# Narrowband PPKTP source for entangled photons

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**Abstract.**
We present our efforts to create a narrow-bandwidth source of entangled photons with a high spectral brightness to facilitate their interaction with single trapped atoms. A pump beam with λ=407 nm, focused into a type 2 PPKTP crystal, is down-converted to obtain signal and idler beams; their frequency can be tuned via the temperature of the crystal. By changing the beam waist inside the crystal, we determine the optimal focusing parameters for our source. We observe that weak focusing results in large pair to single ratio (efficiency). For a beam waist of 170 microns we observe efficiencies > 25%. This efficiency of our single pass set-up already exceeds typical double pass configurations in common use [1]. Further, tight focusing produces a larger absolute number of pairs.
A narrow-band pump beam leads to a bandwidth of the down-converted beams compatible with what is expected due to the finite length of the crystal. A narrow band pump also yields higher absolute number of pairs. We thus try to prepare narrow-band entangled photons not by spectral filtering the signal and idler beams (and consequently loosing both intensity and some entanglement ) as in [2], but aim for using the down-conversion source directly. Furthermore, experimental measurements of the temperature dependence of the wavelengths of the signal and the idler beams have been found to match theoretical calculations.

## References

1. Marco Fiorentino, Gaétan Messin, Christopher E. Kuklewicz, Franco N. C. Wong, and Jeffrey H. Shapiro , Generation of ultrabright tunable polarization entanglement without spatial, spectral, or temporal constraints, Phys. Rev. A 69, 041801(R) (2004)}
2. A tunable narrowband entangled photon pair source for resonant single-photon single-atom interaction, Albrecht Haase, Nicolas Piro, Jürgen Eschner, Morgan W. Mitchell, arxiv 0808.1988v2 August 2008.