G0 IA Cell Alignment Procedure

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This document is a "how-to" for G0 collaborators who would like to align an IA cell. The basic procedure was originally detailed to the authors of this document by Mark Pitt.

The IA cell consists of an upstream linear polarizer, a waveplate (usually $\frac{\lambda}{4}$ or $\frac{\lambda}{10}$), a Pockels Cell, and a downstream linear polarizer. The laser should be turned on the whole time during the alignment procedure.

1. Place the upstream linear polarizer on a rotating mount, and have the transmission axis oriented in a convenient direction (perhaps perpendicular to the table). Keep this in place, and do not touch after this step is done.

2. Place the downstream linear polarizer on a rotating mount, and insert it in the beamline. Make sure there is enough room for the Pockels cell and the waveplate to be placed between the upstream and downstream linear polarizers.

3. Orient the downstream linear polarizer such that is is nearly "auto-collimated". This means the optical face of the cube is nearly (but not perfectly) perpendicular to the incident beam. This can be done by using an IR viewer to observe the reflection of the laser off the polarizer, and making sure that the reflected ray is "near" the incident ray. One can use an IR viewer and a piece of paper to see the relative locations of the reflected and incident rays. If the reflected ray matches the incident ray, then they could interfere and cause problems. Thus, make sure the reflected spot is a few millimeters away from the incident ray.

4. Begin rotating the downstream linear polarizer until minimum transmission is achieved (this is when the two polarizers are in the crossed-mode). Note the transmitted intensity with a power meter as well as the angle of the polarizer. Now rotate the downstream polarizer by 90 degrees (clockwise or counter clockwise, it doesn't matter). This is where the two polarizers are in parallel-mode. Note the transmitted intensity and the angle of the polarizer. Determine the extinction ratio: $I_{parallel}/I_{crossed}$.

Now rotate the downstream polarizer back into its crossed-mode.

5. Insert the waveplate. It needs to be on a rotating mount. Rotate the waveplate until minimum transmission is achieved, and note the angle of the waveplate. Again, determine the extinction ratio by noting the transmission in the crossed and parallel-modes of the two linear polarizers.

6. Now cross the polarizers for minimum transmission. Insert the Pockels cell. Leave the voltage off. The voltage leads should be approximately parallel to the transmission axis of the upstream linear polarizer. Orient the

pitch and yaw of the Pockels cell until minimum transmission is achieved. One must be particularly meticulous about this alignment, since it is possible to end up in a secondary minima. Once minimum transmittion is achieved, measure the extinction ratio again by making the polarizers crossed and parallel.

7. Rotate the waveplate by 10 degrees.

8. Set the downstream linear polarizer to parallel mode for maximum transmission. Start measurements.