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Physical Model for Electric Drive Equipped Production Unit Simulation with Edge Computing Based Monitoring Technology

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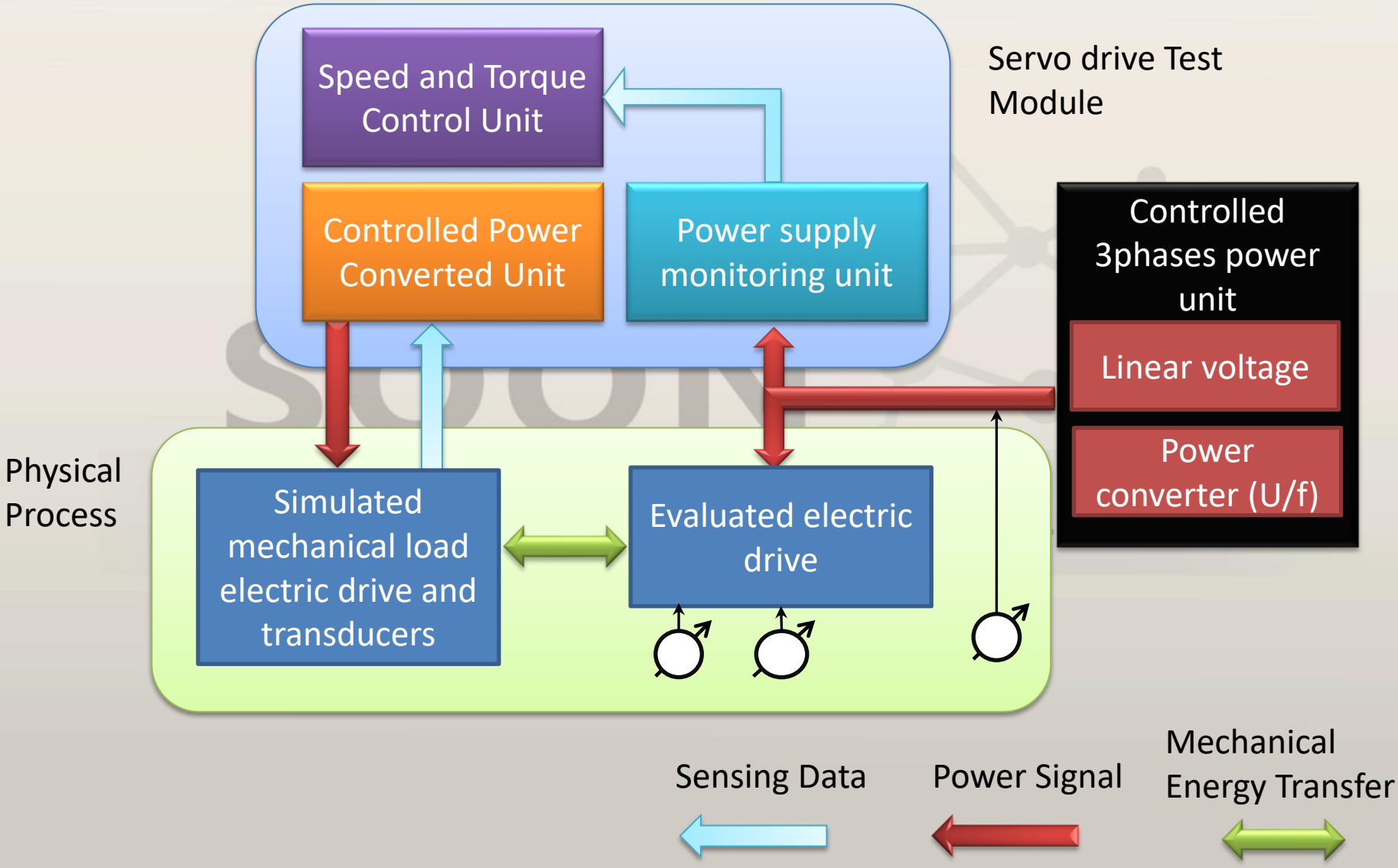
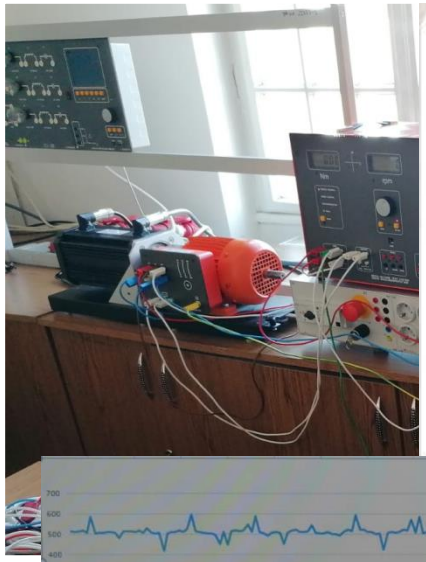
Aim and Scope

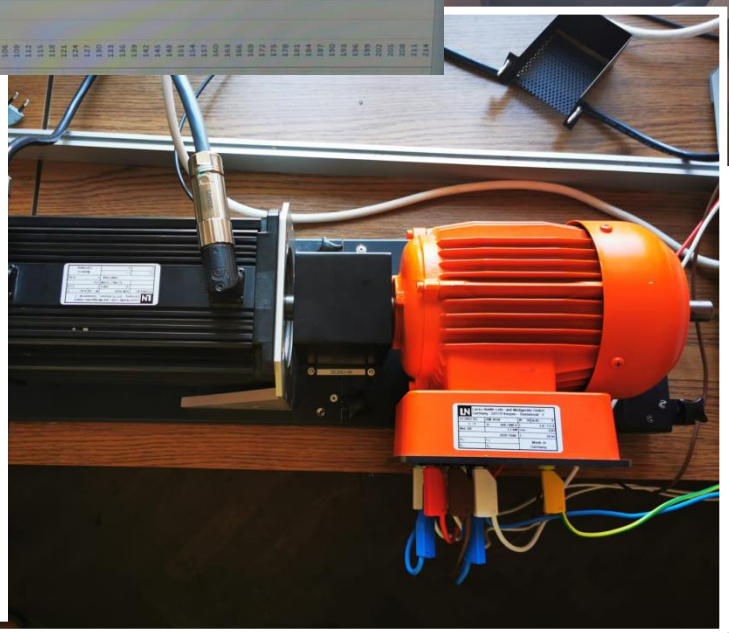
- Setup configuration to mimic real industrial processes;
- Real & Realtime data generator;
  - Process to cloud interfaces and performances assessment;
- Simulation of different operating regimes scenarios:
  - Different load cases;
  - Under fault conditions
    - Internal
      - Electrical;
      - Mechanical;
    - External
      - On the input parameters (eg. Power supply,);
      - Perturbations (external vibrations).

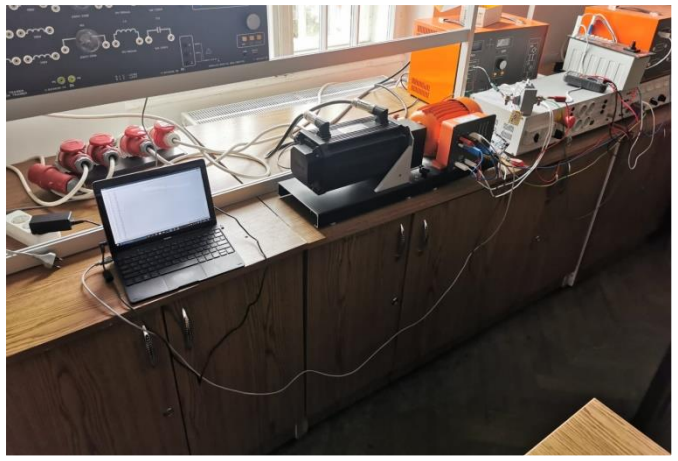
Physical Infrastructure



Everything put Together





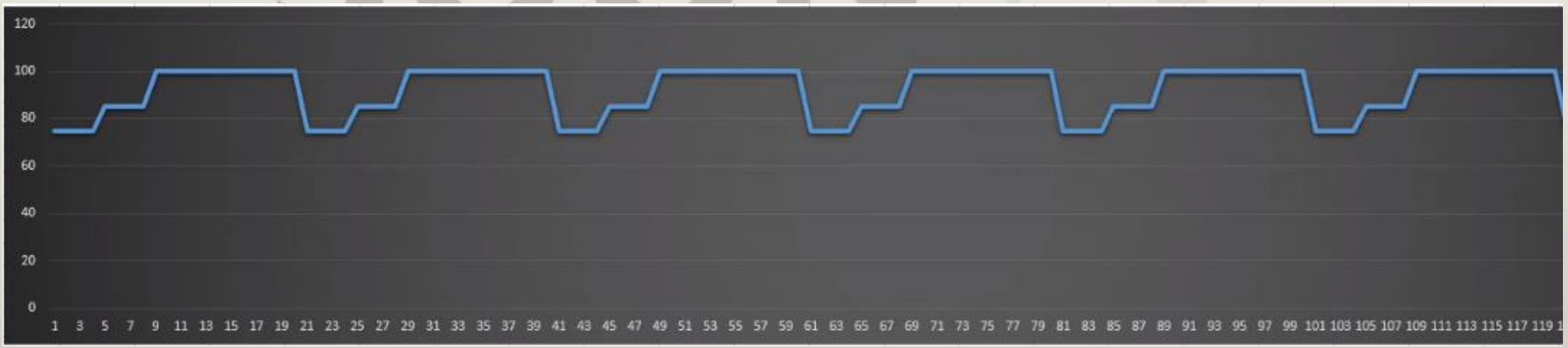


Data Aquisition Strategy and Chalenges

- Multiple variants of signals with speciffic time constant
- Samplig time (theory OK, in practice: problems coming from digital hardware)
- Managing time stamps (not synchronised SoCs)
- Power converter behaviour (protection to abnormal operation)

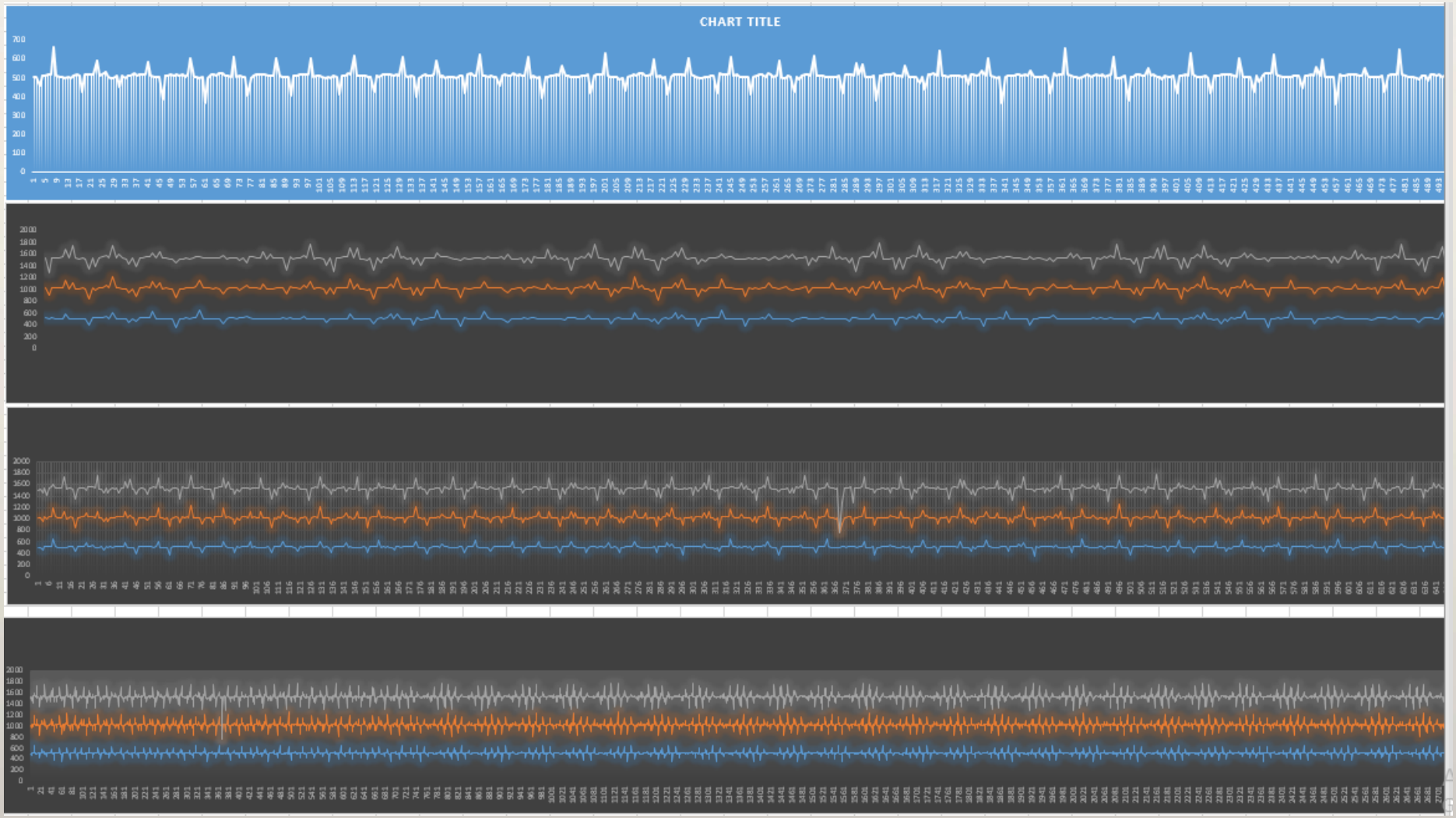
Test scenarios

- Speed drive operation with constant load
- Fault:
  - Operation: manual (to be seen for automatic)
  - Type: unbalanced currents



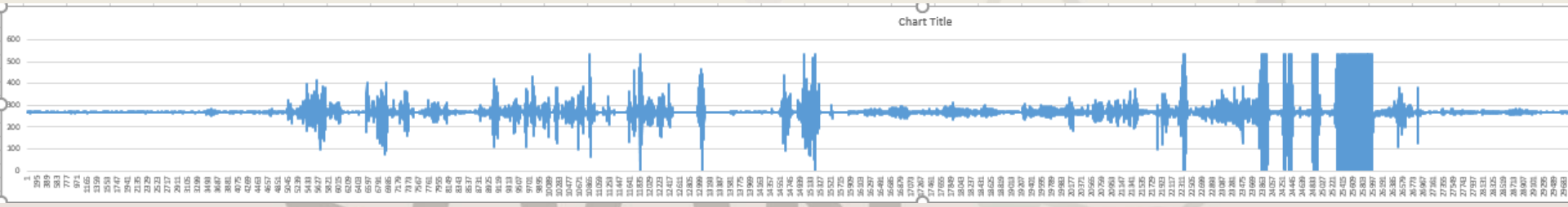
Sample Data

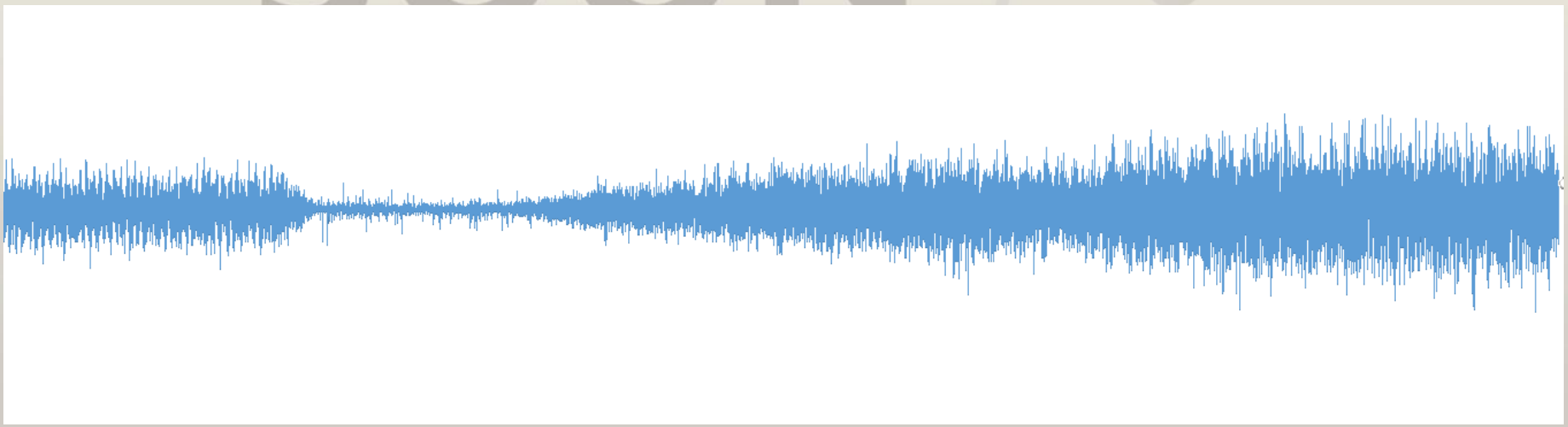
- Drive consumption (three phase currents)



Sample Data

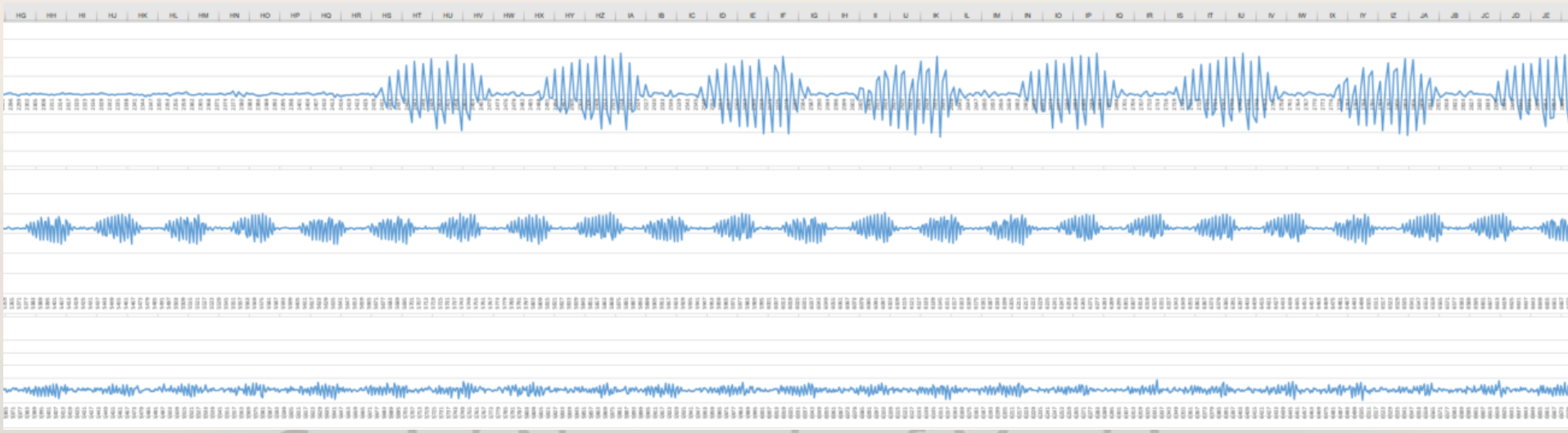
- Vibrations (in audio spectrum) – Capacitive sensor

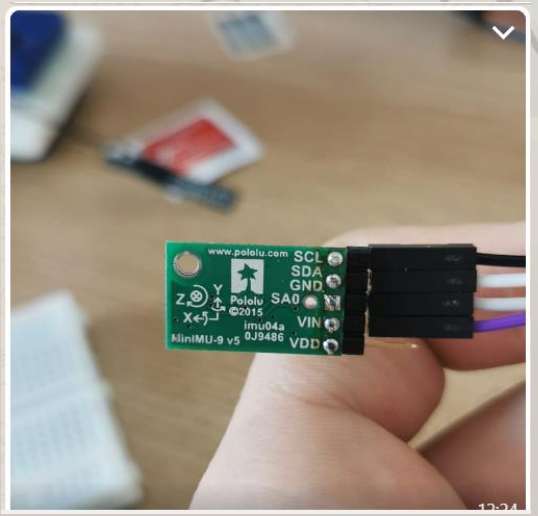




Sample Data

- Vibrations (mechanical) – accelerometer sensor

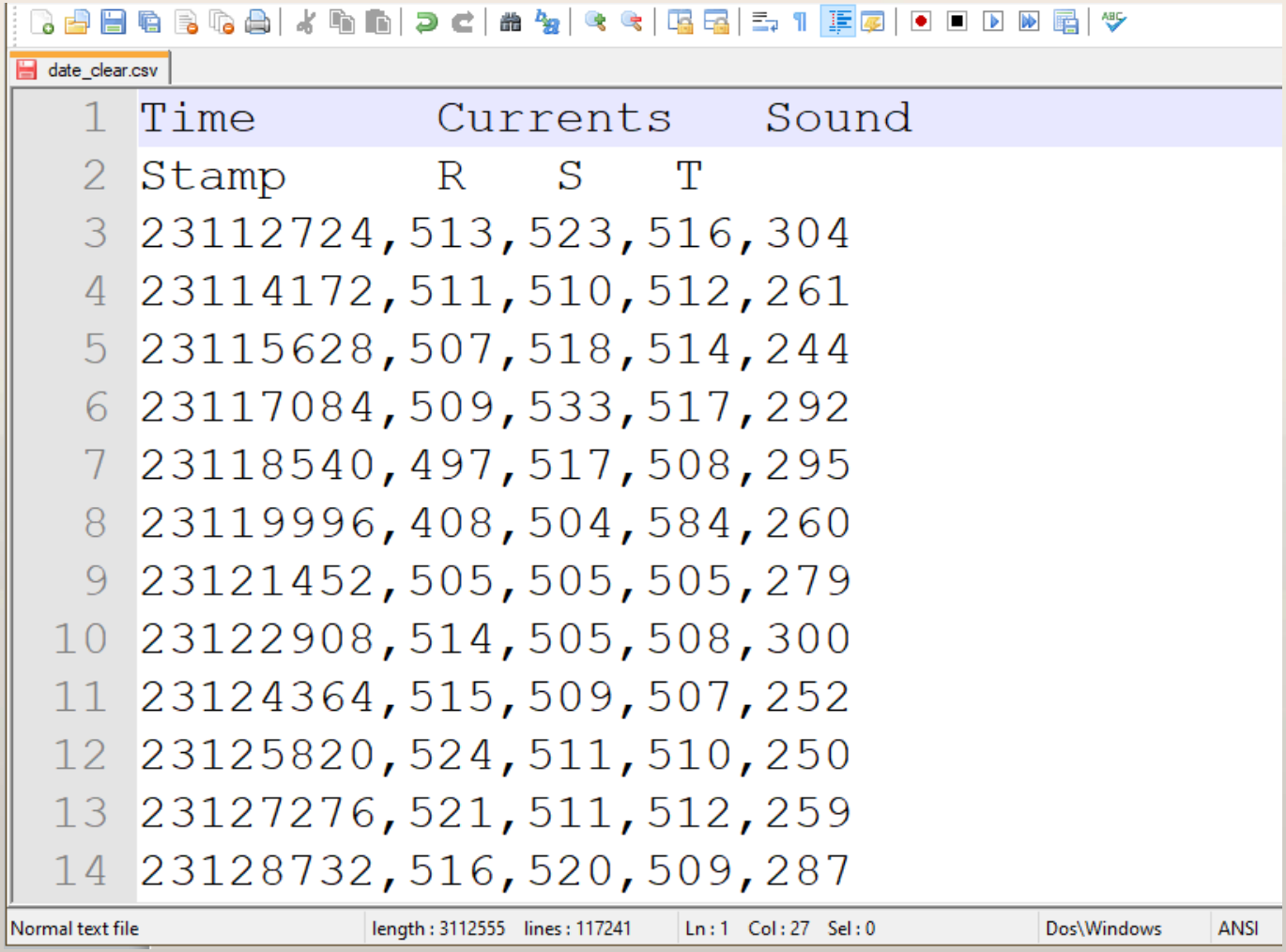




Connectivity (I^2C):
Gyro: one 16-bit reading per axis
Accelerometer: one 16-bit reading per axis
Magnetometer: one 16-bit reading per axis
Sensitivity range:
Gyro: ±125, ±245, ±500, ±1000, or ±2000°/s
Accelerometer: ±2, ±4, ±8, or ±16 g
Magnetometer: ±4, ±8, ±12, or ±16 gauss

Raw Data: Specifications

- Currents and audio with no perturbations (117240 samples aprox. 3 min.)


date_clear.csv

```
1  Time        Currents    Sound
2  Stamp       R    S    T
3  23112724,513,523,516,304
4  23114172,511,510,512,261
5  23115628,507,518,514,244
6  23117084,509,533,517,292
7  23118540,497,517,508,295
8  23119996,408,504,584,260
9  23121452,505,505,505,279
10 23122908,514,505,508,300
11 23124364,515,509,507,252
12 23125820,524,511,510,250
13 23127276,521,511,512,259
14 23128732,516,520,509,287
```

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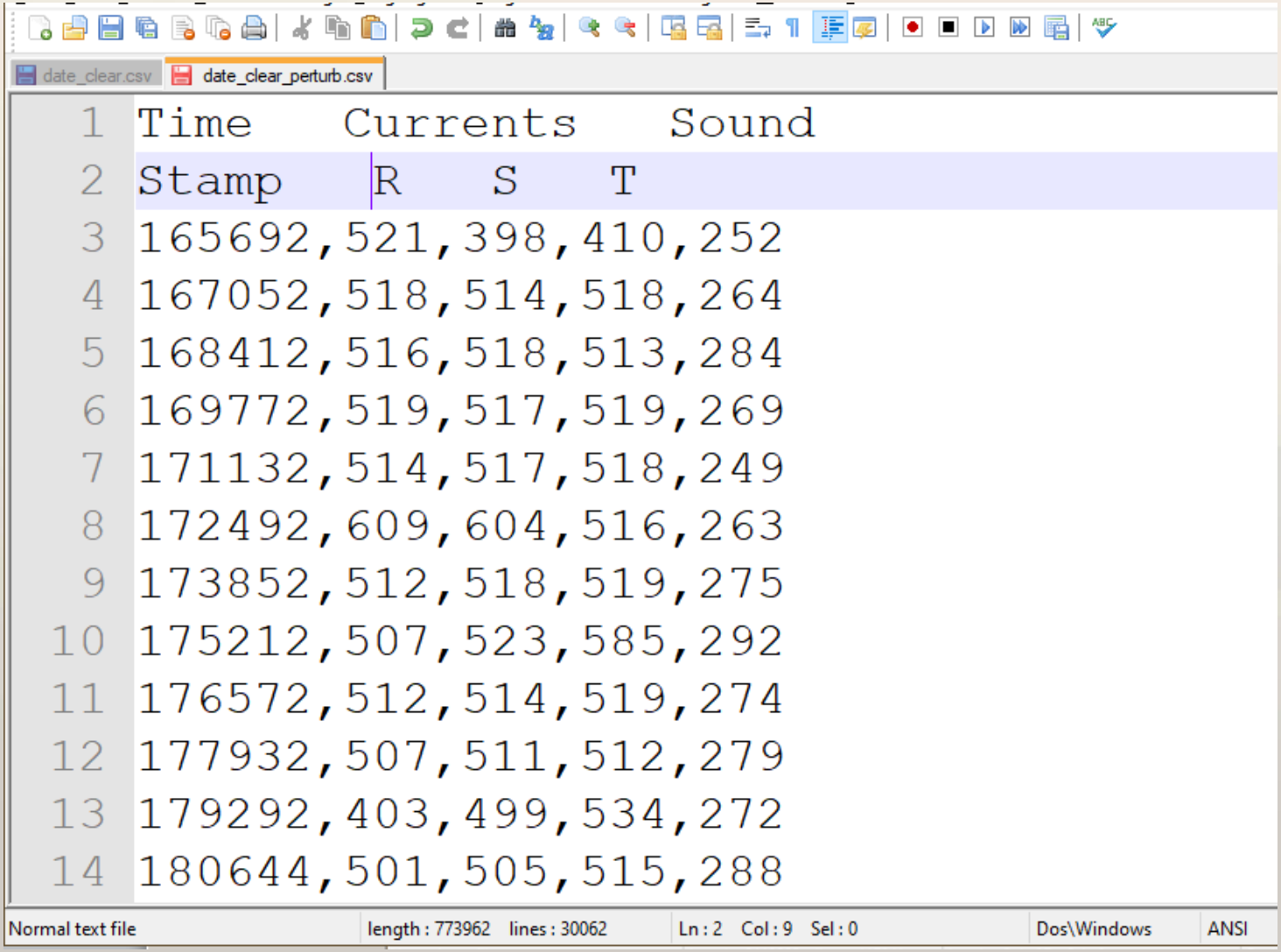
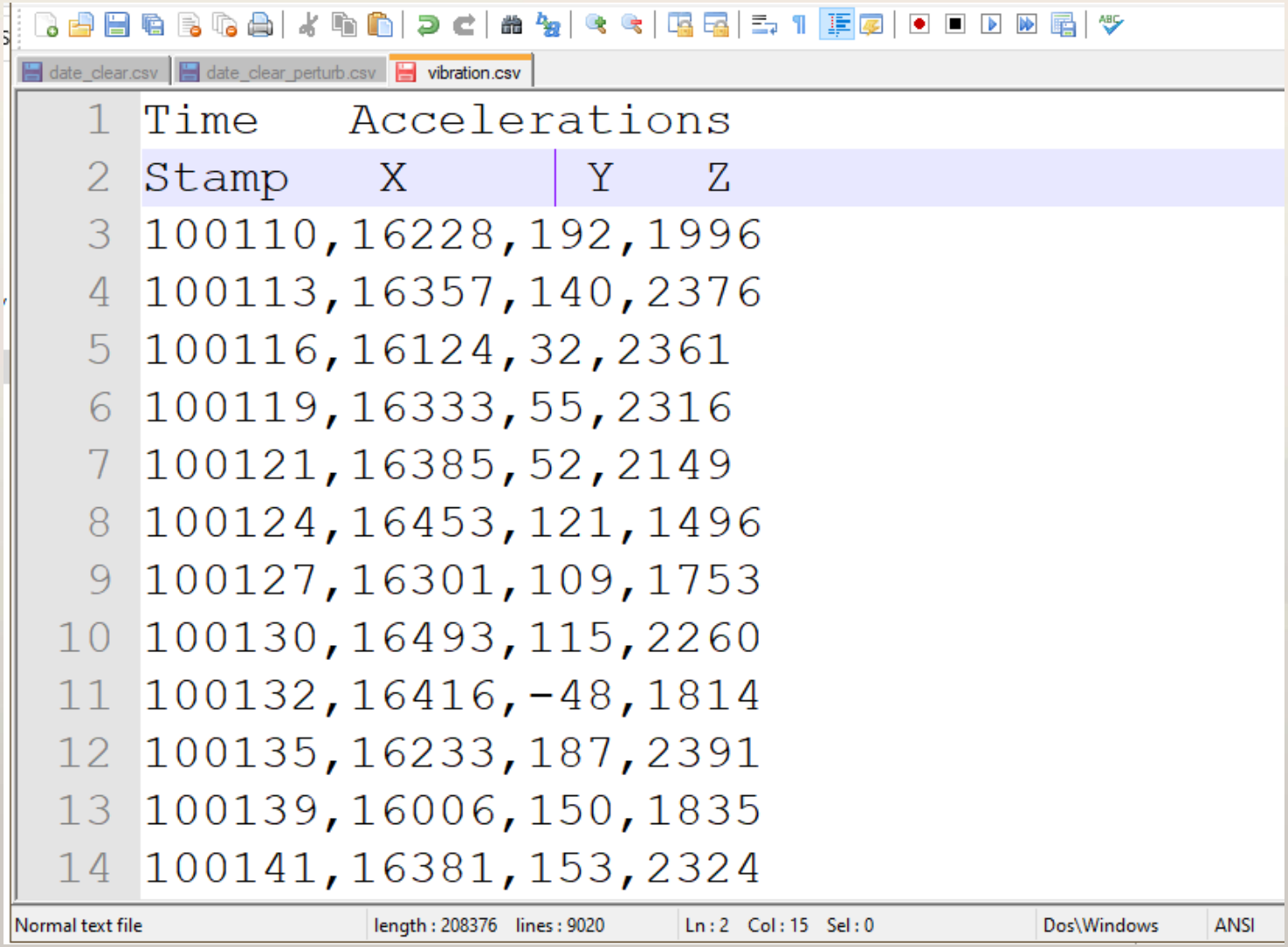
Raw Data: Specifications

- Currents and audio with perturbations (30185 samples – 45 sec.)



Raw Data: Specifications

- Vibrations – test of sensor (9017 samples – 25 sec.)



Next step

- To do
  - Mechanical fault simulation
  - Long term tests (30 min. 1 h)

- First step chalenge: extract bigdata from sensors
- Any idea or suggestion?

Thank you!

SOON

Social Network of Machines