The files contained in this directory are the Matlab *.m files , Mathematica *.nb files and supporting documents for the numerical simulation of Type-I entangled photon sources.

Guide to Temporal Compensation ONLY:

If you are only planning on doing temporal compensation calculations (and no spatial compensation) for downconversion in BBO with either BBO or quartz precompensators then the following Mathematica files are easier to use.

Delay_BBO_Downconversion.nb : Computes net delay in downconversion crystals, given crystal thickness and cuts, and pump and downconversion wavelengths.

Precompensator_Quartz.nb: Computes the thickness of quartz needed (given delay) and delay (given thickness of a piece of quartz). Use this to calculate the precompensator needed.

Precompensator_BBO.nb: Computes the thickness of BBO needed (given delay) and delay (given thickness of a piece of BBO). Use this to calculate the precompensator needed.

Guide to Spatial Compensation, general-caseTemporal Compensation and Joint Compensation:

As outlined in the "Optimizing Type-I Polarization-Entangled Photons" paper, we first calculate spatial phase results, then temporal phase results and finally combine the two.

Spatial Decoherence/Compensation Calculation:

The top level program for the simulation is: PHASEMAP_AND_RHO.m. The comments at the top of PHASEMAP_AND_RHO.m explain the inputs and outputs of the program, as well as an outline of the simulation algorithm. The file example_simulation.txt contains a step-by-step procedure of running a simulation for a particular entangled photon source.

Temporal Compensation and Joint Calculations:

Both Matlab and Mathematica files are available for temporal compensation. As explained in the earlier note "Guide to Temporal Compensation ONLY", the latter programs are restricted to temporal compensation of BBO using BBO or quartz precompensators.

Matlab files (for BBO, BiBO , quartz and custom crystals)

First calculate net delay using:
1. temporal_delay_precomp_only.m: Use this to calculate net delay if you are not doing any spatial compensation.
or
2. temporal_delay_precomp_and_spacomp.m: Use this for calculating net delay for joint spectral and spatial compensation.

To use the Matlab files for temporal compensation you will need most of the other supporting Matlab files, such as set_crystal_param.m etc. So it is better to download all the matlab files even if you are not planning on calculating spatial compensation / decoherence results.

Finally, calculate the net concurrence using:

Concurrence_Delay.m
Note: you will need to input a density matrix to compute concurrence. You can either calculate your expected density matrix using PHASEMAP_AND_RHO.m or input the ideal density matrix (or any 2-qubit density matrix,e.g., as determined from a quantum state tomography [see our other web interface here:
http://research.physics.illinois.edu/QI/photonics/Tomography/]

or arising out of, in whole or in part the use of the software*.