

# Beam Optics and Tevatron Studies

*Alexander Valishev for Tev group*

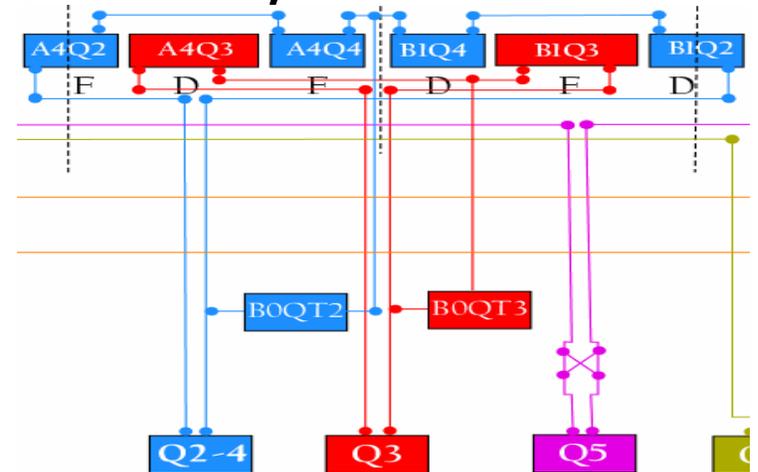
CDF/D0/AD Joint Luminosity Meeting,  
2/7/06

# Contents

- Studies for the period 11/1/05 - 2/7/06
- Present collision optics
- Ongoing projects and plans

# Studies

- Maintenance
  - 12/8 BOQT3 moved upstream, waist by 1.5-2cm



- 12/22 Separator scans
- 1/7 Work with LBSEQ 17, 18
- 2/3 Orbit move at IPs
- Measurements
  - 11/19 Turn-by-turn for nonlinearities
  - 1/26 Optics measurement at 150 and LowBeta

# LowBeta: $\beta^*$ Values

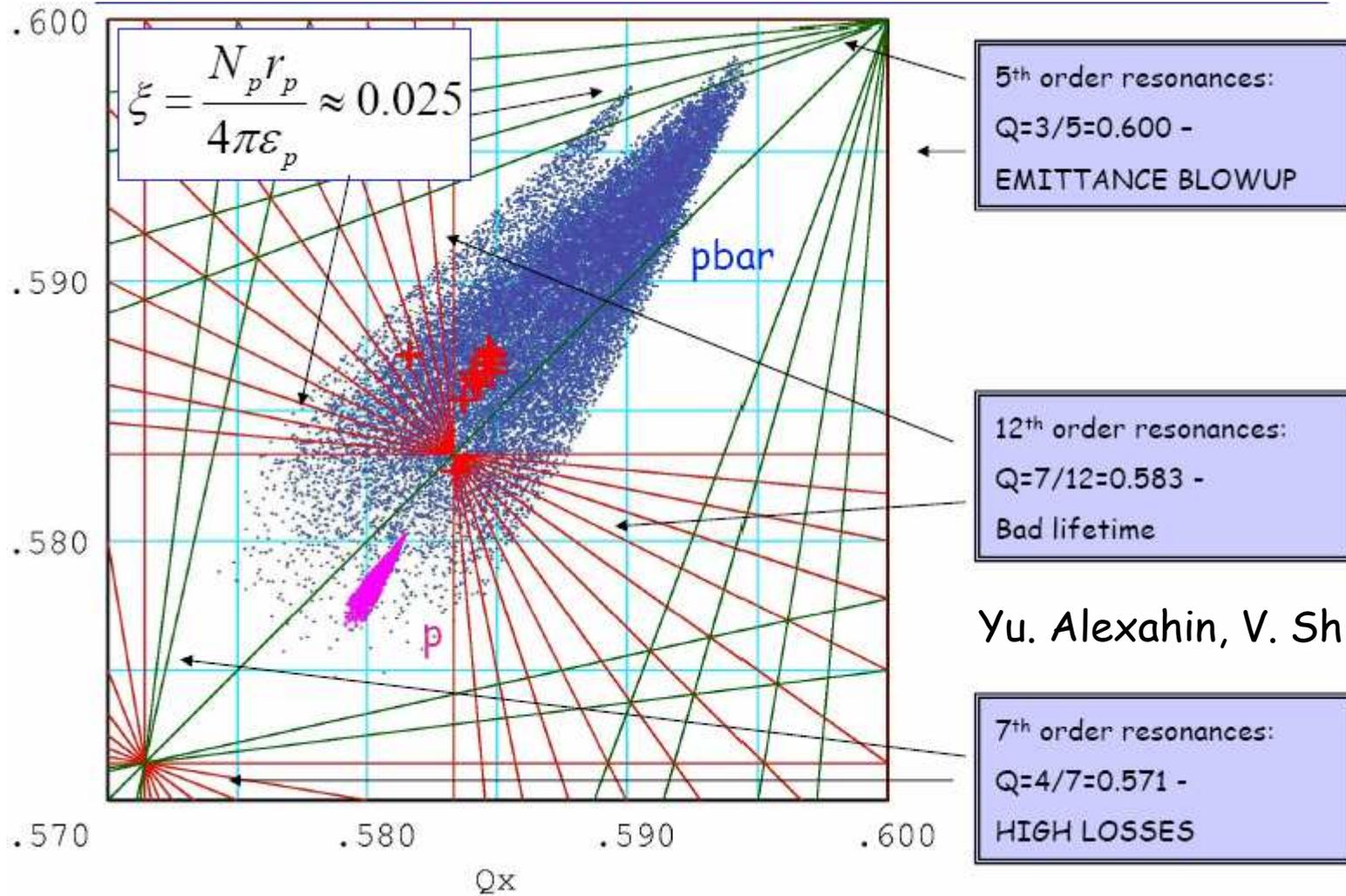
	x	y
CDF	28.1	32.7
DO	26.9	31.3

Note: data quality was poor - error is large

# Next Steps

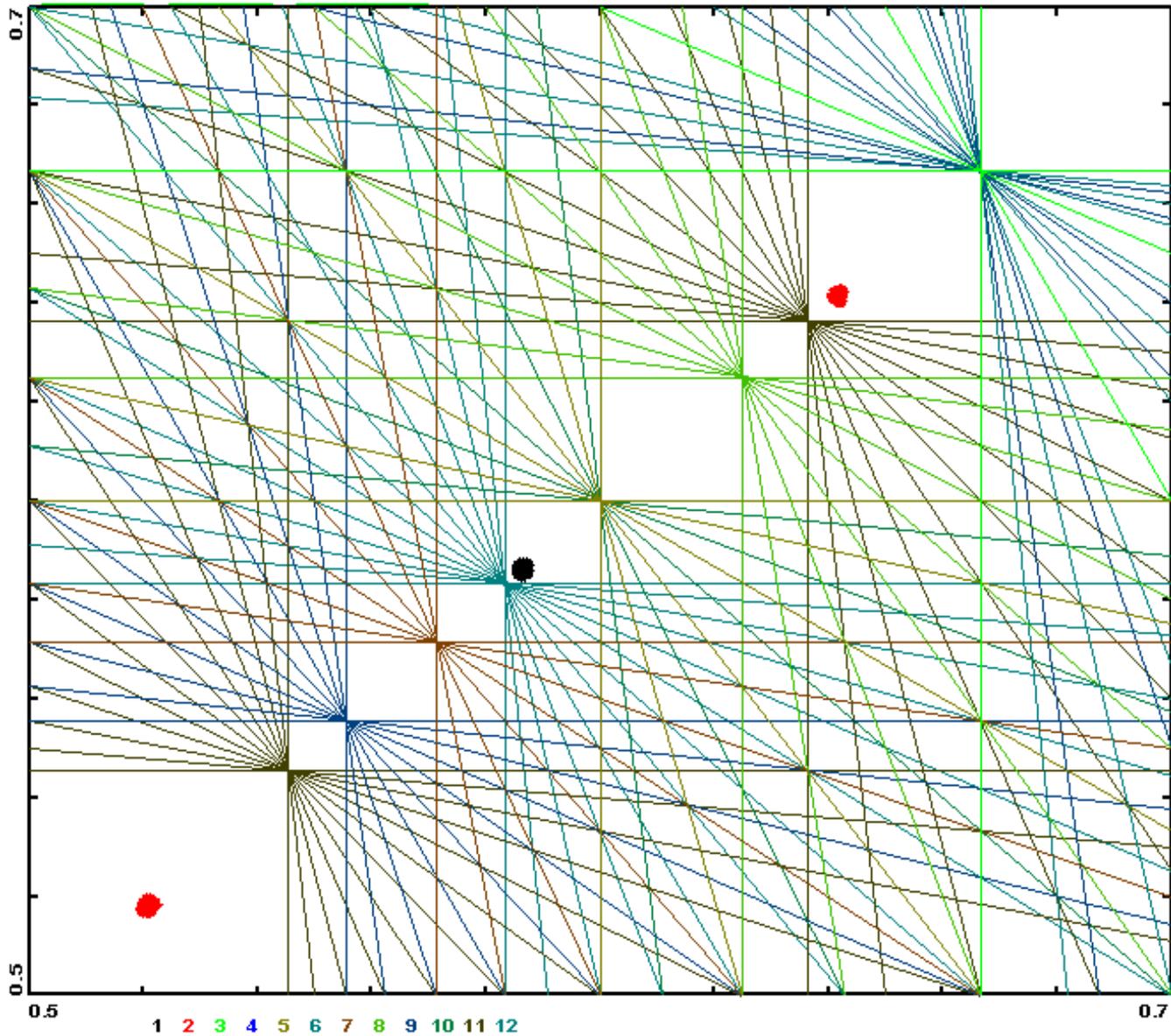
- Further increase in luminosity is associated with increase of the beam intensities -> larger beam-beam effects
- Intensity and emittance life times determined by high order nonlinear betatron resonances
- To mitigate their effect, one needs to either decrease tune spread or increase available space in the tune diagram -> New working point

# Resonance Grid



Yu. Alexahin, V. Shiltsev

# New Working Point - 1/2 or 2/3 ?



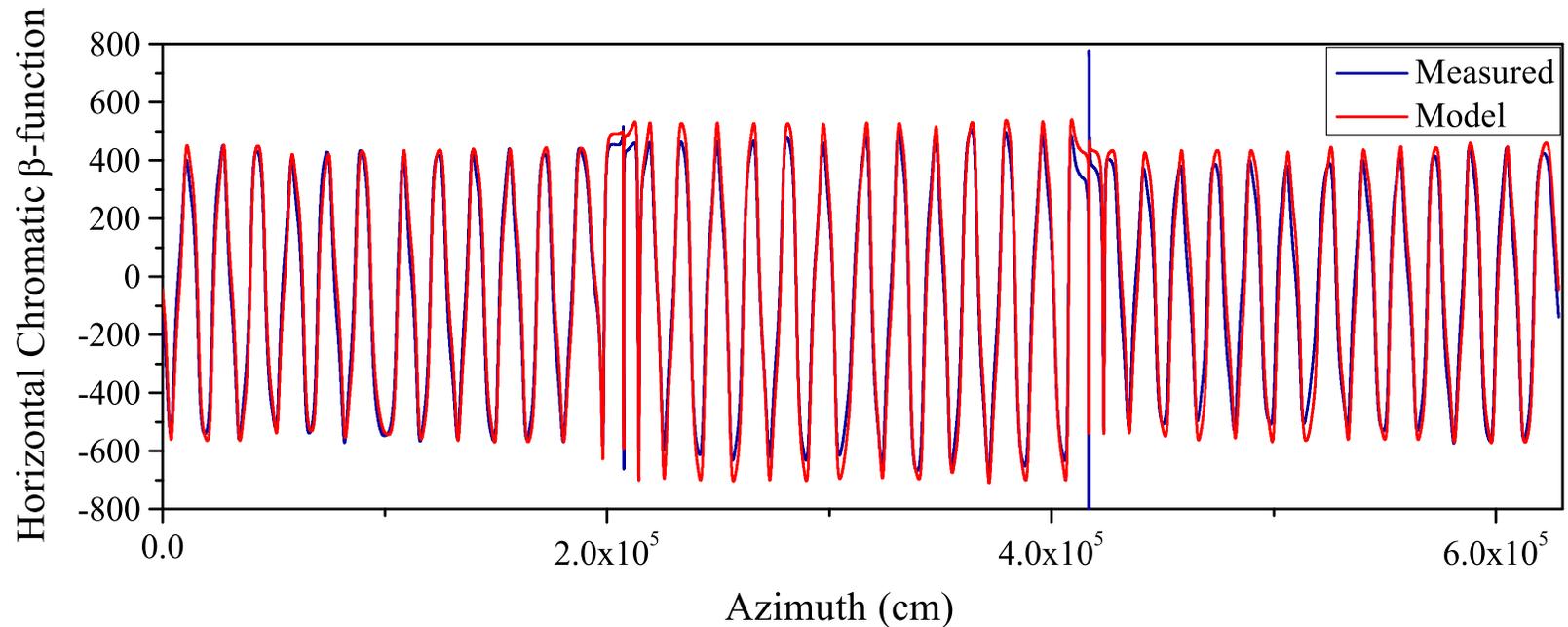
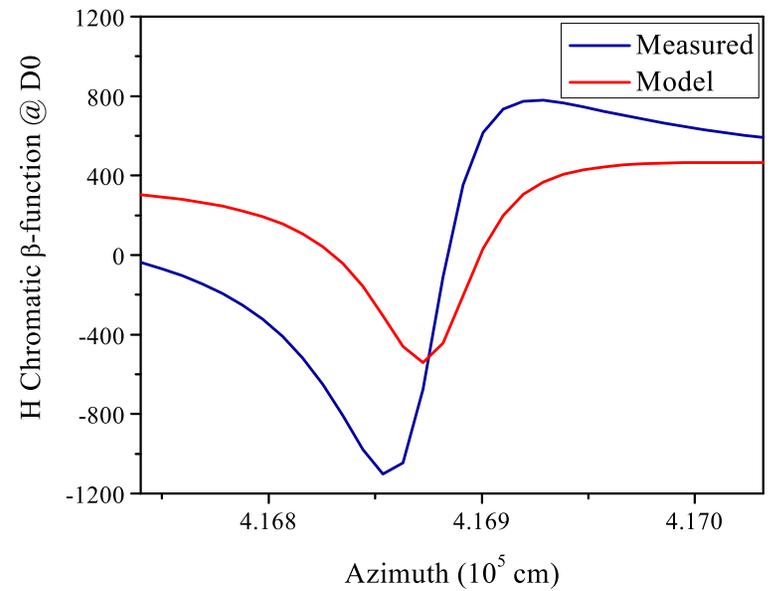
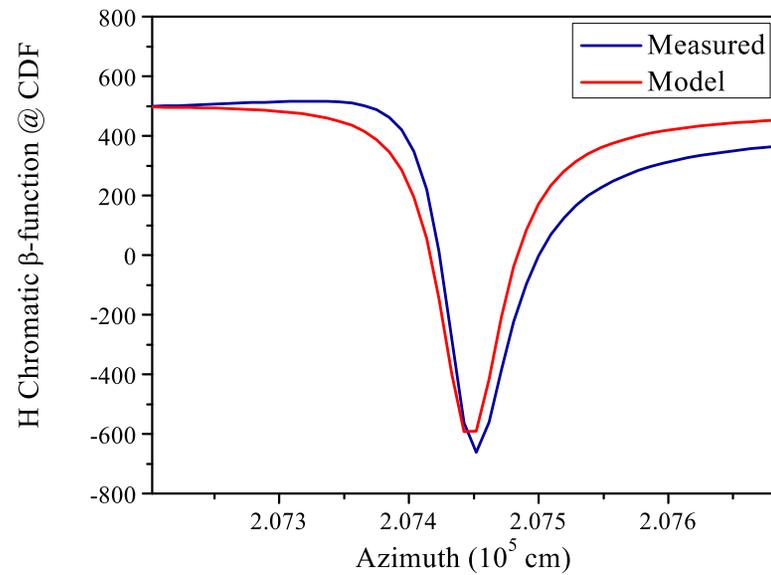
# Limiting Factor - Width of Resonance

1. 2/3 - Dominated by distribution of sextupole errors and lattice sextupoles. Measured width is  $\sim 0.015$
2. 1/2 - Driven by quadrupole errors which cause distortions of beta-function. Primary source - chromatic errors. Measured  $\sim 0.02$

$$G = -\frac{e}{pc} \frac{\partial B_y}{\partial x} = G_0 \left( 1 - \frac{\Delta p}{p} \right)$$

$$\frac{\Delta \beta_{x,y}(s)}{\beta(s)} / \frac{\Delta p}{p} = \frac{\mp 1}{2 \sin(2\pi Q_{x,y})} \sum_i GL_i(\beta_{x,y})_i \cos(2|\varphi(s) - \varphi_{x,y i}| - 2\pi Q_{x,y})$$

# Beta-Function Chromaticity - X - Measured

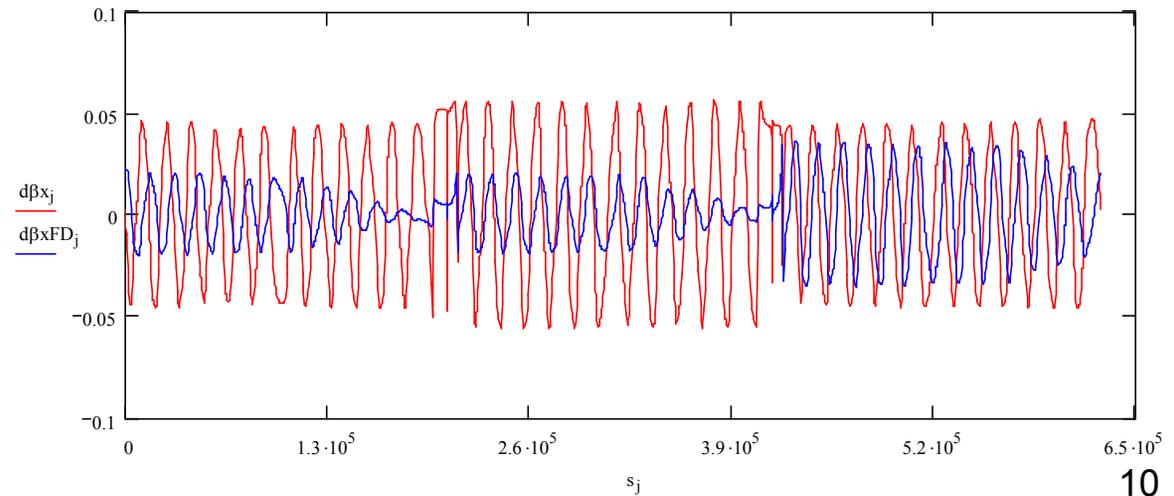
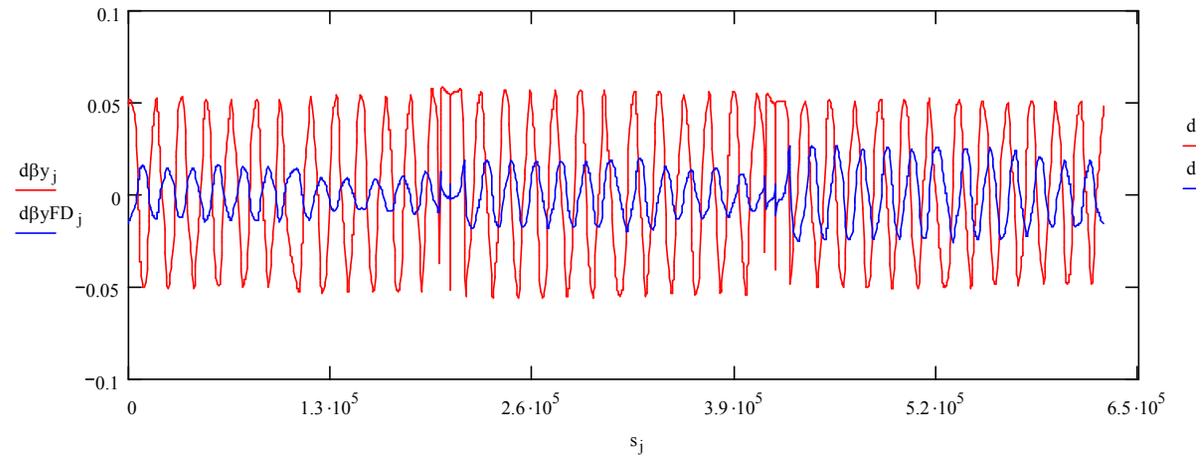


# Correction of Chromatic Betas - V3

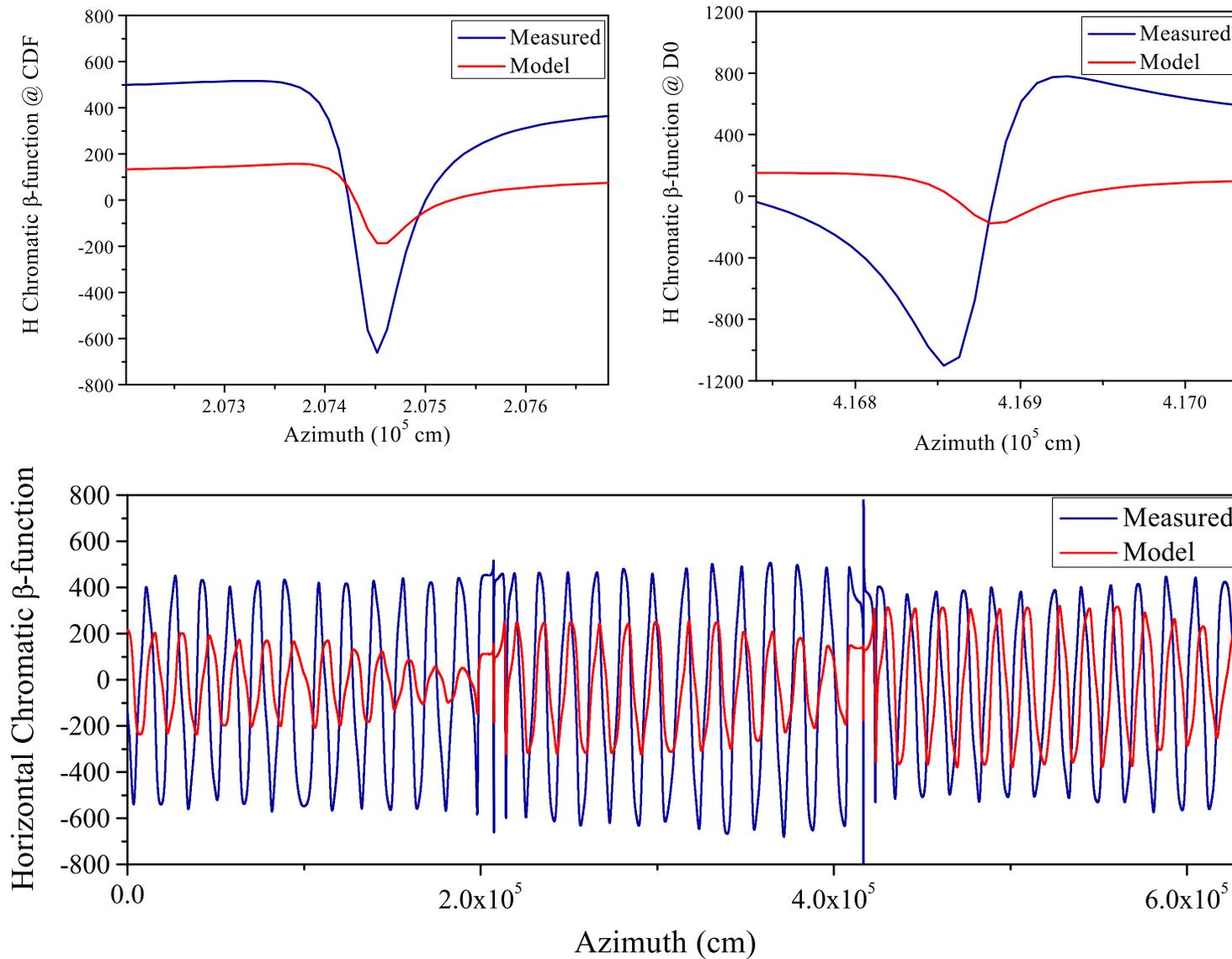
SF=12A  
SD=-32A

SF=12A  
SF4=-27A  
SF6=18A

SD=-32A  
SD4=43A  
SD6=33A



# Beta-Function Chromaticity - X -Corrected V3



# Plan

- During the shutdown, pull cables for the new sextupole circuits and do preparation work
- Test beta chromaticity compensation
- Develop optics for working point near  $\frac{1}{2}$
- Measure distribution of sextupole nonlinearities and develop correction methods