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Optimization of Stacking by Varying ßH

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USDOE Office of Science (SC)

DISCLAIMER

No. 10 Blumberg

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:

$\alpha_H = + 3.6$ $\quad\quad$ $\alpha_V = + 2.3$

$\beta_H = 29.9$ $\quad\quad$ $\beta_V = 14.2$ m

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

$\alpha_H = - 0.6$ $\quad\quad$ $\alpha_V = - 2.1$

$\beta_H = 13.0$ m $\quad\quad$ $\beta_V = 82.3$ 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):

$\alpha_H = 0$ $\quad\quad$ $\alpha_V = 1.0$

$\beta_H = 10.0$ m $\quad\quad$ $\beta_V = 13.0$ m

These specified ellipse parameters approximate somewhat the present 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 actual 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 calculations and implementation of the computed data.

4. Emittance data taking was repeated, also since linac had readjusted LEBT quads, after a "spontaneous" variation of the preinjector 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.

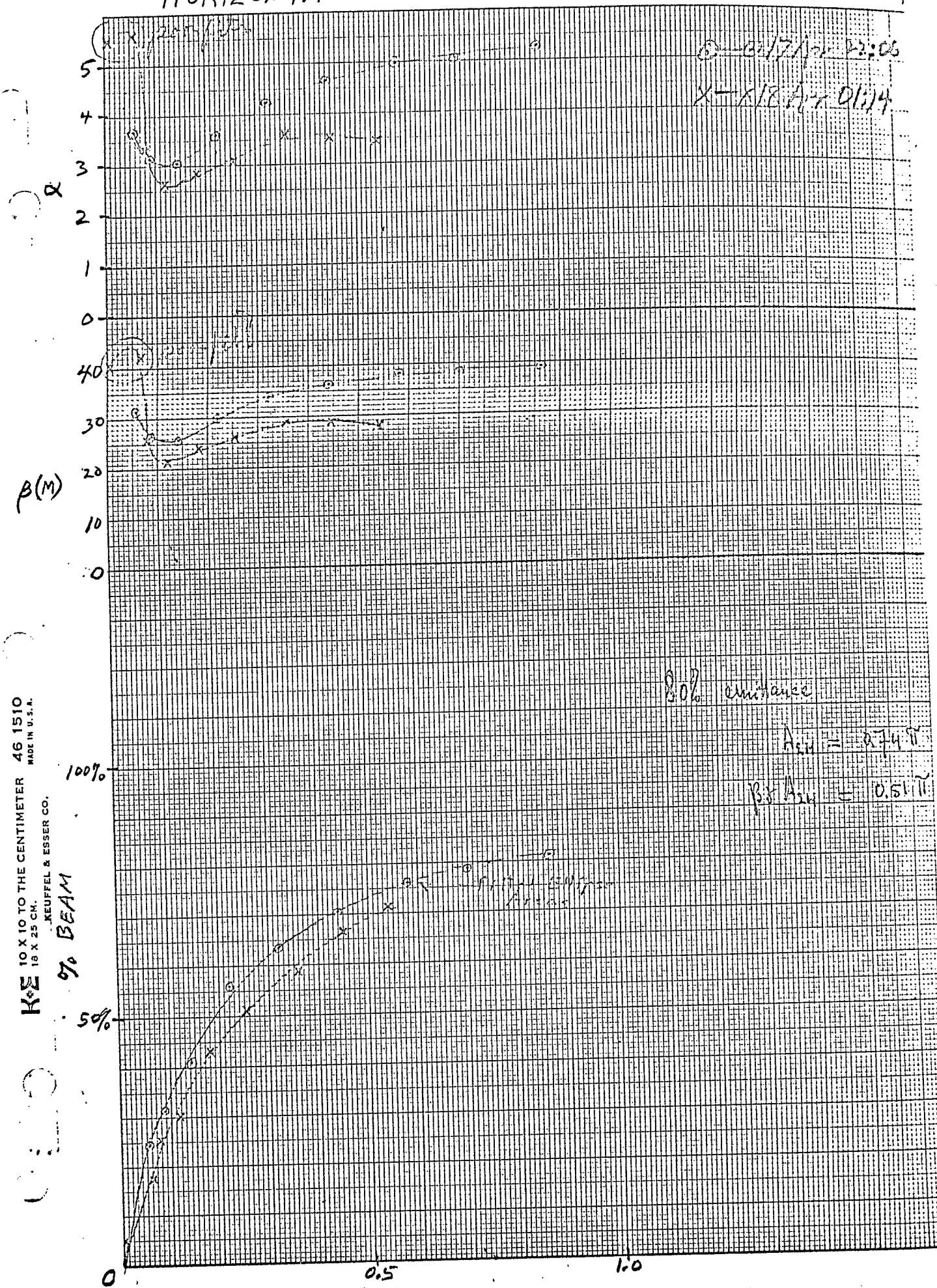
Later, the average of these two runs was taken as input. Note again, both α's positive.

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.

17 Apr
18 Apr

HORIZONTAL 200 MeV Emittance.



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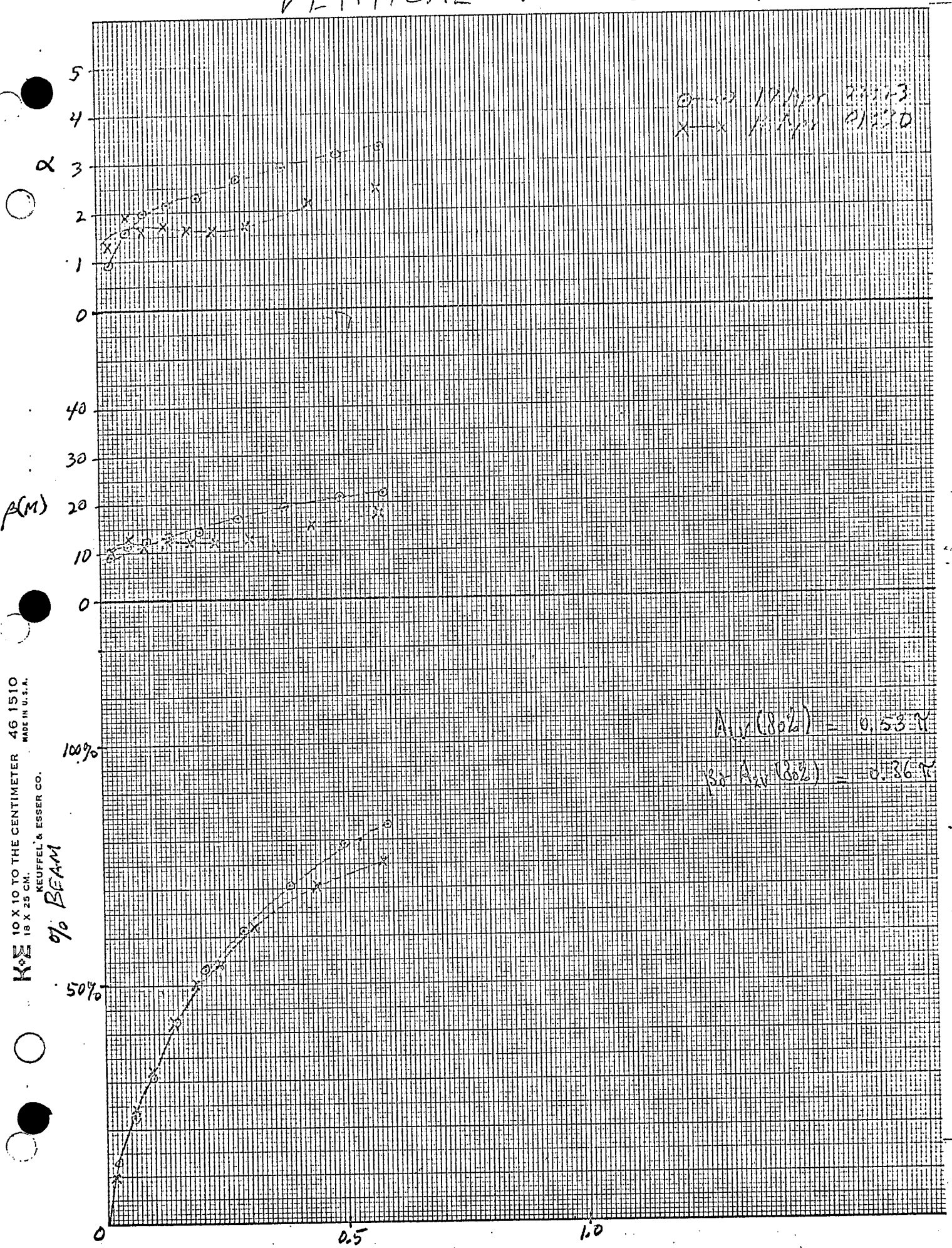
18 APR

VERTICAL 200 MeV Emittance.



KE 10 X 10 TO THE CENTIMETER 46 1510
18 X 25 CM. KEUFFEL & ESSER CO. MADE IN U.S.A.

Transport and Matching Results

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Subject

Date April 17,

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

EMITTANCE AT INPUT

	HOR.	VERT.	
EMITTANCE/PI	0.50	0.63	CM-MRAD
ALPHA	3.600	2.300	
BETA	29.910	14.240	M
GAMMA	0.467	0.442	1/M

	HOR.	VERT.	
ALPHA	-0.157	1.105	
BETA	9.943	12.959	M
GAMMA	0.103	0.171	1/M

SHOULD THESE MAGNETCURRENTS BE IMPLEMENTED?' 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	2209.1708						
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	4065.0001						
		-2.23	8.75	-0.19	0.09	0.70	0.90

EMITTANCE AT INFLECTOR EXIT