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

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MCE Jet

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

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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 ≈ 95 μsec 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 ≈ 100 msec (48 msec from injection) no measurements were attempted before this time. We list the results.

Time	βγ	GC	Size	Normalized ϵ/π β_{max} = 22 meters
115	2.05	3,682	1.37"	28 μrad 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 " "
550	28.86*	52,583	.49"	50.4 " "

*scaled from 172 Gauss Clock readings.

From this data we see that the only growth in emittance occurs after transition (presumably) which occurs at ≈ 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 ≈ 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.