Wire Measurements of VELO Mockup

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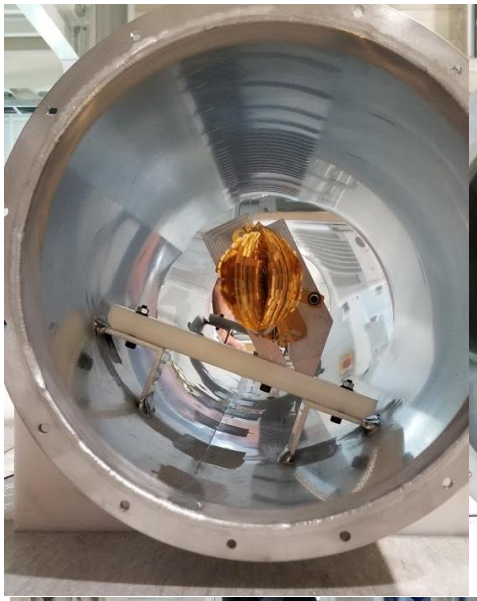
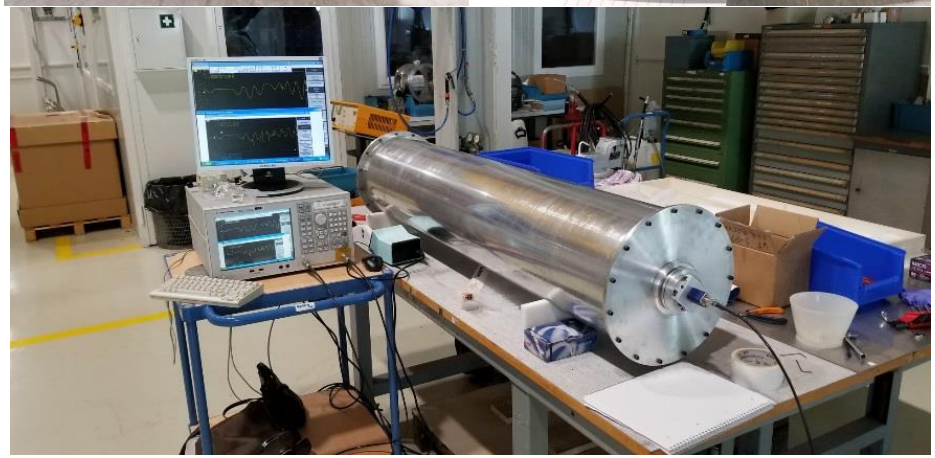
Wire Measurements

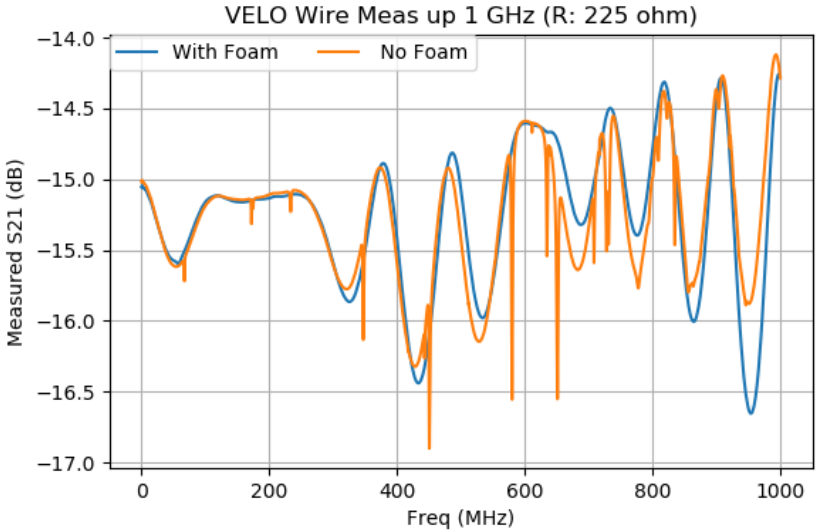
- **GOAL: Benchmark simulation model of VELO**
- Mockup with wake suppressors was inserted into aluminum tank
  - Tank provides defined boundaries
- Wire measurement of mockup in closed position
  - Wakefield suppressor inserted
- Wire measurements with & without absorbing foam
  - Disentangle tank modes & possible VELO modes
- Post-processing to determine the longitudinal impedance
  - See ref [1]

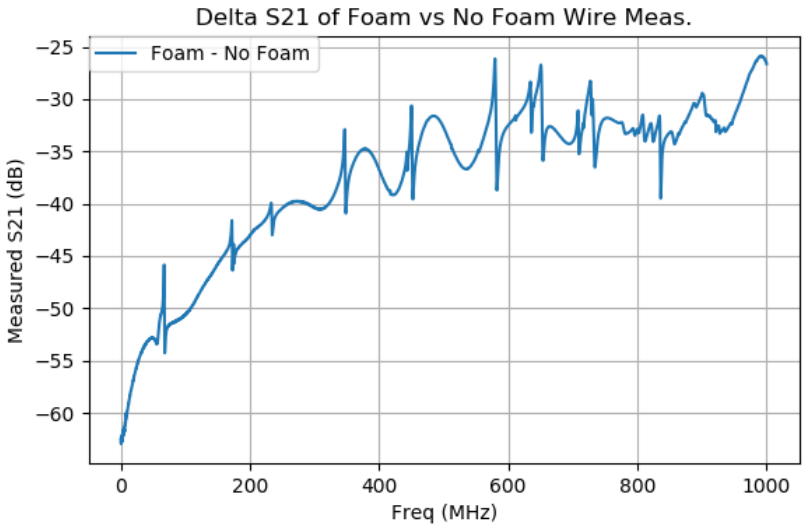
Wire Measurement Setup & S- Parameters

No Foam Inserted Foam Inserted





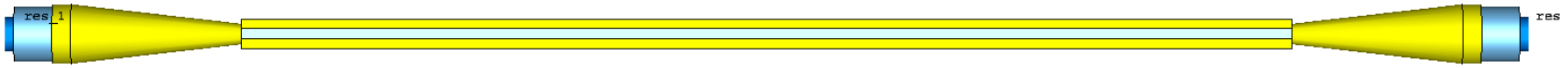




Longitudinal Impedance Calculations

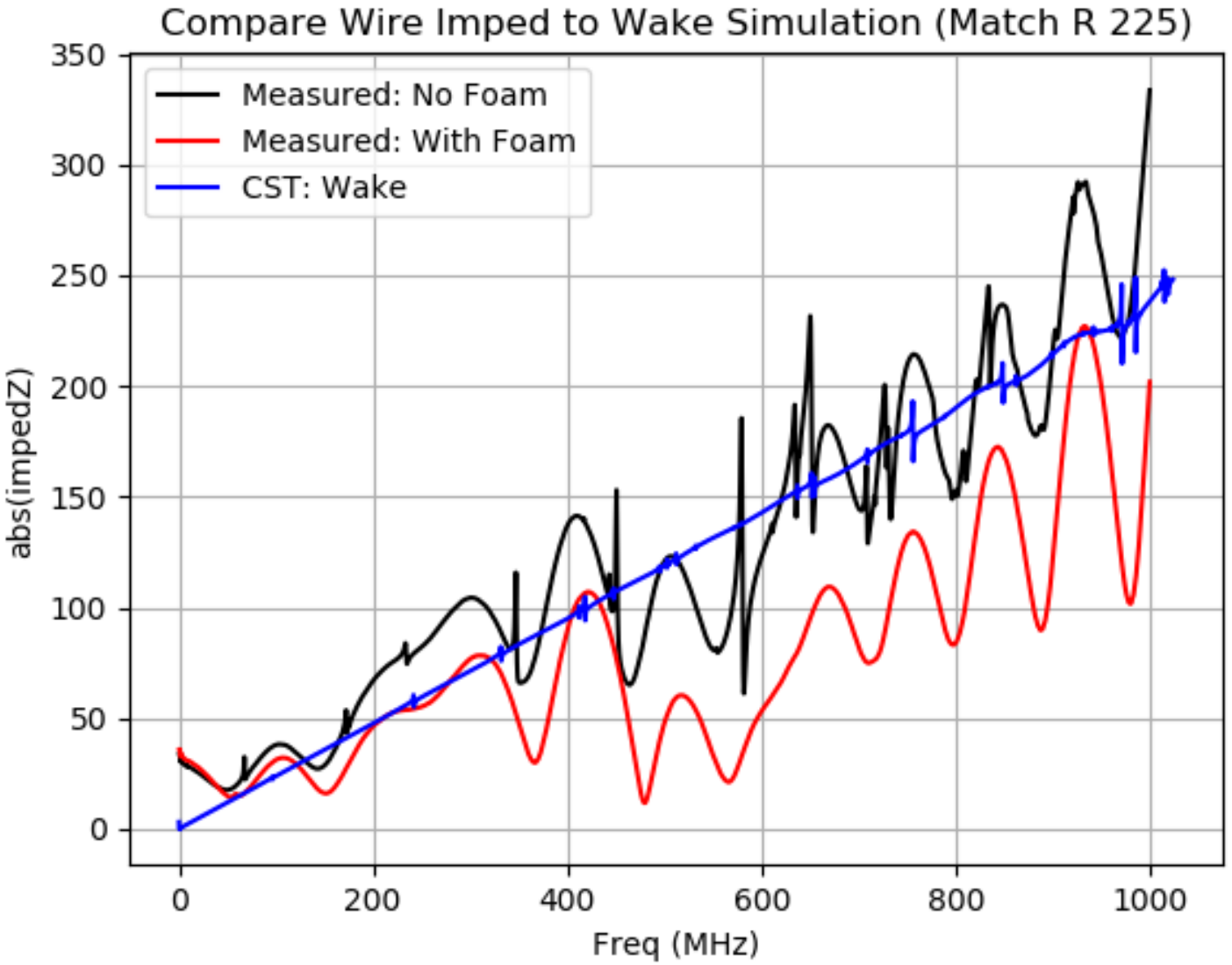
- Log Formula:
  - $Z = - Z_L \ln S_{21}$
  - $S_{21} = \frac{S_{21\,VELO}}{S'_{21\,REF}}$
  - $S'_{21\,REF}$ is ideal reference line (match resistors & elect. length)
    - Coax – Plate - Coax
- Series resistor matching (R_s)
  - $R_s = Z_L – Z_0 = 225$ ohm
  - Z_0 is the 50 ohm of VNA
  - Z_L is the impedance of VELO
    - Measurement showed Z_L of 275 ohm
      - Match resistor (R_s) 225 ohm

225 Ω CST Model of S21 Reference 225 Ω



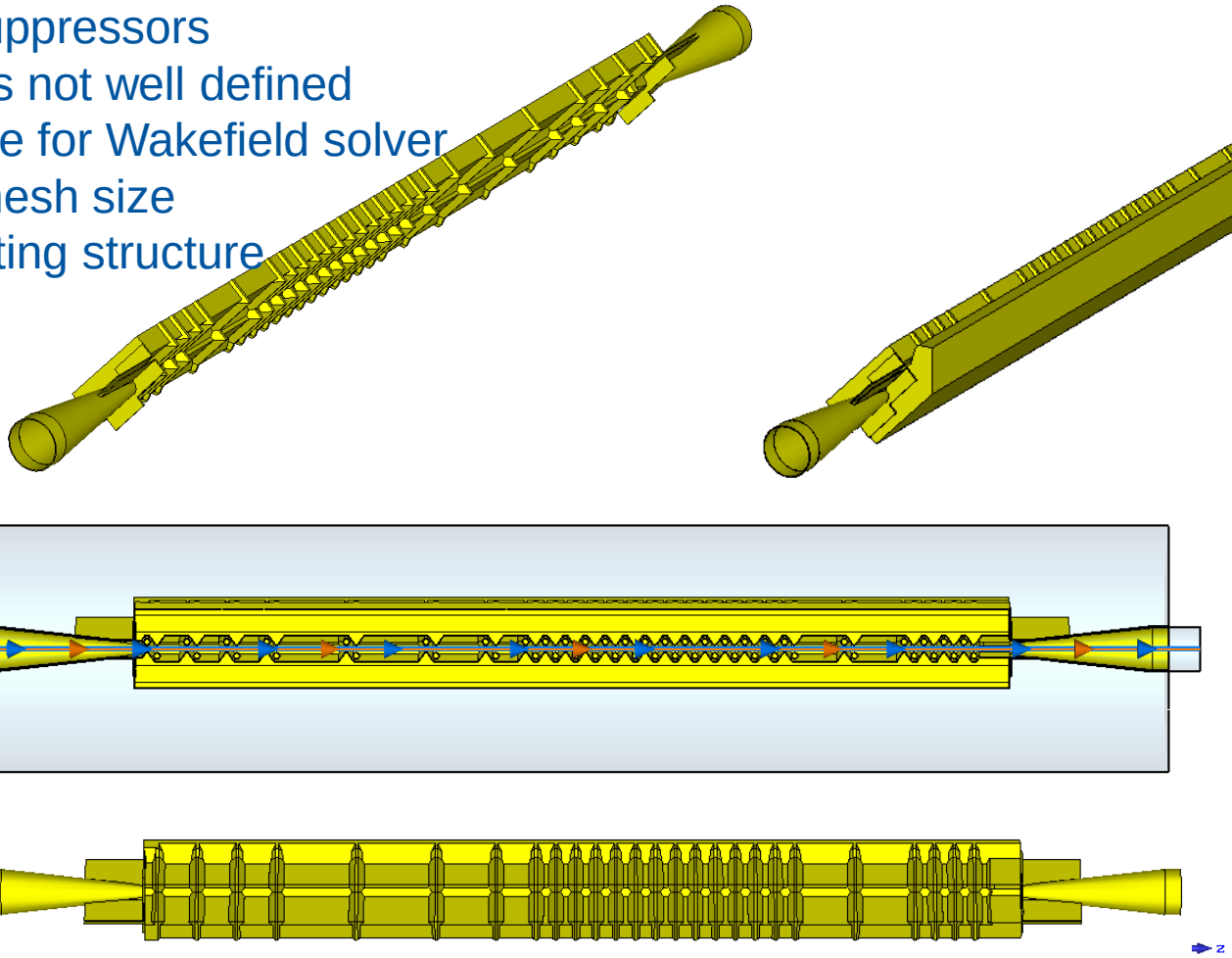
Coax (Supressor) Parallel Plate (VELO) Coax (Supressor)

Longitudinal Impedance from Measured S21

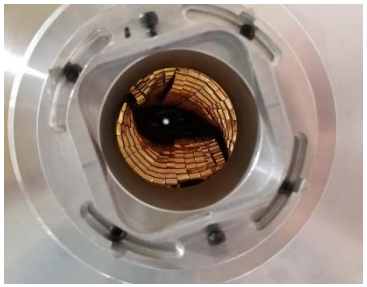


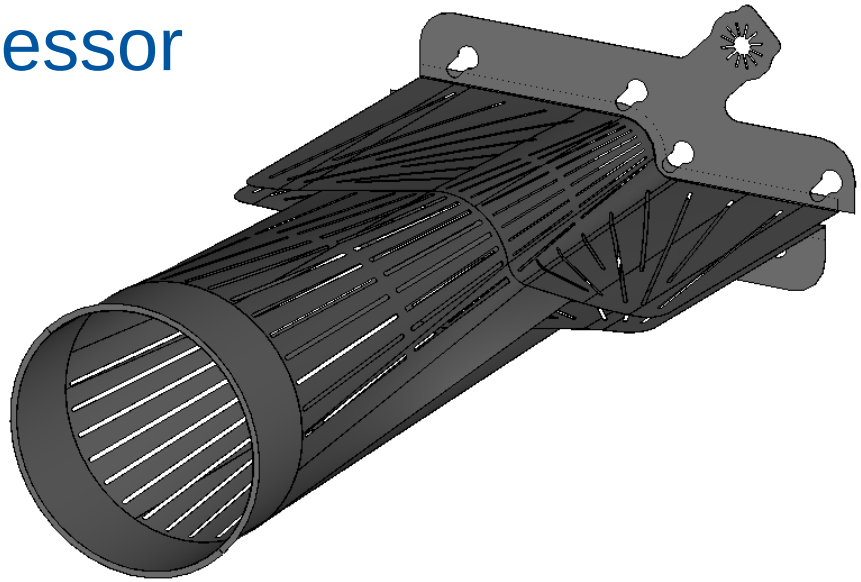
CST Model of VELO Mockup

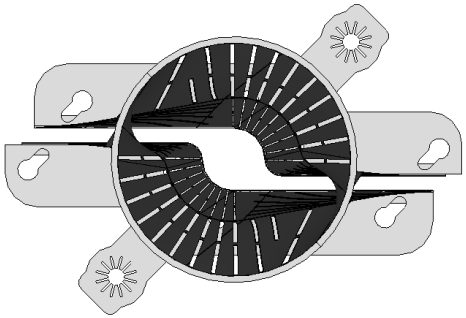
- Large, complex structure
- Wakefield suppressors
  - Shape is not well defined
- Long run time for Wakefield solver
  - Large mesh size
  - Resonating structure

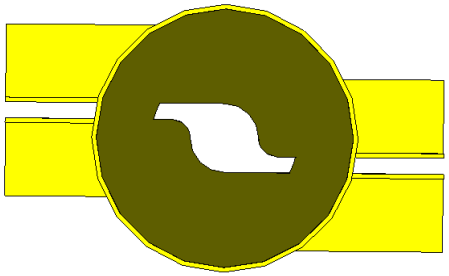


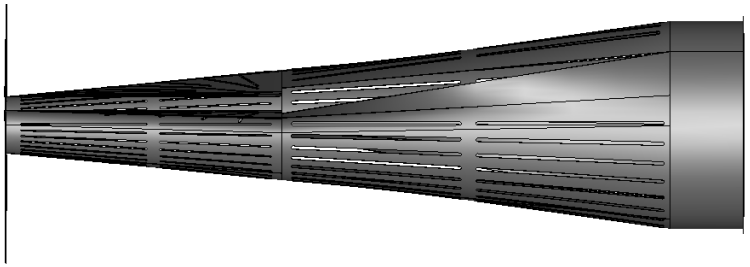
CST Model of Wake Suppressor

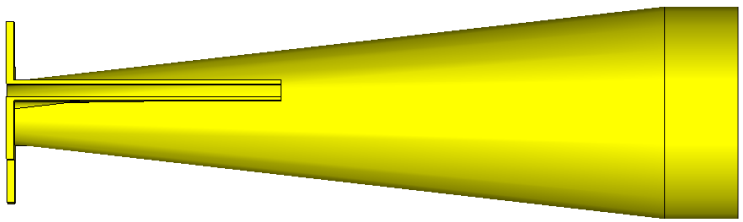


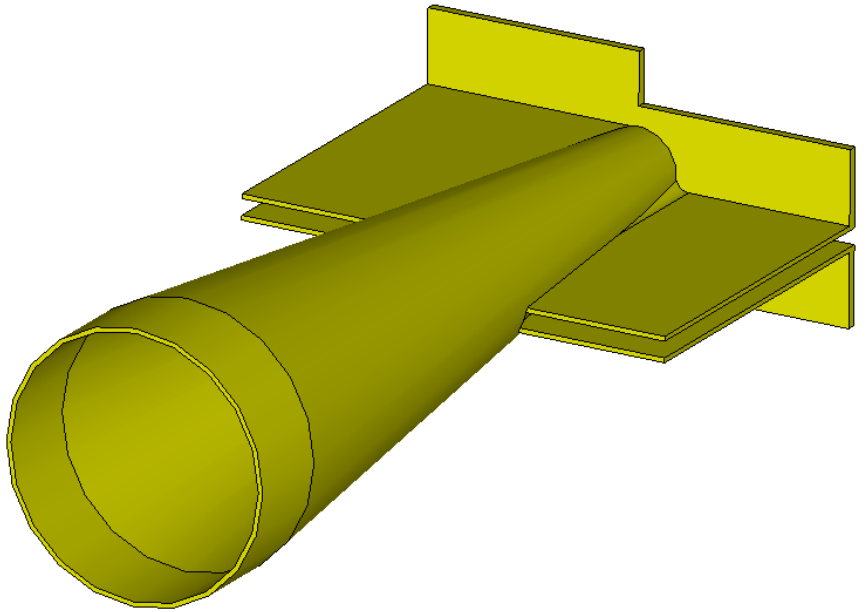




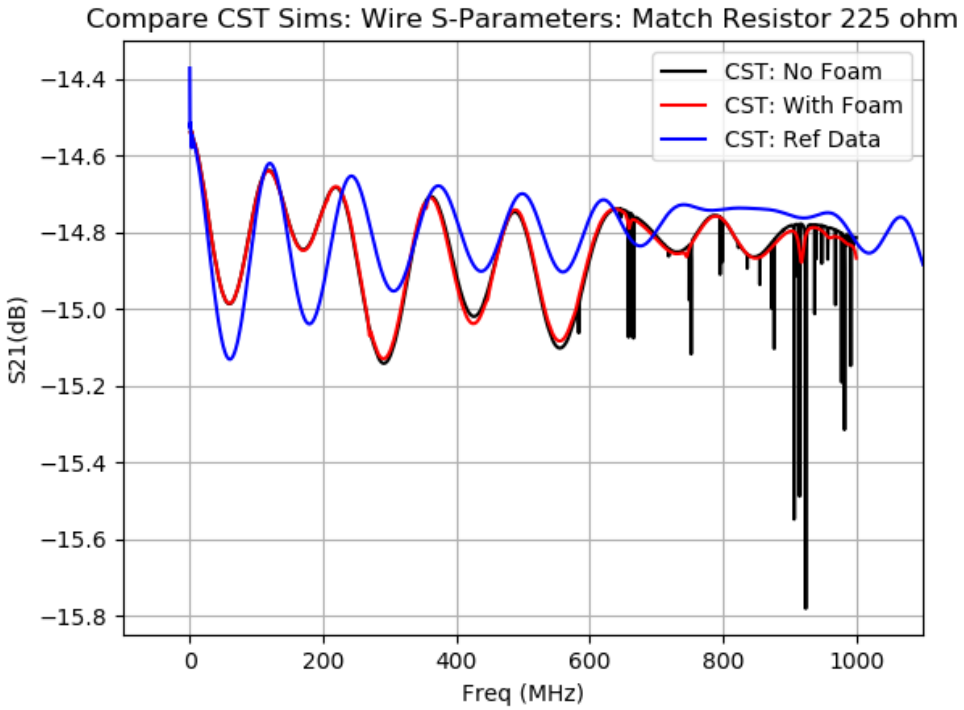


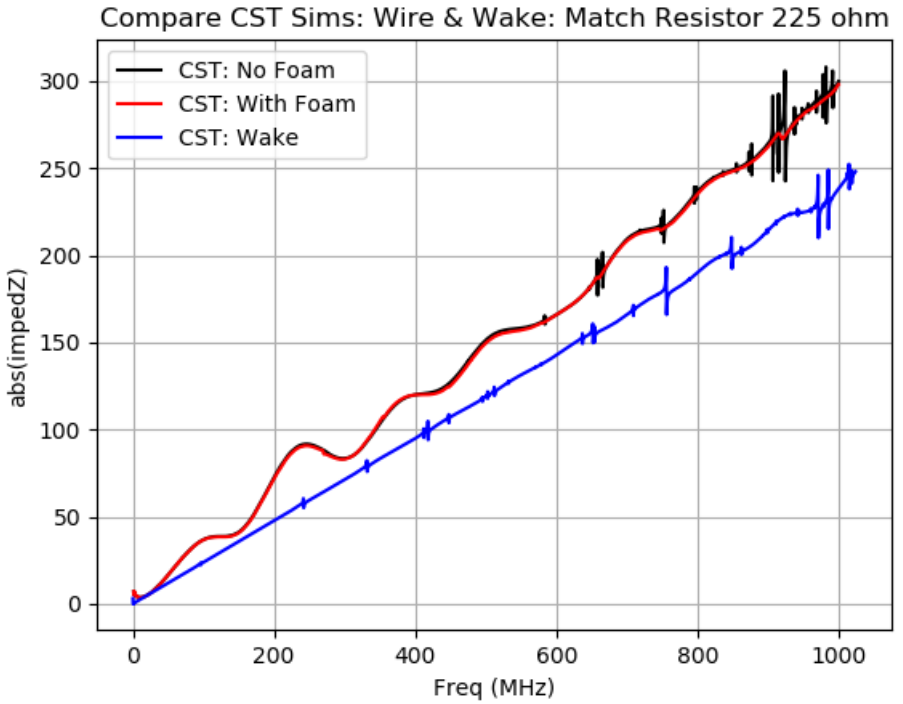




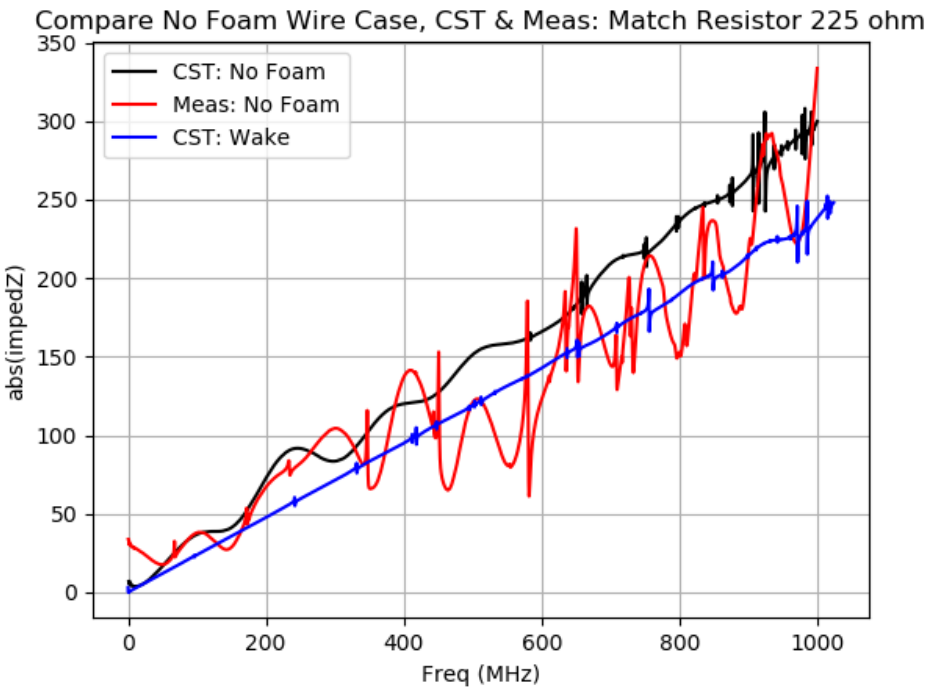


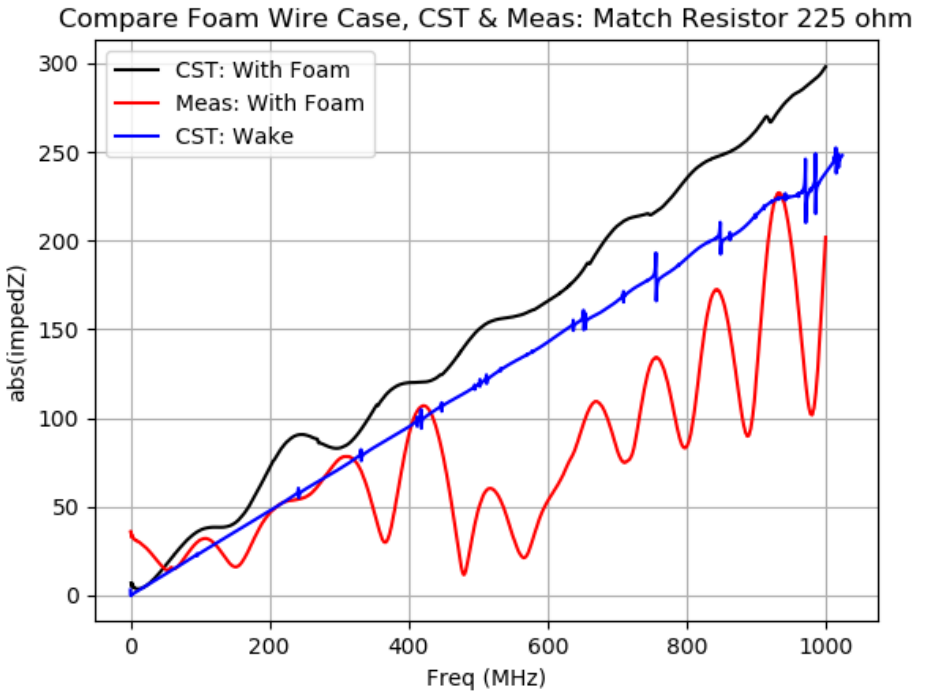
Compare CST Simulations: Wire & Wakefield



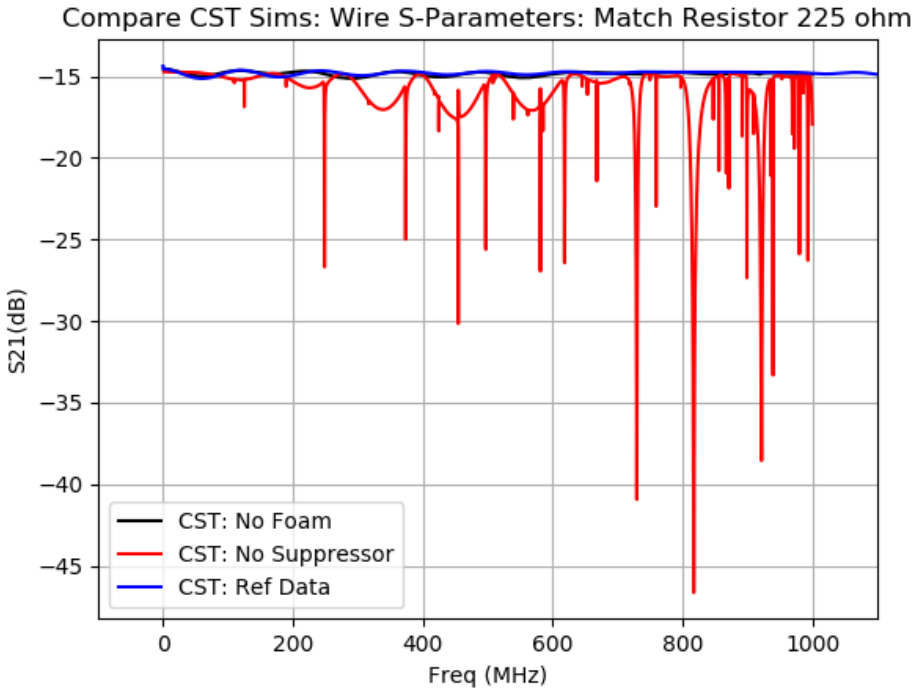


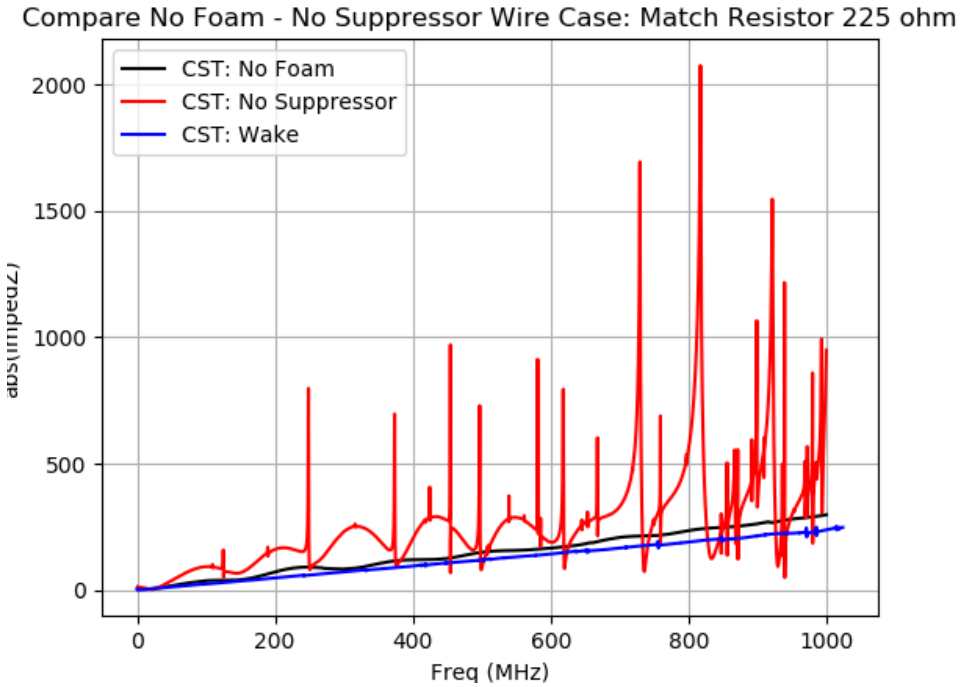
Compare CST Simulations & Measurement





No Suppressor Wire Simulations





Path Forward

- Measurements without Wakefield Suppressors
- Simulation with actual VELO tank
  - Long and complex simulation

References

1. T. Kroyer, F. Caspers, E. Gaxiola, “Longitudinal and Transverse Wire Measurements for the Evaluation of Impedance Reduction Measures on the MKE Extraction Kickers”, AB-Note-2007-028

Questions?

With Eigenmode (Mockup, no teeth)