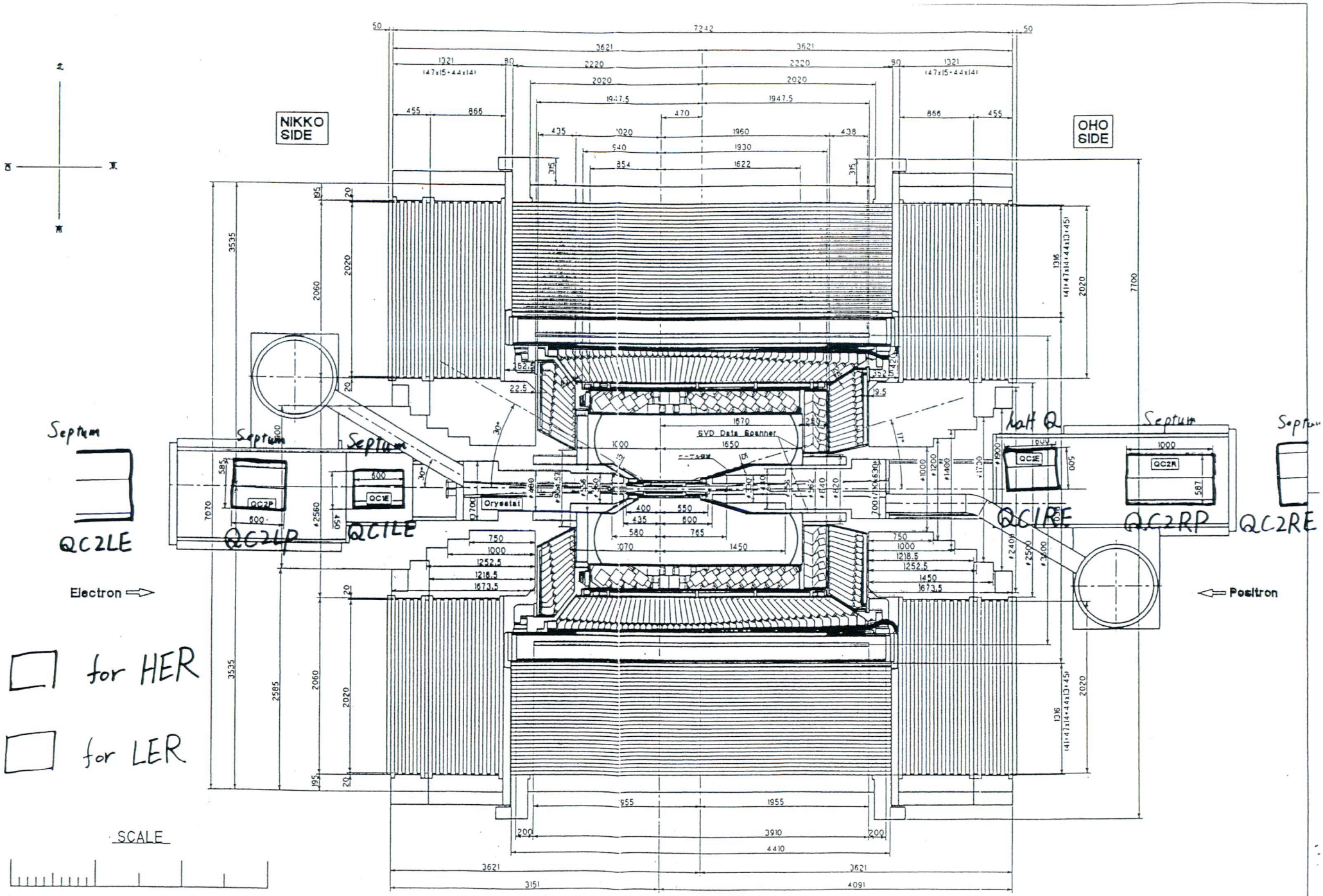
Interaction Region / IRQ

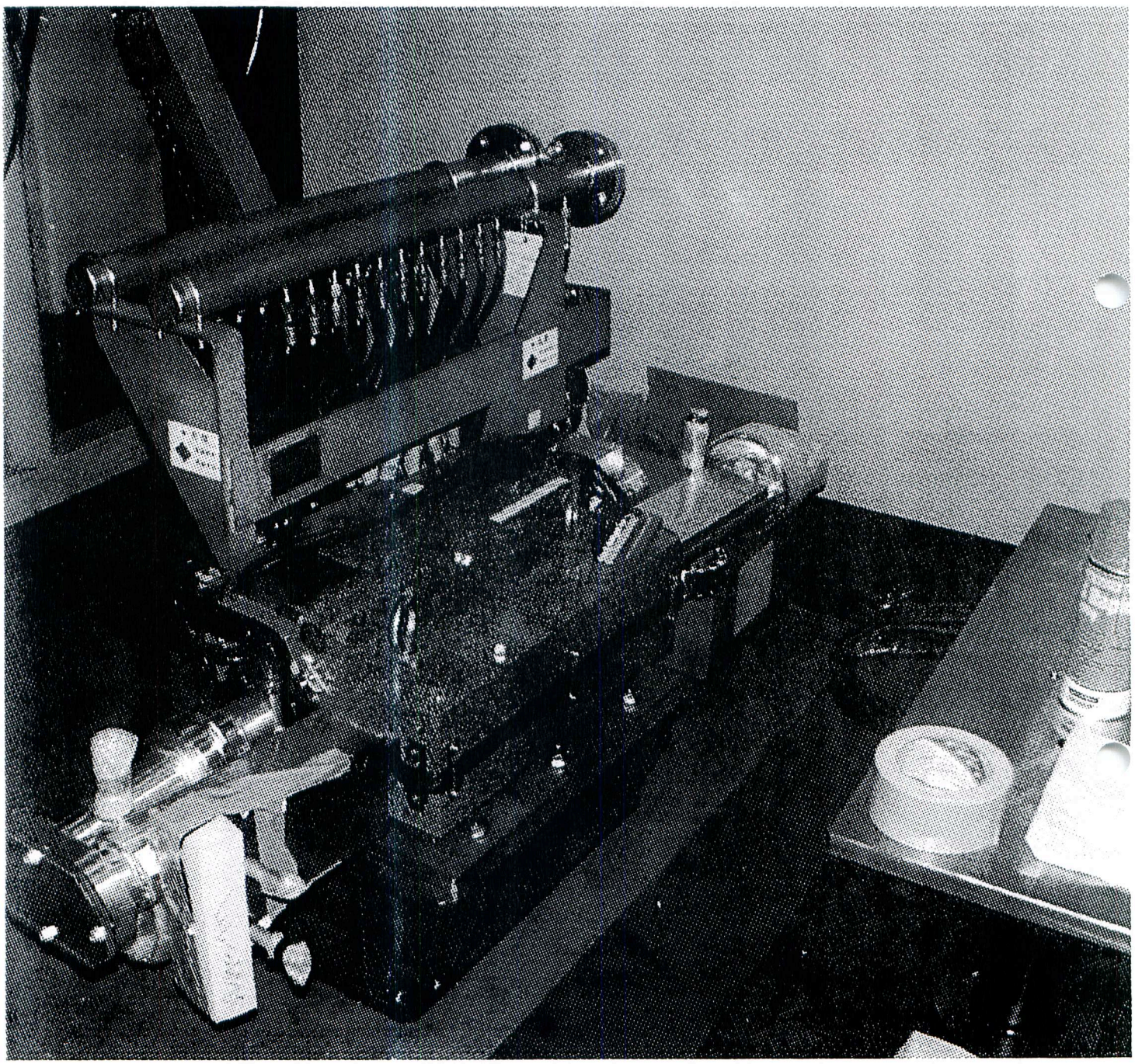
(IRQ field measurements results)

3/9/99
KEKB MAC
M. Tawada


NIKKO SIDE
OHO SIDE
Septum
Septum
Septum
Septum
Septum
QC2LE
QC2LP
QC1LE
QC1RE
QC2RP
QC2RE
half Q
QC1E
QC2E
QC2P
QC2R
Cryostat
DVD Data Scanner
Electron
Positron
for HER
for LER
SCALE
0
1
2
3(m)
Belle detector
BELLE測定器 平面図
str-970204-top
1997.01.29
KEK

item	symbol	unit	QC1LE	QC1RE	QC2LE	QC2RE	QC2LP	QC2RP
field gradient	g	T/m	13.14	11.69	3.11	9.99	6.11	2.88
(for 8.4&3.7GeV)		T/m	13.80	12.28	3.27	10.49	6.46	3.05
x_apperture(Q field)		mm	30	90	75	80	65	75
y_apperture(Q field)		mm	21	27	14	20	13	16
bore radius	R0	mm	38	70	60	60	45	42
pole length	LP	mm	600	600	2,000	600	600	1,000
yoke shape			septum Q	half Q	septum Q	septum Q	septum Q	septum Q
current density	i	A/mm^2	85	11.5	8.1	30	17.1	20.5
magnetomotive force	NI	A turn/P	9,000	25,520	4,950	15,840	5,500	2,250
conductor		mm	6x8 - ϕ4	10x10 - ϕ7	8.5x8.5 - ϕ6	9x9 - ϕ6.5	8x8 - ϕ6	8x8 - ϕ6
turn	N	turn/P	3	36	18	10	9	3
max. current	Imax	A	3,000	709	275	1,584	611	733
max. voltage	Vmax	V	41.5	32.7	38.3	47.2	19.1	11.2
resistance(50℃)	R	mΩ	13.8(55℃)	46	139	30	31	15
power	W	kwatt	124.5	23.2	10.5	74.8	11.7	8.2
cooling			water	water	water	water	water	water
temperature rise of coil	$\Delta\theta$c	℃	50	40	20	40	20	15
water input temparture	θw	℃	30	30	30	30	30	30
the amount of water	Qw	l/min	40.0	8.3	7.5	26.7	8.4	7.8
No. of water lines	nw		12	4	4	4	4	4
pressure drop	Δpw	kg/cm^2	2.9	0.9	3.7	5.6	1.6	1.3
magnet size	width	mm	600	500	800	900	580	600
	height	mm	830	800	500	700	410	320
	length	mm	1,098	750	2,157	742	716	1,080
weight	Wt	kg	600	1,370	5,270	1,900	980	1,250
iron material			SUYP-1	SUYP-1	XC06	S10C modify	S10C modify	S10C modify
			mover	mover	—	mover	mover	mover

tzC



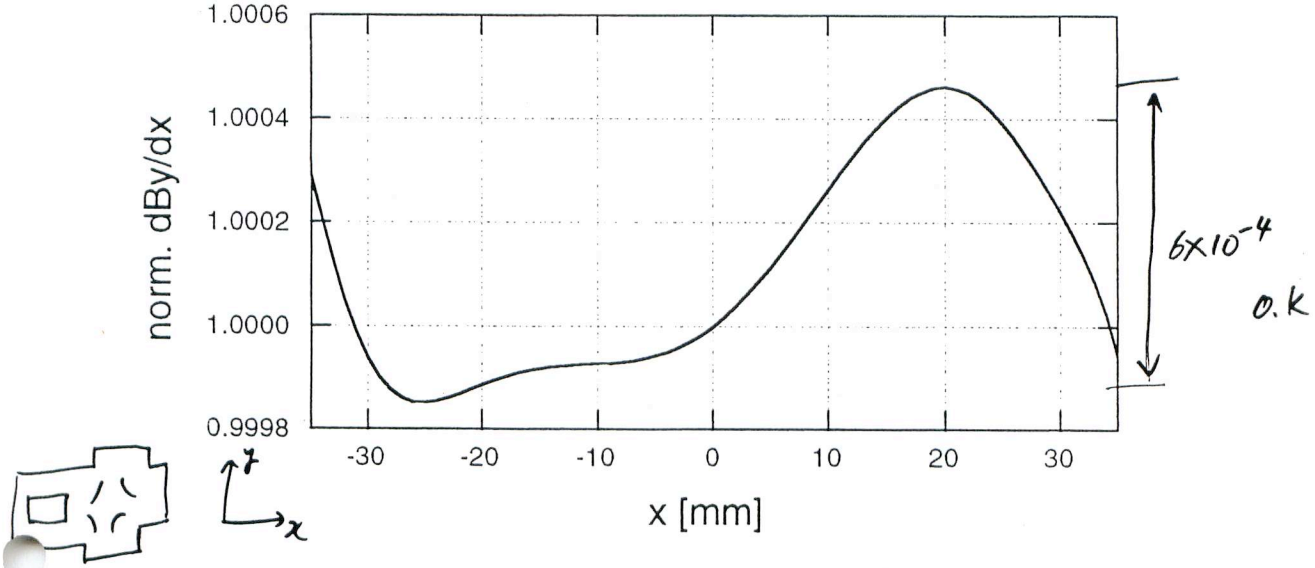
QC1LE & Vac ch.

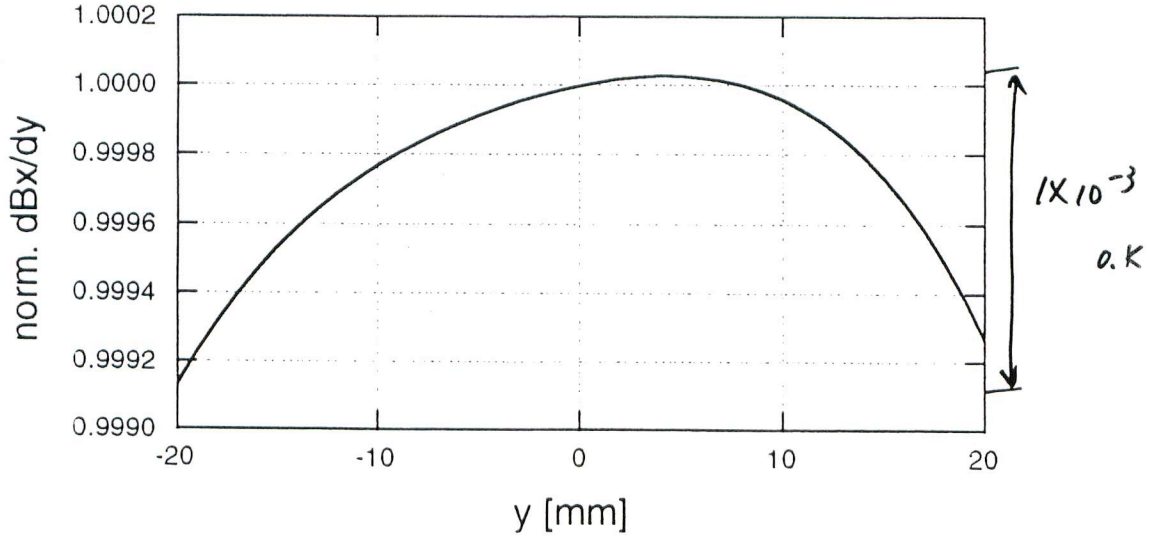
Leakage fields for e^+ ~ 4 Gauss

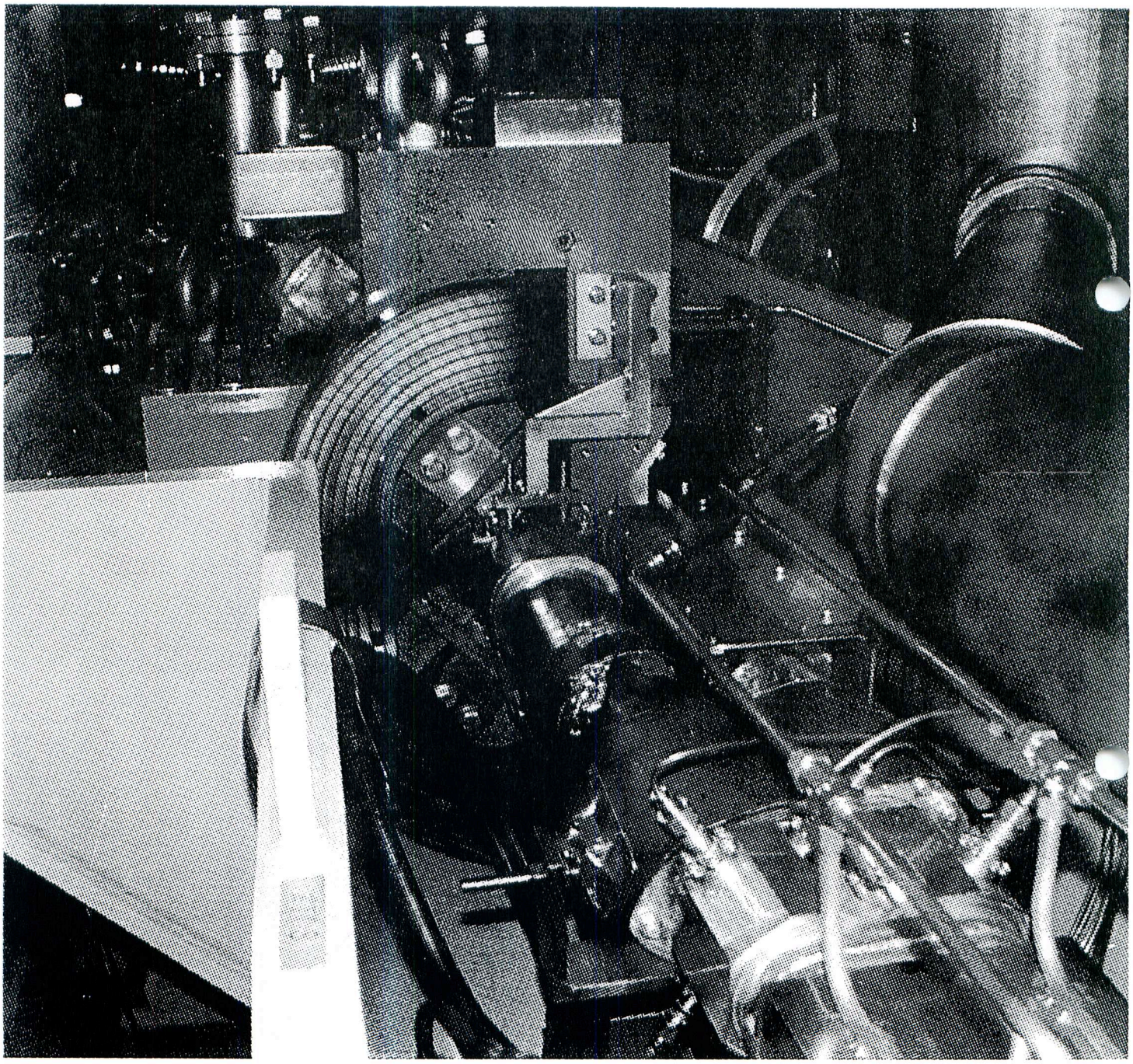
QC1LE with end-shim correction

IRQ has an asymmetric pole shape. It accompanies higher order multipole components. The multipole components were measured by harmonic coil (r=35, l=1600mm). We optimized the ehd-shim's shape and thickness as normarized dB/dx distributions < 1.0E-3 in the aperture.

Field strengths and field distributions satisfy the requirements.







QC1RE (half Q)

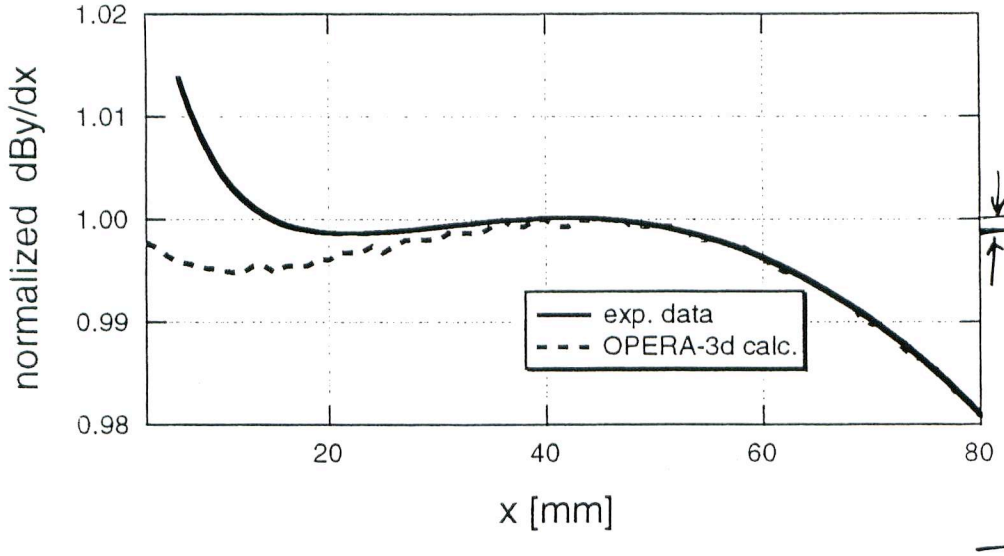
fringe's leakage field ~ 30 Gauss

QC1RE w/o end-shim correction

QC1RE was designed by 2d code. Unexpectedly, it has strong fringe's fields.

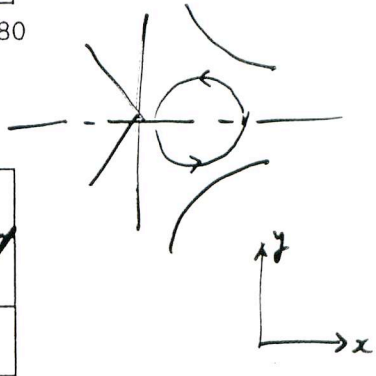
Measurement data is consitent with 3d calculation.
(But it took 2 weeks to calculate it.)

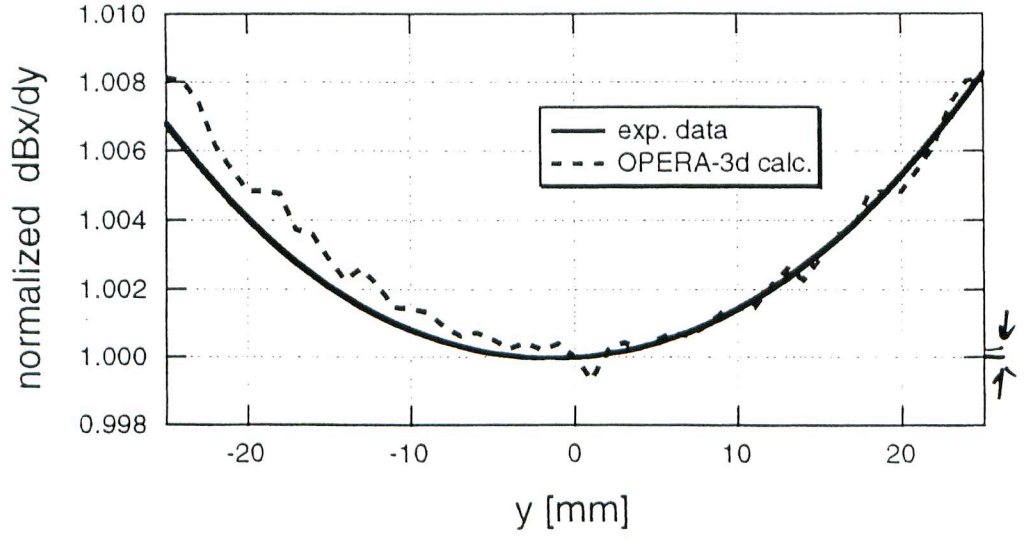
I think the difference x= 0 between meas. data and calculation is due to the gap between upper and lower part of mirror plates, or coercive force.



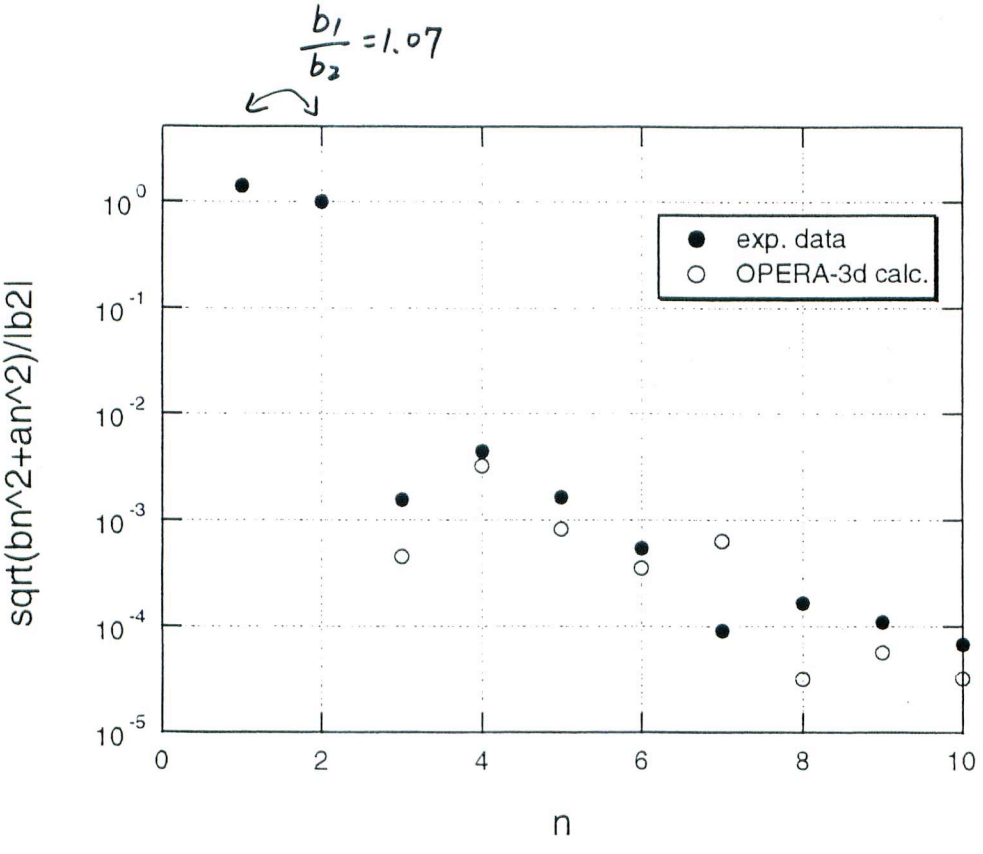
requirement

$\frac{dB}{dx} < 1 \times 10^{-3}$



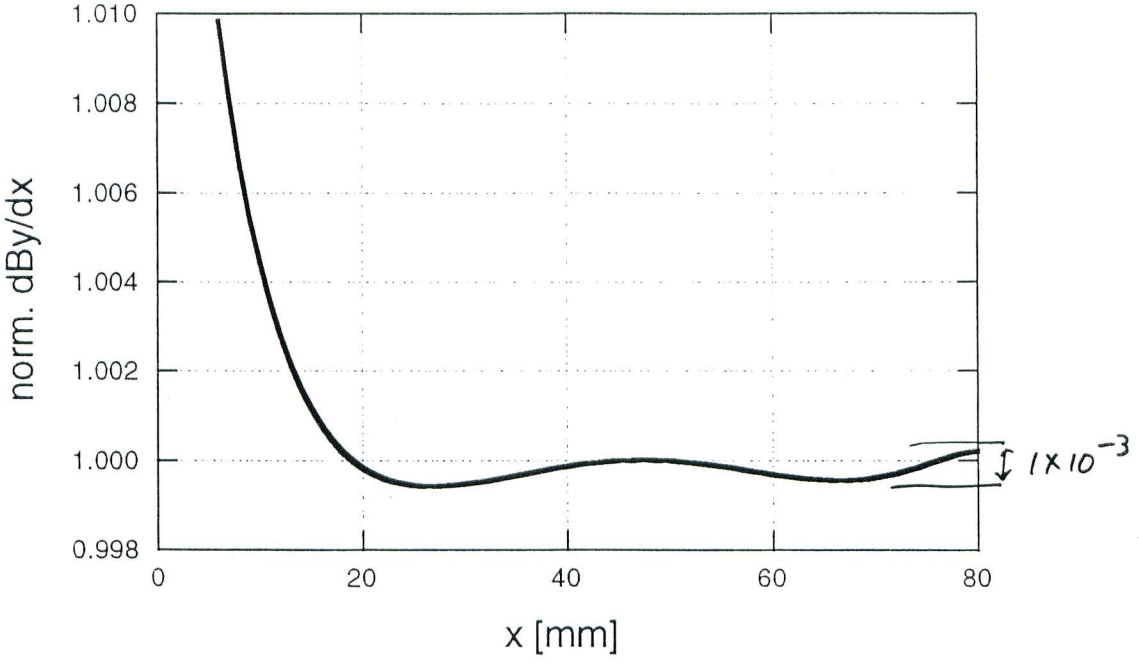


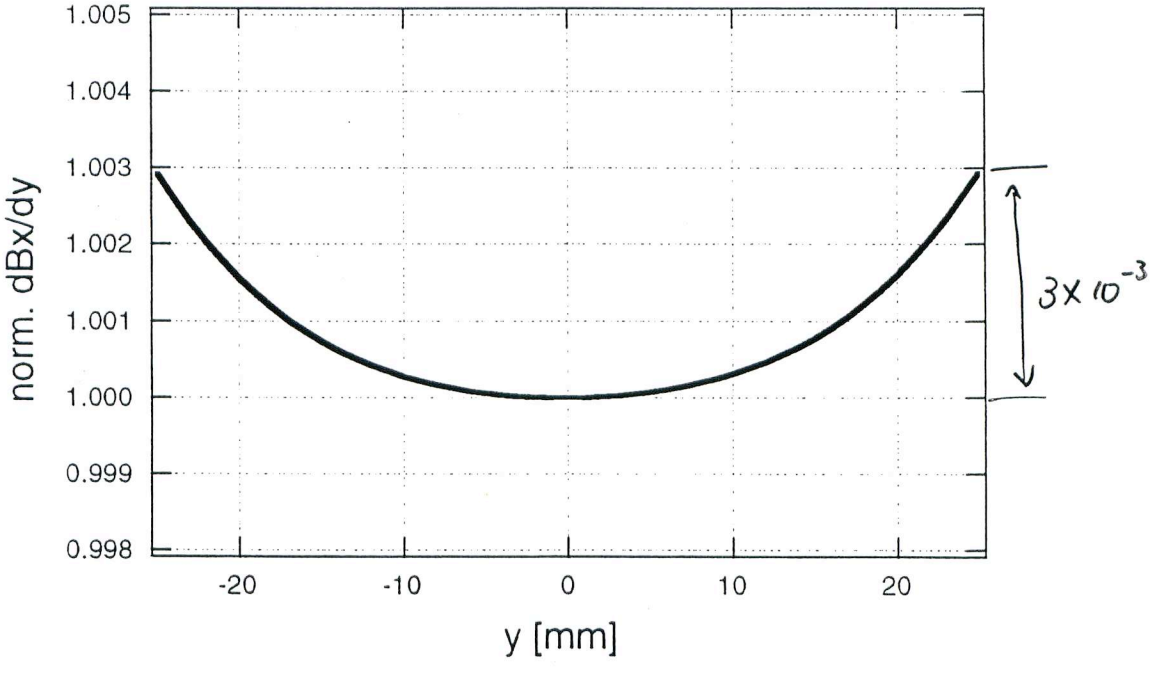
QC1RE w/o end-shim correction



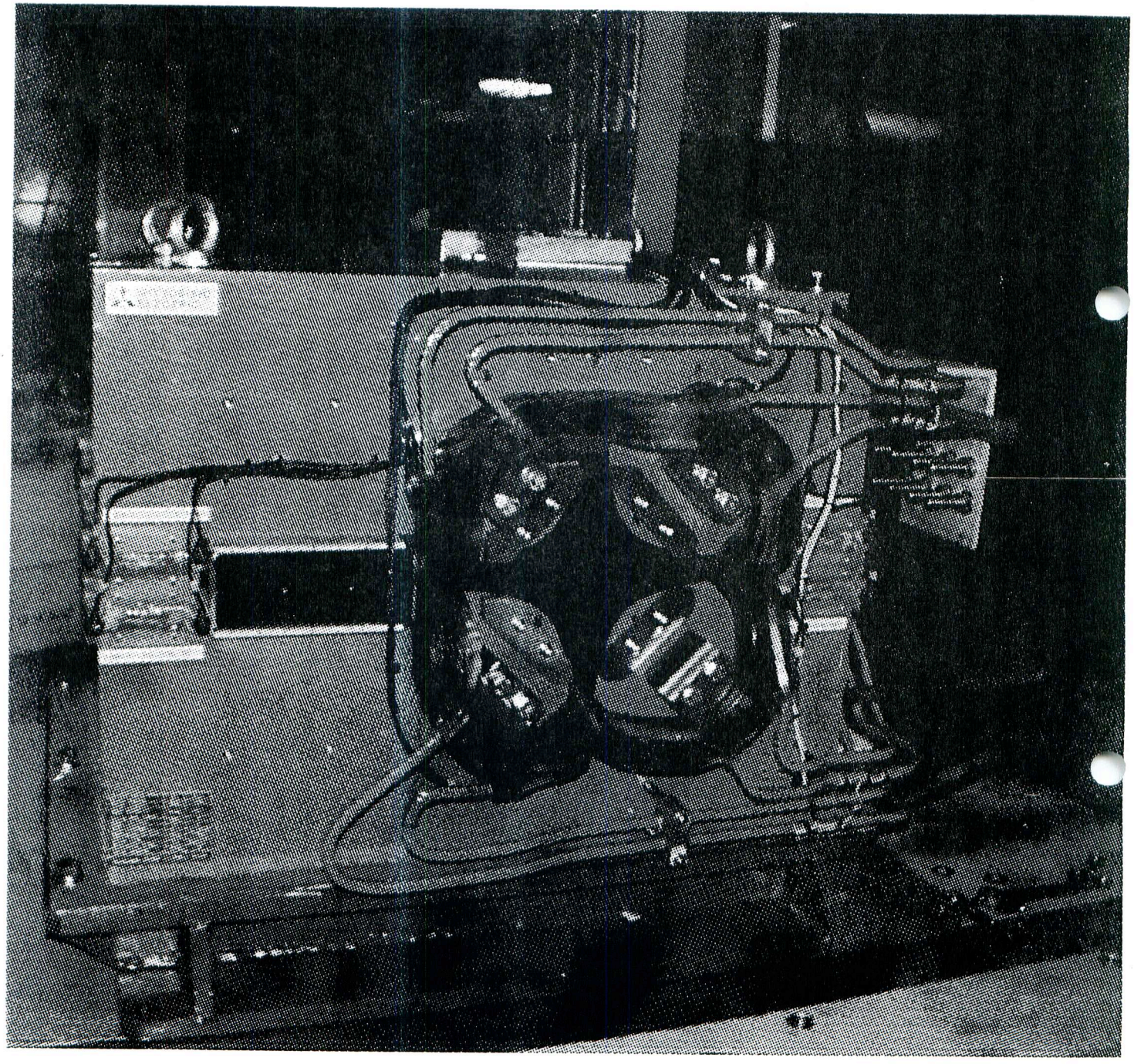
The electron beams go through the off-center of QC1RE.
The ratio of b1/b2 is important value for optics design.
The mirror plate should be longer to reduce b1/b2.

QC1RE with end-shim correction





We tried to do corrections by end-shims.
But the field distributions of dBy/dx, dBx/dy are still bad.

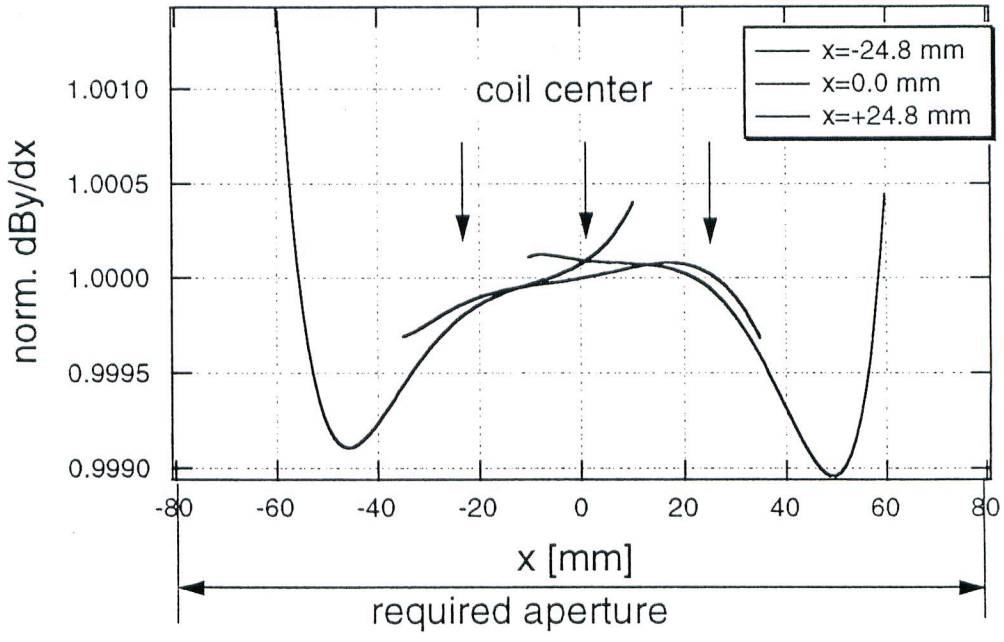


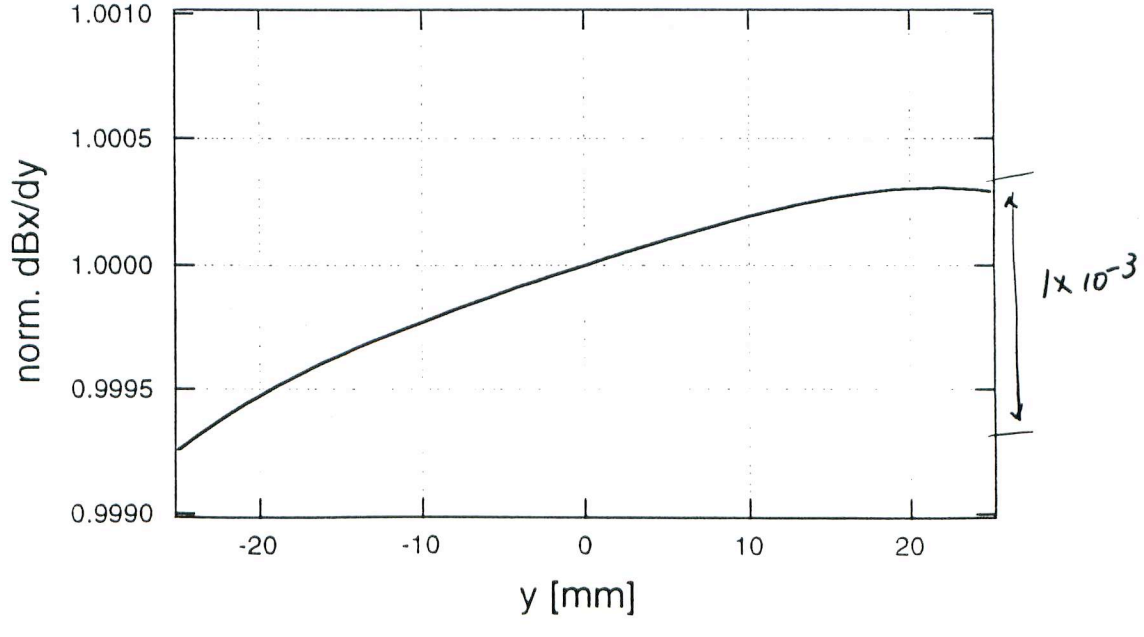
QC2 RE

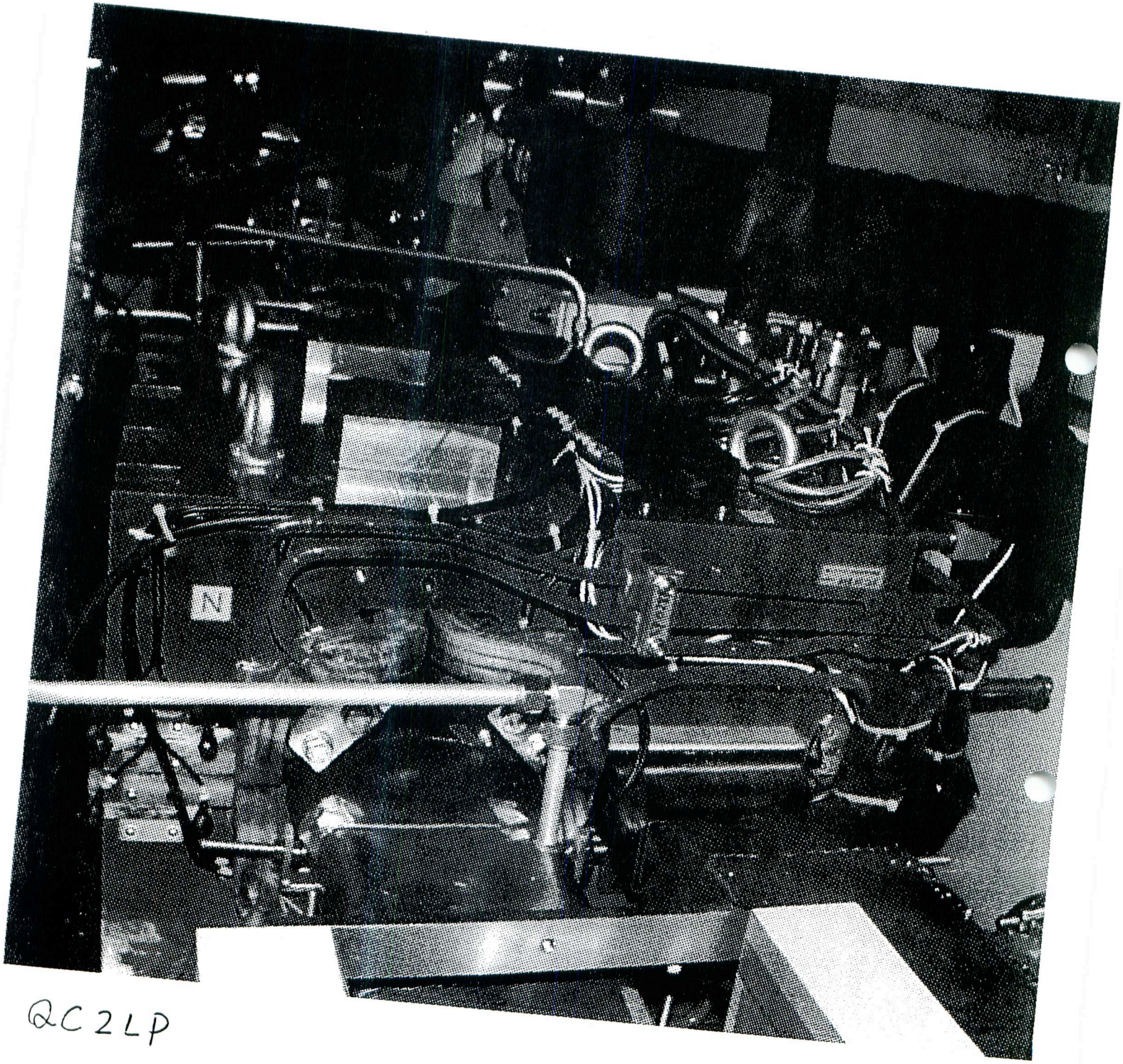
Leakage fields ~2 G

QC2RE with end-shim

The required horizontal aperture for QC2s (QC2RE, QC2LE, QC2RP, QC2LP) is larger than bore radius.
We tried to measure the field distributions by shifting the coil center. But all the regions the beams may exist could not be covered.

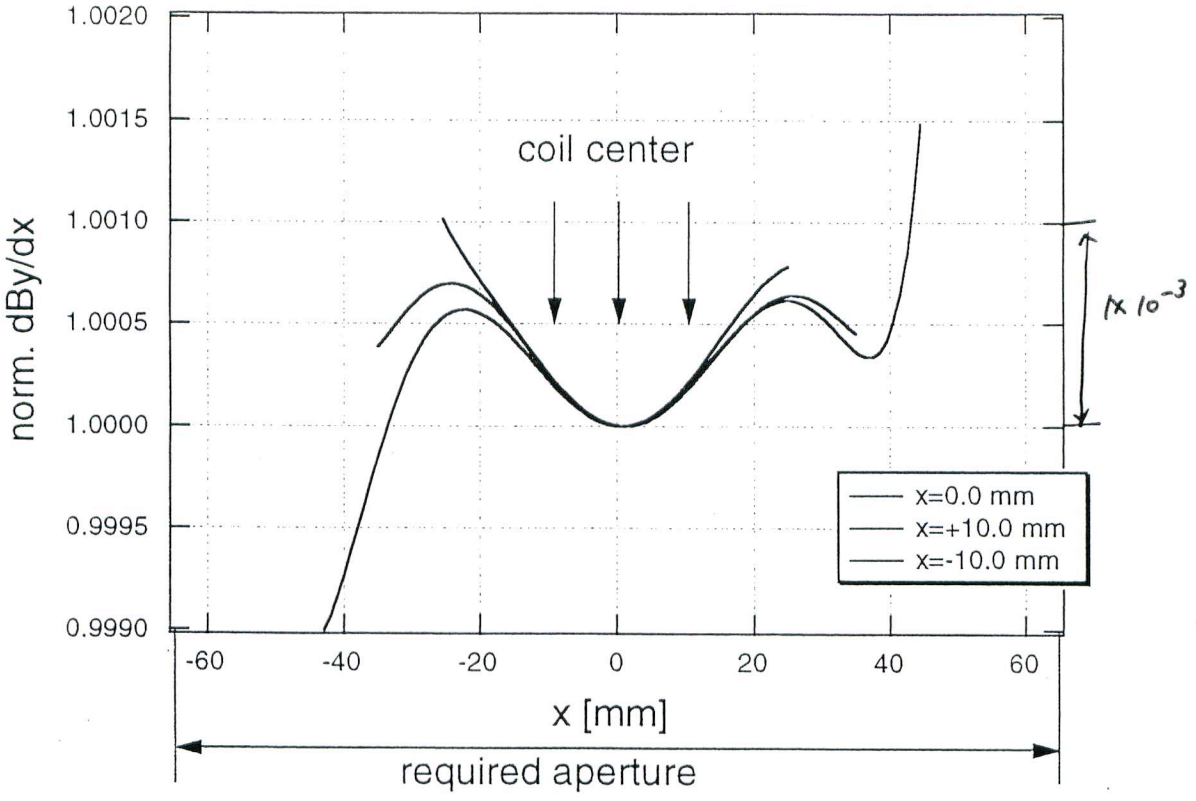


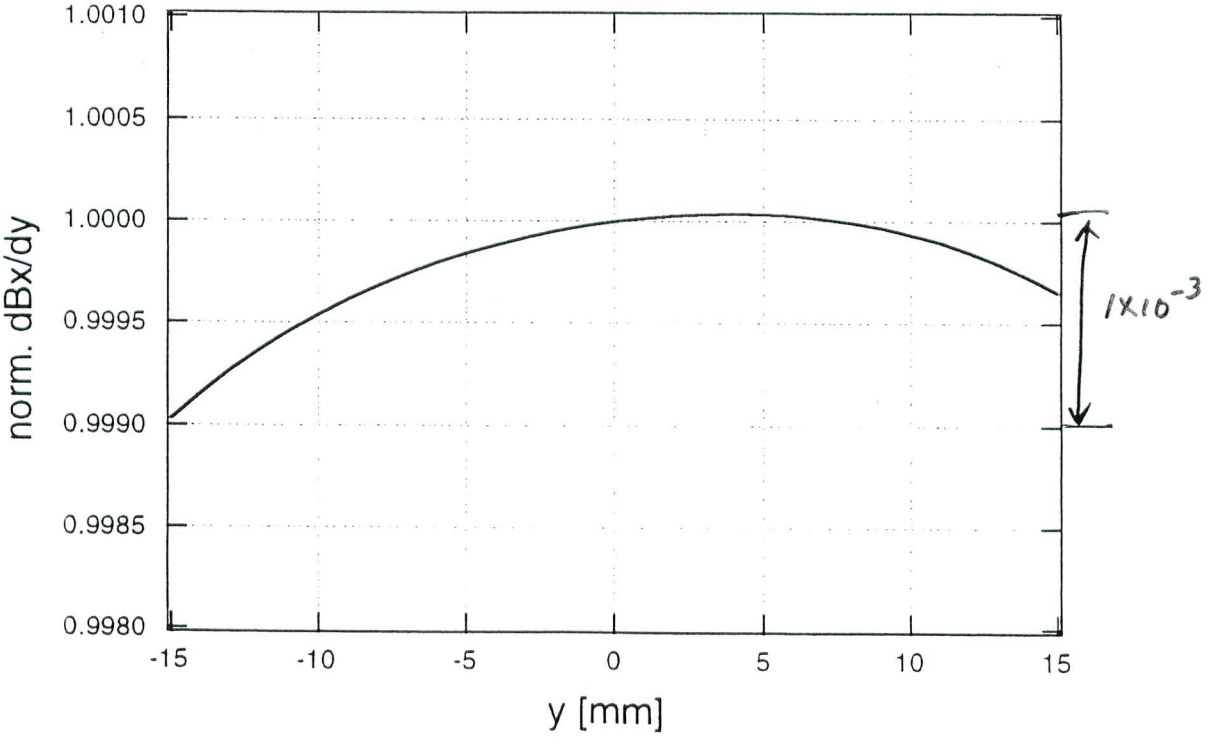


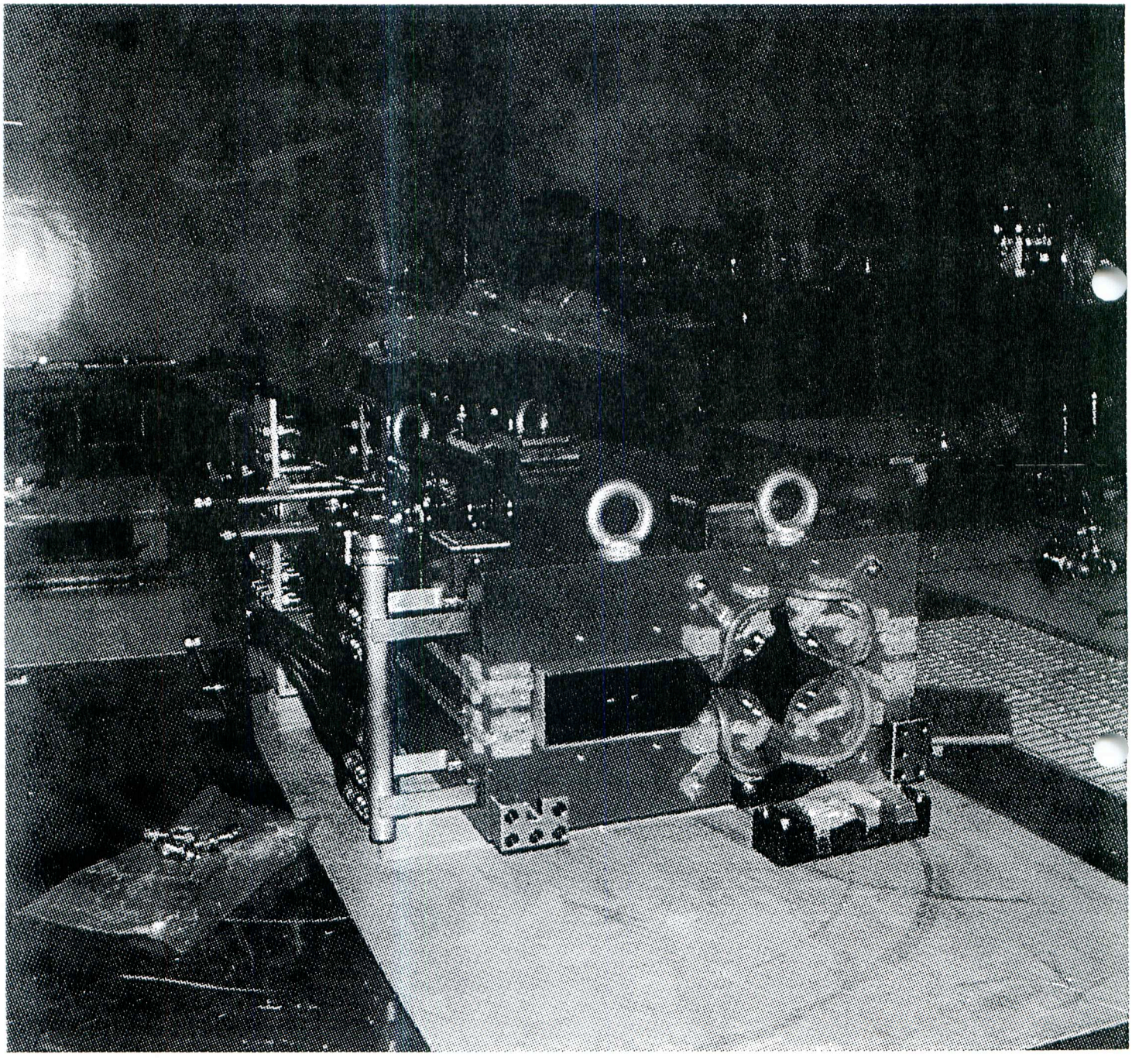


QC2LP

QC2LP with end-shims



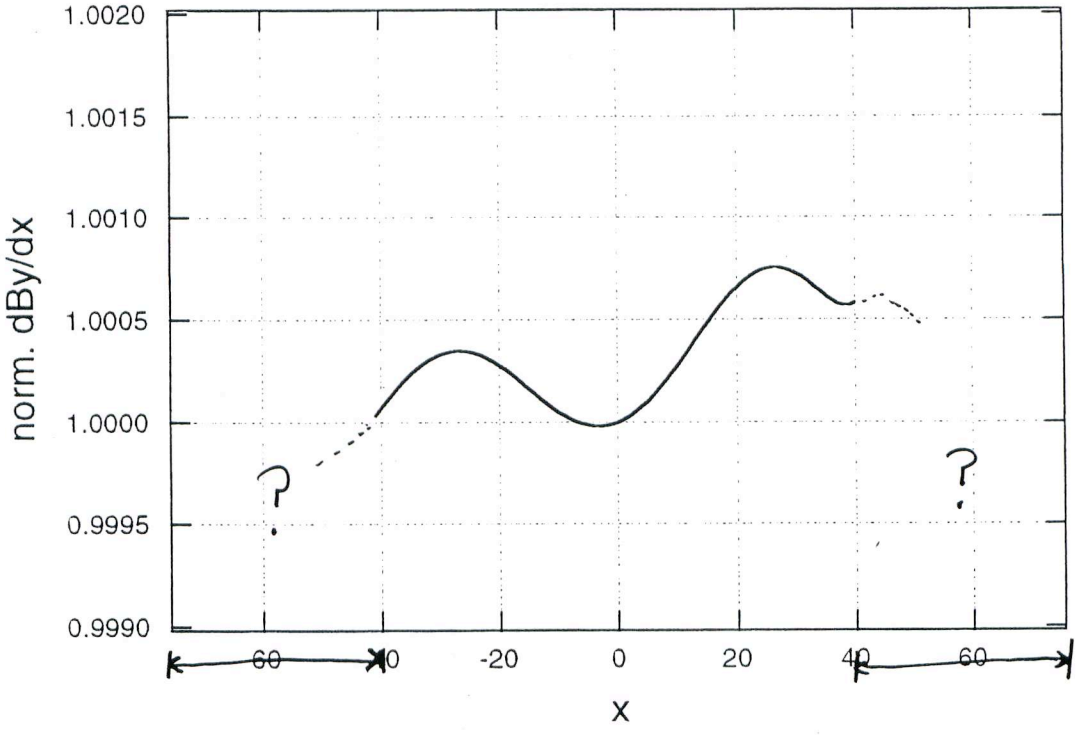


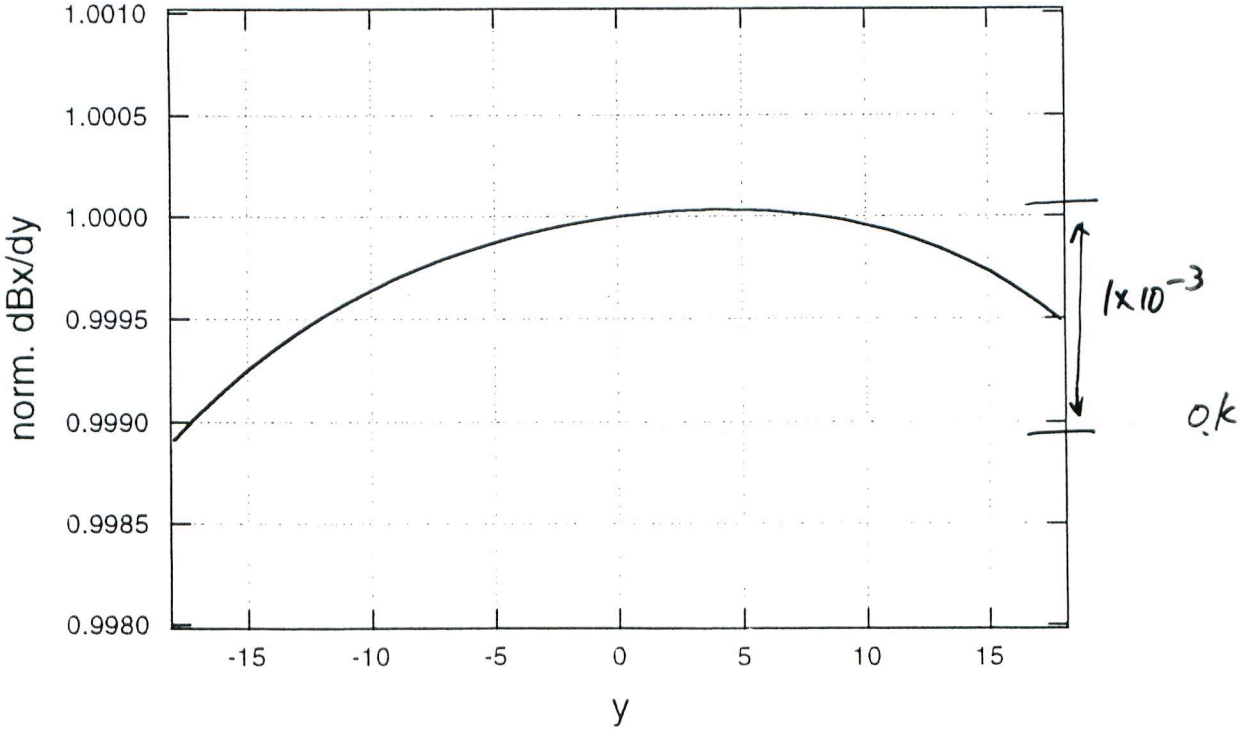


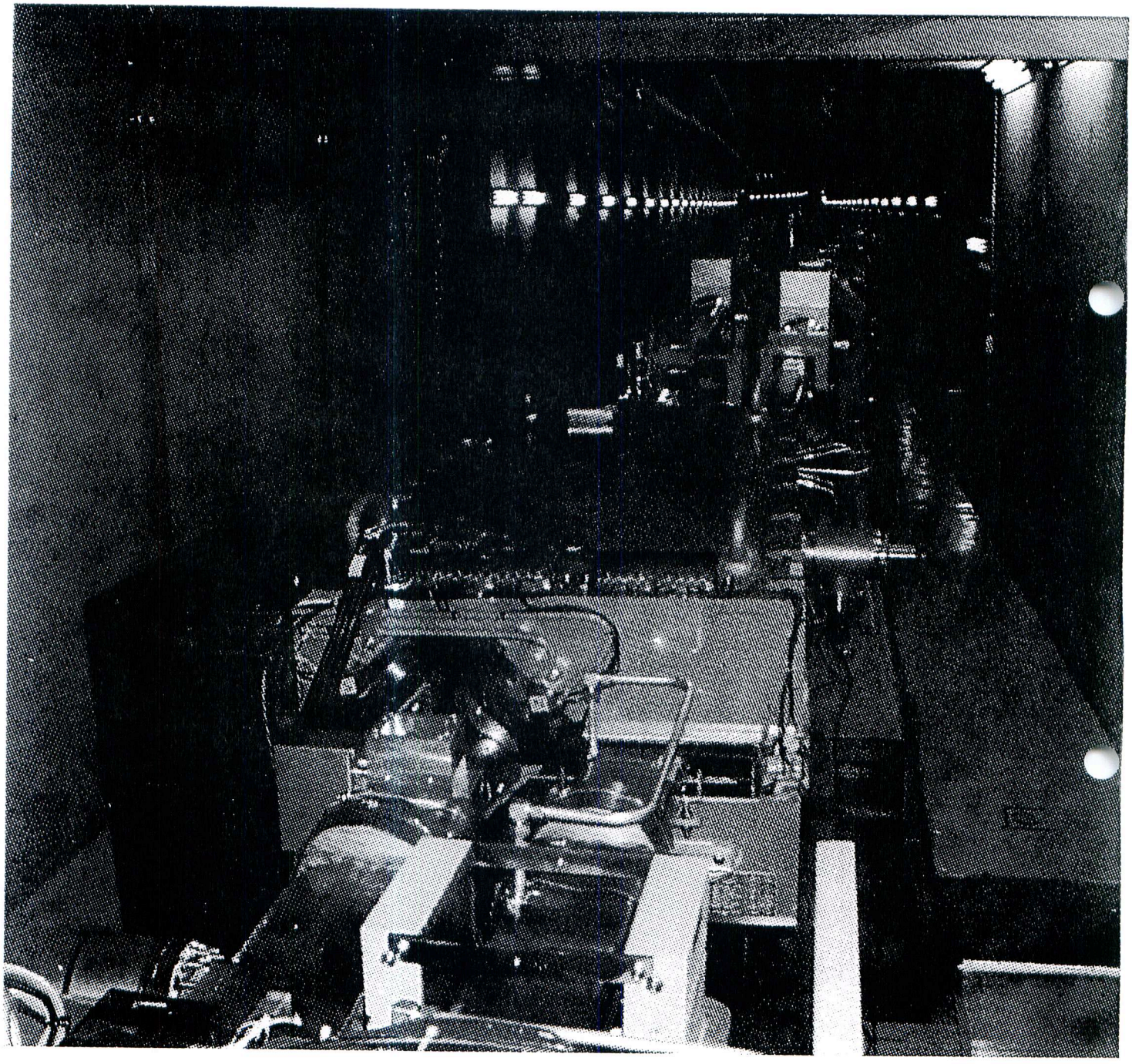
QC 2 RP

Leakage fields ~5 G

QC2RP with end-shim



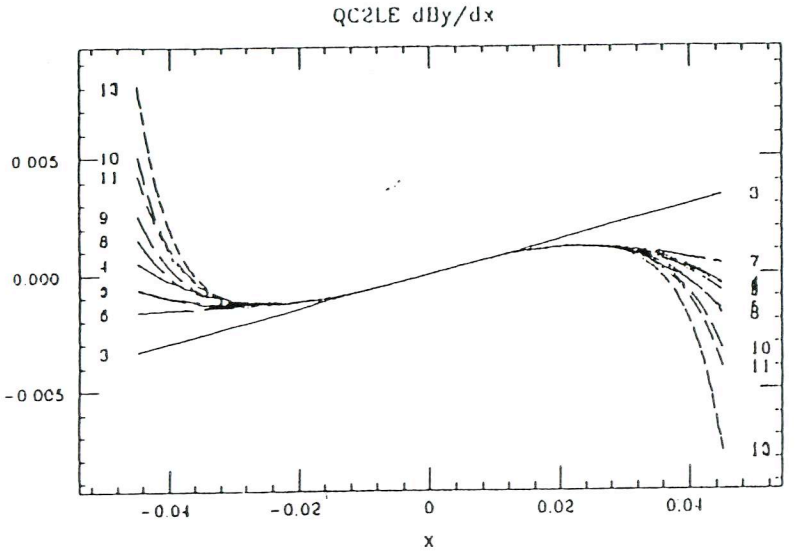


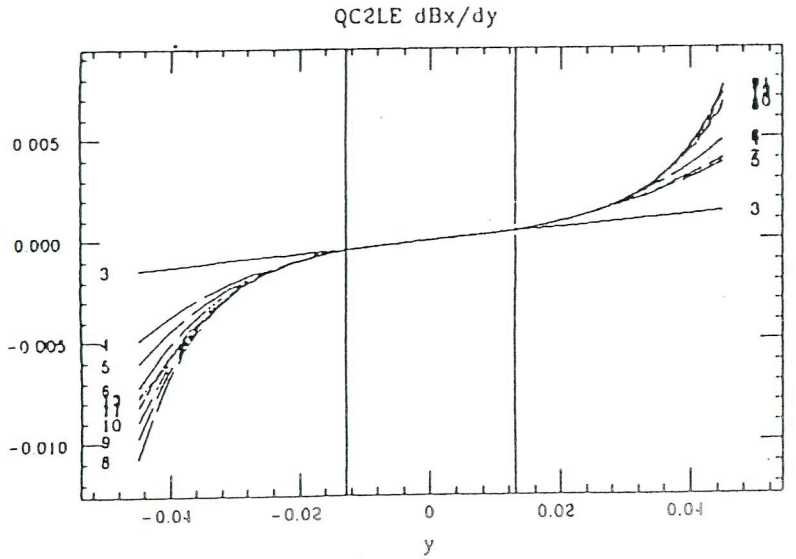


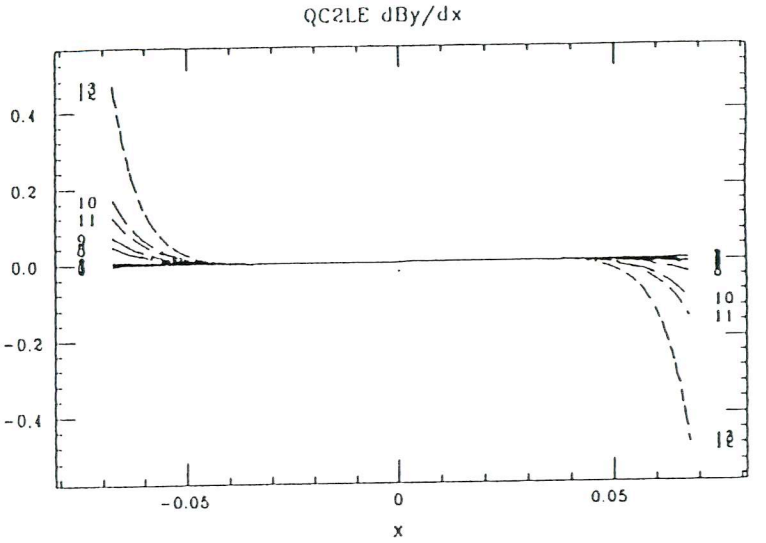
QC2LE

Leakage field ~ 5G

QC2LE was measured by harmonic coil for HER ring magnets but could not be measured correctly. The coil has a problem for odd-th multipole components.







Summary

1, QC1LE(field strengths, distributions) OK.

2, QC1RE has many problems.
We need to re-design QC1RE.

3, All the aperture region of QC2s was not measured. To measure all region, we are going to develop a measurement system for QC2s.

4, QC2LE was not measured correctly. We will measure it by another harmonic coil.