Beam spectrum, impedance and dissipated power
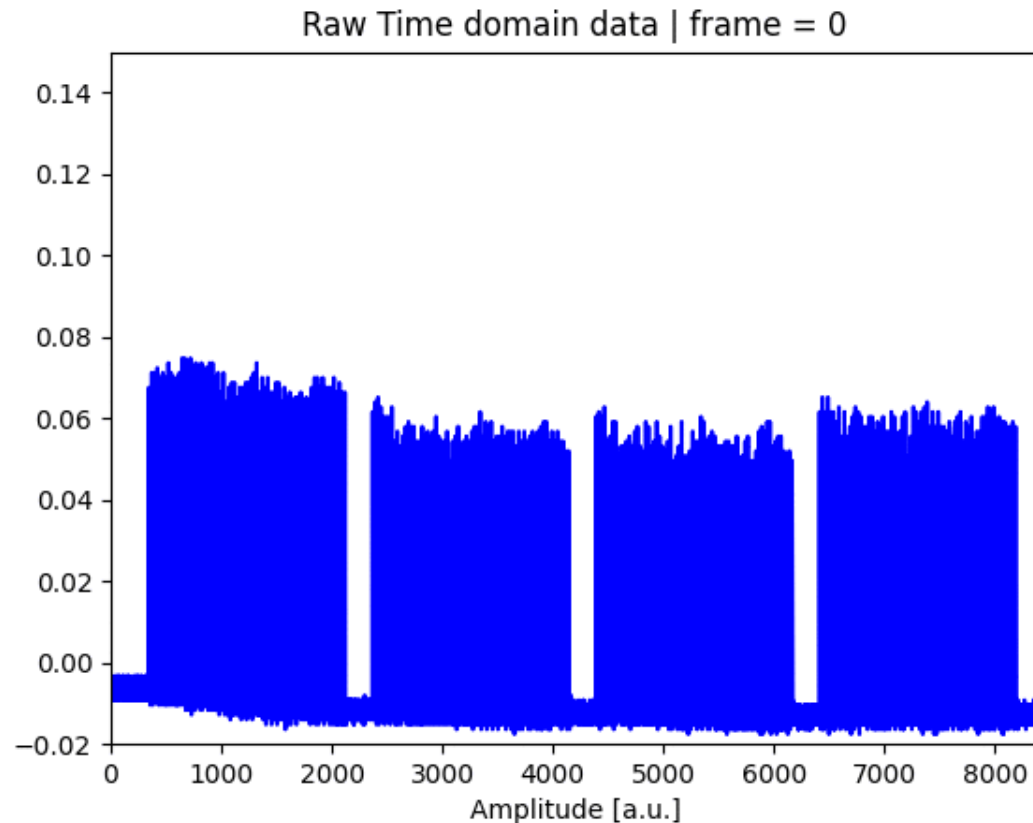
Niky, Giulia, Alice, Rama, Leo, Elena, Carlo, Christine, Michael and Benoit
for the IWG/ABP/RF teams

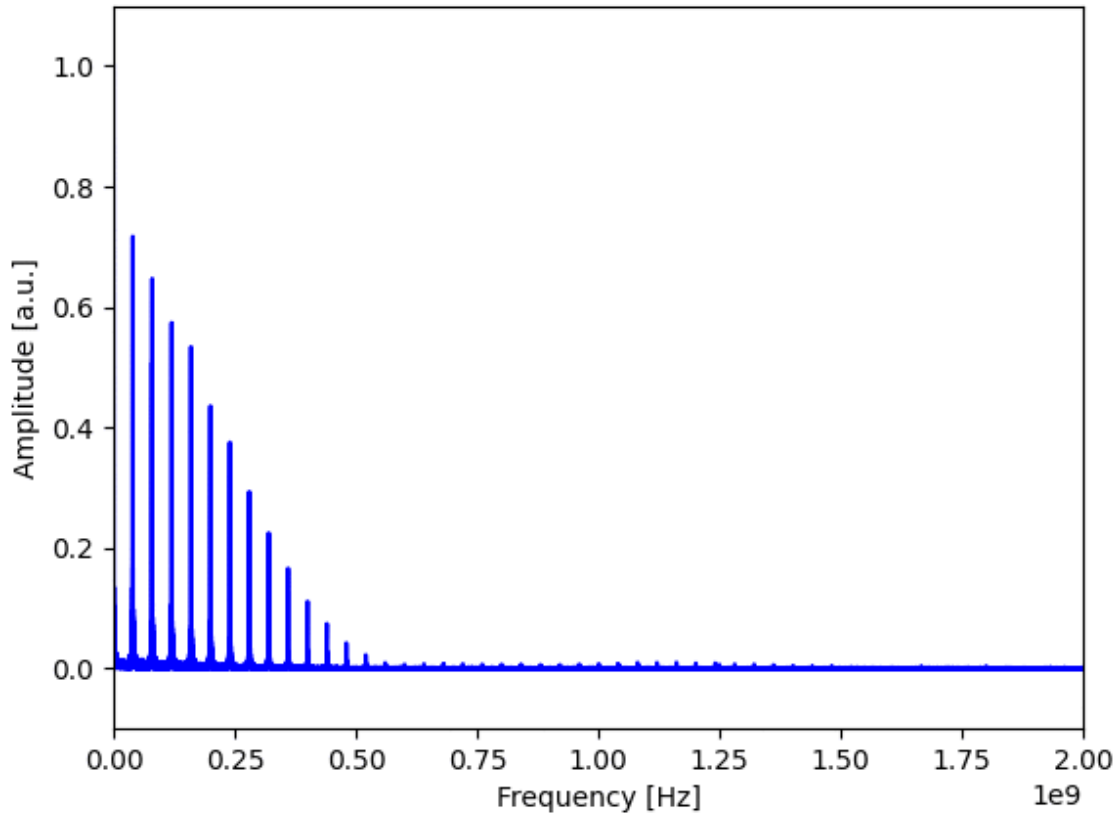# Beam spectrum measured during tests to reproduce the beam that broke the scanner

- Same beam parameters, except bunch intensity left at 1.5e11 p/b to avoid disturbing the other users.
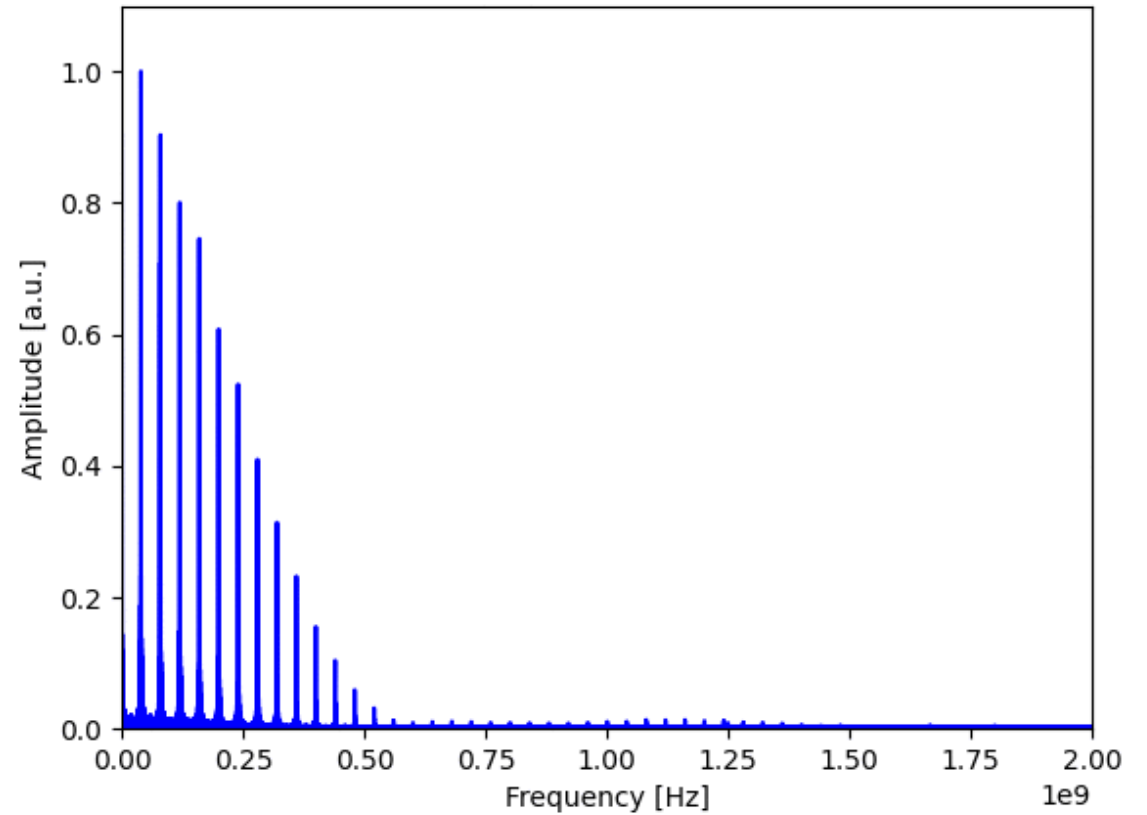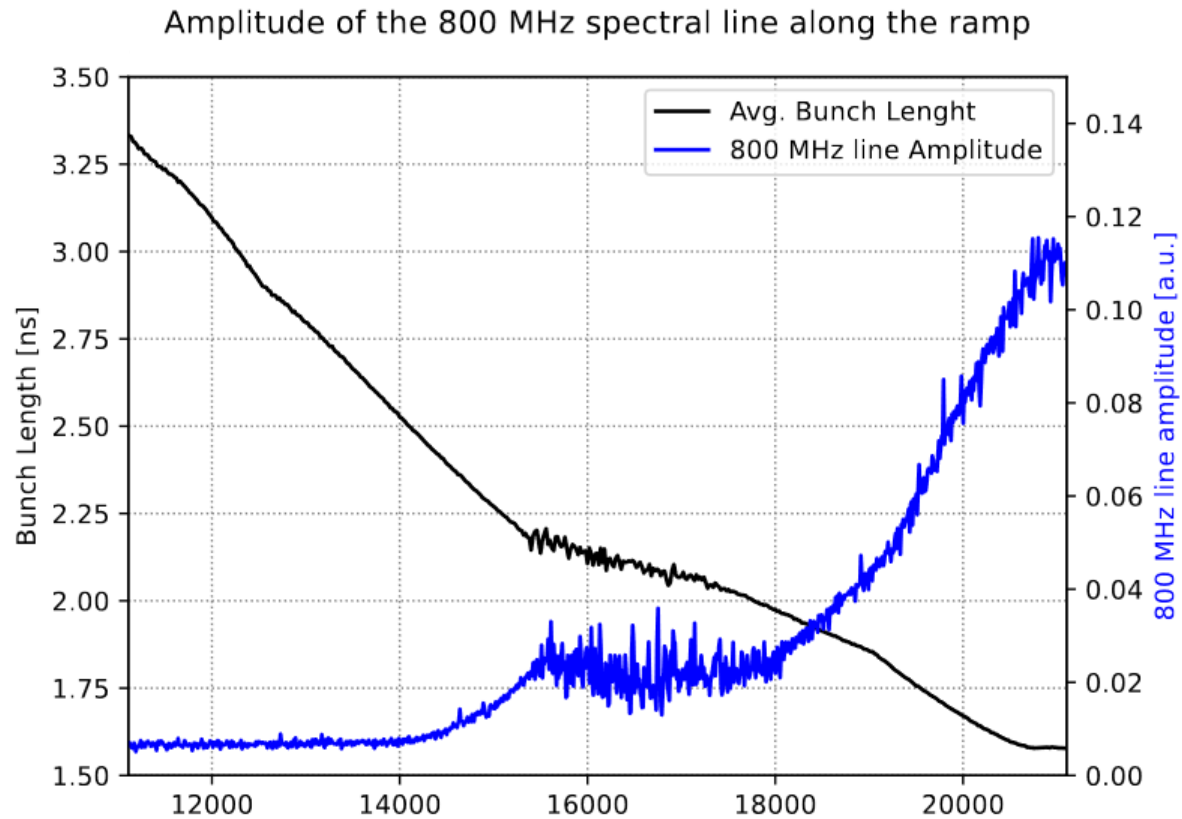
Frequency domain data

uncorrected

corrected

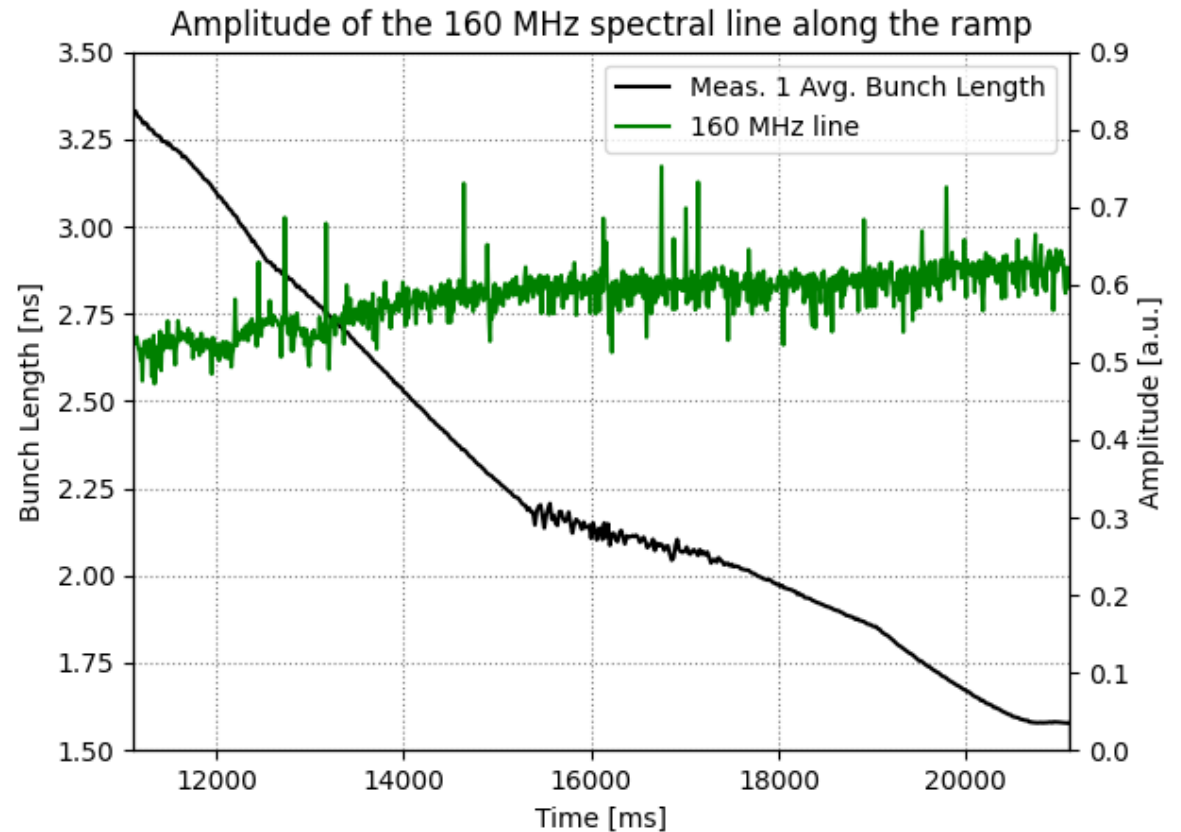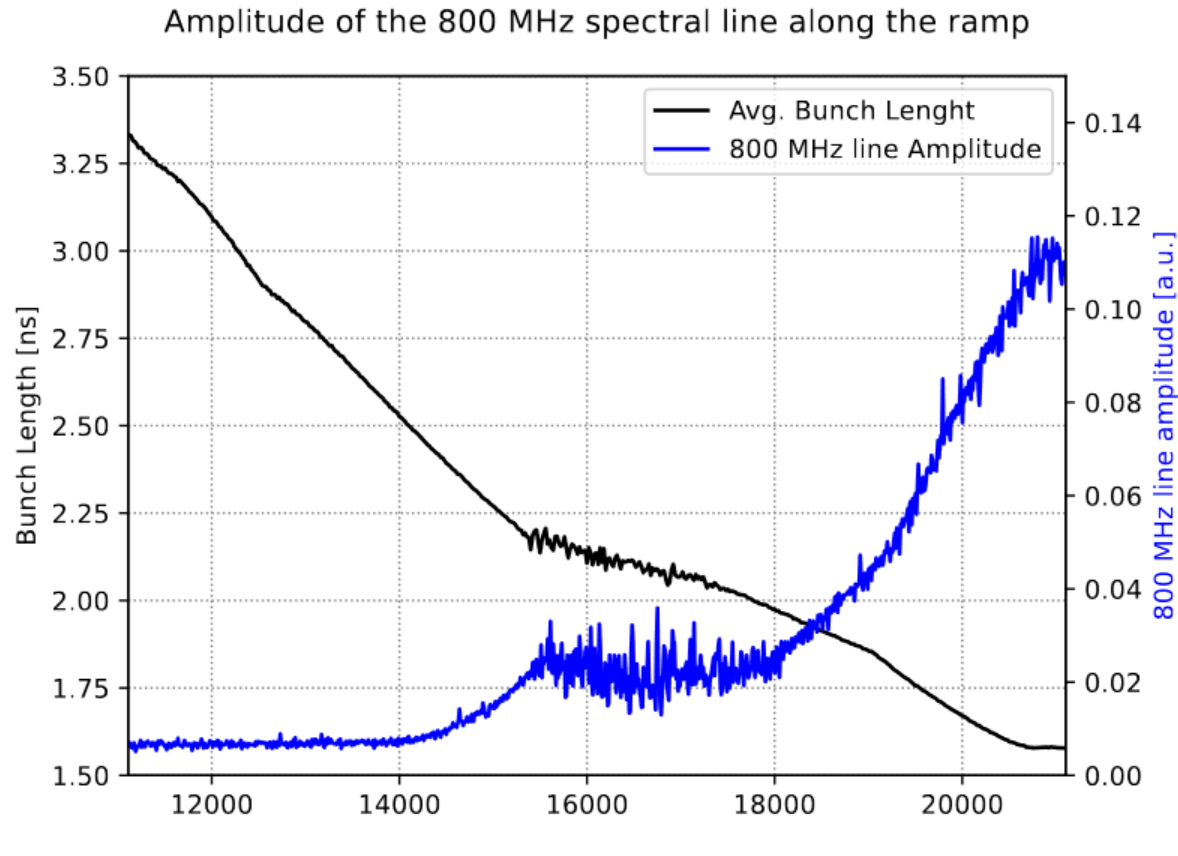# Beam spectrum along the cycle @ 800 MHz

Amplitude of the 800 MHz spectral line along the ramp

→ Amplitude of 800 MHz line increases by a factor 30 between injection and top energy

# Beam spectrum along the cycle @ 800 MHz and 160 MHz

→ Amplitude of 160 MHz line does not change much when reducing bunch length
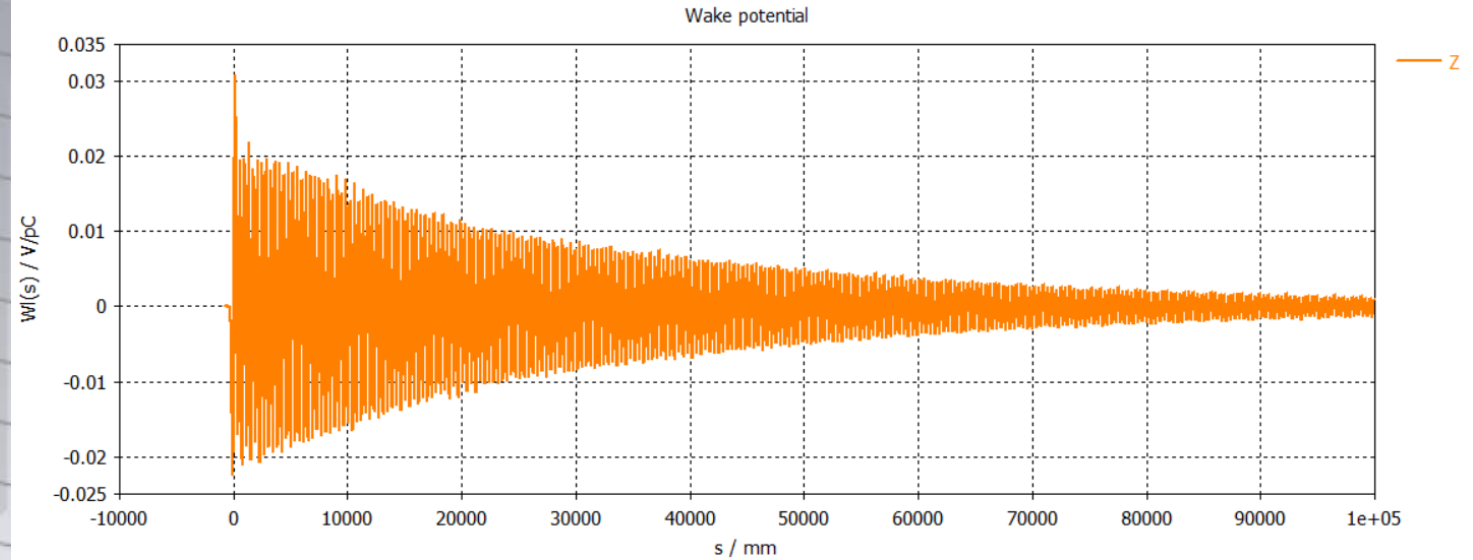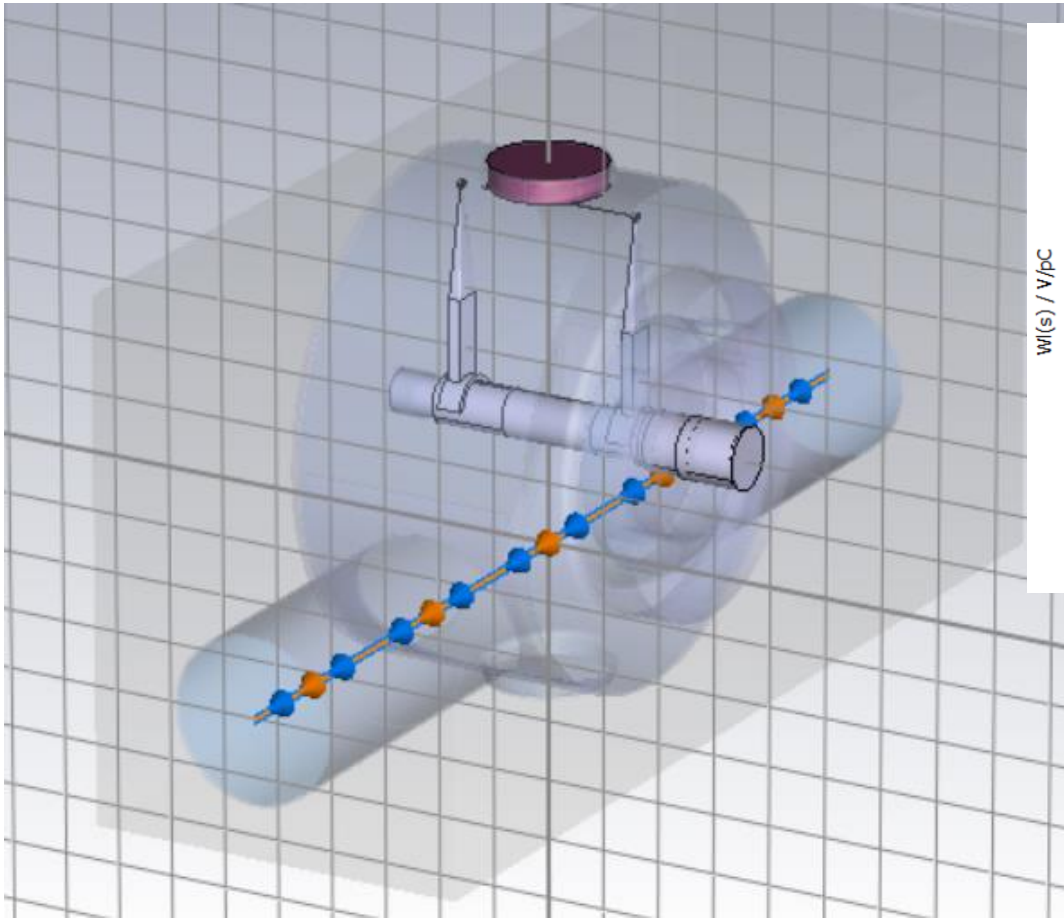
Impedance without ferrite (with feedthrough)

Eigenmode simulation without Ferrite (feedthrough still in)

- f= 786 MHz
- Rs = 1.7 kOhm
- Qr = 250

→ Measurement of beam spectrum can be affected by errors and transfer function
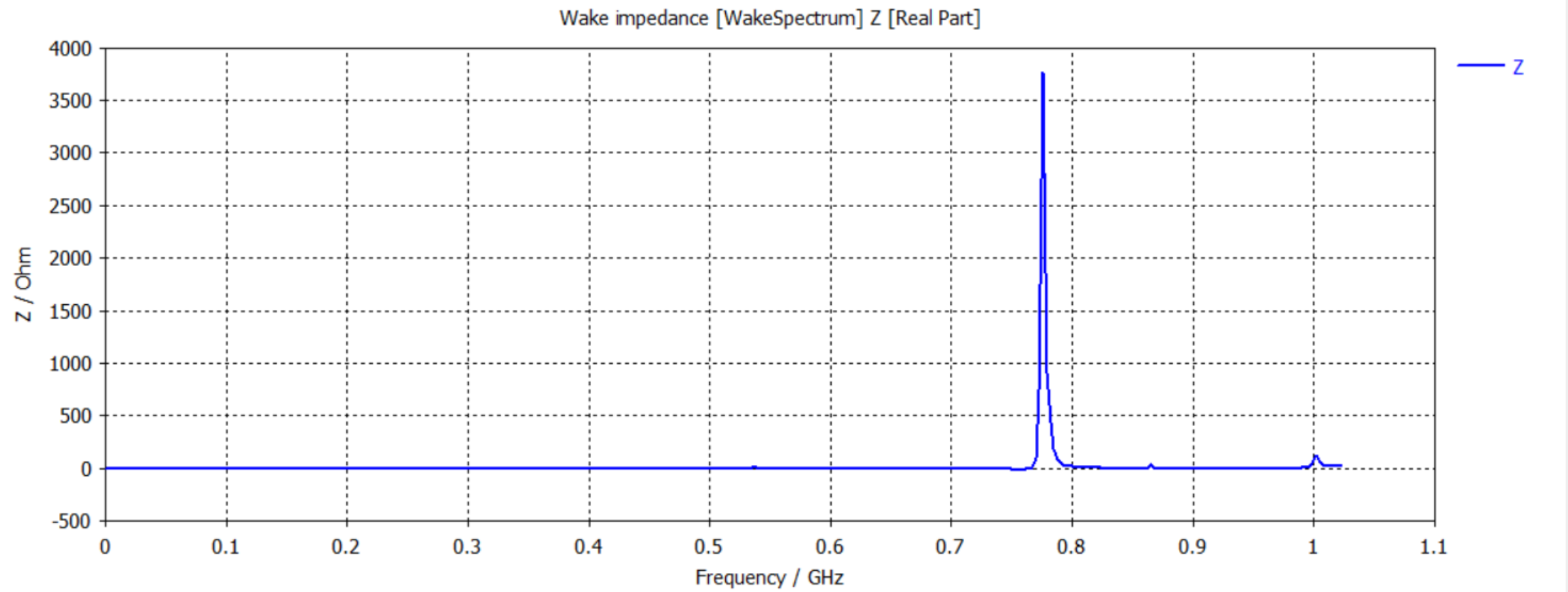→ Important to also check with Gaussian model and take the most pessimistic case

Power loss without ferrite
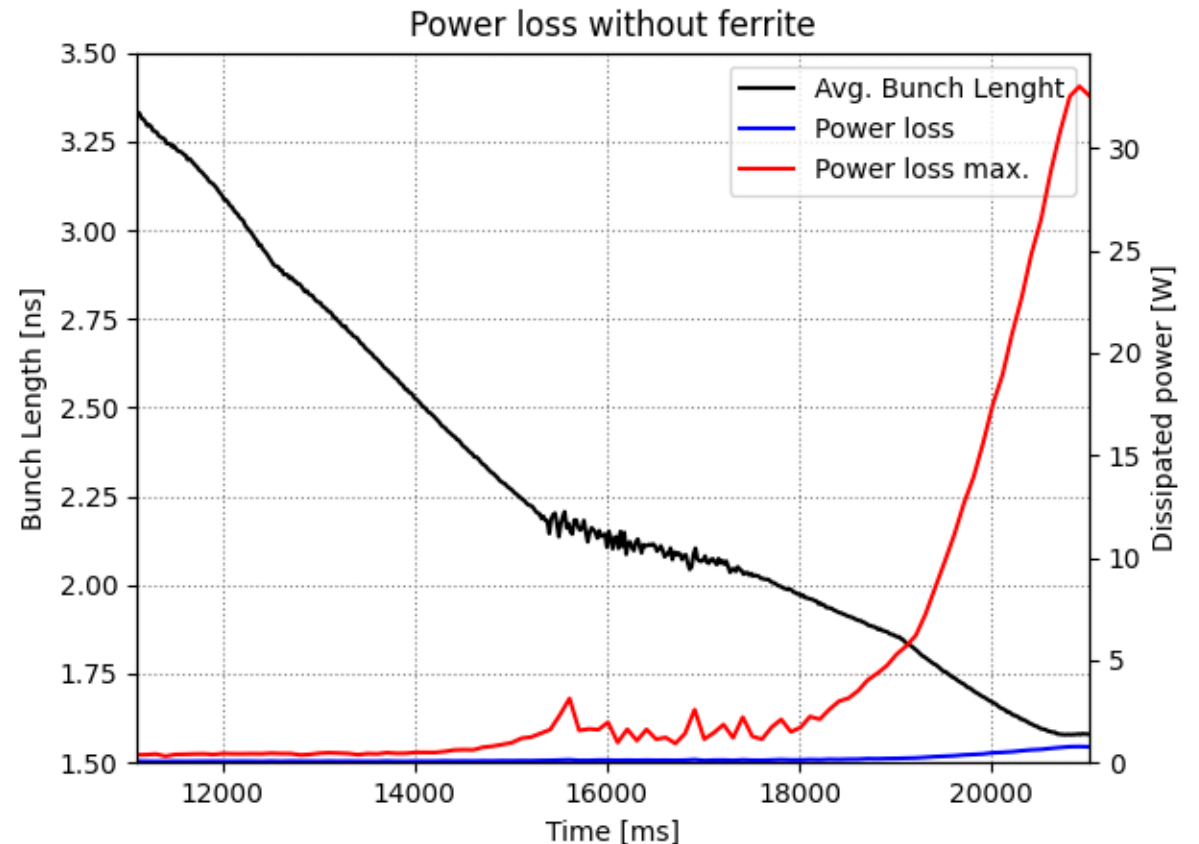
Impedance with ferrite in the viewport

→ Main modes have well decayed

Impedance with ferrite (wakefield simulation)

Wake impedance [WakeSpectrum] Z [Real Part]

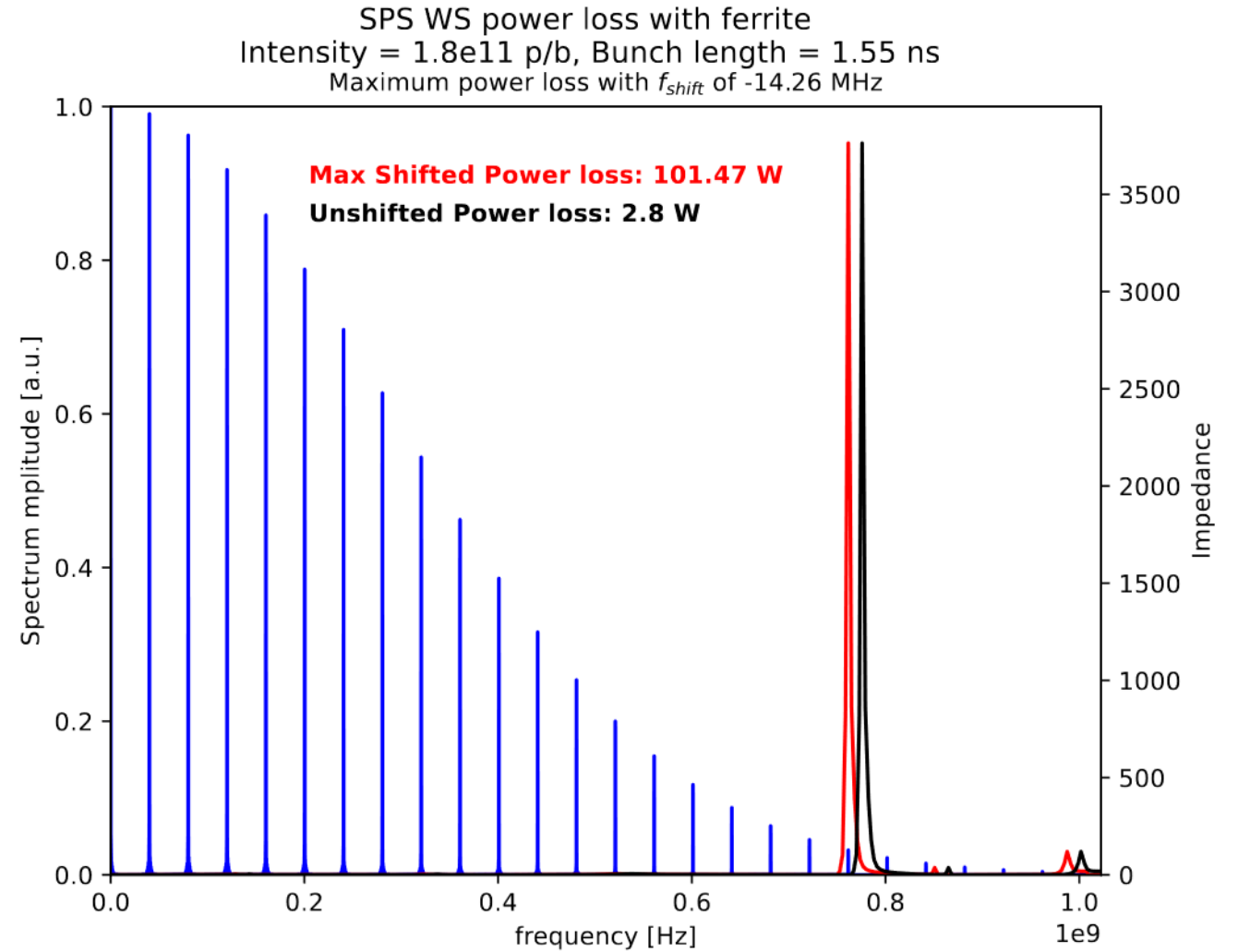# Power loss with ferrite
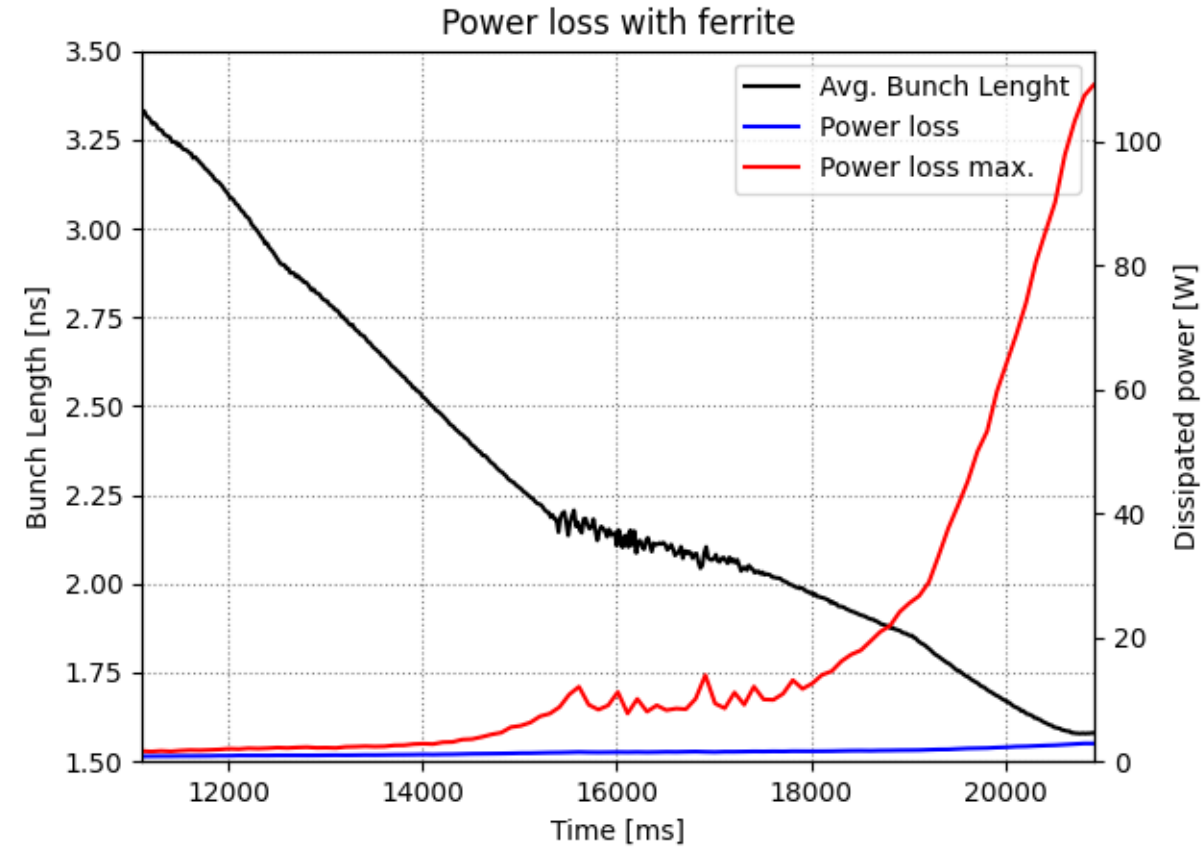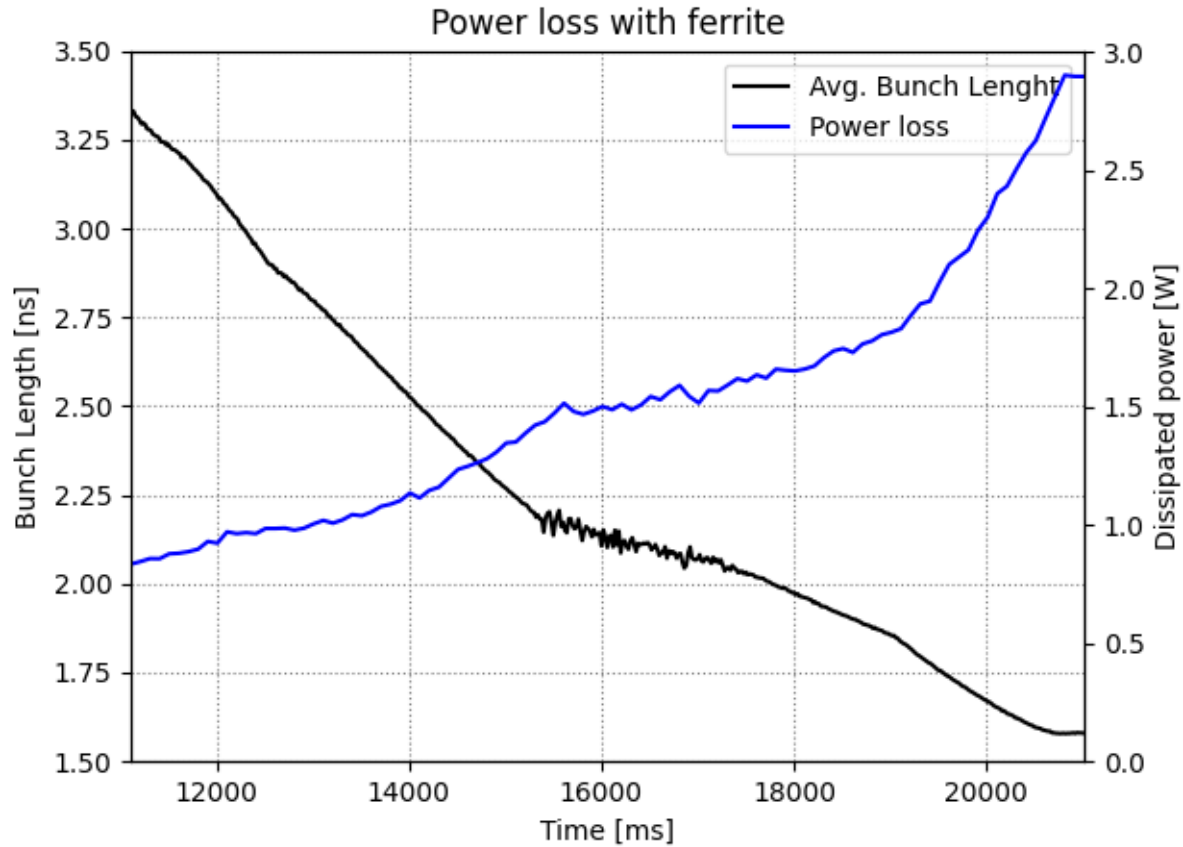
→ Potentially large power loss on ferrite for some time close to flat top

Power distribution

SPS WS power loss with ferrite
Intensity = 1.8e11 p/b, Bunch length = 1.55 ns
Maximum power loss with f_{shift} of -14.26 MHz

Max Shifted Power loss: 101.47 W

Unshifted Power loss: 2.8 W

Next steps

- Use a smaller ferrite that does not enter in the cylinder volume
- Remove the feedthrough in wakefield simulations to see if should be kept or not
- Identify the resonant frequency in measurements (for the ferrite or no ferrite case)