IPID4all Doctorate Research Exchange with Carl von Ossietzky University Oldenburg

Feedback report

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Introduction

The role of the four week research was to start measurements with the newly installed delay line detector at the host university. The ultrafast photoemission of plasmonic nanoparticles was examined.

Research Undertaken

In this four week we managed to detect electrons from the plasmonic nanostructures and set up the the delay line detector. We had to build a new beam line from the 1600 nm and 15 fs laser source to the vacuum chamber holding the whole setup with the samples and the detector below 10^{-6} mbar vacuum. After installing a grating and a "flight tube" between the sample and the detector we could produce a homogeneous electromagnetic field to the detector and we got our first signal on the multichannel plate of the detector.

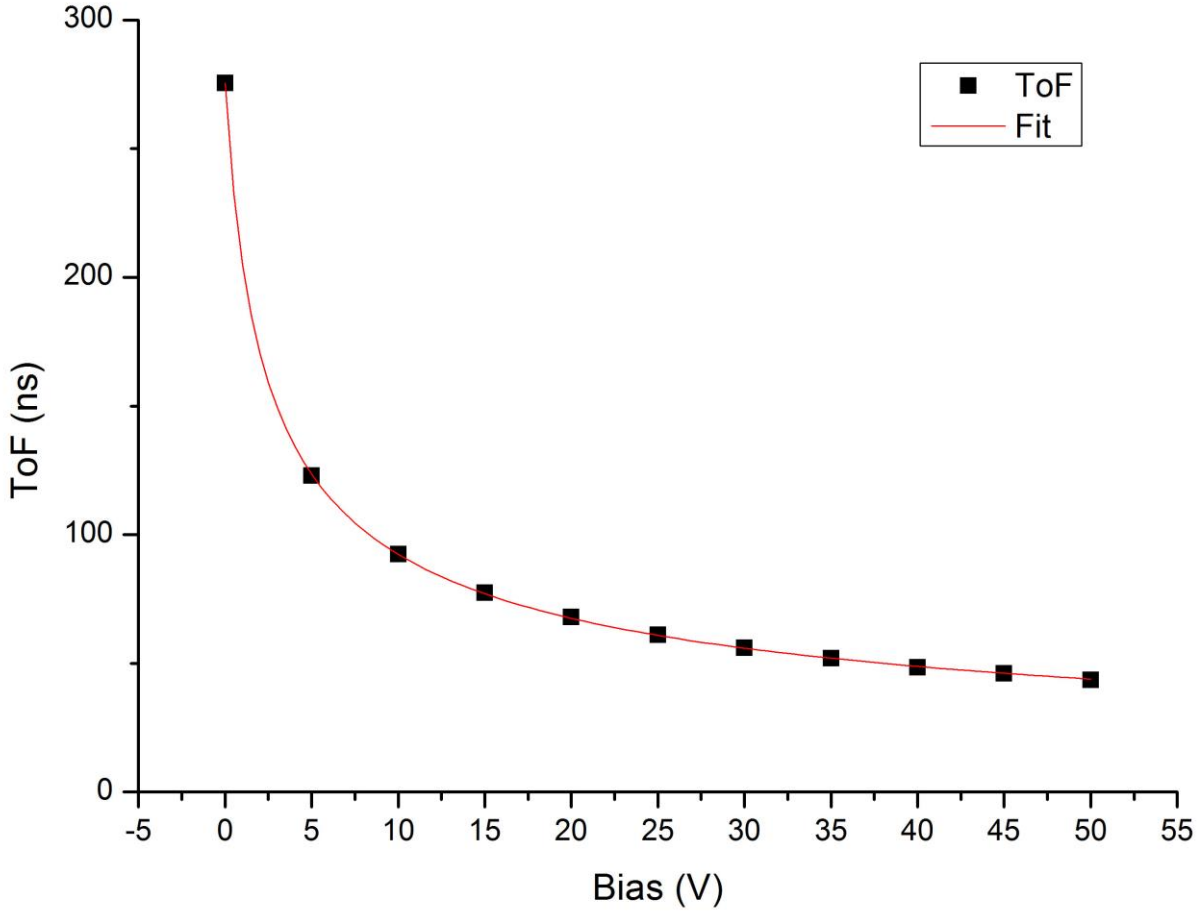

Figure: The measured time of flight as the function of the bias applied to the sample.

After getting the first signal the next task was to calibrate the flight time. This is needed to get a proper values of the kinetic energy of the emitted photoelectrons, this calibration is shown in the fig-

ure above. We changed the bias applied to the sample and with this we gave a starting potential to the electrons which leads to an exact plus energy in the kinetic energy of the electrons. We measured the time of flight with the delay line detector and varied the bias of the sample. From the data we could calculate the base kinetic energy of the electrons, and we got 8-10 eV, which is a quite realistic result due to former experience.

After the calibration measurement we started to measure the photoelectron signal systematically but the detector was not able to resolve the issue, that above a certain laser intensity more electrons per laser pulse hit the detector, and we got unreliable data. This was not fixed in this four week period unfortunately.

Personal Experience

I get to know a new detector type, the already mentioned delay line detector. I made improvements of calculating electromagnetic field with finite element method using MATLAB. Further on I empowered my skills in usual laboratory work and data processing as well.

Conclusions

We started measurements with a new delay line detector and made the first steps on running it on every day routine. We made calibrations and measurements, but the second needs further improvement, especially on resolving more events per laser pulse.

Outlook

We plan further exchange in the future to develop the measurement methods together. We also started another collaboration in other research topic with the group, but this is not my competence. We hope that we will have nice results and we will be able to publish it in the near future.

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