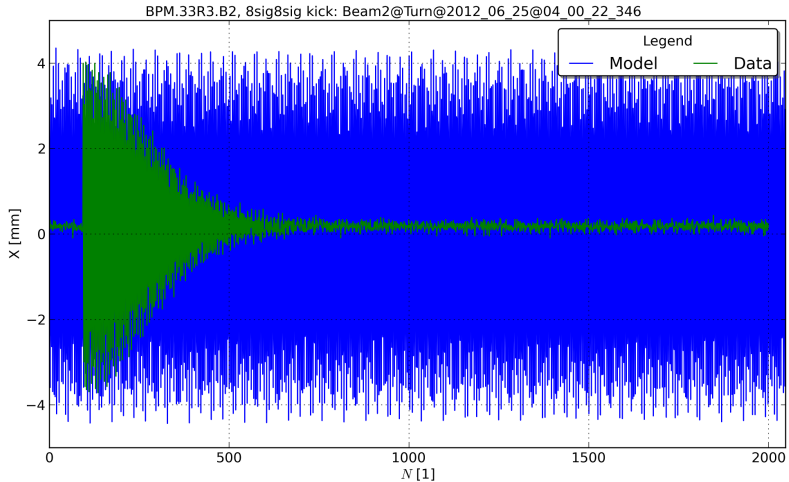# Strong (1,2) line in horizontal BPM spectrum of 2012 kick data

Robert Westenberger
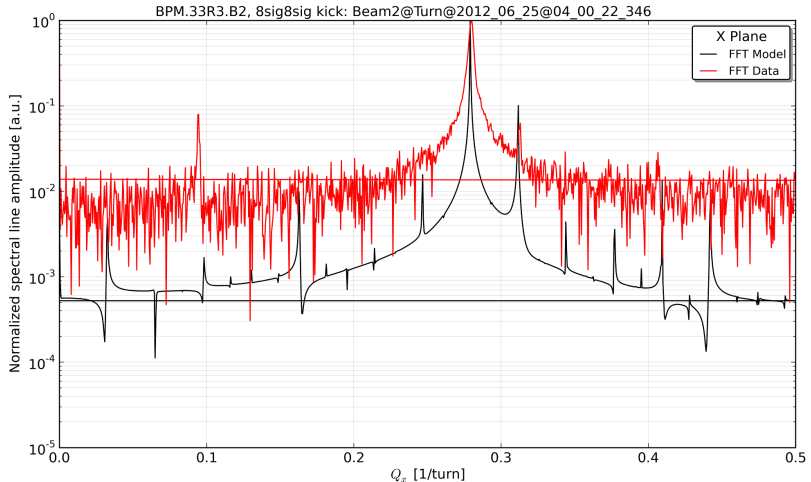
BE-ABP
Non-linear studies meeting

27.06.2014
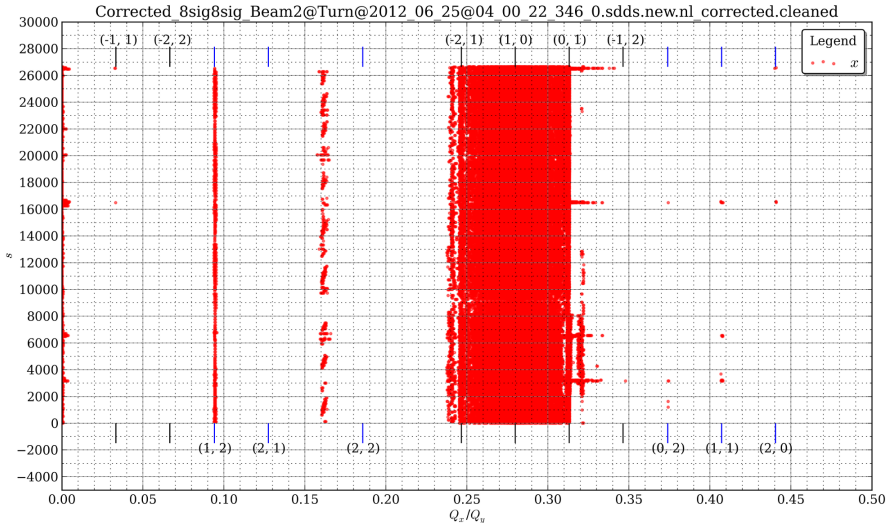
Model comparison for one example BPM (signal)

BPM.33R3.B2, 8sig8sig kick: Beam2@Turn@2012_06_25@04_00_22_346

Model comparison for one example BPM (spectrum), very
strong (1,2) line at $Q_x \approx 0.094$

BPM.33R3.B2, 8sig8sig kick: Beam2@Turn@2012_06_25@04_00_22_346
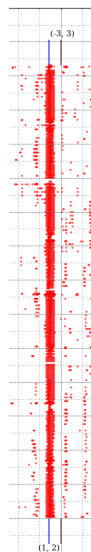
You might remember `plotSpectrum.py`:

8sig/8sig diagonal kick data

- ▶ strong (1,2) line in horizontal spectrum (about 2 orders of magnitude above model expectations)
- ▶ seems to be appearing in all BPMs

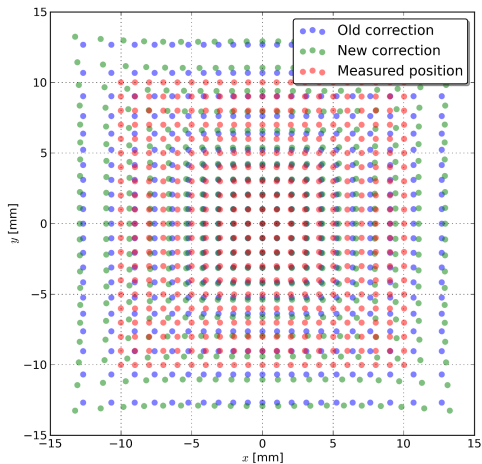# First possible explanation: BPM non-linearity

With: u and $v \in \{x, y\}$

Old correction (2011-2013):

$$u_{\text{bpm}} = A\, u_{\text{raw}}^5 + B\, u_{\text{raw}}^3 + C\, u_{\text{raw}} \tag{1}$$
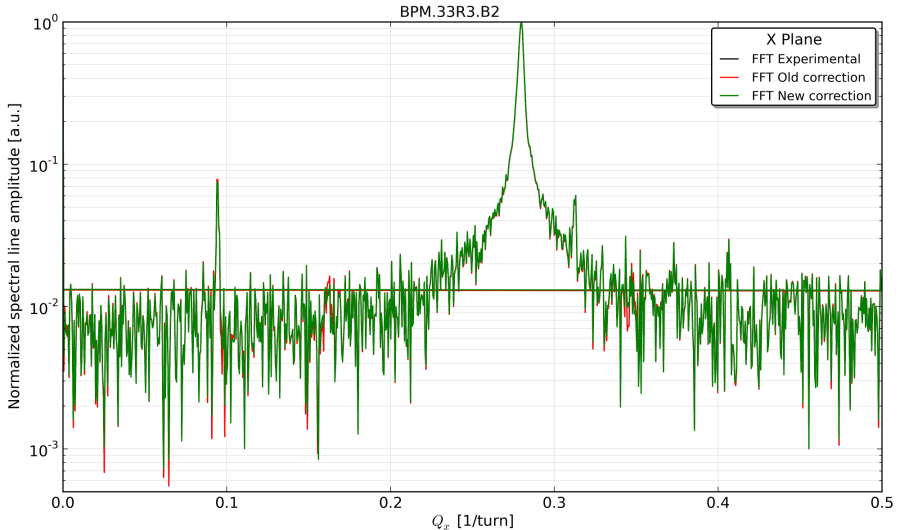
New correction (2015-):

$$\begin{aligned}
u_{\text{bpm}} = {} & A\, u_{\text{raw}}^5 + B\, u_{\text{raw}}^3 + C\, u_{\text{raw}} \\
& + D\, u_{\text{raw}}^3 v_{\text{raw}}^2 + E\, u_{\text{raw}} v_{\text{raw}}^4 + F\, u_{\text{raw}} v_{\text{raw}}^2
\end{aligned} \tag{2}$$

Comparison between measured beam positions from -10 mm to
10 mm, old and new correction

Deviation between measured
data and correction in order
of 10 %

So what's the influence on our spectrum? None (roughly).

Possible explanations would be:

- $\times$ line coming from the BPMs:
  $\rightarrow$ BPM non-linearity: new 2015 BPM non-linearity correction applied to the data, leading only to some minor changes

- ? bug in data analysis (unlikely but possible)
  Test-driven developement should avoid most common error sources.

- ? line coming from the machine:
  $\rightarrow$ unkown resonance?
  Turn-by-turn data split into parts with and without kick response, (1,2) amplitude nearly constant while (1,0) amplitude decreases! Further analysis needed.
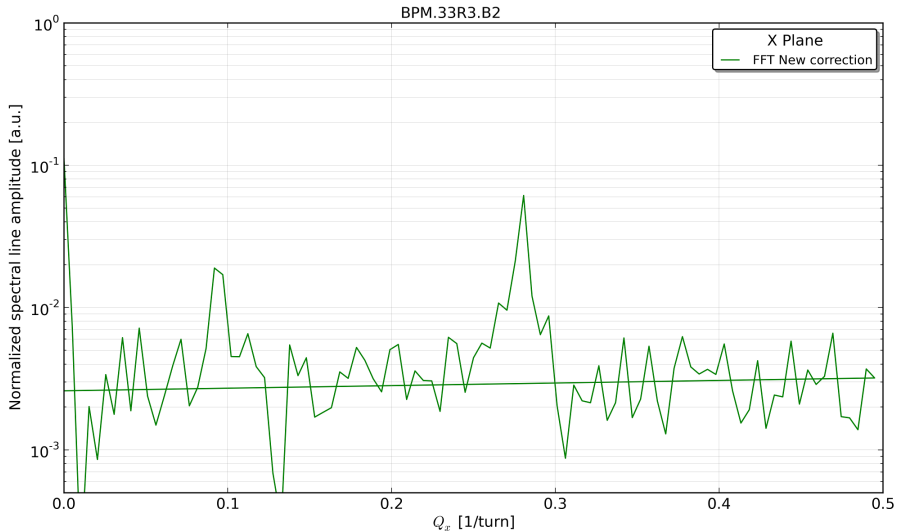
- ? other source?

FFT of turns 93 to 300:
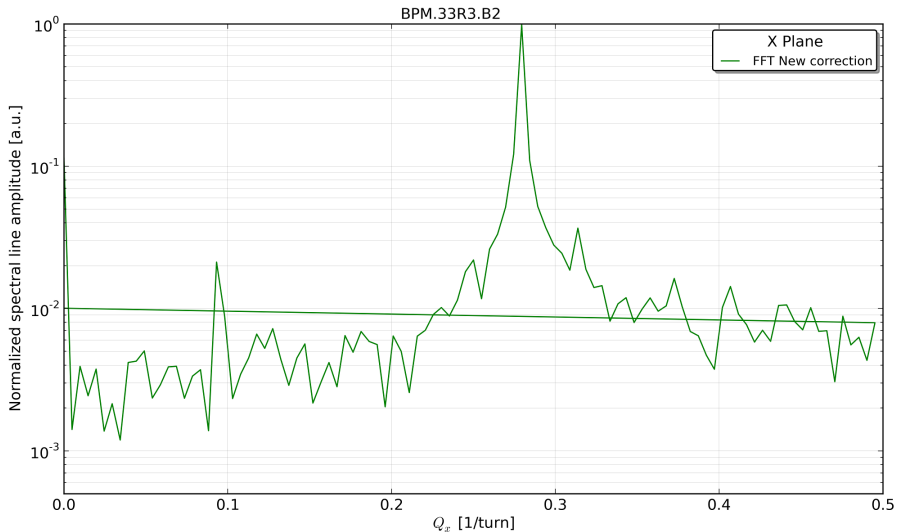
FFT of turns 301 to 500:
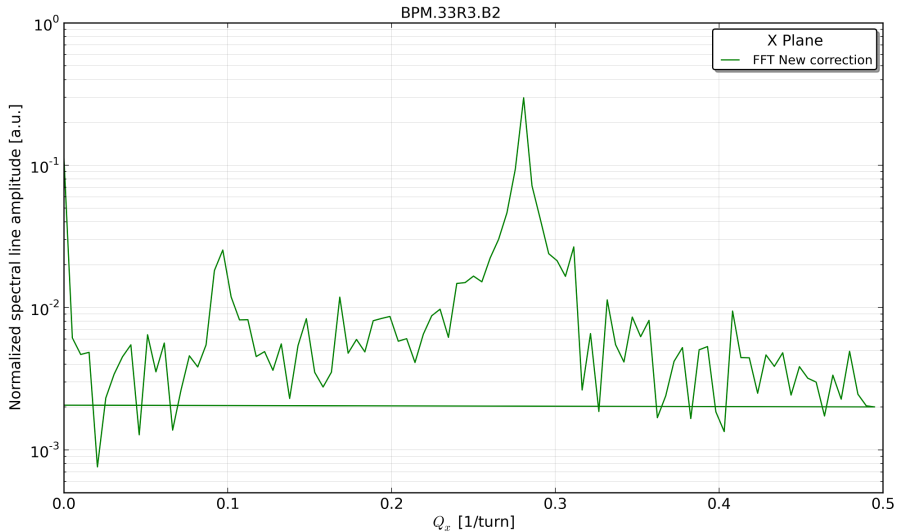
FFT of turns 501 to 700:

FFT of turns 701 to 900: