) 25mA, 300/10pm, 2.e-3, 1ps in South, 100fs in North beamlines



- D) The option of large bunch charge (1nC) with low repetition rate (100kHz), without energy recovery, is not used for x-ray users.
up to 1nC is used for accelerator studies, e.g. of XFEL or HGHG FELs



	Energy recovered modes			ERL mode	
Modes:	THz	Compton gamma	Compton x-ray	Seeding FEL	Units
Energy	>100MeV<1GeV	>300MeV	>25MeV for IR laser for 10keV	>2GeV HHG for Sxr >5GeV for selfseeding Hxr ?	GeV
Current	>1mA	>1mA	Large?	kA peak	mA
Bunch charge		Cavity length as long as possible	As large as pos	As high as pos	pC
Repetition rate	for 75MHz	Therefore as low as possible	As low as pos for given current	<1MHz if echo enhanced	MHz
Norm. emittance	Gamma $\lambda/4\pi$	Laser $\lambda/4\pi$	Gamma $\lambda/4\pi$ for beam matching		mm mrad
Geom. emittance	$\lambda/4\pi$	Laser $\lambda/4\pi/gamma$			pm
Rms bunch length	<100fs	< hourglass > Energy spread if	< hourglass	Somewhat > 30fs+- 20fs jitter laser length	fs