High-Efficiency, High-Power, TEM_{00}, Fundamental and Frequency-Doubled Nd:YLF Lasers

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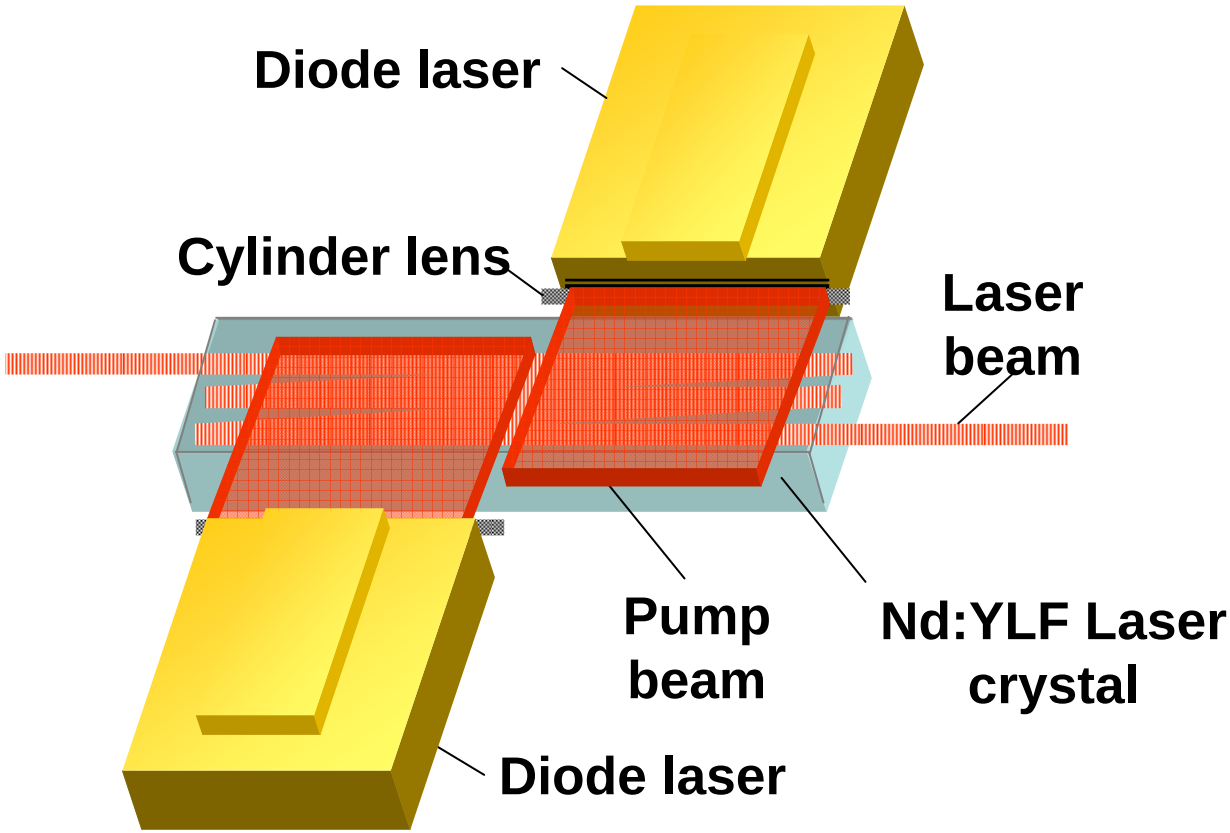
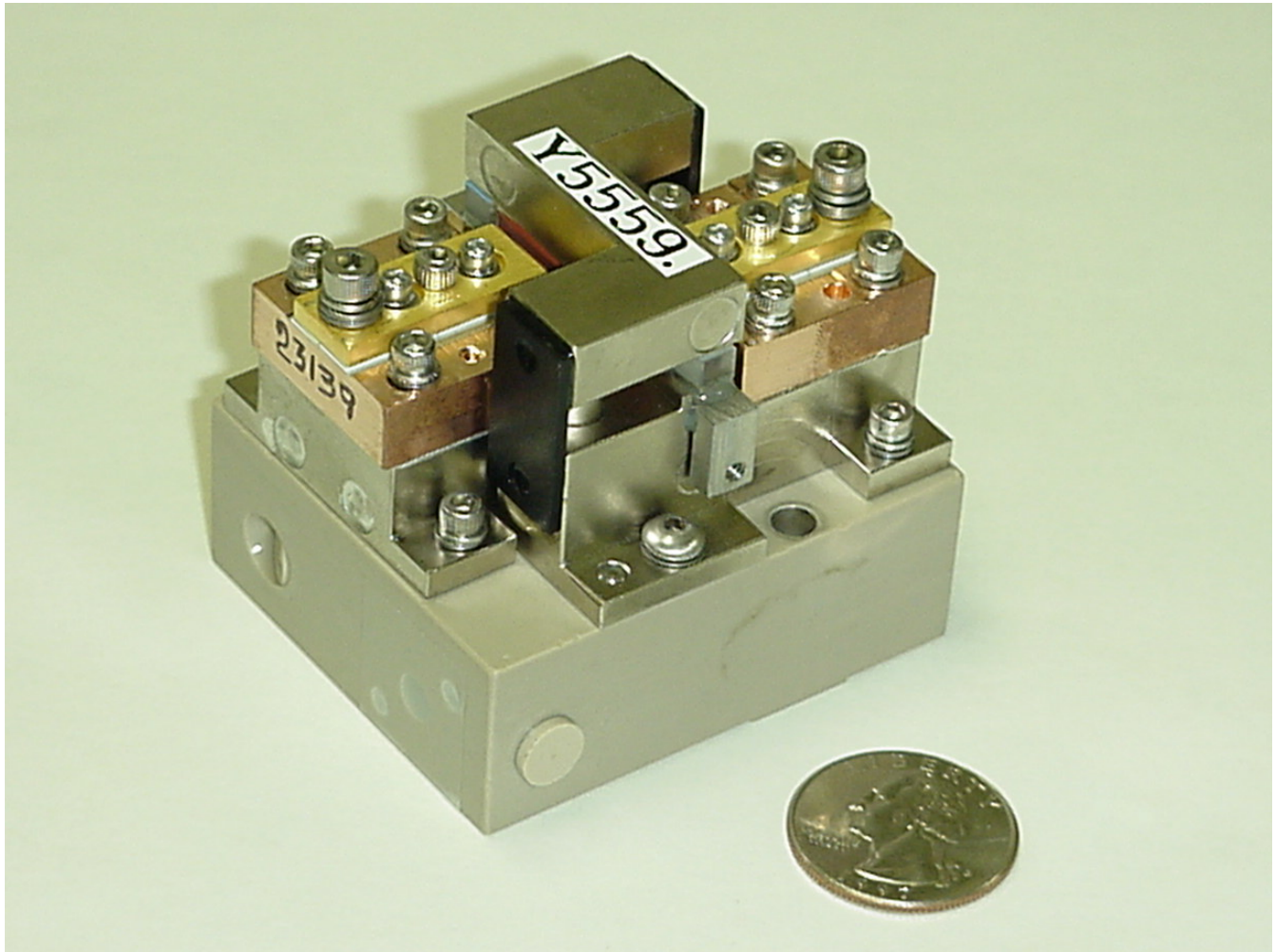
Outline

- Review of MPS design, performance
- Scaling results with higher-power pump lasers
  - CW performance
  - Q-switched performance
  - Amplifiers
- Harmonic generation
- RGB OPO operation
- Conclusions

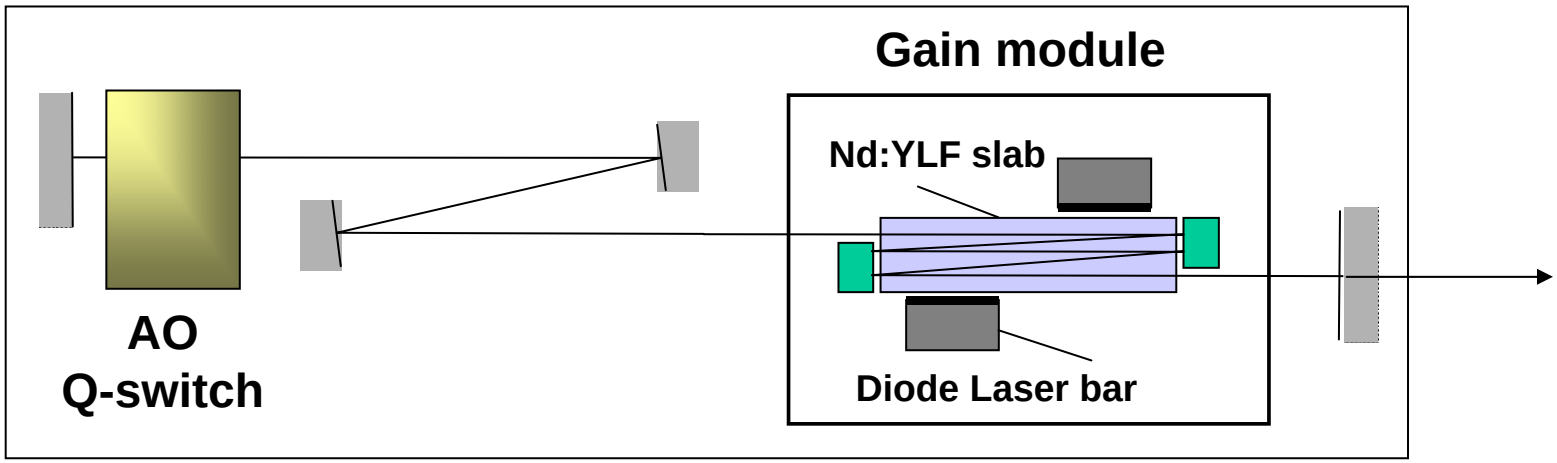
Multi-pass slab (MPS) design is side-pumped



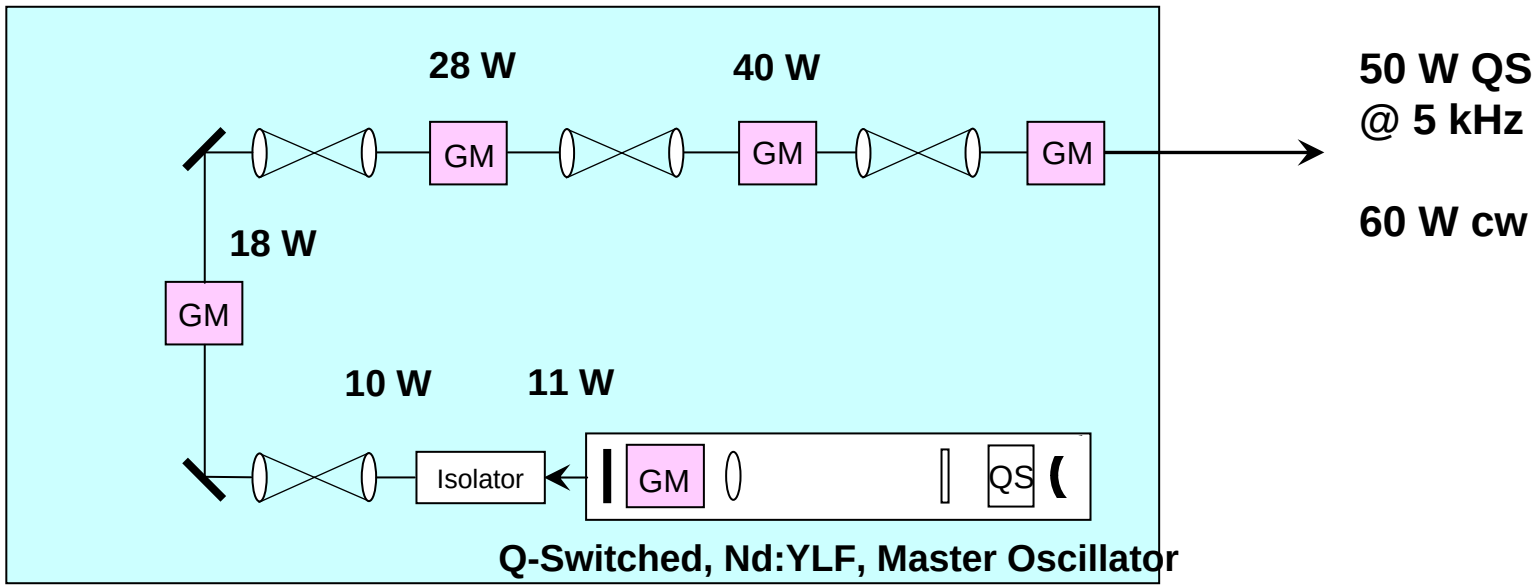
Photograph of actual Gain Module



Resonator added makes a MPS oscillator



MOPA design allows scaling to 60 W cw



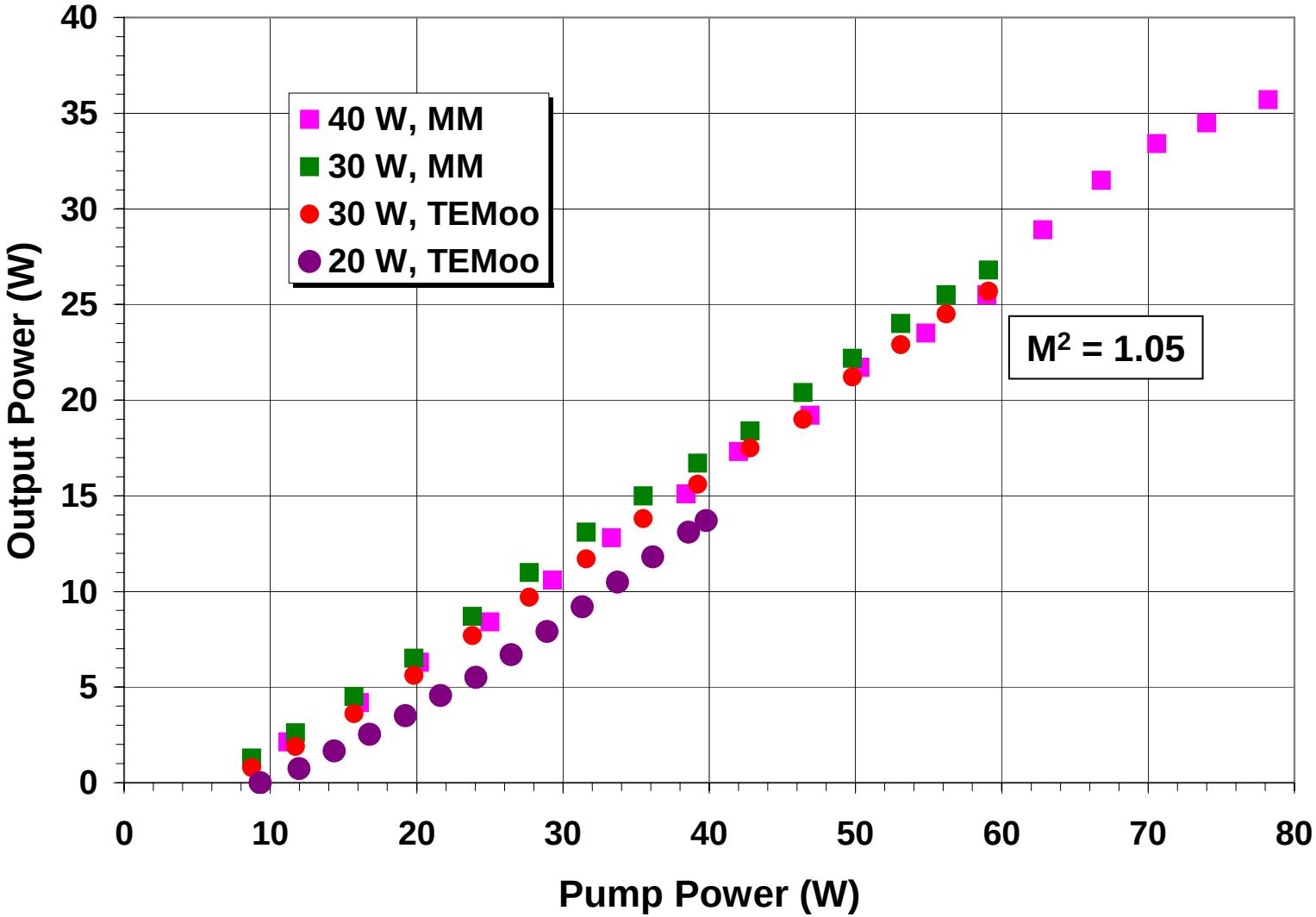
Relay Optics

Mirrors

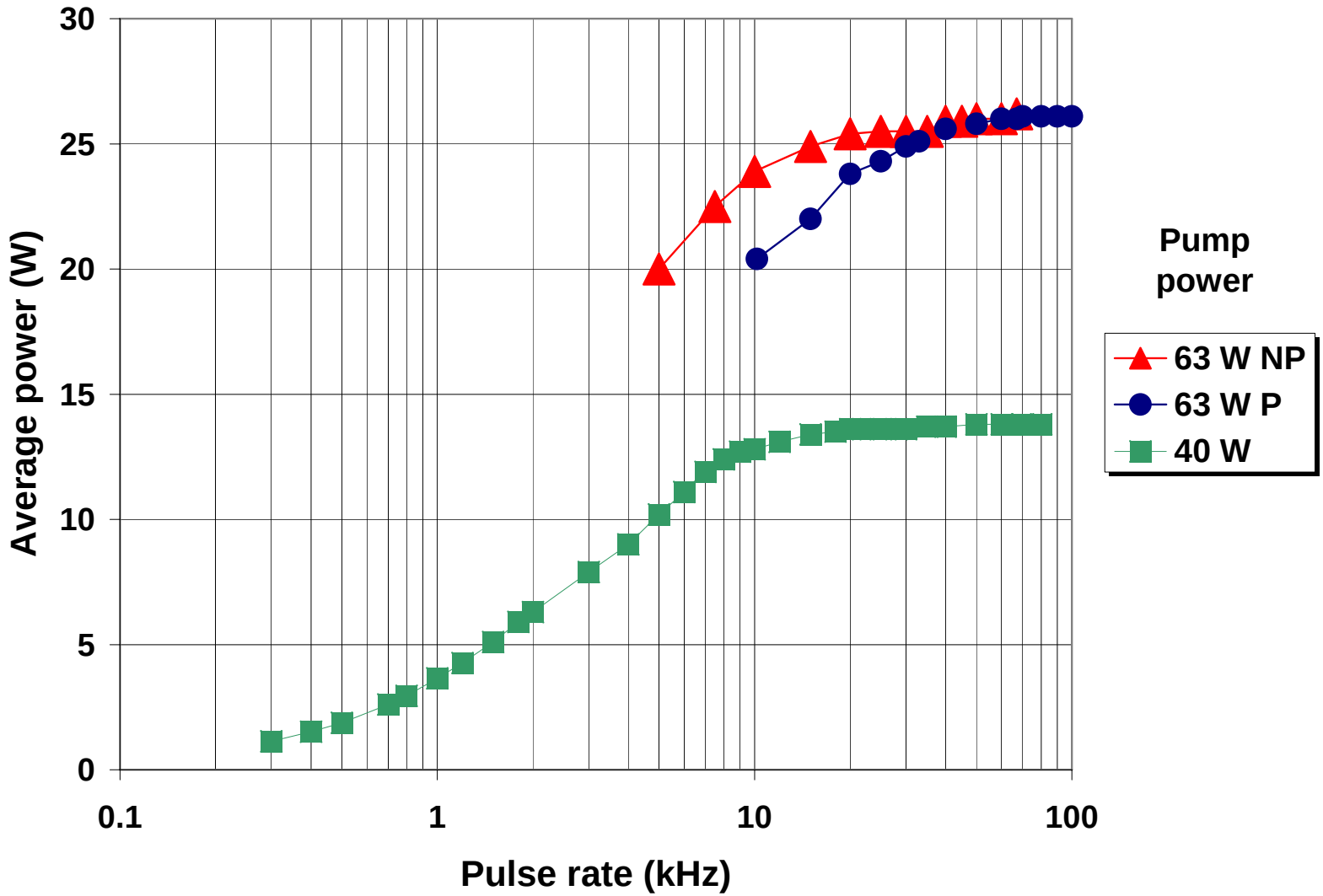
GM Gain Module

QS AO Q Switch

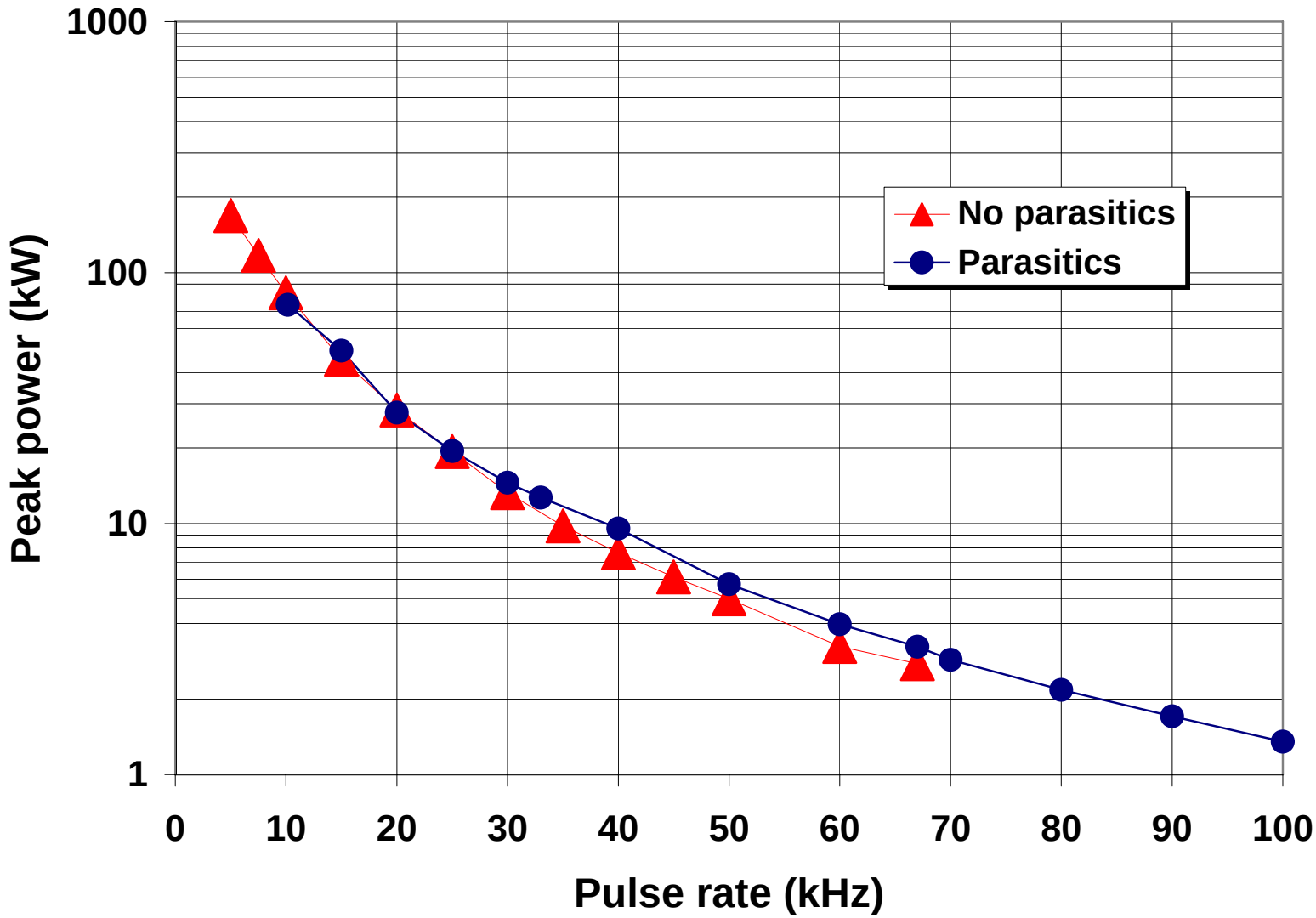
CW oscillator performance scales with pump lasers



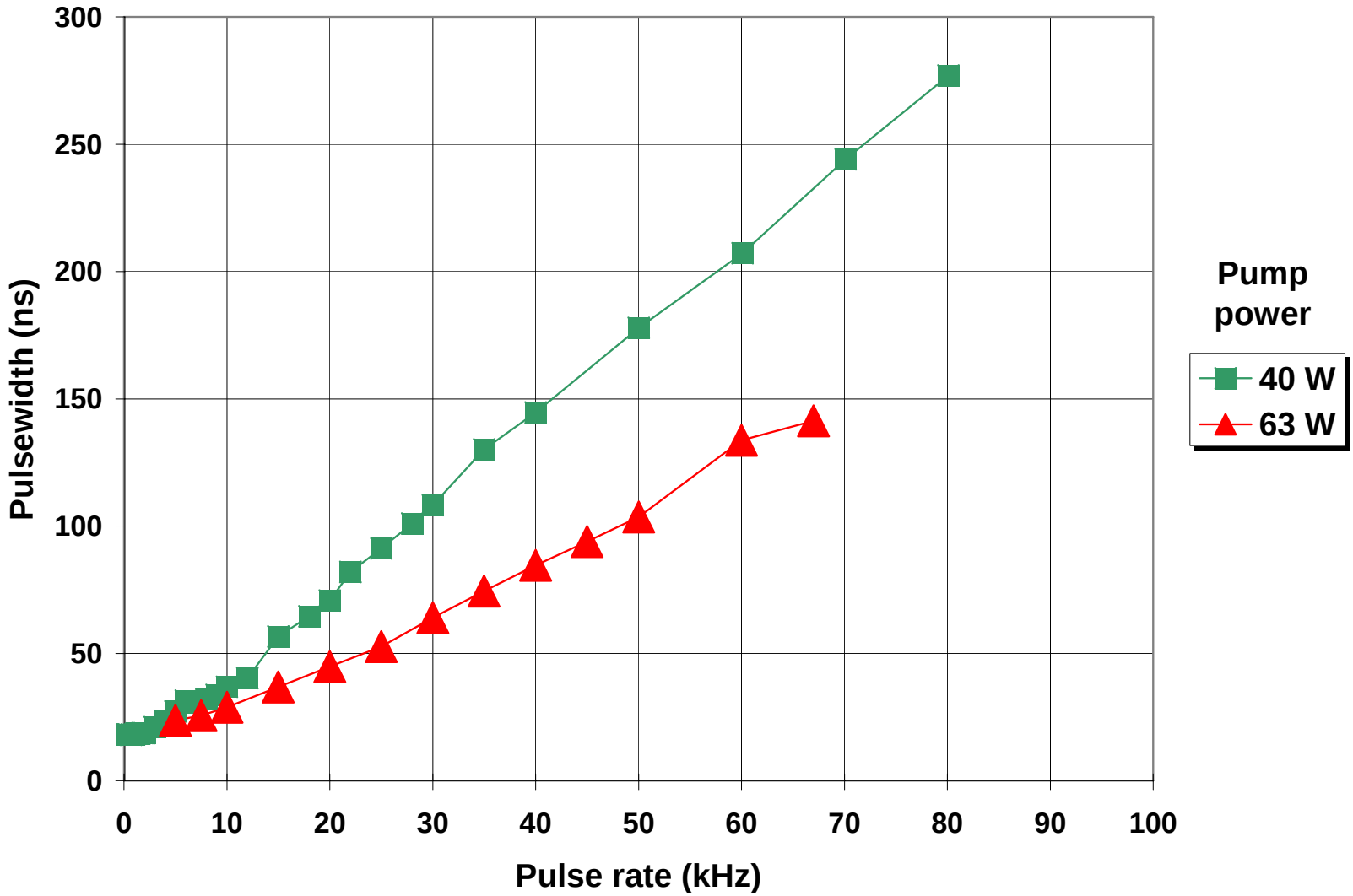
Parasitic elimination improves Q-switched performance



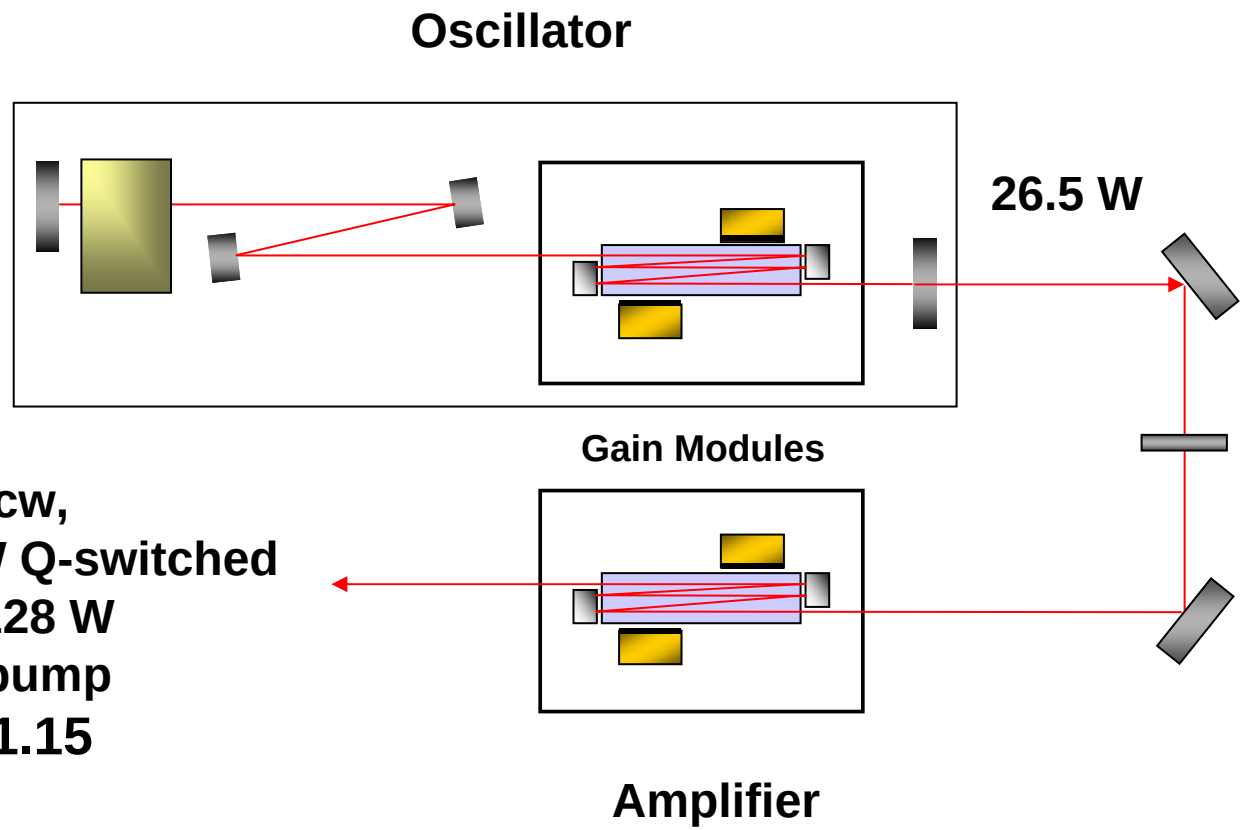
Peak power reaches 170 kW at 5 kHz



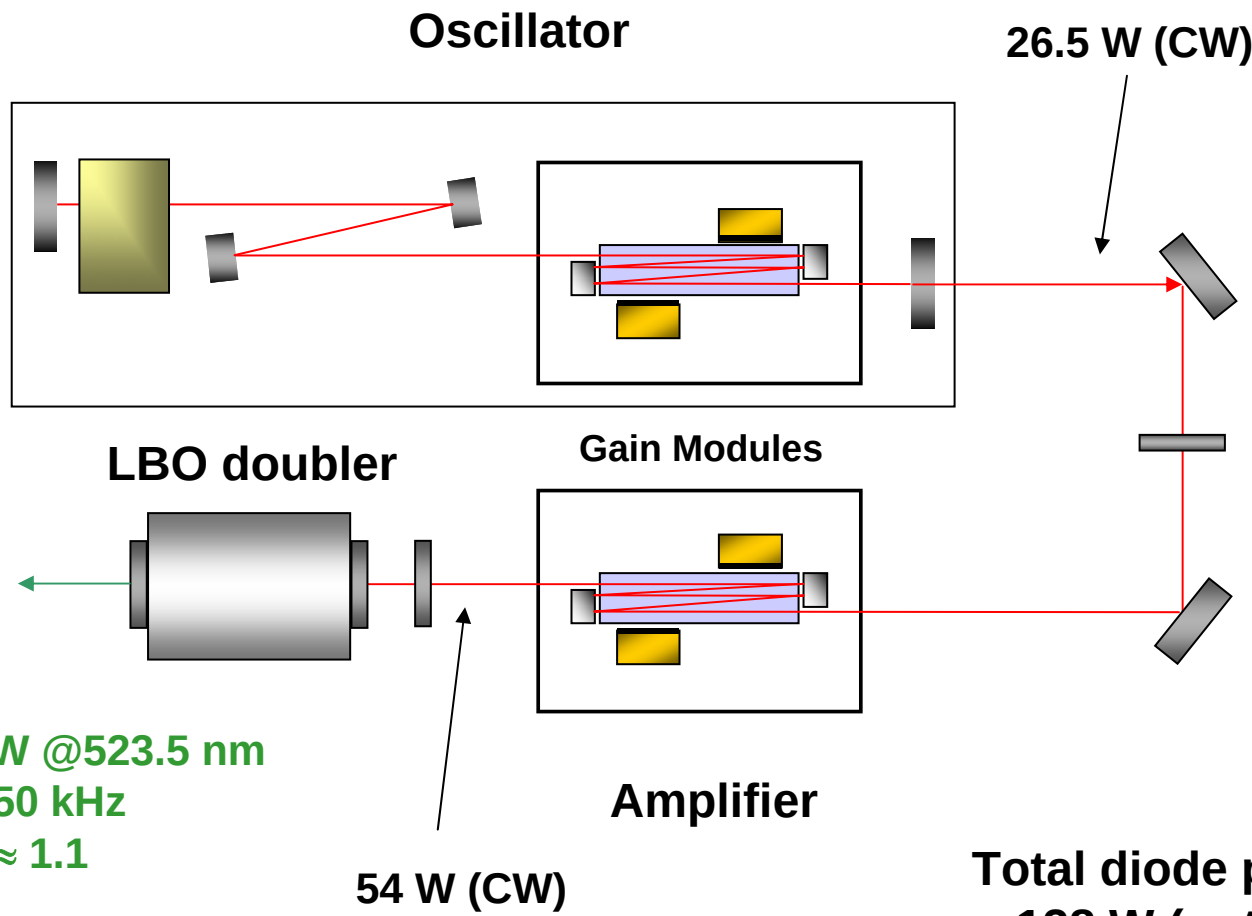
Higher gain leads to shorter pulses



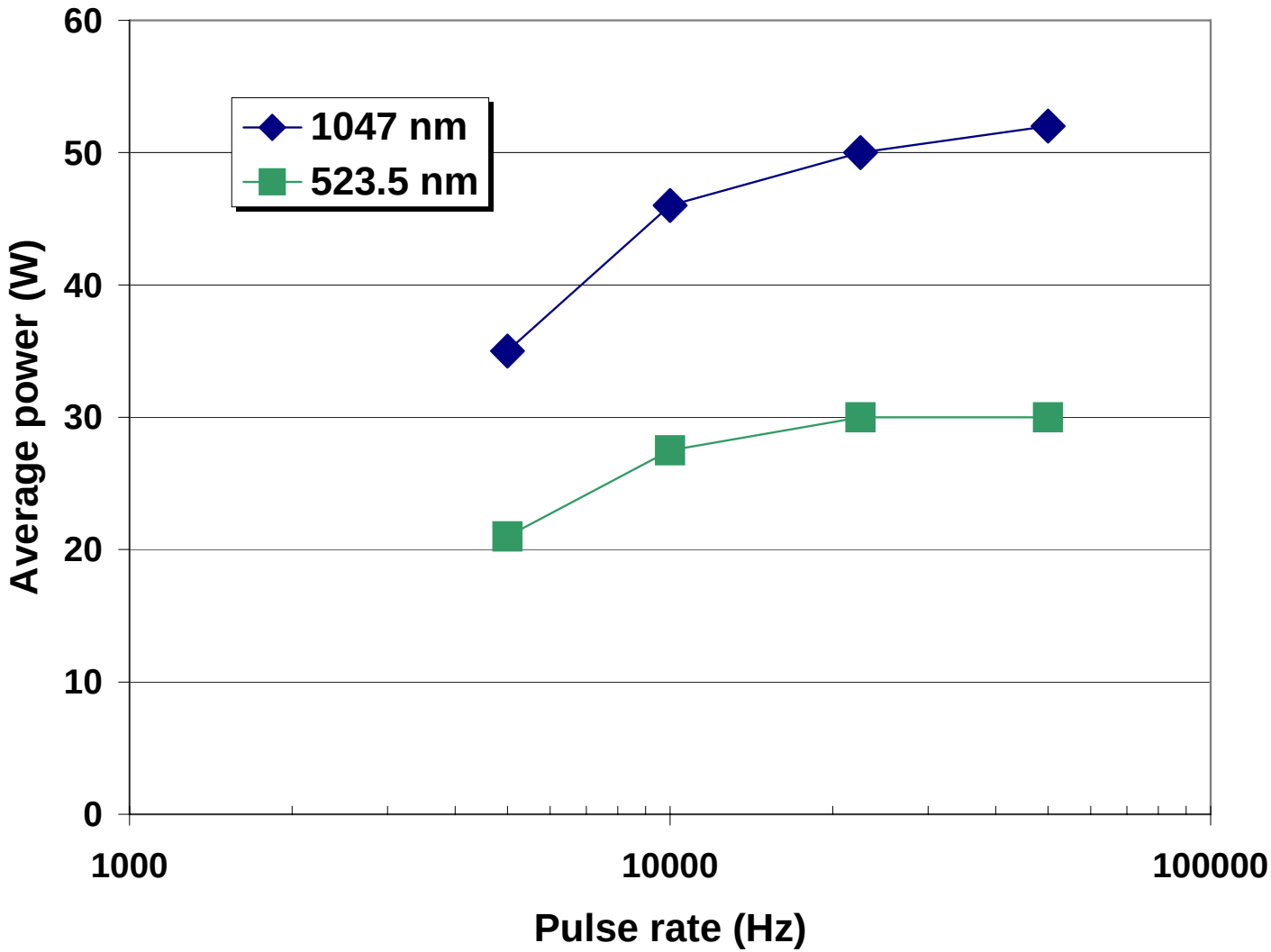
Extraction from an amplifier equals that from an oscillator



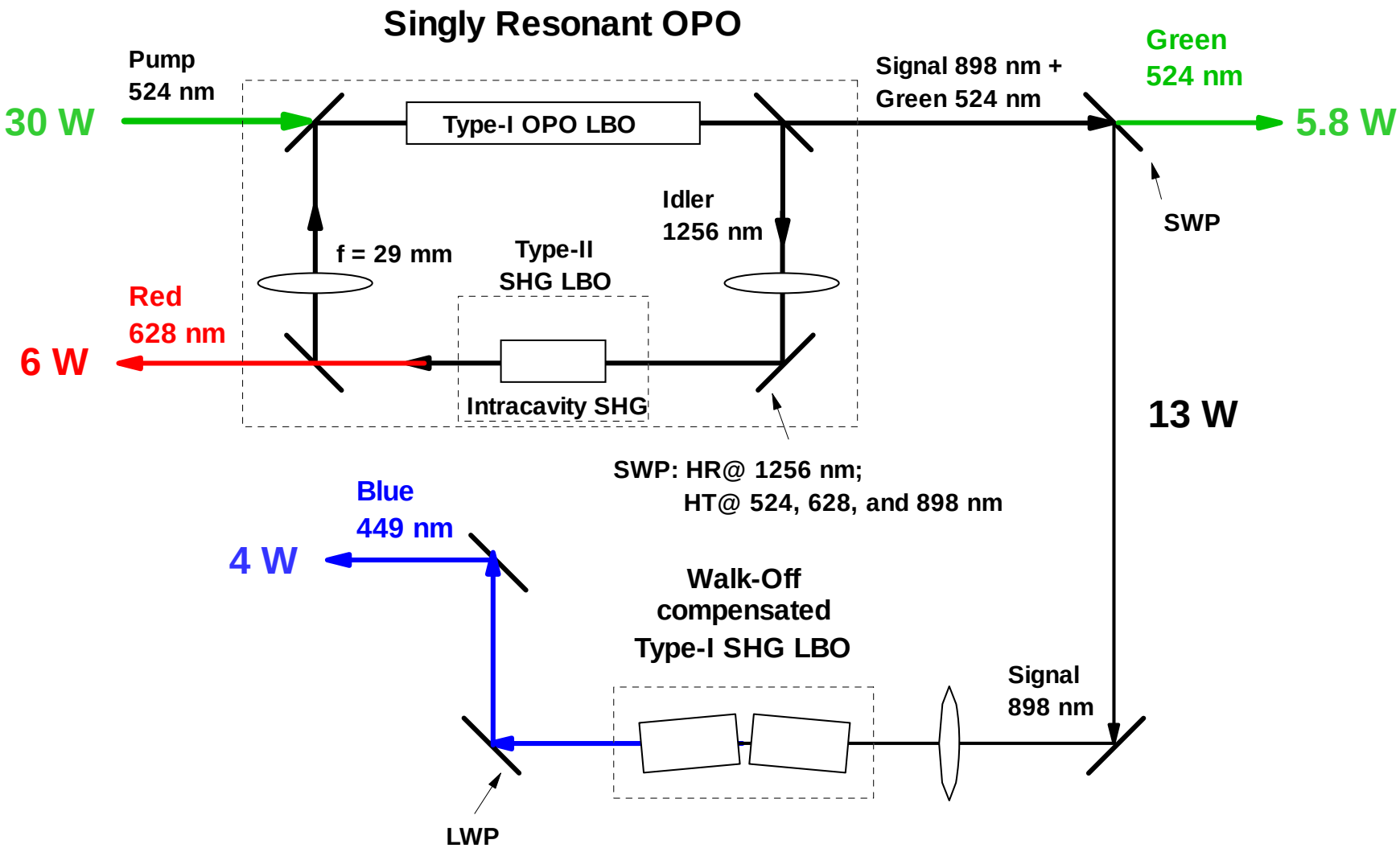
Harmonic generation yields 30 W of power from 10 - 50 kHz



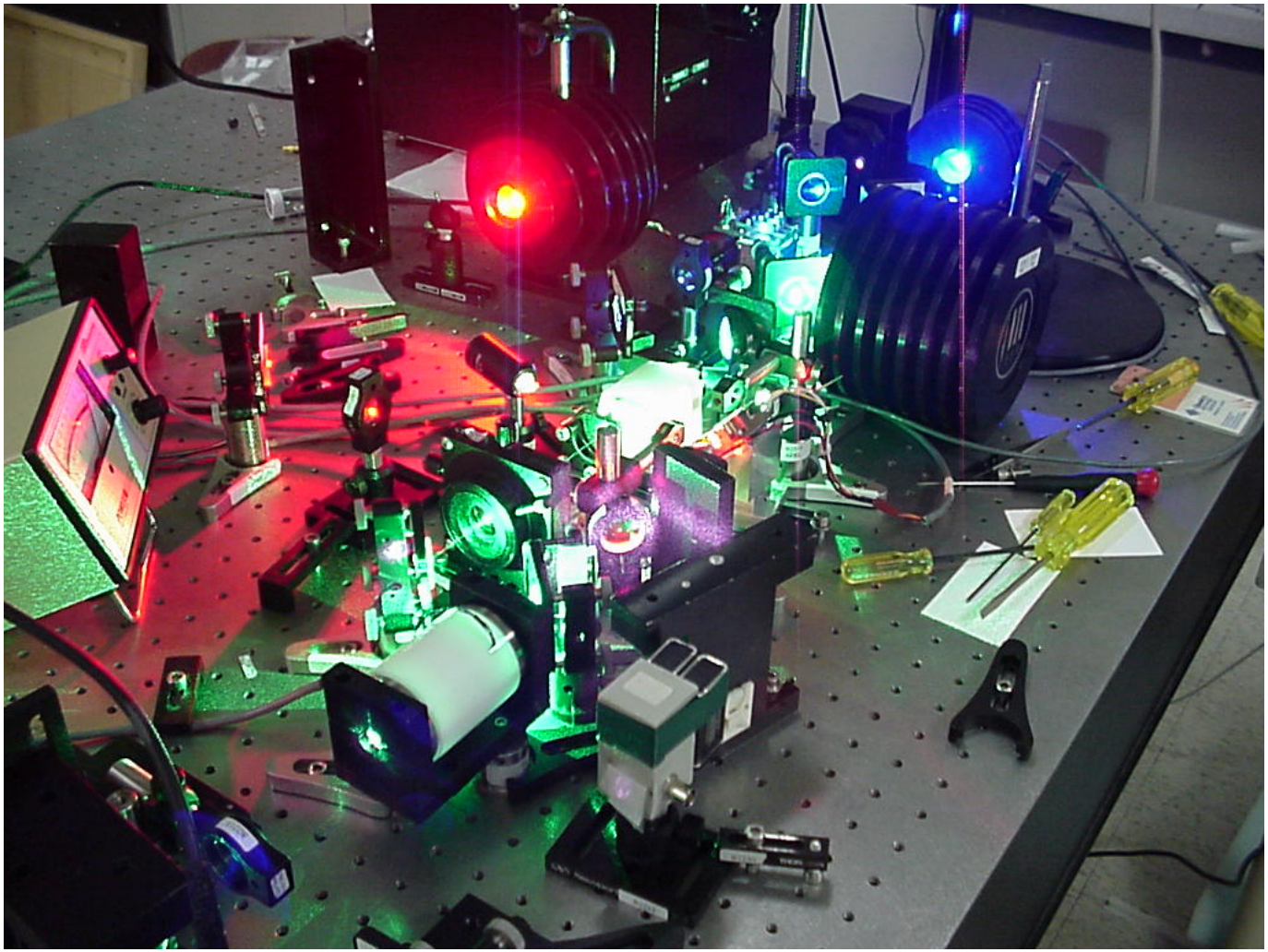
Harmonic efficiency is 60%, 5-50 kHz



Green pumps OPO to generate red, blue



RGB OPO in the laboratory



Conclusions

- MPS design with Nd:YLF can be scaled in power with higher-power pump lasers
  - 26.5 W CW, TEMoo (M^2 = 1.05) with 64 W of pump
  - 36 W multimode with 79 W of pump
  - Q-switched operation improved by parasitic elimination
  - approaching 50% optical conversion, 20% electrical
- MPS amplifier has the same extraction as oscillator
  - 54 W CW, > 50 W Q-switched with diodes at 32 W
  - Slight reduction in beam quality?
- SHG in LBO is 60% efficient, 5-50 kHz
- Application to high-power RGB displays