The incident field into the cavity, expressed in the orthonormal basis U_n of the cavity, can be written, in the presence of a misalignment, as

$$\Psi_{in} = \alpha U_0 + \beta U_1 \tag{1}$$

where $\alpha^2 + \beta^2 = 1$.
If the cavity is out of resonance, the reflected beam is basically the same as the incident one: $\Psi^r_{out} = \Psi_{in}$. If the cavity is on resonance, the part of the incident beam that is coupled into the cavity (αU_0) resonates in it and is reflected with a dephasing of 180 deg and multiplied by the cavity reflectivity r. The not-coupled part (βU_1) is promptly reflected. The reflected beam when the cavity is on resonance is then:

$$\Psi^r_{res} = -r\alpha U_0 + \beta U_1 \tag{2}$$

The overlap integral between the reflected beams when the cavity is on resonance and when the cavity is out of resonance is

$$\langle \Psi^r_{out} | \Psi^r_{res} \rangle = \langle \alpha U_0 + \beta U_1 | - r\alpha U_0 + \beta U_1 \rangle = -r\alpha^2 + \beta^2 = (1+r)\beta^2 - r \tag{3}$$

with $r = \sqrt{0.75}$.

Assuming that the reflected beam is perfectly matched on the LO (i.e. AMC) when the cavity is on resonance, the amount of power not coupled into LO when the cavity is out of resonance will be

$$1 - \frac{\langle \Psi^r_{out} | \Psi^r_{res} \rangle^2}{|\Psi^r_{res}|^2 |\Psi^r_{out}|^2} = 1 - \frac{((1+r)\beta^2 - r)^2}{(1-r^2)\beta^2 + r^2} \tag{4}$$

The plot below shows the quantity above as a function of β^2, whit $R = r^2 = 0.75$.

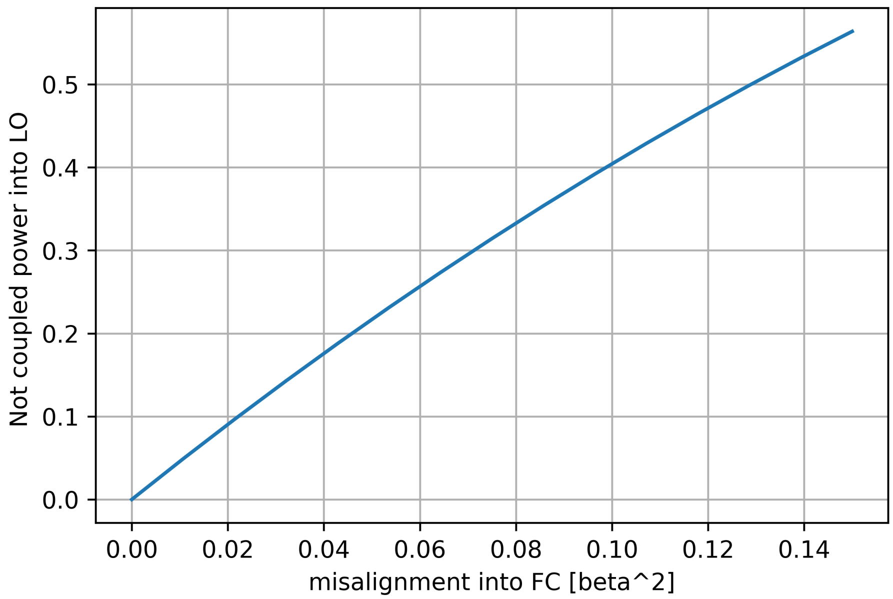

Figure 1: Amount of non matched power into LO as a function of misalignment into the FC β^2, when the reflected beam is aligned into LO with FC resonant and then detuned.

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