# BPM Status

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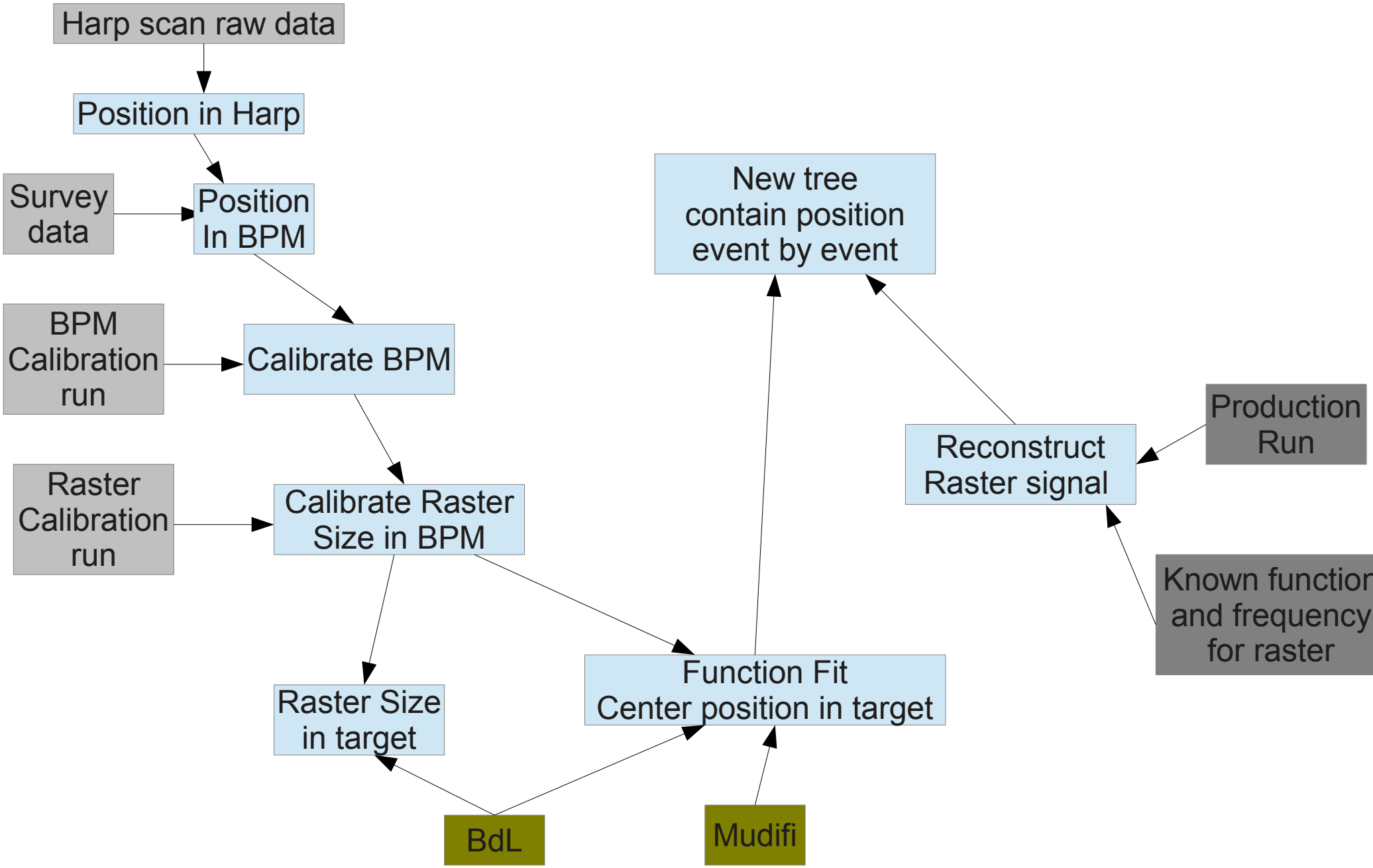
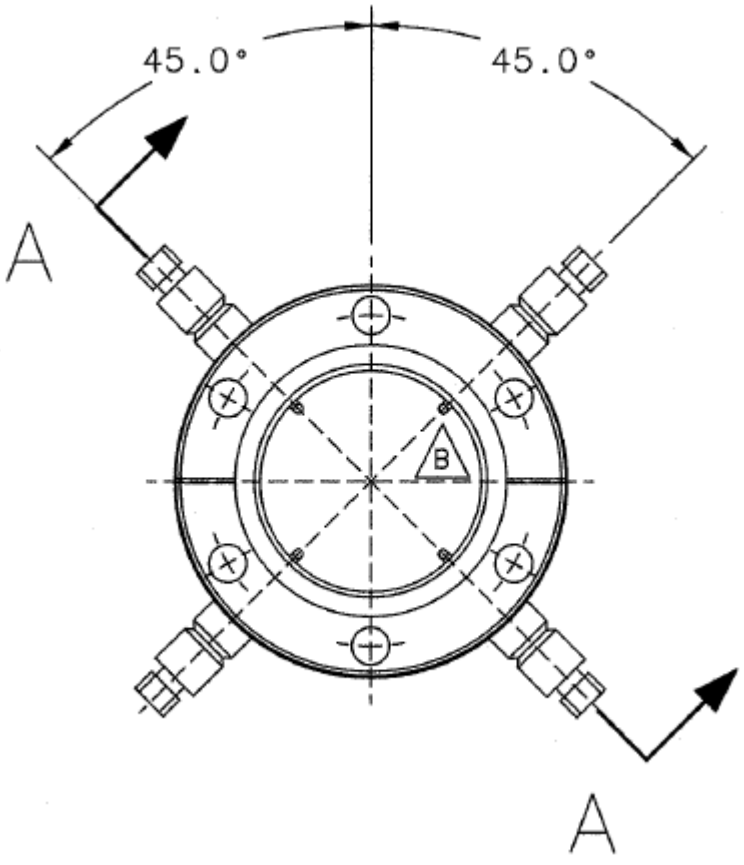
# BPM Calibration Procedures






*Signal for each antenna:*

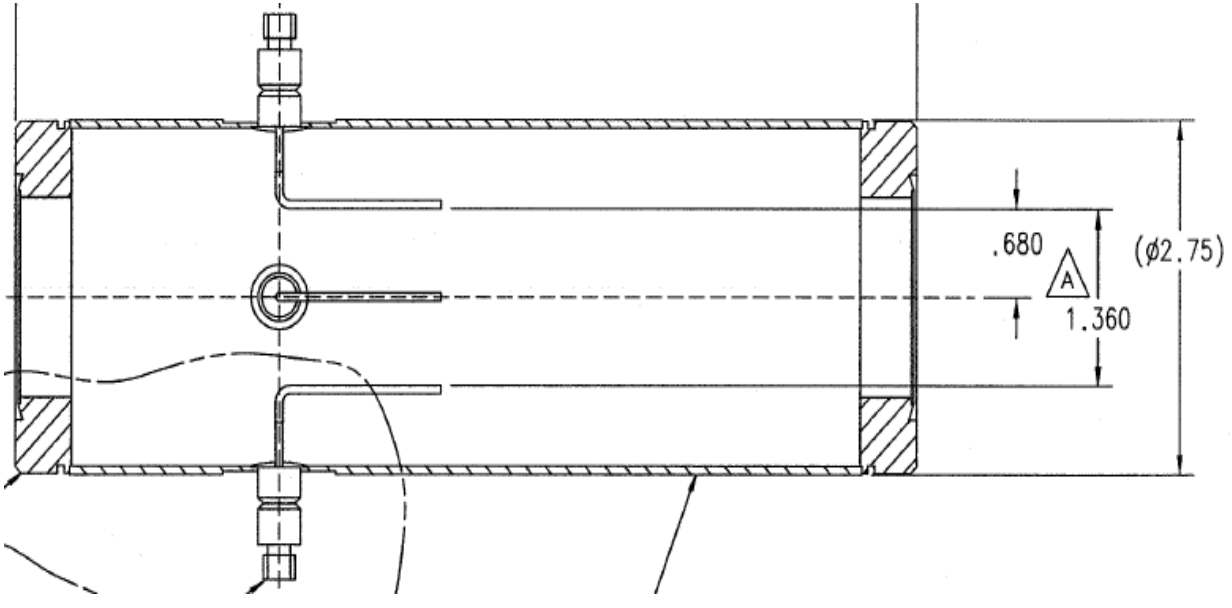
$$\varphi = \varphi_0 \frac{r^2 - \rho^2}{r^2 + \rho^2 - 2r\rho\cos(\theta - \theta_0)}$$

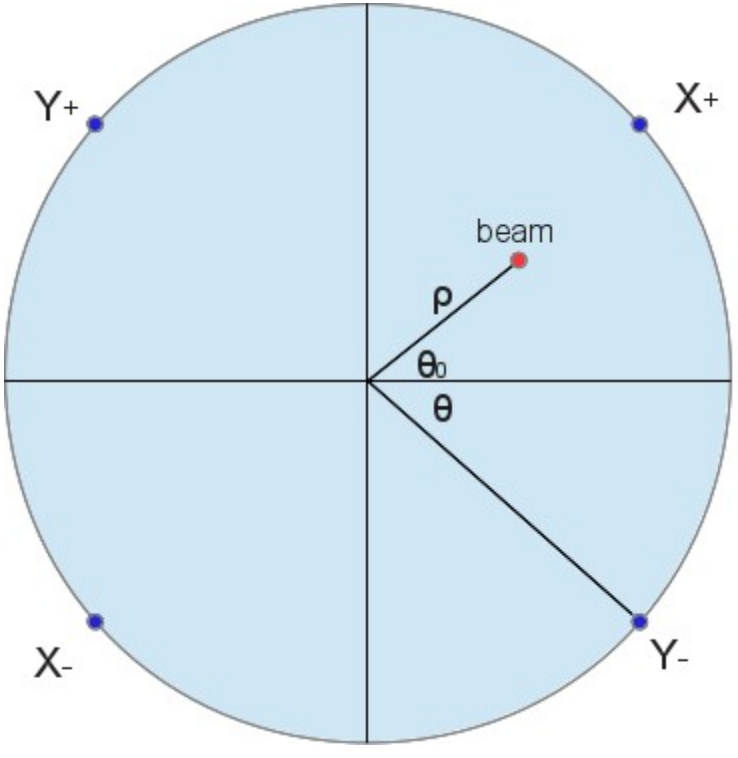
$\theta = \frac{\pi}{4} \quad \frac{3\pi}{4} \quad -\frac{3\pi}{4} \quad -\frac{\pi}{4}$ *angle for 4 antennas*

$r$: *BPM vacuum chamber radius*(17.3mm)

$\rho$: *radial position of beam*

$\theta_0$: *angle position of beam*



# Nonlinearity for the method before

*Signal for each antenna:*

$$\varphi=\varphi_0\frac{r^2-\rho^2}{r^2+\rho^2-2r\rho\cos(\theta-\theta_0)}$$

$\theta=\frac{\pi}{4}\quad\frac{3\pi}{4}\quad-\frac{3\pi}{4}\quad-\frac{\pi}{4}$ *angle for 4 antennas*

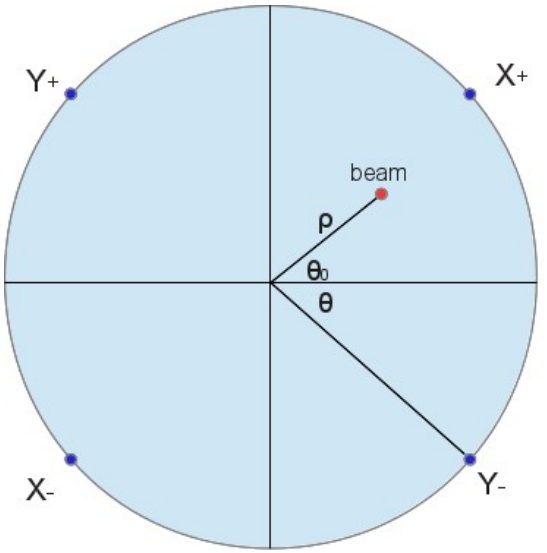
$r$: *BPM vacuum chamber radius*(17.3mm)

$\rho$: *radial position of beam*
$\theta_0$: *angle position of beam*

Diff/Sum: $$X_{BPM}=\frac{X_+-X_-}{X_++X_-}=a\frac{x}{1+\frac{x^2+y^2}{r^2}}$$

Diff/Sum2: $$X_{BPM}=\frac{(X_++Y_-)-(X_-+Y_+)}{(X_++Y_-)+(X_-+Y_+)}$$

log: $$X_{BPM}=lg\frac{X_+}{X_-}$$

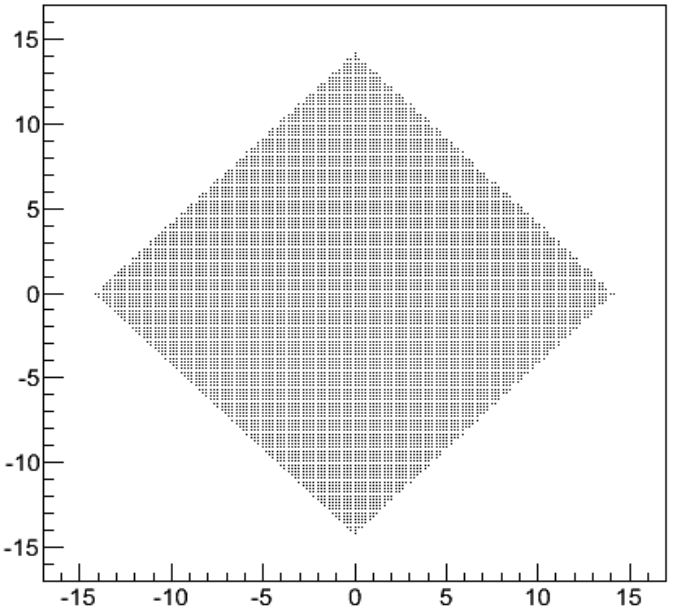


Nonlinearity for the method before

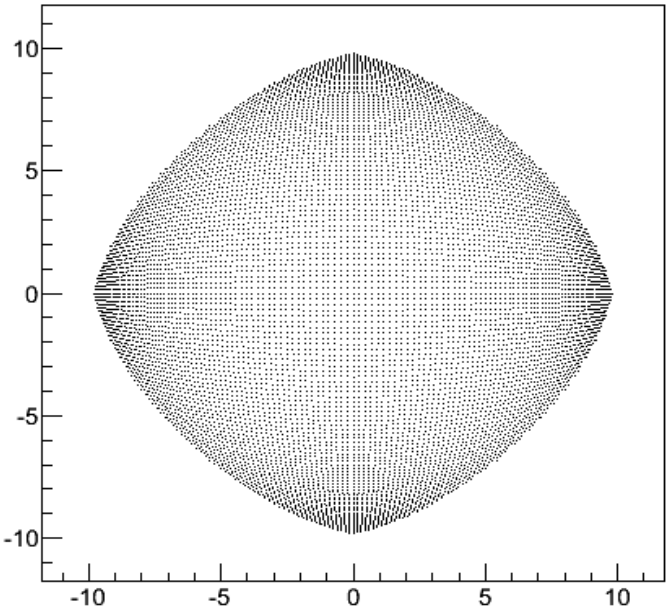
diamond

Center in (0,0)

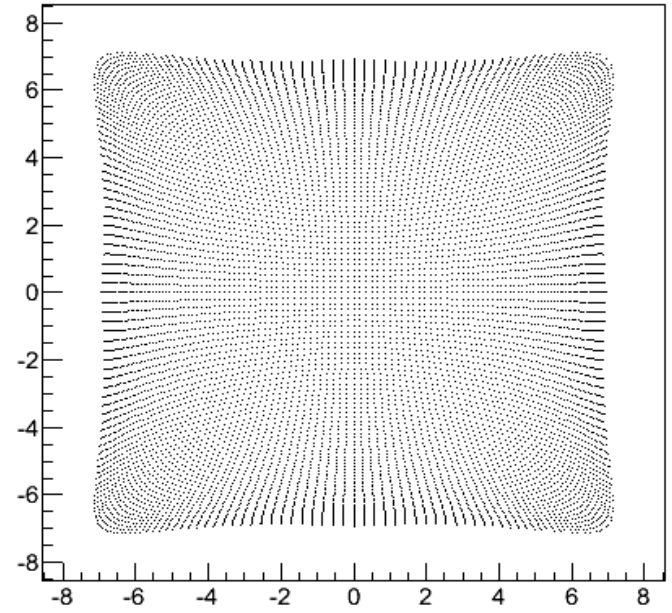
real position



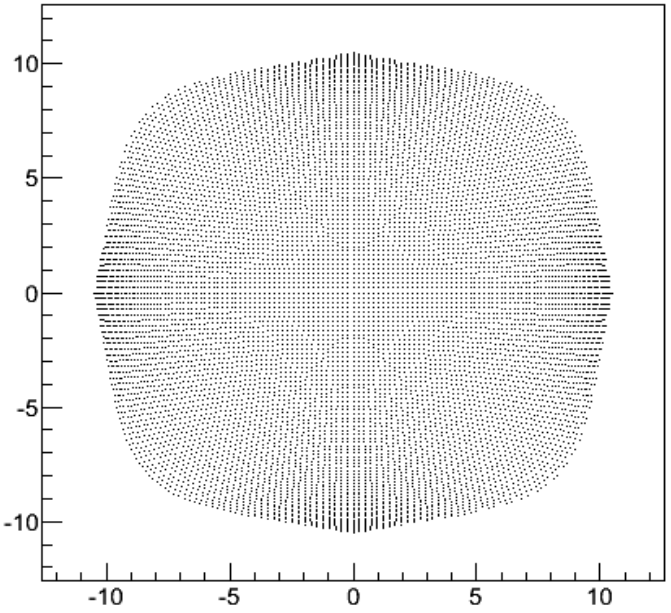

bpm feedback(method 1) $\frac{X_+ - X_-}{X_+ + X_-}$




bpm feedback(method 2) $\frac{(X_+ + Y_-) - (X_- + Y_+)}{(X_+ + Y_-) + (X_- + Y_+)}$




bpm feedback(method 3) $lg\frac{X_+}{X_-}$

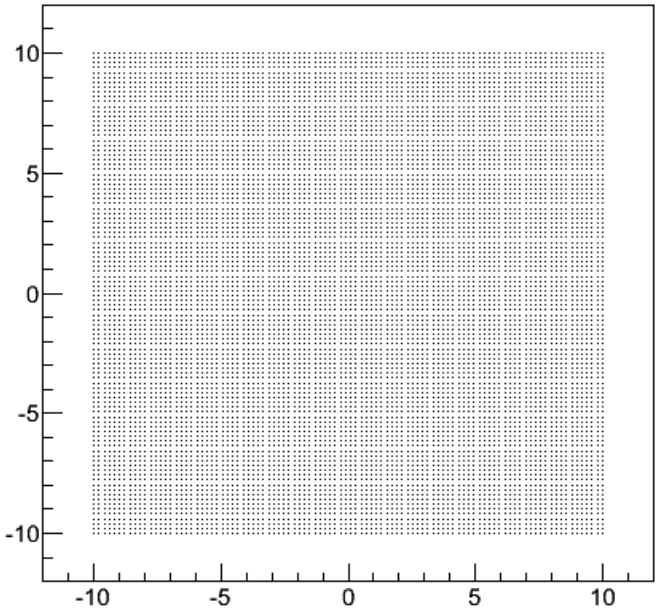


Nonlinearity for the method before

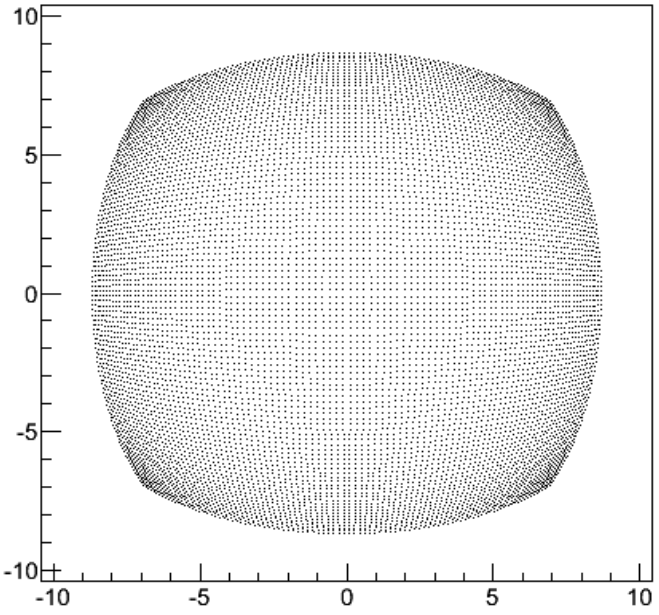
rectangle

Center in (0,0)

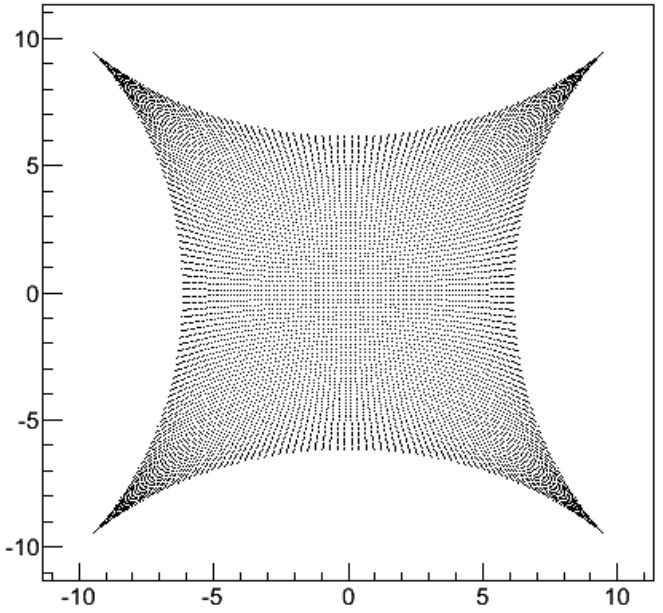
real position



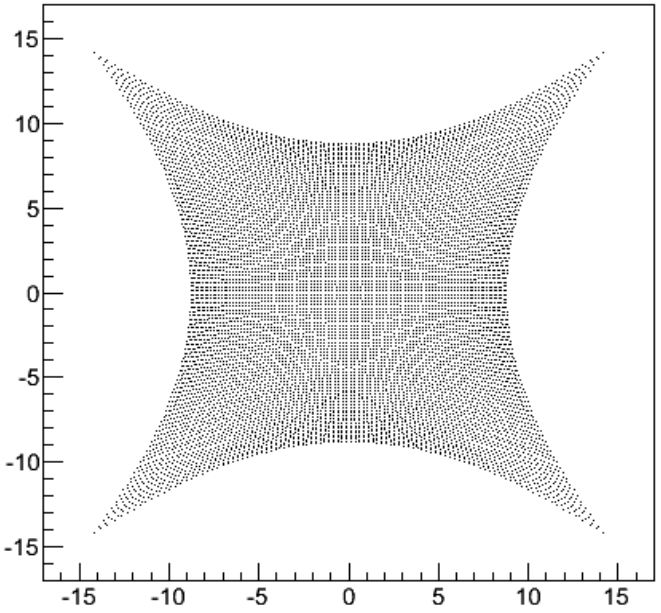

bpm feedback(method 1) $\frac{X_+ - X_-}{X_+ + X_-}$




bpm feedback(method 2) $\frac{(X_+ + Y_-) - (X_- + Y_+)}{(X_+ + Y_-) + (X_- + Y_+)}$




bpm feedback(method 3) $lg\frac{X_+}{X_-}$

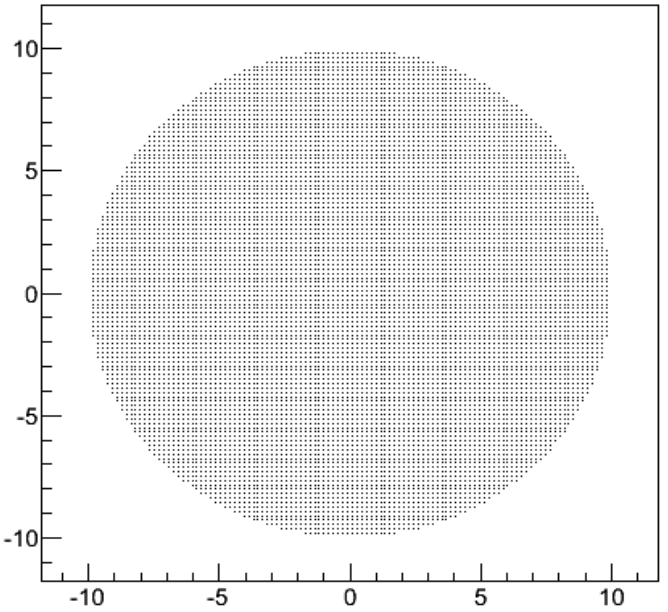


# Nonlinearity for the method before

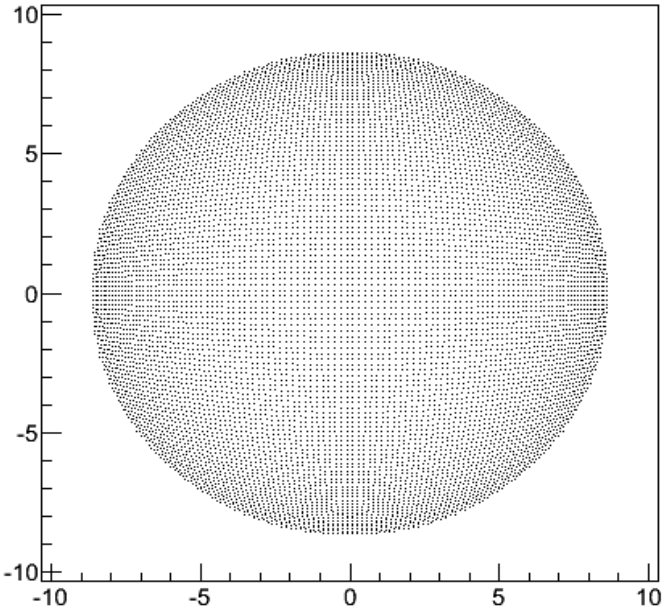
circle

Center in (0,0)

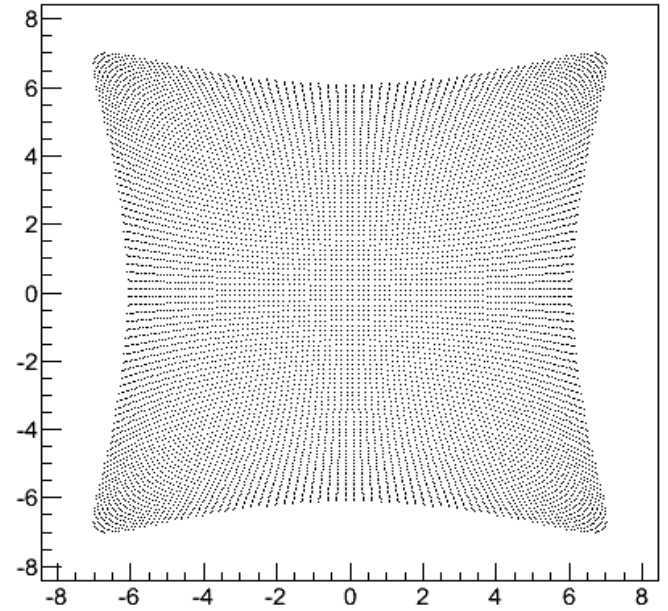
real position



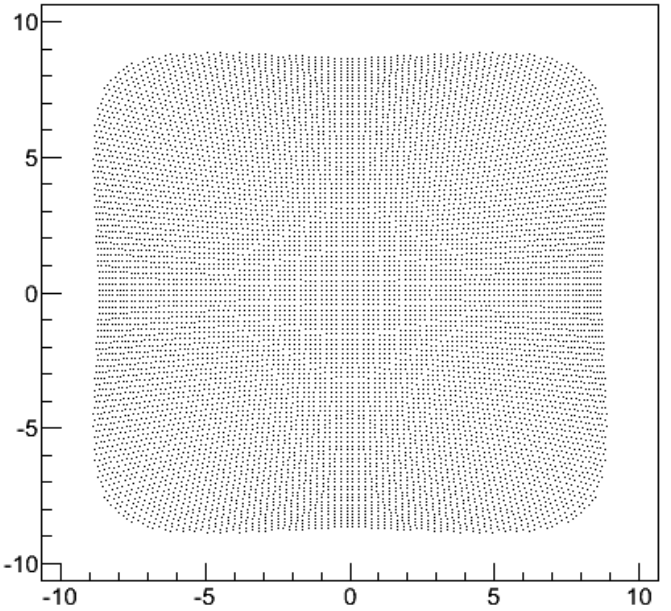

bpm feedback(method 1) $\frac{X_+ - X_-}{X_+ + X_-}$




bpm feedback(method 2) $\frac{(X_+ + Y_-) - (X_- + Y_+)}{(X_+ + Y_-) + (X_- + Y_+)}$




bpm feedback(method 3) $lg\frac{X_+}{X_-}$

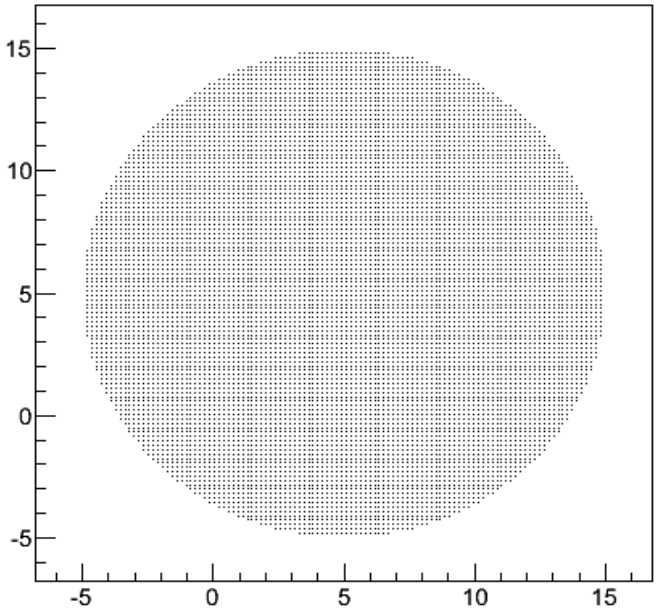


Nonlinearity for the method before

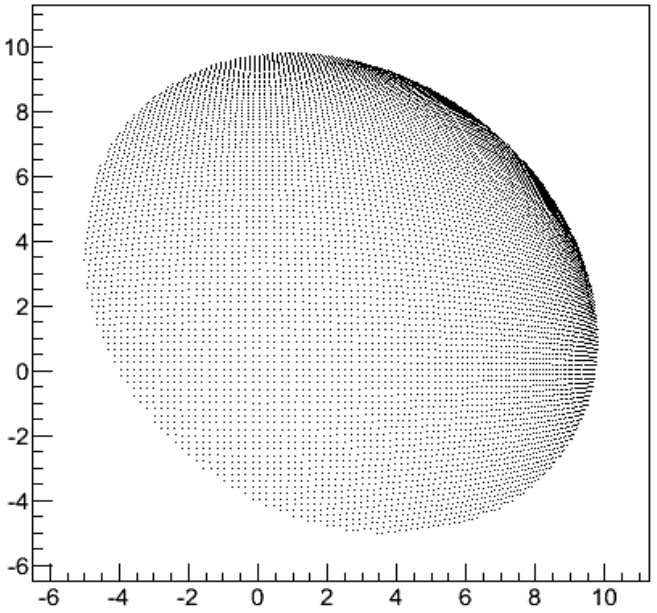
circle

Center in (5,5)

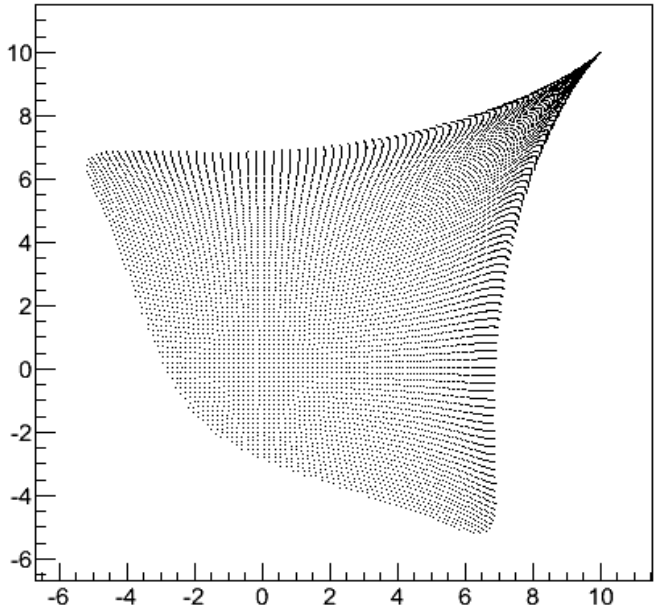
real position



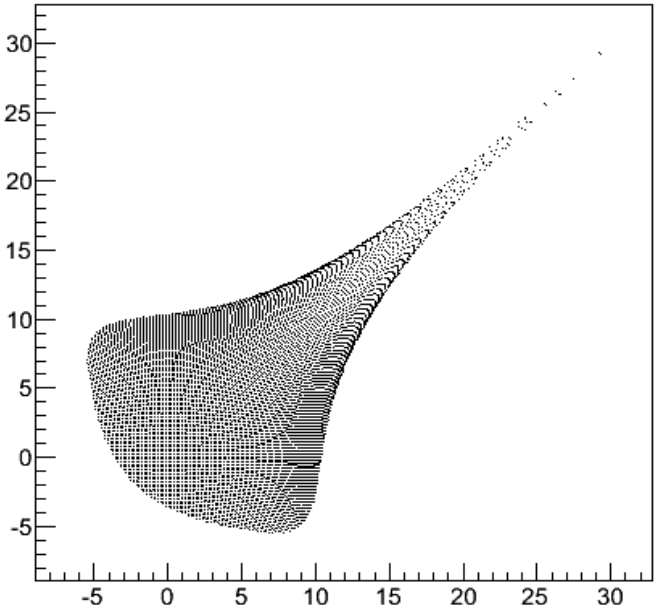

bpm feedback(method 1) $\frac{X_+ - X_-}{X_+ + X_-}$




bpm feedback(method 2) $\frac{(X_+ + Y_-) - (X_- + Y_+)}{(X_+ + Y_-) + (X_- + Y_+)}$




bpm feedback(method 3) $lg\frac{X_+}{X_-}$



# Nonlinearity Correction

1. correction between [x,y] and [x_bpm,y_bpm]
   ---- 11th order polynomial correction
2. minimization algorithm  %$^&#>#{}/?@