

IFU Terminology

Integral field spectroscopy, available in JWST's NIRSpec and MIRI instruments, has a variety of terms and acronyms in common use that may be confusing to those unfamiliar with the field.

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Generic terminology

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Many acronyms and naming conventions are in general use across a variety of integral-field spectrographs and are commonly adopted in the literature. These include:

- **Data cube:** A 3-dimensional data product often produced using IFS data. Typically, this has two spatial dimensions (e.g., right ascension and declination) and one spectral dimension (wavelength). This may be produced from a single exposure or multiple dithered and/or mosaiced exposures. Generally such 'cubes' are strictly more like long rectangular prisms with the wavelength axis containing substantially more elements than the spatial axes.
- **IFU:** Integral Field Unit. This acronym refers to the physical hardware that breaks the focal plane up into multiple pieces prior to dispersal by a spectrograph. It can take the form of either a set of image slicers, a lenslet array, or an optical fiber bundle.
- **IFS:** Integral Field Spectrograph, Spectrometer, Spectra, or Spectroscopy. This acronym can have multiple meanings, either referring to the overall technique of integral field spectroscopy, the spectra obtained using such a technique, or the hardware system encompassing both the integral field unit and the spectrograph/spectrometer.
- **LSF:** Line Spread Function. This is the characteristic shape of an unresolved spectral feature, i.e. the effective spectral resolution of the reconstructed data cube.
- **Pixel/Spaxel/Voxel:** A pixel refers to a physical detector pixel that is read out by some series of electronics. A spaxel ('spatial pixel') refers to a spatial element of a reconstructed data cube, while a voxel ('volume pixel') refers to a volume element (spatial x spatial x spectral) of a data cube. Each spaxel in a data cube therefore has an associated spectrum composed of many voxels.
- **PSF:** Point Spread Function. Typically (and somewhat loosely) refers to the spatial intensity profile of an unresolved point source either incident upon the slicer optics (i.e., the telescope PSF) or in the reconstructed data cube (i.e., the reconstructed PSF).
- **RSS:** Row stacked spectra. A common data format for fiber-type IFUs that consists of a 2-dimensional array with each row in the array corresponding to the 1-d spectrum of a single fiber.
- **Slice:** Multi-use term. This can either refer to an element of the slicing unit that chops up the focal plane (for slicer-type IFUs), or to an image at a single wavelength plane extracted from the reconstructed data cube.

JWST and WFIRST specific terminology

JWST MIRI MRS

- **Channel:** The MRS has four channels that together cover the wavelength range 5-28 microns. Channels 1 and 2 share a detector, as do channels 3 and 4.
- **Band:** Each MRS channel is divided into 3 wavelength ranges: SHORT(A), MEDIUM(B), and LONG(C). A single 'unit' of wavelength coverage is therefore, e.g., band 1A (the A section of channel 1).

WFIRST

- **IFC:** Integral Field Channel. This specific name refers to the integral field spectrograph on the WFIRST telescopes (for parity in naming conventions with the Wide-Field and Coronagraphic Channels).