

We first determined the resonance frequency by linearly ramping the rf-dipole's frequency by $\Delta f/2 = \pm 2$ kHz around the calculated f_r ; we then continued by making ± 2 kHz ramps next to each side of the previous frequency range until the beam was either spin-flipped or depolarized, as shown in Fig. 2. A gaussian fit to the data yields a central frequency of the resonance of $f_r = 1\,306 \pm 1$ kHz. The dip, however, is much wider than the intrinsic width of the resonance $w = 2\epsilon f_r$ [?], expected to be only 59 ± 3 Hz. Measurements with $\Delta f/2 = \pm 1$ kHz (Fig. 2) show an even shallower dip of comparable width. This feature of the data can be explained by taking into account the spin tune spread $\delta\nu_s$, induced by the momentum distribution of the beam. Therefore, the resonance strength is smeared out by

$$\delta f_r = G f_c \delta\gamma = G f_c \frac{d\gamma}{dp} \delta p = G f_c \beta^2 \gamma \cdot \frac{\delta p}{p}. \quad (1)$$

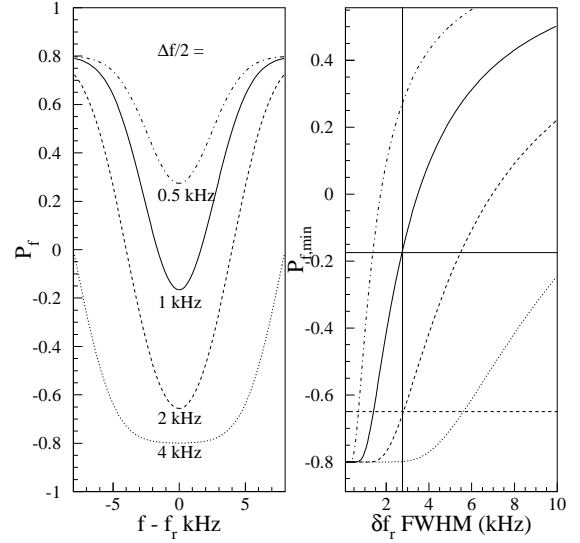
With an estimated momentum spread of $\delta p/p = 2.5 \cdot 10^{-4}$ we obtain a standard deviation $\delta f_r \approx 1.23$ kHz which corresponds to a spin tune spread $\delta\nu_s$ of $8 \cdot 10^{-4}$. When the frequency sweep is centered on the resonance, the final polarization is given by the fraction of the beam particles for which the resonance condition is met. Assuming a gaussian momentum distribution one obtains

$$\frac{P_f}{P_i} \Big|_{\text{minimum}} = 1 - 2 \operatorname{erf} \left(\frac{\Delta f}{\sqrt{2} \delta f_r} \right) \quad (2)$$

which yields $P_f = -0.65(-0.18)$ in the minimum for $\Delta f/2 = \pm 2$ kHz (± 1 kHz) in good agreement with the data.

Not for the paper and just to illustrate: using $P_i = 0.8$, information on δf_r is contained in the depth/shalowness of the dip and not the width!

On the right: vertical line at $\delta f_r = 2.77$ kHz (FWHM) or 1.18 kHz (standard deviation). Horizontal lines: measured P_f at the minimum of the dip for $\Delta f = \pm 1$ kHz (solid line) or ± 2 kHz (dashed line). This uses Eq. (2).



Eq (1) could also be shortened:

$$\delta f_r = G f_c \delta\gamma = G f_c \beta^2 \gamma \cdot \frac{\delta p}{p}.$$