NeTIRail

Needs Tailored Interoperable Railway Infrastructure

# Current and voltage monitoring, for the overhead contact line system

NeTIRail-INFRA final conference

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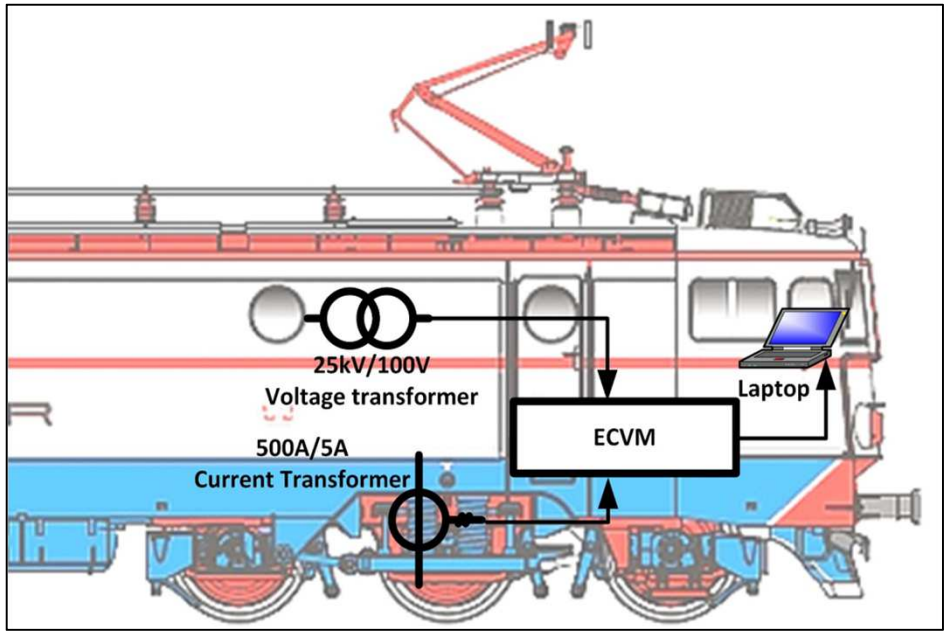
Tudor Popa

Analogic & Digital Systems

# Description of the developed system (1)

## **ECVM** and system installation on the locomotive




- The system is designed for on-board monitoring for current, voltage and power spikes of the railway power supply system
- Central unit of the system: **ECVM** - **E**quipment for **C**urrent & **V**oltage **M**onitoring; also there is one Laptop with Software Application
- It is used the instrumentation transformers from locomotives as sources of data
- The **ECVM** connection with the Laptop is done via a USB serial standard cable

# Description of the developed system (2)

## ECVM has two blocks:

- PSM - Power Supply Module; the design depends by the locomotives offering power supply(ex. 230 Vac, 110 Vdc, etc.)

- DCVM – Device for Current and Voltage Monitoring; has the same design for all situations, less ADC inputs adaptation

Experiments sessions were organised at SZ-Slovenia and AFER-Faurei

# Advantages of the using system

- The system developed makes registration of the power supply parameters, from the locomotive side; provide image of quality for the energy absorbed
- Could be earlier identified defects on the contact wire but also on the carbon stripe of the pantograph
- Historical data analysis provide info about wearing degree and helps maintenance activities
- Versatile using for different energy counter types

# Experiment session at SZ – Slovenia (1)

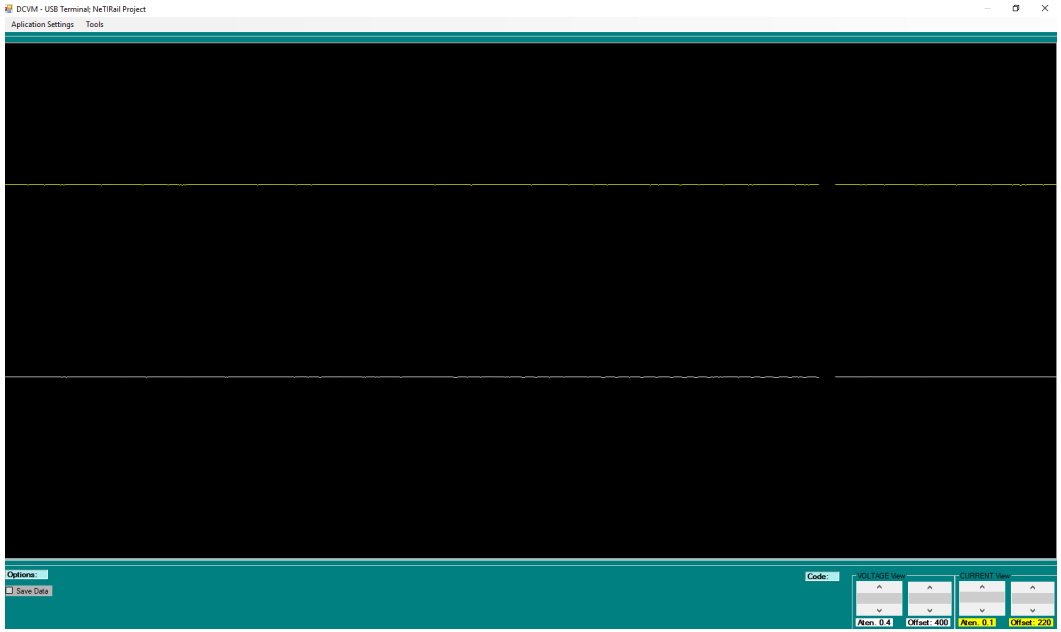

Locomotive used

Installation and putting in function of the ECVM; inside the locomotive cabin

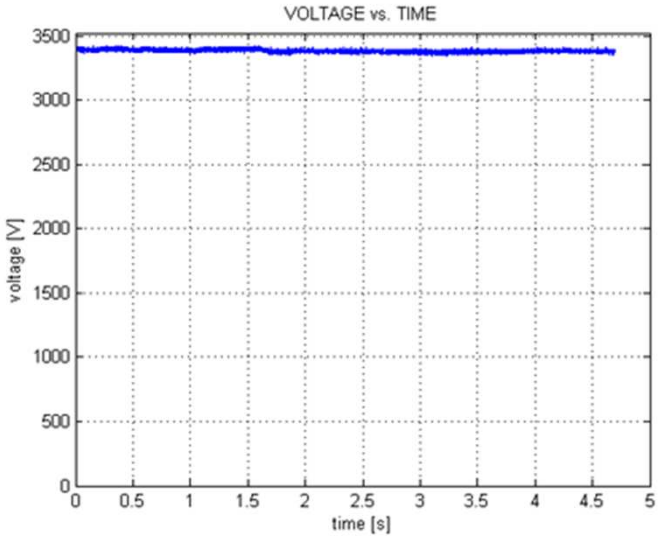
The locomotive energy counter provided the primary data

# Experiment session at SZ – Slovenia (2)

## Terminal Interface for showing and saving data



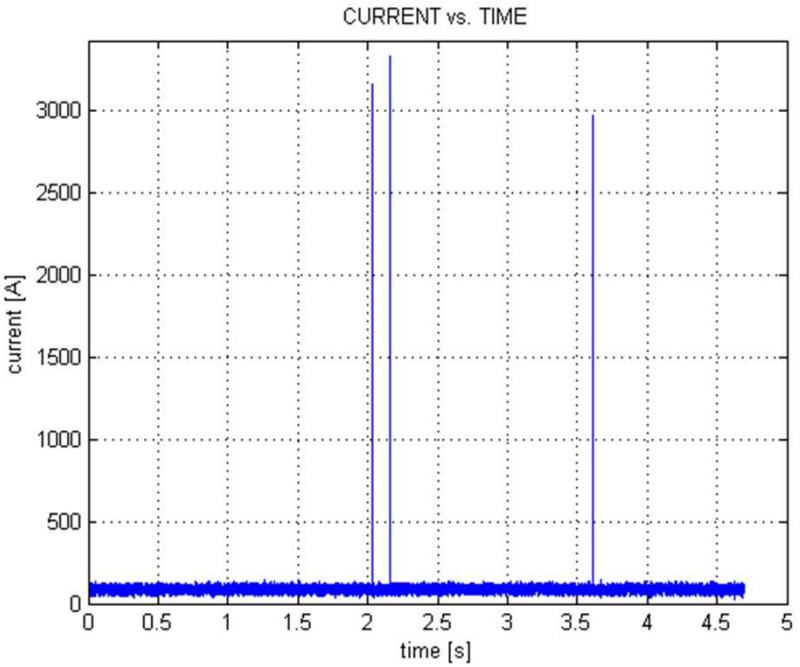

## Expected shape of voltage

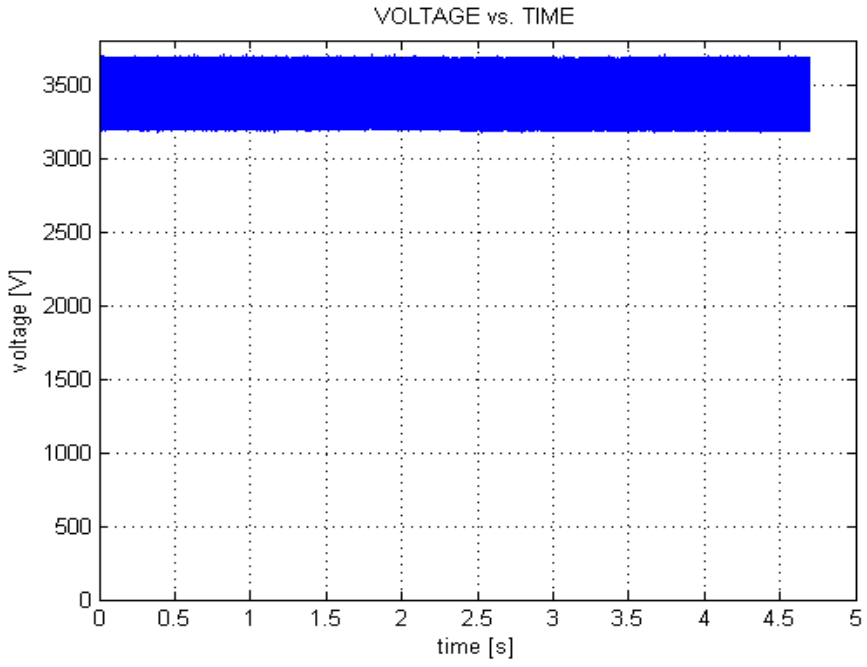



- Were registered around 8 hours of samplings: current and voltage
- As default was set the acquisitioning sampling rate as 5000 SPS

# Experiment session at SZ – Slovenia (3)

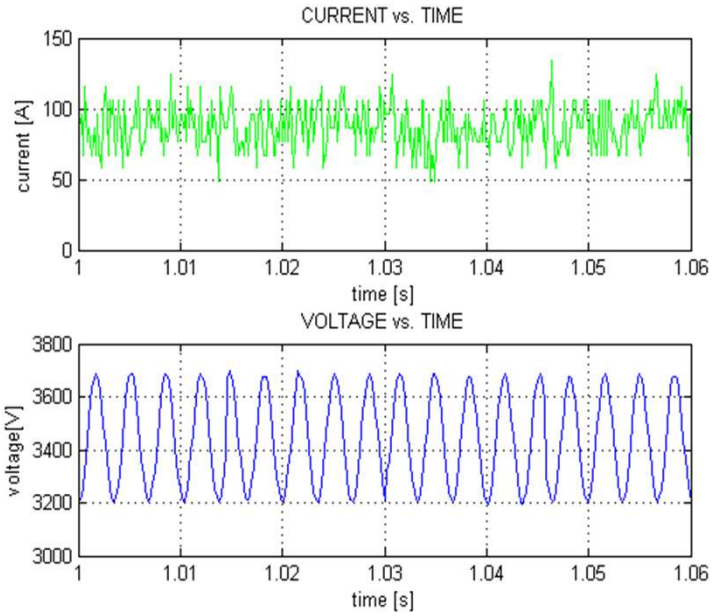
- Current and voltage amplitudes, in time domain for a sequence selected
- Large variations of current amplitude but very short time (microseconds range)
- Long time (10-15 min.) of alternative sinus voltage

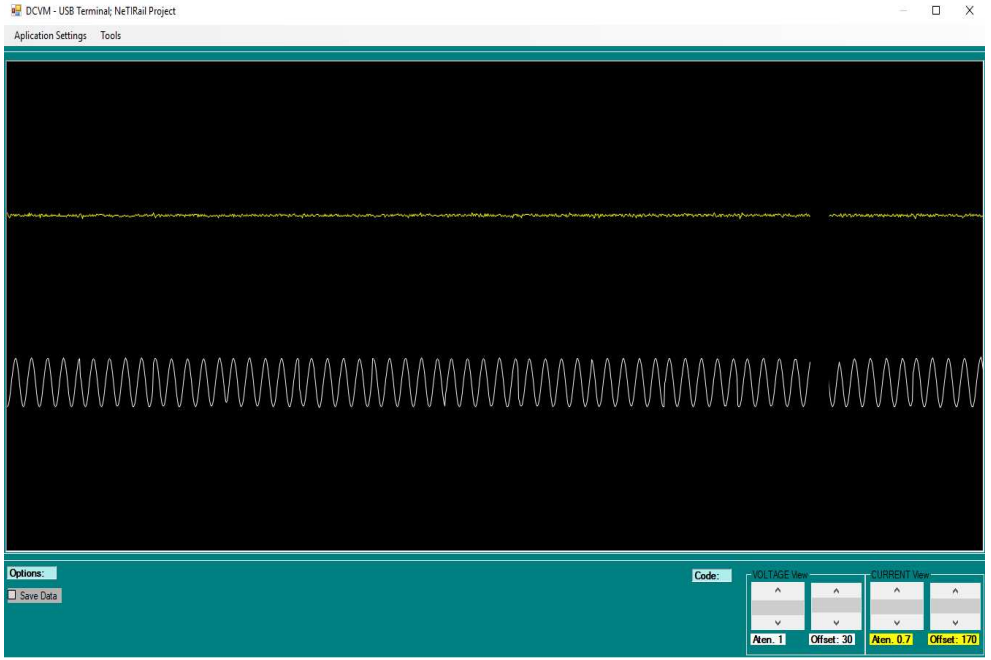


# Experiment session at SZ – Slovenia (4)

## Narrow frame time representation and terminal interface, show sinus voltage

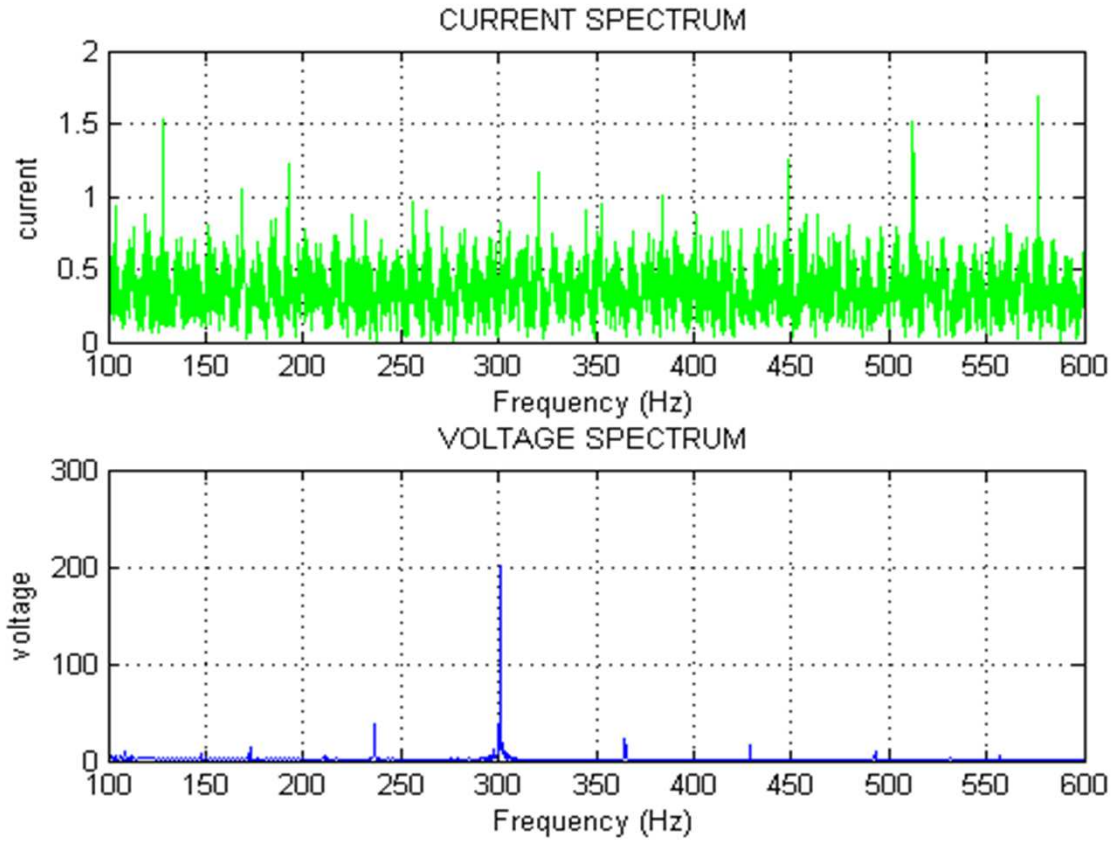


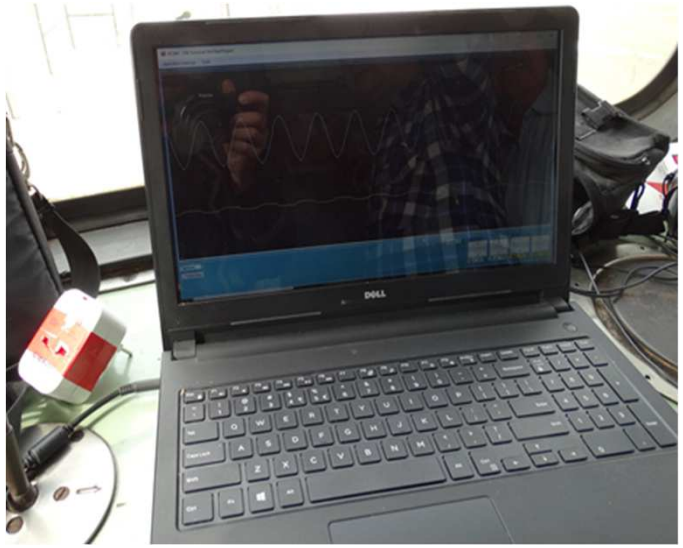

- Long time of alternative sinus voltage received; hundreds of volts overlaps the continuous component

# Experiment session at SZ – Slovenia (5)

Energy spectrum for the current and voltage show a large voltage ripple (around 500 Vpp) is present on the 300 Hz frequency



# Experiment session at AFER – Faurei (1)

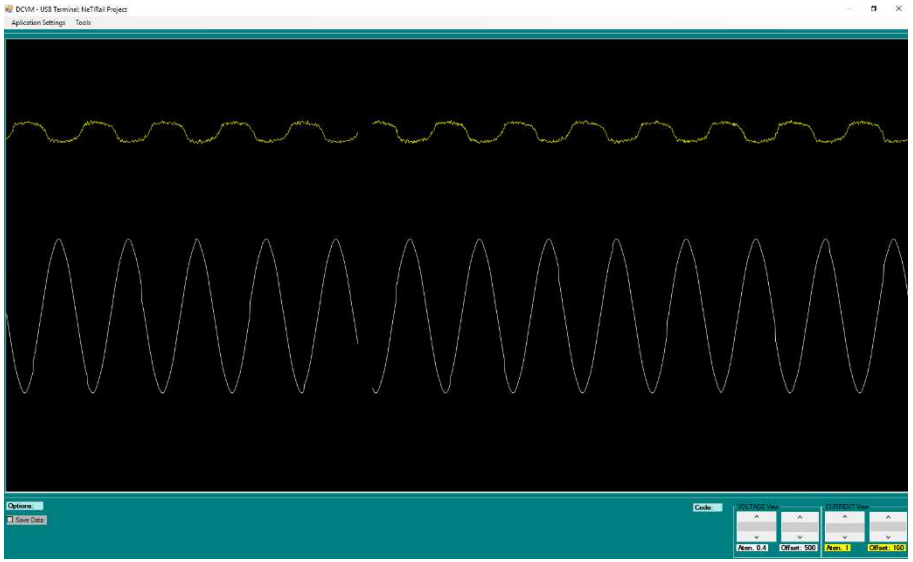



The session started on 26 and ended on 30 March 2018

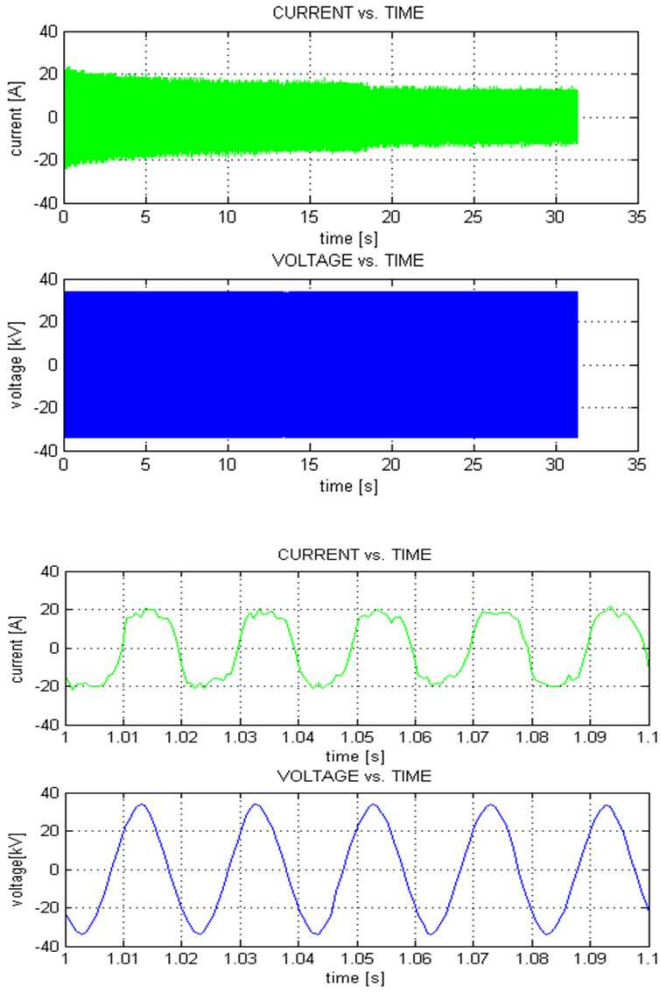
ECVM installation and starting Laptop application

# Experiment session at AFER – Faurei (2)

## Interface for receiving, showing and saving data

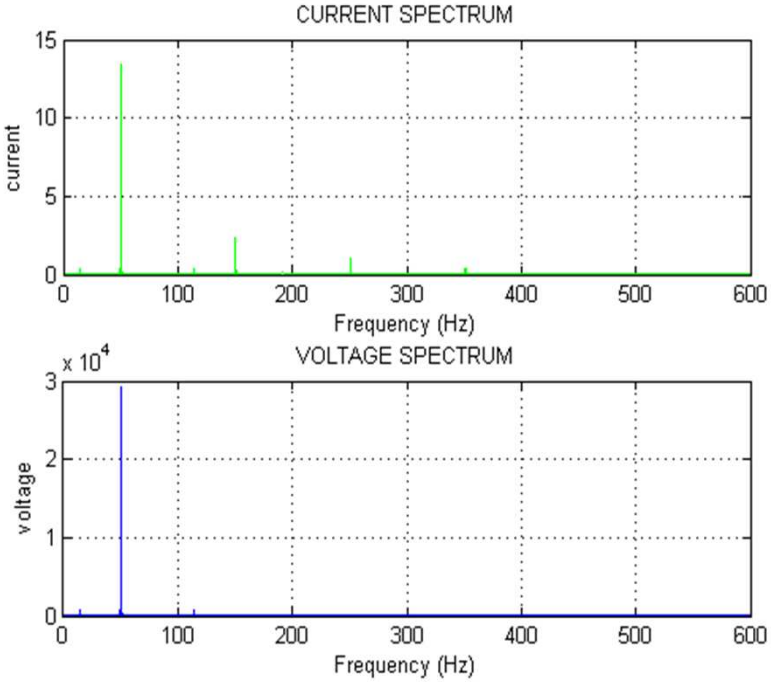


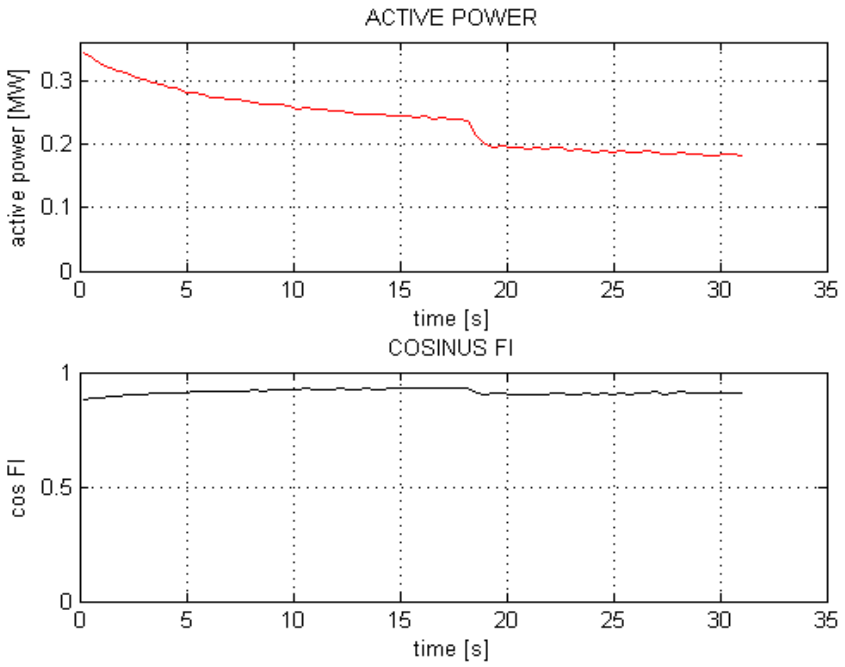
## MatLab post processing




- Were observed also, large variations of the current, for very short time, like on SZ tests
- There are relation with when opening or closing the power modules from the locomotive

# Experiment session at AFER – Faurei (3)




- Spectrum for the current and voltage has main 50 Hz component

- Active power for the energy consumed
- Power factor is very high, close to 1