CERN - PS /AC1

FRINGING FIELD MEASUREMENTS

A. Citron

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On model No. 2 (Bergen model, scale 1:8) measurements of fringing fields were carried out. The purpose of these measurements was to collect information needed for the calculation of trajectories of various secondaries emitted from a target placed somewhere in a straight section. No great accuracy was aimed at.

Measuring equipment.

The measurements were carried out with search coils and a ballistic galvanometer by field reversal. The galvanometer used bears the number 4 A 24. It has an internal resistance of 12.9 Ω and a critical damping resistance of 22 Ω. A variable shunt arrangement belongs to the galvanometer. In position D it connects the voltage source directly to the instrument terminals. In all other positions the galvanometer is connected to the two ends of a resistance of 22 Ω. The source is connected across a fraction 1/N of this resistance for the position labelled N. So the galvanometer always sees its critical damping resistance and its readings have to be multiplied by a factor of N, provided the source has a resistance $\gg$ 22 Ω. This was not the case for our measurements.

Two coils were used. The search coil brought from Bergen, which is mounted inside a rod, with its center 5 mm from the top of this rod. It has a diameter of about 3 mm, about 40 cm^2 area turns and a resistance of 18 Ω. Its terminals are marked red. (Coil A). Another coil used was mounted inside a cork. It had a diameter of 12.5 mm and 1000 turns, giving 1.22×10^3 cm^2 area turns and a resistance of 99 Ω. (Coil B).

The combinations galvanometer-shunt-search coil were calibrated with a mutual inductance. The calibration was checked by a condenser discharge method.

The following conversion factors were found. (Distance galvanometer window to scale 97 cm).

	Shunt position	Gauss/mm
Coil A	D	2.8
	1	4.7
	3	9.9
	10	27
	30	72
	100	240
	300	720

	Shunt position	Gauss/mm
Coil B	D	0.169
	1	0.49
	3	1.33

It is understood that more accurate calibrations carried out by Denis will be circulated within short.

Results.

The magnet coils were energized by a current of 15 A. This resulted in a maximum measured field of 4800 gauss which, according to Blewett's measurements inside the gap, corresponds to a fieldstrength B_o at the equilibrium orbit of 3200 gauss.

Coil B was used for distances $\gtrsim$ 10 cm from the magnet only because of its big dimensions.

Measurements were taken in the orbit plane only. The lines along which values were taken can be recognized on the diagram as loci of the little rings. Their intersects with the contour lines were found by graphical interpolation. In order to obtain the field shape as it would be between 2 sectors at a distance of 144 cm (=18 cm in the model), the measuremennts were extended beyond the line of symmetry between the two sectors; then field values at symmetrical positions with respect to that line were added up. This can be done because all lines of force cross the orbit plane at right angles.

The result is presented in the diagram. It is seen that the minimum field at the equilibrium orbit is about $B_o/300$. The sign of the field gradient inside the gap does not seem to influence the shape of the fringing field appreciably, but the yoke position does of course.

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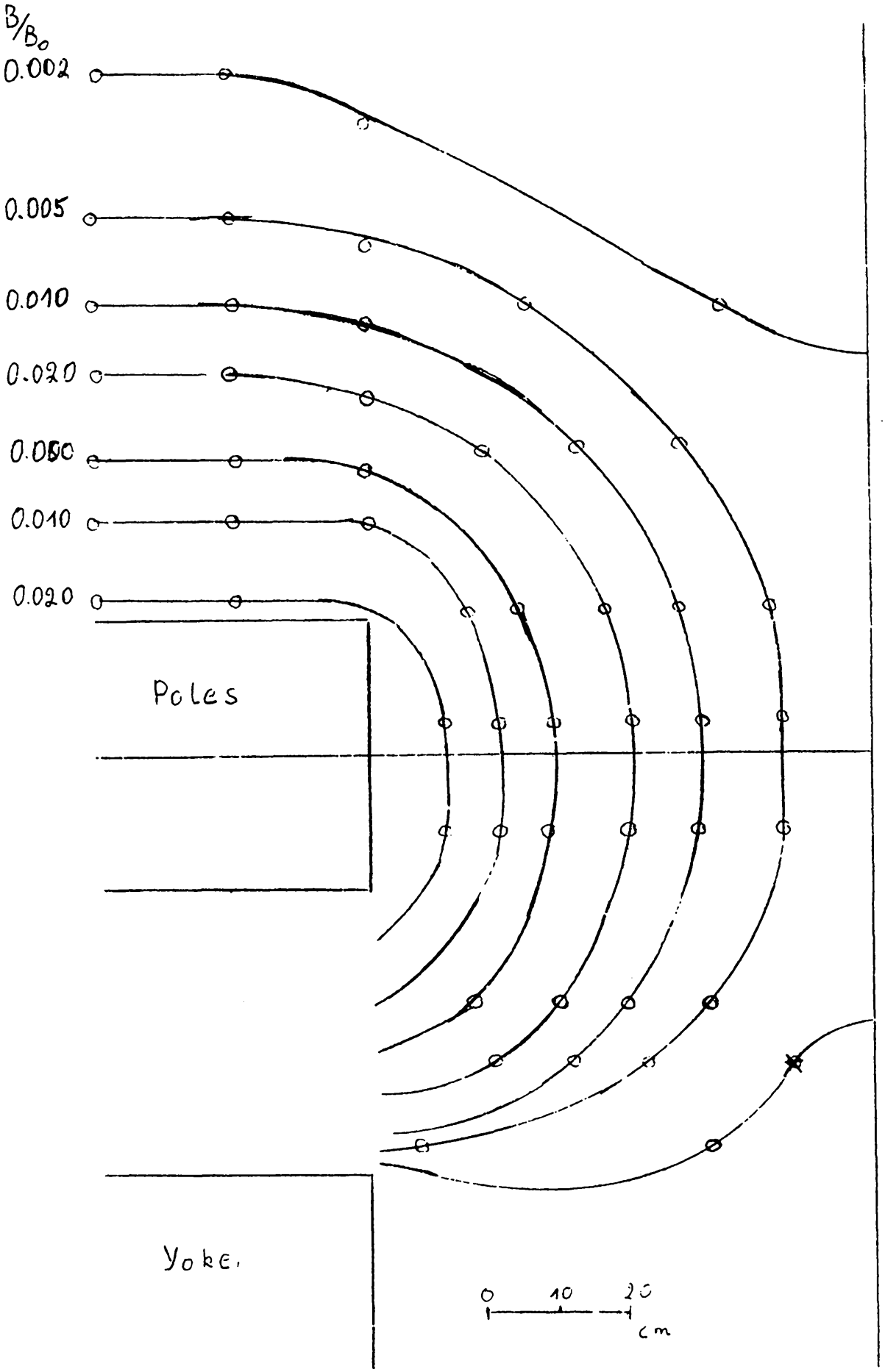
B/B0
0.002
0.005
0.010
0.020
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0.010
0.020
Poles
Yoke.
0
10
20
cm