# Study of Differential Chromaticity at 150GeV

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# Motivation

- After shutdown, vertical chromaticity on the pbar helix at LowBeta is high, which is believed to increase beam-beam induced losses
- We consider possible use of O1(2) family for compensation of difference between proton and pbar helices
- To increase the efficiency of O1(2), one needs to flip polarities of several octupoles
- Since this family is used at injection energy, a measurement of its effect on differential chromaticity was required

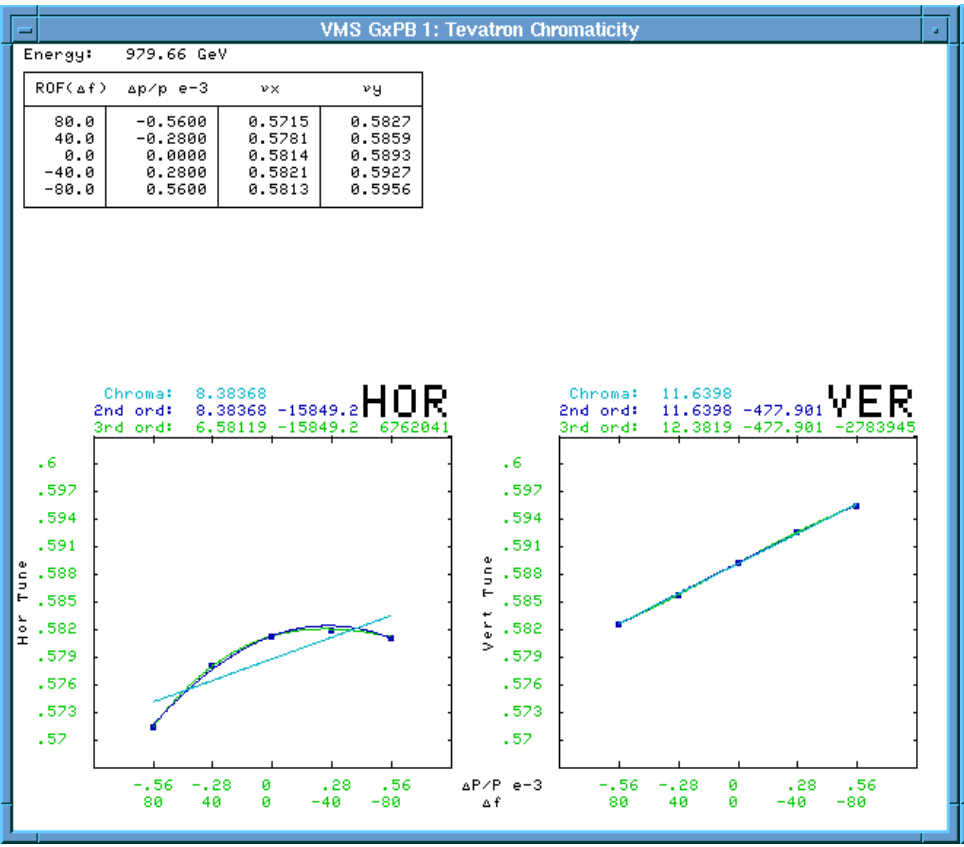
# Differential Chromaticity at LowBeta Before Shutdown

## Proton helix

VMS GxPB 1: Tevatron Chromaticity

Energy: 979.66 GeV

| ROF(Δf) | Δp/p e-3 | νx | νy |
|---|---|---|---|
| 80.0 | -0.5600 | 0.5715 | 0.5827 |
| 40.0 | -0.2800 | 0.5781 | 0.5859 |
| 0.0 | 0.0000 | 0.5814 | 0.5893 |
| -40.0 | 0.2800 | 0.5821 | 0.5927 |
| -80.0 | 0.5600 | 0.5813 | 0.5956 |



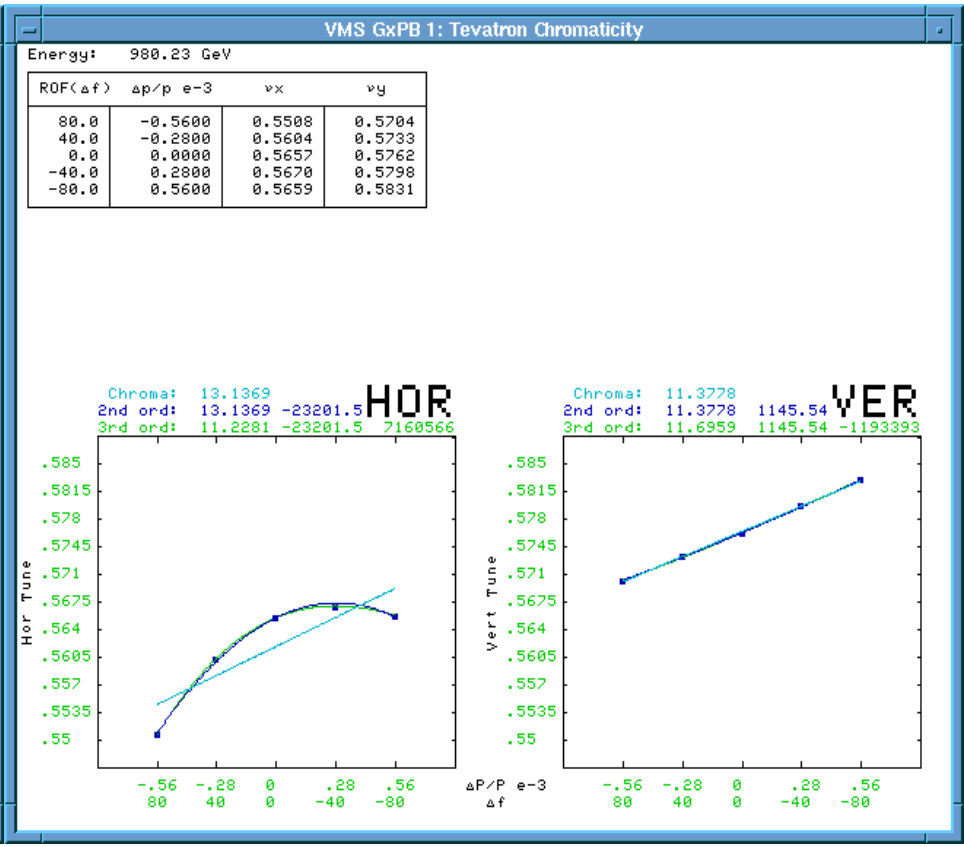

Ch=6.5 Cv=12.4

## Antiproton helix

VMS GxPB 1: Tevatron Chromaticity

Energy: 980.23 GeV

| ROF(Δf) | Δp/p e-3 | νx | νy |
|---|---|---|---|
| 80.0 | -0.5600 | 0.5508 | 0.5704 |
| 40.0 | -0.2800 | 0.5604 | 0.5733 |
| 0.0 | 0.0000 | 0.5657 | 0.5762 |
| -40.0 | 0.2800 | 0.5670 | 0.5798 |
| -80.0 | 0.5600 | 0.5659 | 0.5831 |



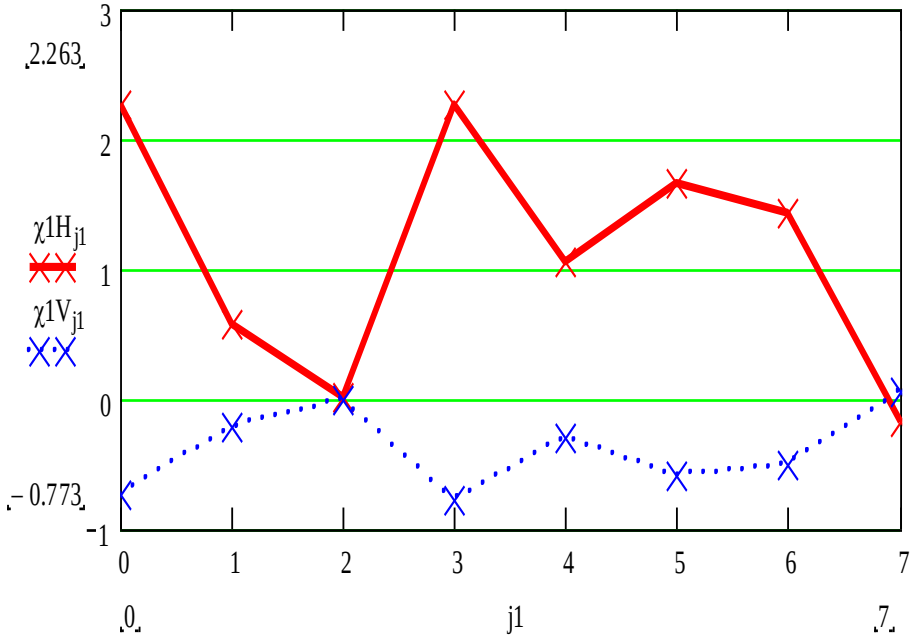

Ch=11.2 Cv=11.7

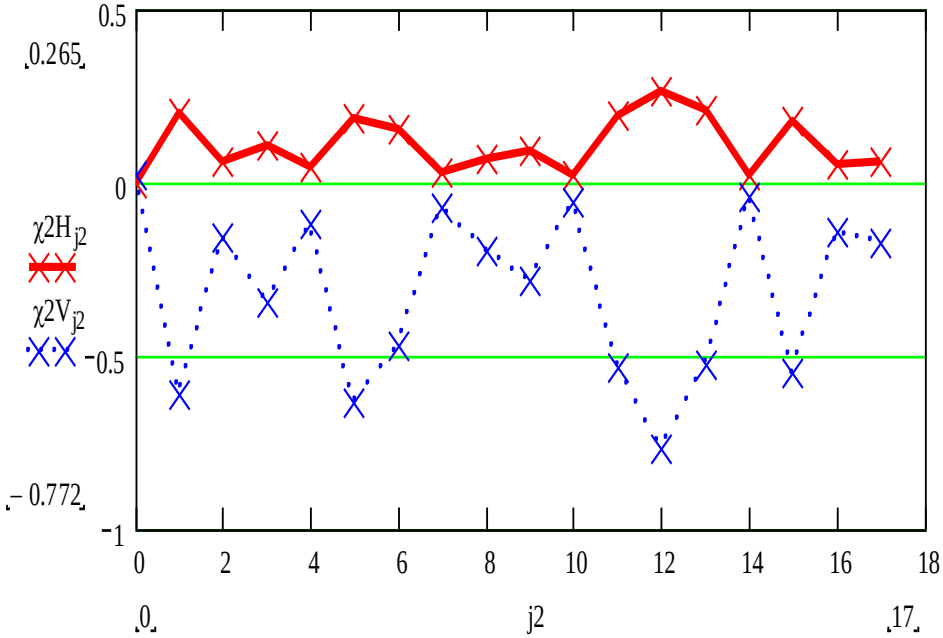
# Effect of O1 and O2 on Differential Chromaticity at LowBeta (Before Shutdown)

| | dCh | dCv |
|---|---|---|
| O1 (+40A) | 5 | -4 |
| O2 (+50A) | 1.5 | -2.5 |

dC = dCp - dCa

# Possible Changes to the Octupole Families




O1- 6

O2 – 3,4,9,12,15

dCh = 6.2 (5) -> 9

dCv = -2.0 (-4) -> -3

dCh = 0.5 (1.5) -> 1.9

dCv = -1.5 (-2.5) -> -5.7

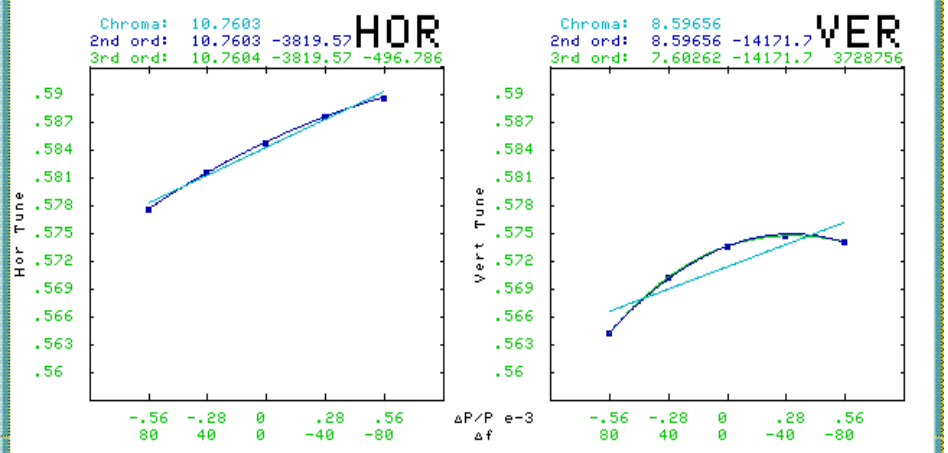
# Differential Chromaticity at LowBeta After Shutdown (6/10/06)

## Proton helix

VMS GxPC 1: Tevatron Chromaticity

Energy: 980.23 GeV

| ROF(Δf) | Δp/p e-3 | νx | νy |
|---|---|---|---|
| 80.0 | -0.5600 | 0.5778 | 0.5644 |
| 40.0 | -0.2800 | 0.5817 | 0.5704 |
| 0.0 | 0.0000 | 0.5850 | 0.5737 |
| -40.0 | 0.2800 | 0.5877 | 0.5748 |
| -80.0 | 0.5600 | 0.5898 | 0.5742 |



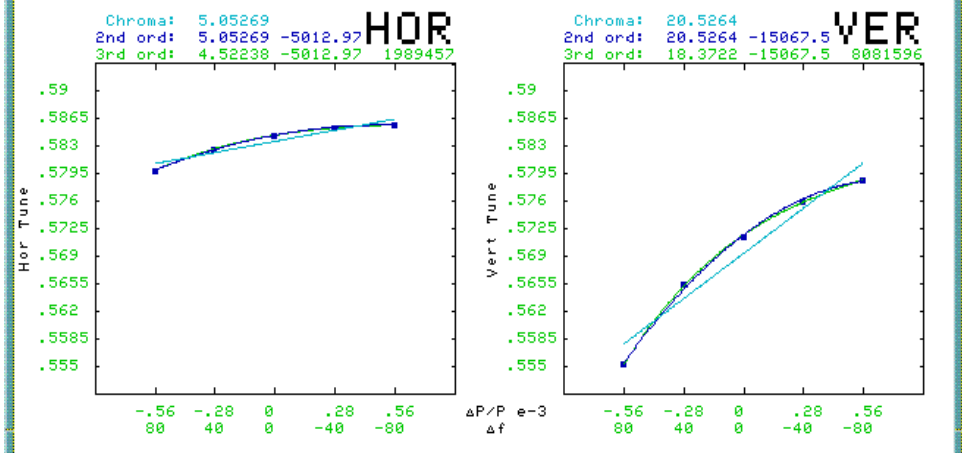

Ch=10.7 Cv=8.6

## Antiproton helix

VMS GxPC 1: Tevatron Chromaticity

Energy: 980.23 GeV

| ROF(Δf) | Δp/p e-3 | νx | νy |
|---|---|---|---|
| 80.0 | -0.5600 | 0.5800 | 0.5554 |
| 40.0 | -0.2800 | 0.5828 | 0.5655 |
| 0.0 | 0.0000 | 0.5845 | 0.5716 |
| -40.0 | 0.2800 | 0.5854 | 0.5761 |
| -80.0 | 0.5600 | 0.5858 | 0.5788 |




Ch=5.0 Cv=20.5

# Effect of O1 and O2 on Differential Chromaticity at LowBeta (After Shutdown)

| | dCh | dCv |
|---|---|---|
| O1 (-40A) | 1.4 | -4.7 |
| | | |

dC = dCp - dCa

# Effect of O1 Octupoles at 150GeV

| | ON | | OFF | |
|---|---|---|---|---|
| | Ch | Cv | Ch | Cv |
| proton | 4.1 | 3.5 | 4.7 | 3.2 |
| pbar | -0.3 | 2.6 | -0.6 | 2.0 |

# Effect of O2 on Differential Chromaticity at 150GeV (After Shutdown)

| | dCh | dCv |
|---|---|---|
| O2 (-1.27A->0A) | -0.5 | 1.7 |
| O1 (-0.2) | 0.9 | 0.3 |

dC = dCp - dCa