BPM status

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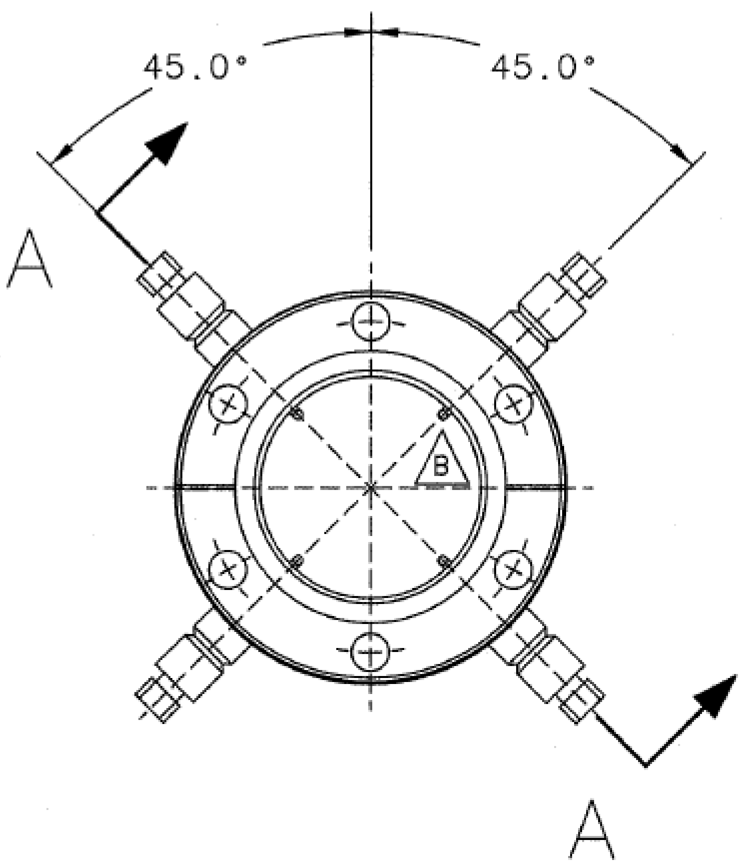


Signal for each antenna:

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

link1

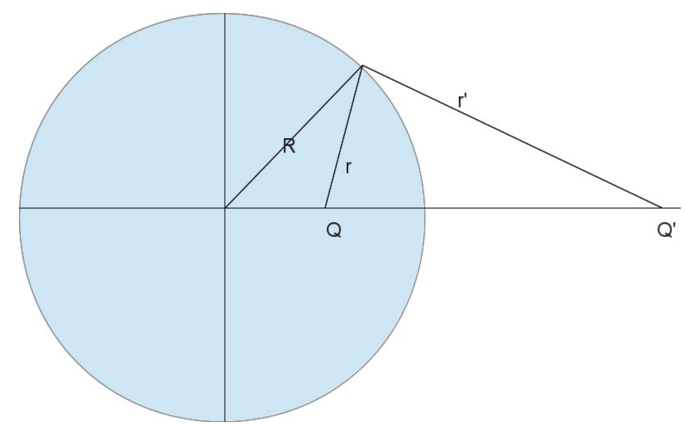
link2

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

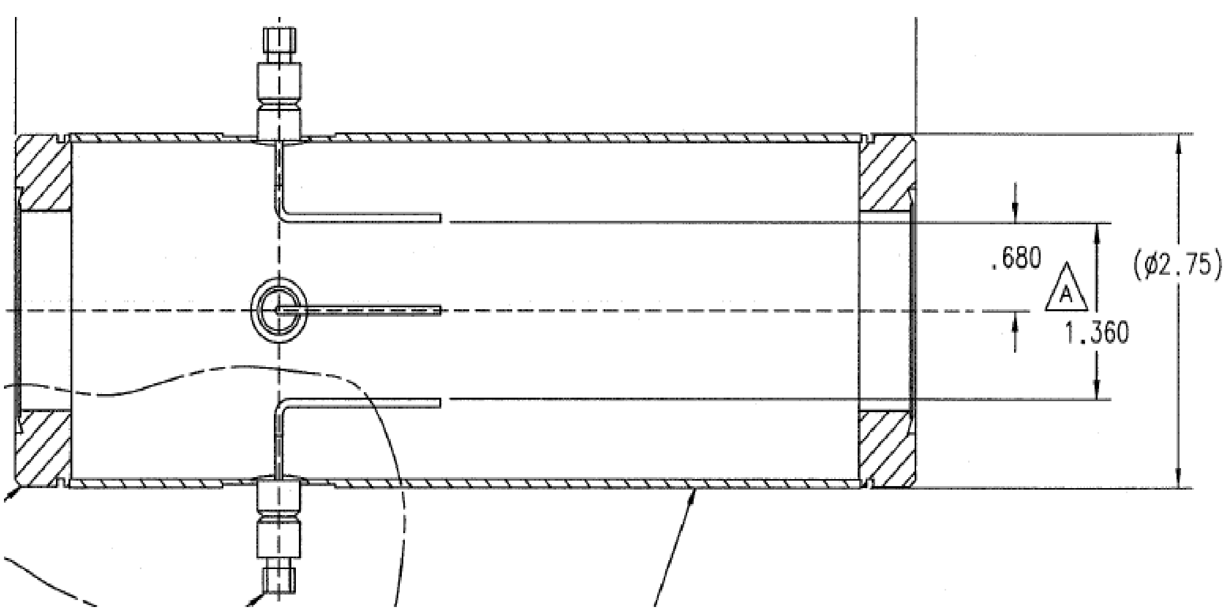
r: *BPM vacuum chamber radius*(17.3mm)

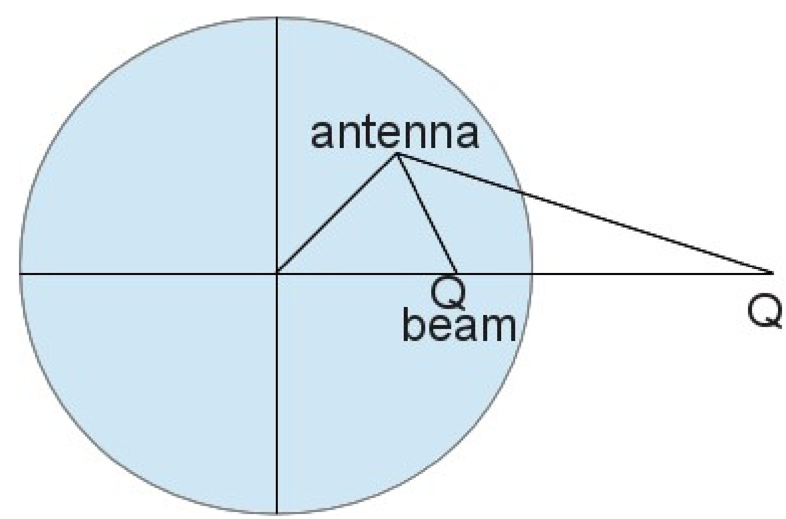
ρ: *radial position of beam*

θ_0: *angle position of beam*



Assume:
Infinite chamber
Antenna small enough





$$x_b = \frac{X_+ - X_-}{X_+ + X_-} = \frac{\frac{1}{r^2 + \rho^2 - 2r\rho\cos(\theta - \theta_0)} - \frac{1}{r^2 + \rho^2 - 2r\rho\cos(\theta - \theta_0 + \pi)}}{\frac{1}{r^2 + \rho^2 - 2r\rho\cos(\theta - \theta_0)} + \frac{1}{r^2 + \rho^2 - 2r\rho\cos(\theta - \theta_0 + \pi)}} = \frac{\rho\cos(\theta - \theta_0)}{1 + \frac{\rho^2}{r^2}} = \frac{x}{1 + \frac{x^2 + y^2}{r^2}} = x + \ldots$$

$$\frac{y_b}{x_b} = \tan(\theta - \theta_0)$$

$$\rho = r\left(\frac{1}{\sqrt{x_b^2 + y_b^2}} - \sqrt{\frac{1}{x_b^2 + y_b^2} - 1}\right)$$

$$x_b = \frac{(A_+ - A_{0+}) - g_x(A_- - A_{0-})}{(A_+ - A_{0+}) + g_x(A_- - A_{0-})}$$

$$\frac{B_+}{B_-}g_x - \frac{A_+}{A_-}g_y + \tan\left((\theta - \theta_0) - \frac{\pi}{4}\right)g_x g_y = \tan\left((\theta - \theta_0) - \frac{\pi}{4}\right)\frac{A_+ B_+}{A_- B_-}$$