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PhD31: Measurements prep ATF May26

Laura Karina Pedraza, Nuria Fuster, Daniel Esperante, Benito Gimeno

PhD Journal, 09/05/2026



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PhD31:
Measurements
prep ATF May26

LabRF meeting, 09/05/26

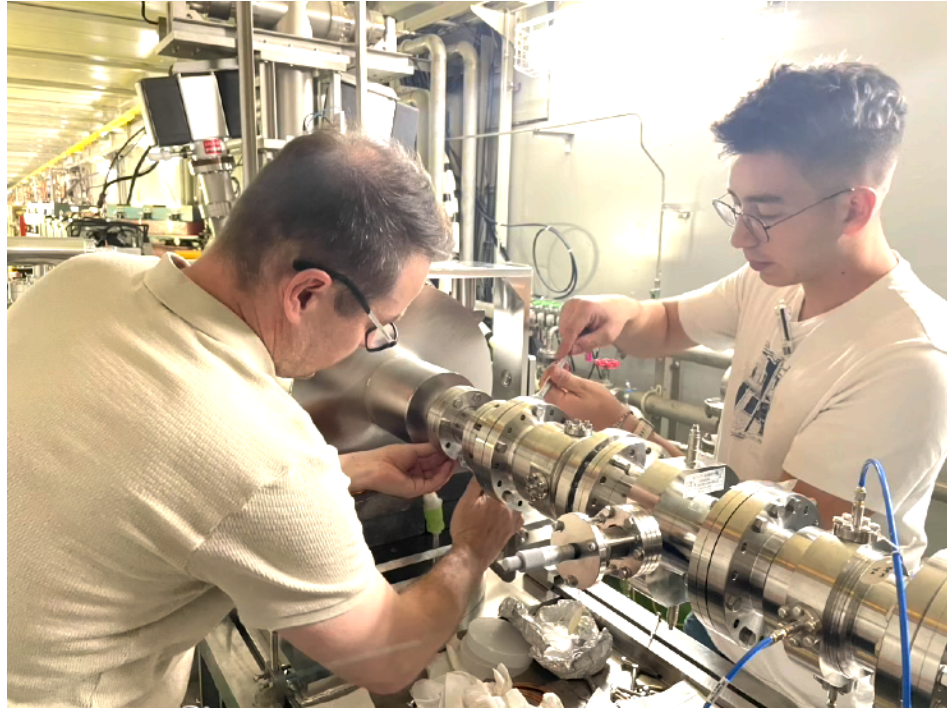
-
- I. BPM Installation
 - A) Installation
 - B) Lattice measurements

 - II. VNA Measurements
 - A) Before installation
 - B) After installation with vacuum

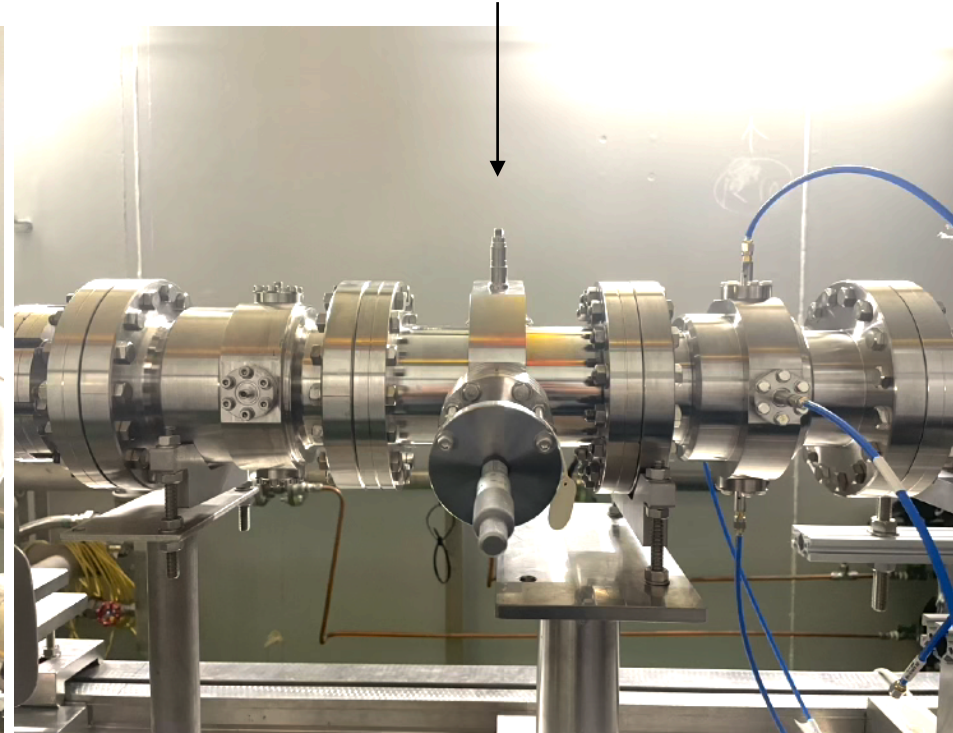
 - III. Plans
 - A) Before shifts
 - B) First shift
 - C) Second shift
-

I. BPM installation

A) New BPM installation



Nos tocó dejar el REF BPM de los coreanos rotado



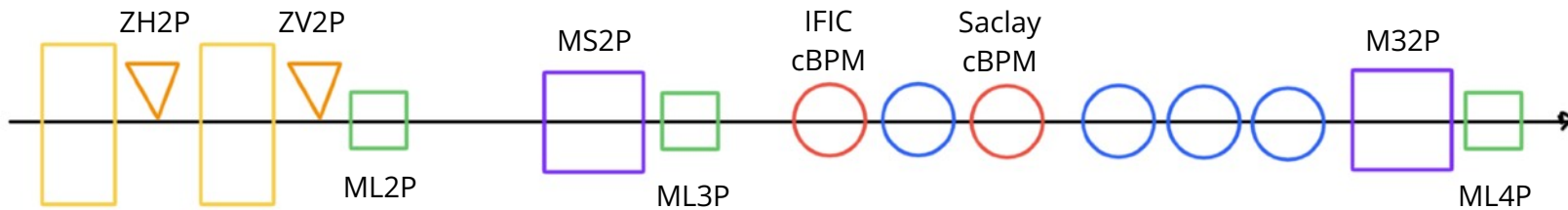
IMPORTANTE: las bridas del BPM deben poder rotarse!!!

I. BPM installation

B) Lattice measurements

Measurements performed on 13th of May after new cBPM installation

quadrupoles
steering magnets
stripline BPMs
profile monitors
our cavity BPMs
corean cavity BPMs



Element	BPMS03	MS2P	BPMT01	IFIC BPM	REF BPM	Saclay BPM	corean BPM1	corean BPM2	corean BPM3	MS PIP	BPMT07
Type	stripline BPM	profile monitor	stripline BPM	cBPM	corean cBPM	cBPM	corean cBPM	corean cBPM	corean cBPM	profile monitor	stripline BPM
EPICS label	ML2P	MS2P	ML3P	-	-	-	-	-	-	MS3P (?)	ML4P
Distance (cm)	0	283	29.8	105.5	21.5	14.1	30.5	43.1	52.8	31.8	36.5

distance from the last element

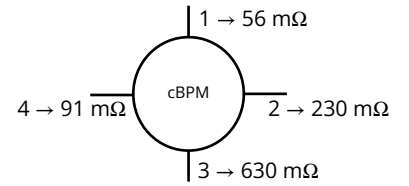
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II. BPM VNA measurements

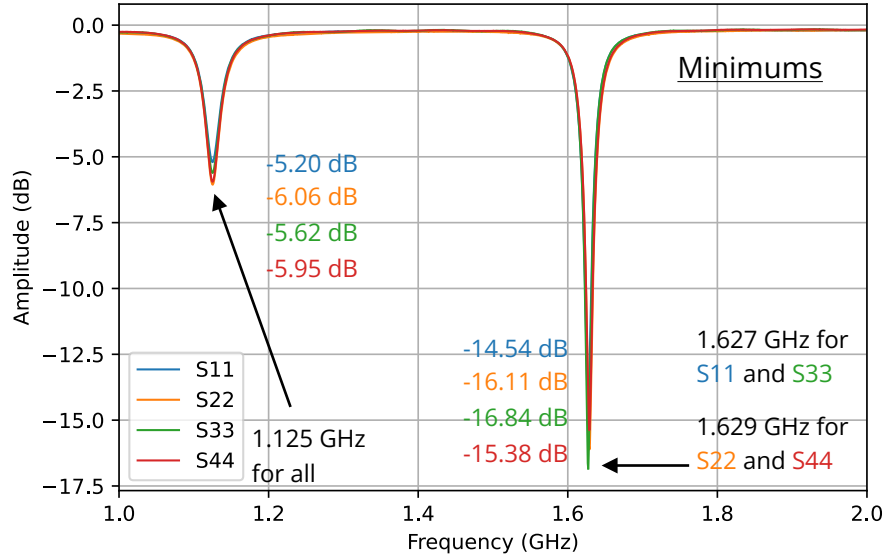
A) IFIC BPM measurements without vacuum



at IFIC without vacuum:

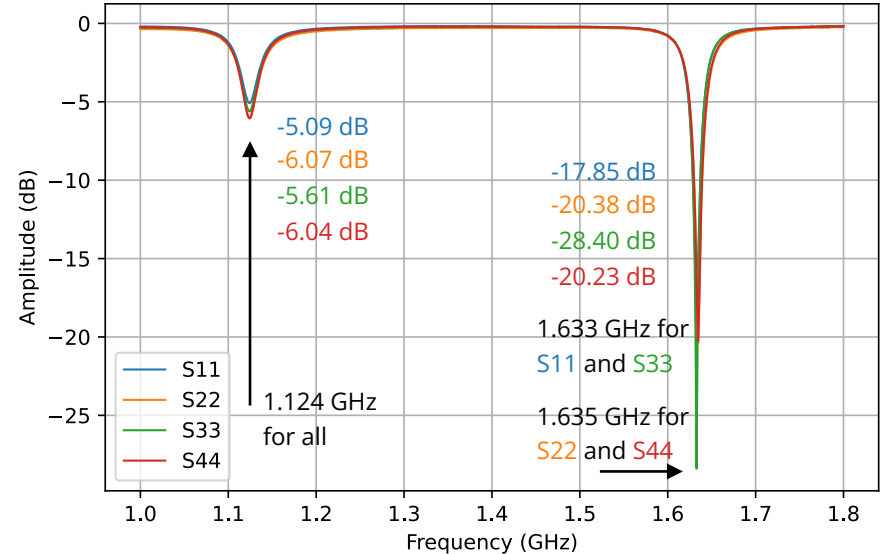
Reflection

VNA calibrated for the 4 ports with window 10 MHz - 3 GHz and step of 300 kHz



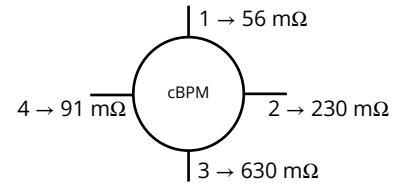
at ATF without vacuum:

nanoVNA calibrated for 2 ports with window 1 GHz - 1.8 GHz and step of 300 kHz



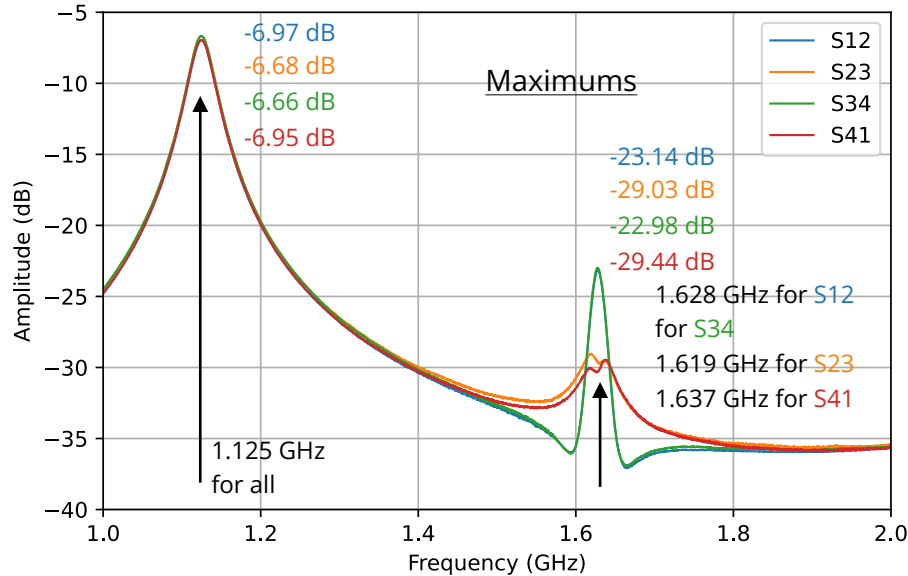
II. BPM VNA measurements

A) IFIC BPM measurements without vacuum



at IFIC without vacuum:

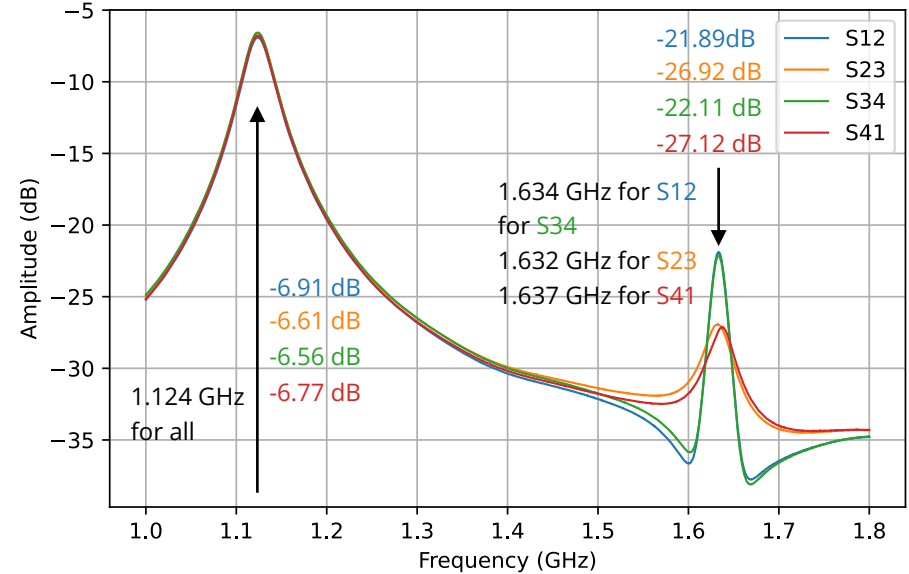
VNA calibrated for the 4 ports with window 10 MHz - 3 GHz and step of 300 kHz



Cross-talk

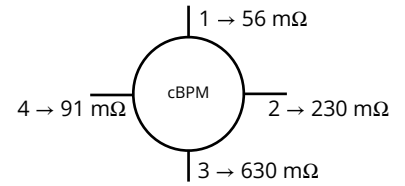
at ATF without vacuum:

nanoVNA calibrated for 2 ports with window 1 GHz - 1.8 GHz and step of 300 kHz



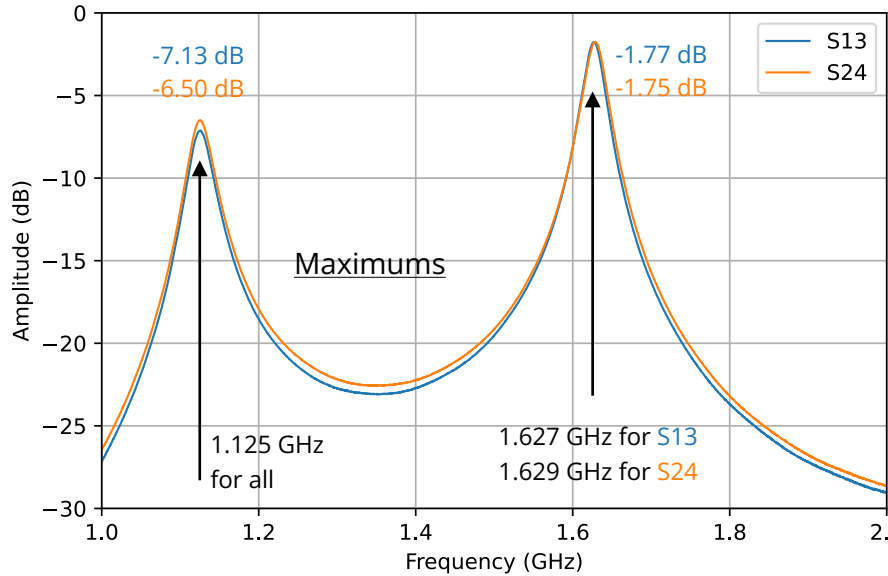
II. BPM VNA measurements

A) IFIC BPM measurements without vacuum



at IFIC without vacuum:

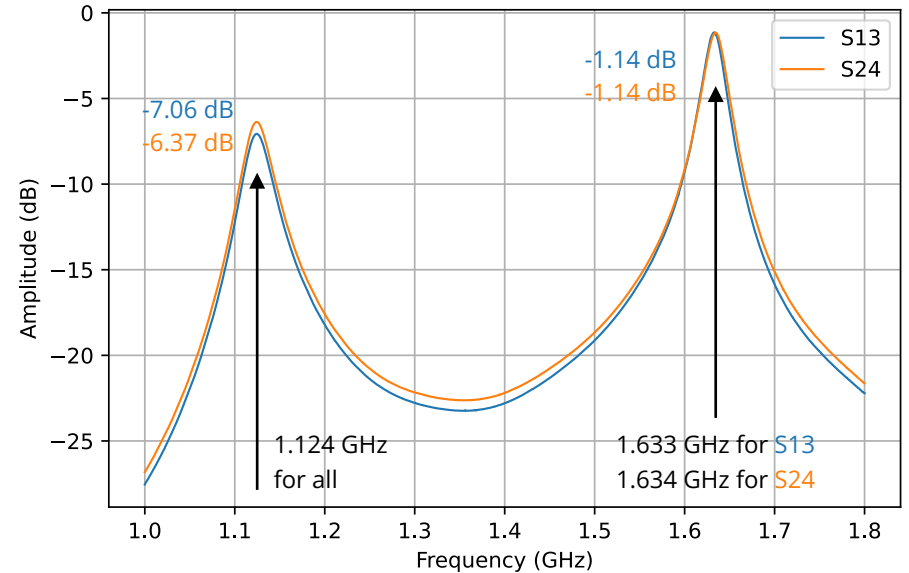
VNA calibrated for the 4 ports with window 10 MHz - 3 GHz and step of 300 kHz



Transmission

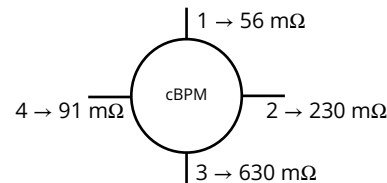
at ATF without vacuum:

nanoVNA calibrated for 2 ports with window 1 GHz - 1.8 GHz and step of 300 kHz



II. BPM VNA measurements

A) IFIC BPM measurements without vacuum



at IFIC **with** vacuum:

VNA calibrated for the 4 ports with:

center_freq = 1.125 GHz

and

center_freq = 1.630 GHz

span = 100 MHz

step = 10 kHz (points = 10000)

Quality factor:

(from reflection measurements)

$$Q_L = \frac{f}{BW}$$

at ATF without vacuum:

nanoVNA calibrated for 2 ports with window
1 GHz - 1.8 GHz and step of 300 kHz

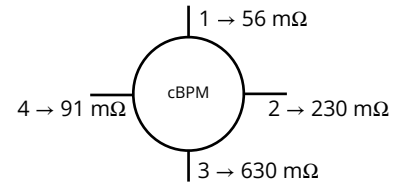
(coarser measurements will be performed after installed)

Loaded Quality factor		
	Monopole mode	Dipole mode
Oscillation frequency	1.125 GHz	1.631 GHz
S-param at minimum	-5.70 dB	-20.76 dB
Band-width (at -3 dB)	24.0 MHz	28.2 MHz
Loaded quality factor	46.98	57.84

Loaded Quality factor		
	Monopole mode	Dipole mode
Oscillation frequency	1.124 GHz	1.634 GHz
S-param at minimum	-5.70 dB	-21.71 dB
Band-width (at -3 dB)	23.9 MHz	27.5 MHz
Loaded quality factor	47.15	59.45

II. BPM VNA measurements

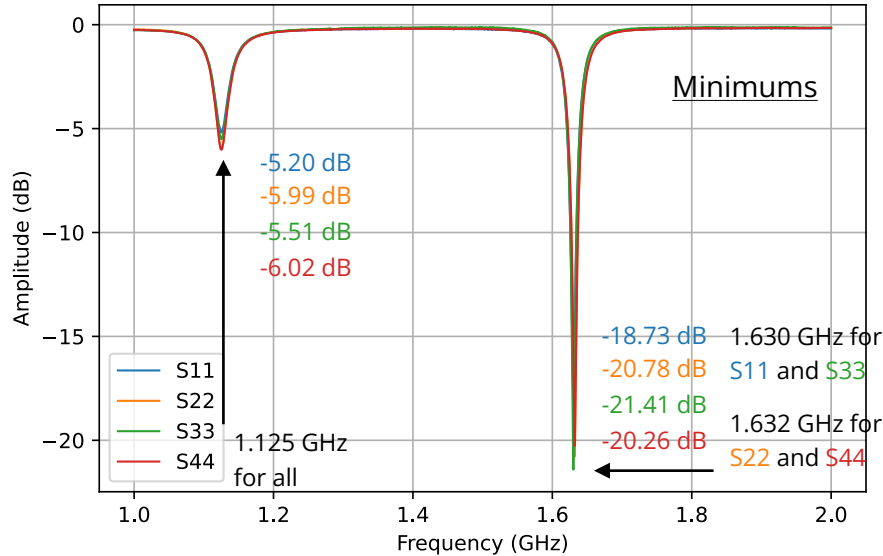
B) ATF measurements after installation



Reflection

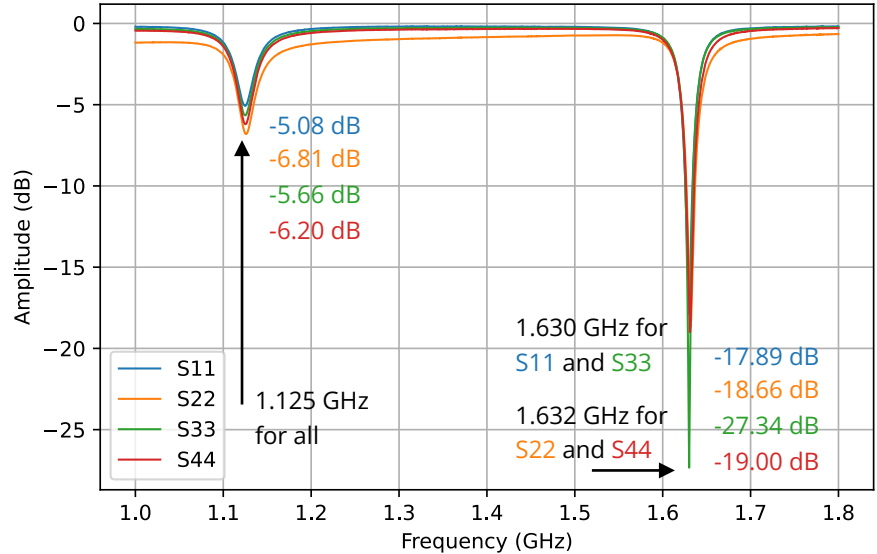
at IFIC with vacuum:

VNA calibrated for the 4 ports with window 10 MHz - 3 GHz and step of 100 kHz



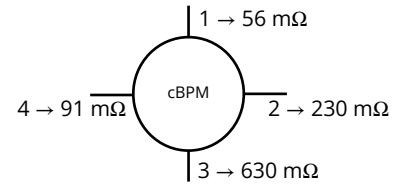
at ATF with vacuum:

nanoVNA calibrated for 2 ports with window 1 GHz - 1.8 GHz and step of 300 kHz



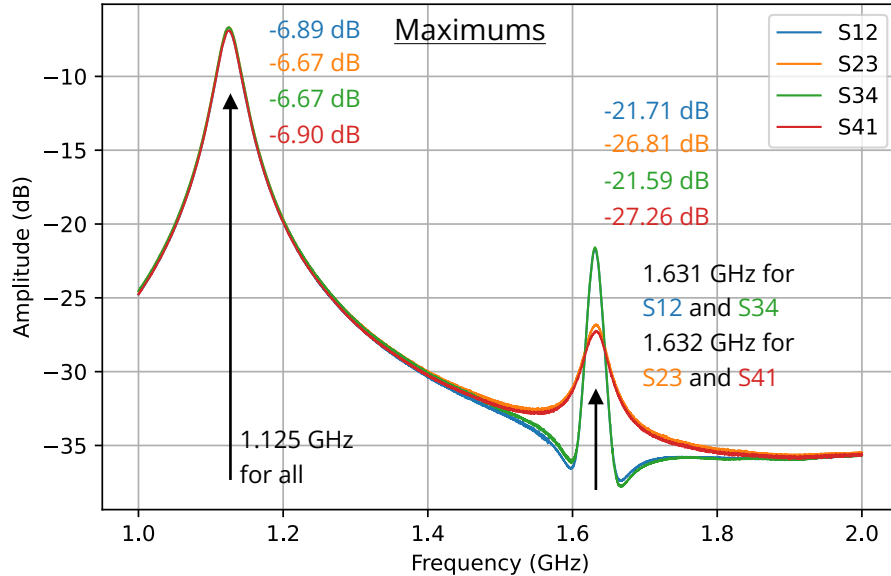
II. BPM VNA measurements

B) ATF measurements after installation



at IFIC with vacuum:

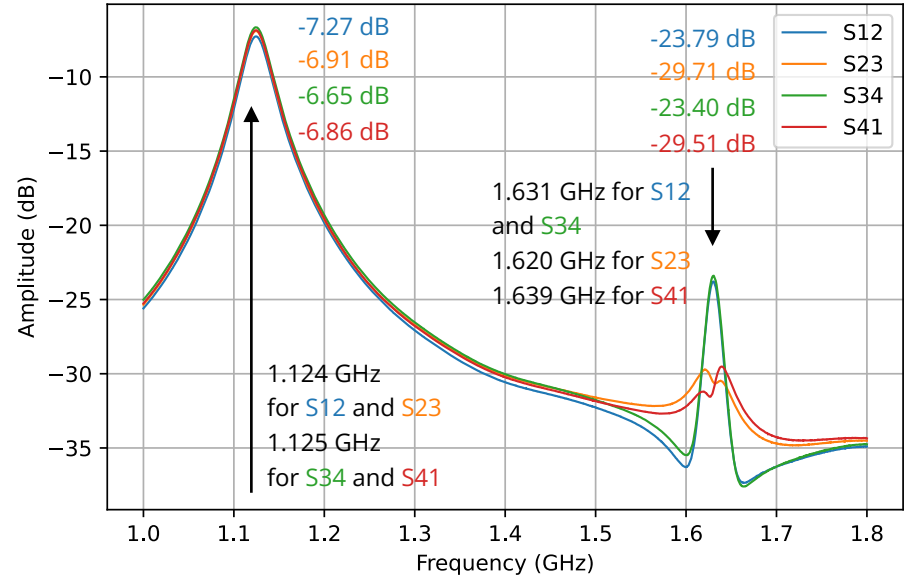
VNA calibrated for the 4 ports with window 10 MHz - 3 GHz and step of 100 kHz



Cross-talk

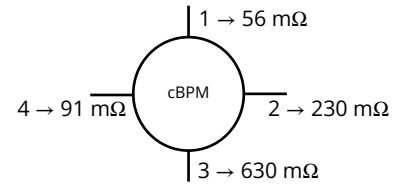
at ATF with vacuum:

nanoVNA calibrated for 2 ports with window 1 GHz - 1.8 GHz and step of 300 kHz



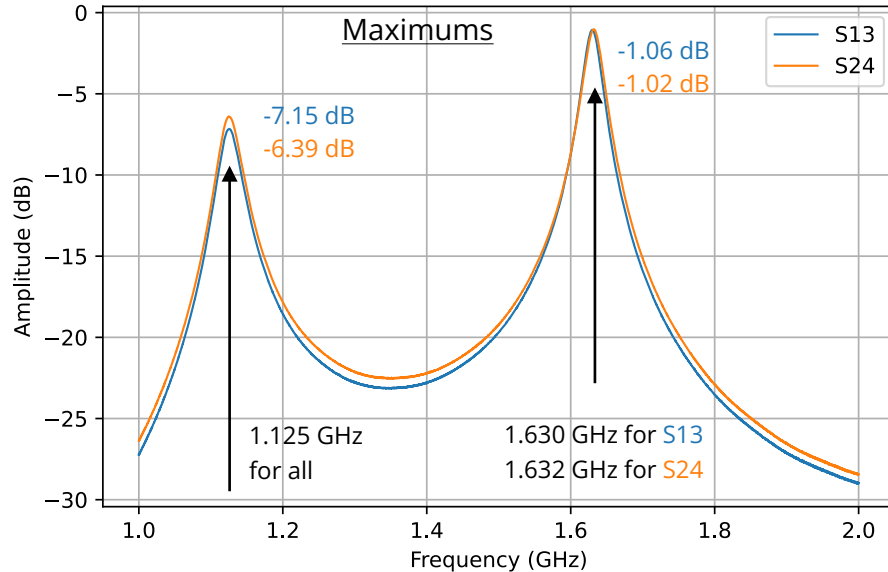
II. BPM VNA measurements

B) ATF measurements after installation



at IFIC with vacuum:

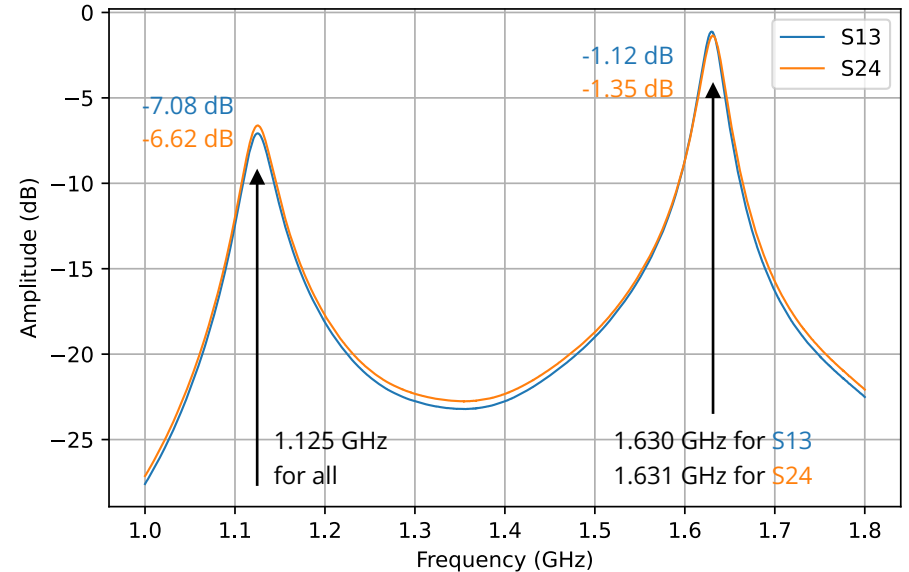
VNA calibrated for the 4 ports with window 10 MHz - 3 GHz and step of 100 kHz



Transmission

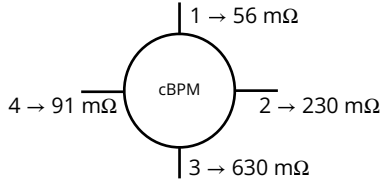
at ATF with vacuum:

nanoVNA calibrated for 2 ports with window 1 GHz - 1.8 GHz and step of 300 kHz



II. BPM VNA measurements

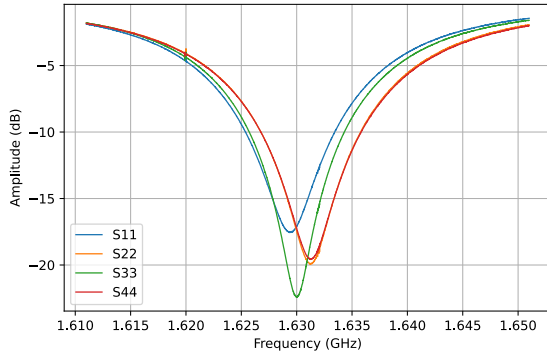
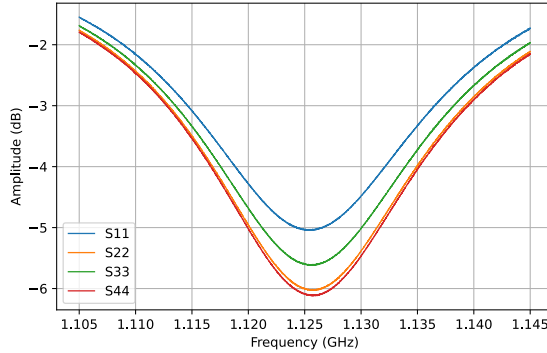
B) ATF measurements after installation



VNA calibrated for 2 ports
with:
center_freq = 1.125 GHz
span = 40 MHz
step = 10 kHz
points = 4000

VNA calibrated for 2 ports
with:
center_freq = 1.631 GHz
span = 40 MHz
step = 10 kHz
points = 4000

Reflection minimum at monopole and dipole frequencies



IFIC BPM after ATF installation

=== Quality Factor Q for **Port 1 (S11)** ===

Monopole:

f0 = 1.12572 GHz

S_min = -5.05 dB

BW (-3dB) = 0.0219 GHz

Q = 51.44

Dipole:

f0 = 1.62937 GHz

S_min = -17.56 dB

BW (-3dB) = 0.0265 GHz

Q = 61.40

=== Quality Factor Q for **Port 3 (S33)** ===

Monopole:

f0 = 1.12572 GHz

S_min = -5.62 dB

BW (-3dB) = 0.0247 GHz

Q = 45.66

Dipole:

f0 = 1.63003 GHz

S_min = -22.41 dB

BW (-3dB) = 0.0269 GHz

Q = 60.63

=== Quality Factor Q for **Port 2 (S22)** ===

Monopole:

f0 = 1.12574 GHz

S_min = -6.03 dB

BW (-3dB) = 0.0262 GHz

Q = 42.91

Dipole:

f0 = 1.63127 GHz

S_min = -19.93 dB

BW (-3dB) = 0.0288 GHz

Q = 56.71

=== Quality Factor Q for **Port 4 (S44)** ===

Monopole:

f0 = 1.12599 GHz

S_min = -6.12 dB

BW (-3dB) = 0.0267 GHz

Q = 42.16

Dipole:

f0 = 1.63129 GHz

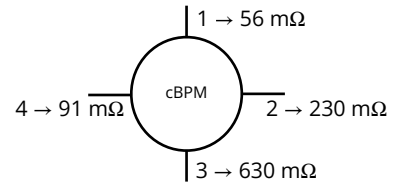
S_min = -19.58 dB

BW (-3dB) = 0.0292 GHz

Q = 55.95

II. BPM VNA measurements

B) ATF measurements after installation



at IFIC with vacuum:

VNA calibrated for the 4 ports with:
 center_freq = 1.125 GHz
 and
 center_freq = 1.630 GHz
 span = 100 MHz
 step = 10 kHz (points = 10000)

Quality factor:
(from reflection measurements)

$$Q_L = \frac{f}{BW}$$

at ATF with vacuum:

VNA calibrated for 2 ports with:
 center_freq = 1.125 GHz
 and
 center_freq = 1.630 GHz
 span = 40 MHz
 step = 10 kHz (points = 4000)

Loaded Quality factor		
	Monopole mode	Dipole mode
Oscillation frequency	1.12512 GHz	1.63112 GHz
S-param at minimum	-5.70 dB	-20.76 dB
Band-width (at -3 dB)	24.0 MHz	28.2 MHz
Loaded quality factor	46.98	57.84

Loaded Quality factor		
	Monopole mode	Dipole mode
Oscillation frequency	1.12579 GHz	1.63049 GHz
S-param at minimum	-5.70 dB	-19.87 dB
Band-width (at -3 dB)	24.9 MHz	27.8 MHz
Loaded quality factor	45.54	58.67

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III. Plans

A) Before the shifts

Electrónica:

- Verificar línea REF X-microwave
- Etiquetar
- Medir linealidad de líneas faltantes
- Juntar salidas LE y poner muros en X-microwave
- Probar aisladores VNA
- Generar dos salidas: 1DC y 2DC (faltan los splitters)
- Montaje final
- Poner phase-shifter LO (se puede antes del PLL?)
- Caracterizar cables de salida del túnel
- Usar terminaciones en todo!
- Usar tornillos y bridas
- Volver a medir fase de phase shifters + híbridos?

- Comprobar phase-locking

- Hacer esquemas: diagramas de bloque de todas las líneas

Preparación del orbit bump

Adquisición de datos:

- Extract sampling rate / time window / # points from oscillo
- Definir adquisición de EPICS (callback?)
- Sacar time axis de oscilloscope settings en `f_digital_processing`
- Check intercept error
- Agregar mas BPMs
- Add acquisition of second BPM
- Fusionar mi código con adquisición de Marça
- Incluir en excel BPM usado, #de down-conversions, oscilo usado y # striplines para calculo de resolución
- Unificar plotting style
- Crear nuevo GitLab

- Probar adquisición Marça

- Incorporar signal processing en calibración y resolución?
- Código que reenvíe readings en tiempo real del BPM?
- Código alternativo SVD calculation
- Error de la resolución

Calibración striplines: Alex propuso calibrar electrónica

III. Plans

B) Shifts objectives:

Overall objectives:

- ◆ Recreate measurements from 2025 (same BPM and same settings)
- ◆ Test new BPM and read-out chain
- ◆ Perform calibration and resolution measurements on both BPMs
- ◆ Test the influence of different values on systems performance...

Side-quests:

- * LINAC striplines electronics calibration
- * Generate an orbit bump

Influence on the resolution measurements of:

- average beam position
- sampling rate
- 1 down-conversion or 2 down-conversions
- attenuation of reference channel
- beam charge (the beam position has to be corrected)
- type of electronics (Mini-circuits or X-microwave)

Further characterization:

- Cross-talk measurements

Influence on the dynamic range of:

- attenuation on the position channels

III. Plans

C) First shift: 25th of may (17:00-24:00)

Considerations:

- **Main objective:** recreate measurements from 2025 (Saclay BPM with RIGOL oscillo)
- only one down-conversion available
- if there is time, test new BPM
- RIGOL oscilloscope for Saclay BPM at 2GS/s

Main points to achieve:

- Comprobar adquisición de Marça
- Medir la potencia de salida de los dos BPMs
- Comprobar phase-locking en la LO y definir atenuación para proteger la electrónica
- Hacer test de prueba con adquisición de Marça (y procesarlos)
- Hacer calibración en eje X
- Medida de resolución en eje X (para varias posiciones)
- Hacer calibración en eje Y
- Medida de resolución en eje Y (para varias posiciones)
- Repetir para IFIC BPM si la adquisición no era simultánea

III. Plans

D) Second shift: 29th of may (17:00-24:00)



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Thank you for your attention

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Back-up slides