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Experimental validation of an advanced DC protection scheme for
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Name: Abdullah Emhemed and Chung Fong
University: Strathclyde
Supervisor: Graeme Burt
Email: Abdullah.emhemed@strath.ac.uk



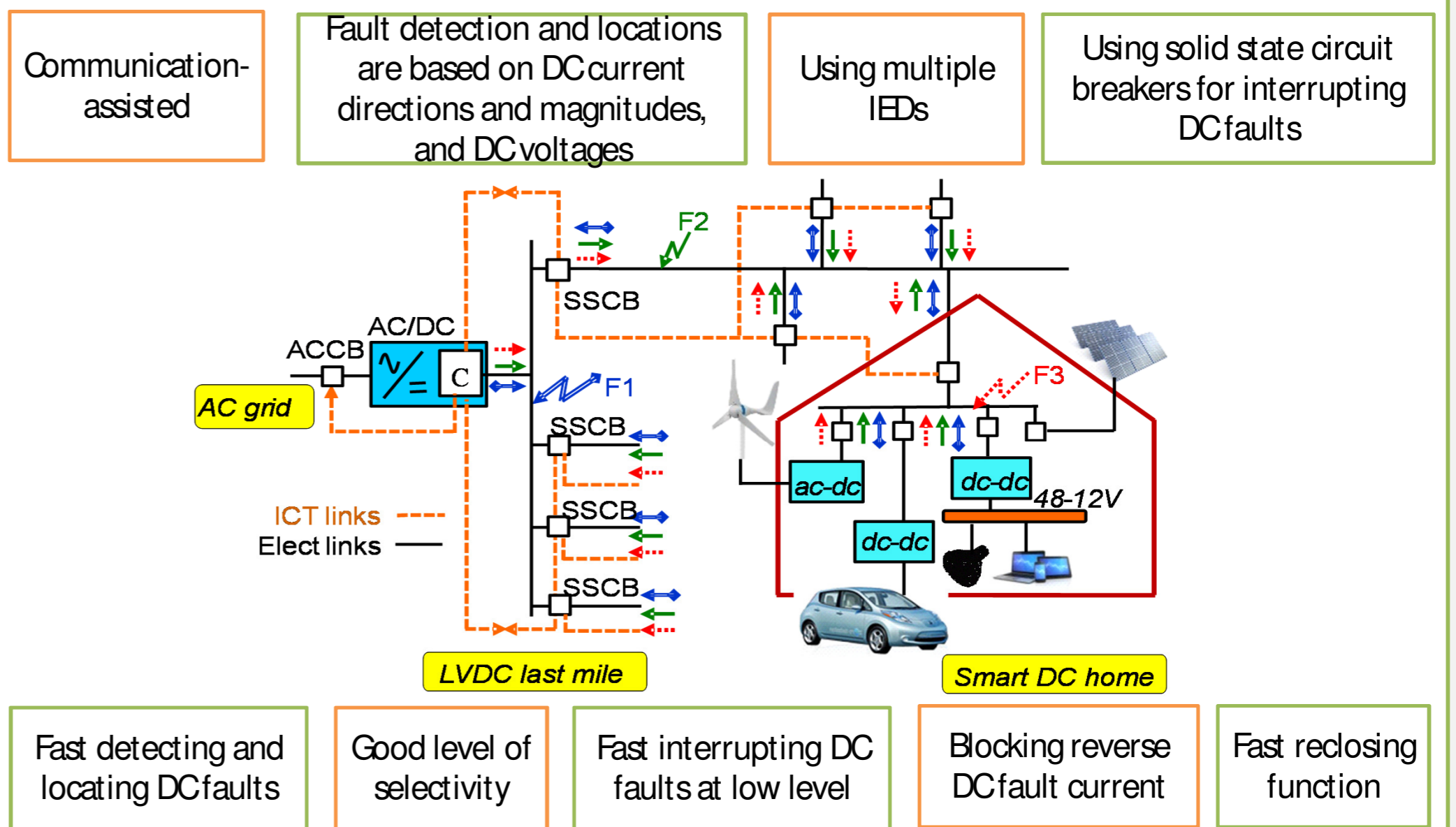
Introduction

LVDC distribution systems have the potential to support future realisation of smart grids functionality. They do however present significant protection challenges that existing schemes based on DC fuses and conventional circuit breakers cannot manage due to slow device performance. Therefore, this research introduces an advanced protection scheme that addresses the outstanding challenges facing realisation of last mile DC distribution. The developed scheme has been validated using experimental testings.

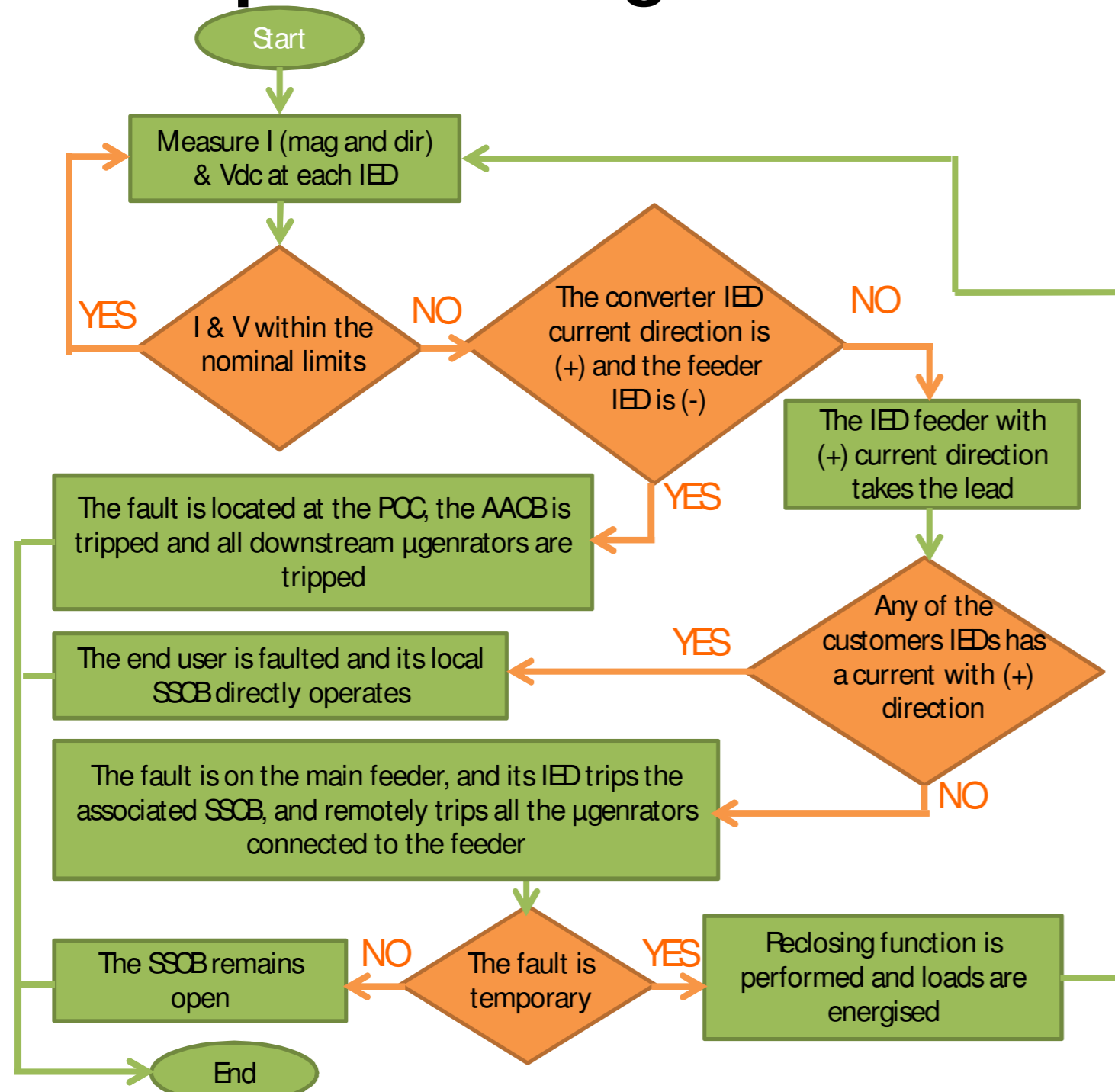
Why LVDC protection is an issue?

- Very high transient DC fault currents
- Slow performance of existing LV non-unit protection schemes
- Sensitive devices become defenceless against high transient DC faults
- The rapid depression of DC voltages will spread due to the limited impact of cable reactance leading to unnecessary converter trips, and poor protection selectivity.
- Power quality issues due to high post-fault transient spikes of DC voltages
- Sympathetic tripping of local microgeneration against remote DC faults

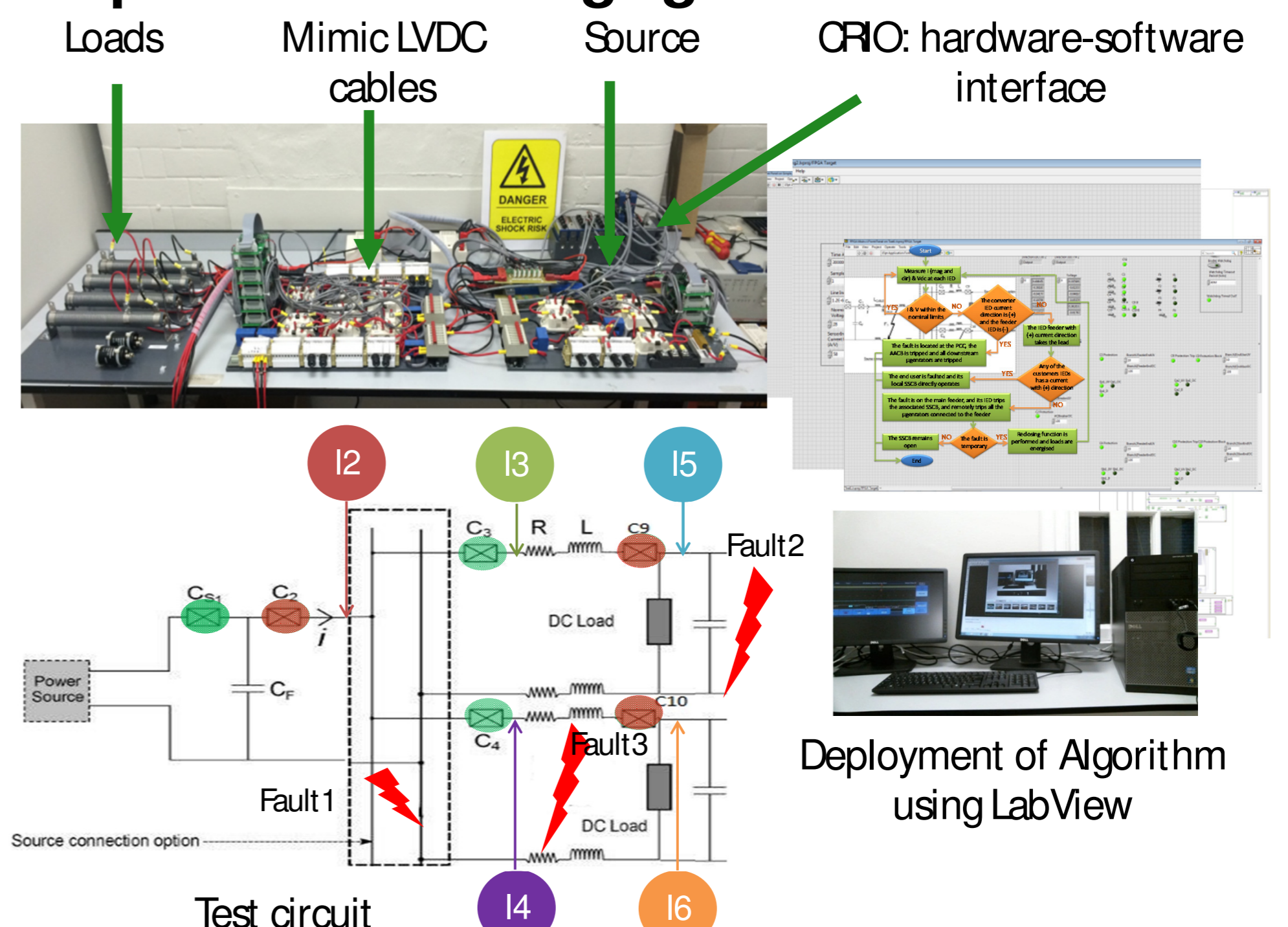
Fast acting multi-function LVDC protection scheme



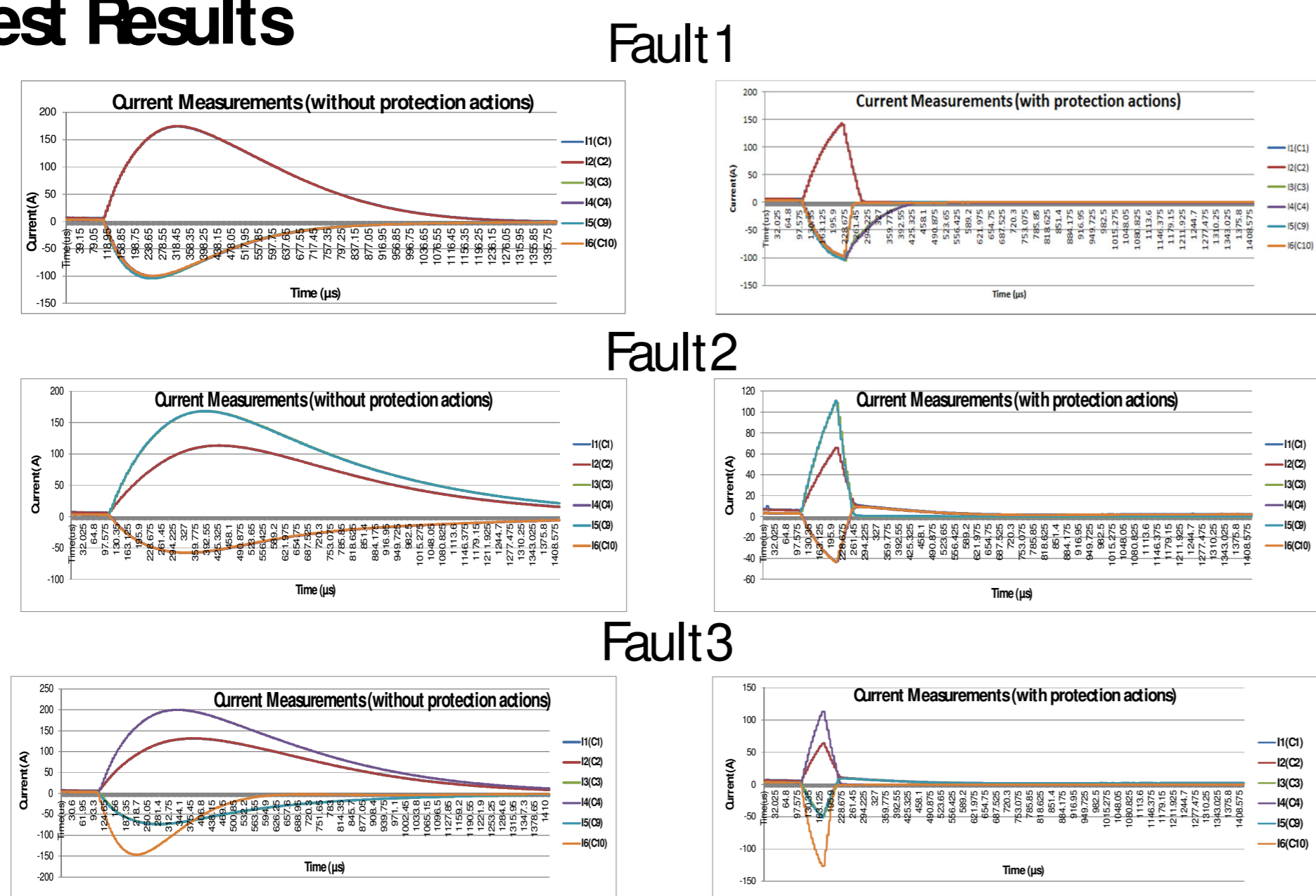
Multifunction protection algorithm



Low power LVDC testing rig



Test Results



Conclusions

- The developed DC protection scheme has demonstrated more resilient LVDC network performance by offering the following protection functions: fast detection of DC fault, good selectivity level, interrupting DC faults at low levels, and blocking reverse DC fault.
- The AC-DC converter and local generation ride through capabilities can be improved by interrupting the DC faults during capacitors' discharging periods.
- This work has supported IEC SG4 and the IET LVDC power systems code of practice