

Achieving Practical & Cost-Effective Low EMI/RFI Research Environments

Presented by:

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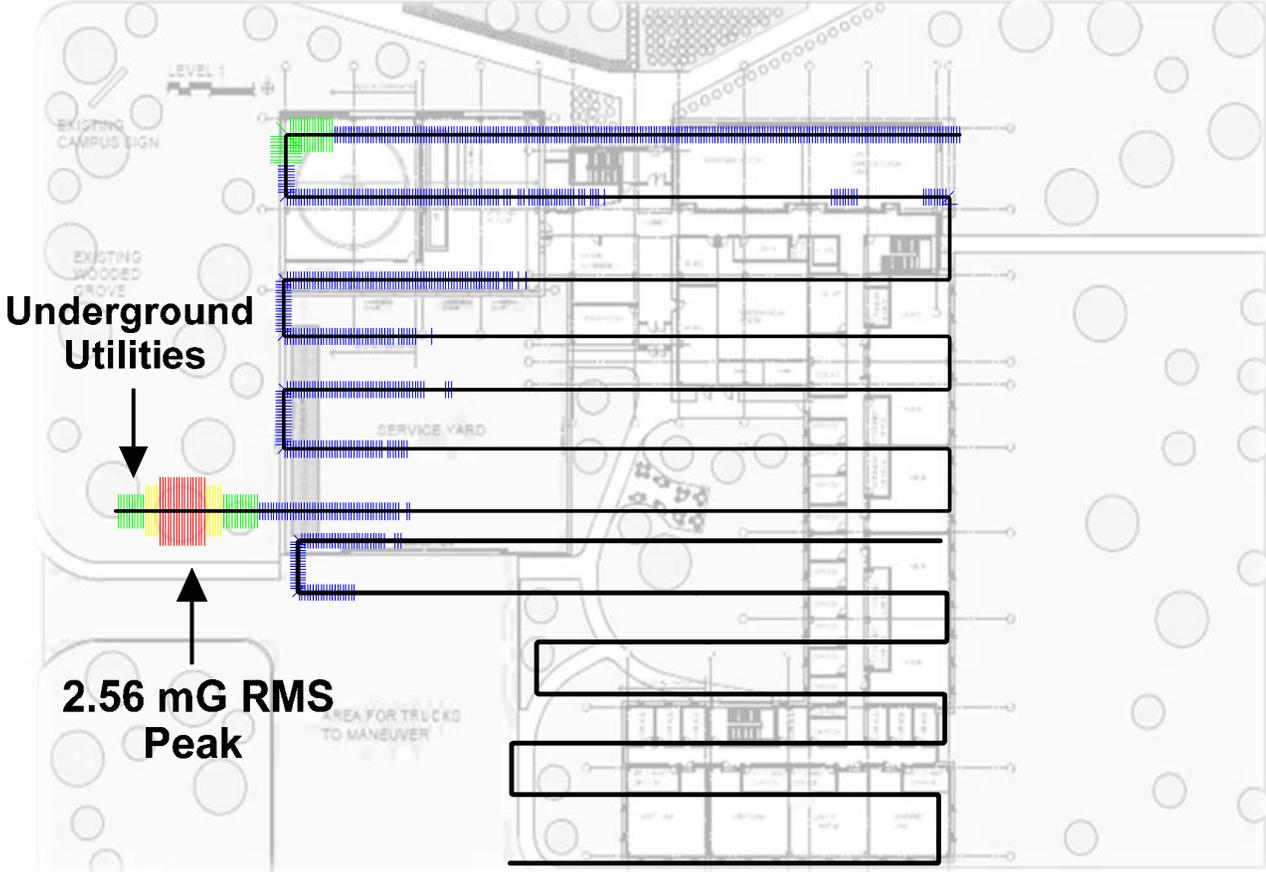
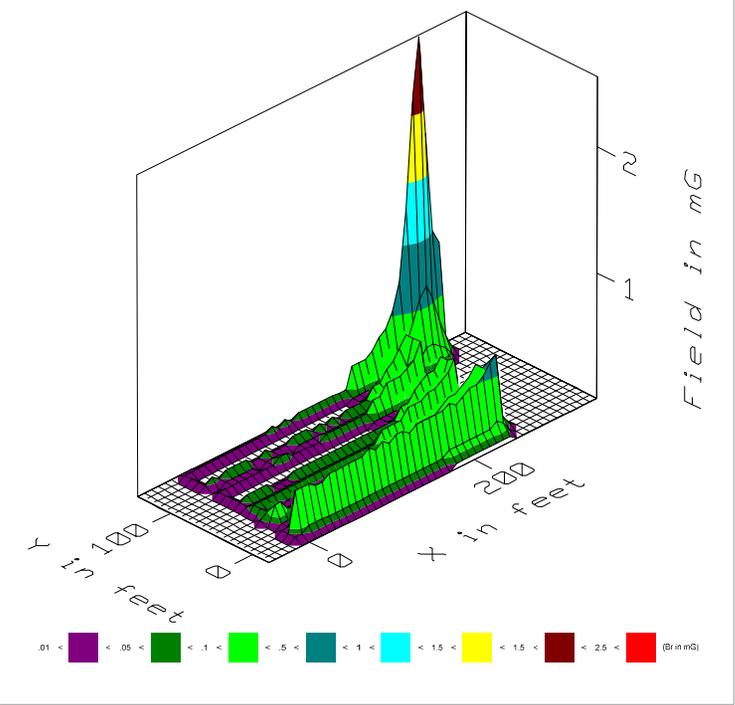


Sources of EMI and RFI



EMI Mapped Measurements

50/60 Hz Sources Include:
Feeders,
distribution/transmission lines,
Transformers, electrical
panels, substations, etc.,

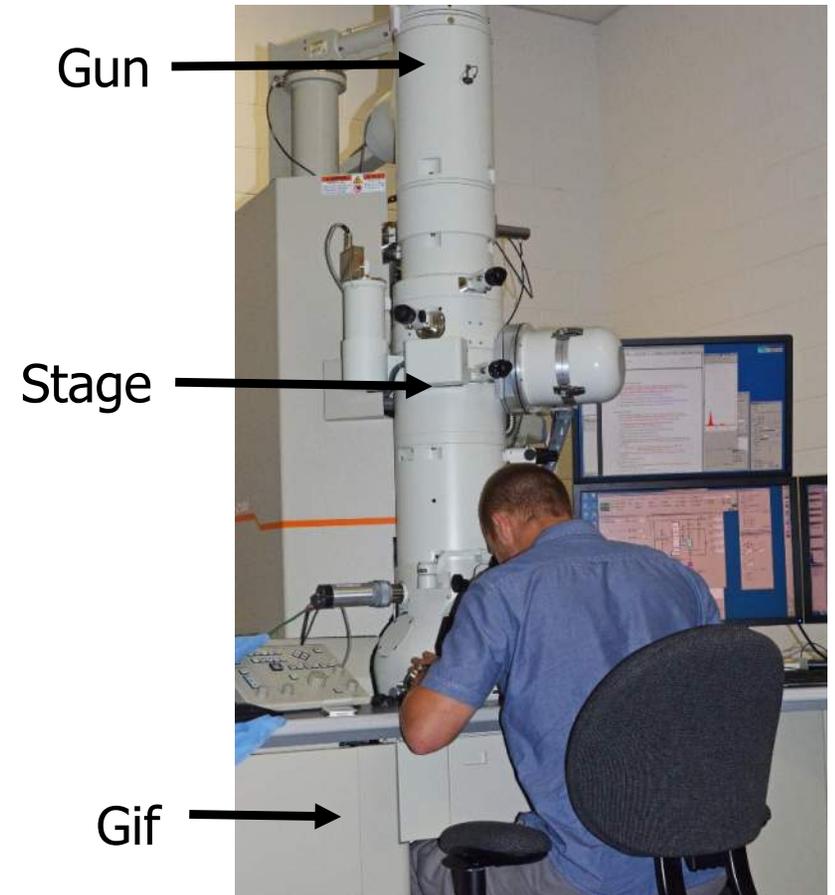


Detection & Control:
Underground/Overhead EMI
sources and/or net ground
currents.

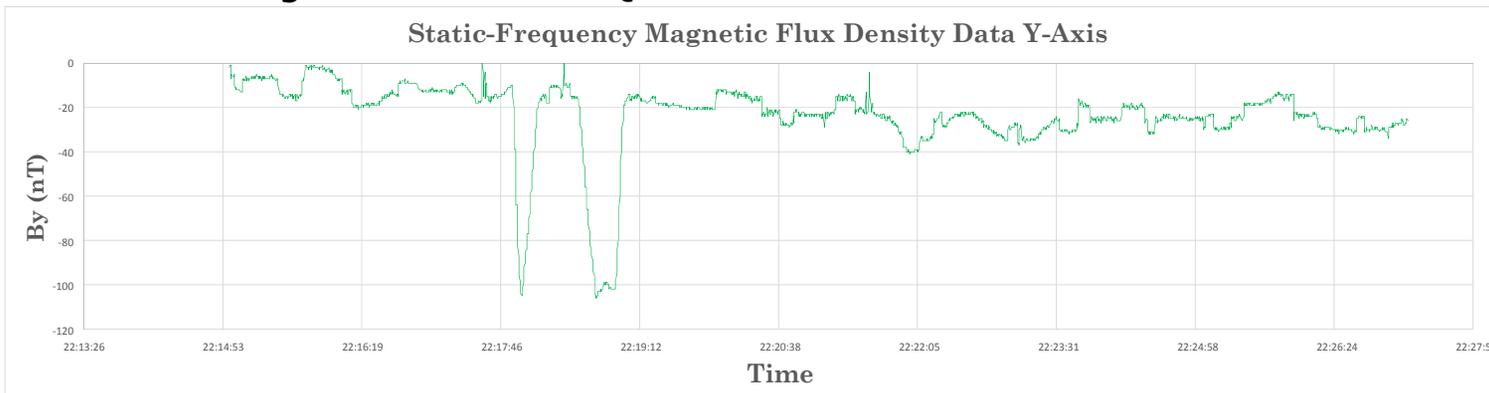


EMI/RFI Timed Measurements

- Testing AC ELF 60 Hz Power Frequency and Quasi-Static DC EMI frequencies from 0 Hz to 3kHz
- Test up to 24 hours for complex internal/external environments
- Measurements should be recorded according to instrument siting criteria or at simply 1 meter from the laboratory/room floor



Signature Profile of Quasi-Static Elevator Emissions



Simulation Modeling



Simulations & Profiles - define safe limits and distances from EMF sources, also known as prudent avoidance.

Shielding Conduits with RGS and EMT

LOAD: 225 Amps

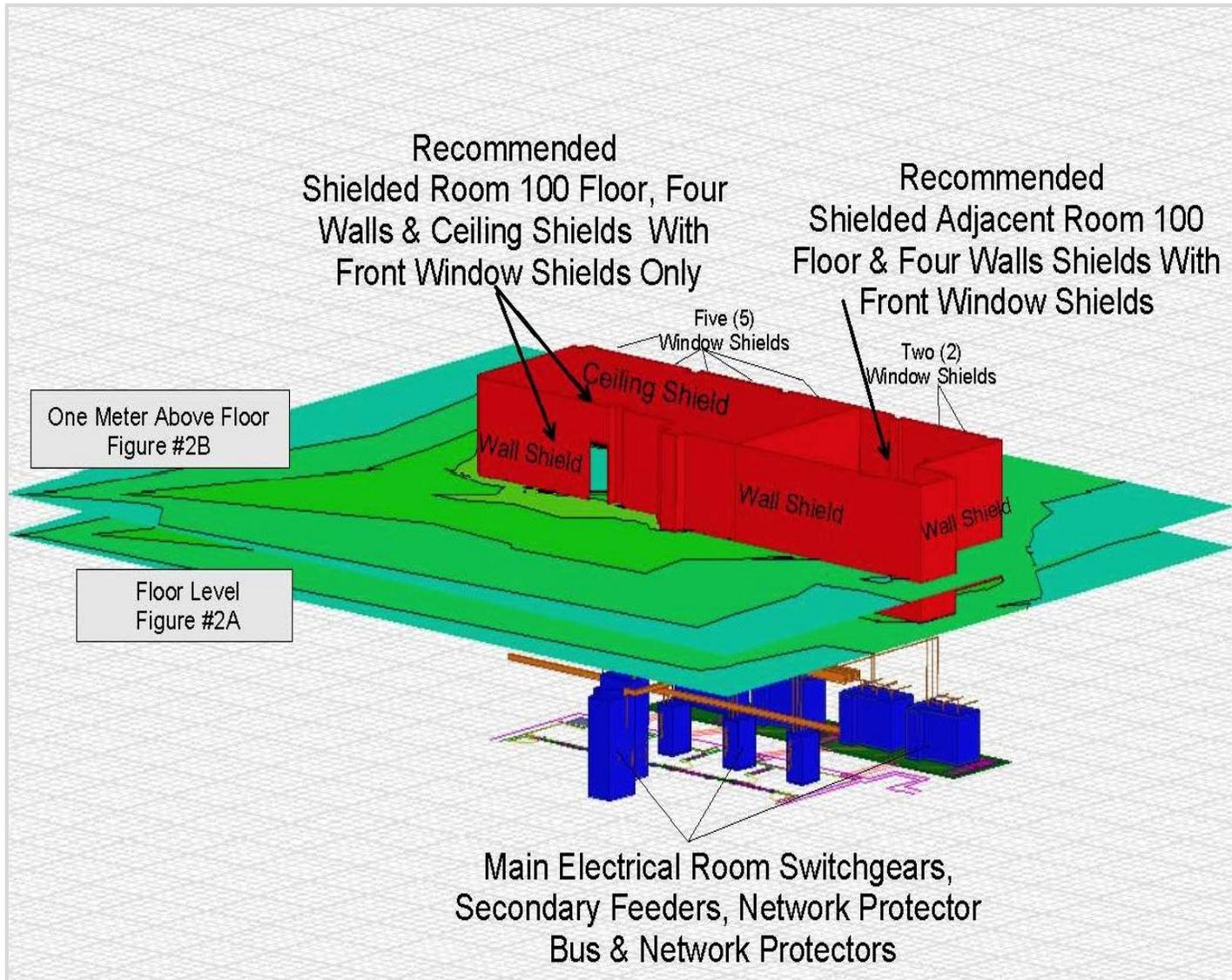
Distance (meters)	Distance (feet)	PVC		EMT		RGS	
		Separated (mG)	Twisted (mG)	Separated (mG)	Twisted (mG)	Separated (mG)	Twisted (mG)
0.25	0.82	399.700	160.100	54.510	14.310	20.350	8.389
0.50	1.64	97.410	39.310	13.340	3.525	4.980	2.078
1.00	3.28	24.330	9.934	3.315	0.878	1.239	0.518
2.50	8.20	4.010	1.685	0.530	0.141	0.199	0.083
5.00	16.40	1.062	0.471	0.133	0.036	0.051	0.022
10.00	32.81	0.302	0.152	0.035	0.010	0.015	0.007



Not in the budget?
 -A Separation distance of 50' or greater is recommended between conduits to sensitive instrumentation.

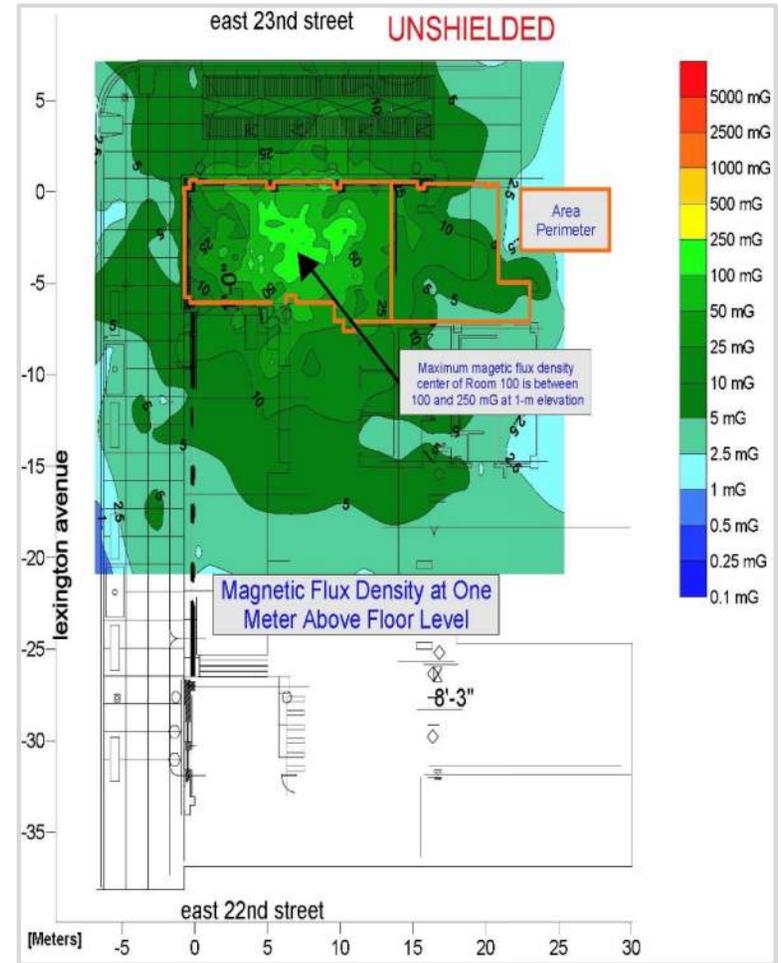
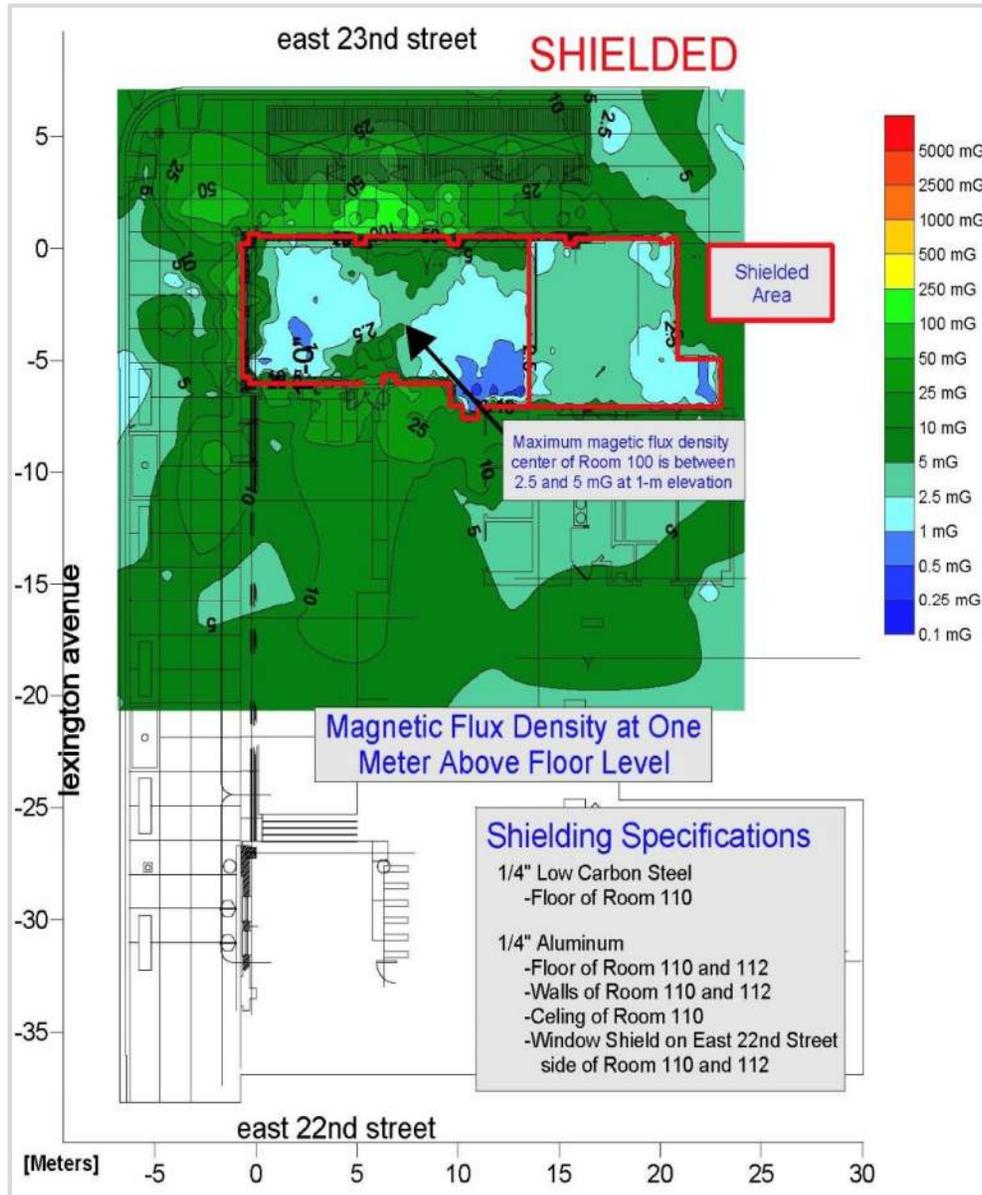


Magnetic Shield Simulation Modeling



- Calculate Shielding Factor & Performance
- Simulate 2-D & 3-D Magnetic Field Emissions

Magnetic Shield Simulation Modeling



Cost-Effective Passive Shielding



American Society of Testing and Materials (ASTM) approved alloy plate used in all installations.

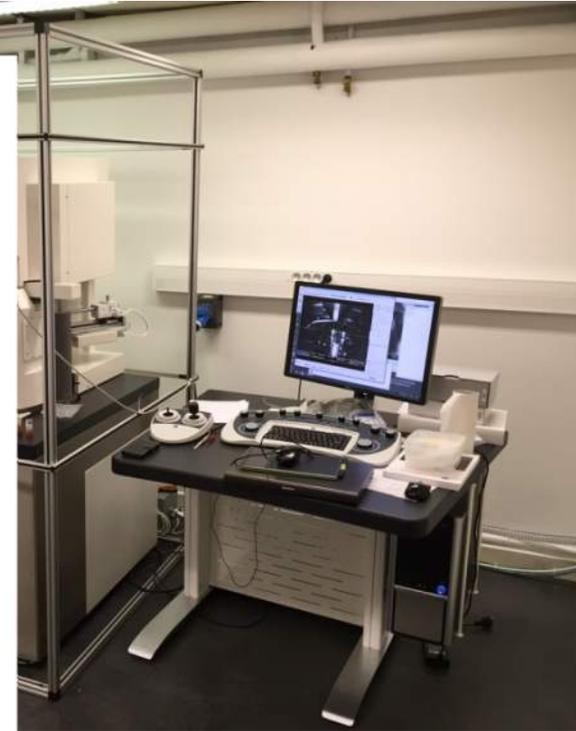
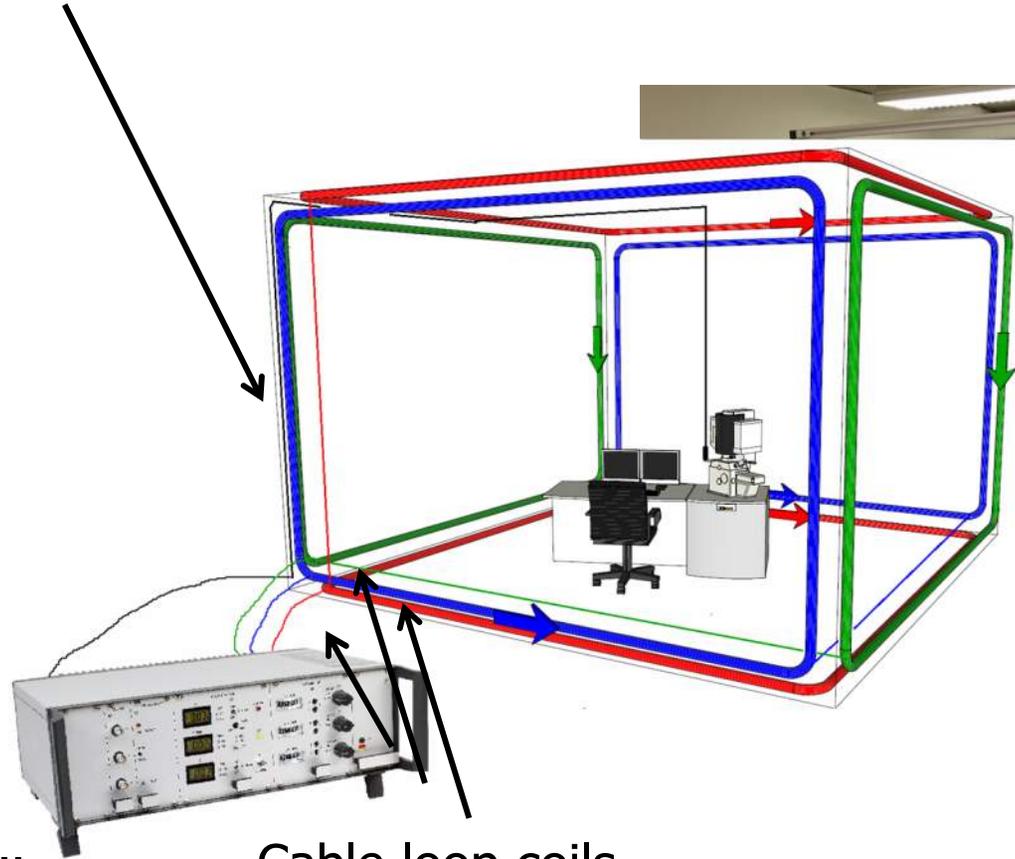
Material	AC ELF Reduction	Quasi-Static DC Reduction	Remarks
Aluminum	Excellent	No Attenuation	Easy to fabricate. No corrosion
Low-Carbon Steel	Fair	Poor	Difficult to Fabricate. Can Rust.
Non-Oriented M-36	Fair	Poor	Difficult to Fabricate. Can Rust.
Oriented M-6	Good	Poor	Difficult to Fabricate. Can Rust.
Nu-Metal	Excellent	Fair	Extremely Expensive!

Incorporating Passive Shielding



Active Compensation Systems (ACS)

Magnetic field sensor



Feedback controller

Cable loop coils
X, Y, and Z

A counteracting field is established by currents through cable loops connected to a feedback controller.

Combining Passive Shielding and ACS



- Simultaneous cancelling of quasi-static (DC) and AC magnetic fields
- Cancellation coils can be mounted to walls
- Cancellation Design configures with MEP and other engineering controlled wall fixtures

Thank you!

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