LHC AC dipole preliminary noise considerations

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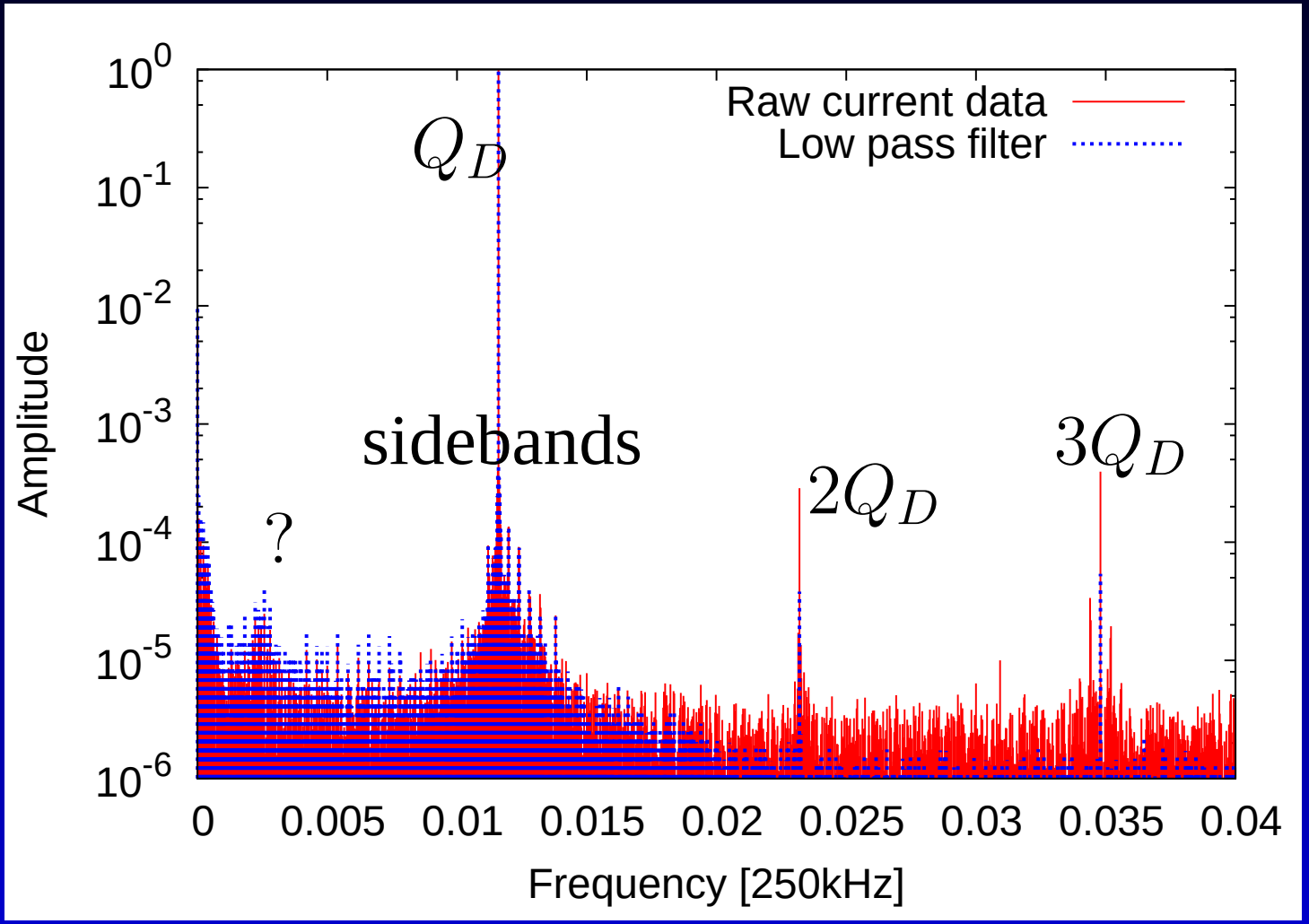
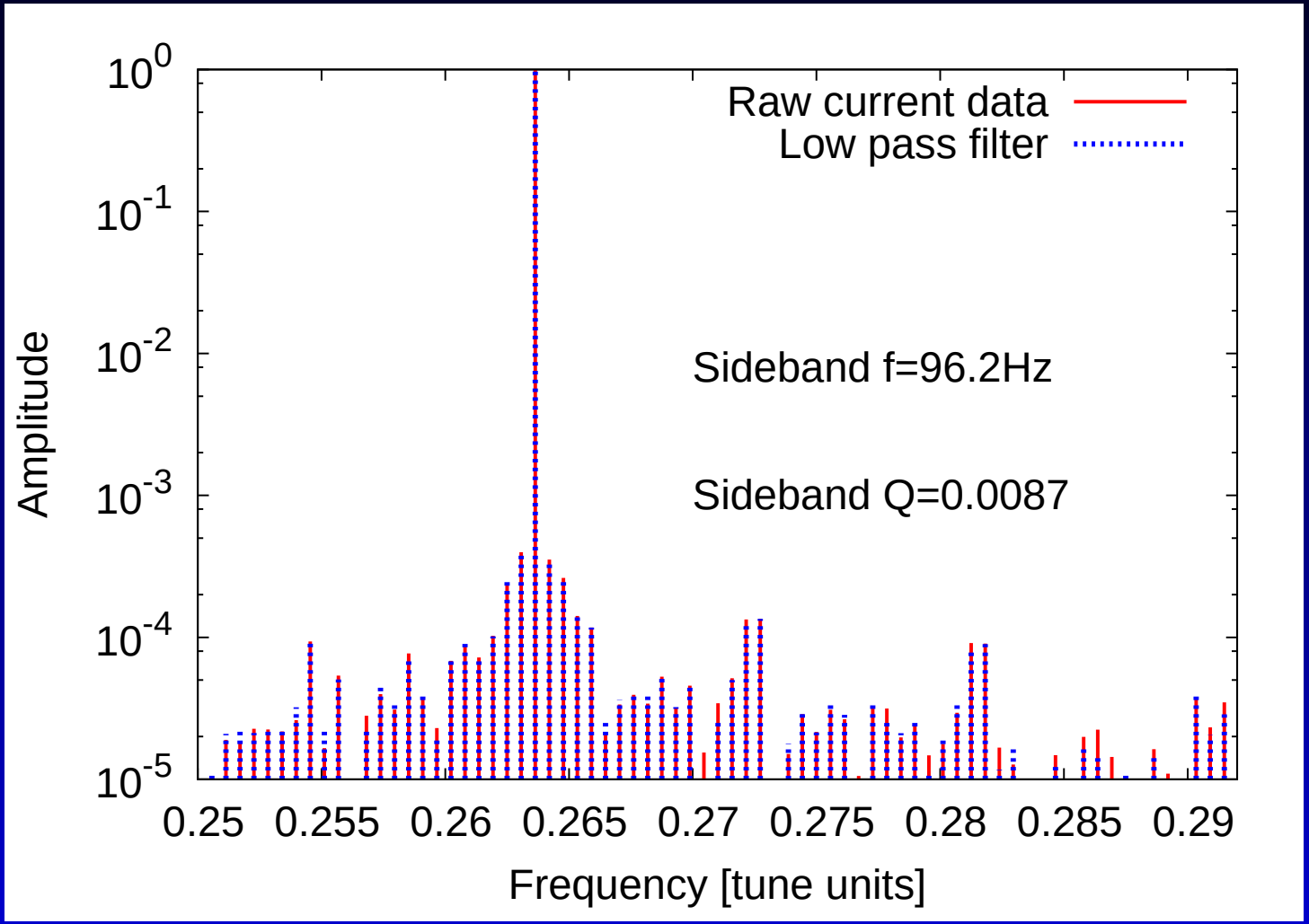
AC dipole signal from Javier



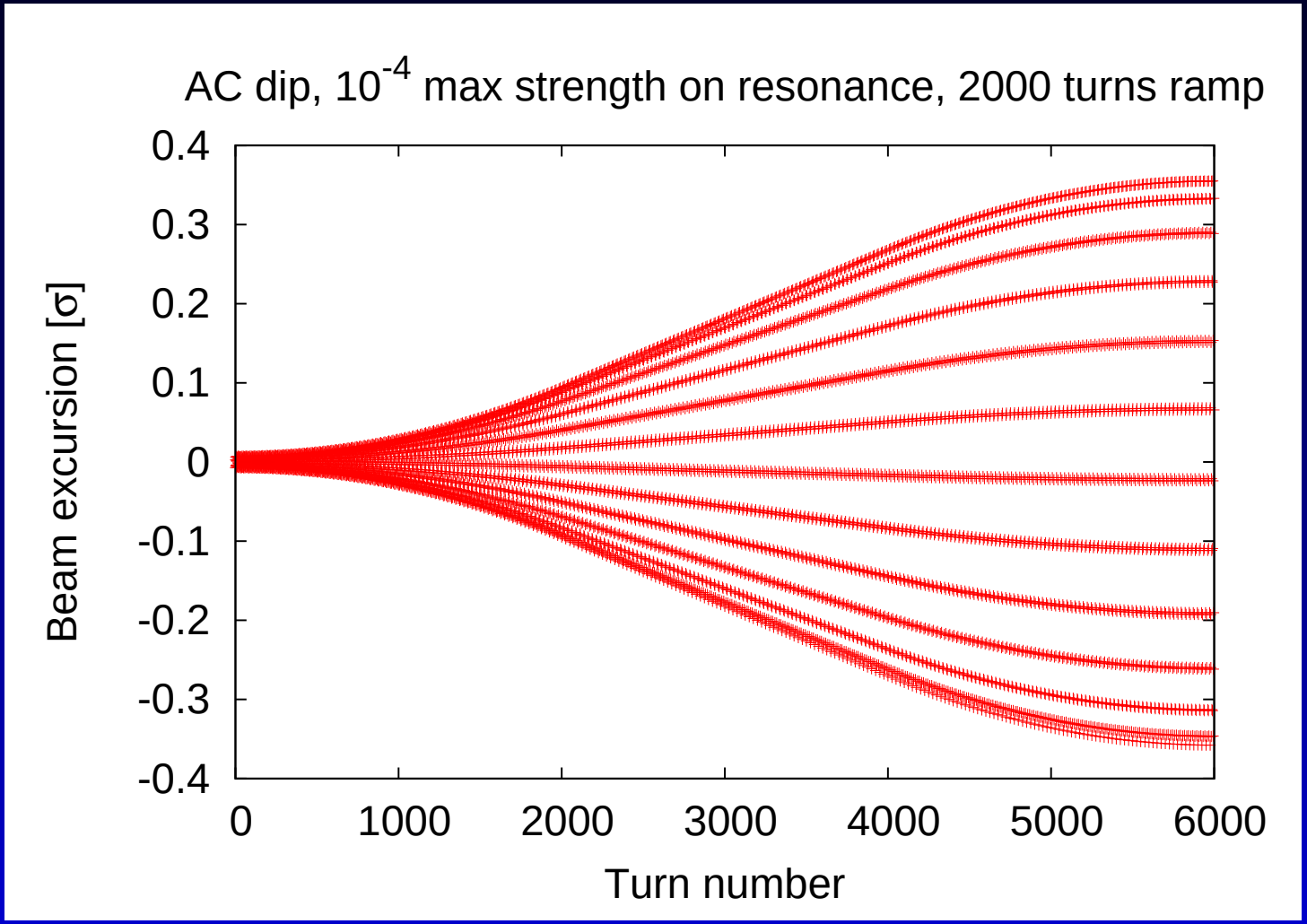
Noise floor at 10^{-5} level and sidebands and peaks close to 10^{-4} level.

Zoom on sidebands



Are these sidebands real?

Simulating a 10^{-4} peak on Q_x at max AC str



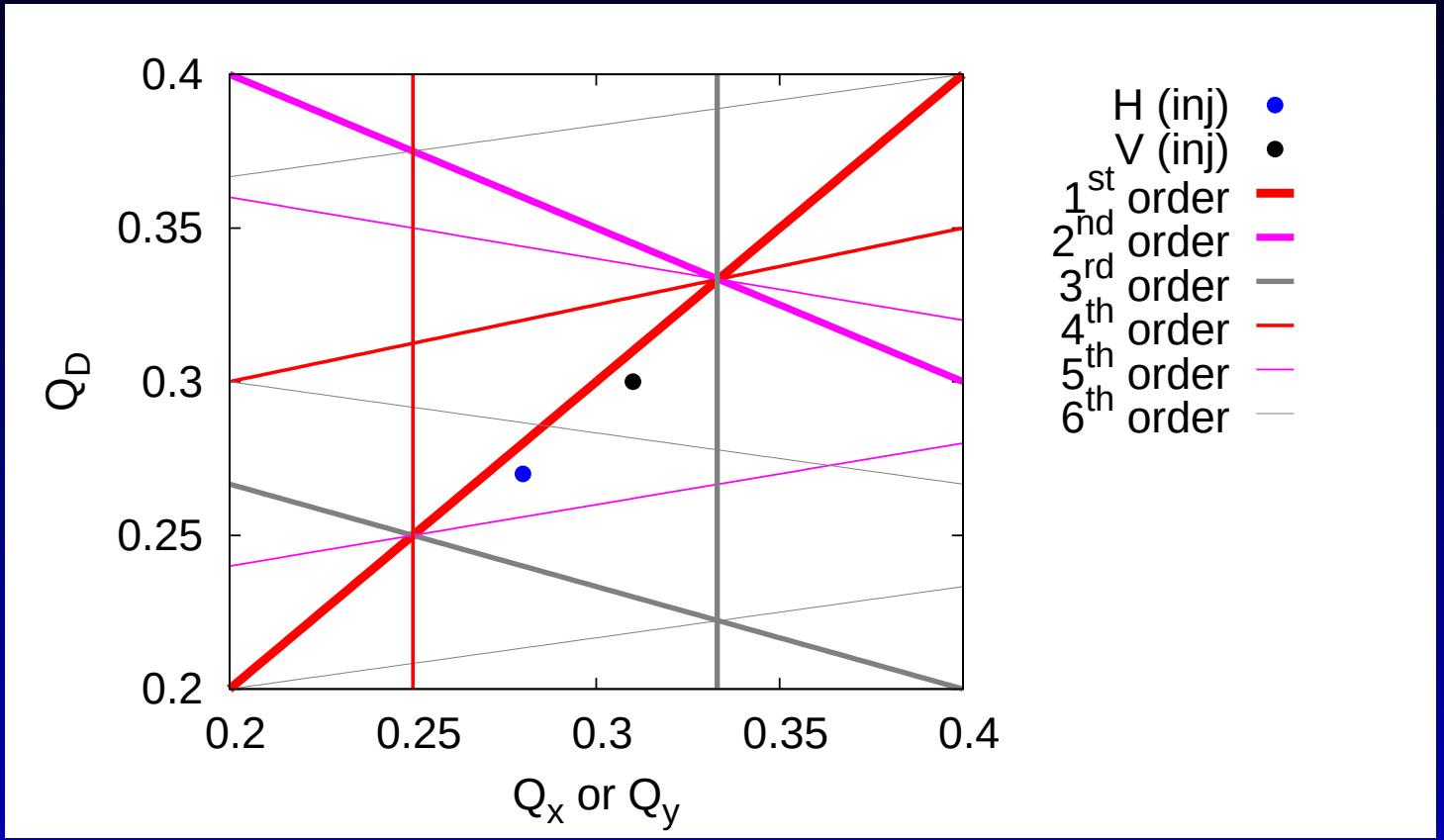
10^{-4} noise peak on resonance causes 0.4σ oscillation

$\longrightarrow$ 16% emittance blow-up

So,

- Noise floor is well at 10^{-5} level ($\approx$0.2% blow-up)
- Sidebands are worrysome
- Peaks at 10^{-4} seem dangerous only if on resonance
- Avoid resonance conditions of the form $NQ_D + Q_{x,y} = Z$
- Which was anyway suggested to avoid non-linear resonances from a perfect AC dipole: PRSTAB **5** 54001 and "Reliable Operation of the AC dipole in the LHC", EPAC08.

AC dipole non-linear resonances



$$-Q_x + (k - j + 1)Q_D = p \ , \ \text{with} \ (j, k, p) \in Z^3$$

$\longrightarrow$ In presence of strong coupling the diagram is 3D!

The effect of $-Q_x-3Q_D=-1$