

Remote Power Distribution Prototyping For Bergoz ACCT

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FERMILAB-POSTER-24-0160-STUDENT

Background

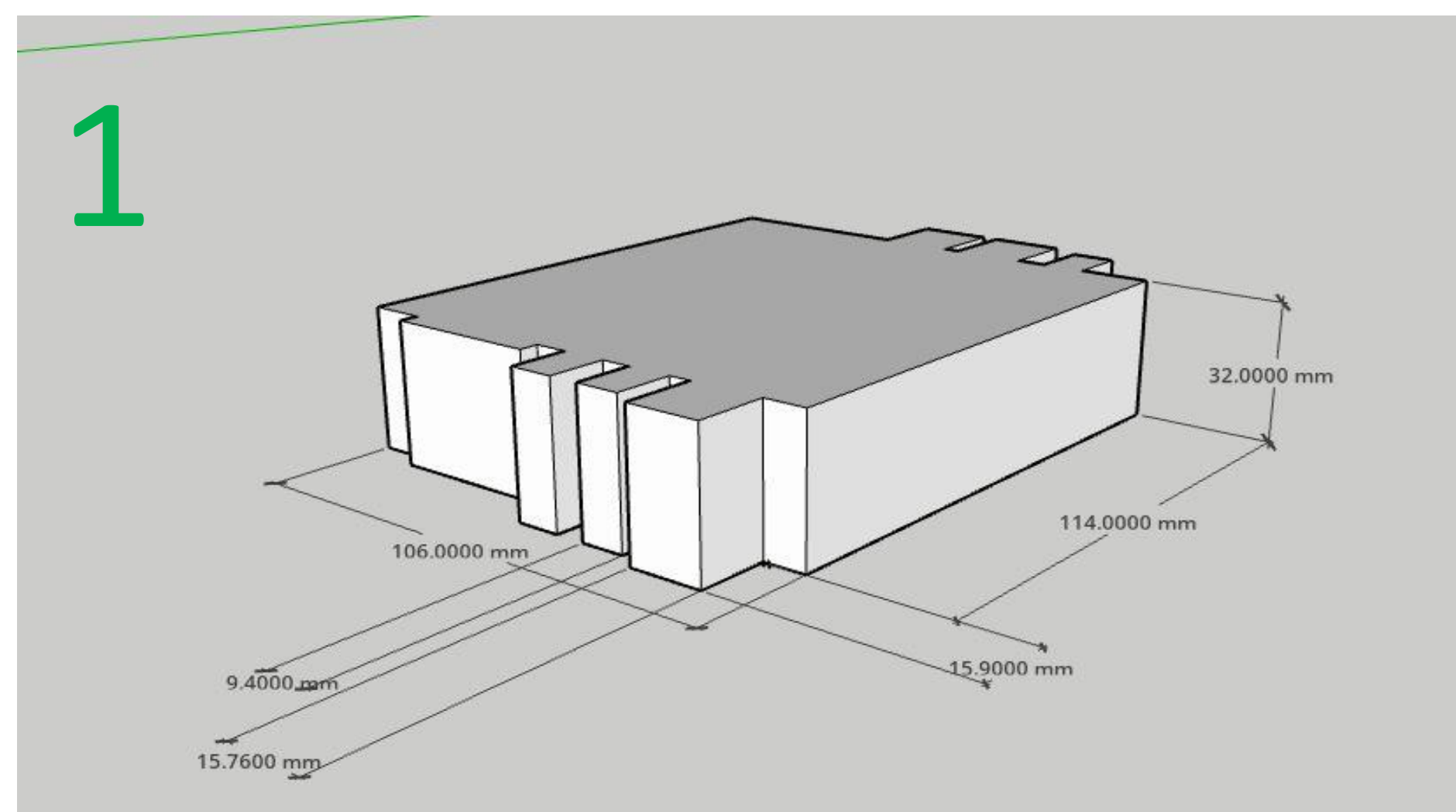
The Bergoz ACCT is used at Fermilab for the PIP-II BCM systems to provide accurate, real-time measurements of the AC components of the beam current. However, there are scheduled power outages on site, which can temporarily result in a power surge and force electronics such as the ACCT to operate outside their range, damaging them if they are not shut off. For PIP-II, the BCM system architecture needs the capability to remotely monitor and control power to the ACCT amplifiers.

Procedure

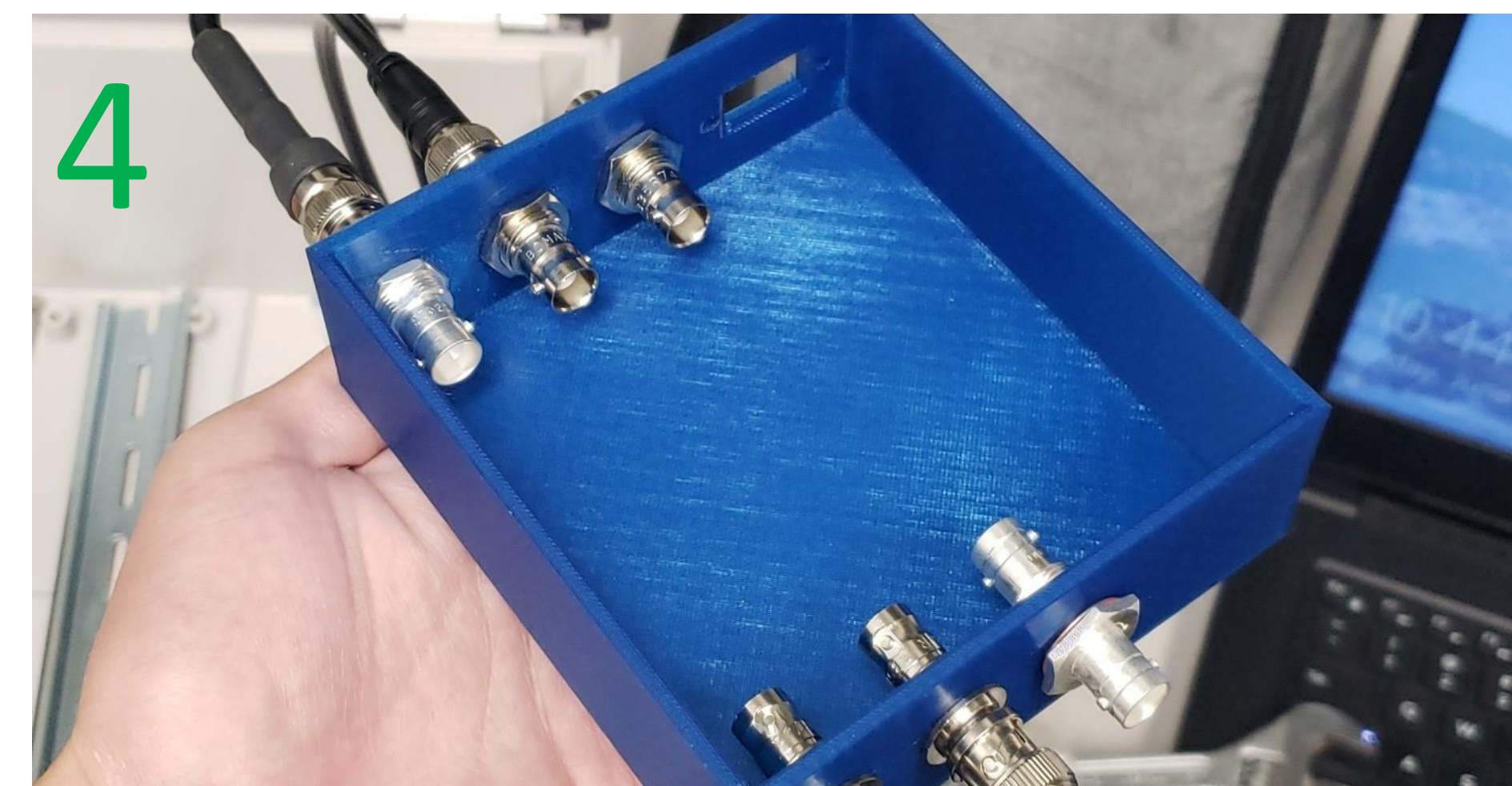
Fermilab has not yet procured the electronics module, also referred to as an amplifier, so prototype development involving designing and constructing a placeholder as well as simulating its fitment inside its enclosure is necessary. A placeholder for the amplifier can be designed using CAD, and a junction box can be modified to function as a mountable enclosure for the amplifier. Both the power source and the amplifier must be placed outside the tunnel. Instead of locally plugging into a socket, it is possible to use power over ethernet. Power over ethernet technology allows for the delivery of both power and data over a single ethernet cable. While ethernet data does not pertain to the amplifier, a remotely managed power over ethernet switch can be used to shut off power to the amplifier remotely.

DC/DC Converter & Amplifier

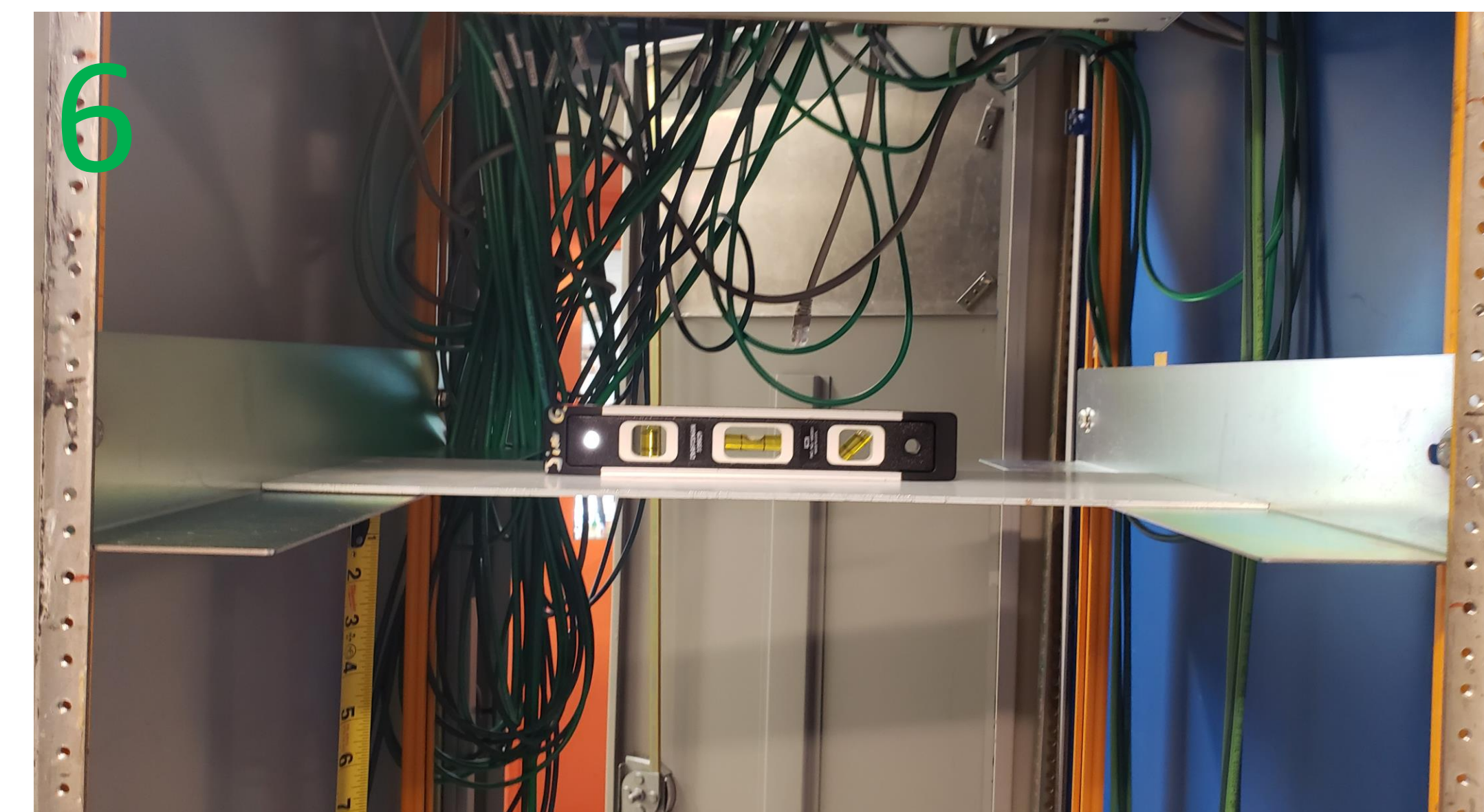
Note: Only 1 connection needed, ethernet data pins not used by amplifier



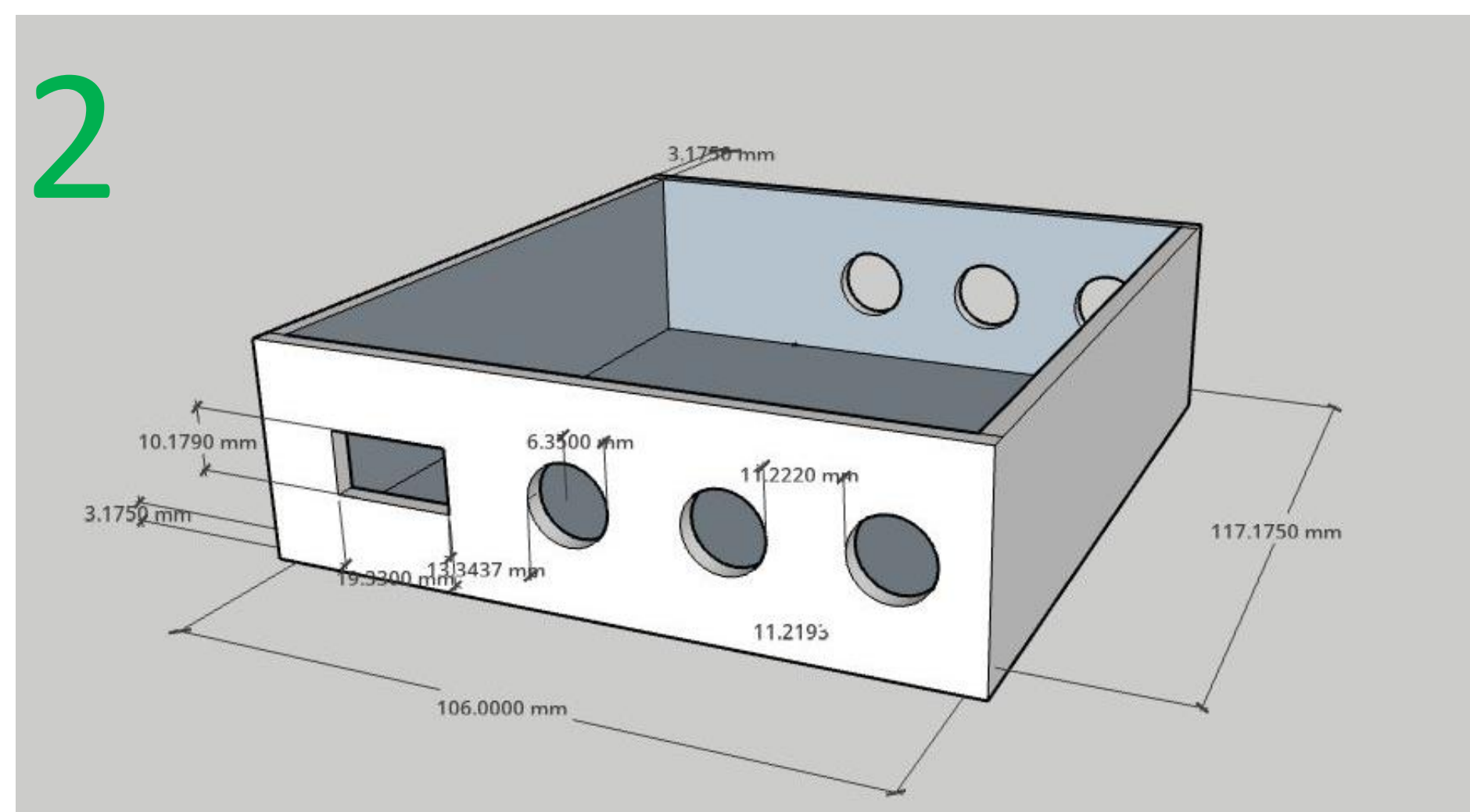
Amplifier placeholder first iteration in Sketchup



Final product with BNC connectors



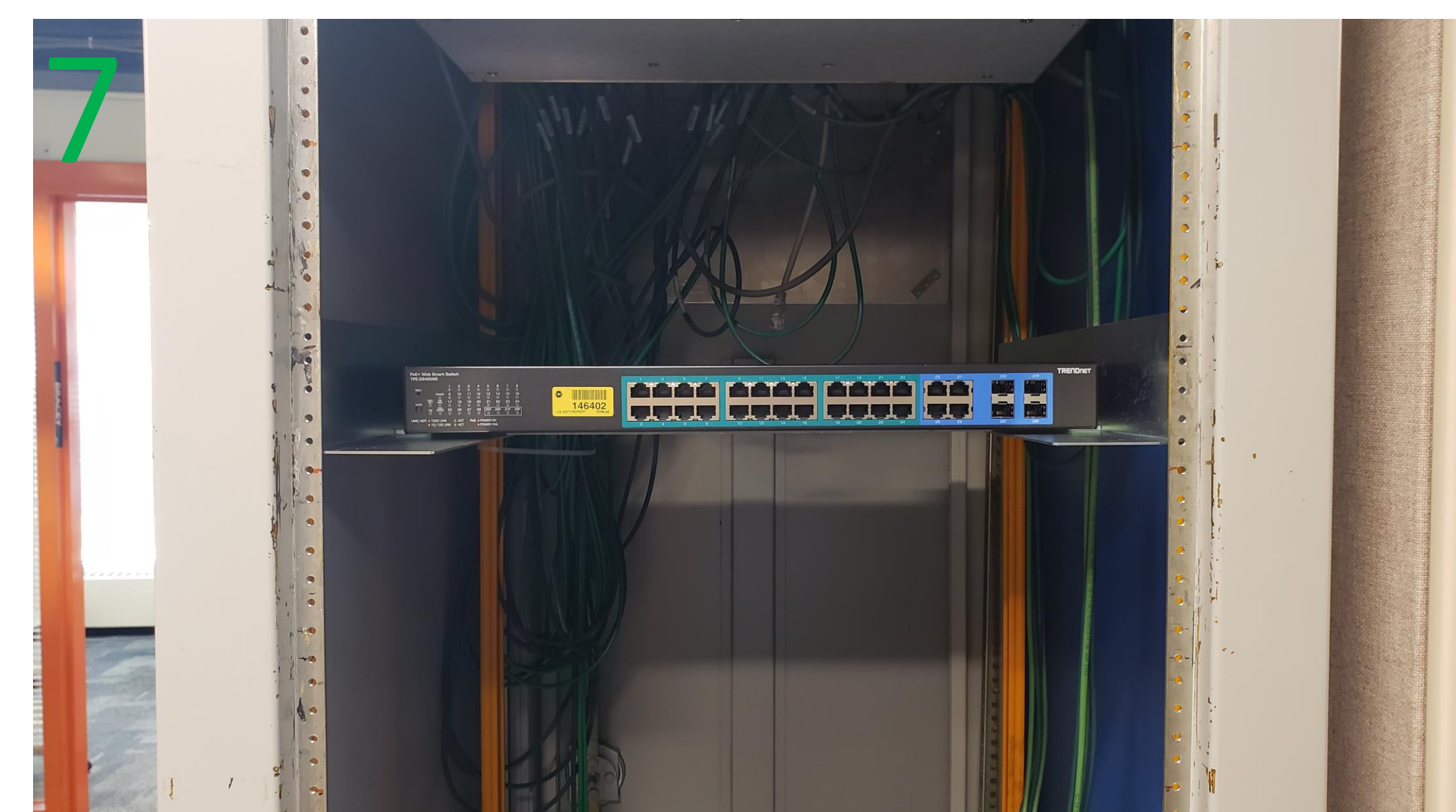
Mounting bracket installation for PoE switch using spirit level, measuring tape, nuts and bolts



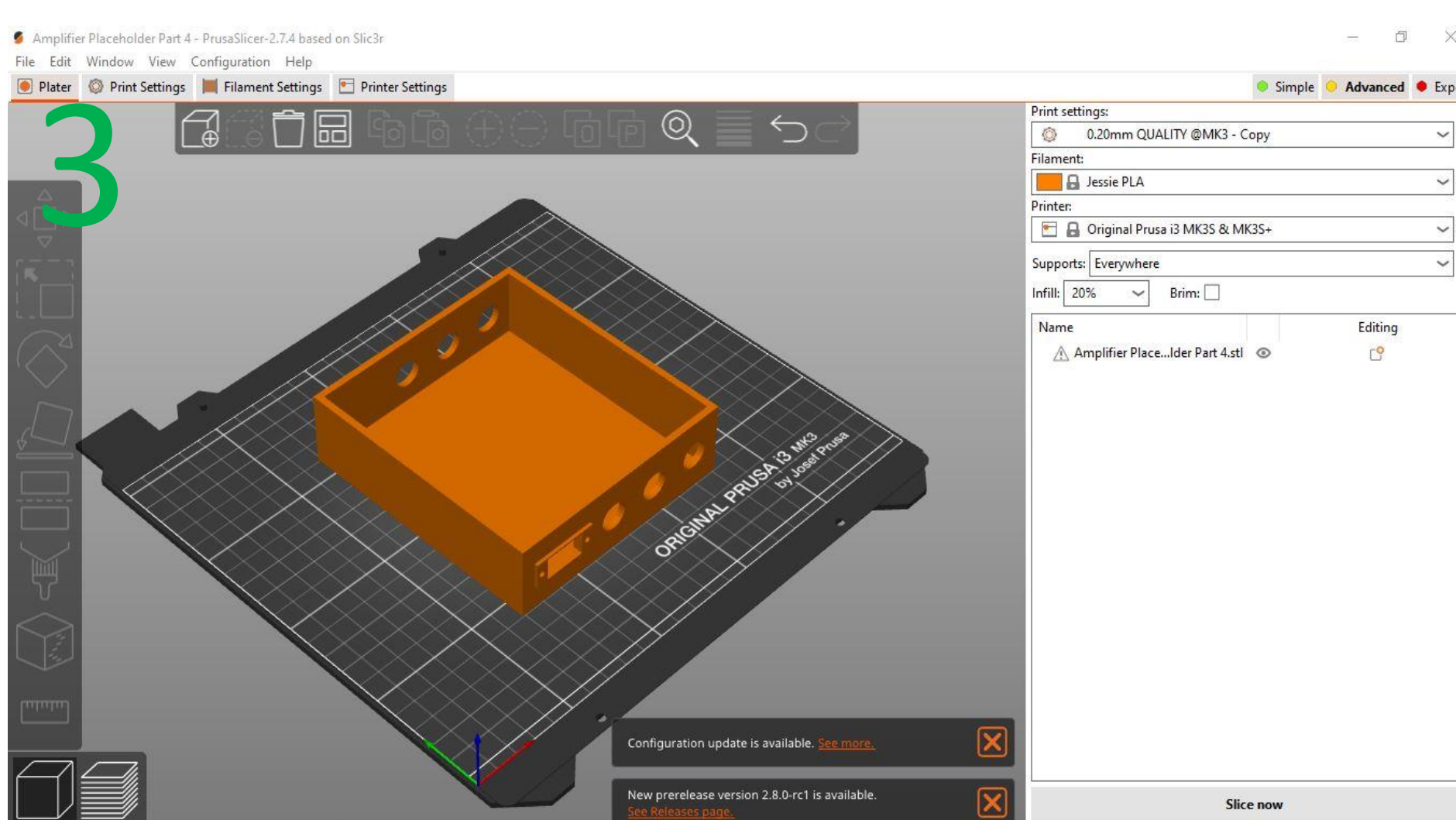
Amplifier placeholder second iteration in Sketchup



Electronics mounted using 35 mm DIN Rail (Note: Not all wires attached, hole punch outs not yet made at this point)



Switch mounted in rack



Second iteration in PrusaSlicer for 3D printing with Prusa i3 MK3S+ using Jessie PLA filament

Port	Throughput	Loopback Detection	Distance	Device Name	Device Info	PoE On/Off	PoE Status	PoE Standard
1	0 Mbps	Normal	-		MAC: IP:	OFF <input checked="" type="checkbox"/> ON	POWER OFF	PoE
2	0 Mbps	Normal	-			OFF <input checked="" type="checkbox"/> ON	POWER OFF	PoE
3	0 Mbps	Normal	-			OFF <input checked="" type="checkbox"/> ON	POWER OFF	PoE
4	0 Mbps	Normal	-			OFF <input checked="" type="checkbox"/> ON	POWER OFF	PoE
5	0 Mbps	Normal	-			OFF <input checked="" type="checkbox"/> ON	POWER OFF	PoE
6	0 Mbps	Normal	-			OFF <input checked="" type="checkbox"/> ON	POWER OFF	PoE
7	0 Mbps	Normal	-			OFF <input checked="" type="checkbox"/> ON	POWER OFF	PoE
8	0 Mbps	Normal	-			OFF <input checked="" type="checkbox"/> ON	POWER OFF	PoE

PoE switch web interface used to enable/disable power

Conclusion

The enclosure is now fully prepared to securely house the real amplifier module. Although the amplifier has not yet been procured, power distribution through the PoE switch was tested through the web interface by disabling and enabling PoE and confirmed to work through a load test using an older ACCT. The PoE switch is able to be remotely accessed through the Fermi Controls network using the switch's built-in interface. With the amplifier powered and remotely managed through PoE, the amplifier can be easily maintained and the risk of any serious component failure is reduced. In the future, the real amplifier module will replace the placeholder inside the enclosure and the project will be integrated into PIP-II.