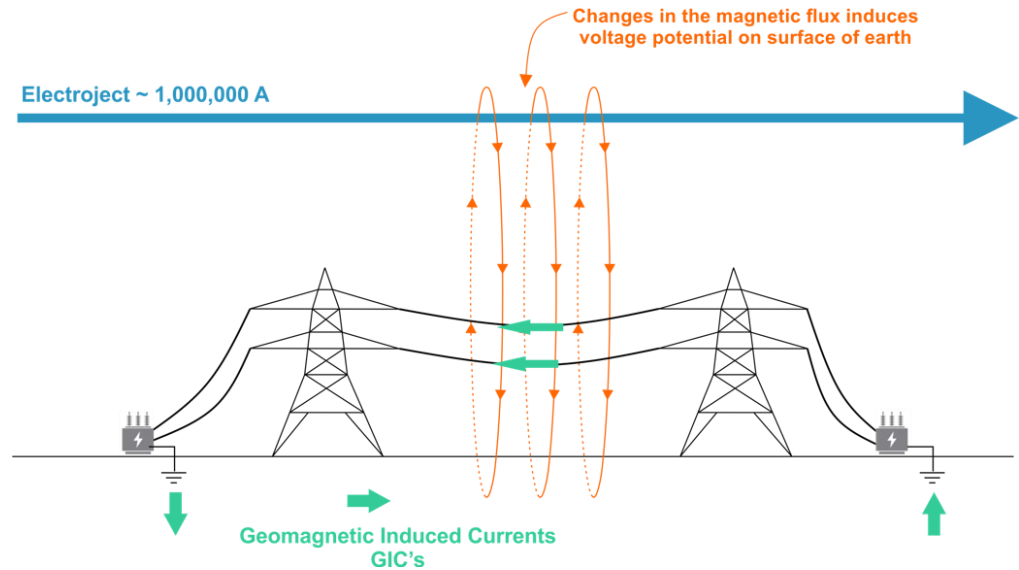
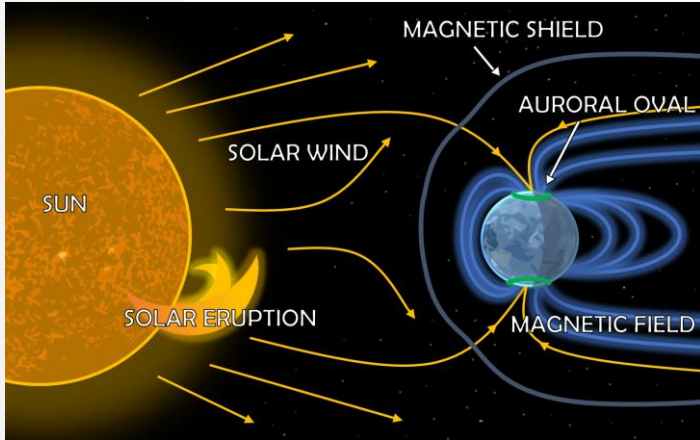


# GEOMAGNETICALLY INDUCED CURRENTS IN POWER SYSTEMS

Rute Santos, João Cardoso, M. Alexandra Pais, Miguel Silva,  
Joana Alves Ribeiro, Fernando Pinheiro

Shield Wires effect on GICs in power network and design of an instrument to monitor GICs

# Geomagnetically Induced Currents in Power Systems



# The importance of GICs mitigation

Numerous records of damage and wear of electrical network components

Half-cycle saturation of power transformers

(One of the main problems in power systems)

## GIC Modelling

to understand damage to Power Systems

## GIC Measuring

to validate the models

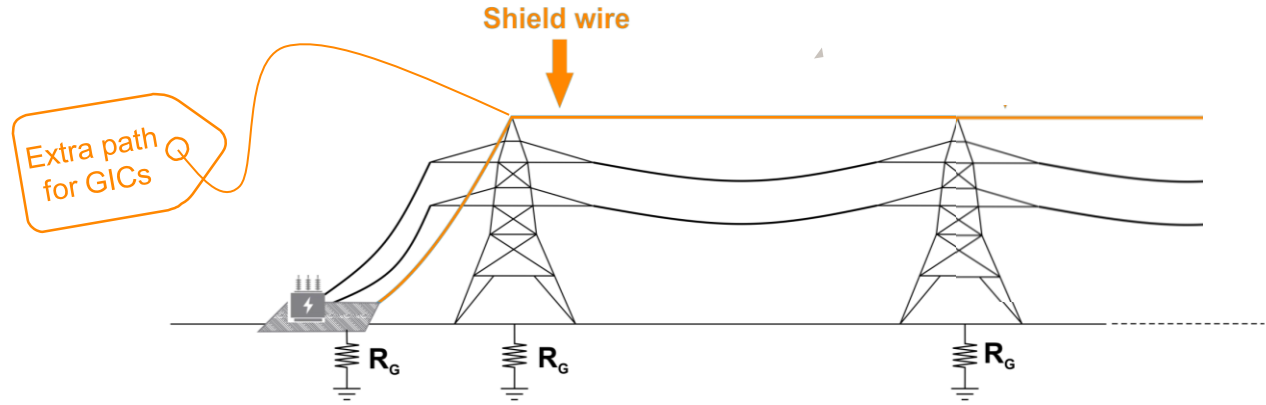


From Marusek, 2007

1.

# GIC Modelling

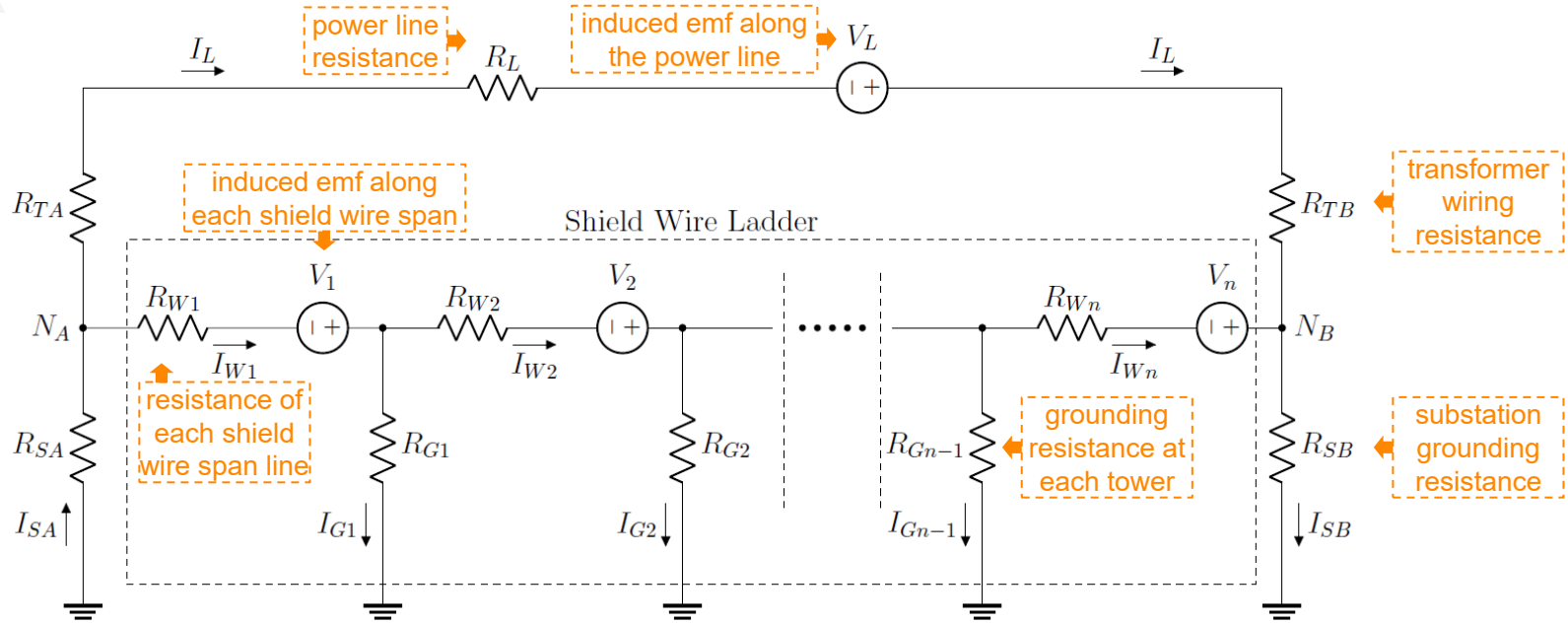
The effect of the Shield Wires



# Shield Wires

Protect the power transmission line  
from the effect of lightning

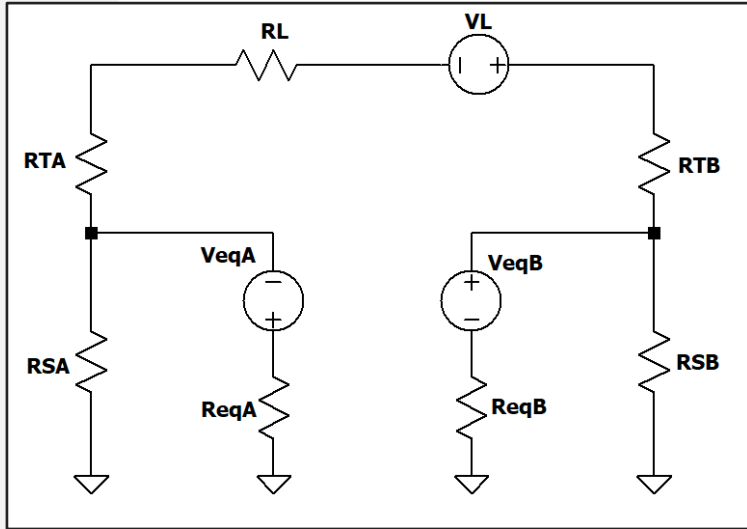
# Model for analysing the effect of shield wire on GIC



## In Portuguese Network

- ▶ In Portuguese Power Transmission Network, **first initial tests** on single lines gave **errors of 5% for a short line**, if shield wires were not considered.
- ▶ It is important to **study this effect** and understand if it is necessary to include shield wires in the GIC calculation models

# How can we simplify this study?

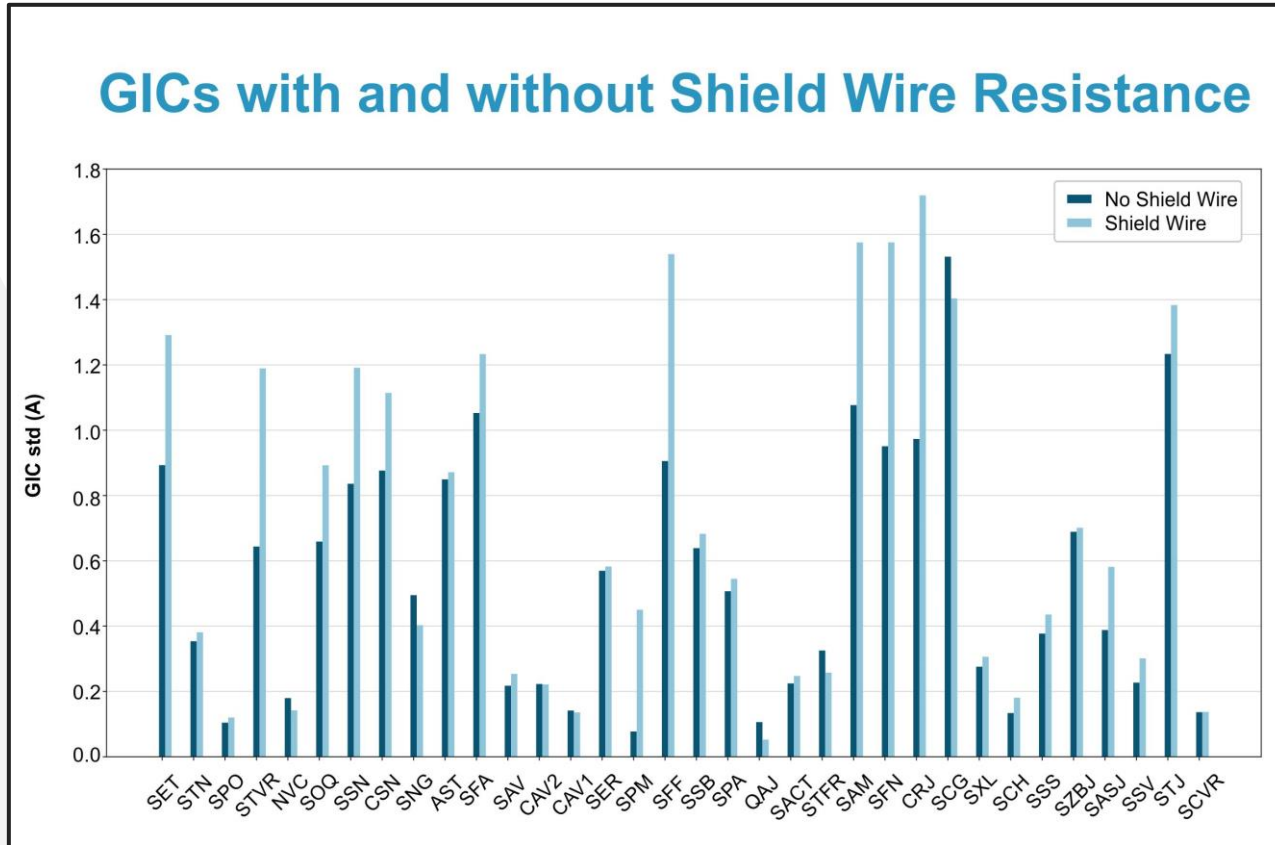


## Getting a simpler circuit!

In which it would be sufficient to deal with a Thévenin equivalent circuit connected to each substation, as shown on the left



Results in a simulation where the induced electric field along shield wires has been neglected



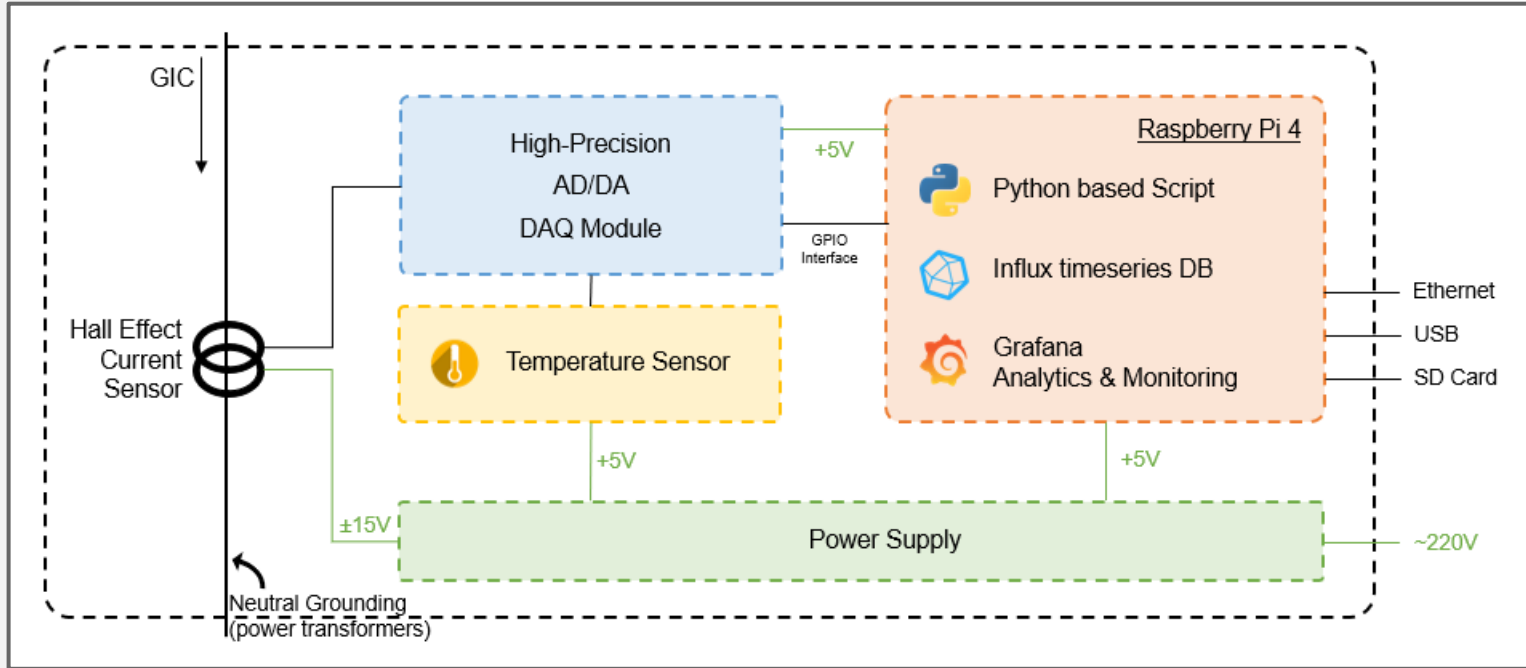
Credits to Joana Alves Ribeiro

2.

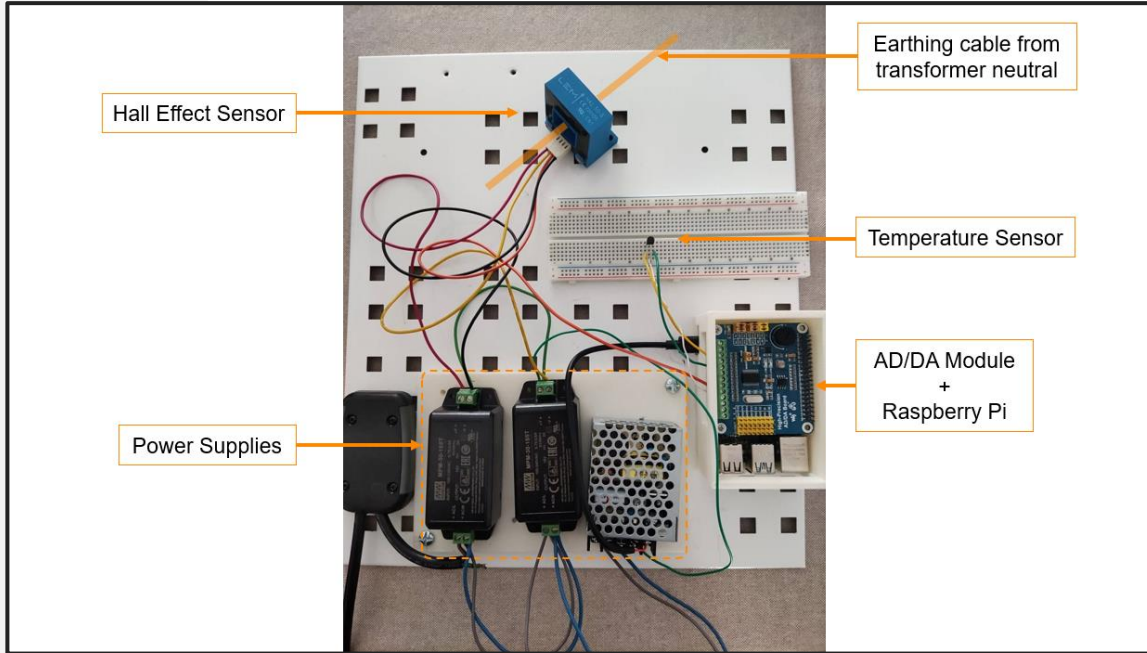
# GIC Measuring

The design of an equipment to monitor GICs

# GIC Acquisition System



# Instrument to monitor GICs



The first prototype will be installed to measure the **neutral point current** on a transformer, at a substation belonging to the national transmission system operator (REN)



## Grafana Dashboard

It will be possible to obtain the data in real time and a wi-fi interface allows rapid long term trend visualization through a customized dashboard - Grafana.

# THANKS!

**Any questions?**

You can contact me: **[rute2rodrigues@gmail.com](mailto:rute2rodrigues@gmail.com)**