

EMU-120/65 Spectrograph

Broad Wavelength Coverage, Portable and High Resolution for Isotope Detection



The resolution, portability, and broad wavelength coverage of the EMU-120/65 is suitable for many isotopic and other high resolution applications. The average resolving power across the spectrum can exceed 50,000 (λ/FWHM) using the new IXU series of dispersion cassettes.

The 120mm focal length collimating mirror, combined with the 65mm camera focusing optics, reduces the slit image size by 0.54x at the focal plane. The 120mm collimator is better matched with the most commonly used input optics, which can improve overall resolution and throughput. The spectrograph can be used with the same cassettes as the EMU-65 for flexibility in meeting the needs of various applications.

The EMU-120/65 is designed to take advantage of the characteristics of EMCCD cameras. These cameras have higher quantum efficiency, resolution, and frame rate than ICCD cameras commonly used for LIBS (laser-induced breakdown spectroscopy). EMCCDs are more compact and robust than ICCDs, they cannot be damaged by over exposure to light, and they are less expensive than intensified cameras.

KestrelSpec™ software is used with the EMU-120/65 to calibrate and create spectral data. Wavelength calibration is fast and accurate using an Hg/Ar light source.

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.

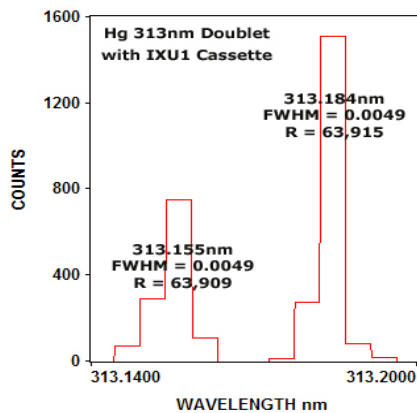
- Very high etendue (numerical aperture x slit area) with nearly twice the focal length at the collimator compared to the camera focusing optics.
- Covers the entire wavelength range of the CCD detector (UV-VIS-NIR) and acquires completely linearized spectra in units of wavelength or Raman cm^{-1} shift.
- A variety of interchangeable dispersion cassettes, aperture stops, and entrance slits are adaptable to many user applications.
- Resolving power $> 50,000 \lambda/\text{FWHM}$ with the IXU series of dispersion cassettes.



The custom dispersion cassettes on the EMU-120/65 are interchangeable

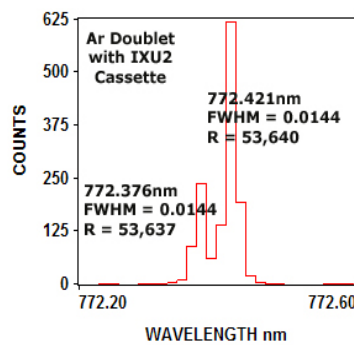
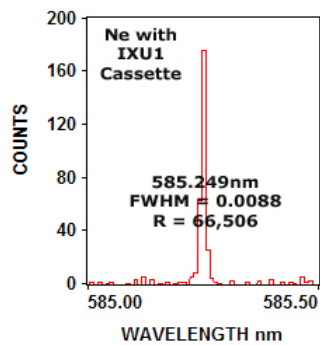
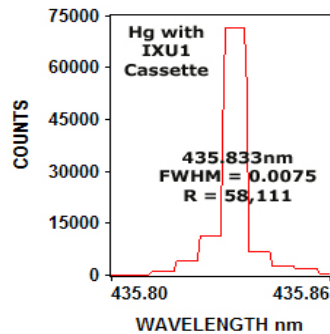
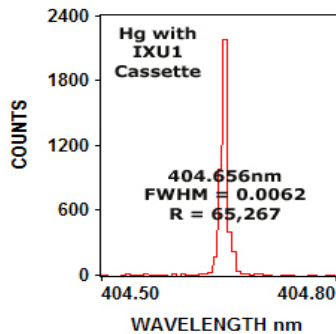
Resolving Power

The EMU-120/65 optical design can yield *single pixel* resolving power with high throughput.



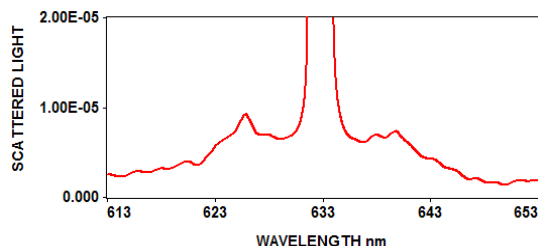
The Hg 313.155/313.184nm doublet is clearly resolved using the IXU1 cassette. Each peak is one 8μ CCD pixel wide using an 8μ width slit. Each peak has 0.0049nm FWHM resolution, resulting in a resolving power of $\sim 63,900$ at each peak.

The following spectra show examples of the resolving power of the IXU cassettes at various wavelengths.



Stray and Scattered Light

The overexposed HeNe 633nm laser line below shows the small angle scattering caused mostly by the grating. Scattered light is measured as a fraction of the HeNe peak intensity, and it drops below the CCD dynamic range limit at a fraction of a nm from the peak. The EMU-120/65 is designed to minimize stray light beyond the region affected by the scattering.



KestrelSpec™ Software

Industry-standard KestrelSpec™ software controls the EMU-120/65 system, with complete real-time camera control and spectral acquisition. Our unique "3-point calibration" is performed quickly and easily with high accuracy. Spectral diffraction orders are automatically linked, linearized and plotted as data is acquired. 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: $\sim 0.54x$
 - Wavelength Coverage: 190-1100nm
 - Resolving Power* (λ /FWHM)
 - ISU Series Cassettes (at F/3.3**)
 - 35,000 with 14μ wide slit
 - IXU Series Cassettes (at F/6.5**)
 - 45,000 to 55,000 with 14μ wide slit
 - Scattered Light: $2.E-05$ at 1nm from HeNe 633nm peak using the HRU2 cassette
 - Stray Light: $\sim 2.E-6$
 - Unit Volume: 6227 cm^3 (380 cubic inch)
 - Fits into a 356 (14) x 210 (8.5) x 110 (4.5) mm (inch) box excluding camera, adapters and base
 - Weight: 5 kg (11 lb) w/o camera, base, adapters
 - Fiber Optic Input: SMA connector
 - Slits: User interchangeable
 - Dispersion Cassettes: User interchangeable
- * Resolving power is listed as the average λ /FWHM from 200-1100nm using an $8x8\mu$ pixel detector.

** The listed F-number is for the camera focusing optics. The collimator F-number is 1.85x larger.

Computer System Requirements

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

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