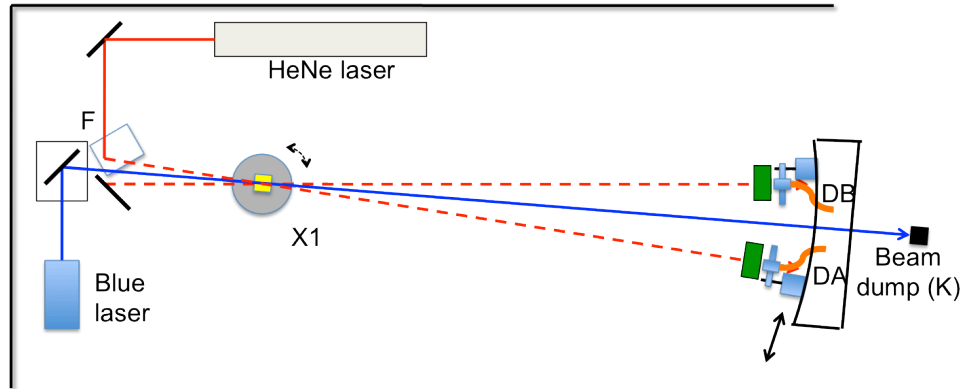
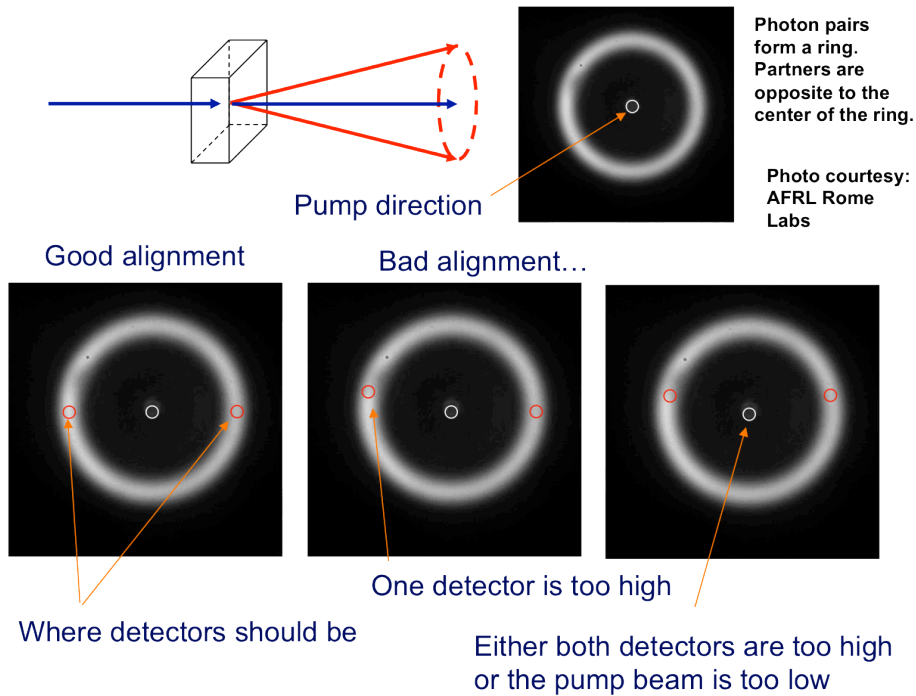


## What if you still do not get coincidences?

- 1- Make sure that the crystal is properly aligned. You do this by tilting the crystal. The counts of both singles should rise sharply as a function of the tilt and together go down as you keep tilting. If they do, go to #2. If not, then there are three options:
  - a. Neither channel rises sharply at some tilt angle. There are two possibilities.
    - i. If there are no counts above background (a few hundred counts/s) in either detector, you are in a dark place... You must set the collimators at the proper positions, forming equal angle with the pump and at the same height. See procedures we have posted to do this.
    - ii. If there are a lot of counts, the problem is that the crystal is at the wrong orientation and some other IR is getting to the detector: Some blue lasers have a strong IR component that could be scattered by the crystal; or some piece of optics (filter etc.) that is in the path of the blue laser is fluorescing, and you are getting that fluorescence; or the pump somehow found a way to your detectors through some odd reflection. You can solve this by tilting the crystal. This normally gets rid of this. Otherwise you need to put a filter that passes the pump and blocks the IR. You can also use cross polarizers before and after the crystal (down-converted photons are perpendicular to the pump), but this should be a temporary solution, because the polarizer after the crystal could wedge the down-converted photons or the polarizer before could also produce IR fluorescence.
  - b. If one channel rises sharply but not the other, that is suspicious. Your other collimator could be way off in alignment, or the optical fibers are not being hooked-up correctly. The crystal may well be in the wrong spot: both detectors have to have a sharp dependence with the tilt of the crystal.
  - c. If both detectors show a sharp peak with the tilt of the crystal but they do not peak at the same spot, then in this case the two collimators/detectors are not at the same angle relative to the pump beam. Fix: Tilt the crystal until ch1 is a maximum, then displace collimator 2 along a curved path centered about the crystal until it peaks. Then repeat the tilting until you see that both peak at the same tilt angle. We make a plate that has a 1-m radius of curvature and place the collimator mount against it (see figure below). When we slide the collimator mount with the plate as a guide, the collimator changes position while still looking at the crystal. If you have a straight-plate guide that can also work, but if you go too far the collimator will get out of alignment.



- 2- If both detectors peak with the tilt and the coincidences are low, then you are detecting coincidences but not the partners. There are two possibilities:
- There are three "beams" of photons in this problem: the pump, and the two down-converted photons. All three have to be in the same horizontal plane (see below). If they are not, then you can get high single counts but no partners. The fix is to realign the paths and make sure all three are at the same height. We do this with an auxiliary visible laser beam.



- We use narrow band-pass filters (1, 10, 25, 40 nm). It is possible that the filters are missing the partners. Measure the wavelength of the pump. The filters should be within twice the wavelength of the pump. Some blue diode lasers can be way off the nominal value (405 nm). If a diode is say at 408 nm and the filters are set to  $810 \pm 5$ , the filters are just missing

the partners. The filters will still get other down-converted photons: 810 nm but with partners at 822 nm, which is blocked by the filter.