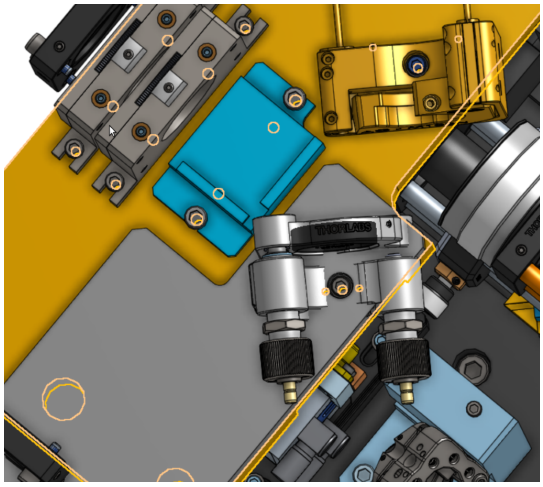
Global diving board dimension

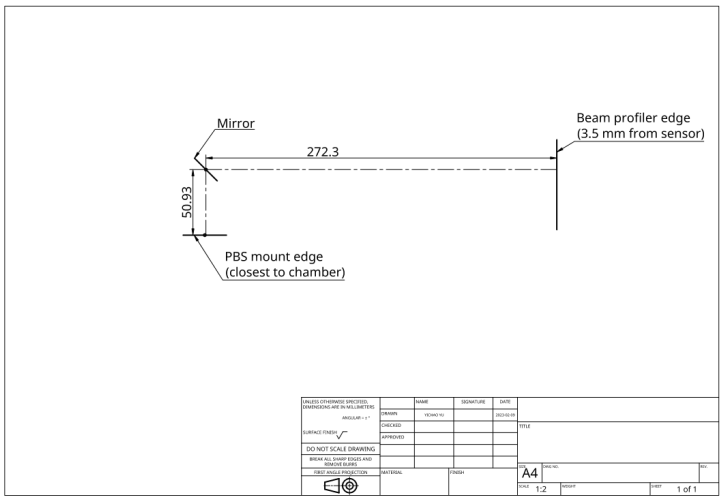
Thursday, February 9, 2023 11:45 AM



Distance measurements

The global diving board folds the beam across the last global mirror. To compare the two path lengths, I just need to find the distance from a point on the mirror surface to the ion/beam profiler plane. (This comparison does not depend on the selection of the point.) Here I used the center point of the mirror,

Diving



So the focus is 272.3 + 3.5 = 275.8 mm from the mirror center according to the diving board.

The distance from the PBS mount edge to the center of the trap is 209.0 mm so the total distance from the mirror center to trap center is 259.9 mm.

Accounting for the glass

When the beam is focused on the beam profiler, the distance from the mirror center to where it focuses in the chamber is actually longer than the 275.8 mm measured above because of the glass it passes through. This beam goes through two thick pieces of glass, the 1inch PBS and the 4mm window. The focus shift when passing a parallel piece of glass of thickness d is (n - 1) * d. Using an index of refraction of ~ 1.5 (BK7 is 1.53, fused silica is 1.47 for 355 nm) this means that the focus will be shifted by roughly (25.4 + 4) * 0.5 = 14.7 mm so the distance between the mirror center and the place where the beam is focused in the chamber is actually 275.8 + 14.7 = 290.5 mm.

This is 30.6 mm further from where the trap center is and agrees with our previous measurements.