

# WP2 STATUS UPDATE

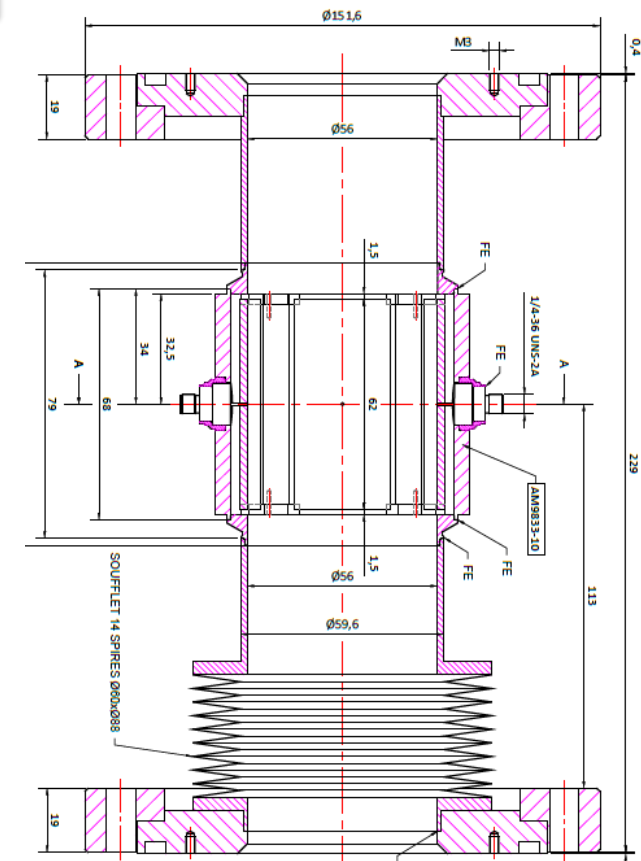
## CHARACTERIZATION OF MYRTE BPMs AND ACQUISITION ELECTRONICS

**Work :** Design & build a sensitive sensor and associated signal processing

- Prototyping & test of the sensor
- Define signal and data processing (noise, transfer functions),
- Specify & build electronics

## MYRTE BPM:

- 2 BPMs: inner pipe diameter = 56 mm
- October 2016: Launch of call for offers for BPM manufacturing and BPM Electronics acquisition modules
- Fall December 2016:
  - quotation for manufacturing 2 BPMs within Solcera
  - Quotation for realization of two BPM electronic acquisition modules within Itech
- Mechanical interfaces : CF63 flanges with copper joints: rotate flange on one side and fixed flange on the other.
- BPMs to delivered and bench test upgraded within mid November
- Fall 2017: Test and characterization of 2 BPMs on IPNO test Bench (Electrical center, sensitivities, mappings)
- Fall 2017: Validation of the BPM electronics modules

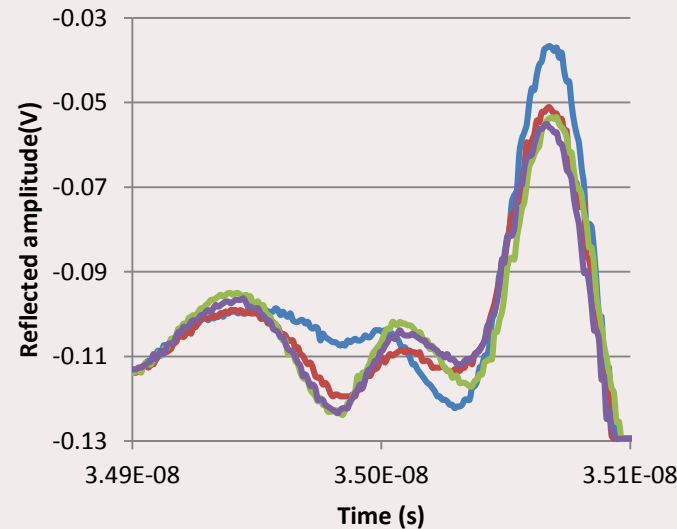
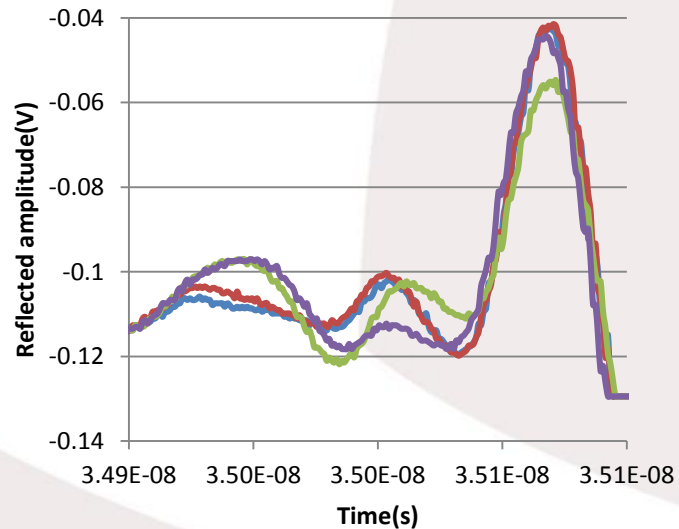


- Electrodes characterization
- Characterization test bench
- Mechanical and electrical centers
- Position sensitivity
- Phase vs Beam position
- Transverse shape sensitivity

- Capacitance measurement results:

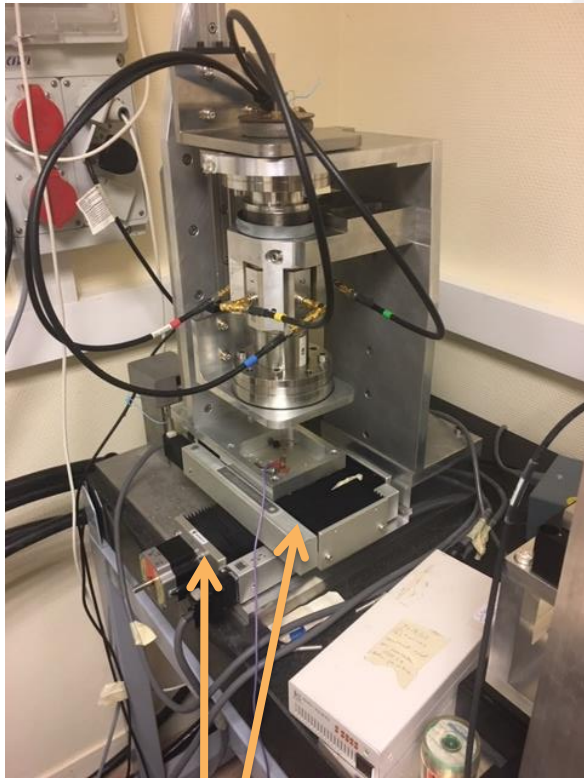
<b>BPM1</b>	Electrode1	Electrode2	Electrode3	Electrode4	Difference
	13,06pF	13,11pF	13,06pF	13,07pF	0,05pF
<b>BPM2</b>	Electrode1	Electrode2	Electrode3	Electrode4	Difference
	13,12pF	13,16pF	13,11pF	13,09pF	0,07pF

- Reflectometry results: incident signal (1V, 100fs pulse)



- Expected Results: tiny difference between BPM mechanical and electrical centres: Position quadrupolar moment offsets close to 0

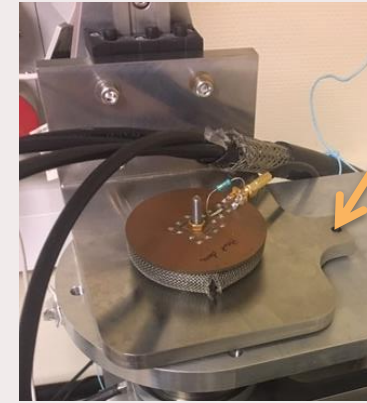




**Motorized X,Y  
linear Stages**



**Powermeters &  
probes**



**Referencing  
system**



**Distance measuring  
devices based on laser**

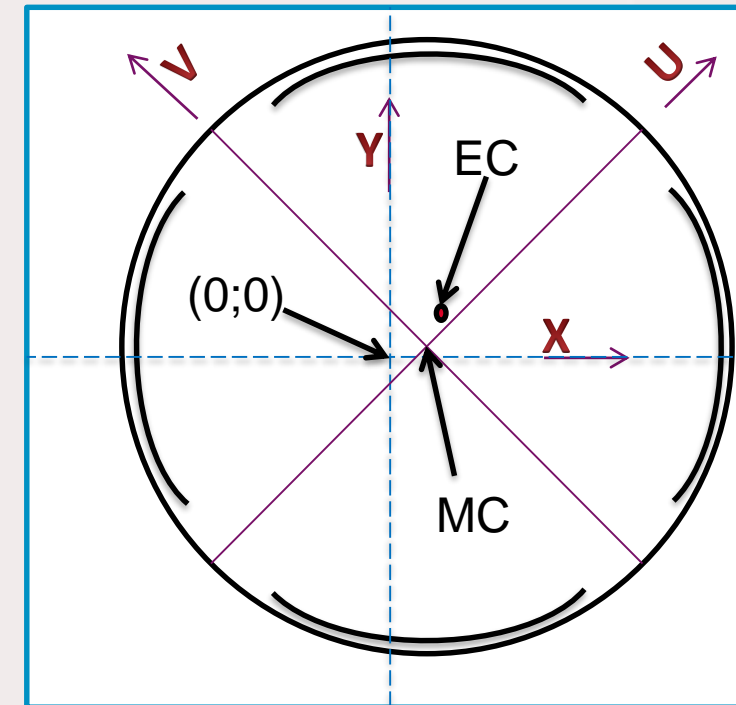
## Mechanical centre (MC) :

1. The wire (red dot) moves on the U and V axes until it touches the BPM corps (short circuit)
2. BPM mechanical centre coordinates in the (U,V) reference is calculated
3. BPM mechanical centre coordinates in the (X,Y) reference is calculated

## Electrical centre (EC) :

1. Wire placed on the BPM mechanical centre, +17dBm signal at 176,1MHz is applied
2. Wire is displaced over X,Y axis until the opposite electrodes received signals show the same amplitude

Referencing table

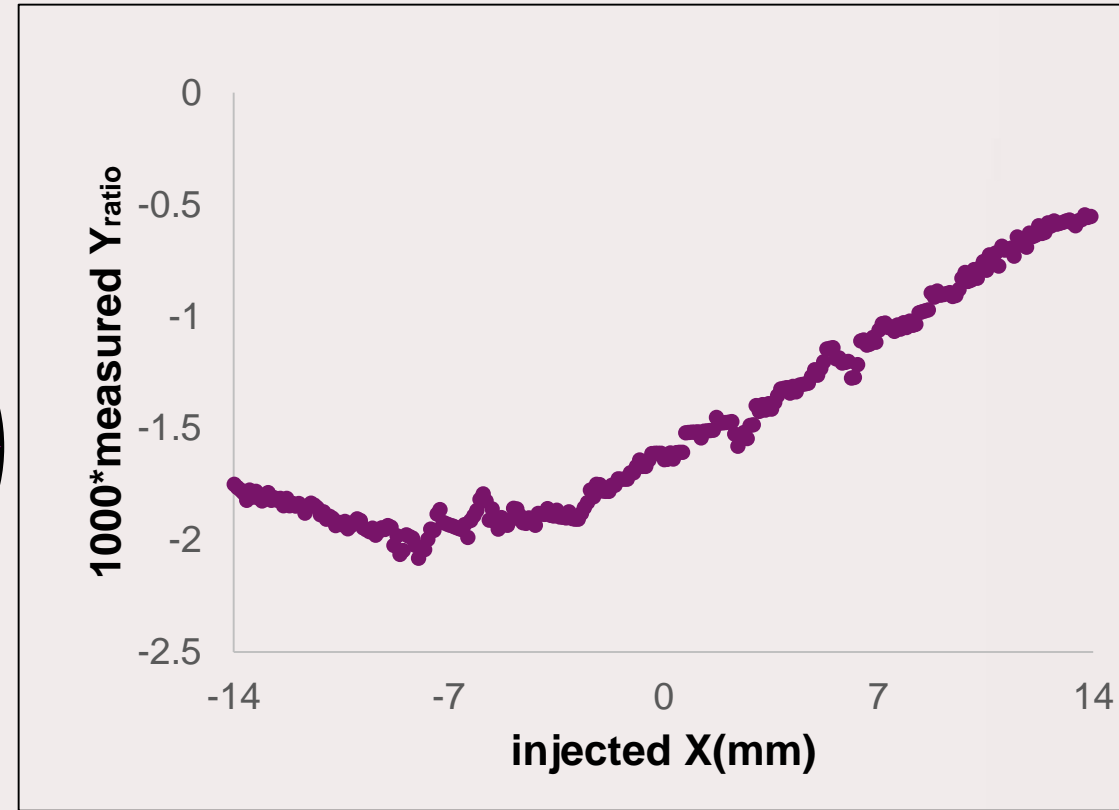
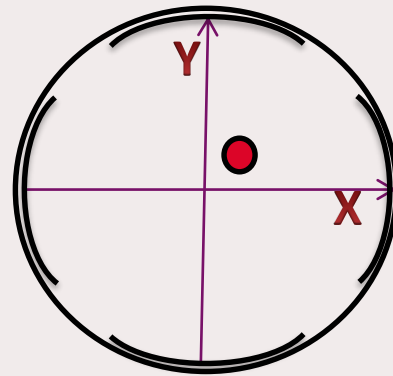
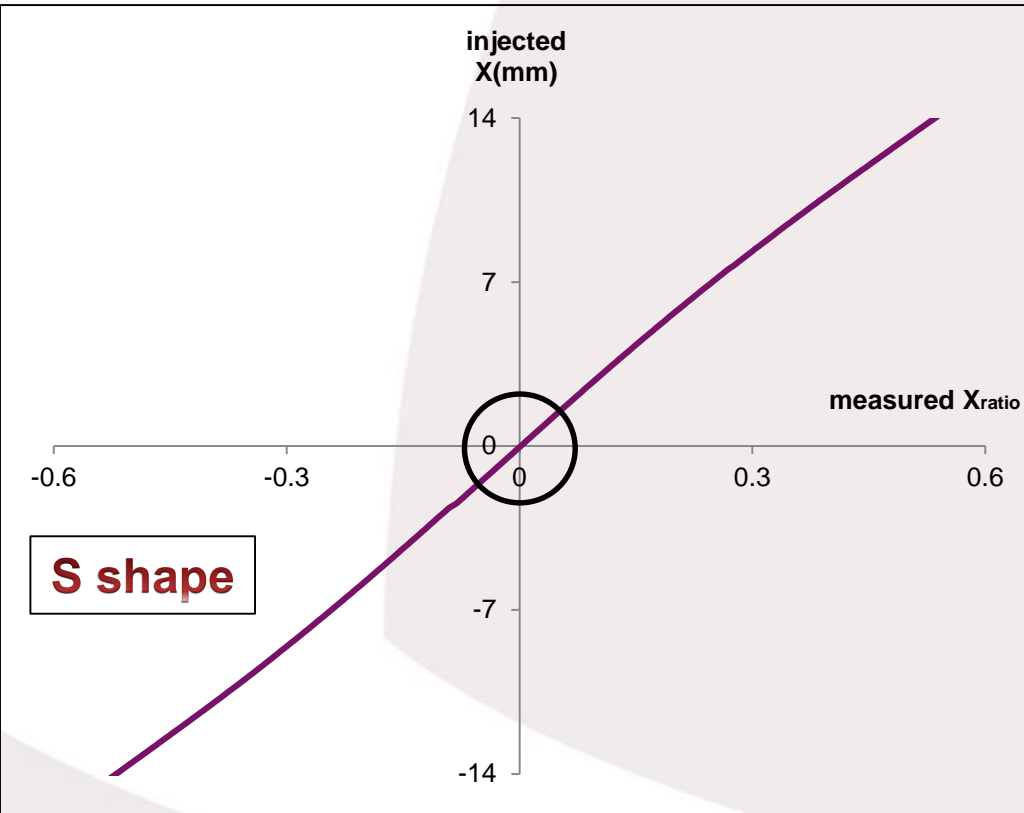


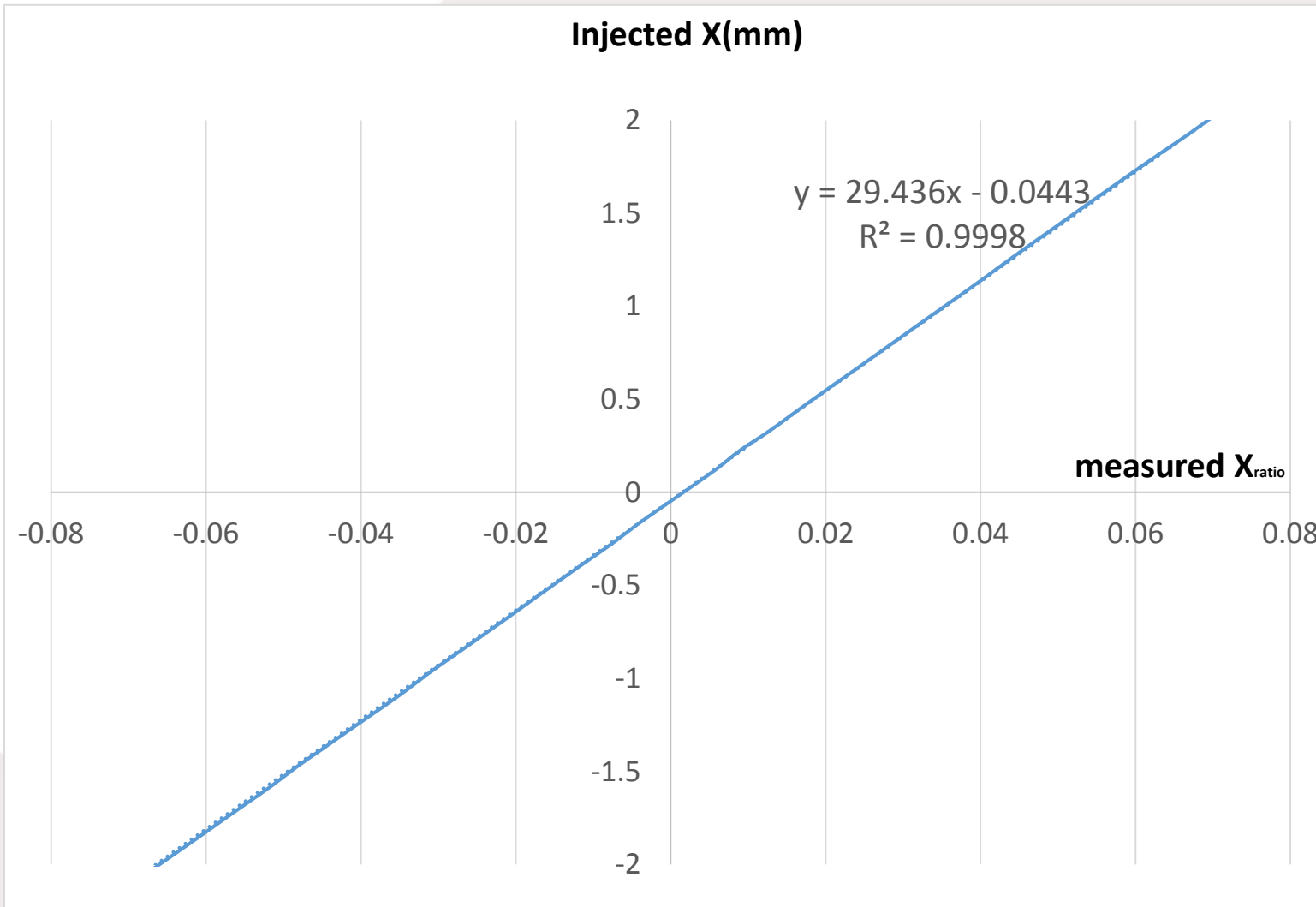
## Results

Mechanical centre (μm)		Electrical centre(μm)					
Injected position	Measured position(laser)	Injected position	Measured position(laser)	Received amplitudes (dBm)			
				X1	X2	Y1	Y2
(-33;21)	(-46;31)	(-59;51)	(-41;43)	-28,187	-28,188	-28,188	-28,188

$$X(Y) = K_{x(y)} * X(Y)_{ratio} = K_{x(y)} * \frac{X2(Y2) - X1(Y1)}{X1 + X2 + Y1 + Y2} + X(Y)_{offset}$$

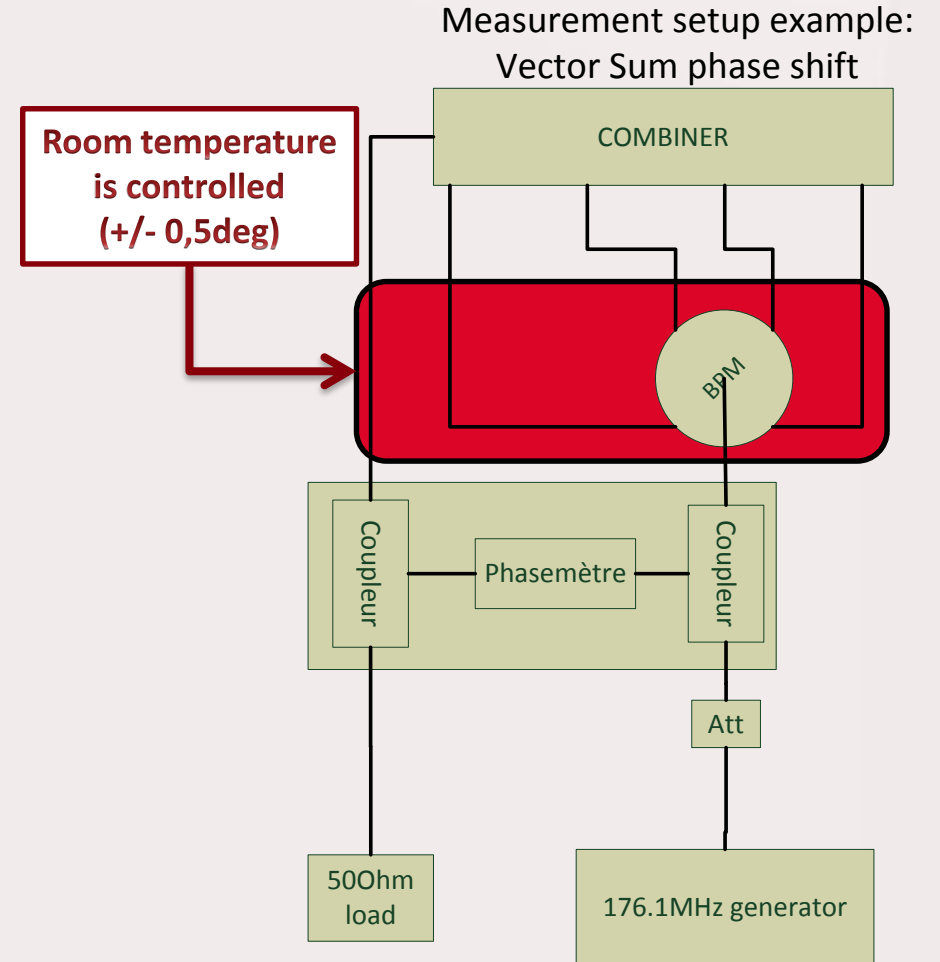
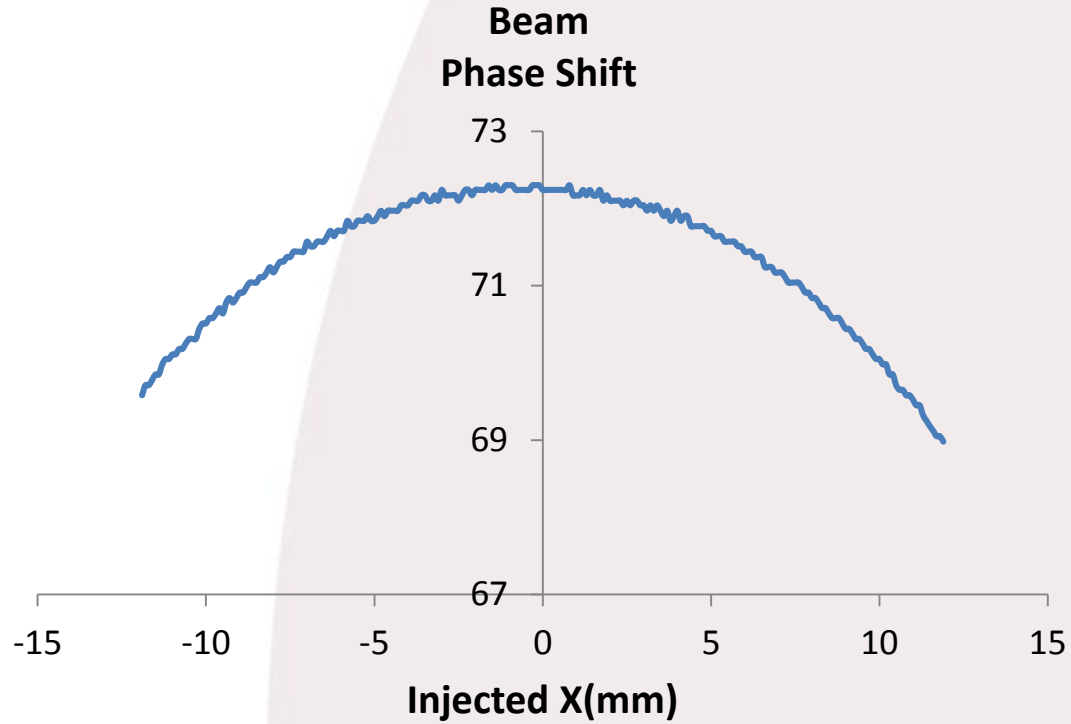
**X1, X2, Y1 and Y2 are measured in mV**





$K_x = 29,436mm$   
 $K_y = 29,431mm$   
Theoretical  
Value=29,321mm



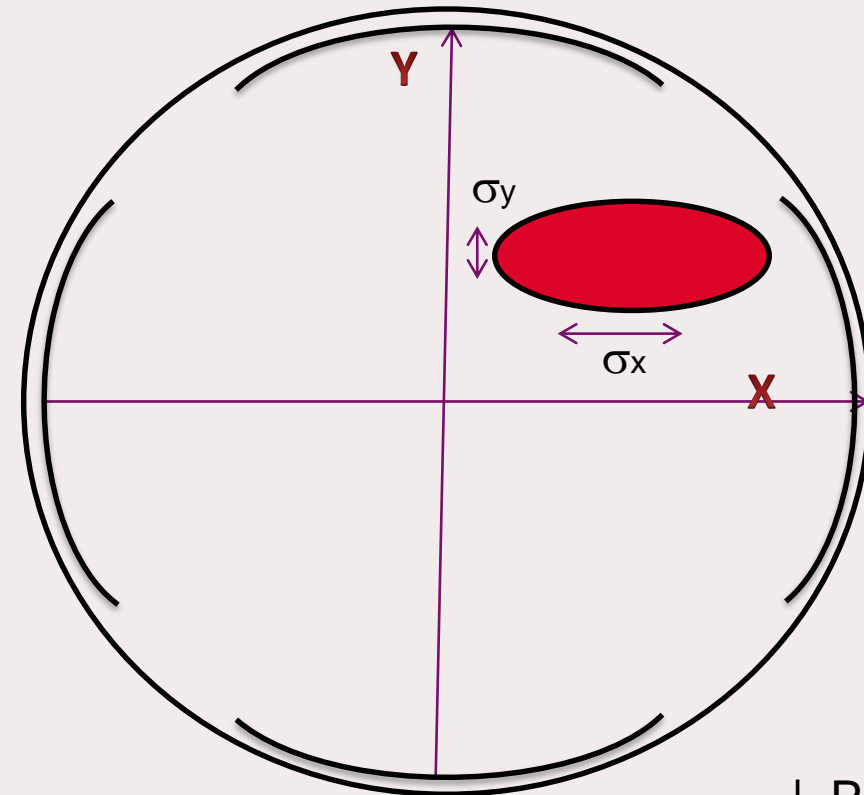
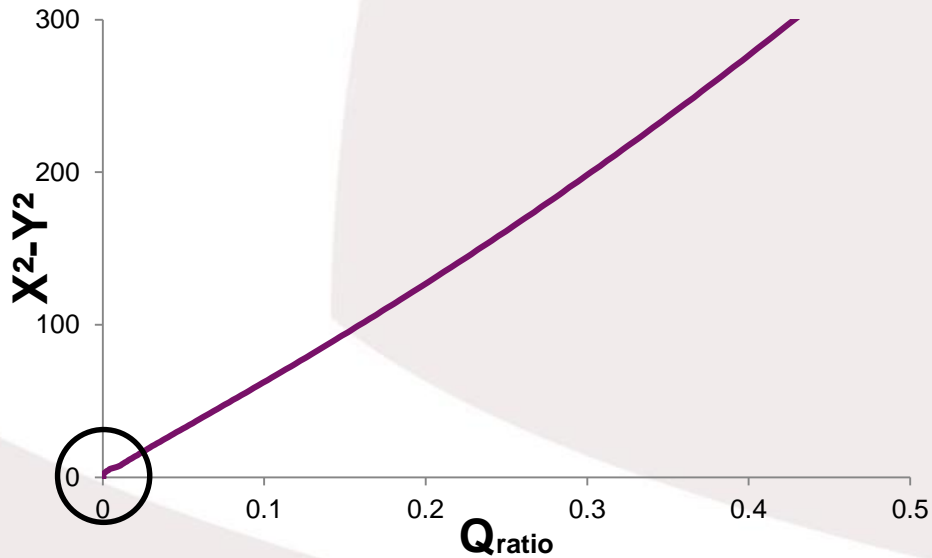


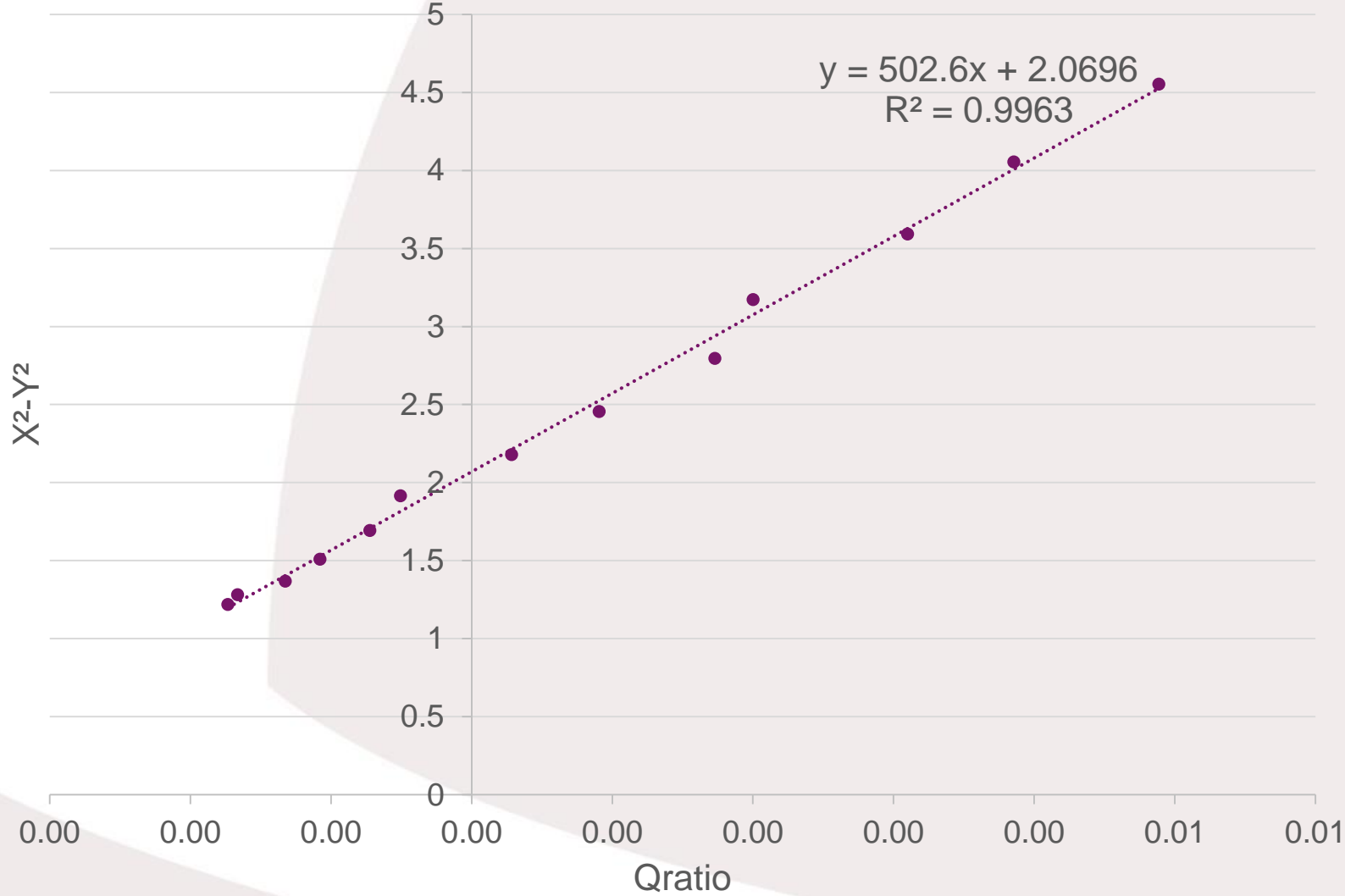
$$\underbrace{\sigma_x^2 - \sigma_y^2}_{X^2 - Y^2} = K_q * Q_{ratio} = K_q * \frac{X2 - Y2 + X1 - Y1}{X1 + X2 + Y1 + Y2} + Q_{offset}$$

X1, X2, Y1 and Y2 are measured in mV

$$X^2 - Y^2 = K_q * Q_{ratio} = K_q * \frac{X2 - Y2 + X1 - Y1}{X1 + X2 + Y1 + Y2} + Q_{offset}$$

For circular beam

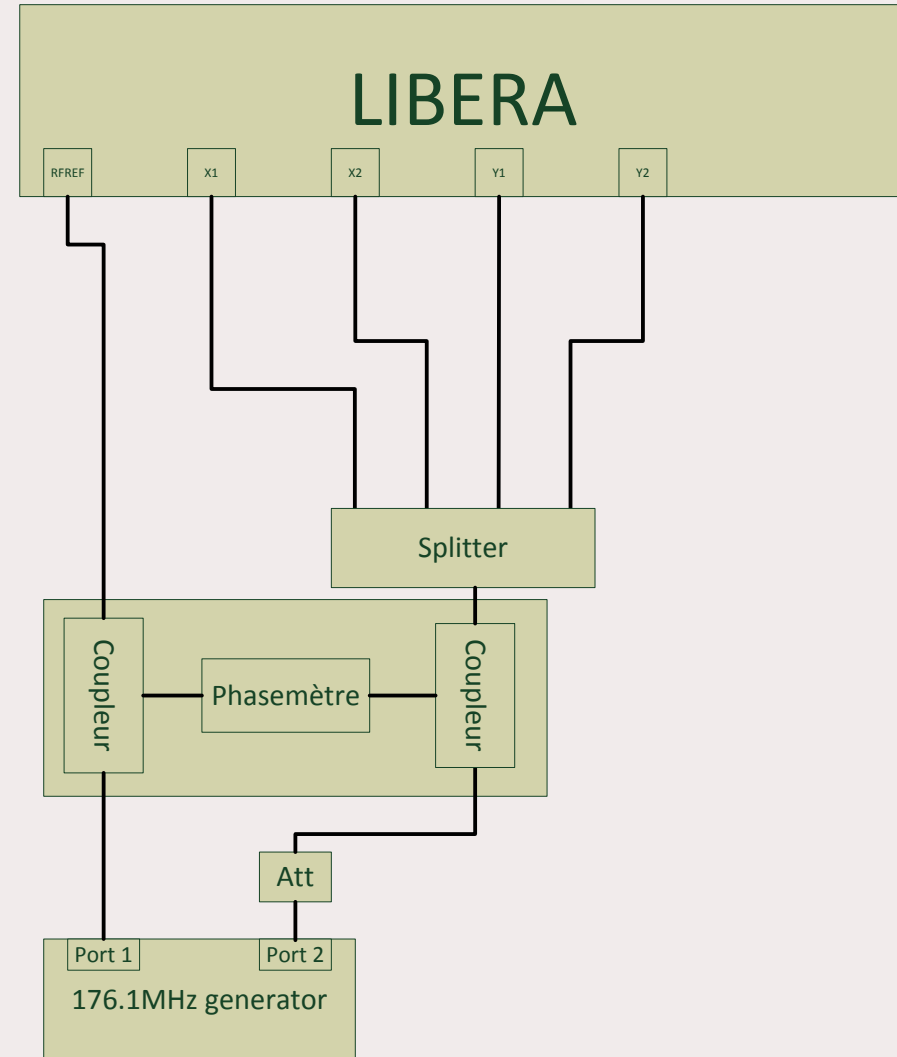
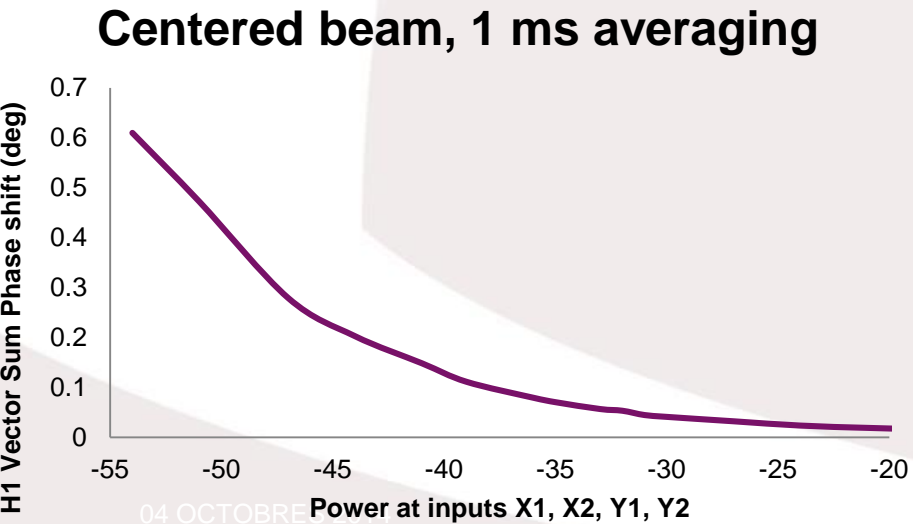
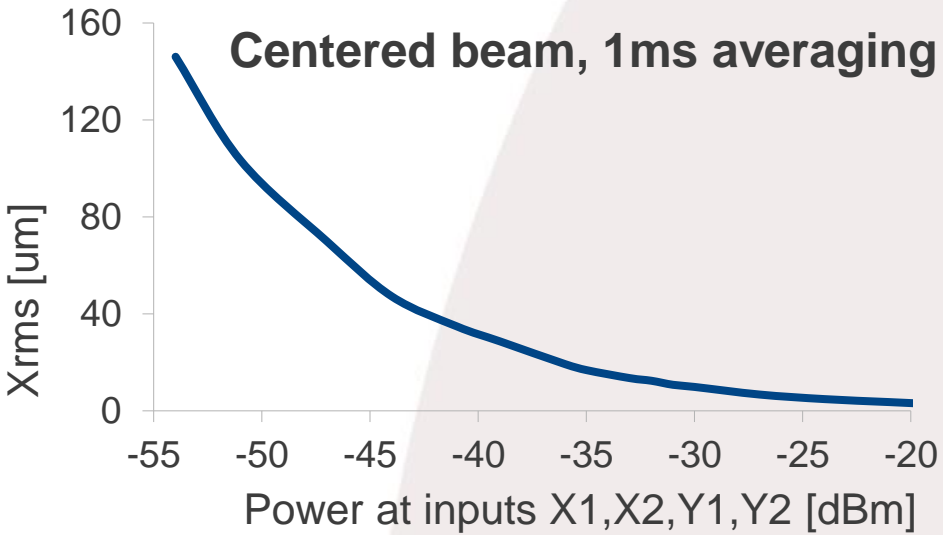




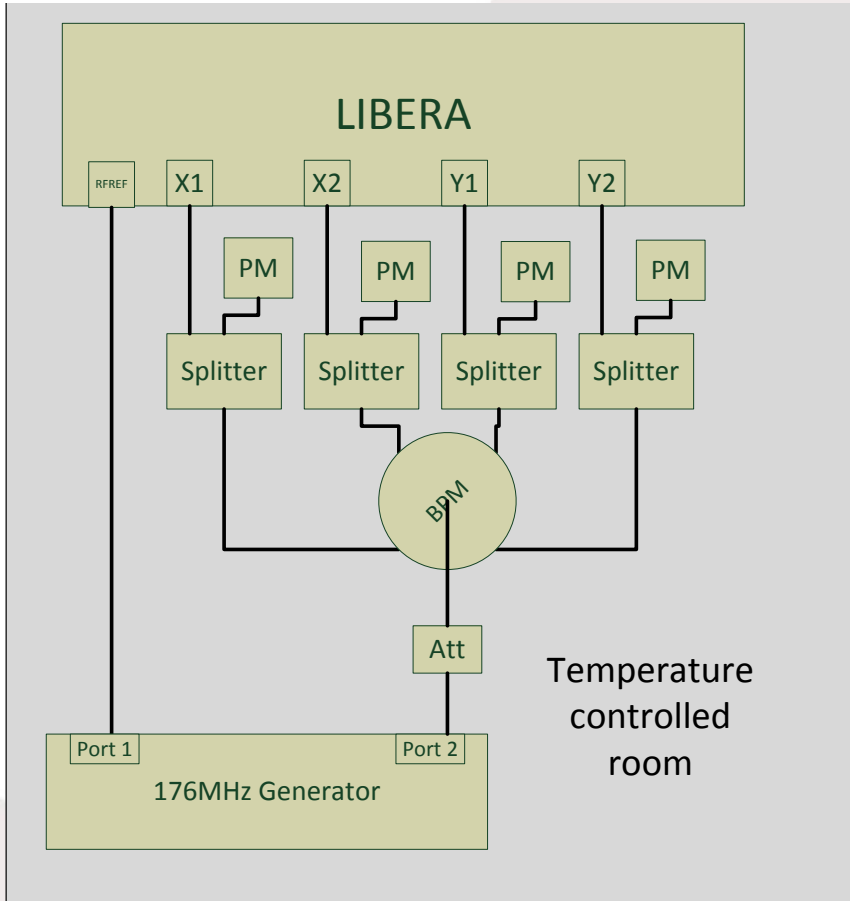
$K_q = 502\text{mm}^2$   
Theoretical  
Value=474mm<sup>2</sup>

- Dynamic range requested: -55dBm to -15dBm
- Position and Phase Measurement:
- Three test ranges:
  - High level Beam: [1mA;4mA]  $\Leftrightarrow$  [-36dBm;-24dBm]
  - Medium level Beam:[0,4mA;1mA]  $\Leftrightarrow$  [-44dBm;-36dBm]
  - Low level Beam :[0,1mA;0,4mA]  $\Leftrightarrow$  [-56dBm;-44dBm]

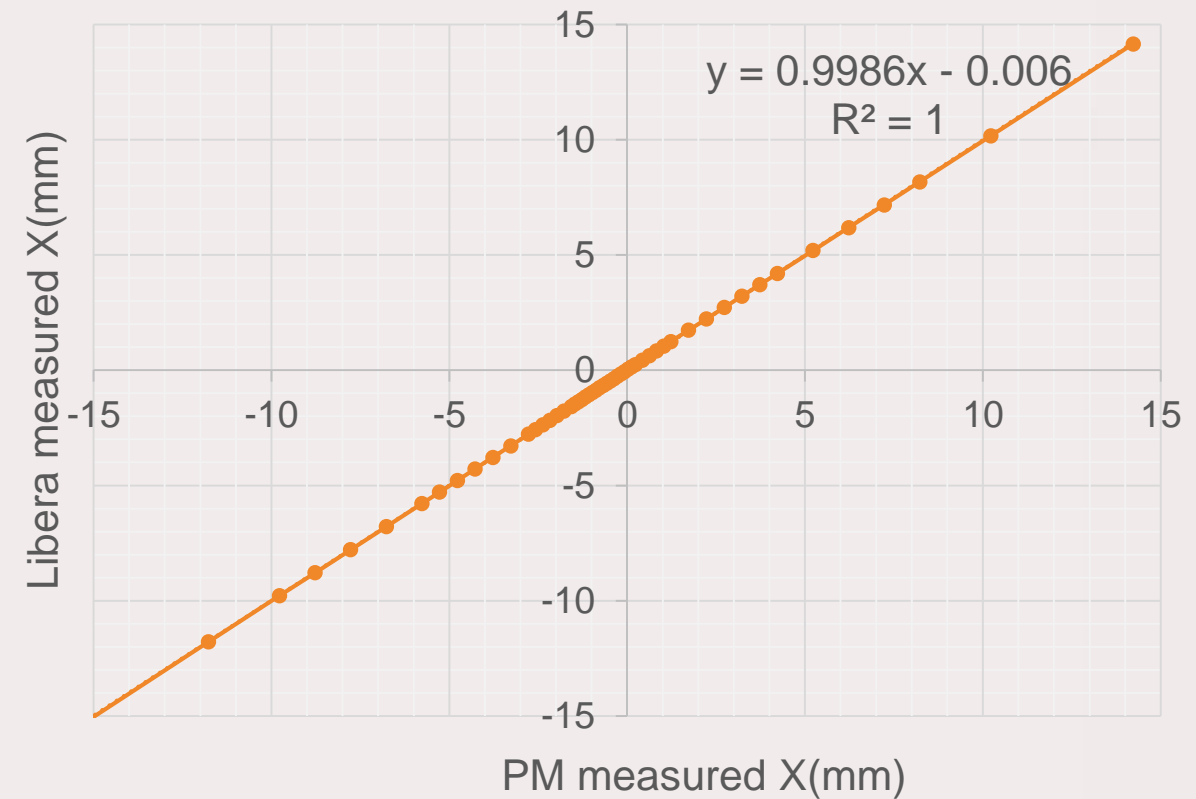


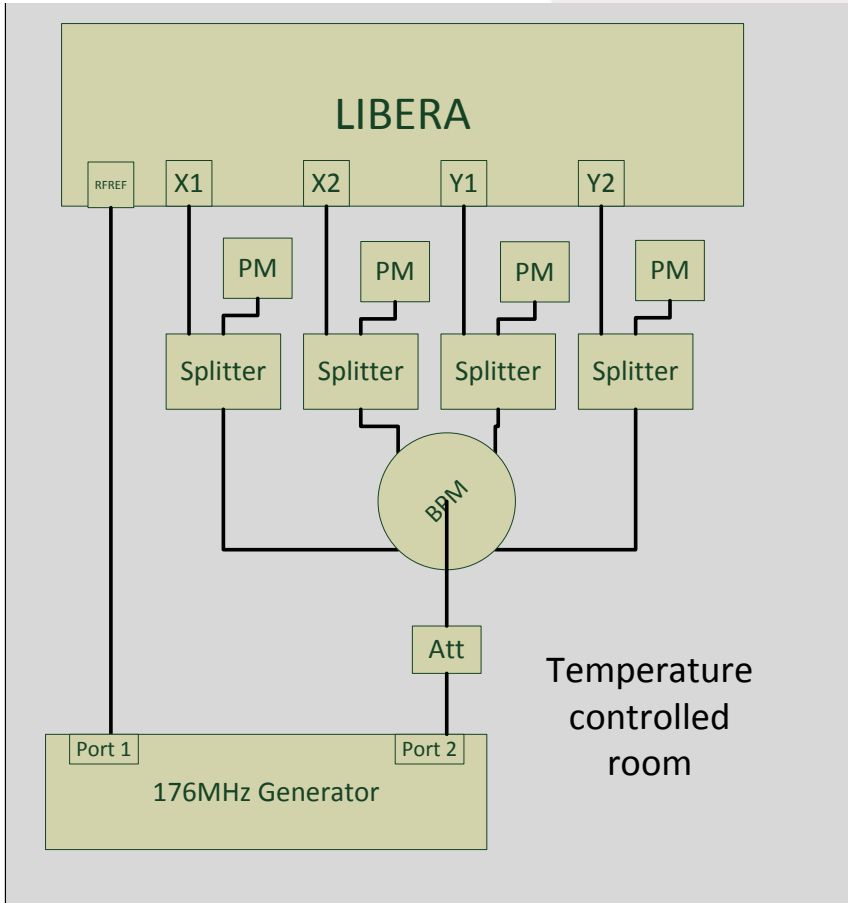




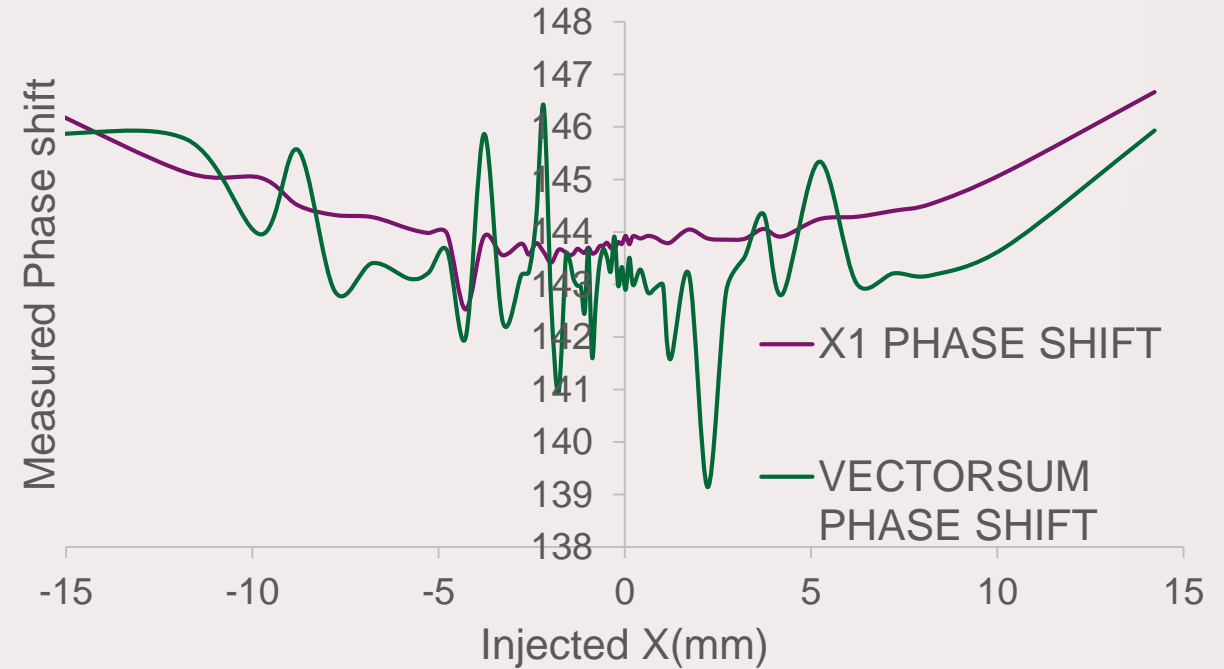


Power at input=-30dBm for centered beam





Power at input = -30dBm for centered beam



Issue with phase measurement to be solved

- Tests of electronics with BPM at middle level and low level beams (-40dBm and -55dBm)
- Tests of interlock and postmortem features
- Tests of electronics with the 2 BPM both in operation
- BPM electronics C/C interface (communication with cosylab)

**Expected completion date :**  
**03/2019**

- Two BPMs were realized for MYRTE
- BPMs characterization shows results in agreement with expectations
- BPM acquisition electronics are under test:
  - Dynamic range OK
  - Position measurement at high level beam OK
  - Phase measurement raises up some issues
- Full qualification should be finished by 02/2019