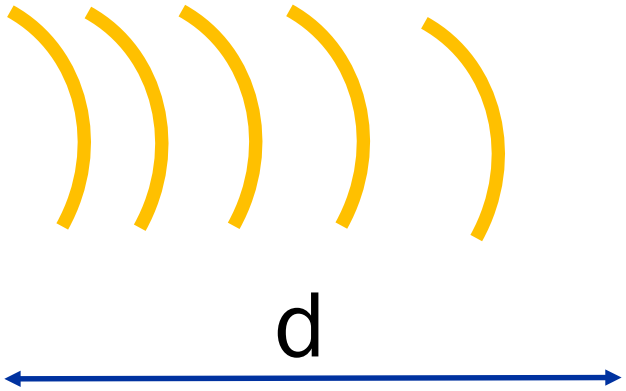
The investigation of environmental influence on PDSs primarily focuses on parasitic coupling and mesh influence

Parasitic coupling

Mesh influence

A magnetic PDS uses magnetic field strength received by an MWC to determine the distance between the generator and the MWC

B-Field Generator



Miner Wearable Component (MWC)

- Important assumption: field variation is solely caused by distance change

Presence of trailing cables can alter the magnetic field without changing the distance between the generator and the MWC

1. Coupling from generator to cable
2. Propagation along cable
3. Coupling from cable to MWC

Generator

MWC

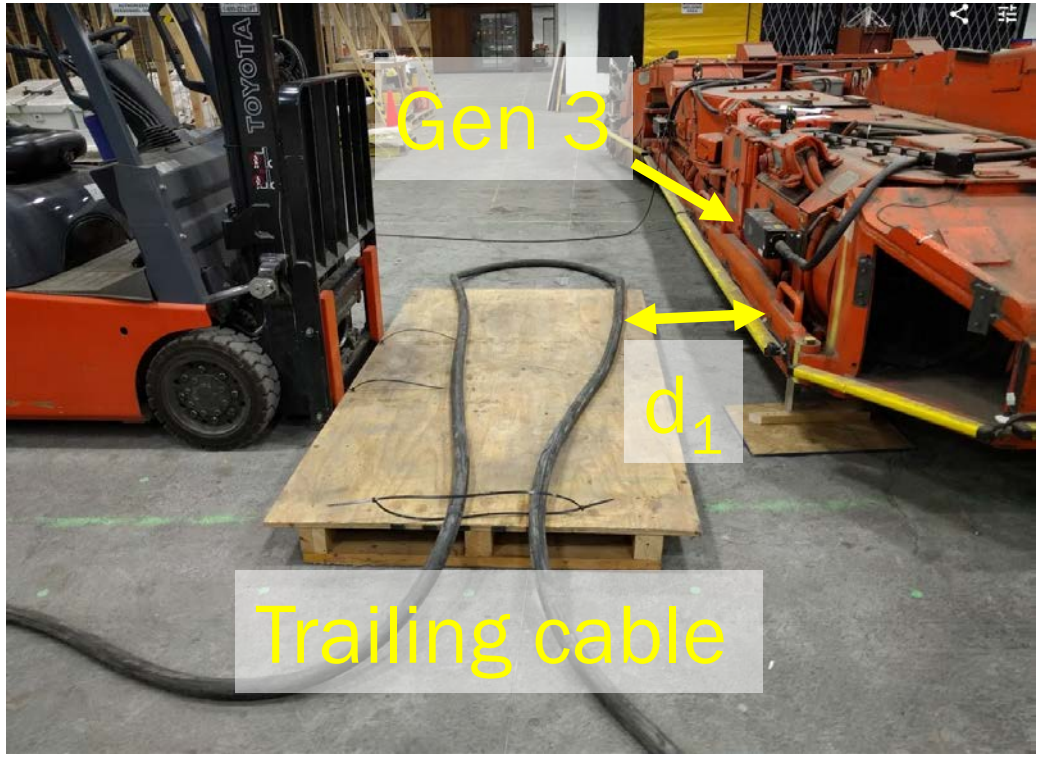
1

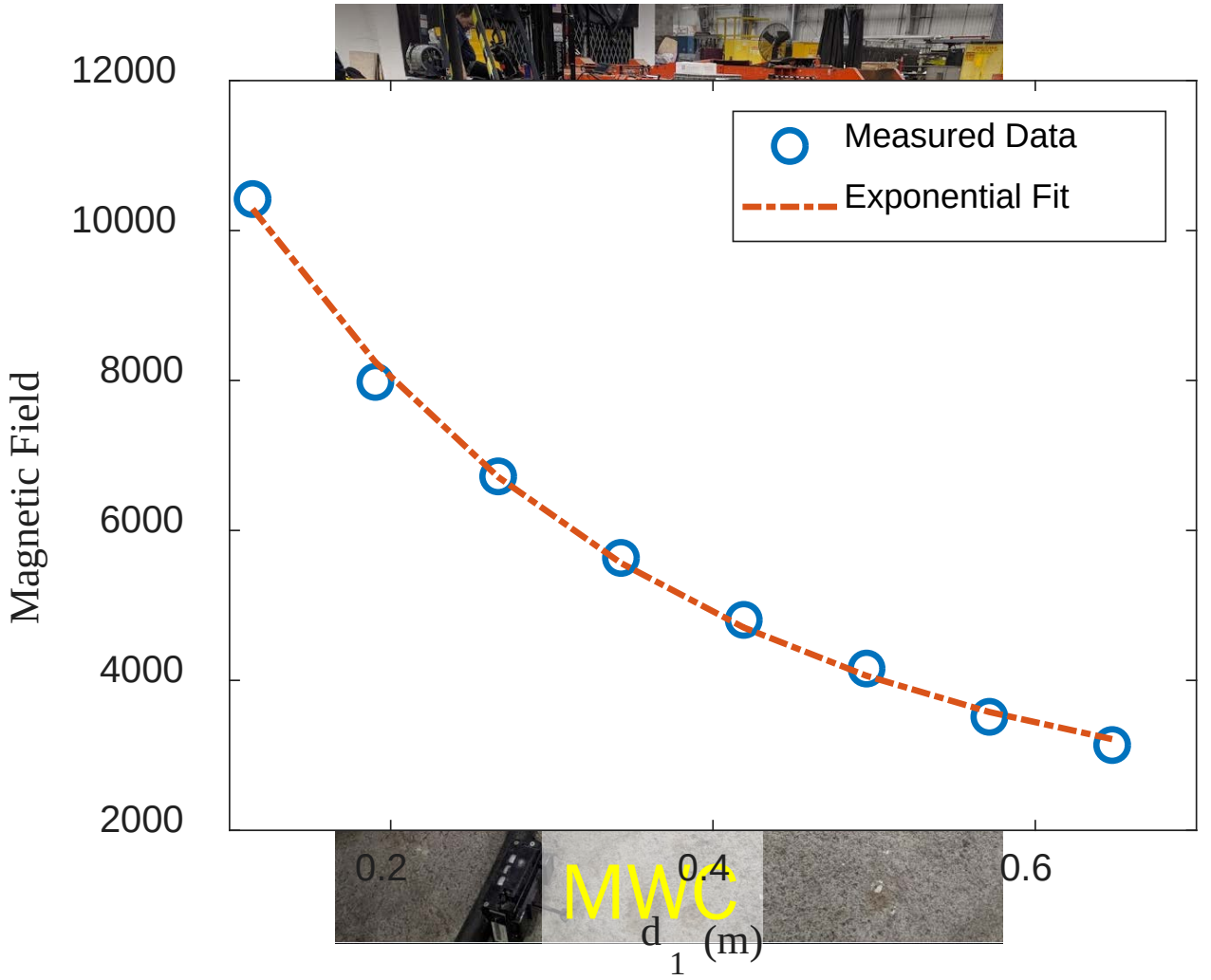
3

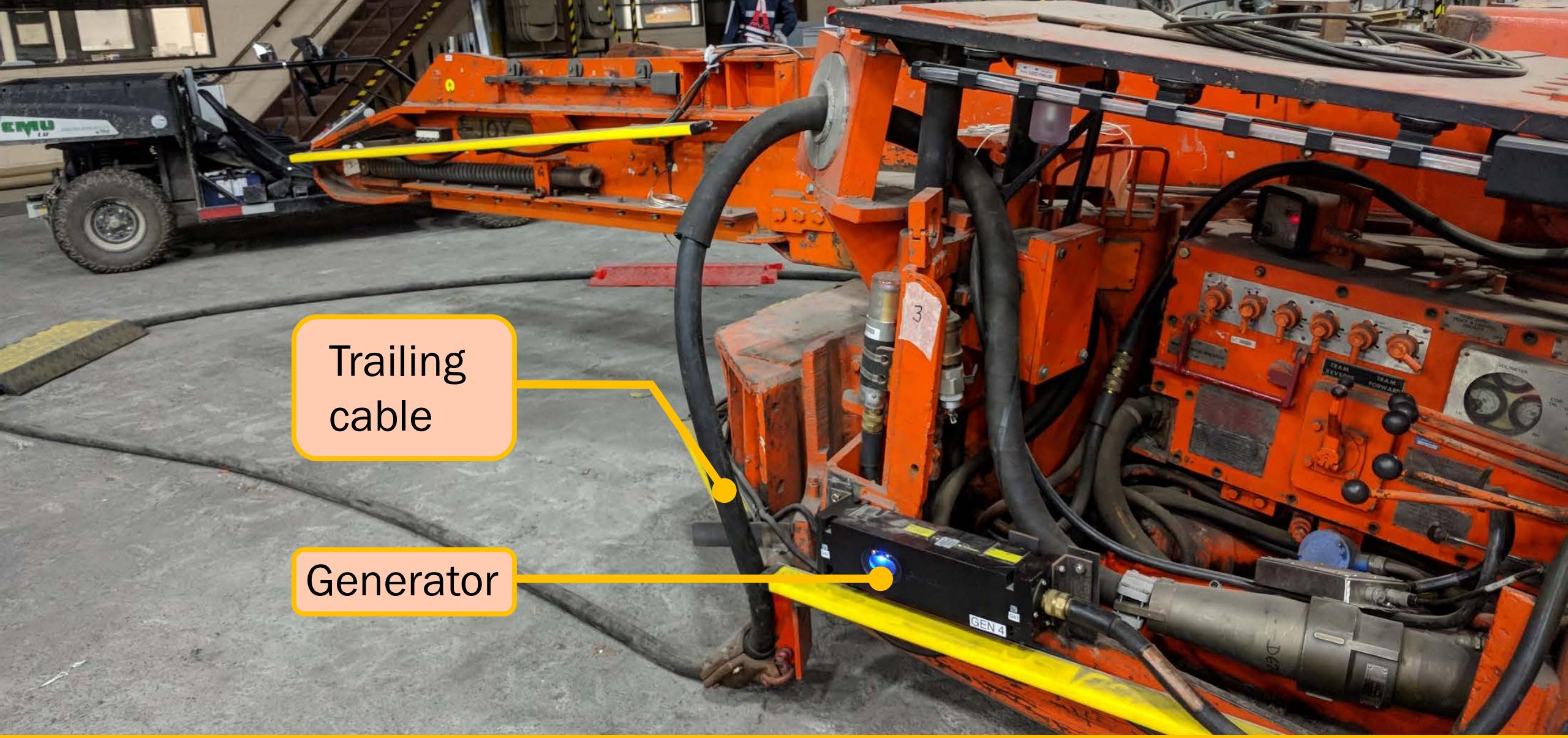
Trailing cable

2

1 The coupled magnetic field decreases exponentially with the distance between the generator and the trailing cable

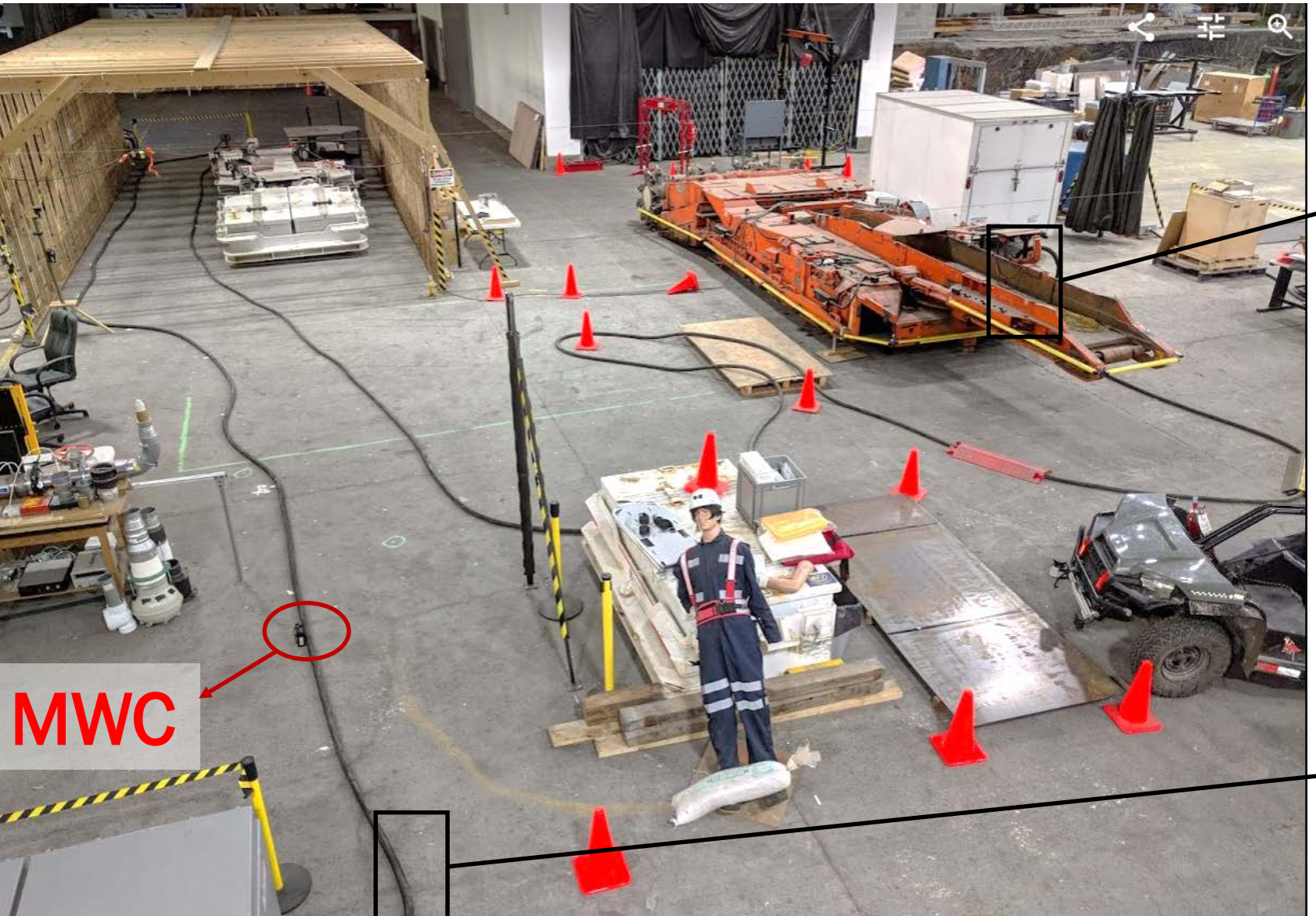




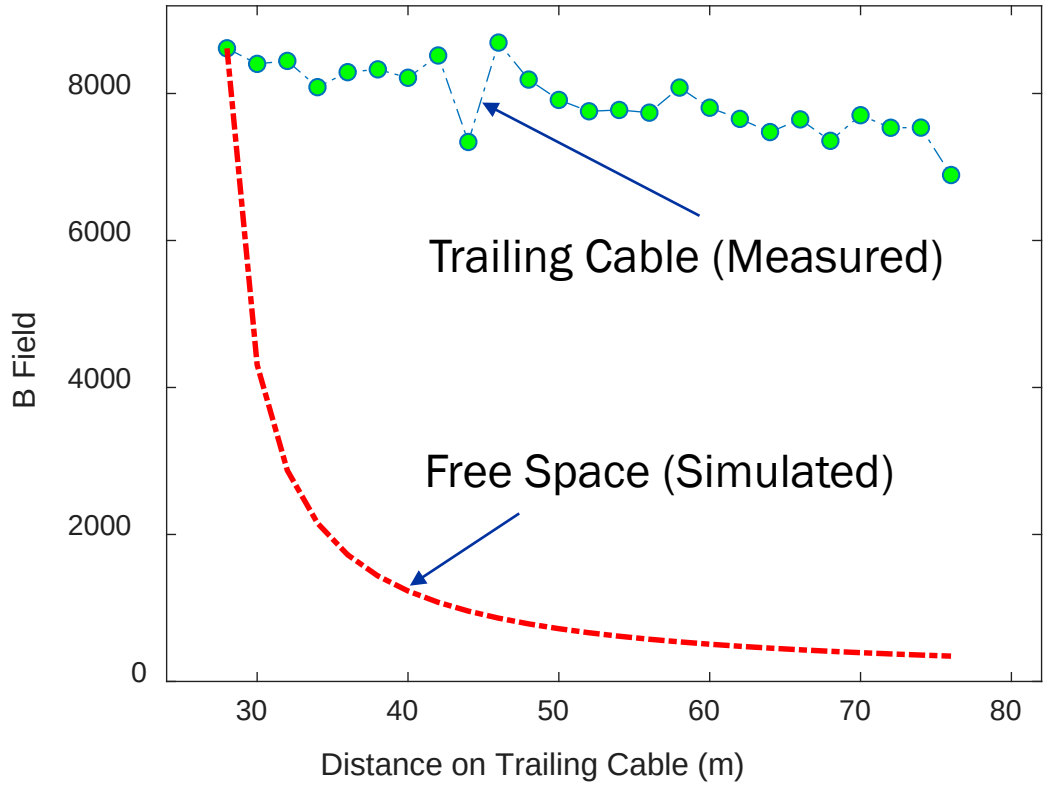


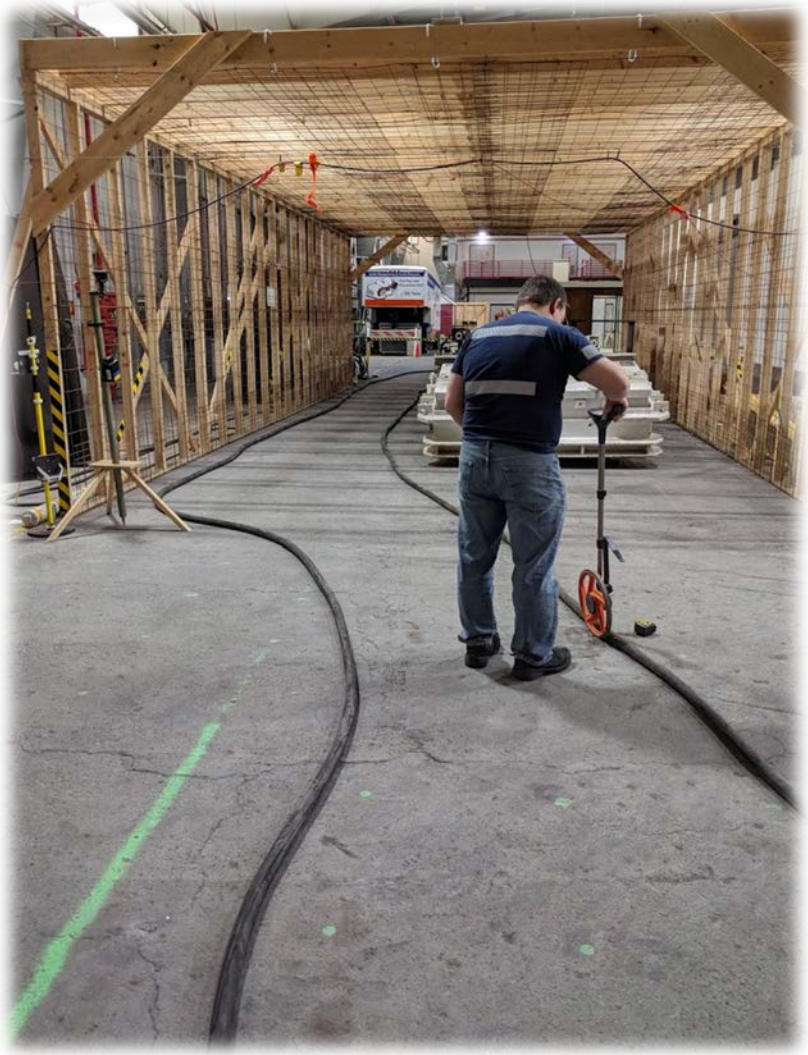
Attention: mounting a generator too close to a trailing cable could result in significant trailing cable coupling

2 Measuring the power loss of coupled field propagating along a trailing cable



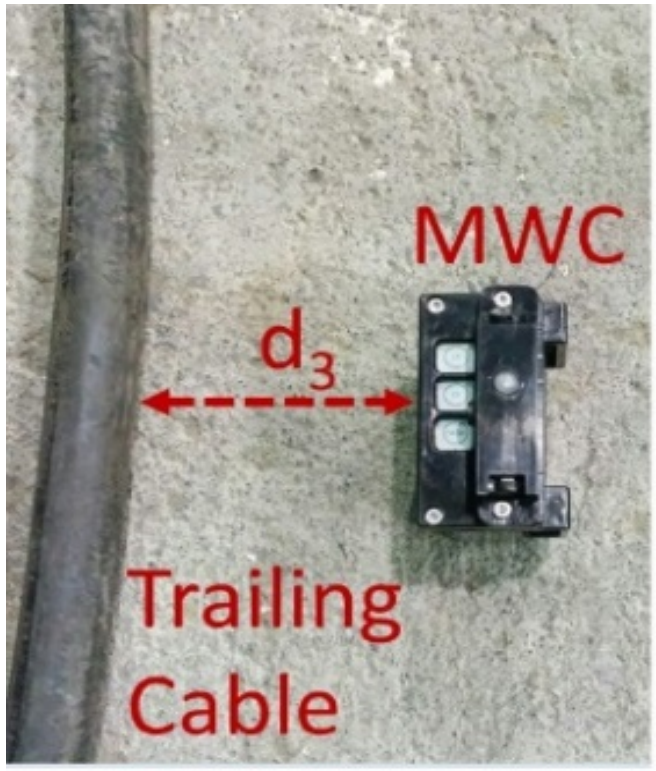
2 The coupled magnetic field can propagate along a trailing cable for a long distance with a minimum loss

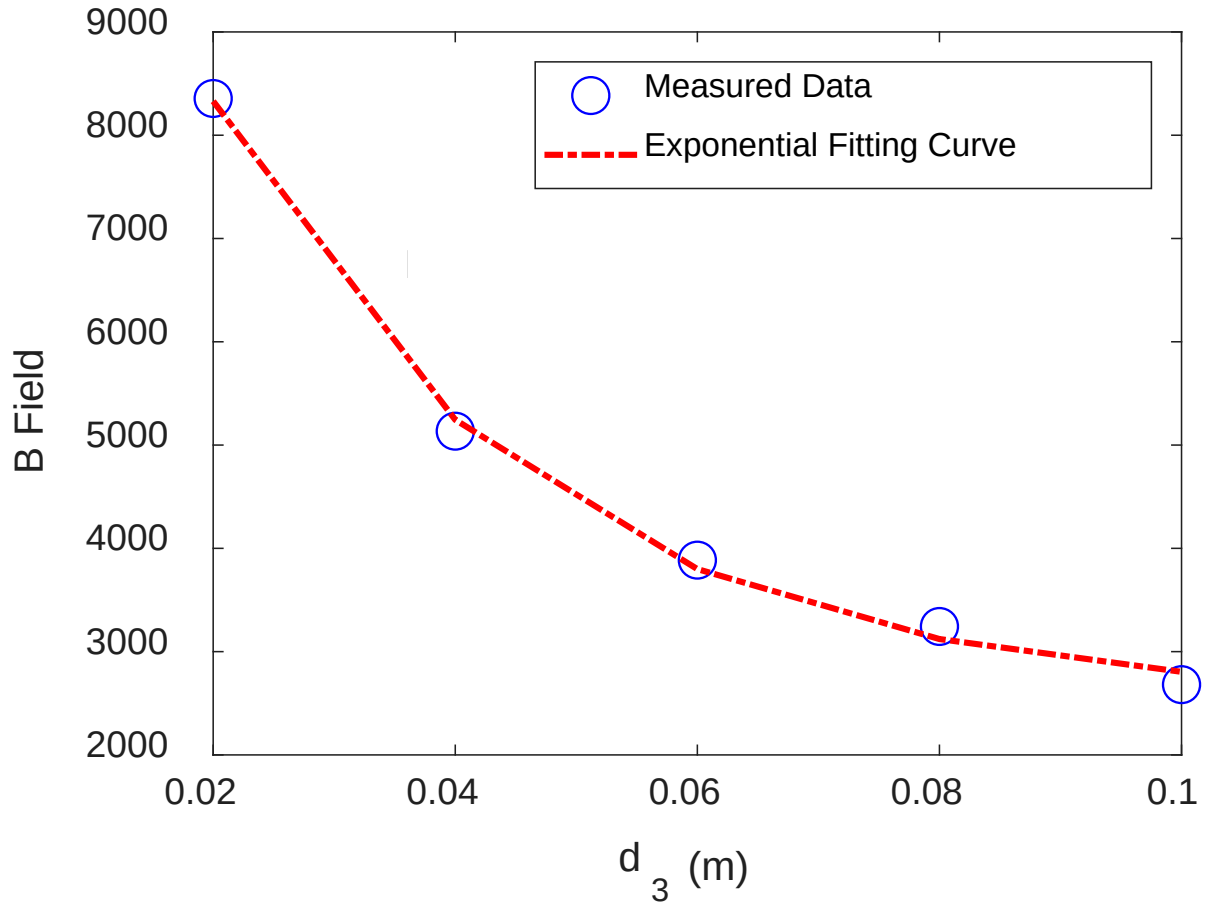




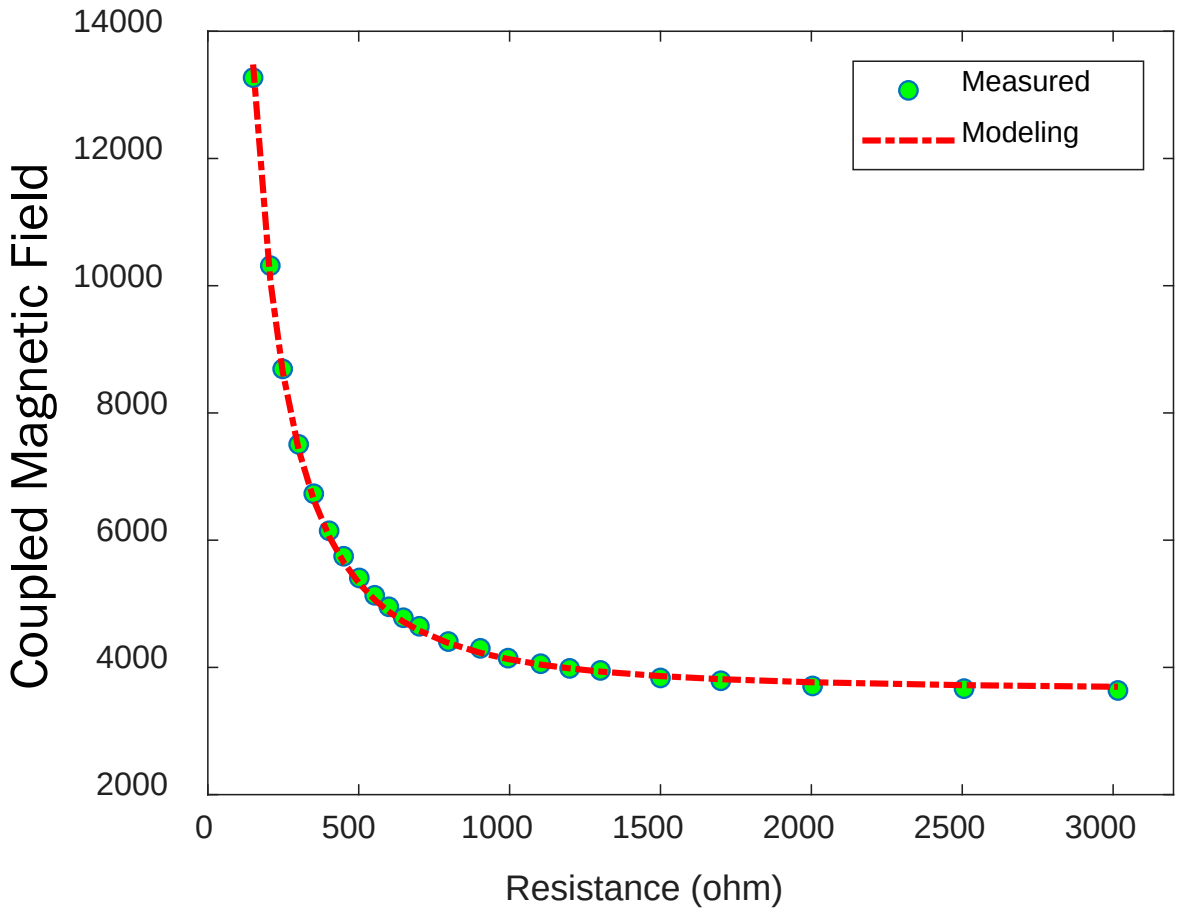
Only 15% power loss after propagating 50 meters

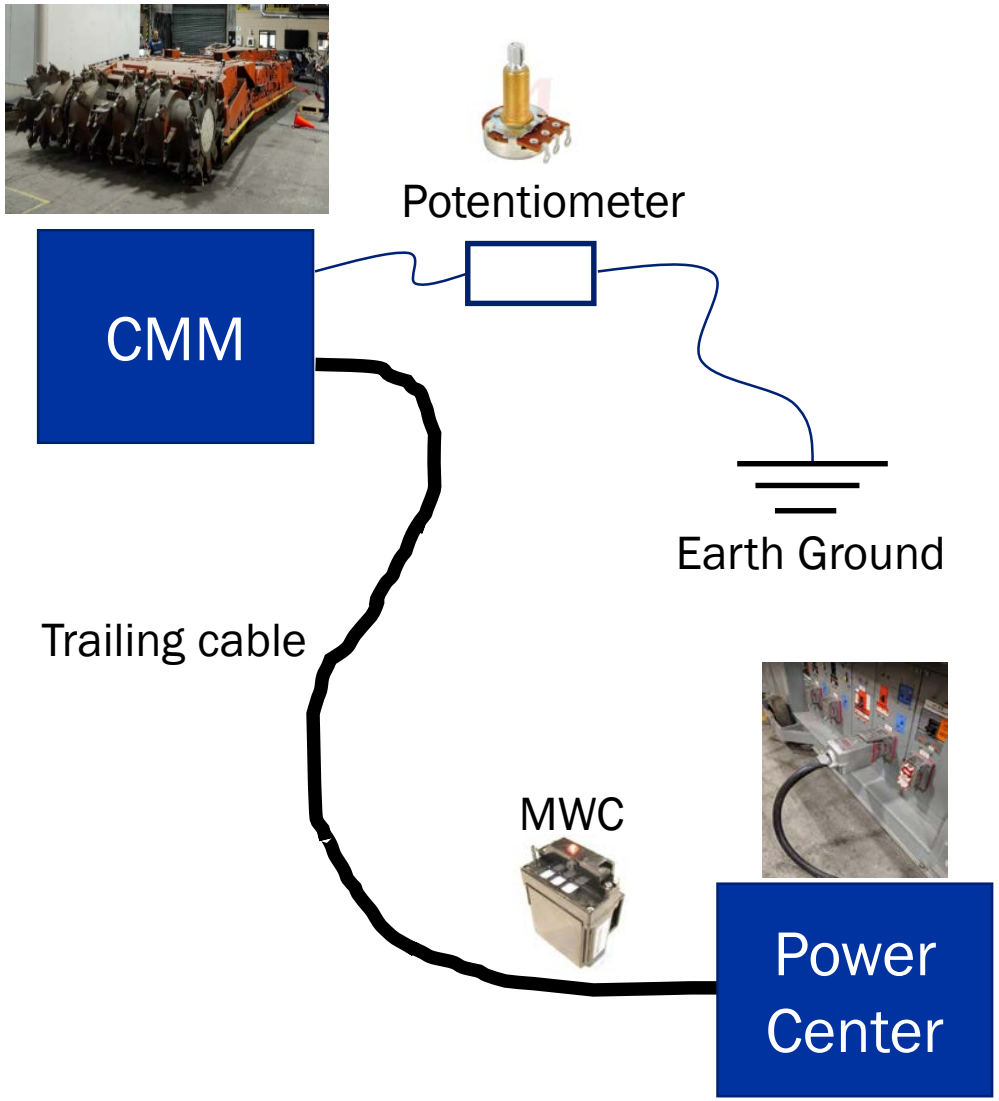
3 Coupled magnetic field strength exponentially decreases with the distance between the MWC and the trailing cable





Coupled signal power varies with the impedance between the CMM and the ground



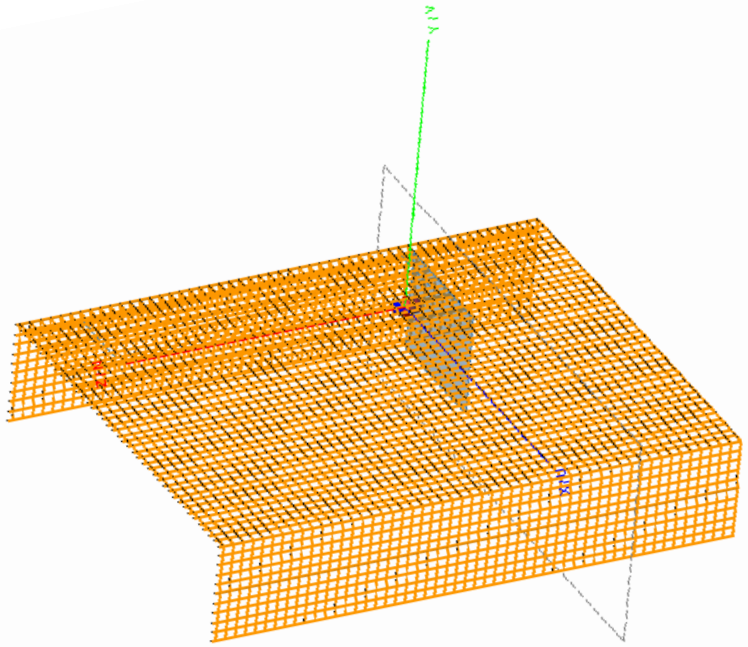


How to mitigate parasitic coupling effect?

- Best practices: Maintain a minimum separation distance between:
  - Generator and trailing cable
  - Trailing cable and MWC

- Engineering control: Adding electrical components (e.g., inductors) to increase the impedance of existing ground loops when possible

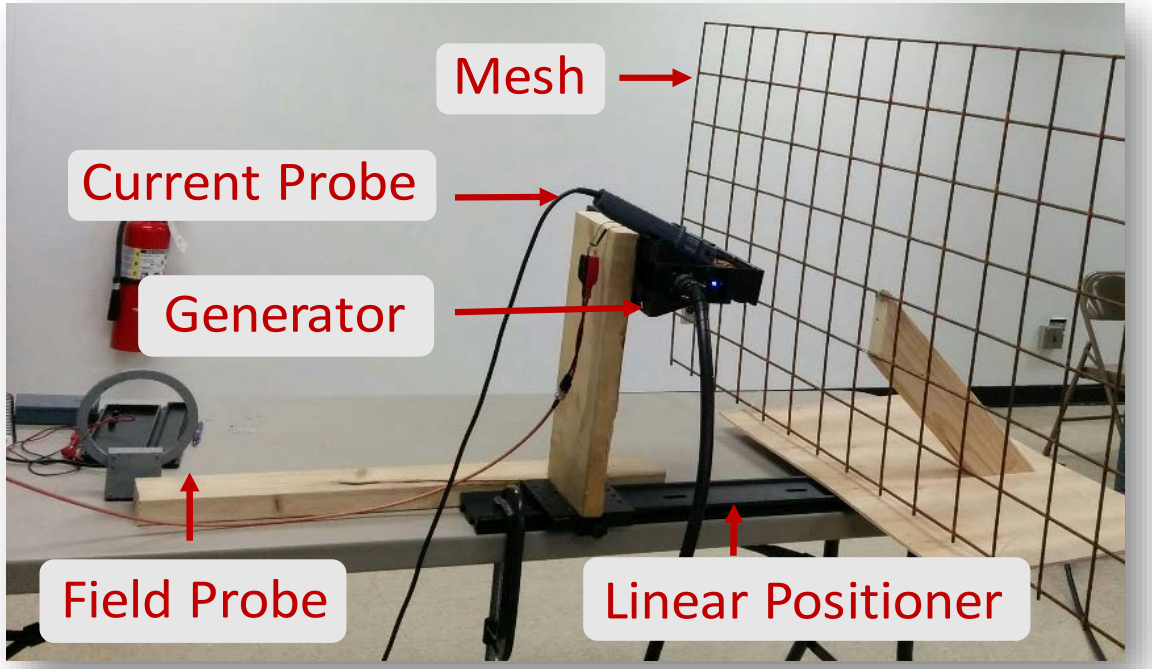
Wire mesh can possibly influence the performance of PDSs by changing the generator current and magnetic field distribution

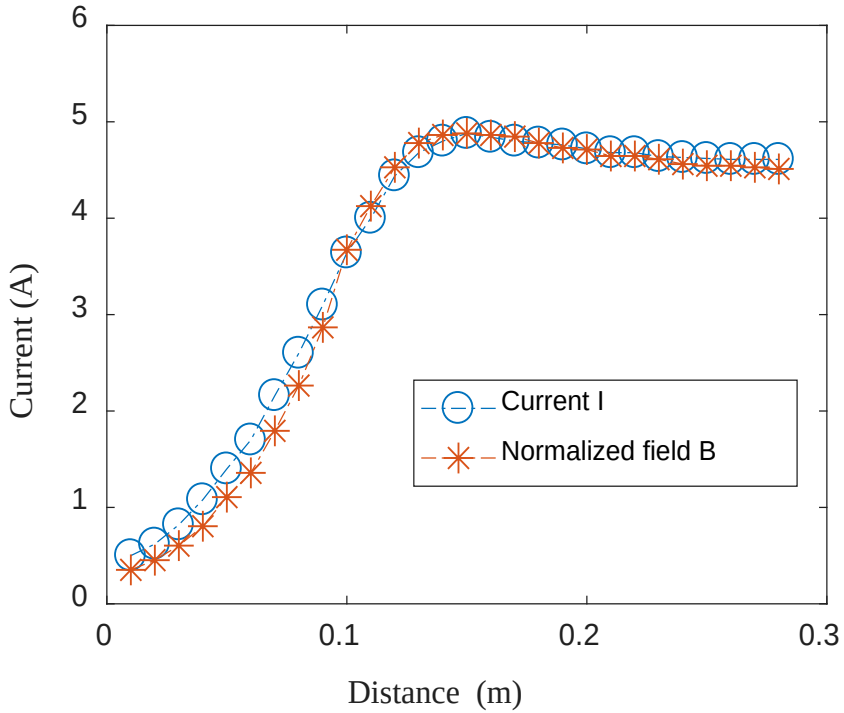


Magnetic field distribution change (shielding effect)

Generator current (antenna detuning)

The magnetic field change caused by antenna detuning can be very significant (on the order of 10)

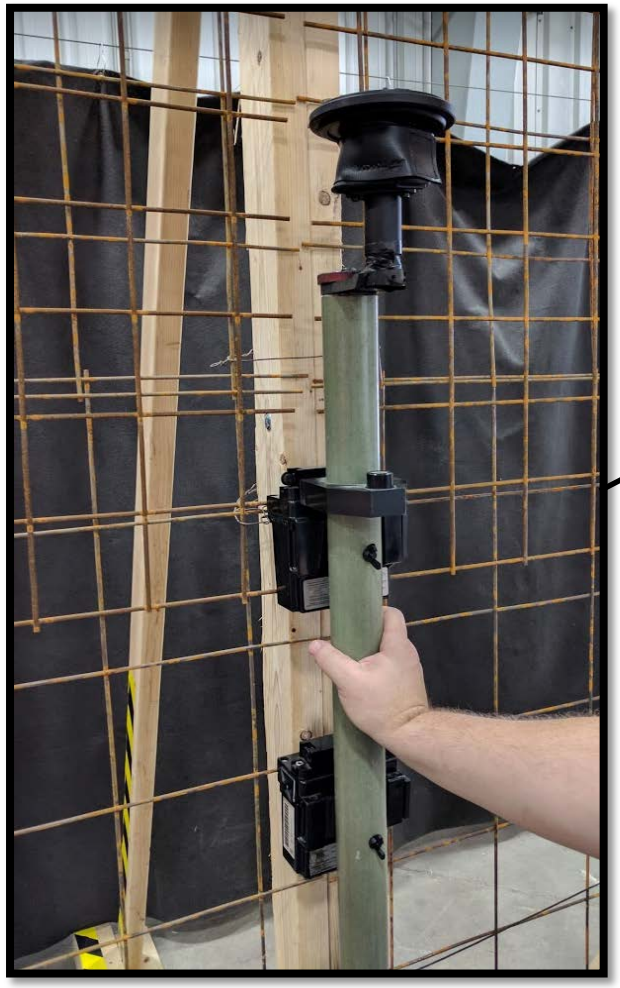


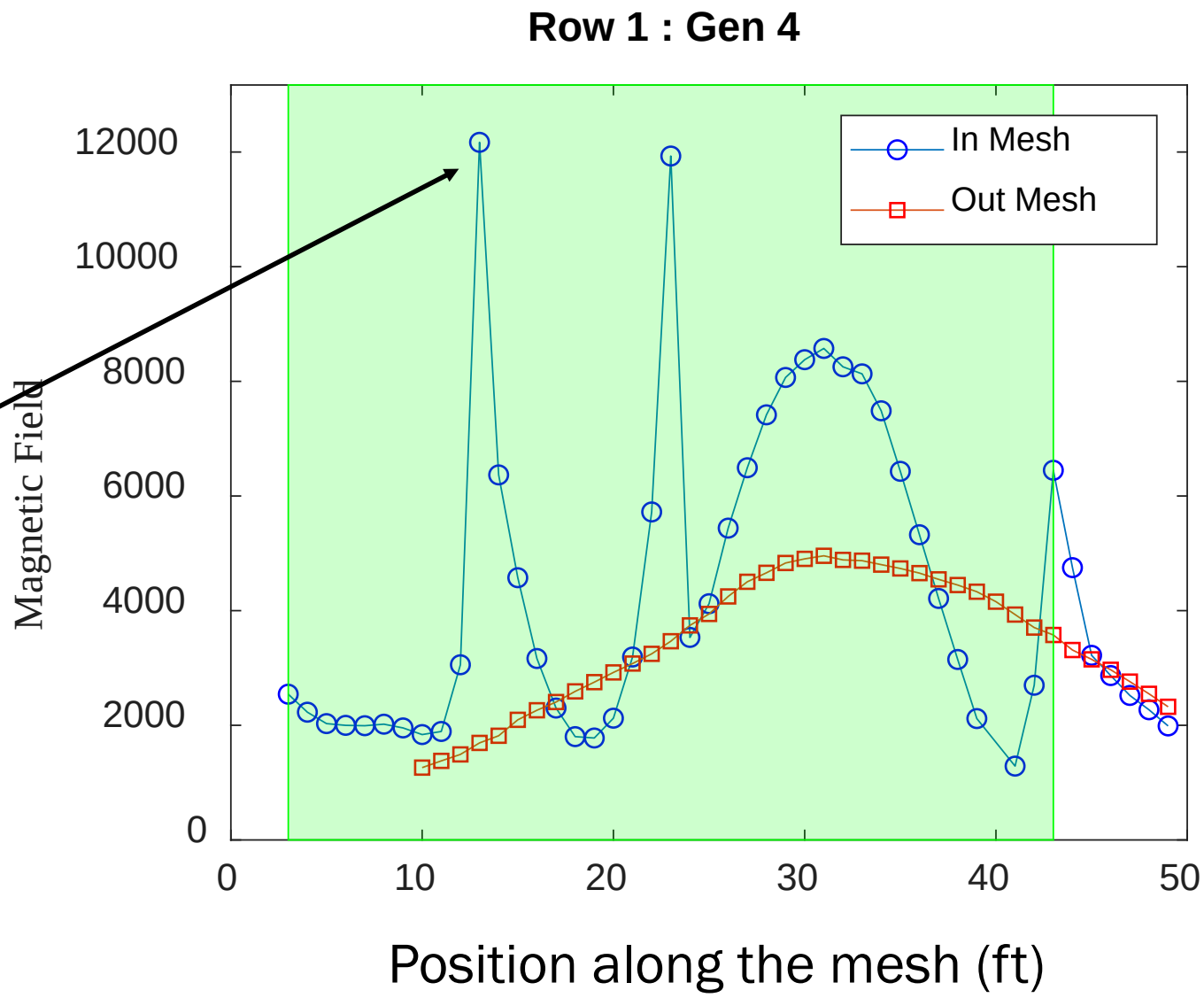


- Mitigation strategy:
  - Best practice: Maintain a minimum separation distance (~ 0.2 m) between the generator and the mesh
  - Engineering control: Maintain a constant current in the generator antenna

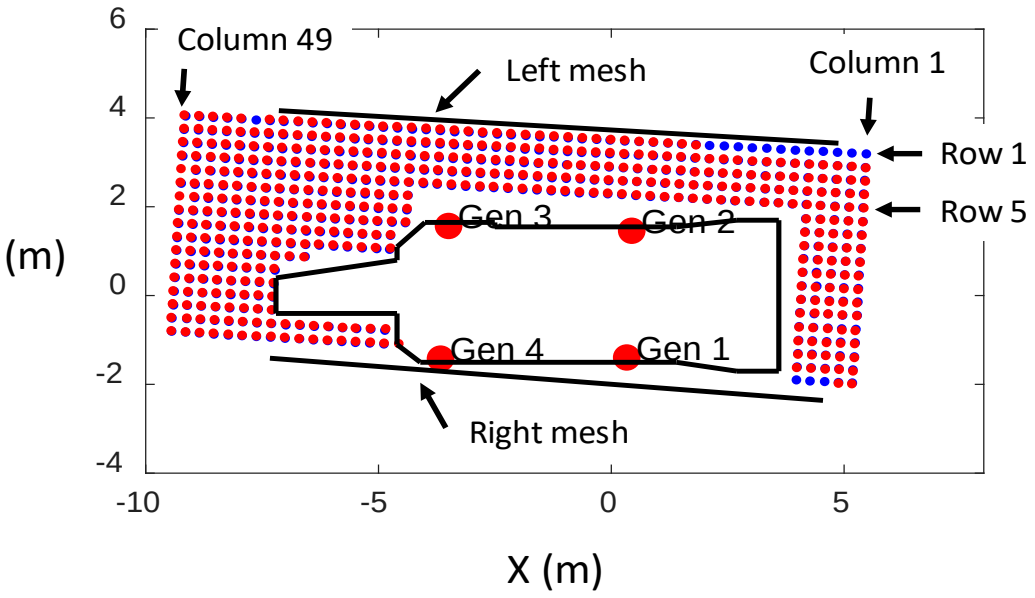
Measuring the magnetic field distribution change caused by mesh

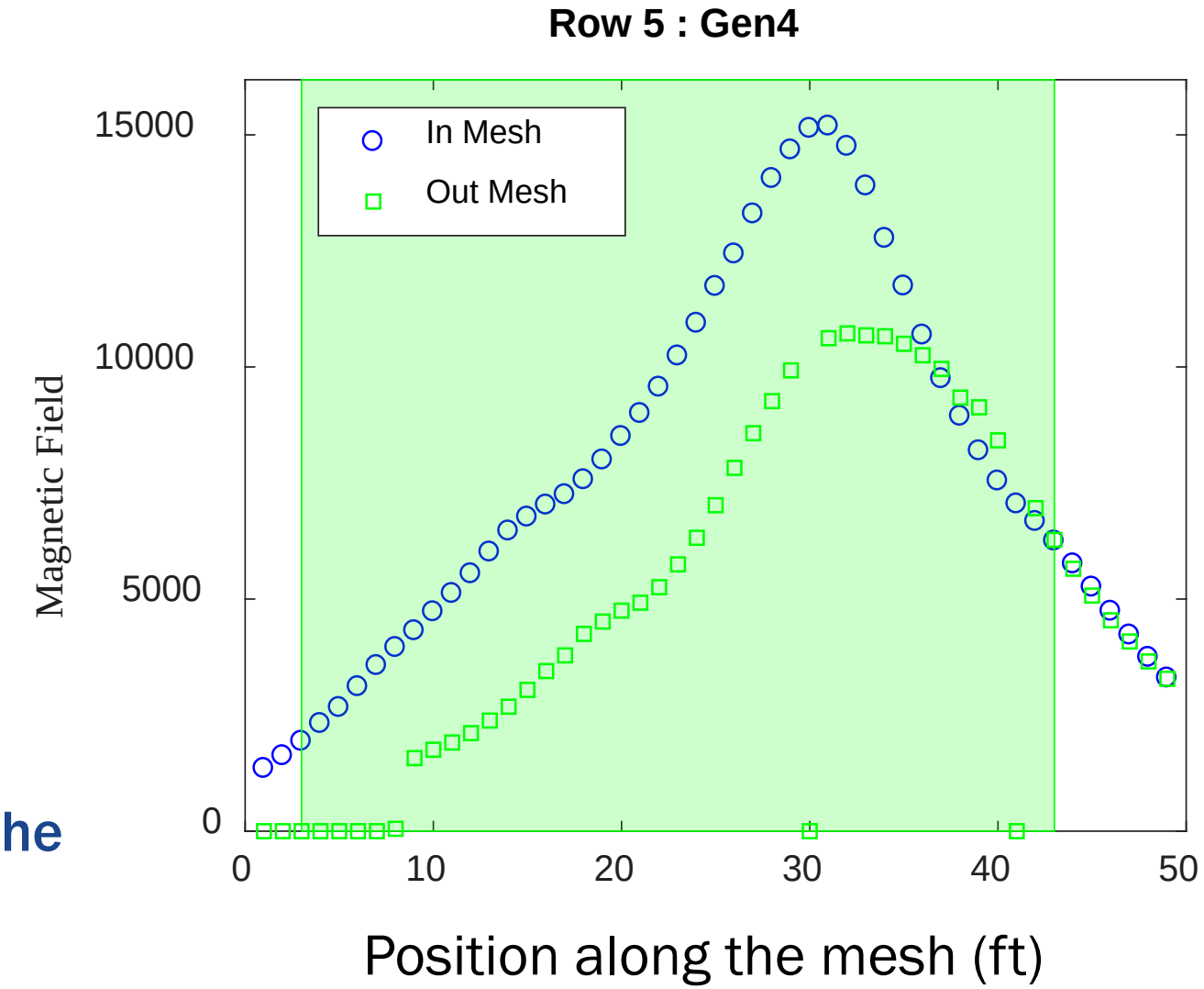
Significant magnetic field enhancement observed around the joint of two mesh sections





Magnetic field enhancement caused by mesh joints is reduced when the MWC is away from the mesh

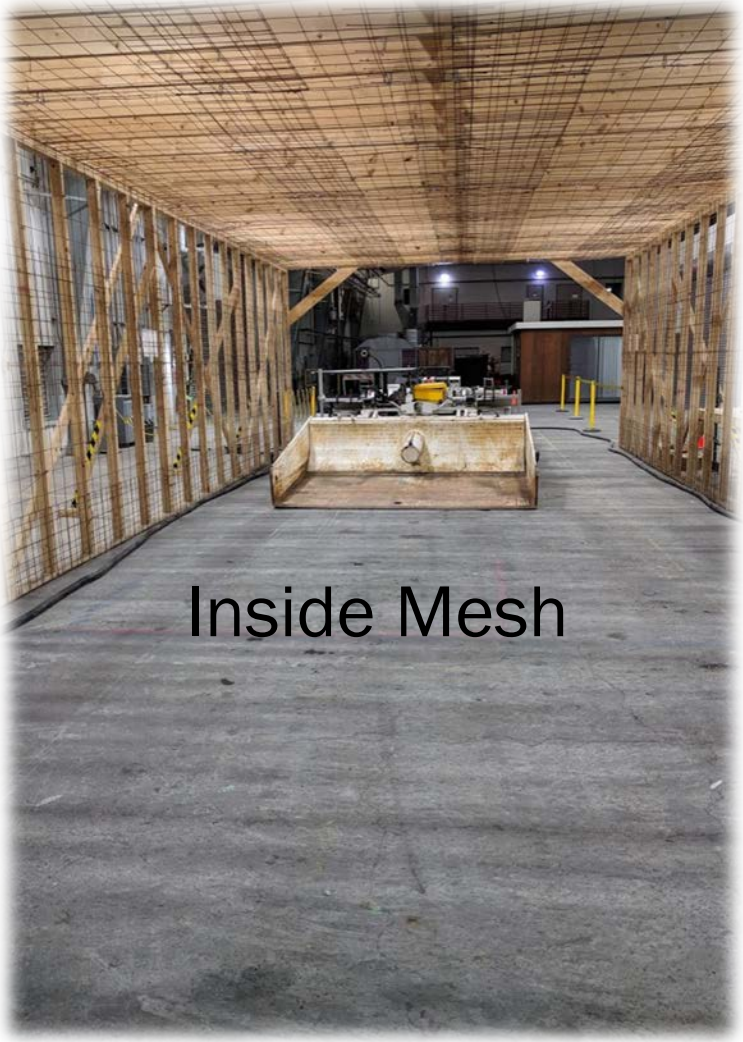




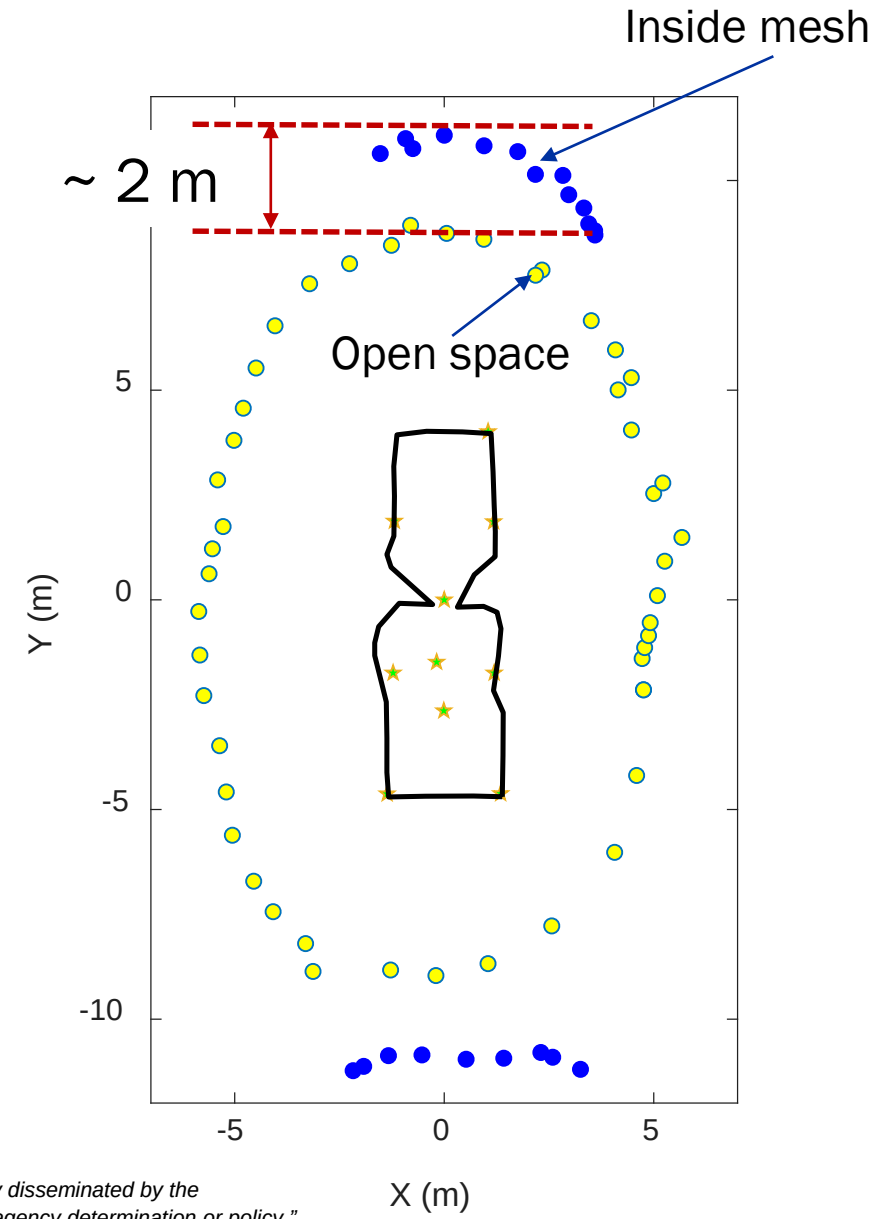
The presence of mesh generally causes the magnetic field to increase

The size of the yellow zone increases approximately two meters when the scoop is inside the mesh

Open Space



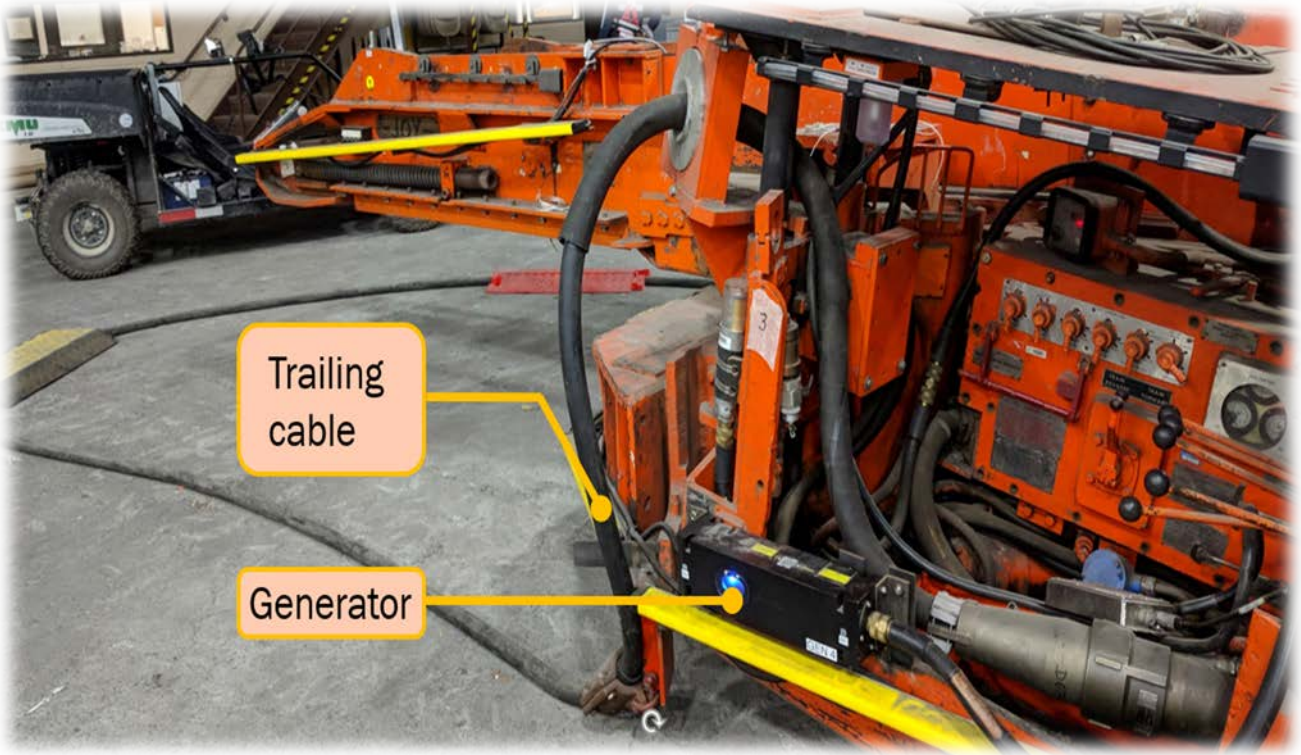
Inside Mesh



How to mitigate the influence of wire mesh

- Maintain a minimum separation distance from mesh (for generator and MWC)
- Engineering solution
  - Adjust generator current based on environment (a partial solution)
- Replace steel mesh with plastic mesh when possible

Questions?



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