Waveform Capture On-Site

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EMPIR
EURAMET
MeterEmi
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Introduction

- Static meter misreadings
- Impulsive current drawn from the net
  - Standalone commercial off the shelf equipment
- Characterizing the currents
- Time domain EMI measurements
  - Analyzing noisy waveforms
  - Identifying their fundamental parameters
- On-site scenarios (EV chargers)
  - Coexist in superposition with other components
- Realistic waveforms
- Used for new standardized type-testing

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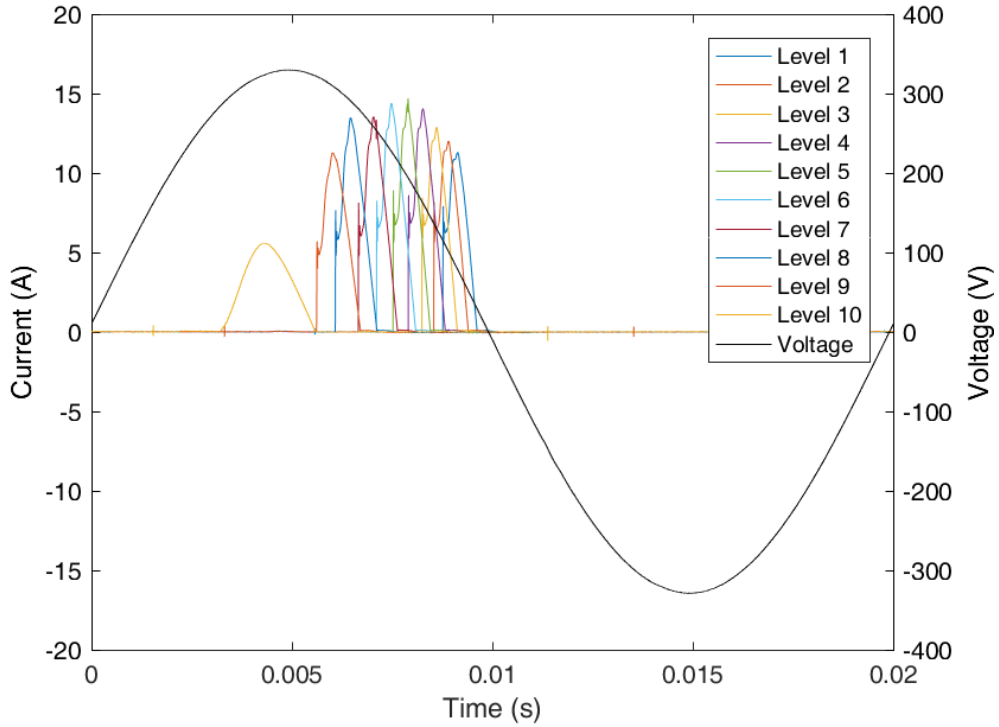
Waveform Characterization

- High di/dt and phase shift
- Saturation of the current sensing element
- Identify the critical parameters
  - di/dt
  - Rise time
  - Fall time
  - Phase
  - Frequency
  - Energy (duration of pulse)
  - Superpositions
- Capture of impulsive interferences
  - High resolution (high dynamic range)
  - High sample rate (high frequency)



On-site Measurements

- Smart meter manufacturer

- Other products
  - Evaluate EV and PV facilities
  - Not possible to evaluate the PV installation yet

- Measurements
  - Time and frequency domain
  - Employ APD and other triggering techniques
  - Preliminary measurements
  - 10 days measurements will be done in the future

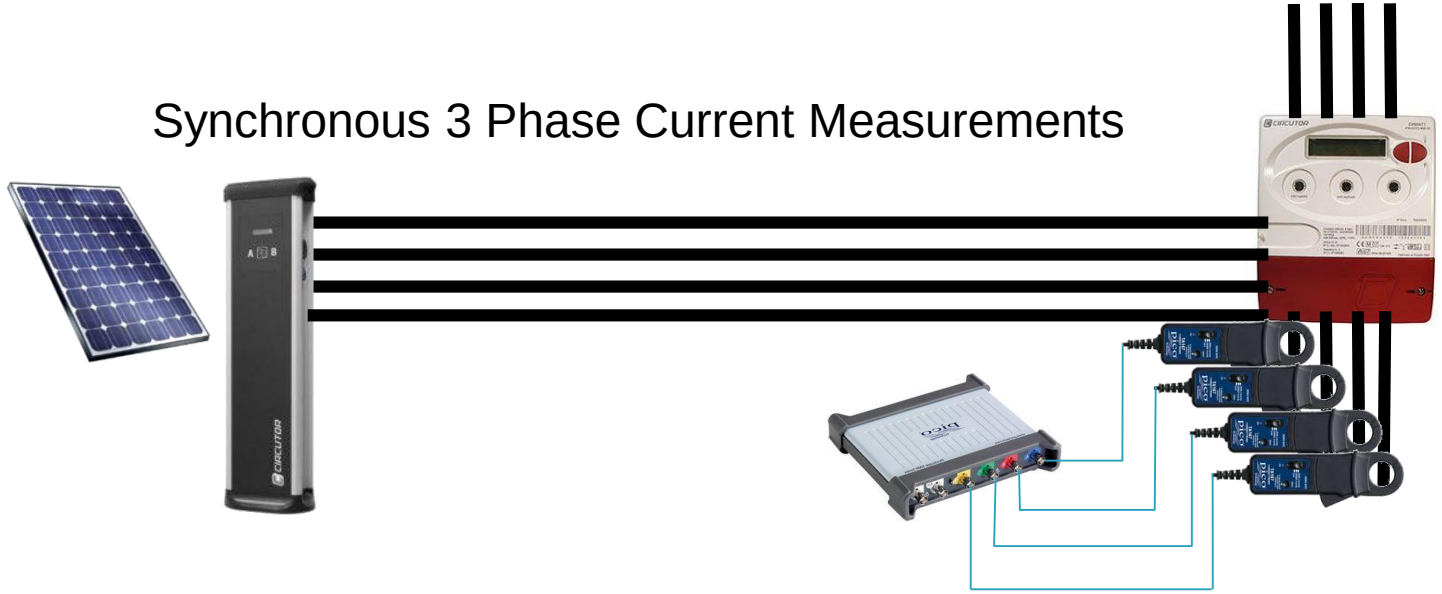
On-site Measurements (23rd February)

- UPC, NPL, UT
- DC charging station (50 kW)
- Charging management done by car
  - Not possible to control it
- 2 cars
- Unknown devices connected at the same network

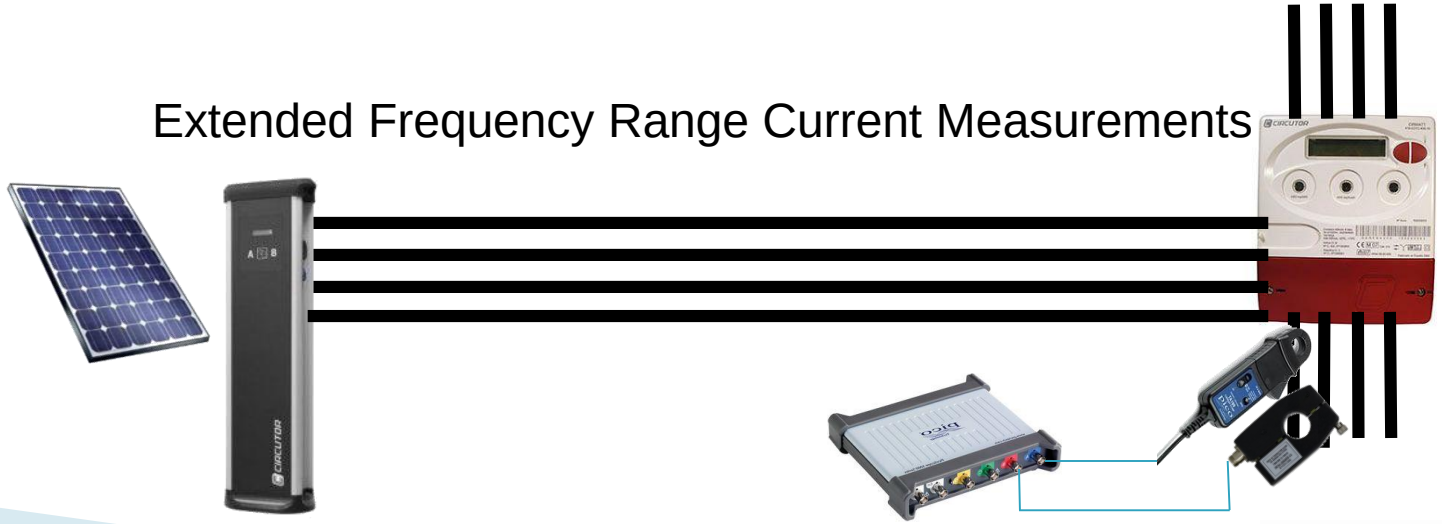
Reference	Car type	Charging State	sample rate	Dwell time
M1	Type 1	No Charging	500 kSa/s	200 ms
M2	Type 1	Charging	500 kSa/s	200 ms
M3	Type 2	Charging	500 kSa/s	200 ms
M4	Type 1	Charging	62.5 MSa/s	30 ms

On-site Measurements

Synchronous 3 Phase Current Measurements



Extended Frequency Range Current Measurements



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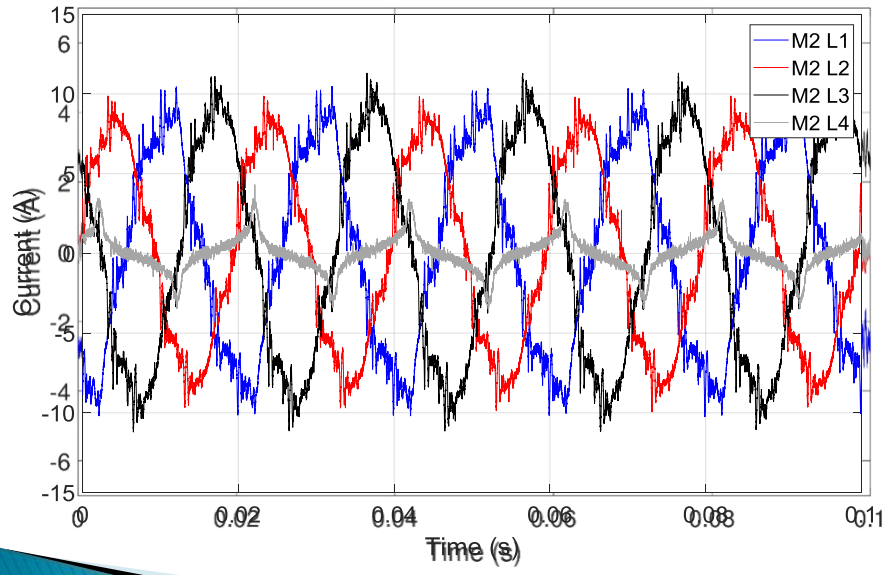
Results

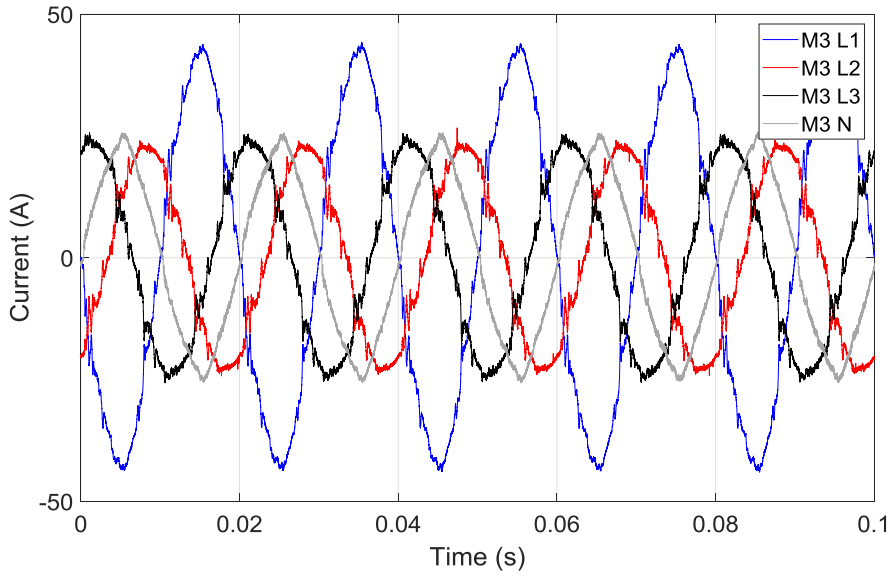
- Vehicle 1 not charging -> charging
- Same contribution from unknown devices
- Impulsive current is still observable

Electric Vehicle 1



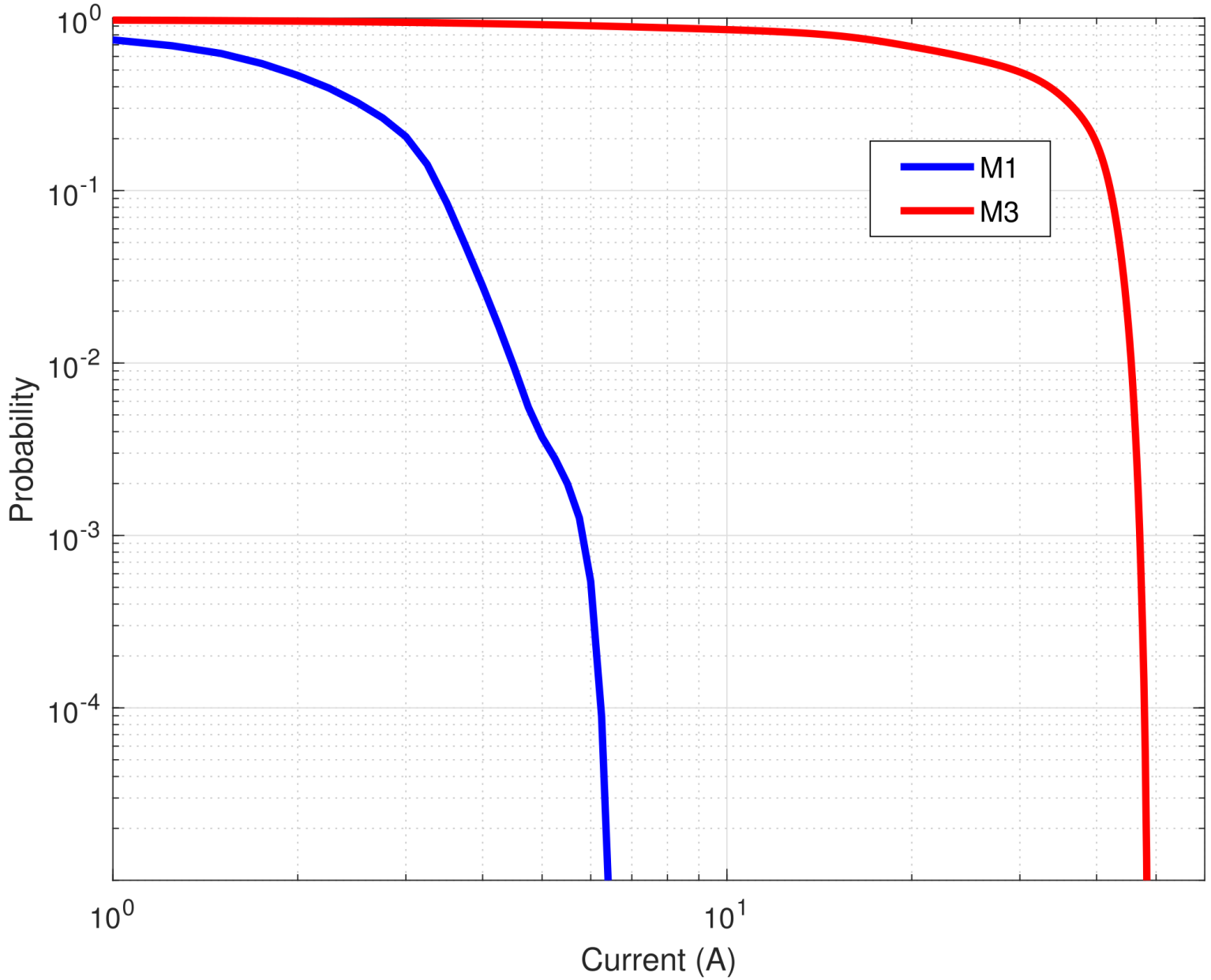
- Impulsive noise could saturate the sensing coil easier
- Vehicle 2 charging
- 2 hours after previous results

Electric Vehicle 2



Results

- Identify impulsive currents
- No charging (M1):
  - Heavy tailed distribution
- Charging (M3):
  - Gaussian distribution



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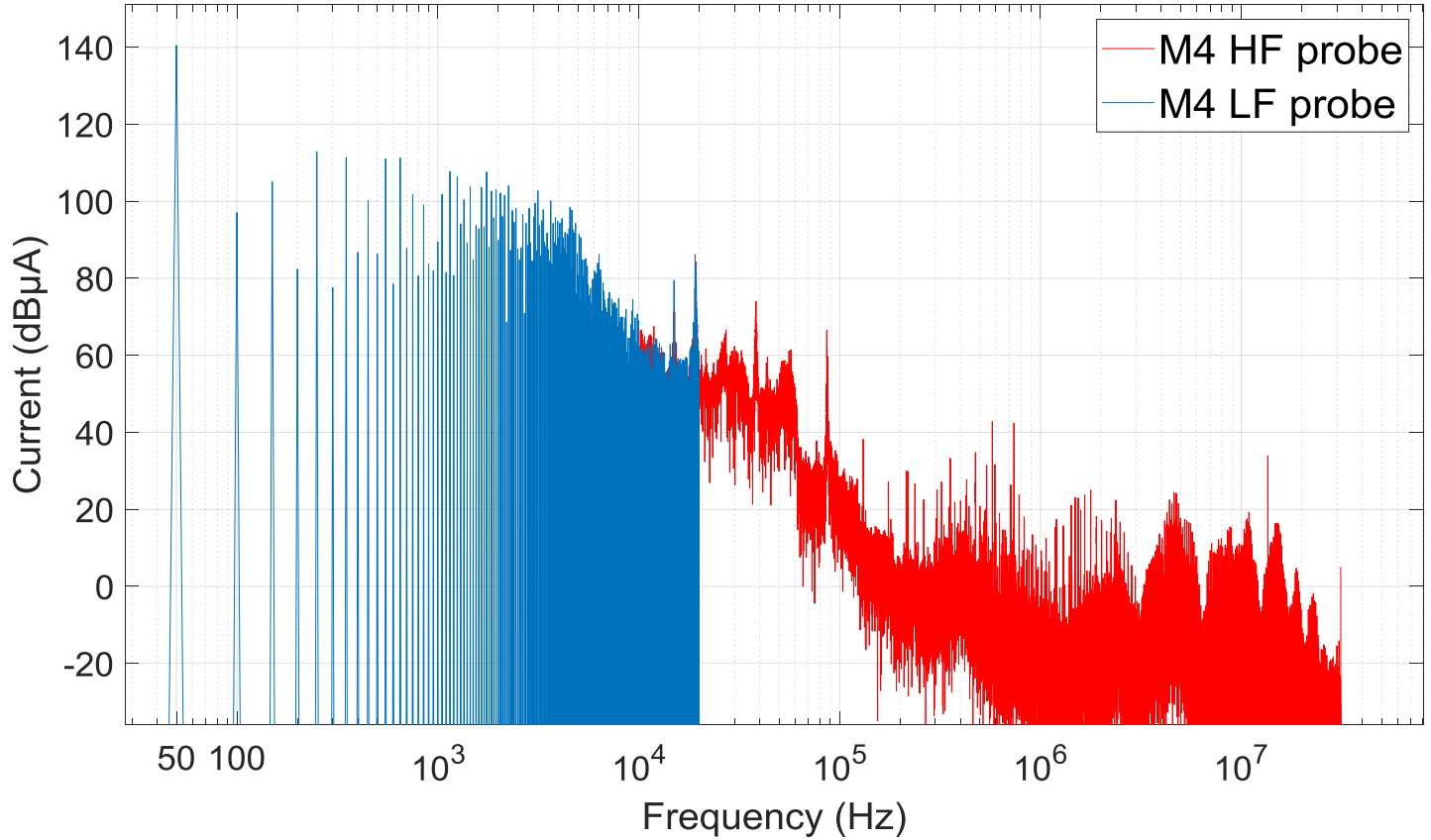
Results

- Frequency range extension
  - Synchronous measurement
- Using LF and HF probes
  - Picoscope TA167 (DC – 20 kHz)
  - 9123-1N RF (10 kHz – 500 MHz)
- Overlap to confirm capability
- Measurements up to 30 MHz
- Identify impulsive currents more accurately



Conclusion

- Measurement technique
- TEMPS
- Synchronous on-site measurements
  - 3 Phases (L1, L2, and L3) and Neutral (N)
- Reproducible measurements
- Amplitude Probability Distribution
- Characterization impulsive currents
- Identification

- Frequency range extension
- Better accuracy over a bigger range

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Next Steps

- Measurement campaign
  - Scheduled next month
- Big data set with waveforms
- Automatic identification
- Empirical Mode Decomposition

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Demo

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End of the Presenation

- Time for questions

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CIRCUTOR measurements

Future relationship within MeterEMI

- **10 days** measurements (next month)
- Including **PV installation**
- Possibility to send **static meters** to the partners
- Contact person: **Alfonso Collado** (stakeholder list)
- Keep going being a collaborator of the project

Thank CIRCUTOR for the extremely good hospitality!