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Subject RLRM Response and Prototype Test

Introduction

In view of a need to increase the sensitivity of the RLRM system, studies were performed to assay the response with different detector locations, and to test a prototype chamber with larger volume and greater pressure.

Method

The test location was the E-12 RLRM station (magnets E-11 and E-12). The standard geometry is a 20 foot length of RG 318/U coaxial cable (~ .9" effective ID for outer conductor, .35" OD for inner conductor) pressurized to 30 psig with Argon gas (no flow); the chamber is located just below the upper plate of the magnet support girder, on the outer radius side.

Orbit distortion to provide beam loss at this azimuth, as suggested by E. Gill, was provided by the "E-10 bump," a DC backleg winding. A representative orbit is shown in Fig. 1. Beam losses produced by this bump occur from injection to about 15 msec after.

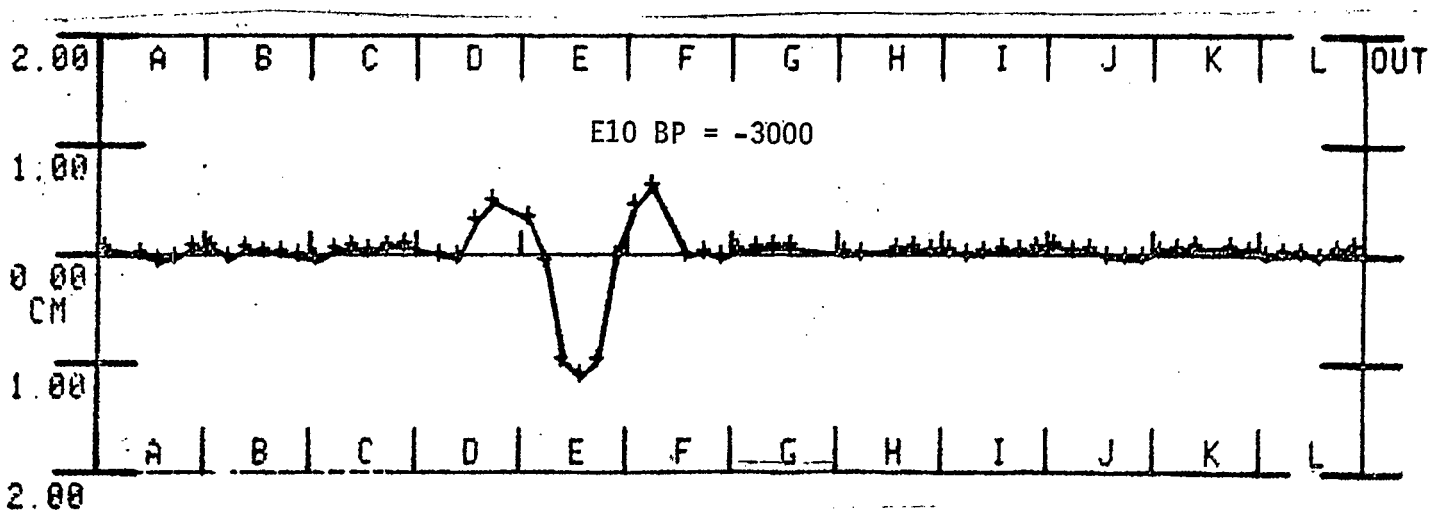

Fig. 1

Beam loss data was supplied by the analog and digital outputs of the RLRM system, and in some cases correlated by the E-20 circulating beam monitor difference (bump off-bump on). Digital data from the RLRM system always included a beam off reading to provide offset corrections.

The prototype chamber was 20 feet long, consisting of a nominal 2" copper water tubing outer electrode, and a nominal 3/8" copper tube inner electrode. All fittings except one were soft soldered (95% Sn, 5% Sb), One threaded fitting facilitated disassembly but reduced rated working pressure limit from 300 psig to 175 psig. The chambers were operated at 150 psig. The central electrodes were maintained coaxially with the outer tubing by means of acrylic disks.

Results

Preliminary values for RLRM output for the standard chamber at E-12 in standard location, and a standard chamber at E-12 on the dust cover, on the median plane, (E-12′) are listed in Table I as a function of the E-10 bump amplitude. The CBM column reflects intensity at 100 msec; no direct indication of beam loss is shown for the digital data. The RLRM digital data are corrected for background (beam off) and neglect channels with less than 2 counts above background. Analog data is from scope photos. ΔCBM is the difference in the E-10 CBM (bump off-bump on) at 100 msec; E-12′ is the peak amplitude of the pulse from the test chamber on the median plane.

TABLE I

	Digital							Analog	
E-10 Bump	CBM	E-12 RLRM	E-12′ RLRM	Max CH	Max Amp	Total	Max/Total	ΔCBM	E-12′
0	988	0	0	F-2	24	106	.23	$x10^{-12}$	V
+3000	520	0	27	E-20	48	178	.27	5.7	0
-2000	782	6	646	E-12	646	787	.82	1.8	3.5
-2000	802	8	756	E-12	756	888	.85		
-3000	628	64	478	E-12	478	601	.80	4.4	12(sat.)

Note the gain obtained by positioning the detector on the dust cover is as high as 100. One inconsistency is that the digital data decreased by one third with a change in bump amplitude from -2000 to -3000, but the analog data increased from 3.5V to saturation (12V) with the same change in bump amplitude!

The relative signal output for the prototype chamber compared to the standard unit was determined with both units in the standard position at E-12, using the RLRM electronics for both channels. In two runs the ratio was 31/1 and 31/2, or a mean of 20 ± 10 to 1.

The relative signal atop the magnets was 8, and inside the magnet ring (above the catwalks) 4, compared to the standard location just below the girder top which measured 32. All measurements were made with the prototype chamber.