



Brief introduction to Imtech Power Electronics



“High Gradient Day”, 31 January 2013





Imtech N.V.

- European technology supplier: core competences: electrical, ICT, mechanical
- Maritime worldwide partner
- Euronext AMX stock exchange
- 5.1 billion euro profitable turnover (2011)
- Over 29.000 employees
- Over 345 establishments in Europe
- Global network of 70 maritime branches





Organisation Imtech Power Electronics

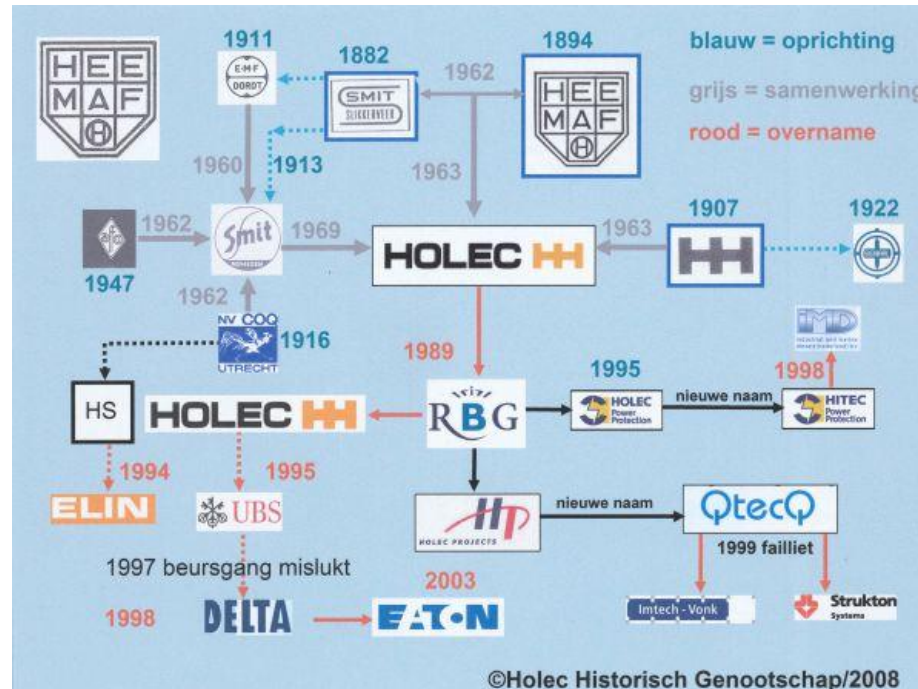
Imtech
Nederland

Imtech Industry
International
B.V.

Power
Electronics

Oil & Gas

Energy

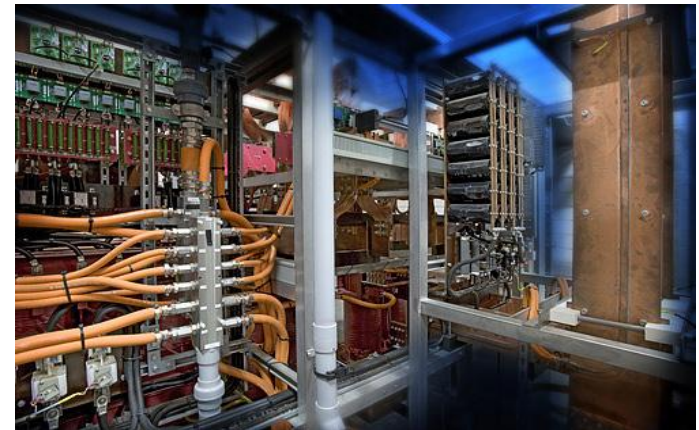


Imtech Power Electronics is derived from the well-known Holec group



Capabilities and experiences

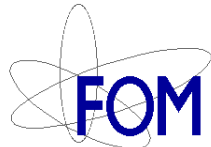
- **Examples of systems designed and built in house:**
 - DC rectifiers for fusion experiments and high field magnets
 - Power supplies for particle accelerator magnets
 - HV power supplies and pulse modulators



■ Some of our customers:



Max-Planck-Institut für Plasmaphysik



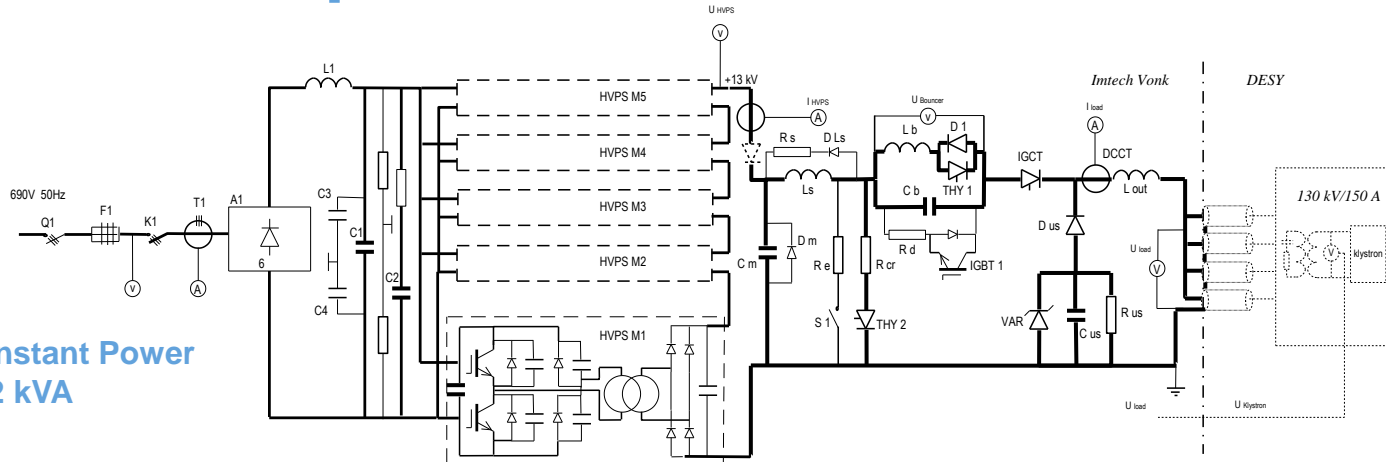
European Organization for Nuclear Research





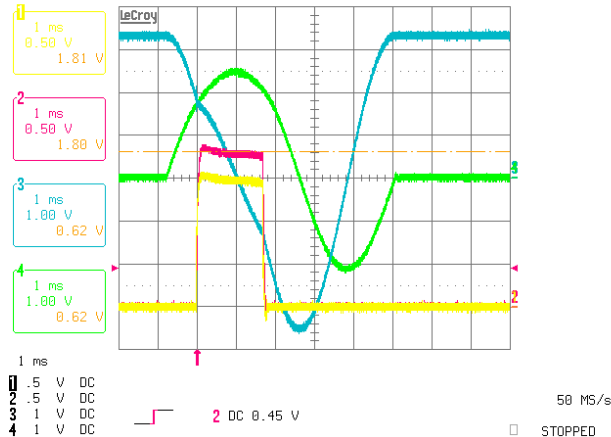
Experience: Bouncer Modulator

380 kW Constant Power
Variation: 2 kVA



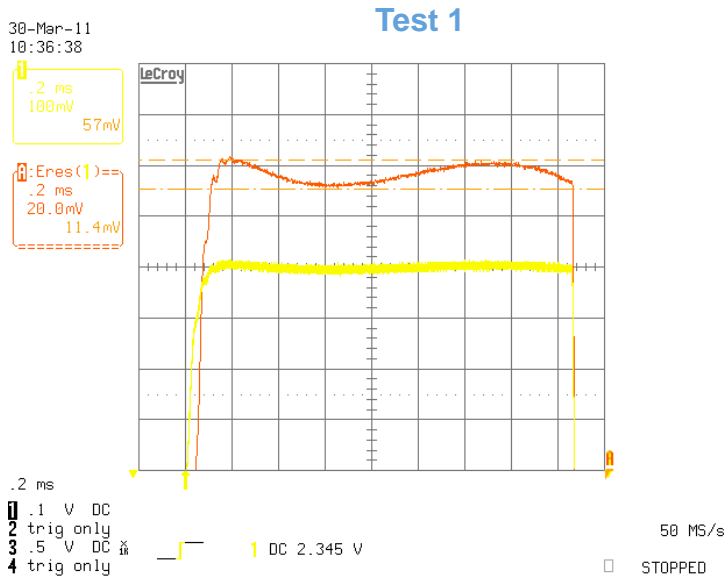
21,6 MW pulse
1,57 ms @ 10Hz

18-Jun-10
12:45:33

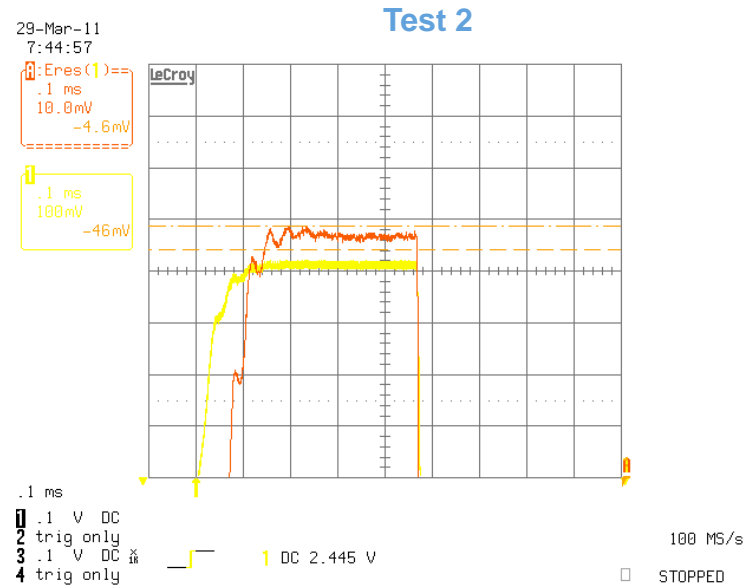




Some test results of the prototype



- Pulse length: 1,7 ms
- Mean value 2,845 V
- (85,35 kV on 5 MW Klystron)
- Flat top: 11,4 mV => +/- 0.20 %



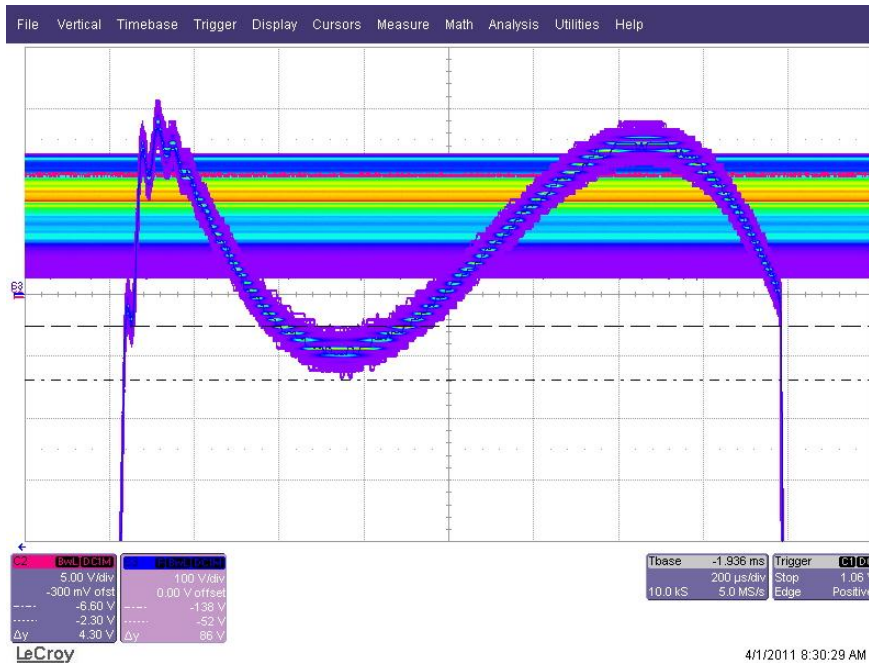
- Pulse length: 500 us
- Mean value 2,954 V
- (88,62 kV on 5 MW Klystron)
- Flattop: 4,6 mV => +/- 0.08 %

CLIC requirement:

- Pulse length: 140 us
- Flat top: 10 ppm (+/- 0,0001%)?



Pulse-to-pulse stability test of the prototype (12h)



- Pulse length: 1,7 ms @10 Hz
- 400 V mains voltage instability : > 10V = 2.5 %
(Mean value 105,784 kV on 5 MW Klystron)
- Klystron voltage instability: 86 Vt (+/- 43 V)
- Flattop worst case deviation (including mains voltage variation) = +/- 0.04 %



Challenges for the CLIC project

CLIC requirement:

- Pulse length: 140 us
- Flat top: 10 ppm (0,0001%)?

- **The pulse transformer introduces unwanted properties**
 - Rise and fall times are in the order of 50 us at least (CLIC requirement: 5 us?)
 - Non linear effects on flat top
 - (Correction of non linear effects by “active bouncer”?)



Ambitions (for the CLIC project ?)

■ Study of a High Voltage Hard Switch Modulator (without pulse transformer)

- Flexible pulse length (no transformer limitations)
- Flexible pulse frequency (no transformer reset)
- Flat top (no transformer non-linear effects)
- Higher efficiency (no transformer rise and fall times)

Disadvantages:

- High input voltage
- Oil insulation of power electronics required



Interaction with CERN in the development phase ?

- **Imtech Power Electronics is an engineering and contracting company**
- **We are custom developing**
- **Nevertheless the following may help**
 - Newsletter by which CERN presents and clarifies the CLIC modulator requirements
 - Set up an internet-forum where registered members can discuss with CERN about the CLIC modulator requirements



Shared Success with Imtech

- **A reliable and knowledgeable partner in Power Electronics**
 - In depth knowledge of electrical systems and power electronics
 - Production and test facilities for small and medium size batches
 - A quality conscious organisation working to high and if necessary special standards
- **Strong focus on our customers**
- **Added value for mutual benefit**

Imtech Power Electronics

Technology is ours, Results are yours

Shared Success!