NANONIS APPLICATION NOTE

SPIN VALVES INVESTIGATED WITH BEMM – A CASE FOR NANONIS'S PROGRAMMING INTERFACE

Recently a big effort has been put into the investigation of so-called spin valves, devices promising important advances in magnetic sensors, e.g. for hard disk read heads. Ballistic Electron Magnetic Microscopy (BEMM) is one method for investigating these devices. Electrons are injected through the tip of a Scanning Tunneling Microscope into a magnetic layer of a sample. The ballistic flow of electrons through the sample is studied at different magnetic fields while the tip-sample separation is controlled with the regular tunneling current.

Our goal was to put together an automation routine which would do the following:

- Go to a specific point on the sample and scan the area.
- Measure and analyze the BEEM characteristics at that point.
- Decide whether to start a full magnetic field sweep.
- Analyze the hysteresis curve and write the data into a file.
- Drive the xy-coarse stage to the next point on the grid

One possibility for us would have been to develop our own SPM controller and do these measurements from there, but we did not want to reinvent the wheel: we wanted to focus on the speciality of our experiment, not generic control problems. Here, the Nanonis SPM Control System proved to be the best solution for us.

Nanonis's LabVIEW programming interface allowed us to get the best from both worlds: a well working control system which takes care of the scanning and feedback, and a programming environment in which we can develop our own analysis routines and graphical user interface specific to our needs. To further simplify our task, we use the generic sweeper module of the Nanonis system to record the hysteresis curve and the bias sweep module to record the BEEM data.

Contrary to scripting languages, Nanonis's solution let us fully benefit from the LabVIEW development environment. We could use the complete LabVIEW functionality while still being able to access all features of the Nanonis Control System. Using the programming interface we could reduce the measurement time for one data set from weeks to less than 36 hours.

Reference:

E. Heindl et al., Ballistic electron magnetic microscopy on epitaxial spin valves, Phys. Rev. B, 75, 073307 (2007)

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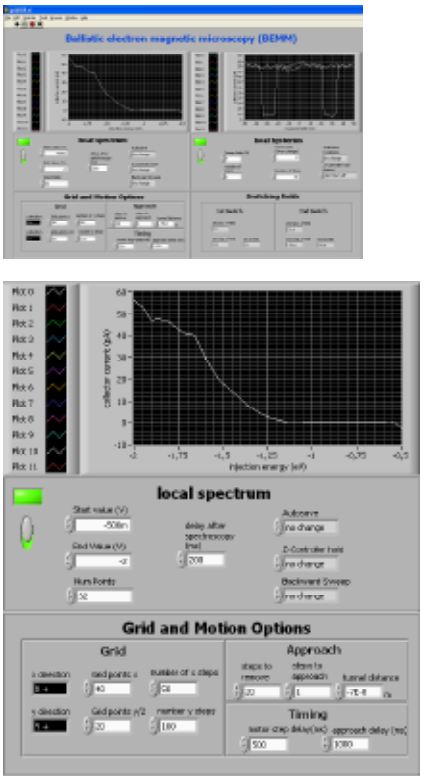

User interface of the LabVIEW application written with the Nanonis programming interface

Nanonis Modules in Use:

- Base Package
- Programming Interface
- Generic Sweeper
- Bias Sweep
- Omicron Adaptation Kit

System:

- Omicron UHV-STM

NANONIS
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