

IBR (Inverter-Based Resources) Model Verification

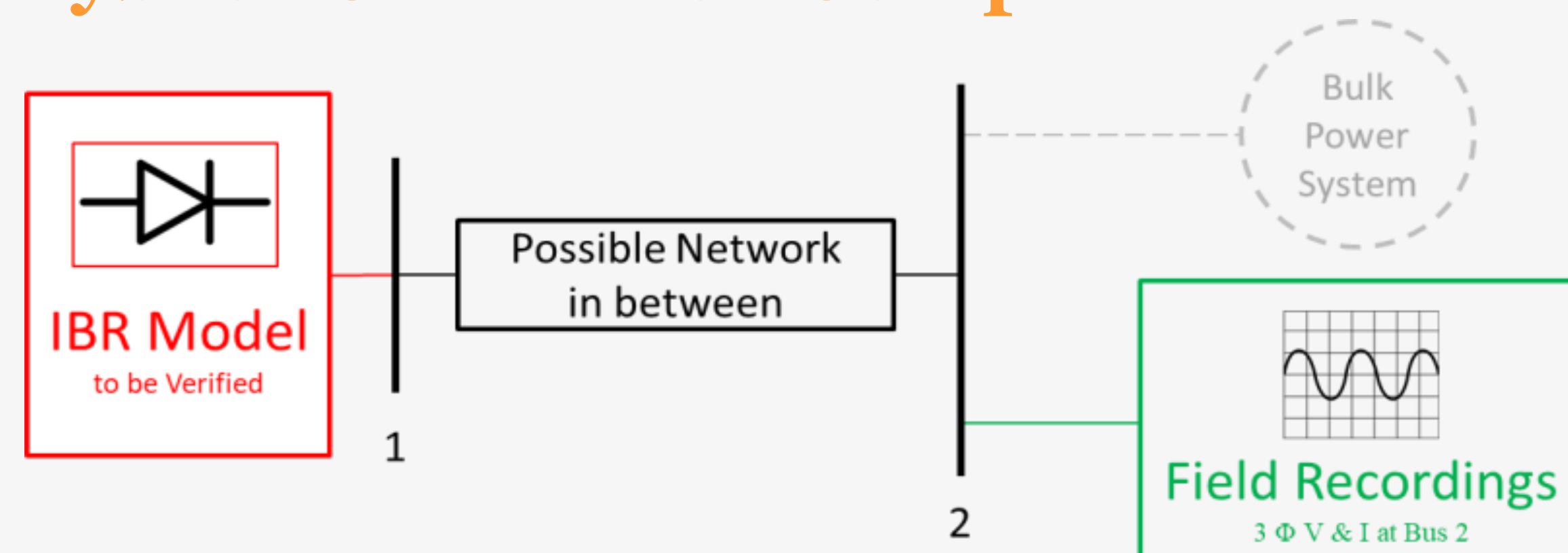
Using EMT (Electromagnetic Transient) Playback Simulation

Main Idea

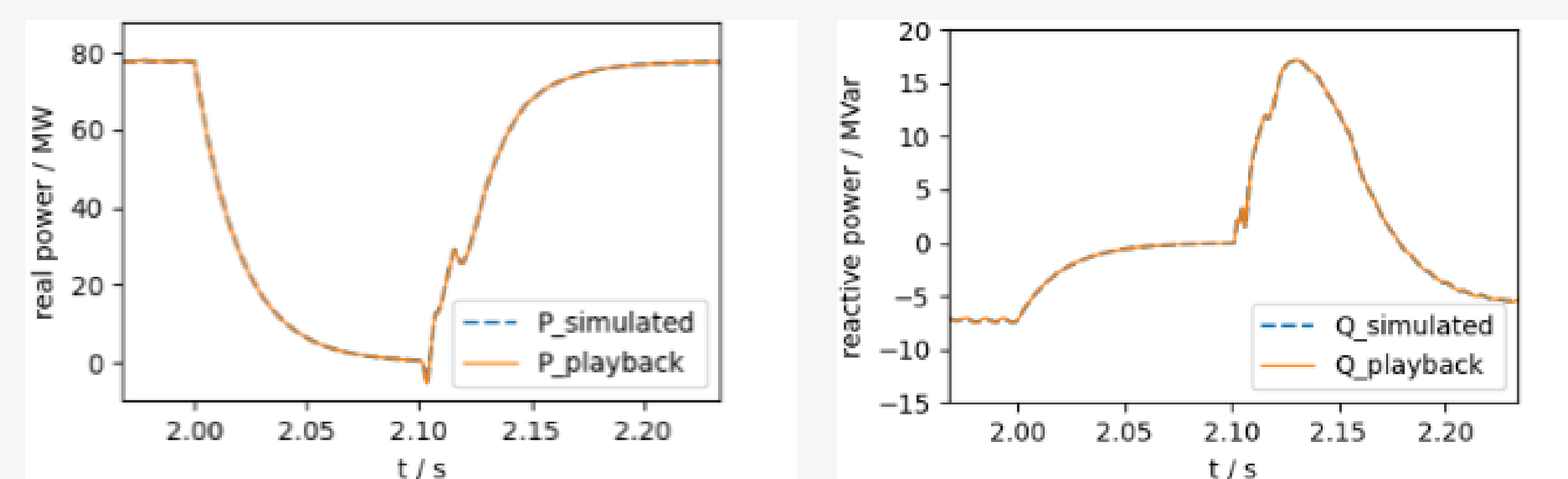
Use grid voltage measurements as input to the EMT model and compare the simulated current and power outputs with the measured ones.

Playback Simulation Approach

Playback Simulation Setup



Playback of Simulated Data



Advantages

- ❖ No need to simulate the whole system
- ❖ Results are straightforward to interpret
- ❖ Provides a solution for facility owners to verify their models

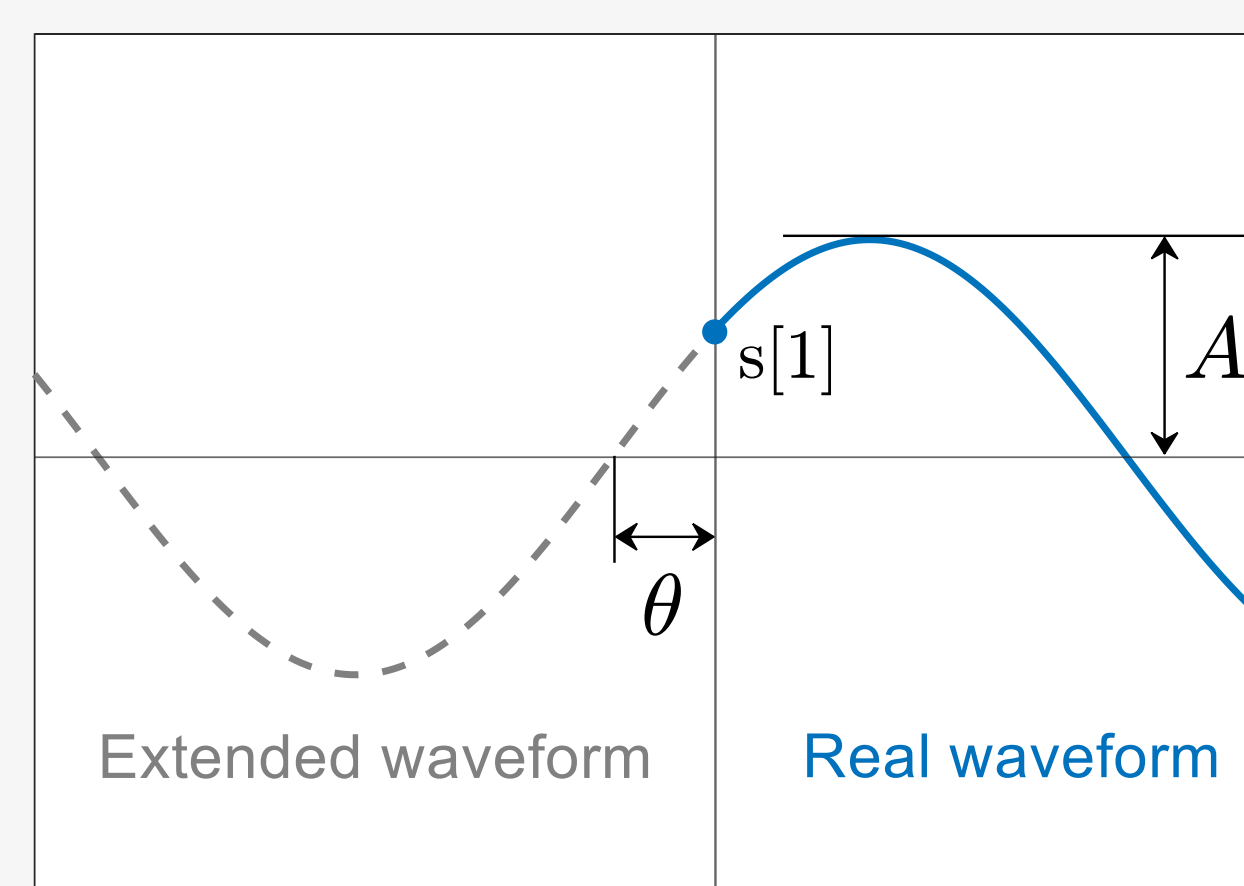
IBR Model Ramp-up Technique

Waveform Extension

Match the magnitude and phase angle with a given sine signal s .

$$A = \sqrt{2} \times \text{RMS}(s)$$

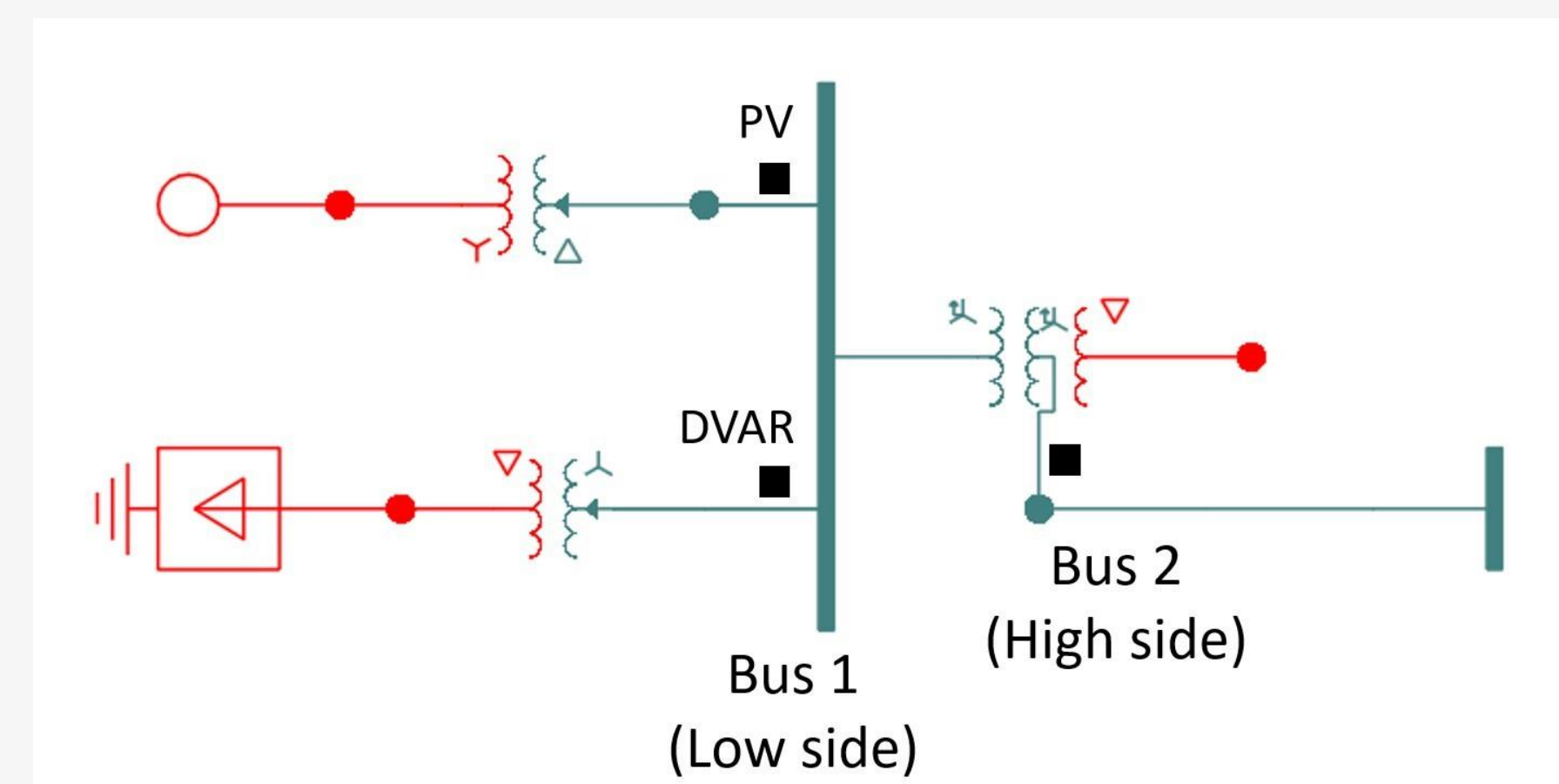
$$\theta = \arcsin(s[1]/A)$$



Application on Real Event

Facility Information

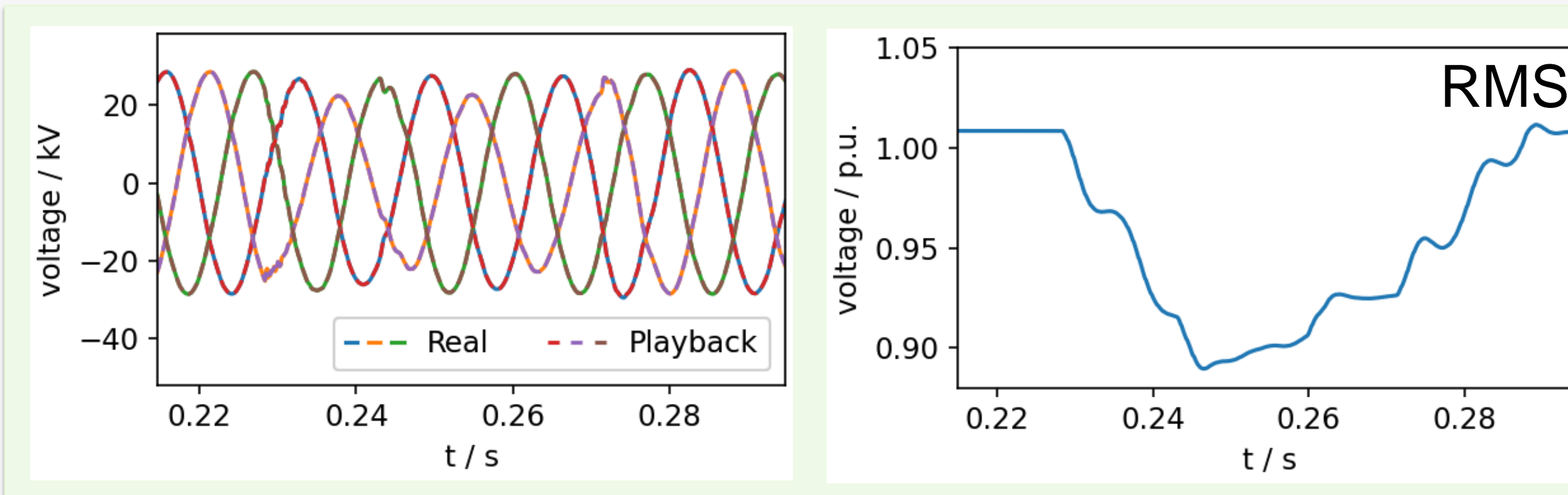
PV generation facility near the event site.



Event Information

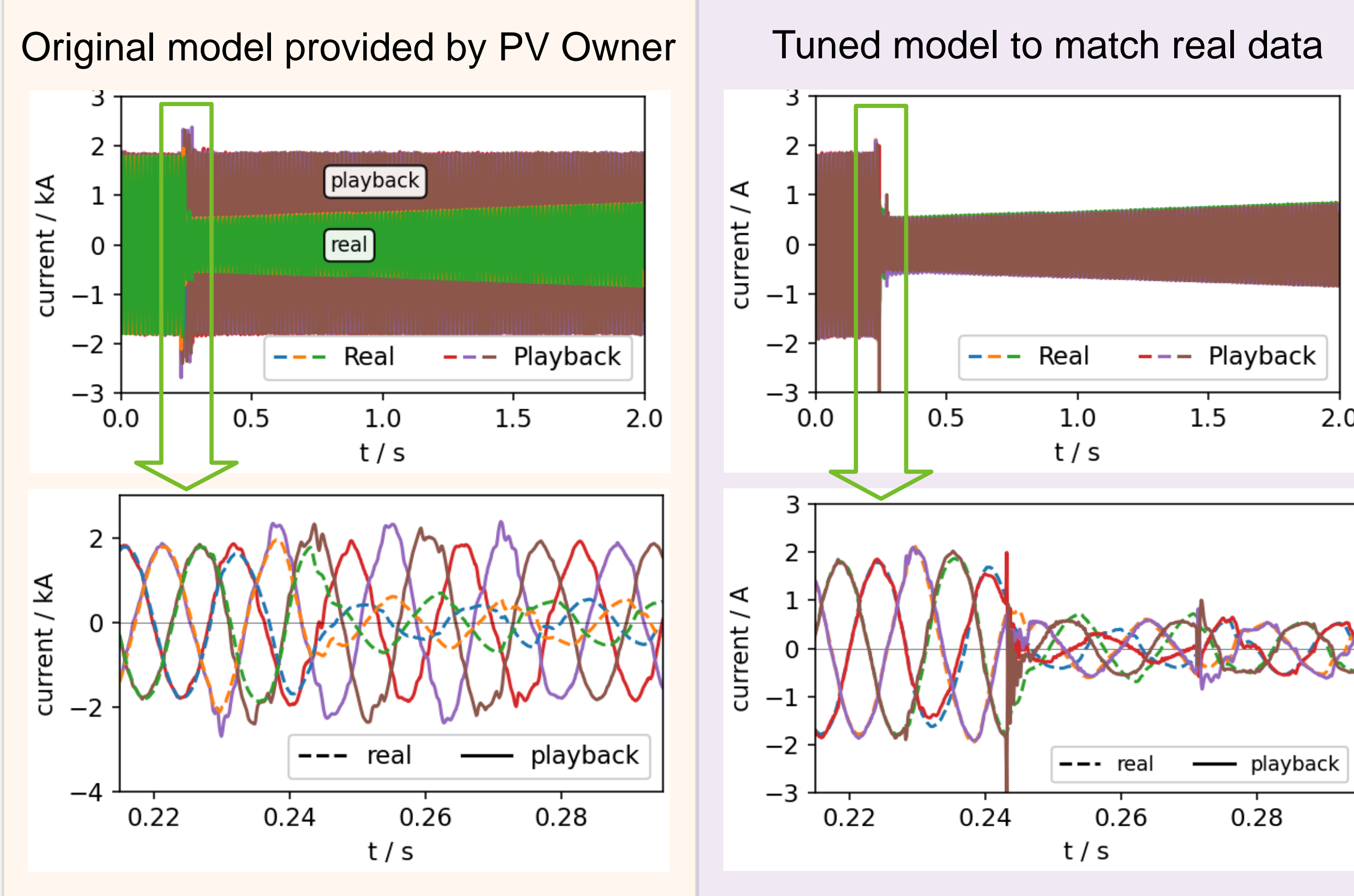
A bus near a power station tripped, causing a voltage dip in the neighborhood.

Bus 1 Voltage

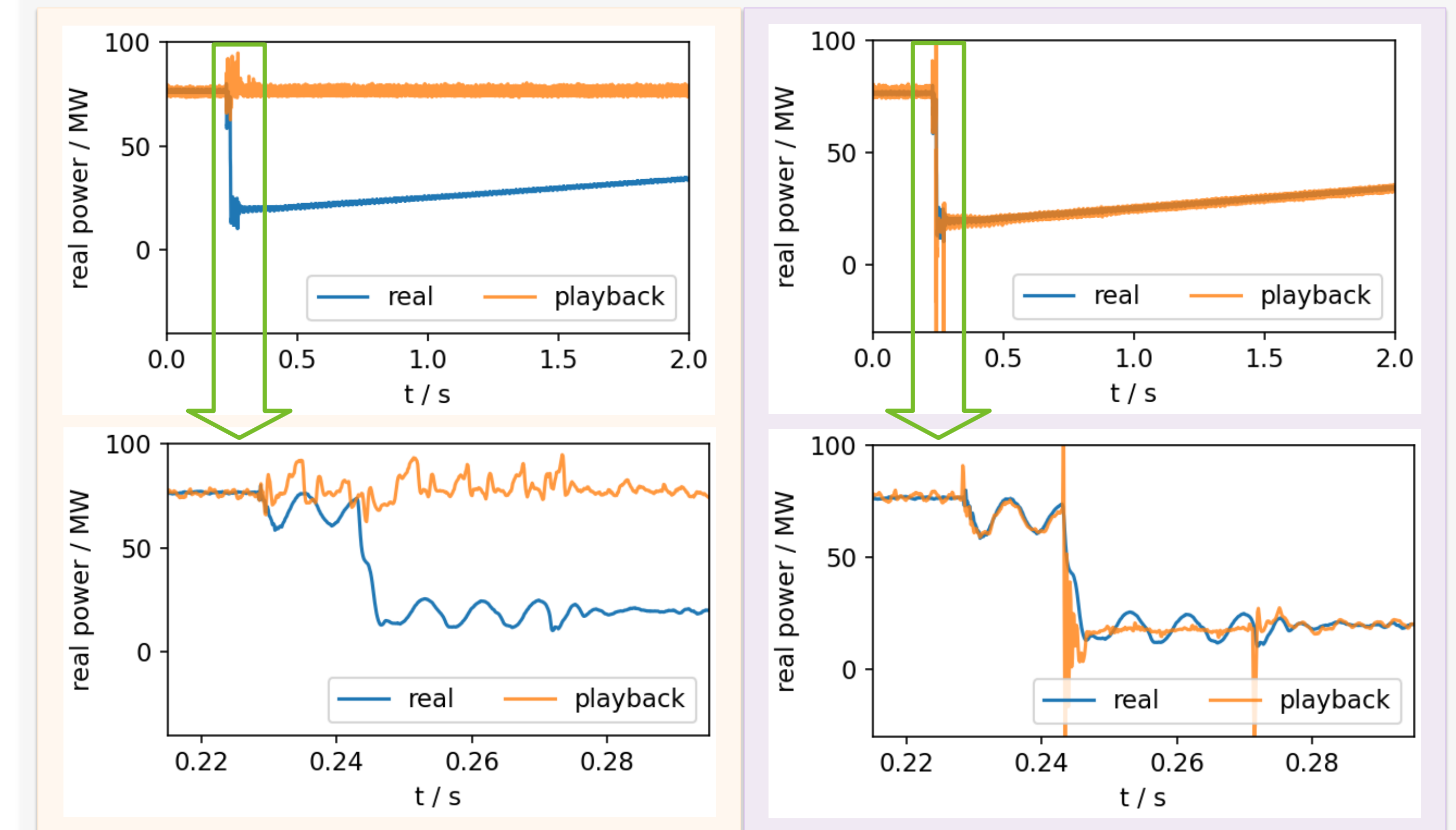


Playback Results

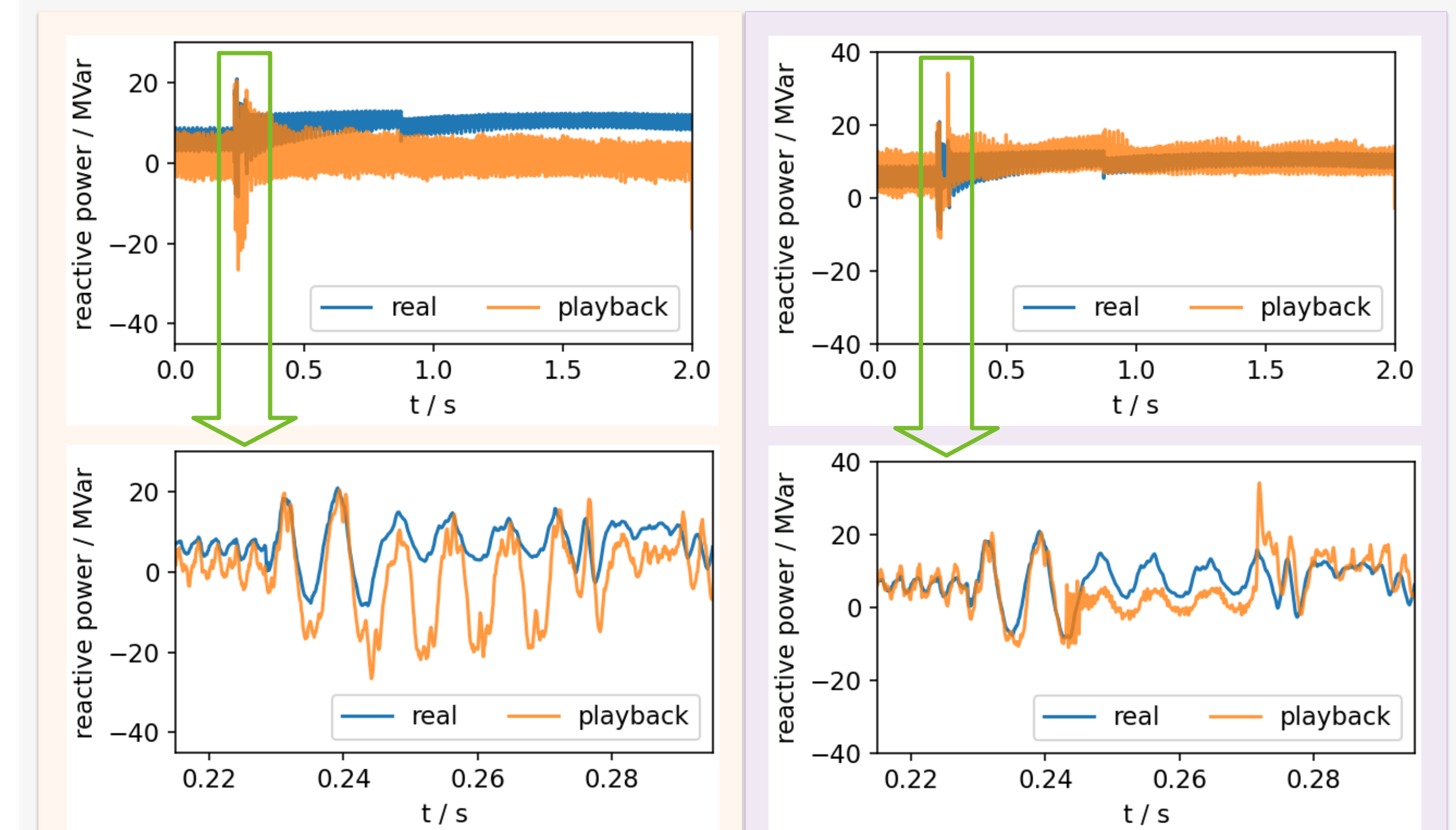
PV Output – Current



PV Output - Real Power



PV Output - Reactive Power



Result analysis: The original model provided by PV plant owner does not reflect the actual protection and control logics during this event.

Conclusions

- EMT playback simulation is efficient and effective as an IBR model verification solution.
- The subject IBR did not perform well during the minor voltage event like its EMT model did.

