

Paris Session 2022



Application of RSFCL for MTDC Grid protection

SC A3

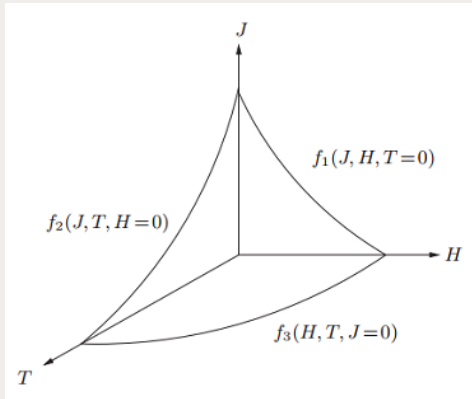
PS1 Q3 Can specialists give any perspective views of new technologies applicable to T&D equipment ?

Christophe Creusot – France



What is a Resistive Superconductive Fault Current Limiter ?

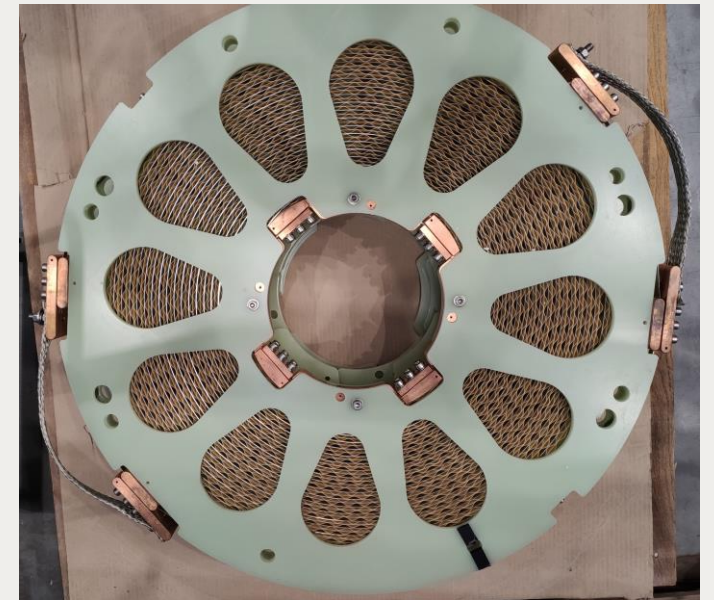
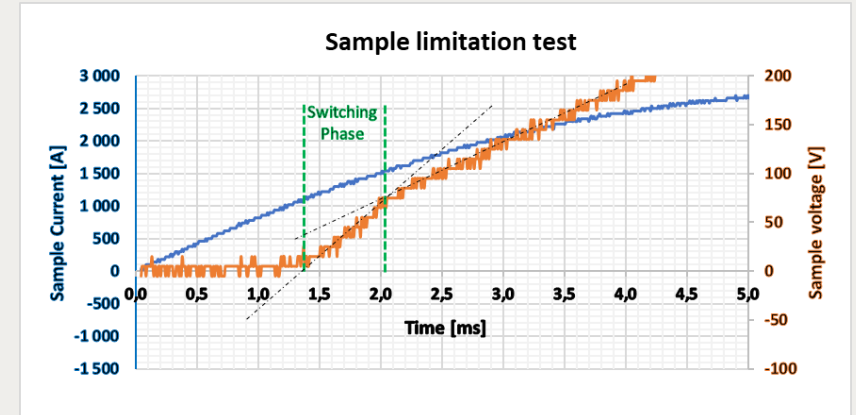
- *Basic property of High Temperature Superconductive material*



- A passive, no loss material if $T < T_c$ and $J < J_c$
 - a current density exceeding J_c will make the material switch to resistive state
- An ultra fast device switching from low loss state to resistive state in less than 1 ms

- *Operation at temperatures around 70 K (~-200°C) in liquid nitrogen bath*
- *Scalable principle from medium voltage to high voltage*
 - *Bifilar pancake type winding*
 - *Series and parallel connexions to meet the required nominal current as well as nominal voltage*

Group Discussion Meeting



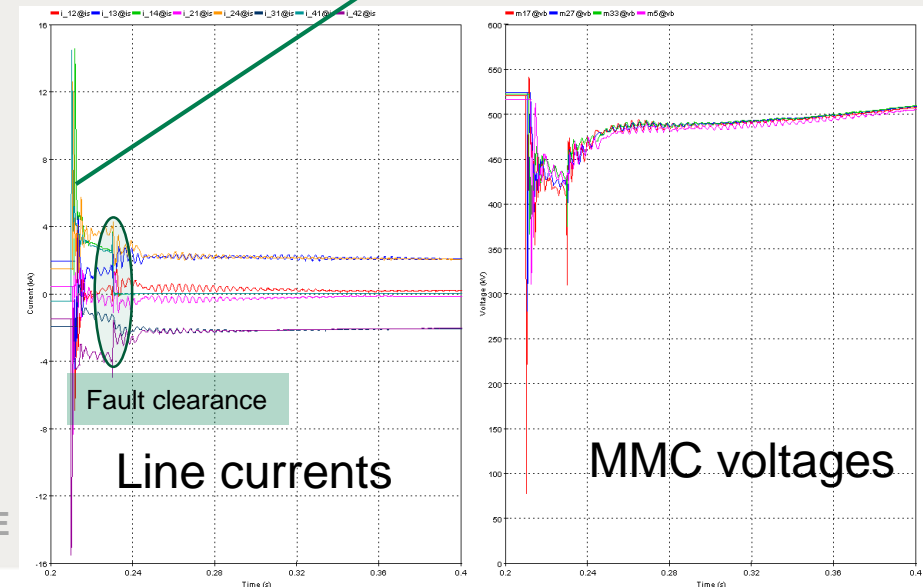
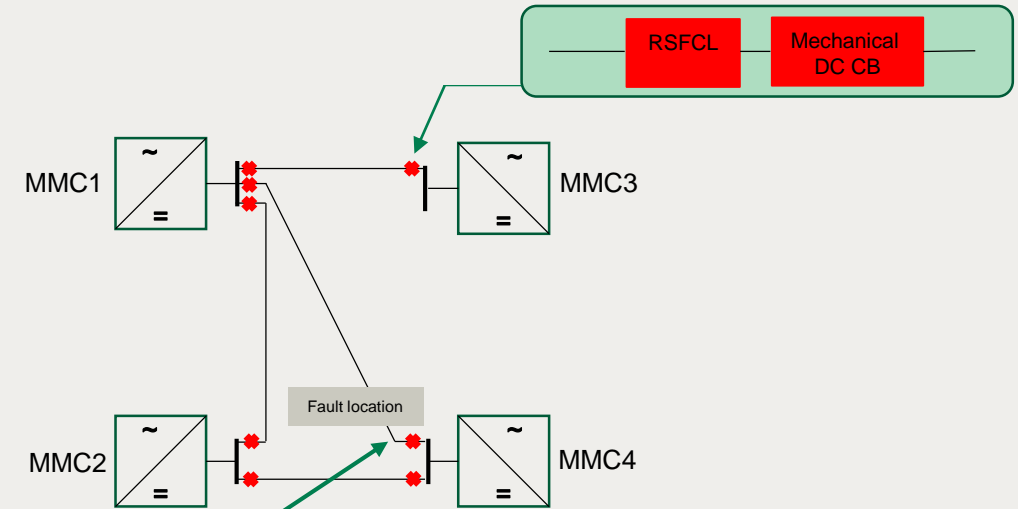
Benefits for the protection of the Multi Terminal DC grid

• Example of PROMOTioN Benchmark MTDC upgraded at 500 kVdc

- 1GW per pole $U_{max}=525$ kVdc
- Converter self protection and restoring capability are modelled
- RFCL+Mech DC CB at each line extremity
- No device at converter output
- No series reactor

• Fault simulation results:

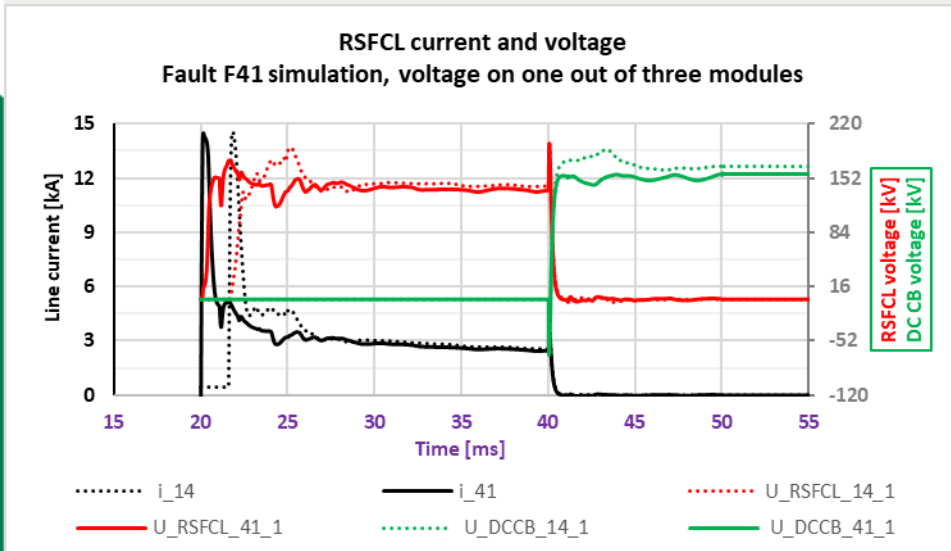
- Converter arm Current is low enough to avoid blocking and loss of control
- Fault detection location is achieved by the quenching only of the RSFCLs of the faulty line
- Power restoration on the healthy lines after fault clearance



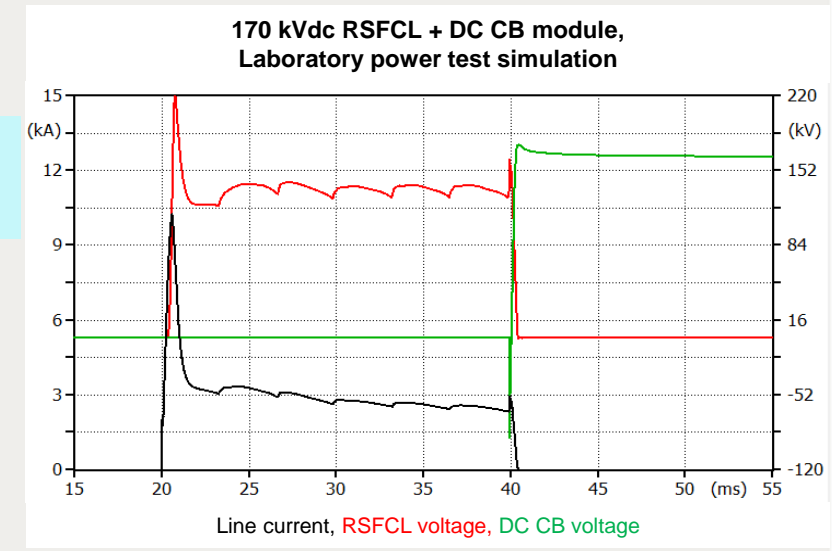
Can the RSFCL be tested in DC short circuit ?

- *DC short circuit power lab*

- A Diode 6 pulse rectifier fed by a short circuit generator delivering up to 200 kVdc
- Ex of Test of a 170 kVdc RSFCL + Mechanical DCCB module



From MTDC grid simulation
To validation test



Simulations and testing show the promising advantage of RSFCL+DC CB for Grid selective protection and a full control of the converter during a fault