

# Bilz Vibration Technology AG

## *Magnetic field cancellation*



**LESS**

*Interference*

**BETTER**

*Results*



**Bilz Vibration Technology AG**

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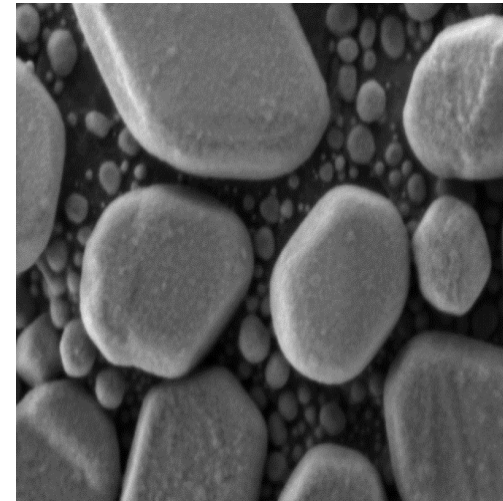
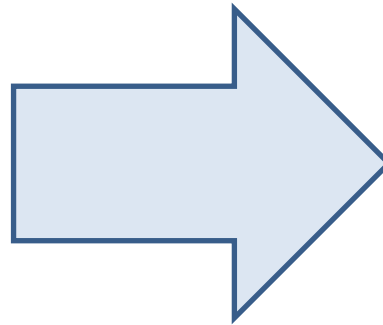
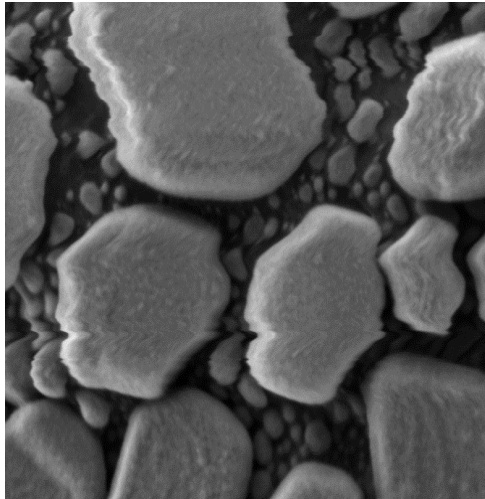
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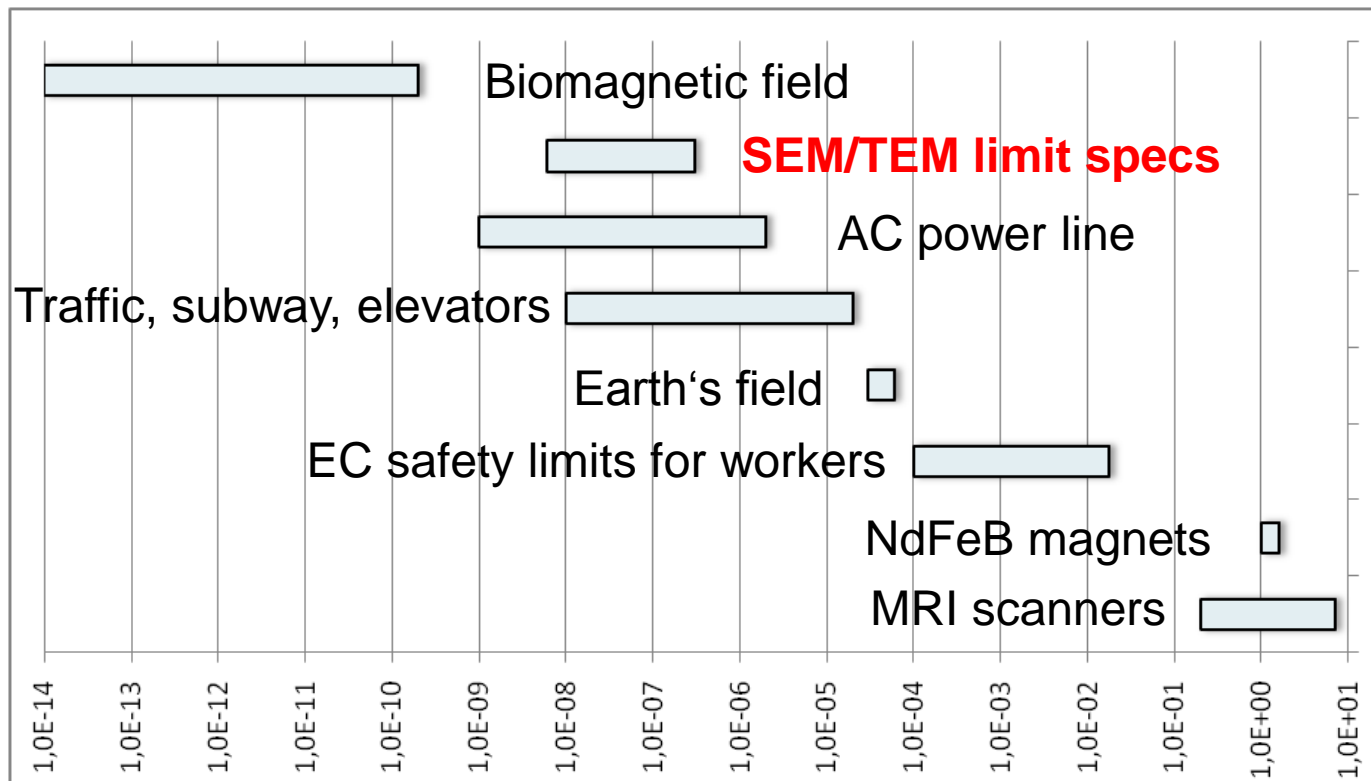
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# SEM and TEM image improvement by reduction of magnetic field disturbances



# Magnetic field basics

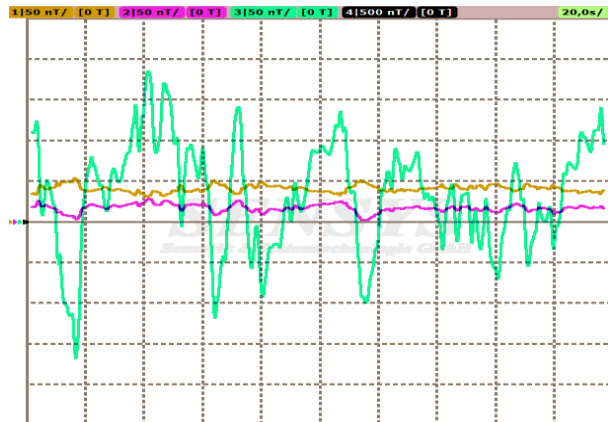
Units of magnetic flux density: Tesla (T,  $\mu\text{T}$ , nT, ...), Gauss (G, mG, ...)



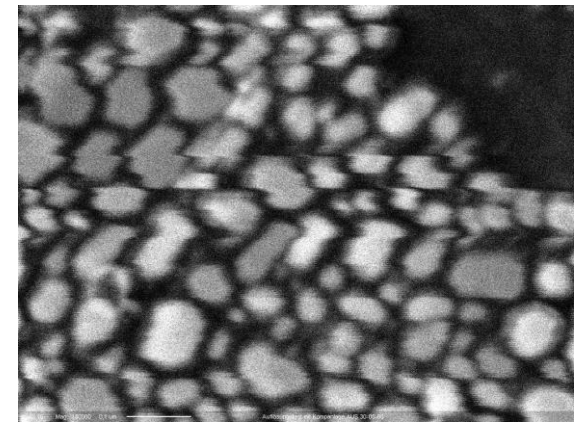
1 G = 100  $\mu\text{T}$   
1 mG = 100 nT

Graphic in Tesla (T)

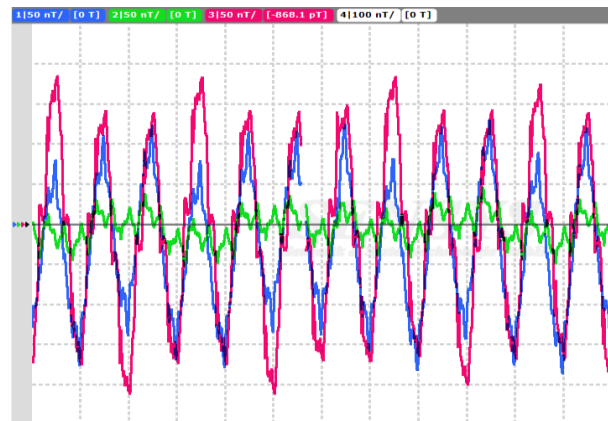
# Influence of magnetic field frequency on SEM images



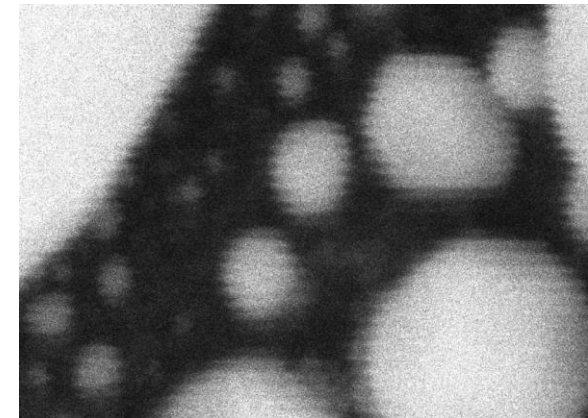
DC – e.g. from subway



Mag = 150k



AC – e.g. from power supply



Mag = 318k

## Magnetic field cancelling systems are required for:

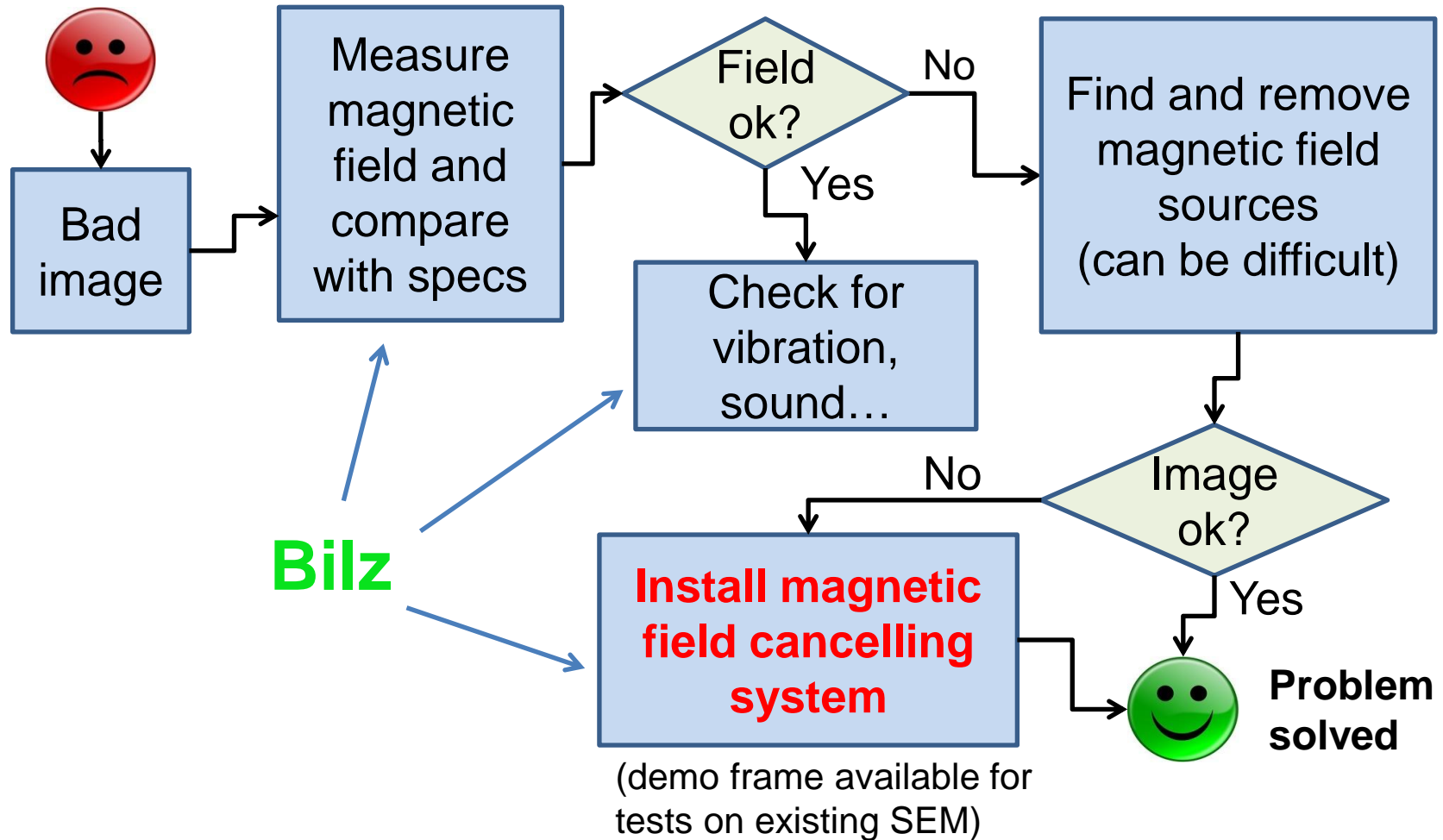
- 1) Already installed microscope with unstable images or disturbances  
→ **performance enhancement, improvement of working conditions**
- 2) New microscope to be acquired when room is not matching microscope specifications or to prevent future disturbances  
→ **anticipation of future problems**

Typical electron microscope specifications :

- < 0,5 – 3 mG for SEM, FIB on 3 axis
- < 0,06 - 1,2 mG for TEM on 3 axis and all along the column

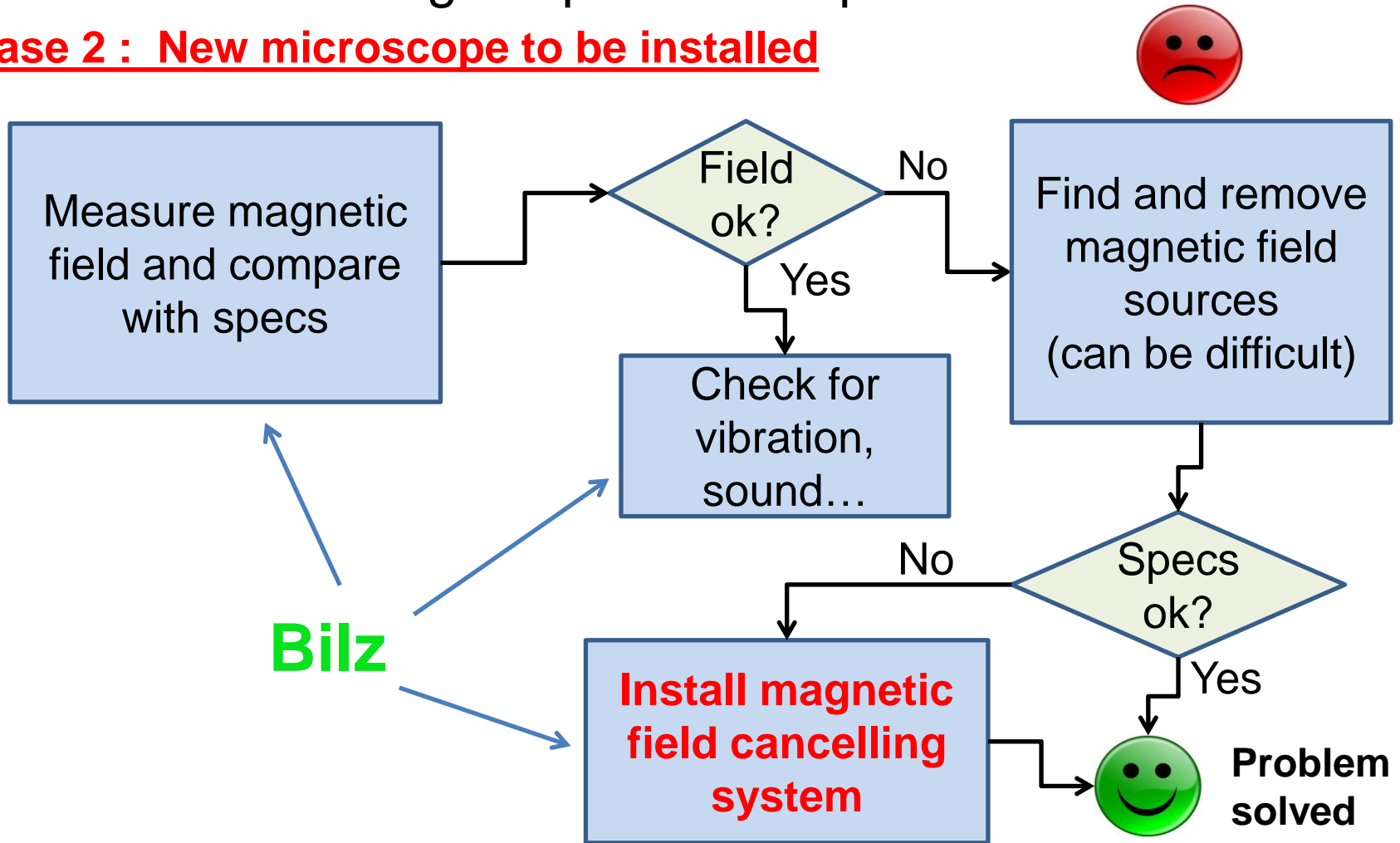
# SEM and TEM image improvement process

## Case 1 : Existing microscope with disturbances



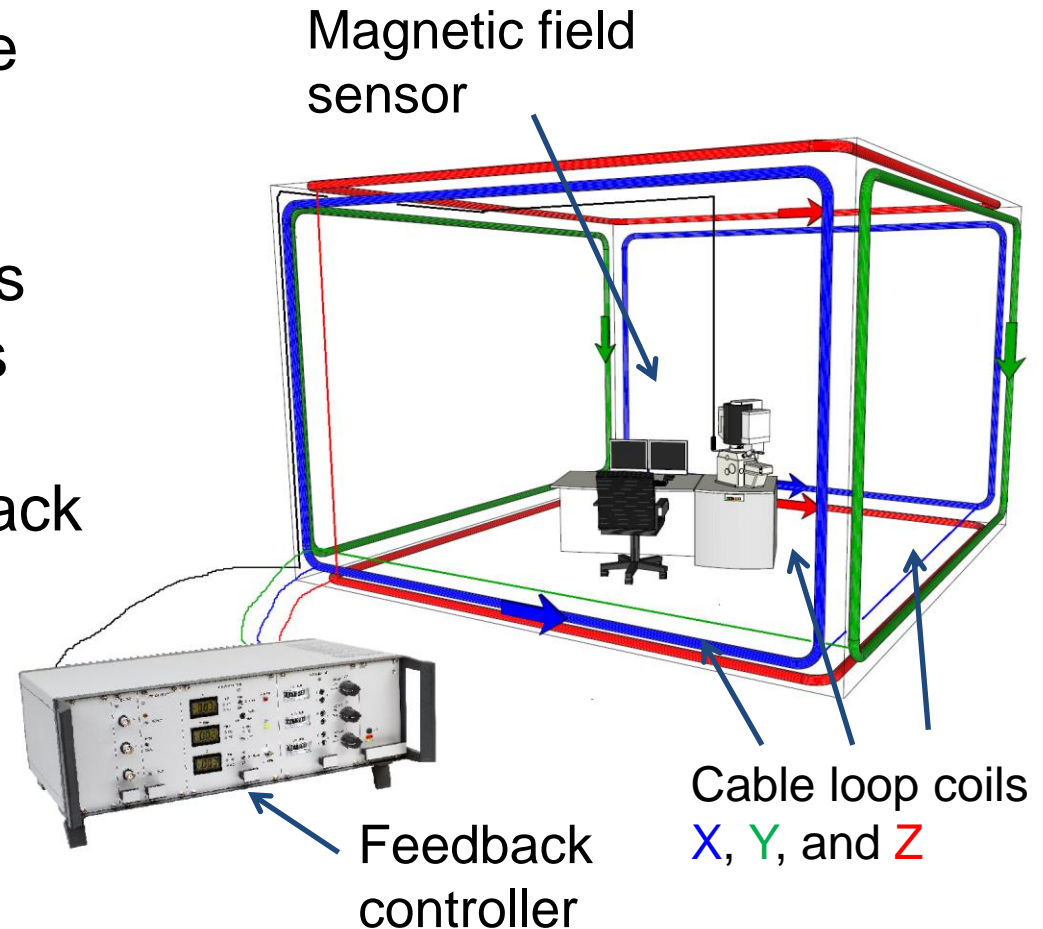
# SEM and TEM image improvement process

## Case 2 : New microscope to be installed



## Components and Function

1. Magnetic field is measured with a 3-axis magnetic field sensor attached to the SEM/TEM column
2. A counteracting field is generated by currents through cable loops connected to a feedback controller



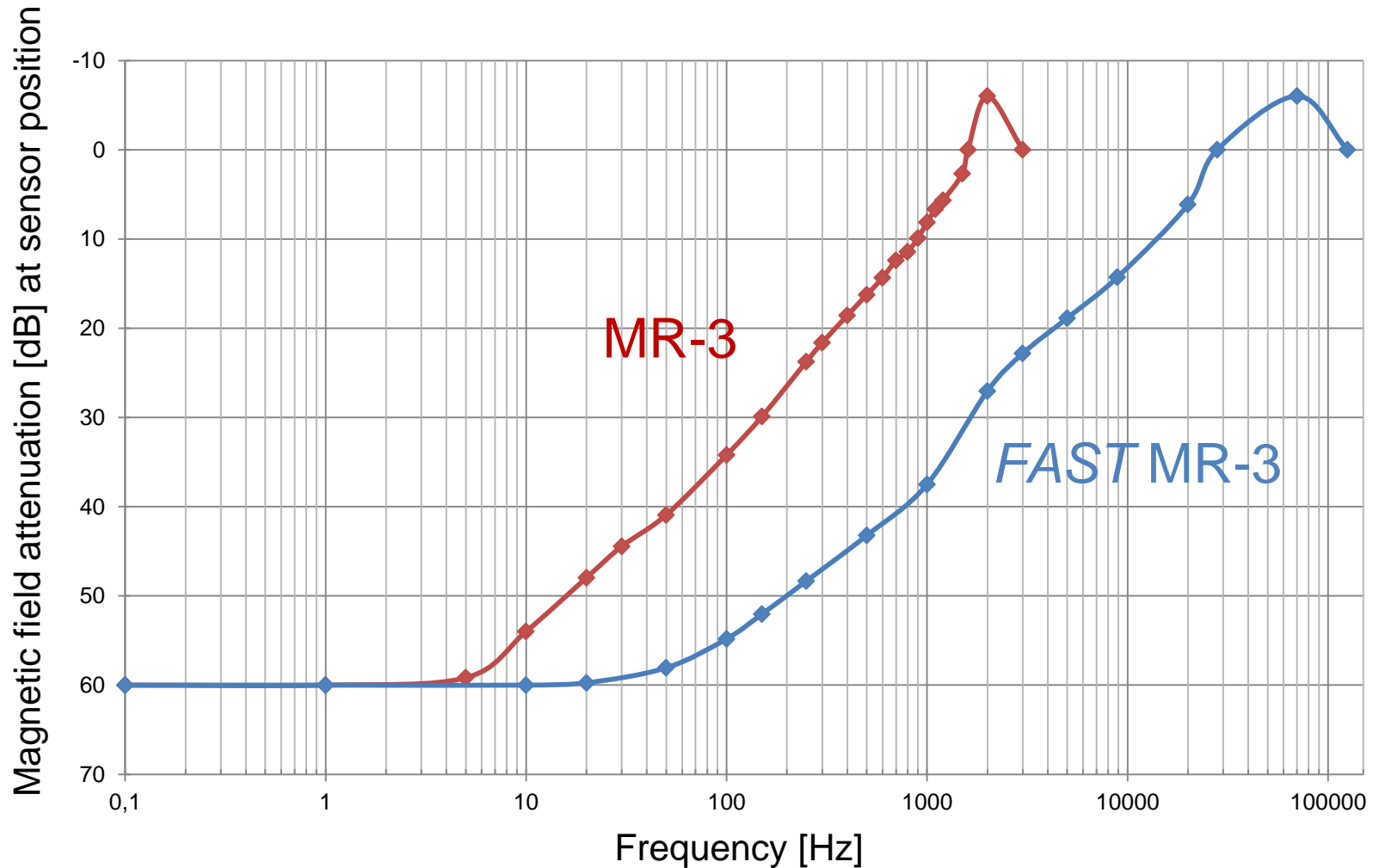


# Magnetic field compensation system

- More than 500 units installed worldwide
- For SEM and TEM
- Continuous compensation from DC to 10 kHz
- Small size 3-axis fluxgate magnetic field sensor with sub-nanotesla resolution and high stability
- Display and alarm functions
- High reliability through robust analog design, easy programming
- Made in Germany

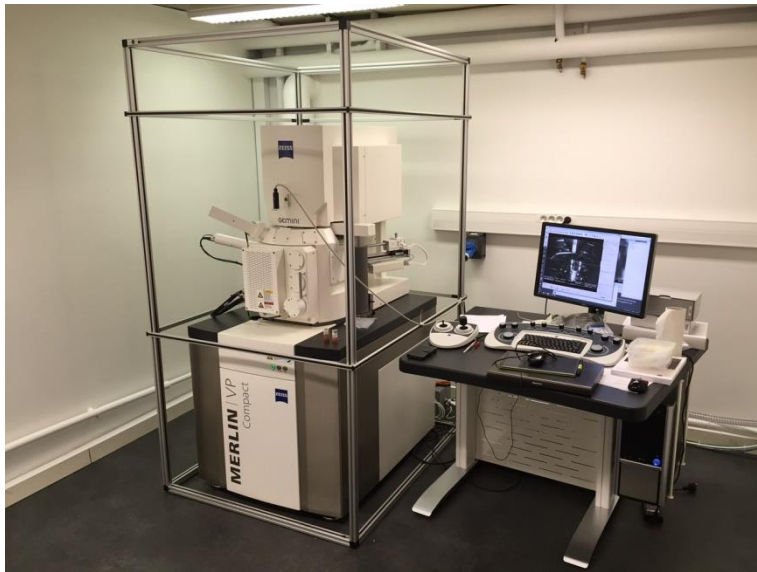


# Performance of cancelling system MR-3



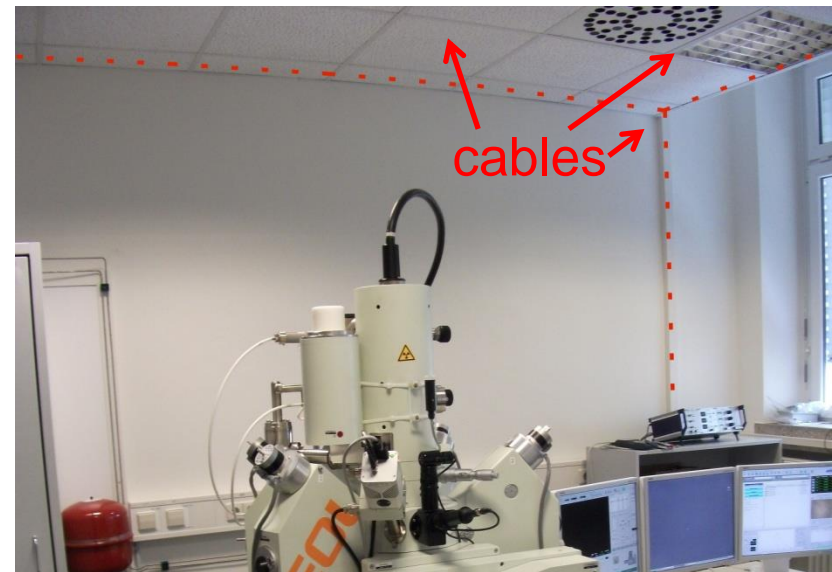
# Magnetic field compensation coils for SEM

## Frame installation



- Individual compensation of multiple SEM in a common room
- Demo frame available

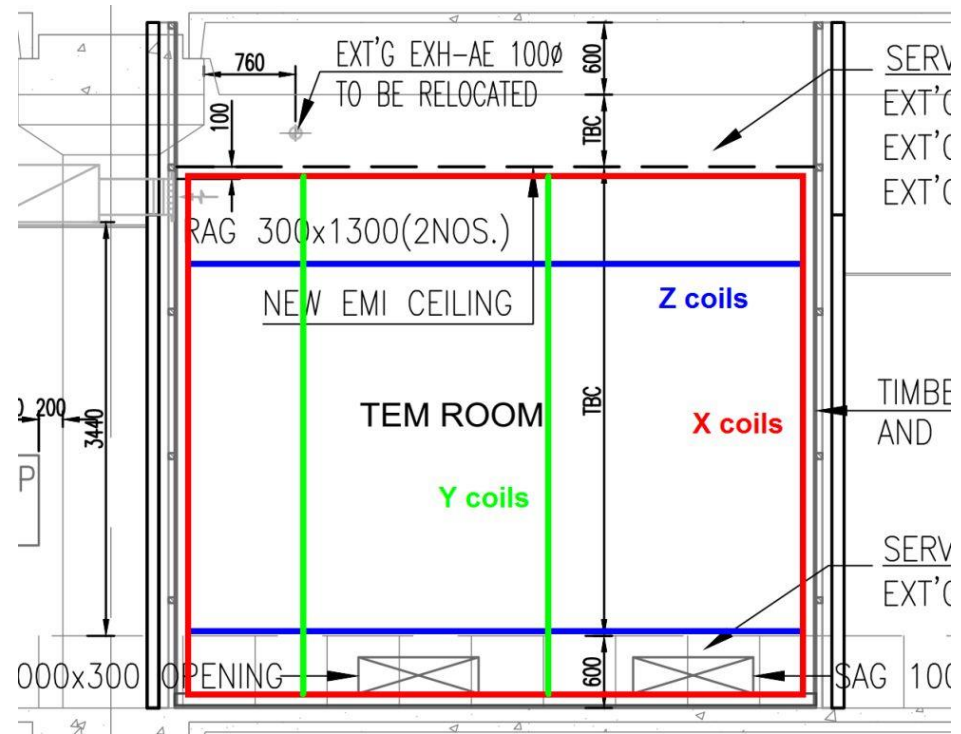
## Room installation



- Homogeneous magnetic field
- Full access to SEM column

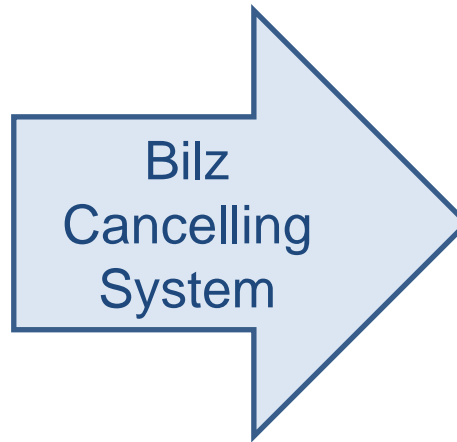
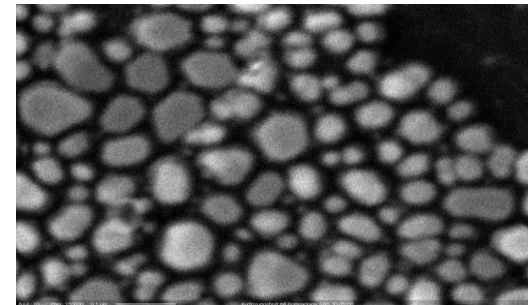
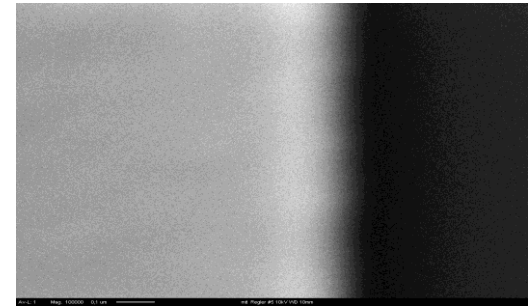
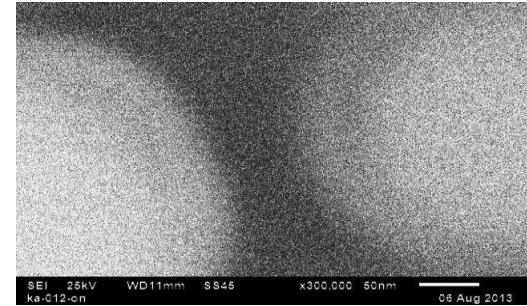
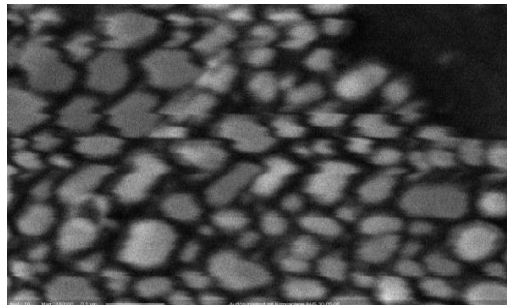
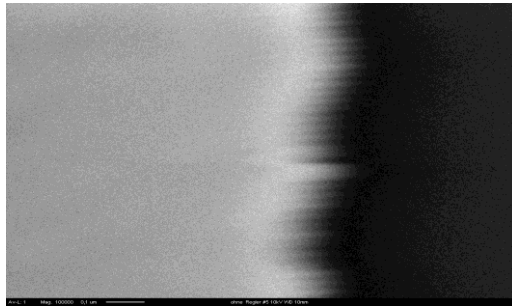
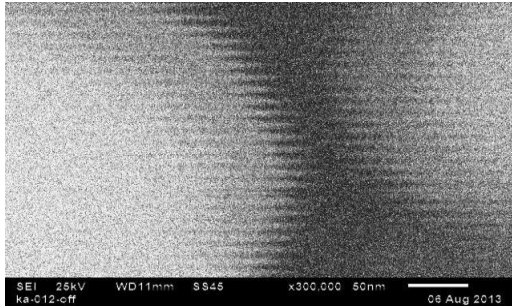
# Magnetic field cancellation for TEM

- Magnetic field specifications for TEM often more stringent than for SEM
- Large size of TEM column requires homogeneous magnetic field
- Magnetic field gradient measurement necessary during site survey
- Customized planning of compensation coils is essential for field homogeneity



Side view

# Image improvement examples





**PRECISION**  
VIBRATION  
TECHNOLOGY  
MORE  
QUALITY



**MAGNETIC**  
LESS  
**FIELD**

**Thank you!**