Kapteyn-Murnane Laboratories Inc.
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Competitive Features: Griffin

Femtosecond ti:sapphire laser

The most distinguishing feature of the Griffin laser oscillator is its flexibility. The design of this laser allows the user to exchange and move the various intracavity optics, as the intended application changes. If one laser must suffice for multiple applications, this is a good source for meeting multiple needs on a limited budget.

Distinguishing capabilities include:
♦ Generation of ultrashort pulses with bandwidth >70 nm (minimum) 90 to >100 nm (typical).
♦ Pulse duration <12 fs (with proper external dispersion compensation) when running with a spectrum centered at approximately 800 nm.
♦ Tunability from ~750 nm to ~840 nm, with <25 fs pulse duration, using the standard optics set.
♦ Shortwave (Option-750: 710-760nm center) and Longwave (Option-850: 840-890nm center) optics sets are available for easy exchange, as a future or original purchase.
♦ Several output coupler options are available, allowing the user to optimize the balance between bandwidth and power. A new and different output coupler may be purchased at any time.
♦ Output power >400 mW for a 15 fs pulsewidth when pumped with <5 watts from a high-quality Argon-ion or CW 532 nm laser (i.e. Coherent Verdi, or Spectra-Physics Millennia or Centennia).
♦ Reconfigurable design that allows for customized configurations.
♦ Pulse repetition-rate is easily user-adjustable, (typically ~90MHz, range of ~80-97MHz)
♦ Ideally-suited for use as a seed-pulse source for ultrashort-pulse amplification. The real time control of bandwidth and center wavelength allows one to optimize the oscillator for the particular amplifier it will seed.
♦ Easy tunability by use of a tuning slit. This slit is controlled by a (supplied) USB card, driven by a user-supplied PC running Windows.
NOTE: Lasers using mirror dispersion compensation (MDC) (instead of the prisms within a Griffin) do not allow for tunability since the laser spectrum is not dispersed in the laser cavity.
♦ Easy bandwidth control, by adjusting the intracavity prism dispersion, or the tuning slit width. This allows the user to: - tune the transform limited pulse duration (<12fs to >45fs), - control the photon energy uncertainty, and - optimize the balance between power, bandwidth, and center wavelength in real time, for each application.

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NOTE: MDC lasers run at fixed bandwidth, determined by the characteristics of individual mirror sets.
♦ Capability for fourth-order dispersion-limited operation, with spectral characteristics ideally suited for ultrashort-pulse amplification; i.e. a modulated spectrum that reduces the effects of gain narrowing. Reference the KMLabs model TS laser.[1, 2]
NOTE: The spectrum of an MDC laser is not adjustable, and cannot be optimized for ultrafast laser seed pulse injection.
♦ Robust operation of the Griffin design minimizes the effect of thermal lensing on laser stability, and thus does not require tight control of crystal temperature to obtain stable operation. No chiller is necessary.
NOTE: MDC lasers require thermoelectric cooling of the crystal to obtain stable operation. This is the result of the much-tighter focusing geometry made necessary by the limited dispersion compensating capability of MDC mirrors.
♦ Operating characteristics that are much less sensitive to variations in optics. The Griffin laser uses standard broadband, 1/4-wave single-stack mirrors that can be manufactured with a good degree of repeatability. Although there is some variation in tuning characteristics of the laser due to variations in stack center wavelength and output-coupler characteristics, optics from many suppliers can be used, and optics from different coating runs can typically be used together without narrowing the achievable bandwidth.
NOTE: MDC lasers depend on expensive custom optics sets. Furthermore, damage of one optic may necessitate replacement of the entire optics set to retain dispersion-matched characteristics. On replacement, the spectral characteristics of the laser may change appreciably, creating difficulties.
♦ The Griffin's optical configuration is exceptionally stable, as a result of the "space-time focusing" effect that stabilizes modelocked operation, and is a direct result of ultrashort-pulse operation.[3, 4]

References:

[1] S. Backus, C. Durfee, M. M. Murnane, and H. C. Kapteyn, "High Power Ultrafast Lasers,"Review of Scientific Instruments, vol. 69, pp. 1207-1223, 1998.

[2] E. Zeek, R. Bartels, M. M. Murnane, H. C. Kapteyn, S. Backus, and G. Vdovin, "Adaptive pulse compression for transform-limited 15-fs high- energy pulse generation," Optics Letters, vol. 25, pp. 587-589, 2000.

[3] I. P. Christov, H. C. Kapteyn, M. M. Murnane, C. P. Huang, and J. P. Zhou, "Space-time focusing of femtosecond pulses in Ti:sapphire," Optics Letters, vol. 20, pp. 309-311, 1995.

[4] I. P. Christov, V. Stoev, M. Murnane, and H. Kapteyn, "Mode-locking with a compensated space-time astigmatism," Optics Letters, vol. 20, pp. 2111, 1995.