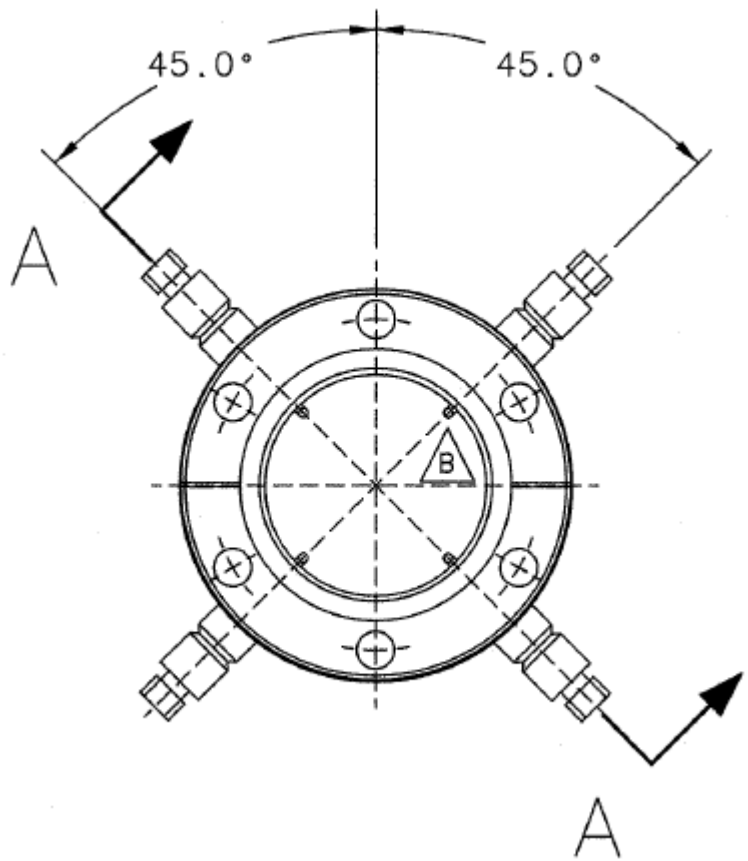


# Bpm status

Pengjia Zhu  
10/16/2012



Signal for each antenna:

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

link1

link2

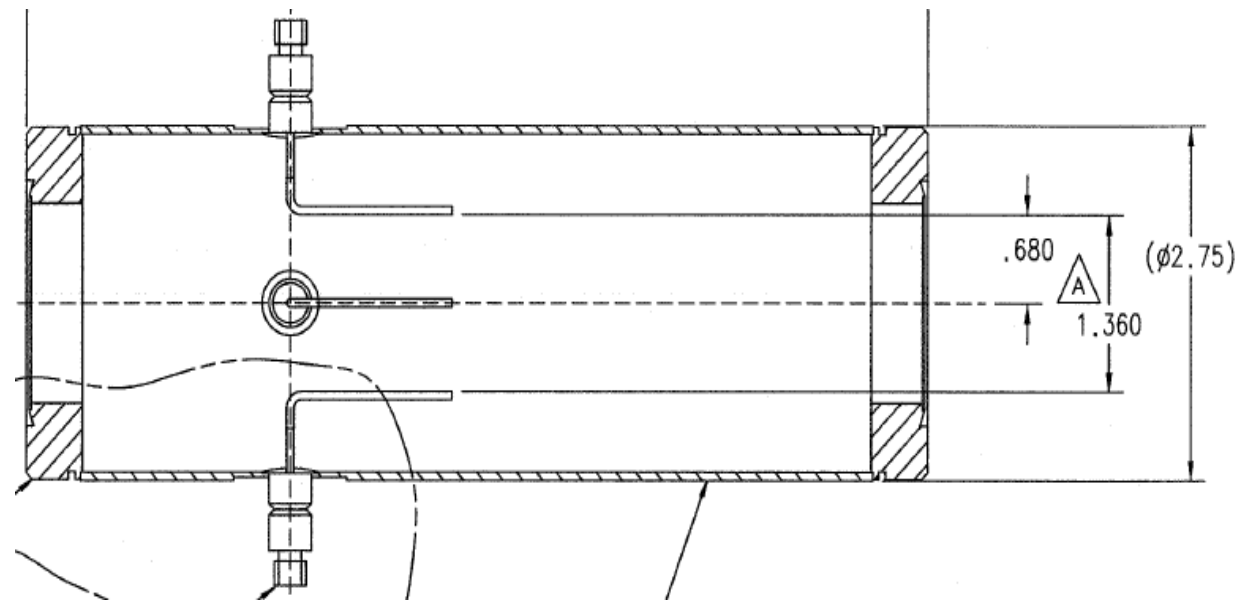
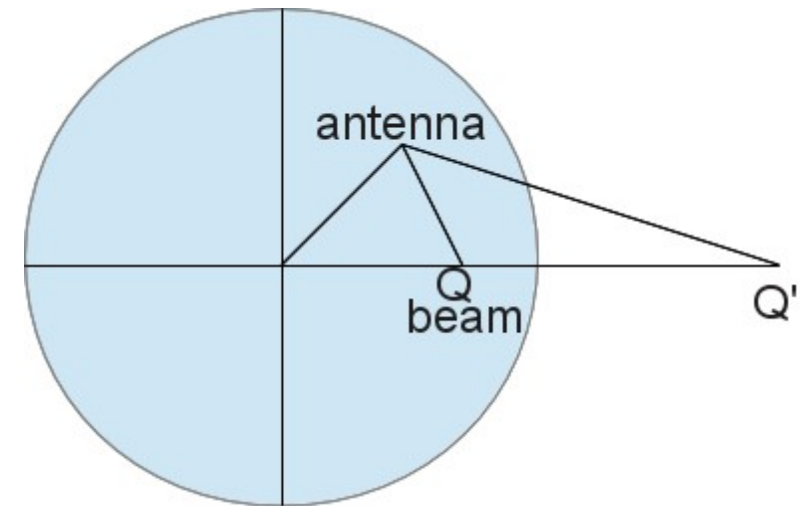
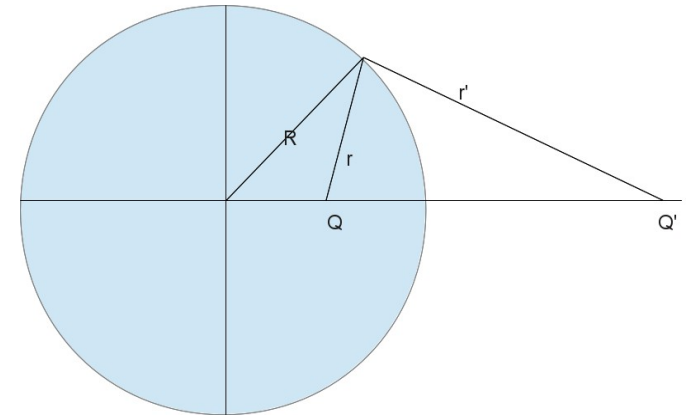
$$\theta = \frac{\pi}{4} \quad \frac{3\pi}{4} \quad \frac{5\pi}{4} \quad \frac{7\pi}{4} \quad \text{angle for 4 antennas}$$

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

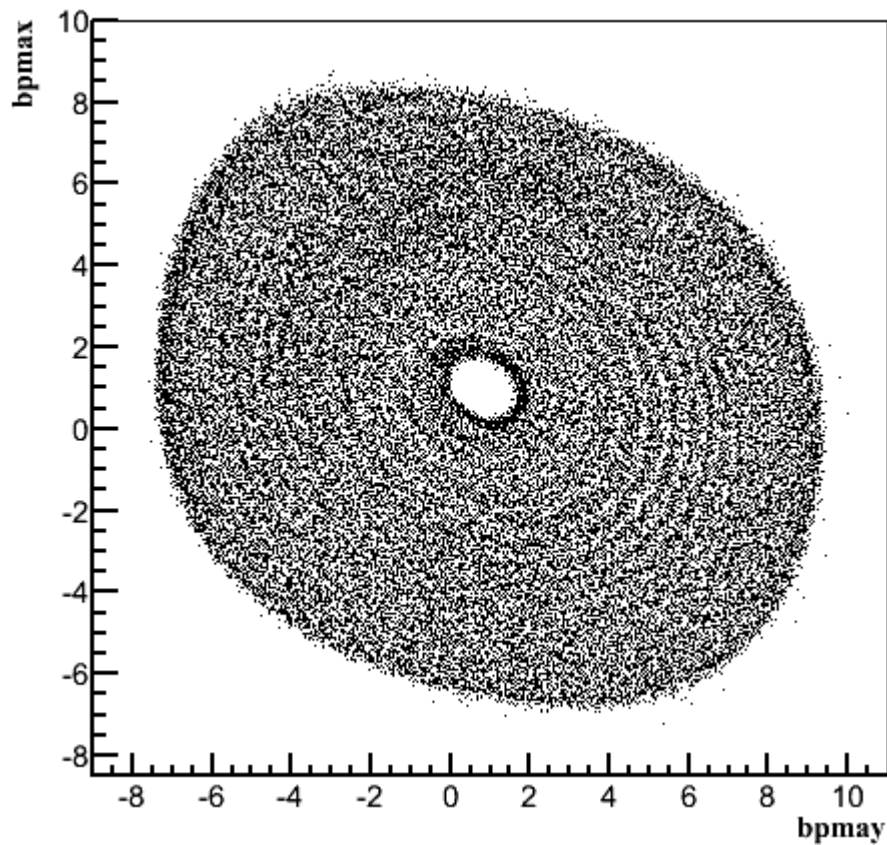
$\rho$ : radial position of beam

$\theta_0$ : angle position of beam

Assume:  
Infinite chamber  
Antenna small enough



bpmax:bpmax



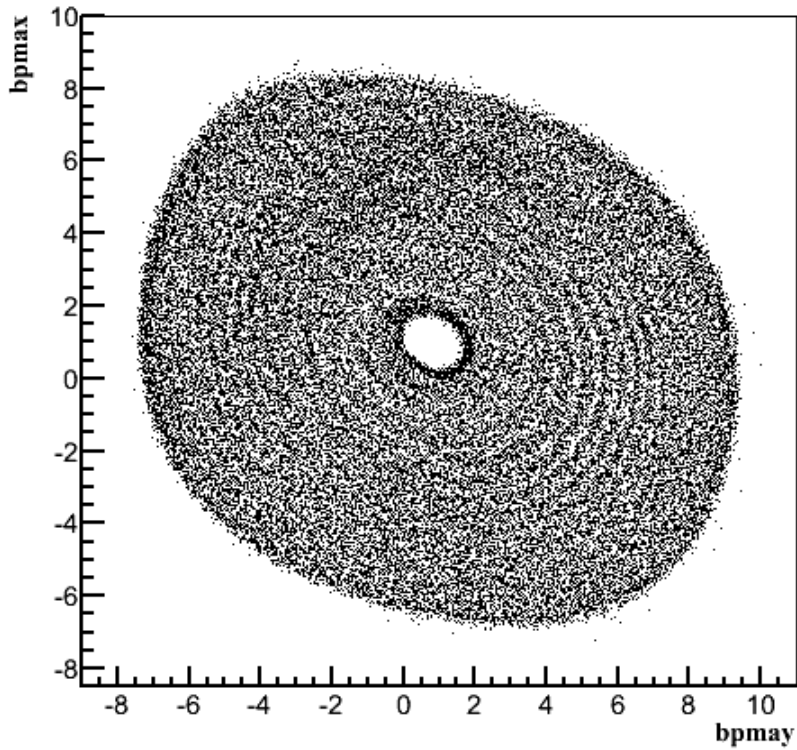
$g_x, g_y$  calculated by the middle point  
r: use diagram 34.925mm

$$x_b = \frac{A_+ - g_x A_-}{A_+ + g_x A_-}$$

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

$$\begin{bmatrix} x_{harp1} \\ x_{harp2} \\ x_{harp3} \end{bmatrix} = \begin{bmatrix} x_1 & y_1 & 1 \\ x_2 & y_2 & 1 \\ x_3 & y_3 & 1 \end{bmatrix} \begin{bmatrix} a \\ b \\ c \end{bmatrix}$$

**bpmax:bpmax**

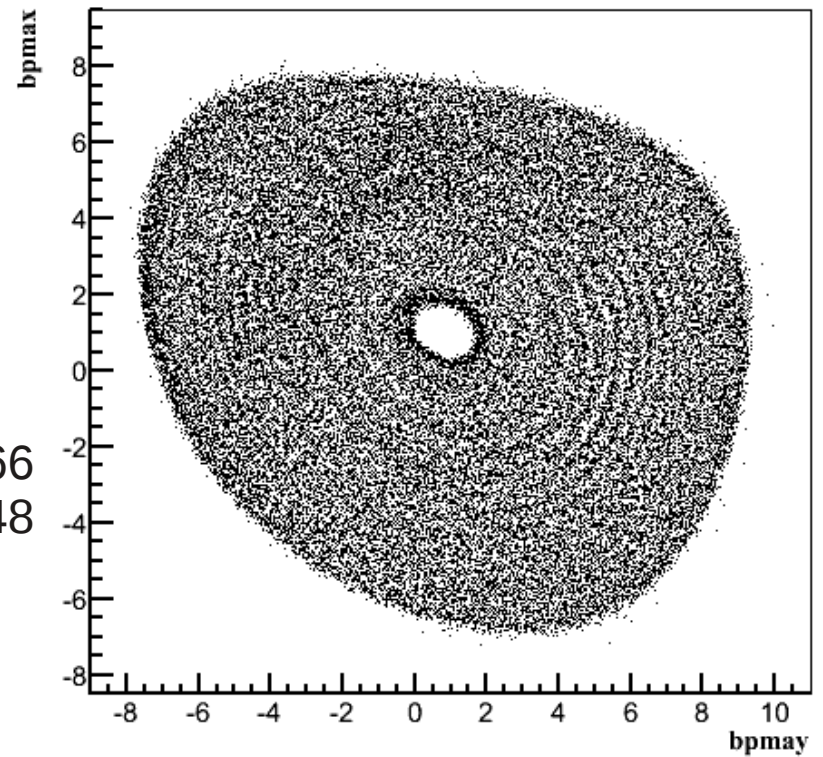


$gx=0.706871725914766$   
 $gy=0.943301248780548$

Wrong  $gx$  and  $gy$

$gx=1.706871725914766$   
 $gy=0.943301248780548$

**bpmax:bpmax**



BPM Calibration for 03/13/2012

$$x_b = \frac{A_+ - g_x A_-}{A_+ + g_x A_-}$$

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

gx=1.0722996581891833  
gy=1.0286356747205532

$$\begin{bmatrix} x_{harp1} \\ x_{harp2} \\ x_{harp3} \end{bmatrix} = \begin{bmatrix} x_1 & y_1 & 1 \\ x_2 & y_2 & 1 \\ x_3 & y_3 & 1 \end{bmatrix} \begin{bmatrix} a \\ b \\ c \end{bmatrix}$$

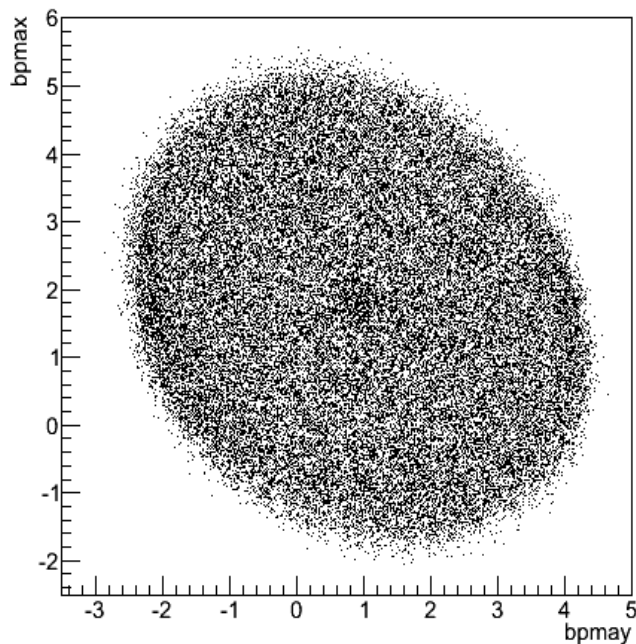
a,b,c for x:

[-1.147333113859084, 0.04495679676062258, -0.561120874072944]  
[2.3375917744715213, -3.340961788589443, -1.4319690925202109]  
[-1.0830033599181617, 0.09371430660045248, -0.5173635133599592]  
[-1.1506680754819096, 0.09782810458627977, -0.6944220877890226]

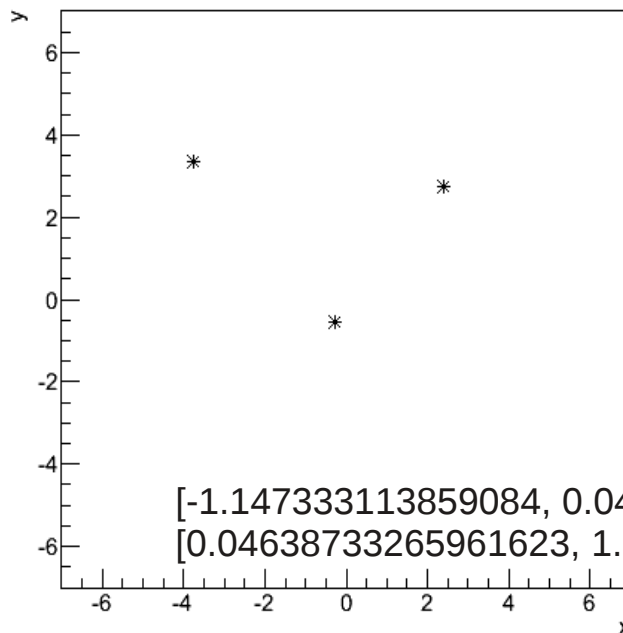
a,b,c for y:

[0.04638733265961623, 1.1596826433411371, 0.09867917502247106]  
[-3.458621046644308, 4.565114150066631, 0.9745460589775309]  
[-0.018313151232162445, 1.1106441458071312, 0.05466964228654306]  
[0.04974151354075996, 1.1065066401583377, 0.23274859861628952]

bpmax:bpmax {Entry\$<50000}

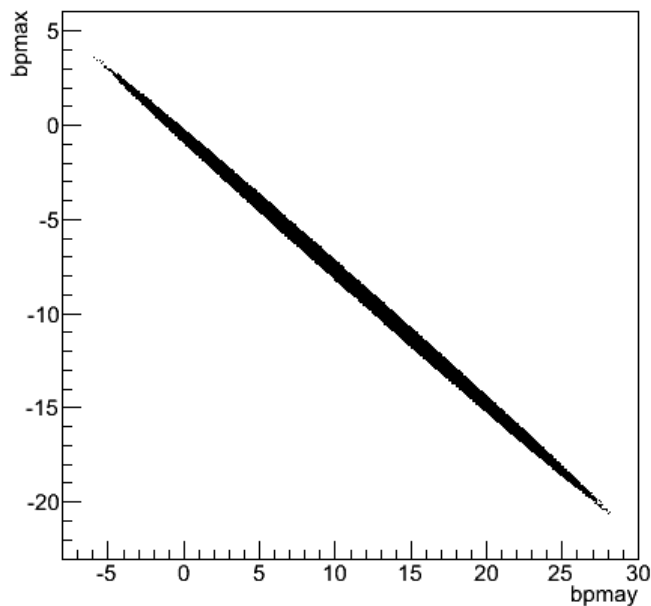


harp position

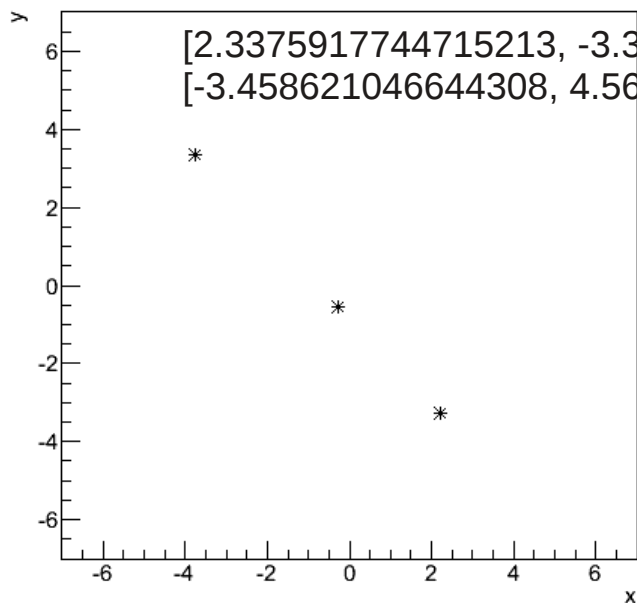


Small raster size

bpmax:bpmax {Entry\$<50000}

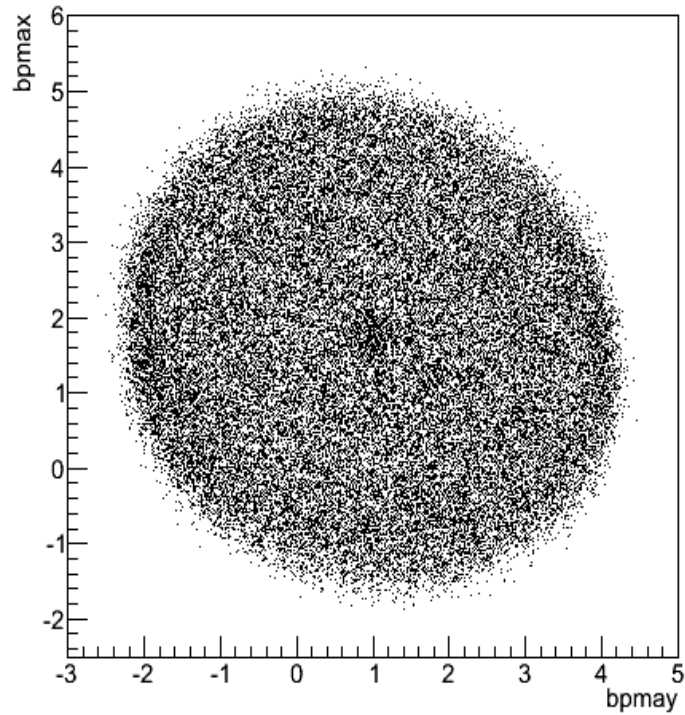


harp position

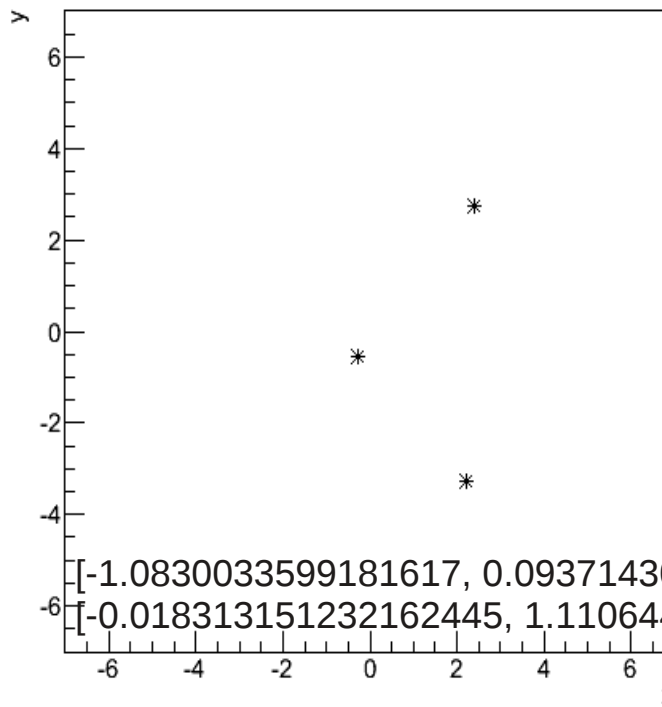




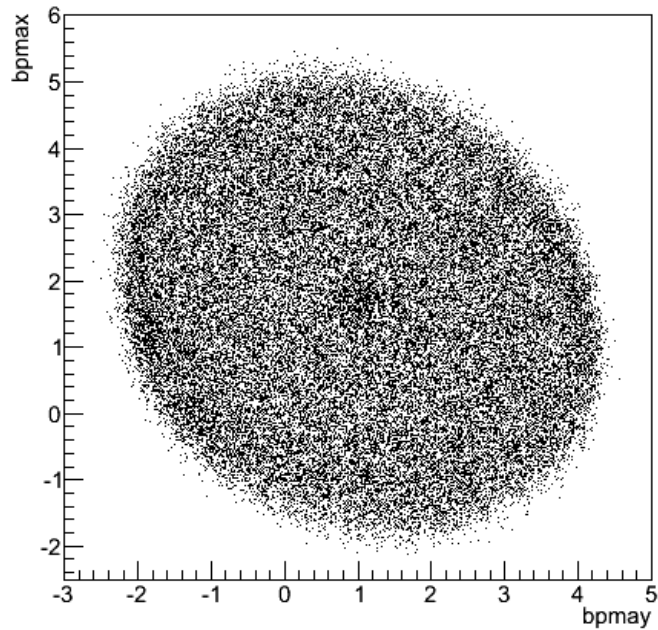
bpmax:bpmax {Entry\$<50000}



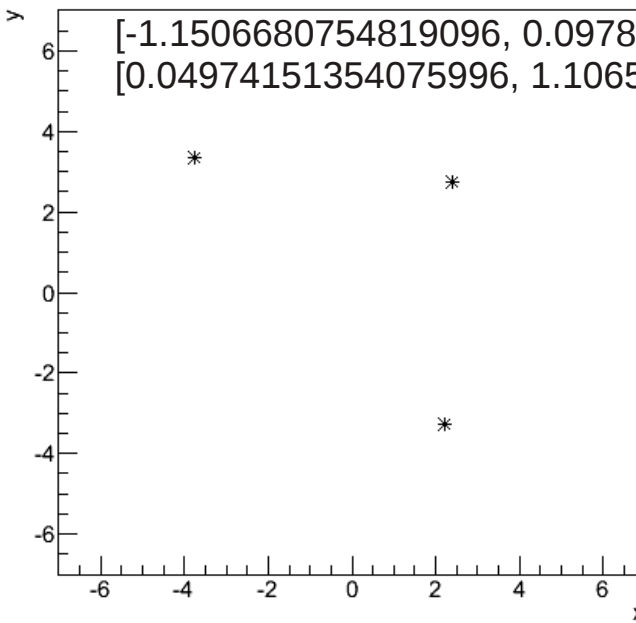
harp position



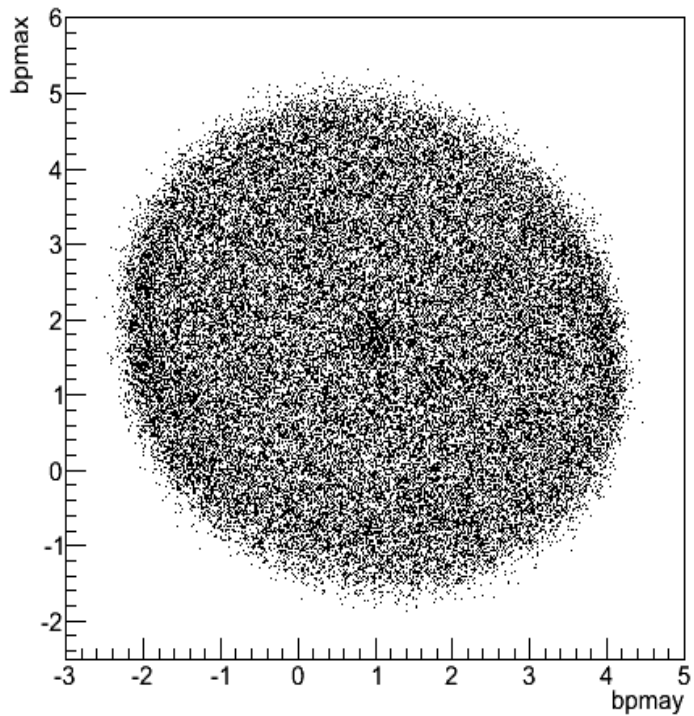
bpmax:bpmax {Entry\$<50000}



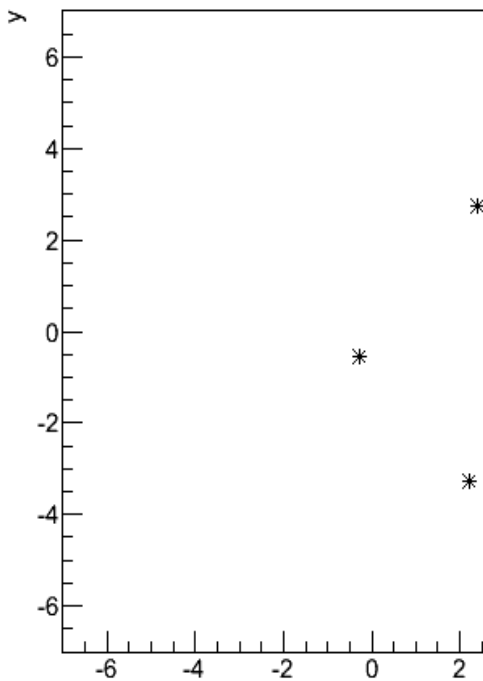
harp position



bpmax:bpmax {Entry\$<50000}

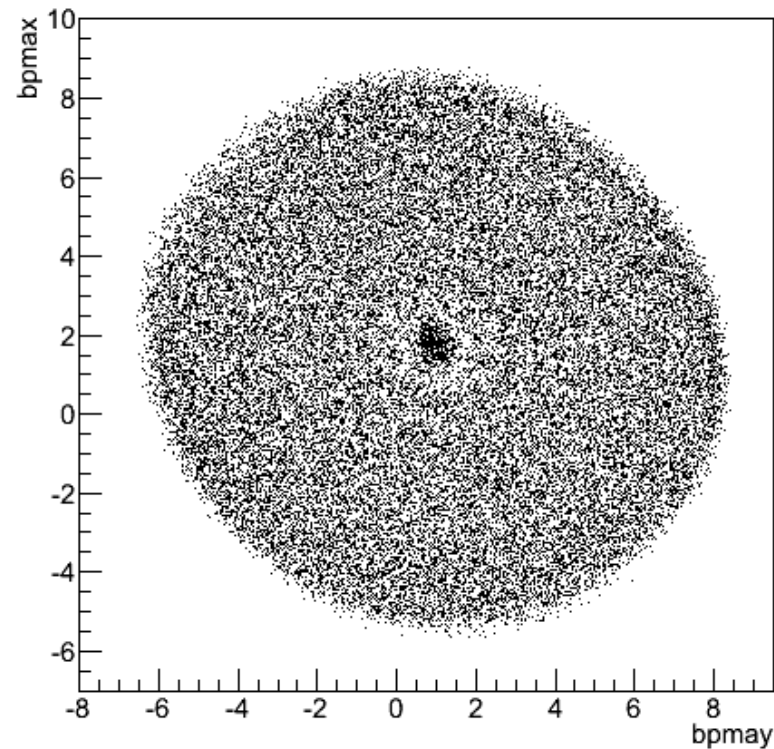


harp position

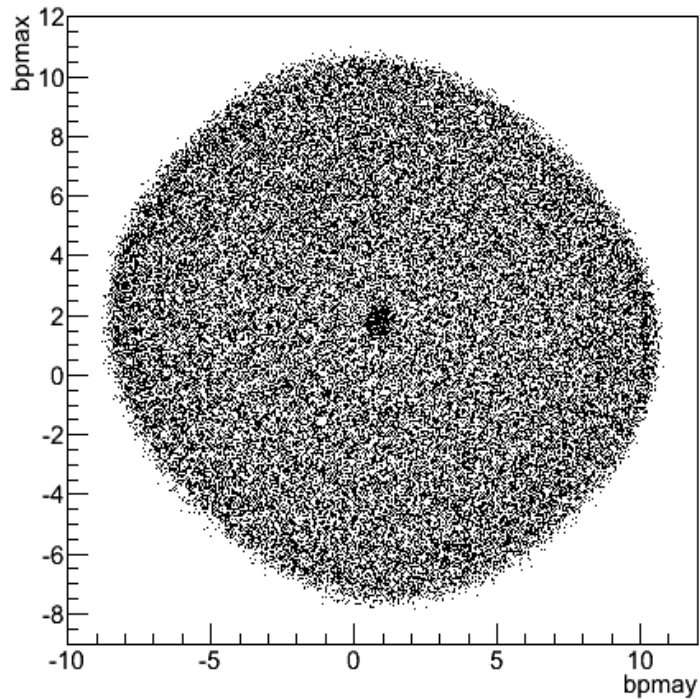


Small vs Big raster size

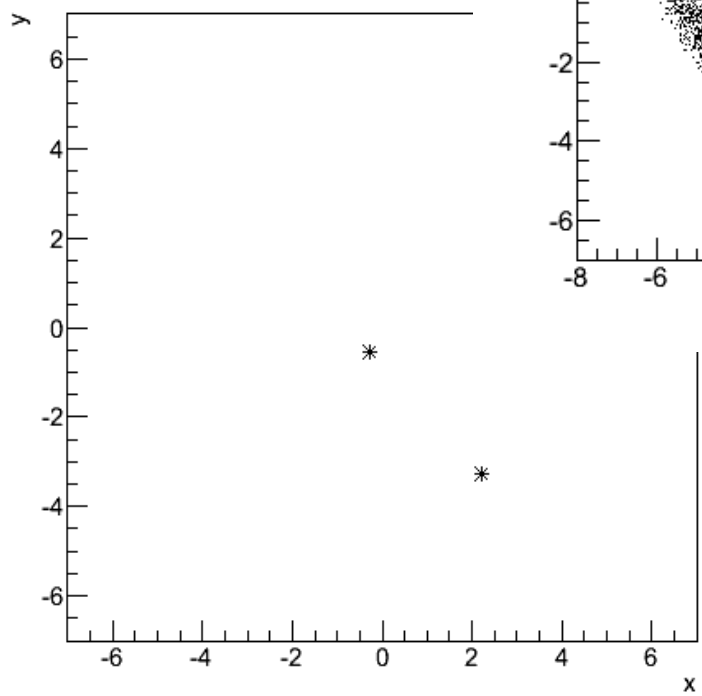
bpmax:bpmax {Entry\$<194000&&Entry\$>154000}



bpmax:bpmax {Entry\$<306000&&Entry\$>242000}

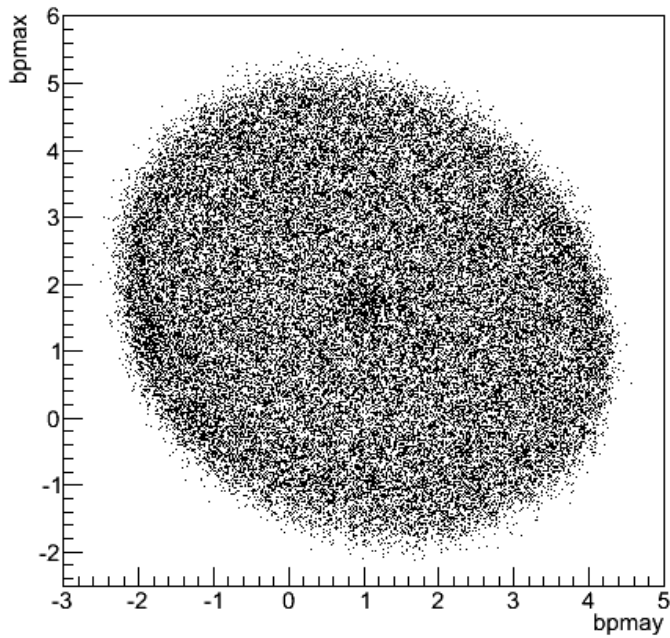


harp position

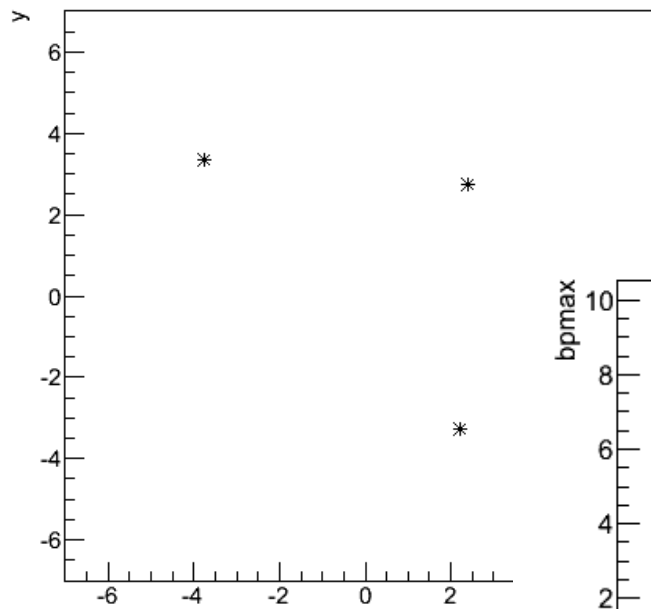




bpmax:bpmax {Entry\$<50000}

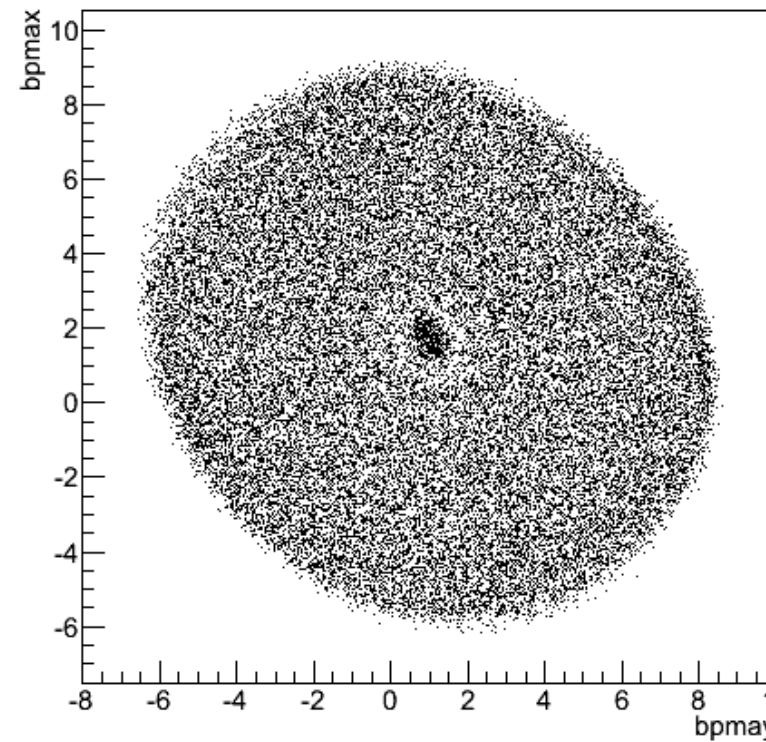


harp position

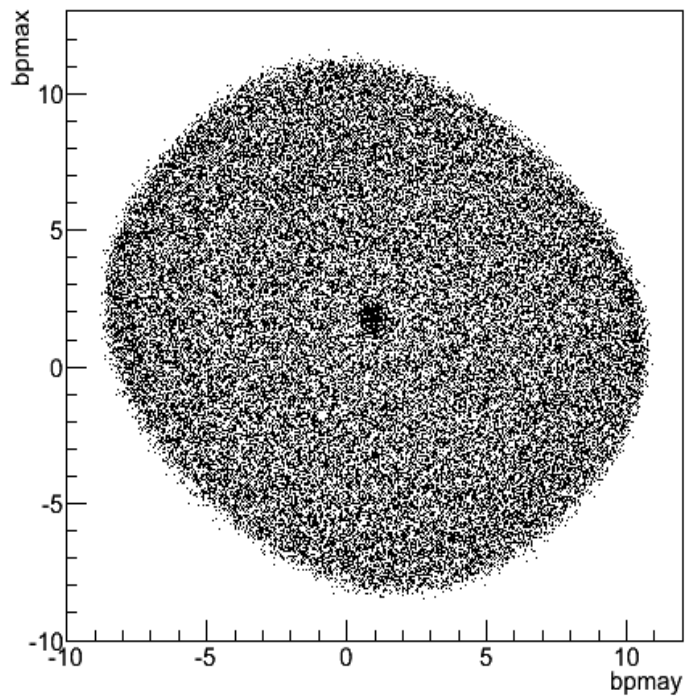


Small vs Big  
raster size

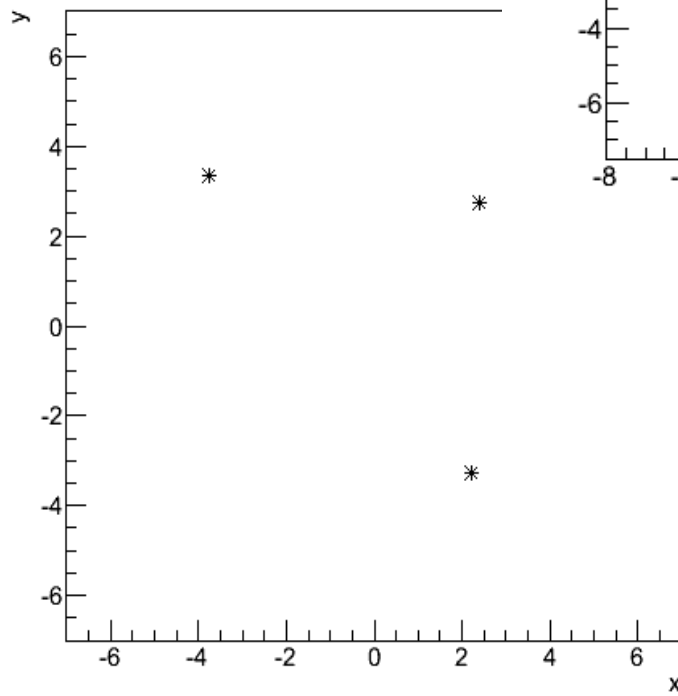
bpmax:bpmax {Entry\$<194000&&Entry\$>154000}



bpmax:bpmax {Entry\$<306000&&Entry\$>242000}



harp position



# BPM Calibration for 05/02/2012

$$x_b = \frac{A_+ - g_x A_-}{A_+ + g_x A_-}$$

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

gx=0.706871725914766  
gy=0.943301248780548

$$\begin{bmatrix} x_{harp1} \\ x_{harp2} \\ x_{harp3} \end{bmatrix} = \begin{bmatrix} x_1 & y_1 & 1 \\ x_2 & y_2 & 1 \\ x_3 & y_3 & 1 \end{bmatrix} \begin{bmatrix} a \\ b \\ c \end{bmatrix}$$

a,b,c for x:

- [-0.8836071547432574, 0.027475649699942196, 2.378199575524587]
- [-0.953883263412405, -0.0534116988064567, 2.477566771392979]
- [-0.8933019198145792, 0.01631703753626187, 2.391907528881472]
- [-0.8964554964606897, 0.03518124888462045, 2.3934623657328653]
- [-0.9044448464377722, 0.03997274104940246, 2.4029530669675068]
- [-0.8997753650399172, 0.030059737828339053, 2.3983243965682344]
- [-0.8963227524577644, 0.02642088446833493, 2.335991773890567]
- [-0.8938115736439096, 0.026629188015102636, 2.3443273110491383]
- [-0.893963028194142, 0.029693664376936112, 2.330187830332943]
- [-0.8963746457601725, 0.029845553228061924, 2.358458617863342]

a,b,c for y:

- [0.027929493875117346, 1.0467616938492135, -0.04154897030552011]
- [0.22740720451858917, 1.2763592541814164, -0.3236013081520293]
- [0.04017692330459777, 1.0608584062502064, -0.05886627403861338]
- [0.06439932465963778, 1.0248894628221328, -0.08487217795653822]
- [0.05425382010936245, 1.0309740761761408, -0.07282013957574907]
- [0.06018349460168744, 1.0183857655407722, -0.07869798905439845]
- [0.06402253274120898, 1.0497556295928372, 0.07825725973044216]
- [0.04082077070701214, 1.047831031752047, 0.0012419757079028004]
- [0.04222011846118255, 1.019517137530574, 0.13188216152594087]
- [0.06450199523388278, 1.0181137771007933, -0.12932268823655146]

Picture will post later

# Solution

Will try to use Tminuit Fit later – to combine several calibration constants