VERTICAL IMPEDANCE (TRAPPED MODES) OF THE SPS BPH

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- **Simulations with MAFIA by Bruno Spataro (Frascatti) of the SPS BPM impedances**
- **Reminder: 108 BPH and 108 BPV**
- **TMCI intensity threshold from MOSES (at SPS injection with bunches of low longitudinal emittance…)**

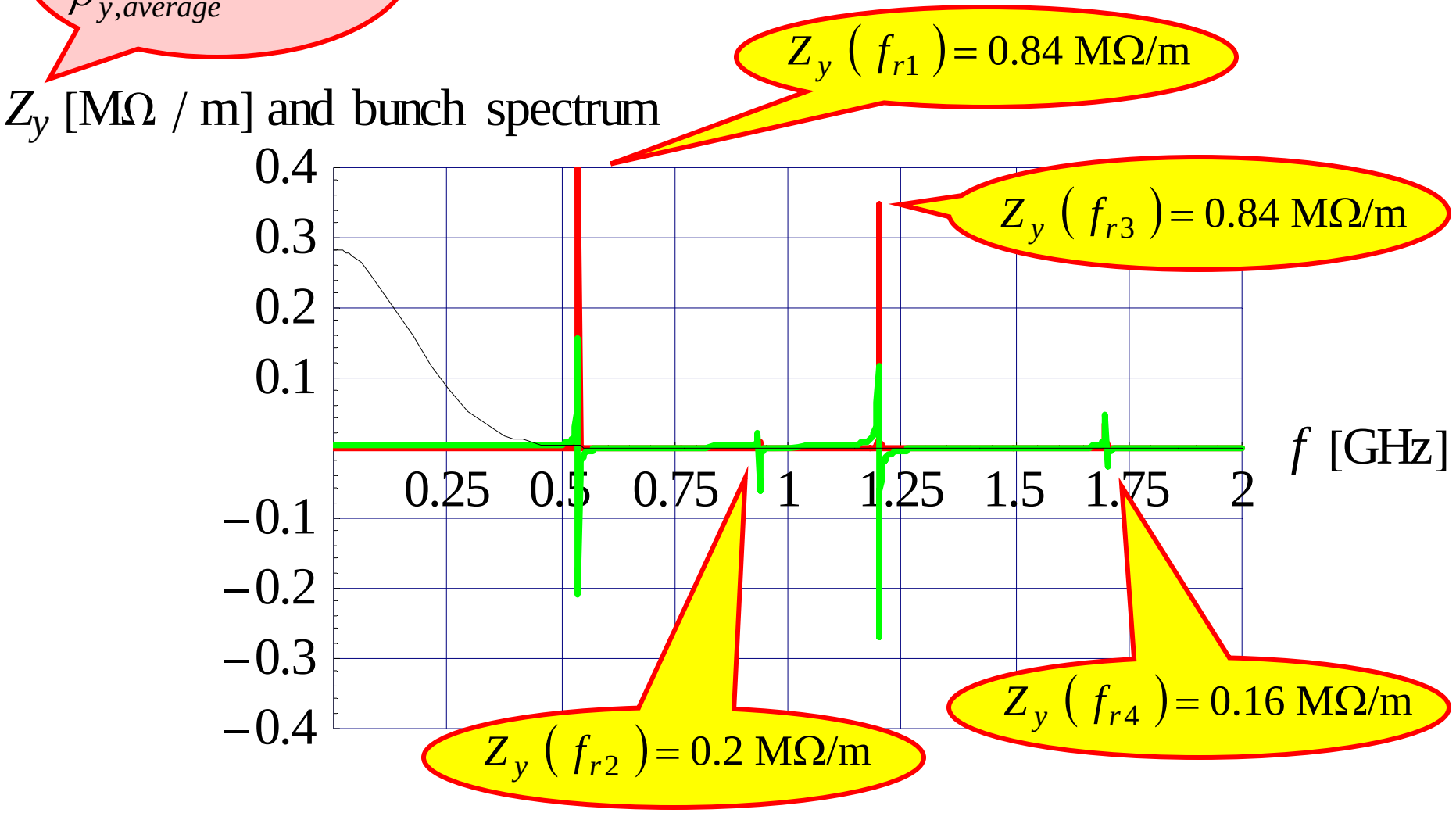
Most critical vertical trapped modes of 1 BPH (the BPV contributes almost nothing, and mainly for the longitudinal)

$f_{r1} = 0.537$ GHz	$Q_1 = 1650$	$R_{y1}/Q_1 = 9.5\ \Omega/\mathrm{m}$
$f_{r2} = 0.9365$ GHz	$Q_2 = 2165$	$R_{y2}/Q_2 = 1.72\ \Omega/\mathrm{m}$
$f_{r3} = 1.2$ GHz	$Q_3 = 2300$	$R_{y3}/Q_3 = 6.8\ \Omega/\mathrm{m}$
$f_{r4} = 1.7$ GHz	$Q_4 = 2900$	$R_{y4}/Q_4 = 1\ \Omega/\mathrm{m}$

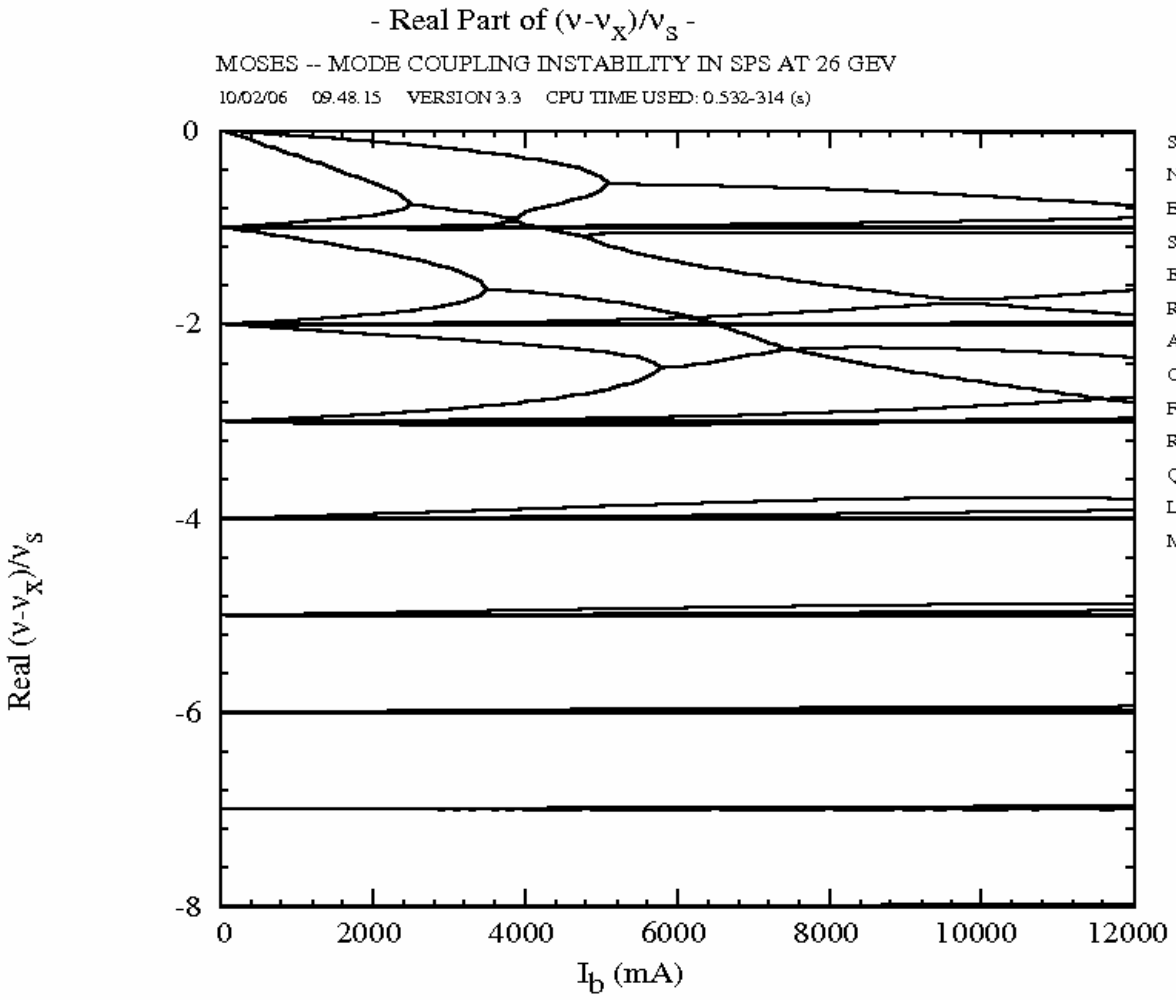
$$\beta_{y,average}^{SPS} = \frac{R}{Q_y} = 42\ \mathrm{m} \qquad \beta_y^{BPH} = 21\ \mathrm{m}$$

Total impedance of the 108 BPH

$\frac{\beta_y^{BPH}}{\beta_{y,average}^{SPS}}$ included



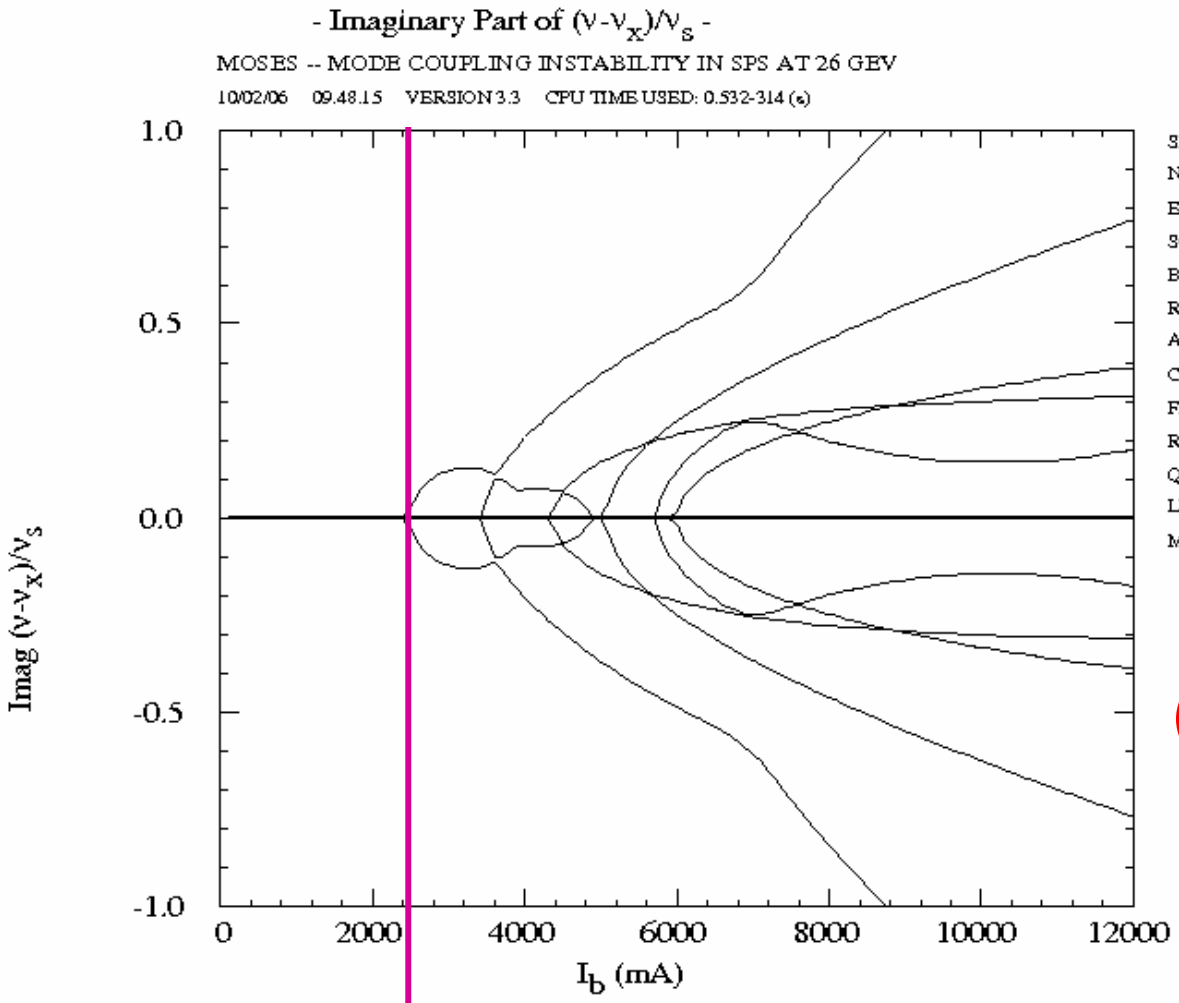
TMCI intensity threshold (1/2)



Only the 1st (most critical) resonance

TMCI intensity threshold (2/2)

$$N_b = 1.2\,10^{11}\ \text{p}$$
$$\Leftrightarrow I_b = 0.83\,\text{mA}$$



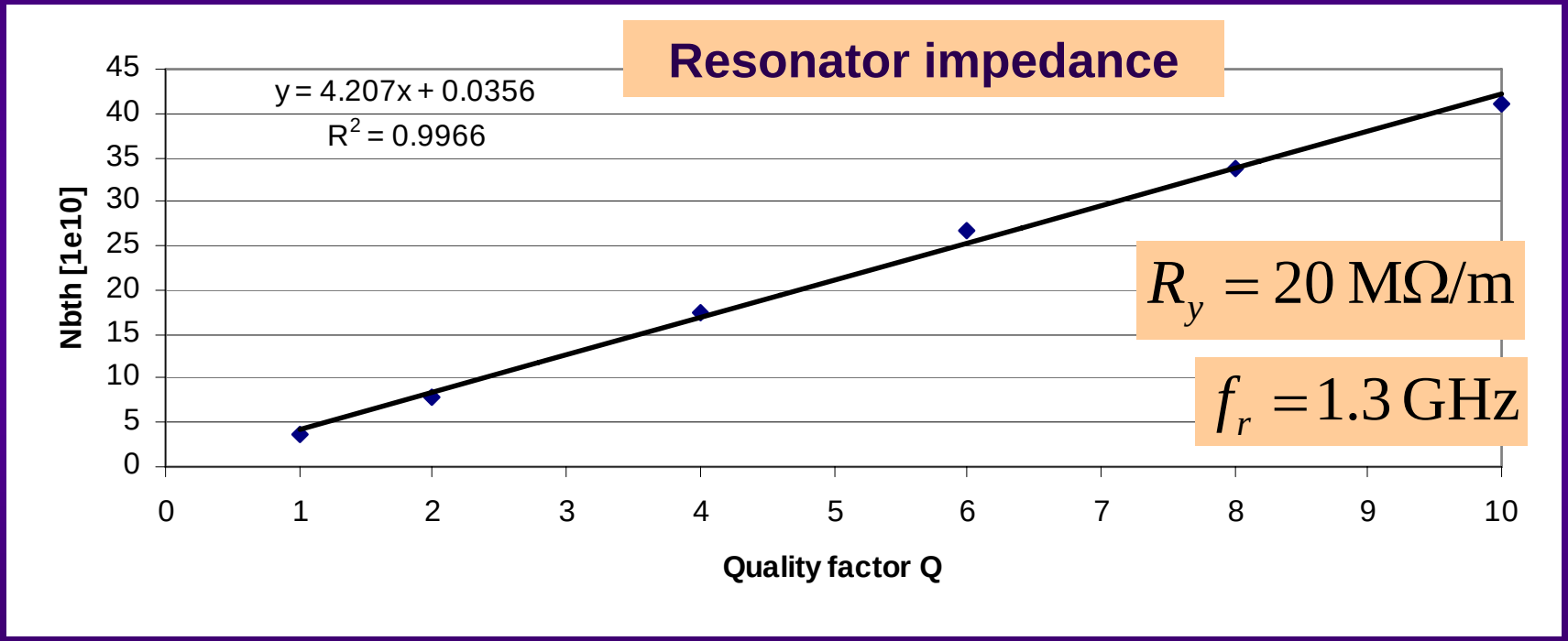
Only the 1st (most critical) resonance

$$I_b^{th} \approx 2400\,\text{mA} \Rightarrow N_b^{th} \approx 3.5\,10^{14}\ \text{p}\,!$$

CONCLUSION ⇒ Slide from APC 02/02/06

- It is a single-bunch instability ⇒ Short-range wake field ⇔ BB impedance
- Intensity threshold vs. quality factor (from MOSES)

$$N_b^{th} \sim \propto Q$$



⇒ At the end (i.e. after summing all the impedance contributions) the impedance has to be BB, i.e. low Q, to drive this instability (or really very high peak impedance value)