

Beam size (vertical) before and after transition with 75 mA 95 μ sec injected beam.

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Date 12/22/76 Time 1700-1800 Experimenters E. Raka

Subject Beam size (vertical) before and after transition with 75 mA 95 μ sec injected beam.

OBSERVATIONS AND CONCLUSION

The vertical targets at J-19 (a β_{\max}) were used to measure the beam size at 172, 115, 255, 370, 550 msec. An injected beam of 75 mA for \approx 95 μ sec was being used resulting in peak intensities of 10^{13} and average $> 9.5 \times 10^{12}$. The 95% size and emittance was measured using visual observation of the normalized current transformer signal. Since some beam loss was present up to \approx 100 msec (48 msec from injection) no measurements were attempted before this time. We list the results.

Time	BY	GC	Size	Normalized ϵ/π	$\beta_{\max} = 22$ meters
115	2.05	3,682	1.37"	28 μ rad meters	
172	5.56	10,129	.810"	26.7 " "	
255	11.16*	20,331	.818"	54.8 " "	
370	18.39*	33,508	.63"	51.2 " "	* scaled from 172
550	28.86*	52,583	.49"	50.4 " "	Gauss Clock readings.

From this data we see that the only growth in emittance occurs after transition (presumably) which occurs at \approx 214 msec. If one extrapolates the 115 msec value back to injection we obtain 2.36" as the 95% beam size at a β_{\max} . This is not too far from the maximum potentially available aperture of \approx 2.75". It represents at least a factor of two in emittance over what one might expect from the linac however.

The blow-up at transition could be due to the fact that the vertical dispersion is not zero in the AGS. This is due to the presence of a significant skew quadrupole field which can cause a beam size contribution due to momentum spread. The latter is much greater after transition due to the fact that the uncompensated space charge effect at transition causes a very large blow-up in longitudinal phase space. One should repeat these measurements at 4×10^{12} where it is possible to pass transition with no dilution if the initial longitudinal phase space area is large enough.