ULTRA-HIGH SPEED TRANSMISSION LINE PROTECTION PERFORMANCE IN TIME DOMAIN DUE TO SEVERAL CONTINGENCY SITUATIONS

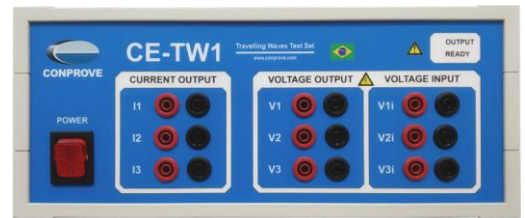Paulo Sergio Pereira Junior

Why Traveling Waves?

Why Traveling Waves?

- More **accurate** Fault Location

- **Faster** Protection Performance

- Better Performance in **Hybrid** and **Compensated** Line

- Improved Performance with **IBRs**

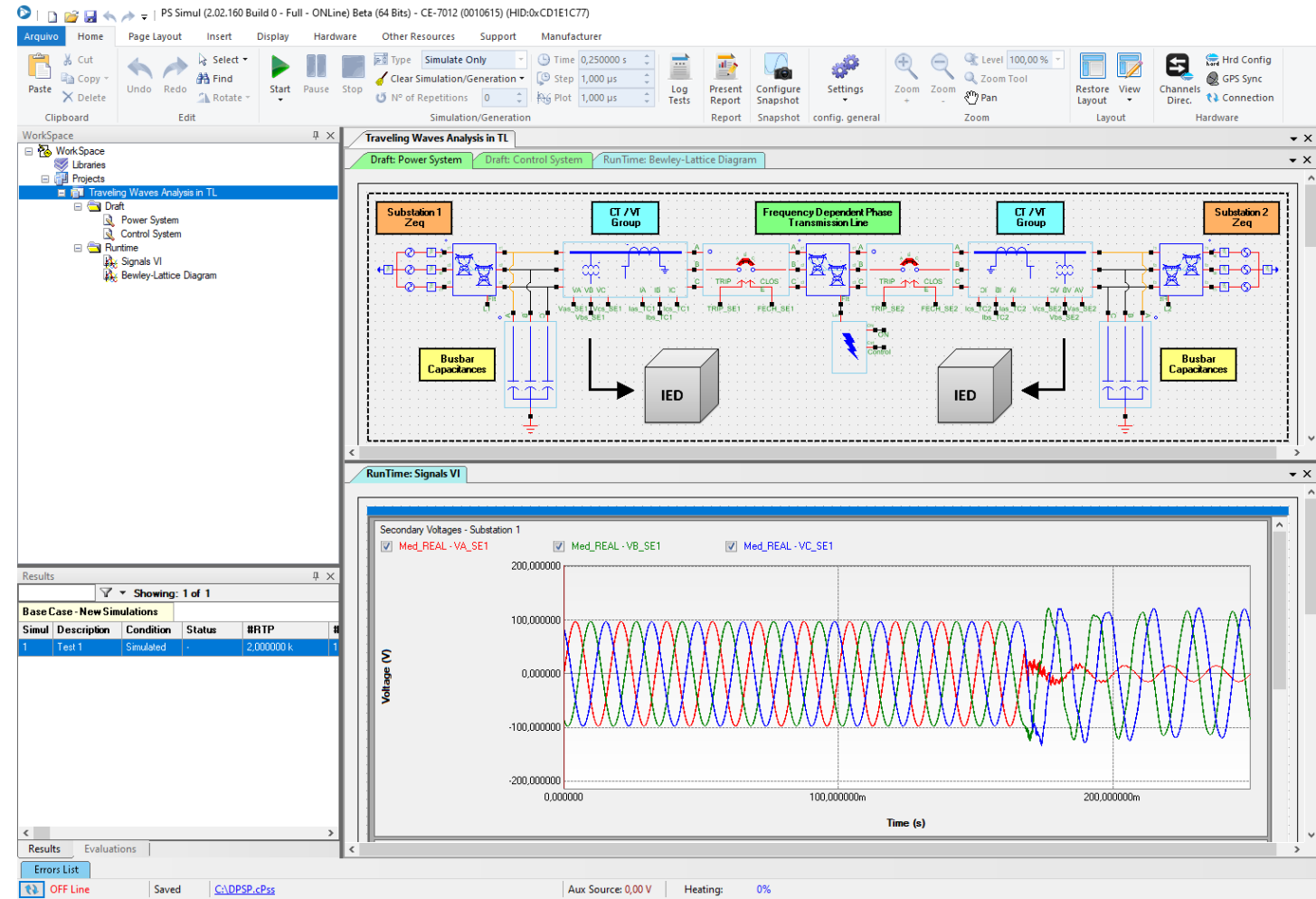- **Faster** Fault Elimination -> **Safety**, **Stability**

| FEATURE	CE-TW1	PULSE GENERATOR

- **Brazilian** software for simulation of **electromechanical** and **electromagnetic transients**

- Developed since **2009**

- **Friendly interface**

- + **400 components**

- Allows the **reproduction / acquisition** of the simulated signals by the **test set**

- **Closed Loop** Test

COMTRADE

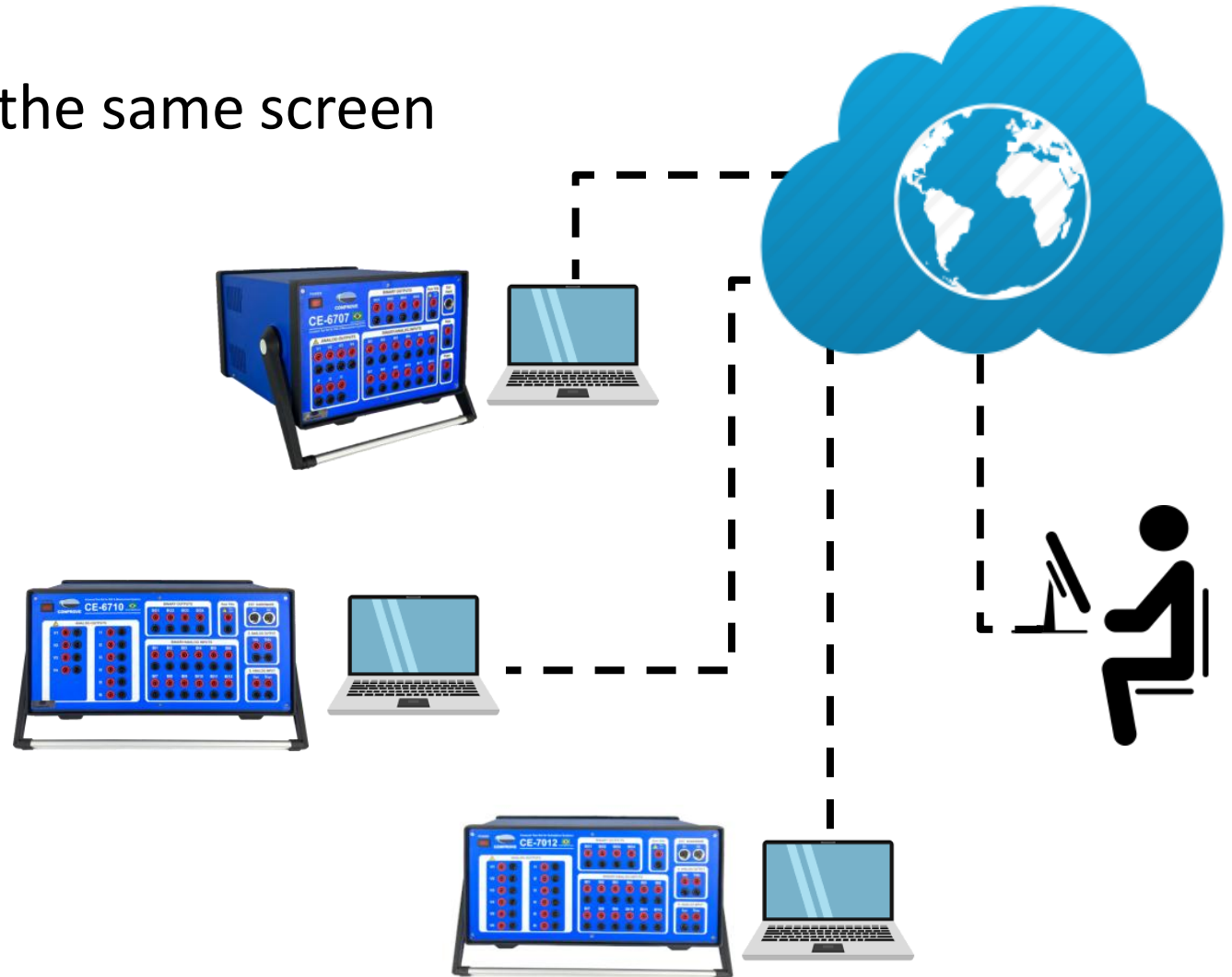**PS Simul + CE-TW1** solution allows:

– **Importing** COMTRADE:

- **Analysis** (Bewley-Lattice)

- **Reproduction** (Secondary Levels)

– **Exporting** COMTRADE:

- Reproduction (**Playback**)
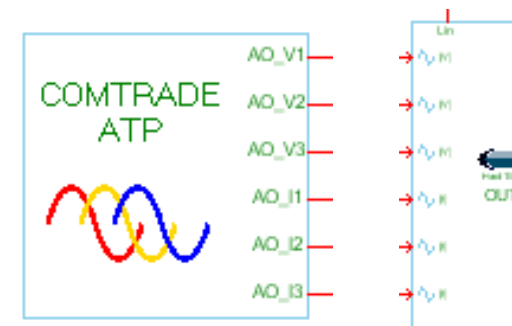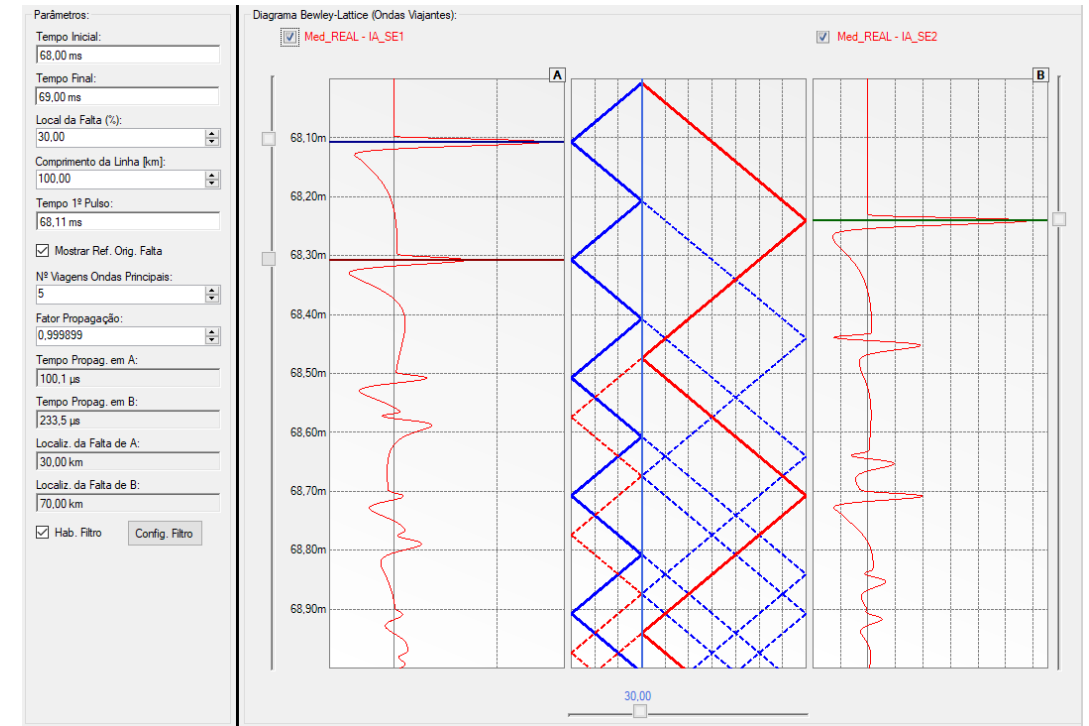
Remote Generation

- Controlling **multiple test sets** on the same screen

- **Local** Network or **Cloud**

- Centralized Control

- **Report Concentration**

- Application:

  – **End-to-end** testing
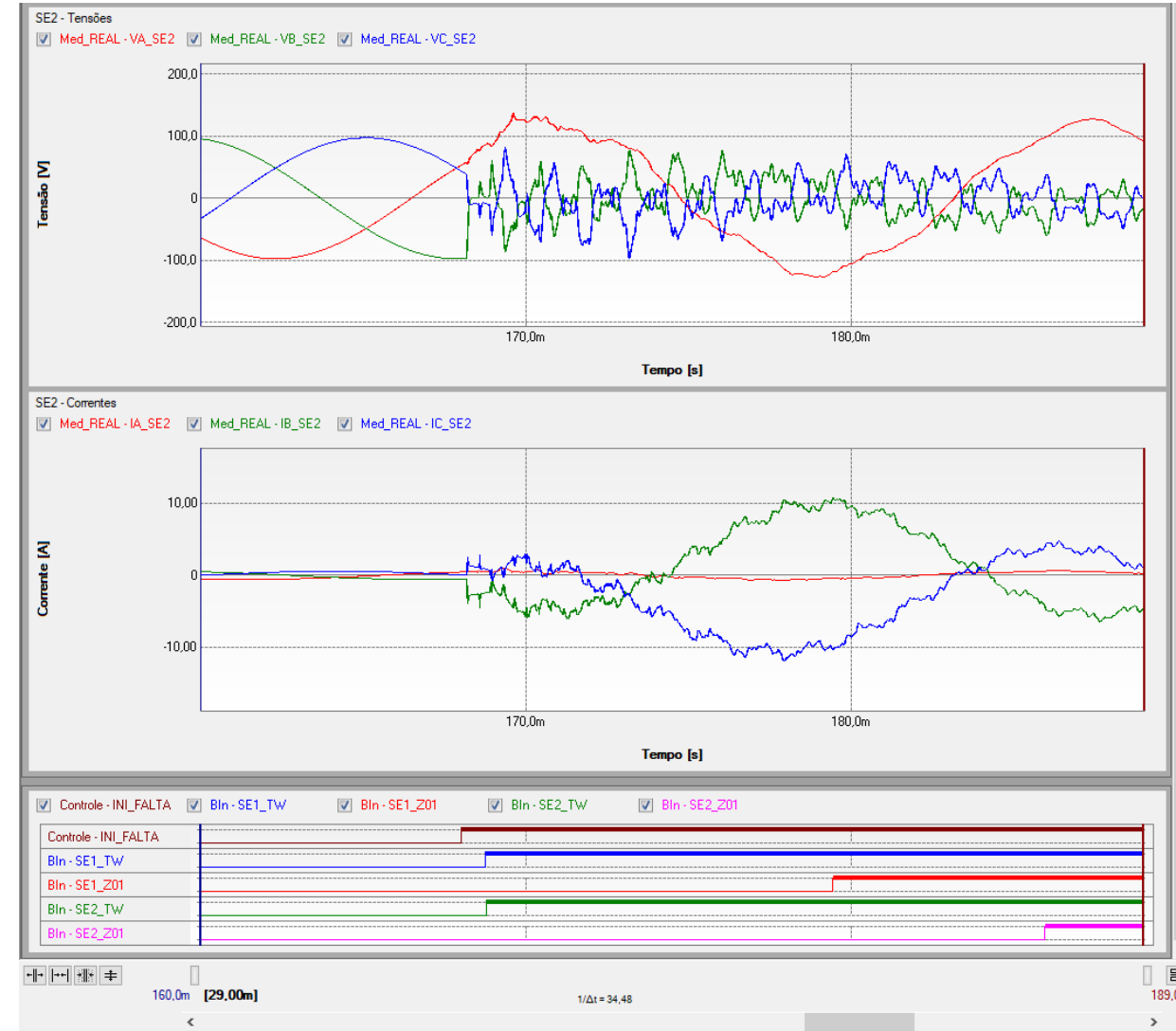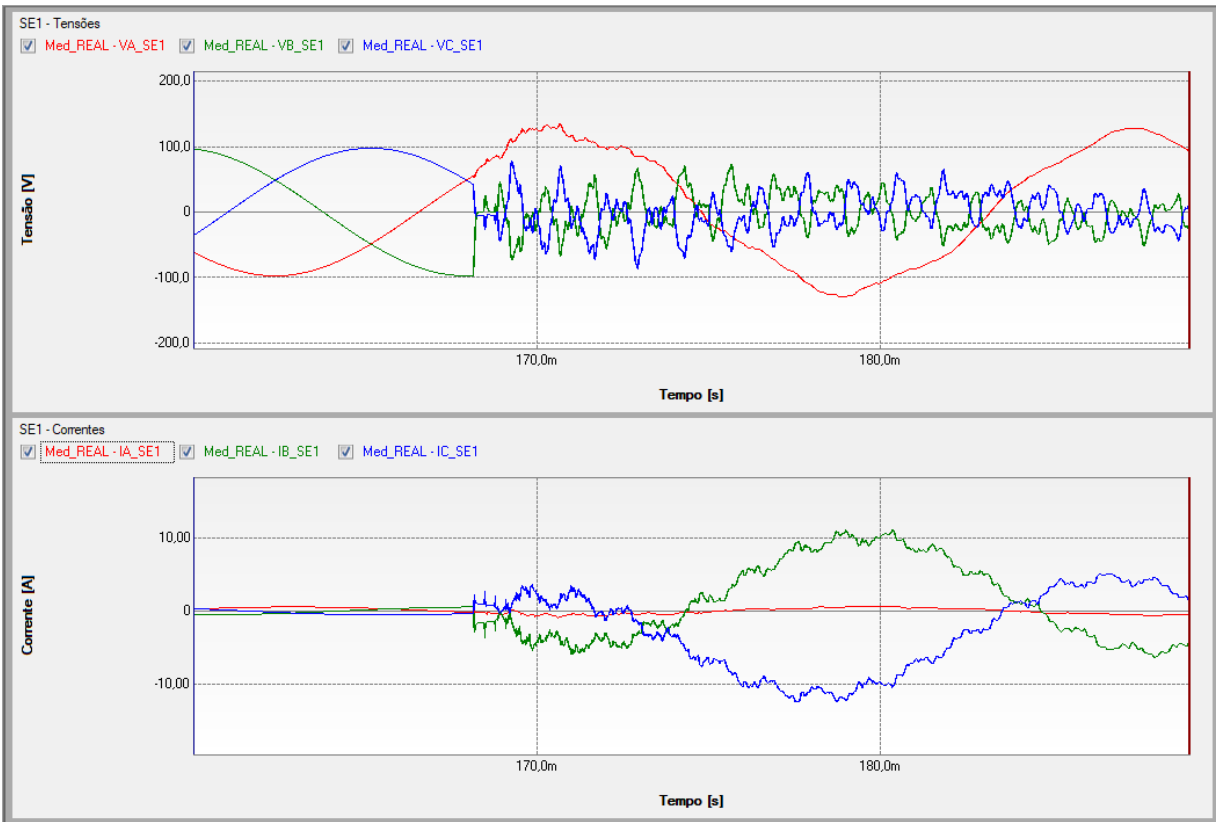
  – **Distributed** testing

Case Study

- Power System (230 kV class) modeled in **PS Simul**

- Test cases changing: **Fault type, fault location, incidence angle**

- Running **76** test scenarios repeated **3** times each **-> 228 tests**
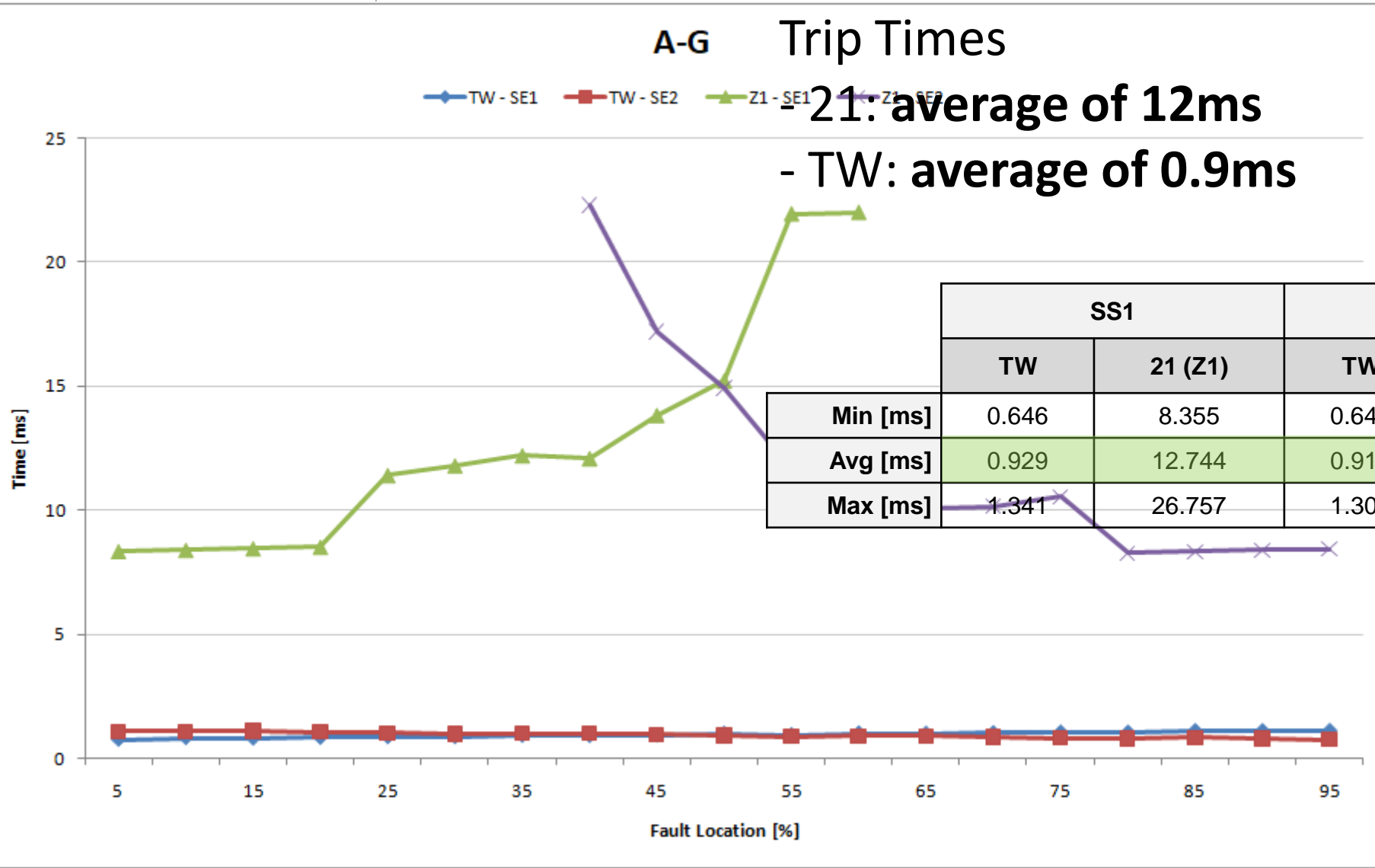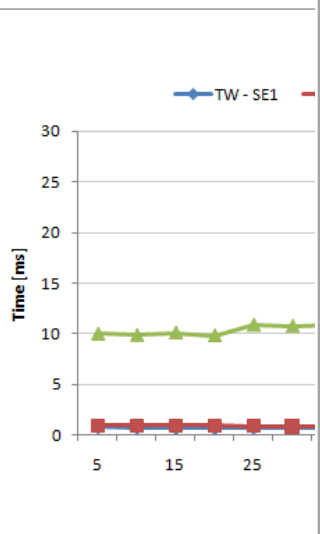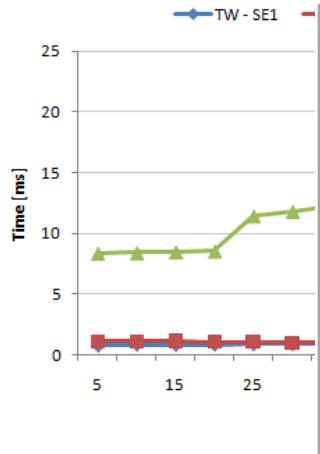
- Injection into **commercial IEDs**
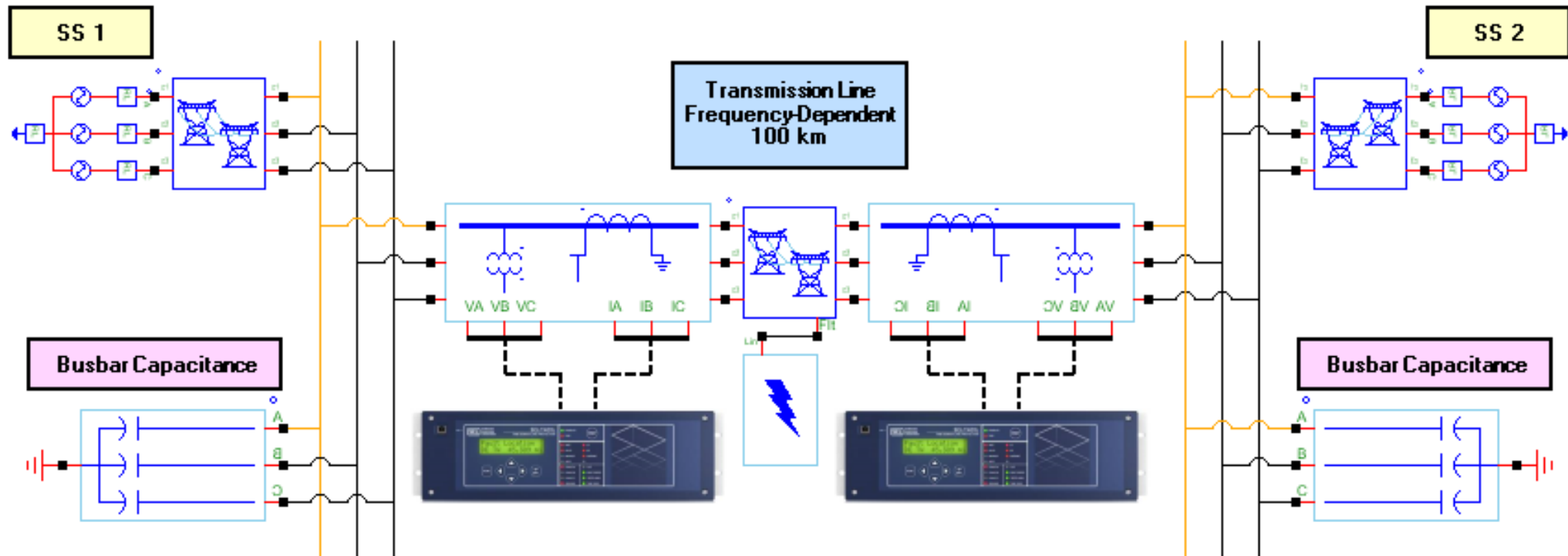
- **BC-G** Fault
- Location: **45%**

Trip Times

- 21: **average of 12ms**

- TW: **average of 0.9ms**

	SS1		SS2	
	TW	**21 (Z1)**	**TW**	**21 (Z1)**
Min [ms]	0.646	8.355	0.646	8.250
Avg [ms]	0.929	12.744	0.918	12.223
Max [ms]	1.341	26.757	1.306	27.035

Trip Time x Fault Location

- The further away from the terminal, the longer the operating time

Conclusion
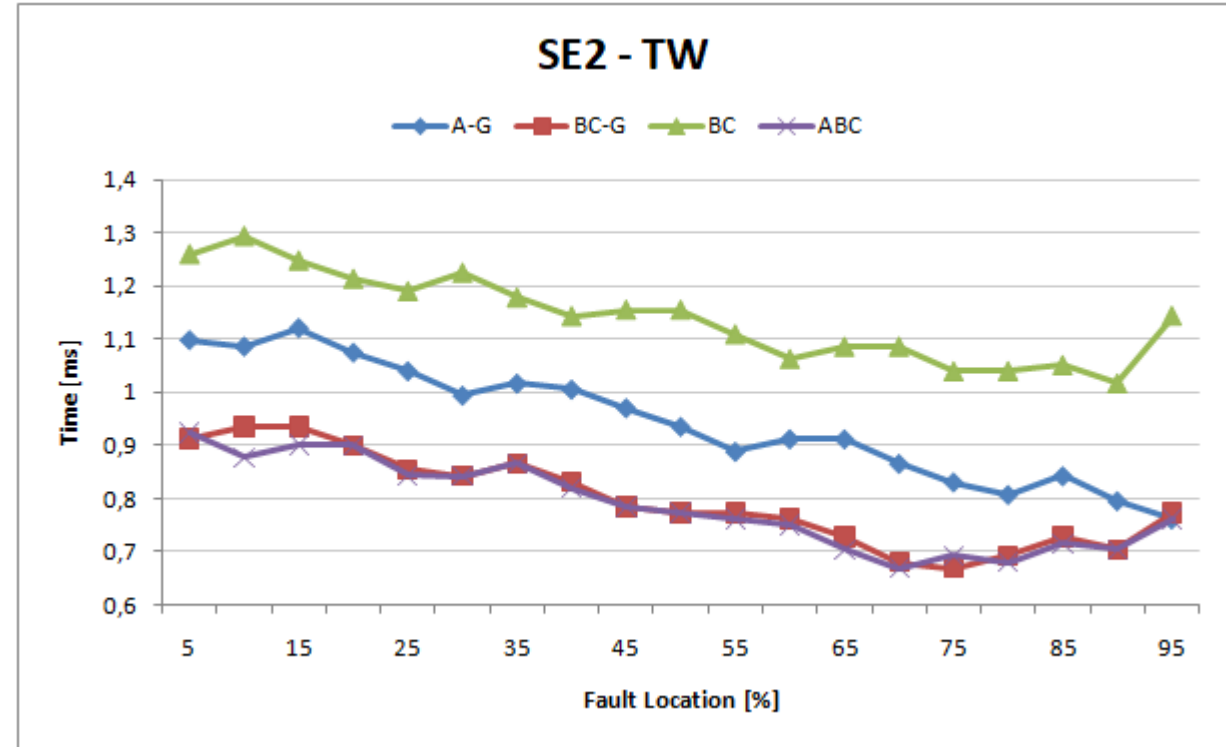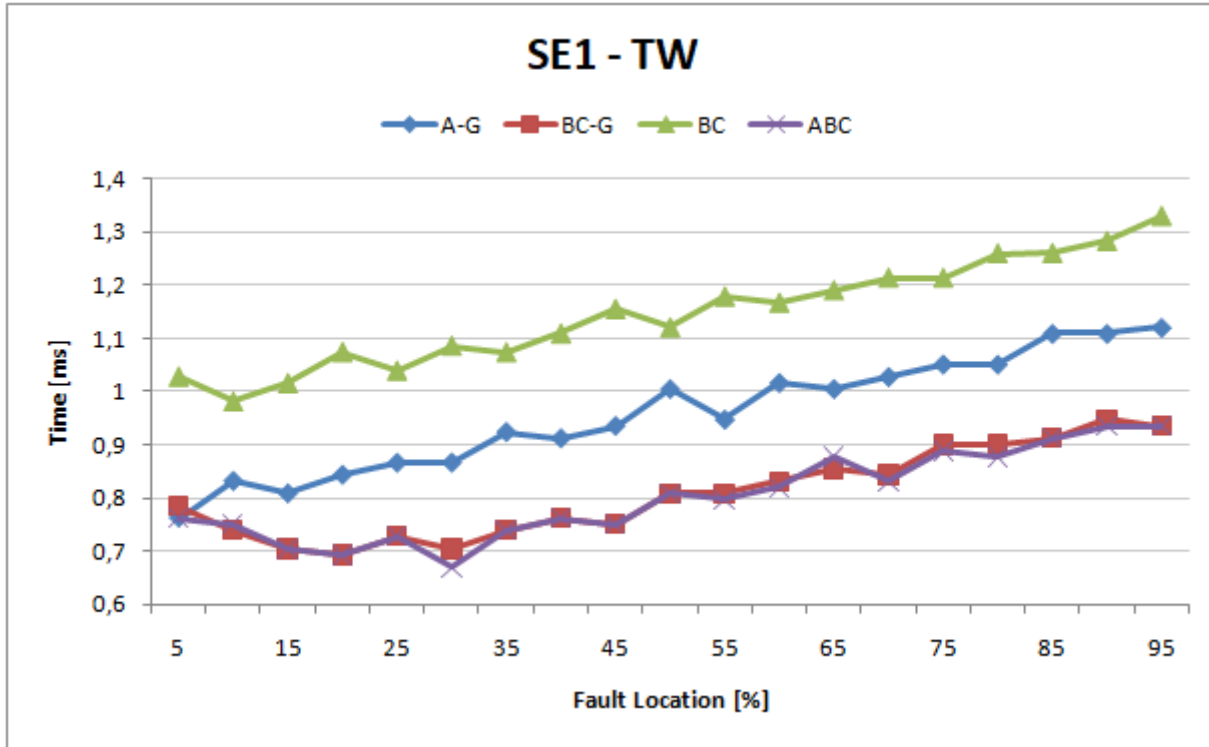
- **228 Contingency scenarios** tested

- Most **Trip times less than 1ms**

- **Min = 646 us**

- Importance of **testing** the IED in **conditions** close to **real** ones

- **PS Simul** -> reliable models -> realistic waveforms

- **CE-TW1**

  - **Powerful** tool

  - **Secondary level**

  - **Megahertz**

THANK YOU!

Paulo Sergio Pereira Junior

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