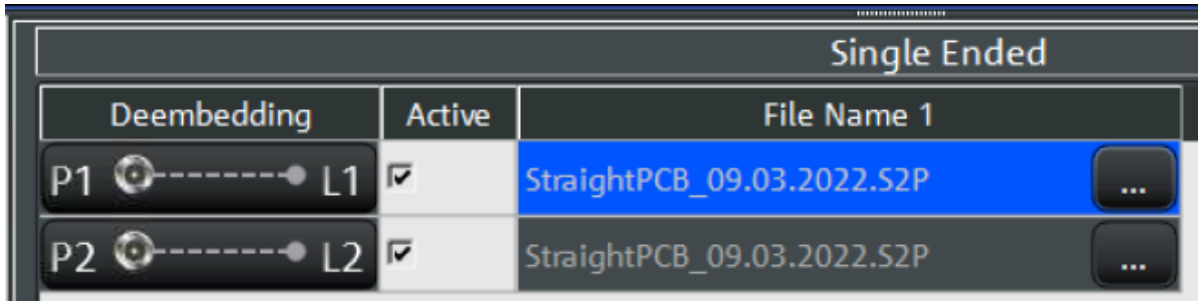
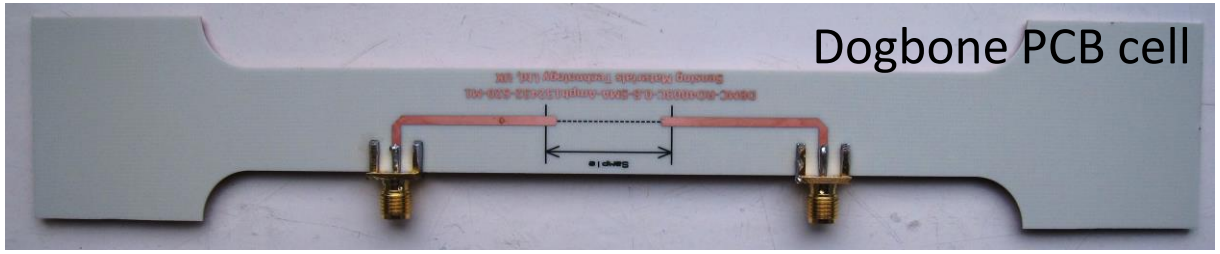
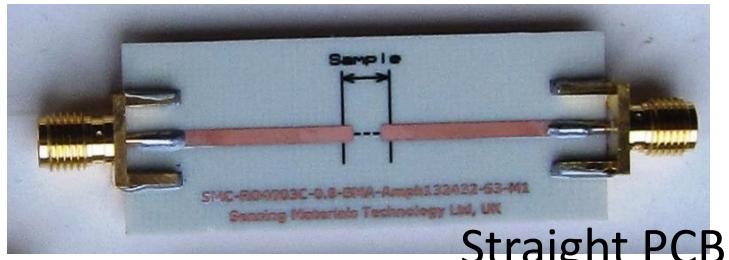
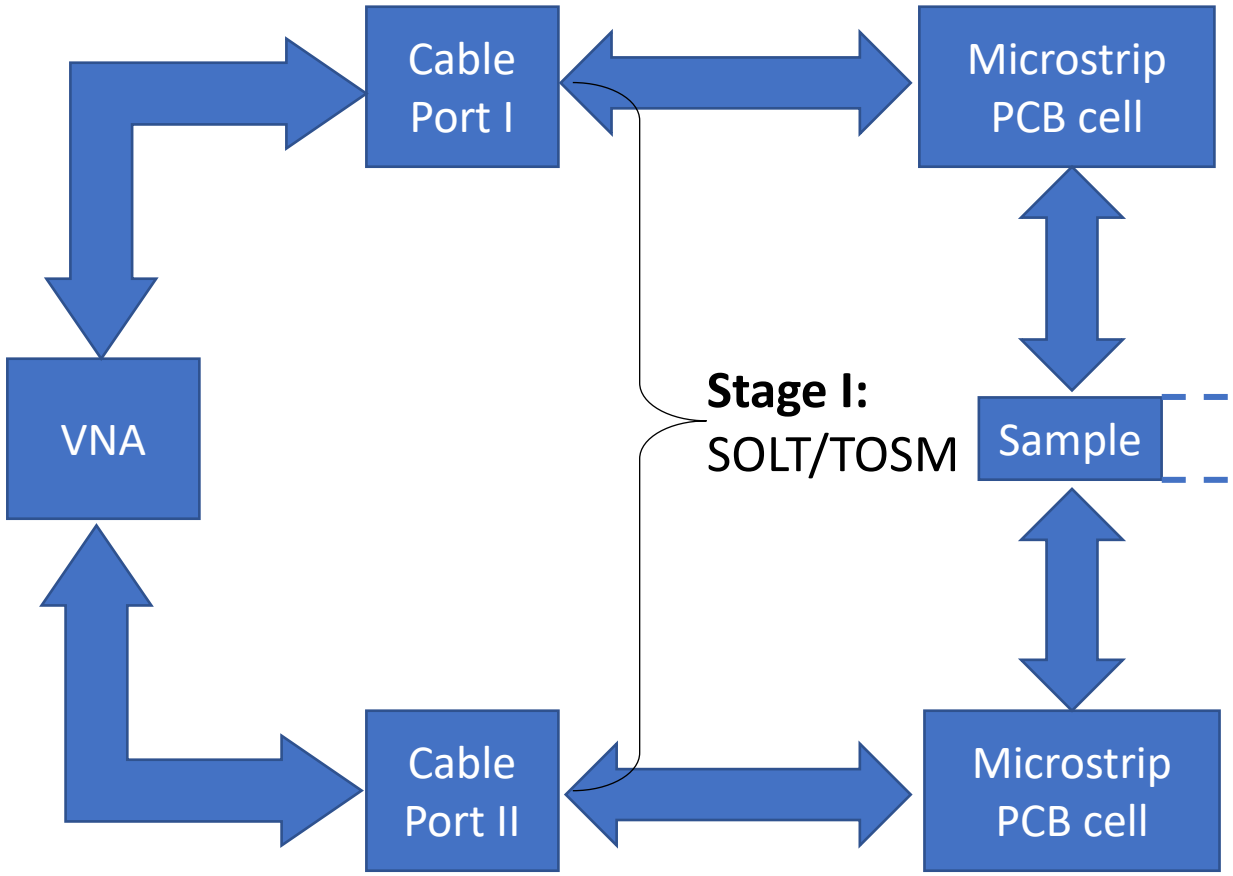
SOLT/TOSM – standard 2-port VNA calibration procedure with the coaxial terminations (R&S mechanical cal kit)









Stage II:
Deembedding

Stage I:
SOLT/TOSM

Stage III:
Delay Time Compensation

Stage II:
Deembedding

SP4T RF switch inside the antenna pillars with SOL/OSM coaxial terminations

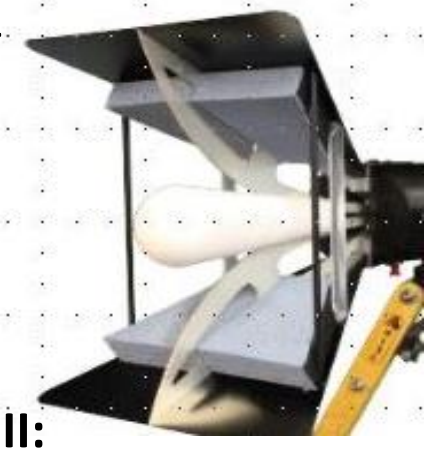
Short cable before the switching box Port I

Long antenna cable

Stage II:
Deembedding

Antenna and free space

Stage III:
- Response&Isolation
- TRL



VNA

SP6T RF switches at the switching box with SOLT/TOSM coaxial terminations

Stage I:
SOLT/TOSM

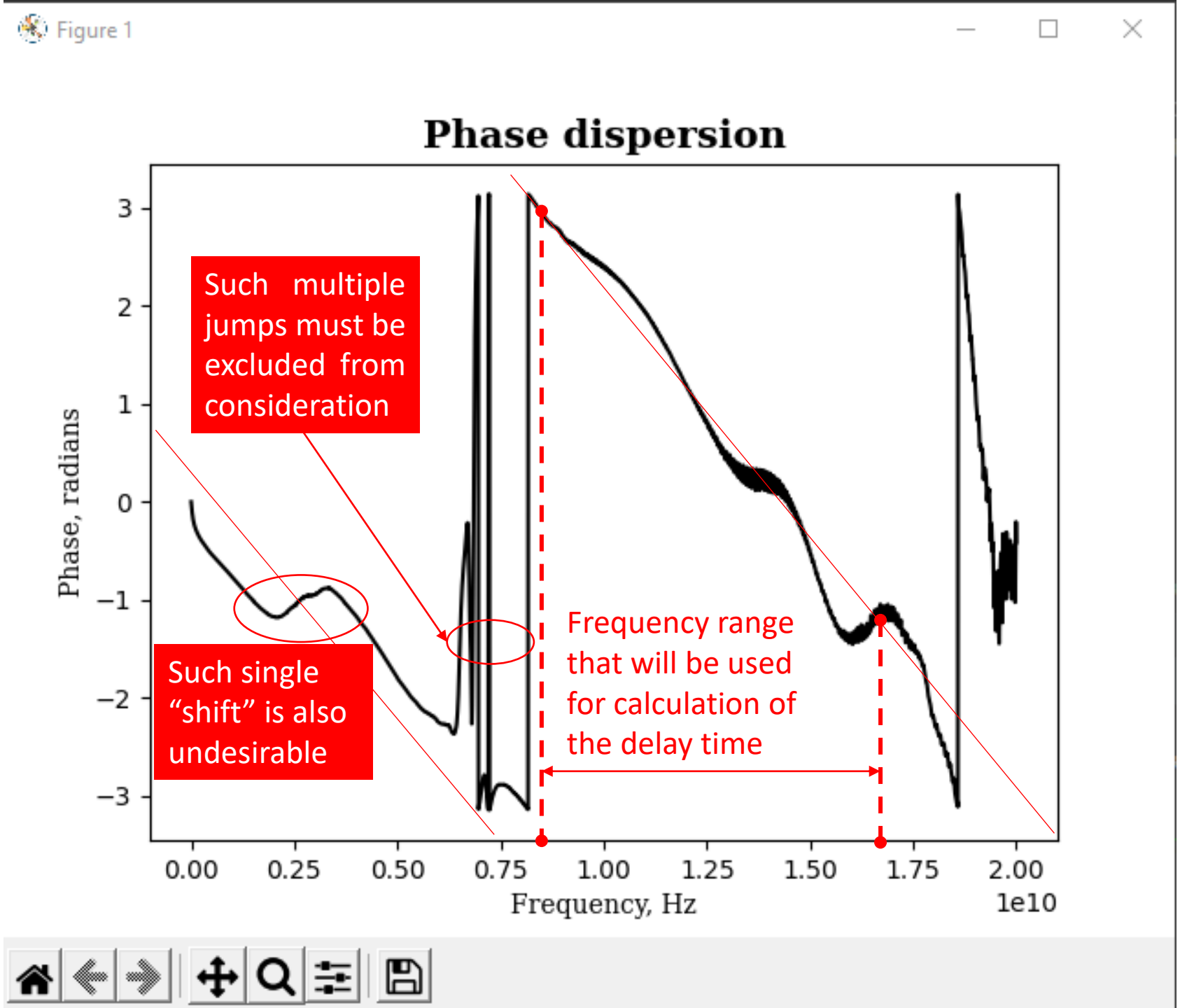
Sample

Stage II:
Deembedding

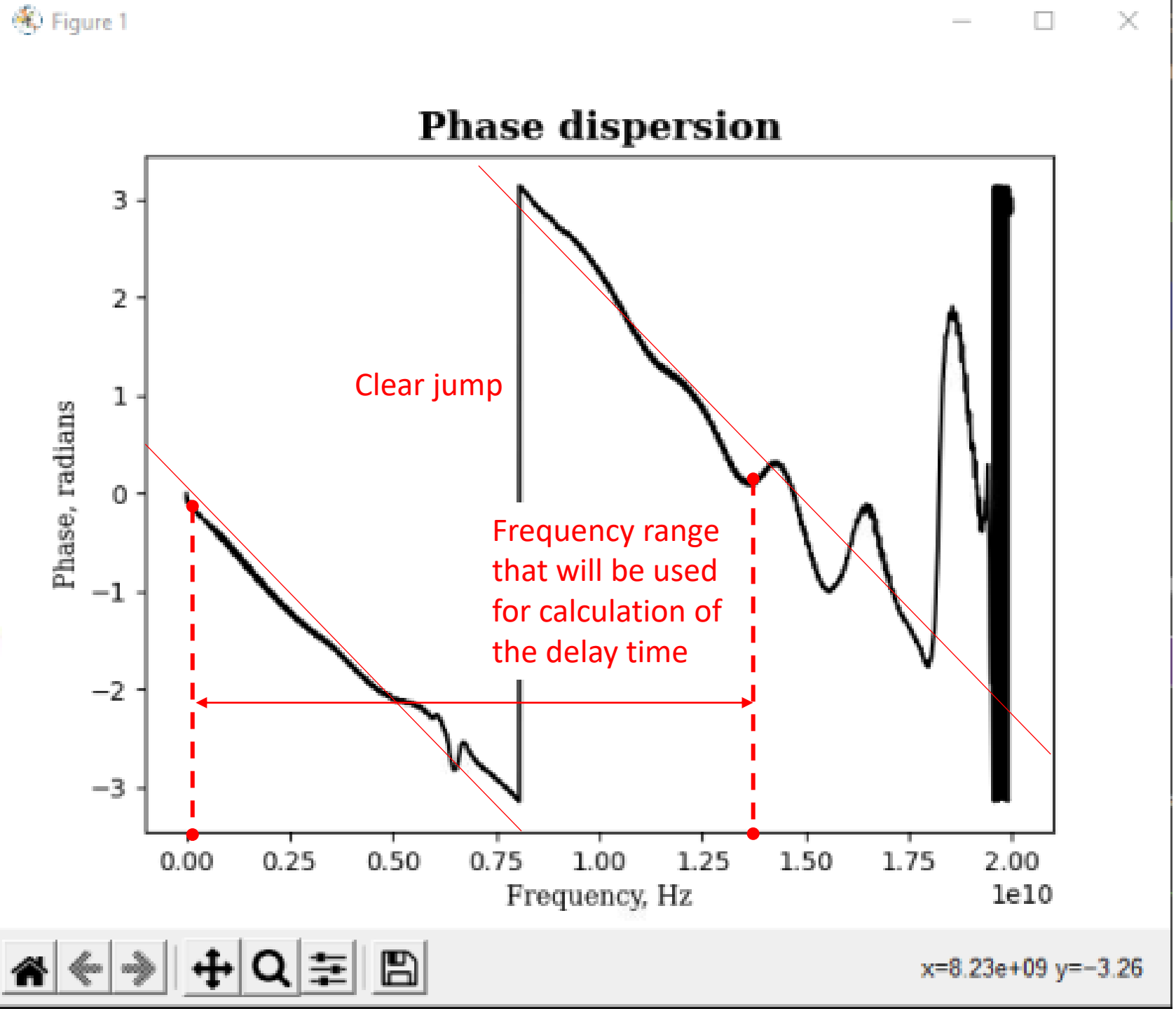
Stage III:
- Response&Isolation
- TRL

Short cable before the switching box Port II

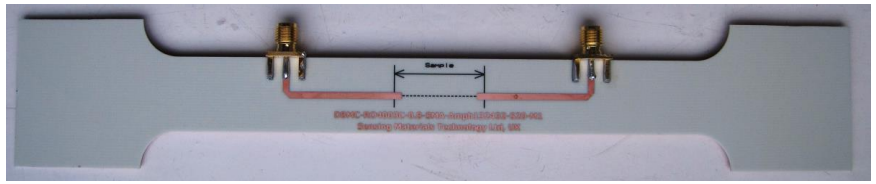
Long antenna cable



- Choose parallel lines in the phase dispersion
- The frequency range may include the phase jumps but they must be "clear", not as in this graph on the right
- That is why we will choose only the second line after the multiple jumps on the left and before the jumps on the right
- Even for this part (without jumps), we will select a narrower frequency range



Although the two phase dispersion lines before and after the jump do not look perfectly parallel, we could try to combine them into an unwrapped phase.



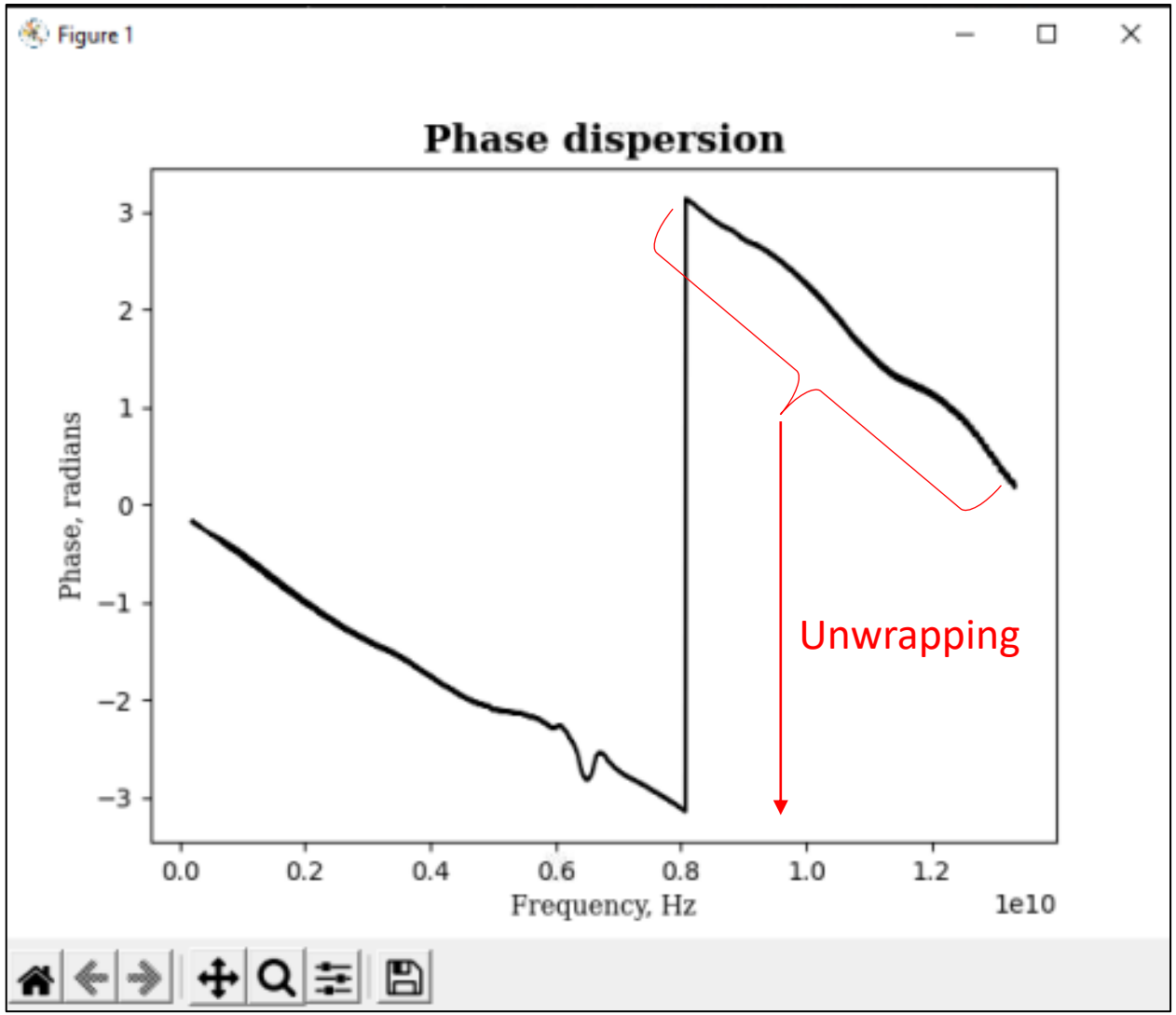


Figure 1
Phase dispersion
Phase, radians
3
2
1
0
−1
−2
−3
0.0
0.2
0.4
0.6
0.8
1.0
1.2
Frequency, Hz
1e10
Unwrapping

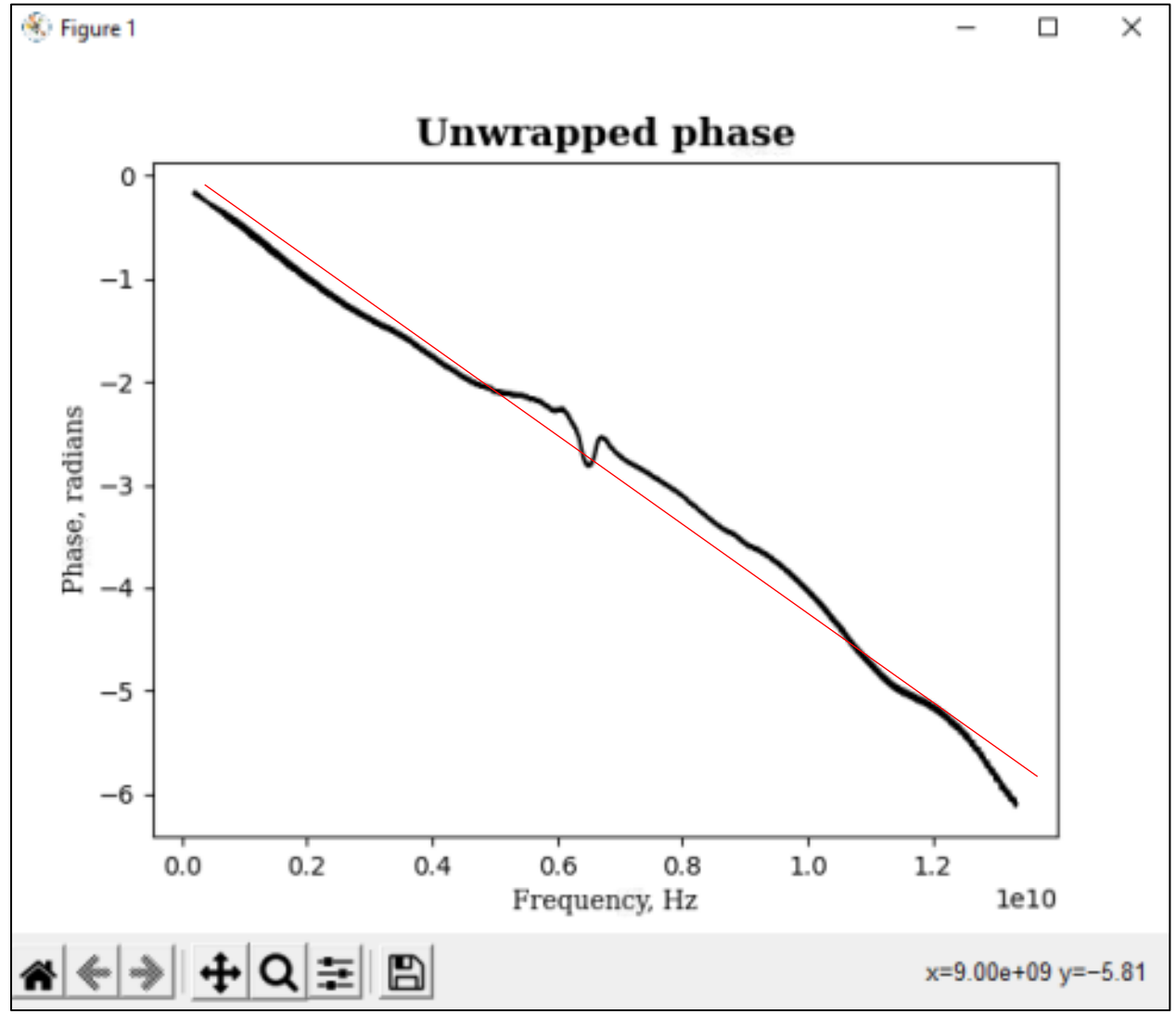
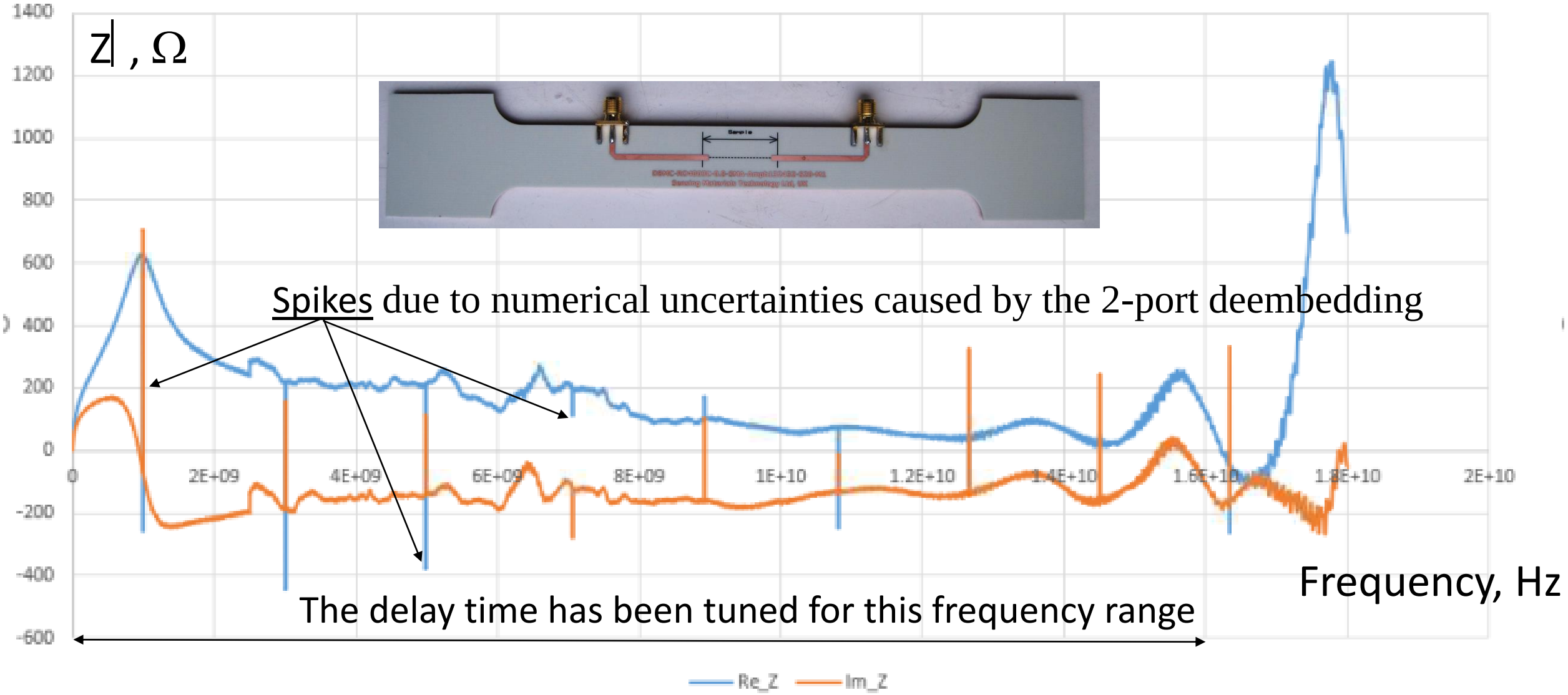
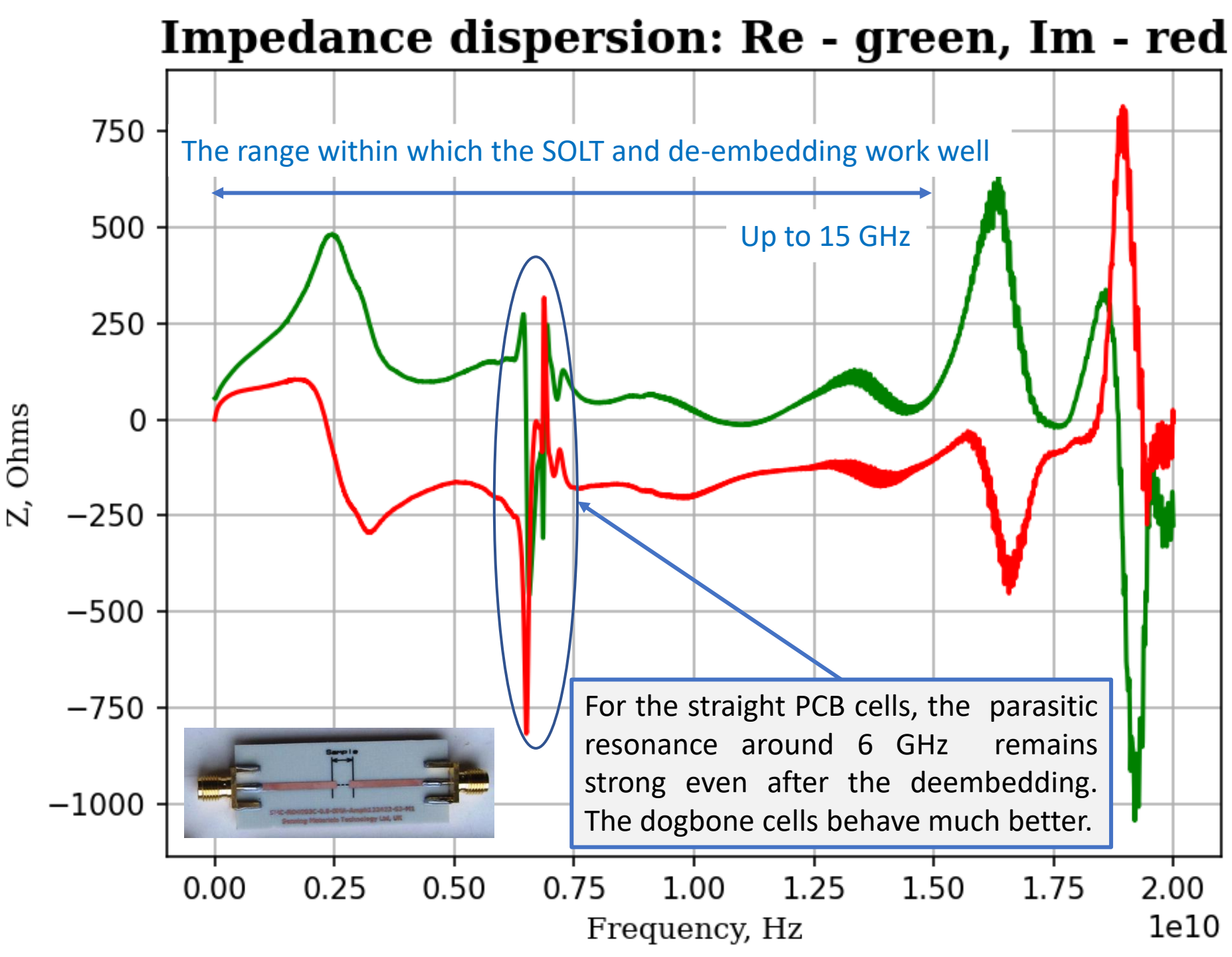


Figure 1
Unwrapped phase
Phase, radians
0
−1
−2
−3
−4
−5
−6
0.0
0.2
0.4
0.6
0.8
1.0
1.2
Frequency, Hz
1e10
x=9.00e+09 y=−5.81

$$\bar{S}_{21} = S_{21} \times \exp(i\omega\Delta t) \quad \Rightarrow \quad \mathrm{Z} = 100 \times \frac{1-\bar{S}_{21}}{\bar{S}_{21}}$$



Impedance dispersion measured in a ferromagnetic wire


Impedance dispersion: Re - green, Im - red
The range within which the SOLT and de-embedding work well
Up to 15 GHz
For the straight PCB cells, the parasitic resonance around 6 GHz remains strong even after the deembedding. The dogbone cells behave much better.
Z, Ohms
750
500
250
0
−250
−500
−750
−1000
0.00
0.25
0.50
0.75
1.00
1.25
1.50
1.75
2.00
Frequency, Hz
1e10