About Chirps

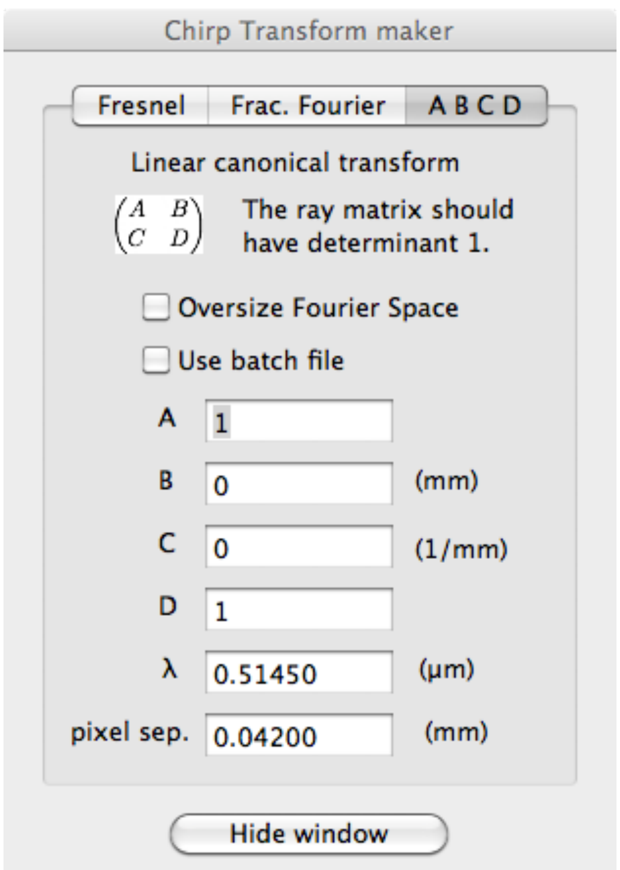
## ABCD GENERAL LINEAR RAY MATRIX

This program uses two algorithms to calculate the general linear matrix. The matrix may be factored in may ways I have chosen two.

$$\begin{pmatrix} A & B \\ C & D \end{pmatrix} = \begin{pmatrix} 1 & 0 \\ \frac{D-1}{B} & 1 \end{pmatrix} \begin{pmatrix} 0 & f_c \\ \frac{1}{f_c} & 0 \end{pmatrix} \begin{pmatrix} 1 & 0 \\ \frac{-B}{f_c^2} & 1 \end{pmatrix} \begin{pmatrix} 0 & f_c \\ \frac{1}{f_c} & 0 \end{pmatrix} \begin{pmatrix} 1 & 0 \\ \frac{A-1}{B} & 0 \end{pmatrix}$$

$$\begin{pmatrix} A & B \\ C & D \end{pmatrix} = \begin{pmatrix} 0 & f_c \\ \frac{-1}{f_c} & 0 \end{pmatrix} \begin{pmatrix} 1 & 0 \\ \frac{f_c-B}{f_c^2 D} & 1 \end{pmatrix} \begin{pmatrix} 0 & f_c \\ \frac{-1}{f_c} & 0 \end{pmatrix} \begin{pmatrix} 1 & 0 \\ \frac{D}{f_c} & 1 \end{pmatrix} \begin{pmatrix} 0 & -f_c \\ \frac{1}{f_c} & 0 \end{pmatrix} \begin{pmatrix} 1 & 0 \\ \frac{1+f_c C}{f_c D} & 1 \end{pmatrix}$$

The first of these is shorter but clearly fails if B = 0. Since the determinant is equal to 1 then B and D cannot both be zero. The value of B is the test that determines which algorithm is used. We use either 5 steps or 6 as the case may be.




Case B ≠ 0.
1) lens function
2) inverse FFT
3) lens function
4) FFT
5) lens function

$$\phi_1 = \frac{\pi \Delta^2 (A-1)}{\lambda B}(n^2+m^2)$$
$$\phi_3 = \frac{-\pi B \lambda}{N^2 \Delta^2}(n^2+m^2)$$
$$\phi_5 = \frac{\pi \Delta^2 (D-1)}{\lambda B}(n^2+m^2)$$

Δ is the pixel separation & $f_c = N\Delta^2/\lambda$ .

No attempt is made to assure that the determinant of the matrix is actually equal to one. You can cheat all you want as long as you get the right answer.