



ArgonCube 2x2 Bern Visit: Feb. 4-7, 2020

Linda Bagby

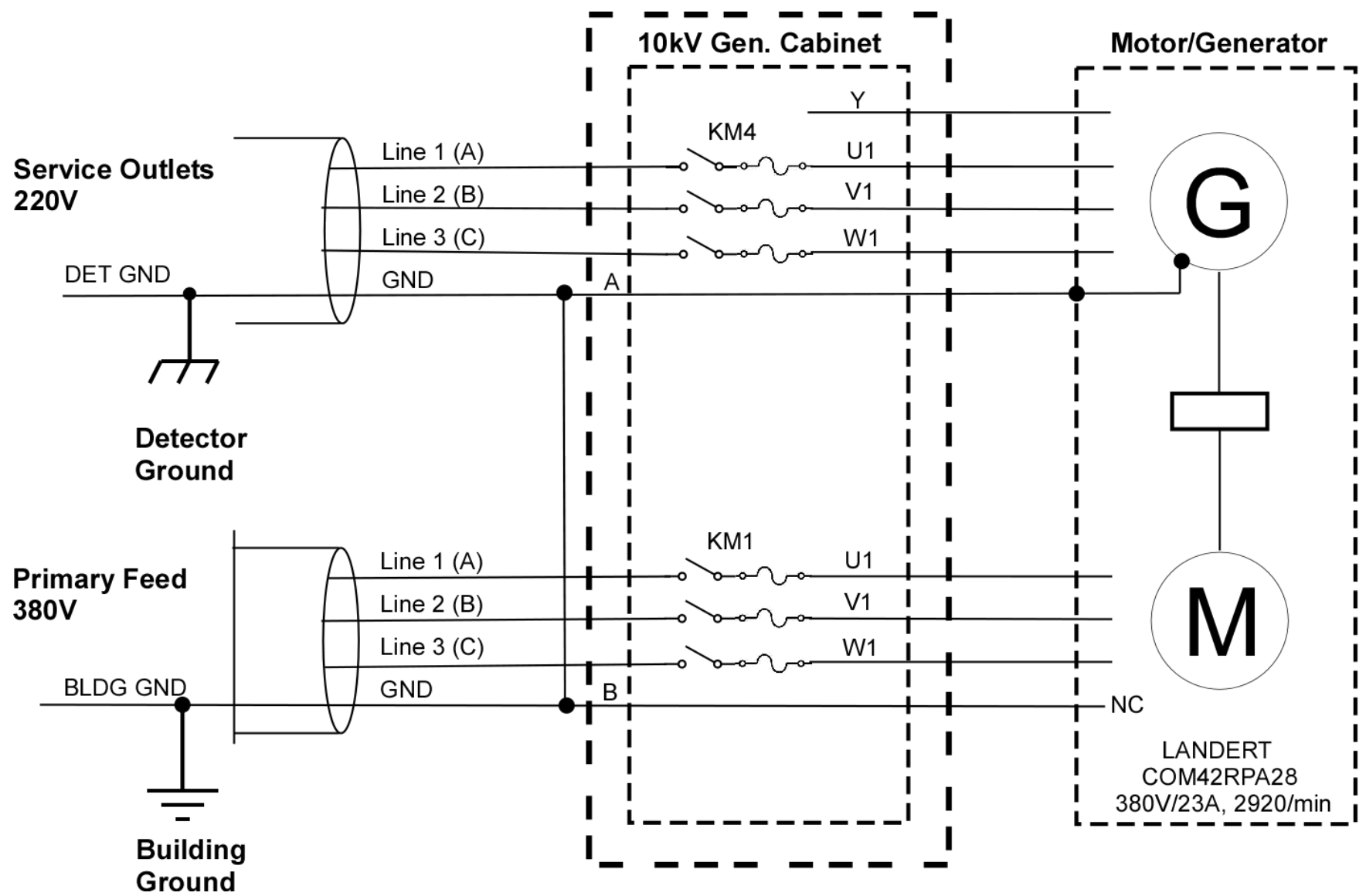
ArgonCube Electronics

February 20, 2020

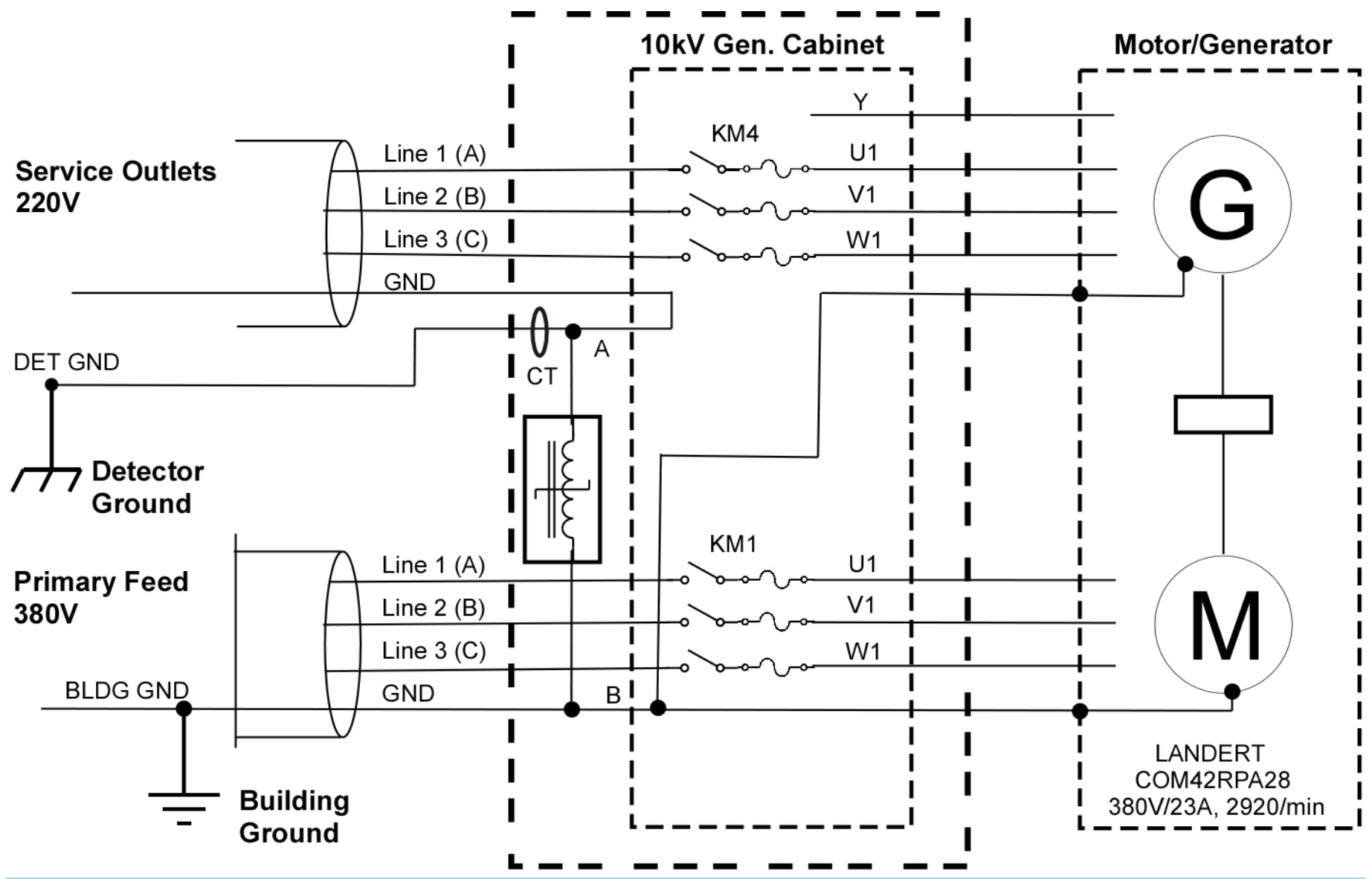
Outline

- Detector Power Configuration Options
- Noise Scan
- Cryostat Isolation Study
- Summary

Current Configuration



Proposed Configuration

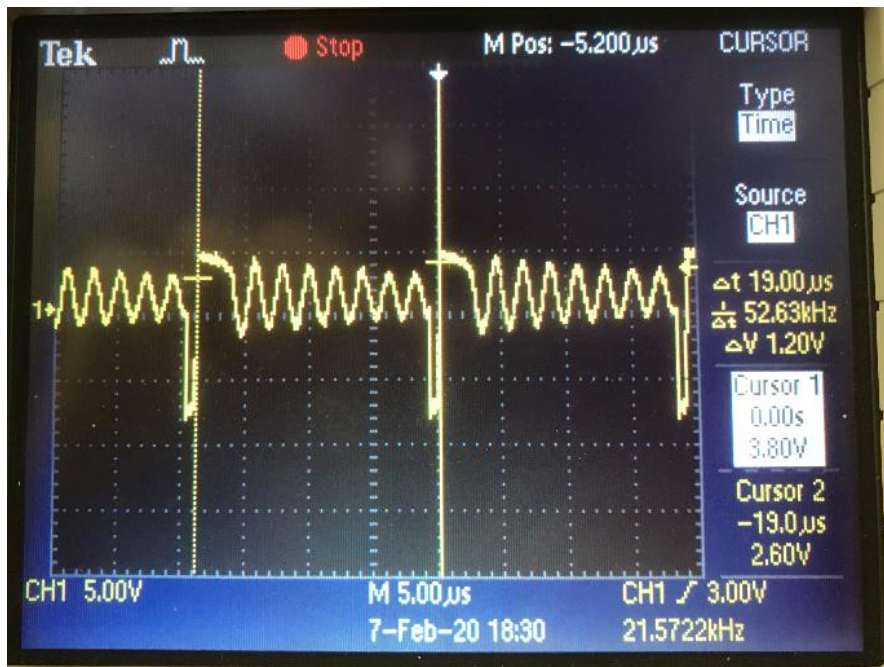


System Comments

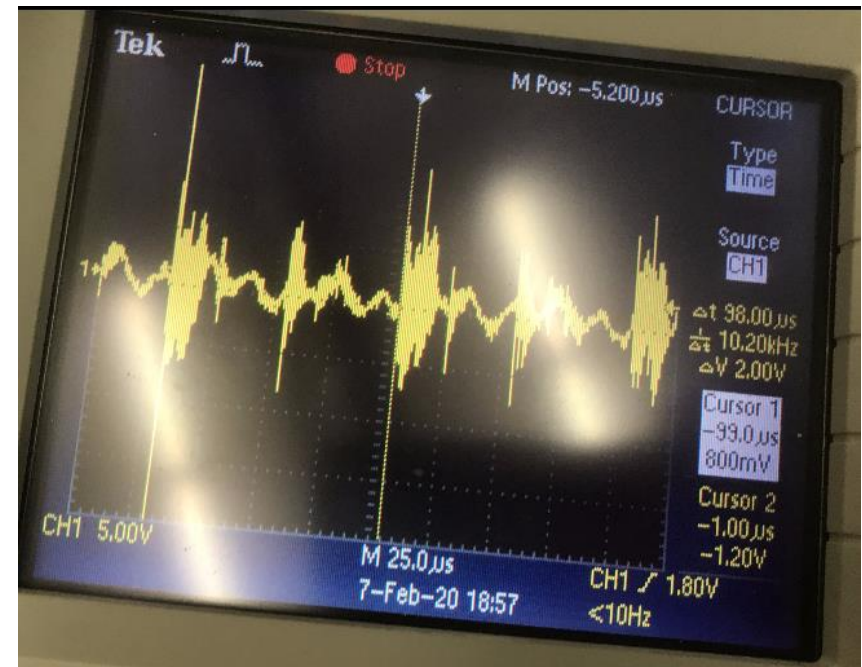
- The body responsible for electrical safety should review and approve the changes to the system before implementation.
- To monitor shorts as they occur, a current transformer (Pearson 2100, ~\$500) and Impedance Monitor chassis (~\$1500/parts) are required.
- The Detector power distribution circuit outlets are housed in conductive enclosures. According to our NEC code, the ground wire must be electrically attached to the PDU housing. If the Swiss electrical code is the same, the enclosures need to be isolated from the railing and concrete floor.

Noise Scan

- Francesco and I performed a noise scan using a capacitive pick up probe and Spectrum Analyzer.
- Measured EMI from pump VFDs and 10kHz throughout building.



VFD



10kHz

Cryostat Isolation

- Francesco and I verified the cryostat is isolated by removing the internal pump AC power cord.
- A 10K resistor was attached between the building ground and the cryostat to prevent charge buildup on the cryostat.

Summary

- A proposed schematic for adding the saturable inductor and current transformer is provided.
- A noise scan indicates a 10kHz noise signature—source unknown.
- The cryostat is isolated and referenced to the building with a 10K ohm resistor.

System Components

15kVA
XFMR



Saturable Inductor Module



Current Transformer



- FLAG CONNECTION TO DETECTOR GROUND
- 14mm HEX HEAD LUG, 10mm HOLE
- PEARSON 2100 CURRENT TRANSFORMER
- FLAG CONNECTION TO SATURABLE INDUCTOR

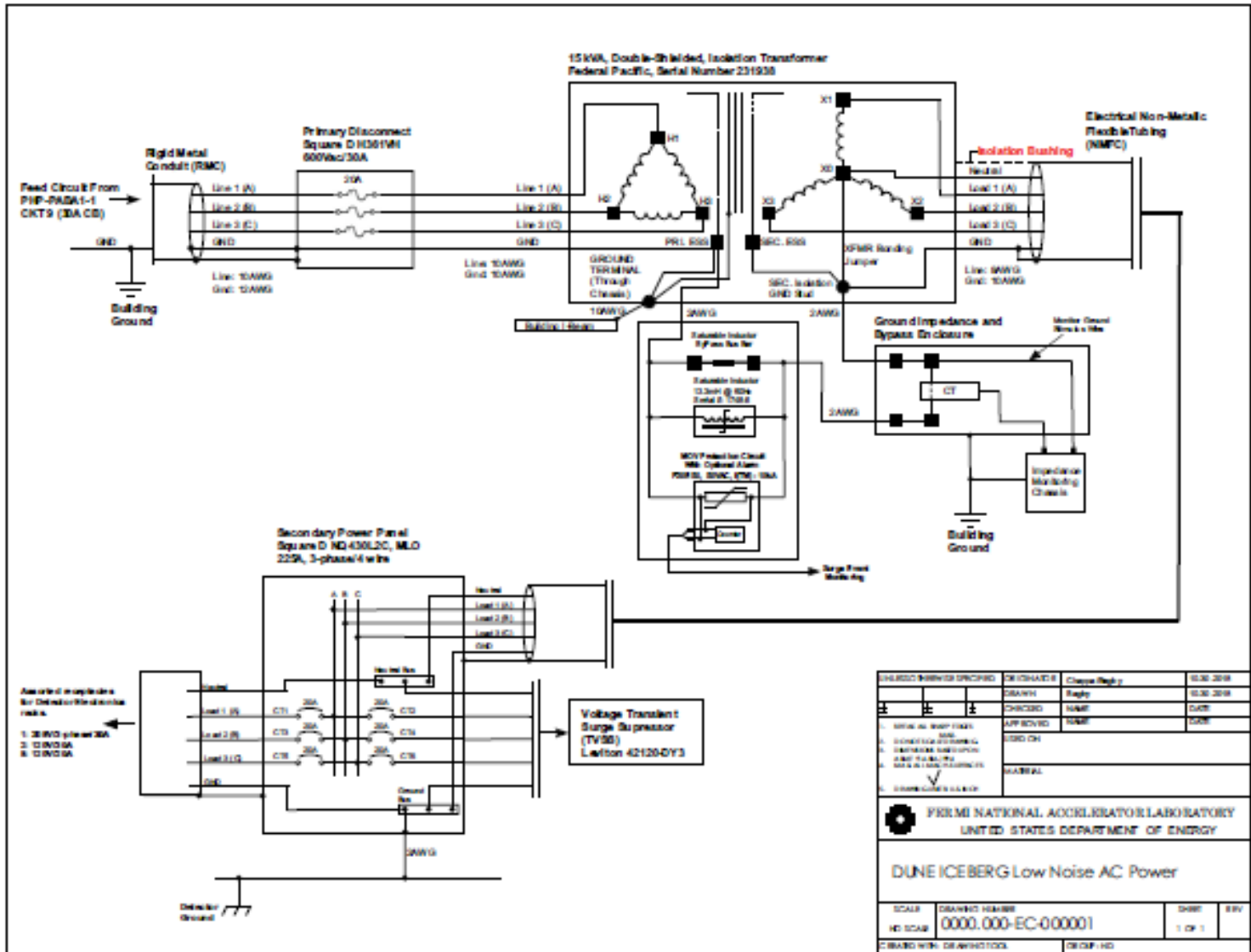
IMPEDANCE MONITOR



Impedance Monitor (GIZMO)

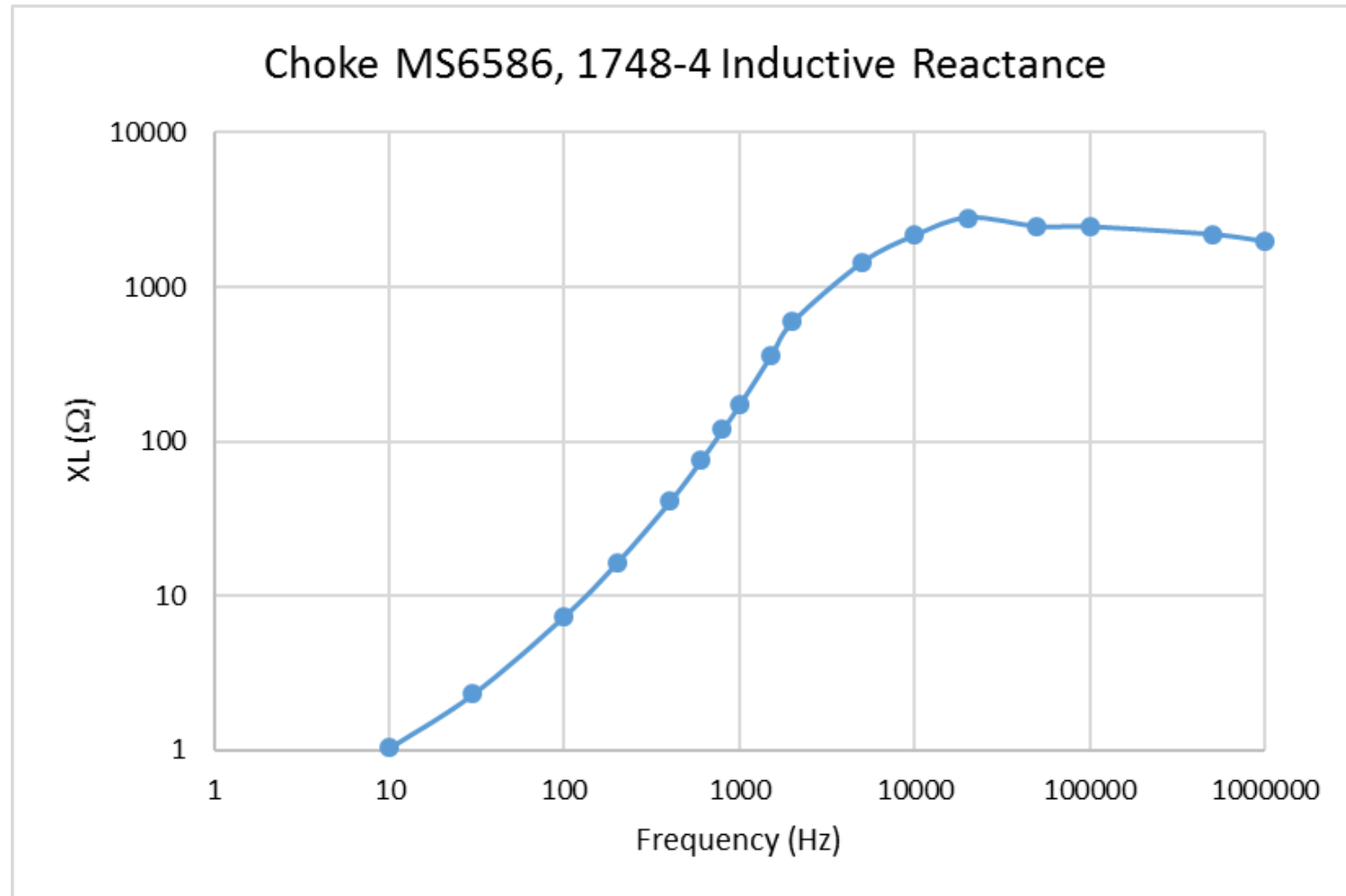


Example: AC Schematic for Detector electronics



| DESIGNED BY/REVISED BY/DATE | DR/CHANGED BY | Checked/Revised | DATE |
|--|--------------------|-----------------|------|
| | DR/CHANGED BY | Checked/Revised | DATE |
| | DR/CHANGED BY | Checked/Revised | DATE |
| | DR/CHANGED BY | Checked/Revised | DATE |
| FERMI NATIONAL ACCELERATOR LABORATORY UNITED STATES DEPARTMENT OF ENERGY DUNE ICEBERG Low Noise AC Power | | | |
| SCALE | DRAWING NUMBER | DATE | REV |
| NO. SCALE | 0000.000-EC-000001 | 1 OF 1 | |
| DRAWING WITH: DRAWING TOOL | | DWG. NO. | |

Saturable Inductor Reactance



Grounding Rules

- Dielectric breaks on all cryogenic piping.
- Detector electronics powered from 'low-noise' power.
- Galvanic, or preferably, optical isolation required between equipment powered across the ground boundary.
- Cable tray for copper cables between electronics rack and cryostat is isolated from building ground, connected to detector ground.
- Identify Charge Readout grounding rules for
 - Pixel Board
 - Electronics
 - HV Drift
- Identify Light Readout grounding rules for
 - Electronics
 - Bias
- Instrumentation
- Signal and power cabling/shield treatments should be reviewed.