Optimization of Stacking by Varying ßH

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DISCLAIMER

Injection Studies   April 17-18, 1973

van Steenbergen, Brown, Claus   10:00 pm - 4:00 am

Objective: Further optimization of stacking efficiency, horizontal by
               variation of β_H only, for various injection bump collapse
               rates.

Procedure: See studies note of April 10, 1973.

Results: 1. Determined 200 MeV beam emittance. See attached data
               (p. 3,4). From this, input ellipses to matching system:

$$\alpha_H = +\,3.6 \qquad\qquad \alpha_V = +\,2.3$$
$$\beta_H = 29.9 \qquad\qquad \beta_V = 14.2 \text{ m}$$

               2. Using these values and <u>existing</u> transport quad settings,
               the resultant emittance at the inflector exit is:

$$\alpha_H = -\,0.6 \qquad\qquad \alpha_V = -\,2.1$$
$$\beta_H = 13.0 \text{ m} \qquad\qquad \beta_V = 82.3 \text{ m}$$

               Note: High β_V value at exit inflector. Also, note, for input
               data both α's pos. contrary to previous experience.

               3. Using the input values (somewhat suspect for the reasons
               noted) a "match" was requested to (at exit inflector):

$$\alpha_H = 0 \qquad\qquad \alpha_V = 1.0$$
$$\beta_H = 10.0 \text{ m} \qquad\qquad \beta_V = 13.0 \text{ m}$$

These specified ellipse parameters approximate somewhat the pre-
sent assumed operational data, as has been measured and established
by computer transport checks on a number of previous occasions.

     The computed results are indicated on p.5. The matching quad
settings were implemented and minor corrections were made to the
steering dipoles. The stacked beam intensity was essentially
zero. This was contradictory to previous experience whereby the
computed settings for the matching quads, requesting the above
ellipse at the inflector exit, had yielded close to or equal actu-
al running stacked beam intensities.

     Since confidence in and knowledge of the ellipse data at the
exit of the inflector is essential to the planned studies, all
the study time was spent in repeat measurements, repeat calcula-
tions and implementation of the computed data.

4. Emittance data taking was repeated, also since linac had re-
adjusted LEBT quads, after a "spontaneous" variation of the pre-
injector beam. These data are also plotted on p.3 and p. 4. The
resultant data were sufficiently different, so that the transport
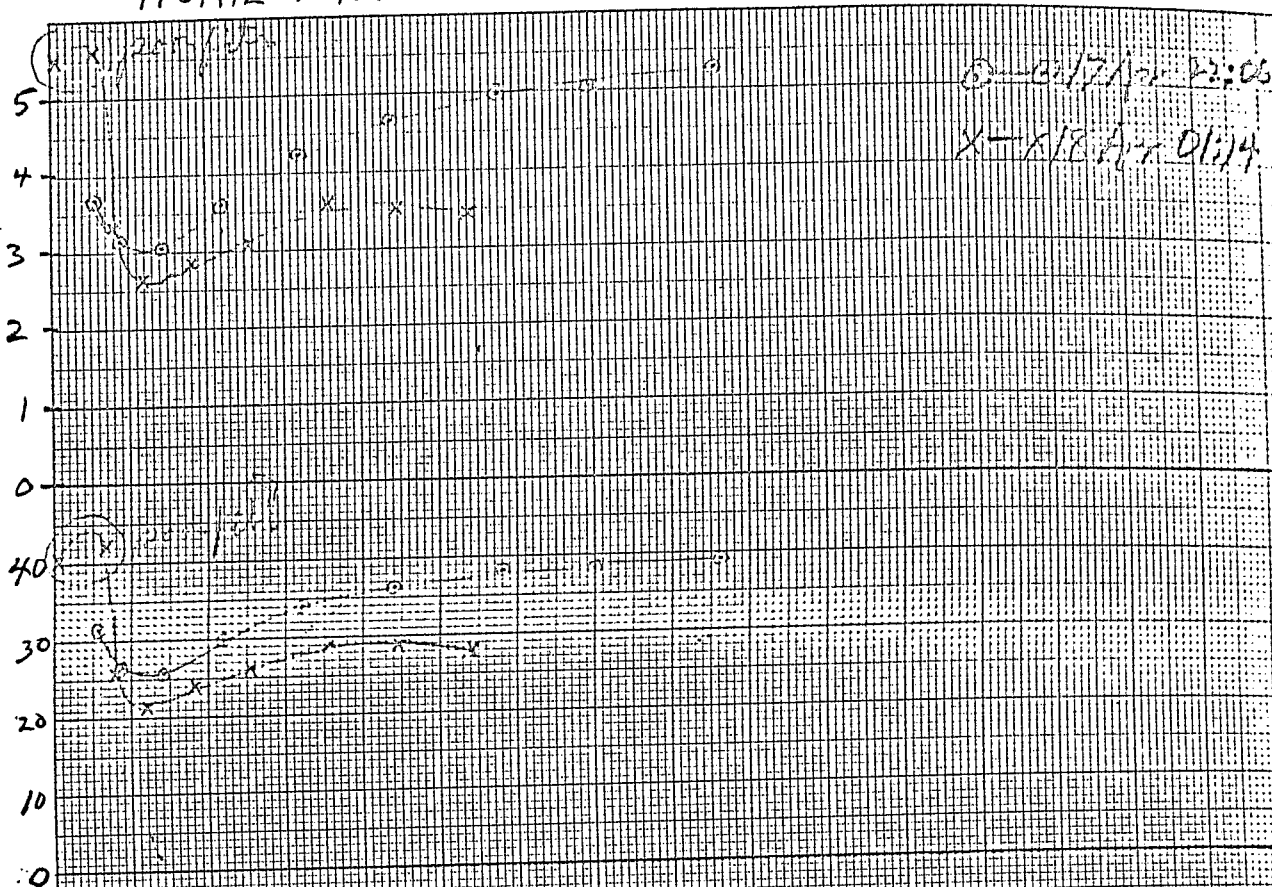program input was changed.

Later, the average of these two runs was taken as input. Note again, both α's positive.

5. In subsequent computer trials the sign of α_V was deliberately changed (notwithstanding the measured data) based on input from previous studies. Again after matching calculations and implementation of the quad settings no reasonable results.

6. Subsequent computational checks with the 6600 programs verified the correctness of the transport and matching calculations. Further checks on the emittance program and operational programs are in progress.

HORIZONTAL 200 Mev Emittance

⊙ — 017/12 2:06
X — X18/4pr 0114

80% emittance

$A_{SH} = 074\pi$

$\beta \cdot A_{SH} = 0.51\pi$

α

β(M)

% BEAM

5
4
3
2
1
0

40
30
20
10
0

100%

50%

0   0.5   1.0
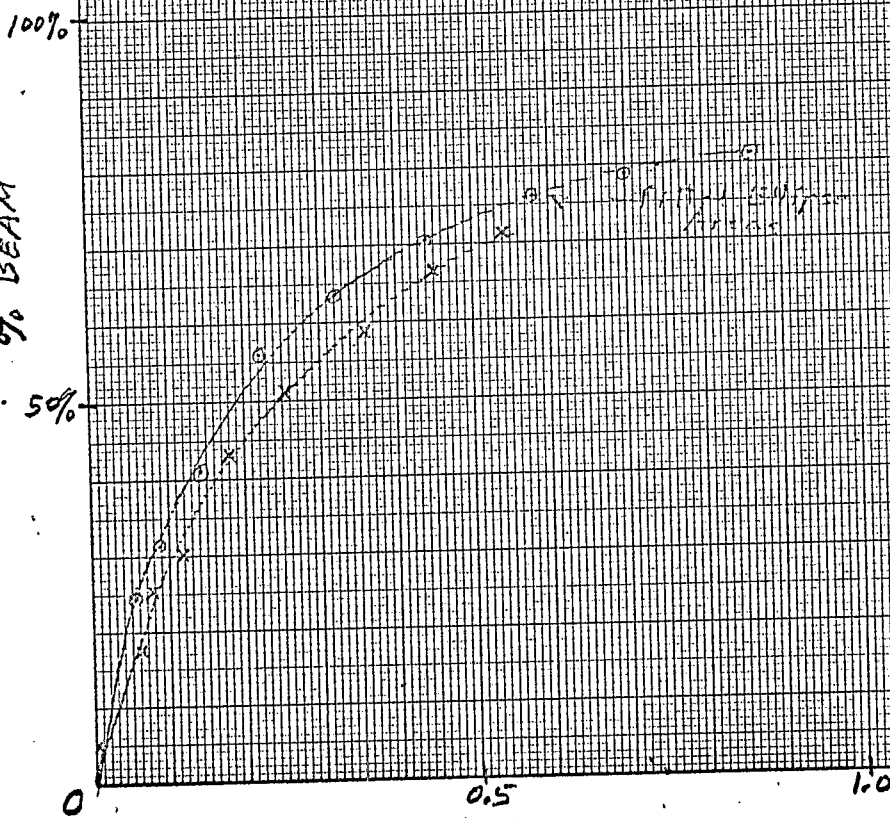
VERTICAL 200 MeV Emittance.
p. 4. 17 APR 73
18 APR
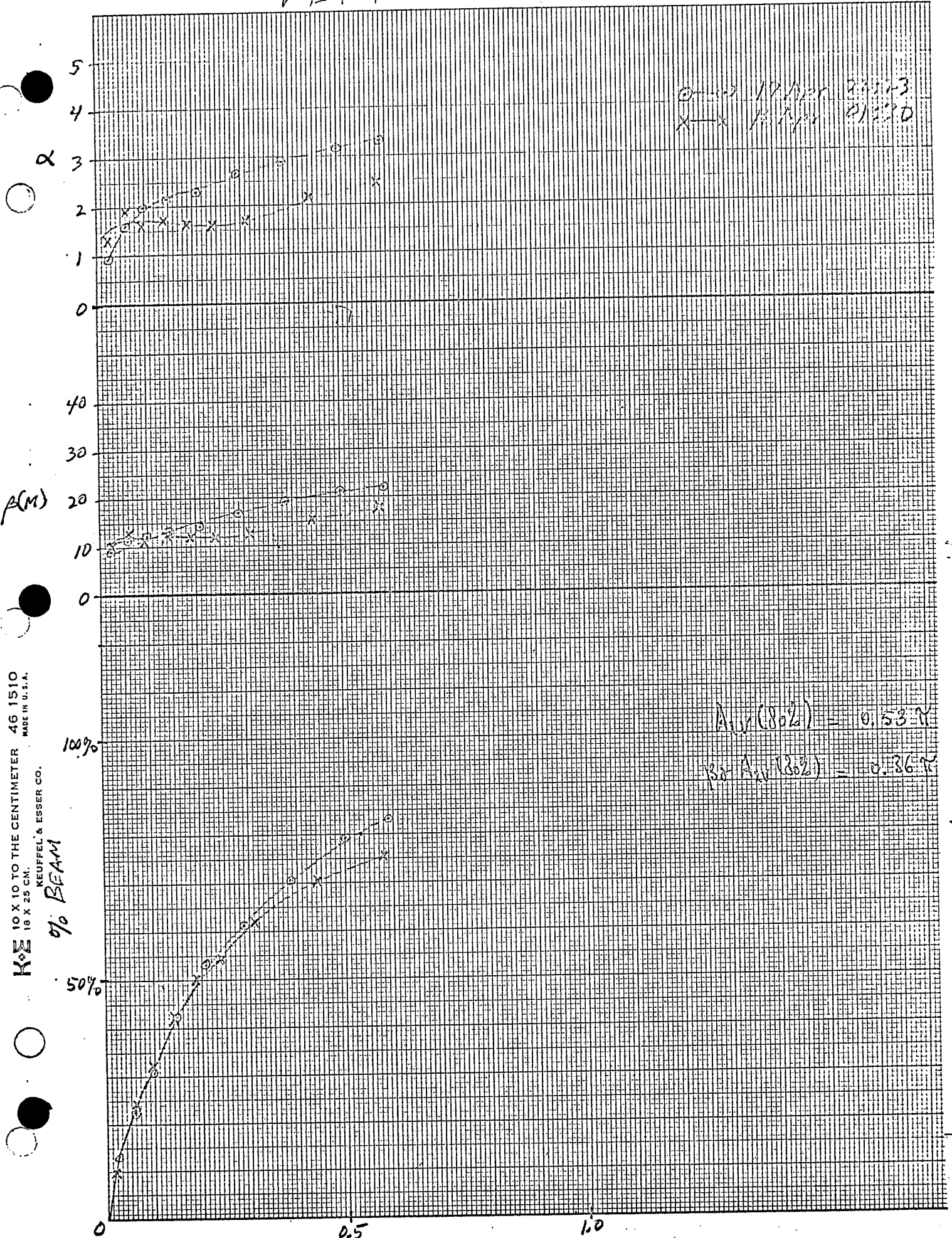
Transport and Matching Results

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		HOR.	VERT.	
EMITTANCE/PI		0.50	0.63	CM-MRAD

EMITTANCE AT INPUT

	HOR.	VERT.		ALPHA	-0.157	1.105	
EMITTANCE/PI	0.50	0.63	CM-MRAD	BETA	9.943	12.959	M
ALPHA	3.600	2.300		GAMMA	0.103	0.171	1/M
BETA	29.910	14.240	M				
GAMMA	0.467	0.442	1/M				

SHOULD THESE MAGNETCURRENTS BE IMPLEM
ENTED?' YES OR NO?

PROPOSED MAGNETCURRENTS AND BEAMCHARACTERISTICS

ENERGY: 200.00 MEV, BEAMCURRENT: 100.00 MA

	CURRENT (A)	X (CM)	X' (MRAD)	Y (CM)	Y' (MRAD)	WIDTH/2 (CM)	HEIGHT/2 (CM)
		0.00	0.00	0.00	0.00	1.22	0.94
Q18	-2253.2395						
		0.00		0.00		0.83	0.44
Q19	2289.1708						
Q20	3179.8901						
Q21	1959.3831						
		0.00		0.00		0.72	0.24
Q22	2917.5865						
		0.00		0.00		0.58	1.15
Q23	1179.7144						
VS3	-260.0000						
IFC	3149.9963						
		-22.15		-0.19		0.71	1.14
VS4	200.0000						
TRC	4055.0091						
		-2.23	8.75	-0.19	0.09	0.70	0.90

EMITTANCE AT INFLECTOR EXIT