Magnetic Particle Imagining with a Cantilever Detector

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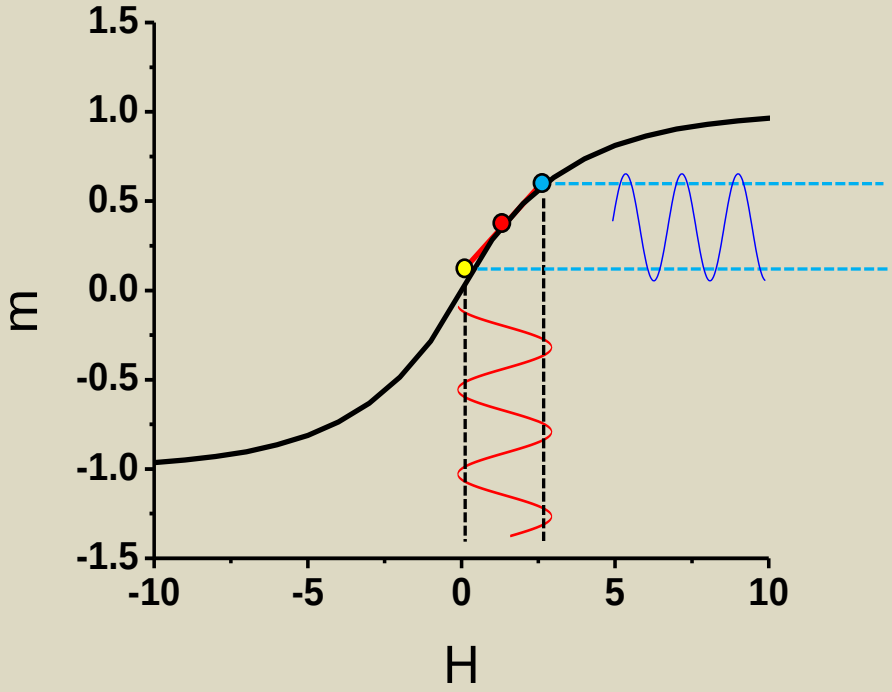
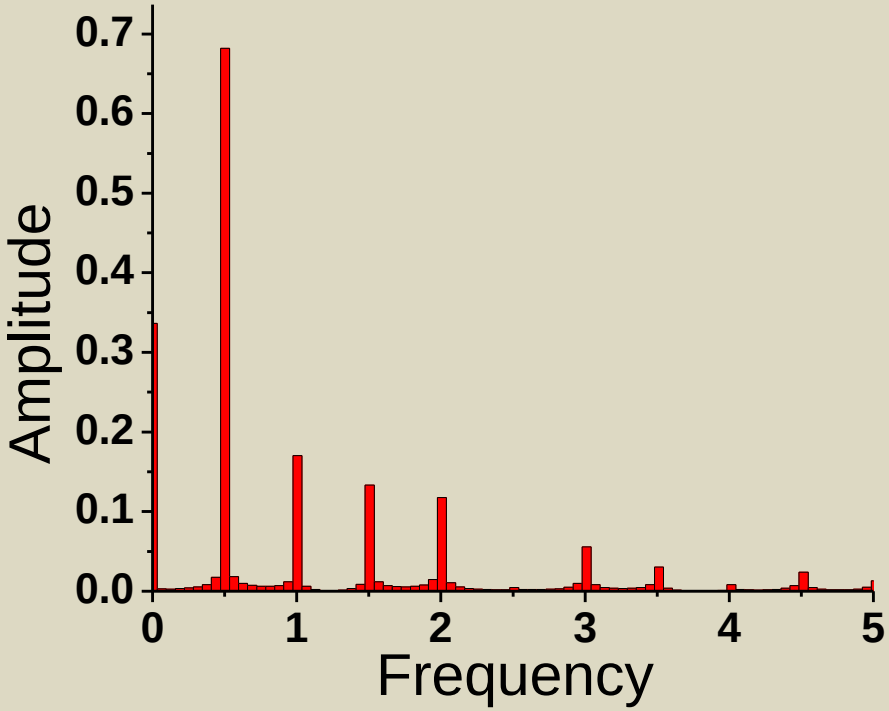
Outline

- What is Magnetic Particle Imaging
- How can we apply it to a cantilever setup
- Initial results
- Future plans

MPI Signal Detection Scheme



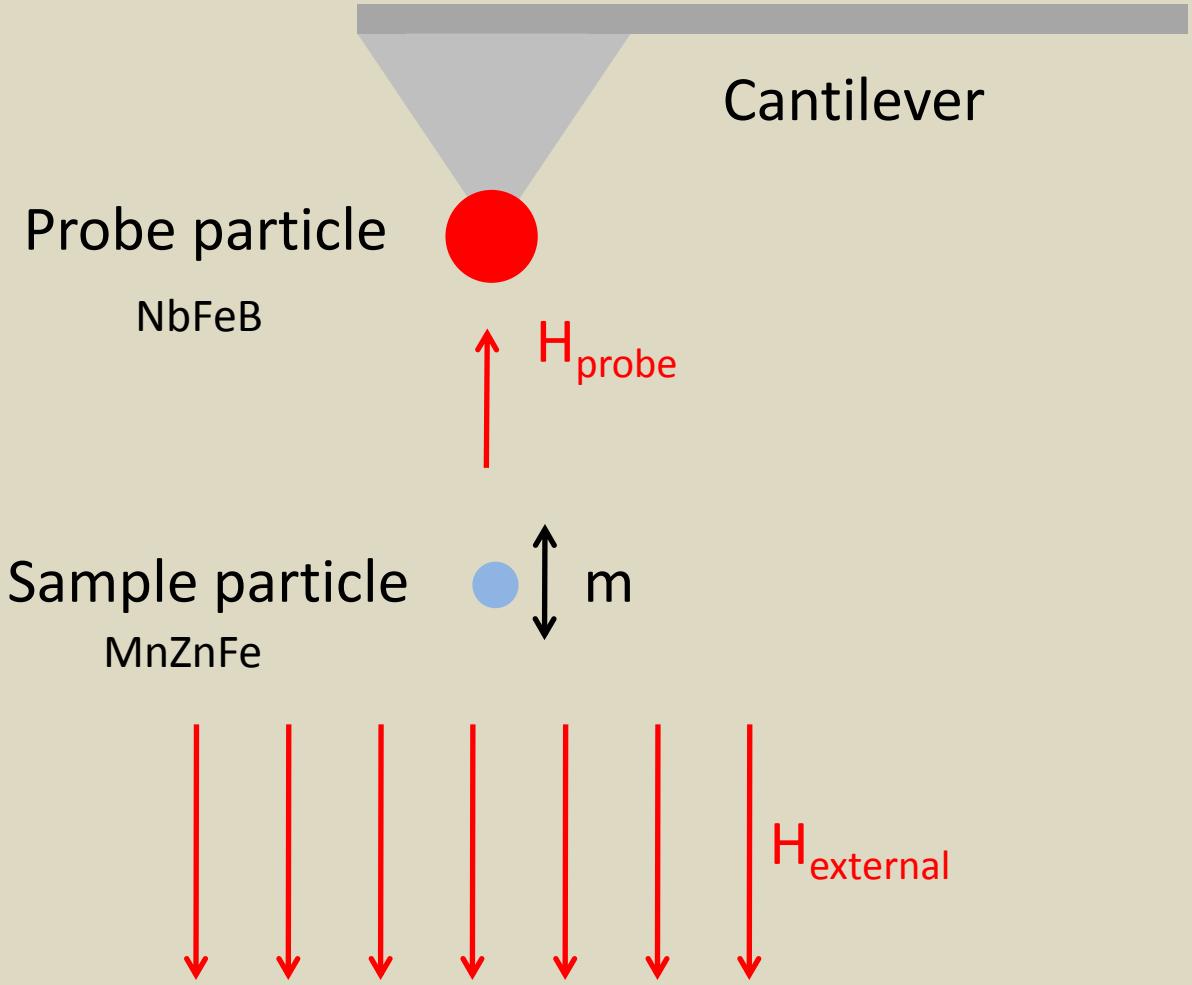


Excitation at $f_0/2$

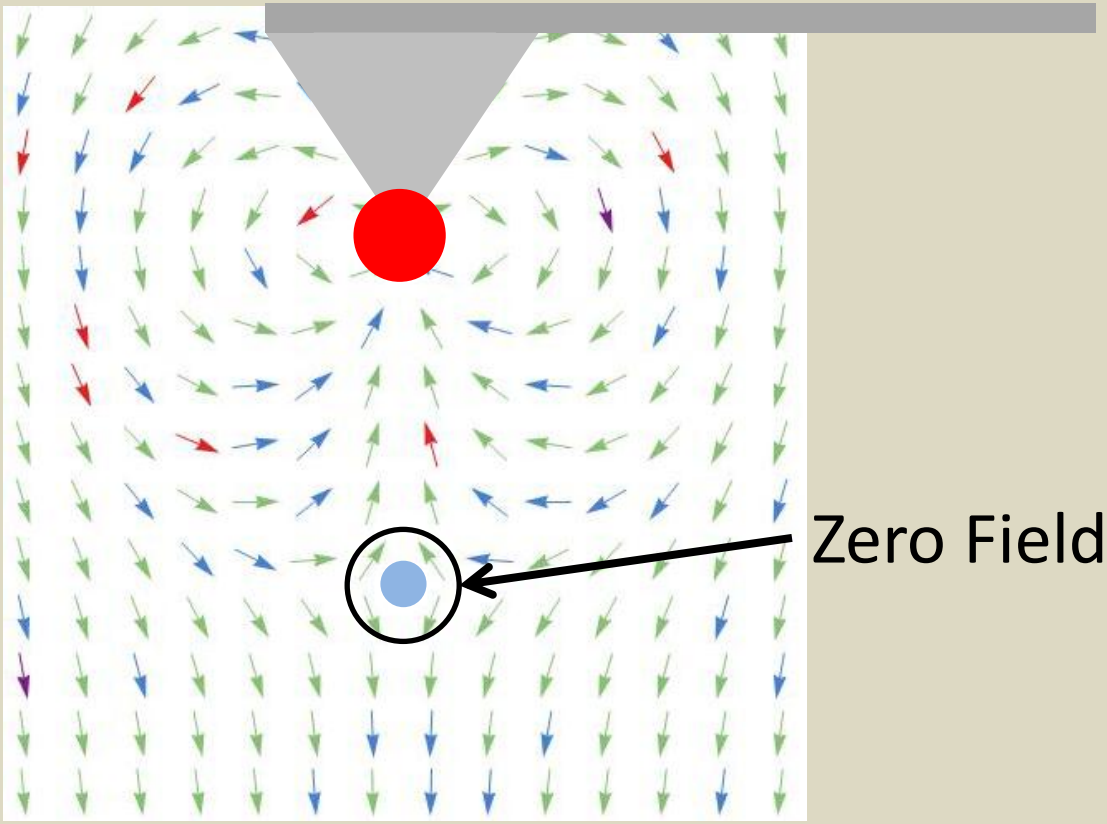
Detection at f_0

Gleich B, Weizenecker J (2005) Tomographic imaging using the nonlinear response of magnetic particles. *Nature* 435:1214-1217.

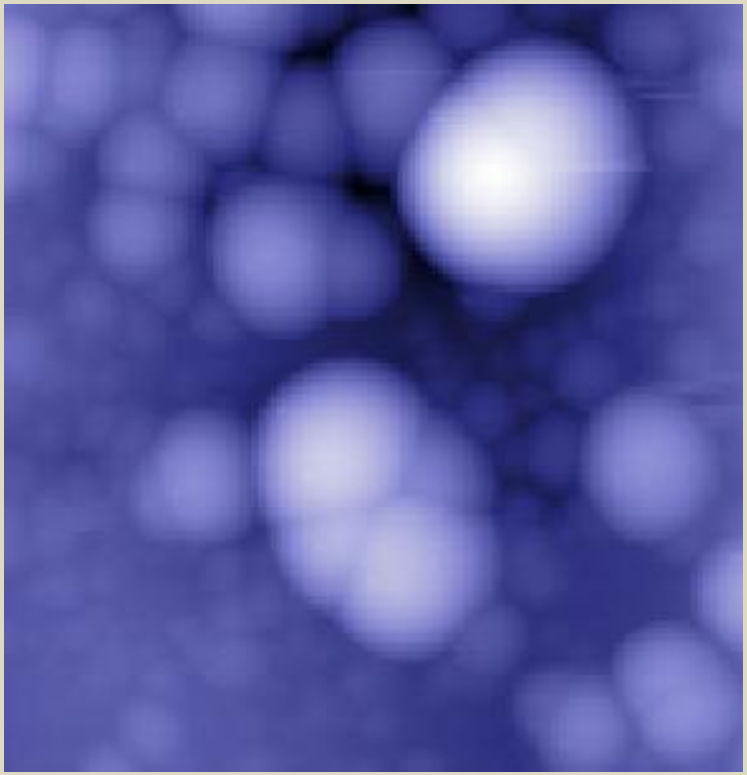
Cantilever Detection Configuration



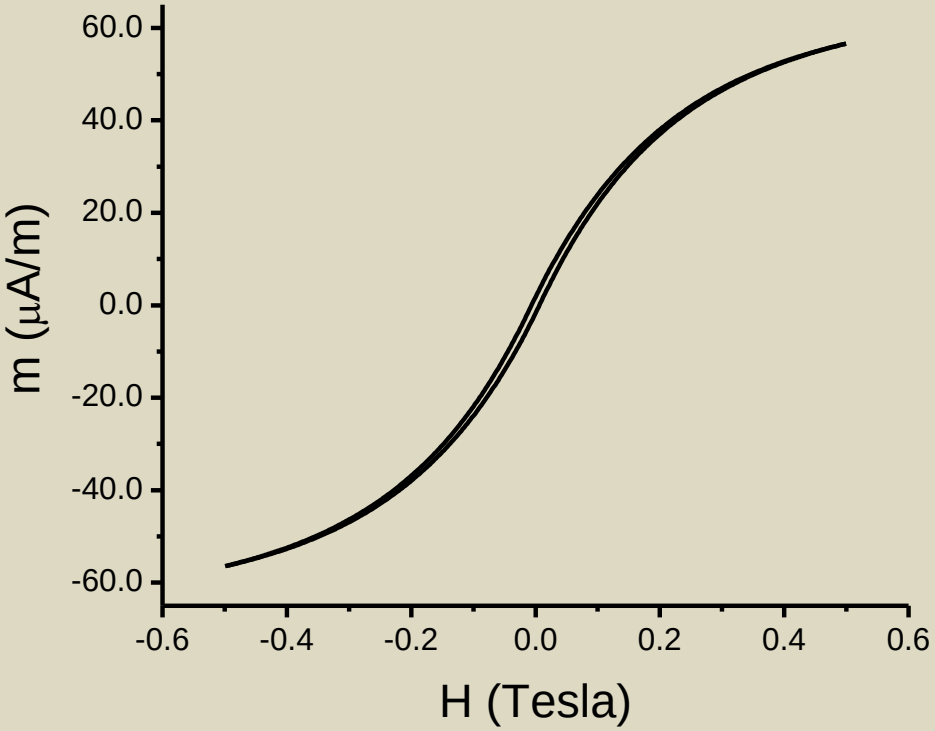
Magnetic field pattern



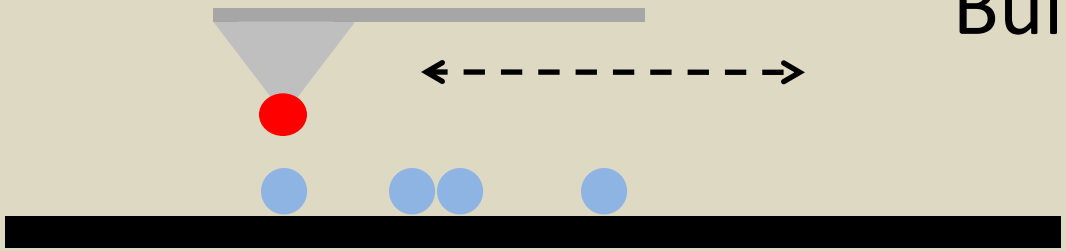
Test Particles



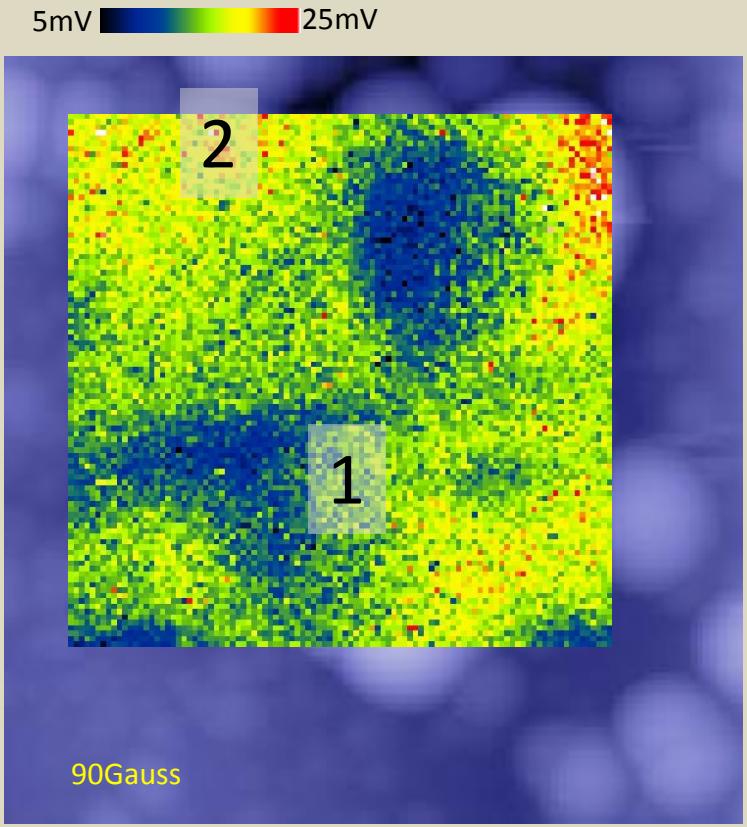
51.6μm



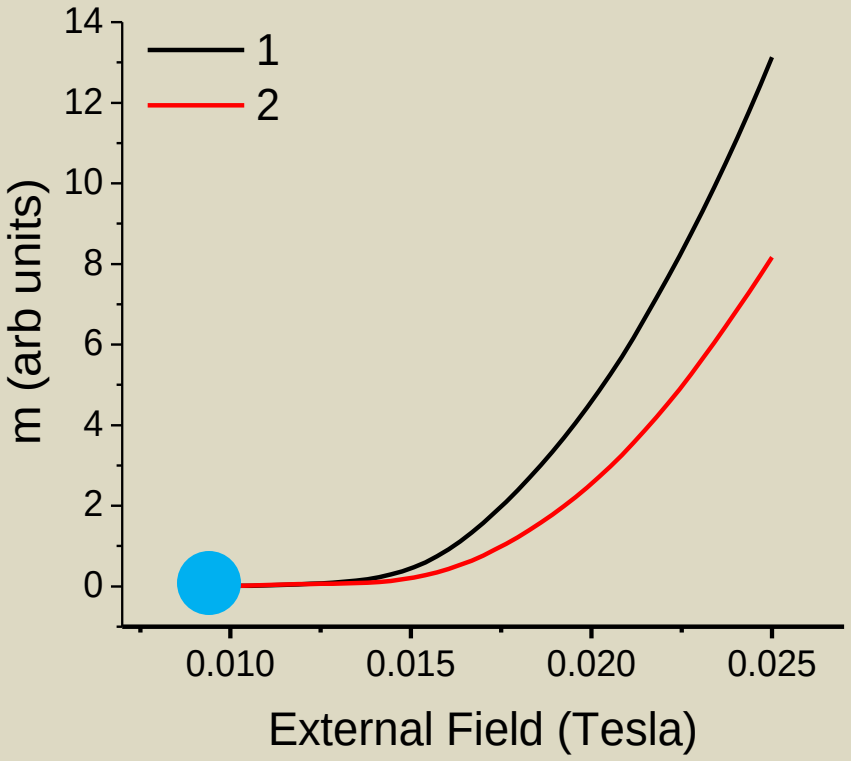
Bulk AGM data

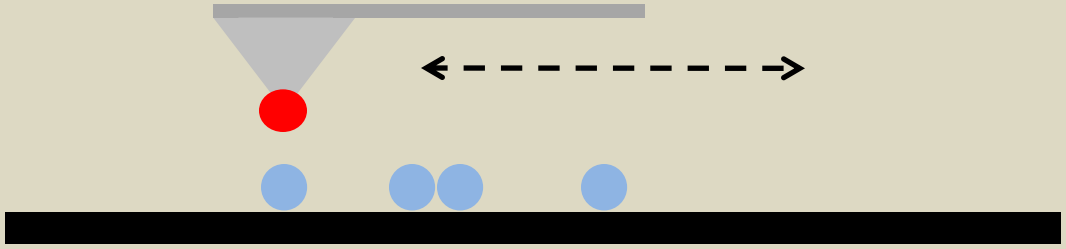


Low External Field

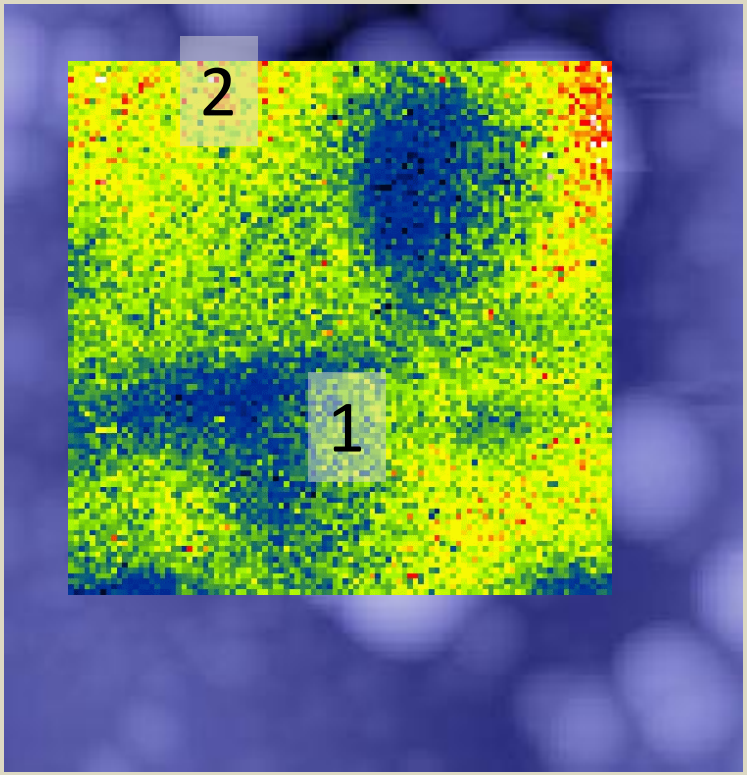


51.6μm

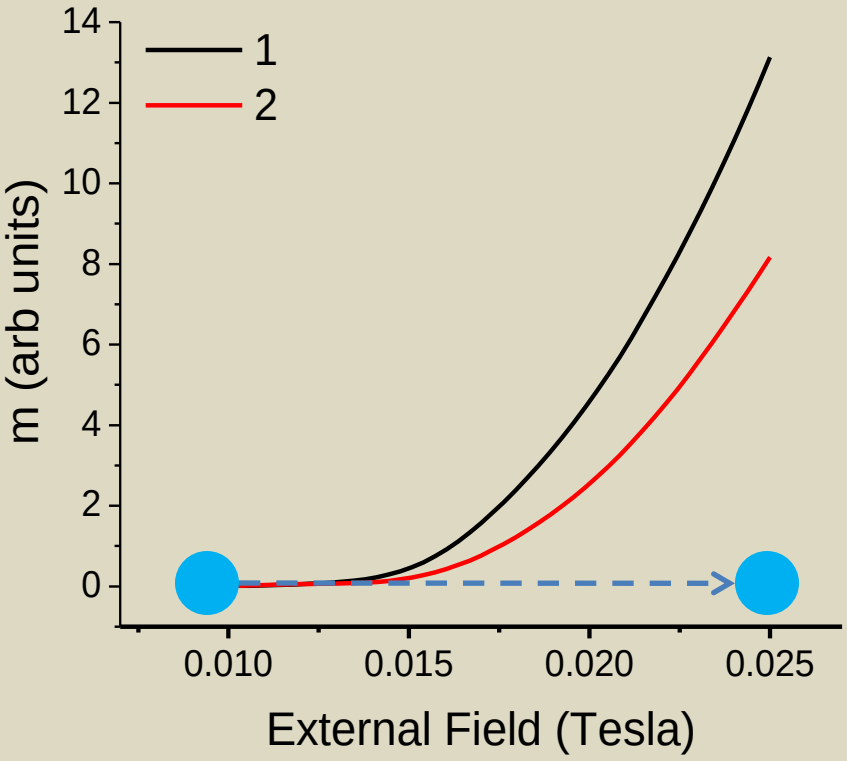


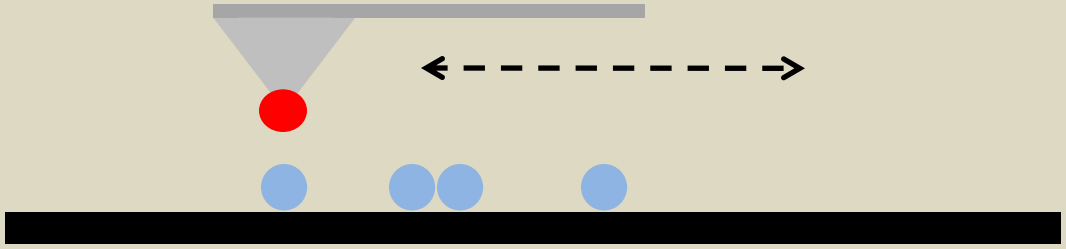


Increasing Field

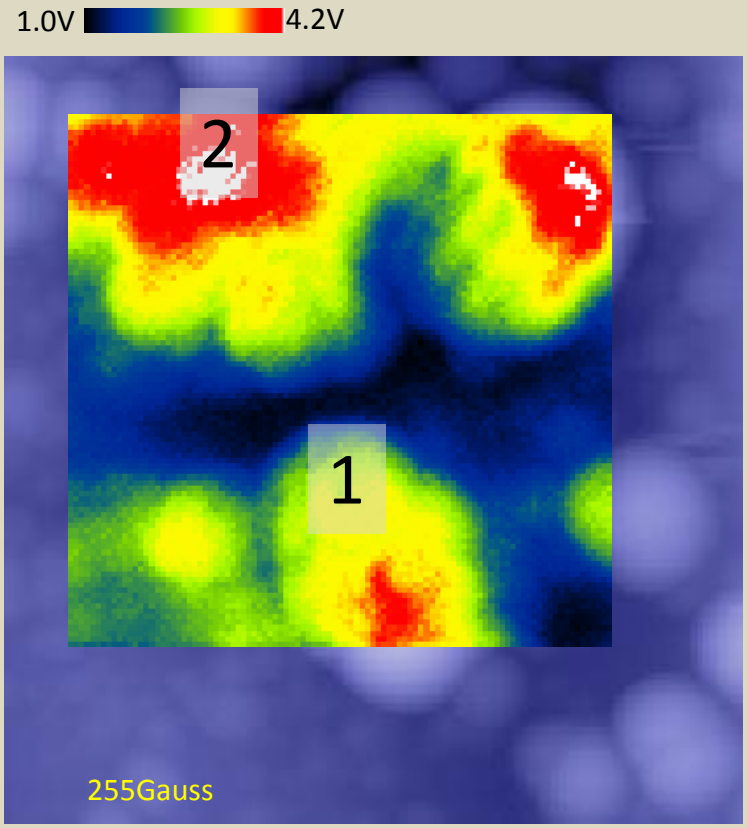


51.6μm

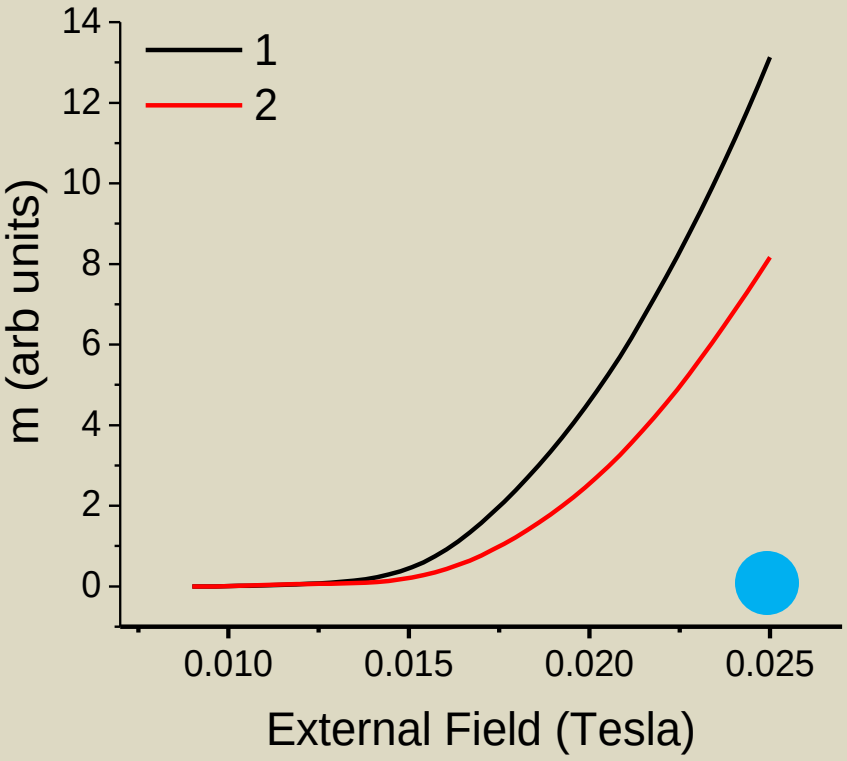


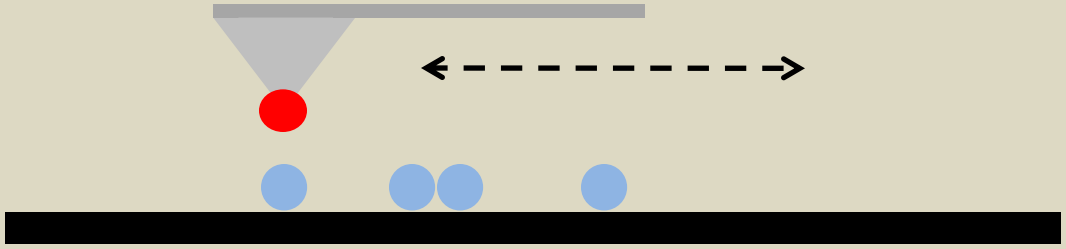


Max Field

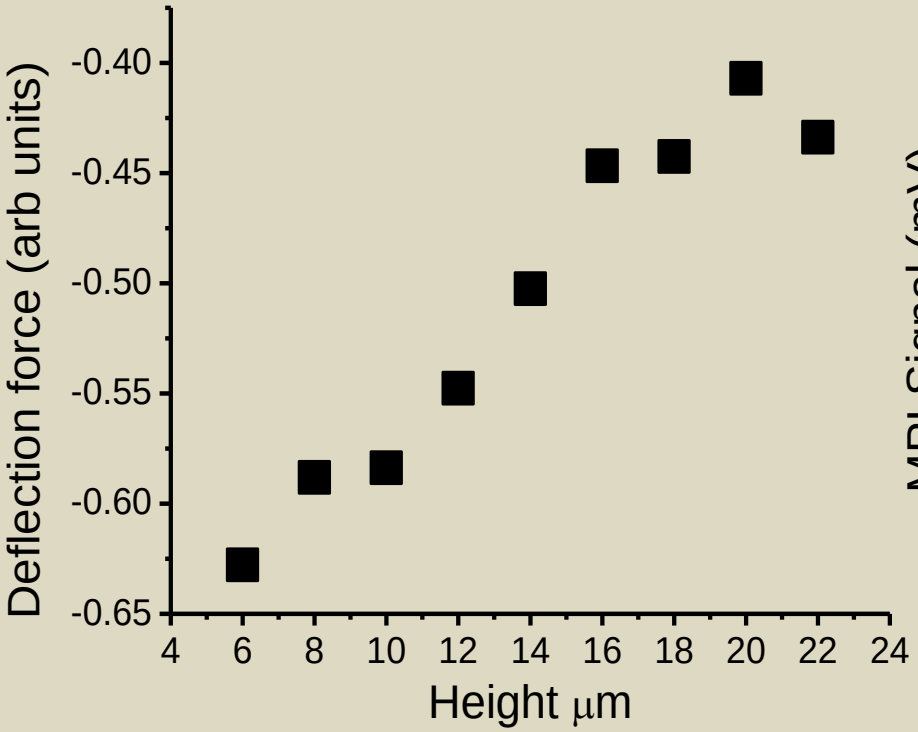


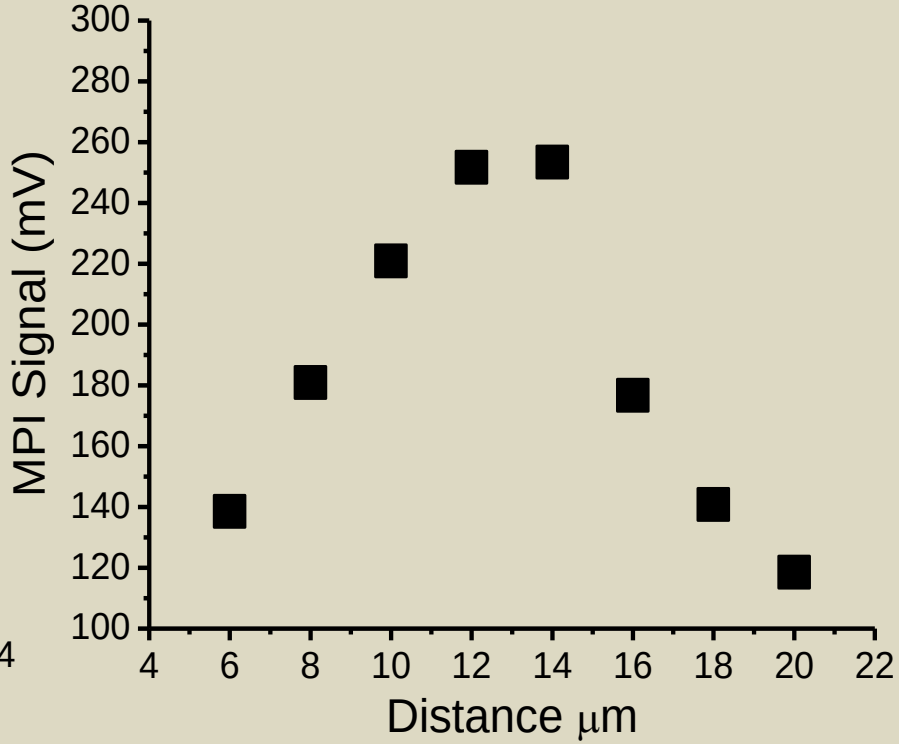
51.6μm

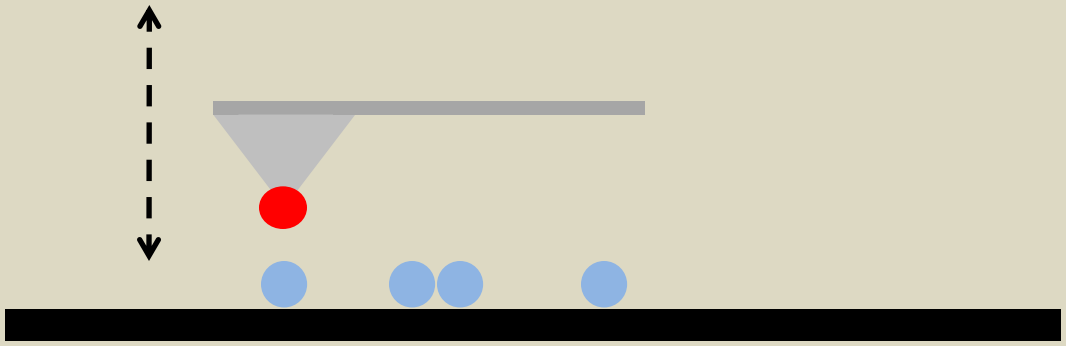




Distance Dependence







Conclusions

- MPI-MFM represents a new method of measuring local m-H curves on isolated particles

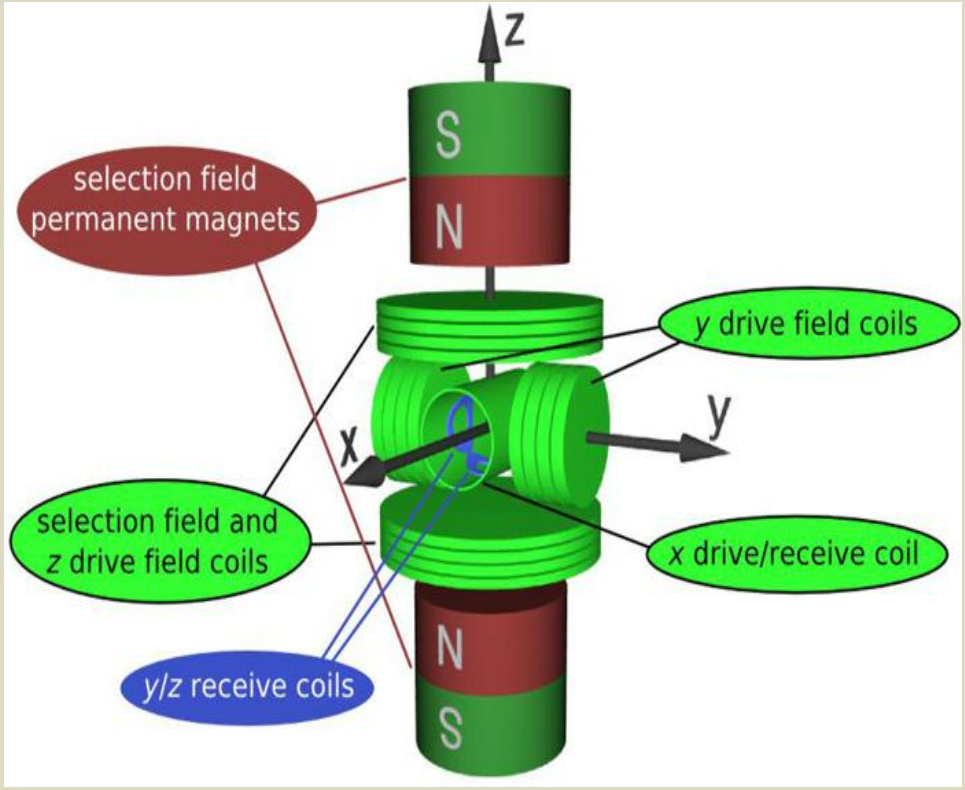
- Can be quantitative with additional hardware, calibrated samples, hall probes

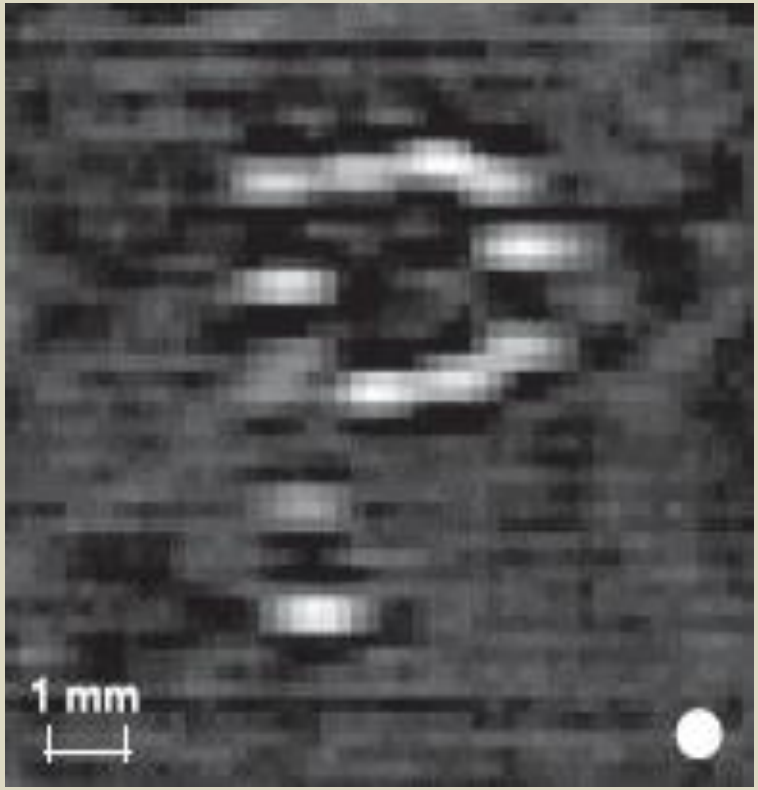
- Need a method of generating larger external fields (0.5Tesla), that is compatible with our setup

Future Plans

- Applications to Geology and Portable integrated MEMS devices
- Biological applications for biogenic magnetic particles
- Device characterization on the nano scale

Magnetic Particle Imaging





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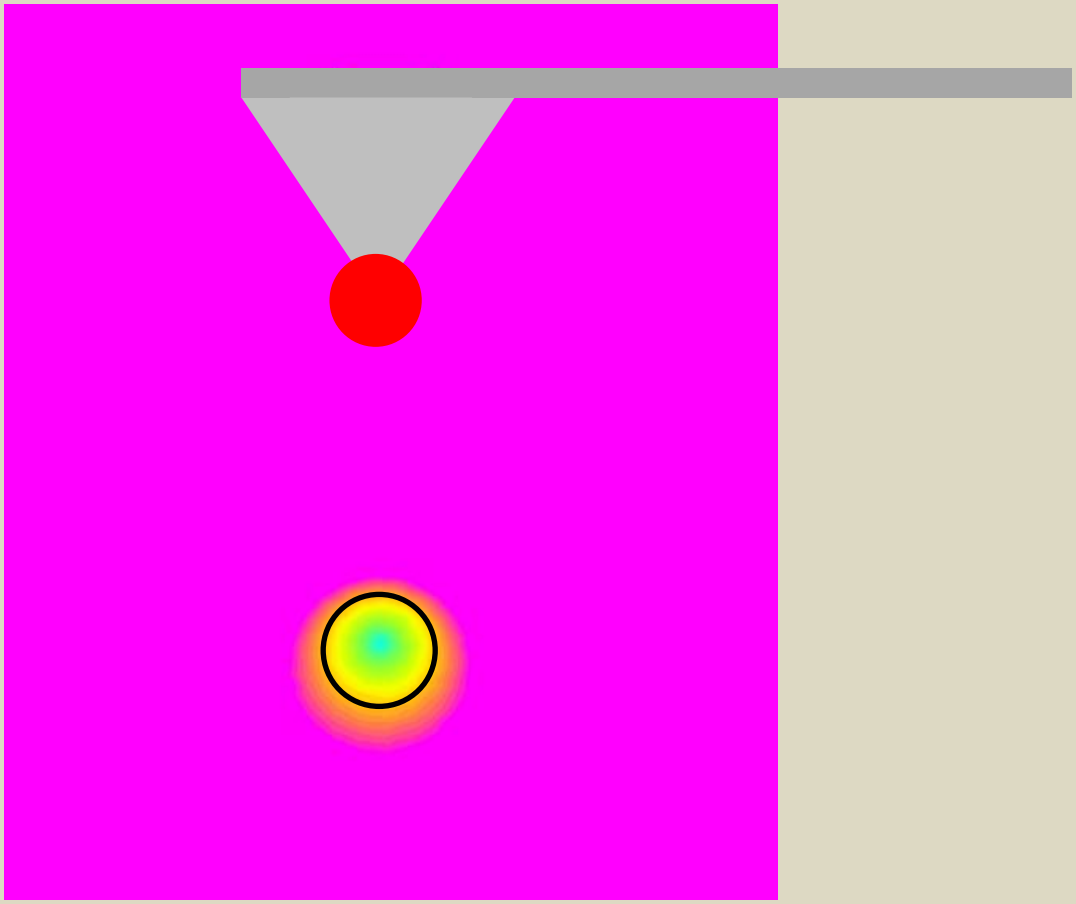
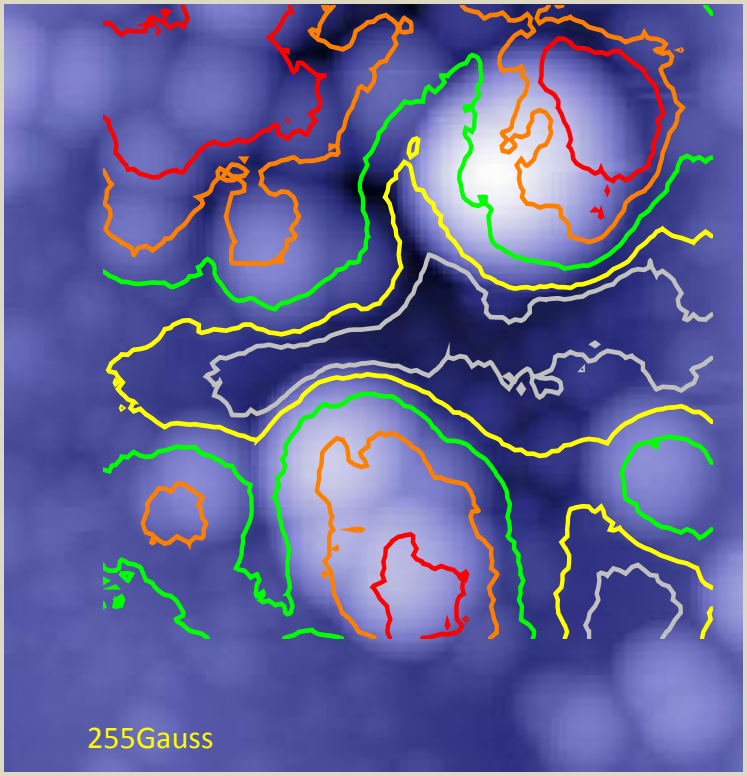
Magnetic Field Strength

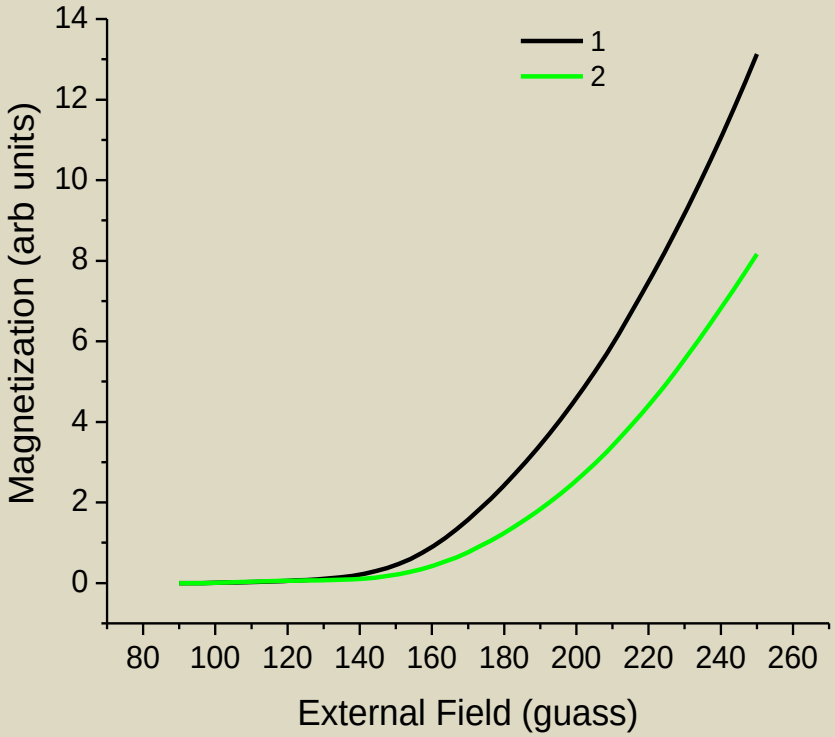
high field

low field

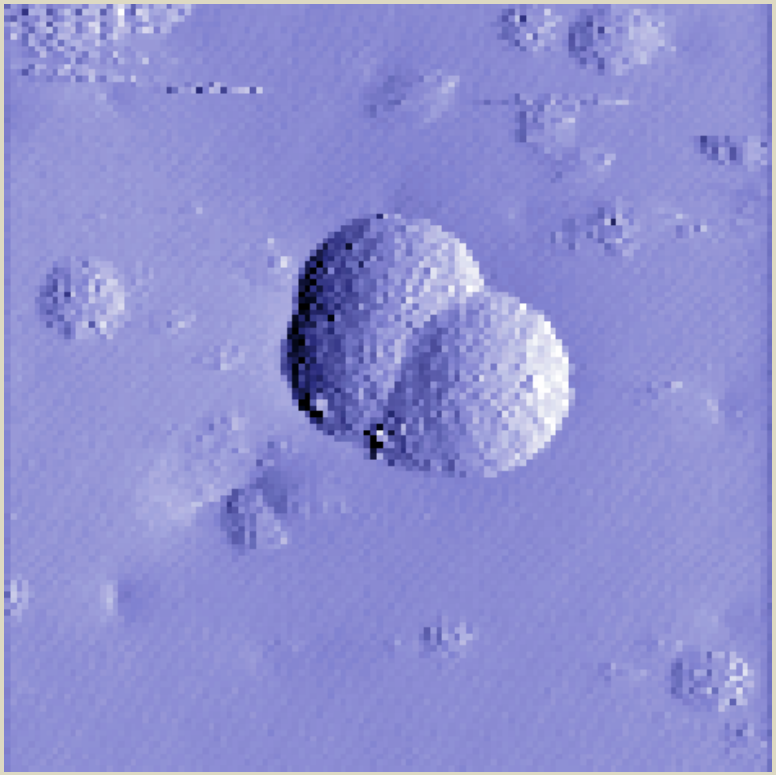


Integrated Intensity





Distance Dependence



30microns