

The EMU-120/65 VIS/NIR/SWIR is based upon the same echelle design as the UV/VIS/NIR model, except it covers a higher wavelength range. There are two possible wavelength ranges depending upon the adjustment of the optics in the spectrograph and the camera sensitivity:

350nm to 1100nm wavelength range
400nm to 1700nm wavelength range

The same interchangeable dispersion cassettes are available with the VIS/NIR/SWIR model. The average resolving power across the spectrum can exceed 50,000 (λ/FWHM) with our IX cassettes.

The input optics of the 120mm focal length collimating mirror can be as fast as F/4. The 120mm collimator is better matched with the most commonly used input optics, which can improve overall resolution and throughput.

The 65mm camera focusing optics can be as fast as F/2. The collimating mirror combined with the camera focusing optics will reduce the slit image size by 0.54x at the focal plane, which can either improve resolution or increase the slit size for the same resolution. The throughput of the EMU-120/65 can be 10x to 20x higher than other broadband echelle instruments, which are typically $\sim F/10$.

Because of its high étendue and resolving power, the EMU-120/65 is an echelle spectrograph that is versatile enough for both LIBS (laser-induced breakdown spectroscopy) and Raman applications. Its low stray light offers performance more comparable to double monochromators than other echelle-type spectrographs.

The EMU-120/65 is designed, manufactured and marketed by Catalina Scientific Instruments, LLC, and it is protected under US Patents 7,936,454 and 7,936,455.

EMU-120/65 VIS/NIR/SWIR

High Resolution High Throughput Ultra-Low Stray Light Echelle Spectrograph

- High étendue (numerical aperture x slit area).
- Covers the VIS-NIR-SWIR range and acquires completely linearized spectra in units of wavelength or Raman shift.
- Can be used with a variety of EMCCD, CCD, ICCD, CMOS, SWIR cameras.
- A variety of user interchangeable dispersion cassettes, aperture stops, entrance slits to optimize applications.
- Highest resolving power over 50,000 with the IX series dispersion cassettes.
- As an option, a 65mm collimator can be used instead of the 120mm collimator. It depends upon which collimating optics are a better match to the user's input optics for optimizing throughput.

Interchangeable Dispersion Cassettes



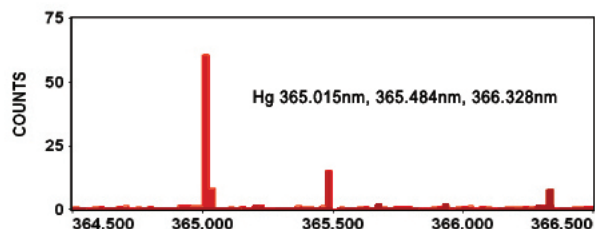
grating

HT Series:	up to $R = 9,500$
HR Series:	up to $R = 12,000$
UV Series:	up to $R = 30,000$
IS Series:	up to $R = 40,000$
IX Series:	up to $R = 60,000$

The custom dispersion cassettes on the EMU-120/65 are interchangeable. The above values for R (λ / FWHM) are based upon $8 \times 8 \mu$ pixel size and 8μ wide entrance slit.

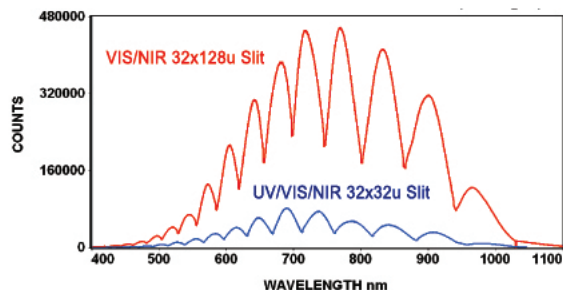
Resolving Power

The EMU-120/65 optical design can yield **single pixel** resolving power with high throughput. The Hg 365.015nm peak below is one 8 μ CCD pixel wide using an 8 μ wide slit. The FWHM is 0.025nm with the HR2 cassette.



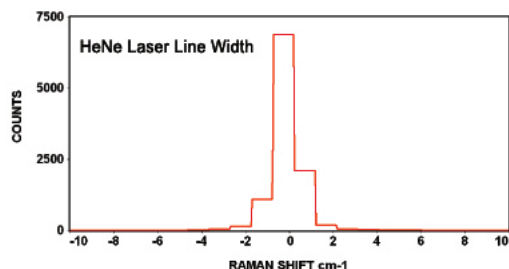
Throughput/Etendue Comparisons

The tungsten spectra below compare the throughput of the VIS/NIR model (red) with the UV/VIS/NIR model (blue) of the EMU-120/65. Both systems used the same grating, camera and aperture stop. The resolving power of the two models is the same. The high dispersion prism in the VIS/NIR model allows 4x taller entrance slits to be used than the UV/VIS/NIR model, allowing for greater throughput.

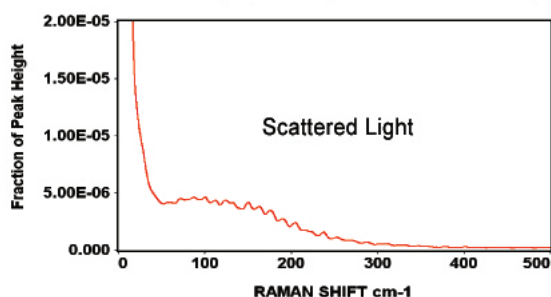


Stray and Scattered Light

The resolution for the HeNe 633nm laser line shown below is 1 cm^{-1} FWHM using the HR2 dispersion cassette.



The HeNe laser line below is over exposed by ~6000x to show the small angle scattering caused primarily by the grating. Scattered light is measured as a fraction of the HeNe peak intensity. It drops below the CCD dynamic range limit at a fraction of a nm from the peak. The VIS/NIR/SWIR model minimizes stray light beyond the scattering region.



KestrelSpec™ Software

Industry-standard KestrelSpec™ software controls the EMU-120/65 system, with complete real-time camera control and spectra acquisition. Our unique "3-point calibration" to calibrate the EMU spectrograph is performed quickly and easily with high accuracy. Spectral diffraction orders are automatically linked, linearized and plotted as the data is acquired in either nm or cm^{-1} units. Image and spectral data can be easily exported in various formats. An Element Identification tool with a user-editable reference library can identify the elements in atomic emission spectra. A Windows DLL (dynamic link library) is available for control of the EMU spectrograph by third party developers' applications.

EMU-120/65 Specifications

- At the collimator: F/4 to F/16
- At the detector: F/2 to F/8
- Focal Length (collimator): 120mm
- Focal Length (camera focusing optics): 65mm
- Magnification: ~ 0.54x
- Wavelength Coverage: 350 - 1100nm; 400 - 1700nm
- Scattered Light: 2.0E-05 at 1nm from the HeNe 633nm peak with an HR2 cassette
- Stray Light: ~1.0E-07
- Unit Volume: 6335 cm^3 (386 cubic inches)
Fits into a 385 x 255 x 110 mm box (15 x 10 x 4.5 inches) excluding camera, adapters and base
- Weight: 6 kg (13 lb) without camera, base, adapters
- Fiber Optic Input: SMA connector
- Entrance Slits: user interchangeable in varied sizes
8 to 128 μ wide; 12 to 128 μ tall
- Aperture Stops: user interchangeable in varied sizes
12 to 30mm in diameter
- Dispersion Cassettes: user interchangeable gratings
with blaze angles from 32° to 76°

Computer System Requirements

- Windows™ XP/Vista/7 (32-bit or 64-bit)
- Appropriate driver to interface with the detector

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