

# Detector Applications on MicroTCA.4 Platform at CAEN ELS

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## Summary

- Company Profile
- AMC-PICO-8 and HV-PANDA
- AMC-PICO-8 Front-end Customization
- Software

## CAEN ELS d.o.o.

- Spin-off company of CAEN SpA, founded in 2009 in Slovenia
- Oriented and dedicated to particle accelerator facilities
- Know-how and hands-on large installations and maintenance
- Industrial capability
- Customization and dedicated support

## Product Lines

- MicroTCA and FMC instrumentation
- Power Supply Systems
- Beamline Electronic Instrumentation
- Precision Current Transducers

## AMC-PICO-8 and HV-PANDA

### TetrAMM Picoammeter with integrated HV source



## AMC-PICO-8 and HV-PANDA

### TetrAMM Picoammeter with integrated HV source



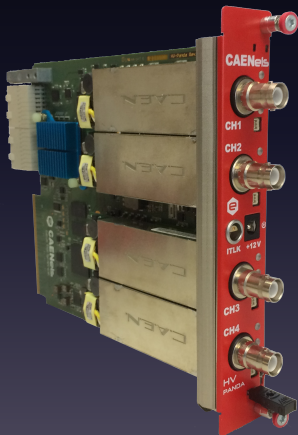
#### High-Voltage source



#### Picoammeter



## HV-PANDA



- 4 channels
- Various channel configurations
  - 500 V @ 1.5 W
  - 4 kV @ 7 W
  - other values (ask)
- Factory selectable polarity
- Developed under HVF
- Possibility for enhancements
  - Rear Transition Module D1.1
  - DDR3 memory (512 MB)
  - PCIe with DMA (60 MB/s)
  - Gigabit Ethernet on backplane
  - JTAG on backplane

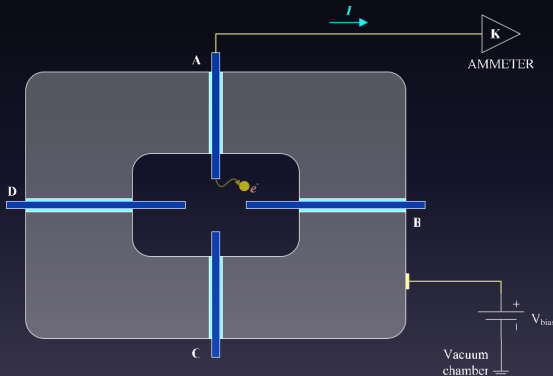
## AMC-PICO-8



- 8 channel bipolar picoammeter
- Two selectable ranges (changeable on request)
  - 1 mA (10 kHz)
  - 1  $\mu$ A (10 kHz)
- Floating up to 300V
- Trigger inputs from various sources
- Based on DAMC-FMC25 from DESY
- BSP available



## Application example: blade-gap monitor

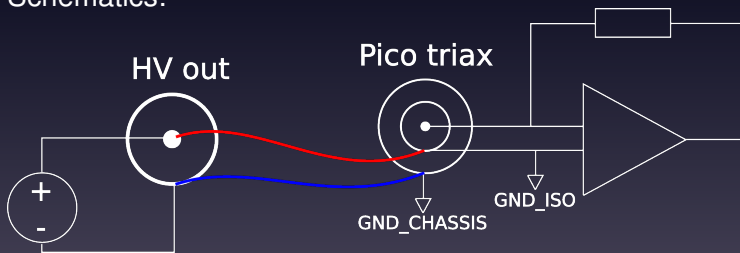


(from E. Braidotti: Design and Development of a Picoammeter for Global Orbit Feedback at Elettra)

## Test setup (schematics)

We wanted to see the performance of the combined system (in terms of noise)

Schematics:

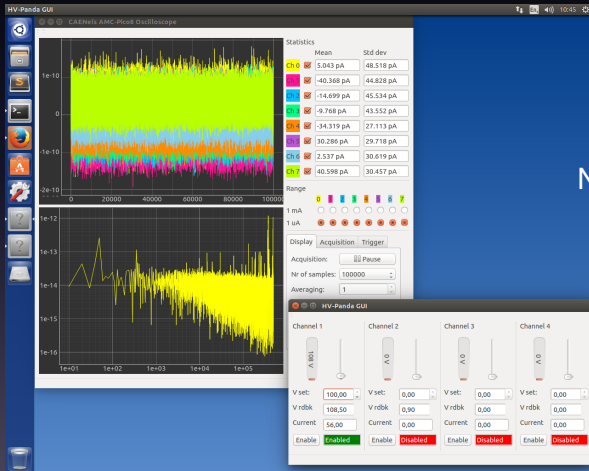




## Test setup (closer look)



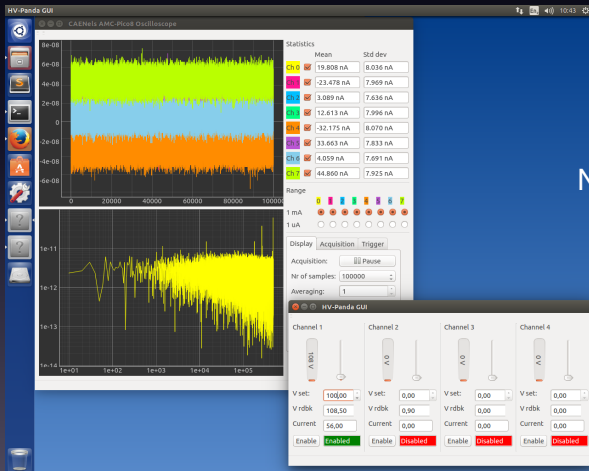
## Results (1uA range)



## Noise

- shielded = 30.5 nA (SNR = -90.3 dB)
- biased = 48.5 nA (SNR = -86.3 dB)

## Results (1 mA range)



## Noise

- shielded = 8.1 nA (SNR = -101.8 dB)
- biased = 8.1 nA (SNR = -101.8 dB)

## AMC-PICO-8 Front-end Customization

- The front-end can be customized to fit the user's needs
- Default configuration:
  - 1 mA (10 kHz)
  - 1  $\mu$ A (10 kHz)
- Always a trade-off between FS range, bandwidth and noise
- Calibration data is stored on EEPROM on FMC boards

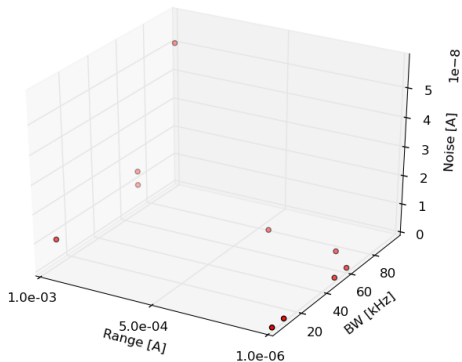
## Various combinations

This are the results (measured noise) from all the combinations of the front-end parameters we have tried

| FS Range[A]  | Bandwidth[kHz] | Noise RMS [A] |
|--------------|----------------|---------------|
| 1 $\mu$ A    | 10.0           | 30 pA         |
| 1 $\mu$ A    | 1.0            | 120 pA        |
| 0.39 $\mu$ A | 50.0           | 440 pA        |
| 1 $\mu$ A    | 60.0           | 570 pA        |
| 100 $\mu$ A  | 70.0           | 1.2 nA        |
| 400 $\mu$ A  | 70.0           | 3.2 nA        |
| 1 mA         | 10.0           | 8 nA          |
| 1 mA         | 70.0           | 8.5 nA        |
| 1 mA         | 70.0           | 13 nA         |
| 1 mA         | 100.0          | 50 nA         |



## Various combinations



## Software for HV-PANDA

- User-space driver (just three files)



panda.map

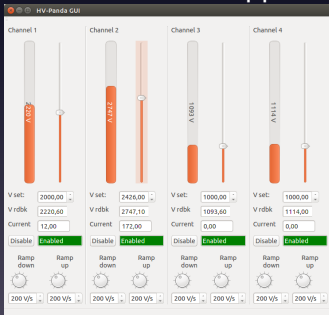


panda\_gui.py



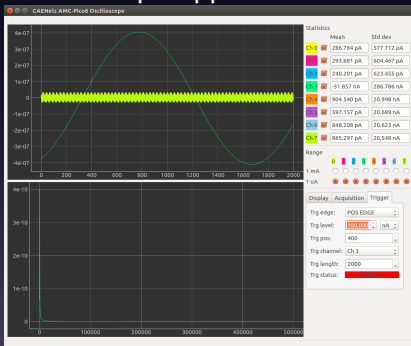
panda\_gui.ui

- GUI and console application



## Software for AMC-PICO-8

- Linux driver with support for DMA
- Oscilloscope application



- Smaller utility to dump data into CSV

Thank you