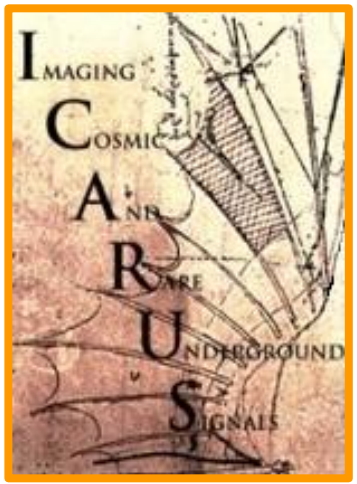
Drift HV System Installation 07/01/2020



Zachary Williams

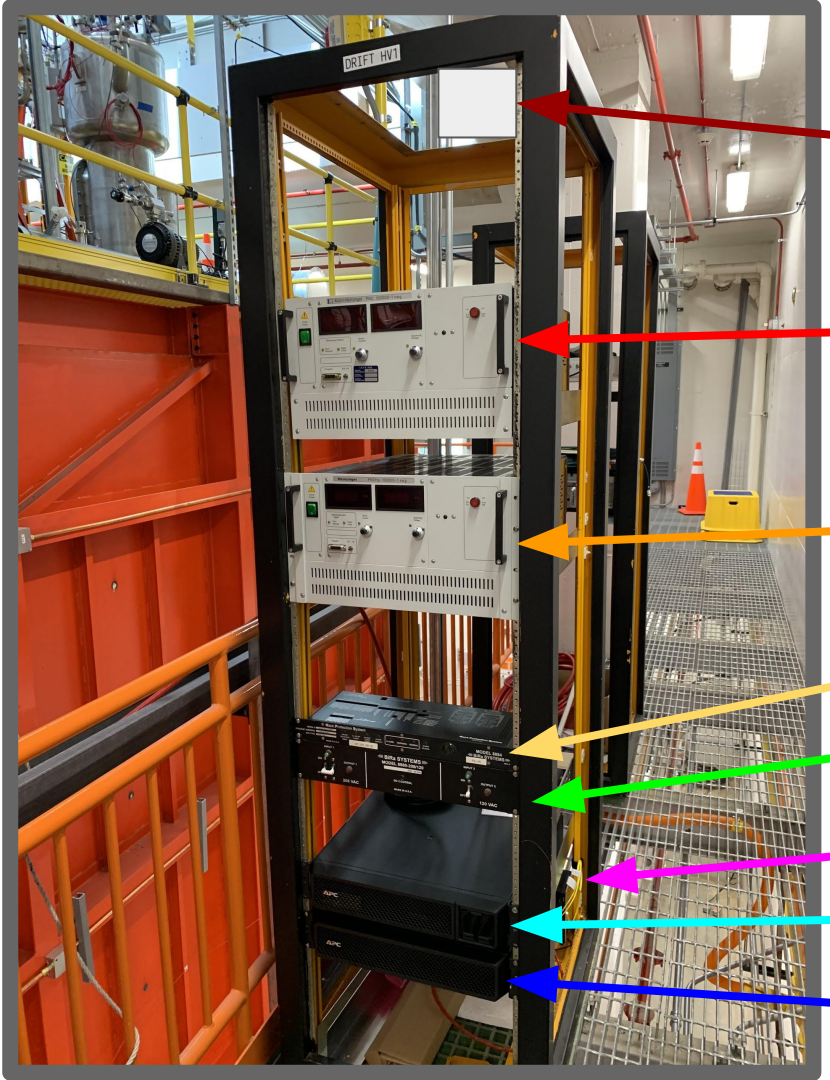
The Installation Work:

Over the past two weeks, the final steps of the installation of the Drift HV equipment were completed. These steps included:

1. Putting the equipment that had been used in the test rack at DAB into the racks at SBN-FD, as well as having a cable made for the Heinzinger PS.
2. Routing the monitor cables for the voltage dividers on both TPCs. This included the placement of the bridle rings, too.
3. Plugging in the last feedthrough cable that had been giving us some difficulty.
4. Making and then submitting a pORC request document so that we could have the electrical racks reviewed.

Now let me show you the racks:

Drift HV Rack 1 Diagrams



Drift HV Rack 1

Smoke Sensor

Spare Heinzinger Power Supply

Main Heinzinger Power Supply

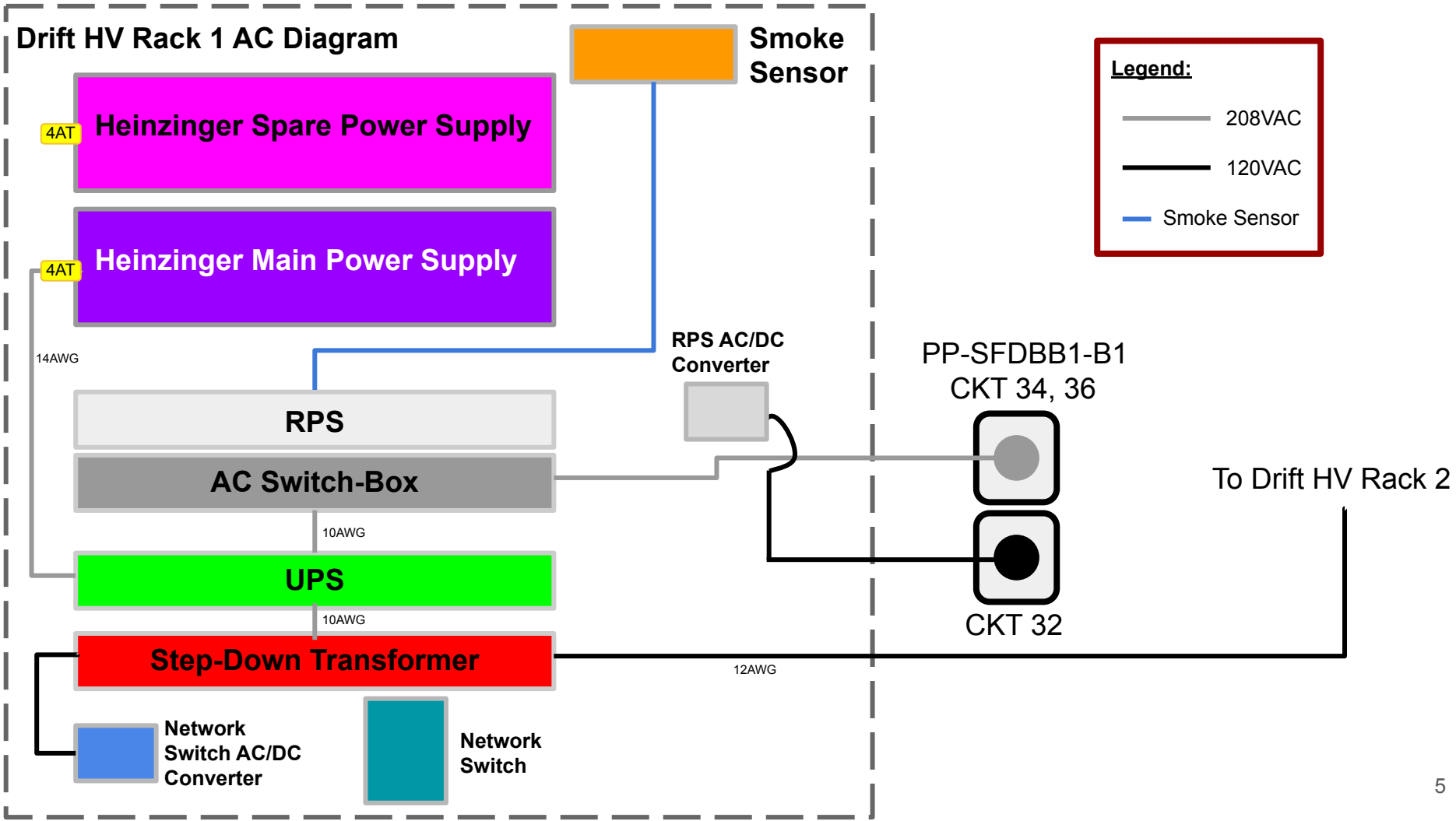
RPS

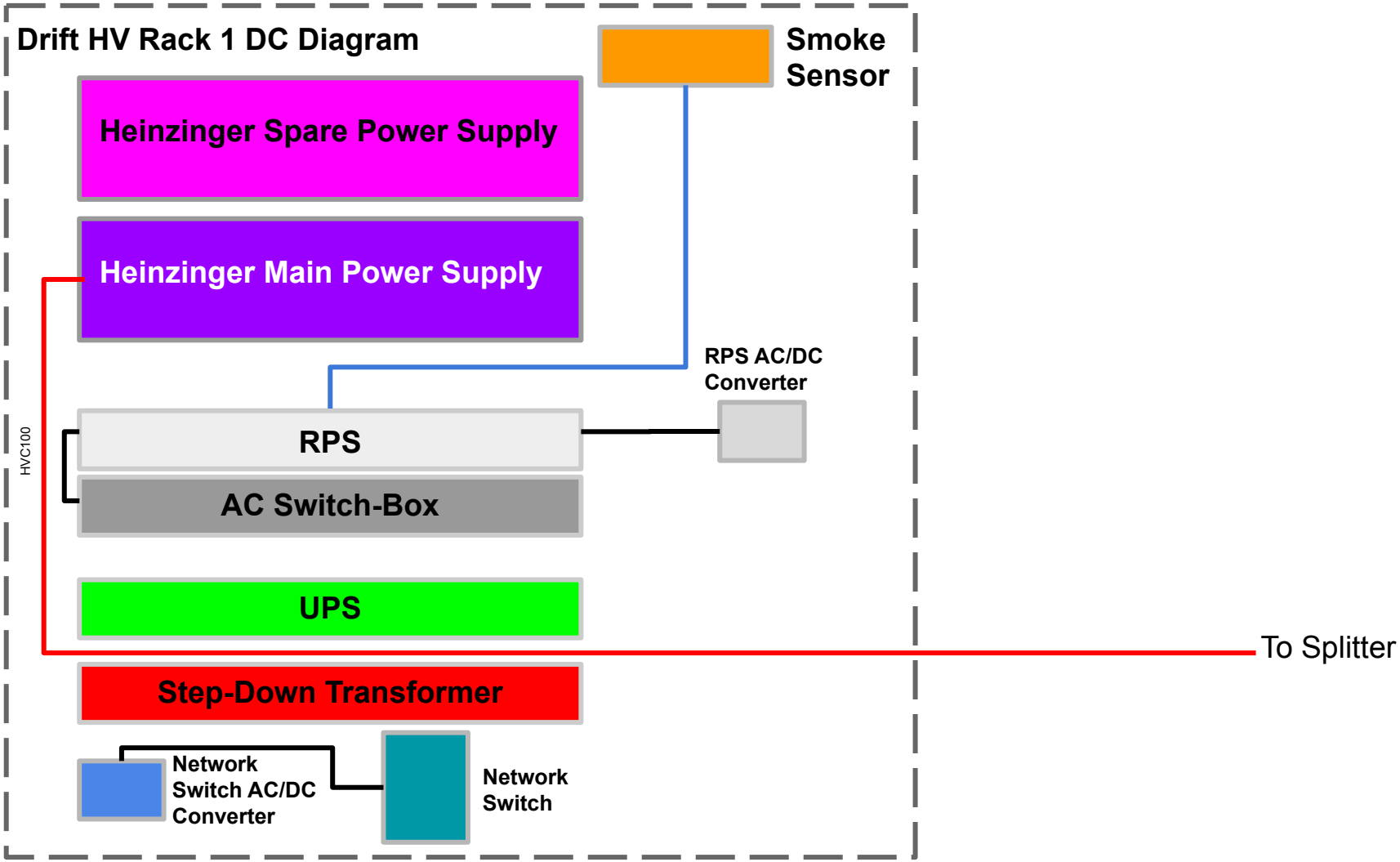
AC Switch-Box

Network Switch

APC UPS

APC Step-Down Transformer


Drift HV Rack 1 AC Diagram
Smoke Sensor
Heinzinger Spare Power Supply
4AT
Heinzinger Main Power Supply
4AT
14AWG
RPS
AC Switch-Box
10AWG
UPS
10AWG
Step-Down Transformer
Network Switch AC/DC Converter
Network Switch
RPS AC/DC Converter
PP-SFDBB1-B1
CKT 34, 36
CKT 32
To Drift HV Rack 2
12AWG
Legend:
208VAC
120VAC
Smoke Sensor


Drift HV Rack 1 DC Diagram
Smoke Sensor
Heinzinger Spare Power Supply
Heinzinger Main Power Supply
RPS AC/DC Converter
RPS
AC Switch-Box
HVC100
UPS
To Splitter
Step-Down Transformer
Network Switch AC/DC Converter
Network Switch

Drift HV Rack 2 Diagrams

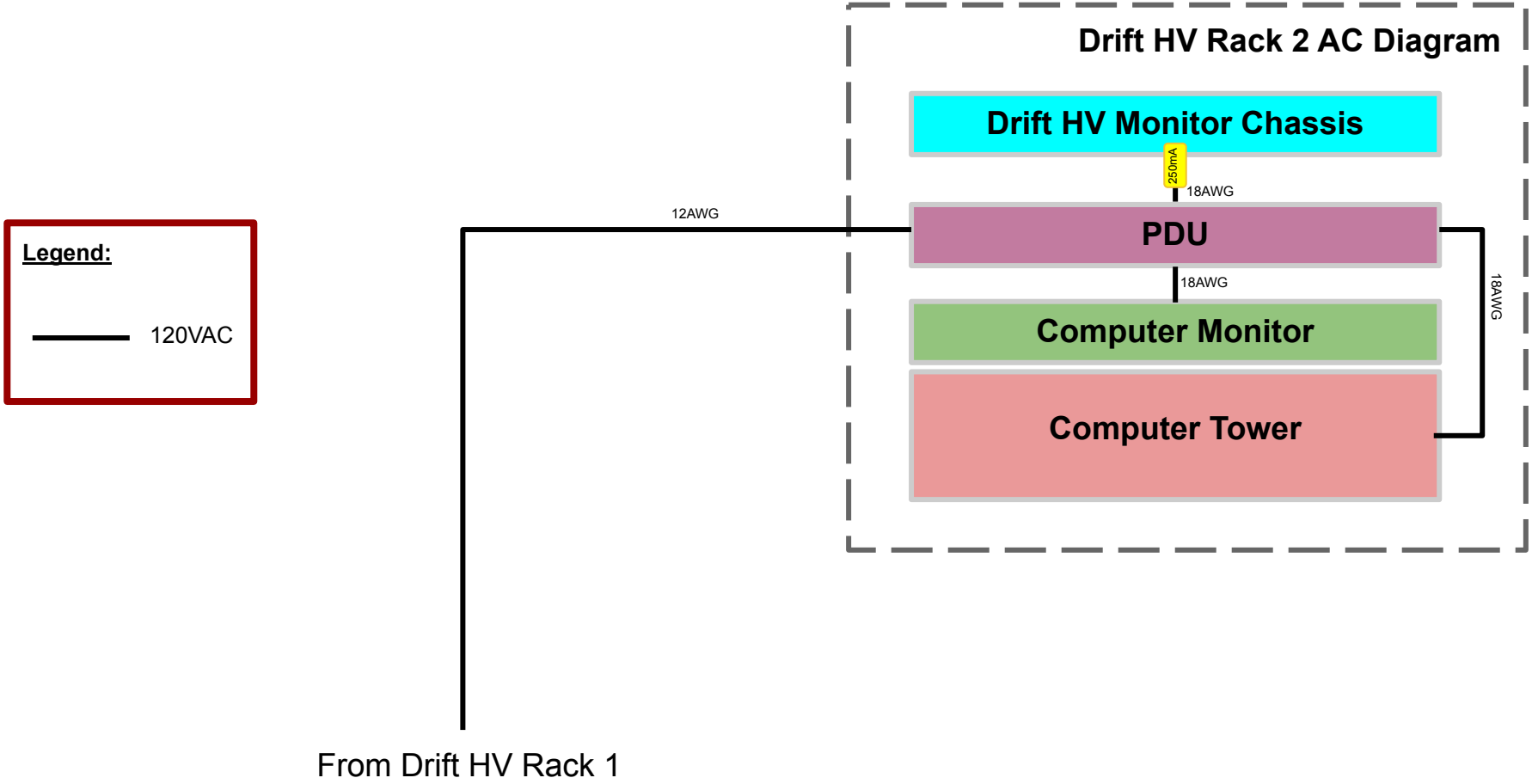
Drift HV Rack 2

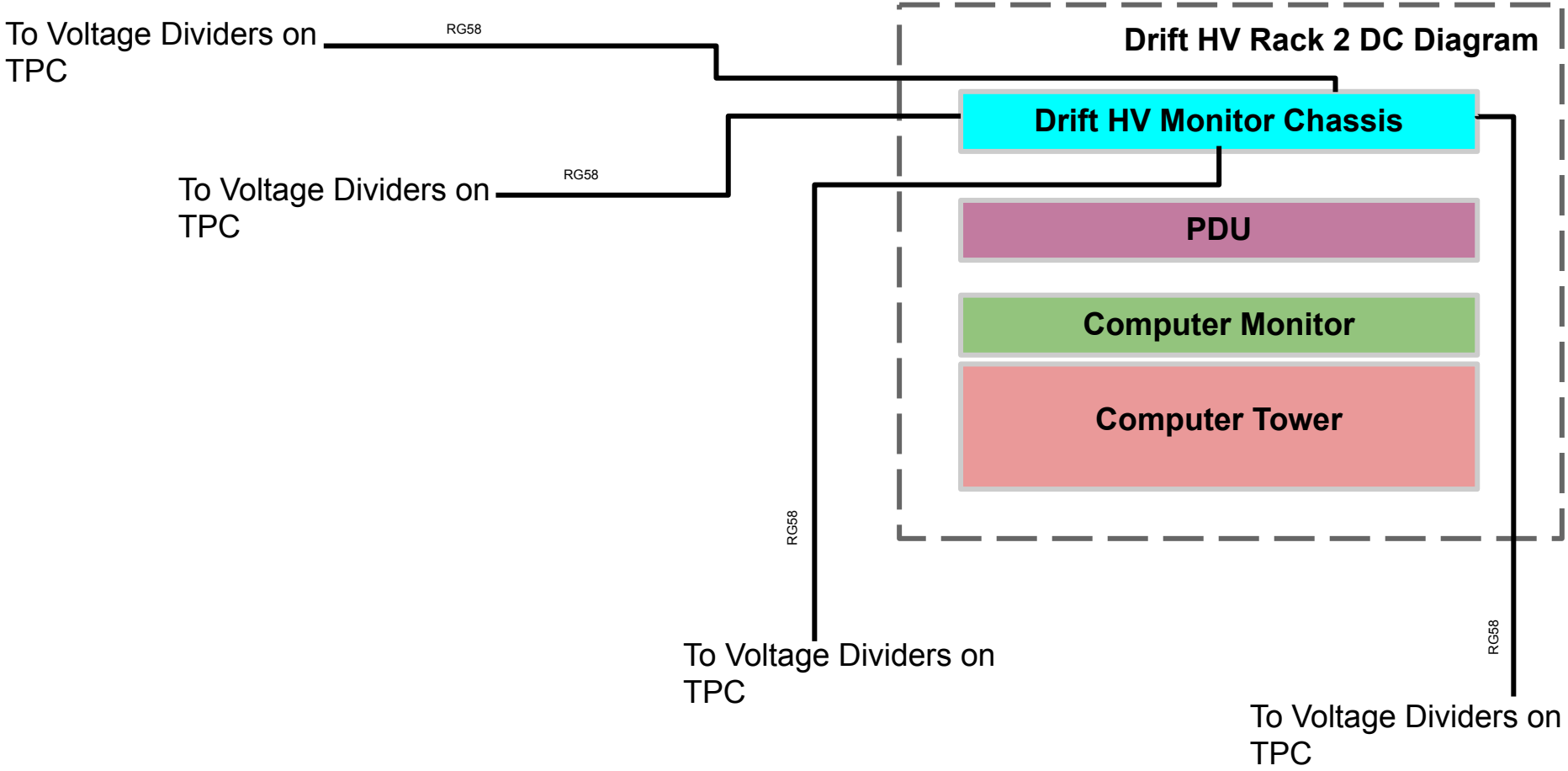
Drift HV Monitor Chassis

120VAC PDU

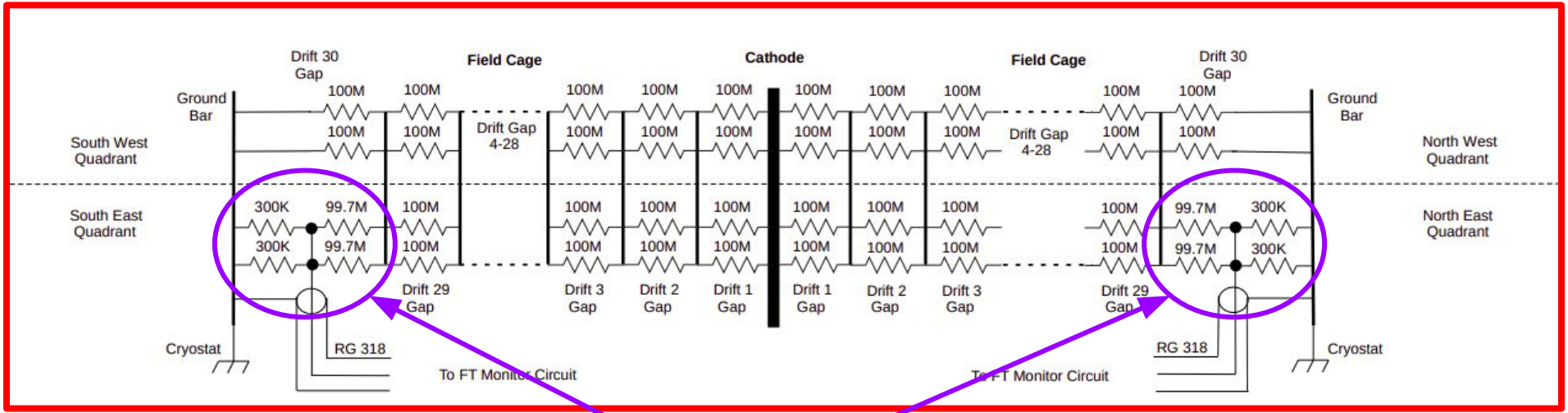
Computer Monitor

Computer Tower


Drift HV Rack 2 AC Diagram
Drift HV Monitor Chassis
250mA
18AWG
12AWG
PDU
18AWG
18AWG
Computer Monitor
Computer Tower
Legend:
120VAC
From Drift HV Rack 1

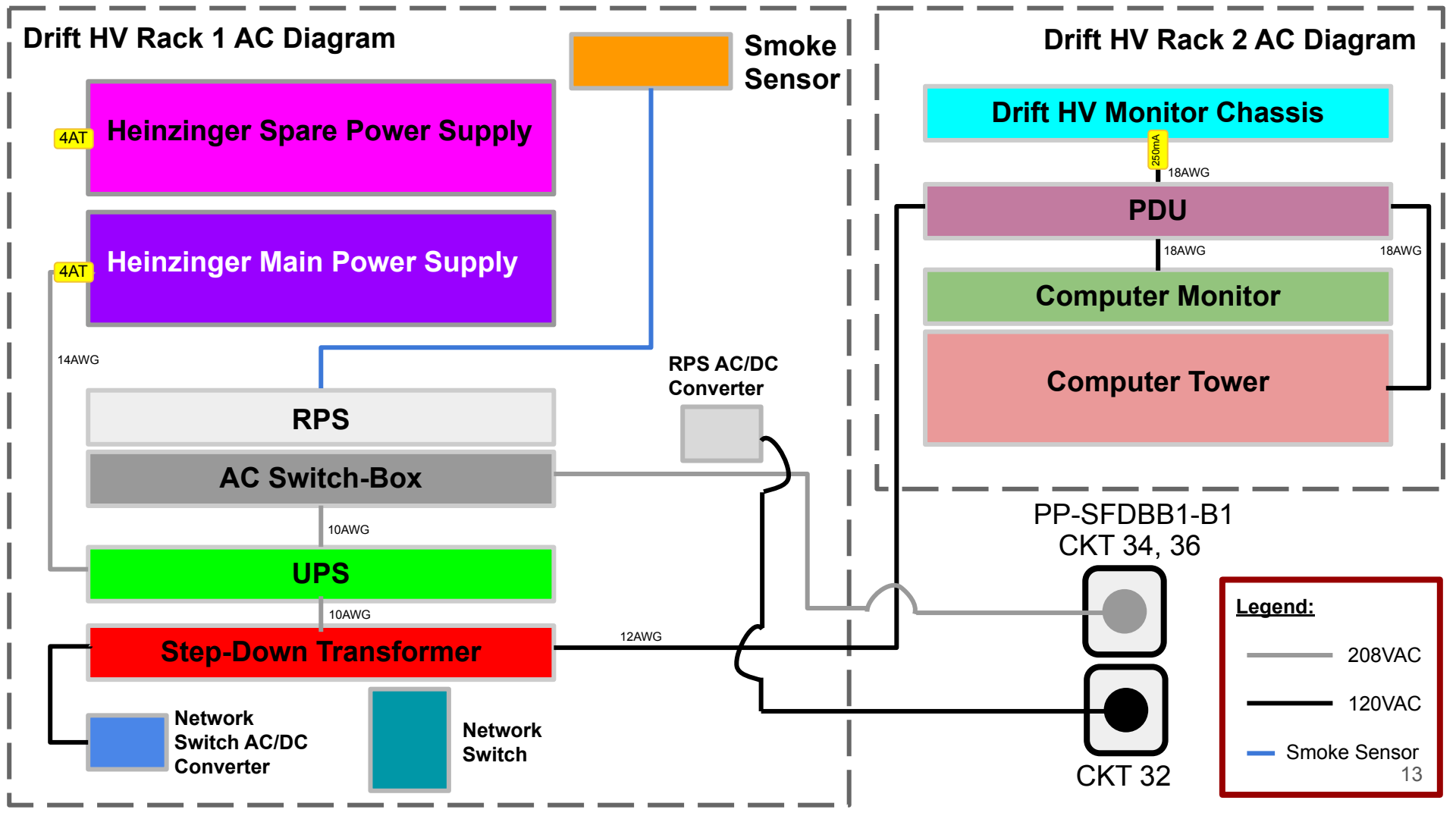

Drift HV Rack 2 DC Diagram
Drift HV Monitor Chassis
PDU
Computer Monitor
Computer Tower
To Voltage Dividers on TPC
RG58
To Voltage Dividers on TPC
RG58
To Voltage Dividers on TPC
RG58
To Voltage Dividers on TPC
RG58

Inside the Cryostat:



The voltage divider is shown in the circles and is in the last step of the voltage degrader circuit and will give a proportionality of 10^{-4} in comparison to what is applied at the Cathode. For example, if our Cathode was put at 56kV, the voltage dividers would read 5.6V.

Drift HV Racks Combined Diagrams


Drift HV Rack 1 AC Diagram
Smoke Sensor
4AT
Heinzinger Spare Power Supply
4AT
Heinzinger Main Power Supply
14AWG
RPS
AC Switch-Box
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250mA
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PDU
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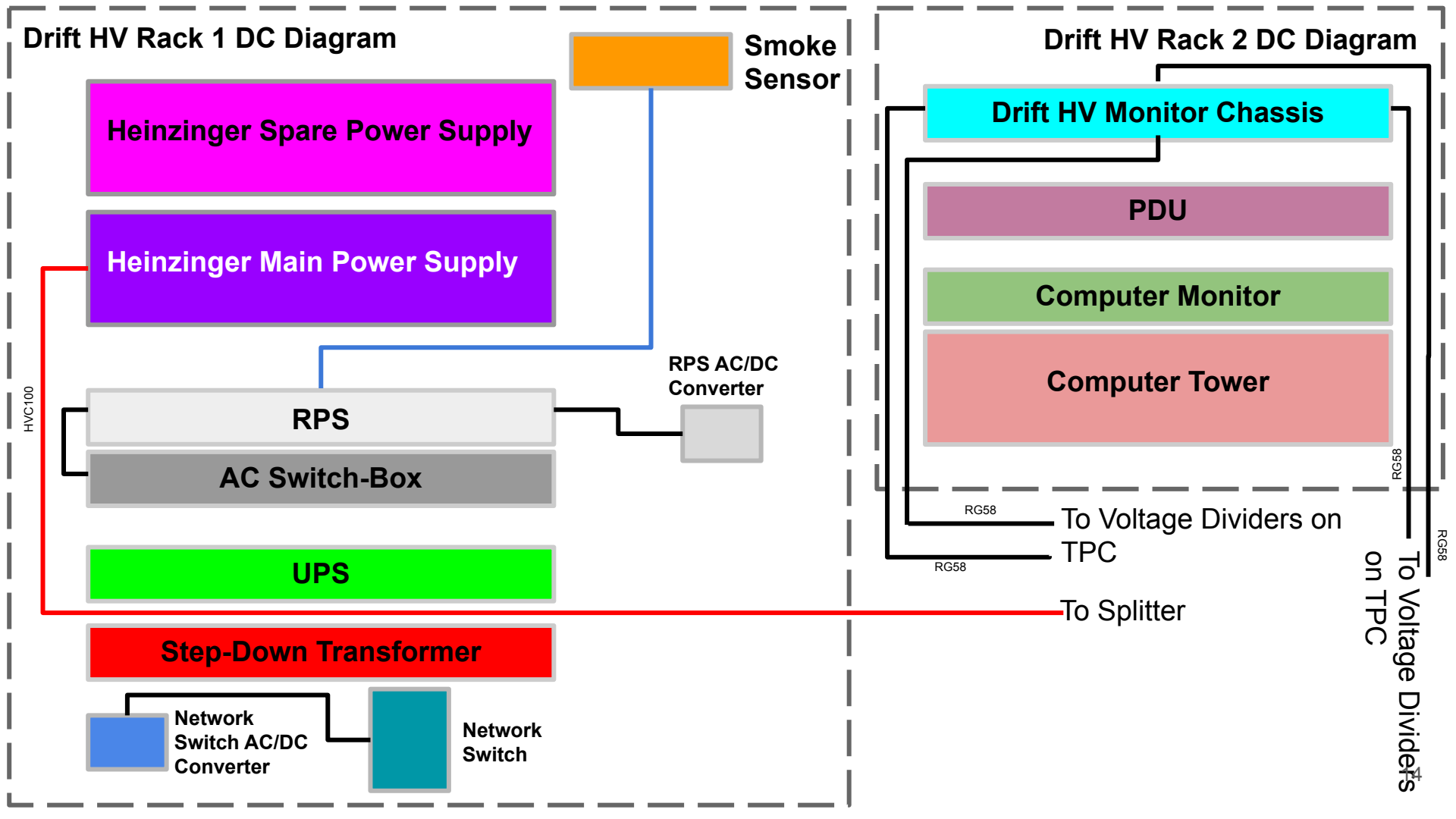
Computer Tower
PP-SFDBB1-B1
CKT 34, 36
CKT 32
Legend:
208VAC
120VAC
Smoke Sensor


Drift HV Rack 1 DC Diagram
Smoke Sensor
Heinzinger Spare Power Supply
Heinzinger Main Power Supply
RPS AC/DC Converter
HVC100
RPS
AC Switch-Box
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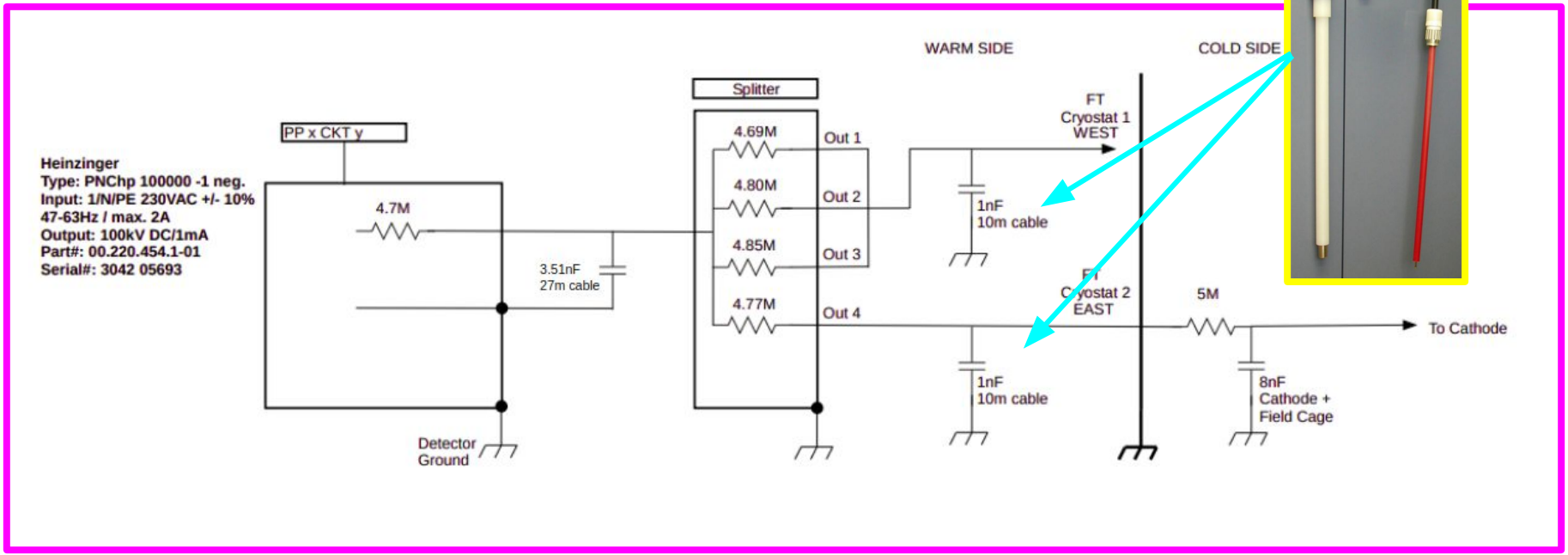
Step-Down Transformer
Network Switch AC/DC Converter
Network Switch
Drift HV Rack 2 DC Diagram
Drift HV Monitor Chassis
PDU
Computer Monitor
Computer Tower
RG58
RG58
To Voltage Dividers on TPC
RG58
To Splitter
RG58
To Voltage Dividers on TPC

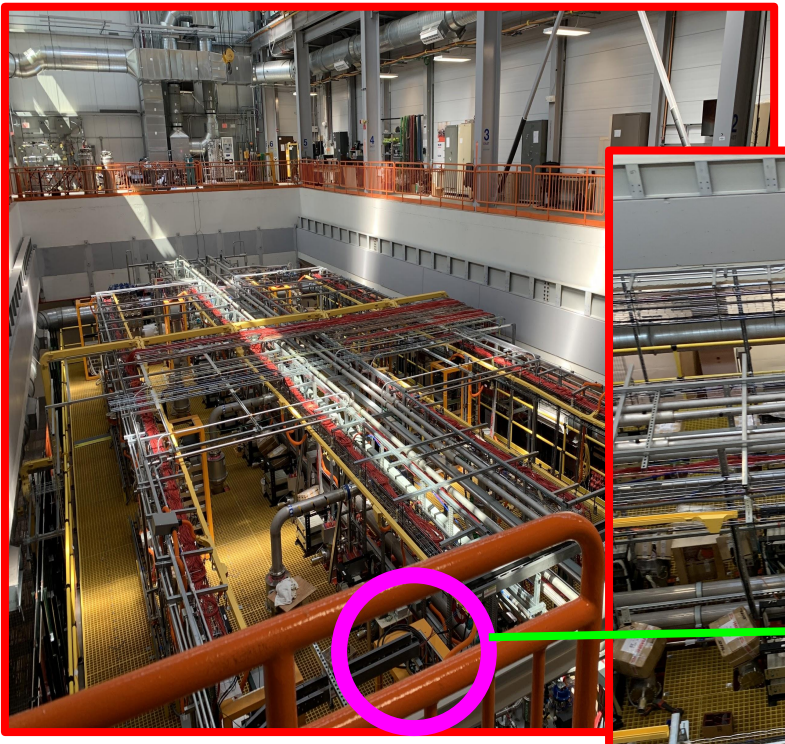
Splitter Box Location

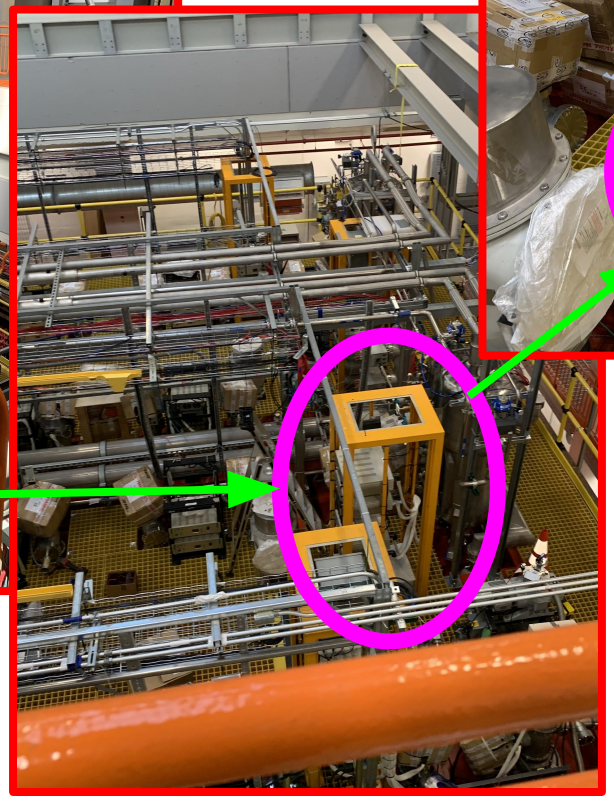
Splitter Box in the System:



Circuit diagram of the connections between the Heinzinger power supply and the Splitter Box on the top of the West Module and then to the feedthroughs of both TPCs.

Splitter on Top West Module:



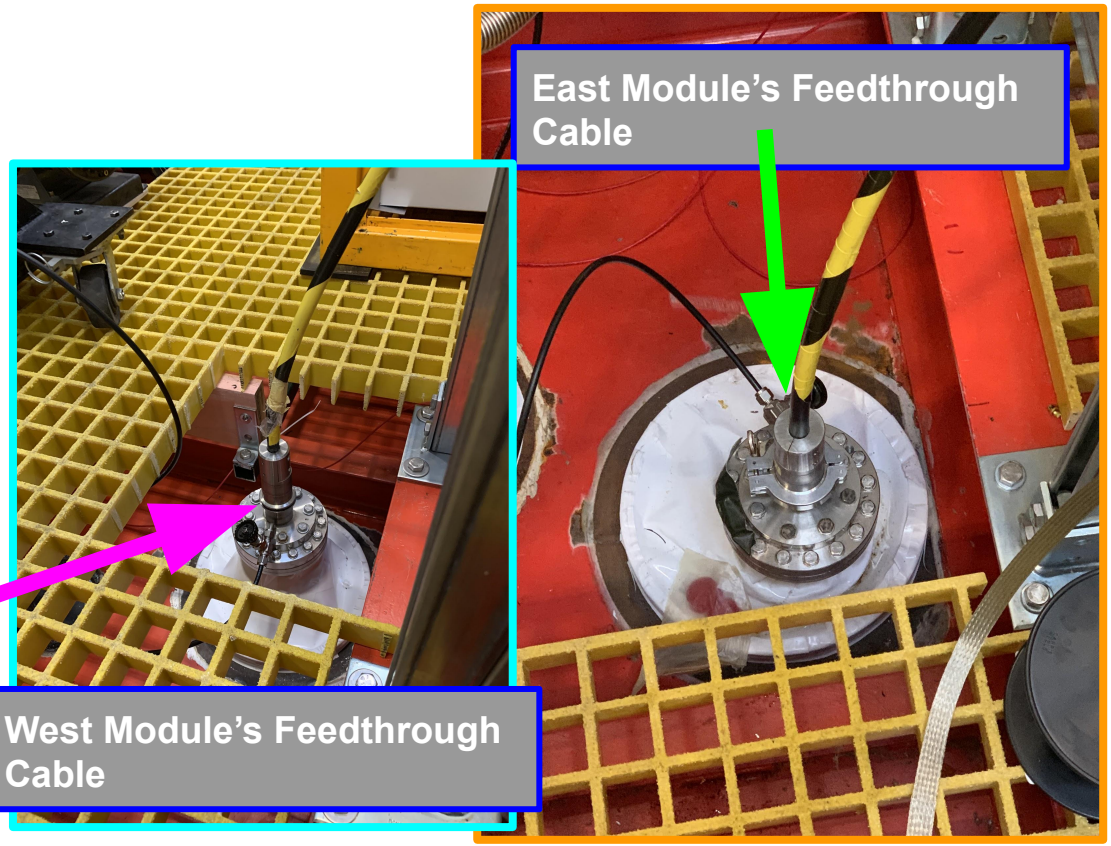


Feedthrough Cable Installation

Plugging in the Feedthrough Cable:

The East Module's cable has been installed!

The West Module's cable has been installed and connected to the Splitter on top of the detector for a while, which is shown in this picture here



The pORC Request Document:

1 Introduction

The Drift High-Voltage (HV) System is one of the most vital subsystems of the ICARUS Detector which, by using a Heinzinger Power Supply, will provide the high-voltage required to set up the uniform electric field necessary for ionization electrons to drift over to the wire planes of the ICARUS Detector. Without a drift electric field, there will be nothing for the wire planes to read out.

The Drift HV Working Group of the ICARUS Collaboration has assembled two electrical racks that will supply and monitor the Drift HV of the ICARUS Detector and are both located on the South Mezzanine of the SBN-FD Building. This document describes the current contents of the racks for the purposes of a partial operational readiness clearance (pORC) review. Both racks are a mixture of commercially available equipment and custom equipment that has already passed a SEDR review.

This document starts with a discussion of the Drift HV System and where these components are installed at the SBN-FD Building in Section 2. After, Section 3 gives details of the Drift HV 208V Rack on the South Mezzanine of the SBN-FD Building, provides diagrams of the connections made to the rack, and the components that are installed in the rack for the operation of the Drift HV System of the ICARUS Detector. Section 4 gives details of the Drift HV 120V Rack on the South Mezzanine of the SBN-FD Building, provides diagrams of the connections made to the rack, and the components that are installed in the rack (both commercial and custom equipment). And finally, Section 5 gives the complete power distribution of the ICARUS Drift HV electrical racks as well as a diagram of the entire Drift HV electrical racks and the connections between the two.

2 ICARUS Drift HV System

This section details the ICARUS Drift HV System and the ma
main objective of the Drift HV Subsystem is to provide the
T300 modules, so that a uniform electric field will be in pl
produced by charged particles traveling through the LAr ov
electric field must be stable enough to drift potential signal el
of 1.5m.

The electric field is set up by biasing the central cathode
punched stainless-steel sheets (this allows a 58% optical transp

Heinzinger HVC100			
	Nennspannung	100kV DC	*Rated voltage*	*100kV DC*
	Prüfspannung	200kV DC	*Isolation voltage*	*200kV DC*
	Kapazität	130pF/m	*Capacity*	*130pF/m*
	Induktivität	0,41µH/m	*Inductance*	*0,41µH/m*
	Wellenwiderstand	51Ω	*Impedance*	*51Ω*
	Innenleiter Material	Cu	*Center wire Material*	*Cu*
	Durchmesser	2,2mm	*Diameter*	*2,2mm*
	Dielektrikum Material	PE	*Dielectric Material*	*PE*
	Durchmesser	11mm	*Diameter*	*11mm*
	Schirmung Material	CuSn	*Screening Material*	*CuSn*
	Durchmesser	12mm	*Diameter*	*12mm*
	Außenmantel Material	PVC	*Covering Material*	*PVC*
	Durchmesser	ca. 14mm	*Diameter*	*ca. 14mm*
	Farbe	rot	*Color*	*red*
	Biegeradius	min. 280mm	*Bending radius*	*min. 280mm*
	Temperatur-beständigkeit	bis 60°C	*Temperature resistance*	*up to 60°C*
	Bestellnummer	**00.220.853.9**	***Part Number***	***00.220.853.9***

Figure 5: The specifications for the 27m cable that connects between the power supply and the splitter box on the top of the detector.

Bis 100kV / *Up to 100kV*	Stecker HVS100	*Plug (male) HVS100*
	Hochspannungsstecker bis 100kV DC **00.220.861.9**	*high voltage plug up to 100kV DC* ***00.220.861.9***
	Stecker HVS100 komplett konfektio-niert mit 3 Meter HV-Kabel HVC100 (wie im Original-Lieferumfang der HV-Netzgeräte bis 100kV enthalten) **00.220.861.901**	*Plug (male) HVS100 ready-made with 3 meter HV cable 3 HVC100 (as included in the extent of delivery of HV power supplies up to 100kV)* ***00.220.861.901***

the plug on the end of the 27m cable that connects to the power

Supply: The spare power supply that will be used in case of failure

voltage dividers is shown in Figure 2 which is a look inside of the cryostat.

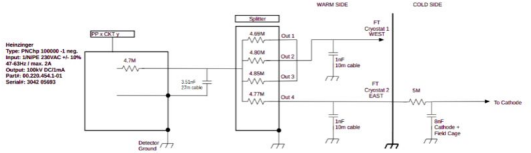


Figure 1: The circuit diagram for the power supply to the splitter and from the splitter to the feedthroughs on the top of the detector.

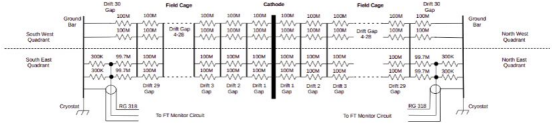


Figure 2: Circuit Diagram of an ICARUS-T300 module's race track electrodes and voltage dividers within the cryostat.

3 ICARUS Drift HV 208V Rack

This section details the ICARUS Drift HV 208V Rack and the components that both comprise it.

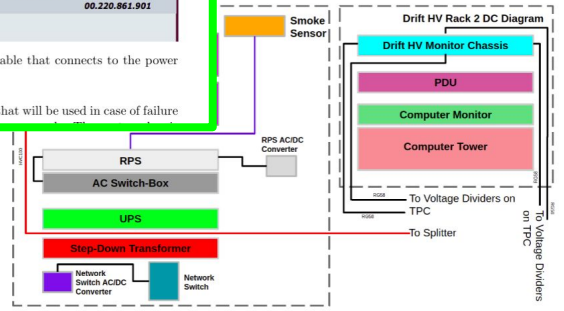
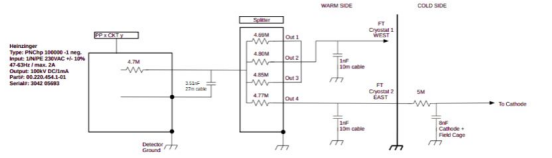


Figure 19: Entire DC Circuit Diagram of both of the ICARUS Drift HV Electrical Racks.



Next Steps:

1. Address the findings of the pORC review.
2. There are a few tests that we have planned for the Drift HV System to ensure the safe operation of the Drift HV for the TPCs that need to be performed.
3. Finish implementation of the control and monitoring of the Power Supply and system into the Slow Controls (~2 weeks).

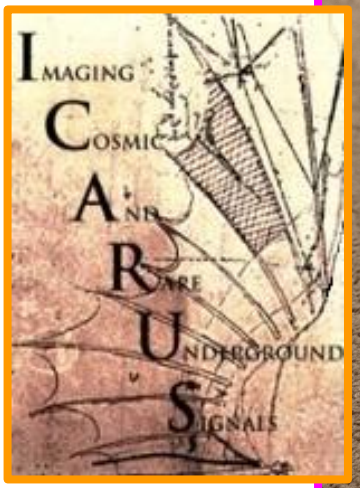
A Huge, Amazing THANK YOU to:

There are SO many people I have to thank for their help in getting the Drift HV Electrical Racks to the point that they are, but in particular I'd like to give an enormous **THANK YOU!!** to:

- Claudio,
- Donatella,
- Geoff,
- Linda,
- and Skippy.

Thank you all very, very much for your help and patience!

UNIVERSITY OF TEXAS ARLINGTON



Thank you!