DUNE Infrastructure Grounding Plan – Changes due to removal of rock septum

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11 April 2018

DUNE Grounding Infrastructure

- All current DUNE Infrastructure Grounding is detailed in DUNE DocDB #285.

https://docs.dunescience.org/cgi-bin/private/ShowDocument?docid=285

- Document was approved by a previous tech board and is now under change control.

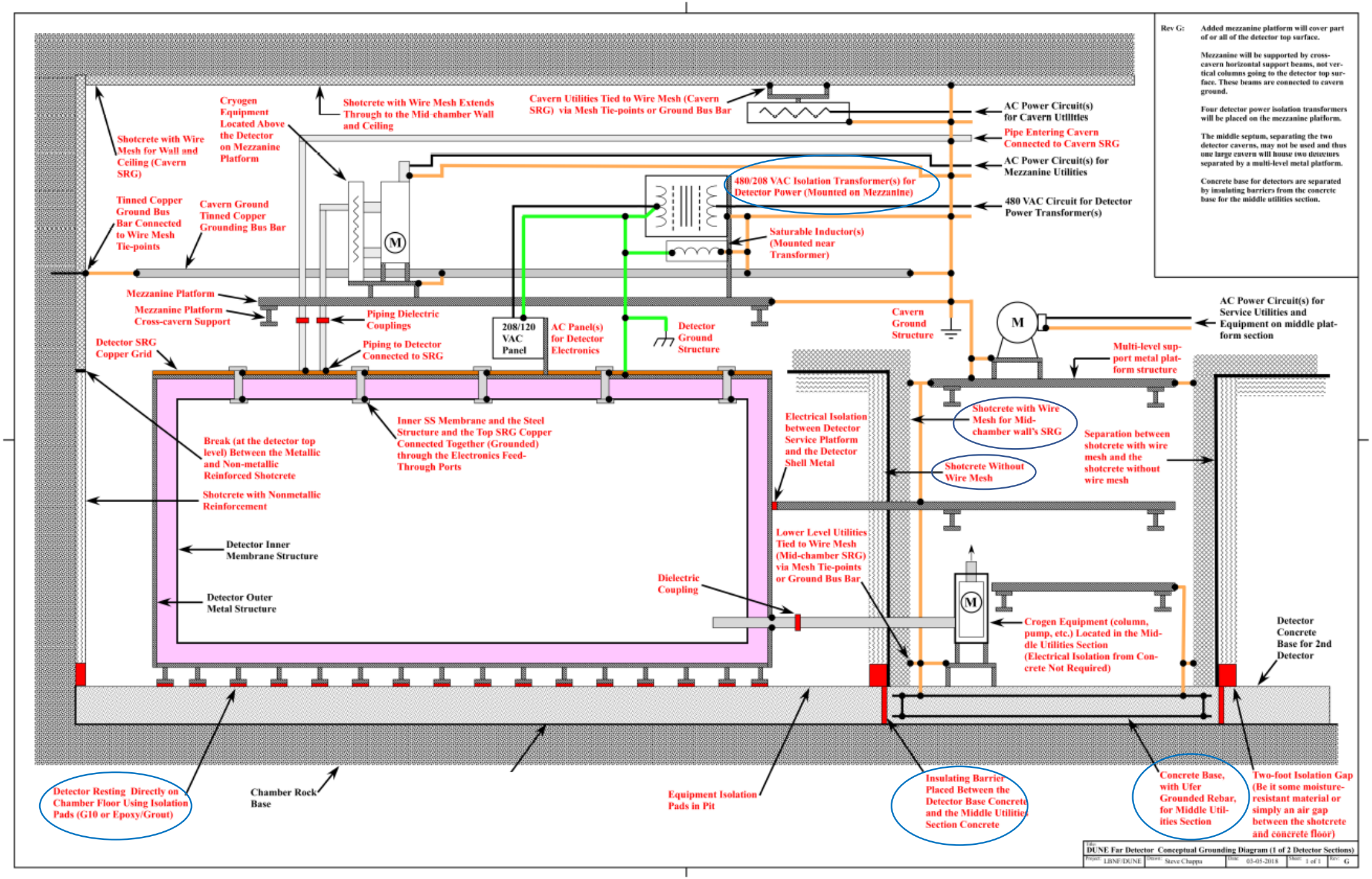
- A proposed revision to this plan has been posted to this agenda.

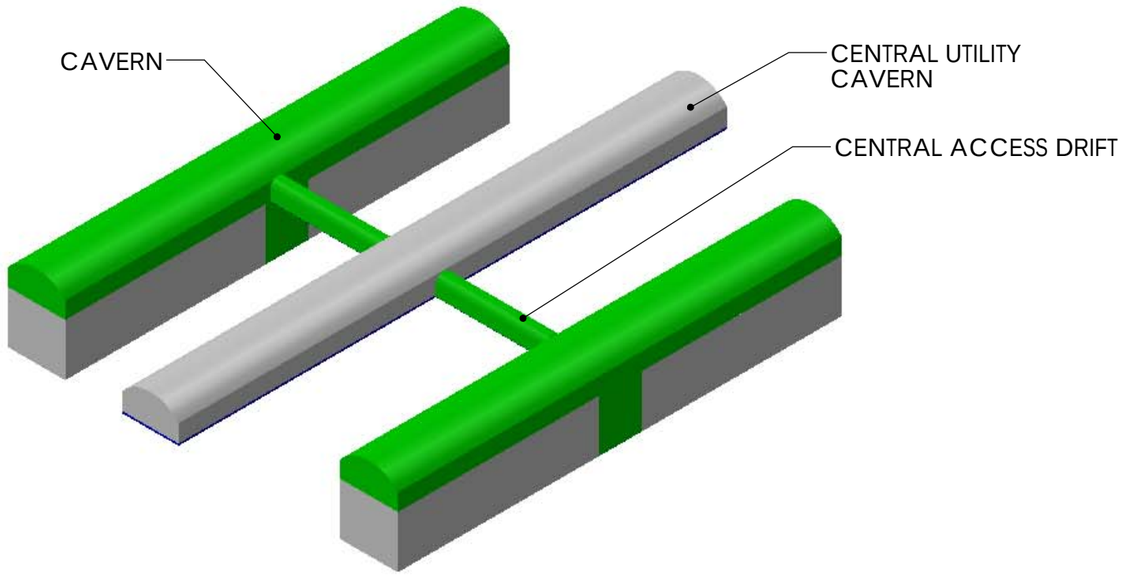
DUNE Grounding Infrastructure

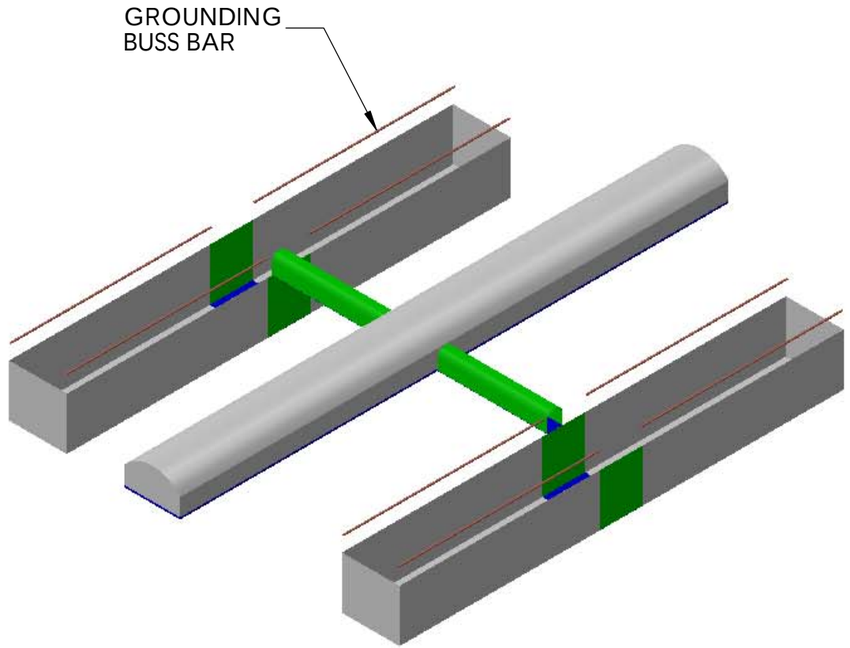
- Changes we would like to make:
  - ➢Require DC isolation between the Cryostat steel structure and the concrete pad is rests upon.
    - Concrete cannot be treated as a passive element; ions in concrete will conduct stray currents.
    - A thin G10 dielectric placed beneath the I-beams can provide a DC isolation.
  - ➢Place the “isolated” transformers on the mezzanine structure rather than the top of the detector.
  - ➢Require the concrete of the slab under each cryostat warm structure be kept dry from naturally occurring water
    - This will provide a more consistent moisture level in the concrete.

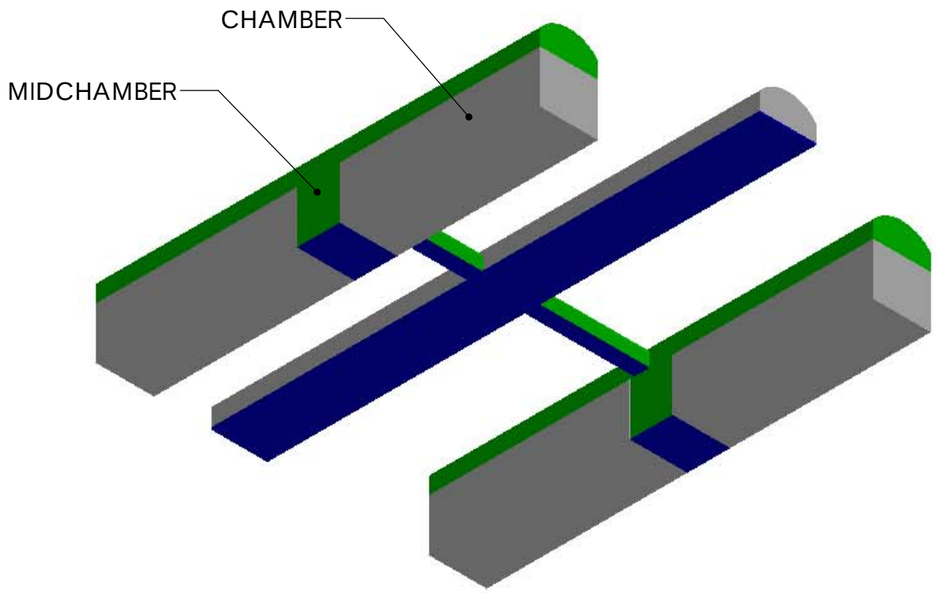
DUNE Grounding Infrastructure

- Change requests due to removal of the rock septum
  - The new lower level mid-chamber floor will remain part of the **UFER Ground.** The newly created mid-chamber wall, shall contain wire mesh and be part of the **Cavern Ground.** The mid-chamber-wall shall provide a well bonded path between the central access drift **UFER Ground** and the mid-chamber floor **UFER Ground**.
  - Concrete pours between the cryostat/chamber pad areas and the mid-chamber area between the cryostat pads shall be isolated from each other. Use of a high resistive rubber barrier, or equivalent, is required.


Rev G: Added mezzanine platform will cover part of or all of the detector top surface.
Mezzanine will be supported by cross-cavern horizontal support beams, not vertical columns going to the detector top surface. These beams are connected to cavern ground.
Four detector power isolation transformers will be placed on the mezzanine platform.
The middle septum, separating the two detector caverns, may not be used and thus one large cavern will house two detectors separated by a multi-level metal platform.
Concrete base for detectors are separated by insulating barriers from the concrete base for the middle utilities section.
Shotcrete with Wire Mesh for Wall and Ceiling (Cavern SRG)
Cryogen Equipment Located Above the Detector on Mezzanine Platform
Shotcrete with Wire Mesh Extends Through to the Mid-chamber Wall and Ceiling
Cavern Utilities Tied to Wire Mesh (Cavern SRG) via Mesh Tie-points or Ground Bus Bar
AC Power Circuit(s) for Cavern Utilities
Pipe Entering Cavern Connected to Cavern SRG
AC Power Circuit(s) for Mezzanine Utilities
480/208 VAC Isolation Transformer(s) for Detector Power (Mounted on Mezzanine)
480 VAC Circuit for Detector Power Transformer(s)
Tinned Copper Ground Bus Bar Connected to Wire Mesh Tie-points
Cavern Ground Tinned Copper Grounding Bus Bar
Saturable Inductor(s) (Mounted near Transformer)
Mezzanine Platform
Mezzanine Platform Cross-cavern Support
Piping Dielectric Couplings
208/120 VAC Panel
AC Panel(s) for Detector Electronics
Detector Ground Structure
Cavern Ground Structure
AC Power Circuit(s) for Service Utilities and Equipment on middle platform section
Detector SRG Copper Grid
Piping to Detector Connected to SRG
Multi-level support metal platform structure
Inner SS Membrane and the Steel Structure and the Top SRG Copper Connected Together (Grounded) through the Electronics Feed-Through Ports
Electrical Isolation between Detector Service Platform and the Detector Shell Metal
Shotcrete with Wire Mesh for Mid-chamber wall's SRG
Separation between shotcrete with wire mesh and the shotcrete without wire mesh
Break (at the detector top level) Between the Metallic and Non-metallic Reinforced Shotcrete
Shotcrete Without Wire Mesh
Shotcrete with Nonmetallic Reinforcement
Detector Inner Membrane Structure
Lower Level Utilities Tied to Wire Mesh (Mid-chamber SRG) via Mesh Tie-points or Ground Bus Bar
Dielectric Coupling
Detector Outer Metal Structure
Crogen Equipment (column, pump, etc.) Located in the Middle Utilities Section (Electrical Isolation from Concrete Not Required)
Detector Concrete Base for 2nd Detector
Detector Resting Directly on Chamber Floor Using Isolation Pads (G10 or Epoxy/Grout)
Chamber Rock Base
Equipment Isolation Pads in Pit
Insulating Barrier Placed Between the Detector Base Concrete and the Middle Utilities Section Concrete
Concrete Base, with Ufer Grounded Rebar, for Middle Utilities Section
Two-foot Isolation Gap (Be it some moisture-resistant material or simply an air gap between the shotcrete and concrete floor)
DUNE Far Detector Conceptual Grounding Diagram (1 of 2 Detector Sections)
Project: LBNF/DUNE
Drawn: Steve Chappa
Date: 03-05-2018
Sheet: 1 of 1
Rev: G







CAVERN GROUND (WIRE MESH)

UFER GROUND (REBAR)

GROUNDING BUSS BAR

Sanford Underground Research Facility

MATERIAL:	DRAWN BY: BC	CHECKED BY: PB	APPROVED BY: PB	DATE: 3/13/2018	SCALE:
UNLESS OTHERWISE SPECIFIED	DRAWING TITLE: LBNF/DUNE GROUNDING			SHEET: 1	OF: 1
UNITS: INCHES					
TOLERANCES: ANGULAR ± 1.0° 2 PLACES .XX ± .06 3 PLACES .XXX ± .010	DRAWING NUMBER: **LBNF GROUNDING**			REVISION: **1**	SIZE: **B**