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Vertical Beam Size and Emittance at Low and High Intensity

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OBSERVATIONS AND CONCLUSION

Purpose: To measure the vertical emittance of the AGS beam at different intensity levels and momenta in order to determine the magnitude of phase space dilutions that are present.

AGS Conditions: Measurements were made parasitically on SEB runs at 5 GeV and $\approx 3 \times 10^{12}$ protons/pulse and normal 28.5 GeV SEB running at $\approx 9.5 \times 10^{12}$/pulse; linac current $\approx$ 70 mA. $\approx$ 110 μsec at high intensity and 5-6 turns at low intensity.

Procedure: The J19 vertical targets were used to remove either 5 of 10% of the beam from the top or bottom. Records of the beam frequency and gauss clock reading were made at the end of the loss pattern as observed on the normalized current transformer. The latter signal was measured before and after by an A to D converter and the difference multiplied by five displayed.

Results:

	Size	βγ	GC	Emittance*	Time	
3×10^{12}	1.45"	1.33	--	20.5 πμradM	95 msec	
6 turns 79 mA	.77"	5.34	--	23.2 "	175 "	
3×10^{12}	1.215"	1.34	--	14.5* "	96 "	*90% emittance
5 turns 76 mA						
9.5×10^{12}	1.675"	1.39	2459	28.5 "	94 "	
72 mA	.845"	6.88	12625	36 "	194 "	
	.795"	6.88	"	31.8 "	194* "	*zero theta skew quad program on.
1.3×10^{12}*	1.88"*	.686	--	17.7 "	52*	*i.e. injection spiraling beam only

*95% except as noted.

Comments: Both the low and high intensity results indicate that the emittance growth from about twice injection momentum to near transition energy can be controlled. There is still significant growth from injection to a $\beta\gamma \approx 1.4$ although the accuracy of the spiraling beam measurement is less than that of the others. Also HEBT emittance of $\approx 5\ \pi$ for 90% have been obtained by J-L LeMaire which imply considerable dilution in the injection process. The latter is apparently only mildly intensity dependent.