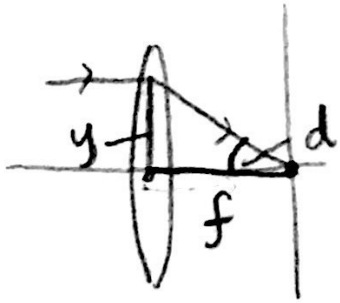
SURP week 8

Preventing spectrum overlap part 3

After some more analysis I realize the last step was unnecessary and that the relationship between slit separation (s) and angle difference leaving the collimator (α) are fully described by

$$s(\alpha) = f\left[\tan(d-\alpha) + \tan(d)\right]$$



or, using $d = \arctan\left(\frac{y}{f}\right)$

$$s(\alpha) = f\left[\tan\left(\arctan\frac{y}{f} - \alpha\right)\right] + y$$

The height of lens contact (y) is arbitrary and only acts to shift the function horizontally so I want to remove the dependence on y eventually

for now, the next step is to write α in terms of the diffraction of the grism

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Using $\sin\theta = m\lambda N \Rightarrow \theta = \arcsin(m\lambda N)$

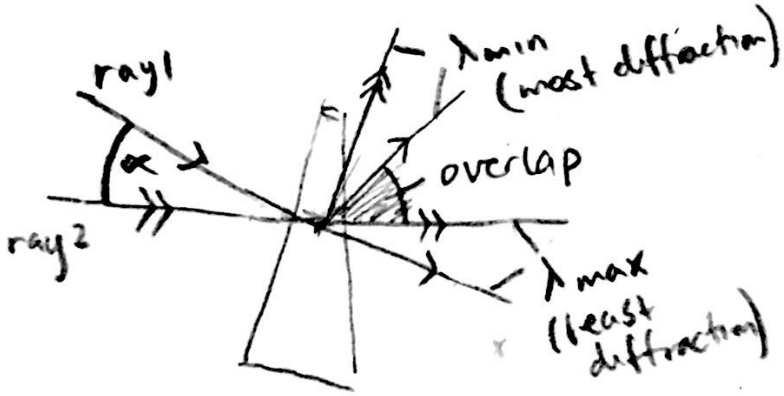
where θ is diffraction angle,

λ is wavelength,

N is slit density

m is assumed to be 1,

we can see that for no overlap,



$$\alpha = \theta(\lambda_{min}) - \theta(\lambda_{max})$$
$$= \arcsin(\lambda_{min} N) - \arcsin(\lambda_{max} N)$$

subbing this back into $s(\alpha)$,

$$s(\alpha) = f_{col}\left[\tan\left(\arctan\frac{y}{f_{col}} - \arcsin(\lambda_{min}N) + \arcsin(\lambda_{max}N)\right]\right] + y$$

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