CROSSING TRANSITION WITH TMCI

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Explanation of the comment I made at the 06/07/06 APC

- **Since the work of Pellegrini&Sands1969 on the (low-intensity) Head-Tail instability, the sign of the H and V chromaticities is changed when the transition is crossed (i.e. when the sign of the slip-factor η changes) $\Rightarrow$ The chromatic frequency is kept positive**
- **Before, the Head-Tail instability above transition was damped (e.g. in the PS) using Landau octupoles**
- **It is proposed now not only to change the sign of the chromaticity when the transition is crossed but to correlate its variation with the one of the slip-factor (due to TMCI reason)**

- **TMCI intensity threshold**

$$\eta = \gamma_{tr}^{-2} - \gamma^{-2}$$

$$\xi_y = \left(dQ_y / dp\right)\left(p / Q_y\right)$$

$$N_b^{th,y} \propto |\eta| \left(1 + \frac{f_{\xi_y}}{f_r}\right)$$

$$f_{\xi_y} = \frac{\xi_y}{\eta} Q_y \, f_{rev}$$

- **Consider the case below transition ($\eta < 0$ and $\xi < 0$) where a TMCI is stabilized by decreasing ξ and let's call**

$$\kappa = |\eta| \left(1 + \frac{f_{\xi_y}}{f_r}\right)$$

$\kappa = \kappa_0$ in the stable situation below transition

- **During transition crossing (and after), one wants to keep $\kappa \geq \kappa_0$**

$\kappa = \kappa_0 \Rightarrow$

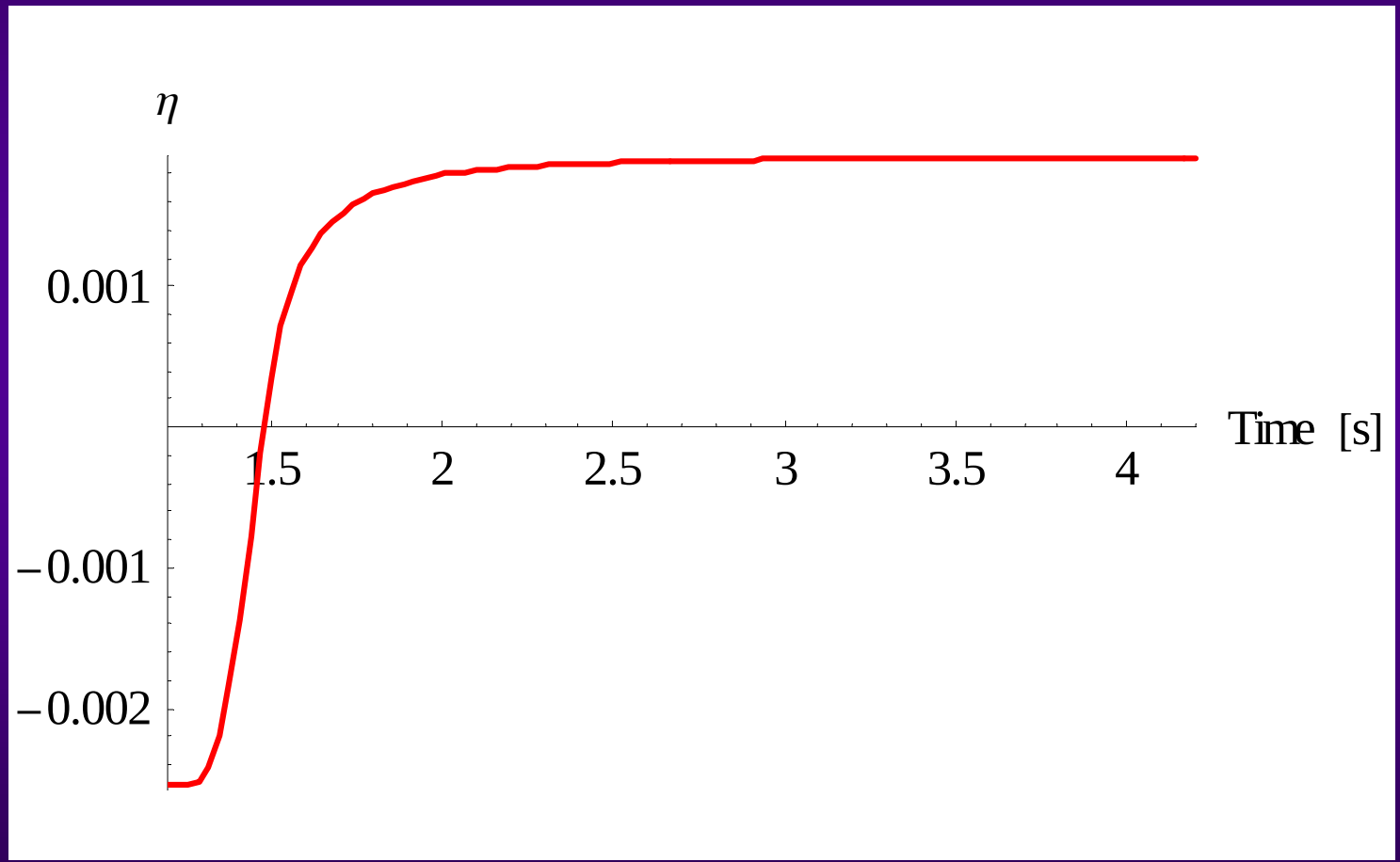
$$\xi_y = \frac{\eta \, f_r}{Q_y \, f_{rev}} \left(\frac{\kappa_0}{|\eta|} - 1\right)$$

Increasing the longitudinal emittance (e.g. in the PS) would not be required anymore

- **This could (should) be checked with HEADTAIL first**

IN THE SPS

⇒ **The chromaticity has to follow the slip factor which is given below (thanks to Elena Shaposhnikova) for the CNGS or SFTPRO beam**



IN THE PS

⇒ **The chromaticity has to follow the slip factor which is given below (thanks to Michel Martini) near transition only**