

Replacement of Chopper Servo

The servo that positions the chopper wheel will eventually need replacement, typically after 1 to 1-1/2 years of continuous use. This document describes the procedure and identifies important issues concerned with the replacement of this unit.

The servo should be replaced with a Hitech brand model HS-81 available at most RC hobby shops or on line, see http://www.servocity.com/html/hs-81_micro.html.

The servo has three leads, black (GND), red (3.25-3.5V power) and yellow or white (the control signal). The servo is controlled by a pulse width modulated signal that originates from the AMS software/NI boards which is applied to this line. This signal is a 50 Hz TTL pulse with a variable high pulse period of ~1-2 ms. The duration of the pulse sets the rotational position of the servo.

Note that the servo controls only the position of the chopper. A separate motor controls the spinning of the chopper. Turn off the chopper power (i.e., the chopper should not be spinning) during this repair.

Check that new servo runs:

- 1) Vent the system and remove the chopper flange. Note the alignment mark that is scribed on the outer diameter of the chopper flange and the vacuum chamber. When reinstalling, realign the flange to this alignment. Note that removing the chopper flange may change your current velocity calibration. Redo the velocity calibration afterwards.
- 2) Place the entire flange assembly with the cable attached on a nearby surface such that the chopper wheel and slide assembly are free to move.
- 3) Before you mount the new servo on the chopper hardware, check that it works. Disconnect the servo 3-pin electrical connector and plug in the new servo, make sure to match up the black/red/yellow (or white) colors on the connector between the mating connectors.
- 4) Run the Chopper Servo Control program (icon is red and yellow circles) or CRiTR (icon is red ARI). Make sure to turn off your DAQ before you run this software. Move the chopper position between open and closed and observe that the new servo is actually moving. If it is not, contact us at Aerodyne (Brooks@aerodyne.com).

Mount new servo and set position:

- 5) The next step is to remove the failed servo unit. Pay close attention to how the mechanical linkage is attached, ie. which side the mechanical linkage is on (away from the chopper).
 - Detach the black/silver lever arm by pulling the loop off the ball.
 - Remove the Phillips mounting screw holding the white servo output arm onto the servo. Now remove the servo arm by gently prying it off of the servo body. Note that the output shaft has splines to align the output arm.
- 6) Mount the new servo unit and secure with the two #2-56 machine screws and tie the servo cable to the side of the assembly.
- 7) Next replace the white servo output arm onto the output shaft. Do not replace the Phillips screw yet. Do not attach the black/silver lever arm yet.
- 8) Go to Chopper Servo Control or CRiTR and set the chopper “Chop” position to 35. This is the electronic center position for the servo. Set the servo position to Chop.
- 9) Check that the white servo arm is horizontal as shown in the photo (perpendicular to the long dimension of the servo).
- 10) If the white servo arm is not perpendicular to the motor, then rotate the white servo arm to horizontal, by gently pulling it off and putting it back in the correct orientation.

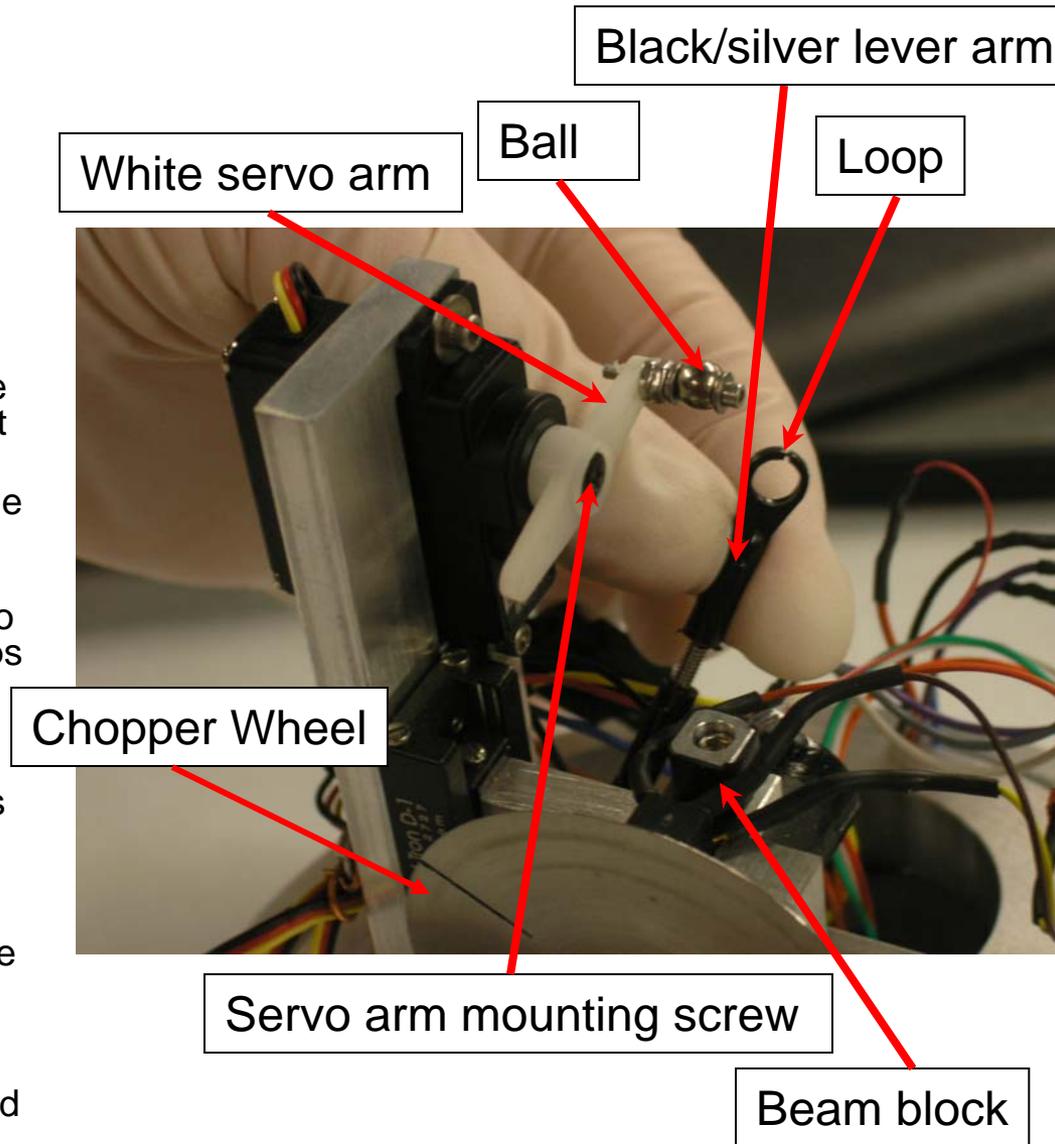


Figure 1. Chopper hardware.

Check position of chopper:

- 11) Disconnect the 10-pin circular connector (red cable) on the chopper flange. When disconnecting this cable carefully observe the servo output shaft and verify that the servo position did not “jump” when power was removed. If it did, repeat steps 8-10.
- 12) Reconnect the cable to the flange.
- 13) Connect the black/silver lever arm to the white servo arm by slipping the loop over the ball. Make sure the loop is on the ball, not the pin behind the ball.
- 14) Use Chopper Servo Control or CRiTR to set chopper position to open.
- 15) Use a set of calipers to measure the distance between the chopper flange and the particle beam position (2.150 in/ 5.46 cm). See Figure 2 (mechanical drawing) and Figure 3 (photo). Check that the particle beam is past the edge of the chopper, and that the chopper is not hitting the flange.
- 16) Use Chopper Servo Control or CRiTR to set chopper position to Chop.
- 17) Check that particle beam position (measured with calipers) is over the slit and misses the beam block (see Figures 1, 4 and 5).
- 18) Use Chopper Servo Control or CRiTR to set chopper position to Block.
- 19) Check that particle beam position (measured with calipers) hits the beam block.
- 20) Steps 14 to 19 set the approximate position of the servo. You will fine tune the position with the Servo Calibration routine in the DAQ.
- 21) Replace the Philips screw holding the white servo arm to the servo motor.
- 22) Replace the flange on the vacuum chamber, making sure to line up the score mark on the flange with the score mark on the chamber.

Check operation of servo/chopper:

- 23) Close Chopper Servo Control or CRiTR. You cannot run the DAQ while those programs are running.
- 24) Run Servo Calibration routine in DAQ. Set chopper open/chop/block positions in parameter menu.
- 25) Check that pTOF airbeam is roughly equal to MS airbeam.
- 26) Redo velocity calibration.

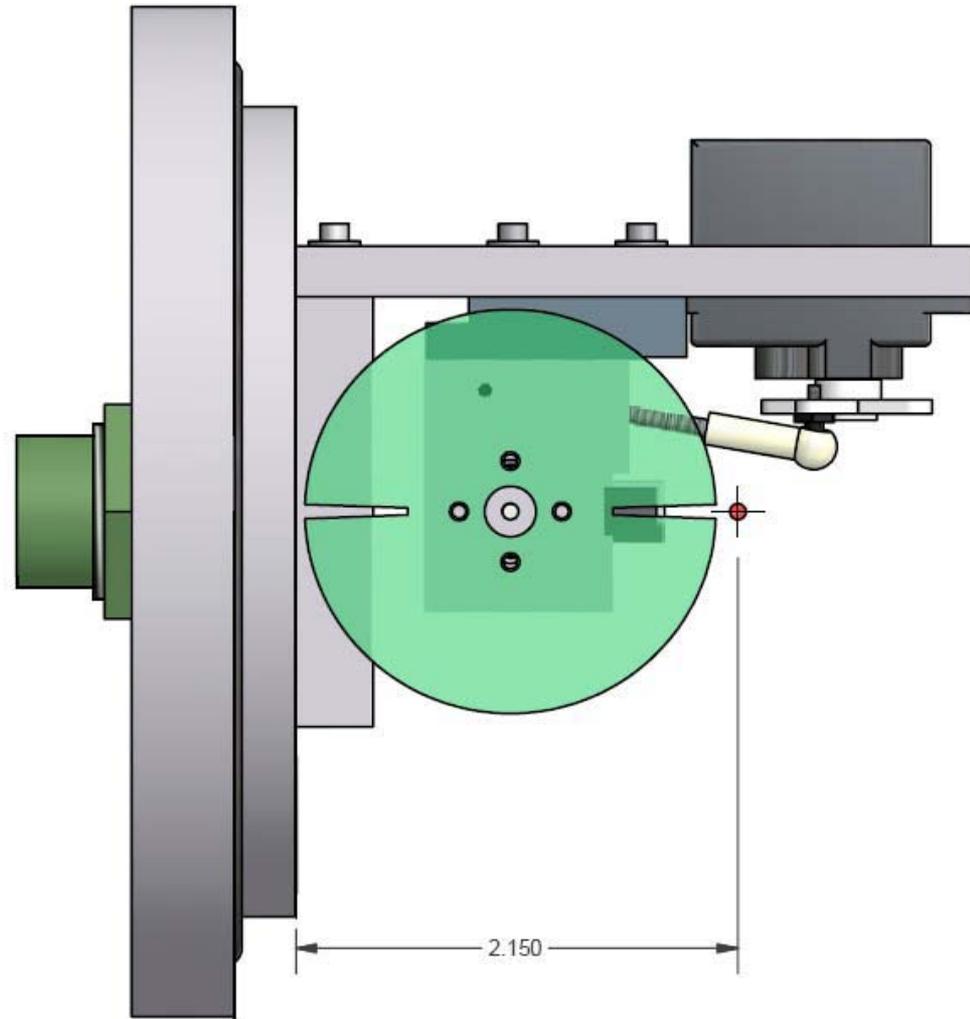
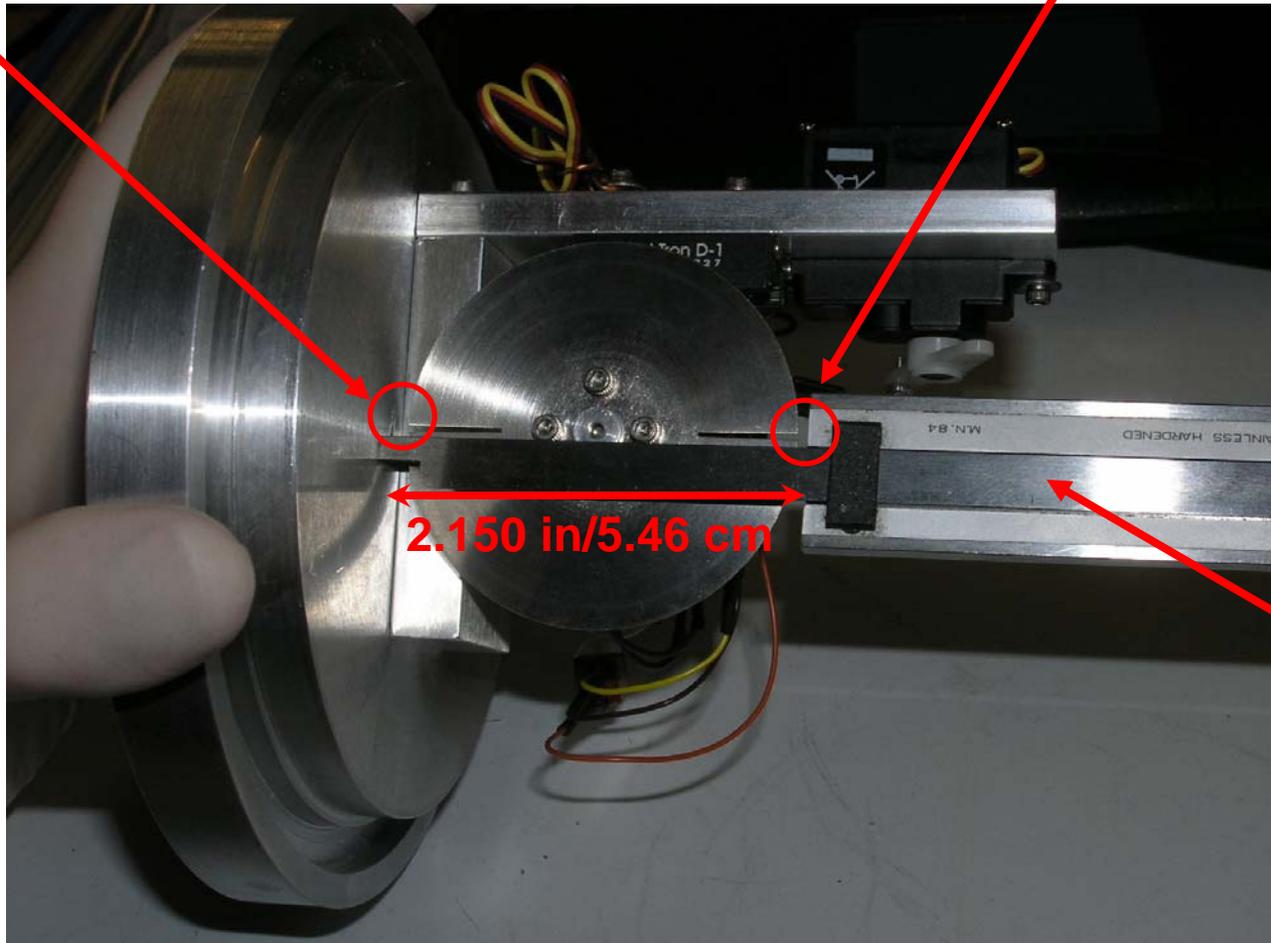


Figure 2. Mechanical drawing of chopper in Open

Make sure chopper is not hitting flange.

Make sure particle beam position is past edge of chopper.



Calipers

Figure 3. Photo of chopper in Open, measured with calipers.

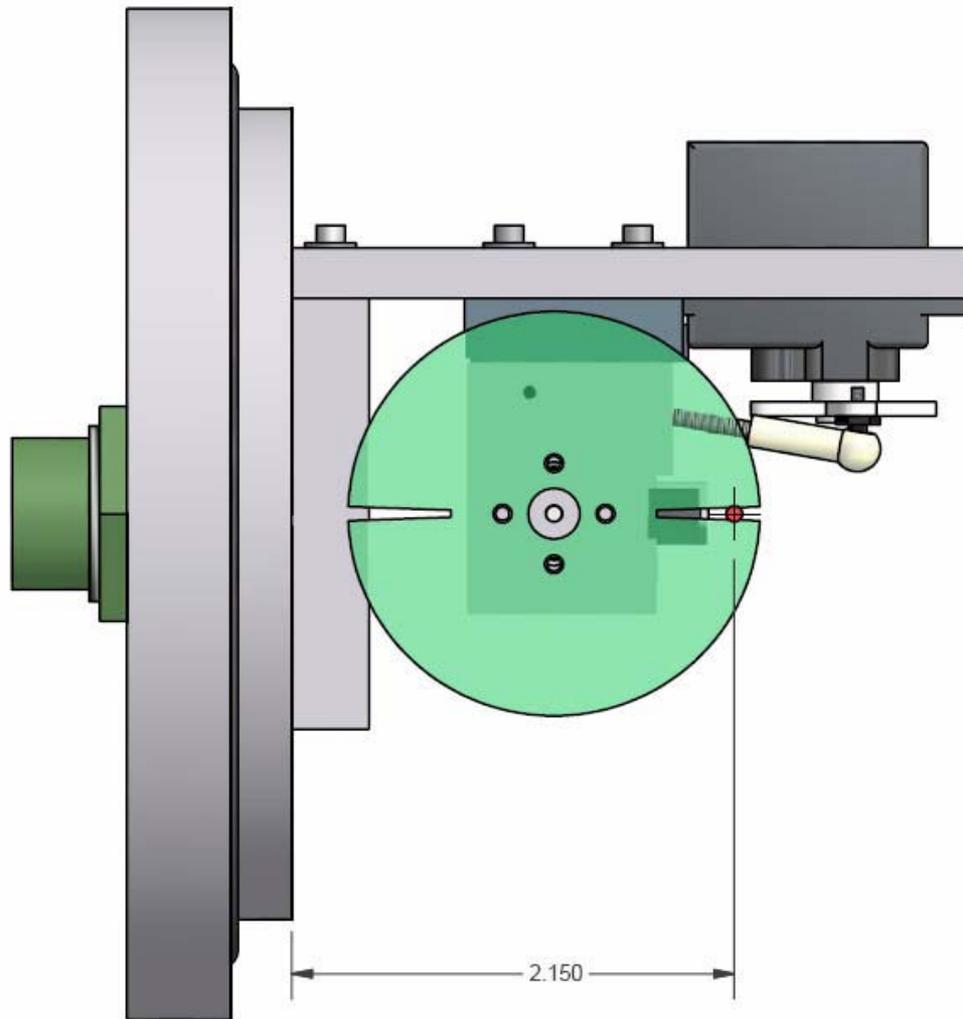


Figure 4. Mechanical drawing of chopper in Chop position.

Note that particle beam position is on slit, but passes beam block (see Figure 1).

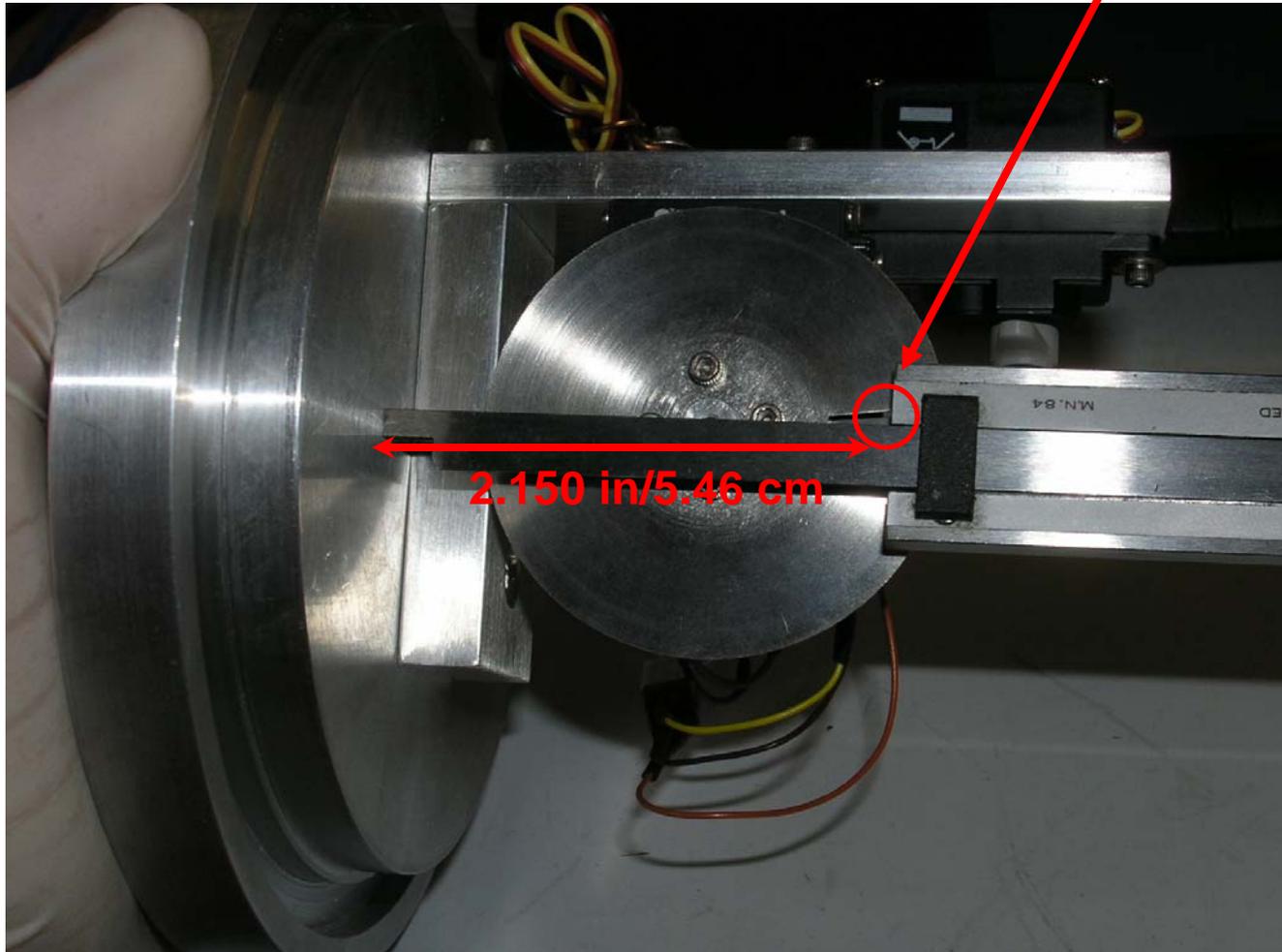


Figure 5. Photo of chopper in Chop, measured with calipers.

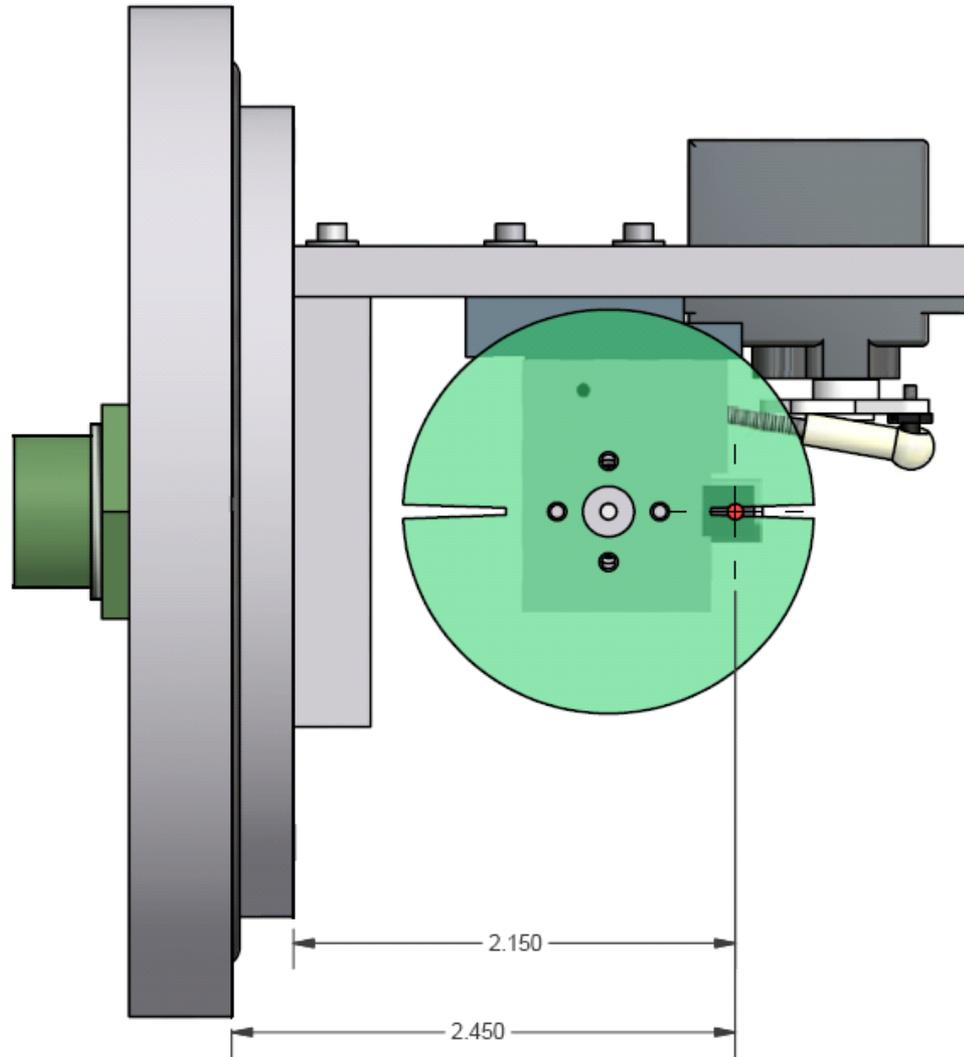


Figure 6. Mechanical drawing of chopper in Block position. Note that particle beam hits beam block (see Figure 1).