V-SX 高輝度光源計画における

挿入光源

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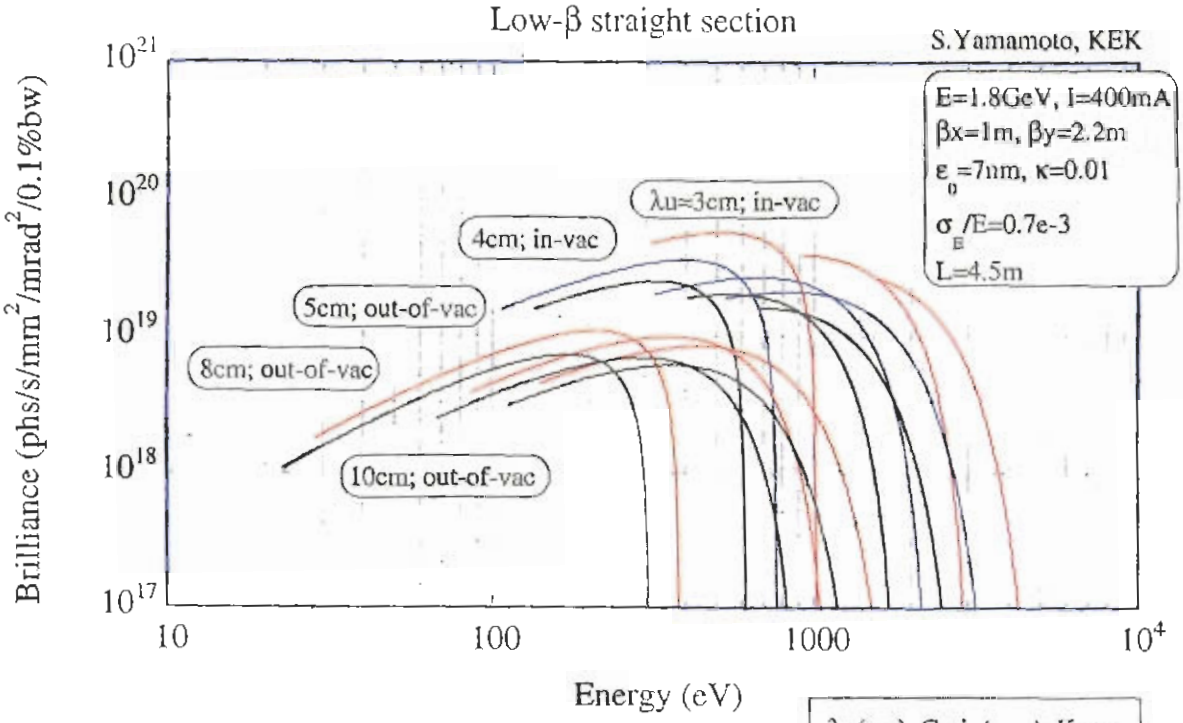
V-SX 加速器 WG

1. V-SX 光源としての特徴

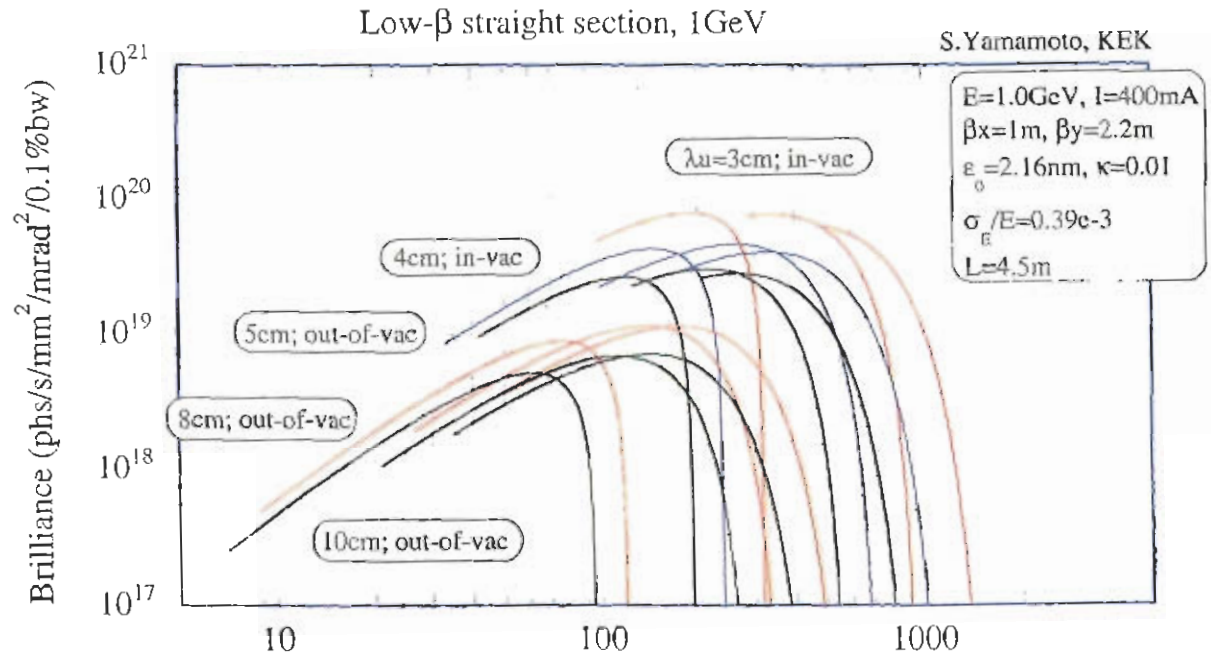
- 加速エネルギ選定の重要性：1.8GeV & 1.0GeV
- 長尺 Undulator ：輝度 ∝ 分解能
- 回折限界光@VUV

2. 新しい円偏光 undulator の可能性

- 斜行揺動型 undulator による偏光の高速切り替え



λu(cm)	Gmin(mm)	Kmax
3	8	2.16
4	8	3.51
5	20	2.66
8	20(28)	5
10	20(42)	5



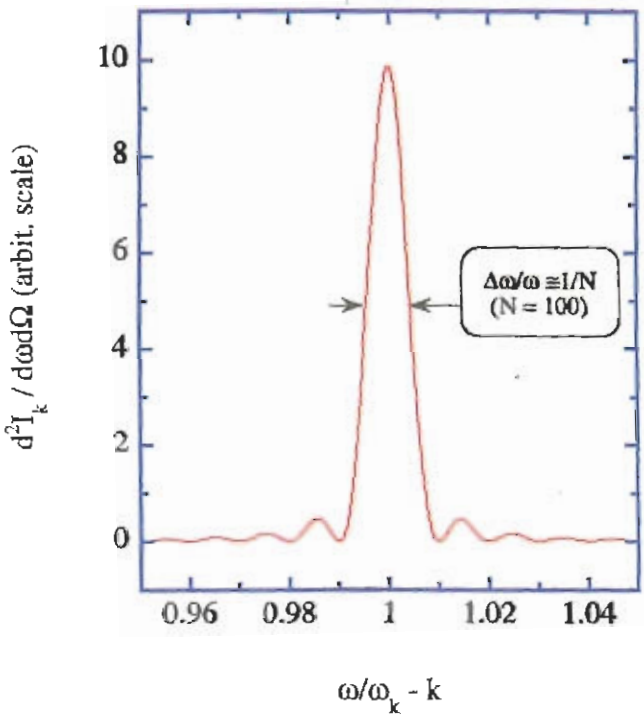
λu(cm)	Gmin(mm)	Kmax
3	8	2.16
4	8	3.51
5	20	2.66
8	20(28)	5
10	20(42)	5

Long undulators (large N) vs. $\mathcal{B}$

For diffraction limited (or ε=0) e$^-$ beam with σ_E/E =0,

$$\mathcal{B} \propto N^2$$

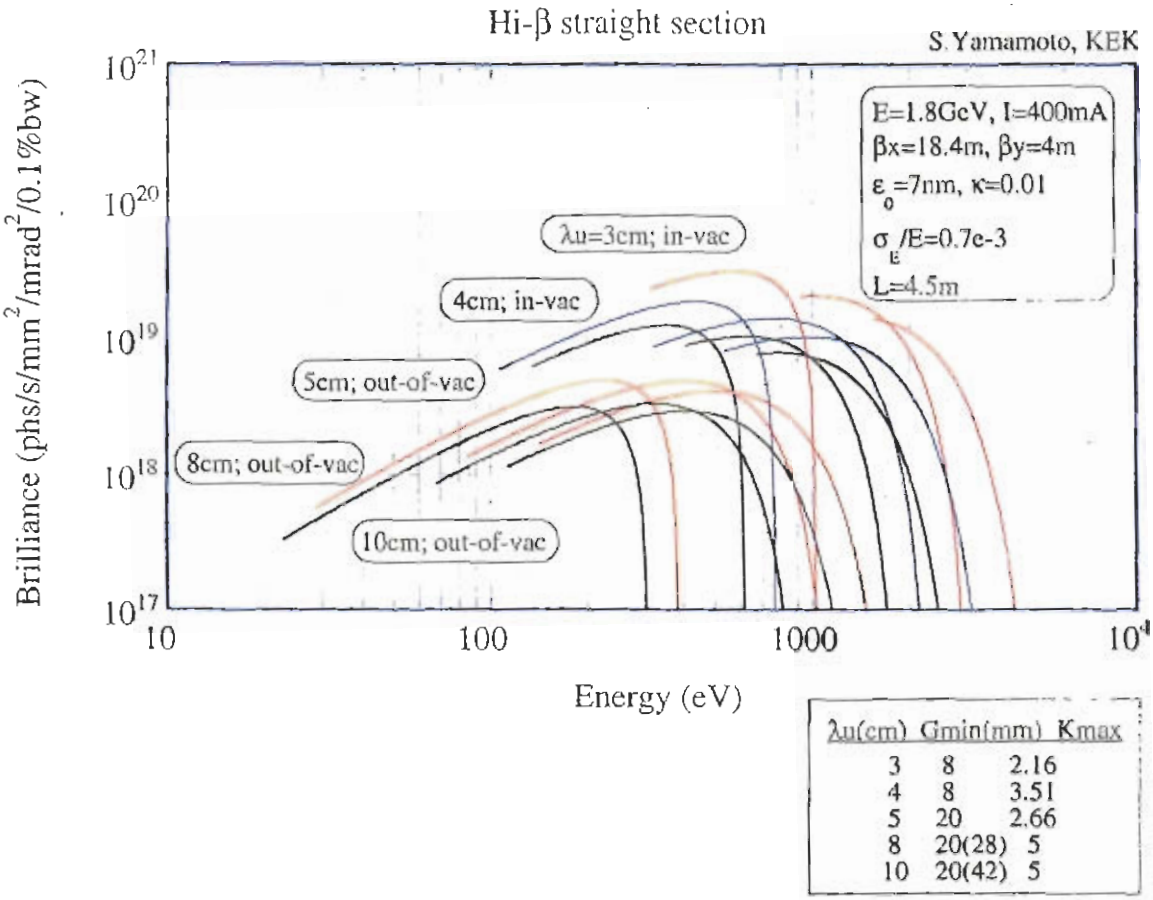
$$\left(\frac{\Delta\omega}{\omega}\right)_{HWHM} = \frac{1}{2N}$$



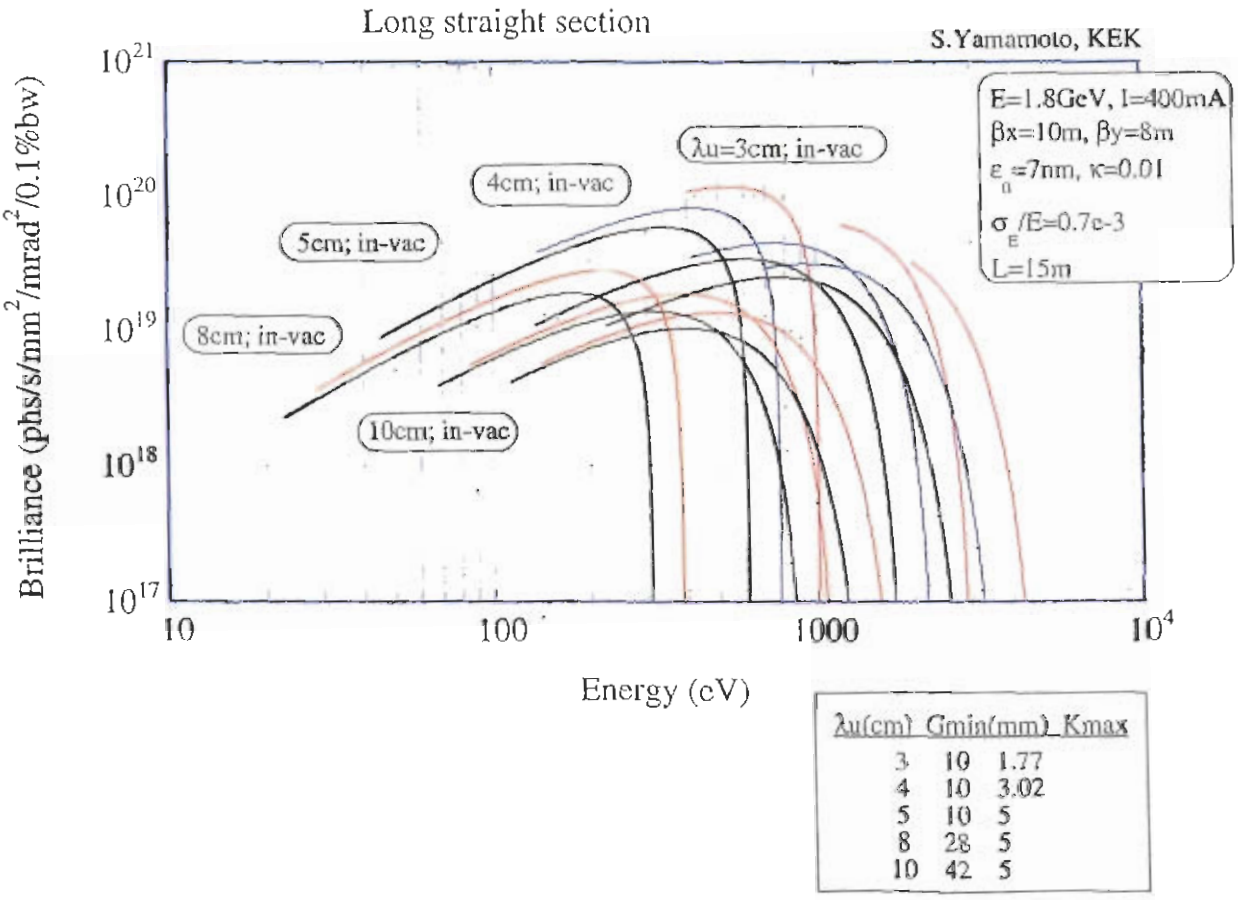
$$\lambda = \frac{\lambda_U}{2k\gamma^2}\left(1+\frac{K^2}{2}\right)$$

$$\frac{\Delta\omega}{\omega} = \frac{\Delta\lambda}{\lambda} = 2\frac{\Delta\gamma}{\gamma} = 2\frac{\sigma_E}{E}$$

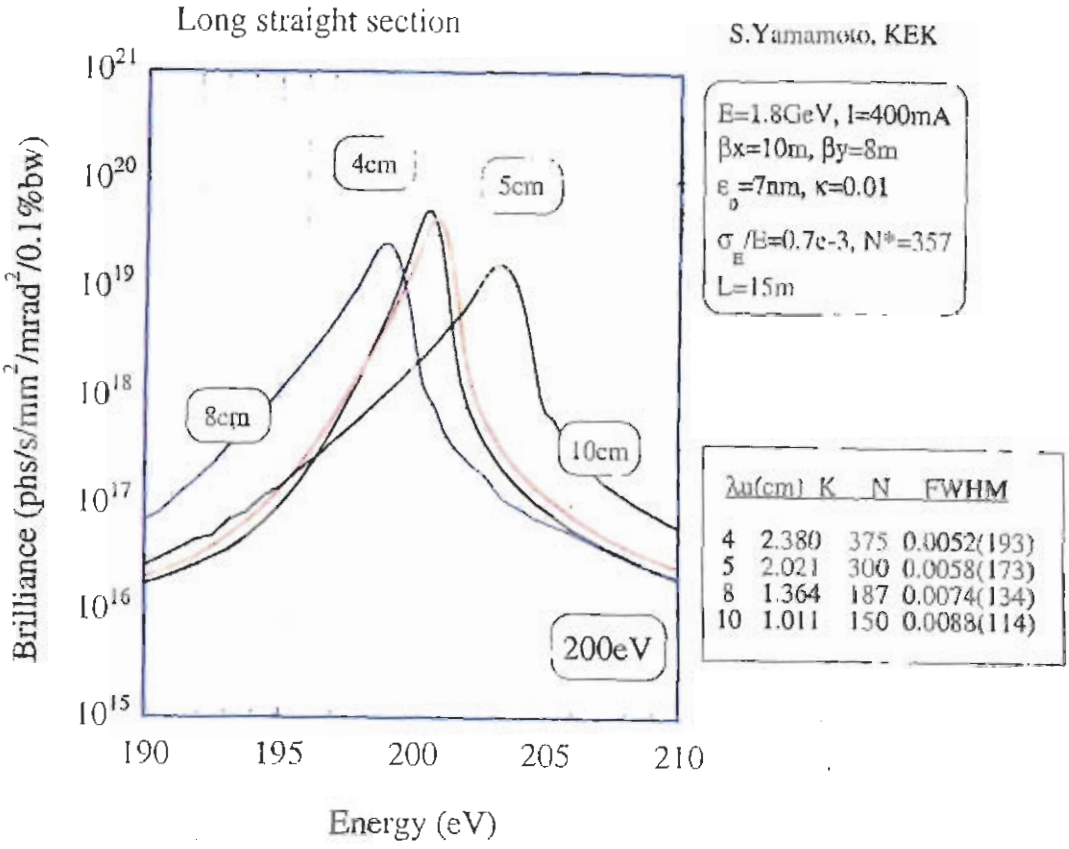
$$\frac{1}{N^*} = 4\frac{\sigma_E}{E}, \text{ if } \frac{\Delta\omega}{\omega} = \left(\frac{\Delta\omega}{\omega}\right)_{HWHM} = \frac{1}{2N}$$

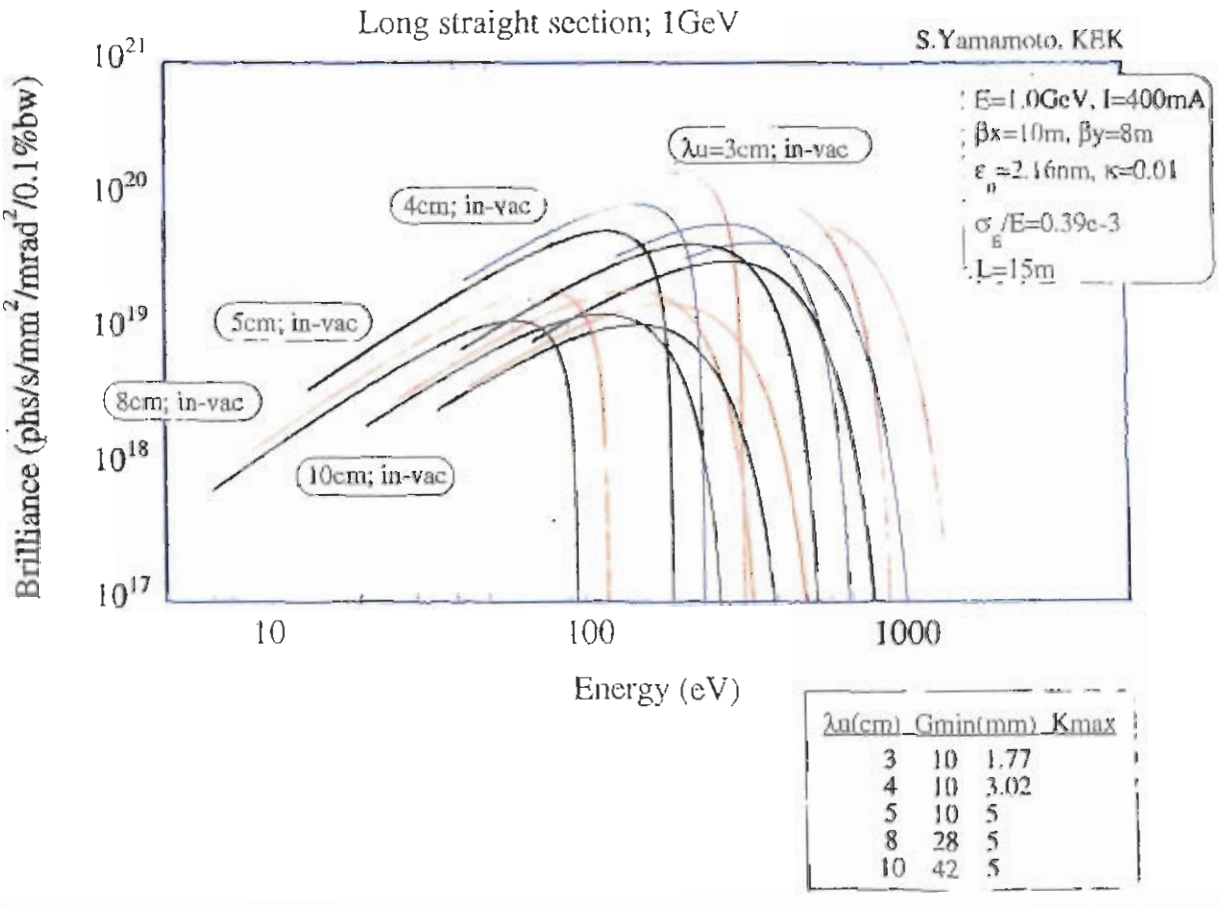


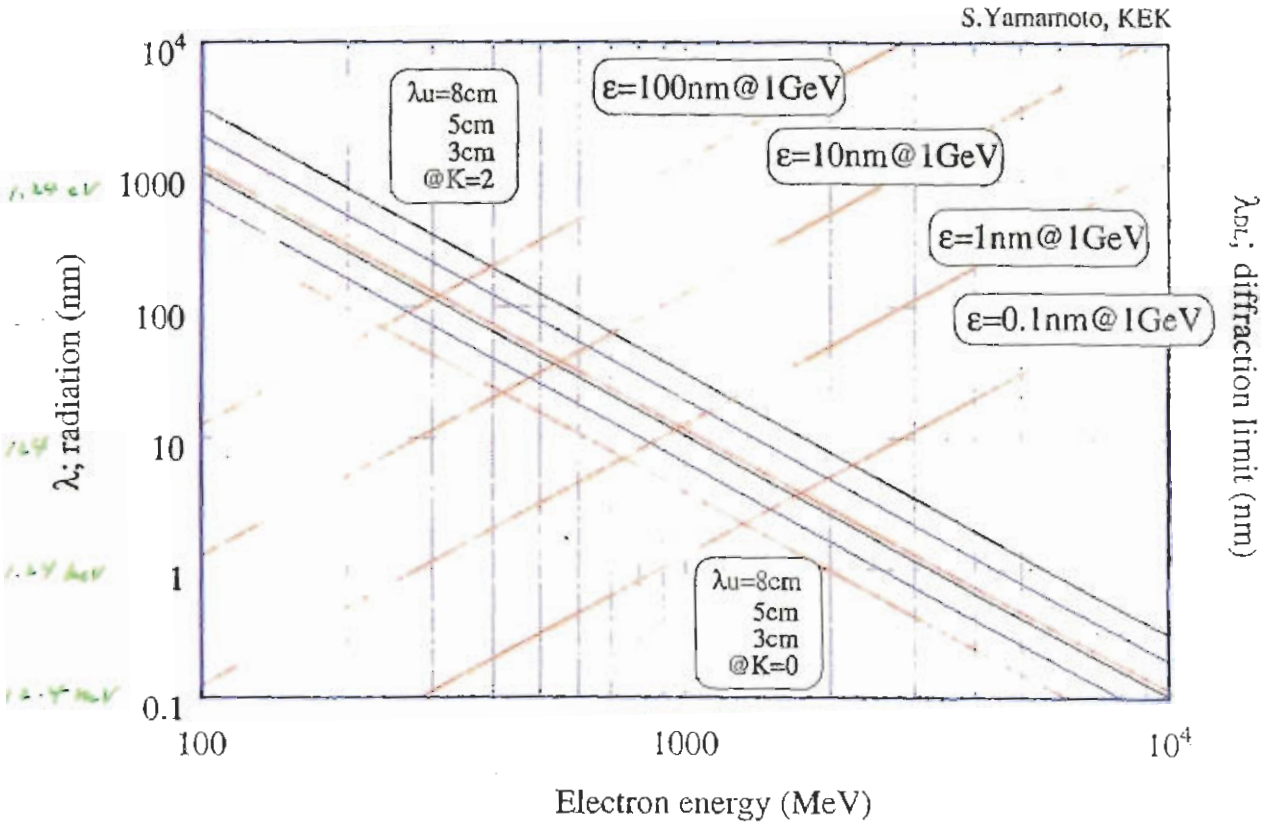
λu(cm)	Gmin(mm)	Kmax
3	8	2.16
4	8	3.51
5	20	2.66
8	20(28)	5
10	20(42)	5

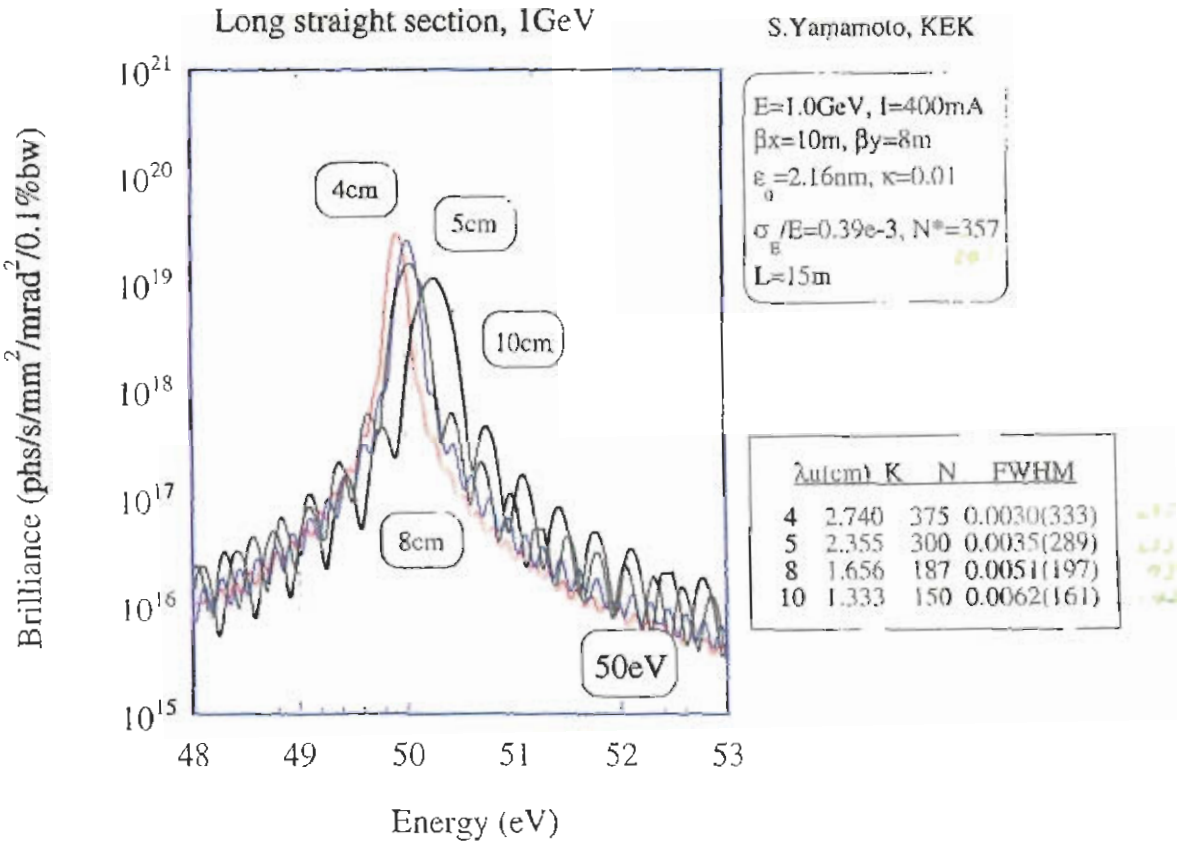


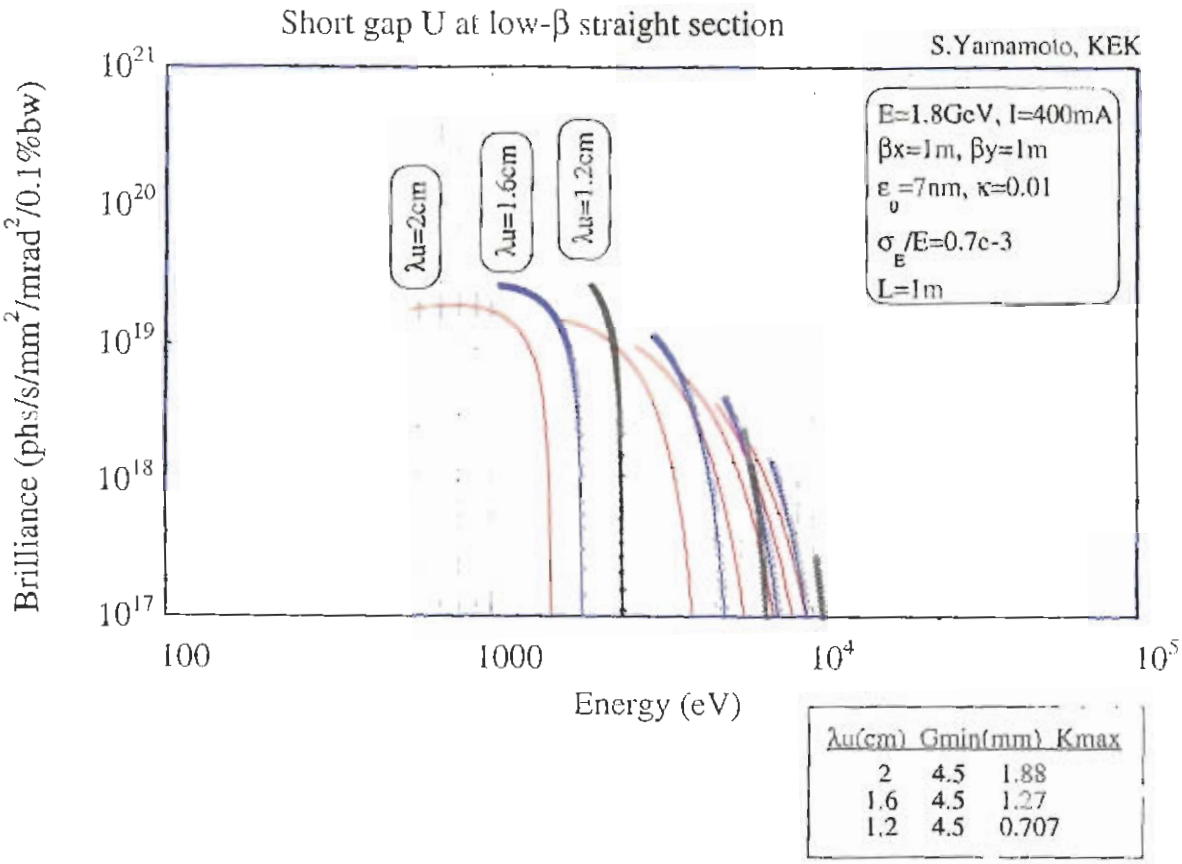
λu(cm)	Gmin(mm)	Kmax
3	10	1.77
4	10	3.02
5	10	5
8	28	5
10	42	5


Long straight section
S.Yamamoto, KEK
E=1.8GeV, I=400mA
βx=10m, βy=8m
ε0=7nm, κ=0.01
σE/E=0.7e-3, N*=357
L=15m
4cm
5cm
8cm
10cm
200eV
Brilliance (phs/s/mm2/mrad2/0.1%bw)
Energy (eV)
λu(cm) K N FWHM
4 2.380 375 0.0052(193)
5 2.021 300 0.0058(173)
8 1.364 187 0.0074(134)
10 1.011 150 0.0088(114)

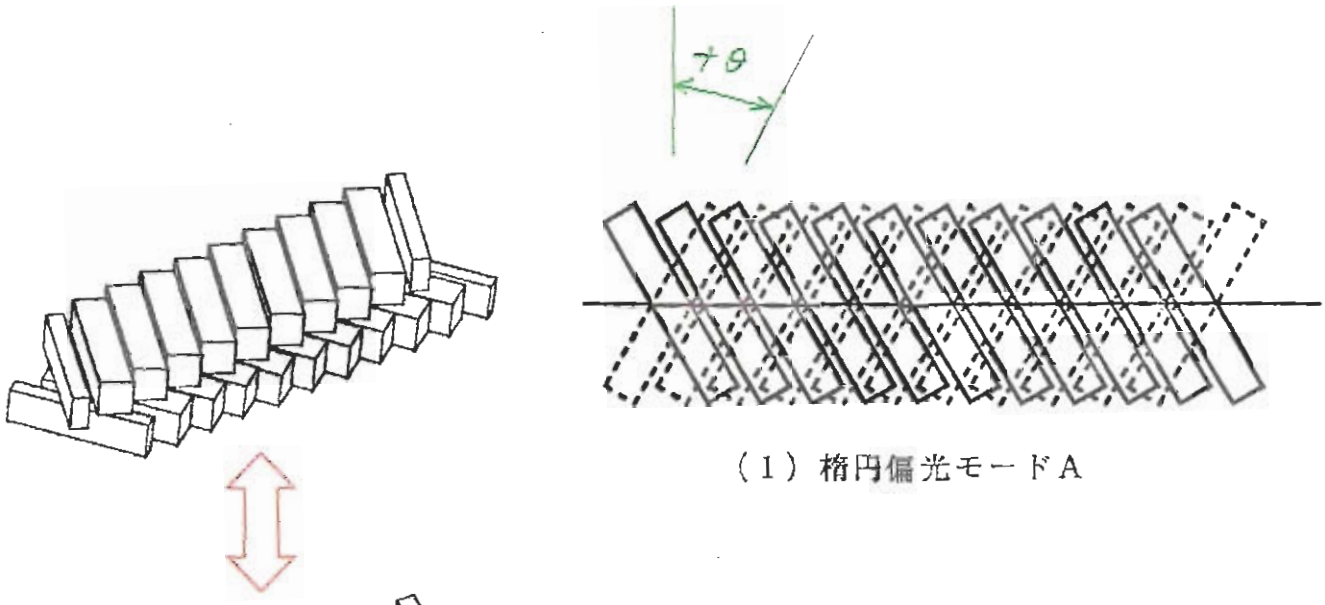

Long straight section; 1GeV
S.Yamamoto, KEK
E=1.0GeV, I=400mA
βx=10m, βy=8m
ε0=2.16nm, κ=0.01
σE/E=0.39e-3
L=15m
λu=3cm; in-vac
4cm; in-vac
5cm; in-vac
8cm; in-vac
10cm; in-vac
Brilliance (phs/s/mm2/mrad2/0.1%bw)
Energy (eV)
λu(cm) Gmin(mm) Kmax
3 10 1.77
4 10 3.02
5 10 5
8 28 5
10 42 5


S.Yamamoto, KEK
λu=8cm
5cm
3cm
@K=2
ε=100nm@1GeV
ε=10nm@1GeV
ε=1nm@1GeV
ε=0.1nm@1GeV
λu=8cm
5cm
3cm
@K=0
λ; radiation (nm)
λDL; diffraction limit (nm)
Electron energy (MeV)


Long straight section, 1GeV
S.Yamamoto, KEK
E=1.0GeV, I=400mA
βx=10m, βy=8m
ε0=2.16nm, κ=0.01
σE/E=0.39e-3, N*=357
L=15m
4cm
5cm
10cm
8cm
50eV
λu(cm) K N FWHM
4 2.740 375 0.0030(333)
5 2.355 300 0.0035(289)
8 1.656 187 0.0051(197)
10 1.333 150 0.0062(161)
Brilliance (phs/s/mm2/mrad2/0.1%bw)
Energy (eV)



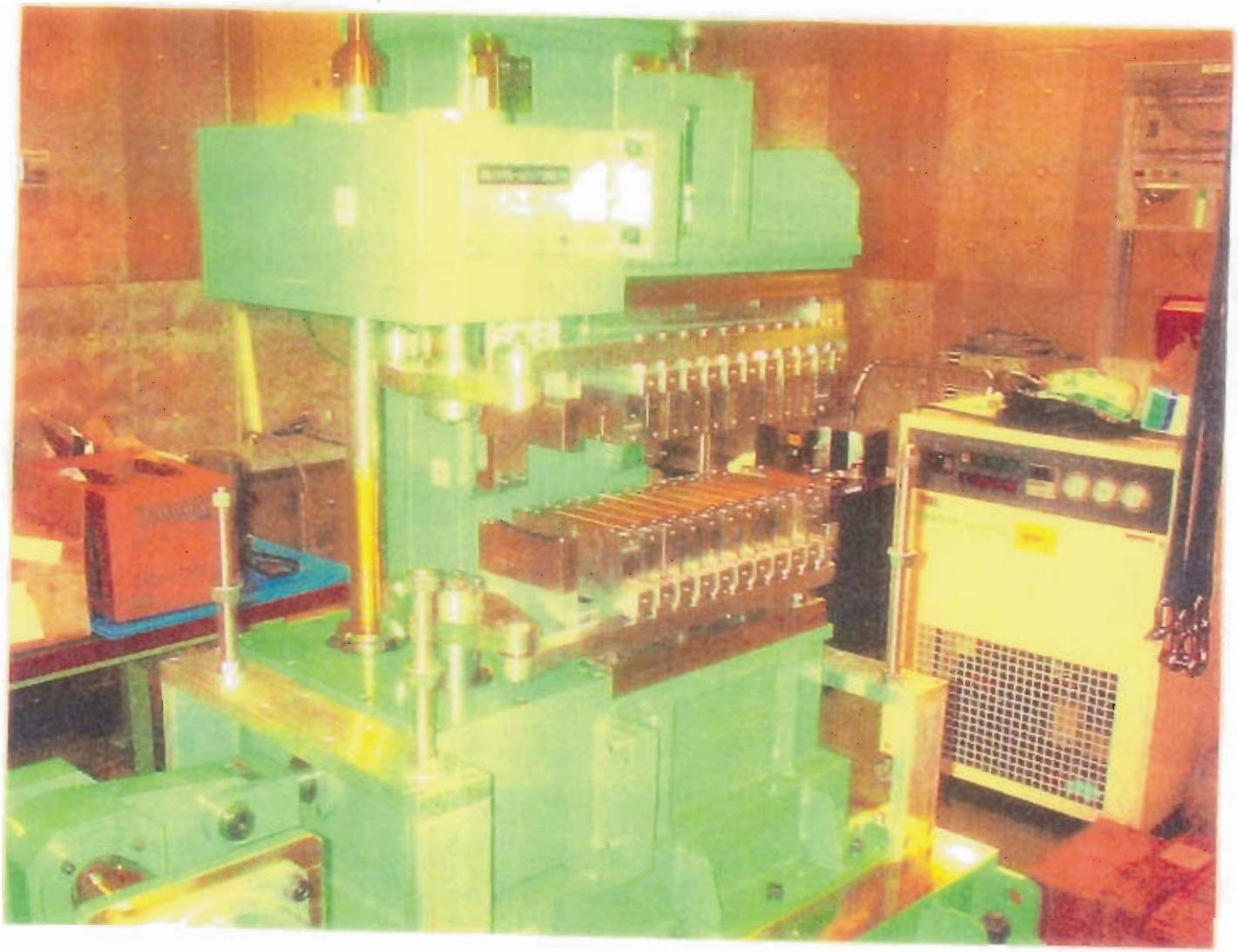
λu(cm)	Gmin(mm)	Kmax
2	4.5	1.88
1.6	4.5	1.27
1.2	4.5	0.707

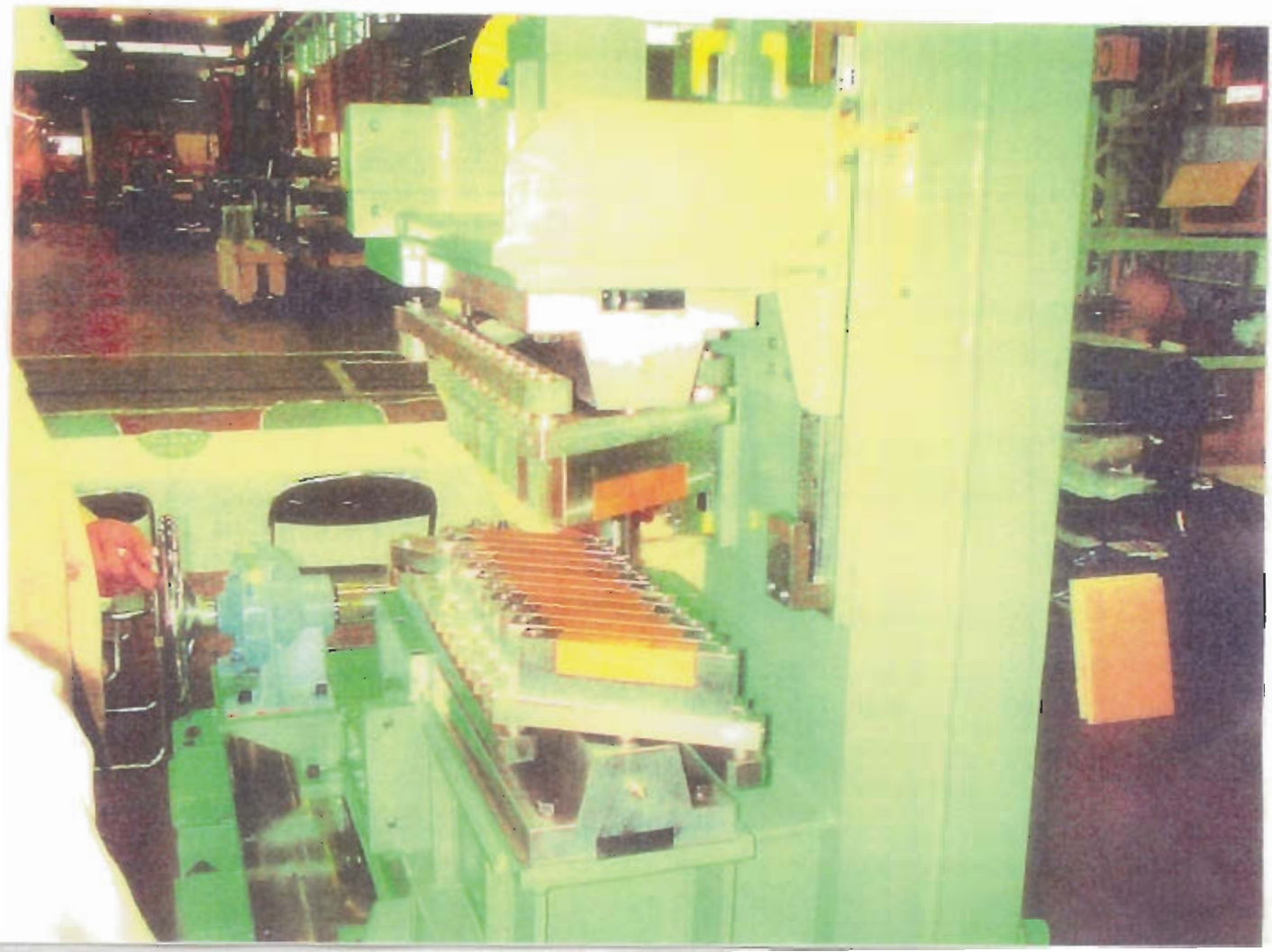


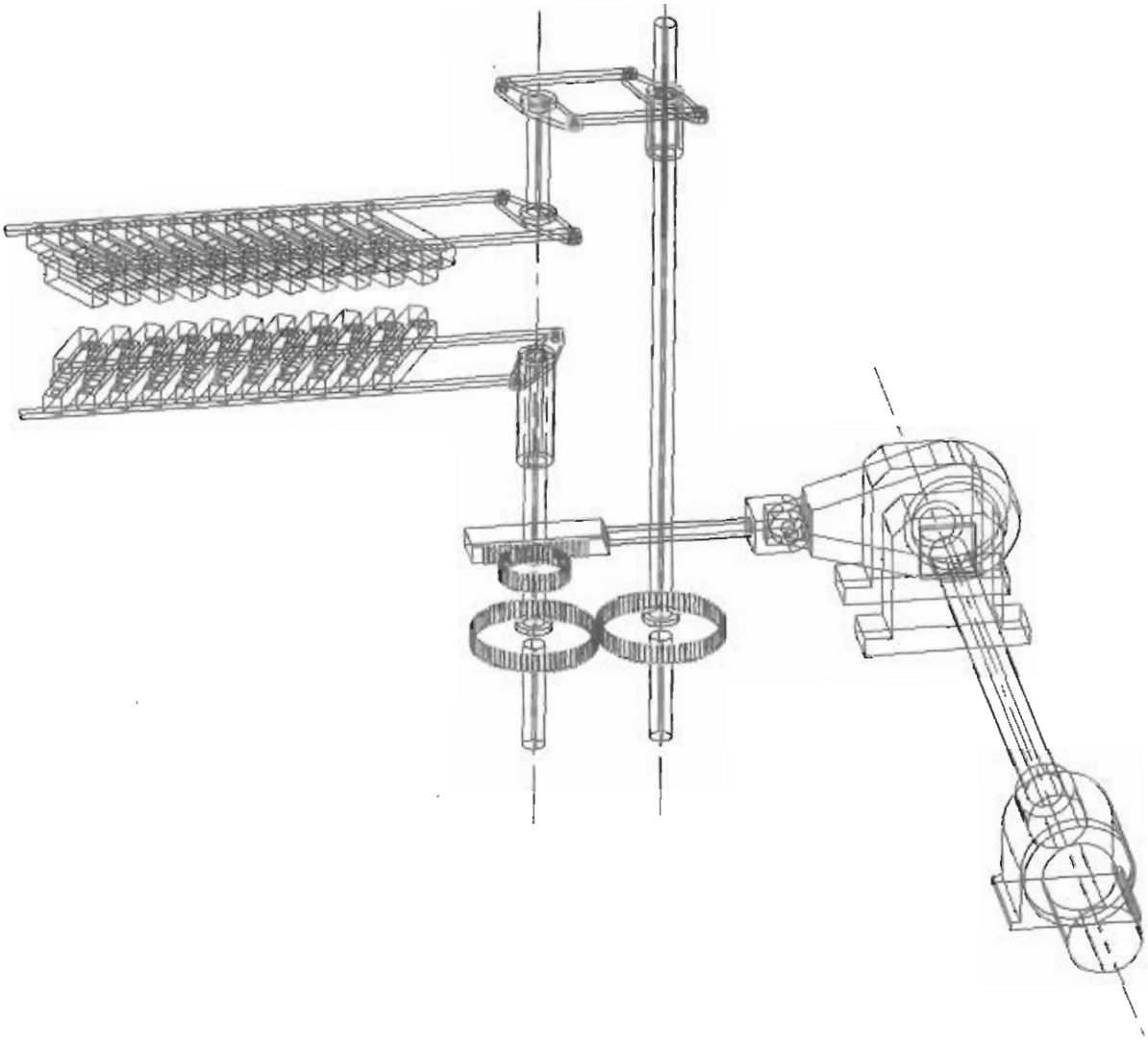
（１）楕円偏光モードＡ

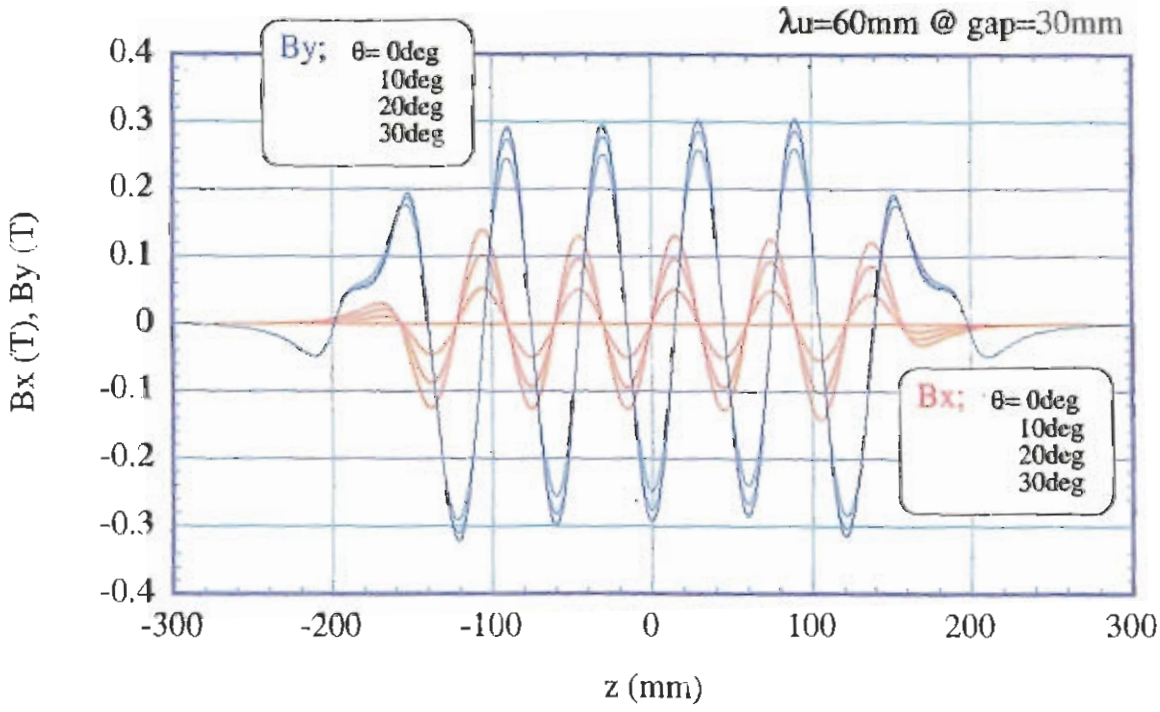
（２）直線偏光モード

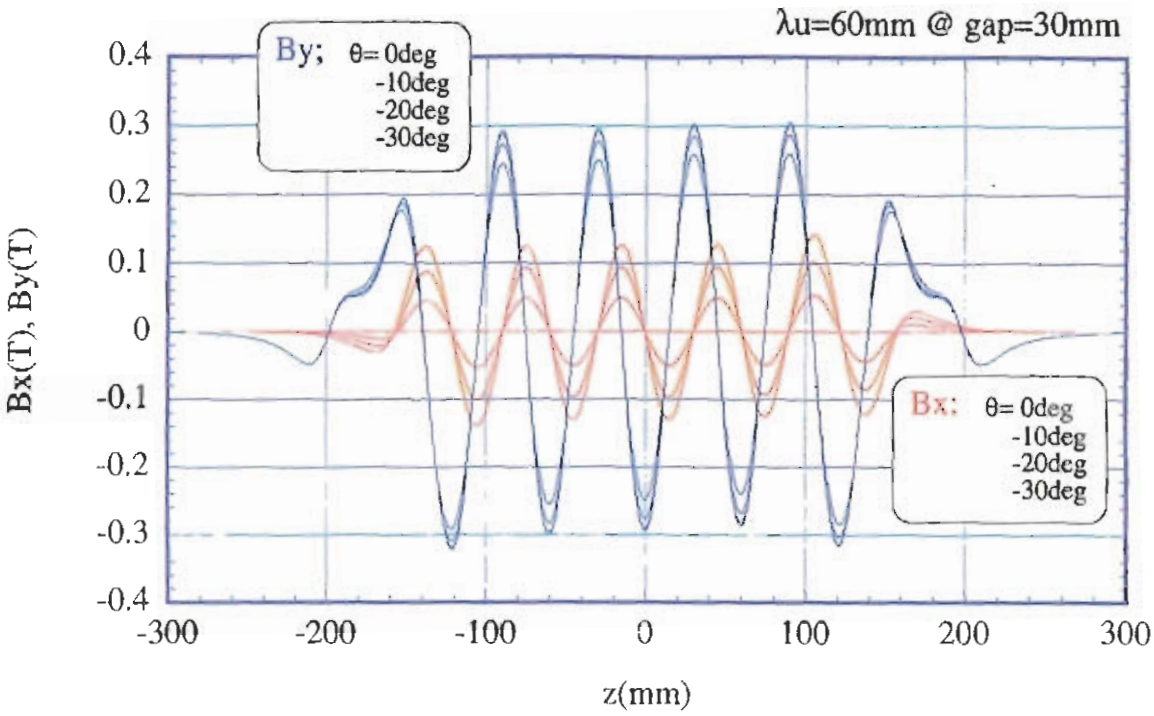
（３）楕円偏光モードＢ

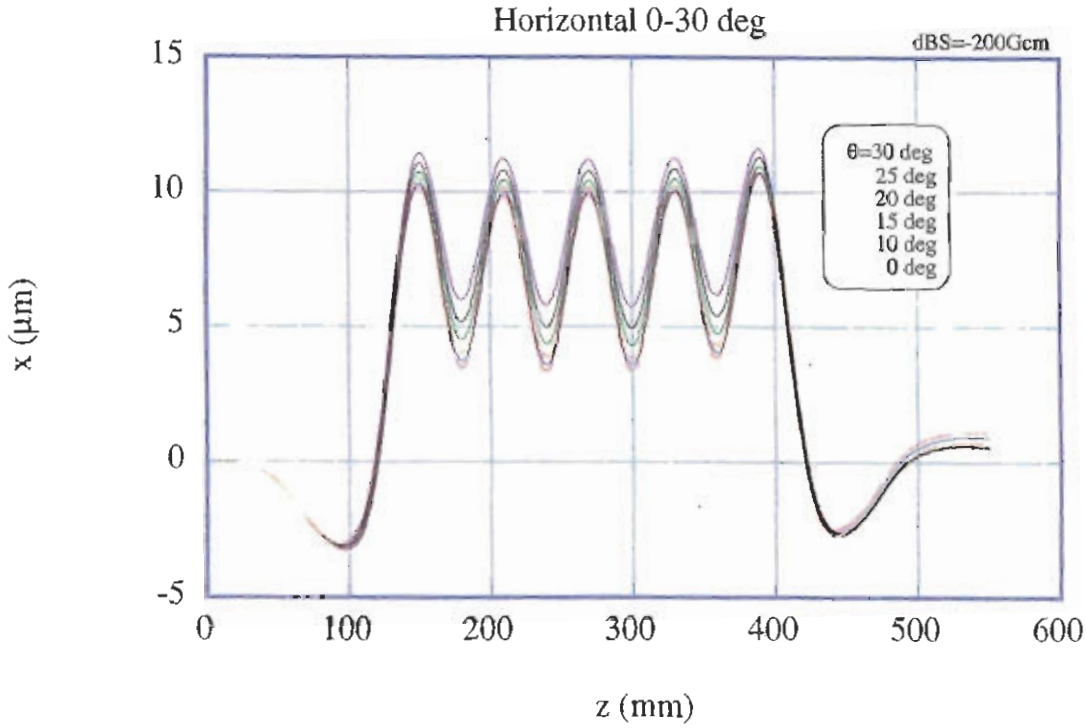


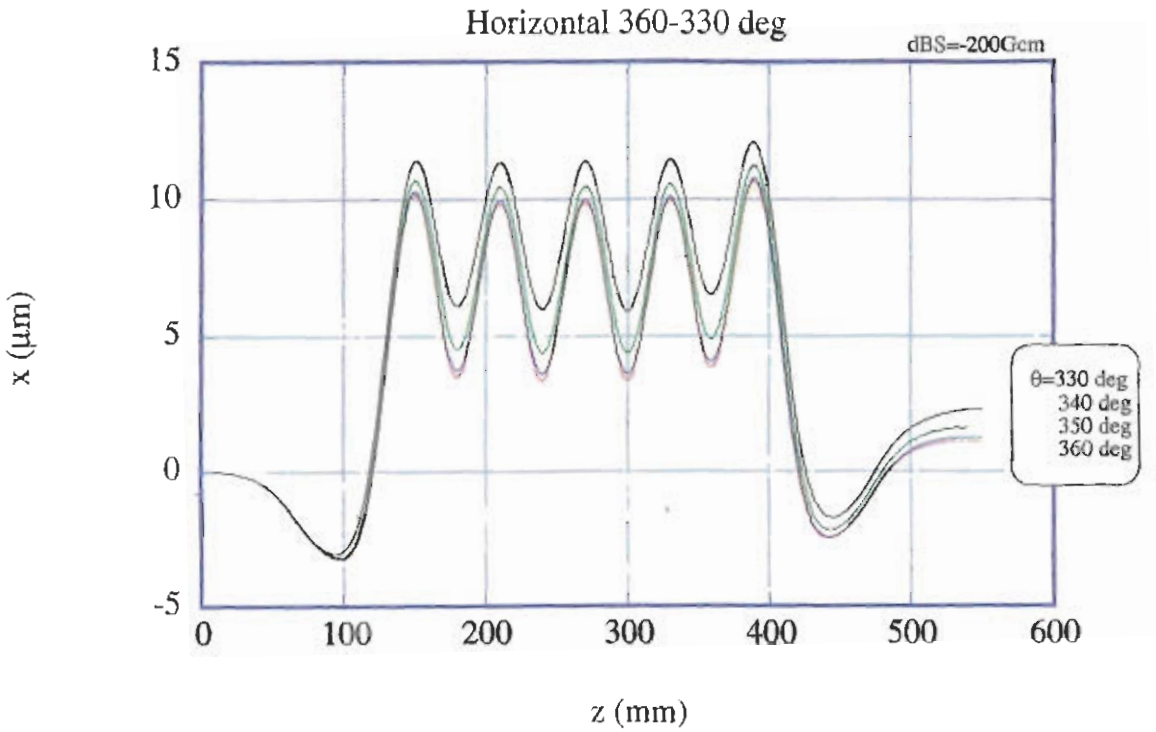


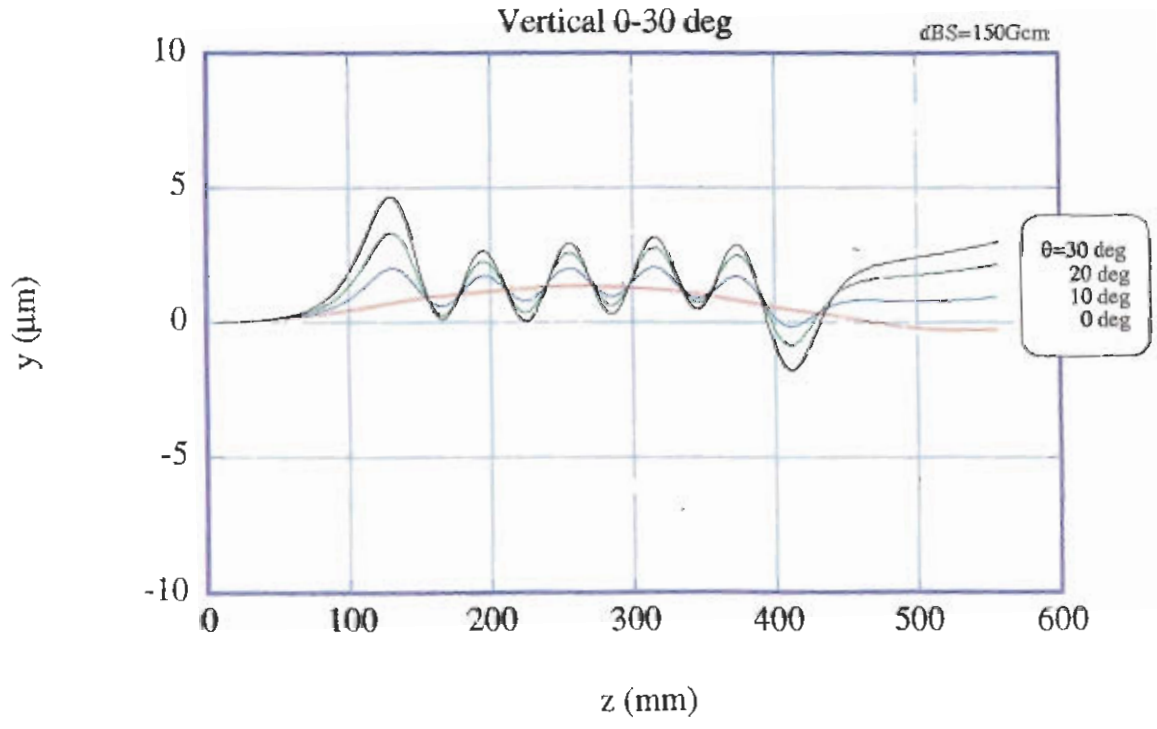


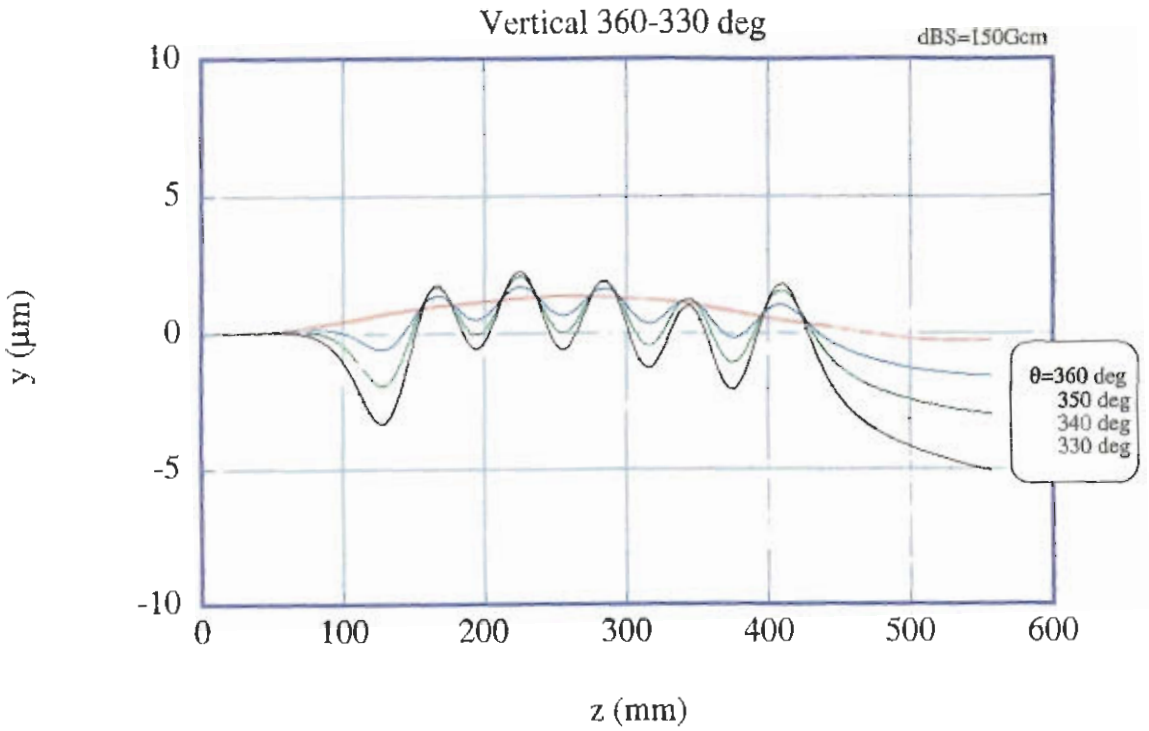

λu=60mm @ gap=30mm
By; θ= 0deg
10deg
20deg
30deg
Bx; θ= 0deg
10deg
20deg
30deg
Bx (T), By (T)
z (mm)
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-300
-200
-100
0
100
200
300

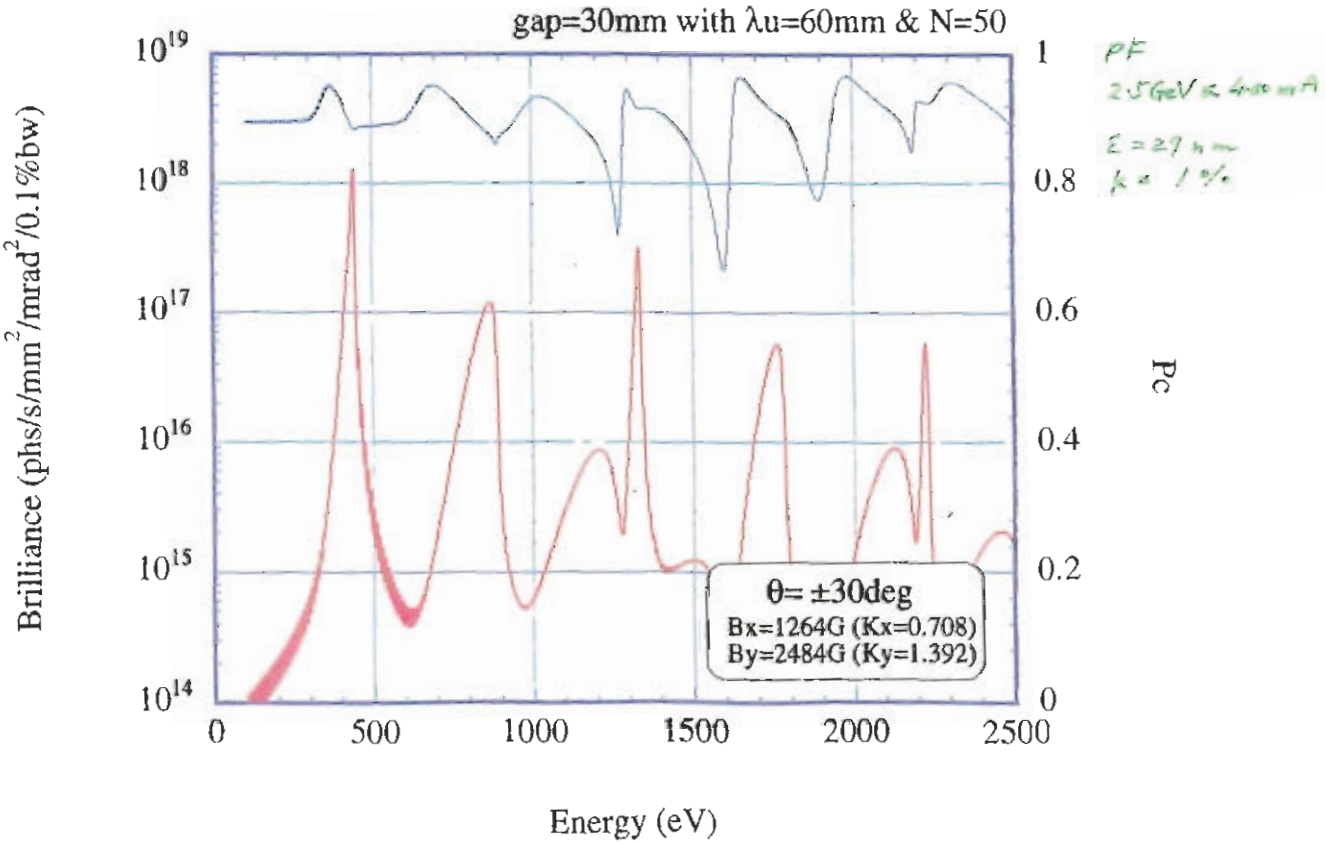

λu=60mm @ gap=30mm
By; θ= 0deg
-10deg
-20deg
-30deg
Bx: θ= 0deg
-10deg
-20deg
-30deg
Bx(T), By(T)
z(mm)
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-300
-200
-100
0
100
200
300


Horizontal 0-30 deg
dBS=-200Gcm
θ=30 deg
25 deg
20 deg
15 deg
10 deg
0 deg
x (μm)
z (mm)
15
10
5
0
-5
0
100
200
300
400
500
600


Horizontal 360-330 deg
dBS=-200Gcm
15
10
5
0
-5
0
100
200
300
400
500
600
θ=330 deg
340 deg
350 deg
360 deg
x (μm)
z (mm)


Vertical 0-30 deg
dBS=150Gcm
10
5
0
-5
-10
0
100
200
300
400
500
600
θ=30 deg
20 deg
10 deg
0 deg
y (μm)
z (mm)


Vertical 360-330 deg
dBS=150Gcm
10
5
0
-5
-10
0
100
200
300
400
500
600
y (μm)
z (mm)
θ=360 deg
350 deg
340 deg
330 deg


gap=30mm with λu=60mm & N=50
Brilliance (phs/s/mm²/mrad²/0.1%bw)
Pc
Energy (eV)
θ= ±30deg
Bx=1264G (Kx=0.708)
By=2484G (Ky=1.392)
PF
2.5GeV
E = 2.7 keV

$1+(K_x^2+K_y^2)/2$