ÉCOLE POLYTECHNIQUE
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PMU-Based Point-on-Wave Data Collected on the 20 kV Network of EPFL-Campus

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NASPI Distribution Task Team (DisTT) Conference Call / September 13 @ 10:00am PT / 1:00pm ET

GitHub link & contacts

- The point-on-wave data are available online at:

https://github.com/DESL-EPFL/Point-on-wave-Data-of-EPFL-campus-Distribution-Network

- For any question or further information please contact us:

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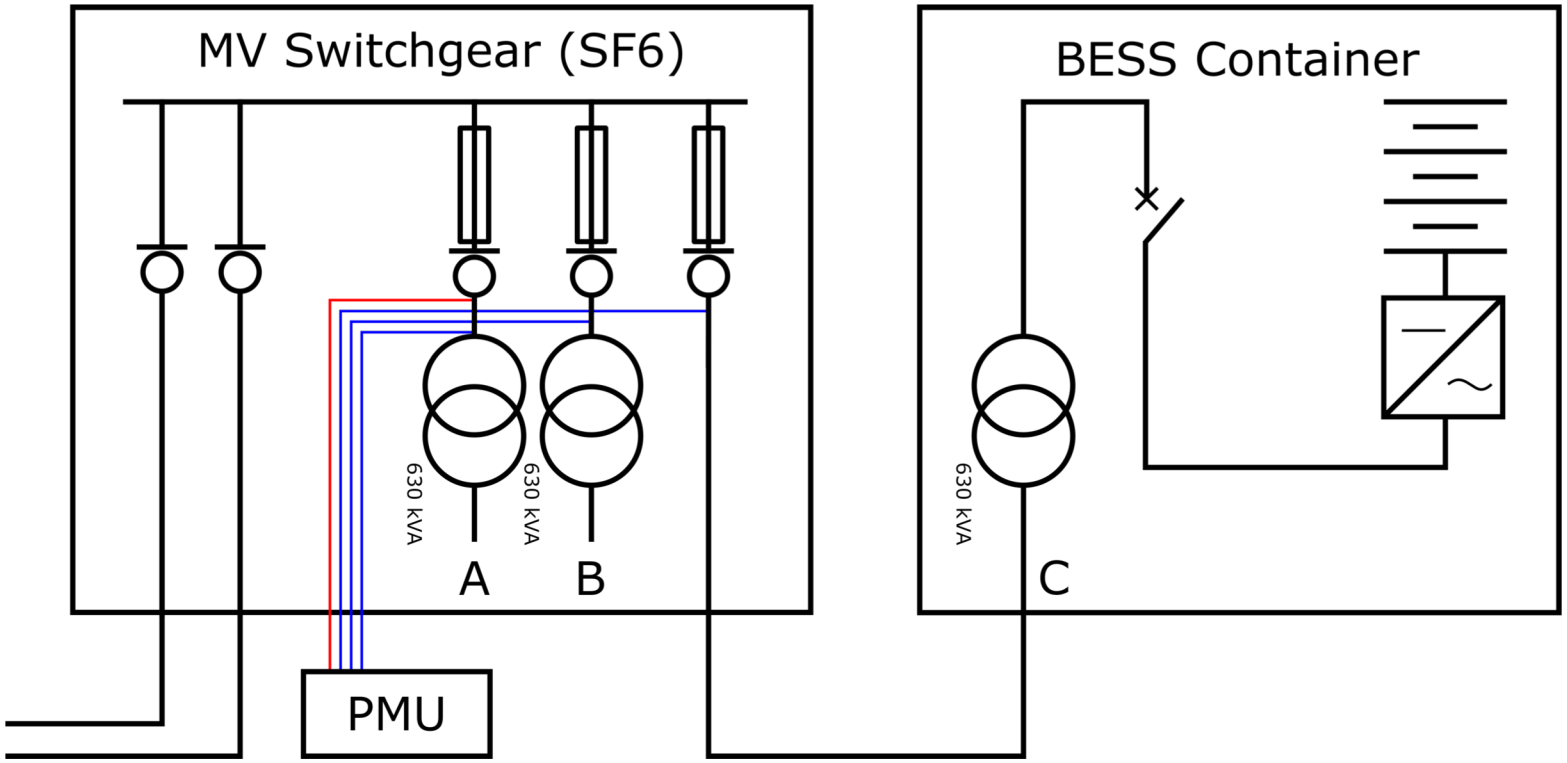
Considered scenario

Experimental setup

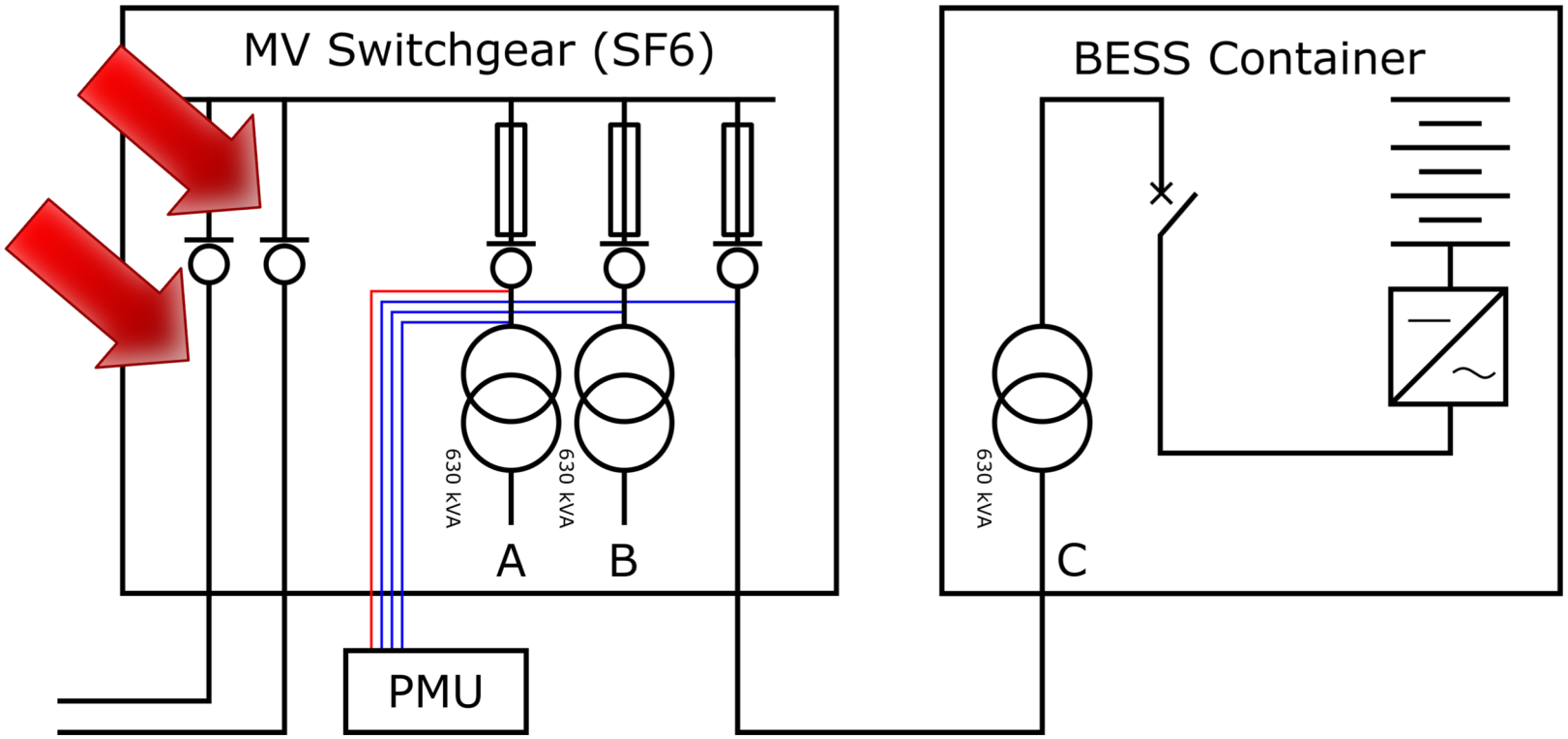
- The data refer to the **medium voltage network** of EPFL campus:
  - a **20 kV substation** coupled with a **battery energy storage system (BESS)**.



Considered scenario

Experimental setup

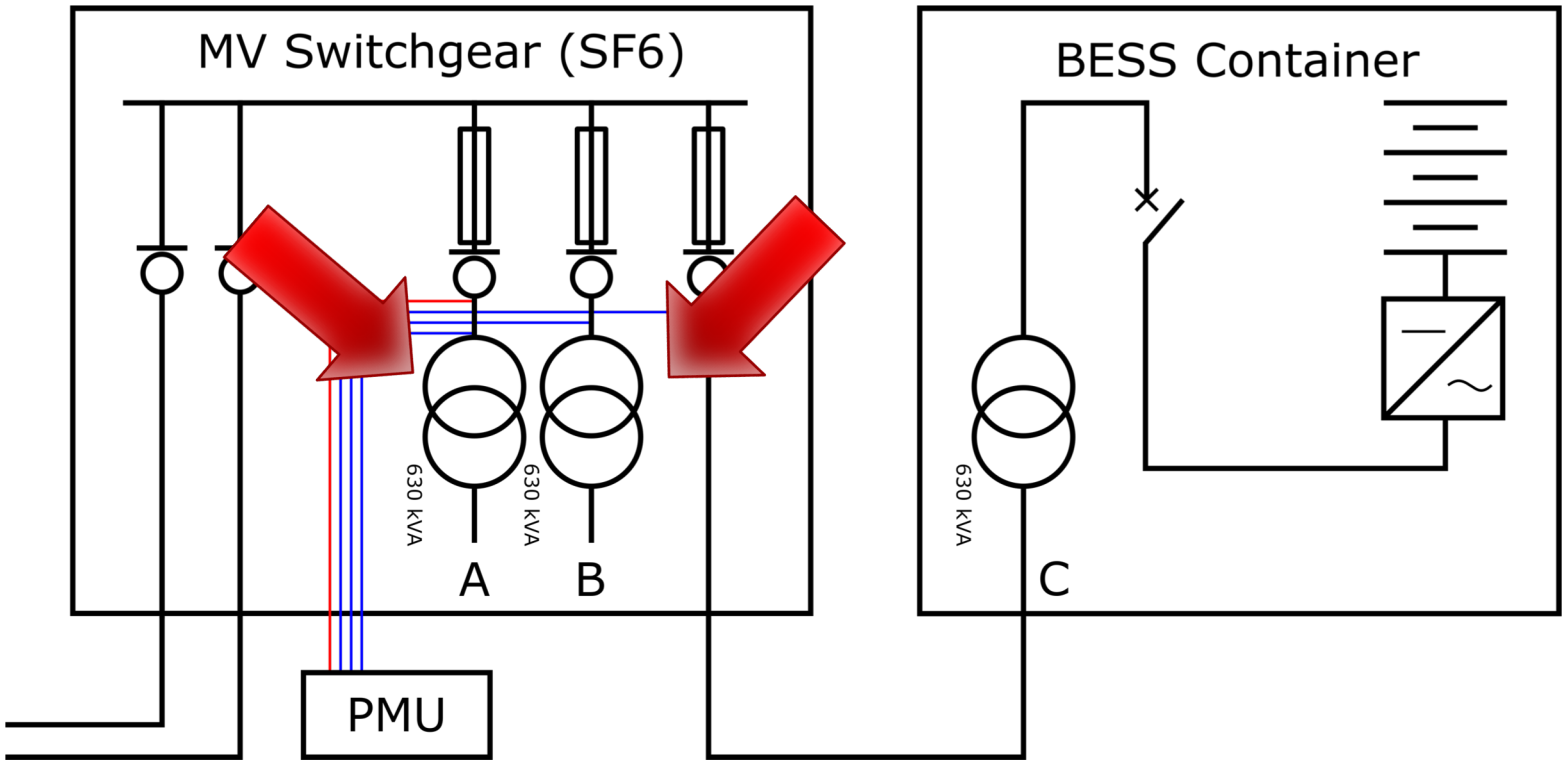
- Two lines connecting **neighboring substations**.



Considered scenario

Experimental setup

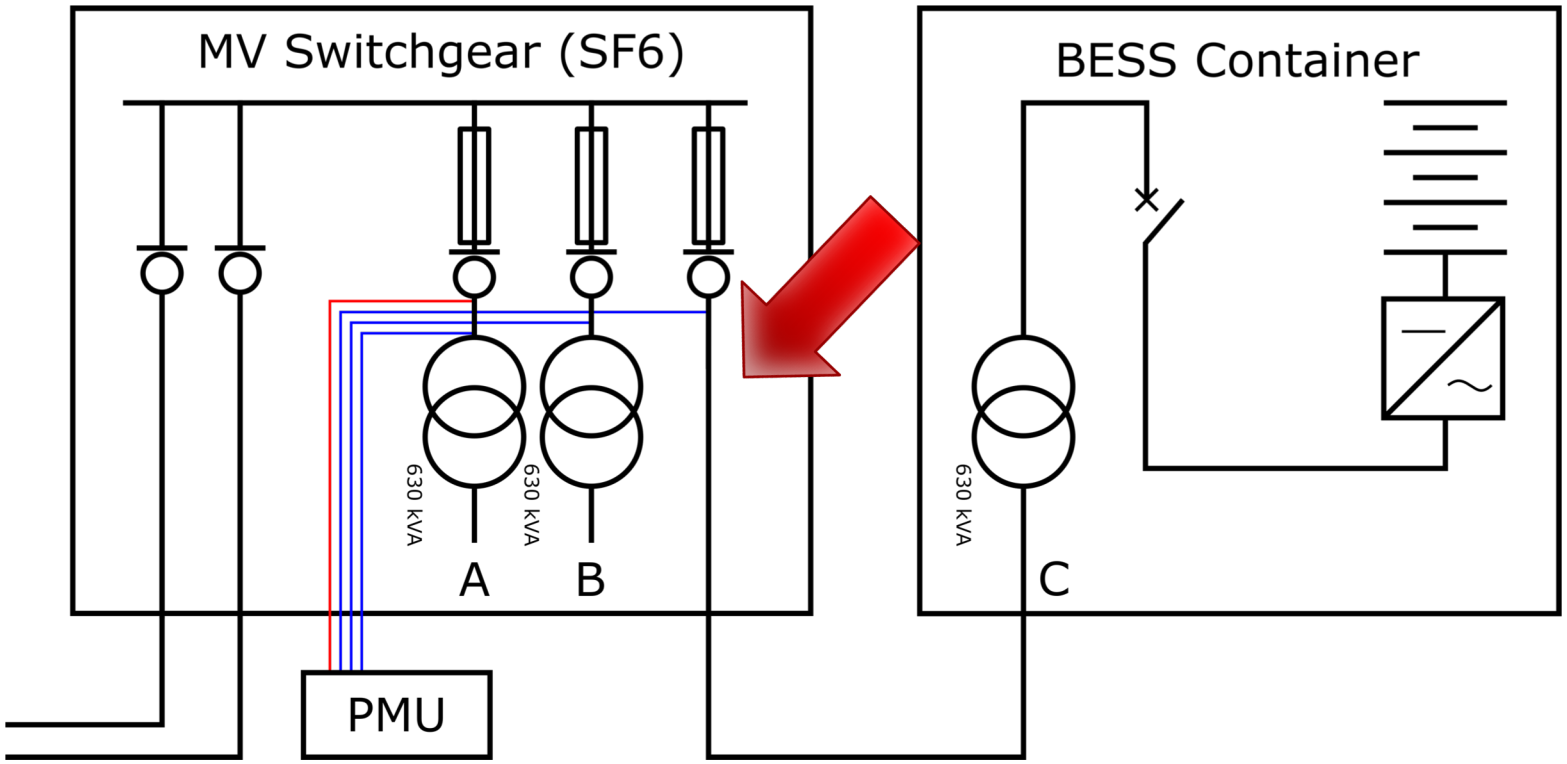
- Two MV/LV transformers (630 kVA) supplying electricity to **office buildings**.



Considered scenario

Experimental setup

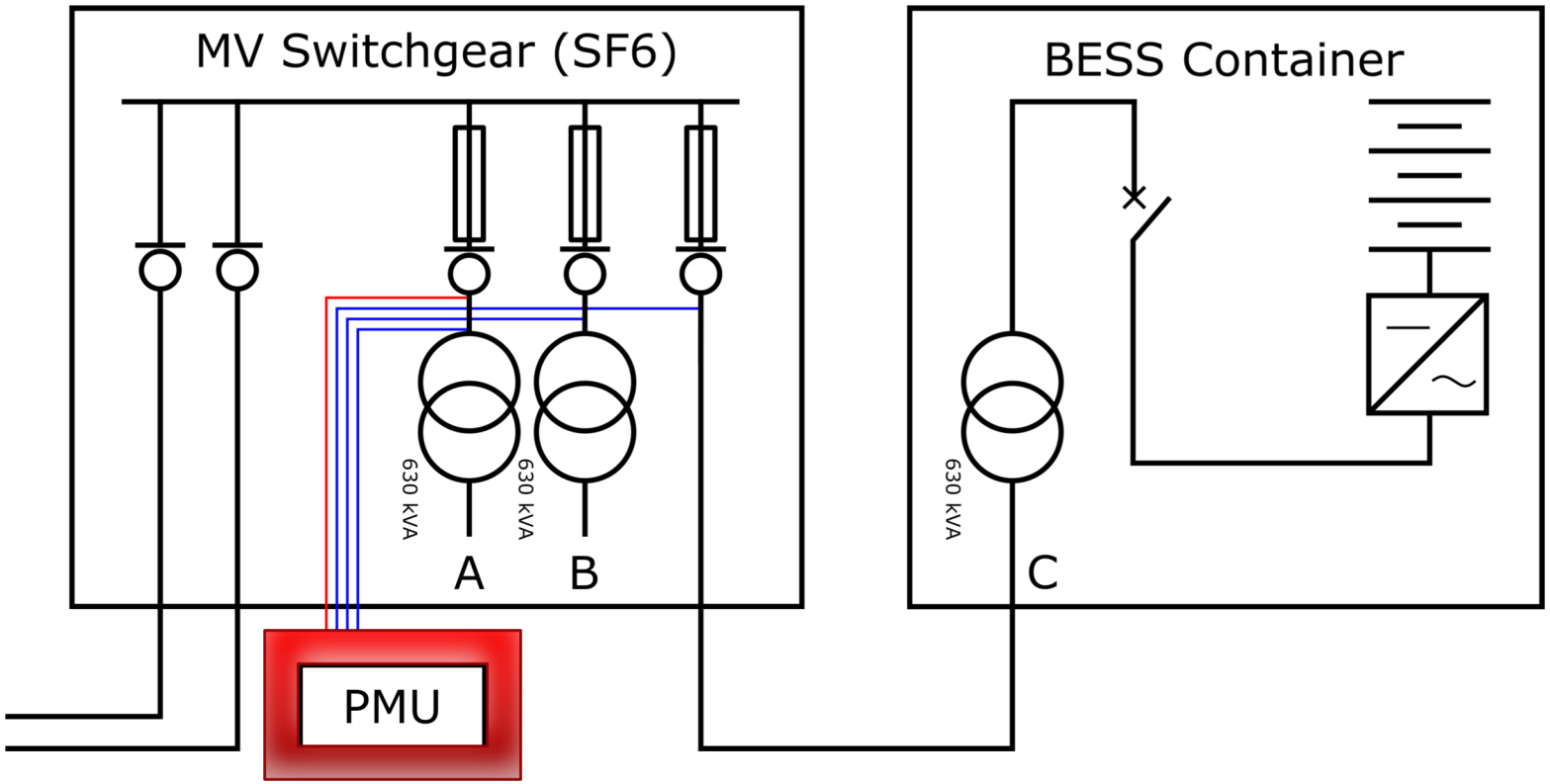
- The connection with the **battery energy storage system (BESS)**.



Considered scenario

Sensing infrastructure

- The waveform acquisition is carried out by a **PMU developed at EPFL-DESL**.



Dataset presentation

Acquisition parameters

- In the EPFL-DESL PMU we implemented a **waveform recorder**:
  - sampling rate 50 kHz
  - input range ±10 V
  - resolution 16 bit

- **Instrument transformers** by Altea solutions http://www.alteasolutions.com/
  - CS-50-I current class 0.2
  - VS-24-C voltage class 0.5

Dataset presentation

BESS parameters

- The waveforms relate to **current magnitude variations** that are induced by a **560 kWh / 720 kVA BESS**.

- BESS: Lithium titanate oxide (LTO) cells connected to a DC bus (from 590 to 810 V), interfaced with the MV grid through a **four quadrant DC-AC converter** and a 0.3/21 kV, 630 kVA transformer.

- **Power injections** by requesting active and reactive power setpoints to the converter (ModBUS TCP protocol).

Dataset presentation

Reproduced configurations

- Five tests (**sampling rate 50 kHz, time duration 2 s**):
  - BESS idle;
  - step in BESS power from 0 to 500 kW;
  - step in BESS power from 0 to -500 kW;
  - step in BESS power from 0 to 200 kW;
  - step in BESS power from 0 to -200 kW;
  - step in BESS power from -500 to 500 kW.

- **Sign convention**: positive BESS active power corresponds to BESS discharge, i.e. injecting power into the grid.

Dataset presentation

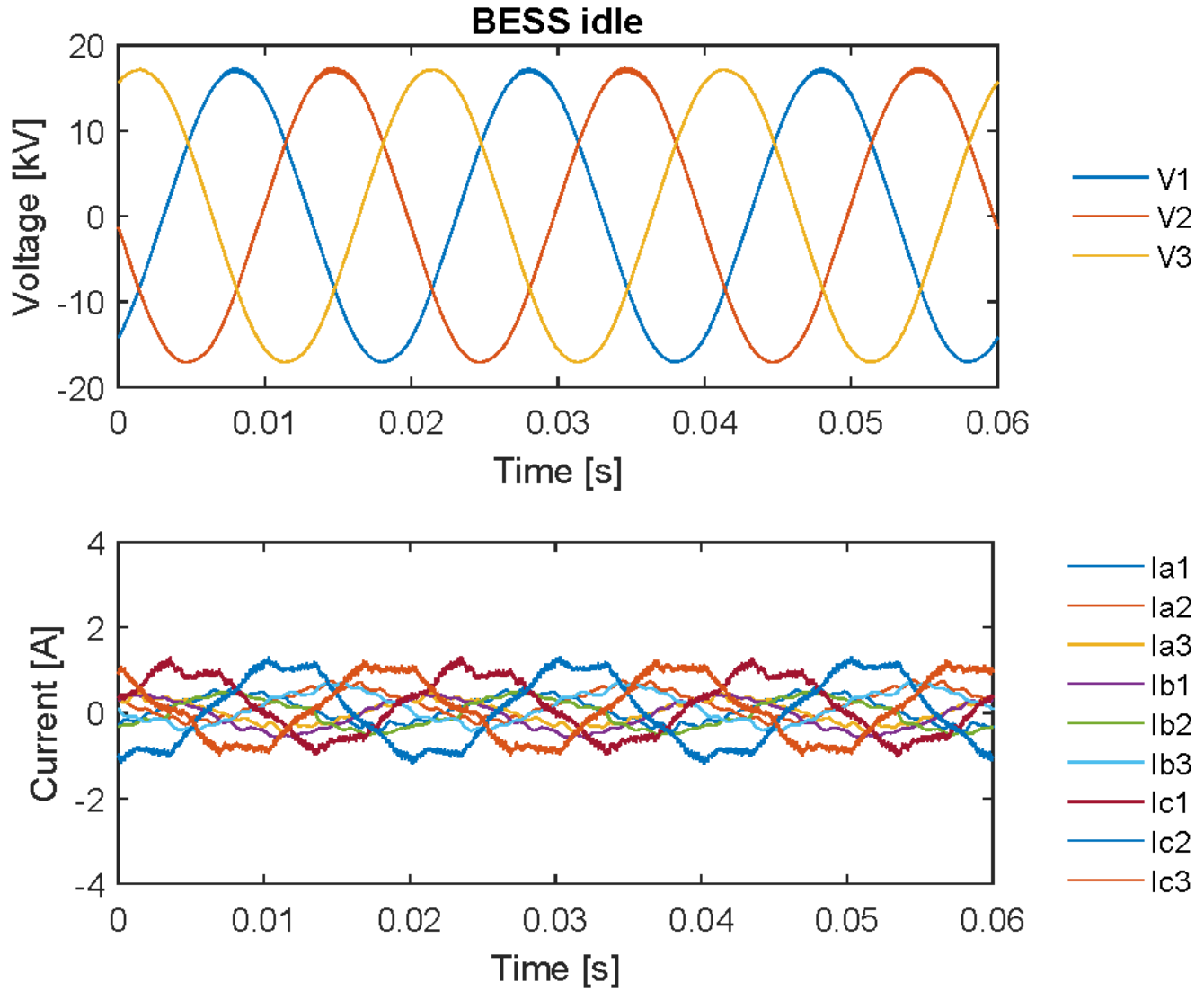
Data format

- For each test, a **Matlab structure variable** with **12 fields**:
  - three-phase voltages at the busbar (V1, V2, V3);
  - 2 x three-phase line currents absorbed by two transformers (ia1, ia2, ia3 and ib1, ib2, ib3).
  - three-phase line currents absorbed by the BESS transformer (ic1, ic2, ic3);

- **Amplification gain**: 3500 for voltages, 3.1 for currents absorbed by the BESS, and 1 for those by the two transformers.

Waveform examples

BESS idle (steady state)



Waveform examples

Step in BESS power (+500 kW)