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Optimum Radial and Skew Position of the E-20 Beam Catcher

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Subject: Optimum Radial and Skew Position of the E-20 Beam Catcher

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Reported by: M. Tanaka

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$ 0. Introduction

This study is a part of continuous efforts to find the optimum position and skew of the E-20 beam catcher in order to minimize the radiation levels around the ring for the normal AGS runs/studies, following the previous studies (#175 & #176). Special attention was made to reduce the radiation losses at the F superperiod by skew.

$ I. Measurement Procedure

The beam with an intensity of 5.7*10**12 ppp was accelerated to t=300 msec at which point the R.F. was turned off to dump the beam inside the AGS ring. Then radiation losses around the ring were measured by Ring Loss Radiation Monitor (RLRM) with t = 280 - 340 msec as a function of both the upstream and downstream positions (RZE_US and RZE_DS) of the E-20 beam catcher.

The previous catcher studies with a R.F. off at t = 200 msec show that the catcher starts catching the majority of the dumpped beam at RZE (_US & _DS) = 700 mils and reaches the maximum shadowing at RZE = 1000 mils. The optimum catcher position is defined as a position where the catcher is most efficient to catch the lost ,dumped or excess beam without interfering the circulating stable beam.

Skew data were taken using F2,F6,F8 and F12 radiation monitors in the following conditions:

	RZE_US (mil)	RZE_DS (mil)
Case #1 :	848 fixed	849 to 948
Case #2 :	848 to 949	849 fixed
Case #3 :	999 fixed	999 to 1095

e.g. in Case #1 the catcher ends were skewed around the 848 mils position and the downstream end(RZE_DS) was moved radially outwards while the upstream end(RZE_UP) was fixed at 848 mils. v.v. in Case #2.

$II. Results

Fig.1, 2, and 3 show the results in Case #1, #2, and #3 respectively, wherer SUM is the total radiation loss around the ring and CBM is the circulating beam intensity at t = 300 msec. All losses are normalized to CBM = 5.7*10**12 ppp.

In Case #1 , the radiation levels at F6,F8 and F12 increase slightly as RZE_DS increases while SUM and F2 values are almost constant in the measured RZE_DS range. The similar result was obtained in Case #3 too.

In Case #2, the radiation levels at F6,F8 and F12 as well as SUM reduce as RZE_US increases and show some minima around RZE_US = 910 mils while the F2 value increases slightly and stays constant at RZE_US > 890 mils. Since the F2 monitor is located immediately after the downstream end of the catcher and must receive most of the forward leaks, its increase is acceptable as long as SUM does not increase.

$III. Conclusions

Based on the catcher studies done so far and a supplementary study during the 1985-fall FEB run (see $ Appendix), we can make the following conclusions;

1. The optimum E-20 catcher position should be between RZE(_US & _DS) = 800 and 1000 mils. At RZE < 650 mils the majority of the lost/dumpped beam will be caught in the restricted aperture at L12 (a bump appears at L14 & L16) rather than at the catcher. At RZE > 1100 mils it appears that the catcher will interfere with the circulating stable beam and start causing an excess beam loss.

2. The skew data for Case #2 show some minima in F6, F8 & F12, indicating that the optimum skew position is at RZE_US = 910 mils and RZE_DS = 850 mils though the skew data are not complete and the effect on the F superperiod is rather weak (20 -30 % deduction).

3. Additional data on the effects of skew are needed.

4. It will be difficult to find the more fine optimum position and skew since the fine structures of the radiation loss spectrum around the ring depend on not only the beam energy and intensity but also on details of the running conditions.

$ Appendix

During the 1985_fall FEB run, the radiation levels around the ring (RLRM plot) had been carefully monitored as a function of the catcher position with t= 65 - 665 msec. A typical result is shown in Fig.4.

Fig.5 shows SUM, E20+F2+F4, L14+L16, C6 and SUM-E20-F2-F4 as a function of the catcher position. All values are 3-to-5 pulse average and are normalized to the beam loss dCBM = CBM(65) - CBM (665) = 4 *10 **12 during acceleration (mainly at transition).

Since dCBM is known to be not so reliable, these results should be taken just as the supplementary data. However it is clear that at RZE > 800 mils two predominant bumps (i.e. hot spots) at the C anf L superperiods will disappear.

$ References

1. Y. Makdisi, AGS Studies Report #175, " E-20 Beam Catcher Position and Skew".

2. Y. Makdisi, AGS Studies Report #176, " Additional Position Studies on the Beam Catcher at E-20".

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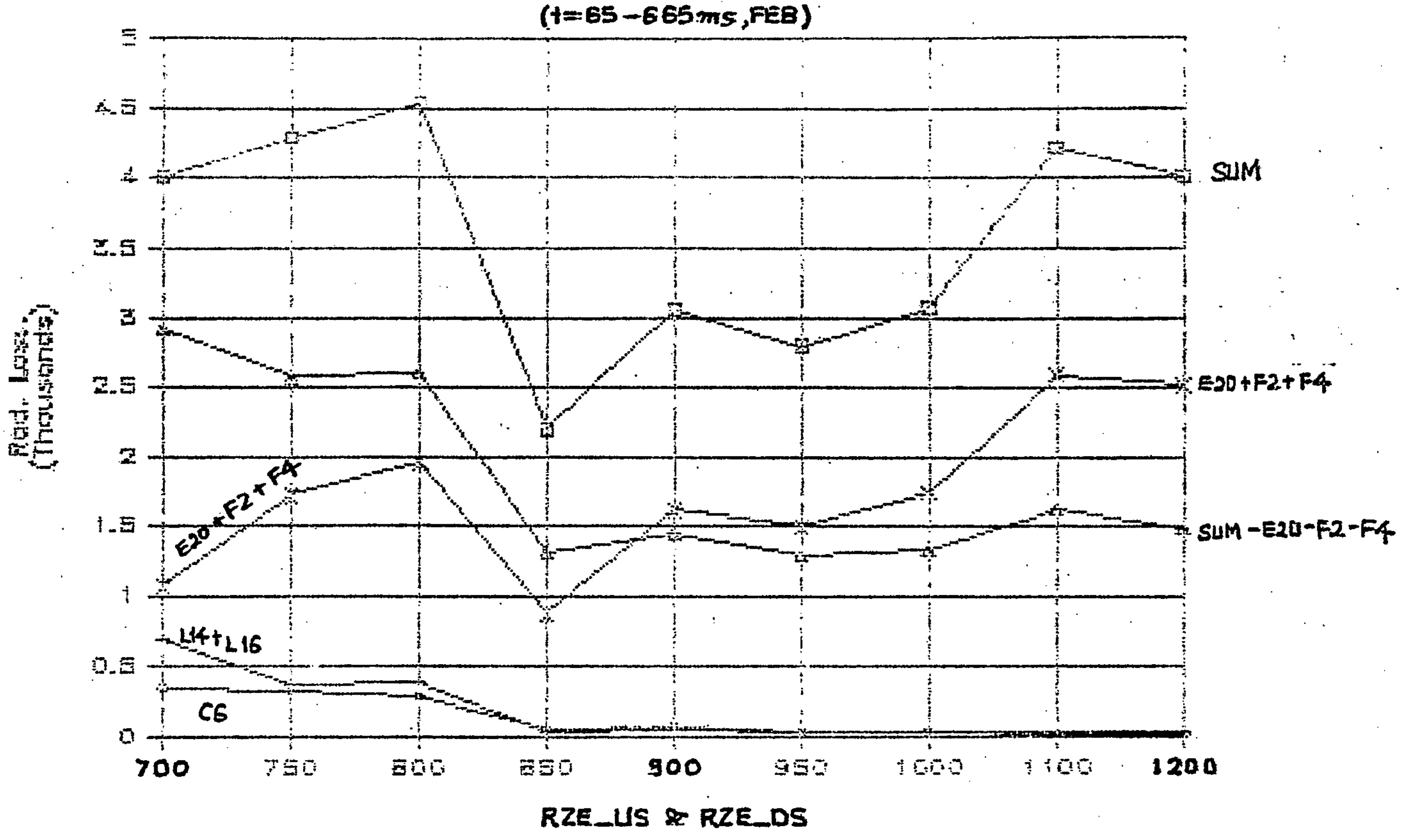
Fig.4 Rad. Loss VS Catcher Pos.

(t=65-665ms,FEB)



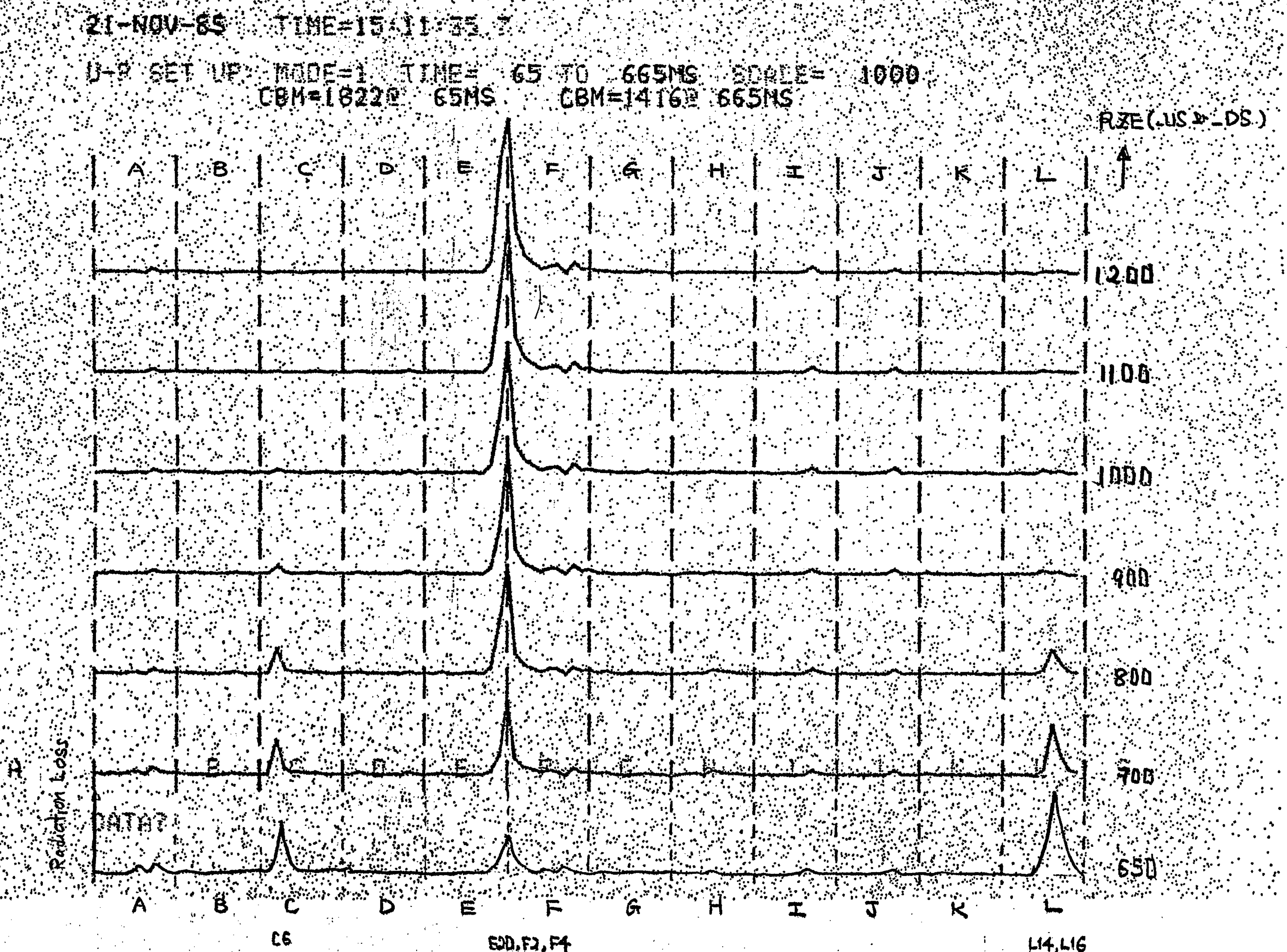


Fig. 4 AGS Ring Superperiod

Fig. 1 Rad. Loss VS Catcher Pos. Case #1

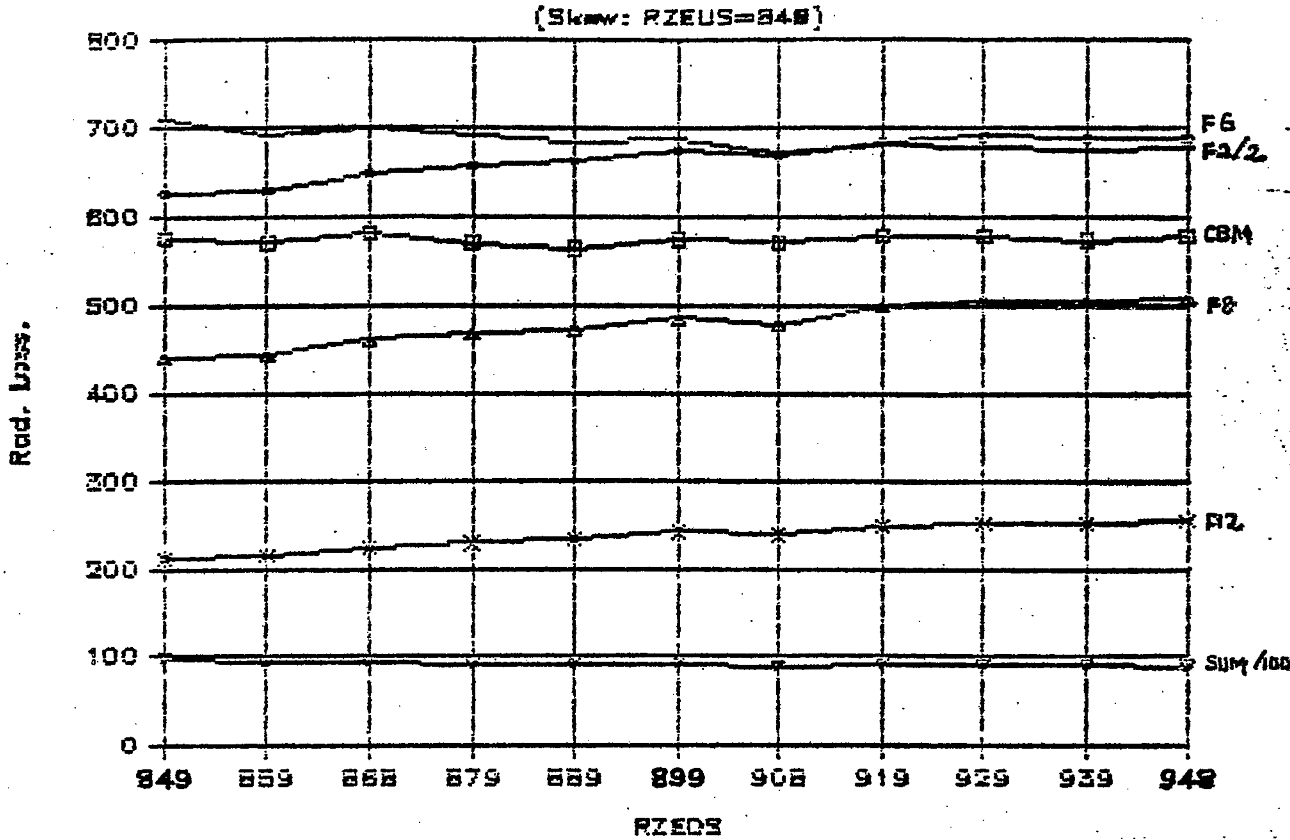


Fig. 2 Rad. Loss VS Catcher Pos. Case #2

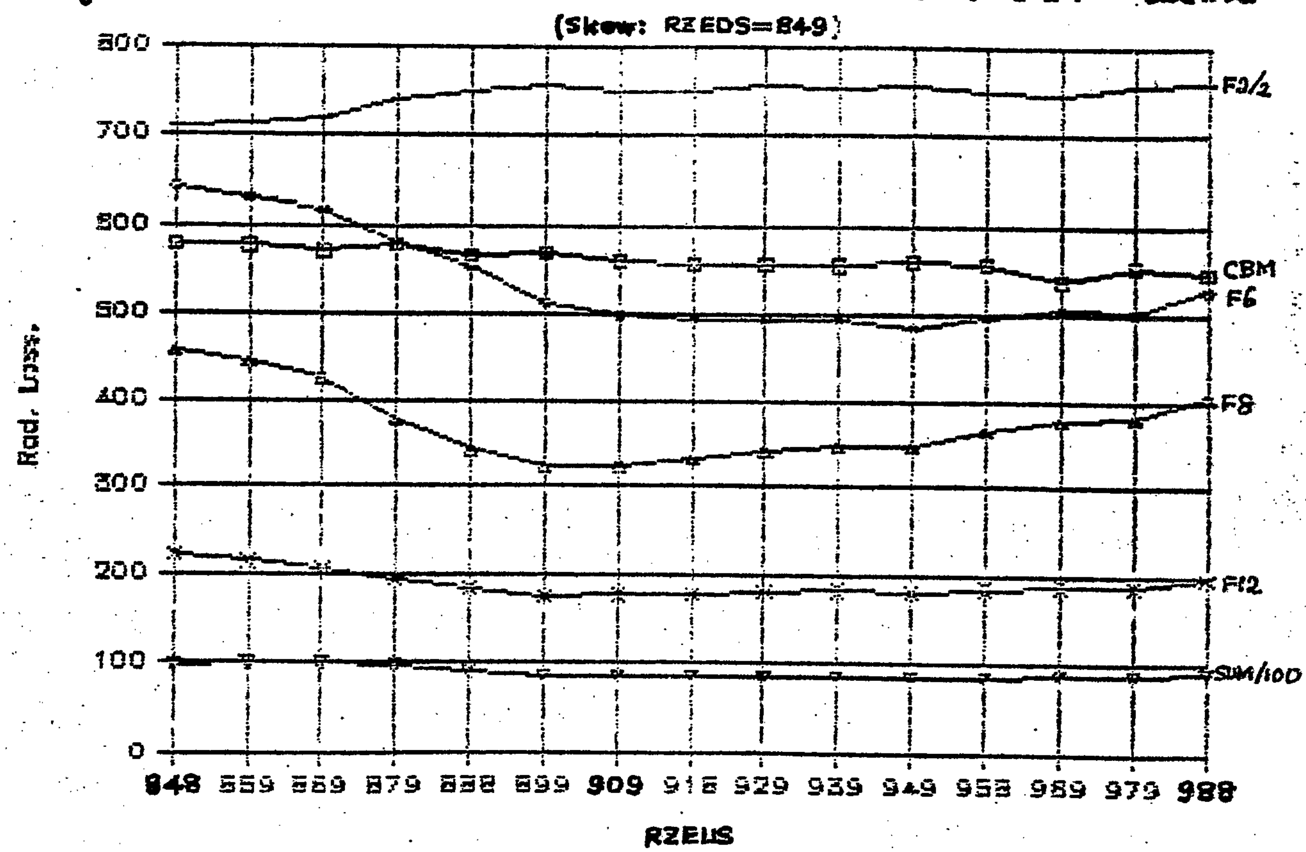


Fig. 3 Rad. Loss VS Catcher Pos. Case # 3