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# BETWEEN INVERTER AND PCC

## AC Side Challenges in PV Power Plants and State of the Art of Fraunhofer ISE

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Robin Grab

Seminario: Desafíos y Soluciones para los  
Sistemas Fotovoltaicos

Expo ERNC 2018

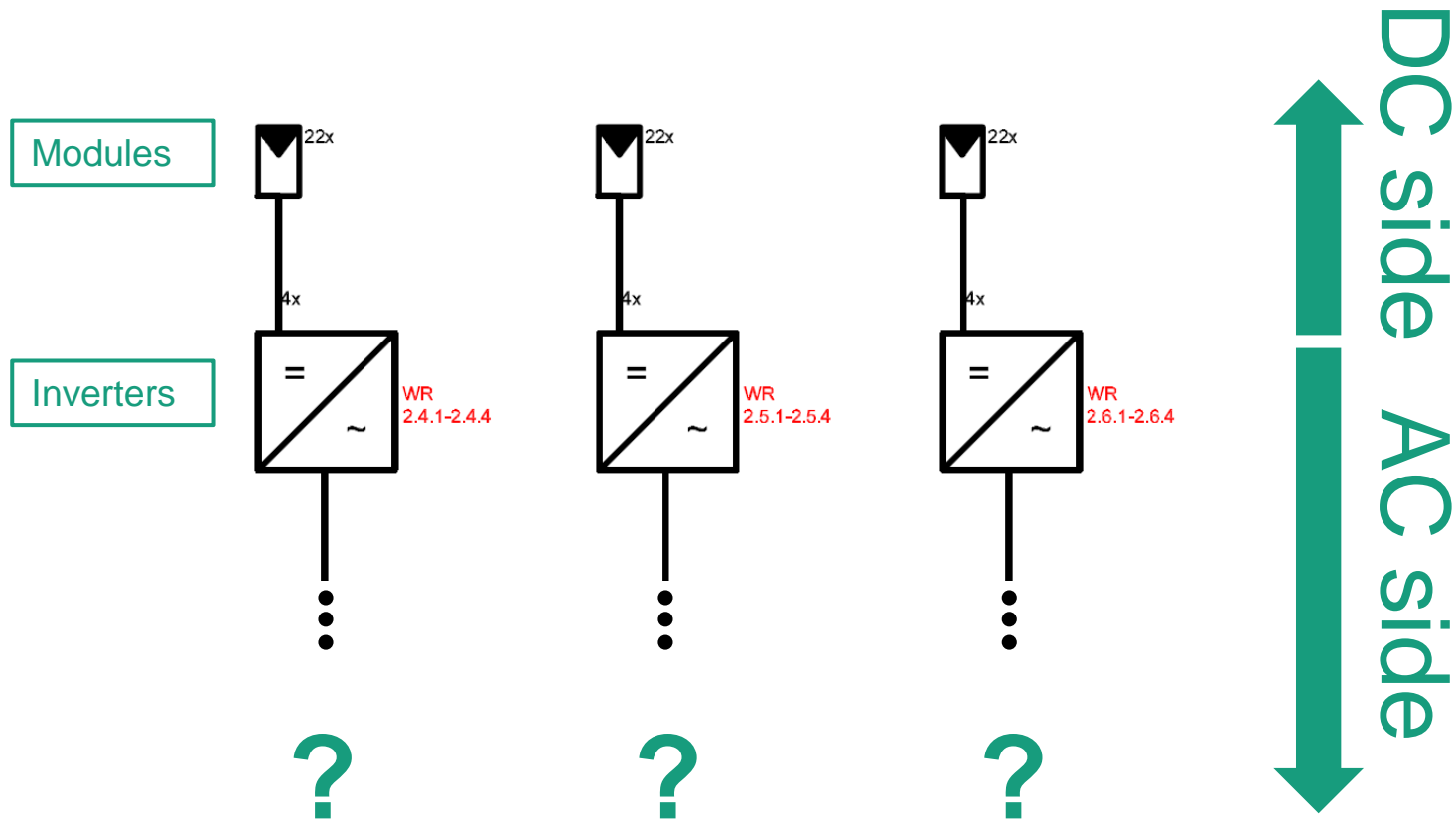
Santiago de Chile

November 21<sup>st</sup>, 2018

[www.fraunhofer.cl](http://www.fraunhofer.cl)

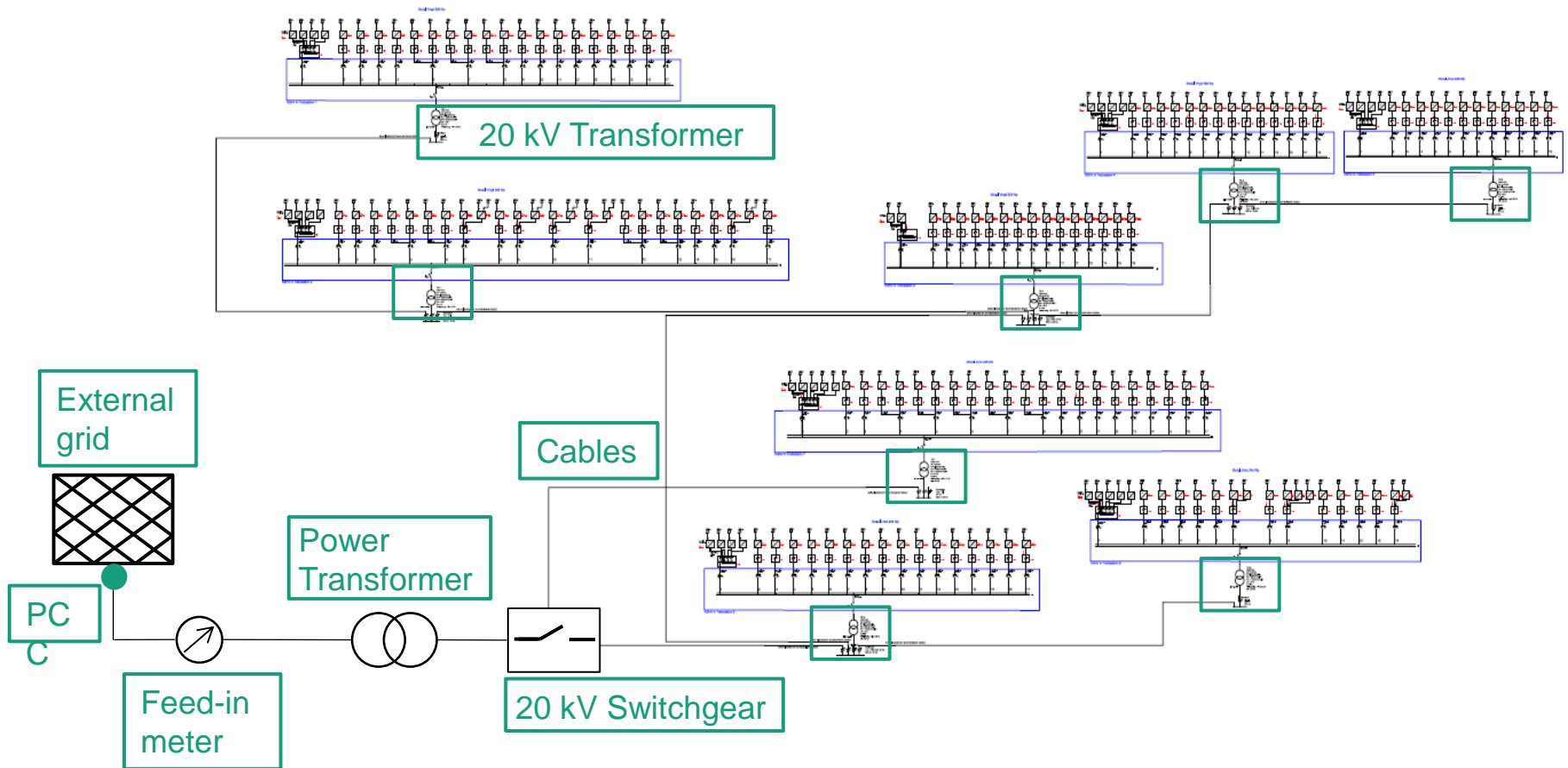
# Why does the AC side matter?

## Module string and inverter



# Why does the AC side matter?

## The even bigger picture...



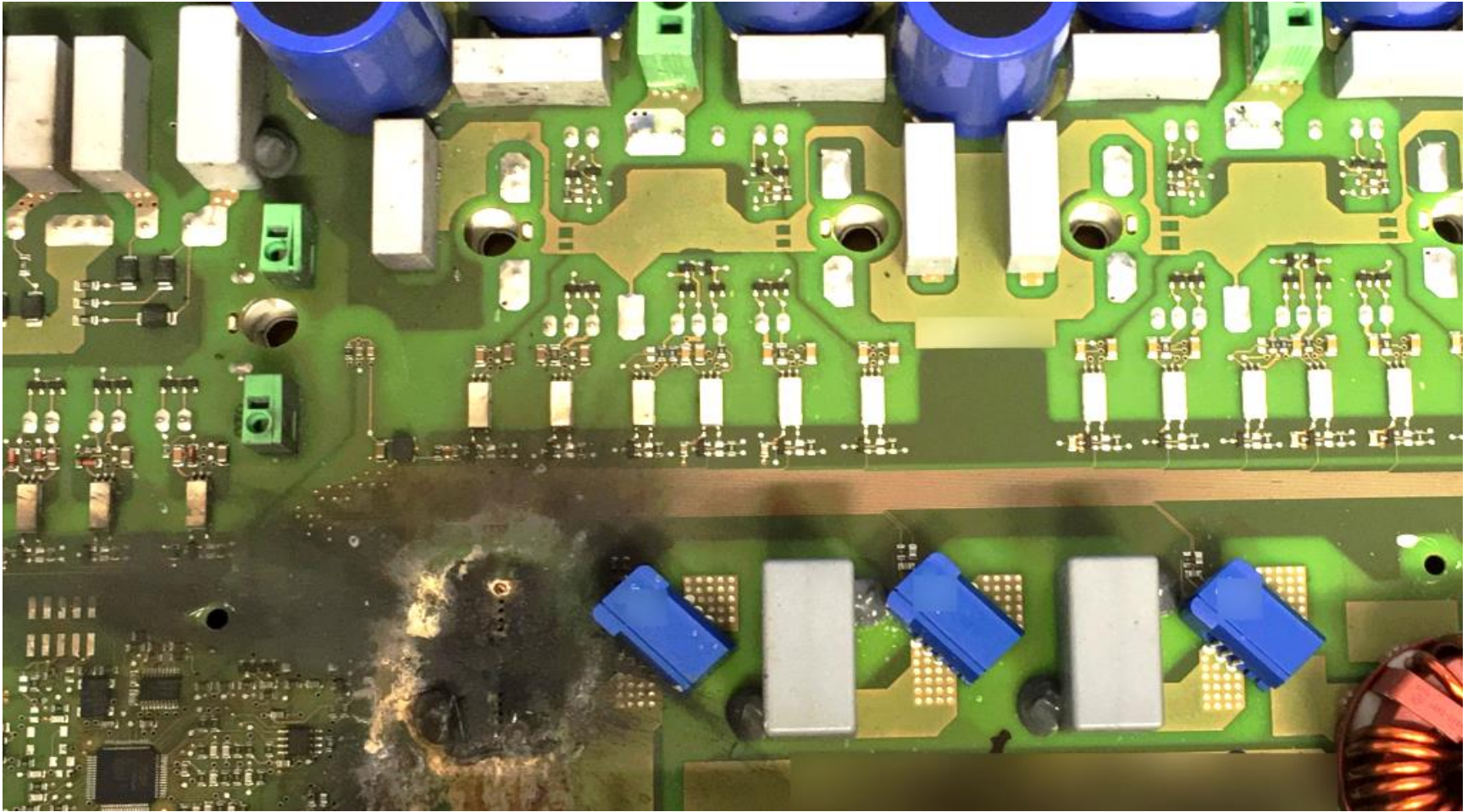
# AC challenges

## Defects



# AC challenges

## Defects



# AC challenges

## Oscillations and underperformance

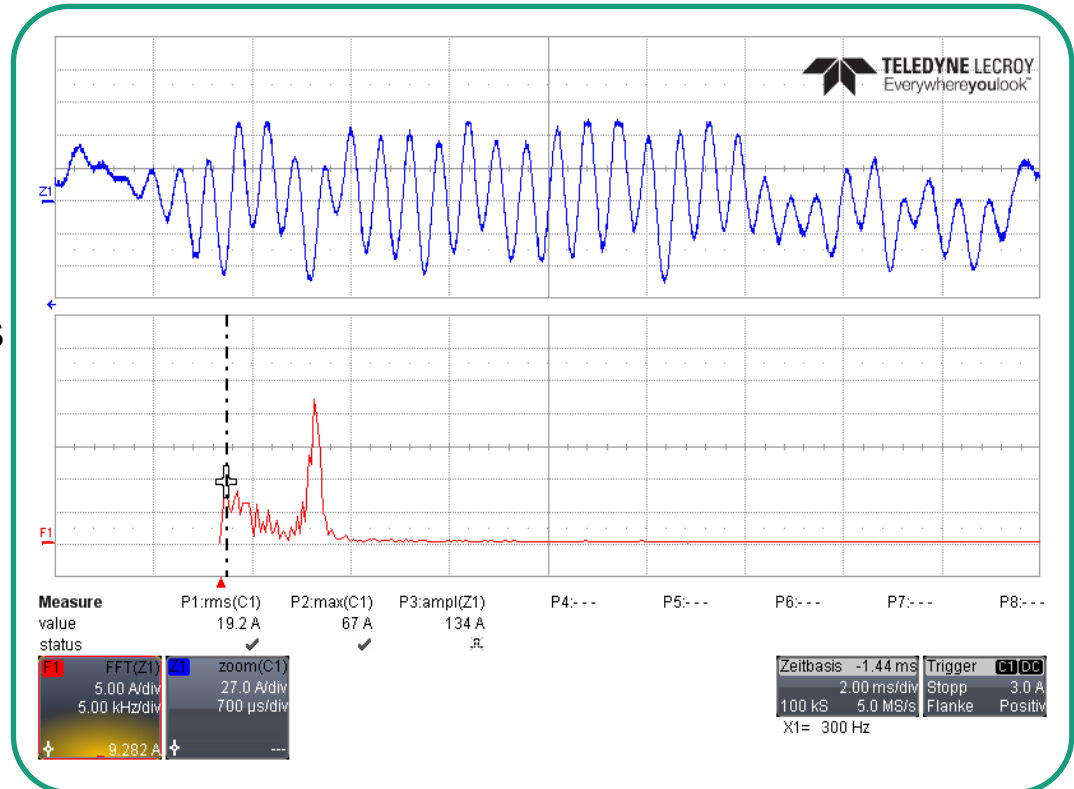
Underperformance of  
inverters observed



Oscillations between inverters  
and passive elements  
detected

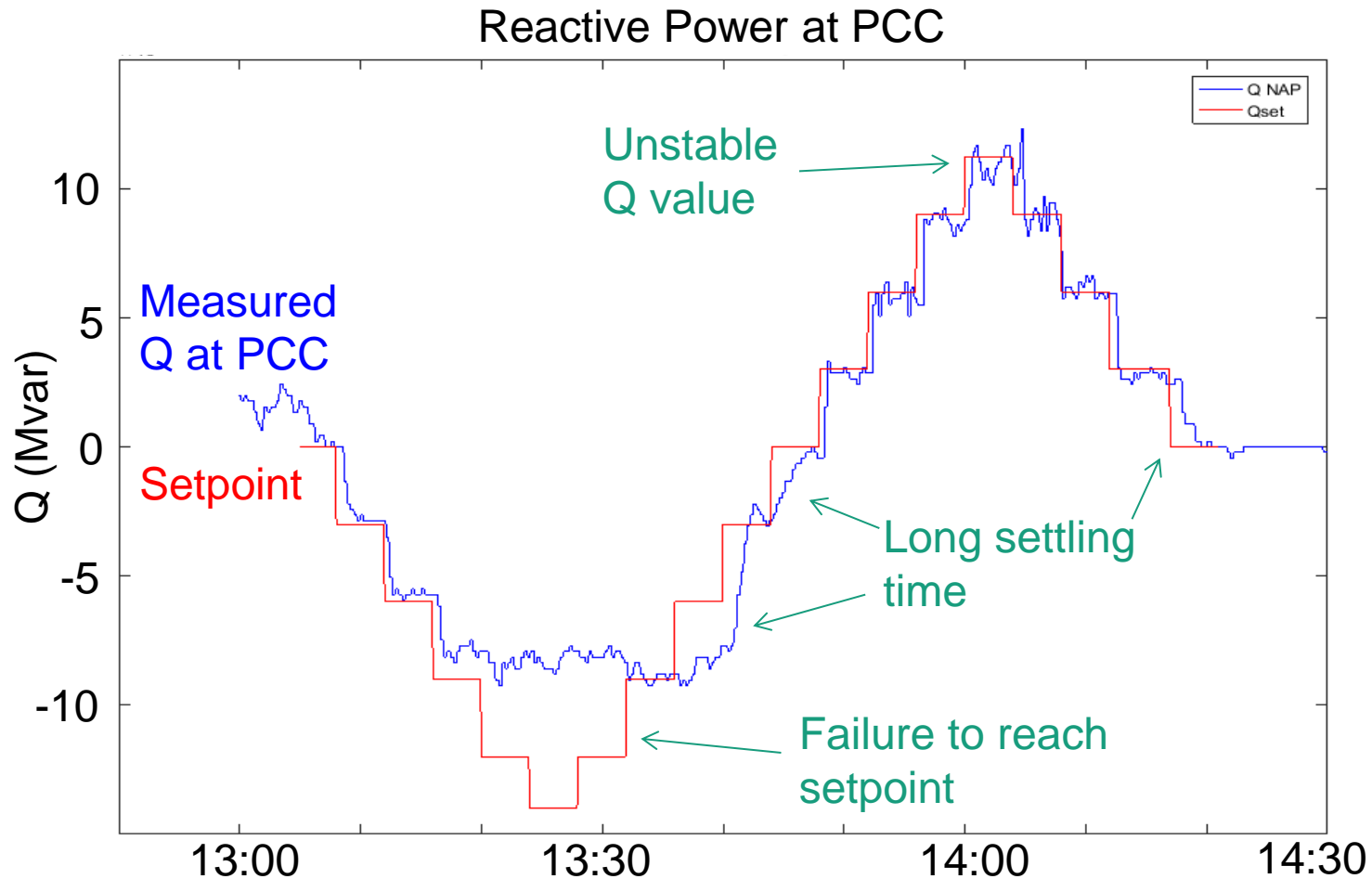


Hardware defects possible



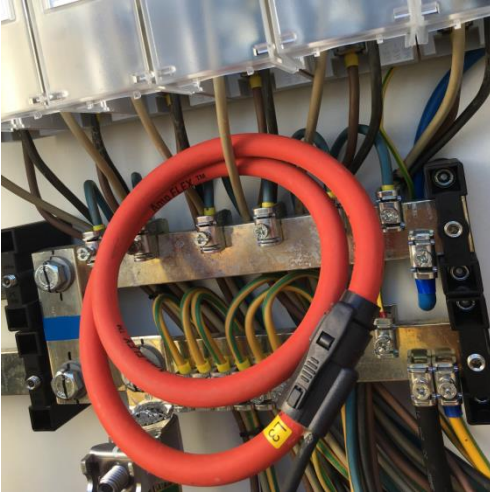
# AC challenges

## Compliance with grid requirements



# Analyses at Fraunhofer

## AC Measurements



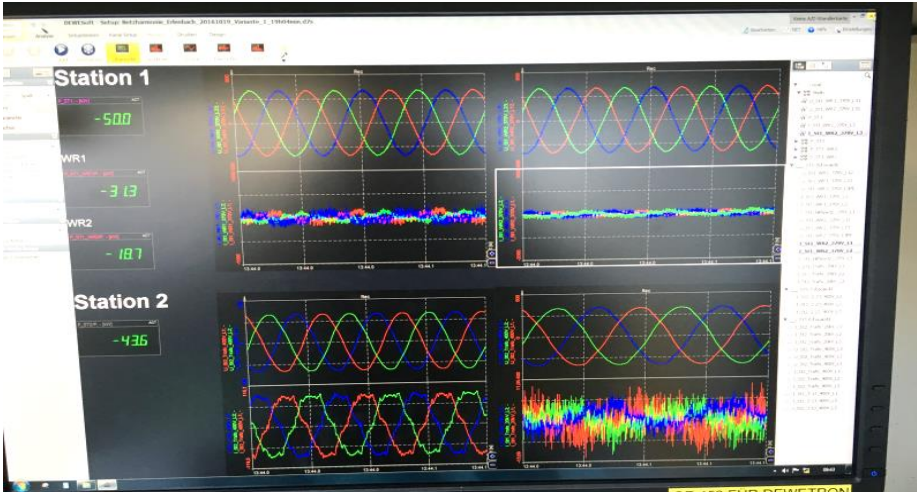
- High precision power measurements up to 5.000 A / 1.000 V
- Sampling rate up to 1.000 kHz
- GPS coordination of up to 96 measurement channels
- Access to Fraunhofer ISE's measurement equipment and expertise



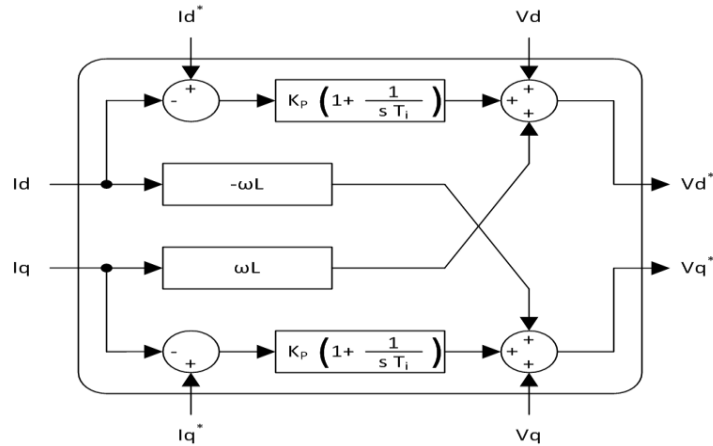
# Analyses at Fraunhofer AC Measurements



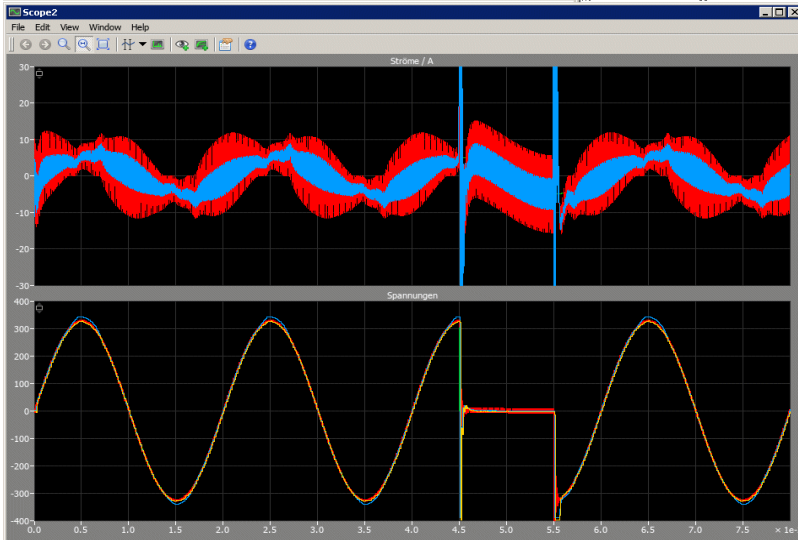
- High precision power measurements up to 5.000 A / 1.000 V
- Resolution up to 1.000 kHz
- GPS coordination of up to 96 measurement channels
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# Analyses at Fraunhofer Modelling

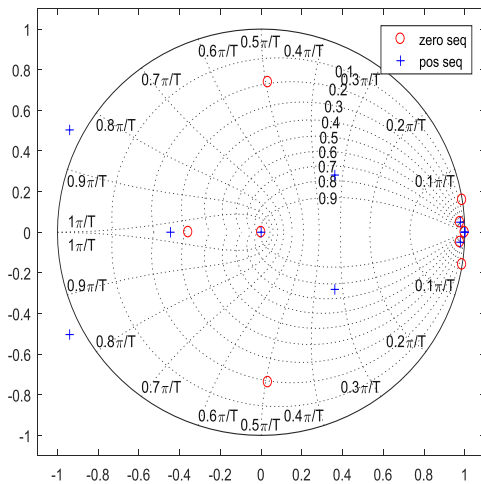
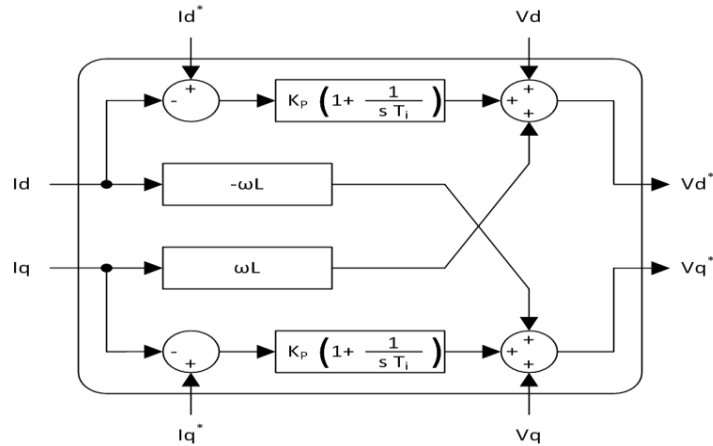


- Stability studies for internal park grids
- Modelling of passive components, power electronic devices, and control



# Solutions

## Controller Optimization



Root Locus Diagram for parameter set A7

- Stability studies for internal park grids
- Modelling of passive components, power electronic devices, and control
- Development of ideal control parameters for stable operation
- Dimensioning of damping elements

# Solutions

## Third party opinion



**Confidencial**

Reporte  
Fraunhofer Chile Research Foundation -  
Center for Solar Energy Technologies (CSET)

Análisis del comportamiento de la parte AC de

- Expert assessments on critical topics
- Arbitration of legal disputes and warranty issues
- Neutral expertise, world-wide reputation



## For a Solar Future of Chile

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