

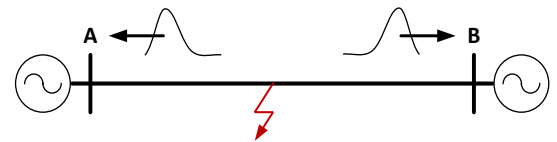
# HIL Traveling-Wave Test System

OPAL-RT has achieved the first FPGA-based Hardware-in-the-Loop (HIL) test of traveling wave fault locators using a three-phase power grid model simulated at a time step of 500 ns. OPAL-RT's objective is to bring to the protection market an advanced traveling-wave test system. The successful and accurate operation of two SEL-T400L in protective relays in OPAL-RT labs using an OP4510 Real-Time Simulator is a major breakthrough towards that goal.



## WHAT IS TRAVELING-WAVE FAULT LOCATION?

Traveling-wave fault location (TWFL) is a technique that allows for faults to be located along transmission lines with an accuracy of a few meters for lines of hundreds kilometers long. Protective relays with traveling-wave based fault locating techniques are being introduced coming to the market.



## HOW TRAVELING-WAVE FAULT LOCATION WORKS.

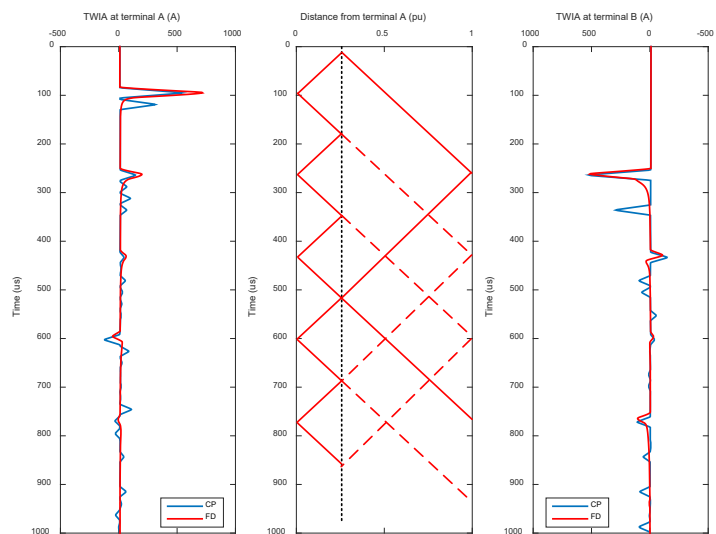
Following a fault, the wave fronts travel along the line at a speed close to the speed of light. The arrival times of the wave fronts travelling from the fault location to the ends of a transmission line are compared in order to locate the fault. To achieve a few meters resolution, measurements need to be taken at a very high sampling rate, for example, 1 MHz in the SEL-T400L.

## TRAVELING-WAVE TESTING SOLUTION

HIL Traveling-Wave Testing Solution is the ideal testing approach for the latest TWFL technologies. However, the real-time power grid model needs to be executed at a high sampling rate.

Moreover, transmission line models need to be accurate to avoid introducing artificial transients that are present in simplified line models such as the constant parameter (CP) line, also known as the Bergeron Line Model.

OPAL-RT is bringing the world's first accurate sub-microsecond HIL TWTS to the market.



### ABOUT OPAL-RT TECHNOLOGIES

OPAL-RT is the world leader in the development of PC/FPGA Based Real-Time Digital Simulator, Hardware-In-the-Loop (HIL) testing equipment and Rapid Control Prototyping (RCP) systems to design, test and optimize control and protection systems. used in power grids, power electronics, motor drives, automotive industry, trains, aircraft and various industries, as well as R&D centers and universities.