Experiences with Remote Lab Access Services on the Example VILLAS4ERIGrid

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H2020 ERIGrid / ERIGrid 2.0

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Webinar "Remote Testing & EIRIE Platform"
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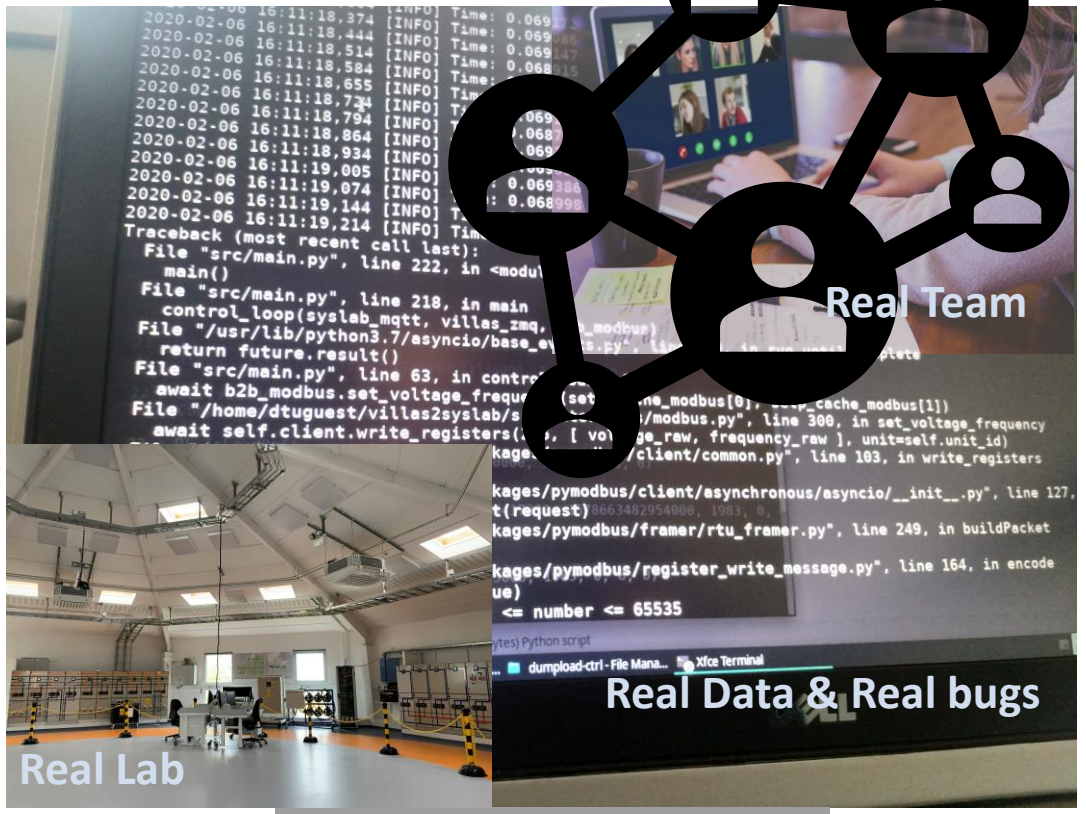
doi:10.5281/zenodo.4573000

Disclaimer

”Virtual access”



”Remote access”

VILLAS4ERIGrid (ERIGrid-1 Lab Access project) – Part II: Geographically Distributed PHIL (GD-PHIL)

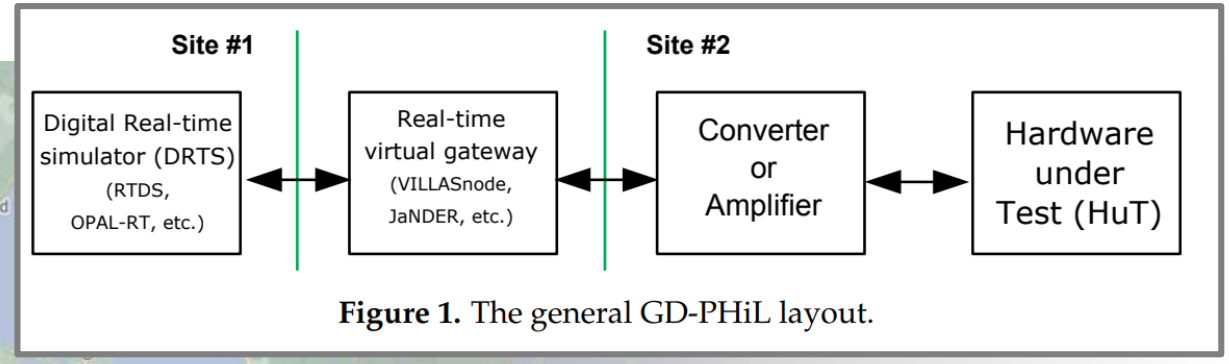
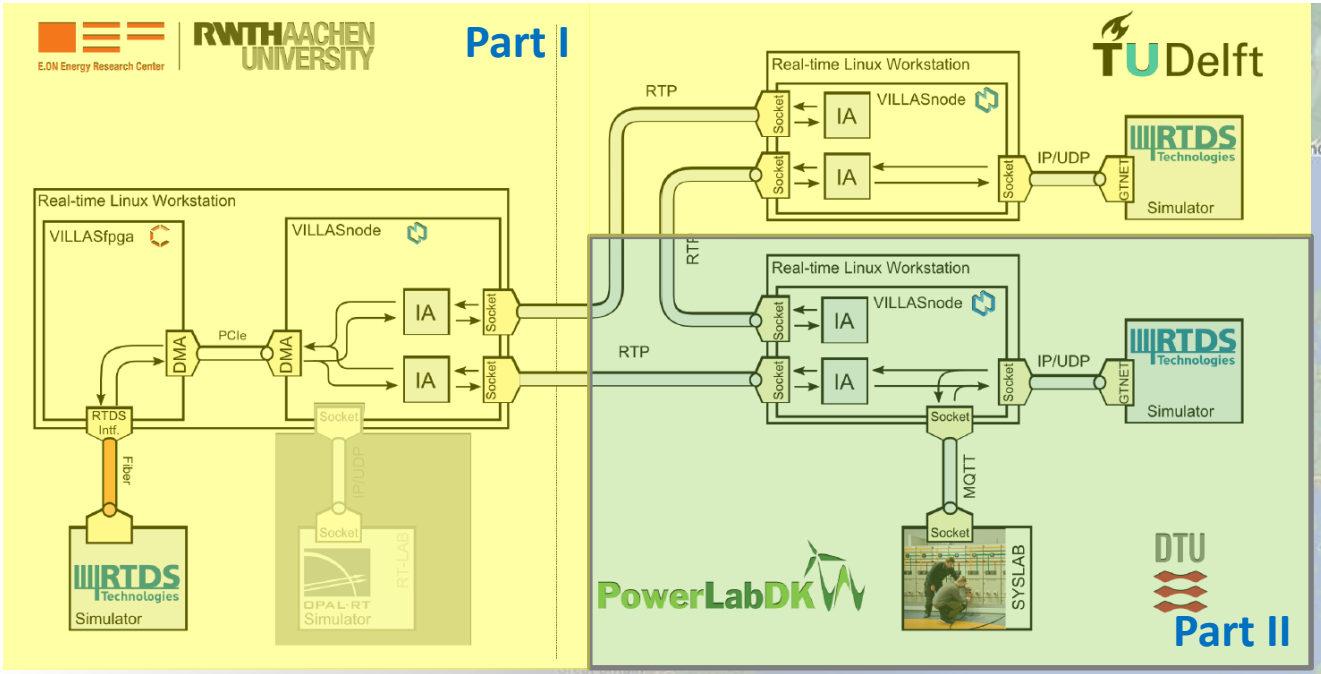
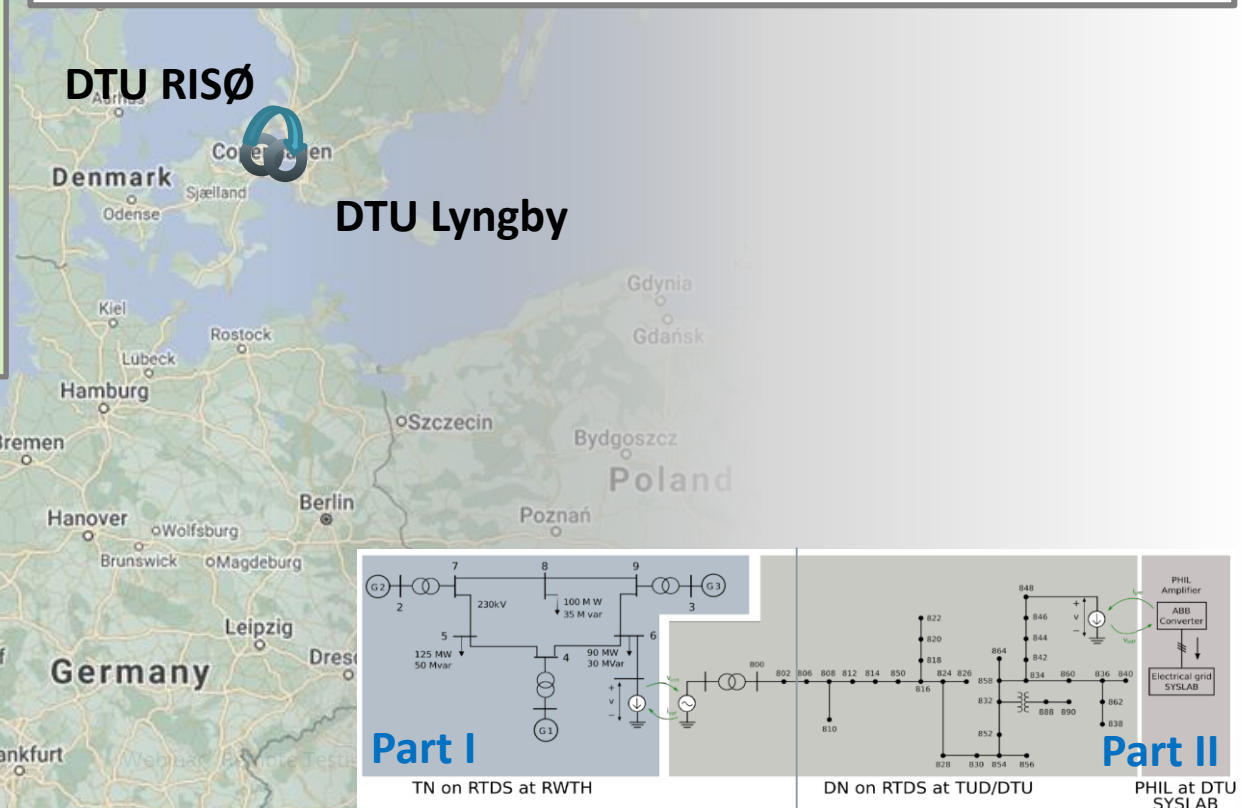
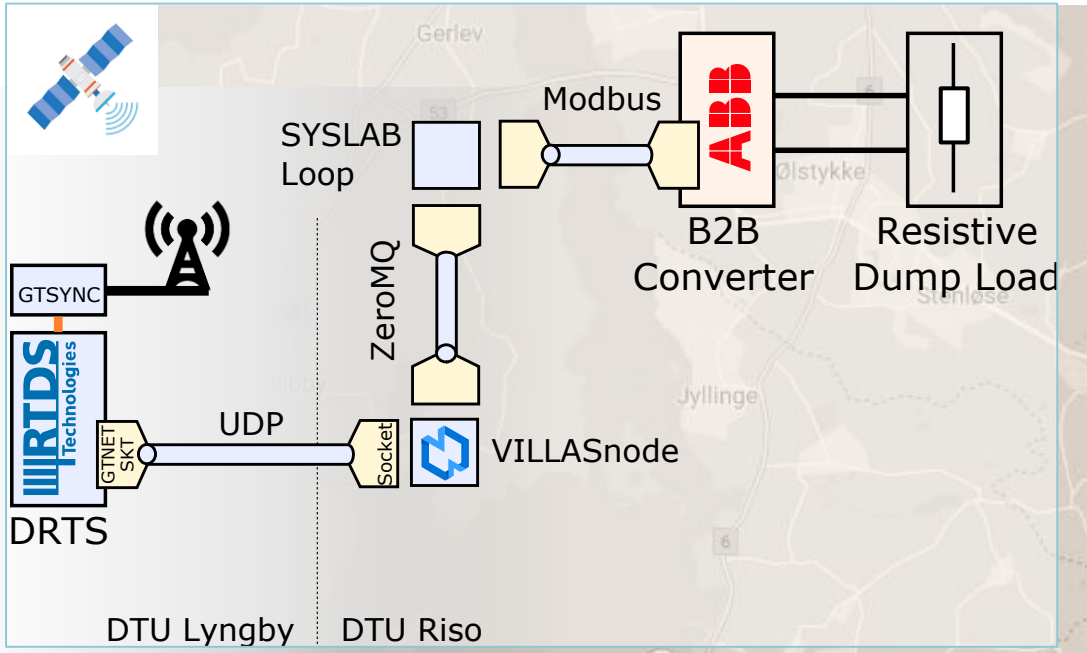


Figure 1. The general GD-PHiL layout.





VILLAS4ERIGRID – Overview of Lab Acces (Part II)



RTDS
DTU Lyngby campus

SYSLAB
DTU RISØ Campus

~30 km

2.5 ns

Access Timeline

Acces #1 – October ‘19

Acces #2 – November ’19

Acces #3 – February
(remote: Aachen)

Acces #4 –March-April ’20
(ALL REMOTE)

On-site access: preparation & late hours.

ERIGrid 2.0
Connecting European Smart Grid Infrastructures

Access Timeline
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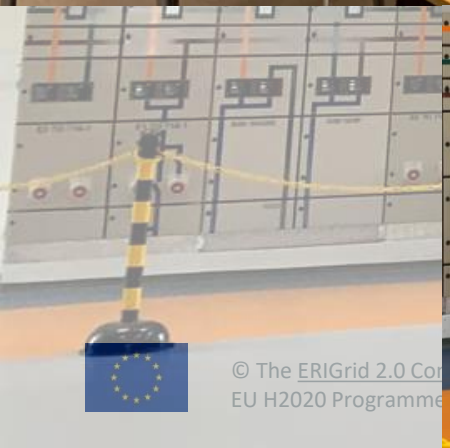
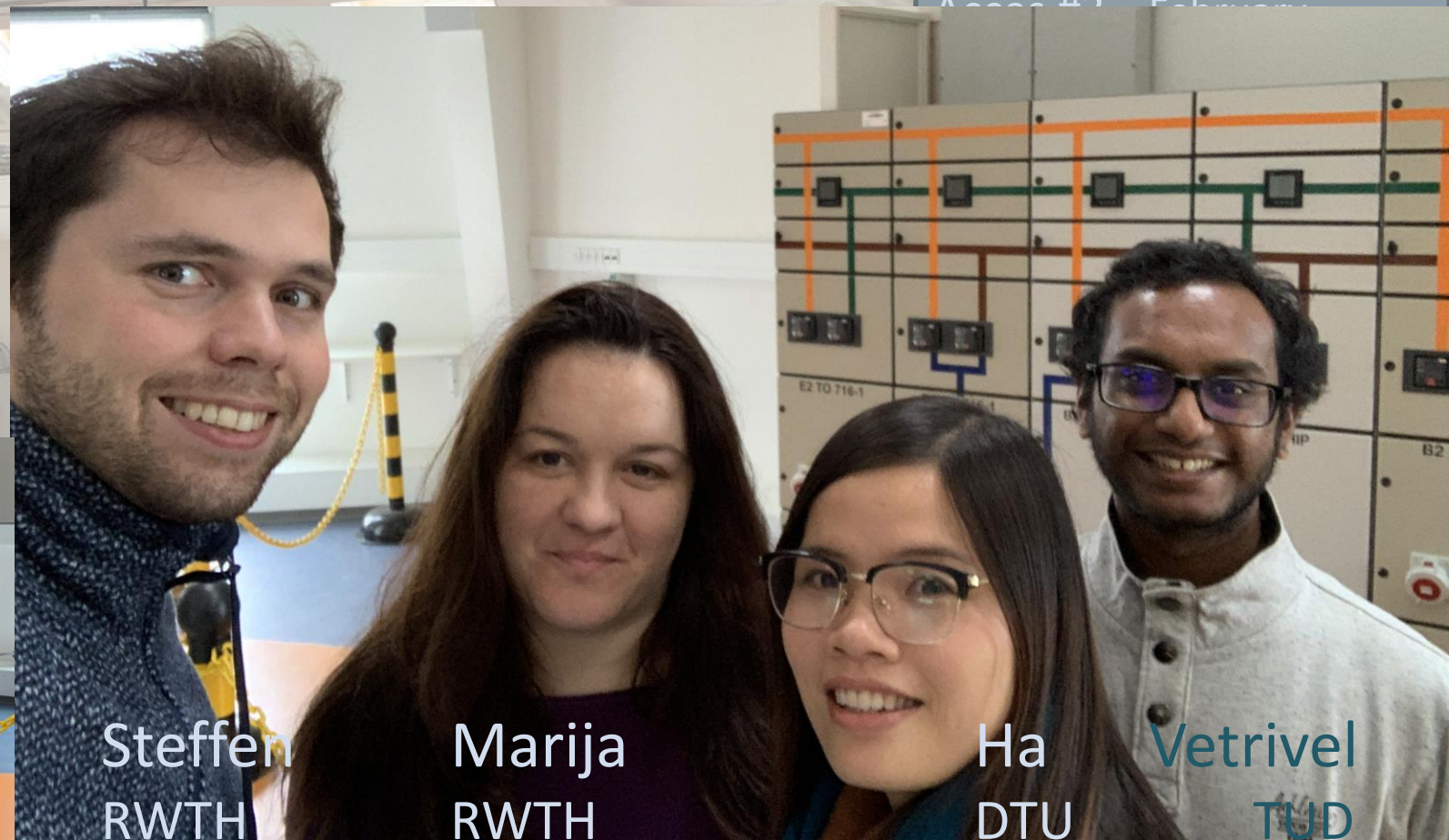
Acces #3 – February

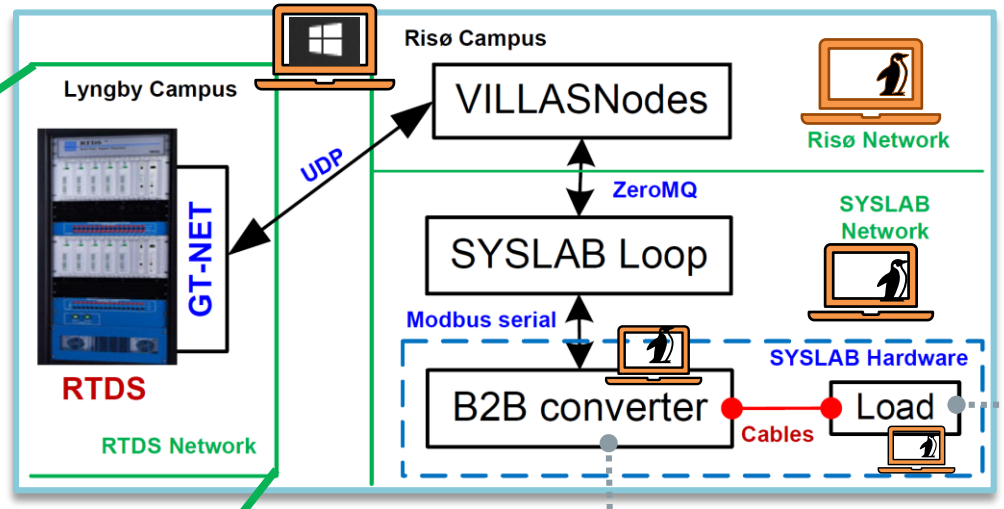




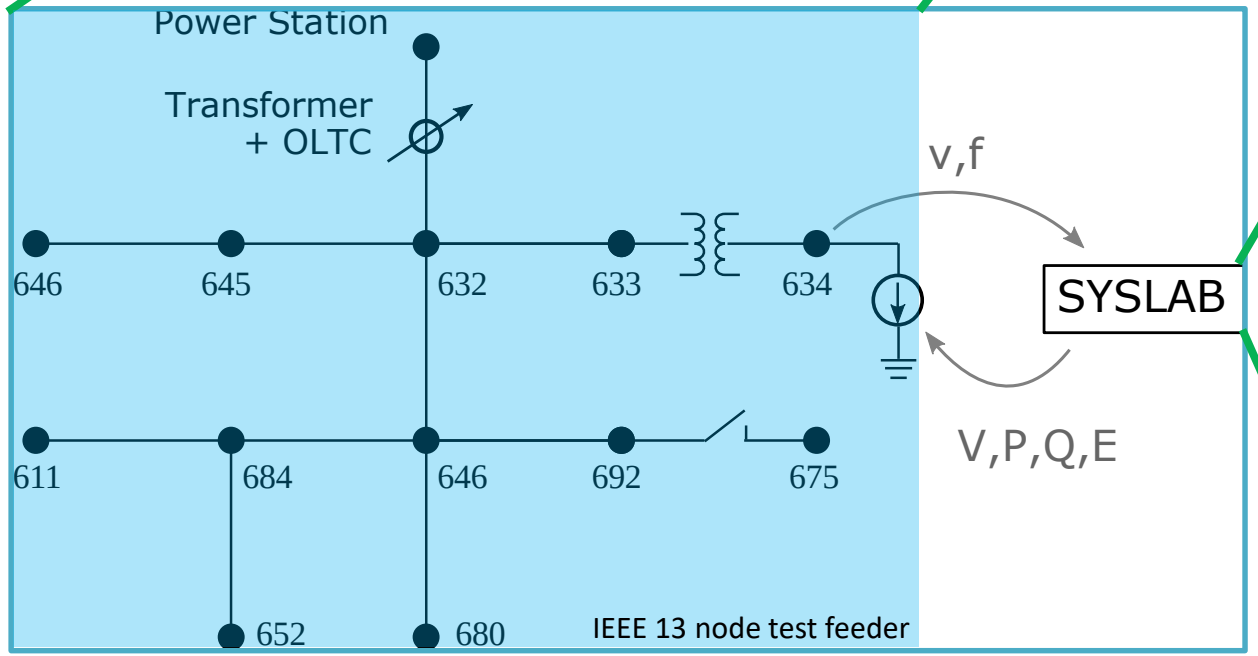
Steffen RWTH
Marija RWTH
Ha DTU
Vetrivel TUD

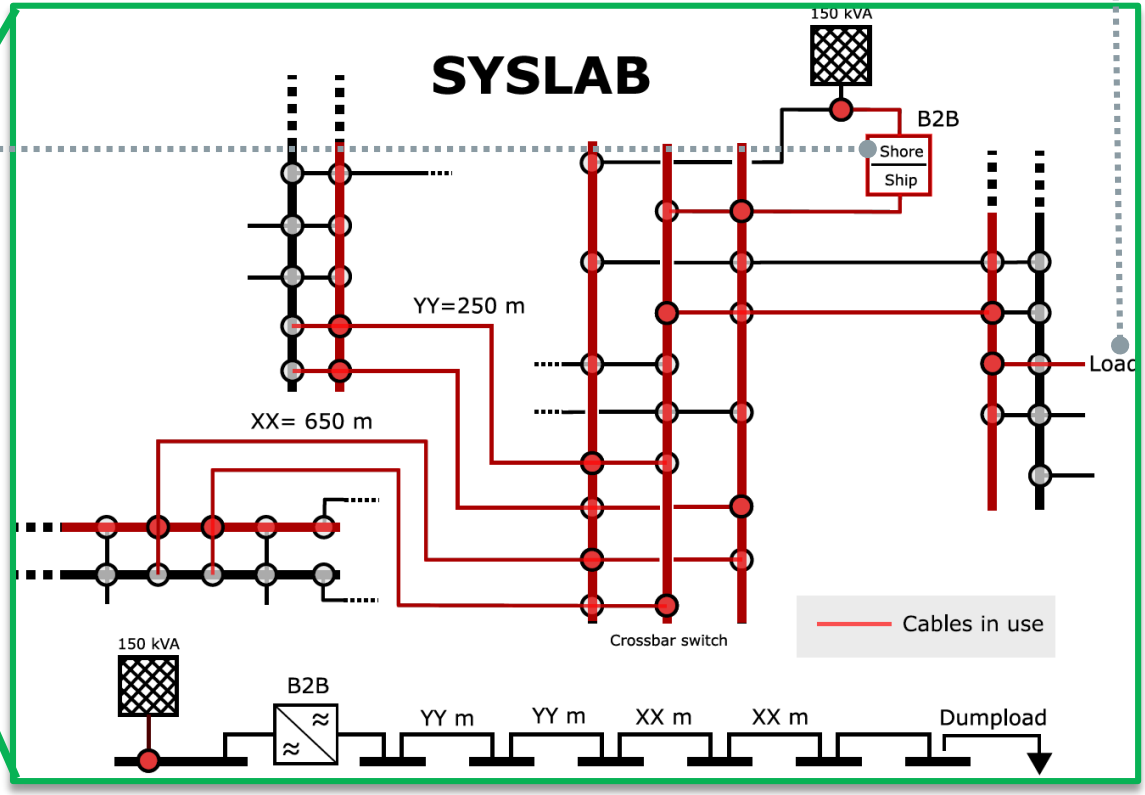
Experiment Setup

GD-PHIL



***3-4** controlling PCs*





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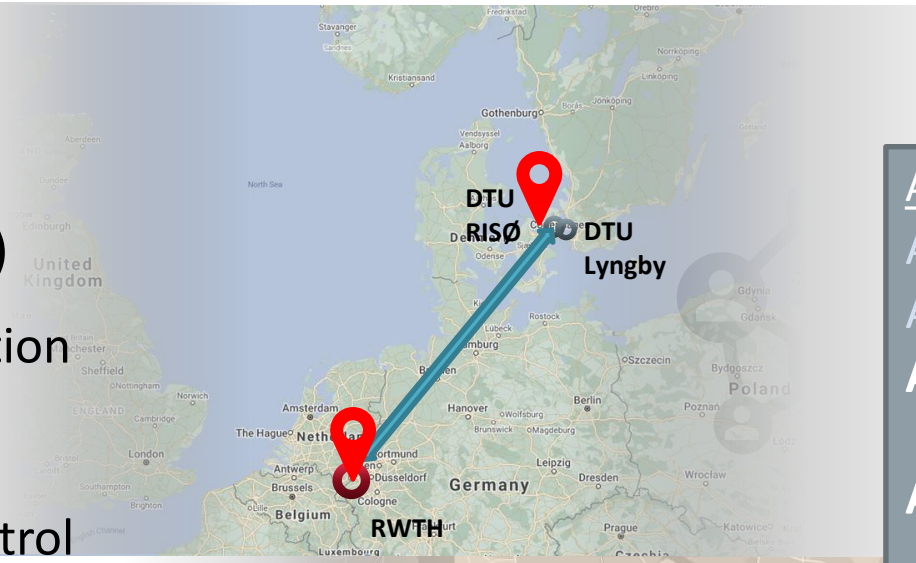
Remote Experiences

- ***Remote from Aachen*** **(Marija & Steffen)**
  - Skype & screenshare – life coordination
  - Controlling PCs still in one room
  - Lab automation enables remote control
  - *On-site*: Ha & Kai (Risø Campus)
- **COVID-19 lockout → *All remote***
  - 3 PCs required remote access
  - Remote access for DTU staff
  - Skype 'party' – screen share / chat / video
  - On-site: Only lab technician (for safety)



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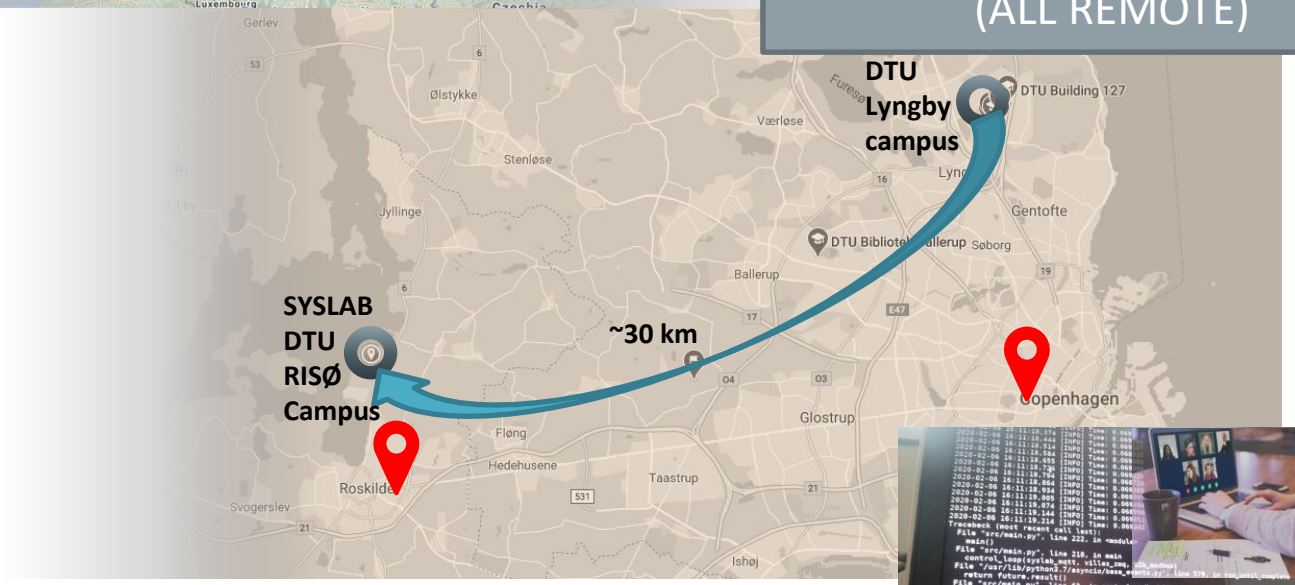

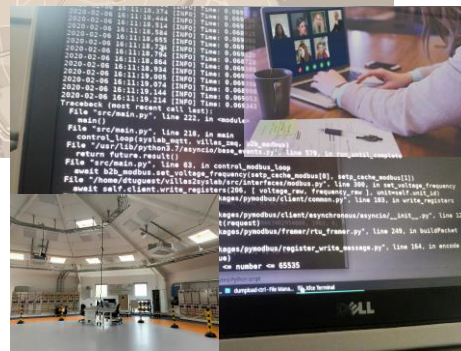

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Results

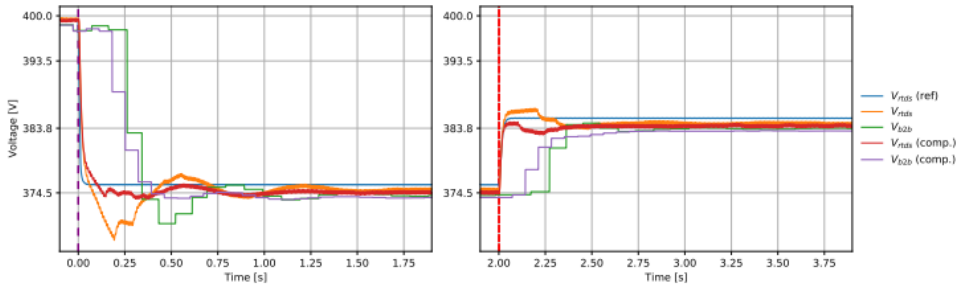


Figure 12. Inset graphs of voltage response during closed-loop test: DL step (**left**); and OLTC tap change (**right**).

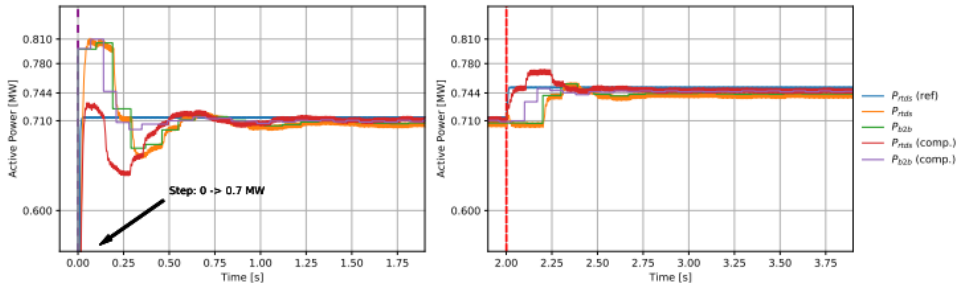


Figure 13. Inset graphs of power change during: DL step (**left**); and OLTC tap change (**right**).

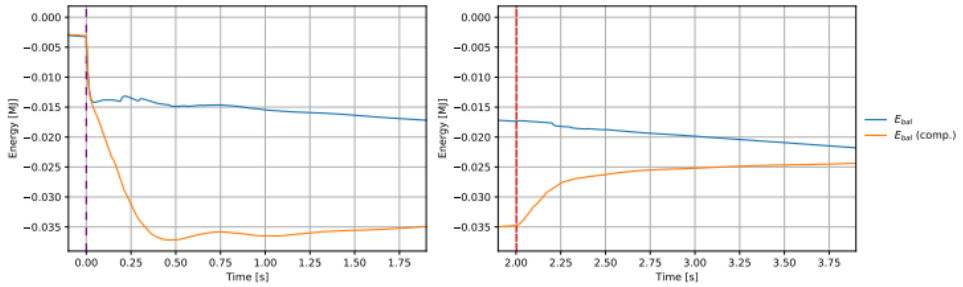
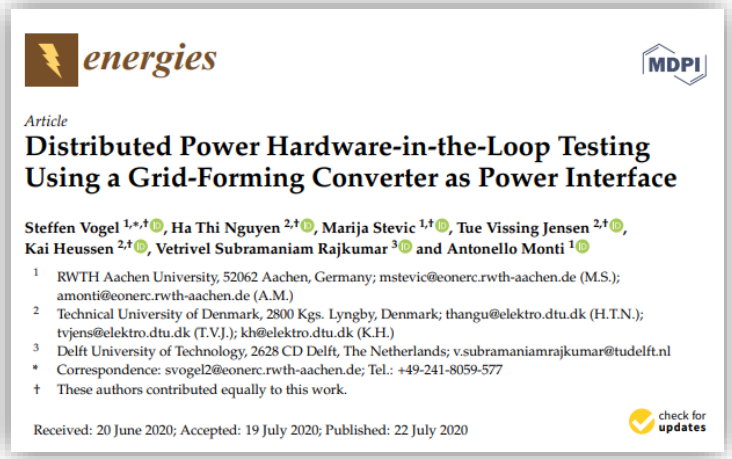


Figure 14. Inset graphs of interface energy during: DL step (**left**); and OLTC tap change (**right**).

Contributions

- Quasi-static PHiL (G.D.- QsPHiL) in a multi-rate setup
- Identification of limiting factors
- Compensation algorithm takes advantage of the different timescales
- novel Energy-Based Metric (EBM)



energies

MDPI

Article

Distributed Power Hardware-in-the-Loop Testing Using a Grid-Forming Converter as Power Interface

Steffen Vogel [1,*,†], Ha Thi Nguyen [2,†], Marija Stevic [1,†], Tue Vissing Jensen [2,†], Kai Heussen [2,†], Vetrivel Subramaniam Rajkumar [3] and Antonello Monti [1]

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check for updates

Insights

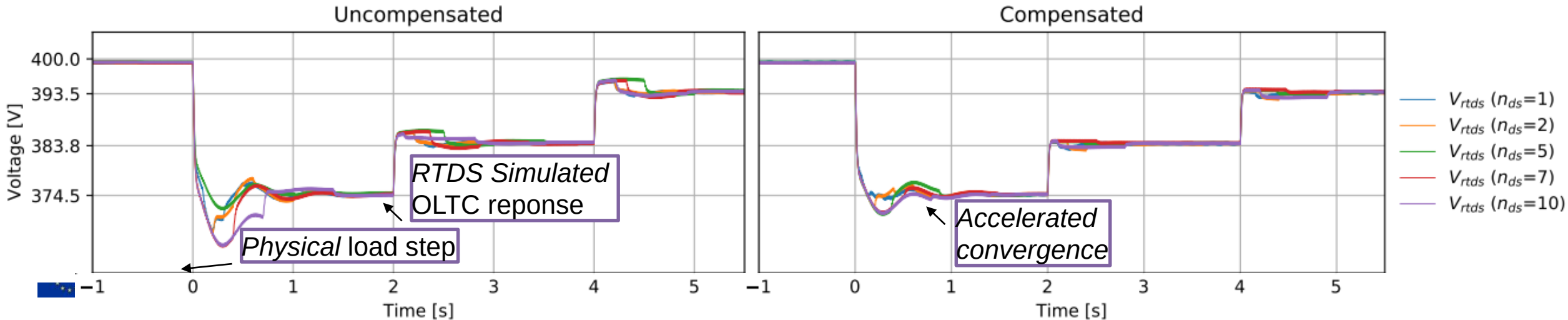
- Modbus communication main bottleneck for faster convergence
- Compensation Algorithm improved voltage response of PHIL setup
- Energy Metric reveals imbalance after transients
  - Energy focused compensation necessary?
  - How to mix different types of compensation algorithms? (voltage / energy focused)

Vogel S, Nguyen HT, Stevic M, Jensen TV, Heussen K, Rajkumar VS, Monti A. Distributed Power Hardware-in-the-Loop Testing Using a Grid-Forming Converter as Power Interface. *Energies*. 2020; 13(15):3770. https://doi.org/10.3390/en13153770

Observations & insights

- ”On-site preparation as part of the TA followed by the subsequent remote testing via remote control of your SYSLAB and RTDS systems.
  In my opinion this step was only possible due to the high amount of automation in SYSLAB “
  – Steffen Vogel, RWTH
- *1. On-site preparation*
  2. On-line collaboration

- Clear “frame” for online collaboration needed.
- Fixed/agreed experiment protocols & roles
  - Lab automation very helpful
- ➢ Travel time can be reduced
- ➢ Stress “on-site” eased due to possible follow-up
- ❑ *not tried: reverse situation - to start “remote”*
  - or pure remote.



ERIGrid-1 & ERIGrid 2.0 Remote Access

ERIGrid-1 Experience

- very limited experience with remote access (two projects)
  - VILLAS4ERIGrid:
    12 access days at DTU
    (6 physical lab access
    + 6 remote lab access).
  - H2AI:
    12 access days at D-NAP/
    University of Strathclyde
    (7 physical lab access
    + 3 remote lab access).

ERIGrid 2.0 expectation

- Remote Access is completely different from virtual access!
- Remote Access is possible, in principle.
  (1st round of Lab Access to be started soon)
- Can be an efficient alternative suitable in some cases (specially now due to pandemic situation).
  - different implementations depending on the lab capabilities:
    Skype-call to component control.
- Can be used in preparation & follow-up of visits.

EU H2020 Programme GA No. 870620

www.erigrid2.eu

@ERIGrid 2.0 Project

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