RHIC-PG-45

RHIC PERFORMANCE AND THE CHOICE OF THE RF FREQUENCY

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April 3, 1984

~~RHIC~~

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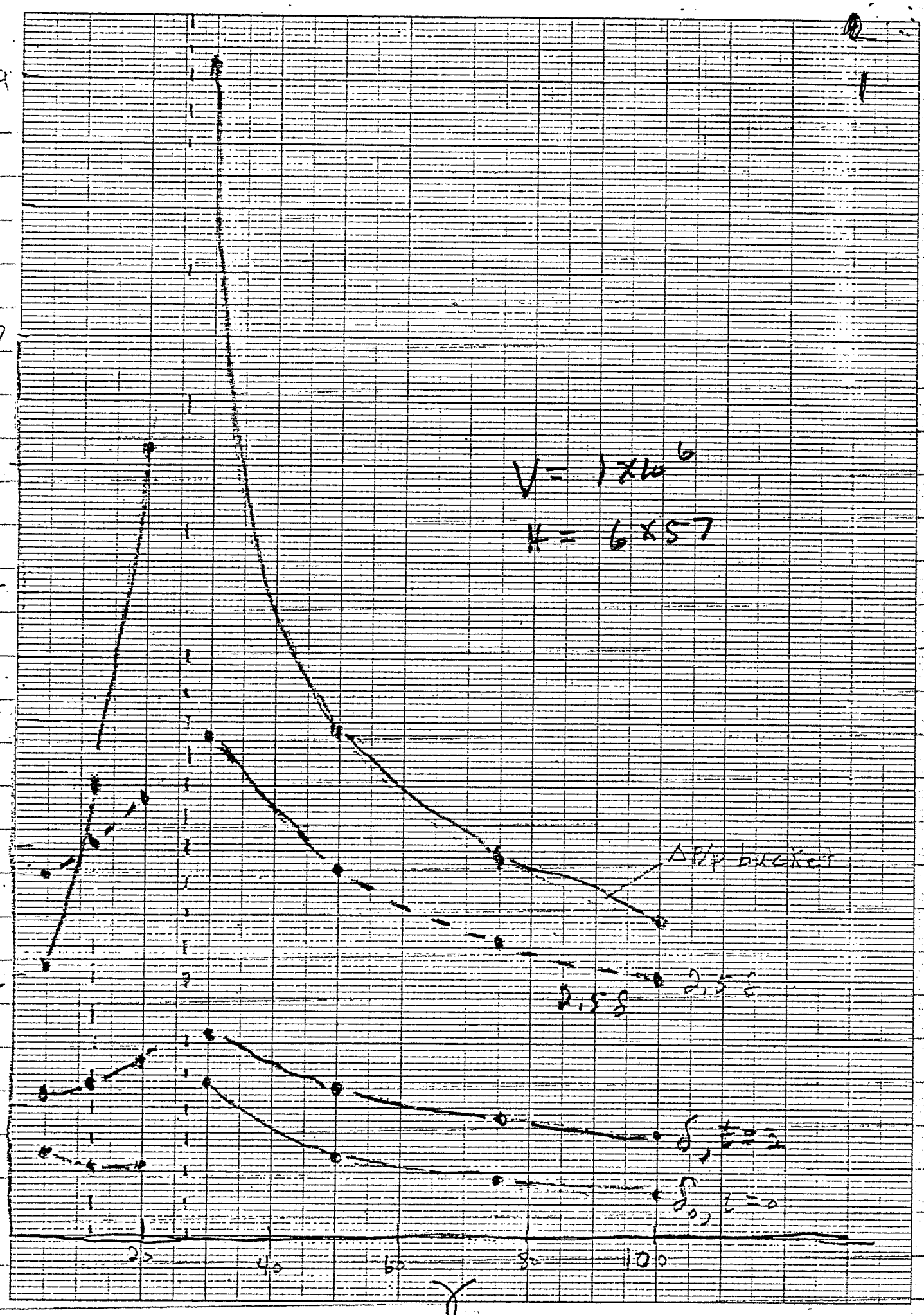
The attached graphs ~~[illegible]~~ indicate how the choice of the RF frequency, $h = 6 \times 57$ versus $h = 12 \times 57$ influences the intra-beam scattering and thus the RHIC performance.

Figure 2 shows that $h = 12 \times 57$ RF requires the voltage of $V = 2 \times 10^6$ compared to $V = 1 \times 10^6$ for $h = 6 \times 57$.

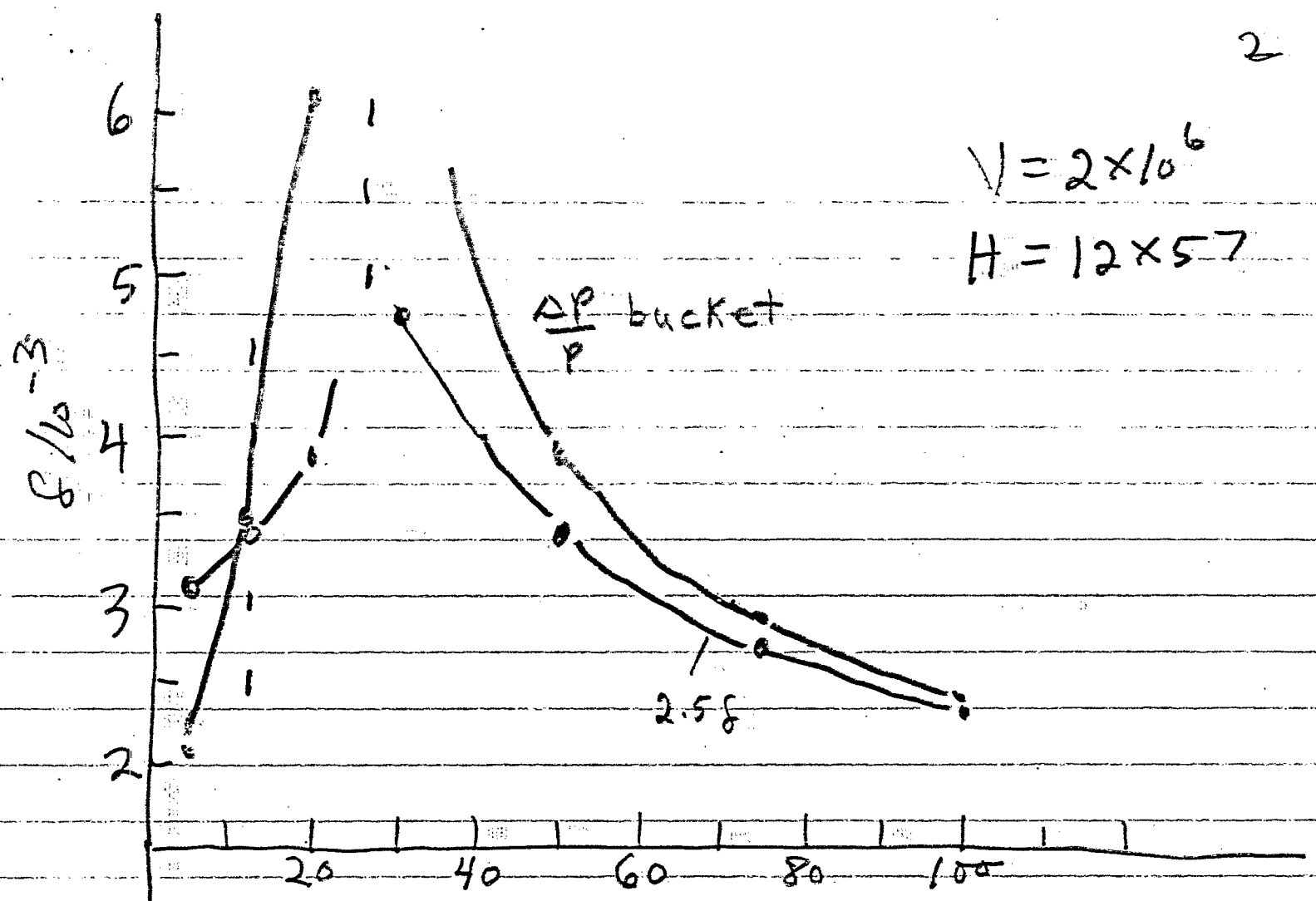
Figure 3 shows that the rms bunch length, σ_e in cms, at $\gamma = 100$ is

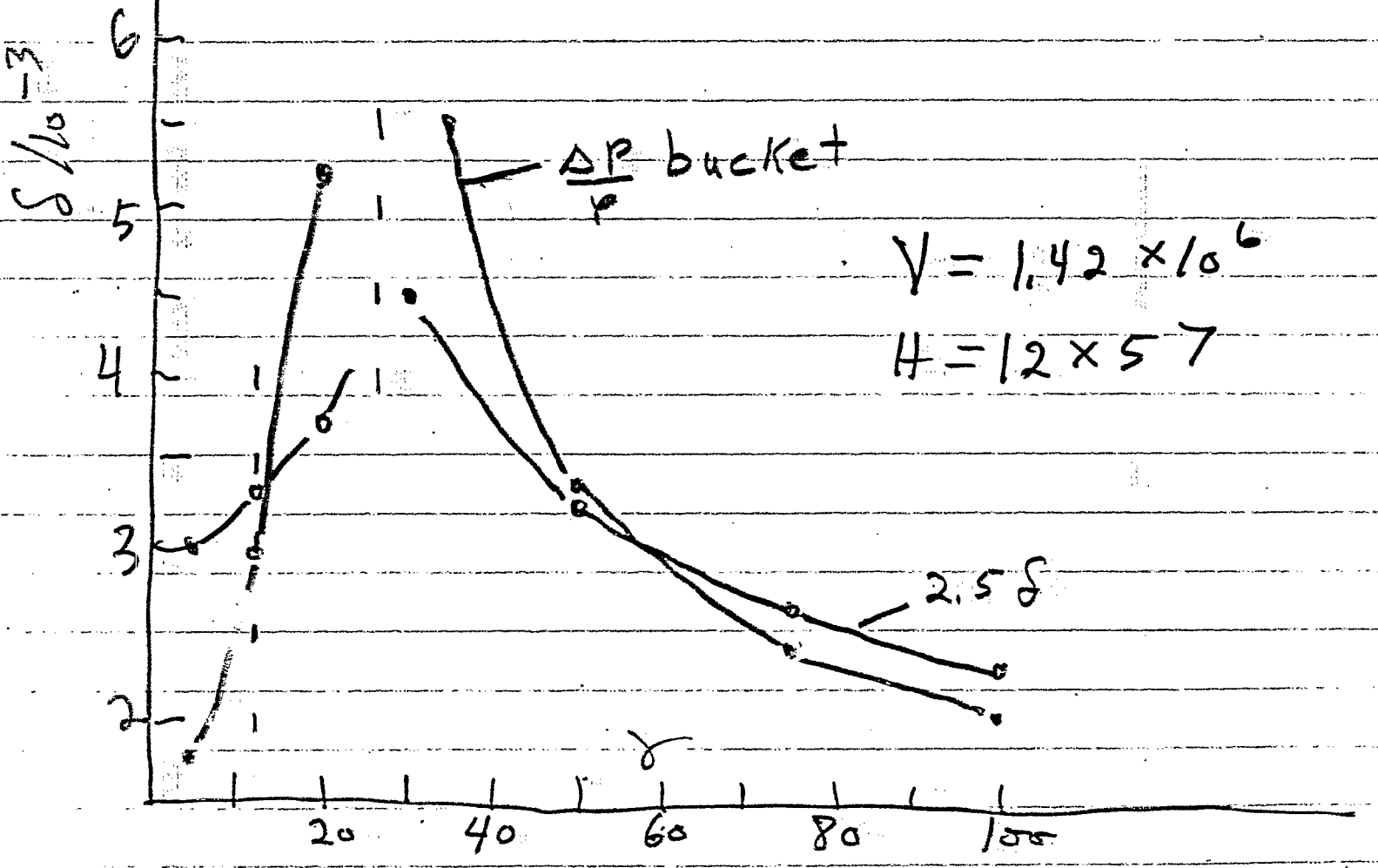
$$h = 6 \times 57 \qquad \sigma_e = 110 \text{ cms}$$
$$h = 12 \times 57 \qquad \sigma_e = 70 \text{ cms}$$

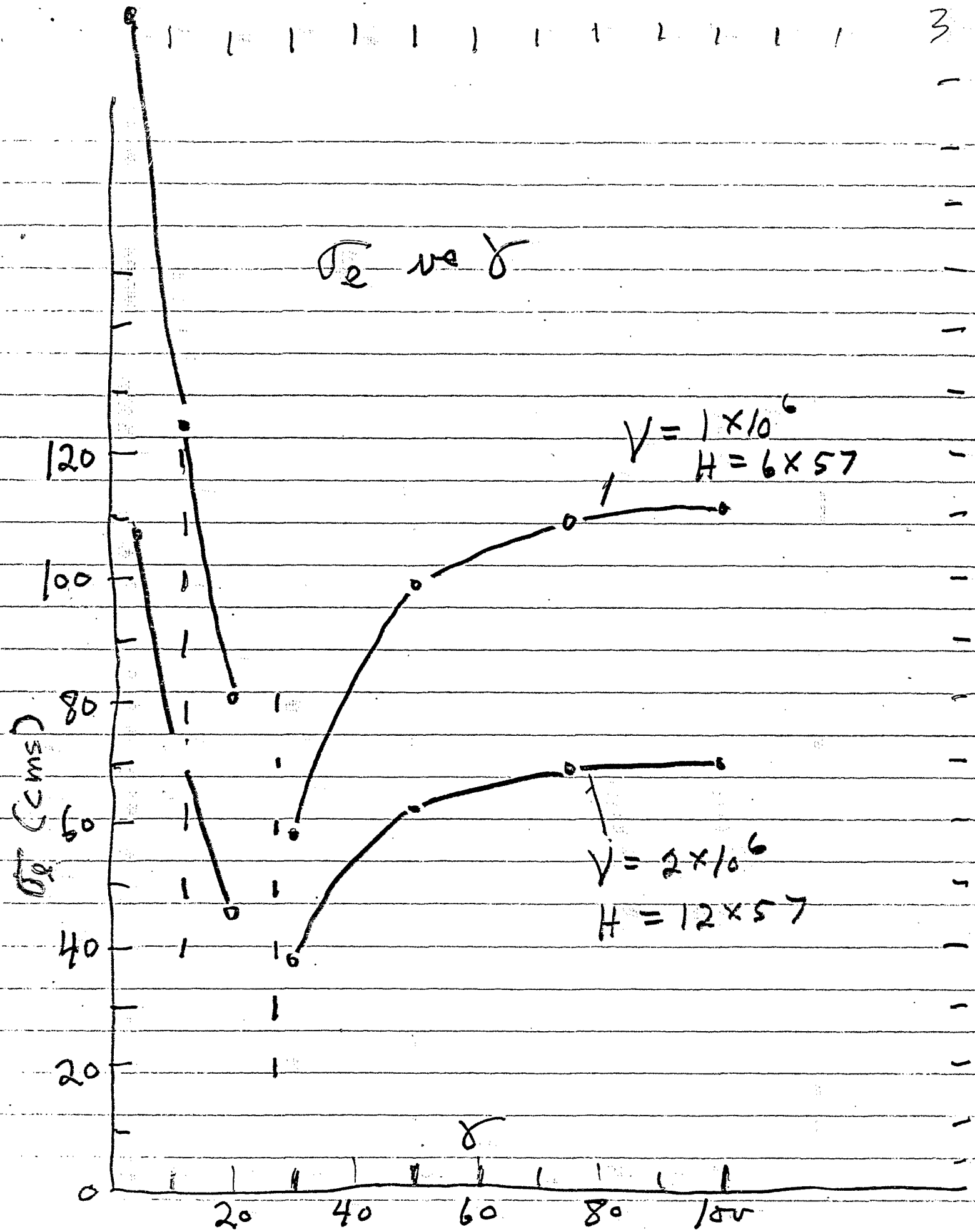
Figure 4 shows that $h = 12 \times 57$ RF leads to a somewhat larger emittance growth, due to the shorter bunch length, and about 10% smaller aperture than that found for $h = 6 \times 57$ RF.

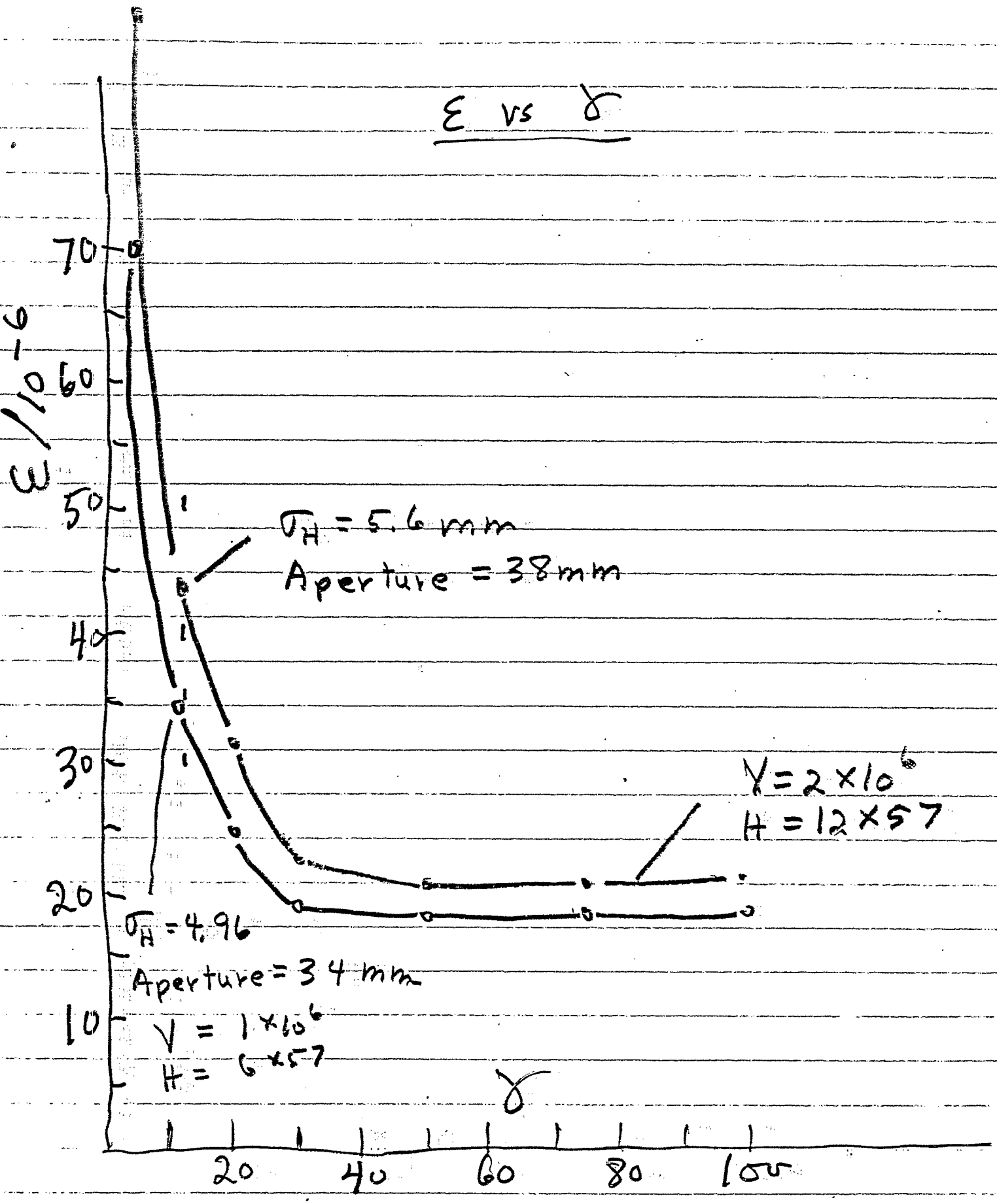


V = 1×10^6
H = 6×57
ΔP/P bucket
2.5 δ
2.5 δ
δ, t=2
δ0, t=0
δ/10^-3
γ
20
40
60
80
100
1
2
3
4
5
6
7
8
9


V = 2×10^6
H = 12×57
ΔP/P bucket
2.5δ
δ/10^-3
6
5
4
3
2
20
40
60
80
100


ΔP/P bucket
V = 1.42×10^6
H = 12×57
2.5δ
δ/10^-3
6
5
4
3
2
20
40
60
80
100


σ_e vs γ
$V = 1 \times 10^6$
$H = 6 \times 57$
$V = 2 \times 10^6$
$H = 12 \times 57$
σ_e (cms)
γ
0
20
40
60
80
100
120


ε vs γ
ε/10^-6
70
60
50
40
30
20
10
σH = 5.6 mm
Aperture = 38mm
V = 2×10^6
H = 12×57
σH = 4.96
Aperture = 34 mm
V = 1×10^6
H = 6×57
γ
20
40
60
80
100