particle beam/laser beam alignment procedure

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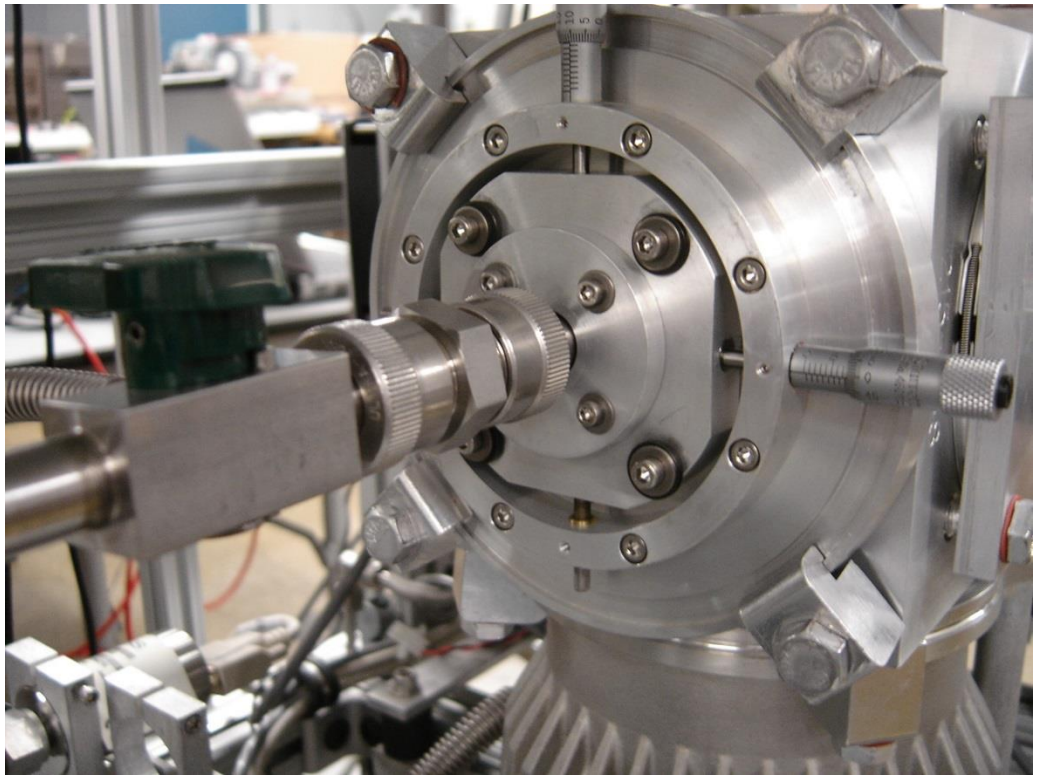
What you need to do the alignment

- The vaporizer needs to be in
- Ammonium Nitrate particles
- Black carbon particles (I use regal black but you don’t have to use regal black)
- Atomizer, DMA(I prefer monodisperse when doing the alignment)
- CPC is useful so that you can normalize signal to # concentration

Step 1

Do the particle beam alignment for Ammonium Nitrate as you would with a conventional AMS. Center the lens both vertically and horizontally with respect to the AN particle beam.

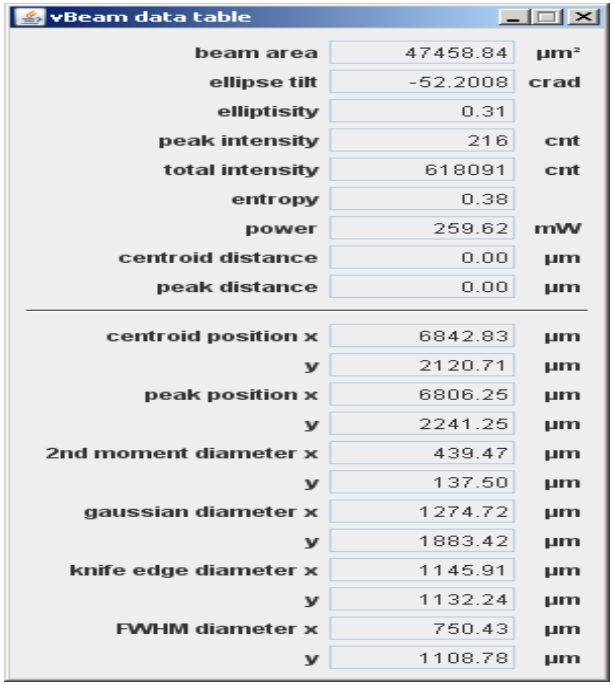
If you haven't aligned this lens in a very long time it is a good idea to turn the TPS off, make sure you can move the lens horizontally and vertically without the system venting, then turn TPS back on and find the edges of your AN beam



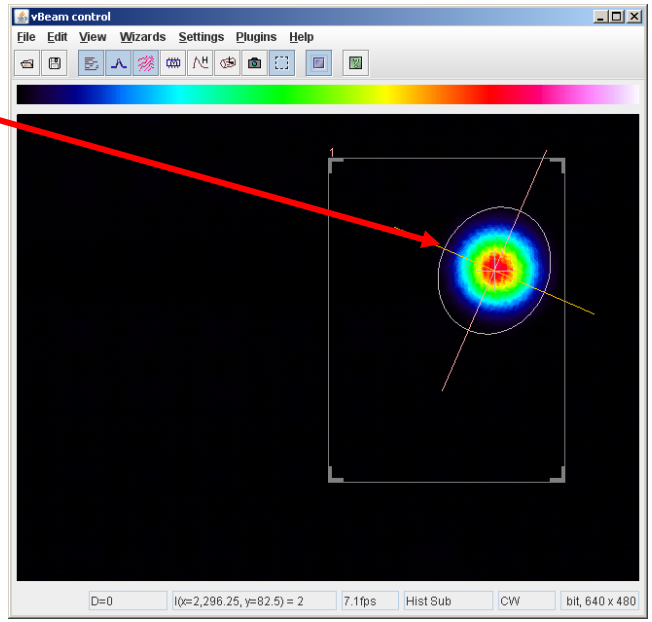
Also, It's a good idea to run an IE in this centered position with AN

Step 2

Now you are going to use the black carbon particles. Make sure you have a TEM00 that you are happy with. It should be more or less in the middle of the camera image. The reason you want to have it more or less in the middle is just that that gives you room to adjust in the vertical without going off the camera. If you cant get a TEM00 in the middle then go with one a little bit off that is fine it is just going to cut down on your range of motion if you have to move in a certain direction.



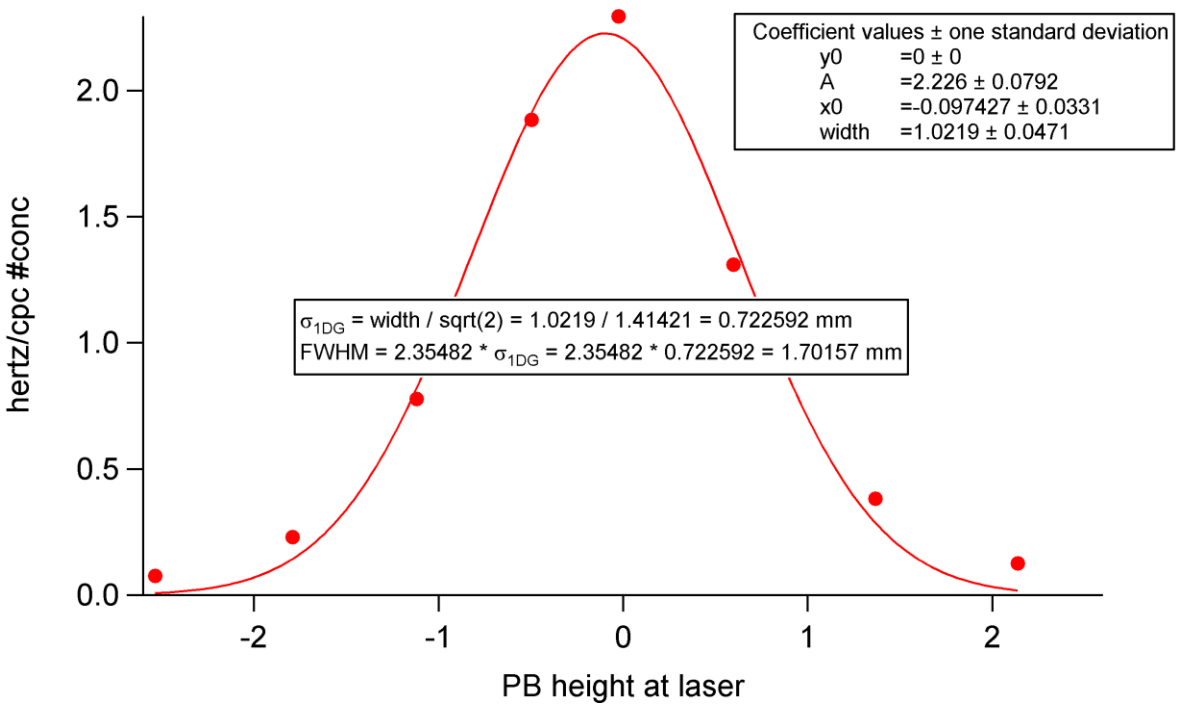
Note: this is a nice TEM00 but not to close to the middle so my range of motion if I need to move the beam wont be that large



Step 3

Do the particle beam walk with the black carbon particles. Move the particle lens vertically and save cycles for each point process in IGOR and see if the vertical peak for black carbon signal is at the same point as the center was for ammonium nitrate. In my experience instead of the flat top that you get with ammonium nitrate sensitivity you will get a more pointed peak.

On this graph 0 height on the x axis is the center of the AN particle beam. The more points you take the better the resolution. Should have done more points here but in this case the black carbon peak is basically on the 0 height so it basically shares the same center as the AN particle beam

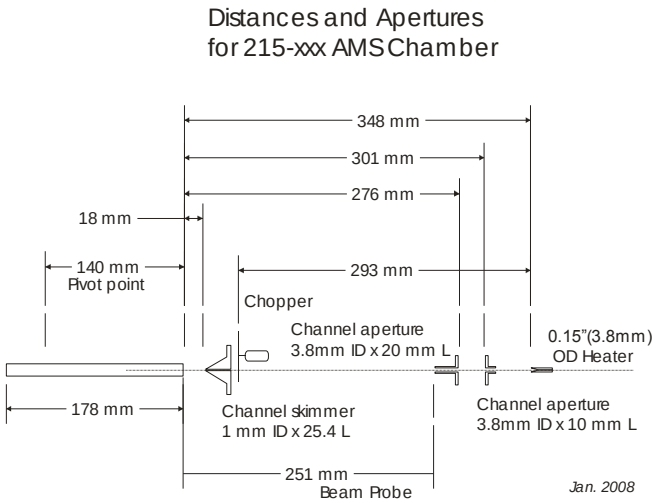


Step 4

Once you have your two peaks calculate how far apart they are in real space at the ion cage. This will determine whether you need to move the laser in the vertical dimension.

Use the equation (348 mm/140 mm) * (center AN on the lens vertical - center BC on the lens vertical) to determine how many millimeters off of center the BC peak is at the vaporizer. If it is more than about .5 millimeters you really ought to move the vertical laser position in order to bring it closer to the vaporizer center. If you are within .5 you are close enough, I know it is hard to be exact because it is hard to move the TEM00 image just a tiny amount.

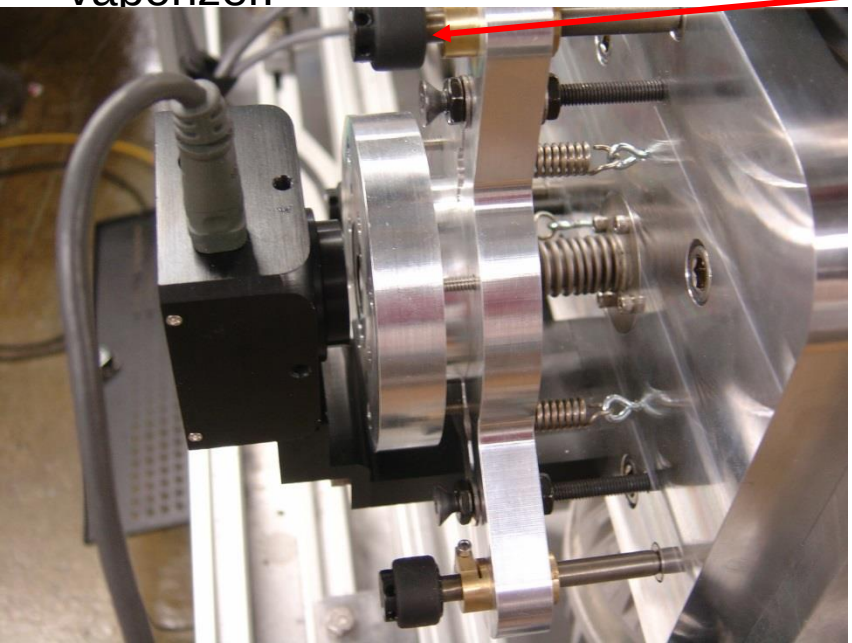
This diagram shows that if you move the lens down .1 mm or 100 um you raise the particle beam at the point of the vaporizer by (348/140)*.1 mm = .248 mm rise at vaporizer

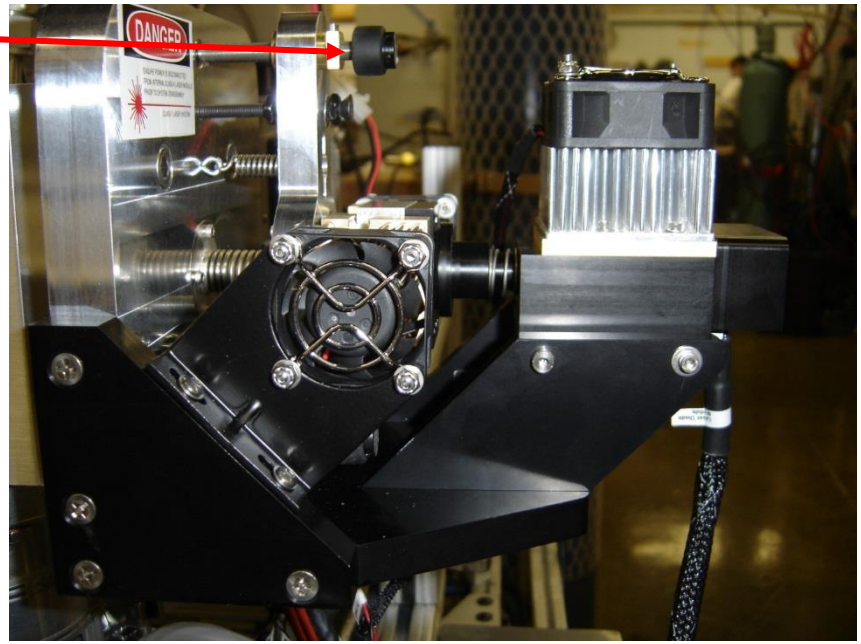


Step 5

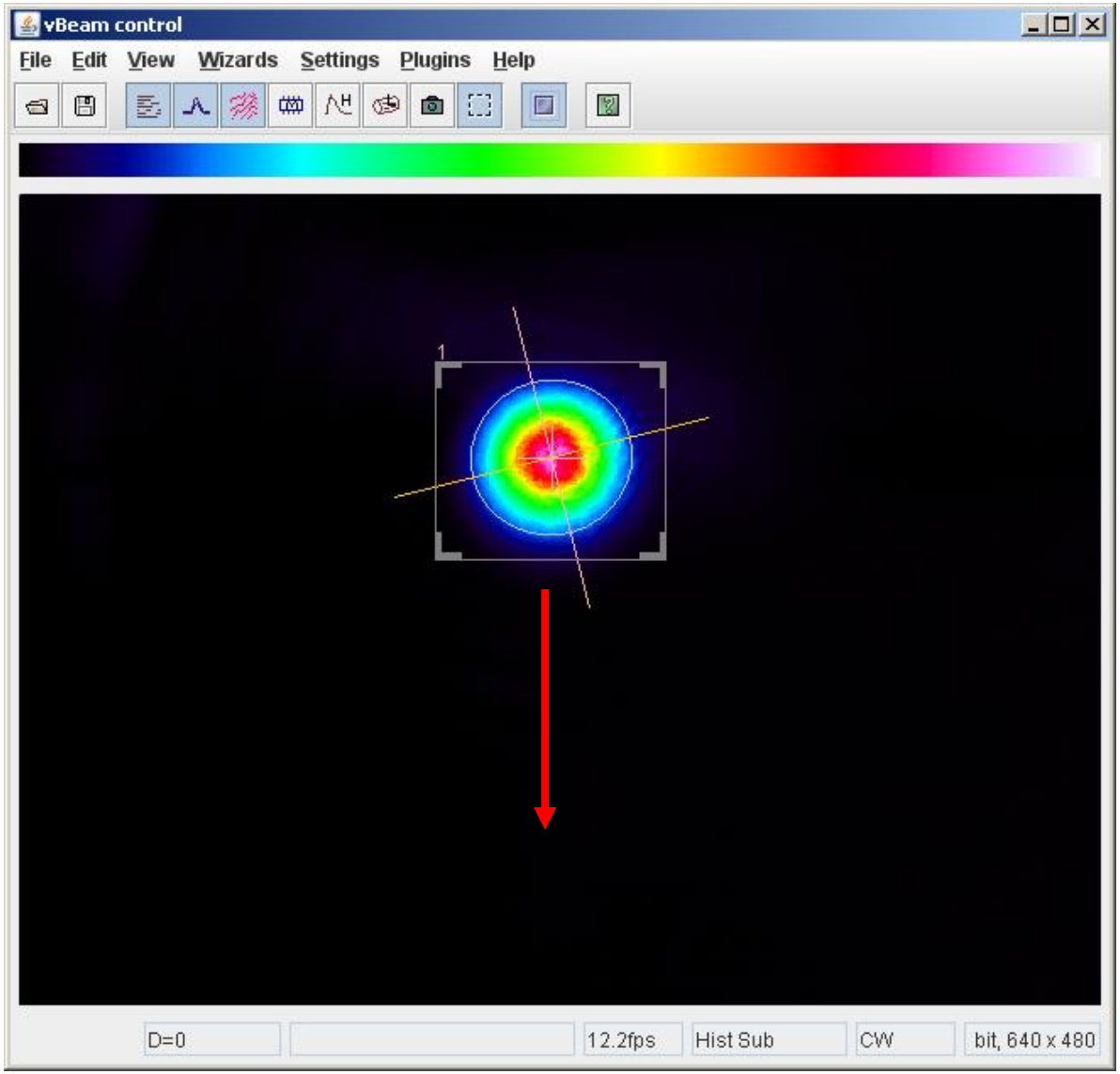
BEFORE YOU MOVE THE KNOBS AT ALL TAKE A SCREEN SHOT WHICH SHOWS WHERE THE CAMERA IS SO YOU CAN GO BACK TO THAT POSITION LATER. DO THIS FOR ALL OF THE TEM00 POSITIONS YOU GO TO

If you have to move the laser vertically walk the laser by moving the top adjuster screw on both sides of the ToF by roughly the same amount but opposite directions. If the screw is pushing further out on one side it should be moving closer in on the other side. Get a new TEM00 at this new position and repeat the particle beam walk see if you are closer to the center of the ammonium nitrate and figure out how much more you need to move the laser beam to achieve this situation where the peak for the black carbon is within .5 millimeter of the center of the vaporizer at the vaporizer.





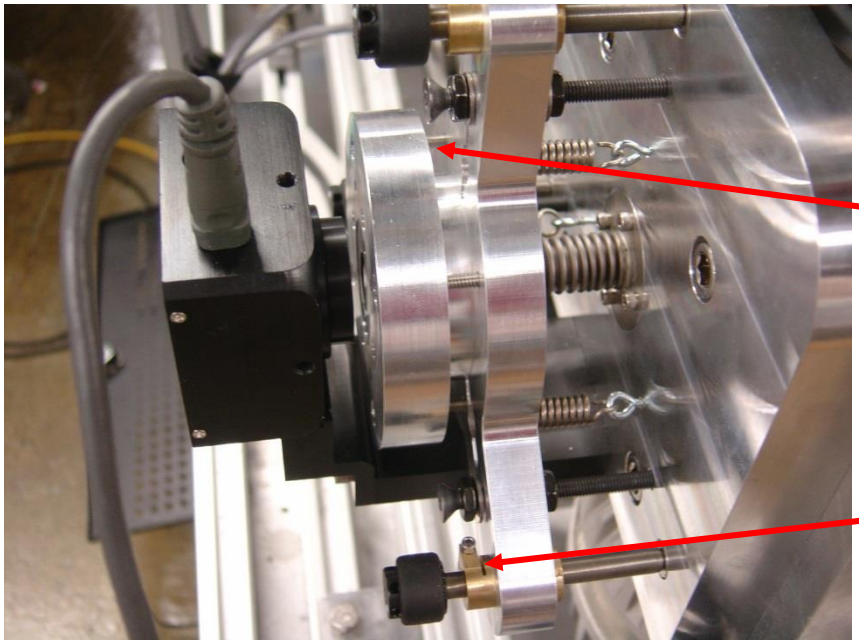
Moving the image down as shown with the arrow moves the laser beam up in reality inside the ionization chamber because the camera is inverted

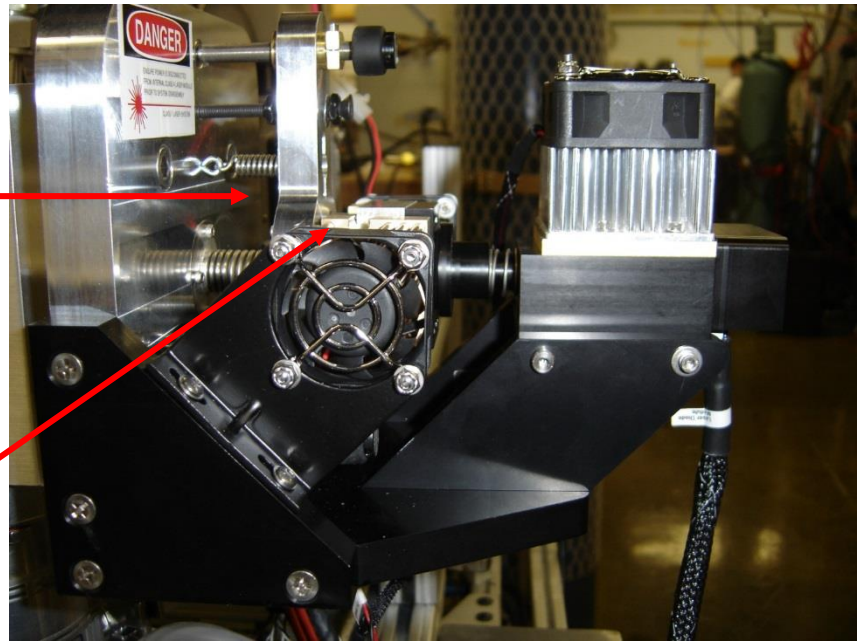


Step 6

Horizontal movement of the laser beam; do this after all vertical centering.

Walk the TEM00 horizontally by some combination of moving the screws on both sides of the TOF. Check sensitivity at these different horizontal positions. The optimum sensitivity will probably be near the center but it is good to check it and verify. Make sure whatever adjustment you make you can undo.





Moving the beam to the right in camera space moves the laser beam forward in the ionization chamber because the image is inverted