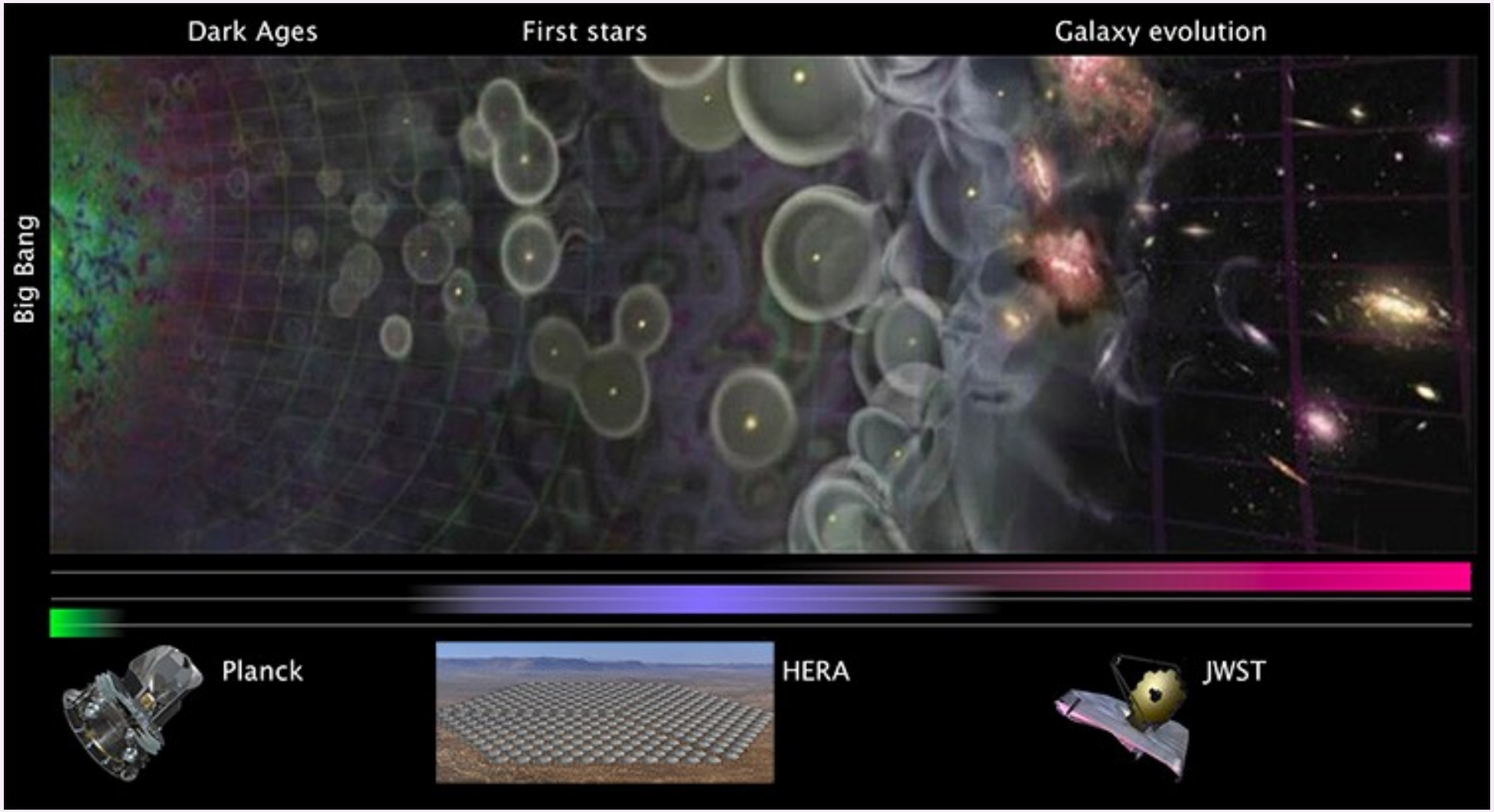
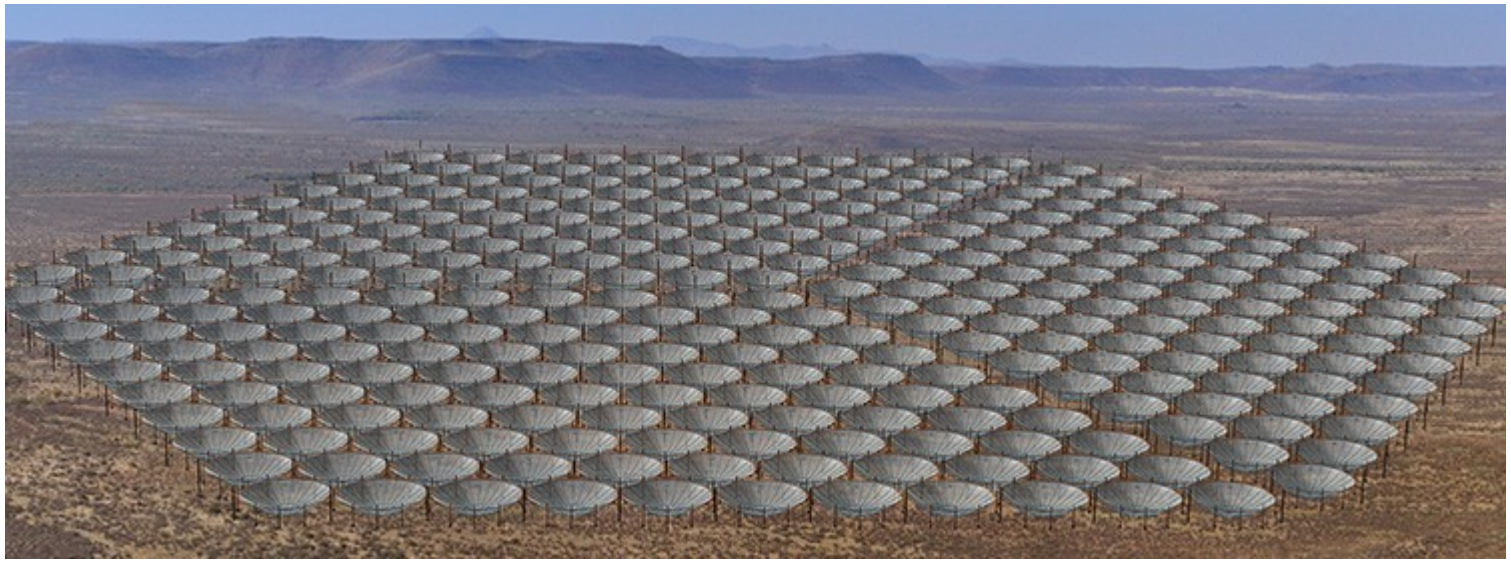
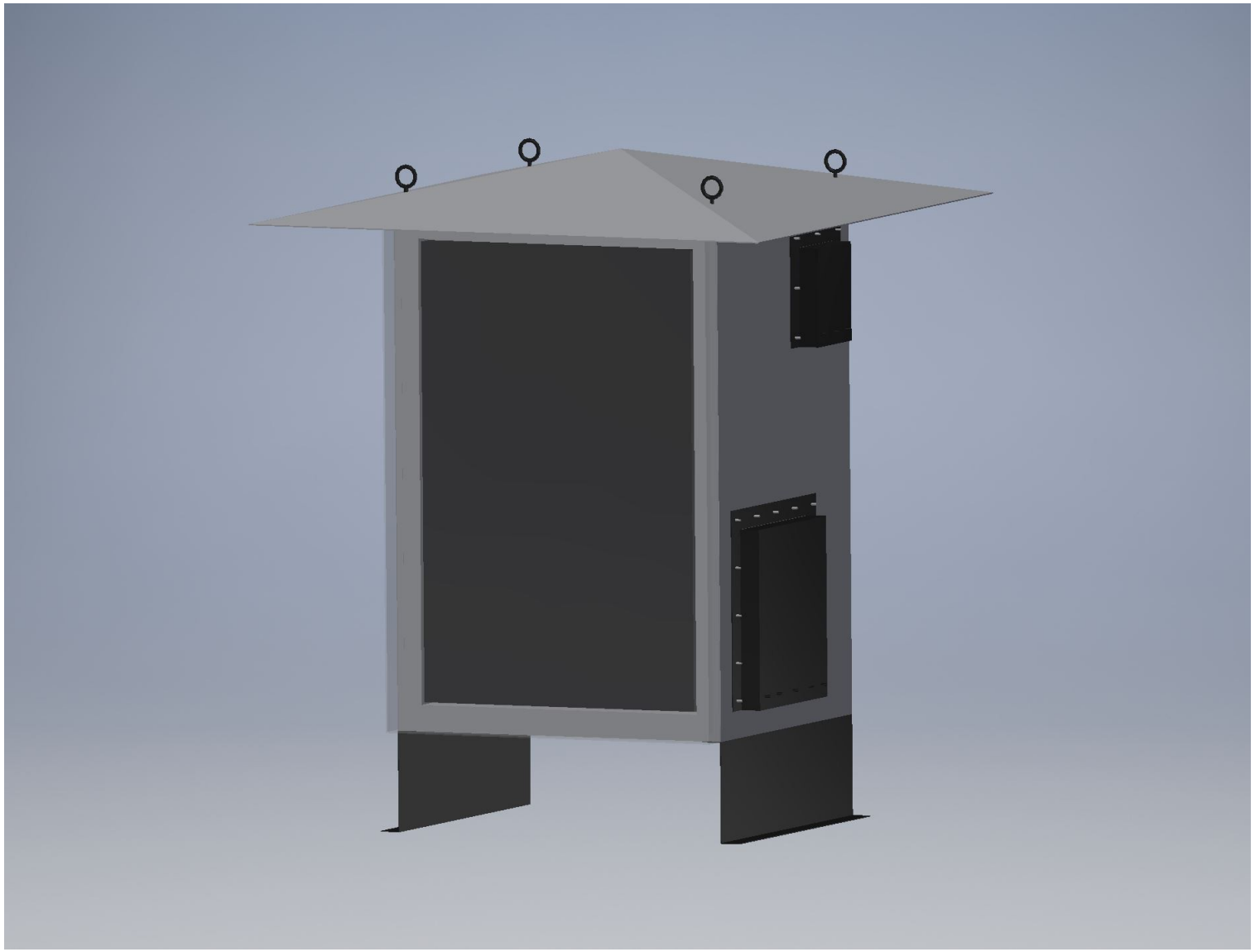
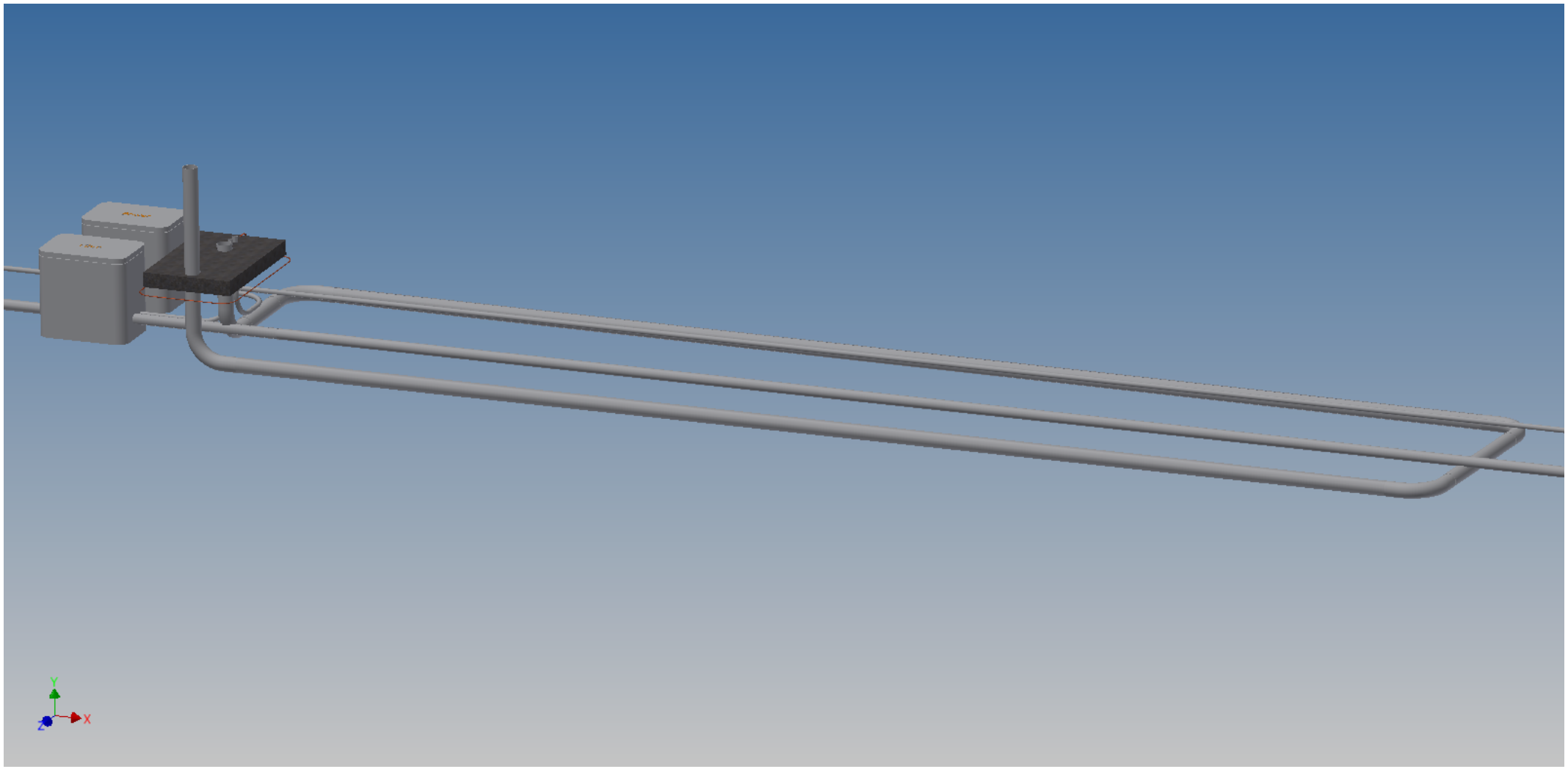
HERA Node Architecture and Signal Processing

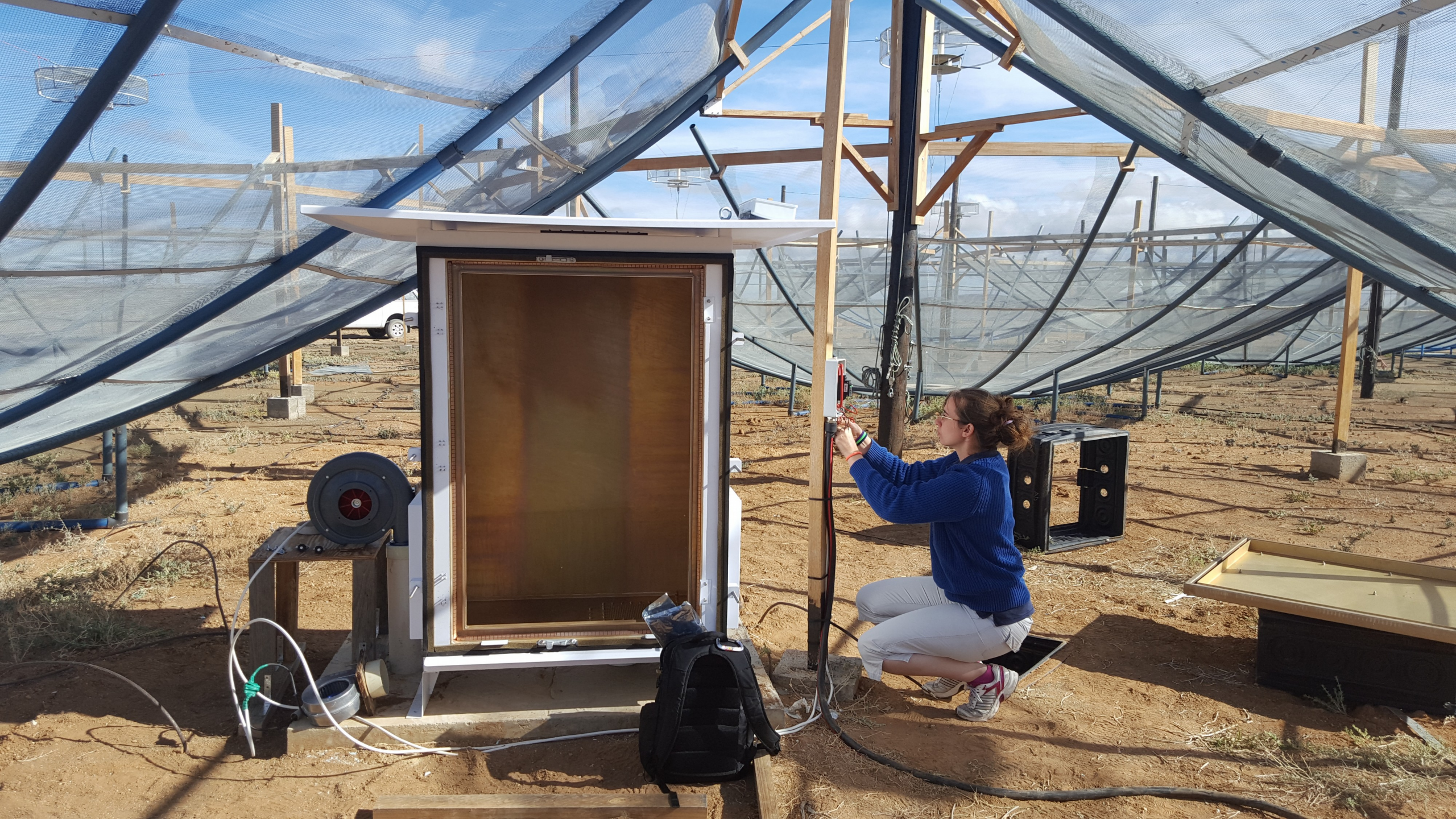

Dark Ages
First stars
Galaxy evolution
Big Bang
Planck
HERA
JWST

- Hexagonal packed structure to minimize noise from synchrotron emission
- 350 dishes
- 30 Processing Nodes

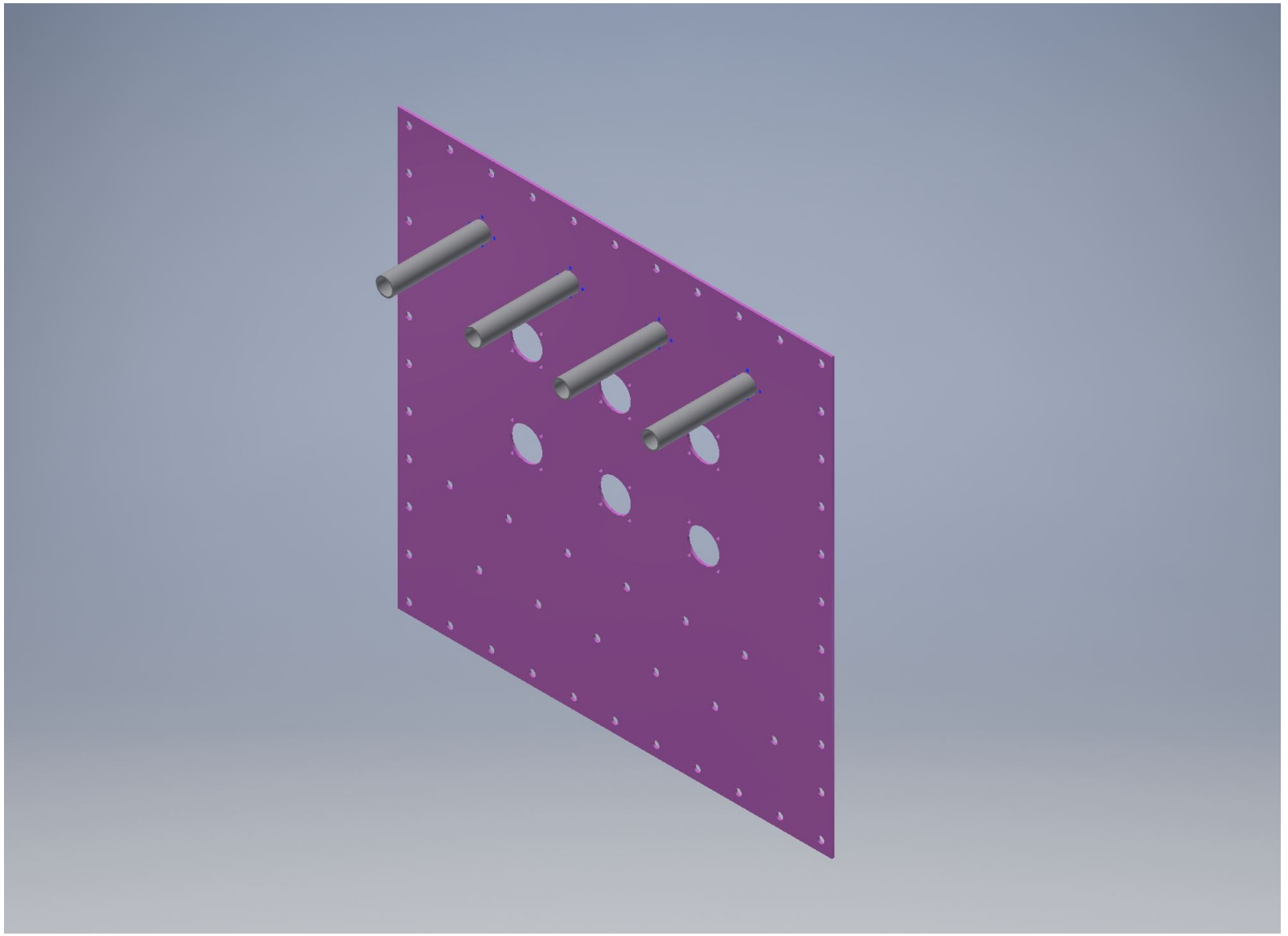




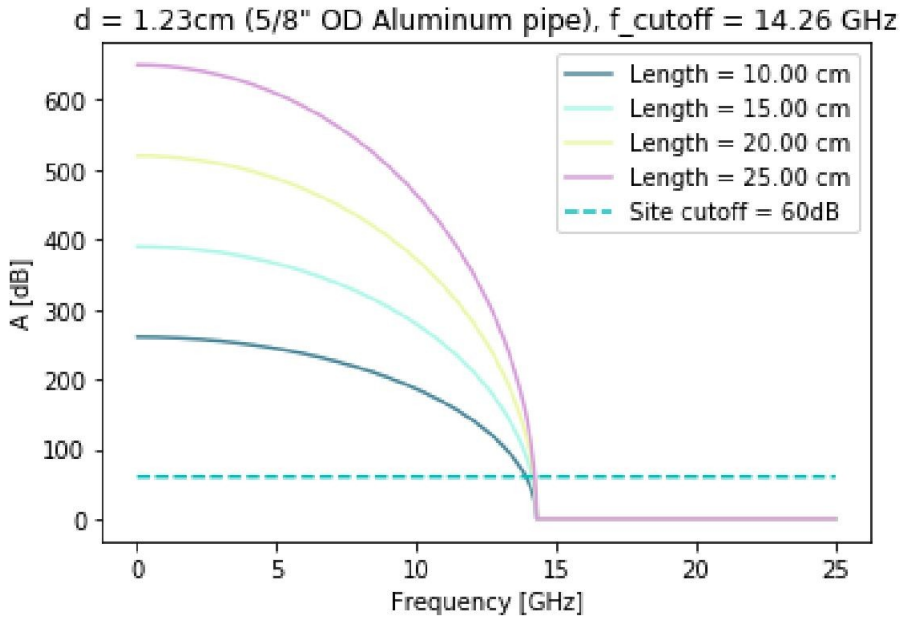

Y
X
Z

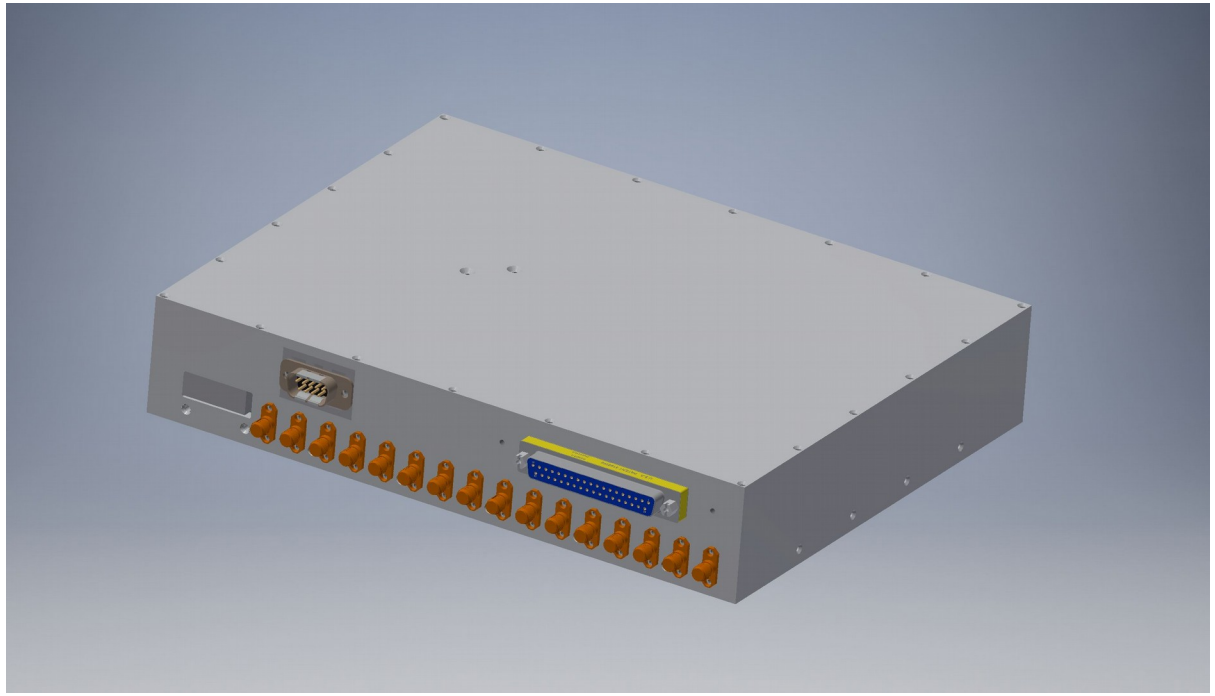


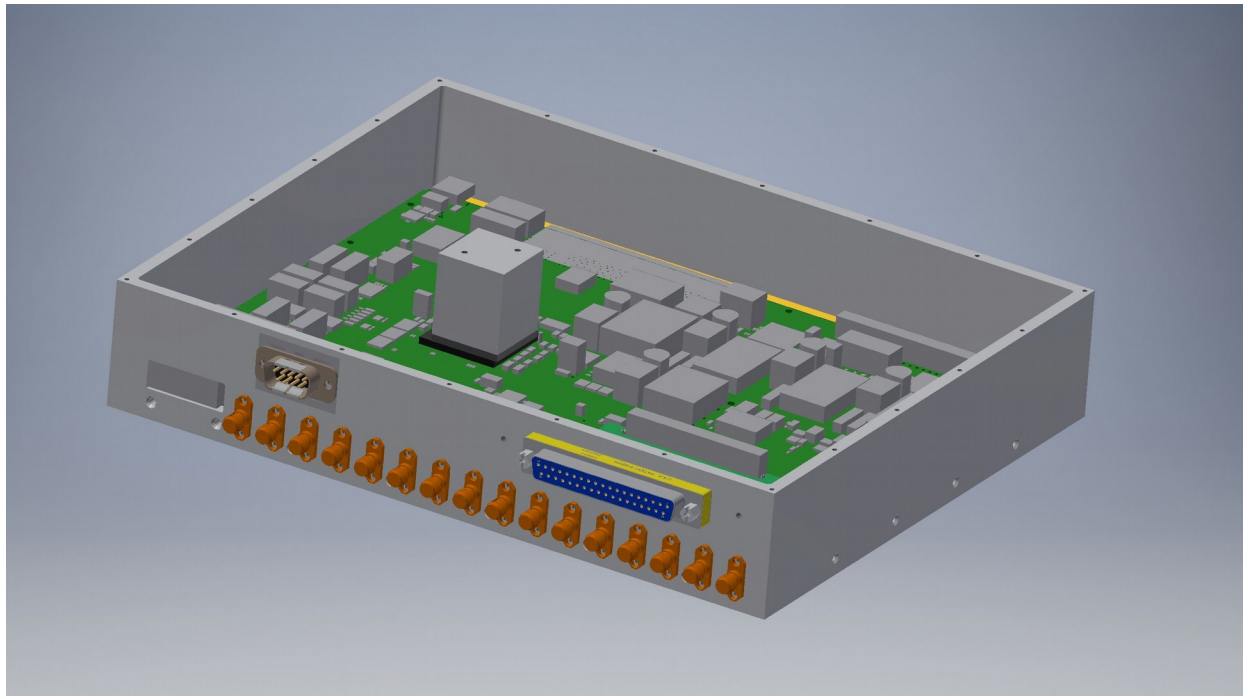
RFI Tight Panels

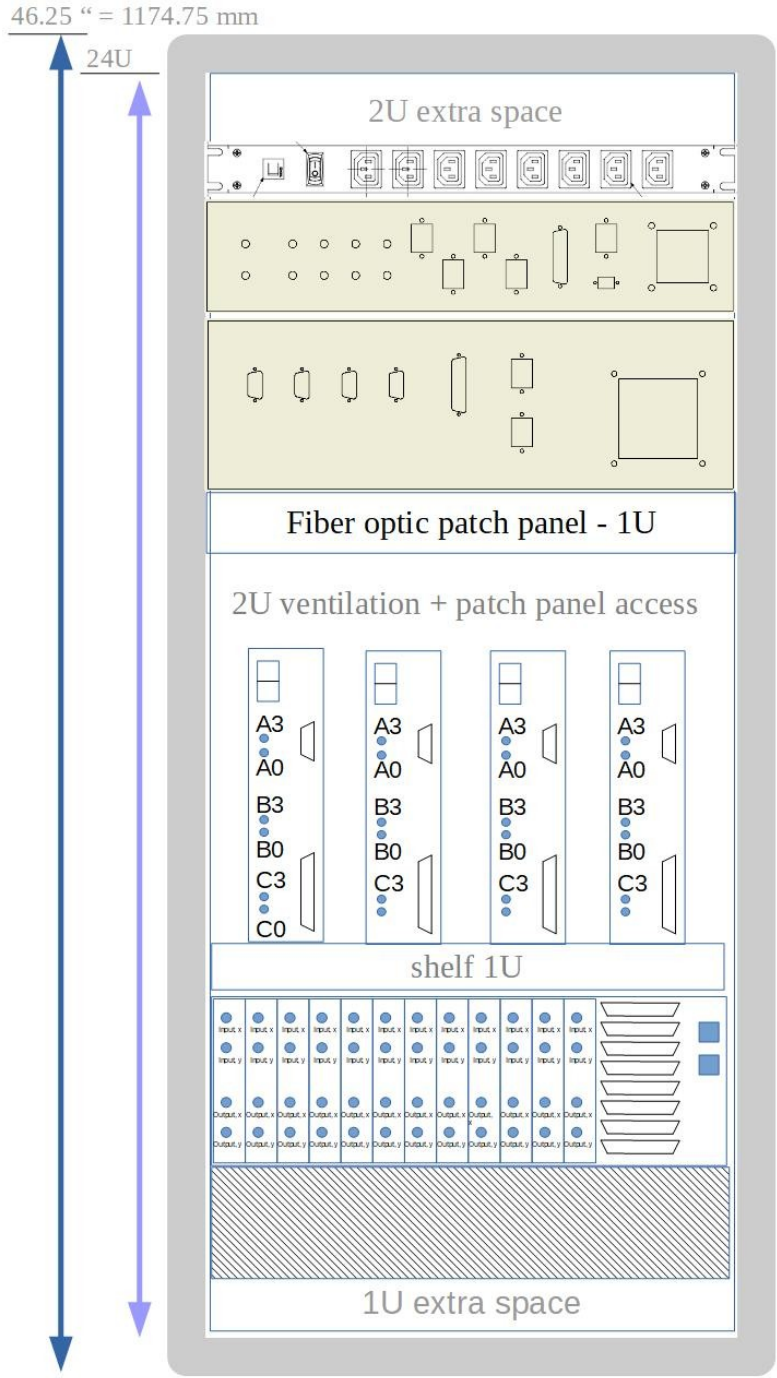


Waveguide Calculations









Power Strip - 1U

NMT - 2U
Rails

PDU - 3U
Rails

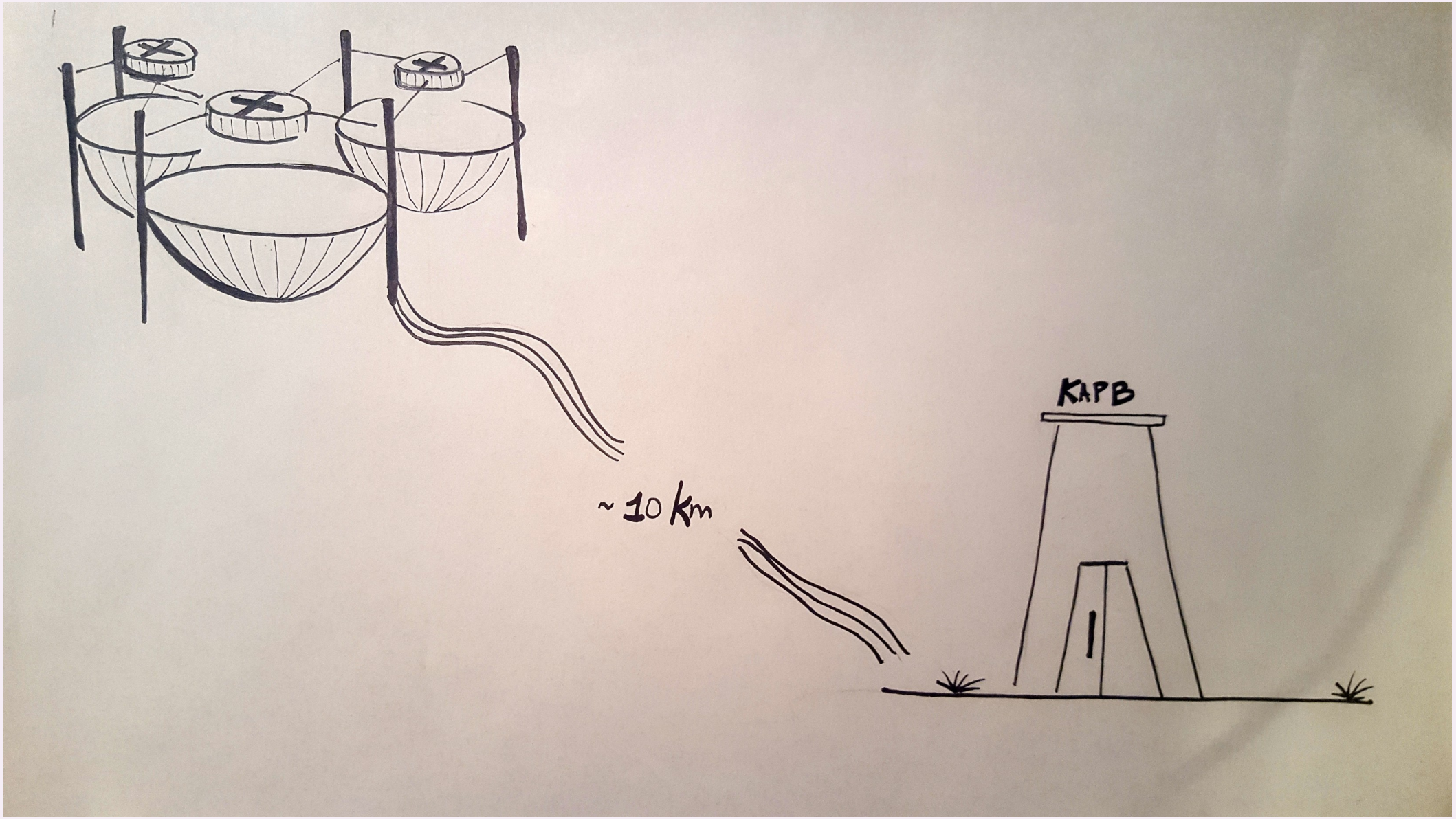
SNAP boards - 6U

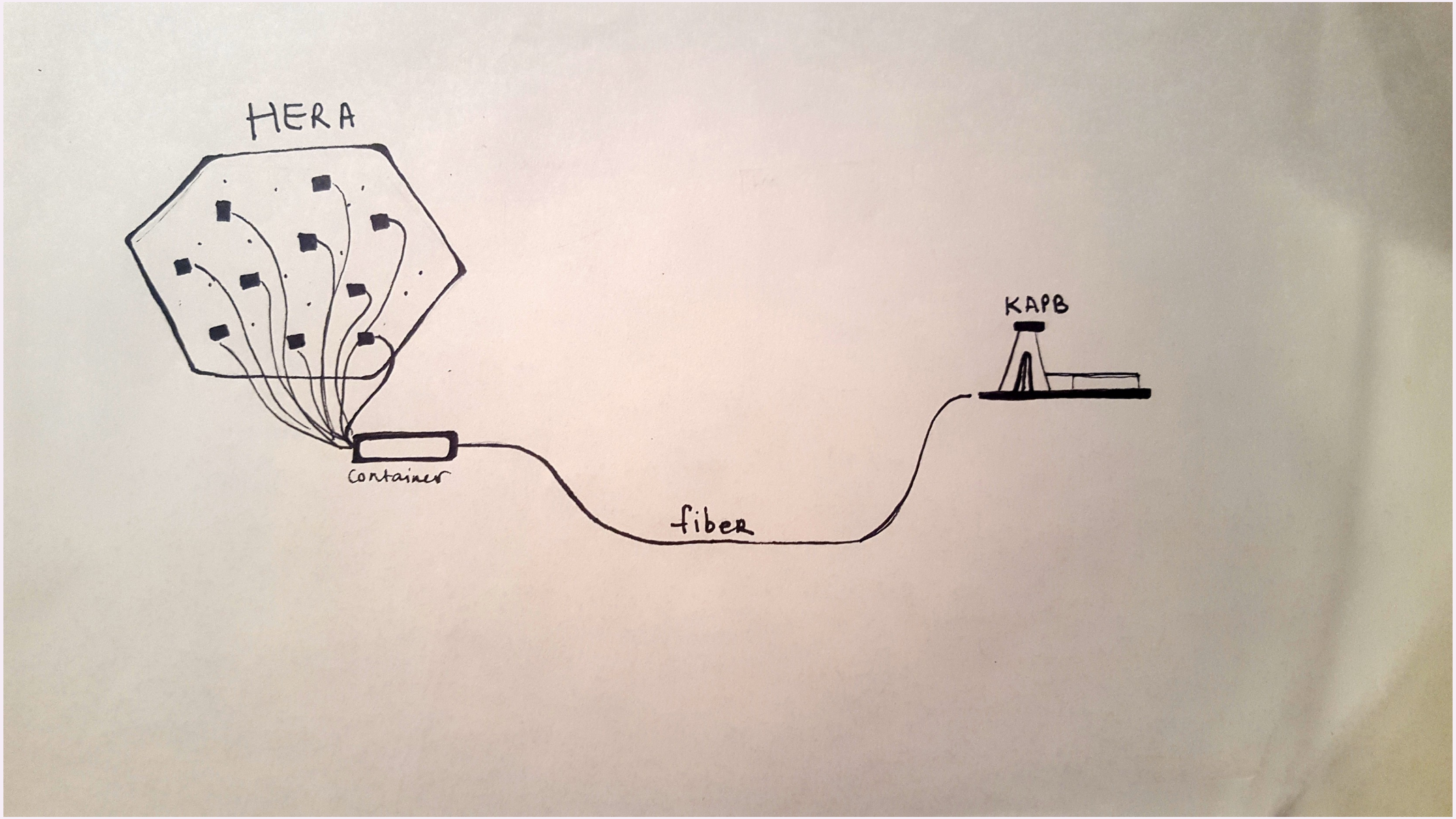
Sliding shelf

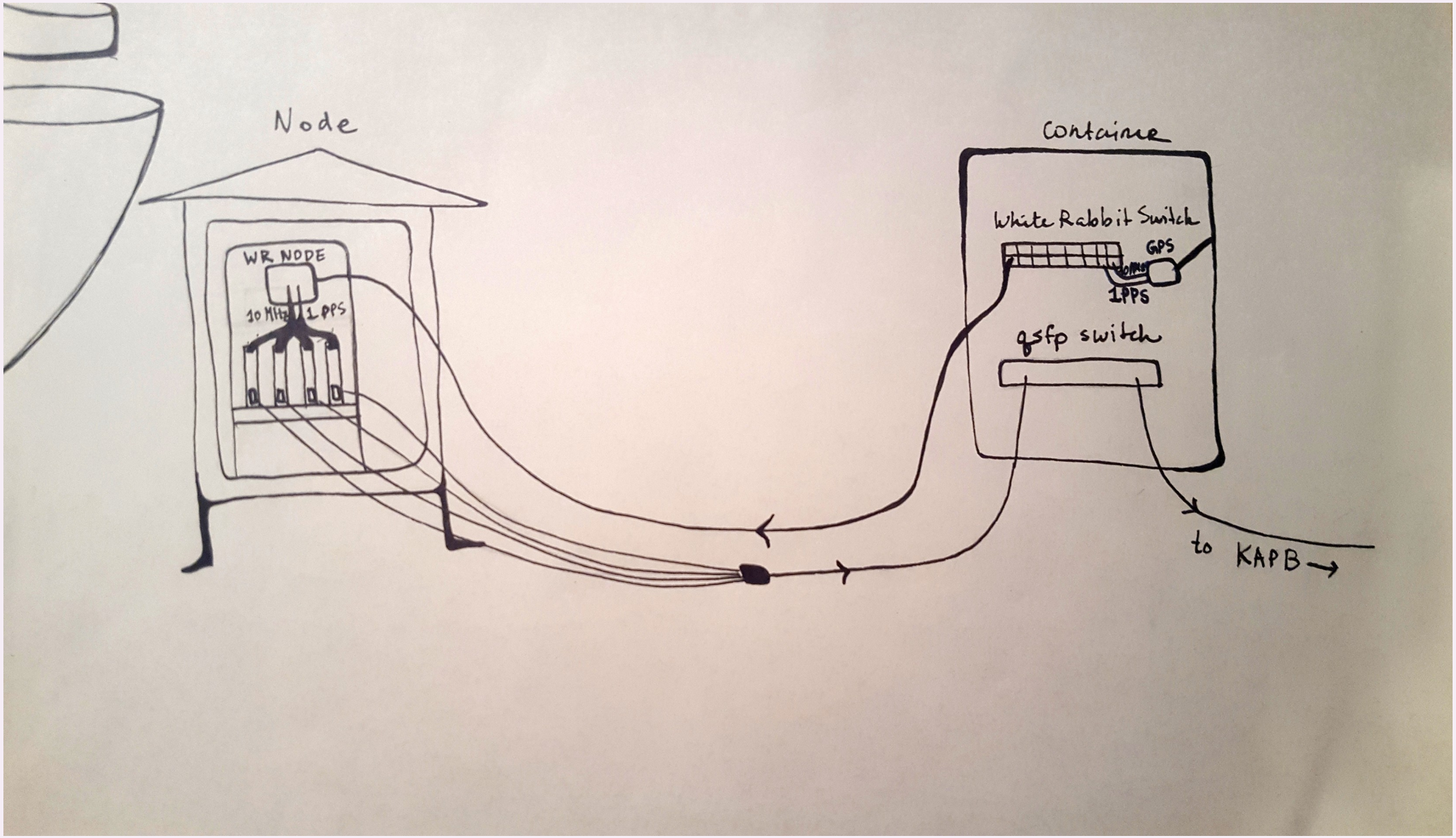
PAM - 3U
Rails

Power in case of RF over fiber - 2U

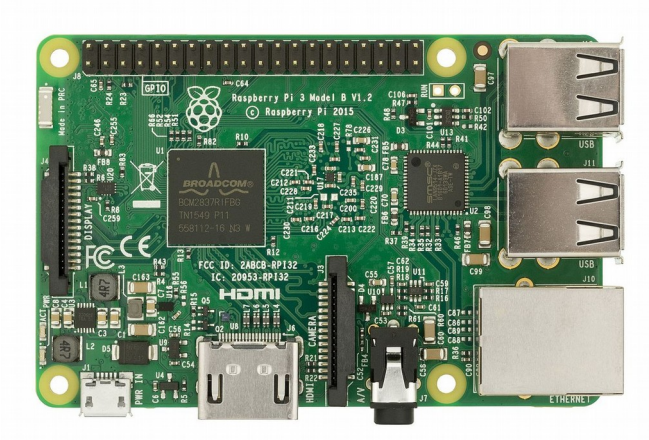
6/27/17


KAPB
~ 10 km

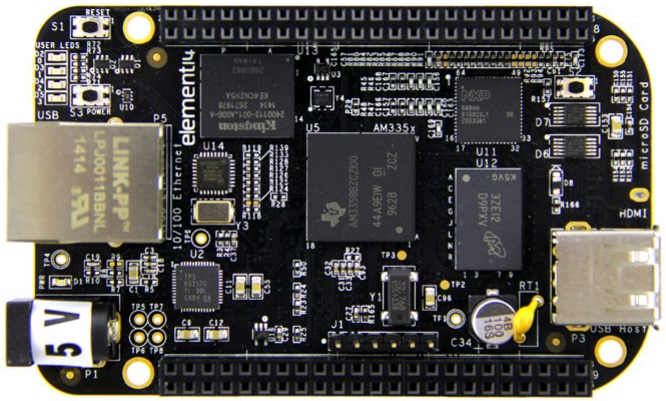

HERA
KAPB
container
fiber


Node
WR NODE
10 MHz
1 PPS
Container
White Rabbit Switch
GPS
1PPS
qsfp switch
to KAPB

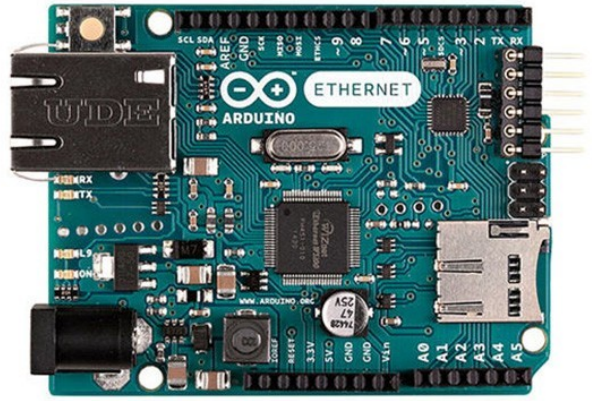
Which microcontroller to use?



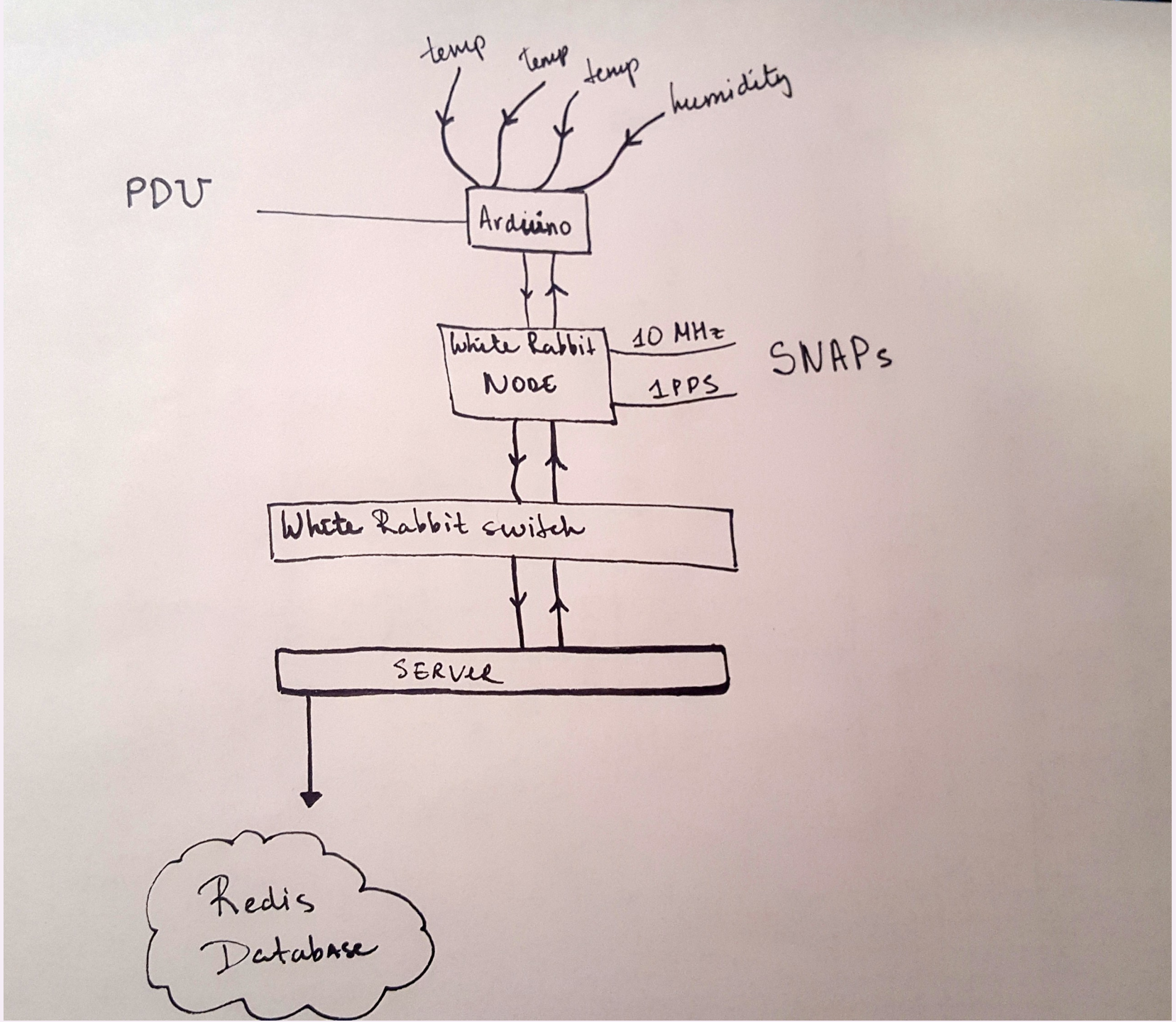
Raspberry Pi

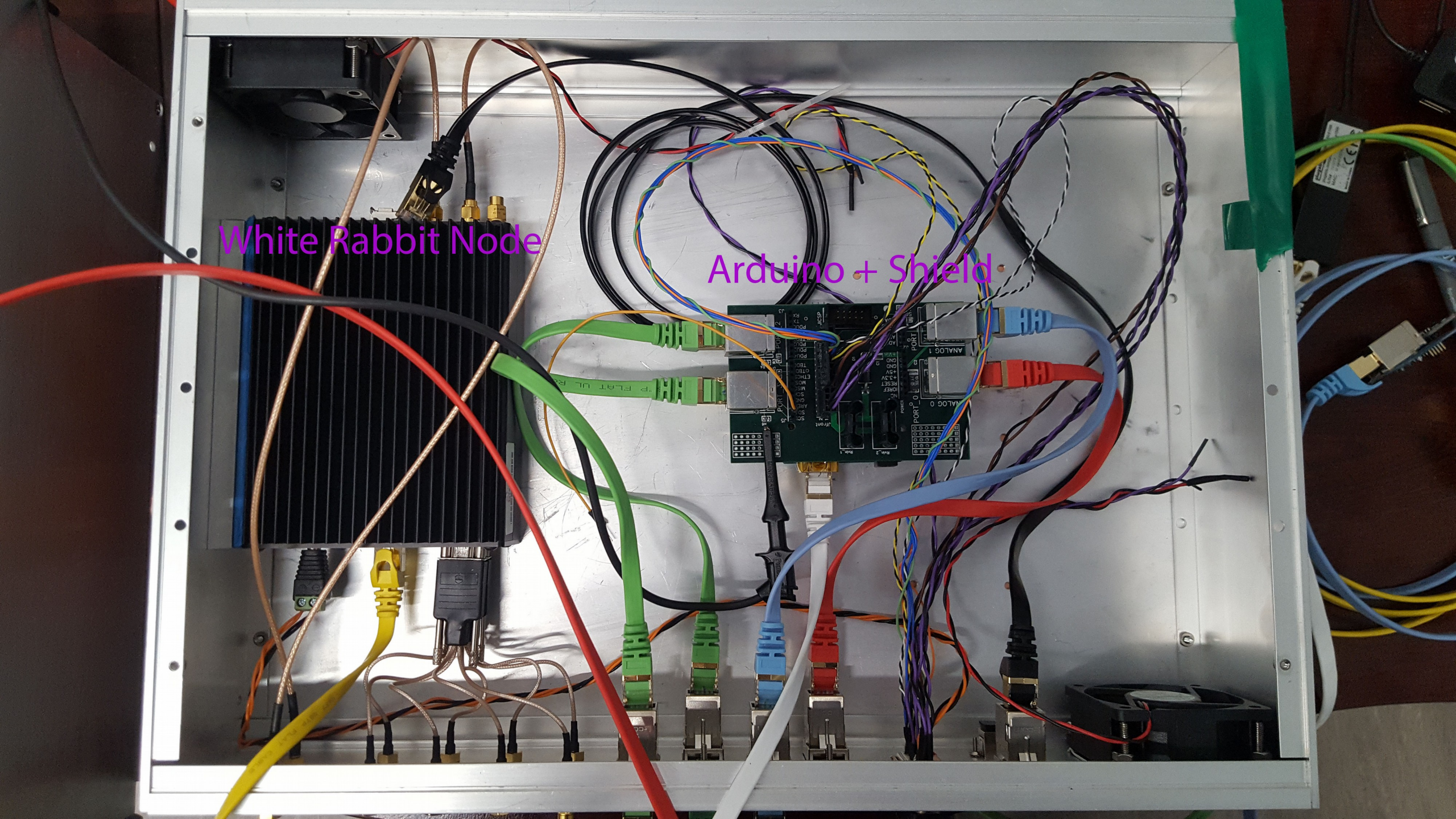


Beaglebone Black



Arduino Ethernet


temp
temp
temp
humidity
PDU
Arduino
White Rabbit
NODE
10 MHz
1PPS
SNAPs
White Rabbit switch
SERVER
Redis
Database


White Rabbit Node
Arduino + Shield

Challenges

- Ability to update software on ~30 Arduinos
- Robust code that doesn’t get stuck
- Ability to reset when things go real bad
- Which node?
- Server has control over Arduino
- Protocols for shut down conditions