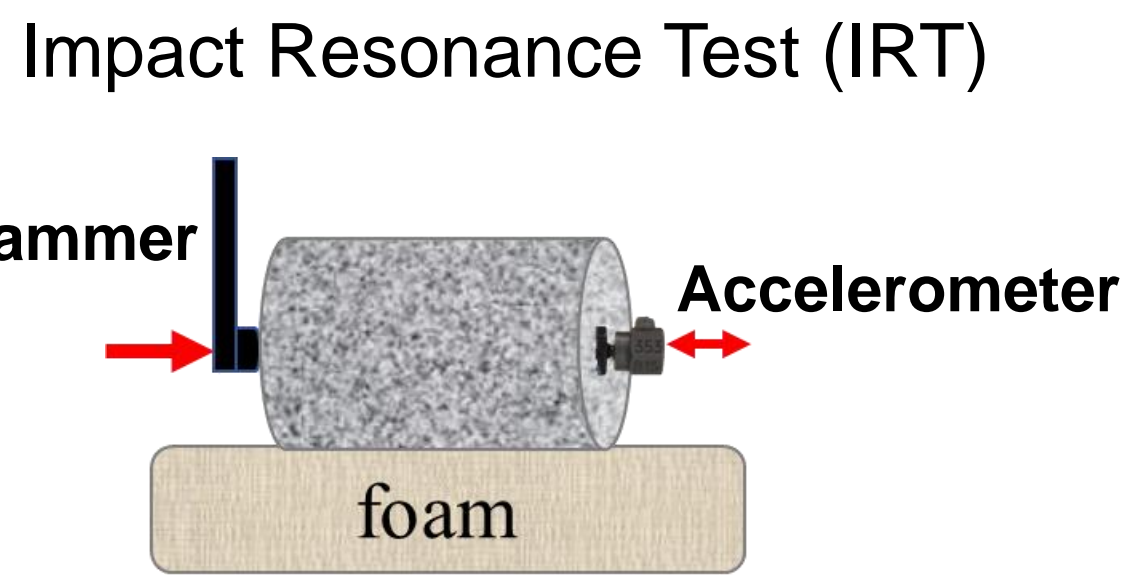




CONTEXT AND OBJECTIVES

LABORATORY SCALE

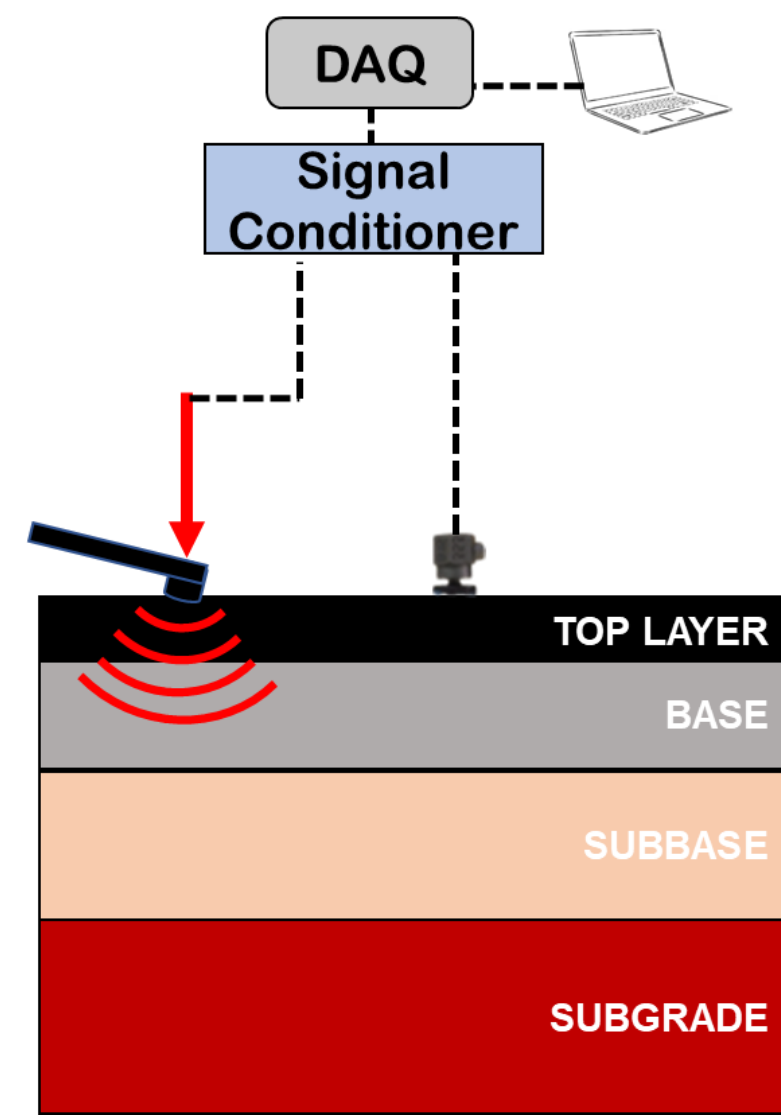


- Linear viscoelastic (LVE) characterization
- Resonance phenomenon
- Low cost, quick and easy to execute

OBJECTIVE 01

To validate the accuracy of the laboratory IRT for different types of bituminous mixtures (granulometry, bitumen, bitumen content and air voids)

FIELD SCALE

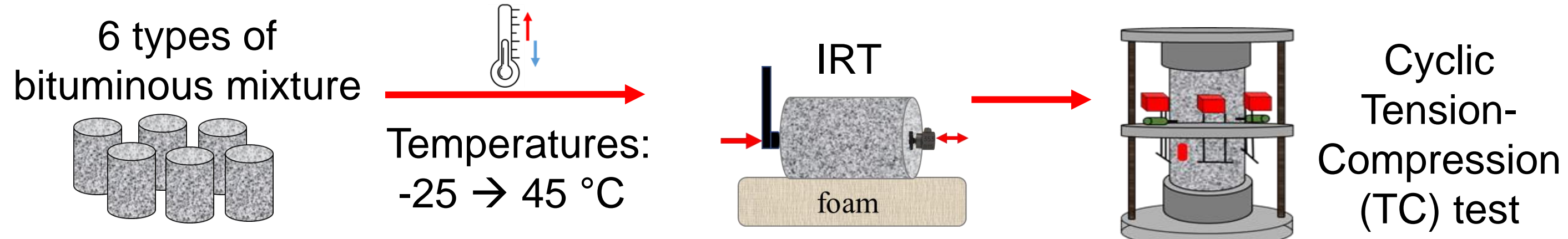


OBJECTIVE 02

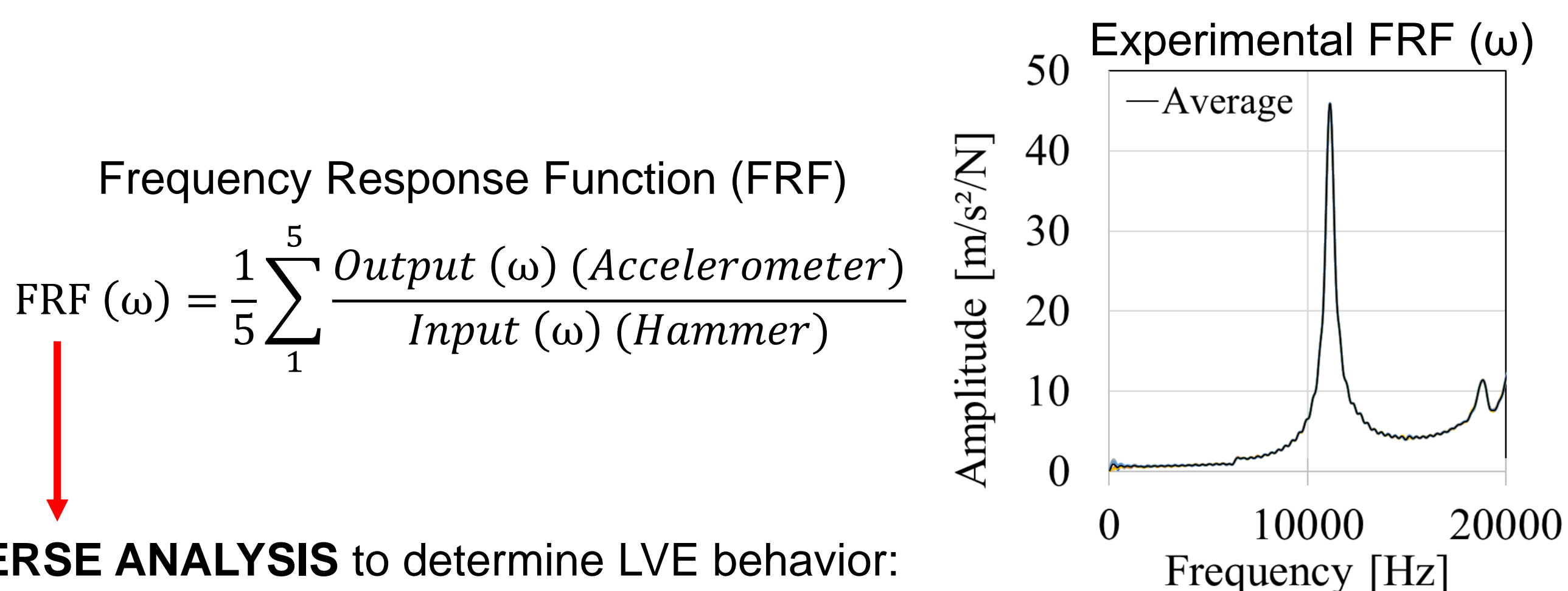
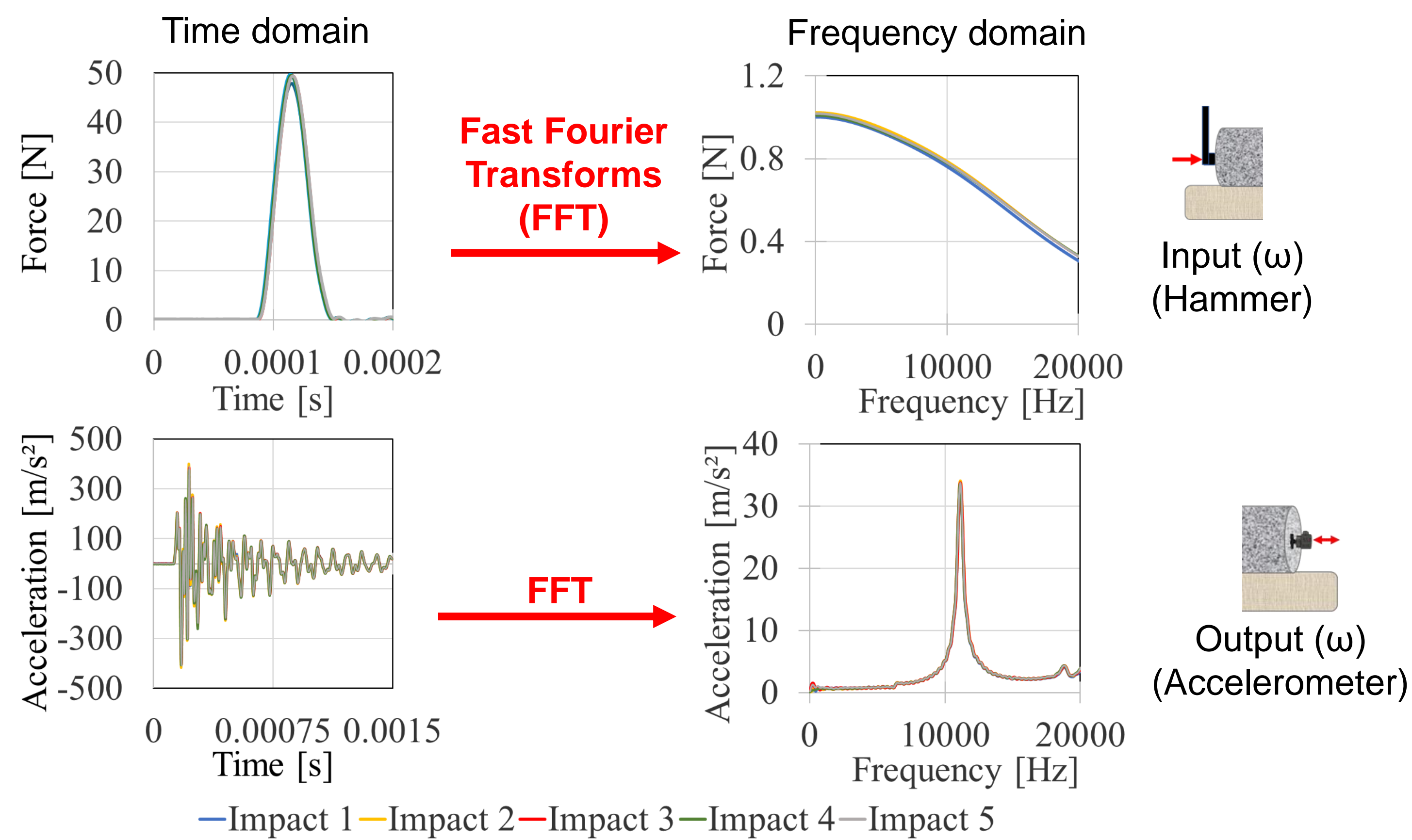
To develop a methodology for performing non-destructive test in the field, and to propose a method for analyzing data and characterizing LVE behavior

MATERIALS AND METHODS

LABORATORY SCALE



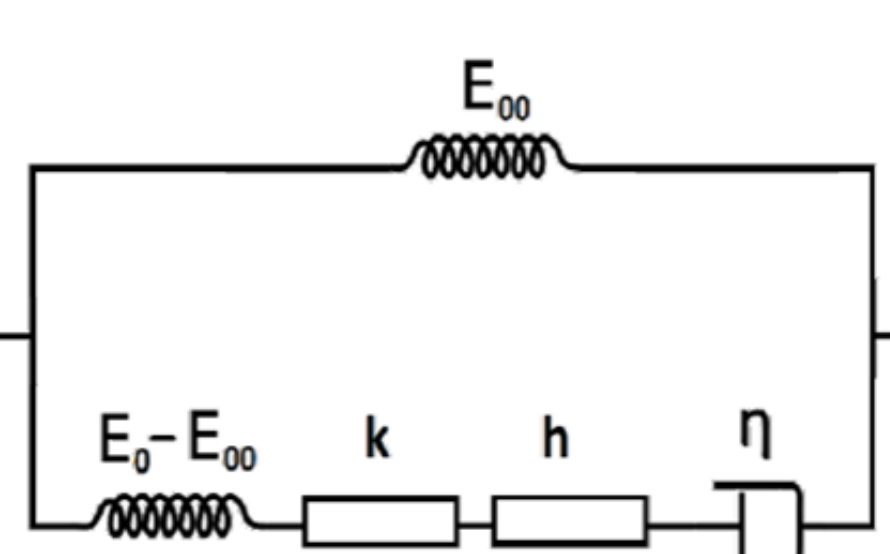
Example of Impact Resonance Test (IRT) results at -5°C:



INVERSE ANALYSIS to determine LVE behavior:

- FEM simulation to calculate numerical FRF
- Optimization of numerical FRF on experimental FRF

LVE modeling 2S2P1D model



$$E^*(\omega) = E_{00} + \frac{E_0 - E_{00}}{1 + \delta(i\omega\tau_E)^{-k} + (i\omega\tau_E)^{-h} + (i\omega\beta\tau_E)^{-1}}$$

7 constants in 1-D
3 constants in 3-D: v_0, v_{00}, τ_v
2 constants for WLF Equation: C_1, C_2 } 12 parameters

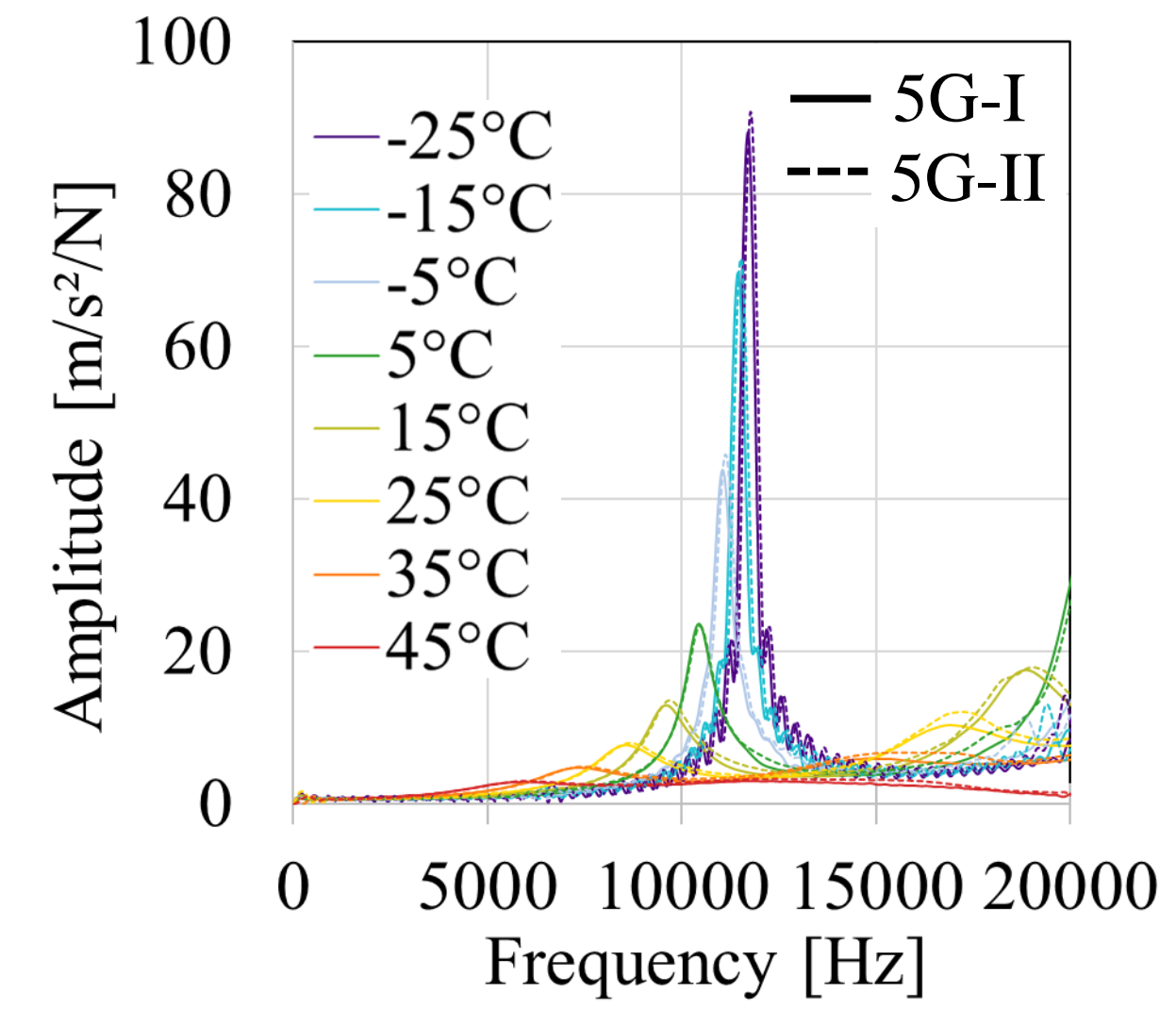
4 parameters to be optimized (E_0, k, δ and τ_E)
8 fixed parameters

EXAMPLE OF RESULTS

EXPERIMENTAL FRF FROM IRT TESTS

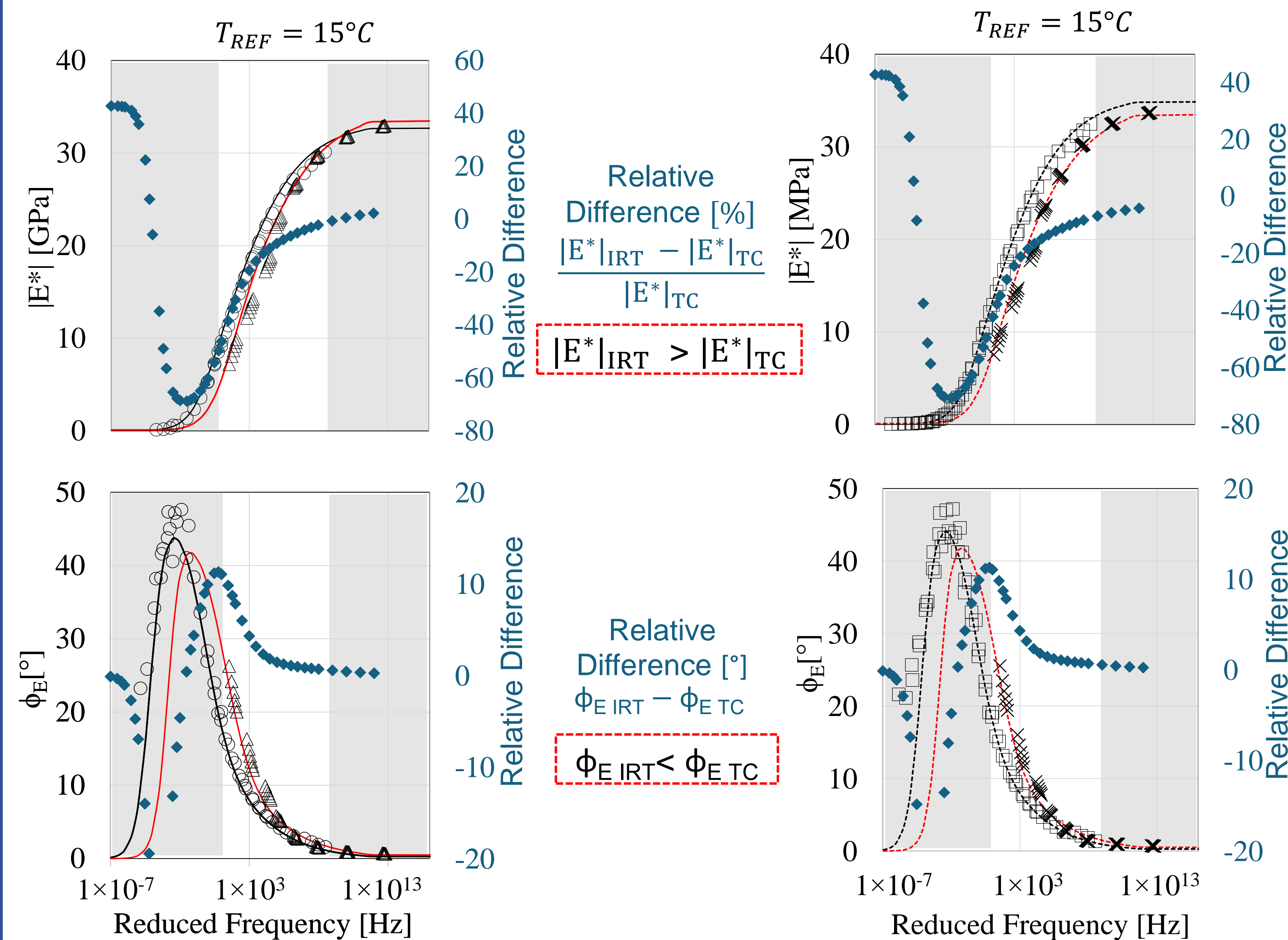
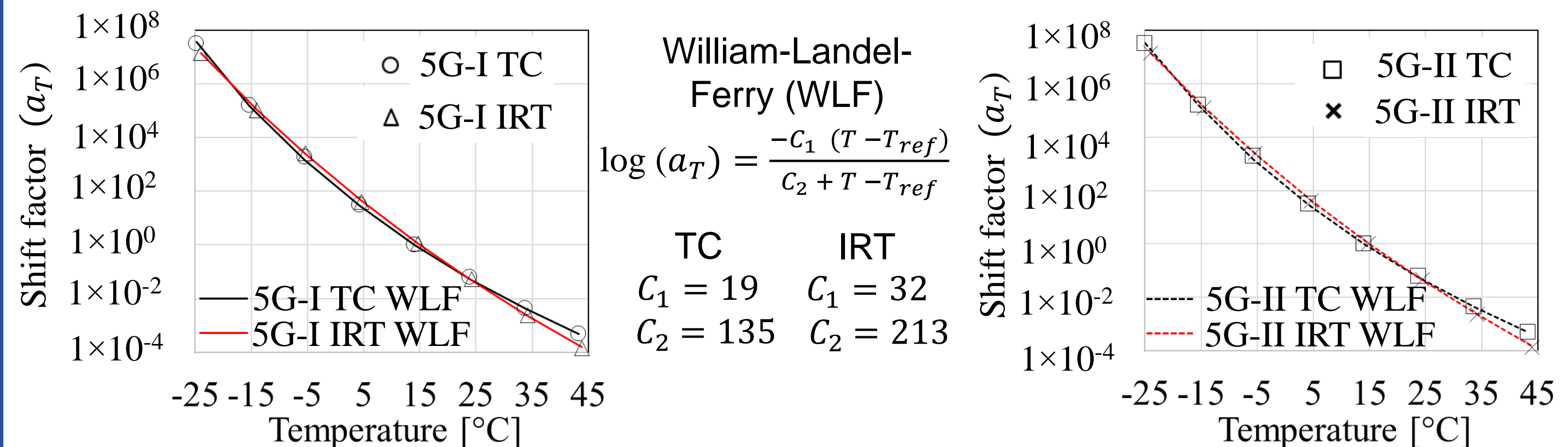
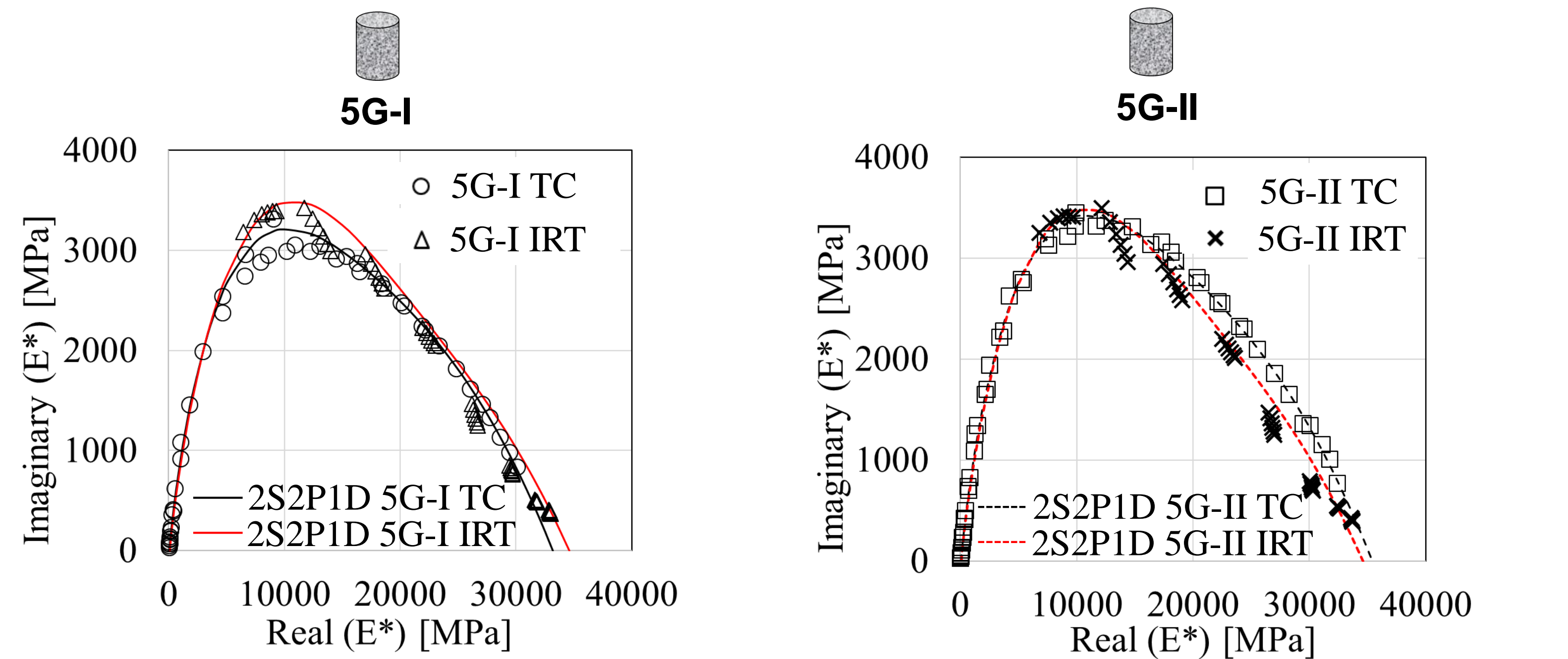
Mixture BBSG
Granulometry: 0/10 mm
Bitumen type: 50/70
Bitumen content: 5.2%

2 specimens
5G-I Air void: 5.8%
5G-II Air void: 5.2%



↑ Temperature
↓ Resonance Frequency
↓ Amplitude

COMPARISON BETWEEN IRT AND TC TESTS



PERSPECTIVES

- To finalize the experimental campaign on a laboratory scale;
- Carrying out in situ measurements on an experimental section pavement.