Transverse Schottky signals with space charge

- Important diagnostic tool in storage rings/mode
- Obtain coherent spectrum of stable beam.
- Measure Landau damping.
- Code validation !

Recent publications:

Pestrikov, NIM A (2007/2008)

Boine-Frankenheim, Kornilov, Paret, PRST-AB (2008)

Transverse Schottky signal:

$$d(t) = \sum_{j=0}^{N} x_j(t) I_j(t)$$

coasting beam coherent betatron lines:

$$\Omega_n = (n \pm Q_0) f_0$$

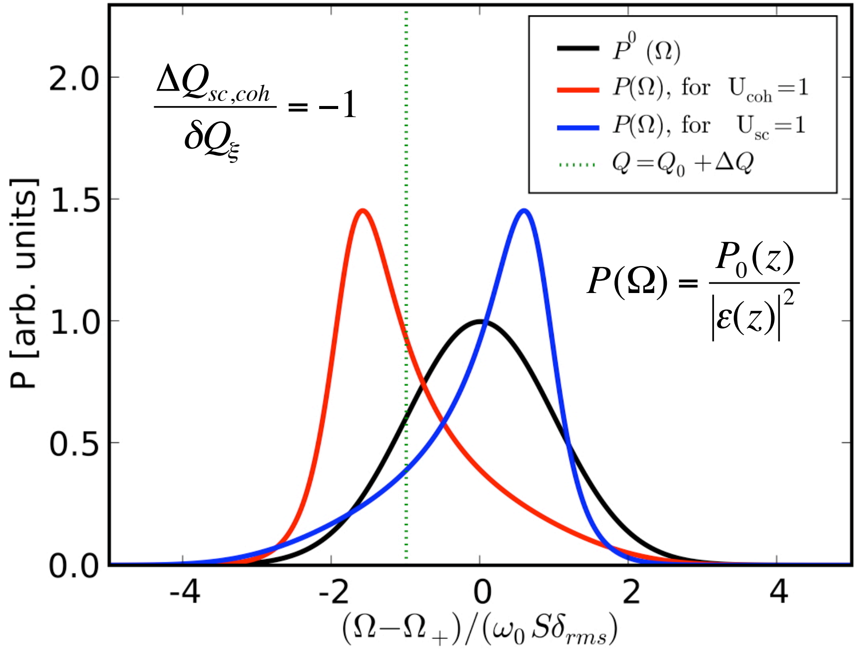
Low intensity Schottky band: $P^0(\Omega)$

Modified Schottky band (analytic approach):

- Assuming linear space charge (KV-dist.)
- Dispersion relation with space charge:

$$\varepsilon(z) = 1 - D(z)$$

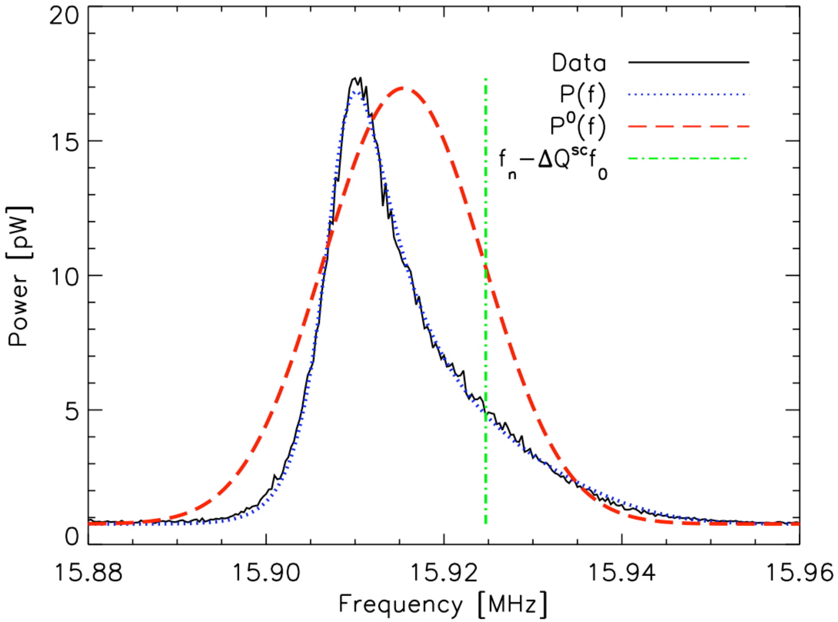
-For D(z) see e.g. B. Ng



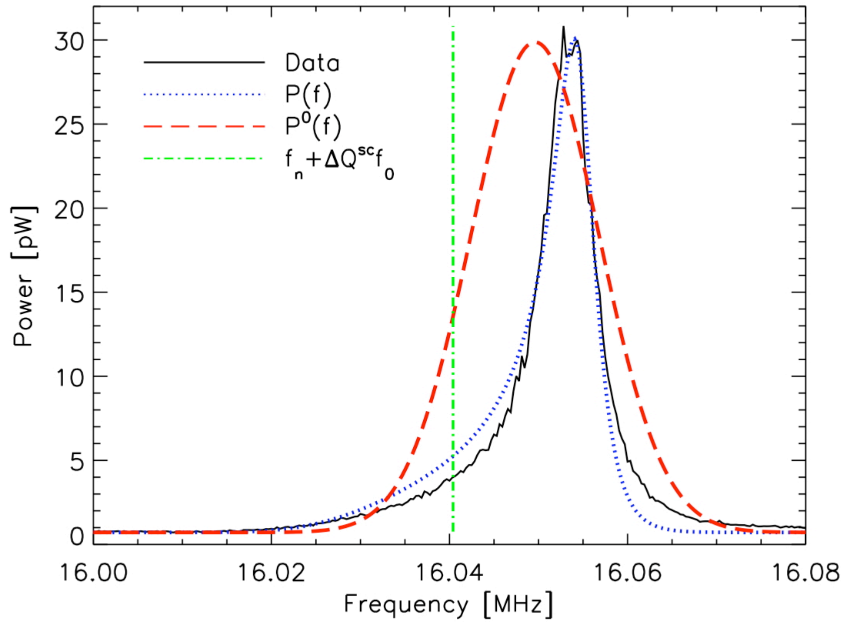
Schottky noise measurement in SIS-18

coasting beam with space charge

Lower sideband (n=75)



Upper sideband (n=75)



Comparing the measured Schottky bands with P(z) we can obtain the space charge parameter.

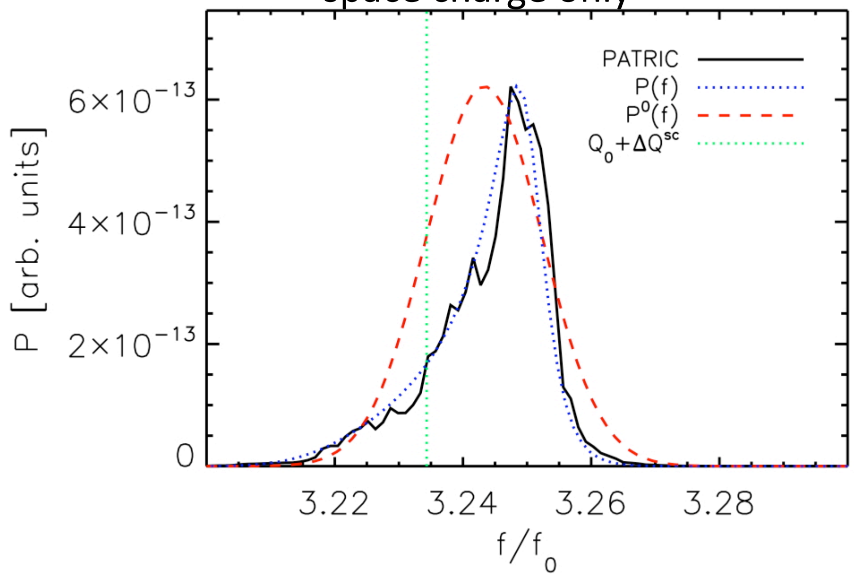
$$\frac{\Delta Q_{sc}}{\delta Q_{\xi}} = -1.1/1.3$$

From: Boine-Frankenheim, Kornilov, Paret, PRST-AB (2008)

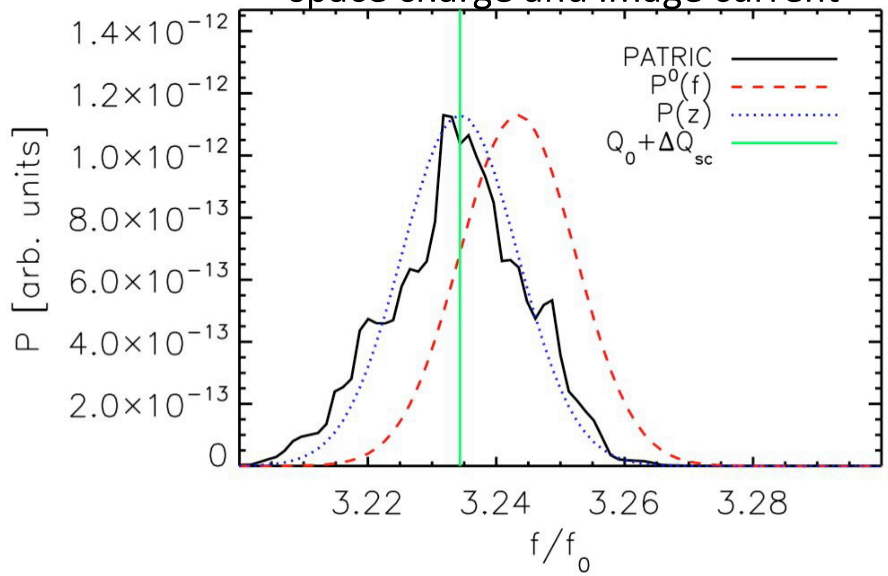
Transverse Schottky signal from a computer beam:

$$d(t) = \sum_{j=0}^{N_p} x_j(t) I_j(t)$$

space charge only



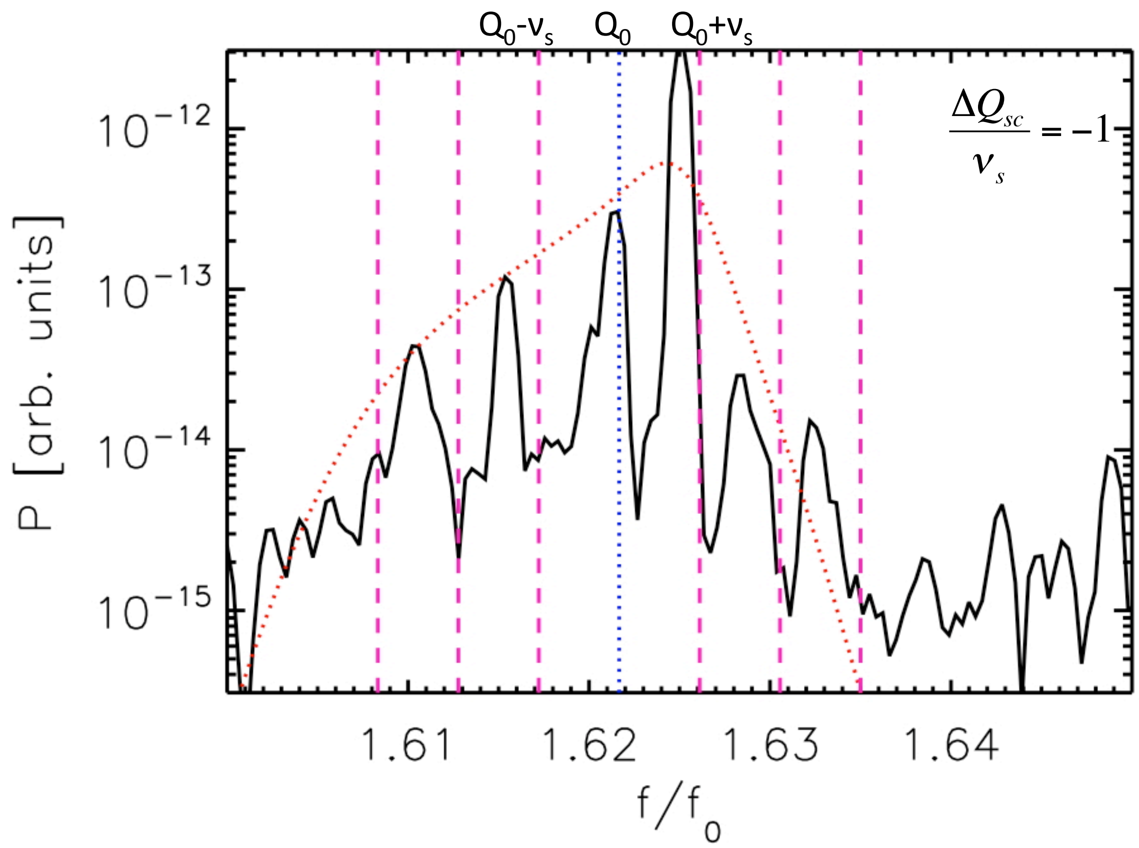
space charge and image current



Simulation of transverse Schottky signals with space charge

Bunched beams

Central line is not shifted, but synchrotron satellites are.
Amplitudes seem to follow the coasting beam results P(z).



Next step:

-Measurement and interpretation of transverse Schottky noise from bunches with space charge in SIS-18.

Questions:

-Mode spectrum in (long) bunches with space charge and image currents.

-Landau damping of these modes.

-Mode coupling with space charge and image currents.