Depolarization studies for W threshold

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Introduction

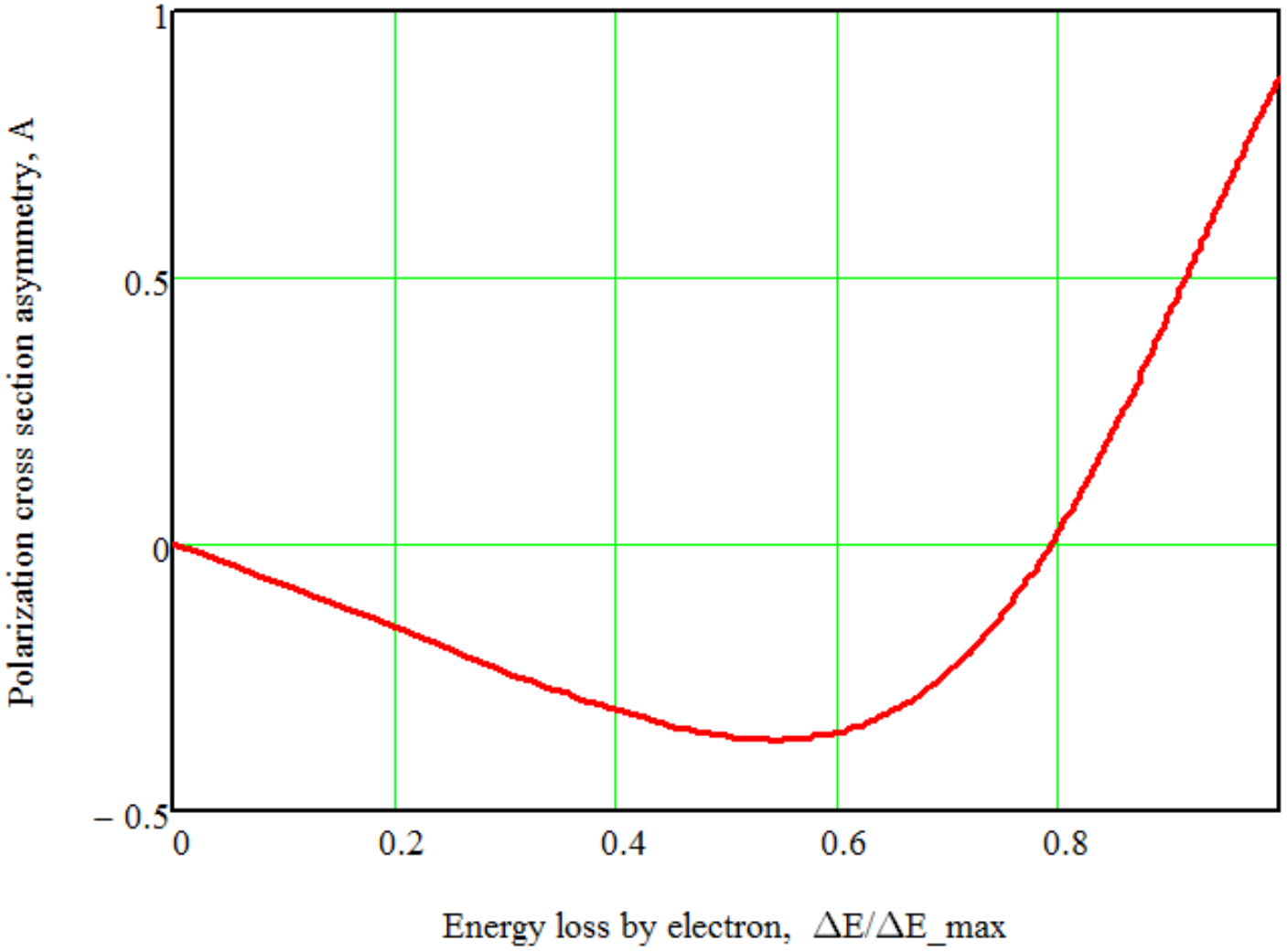
- Large value of synchrotron modulation index $\xi = \nu_0 \sigma_\delta / Q_s$ (at W ν_0=182.5, σ_δ=.00066, Q_s=0.05 $\rightarrow$ $\xi = 3.2$) led to overlap of many synchrotron side band resonances and, as a result, the resonant depolarization does not work – no sharp depolarization at the resonant frequency is observed during a scan in my simulations, unless Q_s >0.075 (a talk at 16.11.2017 video-conference meeting).

- Here I will present a new idea of how the resonant frequency at W energy range can be measured at somewhat lower Q_s=0.05, at least.

- The idea is not use the standard scanning method, but, instead, deflect spins by strong Flipper device from the vertical direction to some large enough angle and measure turn by turn free precession frequency of spin ensemble using the Compton Super-Polarimeter.

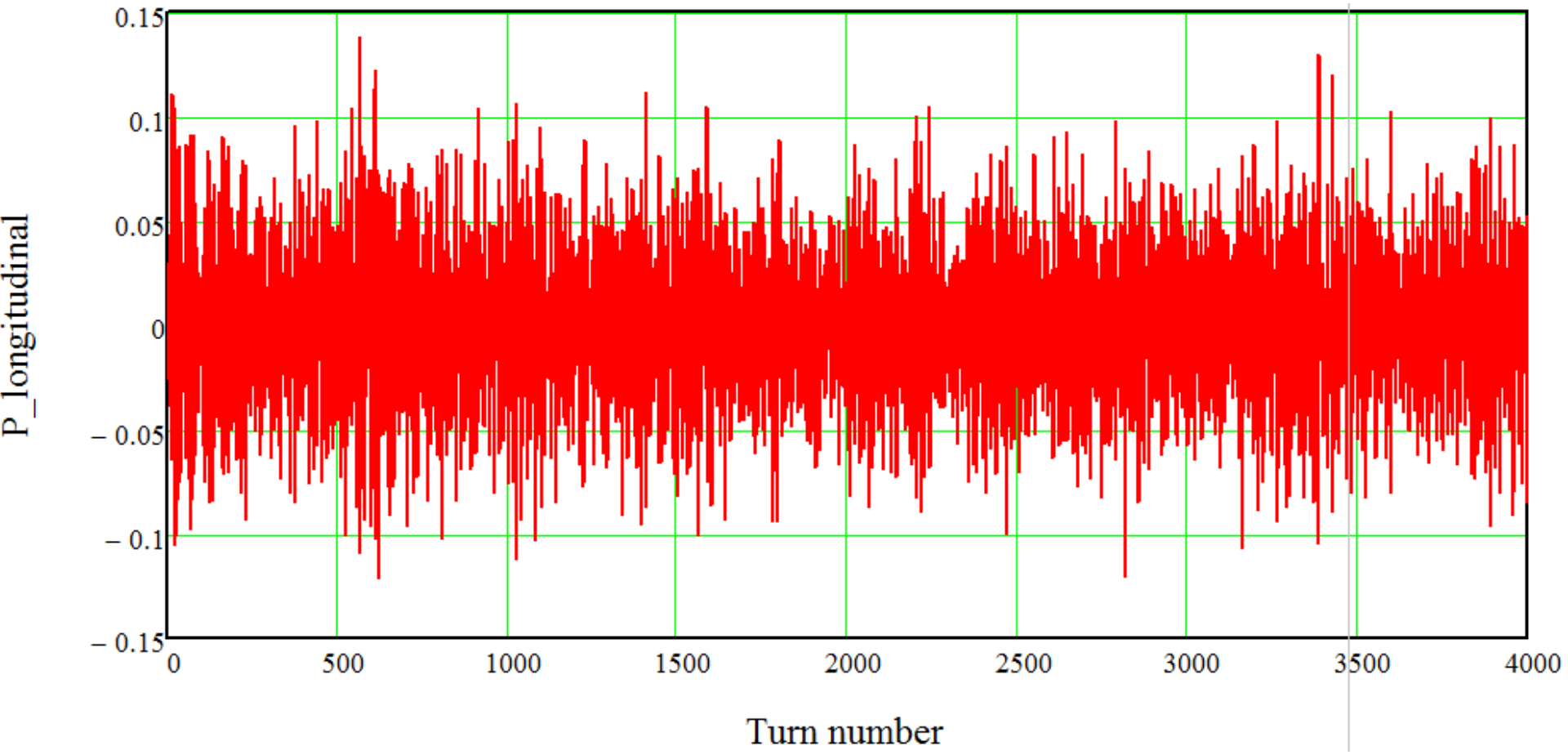
Longitudinal Compton Polarimeter

Compton cross section asymmetry for scattering of circularly polarized light on 80 GeV electron.



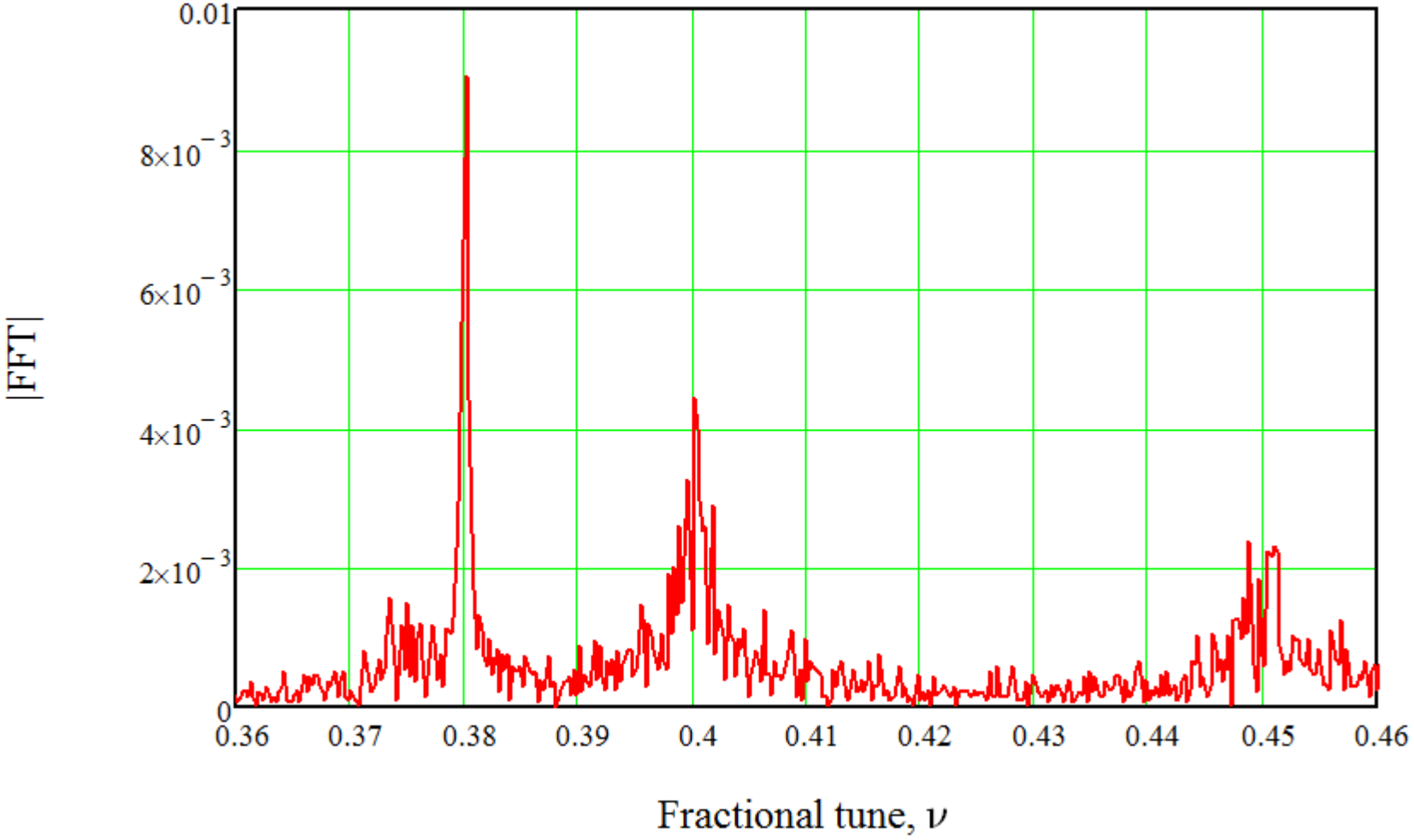
Flipping 80 GeV beam spin ensemble

Flipping of N=250 spins by a Flipper with w=0.01, Q_s=0.075 and the detuning from a resonance Δν=-0.02. The longitudinal polarization component oscillates between -0.12 and +0.12.



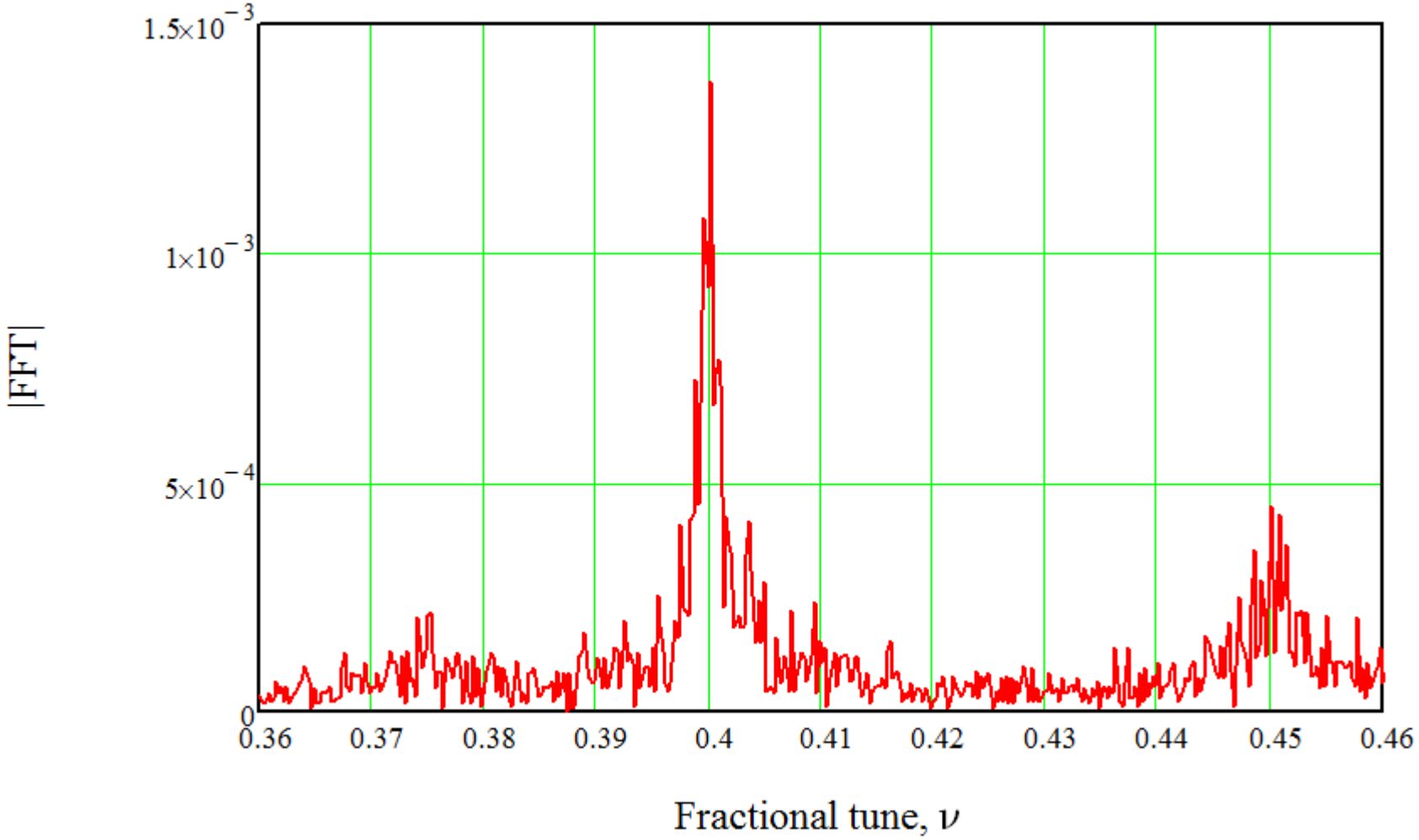
Spectrum of flipping 80 GeV beam

Fast Fourier Transform of the previous data. One can see here two main peaks: ν=0.38 – the flipper frequency and ν=0.40 – free spin precession tune. Remind: w=0.01, Q_s=0.075 .



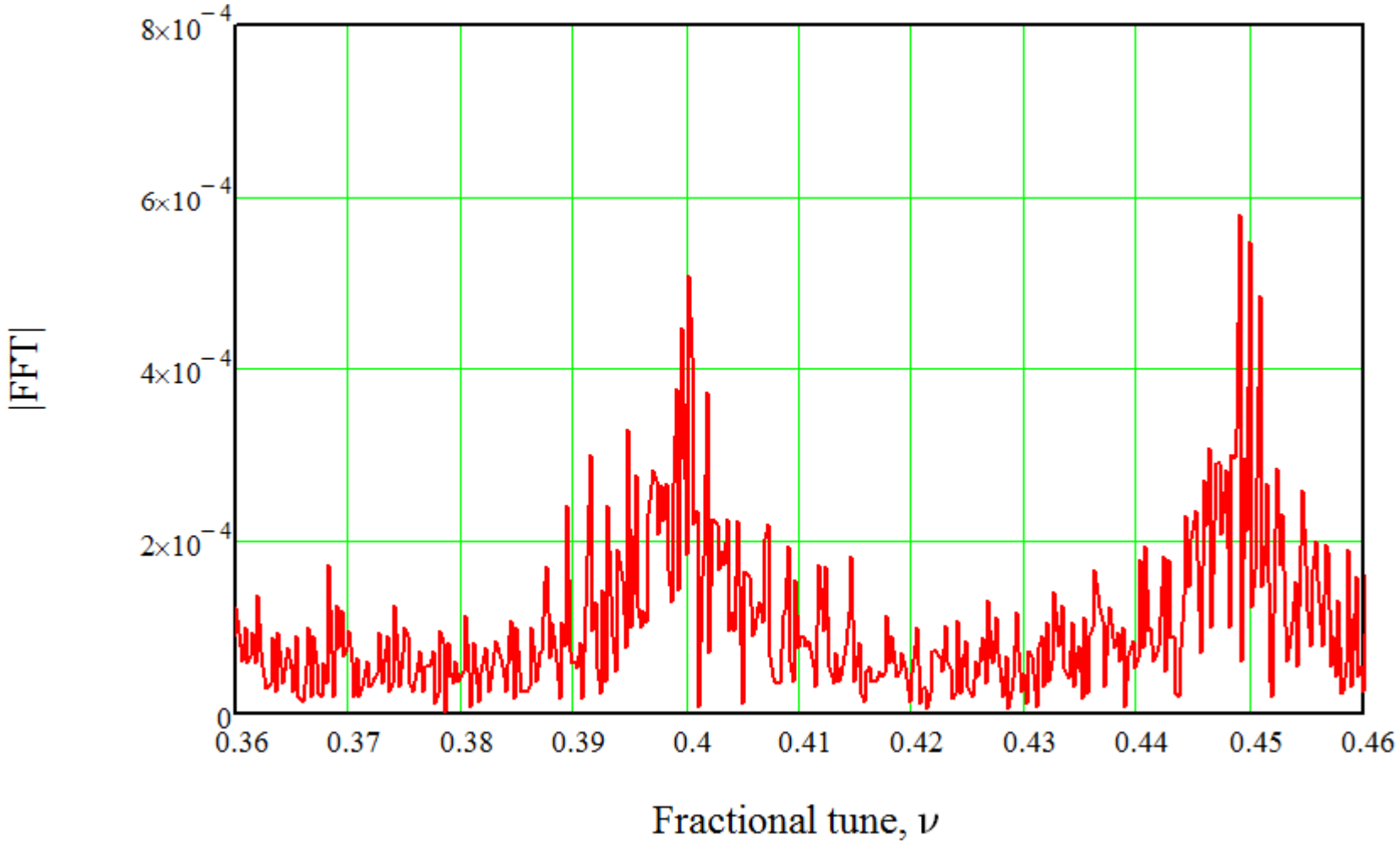
Spectrum of free precession 80 GeV beam

Spectrum of free precession after switch off the Flipper. One can see only one main peak: ν=0.40 – free spin precession tune. Remind: Q_s=0.075 .



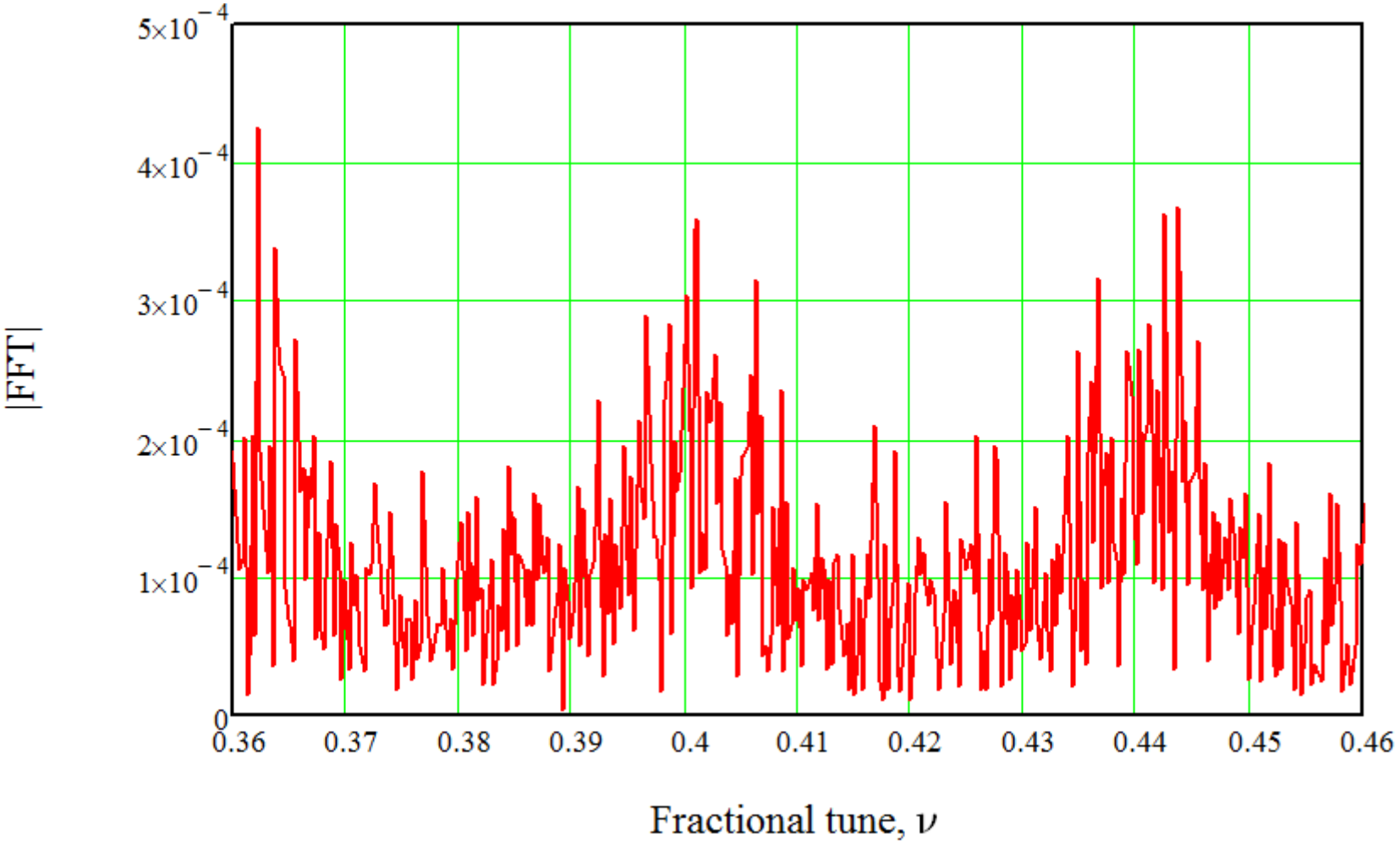
Spectrum of free precession 80 GeV beam

Spectrum of free precession after switch off the Flipper. One can see smaller peak: ν=0.40 – free spin precession tune and the side band - ν=0.45 . Remind: Q_s=0.05 .



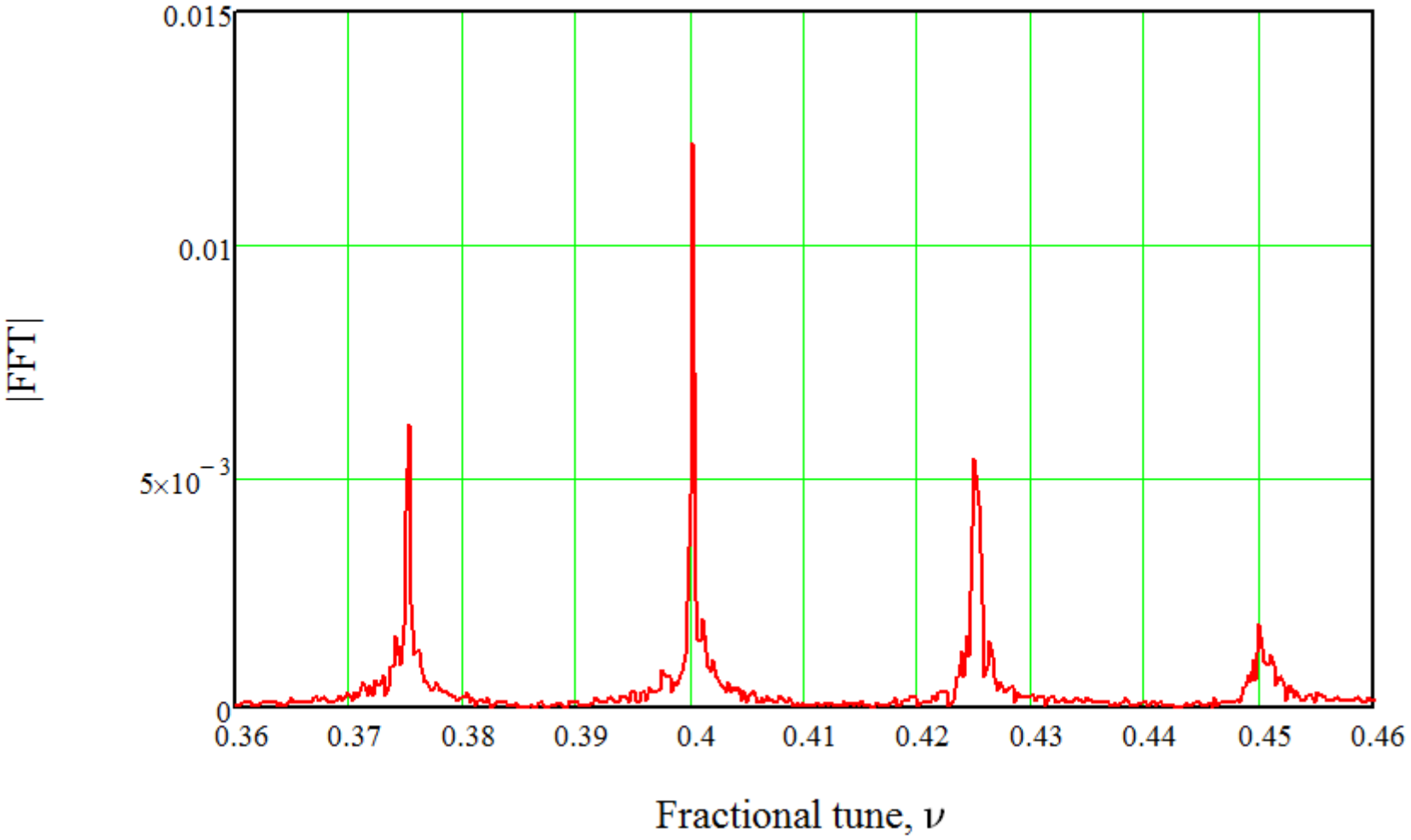
Spectrum of free precession 80 GeV beam

Spectrum of free precession after switch off the Flipper. One can see smaller peak: ν=0.40 – free spin precession tune and the side band - ν=0.44 . Remind: Q_s=0.04 .
Such pattern can not be considered as good one!



Spectrum of free precession 45 GeV beam

Spectrum of free precession after switching off the Flipper. One can see main peak: ν=0.40 – free spin precession tune and 3 side bands - ν=0.375, 0.425, 0.45 . Remind: Q_s=0.025 . Beautiful picture!



Conclusion

- The proposed method to measure the free spin precession frequency, deflecting beforehand the spins by the strong Flipper device (w=0.01 or about this), substantially widens the applicability of the spin resonant calibration idea to conditions with low Q_s=0.05.