17TH ADVANCED BEAM DYNAMICS WORKSHOP ON

FUTURE LIGHT SOURCES

Exotic Undulators with Special Polarization Characteristics

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Exotic undulators with special polarization characteristics

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Harima RIKEN, SPring-8

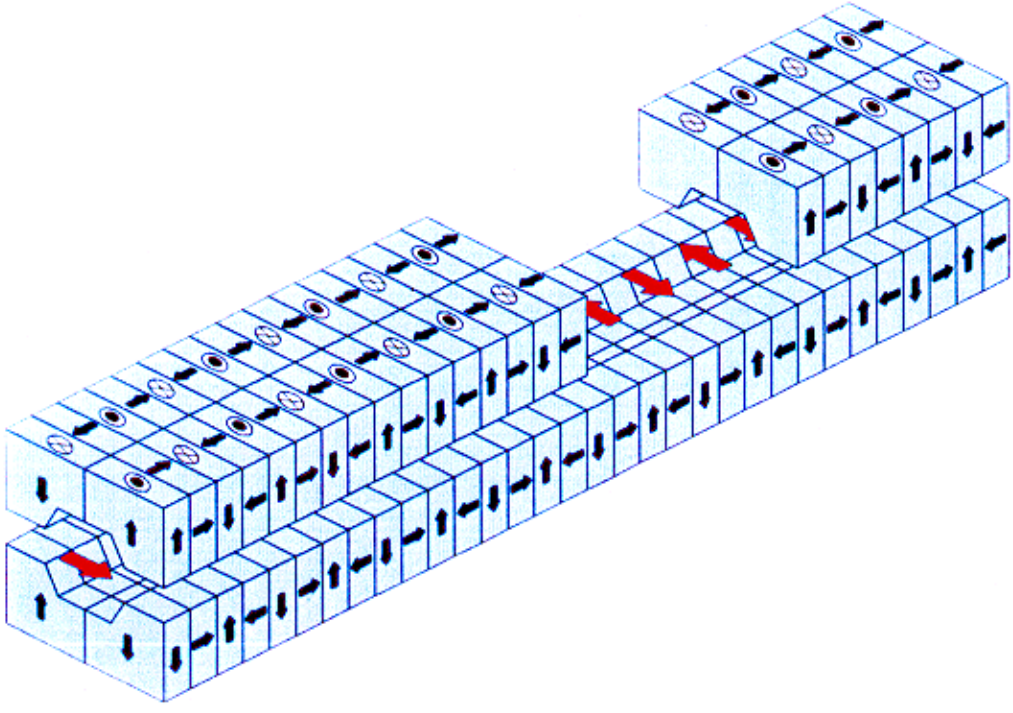
1. Tandem vertical undulators

2. Twin helical undulators

3. Elliptic wiggler

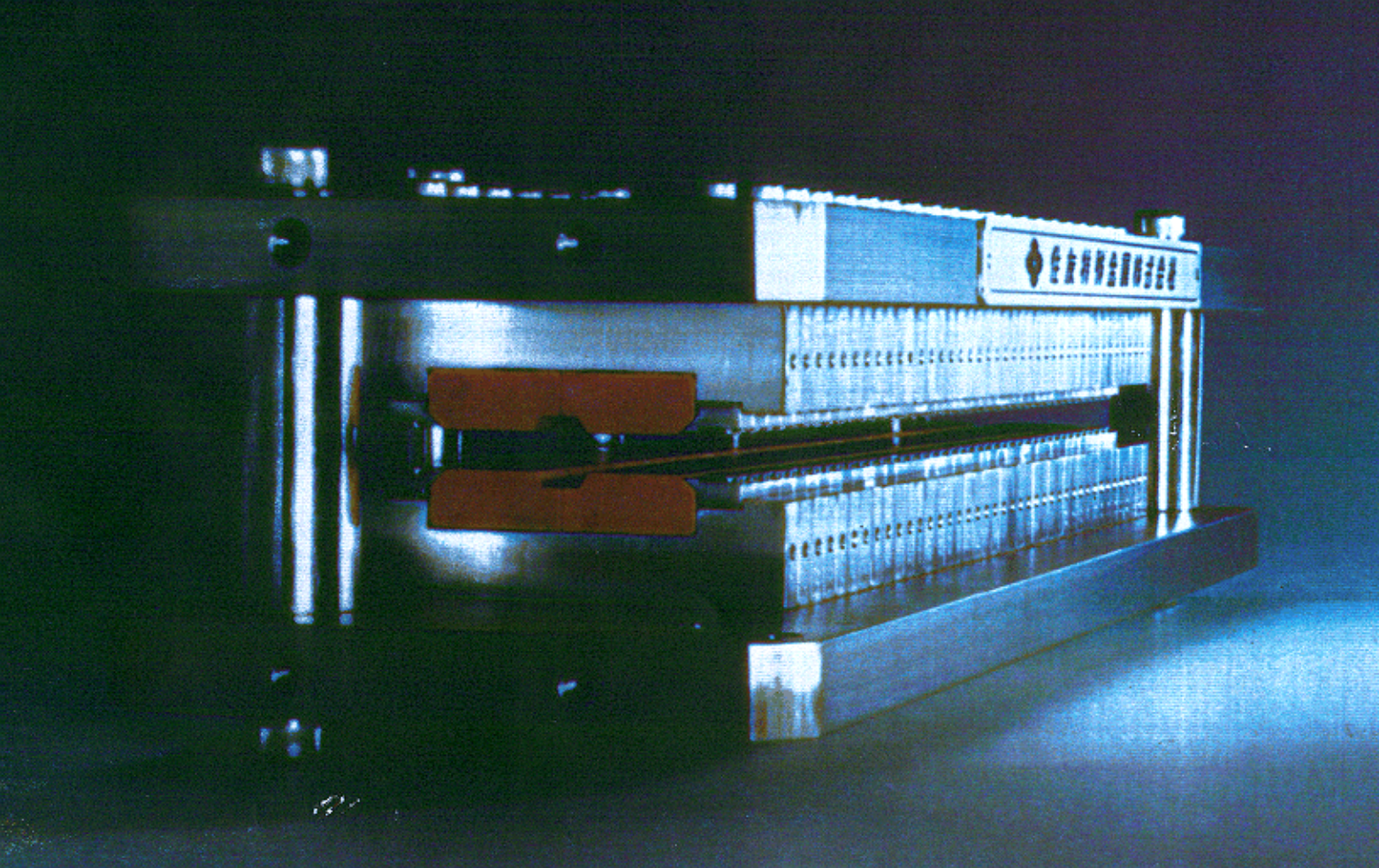
4. Figure-8 undulators
for soft x-ray region
for x-ray region

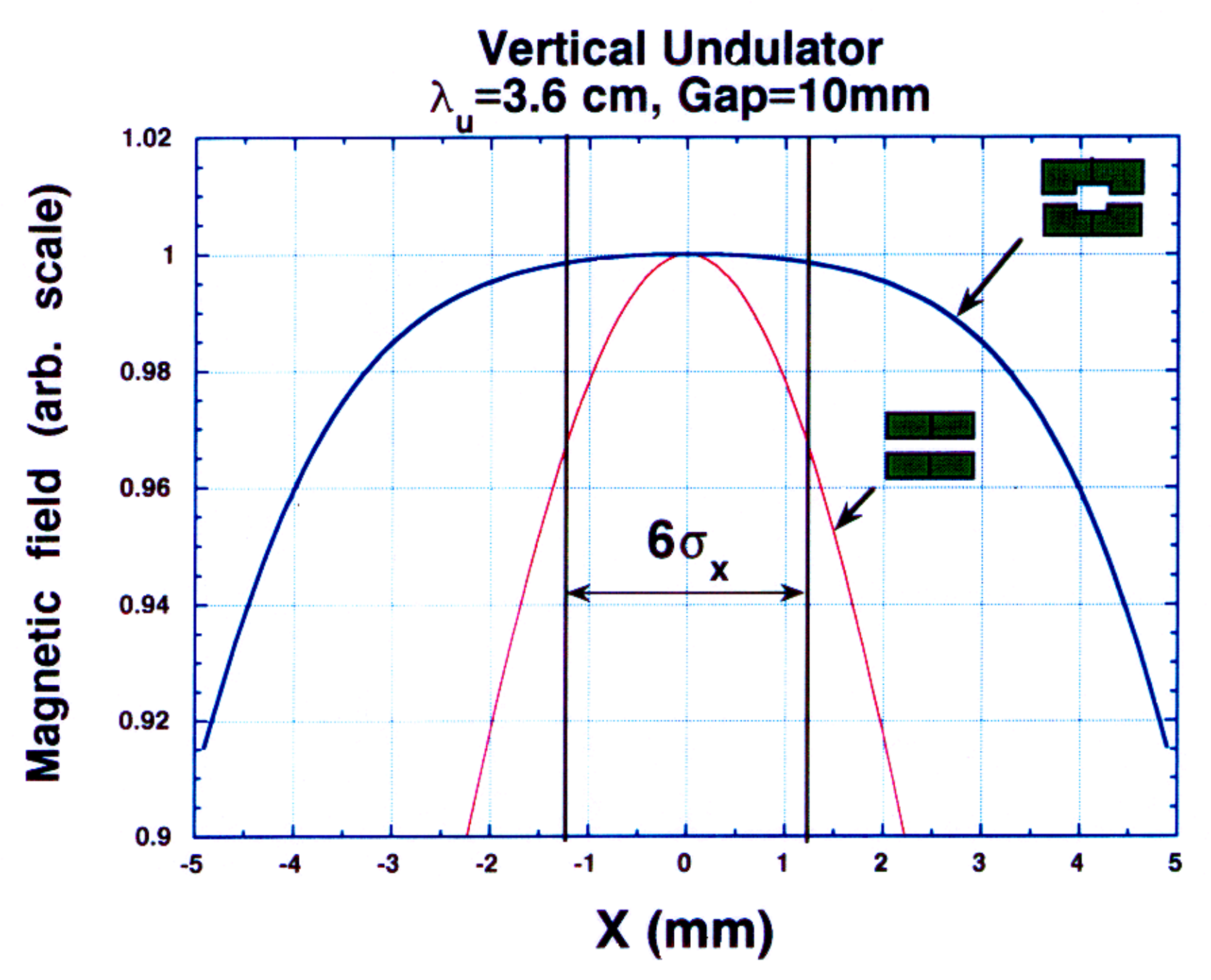
Vertical Undulator



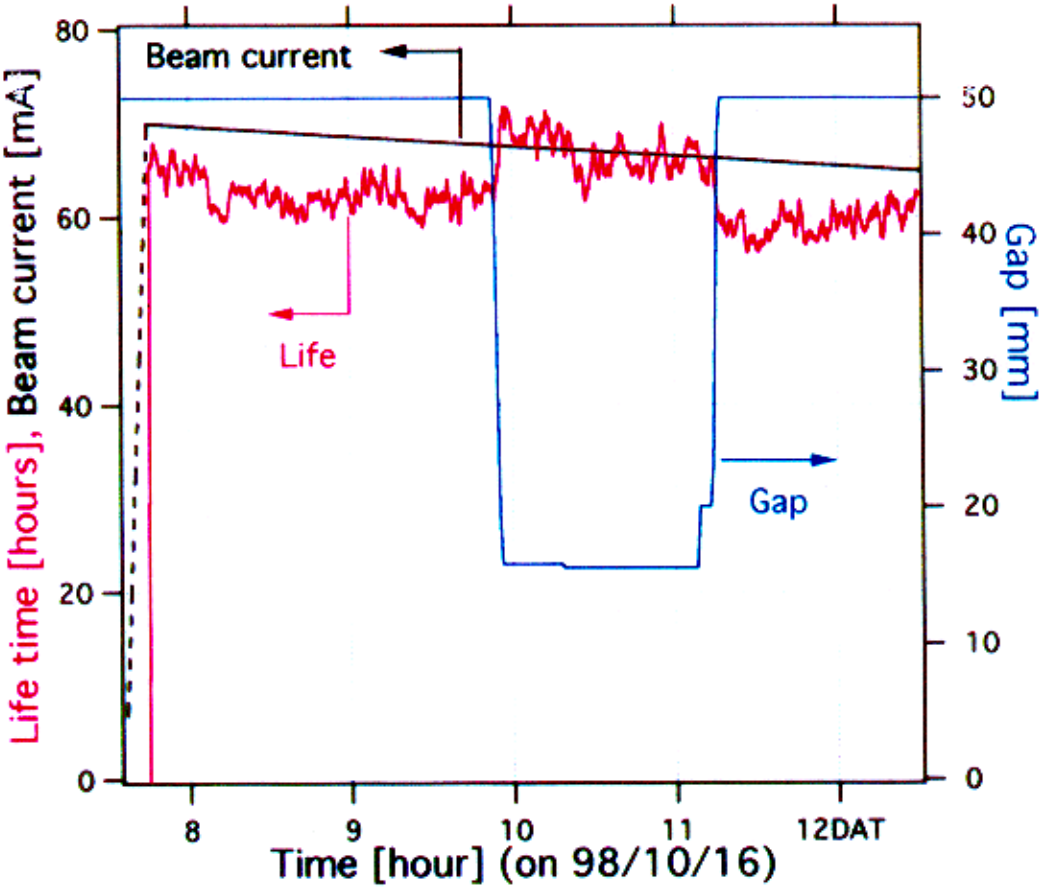
$\lambda_u = 37mm$, $N = 2 \times 37$, $G_{min} = 8mm$

$B_{max} = 0.49T$




Vertical Undulator
λu=3.6 cm, Gap=10mm
Magnetic field (arb. scale)
1.02
1
0.98
0.96
0.94
0.92
0.9
-5
-4
-3
-2
-1
0
1
2
3
4
5
X (mm)
6σx

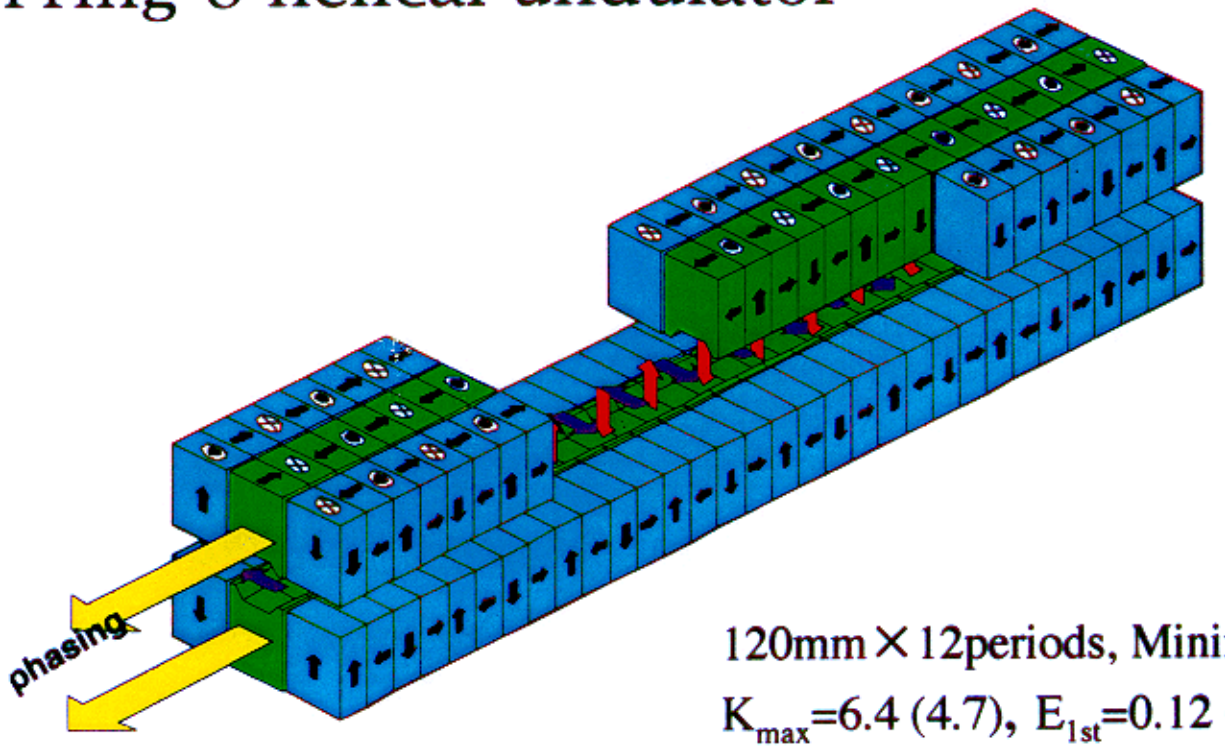
ID45 (vertical undulator) gap v.s. life time (2/3 filling)



$\frac{\varepsilon_y}{\varepsilon_x} < 0.25\%$ (x-ray interferometer)

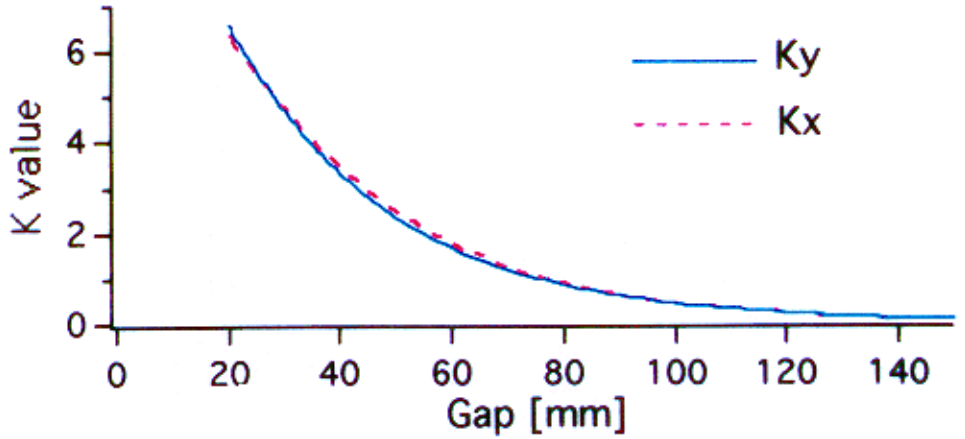
$\sim 0.1\%$ (lifetime)

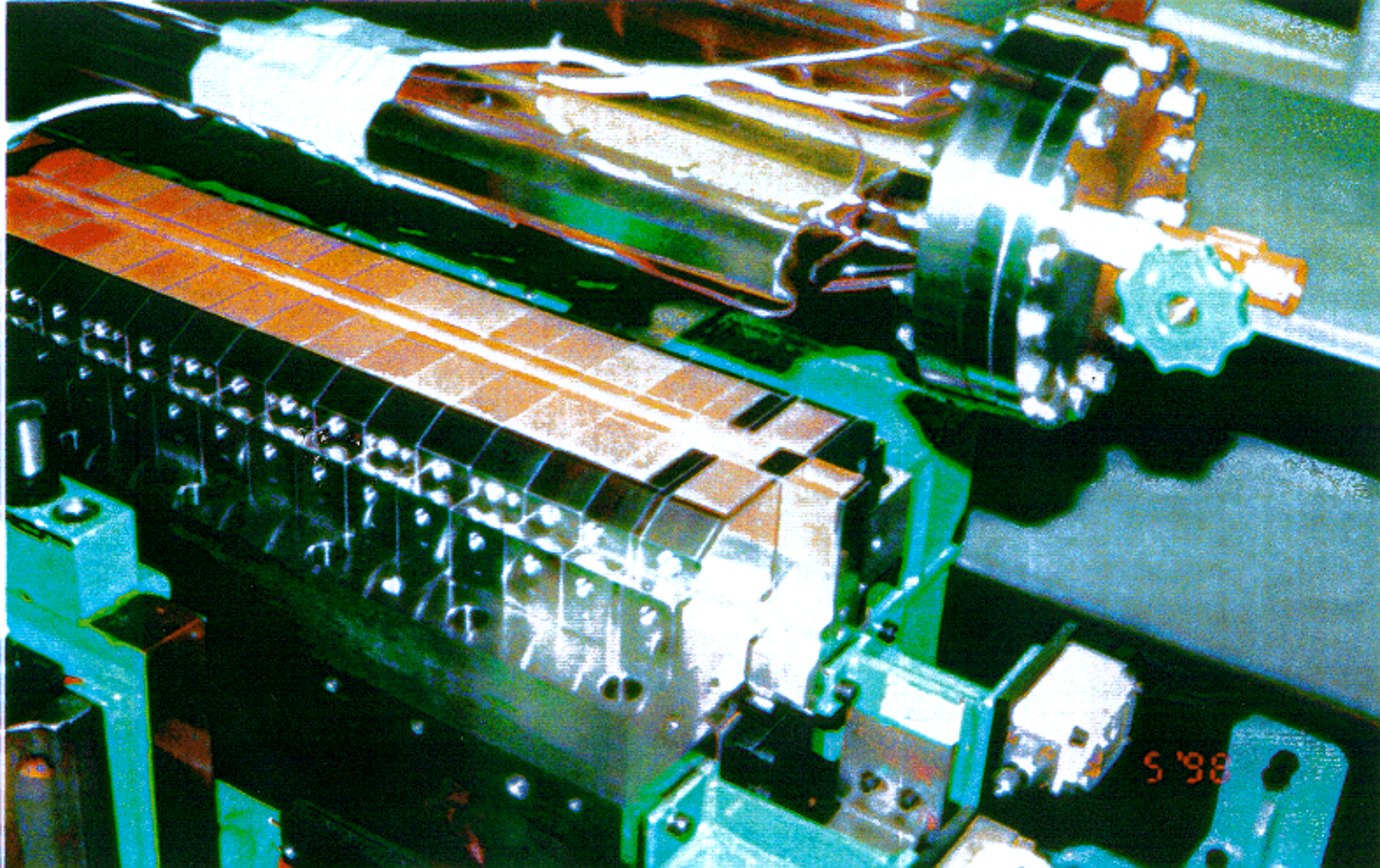
SPring-8 helical undulator

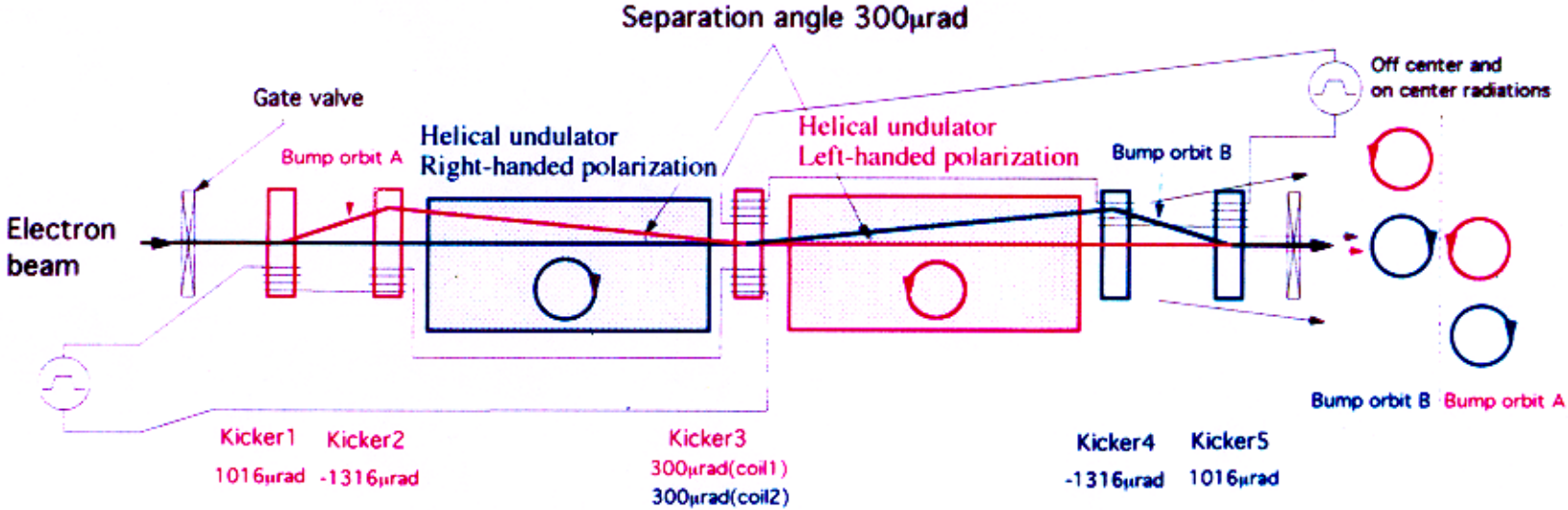


120mm × 12periods, Minimum gap 20mm (30mm),

K_{max}=6.4 (4.7), E_{1st}=0.12 (0.22) ~ 4.8keV,

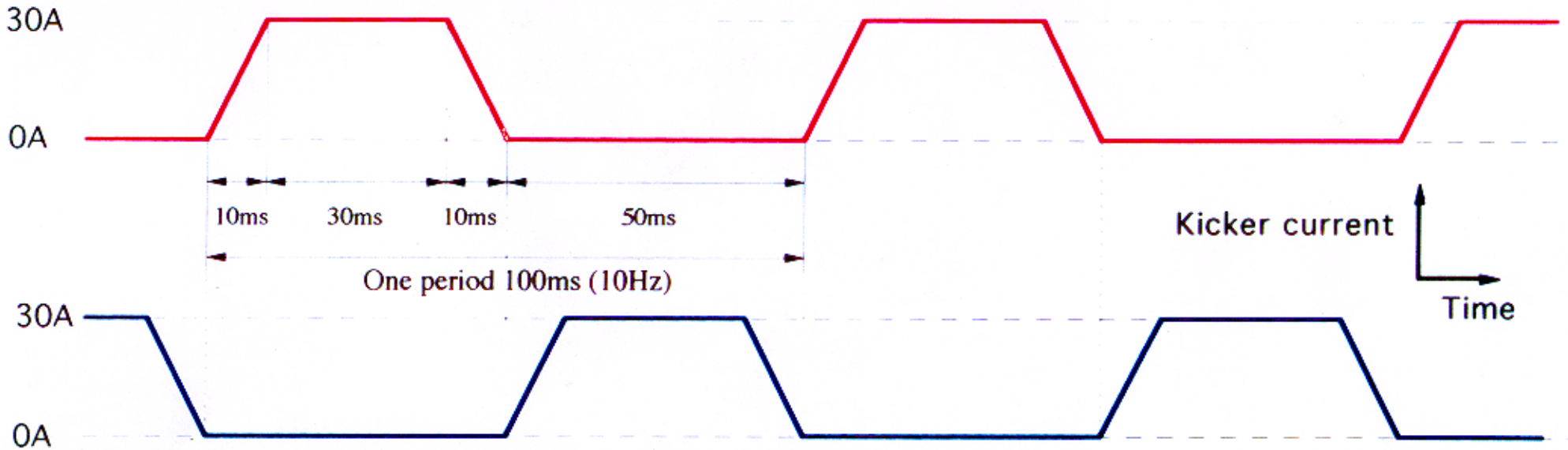



5'98



Twin helical undulator polarization switching

Excitation of local orbit bump A (kicker1+kicker2+kicker3)



Excitation of local orbit bump B (kicker3+kicker4+kicker5)

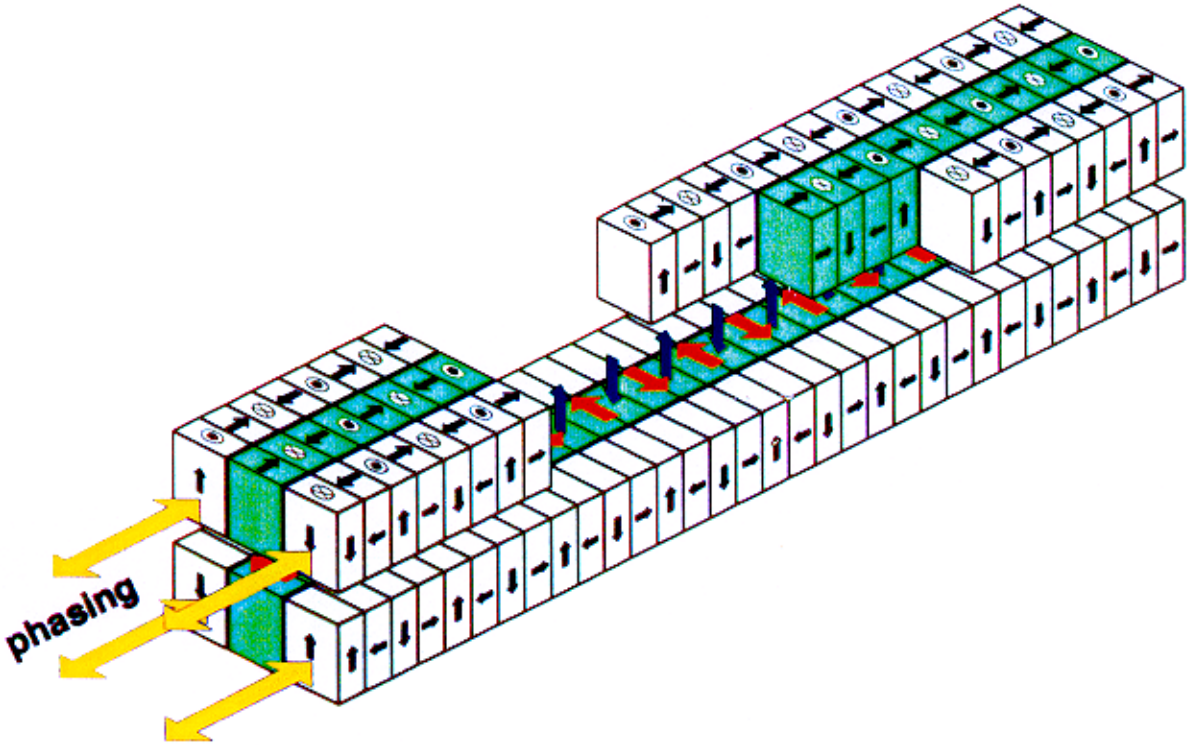
Kick angle

- Bump A

  kicker1(1016μrad)+kicker2(-1316μrad)+kicker3(300μrad)=total 0μrad

- Bump B

  kicker3(300μrad)+kicker4(-1316μrad)+kicker5(1016μrad)=total 0μrad

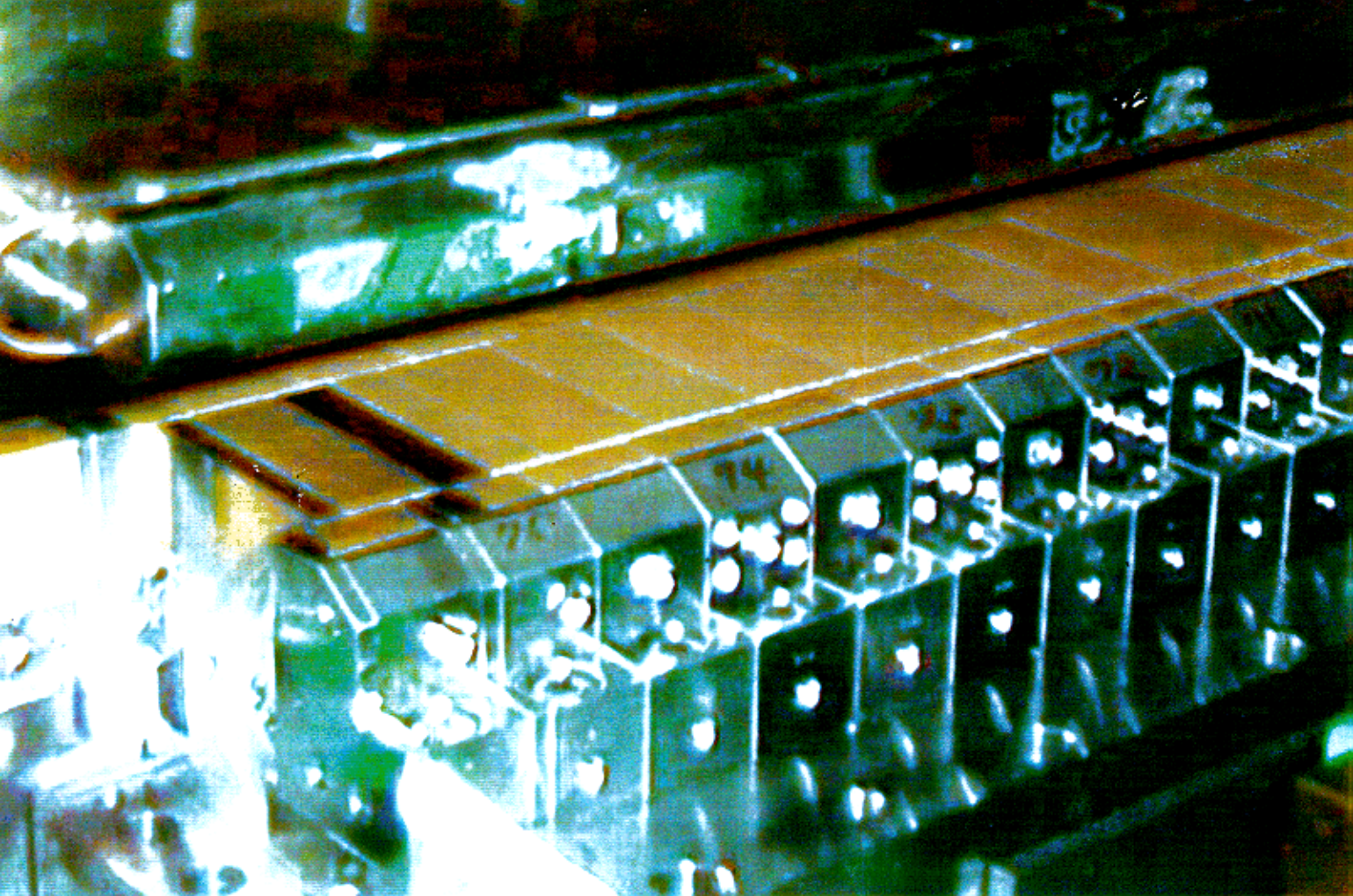


Elliptic Wiggler

λ_u = 120mm, N = 37, G_{min} = 20mm

Bv_{max} = 1.17T, Bh_{max} = 0.11T

$\Delta x < 7\,\mu m$, $\Delta y < 3\,\mu m$



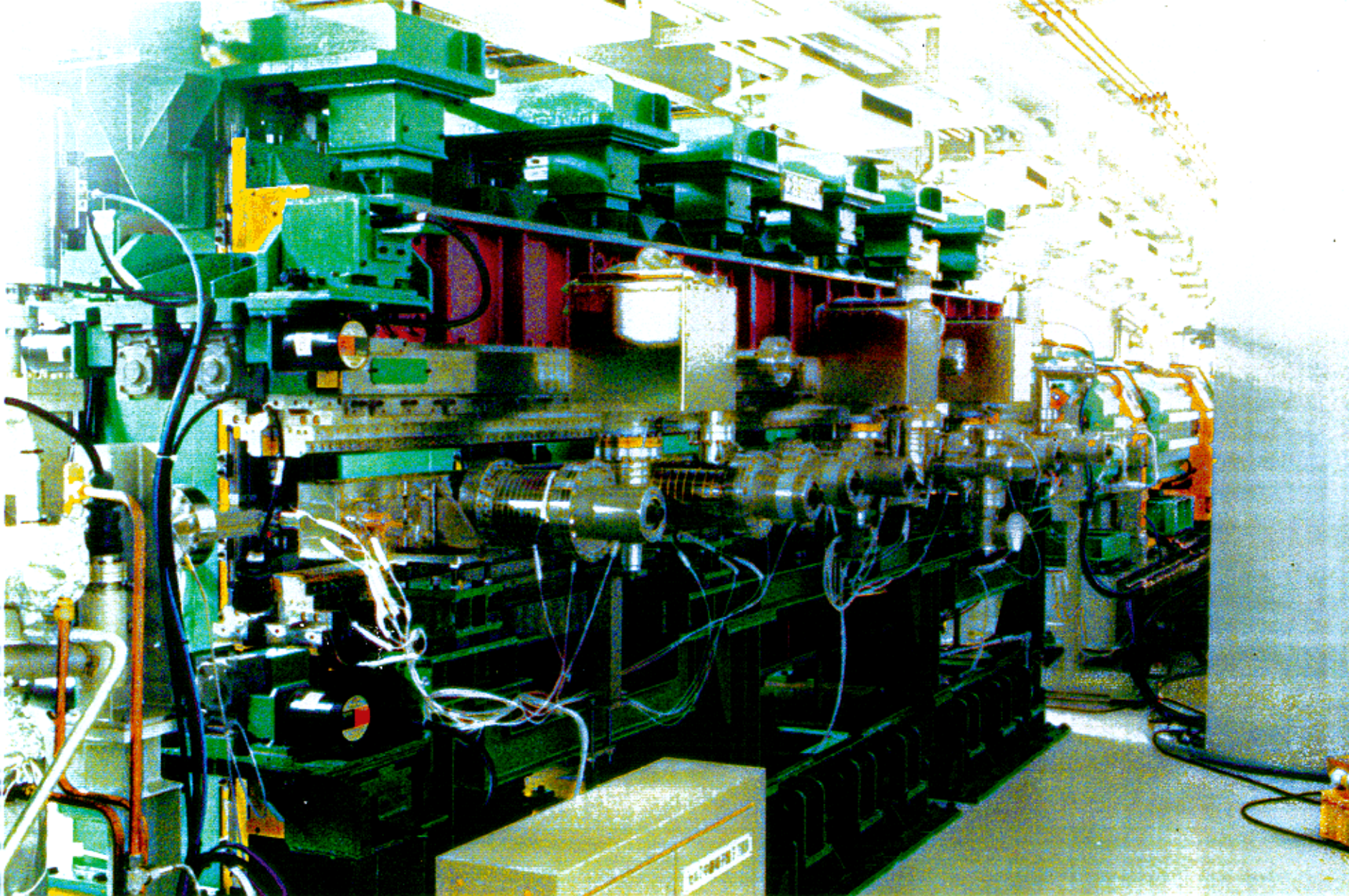
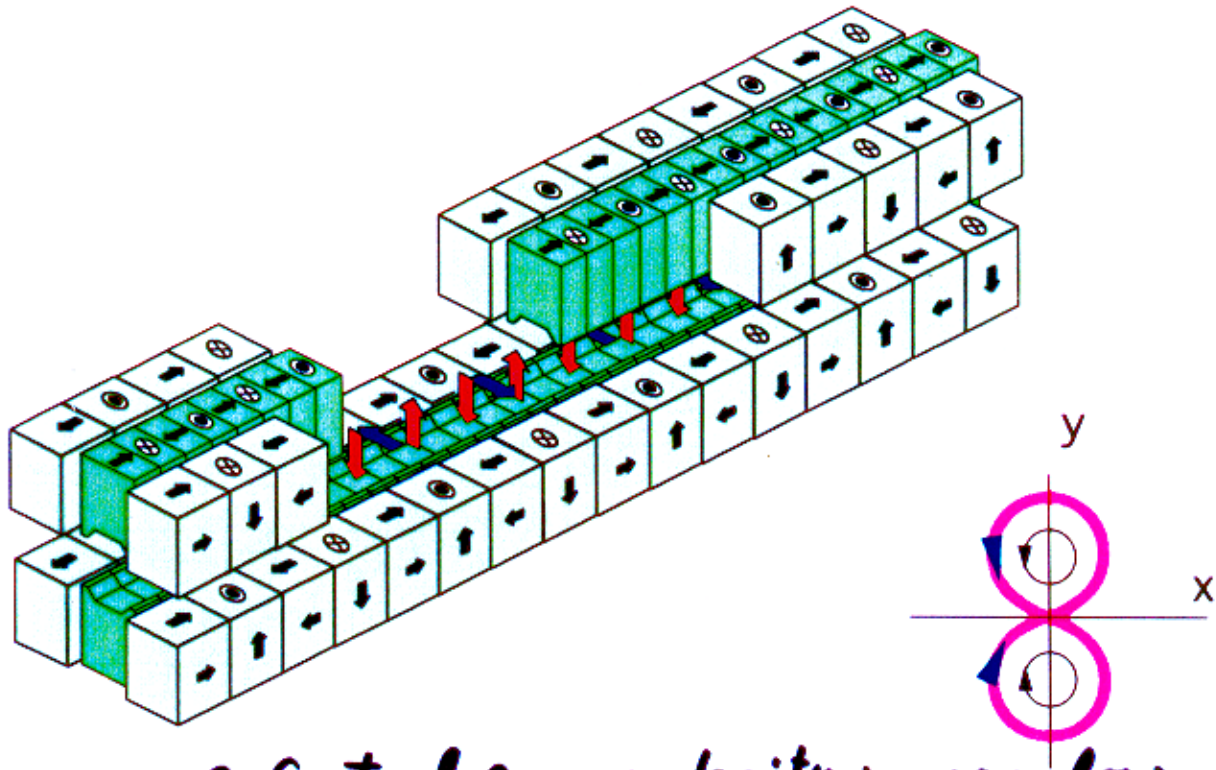


Figure-8 Undulator



- Central power desity is very low.
- Both horizontal and vertical polarization are available.

For soft x-ray region

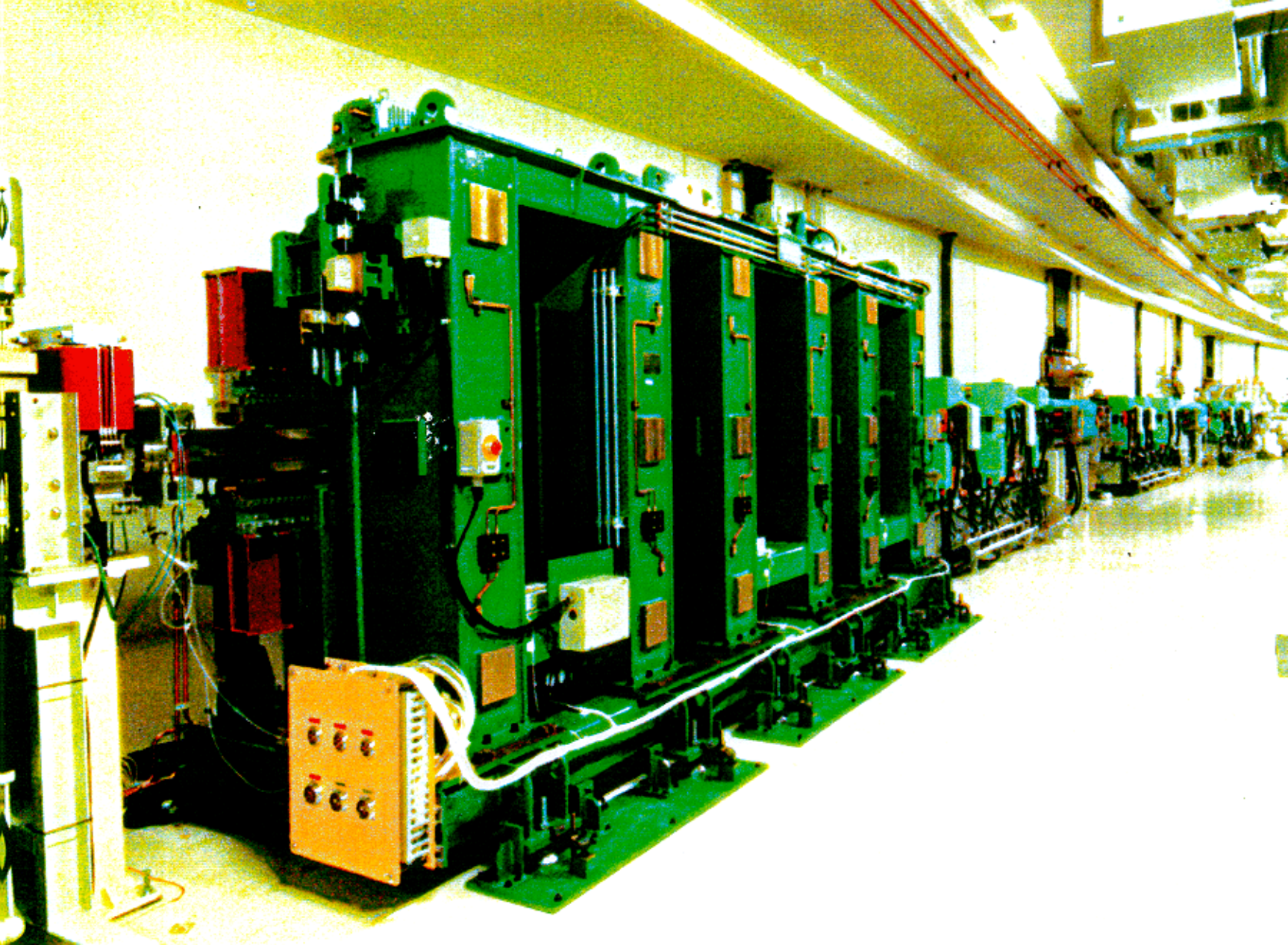
λ_u = 100mm, N = 45, G_{min} = 30mm

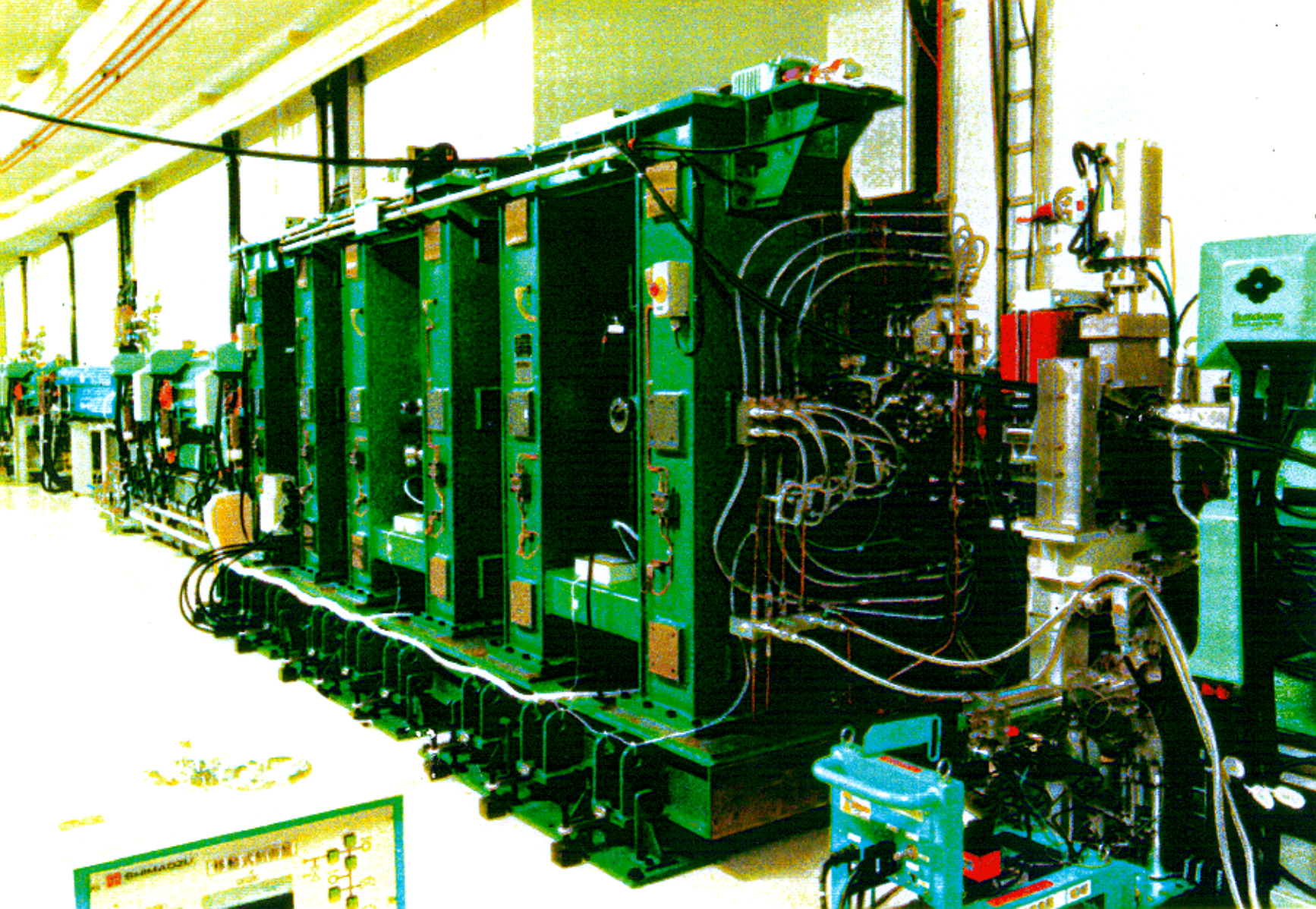
B_{vmax} = 0.73T, B_{hmax} = 0.23T

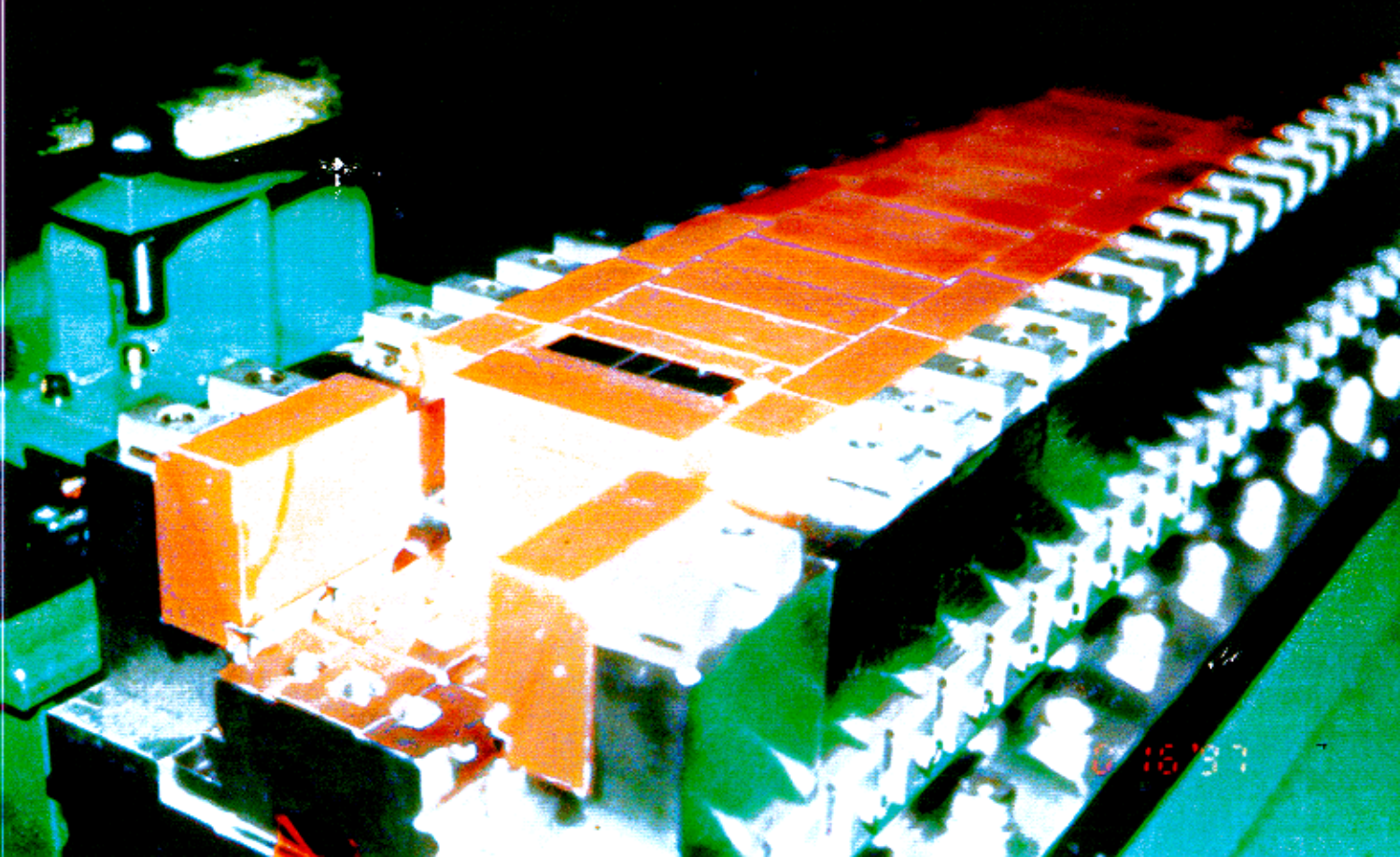
For x-ray region

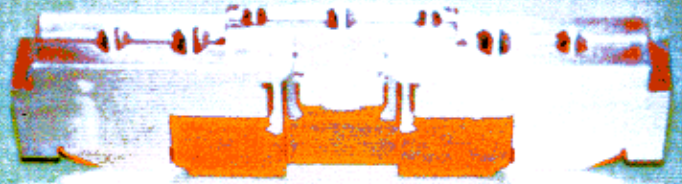
λ_u = 26mm, N = 171, G_{min} = 5mm

B_{vmax} = 0.99T, B_{hmax} = 0.30T

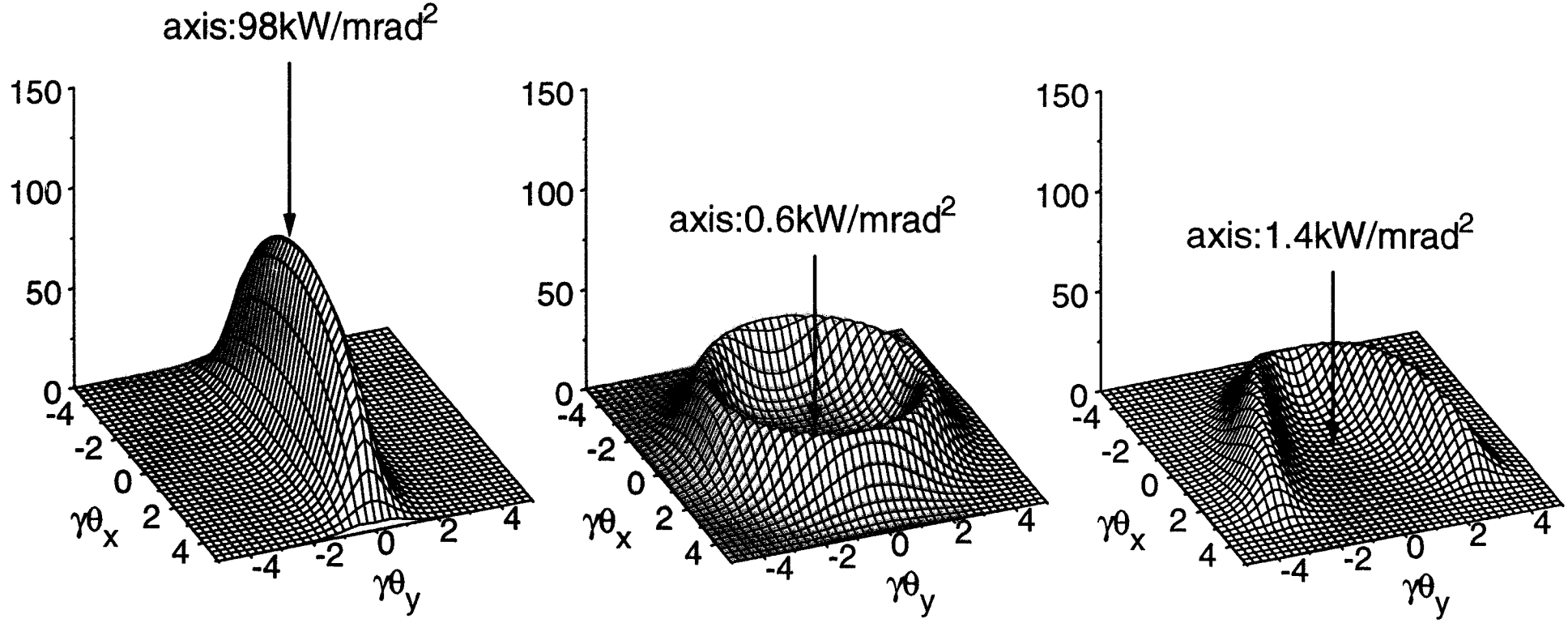








8 197



Planar

Helical

Figure-8

by Tanaka

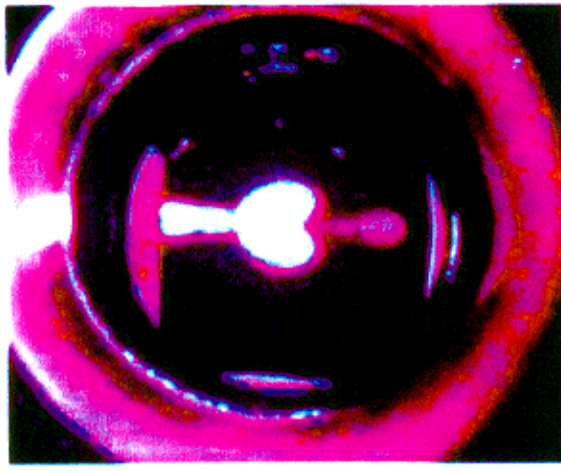
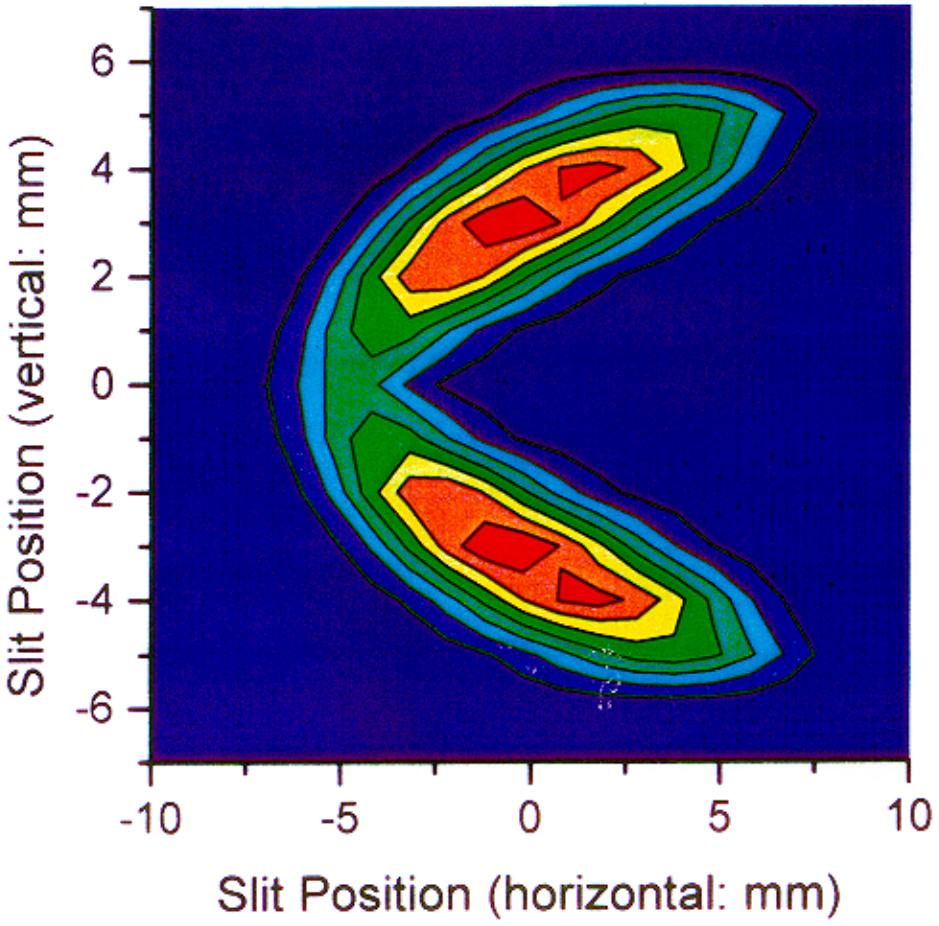
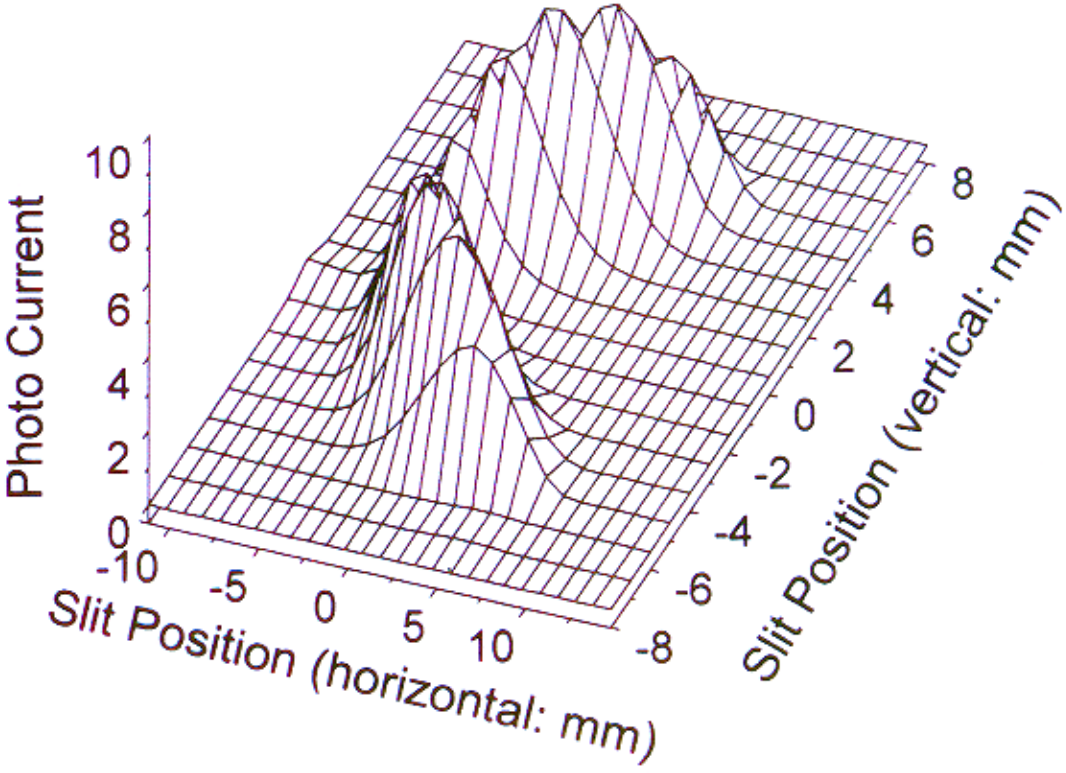


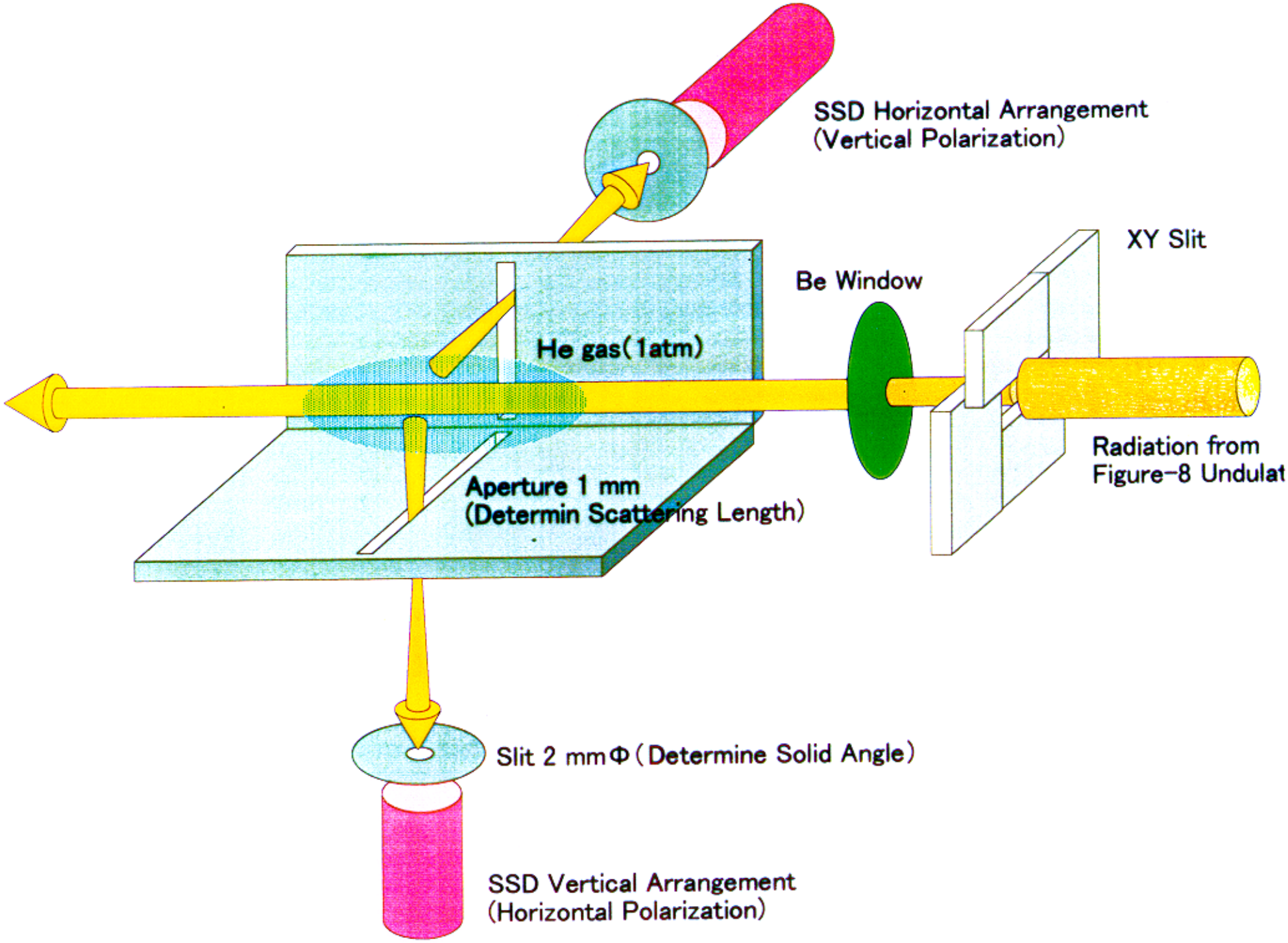
Figure-8 U (λu=100mm, N=44)

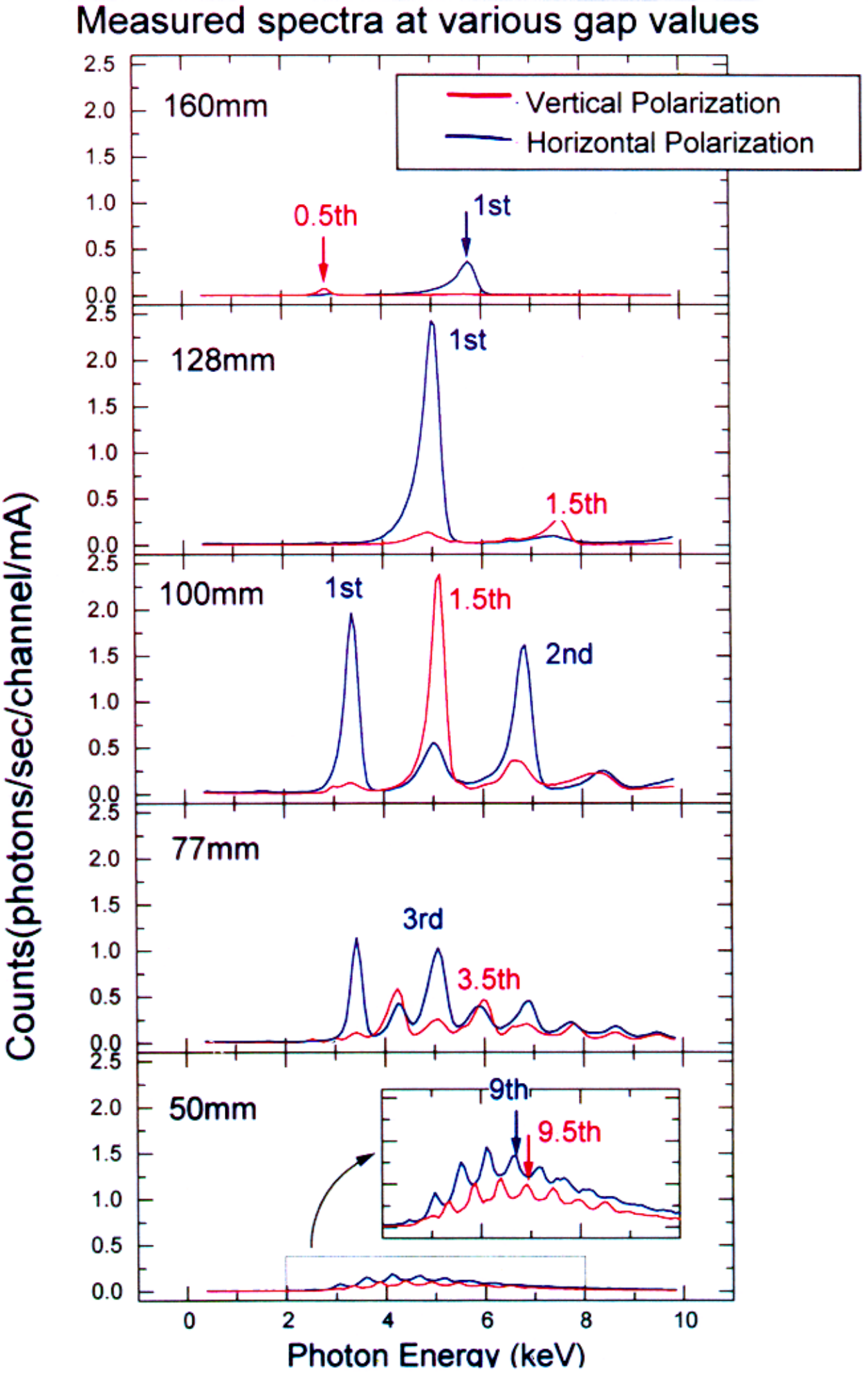
INV-F8 (λu=26mm, N=172)

Gap = 50 mm, Distance from the souce = 29 m






SSD Horizontal Arrangement
(Vertical Polarization)
XY Slit
Be Window
He gas(1atm)
Radiation from
Figure-8 Undulat
Aperture 1 mm
(Determin Scattering Length)
Slit 2 mmΦ(Determine Solid Angle)
SSD Vertical Arrangement
(Horizontal Polarization)


Measured spectra at various gap values
Vertical Polarization
Horizontal Polarization
160mm
0.5th
1st
128mm
1st
1.5th
100mm
1st
1.5th
2nd
77mm
3rd
3.5th
50mm
9th
9.5th
Counts(photons/sec/channel/mA)
Photon Energy (keV)
0
2
4
6
8
10
0.0
0.5
1.0
1.5
2.0
2.5