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Numerical Modeling and Optimization of Type-I Entangled-Photon Sources GLEB AKSELROD, JOSEPH ALTEPETER, MICHAEL GOGGIN, JAIME VALLE, JOSEPH YASI, PAUL KWIAT, University of Illinois at Urbana-Champaign, KWIAT QUANTUM INFORMATION TEAM — A numerical model of double-crystal entangled-photon sources based on type-I down conversion is presented. The purity of such sources is reduced by spectral and spatial decoherence resulting from crystal birefringence, imperfect phase-matching conditions, collection optics, and pump beam bandwidth and spatial modes. By accounting for these experimental phenomena, we simulated the total two-photon quantum state for sources employing uniaxial or biaxial nonlinear crystals. To verify the model, the predicted state was compared with experimentally obtained quantum state tomography data, showing good agreement. Furthermore, the model was used to design spatial and temporal phase compensation crystals to reduce the phase decoherence and improve the brightness and purity of our sources. This code will be freely available to the quantum optics community as a resource for designing and characterizing optimized entangled-photon sources.

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