Tackling obsolescence issues for power electronics

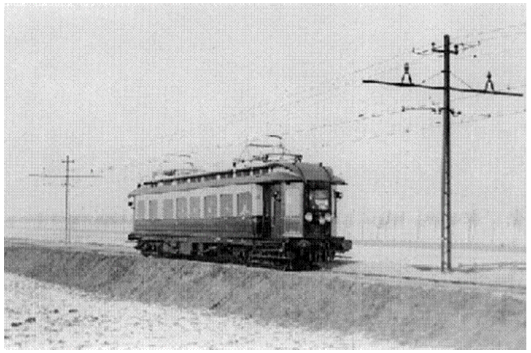
Wim Platschorre

Engineering & development Strukton Rolling Stock

Early 1900 | 1999 | 2005

Holec Traction:

- virtually all trains in the Netherlands
- Class 323 (UK & Malaysia)
- Citadis / Regiocitadis



Acquisition by **Alstom** (France)

- Alstom moves development to France
- Engineering core (Traction Centre of Excellence) acquired by **Strukton Rail**

Strukton Rail:

- Turnover $832 Mln. (2013)
- 3,400 employees

Strukton Rolling Stock:

- Turnover $32 Mln. (2013)
- 120 employees

Train operators worries:

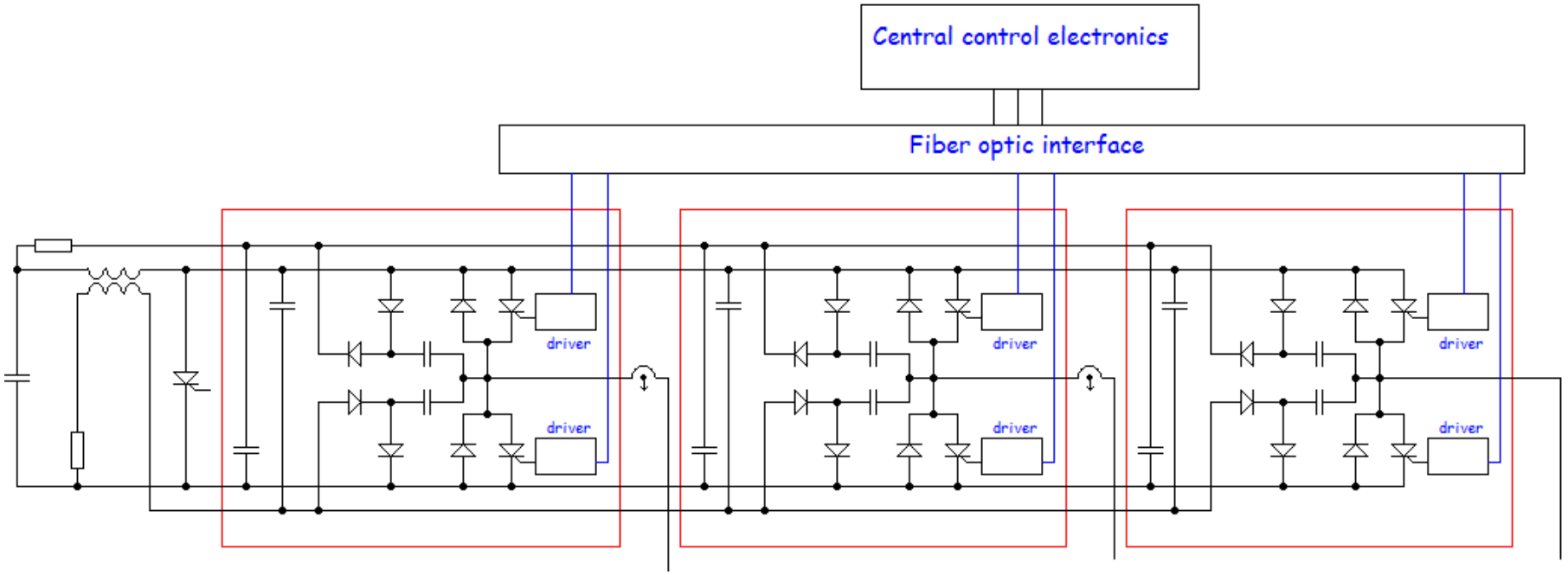
- 15 – 20 years ago: power electronics based on Gate Turn Off-thyristors
- Obsolescence of GTO’s
- DC, or upgrade to AC? Costs analysis

Train operators worries:

- Control electronics: replace or rebuilt

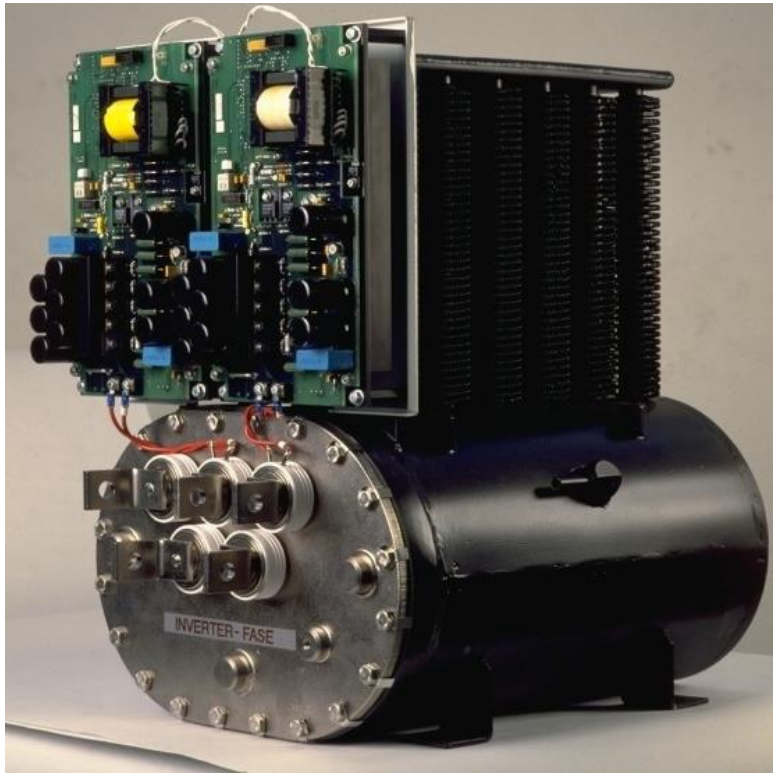
Example GTO inverter 90's

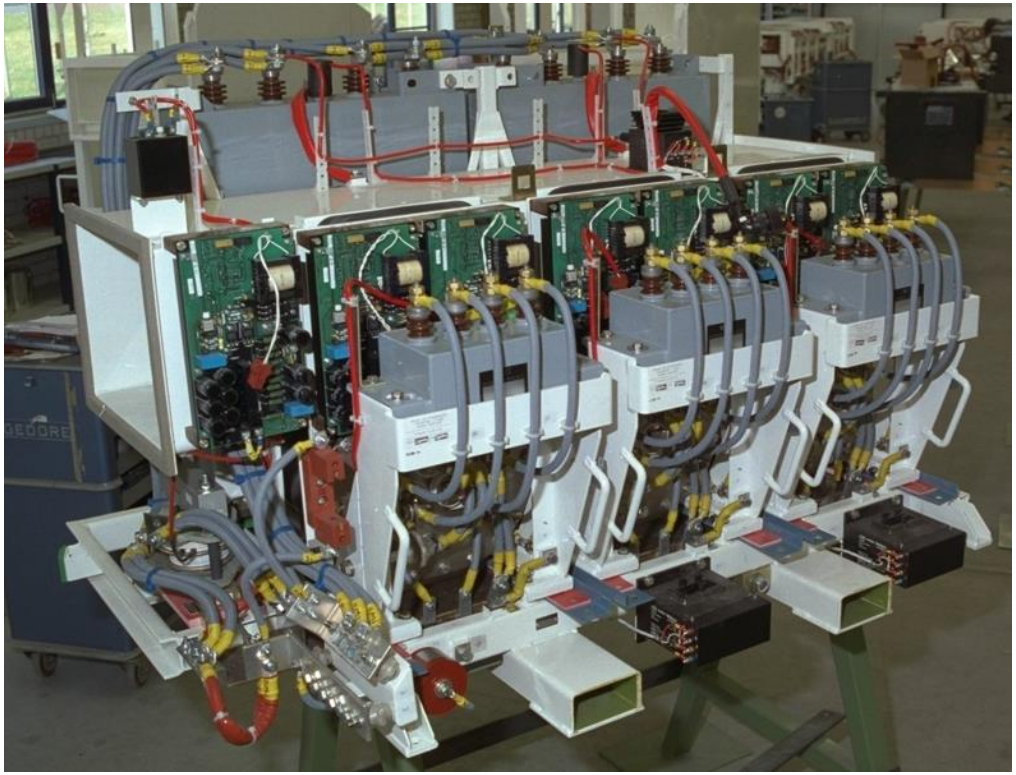
- Only partial modular, shared components
- Critical fibre optic control



Strukton Rail

Example GTO inverter 90's

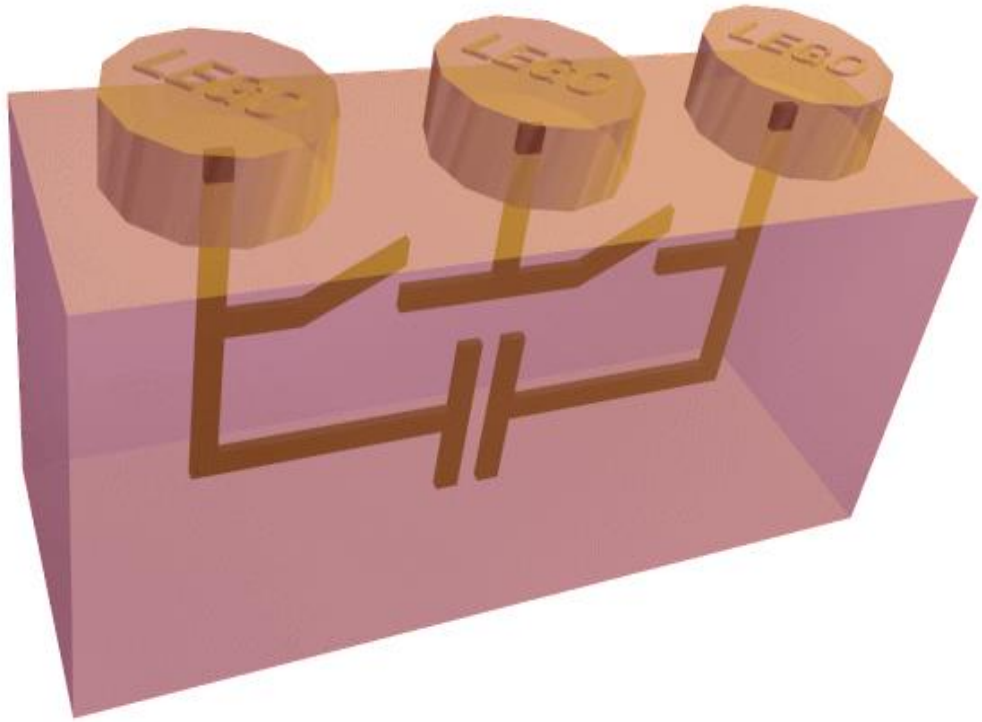




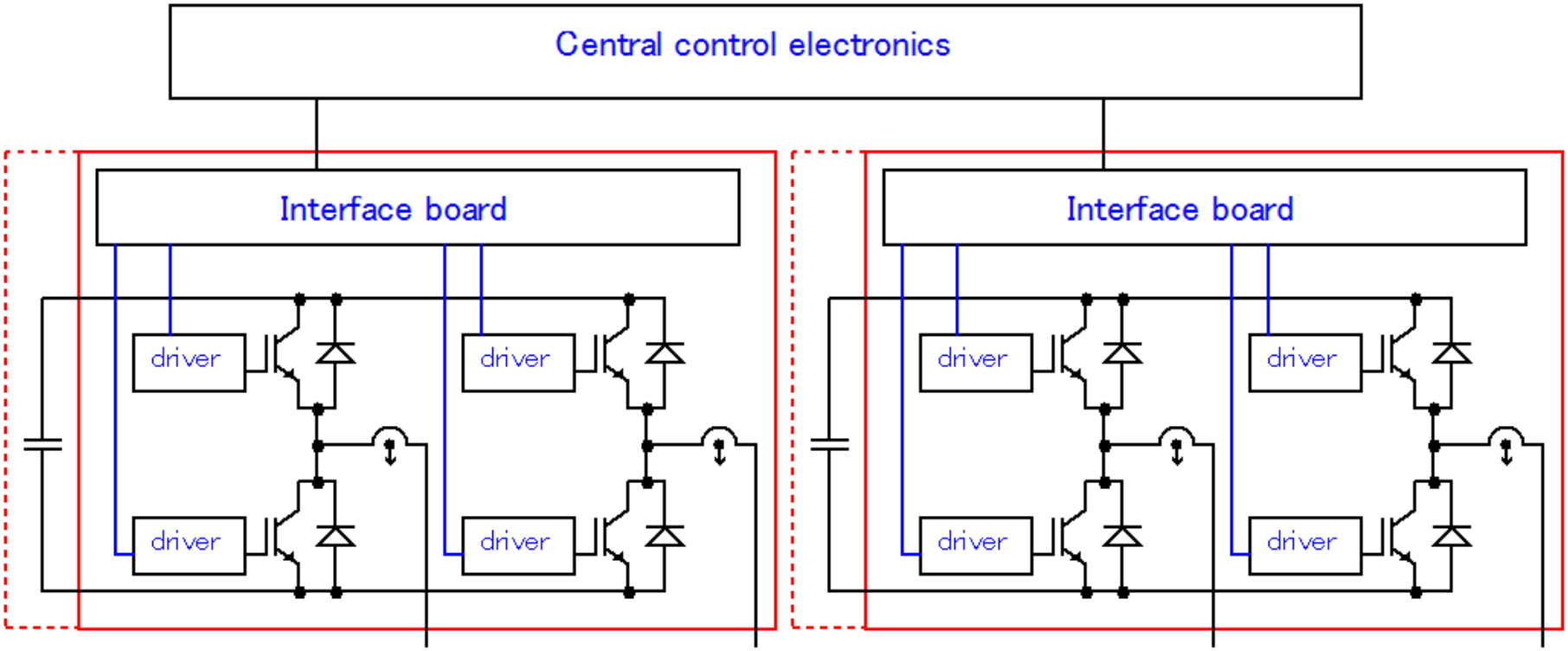
Strukton Rail

Ideal power module

- All components on modules
- Module functionality independent
- Protection and diagnosis onboard every module

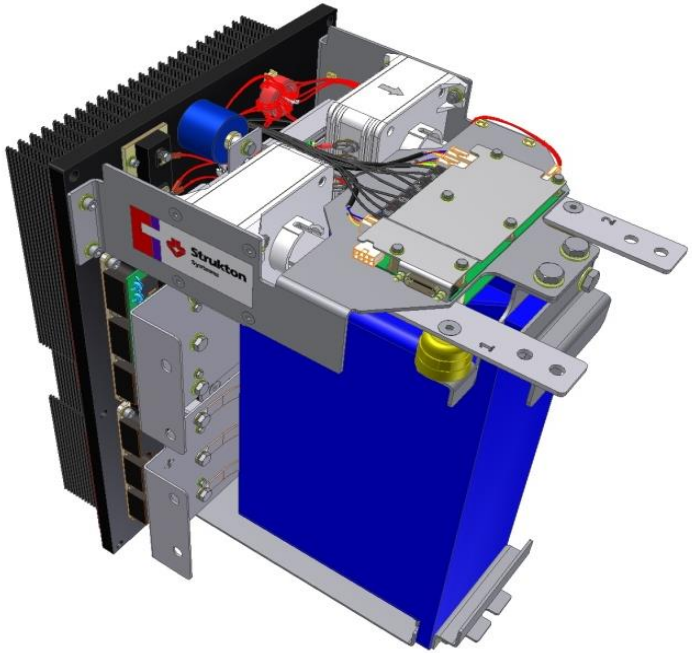


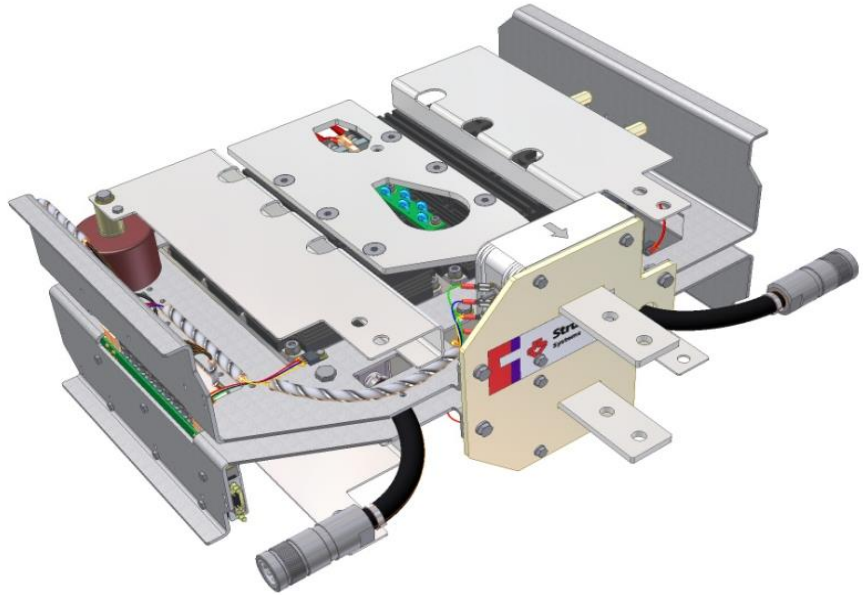
Realization

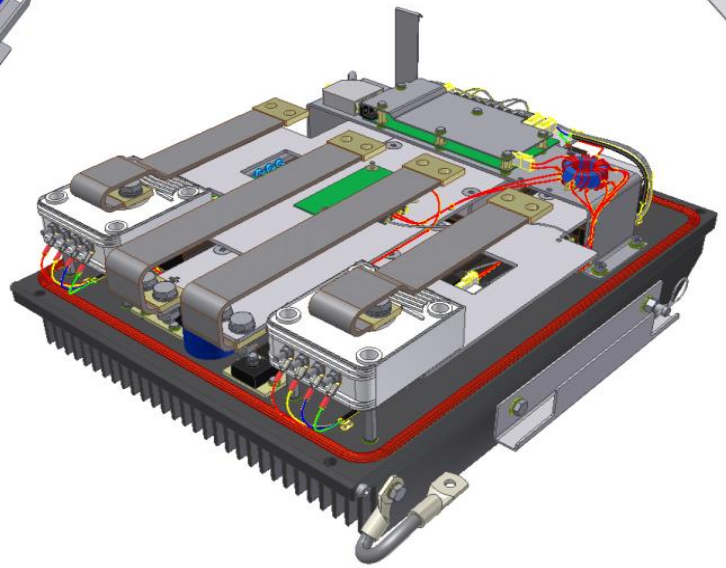


Strukton Rail

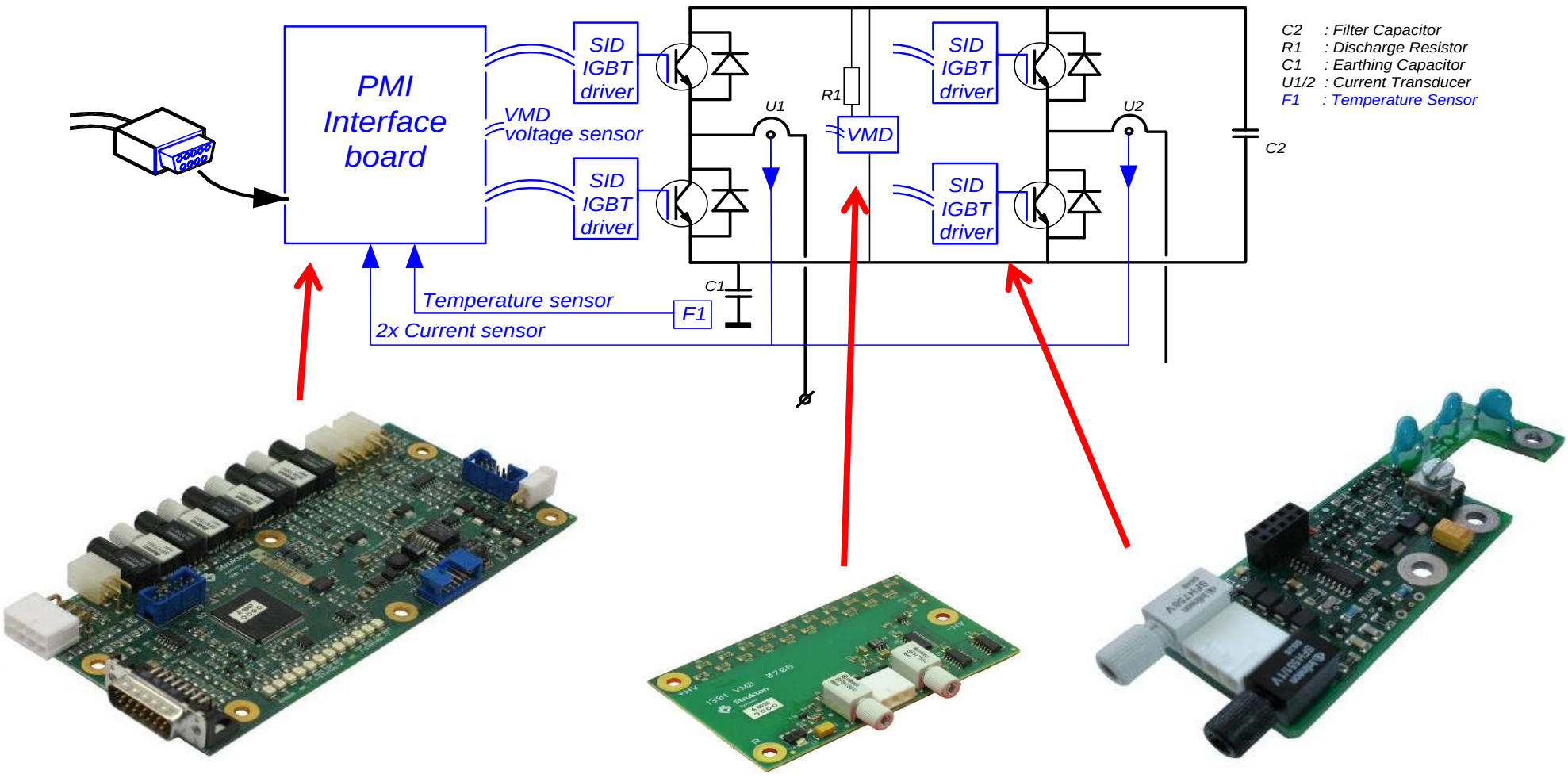
Realization





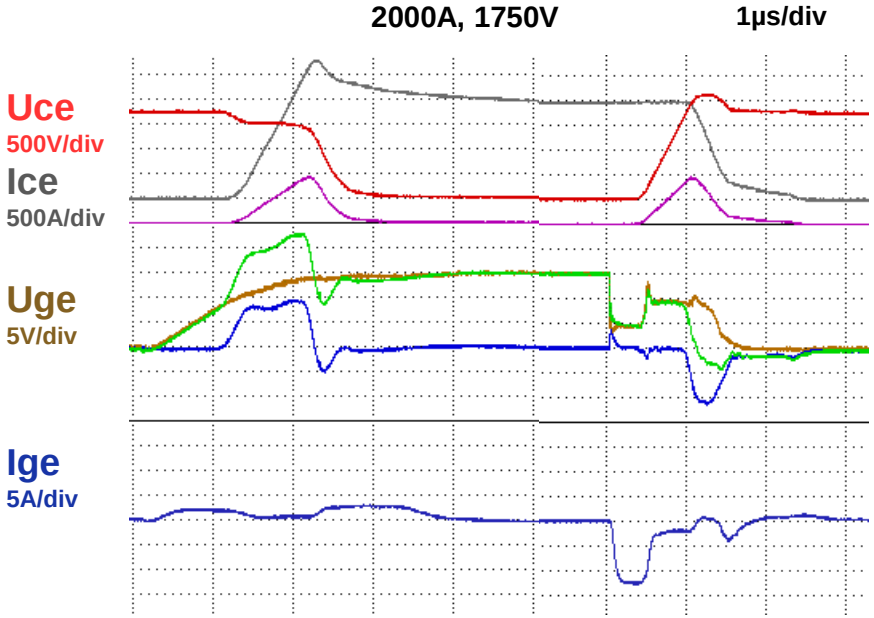


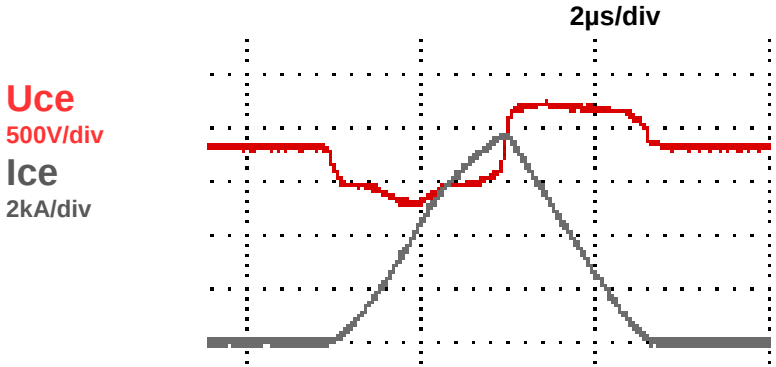
Schematics and boards



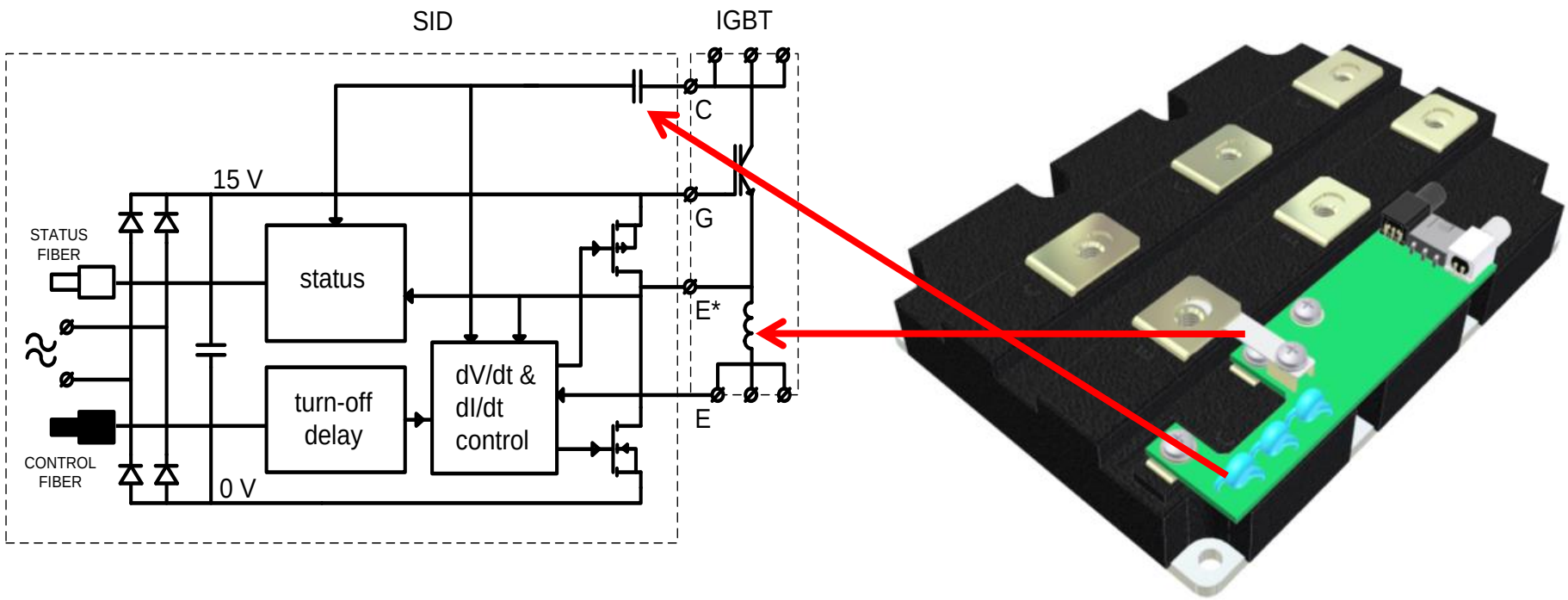
IGBT driver

- dI / dt and dV / dt control => optimized switching behaviour
- Zero dead band: turn-off and turn-on within one phaseleg simultaniously
- Fast short circuit detection





IGBT driver

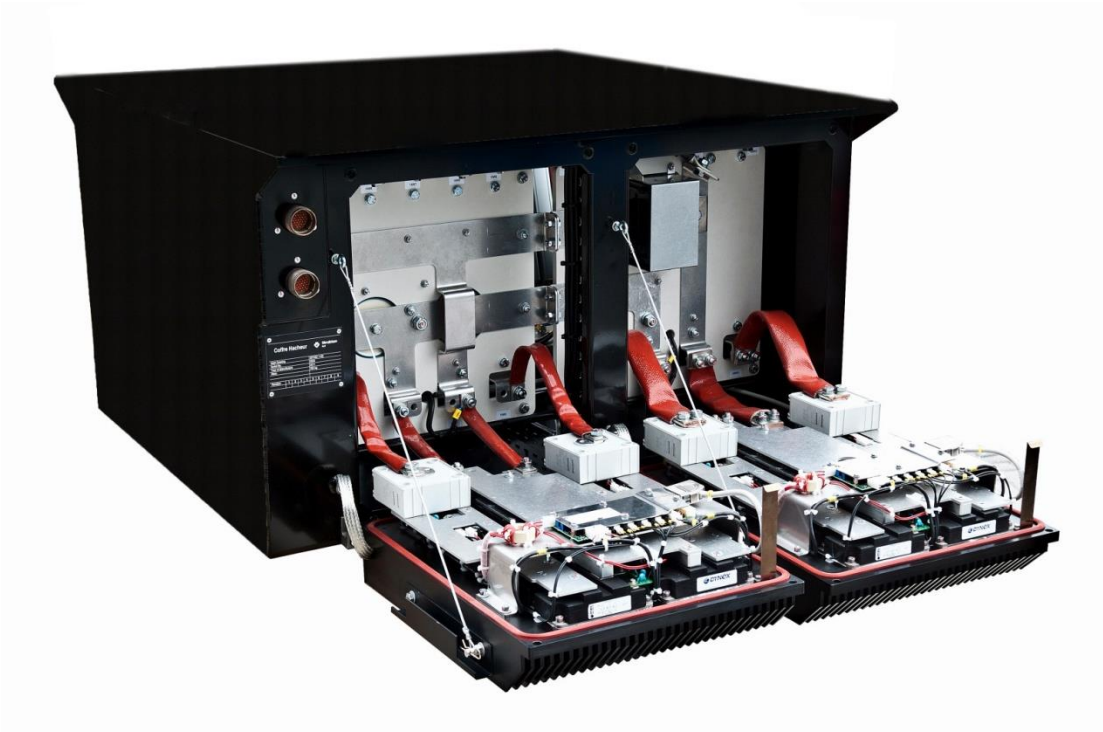

SID
IGBT
C
G
E*
E
15 V
0 V
STATUS
FIBER
CONTROL
FIBER
status
turn-off
delay
dV/dt &
dI/dt
control

Chicago O’Hare airport shuttle

- DC motors not replaced
- New control electronics
- IGBT based DC Chopper
- Integrate existing brake control in new drive box

France, Toulouse metro

- DC motors re-used
- Control electronics updated, interface to new power electronics
- Battery charger also renewed

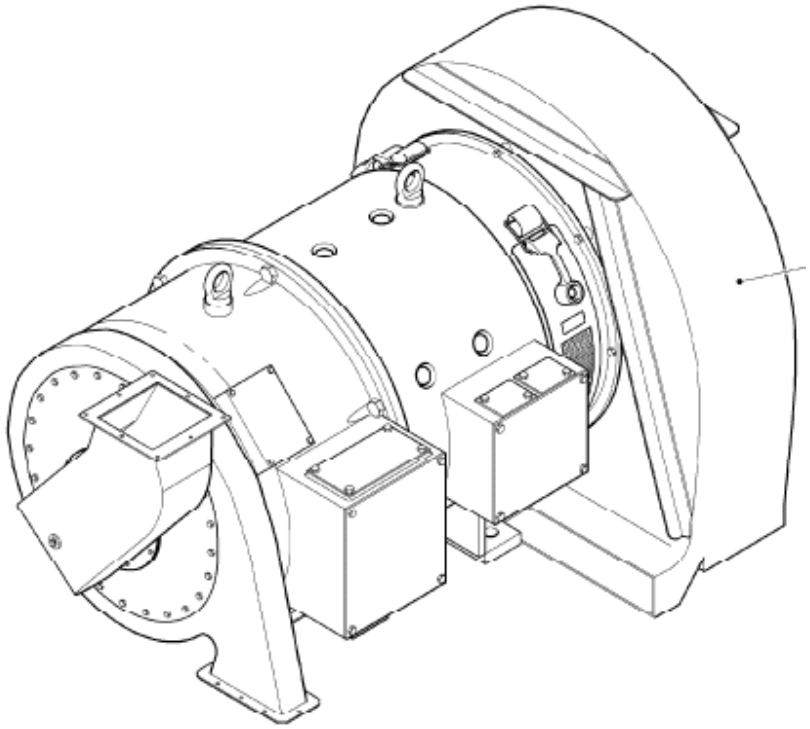


India, 6000 HP locomotive

- New build locomotives, but existing design, originally with GTOs.
- 4.5kV IGBTs
- Watercooled

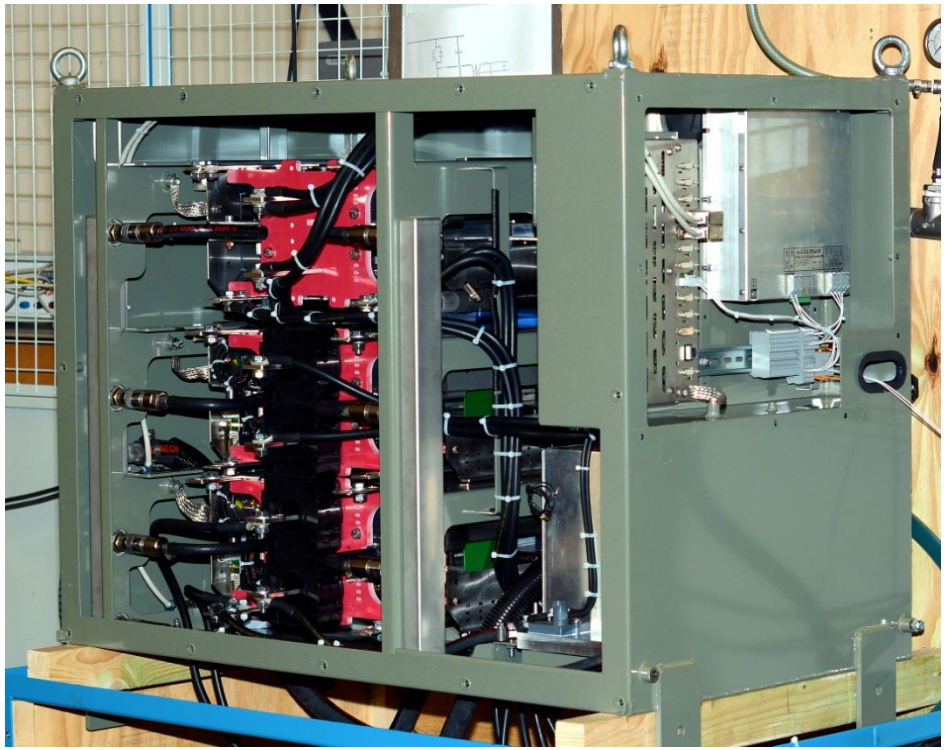
South Africa, Transnet

- Replacement rotating converter for a static converter
- Power: 150kW
- Line voltage 3kV



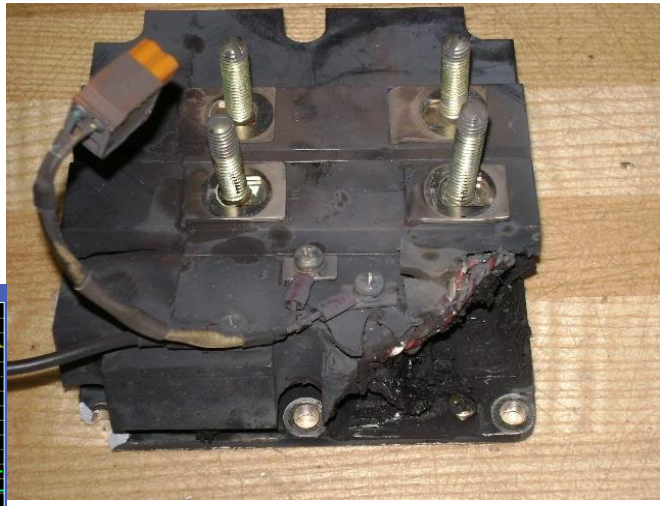
Strukton Rail

South Africa, Transnet

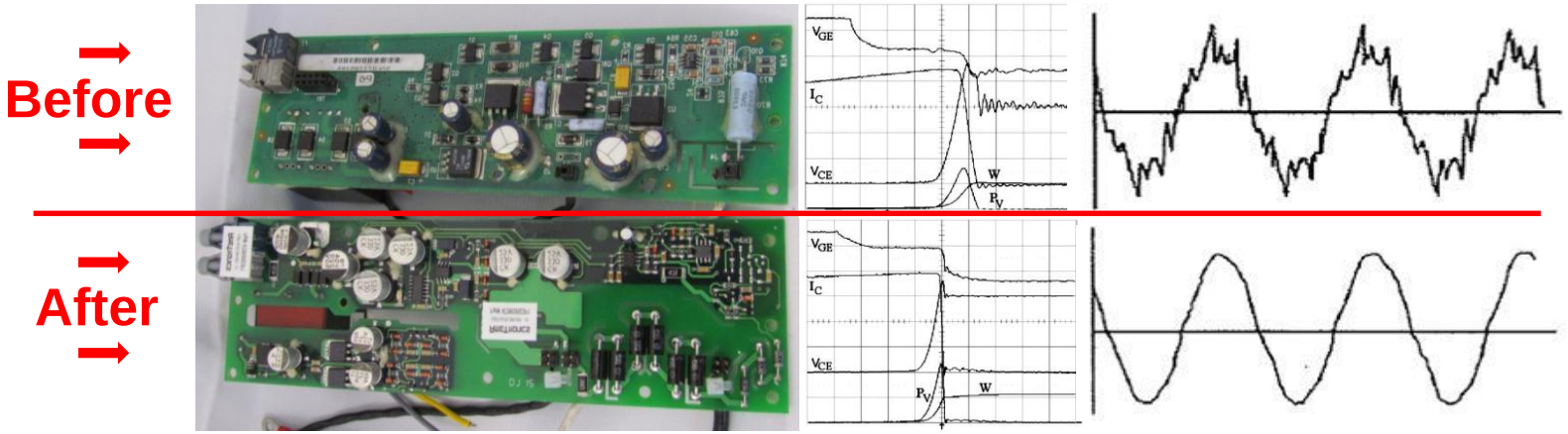


IGBT Obsolescence

- Obsolete IGBT Purchasing can a challenge
- Used and Counterfeit Problem
- Premature Failures due to Incorrect Gate Driver

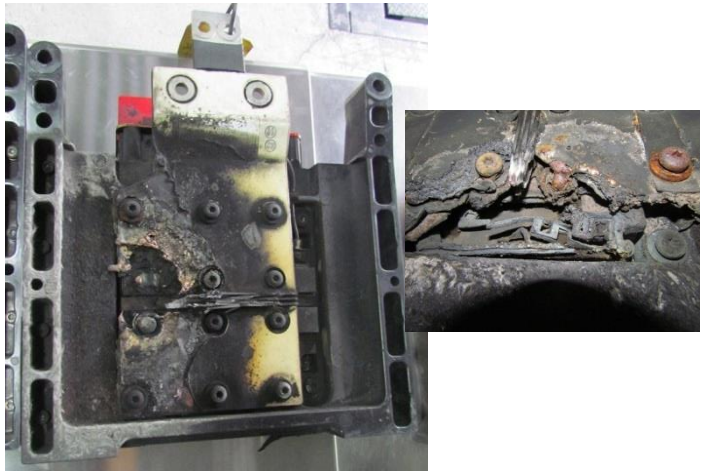


Plug & Play Gate Driver Update



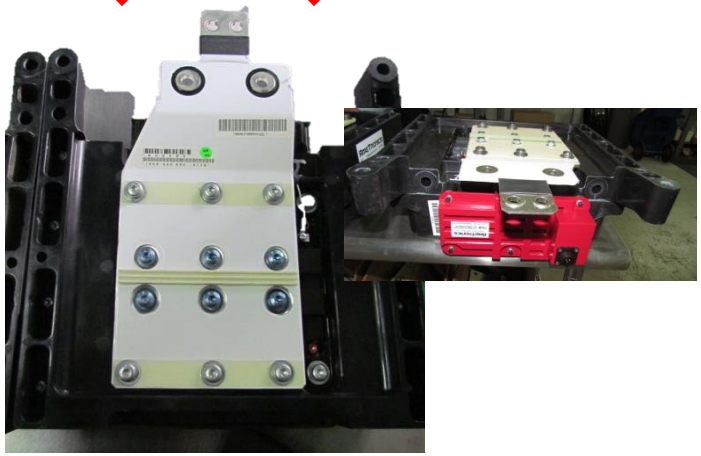
- New Gate Driver is required in order to update IGBT Model
- Maintain Same Drive Control Unit
- Fine tune switching behavior to improve IGBT Performance and Losses
- Implement new features and protection like IGBT Parameters Logging, Fast Type I short circuit protection and Enhanced Fiber Optic interface

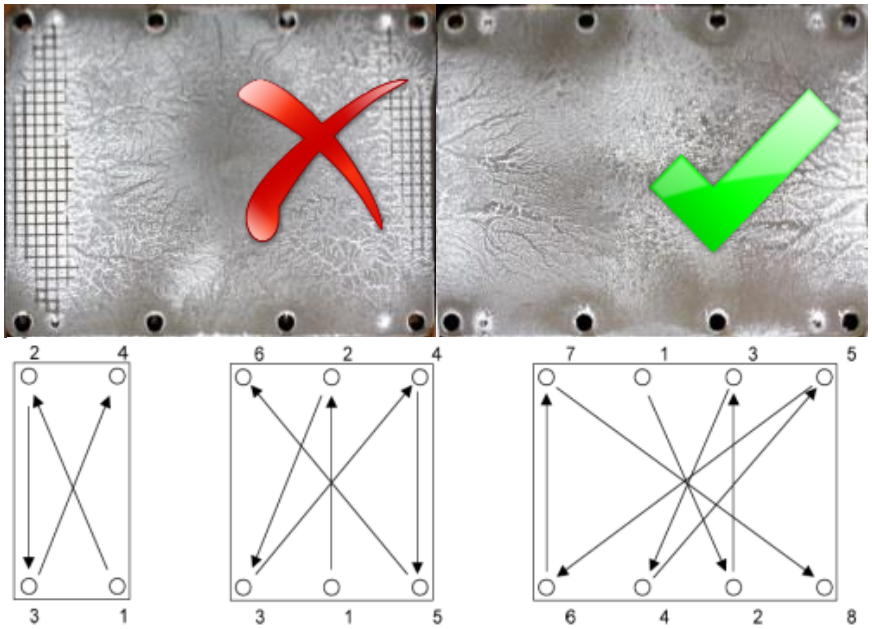
Plug & Play Phase Inverter Update



Before

After





- Correct IGBT replacement procedure
- Busbar reengineering and/or redesign

Booth 1249

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