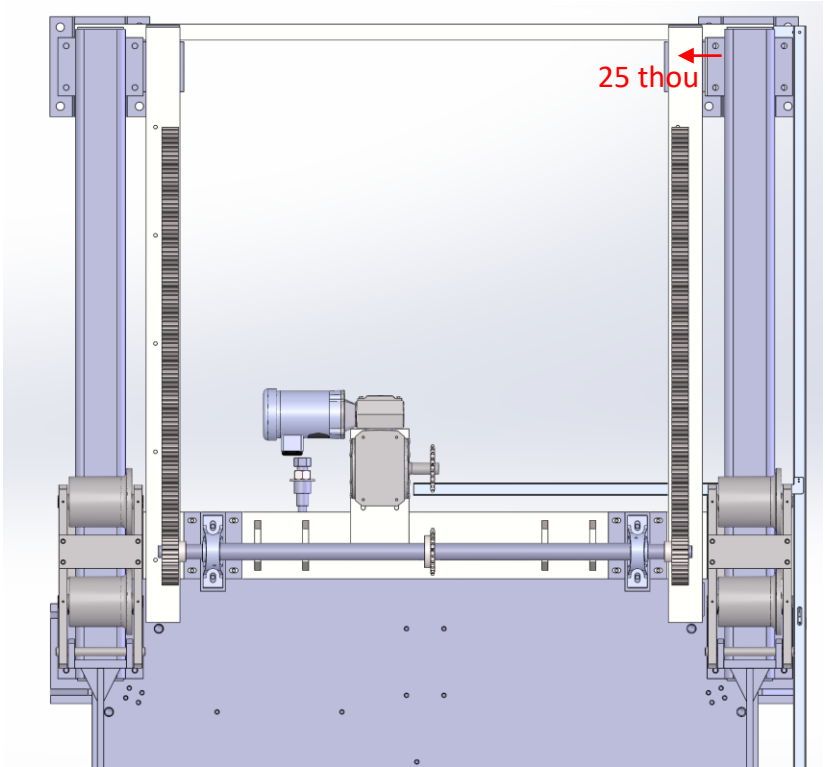
Day 1 (2024-04-22)

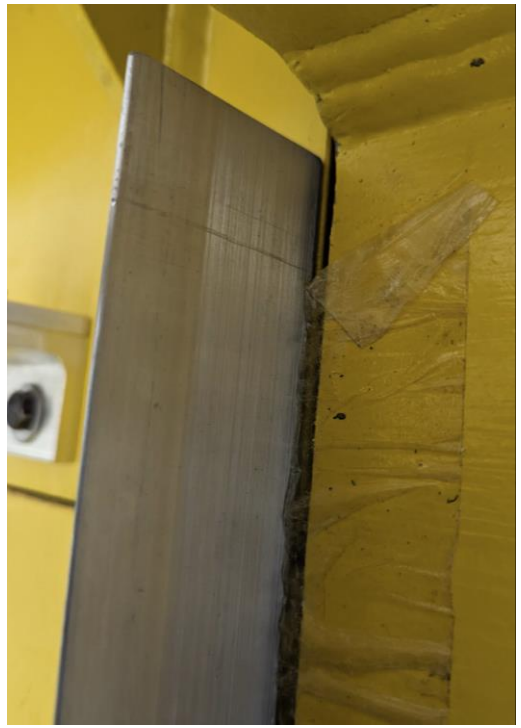
- An attempt was made to correct misalignment by moving this structural beam inward slightly, approx. 25 thou.
- The vault was remotely opened and closed while monitoring the dial indicator. Prior to this test, the dial indicator moved 185 thou when the door was fully opened. During this test, the same result was observed. This means the adjustment made no difference, however it is likely attributed to the fact that the roller car “bottoms out” on the structural tube so the measurement is actually saturated and maxed out.

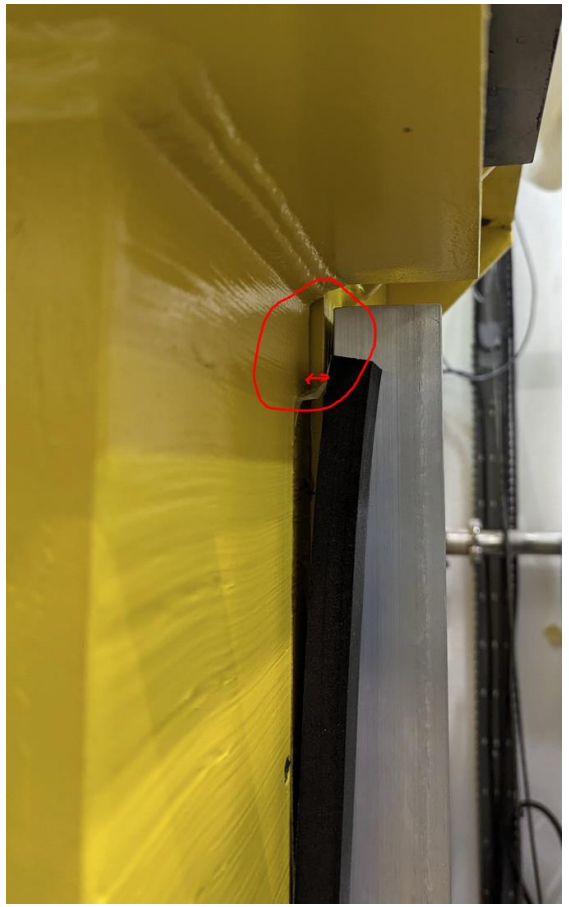


What was discovered?

1. It was noticed that when looking at the vault head-on, there is a lateral shift which is approx. ¼”, as evident from both sides of the vault:

Left side (facing head-on)
(difficult to see but there is slight overlap)



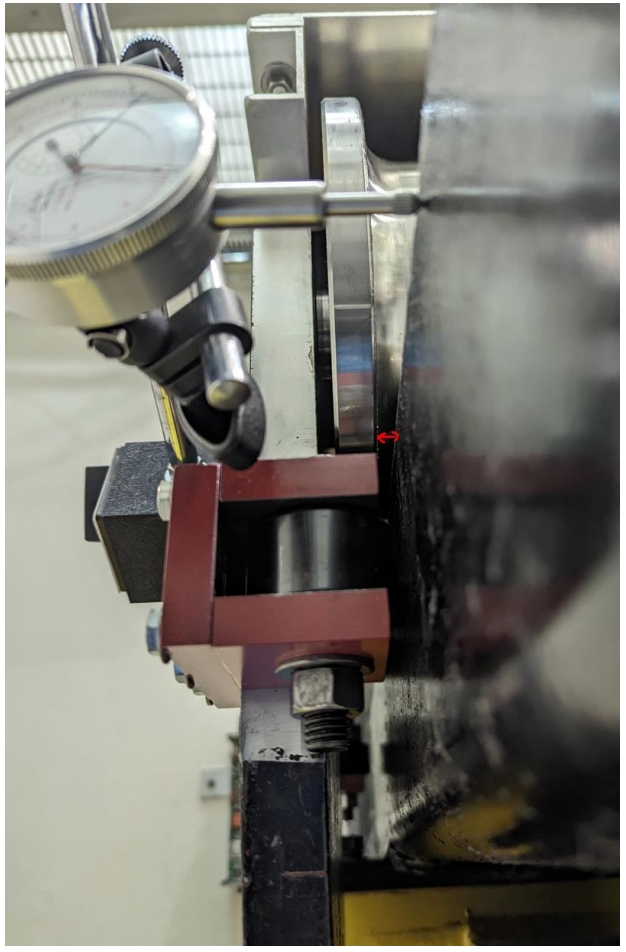


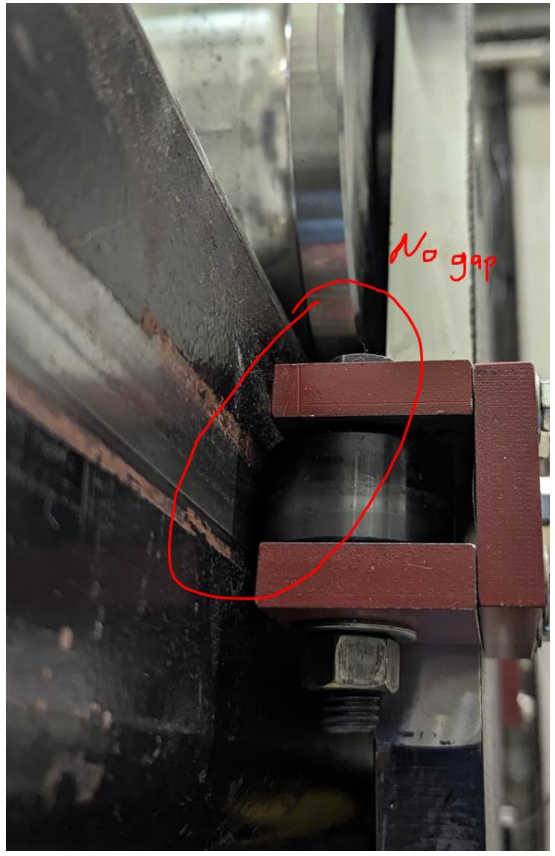
Right side (facing head-on)

What was discovered?

2. It was also noticed that the large rollers (and smaller rollers) exhibit a similar lateral shift:

Left side (facing head-on)



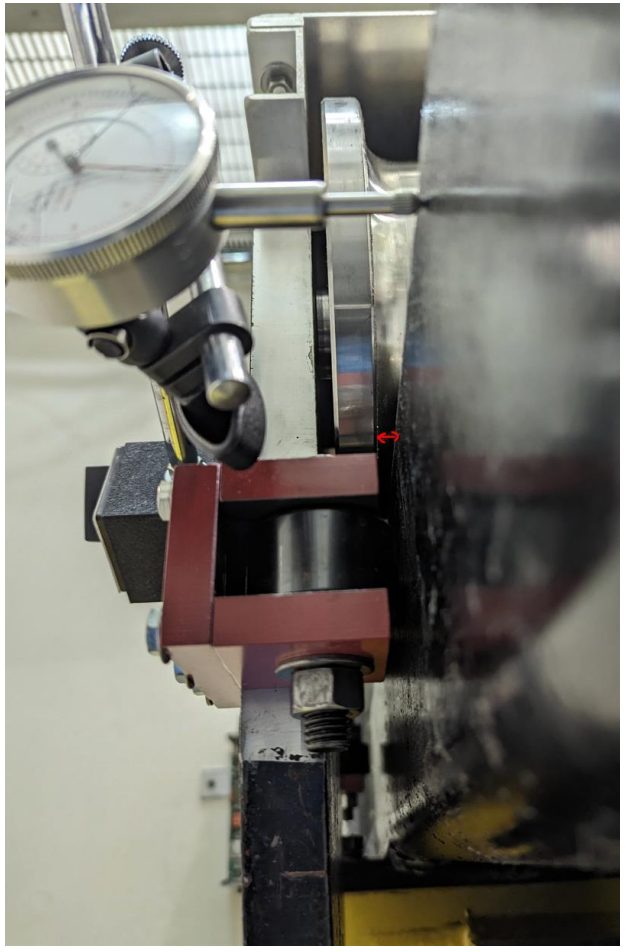


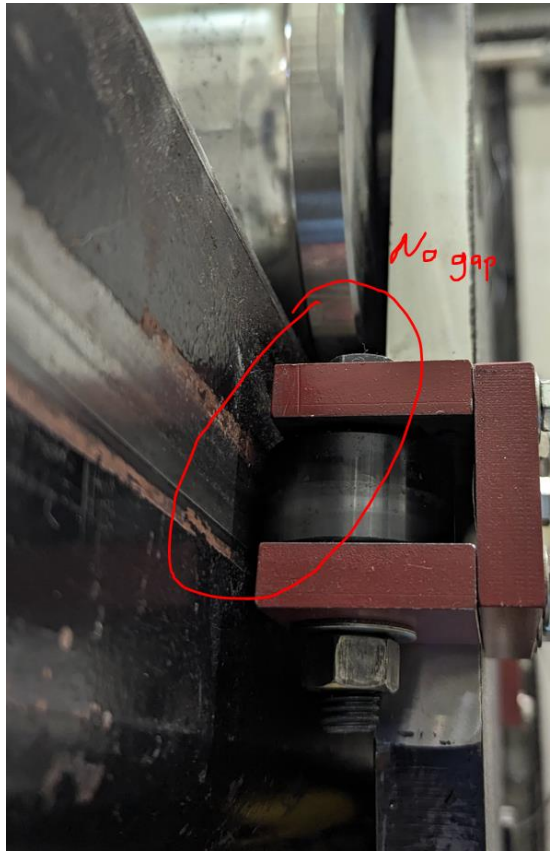
Right side (facing head-on)

What was discovered?

2. It was also noticed that the large rollers (and smaller rollers) exhibit a similar lateral shift:

Left side (facing head-on)

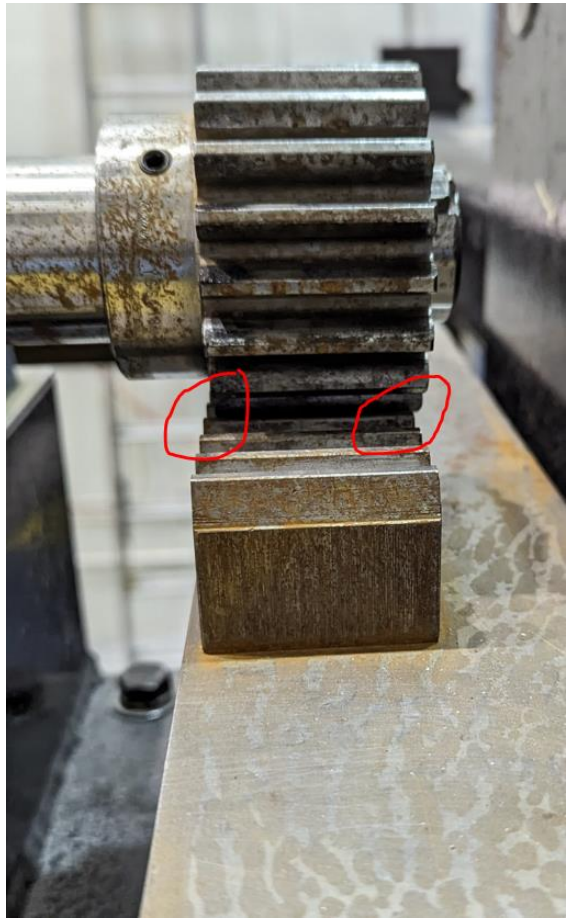




Right side (facing head-on)

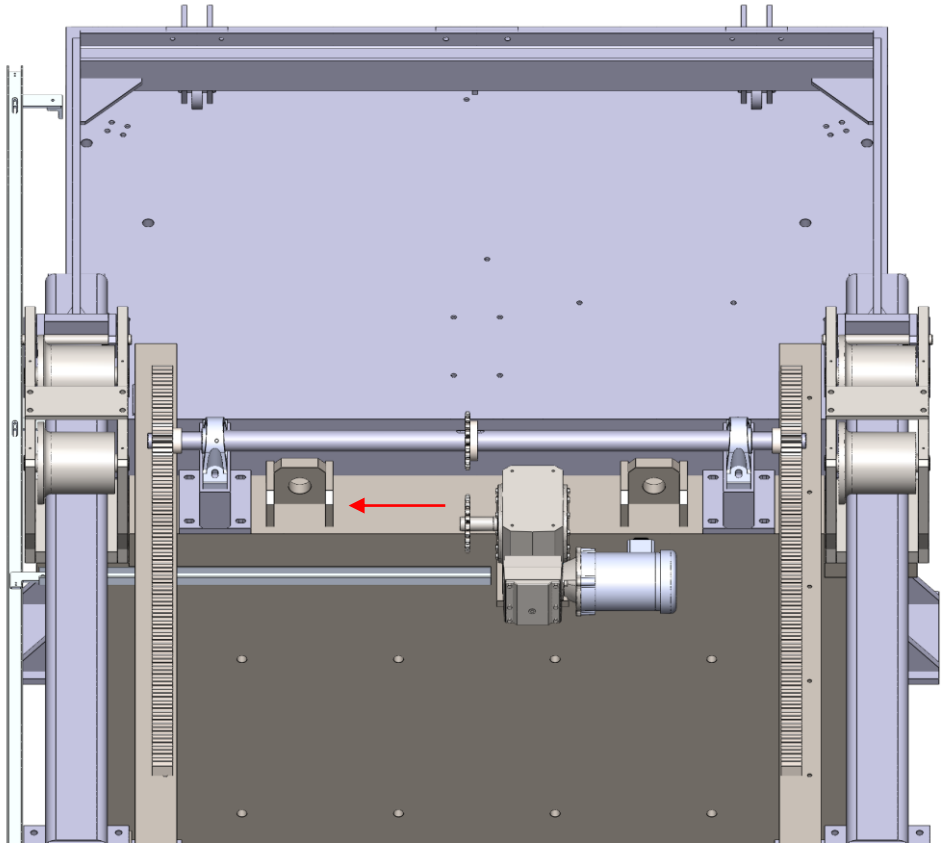
What was discovered?

3. This shift is also slightly noticeable in the rack and pinion assembly:



What does this imply?

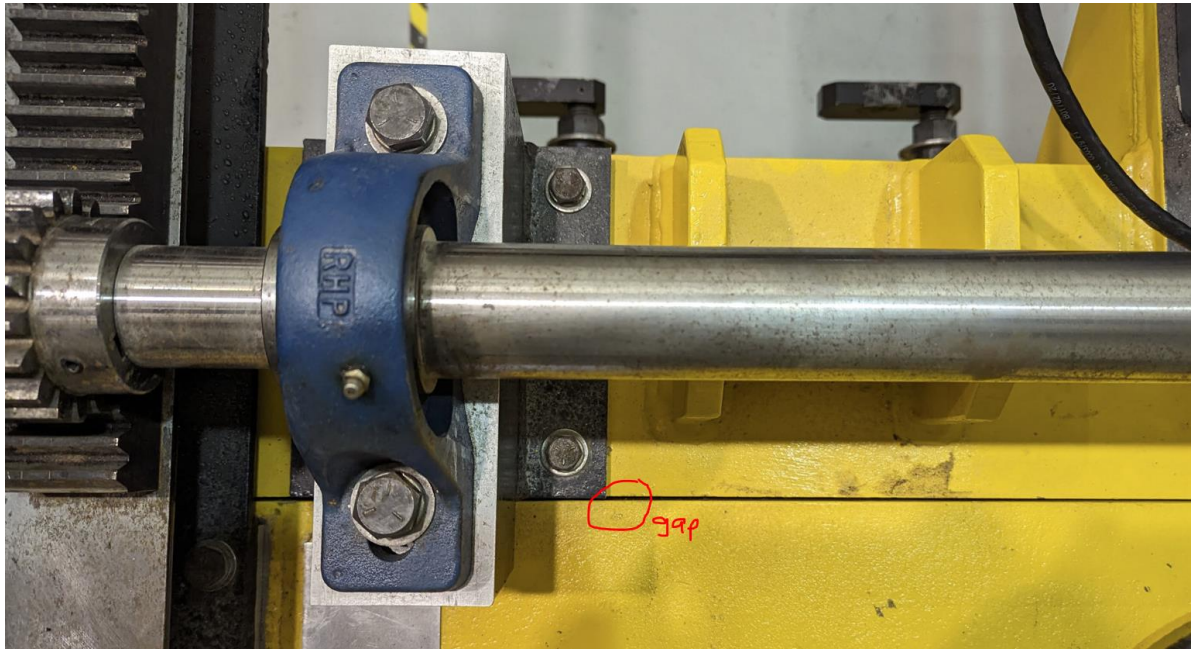
It seems that the entire door assembly is slightly laterally shifted, half of the approximately ¼” gap observed, and should therefore be moved approx. 1/8” to the right in the image below (looking head-on) [note: measure to confirm the amount]



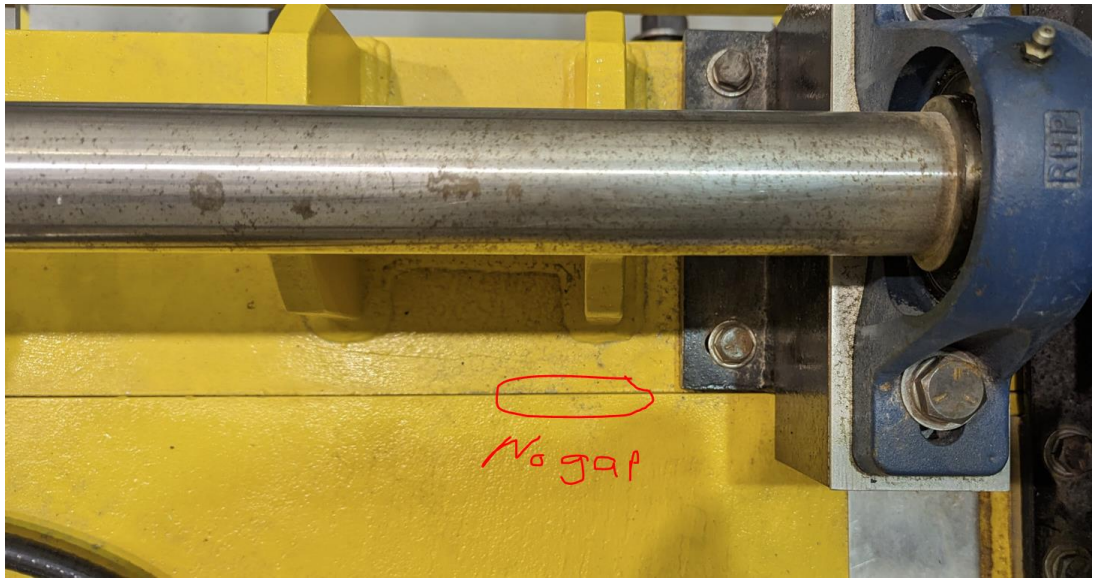
What else was discovered?

4. It was also noticed that, when viewing from above, there's a gap between door and vault on the left side, but *not* on the right side.

Left side (from above)

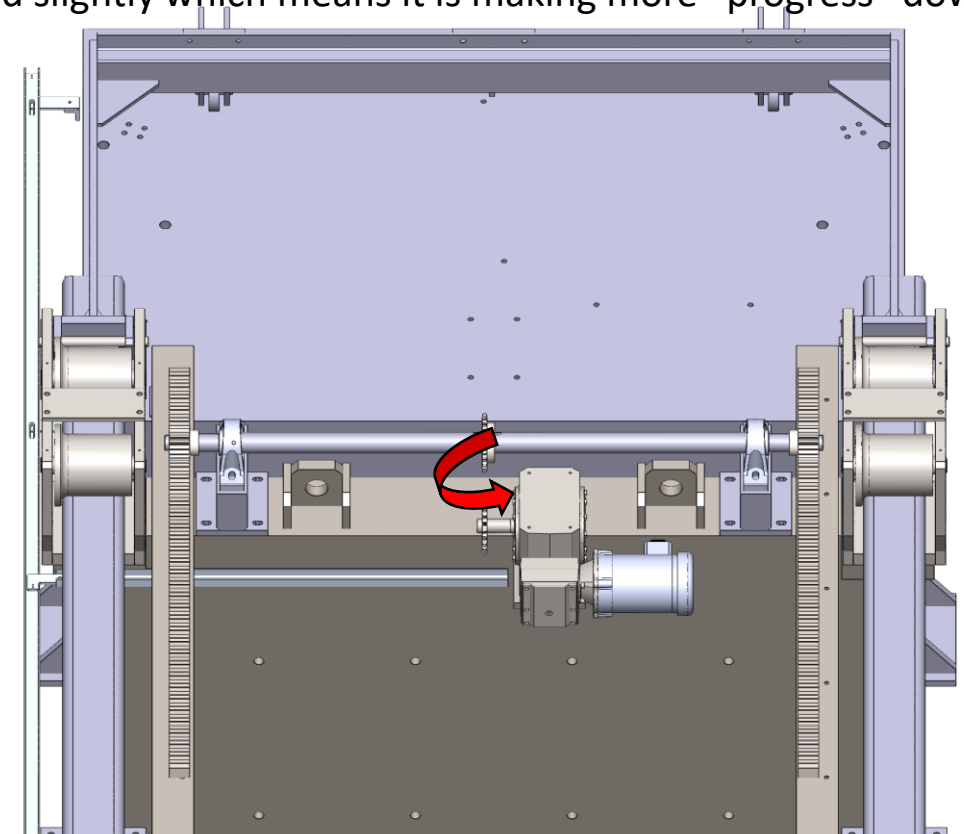


Right side (from above)



What does this imply?

It seems that the entire door assembly is also slightly rotated, which could be a result of one of the bearings (which holds the shaft assembly) being incorrectly positioned. If this is correct, it is possible that this is the explanation for the door skewing as it opens up – if one pinion is more constantly loaded than the other, it can pull the entire assembly over. It is suspecting that the "clocking" of the pinions with respect to each other may be slightly off as well, which could also cause this (in other words, one of them is rotated slightly which means it is making more "progress" down the length of the track).

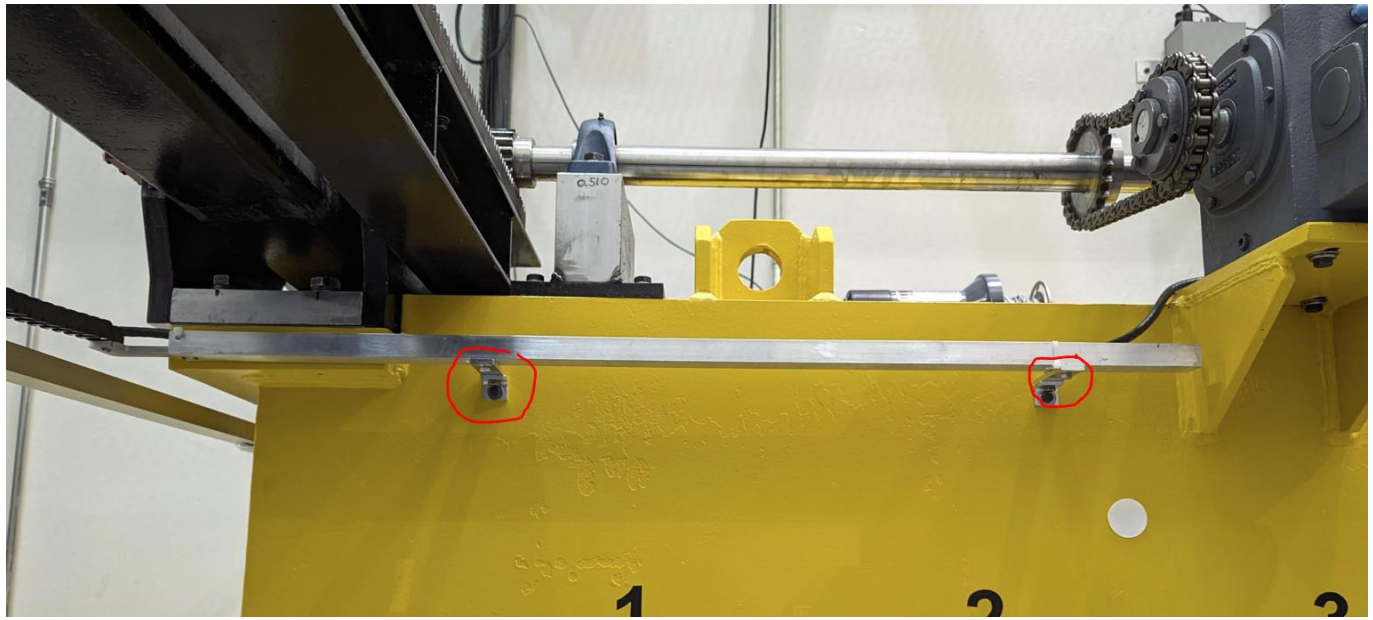


How do we fix this?

1. We need to revert back to normal state (before 2024-04-22) adjustment.
2. Lift door slightly and translate it to ensure the door is centred laterally with respect to the vault (do this by checking the sides – the obvious gap on one side should reduce in half). In order to lift the door, the drive shat will need to come off which is important for the next step.
3. When putting the door back in place, push it so it is flush up against the vault to correct the rotational misalignment. With it properly in place, the bearings and shaft assembly can be reinstalled and set to maintain this position. Furthermore, the pinions should be loosed at this point so they can be clocked in at the same position, and also centred laterally in their racks.

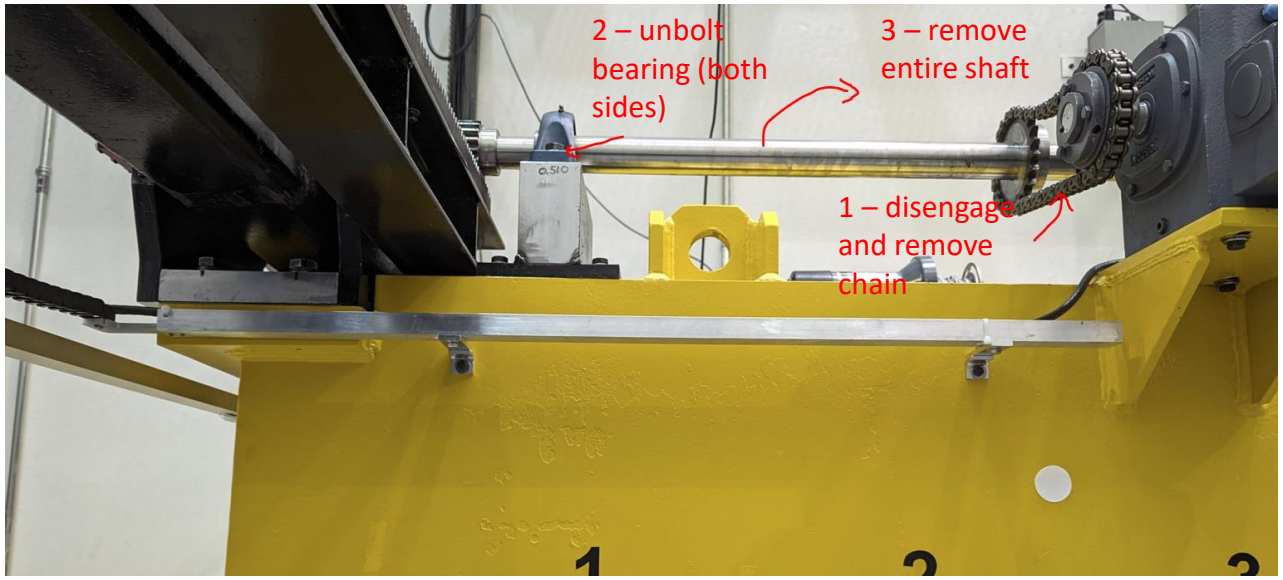
Plan for Day 2

1. First, revert the adjustment which was made yesterday – move the beam back ~25 thou so it is at “0”. The reason for this is that we are not certain if this modification was ever needed in the first place.
2. Next, take photos and measurements of anything that may be changed (read ahead to see suggested modifications then make measurements to obtain a reference point for each important item).
3. *Temporarily* mark first, then unbolt the aluminum cable track so it is floating – this is to prevent stressing it when moving the door around. Slotted holes should allow for the range of motion necessary. The plastic e-chain itself is flexible.



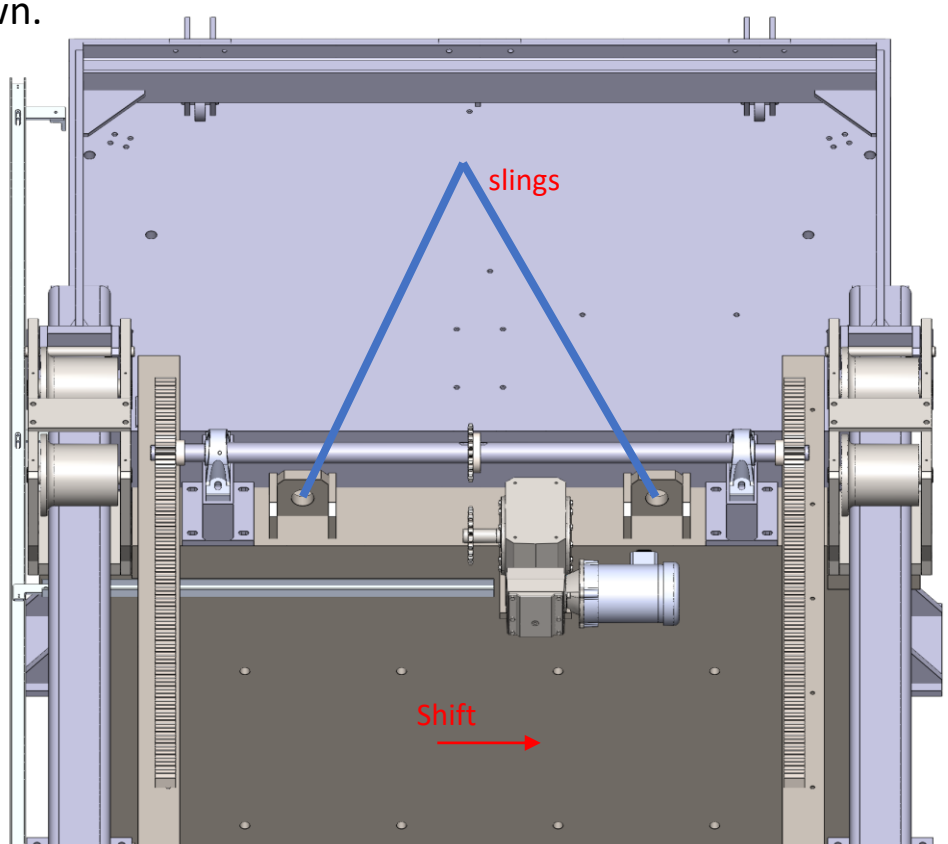
Plan for Day 2

4. Next, after measuring to obtain some reference points, disconnect the motor chain and set aside, then unbolt the bearings and remove the entire shaft assembly if it is free.



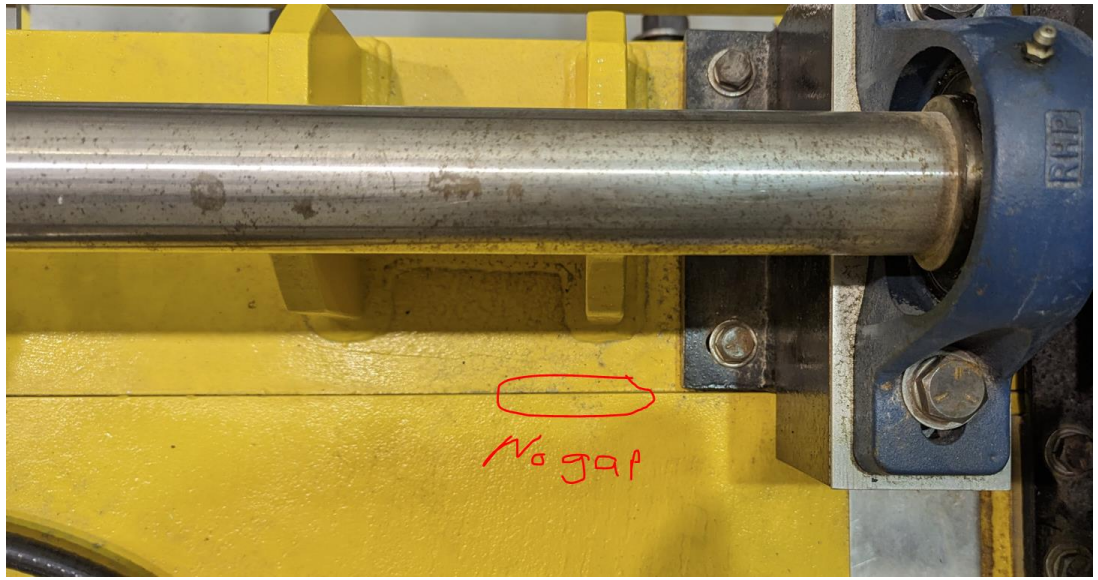
Plan for Day 2

5. Support the load of the door using the two lifting features and the overhead crane.
6. With a dial indicator set up (or other measurement method), nude the door laterally to the right in order to centre the door. In other words shift it approximately half the distance of the measured gap.
7. Lower the door back down.



Plan for Day 2

8. Ensure the door is pushed up against the vault so it is flush all the way along, and there's minimal gap observed (it should ideally look like this all the way along:



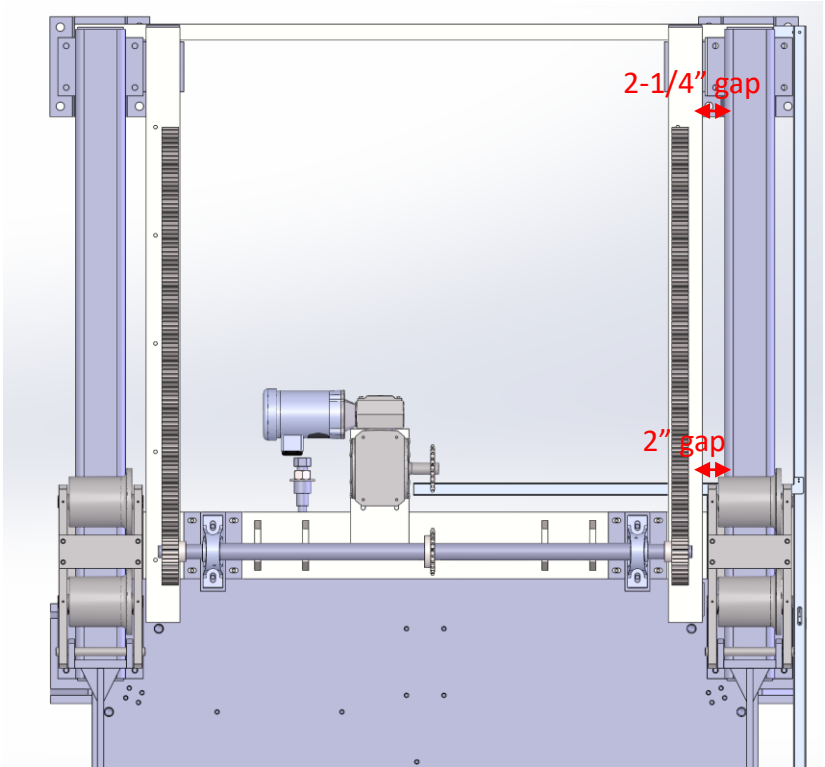
9. Then re-install the bearing + shaft assembly, while the two pinions' set screws are loose (important for clocking).
10. With the bearings roughly in position, set the two pinions so they're centred with respect to their rack, and ensure they're clocked the same (they should just settle in place because they are not loaded in this situation). Tighten their set screw.
11. Tighten the bearing blocks.
12. Reinstall the chain and check slack is OK.

Plan for Day 2

13. Re-tighten the aluminum cable track.
14. Perform a walkaround of the entire vault to check that both the lateral and rotation misalignments have been fixed and that nothing else appears wrong.
15. Set up a dial indicator on each side of the vault, and a camera to watch them – this will be used to confirm alignment when remotely opening/closing.
16. Move anything which could be in the way of the vault opening out of the way.
17. Lock out the target hall.
18. Attempt to remotely open and close the door, monitoring the dial indicators.
19. Confirm alignment resolved sufficiently. If it looks acceptable, open and close the door fully at least three times.
20. If no issues observed, enter the target hall and engage two random trays, then repeat the above three steps to confirm tray engagement doesn't impact alignment.
21. Test that the emergency close mechanism functions as expected still.

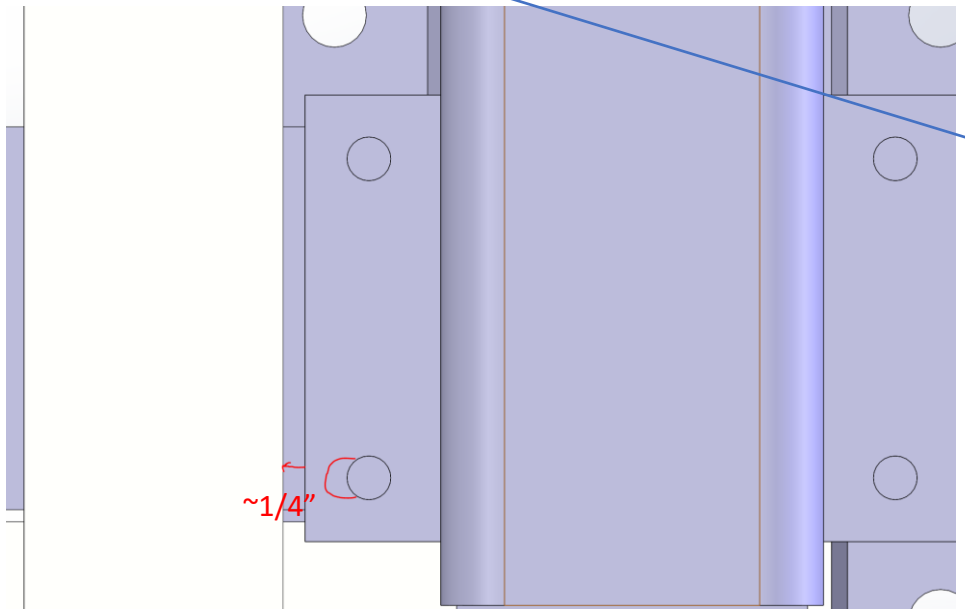
Day 2 (2024-04-23)

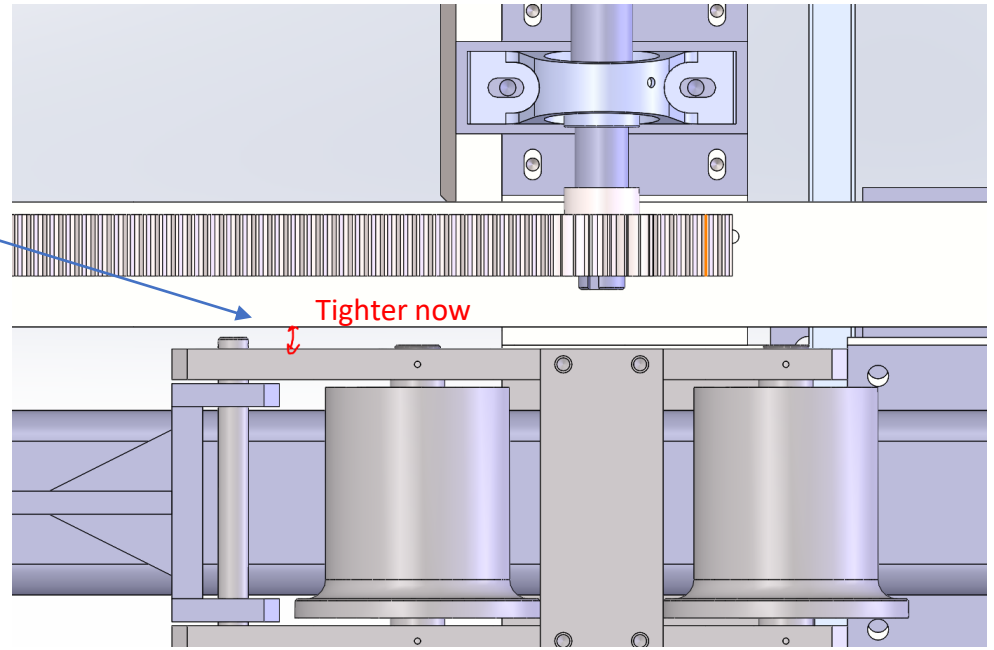
- Started off making measurements… the following was observed:
- The two structural members were essentially parallel w.r.t. each other
- The two pinion supports were essentially parallel w.r.t. each other
- Gap was measured between pinion support and structural beam on both side… the following was found:



Day 2 (2024-04-23)

- Unbolted the right (from top view) structural member, shifted it approximately ¼”, then drilled out the hole in the lower part.
- Bolted it back together so now the gap difference was reduced.
- Tested – OK.
- Some concern now about the entire large roller car assembly rubbing up against the rack mounting part when the door is fully opened





Day 3/4 (2024-04-23/24)

- Unbolted the right (from top view) structural member, shifted it approximately ¼”, then drilled out the hole in the lower part.
- Bolted it back together so now the gap difference was reduced.
- Tested – OK.
- Some concern now about the entire large roller car assembly rubbing up against the rack mounting part when the door is fully opened

Day 6 (2024-04-29)

On 2024-04-26, an issue was discovered when remotely operating the door to test it:

- When opening the door all the way, things behaved as normal, except when the door was fully opened and needed to be closed, it did not function as expected…
- When closing from fully opened state, normally it is required to briefly press the “close override” button then the “close” button. However, now, it required “close” then “close override” then “close” again. This suggests that the close override limit (AKA the soft limit) was being passed because the entire door assembly had shifted. This is further evidenced by the fact the when closing the door fully, now the door slams into the vault rather than stopping at a soft limit to cause a bit of a gap before the final closing motion.
- The following adjustments were made:
    - Slide the flag for the final close limit *back* approximately ¼” (so that it toggles the limit switch *later* during its opening travel, which creates a larger gap between the soft limit and this hard limit)
    - Slide the limit switch at the back side of the vault (which was suspected to be the soft limit for closing the door, but it turns out this is not true) *forward* approximately ¼” so that it hits this soft limit *earlier* during its close travel. Note: this did not have the intended effect. See next set of notes. In any case, it was left as-is.
- Door opens as expected but during opening from closed state, now the gap between when you need to override and when you can press the normal "open" button is slightly increased. This is OK. This is a result of moving the LS on the back of the vault. It appears the only thing that LS affects is the logic for opening door from closed state. Because it still works fine, I'll just leave it as-is.
- When door is opened, it hits the soft limit as expected and requires override to hit the final limit. This soft limit has been confirmed to be the bottom of the two LSs on the "door open" side of the vault, as we suspected.
- Door hits final limit when overriding the first LS as it normally is supposed to - this is because of the adjustment we made to the flag which is mounted on the trailing side of the door. It now contacts the final LS later during door open (meaning the gap between it and the soft limit is increased).
- When it hits the final limit, pressing the "open" or "open override" buttons do not allow further motion. This was also confirmed by watching the clutch on the motor - it did not move, which indicates the motor did not have permission to run, which is correct. Furthermore, it did not appear the hard end stop was hit at this time. We still need to confirm that this limit is set correctly by opening up the vault with a tray engaged, to confirm if all pails are reachable via crane tool.
- When closing the door from its fully open state, it behaved correctly (i.e. required "close override" first and then "close"). This issue appears to be resolved.
- Note that when the door was almost fully closed, it did not stop at any soft limit, but rather continued to bump into the vault. This means that the LS mounted on the back of the vault has no effect on this logic. It seems to be entirely handled by the two different style LSs which are mounted on the top-front of the vault which get hit by the small L-bracket on the door to signal "door is closed". It is suspected, but not confirmed, that one of these is the soft limit as it hits slightly earlier, and one is the hard limit.
- In the future, the door close situation will be ironed out when we do the ISAC target hall controls overhaul because then we have more control over the hardware/software and can get a better understanding of how these limits work. I will make note of this.
- Still to do:
    - Test vault when tray(s) engaged to confirm no impact on alignment during opening.
    - Also confirm all pails are accessible at fully open limit
    - Test emergency close mechanism

Day 7 (2024-05-01)

- Open and close vault door with trays 4 and 6 engaged
  - Door fully opens to allow for access to all pails... perhaps even more than before but this is acceptable and considered an improvement. We looked around with camera and there's no major concern.
  - Door closes correctly.
  - No interferences observed during travel.
- Open door with the two trays engaged still, and emergency close
  - The door successfully closes using emergency override mechanism
  - Confirmed closed via camera views
  - **(NOTE: before vault is used again, the emergency mechanism must be reset! Hopefully we can do this tomorrow)**