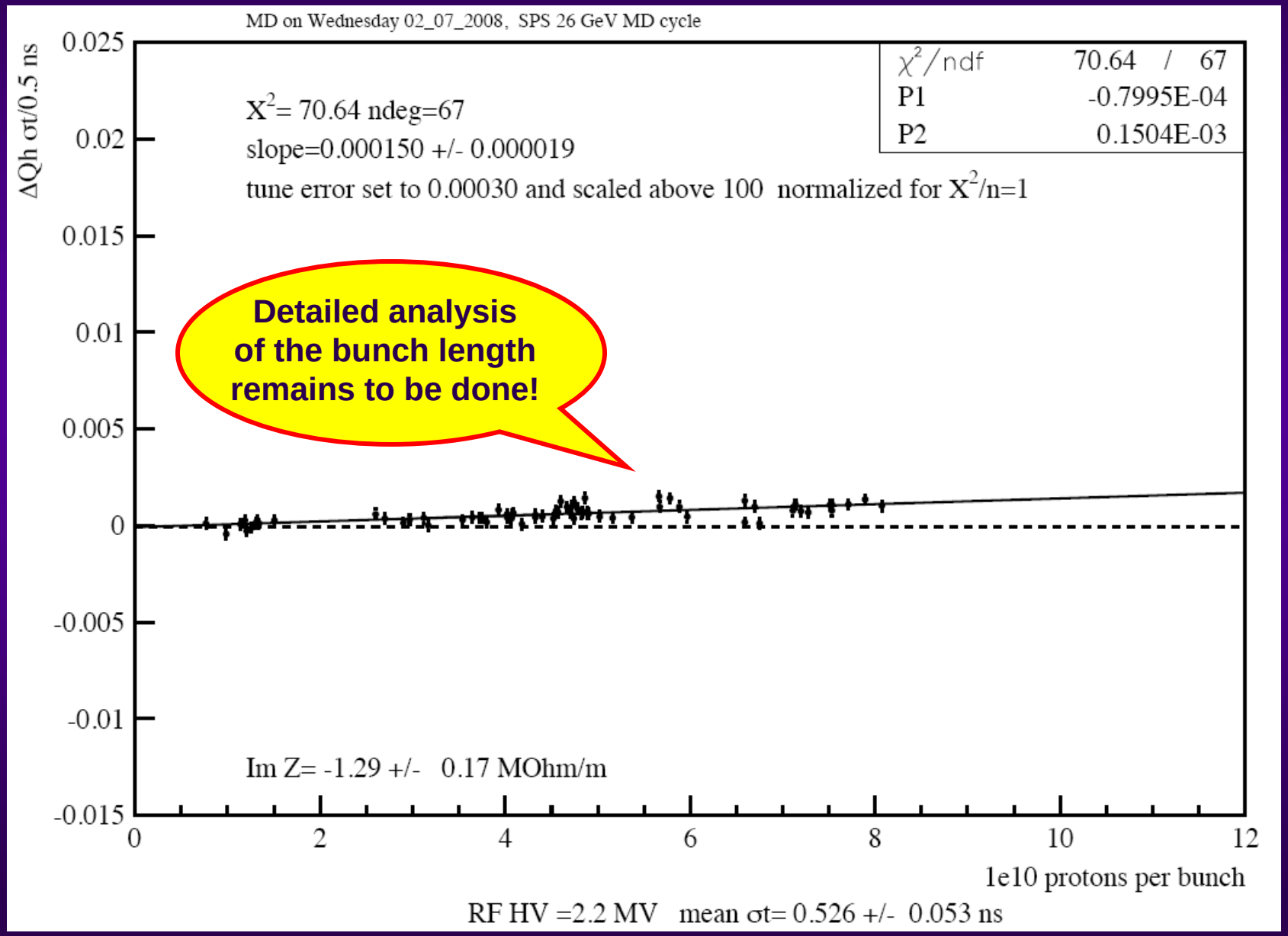
# SPS IMPEDANCE FOLLOW-UP

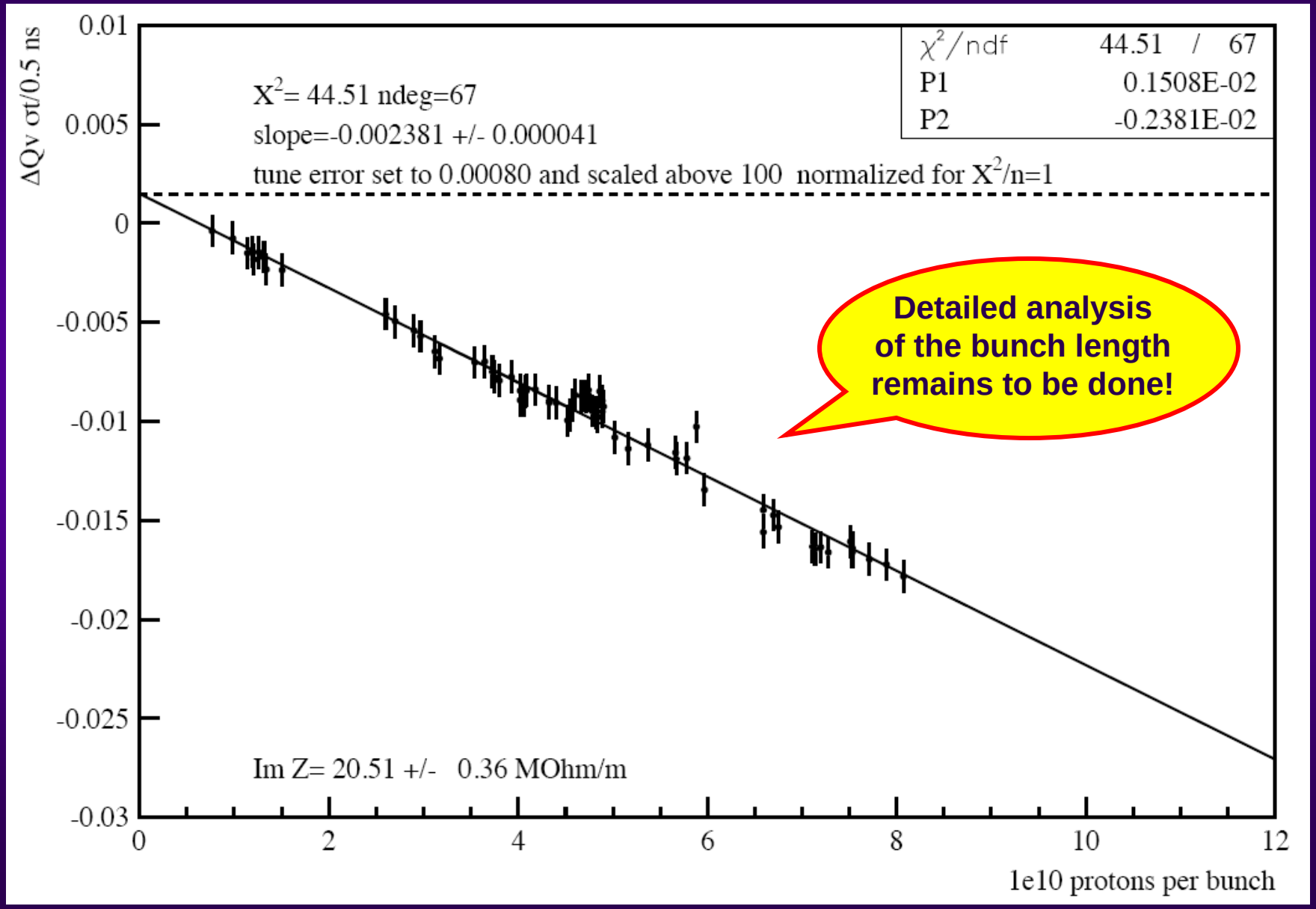
E. Métral

- **Transverse impedances from Helmut's measurements in 2008**
- **Reminder on the possible contributors to the positive tune shifts measured in the SPS in the horizontal plane $\Longrightarrow$ Important to understand as it has an effect for the vertical measurements as well**
- **Conclusions and next step**

# Transverse impedances from Helmut's measurements in 2008 (1/4)

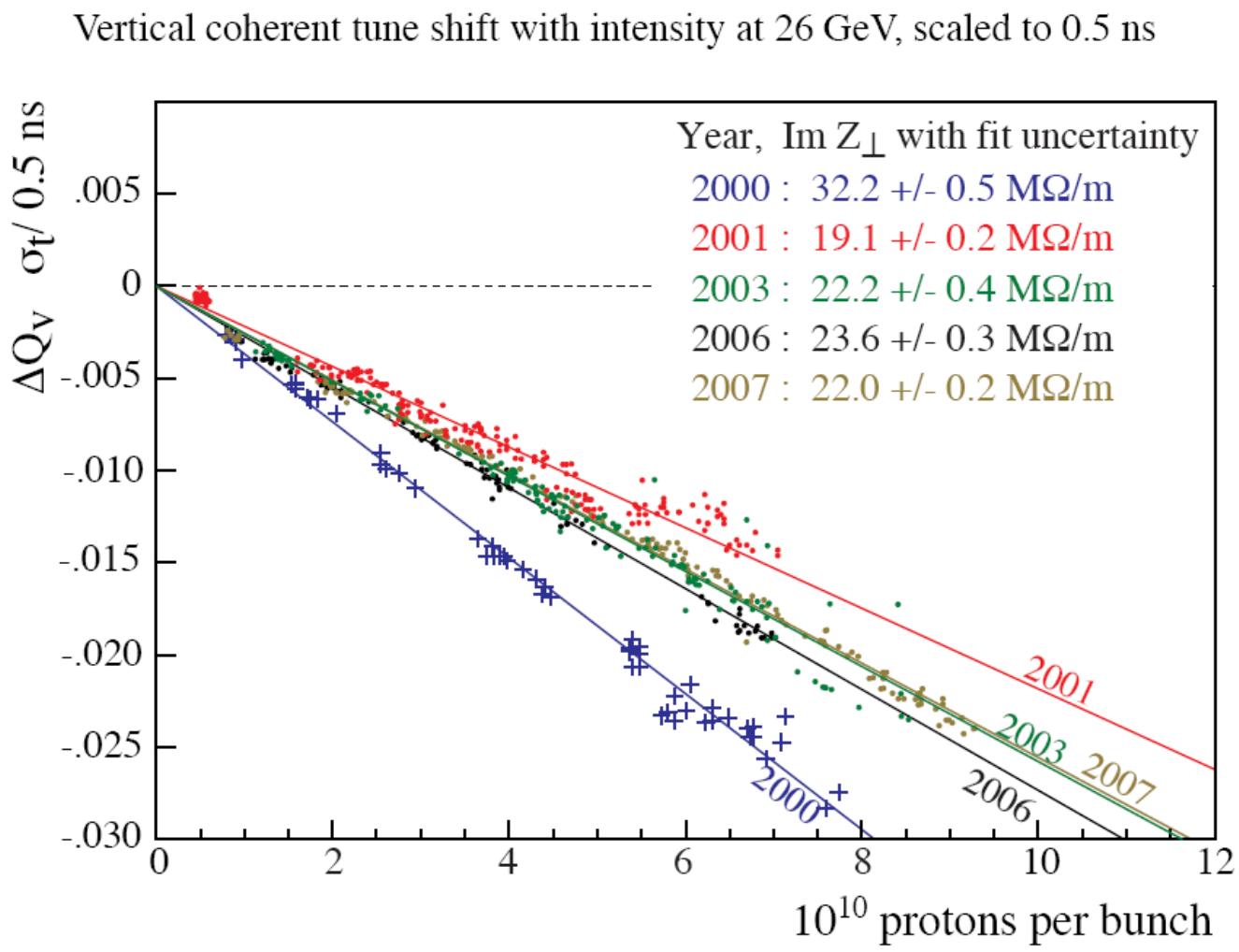


# Transverse impedances from Helmut's measurements in 2008 (2/4)



# Transverse impedances from Helmut's measurements in 2008 (3/4)

**Reminder 1:**




Same analysis and very similar beam parameters (~ 0.5 - 0.6 ns rms bunch length)
The measured slopes can directly be compared. Estimated uncertainty ~ 10 - 20 %.

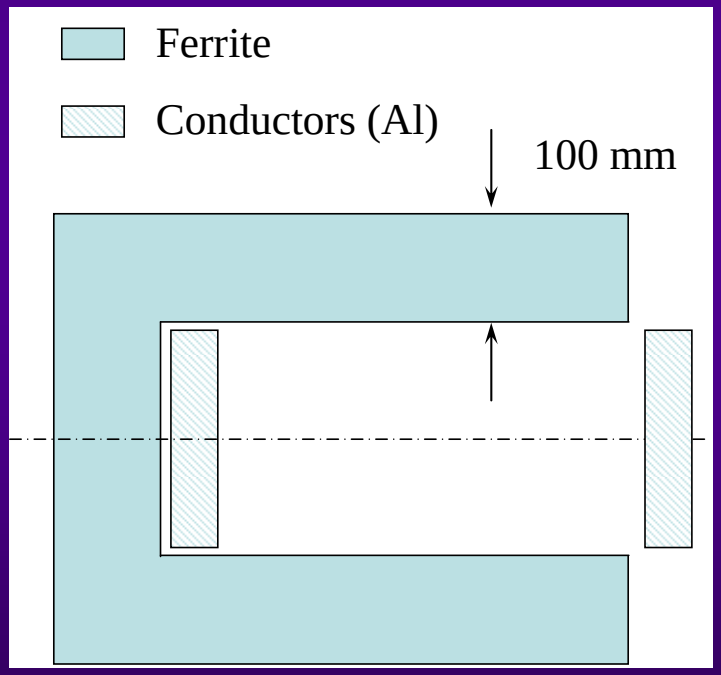
# Transverse impedances from Helmut's measurements in 2008 (4/4)

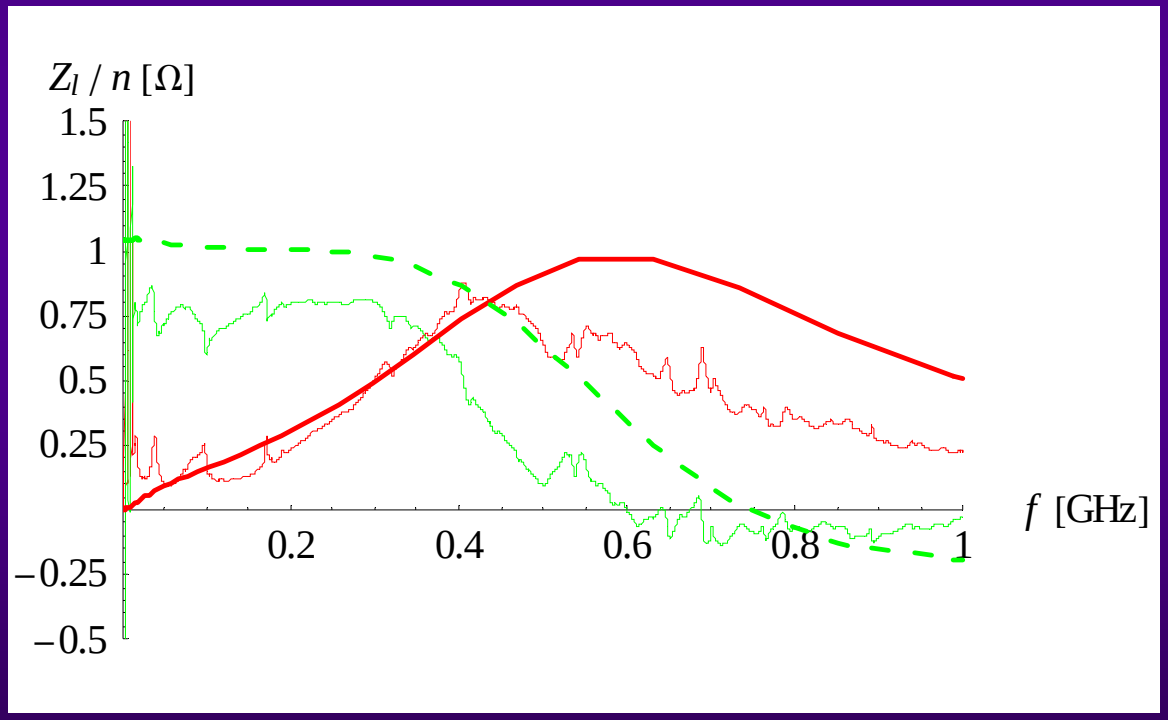
**Reminder 2:** **Be careful with Helmut's normalization with the bunch length as the bunch length also appears in the impedance deduced from the plot (which is an "effective generalized impedance")**

# Reminder on the possible contributors to the positive tune shifts measured in the SPS in the horizontal plane (1/2)

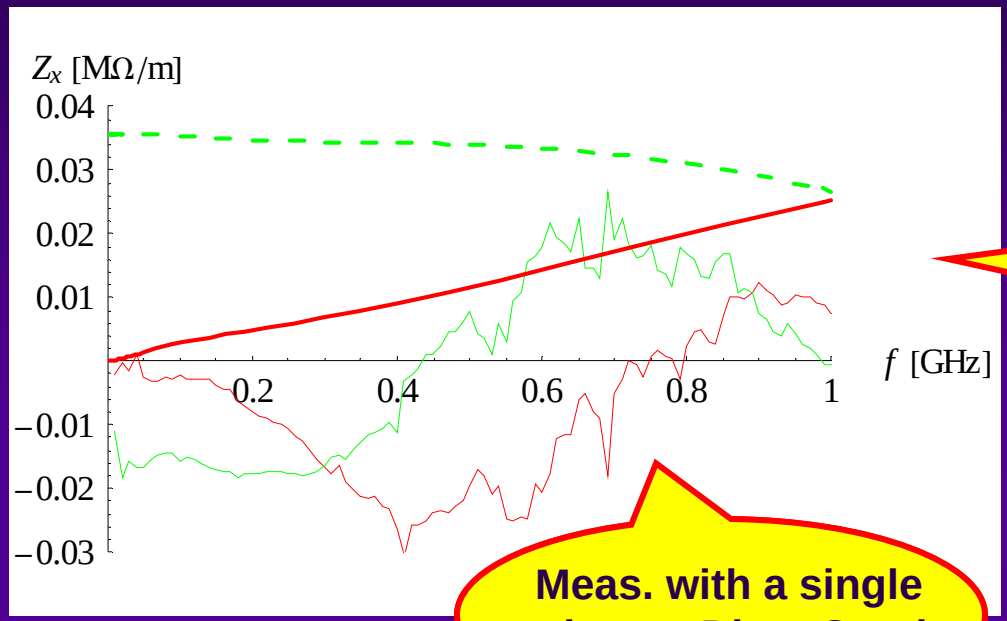
⟹ **On the example of a PS kicker**

**(see http://doc.cern.ch/archive/electronic/cern/preprints/ab/ab-2006-051.pdf)**



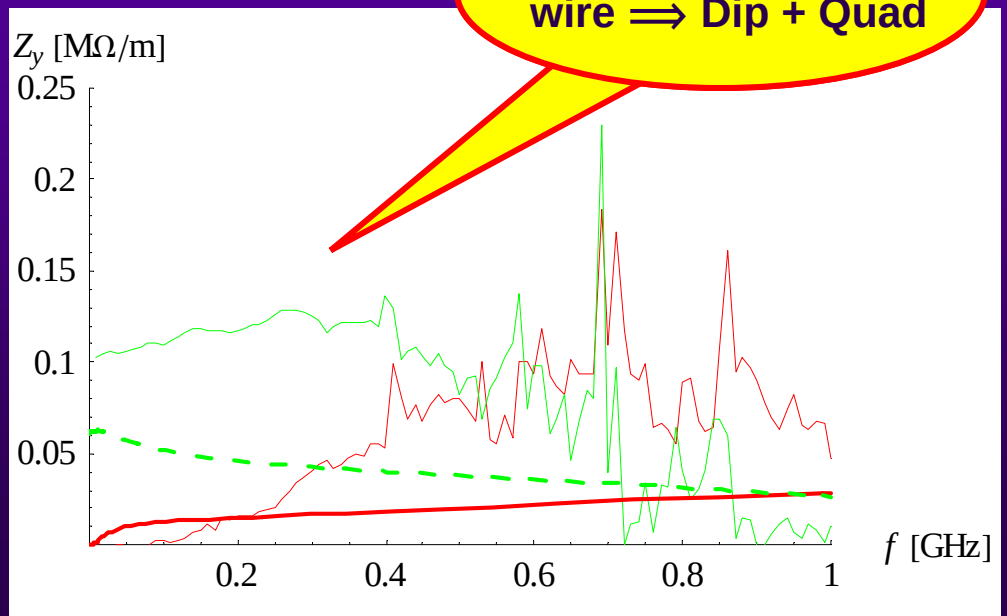



# Reminder on the possible contributors to the positive tune shifts measured in the SPS in the horizontal plane (2/2)

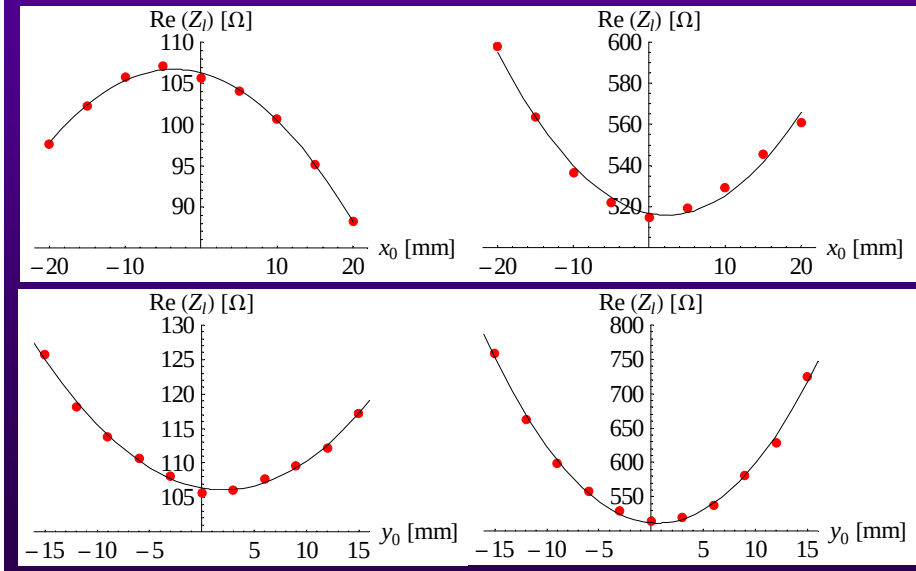



**If the bunch spectrum does not extend much above 400 MHz, the horizontal coherent tune shift is positive**

**Meas. with a single wire ⟹ Dip + Quad**




**200 MHz** **1 GHz**



# Conclusions and next step (1/2)

- **Up to now, in our analytical estimates for the SPS kickers, one deduced the quad term from the dipolar one, assuming 2 infinite plates (Reminder: The horizontal tune shift is always $\leq 0$ in an elliptical chamber composed of 1 material $\Longrightarrow$ Can only be 0 at maximum, i.e. for 2 infinite plates = very flat ellipse!)**

- **Assuming 2 infinite plates gave us a reasonably good dipolar impedance (checked in the past by measurements)**

- **However, one does not know the quadrupolar impedance well (conductors on both sides of the kickers) $\Longrightarrow$ One should measure (or simulate) the SPS kickers with**
  - **2 wires to have the dipolar impedance**
  - **1 wire to have the dipolar + quadrupolar impedances (and hence the quadrupolar term can be deduced)**

# Conclusions and next step (2/2)

⟹ **To make more precise comparisons with measurements,** one needs (ideally) for each SPS equipment (and in particular for the complicated geometries!), 5 impedances (normalized by that betatron functions for the transverse ones):

- Longitudinal
- Horizontal dipolar (driving)
- Vertical dipolar (driving)
- Horizontal quadrupolar (detuning)
- Vertical quadrupolar (detuning)