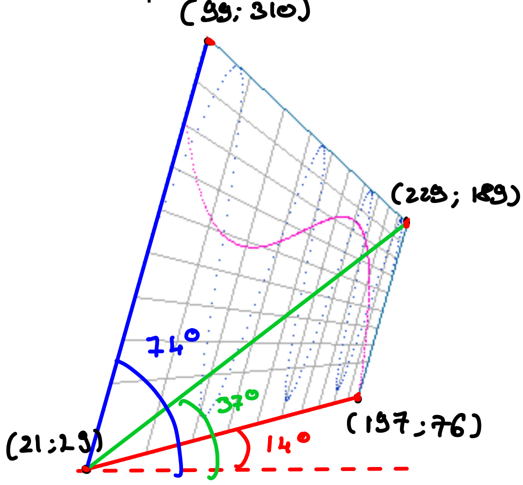
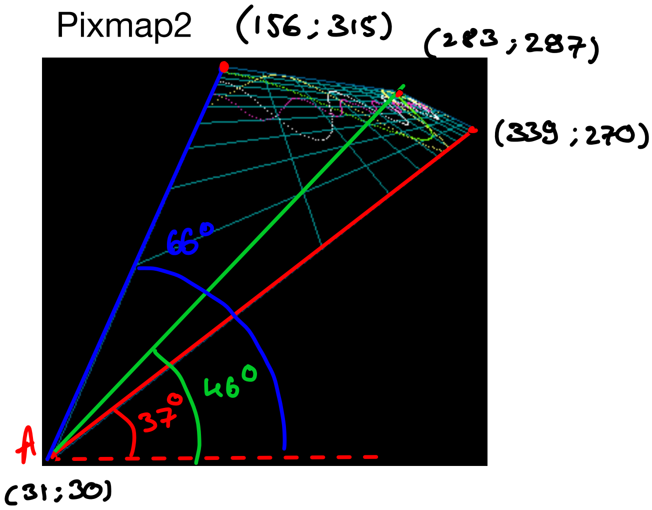
MATLAB

Partie 1 : orderCorners

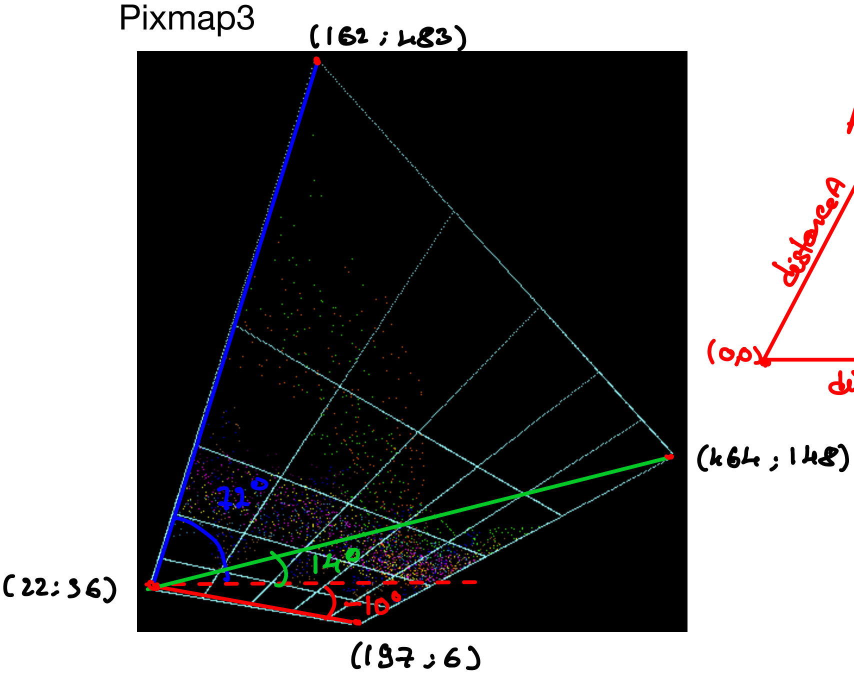
Pixmap1

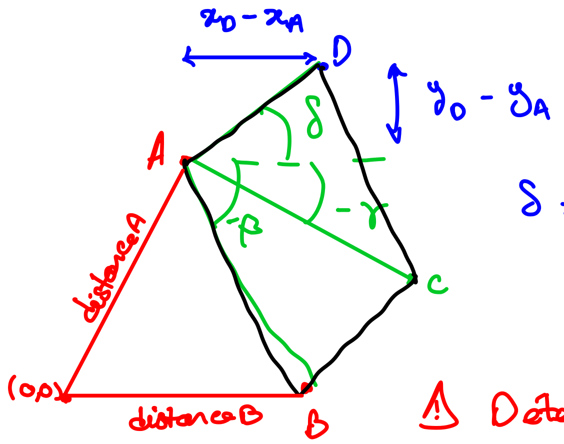


Pixmap2



Pixmap3





$$\delta = \arctan\left(\frac{y_D - y_A}{x_D - x_A}\right)$$

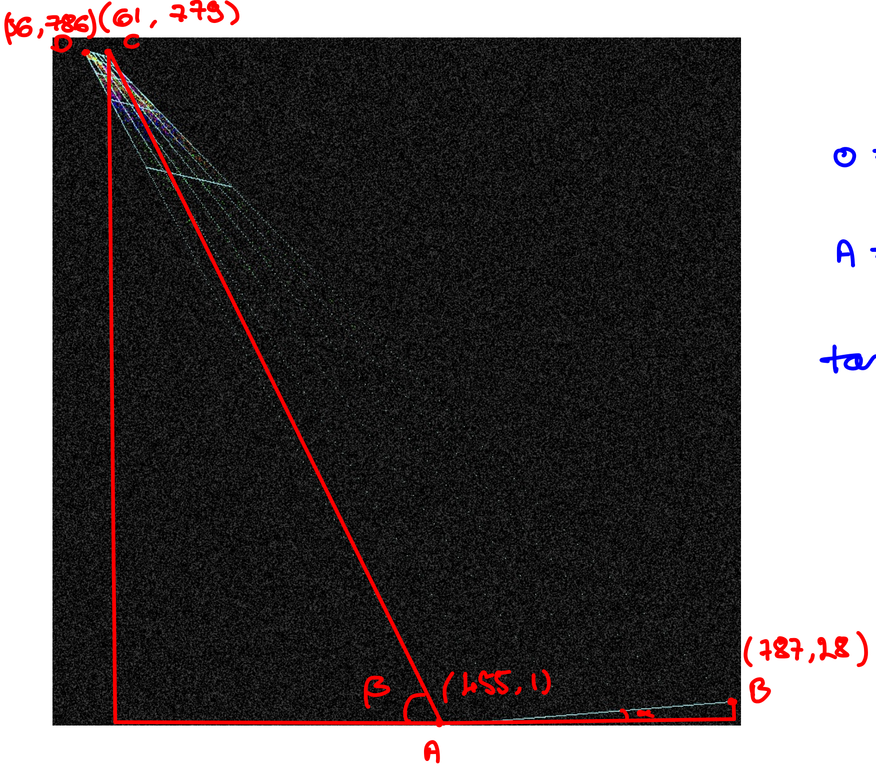
⚠ Déterminer quelle distance à (0,0) est la plus petite pour le point savoir point de référence A !

Point A : Plus petite distance (polaire) de l'origine

```
for  n = 1 : 4
     distances (n) = sqrt(corners(n,1)^2 + corners(n,2)^2);
end
idxA = find(min(distances));
Tmp = Corners (1, :);
corners (1, :) = Corners(idxA, :);
Corners(idxA, :) = Tmp ;
```

Calcul des angles : $\theta = \arctan\left(\frac{y - y_A}{x - x_A}\right)$

$\beta < \gamma < \delta$ => classer les points



$O = y_B - y_B$

$A = x_B - x_A$

$\tan(\alpha) = \frac{O}{A} = \frac{y_B - y_B}{x_B - x_A}$

$\alpha = \arctan\left(\frac{y_B - y_B}{x_B - x_A}\right)$

$\beta = \arctan\left(\frac{y_C - y_A}{x_C - x_A}\right)$

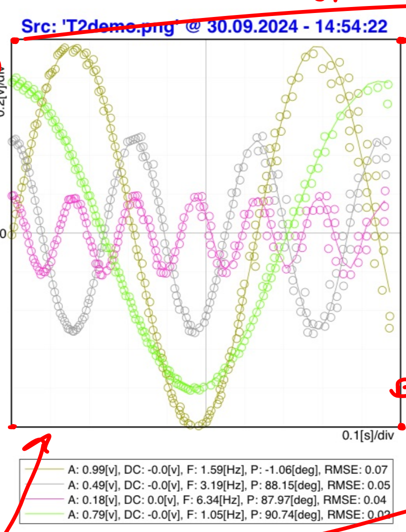
⚠ Attention au quadrant : => utiliser atan2

- Quadrant I ($x > 0$, $y > 0$) : $\theta = \arctan \frac{y}{x}$, angle entre 0° et 90°
- Quadrant II ($x < 0$, $y > 0$) : $\theta = \arctan \frac{y}{x} + 180°$, angle entre 90° et 180°
- Quadrant II ($x < 0$, $y < 0$) : $\theta = \arctan \frac{y}{x} + 180°$, angle entre $-180°$ et $-90°$
- Quadrant II ($x > 0$, $y < 0$) : $\theta = \arctan \frac{y}{x}$, angle entre $-90°$ et 0°

Partie 3 : Compute H

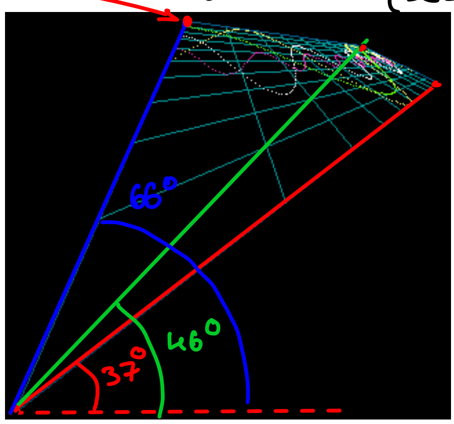
$W = x_{max}$ dans Corners $\qquad$ $H = y_{max}$ dans Corners

D $(0, H)$ $\qquad$ C (W, H)



A $(0,0)$ $\qquad$ B $(W, 0)$

Pixmap2 $\quad (156 ; 315) \quad (283 ; 287) \quad (339 ; 270)$



A $(31 ; 30)$

$$\begin{pmatrix} x'_h \\ y'_h \\ z'_h \end{pmatrix} = M \begin{pmatrix} x_h \\ y_h \\ 1 \end{pmatrix} = \begin{pmatrix} a & b & c \\ d & e & f \\ g & h & 1 \end{pmatrix} \begin{pmatrix} x \\ y \\ 1 \end{pmatrix} = \begin{pmatrix} ax + by + c \\ dx + ey + f \\ gx + hy + 1 \end{pmatrix}$$

⚠ Homogène

Homogène → Cartésien : $(x'_h, y'_h) \rightarrow (x_c, y_c)$

$$\begin{pmatrix} x'_h \\ y'_h \\ z'_h \end{pmatrix} \longmapsto \begin{pmatrix} x_c = x'_h / z'_h \\ y_c = y'_h / z'_h \end{pmatrix}$$

A : $\quad x'_A = \dfrac{a x_A + b y_A + c}{g x_A + h y_A + 1} = 0 \qquad y'_A = \dfrac{d x_A + e y_A + f}{g x_A + h y_A + 1} = 0$

B : $\quad x'_B = \dfrac{a x_B + b y_B + c}{g x_B + h y_B + 1} = W \qquad y'_B = \dfrac{d x_B + e y_B + f}{g x_B + h y_B + 1} = 0$

C : $\quad x'_C = \dfrac{a x_C + b y_C + c}{g x_C + h y_C + 1} = W \qquad y'_C = \dfrac{d x_C + e y_C + f}{g x_C + h y_C + 1} = H$

D : $\quad x'_D = \dfrac{a x_D + b y_D + c}{g x_D + h y_D + 1} = 0 \qquad y'_C = \dfrac{d x_D + e y_D + f}{g x_D + h y_D + 1} = H$ ✓

Eq. linéaire :

$$x'_A (g x_A + h y_A + 1) - (a x_A + b y_A + c) = x'_A x_A g + x'_A y_A h + x'_A - a x_A - b y_A - c = 0$$

$$y'_A (g x_A + h y_A + 1) - (d x_A + e y_A + f) = y'_A x_A g + y'_A y_A h + y'_A - d x_A - e y_A - f = 0$$

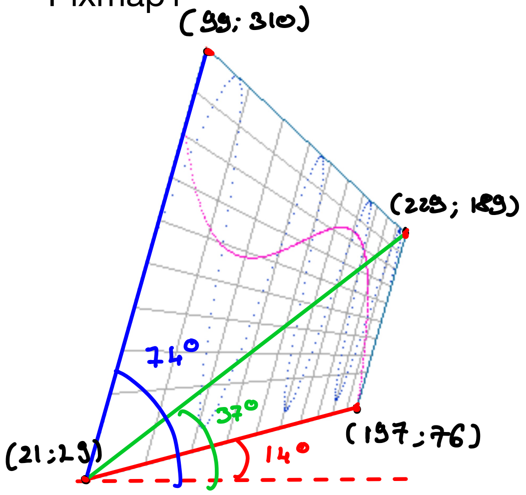
$$\Rightarrow \begin{cases} - x'_A x_A g - x'_A y_A h + a x_A + b y_A + c = x'_A \\ - y'_A x_A g - y'_A y_A h + d x_A + e y_A + f = y'_A \end{cases} \quad \times 4$$

$$
\underbrace{\begin{bmatrix}
x_A & y_A & 1 & 0 & 0 & 0 & -x'_A x_A & -x'_A y_A \\
0 & 0 & 0 & x_A & y_A & 1 & -y'_A x_A & -y'_A y_A \\
x_B & y_B & 1 & 0 & 0 & 0 & -x'_B x_B & -x'_B y_B \\
0 & 0 & 0 & x_B & y_B & 1 & -y'_B x_B & -y'_B y_B \\
x_C & y_C & 1 & 0 & 0 & 0 & -x'_B x_B & -x'_B y_B \\
0 & 0 & 0 & x_C & y_C & 1 & -y'_C x_C & -y'_C y_C \\
x_D & y_D & 1 & 0 & 0 & 0 & -x'_B x_B & -x'_B y_B \\
0 & 0 & 0 & x_D & y_D & 1 & -y'_D x_D & -y'_D y_D
\end{bmatrix}}_{A \;\; 8\times 8}
\underbrace{\begin{bmatrix} a \\ b \\ c \\ d \\ e \\ f \\ g \\ h \end{bmatrix}}_{x}
=
\underbrace{\begin{bmatrix} x'_A \\ y'_A \\ x'_B \\ y'_B \\ x'_C \\ y'_C \\ x'_D \\ y'_D \end{bmatrix}}_{\substack{b \\ 8\times 1}}
$$

$Ax = b \quad 8\times 8 \times 8\times 1$

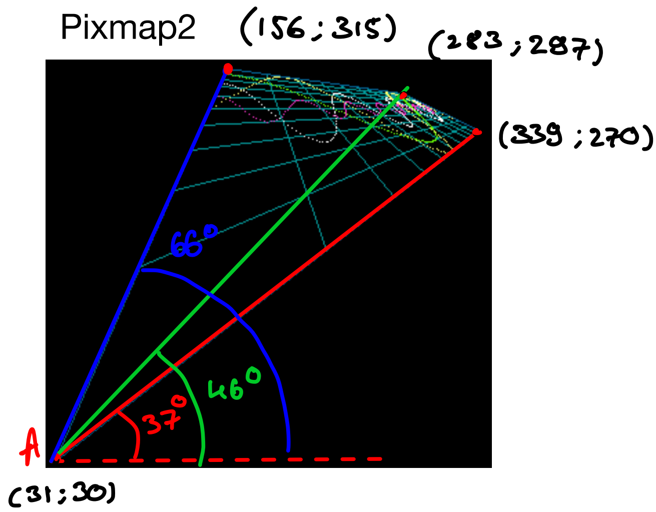
$H = x$

Pixmap1



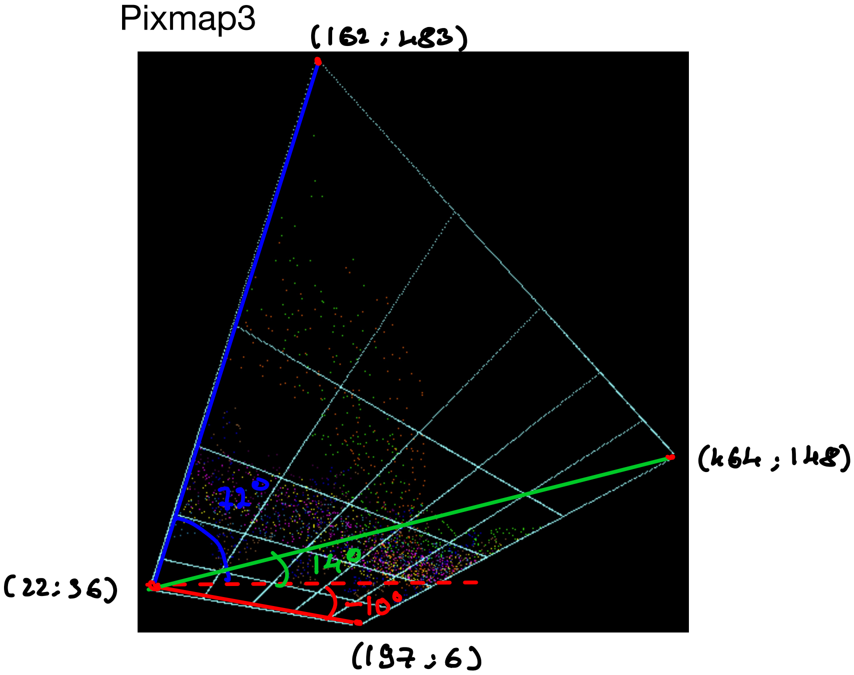
$$
H = \begin{pmatrix} 0.5422 & -0.1505 & -7.0222 \\ -0.7797 & -0.8377 & 336.8914 \\ -0.0035 & 0.0010 & 1.0000 \end{pmatrix}
$$

Pixmap2



$$
H = \begin{pmatrix} 0.0949 & -0.0416 & -1.6923 \\ -0.1312 & 0.1683 & -0.9836 \\ -0.0008 & -0.0024 & 1.0000 \end{pmatrix}
$$

Pixmap3



$$
H = \begin{pmatrix} 2.4080 & -0.7542 & -25.8251 \\ 0.9312 & 5.4320 & -216.0391 \\ -0.0005 & 0.0091 & 1.0000 \end{pmatrix}
$$

Partie 2 : applyM

function $[x \ y] = \text{apply}(M, x, y)$

$W_h = MV_h$ avec V_h en coord. homogènes

Ex : Corners [22 36 ; 197 6 ; 464 148 ; 162 483] (Pixmap 3)

$$W_h = \underbrace{\begin{pmatrix} 2.4080 & -0.7542 & -25.8251 \\ 0.9312 & 5.4320 & -216.0391 \\ -0.0005 & 0.0091 & 1.0000 \end{pmatrix}}_{M} \underbrace{\begin{pmatrix} 22 & 197 & 464 & 162 \\ 36 & 6 & 148 & 483 \\ 1 & 1 & 1 & 1 \end{pmatrix}}_{V_h}$$

⚠ rajouter 1 dans V_h car homogènes !

$$W_h = \begin{pmatrix} 0 & 19,2297 & 12,7949 & 0 \\ 0 & 0 & 11,8830 & 31,5751 \\ 0,9008 & 0,0567 & 0,0377 & 0,1002 \end{pmatrix}$$

conversion homogènes → cartésiens

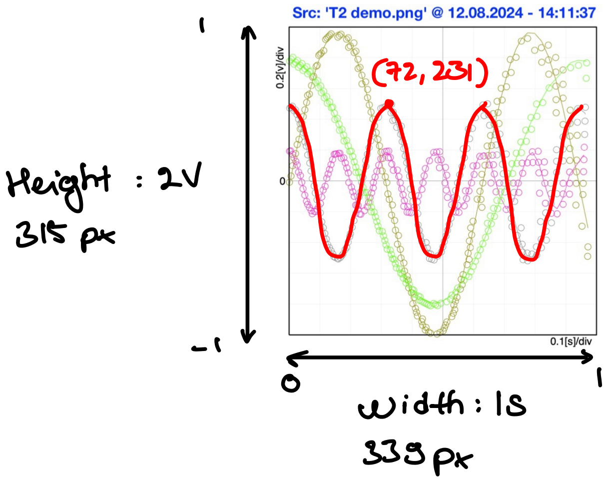
$$W_c = \begin{pmatrix} 0/0,9008 & 19,2297/0,0567 & 12,7949/0,0377 & 0/0,1002 \\ 0/0,9008 & 0/0,0567 & 11,8830/0,0377 & 31,5751/0,1002 \end{pmatrix}$$

$$W_c = \begin{pmatrix} 0 & 339 & 339 & 0 \\ 0 & 0 & 315 & 315 \end{pmatrix} = \begin{pmatrix} x_A & x_B & x_C & x_D \\ y_A & y_B & y_C & y_D \end{pmatrix}$$

$$W_c^T = \begin{pmatrix} x_A & y_A \\ x_B & y_B \\ x_C & y_C \\ x_D & y_D \end{pmatrix} = \begin{pmatrix} 0 & 0 \\ 339 & 0 \\ 339 & 315 \\ 0 & 315 \end{pmatrix}$$

Partie 4 :

```
function [ParamStr, yfitted] = FindTrace(X, Y ,Width, Height)
```

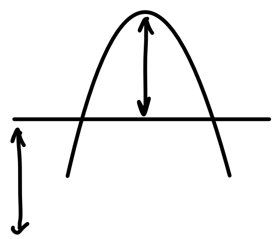


$y \in [-1, 1]$

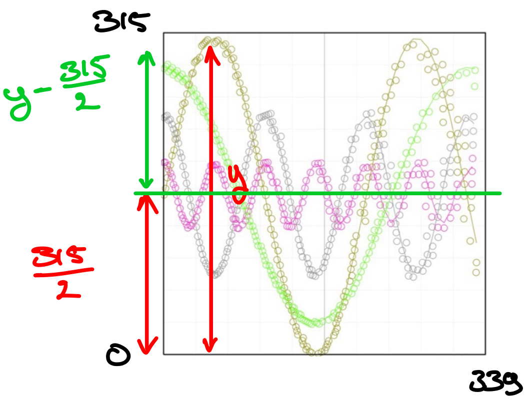
$x \in [0, 1]$

Centre : $0 \equiv \frac{315}{2}$

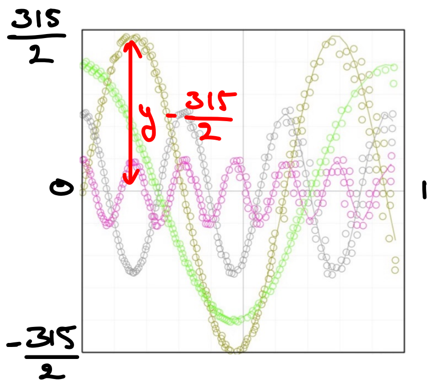
$$Y = \left(y - \frac{315}{2}\right) / \frac{315}{2} = \left(231 - \frac{315}{2}\right) / \frac{315}{2}$$



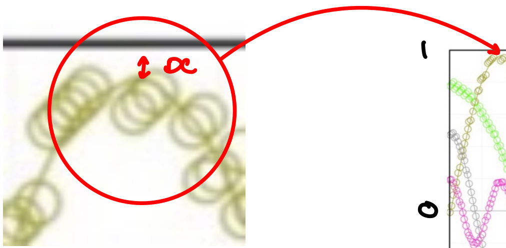
$$X = \frac{x}{339} = \frac{72}{339}$$

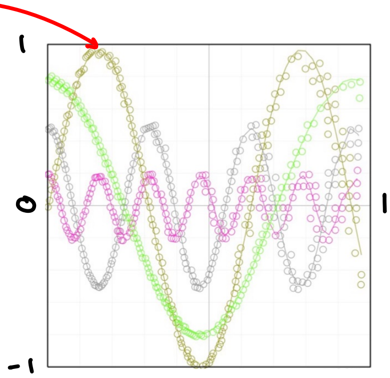


$$\xrightarrow[\frac{x}{339}]{y - \frac{315}{2}}$$



$$\downarrow \left(y - \frac{315}{2}\right) / \frac{315}{2}$$





$$DC = \frac{y_{max} + y_{min}}{2}$$