
High-Efficiency 532-nm Generation with PPSLT

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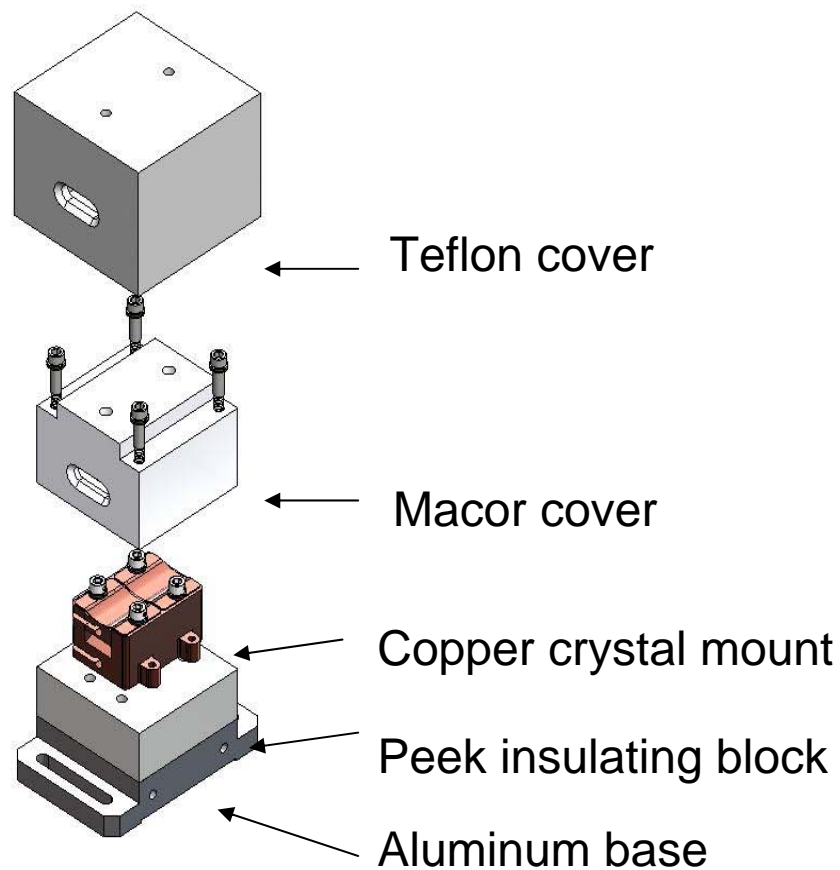
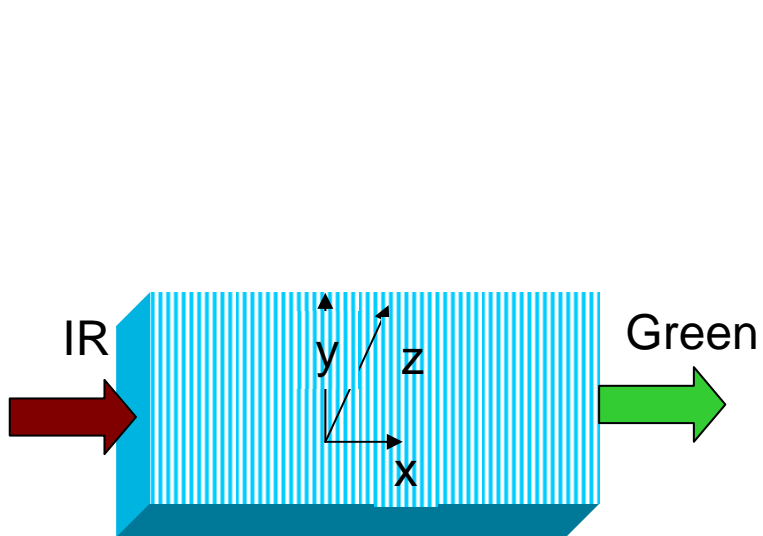
Motivations

- To efficiently generate green light using a periodically poled stoichiometric lithium tantalate (PPSLT) crystal.
- To compare the performances of MgO-doped and undoped PPSLT crystals.

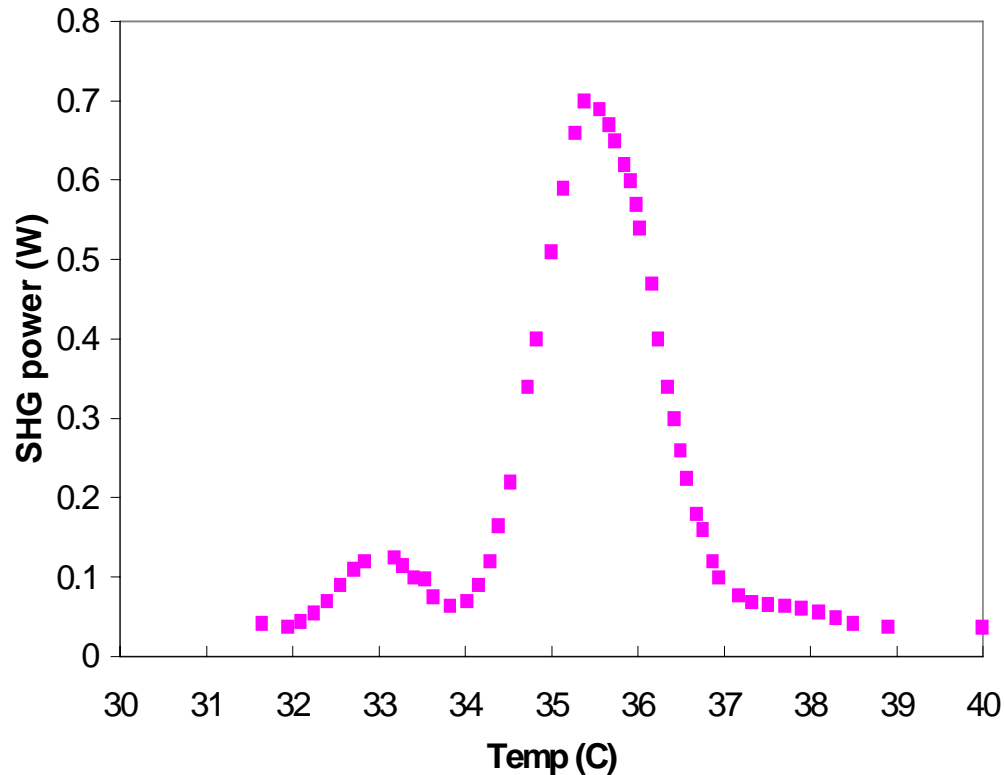
Fundamental beam parameters

- Average power = 22 W
- Repetition rate = 200 kHz
- Pulselwidth < 7 ns
- Spectral width 0.08 nm
- $M^2 = 1.19$ (horizontal), 1.14 (vertical)
- Wavelength = 1064 nm

Oven design



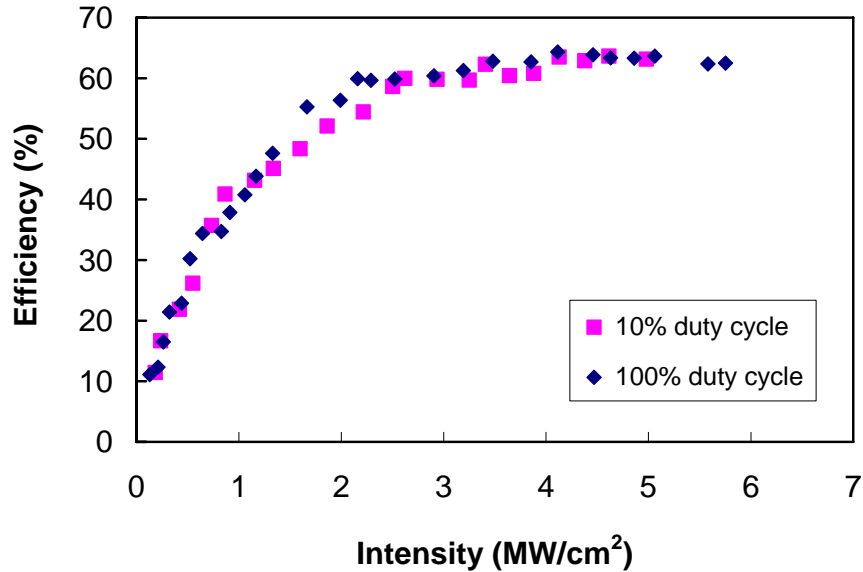
Temperature tuning curve, MgO-Doped



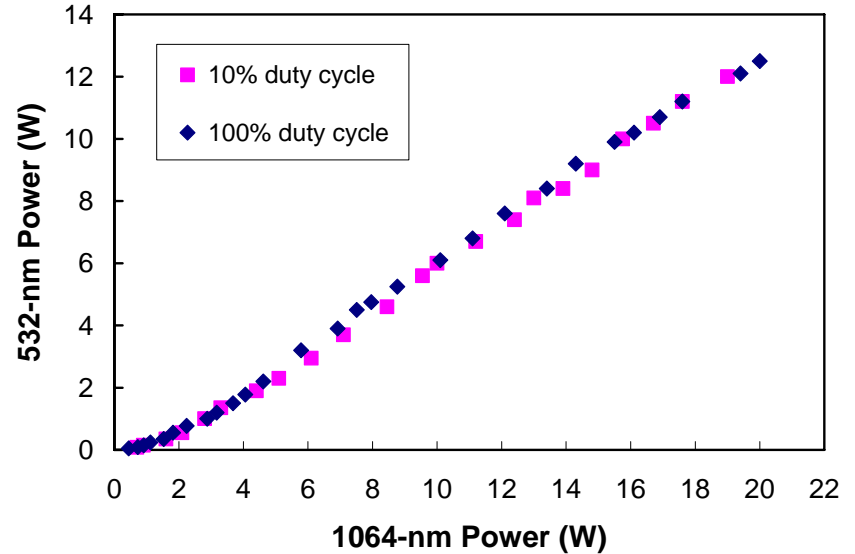
- Crystal size:
Height = 0.5mm
Width = 2 mm
Length = 20 mm

- FWHM of tuning curve = 1.6 °C

SHG power and efficiency

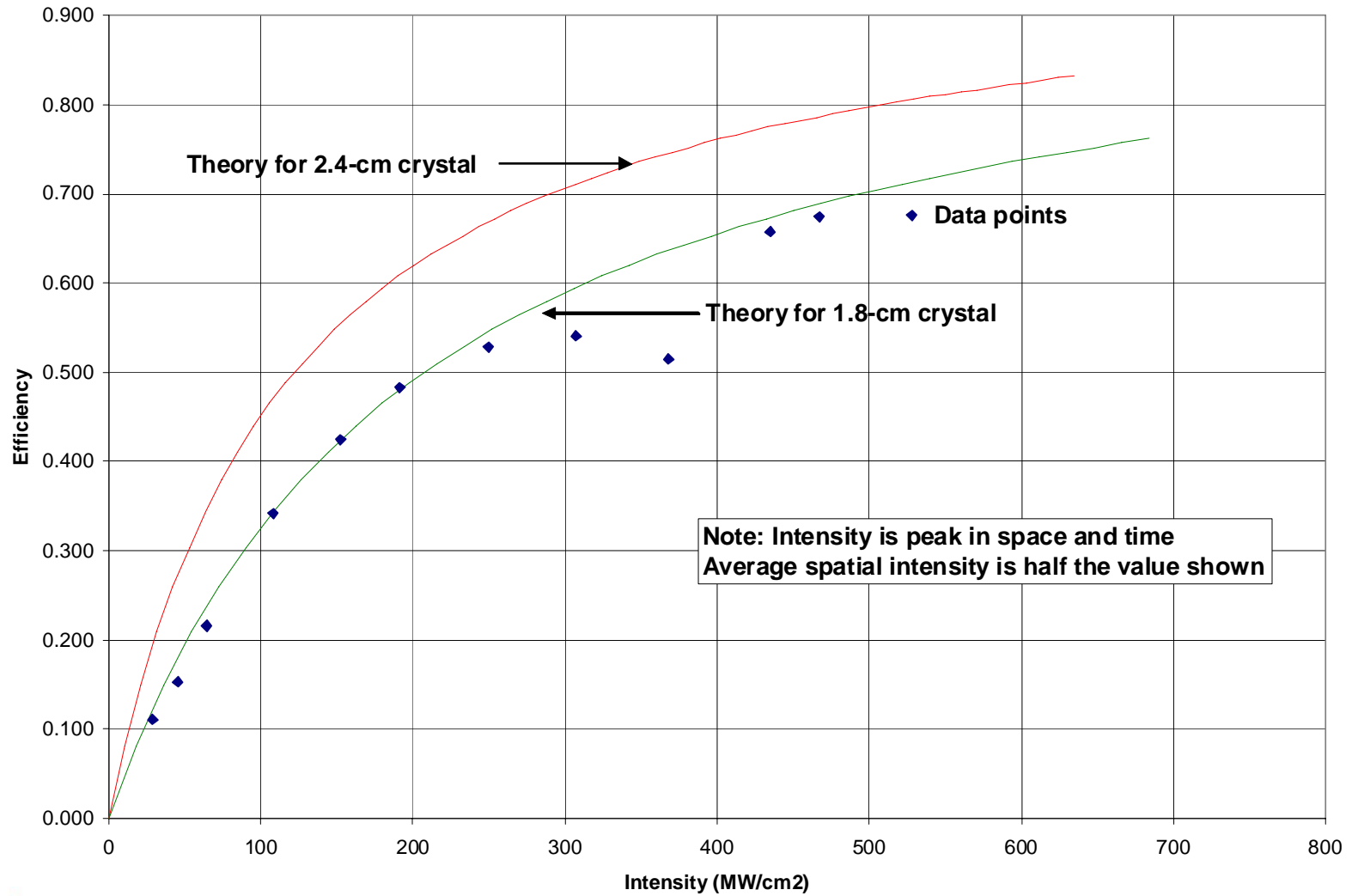


532-nm power vs. 1064-nm power for a MgO-doped PPSLT crystal.



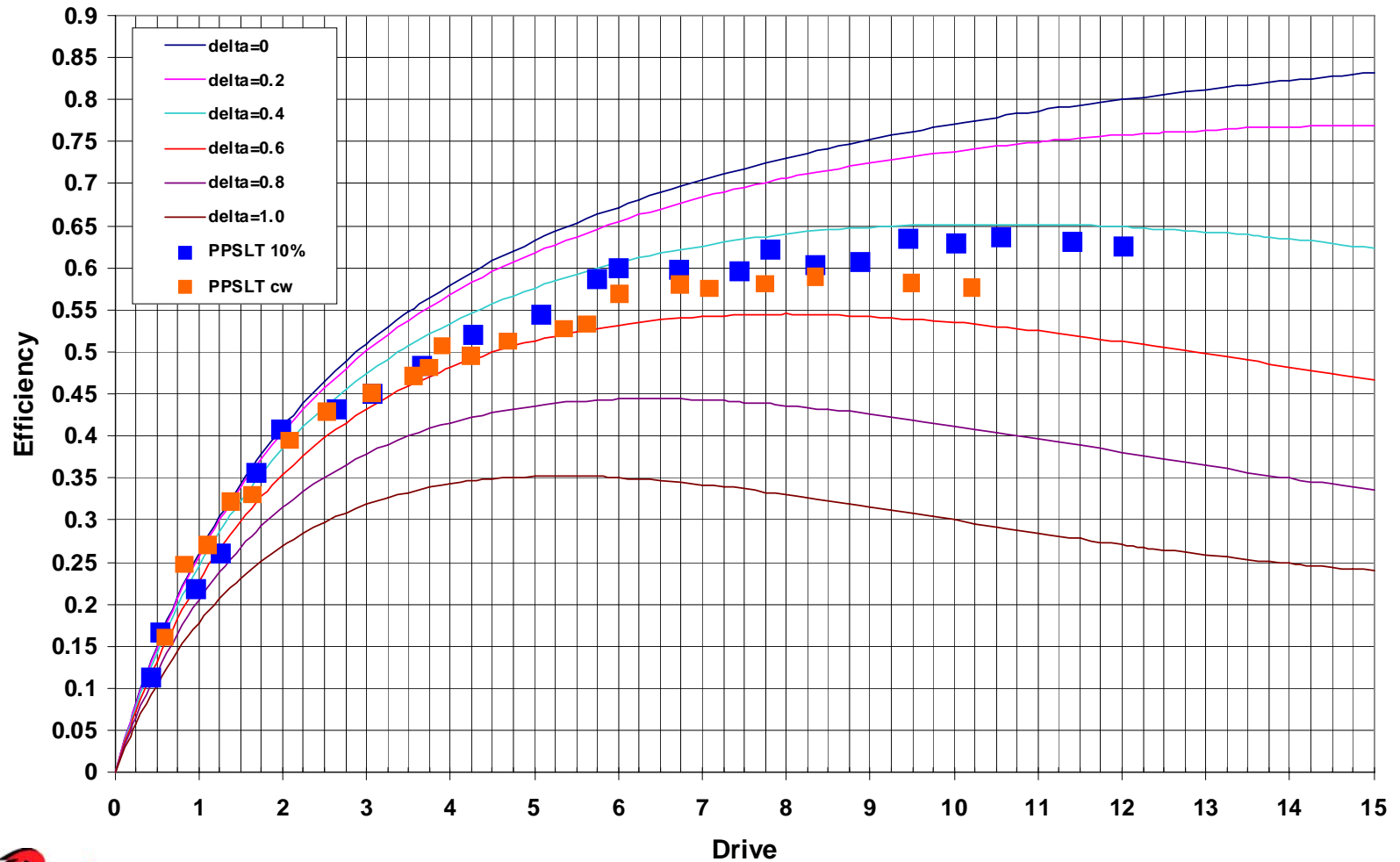
The SHG efficiency as a function of intensity for a MgO-doped PPSLT crystal.

SHG model applied to NCPM LBO

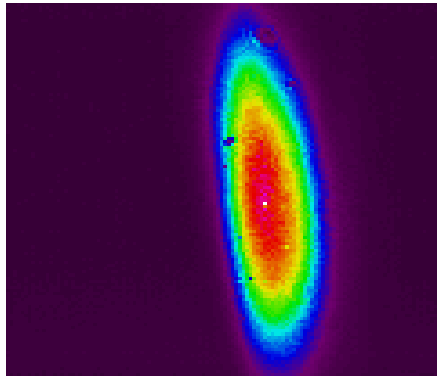


Calculation of efficiency in PPSLT

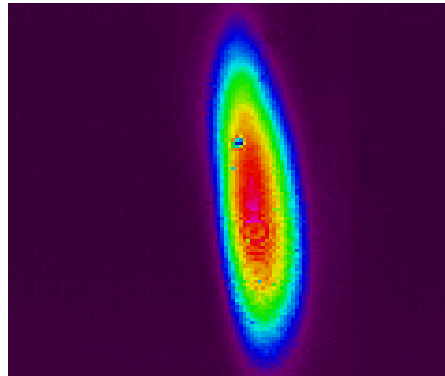
Conversion efficiency vs. drive, dephasing



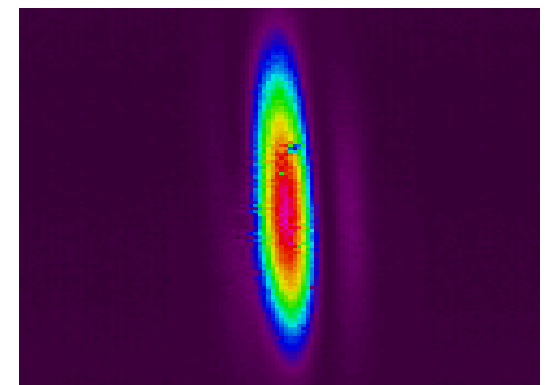
Green beam profiles at different IR powers



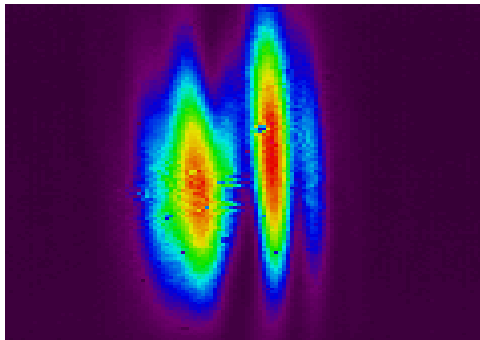
0.9 W



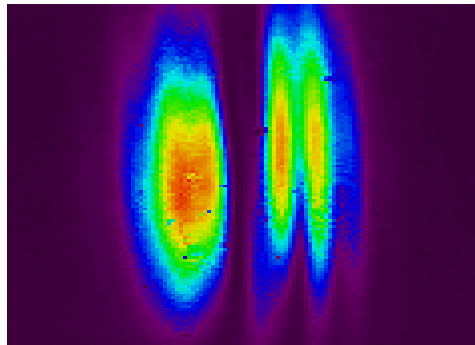
3.2 W



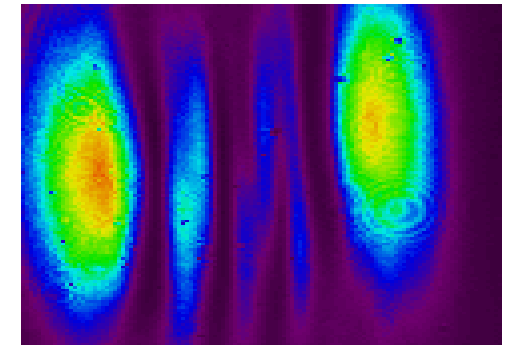
8.8 W



11.1 W

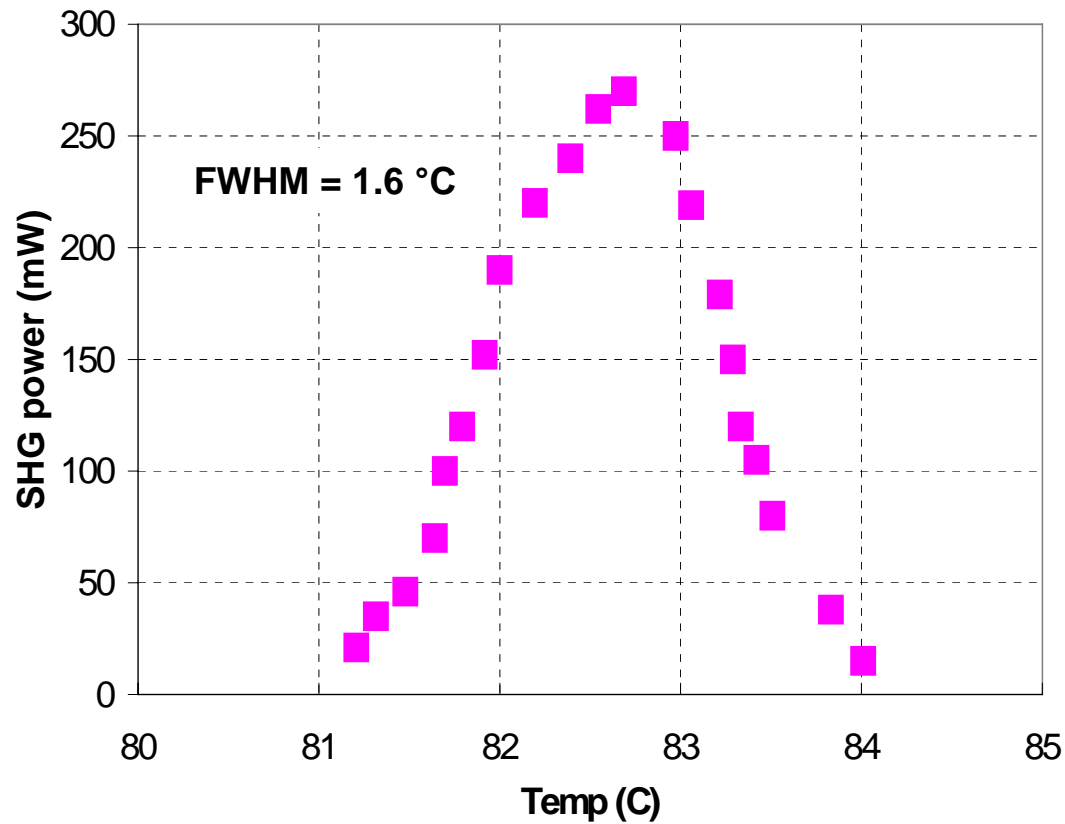


13.5 W



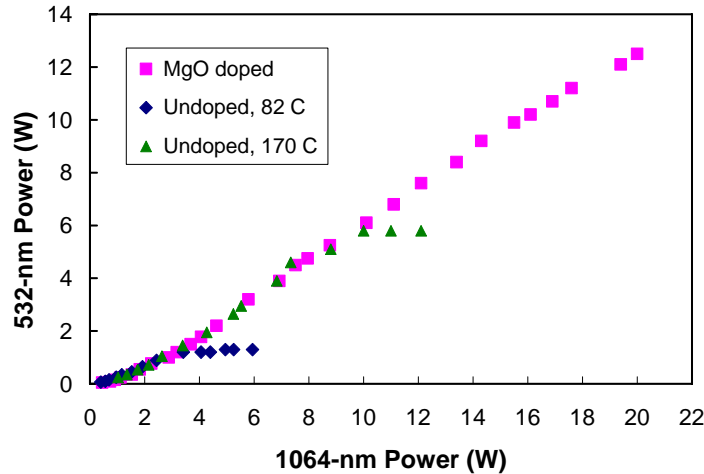
16.9 W

Temperature tuning curve

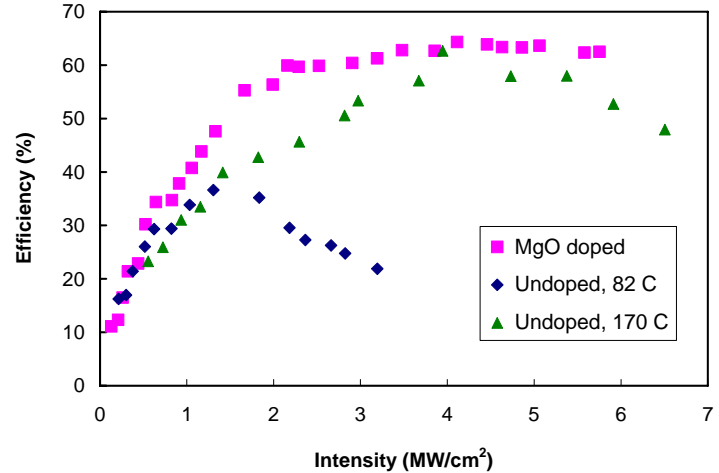


Undoped PPSLT
crystal at 82 °C

MgO-Doped vs. Undoped Crystal



Green power as a function of 1064-nm power for MgO-doped and undoped PPSLT crystals.



SHG efficiency as a function of 1064-nm intensity with and without MgO doped PPSLT.

•Undoped crystal:

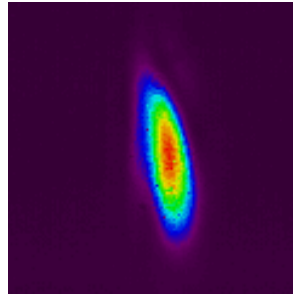
Height = 0.5 mm
Width = 11 mm
Length 20 mm
Width of grating = 1 mm
Beam size = 666 x 254 μm

•MgO doped crystal:

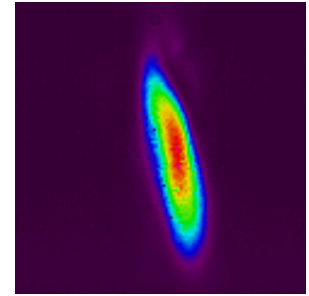
Height = 0.5 mm
Width = 2 mm
Length = 20 mm
Beam size = 1296 x 244 μm

Green beam profile at different IR power

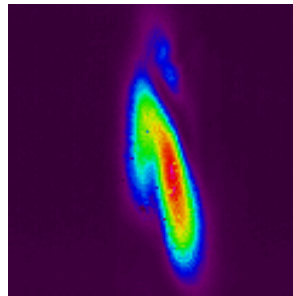
Undoped
PPSLT crystal
at 82 °C



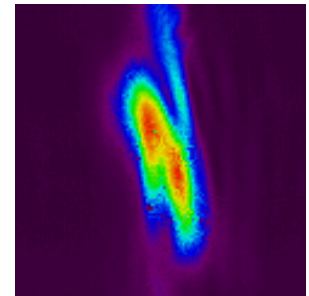
0.56W



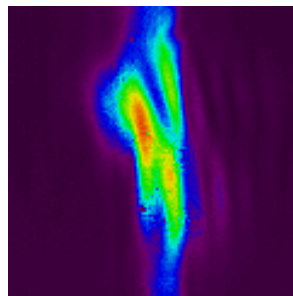
0.96W



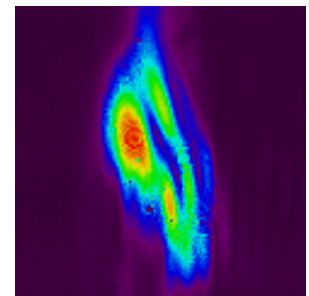
1.9W



3.4W



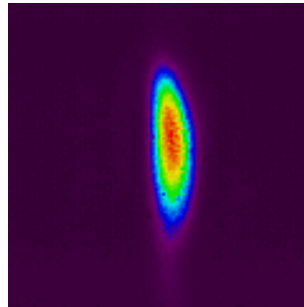
4.9W



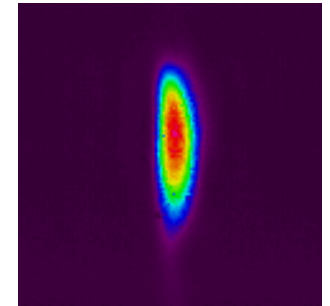
6W

Green beam profile at different IR power

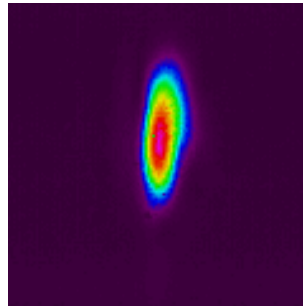
Undoped
PPSLT crystal
at 170 °C



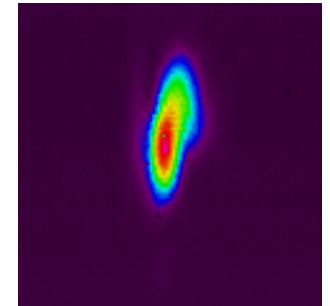
1W



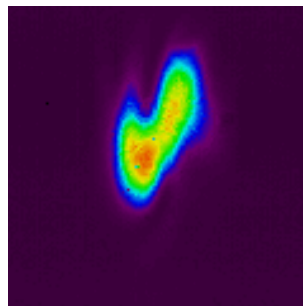
3.4W



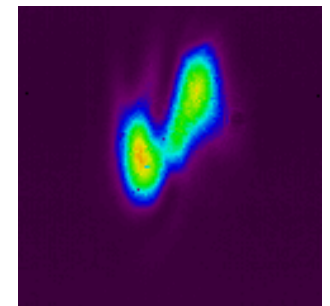
5.5W



7.3W



10W



12W

Conclusions

- MgO doped PPSLT crystal shows 6% IR power absorption compared to 2% absorption in the undoped crystal.

- Beam distortion due to photo refractive damage occurs at
 - ~3 MW/cm² for MgO doped crystal at 35.5 °C
 - ~1 MW/cm² for undoped crystal at 82 °C
 - ~2.7 MW/cm² for undoped crystal at 170 °C

- Doping with MgO increases the photo refractive damage threshold

- Increasing the temperature in the undoped PPSLT also increases the photo refractive damage threshold



Acknowledgement:

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