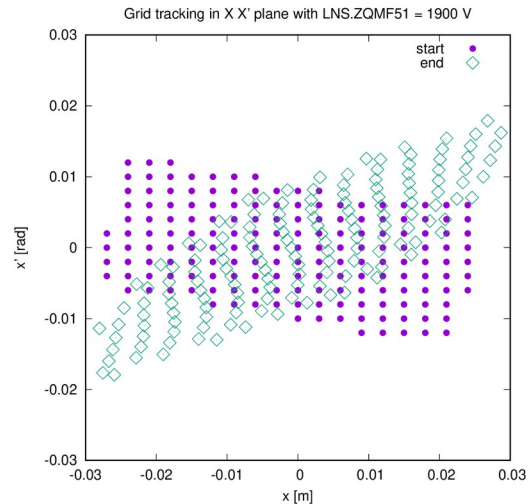
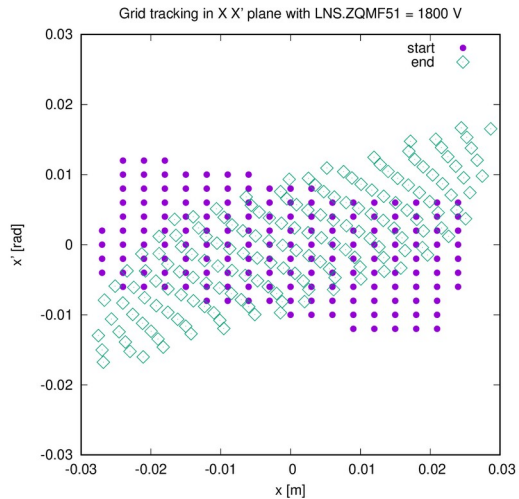
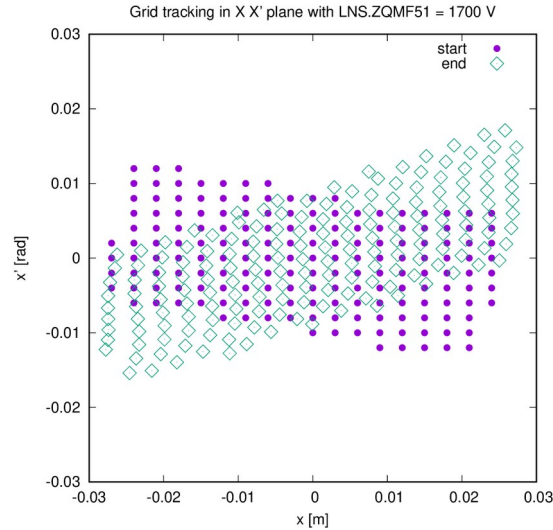
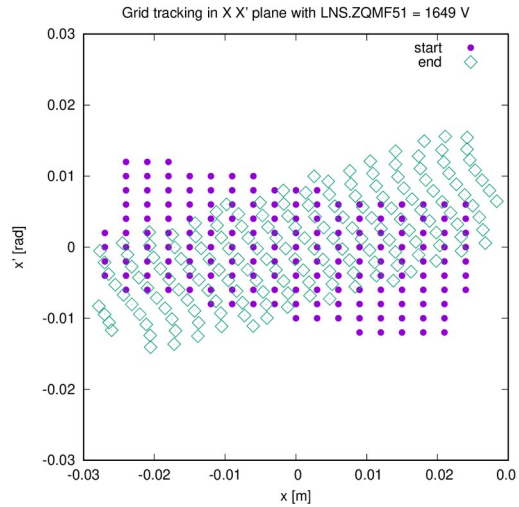


# X X' Grid tracking

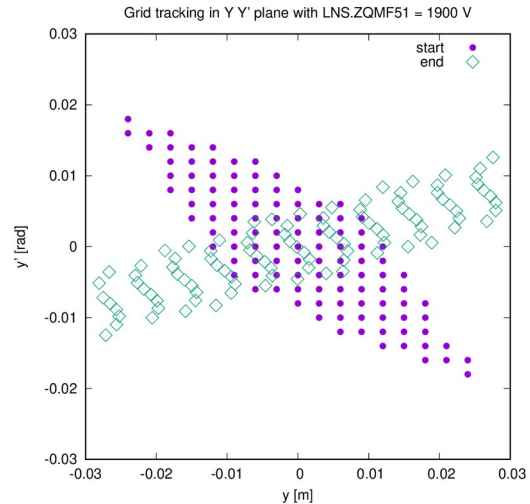
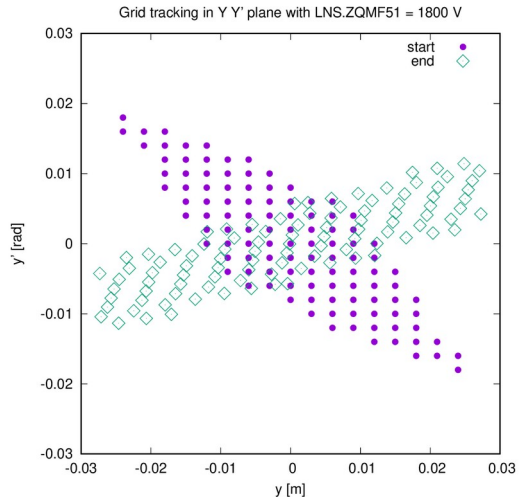
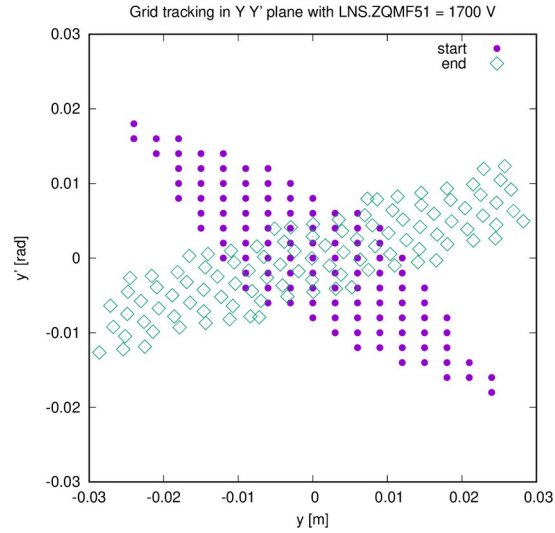
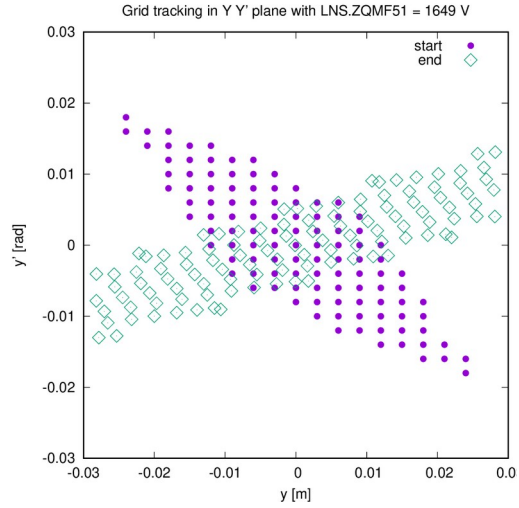


- Tracked an initial grid large enough to fill the available aperture.
- Only those initial and final coordinates are displayed on the images which are belonging to particles which are not lost.

It gives an idea what range of the phase space is transmitted.

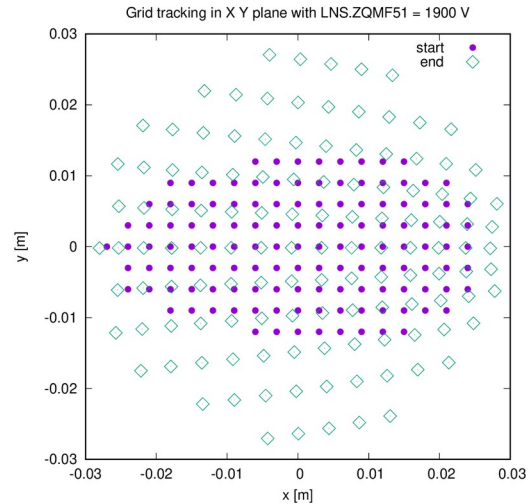
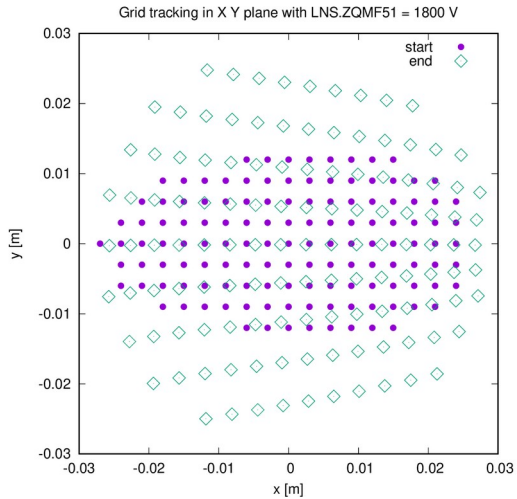
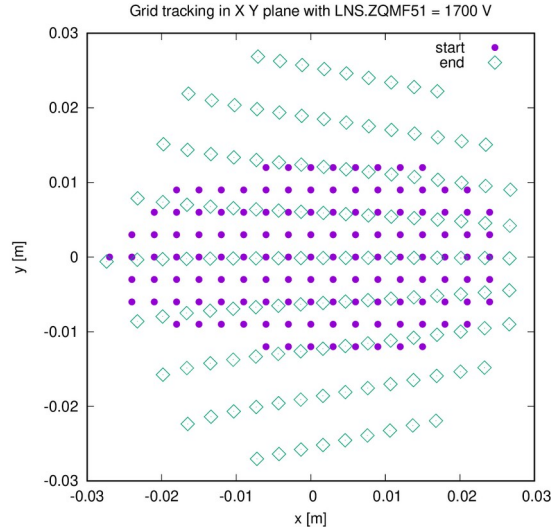
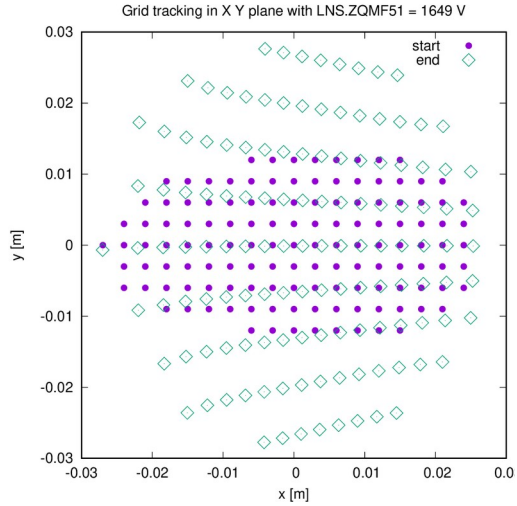
Used the the present operation settings, expect the LNS.ZQMF51 which was scanned.

# Y Y' Grid tracking



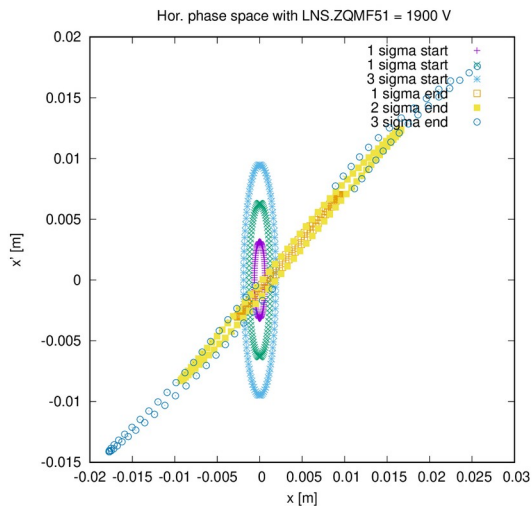
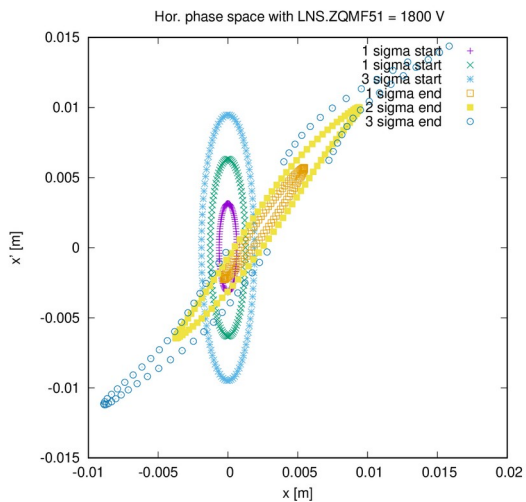
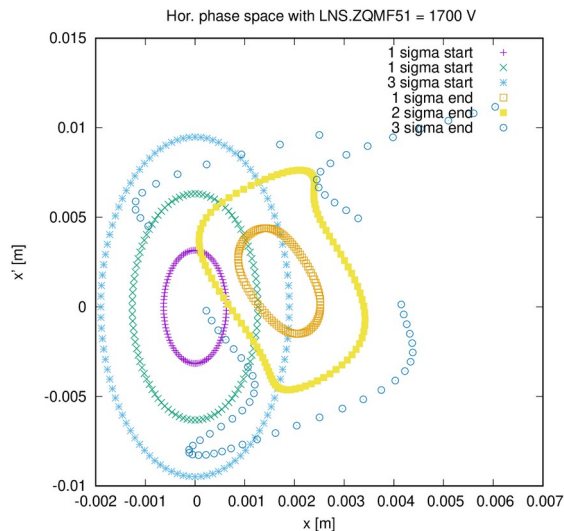
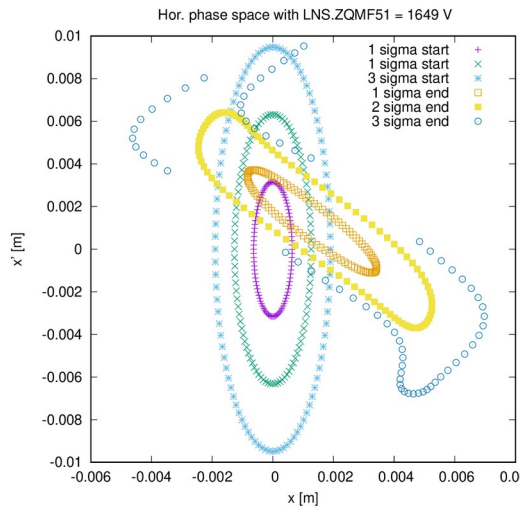
- Same as on the previous slide, but the  $y y'$  plane is plotted.
- Some non linearity is visible.

# X Y Grid tracking



- Same as on the previous slide, but the x y plane is plotted.
- Some non linearity is visible also here.

# 1,2,3 sigmas circles tracking, X X' plane



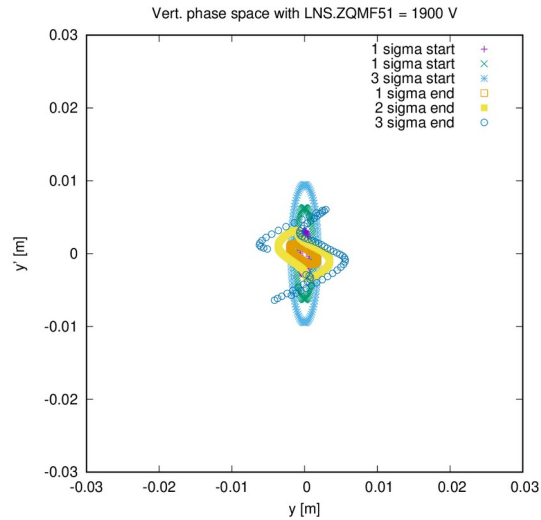
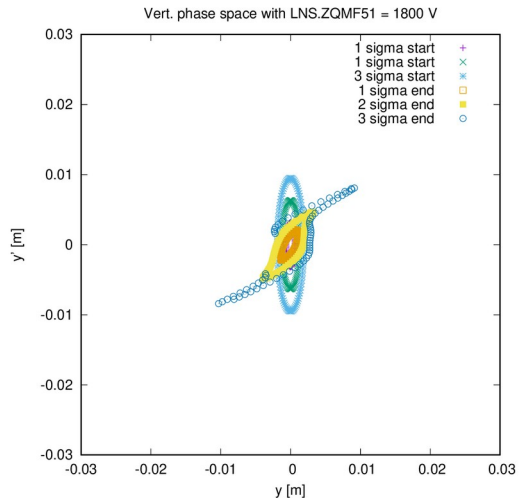
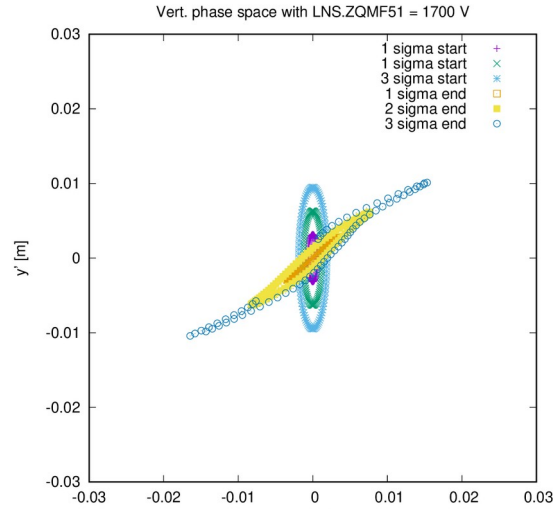
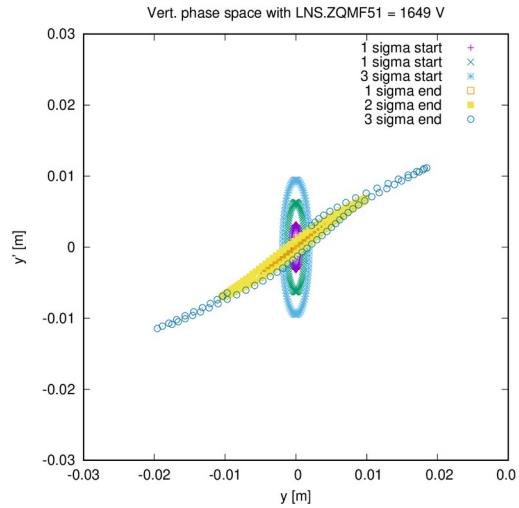
- Instead of a grid here started with a circle in X X' plane.

-Emmittances of the initial circles:  
2 [pi mm mrad]  
8 [pi mm mrad]  
18 [pi mm mrad]

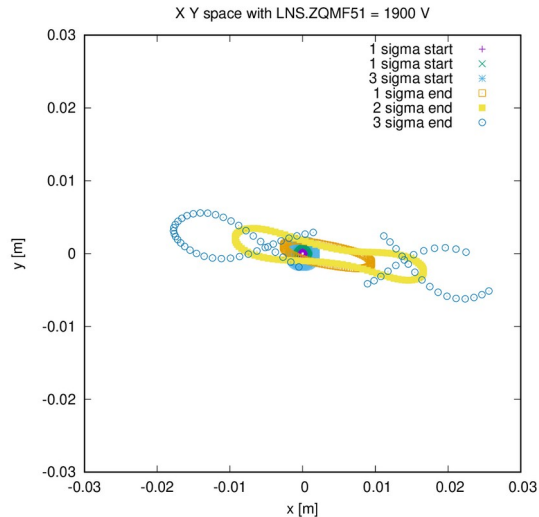
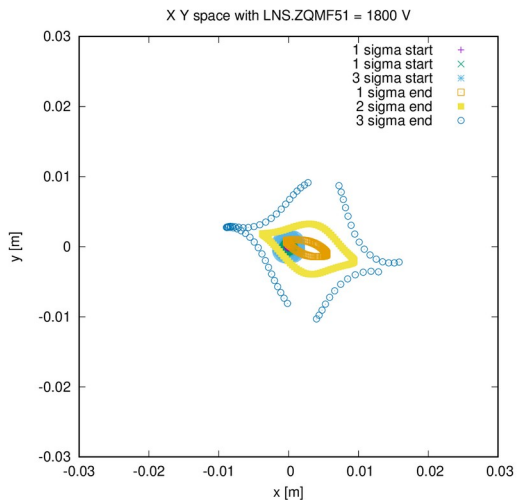
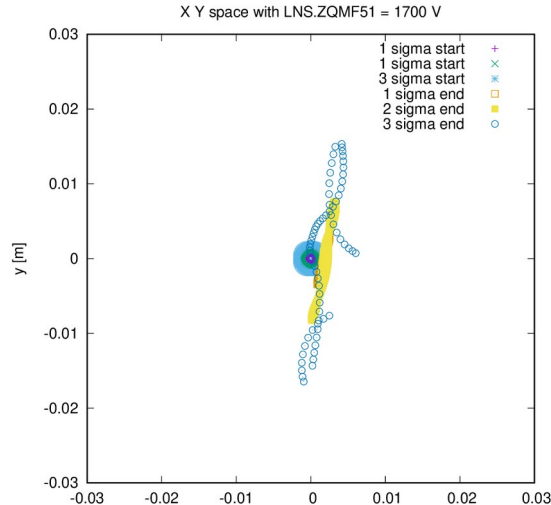
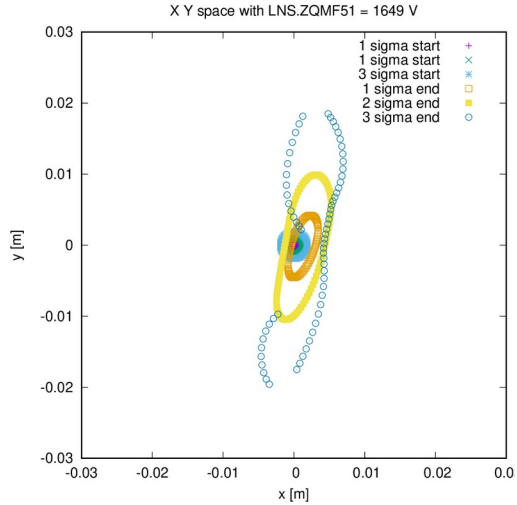
- The non linearity is important

- Same losses on the biggest circle.

# 1,2,3 sigmas circles tracking, Y Y' plane



# 1,2,3 sigmas circles tracking, X Y plane



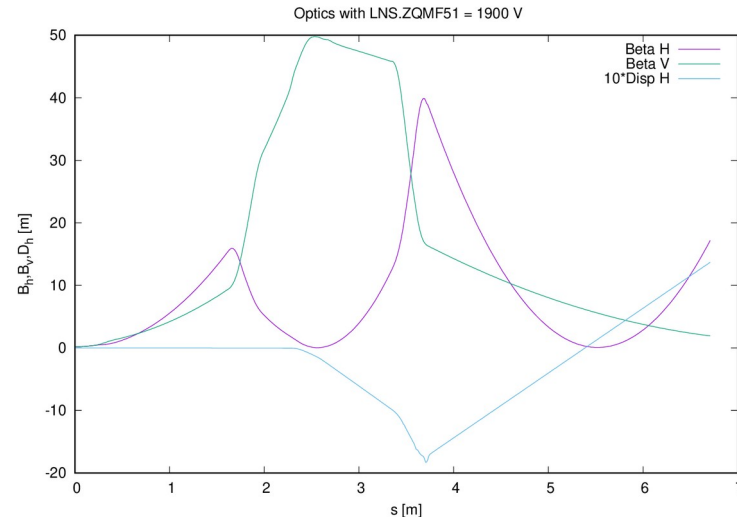
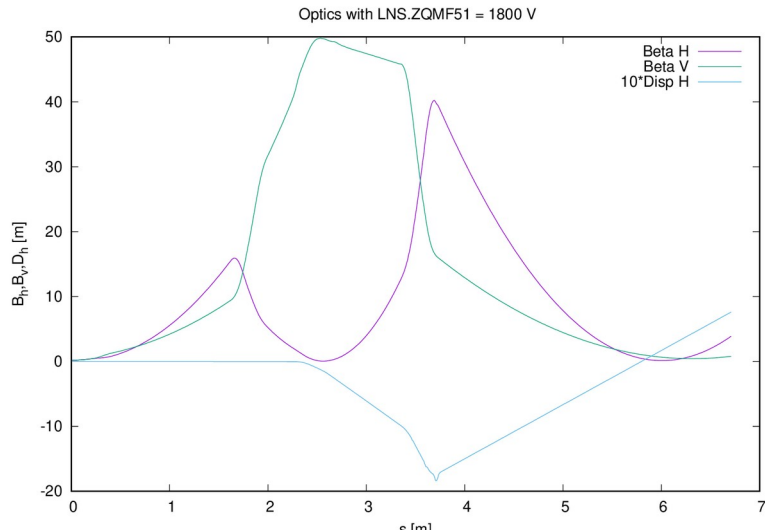
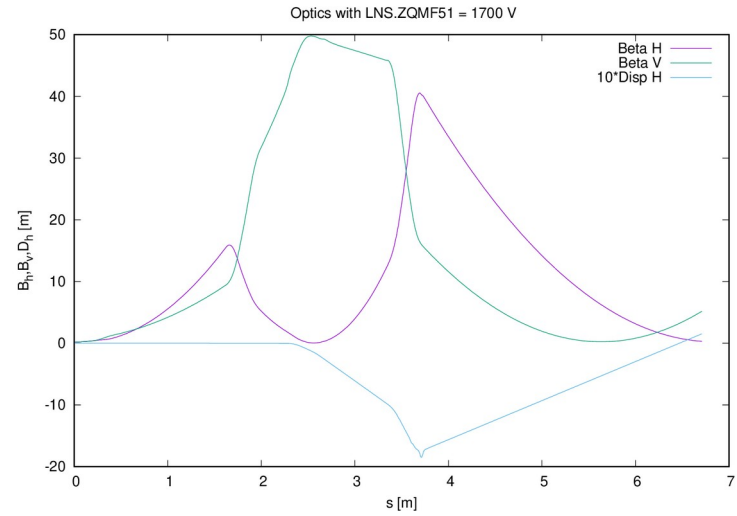
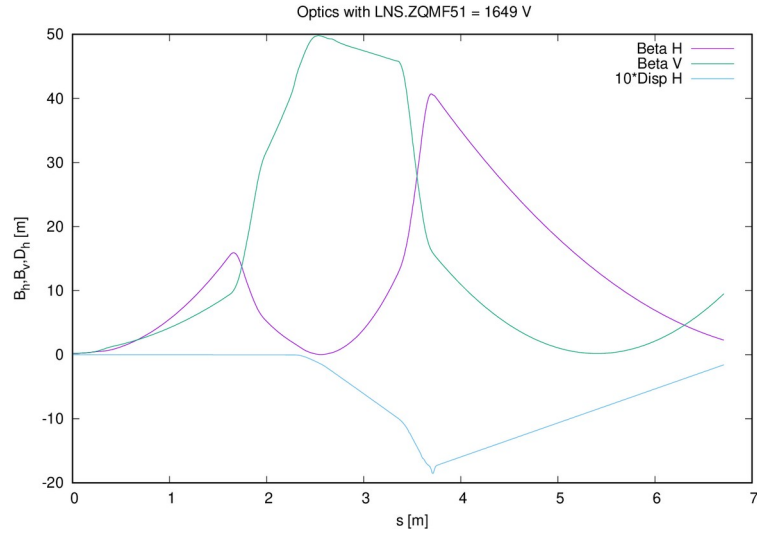
- Highly non linear behavior visible in the X Y plane.

- Similar in nature to the BTV images.

- The nonlinear correlation of the initial coordinates ( a circle, related with sin and cos ) transformed gives these images. Probably the source also have strong nonlinear correlations between the phase space coordinates.

- Tracking a Gaussian bunch does not show this behavior.

# Optics



Optics calculated  
by SIMPA  
is not too far  
from mad-x.

# Parameters used for the the initial circles and optics calculation

# 1. operational quad settings WITHOUT correctors and ion switch at nominal value 26200 V

```
scalings= [{"LNS.ZQSF.0001_38.bin":1500.0}, {"LNS.ZQSD.0002_38.bin":1500.0},  
{"LNS.ZCV.0020_38.bin":0.0}, {"LNS.ZCH.0020_38.bin":0.0}, {"LNS.ZQMF.0020_38.bin":1900.0},  
{"LNS.ZQMD.0021_38.bin":1000.0}, {"LNS.ZDSIA.0030_38.bin":26200.0},  
{"LNS.ZCH.0050_38.bin":0.0}, {"LNS.ZCV.0050_38.bin":0.0}, {"LNS.ZQMD.0050_38.bin":1324.0},  
{"LNS.ZQMF.0051_38.bin":1855.0} ]
```

# Hor. beta=0.2 , Vert. beta=0.2

```
initial-twiss -x 0 -y 0 -xp 0.0 -yp 0.0 -ha 0.0 -va 0.0 -hb 0.2 -vb 0.2 -hd 0.0 -vd 0.0 -hdp 0.0 -vdp 0.0
```

# 2 sigma initial emittances for the circle tracking

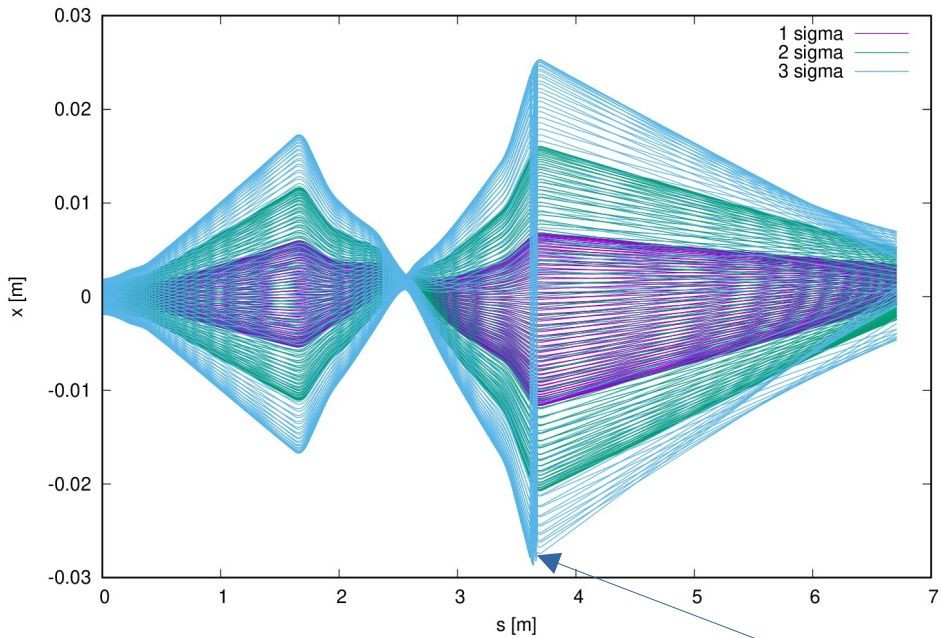
```
EM_H=2E-6 # [pi*mm*mrad]
```

```
EM_V=2E-6
```

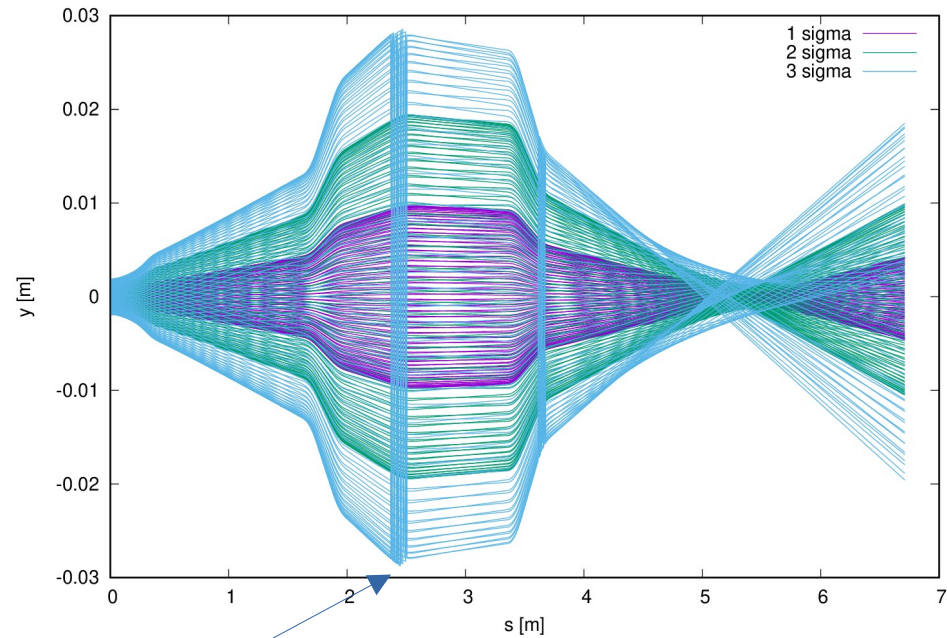


# Trajectories

Horizontal trajectory with LNS.ZQMF51 = 1649 V



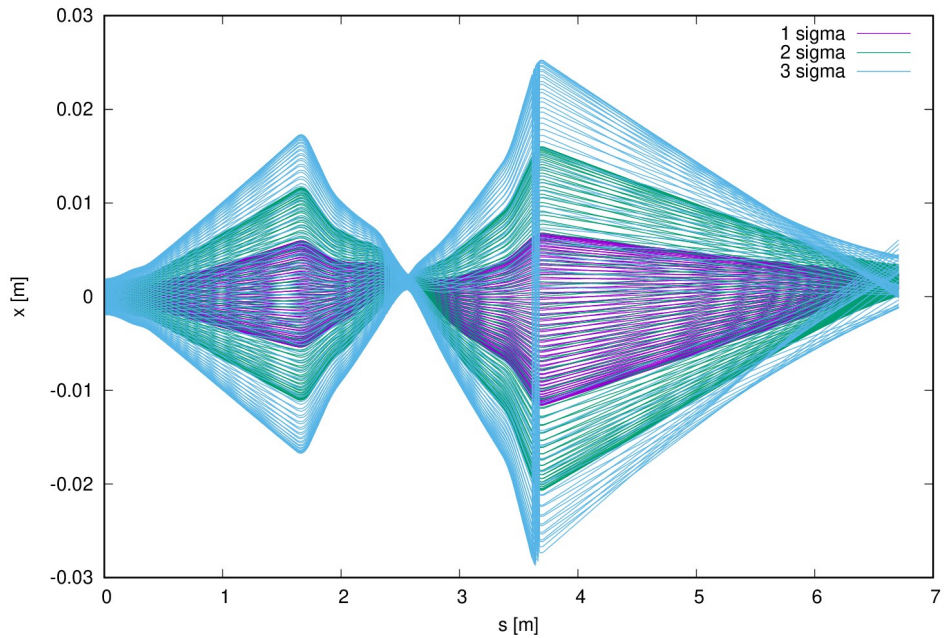
Vertical trajectory with LNS.ZQMF51 = 1649 V



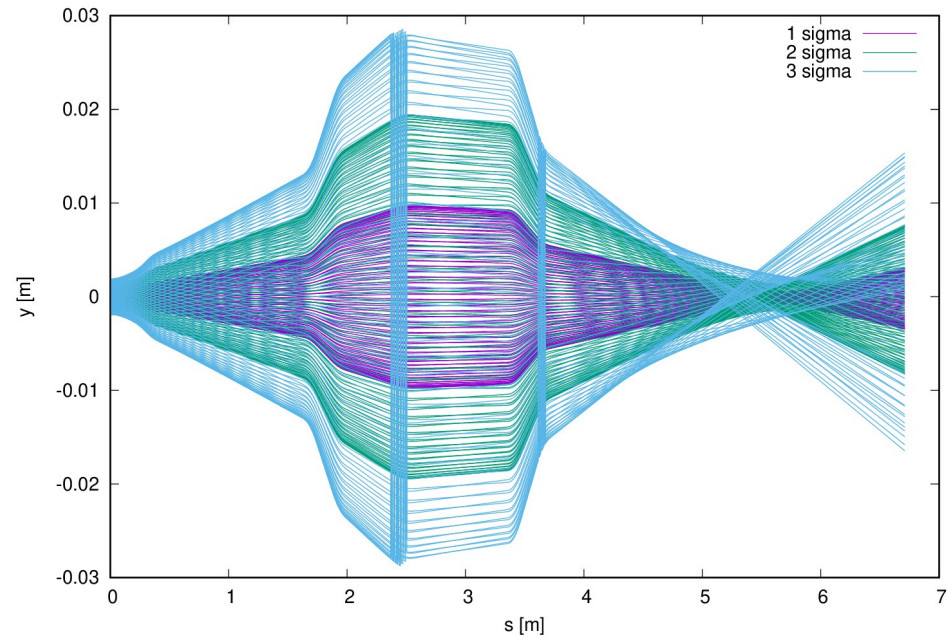
The vertical lines  
are losses

# Trajectories

Horizontal trajectory with LNS.ZQMF51 = 1700 V

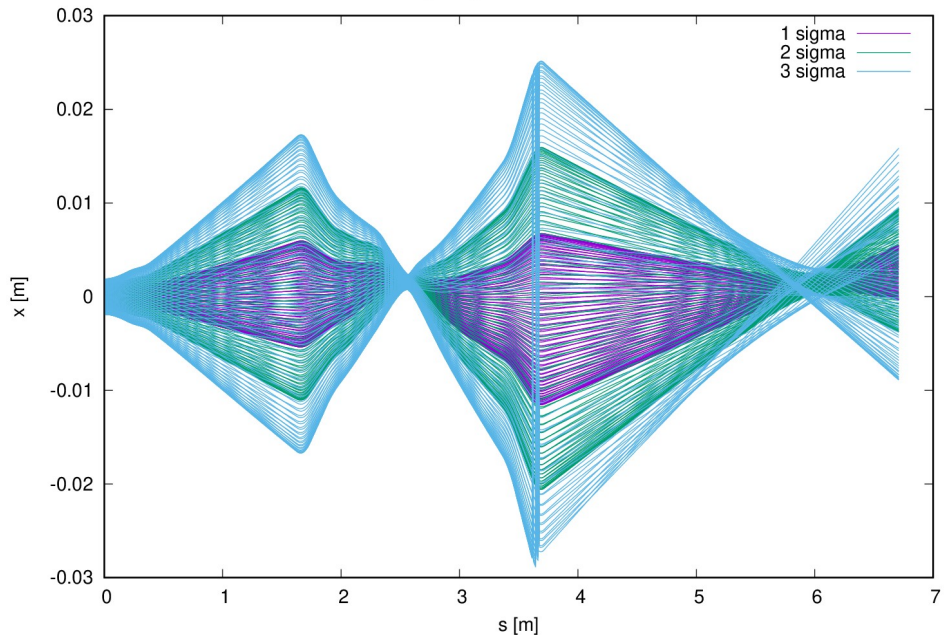


Vertical trajectory with LNS.ZQMF51 = 1700 V

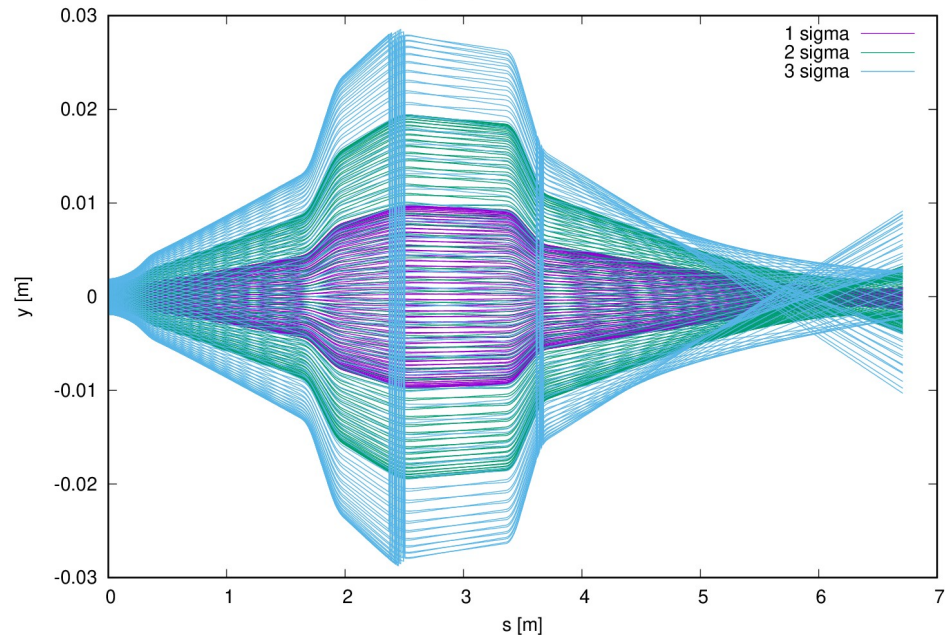


# Trajectories

Horizontal trajectory with LNS.ZQMF51 = 1800 V

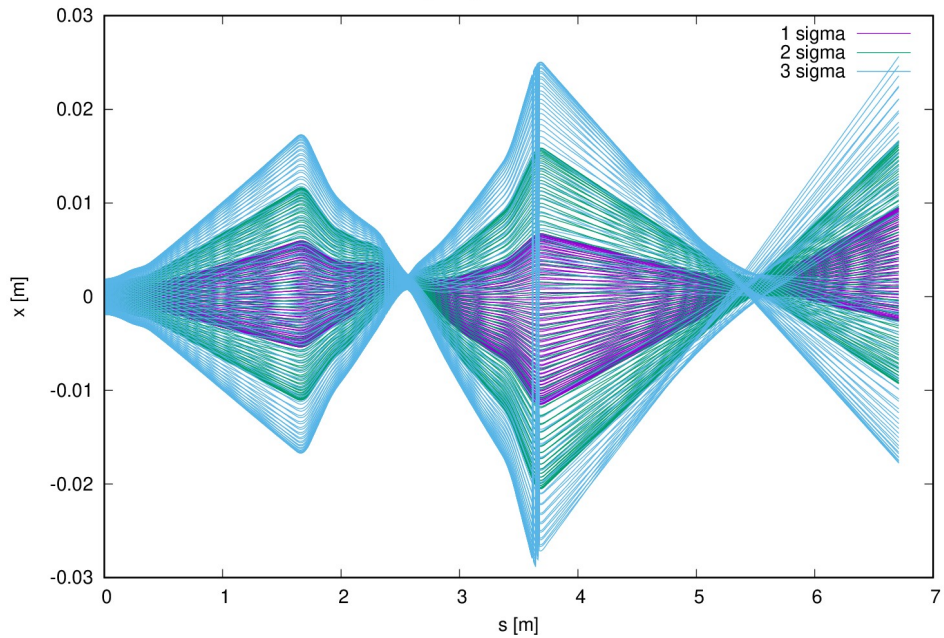


Vertical trajectory with LNS.ZQMF51 = 1800 V

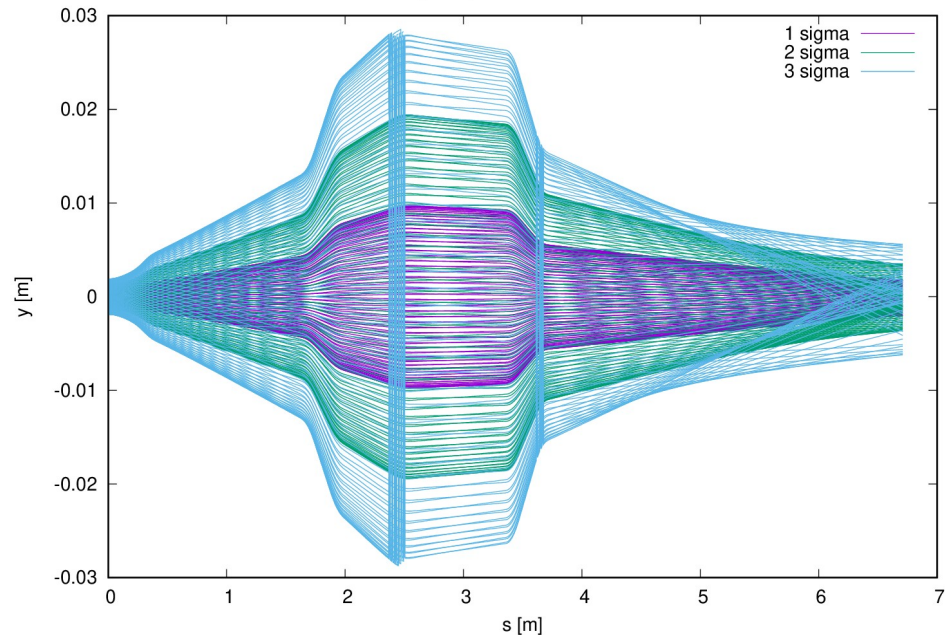


# Trajectories

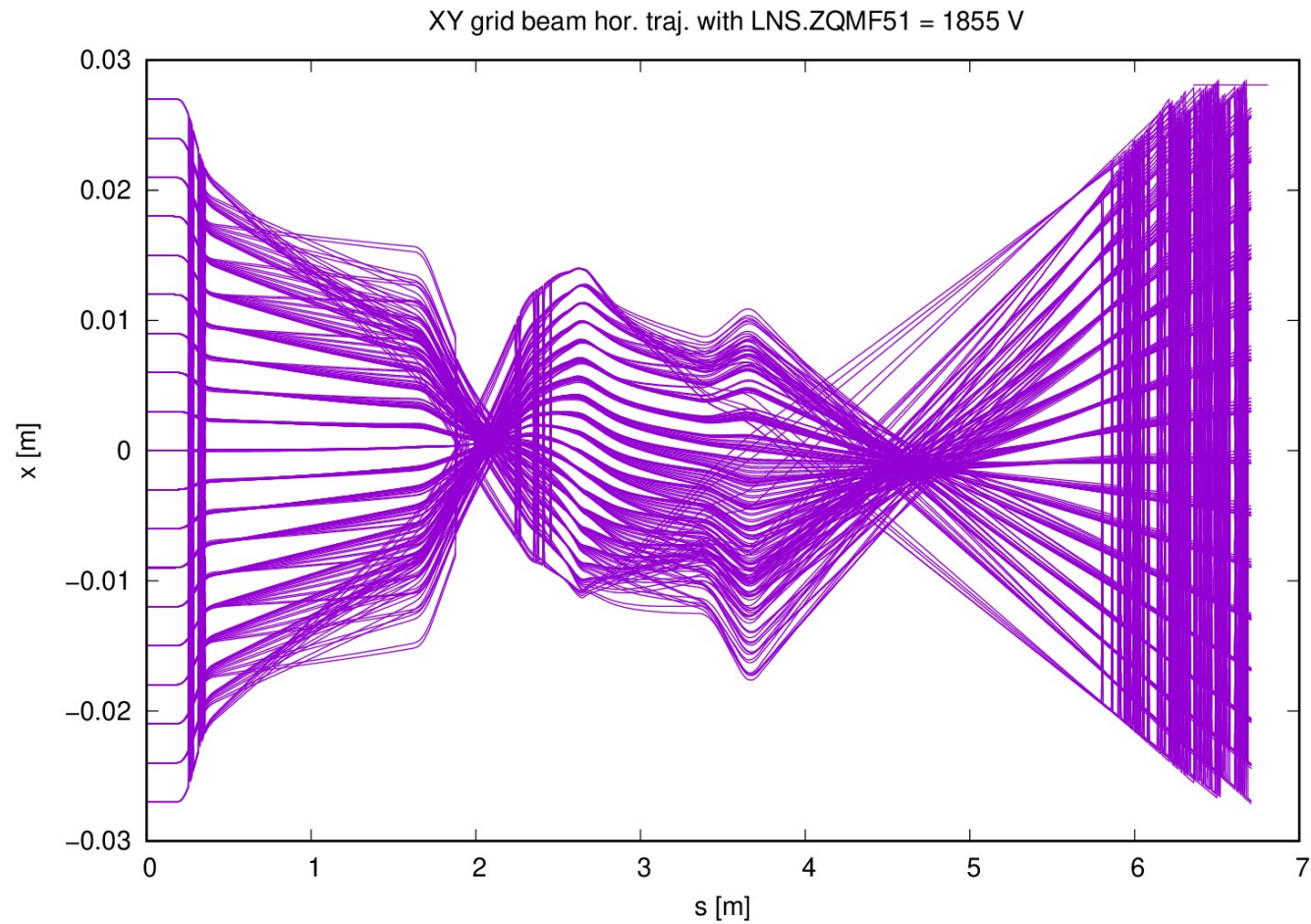
Horizontal trajectory with LNS.ZQMF51 = 1900 V



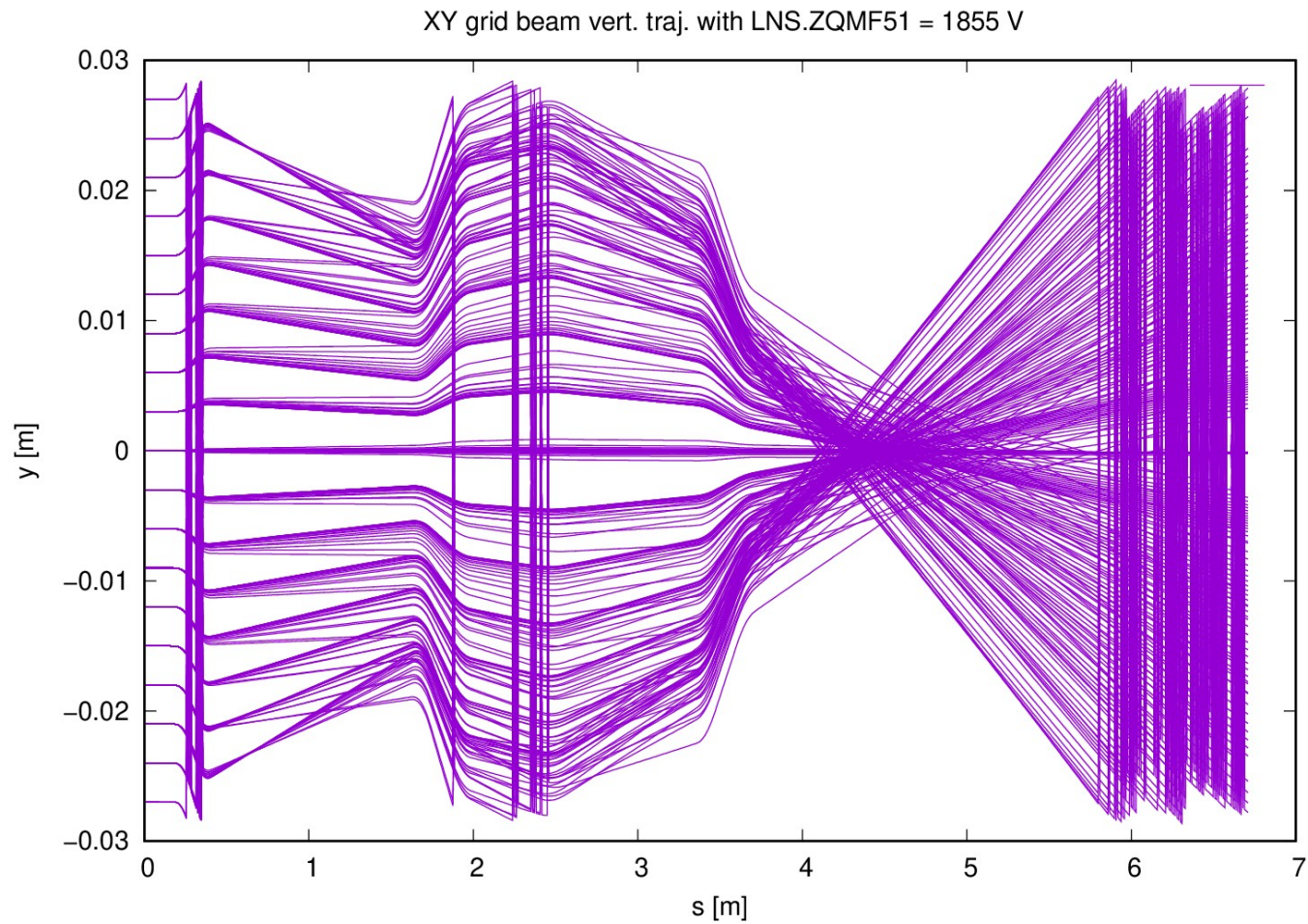
Vertical trajectory with LNS.ZQMF51 = 1900 V



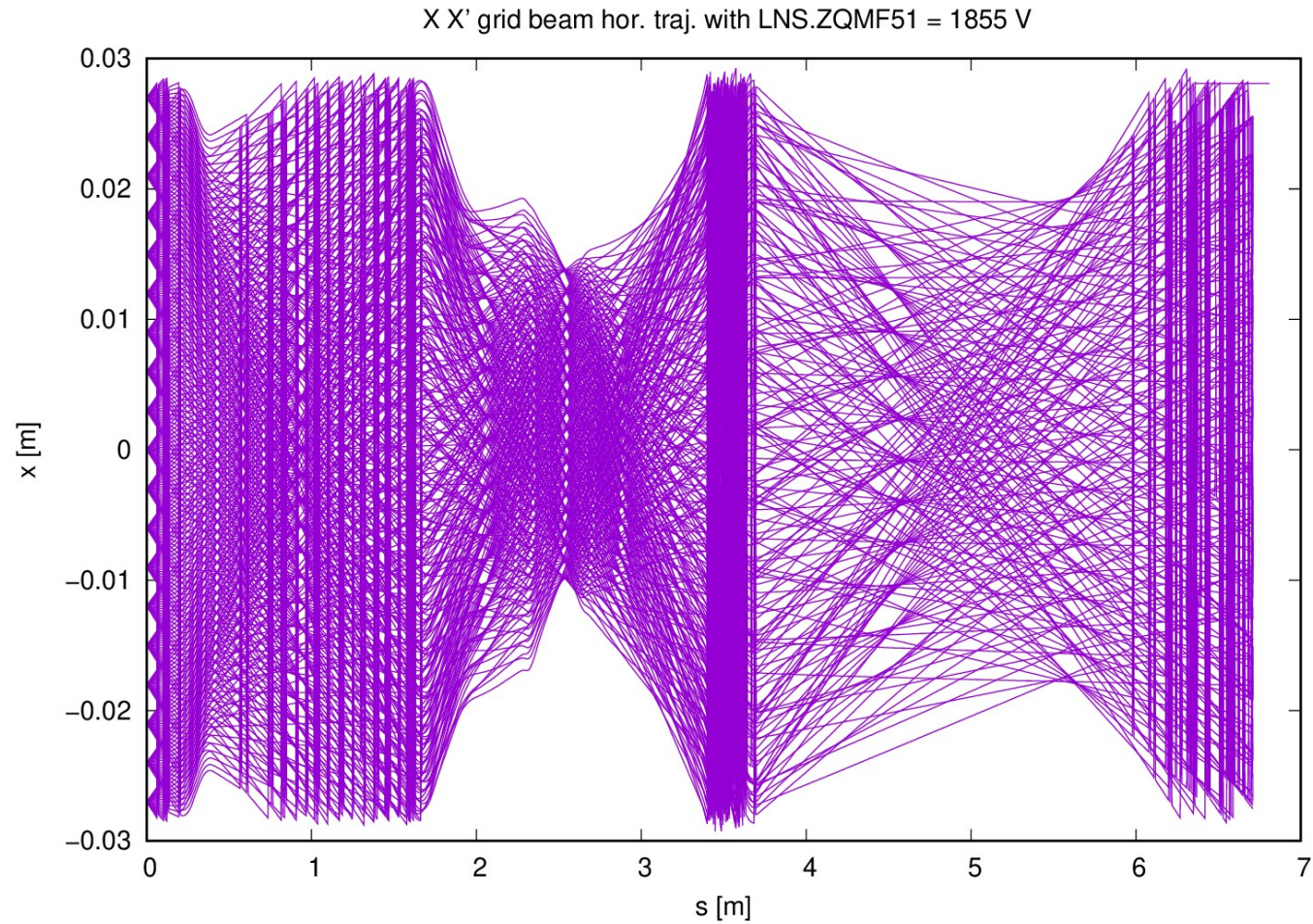
# XY initial grid trajectories



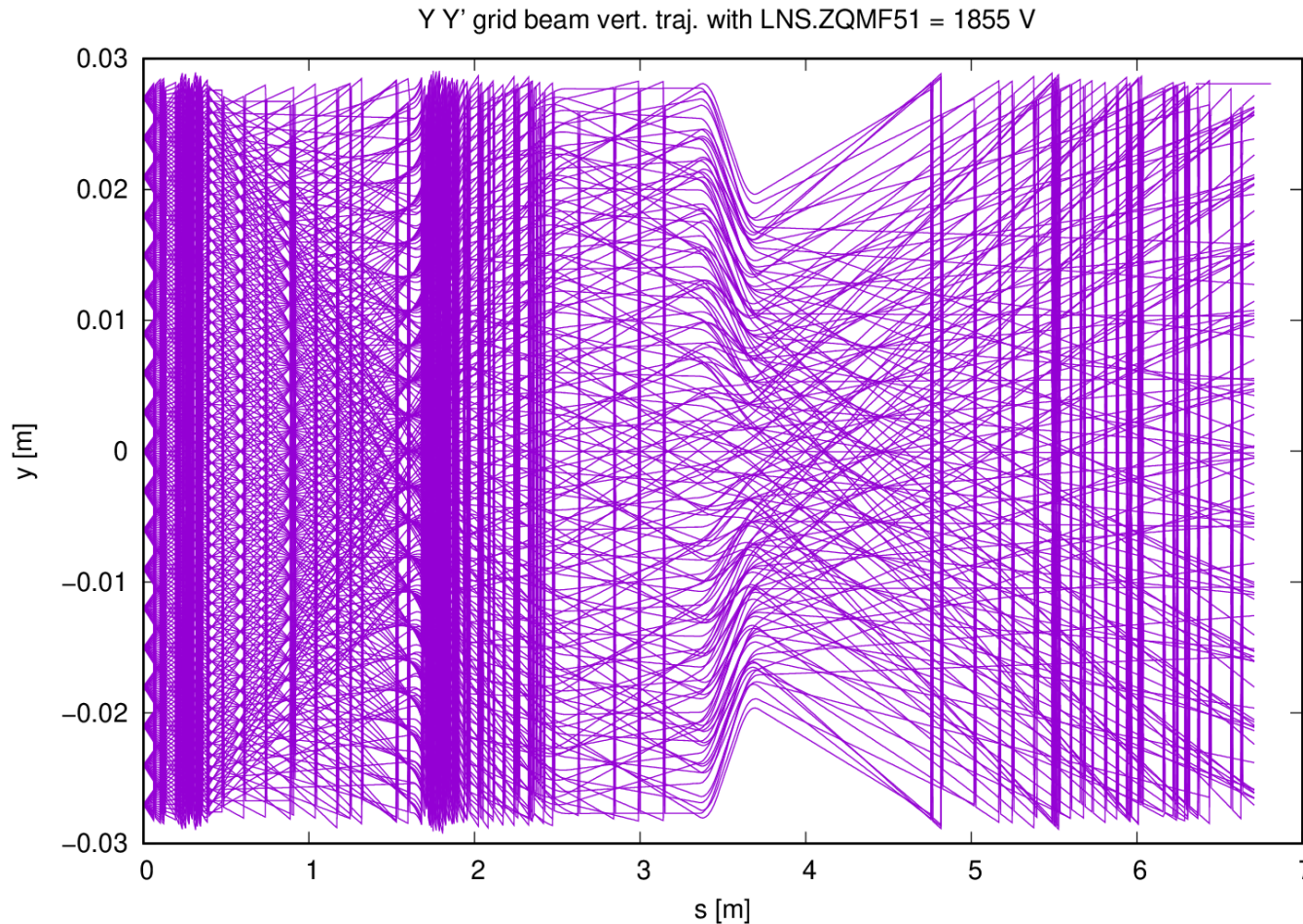
# XY initial grid trajectories



# X X' initial grid trajectories



# Y Y' initial grid trajectories



- No particular bottleneck with the current LNS line setting.

-Losses a bit everywhere with an initial grid.