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$\bar{p}$ Note #396

MAGNETIC MEASUREMENTS OF THE TEV I PULSED SEPTUM

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Magnetic Measurement of the TeV I Pulsed Septum

S. Holmes & D. Poll

We have measured the magnetic field of the recently constructed TeV I pulsed septum prototype. Several measurements were made:

① Central field as a function of excitation

② Field uniformity as a function of position

③ Field in the 'field free' region

The pulsed septum is designed to operate at a field of 6.0 kGauss at a current of ~20000 A. The pulse shape is a half sine wave of width 0.4 msec. The magnet is 80" long with an aperture of approximately 1½" × 2". The design specifications on field quality were: ① field uniformity to one part in 10^3 over a 1.4" wide region on the median plane; ② a field of <2 Gauss in the field free region.

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SUBJECT: Septum Field Measurements

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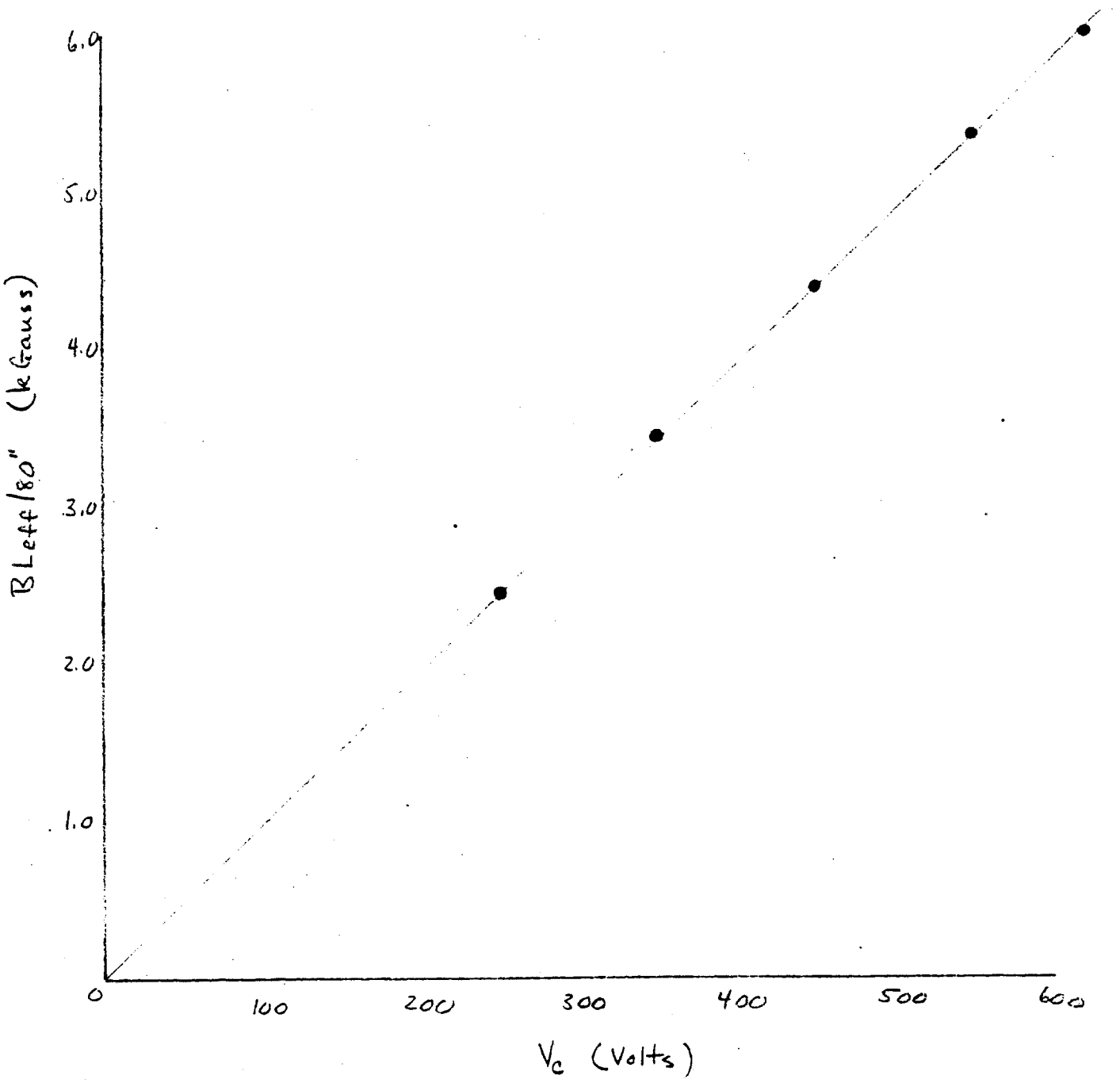


Figure 1

Central Field vs. Excitation

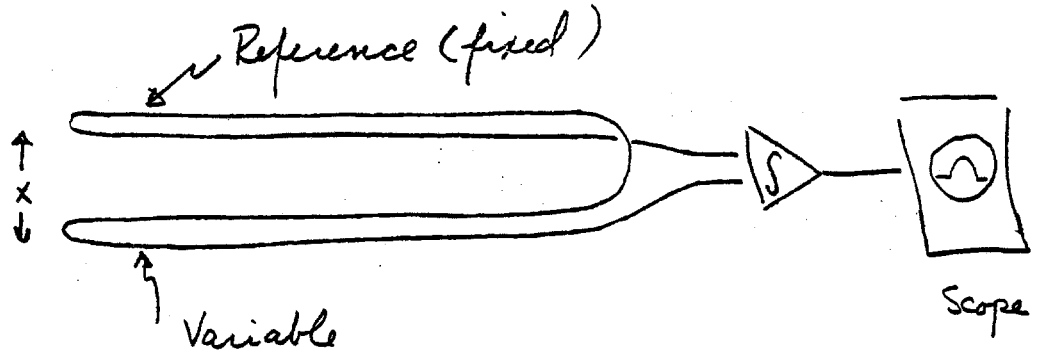
A probe of length 96" with cross section 1/8" x 1" was used to measure the field. The induced EMF on a single turn of wire was sent through an integrator and displayed on a Tektronix 468 digital scope. The field at the peak of the pulse was read directly off the scope.

The field as a function of the voltage on the capacitor in the pulse forming network was measured and is shown in Figure 1. The measurement of the field has a precision of ~1%. To the accuracy of the measurement the field is linear in the current. The current was not measured directly - the conversion between voltage & current is thought to be 20000 A / 620 V.

Field Uniformity

In order to be sensitive to field variations down to one part in 10^4 two matched probes were used, one serving as a fixed reference. The setup is shown on the following page. Since the two probes are bucked against each other the integrator output is proportional to the

difference in the flux through the two probes.



The two probes are matched in area to 1.7%. This produces a x60 increase in sensitivity compared to a single probe measurement.

Figure 2 shows the field variation as a function of distance from the copper septum along the median plane within the aperture. The open and closed circles represent data taken on different days. The measurement precision is better than 10^{-4}. The field is uniform to 3×10^{-4} over a region covered by the expected beam size and to 10^{-3} over the specified good field region. Measurements were also taken 0.25" above and below the median plane. These results are nearly identical to those shown.

The effect on the emittance of the measured field non-uniformity for a 10π mm-mrad beam centered at $x = 0.625$" at the entrance to the Accumulator is shown in Figure 3. The emittance distortion is a fraction of a percent.

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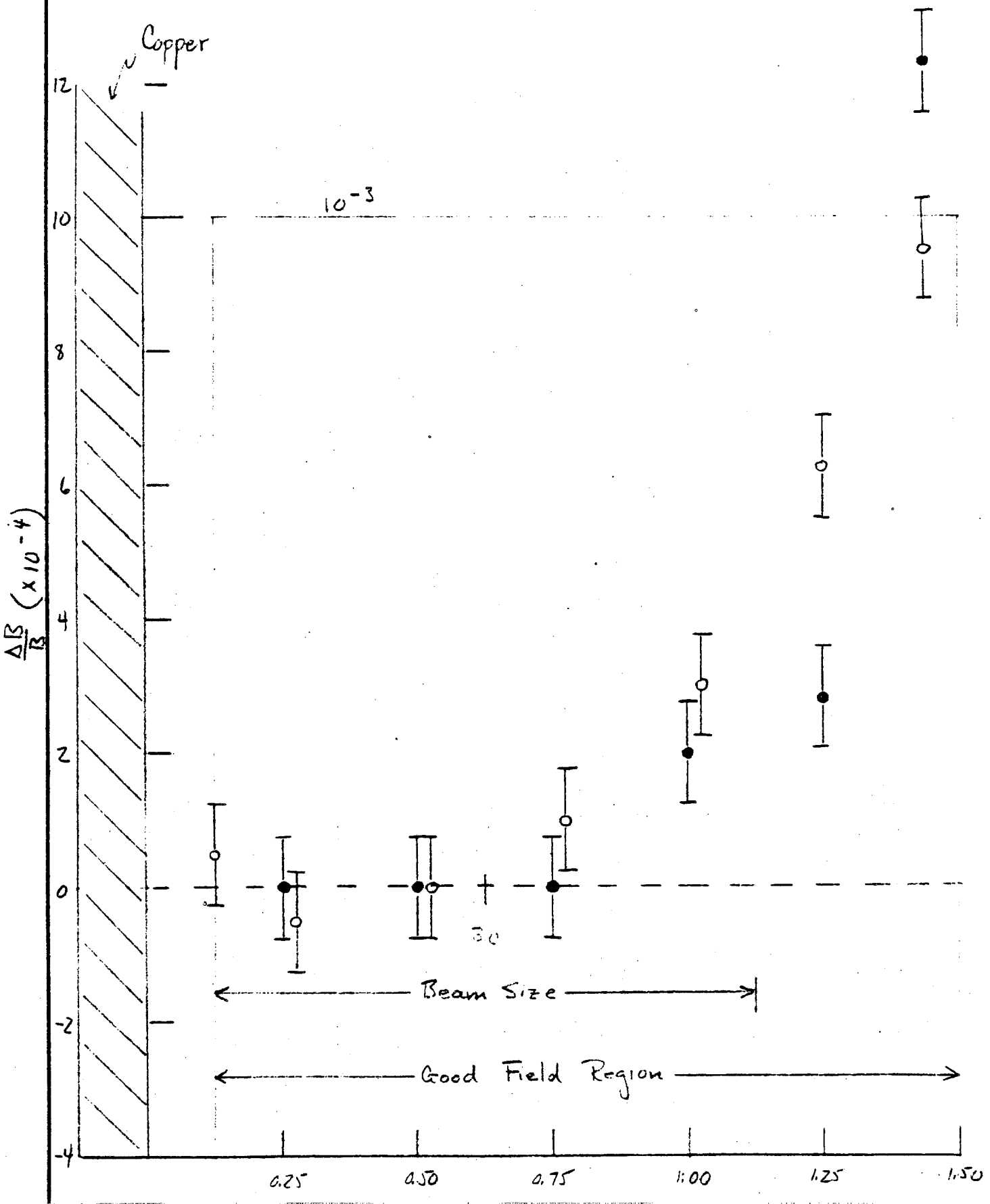

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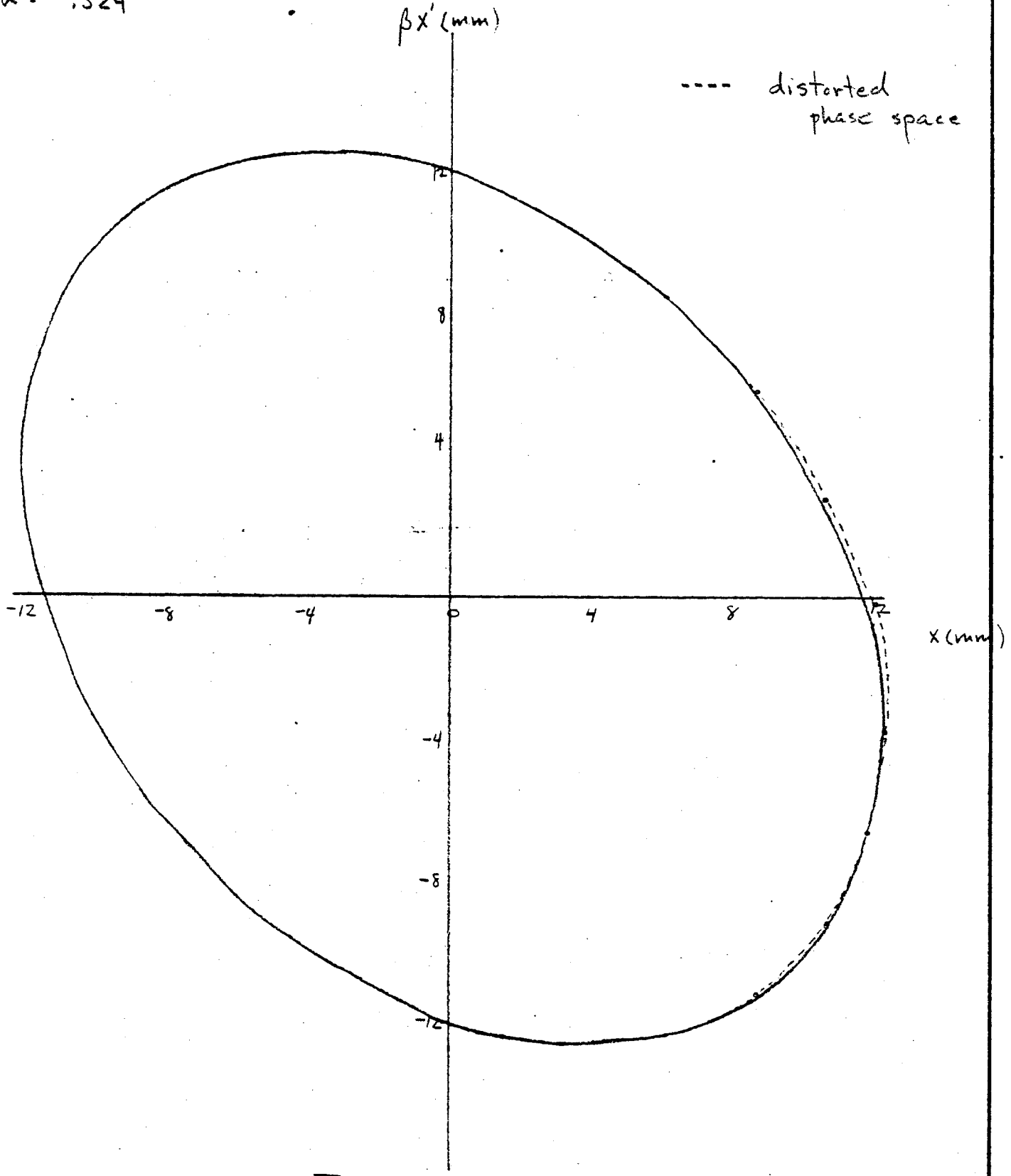
Septum Emittance Distortion For Measured Field	SDH	7/28	

$\beta = 15m$

$\alpha = .324$

$\epsilon = 10\pi$ mm-mrad



Field Free Region

A single probe was used to measure the field between "1/4" and 3/4" into the field free region. The field in this region was measured to be 1.0 ± 0.5 Gauss.