MADX-III

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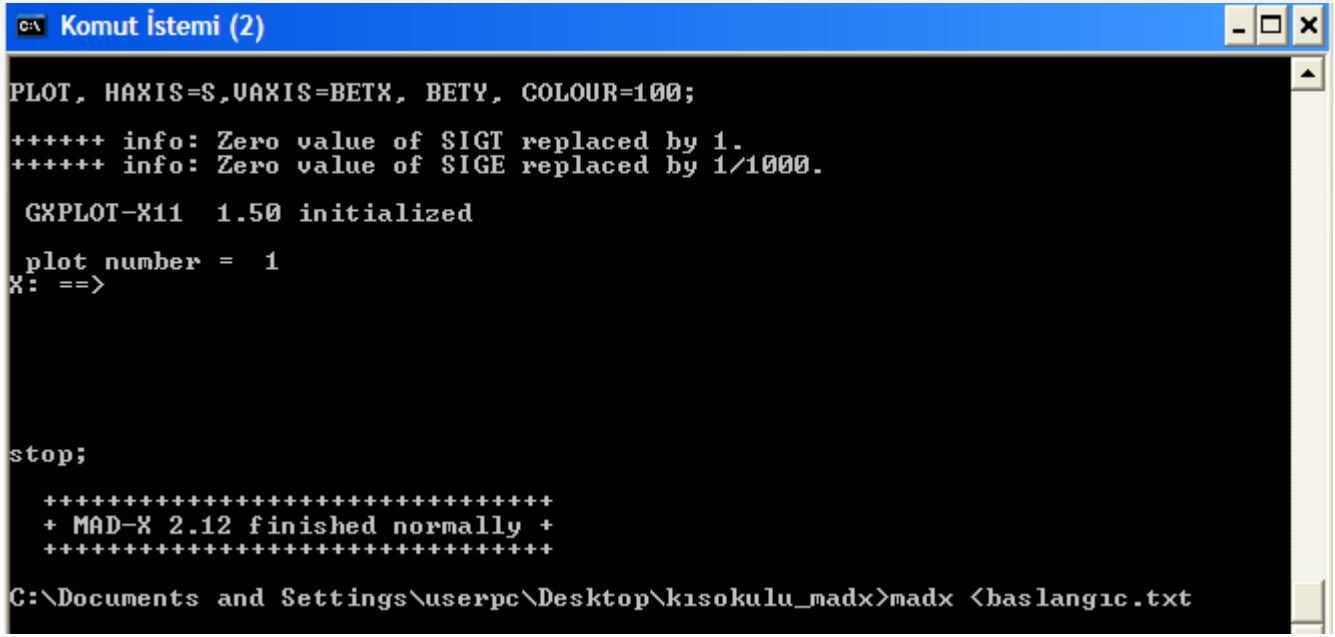
Table 1: Physical Units

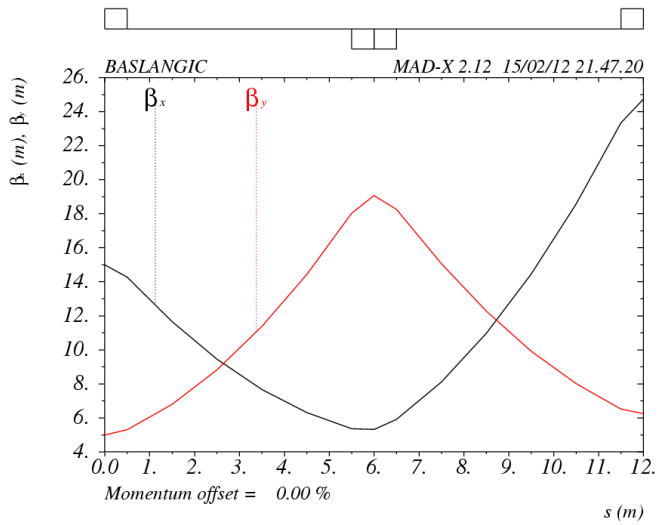
Length	m (metres)
Angle	rad (radians)
Quadrupole coefficient	m**(-2)
Multipole coefficient, 2n poles	m**(-n)
Electric voltage	MV (Megavolts)
Electric field strength	MV/m
Frequency	MHz (Megahertz)
Phase angles	2 pi
Particle energy	GeV
Particle mass	GeV/c**2
Particle momentum	GeV/c
Beam current	A (Amperes)
Particle charge	e (elementary charges)
Impedances	MOhm (Megohms)
Emittances	pi m mrad
RF power	MW (Megawatts)
Higher mode loss factor	V/pc **Table 1:** Physical Units

Basit Bir Kaç Örnek Yapalım

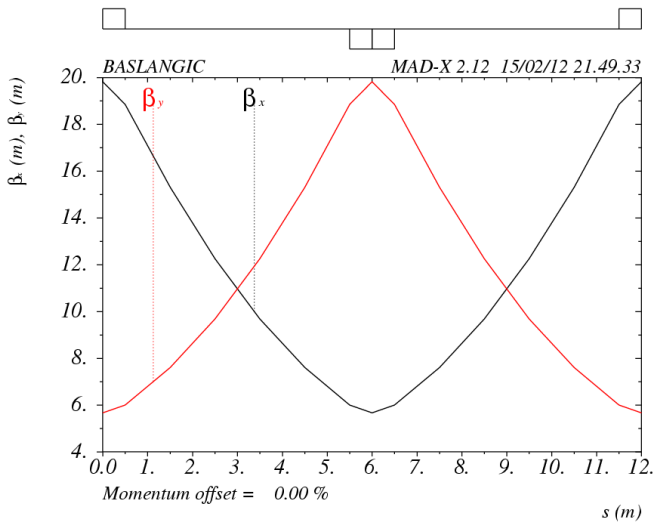
```
TITLE, 'BASLANGIC';

BEAM, PARTICLE=ELECTRON, PC=3.0;

D: DRIFT, L=1.0;
QF: QUADRUPOLE, L=0.5, K1:=0.2;
QD: QUADRUPOLE, L=0.5, K1:=-0.2;
FODO: LINE=(QF, 5*(D), QD, qd, 5*(D), QF);
USE, PERIOD=FODO;

TWISS, SAVE, BETX=15.0, BETY=5.0;
PLOT, HAXIS=S,VAXIS=BETX, BETY, COLOUR=100;
MATCH, SEQUENCE=FODO;
PLOT, HAXIS=S,VAXIS=BETX, BETY, COLOUR=100;
stop;
```

Yukarıdaki dosyayı notepad gibi herhangi bir text editorde hazırlayalım adını baslangıc koyup komut isteminde asagıdaki gibi calıstıralım





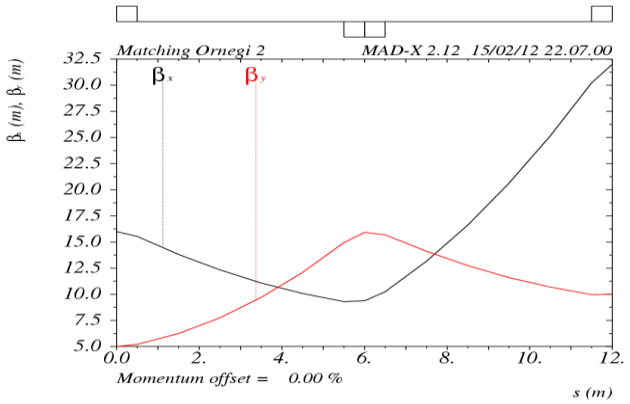
Başlangıç değerleri 15 ve 5 m

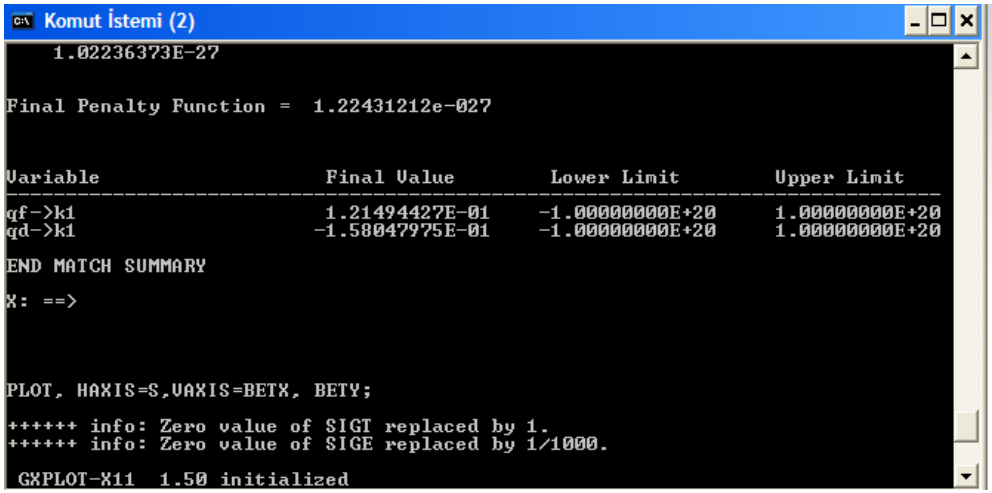


Periyodik örgü

MATCHİNG

```
// son beta fonksiyonlarını  HUCRENIN BITIMINDI MATCH EDELIM
MATCH, SEQUENCE=FODO, betx=16, bety=5; // baslangıc degerleri
CONSTRAINT, SEQUENCE=FODO,range=#E, betx=32, bety=10;
VARY, NAME=QF->K1;
VARY, NAME=QD->K1;
LMDIF, CALLS=500, TOLERANCE=1E-20;
ENDMATCH;
```





UYGULAMA YAPALIM

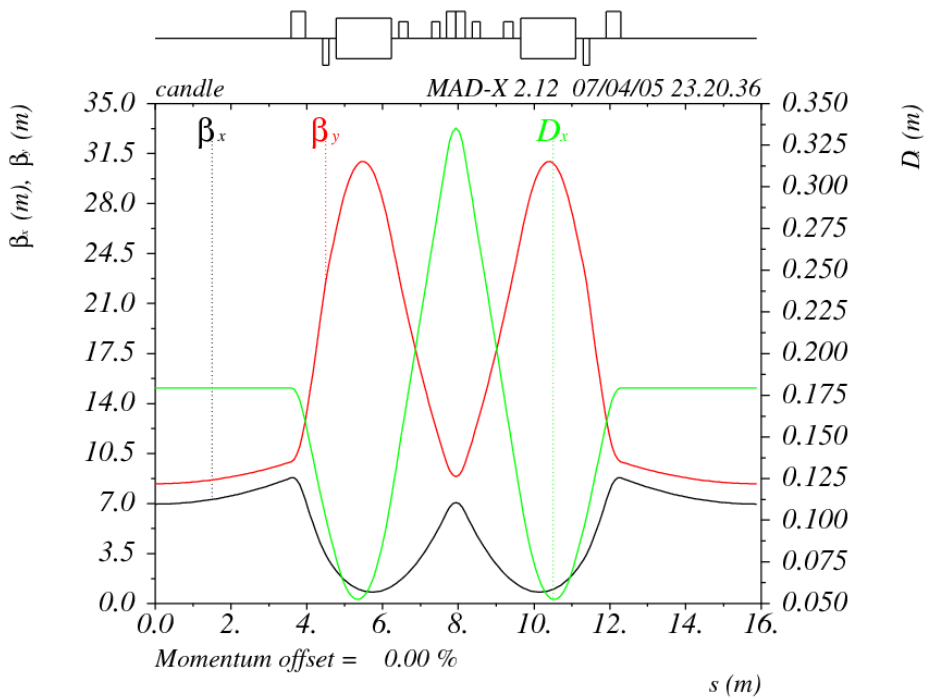
CANDLE magnet parametreleri

- ODAKLAYICI KUADRUPOL 1-> L=0.38, K1=1.65;
- ODAKLAYICI KUADRUPOL 2-> L=0.25, K1=1.7;
- DAĞITICI KUADRUPOL -> L=0.16, K1=-1.29;
- SEXTUPOLE MAGNET 1 -> L=0.25, K2=35.1;
- SEXTUPOLE MAGNET 2 -> L=0.21, K2=29.7;
- BOŞLUK -> L=3.587;
- BOŞLUK -> L=0.45;
- BOŞLUK -> L=0.20;
- BOŞLUK -> L=0.20;
- BOŞLUK -> L=0.62;
- BOŞLUK -> L=0.18;

- Demet Enerjisi 3 GeV, paketçik sayısı 25
- Yarım temel hücre aşağıdaki gibi dizilmektedir.

DR1,QF1,DR2,QD1,DR3,M1,DR4,SD,DR5,SF,DR6,QF2

- Temel hücrenin betatron ve dispersiyon fonksiyonlarını çizdiriniz



Temel Hücrenin Twiss Parametreleri

```
TITLE  “HPFBU";
QF1:QUADRUPOLE, L=0.38, K1=1.65;
QD1:QUADRUPOLE, L=0.16, K1=-1.29;
QF2:QUADRUPOLE, L=0.25, K1=1.7;
SD: SEXTUPOLE, L=0.25, K2=35.1;
SF: SEXTUPOLE, L=0.21, K2=29.7;
DR1:DRIFT, L=3.587;
DR2:DRIFT, L=0.45;
DR3:DRIFT, L=0.20;
DR4:DRIFT, L=0.20;
DR5:DRIFT, L=0.62;
DR6:DRIFT, L=0.18;
M1 :SBEND,L=1.450,ANGLE=PI/16,E1=0.0, E2=0.0,FINT=0.45,HGAP=0.0275,K1=-0.33;
BEAM, PARTICLE=ELECTRON,ENERGY=3, kbunch=25, npart=1.E5,sigt=0.5, sige=.01,
deltap=0.01, sequence=ZAFER;
ZAF: LINE=(DR1,QF1,DR2,QD1,DR3,M1,DR4,SD,DR5,SF,DR6,QF2);
zafer: LINE=(ZAF,-ZAF);
Y1TAC: LINE=(zafer, zafer, zafer, zafer);
YTAC: LINE=(Y1TAC,-Y1TAC);
TAC: LINE=(YTAC,-YTAC);
USE,PERIOD=ZAFER;

select,flag=twiss,column=name,s,x,y,mux,betx,muy,bety,dx,dy;
twiss,save,centre,file=twiss.out;
plot,haxis=s,vaxis1=betx,bety,vaxis2=DX colour=100,interpolate,title=TAC;
stop;
```

Şimdi Geometrimizi Görelim

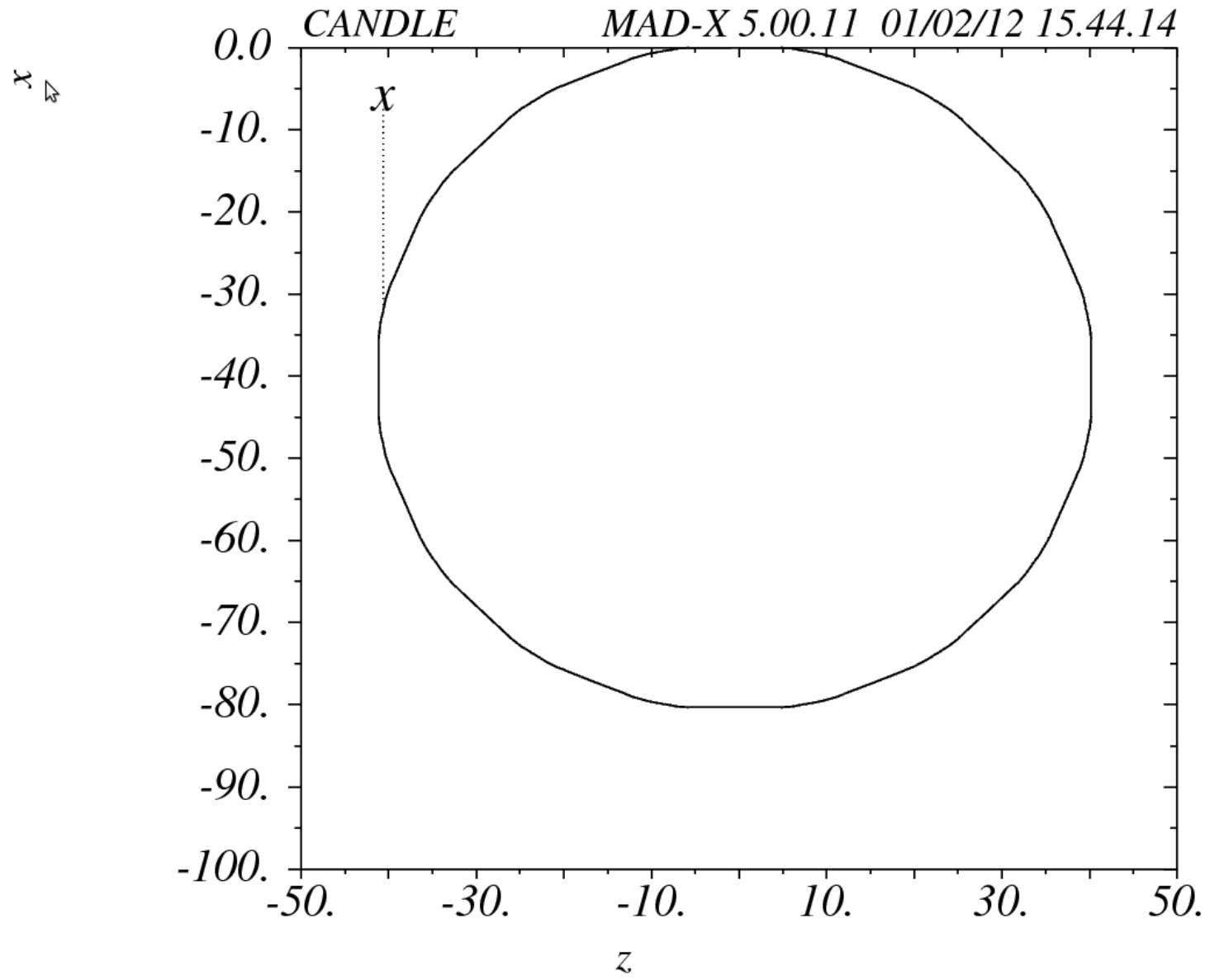
- Bu amaçla SURVEY komutu kullanılır
- Sequence=TAC ve USE PERIODE=TAC yaptıktan sonra

SURVEY, file=survey.out;

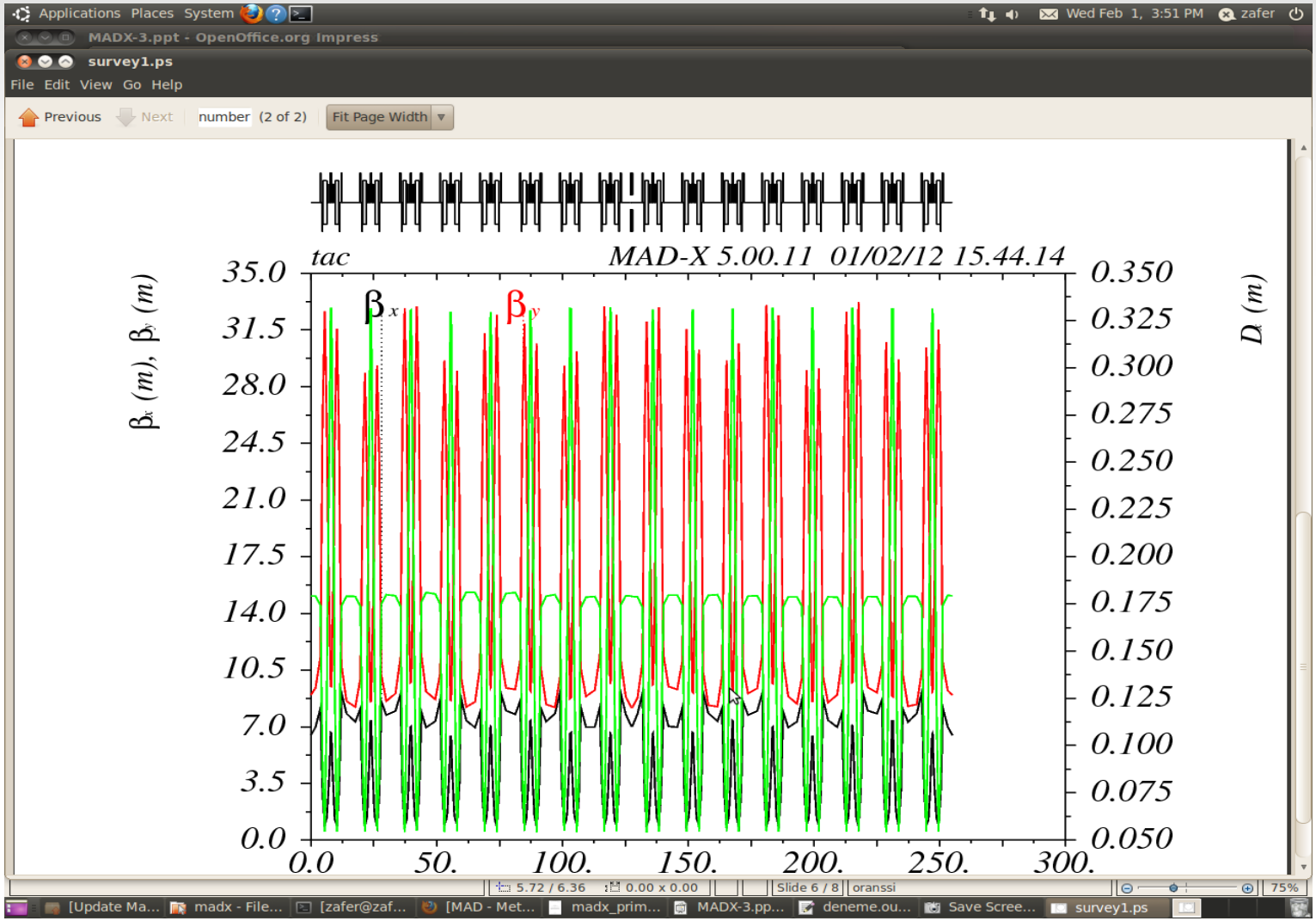
WRITE, table=survey;

plot, file="survey1" ,table=survey, haxis=z,vaxis=x;

- Grafiğin tam bir ring olması gerekli


CANDLE
MAD-X 5.00.11 01/02/12 15.44.14
x
0.0
-10.
-20.
-30.
-40.
-50.
-60.
-70.
-80.
-90.
-100.
-50.
-30.
-10.
10.
30.
50.
z

Tüm halk boyunca Twiss parametreleri



Emittansın Hesaplanması

- İlk önce sisteme RFCAVITY parametrelerinin girilmesi gerekli

RFC: RFCAVITY, L=0.5, VOLT=3.6, LAG=0.480,HARMON=448;

- RFCAVITY halka üzerine yerleştirilmeli (Yeri tasarıma göre belirlenip). Mesela:

YTAC: LINE=(Y1TAC,-Y1TAC, RFC);

- Radiate komutu true olmalı

BEAM,....., RADIATE=True, sequence=TAC;

- EMIT,DELTAP=0.001 ; Eklendiğinde emittans ve sönüm ile ilgili parametreler ekrana yansır.

Applications Places System Wed Feb 1, 3:49 PM zafer

deneme.out (~/Desktop/madx) - gedit

File Edit View Search Tools Documents Help

Open Save Undo

deneme.out

```
 C                  254.984 m          f0             1.175728468 MHz
 T0              0.8505365202 musecs   alfa        0.001687680067
 eta           0.001687651112          gamma(tr)       24.34192609
 Bcurrent     1.883727686e-08 A/bunch  Kbunch             25
 Npart                 100000 /bunch   Energy                      3 GeV
 gamma            5876.724864          beta             0.9999999855
guess:          0                  0                  0
     U0              0.971864 [MeV/turn]

                                                  M o d e   1         M o d e   2         M o d e   3
 Fractional tunes            undamped              0.74622815          0.16324508          0.01683008
                             damped                0.74622815          0.16324508          0.01683003

 beta* [m]                   x                 0.65545488E+01      0.34463529E-35      0.46160049E-02
                             y                 0.62195982E-30      0.95318564E+01      0.58750504E-30
                             t                 0.75183815E-02      0.20089964E-27      0.40242100E+01

 gamma* [1/m]                px                0.15254131E+00      0.13439704E-36      0.14436323E-05
                             py                0.58040725E-32      0.10496741E+00      0.10144518E-29
                             pt                0.88662309E-06      0.25003069E-30      0.24845541E+00

 beta(max) [m]               x                 0.94887257E+01      0.35124071E-34      0.17825735E-01
                             y                 0.93245983E-30      0.29254810E+02      0.58750544E-30
                             t                 0.29139097E-01      0.66442084E-27      0.40359694E+01

 gamma(max) [1/m]            px                0.29868263E+01      0.66969797E-35      0.14436323E-05
                             py                0.29660107E-30      0.55265347E+01      0.10436354E-29
                             pt                0.51268303E-02      0.12552190E-27      0.24845541E+00

 Damping partition numbers                         1.44162661          1.00094416          1.56121096
 Damping constants [1/s]                           0.27454546E+03      0.19062126E+03      0.29731928E+03
 Damping times [s]                                 0.36423840E-02      0.52460046E-02      0.33633877E-02
 Emittances [pi micro m]                       0.70755005E-02      0.58555070E-30      0.46284898E+01
++++++ warning: EMIT: beam not updated, non-zero deltap:          0.001

 RF system:
 Cavity                      length[m]        voltage[MV]              lag          freq[MHz]             harmon
 rfc                               0.5                3.6             0.48        526.7263537                448
```

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Ödev

- Sesamenin temel hücresi yandaki gibidir.
- Bu temel örgünün Twiss Parametrelerini Mad X ile çizdiriniz

Name code	Element	Length(m)	ρ(m)	$k(m^{-2})$	$m\ (m^{-3})$
1	D1	1.505			
2	SI	0.14			9.1941
3	D2	0.155			
4	Q1	0.285		2.038	
5	D3	0.255			
6	S2	0.14			-12.9194
7	D4	0.205			
8	BM	2.34	5.95651	-.36358	
9	D5	0.205			
10	S3	0.14			-12.5963
11	D6	0.255			
12	Q2	0.285		2.02928	
13	D7	0.155			
14	S4	0.14			8.94741
15	D8	1.596			

KAYNAKLAR

- MADX Manual
- CANDLE Design Report
- SESAME, yellow book
- V. Zieman, MADX suumu, UPSALA Üniversitesi