

ioLS Status Update

David Rivera

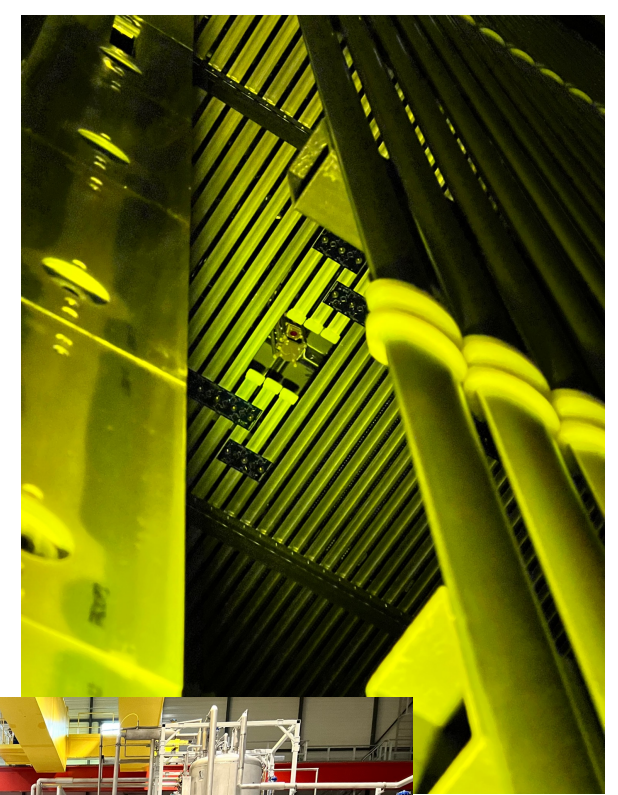
CALCI Consortium Meeting

April 13, 2023



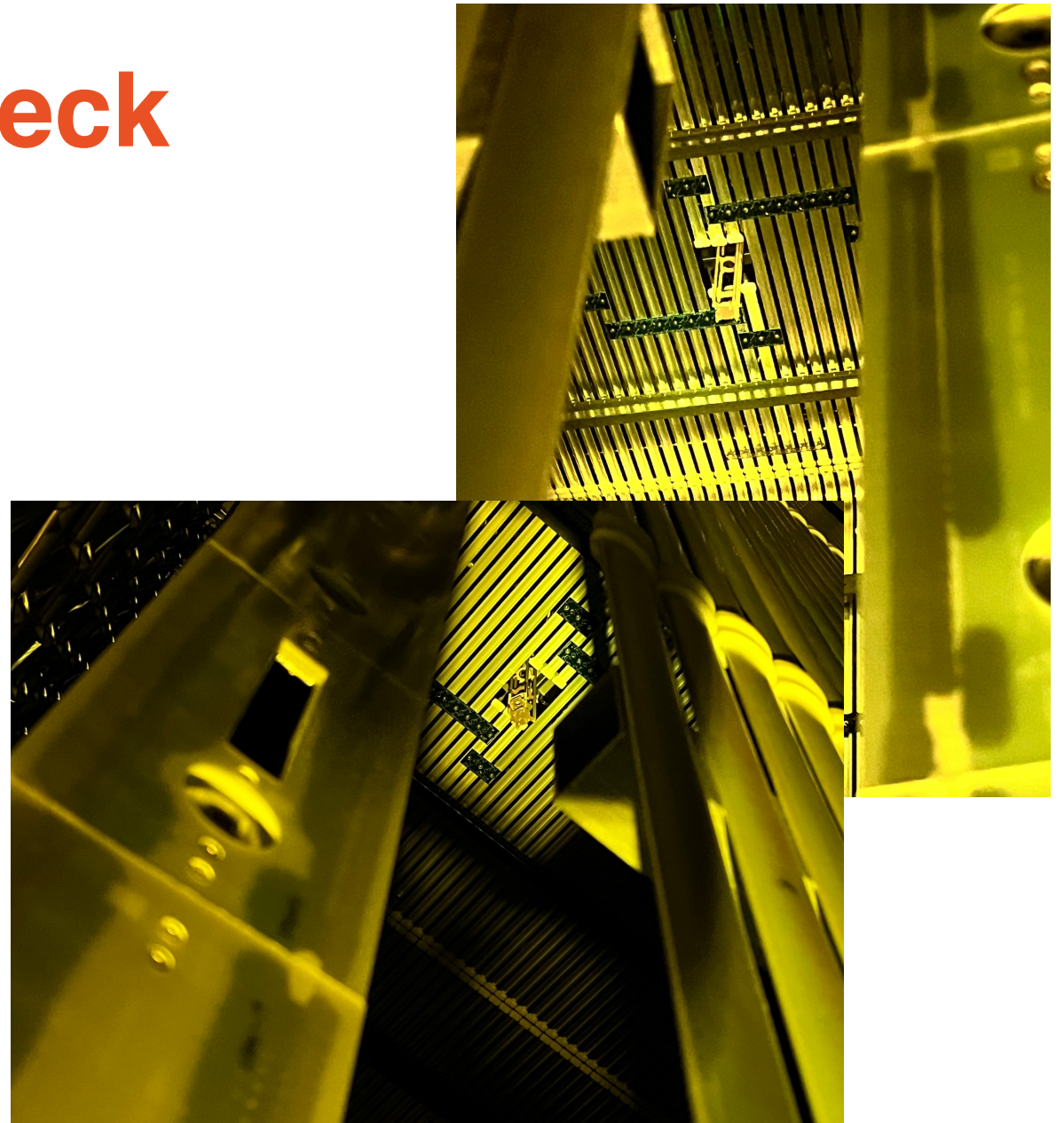
P1 Installation

- Went well!
 - Installed onto the P1 feedthrough w/ the Translation Stage (TS) in the fully retracted position, expected ~10cm clearance between bottom of P1 and the field cage cutout for it
- Adjusted the port aligner until MDC levelmeter mounted onto the MDC was zeroed
- TS driven to fully extended position while checking that the periscope fully cleared the square cutout on the field cage
- MDC tilt changed slightly while extending the TS to the fully extended position
 - Adjusted the port aligner again at the fully extended position to zero the tiltmeter readings while checking that the periscope still cleared the cutout



Rotary clearance check

- Rotated P1-RNN600, in the fully extended position, while monitoring from inside the cryostat to make sure that the periscope cleared the cutout
 - 360° rotation check
 - Had to keep an eye on the cables to make sure they didn't get stuck during the full rotation

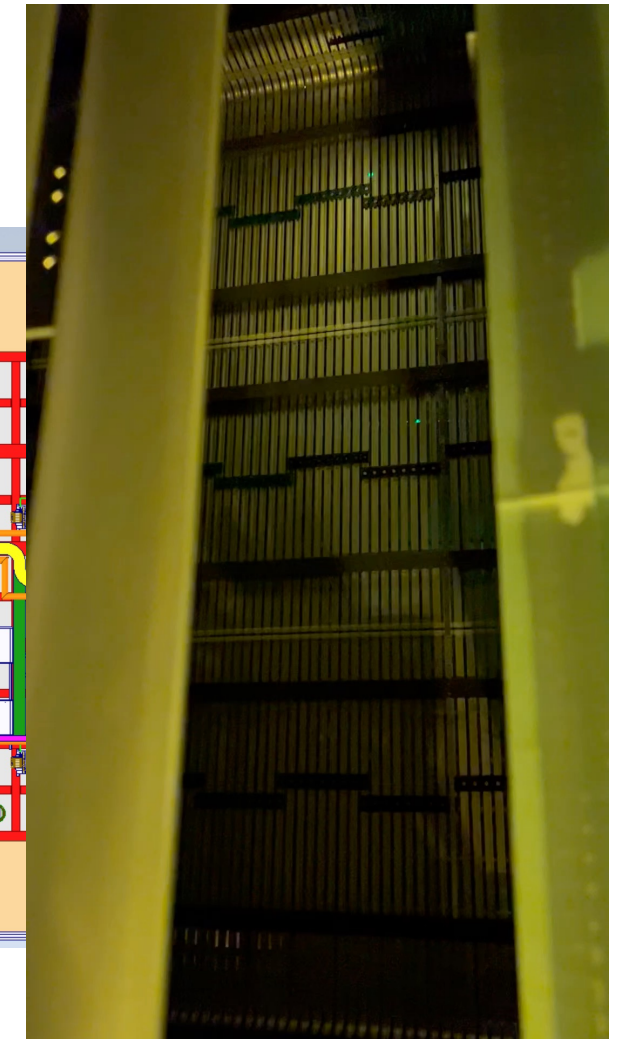


Vertical scans w/ P1

- Rotated RNN600 to roughly align the periscope w/ the +z axis of the detector (beam direction)
 - Rotated to the nearest field cage gap (FCG) to the left of this (when looking in the +z direction)
- Attempted to scan vertically up and down along the FCG
 - Observed a 0.6° tilt in the +x (detector) direction as the laser mirror tilts the spot down.
 - Used the port aligner to compensate for the 0.6° to check if this is a tilt of the flange relative to field cage



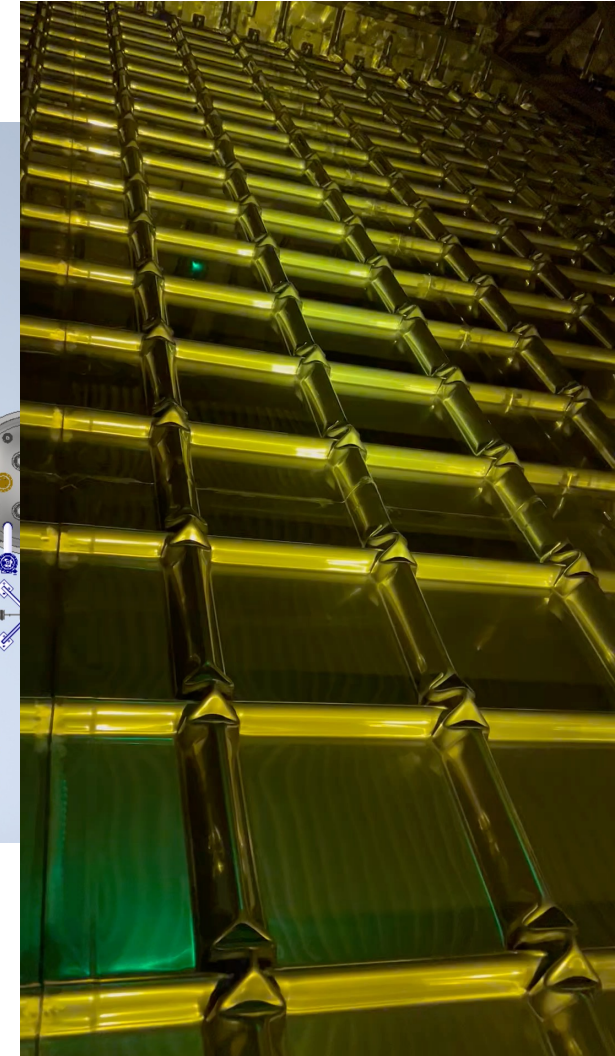
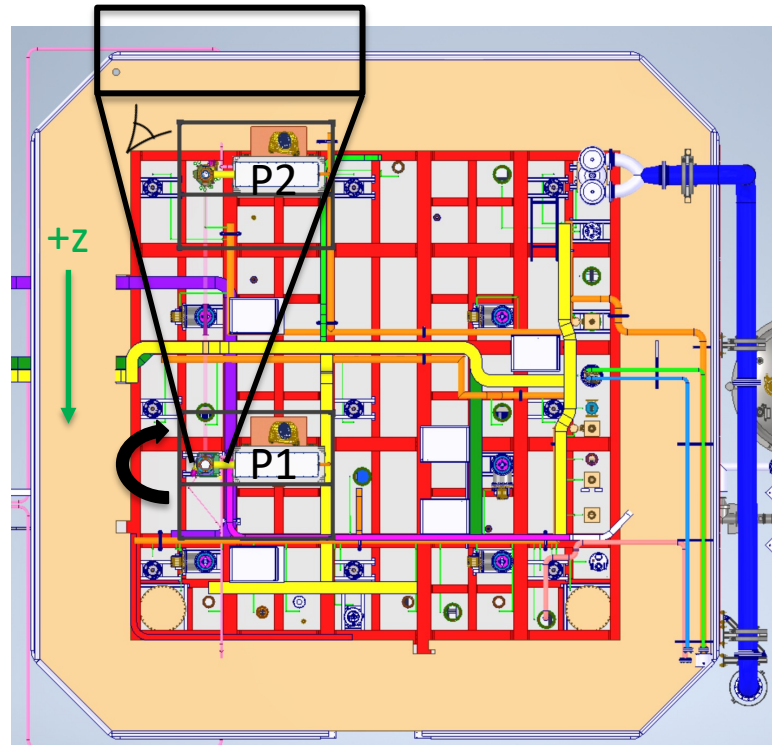
With top flange leveled.
Beam trajectory has -0.6° tilt
(from vertical)



After introducing $+0.6^\circ$
tilt with port aligner to
compensate

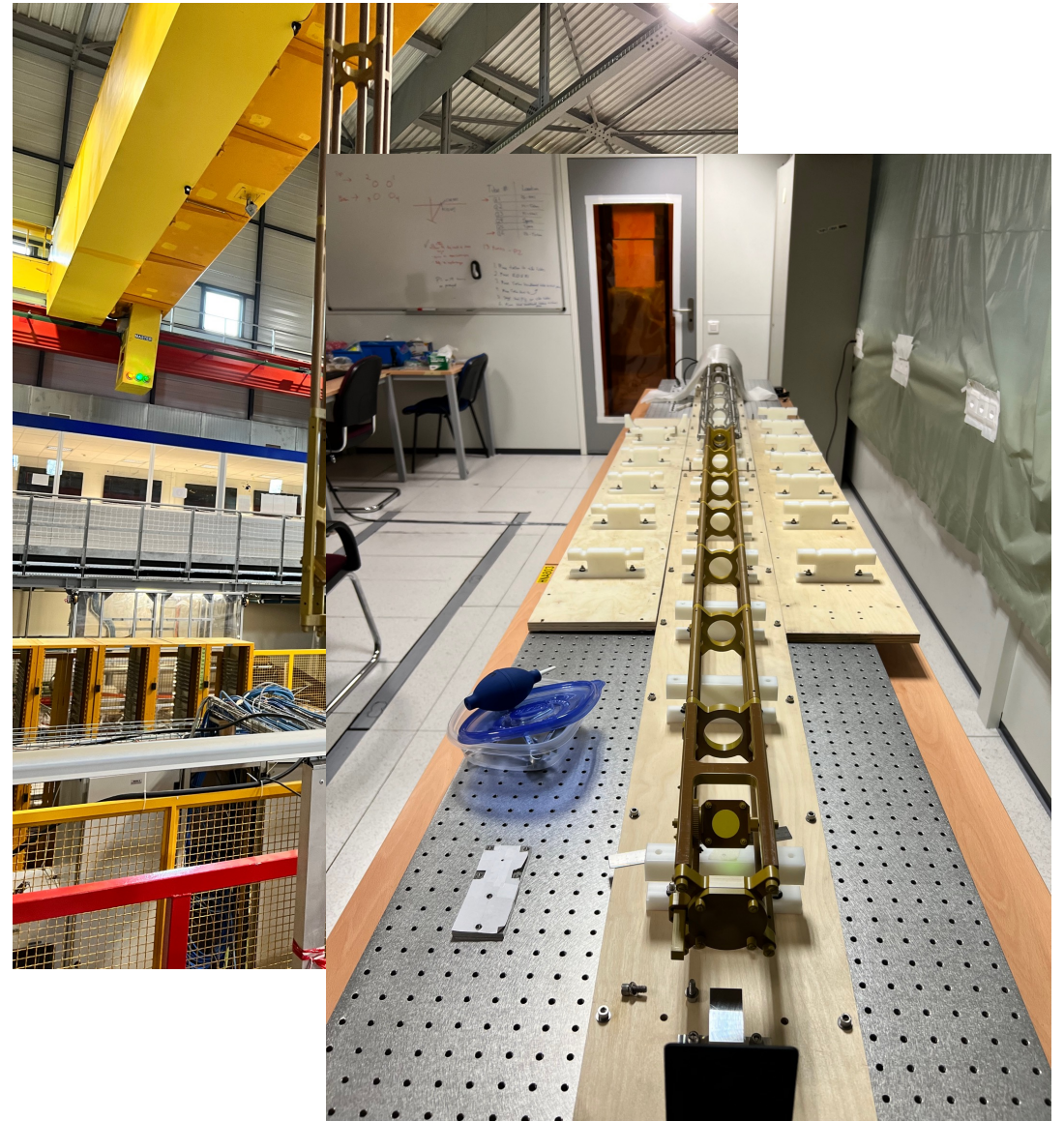
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- Rotated the RNN600 by 180° and measured the tilt of the beam on the opposite cryostat wall w/ the port aligner w/ the 0.6° compensation still in place
 - Cleared the cutout during the rotation with a *very small margin*
- The tilt on the opposite wall was roughly twice the tilt observed originally
 - ∴ the 0.6° tilt is on periscope and not between the flange and the field cage itself



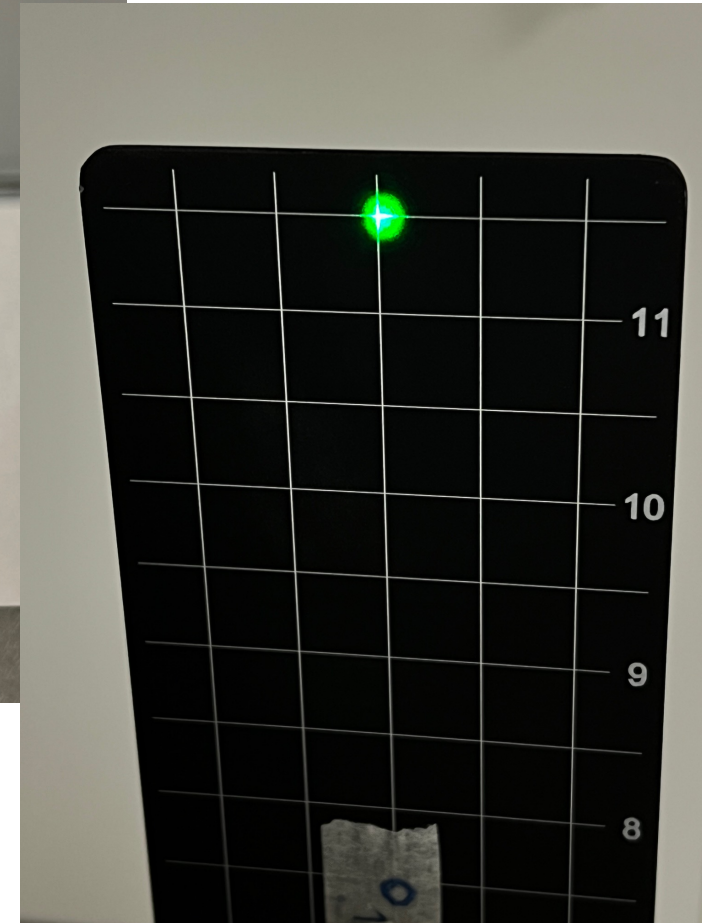
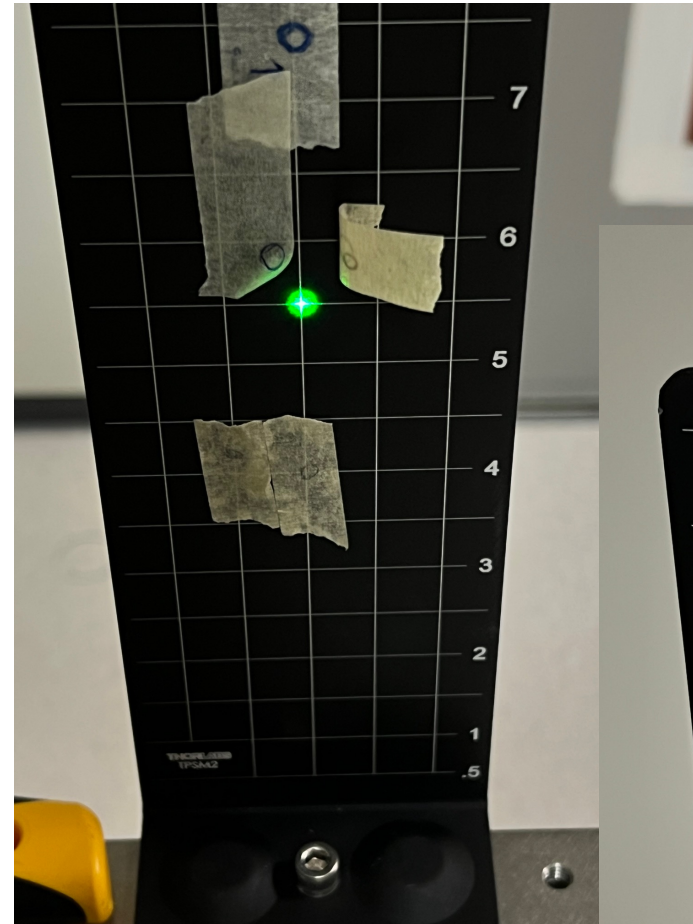
P1 uninstalled

- Went smoothly
- P1 placed back onto the horizontal setup in the cleanroom



Horizontal tests

- Used the tiltmeters to more accurately level the table supporting the breadboard for P1 Torlon (previously only used circular bubble levels)
- Re-aligned the optical table to be on-axis w/ the Steel optical table
- Confirmed that the angle observed by scanning the inside the cryostat also visible on the table
- Installed a set of Polyethylene assembly pieces onto the breadboard, next to the plywood, to “re-adjust” P1



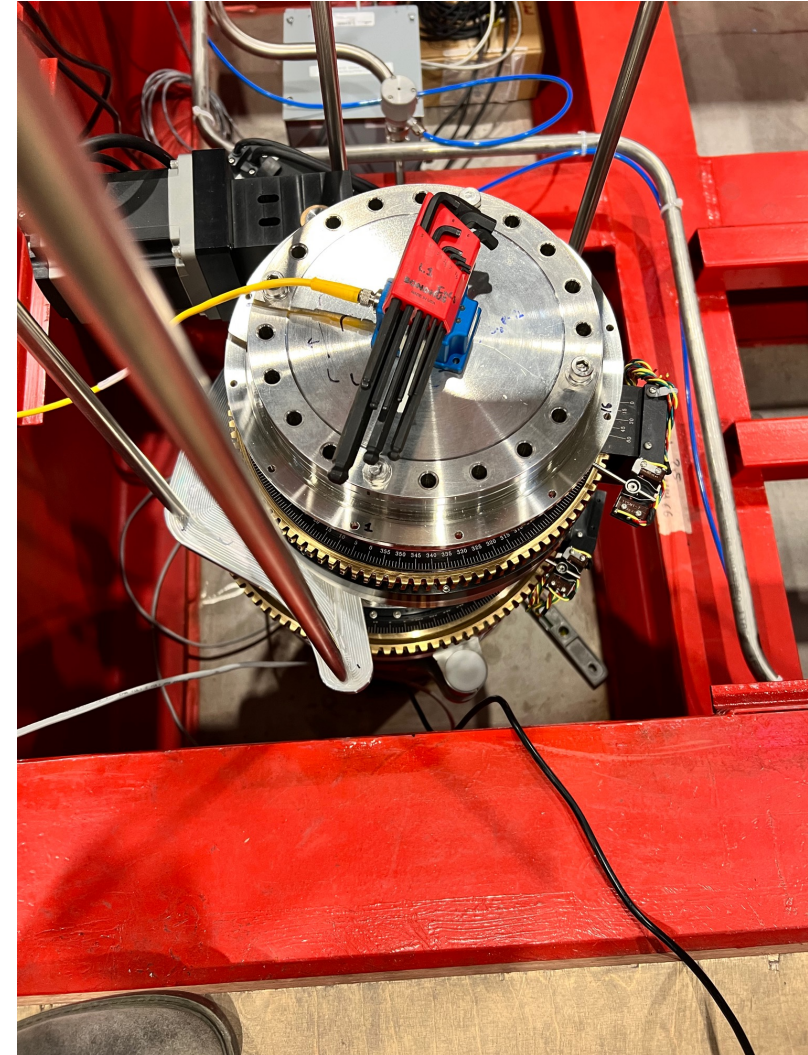
Twist compensation

- Managed to counter the angle observed on the horizontal setup by twisting the Torlon bottom in the opposite direction compared to the twist in the Torlon top
- Will check if the twists creep over time w/ P1 in the horizontal setup (next visit to CERN)
- How will this change in the cold?



Flange tilt measurement

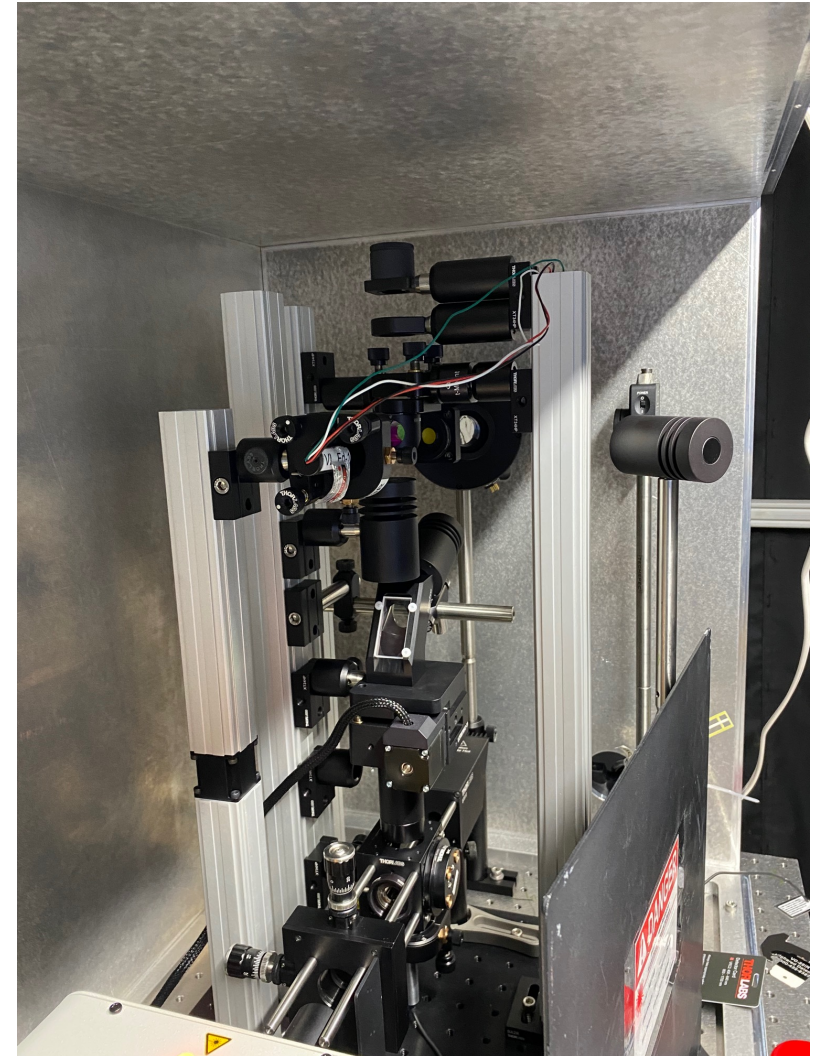
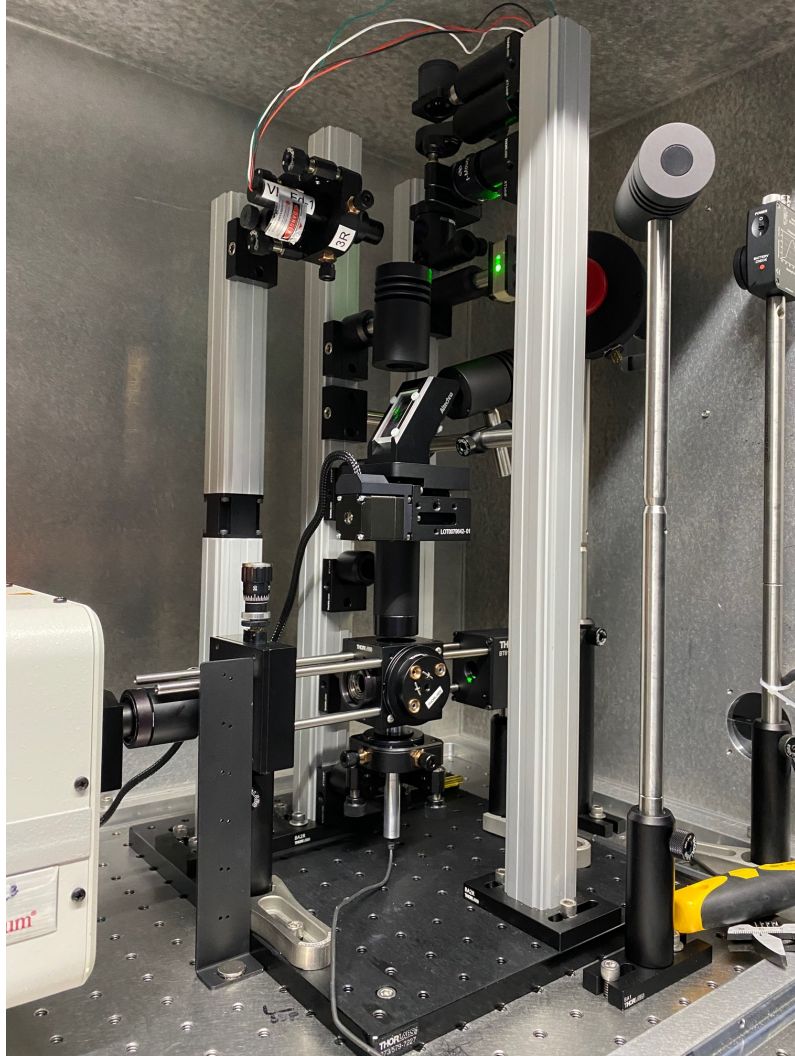
- Rotated the RNN600 until one tiltmeter axis was zeroed, $\theta_{yz} \cong 0^\circ$
- Check the direction and magnitude of the non-zero axis, $\theta_{xz} \cong 0.35^\circ$
- Should be able to orient all stages in the model to agree w/ what we have at ProtoDUNE
 - Can reconstruct the angle of the tilt using the measurements
- Exploring ways to mitigate this (software or w/ additional flange)



Ongoing activities at LANL

- L3 tests
 - Beam composition measurements
 - Vertical setup and fast shutter tests
 - Noise tests and shielding
 - Heat load
- Shipment 16
 - Laser tent brackets and wheel mounts
 - Hardware
 - Optics
- Laser stand hardware tests

Shutter tests



Next steps

- Fast shutter tests are ongoing:
 - Using the shutter to block the UV beam when desired
 - Currently driving the fast shutter using the signal derived from laser Flashlamp TTL pulse
- Also using the vertical setup and a spectrometer to sample the beam composition after the attenuator
- Ship lasers to CERN



Laser stand

- Received the perforated panels for the laser stands back from the shop
 - Checked that they fit well
 - Checked the position of the cutout for the umbilical and HV cables on the PCU



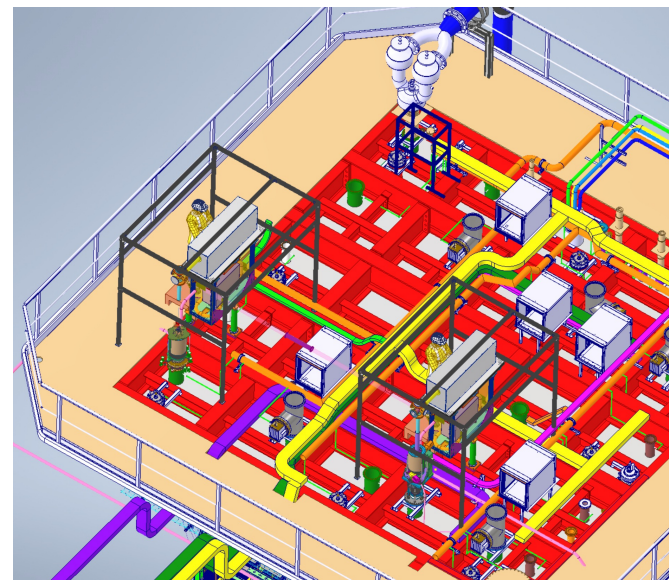
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- Platform used to roll out the laser Power and Cooling Unit when refilling water or replacing water filters
- Will ship after minor mods



Next steps at CERN

- All Aluminum profiles for the tents have arrived and been cut to length at CERN
- Expect to be at CERN again for tent assembly some time after tent fabric arrives
- Will complete final installation of periscopes following the TCO closure in Summer 2023



BACKUP

- The periscope naturally tends to have some twist, like a helix, which may be due to the tightening
 - All rods have right hand (RH) threads
- Possible improvement for next iteration of the periscopes:
 - Use RH *and* LH threaded rods to counterbalance twists from tightening
 - Design a locator plate for both ends of the Steel and Torlon portions of the periscopes
 - Currently the MDC serves as an anchor point for the steel top, but the steel bottom is unconstrained
 - Torlon is assembled starting at the bottom (mirror assembly) and going up. A locator plate is used on the Torlon bottom, but the top is not constrained