S3UNICA
Interreg Europe

European Union
European Regional
Development Fund

MV real-time platform

University of Trieste

detef
Digital
Energy
Transformation &
Electrification
Facility

University of Trieste

Department of Engineering and Architecture

Ing. Marco Dalle Feste - mdallefeste@units.it
Prof. Ing. G. Sulligoi - gsulligoi@units.it

Summary

- Goal of the project
- Phases timeline
- Technical project description
- Setup, validation and tuning
- What we are working on

Goals of the Units Smart Campus

1. **improve the energy efficiency of University Campus buildings**

2. **provide new energy management and control systems** built over the IoT paradigm installed at buildings and energy infrastructure level

3. **use University Campuses as new technology demonstrators** for electrical and thermal energy distribution and storage.

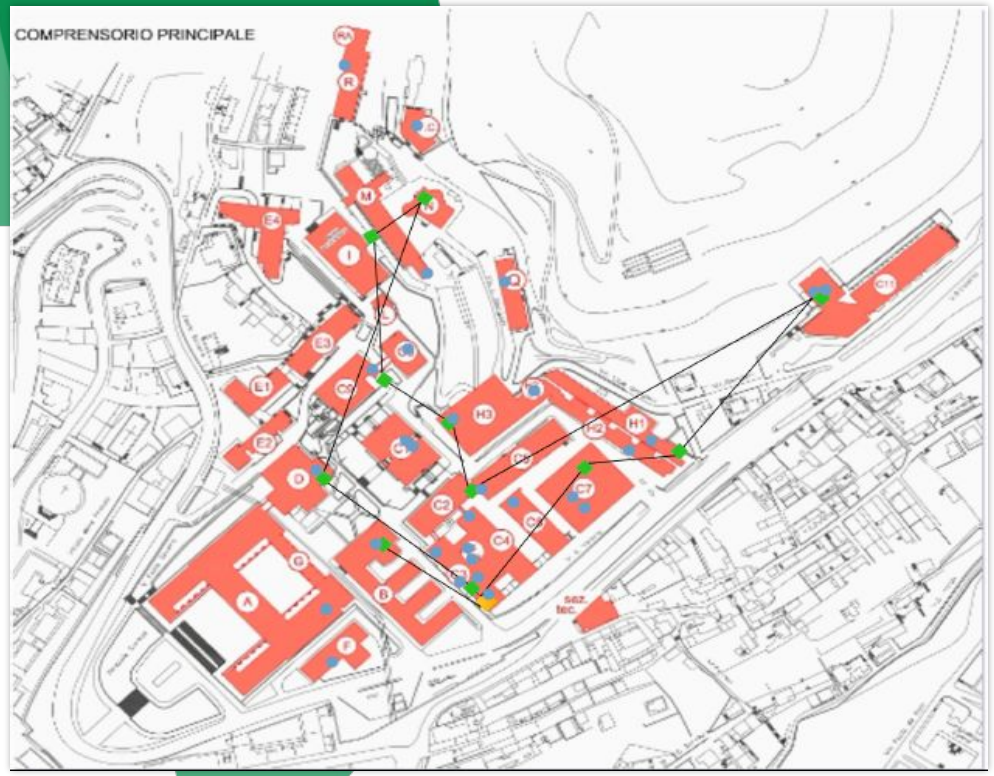
4. **involve other university partners**

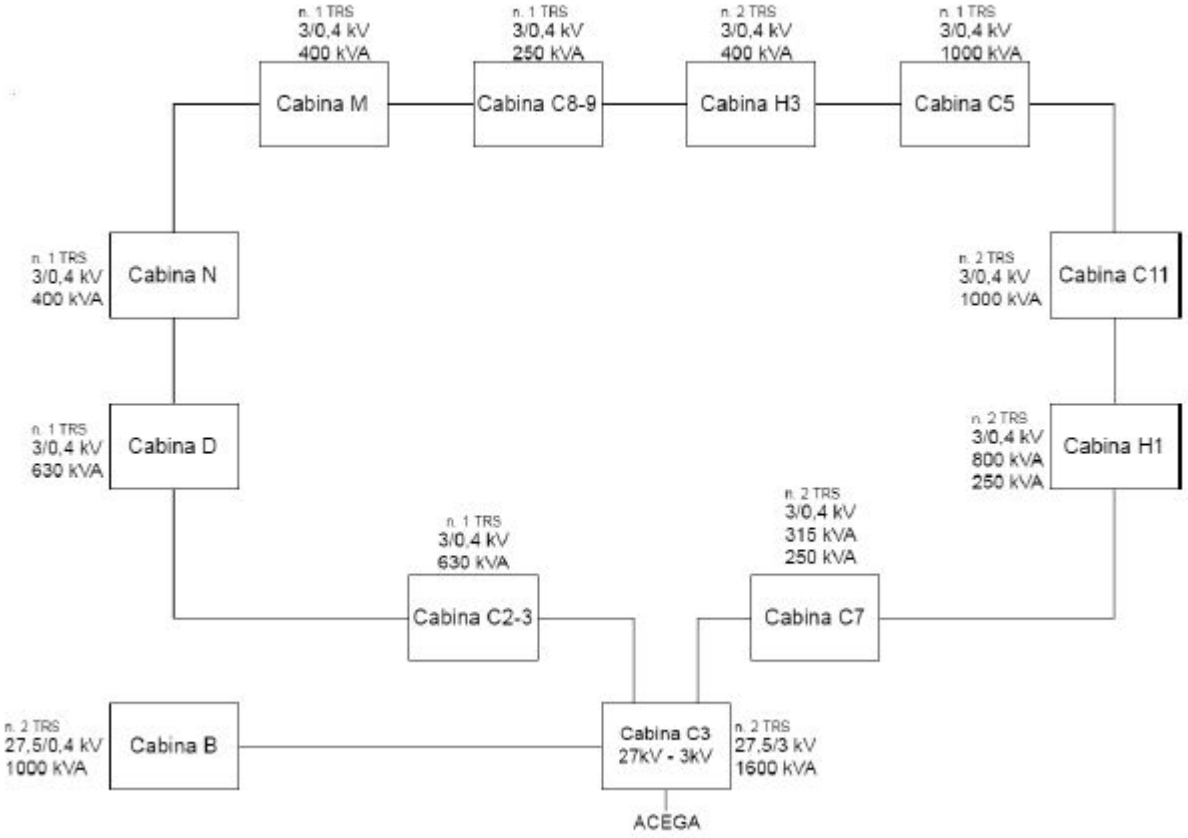
Preview of PowerEng2021 paper

Phases timeline

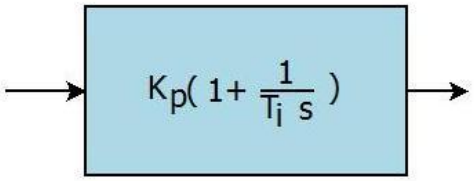
- Design and prototyping **are achieved**
- HW production is initialized
- **Several UniTs live** cabinet are installed

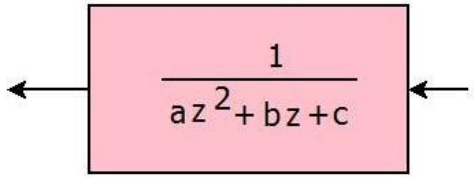
Project description:
Electrical UniTS Campus grid

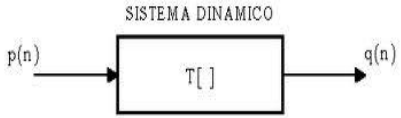


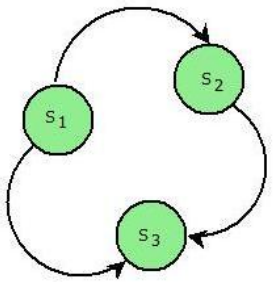


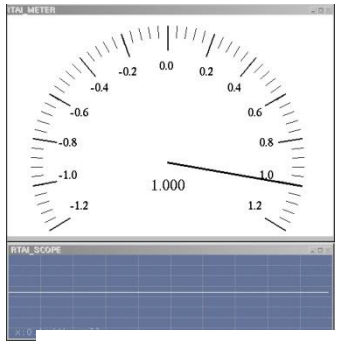
Hardware and software platform: requested functionalities for MV grid control

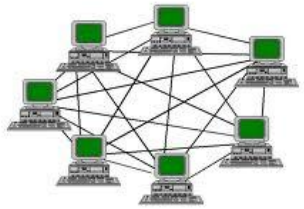


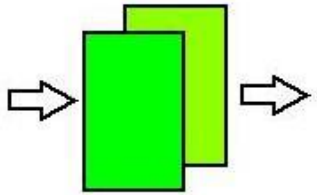






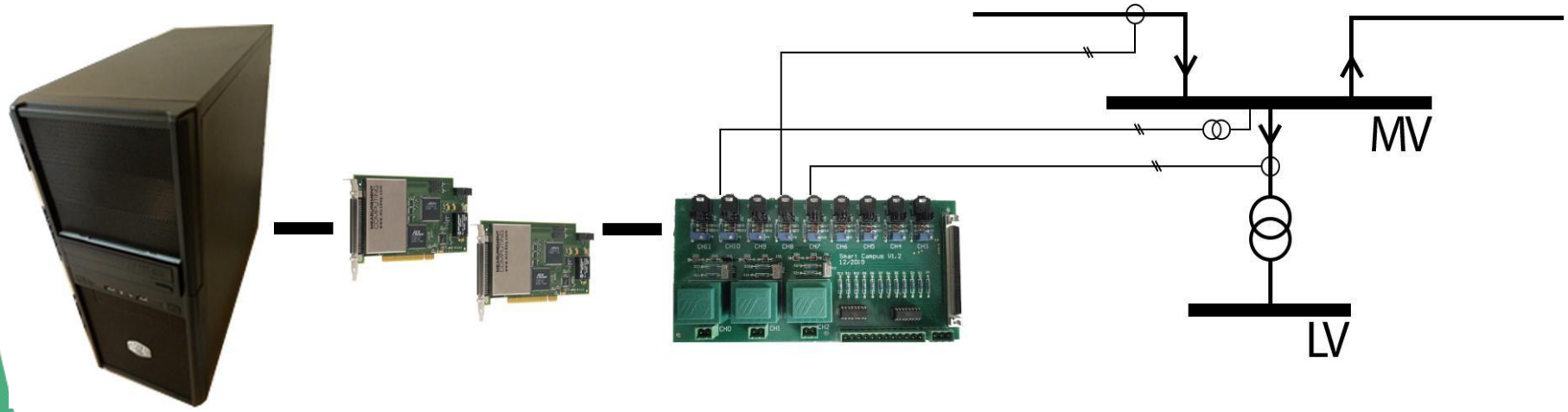






- Linux real-time
- Standard PC, I/O
- Digital I/O
- Electromechanical quantities at 50 Hz
- Monitoring and Control
- Algorithms written in Simulink
- C code generated automatically from Real-Time Workshop

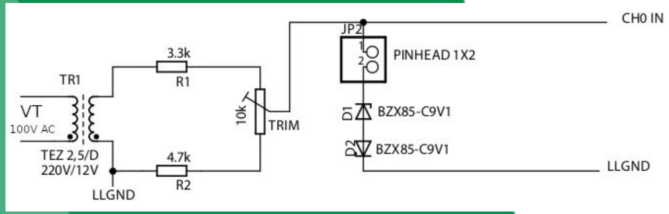
Hardware/software platform

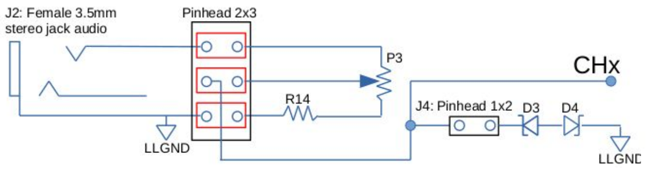


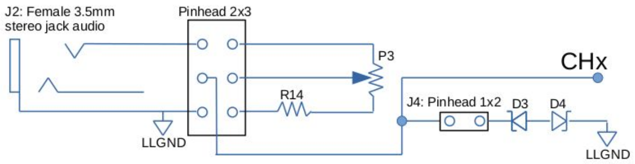
- GPP: IA-32 (x86, x86-64 ...)
- RTOS: Linux + RTAI + RTAI-Lab
- I/O: schede PCI

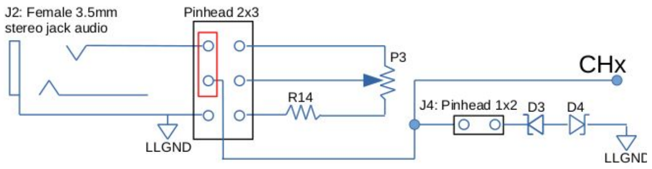
- 16 channels 12-bit analogue input configurable as 8 differential or 16 single-ended
- 4 range: +- 5 V; +-10 V; +-500 mV; +-50 mV
- 2 12-bit analogue output
- 32 DIO channels

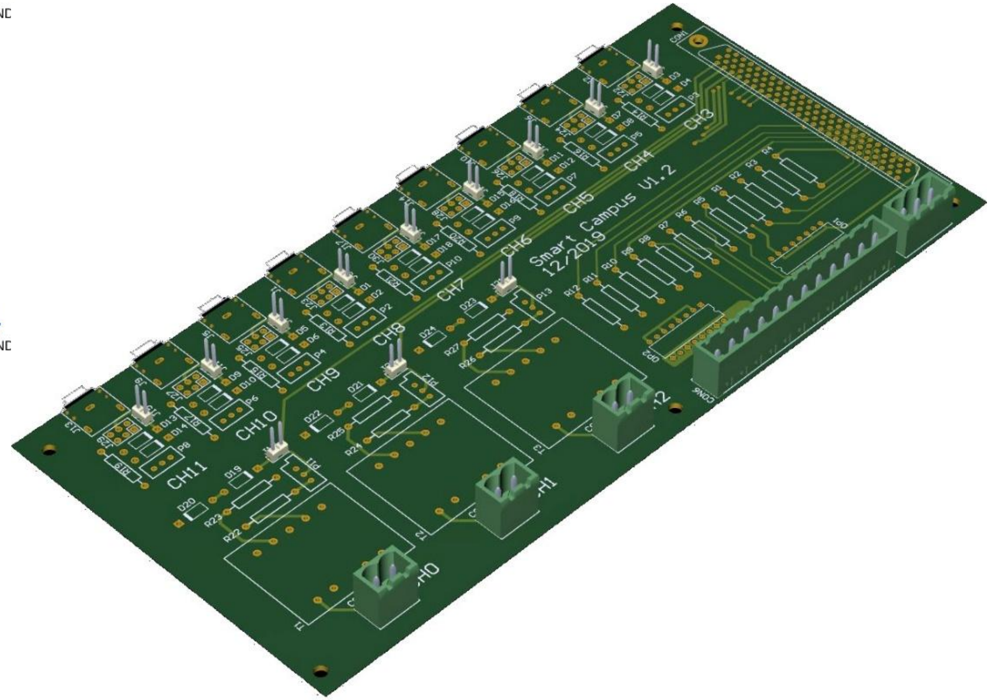
Conditioning hardware



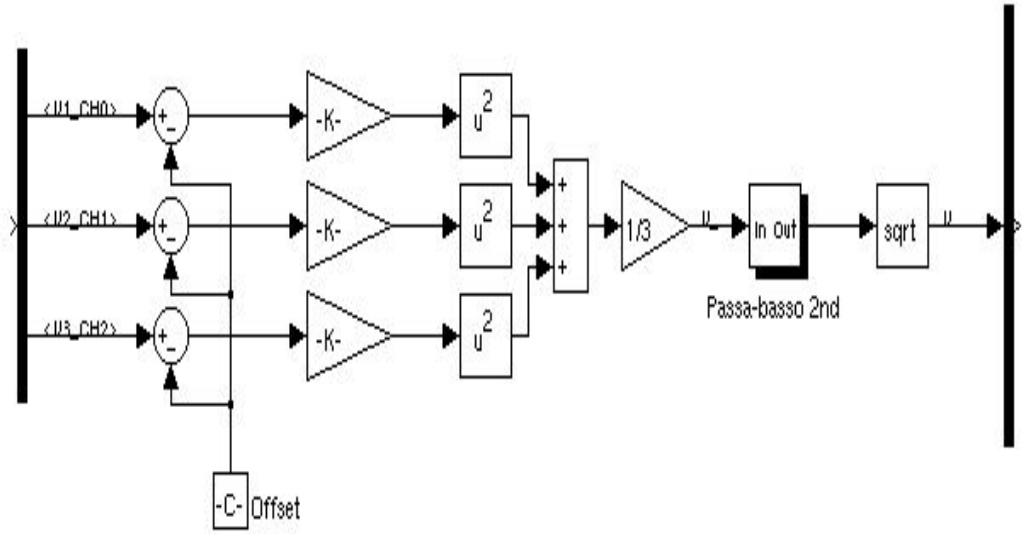


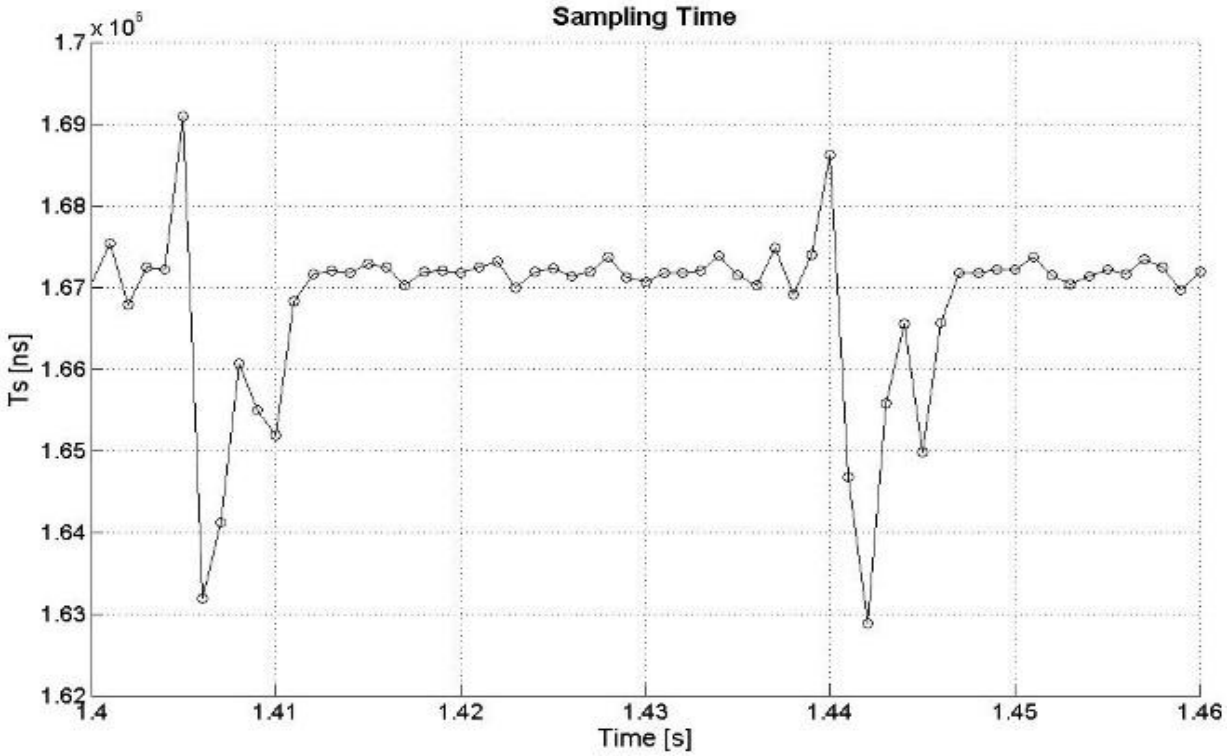






Simulink model: three-phase example

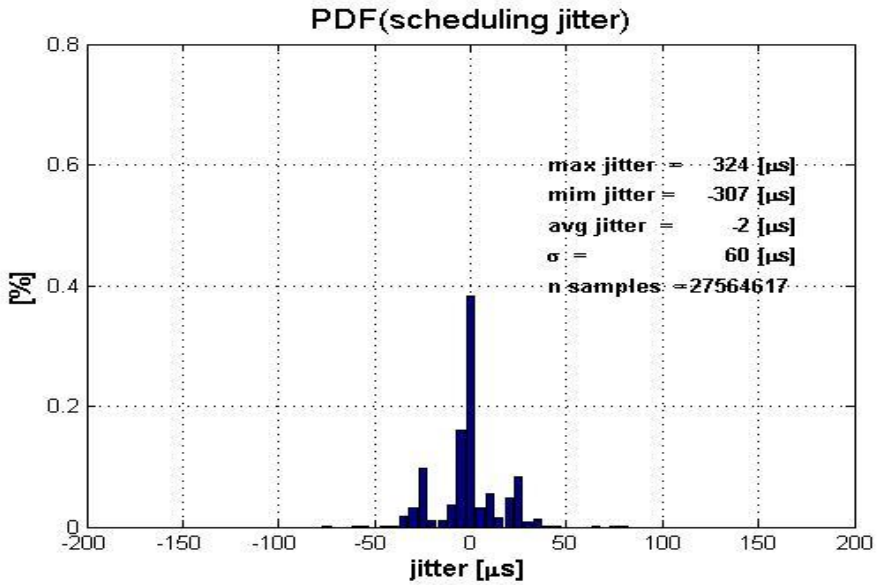


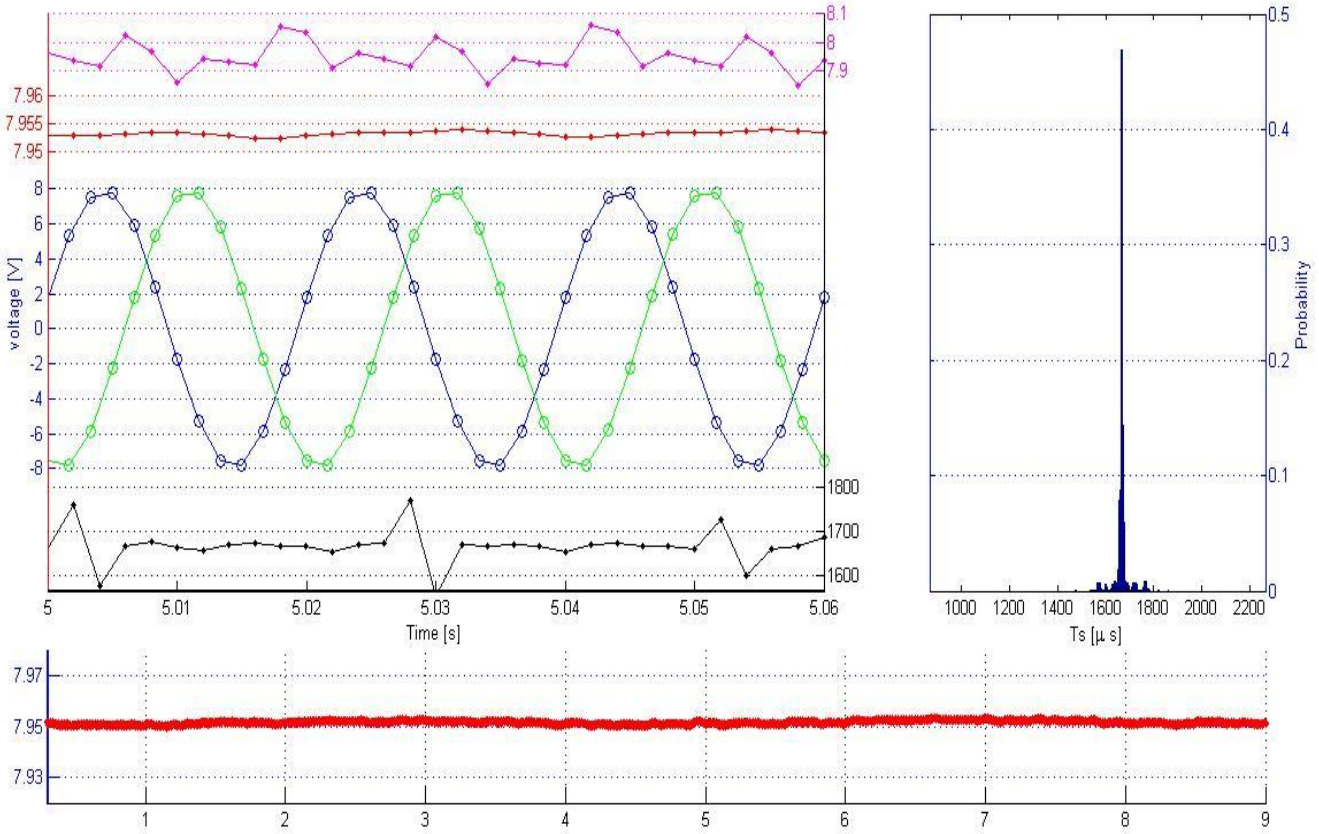


Test and Analisys of real time performance

Sample scheduling jitter

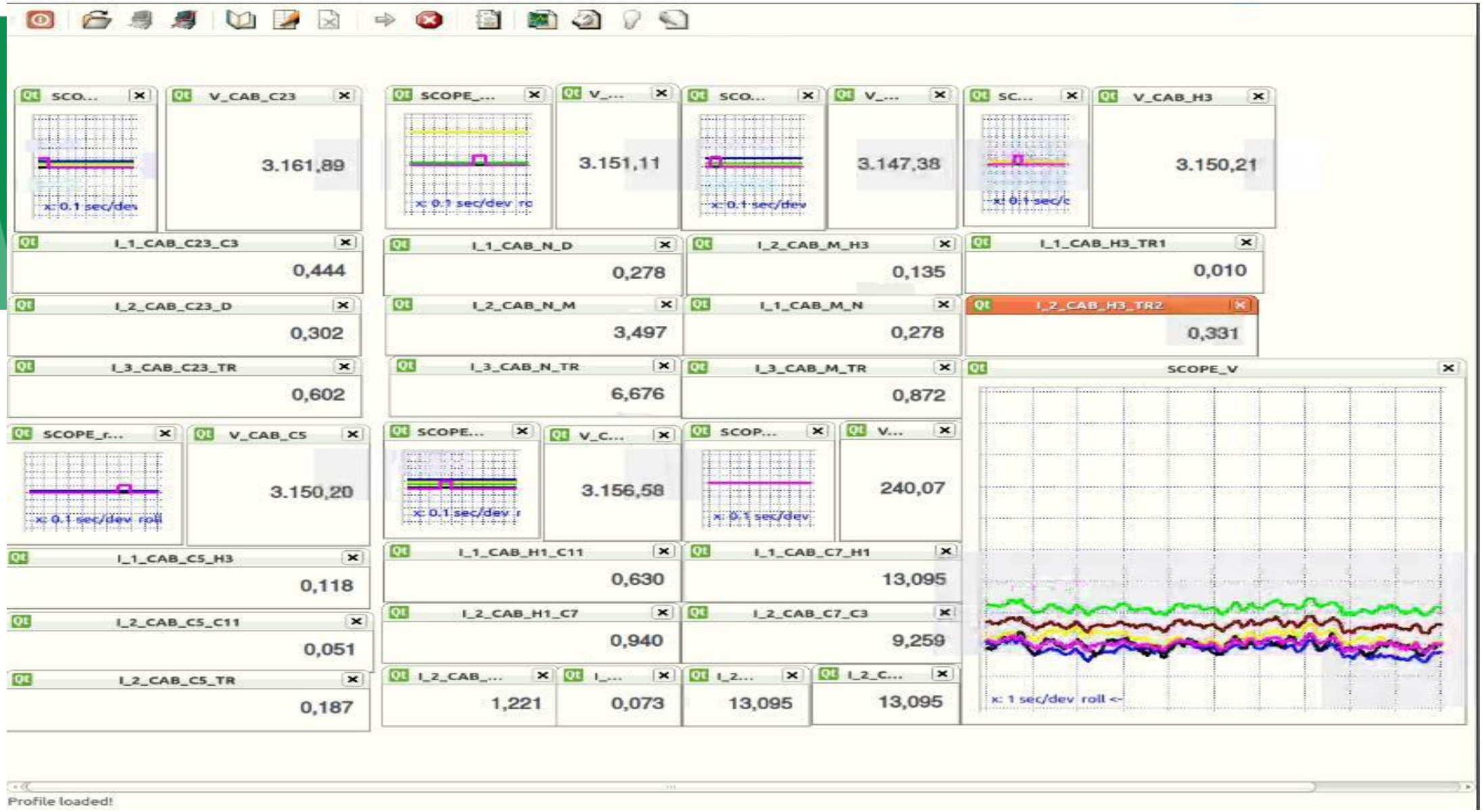
($T_s = 1.666$ ms)



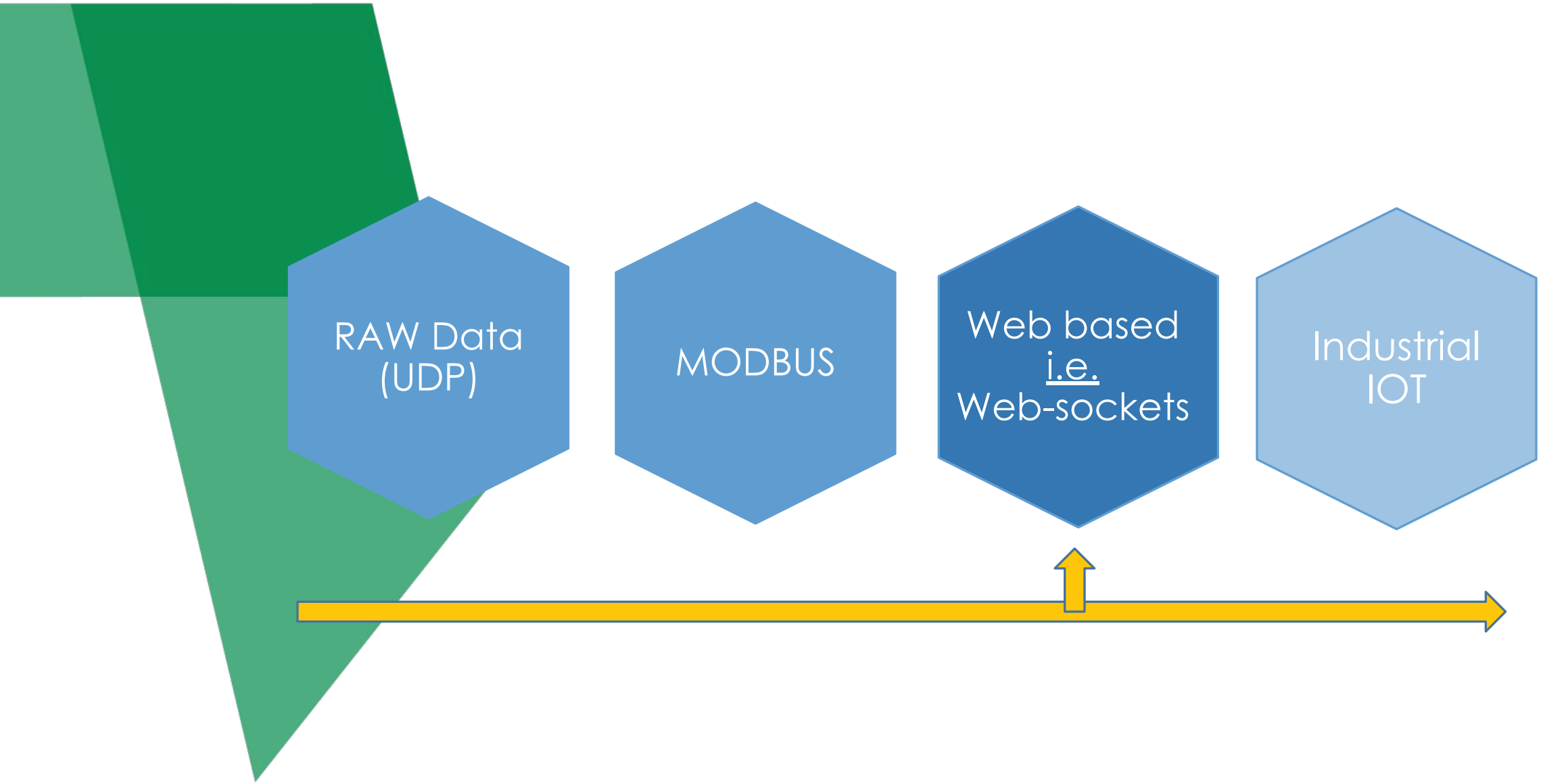


Setup, validation and tuning

Real time monitoring and control



Communication protocols



What we are working on

- **Archiving data**: using a time series optimized database
- **Refinements of measures:** Comparison with LV data
- **Provide an high level interface for data analisys**

Timescale

Grafana

Thanks for your attention

Università degli Studi di Trieste

Dipartimento di Ingegneria e Architettura

Ing. Marco Dalle Feste - mdallefeste@units.it
Prof. Ing. G. Sulligoi - gsulligoi@units.it