BNL-104091-2014-TECH

AGS.SN215;BNL-104091-2014-IR

To Explore the Potential of the Presently Installed Horizontal Sextupoles for Chromaticity Correction

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December 1986

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U.S. Department of Energy

USDOE Office of Science (SC)

DISCLAIMER

12/30/86

Number 215

AGS Studies Report

Date(s) December 9, 1986 Time(s) 0830 - 1630

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Reported by W.K. van Asselt

Subject/Purpose To explore the potential of the presently installed horizontal sextupoles for chromaticity correction

Observations

While observing the sextupole magnets in the ring and the power supply, the current in the string was increased to the maximum attainable value of 575 A at a 50% duty cycle. At this duty cycle, the power level was considered maximum for the power supply. The temperature of the magnet coils rose to maximum values of 85-88°F under these conditions.

Next, a low intensity beam (3×10^{11} ppp) was setup to allow internal dumping of the beam, without an excessive radiation load on the AGS. Tune measurements were done as a function of radius to determine the chromaticity at 27 GeV/c for some values of the current in the horizontal sextupole string. Because we could not use the PUE system at these low intensities, the necessary radial information was derived from measurements of the rf frequency.

Figures 1 and 2 show some results of the measurements. Although no absolute radial information could be obtained, it is known from earlier measurements that the point where the lines in the figures cross corresponds to a radius of approximately -4 mm (Studies Report 182). Because the behavior in this region is the most linear, the chromaticities were determined from the slope of the lines in this region. The following table gives the results.

I_H(A)	ξ_H	ξ_V
0	- 2.84	+ 0.722
200	- 1.98	+ 0.103
400	- 1.13	- 0.41
560	- 0.21	- 0.98

During the experiment, IPM scans were also taken. Figure 3 shows how the vertical emittance increases when we fully power the horizontal sextupoles. This is explained by the fact that the vertical chromaticity is out of control at lower momenta, due to the rise time of the power supply. A measurement, where the horizontal as well as the vertical sextupoles were powered in such a way that both chromaticities were zero at 20 GeV/c, showed that there was no increase in emittance at that momentum, see Figure 3. (In this case, there is still an increase in emittance at lower momenta, presumably due to a mismatch of the currents in both sextupole strings.)

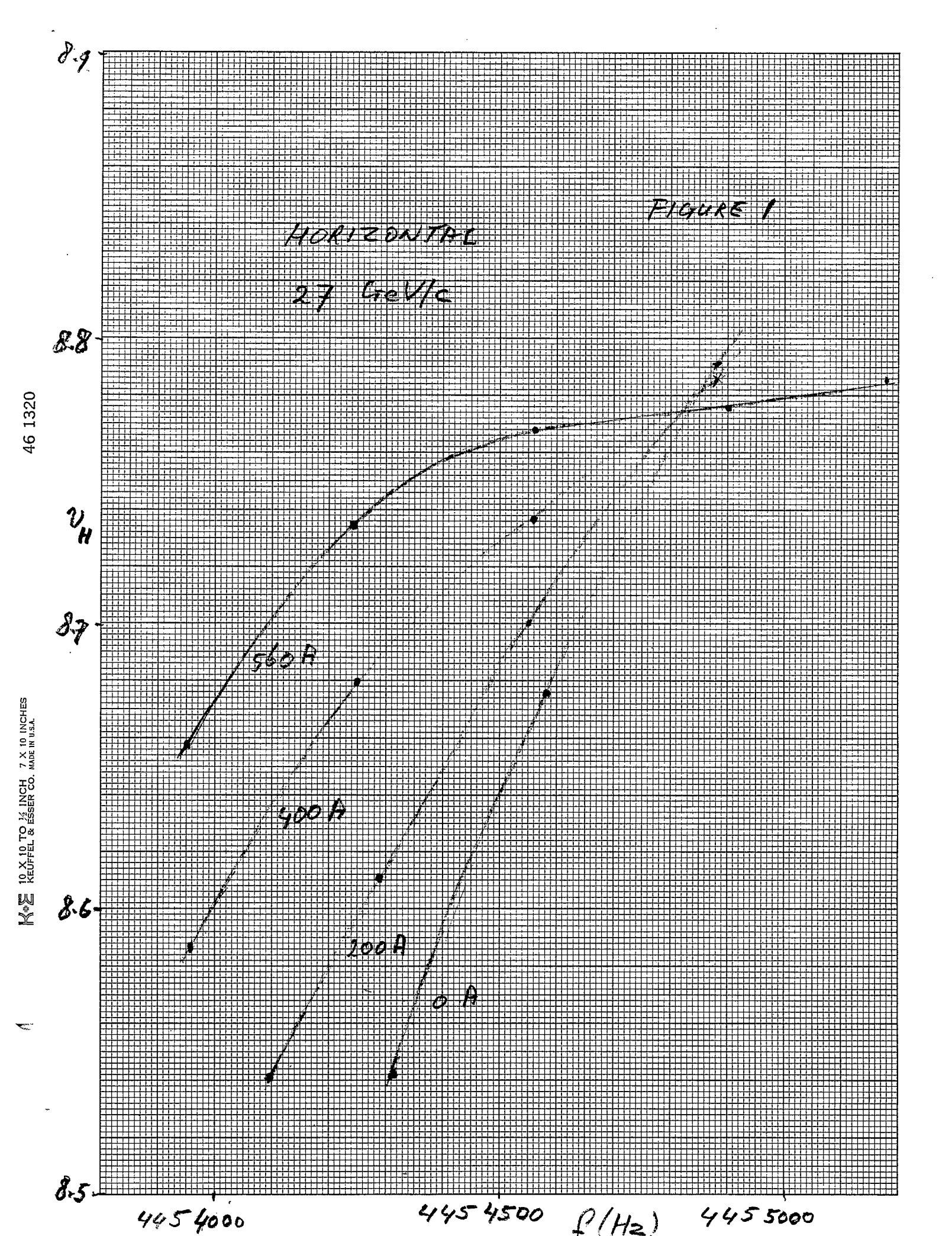
Conclusion

The possibility to correct the chromaticity is at present severely restricted for the following reasons:

1. The sextupole strength is insufficient, because there are only 8 magnets for the horizontal string and because of current limitations of the power supply.
2. The voltage of the power supply is insufficient to produce the required ramp rate of the current pulse.

The heat run has shown that there is no problem in running the sextupoles at the power levels used and that it is feasible to run the sextupoles at even higher currents, especially when the cooling of the magnet coils is improved (at present each two coils are cooled in series).

The chromaticity measurements do not indicate that there is any talk of saturation in the sextupole magnets.



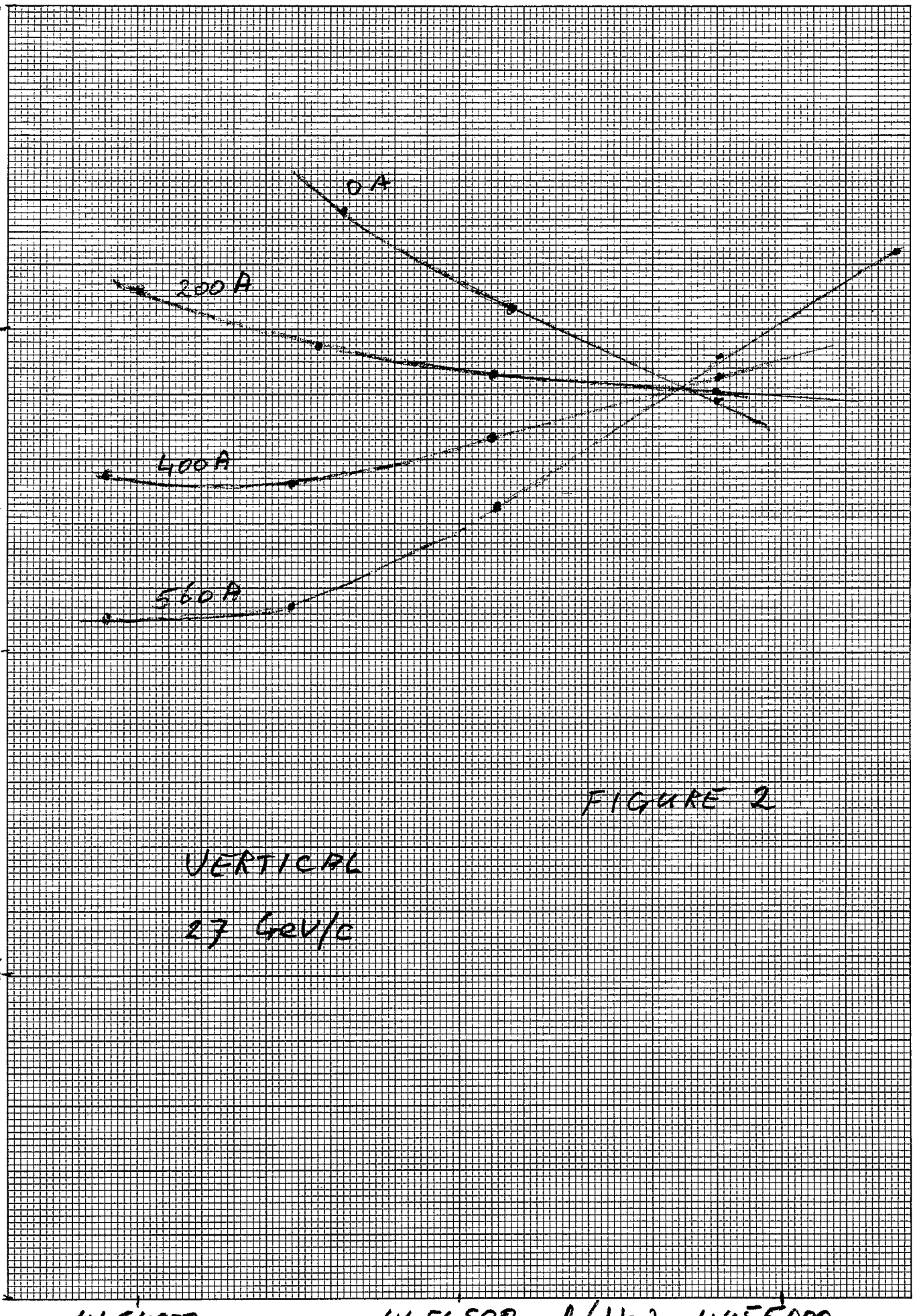
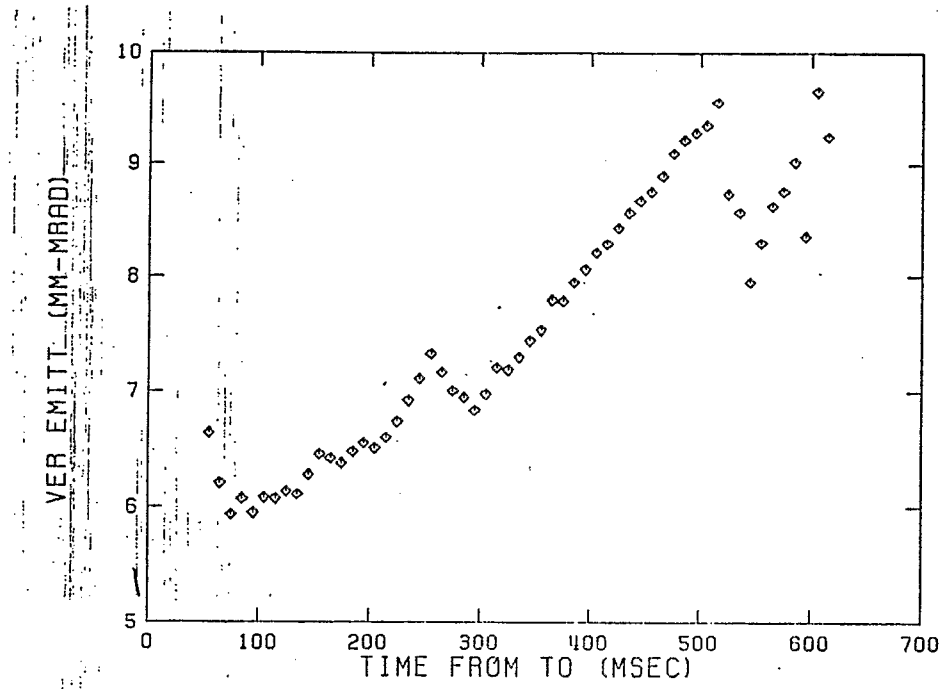


FIGURE 2

VERTICAL

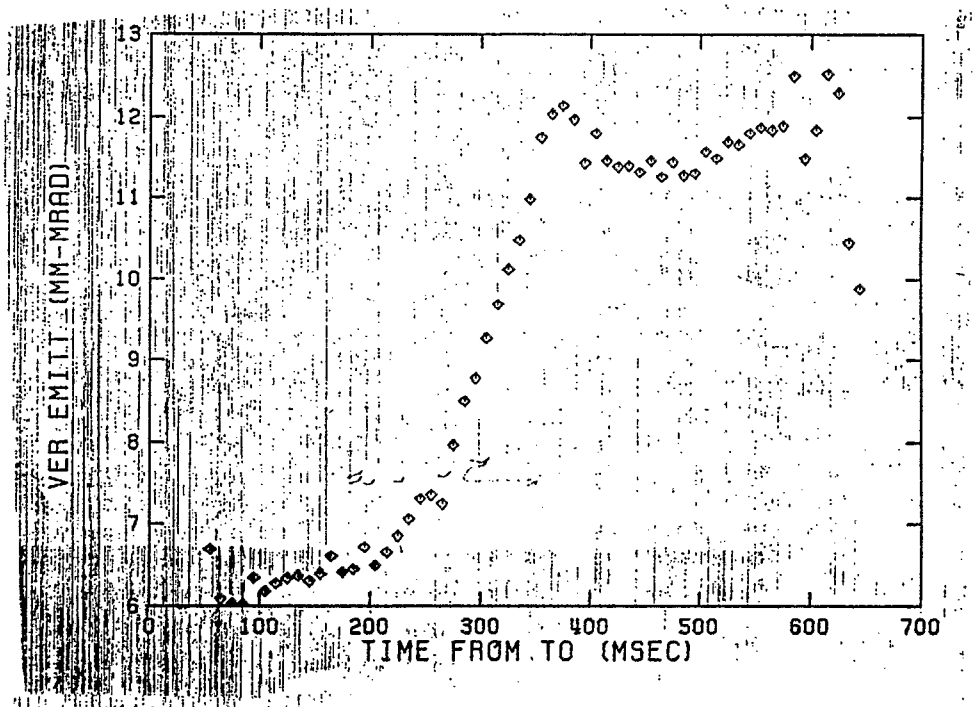
27 GeV/c

FIGURE 3



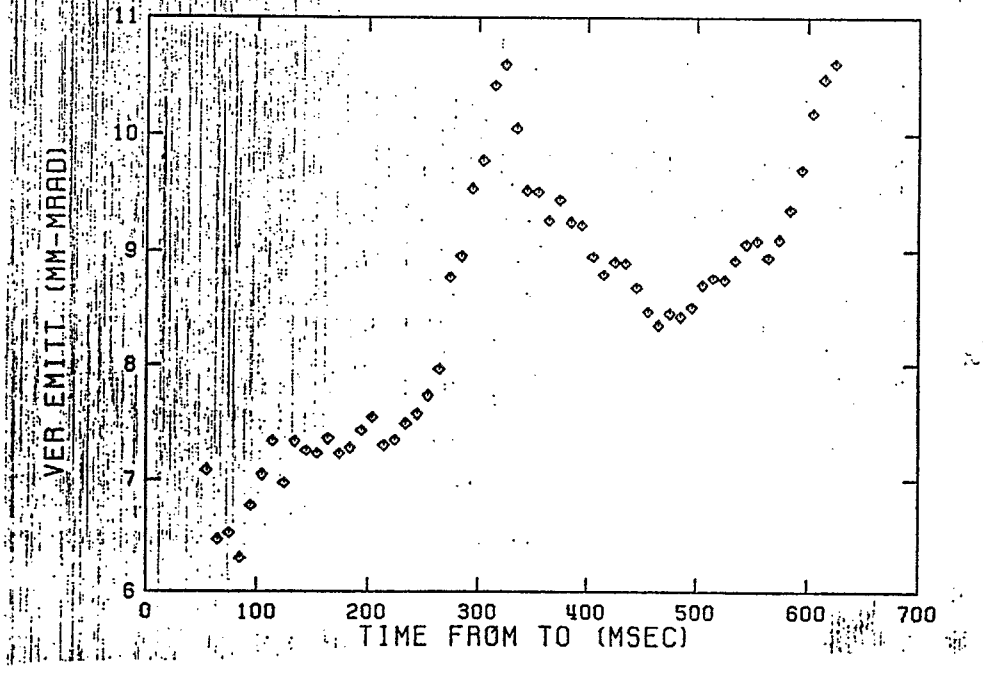
a

$I_H = 0$ A



b

$I_H = 560$ A



c

$I_H = 400$ A

$I_V = 200$ A