

## MONTHLY MAINTENANCE CHECKLIST

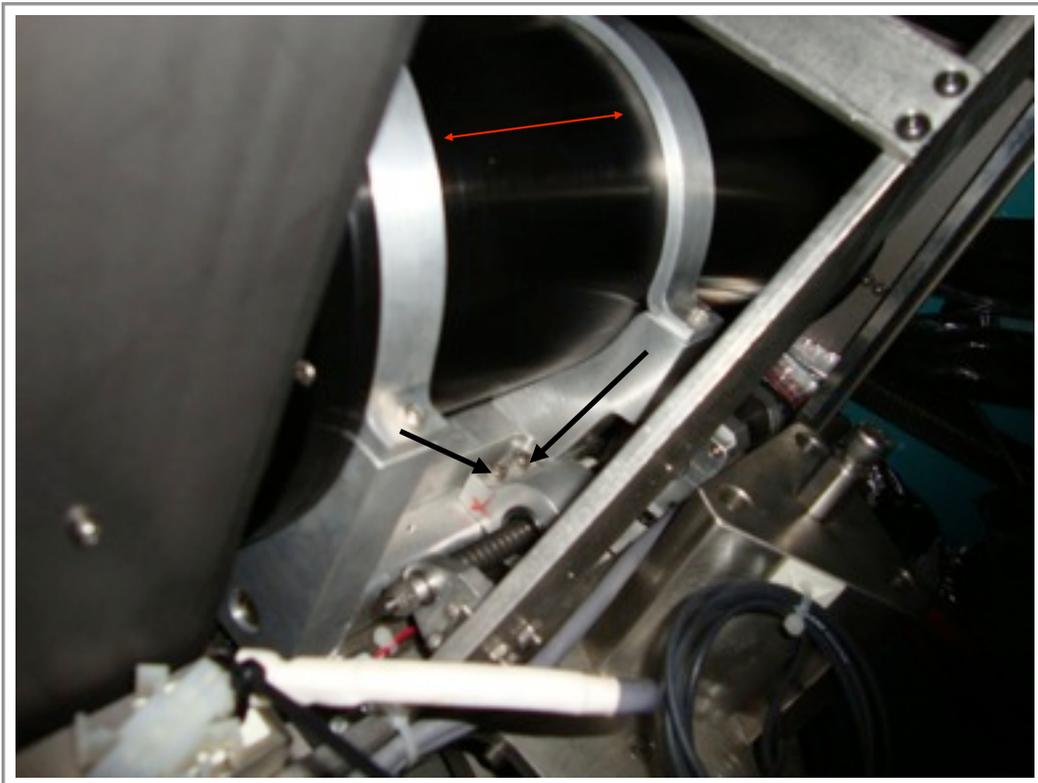
The following maintenance items should be addressed at least once per month:

- I. Check the condition of the camera focus stage coupling nut
- II. Set the compression of the piezo-electric flexure compensation actuators
- III. Check camera motion and lubricate/establish clearances if necessary
- IV. Check slit stage motion and lubricate/establish clearances if necessary

Instructions for doing so follow.

### I. Check the condition of the camera focus stage coupling nut

There is a motorized leadscrew on the right hand side of the camera optics tube (as viewed from the shutter end of the camera). The leadscrew drives a traveling nut that is threaded into an aluminum barrel with a mounting flat built into it. Two screws secure this flat to the surface of a crossed-roller-bearing stage that provides back and forth translation of the camera optics tube. These screws (indicated by arrows below) can work loose, resulting in excessive backlash in the camera focus.



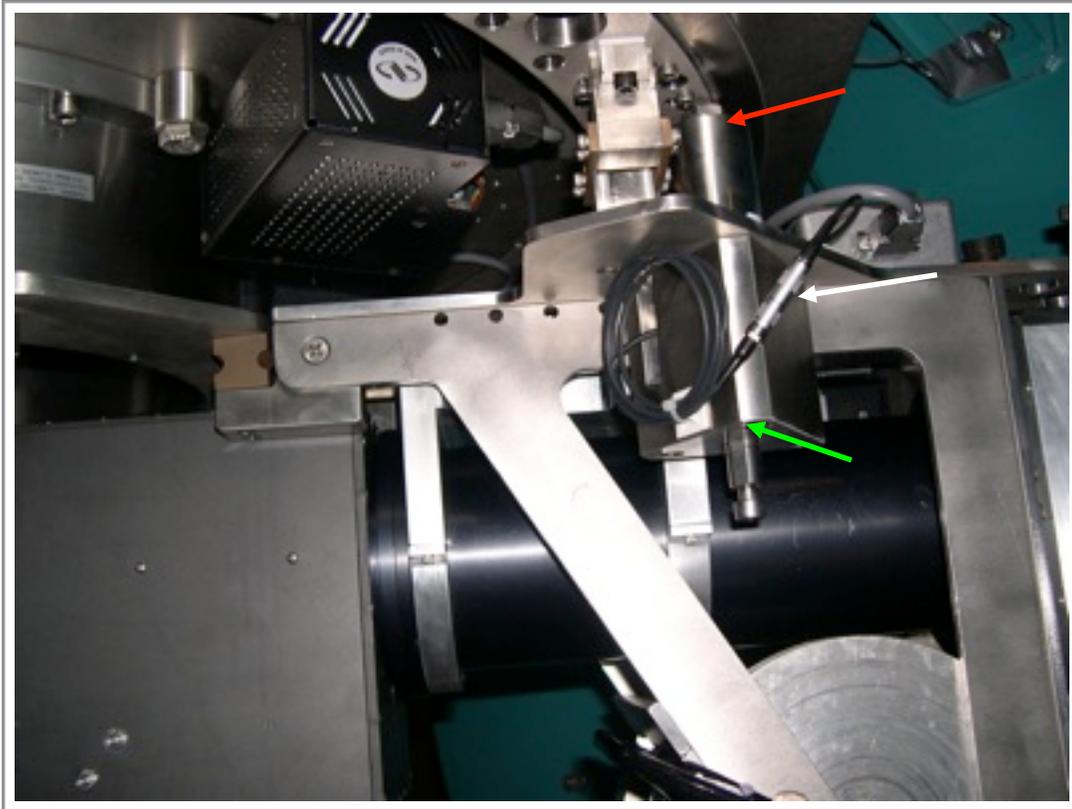
PROCEDURE:

1. Make sure that the instrument power is on and that the camera focus is responding to commands (i.e. no red light, camera moves when commanded).
2. Grasp the top of the camera optics tube in the region between the retaining clamps (see red arrow).
3. Gently push and pull the camera tube toward and away from the dewar.
4. If there is any detectable motion of the stage, tighten the two screws until they are snug (see enlarged picture below).
5. Retest for play and retighten if any is detected.



## II. Set the compression of the piezo-electric flexure compensation actuators.

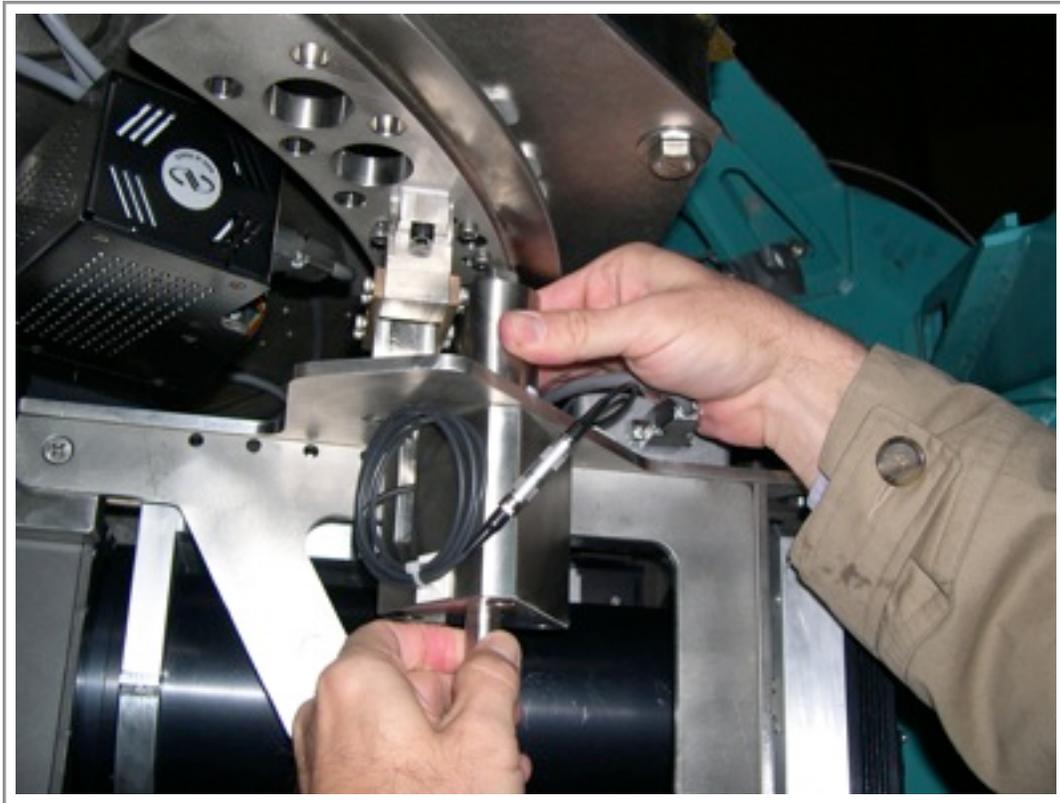
On each side of the camera optics tube there is a triangular housing in which a cylindrical piezo actuator resides (see the white arrow below). The crowned tip of the actuator pushes on a curved plate that is attached to bearing blocks that travel on a curved rail. The action of this actuator, working against a pair of phosphor bronze flexures, raises and lowers the camera to provide flexure compensation in the y-axis (spatial axis) of the CCD camera. The actuators can rattle loose and need retightening.



### PROCEDURE:

1. Make sure power to the instrument is on and the wavelength assembly is initialized (homed) with no red light.
2. Rotate the Nasmyth cage until the instrument is upside down (as shown in picture; rotator angle 180 degrees)
3. Grasp the piezoelectric cylinder (near red arrow) to prevent it from turning, but be careful not to push it off of alignment to the vertical in any direction.

4. While holding cylinder immobile, turn compression nut (green arrow) counter-clockwise to extend length of assembly until the piezo actuator is wedged in place (see image below). It is not possible to overtighten the assembly by hand, so apply as much torque as possible to the compression nut.

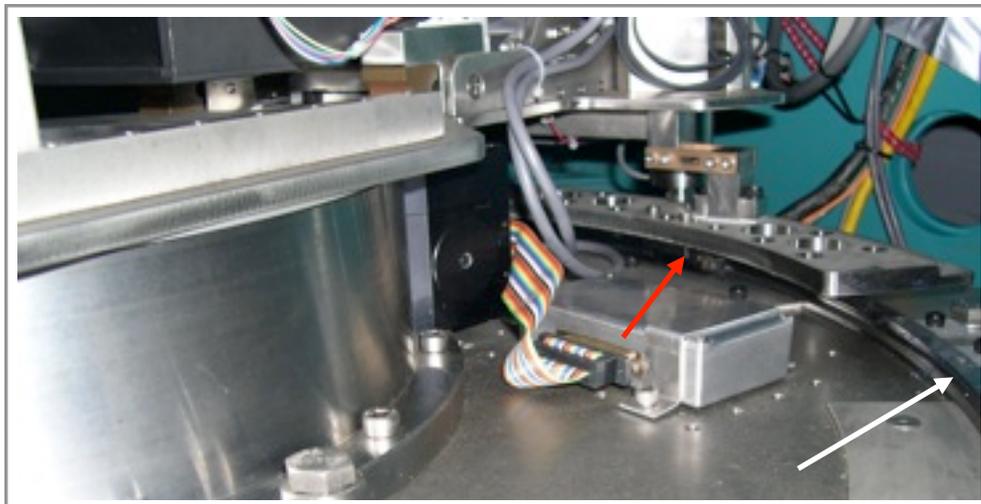


5. It is also possible to prevent the actuator from rotating by using a hex wrench in the M9 screw, and to use a wrench on the flats of the compression nut (see below). However, the wrench should be applied very gently, using no more than 30 oz-inches of torque. This method is not recommended
6. Repeat the operation for the piezo actuator on the opposite side. The order of tightening does not matter.
7. Recheck first side to make sure the piezo is still tight. If not repeat steps 3-7 until both sides are tight at the same time.



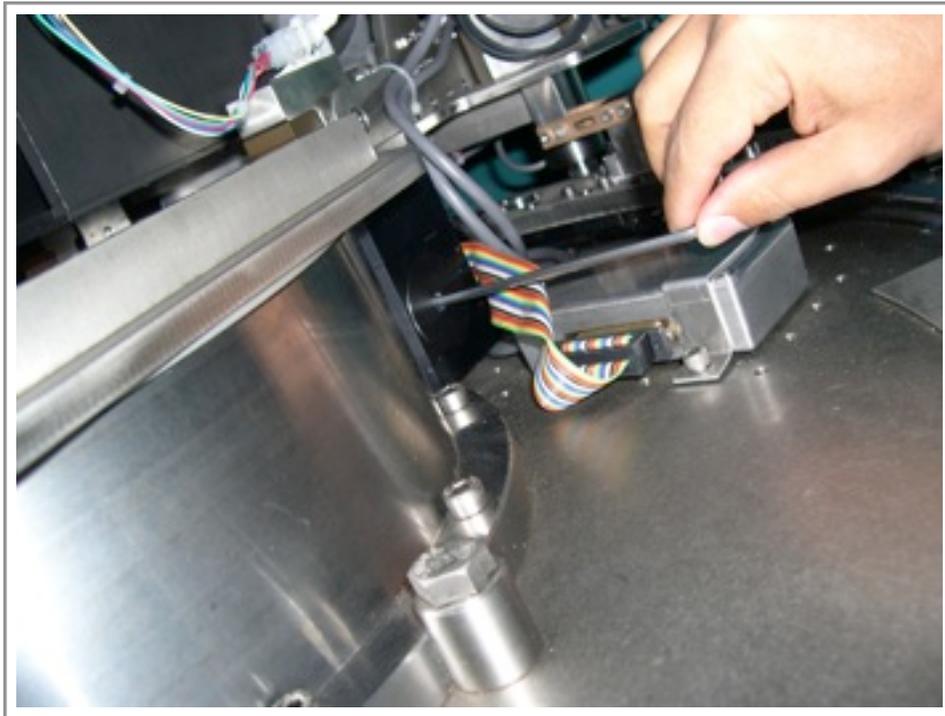
### **III. Check camera motion and lubricate/establish clearances if necessary.**

The variable camera-collimator angle in the spectrograph is set to angles between 0 and 88 degrees by a centrally driven annular stage. To reduce flexure, the camera and dewar also ride on bearing blocks (red arrow below) that travel along a curved rail (white arrow). Upon initial assembly of the spectrograph, this rail was hand aligned to be perfectly concentric with the central bearing and should never be loosened or removed. Occasionally the camera motion is hindered by a change in cabling or because foreign matter collects on the track. The full range of motion should be verified and re-established if necessary.



PROCEDURE:

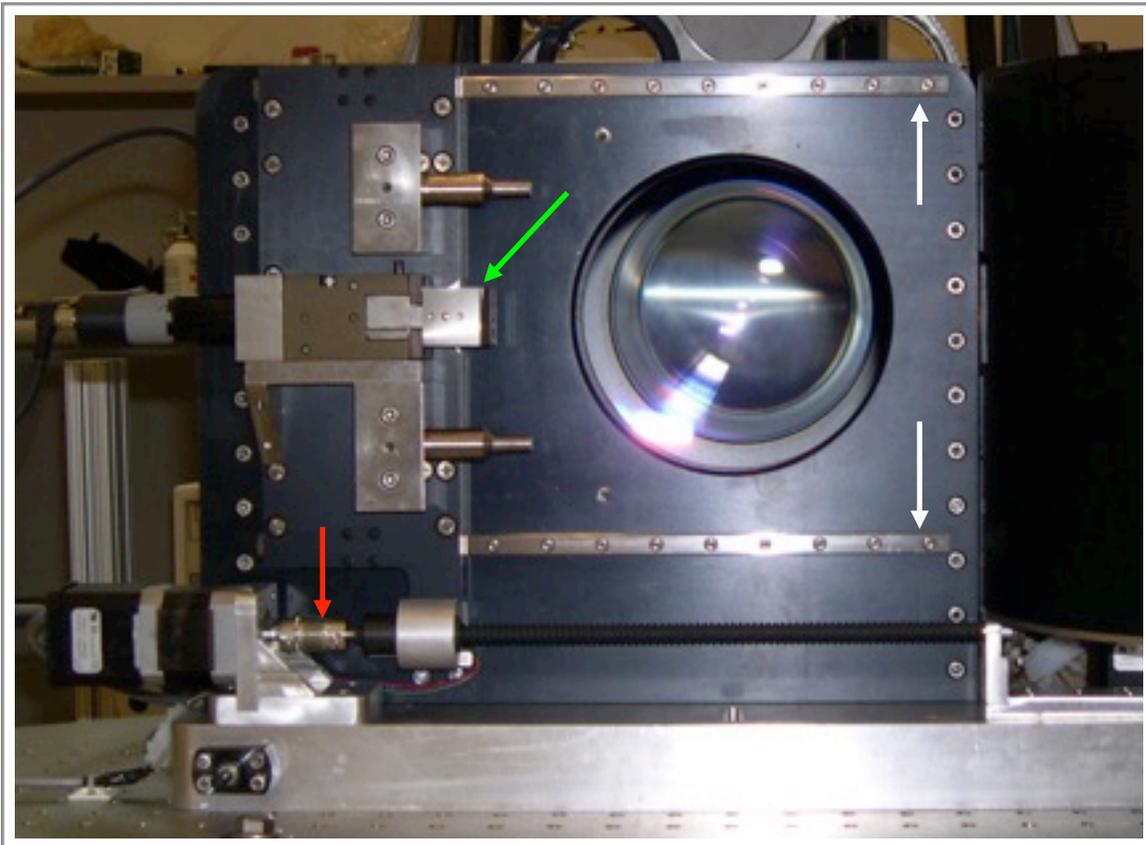
1. Shut down the instrument and turn off the power.
2. Insert the correct metric hex wrench into the manual drive hole of the large annular stage (see figure below).
3. Rotate wrench counter clockwise until stage reaches stop, then clockwise until it reaches the opposite stop. If any unusual resistance or stuttering occurs STOP IMMEDIATELY and inspect cables and stage for interference.



4. Correct any problems noted (i.e. by establishing necessary slack in cables or cooling lines) and continue until stage travels freely through entire range.
5. Clean any debris collected by traveling bearing blocks. If blocks have no more grease or rails appear dry, apply grease to nipples on bearing blocks using grease gun provided.
6. Remove hex wrench from stage and return it to the toolbox.

#### IV. Check slit stage motion and lubricate/establish clearances if necessary.

The slits for the spectrograph are stored in a carousel. A traveling stage with a gripper removes slits from the carousel and transports them into and out of the field of view. This stage rides on bearing blocks that travel on two rails (see white arrows in picture below). The rails can become contaminated or lose lubrication, and cables can restrict the range of motion. The full range of motion should be verified and re-established if necessary.



#### PROCEDURE:

1. Shut down the instrument and turn off the power.
2. Grasp shaft coupler (red arrow) and use it to turn leadscrew until the stage travels from position shown until gripper reaches the cutout in the black drum on right. . If any unusual resistance or stuttering occurs STOP IMMEDIATELY and inspect cables and stage for interference.
3. Correct any problems noted (i.e. by establishing necessary slack in cables or cooling lines) and continue until stage travels freely through entire range.
4. Clean any debris collected by traveling bearing blocks. If blocks have no more grease or rails appear dry, apply grease to nipples on bearing blocks using grease gun provided.