Estimate Of Intrabeam Scattering For The Lattice: ß= 40m, ?= 2.0m

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DISCLAIMER

ESTIMATE OF INTRABEAM SCATTERING
FOR
THE LATTICE: $\tilde{\beta}$ = 40m, $\bar{\eta}$ = 2.0m

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J. Claus lattice

Contribution from Regular Cell only

$$\bar{\beta} = 39.18424 \text{ m} \implies 40. \text{ m}$$

$$\bar{\eta} = 2.023605 \text{ m} \implies 2. \text{ m}$$

This corresponds to case # 82

The numbers in the following Tables correspond to

Gold : $A = 197$, $Z = 79$

Bunched Beam

Peak Current = 1. Amp-electric

$\mathcal{E}_N$ is normalized emittance
σ_E/E r.m.s. energy spread

τ^{-1} are growth rates in hour^{-1}

$$\gamma = 100 \qquad\qquad \varepsilon_N = 10\pi \ \text{mm·mrad}$$

σ_E/E	τ_E^{-1}	τ_H^{-1}	τ_v^{-1}
$.5 \times 10^{-3}$	.3471	1.0204	$-.0208$
.8	.0923	.6946	$-.0142$
1.0	.0483	.5681	$-.0116$
1.2	.0283	.4793	$-.0098$

$$\gamma = 100 \qquad\qquad \sigma_E/E = 0.1\%$$

ε_N	τ_E^{-1}	τ_H^{-1}	τ_v^{-1}
5. π mm·mrad	.0931	2.1901	$-.0447$
8.	.0598	.8788	$-.0179$
10.	.0483	.5681	$-.0116$
12.	.0405	.3971	$-.0081$

Variation of Diffusion Rates with emittance and energy spread –

τ_E^{-1}

hour

τ_H^{-1}

$\tau_E^{-1} \sim \dfrac{1}{\varepsilon_N}$

$\tau_H^{-1} \sim \dfrac{1}{\varepsilon_N^2}$

τ_H^{-1}

hour

$\pi \, mm \cdot mrad$

ε_N

τ_H^{-1}

τ_E^{-1}

$\tau_H^{-1} \sim \dfrac{1}{\tau_E / E}$

$\tau_E^{-1} \sim \dfrac{1}{(\tau_E / E)^3}$

τ_E / E

$\times 10^{-3}$
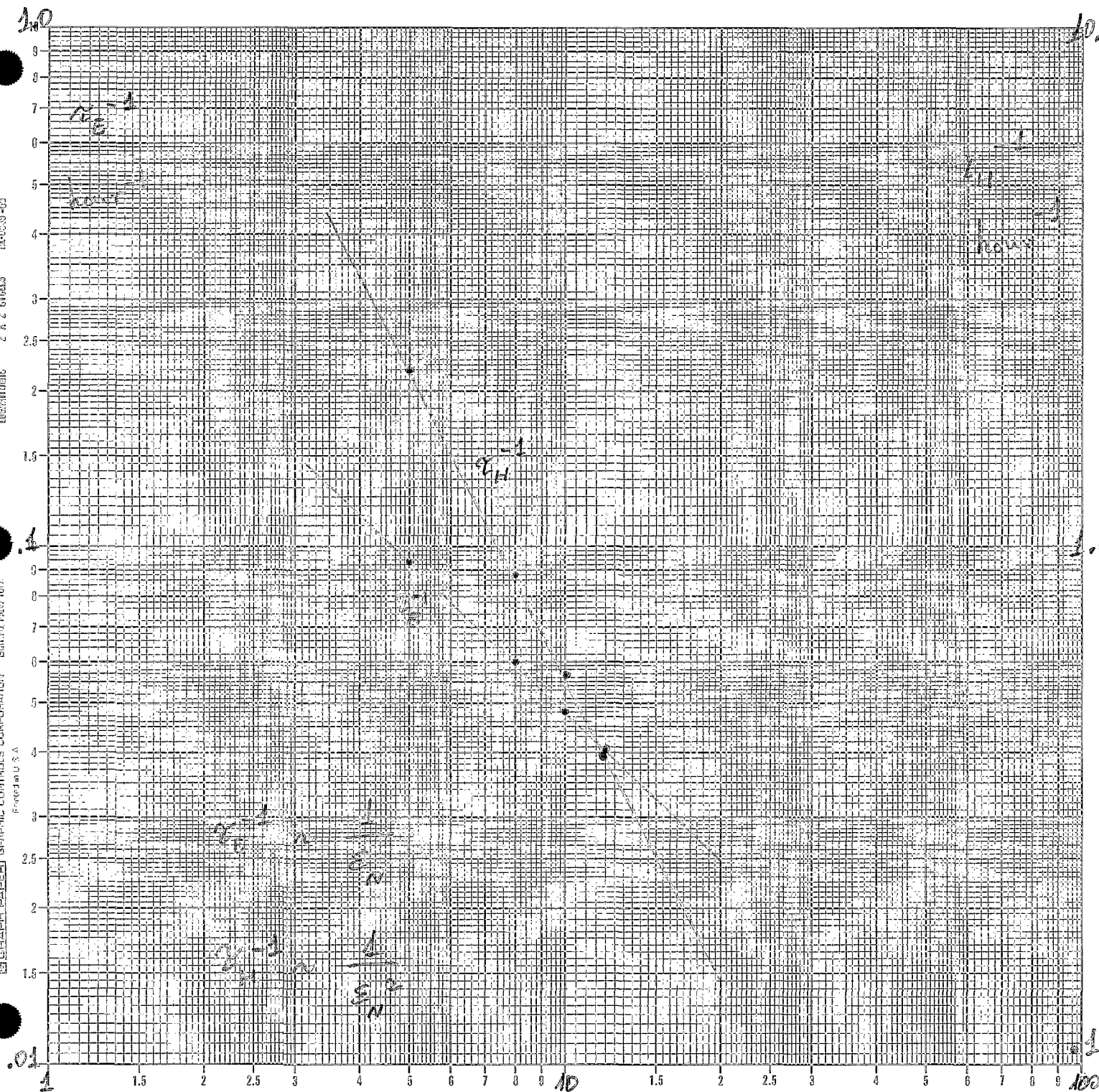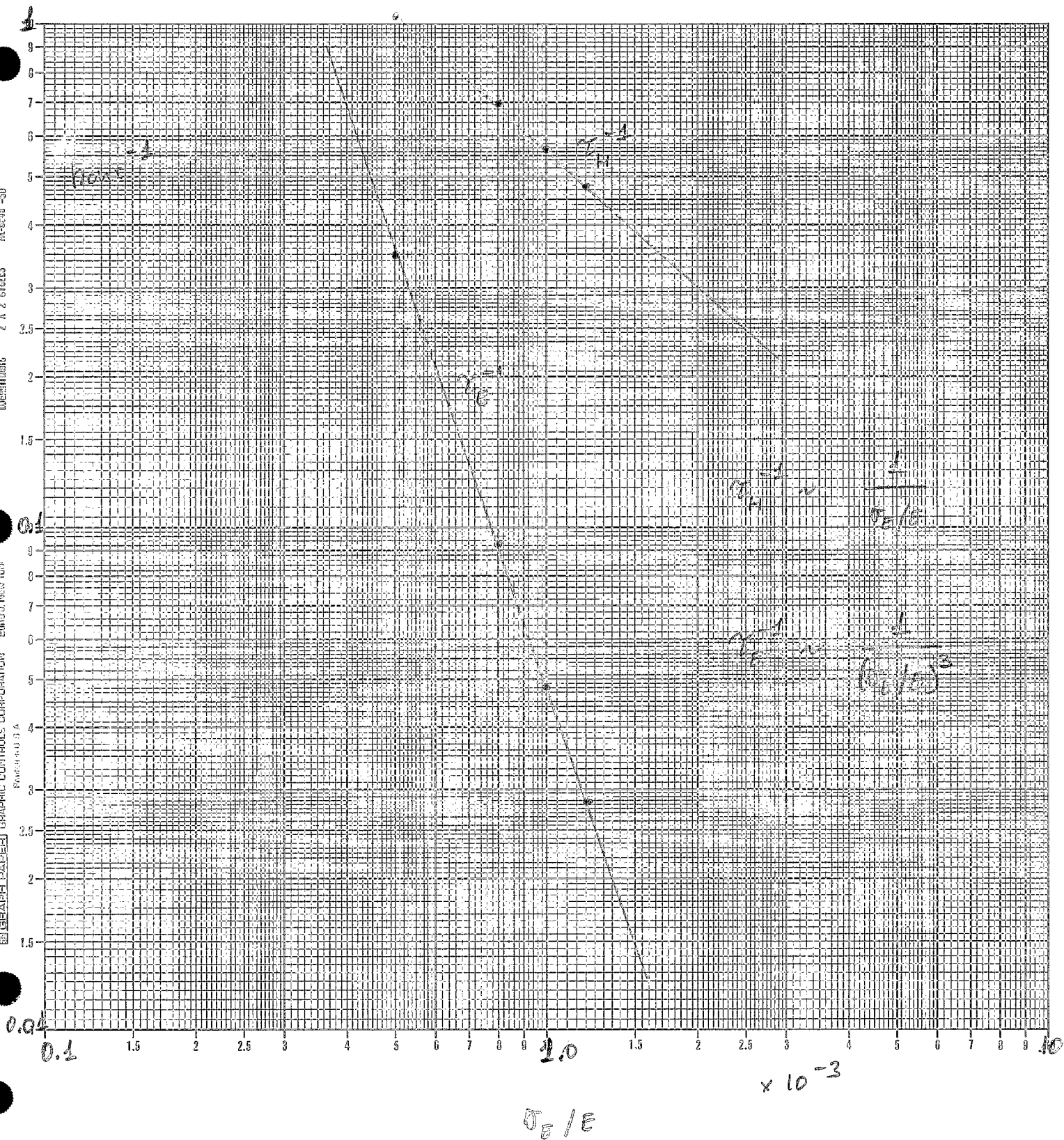
$$\mathcal{E}_N = 10\pi \text{ mm} \cdot \text{mrad} \qquad \sigma_E/E = 10^{-3}$$

γ	τ_E^{-1}	τ_H^{-1}	τ_V^{-1}
5	-2.9269	12.0445	13.7651
10	-.3359	.4011	.8022
12	-.0946	.0528	.1885
20	.1725	.2068	-.2068
40	.1480	.6214	-.0888
60	.0969	.6590	-.0388
80	.0667	.6198	-.0200
100	.0483	.5681	-.0116

Variation of Diffusion Rates with γ

Comparison with neighbouring lattices

$\gamma = 100$ $\sigma_E/E = 10^{-3}$ $\varepsilon_N = 10\pi \text{ mm} \cdot \text{mrad}$

$\bar{\beta}$ / $\bar{\eta}$	1.5 m	2.0 m	2.5 m	
35 m	.0589	.0515	.0451	E
	.4423	.6951	.9579	H
	−.0124	−.0108	−.0095	V
40 m	.0543	.0483	.0429	E
	.3537	.5681	.7936	H
	−.0130	−.0116	−.0103	V
45 m	.0502	.0454	.0407	E
	.2875	.4717	.6680	H
	−.0135	−.0123	−.0110	V

For a comparison with the lattice
$\bar{\beta} = 30\,m$ and $\bar{\eta} = 0.5\,m$ see RHIC-PG-10

Comparison between two lattices

$\overline{\beta}$ $\overline{\eta}$	30. m 0.5 m	40. m 2. m
τ_E^{-1}	.0816 h^{-1}	.0483 h^{-1}
τ_H^{-1}	.0669	.5681
τ_V^{-1}	-.0147	-.0116

$\gamma = 100$

$\sigma_E/E = 1 \times 10^{-3}$

$\varepsilon_N = 10\pi$ mm·mrad

"Gold"