SPS flanges
Simulations & Measurements
Update

Fritz Caspers and Jose E. Varela

Outline

- Introduction
- The ‘Thomas Bohl’
- Simulations
- Measurements
- Next Steps
- Conclusions

Introduction

- We continue to search for possible causes of the suspected 1.4GHz microwave instability in the SPS.

- The ‘Thomas Bohl’ has been completed.
  - We now have a list of the different flange setups, location and total number.
- The three ‘most numerous’ flange setups have been simulated.
  - We have now impedance and R/Q.
- More refined measurements have been carried out.
  - Still, one more version of the measurement set-up is under preparation (expected for mid September).

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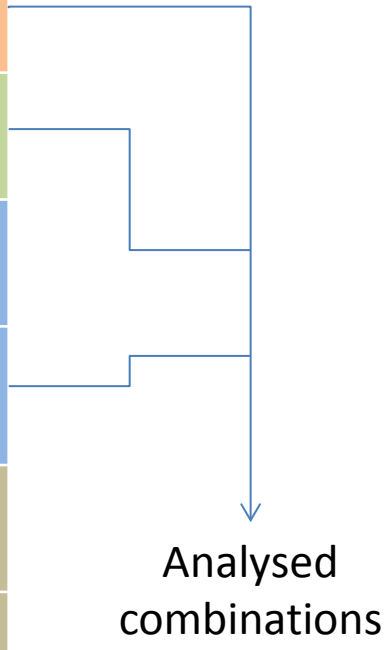
The ‘Thomas Bohl’

		Type																		Isolated		Bellow			Shielded		Dampers	
		159																219										
	Position	QD-QD	BPV-QD	BPCN-QD	BPVC-QD	QF-QF	QF-MBA	MBA-QF	MBA-MBA	VSA-Q	BA-BCT-SS1	159-MPH-QPV-QD	159-GB-SS	BPH-QF	145-BPD-SS1	Yes	No	Short	Long	No Bellow	Yes	No	Yes	No
SSS 001	10101									1							1		1			1		
	10105	1															1	1				1		
	10107	1														1		1				1		
	10108		1													1			1			1		
SSS 002	10205					1											1	1				1		
	10207						1									1		1				1		
	10209													1		0	0		1		1			
SSS 003	10305	1															1	1				1		
	10307	1														1		1				1		
	10308		1													1			1			1		
SSS 004	10407						1									1		1				1		
	10409													1		0	0		1		1			
SSS 005	10507	1														1		1				1		
	10508		1													1			1			1		
SSS 006	10607						1									1		1				1		
	10609													1		0	0		1		1			
SSS 007	10705	1															1	1				1		
	10707	1														1		1				1		
	10709		1													1			1			1		
SSS 008	10801							1									1		1			1		
	10805					1											1	1				1		
	10807						1									1		1				1		
	10809													1		1			1			1		
SSS 009	10907	1														1		1				1		
	10910		1													1			1			1		
SSS 010	11007								1							1		1				1		
	11009													1		0	0		1		1			
SSS 011	11105	1															1	1				1		
	11107	1														1		1				1		

Disclaimer: The ‘Thomas Bohl’ does not include the LSSs

The ‘Thomas Bohl’

	Flange	1	2	3	4	5	6	Total
156	QF-MBA	14	14	15	13	13	14	83
156	MBA-MBA	2	1	2	4	3	2	14
156	QD-QD	16	16	18	16	17	16	99
156	QF-QF Non-enamelled	8	8	5	9	9	7	46
156	QD-QD Non-enamelled	12	13	12	12	14	12	75
219	BPV-QD	14	15	16	15	17	13	90
219	BPH-QF	16/ 12	15/ 7	18/ 10	18/ 12	18/ 11	17/ 11	102/63



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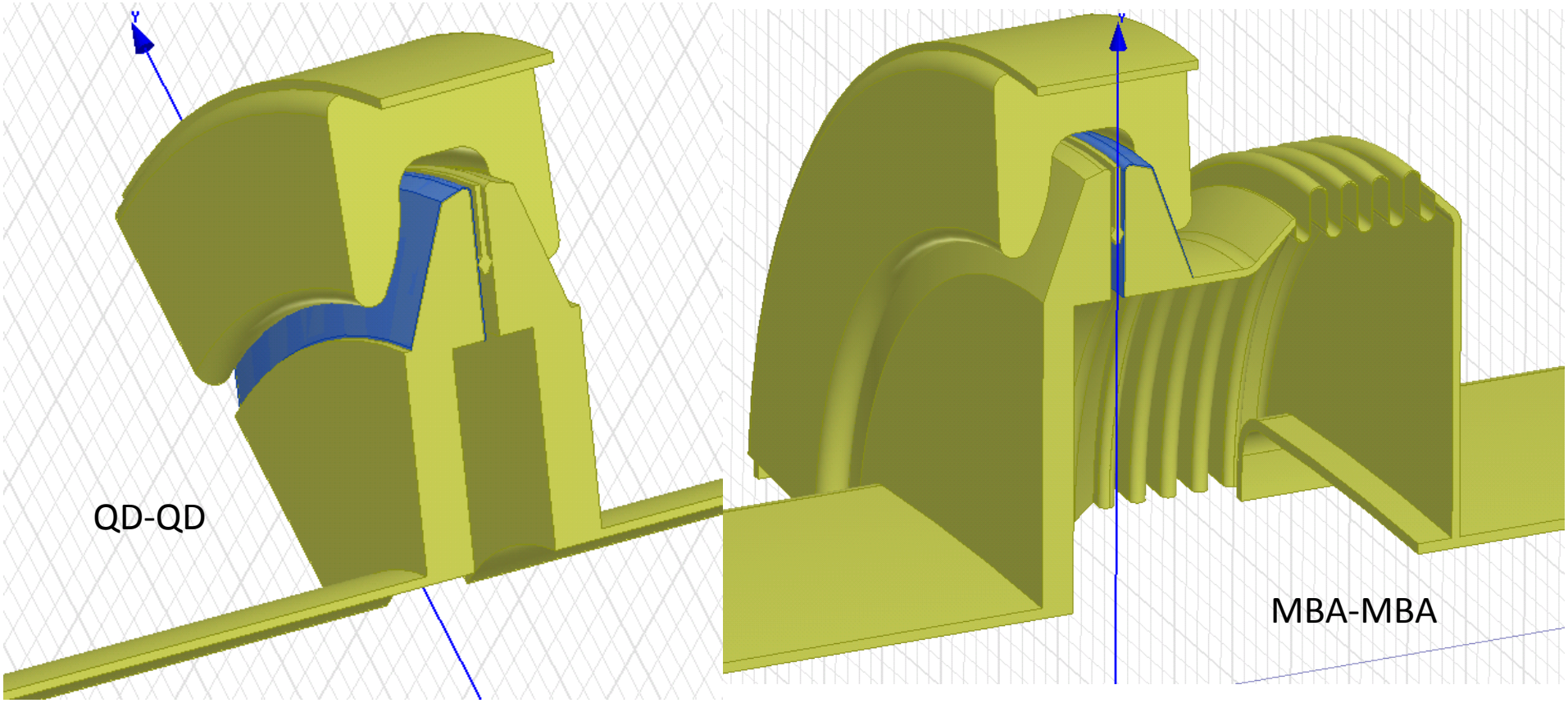
- Introduction
- The ‘Thomas Bohl’
- Simulations
  - BPV QD-QD enamelled flange
  - BPV QD-QD non-enamelled flange
  - BPH MBA-MBA enamelled flange
  - Total Impedance so far
- Measurements
- Next Steps
- Conclusions

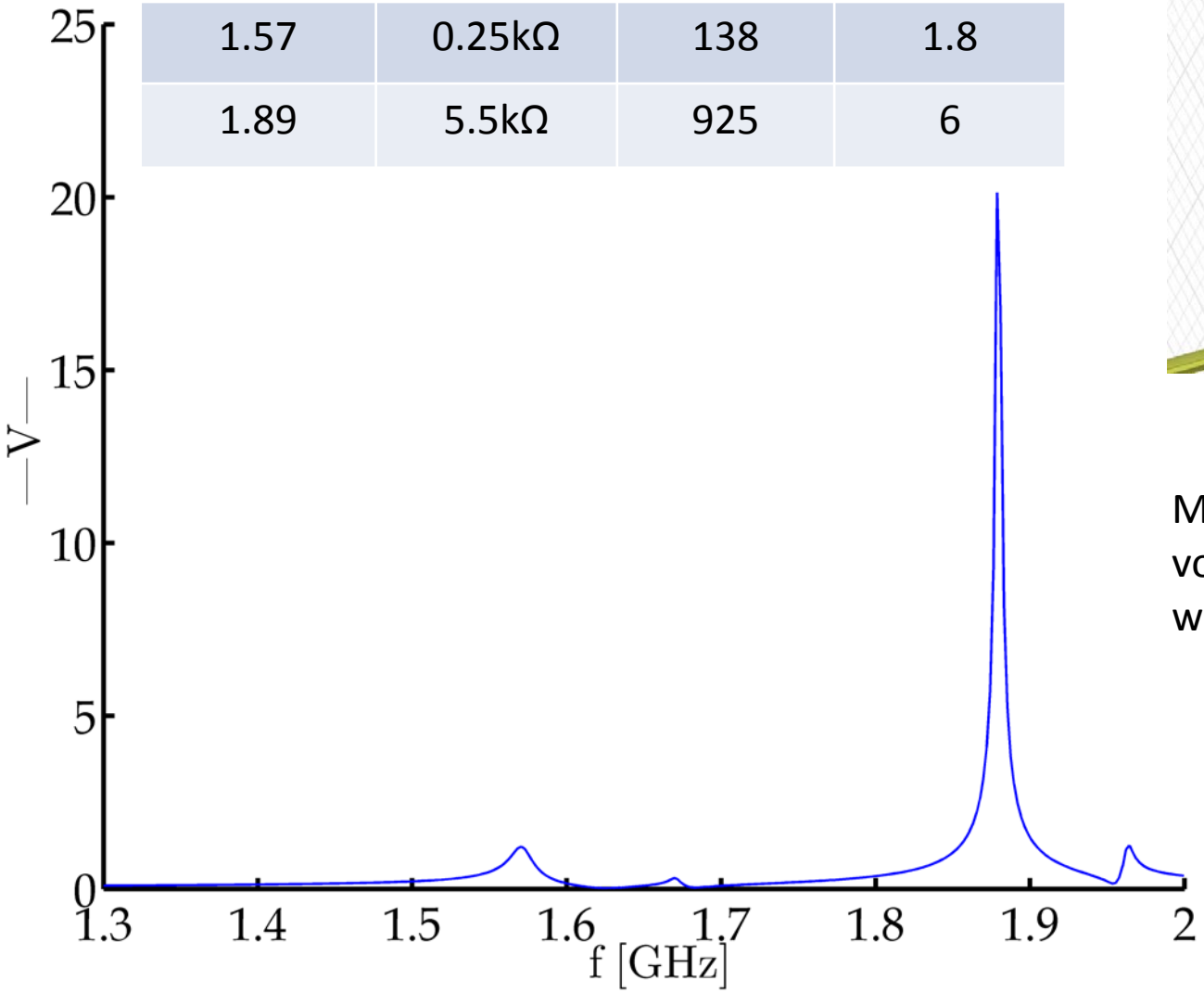
Simulations

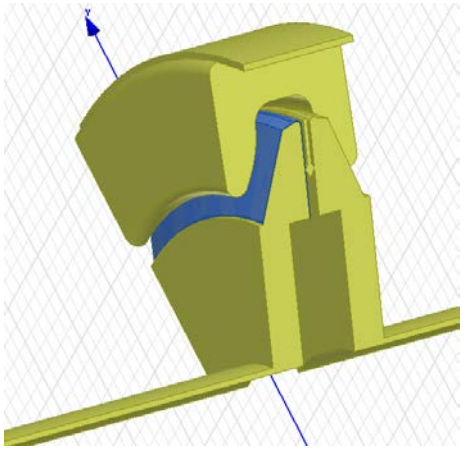
HFSS models for the enamelled QD-QD and MBA-MBA+bellow flanges.



Simulations – QD-QD enamelled flange

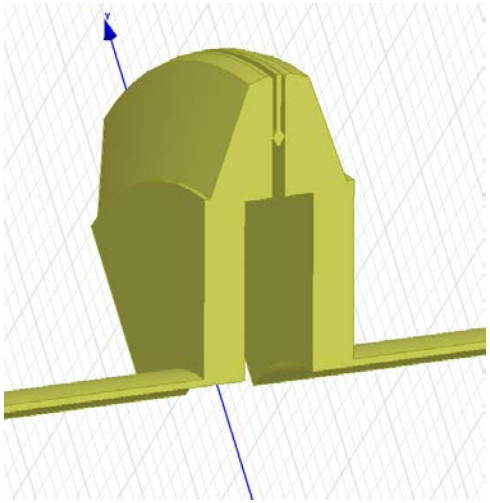
Frequency [GHz]	Impedance	Q	R/Q
1.57	0.25kΩ	138	1.8
1.89	5.5kΩ	925	6





Modulus of the voltage for a 1W plane wave source.

Simulations – QD-QD non-enamelled flange

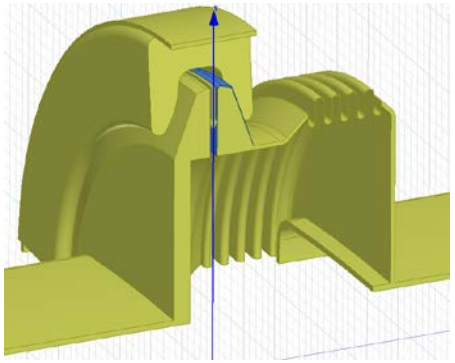


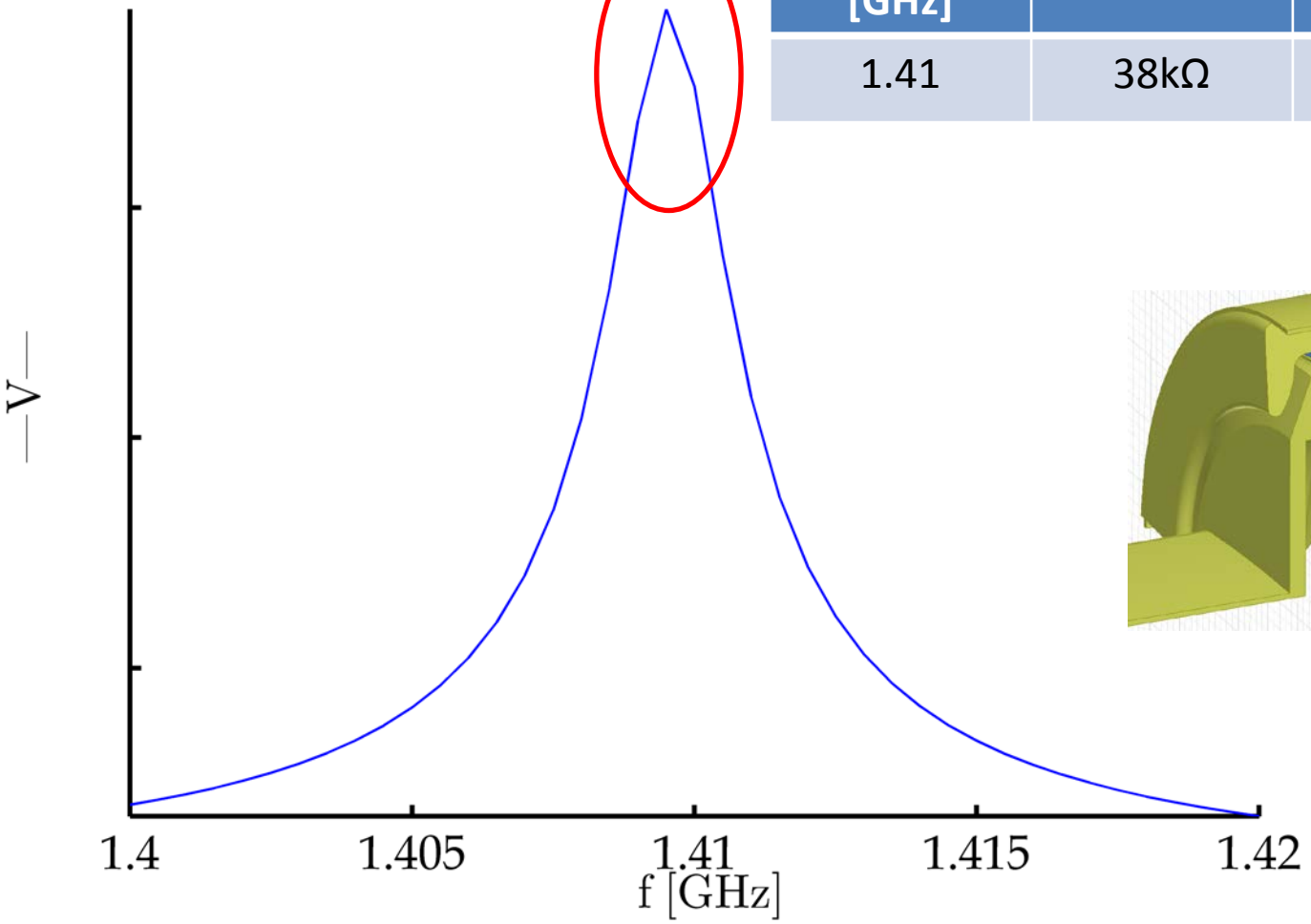
Frequency [GHz]	Impedance	Q	R/Q
1.8	78kΩ	9350	8.5

Simulations – MBA-MBA enamelled flange

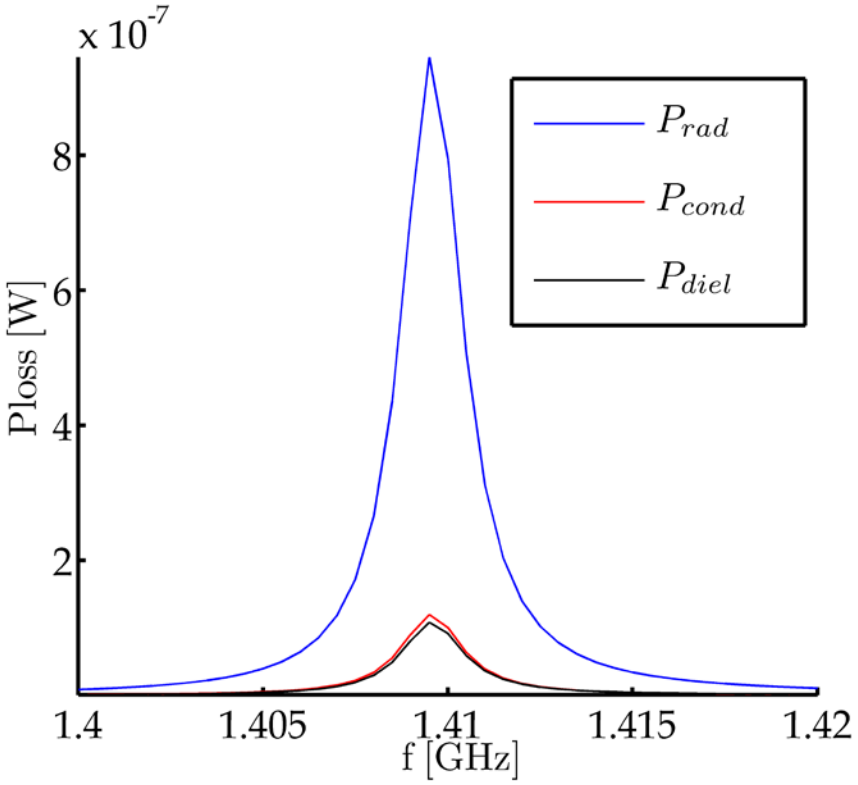
Under sampled bell

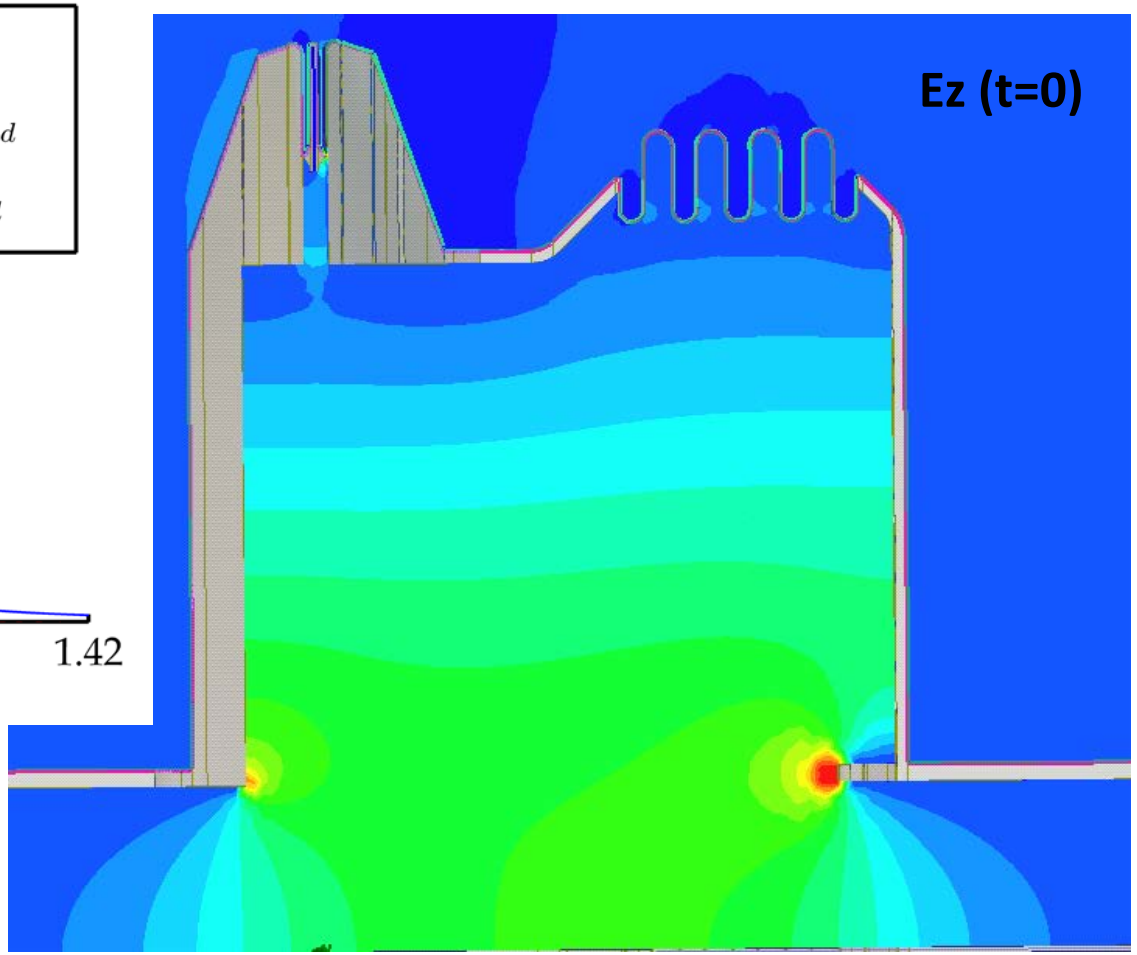
Frequency [GHz]	Impedance	Q	R/Q
1.41	38kΩ	1000	38





Simulations – MBA-MBA enamelled flange





Simulations – Total Impedance so far

Freq [GHz]	Num. of elements	Impedance	R/Q
1.41	97	3.68MΩ	3686
1.57	99	50kΩ	178
1.8	75	5.85MΩ	637
1.89	99	544kΩ	594

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- Introduction
- Simulations
- MBA-MBA enamelled flange with bellow
  - Previous Wire Measurement
  - Shielded BPH Wire Measurement
  - Reflection Measurements
- Next Steps
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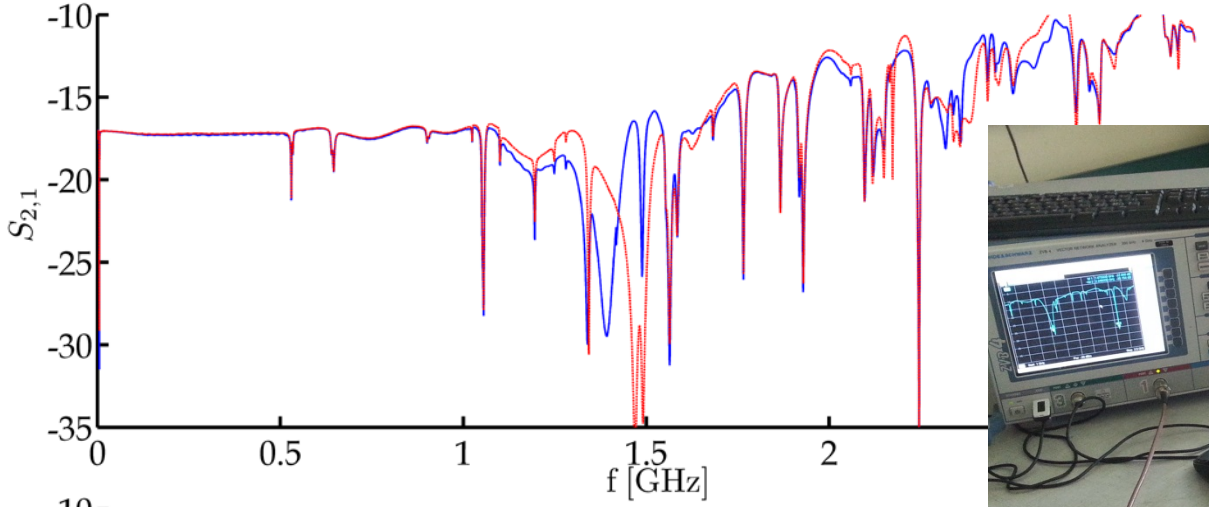
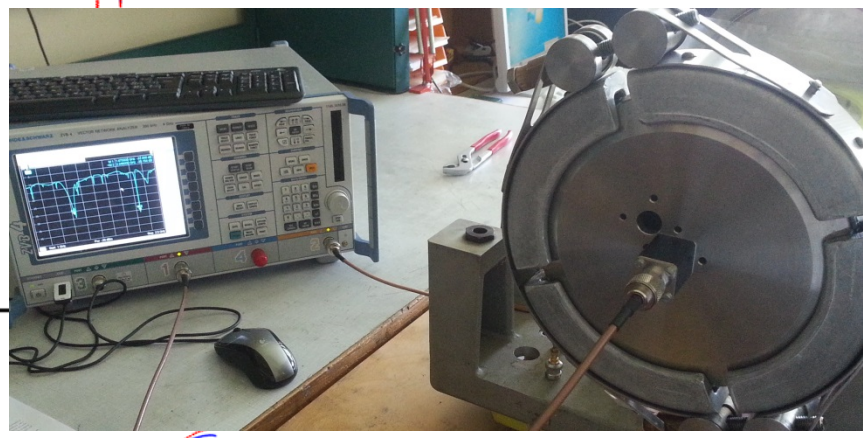
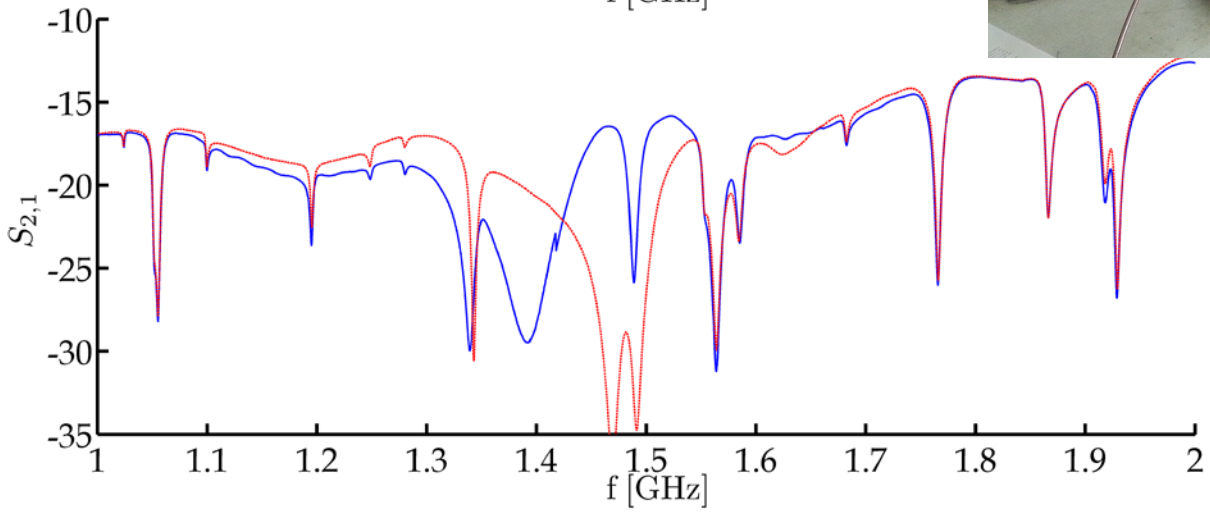
Measurements – Previous Meas.

Last meeting we showed a not so clear wire measurement of a BPH.

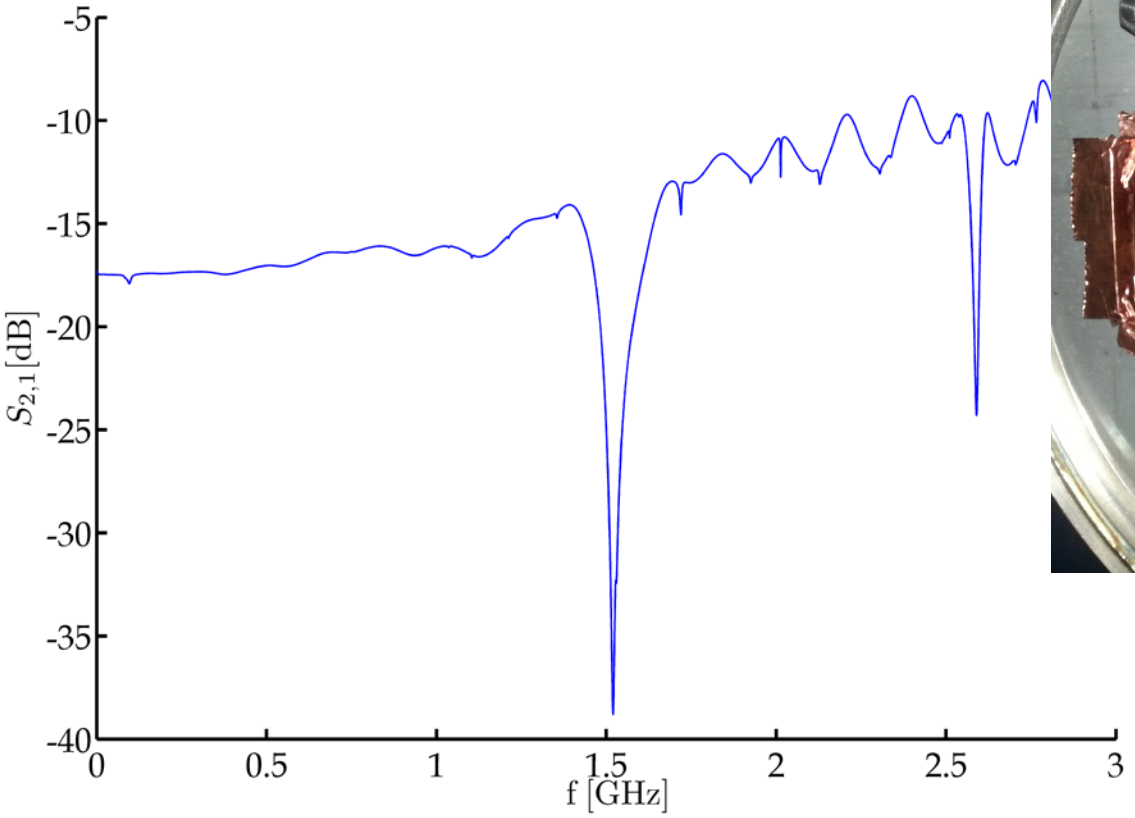


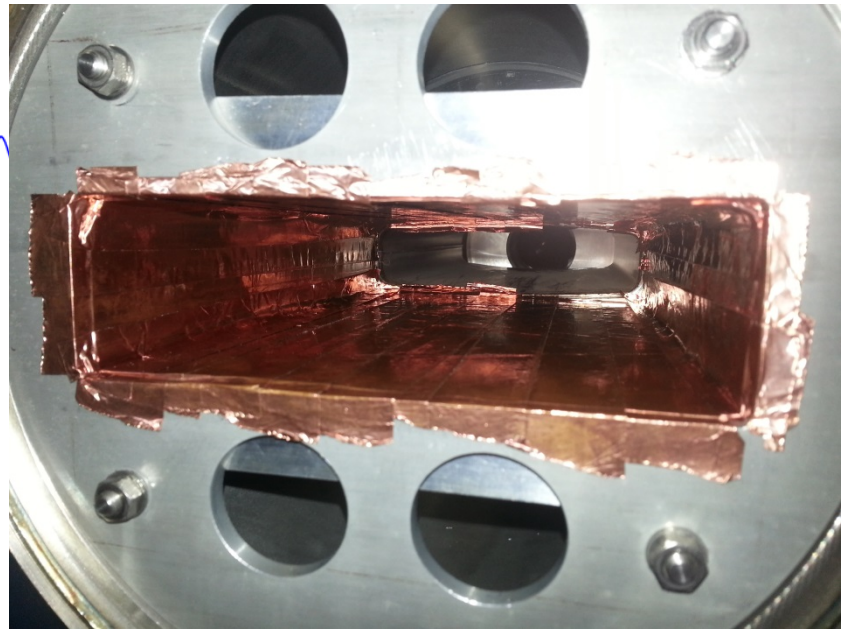




Measurements – Shielded BPH

New wire measurement once the pick-up has been shielded.



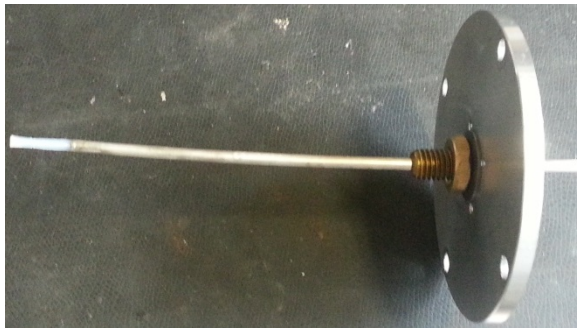


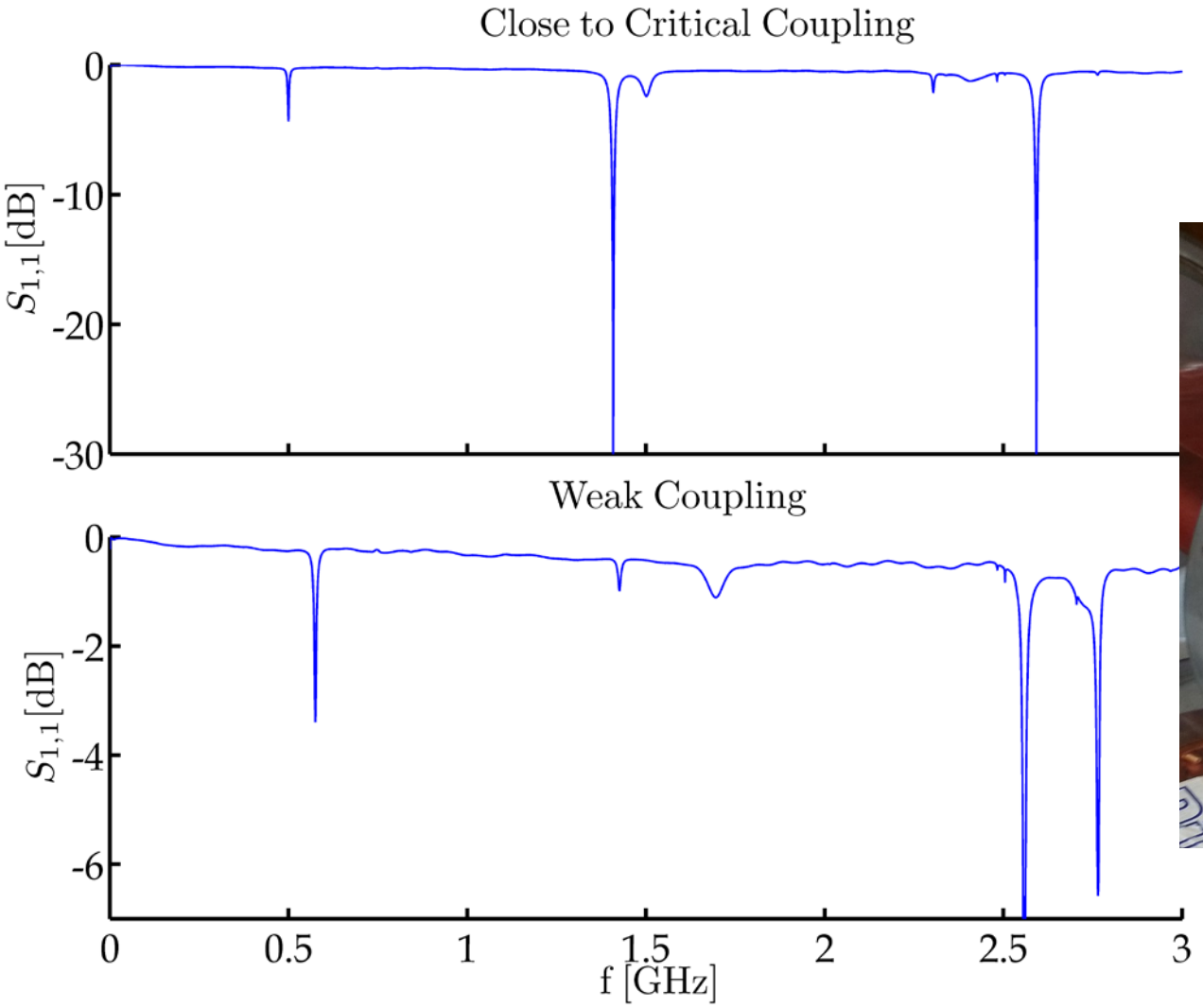
Very thin wire used. ≈0.1mm

Rappel: TE and TM resonant mode classification is only valid for ‘pillbox’ cavities.

Measurements – Reflection Meas.

Reflection measurement with a probe.

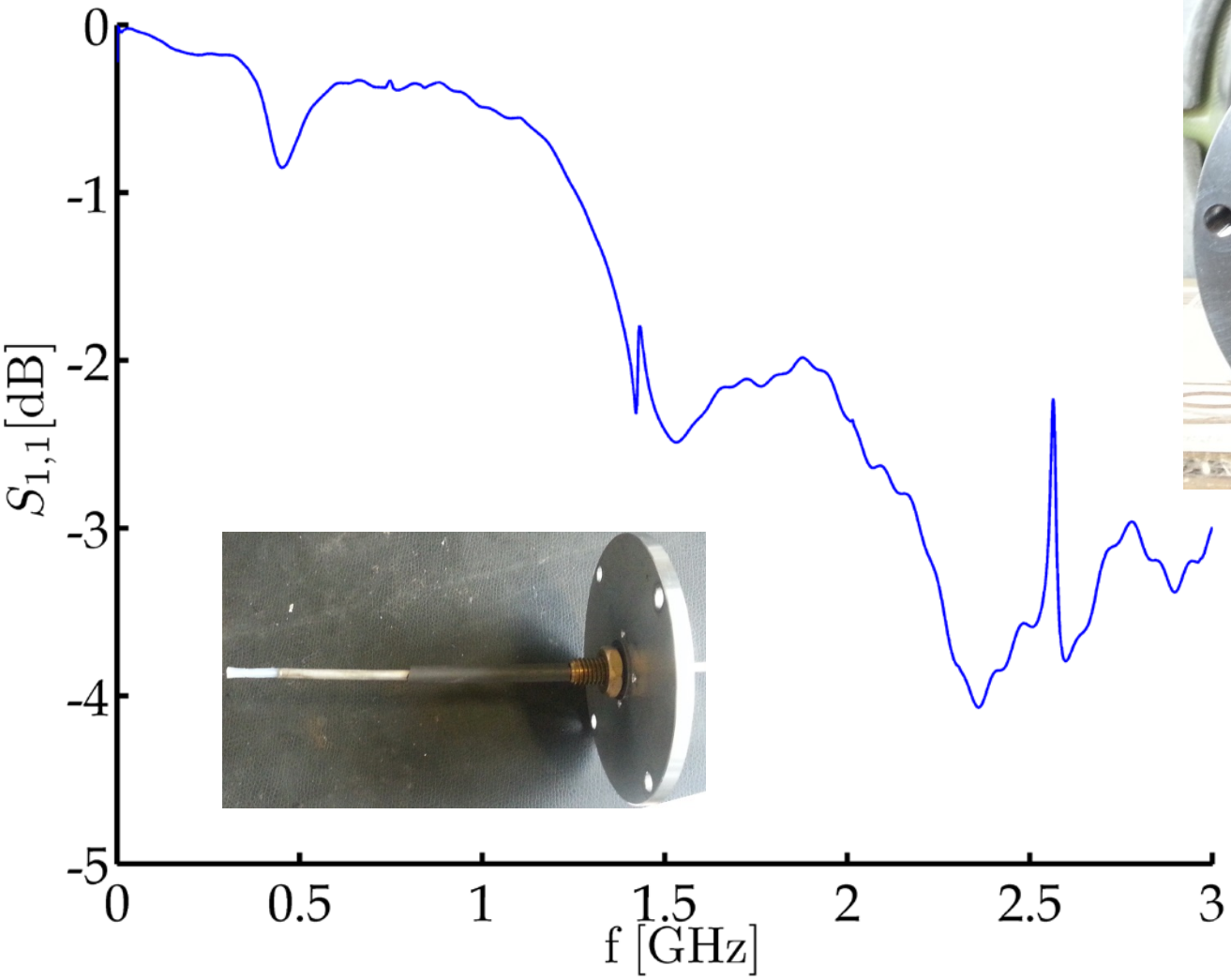




Weak coupling checked via Smith Chart

Measurements – Reflection Meas.

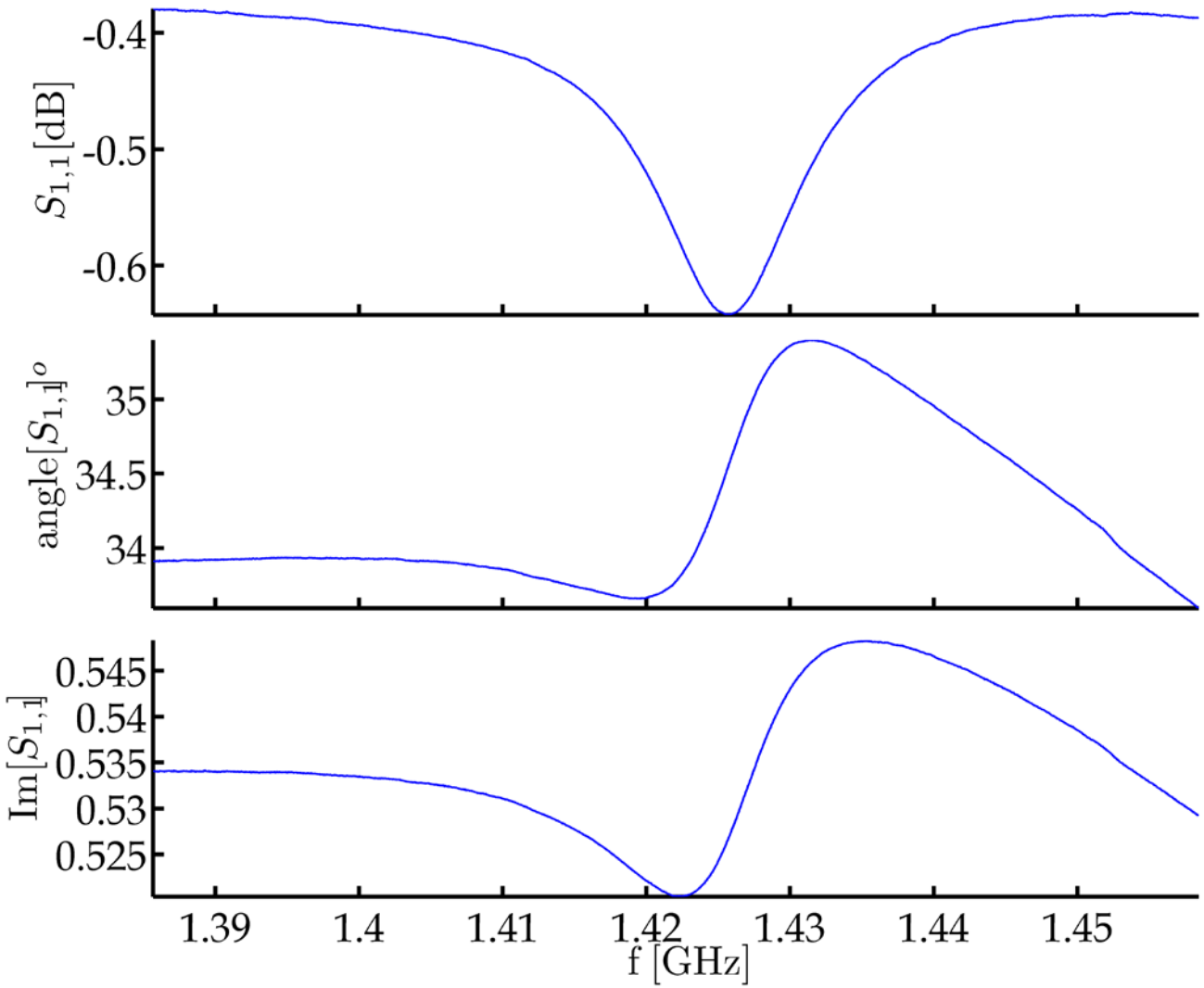
Reflection measurement with a probe. Coaxial mode damping.



Ferrite + foam to damp the coaxial resonances created by the probe.

Measurements – Reflection Meas.

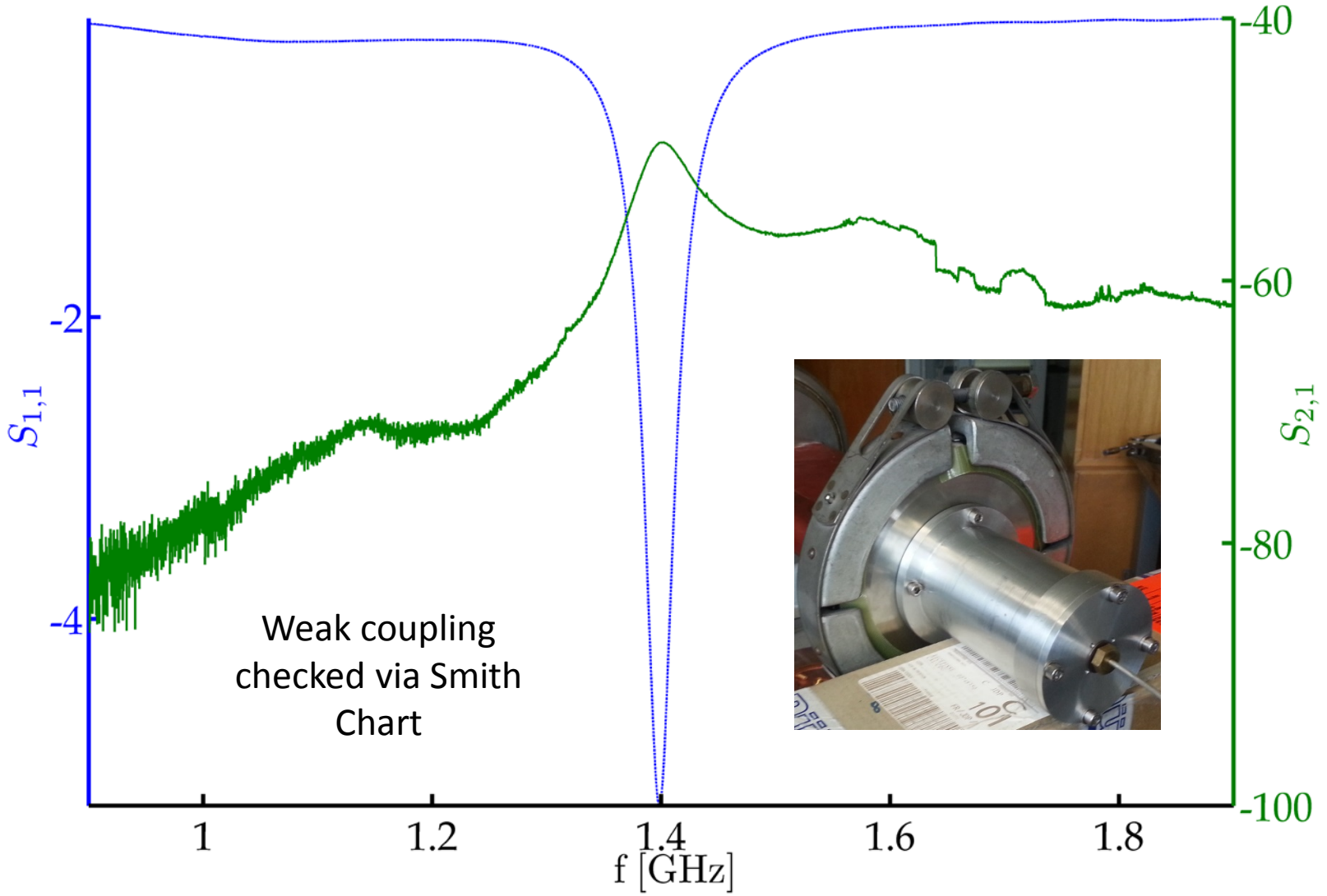
Reflection measurement with a probe. Q measurement.



Measured
Q = 110

Measurements – Transmission Meas.

Transmission measurement with two probes.



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Next Steps

- Simulations
  - Complete all possible flange combinations.
  - Special attention to the QF-QF non-enamelled case.
  - Find a way to overcome current limitations.

- Measurements:
  - Wait for the new set-up. Expected for mid september.

- Suggestions?

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Conclusions

- We have values for the impedance and R/Q of three of the most numerous flange combinations.
- After shielding the pick-up, the BPH flange measurements are cleaner. A Q of 120 has been measured for the 1.4GHz resonance.
- Simulations and Measurements clearly show a 1.4GHz resonance.
  - Whether or not, this resonance is responsible for the instability is left for discussion.