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Vertical Bump at E-20

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AGS Complex Machine Studies (AGS Studies Report No. 326) Vertical Bump at E-20
Study Period: March 11 and 12, 1995
Participants: MCR, R. DiFranco, J. Funaro, R. Zapasek
Reported by: E. Gill and A. Soukas
Machine: AGS Proton Complex
Aim: To Dump Beam on E-20 Catcher (vertically)

SUMMARY

By using a set of overpowered AGS injection dipoles, the beam was deflected vertically in the vicinity of the catcher, resulting in placing the beam loss into the E-20 catcher.

INTRODUCTION

Localized injected beam losses have been noted especially in three AGS locations; namely, H12, J15, and K12. These are thought to be due to vertical beam apertures. The normal orbit correction dipole system does not provide enough deflection to minimize these losses at all locations. They can be moved from one spot to another. The desire is to place as much of the loss as possible into the E-20 catcher.

STUDY

The beam loss pattern with a normal machine, i.e., the orbit bump off, is shown in Plot A. Large losses are seen to occur in H and J, and Table A at an intensity of 45 TP.

As part of our test, a special $3/2$ lambda vertical bump was created around the AGS E-20 straight section using two sets of the regular low field dipole magnets but by pulsing them up to approximately 6 Amperes. Their normal maximum currents are approximately 2 Amperes. Several of the old beta quadrupole power supplies were used since they are rated for higher voltage and current. The resulting orbit is shown in Plot C. The loss pattern as measured by the AGS RLM system is shown in Plot B and Table B.

It appears that to place a large fraction of the beam loss on the E-20 catcher, a vertical 1.0 lambda or $3/2$ lambda bump should be created by moving several magnets vertically. This can be augmented by using the normal low field dipoles for trimming purposes.

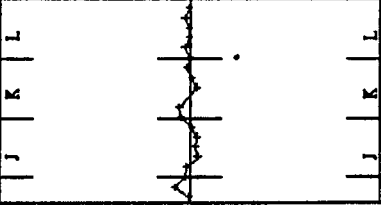
DIBBUK
++II++

I H S

E: SAT MAR 11 13:42:44 1995
- 3756 AND 3856 (div by 24.0
ILSES: 1

11	12
01	0.003 0.004
02	0.003 0.002
03	0.004 0.004

0.01	0.02	0.00
0.01	0.03	0.01
-0.02	-0.01	0.00
-0.01	-0.02	0.00
-0.02	-0.01	0.01
0.00	0.01	0.00



I H S

Bump off
PLOT A

(A)

A1 @ 45TP

12-Mar-95 TIME=10:36:39.1
U-P SET UP: MODE=1 TIME= 50 TO 500MS SCALE= 1000
CBM= 5900 50MS CBM= 7040 500MS



DATA2

screen will be printed after the flash

Command:

UP
FILE

pdp10

DIBBUK
+++II+++

I H S

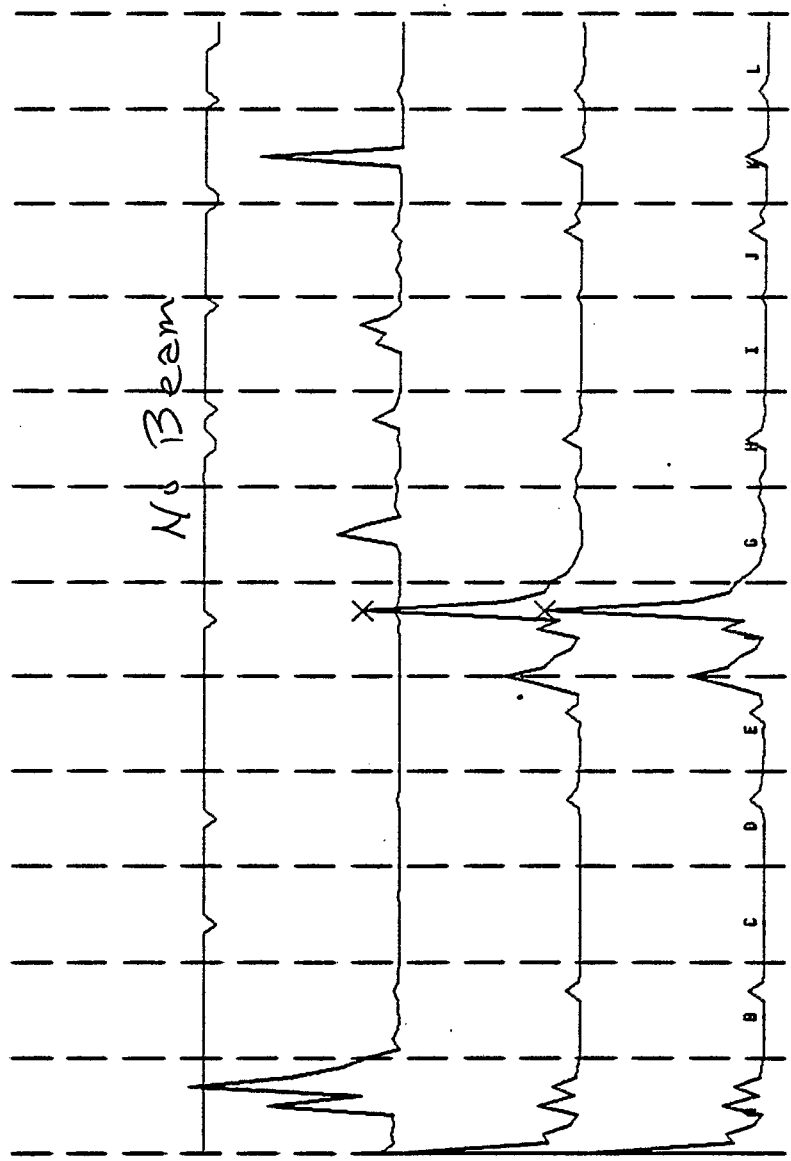
I H S

PLOT B

12-MAR-95 TIME=10:44:49.5
U-P SET UP: MODE=1, TIME= 50 TO 500MS SCALE= 1000
CBM= 7840 50MS CBM= 7840 500MS

~ 5.7 AMP

No Beam

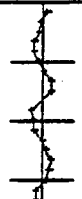


DATA?

11	12
57 0.049	-0.017
07 0.023	-0.030
57 0.034	0.035

-0.02	0.04	0.02
-0.04	0.06	0.05
-0.05	0.04	0.04
-0.02	-0.05	0.02
0.00	-0.05	0.01
0.04	-0.01	-0.03

J | K | L



J | K | L

Command: I screen will be printed after the flash

X BAD DATA POINT

2

DIBBUK
+++II++

I H S

TOGGLE

pdp10

Table A

(A)

Bump off

U-P SET UP: MODE=1 50 TO 500MS
12-MAR-95 TIME=10:22 56.4

	A	B	C	D	E	F	G	H	I	J	K	L	S
1111	21	3	3	3	8	16	19	16	25	38	7	5	-4
198	3	3	3	3	10	23	7	32	8	3	3	3	-5
214	3	3	3	3	3	15	3	3	17	3	3	85	628
65	3	3	3	3	3	3	3	3	3	3	3	3	634
34	3	3	3	3	7	3	3	3	3	5	3	3	668
971	3	3	3	3	3	82	19	245	14	31	345	53	654
238	3	3	3	3	17	3	3	189	3	3	151	6	-4
375	91	3	3	3	95	13	29	196	492	128	128	-5	-5
88	13	3	3	3	25	12	21	177	275	148	148	-5	-5
53	7	3	3	3	17	64	6	78	206	15	15	-4	-4

TOTAL = 6926 CBM AT 50MS = 780 CBM AT 500MS = 784
TOTAL COUNTS

1843*	25	6	6	6	334	742	836	75	348	53	16	5	-4
228	6	6	6	6	92	182	168	111	31	6	18	6	-5
258	6	6	6	6	57	2817	19	56	67	6	6	127	4352
98	6	6	6	6	16	22	381	16	6	7	6	11	4452
41	6	6	6	6	48	634	6	6	6	6	6	6	4639
1886	6	6	6	6	27	6	5160	38	281	39	375	65	4895
267	93	6	6	6	38	12	1414	6	210	8	58	173	-4
415	93	6	6	6	185	16	1315	6	231	35	683	58	-5
97	19	14	47	68	537	123	136	6	683	58	58	-5	-4
65	11	6	71	338	548	52	134	6	284	6	284	-5	-4

TOTAL = 24267 DATA2

UP
TOGGLE

pdp10

I H S

Table B

(B)

Bumpon

U-P SET UP: MODE=1 50 TO 500MS
12-MAR-95 TIME=10:44 40.5

	A	B	C	D	E	F	G	H	I	J	K	L	S
968	3	3	3	3	18	415	162	26	33	28	3	3	-4
175	3	3	3	3	3	288	87	33	3	3	3	3	-5
289	3	3	3	3	3	144	35	10	3	3	3	49	620
63	3	3	3	3	3	53	19	3	3	3	3	3	634
28	3	3	3	3	3	15	3	3	3	3	3	3	-5
231	3	3	3	3	3	235	22	188	3	3	119	-4	-4
42	90	3	3	3	17	84	128	26	25	3	23	-4	-5
166	14	3	3	3	25	23	299	13	3	95	-5	-5	-5
22	6	3	3	3	17	219	285	41	13	19	-4	-4	-4

TOTAL = 6735 CBM AT 50MS = 784 CBM AT 500MS = 784
TOTAL COUNTS

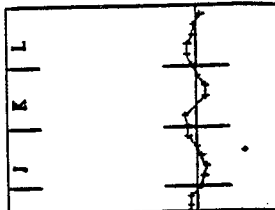
1853	6	6	6	6	225	974	762	78	267	49	6	6	-4
212	6	6	6	6	64	260	215	189	13	6	6	6	-5
218	6	6	6	6	35	2489	52	37	44	6	6	71	432
22	6	6	6	6	13	267	25	6	6	6	6	6	4453
228*	6	6	6	6	6	49	397	6	6	6	6	6	-5
173	98*	6	6	6	6	6	4150	33	127	6	6	122	-4
28	16	6	6	6	38	22	237	10	6	38	124	-4	-4
25	6	6	6	6	51	277	85	43	6	183	-4	-4	-4

TOTAL = 19282 DATA2

BE: SAT MAR 11 13:42:44 1995
- 3512 AND 3836 (div by 24.0
ILSES: 1

11	12
37	0.049 -0.017
07	0.023 -0.030
57	0.054 0.035

-0.02	0.04	0.02
-0.04	0.06	0.05
-0.05	-0.05	0.04
0.00	-0.05	0.02
0.04	-0.01	-0.03



CC

PLOT C

VERTICAL

CURRENT DATE: SUN MAR 12 18:46:55 1995 FILE DATE: SAT MAR 11 13:
 INPUT DATA: ORBIT - FILE std400a NORM: F15 - 3512 AND 3P ((
 GAIN: LOW REAL TIME: 400 MS. NUMBER OF PULSES: 1

HARMONIC ANALYSIS:

N	5	6	7	8	9	10	11	12
SIN	-0.034	0.025	0.004	-0.037	0.047	-0.057	0.049	-0.017
COS	-0.040	0.058	-0.056	0.048	-0.067	0.007	0.023	-0.030
AMP	0.053	0.063	0.057	0.061	0.082	0.057	0.054	0.035

AVERAGE POSITION: -0.005 AVERAGE SIGMA: 0.000

0.02	-0.01	0.05	0.00	-0.03	-0.64	0.11		-0.02	-0.02	0.04	0.1
-0.03	-0.01	0.04	0.02	0.01	-0.55	0.04		-0.02	-0.04	0.06	0.1
0.02	-0.04	0.00	0.06	0.28		-0.01	0.01	0.02	-0.05		0.1
0.05	-0.04		0.06	0.25	0.15			0.05	-0.02	-0.05	0.1
0.02	-0.02	-0.05	0.02	0.10		-0.02	-0.05	0.03	0.00	-0.05	0.1
0.02	0.00	-0.01	-0.03	-0.39	0.24	-0.04	-0.05	0.03	0.04	-0.01	-0.1

