A Brief Introduction of SAD

for ATF2 Flight Simulator

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mini work shop for flight simulator(LAL)2008

SAD Input File(deck/daihon)

Example

….

! Element/Line Definition

DRIFT D1=(L=1) D2=(L=1);

QUAD Q1=(L=1 K1=0.1);

LINE L1=(IBEG D1 Q1 D2);

MARK IBEG=(AX=0 AY=0
BX=1, BY=1)

;

….

FFS USE=L1;
trpt;cal; end

….

Element/Line definition is similar to MAD, and easily converted to and from MAD.

Unit is in MKSA.

Slight difference:
e.g. K1=B'L/Bρ
K2=B''L/Br, K3=B'''L/Bρ, ….
(KN is the integrated strength [1/m^N]. Also no factorials in definition.)

Calculation is done in FFS
Matching, Tracking, ….

'trpt' means transport line. When yo
Like to impose periodic boundary condition, type 'cell' instead.

What Can Be Done in SAD

Matching

Example(in FFS)

```
....
!( after getting initial condition at the
! entrance of ATF2 )
fit ip bx 0.04 by 1e-4 ax 0 ay 0;
free qm*;
go;end
....
```

'fit ip' specifies the position of fit.

'bx 0.04' imposes the fitting condition of beta-x to be 4cm.

'free qm*' specifies the free parameters. In this case K1 of QM11FF,QM12FF,… will be varied.

Other fitting parameters: ex(η), epx(η'), nx(νx), ny(νy), …

e.g. for phase advance of WSs

```
fit MW2X MW3X nx Pi/3 ny Pi/3
```

User defined condition can be imposed by FitFunction;

e.g. FitFunction:={Twiss["BX","IP"]-2*Twiss["BY","IP"]};

What Can Be Done in SAD(2)

Tracking

Useful functions;

DynamicApertureSurvey[range,nturn,options]

(useful for ring analysis)

TrackParticles[beam, destination-component]

(for simple tracking)

….

Usage of ‘TrackParticles’

e.g. beamout= TrackParticles[beamin, “IP”]

format of beamin/out

{ location coordinate }

coordinate={{x, px, y, py, z, dp/p, flag}x(# of particles)}

(flag=1(when the particle is alive), 0(when dead).)

What Can Be Done in SAD(3)

User defined program

Users can make their own program with ‘Mathematica’-like language.

Twiss, Element,….
:SAD function

e.g.1

```
InitDist[npart_]:=(
      sigmax1=Sqrt[EMITX Twiss["BX",1]];
      x1=Table[sigmax1*GaussRandom[],{npart}];
….
      beamin={1,{xi,xpi,yi,ypi,zi,pi,Table[1,{npart}]}};
);
Tk[npart_]:=(InitDist[npart_]; beamout= TrackParticles[beamin, “IP”] );
! Typing Tk[1000] initiates tracking of 1000 particles.
```

e.g.2

```
KnobWaistX[wx_]:=(
      Element["DX","SF1"]=Element["DX","SF1"]-0.00043123*wx;
      Element["DX","SD4"]=Element["DX","SD4"]+0.00256159*wx;
      Element["DX","SF6"]=Element["DX","SF6"]-0.0167073*wx;););
! Typing KnobWaistX[1e-3] changes horizontal waist position by 1mm.
```

What to Be Prepared for FS

Input/Output interface from/to ‘trusted’ FS

SAD needs information on BPM reading, magnet setting, ….
and like to write new magnet strengths, ….
Format?

Graphics

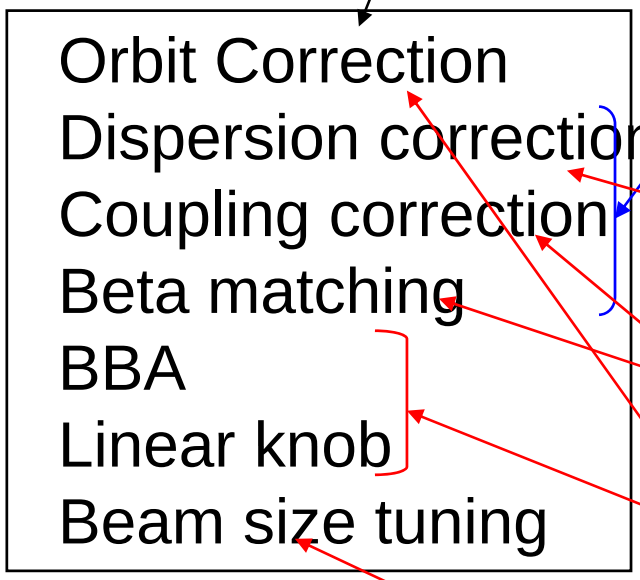
SAD standard: draw(Top Drawer), Plot,….(mathematica)
Tkinter?

For the time being, interactive mode is useful(when the deck er
with ‘end’, SAD is waiting for next command from keyboard). It
is also useful for debugging. SAD interface for non-SADists aft
debugging.

Programs needed for ATF2

Need to steer beam to the dump.
But without this we can maybe.

Need to access Cav.BPM.
for almost all software



When things go well, these can be studie
in 2008. In that sense, they have 1st prio

Need DF control

Need WS control(already done)
LW?(maybe later)

Need mover control in FF section

Control of Carbon WS, Honda/Shintake monitor

Preparation in ‘trusted’ FS