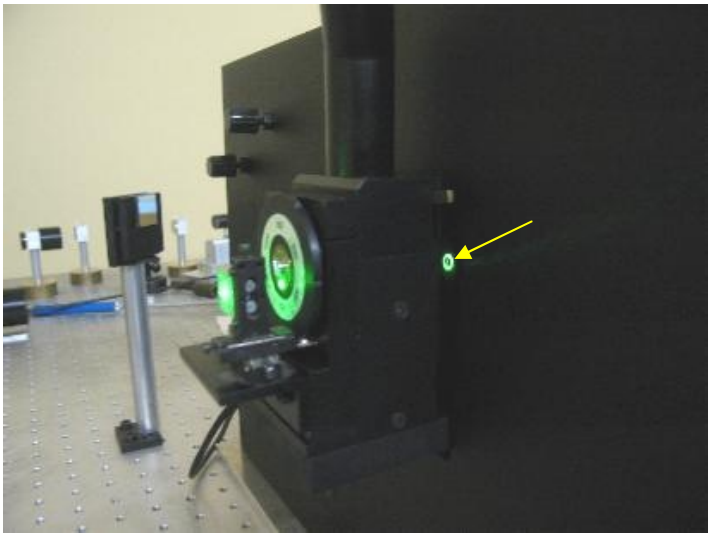
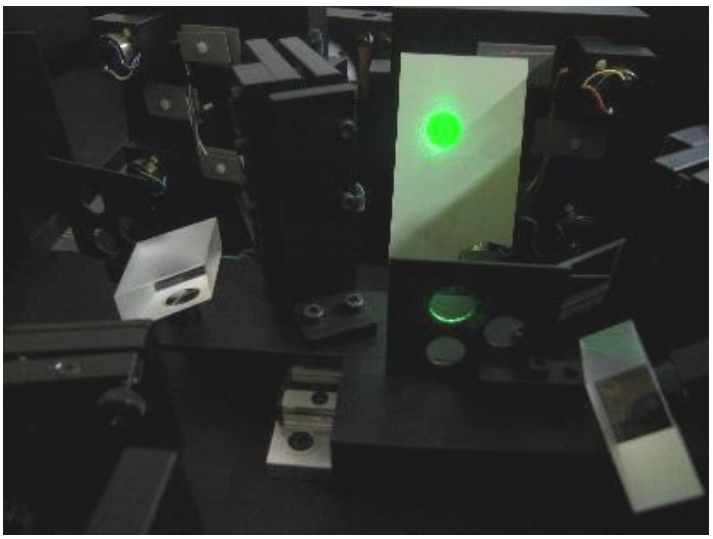
Alignment of Optics



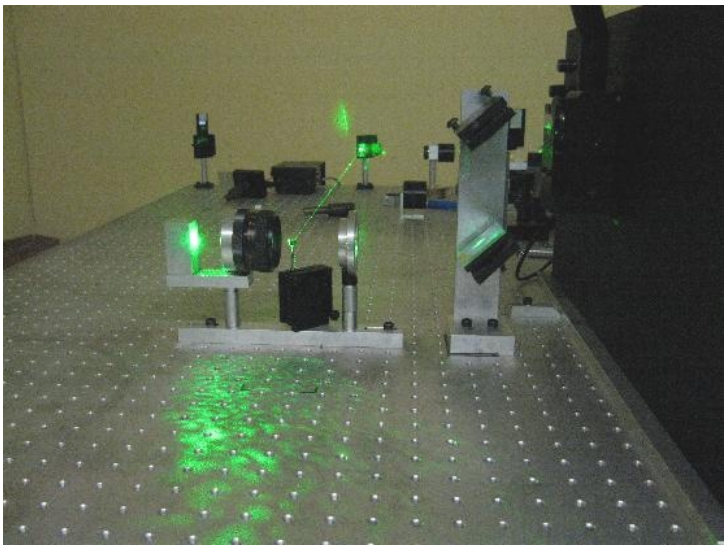
This section is intended for checking the fine alignment of the spectrometer. If major changes have been made you may need to refer to the more complete instructions in sections 3.1 and 3.2 of the manual.

A light source will be required. Two possible sources are described in the document “TFP – suitable light source for alignment”.

If an expanded laser beam is chosen, as shown here, check that the aperture A1 is fully illuminated.

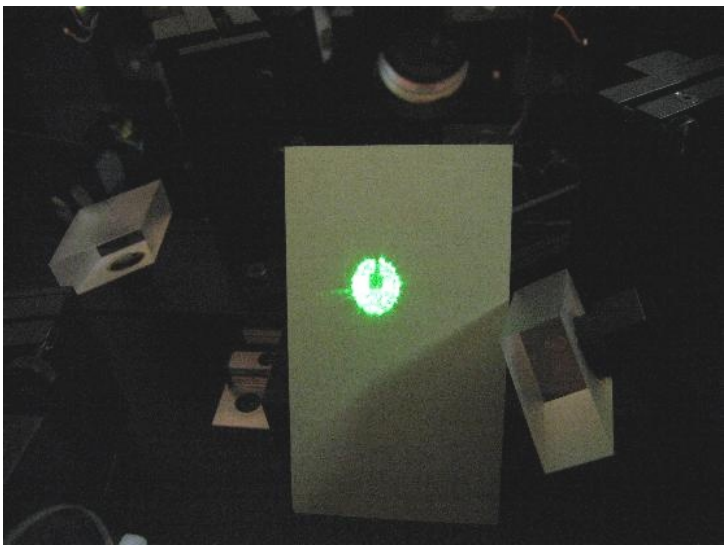


Check that a nice uniform wavefront is seen inside the spectrometer.



Alternatively, if back scattered light is used, from an arrangement similar to that illustrated, check again that the aperture A1 is fully illuminated.

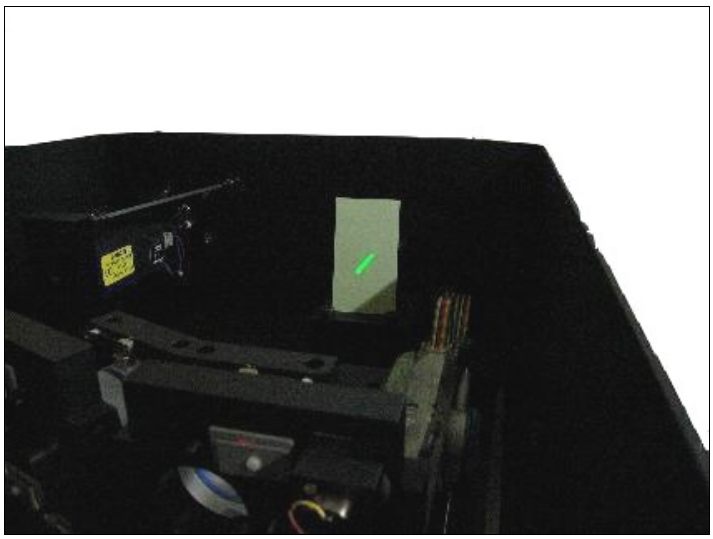
Look for a clean, well focussed image in front of FP1. The shadow of the small prism should be clearly visible.



The next step is to make sure that the light falling on FP1 is reflected back out of the input pinhole. Choose the 1000m pinhole and set the optics to “Tandem”.

If you are using an expanded laser beam you should see the reflected beam going back towards the laser. Apply a slight pressure to the holder of M2 and the beam will move. Adjust M2 so that the beam folds exactly back on itself.

If you are using back scattered light, hold a thin glass plate in the scattered beam close to the input pinhole, and rotate it slightly so that the light reflected from FP1 falls onto a small piece of paper placed near the pinhole.
Caution: do not rotate the glass plate too far or the scattered light beam will be displaced so that it does not enter the pinhole. If the light does not go in, it cannot come out again!
The reflected image should be sharp and clear. Progressively reduce the pinhole size and adjust M2 to get the best image.

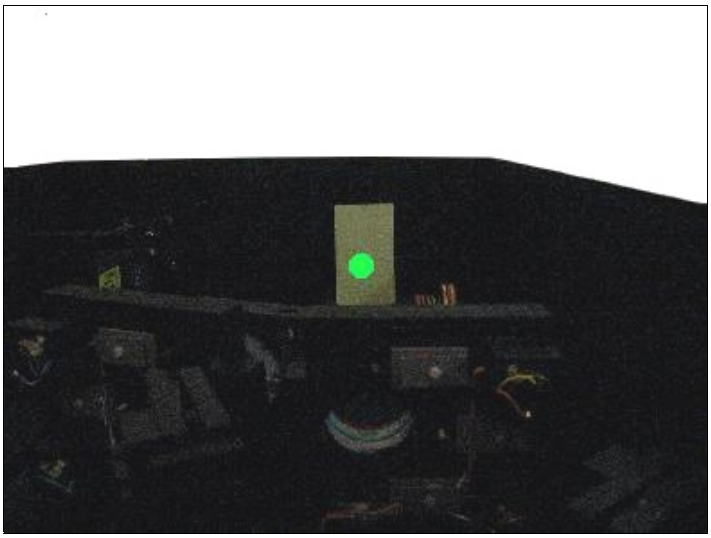


Place a piece of card in front of M3 and observe the light transmitted by FP1. Probably 1 fringe will be visible. If no fringe is visible, adjust Z until a fringe comes into view.

Assuming a fringe as shown, adjust the axis Y1 and the fringe will rotate.

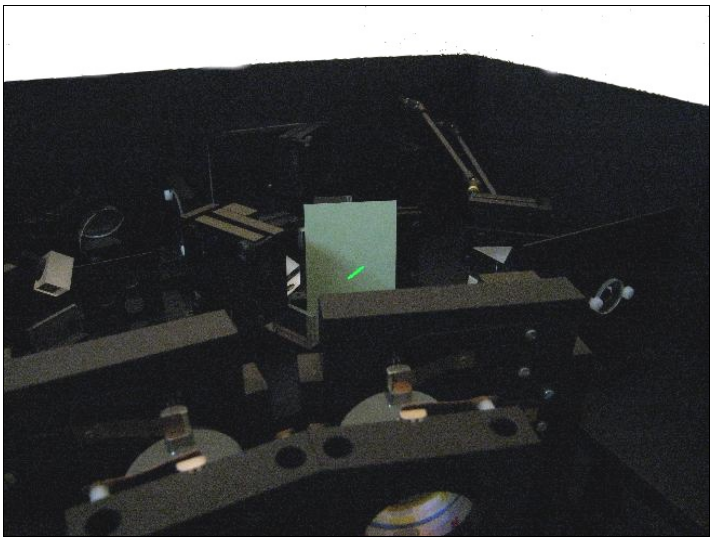
Continue to adjust Y1 until the fringe is vertical. Now adjust the X1 axis and the fringe will get narrower or broader.

It will be necessary to adjust Z in order to keep the fringe in sight.

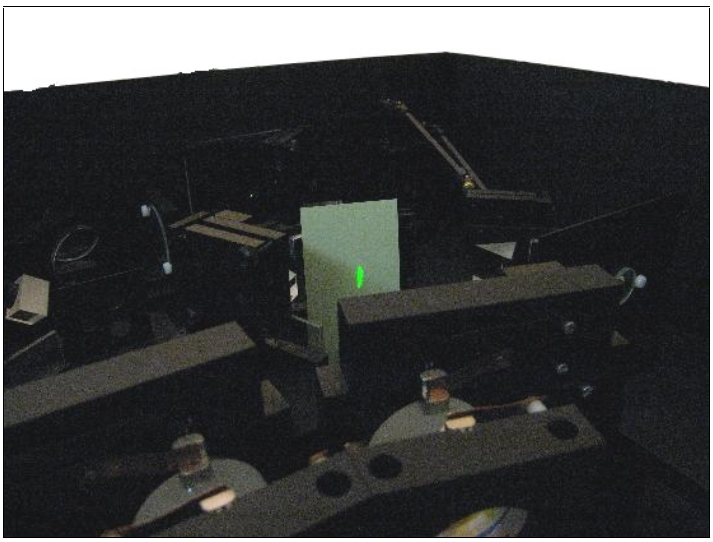


Adjust X1 until the fringe is so broad that it fills the whole field of view.

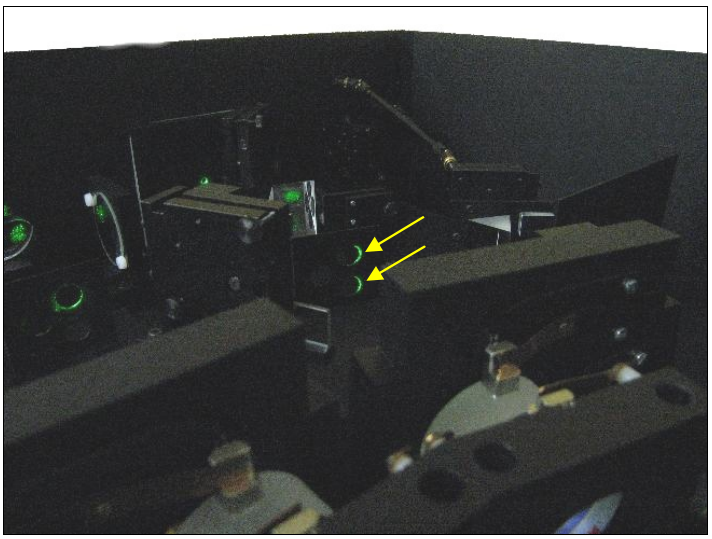
Maintain transmission through FP1 and now place the card after FP2.



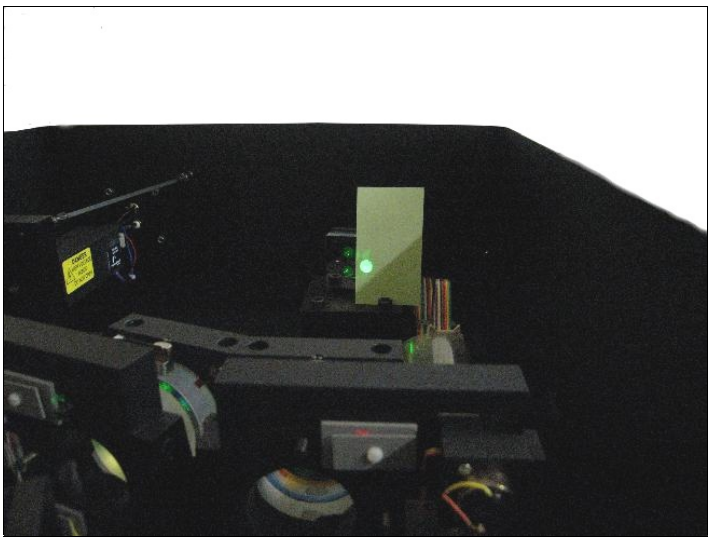
Adjust ΔZ until a fringe is seen.



Adjust Y2 until the fringe becomes vertical and then adjust X2 until the fringe fills the field of view.
If ΔZ is slightly detuned some fringes will be seen which come from the external path including M3. Touch the holder of M3 gently and the fringes will move. Adjust M3 until about 5 fringes are visible. Under full alignment these fringes will hardly be visible.
If you take too long over this alignment you will find that FP1 is no longer transmitting. It is a good idea to turn off any vicious air-conditioner while you do this.

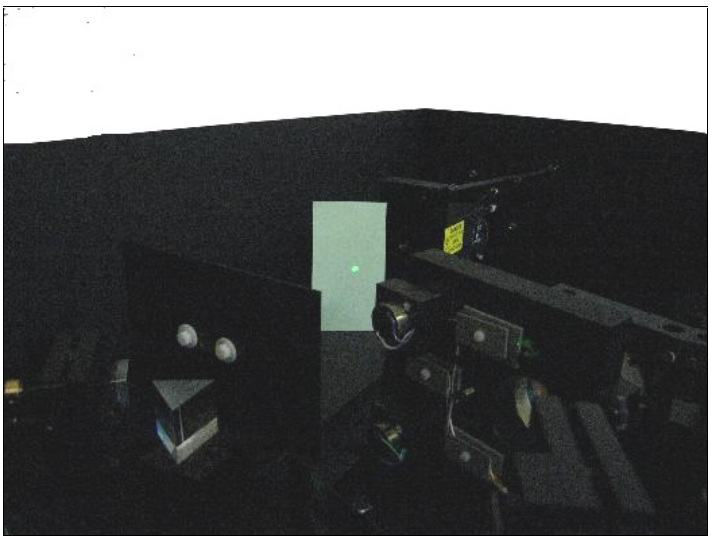


With full alignment, remove the piece of card so that the transmitted beam reaches the prism PR1. Look on the small aperture after FP2 and you will probably see some light striking the sides of the first two holes as shown here. The prism can be rotated slightly about a vertical axis until these multiple reflections disappear.



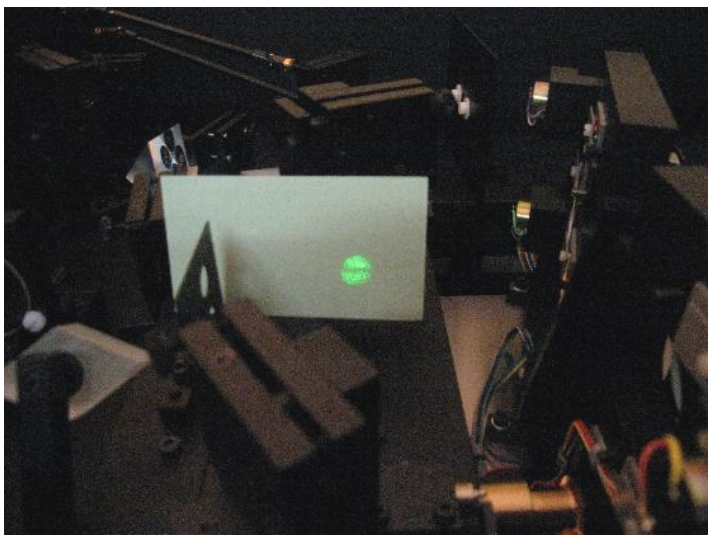
If you have done a good job of alignment you should now see the transmitted light in front of the cat's-eye M4. Tweak the alignment piezos to give maximum intensity.

Place a piece of card in front of M3 (avoiding the first pass) and the fifth pass should be seen. If the beam is in any way cut, rotate the cat's-eye to get optimum transmission.



The beam after 6 passes can now be seen in front of the photon counter.

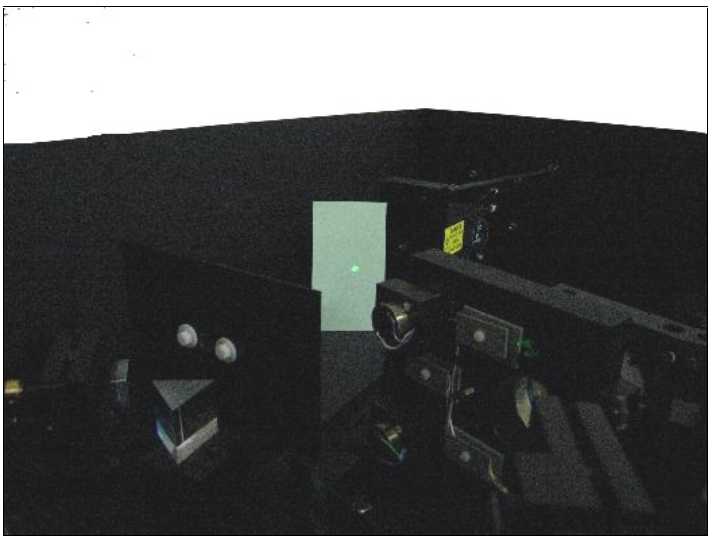
Check that the light passes through the largest output pinhole (1300μm).



Check the alignment mode optics by switching to “align”. Place a piece of card in front of BS2 as shown, and the light reflected from FP1 will be seen. When FP1 transmits, the reflection will go dark. Typically a dark fringe will be seen which can be adjusted to fill the field of view using X1, Y1 and Z.

Detune Z so that the reflected beam becomes bright. Place the card in front of M3 and look for the light transmitted by FP2. Optimise using X2, Y2 and ΔZ. The light reflected from FP2 should pass through the glass block G2 on its way to the photon counter. Check that the beam passes through the largest output pinhole.

This light beam transmitted by FP2 should strike the centre of the aperture A2. If this is not the case it can be “walked” by successive movements of BS1 and BS2,while making sure that the output beam continues to pass through the output pinhole.



Check the beam after lens L2. The beam should be circular in section and not clipped. If clipped, try rotating the glass block G2 to obtain a better transmission. (G2 can be rotated about its vertical axis by applying a light force).

The final alignment is made using the reference beam and the photon counter.

If you have not already adjusted the reference beam splitter, do this now. (See the document “TFP – aligning reference beam splitter”).

Remove the light source and align the interferometer using the photon counter in the usual manner. In the tandem mode, adjust M6 to give maximum amplitude, using successively smaller output pinholes. Return to the alignment mode and optimise the intensity of the alignment mode beam using BS1. (The optimisation must be done in this order).