Update for depolarization studies at W threshold

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Spin resonance width and new RD technique

- My spin tracking code has revealed dramatic increase of the width of the central resonance line at W threshold for chosen by FCC-ee team the synchrotron tune value: Qs=0.05.

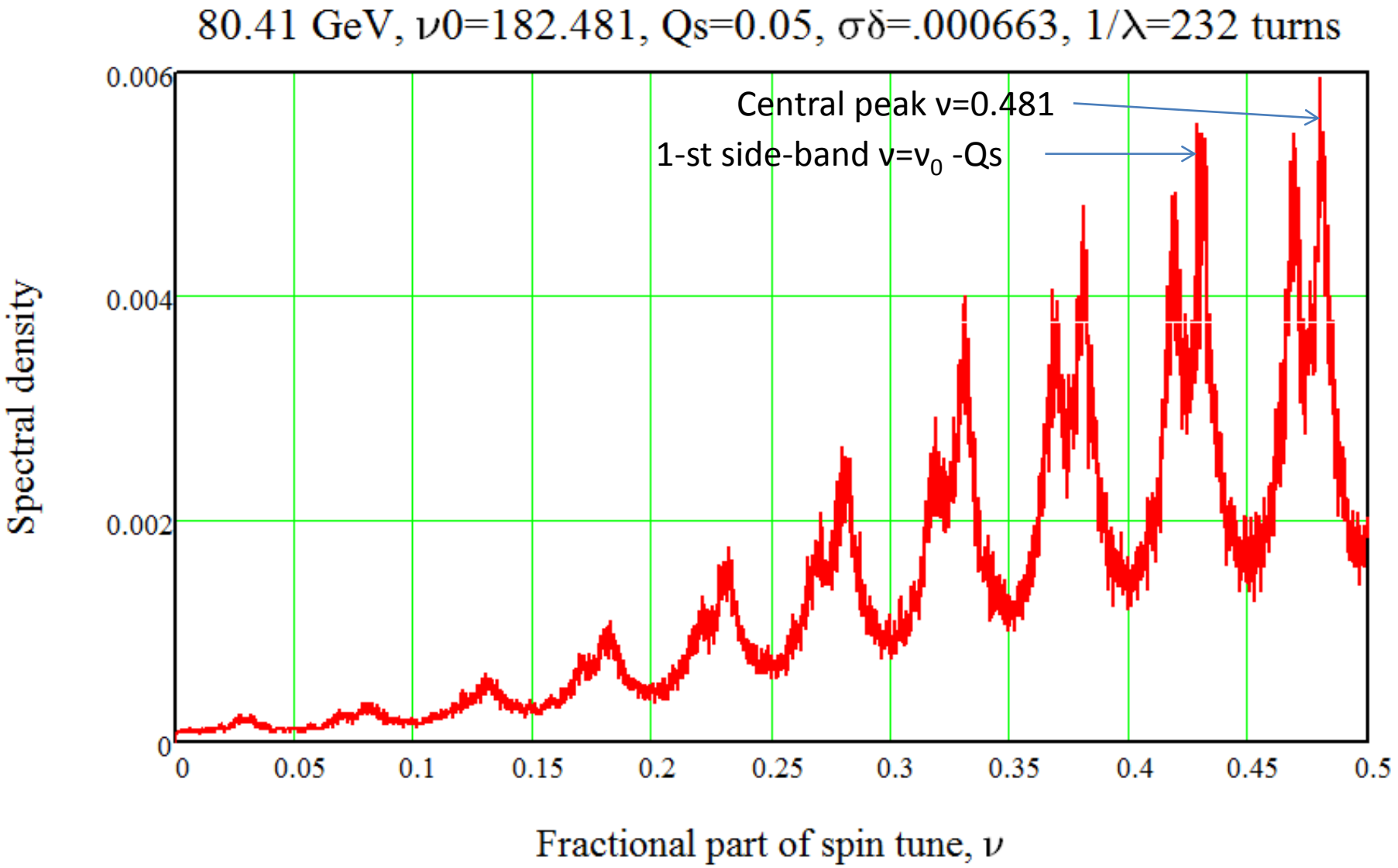
- With such low synchrotron tune and, subsequently, too high value of the synchrotron modulation index $\xi=\nu_0\sigma_\delta/Qs=2.4$ a width of the central spectrum line becomes very large: $\Delta\nu=\pm0.002$.

- In such situation there is no any sense to scan the resonance monotonically – no sharp changes in the polarization degree are expected.

- Much more economic is to do probing of the depolarization efficiency in few depolarizer's tune points around the center of a peak – then steps in polarization degree became quite visible. This idea was proposed by Alain Blondel, as been tested already at LEP.

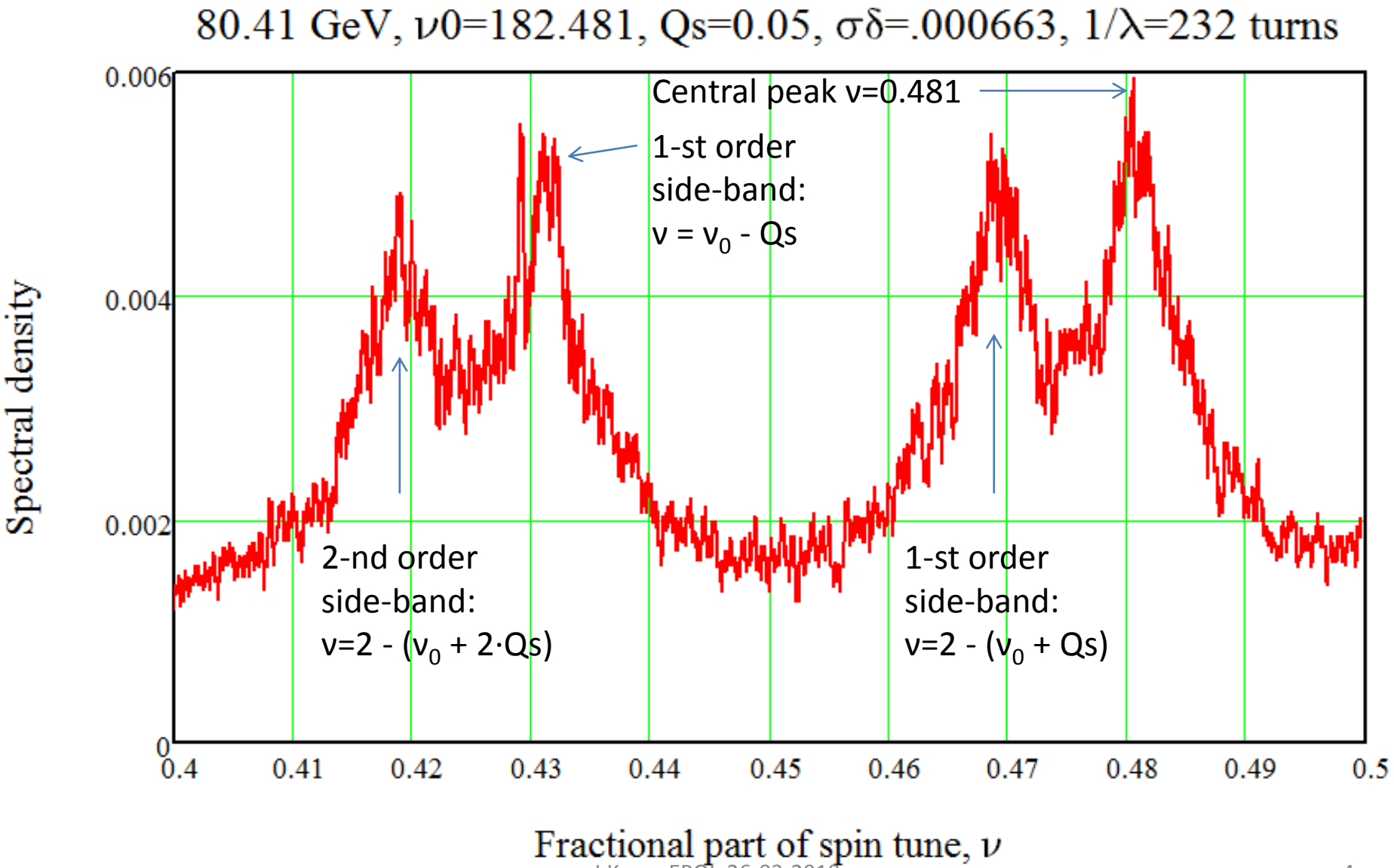
Spectrum of 80 GeV single particle spin motion

Spectrum of free spin precession of single particle during 40000 turns. Q_s=0.05.



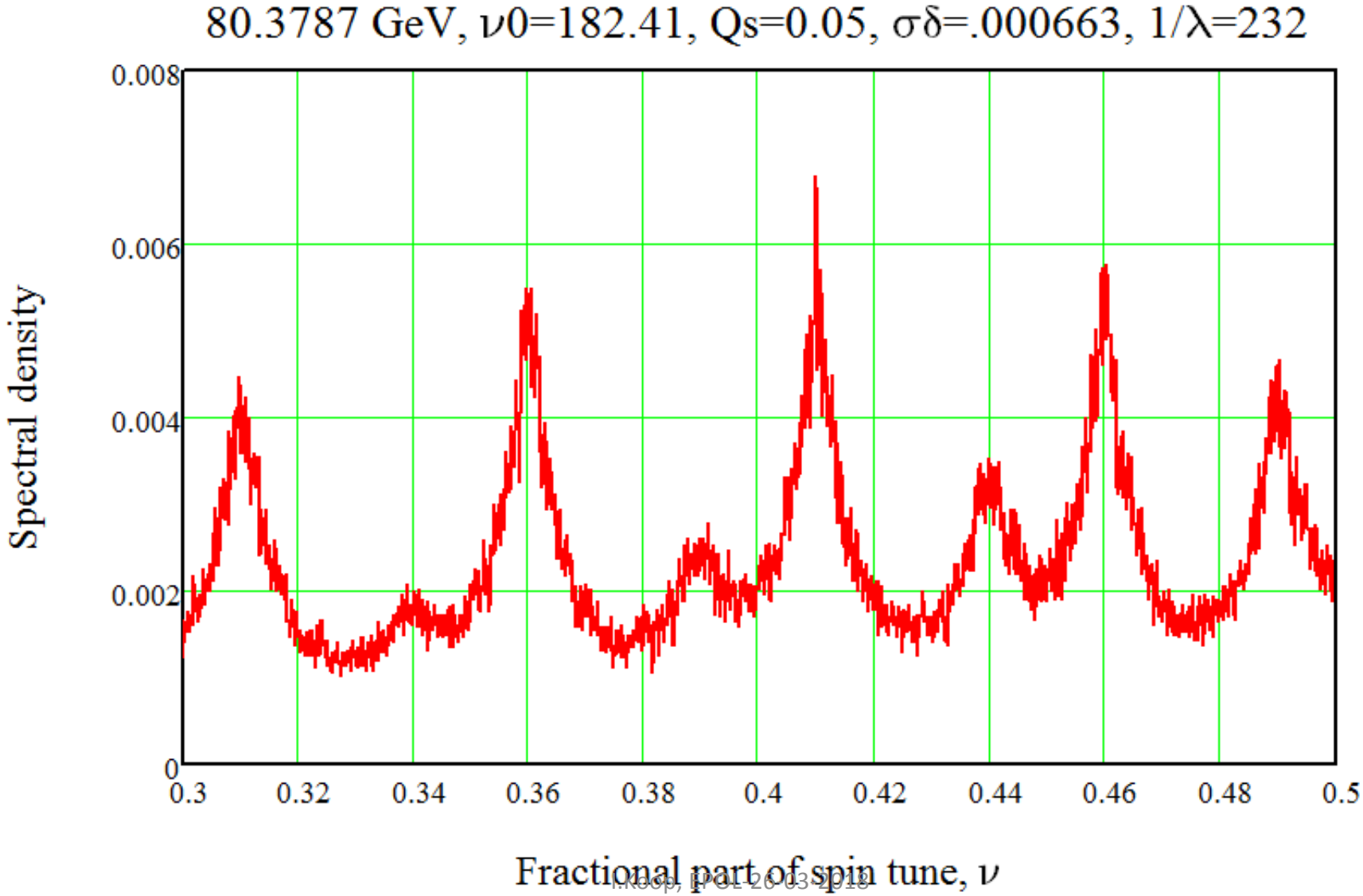
Zoom of spectrum of single particle spin motion

Spectrum of free spin precession of single particle during 40000 turns. Q_s=0.05.



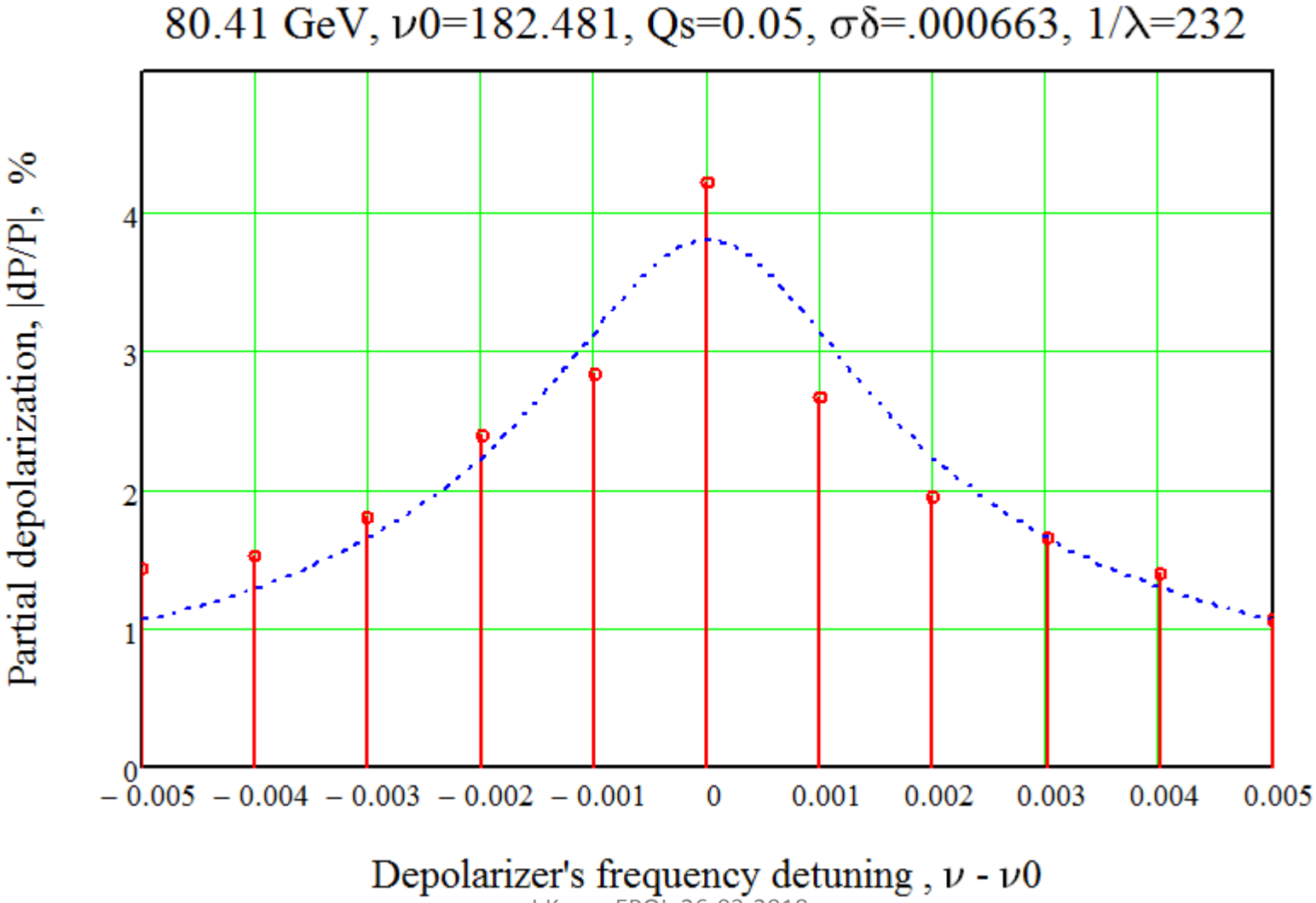
Spectrum for slightly shifted spin tune $\{\nu_0\}=0.41$

Mirror symmetric the left and the right wings of the central line with this choice of $\{\nu_0\}$. It is better to reduce a possible error in determination of a the center of a peak!



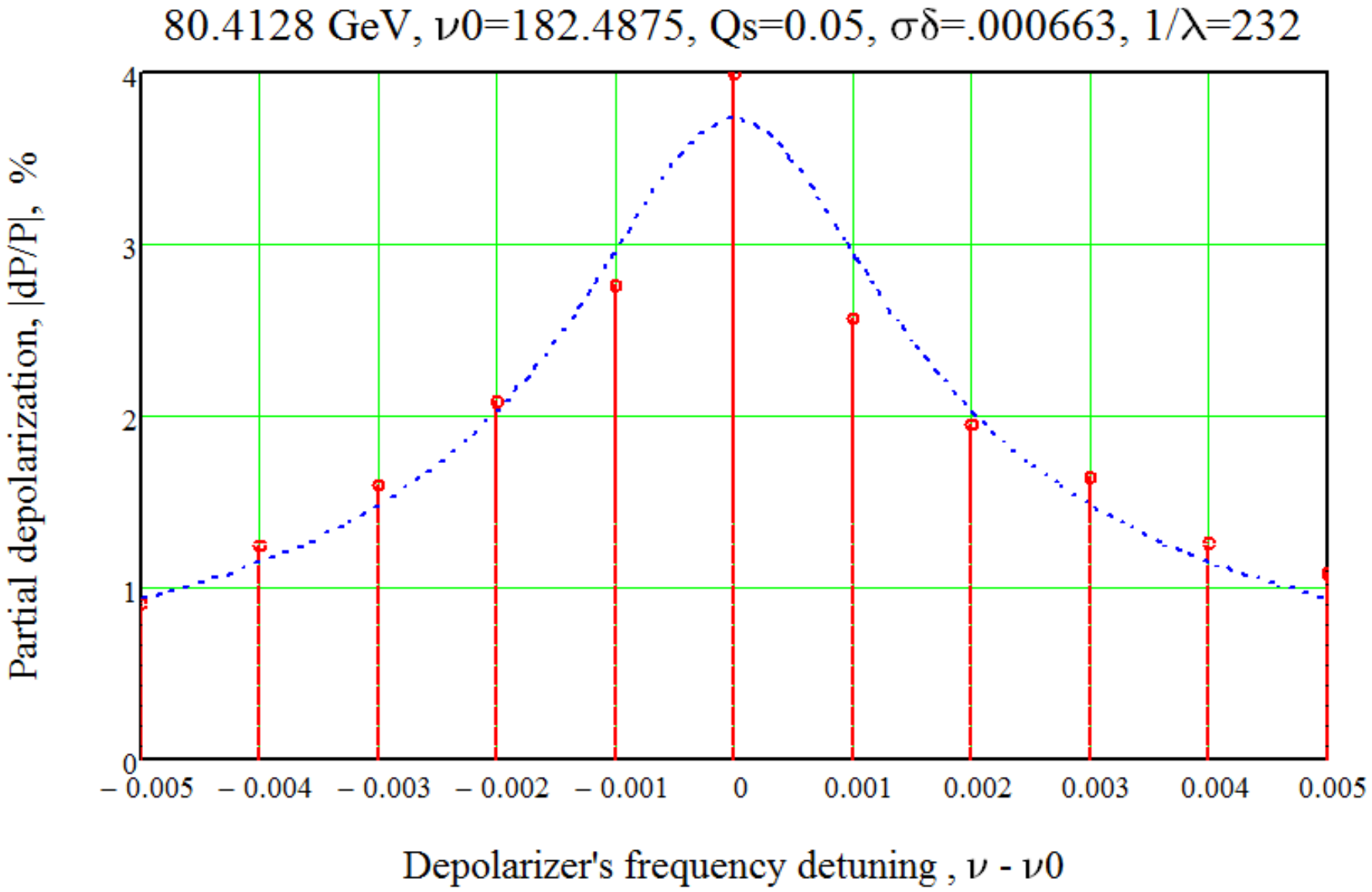
Partial depolarizations by 11 steps in depolarizers frequency

The left and the right wings of the central line are slightly asymmetric due to close proximity of 1-st order synchrotron side-band. This should be accounted when do fitting to a model. The presented at the plot fit is symmetric – hence not fully correct.



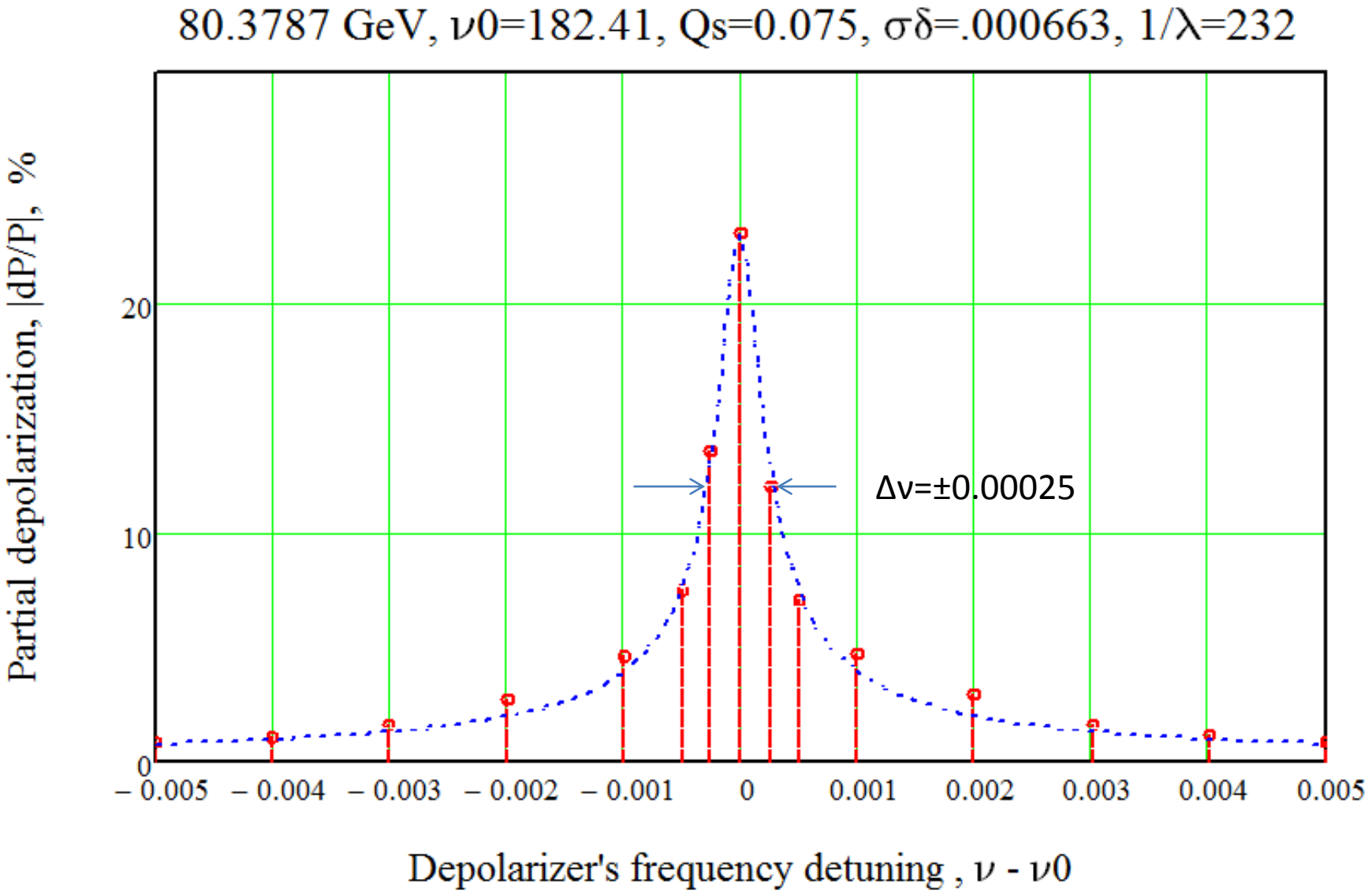
Partial depolarizations by steps, $\{\nu_0\}=0.4875$

The left and the right wings became symmetric with this choice of fractional part of ν_0.



Partial depolarizations by steps with Qs=0.075, $\{\nu_0\}$=0.41

The RD peak with Qs=0.075 is 8 times more narrow in comparison with the case Qs=0.05



Conclusion

- Spin tracking of a motion of a single particle reveals the dependence of the spectrum width from the synchrotron tune and other beam parameters.

- The width becomes very large for choice of the synchrotron tune Qs=0.05 and standard RD procedure becomes not applicable.

- The
discussed above new RD procedure (by steps) works well even in cases when a width of the spin resonance became very large. That is just a case with Qs=0.05.

- Still the accuracy of a method needs to be studied further.