

# Dispersion Measurements at the VUV-FEL

Accelerator Studies - Week 14 2006

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# Overview

## INTERMEDIATE GOAL

Obtain a dispersion in the undulator smaller than 1 cm in both planes

## GOAL of WEEKS 14&16

- Measurement of orbit and dispersion response for all the steerers and quads
- Measure and correct dispersion

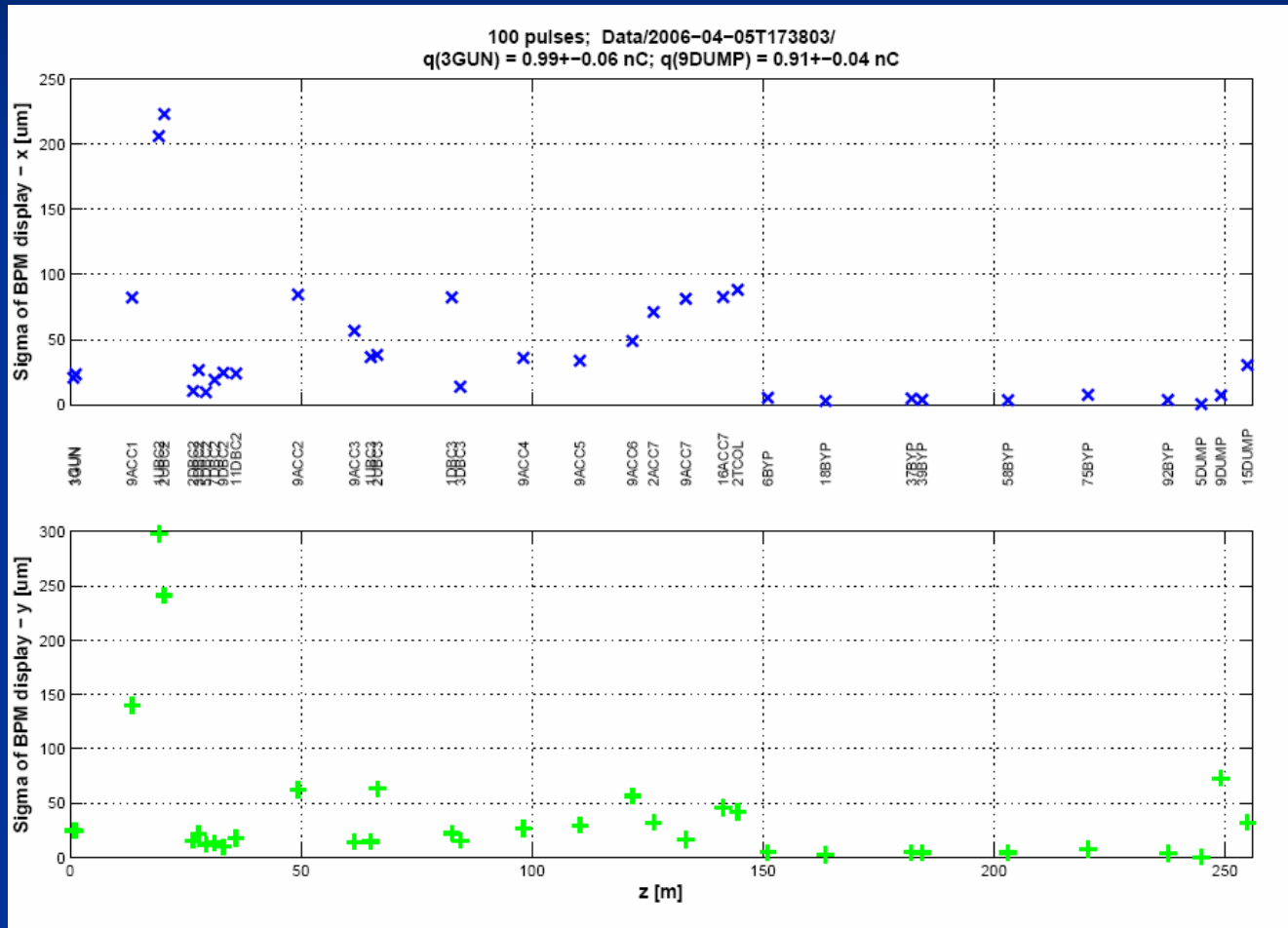
## DIFFICULTIES (week 14)

- Charge instability
- Losses in the undulator

## ACHIEVEMENTS (week 14)

- Successful test of on-crest phase measurement (ACC1)
- Measured orbit & dispersion response for 18 steerers (up to ACC2)

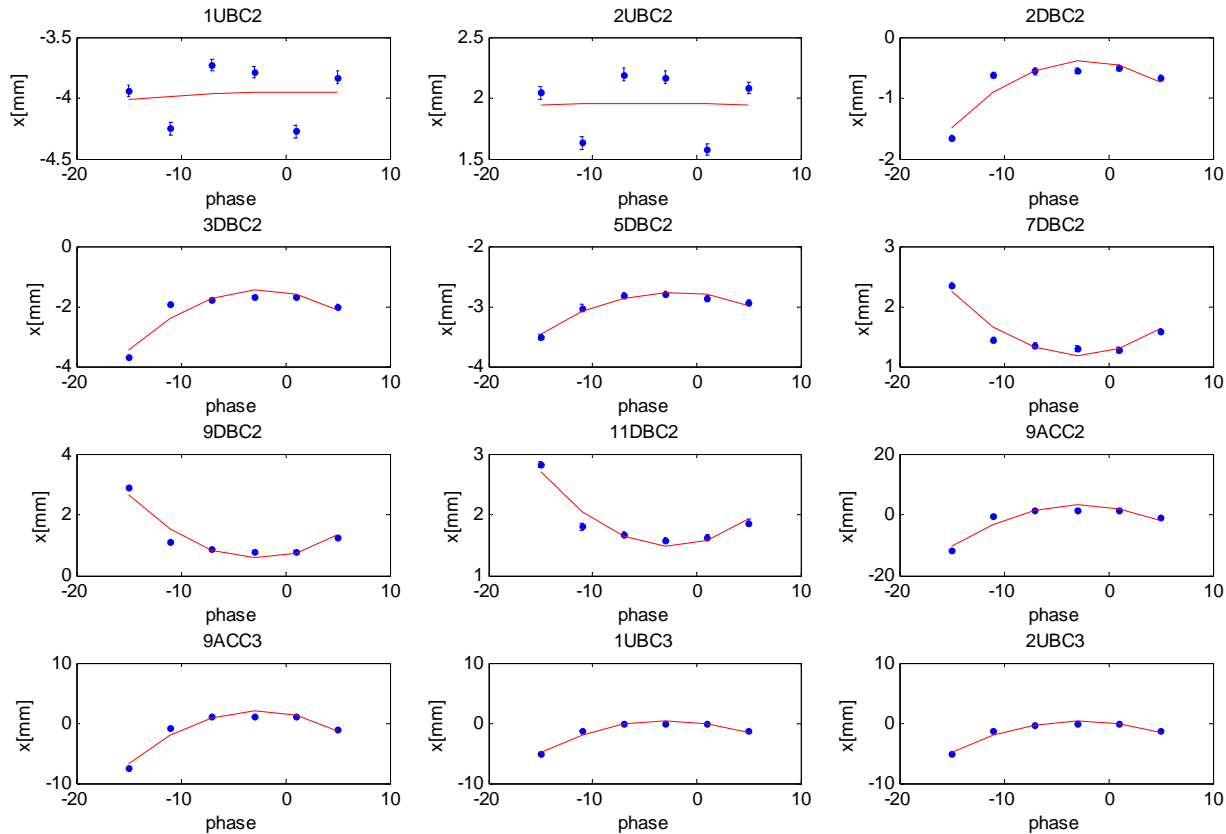
Beam jitter too high during part of the shift...



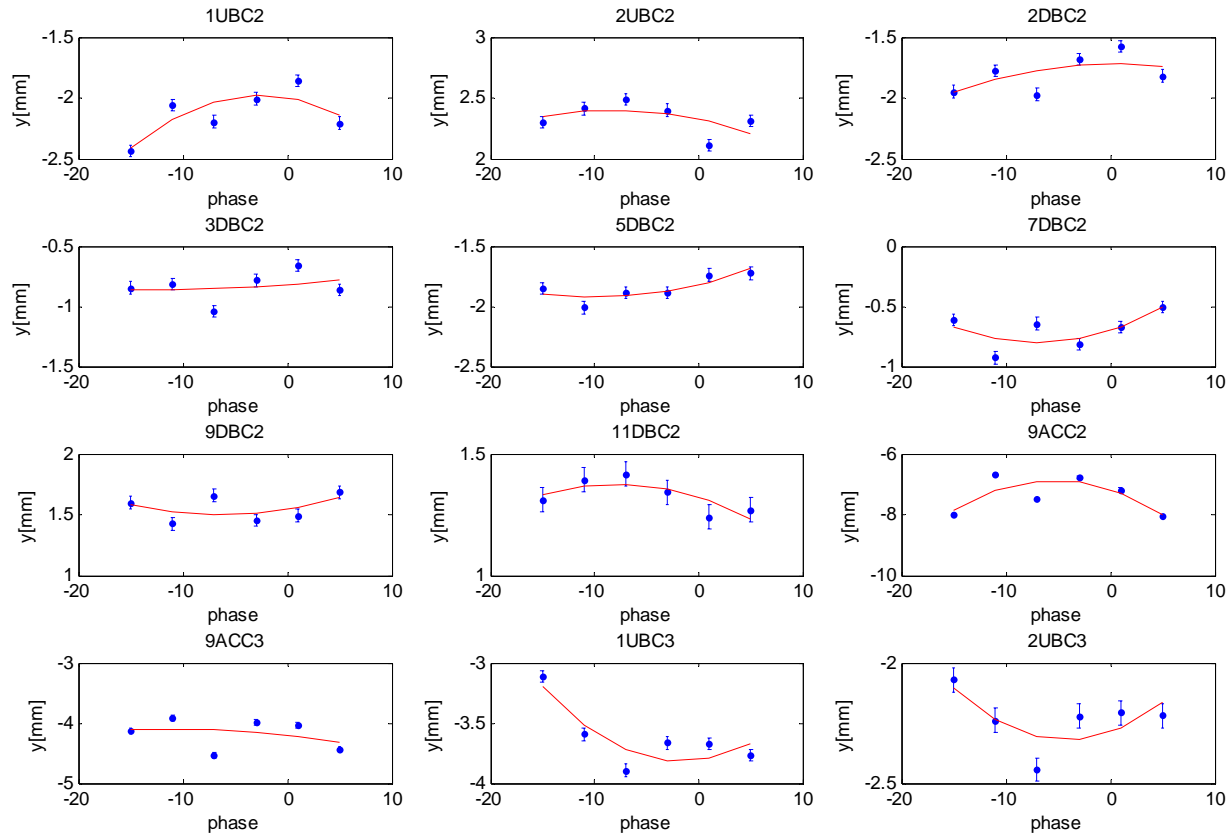
# On-crest phase measurement

- The idea is to make a phase scan and look at the orbit response in the BPM's
- For each BPM a 2<sup>nd</sup> order fit is done, and maximum/minimum is derived.
- Maximum/minimum corresponds to the on-crest phase.
- This method is very reliable since all BPM's in the machine can be used.

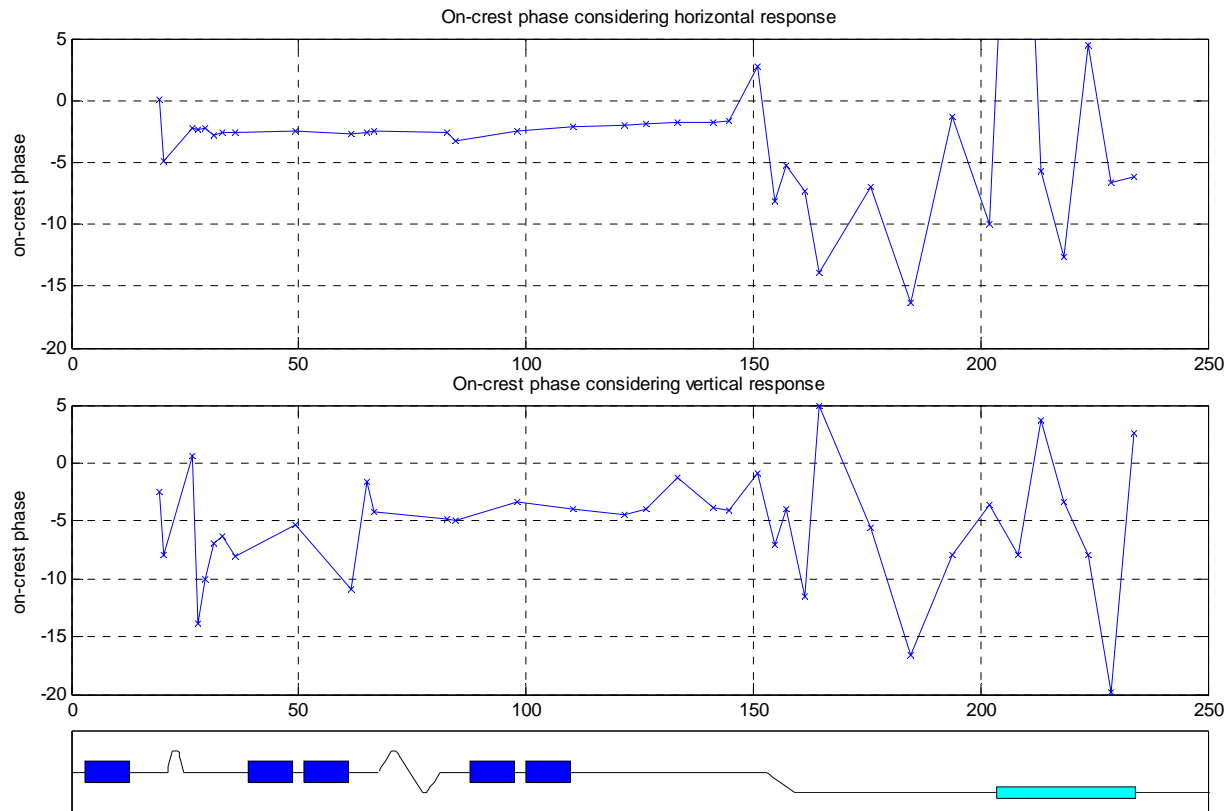
# On-crest phase measurement (ACC1)



# On-crest phase measurement (ACC1)



## On-crest phase measurement (ACC1)





# Orbit and dispersion response measurements

➤ Orbit response

$$O_{i,j} = \frac{\Delta x_i}{\Delta \theta_j}$$

➤ Dispersion response

$$D_{i,j} = \frac{\Delta D_i}{\Delta \theta_j}$$

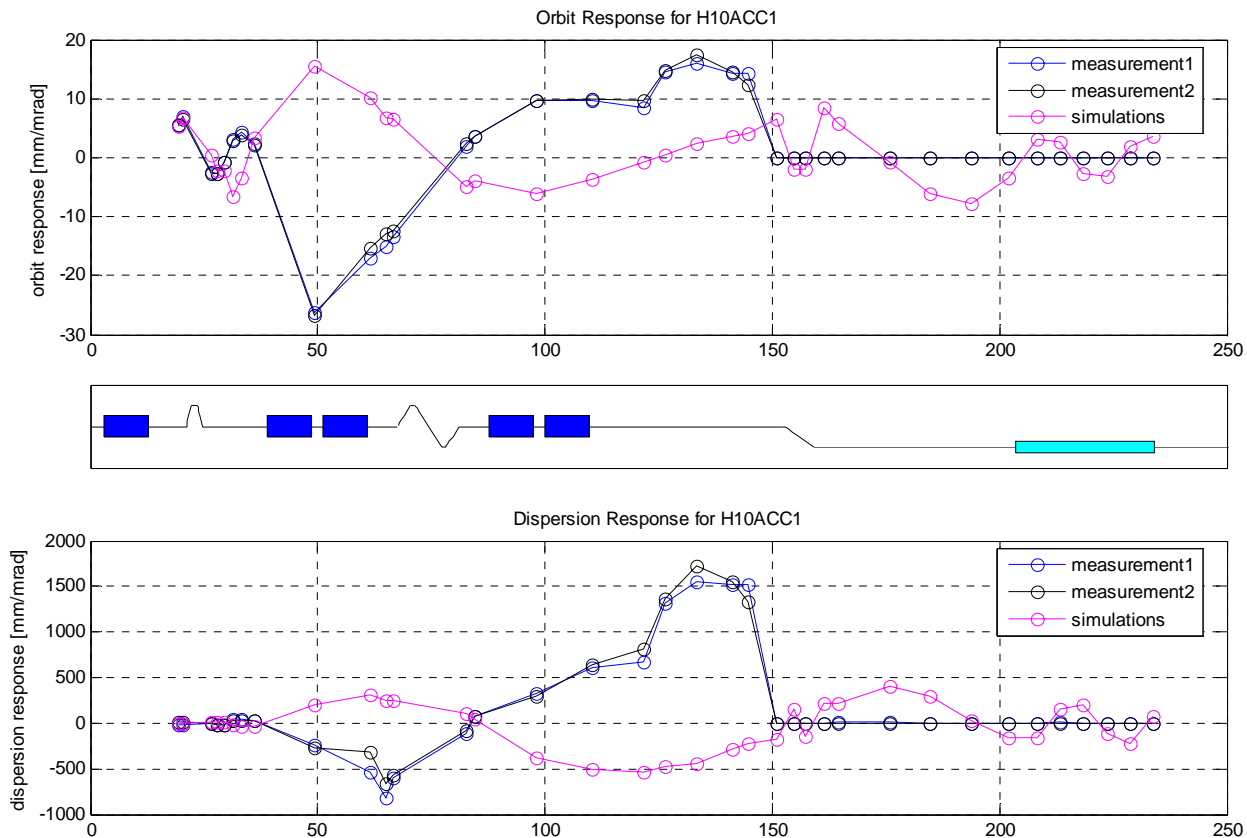
$\Delta x_i / \Delta D_i$  -----> change of the orbit / dispersion at the BPM  $i$   
 $\Delta \theta_j$  -----> change of the kick angle of the steerer  $j$

**We measured the response for the following correctors:**

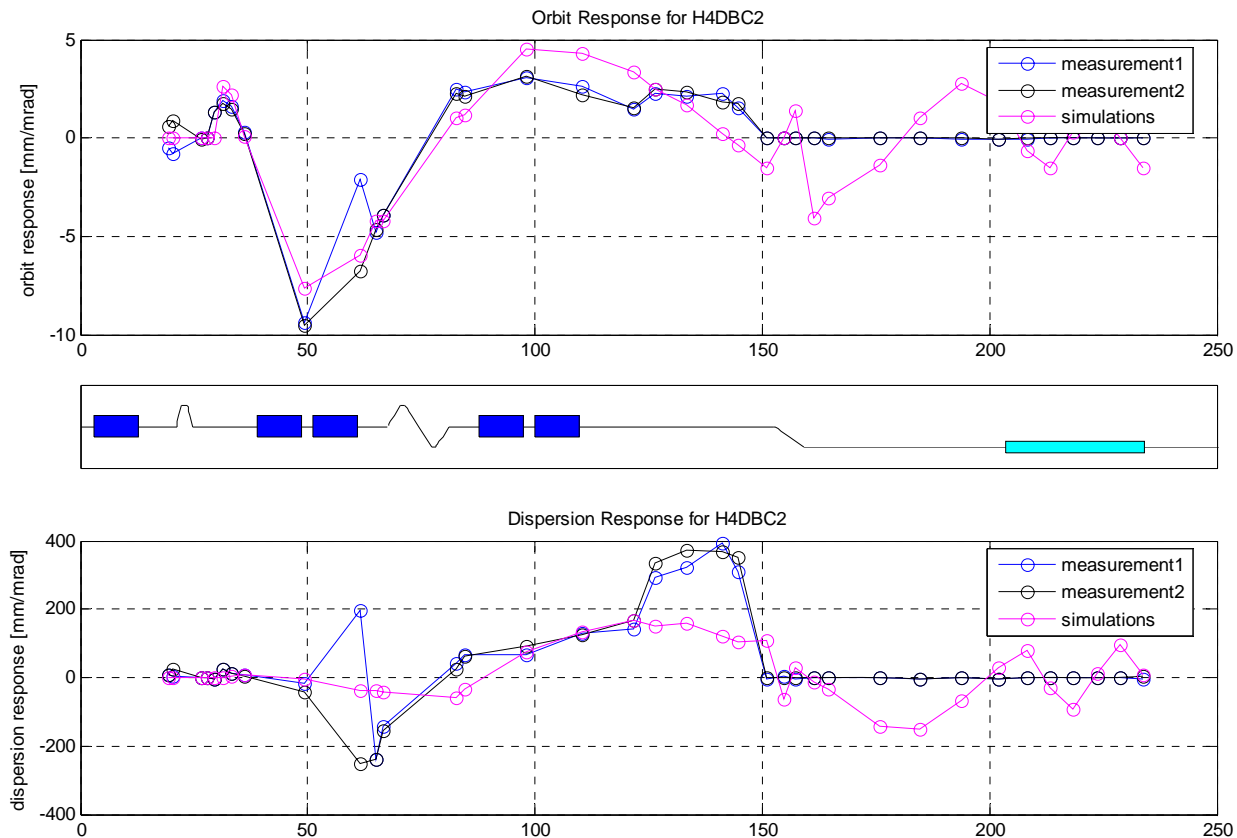
H10ACC1 - H1UBC2 - H1DBC2 - H2DBC2 - H4DBC2 - H5DBC2 - H8DBC2 - H9DBC2 - H11DBC2

V10ACC1 - V1UBC2 - V1DBC2 - V2DBC2 - V4DBC2 - V6DBC2 - V8DBC2 - V10DBC2 - V11DBC2

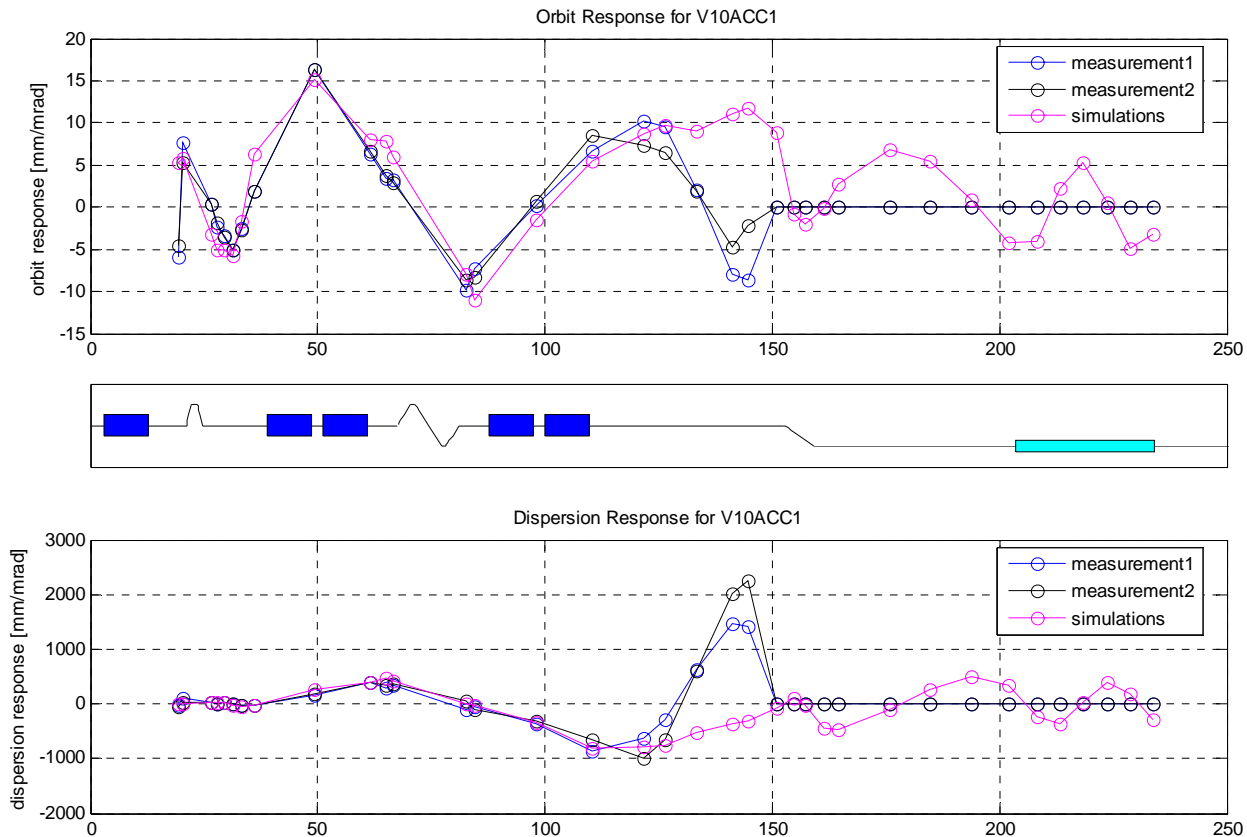
# Orbit and dispersion response measurements example: H10ACC1



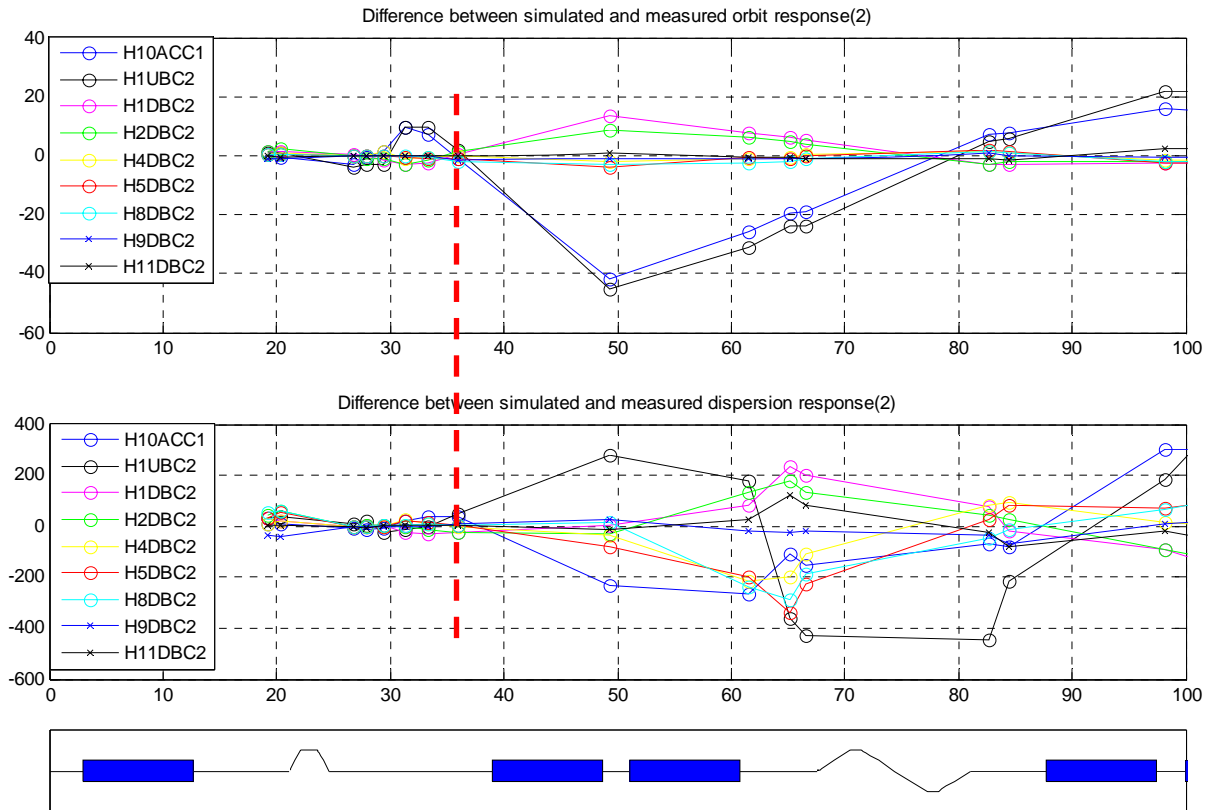
# Orbit and dispersion response measurements example: H4DBC2



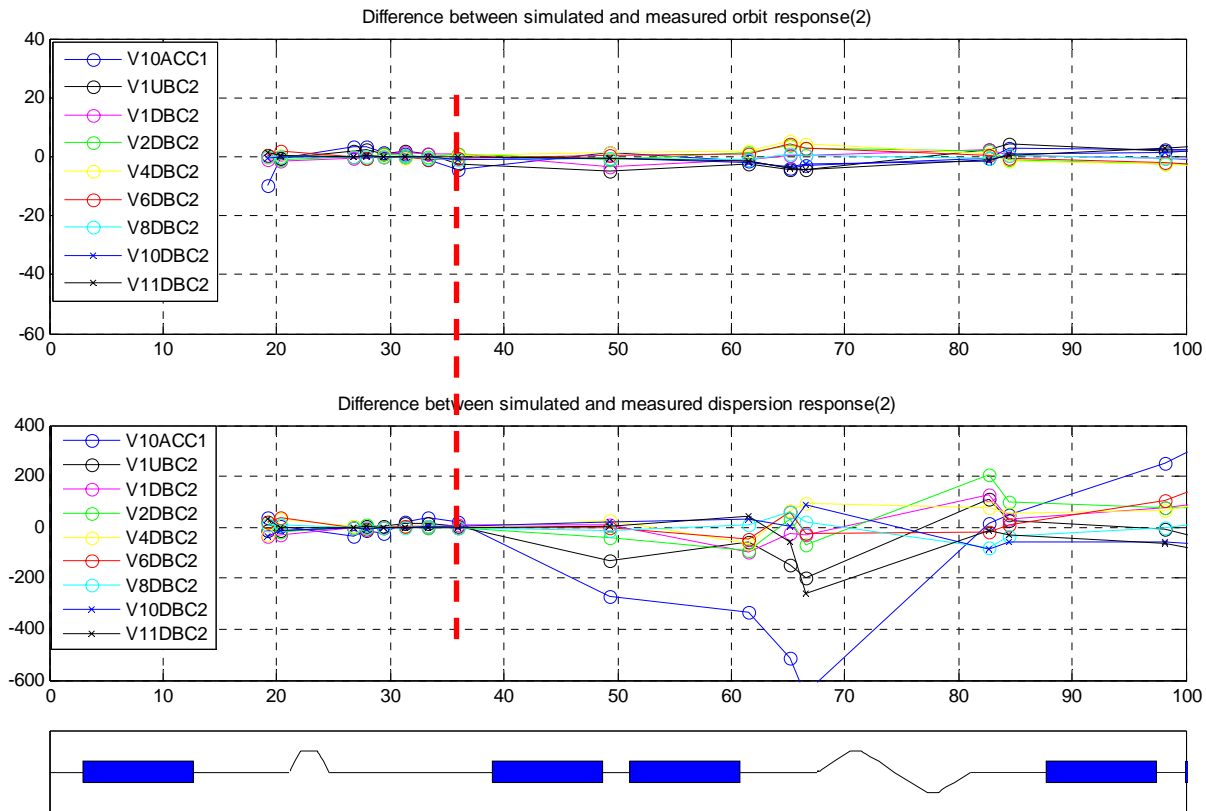
# Orbit and dispersion response measurements example: V10ACC1



# Difference between measurements and simulations (horizontal case)



# Difference between measurements and simulations (vertical case)



# Summary & next measurements

- Successful test of on-crest phase measurement using the orbit response in the BPMs
- Measured orbit & dispersion response for 18 steerers. Still remaining about 40 steerers and 20 quad movers.
- Next steps:
  - Analyze obtained data (J. Keil)
  - Measure response for the rest of steerers and quads ( $\sim 1.5$  shifts)
  - Measure and correct dispersion along the machine ( $3 \times \frac{1}{2}$  shifts)

Thank you!