Using SIXTRACK (Version 1.1 and Version 1.1a) on Cosmos

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1 Introduction

There are 2 versions of SIXTRACK on the cosmos-cluster: SIXTRACK3.1 (original version form Frank Schmidt, ask J. Keil) and SIXTRACK1.1a (additions by Winfried Decking, i.e wiggler treatment).

2 Which files are needed ?

SIXTRACK is supported by the user **wdecking** at the moment. The source is found at: **wdecking/six/source/six11a/new** which includes also a makefile.
The executable program is named: **wdecking/bin/six11a**.

To execute the program, you need at least one (usually two) input files:

parameters including the control statements for each SIXTRACK run.

(structure) including the lattice of the investigated ring (if not defined in the **parameters**-file)
The structure file can be created form PETROS with the program **wdecking/six/convert/@pettosix** or from the shell script PETROS9. The structure file is the same for both SIXTRACK versions. The structure file can also be created by running the script **wdecking/bin/mad_c6t** with a valid MAD input file including a 'USE' and 'TWISS' command.

SIXTRACK will produce a number of files, which are described below. Each filename may be followed by a user-defined extension, as described in the following chapter.

output Contains informations about the run.

optic Contains the linear optics, if requested.

stacoor Contains the start coordinates.

endcoor Contains the end coordinates.

data Binary file with the turn-by-turn particle coordinates of all runs if no postprocessing is performed, otherwise only the tbt coordinates of the last run.

fft Contains the FFT, if POST is used for postprocessing.

sumdata Contains a summary of the run, if POST is used for postprocessing.

coor Contains the turn-by-turn coordinates, if POWI is used.

fftw Contains the FFT, if POWI is used.

sum Contains a summary of the run, if POWI is used.

3 Differences to SIXTRACK (Version 1.1)

2.1.1 Program Version

Format line 1: *keyword irid*

line 2: *title*

keyword GEOM or FREE

irid Runidentifier (max. 10 chracters)

title Title of the run (max. 60 characters)

2.5.2 Tune Variation

Format line 1: *name1 Qx dqx idqx idummy*

line 2: *name2 Qz dqz idqz idummy*

line 3: unchanged

line 4: unchanged

name1 Name of quadrupole to change the tune.

Qx Q-value to be reached.

dqx Q-increment for tune scans.

idqx Number of steps with increment dqx.

idummy Dummy, should be 1.

2.5.10 Postprocessing

Keyword POST

Format line 1,3,4: unchanged

line 2: *na nstart nstop iw dx dy iskip inoft*

inoft **0:** postprocessing performed in any case
1: postprocessing only if maximum number of turns reached

Keyword POWI

Format line1: *dqx dqz ifile iturn inoft ix iy*

dqx increment of tune changes at tune scans

dqz increment of tune changes at tune scans

ifile **0:** creates all files (i.e. fftw*irid*,fftwi*irid*, coor*irid*,reso*irid*,sum*irid*)
1: creates only sum*irid*

iturn postprocessing only with every iturn'th turn

inoft **0:** postprocessing performed in any case
1: postprocessing only if maximum number of tirns reached

ix,iy for fft, 0 = tune from 0.0 to 0.5, 1 = tune from 0.5 to 1.0

2.5.10 Tracking Parameters

Format line 1,2,3: unchanged

line 4: *napy dampy ystart*

napy number of z-amplitude steps

dampy increment of z-amplitude step

ystart vertical start amplitude

4 Introduction of Wigglers

Wigglers are introduced as nonlinear elements (i.e. length 0.0) in the single element list and in the structure input. The parameters of are defined in a **WIGGLER DATA** input in the structure file.

Keyword WIGGLER DATA

FORMAT line 1: *name nop lambda b0 kx nofsteps eps*

line 2: > *gap width height air br iapwig*

line 3: >> *istart noharm irec xrms zrms*

line 4: >>> *iord nmpstep tlmap*

name name as defined in the single element list.

nop number of periods.

lambda periodlength [m].

b0 peak on axis field [T].

kx horizontal field parameter.

nofsteps number of steps per period/wiggler.

eps accuracy of newton search.

gap full gap of wiggler [m].

width full width of wiggler [m].

height height of wiggler block [m] (*).

air space between different blocks [m] (*).

br remanent field of block (*).

iapwig aperture limit defined by gap/2 and width/2.

istart starting point for integration (*).

noharm number of harmonics (*).

irec REC or Hybrid device (*).

xrms,zrms Horizontal/vertical displacement of blocks (*).

iord Order of taylor expansion.

nmpstep number of steps through map.

tlmap total length of map.

(*) are historicall values which are not used in the moment.

The different methods to describe the wiggler are listed in the following:

label 12: Integration through Smith Hamiltonian with kx=0.

label 14: Integration through Smith Hamiltonian.

label 16: Only Quadrupole term.

label 19: Analytical generating function (recommended).

label 20: Numerical taylor map (ask expert).

label 21: Numerical taylor map (ask expert).

5 Content of the Output Files

File **coor***irid*:
1: turnnumber 2: x[mm] 3: xp[mrad] 4: z[mm] 5: zp[mrad] 6: σ[mm] 7: $\delta p/p$ 8: E[MeV]

File **fftw***irid*:
1: tune [$\frac{1}{2\pi}$] 2: abs(x) 3: abs(z) 4: abs(σ)

File **sum***irid*:
1: runnumber 2: turnnumber 3: Qx 4: Qz 5: Qx(FFT) 6: Qz(FFT) 7: max(x) 8: max(z) 9: max(ε_x) 10: max(ε_z) 11: max(ε_x)+max(ε_z) 12: $\frac{max(\varepsilon_x)+max(\varepsilon_z)}{init.(\varepsilon_x)+init.(\varepsilon_z)}$ 13: Qx-Qx(FFT) 14: Qz-Qz(FFT) 15: init.x 16: init.z 17: init$\frac{\delta p}{p_0}$ 18: *dtune* ala Laskar 19: *Qs*

File **sumdata***irid*:
26: $< \varepsilon_x >$ 27: $< \varepsilon_z >$ 28: Qx(FFT) 29: Qz(FFT)

6 Plotting

The PAW routines are not active in the current SIXTRACK-version. Plotting can be done with the data stored in the above files and appropriate GNUPLOT-files, like the files tbytdata.gp, sumplot.gp optic.gp and sumdataplot.gp, which can be found in the directory **wdecking/public/six/post**.

In addition a MATLAB postprocessing exist, which is not documented yet.

7 Example

In the following, an example of a **structure** and a **parameters** file are given.

```
 /ARI BOOSTER Linear Optik 15.3.99
SINGLE ELEMENTS
DR0 0 0.0 0.0 1.1
DR1 0 0.0 0.0 0.42
DR2 0 0.0 0.0 0.32
DR3 0 0.0 0.0 0.6
DR4 0 0.0 0.0 0.635
DR5 0 0.0 0.0 0.635
DR6 0 0.0 0.0 0.6
DR7 0 0.0 0.0 0.32
DR8 0 0.0 0.0 0.42
DR9 0 0.0 0.0 1.1
QF1 2 0.0 -2.54 0.09
QD1 2 0.0 4.85 0.09
QF2 2 0.0 -6.00 0.09
BF 6 -0.261800665 -0.582 1.5
BD 6 -0.261800665 0.436 1.5
EDGE 8 -0.261800665 0.0 1.5
BFS 6 -0.261800665 -0.582 0.5
BDS 6 -0.261800665 0.436 0.5
SF 3 0.0 1.0 0.0
SD 3 0.0 1.0 0.0
NEXT
BLOCK DEFINITIONS
1 1
BBF1 EDGE BF EDGE
BBD1 EDGE BD EDGE
BBF3+ EDGE BFS
BBF3- BFS EDGE
BBF3 BFS
BBD3+ EDGE BDS
BBD3- BDS EDGE
BBD3 BDS
B01 DR0 QF1 QF1 DR1 QD1 QD1 DR2
B02 DR4 QF2 QF2 DR4
B03 DR2 QD1 QD1 DR1 QF1 QF1 DR0
BDR3 DR3
NEXT
STRUCTURE INPUT
B01 BBF3+ SF BBF3 SF BBF3- BDR3 BBD3+ SD BBD3 SD BBD3- B02
BBD3+ SD BBD3 SD BBD3- BDR3 BBF3+ SF BBF3 SF BBF3- B03
B01 BBF3+ SF BBF3 SF BBF3- BDR3 BBD3+ SD BBD3 SD BBD3- B02
BBD3+ SD BBD3 SD BBD3- BDR3 BBF3+ SF BBF3 SF BBF3- B03
B01 BBF3+ SF BBF3 SF BBF3- BDR3 BBD3+ SD BBD3 SD BBD3- B02
BBD3+ SD BBD3 SD BBD3- BDR3 BBF3+ SF BBF3 SF BBF3- B03
B01 BBF3+ SF BBF3 SF BBF3- BDR3 BBD3+ SD BBD3 SD BBD3- B02
BBD3+ SD BBD3 SD BBD3- BDR3 BBF3+ SF BBF3 SF BBF3- B03
NEXT
WIGGLER DATA
U5 98 .05 .83 .0 20
> .011 .10 .025 .0 1.25 1
>> 5 1 1 .0 .0
NEXT
```

```
GEOM
ARI BOOSTER
FLUCTUATION RANDOM STARTING NUMBER-----------------------------------
9833965
NEXT
ITERATION ERRORS-----------------------------------------------------
10 1.D-4 1.D-4
20 1.D-3 1.D-4
10 1.D-2 1.D-3
1.D-3 1.D-3 1.D-2
NEXT
PRINTOUT OF INPUT PARAMETERS-----------------------------------------
NEXT
LINEAR OPTICS CALCULATION--------------------------------------------
ELEMENT 0
NEXT
TRACKING PARAMETERS--------------------------------------------------
512 0 1 0.  30.  0 1
1 1 0 1
0 0 1 1 1 10000 1
1 2.0 0
NEXT
INITIAL COORDINATES--------------------------------------------------
1 0.  0.  .1
1.0
0.
0.0
0.
0.
0.01
0.
0.
0.
0.
0.
0.
1500.
1500.
1500.
NEXT
POWI
ARI BOOSTER
0.0 0.0 0 1 1 0 0
NEXT
ENDE=================================================================
```