

Resonance Testing at different locations

VT 1190

Purpose

My goal is to characterize the resonance of the machine at eight (8) different points.

Then to start selectively breaking my machine and measuring the resonance.

With this I hope to build a database of what the input shaping graphs will look like with different issues.

One can then use this database to diagnose and fix the issue.

Trident 300 – self sourced

XOL, ebb36, revo voron,
chaotic labs cnc ab tensioners, Orbiter 2.0,
tap R8

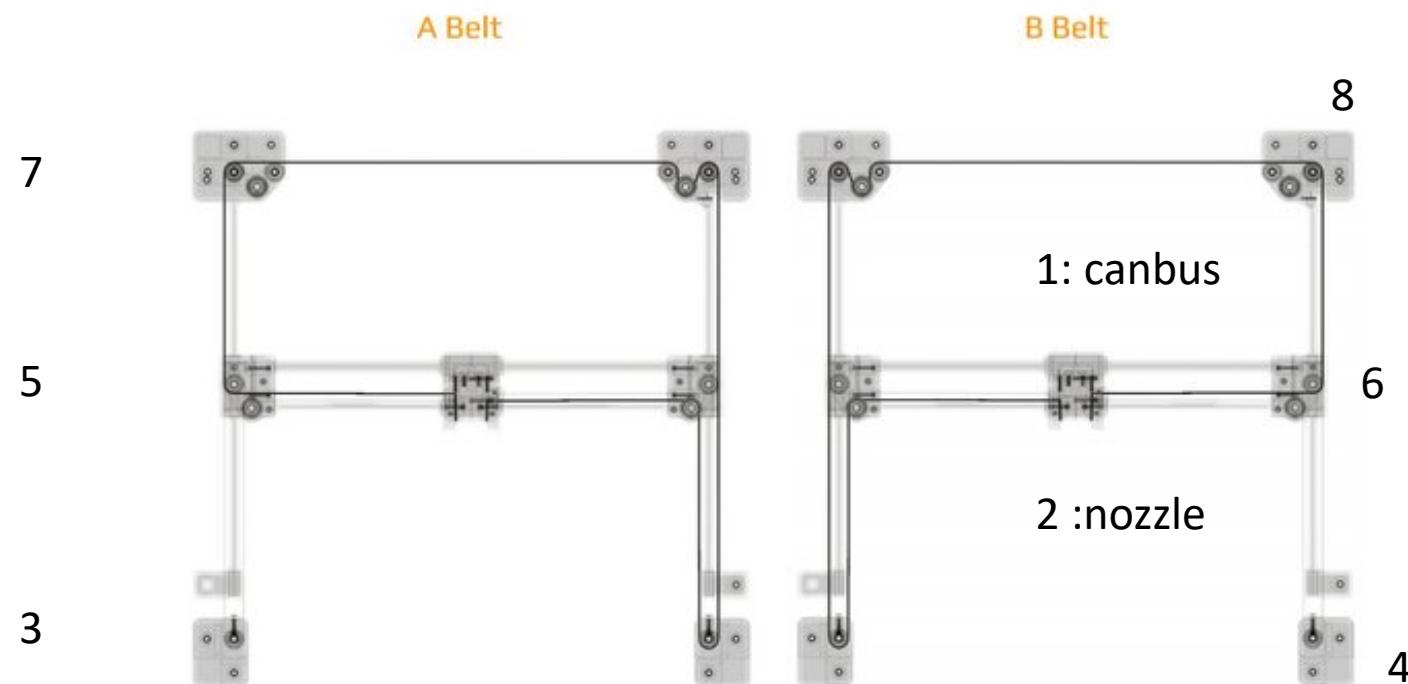


```
#Ebb36# [adxl345]
# cs_pin: ebb36:PB12
# spi_software_sclk_pin: ebb36:PB10
# spi_software_mosi_pin: ebb36:PB11
# spi_software_miso_pin: ebb36:PB2
# #axes_map: x,y,x

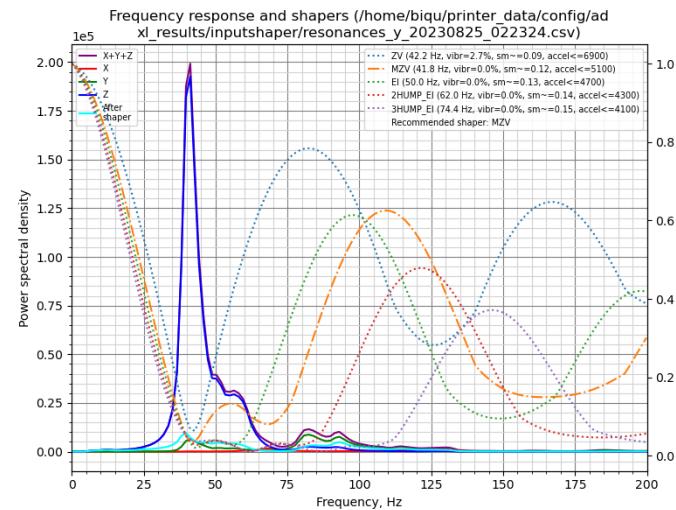
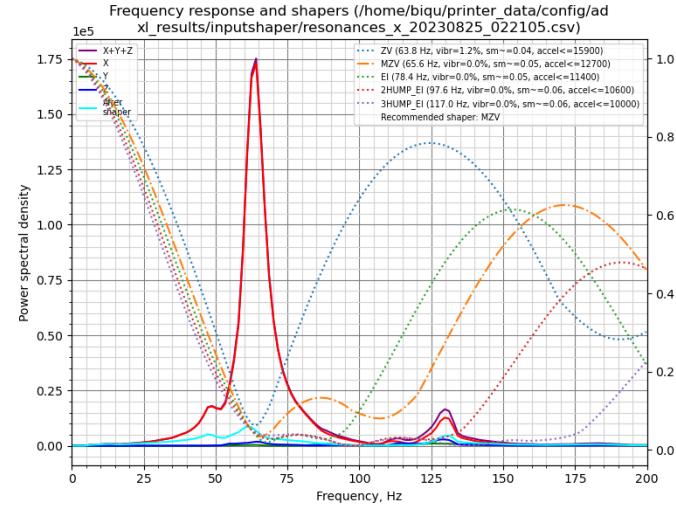
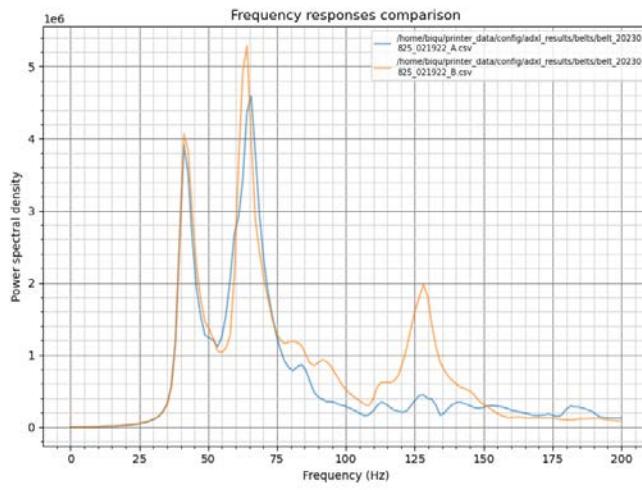
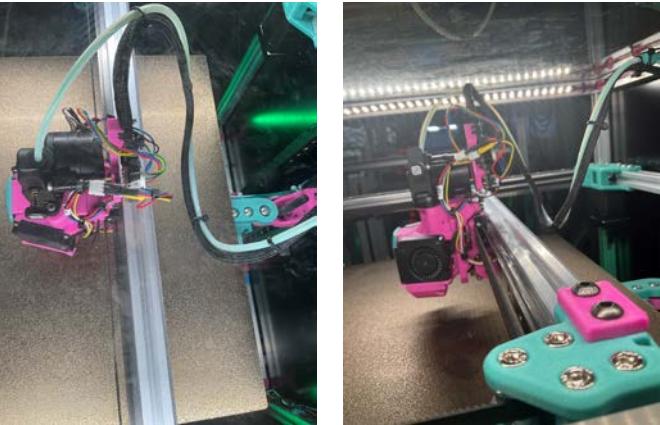
# #Nozzle[mcu ampon]
serial: /dev/serial/by-id/usb-Anchor_Ampon-if00[adxl345]
cs_pin: ampon:CS
#Test
[resonance_tester]
accel_chip: adxl345 probe_points: 175, 175, 20
accel_per_hz: 100

[input_shaper]
shaper_freq_x: 62.8shaper_type_x: mzv
#accel_x: 11,600
shaper_freq_y: 41.2
shaper_type_y: mzv
#accel_y: 5000
```

ADXL locations



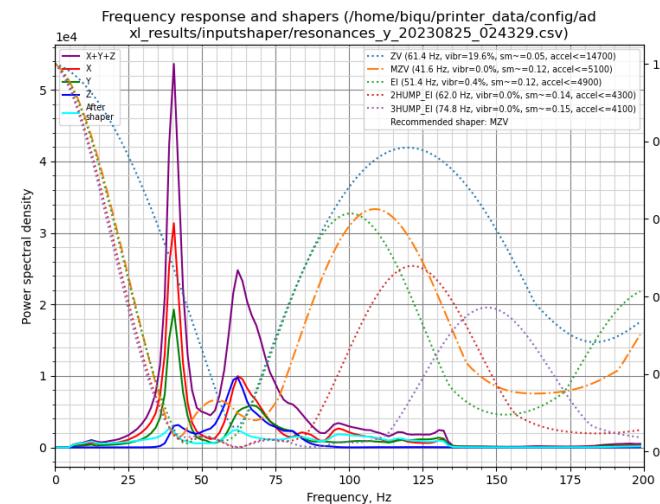
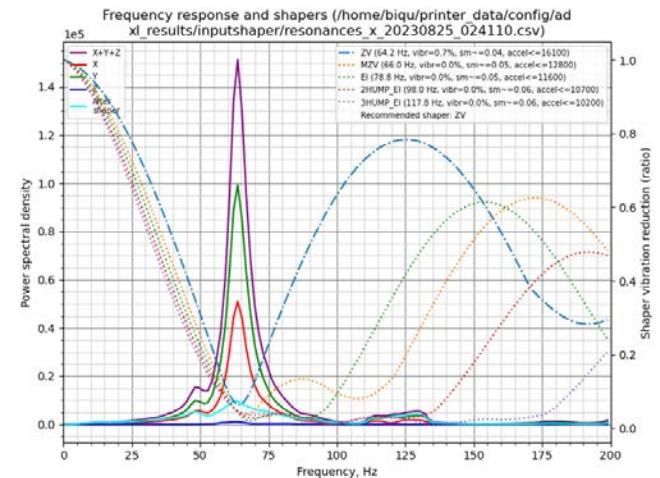
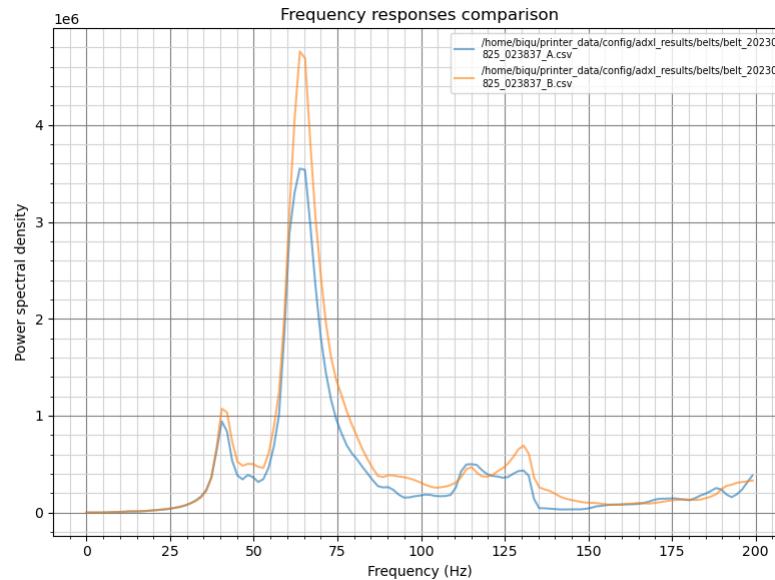
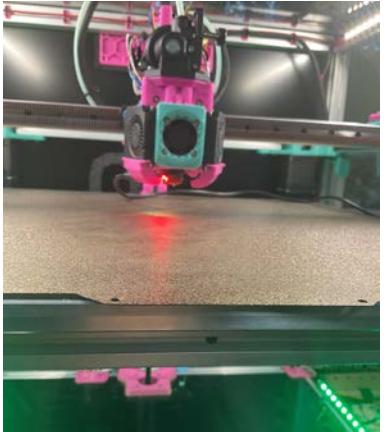
1: EBB36 adxl – canbus boxxy nozzle adxl not connected



2: Boxxy nozzle probe - at nozzle

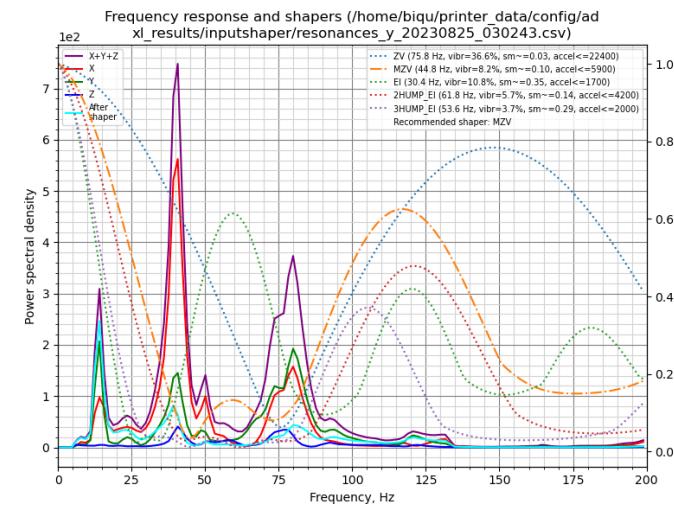
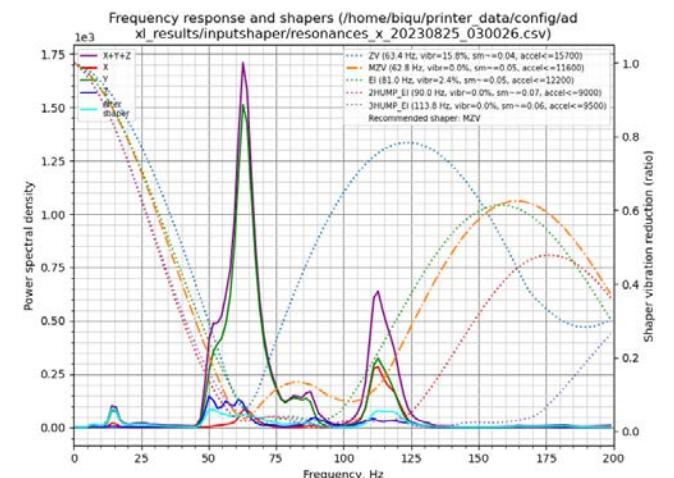
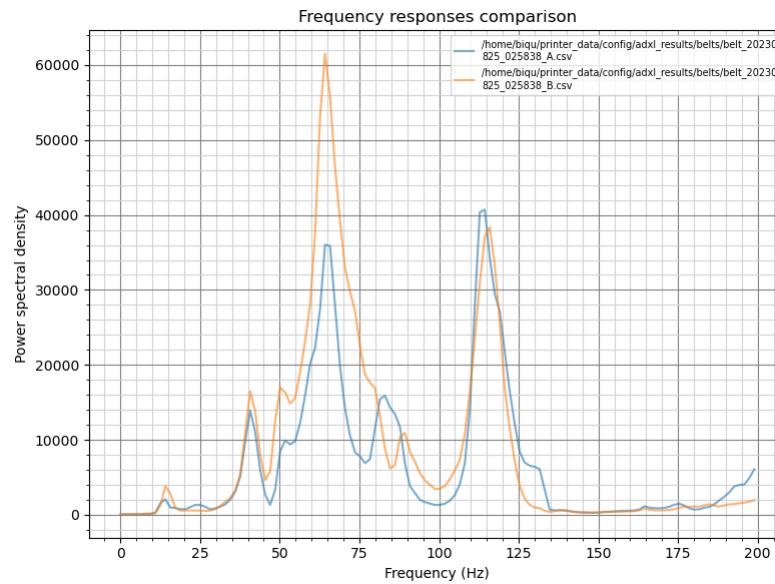
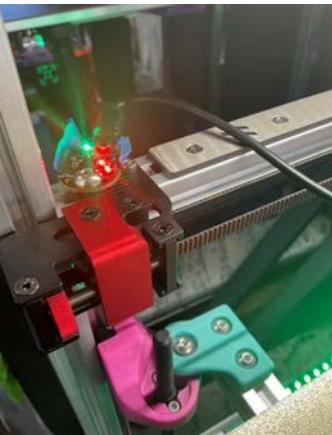
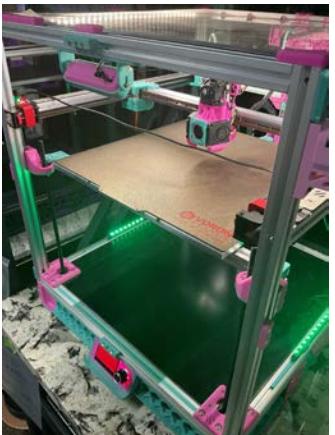
remember -revo voron-

not as good as other nozzles without springs.

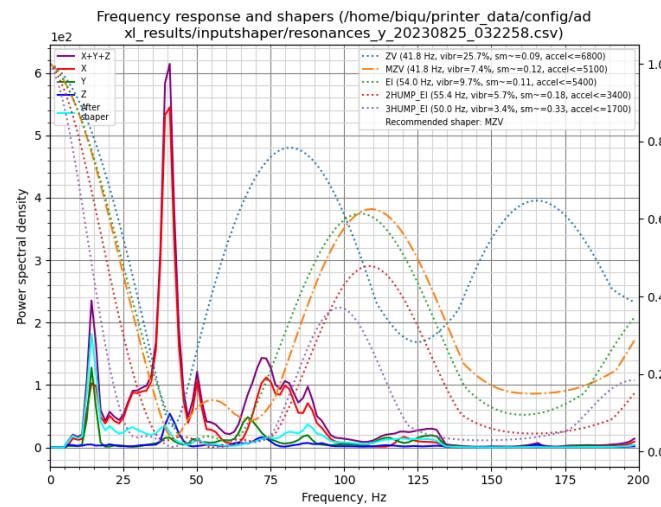
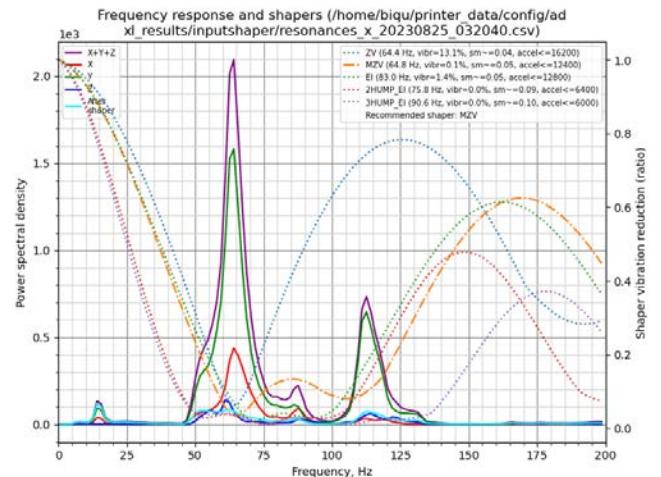
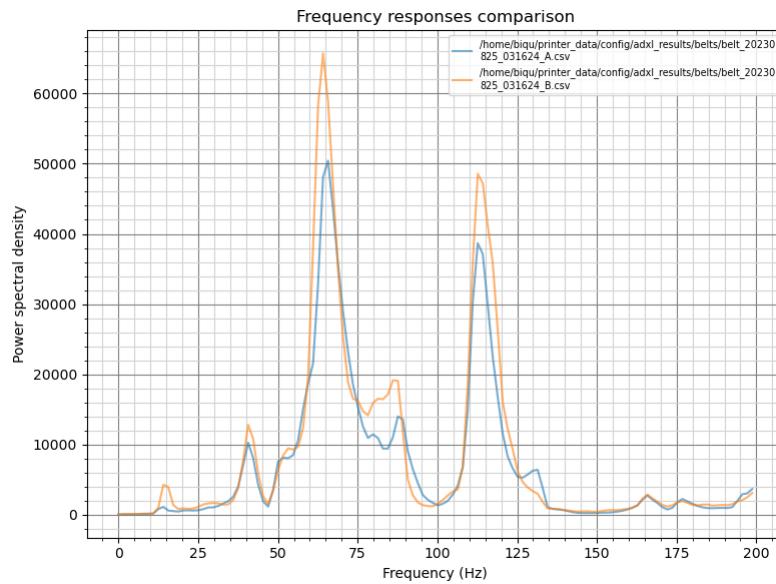


3: Boxxy nozzle probe - front left idler

not ideal cable routing

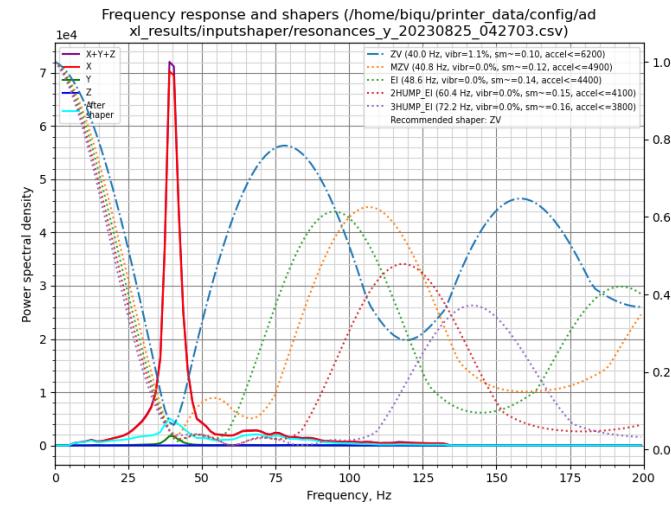
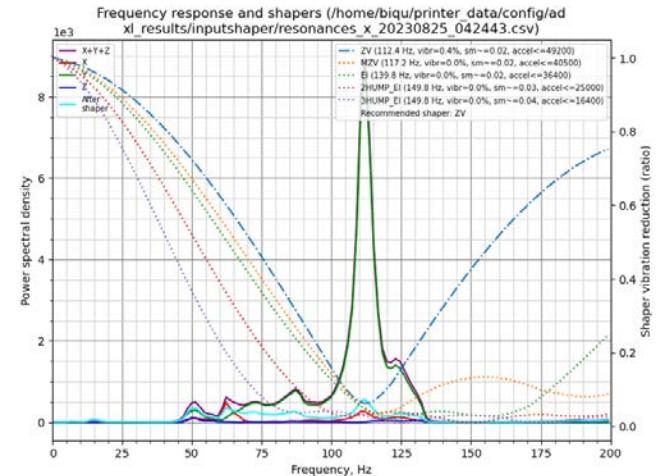
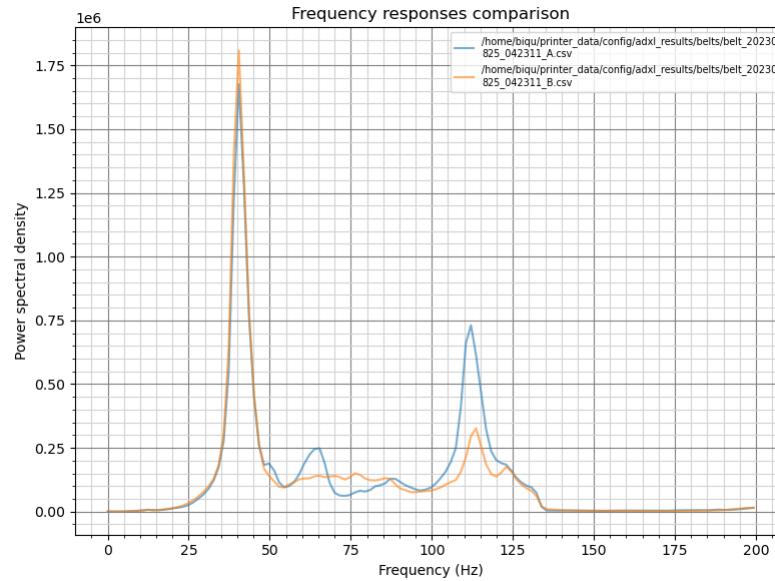


4: Boxxy nozzle probe - front right idler

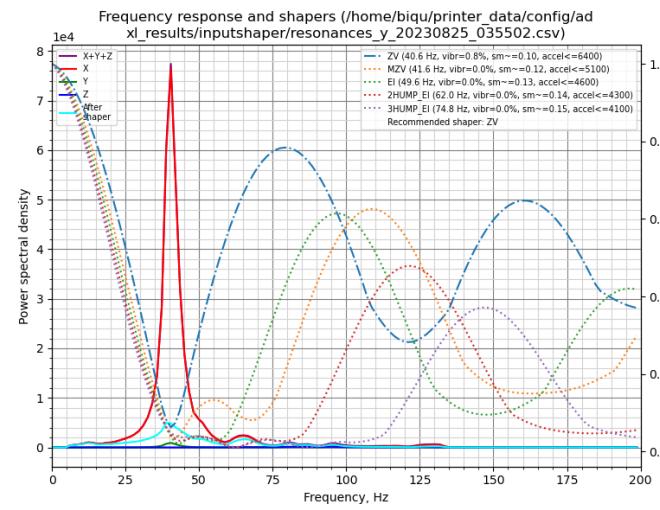
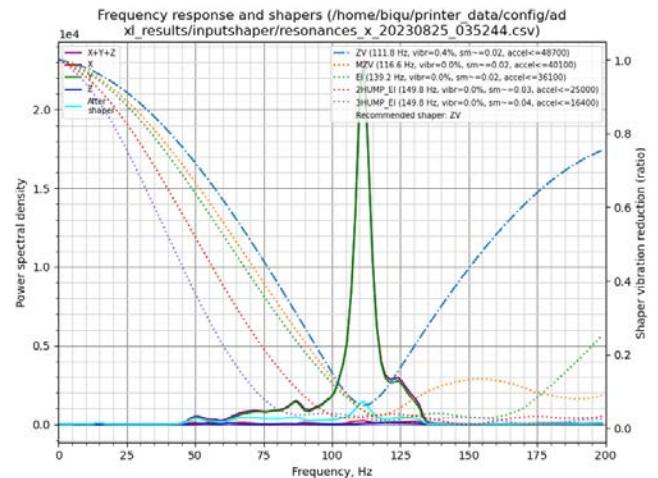
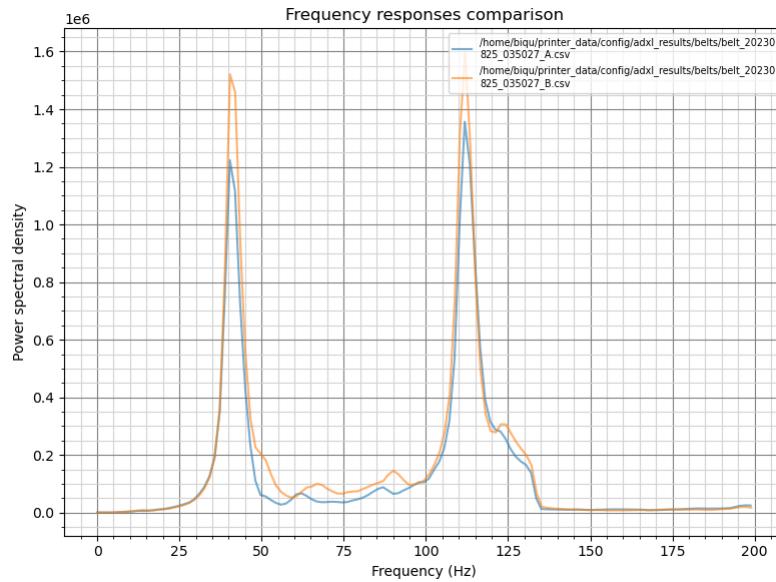
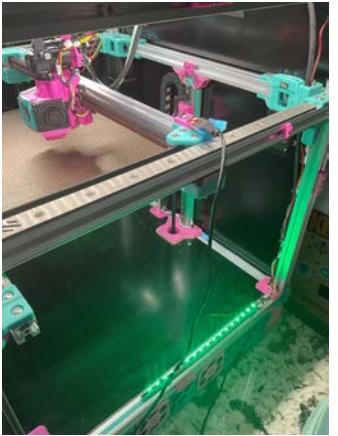


5: Boxy nozzle probe – left xy-joint

note: need to replace m5x10 with an m5x12 in order to screw in nozzle probe

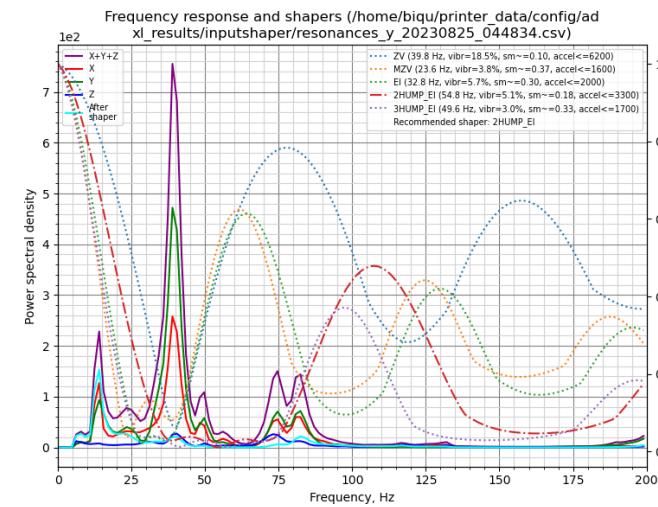
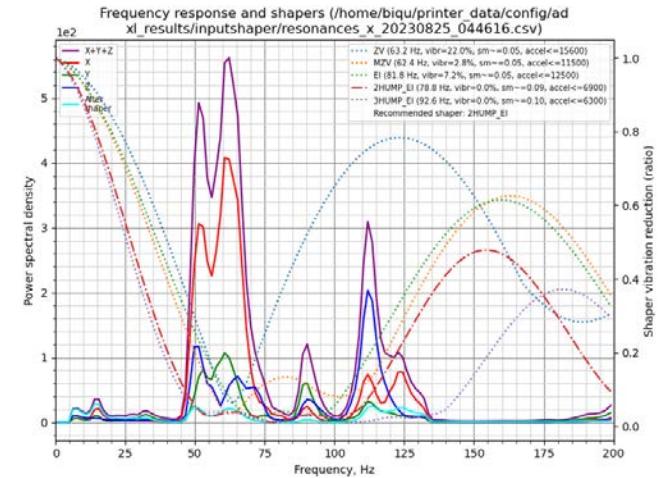
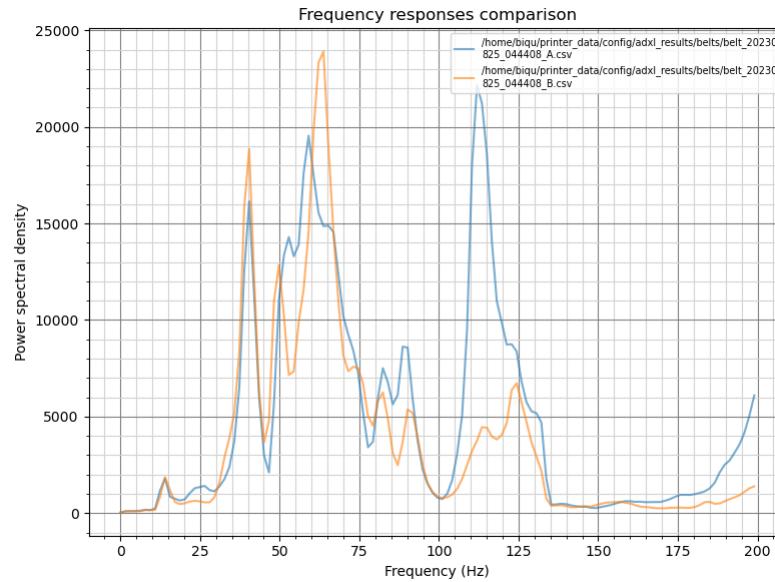
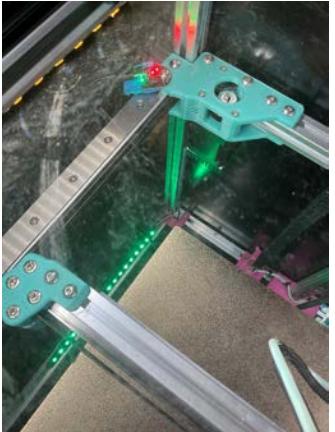


6: Boxxy nozzle probe - right xy-joint



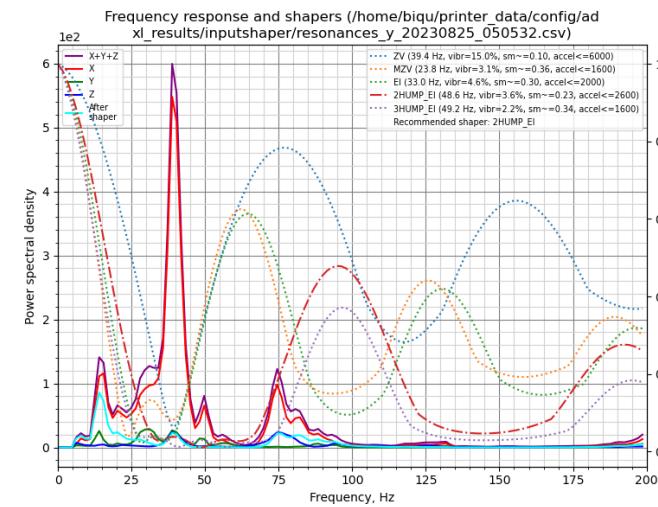
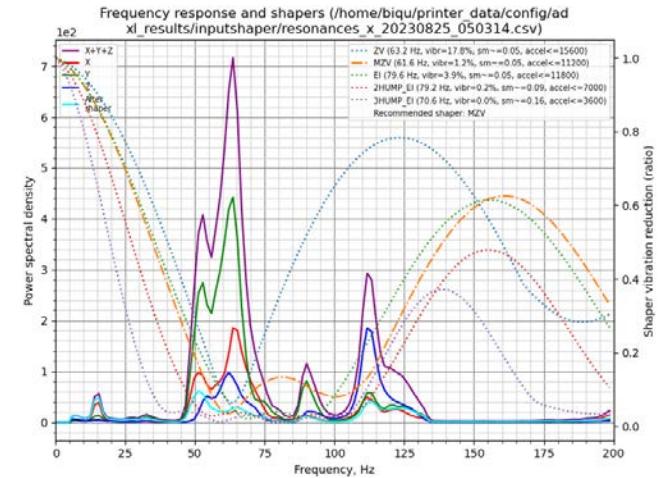
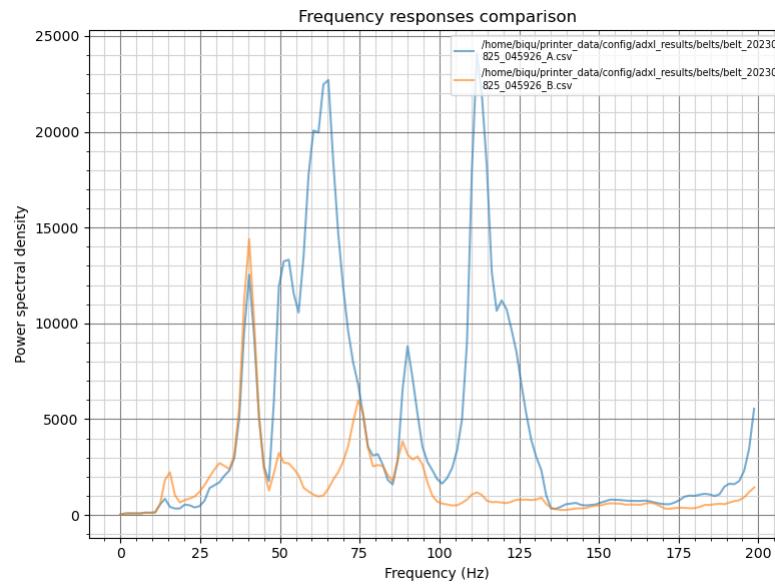
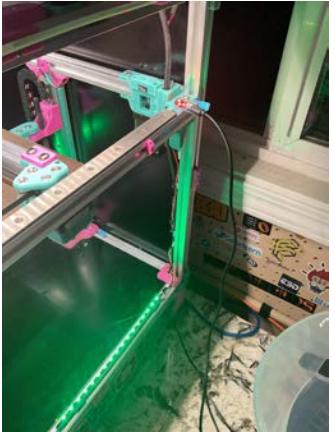
7: Boxy nozzle probe – left rear joint

note: need to replace m5x10 with an m5x12 & washer in order to screw in nozzle probe



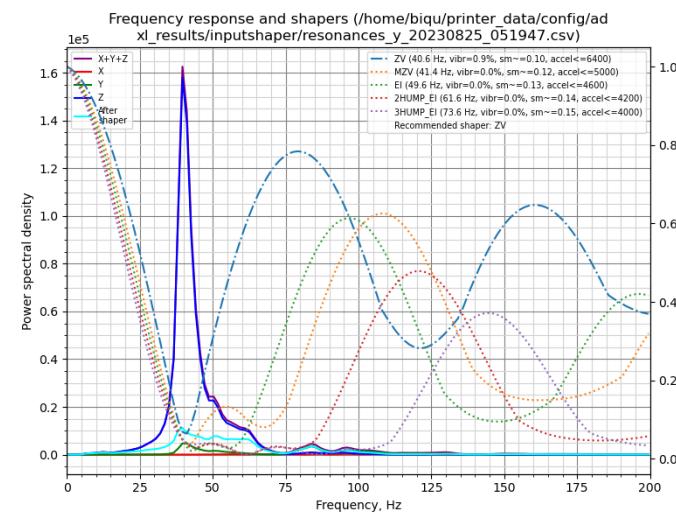
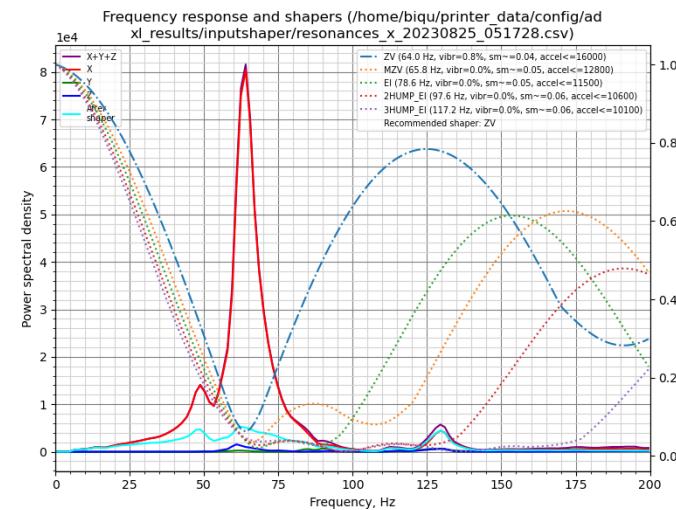
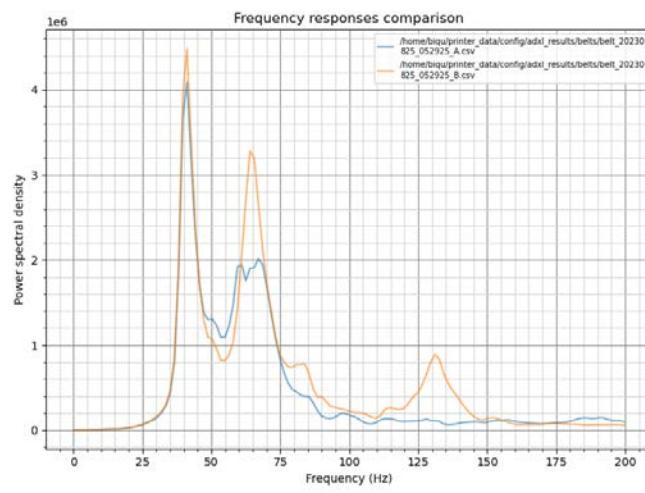
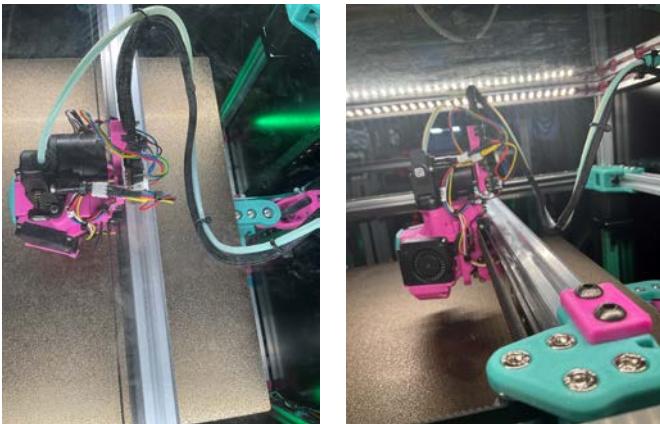
8: Boxy nozzle probe – right rear joint

note: need to replace m5x10 with an m5x12 & washer in order to screw in nozzle probe



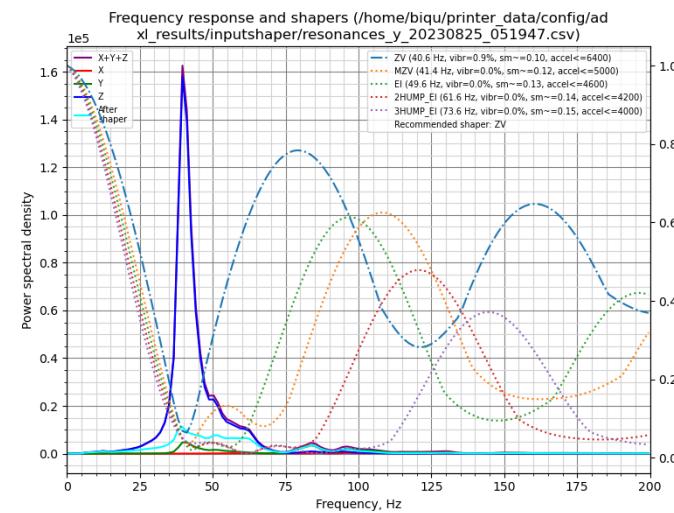
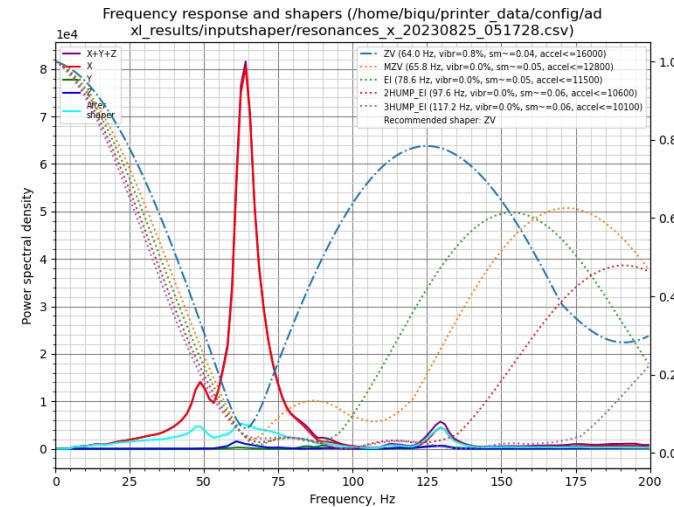
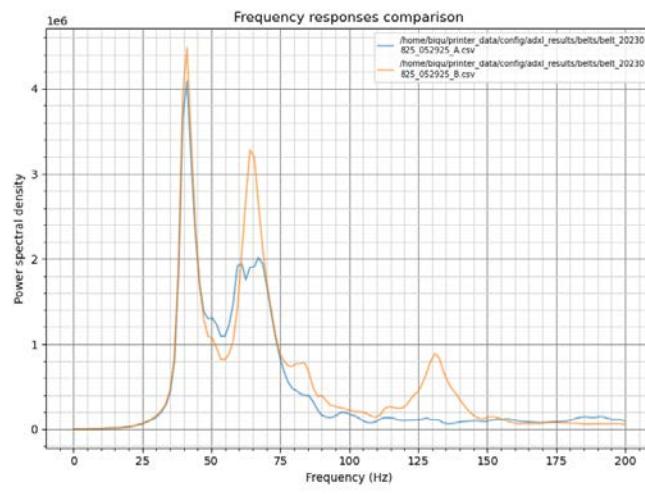
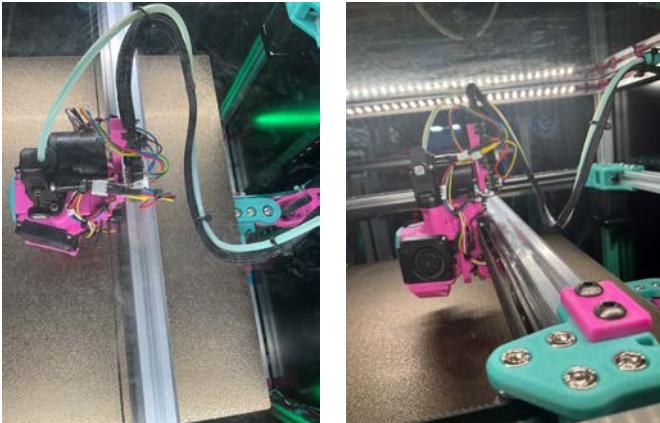
1b: EBB36 adxl – canbus

verification run after all test



1c: EBB36 adxl – canbus

after installing <https://github.com/lhndo/ResHelper>



Resonance Testing using Multiple ADXLs

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How to measure multiple ADXLs at a time

This uses the macros from frix_x

https://github.com/Frix-x/klippain/blob/main/docs/features/is_workflow.md

which are modified as shown to measure multiple adxl5 without restarting klipper

Printer.cfg

```
#####
# Resonance Testing
#####
#Ebb36[adxl345 ebb36th]
cs_pin: ebb36:PB12
spi_software_sclk_pin: ebb36:PB10
spi_software_mosi_pin: ebb36:PB11
spi_software_miso_pin: ebb36:PB2

#Nozzle
[mcu ampon]
serial: /dev/serial/by-id/usb-Anchor_Ampon-if00
[adxl345 rightxy]
cs_pin: ampon:CS

[resonance_tester]
accel_chip: adxl345 ebb36th
probe_points: 175, 175, 20
accel_per_hz: 100
```

multi_adxl_shaper.cfg

MODIFIED FRIX_X IS_SHAPER_CALIBRATE.CFG

```
[gcode_macro MULTI_ADXL_SHAPER]
description: Run standard input shaper test for all axes
gcode:
    {% set verbose = params.VERBOSE|default(true) %}
    {% set min_freq = params.FREQ_START|default(5)|float %}
    {% set max_freq = params.FREQ_END|default(133.3)|float %}
    {% set hz_per_sec = params.HZ_PER_SEC|default(1)|float %}

    TEST_RESONANCES AXIS=X FREQ_START={min_freq} FREQ_END={max_freq} HZ_PER_SEC={hz_per_sec} CHIPS=rightxy
    M400
    TEST_RESONANCES AXIS=Y FREQ_START={min_freq} FREQ_END={max_freq} HZ_PER_SEC={hz_per_sec} CHIPS=rightxy
    M400

    {% if verbose %}
        RESPOND MSG="Graphs generation... Please wait a minute or two and look in the configured folder."
    {% endif %}
    RUN_SHELL_COMMAND CMD=plot_graph PARAMS=SHAPER

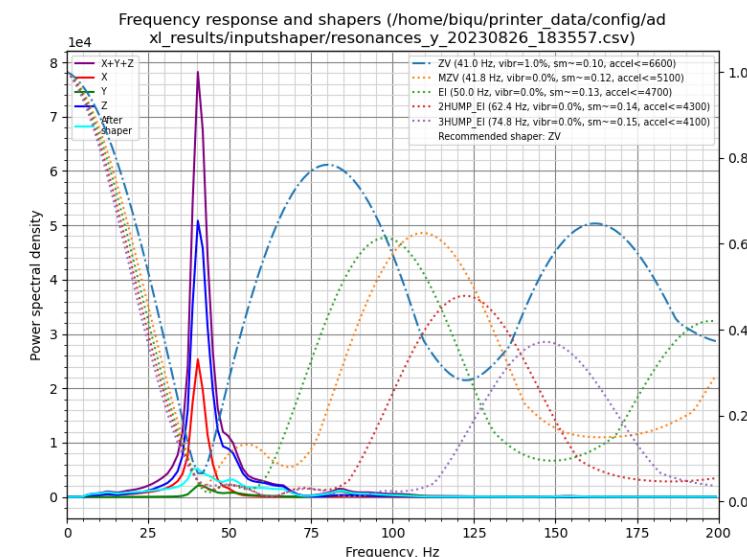
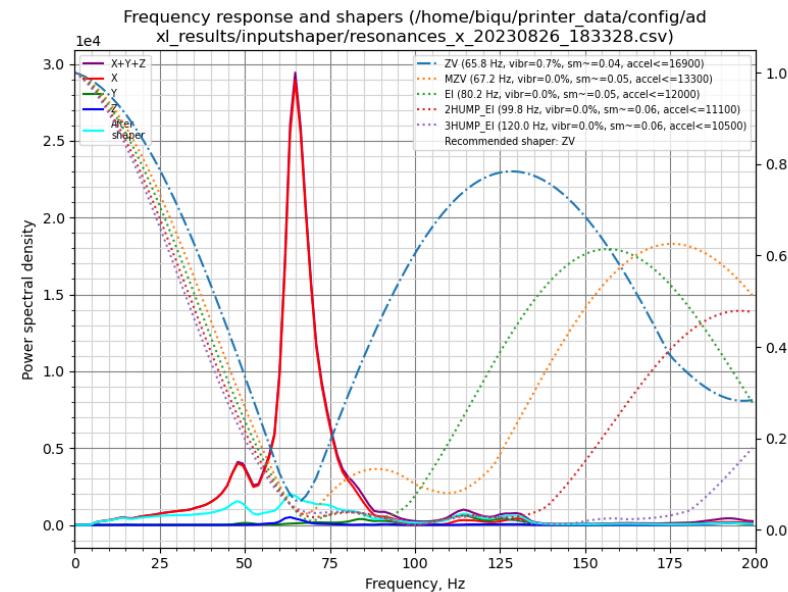
    TEST_RESONANCES AXIS=X FREQ_START={min_freq} FREQ_END={max_freq} HZ_PER_SEC={hz_per_sec}
    CHIPS=ebb36th
    M400
    TEST_RESONANCES AXIS=Y FREQ_START={min_freq} FREQ_END={max_freq} HZ_PER_SEC={hz_per_sec} CHIPS=ebb36th
    M400

    {% if verbose %}
        RESPOND MSG="Graphs generation... Please wait a minute or two and look in the configured folder."
    {% endif %}
    RUN_SHELL_COMMAND CMD=plot_graph PARAMS=SHAPER
```

TEST RESULTS FROM MULTI-ADXL:

run all at same time

- Running multiple ADXLs at the same time using current klipper's built-in TEST_RESONANCE to gather all the data from both ADXLs at once does not work.
- It appears to combine the x and y input shaper graphs for the multiple ADXLs instead of producing separate graphs
- However, this could be due to the Frix_x macros.
- More investigation of this needs to happen.



How to measure multiple ADXLs at the same time

Printer.cfg

```
#####
# Resonance Testing
#####
#Ebb36[adxl345 ebb36th]
cs_pin: ebb36:PB12
spi_software_sclk_pin: ebb36:PB10
spi_software_mosi_pin: ebb36:PB11
spi_software_miso_pin: ebb36:PB2

#Nozzle
[mcu ampon]
serial: /dev/serial/by-id/usb-Anchor_Ampon-if00
[adxl345 rightxy]
cs_pin: ampon:CS

[resonance_tester]
accel_chip: adxl345 ebb36th
probe_points: 175, 175, 20
accel_per_hz: 100
```

```
[gcode_macro MULTI_ADXL_SHAPER]
description: Run standard input shaper test for all axes
gcode:
    {% set verbose = params.VERBOSE|default(true) %}
    {% set min_freq = params.FREQ_START|default(5)|float %}
    {% set max_freq = params.FREQ_END|default(133.3)|float %}
    {% set hz_per_sec = params.HZ_PER_SEC|default(1)|float %}

        TEST_RESONANCES AXIS=X FREQ_START={min_freq} FREQ_END={max_freq}
        HZ_PER_SEC={hz_per_sec} CHIPS=rightxy,ebb36th
        M400
        TEST_RESONANCES AXIS=Y FREQ_START={min_freq} FREQ_END={max_freq}
        HZ_PER_SEC={hz_per_sec} CHIPS=rightxy,ebb36th
        M400

    {% if verbose %}
        RESPOND MSG="Graphs generation... Please wait a minute or two and look in the
        configured folder."
    {% endif %}
    RUN_SHELL_COMMAND CMD=plot_graph PARAMS=SHAPER
```

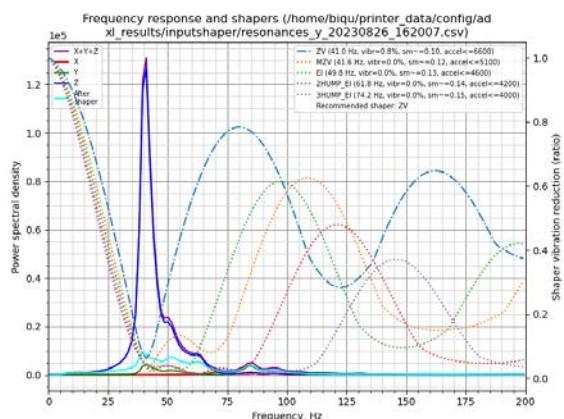
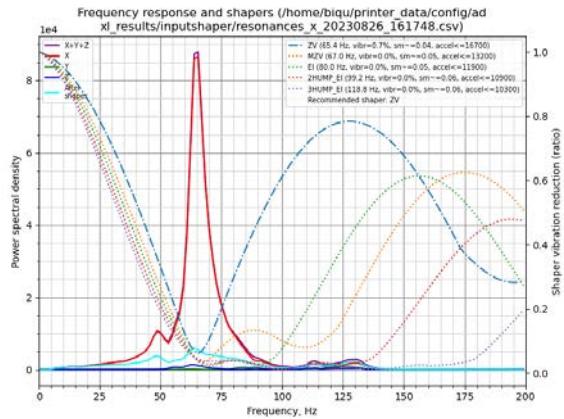
TEST RESULTS FROM MULTI-ADXL:

run at same time

From toolhead:

ADXL=ebbth

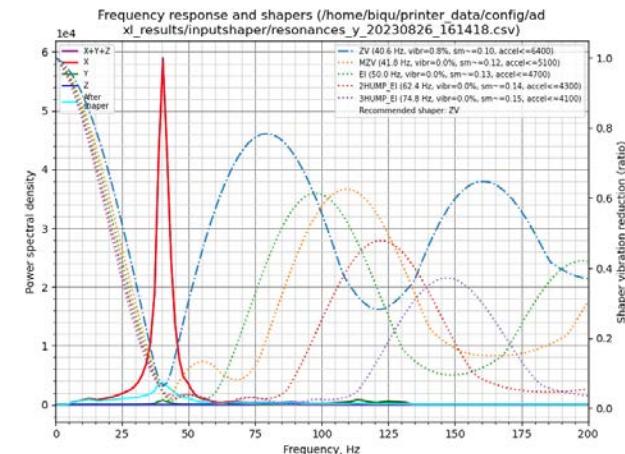
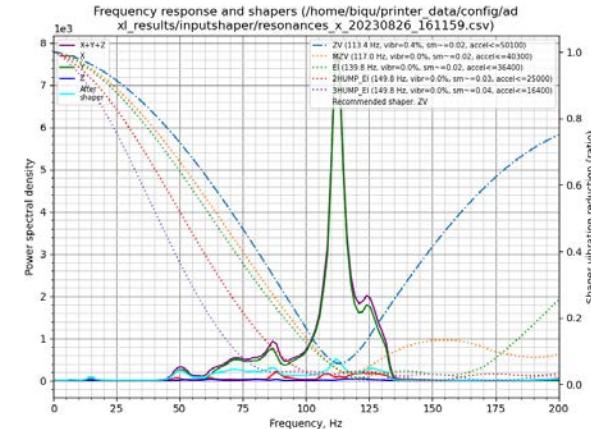
ebb36



- It is possible to measure resonance from multiple ADXL's
- All adxl's must be defined in printer.cfg, but only one defined in [resonance_testor]
- When you call the built-in macro TEST_RESONANCE you define which ADXL you want to use by adding CHIPS=<ADXL_name>

From right xy joint:

Adxl=rightxy (boxxy nozzle probe)



What does this ability potentially give us

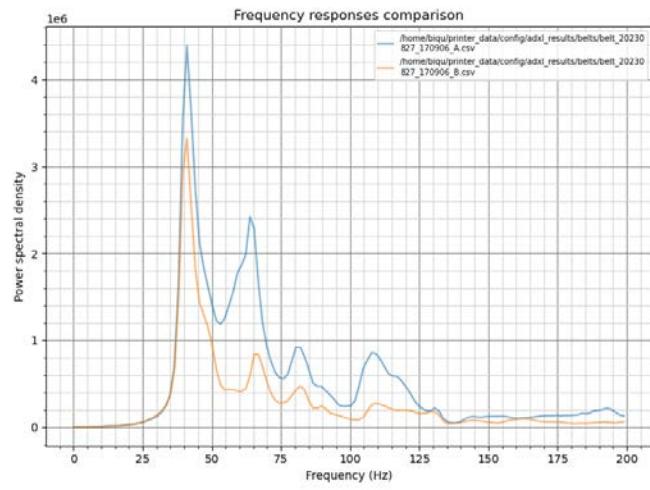
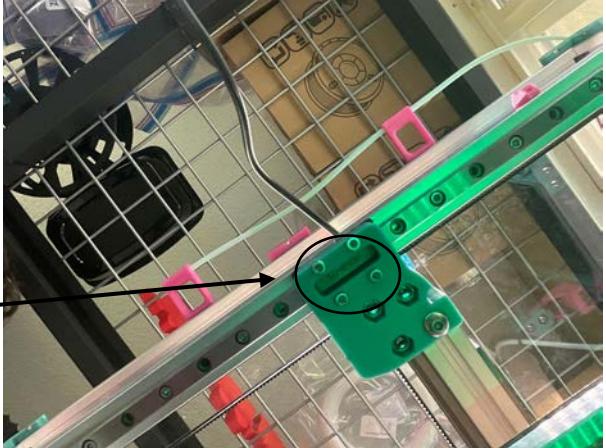
- By having the ability to have multiple ADXLs wired at the same time at different points of the machine (left xy-joint, right xy-joint, and toolhead) we have at least the ability to try and determine mechanical problems/issue in the printer
- This ability will allow one to strategically break the machine, at different points and determine where in the general area the mechanical issue is
- The XY-joints were chosen because of their unique input shaper graphs due to the xy-joints being the connection between the y-axis and x-axis.

Breaking the machine to
check graphs

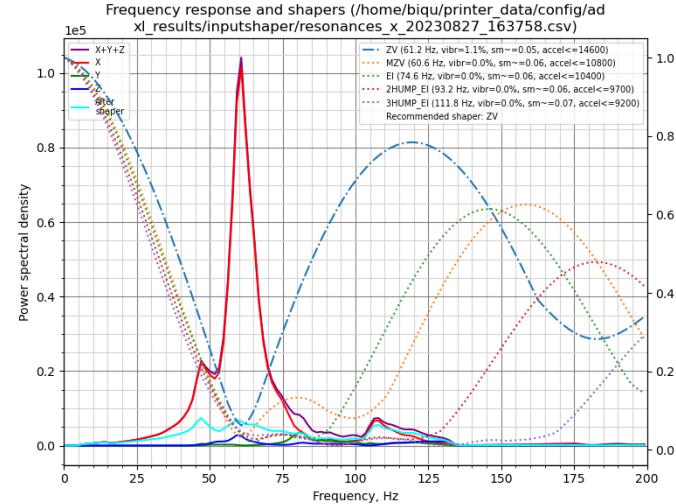
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EBB36 adxl: loose xy-joint to y-carriage

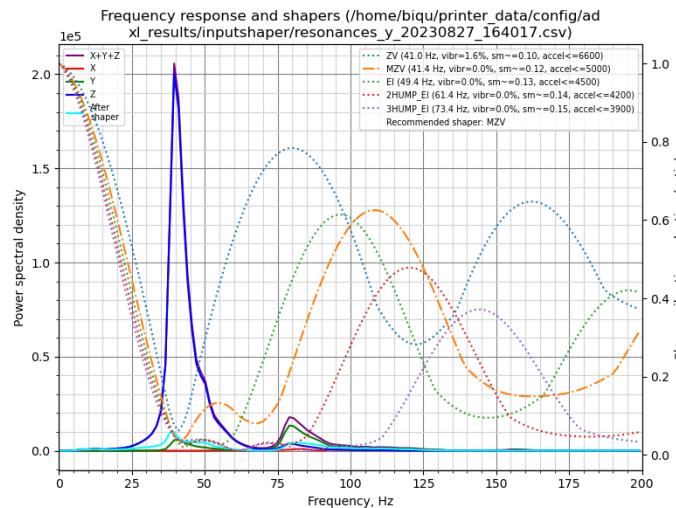
loosened the four screws holding the right xy-joint to the right linear rail (note one screw fell out during the test)



Note belts:
It looks like
vibrations of b-
belt drastically
reduced while
A-belt stayed
the same

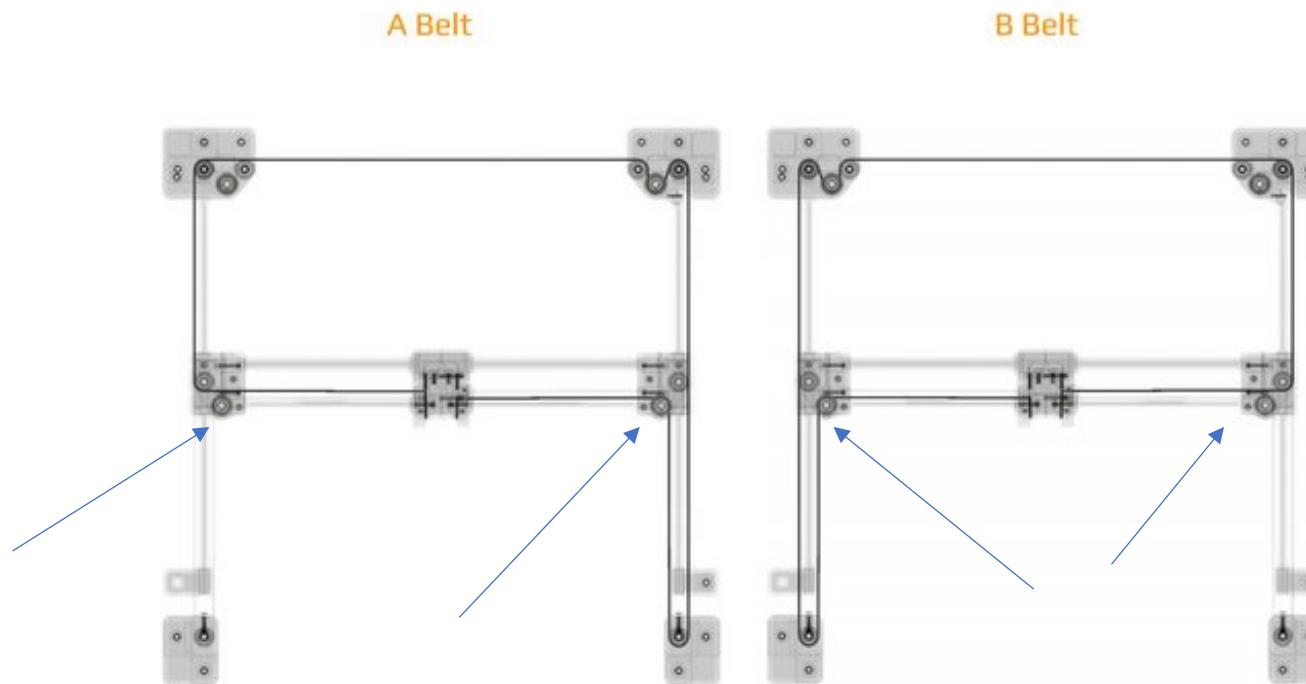


Note x-axis:
It looks like x-
axis gets a fin
starting around
100hz to 135hz



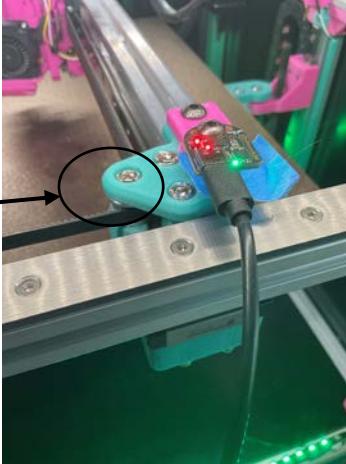
Note y-axis:
It looks like the y-axis
gets a bump around
80hz

Tightening the XY-Joint pulleys

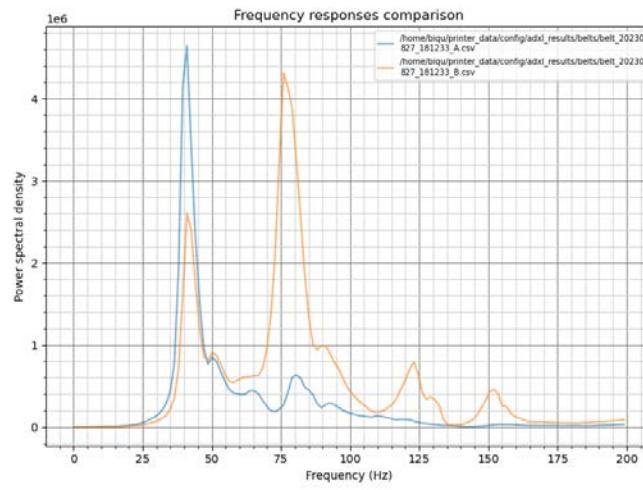


EBB36 adxl: - tight single xy-joint pulley

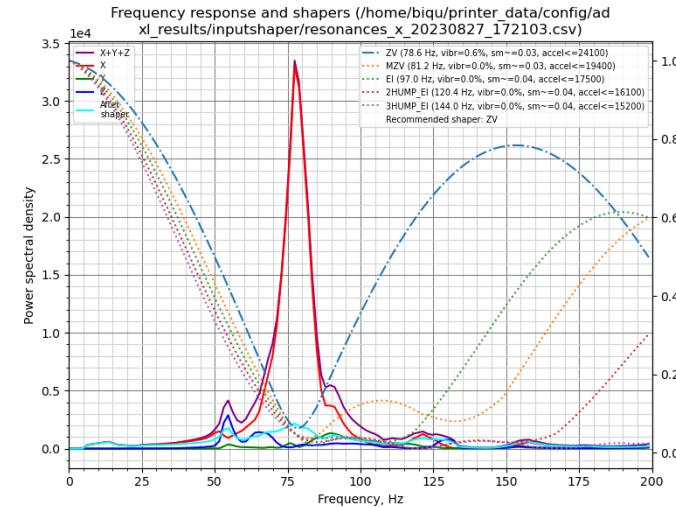
over-tightened the right xy-joint pulley for A-belt.
Tightened all the way then backed out $\frac{1}{4}$ turn



Note belts:
It looks like a-belt dropped around 75hz (lost the 2nd peak, and b-belt dropped around 40hz

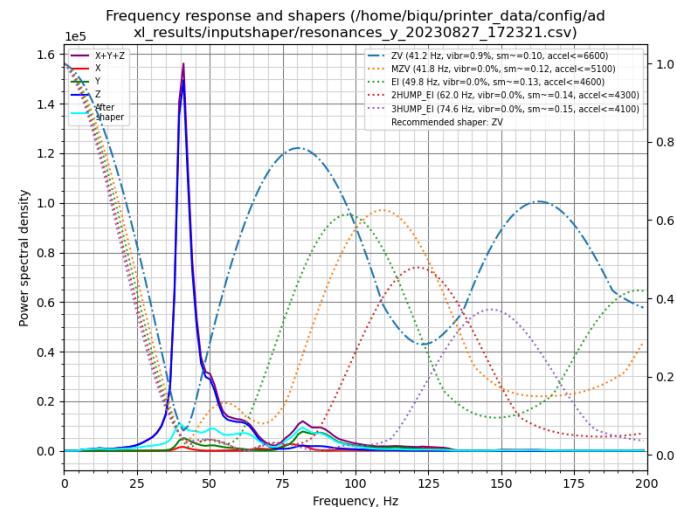


Question: am I not tightening my pulleys tight enough?



Note x-axis:
It looks like x-axis shifted from 65hz to 81hz

It looks like this pulley affects x-axis



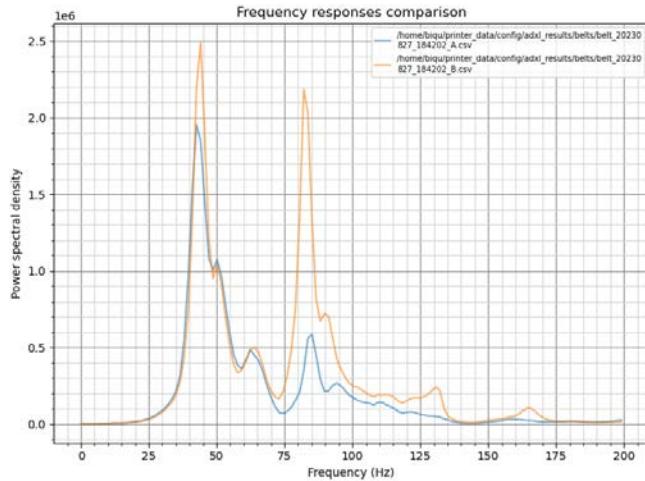
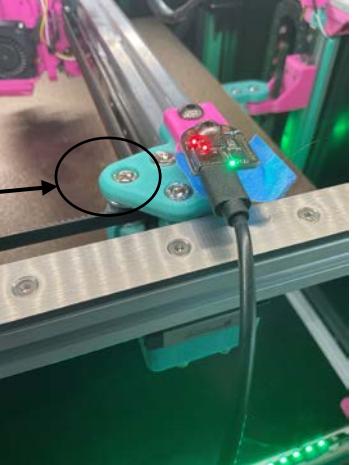
Note y-axis:
Looks about the same

EBB36 adxl: tight both xy-joint pulleys

over-tightened the left and right xy-joint pulley for A-belt.

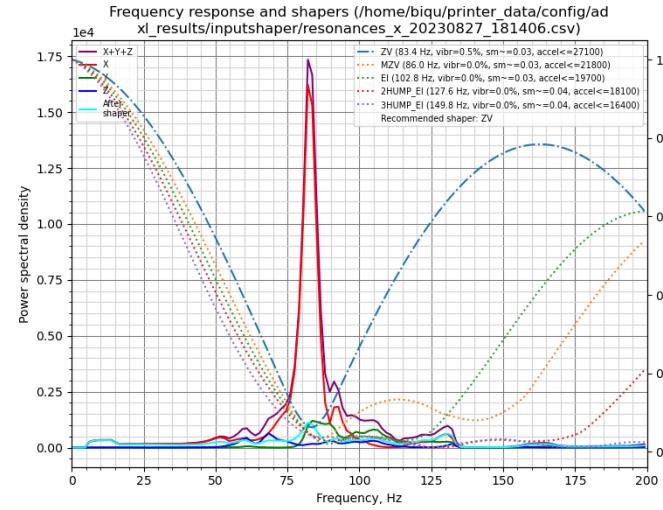
Tightened all the way then backed out $\frac{1}{4}$ turn
going to leave the pulleys as the graphs look better

Same bolt on
both sides
was
overtightened



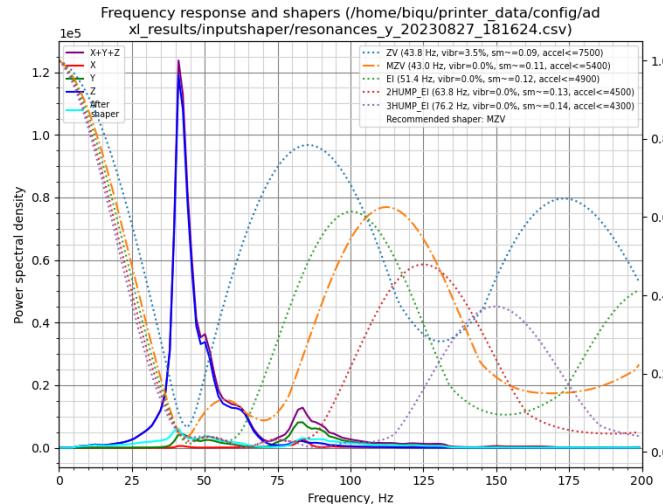
Note belts:
It looks like b-
belt increased.

Question: am I
not tightening
my pulleys tight
enough?



Note x-axis:
It looks like x-
axis shifted from
65hz to 86hz

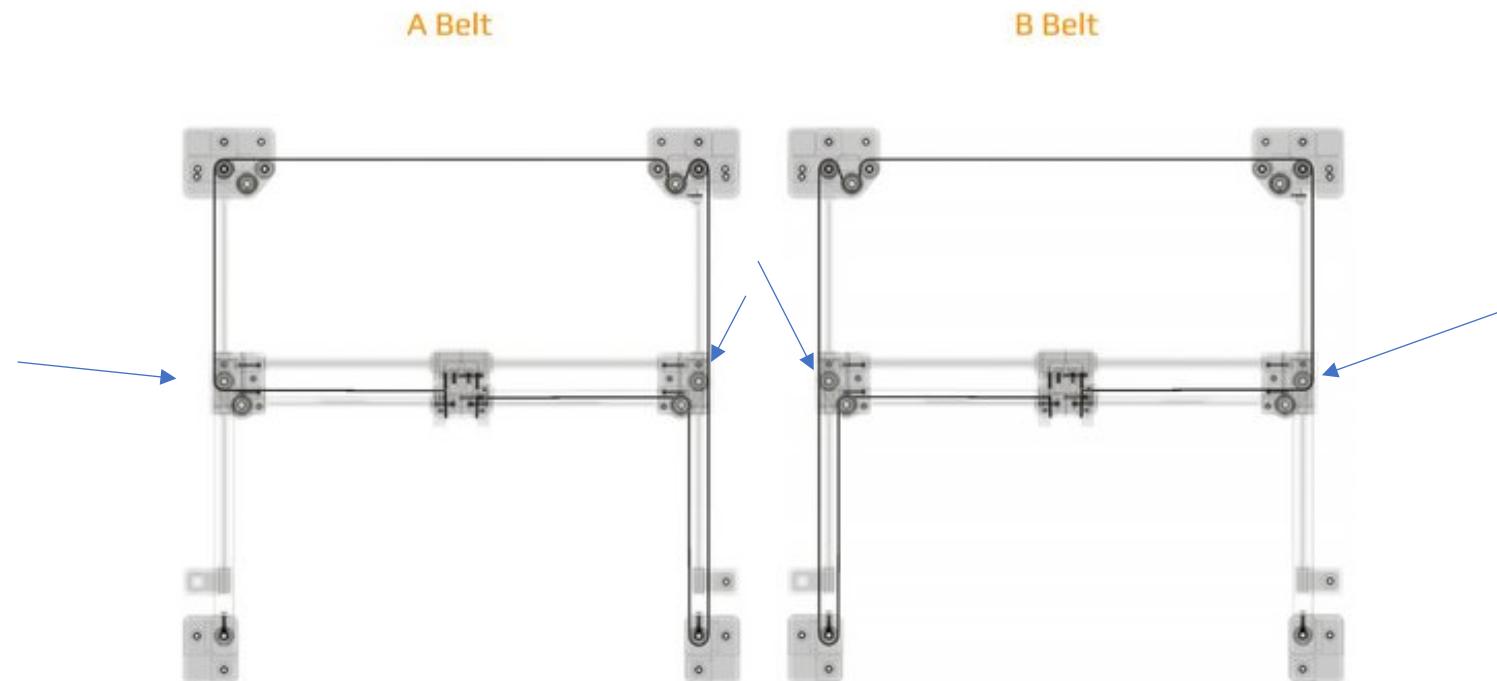
It looks like
these pulleys
affects x-axis



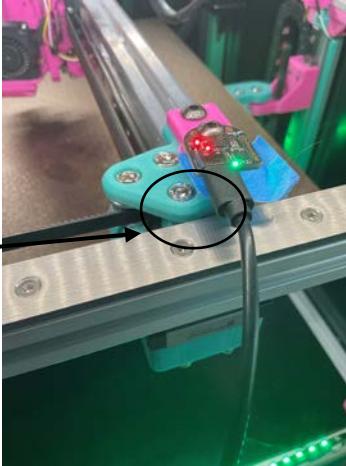
Note y-axis:
Looks about the same,
however appears to be
developing a hump
around 80hz.

Note accel for both x
and y increased.

Tighten the XY-Joint bearings

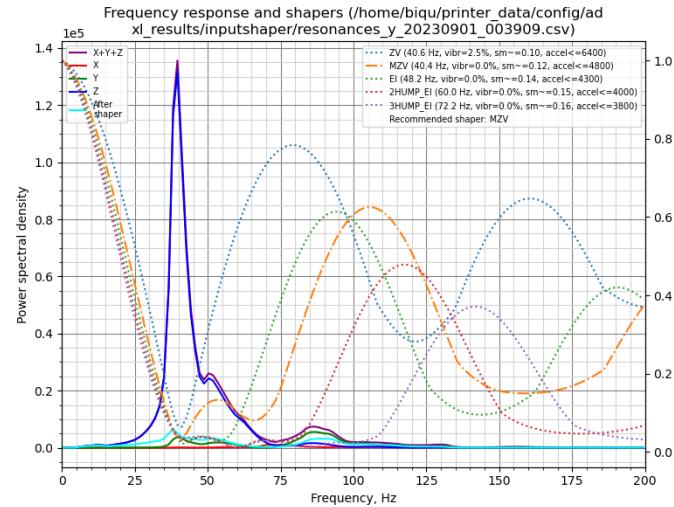
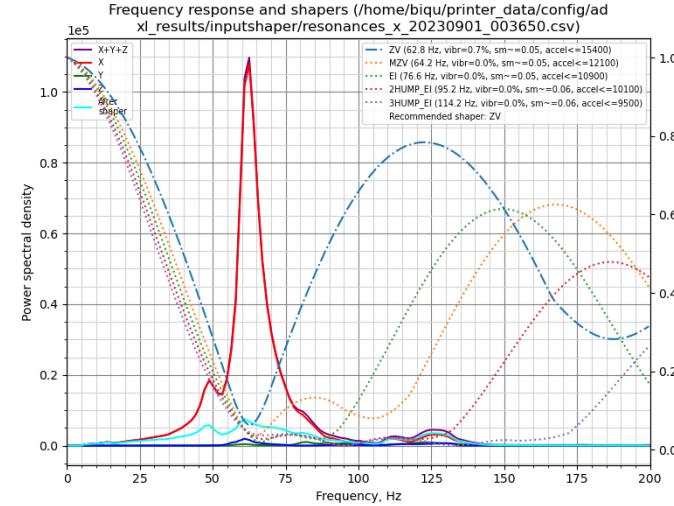
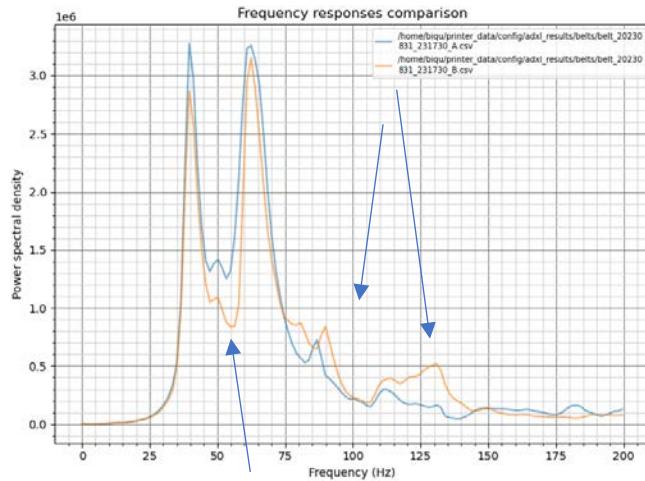


EBB36 adxl: tight single xy-joint bearing over-tightened the right xy-joint pulley for A-belt.



Tightening a single xy-joint bearing appears to create two peaks

And, the middle between the peaks is up



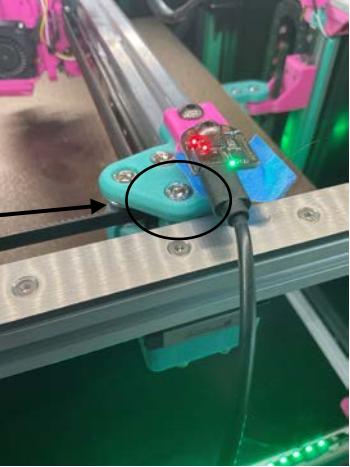
Note x-axis:
Looks the same,
peak went down
in freq

Note y-axis:
Looks about the same,
peaked went down in
freq

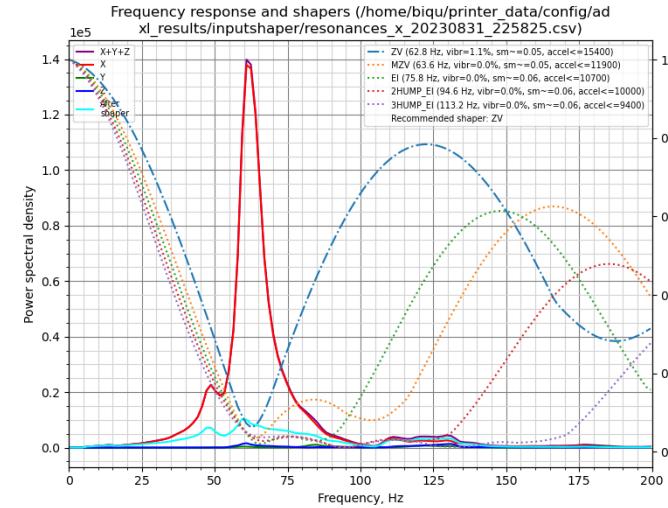
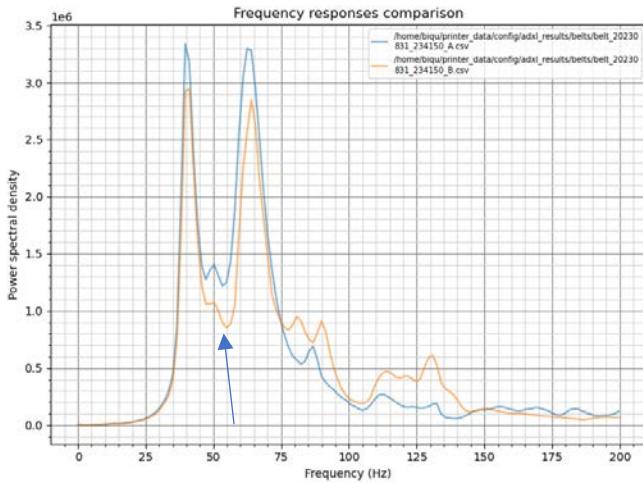
EBB36 adxl: tight both xy-joint bearings

over-tightened the left and right xy-joint pulley for A-belt.

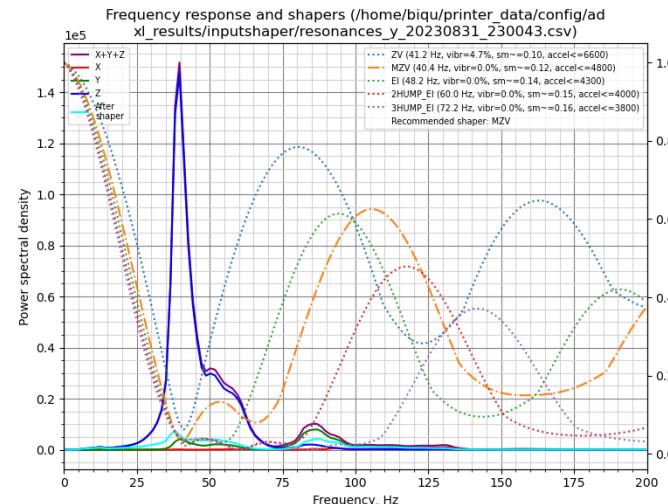
Same bolt on
both sides
was
overtightened



The middle
between the
peaks was
raised up

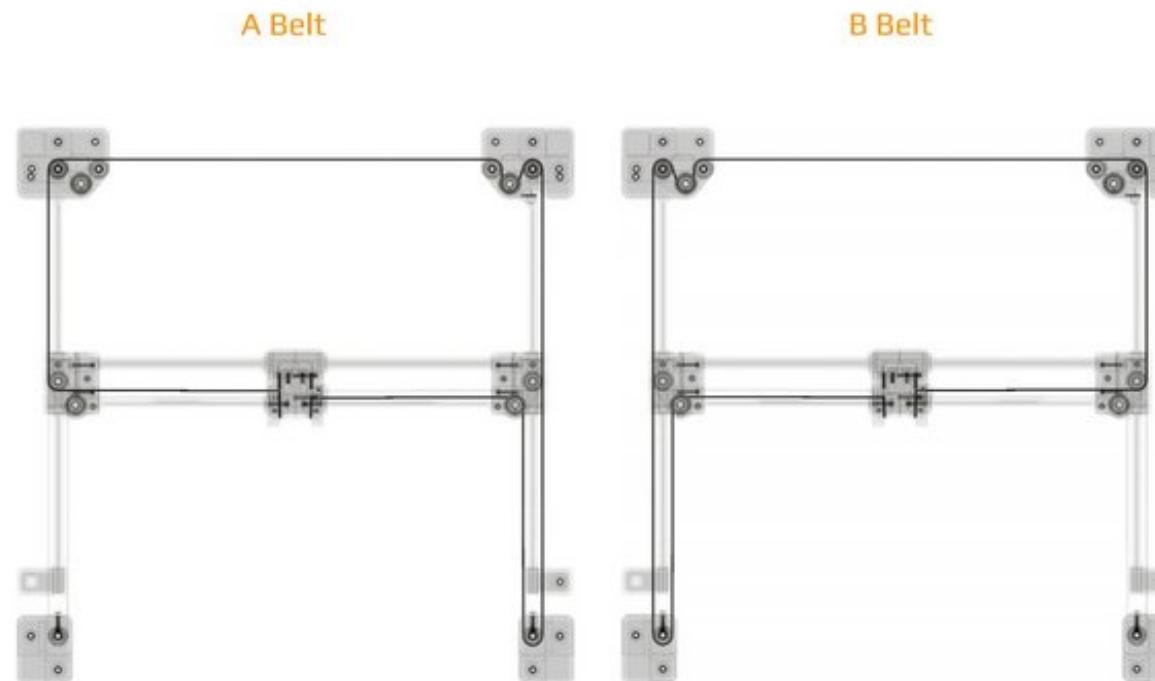


X-axis looks
about the same



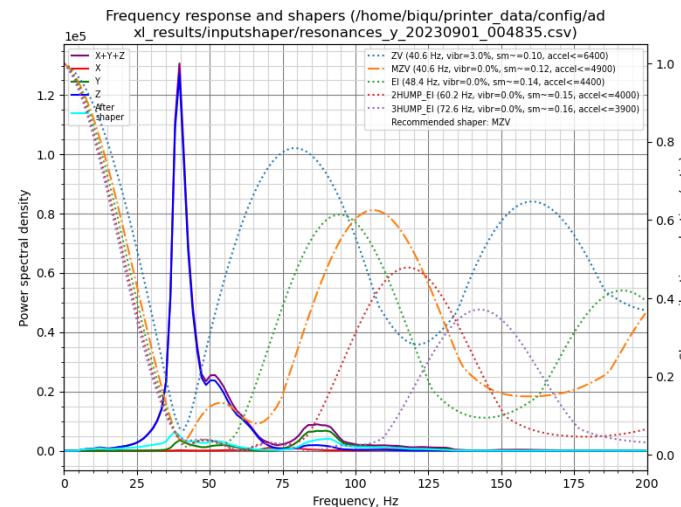
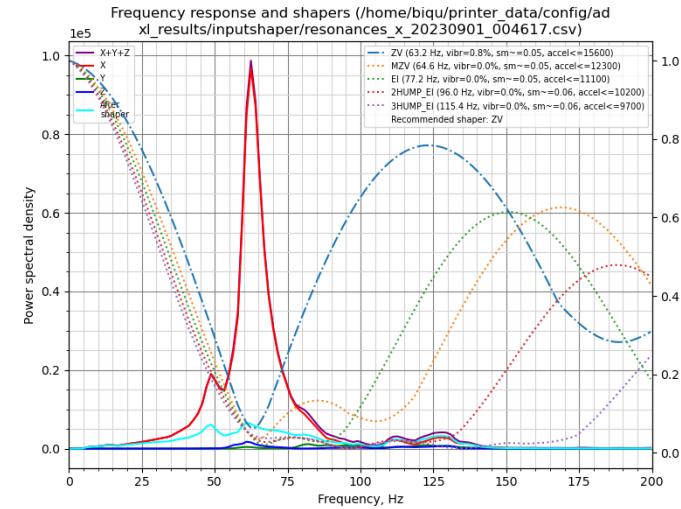
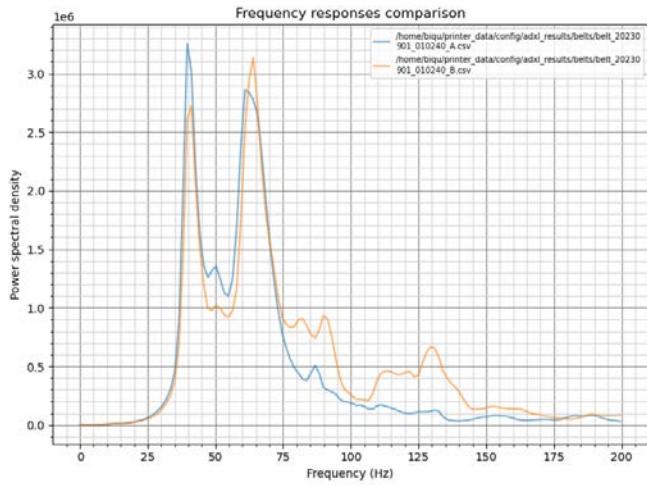
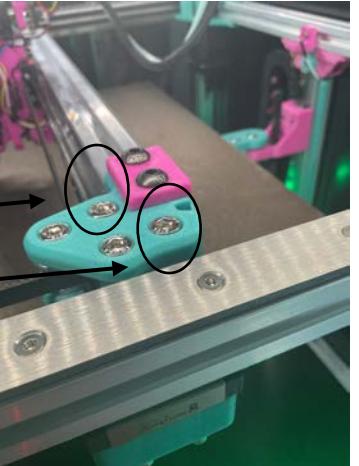
Y-axis looks about the
same

Tighten the XY-Joint Bolts



Before tightening any bolts

These bolts

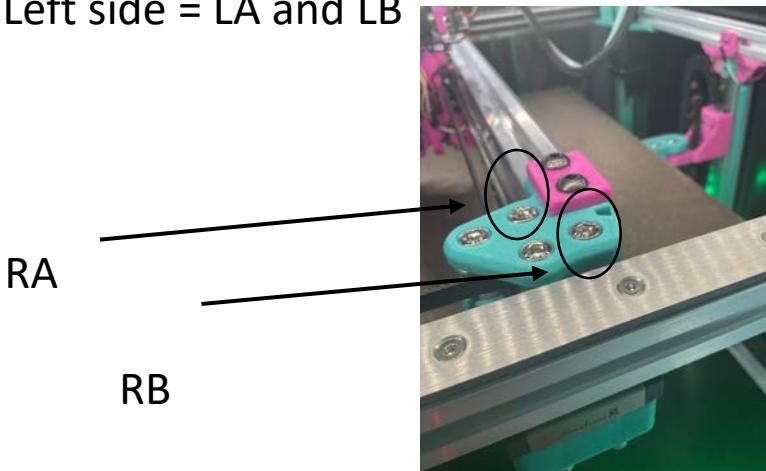


Tightening RB bolt RB, LA, LB normal

These bolts

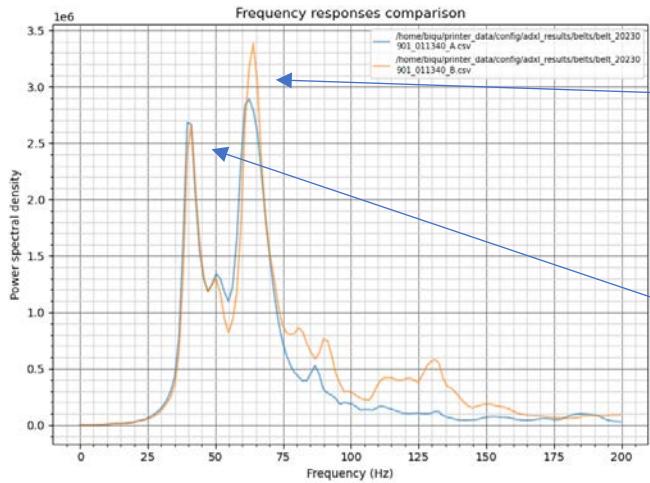
Right side = RA and RB

Left side = LA and LB



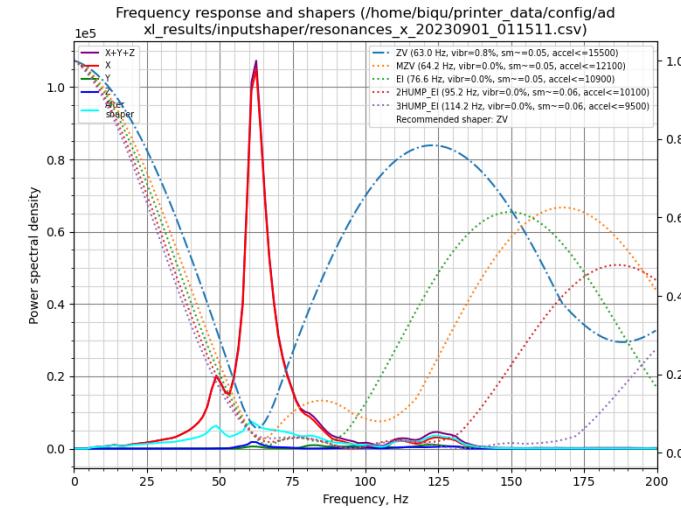
RA

RB

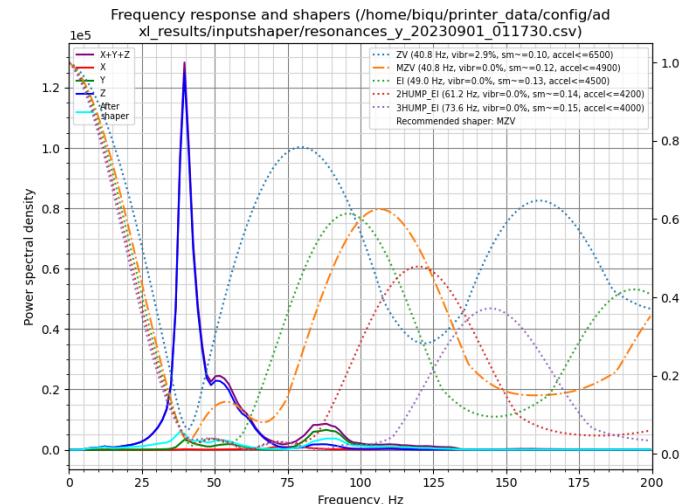


B Peak went up

Both peaks dropped



Peaks went up
But accel went down



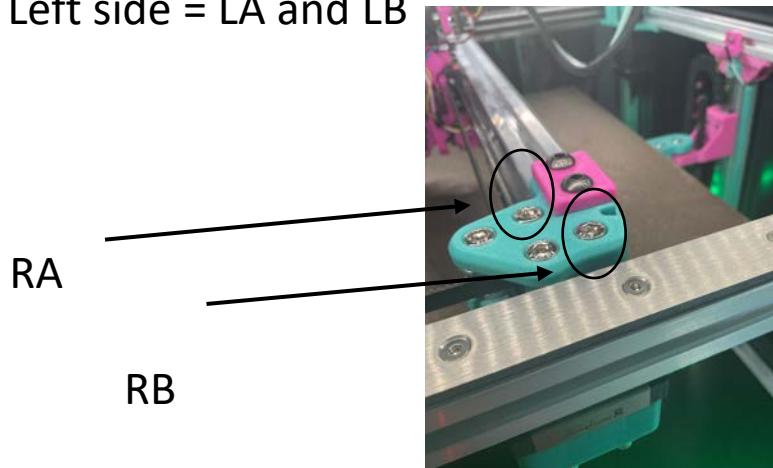
Stayed about
the same

Tightening RA and RB bolts LA, LB normal

These bolts

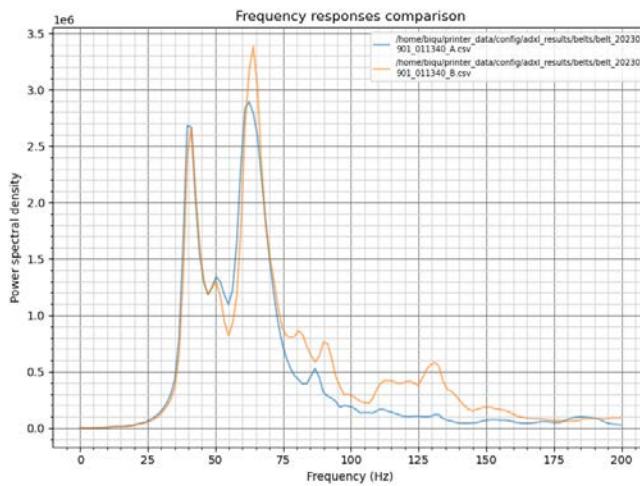
Right side = RA and RB

Left side = LA and LB

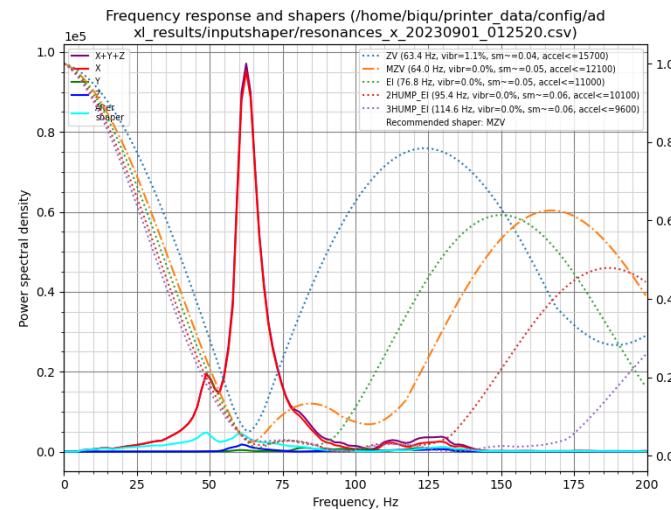


RA

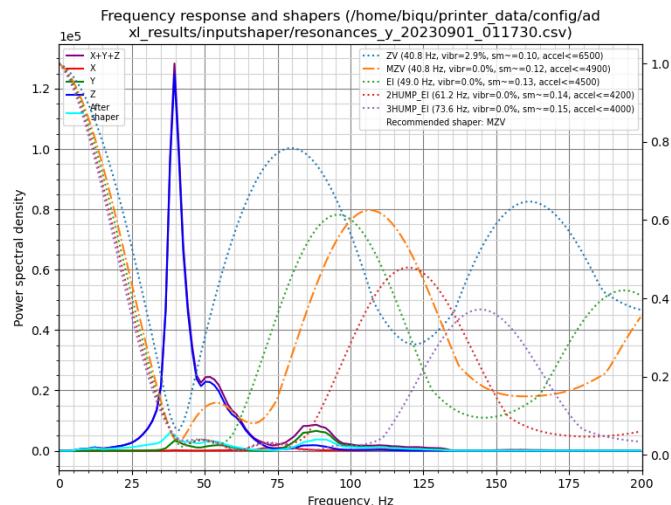
RB



Peaks went up



No change
from Rb
tightened



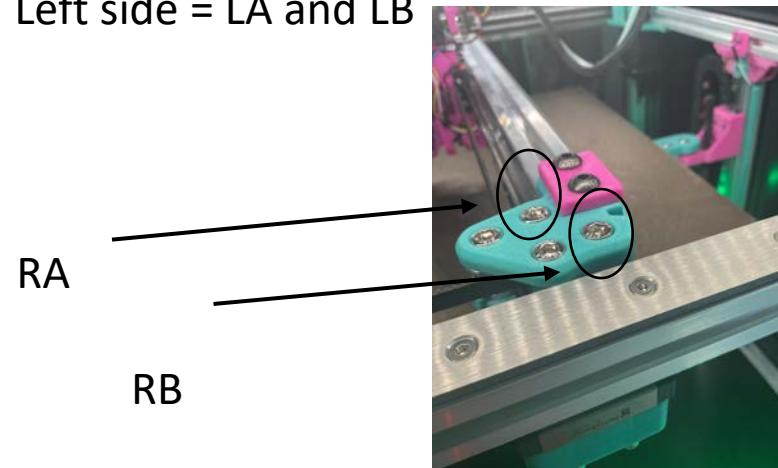
No change
from Rb
tightened

Loosened RA and RB bolts (really loose) LA, LB normal

These bolts

Right side = RA and RB

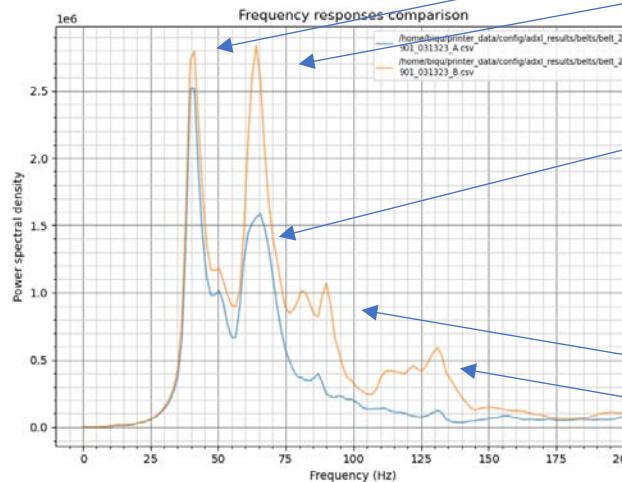
Left side = LA and LB



RA

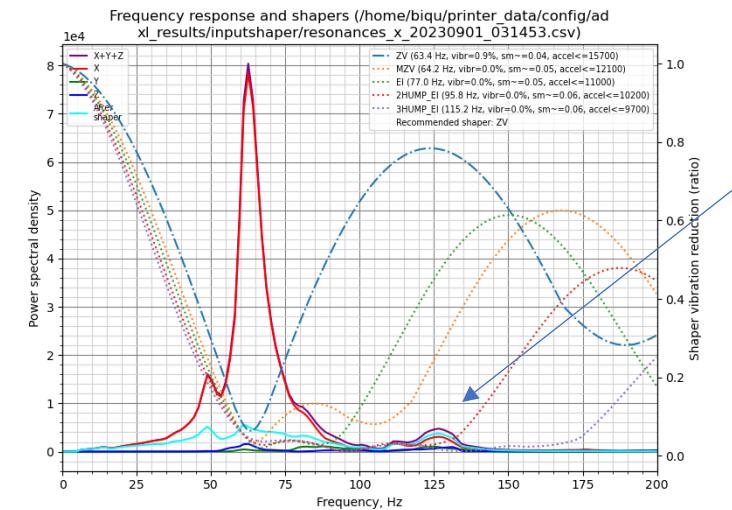
RB

Max power dropped

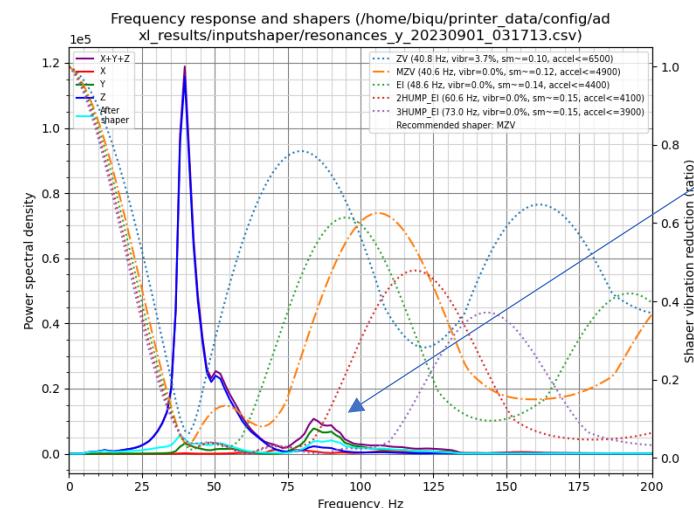


A-belt peak dropped almost in half

B went up on unwanted humps



Hump developed more



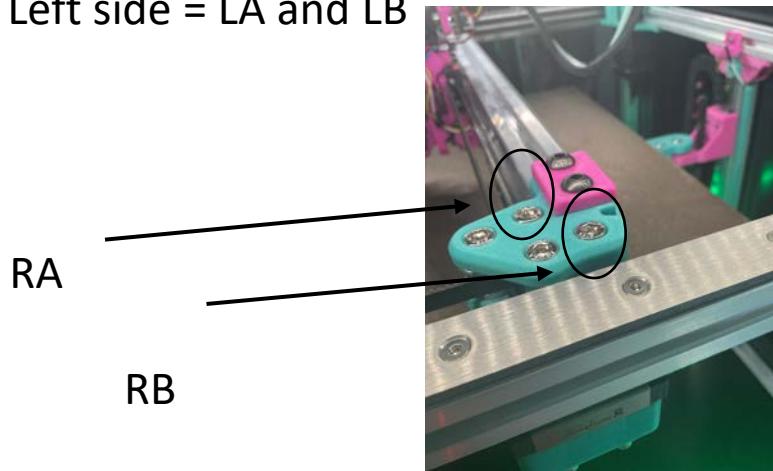
Hump developed more

Loosened RA,RB,LA, and LB bolts (really loose)

These bolts

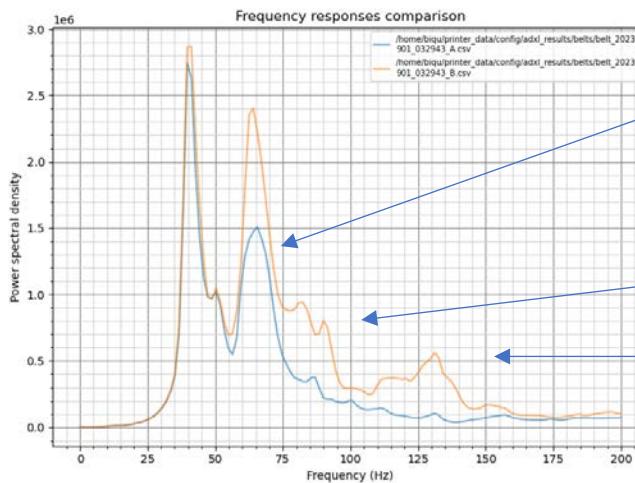
Right side = RA and RB

Left side = LA and LB



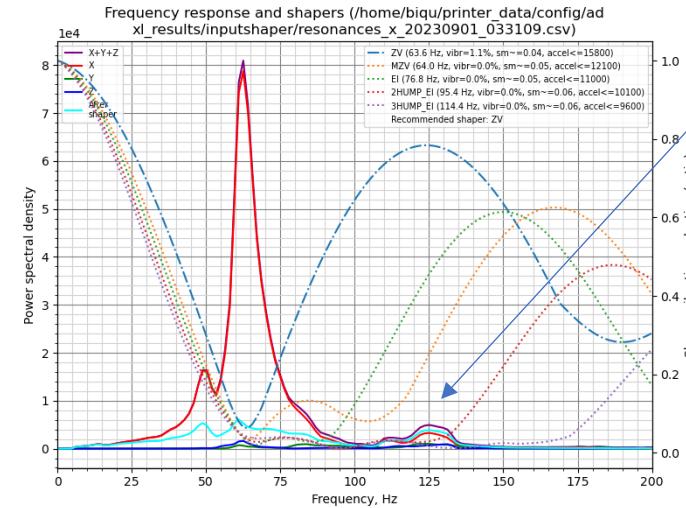
RA

RB

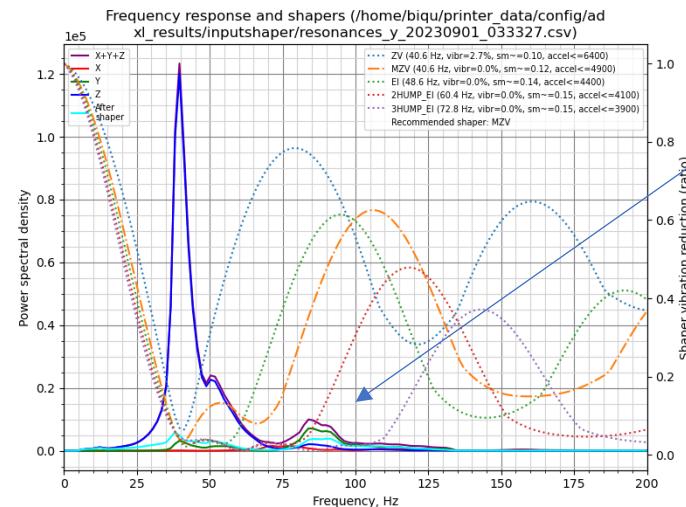


A-belt peak
dropped almost
in half

B went up on
unwanted
humps



Hump
developed
more



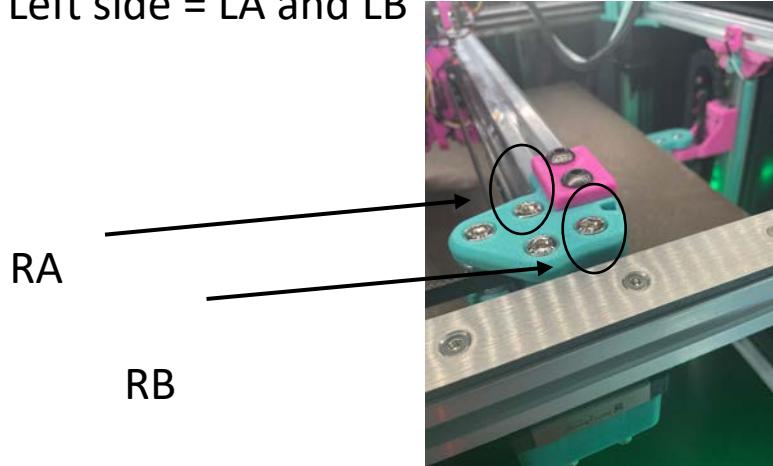
Hump
developed
more

After retightening RA, RB, LA, and LB

These bolts

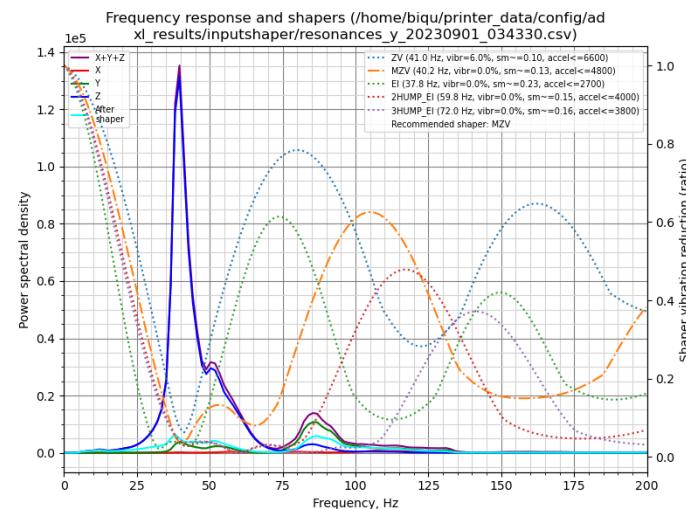
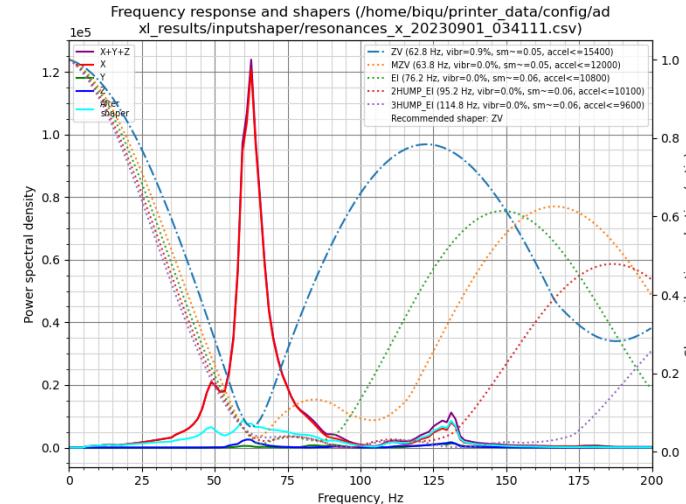
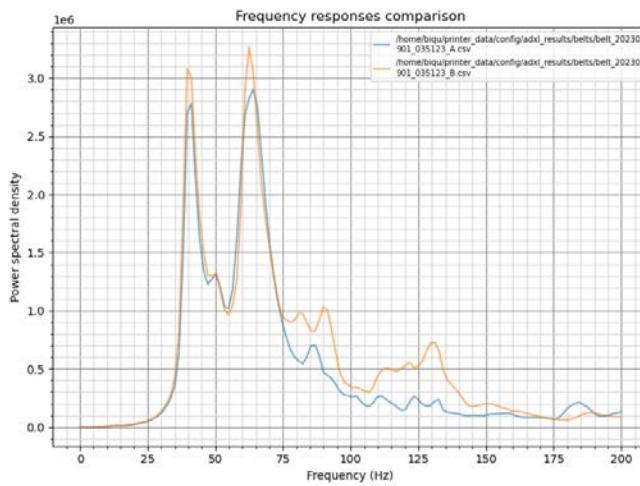
Right side = RA and RB

Left side = LA and LB



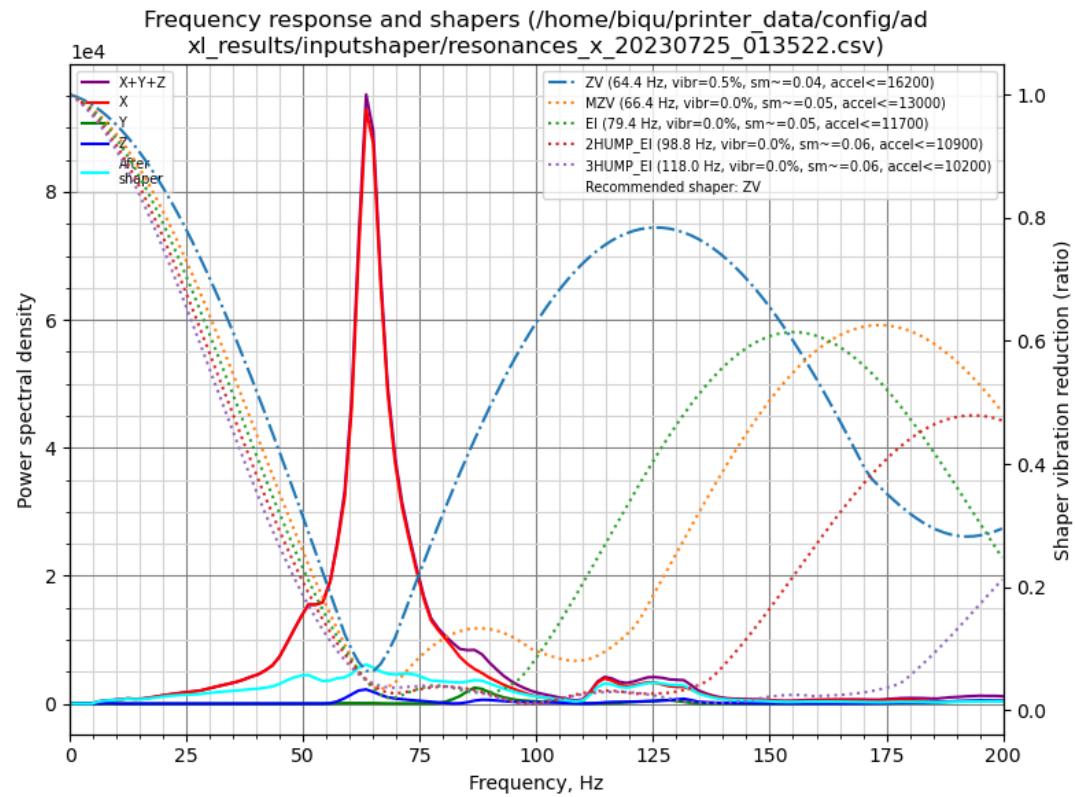
RA

RB

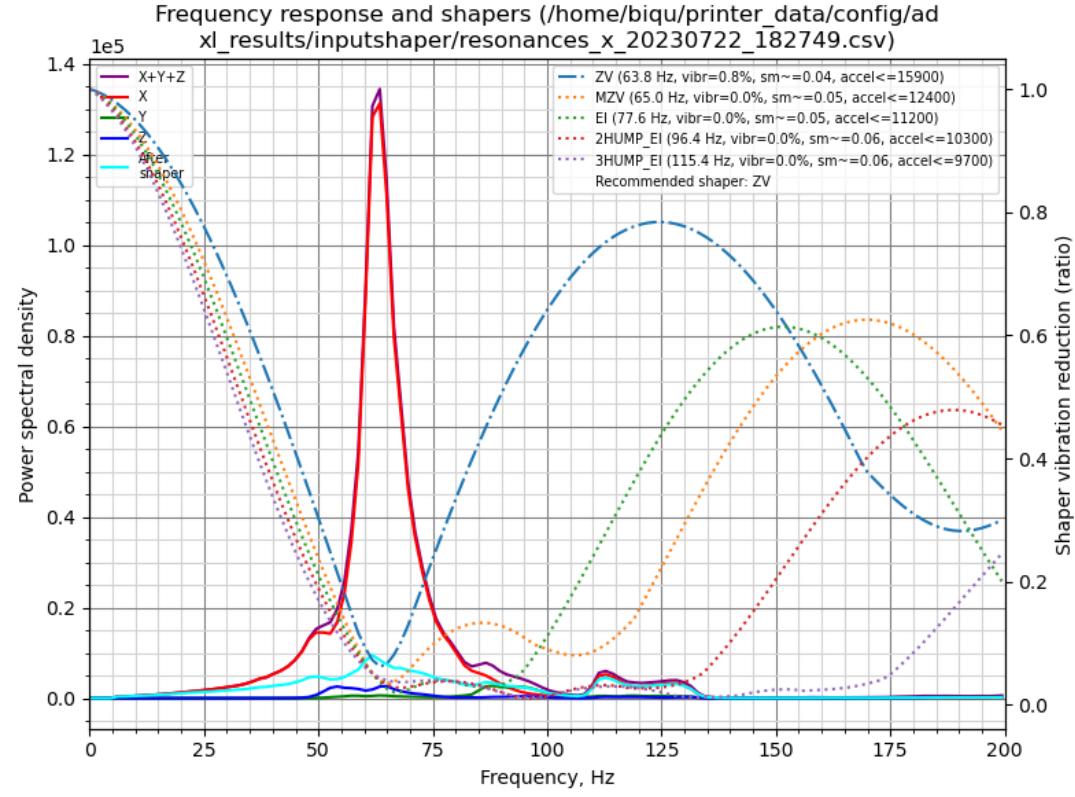


Test #0: replacing amp feet with squash ball feet

x-axis



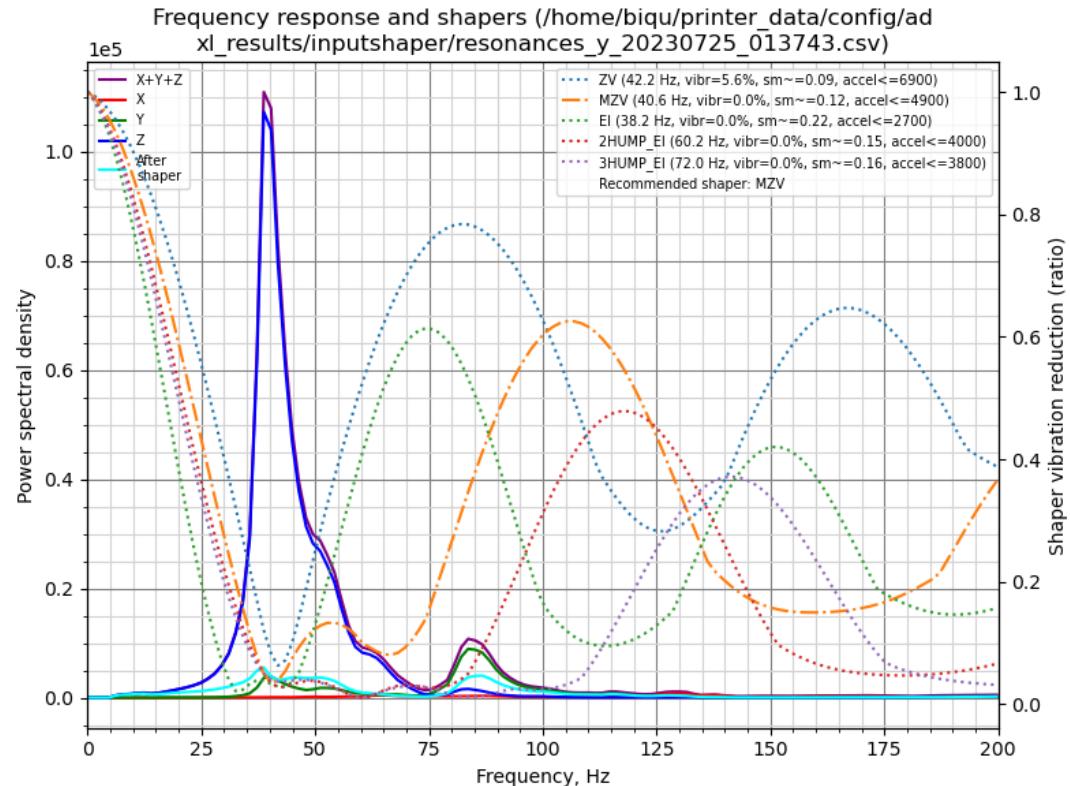
Speaker Amp feet



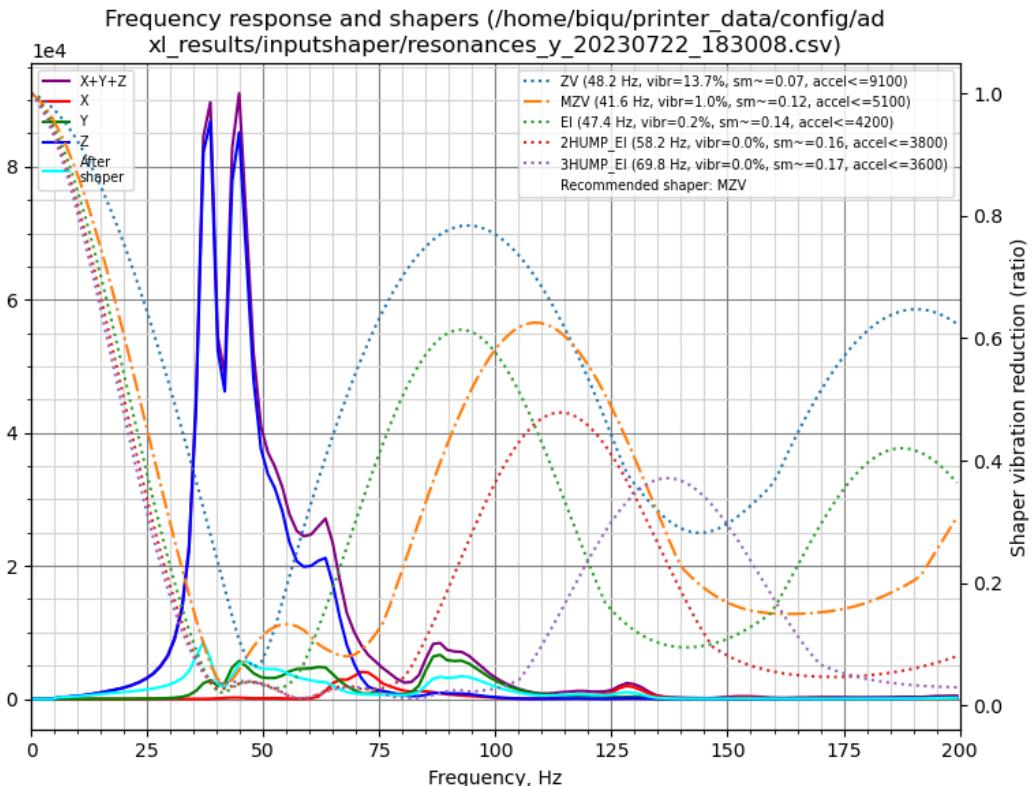
Squash ball feet

Test #0: replacing amp feet with squash ball feet

y-axis



Speaker Amp feet

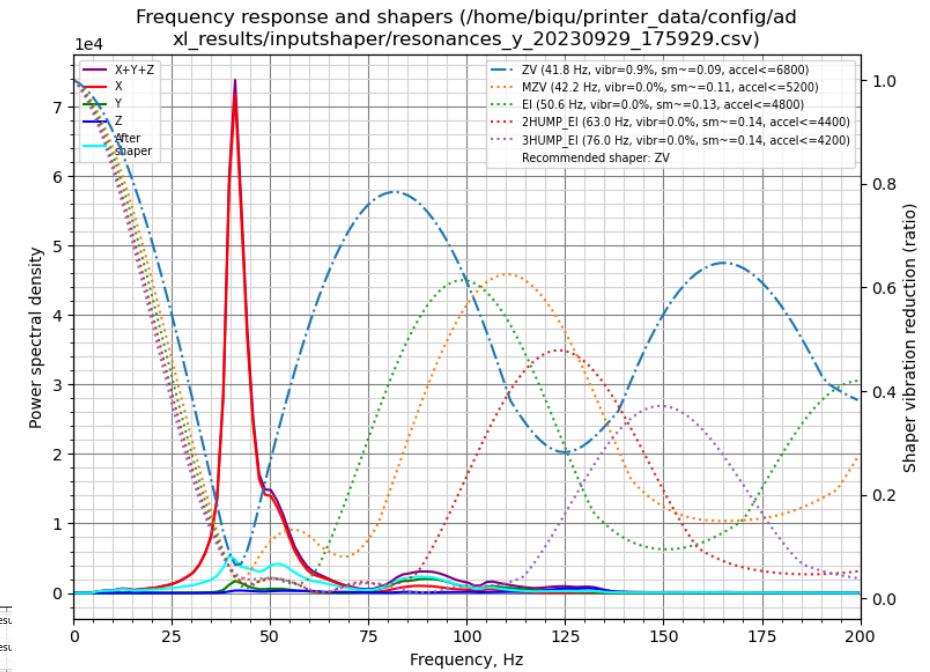
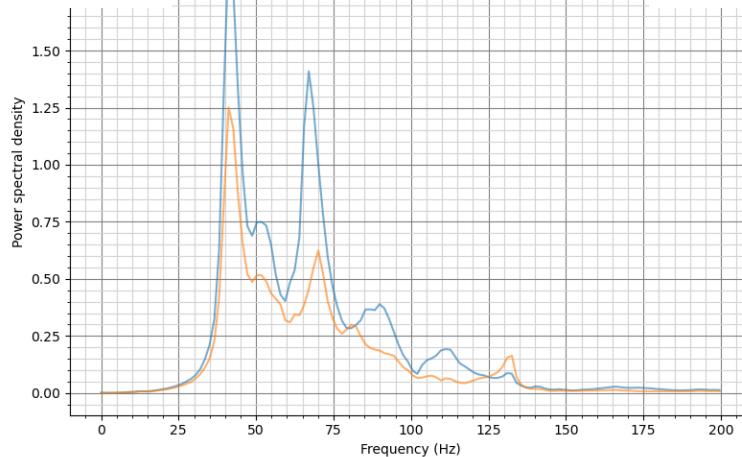
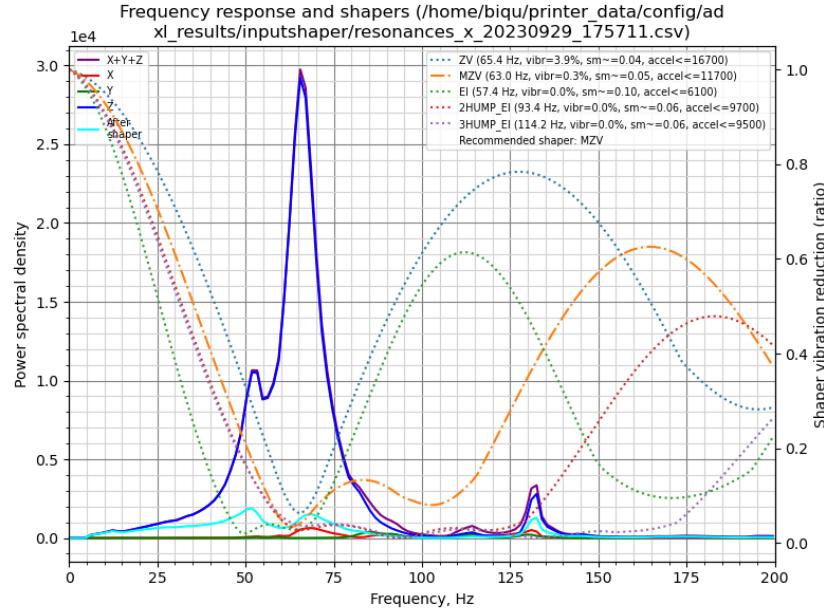


Squash ball feet

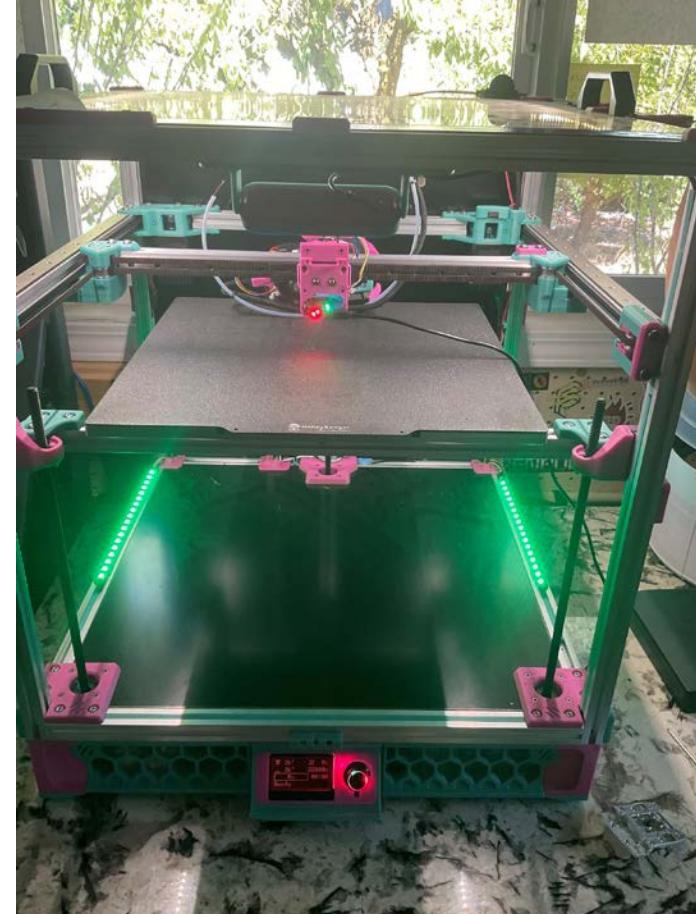
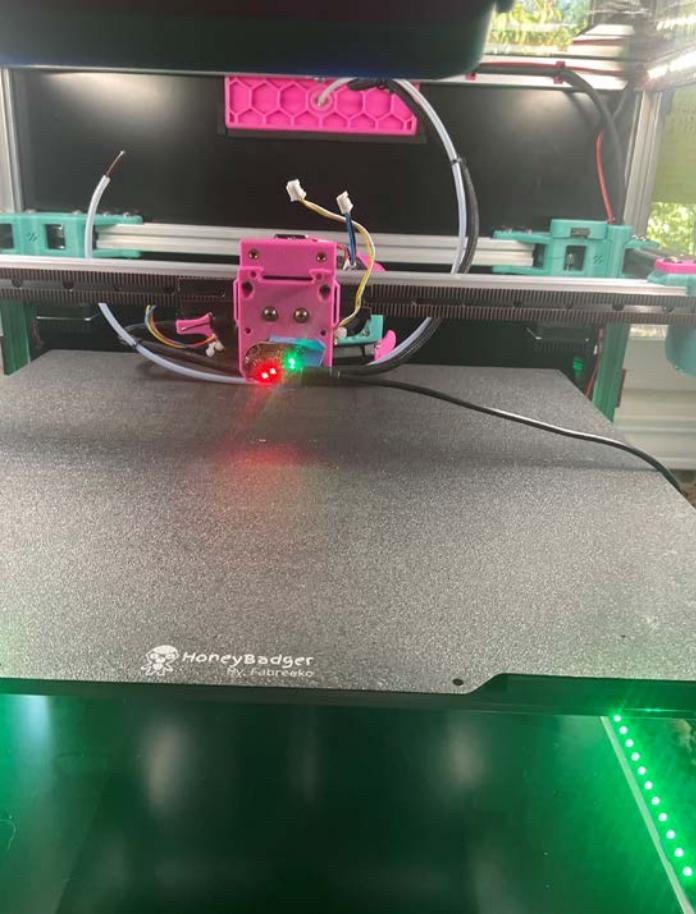
Boxy Probe testing on TAP

- The purpose of this testing is to see if we can differentiate resonance testing between issues with the toolhead and issues with the rest of the resonance testing.
- The system has changed since original testing. I have replaced the CNC front idlers with BFI front idlers. Why? Because it looked better.
- This testing will comprise four main test.
 - Belt shaper and input shaper with XOL toolhead installed on plastic TAP R8
 - Belt shaper and input shaper directly on plastic TAP R8
 - Belt shaper and input shaper directly on Vitalii CNC tap
 - I will try to change out tap without changing belt tension. No promises here
 - Belt shaper and input shaper with XOL toolhead installed on Vitalii CNC tap

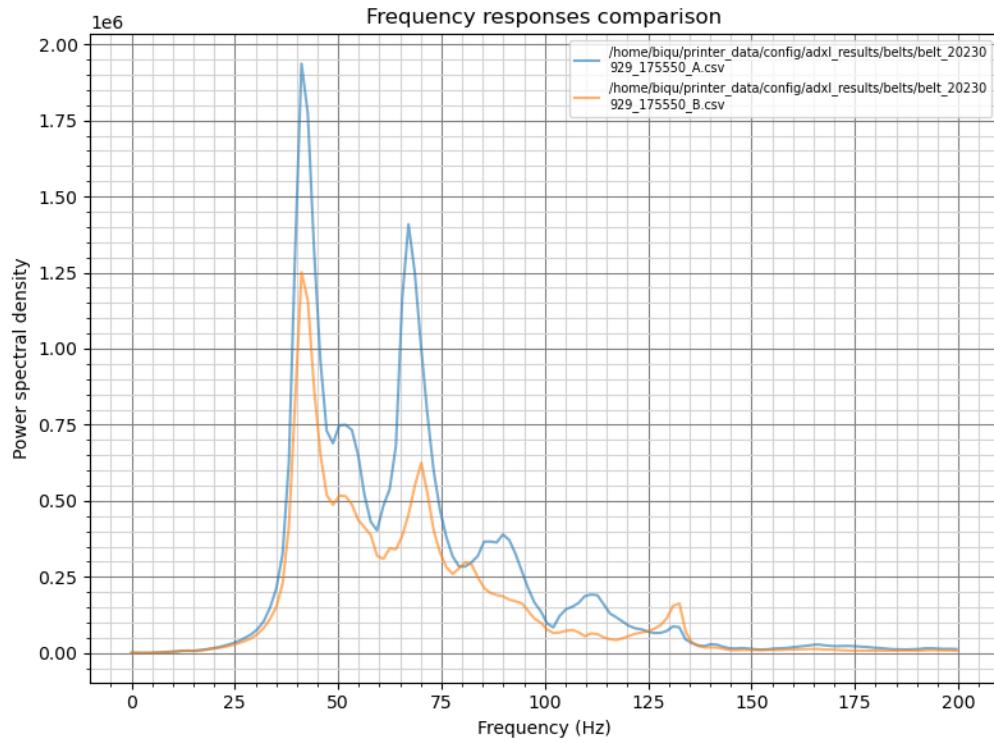
XOL toolhead on plastic TAP R8 using canbus adxl



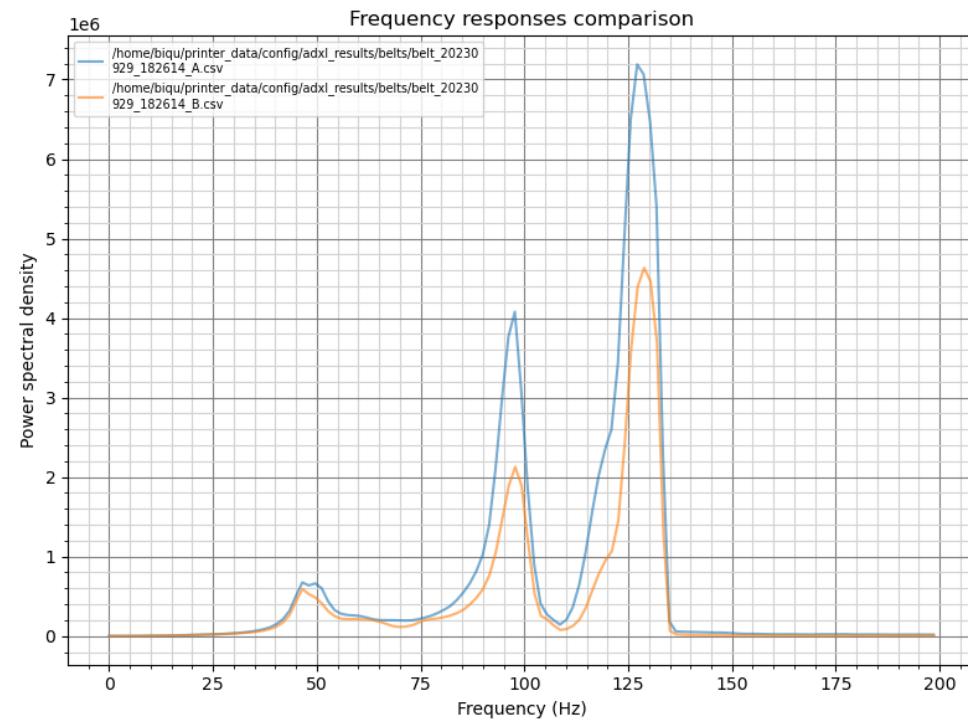
No toolhead on plastic TAP R8 using canbus: setup



Comparison between Toolhead and TAP R8 alone: belt shaper

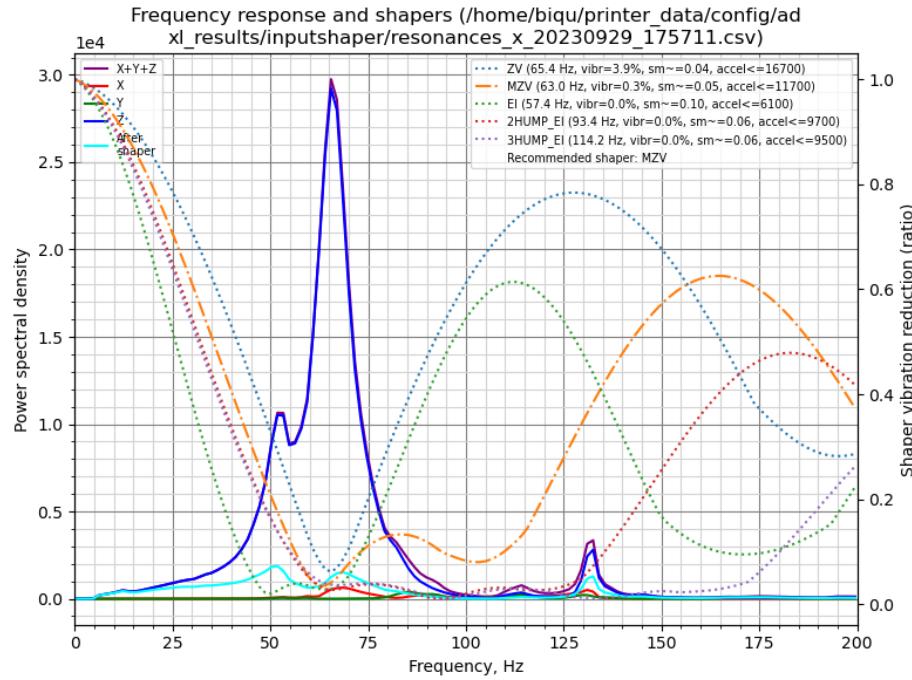


Toolhead and TAP R8

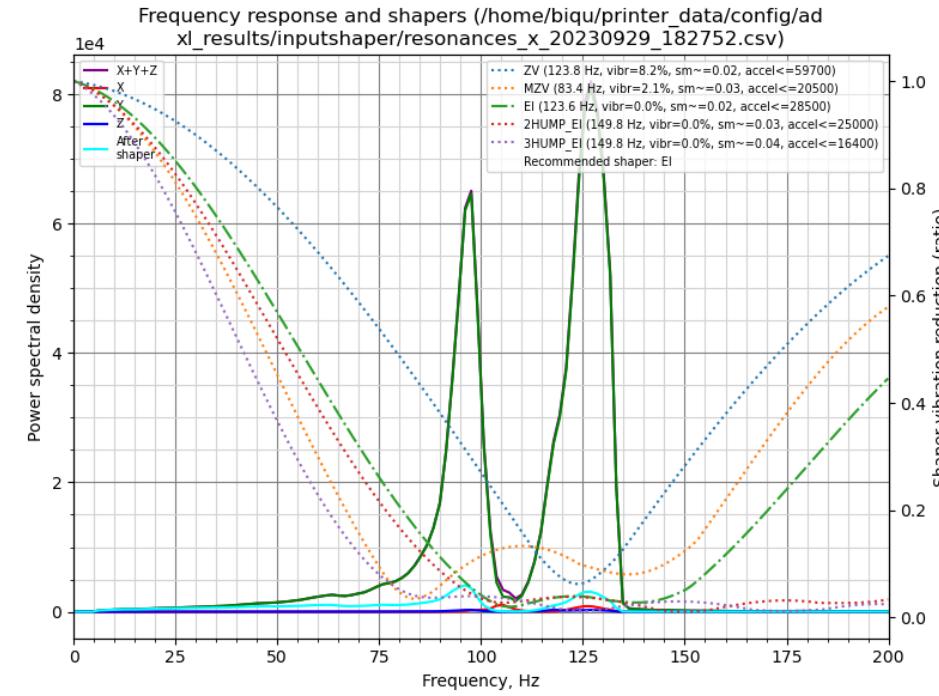


No toolhead and TAP R8

Comparison between Toolhead and TAP R8 alone : input shaper x-axis

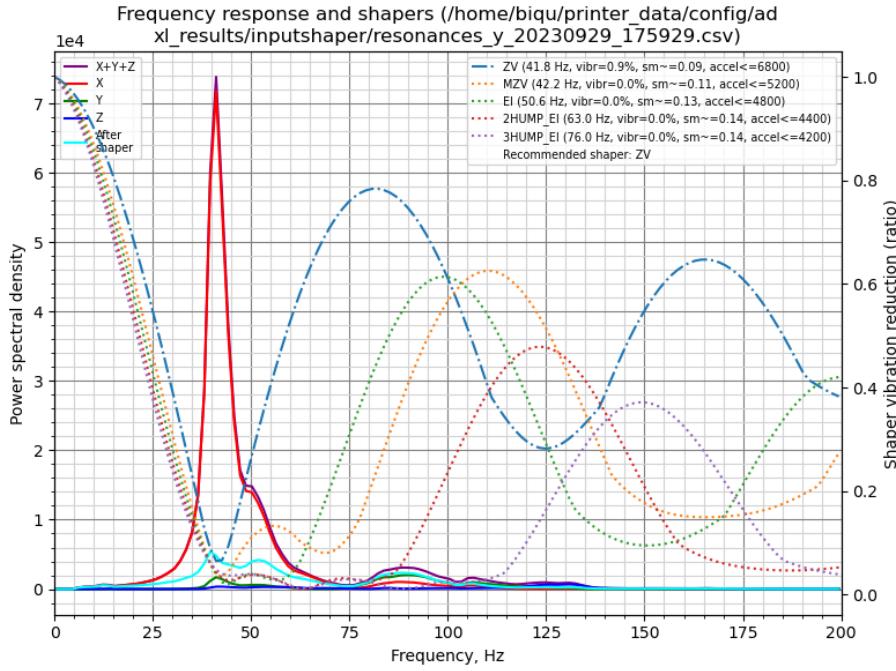


Toolhead and TAP R8

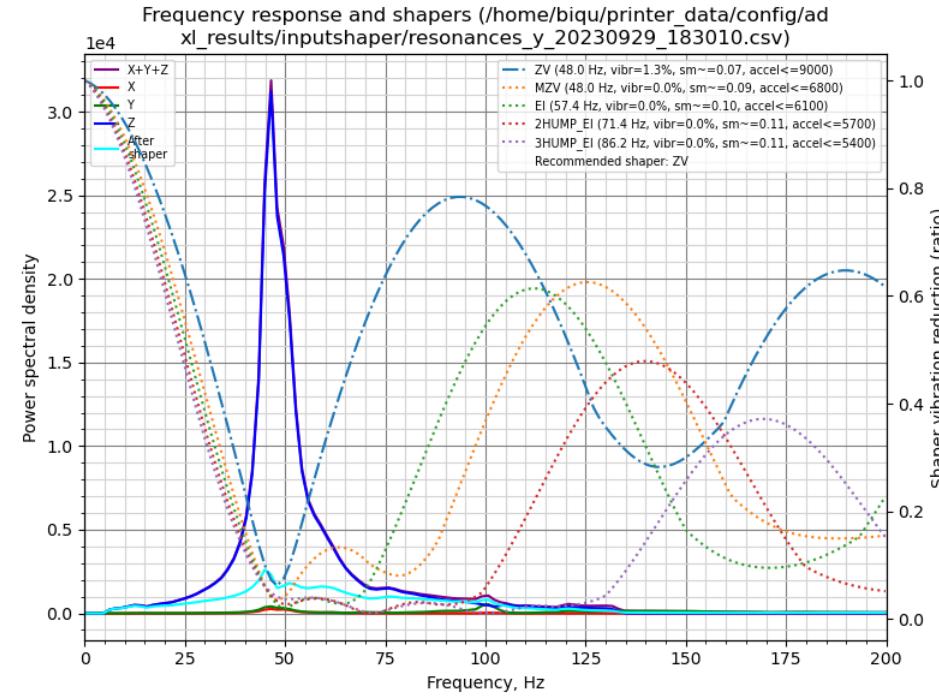


No toolhead and TAP R8

Comparison between Toolhead and TAP R8 alone : input shaper y-axis



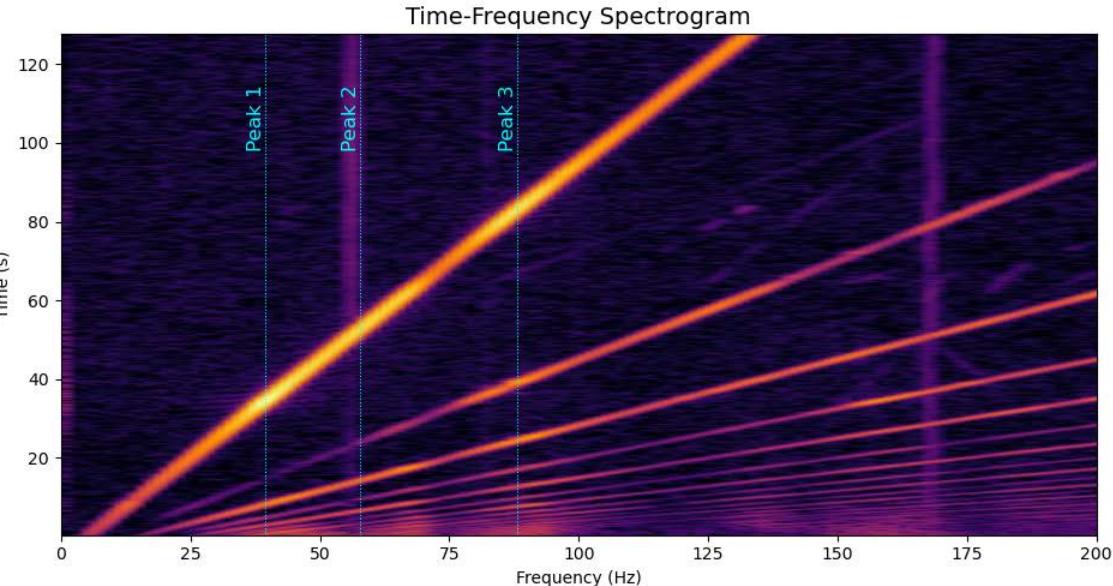
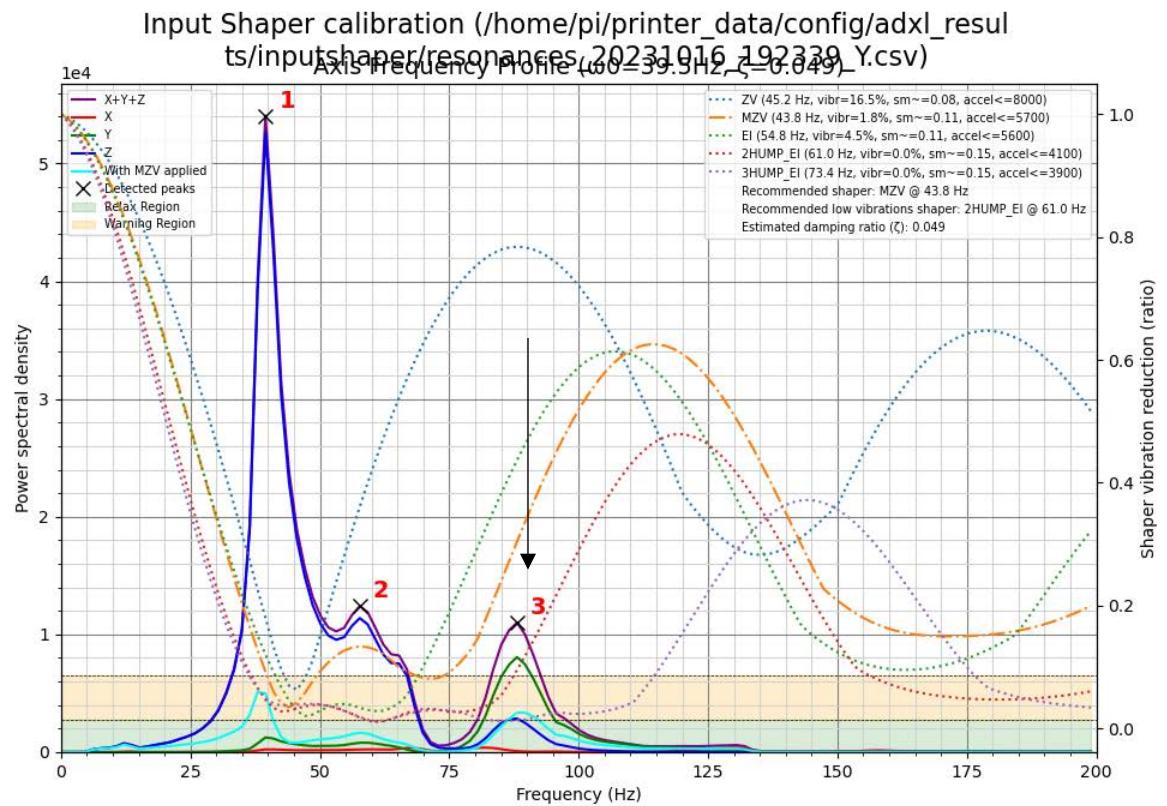
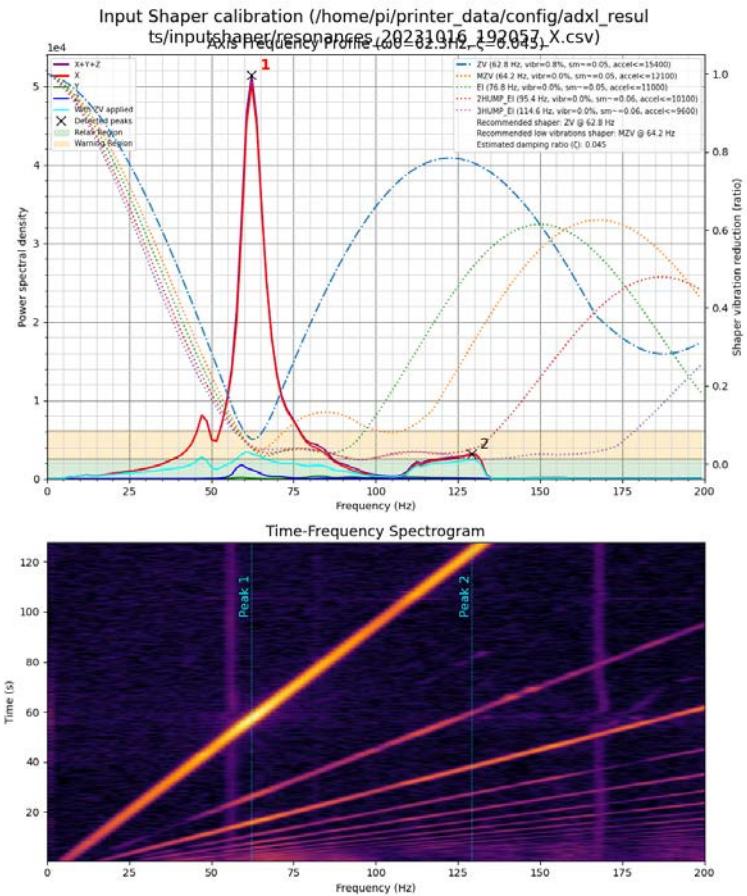
Toolhead and TAP R8



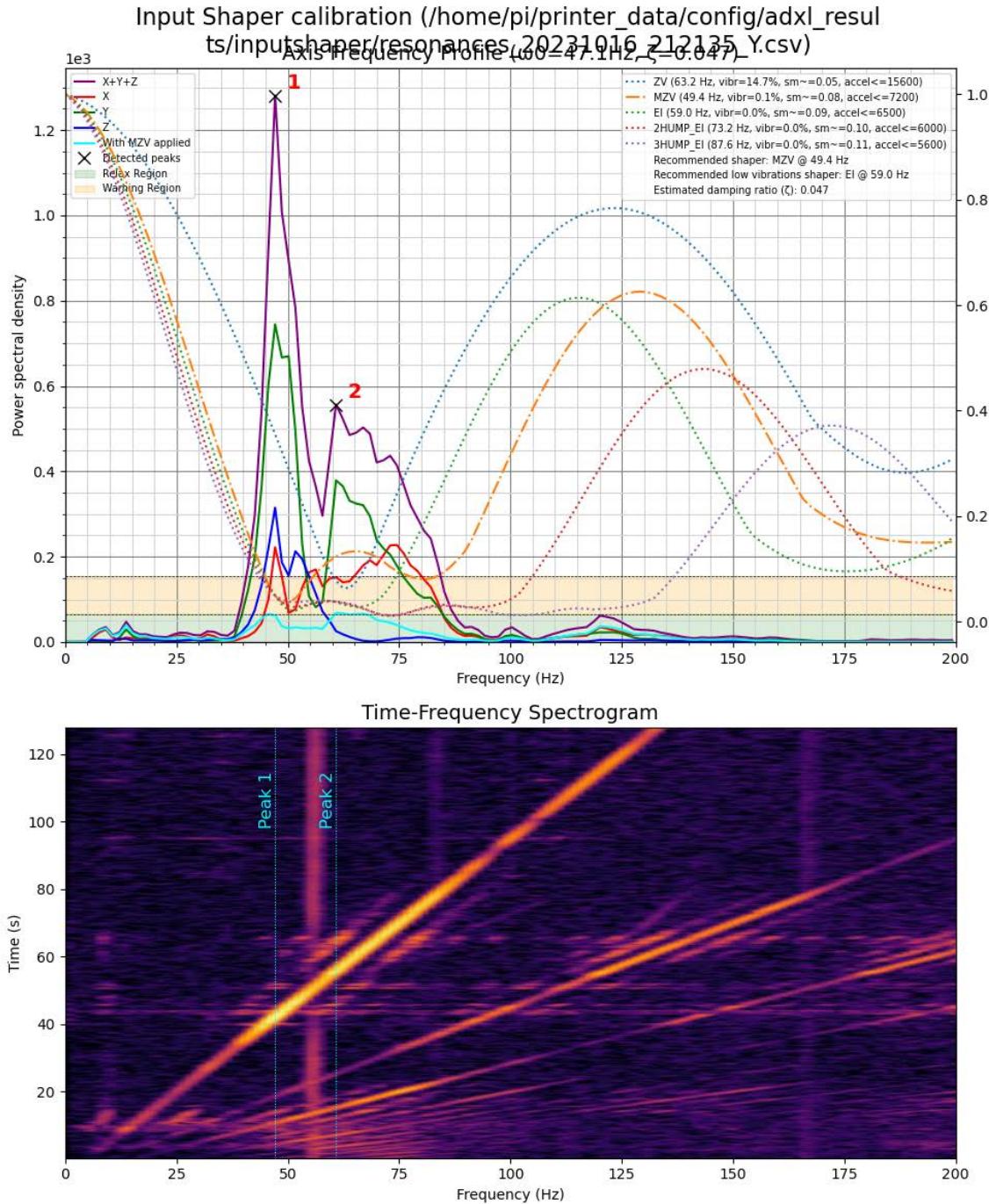
No toolhead and TAP R8

Trying to figure out where 87hz on Y is coming from

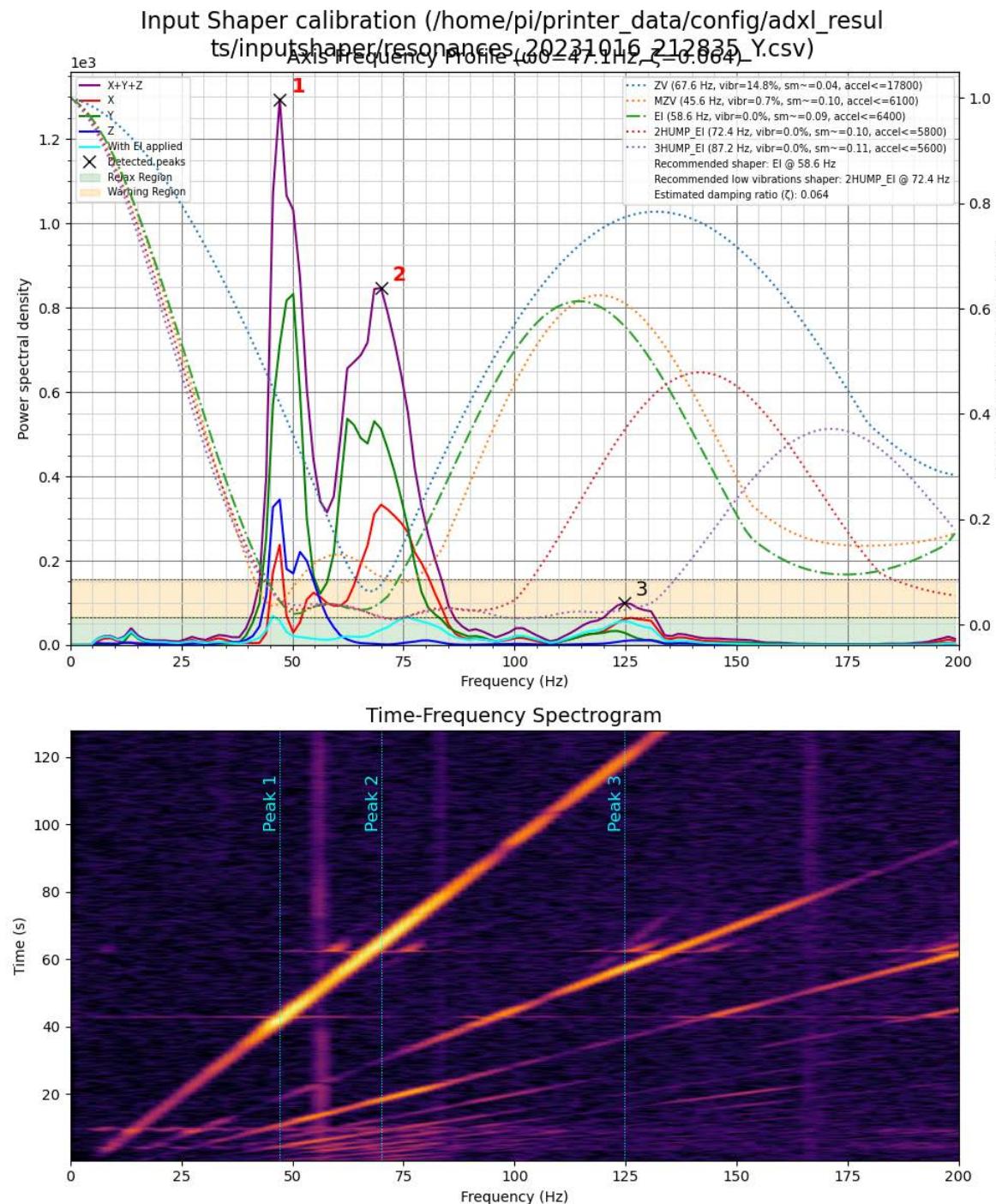
87hz on Y (spike 3)



Removing
toolhead
leaving tap
front on

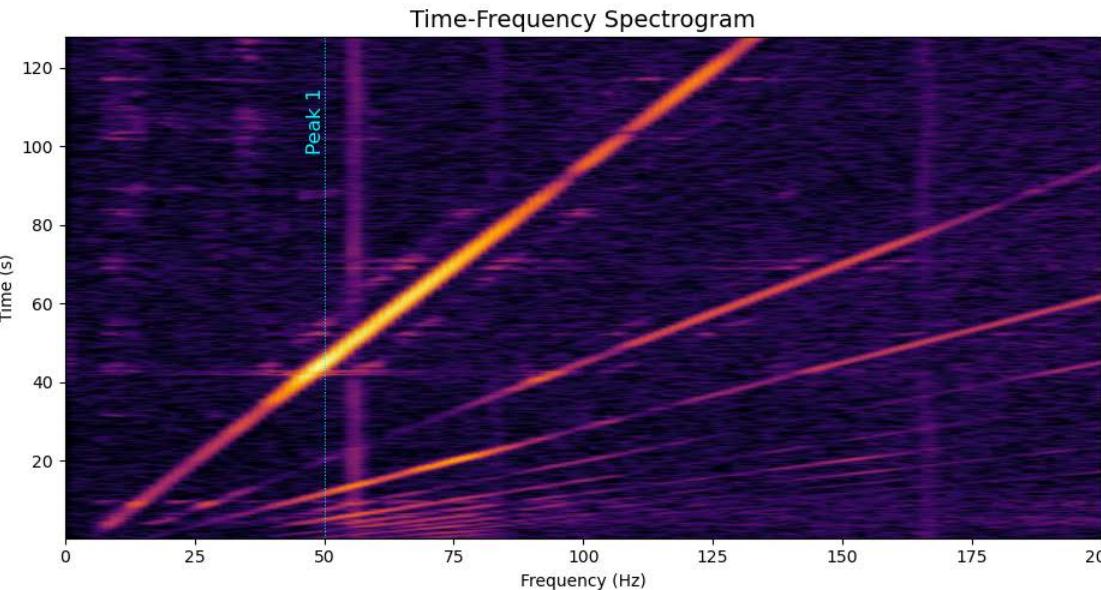
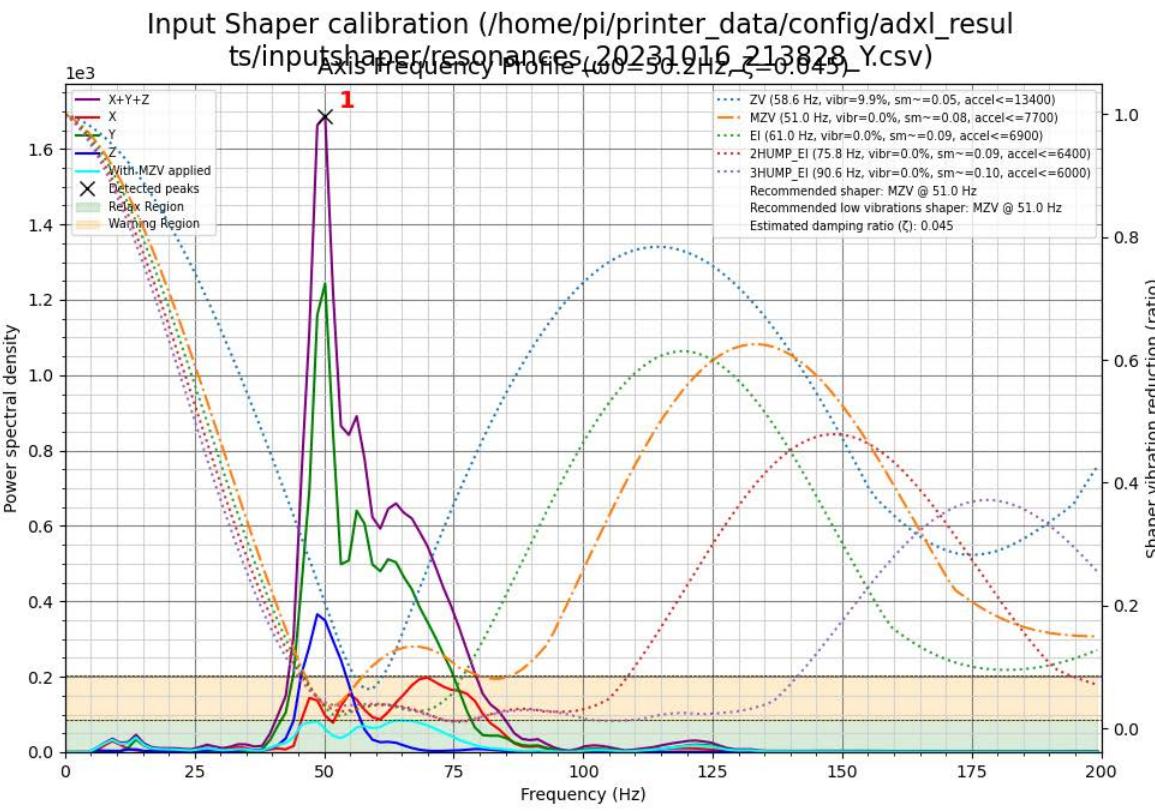


Removing
tap front
and linear
rail carriage.
Boxxy adxl is
screwed into
the middle
tap screw
hole

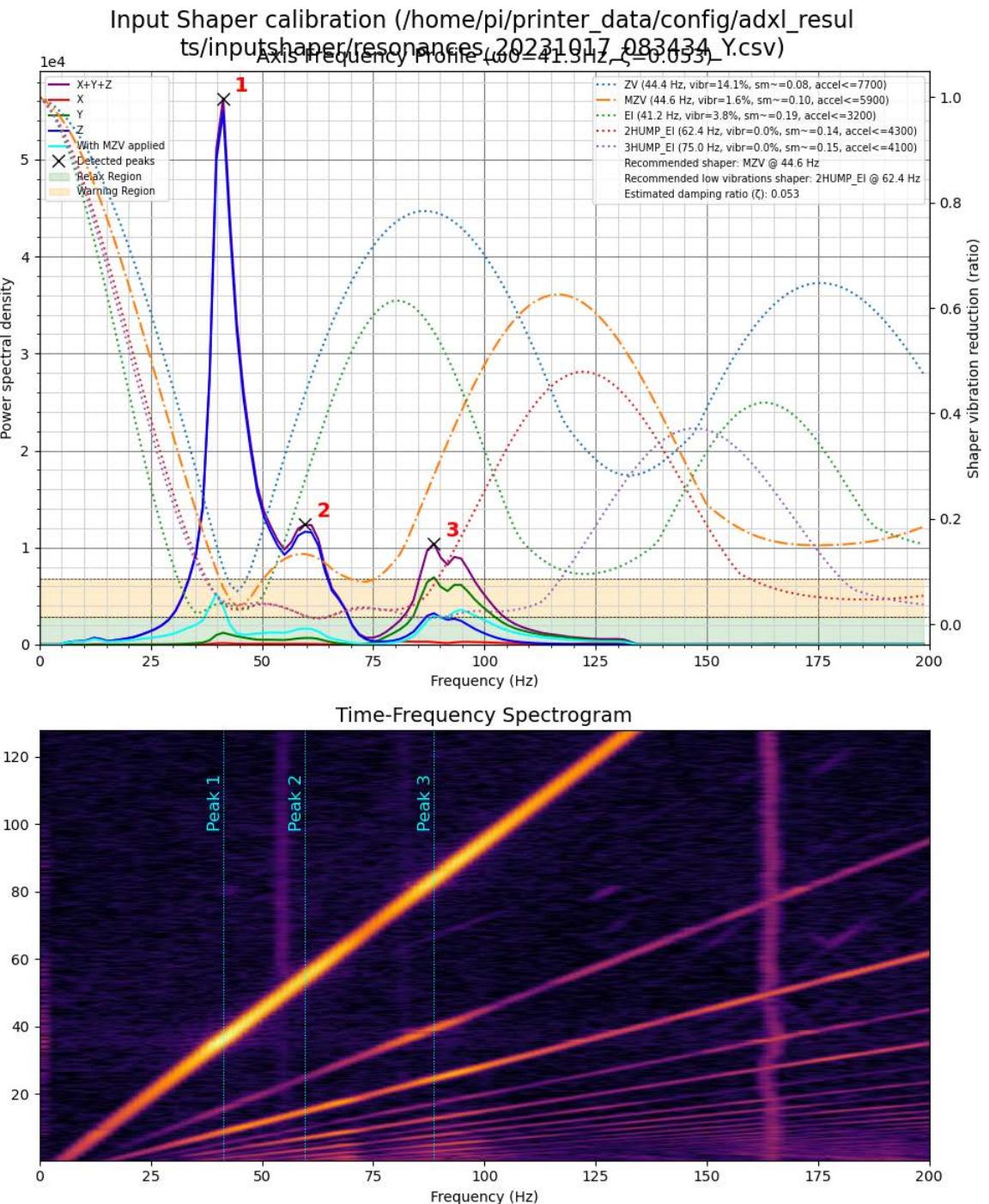
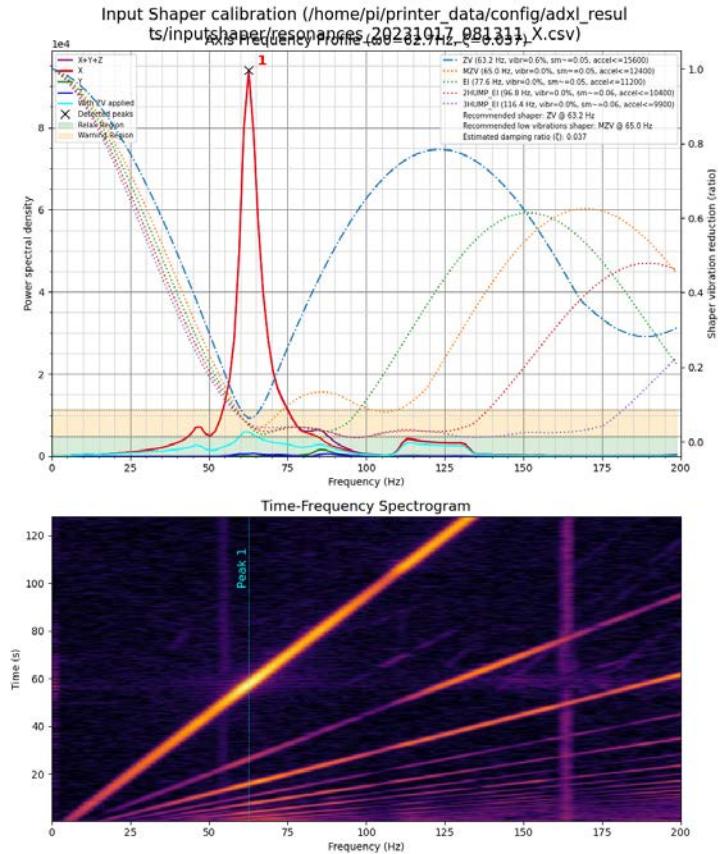


After tightening
screws around
the motor
mounts, and xy
joints

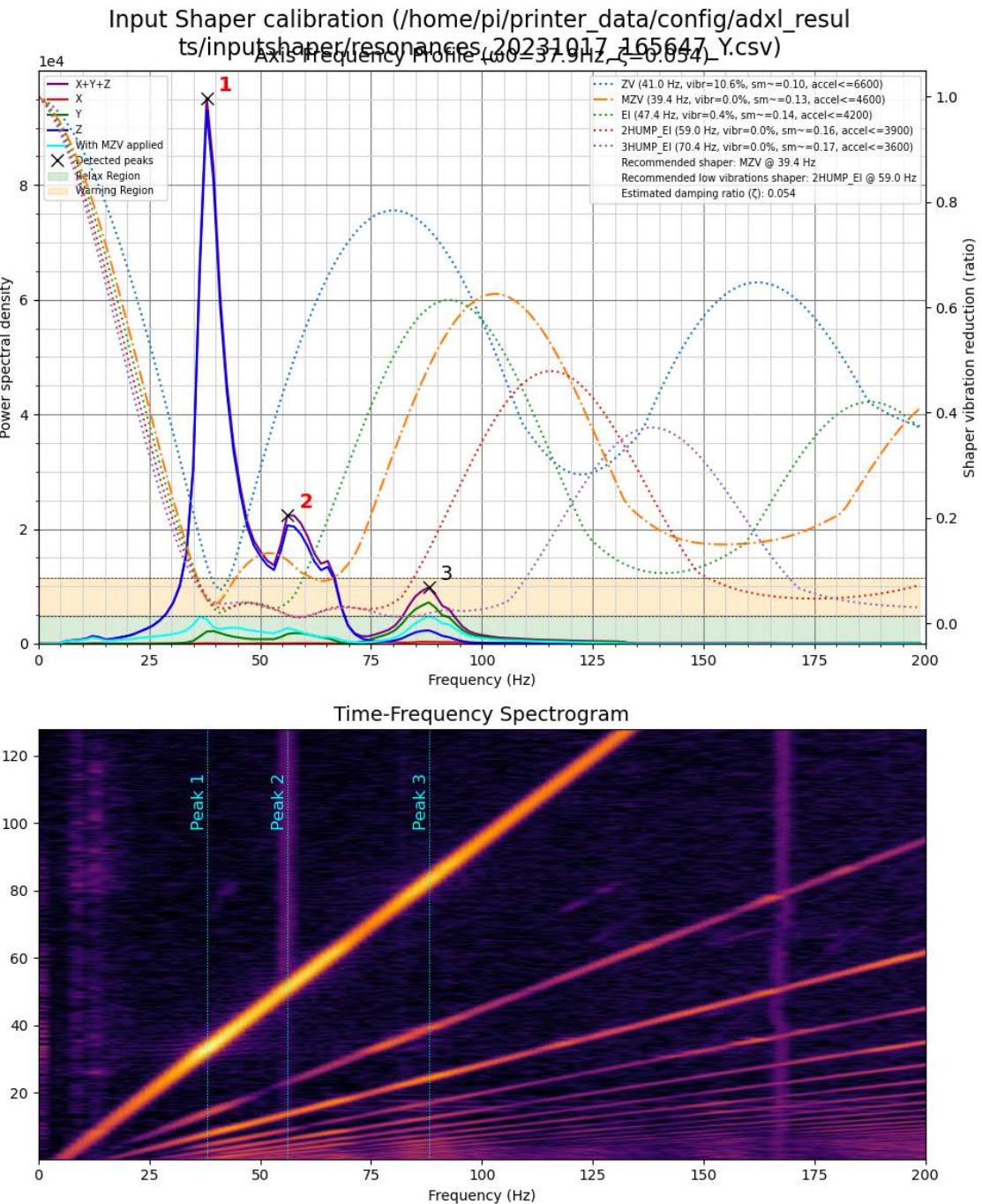
Still not perfect
but better



After putting the toolhead back on



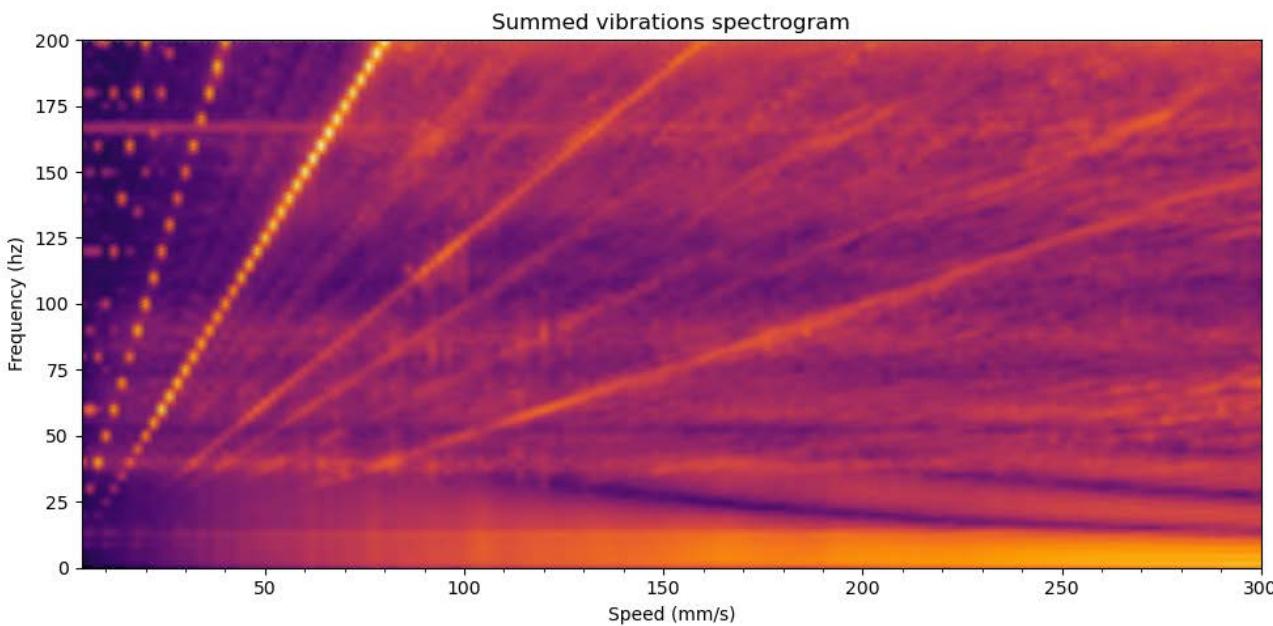
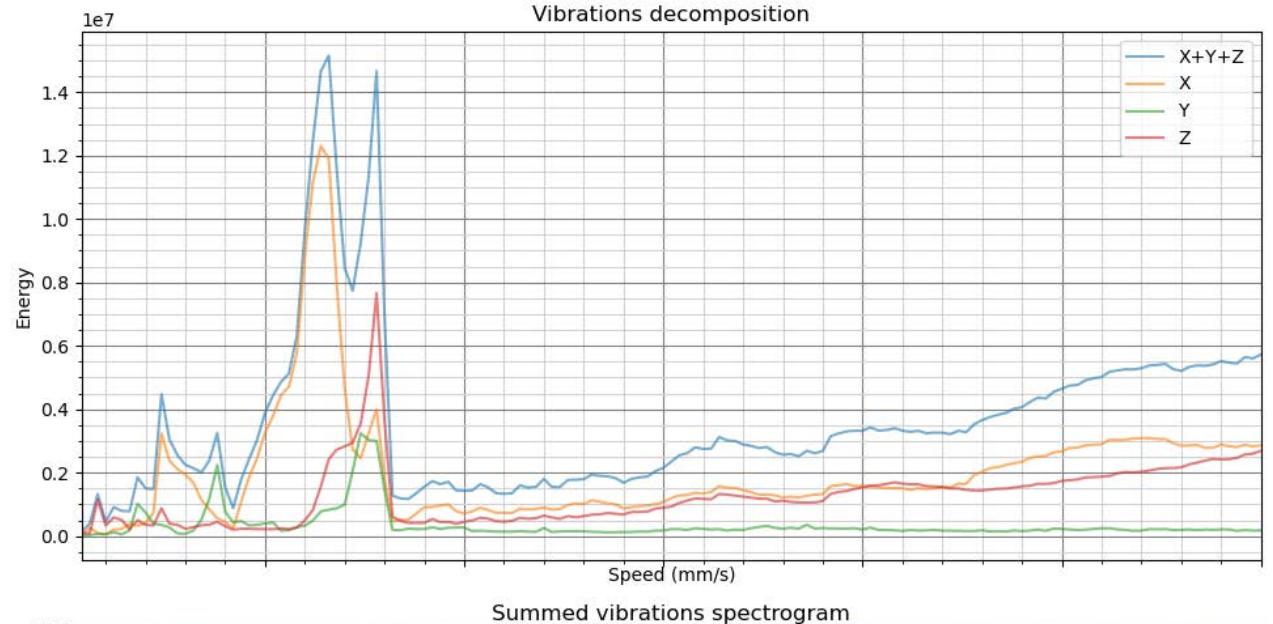
After removing
sheath from canbus
wiring.
The peak at 65 hz
went down enough
to get 0% vibr on
mzv



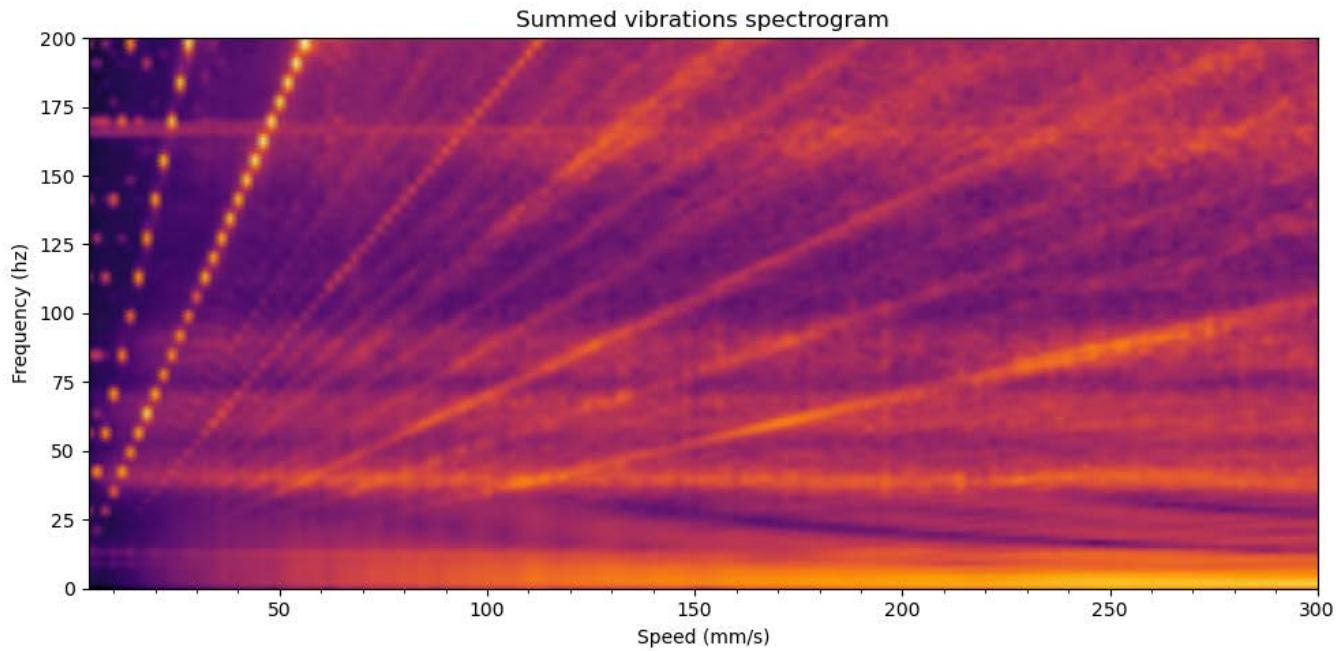
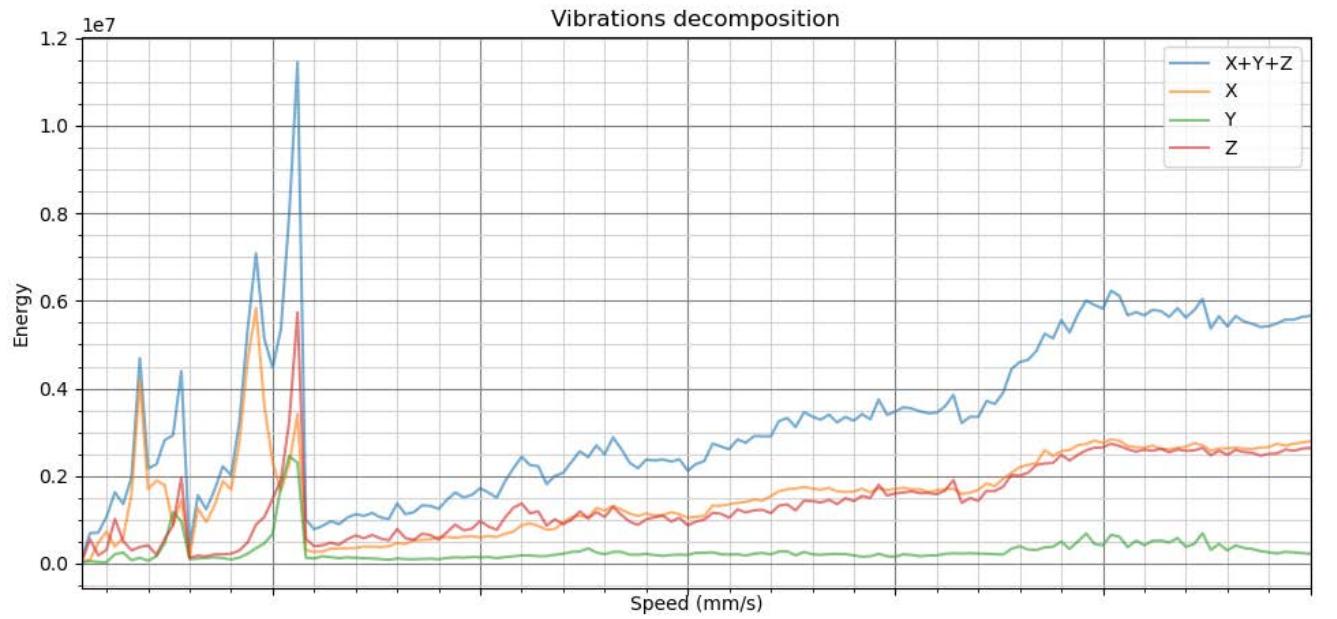
Vibration Calibration

- Initial run

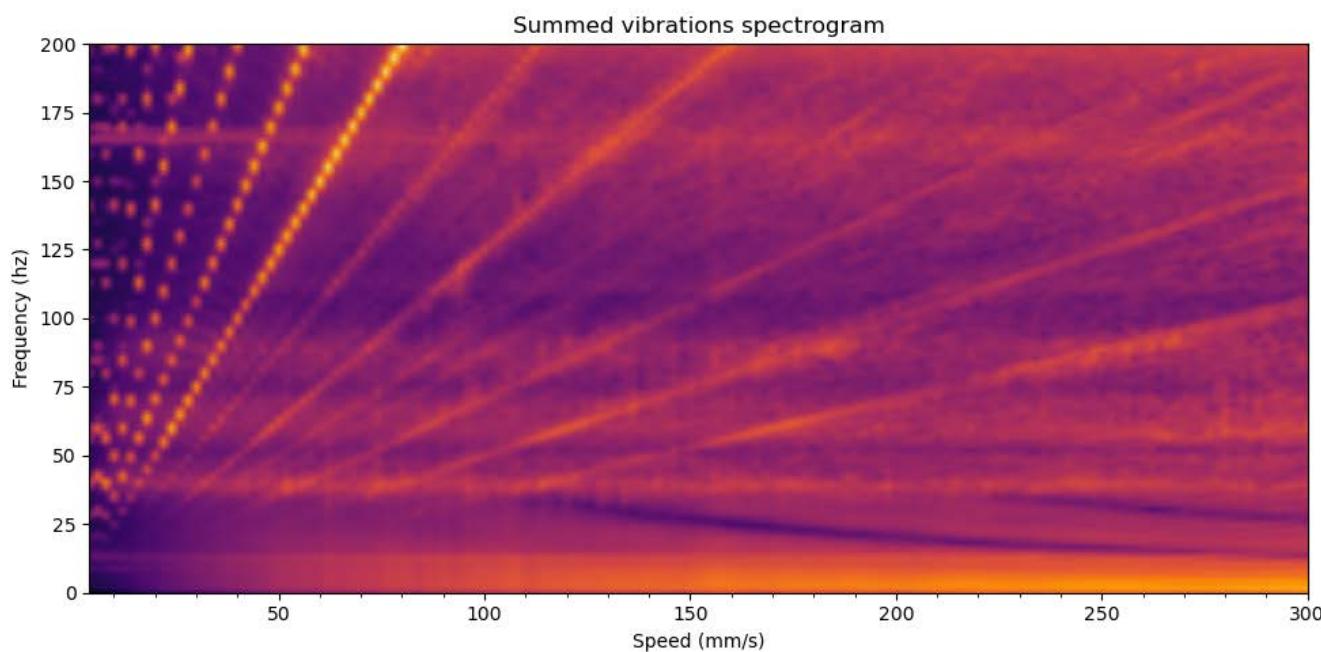
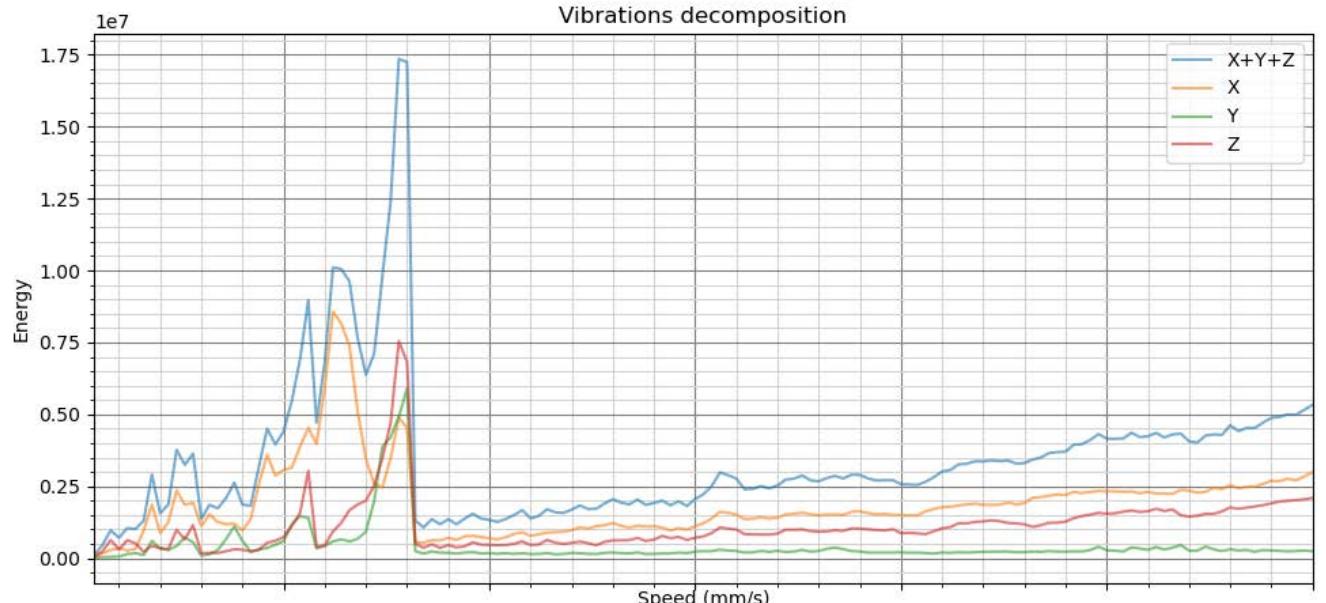
Machine vibrations - XY moves



Machine vibrations - AB moves



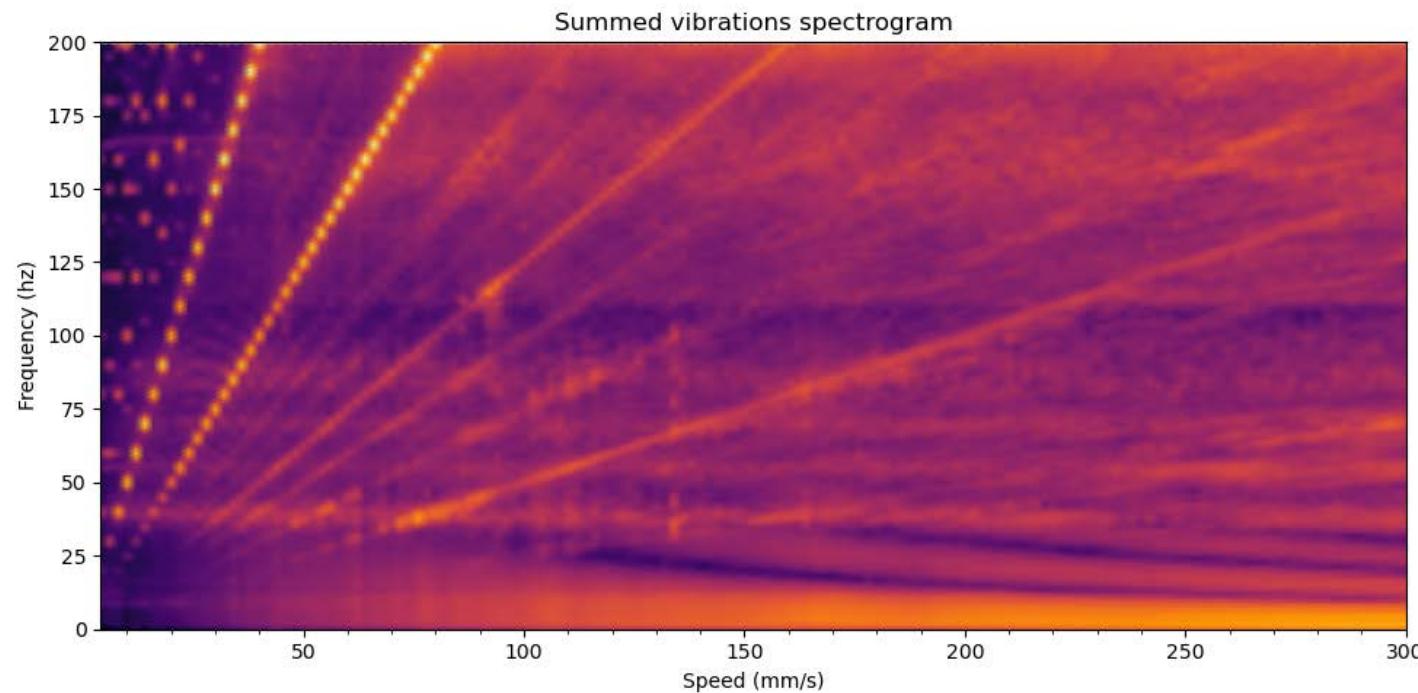
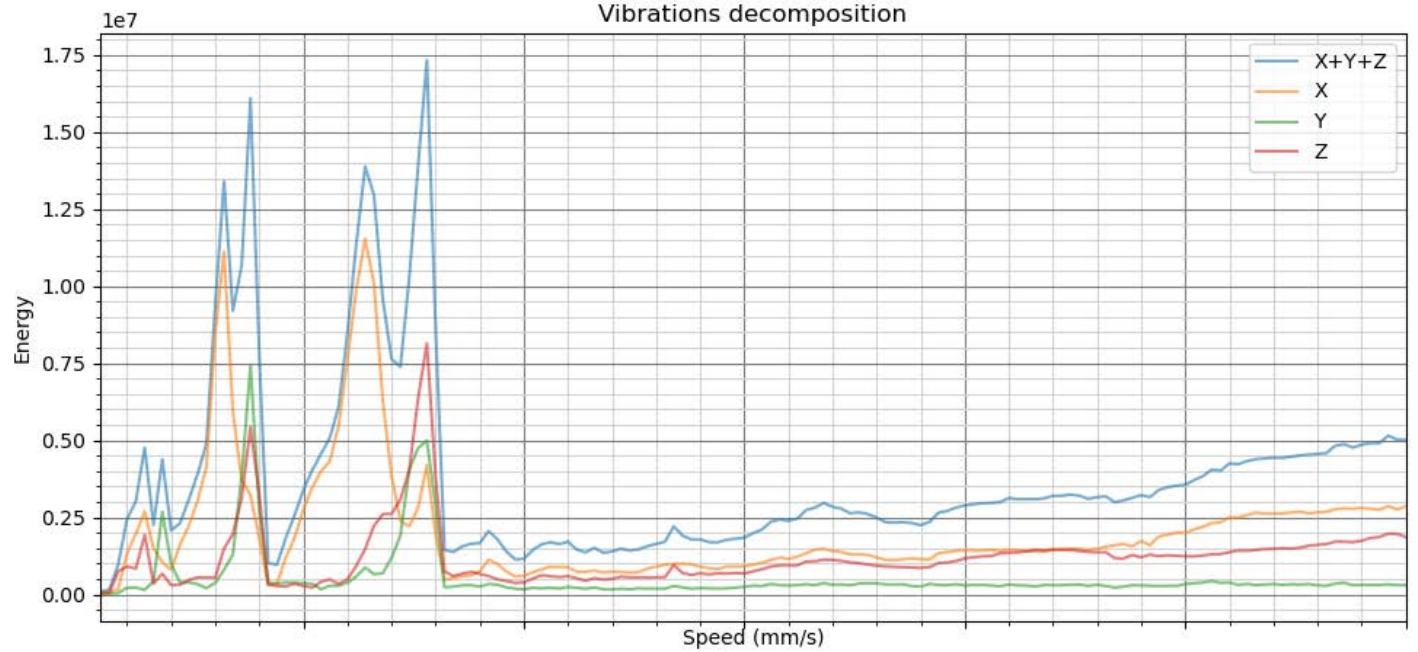
Machine vibrations - ABXY moves



Vibration Calibration: run 2

- Changed microsteps on xy from 64 to 128
- For test changed max_accel from 3000 to 4000
- Disabled autotune
- Changed min speed for test from 4 to 10

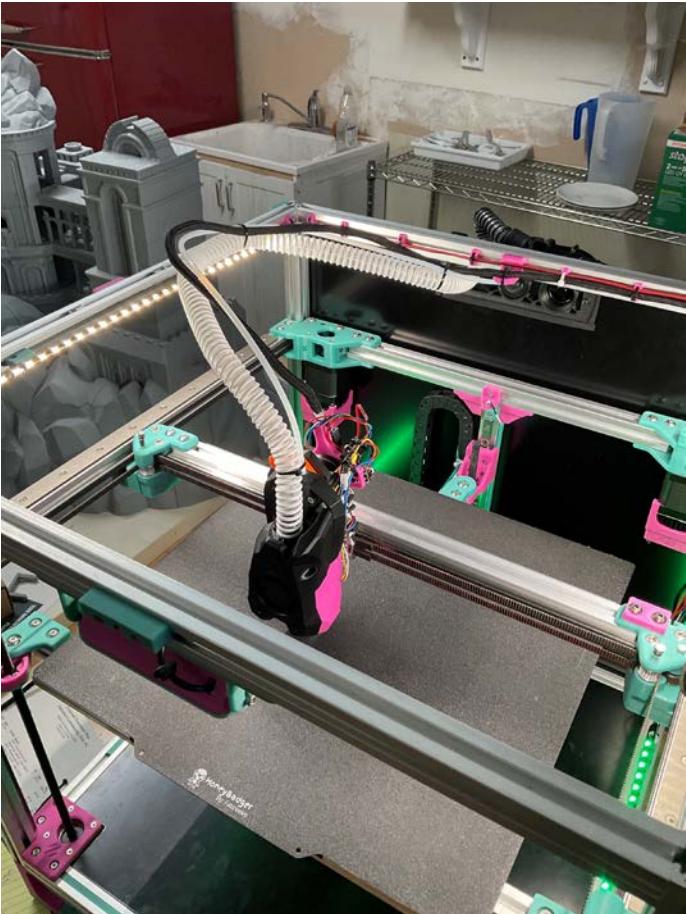
Machine vibrations - XY moves



Vibration Calibration: run 3

- Changed microsteps from 128 to 32

Moved to CPAP



Changed ab motors to ldo-42sth48-2804ac from ldo-42sth48-2504ah

Added stealthburner cpap from

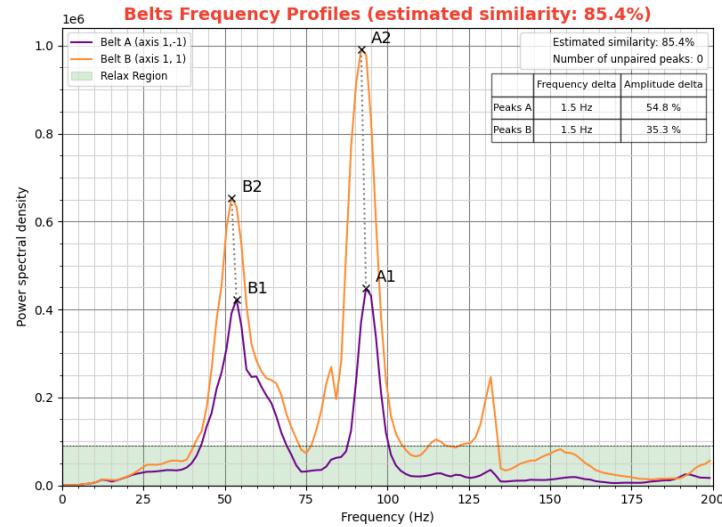
<https://github.com/ogland/Printer-mods/tree/main/V2/CPAP>

Currently using CW2 extruder. Will move to G2E when parts arrive



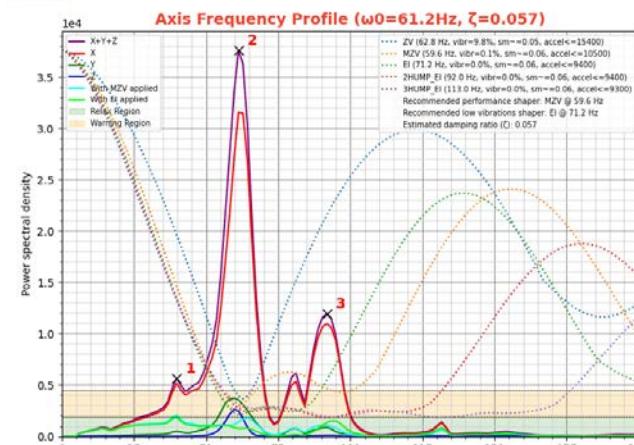
RELATIVE BELT CALIBRATION TOOL

03/12/23 21:01:31

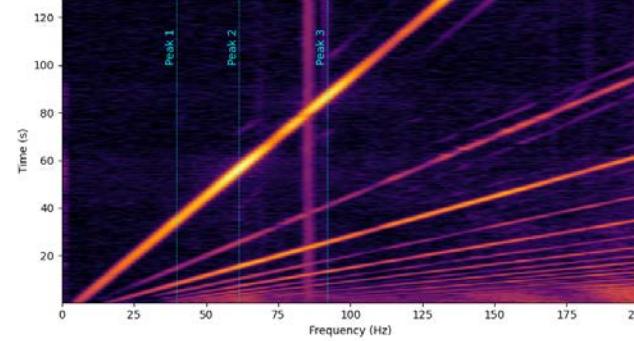


INPUT SHAPER CALIBRATION TOOL

03/12/23 21:04:54 -- X axis

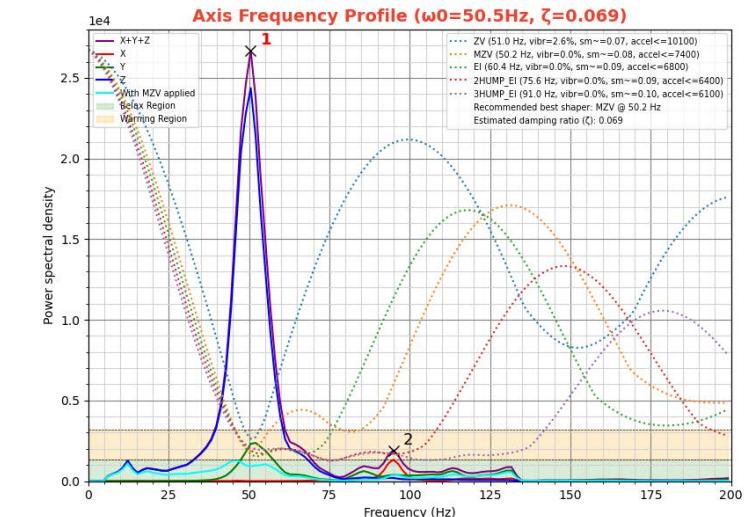


Time-Frequency Spectrogram

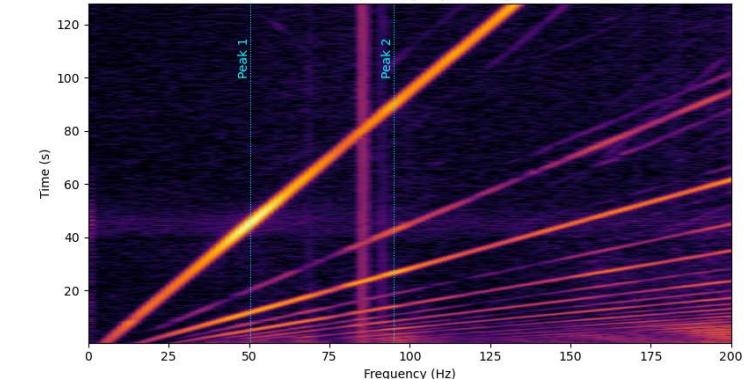


INPUT SHAPER CALIBRATION TOOL

03/12/23 21:07:36 -- Y axis



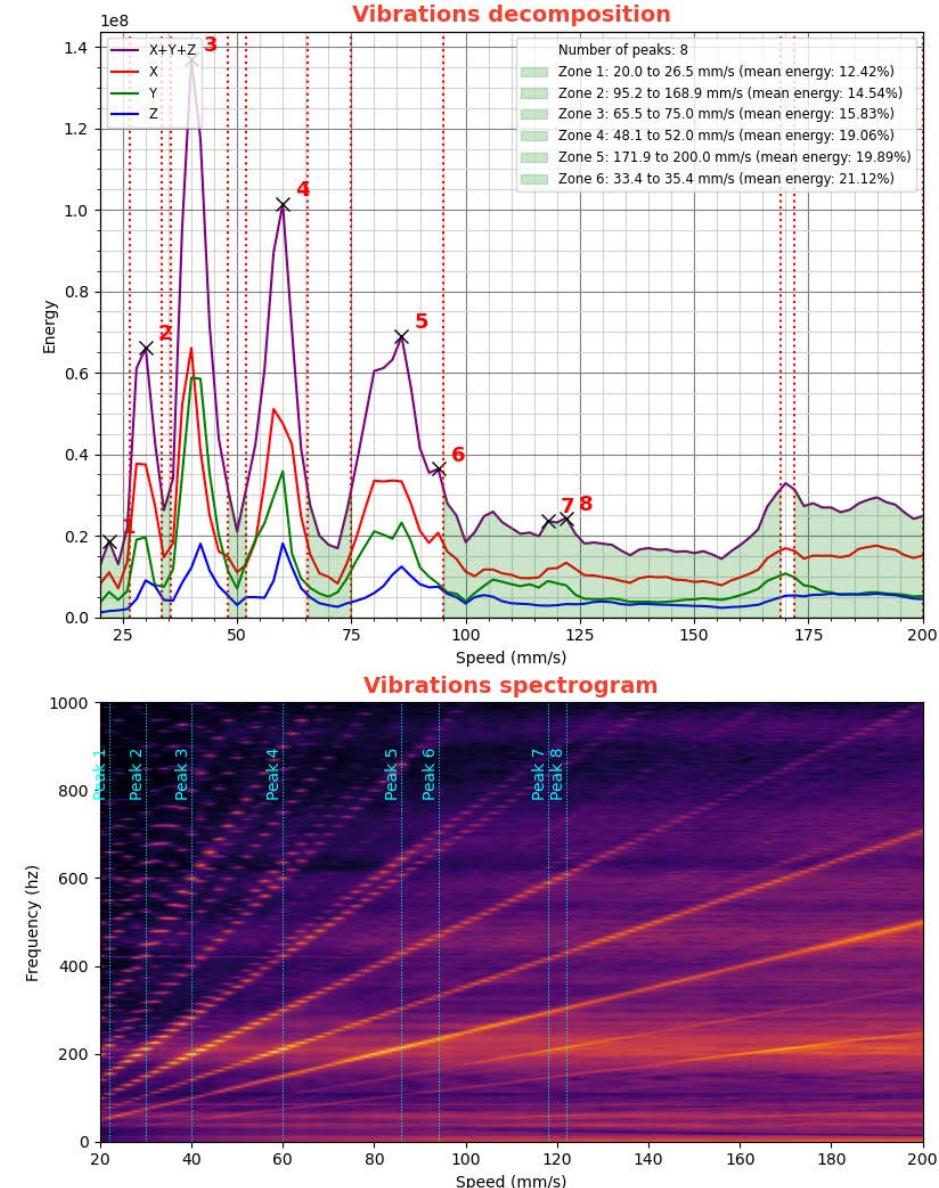
Time-Frequency Spectrogram



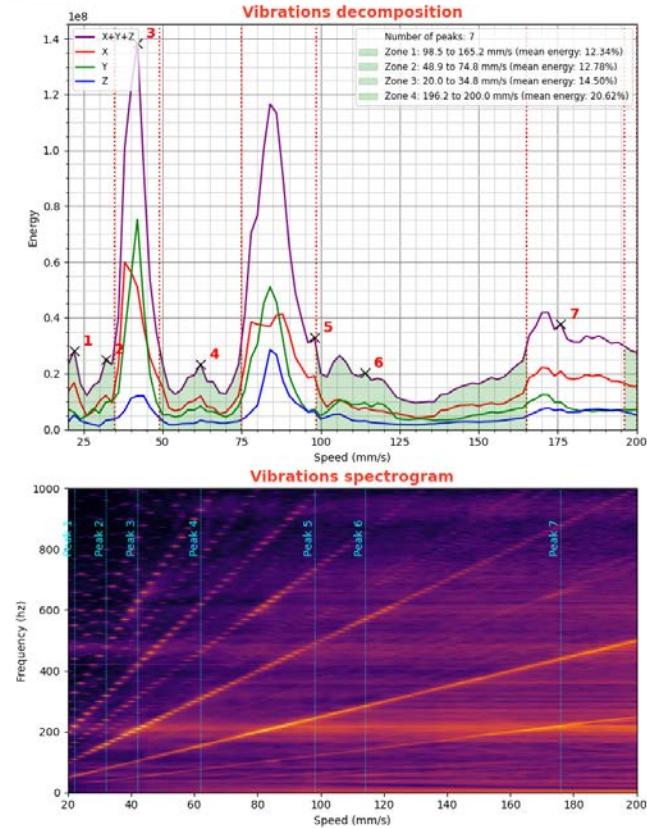


VIBRATIONS MEASUREMENT TOOL

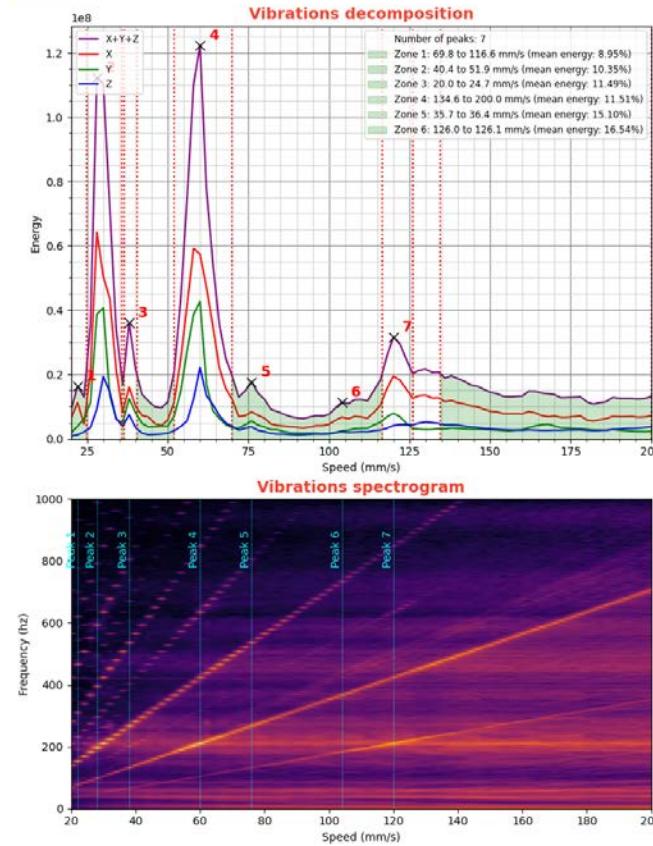
04/12/23 06:21:21 -- ABXY axis



VIBRATIONS MEASUREMENT TOOL
03/12/23 21:48:39 -- XY axis



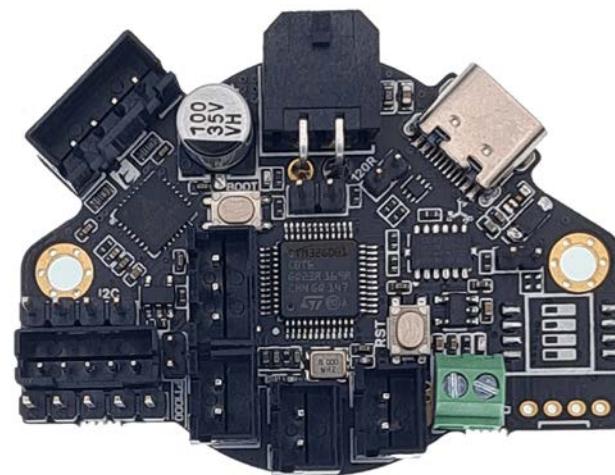
VIBRATIONS MEASUREMENT TOOL
04/12/23 05:56:05 -- AB axis



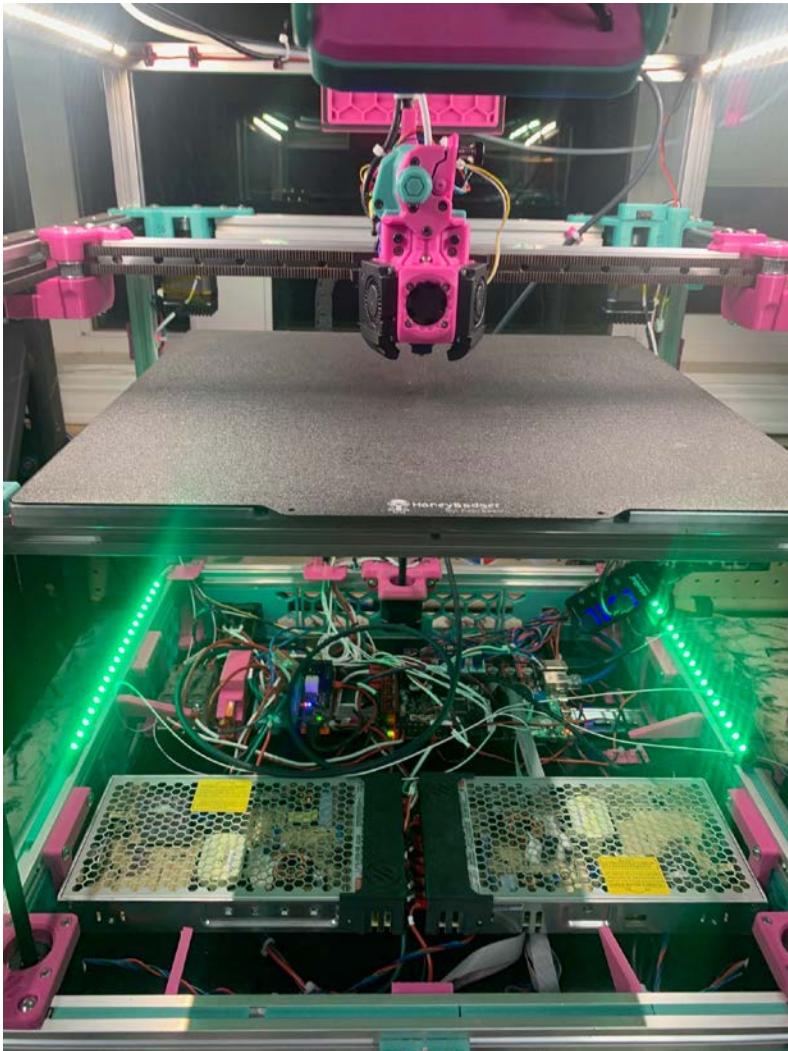
What I learned about CPAP

- Routing of the CPAP tube, canbus, and umbilical is very critical to getting good belt shaper and input shaper graphs.
- If your CPAP is not routed correctly then you are not going to get decent belt shaper graphs.
- For Trident's to make CPAP and the other lines go flat (horizontal) with the top cover is difficult. I choose to take the top cover off because I am printing mainly PLA on this printer.

Cartograph lis2dw vs Ebb36 adxl



Pictures/ State of the printer



Voron Trident 350 – serial 1190

Mods:

Canbus

Ebb36

Xol with Xol x-carriage

48V motors

Inverted electronics

Bowden tube holder thingy

Rama front idlers

G2SA extruder (wristwatch on standby)

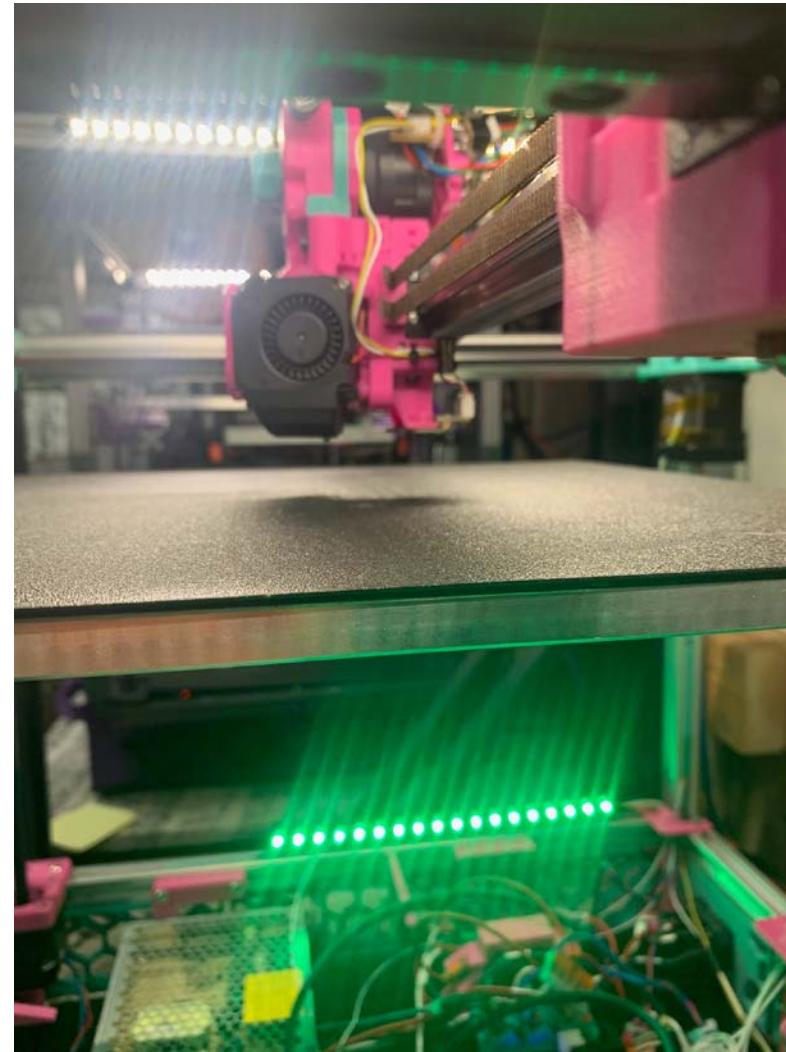
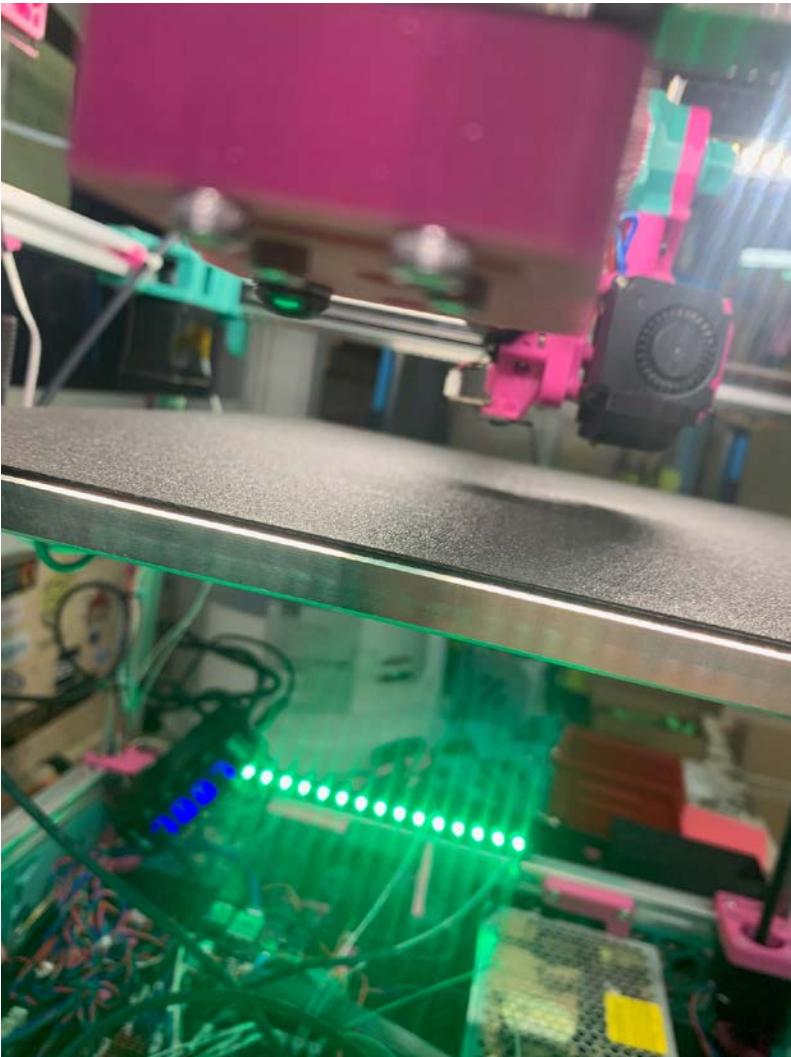
Cartographer probe

Klipper: v0.12.0-102-g9f41f53c

Shaketune: v2.5.0-5-g9fa07a12

Cartographer: v1.0.0-30-gd00ecfe6

Pictures/ State of the printer



Pictures/ State of the printer



Tension provided by pfmakes.com belt tension tool
Also available at west3d.
Neither gives me stuff for free. i.e. not a sponsor.
I just think this tool is the bees knees.



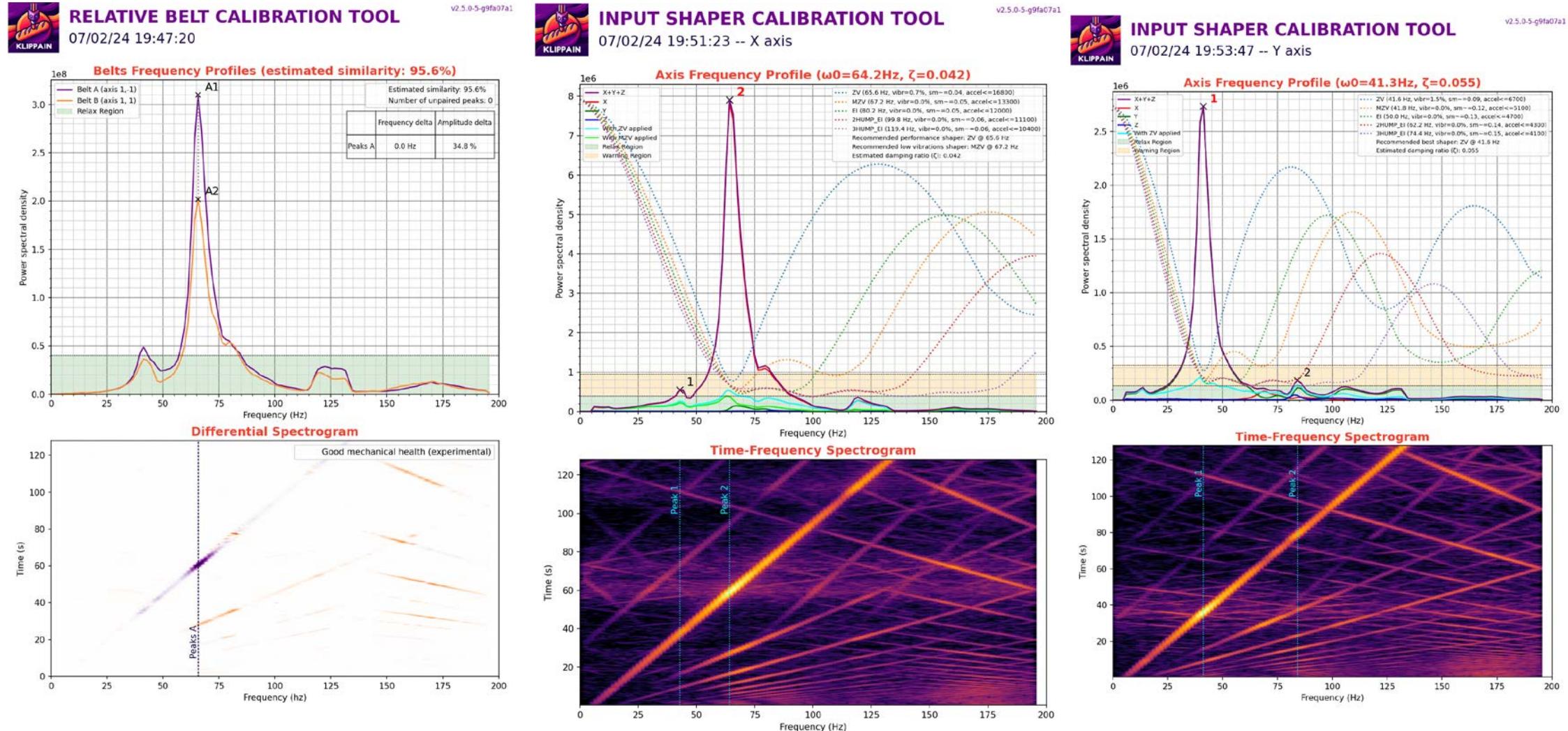
ADXL.cfg

klipper config for testing

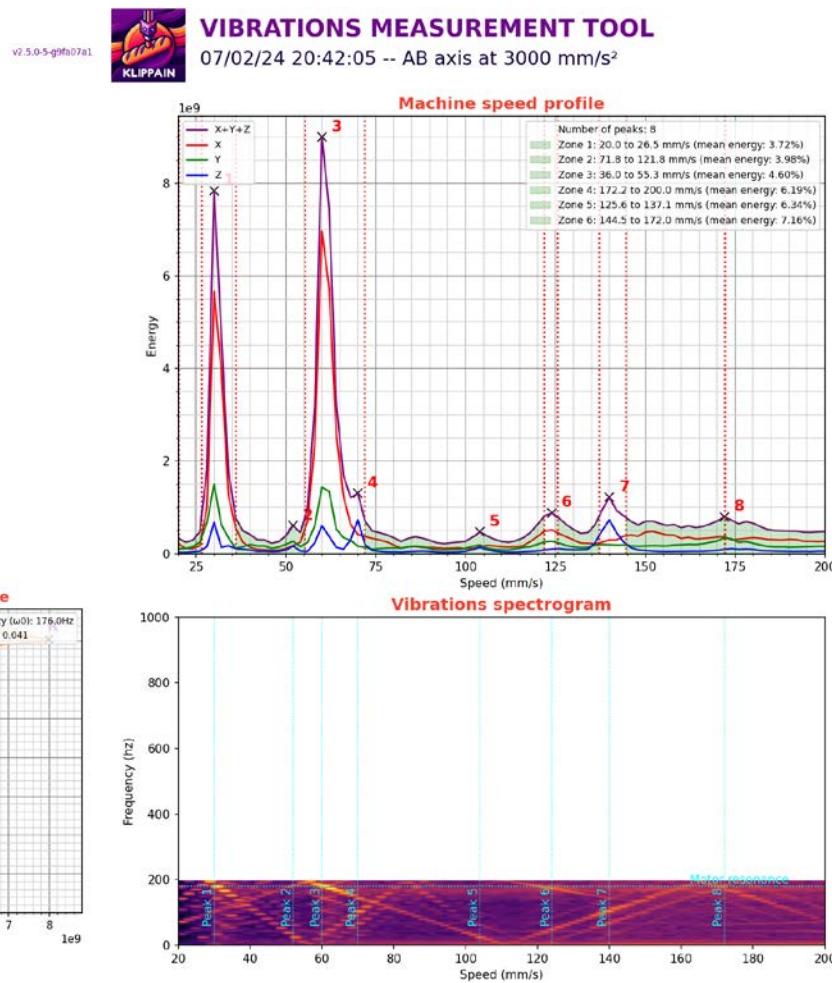
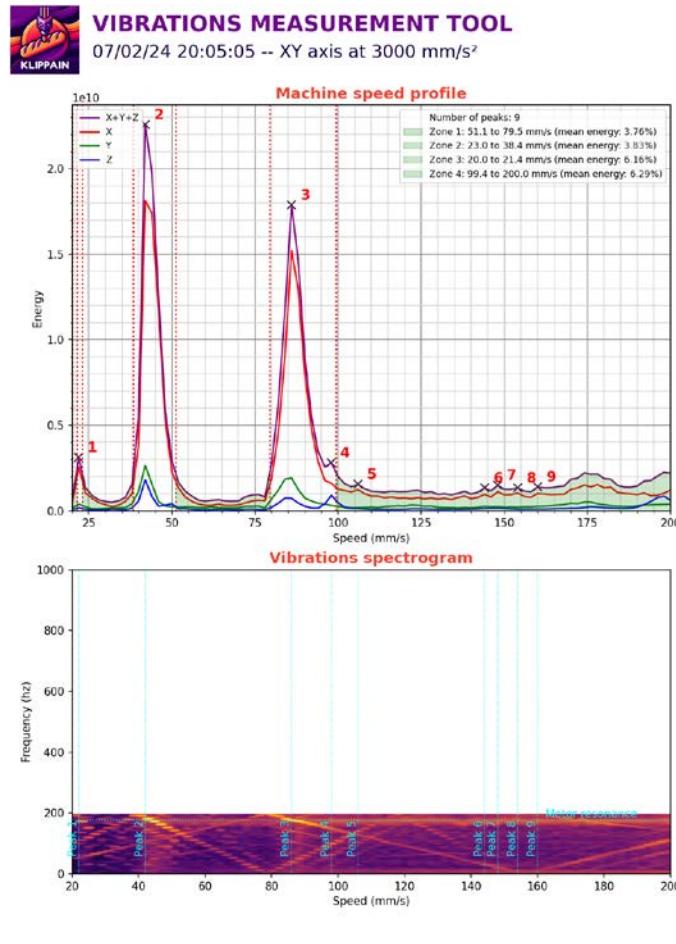
```
#####
# Resonance Testing
#####
#####
Ebb36 canbus board
#####
[adxl345]
cs_pin: toolhead:CS_ADXL
spi_software_sclk_pin: toolhead:ADXL
SCLK spi_software_mosi_pin: toolhead:ADXL莫斯I
spi_software_miso_pin: toolhead:ADXL莫斯O
#####
#cartographer
#####
[lis2dw]
#cs_pin: cartographer:PA3
#spi_bus: spi1

[resonance_tester]
#accel_chip: lis2dw
accel_chip: adxl345
probe_points: 175, 175, 20
accel_per_hz: 100
```

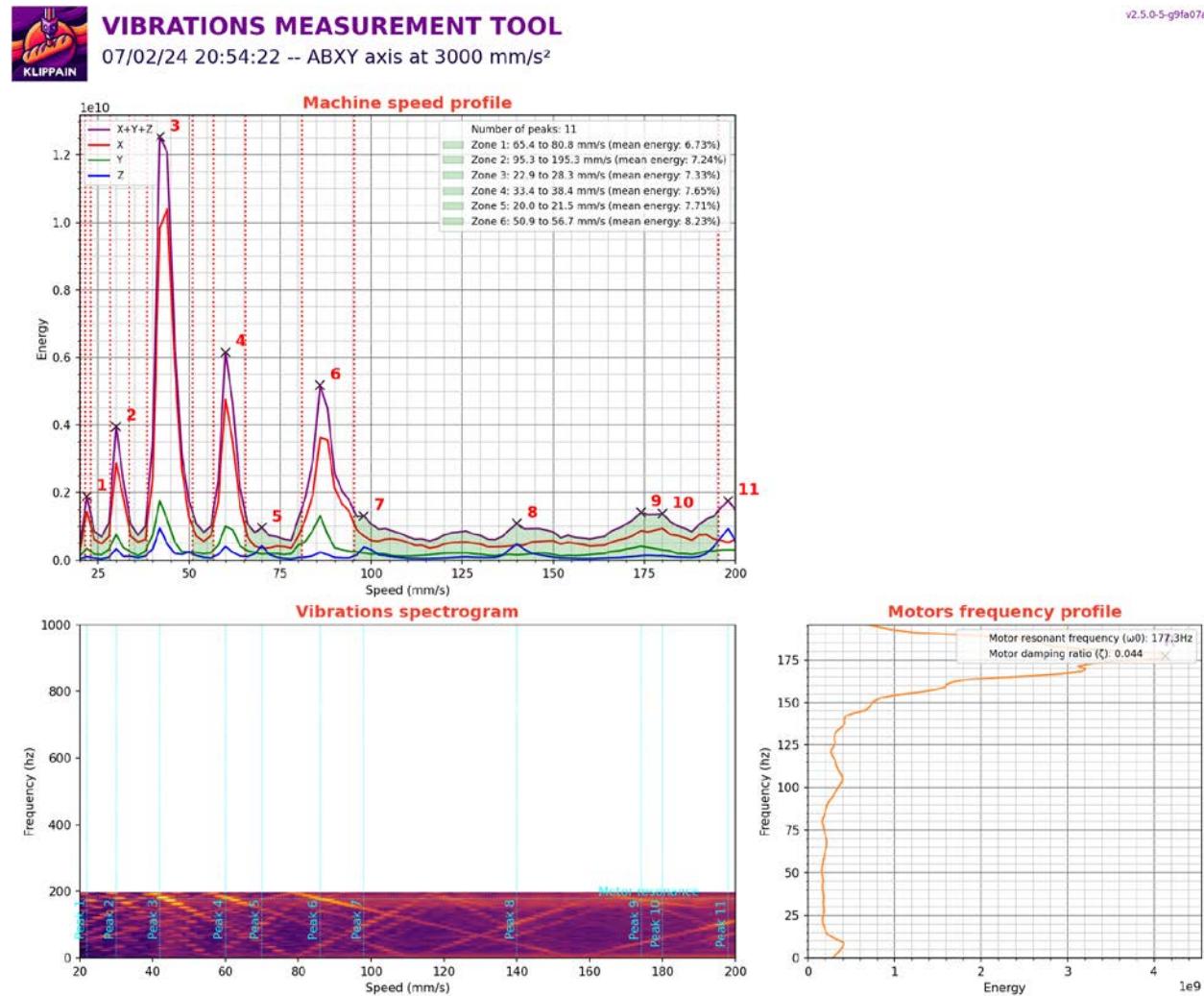
Cartographer – lis2dw



Cartographer – lis2dw



Cartographer – lis2dw

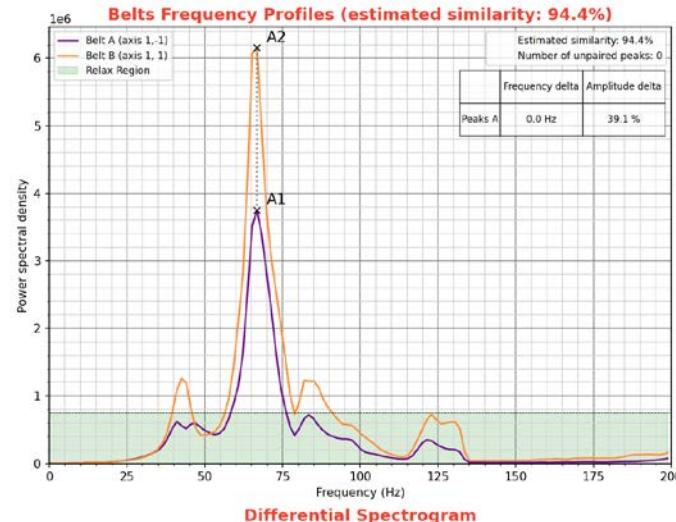


Ebb36 – adxl345



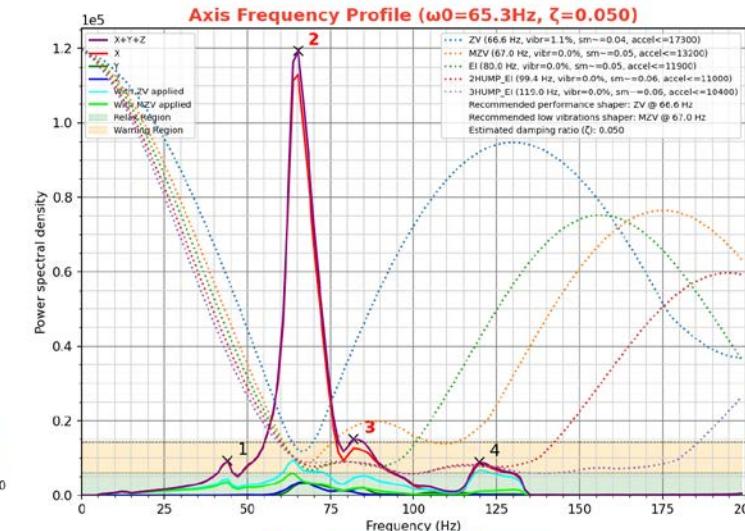
RELATIVE BELT CALIBRATION TOOL

07/02/24 21:31:50



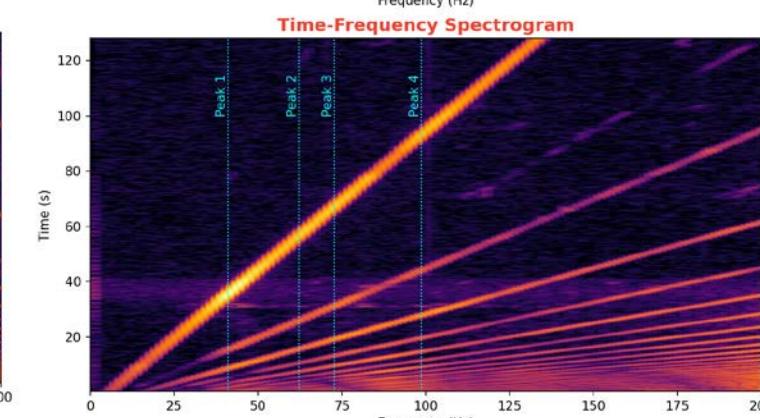
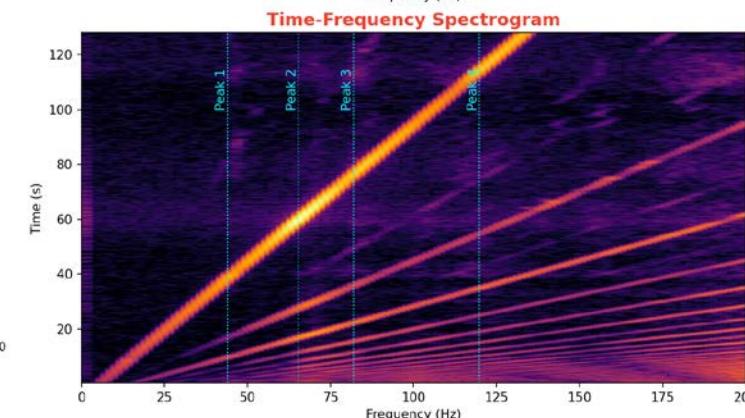
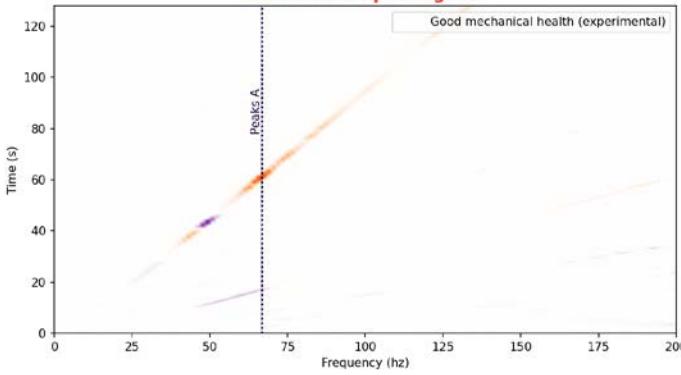
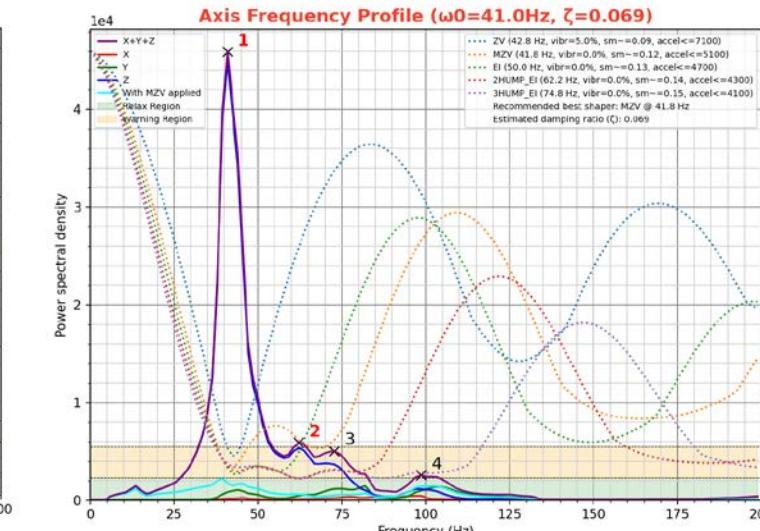
INPUT SHAPER CALIBRATION TOOL

07/02/24 21:35:11 -- X axis

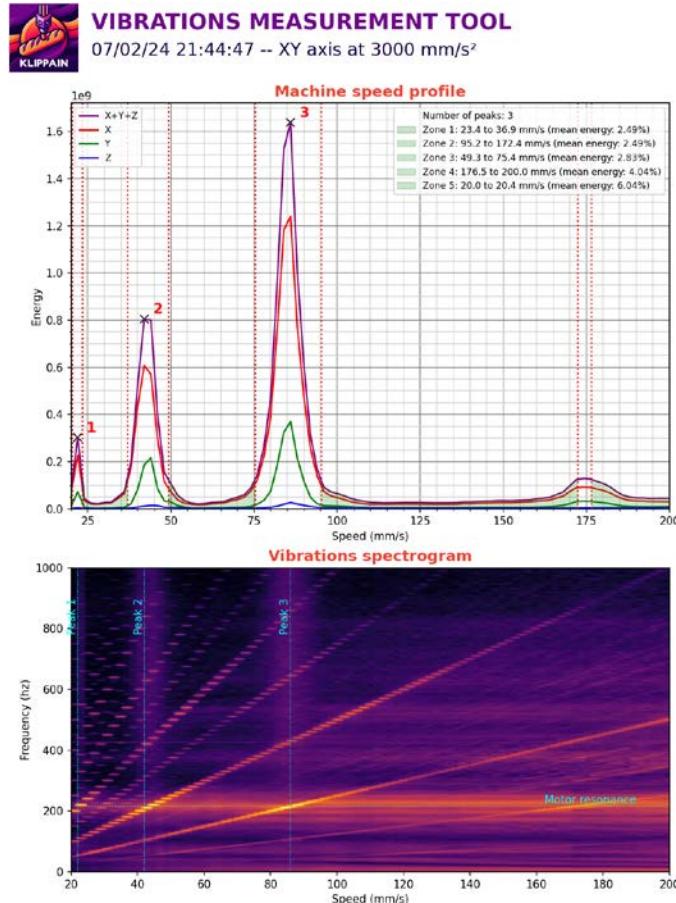


INPUT SHAPER CALIBRATION TOOL

07/02/24 21:37:37 -- Y axis



Ebb36 – adxl345



Ebb36 – adxl345

