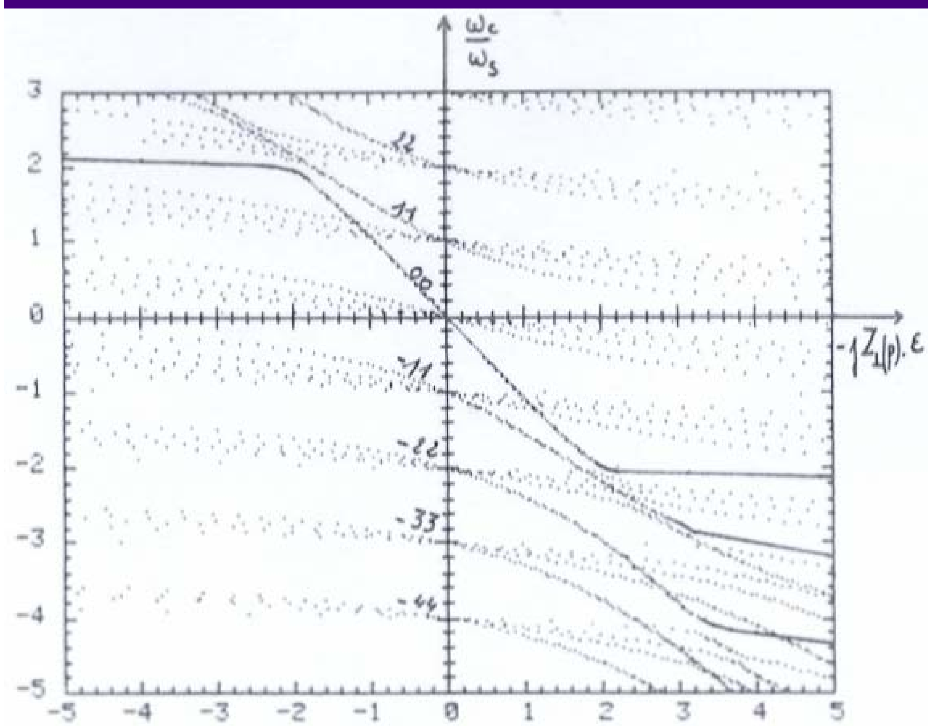
REVIEW OF LACLARE'S THEORY FOR TMCI

E. Métral

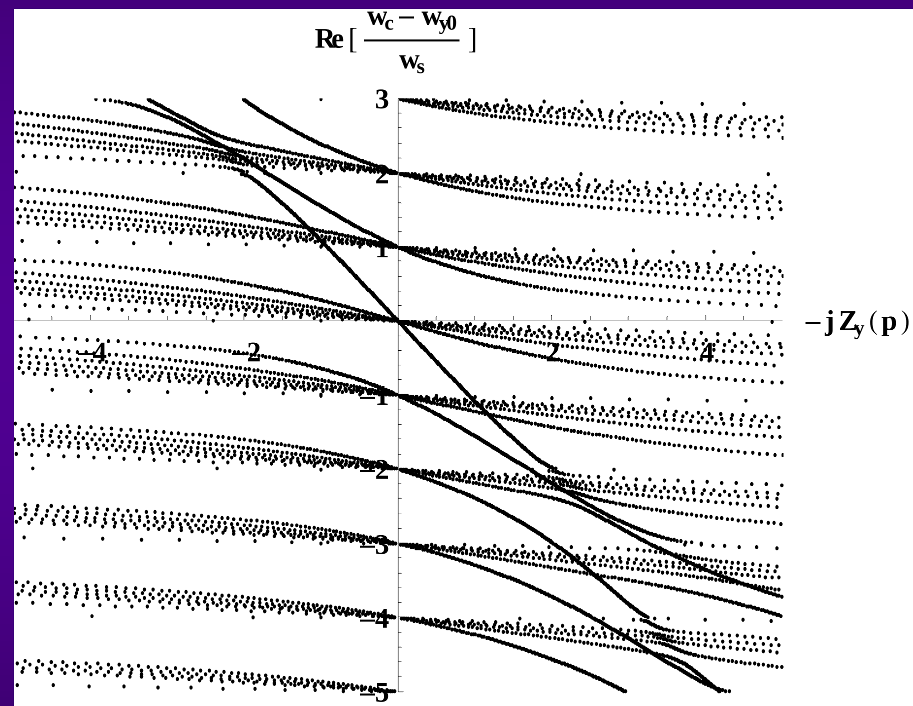
- **Comparison with 4 examples he gave (CERN 87-03)**
- **Application to the SPS**

Example 1: Constant inductive impedance

HIS RESULT



MY RESULT



$$\varepsilon = \frac{e\, I_b}{4\, \pi\, \gamma\, m_0\, c\, Q_y\, B\, \omega_s}$$

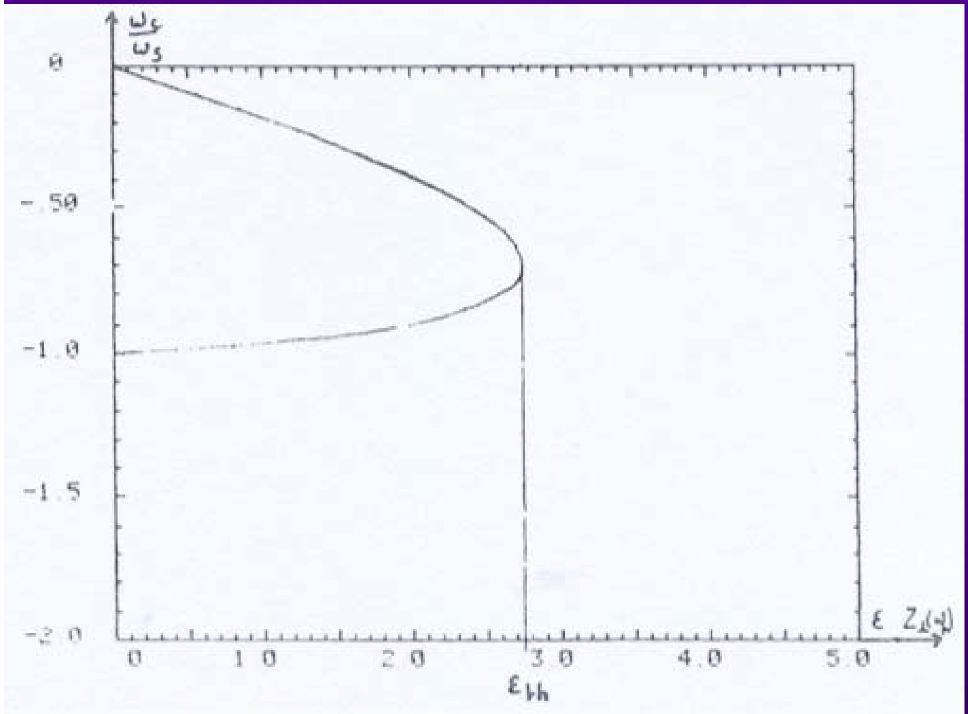
$$B = f_0 \tau_b$$

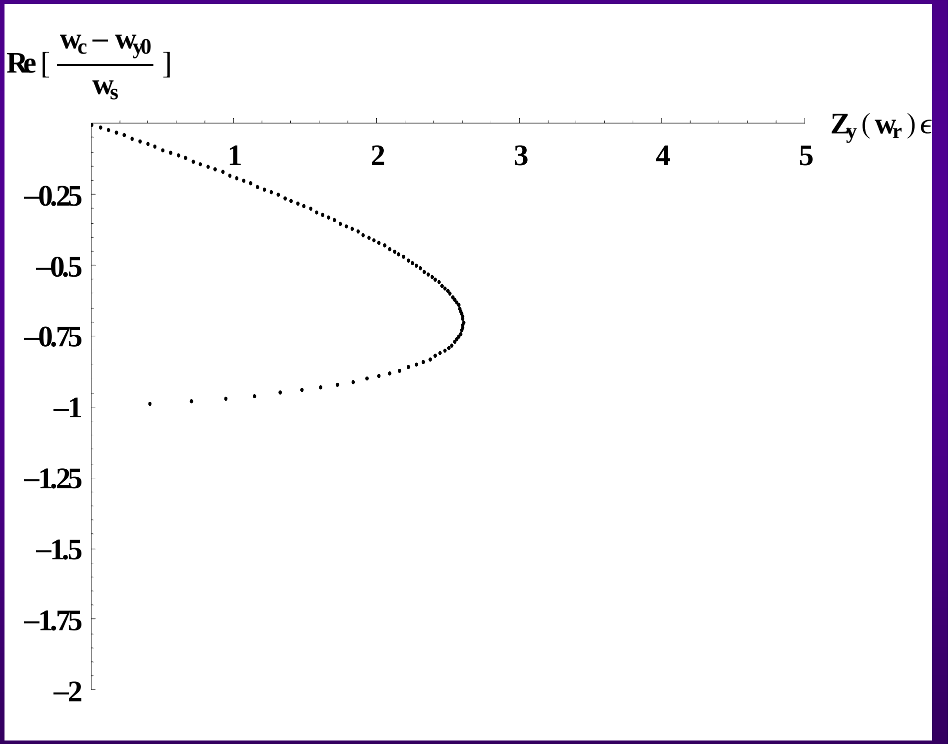
Example 2: Very short bunch interacting with a BB impedance

$$f_r \, \tau_b = 0.2$$

HIS RESULT

MY RESULT

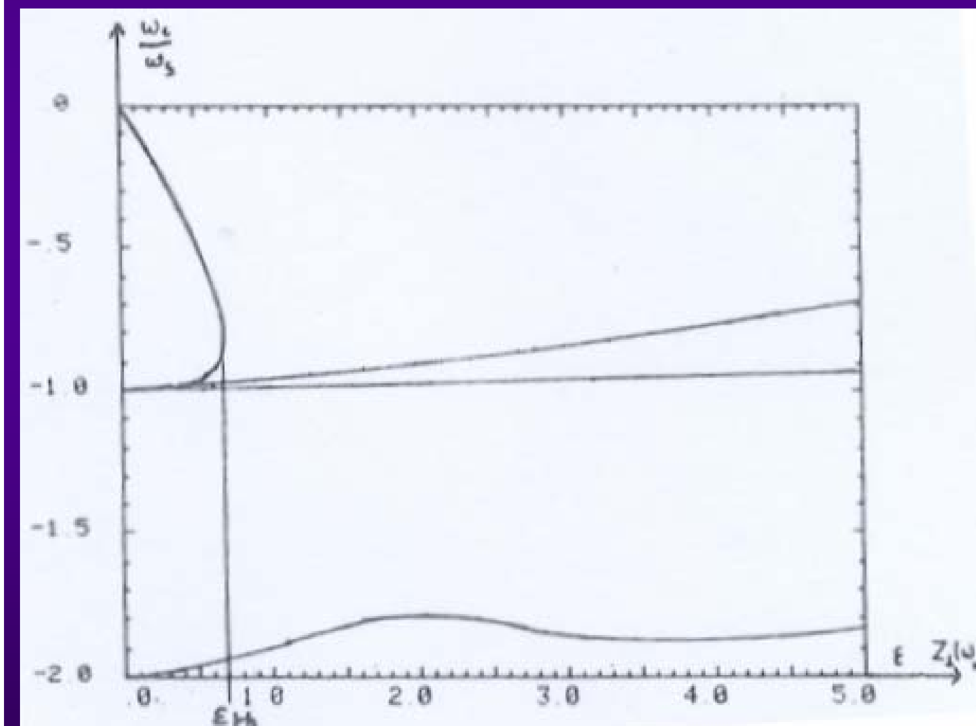




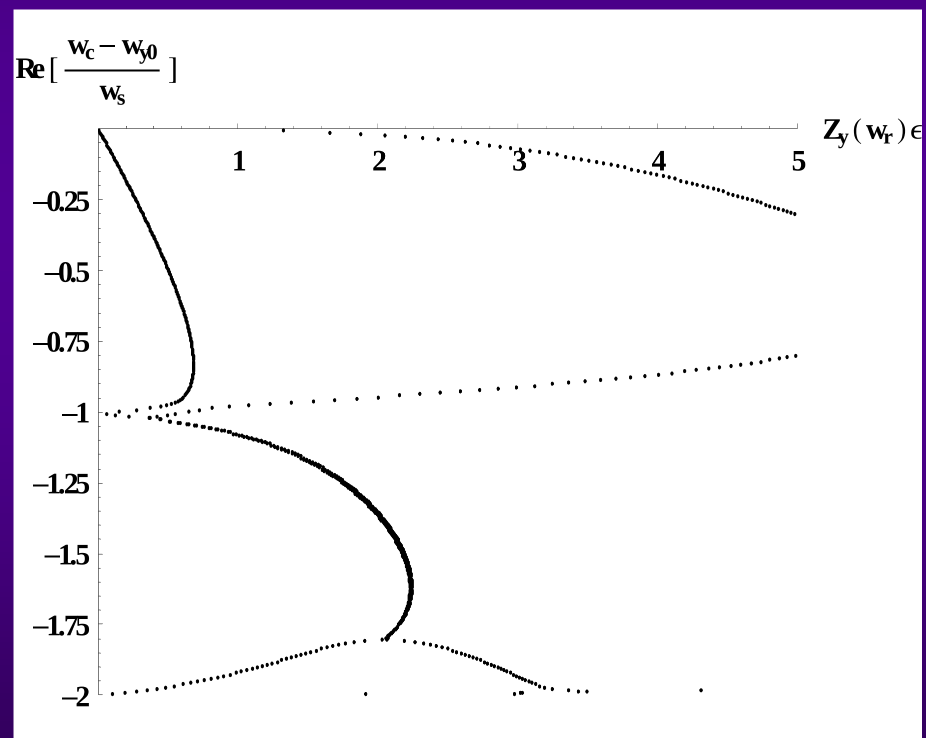
Example 3: Short bunch interacting with a BB impedance

$f_r \, \tau_b = 0.8$

HIS RESULT



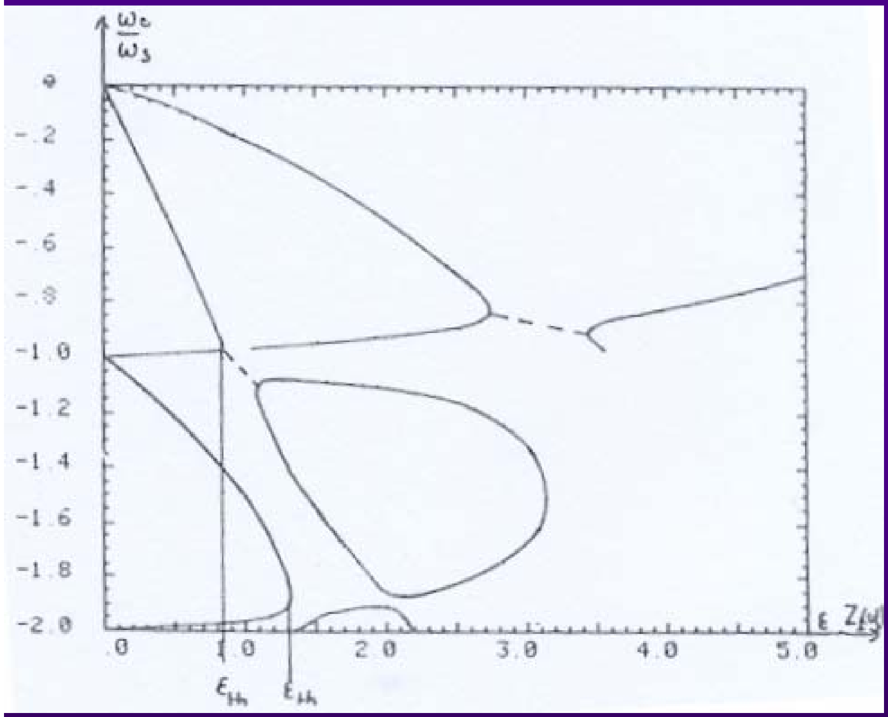
MY RESULT



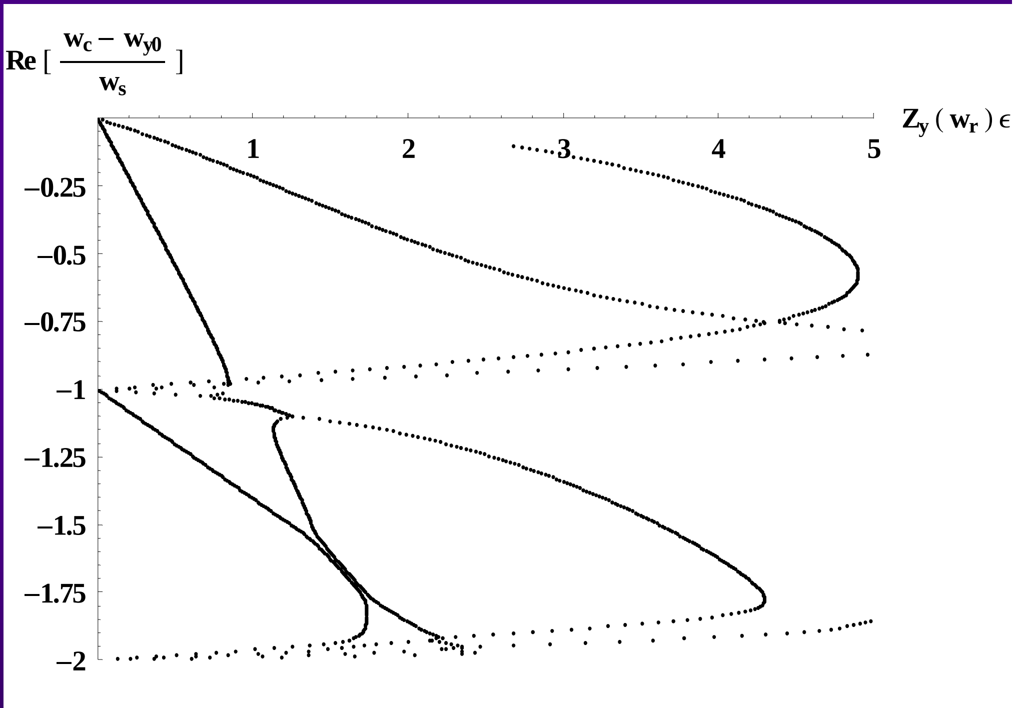
Example 4: Long bunch interacting with a BB impedance

$f_r \, \tau_b = 1.9$

HIS RESULT



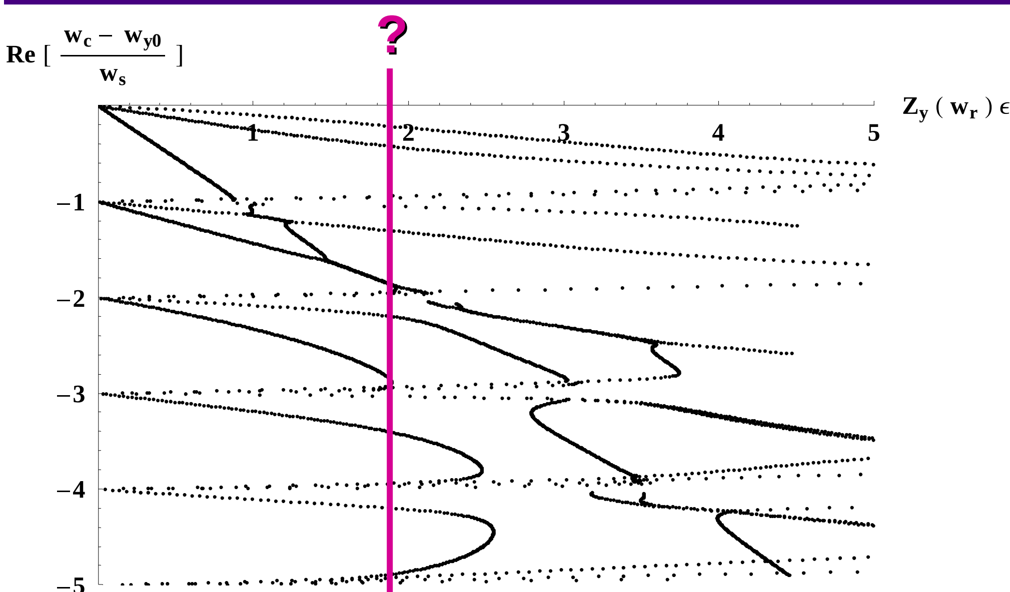
MY RESULT



APPLICATION TO THE SPS (1/2)

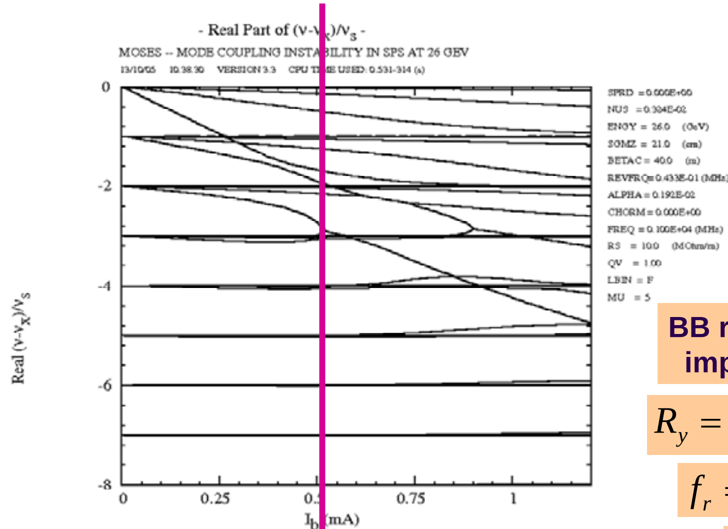
$f_r \, \tau_b = 2.8$

MY RESULT



$I_b^{th} \approx 0.55 \, \text{mA}$

MOSES' RESULT



BB resonator impedance

$R_y = 10 \, \text{M}\Omega/\text{m}$

$f_r = 1 \, \text{GHz}$

$Q = 1$

$I_b^{th} \approx 0.5 \, \text{mA}$

APPLICATION TO THE SPS (2/2)

- Only 1 problem: The imaginary part cannot be obtained with this method

- Note that using Laclare’s formalism, the coherent betatron frequency to be found is inside the coupling matrix…

$\Rightarrow$ To obtain the imaginary part one needs to decompose the modes onto a normalized orthogonal basis composed of the solution modes at low intensity… $\Rightarrow$ Classical method for TMCI