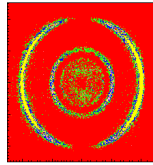# The fADC4 fast sampling ADC units

**RoentDek**
**Handels GmbH**

Supersonic Gas Jets
Detection Techniques
Data Acquisition Systems
Multifragment Imaging Systems

The **RoentDek fADC4** is a product series of fast sampling 4 channel 10 bit ADC modules with 1.25 to 5 GS/s (10 bits) or with 250MS/s (14 bits) sampling rate per channel. Depending on the **fADC4** version and the number of ADC modules (up to 8 interlinked units with up to 4 channels each) a wide application range can be covered. Due to an on-board TDC and very elaborate memory structure with **zero-suppression** functionality and **single pulse trace recognition** it is an ideal tool especially for applications with single or multiple AC pulse signal tracking/analysis, for example in advanced read-out of single particle counting detectors.

A special firmware is optimized for the signal analysis of the **RoentDek DLD** and **HEX** delay-line detectors with micro-channel plates. The main application is advanced multi-hit recovery with the **HEX75/100/120** detectors at high event rate throughput. For this application the **CFD8b**/**TDC8HP** modules are replaced by 2 **fADC4** units, ideally in combination with a **MixA8** for improved system flexibility.
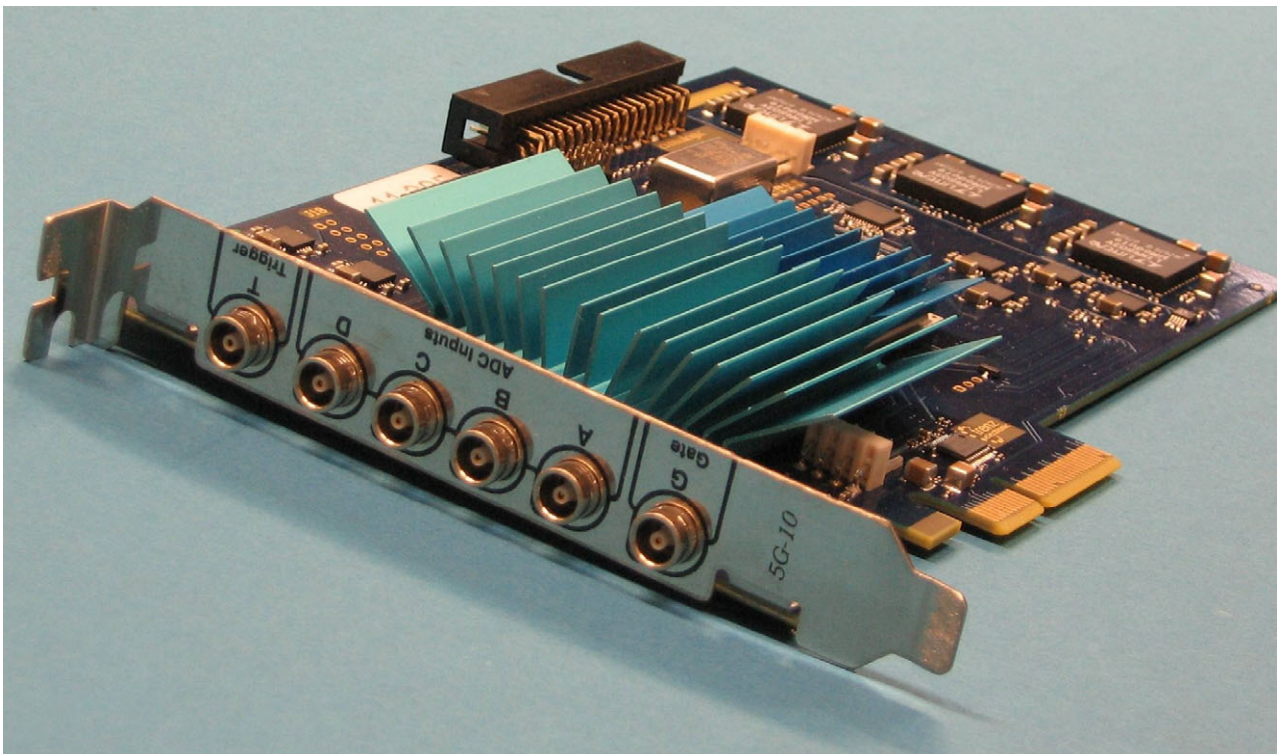


*Figure 1: the* **RoentDek** *fADC4 module*

## Fast signal analysis: width, amplitude, shape

In contrast to conventional ADCs which measure a voltage only in one point the **fADC4** samples the **complete signal trace** similar to a digital oscilloscope. With this information the software can not only analyse the amplitude but also the integral/width/shape of a signal.

# Synchronization:

Up to 8 **fADC4** modules can be used in combination as one synchronized instrument. The driver also allows for a seamless synchronization with our 8 channel TDCs (www link: **TDC8HP**). If not enough PCIe slots are available inside the PC then a crate solution can be used.



*Figure 2: the PCIe-extension crate can house up to 8* **RoentDek** *fADC4 modules (4* **fADC4** *are displayed in this picture). An alternative version linking up to 5* **fADC4** *and up to 2* **TDC8HP** *is in development*

# Software:

The fADC systems are provided with a complete software solution for the data readout and offline data analysis. Simple example programs and LabView-drivers are provided which allow for a very flexible development of customized data readout schemes. The software extracts the timing information and amplitude/width of each signal. Plug-ins for the position computation of particle detectors are available.

# Comparison to the fADC8: (link to the fADC8 description sheet)

**Form factor:**
The **fADC4** is a PCIe-card (with 4 ADC-channels and one TDC-channel) which can be placed directly into a PC or into a PCIe-crate.
The **fADC8** is a VME-module with 8 ADC-channels and one TDC-channel. The VME crate can be read out via USB or "optical link"

**Data readout:**

Each **fADC4**-card provides a data transfer speed of 300 Mb/s net. The internal memory is large enough to buffer up to 40 µs of signal traces. The **fADC8**-crate-controller has a maximum data transfer speed of 120Mb/s but the internal memory is 2Gb in each module. Thus the **fADC4** is well suited for applications with a continuous high data rate. The **fADC8** is especially well suited for applications with extremely high data rates during short time intervals (e.g. measurements with particle traps).

# Summary of fADC4 features:

**5GS/s version:**

- Input range: 0.5V , adjustable offset , 10 bit ADC, AC-50 Ohm impedance, bandwidth 3GHz, additional TDC channel with < 100 ps resolution and veto input

- Channel configurations: Each 4 channel ADC module can be individually addressed as 4x1.25GS/s, 2x2.5GS/s or 1x5GS/s.

**250MS/s version:**

- Input range: 0.5V , adjustable offset , 14 bit ADC, DC-50 Ohm impedance, bandwidth 450MHz, additional TDC channel with < 100 ps resolution and veto input.

**Features common to both versions:**

- On-board *Zero-Suppression Functionality* for selective read-out of pulse traces with high signal transfer rates. No dead time between pulses. No dead time between trigger groups.

- Trigger range: not limited

- Connector type: Lemo00

- I/O interface: PCIe (300Mbytes/s net data transfer rate, 800Mbytes/s nominal)

- External trigger input includes one TDC channel for generation of timestamp information (<100 ps resolution)

- VETO-input: Enables fast gating of signal acquisition

Included software: read-out of pulse-traces to PC RAM and harddrive (for Windows only)

Drivers: WinXP (32), Vista (32/64 bit), Win7 (32/64bit ), Linux (64bit)

Free firmware upgrades (in-system via flash software)

PC not included.