Universität Siegen

HEP Experimental High Energy Physics

CPPS Center for Particle Physics Siegen

All-silicon meeting

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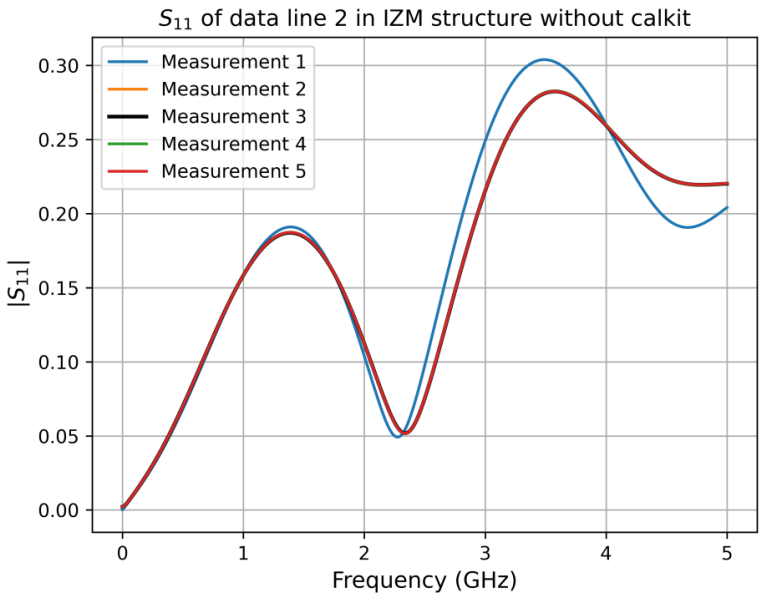
04.09.2026

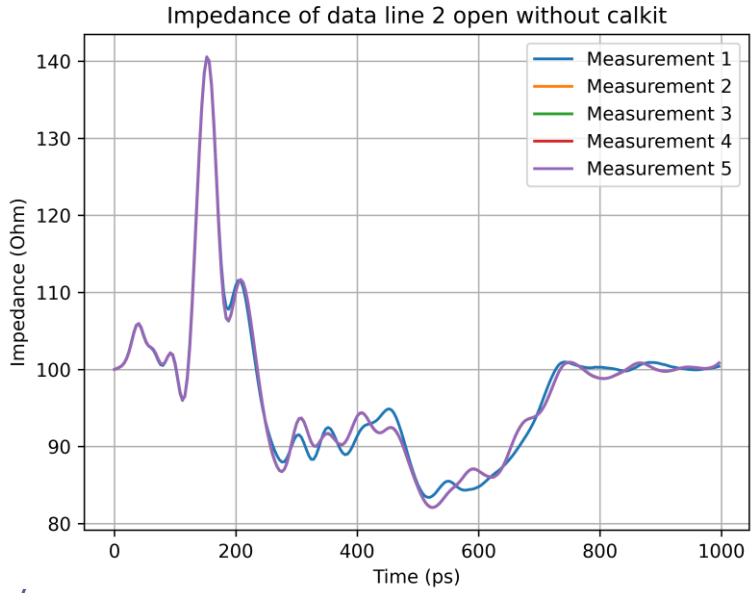
In collaboration with

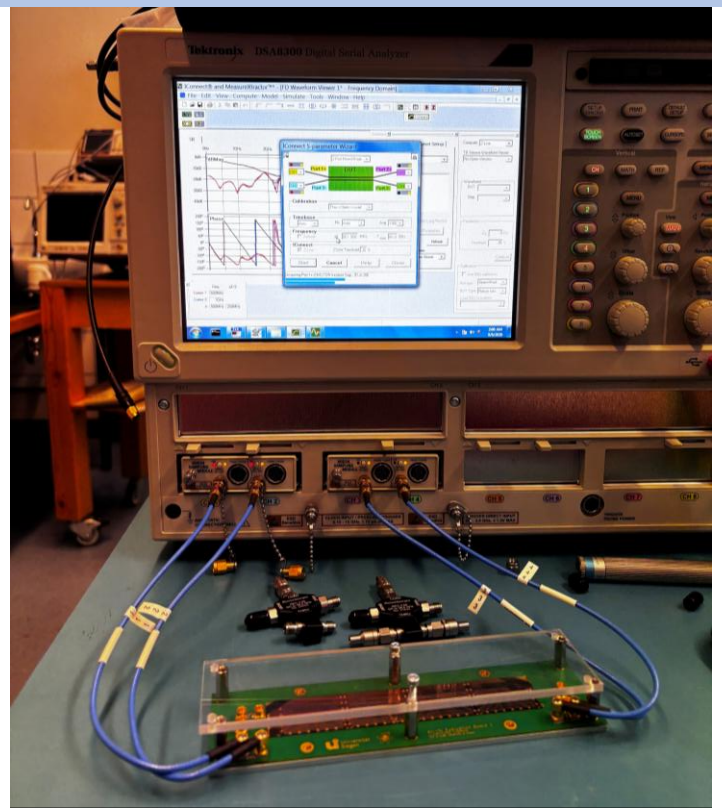
UNIVERSITÄT BONN

GEORG-AUGUST-UNIVERSITÄT GÖTTINGEN IN PUBLICA COMMODA SEIT 1737

TDR measurements

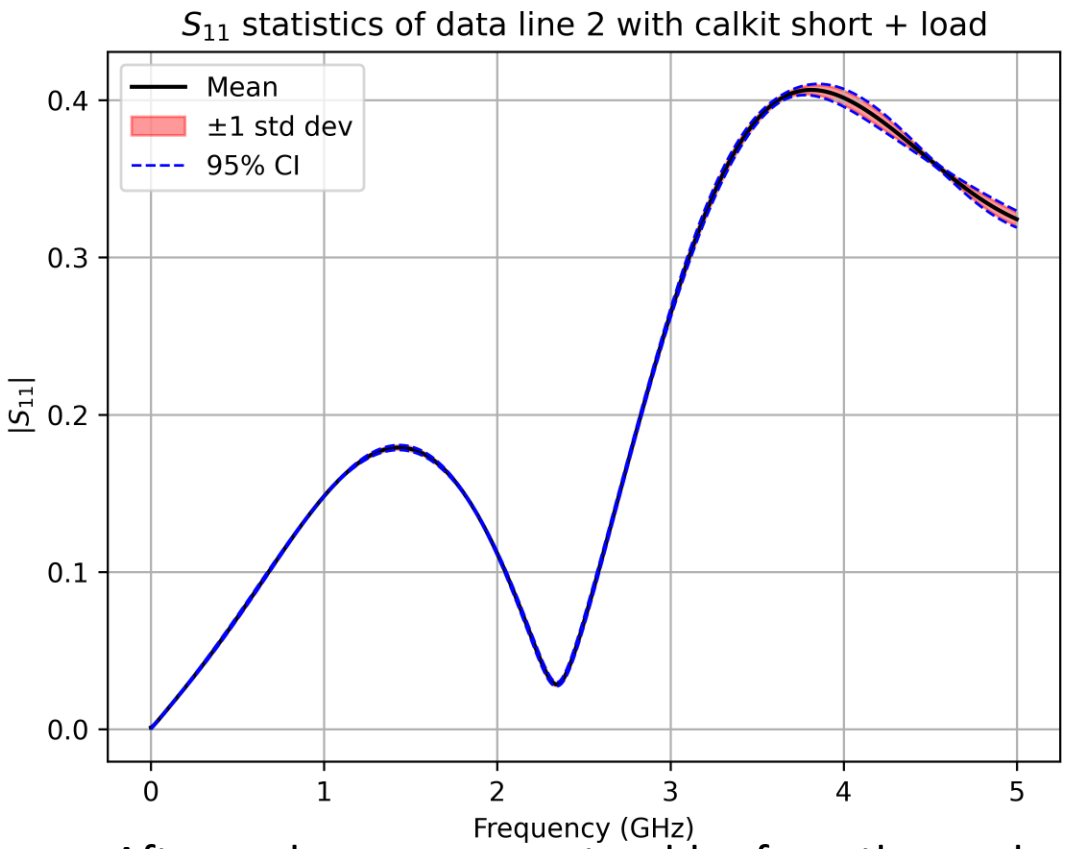


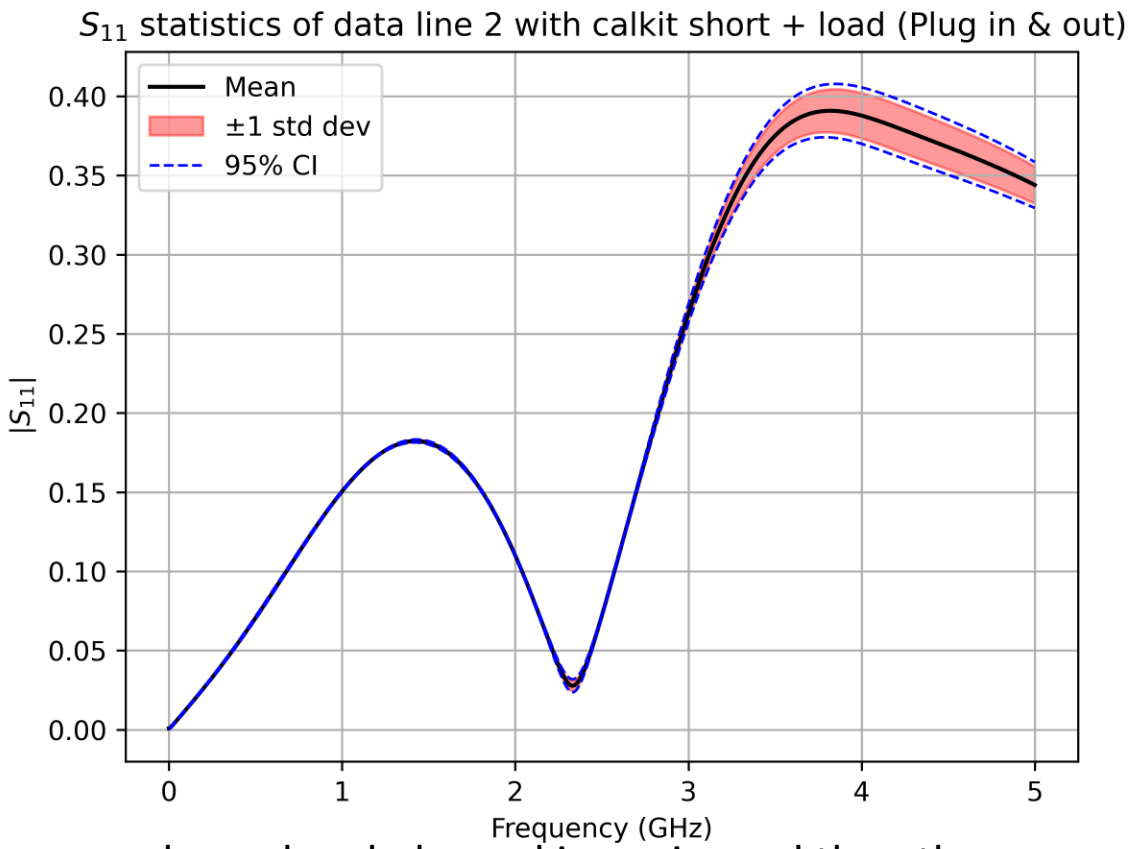




- After measurement 1, cables from the readout PCB were unplugged and plugged in again, and then other measurements were taken
- If we repeat measurements without unplugging and plugging in cables, the results remain the same
- Does this suggest that systematic uncertainty comes from cable orientation??

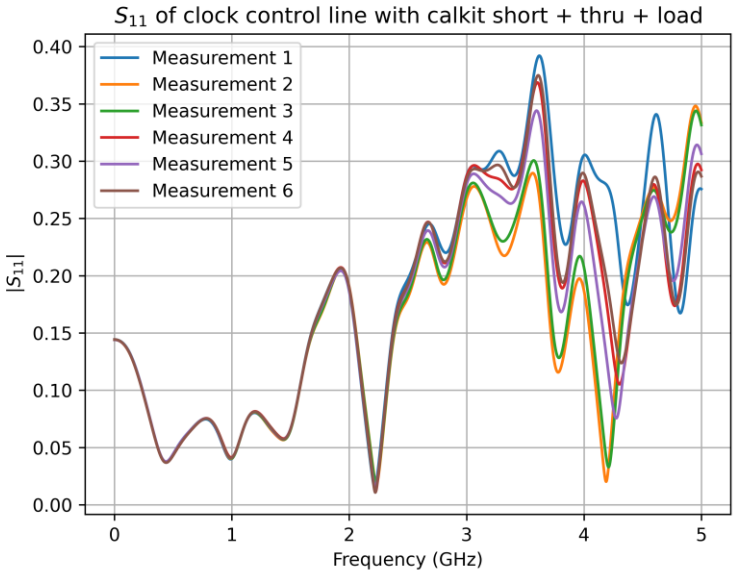
TDR measurements

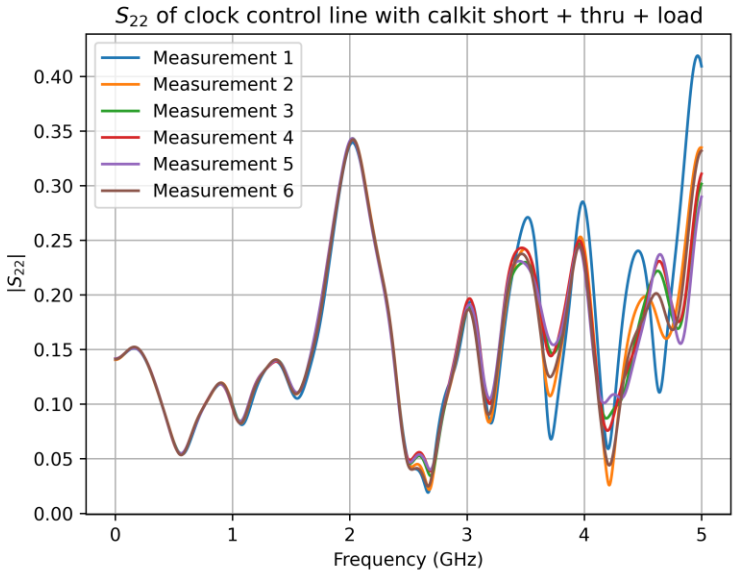


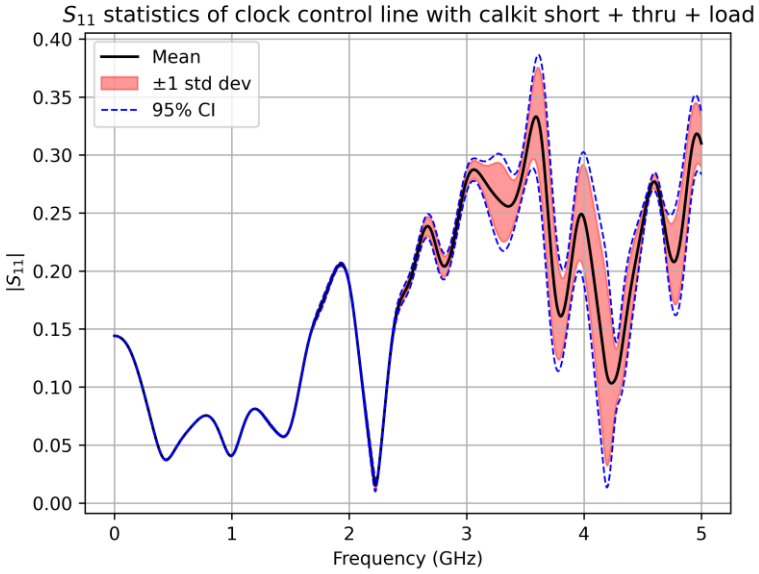


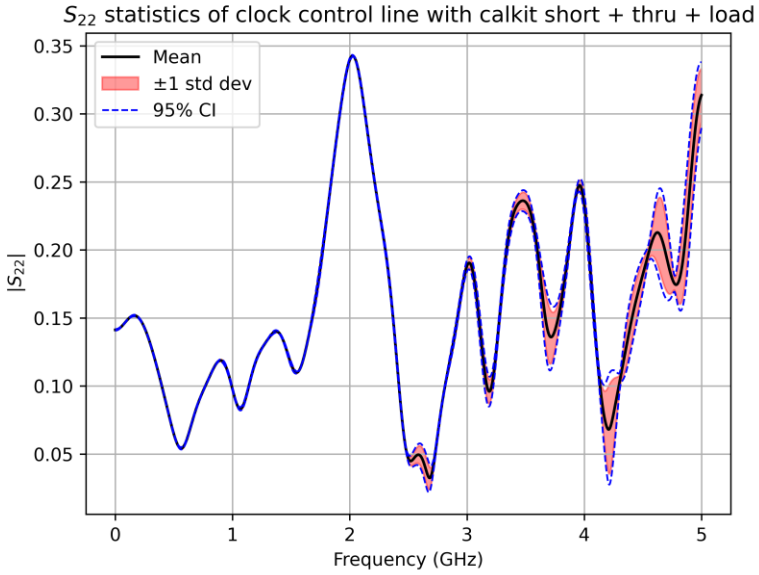
- After each measurement, cables from the readout PCB were unplugged and plugged in again, and then the next measurements were taken for the right side of the plot
- For the left side of the plot, cables were connected all the time, but cables were moving during the measurement
- This suggests that systematic uncertainty comes from cable orientation!!

TDR measurements of the clock control line









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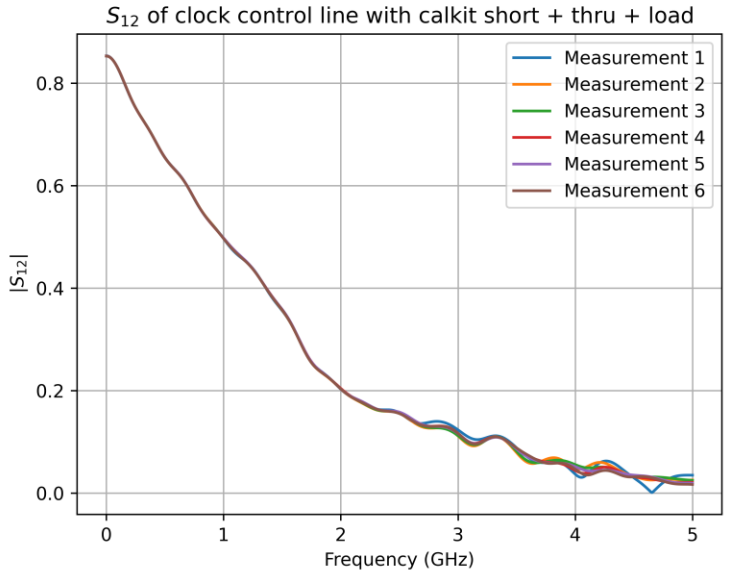
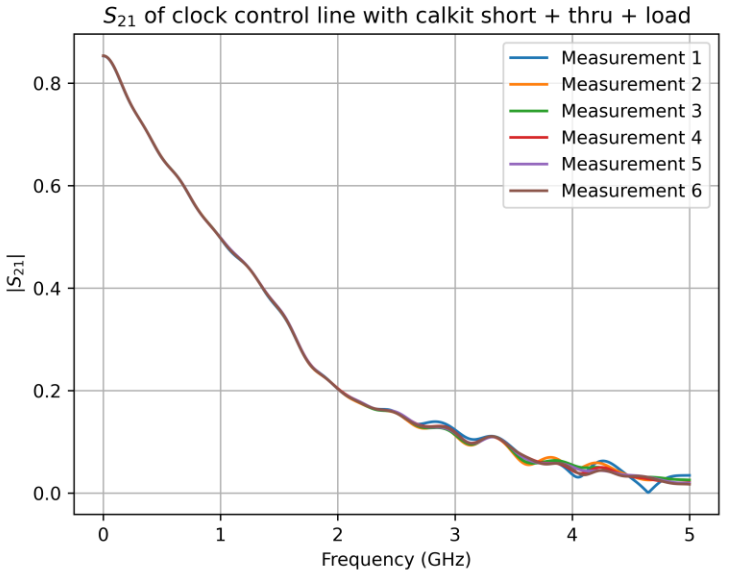
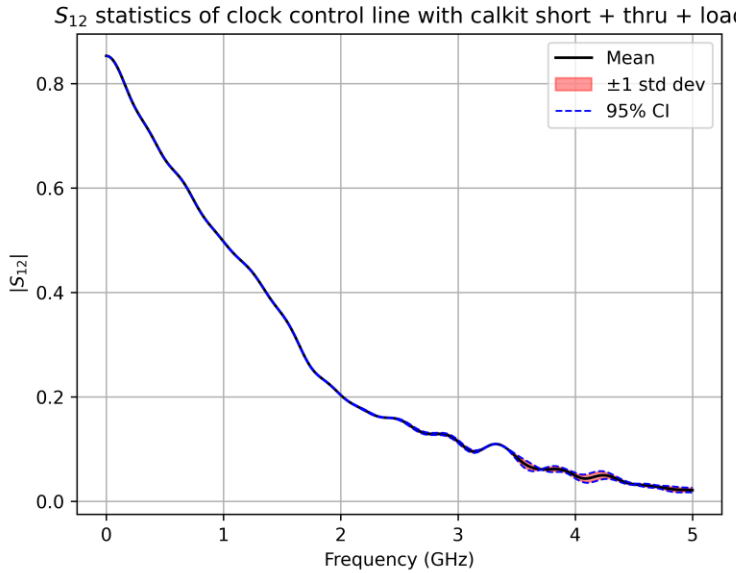
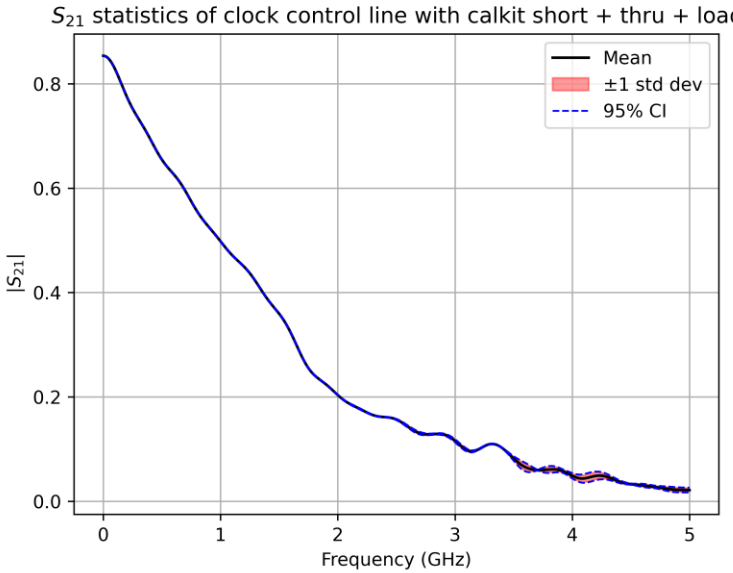
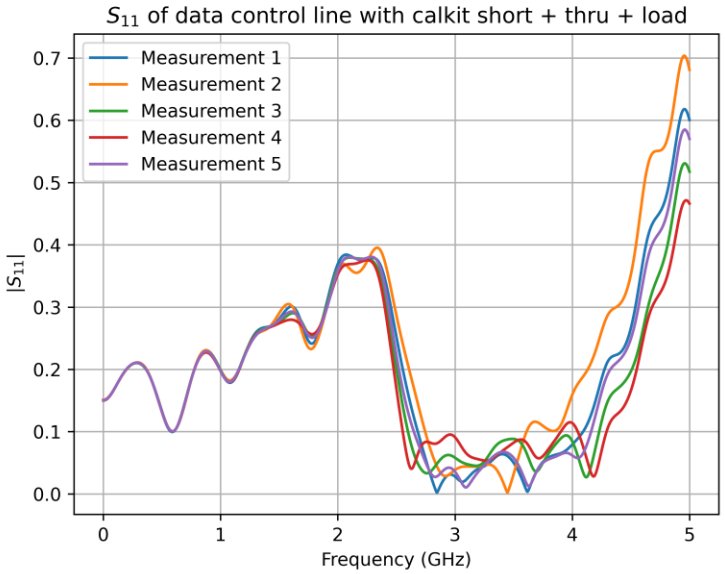


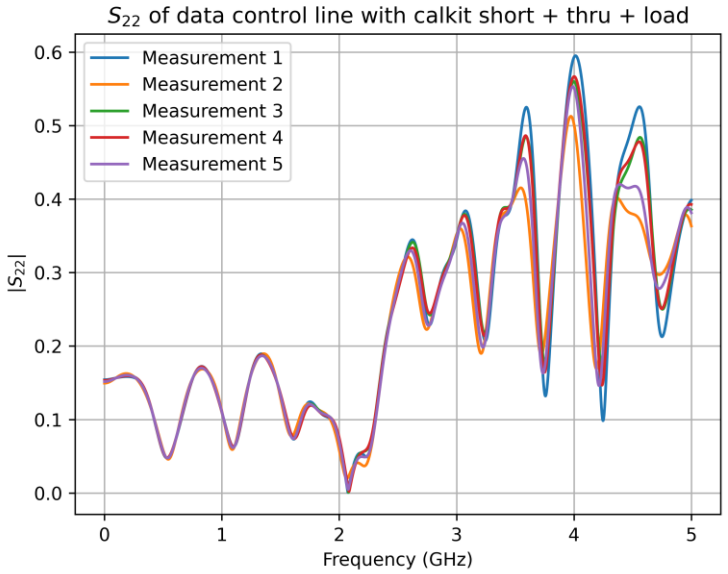


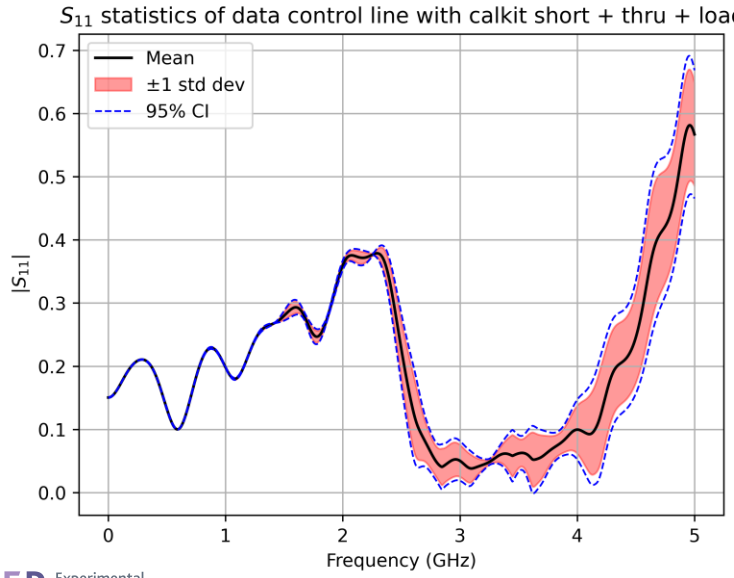


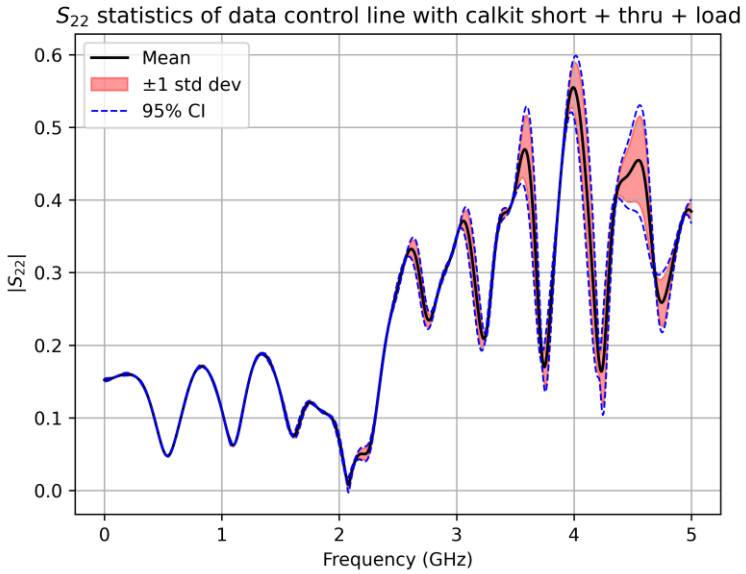


TDR measurements of the data control line

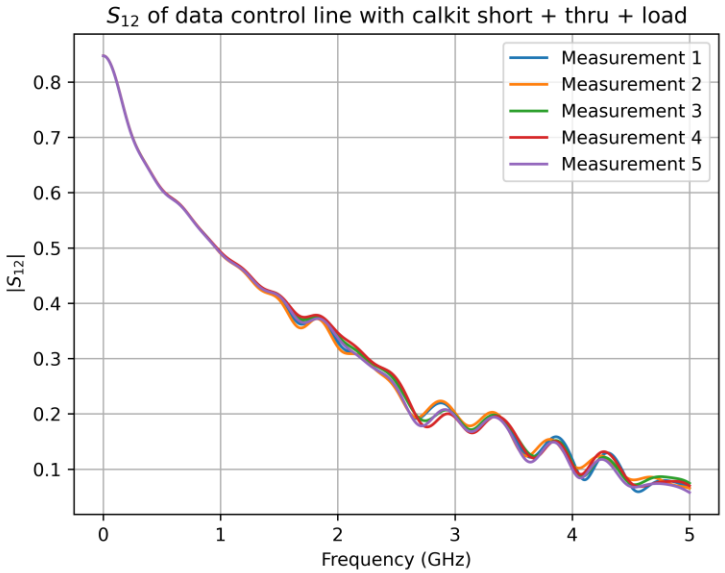


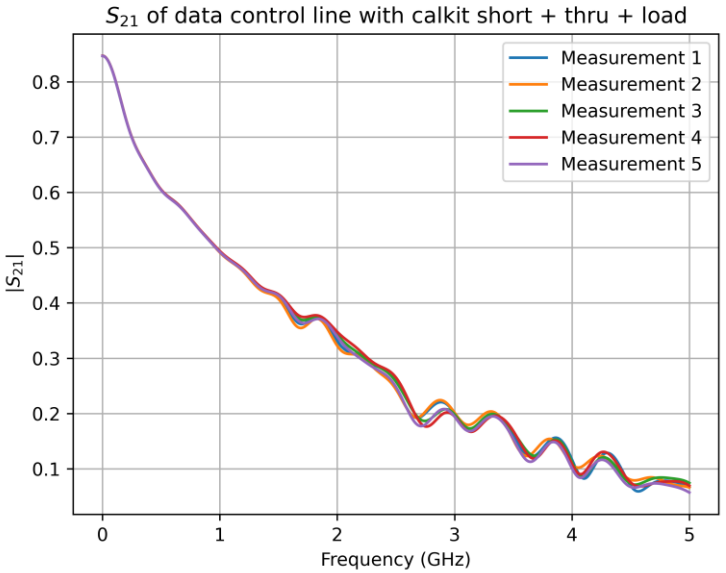


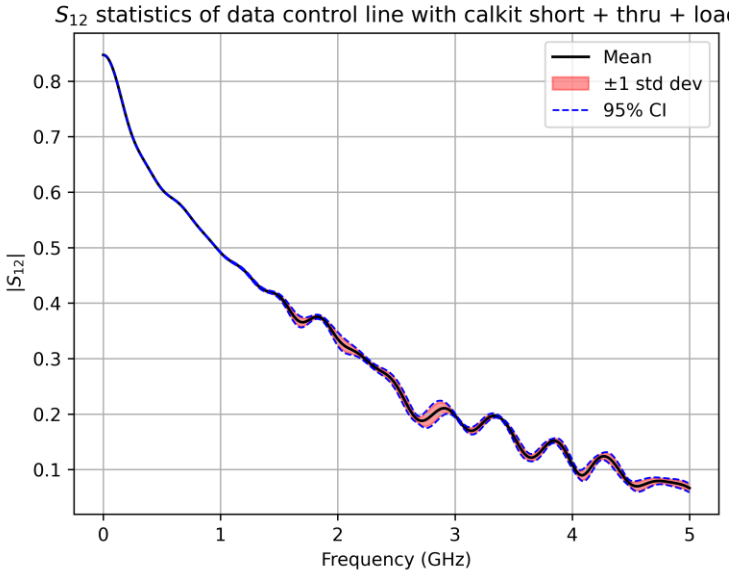


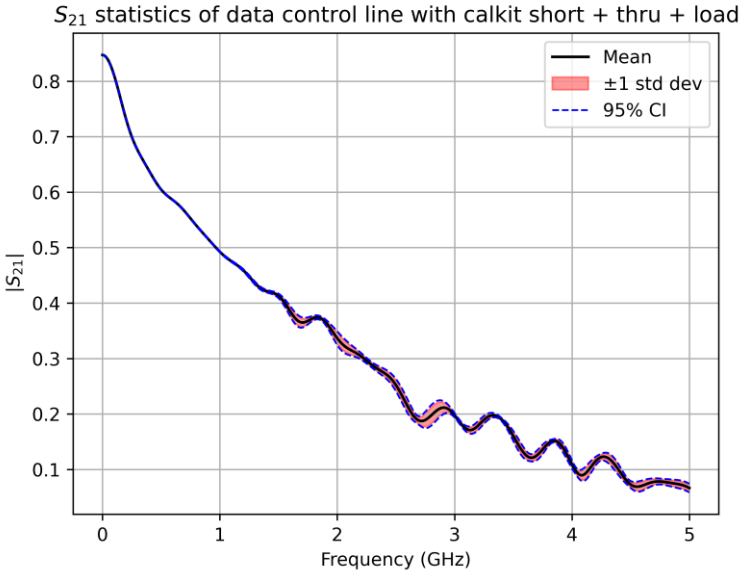


TDR measurements of the data control line

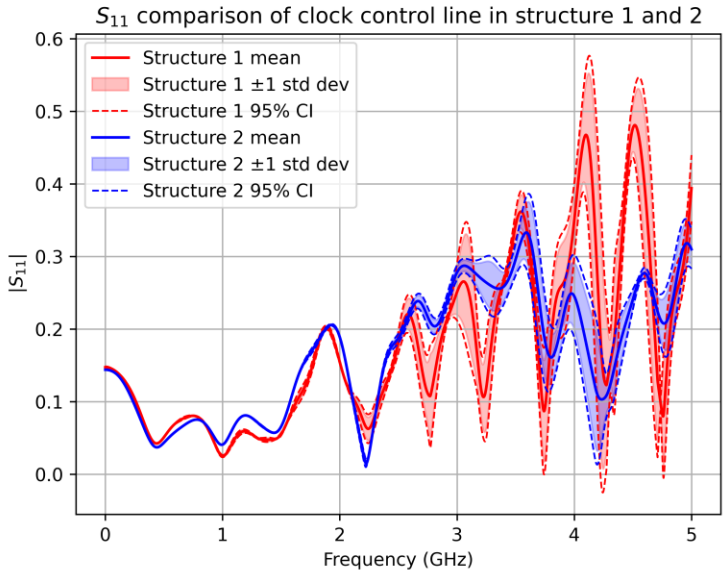


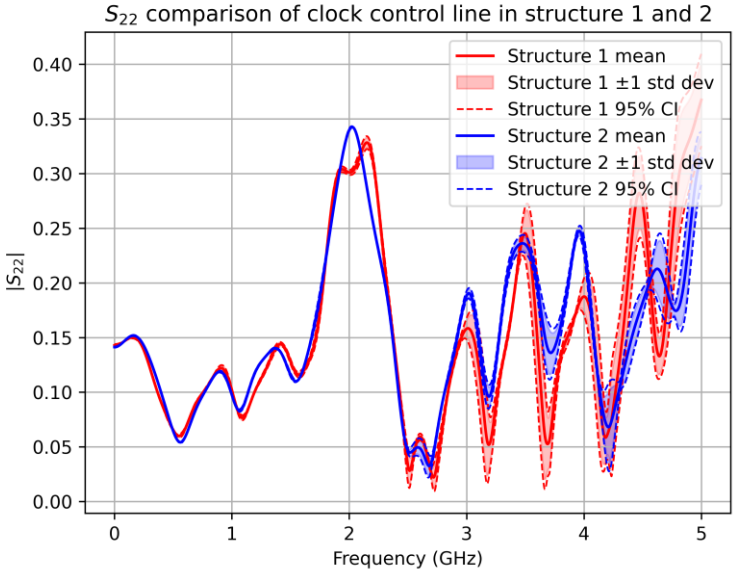


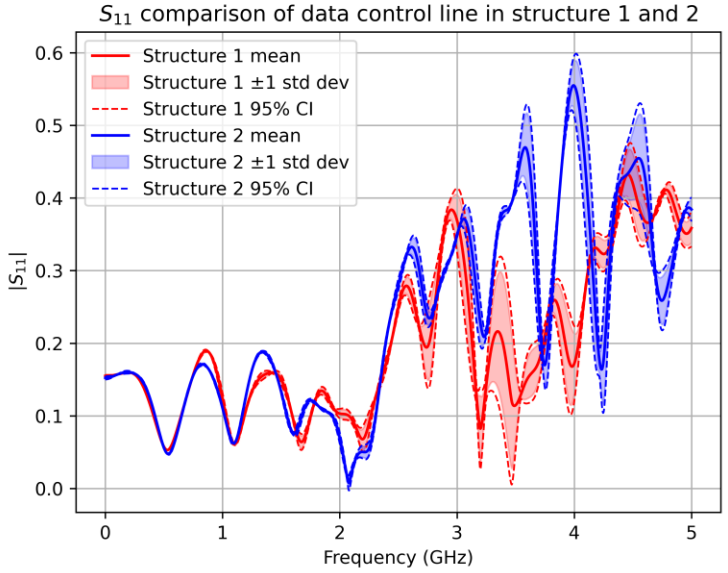


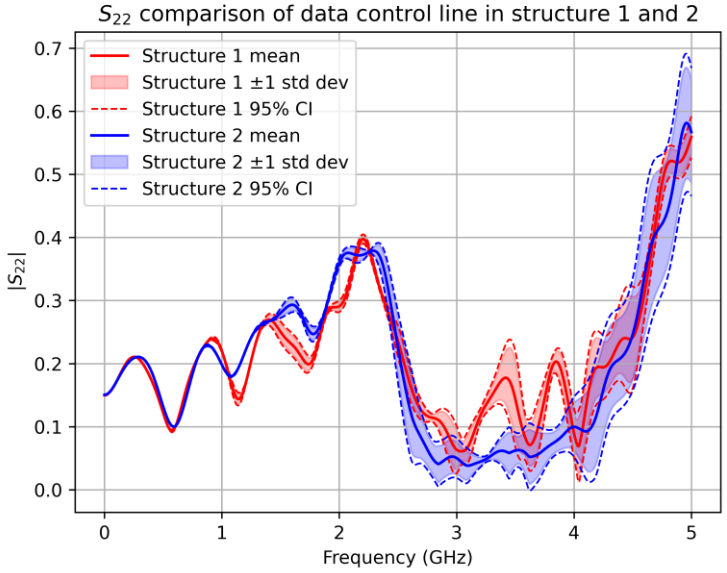


Comparison of structures 1 and 2

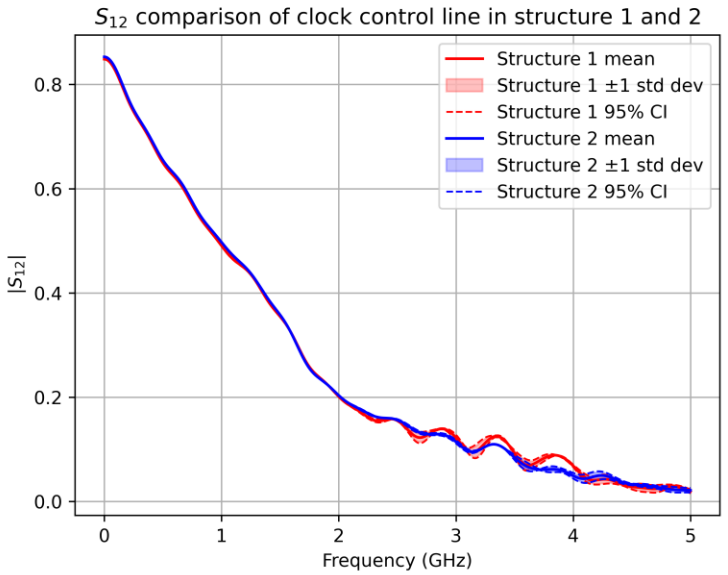


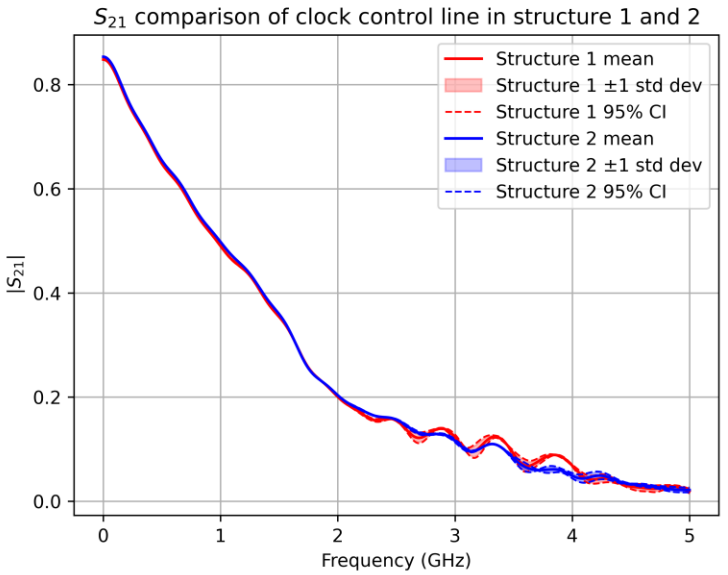


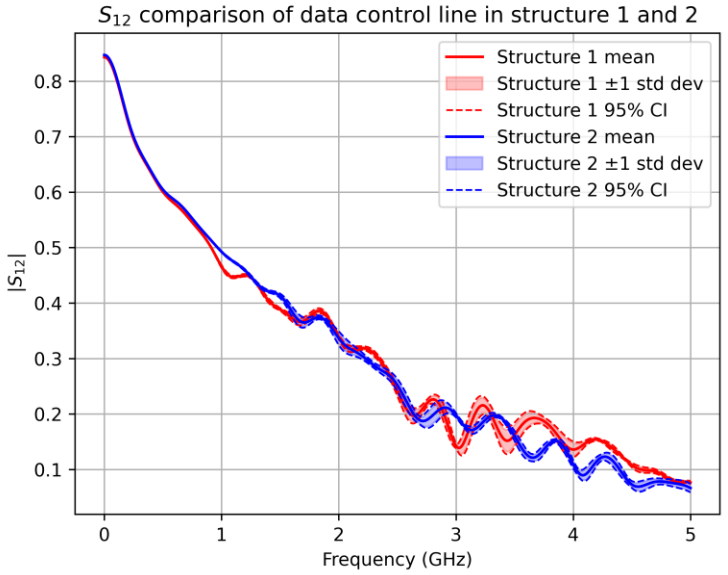


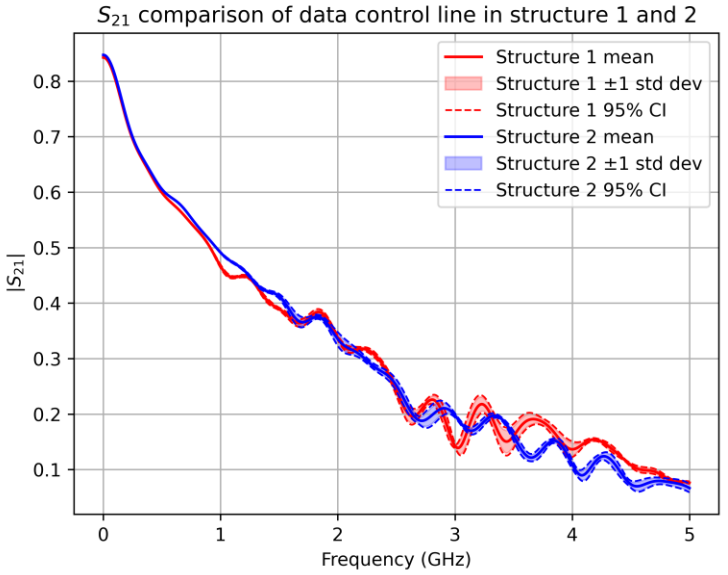


Comparison of structures 1 and 2



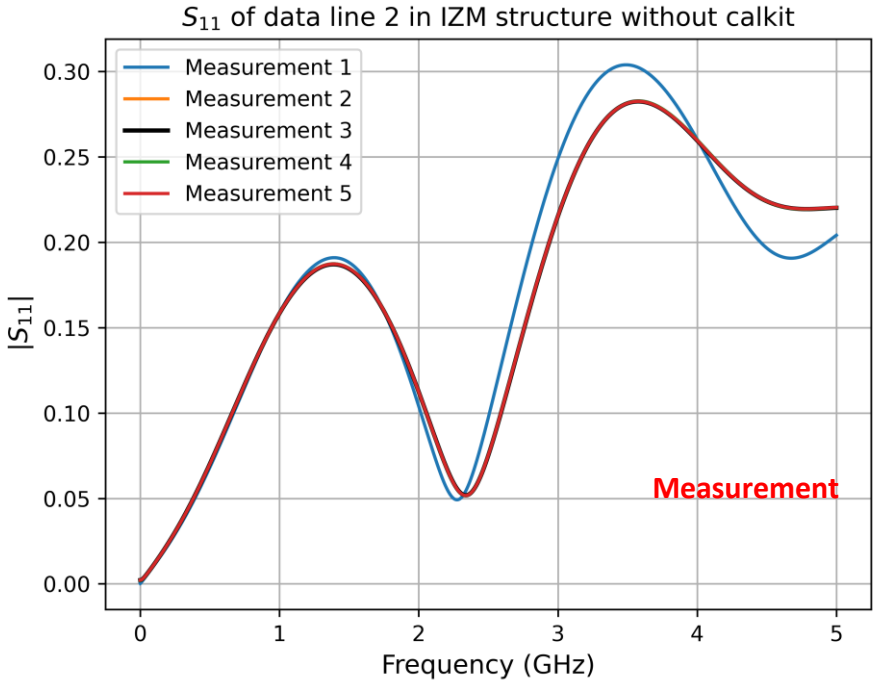


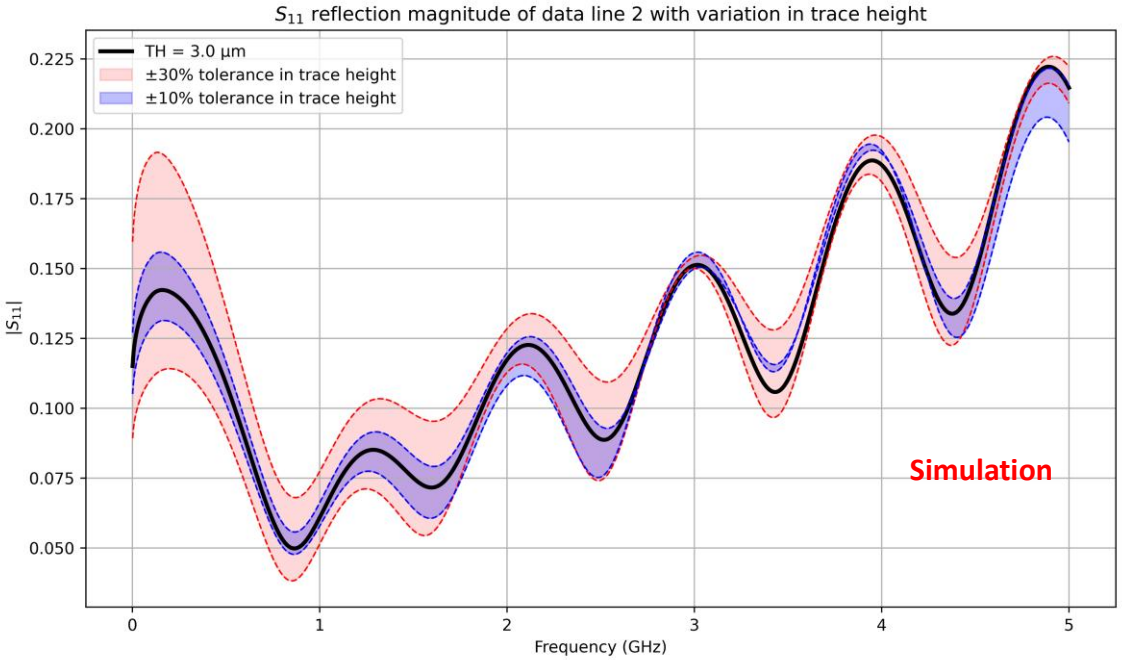




Comparison of simulations and measurements

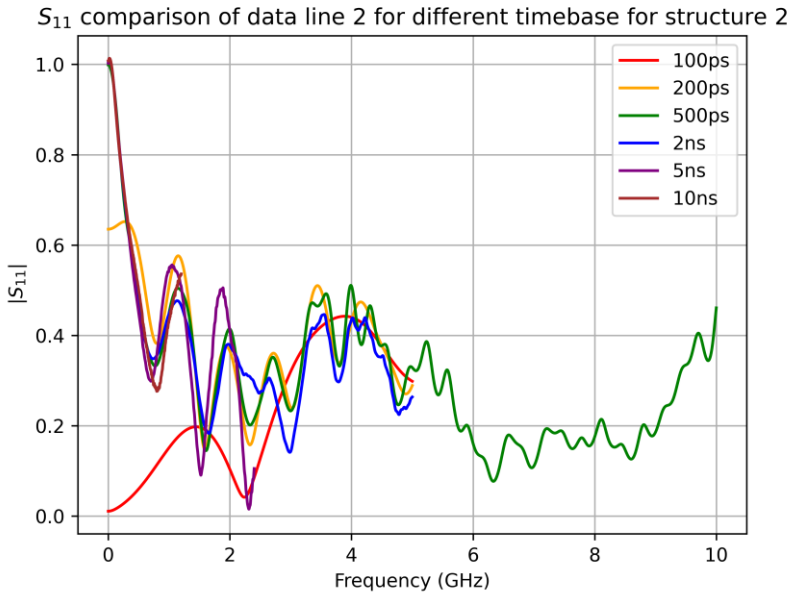
Improved simulations (with frequency-dependent dielectric and rough trace surface)

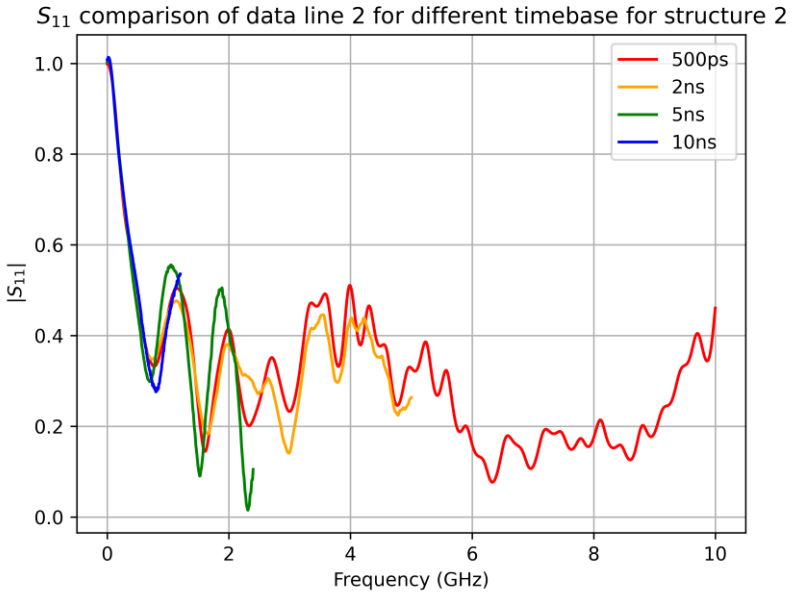




- Reflection pattern in simulation suggests that reflections are occurring at a length of ~95 mm (from the via at the end of the line), but in measurement, it is at a length of ~43 mm (Impedance mismatch in line).
- This is tricky to realize in simulations because of mesh-creating issues
- Currently working on this issue

TDR measurements of data line 2





- Timebase is the time over which the waveform for TDR measurement is acquired. For example 100ps timebase, TDR device will record S-parameters only for the first 100ps. After 100ps, it will not record any reflection coming from the structure.
- Data line 2 is approximately 600ps long, therefore 100ps timebase is not sufficient.
- At least need 2*600ps = 1.2ns. Ideally > 5*600ps = 3ns to cover all the reflections.
- Increase the timebase while keeping the same record length; the oscilloscope has to spread the same number of sample points over a longer time interval; therefore, it decreases the maximum frequency to maintain resolution.

Next steps :

- Redo the measurement of data line 2 in structure 1 with a different timebase
- Improved simulations of the IZM structure with tolerance in trace height and via height are in progress for all transmission lines