FORCAST Grism Observing Modes

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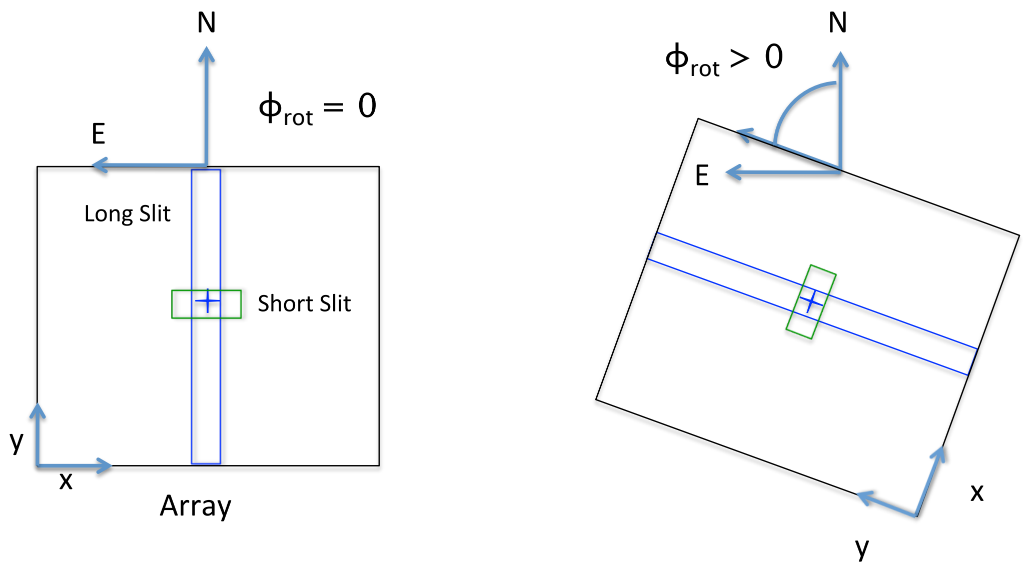
FORCAST spectroscopic observations make use of a set of 6 grisms that are combined with 3 possible slits, two long slits and a short slit. The long slits have a length of 191 arcsec; the short slit has a length of 11.2 arcsec. One of the long slits has a width of 2.4 arcsec while the other has a width of 4.7 arcsec. The short slit has a width of 2.4 arcsec. The long slit is oriented along the y axis of the array, while the short slit is oriented along the x axis of the array. The relative orientations of the long and short slits with respect to the FORCAST array are shown below.

Grism	Wavelength	Slit	Resolving Power
Long Slit Spectroscopy in the Short Wavelength Camera			
G1	4.7-7.8 μm	2.4”x192”	200
		4.7” x192”	100
G3	8.4-13.7 μm	2.4” x192”	300
		4.7” x192”	150
Cross Dispersed Spectroscopy in the Short Wavelength Camera			
G2xG1	4.7-7.8 μm	2.4”x11.25”	1200
G4xG3	8.4-13.7 μm	2.4”x11.25”	800
Long Slit Spectroscopy in the Long Wavelength Camera			
G5	17.6-27.7μm	2.4”x192”	140
		4.7” x192”	70
G6	28.7-37.1μm	2.4” x192”	220
		4.7” x192”	110

The observing modes available with the two slits are similar to those used for imaging: C2N, with a symmetric chop, and C2NC2, with an asymmetric chop. The C2N modes have several sub-modes. Because the short slit is only 11 arcsec long, it will not be possible to chop or nod along the slit. Dithering along the short slit will probably also not be feasible.

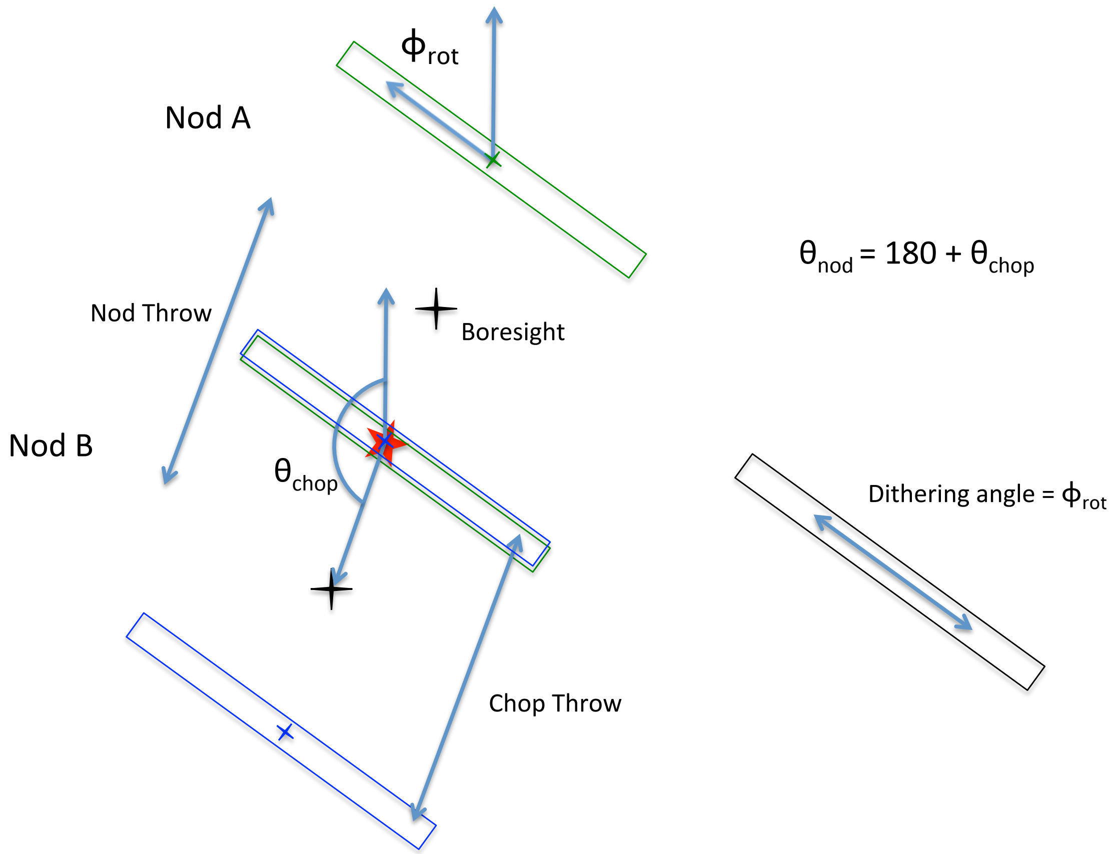
The diagrams for the various proposed modes shown below are drawn for the long slit case, for which the angle of the slit on the array is 0 (or 180) deg and on the sky is given by ϕ_{rot}, where ϕ_{rot} is the rotation angle of the array. They can easily be applied to the short slit as well, after accounting for the fact that the angle of the short slit on the array is 90 deg, and therefore is 90 + ϕ_{rot} on the sky. In all diagrams, North is up and East is left. Positive angles increase from North through East, in the standard astronomical manner.



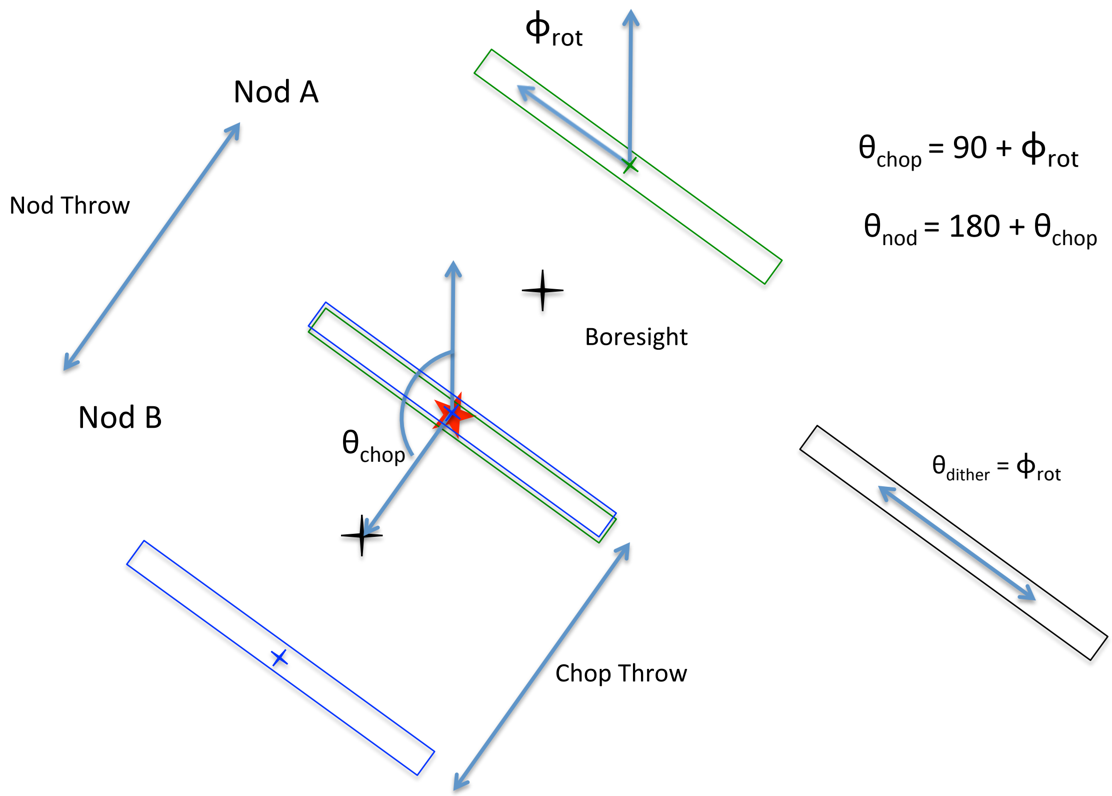
C2N: Nod_Match_Chop (NMC)

In this mode, the telescope is pointed at a position half of the chop throw distance away from the object to be observed, and the secondary chops between two positions, one of which is centered on the object. The nod throw has the same magnitude in arcsec or arcmin as the chop throw (hence the name "Nod_Match_Chop"), and is in a direction exactly 0 or 180 degrees from that of the chop direction. After the telescope nods to the new position, the secondary chops in the same direction as before. The observer should be able to choose the angle θ_{chop} for the chop throw (and then the angle for the nod throw is automatically determined from $\theta_{nod} = 180 + \theta_{chop}$) and the coordinates for the chop angle (sky or array). If the GI specifies sky (or absolute) coordinates, then θ_{chop} refers to the angle on the sky from north through east. However, the observer may instead specify the chop angle in array (or relative) coordinates. A relative angle for the chop/nod is useful if the GI wants to specify the chop/nod positions relative to the orientation of the slit, whose angle on the sky, ϕ_{rot}, cannot be determined until the observations are flight-planned. There are two special relative angles: parallel to (along), and orthogonal (perpendicular) to the slit. To chop along the slit, $\theta_{chop} = 0$ or 180 in array coordinates for the long slit, which corresponds to $\theta_{chop} = \phi_{rot}$ on the sky. To chop perpendicular to the slit, $\theta_{chop} = 90$ or $\theta_{chop} = 270$ in array coordinates, which correspond to $\theta_{chop} = 90 + \phi_{rot}$ or $270 + \phi_{rot}$ on the sky. In all cases, $\theta_{nod} = 180 + \theta_{chop}$. If the GI wishes to dither the observations, the dithers should be along the slit, so the angle for the dithers θ_{dither} = 0 or 180 in array coordinates or ϕ_{rot} in sky coordinates.

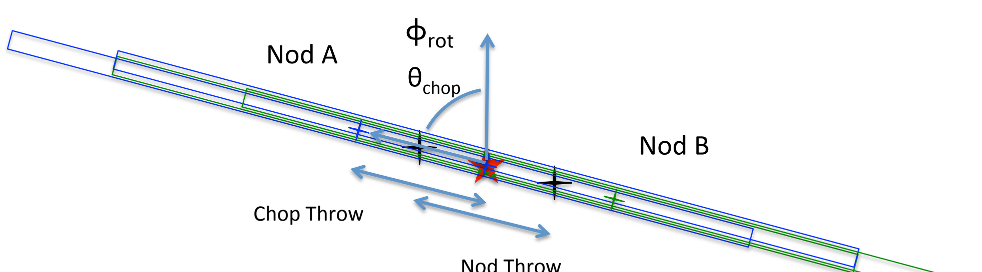
NMC General case:



NMC Perpendicular to Slit:



NMC Parallel to Slit:



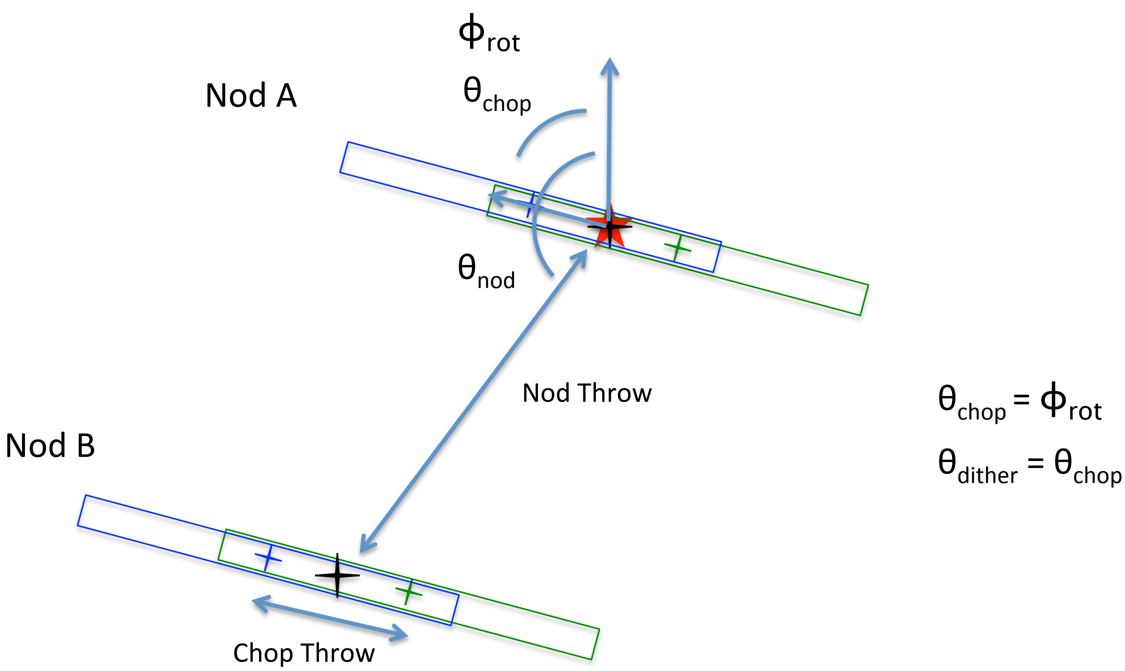
$$\theta_{chop} = \phi_{rot}$$

$$\theta_{nod} = 180 + \theta_{chop}$$

$$\theta_{dither} = \theta_{chop} \text{ or } \theta_{nod}$$

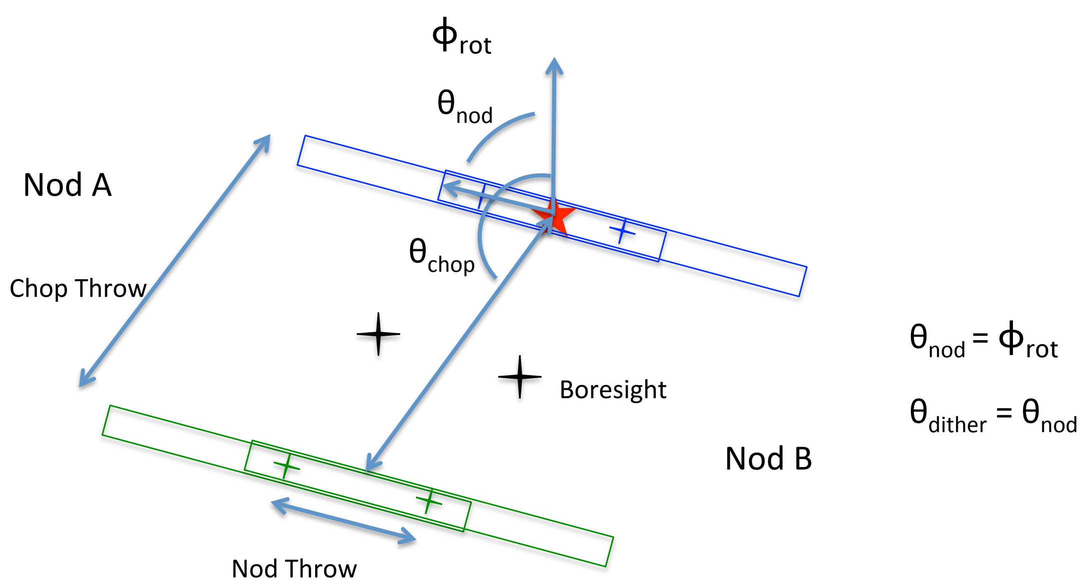
C2N: Chop_Along_Slit

In this mode, the telescope is pointed at the object and the secondary chops between two positions on either side of the object (symmetric chop). The chop throw is oriented such that both positions are aligned with the angle of the slit on the sky. This is known as chopping along the slit, and $\theta_{chop} = 0$ or 180 in array coordinates for the long slit, which corresponds to $\theta_{chop} = \phi_{rot}$ on the sky. The nod throw and nod angle, however, are completely independent parameters specified by the GI. After the telescope nods to the new position, the secondary chops in the same direction as before. The observer should be able to choose the chop throw magnitude in arcsec or arcmin, nod throw magnitude, the angle θ_{nod} for the nod throw and the coordinates for the nod angle (sky or array). If the GI specifies sky (equatorial, or absolute) 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 (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, $\theta_{nod} = 90$ or 270 in array coordinates, which correspond to $\theta_{nod} = 90 + \phi_{rot}$ or $270 + \phi_{rot}$ on the sky. If the GI wishes to dither the observations, the dithers should be along the slit, so the angle for the dithers $\theta_{dither} = 0$ or 180 in array coordinates or ϕ_{rot} in sky coordinates, which is the same as the chop angle θ_{chop}.



C2N: Nod_Along_Slit

In this mode, the telescope is pointed at a position half of the chop throw distance away from the object to be observed, and the secondary chops between two positions, one of which is centered on the object (symmetric chop). The nod throw is oriented such that both nod positions are aligned with the angle of the slit on the sky. This is known as nodding along the slit, and $\theta_{nod} = 0$ or 180 in array coordinates for the long slit, which corresponds to $\theta_{nod} = \phi_{rot}$ on the sky. The chop throw and chop angle, however, are completely independent parameters specified by the GI. After the telescope nods to the new position, the secondary chops in the same direction as before. The observer should be able to choose the nod throw magnitude in arcsec or arcmin, chop throw magnitude, the angle θ_{chop} for the chop throw and the coordinates for the chop angle (sky or array). If the GI specifies sky (equatorial, or absolute) coordinates, then θ_{chop} refers to the angle on the sky from north through east. However, the observer may instead specify the chop angle in array (or relative) coordinates. A relative angle for the chop is useful if the GI wants to specify the chop 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 chop perpendicular to the slit, $\theta_{chop} = 90$ or 270 in array coordinates, which correspond to $\theta_{chop} = 90 + \phi_{rot}$ or $270 + \phi_{rot}$ on the sky. If the GI wishes to dither the observations, the dithers should be along the slit, so the angle for the dithers $\theta_{dither} = 0$ or 180 in array coordinates or ϕ_{rot} in sky coordinates, which is the same as the nod angle θ_{nod}.



C2NC2:

In this mode, the telescope is pointed at the object and the secondary chops between the object and a second position (asymmetric chop). The chop throw, chop angle, nod throw, and nod angle are all completely independent parameters specified by the GI. The chop angle can be specified in array or sky (equatorial) coordinates. If the GI specifies sky (equatorial) coordinates, then θ_{chop} refers to the angle on the sky from north through east. However, the observer may instead specify the chop angle in array (or relative) coordinates. A relative angle for the chop is useful if the GI wants to specify the chop 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 chop perpendicular to the slit, θ_{chop} = 90 or 270 in array coordinates, which correspond to $\theta_{chop} = 90 + \phi_{rot}$ or $270 + \phi_{rot}$ on the sky. For C2NC2 mode, the nod position will usually be a considerable distance from the object. Therefore, the nod angle θ_{nod} should be specified in sky coordinates and refers to the angle on the sky from north through east. If the GI wishes to dither the observations, the dithers should be along the slit, so the angle for the dithers θ_{dither} = 0 or 180 in array coordinates or ϕ_{rot} in sky coordinates.