

# Recent DR Optics

201201 K.Kubo

# DR Optics

- Basically no major change for more than 10 years. (15 years?)
- Gradually changed in tuning process.
- Too large beta/eta mismatch is not desirable for low emittance tuning.
- Reset optics to “design” in 2008 and 2011.
- Most recently
  - Reset Oct. 2011
  - Then, corrected Nov. 2011 based on optics check (ORM)

# ORM (Orbit Response Matrix)

## Measurement

- Record BPM Data (Closed Orbit) changing steering magnet.
- All steering magnets, one by one.
- ~96 BPMs, ~48 H ~51 V steerings

## Analysis

- x-y coupling is not studied here.
- (48+51)x96 matrix

# ORM (Orbit Response Matrix) Analysis

Fitting to reproduce measured response

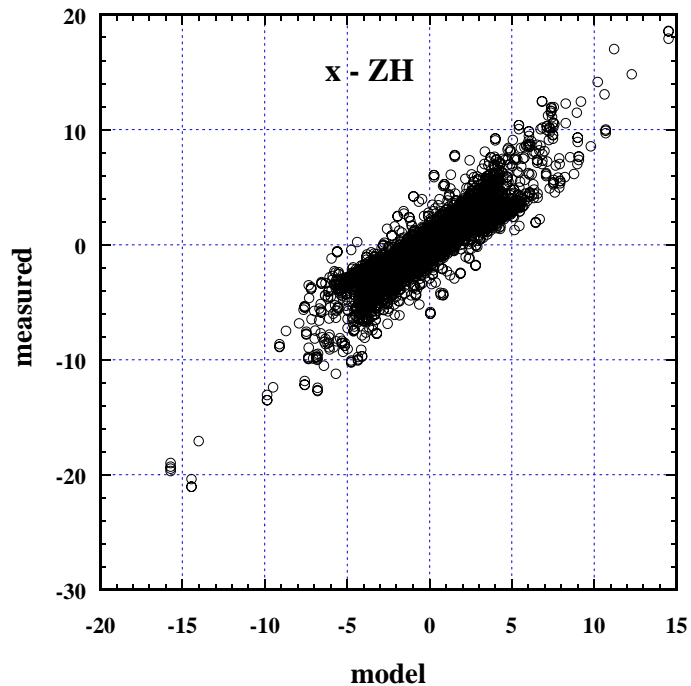
- Free parameters:
  - Strength of Quad magnets except QF1R
    - Same factor for each family.
  - Focus strength (K1) of Bending magnets (BH1R)
    - Two parameters: BH1R.1~6, and BH1R.7~36
  - Strength of steering magnets
    - Same factor for each type

Make new design using fitted K1 of BH1R

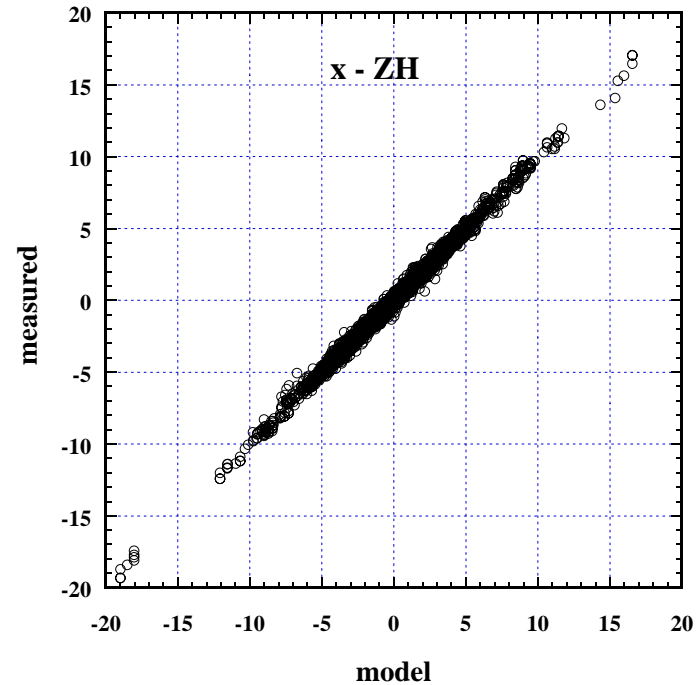
- Zero dispersion in straight sections
- Try to reduce beta and dispersion beating in arc sections
- Some QM trims are used

# X response to ZHs

present model with tune fit  
vs. measured

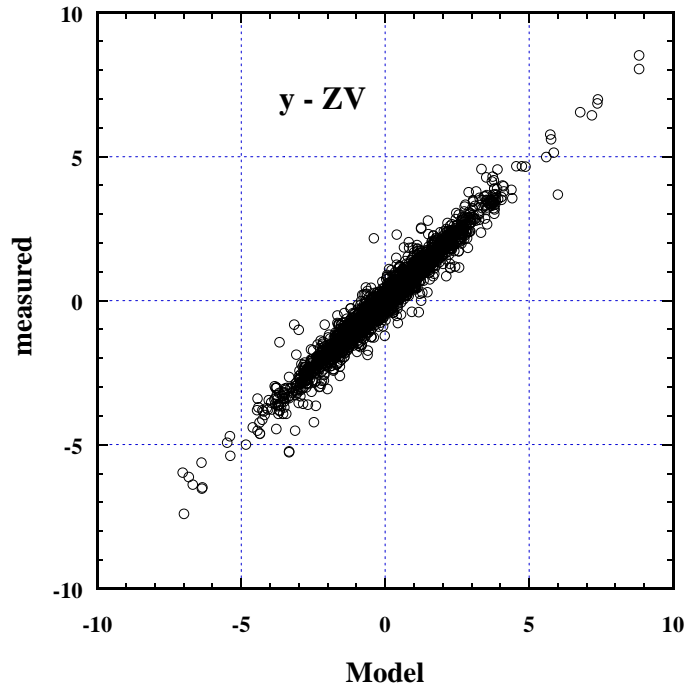


Fitted vs. measured

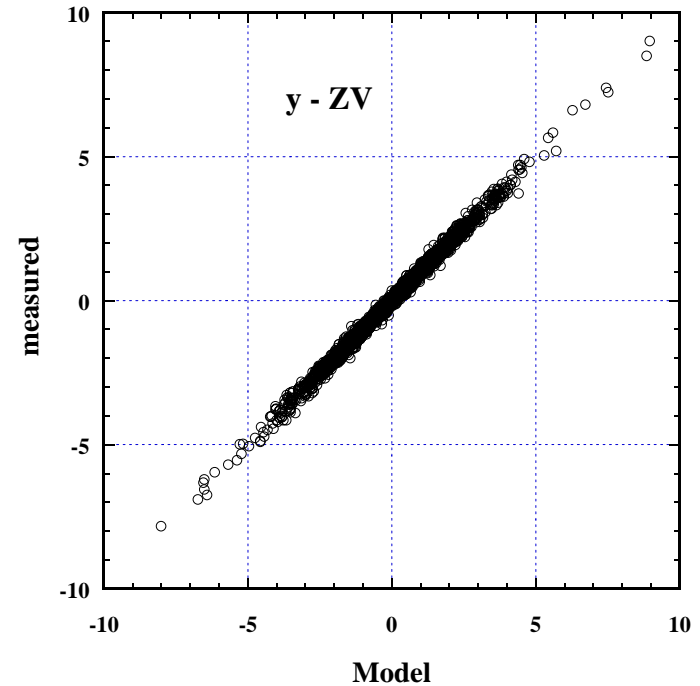


# Y response to ZVs

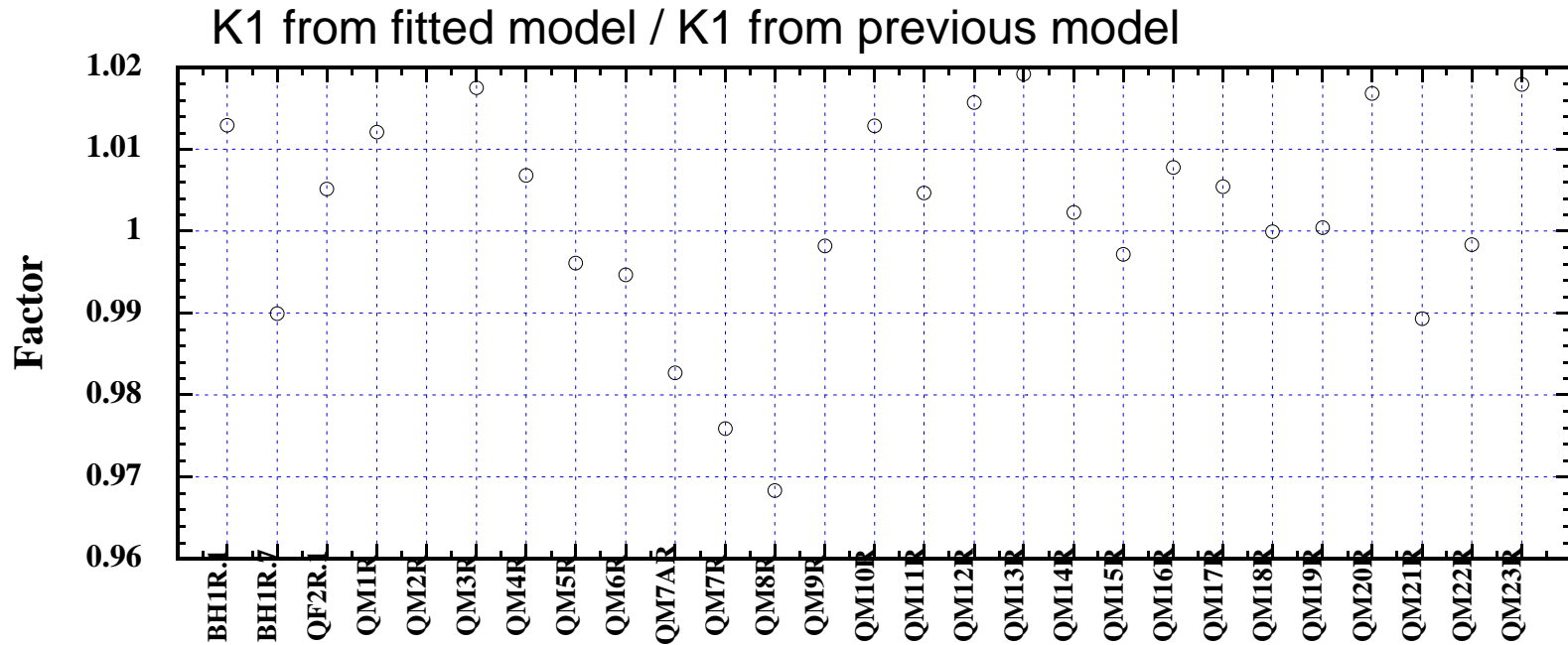
present model with tune fit  
vs. measured



Fitted vs. measured



# Correction factors



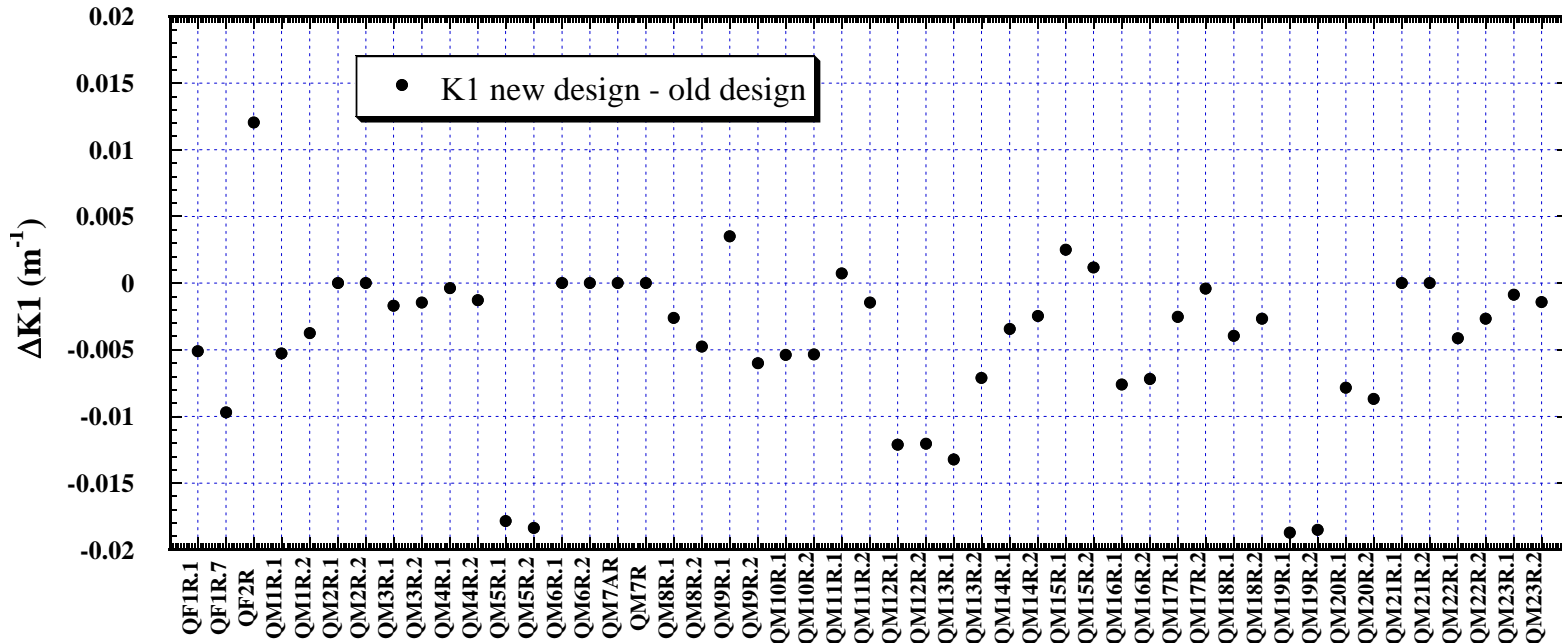
**Ring is not symmetric in the new model**

BH1R.1~6 and BH1R.7~36 have different K1

→ **Need to design new optics**

# New design, old design and previous setting

Difference of new design. From old design



NOTE:

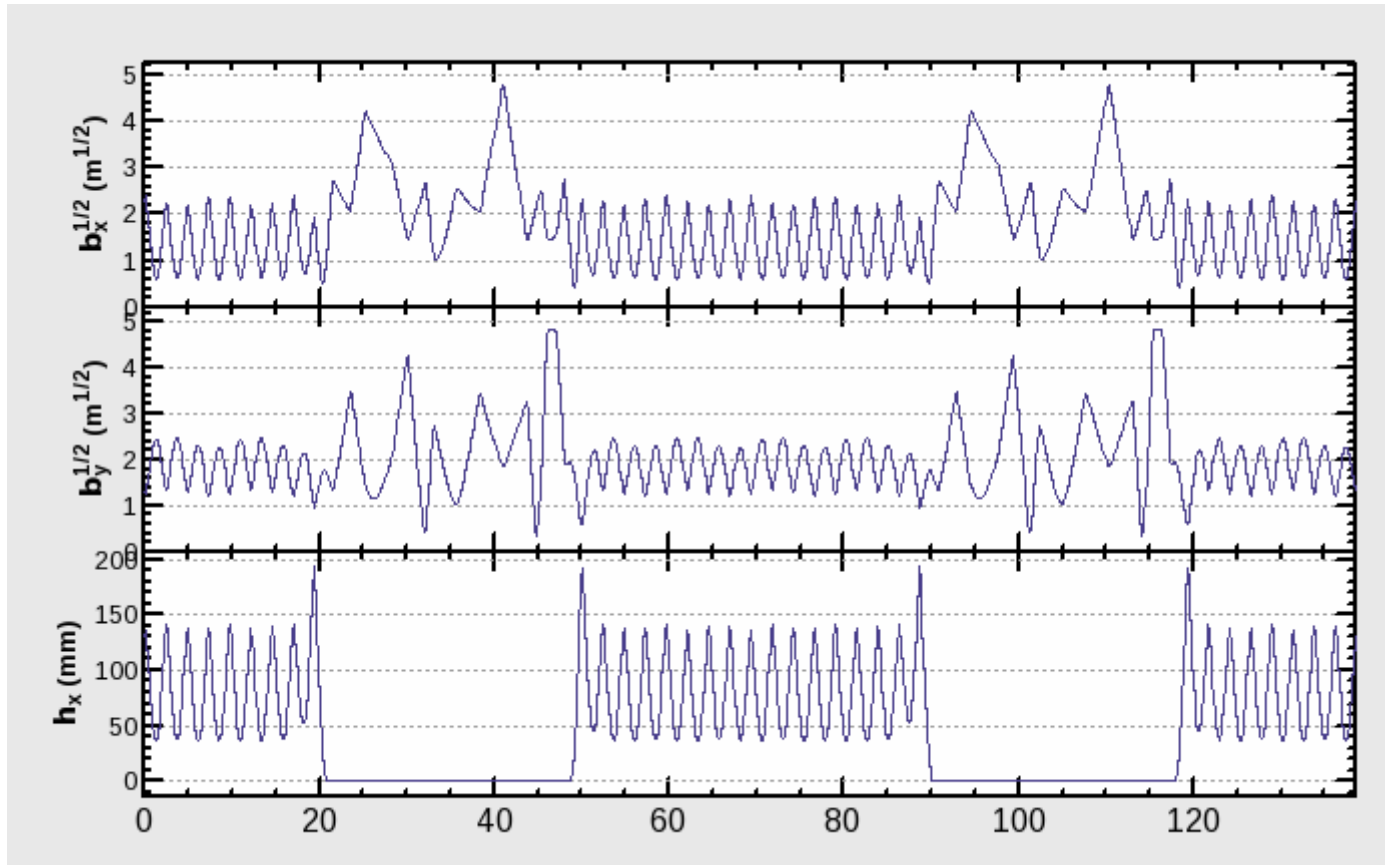
Maximum K1 difference between old and new design is less than 0.02.

QM7R and QM7AR has the same K1 in both designs.

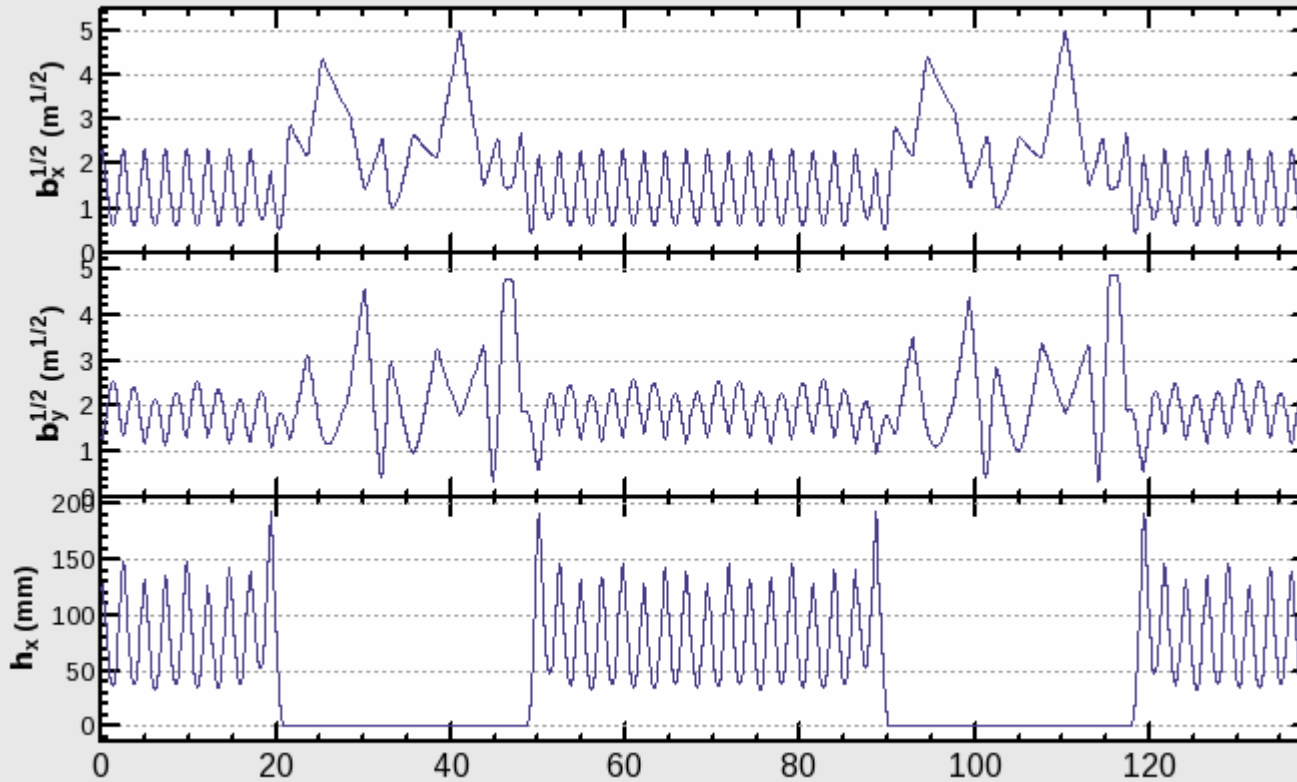
Trims of QF1R are kept as present (0.8A)



# atfdr-design-20111018.sad old design

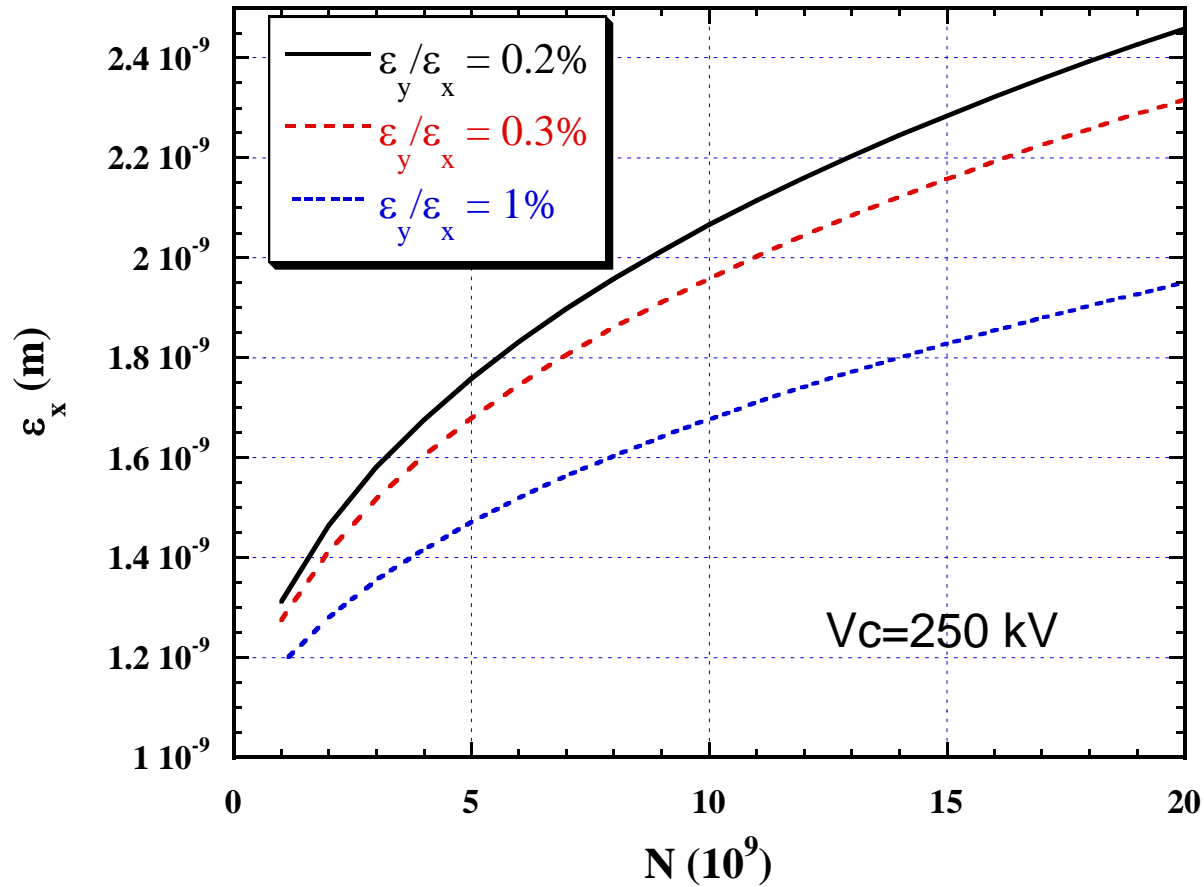


# New design



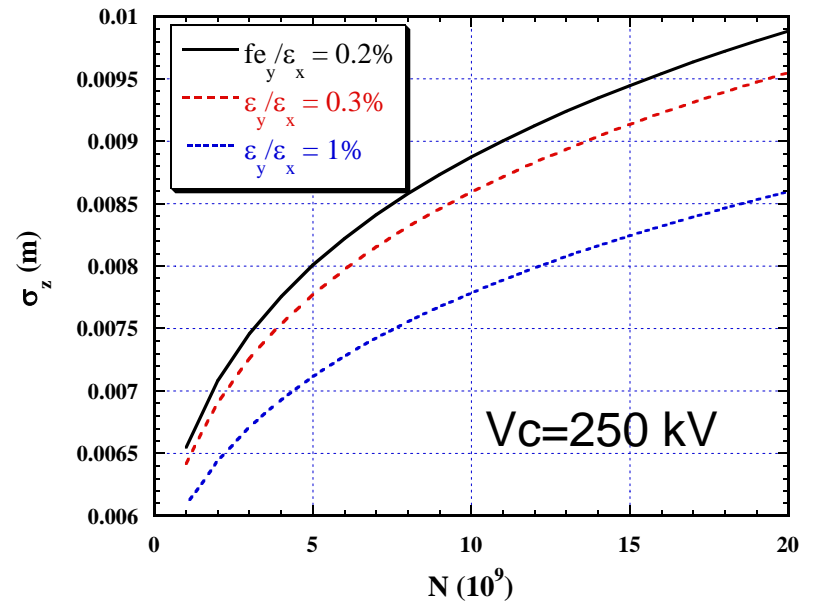
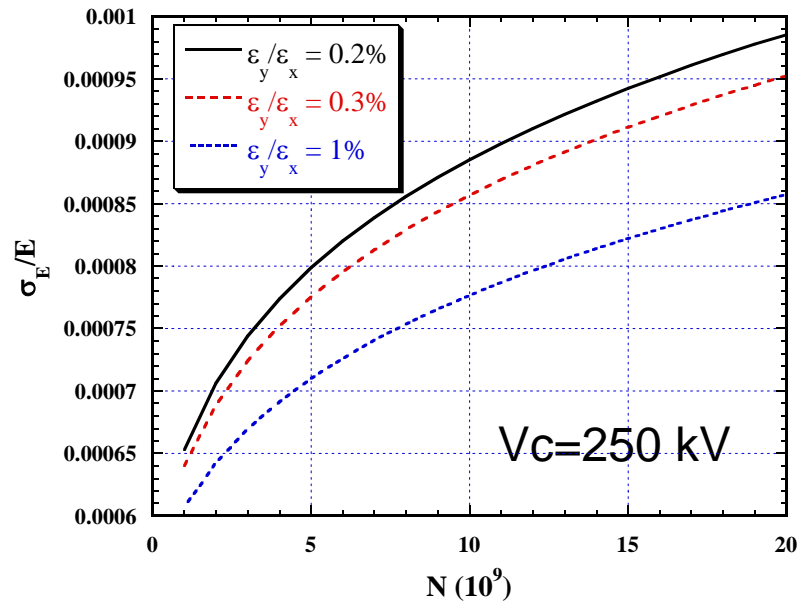
Slightly Larger beat than present design.

# Emittance vs. Bunch Population (Intra-beam Scattering)



No visible difference between new and old optics.

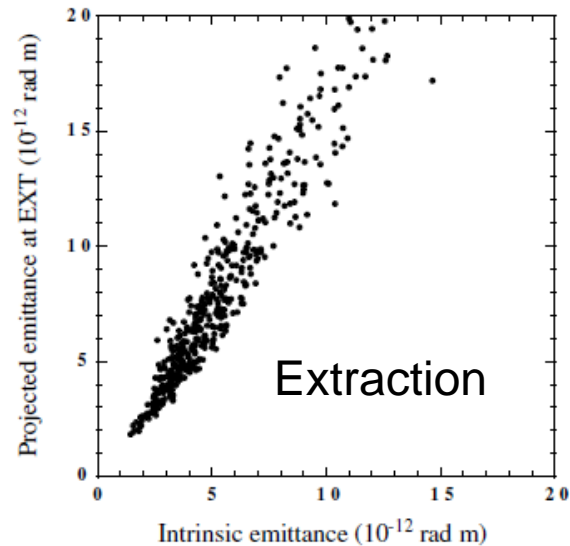
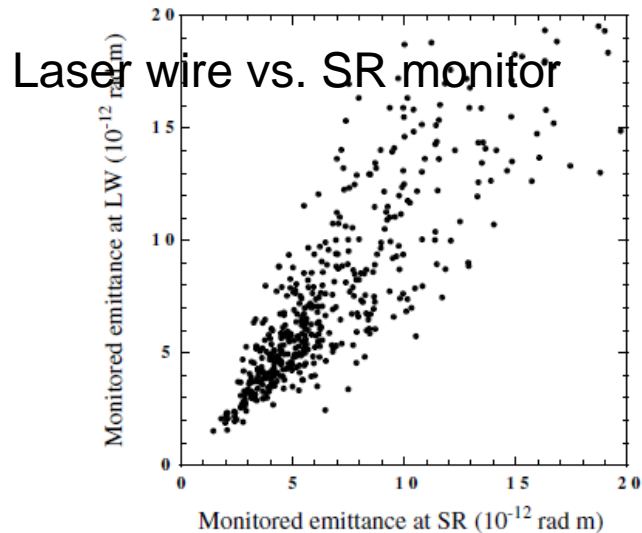
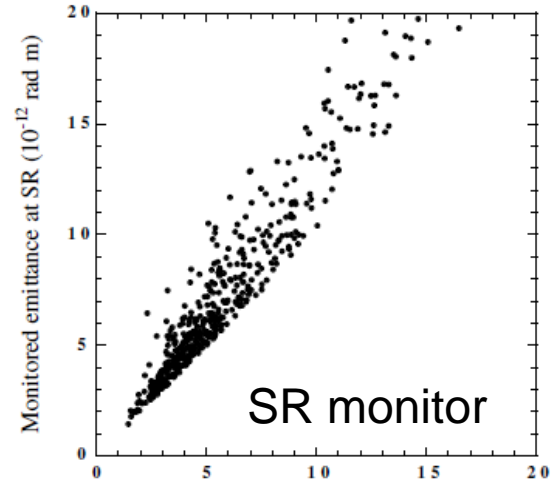
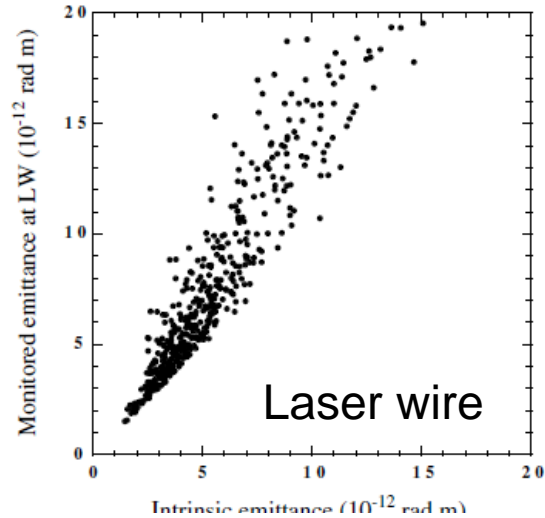
# Energy spread, Bunch length vs. Bunch Population (Intra-beam Scattering)



No visible difference between new and old optics.

# projected vs. intrinsic emittance

$(\sigma_y^2/\beta_y)$  at monitors, projected emittance at EXT vs. normal mode emittance



# How to get design optics (atfsv1)

- Old design
  - /atf/sad/operation/daihon/atfdr-design-20111018.sad  
(Two QM7R: QM7R.1 and QM7R.2)
  - /atf/sad/operation/daihon/atfdr-design-20111018a.sad  
(Introduce QM7AR as an independent magnet)

- For New Design

```
read "/atf/sad/operation/daihon/atfdr-design-20111018a.sad";
FFS USE=RING0;
cell;ring;cal;
Get["/atf/sad/operation/lib/atfringlib-new.n"];
Get["/atf/sad/operation/lib/correctk1-bh1.n"];
indep qf1r.*; indep qm*r.*;
LoadRingOpticsNew2["atfdr-design-20111111.sad"];
setBH1RK1[];
cal;
```