

MixTrain®

Sum and Difference Frequency
Mixer for Tunable CW Lasers

mks | Spectra-Physics

MixTrain is an advanced stand-alone device that enables sum or difference frequency mixing of single frequency CW laser beams in periodically poled crystals. High mixing efficiencies are achieved by precision temperature control to ensure optimal quasi-phase matching over the entire tuning range of the Matisse®. When combined with a high power fiber laser, sum frequency output exceeding 2 W is readily achieved.

The MixTrain is equipped with all optics needed for combining input lasers, mixing in periodically poled crystals, and separation of the desired sum (SFM) or difference (DFM) frequency mixing output from the residual input beams. The platform includes a lens to collimate the output, and an isolator to protect the fiber laser from damage due to back reflections.

Periodically poled mixing crystals are mounted in a removable configuration to allow for alternate fiber input wavelengths. The mixing crystals are housed in a temperature stabilized oven with motorized control, providing hands free tuning over >100 nm of the visible spectrum. When pumped with the Matisse C and the appropriate fiber laser the MixTrain provides hands-free, all solid state output from 488–664 nm for SFM – a attractive and versatile alternative to a CW dye laser. Flexible configuration of mixing and separating optics enables output from 1.1–4.2 μm for DFM, depending on fiber laser input.

The MixTrain Advantage

- Input wavelength range 690 to 1020 nm
- Choose output range from 488–664 nm for SFM and 1.1–4.2 μm for DFM
- Continuous scans of 20 GHz for SFM and 60 GHz for DFM
- Temperature stabilized crystal mount for maximum conversion efficiency and stability of output power
- All solid state solution providing tunable CW visible and near to mid-IR output

Applications

- High-resolution spectroscopy
- Molecular/atomic cooling and magneto-optic trapping
- Tunable visible/IR experiments
- Bose-Einstein condensates
- Atomic clocks
- Frequency combs



MixTrain Sum Frequency Mixing Specifications^{1, 6}

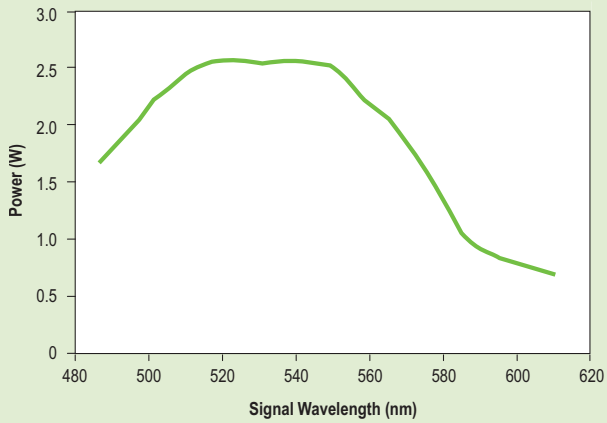
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|---|---|-----------------|
| Wavelength Range | 488–615 nm | 515–664 nm |
| Output Power ² | >2.0 W @ 520 nm | >1.0 W @ 555 nm |
| Automated Scan Range | >20 GHz | >20 GHz |
| Fiber Laser Input Power/Wavelength ³ | 10 W @ 1550 nm | 5 W @ 1950 nm |
| Tunable Input Wavelength | 700 nm–1020 nm | 700 nm–1020 nm |
| Requirements | | |
| Tunable Pump Laser ⁴ | TEM ₀₀ , M ² < 1.1, single frequency laser, linewidth < 5 MHz, linear polarized | |
| Fiber Pump Laser ⁵ | TEM ₀₀ , M ² < 1.1, single frequency laser, linewidth < 5 MHz, linear polarized | |
| Ambient Conditions | Constant temperature in the 20–25°C range | |
| Laboratory | Vibrational isolated optical table, dust-free air (flow box) | |
| Voltage | 115/230 V, single phase, 50/60 Hz | |
| Physical Characteristics | | |
| Size (L × W × H) | 17.13" × 13.94" × 9.37–9.92" (435 mm × 354 mm × 238–252 mm) | |

MixTrain Difference Frequency Mixing Specifications^{1, 6}

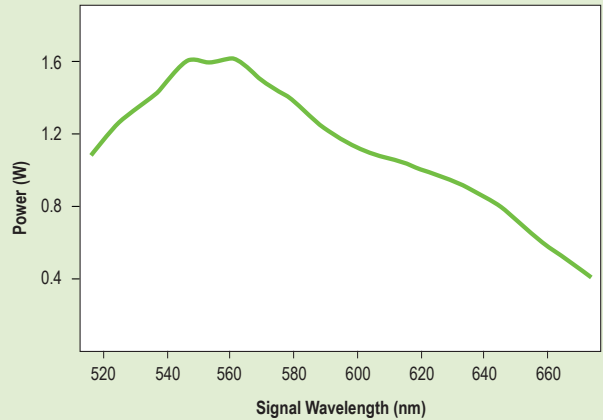
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|---|---|-------------------|-------------------|-------------------|
| Wavelength Range | 1090–1750 nm | 1160–2350 nm | 1650–2800 nm | 1940–4260 nm |
| Output Power ² | >100 mW @ 1350 nm | >170 mW @ 1350 nm | >200 mW @ 1700 nm | >100 mW @ 2350 nm |
| Automated Scan Range | >40 GHz | >60 GHz | >60 GHz | >60 GHz |
| Fiber Laser Input Power/Wavelength ³ | 5W @ 1950 nm | 5 W @ 532 nm | 10 W @ 1550 nm | 5 W @ 1064 nm |
| Tunable Wavelength Input | 690–1015 nm | 690–1020 nm | 690–1000 nm | 690–850 nm |
| Requirements | | | | |
| Tunable Pump Laser ⁴ | TEM ₀₀ , M ² < 1.1, single frequency laser, linewidth < 5 MHz, linear polarized | | | |
| Fiber Pump Laser ⁵ | TEM ₀₀ , M ² < 1.1, single frequency laser, linewidth < 5 MHz, linear polarized | | | |
| Ambient Conditions | Constant temperature in the 20–25°C range | | | |
| Laboratory | Vibrational isolated optical table, dust-free air (flow box) | | | |
| Voltage | 115/230 V, single phase, 50/60 Hz | | | |
| Physical Characteristics | | | | |
| Size (L × W × H) | 17.13" × 13.94" × 9.37–9.92" (435 mm × 354 mm × 238–252 mm) | | | |

1. Due to our continuous product improvement program, specifications are subject to change without notice.
2. Mixtrain output power is given at the 4.5 W peak output of the tunable laser and a fiber laser input of 10 W at the appropriate wavelength. Contact factory for performance specifications at desired output wavelength
3. Contact factory to inquire about non-standard fiber laser wavelengths.
4. Output linewidth of Mixtrain is determined by the broadest input linewidth. For specified linewidth of Matisse, refer to the appropriate Spectra-Physics datasheet.
5. Output linewidth of Mixtrain is determined by the broadest input linewidth. Refer to fiber laser manufacturer's datasheet for linewidth of fiber laser.
6. The MixTrain is a Class IV – High Power Laser, whose beam is, by definition, a safety and fire hazard. Take precautions to prevent exposure to the direct and reflected beams. Diffuse as well as specular reflections can cause severe skin or eye damage.

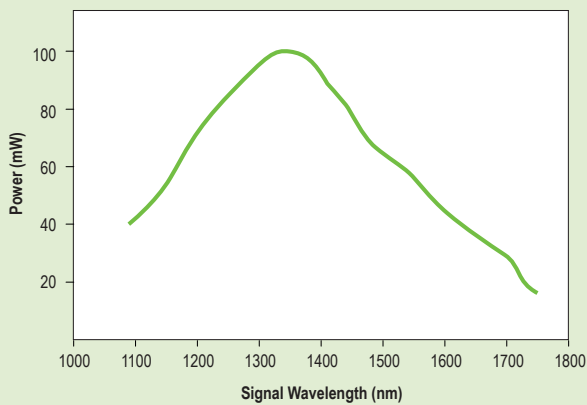
MixTrain SFM with 1550 nm Tuning Curve^{1,2}



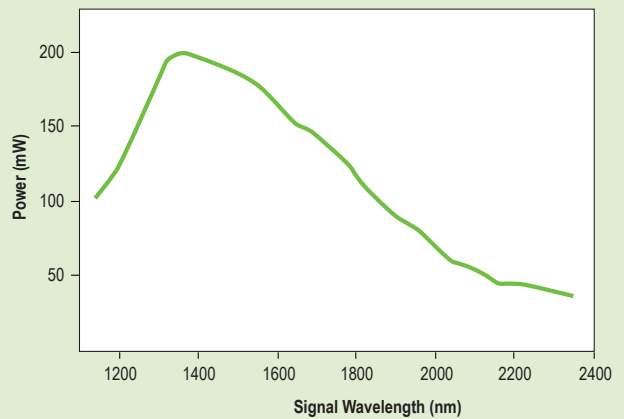
MixTrain SFM with 1950 nm Tuning Curve^{1,2}



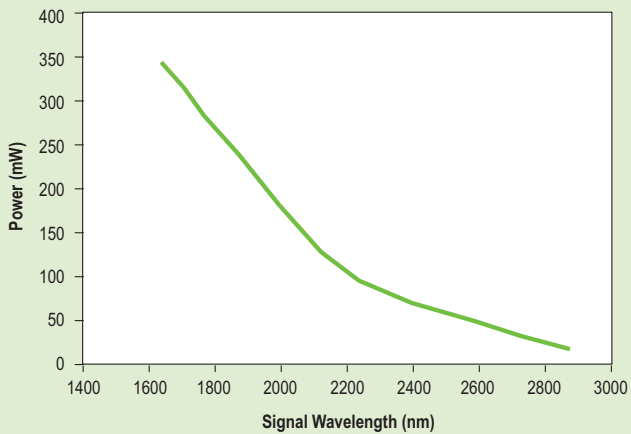
MixTrain DFM with 1950 nm Tuning Curve^{1,2}



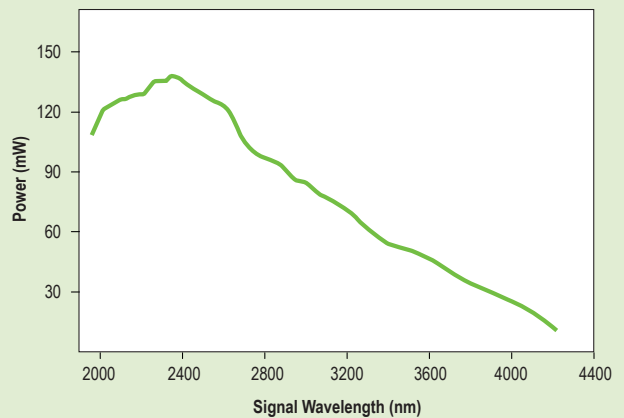
MixTrain DFM with 532 nm Tuning Curve^{1,2}



MixTrain DFM with 1550 nm Tuning Curve^{1,2}

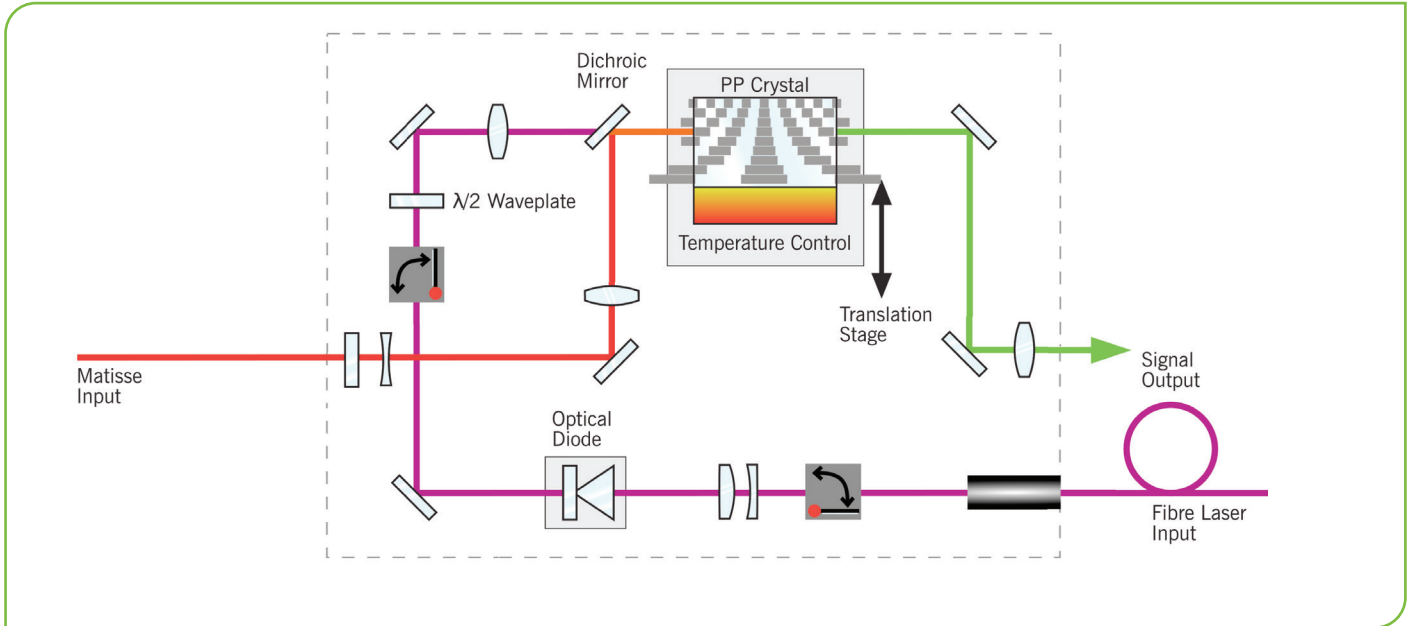


MixTrain DFM with 1064 nm Tuning Curve^{1,2}



1. Typically measured performance; not a guaranteed or warranted specification.
 2. Tuning curve generated using 4.5 W peak input from a Matisse 2 and 10 W input from a 1550 nm single frequency fiber laser.

MixTrain Optical Layout



MixTrain Dimensions

