



Short Baseline Neutrino

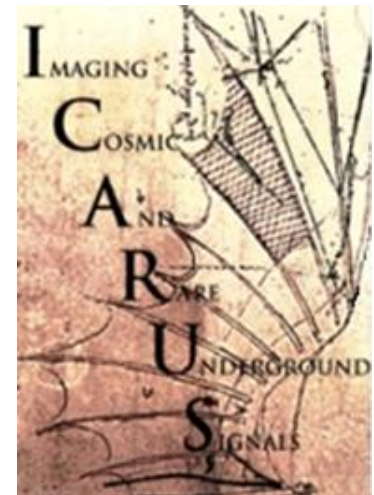


# ICARUS

## Electrical Working Group Kick-Off

Linda F. Bagby

September 20, 2018



# Outline

- Welcome
- Our Mission
- AC Distribution and 'Isolated' Grounding scheme
- Infrastructure options

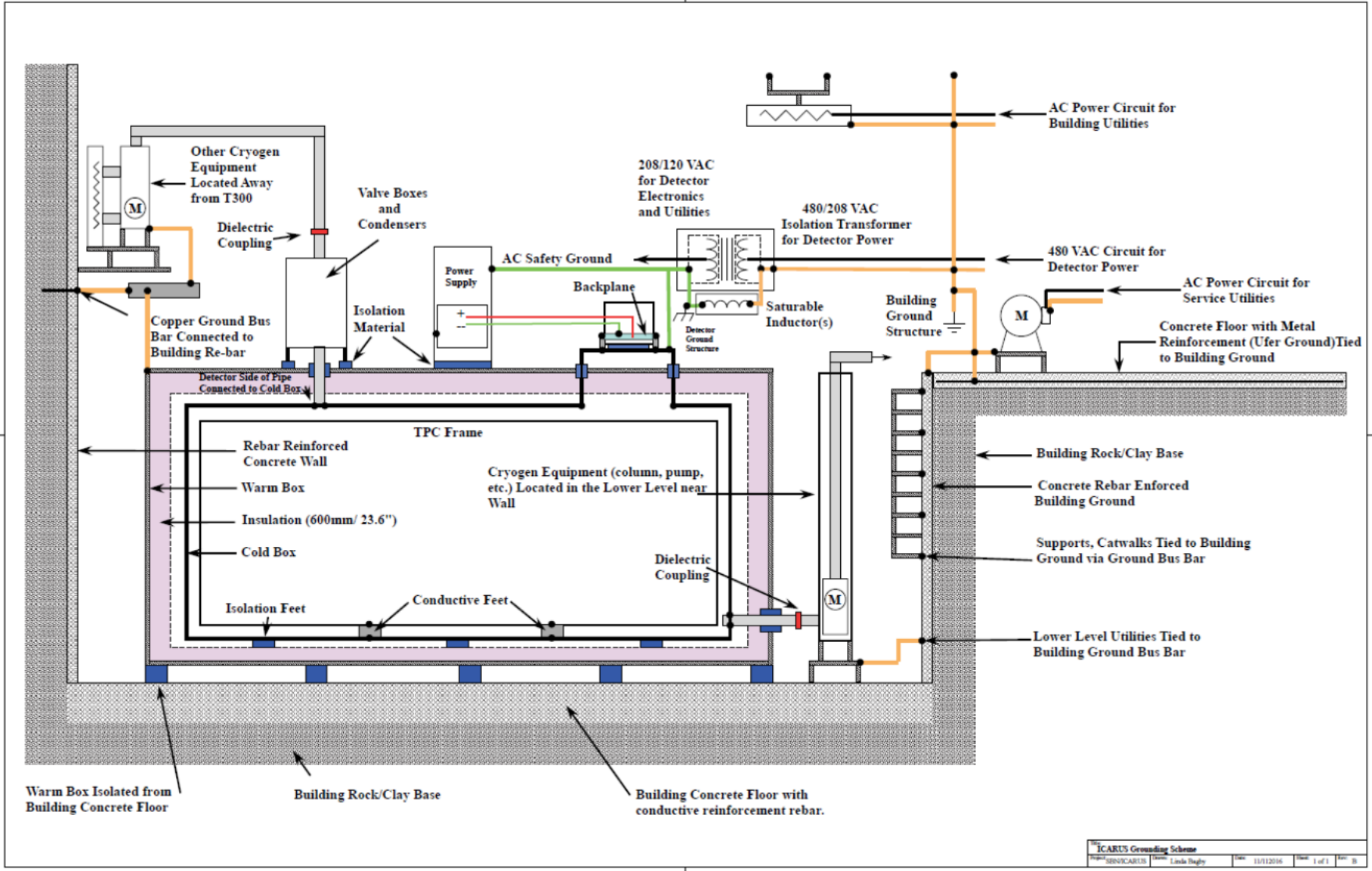
## Our Mission

- Generate electronics rack build specifications and graphics.
  - Donatella and Angela have been instrumental in collecting information.
  - Summarized in SBN DocDB #1383
- Provide design documentation for all custom designed equipment.
  - Summarized in SBN DocDB #1466
- Generate AC and DC power distribution schematics for installation and safety reviews.
- Assist with Operational Readiness Clearance documentation and participate in Reviews.

## AC Distribution

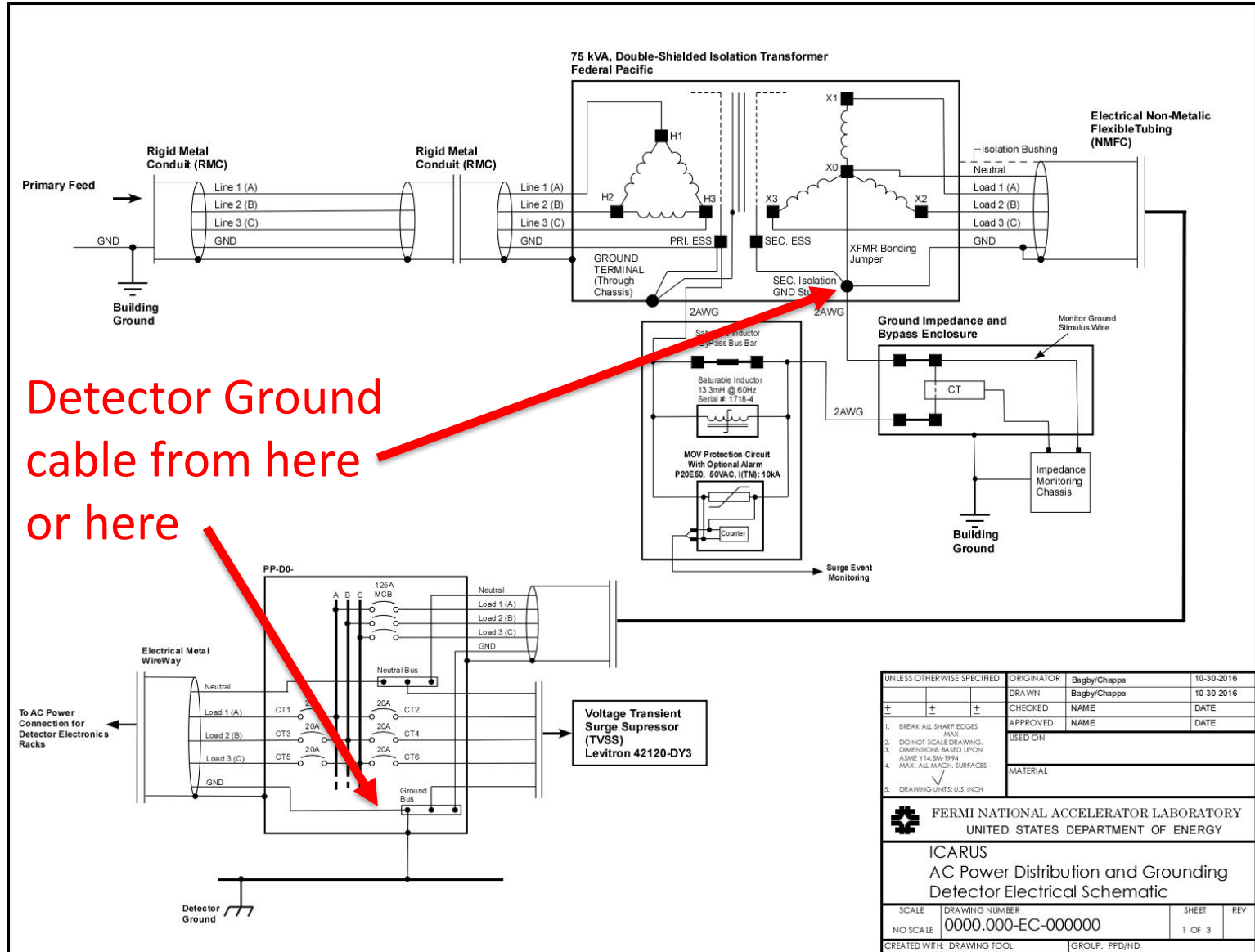
- The AC Distribution has been designed to provide power to individual T300 cryostats.
- 75kVA transformers are provided for each cryostat (T-300).
- All sub-systems are configured to provide services to individual cryostats.
  - EXCEPT the HV Drift.
- Impedance monitor configuration, part of the AC Distribution and Grounding scheme, is an attempt to resolve the general location of a possible short, T300-1 or T300-2.
- This talk provides an explanation of the grounding configuration which defines the stability of the experiment's reference ground.

# AC 'Isolated' Grounding Scheme Graphic



ICARUS Grounding Scheme			
REVISED	Author	Date	Page
	Linda Bagby	11/1/2016	1 of 1
			B

# AC Power Schematic



Detector Ground cable from here or here

UNLESS OTHERWISE SPECIFIED		ORIGINATOR	Bagby/Chappa	10-30-2016
		DRAWN	Bagby/Chappa	10-30-2016
		CHECKED	NAME	DATE
		APPROVED	NAME	DATE
		USED ON		
		MATERIAL		
<b>FERMI NATIONAL ACCELERATOR LABORATORY</b> UNITED STATES DEPARTMENT OF ENERGY				
<b>ICARUS</b> AC Power Distribution and Grounding Detector Electrical Schematic				
SCALE	DRAWING NUMBER	SHEET	REV	
NO SCALE	0000.000-EC-000000	1 of 3		
CREATED WITH: DRAWING TOOL		GROUP: PPD/ND		

# Impedance Monitor Connectorization

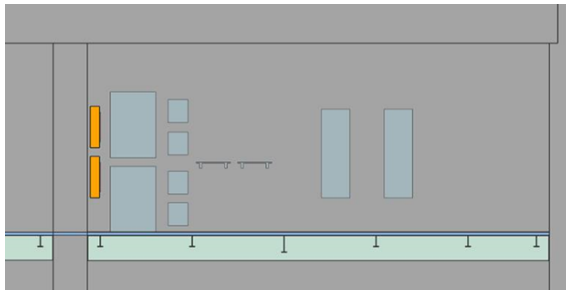
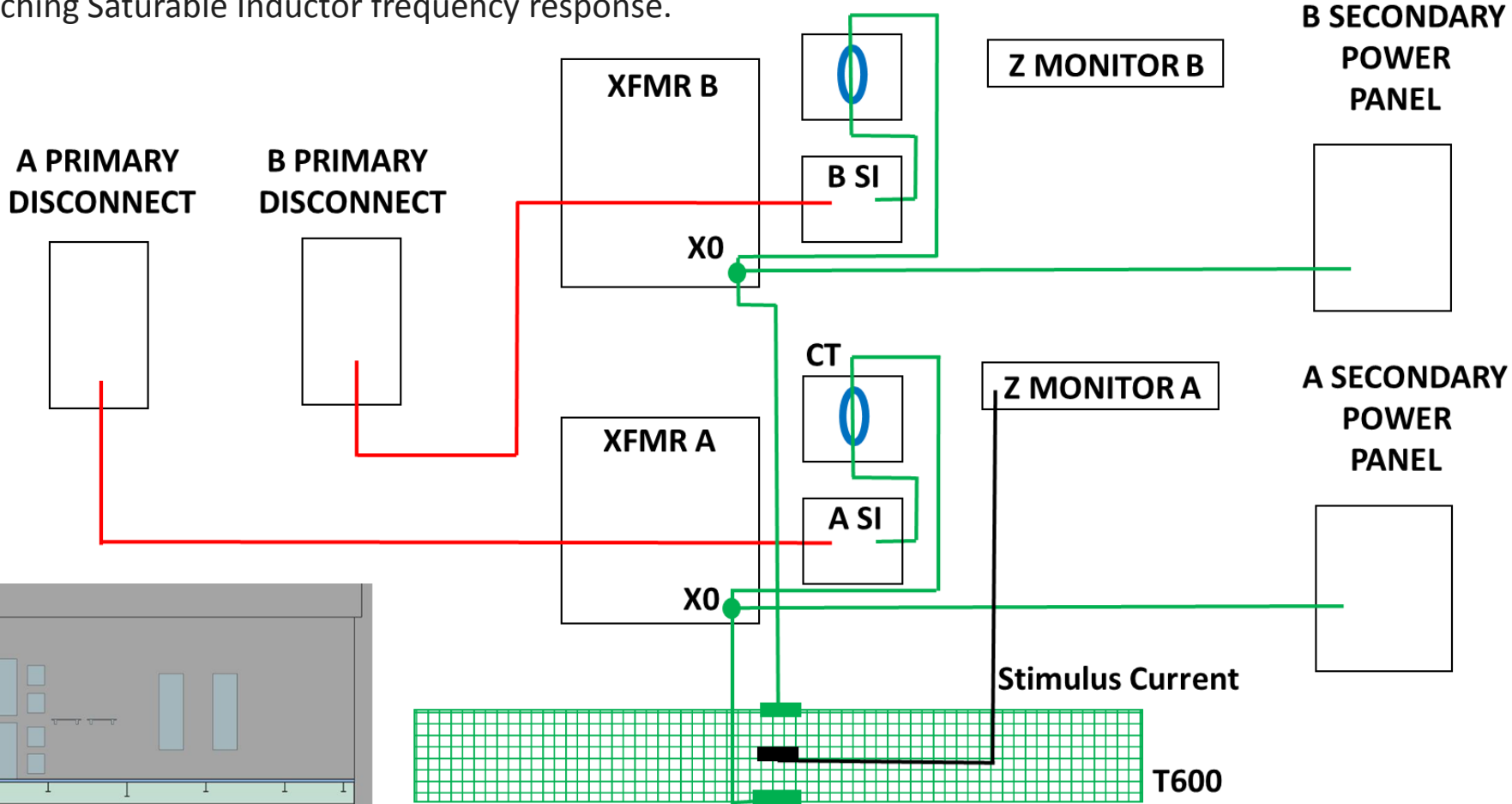
## Key Parameters

XO cable (Detector ground) must be same length to either side of each T-300.

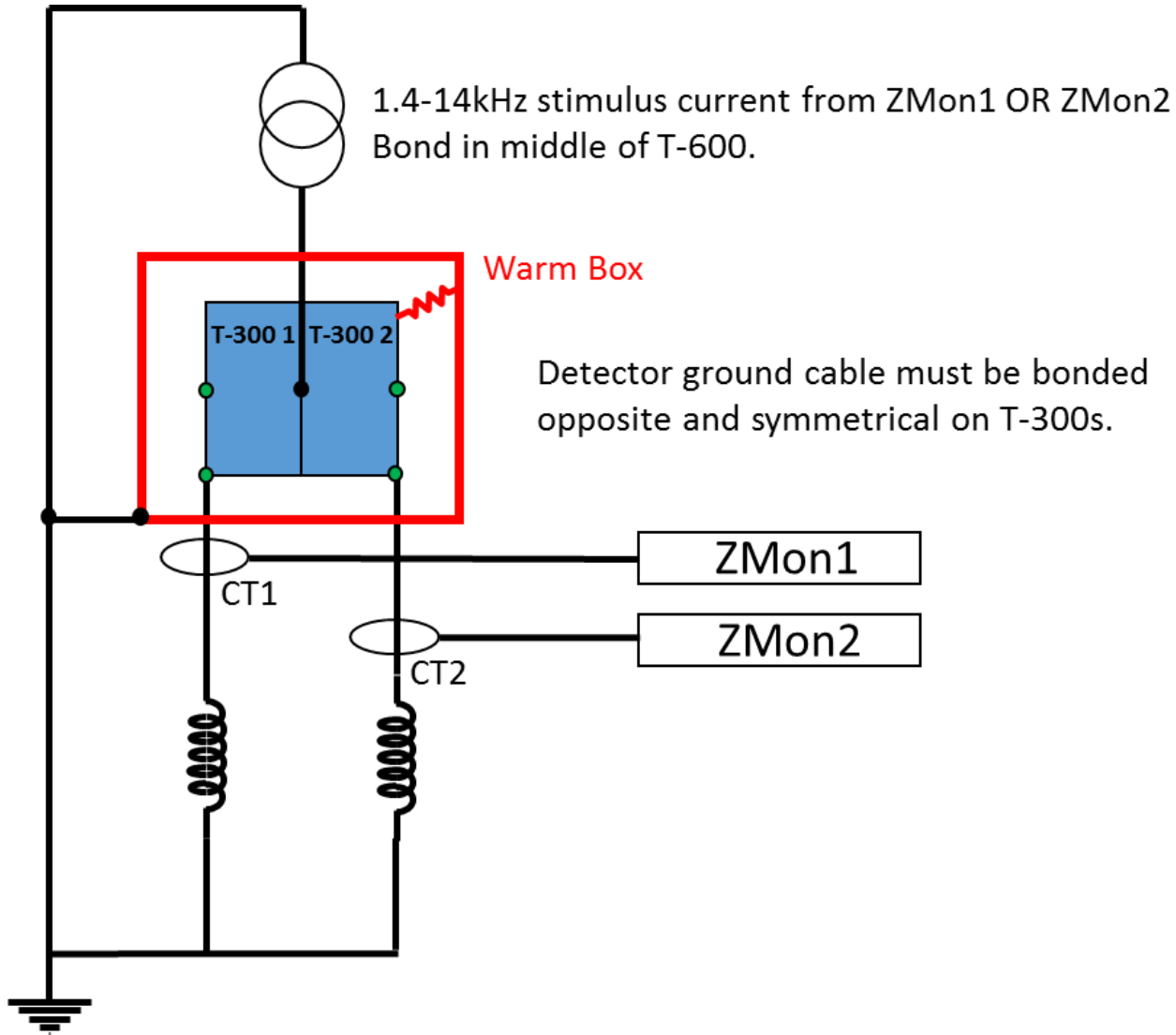
One stimulus current.

Stimulus connected in center.

Matching Saturable Inductor frequency response.



# How it works----

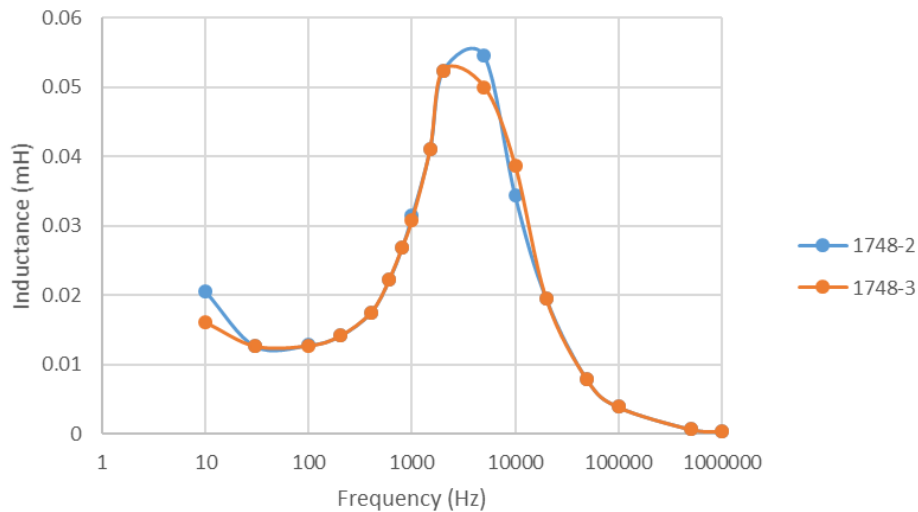




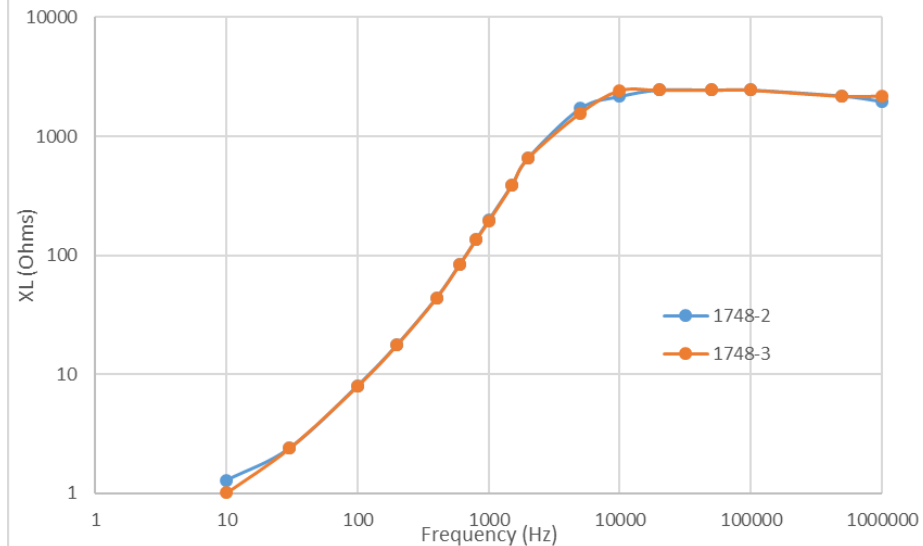
# Saturable Inductor Frequency Response

- Frequency response curves generated for the saturable inductors to find two that match.
- 1748-2 and 1748-3 will be used.

Saturable Inductor Inductance



Saturable Inductor XL



# Rack Protection System and AC Distribution Solutions

Sensor System 2W-B or 2WT-B  
Photoelectric  
smoke/temp (135°F) sensor



Rack Protection Chassis



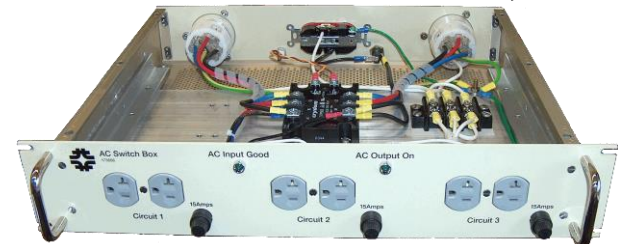
120V/20A (16A cont.)



120V/30A (24A cont.)



208V/3 $\phi$ /30A (24A cont. /  $\phi$ )



# TPC Power Supply AC Distribution Solutions

Managed non-interlockable PDU options

120V/20A (16A cont.)  
PDUMH20NET2



120V/30A (24A cont.)  
PDUMNH30



## Rack AC Distribution Design Requirements

- Racks with deep CAEN chassis equipment or DAQ servers requires a ~3' deep rack to allow room for PDU, cable dressing, maintenance, and air flow.
- AC Distribution within each rack will be selected based on the maximum current capability of the equipment. There are 3 options available:
  - 120V/15A (12A continuous)
  - 120V/30A (24A continuous)
  - 208V, 3-phase, 30A (3 banks of 120V/24A continuous)
- Maximum current load per circuit is regulated through an engineered hardware design.
- Enclosed racks will have a rack protection system equipped with a sensor to monitor smoke and temperature to protect equipment.
- Total rack power is limited based on AC Distribution scheme and cooling infrastructure choices.

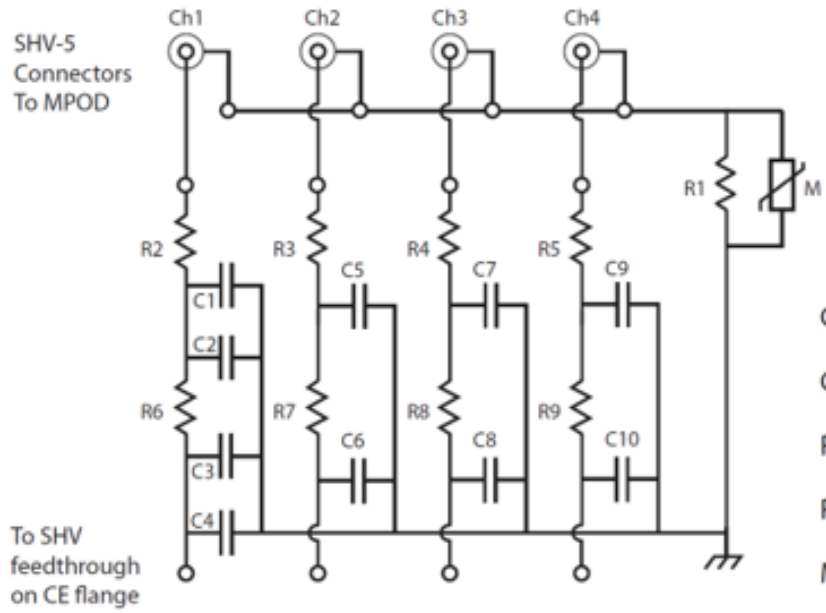
## Summary

- The cryostats are solidly bonded together via the thermal shields, the metal compression plates, and additional grounding straps located on the top ends of the cryostats.
- The ground reference saturable inductors and connecting ground cables are equivalent to minimize a step function between the cryostats.
- Our 1<sup>st</sup> task is to finalize the AC Distribution scheme of the experiment.
  - We'll discuss options after the round table.

# Extras

# DC Distribution

- The TPC power supplies float, meaning the return is referenced only at the TPC warm electronics crate, via the backplane, to the cryostat (Detector Ground).
- Where are the PMT power supplies referenced?
- Where are Wire Bias power supplies referenced, through a resistor via the filter network? Here's an example----



- C1-4: 15nF/3kV/X7R (C2220X153KHRACTU)
- C5-10: 100nF/2kV/X7R (2220Y2K00104KXTWS2)
- R1: 10k/0.67W (P10KALCT)
- R2-9: 24k/0.67W (P24KALCT)
- M: MOV/5V/100A (F2208CT)