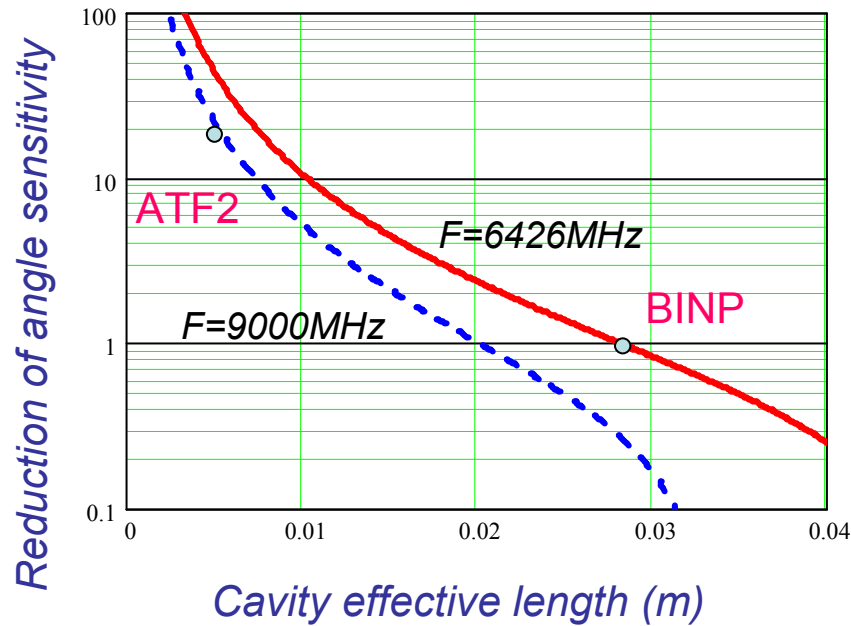


BPM for ATF2 FF

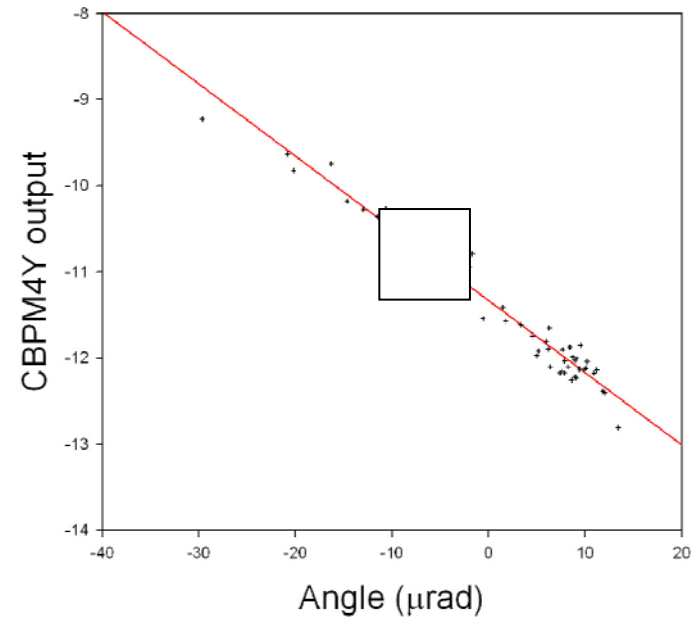
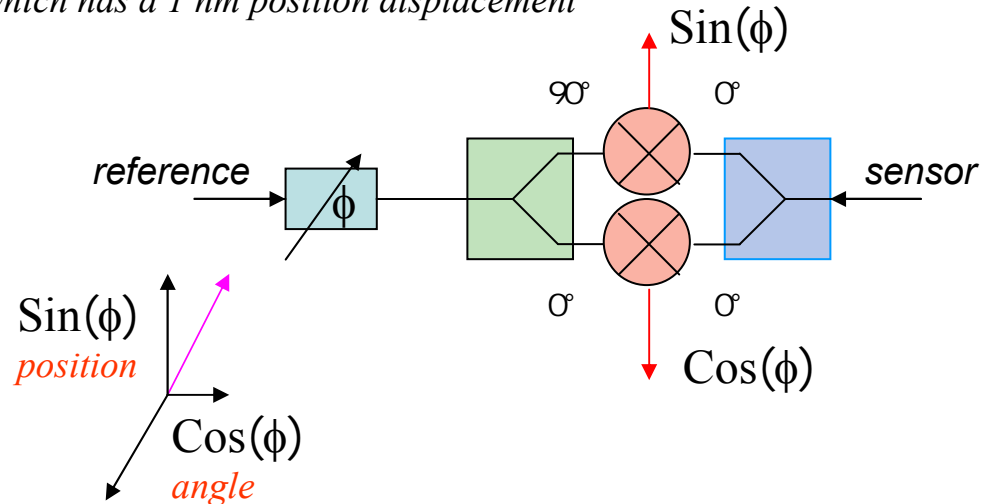
Vladimir Vogel
KEK

March 24, 2005
ATF2 meeting

The purpose of the bunch length shorting in ATF DR is to increase the sensitiveness to the beam offset, which will be worse when we will do shorter the sensor cavity length to reduce the beam angle sensitivity.

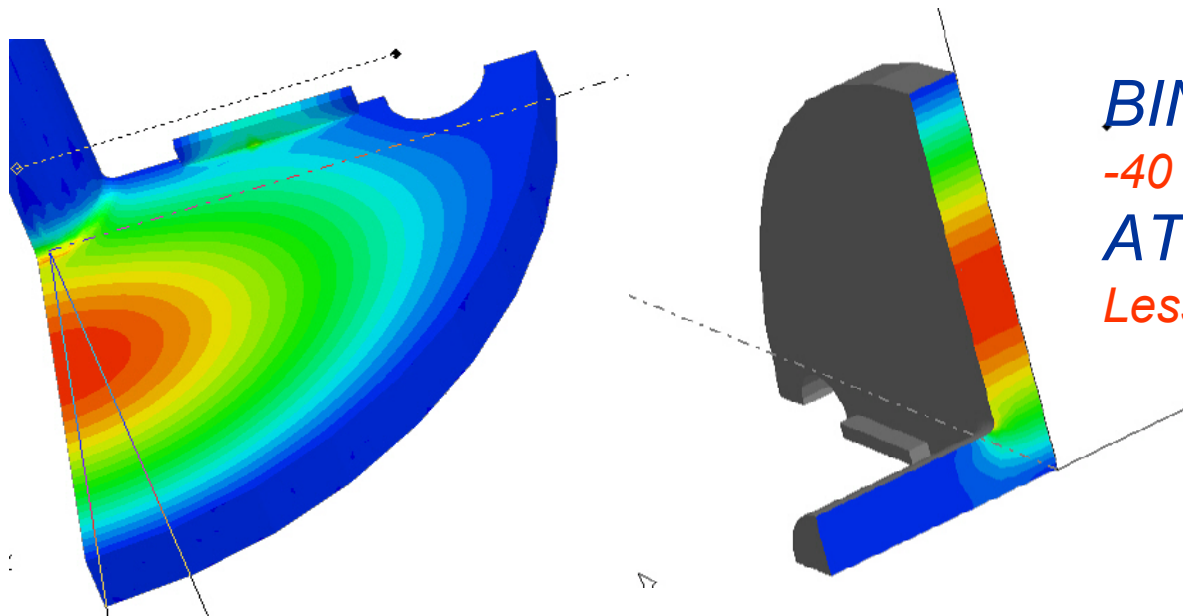


Reduction of the angle sensitivity, in the assuming that the signal proportional to the beam angle is equal to the signal from beam which has a 1 nm position displacement



Beam angle measurement in ATF extraction line. BINP cavity#4, 2001

The beam angle signal has phase difference 90 degree to the signal of the beam offset, **We can use this fact!** If Sin(phi) and Cos(phi) outputs will give us only 20db isolation, we can get enough reduction of the angle sensitiveness.



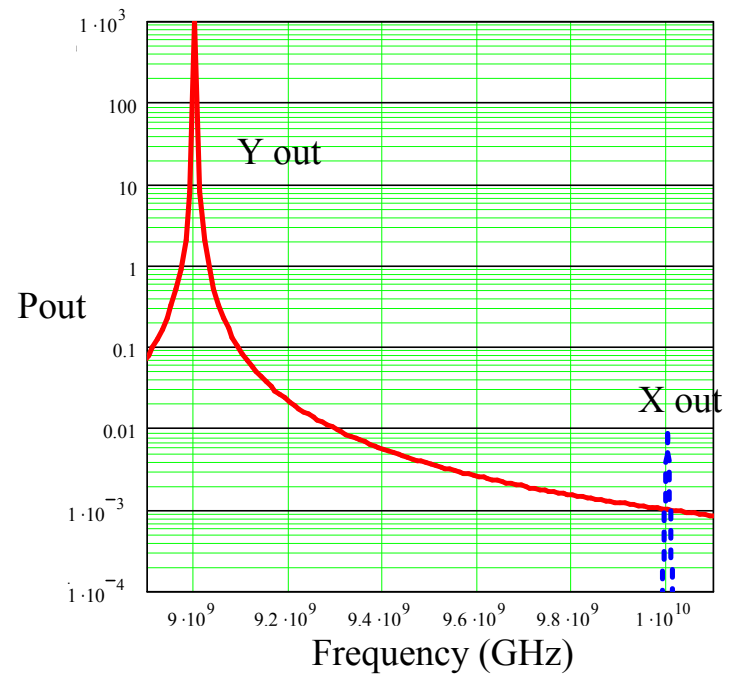
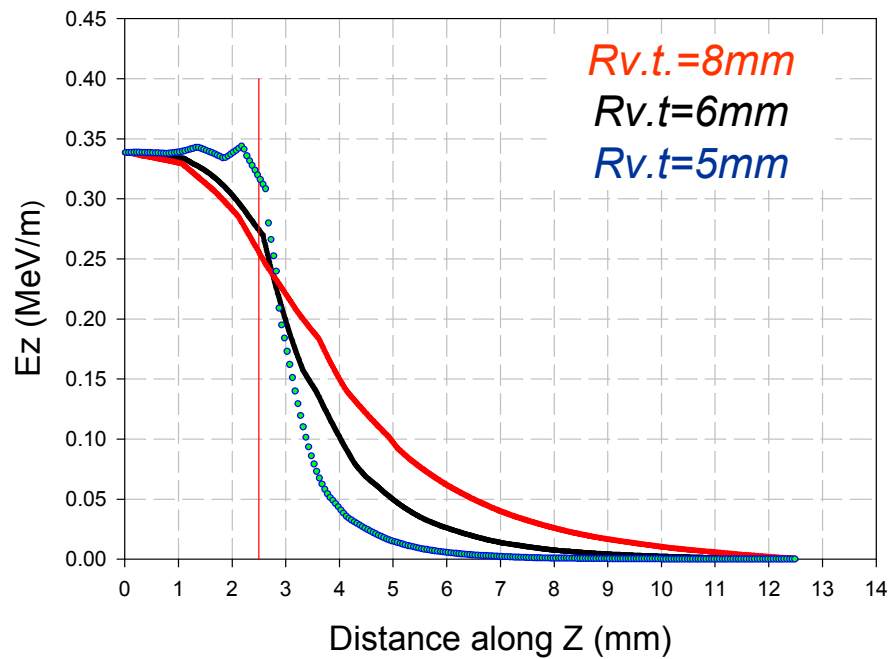
BINP BPM's X – Y coupling

-40 ~ -50 db

ATF2 FF BPM's X-Y coupling

Less than -80db (expected)

Electric field in the sensor cavity

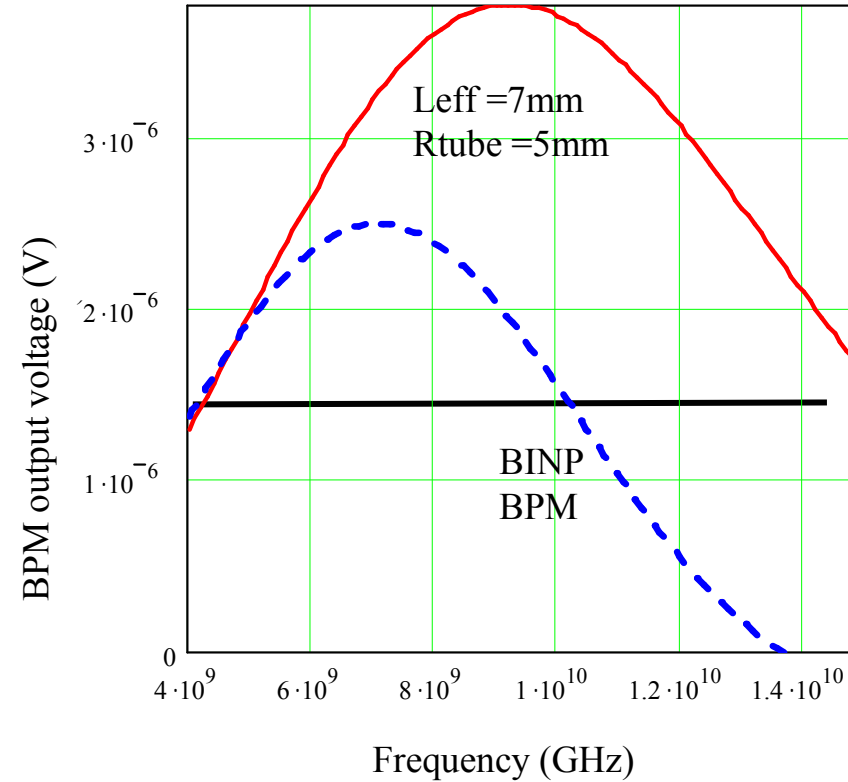


$Q=1 \cdot 10^{10}$,
 $Z_{load}=50 \text{ Ohm}$,
 $\delta=1 \cdot 10^{-9} \text{ m}$,

$\sigma_z = 8 \text{ mm}$

Thermal noise
 ($dF=3 \text{ MHz}$, $T = 300\text{K}$)
 $1.57 \mu\text{V}$

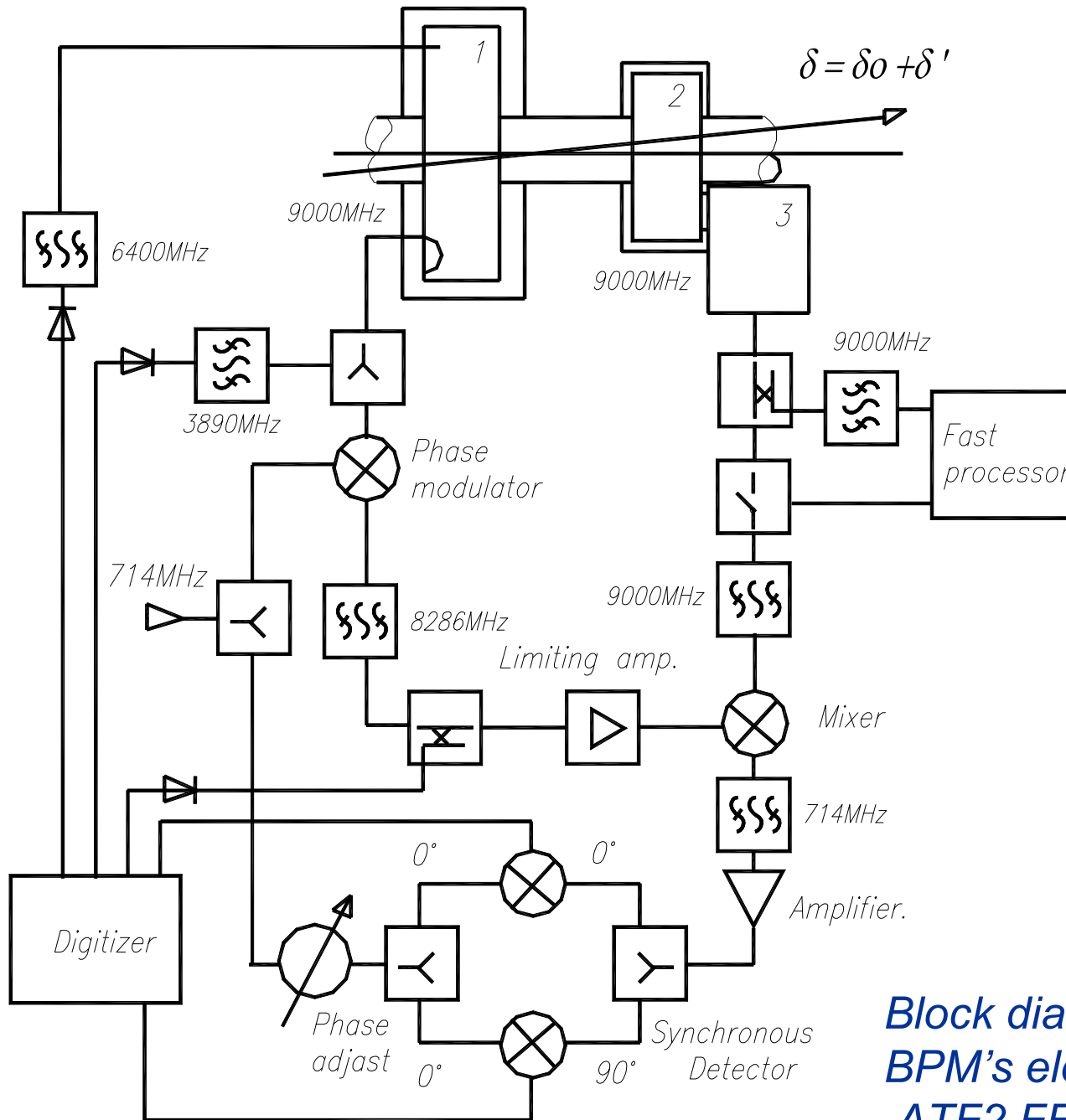
$Q_{load}=1500$
 $\beta = 20$



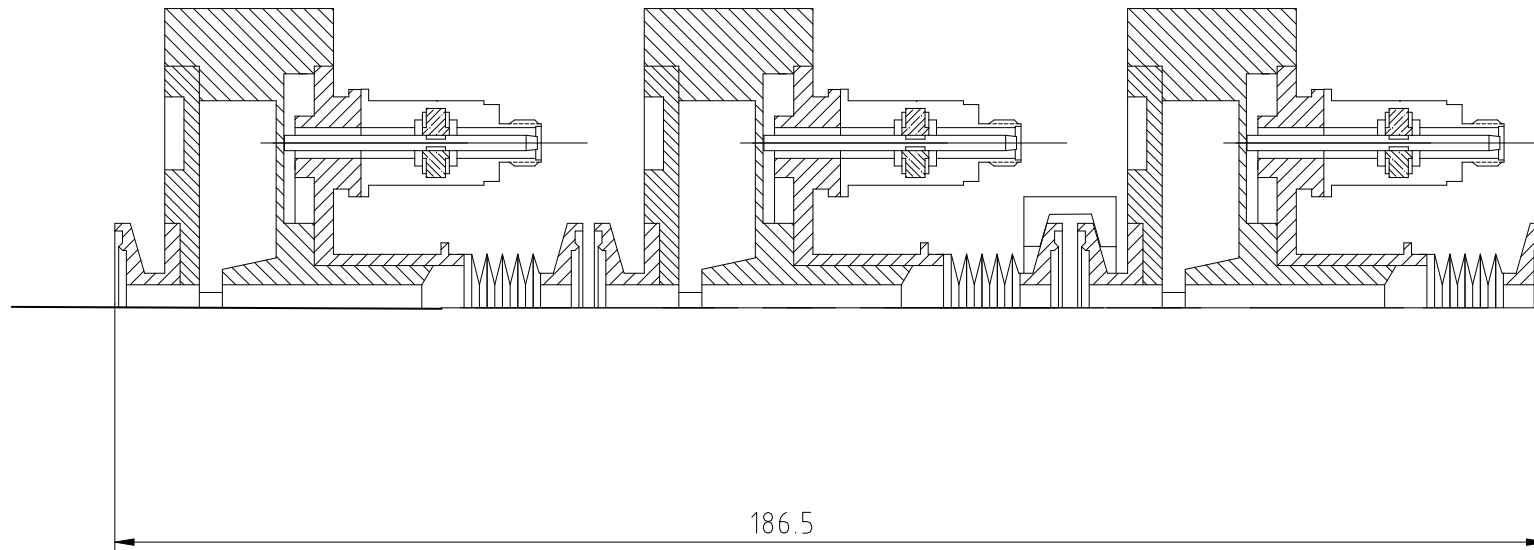
$$V = \pi * 10.8 * \delta * q * f^2 * \left(\frac{R}{Q}\right)^{0.5} * T(\theta/2) * S(\omega, \sigma_z) * \left(\frac{\beta * Z_{load}}{(1 + \beta) * 2 * Q_{load}}\right)^{0.5}$$

$$S(\omega, \sigma_z) = \frac{\sin(\omega * \sigma_z / 2 * c)}{\omega * \sigma_z / 2 * c}, \dots S(\omega, \sigma_z) = \exp(\omega^2 * \sigma_z^2 / 2 * c^2)$$

$$T(\theta) = \frac{\sin\left(\frac{\pi * L_{eff}}{\lambda}\right)}{\frac{\pi * L_{eff}}{\lambda}}$$



**Block diagram of the
 BPM's electronic for
 ATF2 FF test**



VLEPP type vacuum connectors

Welded bellows

IRIE KOKEN CO., LTD

NS122-1, Dmax=22mm

Dmin=8mm

*L from 7 to 17 mm +2*3mm*

FTM110 = 9 GHz,

Leff. = 7 mm

$\beta = 2.0$

Resolution 1-2 nm

Angle sensitivity

To 1 nm -200 μ rad