

**Universität
Stuttgart**

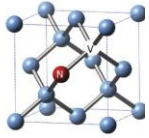
Progress on **PETER** Project

UNISTUTT

10th of June 2021

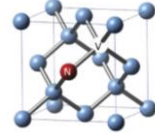
21st -
24th
May

Measurements
of NV centers
without mirror



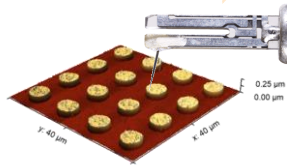
24-25th
May

3D printing of
MW absorber
and EPR tests



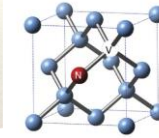
26-27th
May

AFM
measurements
in EPR
conditions



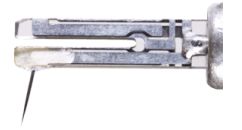
End of
May

3D print of
PETG sample
holder and EPR
tests



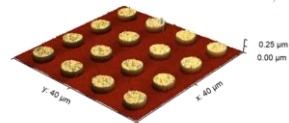
2nd - 7th
July

Frequency
dependence of
single tip



7th - 9th
June

NiFe disks EPR
measurement
(with gold
mirror)



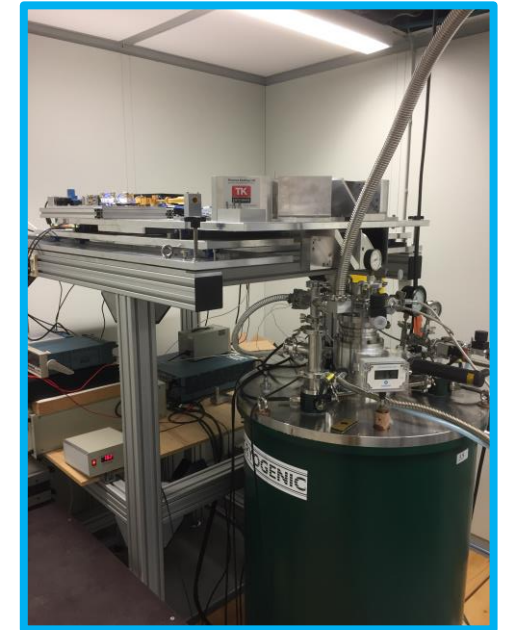
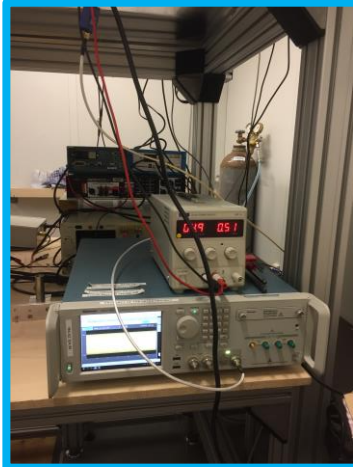
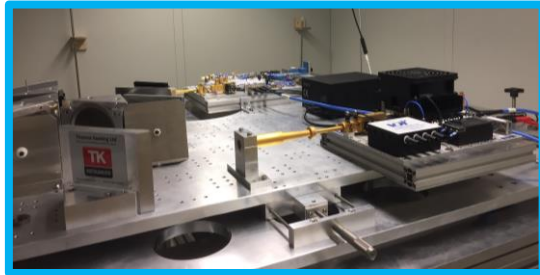
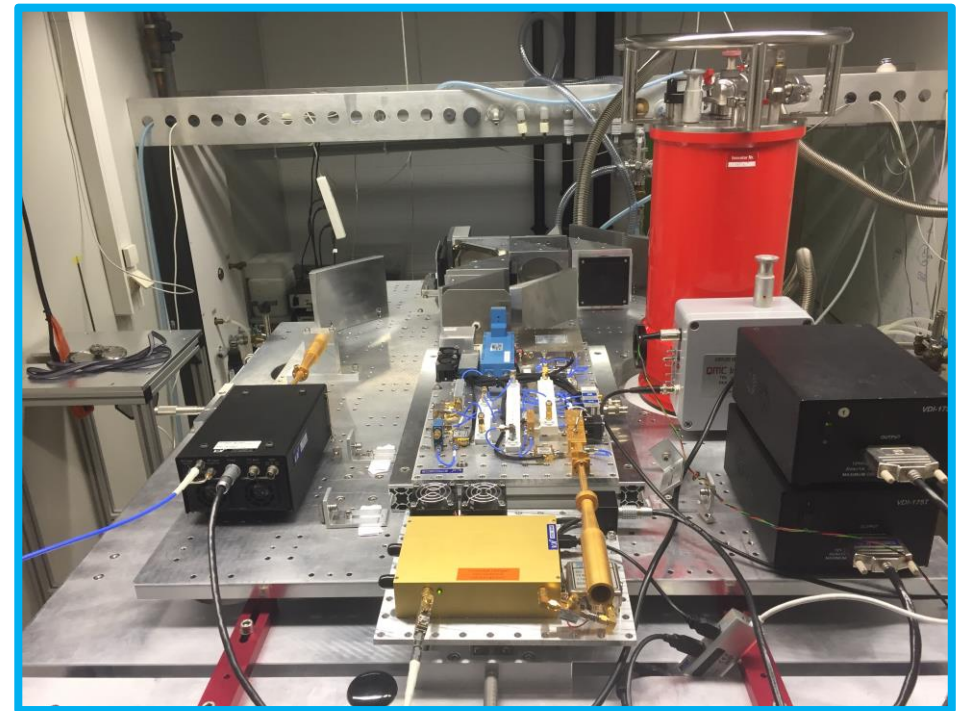
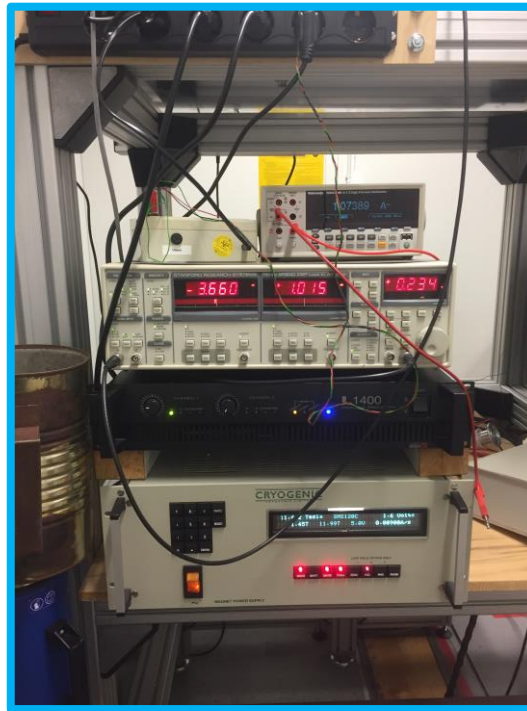
10th
June

**PETER
MEETING**

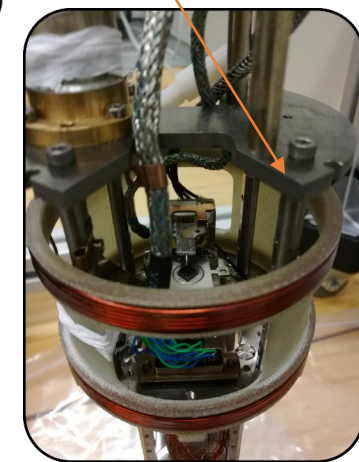
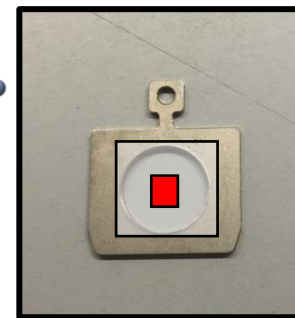
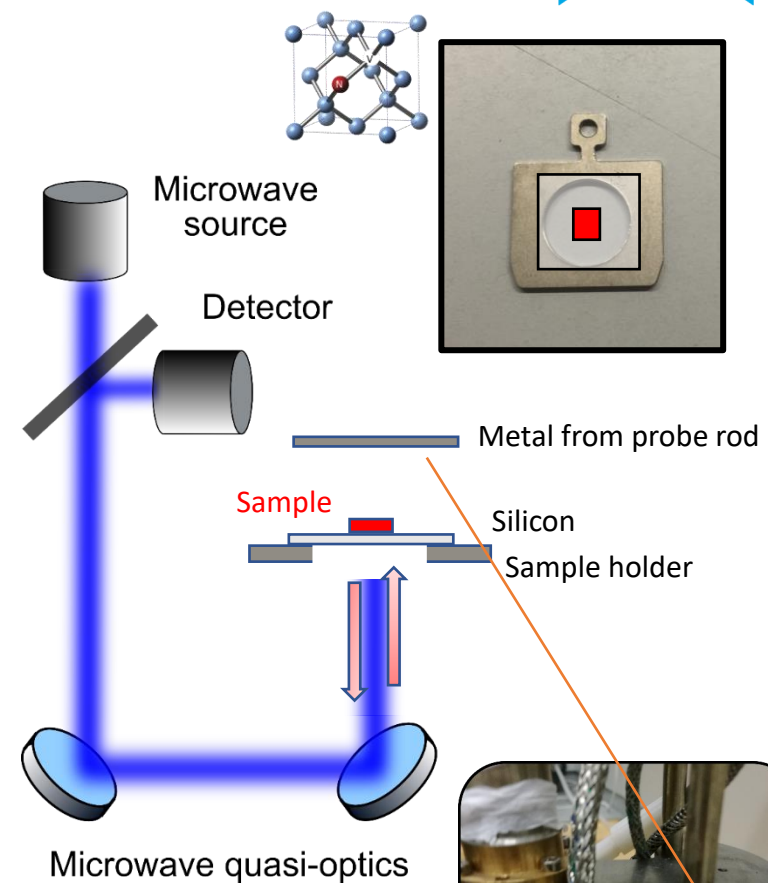
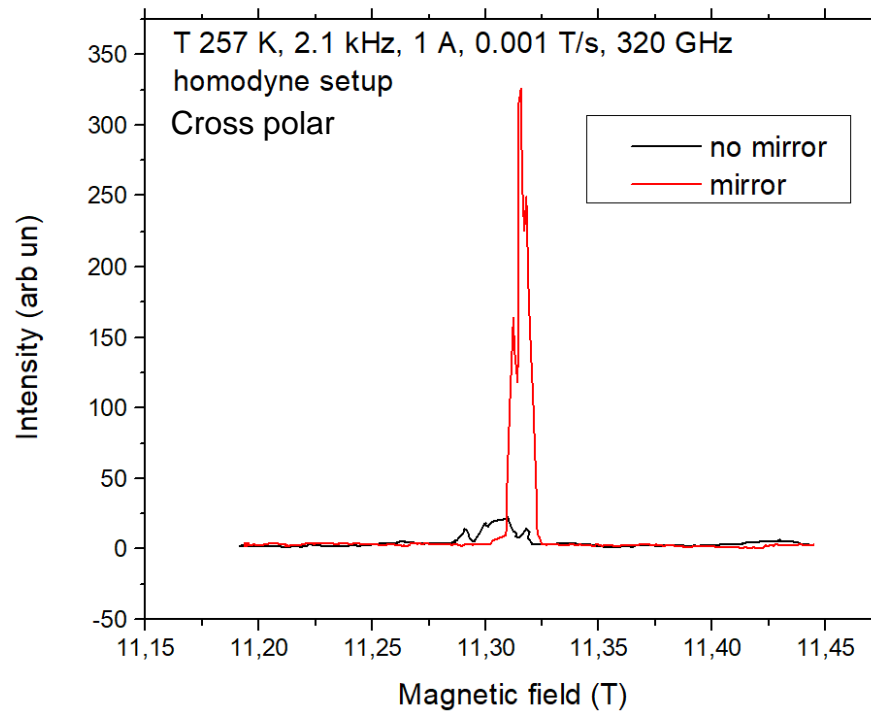
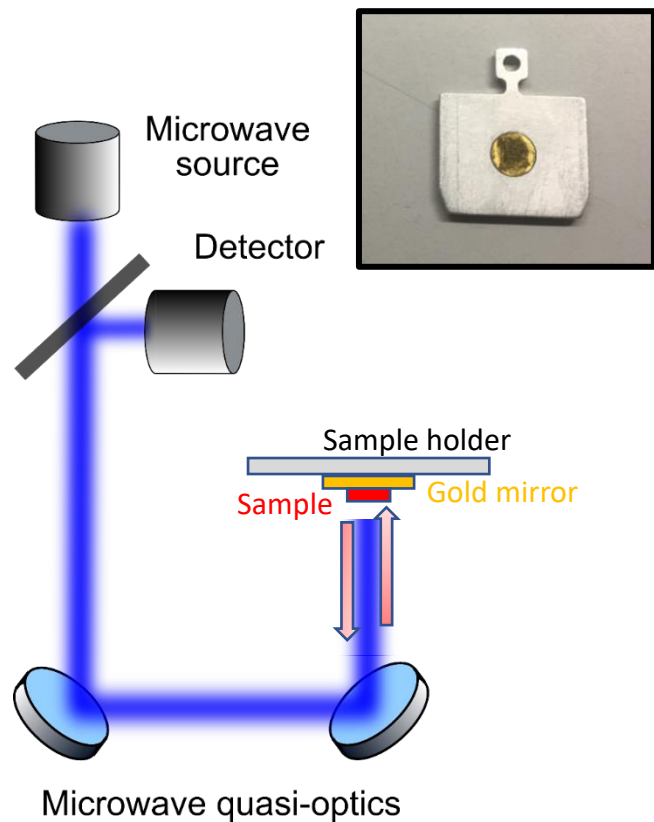
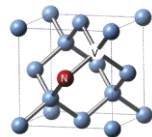
PETER LAB

Currently

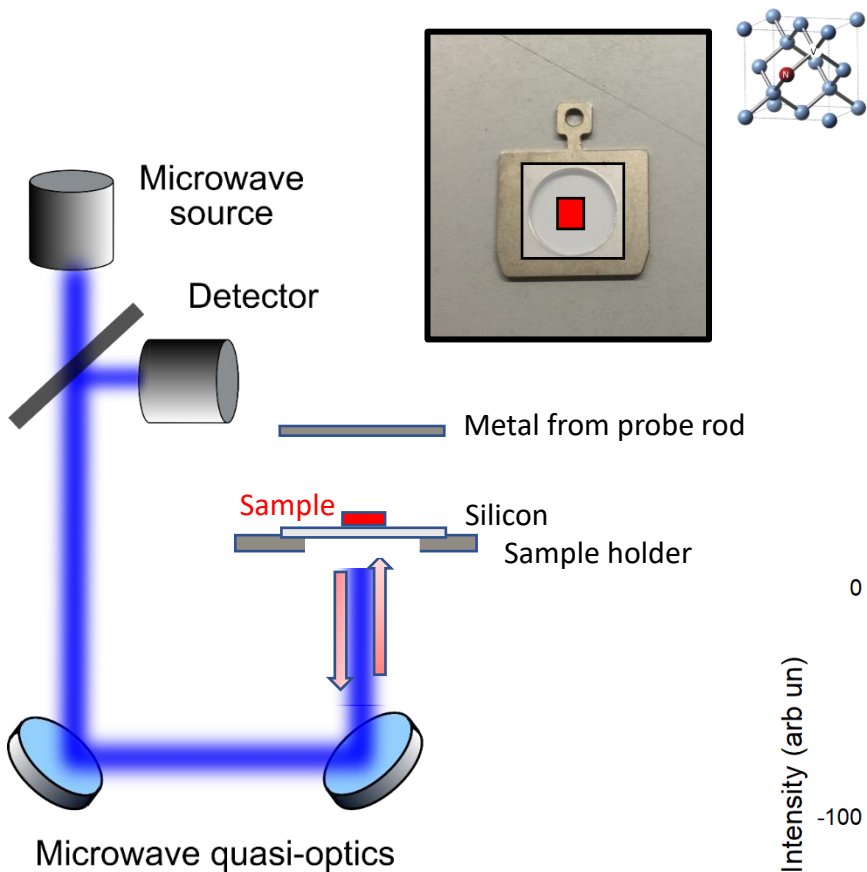
Previously



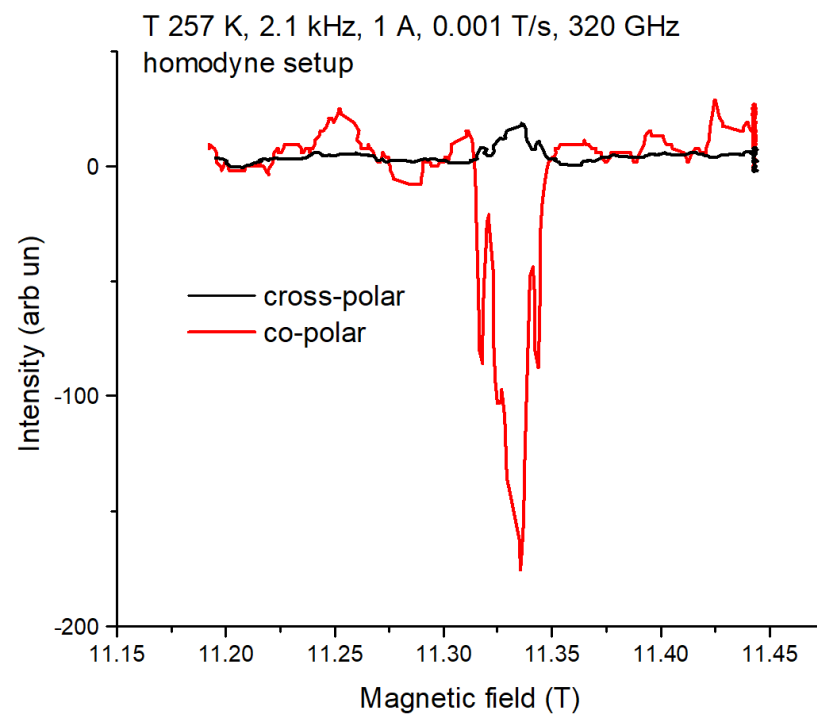
EPR measurements with and without mirror



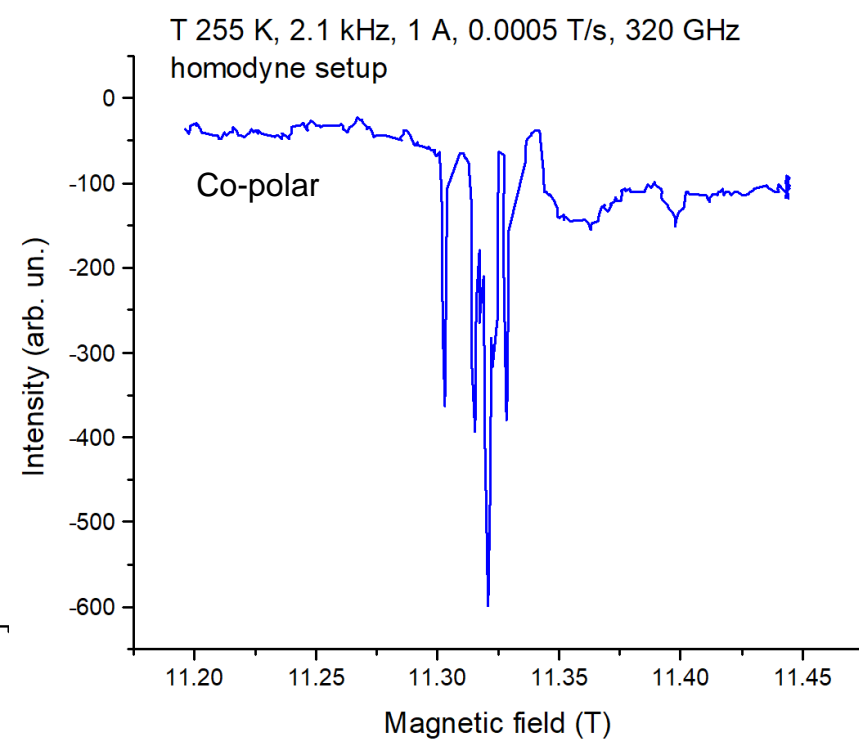
EPR measurements without mirror

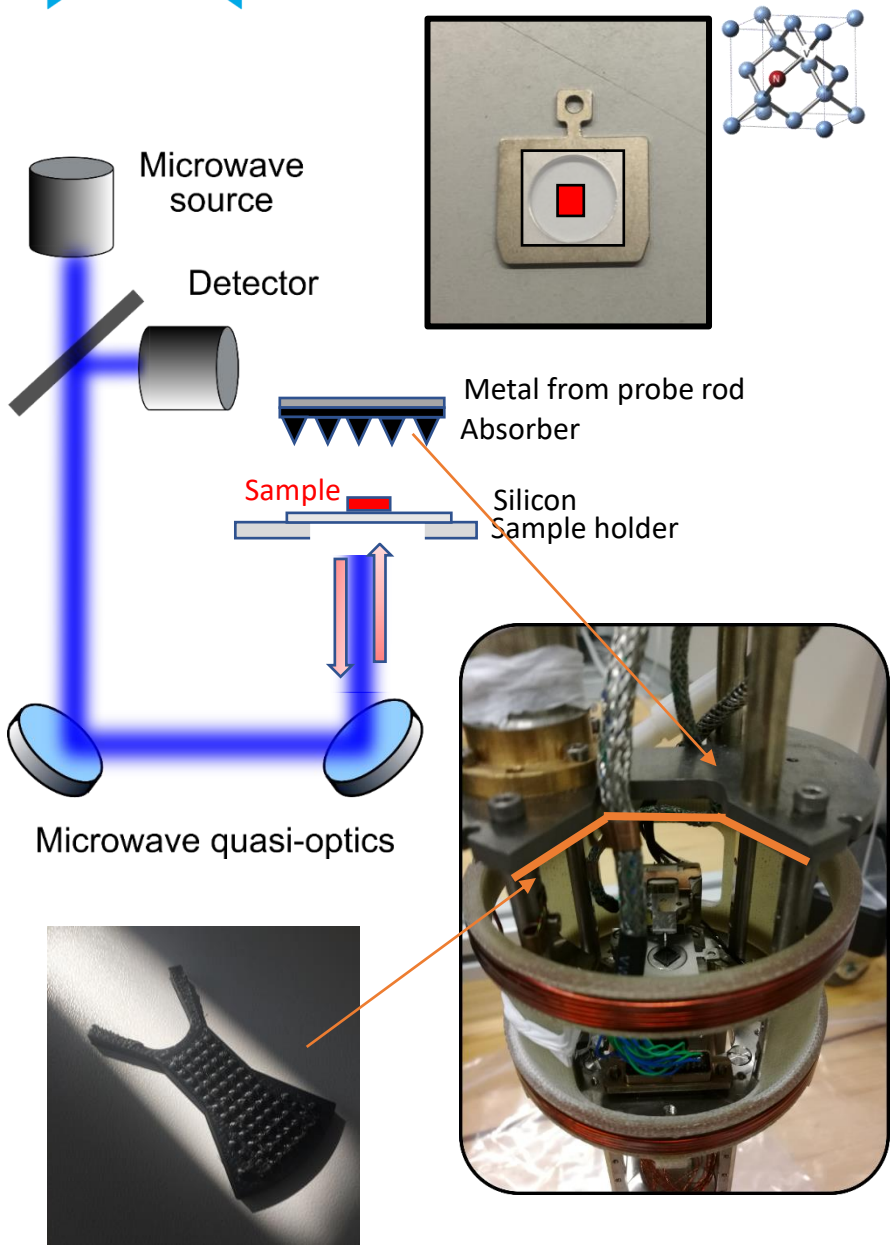


Cross- vs co-polar

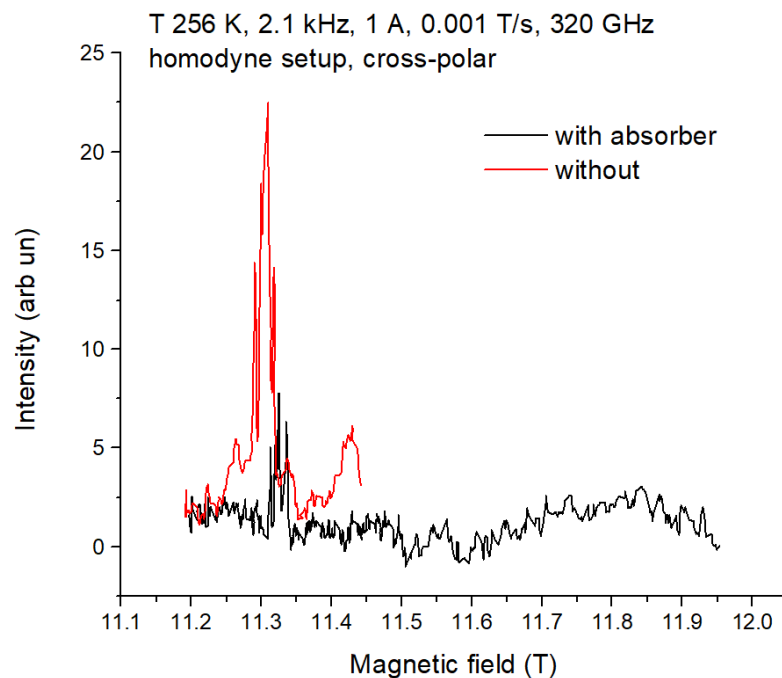


Co-polar slower speed

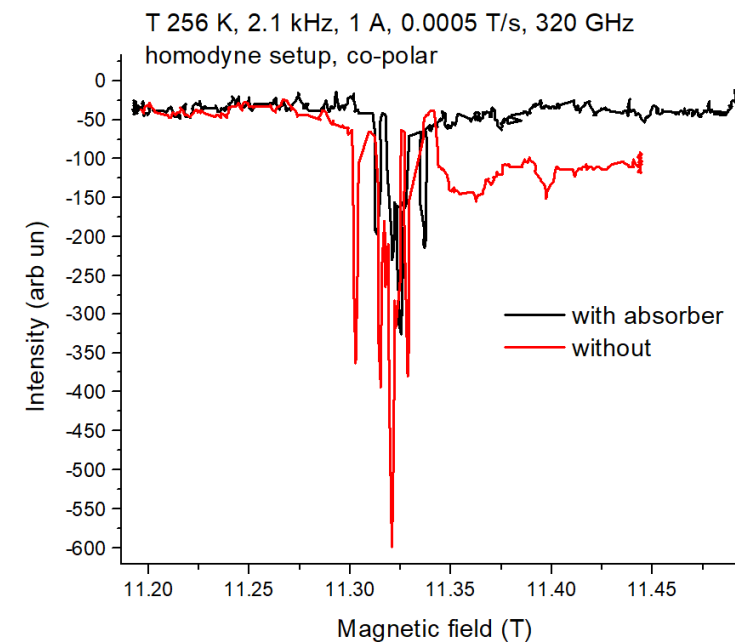




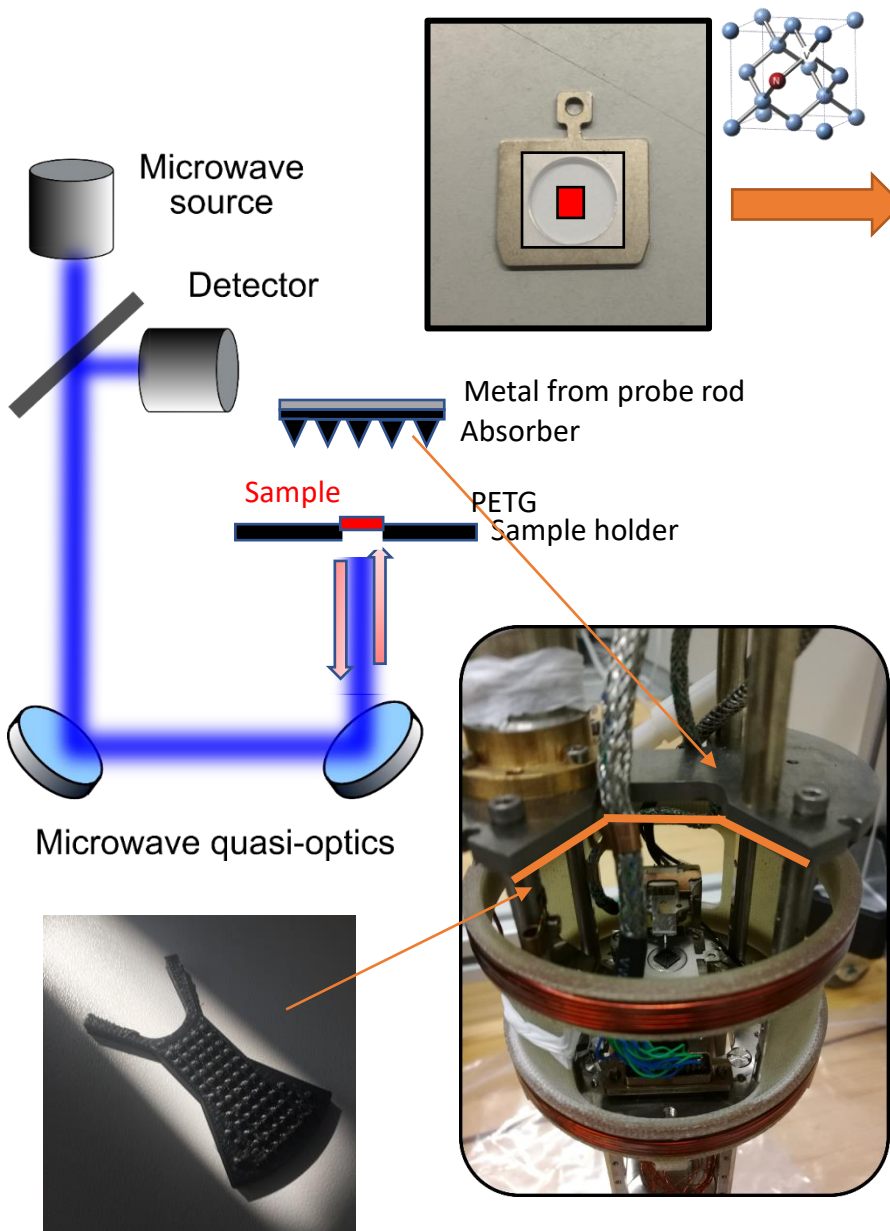
Cross-polar



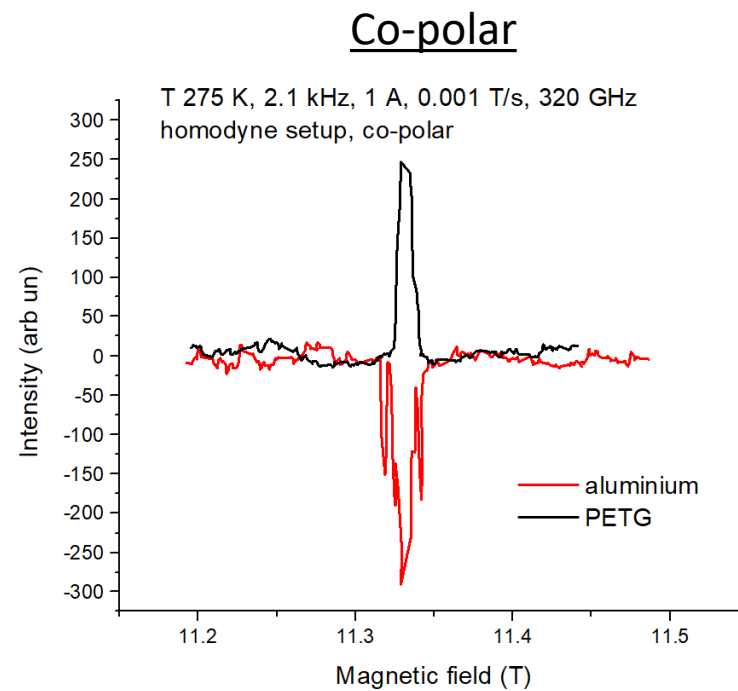
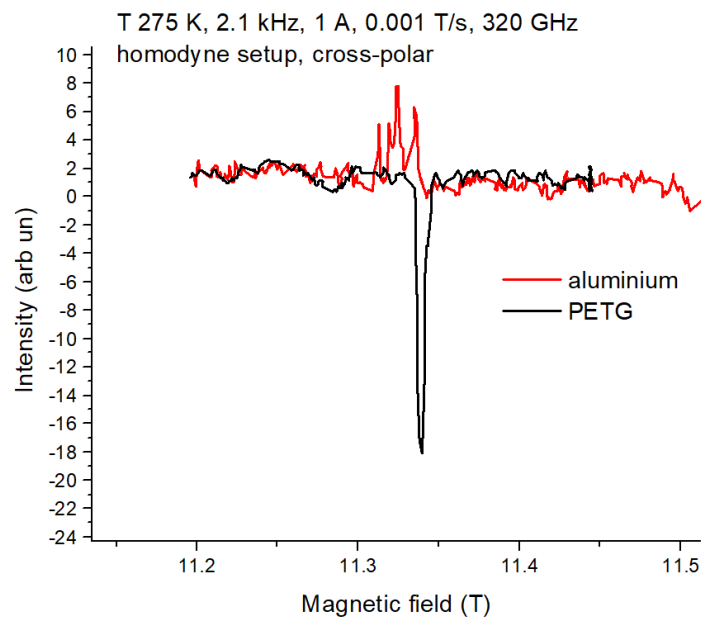
Co-polar



EPR measurements with absorber, with PETG sample-holder

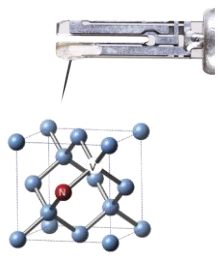
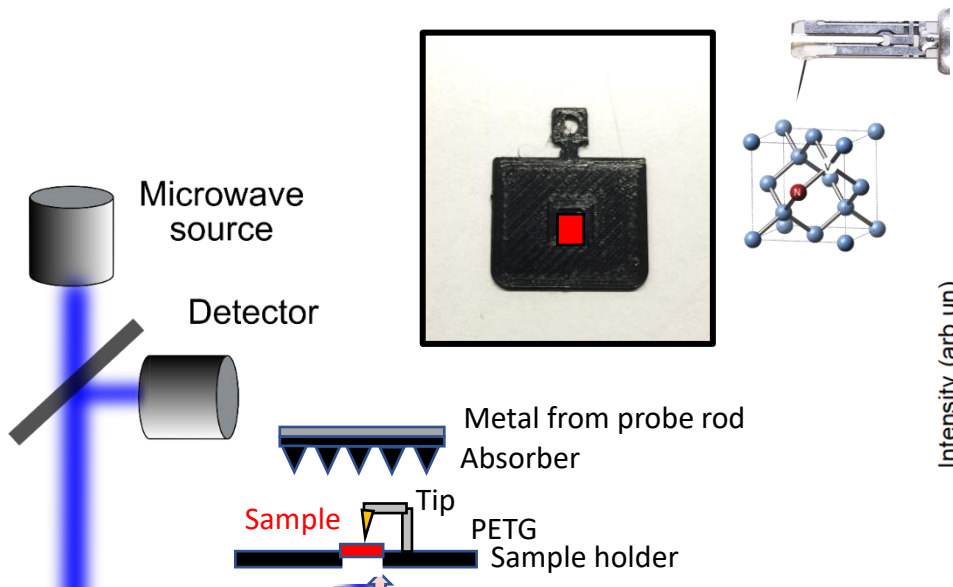


Cross-polar

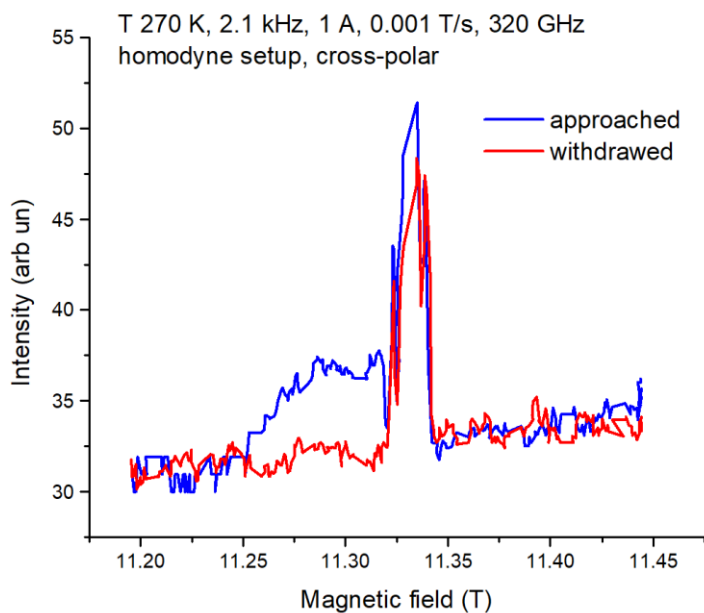


We have now removed most of the radiation that doesn't interact with the sample and that contributes to the background signal. The signal from NVC is now more clear. This is probably back-scattered directly by the sample itself and is unavoidable, unless we change sample.

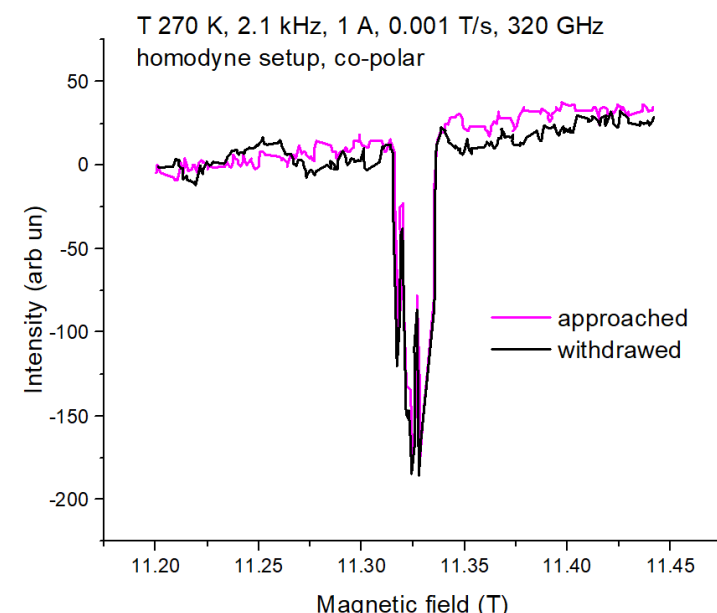
EPR measurements with absorber, with PETG sample-holder, with tip



Cross-polar

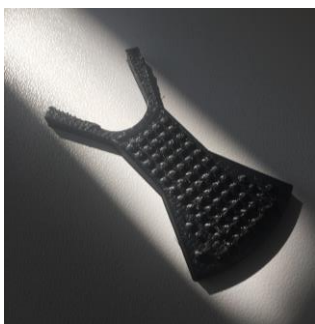
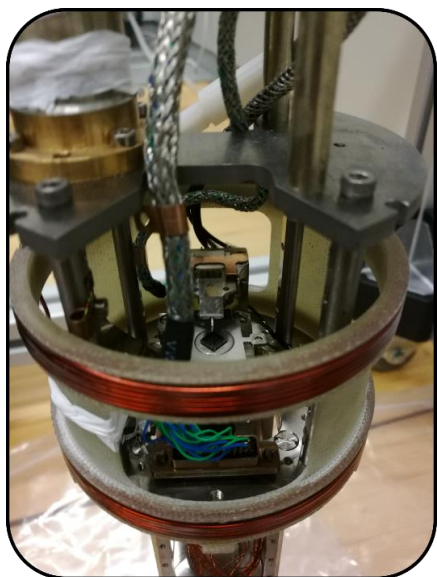


Co-polar



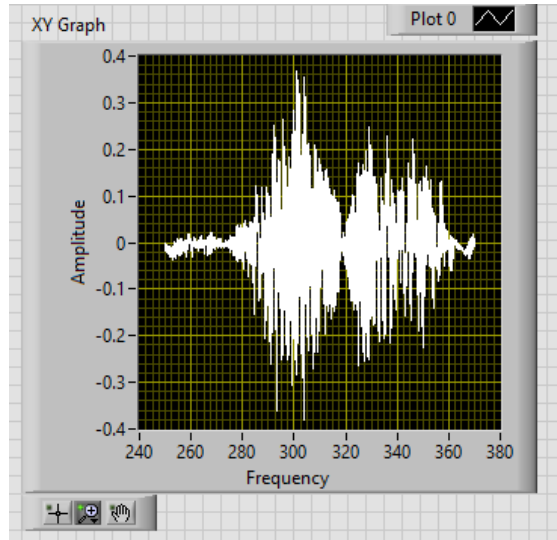
No clear evidence that the tip is enhancing the signal.

- Probably, the diamond itself is back-scattering radiation, providing high level of background signal;
- Wrong polarization of the tip?
- Change Sample (NiFe disks, Phthalocyanine, etc.)?
- Demodulate at tip oscillation frequency? Try also to use 2nd harmonic of that freq.
- Measure at fixed field as a function of tip distance



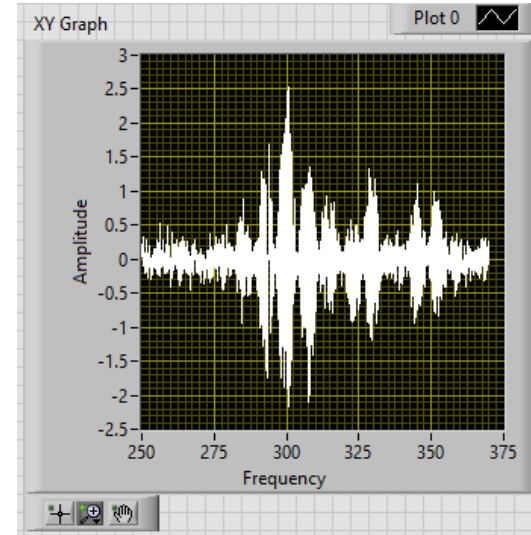
NO DEMODULATION/ NO OSCILLATING TIP

COPOLAR

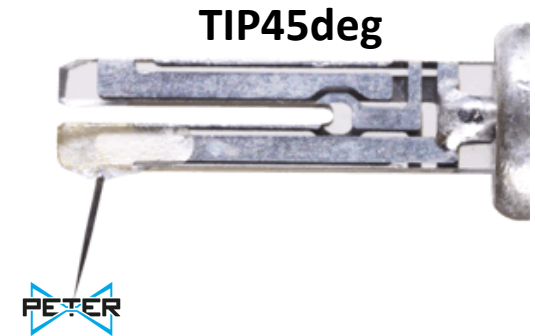


01_TIP_0Hz_tc0ms_
Sweep48sec
_copolar_mod0V

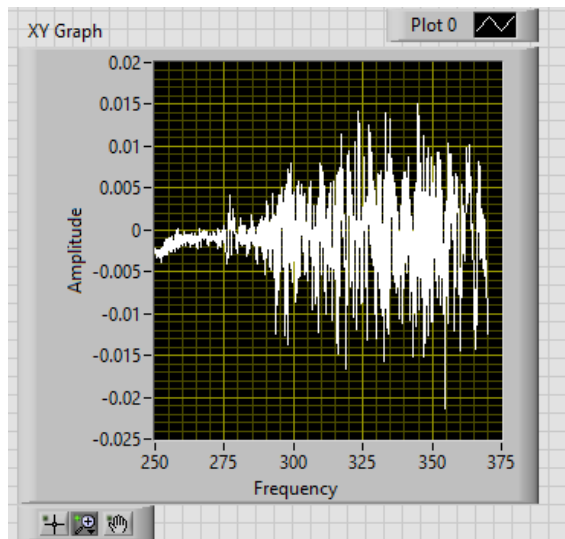
DEMODULATED



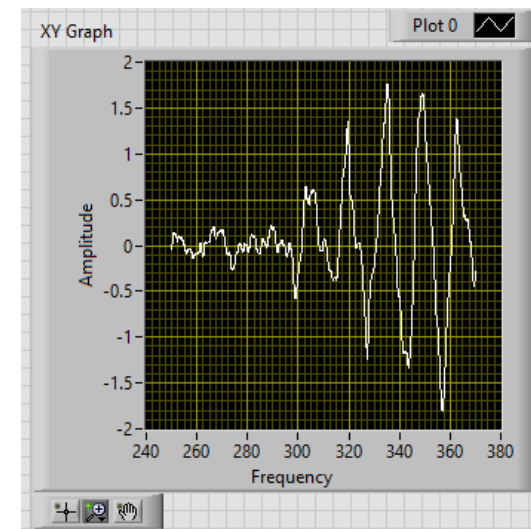
16_TIP45deg_30990Hz
_tc100us_sweep48sec
_copolar_mod5V



CROSSPOLAR



02_TIP45deg_0Hz
_tc0ms_sweep48sec
_crosspolar_mod0V



12_TIP45deg_30990Hz
_tc100ms_sweep48sec
_crosspolar_mod5V

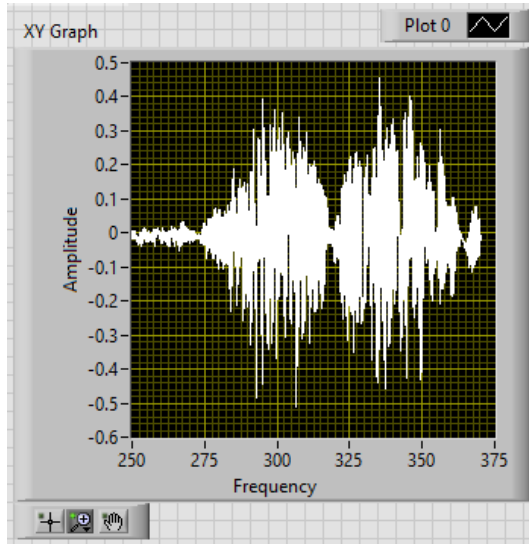
We see a difference with respect to not demodulated, both in co- and crosspolar. However, the same effect in copolar we see also with the FiberTIP. Instead, the crosspolar of TIP45deg is unique: is this due to the antenna?

Frequency dependence of single-tip inside the probe



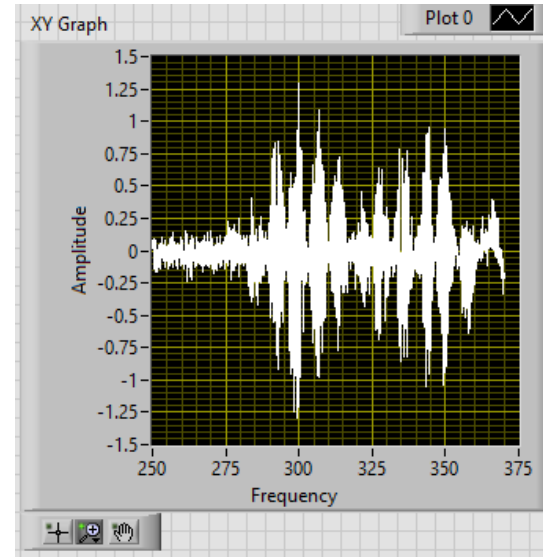
COPOLAR

NO DEMODULATION/
NO OSCILLATING TIP



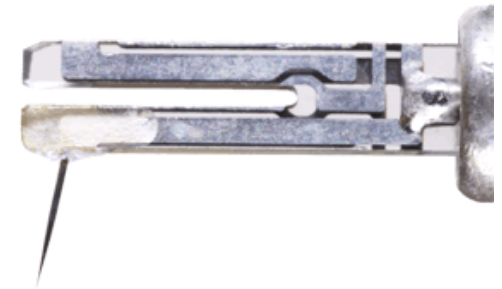
01_noTIP_0Hz_tc0ms_
Sweep48sec
_copolar_mod0V

DEMODULATED

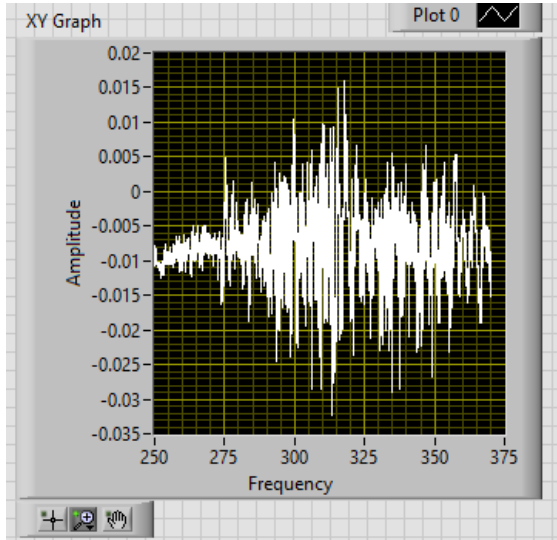


08_noTIP_30990Hz
_tc100us_sweep48sec
_copolar_mod5V

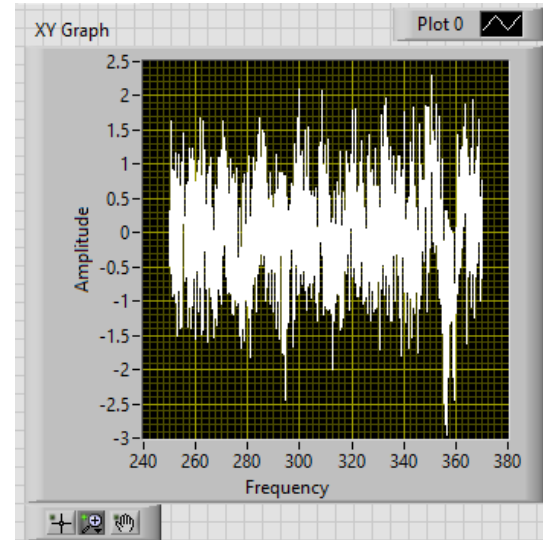
FiberTIP



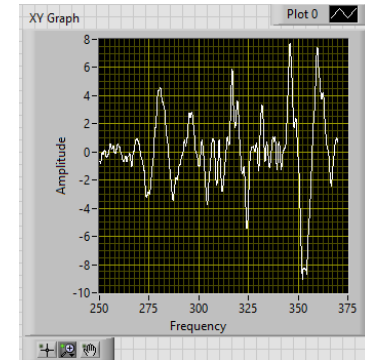
CROSSPOLAR



02_noTIP_0Hz
_tc0ms_sweep48sec
_crosspolar_mod0V



03_noTIP_30990Hz
_tc100us_sweep48sec
_crosspolar_mod5V



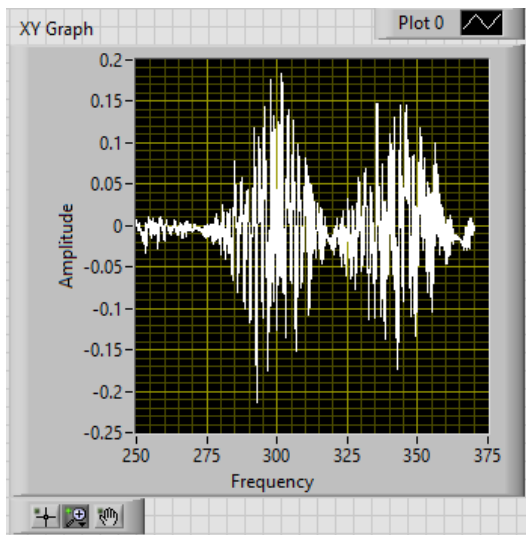
tc100ms

Frequency dependence of single-tip inside the probe



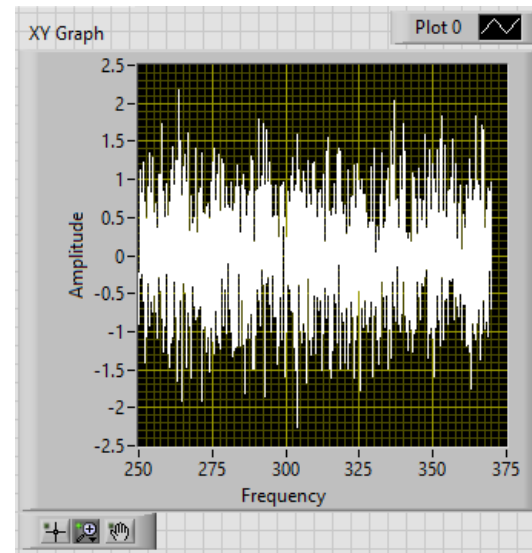
COPOLAR

NO DEMODULATION/
NO OSCILLATING TIP



17_noTIP_0Hz_tc0ms_
Sweep48sec
_copolar_mod0V

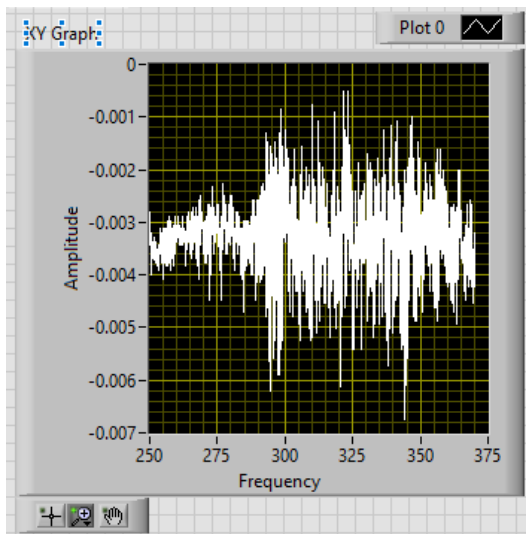
DEMODULATED



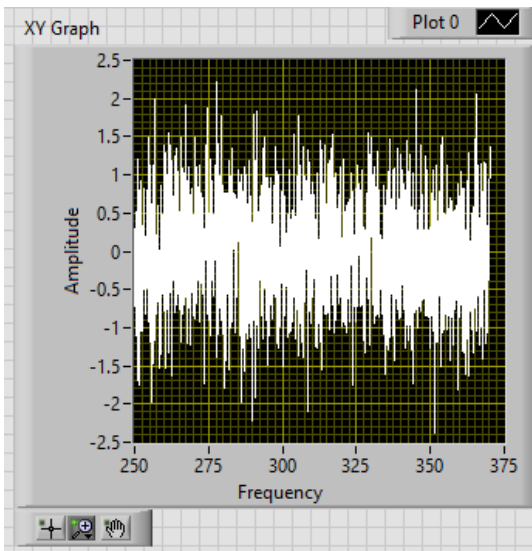
21_noTIP_30990Hz
_tc100us_sweep48sec
_copolar_mod5V

noTIP

CROSSPOLAR



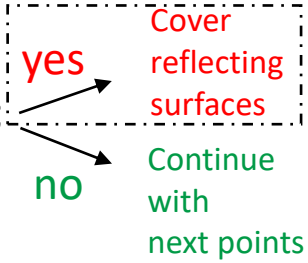
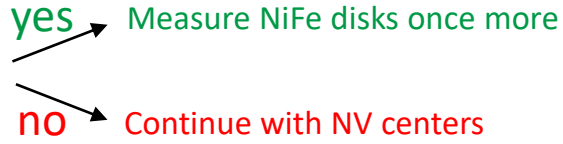
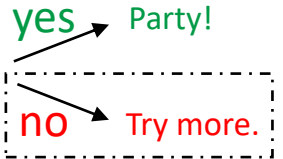
18_noTIP_0Hz
_tc0ms_sweep48sec
_crosspolar_mod0V



19_noTIP_30990Hz
_tc100us_sweep48sec
_crosspolar_mod5V

To-do-list

PREVIOUS LIST

- Check if there is a signal on NV centre, without gold mirror, both in cross and co-polar components; 
- Solve the problems with the modulation coil. 
New modulation coil from TK?
- Measure AFM with the antenna-tip at 10 K, 12 T and including also high modulation field;
- Look for an EPR signal when the tip is approached, compared with not approached and both in co- and cross-polar position. 

NEW LIST

- Try to measure NiFe and CuPc disks.
- Demodulate at the frequency oscillation of the tip.
Also at the 2nd harmonic.
- Measure at fixed field and increasing tip distance.

SECONDARY

- Figure out why the AMC multiplier is not working;
Try to drive it with old synthesizer;
- Power test of AWG;
- Lock-in to repair.