

BNL-105121-2014-TECH

Booster Technical Note No. 74;BNL-105121-2014-IR

Quick reference guide for the Booster lattice and Rf parameters

Z. Parsa

March 1987

Collider Accelerator Department Brookhaven National Laboratory

U.S. Department of Energy

USDOE Office of Science (SC)

Notice: This technical note has been authored by employees of Brookhaven Science Associates, LLC under Contract No.DE-AC02-76CH00016 with the U.S. Department of Energy. The publisher by accepting the technical note for publication acknowledges that the United States Government retains a non-exclusive, paid-up, irrevocable, world-wide license to publish or reproduce the published form of this technical note, or allow others to do so, for United States Government purposes.

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, nor any of their contractors, subcontractors, or their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or any third party's use or the results of such use of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof or its contractors or subcontractors. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

QUICK REFERENCE GUIDE FOR THE

BOOSTER LATTICE AND RF PARAMETERS

AD

Booster Technical Note No. 74

> ZOHREH PARSA March 6. 1987

ACCELERATOR DEVELOPMENT DEPARTMENT Brookhaven National Laboratory Upton, N.Y. 11973

QUICK REFERENCE GUIDE FOR THE BOOSTER LATTICE AND RF PARAMETERS

Zohreh Parsa Accelerator Development Department Brookhaven National Laboratory Upton, New York 11973

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.

QUIÇK REFERENCE AGS BOOSTER PARAMETER LIST

.

	Protons	Polarizei 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^{5} (S), 3×10^{5} (Au)
Lattice Circumference Magnetic bend radius Periodicity Number of cells Cell length Phase advance/cell ν_x/ν_y (nominal) β_y max/min z_p max transition γ		201.78 m (1/4 AGS) 13.75099 m 6 24 FODO 8.4075 m 72.3° /72.45° 4.82/4.83 13.6/3.7 m 2.95 m 4.881	٤
RF System Number of stations Harmonic number Frequency range (MHz) Peak RF voltage Acceleration time (ms) Bentition rate	$2 \\ 3 \\ 2.5 - 4.11 \\ 90 \\ 62 \\ 7.5 Hz (4/AGS pulse)$	$2 \\ 3 \\ 2.5 - 4.11 \\ 90 \\ 62 \\ 1 Hz (1/AGS)$	$2 \\ 3 \\ 0.200 - 2.5 \\ 17 \\ 500 \\ 1 Hz (1/AGS)$
Dipoles Number Length (magnetic) Gap Vacuum chamber aperture Good field region (< 10 ⁻⁴) Injection field (kG) Ejection field	1.56 5.46	36 2.4 m 82.55 'mm 66 mm 16 × 6.6 cm 1.56 5.46	0.108 <i>A/Q</i> 12.74
Quadrupoles Number Length (magnetic) Aperture Vacuum chamber aperture Injection pole tip field (kG) Ejection pole tipe filed (kG) Field Quality 6/2 All other harmonics	1.02 3.6	48 50.375 cm 16.5 cm 15.25 cm 1.02 3.6 0.0 < 10 ⁻⁴	0.068 <i>A/Q</i> 8.3
Chromaticity Sextupoles Number Length (magnetic) Max. pole tip field (kG)		2 × 12 10 cm 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, d C S Cu	+1 +1 +6 +14 +21	1 1 6 16 29	1 2 12 32 63	1.00728 2.01355 11.99671 31.96439 62.91808	0.93828 0.93781 0.93125 0.93047 0.93029
I Au	+29 +33	53 79	127 197	125.88857 196.94846	0.93068 0.93125

TABLE	2.	Injection	Energies	and	Fields
-------	----	-----------	----------	-----	--------

	v/c	f	p .	E _{inj}		B _{inj}
		(MHz)	(GeV/c)	(MeV)	(MeV/nucleon)	(kG)
p, d C v	0.5662	2.5235	0.5444	200.0	200.000	1.563
	0.1767	0.7878	0.3368	30.0	15.000	0.817
	0.1262	0.5623	1.4211	90.0	7.500	0.575
	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	0.2553	7.0489	210.0	1.854	0.590
Au	0.0473	0.2131	8.7803	210.0	1.066	0.645

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

· .

	v/ c	f	p	E _{sjec}		B _{ejec}
	 	(MHz)	(GeV/c)	(GeV)	(GeV/nucleon)	(kG)
p d C S C u I Au	0.9220 0.8699 0.3714 0.8716 0.8534 0.7900 0.6863	4.114 3.377 3.384 3.385 3.804 3.522 3.061	$\begin{array}{c} 2.251 \\ 3.308 \\ 19.347 \\ 52.926 \\ 95.932 \\ 152.345 \\ 173.253 \end{array}$	1.500 1.927 11.602 30.952 53.810 74.623 68.050	1.5000 0.9635 0.9668 0.9672 0.8541 0.5880 0.3500	5.453 8.024 9.170 11.081 12.743 12.743

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





0____5 HETERS NOTE: ALL DIMENSIONS ARE IN METERS

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

	p	Pî	51	Au-22
RF Amplitude Injection Ejection Harmonic Number	90 kV 90 kV 3	7.35 kV 40 kV 3	0.51 kV 17 kV 3	1.5 kV 17 kV 3
RF Frequency Injection E/A	2.5 MHz 200 MeV	2.5 MHz 200 MeV	0.445 MFHz 4.59 MeV	0.206 MEHE 1.07 MeV
Ejection Phase Space Area/A	4.11 MHz ≥ 1.0 eV-s	4.11 MHz 0.3 eV-s	4.13 MHz 0.066 eV-s	3.06 MH= 0.058 eV-s
Intensity (particles (per bunch)	10 ¹³	∿1× 10 ¹¹	5 × 10°	8×10^{9}
Total Gap Impedance (f _{ri} = 4.1 MHz)	< 24 kΩ	No limit	No limit	No linit
Acceleration Time	02 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 <i>İ</i> <i>İ</i> _{ini}	9.5 T/s 1.5 T/s	4.5 T/s ?	4.5 T/s < 0.15 T/s	4.5 T/s < 0.15 T/s

TABLE 4 RF Systems.



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

.