LANDAU DAMPING BY OCTUPOLES OF THE HEAD-TAIL MODES DUE TO AN LHC COLLIMATOR

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PARAMETERS USED

- **Machine and Beam**

$p = 7\ \mathrm{TeV/c}$ $M = 3564$ $N_b = 1.1 \times 10^{11}\ \mathrm{p/b}$

$Q_s = 2.12 \times 10^{-3}$ $\tau_b = 1\ \mathrm{ns}$ $\xi_y = 0$ $\alpha_1 = 3 \times 10^{-4}$ $\Leftrightarrow$ $\gamma_t = 57.7$

$Q_y = 59.32$ $\varepsilon_{rms}^x = \varepsilon_{rms}^y = \varepsilon_{rms} = 0.5\ \mathrm{nm}$

- **Collimator (graphite)**

$b = 2\ \mathrm{mm}$ $l = 20\ \mathrm{m}$

$\rho = 18.1818 \times 10^{-6}\ \Omega\,\mathrm{m}$ $\beta_y = 2 \times \beta_{av} = 143\ \mathrm{m}$

- **Berg-Ruggiero formula for a quasi-parabolic distribution has been used to draw the stability diagram**

See paper “Landau damping with two-dimensional betatron tune spread”, 1996

- **Computation of the tune spreads induced by the octupoles**

$N_{oct}^F = 84$ $\beta_{oct,x}^F = 180\ \mathrm{m}$ $\beta_{oct,y}^F = 30\ \mathrm{m}$

$N_{oct}^D = 84$ $\beta_{oct,x}^D = 30\ \mathrm{m}$ $\beta_{oct,y}^D = 180\ \mathrm{m}$

$K_{oct} = 59100\ \mathrm{T\,m}^{-3}$ $l_{mag} = 0.32\ \mathrm{m}$

Data From O. Bruning

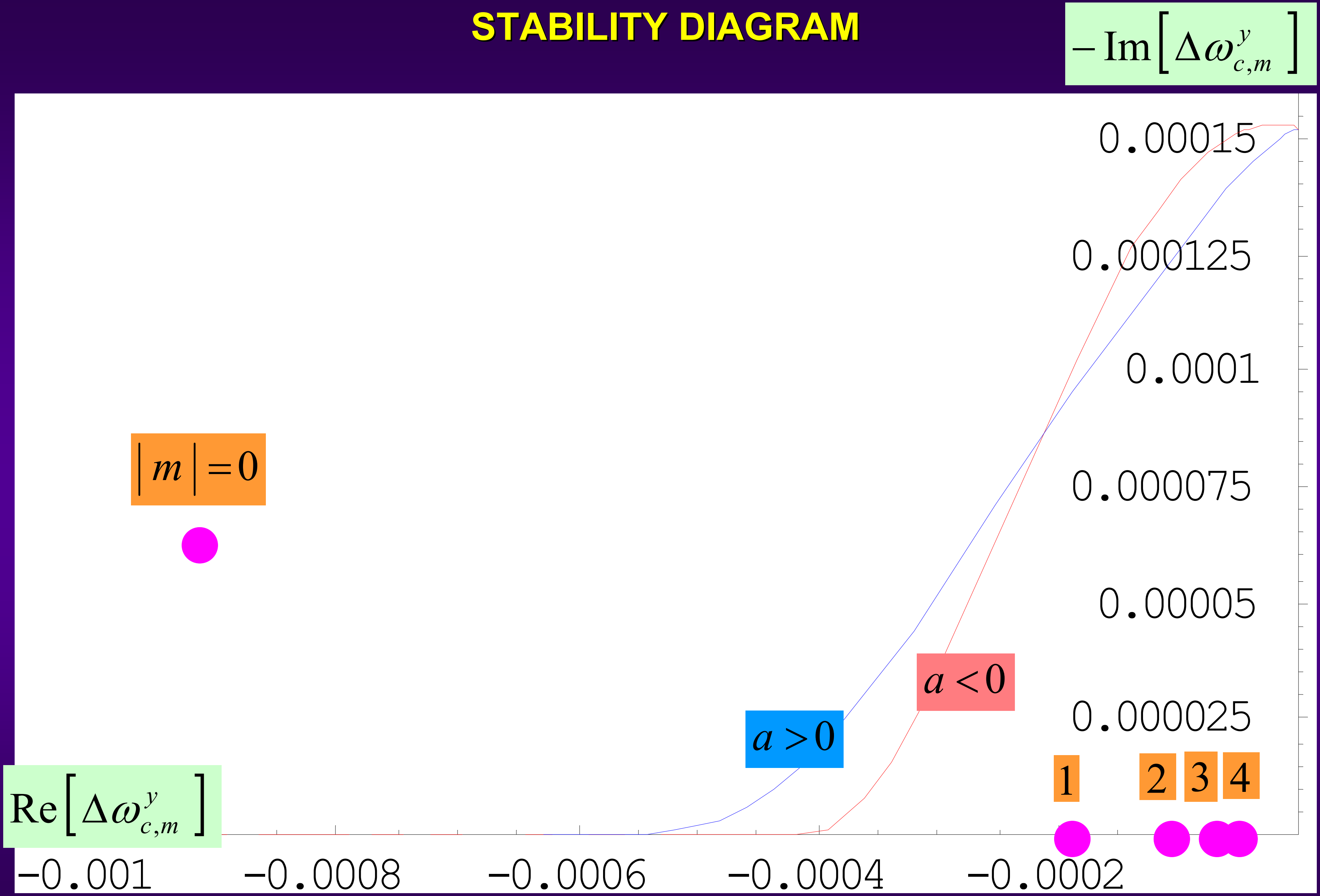
$$\Rightarrow \quad \Delta Q_x^{spread,rms} = \Delta Q_y^{spread,rms} \approx 1.8 \times 10^{-4}$$

$a = 270440$ $b = -175420$ **with** $Q_x\left(J_x, J_y\right) = Q_0 + a\,J_x + b\,J_y$

$c = b / a = -0.65$ $S = 6.8 \times 10^{-4}$

$S = \text{-}5\,a\,\varepsilon_{rms}$ **is the full horizontal tune spread**

STABILITY DIAGRAM



CONCLUSION

- **The dipole mode *m* = 0 is not stabilized !!!**

- **But, all the computations were made considering a single graphite collimator, to be consistent with all my previous computations**

$$b = 2\ \mathrm{mm} \qquad l = 20\ \mathrm{m}$$

$$\rho = 18.1818 \times 10^{-6}\ \Omega\,\mathrm{m} \qquad \beta_y = 2 \times \beta_{av} = 143\ \mathrm{m}$$

- **$\Rightarrow$ See L. Vos presentation for the more realistic case, where all the different collimators with different lengths and apertures are distinguished $\Rightarrow$ Better situation…**