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Booster parameter list with 60 Kv RF voltage and increased ejection energies

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DISCLAIMER

BOOSTER PARAMTER LIST WITH 60 KV RF VOLTAGE AND INCREASED EJECTION ENERGIES

Booster Technical Note

No. 43 A

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ABSTRACT

THIS NOTE DESCRIBES THE PARAMETER LIST FOR THE AGS - BOOSTER. THE FOLLOWING CHANGES WERE MADE AND SHOULD BE NOTED: THE RF VOLTAGE WAS RAISED TO 60 KV; RF CAVITIES FOR PROTON ACCELERATION WAS CHANED FROM ONE TO TWO; THE EJECTION ENERGY FOR PROTN WAS INCREASED (FROM 1GEV) TO 1.5 GEV, AND FOR H.I. (GOLD, FROM .32) TO .35 MEV/AMU. ADDITIONALLY, THE LARGE Q5 QUADRUPOLES WERE REPLACED BY THE NORMAL-SIZED MAIN RING QUADRUPOLES.

INTRODUCTION

This note describes the parameter list of the AGS-Booster with the 60KV RF Voltage for protons and tunes of 4.82 and 4.83. The chromaticity correction sextupole configuration is 1,2,4,7 and the eddy current sextupole strengths are taken to be 0.12 Tesla per meter square [1]. The following changes were made and should be noted: The rf voltage was raised to 60 kV; rf cavities for proton acceleration was changed from one to two; the ejection energy for protns was increased (from 1 GeV) to 1.5 GeV, and for Heavy Ions (GOLD, FROM .32) TO .35 MEV/AMU. Additionally, the large Q5 quadrupoles were replaced by the normal-sized main ring quadrupoles. A schematic lay-out of the Booster lattice and its superperiods are also included [2-4]. In section II the present values of the Booster parameters are tabulated, [note that, the values listed are for theoretical calculations]. This updates the Booster parameter list given in Reference 5.

References:

1. Calculation of Eddy Currents, BST/TN 4, G. Morgan and S. Kahn, (January 1986).

2. Booster Lattice, Booster Tech. Note No. 1, E. Courant and Z. Parsa, (January 15, 1986).

3. Chromaticity Correction for the AGS - Booster with 1,2,4,7 Sextupole Configuration, BST/ TN 17, E. Courant and Z. Parsa, (March 5, 1986).

4. Booster Coordinates, Booster Tech. Note No. 6, Z. Parsa, (January 28, 1986).

5. AGS - Booster Parameter List, Booster Tech. Note No. 2, Z. Parsa, (January 16, 1986); BST/TN 20, Z. Parsa, (March 10, 1986); and BST/TN 25, Z. Parsa, (April, 1986).

6. Private communication, Y. Y. Lee.

AGS BOOSTER PARAMETER LIST

LATTICE

CIRCUMFERENCE	201.78 m (1/4 AGS)
PERIODICITY	6
NUMBER OF CELLS	24 FODO
LENGTH	8.4075 m
PHASE ADVANCE/CELL	72.3 , 72.45 [degrees]
TUNES	QX= 4.82, QY= 4.83
BETAX MAX/MIN	13.865/3.5754
BETAY MAX/MIN	13.644/3.7033
XP MAX	2.9515 m
TRANSITION GAMMA	4.8812

ENERGY [MeV]	@ INJECTION	@ EJECTION
PROTONS	200 MeV [BRHO=21.4962 kG-m]	1.5 GeV [BRHO=75.069 kG-m]
HEAVY IONS	1 > MeV/amu [*BRHO=1.4403A/Q kG-m]	P=5.252 Q/A GeV/amu-c [BRHO=175.194 kG-m]

[Q is the charge of the Heavy Ions (whether fully stripped or not) delivered from the Tandem.]

* At 1 MeV/amu

RF SYSTEM

NUMBER OF STATIONS (4 IN TOTAL)
- 2 FOR PROTONS (INCLUDING POL PROTONS)
- 2 FOR HEAVY IONS
- [where POL== POLARIZED]

HARMONIC NUMBER
- 3 FOR PROTONS (INCLUDING POL PROTONS)
- 3 FOR HEAVY IONS (1 FOR RHIC)

FREQUENCY RANGE (MHz)
- FOR PROTONS (INCLUDING POL PROTONS) 2.5 - 4.12
- FOR HEAVY IONS - (- FOR RHIC)

PEAK RF VOLTAGE [KV]
- FOR PROTONS (INCLUDING POL PROTONS) 60
- FOR HEAVY IONS 17

ACCELERATION TIME [M-SEC]
- FOR PROTONS (INCLUDING POL PROTONS) 50
- FOR HEAVY IONS 500

REPETITION RATE

FOR PROTONS	7.5 Hz	(4 PULSES/AGS PULSE)
FOR POL PROTONS	1 Hz	(1 PULSE/AGS PULSE)
FOR HEAVY IONS	1 Hz	(1 PULSE/AGS PULSE)

DIPOLES

[DIPOLES ARE CURVED AND WEDGED FOR 0 ENTRANCE ANGLE]

NUMBER	36
LENGTH (MAGNETIC)	2.4 M
GAP	82.55 MM
GAP VACUUM CHAMBER	66 MM
	-4
GOOD FIELD REGION (<10)	16 X 6.6 CM

INJECTION FIELD [KG]

FOR PROTONS (INCLUDING POL PROTONS)	1.5633
FOR HEAVY IONS	0.1047 A/Q

EJECTION FIELD [KG]

FOR PROTONS (INCLUDING POL PROTONS)	5.459
FOR HEAVY IONS	12.740

LAMINATION THICKNESS 1.5 MM
[0.6 MM AROUND ENDS]

QUADRUPOLES

NUMBER	48
LENGTH (MAGNETIC)	0.50375 M
APERTURE	16.52 CM

VACUUM CHAMBER AP. [AP.== APERTURE]	HORIZ.	VERT.
	15.25 CM *	5 CM

WITH GF = 11.999 [KG/M]
GD = -12.369 [KG/M]

[* SPECIAL QUADRUPOLE (Q5) FOR INJECTION.]

INJECTION POLE TIP FIELD [KG]

FOR PROTONS (INCLUDING POL PROTONS)
BF =0.9899, BD =1.0204
FOR HEAVY IONS
BF = 0.06635 A/Q , BD = 0.0683 A/Q

EJECTION POLE TIP FIELD [KG]

FOR PROTONS (INCLUDING POL PROTONS)
BF = 3.457 , BD = 3.5635

FOR HEAVY IONS
BF = 8.0706 , BD = 8.3078

LAMINATION THICKNESS 0.6 MM

FIELD QUALITY
SEXTUPOLE HARMONIC 0.0
(6 THETA/2 THETA) (SHAPE POLE TIP TO ELIMINATE)
ALL OTHER HARMONICS $< 10^{-4}$

SEXTUPOLES

LOCATION	1,7 (SF), 2,4 (SD)
NUMBER	24 (12 SF + 12 SD)
LENGTH	10 CM
APERTURE	16.52 CM

AT 1.5 GEV WITH INTEGRATED STRENGTH [T/M]:

INJECTION POLE TIP FIELD [KG]

FOR PROTONS (INCLUDING POL PROTONS)	0.45761
FOR HEAVY IONS	0.03065 A/Q

EJECTION POLE TIP FIELD [KG]

FOR PROTONS (INCLUDING POL PROTONS)	
FOR HEAVY IONS	

OTHER PARAMETERS

MAX. VACUUM PRESSURE (N2 EQU.) 3×10^{-11} TORR

MAX. INTENSITY (PARTICLES PER PULSE)

FOR PROTONS	$1 - 3 \times 10^{13}$
FOR POL PROTONS	10^{12}
FOR HEAVY IONS	10^{11} A/ Q^2