



## Application Note: Frequency Conversion to Visible/Near-IR

### Intracavity frequency conversion

The Argos CW OPO emits low-power (~1 mW), single-frequency, visible and near-infrared output. These are produced by non-phase-matched second harmonic generation (SHG) of the signal wave, and sum frequency generation (SFG) of the pump and signal waves. These two processes provide output from 730 nm to 990 nm and 615 nm to 695 nm. Tuning the pump laser allows 50 GHz mode-hop-free tuning of the visible output. An optional cavity PZT can allow tuning of the near-IR output. Measured spectra of the visible/near-IR outputs are shown below for a single OPO module.

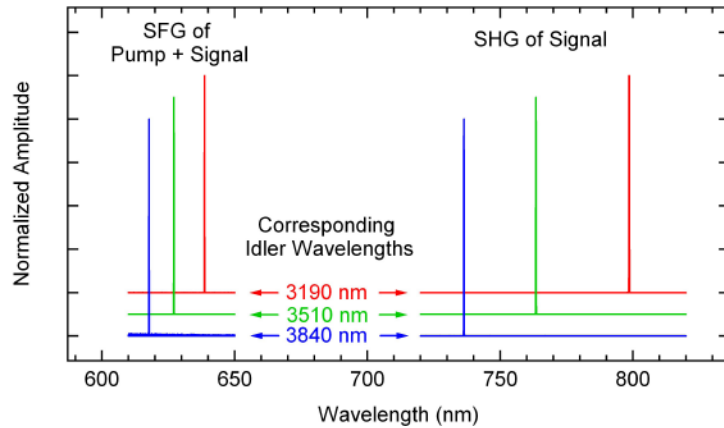


Figure 1: Measured spectra of visible/near IR outputs from Argos module C

### Extracavity frequency conversion

The efficiency of these conversion processes can be greatly increased by phase-matching the conversion process in a nonlinear crystal. The simplest implementation of this is single-pass frequency conversion. By focusing the signal or idler output of the OPO through an appropriately poled nonlinear crystal, idler SHG can cover the 1150 nm to 1450 nm range, while signal SHG provides 730 nm to 990 nm. SFG between pump and signal can provide visible output from 615 nm to 695 nm. Typical SHG conversion efficiency achieved in such a configuration is shown below.

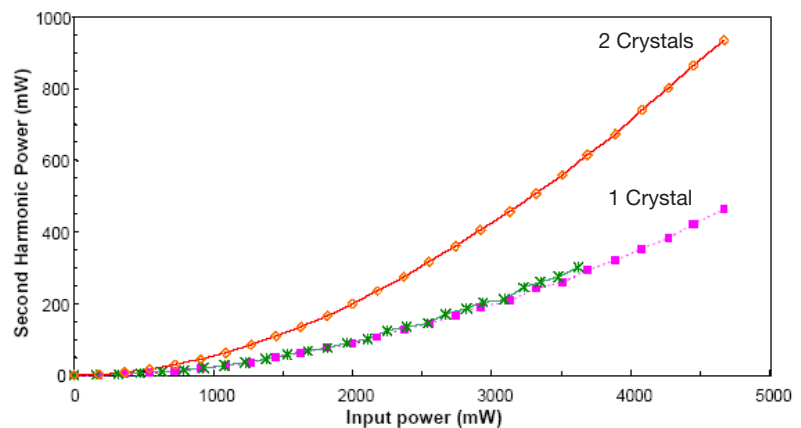


Figure 2: Conversion efficiency demonstrated by single pass SHG to 780 nm in PPLN\*

\* R. Thompson, M. Tu, D. Aveline, N. Lundblad, and L. Maleki, "High power single frequency 780 nm laser source generated from frequency doubling of a seeded fiber amplifier in a cascade of PPLN crystals," Opt. Express 11, 1709-1713 (2003)

