



# MTCA.4 Products and Solutions for Accelerators at CAEN ELS

**Enrico Braidotti**

*Sales & Field Application Manager*



- Company Profile
- Product Lines and Solutions
- FMC – FPGA Mezzanine Cards
  - MTCA.4 Products
    - Q&As



## CAEN ELS d.o.o.



**Spin-off company of CAEN Spa**

Founded in 2009 in Sežana – Slovenia

### **Application fields**

Oriented and dedicated to particle accelerator facilities  
e.g. synchrotron light sources, LINACs and Free Electron Lasers

**“Know-how” and “hands-on” large installations and maintenance**

**Industrial capability**

**Customization and dedicated support**

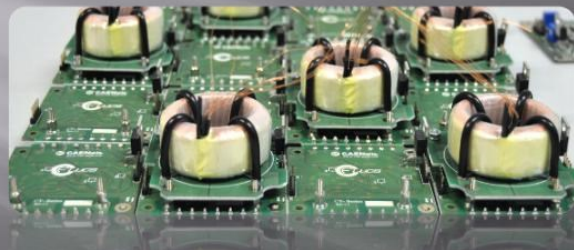




**Digital Magnet Power Supplies**  
Bipolar + Monopolar  
from  $\pm 5A$  (small correctors) to 135A  
Ethernet Interface



MAGNET  
POWER  
SUPPLIES



PRECISION  
CURRENT  
TRANSDUCERS



**DC Current Transducers**  
Closed-loop Technology  
DC + AC monitoring up to kA  
**Complete Digital T&M and Calibration Systems**

**Multi-channel Low Current Measurements**  
Dedicated Systems (Bipolar HV for Optics)  
Beamline Local Feedback Integrated System - **BEST**



BEAMLINE  
ELECTRONIC  
INSTRUMENTATION



MTC4.4  
MicroTCA  
For Physics

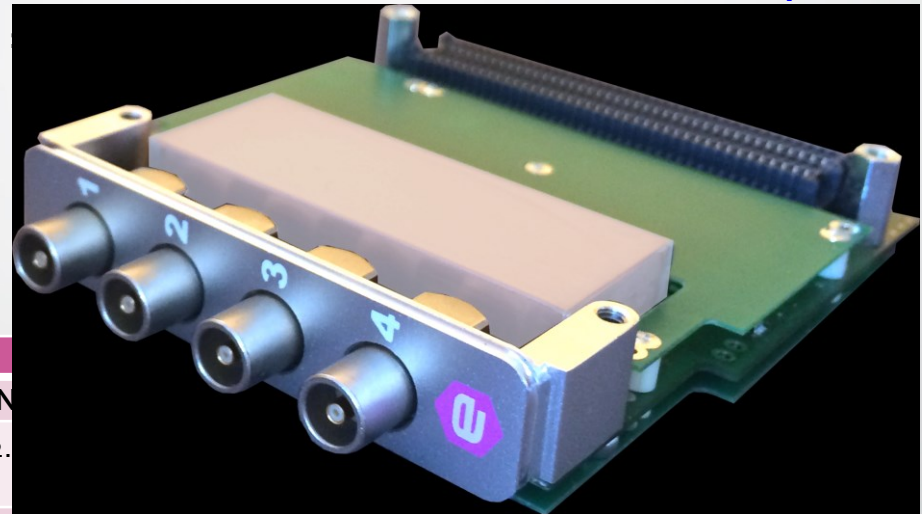


**MicroTCA for Physics**  
FMC cards  
Low-current Measurements and High-Voltage

## Quad-Channel 16/20-bit 1MSPS Floating Ammeter Card

- Standard FMC - Vita 57.1
- Bipolar current-input stage
- Two measuring ranges ( $\pm 1$  mA and
  - *configurable upon request*
- 16-bit and 20-bit versions
- Up to 1 MSPS
- Floating up to  $\pm 300$  V

- FMC-Pico-1M4-16
- FMC-Pico-1M4-20

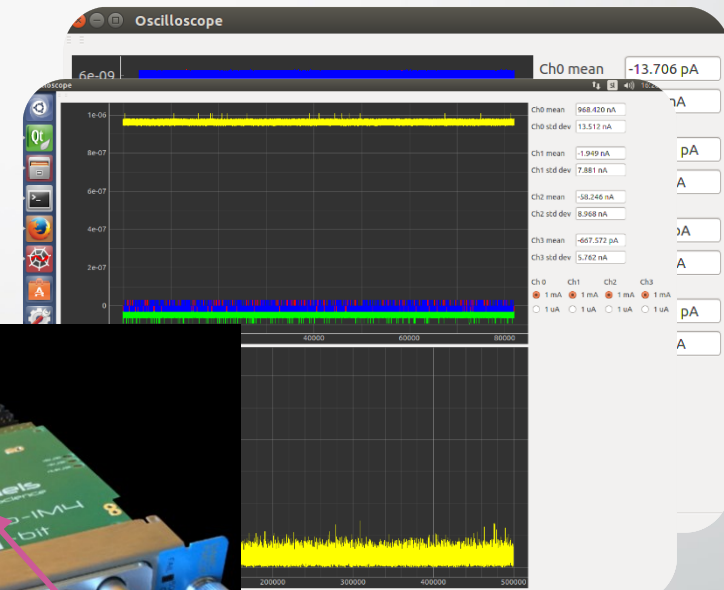


Equivalent Input Noise		
	RNGo: $\pm 1$ mA	RNGo: $\pm 10$ mA
$F_S = 2$ ksp/s	1 ppm/FS -120 dB	2 ppm/FS -110 dB
$F_S = 20$ ksp/s	2 ppm/FS -114 dB	7 ppm/FS -103 dB
$F_S = 200$ ksp/s	5 ppm/FS -107 dB	10 ppm/FS -100 dB
$F_S = 1$ Msp/s	8 ppm/FS -102 dB	15 ppm/FS -96 dB

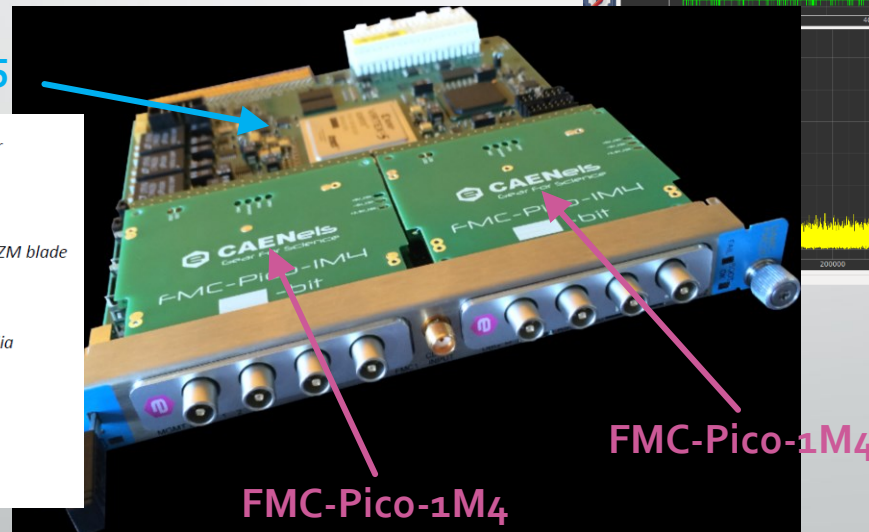
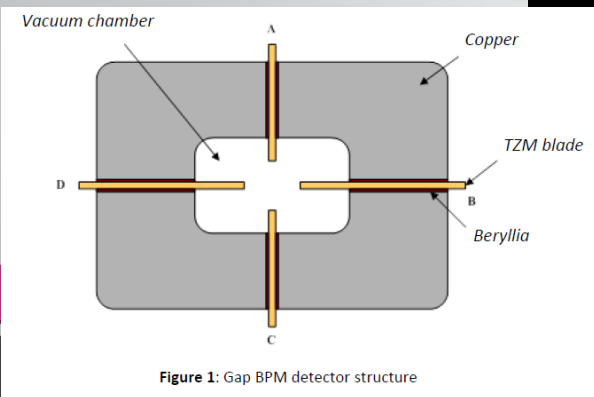
- Extremely low unbalance between channels (by analog design)
- I<sup>2</sup>C EEPROM calibration

### 8-Channel MTCA.4 Floating Ammeter

- Based on the DAMC-FMC25 carrier designed by **DESY** and produced and supported by **CAEN ELS**
- 2 picoammeters FMC-Pico-1M4 supported
- Each FMC – i.e. 4-channel – is floating
  - *Avoid ground loops if two different detectors are connected to the same DAMC-FMC25 - e.g. quadrature detectors*

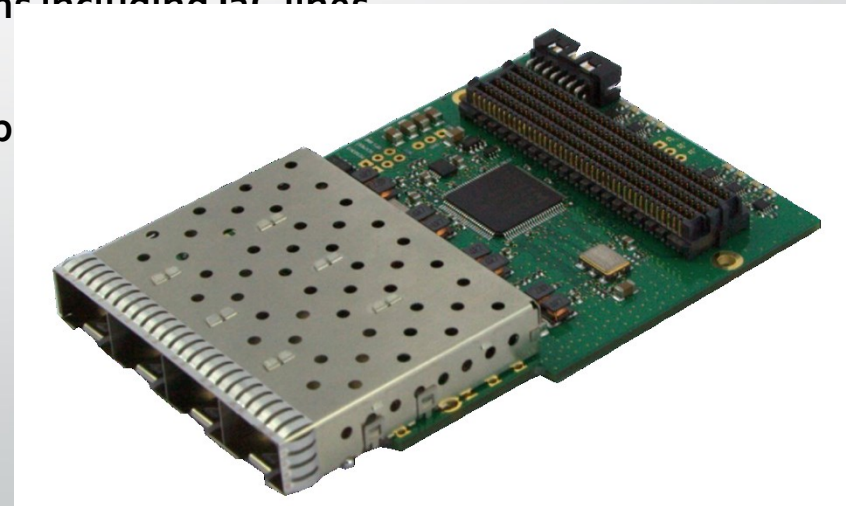


DAMC-FMC25



## Dual- and Quad-channel SFP/SFP+ FMC Adapter

- Designed by **DESY** and produced and supported by **CAEN ELS**
- Dual-channel and Quad-channel versions
  - **FMC-4SFP+2**
  - **FMC-4SFP+4** (w/out FMC bezel)
- Wide I/O operating range:  $V_{ADJ}$  can vary from 1.5V to 3.3V
- True level conversion of all SFP+ module pins including I<sup>2</sup>C lines
- I<sup>2</sup>C-controlled Oscillator (10-280 MHz)
- Compatible with the DAMC-FMC25 carrier board



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**Idea:** bring the widespread and well-known CAEN VME and NIM HV-modules to the MTCA platform

**Thousands of channels sold since 2010**



Cooperation with DESY in the Helmholtz Validierungsfond project «MTCA.4 for Industry» (HVF-0016)

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### HV Positive And Negative Double-width AMC

Voltage / Current rating	VME counterpart	Typical application example
6 kV / 1 mA	V6534	Micro-channel Plates, Drift Chambers
4 kV / 3 mA	V6533	Photomultipliers, Drift Chambers, Silicon & Germanium Detectors
500 V / 3 mA	V6519	Semiconductor devices, Diamond Detectors

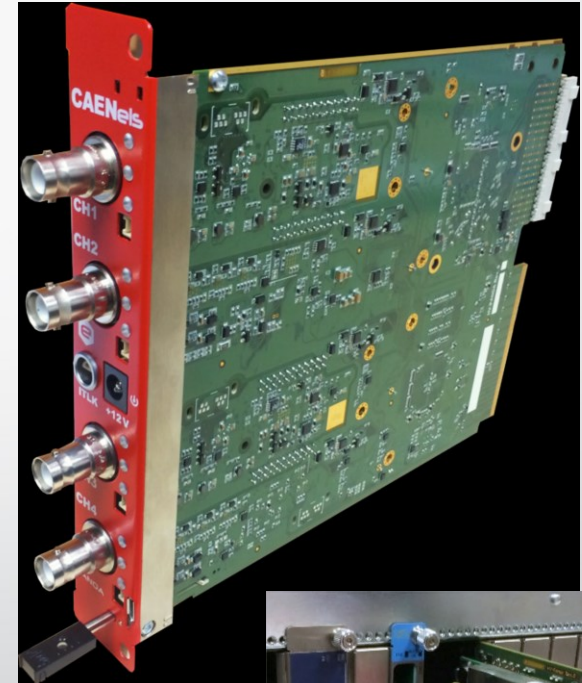


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## HV Positive And Negative Double-width AMC

- Double-Width **AMC** Board – Full Size
- **MTCA.4** carrier
- Four High-Voltage channels
- Output ratings:
  - 500 V @ 1.5 W
  - 4 kV @ 7 W
  - 6 kV @ 6 W
- Polarity selectable
- Provides infrastructure for management of optional **Rear Transition Module (RTM)** boards – class D1.1
- DDR3 On-board Memory (up to 4 Gbit)
- Separate Interlock for each channel and global one
- Stand-by voltage, Ramping, Current Monitoring and Current Limit



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## HV Positive And Negative Double-width AMC

- Floating ground per pair of channels
  - $\pm 20\text{V}$  standard for safety, up to  $\pm 500\text{V}$
- Communication via PCI-e 1x standard
- Gigabit Ethernet Connection on backplane
- User selectable behavior when output current threshold is exceeded :
  - Switch-off
  - Current source mode
- Output voltage ripple :
  - $< 12 \text{ mV @ MAX P}_{\text{OUT}}$  (up to 4 kV)
  - $< 4 \text{ ppm/FS @ MAX P}_{\text{OUT}}$  (up to 6kV)

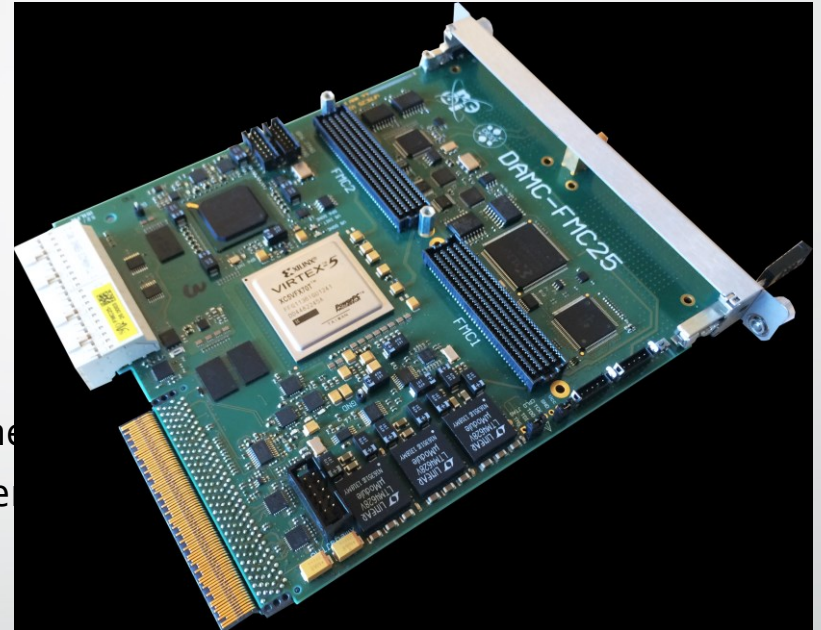


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## AMC Dual High-Pin Count FMC Carrier Board

- Double width AMC board – MTCA.4 carrier
- Two HPC FMC slots
- Data processing on Virtex-5 FPGA
- Board management on Spartan-6 FPGA
- RTM D1.1 connectivity
- DDR2 memories on both FPGAs
- External clock input on front panel SMA connector
- 4.25 Gbps ("-1") and 6.5 Gbps ("-2") transceiver board options



**Turnkey solution with dual 4-channel (8-channel) floating  
picoammeter AVAILABLE!**

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# Thank You for Your Attention!

(Vielen Dank für Ihre Aufmerksamkeit 😊)

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