Paris Session 2022

Practical Experiences with TWFL

Study Committee B5, PS2

Q2.03: What are the experiences to fault identification and location and how to design the scheme to meet the practical application requirement?

Adriano Pires - GE Grid Solutions, BR
Hengxu Ha – GE Grid Solutions, UK

Practical Experiences with TWFL

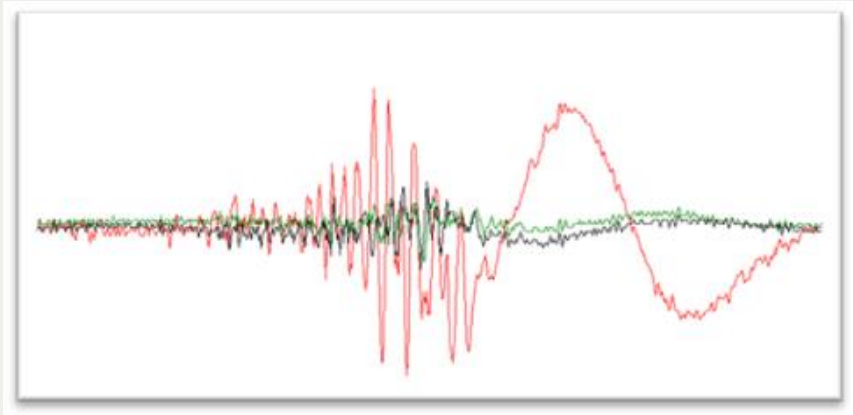
- *Over 15 Years and +300 lines of experience with TWFL*

Challenges with theoretical models

- Literature still debates topics that are **not observed as issues** in practical applications:
  - Faults with 0° inception
  - Low bandwidth of VTs

  Hypothesis: Need models to represent parasitic elements

- Challenges modelling and understanding the high frequency dynamics of a fault

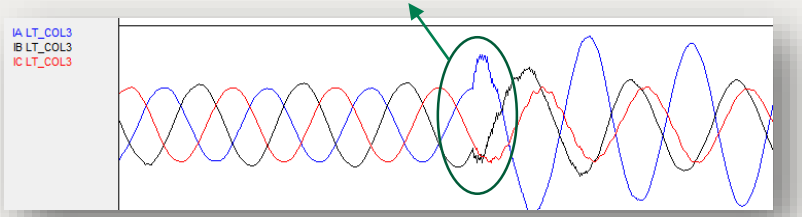


TW Record of a real fault in 765kV line

Practical Experiences with TWFL

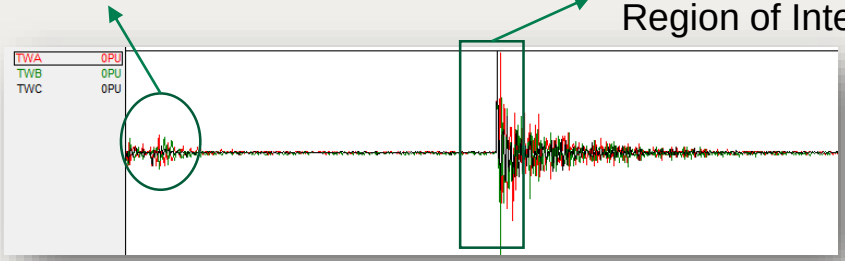
Leveraging lower frequency measurements to increase accuracy and simplify algorithms

Fault detection based in low frequency signal and triggers



Ignore non-fault related TW

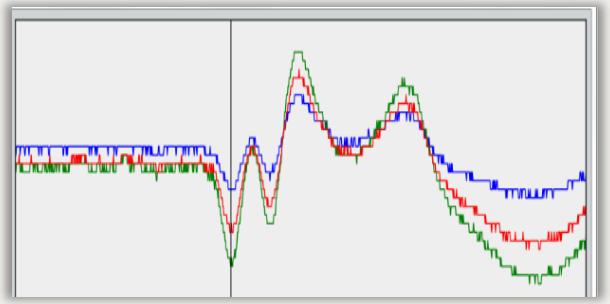
Search for a fault only in the Region of Interest



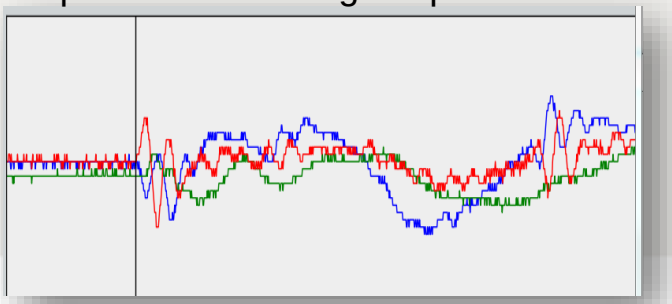
Double Ended TWFL covering all use cases

- Hybrid Lines
- High Impedance faults
- T Lines
- Railways
- HVDC
- Switch - on to Fault
- Short Lines

TW in a 2411km HVDC line in Brazil



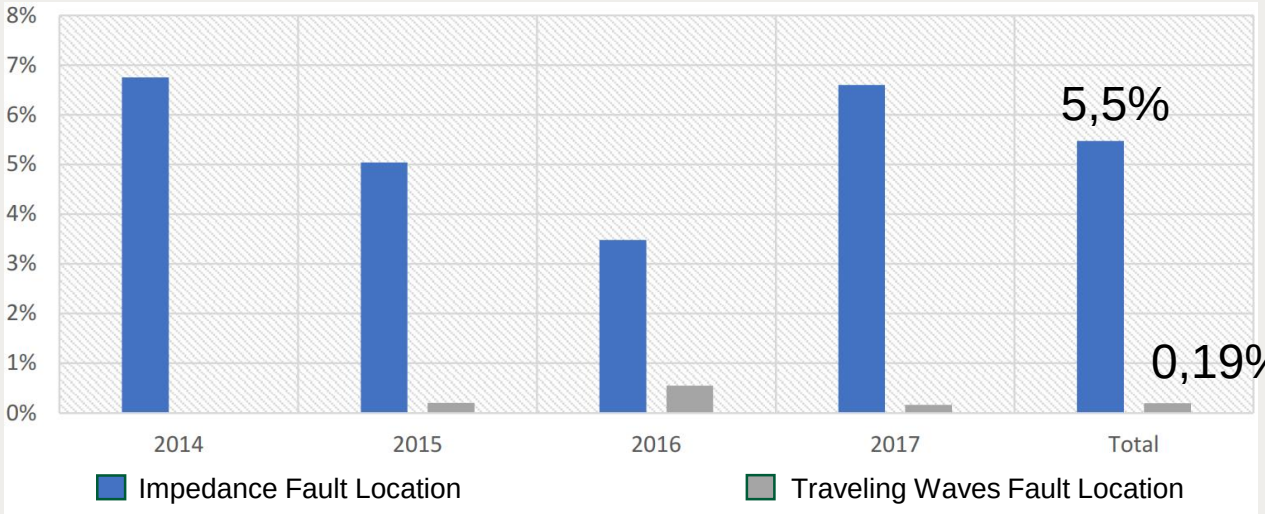
Low power TW in a high impedance fault



Practical Experiences with TWFL

- *Accuracy pays it back – Experience from a Brazilian Utility*

Average Fault Location error: Impedance vs TWFL



Payback analysis table

Line	Length (km)	Payback time
CO-MC	174,0	3,3 years
SM-SB3	248,6	2,5 years
GU-MC	254,9	5,8 years
SM-GU	257,3	3,5 years
IZ-CO	343,5	2,8 years
Average	-	**3,3 years**

- The payback analysis was done based on non-permanent faults

Payback can happen in the first occurrence of a permanent fault