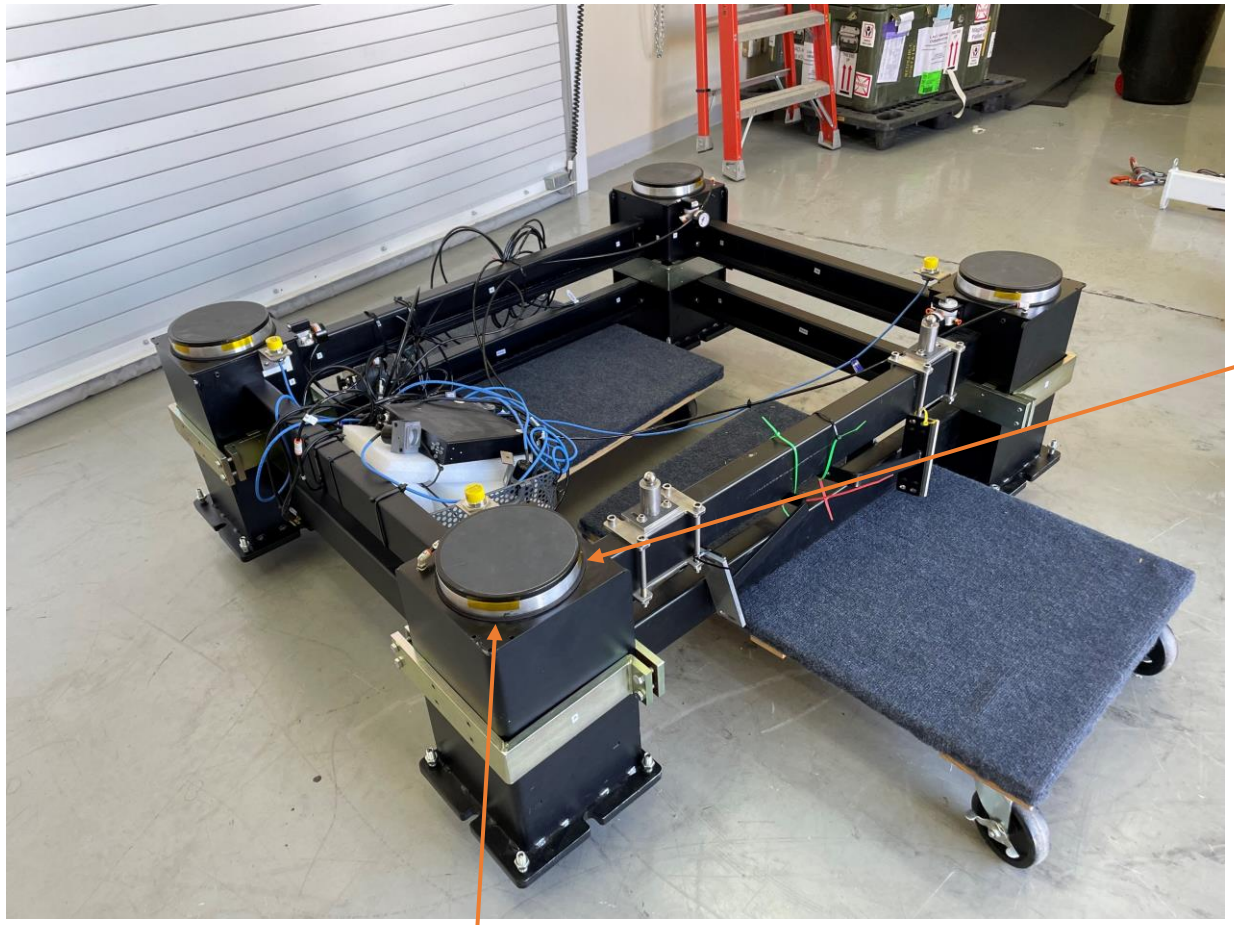
Aligning MagAO-X to the Telescope

Laird Close, March, 2023

Modified by Maggie Kautz, October, 2024

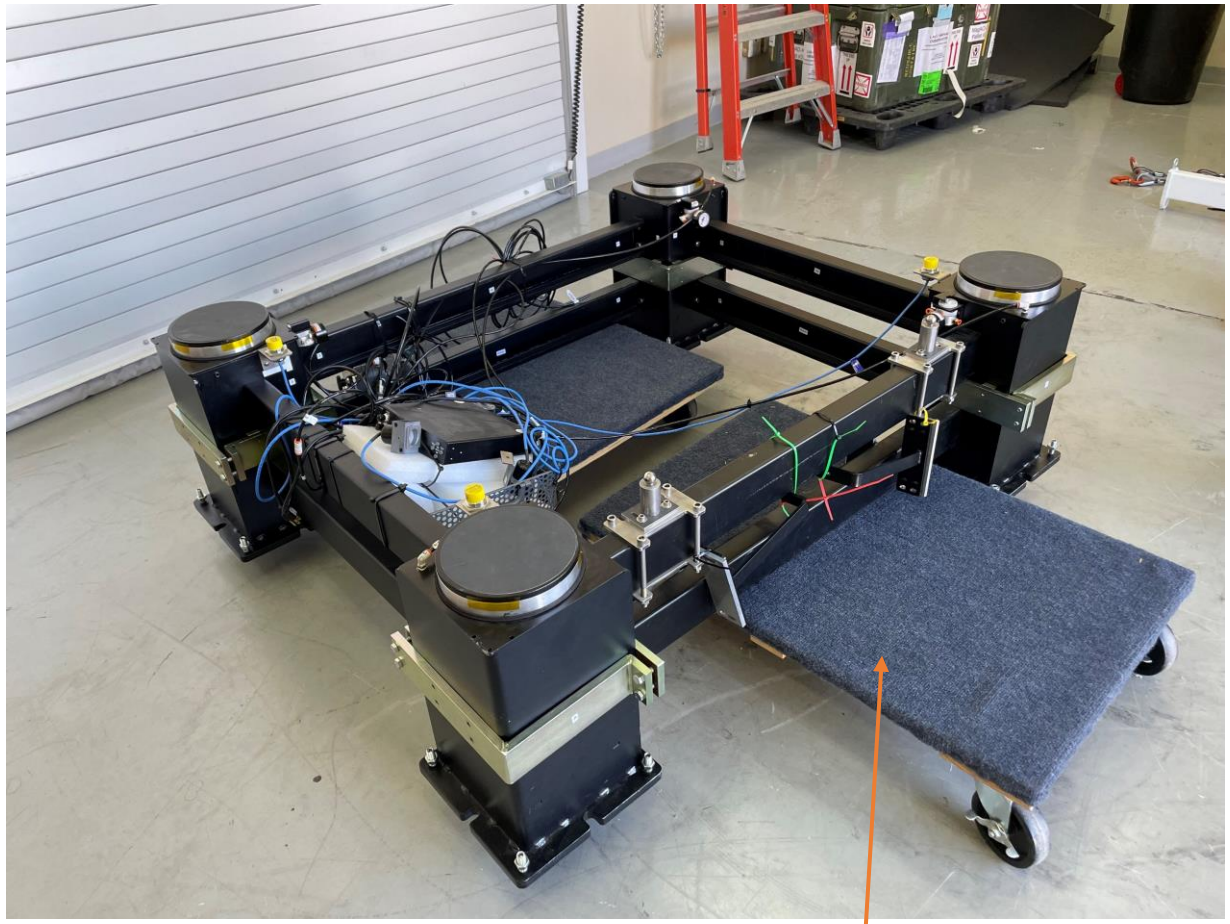
Prepare the legs with Kapton taped platters



Tape the platter (with ¾” thick Kapton tape) to the silver disc in its “floating position” from clean room. If not floated in clean room just center the platters.

3 x pieces of tape on outside of each platter

Slide dollies under the legs



Strap down for transport to telescope

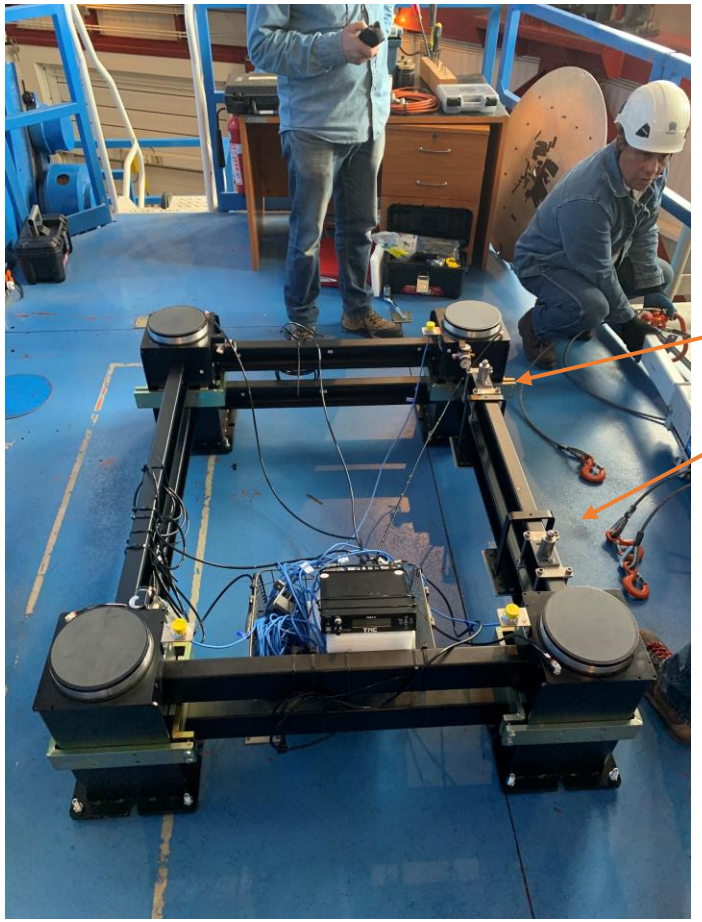
Set up for guider

- Leave mike guider on
- Leave dust cover on
- Make sure ADC is pulled out of beam
- Use the guider like it is “mike” mode (not AO).

Leave legs on elevator

1. Roll MagAO-X, mounted on cart, onto the blue platform
2. Lift MagAO-X and remove cart
    1. On next slide, see specifics for rolling legs under MagAO-X table and aligning them

Location of alignment pins

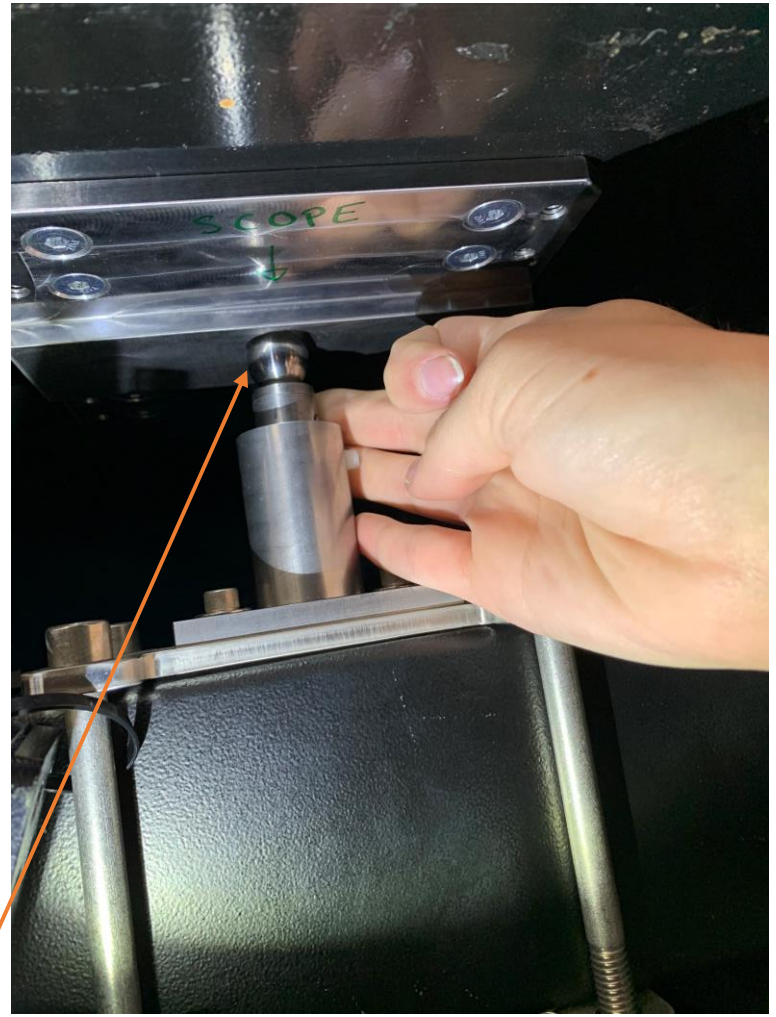


Pins to align table to legs (never slide these along the tie-bar)

Watch out for pinching when using or lowering table down

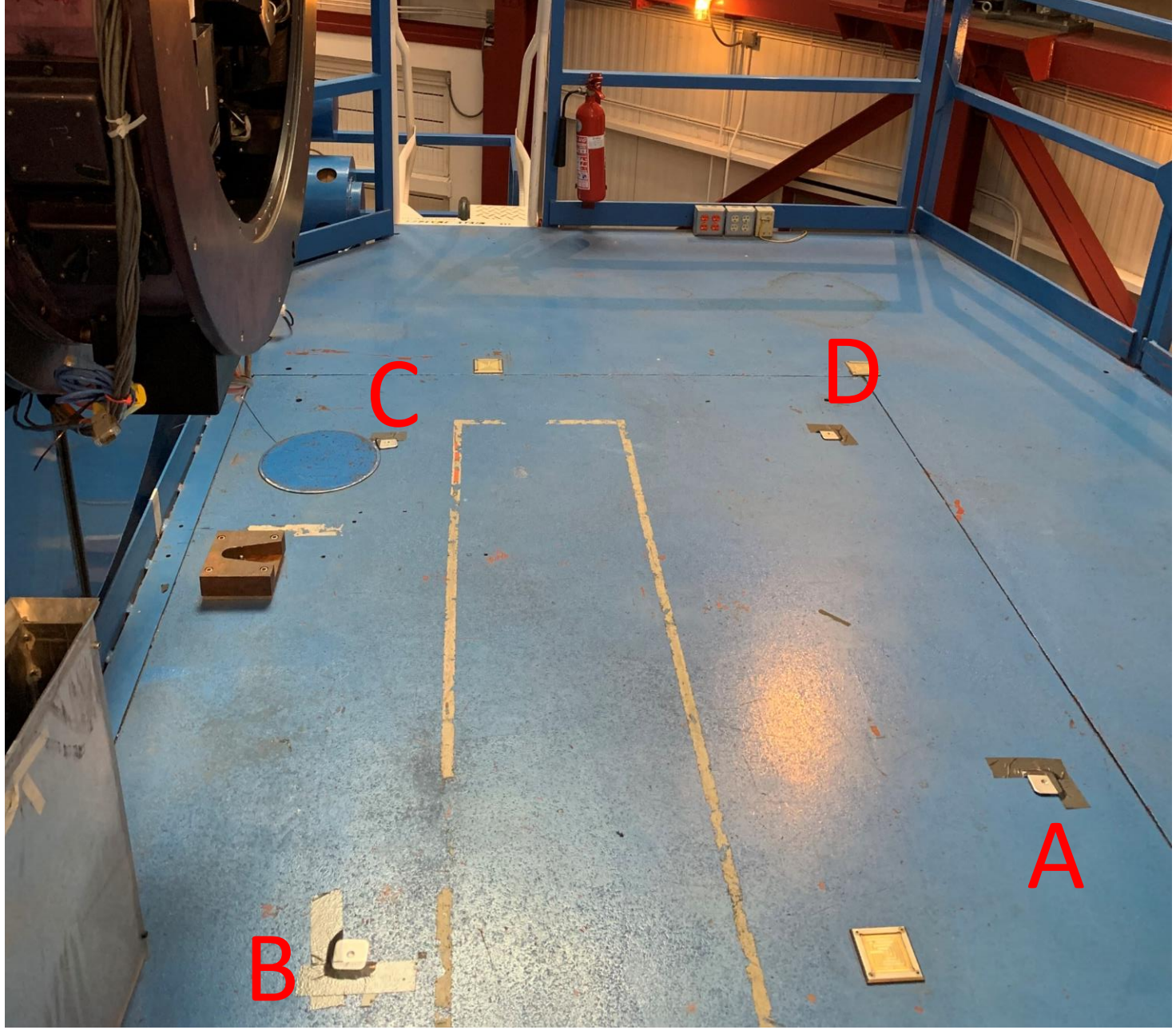
1. Steps to align table to legs

1. Center table on crane on platform
2. Set jib crane to lowest speed “3 hairs”
3. Add the digital levels to the cart
4. Let one person sitting on the ground look at the levels and keep the table level
5. Wheel legs under crane
6. Center platters (should be taped that way already)
7. Align the legs to both the pins (raise the tooling balls up to slots)
8. Slightly tighten the nylon bolts, drop table slowly, keep legs centered on slots
9. If not aligned when lowered: repeat steps 2 -- 5
10. *Optional:* Attach antennae at top directly above window (use stool and use green pen guide for placement –loosen just the one roof cover latch)
11. Remove window cover, and puff optic



The pins should be aligned to ~1 mm (no more than 2 zip ties in gaps)
once you float they will change again by +/-1 mm in random ways it seems…

The **pinned pads** need to be set as shown. Lay these out after table on legs and roll legs into location. B, C, and D pads all go on outer corner of table legs. A pad is on front right corner of that leg.



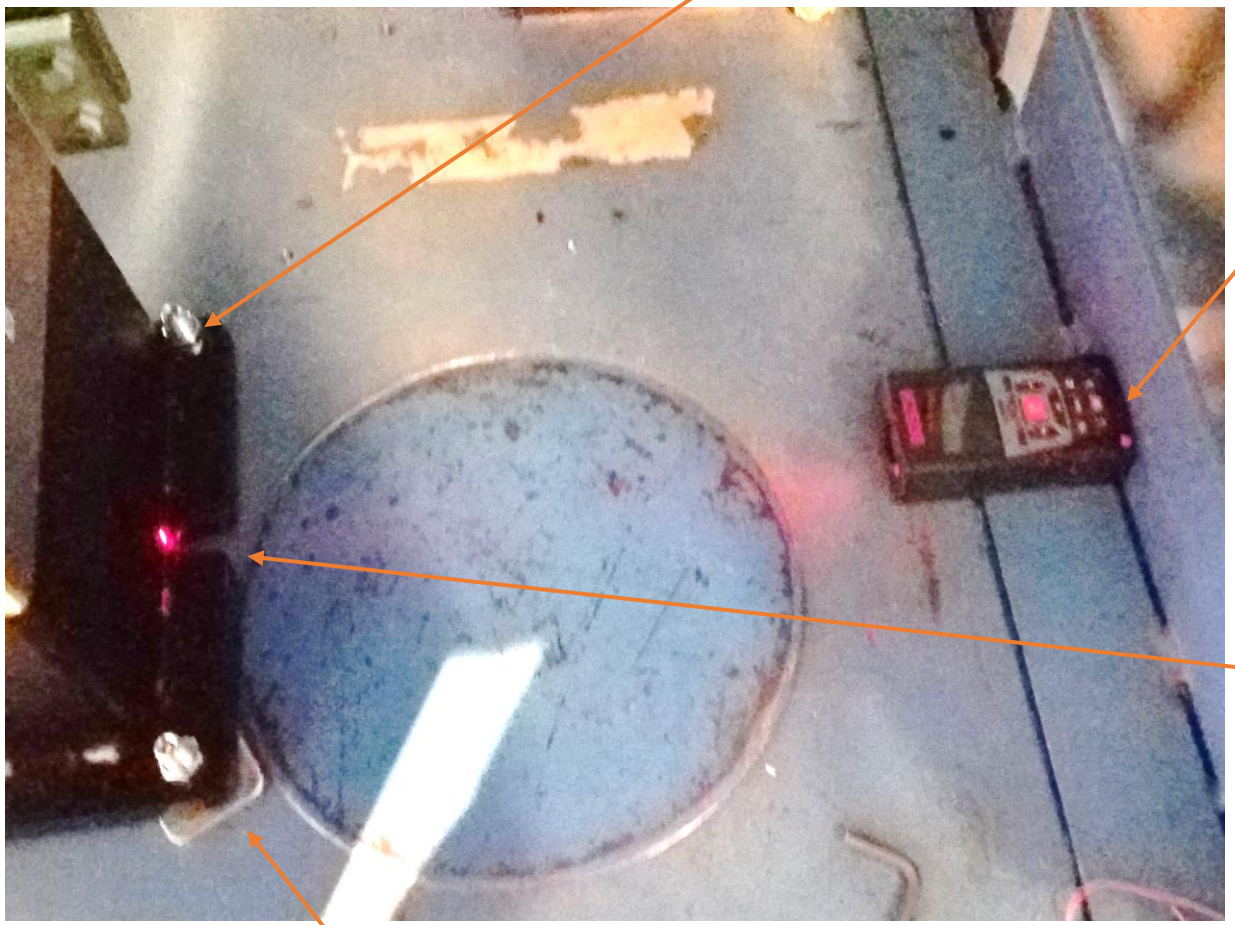
2. Steps to align MagAO-X to scope XY, Yaw

1. Push on legs (not table) till they approach the 4 pinned pads
2. Align the 4 screw holes to the 4 pads *by making sure the conical guide pins (from the cart) drop directly to bottom of the pinned plates*
3. Drop down the 4 jack screws, make sure each enters the holes *(use bright flashlight and look along floor to check each one)*
4. Once all 4 are tight do some sanity checks:
    1. **Check XY**: Is the antenna aligned with the top of the NASE rotator?
    2. **Check Yaw**: is there an extra **43 mm at the B leg** to the wall compared to the C leg? (result: got 45 mm in run #2 off pinned plates)

Need 4-5 team members to push table (by legs) to the pinned plates

Important: the D caster should almost be touching the ground (lowest of the 4), to start the leveling process.

Check on Yaw:



Laser tape hard on wall

On run #2 the measurement at B was 45 mm larger than at C

Laser spot just above notch in leg baseplate. The same measurement at the B leg should be 43 mm bigger than that of the C leg → **sets table Yaw to 2.0 deg.**

Pinned C plate

3. Steps to align MagAO-X to scope in thetaXY

1. Get ready to float: Add the geophones, REMOVE KAPTON TAPE from platters
2. Float the table (extension cable and rocker switch)
3. Place the MagAO-X digital levels correctly at D corner (see photos)
4. Drive legs to get level as shown below (in 2022B **A=34.31 mm, B=37.20 , C=36.03, D=29.87**)
5. Keep going until the levels look correct (see photos below)

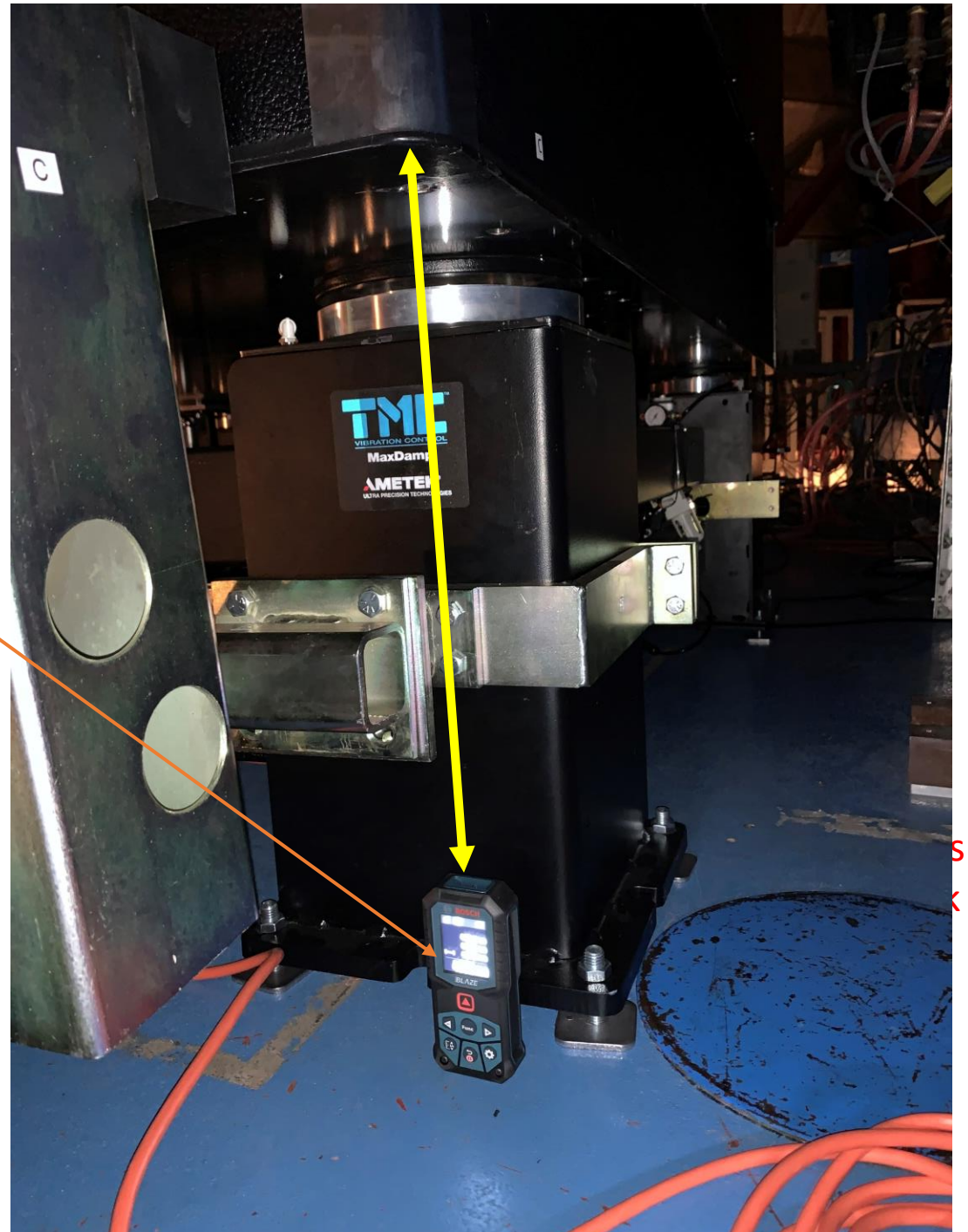
Measure HERE like this on outer jack screw

Must be **0.1 deg in CB long direction** (C lower than B)

Must be **0.0 deg in CD (short) direction**

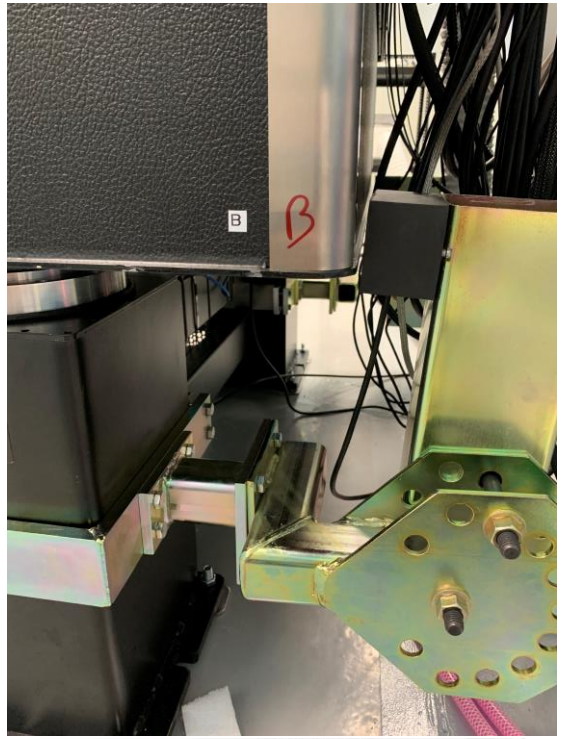
3. Steps to align MagAO-X to scope in thetaXY

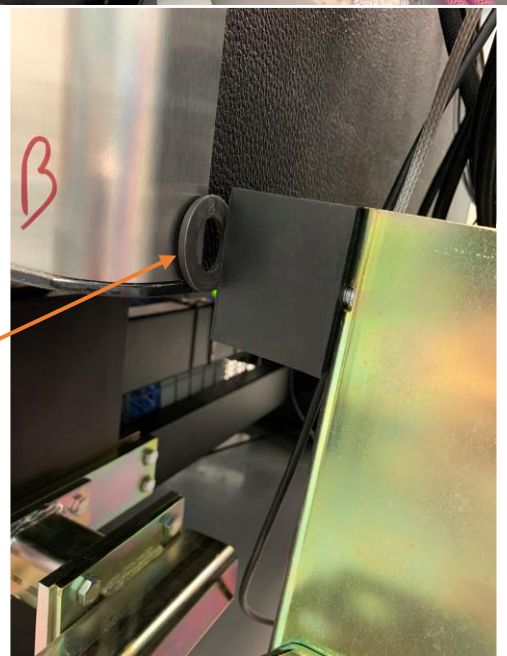
1. CHECK: beam height = 1465.0 mm
2. MEASURE: 487.0 mm from bottom of table to floor at C when floating
3. CHECK: the pins, in run #3 the table shifted by ~1 mm once floated



4. Finish “Daytime” Work

1. Drop float, remove levels, close panels
2. Ok now to cable MagAO-X
3. Add bumpers, one “B” (thick black) washer thickness air gap
    --see lower photo for gap size
    -- use 1 big dia. black bolt in center holes and smaller one for “2 o’clock” bolt
4. Float table, ready to observe

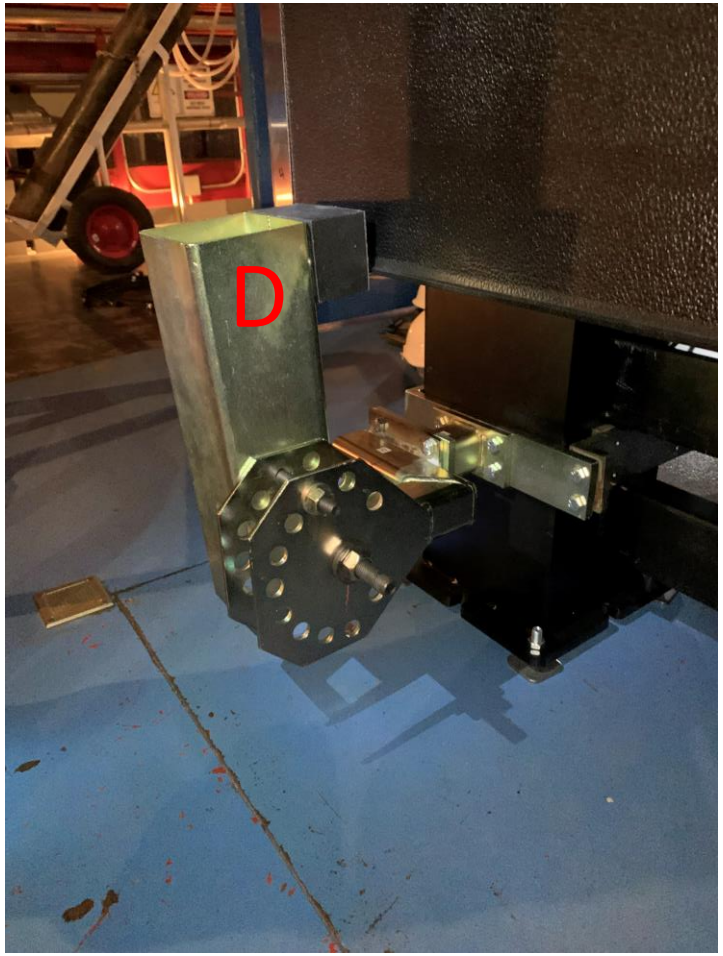


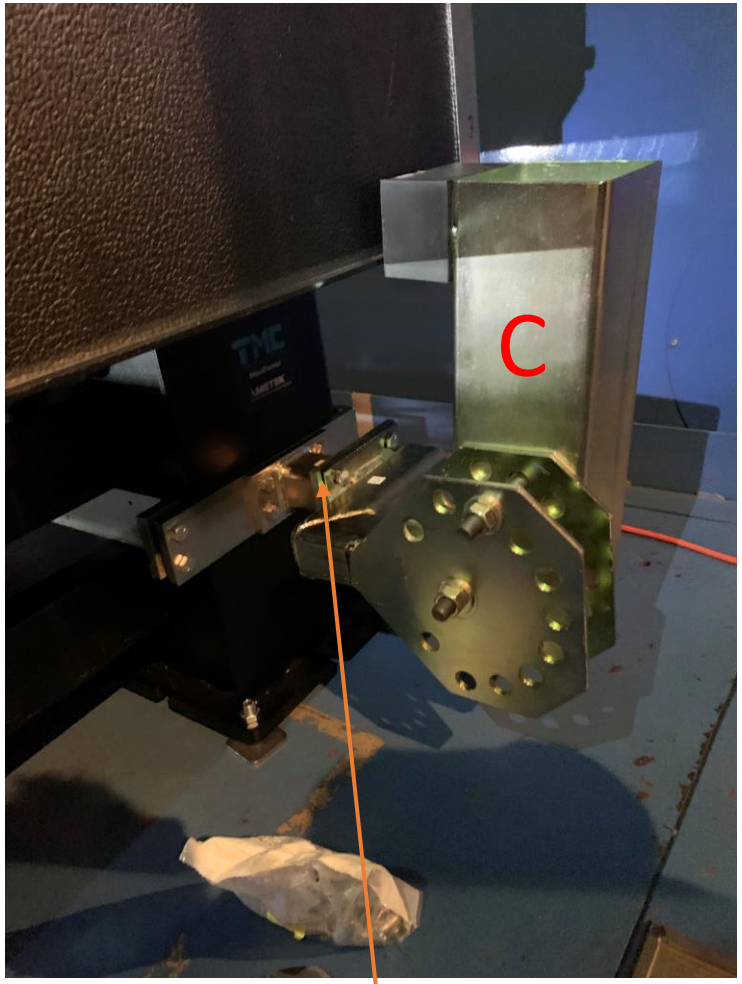


You should be able to pass a thick “B” washer through each bumper pad. Otherwise too tight

Notes about bumpers

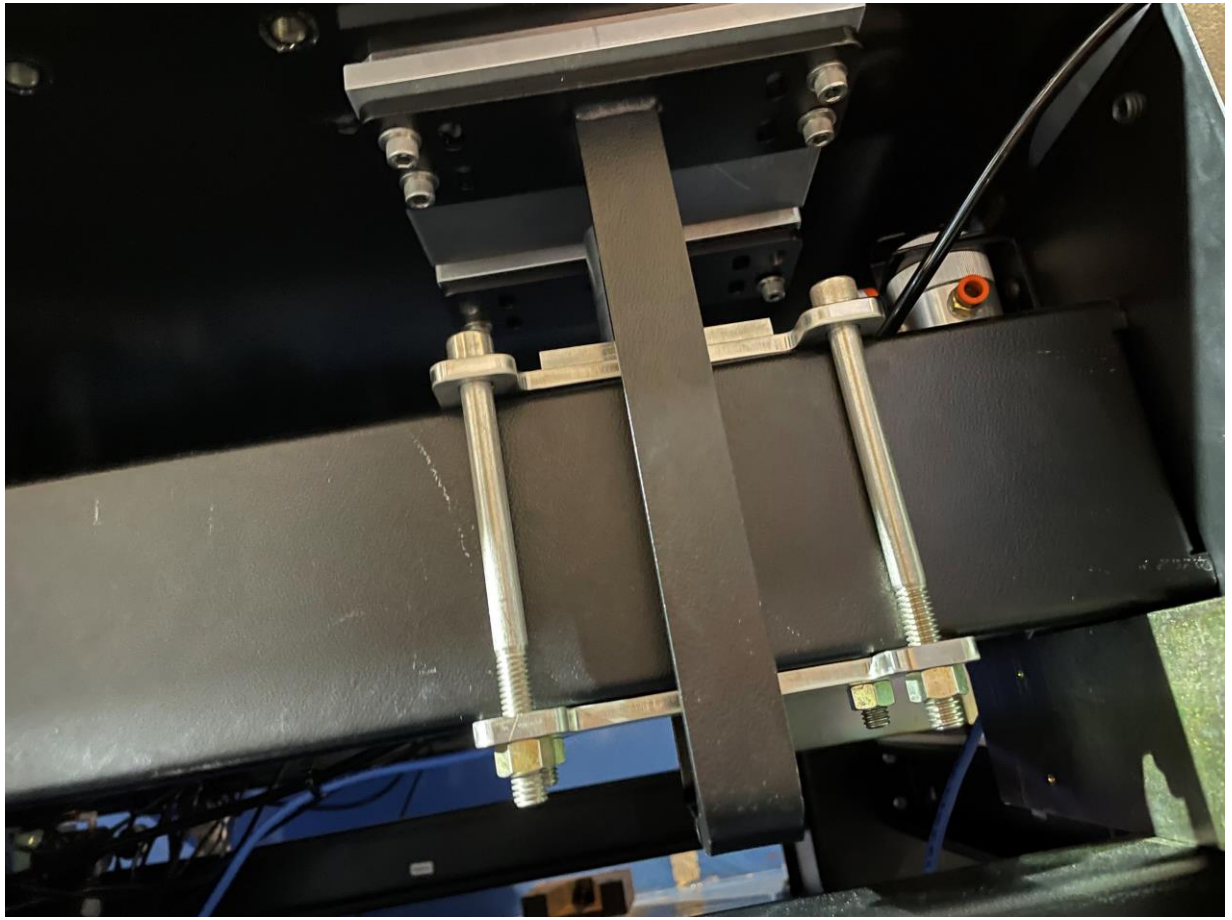
- Use the bumper letter on the cart plates so that they are symmetric
- Note the A bumper might be marked “B” (for cart) and “A bumper” for bumper.
  - This might not be a problem in 2024B onward since we have separate bumper clams.
- The A and B bumpers go to the inside of the clams. The C and D bumpers go to the outside of the clams (not sure that matters).





The C (and maybe A) bumper can only use 2 small bolts – all others use a big central bolt and a small outer bolt. *Also, in 2022B we needed 2 shiny washers in the gap to space out the C bumper…*

Earthquake Bars

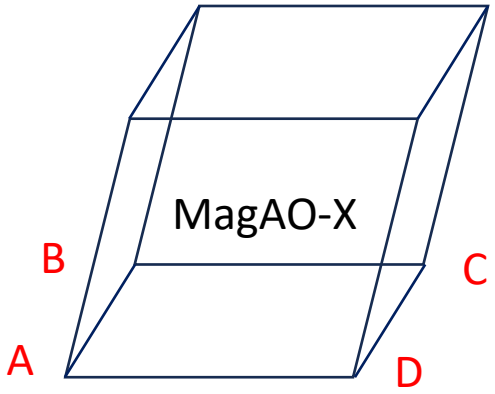


Finished Product: ready to cable Tweeter

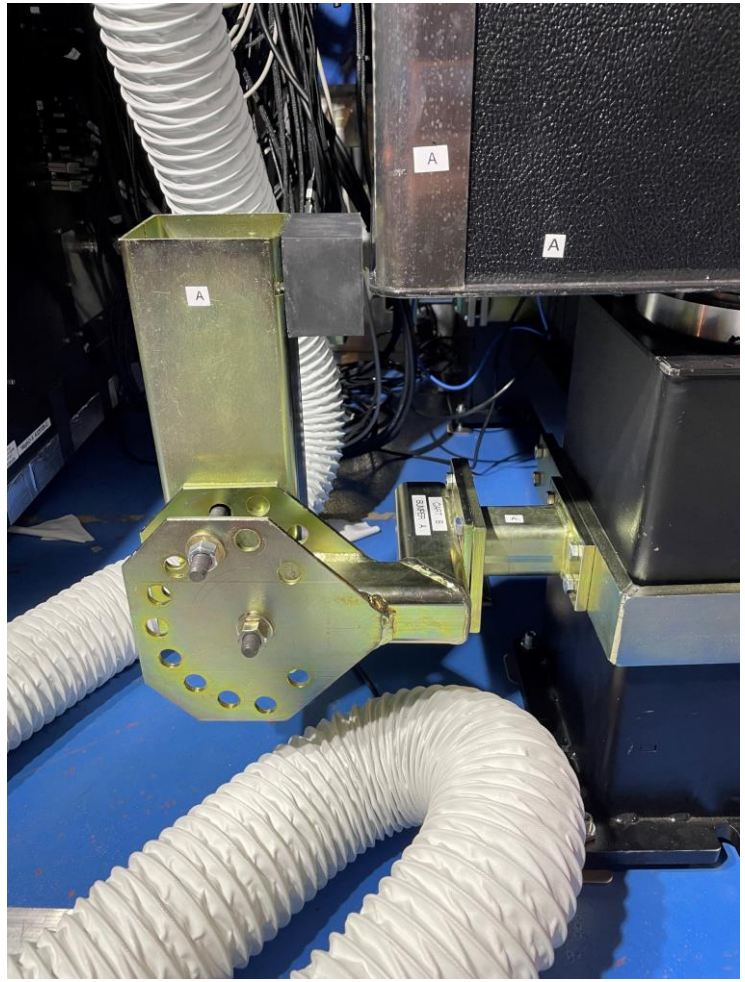
*Tweeter may be cabled before bumpers and earthquake bars as well

Installed earthquake bars

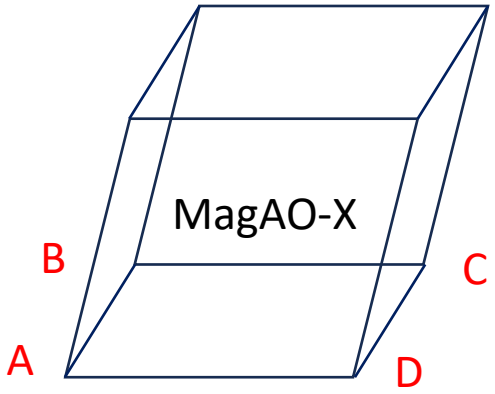
2024Ab Bumper A Photo



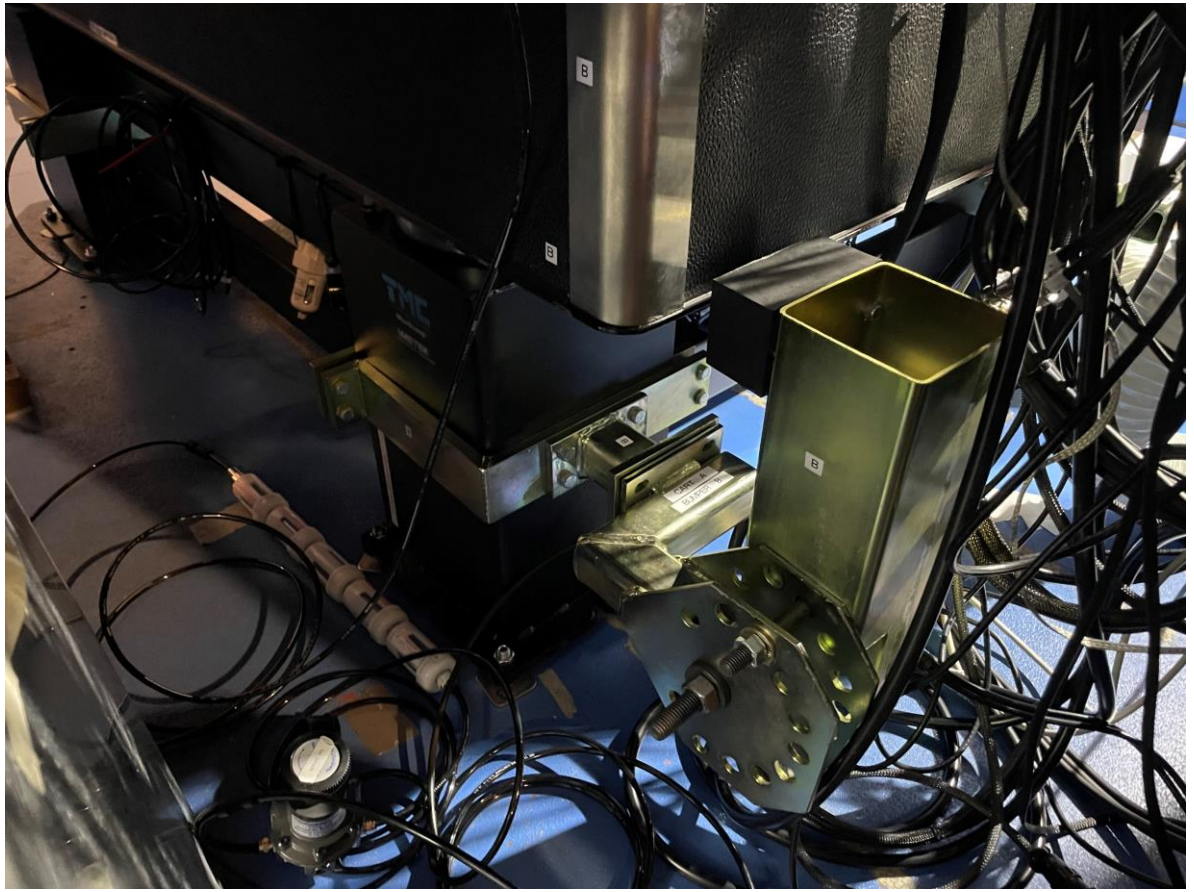
Bumper A is inside the clam



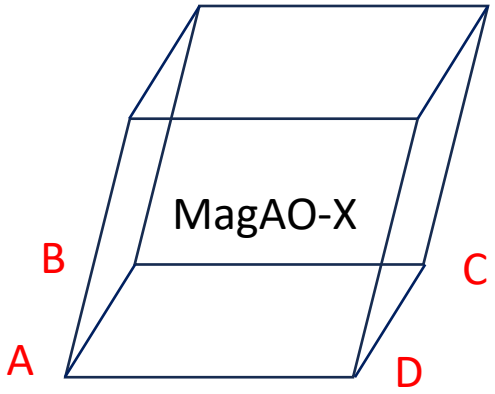
2024Ab Bumper B Photo



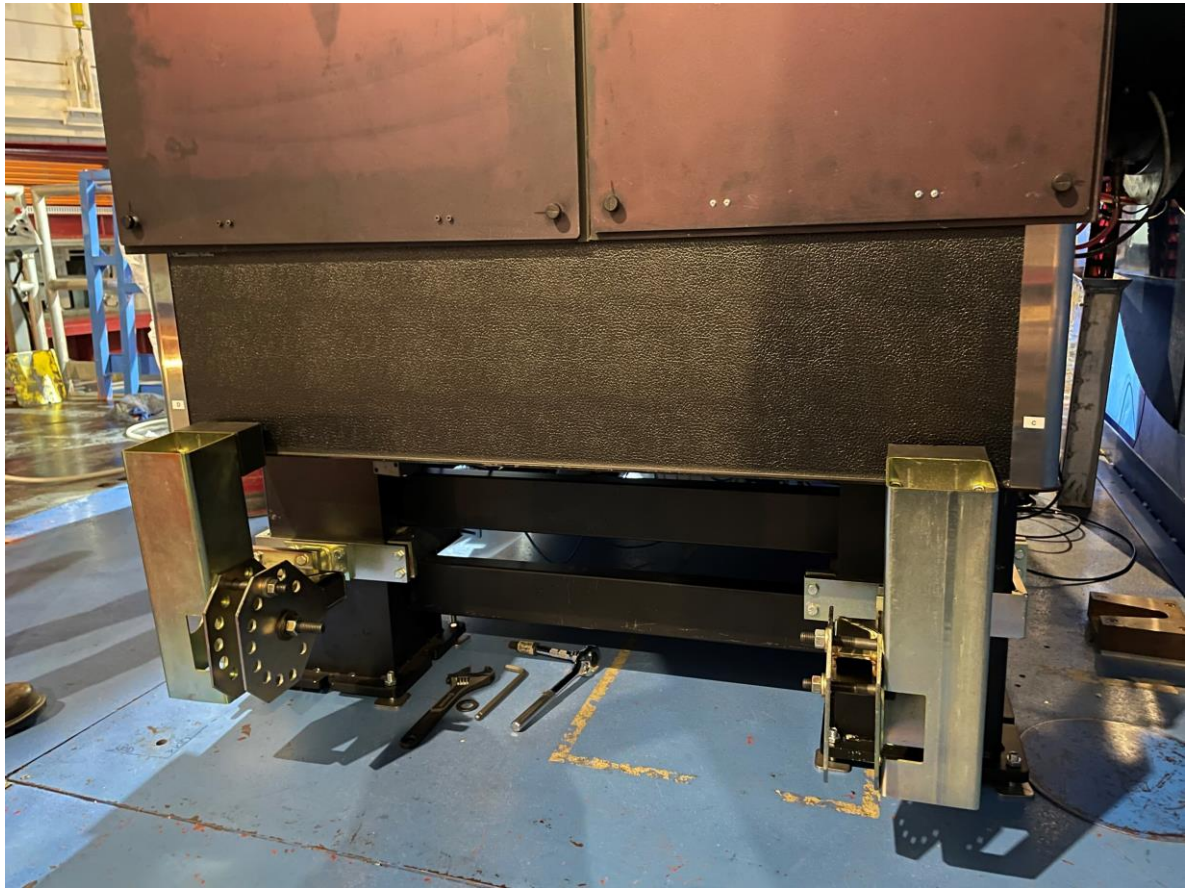
Bumper B is inside the clam



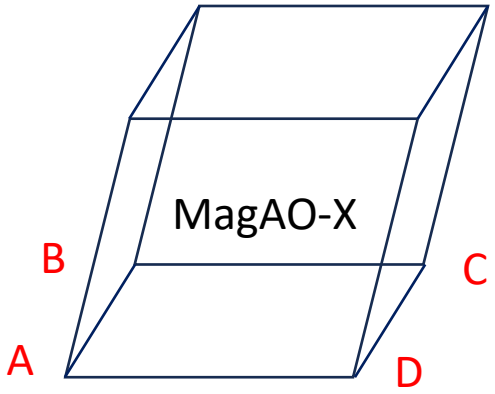
2024Ab Bumper C Photo



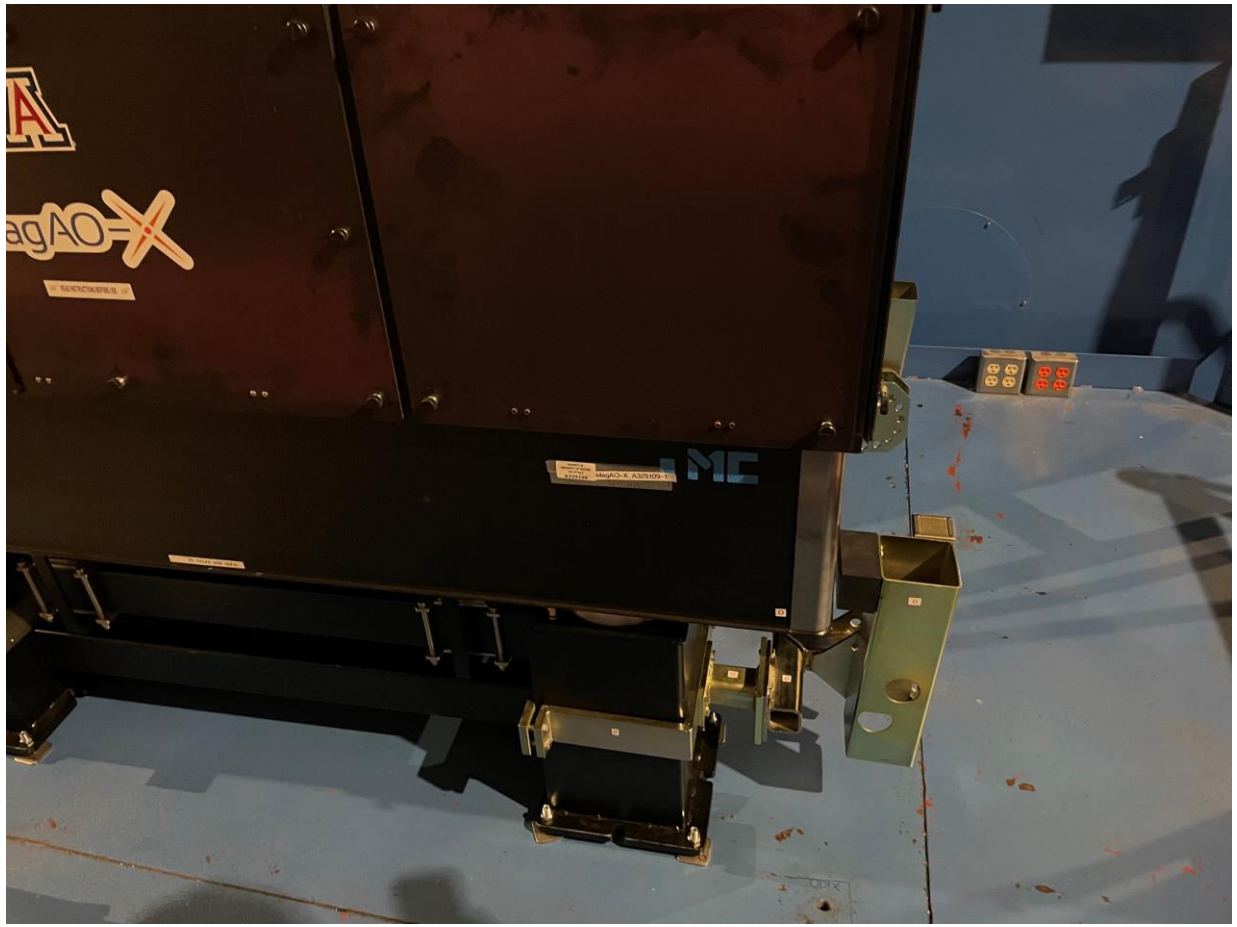
Bumper C is outside the clam



2024Ab Bumper D Photo



Bumper D is outside the clam



5. Night time test

1. Put a bright star on the SH and clean up telescope collimation
2. Put the acquisition camera flipper in the beam, set **all wheels to OPEN, stagebs=58 mm**
3. Set TTM to whatever **X and Y voltages** were used in the lab alignment phase (*that fixes the focal planes*)
4. After SH apply a **1207 = ZIMA** and **-370 = ZSET** to send star to our focus (some 1200um past the nominal f/11 focus)
5. Something like **AEG -18.5, 10** to go from probe center to MagAO-X, star to pixel **X=324 and Y=173** on camacq basler
6. That should allow the starlight to pass through MagAO-X
7. The camscis should see the star and can drive it to the PyWFS center, remove the camacq flipper
8. Set Kmirror: **stageK = (Alt-90)/2-59** (so at zenith stageK=-59, 30deg=-89)
9. Set ADCs (as before in comm1)
10. Put mirror in FPM wheel, then do F test, set ttmpupil with lowfs (*fixes pupil planes*)
11. Test the full range of rotations by driving stageK from -59 to -89 deg and do F test at each extreme
12. Remove FPM mirror
13. Look at pupils on PyWFS and set camera lens to center pupils on OCAM2
14. Focus both camscis
15. Close loop