Colgate University Alpha BFYIII Workshop
Contents of the Memory Stick
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The memory stick has several subdirectories:

1. **Articles** contains pdf files of articles useful in understanding the experiments and implementing them. One subfolder has all the Colgate articles and the other subfolder has articles relevant to undergraduate photon labs.

2. **Calculations** has files for calculating parameters of down-conversion. It includes:
   - "BellviolationplusHBT" is a spreadsheet that calculates the Bell and Hanbury-Brown-Twiss tests. It is quite useful. It gives you errors too.
   - Folder "MathcadCalculations" has Mathcad files and printouts of calculations that are useful in getting crystal parameters for down-conversion.
   - "Mathematica" is an update of the calculations in Mathcad.

3. **ColgateLabwriteups** contains our own write-ups that we use for the undergraduate labs in conjunction our course on quantum mechanics. It is the most recent incarnation where the students do the all the alignment and take the data. These have questions. Also included are pdf's of the solutions to those questions calculated with Mathematica. The instructions are based on our experience with Alpha immersions.

4. **GeneralInformation** has several useful files to help implement the experiments:
   - "Cost of Single Photon Experiments" gives an overview of the costs involved. Some components are vital and others can be implemented with equipment that you may have at hand. We specify which is which.
   - "ImmersionInstructions" contains the most recent set of detailed instructions that we give out to the participants of our Alpha Immersions.
   - "Pricelist18sm" contains the specific parts that we recommend, with prices, model numbers and photos.
   - "Lab Manual" has a lot of information about the experiments. It includes older recommendations that we no longer follow, but which work.
   - "TroubleshootingPhotons17" walks you along the tour the force: what to do when you are stuck. We all get stuck, so this contains suggestions for what to do.

5. "Programs" has several subdirectories:
   - "3D printer Arc file for Quantum Setup" has the file for 3-d printing the plate to guide the detector mounts.
   - "2016Labviews" has two subdirectories:

i. "SourceLabviews" has all of our source codes written in labviews and libraries of vi's that is uses.
ii. "Executables" has the files that you need for running executable versions of two programs. The installer has to be run first and the executables next.

- "ArduinoScripts" has our Arduino scripts.
    i. "Information" has a file with a description of the Arduino programs and photos.
    ii. "ArduinoHomeMadeDAC" has the program for the circuit that involves a home-made DAC using the R-2R ladder.
    iii. "ArduinoLTC1257DAC" has the program for driving the D/A IC LTC1257, which communicates by the serial port of Arduino.
- "Ayars Board" has the files for the new board by Eric Ayars. A subdirectory has the Matlab files to take data with the Ayars board.
- "Photon Matlab" has the Matlab programs written by Behzad Khajavi, which are divided by subtirectories. The programs are:
    i. In "2 Detectors/Continuous Counting/No Piezo:" we have **ContinuousCountingAltera** which is a general purpose free-running program for tuning the apparatus with 2 detectors.
    ii. In "2 Detectors/Continuous Counting/Piezo Manual:" we have **ContinuousCountingPiezo_Altera**, which lets you set up the voltage on the piezo manually, to whatever value that you want.
    iii. In "2 Detectors/Continuous Counting/Piezo Scan:" we have **PiezoScan_2Detectors_Altera**, which takes a scan of the piezo for 2 detectors.
    iv. In "2 Detectors/Continuous Counting/Tomography/4 Rotating Motorized Waveplate:" we have **Tomography_Motorized_Altera**, which is a program that does tomography measurements while driving 4 motorized mounts. This is custom to what we have, but could be adapted to other motorized drives.
    v. In "2 Detectors/Continuous Counting/Tomography/Manual Waveplate:" we have **Tomography_Manual_Altera**, which is a program that takes a tomography but which pauses after each measurement. This is used for when we have waveplates rotated manually. The program does the full tomography measurements.
    vi. In "3 Detectors/Pause (HBT, SG):" we have **Paused_3Detectors_Altera**, which is a program that takes a specified set of measurements for doing Hanbury-Brown-Twiss and other measurements with 4 detectors.
    vii. In "3 Detectors/Piezo Scan:" we have **PiezoScan_3Detectors_Altera**, which is a program that scans the piezo detector and records data from 3 detectors. This

program can be used for single-photon interference with 3 detectors to see fringes and antifringes in the other port. It also computes the triple coincidence. Can also be used for the quantum eraser experiments.

viii. In "4 Detectors/QKD:" we have **QKD_4Detectors_Altera**, which is a program for 4 detectors that could be used for Bell measurements and QKD experiment (Under development)

- "Whitman_DE2_Altera" has the files that you need to use for implementing the Altera DE2 board. You should start with the "Read_me_first" document.