FAST-SLOW BOOSTER INJECTOR SYSTEM

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PURPOSE

To continue the study of the slow booster injector for the (200-400) BeV accelerator. The system studies is a variant of that previously tabulated. A 50 MeV linac injects into a 20 m radius 2 BeV rapid cycling (30/sec) booster. Ten cycles of this beam are synchronously injected into a 200 m radius 50 BeV slow cycling booster. Five turn extraction and subsequent fast injection places this beam into the main ring accelerator.

LINAC PARAMETERS

T = 50 MeV
Rep. Rate: 30/sec
Beam Current: 100 m A
Beam Emittance (each transverse mode): 2.5 π mrad-cm
Energy Spread Following Debuncher: $\pm$ .175 MeV

ACCELERATOR PARAMETERS

	FAST BOOSTER	SLOW BOOSTER	MAIN RING
Radius (M)	20.	200.	1000.
Av. Field (kG)	4.64	8.49	13.37
Cir. Fact.	2	2	1.35
Max. Mag. Field (kG)	9.29	17.0	18.0
Inj. Energy (BeV)	.05	2.0	50.0
Inj. Mag. Field (kG)	1.04	.93	2.29
Aperture	9" x 4"	6.5" x 3"	5" x 2"
Rep. Rate (sec^{-1})	30	.5	.5
Accel. Rise Time (sec)	.0167	1.2	1.5
Front Porch Time (sec)		.3	
Av. Rev. Time (μsec)	.53	4.20	20.96
Accel. Turns (k turns)	31.4	285.4	71.56
Peak Cavity Voltage (MV/turn for $\phi_s = 30^o$)	.124	.336	9.78
Harmonic Number	20	200	1000
Av. Field Index	10	86	400
Tune	3.25	9.25	20.25
Adia. Damp. Fact.	8.97	18.29	7.87
Rad. Dilution Fact.	4 (five turn injection)	2 (five turn injection)	
Vert. Dilution Fact.			
AT INJECTION			
Rev. Freq. (MHz)	.7492	.2261	.047705
ν_s	.0643	.0193	.008
Circ. Curr. (A turns)	.36	1.09	.23
Bunching Factor	.35	.25	.15
Energy Spread (MeV)			
Eq. Orb. Rad. Spread (cm)			
Av. Rad. Betatron Ampl. (cm)	5.54	3.48	.76
Av. Vert. Betatron Ampl. (cm)	2.47	1.56	.54
Radial Beam Emittance (mrad-cm)	5.0 π	5.58 π	.12 π
Vert. Beam Emittance (mrad-cm)	10 π	1.12 π	.06 π
Allowed Tune Shift	.25	.2	.1
Space Charge Limit			1.73×10^{14}

	FAST BOOSTER	SLOW BOOSTER	MAIN RING
AT FINAL ENERGY			
Rev. Freq. (MHz)	2.2608	.2385	.047713
Rad. Beam Emittance (mrad-cm)	5.58π	$.30\pi$	
Vert. Beam Emittance (mrad-cm)	1.12π	$.06\pi$	
EXTRACTED BEAM			
Horiz. Beam Emittance (mrad-cm)	5.58π	$.12\pi$	
Vert. Beam Emittance (mrad-cm)	1.12π	$.06\pi$	

ACCELERATOR PARAMETERS (PHASE I)

Radius (M)	200.	1000.
Av. Field (kG)	8.49	6.70
Cir. Fact.	2	1.35
Max. Mag. Field (kG)	17.0	9.05
Inj. Energy (BeV)	.2	50.
Inj. Mag. Field (kG)	.215	2.29
Aperture	6.5" x 3"	4" x 2"
Rep. Rate (sec^{-1})	.5	.5
Accel. Rise Time (sec)	1.5	1.5
Front Porch Time (sec)		
Av. Rev. Time (sec)		20.96
Accel. Turns (k turns)		71.56
Peak Cavity Voltage (MV/turn for $\phi_s = 30^\circ$)		4.19
Harmonic Number	200.	1000.
Av. Field Index	86	400
Betatron Tune	9.25	20.25
Adia. Damp. Fact.	79.	3.95
Rad. Dilution Fact.	2 (five turn extraction)	
Vert. Dilution Fact.		
AT INJECTION		
Rev. Freq. (MHz)	.135	.0477
ν_s	.144	.008
Circ. Curr. (A turns)	.036	.023
Bunching Factor	.35	.15
Energy Spread (MeV)		
Eq. Orb. Rad. Spread (cm)		
Av. Rad. Betatron Ampl. (cm)	3.48	.37
Av. Vert. Betatron Ampl. (cm)	1.56	.26
Radial Beam Emittance (mrad-cm)	5.58π*	$.028\pi$
Vert. Beam Emittance (mrad-cm)	1.12π*	$.014\pi$
Allowed Tone Shift	.25	.1
Space Charge Limit	$\sim 3.7 \times 10^{12}$	1.7×10^{14}

*Note that linac emittance at 200 MeV is $\sim\pi$ mrad-cm.

	FAST BOOSTER	SLOW BOOSTER	MAIN RING
AT FINAL ENERGY			
Rev. Freq. (MHz)		.24	.04-7
Rad. Beam Emittance (mrad-cm)		.071π	
Vert. Beam Emittance (mrad-cm)		.014π	
EXTRACTED BEAM			
Horiz. Beam Emittance (mrad-cm)		.028π	
Vert. Beam Emittance (mrad-cm)		.014π	

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