Broadband FMR Spectrometers

NanOsc Instruments AB

The NanOsc Instruments AB line of broadband ferromagnetic resonance (FMR) spectrometers offer a simple turn-key solution to the burgeoning field of magnetodynamics research. Broadband FMR spectroscopy allows for measurements continuously spanning several 10's of GHz. Measurements over a wide frequency range allow for significant improvements in accurately extracting a variety of material parameters not accessible by static measurement techniques.

Broadband FMR is particularly well-suited for studying magnetic thin films, which not only form the backbone of fundamental spintronics and magnonics research but are also constituents of current and future technologies focused on magnetic memories, sensors, logic, and microwave signal processing.

Key Features:

- Turn-key FMR spectrometer with easy to use software interface
- Broadband FMR using a coplanar waveguide
- Measures effective magnetization (M_{eff}), anisotropy (K), gyromagnetic ratio (γ), damping (α), inhomogeneous broadening (ΔH_o), exchange stiffness (A), inverse spin Hall effect (ISHE) voltage

Specifications:

Instrument	Bandwidth*	Temperature Range	Magnetic Field
PhaseFMR-8	2-8 GHz	Room Temperature	User Supplied Electromagnet/Power Supply
PhaseFMR	2-18 GHz		
PhaseFMR-40	2-40 GHz		
CryoFMR-8	2-8 GHz	4-400 K: PPMS®/DynaCool™ 55-400 K: VersaLab™ 10-350 K: MI Cryostation	±9, 14, 16 T: PPMS®/DynaCool™ ±3 T: VersaLab™ ±0.7 T: MI Cryostation
CryoFMR	2-18 GHz		
CryoFMR-40	2-40 GHz		

*Frequency accuracy of 0.05 GHz. SNR better than 10 for 10 nm $Ni_{80}Fe_{20}$ @ 40GHz

CryoFMR Probe Insert for PPMS® (VersaLab™)

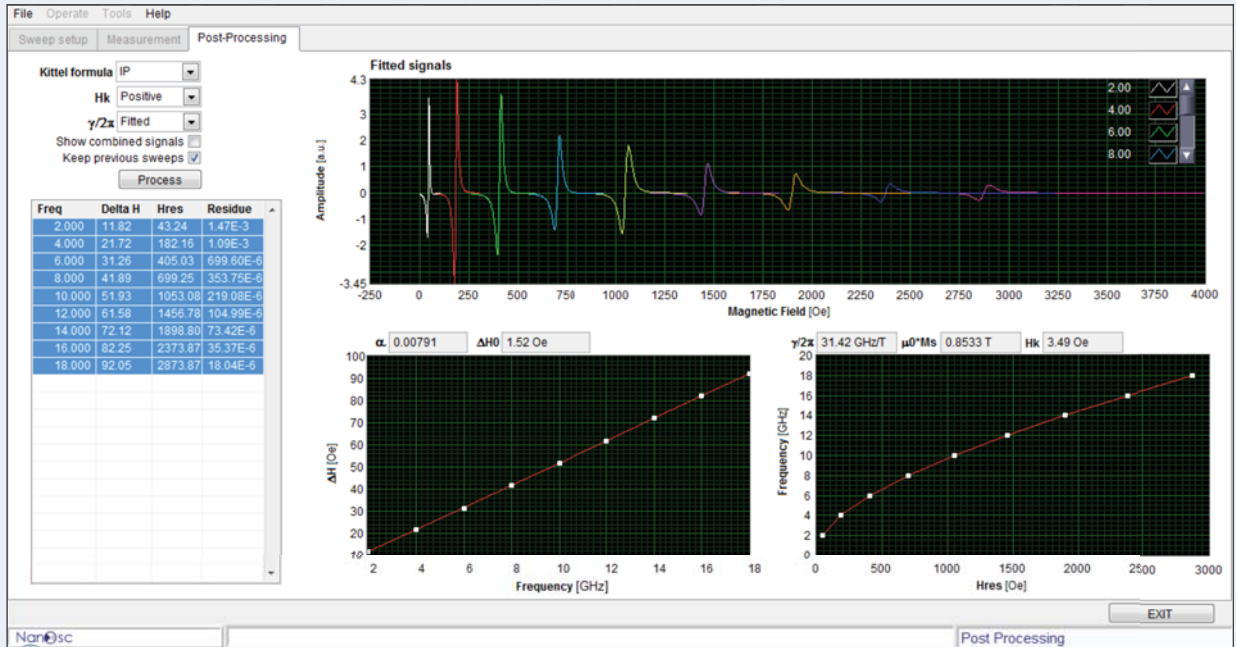Coplanar Waveguide (CPW) for room temperature PhaseFMR
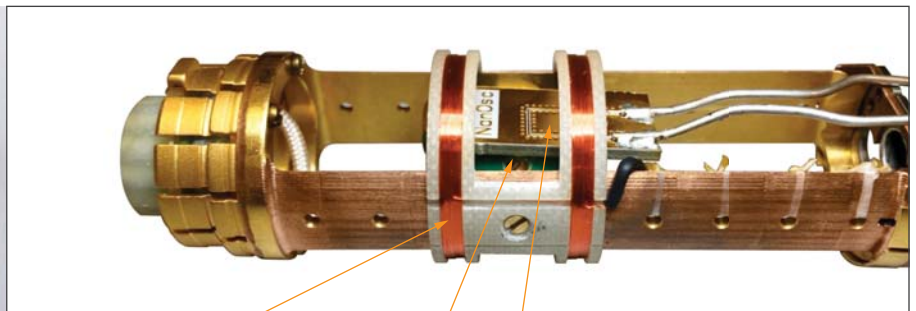
Helmholtz coils for field modulation

Temperature sensor

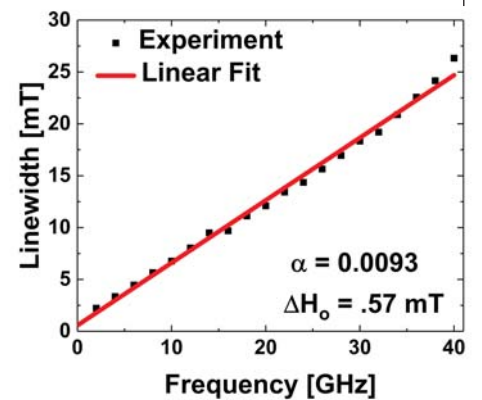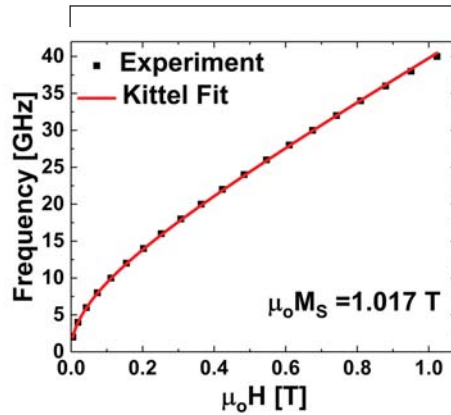CPW for in-plane analysis
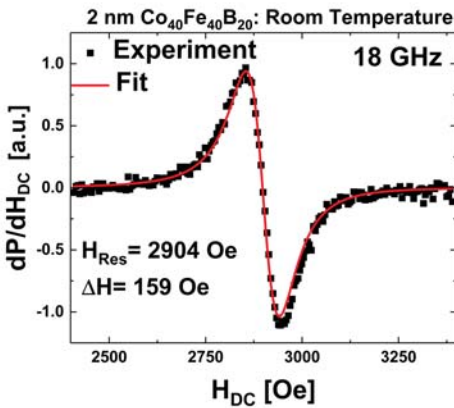
*(out-of-plane) CPW also available

Software makes FMR Easy: The software user interface is divided into three tabs:
1. Setting up the measurement sweeps
2. Monitoring the running measurements
3. Post-processing and parameter extraction

Example Data:

10 nm Permalloy Film

2 nm $Co_{40}Fe_{40}B_{20}$: Room Temperature

- Experiment
- Fit

18 GHz

H_{Res} = 2904 Oe
ΔH = 159 Oe

- Experiment
- Kittel Fit

$\mu_o M_S$ = 1.017 T

- Experiment
- Linear Fit

α = 0.0093
ΔH_o = .57 mT