TRIUMF Beam Physics Note
TRI-BN-23-17
May, 2023

ISIS 5:1 Selector Operation Notes

R. Baartman

TRIUMF

Abstract: These are from the test performed May, 2023.

4004 Wesbrook Mall, Vancouver, B.C. Canada V6T 2A3 Tel: 604 222-1047 Fax: 604 222-1074
www.triumf.ca

1 Tune Calculation:

Here is `TRANSOPTR` file `Data.dat`

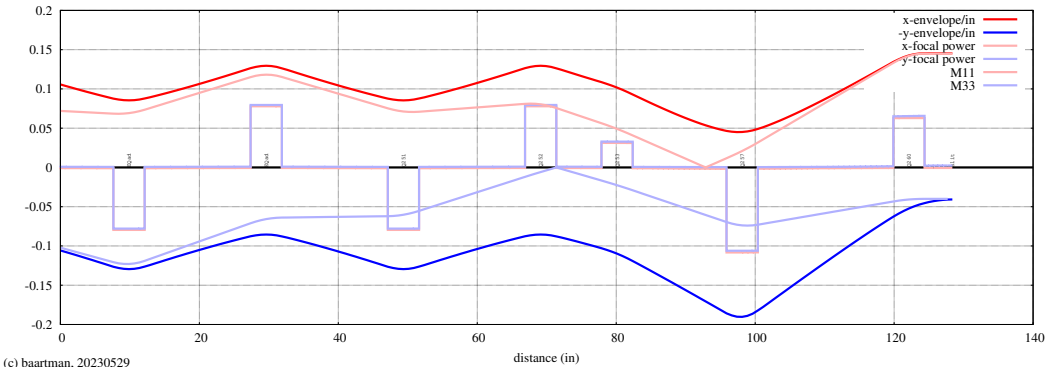
```
 0.296 0 0 939.3 1. 0.0003   !last is current in Amps
 1 4 1. 1.E-4
 0 -0. 0. 0.
 .1 1. .1 1. 3. .001
 0.3937008  1.  0.3937008  1.  0.3937008  1. 0. 0.3937008
 0
 12
 1.3588  -1. 100. 1
 55.91   0. 500. 1
 0.0002 0.00001 0.001 0
 1. 0. 10. 0 !periodic weight
 4.5 4. 5. 0
3.00 0. 5. 0 !peridic quads
3.00 0. 5. 0 !251
3.00 0. 5. 0 !252
1.24 0. 5. 1 !253
4.07 0. 5. 1 !257
2.43 0. 5. 1 !260
0.04 0.00 0.1 0 !desired size (inch) at slit 146
 1.E-6 50
 1 0. 0.9 50

As found May3, 2023:
3.77 0. 5. 0 !251
3.44 0. 5. 0 !252
1.48 0. 5. 0 !253
3.34 0. 5. 0 !257
2.57 0. 5. 0 !260

Hard to get final size below 0.04" at 300uA. Can get 0.03" at 100uA.
```

...and here is the `sy.f`:

```
      SUBROUTINE tSYSTEM
      COMMON /BLOC1/ax,bxu,exu,wp,deff,QP,q251,q252,q253,q257,q260,dsrd
      COMMON/SCPARM/QSC,ISC,CMPS
      COMMON/PRINT/IPRINT,IQ(8)
```

```
iq(1)=4
cmps=2.
wt=1.
dtot=39.5
dt=(dtot-deff-deff)/4.
ay=-ax
byu=bxu
eyu=exu
call cic(ax,bxu,exu,ay,byu,eyu)
call fringeQ(0.18,0.0,0.0,-0.33)
call DR(dt,0,0)
call EQ(  -qp,   1.0000,   deff,wt,0,0)
call DR(2.*dt,0,0)
call EQ(   qp,   1.0000,   deff,wt,0,0)
call DR(dt,0,0)
call twissmatch(1,ax,bxu*2.54,wp,1)
call twissmatch(3,-ax,bxu*2.54,wp,1)
call print_lattice
call vective(10)
call DR(dt,0,0)
call EQuad(  -q251,   1.0000,   deff,wt,'Q251')
call DR(2.*dt,0,0)
call EQuad(   q252,   1.0000,   deff,wt,'Q252')
call DR(6.5,0,0)
call EQuad(   q253,   1.0000,   deff,wt,'Q253')
call DR(13.5,0,0)
call EQuad(  -q257,   1.0000,   deff,wt,'Q257')
call DR(19.5,0,0)
call EQuad(   q260,   1.0000,   deff,wt,'Q260')
call DRift(                       4.0,'slit')
call waist(1,1.,1)
call waist(3,1.,1)
call fit(1,3,3,dsrd,1.,1)
call vective(10)
RETURN
END
```

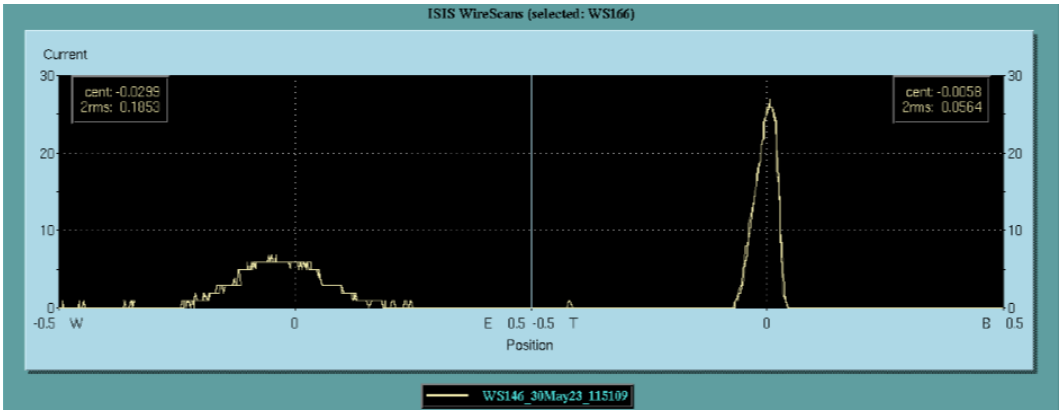
The parameters in the data file though allowed to vary, are already the correct settings for the waist at the slit. Here is the envelope:



Note that the envelope vertical (y) size is 0.04", or full size of 0.080". This is adequate. The light-coloured traces are the absolute values of matrix elements M_{11} and M_{33} calculated backward from the slit. This is to give an idea on where best to apply steering correction, namely, at the locations where this matrix element is small or near zero.

2 Tuning the beamline

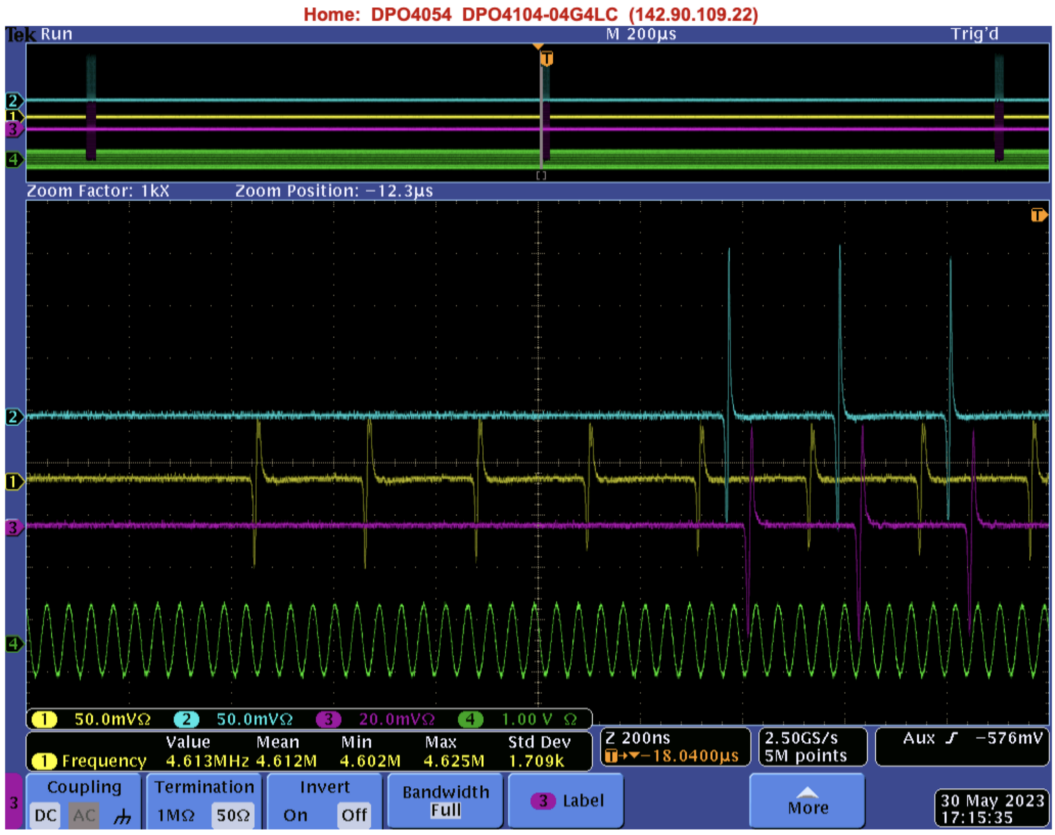
We found periodic sections not at their desired values. We worked quads TW numbers 251,252,272 down from 3.6kV to 3.0kV. The small vertical size was achieved simply by raising 257 from 3.5kV to 4.2kV. We could get ALL the beam through a 0.100" slit 146 vert. size. We worked at a 0.080" size and got $> 90\%$. Scanner pic below:



This worked well for the 1nA tests on BL1B. But operators later after the development shift found it difficult to use this tune at high intensity. There?s likely more work needed to re-match to the 273 periodic section.

3 Operating the 5:1

The (TW206) amplitude was raised while also raising the bias plate TW214. This got to 622 (volts) for TW206 and 800volts for TW214. I thought this was marginal so we got Fu to raise the amplifier limit to 1000. We ran 206 at 800, and TW214 was 1.1kV. At that level, we could no longer see any satellite bunches on the scope. Scope trace below:



(Yellow is CNIM11, cyan is CNIM25. Green is 23MHZ reference.)

4 Further dev. plan

But we should probaby go farther yet with the amplifier power. Last major use was December 2010 (See shift summary or elog .) At that time, bias plate was higher: 1.259kV.

Also, next time we could possibly use only TW257 to get what we want.