中科采象
SERTICS TECHNOLOGY

Full-Stack Data Acquisition Solutions for Experimental and High-Energy Physics

Sertics Technology Co., LTD.

CEPC2026，Shanghai

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About Sertics Technology

Sertics Technology: Striving to become a leader in interdisciplinary DAQ techniques

中科采象

one of the first enterprises of USTC under the technology-empowerment reform initiative

Founded in December 2021, it was jointly established by the research team from the School of Nuclear Science and Technology & State Key Laboratory of Nuclear Detection and Nuclear Electronics of USTC, together with the Advanced Technology Institute of USTC.

Ultimate performance derived from large-scale scientific facilities

Our core technologies originate from advanced detection and data acquisition technologies accumulated from national large-scale scientific facilities, and we are dedicated to delivering reliable, high-performance data acquisition instruments and full-stack solutions for scientific research and engineering applications.

Core Team: Dual Engine of Scientific Research & Engineering Competence

Leading Figure

Ping Cao, Chairman

Associate Professor, USTC

- ✓ **4500-meter deep-sea** nuclear-radiation detection technology — the first implementation in China
- ✓ Back-n electronics system for **CSNS** — internationally leading performance
- ✓ Deputy Director of the Engineering Center, USTC Advanced Technology Institute



Talent Profile

130+
Team size

60%
R&D headcount ratio

30%
Master's degree and above

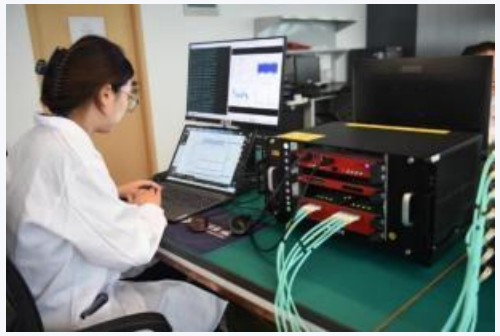
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Core PhD team

All core team members are from USTC, with in-depth expertise in nuclear electronics, data acquisition and related fields

Engineering Capabilities

We have a **3143 ㎡** modern R&D and production base with **ISO9001, CE and CNAS** certifications. We possess complete capabilities covering R&D, production, quality control and full-life-cycle technical service, and has received multiple enterprise honors.

On-site Photo



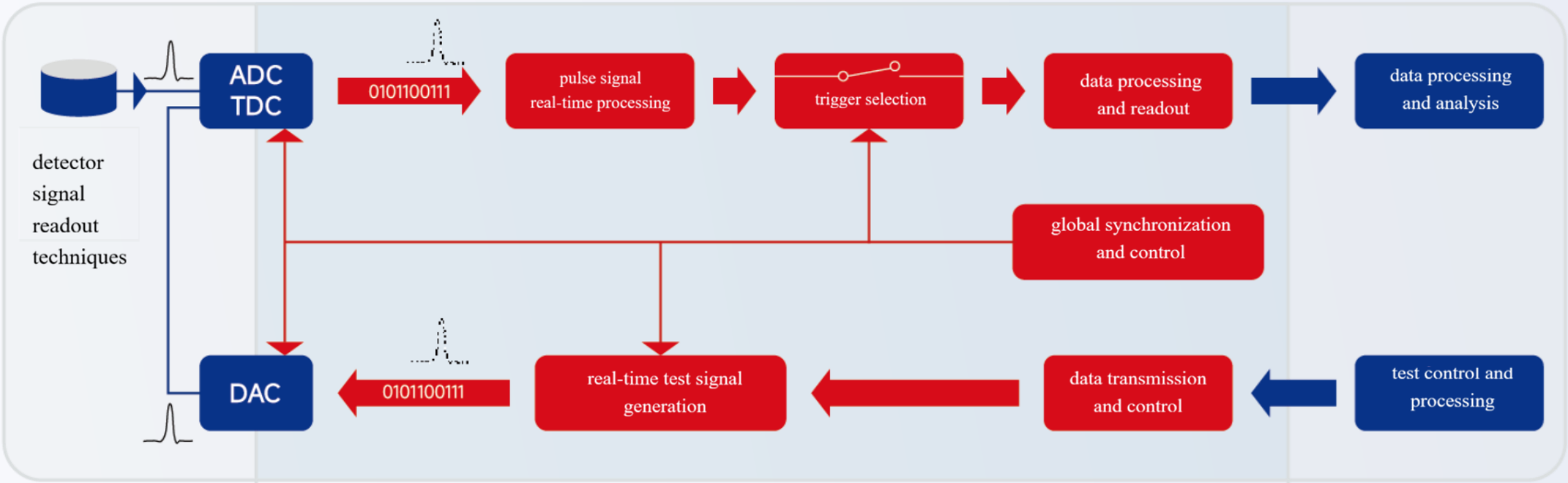


SERTICS

Technical Advantage: Fast-Electronics Technology

Facing extreme experimental conditions. Our DAQ systems deliver ps-level time resolution and μm-level spatial position resolution. Reliably work under extreme environments to capture faint, high-rate physical signals.

- **Extreme operating conditions**: ultra-high radiation background, ultra-low signal amplitude, ultra-large dynamic range, ultra-high event rate, ultra-high-density data, high-temperature high-density strong-magnetic-field environments, etc.
- **Measurement resolution**: time (ps), spatial position (μm), energy (eV), charge (fC)



Technical Advantages: µXI Modular Instrument Solution

Traditional PXIe system	PK	Innovative µXI Modular Instrument Solution
Core Architecture: CPU → PCIe Switch → PCIe →PCIe设备	核心架构	☑ **Core Architecture:** **CPU → Root FPGA → SerDes → µXI设备**
Complex hardware architecture: cascading failure risks and compatibility challenges **Single-point faults may cause system crash or blue-screen events. Hot-swap requires complicated protocol state-machine processing with poor compatibility**	硬件架构	☑ **Reliable hardware architecture: fault isolation and hot-swap support** Complex PCIe interfaces are abstracted away; single-point faults will not crash the CPU. Hot-swap is supported for convenient maintenance and superior system stability.
Cumbersome protocol development: compatibility and quality risks **Generic PCIe protocols are highly complex; driver compatibility varies among vendors. System reliability heavily depends on vendor-side implementation.**	协议开发	☑ **Efficient protocol development: dedicated protocols for simplified integration.** FPGA-native dedicated µXI protocol unifies firmware and drivers, lowering development complexity and easing system integration.

The µXI solution adopts dedicated protocols and Root FPGA isolation to optimize both hardware and development, and roughly doubles overall system reliability VS PXIe.

SERTICS

Application Domains: High-Performance DAQ for Large Scientific Facilities & Frontier Science

DAQ capacities: high-precision acquisition, multi-channel synchronization, real-time processing and complete system-integration.

Serve: nuclear & particle physics, fusion diagnostics, photon-source & accelerator diagnostics and quantum control.

Common Requirements

High Precision

High-fidelity acquisition for faint signals, pulse signals, phase and timing information

High Synchronization

Unified time base for multi-detector, multi-channel and multi-chassis data.

Multi-Channel

Scalable from dozens to hundreds of channels for complex experimental arrays.

Real-Time Processing

Triggering, event selection, event assembly and on-line algorithms to reduce invalid data transmission.

Nuclear & Particle Physics

- **Scenarios:** CSNS Back-n electronics , MCP TOF, BNCT neutron-energy-spectrum, Compton imaging
- **Capabilities:** 500M-5G SPS high-speed sampling、multi-channel synchronization、nuclear-data processing algorithms including CFD/TDC/QDC/PSD

Fusion Diagnostics

- **Scenarios:** Plasma transient current / magnetic-field / optical-signal/microwave measurement, Thomson scattering, fusion-product diagnostics
- **Capabilities:** Near-end acquisition under intense EMI, optical-fiber transmission, synchronization for 300+ channels, GSPS-grade high-speed sampling.

Photon-Source & Accelerator Diagnostics

- **Scenarios**：X-ray pulse intensity & position diagnostics, photoelectron spectroscopy, gas-absorption spectroscopy, BPM measurement for SR facilities
- **Capabilities:** 1-10 GSPS high-speed sampling, clock synchronization, White-Rabbit timing, EPICS interfaces, feature extraction and position computation

Quantum Measurement & Control

- **Scenarios**: Single-photon detection, arrival-time measurement, time-correlation analysis, multi-channel spectral-signal measurement
- **Capabilities:** Ps-level time resolution, low dead time, dual technical paths: ADC waveform acquisition and TDC event timing.

02

Products for Experimental Physics

Product Portfolio: Full Coverage from Sensors to Data Analysis

--Full-stack DAQ products, supporting end-to-end workflows from physical signals to analysis results.

Software Layer

Data Visualization & Analysis

- Data visualization interface
- Data-analysis toolkit
- Data storage management
- User-friendly interactive interface
- Intelligent data-analysis functions

FPGA Layer

Real-Time Signal Processing

- Real-time raw-data preprocessing
- Digital-filtering algorithms
- Feature-extraction technology
- Timestamp tagging
- Mass-data transmissio

Hardware Layer

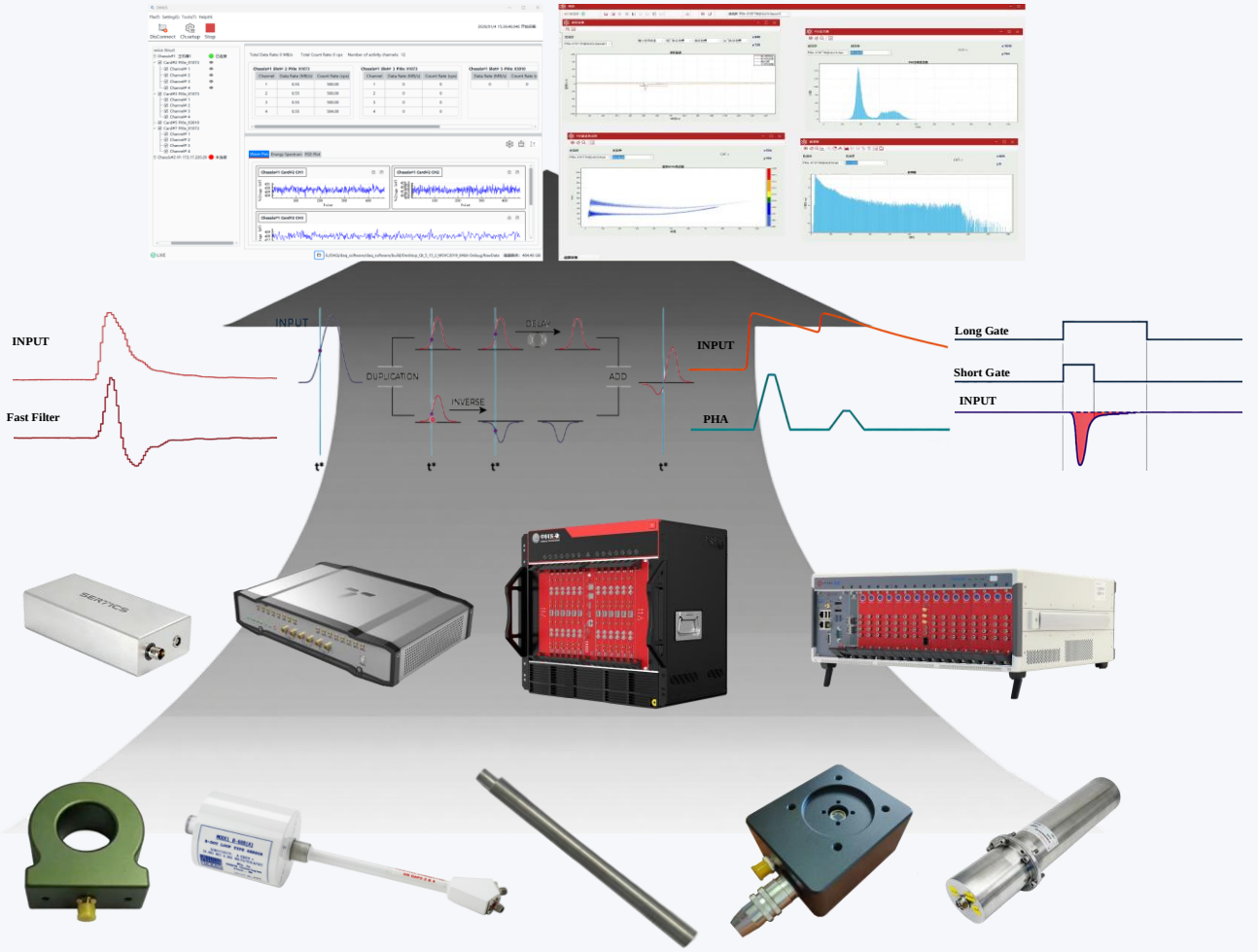
High-Precision Sampling & Conversion

- Signal-conditioning circuits
- ADC converters
- Data-acquisition cards
- Anti-interference design
- Analog-to-digital signal conversion

Sensor Layer

Multi-physical-quantity Detection

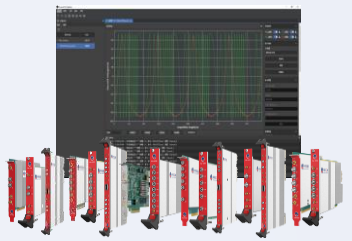
- Rogowski coil (current)
- B-dot probe (magnetic-field)
- Langmuir probe (plasma)
- Photodetector (spectroscopy)
- Radiation detector (neutron, gamma-ray)



Plug-in Digitizers: Multi-Channel, High-Precision, High-Sampling-Rate

Model number	Channels	Sampling Rate	Bandwidth	Resolution	Functions
PCIe/PXIe-X1063	4	100MS/s	50MHz	16bit	WR、PHA
µXI-X1063	8	100MS/s	50MHz	16bit	WR、PHA
PCIe/PXIe-X1073	4	1GS/s	300MHz	16bit	WR、PSD、QDC、CFD
µXI-X1073	8	1GS/s	300MHz	16bit	WR、PSD、QDC、CFD
PCIe/PXIe-X1012	1	10GS/s	3GHz	12bit	WR
µXI-X1012	2	10GS/s	3GHz	12bit	WR
µXI-X1639	32	1/2.5/5GS/s	500MHz	14bit	WR、QDC、CFD









Desktop Signal Processing Modules: Signal Acquisition, Signal Conditioning, High-Voltage Power Supply

Module Name	Model number	Channels	Performance Specifications	Functions
1GS/s Desktop Digitizer	DT-D6303N	16	1GS/s、450MHz、16bit	WR、PSD、QDC、CFD
100MS/s Desktop Digitizer	DT-MCA-01	4	100MS/s、50MHz、16bit	WR、PHA、CFD
Charge-Sensitive Preamplifier	DT-Y6202	1	20V/pC	Charge-to-voltage
Trans-Impedance Amplifier	DT-Y6101	1	10× gain	Current-to-voltage
Fast Voltage Amplifier	DT-Y6302	1	Adjustable gain: 3.5-49	Voltage amplification
High-Voltage Power Supply	DT-X5122		-15000V~+500V	High-voltage power supply for detectors



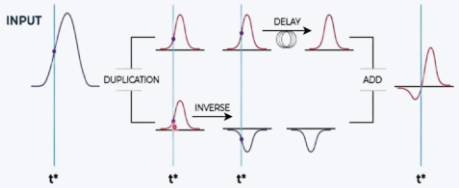




Real-Time Processing Algorithms

CFD

Constant Fraction Discriminator



Principle

Trigger at a fixed fraction of pulse peak amplitude to eliminate time walk caused by amplitude variation.

Key Features

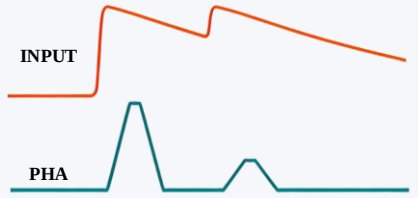
- ns-level resolution
- amplitude-variation immunity
- high-precision timing

Typical Applications

- Time-of-flight (TOF)
- coincidence measurement
- particle arrival-time logging

PHA

Pulse Height Analysis



Principle

Measure pulse height or integrated charge corresponding to particle energy to generate energy spectra.

Key Features

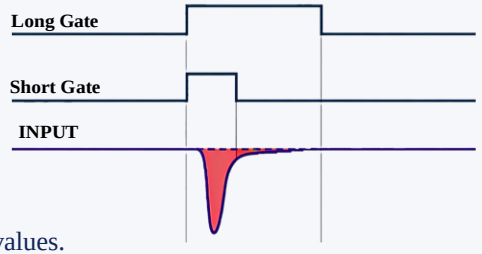
- Superior energy resolution
- accurate energy measurement
- multi-channel analysis

Typical Applications

- Energy-spectrum measurement)
- particle-energy analysis
- radionuclide identification

PSD

Pulse Shape Discrimination



Principle

Distinguish particle types by comparing the ratio between short-term and long-term pulse integration values.

Key Features

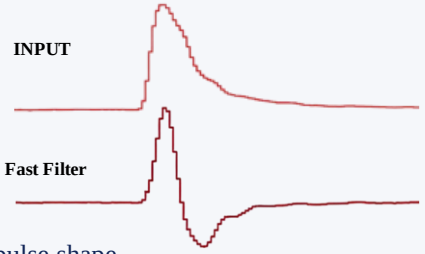
- Real-time discrimination
- high classification capability
- no extra detector required

Typical Applications

- n/γ discrimination
- Energy-spectrum measurement)
- radiation-field monitoring

FF

Fast Filter



Principle

Digital filtering algorithms such as CR-RC trapezoidal filtering for improved signal-to-noise ratio and optimized pulse shape.

Key Features

- Real-time filtering
- noise suppression
- pulse shaping

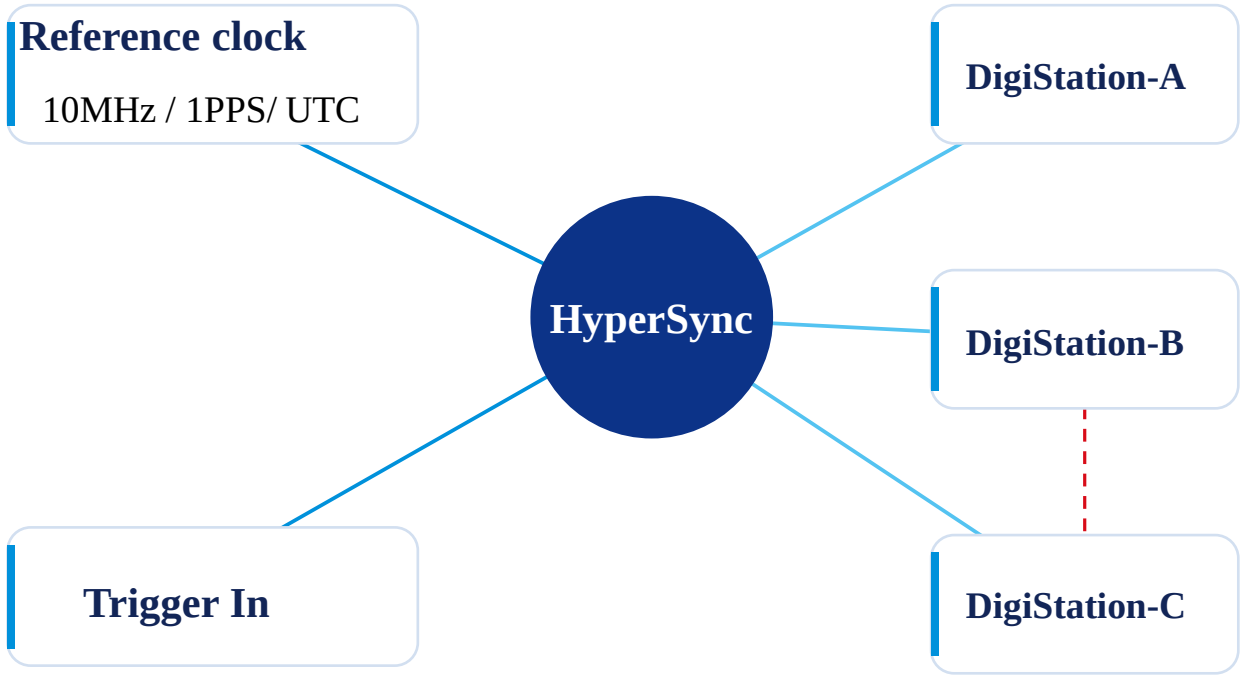
Typical Applications

- Signal preprocessing
- noise reduction
- waveform optimization

HyperSync: System-Level High-Precision Synchronization Solution

Delives unified time base, unified trigger and unified timestamp for multi-channel acquisition systems

ps-level synchronization precision for time alignment across all channels



Workflow: Reference clock → Timestamp generation → Channel-skew calibration → Trigger distribution → Shot-based data alignment

Unified Time Base

Accept external clock input, distribute system clock; compatible with GPS / White-Rabbit timing.

Unified Timestamp

Enable cross-device time correlation for shot-data alignment across multiple diagnostics.

Skew Calibration

Measure and compensate for channel skew and cable delay for system calibration.

Unified Trigger

System trigger management, hardware trigger fan-out.

Cascaded Scalability

Support synchronous expansion for arbitrary numbers of DigiStation acquisition nodes.

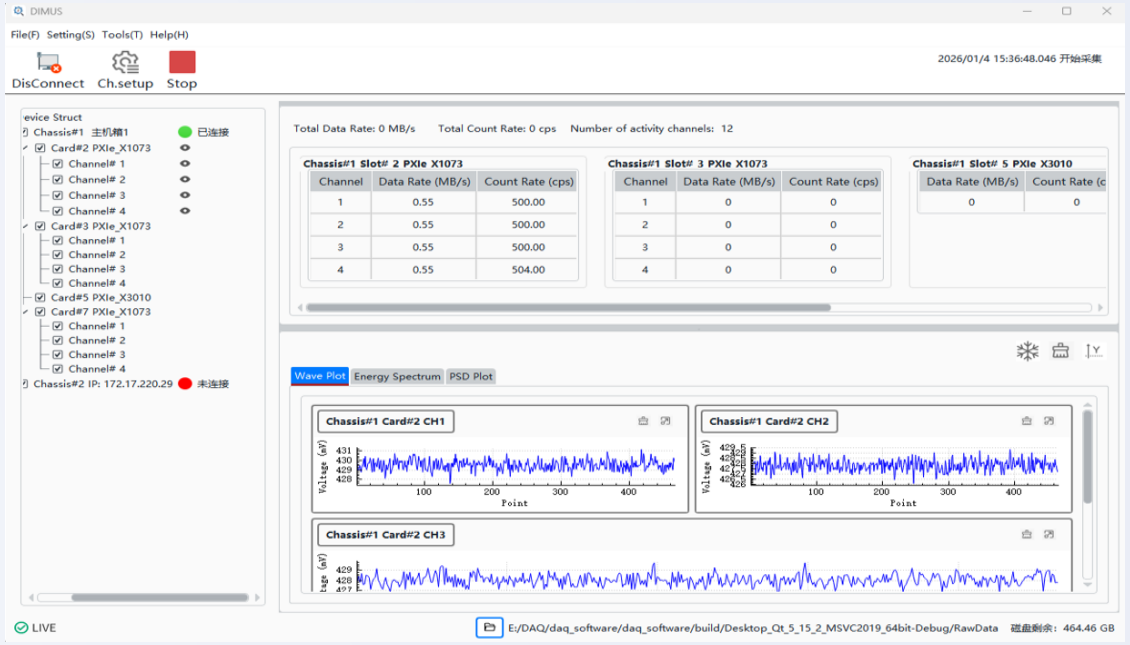
Transient Recorder: BitEdge + Plug-in Digitizers

Core Functions

- Multi-channel high-speed acquisition
- Precise per-channel synchronization
- System-level trigger coincidence
- Online real-time algorithms
- Real-time data monitoring and storage
- Runs on multiple platforms

Typical Application Scenarios

Nuclear & particle-physics experiments, accelerator beam diagnostics, fusion-plasma diagnostics, nuclear-medicine quality control, nuclear-material safety monitoring



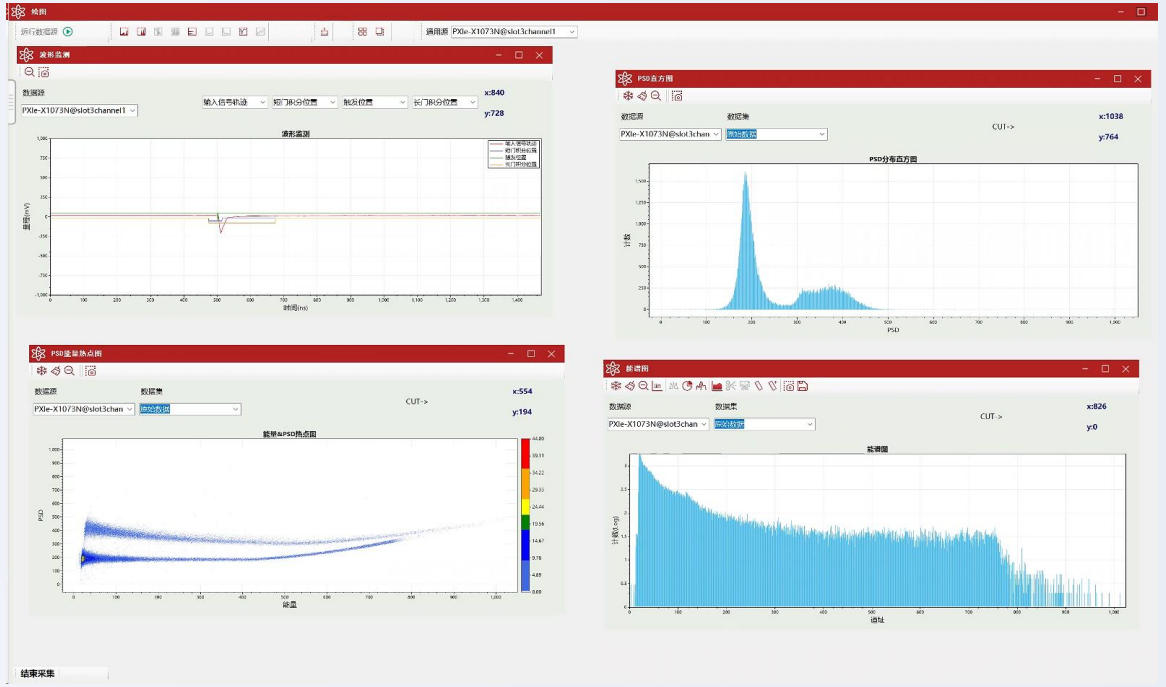
Product Features

- **User-friendly operation:** One-click multi-channel synchronous acquisition
- **Ultra-high sampling rate**: Multiple rate options from 100 MS/s to 10 GSPS
- **Precise synchronization:** 10 ps-level synchronization accuracy
- **Flexible scalability:** Multi-chassis cascaded synchronous expansion
- **Intelligent algorithms:** Rich on-line pulse-processing algorithms embedded
- **Dual output:** Simultaneous output of raw waveforms and on-line processing results

Nuclear-Spectrum Analyzer: NucSight + Desktop Modules / Plug-in Digitizers

Dedicated Solutions for Nuclear Radiation Detection

Sigal pulse acquisition and analysis、Parameters adjustable online、Energy spectrum analysis and fitting、PSD、TOF、Free spectrum and coincidence spectrum analysis、Energy resolution calculation



Typical Application Scenarios

Nuclear-particle-physics research, experimental teaching, medical radioactivity inspection, industrial monitoring, crystal & detector performance testing

Product Features

- **Flexible architecture:**
  Modular design with combinable/replaceable functional modules for diverse detectors.

- **Full-spectrum coverage:**
  Support measurements from low-energy to high-energy, for gamma rays through neutrons.

- **In-depth analysis:**
  Raw-waveform recording and on-line parameter tuning to meet custom analysis requirements

- **Outstanding performance:**
  High count-rate throughput and excellent energy resolution to guarantee measurement accuracy

03

Application Cases

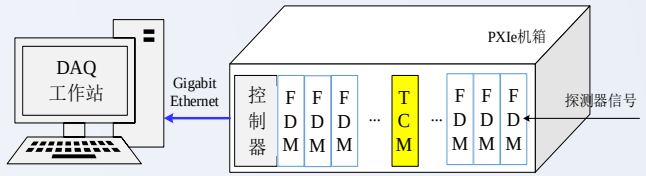
CSNS White Neutron Source Electronics

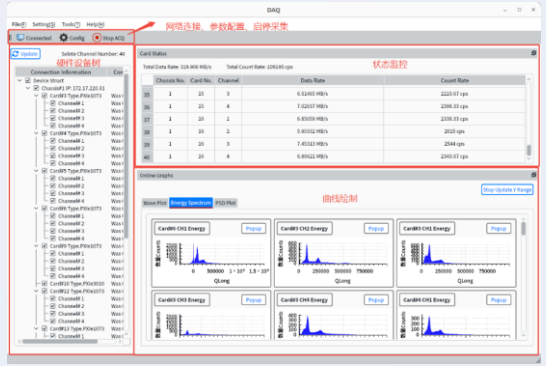
■ Application :

Providing a unified signal readout electronics system for multiple spectrometers at CSNS white neutron source facility.

■ Solution:

- Acquisition: 1 GS/s @ 16-bit, 40 channels
- Synchronization: multi-channel synchronization accuracy ≤ 10 ps
- Real-Time Processing Algorithms: TDC measurement, CFD timing, PSD particle discrimination, QDC charge integration



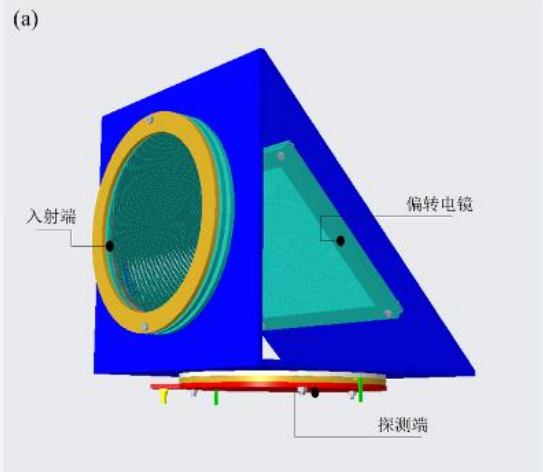


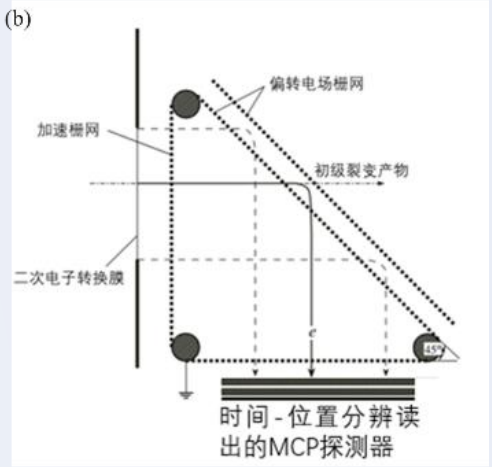


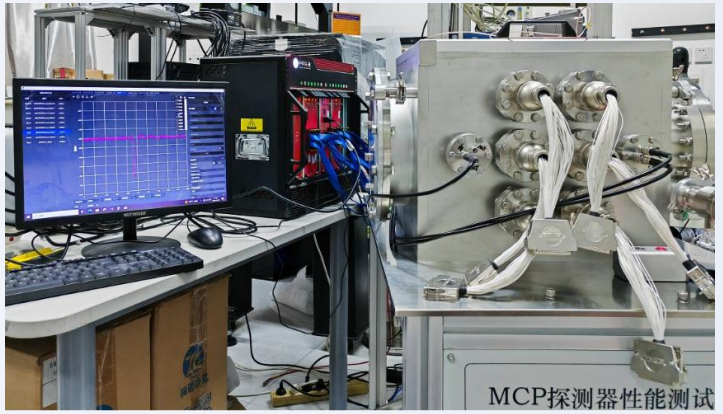


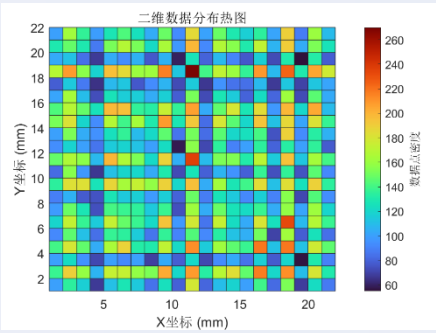
MCP Position-Sensitive and Time-of-Flight Measurement

- Application: Fission fragment mass measuremen
- Solution：
  - Detector: Dual MCP detectors, position resolution 0.8 mm, time resolution 100 ps
  - Acquisition: 5 GS/s @ 14-bit, 512 channels
  - Readout: μXI-X6141 Intel controller
  - Synchronization: timing generator + μXI backplane clock bus and trigger bus





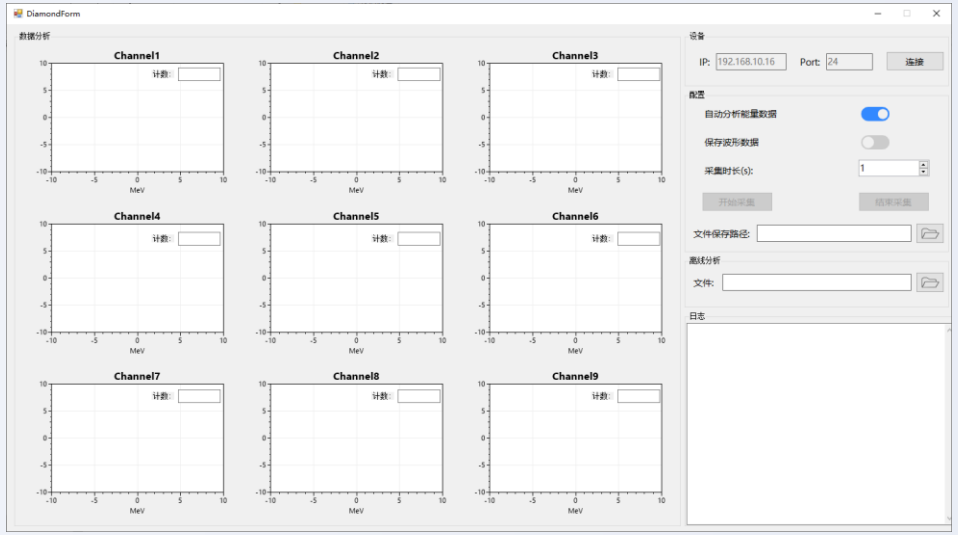




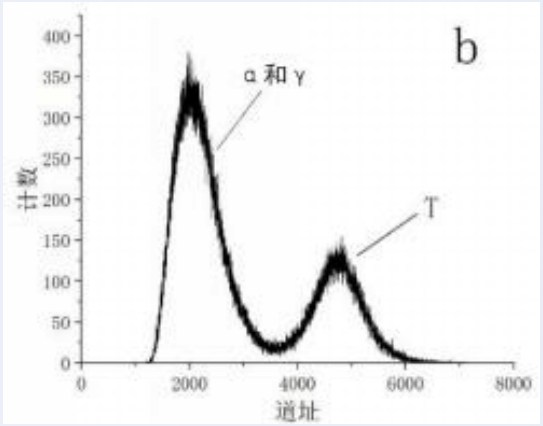
BNCT Neutron Spectrum Measurement

- Application : Boron Neutron Capture Therapy (BNCT)

- Solution:
  - Detector: 9 diamond detectors in one moderator
  - Front-end electronics: 9-channel charge-sensitive preamplifier + high-voltage power supply
  - Acquisition: 500 MS/s @ 16-bit, 9 channels, 2 Vpp range
  - Readout: SiTCP transceivers + μXI protocol
  - Real-time data processing: CFD, PSD, QDC





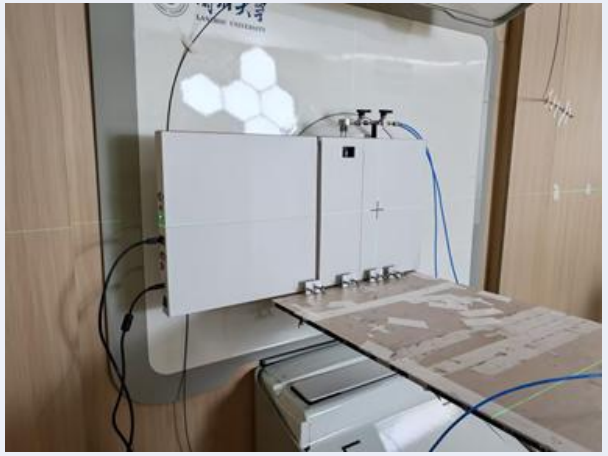


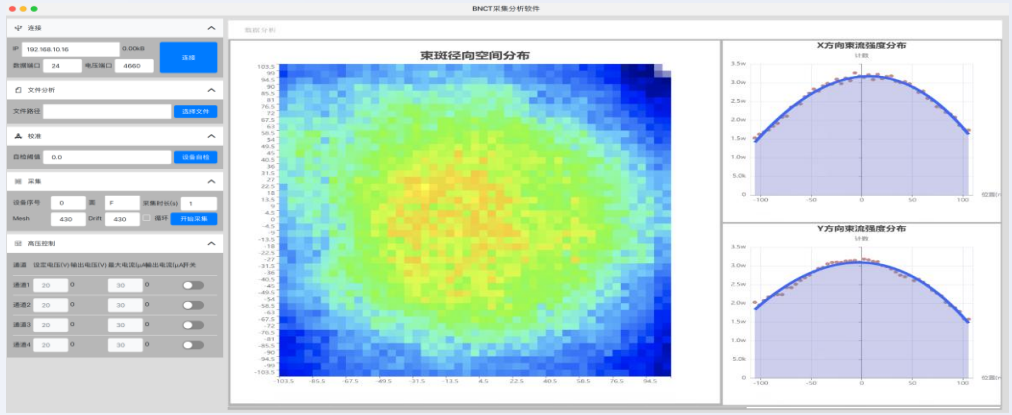
Neutron and Photon Spatial Distribution Measurement System

■ Application : BNCT beam quality evaluation

Technical Specifications:

Detector	Micro-pattern gas detector (MicroMegas)
Effective detector area	≥20 cm × 20 cm
Spatial resolution	≤2mm
Detection efficiency uniformity	≤2%
Fluence rate measurement range	≤2×10⁹ n/cm²/s （epithermal neutrons）
Neutron energy range	0.025 eV ~ 1.2 MeV
Photon energy range	1 keV ~ 11 MeV
Communication interface	Gigabit Ethernet
Analysis mode	Online real-time processing, supports offline data replay and analysis





Thomson Scattering High-Speed Acquisition

Application

- Fusion diagnostics, measurement of plasma electron temperature and density
- High-speed capture of multi-channel scattered light signals

System Highlights

High-density switched-capacitor array acquisition(DRS4), cost-effective

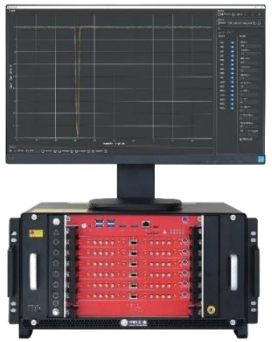
Amplitude and timing correction algorithms ensure acquisition accuracy

Synchronous acquisition, real-time event assembly and storage, highly convenient

- 320-channel synchronous acquisition · solving large-scale channel synchronization challenges

Core Technical Specifications

2.5GS/s	14bit	320 channels
500MHz	<50ps RMS	2Vpp





X-Ray Pulse Intensity / Position Diagnostics

■ Application:

Online diagnostics of absolute photon count and position for X-ray pulse（XFEL）

■ Solution:

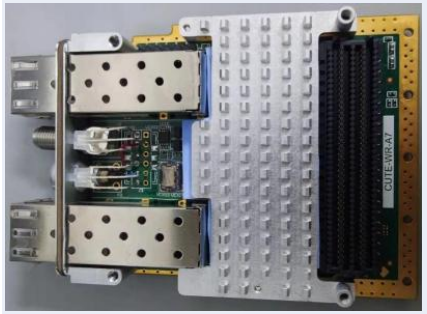
- Detectors: X-ray gas detecto
- Acquisition: 1GS/S PXIe, 4ch × 2, 16-bit
- 1 MHz trigger repetition rate
- Waveform feature extraction and position calculation
- White Rabbit timing
- EPICS interface client program



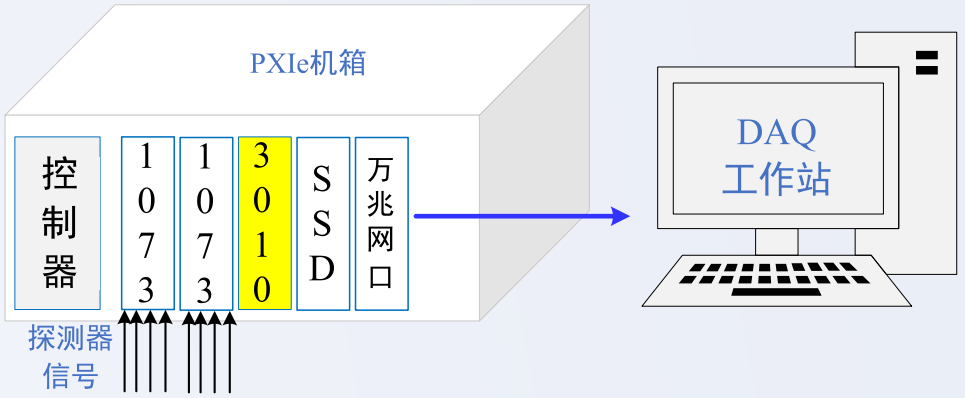
1GS/S acquisition module



Clock synchronization module



WR timing module



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Thank you!

笃行致确 Engineer Certainty