AGS Complex Machine Studies

(AGS Studies Report No. 326)

Vertical Bump at E-20

Study Period: March 11 and 12, 1995

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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

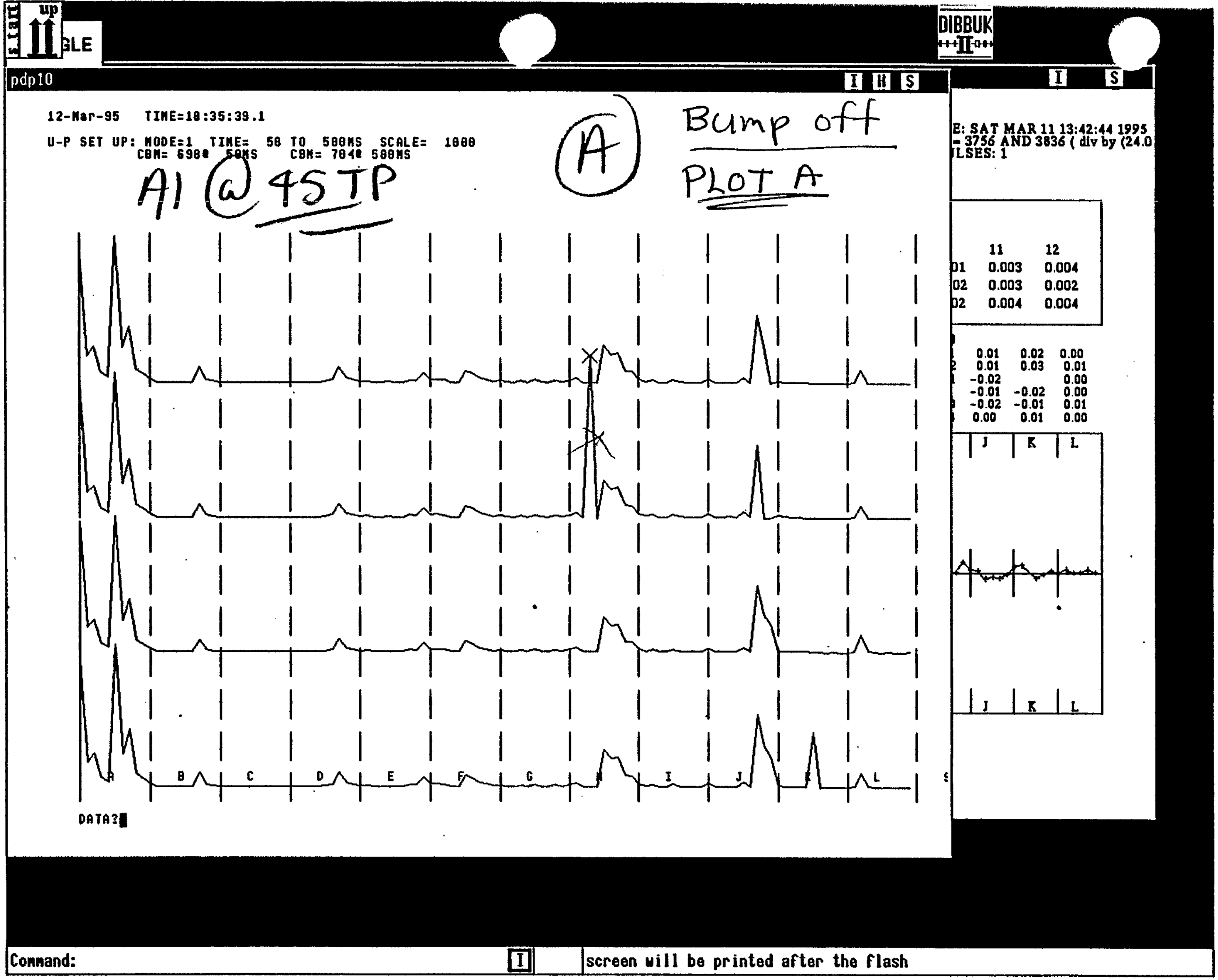
Localized injected beam losses have been noted especially in three AGS locations; namely, H12, J15, and K12. These are thought to be due to vertical beam apertures. The normal orbit correction dipole system does not provide enough deflection to minimize these losses at all locations. They can be moved 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 thy 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.



start
up
GLE
DIBBUK II
pdp10
I H S
I S
A B C D E F G H I J K L
J K L
J K L

```
12-Mar-95    TIME=10:35:39.1

U-P SET UP: MODE=1  TIME=   50 TO   500MS  SCALE=  1000
        CBM= 6980  50MS    CBM= 7040 500MS

DATA?
```

A1 @ 45TP

(A)

Bump off

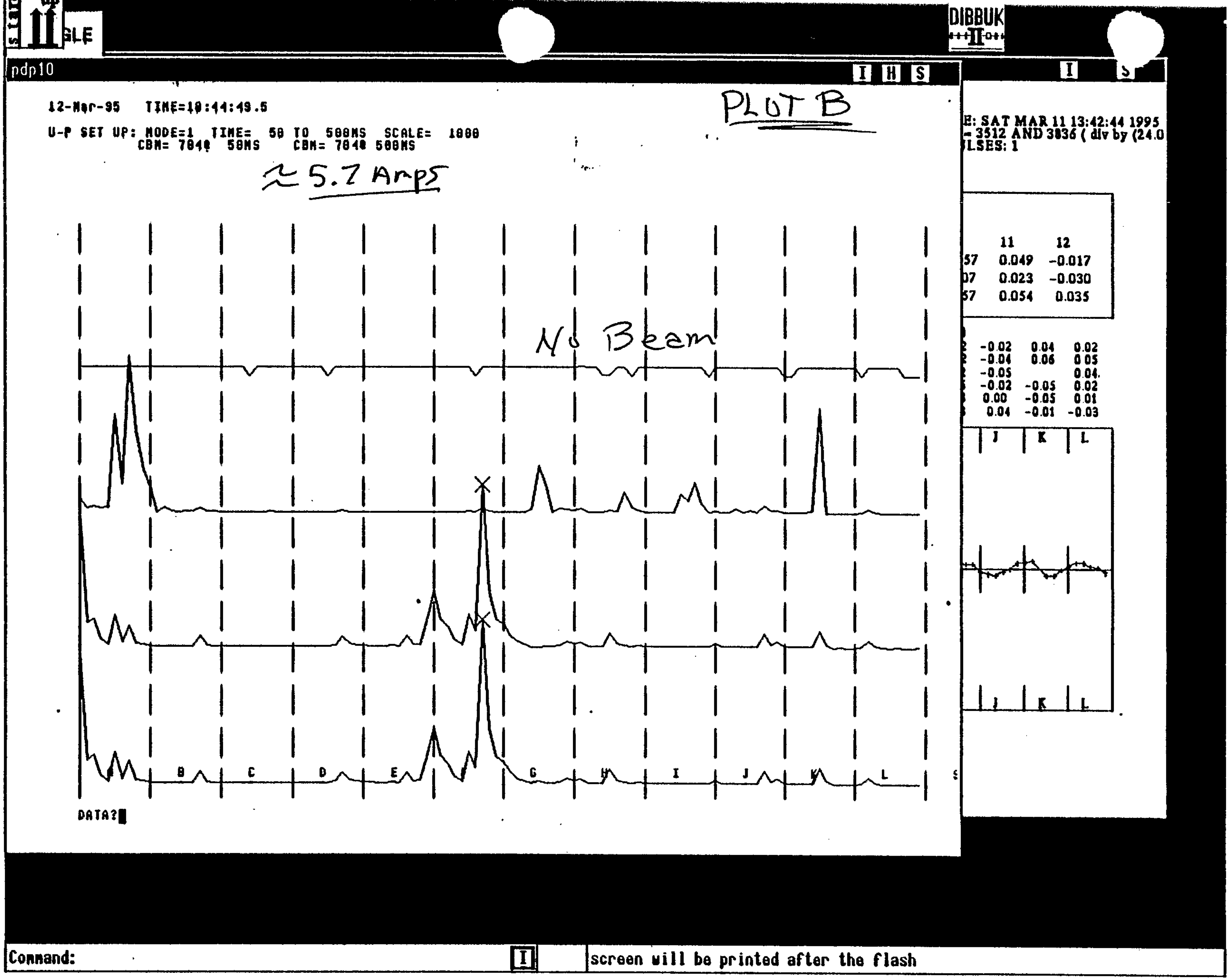
PLOT A

```
E: SAT MAR 11 13:42:44 1995
= 3756 AND 3836 ( div by (24.0
LSES: 1

       11      12
01   0.003   0.004
02   0.003   0.002
02   0.004   0.004

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

```
Command:
screen will be printed after the flash
```


pdp10
I
H
S
DIBBUK
SLE
I
S
A
B
C
D
E
F
G
H
I
J
K
L
J
K
L
J
K
L
I

PLOT B

```
12-Mar-95   TIME=10:44:49.5

U-P SET UP: MODE=1  TIME=  50 TO  500NS  SCALE=  1000
              CBN= 7040  50NS    CBN= 7040 500NS
```

≈ 5.7 Amps

No Beam

```
DATA?
```

```
Command:                          screen will be printed after the flash
```

```
E: SAT MAR 11 13:42:44 1995
= 3512 AND 3036 ( div by (24.0
LSES: 1

        11      12
57   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          0.04
  -0.02  -0.05   0.02
   0.00  -0.05   0.01
   0.04  -0.01  -0.03
```

X BAD DATA Point

②

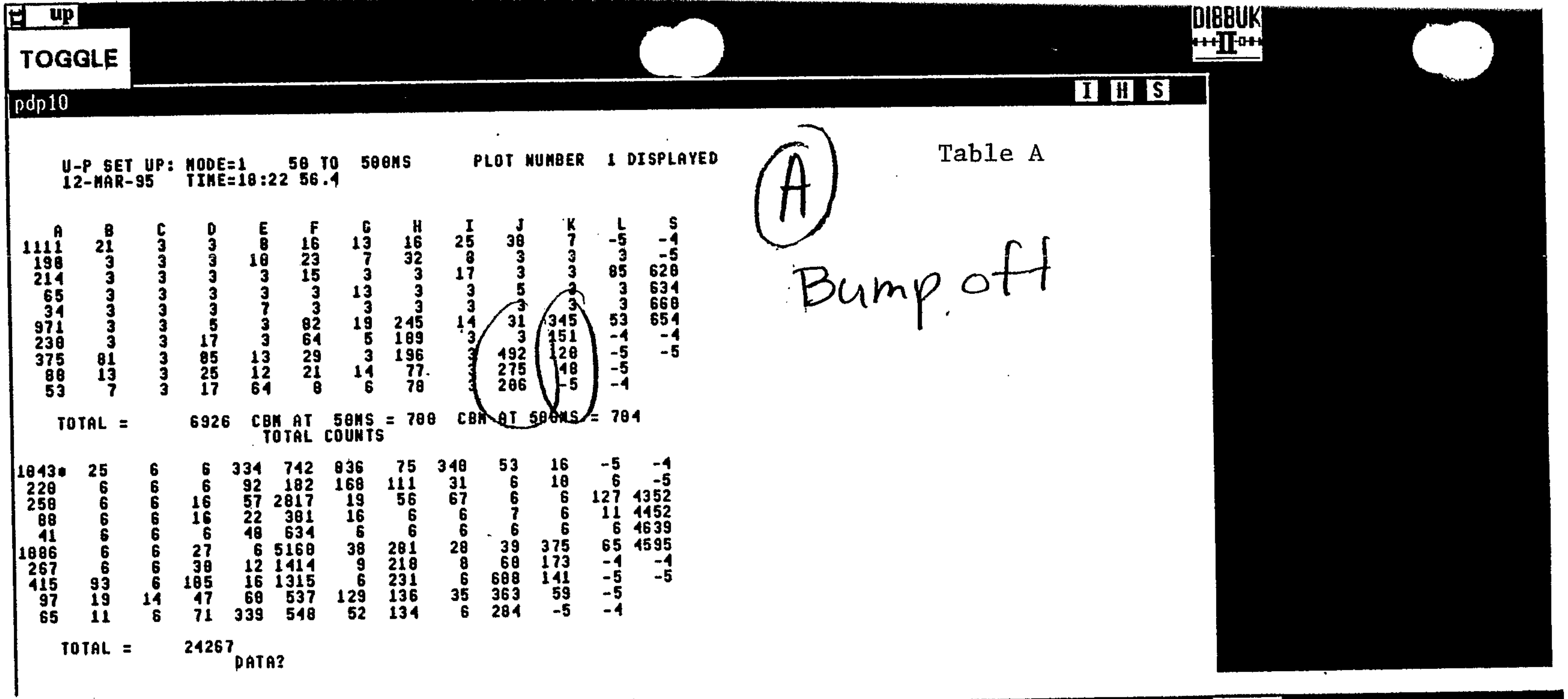


Table A

(A)

Bump off

```
U-P SET UP: MODE=1     50 TO  500MS       PLOT NUMBER  1 DISPLAYED
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     8    16    13    16    25    30     7    -5    -4
  190     3     3     3    10    23     7    32     8     3     3     3    -5
  214     3     3     3     3    15     3     3    17     3     3    85   620
   65     3     3     3     3     3    13     3     3     5     3     3   634
   34     3     3     3     7     3     3     3     3     3     3     3   660
  971     3     3     5     3    82    19   245    14    31   345    53   654
  230     3     3    17     3    64     5   189     3     3   151    -4    -4
  375    81     3    85    13    29     3   196     3   492   120    -5    -5
   80    13     3    25    12    21    14    77.    3   275   148    -5
   53     7     3    17    64     8     6    70     3   206    -5    -4

  TOTAL =       6926  CBM AT  50MS = 700  CBM AT 500MS = 704
                       TOTAL COUNTS

1043*   25     6     6   334   742   836    75   340    53    16    -5    -4
 220     6     6     6    92   182   168   111    31     6    10     6    -5
 250     6     6    16    57  2817    19    56    67     6     6   127  4352
  80     6     6    16    22   381    16     6     6     7     6    11  4452
  41     6     6     6    40   634     6     6     6     6     6     6  4639
1086     6     6    27     6  5160    30   201    20    39   375    65  4595
 267     6     6    30    12  1414     9   218     8    60   173    -4    -4
 415    93     6   105    16  1315     6   231     6   600   141    -5    -5
  97    19    14    47    60   537   129   136    35   363    59    -5
  65    11     6    71   339   540    52   134     6   284    -5    -4

   TOTAL =      24267
                      DATA?
```

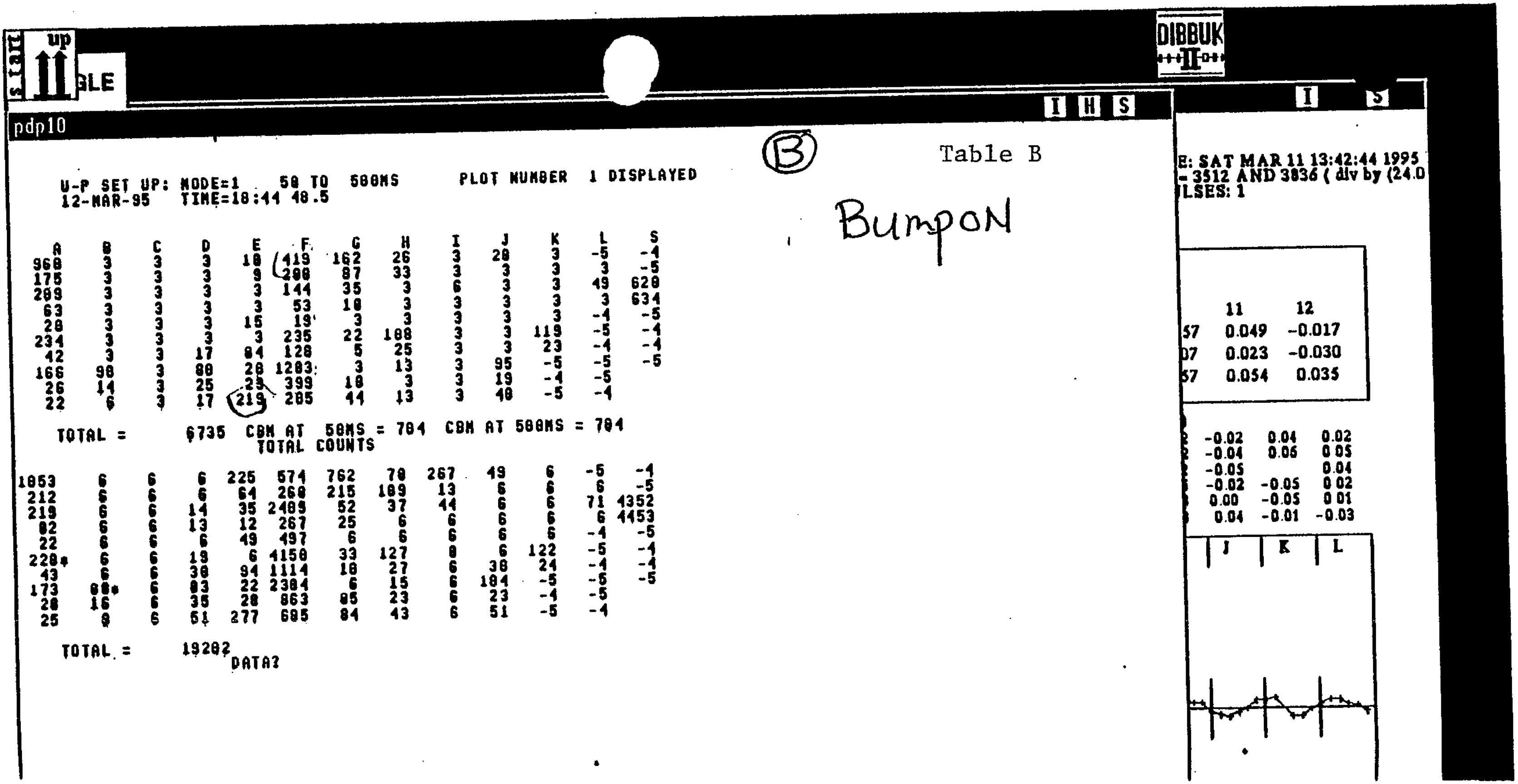


Table B

(B)

BumpON

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

    A     B     C     D     E     F     G     H     I     J     K     L     S
  960     3     3     3    10   419   162    26     3    20     3    -5    -4
  175     3     3     3     9   200    87    33     3     3     3     3    -5
  209     3     3     3     3   144    35     3     6     3     3    49   620
   63     3     3     3     3    53    10     3     3     3     3     3   634
   20     3     3     3    15    19     3     3     3     3     3    -4    -5
  234     3     3     3     3   235    22   100     3     3   119    -5    -4
   42     3     3    17    84   128     5    25     3     3    23    -4    -4
  166    98     3    80    20  1203     3    13     3    95    -5    -5    -5
   26    14     3    25    29   399    10     3     3    19    -4    -5
   22     6     3    17   219   205    44    13     3    40    -5    -4

  TOTAL =       6735  CBM AT  50MS = 704  CBM AT 500MS = 704
                       TOTAL COUNTS

1053     6     6     6   225   574   762    70   267    49     6    -5    -4
 212     6     6     6    64   260   215   109    13     6     6     6    -5
 219     6     6    14    35  2409    52    37    44     6     6    71  4352
  82     6     6    13    12   267    25     6     6     6     6     6  4453
  22     6     6     6    49   497     6     6     6     6     6    -4    -5
 220*    6     6    19     6  4150    33   127     8     6   122    -5    -4
  43     6     6    30    94  1114    10    27     6    30    24    -4    -4
 173    80*    6    83    22  2304     6    15     6   104    -5    -5    -5
  20    16     6    35    20   863    85    23     6    23    -4    -5
  25     8     6    61   277   685    84    43     6    51    -5    -4

   TOTAL =      19202
                      DATA?
```

```
E: SAT MAR 11 13:42:44 1995
= 3512 AND 3836 ( div by (24.0
LSES: 1

         11       12
57    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            0.04
  -0.02   -0.05    0.02
   0.00   -0.05    0.01
   0.04   -0.01   -0.03
```

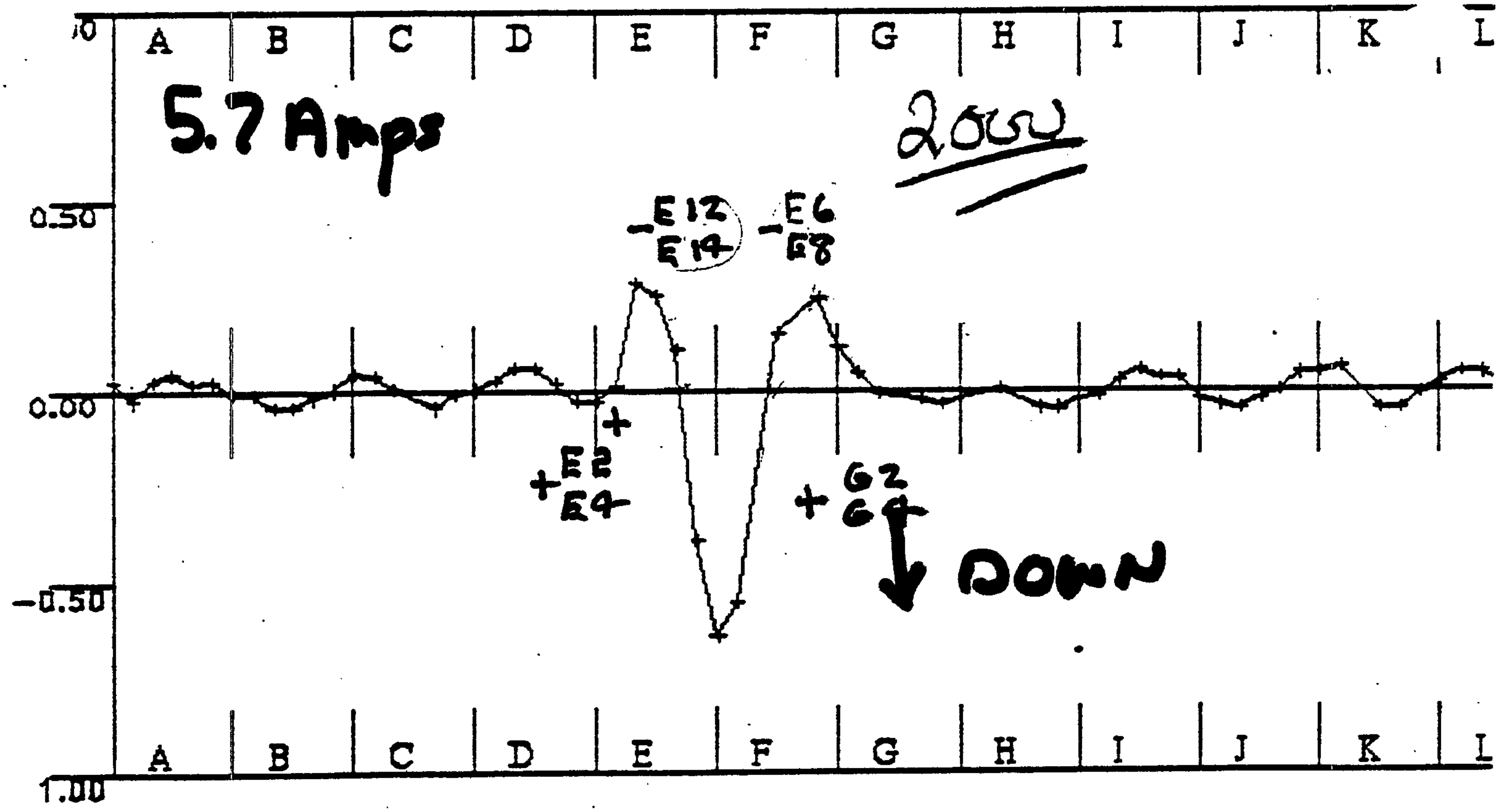
C (d)

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 3
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   0.0
-0.03  -0.01   0.04   0.02   0.01  -0.55   0.04          -0.02  -0.04   0.06   0.0
 0.02  -0.04   0.00   0.06   0.28         -0.01   0.01   0.02  -0.05          0.0
 0.05  -0.04          0.06   0.25   0.15                 0.05  -0.02  -0.05   0.0
 0.02  -0.02  -0.05   0.02   0.10         -0.02  -0.05   0.03   0.00  -0.05   0.0
 0.02   0.00  -0.01  -0.03  -0.39   0.24  -0.04  -0.05   0.03   0.04  -0.01  -0.
```