Analysis ATF data

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Data provided by Eliana Gianfelice

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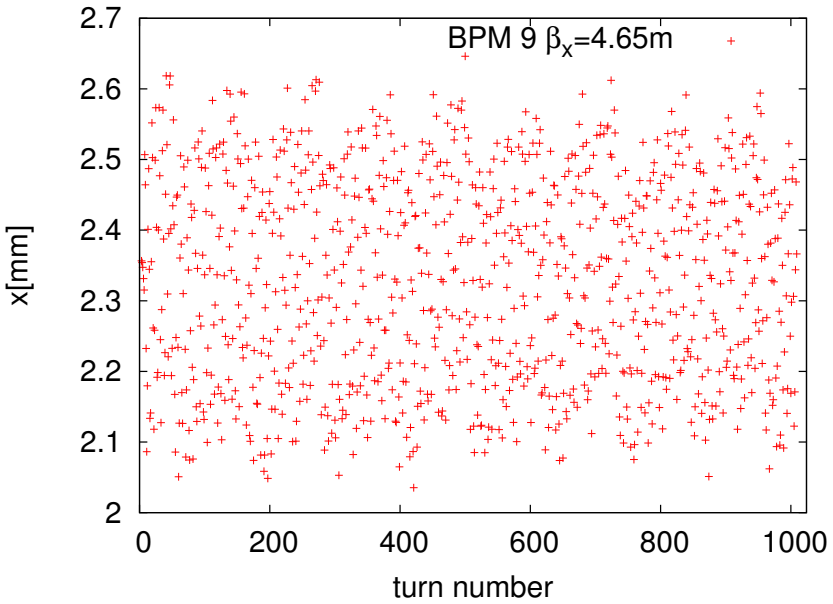
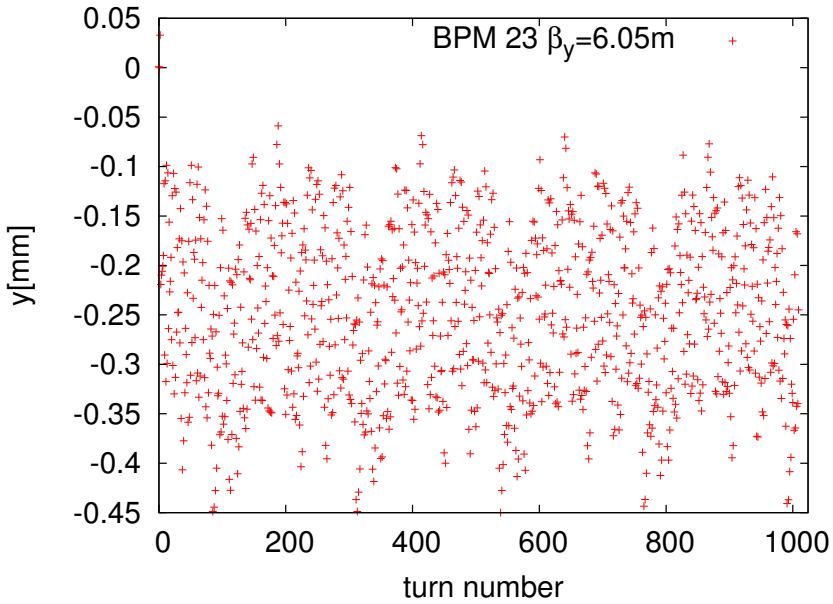
Turn-by-turn data

- For the analysis either kick or injection data is needed.
- SVD or SUSSIX are used to analyze turn-by-turn data.
  - SVD identifies only main betatron line.
  - SUSSIX identifies main and secondary lines.
- GetLLM package is used to calculate several optics parameters:
  - phase and total phase advance.
  - beta either from phase or amplitude.
  - dispersion and normalized dispersion.
  - resonance driving terms to identify non-linear effect.
  - chromatic functions (beta and coupling).



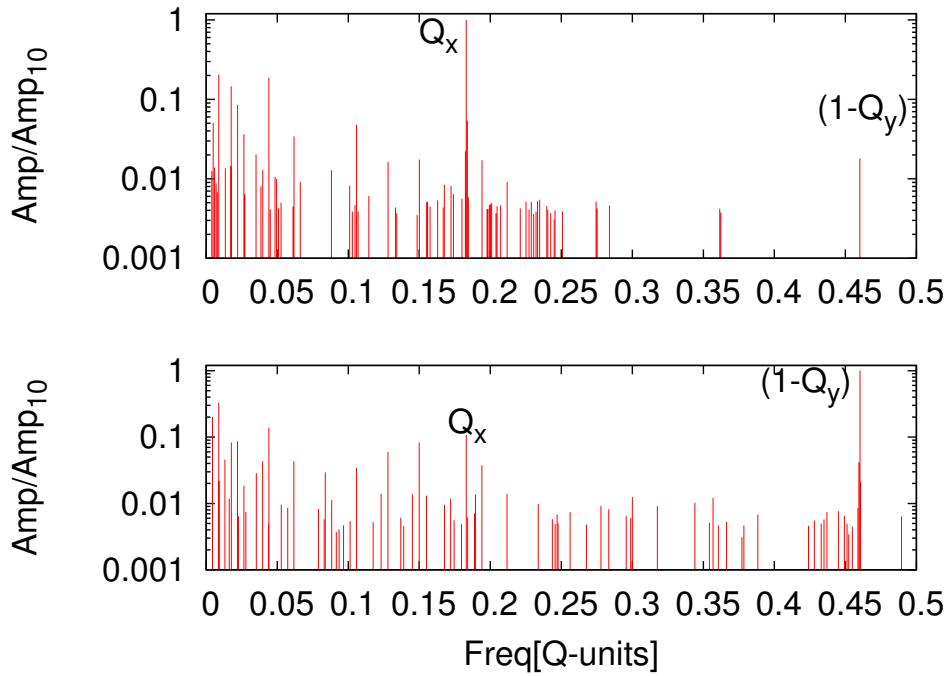


pk2pk : 0.5*mm*

pk2pk : 0.3*mm*

Tune spectrum

- Normalized to $Q_{x/y}$.
- Coupling is visible in both planes.
- High order lines are not visible.

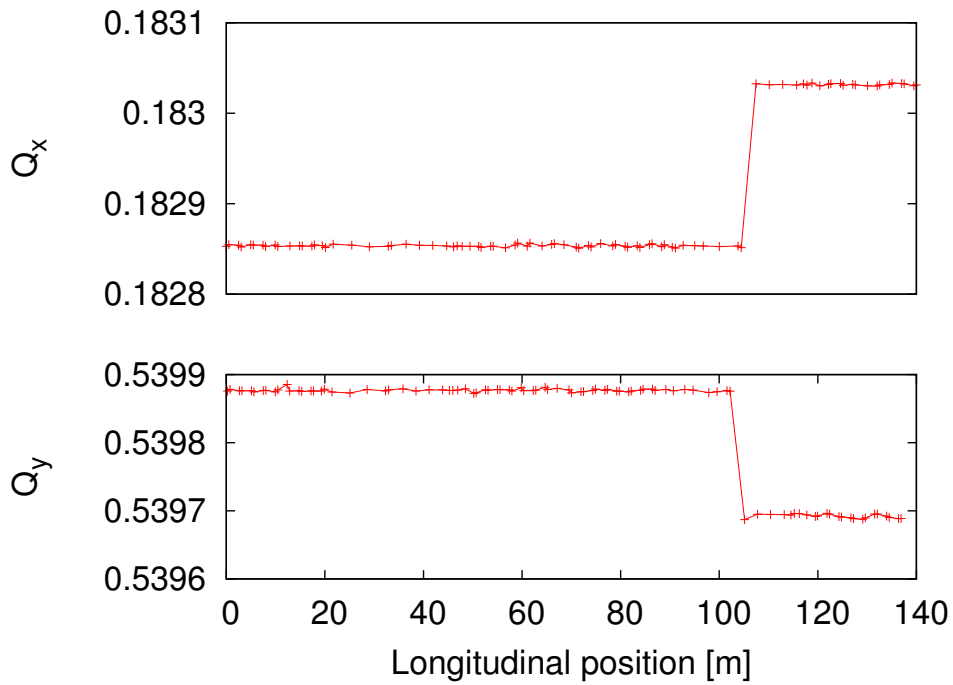


Stability of tune along the ring (1 file)

- $Q_x = 0.18251$ with a RMS of $Q_x^{rms} = 8.7816e^{-7}$.
- $Q_y = 0.53987$ with a RMS of $Q_y^{rms} = 2.0881e^{-6}$.

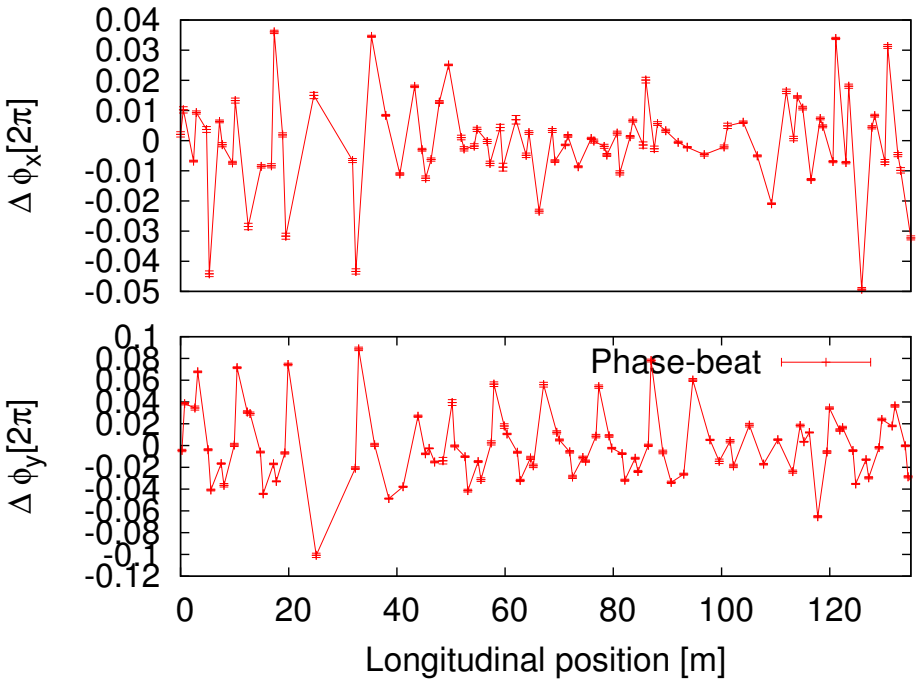
Excluded one file from analysis.

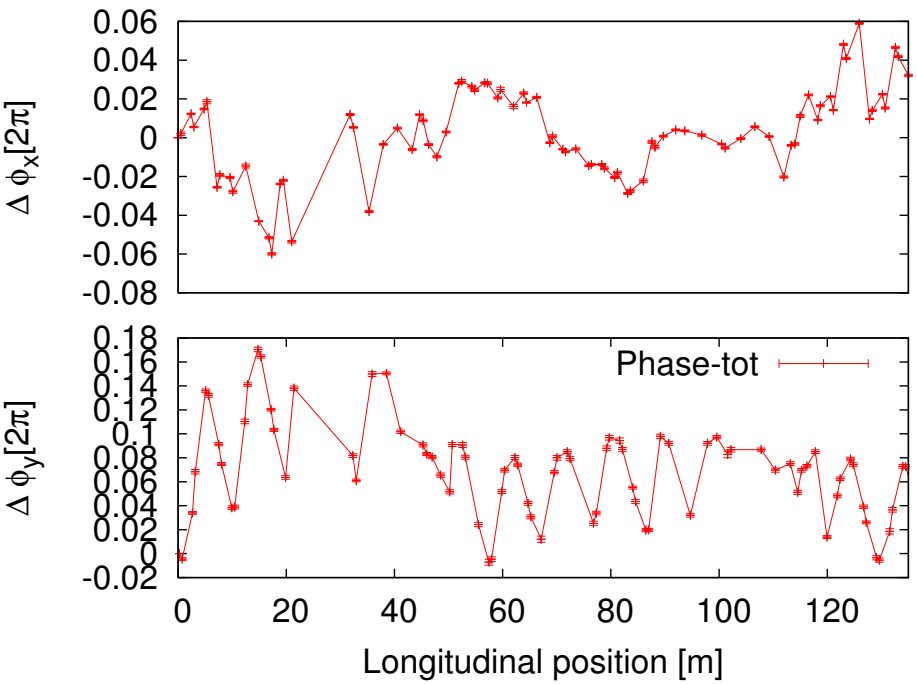
Small jump of the tune at around 110m.



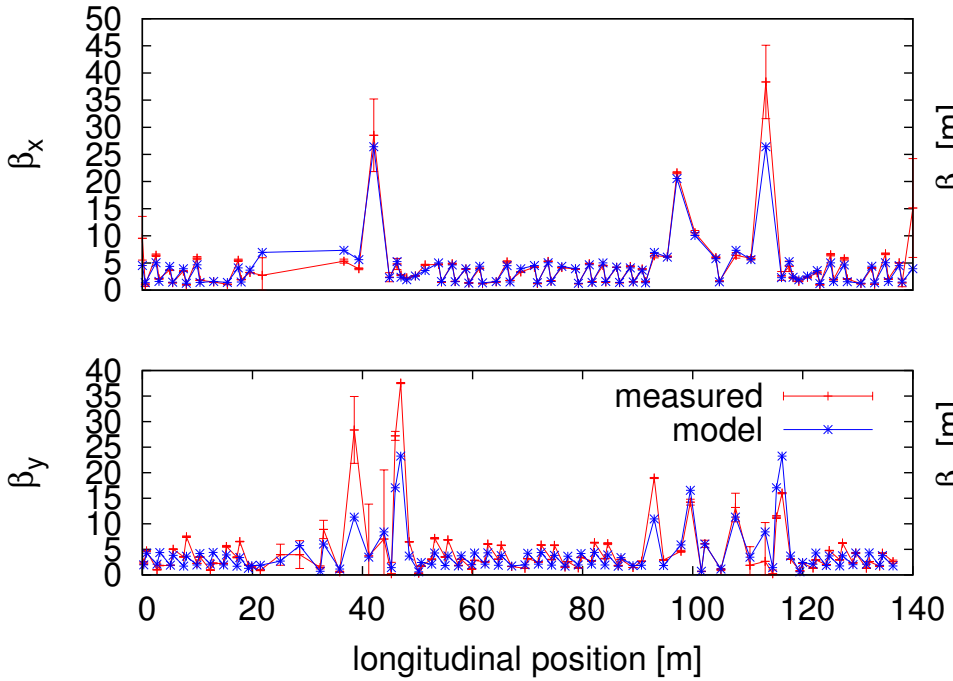
Phase beat:
$\Delta\phi = (\Delta\phi_{me}) - (\Delta\phi_{mo})$

Total phase:
$\phi_{tot} = (\phi_{me}(i) - \phi_{me}(0)) - (\phi_{mo}(i) - \phi_{mo}(0))$

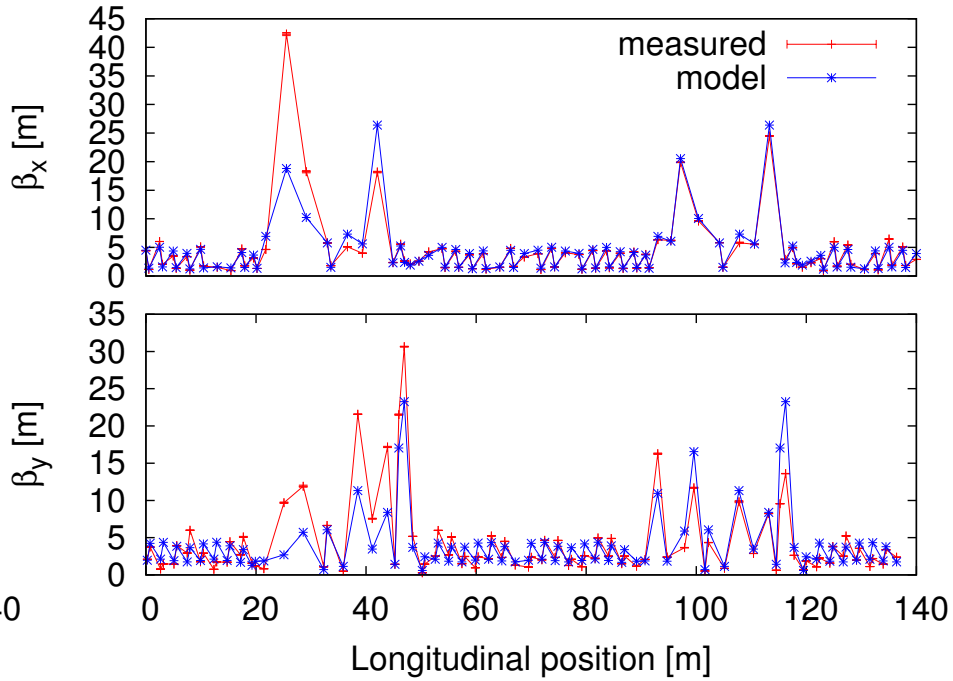




Beta from phase:

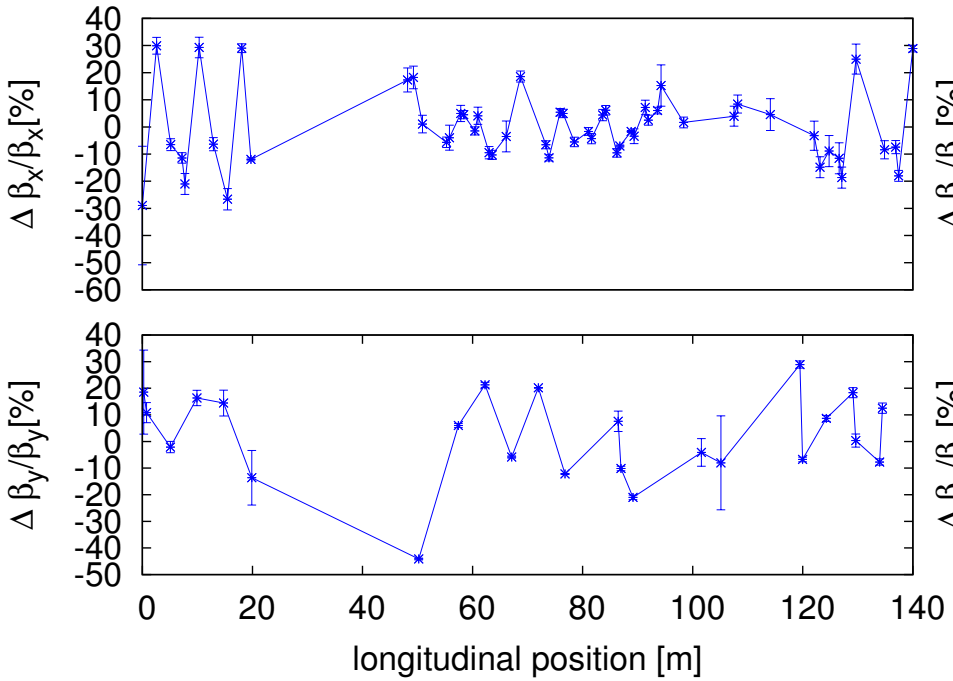


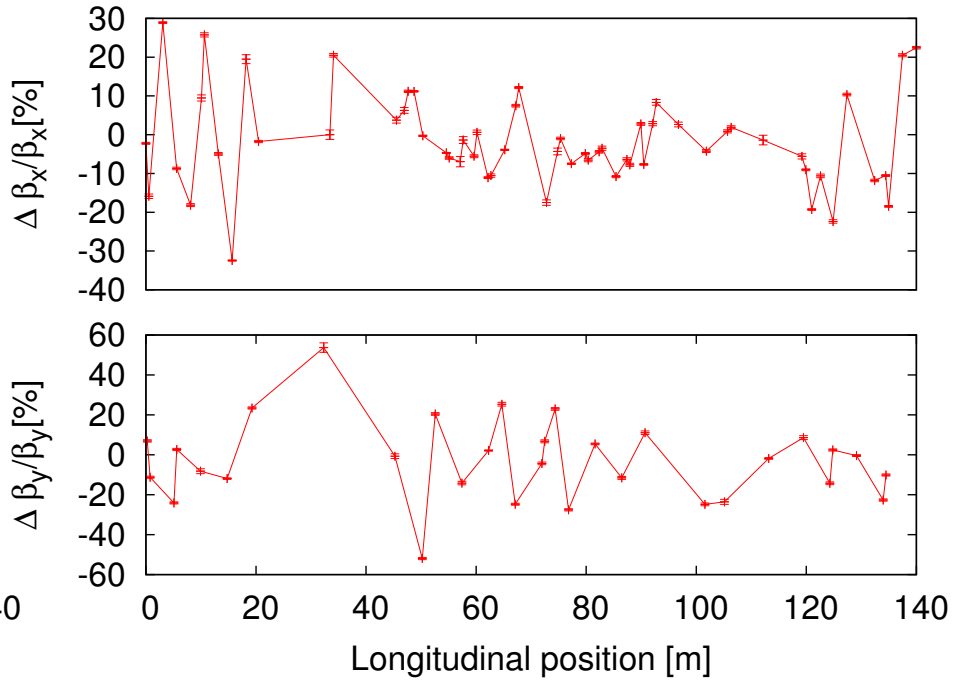
Beta from amplitude



Beta-beat from phase:
$((\frac{\Delta\beta}{\beta})_{rms} =$
$17\%(79); 28\%(64))$

Beta-beat from amplitude:
$((\frac{\Delta\beta}{\beta})_{rms} =$
$15\%(85); 29\%(74))$





Resonance driving terms

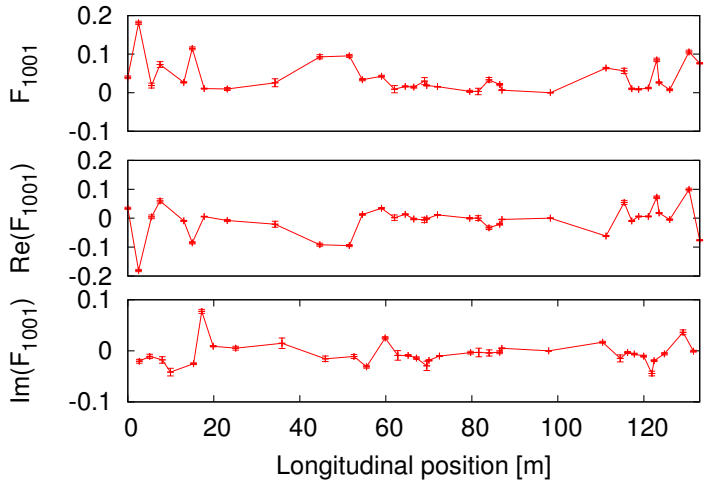
The resonance driving terms are defined as follows:

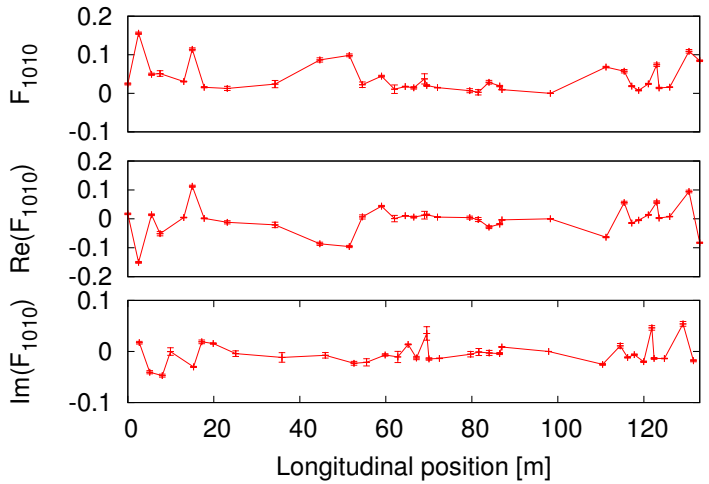
$$f_{jklm} = \frac{h_{jklm}}{1 - e^{(j-k)Q_x + (l-m)Q_y}}$$

f-terms for coupling are:

$$f_{1001} \Rightarrow Q_x - Q_y = p$$

$$f_{1010} \Rightarrow Q_x + Q_y = p$$





- Beta-beat in vertical plane is higher than in horizontal plane.
- First analysis of coupling was done using resonance driving terms.
- Sextupolar or octupolar components could not be identified. Data with stronger kick would be needed.