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Quick reference guide for the Booster lattice and Rf parameters

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Collider Accelerator Department

Brookhaven National Laboratory

U.S. Department of Energy

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QUICK REFERENCE GUIDE FOR THE BOOSTER LATTICE AND RF PARAMETERS

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This is a brief summary of the parameters for the Booster lattice and RF system (which indicates the present status of the Booster as of 3/6/87).

We acknowledge the assistance of E.Courant and G. Cottingham with this list.

QUICK REFERENCE
AGS BOOSTER PARAMETER LIST

	Protons	Polarized Protons	Heavy Ions
Energy			
Injection	200 MeV	200 MeV	$>$ 1 MeV/nucleon
Ejection	1.5 GeV	1.5 GeV	$p = 5.25\ Q/A$ (GeV/c)/nucleon
No. of Particles/Pulse	$1.5 - 3 \times 10^{13}$	$\sim 10^{12}$	15×10^9 (S), 3×10^9 (Au)
Lattice			
Circumference		201.78 m (1/4 AGS)	
Magnetic bend radius		13.75099 m	
Periodicity		6	
Number of cells		24 FODO	
Cell length		8.4075 m	
Phase advance/cell		72.3°/72.45°	
ν_x/ν_y (nominal)		4.82/4.83	
β_y max/min		13.6/3.7 m	
x_p max		2.95 m	
transition γ		4.881	
RF System			
Number of stations	2	2	2
Harmonic number	3	3	3
Frequency range (MHz)	2.5 — 4.11	2.5 — 4.11	0.200 — 2.5
Peak RF voltage	90	90	17
Acceleration time (ms)	62	62	500
Reptition rate	7.5 Hz (4/AGS pulse)	1 Hz (1/AGS)	1 Hz (1/AGS)
Dipoles			
Number		36	
Length (magnetic)		2.4 m	
Gap		82.55 mm	
Vacuum chamber aperture		66 mm	
Good field region ($< 10^{-4}$)		16 × 6.6 cm	
Injection field (kG)	1.56	1.56	0.108 A/Q
Ejection field	5.46	5.46	12.74
Quadrupoles			
Number		48	
Length (magnetic)		50.375 cm	
Aperture		16.5 cm	
Vacuum chamber aperture		15.25 cm	
Injection pole tip field (kG)	1.02	1.02	0.068 A/Q
Ejection pole tipe filed (kG)	3.6	3.6	8.3
Field Quality 6/2		0.0	
All other harmonics		$< 10^{-4}$	
Chromaticity Sextupoles			
Number		2 × 12	
Length (magnetic)		10 cm	
Max. pole tip field (kG)		3.0	
Max. Vacuum Pressure		3×10^{-11} torr	

Reference: Z. Parsa, Booster Parameter List, BNL-39311, 1987; and Design Manual.

TABLE 1. Isotopes, Charge States, and Ionic Masses.

	Q	Z	A	Ionic Rest Mass (u)	Ionic Rest Mass Energy (GeV/nucleon)
p	+1	1	1	1.00728	0.93828
d	+1	1	2	2.01355	0.93781
C	+6	6	12	11.99671	0.93125
S	+14	16	32	31.96439	0.93047
Cu	+21	29	63	62.91808	0.93029
I	+29	53	127	126.88857	0.93068
Au	+33	79	197	196.94846	0.93126

TABLE 2. Injection Energies and Fields

	v/c	f (MHz)	p (GeV/c)	E_{inj} (MeV)	E_{inj} (MeV/nucleon)	B_{inj} (kG)
p	0.5662	2.5235	0.6444	200.0	200.000	1.563
d	0.1767	0.7878	0.3368	30.0	15.000	0.817
C	0.1262	0.5623	1.4211	90.0	7.500	0.575
S	0.1000	0.4457	2.9925	150.0	4.688	0.519
Cu	0.0782	0.3485	4.5969	180.0	2.857	0.531
I	0.0595	0.2653	7.0489	210.0	1.654	0.590
Au	0.0478	0.2131	8.7805	210.0	1.066	0.645

TABLE 3. Ejection Energies and Fields — $B_{max} = 12.74$ kG

	v/c	f (MHz)	p (GeV/c)	E_{ejec} (GeV)	E_{ejec} (GeV/nucleon)	B_{ejec} (kG)
p	0.9230	4.114	2.251	1.500	1.5000	5.459
d	0.8699	3.877	3.308	1.927	0.9635	8.024
C	0.8714	3.884	19.847	11.602	0.9668	8.024
S	0.8716	3.885	52.926	30.952	0.9672	9.170
Cu	0.8534	3.804	95.932	53.810	0.8541	11.081
I	0.7900	3.522	152.345	74.622	0.5880	12.748
Au	0.6868	3.061	173.358	68.050	0.3500	12.748

Reference: Z. Parsa, Booster Parameter List, BNL-39311, 1987; and Design Manual.

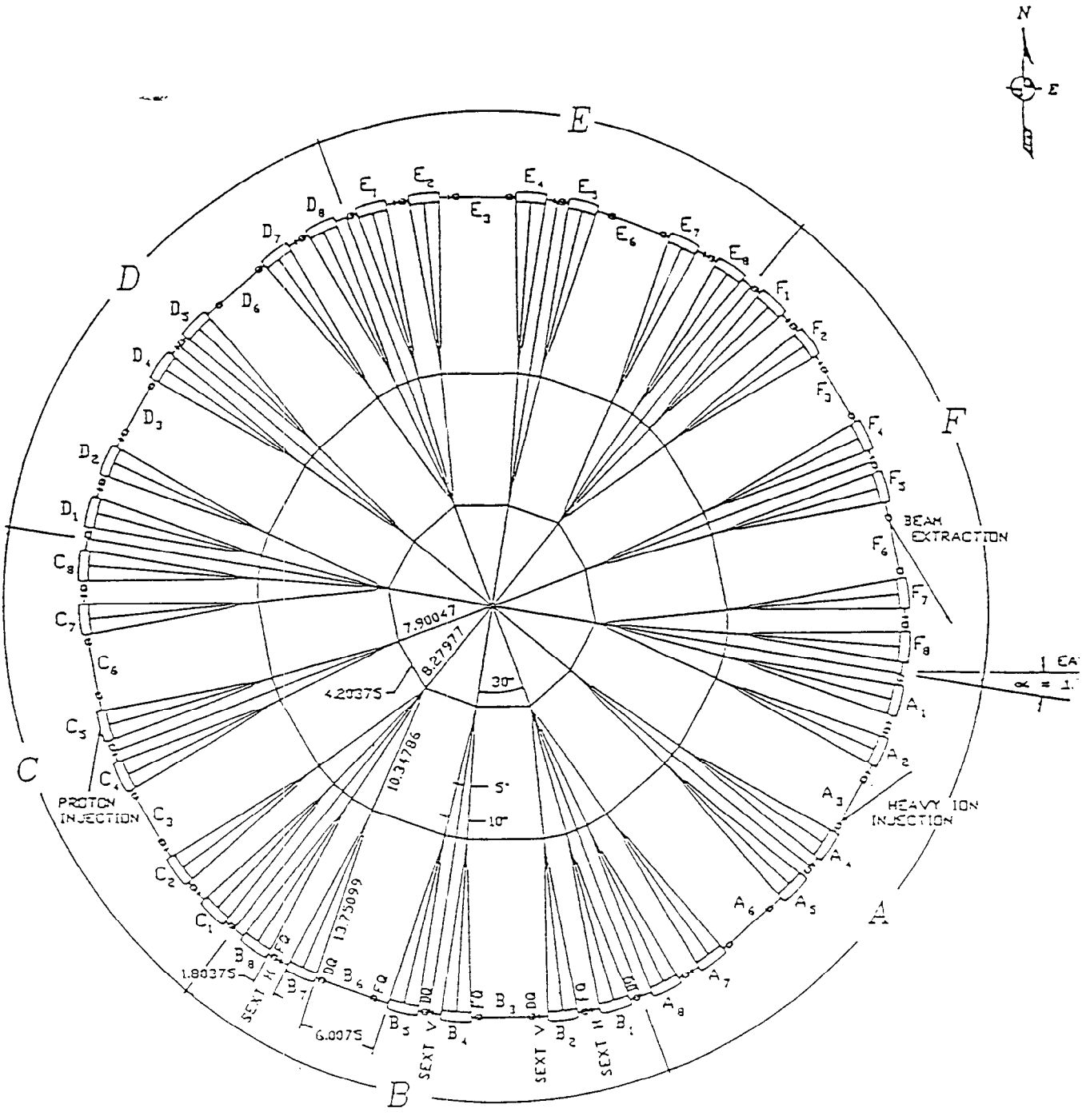

Figure 1. The layout of the Booster.

Reference: Z. Parsa, Booster Parameter List, BNL-39311, 1987; and Design Manual.

TABLE 4 RF Systems.

	p	pi	S^{+4}	Au^{+33}
RF Amplitude				
Injection	90 kV	7.35 kV	0.61 kV	1.5 kV
Ejection	90 kV	40 kV	17 kV	17 kV
Harmonic Number	3	3	3	3
RF Frequency				
Injection	2.5 MHz	2.5 MHz	0.446 MHz	0.206 MHz
E/A	200 MeV	200 MeV	4.69 MeV	1.07 MeV
Ejection	4.11 MHz	4.11 MHz	4.13 MHz	3.06 MHz
Phase Space Area/A	$\geq$ 1.0 eV-s	0.3 eV-s	0.066 eV-s	0.066 eV-s
Intensity (particles (per bunch)	10^{13}	$\sim 1 \times 10^{11}$	5×10^{9}	8×10^{9}
Total Gap Impedance ($f_{rf} = 4.1$ MHz)	< 24 kΩ	No limit	No limit	No limit
Acceleration Time	62 ms	$\leq$ 0.5 s	$\leq$ 0.5 s	$\leq$ 0.5 s
Maximum Power Delivered to Beam	156 kW	< 2 kW	< 1.0 kW	< 2 kW
Maximum $\dot{B}$	9.5 T/s	4.5 T/s	4.5 T/s	4.5 T/s
$\dot{B}_{inj}$	1.5 T/s	?	< 0.15 T/s	< 0.15 T/s

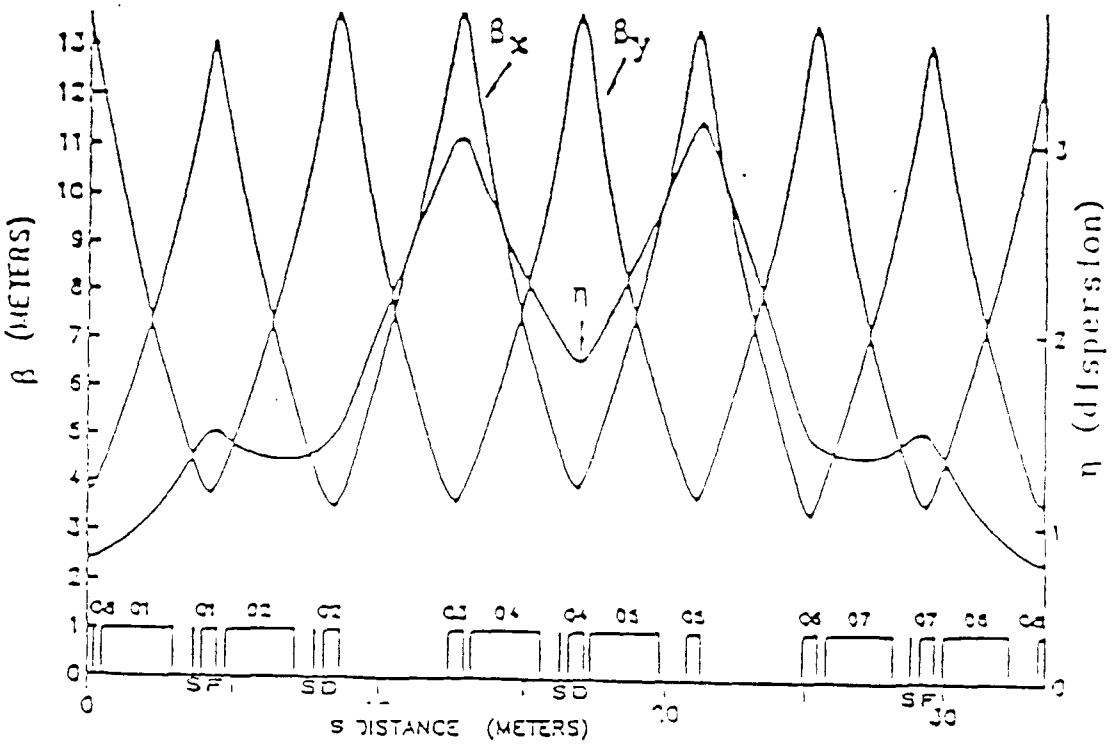

Fig. 2, shows the betatron functions and the amplitude dependence of tunes for the AGS Booster.