Twiss Fitting

A least-square minimiser is used to fit the twiss and emittance at MW0X to the measured beamsizes at each wire-scanner.

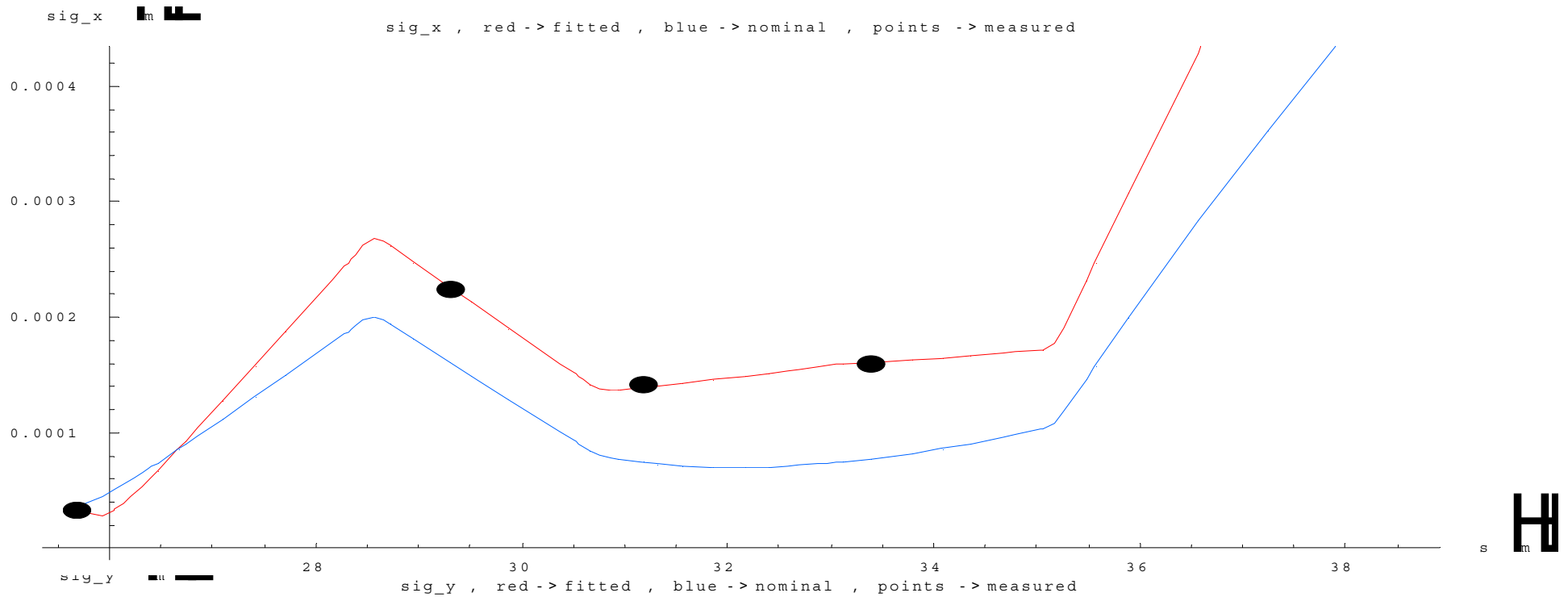
MAR-12 Julien's 2D emittance results

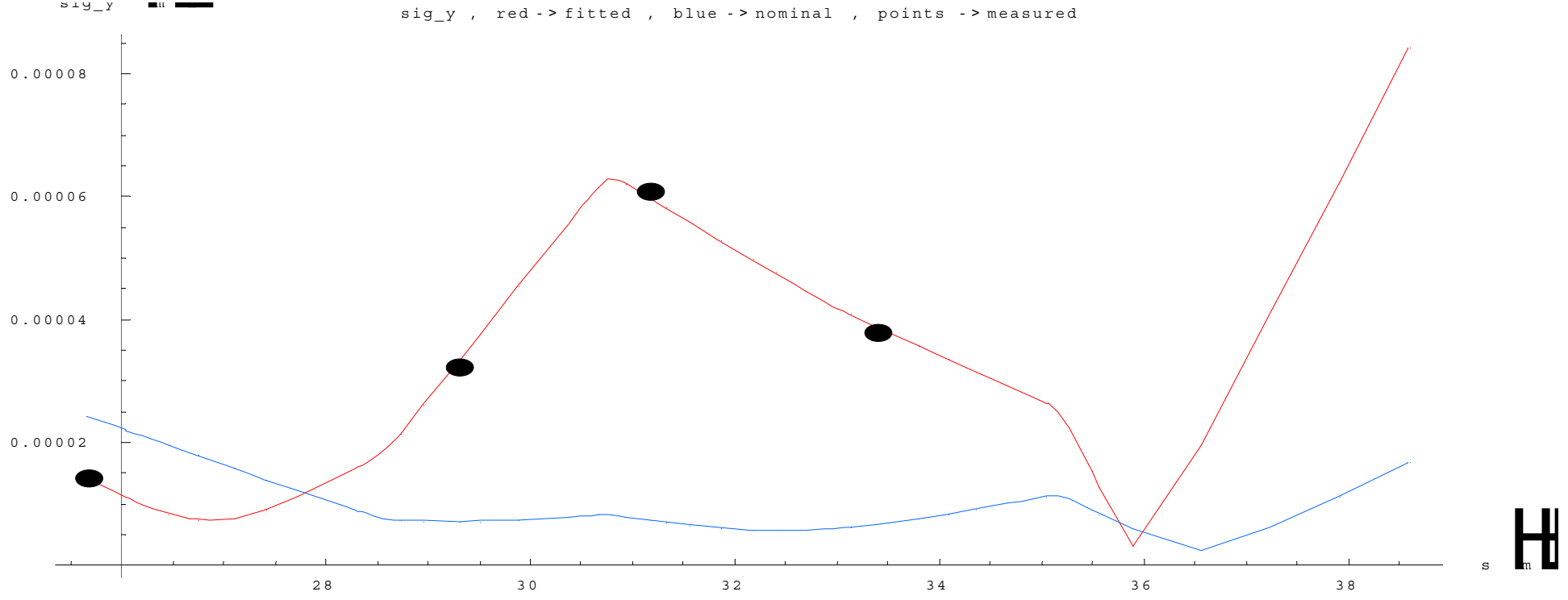
ex	2696 pm.rad
bx	0.388 m
ax	0.654
ey	72.63 pm.rad
by	2.739 m
ay	1.651

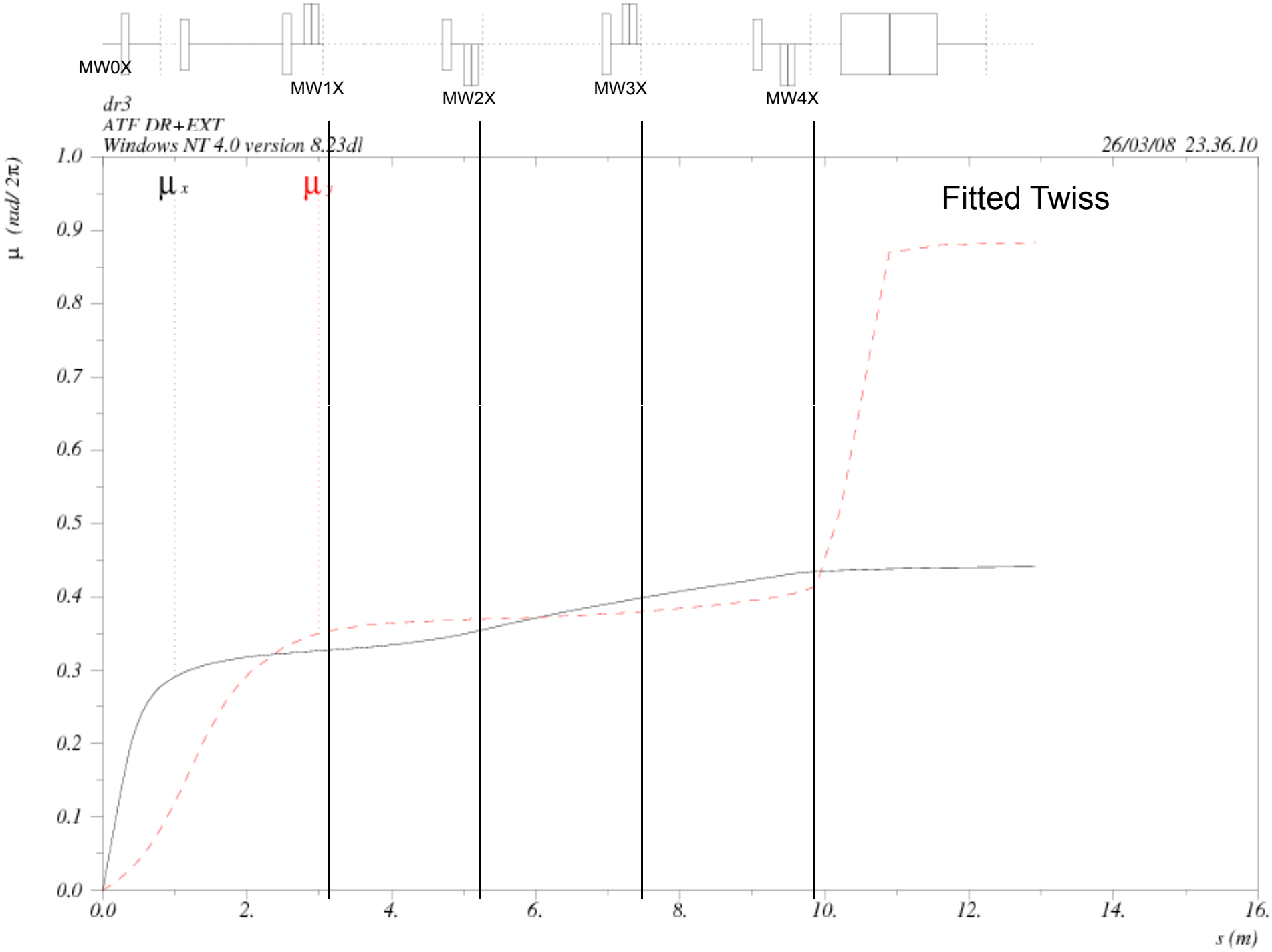
LAL results:

ex = 3290 ± 1280 pm.rad

ey = 81 ± 26 pm.rad


sig_x
sig_x , red -> fitted , blue -> nominal , points -> measured
0.0004
0.0003
0.0002
0.0001
28
30
32
34
36
38
s


sig_y
sig_y , red -> fitted , blue -> nominal , points -> measured
0.00008
0.00006
0.00004
0.00002
28
30
32
34
36
38
s


MW0X
MW1X
MW2X
MW3X
MW4X
dr3
ATF DR+EXT
Windows NT 4.0 version 8.23dl
26/03/08 23.36.10
μ x
μ y
Fitted Twiss
μ (rad/ 2π)
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
0.0
2.
4.
6.
8.
10.
12.
14.
16.
s (m)

Fitted Twiss

	MW0X	Kicker	Design at Kicker
ex	2696 pm.rad	2696 pm.rad	2000 pm.rad
bx	0.388 m	2.673 m	7.21 m
ax	0.654	0.934	1.15
ey	72.63 pm.rad	72.63 pm.rad	20 pm.rad
by	2.739 m	0.652 m	2.903 m
ay	1.651	1.534	-1.721

Vertical DR emittance was recorded as 34 pm.rad

Ellipse Plots

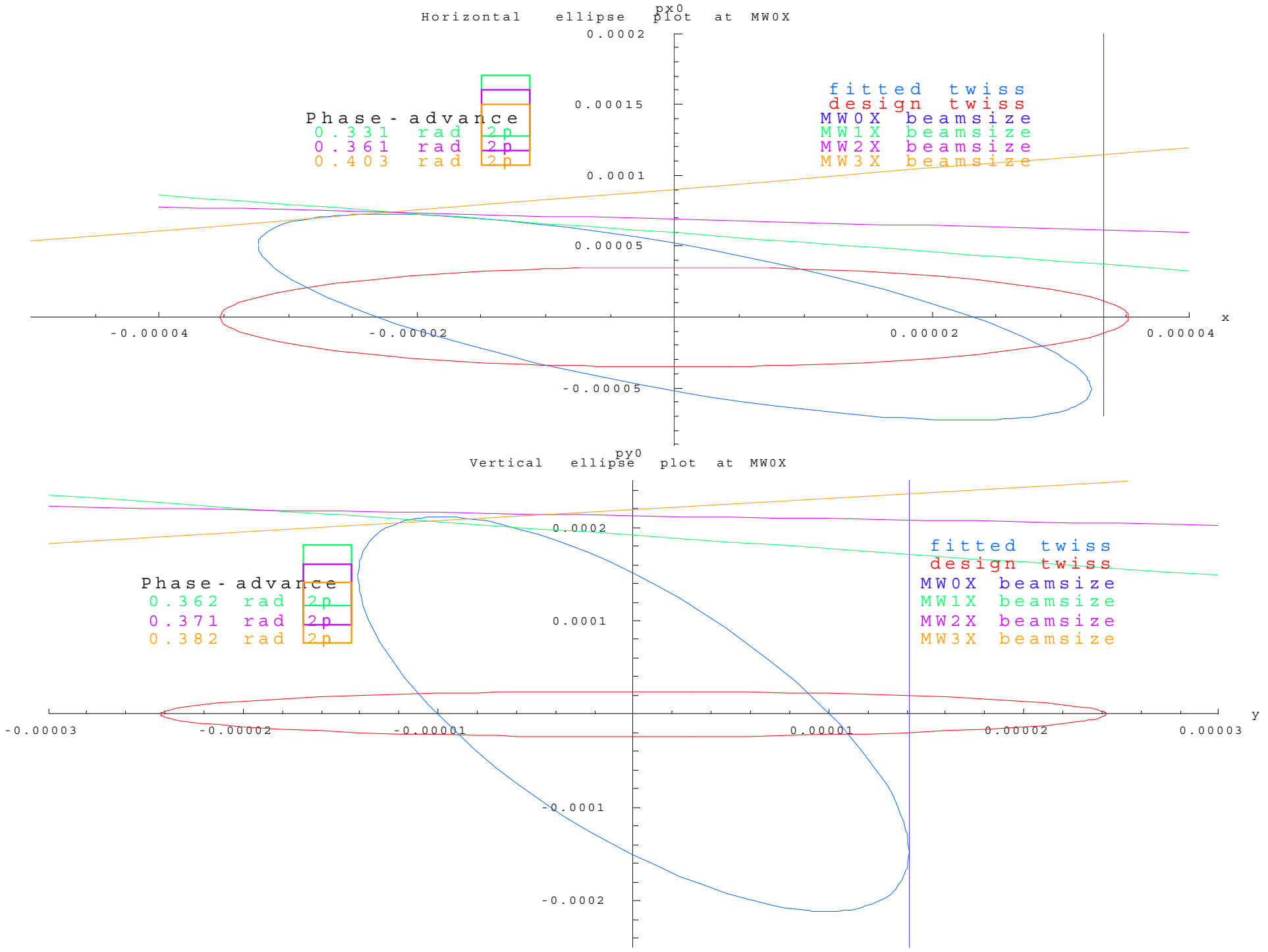
An attempt to recreate the ellipse plots made by SAD.

The design (x, px) ellipse is plotted in an (x, px_0) coordinate system:

$px_0=\alpha_0 x + \beta_0 x'$

where 0 denotes the design twiss at MW0X.

The fitted twiss ellipse is plotted in the (x, px_0) coordinate system along with the back-propagated wire-scanner beamsizes, where their (x, x') at MW0X are:


px0
Horizontal ellipse plot at MW0X
0.0002
0.00015
0.0001
0.00005
-0.00005
-0.00004
-0.00002
0.00002
0.00004
x
Phase-advance
0.331 rad 2p
0.361 rad 2p
0.403 rad 2p
fitted twiss
design twiss
MW0X beamsize
MW1X beamsize
MW2X beamsize
MW3X beamsize
py0
Vertical ellipse plot at MW0X
0.0002
0.0001
-0.0001
-0.0002
-0.00003
-0.00002
-0.00001
0.00001
0.00002
0.00003
y
Phase-advance
0.362 rad 2p
0.371 rad 2p
0.382 rad 2p
fitted twiss
design twiss
MW0X beamsize
MW1X beamsize
MW2X beamsize
MW3X beamsize

Backups

Ellipse Plots

An attempt to recreate the ellipse plots made by SAD.

The design (x, px) ellipse is plotted using the equations:

$$\varepsilon = \gamma_0 \quad x^2 + 2\alpha\, x\, x' + \beta\, x'^2$$

$$px_0 = \alpha_0\, x + \beta_0\, x'$$

where 0 denotes the design twiss at MW0X.

The fitted twiss ellipse is plotted in the (x, px_0) coordinate system along with the back-propagated wire-scanner beamsizes, where their (x, x') at MW0X are:

$$\begin{pmatrix} x \\ x' \end{pmatrix}_{\text{ref point}} = R^{-1} \begin{pmatrix} \sigma_w \\ x'_w \end{pmatrix}$$

x'_w is the undetermined angle variable at the wire and is related to the phase advance