FLITECAM Grism Observing Modes

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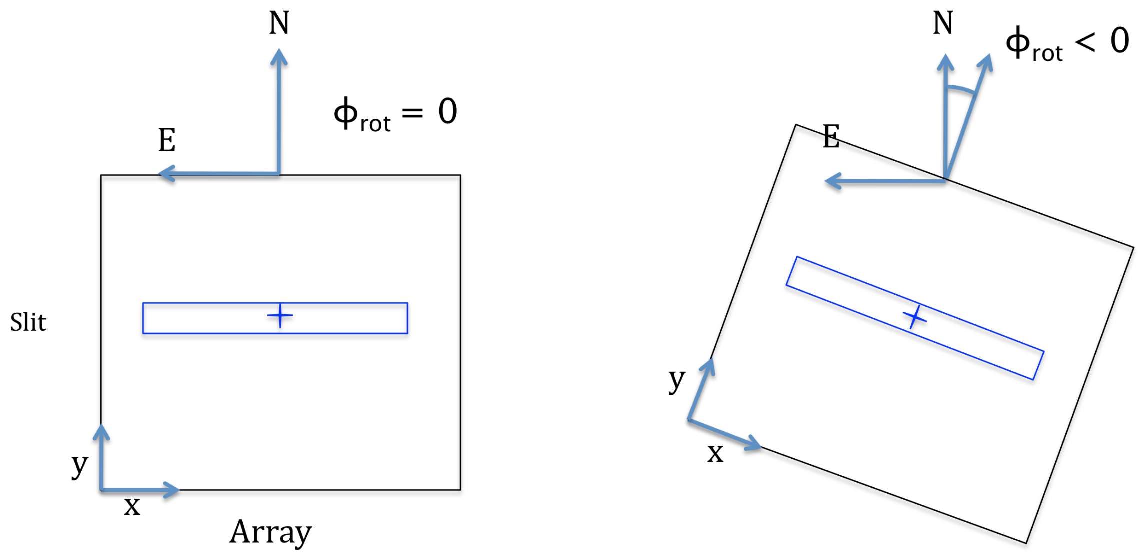
FLITECAM spectroscopic observations make use of a set of 3 grisms that can be used in 3 different orders each and are combined with 2 possible slits. The slits are both 60 arcsec long; the narrow slit has a width of 1 arcec and the wide slit has a width of 2 arcsec. The narrow slit (1”) provides ‘high’ resolution spectroscopy, while the wide slit (2”) provides ‘low’ resolution spectroscopy. The slits are oriented along the x axis of the array. The combinations of grisms, slits, and order sorting filters are listed in the table below.

Grism	Groove Sep. (l/mm)	Order	OSF[a]	SPT Ident.[b]	Coverage (μm)	High-Res ($R=\lambda/\Delta\lambda$)	Low-Res[c] ($R=\lambda/\Delta\lambda$)
A	162.75	1	L&M[d]	A1_LM	4.395 – 5.533	N/A	~ 900
		2	K_{long}	A2_KL	2.208 – 2.724	1690	845
		3	H_{wide}	A3_Hw	1.490 – 1.826	1710	855
B	217	1	L&M	B1_LM	3.300 – 4.079	1780	890
		2	H_{wide}	B2_Hw	1.672 – 2.055	1750	875
		3	J	B3_J	1.140 – 1.385	1720	820
C	130.2	2	L&M	C2_LM	2.751 – 3.401	1670	835
		3	K_{wide}	C3_Kw	1.851 – 2.278	1650	825
		4	H_{wide}	C4_Hw	1.392 – 1.718	1640	820

There are two basic observing modes available with the grisms/slits, similar to those used for FLITECAM imaging and for FORCAST spectroscopy: Nod_Along_Slit and Nod_Off_Slit. Unlike the situation with FORCAST, no chopping is done with FLITECAM (in either the imaging or grism modes). Currently, dithering along the slit (which will be implemented for the FORCAST grism observations) is not supported for FLITECAM grism observations.

In the diagrams for the two modes shown below the angle of the slit on the array is 90 deg and on the sky is 90 + ϕ_{rot}, where ϕ_{rot} is the rotation angle of the array. In all diagrams, North is up and East is left. Positive angles increase from North through East, in the standard astronomical manner. For clarity in the diagrams and consistency with the FORCAST grism document, however, the rotation angle ϕ_{rot} is shown with a negative value.



Nod_Along_Slit:

In this mode, the telescope is pointed such that the object is positioned approximately one-third to one quarter of the distance along the slit and an exposure is taken. This is known as nod position A, or the A beam. Once the integration is finished, the telescope is moved, such that the object is now approximately the same distance from the opposite end of the slit. This is nod position B, or the B beam. The nod throw is the angular distance along the slit between the two nod positions, or equivalently, the distance between the two object positions in pixels along the x axis of the array. For nod A, the telescope is positioned so that the object is located half the nod throw (= nod amplitude) along the slit from the center of the slit. For nod B, the object is on the other side of the center of the slit, half the nod throw away along the slit. Integrations at these two positions generally occur in either an A-B-A-B sequence or more efficiently in an A-B-B-A sequence. The sequences are repeated until the total integration time is completed (or the desired Signal-to-Noise Ratio is achieved).

The SI team has defined default offsets for the A and B beam object positions on the two slits; these are given in array coordinates (pixels) in the table below. The origin is at the lower left corner of the array. The array has 1024 pixels in each dimension and the pixel scale is 0.475 arcsec/pixel.

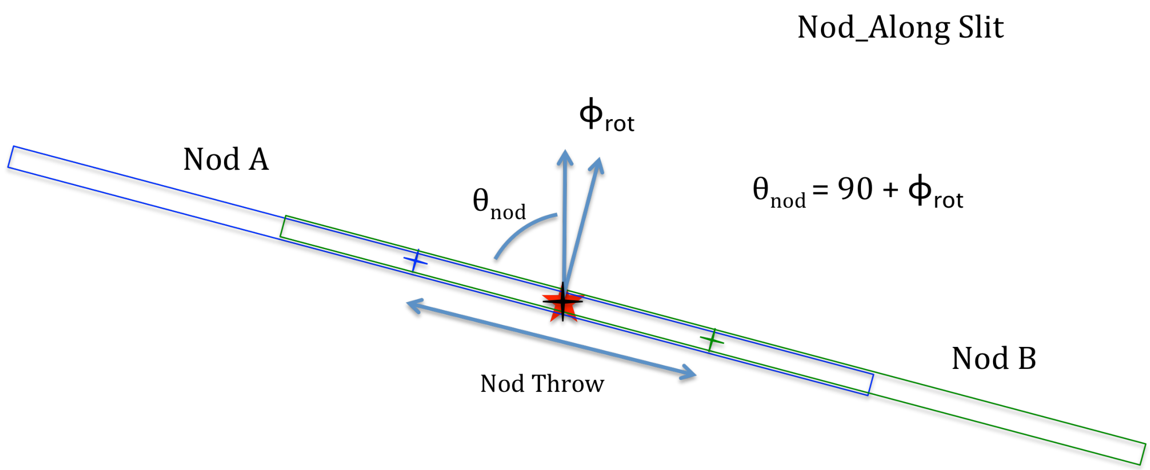
Slit	A beam	Center	B beam
Narrow	(644,485)	(612.5,485)	(581,485)
Wide	(456,485)	(482,485)	(508,485)

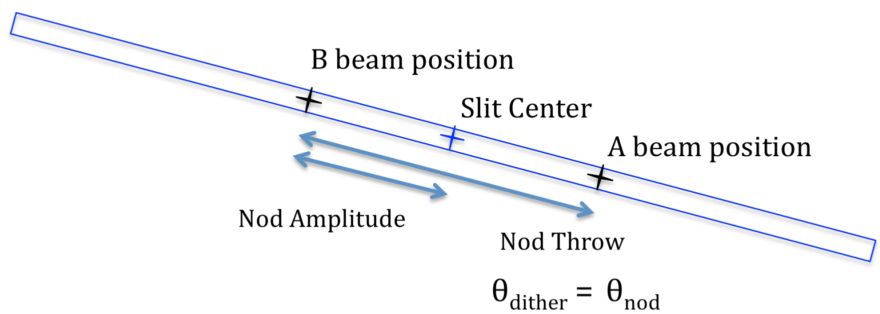
In arcsec, the default distances (dx, dy) of the A and B positions from the center of the slit (nod amplitudes) and the separations between the A and B positions (nod throws) are given in the following table.

Slit	A (dx,dy)	B (dx,dy)	ΔAB
Narrow	14.96”	-14.96”	29.92”
Wide	-12.35”	12.35”	24.70”

(Recall that the telescope moves in the opposite direction of the apparent motion of the object on the array. This means that when the object is in the A position on the slit, to the right of the center of the slit for the narrow slit on the array, the telescope is positioned to the left of the object in array coordinates. Also note that the relative locations of the A and B beams are reversed for the wide slit compared to the narrow slit. The A beams are always farther from the center of the array (x=512) than the B beams.)

The observer should be able to choose the magnitude of the nod throw (that is, the separation along the x axis between the A and B beams; however, the default values should be those given in the first table above). Alternatively, the observer could choose the nod amplitude. The nod angle θ_{nod} for the nod throw is specified in relative (array) coordinates, because the nod angle is parallel to the orientation of the slit, whose angle on the sky, ϕ_{rot}, cannot be determined until the observations are flight-planned. In this mode, θ_{nod} = 90 or 270 in array coordinates, which corresponds to $\theta_{nod} = 90 + \phi_{rot}$ on the sky. (Dithering is currently not supported, but if it were the dithers would be along the slit, so the angle for the dithers would be θ_{dither} = 90 or 270 in array coordinates or $90 + \phi_{rot}$ in sky coordinates.)





Nod_Off_Slit:

In this mode, the telescope is pointed at the object for one exposure (A beam), at the end of which the telescope is moved to a new position completely off of the object (B beam) and another exposure is obtained. Usually the object will be positioned in the center of the slit in the A beam. The sequence of observations can again be A-B-A-B or A-B-B-A. The nod throw and nod angle are completely independent parameters specified by the GI. The nod angle can be specified in array or sky (equatorial) coordinates. If the GI specifies sky (equatorial) coordinates then θ_{nod} refers to the angle on the sky from north through east. However, the observer may instead specify the nod angle in array (or relative) coordinates. A relative angle for the nod is useful if the GI wants to specify the nod position relative to the orientation of the slit, whose angle on the sky, ϕ_{rot}, cannot be determined until the observations are flight-planned. To nod perpendicular to the slit, $\theta_{nod} = 0$ or 180 in array coordinates, which correspond to $\theta_{nod} = \phi_{rot}$ or $180 + \phi_{rot}$ on the sky. Usually, in this mode, the nod position will be a considerable distance from the object and therefore the nod angle θ_{nod} should be specified in sky coordinates. (Dithering along the slit is currently not supported, but if it were the angle for the dithers would be θ_{dither} = 90 or 270 in array coordinates or 90 + ϕ_{rot} in sky coordinates.)