FETS Technical Meeting: Chopper Update
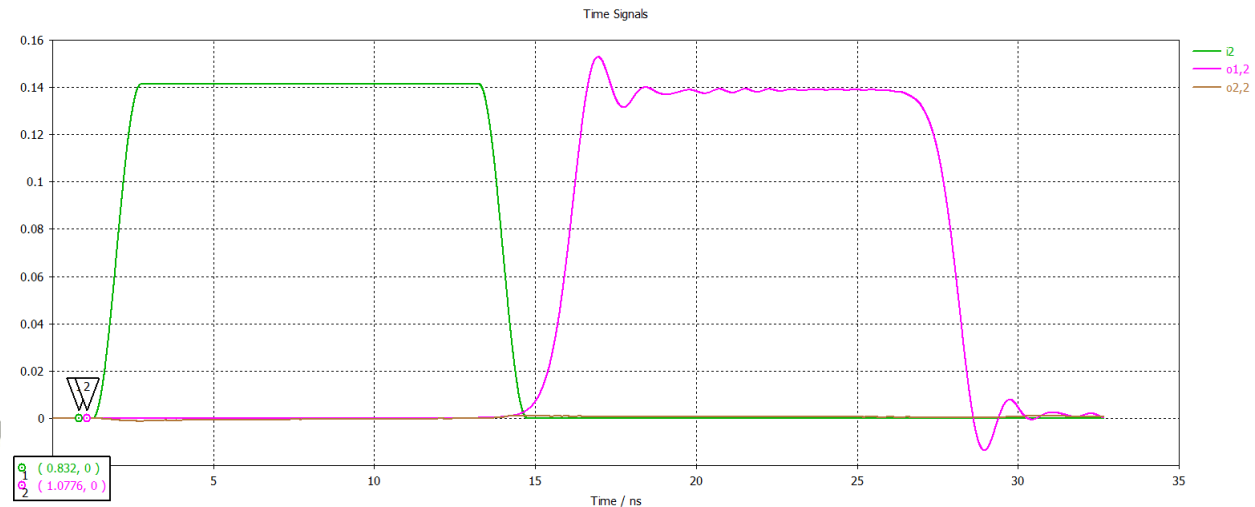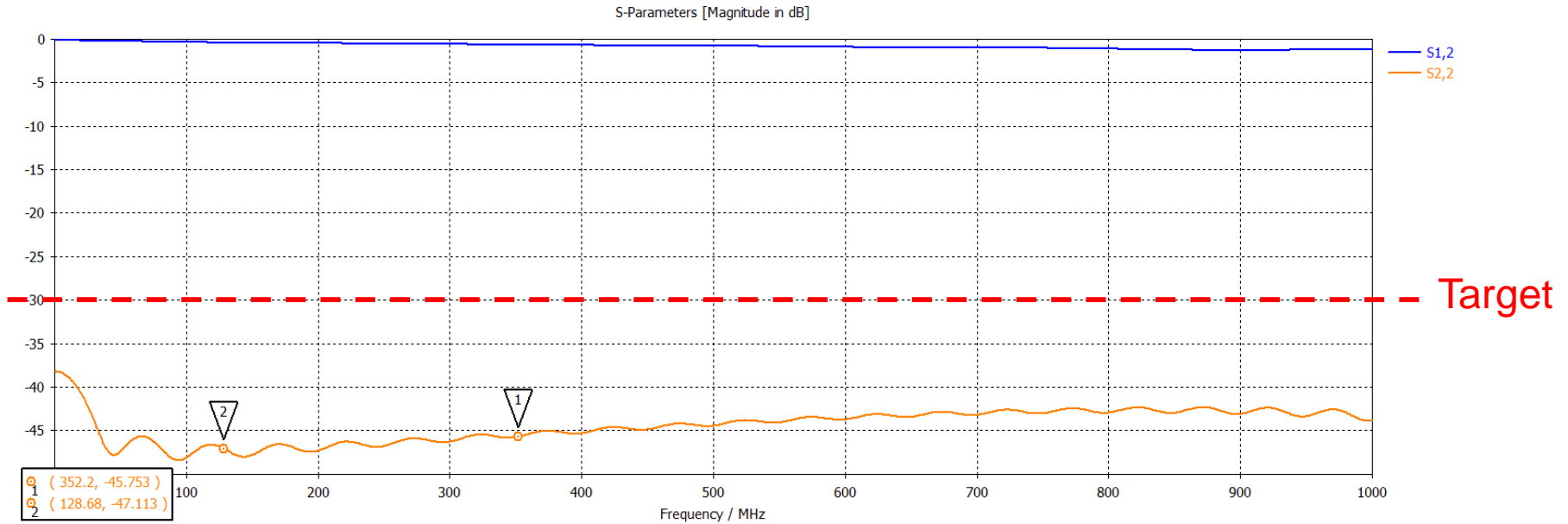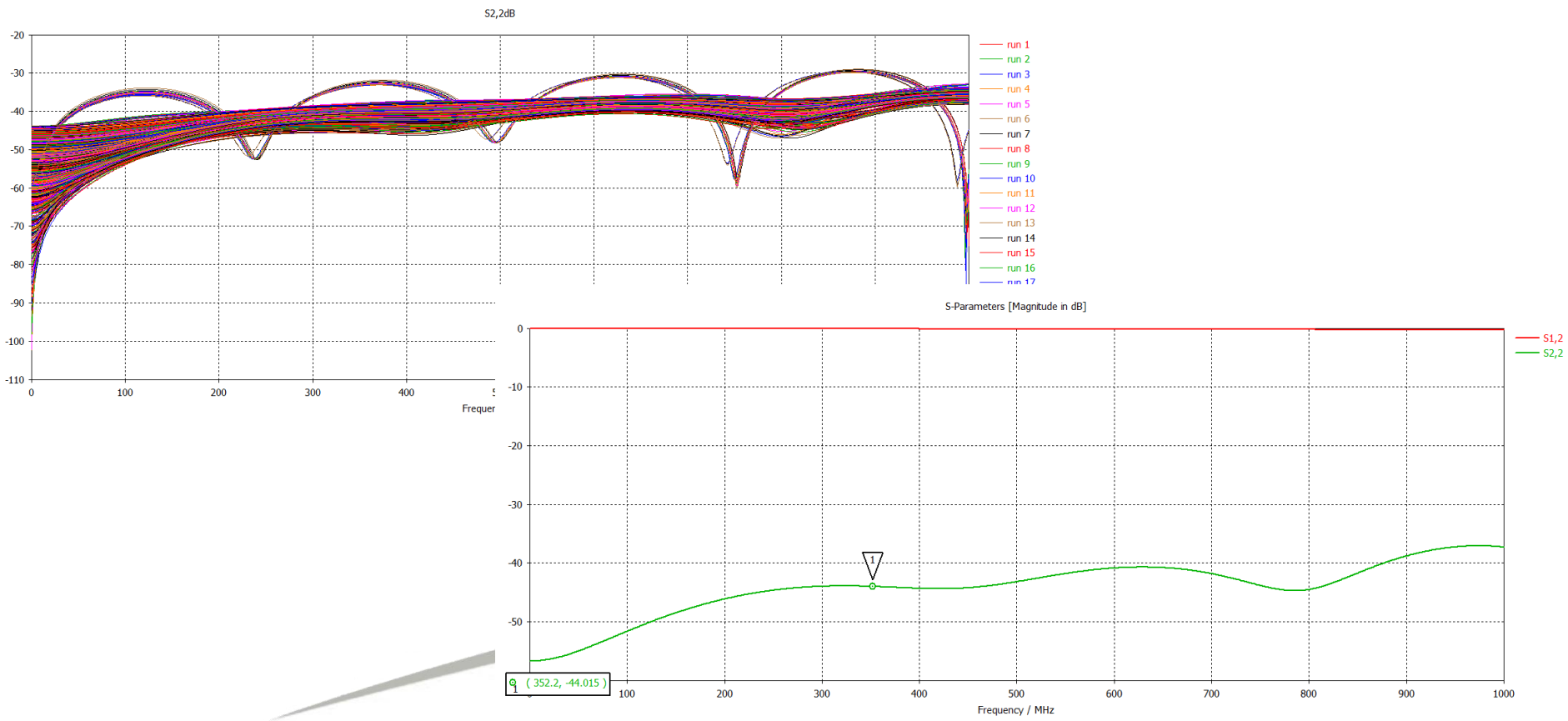
27/04/2016

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Current Design: Transmission Properties over 40 cm

Fine Tuning

- There is still some ongoing fine tuning to further improve the transmission properties.
- Some improvement has been gained but another large scale (>6cm) simulation has not been performed yet for full results.

What's next?

- Recreation of the chopper in ANSYS HFSS simulation software to verify the results calculated with CST MWS.

- Further simulation work, studying:
  - Coverage factor of the kicking signal
  - Effective velocity of the fast chopping signal
  - **Current density in the meander line track**

- Finalising the design will require changes to the transverse width of the ceramic substrate, and the overall length of the structure.
  - Dimensions for the chopper vacuum vessel will need to be agreed prior to setting these dimensions

- Discussions with the CERN LINAC4 team:
  - Feedthrough design – preferably done after seeing how the CERN chopper feedthroughs have been designed, as these should be very similar to our own.
  - Discussions with the CERN design team regarding some unexpected differences in dimensions for impedance matching between our and there designs.

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Vacuum Vessel Internal Dimensions

- The inner dimensions of the vacuum vessel have been shown to have a significant impact of the transmission properties of the new chopper.

- How the chopper will be mounted will affect these dimensions.

- Any required cooling for the chopper plate will also need to be considered.
  - This is dependant on the amount of beam expected to collide with the chopper (~1% at CERN).
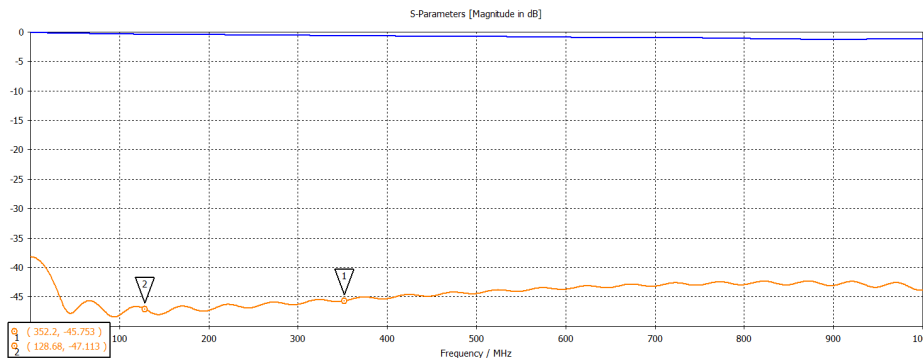
Scattering parameters of the chopper with +10 mm vacuum added to both transverse edges.

Scattering parameters of the chopper with no vacuum.
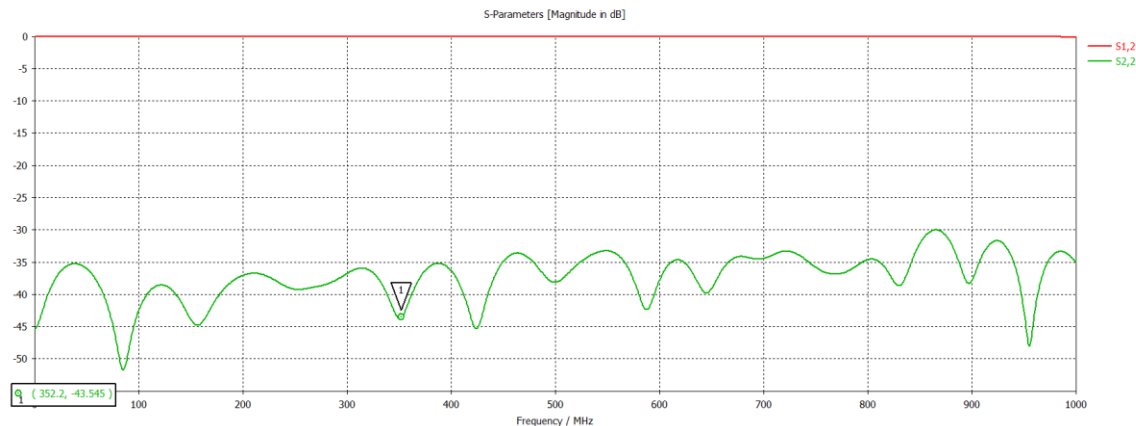
Vacuum Vessel - Feedthroughs

- The feedthroughs of the chopper will need to be designed and impedance matched to the plate to prevent reflected signals.
    - Ideally, these can be the same as those used on the CERN chopper, as both use 50 Ω lines at the feedthrough positions.
    - However this should be discussed with the CERN team as their 50 Ω and 100 Ω line dimensions differ from ours (a separate point that should also be discussed!) and they also use a different length and power of signal.

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Increasing the Simulation Scale

- To both design the RF feedthroughs and to optimise the internal vacuum vessel dimensions, the simulation must now include a much larger area of vacuum around the chopper plate:
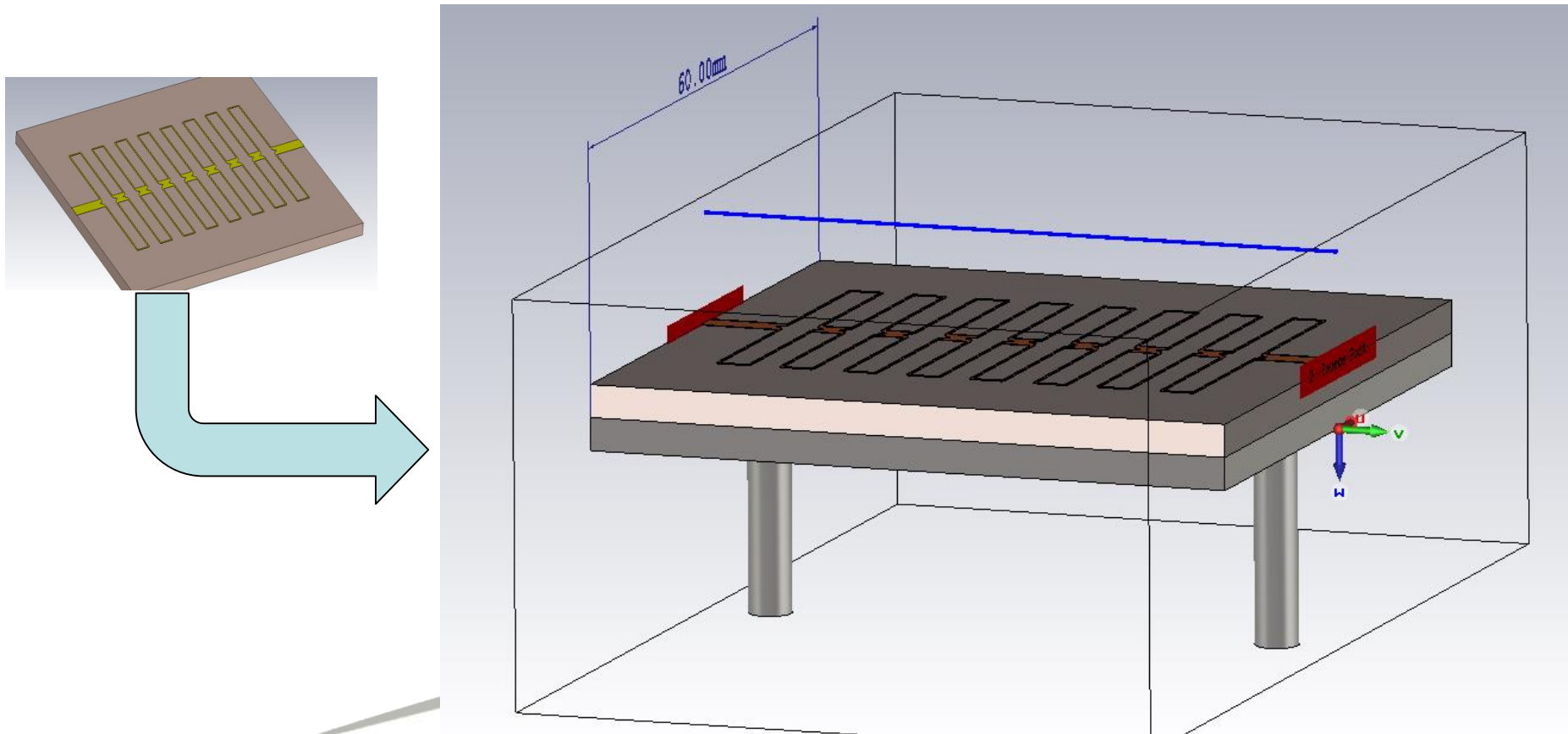
Discussions with the CERN team

- There are a few things that ideally will be discussed with the CERN chopper team, including:
    - Differing track widths when targeting the same impedances as their design.
    - Requirement for water cooling on the chopper plate.
    - Method of mounting the chopper in the vacuum vessel.
    - Details of the feedthroughs used in the CERN design.
    - Impact of cooling and mounting on the performance of the chopper.