George Brims **Revised March 10, 1999**

NIRSPEC Cryomechanics Application Note 12.00

XYZ Adjusters

Introduction

The instrument mounts to the handling frame via three adjusters which are designed to mount it kinematically and give full adjustment in translation and tilt. The front adjuster has all three axes of adjustment, the left rear (shown in Figure 1) has vertical and left-right adjustment but slides freely in the focus direction, and the right rear has vertical adjustment only and slides freely in both horizontal axes.

Figure 1: Left rear adjuster

Vertical adjusters — how they work

The vertical adjusters make use of a simple principle to give us fine adjustment coupled with large load-bearing capacity (the instrument weighs about 1600 pounds). Each uses a combination of two different thread pitches working in opposition to give us a large number of effective threads per inch, even though each thread is actually quite coarse.

There are three threaded pieces to each adjuster. Looking at the vertical adjuster in Figure 1 above, we can see an outer collar which is threaded on the inside. It is the shiny cylinder with the key slot, projecting through the base plate of the dewar. It has a flange around its base which supports the weight of the dewar. There is an inner pillar which is threaded on the outside; only its base is visible from this angle. Connecting these two parts is an outer pillar which is threaded on both the inside and the outside. The outer thread is visible below the black knurled adjustment knob. The outer pillar screws on over the inner pillar, then the outer collar threads onto the outside of the outer pillar. The outer pillar is the part we turn to adjust the height of the dewar.

The pitch of the inner and outer threads of the dual-threaded outer pillar are different. The inner thread is 14 tpi and the outer thread is 12 tpi. If we turn the outer pillar one turn clockwise, the outer collar will rise up it by 1/12 of an inch (raising the dewar), but at the same time the outer pillar will screw *down* the inner pillar by 1/14 of an inch, *lowering* the dewar. The net motion of the dewar is 1/12 - 1/14, or 1/84 of an inch. A thread of 84 tpi would be extremely fine and probably wouldn't be able to support the weight of the dewar, but this arrangement contains only coarse threads while giving us the same effective pitch.

Vertical adjusters — using them

The vertical adjusters worked fine in preliminary testing, but the one drawback we found is that they are extremely difficult to turn when fully loaded. In order to make adjustment easier we put air jacks under the dewar beside the adjusters, and lift most of the weight off the vertical adjuster while turning the knob at the top. The remaining weight ensures we don't have to worry about backlash. We also put a square hole for a 3/8" socket drive in the end of the adjuster knob.

The total motion of the vertical adjuster is about half an inch.

Horizontal adjusters — how they work

The horizontal adjusters use exactly the same principle as the vertical adjusters, except that the weight of the dewar rests on sliding V-blocks. These are shown in Figure 1 also. The blocks are identical for each of the three adjusters, except that there are two, one, or no horizontal threaded adjustments in the front, left rear or right rear adjusters respectively. The V-blocks slide on a material call Glycodur, which is a slippery bearing material incorporating Teflon.

The opposing threads of the horizontal adjusters have pitches of 9 and 11 tpi, giving an effective pitch of 49.5 tpi. This was chosen to give us a little more range of motion. The vertical adjuster is only the fine component of adjustment: the threaded legs supporting the frame on the kinematic mounts in the floor allow coarse height adjustment. The horizontal adjusters have to adjust over a wider range.

Horizontal adjusters — using them

Driving the horizontal adjusters for fine adjustment is the same as the vertical, except that they adjust without using any jacks to unload some of the weight of the dewar off them. In addition, there is a way to get coarse adjustment with more range. The outer collar is clamped rather than keyed to stop it rotating when you turn the knob on the outer pillar. If you loosen the clamp (two screws requiring a 7/16" hex wrench) you can turn the outer collar while holding the inner pillar stationary. This moves both the inner and outer pillars together using the 9 tpi outer thread alone.