Introduction

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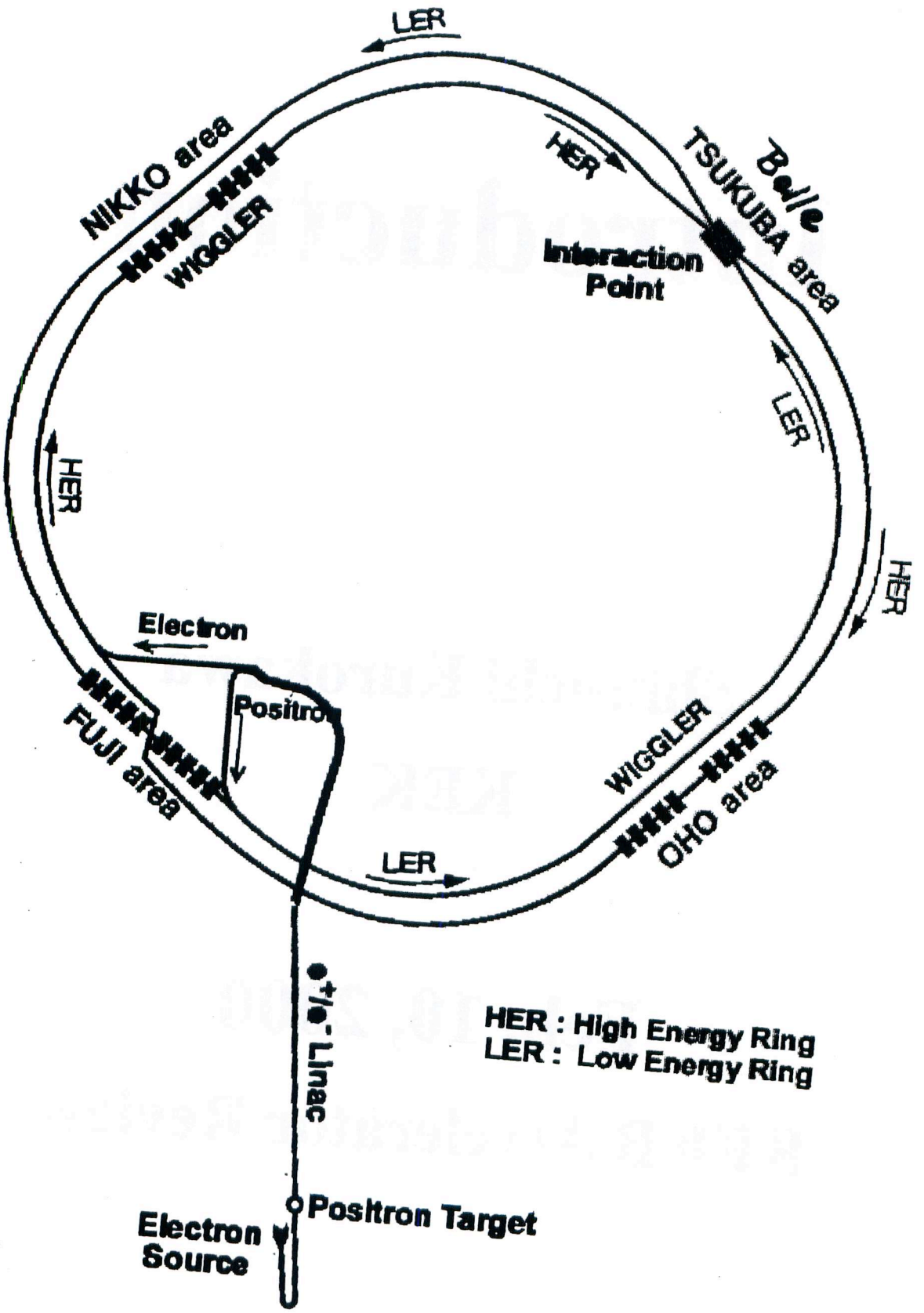
KEK

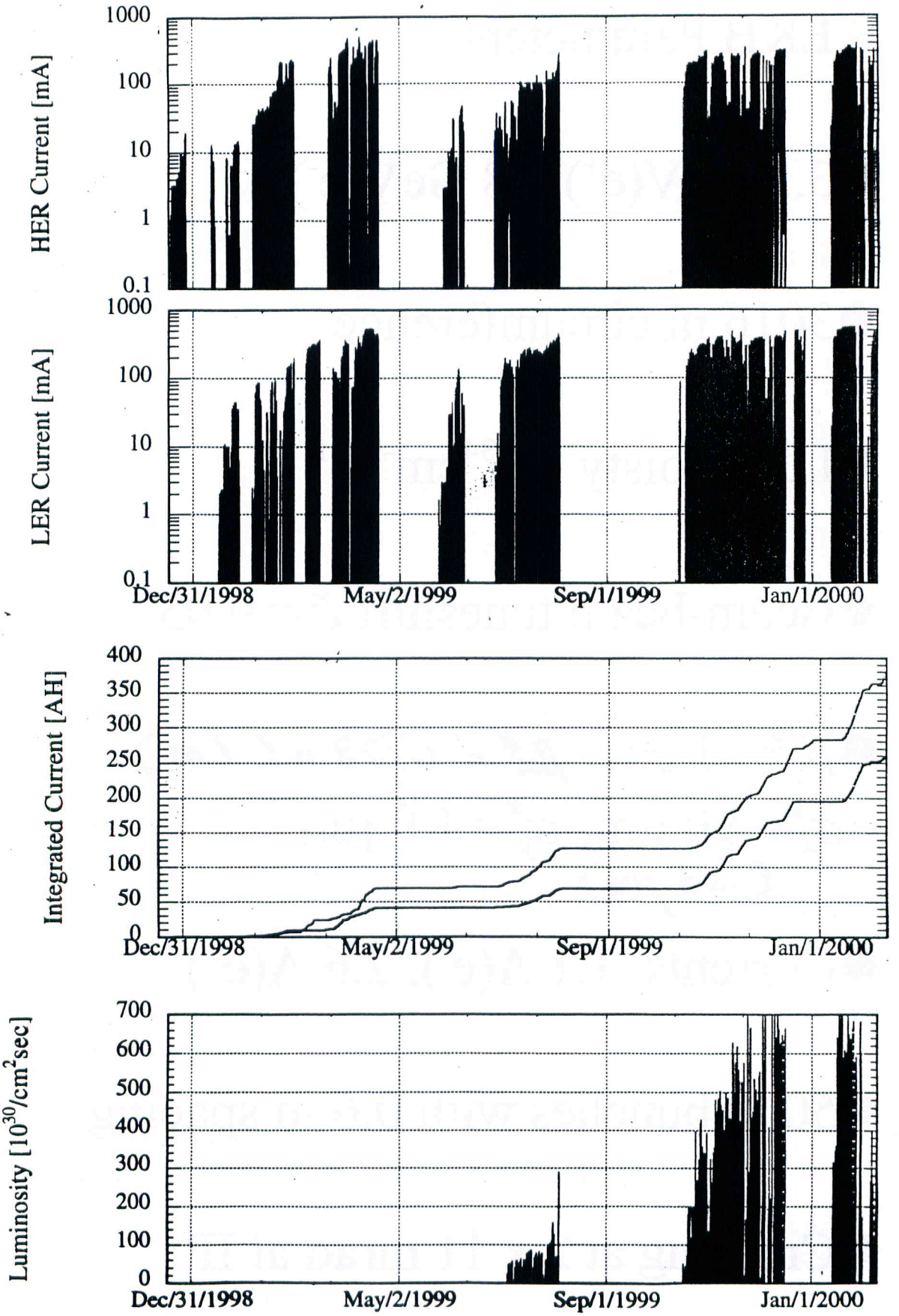
Feb. 10, 2000

KEKB Accelerator Review


LER
HER
Belle
TSUKUBA area
Interaction Point
NIKKO area
WIGGLER
LER
HER
HER
Electron
Positron
FUJI area
WIGGLER
OHO area
LER
e+/e- Linac
HER : High Energy Ring
LER : Low Energy Ring
Positron Target
Electron Source

KEKB Parameters

- 3.5 GeV(e^+) x 8 GeV(e^-)
- 3016 m circumference
- Luminoisty $10^{34} cm^{-2} s^{-1}$
- Beam-beam tuneshift $\xi = 0.05$
- $\beta_y^* = 1$ cm $\beta_x^* = 0.33$ m (1 m)
  $\sigma_x^* = 90$ μm, $\sigma_y^* = 1.9$ μm
  (156 μm)
- Currents 1.1 A(e^-), 2.6 A(e^+)
- 5000 bunches with 0.6 m spacing
- Crossing at 2 x 11 mrad at IP

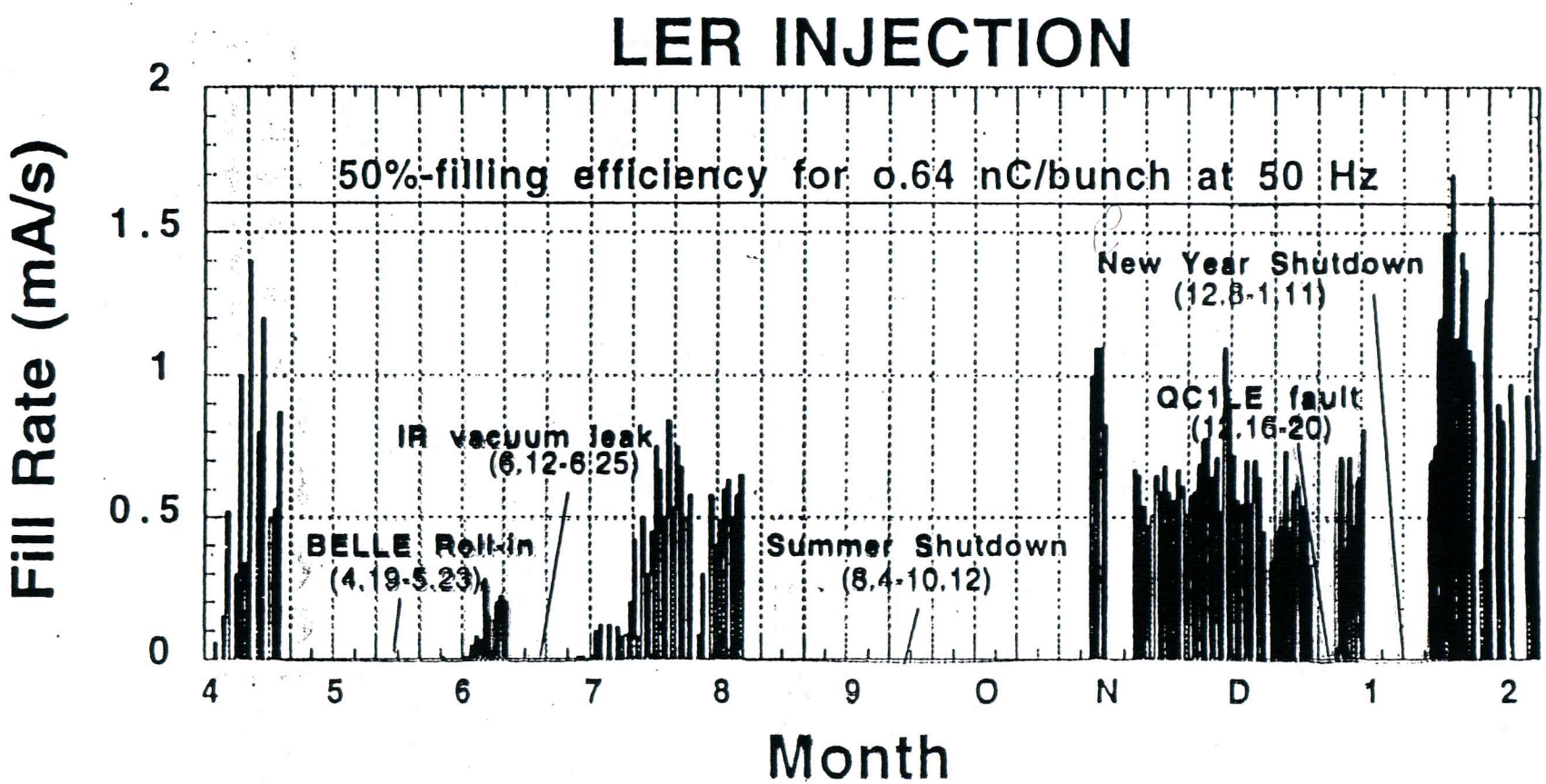

HER Current [mA]
1000
100
10
1
0.1
LER Current [mA]
1000
100
10
1
0.1
Dec/31/1998
May/2/1999
Sep/1/1999
Jan/1/2000
Integrated Current [AH]
400
350
300
250
200
150
100
50
0
Dec/31/1998
May/2/1999
Sep/1/1999
Jan/1/2000
Luminosity [10^{30}/cm^{2}sec]
700
600
500
400
300
200
100
0
Dec/31/1998
May/2/1999
Sep/1/1999
Jan/1/2000

98/12/1	**Commissioning of HER started**
98/12/11	**First circulation of beam in HER**
98/12/27 -99/1/7	**Year-end and new-year shutdown**
1/10	**Commissioning of LER started**
4/19	**End of 1st stage commissioning Max. currents in LER and HER are 542 mA and 514 mA**
5/1	**BELLE roll-in**

5/25	**Start of operation with BELLE**
6/1	**Observation of 1st hadroninc event**
6/9	**First physics run** **Average L=1.05 x 10^{31}** **Integrated L=505/nb** **Observed 1269 hadronic events**
6/11 -6/27	**Shutdown due to vacuum leak at IP**
6/27 -8/5	**Physics run** **Peak L=2.9 x 10^{32}** **Integrated L=26/pb**

8/5 -10/12	**Summer shutdown** **4 ARES in LER and 4 ARES in HER were added** **Replace Al IR duct with Cu duct** **Replace of SVD**
10/12	**Operation resumed**
10/24 -12/16	**Physics run** **Peak L=6.9 x 10^{32}** **Integrated L=300/pb**
12/16	**Burnout of QC1LE coil**
12/27	**Vacuum leak from a movable mask**

99/12/27 -00/1/11	**New-year shutdown**
1/23	**Int L/day=25.5/pb**
1/25	**Peak L=7.4 x 10^{32}** **Integrated L=471/pb** **e^+ injection 1.7 mA/s**
1/30	**Vacuum leak from a movable mask**
2/8	**Physics run resumed**


LER INJECTION
50%-filling efficiency for o.64 nC/bunch at 50 Hz
Fill Rate (mA/s)
2
1.5
1
0.5
0
BELLE Roll-in
(4.19-5.23)
IR vacuum leak
(6.12-6.25)
Summer Shutdown
(8.4-10.12)
New Year Shutdown
(12.8-1.11)
QC1LE fault
(12.16-20)
4
5
6
7
8
9
O
N
D
1
2
Month

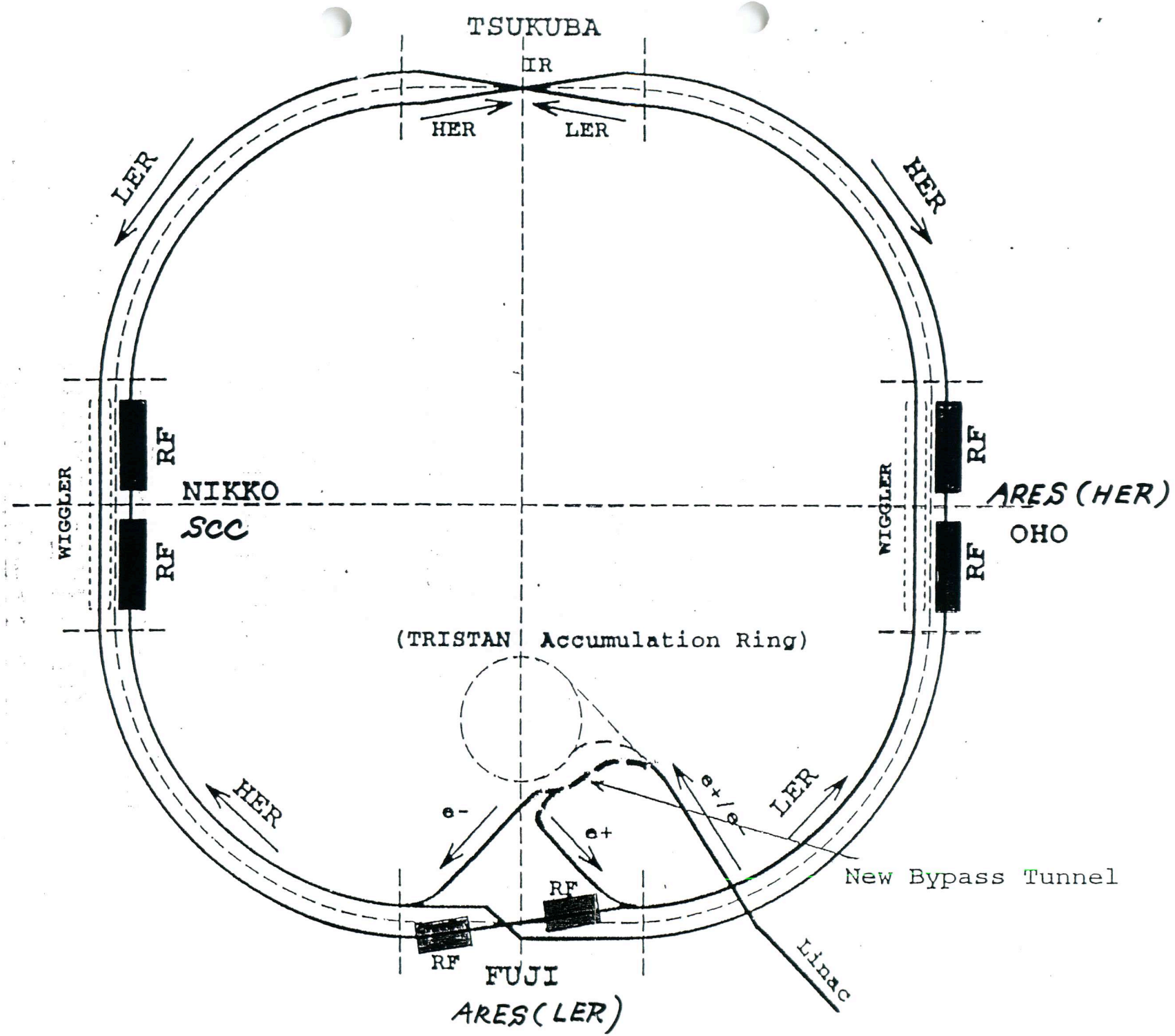
RF system

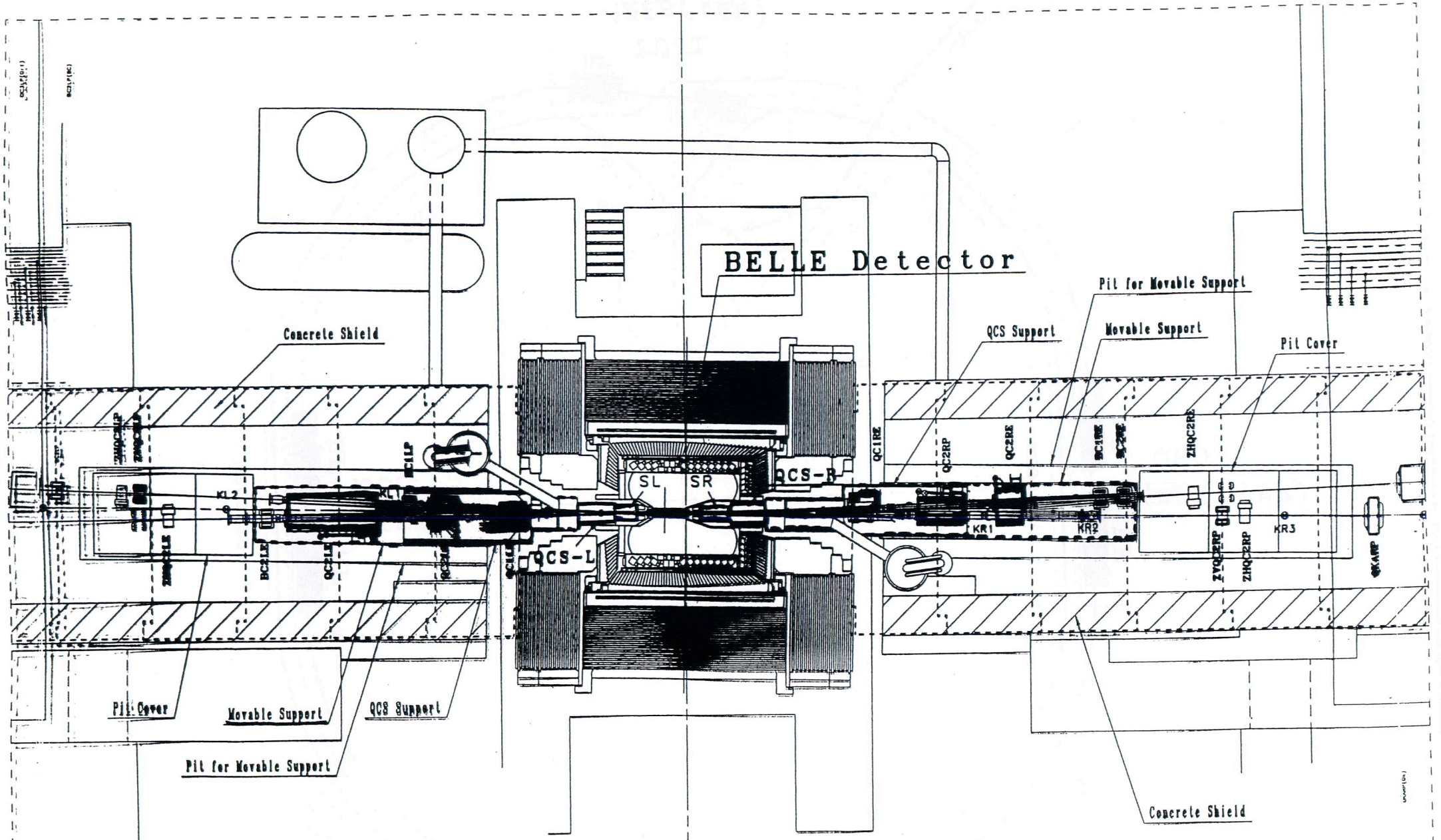
- Number of cavities:

		t=0	Oct. 99	Oct. 00	Oct. 01
LER	ARES	12	16	16	20
HER	ARES	6	10	10	12
	SCC	4	4	8	8

- ARES and SCC are working without any problems

- Breakdowns of SCC is quite rare

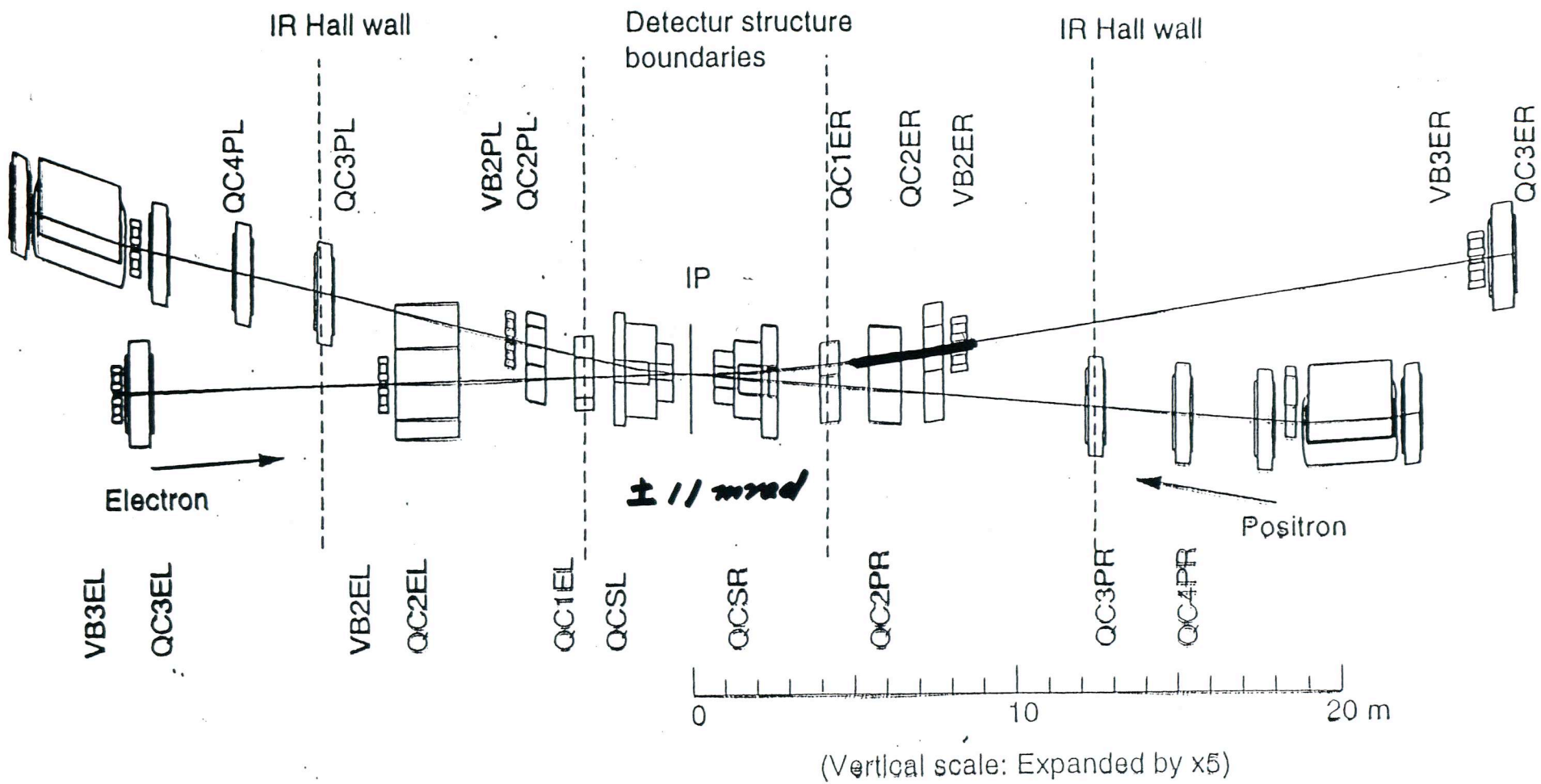

TSUKUBA
IR
HER
LER
LER
HER
RF
RF
WIGGLER
NIKKO
SCC
RF
RF
WIGGLER
ARES (HER)
OHO
(TRISTAN Accumulation Ring)
HER
e-
e+
e+/e-
LER
New Bypass Tunnel
RF
RF
Linac
FUJI
ARES(LER)

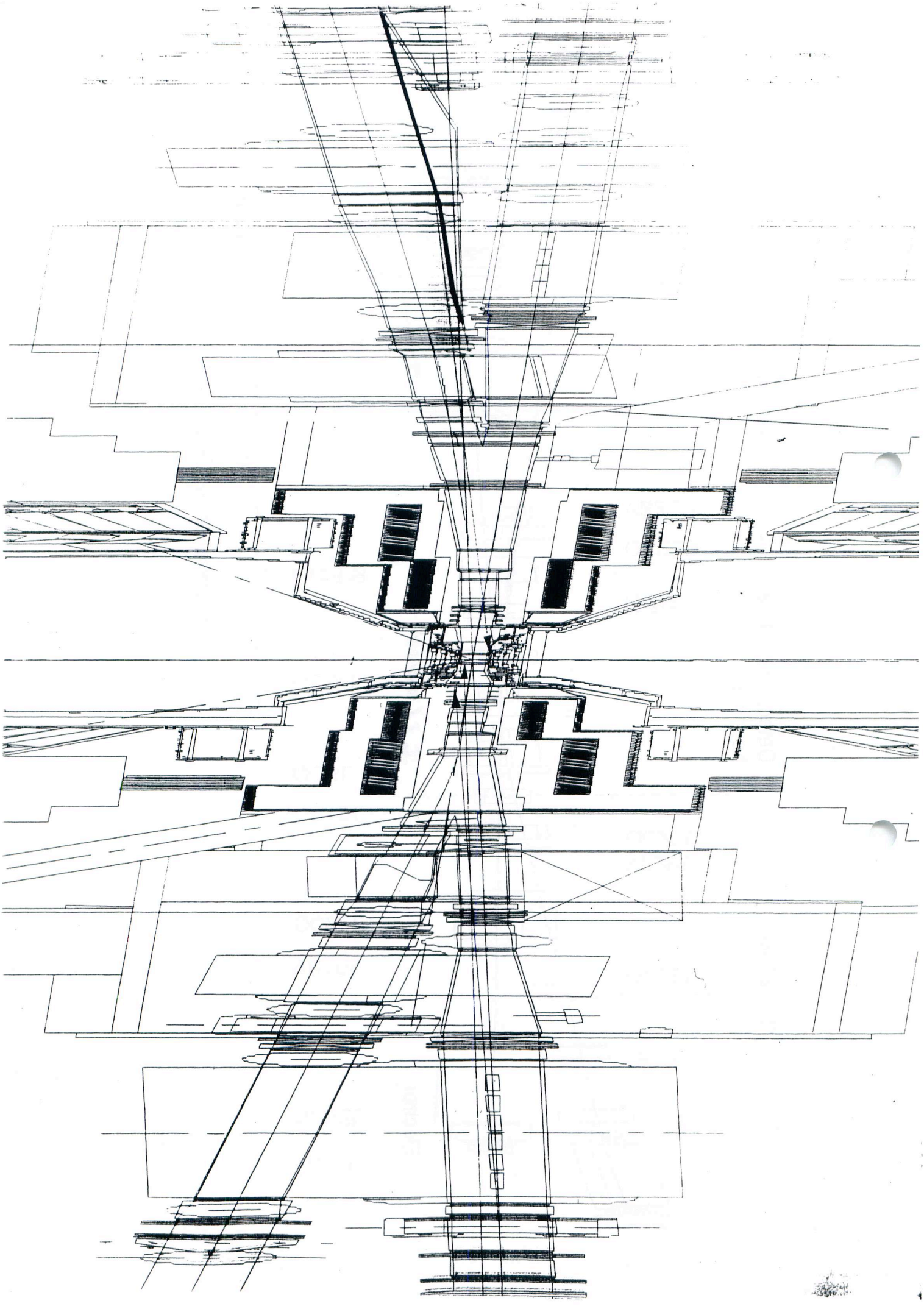


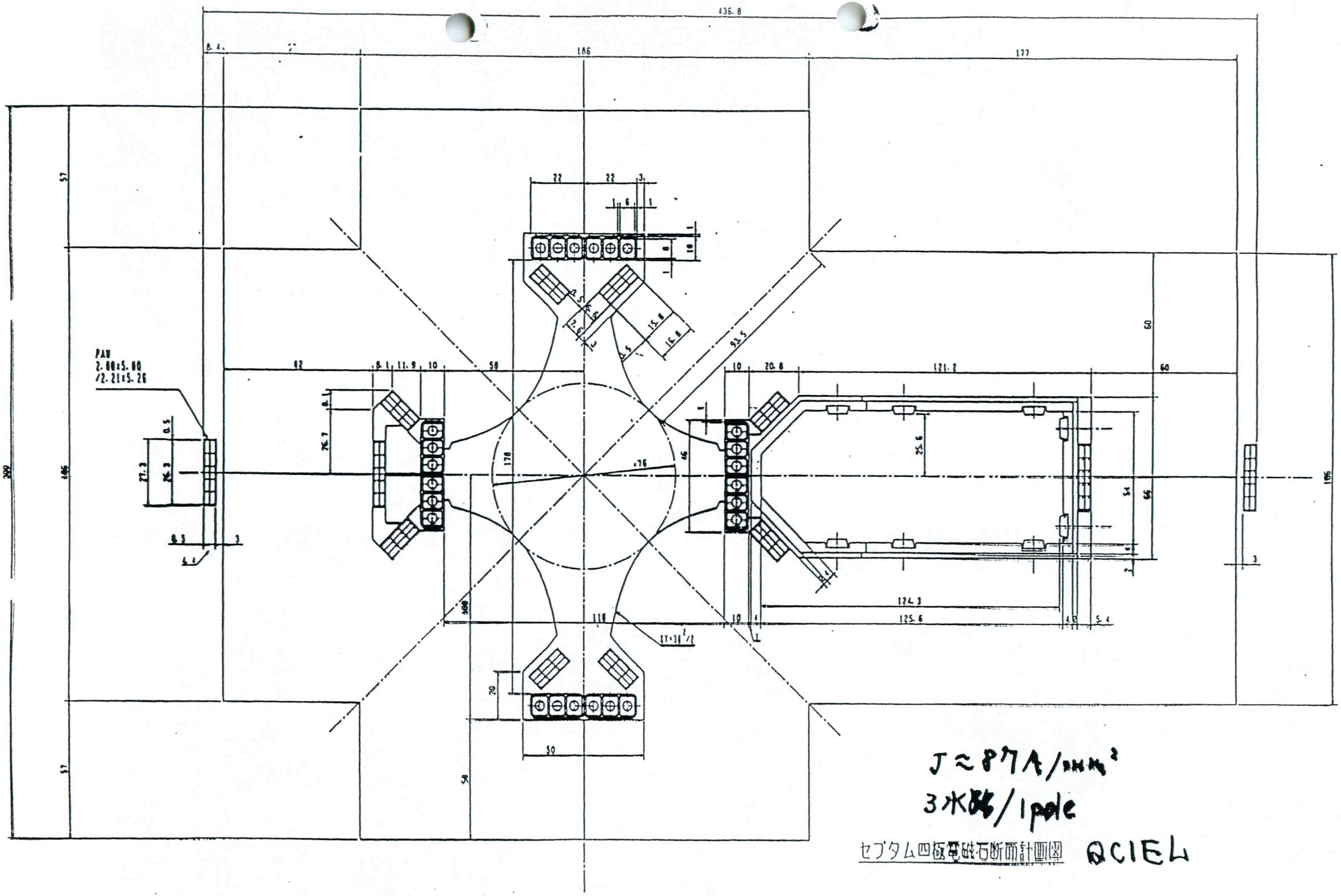
Top View for Tsukuba Interaction Region

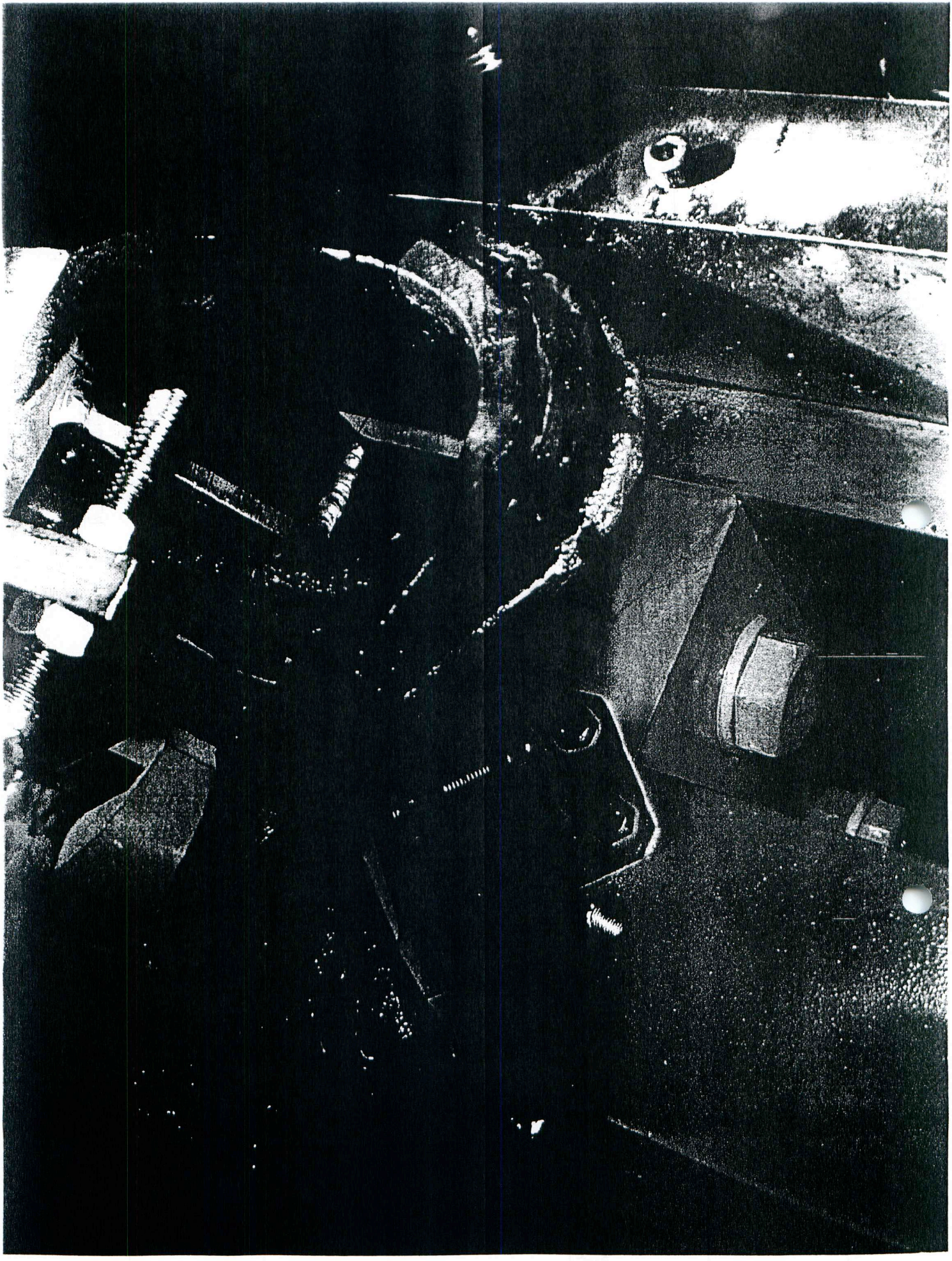
Scale = x 0.013

Tsukuba_IR_E_990111


IR Hall wall
Detectur structure boundaries
IR Hall wall
QC4PL
QC3PL
VB2PL
QC2PL
QC1ER
QC2ER
VB2ER
VB3ER
QC3ER
IP
±11 mrad
Electron
Positron
VB3EL
QC3EL
VB2EL
QC2EL
QC1EL
QCSL
QCSR
QC2PR
QC3PR
QC4PR
0
10
20 m
(Vertical scale: Expanded by x5)




436.8
186
177
PAW
2.00×5.00
/2.21×5.26
J≈87A/mm²
3水冷/1pole
セプタム四極電磁石断面計画図
QCIEL



Photoelectron Instability

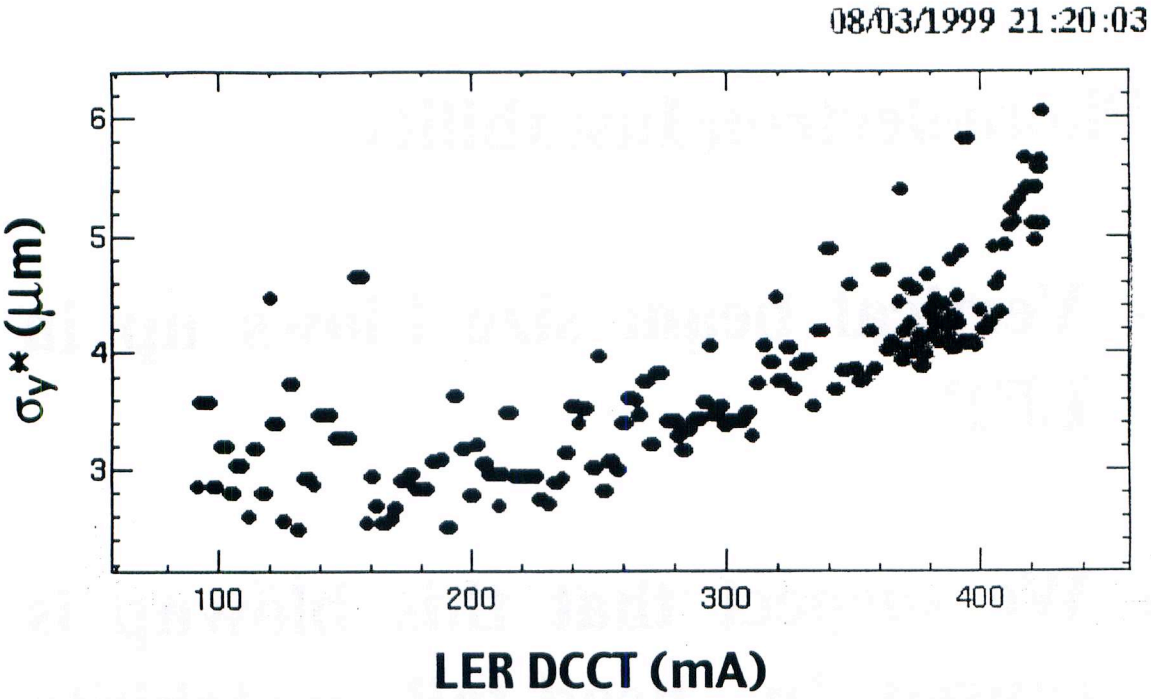
- Vertical beam size blows up in LER

- We suspect that this blowup is caused by head-tail instability due to electron clouds

- We installed permanent magnets along outer side of vacuum pipes downstream of dipole magnets; the effect was not so drastic

- This is the most serious issues at KEKB and will be discussed in this meeting

(2) Blowup of vertical beam size in LER



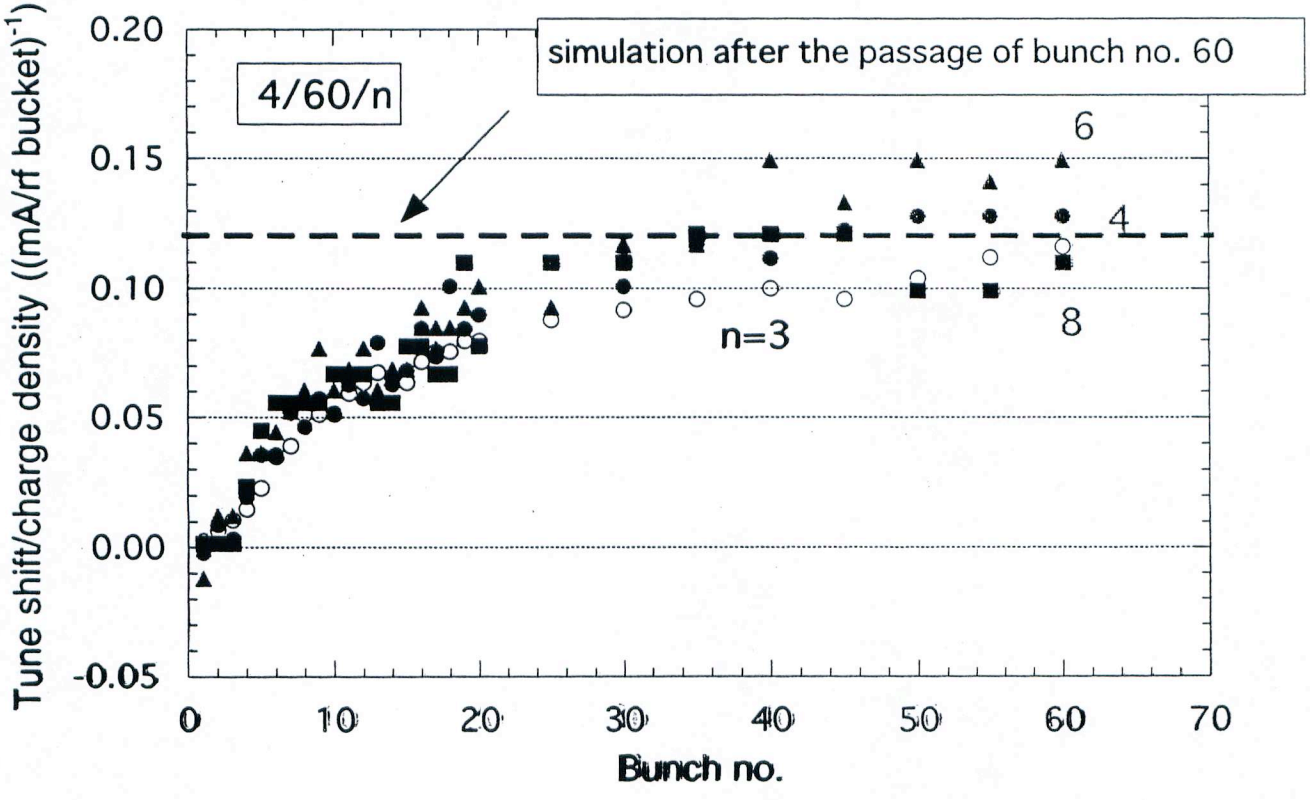
- single-beam phenomenon

- no oscillation is seen at least when ξ_y is high positive value (+5 to +8).

- depends on x, y tunes, chromaticity, dispersions.

- no beam loss.

- relation with multibunch tune-shift and multibunch bunch lengthening (T. Ieiri) is unknown.

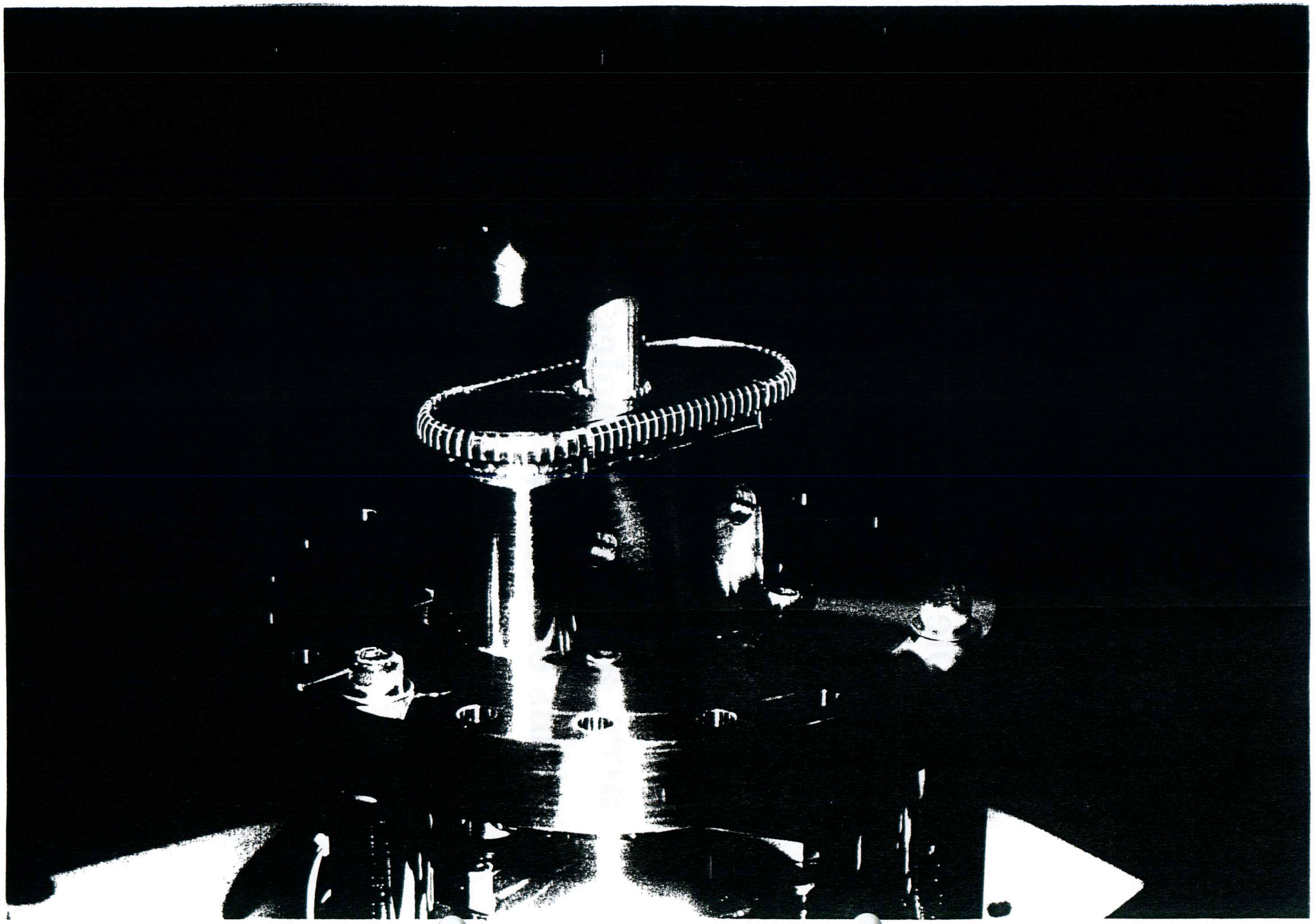

simulation after the passage of bunch no. 60
4/60/n
6
4
8
n=3
Tune shift/charge density ((mA/rf bucket)$^{-1}$)
0.20
0.15
0.10
0.05
0.00
-0.05
0
10
20
30
40
50
60
70
Bunch no.

Movable Masks

- We had three vacuum leaks due to movable masks in LER; movable masks are the most serious limiting factor of stored current

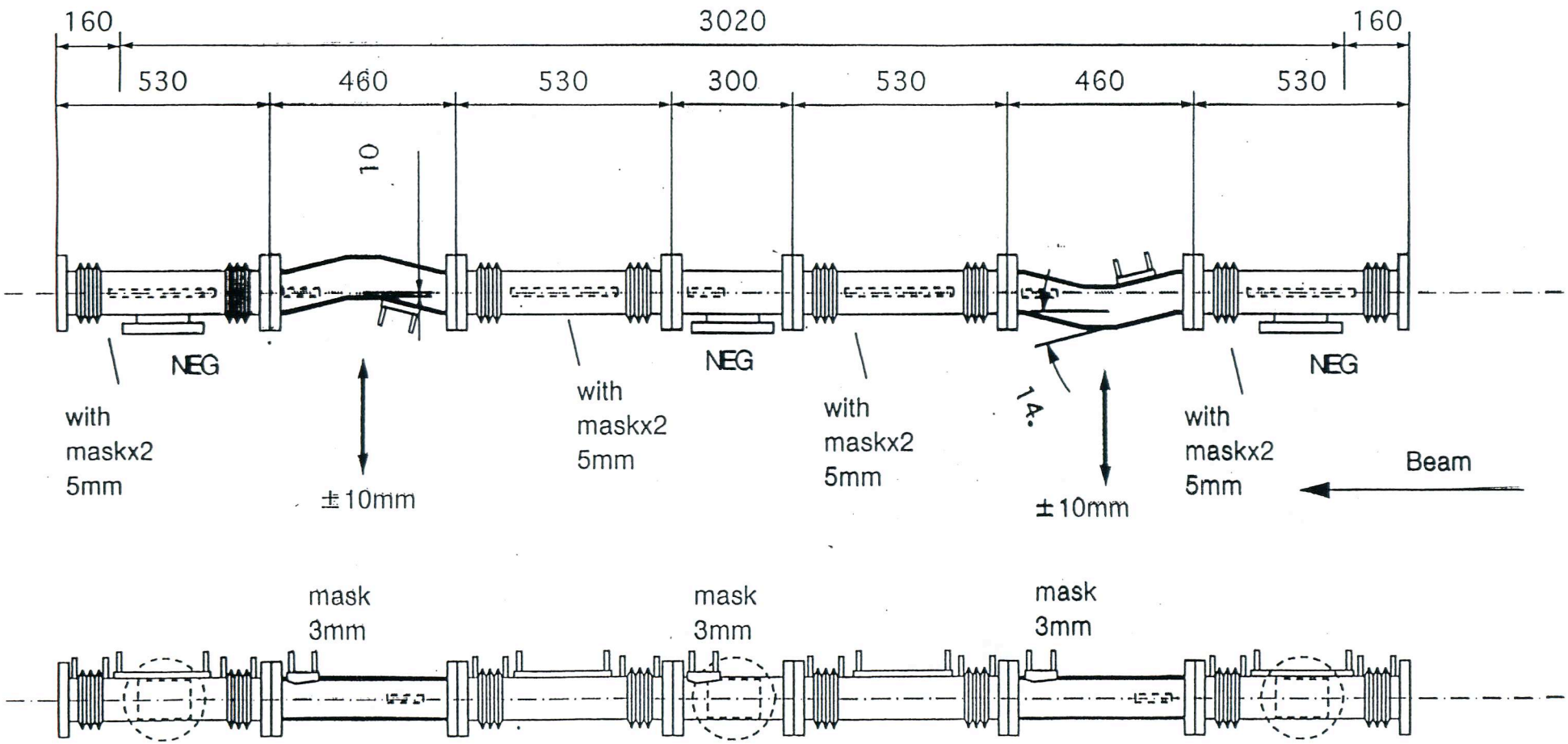
- HOMs excited by beam caused arcs and made holes either on stems or bellows

- New types of masks are now being made and will be installed in March



Ver.4

LER-Vertical Movable Mask ver.4



Crab cavities

- Crab cavity R&D is going on slower than expected

- R&D shows that crab cavity with a coaxial coupler works in principle

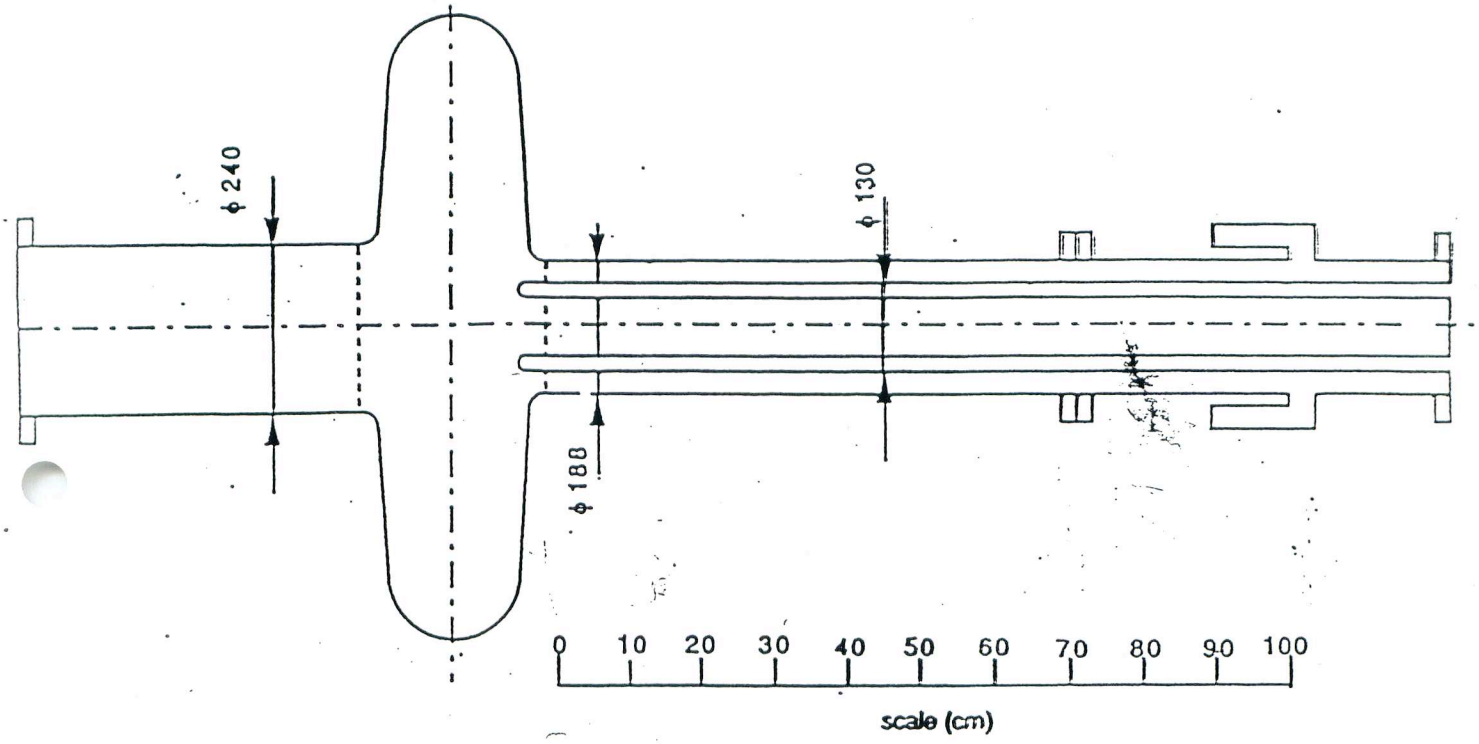
- The first full prototype will be made in JFY2000

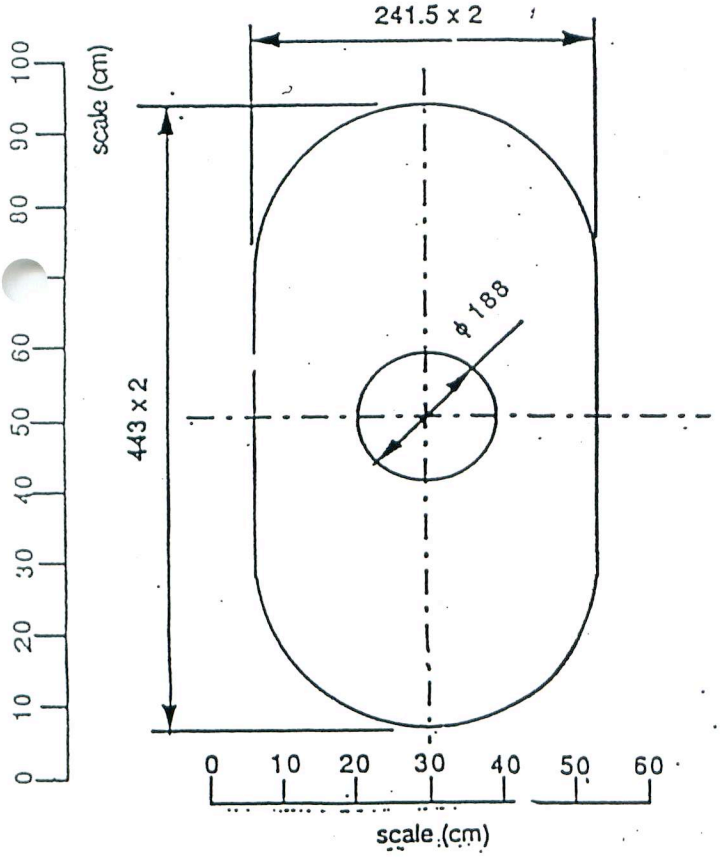
- It will take two years (2001 and 2002) for mass production; installation of the cavities will be in 2003

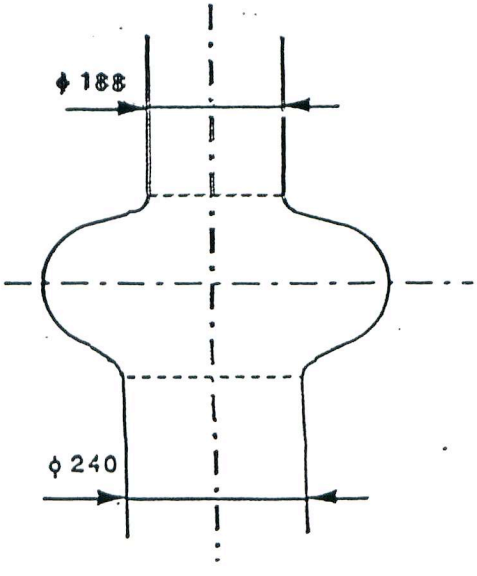
Crab Cavity Group

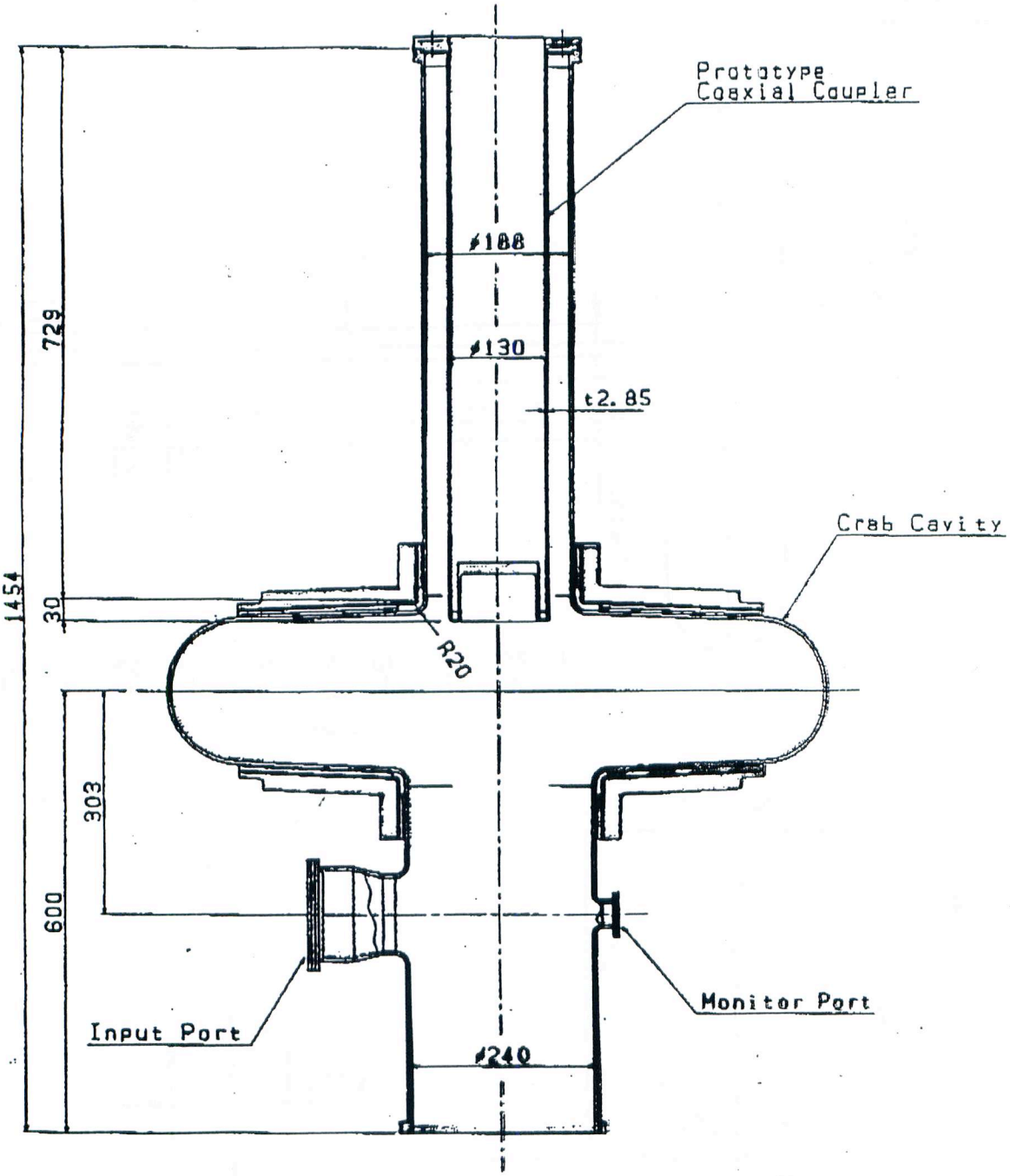
KEK-B Crab Cavity

Mar. 24, 1995
K. Hosoyama
(revised from Mar. 16)





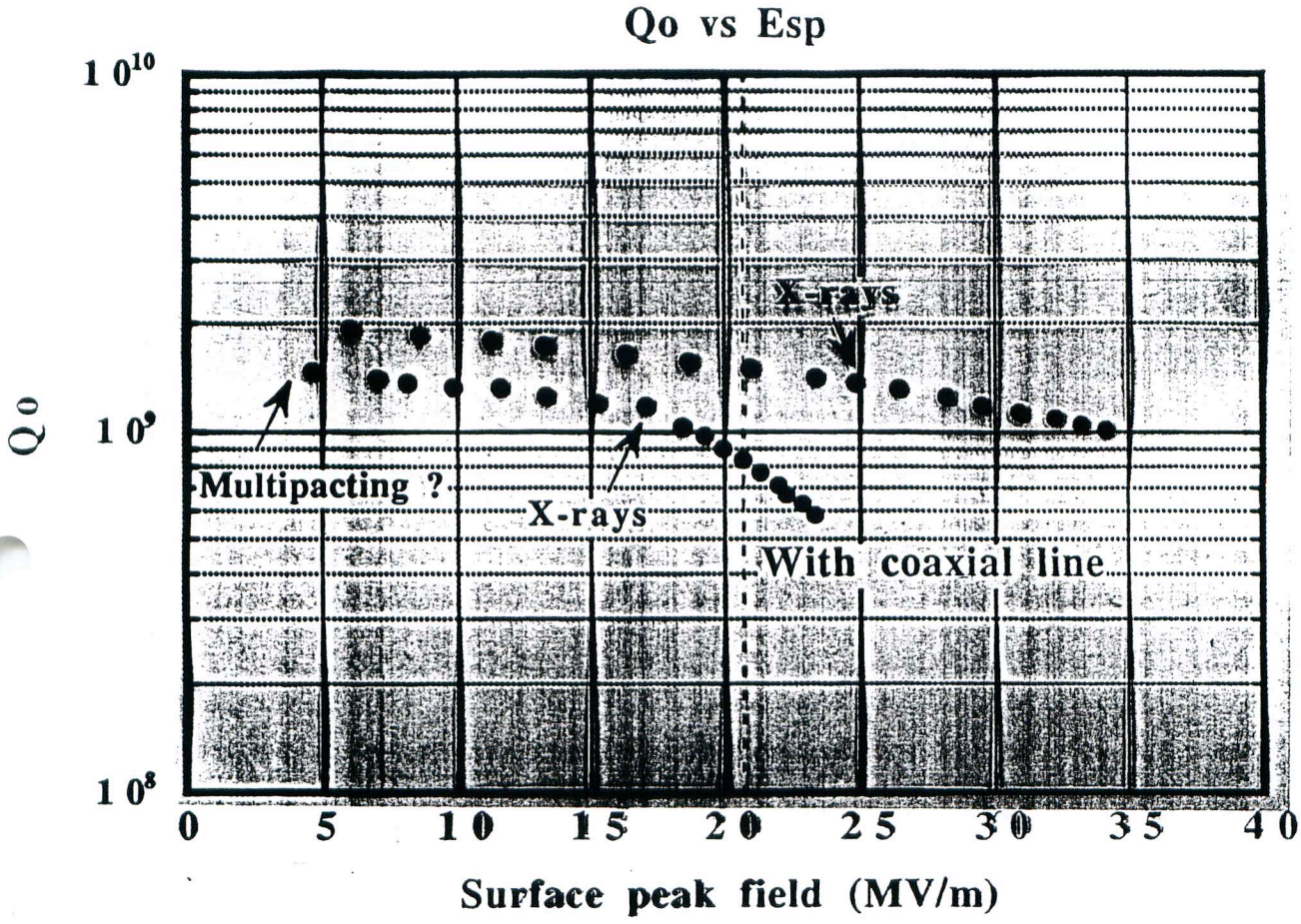


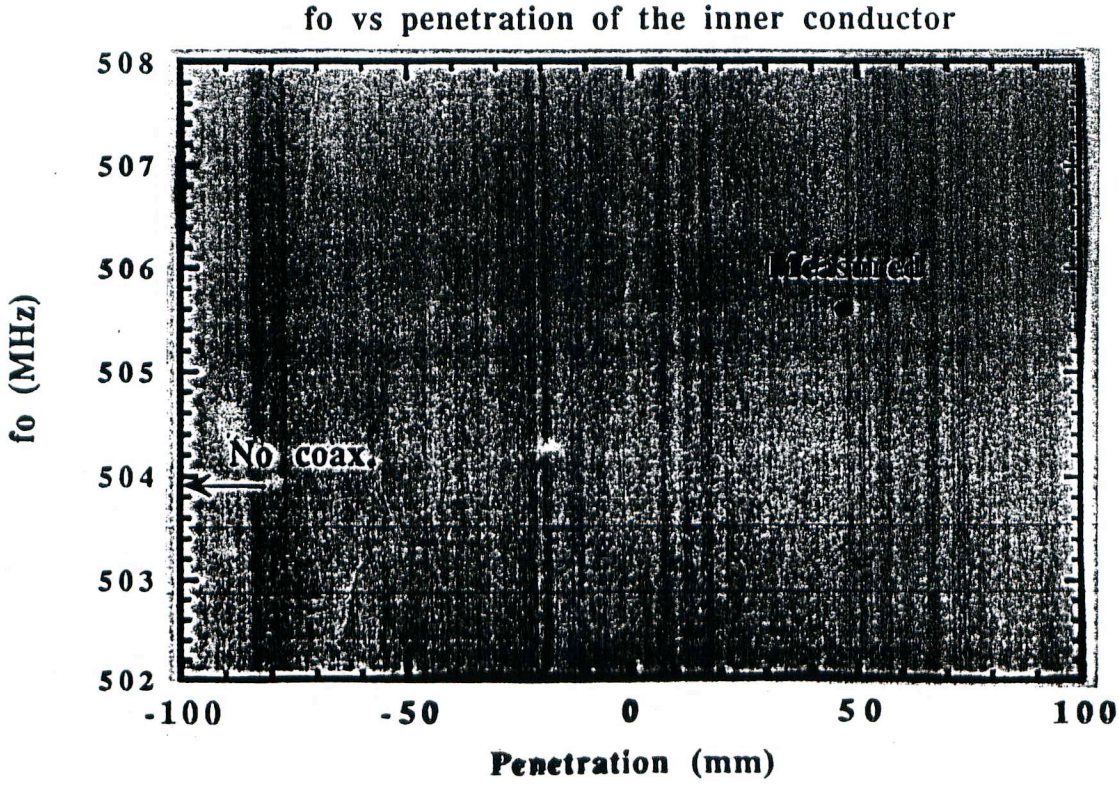


Cross section of the Crab Cavity with
the Prototype Coaxial Coupler

Crab Cavity Group

Full Scale Crab Cavity with Coaxial Coupler





R&D and Construction Schedule for KEKB Crab Cavity

K. Hosoyama