

# Iřınım Kaynakları İin Benzetim Programı: **SPECTRA**

Yrd. Do. Dr. Zafer Nergiz

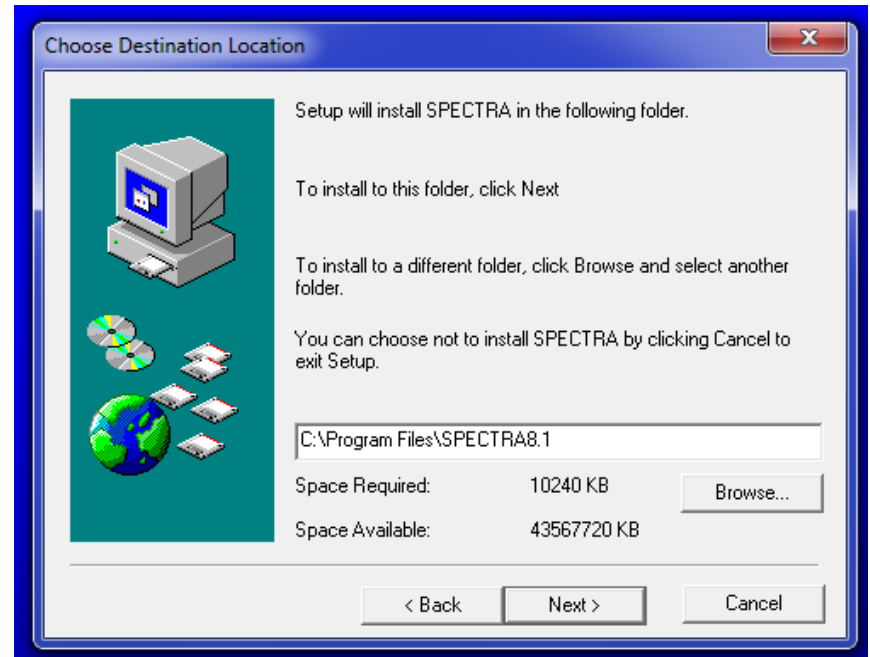
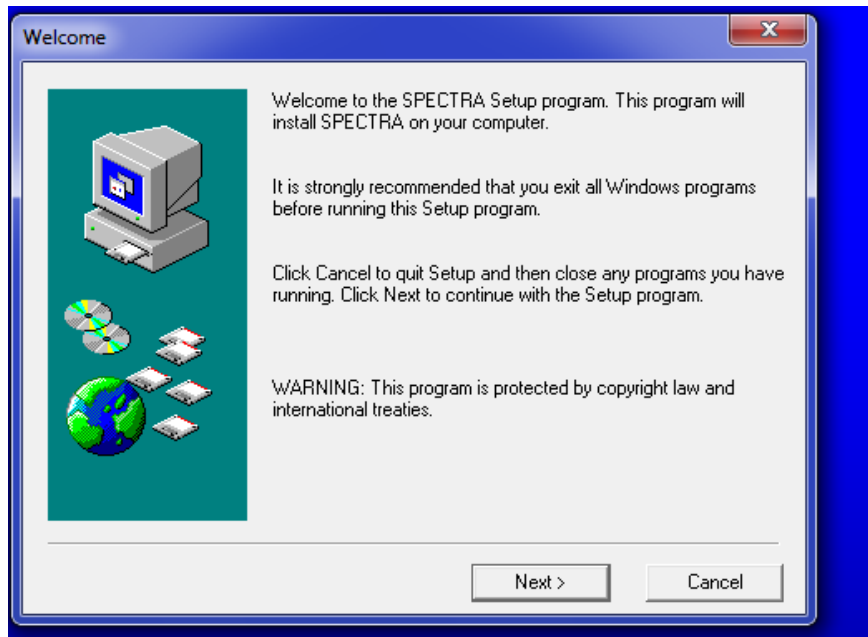
Nide Üniversitesi, Fizik Bölümü

# SPECTRA

- Sinkrotron Işınım kaynaklarında undulatör, wiggler ve eğici magnetlerden üretilecek ışınımın özelliklerini belirlemede kullanılır.
- Spring-8'den T. Tanaka ve H. Kitumura tarafından yazılmıştır.

<http://radiant.harima.riken.go.jp/spectra/>

# Programın kurulması



SPECTRA 8.1 - C:\Program Files (x86)\SPECTRA8.1\prm\lhec\storage\_ring.prm

File Select Calculation Run Open Utility Configuration Help

Accelerator Specification

Storage Ring

Bunch Shape: Gaussian Energy Spread 0.0011

Electron Energy (GeV)	8	$\beta_x(m)$	24	$\alpha_x$	0
Average Current (mA)	100	$\beta_y(m)$	5.8	$\alpha_y$	0
Circumference	1435	$\eta_x(m)$	0	$\eta_x'$	0
Bunches	2436	$\eta_y(m)$	0	$\eta_y'$	0
$\sigma_z$ (mm)	20				
Peak Current (A)	1.17505	$1/\gamma(\mu rad)$	63.8749		
Natural Emittance (m.rad)	5.9e-9	$\sigma_x(\mu m)$	375.7	$\sigma_x(\mu rad)$	15.66
Coupling Constant	0.003	$\sigma_y(\mu m)$	10.12	$\sigma_y(\mu rad)$	1.744
$\epsilon_x(m.rad)$ 5.882e-09		$\gamma\sigma_x'$	0.2451	$\gamma\sigma_y'$	0.02731
$\epsilon_y(m.rad)$ 1.765e-11					

Light Source Description

Linear Undulator

Link Gap & Field  
 Segmented Undulator  
 Special Magnet Setup

Gap Value	20	$\sigma_r(\mu m)$	2.19789	$\sigma_r(\mu rad)$	3.08254
B(T)	0.26105	$\Sigma_x(\mu m)$	375.741	$\Sigma_x(\mu rad)$	15.9562
Periodic Length (cm)	3.2	$\Sigma_y(\mu m)$	10.353	$\Sigma_y(\mu rad)$	3.54184
Total Length (m)	4.5	$\epsilon_{1st}(peak:eV)$	14525		
Number of Periods	140	$\epsilon_{3rd}(peak:eV)$	43642.4		
K Value	0.78	Flux <sub>1st</sub>	4.11454e+14		
$\epsilon_{1st}(eV)$	14562.7	Brilliance <sub>1st</sub>	4.74079e+19		
		Peak Brilliance	5.57064e+20		
		Bose Degeneracy	0.00014334		
		Total Power (kW)	1.23622		

SPECTRA 9.0 - C:\Users\zafer\Desktop\spectra\_input\gnu\_grafar\kring5.prm

File Select Calculation Run Open Utility Configuration Help

Accelerator Specification

Storage Ring

Bunch Profile: Gaussian

Electron Energy (GeV)	3.00	Energy Spread	0.000000
Average Current (mA)	500	$\beta_x(m)$	12.70
Circumference	477	$\beta_y(m)$	7.5
Bunches	795	$\eta_x(m)$	0.09
$\sigma_z$ (mm)	2.2	$\eta_y(m)$	0
Peak Current (A)	54.4011	$1/\gamma(\mu rad)$	170.333
Natural Emittance (m.rad)	0.51e-9	$\sigma_x(\mu m)$	91.86
Coupling Constant	0.01	$\sigma_y(\mu m)$	6.154
$\epsilon_x(m.rad)$ 5.050e-010	$\epsilon_y(m.rad)$ 5.050e-012	$\gamma\sigma_x'$	0.03702
		$\gamma\sigma_y'$	0.0048172

Light Source Description

Linear Undulator

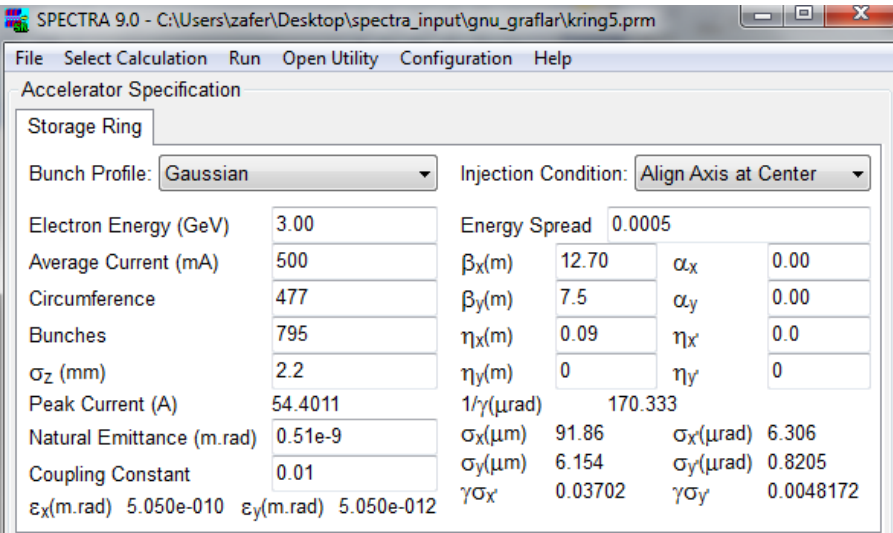
Link Gap & Field  
 Segmented Undulator  
 Special Magnet Setup

Gap Value	5	$\sigma_r(\mu m)$	6.83128	$\sigma_r(\mu rad)$	10.7413
B(T)	1.33872	$\Sigma_x(\mu m)$	92.1116	$\Sigma_x(\mu rad)$	12.4553
Periodic Length (cm)	1.8	$\Sigma_y(\mu m)$	9.19444	$\Sigma_y(\mu rad)$	10.7726
Total Length (m)	4.0	$\epsilon_{1st}(peak:eV)$	1344.05		
Number of Periods	222	$\epsilon_{3rd}(peak:eV)$	4032.95		
K Value	2.25	Flux <sub>1st</sub>	7.13795e+015		
$\epsilon_{1st}(eV)$	1344.61	Brilliance <sub>1st</sub>	1.59111e+021		
		Peak Brilliance	1.73116e+023		
		Bose Degeneracy	56.589		
		Total Power (kW)	20.3896		

Configuration

- Beamline
- Accelerator
- Light Source
  - Source Type
    - Linear Undulator
    - Vertical Undulator
    - Helical Undulator
    - Elliptic Undulator
    - Figure-8 Undulator
    - Wiggler
    - EMPW
    - Bending Magnet
    - Asymmetric Figure-8 Undulator
    - Multipole Field
    - Field Mapping
    - Periodic: User Defined
    - User Defined
  - Solve Equation of Motion
  - Duplicate
  - Change Name
  - Delete
  - Sort
  - Untitled
- Calculation Control

# EĞİCİ MAGNET İŞİNİMİNİ İNCELEYELİM



SPECTRA 9.0 - C:\Users\zafer\Desktop\spectra\_input\gnu\_graflar\kring5.prm

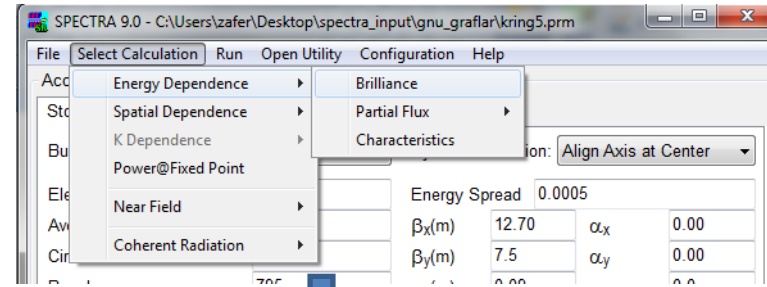
File Select Calculation Run Open Utility Configuration Help

Accelerator Specification

Storage Ring

Bunch Profile: Gaussian Injection Condition: Align Axis at Center

Electron Energy (GeV)	3.00	Energy Spread	0.0005	
Average Current (mA)	500	$\beta_x(m)$	12.70	$\alpha_x$ 0.00
Circumference	477	$\beta_y(m)$	7.5	$\alpha_y$ 0.00
Bunches	795	$\eta_x(m)$	0.09	$\eta_x'$ 0.0
$\sigma_z$ (mm)	2.2	$\eta_y(m)$	0	$\eta_y'$ 0
Peak Current (A)	54.4011	$1/\gamma(\mu rad)$	170.333	
Natural Emittance (m.rad)	0.51e-9	$\sigma_x(\mu m)$	91.86	$\sigma_x(\mu rad)$ 6.306
Coupling Constant	0.01	$\sigma_y(\mu m)$	6.154	$\sigma_y(\mu rad)$ 0.8205
$\epsilon_x(m.rad)$ 5.050e-010	$\epsilon_y(m.rad)$ 5.050e-012	$\gamma\sigma_x'$	0.03702	$\gamma\sigma_y'$ 0.0048172



SPECTRA 9.0 - C:\Users\zafer\Desktop\spectra\_input\gnu\_graflar\kring5.prm

File Select Calculation Run Open Utility Configuration Help

- Energy Dependence
- Spatial Dependence
- K Dependence
- Power@Fixed Point
- Near Field
- Coherent Radiation

Brilliance

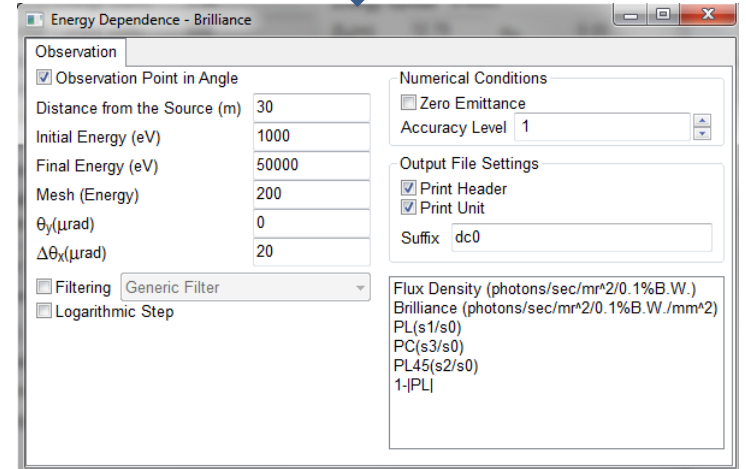
Partial Flux

Characteristics

Align Axis at Center

Energy Spread 0.0005

$\beta_x(m)$	12.70	$\alpha_x$	0.00
$\beta_y(m)$	7.5	$\alpha_y$	0.00



Energy Dependence - Brilliance

Observation

Observation Point in Angle

Distance from the Source (m) 30

Initial Energy (eV) 1000

Final Energy (eV) 50000

Mesh (Energy) 200

$\theta_y(\mu rad)$  0

$\Delta\theta_x(\mu rad)$  20

Filtering Generic Filter

Logarithmic Step

Numerical Conditions

Zero Emittance

Accuracy Level 1

Output File Settings

Print Header

Print Unit

Suffix dc0

Flux Density (photons/sec/mr<sup>2</sup>/0.1%B.W.)

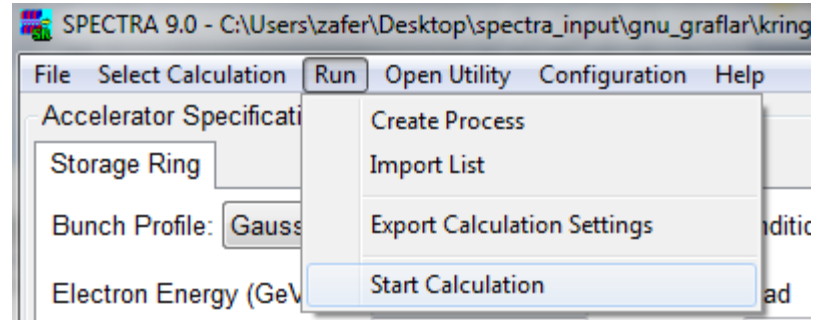
Brilliance (photons/sec/mr<sup>2</sup>/0.1%B.W./mm<sup>2</sup>)

PL(s1/s0)

PC(s3/s0)

PL45(s2/s0)

1-|PL|



SPECTRA 9.0 - C:\Users\zafer\Desktop\spectra\_input\gnu\_graflar\kring5.prm

File Select Calculation Run Open Utility Configuration Help

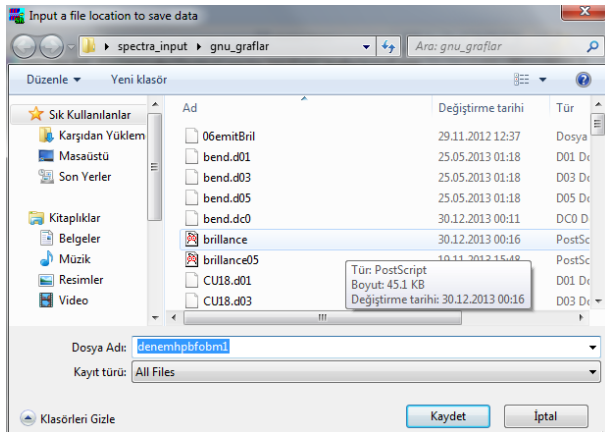
Accelerator Specification

Storage Ring

Bunch Profile: Gaussian

Electron Energy (GeV)

- Create Process
- Import List
- Export Calculation Settings
- Start Calculation



Input a file location to save data

spectra\_input > gnu\_graflar

Ara: gnu\_graflar

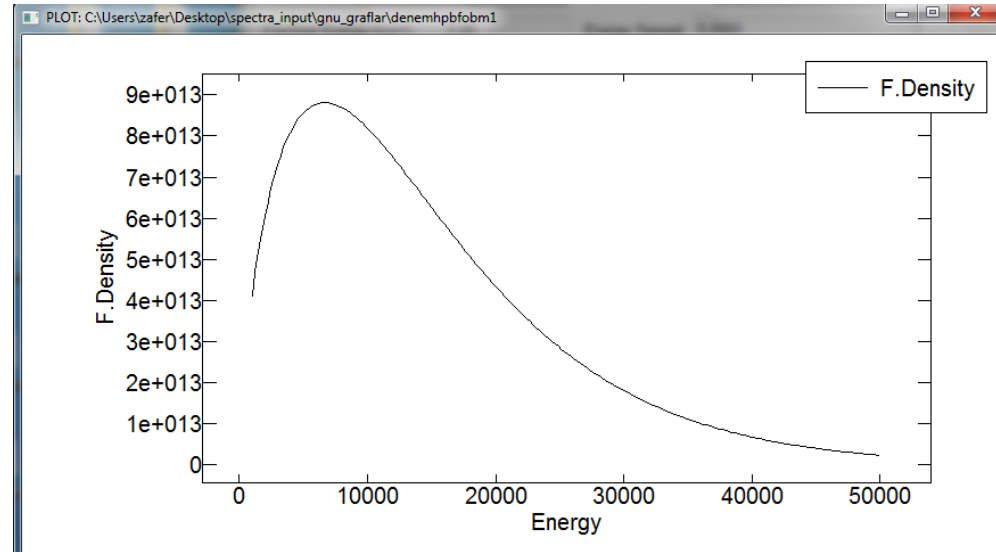
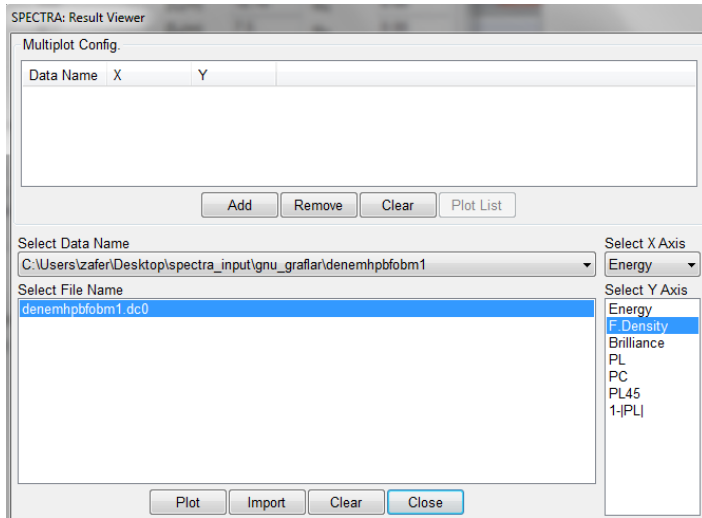
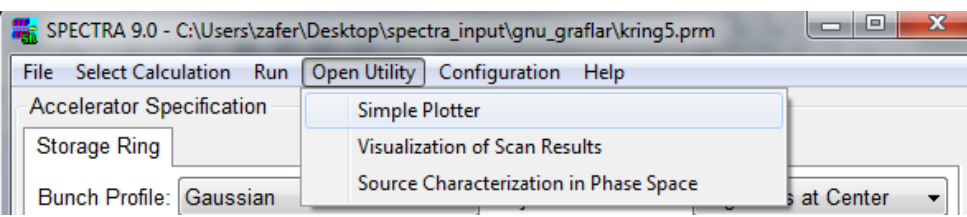
Ad	Değiştirme tarihi	Tür
06emitBril	29.11.2012 12:37	Dosya
bend.d01	25.05.2013 01:18	D01 Dr
bend.d03	25.05.2013 01:18	D03 Dr
bend.d05	25.05.2013 01:18	D05 Dr
bend.dc0	30.12.2013 00:11	DC0 D
brillance	30.12.2013 00:16	PostSc
brillance05	30.12.2013 00:16	PostSc
CU18.d01		D01 Dr
CU18.d03		D03 Dr

Dosya Adı: denemhpbfobm1

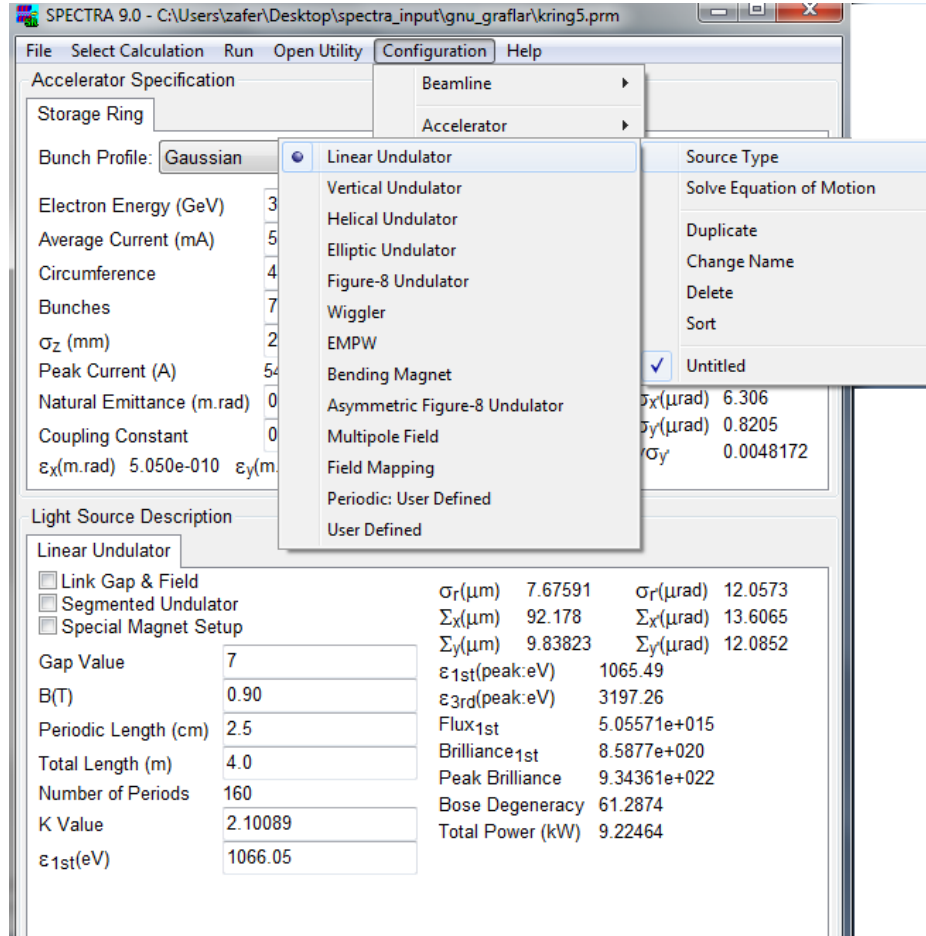
Kayıt türü: All Files

Kaydet İptal

# GRAFİK ÇİZDİRELİM



# Undulator Işımasını İnceleyelim



SPECTRA 9.0 - C:\Users\zafer\Desktop\spectra\_input\gnu\_grafnar\kring5.prm

File Select Calculation Run Open Utility Configuration Help

Accelerator Specification Beamline Accelerator

Storage Ring

Bunch Profile: Gaussian

Electron Energy (GeV) 3

Average Current (mA) 5

Circumference 4

Bunches 7

$\sigma_z$  (mm) 2

Peak Current (A) 54

Natural Emittance (m.rad) 0

Coupling Constant 0

$\epsilon_x$ (m.rad) 5.050e-010  $\epsilon_y$ (m.rad) 0.0048172

Source Type

Solve Equation of Motion

Duplicate

Change Name

Delete

Sort

Untitled

Linear Undulator

Link Gap & Field

Segmented Undulator

Special Magnet Setup

Gap Value 7

B(T) 0.90

Periodic Length (cm) 2.5

Total Length (m) 4.0

Number of Periods 160

K Value 2.10089

$\epsilon_{1st}$ (eV) 1066.05

$\sigma_r$ ( $\mu$ m) 7.67591

$\Sigma_x$ ( $\mu$ m) 92.178

$\Sigma_y$ ( $\mu$ m) 9.83823

$\epsilon_{1st}$ (peak:eV) 1065.49

$\epsilon_{3rd}$ (peak:eV) 3197.26

Flux<sub>1st</sub> 5.05571e+015

Brilliance<sub>1st</sub> 8.5877e+020

Peak Brilliance 9.34361e+022

Bose Degeneracy 61.2874

Total Power (kW) 9.22464

$\sigma_x$ ( $\mu$ rad) 6.306

$\sigma_y$ ( $\mu$ rad) 0.8205

$\sigma_y'$  0.0048172



SPECTRA 9.0 - C:\Users\zafer\Desktop\spectra\_input\gnu\_grafiar\kring5.prm

File Select Calculation Run Open Utility Configuration Help

Acc Energy Dependence Brilliance  
 Spatial Dependence Partial Flux  
 K Dependence Total Flux  
 Power@Fixed Point  
 Near Field  
 Coherent Radiation

Condition: Align Axis at Center

Energy Spread 0.0005

$\beta_x(m)$	12.70	$\alpha_x$	0.00
$\beta_y(m)$	7.5	$\alpha_y$	0.00
$\eta_x(m)$	0.09	$\eta_x$	0.0
$\eta_y(m)$	0	$\eta_y$	0
$1/\gamma(\mu rad)$	170.333		
$\sigma_x(\mu m)$	91.86	$\sigma_x(\mu rad)$	6.306
$\sigma_y(\mu m)$	6.154	$\sigma_y(\mu rad)$	0.8205
$\gamma\sigma_x$	0.03702	$\gamma\sigma_y$	0.0048172

Bunches 795  
 $\sigma_z$  (mm) 2.2  
 Peak Current (A) 54.4011  
 Natural Emittance (m.rad) 0.51e-9  
 Coupling Constant 0.01  
 $\epsilon_x(m.rad)$  5.050e-010  $\epsilon_y(m.rad)$  5.050e-012

Light Source Description

Linear Undulator

Link Gap & Field  
 Segmented Undulator  
 Special Magnet Setup

$\sigma_r(\mu m)$	7.67591	$\sigma_r(\mu rad)$	12.0573
$\Sigma_x(\mu m)$	92.178	$\Sigma_x(\mu rad)$	13.6065
$\Sigma_y(\mu m)$	9.83823	$\Sigma_y(\mu rad)$	12.0852
$\epsilon_{1st}(peak.eV)$	1065.49		
$\epsilon_{3rd}(peak.eV)$	3197.26		
Flux <sub>1st</sub>	5.05571e+015		
Brilliance <sub>1st</sub>	8.5877e+020		
Peak Brilliance	9.34361e+022		
Bose Degeneracy	61.2874		
Total Power (kW)	9.22464		

Gap Value 7  
 B(T) 0.90  
 Periodic Length (cm) 2.5  
 Total Length (m) 4.0  
 Number of Periods 160  
 K Value 2.10089  
 $\epsilon_{1st}(eV)$  1066.05

Energy Dependence - Brilliance

Observation

Observation Point in Angle

Distance from the Source (m) 30  
 Initial Energy (eV) 100  
 Final Energy (eV) 5000  
 Energy Pitch (eV) 10  
 $\theta_x(\mu rad)$  1  
 $\theta_y(\mu rad)$  1  
 $\epsilon_{1st@\theta_{x,y}}(eV)$  1464.04

Easy Calc. > -1 eV  
 Auto Pitch: Rel. Difference 0.5  
 Filtering Generic Filter  
 Convolution

Numerical Conditions

Zero Emittance  
 Zero E-spread  
 Accuracy Level 5

Output File Settings

Print Header  
 Print Unit  
 Suffix dc0

Flux Density (photons/sec/mr<sup>2</sup>/0.1%B.W.)  
 Brilliance (photons/sec/mr<sup>2</sup>/0.1%B.W./mm<sup>2</sup>)  
 PL(s1/s0)  
 PC(s3/s0)  
 PL45(s2/s0)  
 1-|PL|

Input a file location to save data

« gnu\_grafiar » asoninput

Düzenle Yeni klasör

Sık Kullanılanlar

- Karşıdan Yükleme
- Masaüstü
- Son Yerler
- Dropbox
- Kitaplıklar
- Belgeler
- Müzik
- Resimler
- Video

Ad	Değiştirme tarihi	Tür
bendhfb.dc0	01.12.2014 11:28	DC0 D
bendhff.dc0	01.12.2014 11:28	DC0 D
bendlfb.dc0	01.12.2014 11:29	DC0 D
bendlff.dc0	01.12.2014 11:29	DC0 D
brilliance4.eps	01.12.2014 13:20	PostSc
denemeundu25.dc0	03.02.2015 01:12	DC0 D
EPU40.d01	01.12.2014 11:29	D01 D
EPU40.d03	01.12.2014 11:31	D03 D
EPU40.d05	01.12.2014 11:31	D05 D

Dosya Adı: denemeundu25  
 Kayıt türü: All Files

Klasörleri Gizle Kaydet İptal

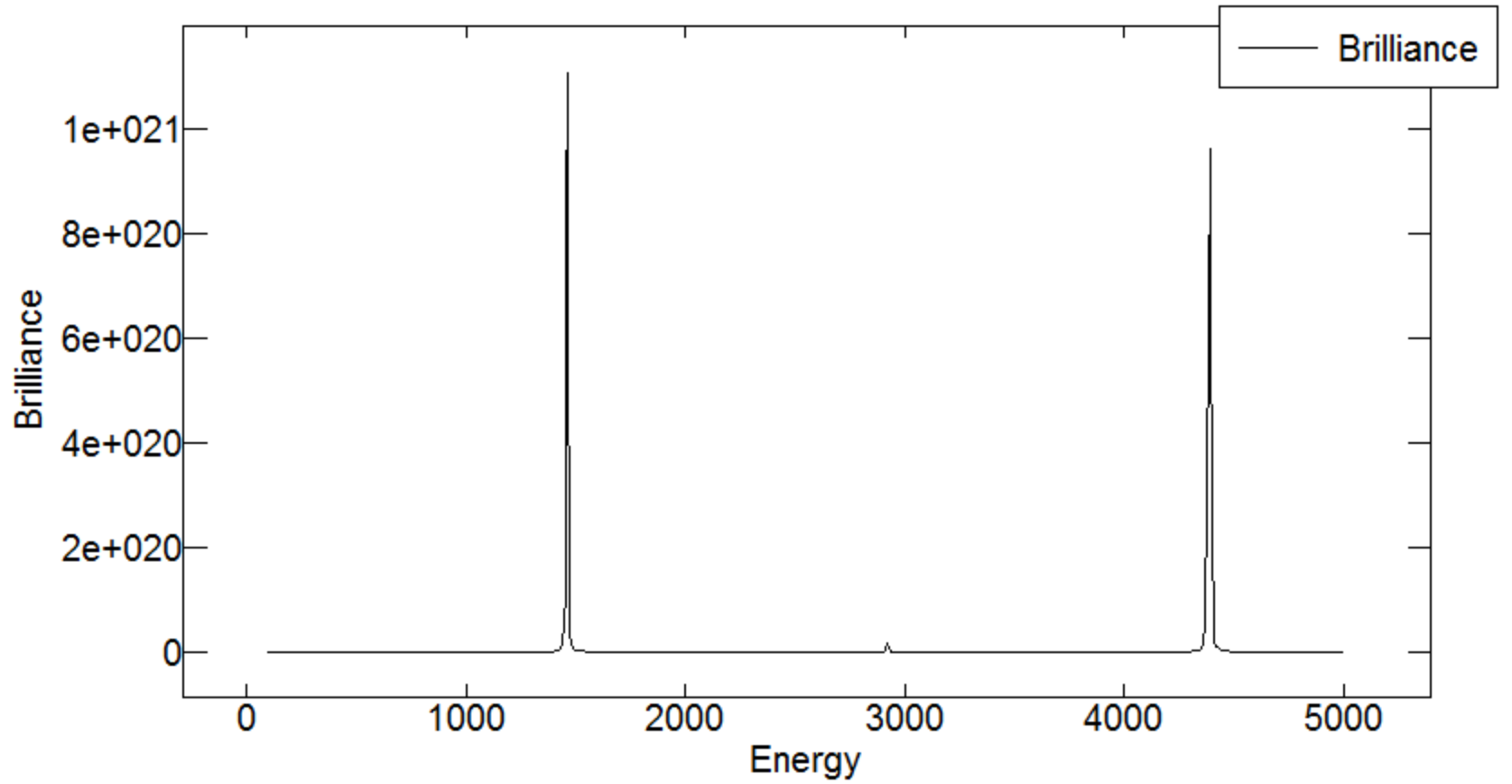
SPECTRA 9.0 - C:\Users\zafer\Desktop\spectra\_input\gnu\_grafiar\kring5.prm

File Select Calculation Run Open Utility Configuration Help

Accelerator Specificati Create Process  
 Storage Ring Import List  
 Bunch Profile: Gauss Export Calculation Settings  
 Start Calculation

Electron Energy (GeV) 500  
 Average Current (mA) 477  
 Circumference 795  
 $\sigma_z$  (mm) 2.2

$\beta_x(m)$	12.70	$\alpha_x$	0.00
$\beta_y(m)$	7.5	$\alpha_y$	0.00
$\eta_x(m)$	0.09	$\eta_x$	0.0
$\eta_y(m)$	0	$\eta_y$	0



# Undulatorun K bağımlılığına Bakalım

**K Dependence - Peak Brilliance**

Observation

Distance from the Source (m) 30

Minimum Harmonic 1

Maximum Harmonic 5

Minimum K Value 0.46

Maximum K Value 2.1

Mesh (K Value) 200

On-Axis Power Density

Numerical Conditions

Zero Emittance

Zero E-spread

Accuracy Level 5

Output File Settings

Print Header

Print Unit

Suffix

Energy (eV)

Flux Density (photons/sec/mr<sup>2</sup>/0.1%B.W.)

Brilliance (photons/sec/mr<sup>2</sup>/0.1%B.W.)

Flux (photons/sec/0.1%B.W.)

Total Power (kW)

Power Density (kW/mrad<sup>2</sup>)

SPECTRA 3.0 - C:\Users\zaren\Desktop\spectra\_input\gnd\_grand\kings.prm

File Select Calculation Run Open Utility Configuration Help

Acc Energy Dependence

Sto Spatial Dependence

Bu K Dependence Easy Calculation Brilliance@Peak Energy

Ele Power@Fixed Point Fixed Energy Characteristics

Av Near Field Peak Energy Brilliance Curve

Cir Coherent Radiation Power

$\alpha_x$	0.00
$\alpha_y$	0.00
$\eta_x$	0.0
$\eta_y$	0

Bunches 795  $\beta_y$ (m) 7.5  $1/\gamma$ ( $\mu$ rad) 170.333

$\sigma_z$  (mm) 2.2  $\eta_x$ (m) 0.09  $\sigma_x$ ( $\mu$ m) 91.86  $\sigma_x$ ( $\mu$ rad) 6.306

Peak Current (A) 54.4011  $\eta_y$ (m) 0  $\sigma_y$ ( $\mu$ m) 6.154  $\sigma_y$ ( $\mu$ rad) 0.8205

Natural Emittance (m.rad) 0.51e-9  $\gamma\sigma_x$  0.03702  $\gamma\sigma_y$  0.0048172

Coupling Constant 0.01  $\epsilon_x$ (m.rad) 5.050e-010  $\epsilon_y$ (m.rad) 5.050e-012

Light Source Description

Linear Undulator

Link Gap & Field

Gap Value	7	$\sigma_r$ ( $\mu$ m)	6.54989	$\sigma_r$ ( $\mu$ rad)	10.2886
B(T)	0.70	$\Sigma_x$ ( $\mu$ m)	92.0911	$\Sigma_x$ ( $\mu$ rad)	12.0671
Periodic Length (cm)	2.5	$\Sigma_y$ ( $\mu$ m)	8.98735	$\Sigma_y$ ( $\mu$ rad)	10.3212
Total Length (m)	4.0	$\epsilon_{1st}$ (peak:eV)	1463.21		
Number of Periods	160	$\epsilon_{3rd}$ (peak:eV)	4390.88		
K Value	1.63403	Flux <sub>1st</sub>	4.59819e+015		
$\epsilon_{1st}$ (eV)	1464.09	Brilliance <sub>1st</sub>	1.12991e+021		
		Peak Brilliance	1.22937e+023		
		Bose Degeneracy	31.1292		
		Total Power (kW)	5.58034		

Windows Explorer window showing the file system path: ZaferNergiz > AppData > Local > VirtualStore > Program Files > SPECTRA8.1. The search bar contains "Ara: SPECTRA8.1".

Navigation buttons: Düzenle, Aç, Bununla paylaş, Yaz, Yeni klasör.

Left sidebar: Sık Kullanılanlar (Frequent Locations) including Karşından Yüklemeleler, Masaüstü, Son Yerler, and Karşından Yüklemeleler.

Ad	Değiştirme tarihi	Tür	Boyut
deneme1.dc0	23.01.2012 11:41	DC0 Dosyası	129 KB
deneme1.dc0.dc0	23.01.2012 11:37	DC0 Dosyası	129 KB
undu1out.dc0	23.01.2012 09:32	DC0 Dosyası	129 KB

undu1out.dc0 - Not Defteri

File menu: Dosya, Düzen, Biçim, Görünüm, Yardım

EB(GeV)	EMITTANCEX	EMITTANCEY	SIZEx(m)	SIZEy(m)	DIVx(rad)	DIVy(rad)
3.000e+00	5.882e-09	1.765e-11	3.757e-04	1.012e-05	1.566e-05	1.744e-06
betax	alphax	betay	alphy	eta	deta	E_spread
2.400e+01	0.000e+00	5.800e+00	0.000e+00	0.000e+00	0.000e+00	1.100e-03
Ibeam(A)	period(cm)	#periods	Kx	Ky		
1.000e-01	3.200e+00	140	0.000e+00	7.800e-01		
thetax(rad)	thetay(rad)					
0.000e+00	0.000e+00					
Energy	F.Density	Brilliance	PL	PC	PL45	1- PL
eV	ph/s/mr^2/0.1%	F.Dens/mm^2	-	-	-	-
1.00000e+04	1.984e+13	8.036e+14	9.954295e-01	0.000000e+00	6.902171e-17	4.570466e-03
1.00300e+04	1.349e+13	5.465e+14	9.916808e-01	0.000000e+00	2.546893e-17	8.319232e-03
1.00600e+04	2.339e+13	9.473e+14	9.941051e-01	0.000000e+00	-4.728363e-17	5.894853e-03
1.00900e+04	6.996e+13	2.834e+15	9.976240e-01	0.000000e+00	-4.298187e-17	2.375973e-03
1.01200e+04	1.947e+14	7.890e+15	9.990007e-01	0.000000e+00	-2.717482e-17	9.993031e-04
1.01500e+04	4.926e+14	1.996e+16	9.995593e-01	0.000000e+00	-1.573422e-17	4.407085e-04
1.01800e+04	1.250e+15	5.064e+16	9.998242e-01	0.000000e+00	-7.684800e-18	1.758462e-04
1.01950e+04	1.972e+15	7.993e+16	9.998962e-01	0.000000e+00	-4.895000e-18	1.038309e-04
1.02100e+04	2.831e+15	1.147e+17	9.999390e-01	0.000000e+00	-3.048319e-18	6.103822e-05
1.02400e+04	2.983e+15	1.209e+17	9.999750e-01	0.000000e+00	-1.330638e-18	2.496299e-05
1.02550e+04	1.934e+15	7.840e+16	9.999817e-01	0.000000e+00	-9.807409e-19	1.825542e-05
1.02700e+04	9.025e+14	3.658e+16	9.999847e-01	0.000000e+00	-8.056118e-19	1.531065e-05
1.03000e+04	9.927e+13	4.024e+15	9.999747e-01	0.000000e+00	-1.088370e-18	2.526388e-05
1.03300e+04	7.730e+13	9.039e+14	9.999432e-01	0.000000e+00	-2.071514e-18	5.675473e-05

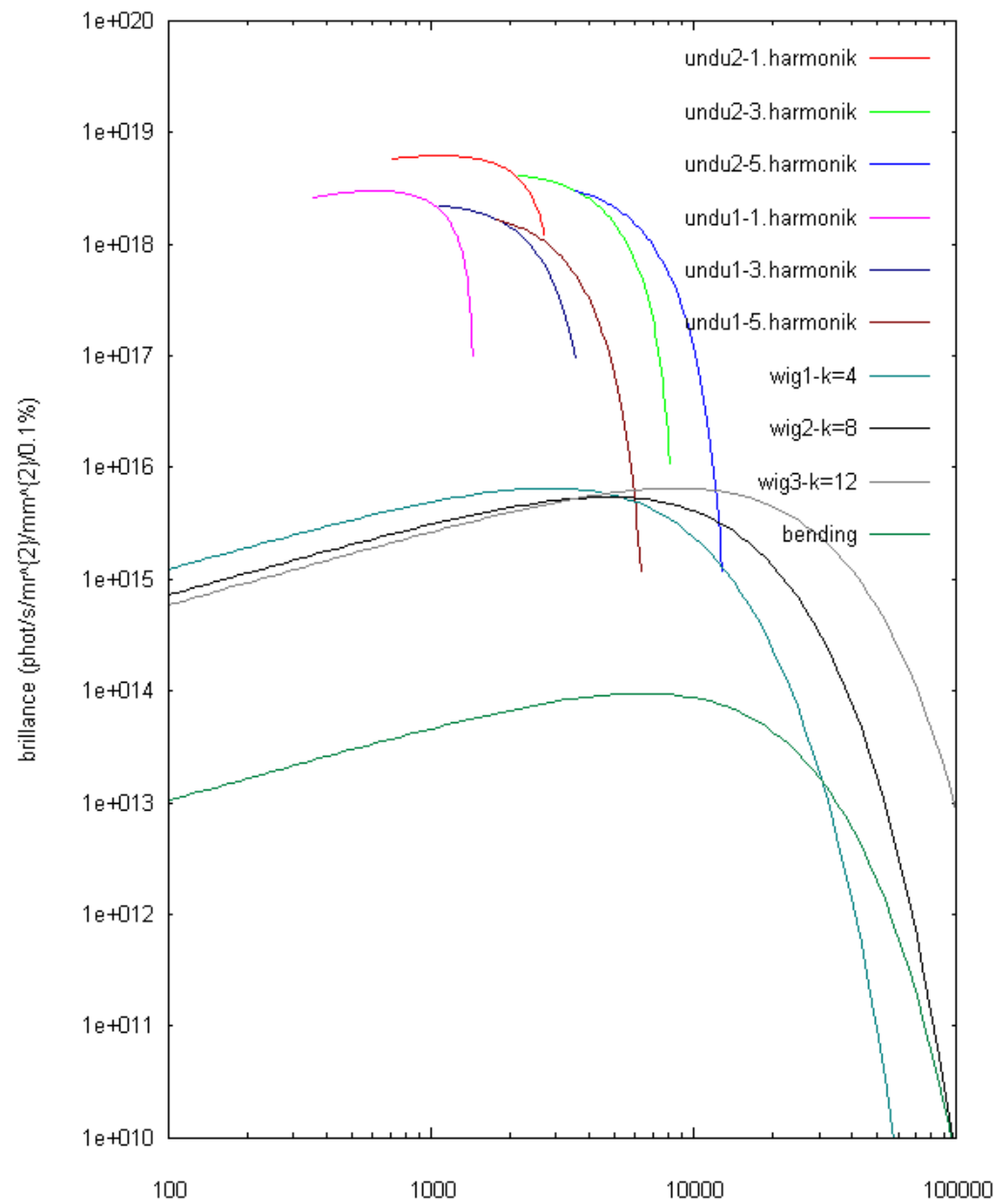
## Elektron demeti parametreleri

Enerji (GeV)	3.56
$I_{\text{ortalama}}$ (mA)	400
Emittans (nm rad)	8
Betax/Betay (m)	2.5/2.5
$D_x/D_y$	0.22

## Işınım kaynağı parametreleri

Işınım kaynağı	Wiggler1	Undulator1	Undulator2
Periyot uzunluğu (cm)	10	8	4
Periyot sayısı	35	45	75
Manyetik alan (T)	0.42	0.16	0.32
K değeri	4	1.2	1.2

Wiggler2 için K=8 ve wigler3 için K=12



3047.39, 2.63665e+020

Enerji (eV)

	$E_{1,\text{pik}}$ (eV)	$E_{3,\text{pik}}$ (eV)	Brilliance <sub>1,pik</sub>	Flux <sub>1,pik</sub> Foton/s/%1 BW	Total Power (kW)
Undulator1	836	2525	$2.6 \cdot 10^{18}$	$8 \cdot 10^{14}$	0.29
Undulator2	1679	5029	$5.5 \cdot 10^{18}$	$1.4 \cdot 10^{15}$	0.96



	$E_c$ (eV)	Total Power (kW)
Wigler1	3489	2.0
Wigler1	5816	5.5
Wigler1	10469	18.0

# UYGULAMA Sesame

Table 4.2: SESAME storage ring parameters (without insertion devices).

Parameter	Unit	Value
<b>General Parameters</b>		
Energy	GeV	2.5
Maximum Beam current	mA	400
Circumference	m	124.802
Natural emittance	nm.rad	24.9
Coupling	%	1
Horizontal emittance	nm.rad	24.65
Vertical emittance	nm.rad	0.2465
Horizontal tune		7.217
Vertical tune		5.192
Relative energy spread	%	0.1119
Chromaticity (horizontal)		-13.1
Chromaticity (vertical)		-13.8
<b>Machine Functions</b>		
Horizontal beta functions		
Wiggler / bending / undulator	m/rad	11.12 / 0.483 / 10.9
Vertical beta functions		
Wiggler / bending / undulator	m/rad	1.89 / 18.75 / 1.73
Dispersion function		
Wiggler / bending / undulator	m	0.453 / 0.135 / 0.534
<b>Beam Sizes and Cross Sections</b>		
Horizontal beam size		
Wiggler / bending / undulator	$\mu\text{m}$	728.6 / 186.3 / 790.9
Vertical beam size		
Wiggler / bending / undulator	$\mu\text{m}$	21.6 / 68 / 20.6
Beam area		
Wiggler / bending / undulator	$\text{mm}^2$	0.099 / 0.0796 / 0.102
<b>R.F-System (2<sup>nd</sup> stage)</b>		
Energy loss per turn	keV	580
R.F-power	kW	413
Cavity Shunt impedance	$\text{M}\Omega$	3.4
R.F-cavity voltage	kV	487

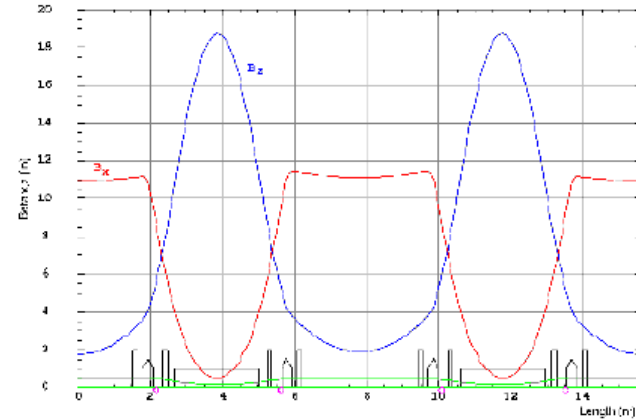
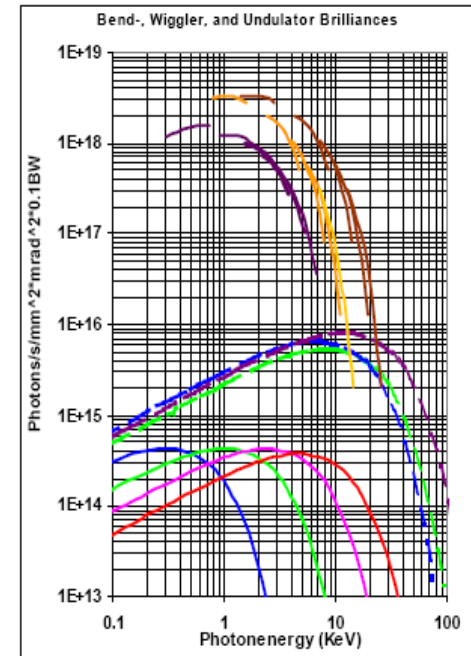


Figure 4.2: Optical functions of SESAME lattice, the green line represents dispersion. The pink circles represent BPMs.



- 1.0 GeV      W120      U40
- 1.5 GeV      W100      U25
- 2.0 GeV      W60      U14
- 2.5 GeV



•**Uygulama1.** SESAME’de Eğici magnetlerden elde edilen ışınımın parlaklık spektrumunu 1.5, 2.0, 2.5 GeV elektron enerjileri için bulalım.

Eğici magnetin eğrilik yarıçapı: 5.9565 m

uzunluğu : 2.34 m

2.5 GeV’de B : 1.4 T

$$B(T)\rho(m) = E(\text{GeV})/0.2998$$

**Uygulama 2.** SESAME'de zigzaglayıcılardan elde edilen ışınımın parlaklık spektrumunu çizdiriniz.

**Table 2.1: Data's of the wigglers foreseen at SESAME.**

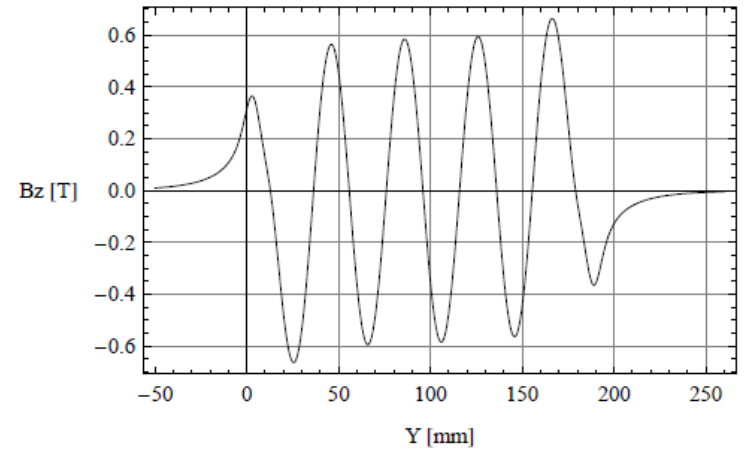
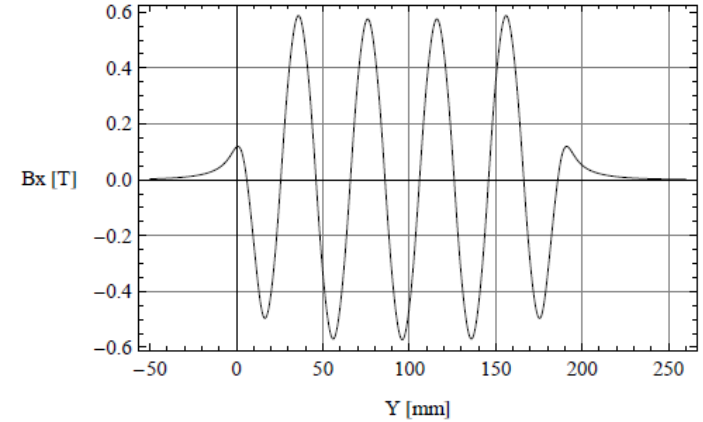
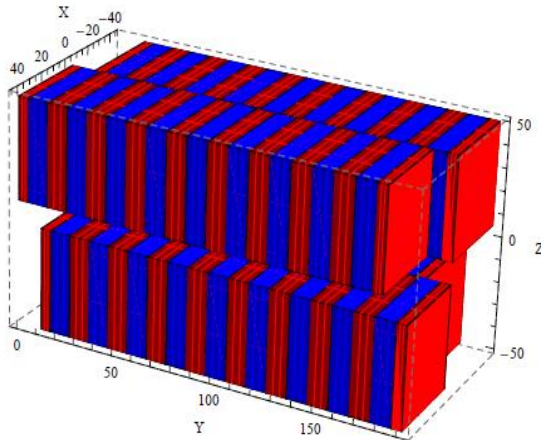
Type	$B_0$	$\lambda_w$	$N_w$	L	K	$X_0$	$X'$
W-100	2.0 T	100 mm	24	2.4 m	18.7	0.061 mm	3.8 mrad
W-120	2.5 T	120 mm	20	2.4 m	28.0	0.109 mm	5.7 mrad
W-60	3.5 T	60 mm	30	1.8 m	19.6	0.038 mm	4.0 mrad

**Uygulama 3.** SESAME'de aşağıda parametreleri verilen salındırıcılarından elde edilecek ışınımın Parlaklık spektrumlarını çizdiriniz.

$\lambda = 14$  mm,  $k = 1-2$ ,  $L = 1.4$  m, coupling = %2

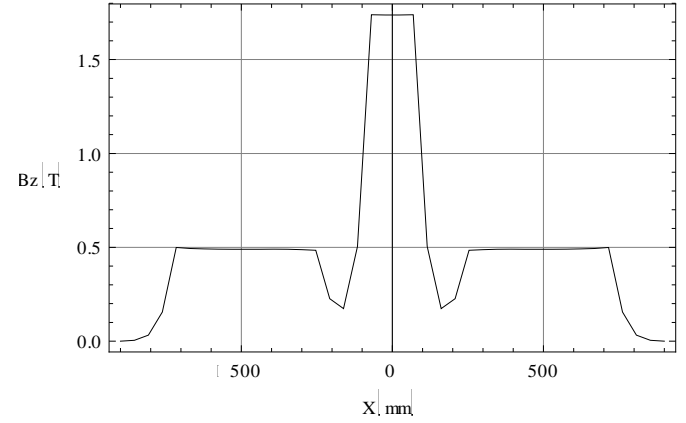
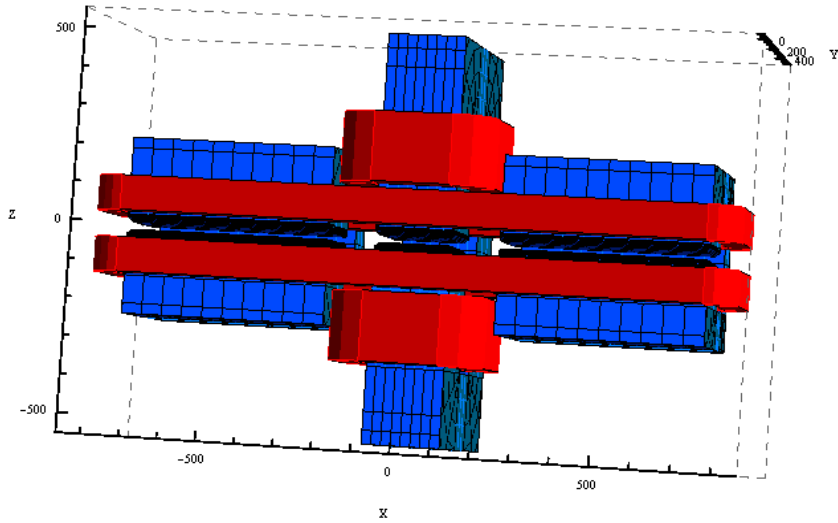
$\lambda = 11$  mm,  $k = 1.4-2.8$ ,  $L = 2.4$  m, coupling = %2

**UYGULAMA 4:** Periyot uzunluğu 4 cm ve periyot sayısı 100 olan Helisel Undulatorde çembersel polarize modda manyetik alan grafikleri grafiklerde verilmiştir. 3 GeV'lik elektronlardan üretilecek ışınımın Parlaklık spektrumunun K bağımlılığını çizdiriniz



$$K = \frac{eB_0\lambda_p}{2\pi mc^2} = 0.934B_0(\text{T})\lambda_p(\text{cm})$$

- **Uygulama 5** Aşağıdaki eğici magnette elde edilecek ışınımın yükdek ve düşük manyetik alan durumlarında parlaklı spektrumlarını çizdirin



# Kaynaklar

- *Takasha TANAKA Cheiron 2011: Light Source I*
- Sarah Cousineau, Jeff Holmes, Yan Zhang, USPAS, January, 2011
- SESAME web sitesi, Yellow Book