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MEASUREMENT OF DUTY FACTOR IN THE SLOW EXTERNAL BEAM

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With a structure-free spill, the expected accidental counts from two counters — placed so that no real events can occur — is given by

$$A = C_1 \; C_2 \; \tau / t_{SPILL}$$

where C_1 and C_2 are singles counts, t_{SPILL} is the duration of the spill, and τ is the time resolution of the coincidence circuit. If the spill has structure, the accidental rate will be higher and an effective gated time t_{eff} can be measured, defined by the equation

$$t_{eff} = C_1 \; C_2 \; \tau / A$$

Since the present slow beam spill is ~400 milliseconds long it is expected that t_{eff} will be always less than 400 milliseconds; the better the quality of the beam the larger the t_{eff}.

Two pairs of counters were placed in the SEB primary cave to measure the effects of the spill structure; one pair was placed behind heavy shielding in the vicinity of target station A, the other near the beam pipe at S50. The geometry of these pairs was such that real events were unlikely. Two coincidences were measured, one with no delays, and one with delay of 75 ft of RG213 cable. The latter coincidence is expected to cancel the effect of any 4.5 MH_z structure present, so that a comparison of counting rates of delayed and undelayed coincidence 61 $\pm$ 1 msec was measured by means of a cable delay curve using a pulser. The results of some measurement taken at about 1500 on 4/17/70 are shown in the table on the next page.

Table 1

Counter	Singles		Accidentals		Gated time	t_{eff}
	C_1	C_2	timed	75' delay	msec	msec
S 100 (vicinity of A)	735 018	722 419	104 881	98 615	1200	328
	412 724	442 233	43 913	42 310	300	263
	363 557	343 475	47 166	45 530	200	161
	145 446	146 682	16 257	15 399	100	84
lower phototube voltage	48 779	46 895	409	402	1000	340
	487 822	460 908	4 252	3 972	1000 x 10	322*
S50	278 873	287 594	20 903	16 931	1000	233
	69 573	72 924	5 092	4 309	100	60.7

*Average of 10 pulses

The run with S100 phototubes at low voltage was taken to see if there was any loss of accidentals at the higher voltage due to saturation of the phototubes. The effective spill time at S100 is seeen to be ~320 milliseconds or .8 of the gated time when the scalers are gated to sample a fraction of the spill. - The fraction of accidentals due to 4.5 MH_z rf structure is seen to be small. At S50 the effective spill time is ~230 milliseconds or .6 of the gated time. The 4.5 MH_z component is also considerably larger here than at S100. The difference in spill structure may result from the fact that the S50 counters measure scraping and are sensitive to fluctuations in beam momentum, while the S100 counters measure total protons incident on target station A.

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