

# Coherent beam-beam effects

**GOAL**: Coherent Beam-Beam Effect for Multiple Bunches and Different Colliding Schemes

- **Analytically**

Matrices Formalism with Linearized Beam-Beam Force and evaluation of the eigenvalues and eigenmodes of the systems

- **Simulations**

- Based on existing Program

- Different collision path (number of IPs, symmetries of the IPs)

- Different beam configurations (number of bunches per beam, gaps)

**Present simulations:** Intensity Fluctuations Bunch to Bunch and  
Effect on the Tune Spectra

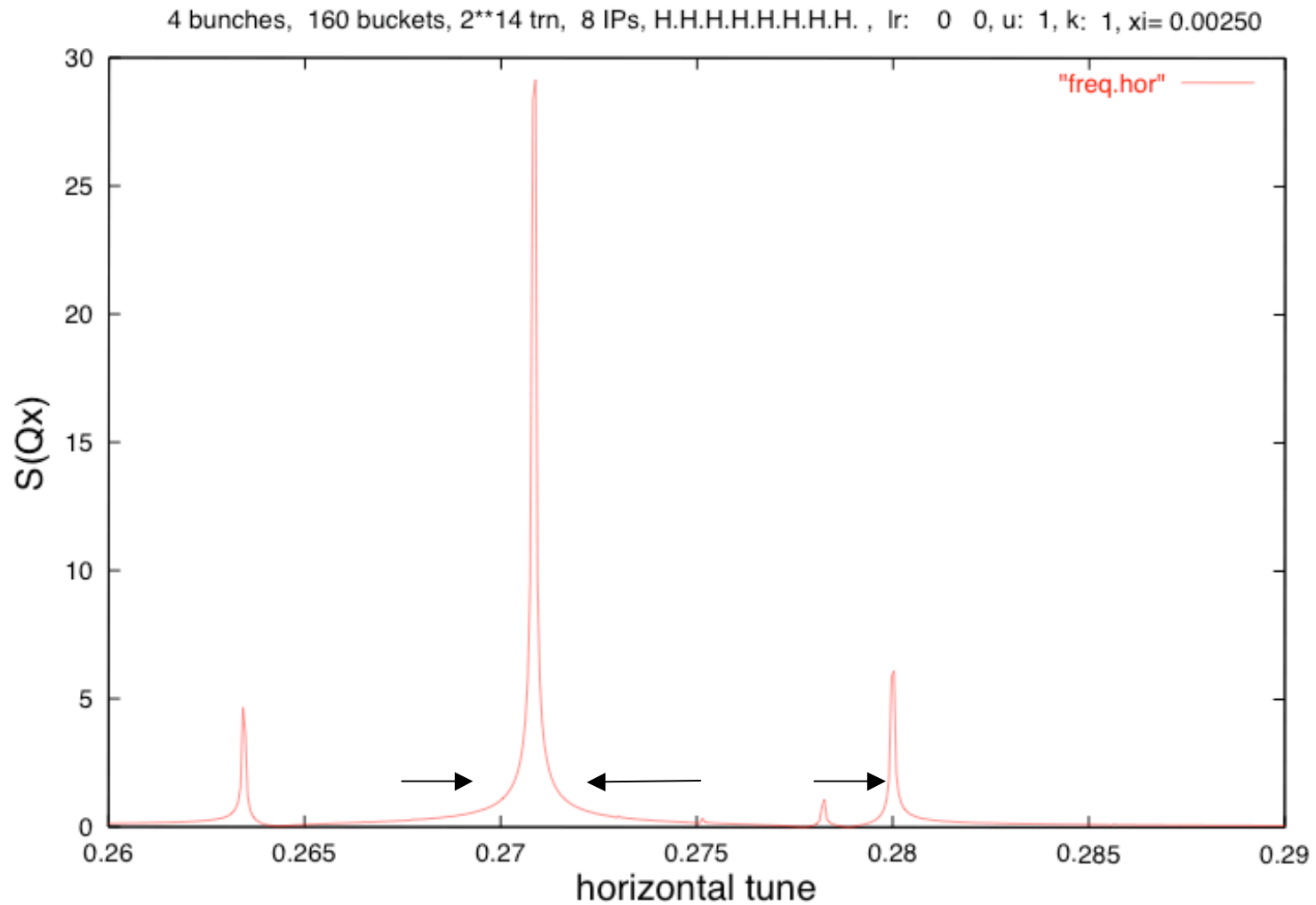
**SIMULATION INPUTS:**

- 2 counter rotating beams, 4 equispaced bunches each
- 8 symmetric Interaction Points
- Symmetric phase advance between Ips (LHC phase advance)
- 2\*\*14 turns
- beam-beam parameter = 0.0025

**PARAMETER:**

**Beam 1** 4 bunches each with relative intensity = 1, 1, 1, **IREL**

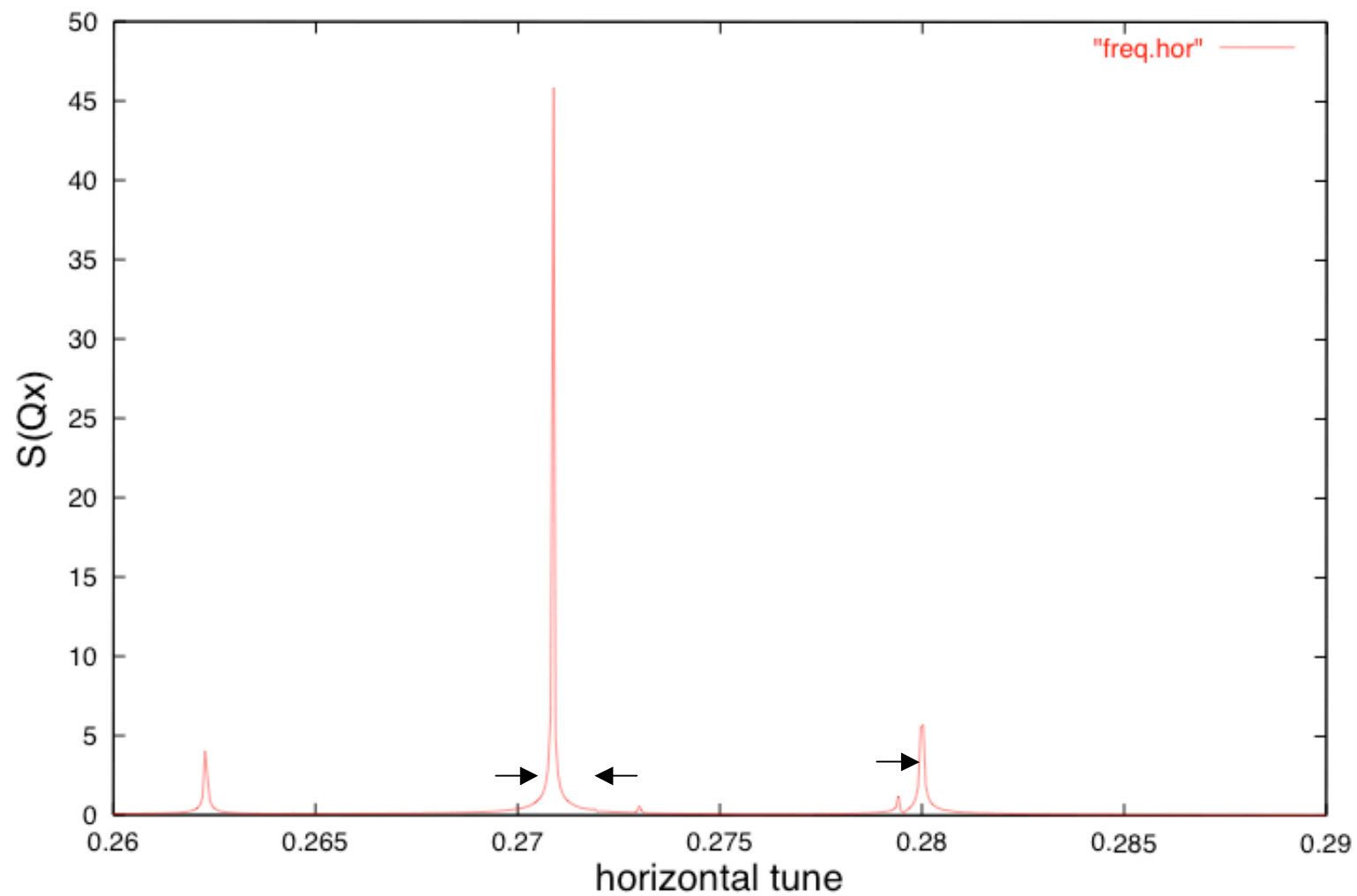
**Beam 2** 4 bunches each with relative intensity = 1, 1, 1, 1



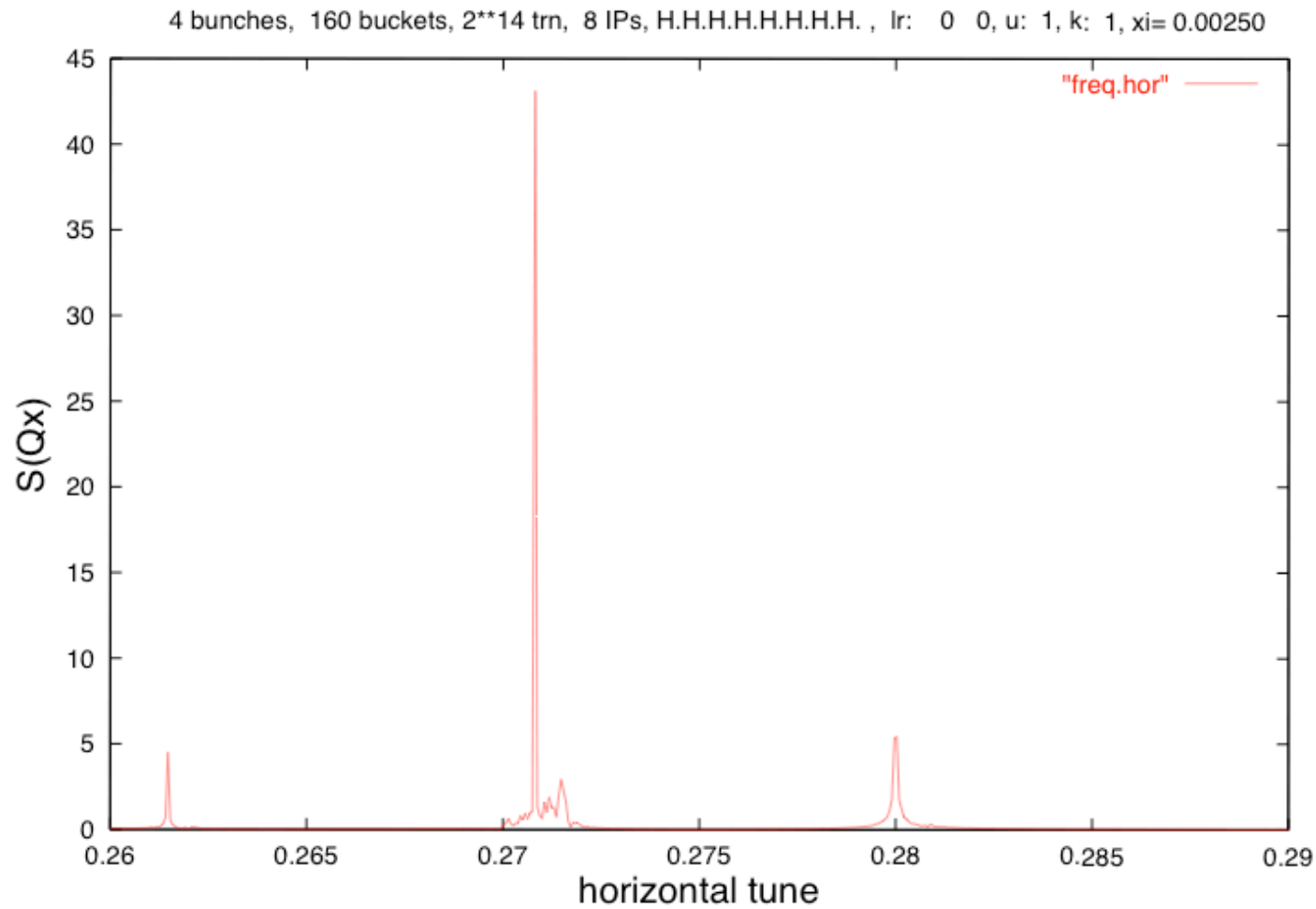
IREL= 0.1

Increasing the IREL the modes slides to higher or  
Smaller tunes

4 bunches, 160 buckets, 2\*\*14 trn, 8 IPs, H.H.H.H.H.H.H.H. , lr: 0 0, u: 1, k: 1, xi= 0.00250



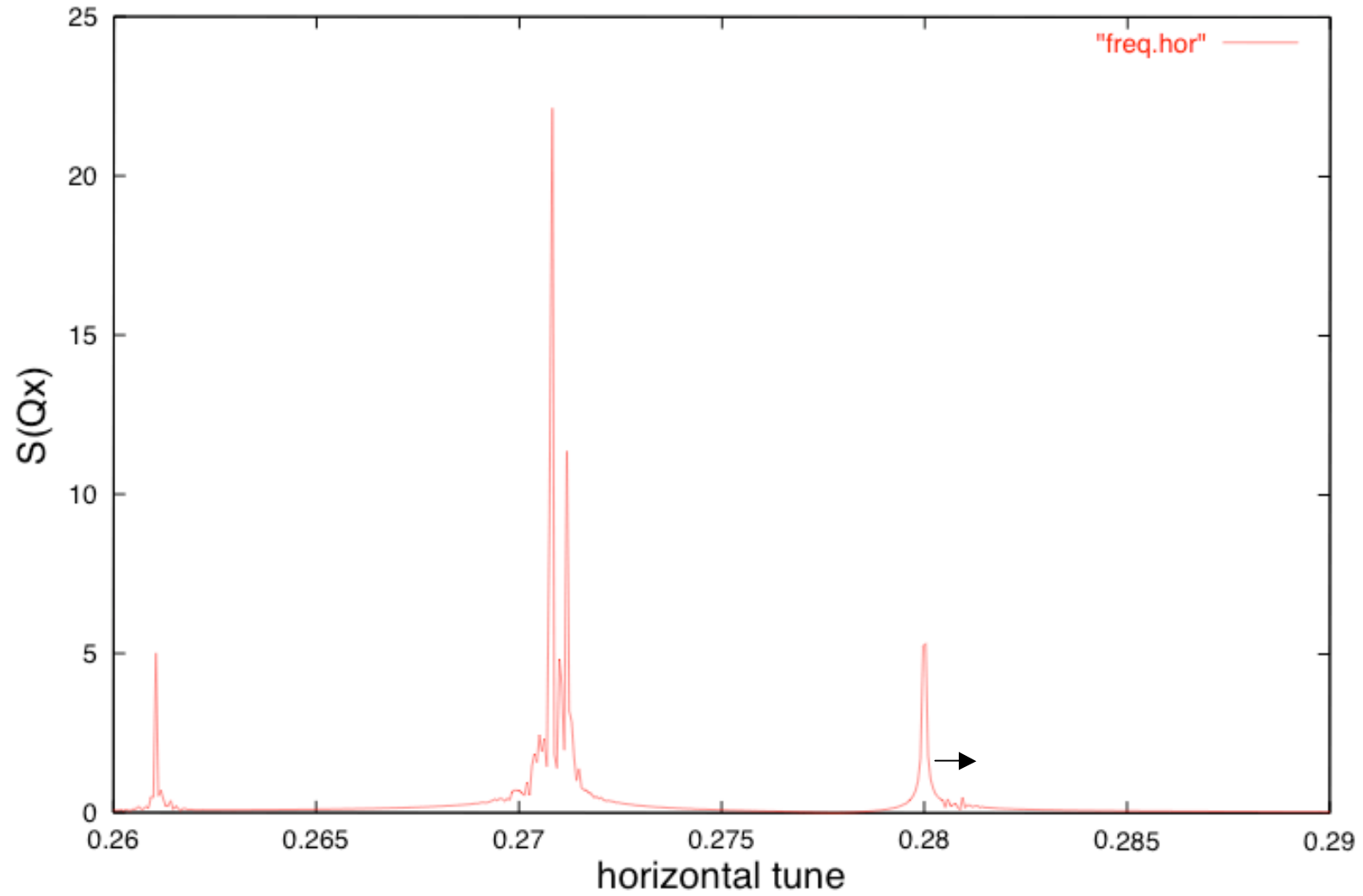
IREL = 0.5



IREL= 0.8

For a certain IREL different modes overlap  
resulting in a wilder spectra

4 bunches, 160 buckets, 2\*\*14 trn, 8 IPs, H.H.H.H.H.H.H.H. , lr: 0 0, u: 1, k: 1, xi= 0.00250



IREL = 0.95

# On-going

- **Simulations**

- Intensity Fluctuation of different bunches**

- Analysis Tune spectra for different variations of the relative intensity

- Different symmetries and configurations

- Use linearized BB Force to compare simulation results with analytical

- **Matrix formalism**

- In linear BB force approximation evaluation of the matrices form to Compare with simulation scenario

- Calculation of the eigenvalues and eigenmodes of the system with a variable intensity to compare with simulation