

Latest MTCA High-Performance Digitizer Technology

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TELEDYNE SP DEVICES
Everywhereyoulook™

MTCA Digitizer Roadmap



ADQ412

12 bits
2/4 channels
1-4 GSPS



ADQ14

14 bits
2/4 channels
2/1 GSPS



ADQ7DC

14 bits
1/2 channels
10/5 GSPS



ADQ7RF

12 bits
2 channels
5 GSPS

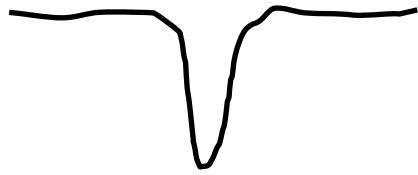


ADQ8

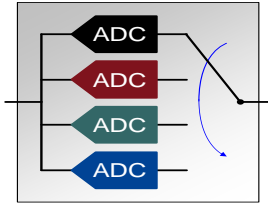
10 bits
8 channels
1 GSPS

ADQ7 – Digital Baseline Stabilizer IP “DBS”

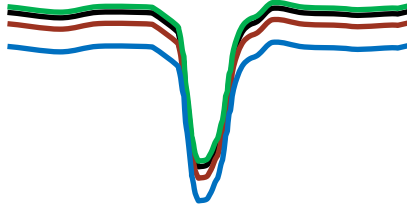
Interleaving correction



High frequency input signal



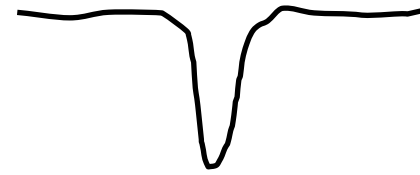
Interleaved ADCs for high sample rate



Typical distorted time-interleaved signal

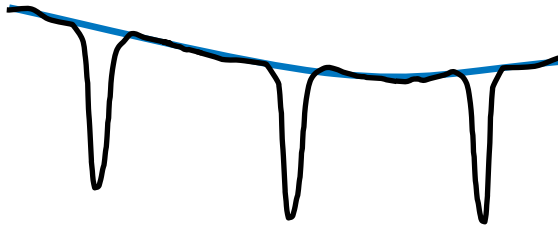


DBS corrects for base-line differences



Signal restored by DBS

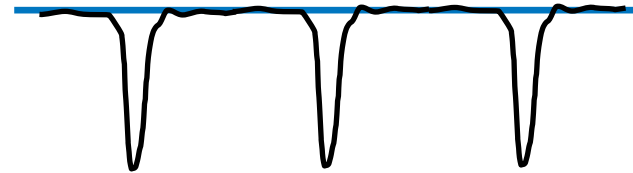
Baseline stabilizer



Baseline fluctuation (for example due to temperature)

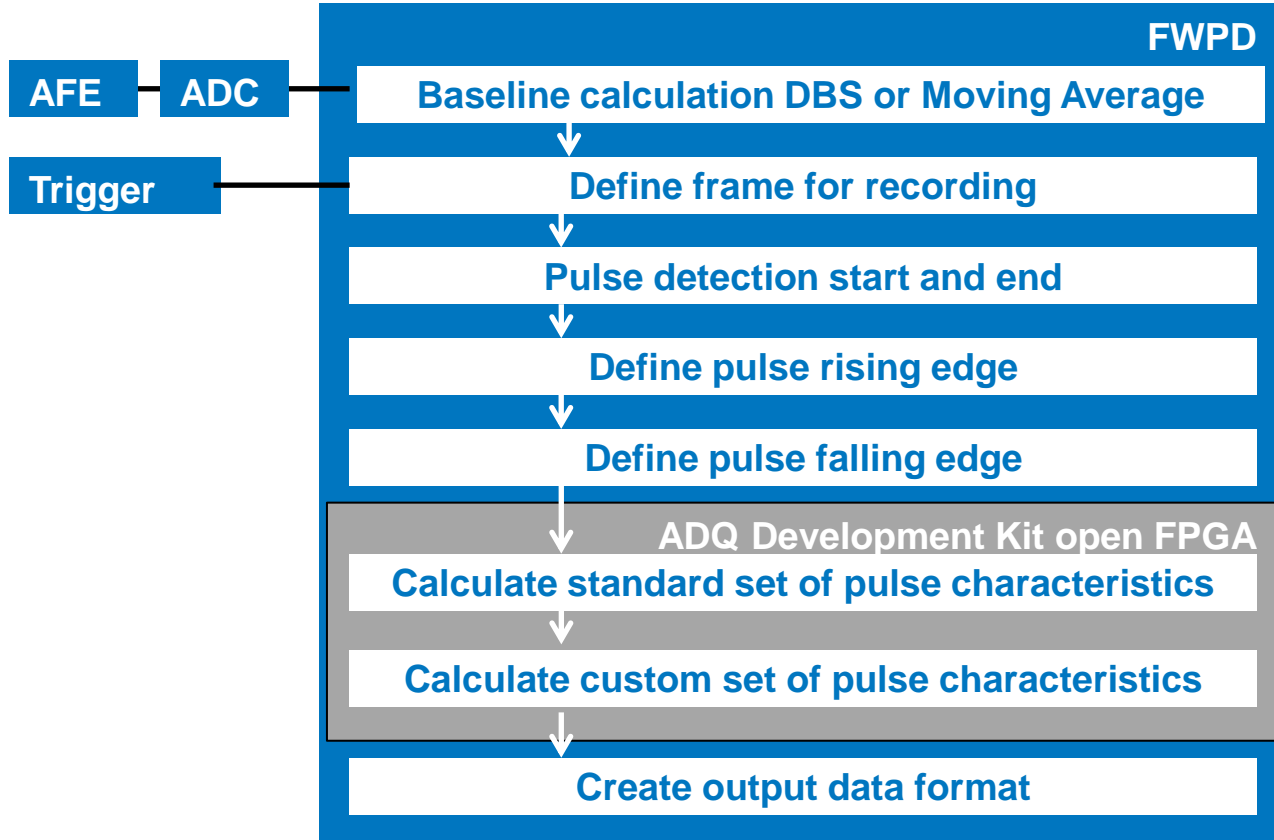


DBS corrects for base-line variations



Signal restored by DBS

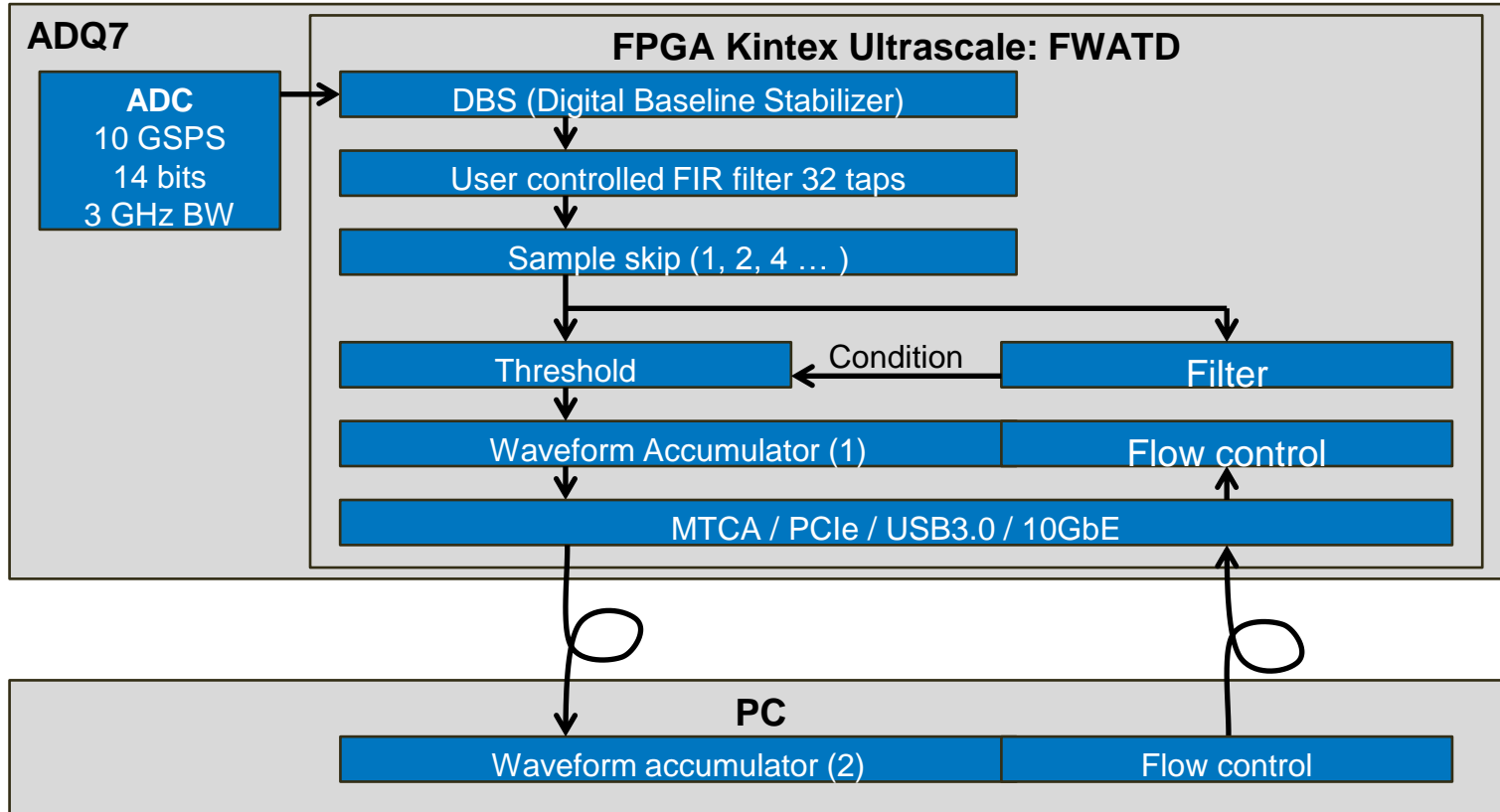
ADQ-FWPD Pulse detection firmware



Each application requires a unique pulse analysis. The FPGA is thus open for custom designs.

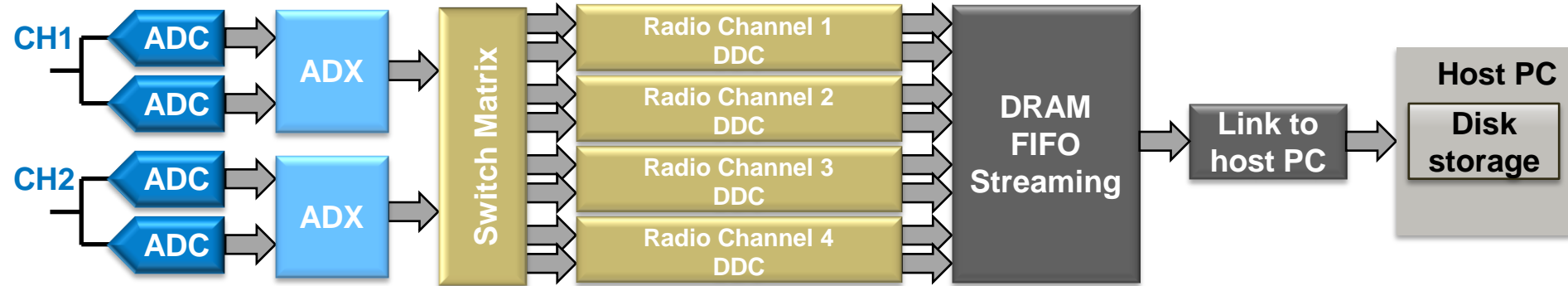
TSPD's design service is available to support the implementation work.

ADQ7-FWATD Advanced time domain firmware



ADQ7-FWSDR Software defined radio firmware

- Two analog RF channels
- Streaming of 4 separate digital RF channels
- Sustained streaming to disk > 5 GBytes/s
- ADX interleaving technology



ADQ14 - Success Story – W7-X

- Wendelstein 7-X stellarator at Max-Planck IPP
- Thomson scattering for plasma temperature measurement
- ADQ14DC-4C-MTCA
 - 14 bits vertical resolution, 4 channels @ 1 GSPS
 - 70 Boards, 280 channels, synchronized sampling
- Comment from the customer^[1]:

“The combination of 14 bits dynamic range and 1 GS/s sampling rate is taking the performance of digitizer for TS system to an unprecedented performance level. The ADC boards are also equipped with Kintex-7 FPGAs for real-time signal processing.”

[1] “The Thomson scattering System at Wendelstein 7-X”



ADQ7- Series Digitizers

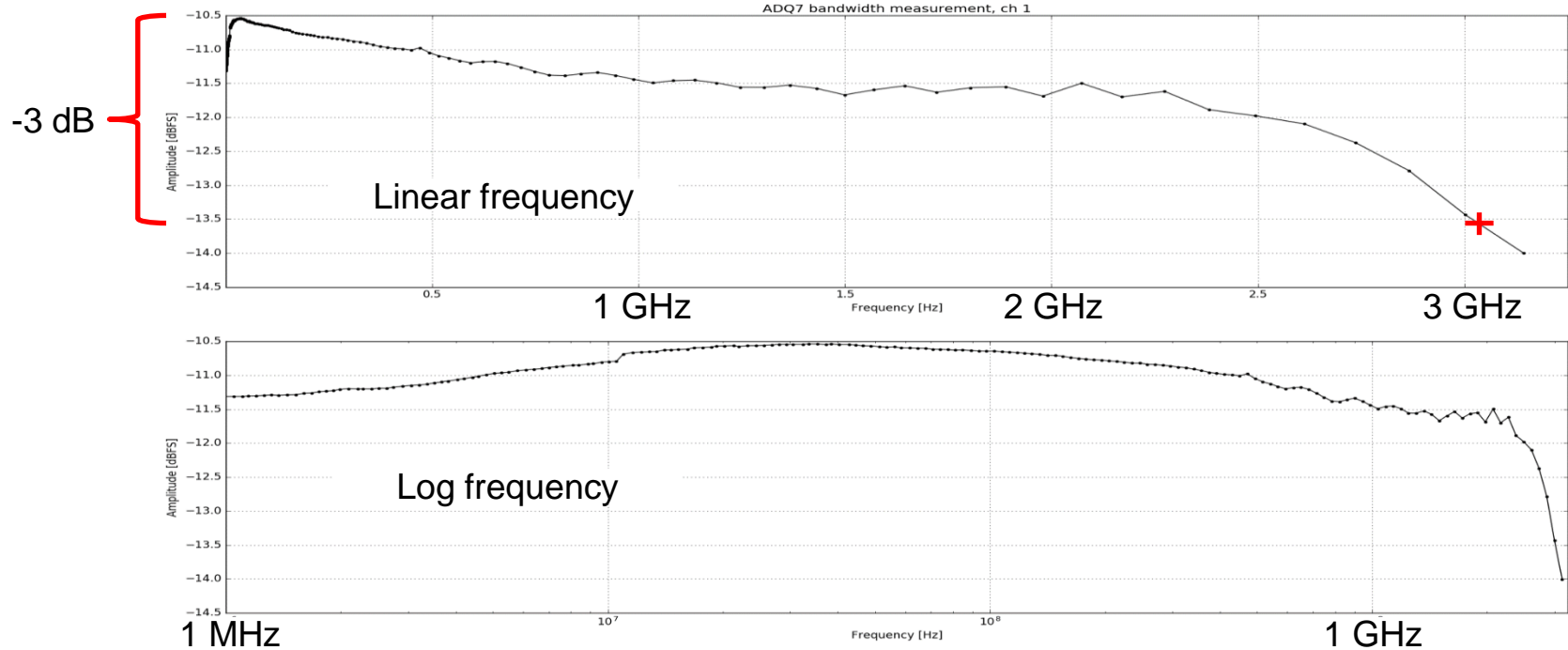
ADQ7DC

- 14 bits vertical resolution
- DC-coupled version for pulse data
 - 1 / 2 channel @ 10 / 5 GSPS
 - 2.5 GHz bandwidth (3 GHz with equalizer)
 - DBS IP for baseline stabilization
- 4 Gbyte onboard DRAM
- Open Xilinx Ultrascale FPGA XCKU085
- High-precision trigger (25 ps)
- Flexible clocking capabilities
- Multi-channel synchronization support
- Multiple form factors incl. MTCA.4
- 6.8 Gbyte/s peak data transfer (PCIe gen3x8)



- SDK supporting multiple environments
- Windows and Linux support
- Firmware options for pulse detection, advanced time-domain and software defined radio
- FPGA firmware development kit optional
- 3-year warranty

ADQ7DC - Bandwidth (1 channel 10 GSPS)



Preview: ADQ7- Series Digitizers (cont'd)

ADQ7RF (Preliminary)

- 12 bits vertical resolution
- AC-coupled version for RF capture
 - 2 channels @ 5 GSPS
 - **Target >4 GHz bandwidth**
 - DBS IP for baseline stabilization
- 4 Gbyte onboard DRAM
- Open Xilinx Ultrascale FPGA XCKU085
- High-precision trigger (25 ps)
- Flexible clocking capabilities
- Multi-channel synchronization support
- PCIe and PXIe form factors (MTCA tbd)
- 6.8 Gbyte/s peak data transfer (PCIe gen3x8)

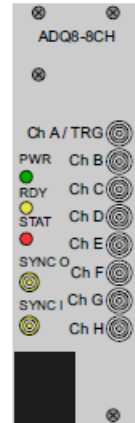


- SDK supporting multiple environments
- Windows and Linux support
- Firmware option software defined radio
- FPGA firmware development kit optional
- 3-year warranty

Preview: ADQ8-8 for multi-channel applications

Key specifications

- 10-bit vertical resolution (8-bit option)
- 8 channels with 1 GSPS / channel
- DC - 250 MHz
- DRAM: 1 Gbyte
- Standard: 1-slot
- Open FPGA architecture
- Superior timing engine
 - 52ns re-arm time
 - 25ps Trigger time-resolution
 - Internal clock reference: 10 MHz +/- 3 ppm
 - Triggered streaming
 - Time-stamp information



Options

- Variable-gain
- 1 MOhm
- Pulse detection firmware
- Streaming to PC + GPU
- FPGA development kit

Upcoming Product Features

White Rabbit



- Ethernet-based time distribution network
- Sub-nanosecond accuracy and picoseconds precision of synchronization for large distributed systems

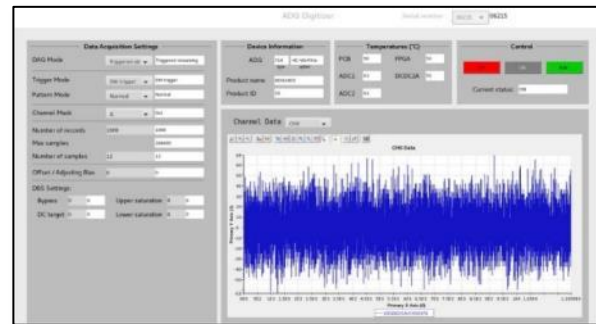
Supported features (ADQ7)

- Clock reference distribution
- Time stamp distribution

EPICS



- Experimental Physics and Industrial Control System – standardized control interface
- Abstracts away device specific protocols
- Supports initially EPICS CODAC Installation
- In collaboration with Cosylab



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