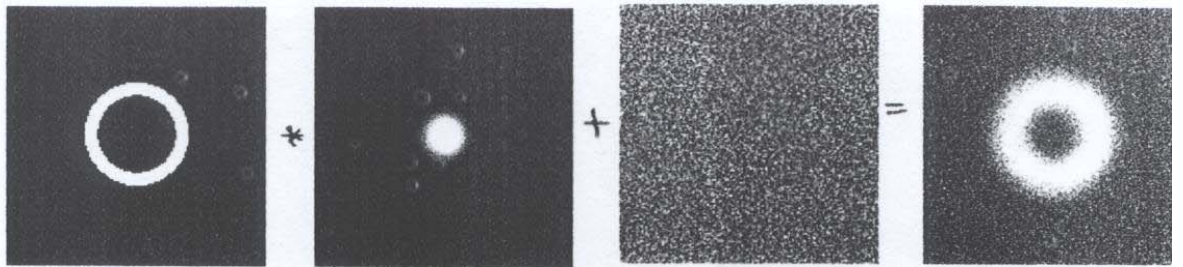


THE STANDARD PROBLEM



$$\begin{array}{ccccccccc} \text{IMAGE} & * & \text{PSF} & + & \text{NOISE} & = & \text{DATA} \\ \text{I} & * & \text{H} & + & \text{n} & = & \text{D} \end{array}$$

The problem is to recover the original image I , given the data D and point spread function H and perhaps some knowledge of the noise n

PXNCAL3 FLOWCHART

INPUT

D DATA
 Φ PSEUDO IMAGE
 H PSF
 σ ESTIMATED NOISE

SET PIXON RADIUS δ TO MAXIMUM
 K_δ IS PIXON FUNCTION FOR RADIUS δ
 AT ALL PIXELS

LOCAL CHISQUARE IS CHISQUARE
 OVER PIXON FOOTPRINT IN DATA
 SPACE

$$\chi^2 = (D - H * K_\delta * \Phi)^2 / \sigma^2$$

$$\chi_{LOC}^2 = \chi^2 * H \quad \text{! SHOULD BE } \chi^2 * H * K_\delta$$

$$Q = \frac{\chi_{LOC}^2 - 1}{\sqrt{2}}$$

$$SNR = \frac{(H * K_\delta * \Phi) N_K}{\sigma \sqrt{N_H}}$$

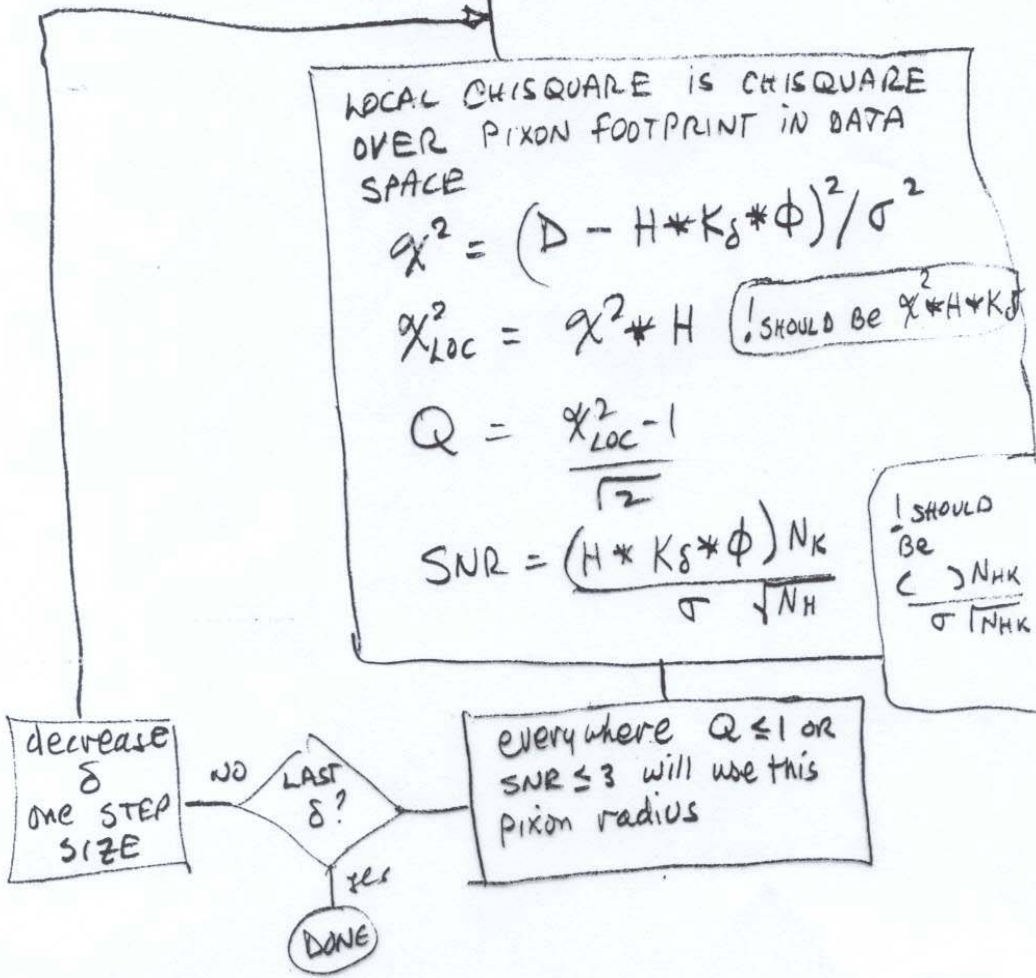
! SHOULD
 BE
 $\frac{C > N_H K}{\sigma \sqrt{N_H K}}$
 $N_K = \# \text{PIX}$
 IN K_δ
 $N_H = \# \text{PIX}$
 IN H
 $N_H K = \# \text{PIX}$
 IN $H * K$

decrease
 δ
ONE STEP
SIZE

NO LAST
 δ ?

everywhere $Q \leq 1$ OR
 $SNR \leq 3$ will use this
pixon radius

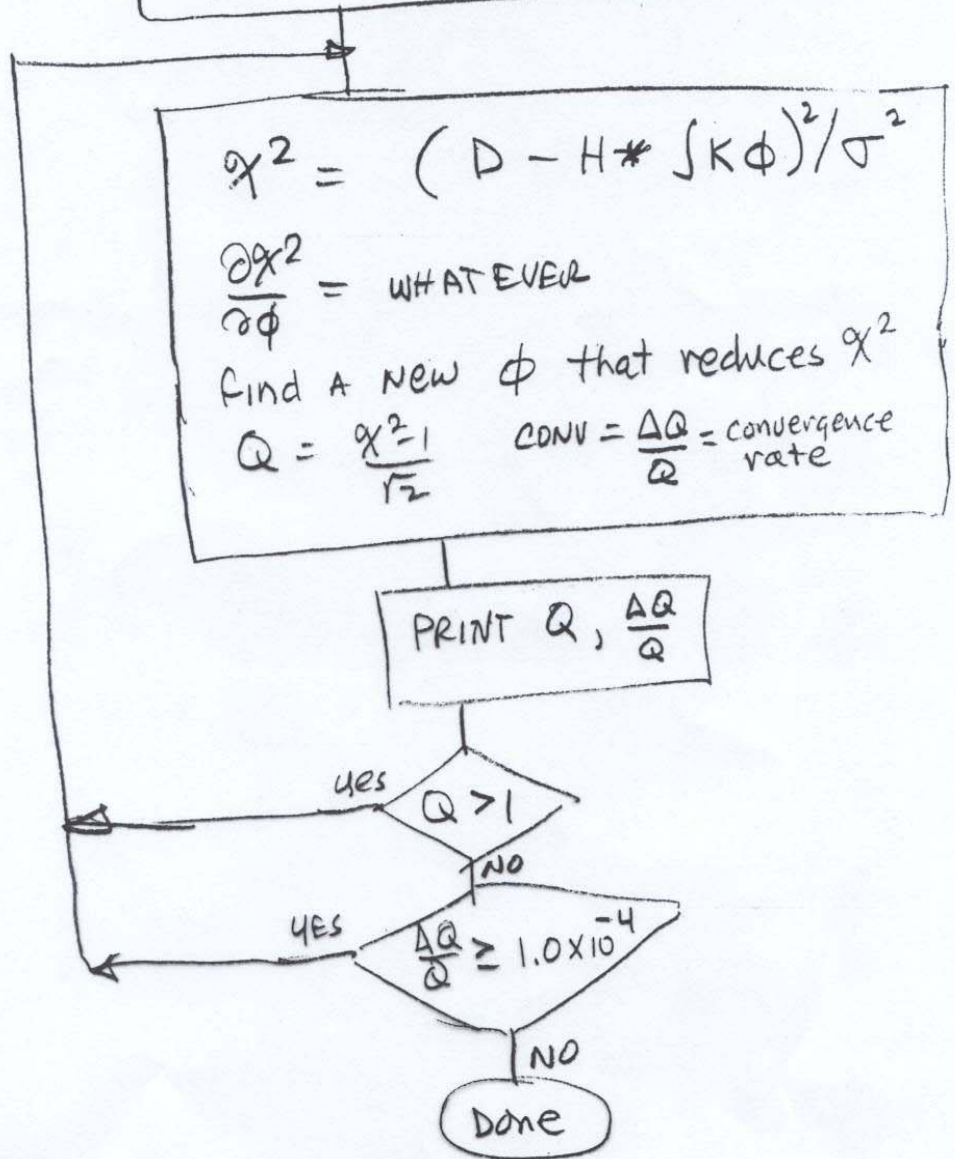
DONE



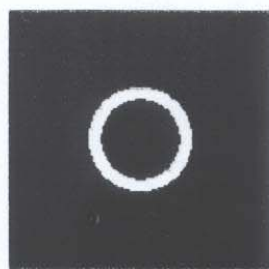
PXNI FLOWCHART

INPUT

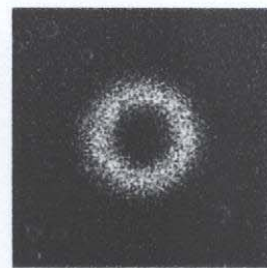
D	DATA
H	PSF
K	PIXON FUNCTION (VARIOUS PARABOLAS)
σ	ESTIMATED NOISE
ϕ	PSEUDO-IMAGE



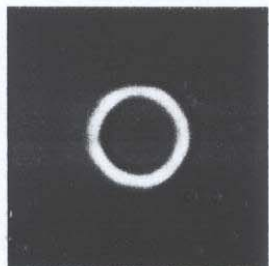
Results - Standard Problem



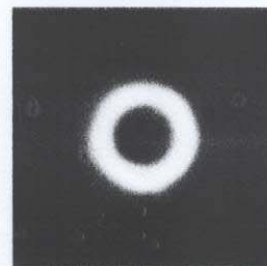
Original Image



Data



Pixon Solution



Pixon Data
Model



Initial Pseudo-Image



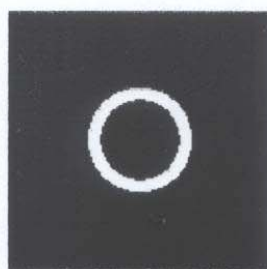
Pixon Strength



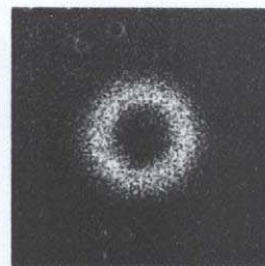
Pixon Radii



Results - Standard Problem



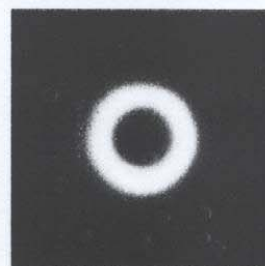
Original Image



Data



Pixon Solution



Pixon Data Model

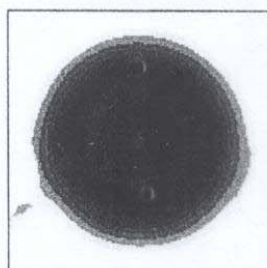


Naval
Research
Laboratory

Initial Pseudo-Image



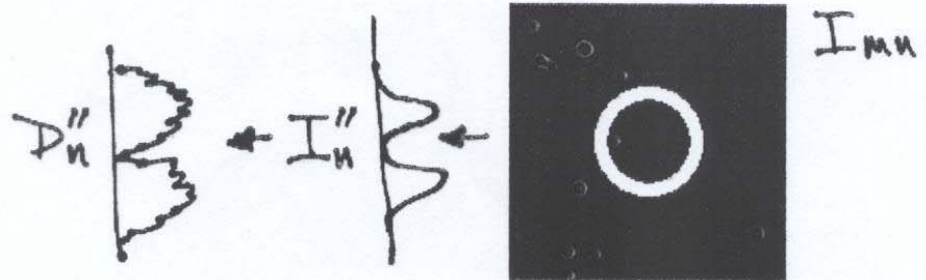
Pixon Strength



Pixon Radii



A SIMPLE TOMOGRAPHY PROBLEM

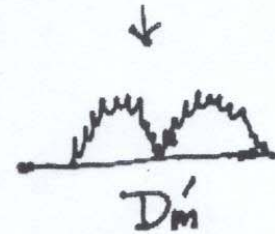
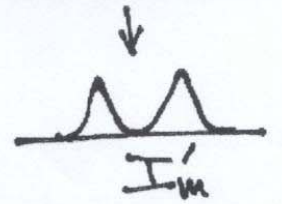


$$I'_m \equiv \sum_n I_{mn}$$

$$I''_n \equiv \sum_m I_{mn}$$

$$D'_m = (I' * H + n)_m$$

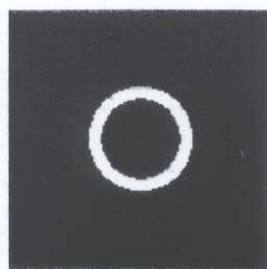
$$D''_n = (I'' * H + n)_n$$



The problem is to recover the original image I given the projected data D'_m and D''_n , point spread function H , and perhaps some knowledge of the noise n .

(Note - in the following examples, noise and convolution were performed prior to summation, but this is not a problem)

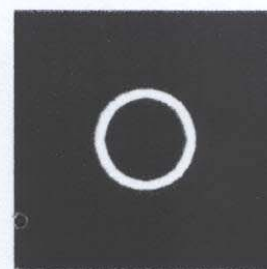
Results - Tomography Problem



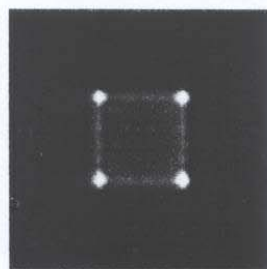
Original Image



Entropy=0.7019



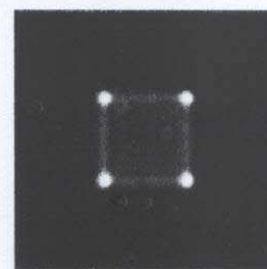
Data



Pixon Solution



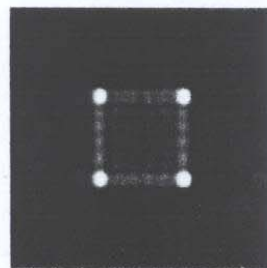
Entropy=0.8263



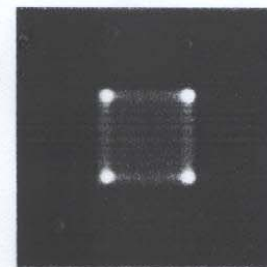
Pixon Data Model



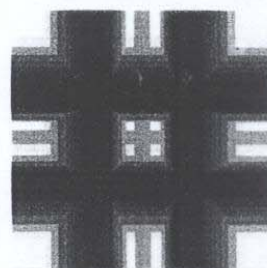
Initial Pseudo-Image



Pixon Strength



Cooks Solution



Pixon Radii

