TechnoAP

2017年度
量子ビームサイエンスフェスタ

会社と製品の概要
Company and Product Overview

株式会社テクノエーピー
TechnoAP Co., Ltd.

TechnoAP

弊社は茨城県ひたちなか市に拠点を置き

放射線・物理計測用モジュールや検出器など

自社で設計・開発・製造・販売する

国内でも数少ない精密測定機器メーカーです。

Our company is located in Hitachinaka city, Ibaraki prefecture.

We design, develop, manufacture and sell modules and detectors for radiation and physical measurement by ourselves.

It is a unique precision measuring equipment manufacturer in Japan.

TechnoAP

放射光施設や放射線に関連した研究を行う

大学や施設などから数多くの引き合いを頂いており

市場のニーズを反映した新製品の開発や

さまざまな課題に対し積極的に取り組んでおります。

We received many inquiries from radiation facilities and universities and facilities that conduct radiation related research. We are actively working on the development of new products reflecting market needs and various issues.

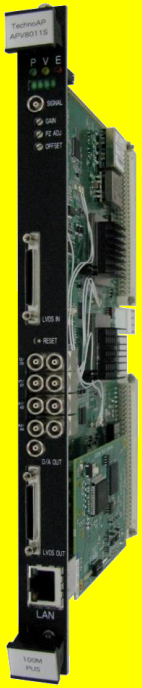
TechnoAP

次世代の超高計数率
デジタルパルスプロセッサー！

Next generation ultra-high count rate digital pulse processor!

TechnoAP

➢ New Pileup Separator Processor



Functions: **Real time Pileup Separator**

In Signal: Silicon Drift Detector etc.

100Msps 16-bit

Functions: **Real time Pileup Separator**

In Signal: Fast-scintillator anode direct

1Gsps 14-bit

➢ New Pileup Separator Processor

The piled up signal is separated by the **nonlinear least squares method**.
The nonlinear least squares method is one of the curve fitting methods for observation data and is a nonlinear model function extension of the least squares method.
For the judgment of the error between the fitted waveform and th
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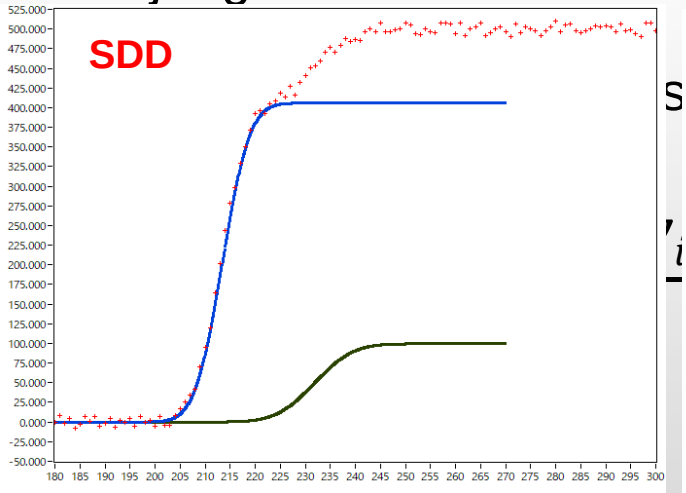
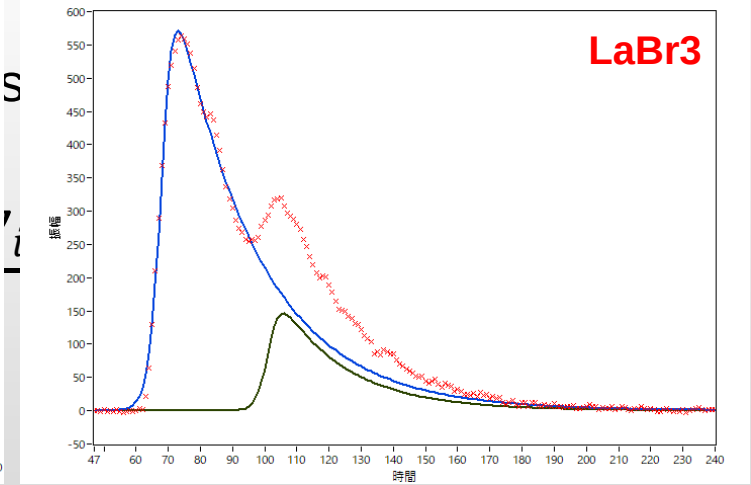
T

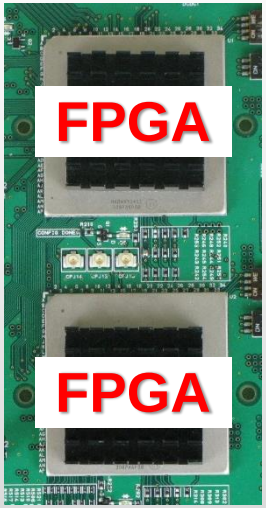


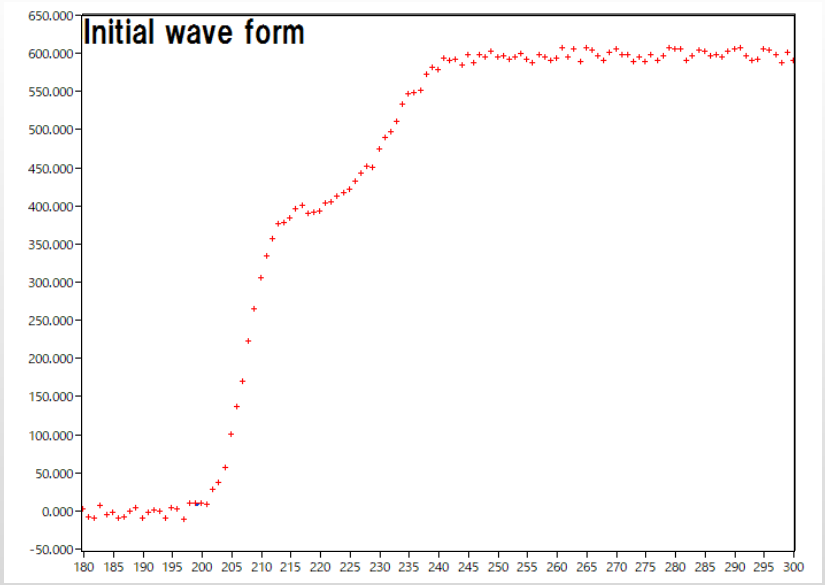


New Pileup Separator Processor

The following animation shows one of the repeated calculations.

The nonlinear least squares method can be checked **repeatedly until fitting optimally**.





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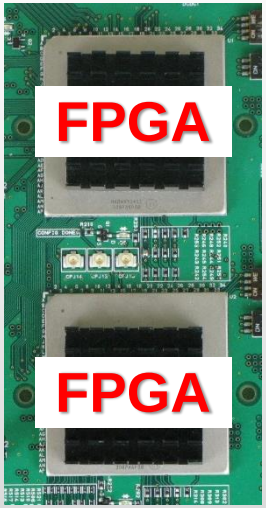

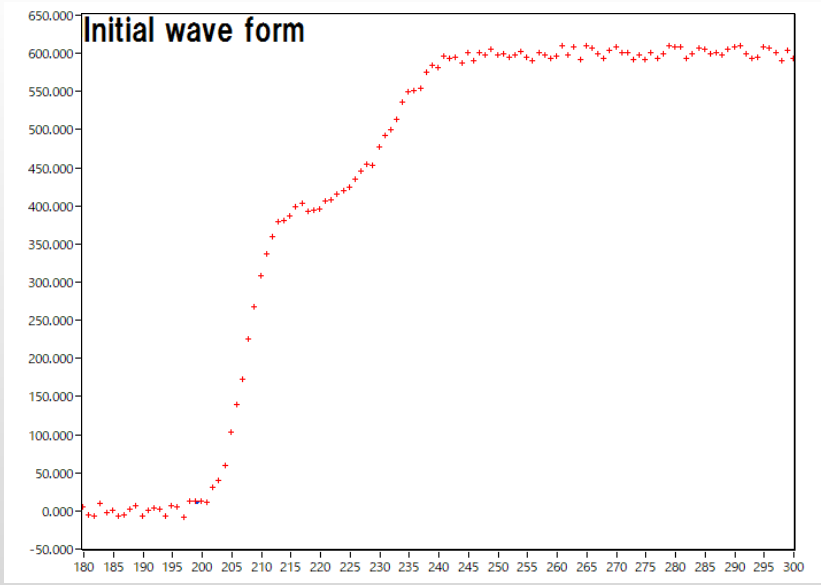

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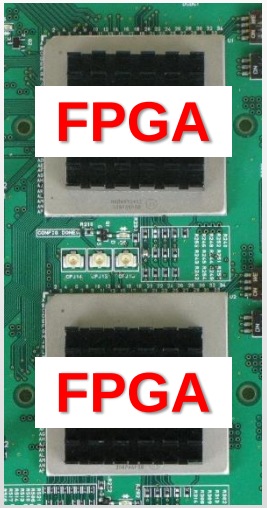

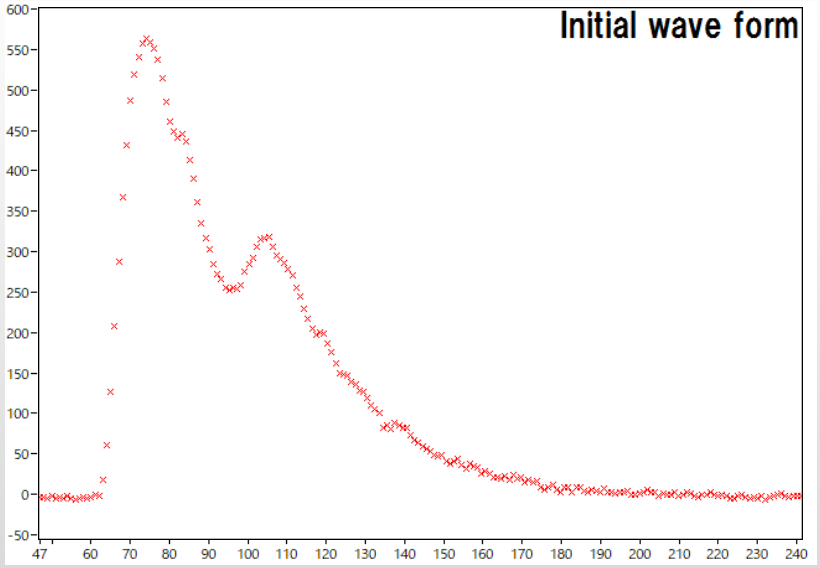

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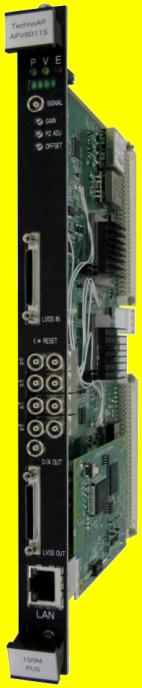
最新のFPGAよるリアルタイム パイルアップセパレーションプロセッシング

REAL-TIME PILE-UP SEPARATION PROCESSING BY STATE-OF-THE-ART FPGA

TechnoAP

➢ New Pileup Separator Processor



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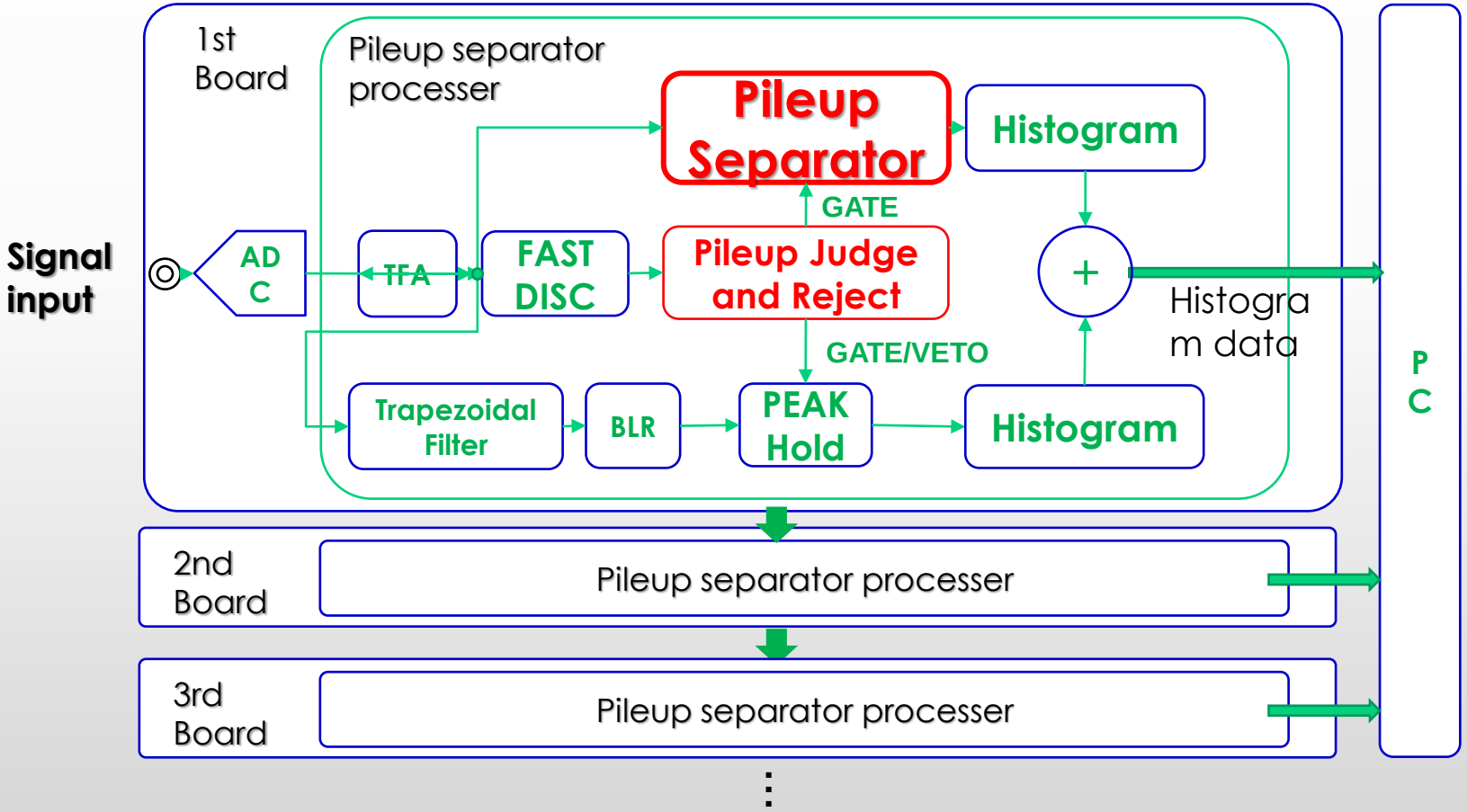
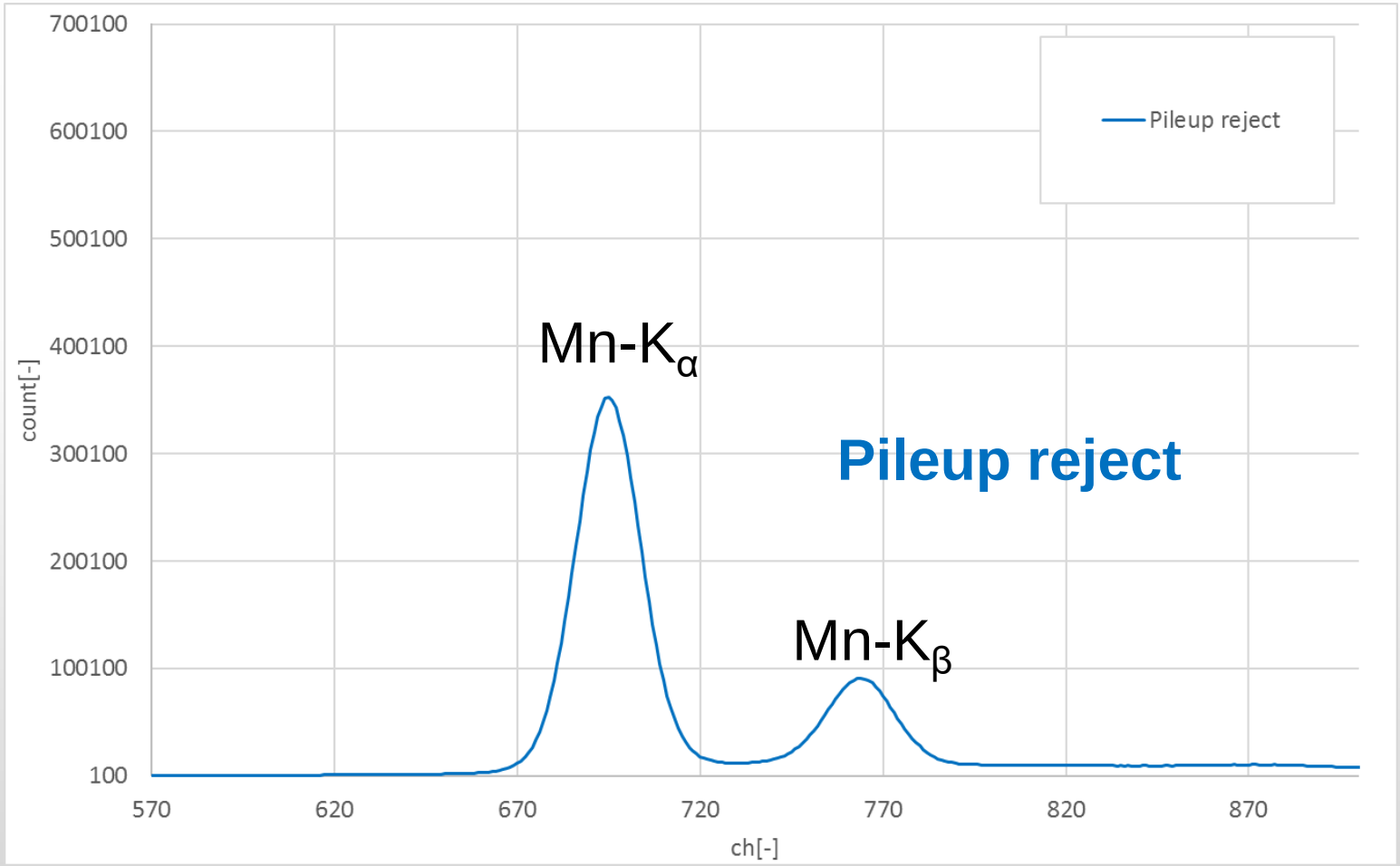
1Gsps 14-bit

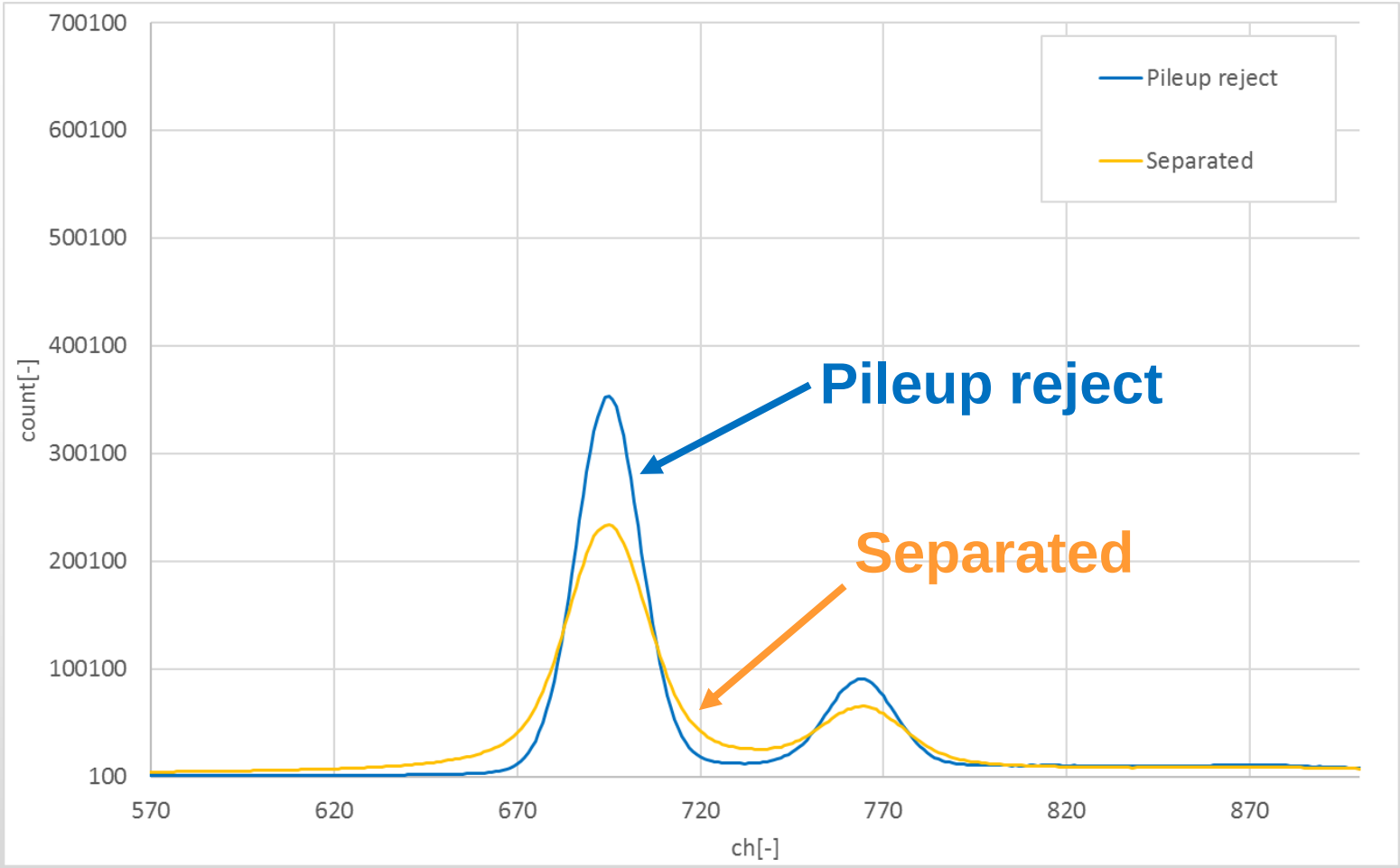
New Pileup Separator Processor Block Diagram



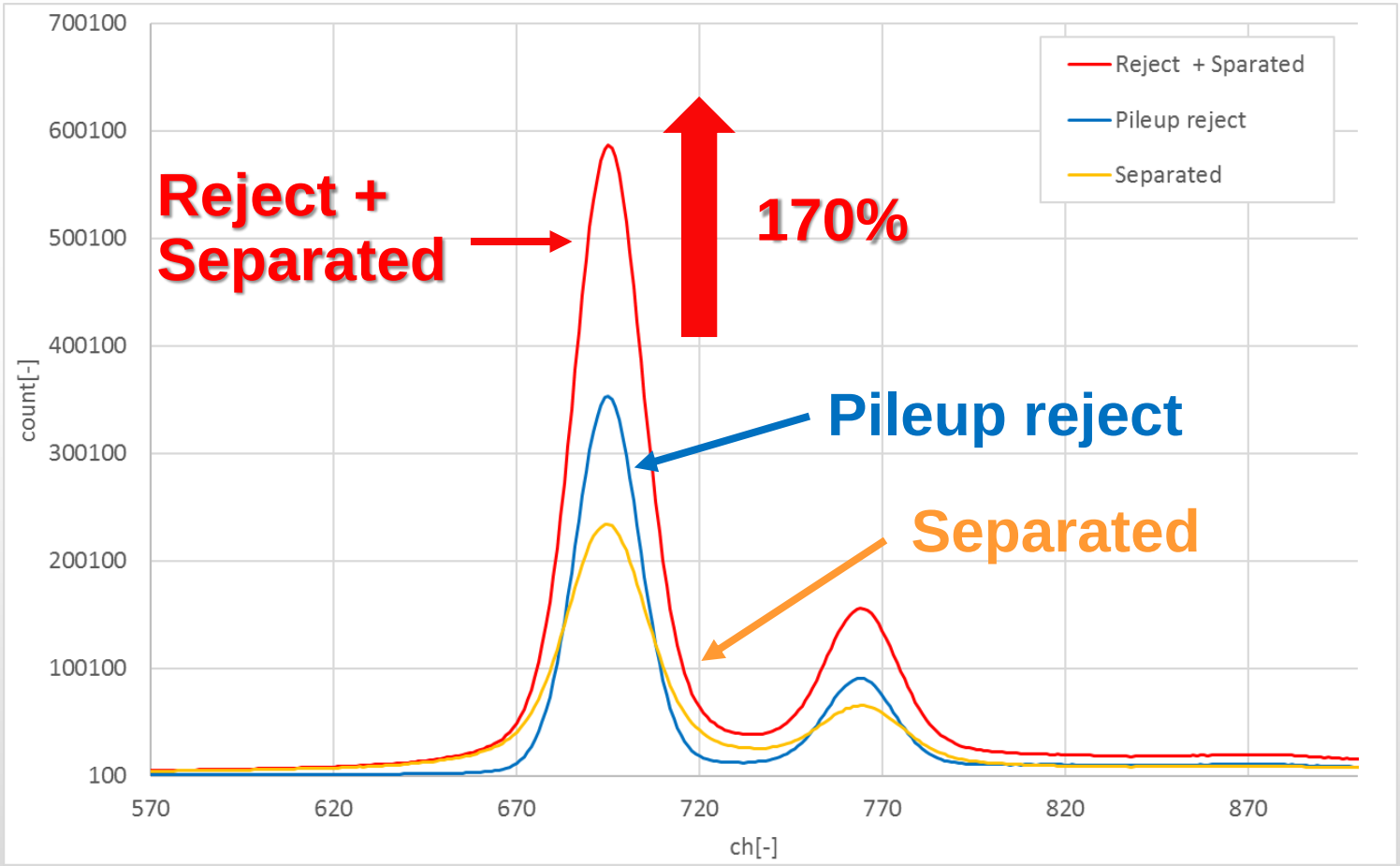
➢ Mn spectrum by SDD



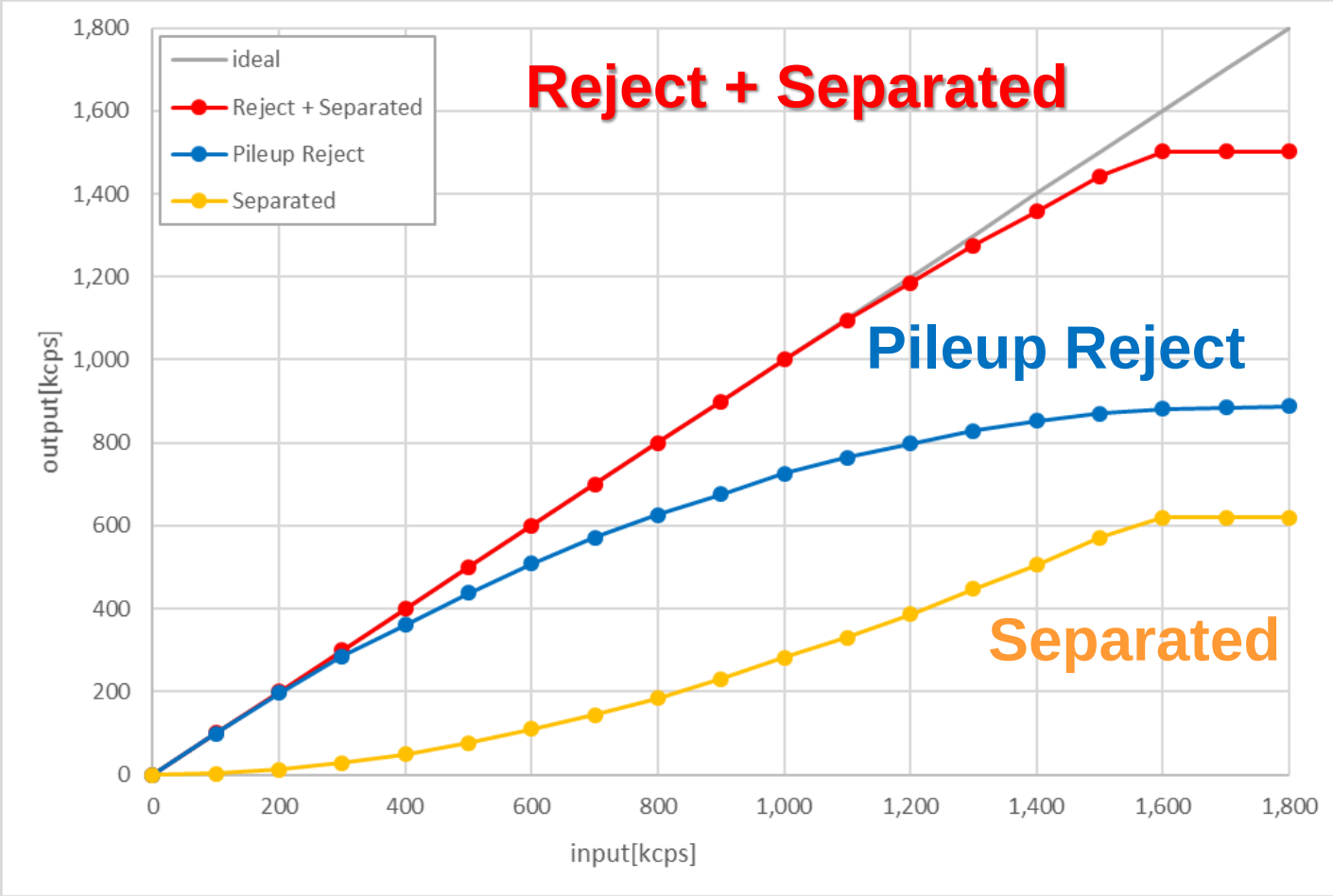
➢ Mounting pileup separator



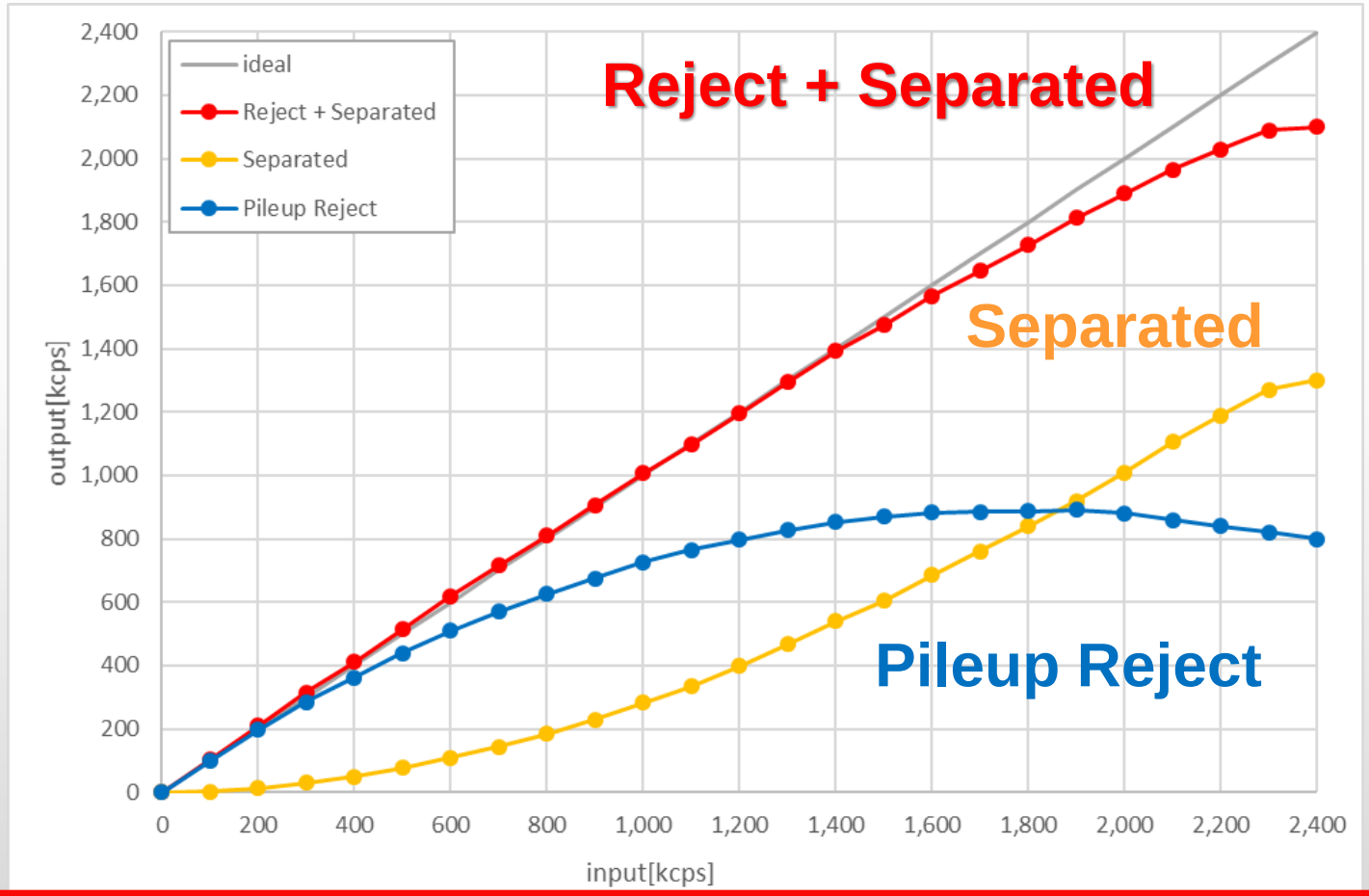
➢ Combining separator spectra @ICR 1.5Mcps



➢ Input vs. output rate by 1 board



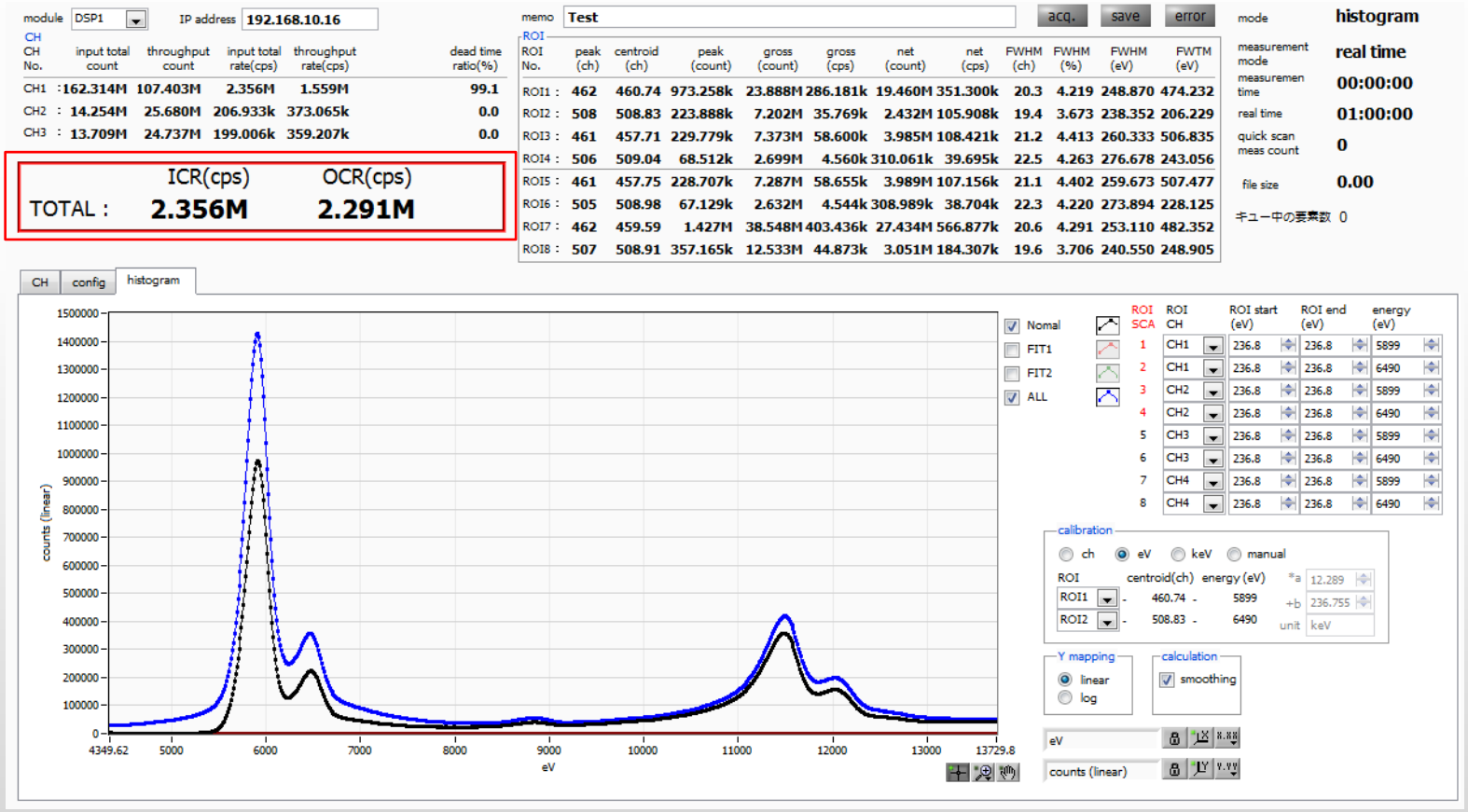
➢ Input vs. output rate by 2 boards



By connecting more boards, you can get bigger output.

➢Demonstration of APV8011S at BL9A KEK-PF

Target: Mn
Model: XSDD50-01



*Images is for illustration purpose.
*Please note that contents may change without prior notice.

➢Demonstration of APV8011S at BL9A KEK-PF

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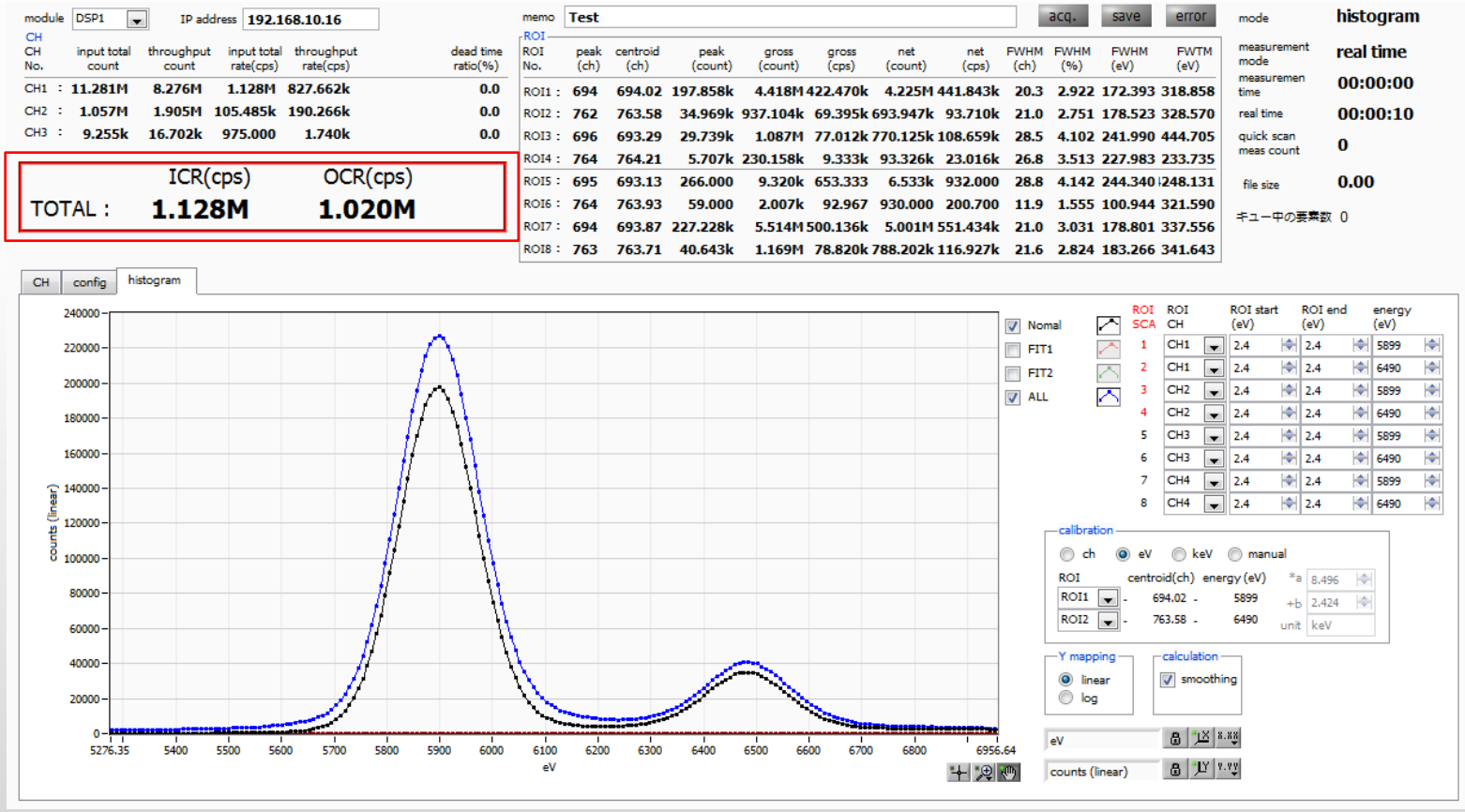

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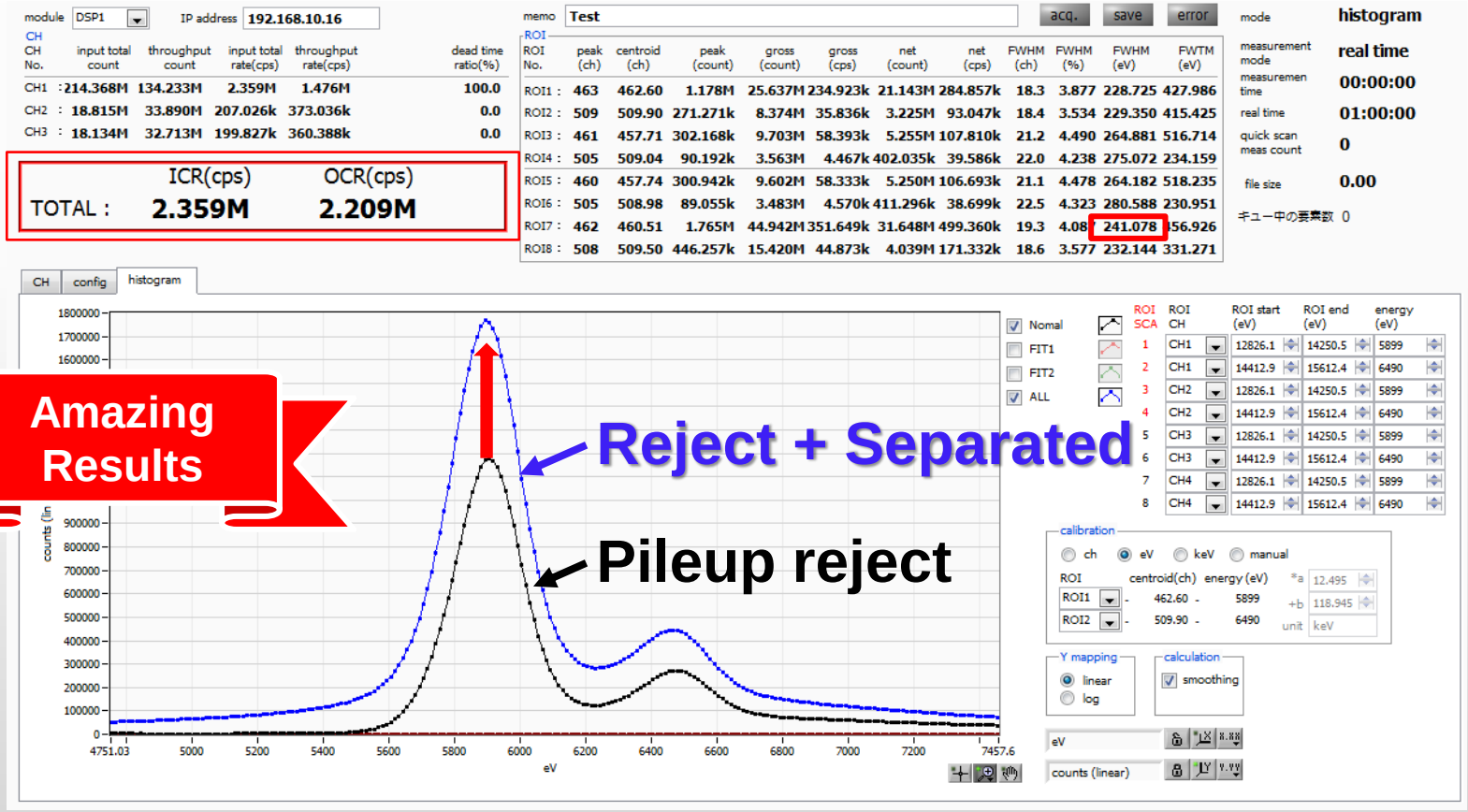

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Introduction of

Silicon Drift Detector

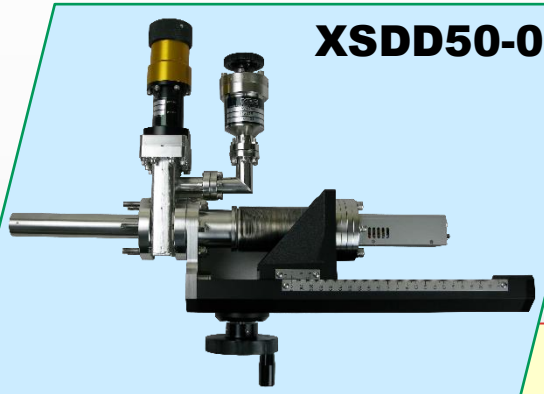
TechnoAP

Multi element SDD system

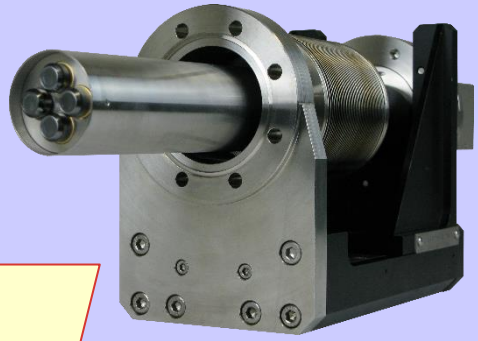
CUSTOM MADE for your needs!

- High Rate Performance
- Ultra-fast Digital Pulse Processors
- Designed to suit customer requirements.
- Detectors are also available with windowless construction.

XSDD50-01



XSDD50-04



XSDD50-04-V-AGL25

XSDD50-07

TechnoAP

➢ 7 element SDD system for X-ray in Air

XSDD50-07

- **Element area**
  455mm² (65mm² x 7 elements)
- **Effective area**
  350mm² (65mm² Collimated to 50mm² x 7 elements)
- **Function**
  Histogram, List, Waveform, ROI-SCA
- **ADC**
  4CH 100Msps 14-bit
- **Energy Resolution**
  244eV@5.9keV Mn-Kα
  OCR: 1000k, Peaking time: 0.25μs
- **Power Supply for SDD**
  -200V, ±5V, +3.3V
- **Interface**
  Ethernet (TCP/IP)

DSP & Power supply

Available for vacuum environment

TechnoAP

➢ 7 element SDD system for X-ray in Air

XSDD50-07

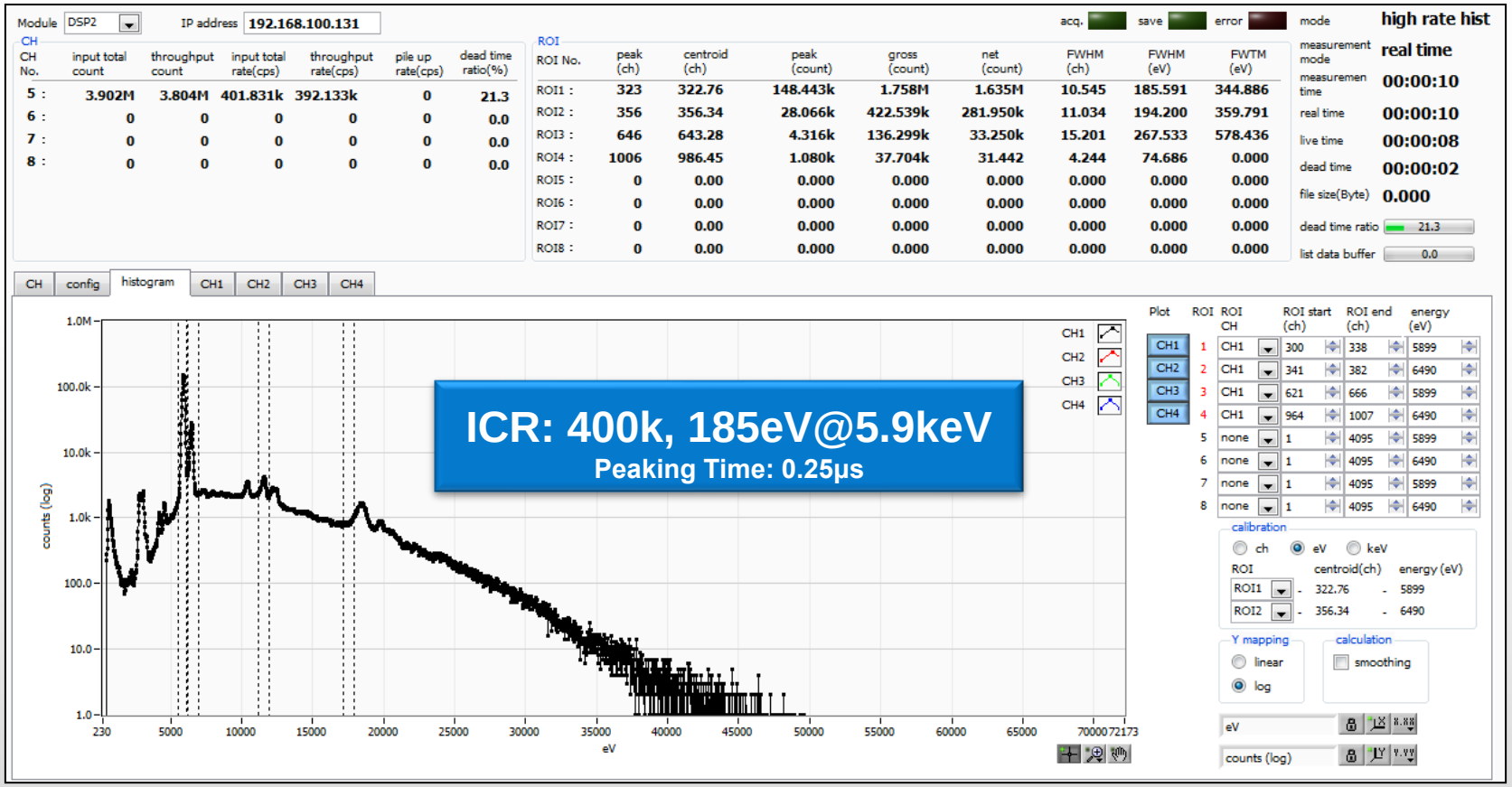
Detector	SDD 65mm^2 collimated to 50mm^2
Element area	455mm^2 (65mm^2 × 7 element)
Active area	350mm^2 (65mm^2 collimated to 50mm^2 x 7 element)
ADC sampling	100Msps, 14-bit
ADC gain	4096, 2048, 1024, 512, 256ch
Energy resolution	125eV@5.9keV, Mn-Kα 10kcps, Peaking time: 1us 150eV@5.9keV, Mn-Kα 300kcps, Peaking time: 0.05us
Output Rate*	Max. 150kcps, Peaking time: 2us Max. 1250kcps, Peaking time: 0.05us
Measurable Element	C (Carbon) ～
Interface	Gigabit Ethernet
Back panel	Monitor output terminal, TTL (SCA) output terminal, VETO input terminal, DC power socket, mini-USB connector, Power LED monitor
External dimensions	80mm(W) × 400mm(D) × 40mm(H)
Weight	About 1100g

Available for vacuum environment

*Depend on measurement module of selected

➢ 7 element SDD system for X-ray in Air

XSDD50-07

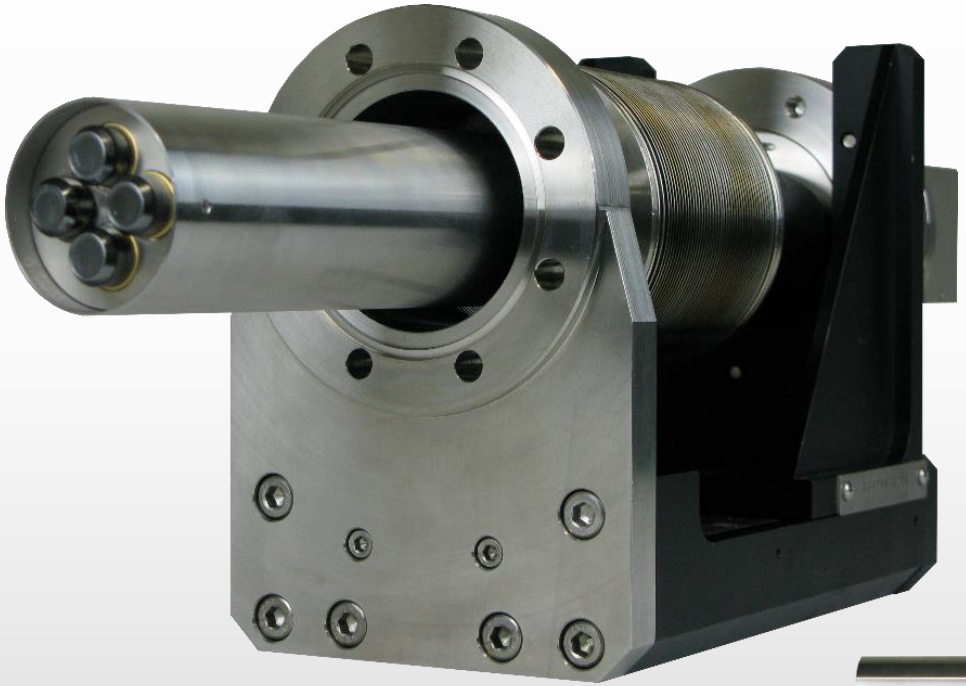


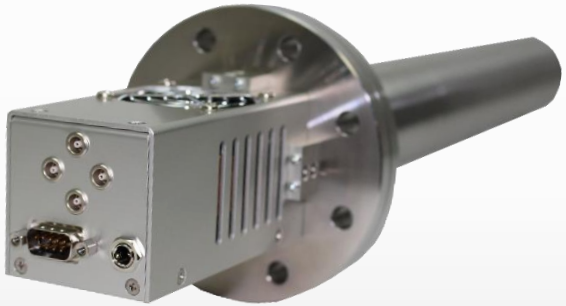
Available for vacuum environment

TechnoAP

➢ 4 element SDD system for X-ray in Vacuum

XSDD50-04





Transport with bellows

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➢ 4 element SDD system for X-ray in Vacuum

XSDD50-04

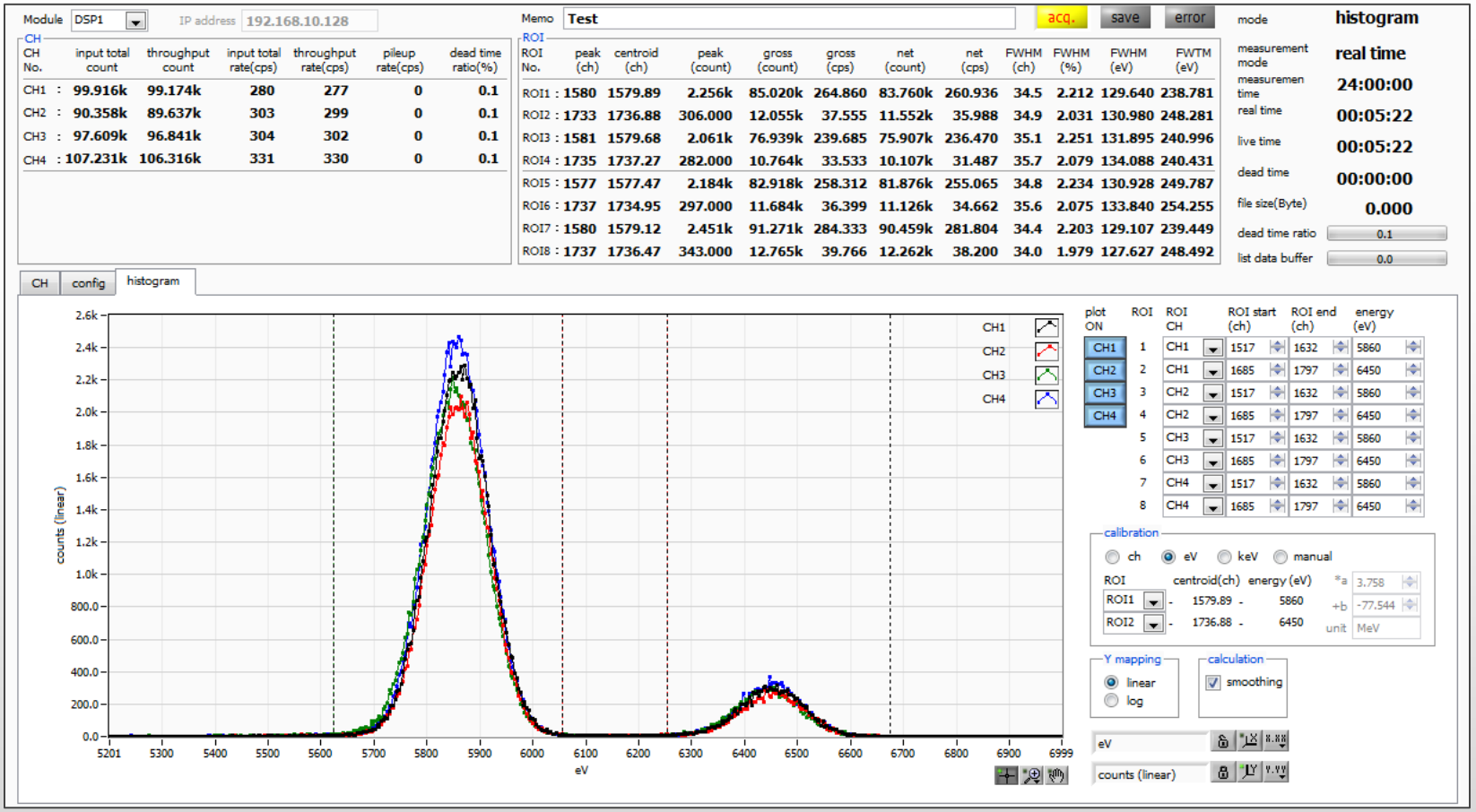
Detector	SDD 50mm^2, Window-less / AP3.3 / Be
Element area	260mm^2 (65mm^2 × 4 element)
Active area	200mm^2 (65mm^2 collimated to 50mm^2 × 4 element)
Measurement mode	Histogram / List / Waveform / ROI-SCA
ADC sampling	4CH, 100Msps, 14-bit
Energy resolution (typ.)	244eV@5.9keV Mn Kα OCR: 1000k, Peaking time: 0.25μs
SDD power supply	-200 V , ±5V, +3.3V
Output Rate*	Max. 150kcps, Peaking Time: 2us Max. 1000kcps, Peaking Time: 0.15us
Interface	Ethernet (TCP/IP)
Option	Z-axis movement mechanism, UHV valve
Vacuum capable	<10^{-5} Pa
Flange type	ICF114 (Standard)

*Depending on the selected module

TechnoAP

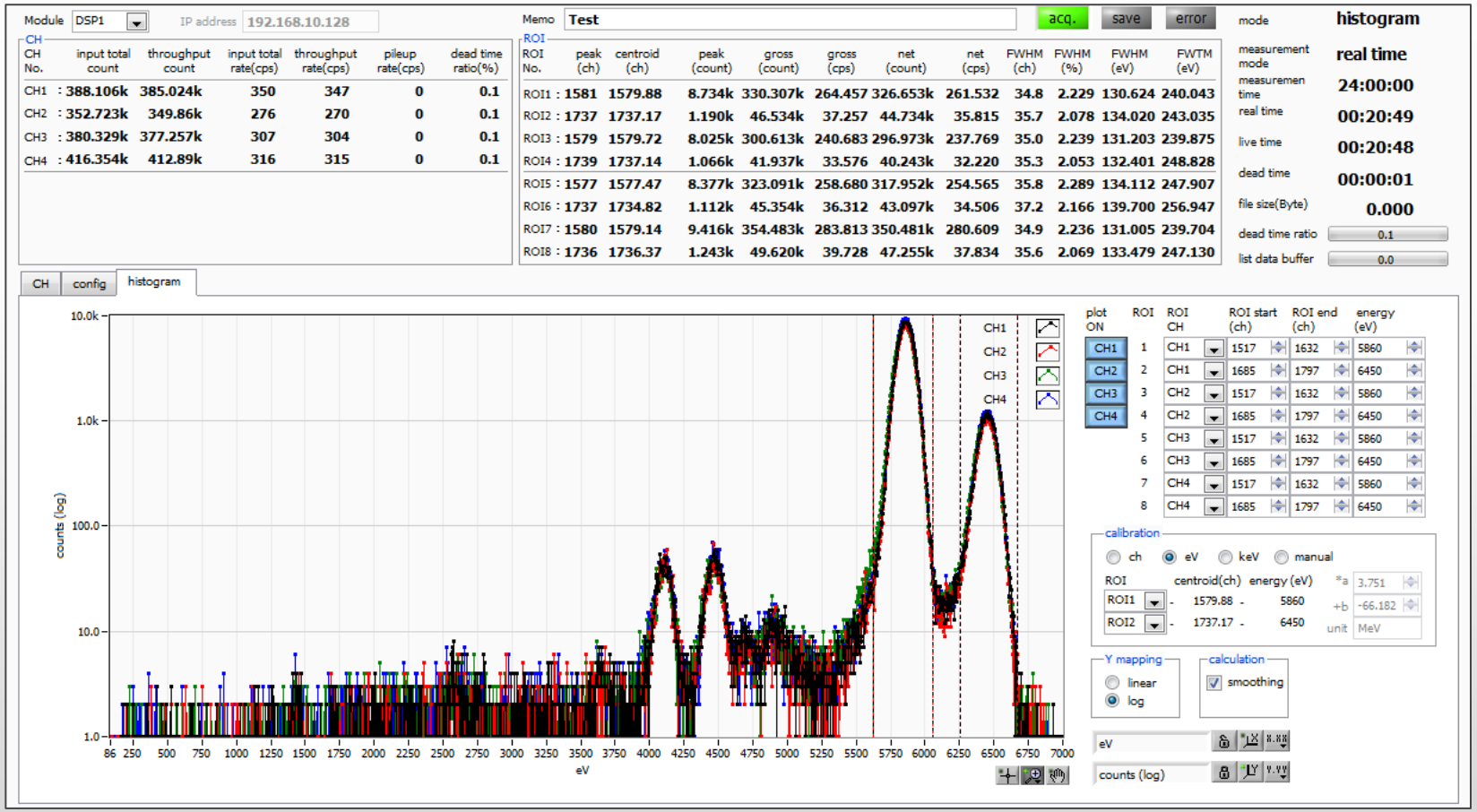
➢ 4 element SDD system for X-ray in Vacuum

XSDD50-04



➢ 4 element SDD system for X-ray in Vacuum

XSDD50-04



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NEW

XSDD50-04-V-AGL25

Window-less

Count Rate

1Mcps or more

JAPAN MADE

For Soft X-ray

Measurable from low energy region to hundreds of eV

65mm² collimated to 50mm²

Surface of Detector

Angle degrees 25

Energy Resolution

- 244eV@5.9keV Mn Kα

  Peaking Time: 0.25μs

- 130eV@5.9keV Mn Kα

  Peaking Time: 1μs

TechnoAP

XSDD50-04-V-AGL25

Window-less

JAPAN MADE

Suitable measurement unit

4CH 100Msps 14-bit

APU504XGbE

Back of Detector

Function

- ✓ Histogram
- ✓ List-mode
- ✓ Wave
- ✓ **FAST Output**
- ✓ **ROI-SCA Output**
- ✓ **Quick-Scan**

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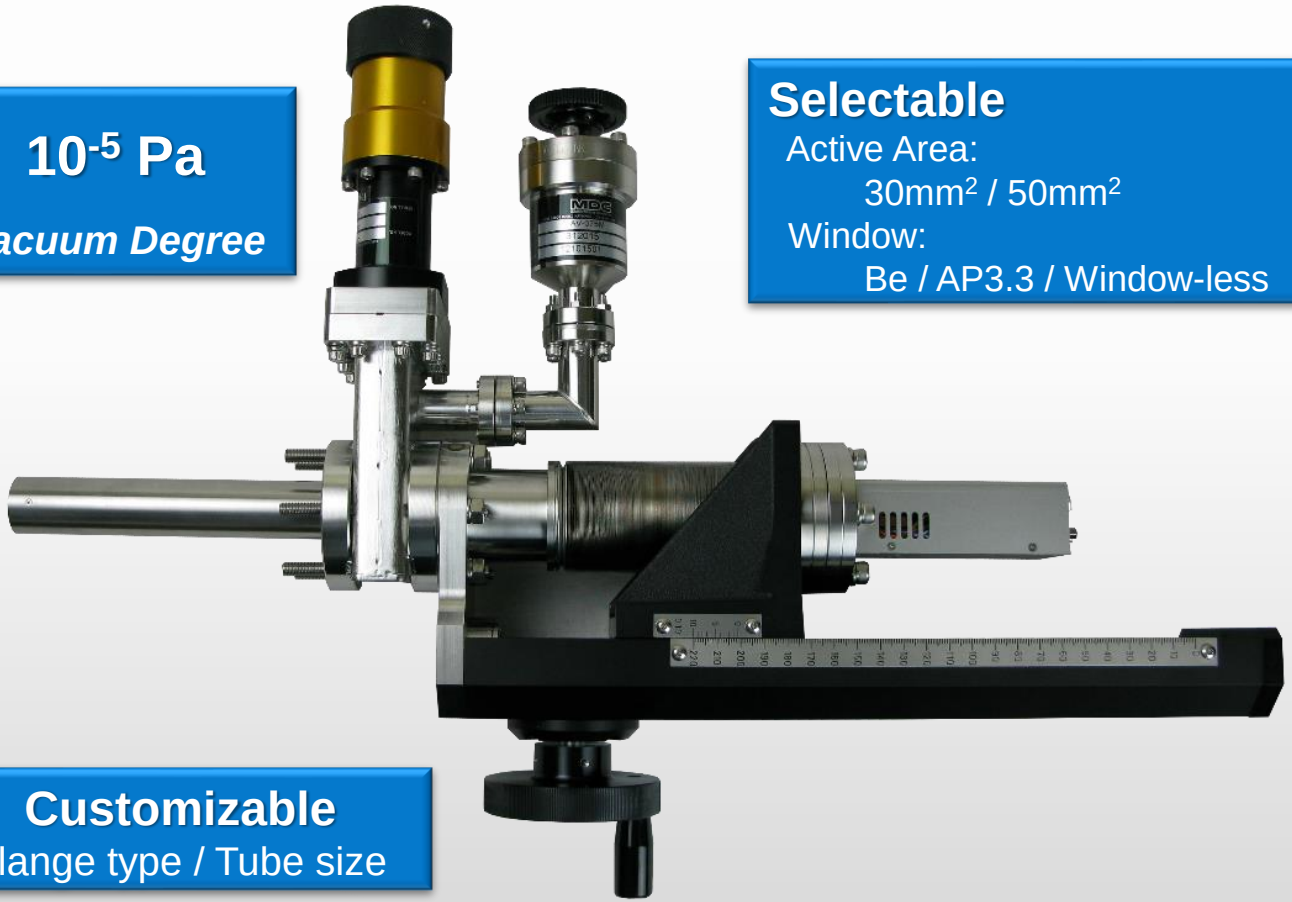
➢ 1 element SDD system for X-ray in Vacuum

XSDD50-01

10^{-5} Pa
Vacuum Degree

Selectable
Active Area:
$30mm^2$ / $50mm^2$
Window:
Be / AP3.3 / Window-less



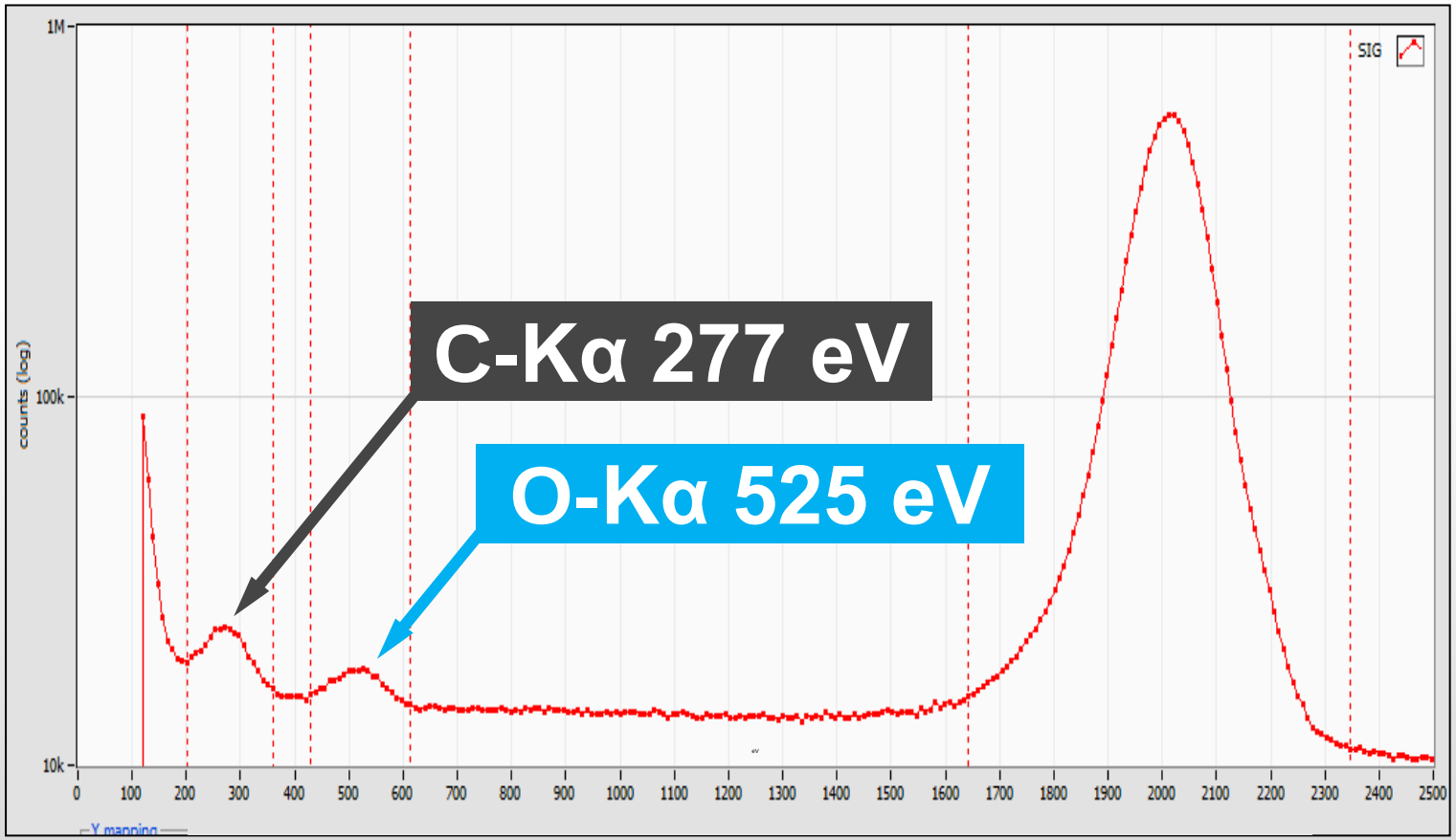
Customizable
Flange type / Tube size

Gate valve and Angle valve transport
with bellows

TechnoAP

➢ 1 element SDD system for X-ray in Vacuum

XSDD50-01



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➢ 1 element SDD system for X-ray in Vacuum

XSDD50-01

Detector	SDD 50mm^2, Window-less / AP3.3 / Be
Element area	65mm^2
Active area	65mm^2 collimated to 50mm^2
Measurement mode	Histogram / List / Waveform / ROI-SCA
ADC sampling	100Msps 14-bit
Energy resolution (typ.)	125eV@5.9keV, Peaking Time: 2us 150eV@5.9keV, Peaking Time:0.15us
SDD power supply	-200 V , ±5V, +3.3V
Output Rate*	Max. 150kcps, Peaking Time: 2us Max. 1000kcps: Peaking Time: 0.15us
Interface	Ethernet (TCP/IP)
Option	Z-axis movement mechanism, UHV valve
Vacuum capable	<10^{-5} Pa
Flange type	ICF70 (Standard)

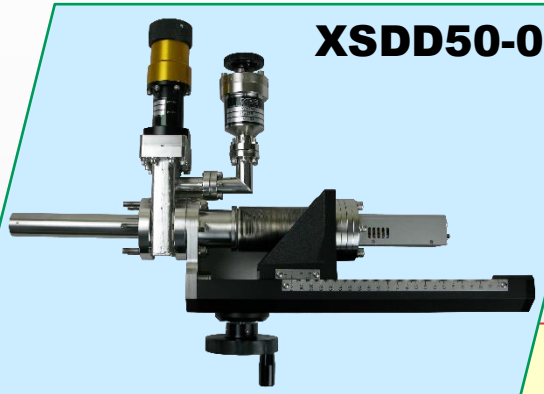
*Depending on the selected module

TechnoAP

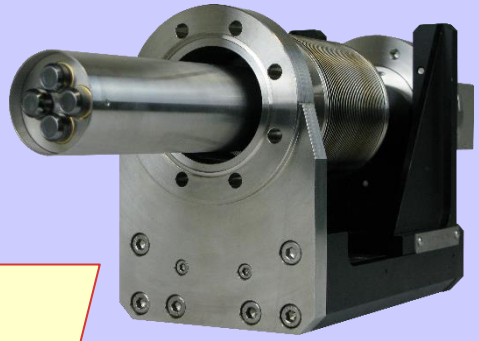
- ✓ High Rate Performance
- ✓ Ultra-fast Digital Pulse Processors
- ✓ Designed to suit customer requirements.
- ✓ Detectors are also available with windowless construction.

CUSTOM MADE
for your needs!

XSDD50-01



XSDD50-04



XSDD50-04-V-AGL25

XSDD50-07

TechnoAP

Introduction of

DSP
(Digital Signal Processing)

VME Standard

➢ DSP (Digital Signal Processing) VME Standard

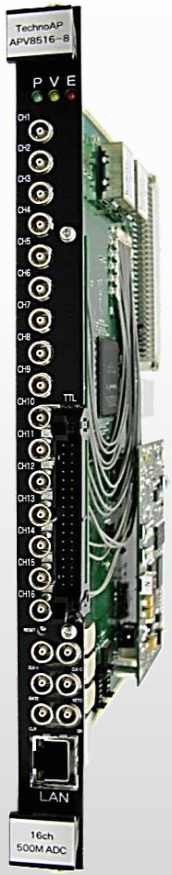
For HPGe semiconductor detector, SDD, Si(Li)

- ◆ APV8004 (4 Ch. 100Msps, 14-bit)
- ◆ APV8016 (16 Ch. 100Msps, 14-bit)

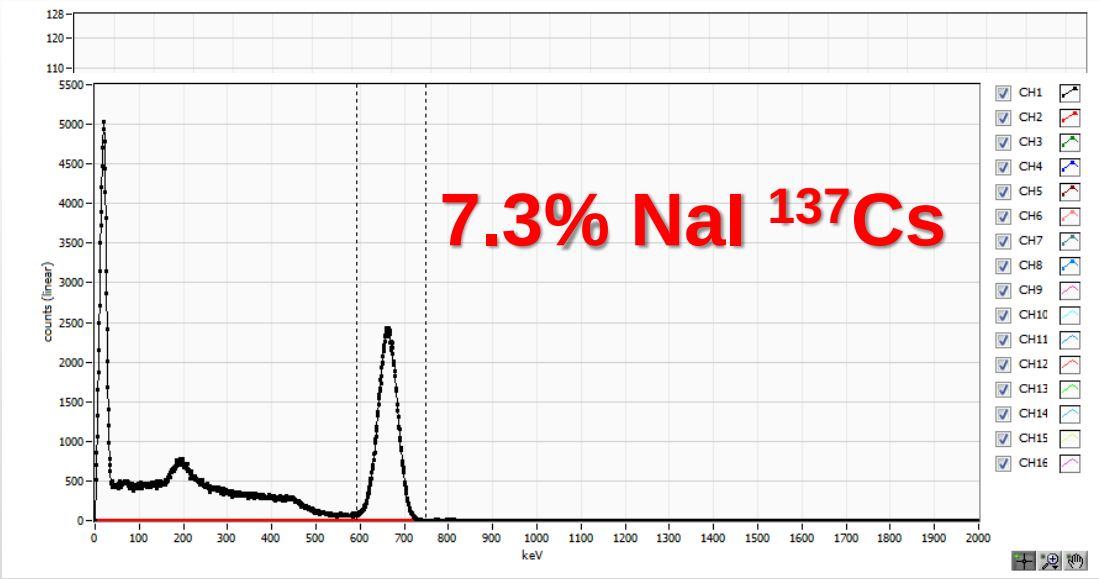
For Scintillation detectors

- ◆ APV8516-8 (16 Ch. 500Msps, 8-bit)
- ◆ APV8104-14 (4 Ch. 1Gsps, 14-bit)
- ◆ APV8702-8 (2 Ch. 3Gsps, 8-bit)
- ◆ APV85G4-10 (4 Ch. 5Gsps, 10-bit)

◆ APV8516-8 (16 Ch. 500Msps, 8-bit)

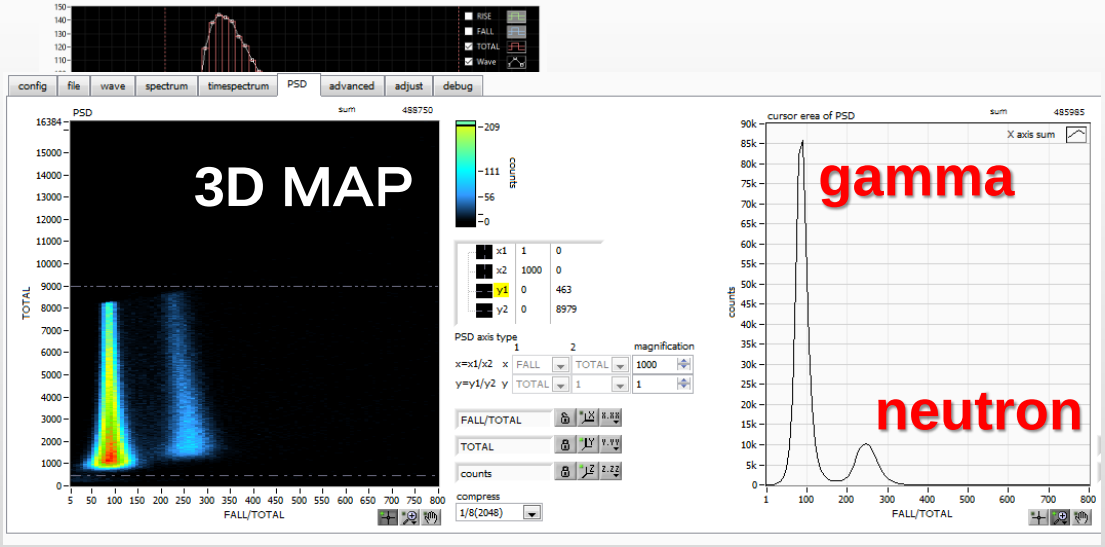


Functions: Real time Digital CFD, TDC, QDC
In Signal type: PMT anode signal **a lot of CH** etc.
Application: $LaBr_3$ anode signal a lot of CH



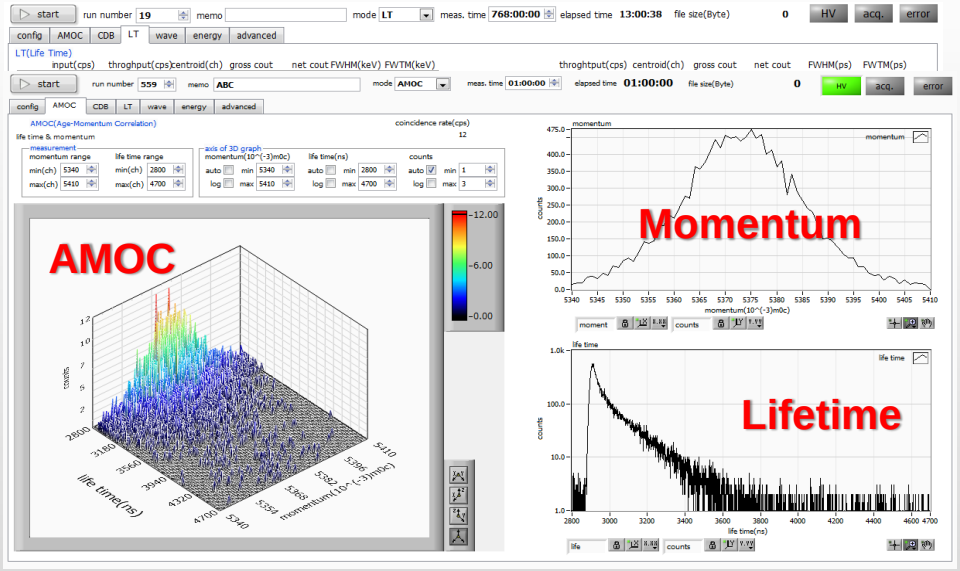
◆ APV8104-14 (4 Ch. 1Gsps, 14-bit)

Functions: **Real time Digital PSA**
In Signal type: PMT anode signal, Liquid Scintillator etc.
Application: Discrimination neutron & gamma



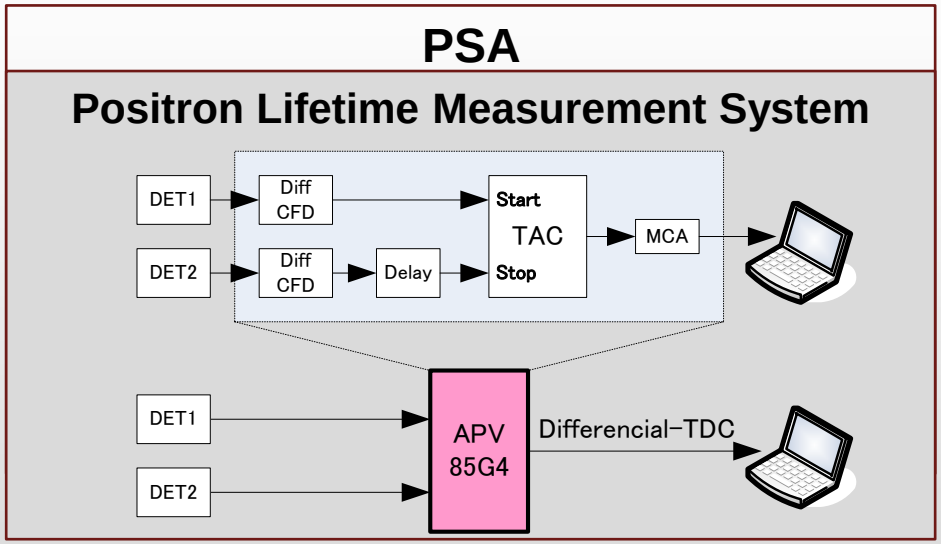
◆ APV8702-8 (2 Ch. 3Gsps, 8-bit)

Functions: **Real time Digital CFD**
In Signal type: Ultra high-speed scintillation detectors etc.
Application: Positron Lifetime Measurement



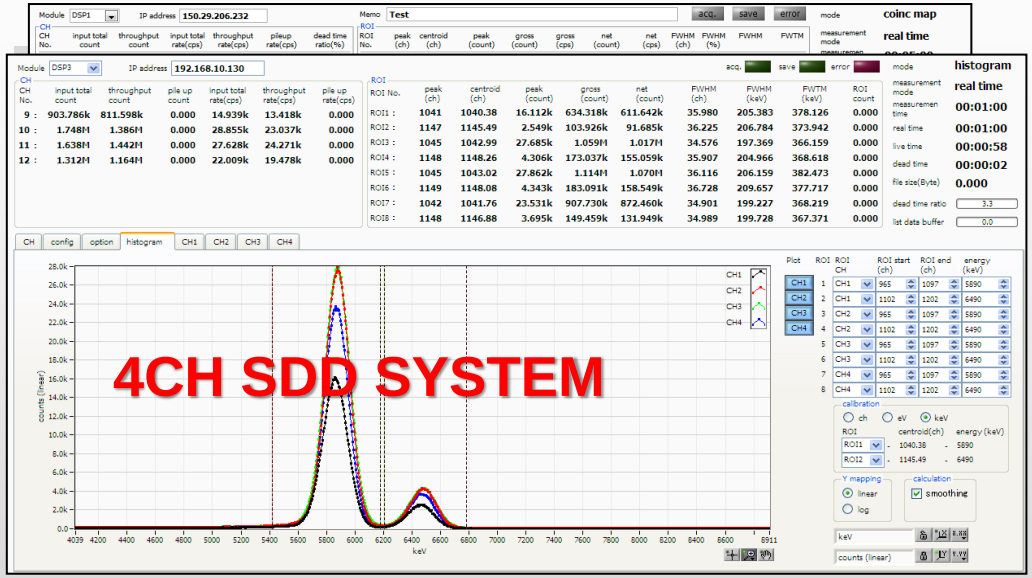
◆ APV85G4-10 (4 Ch. 5Gsps, 10-bit)

Functions: **Real time Digital CFD, PSA**
In Signal type: PMT anode signal, Fast-NIM
Application: PSA, WAVE-LIST, Positron Lifetime Measurement System



◆ APV8004-14 (4 Ch. 100Msps, 14-bit)

Functions: **Real time Trapezoidal filter**
In Signal type: HPGe, SDD, CdTe, Si(Li), SiPin
Application: Coincidence Doppler Broadening
Rise Time Measurement, Waveform-List



◆ APV8016-14 (16 Ch. 100Msps, 14-bit)

Functions: Real time Trapezoidal filter
In Signal type: HPGe, SDD, SSD, Si(Li), SiPin **a lot of CH** etc.
Application: Gamma-Ray Emission Imaging

Application of the digitizer so far is standard.
A sample program can also be provided.
Measurement can be customized.

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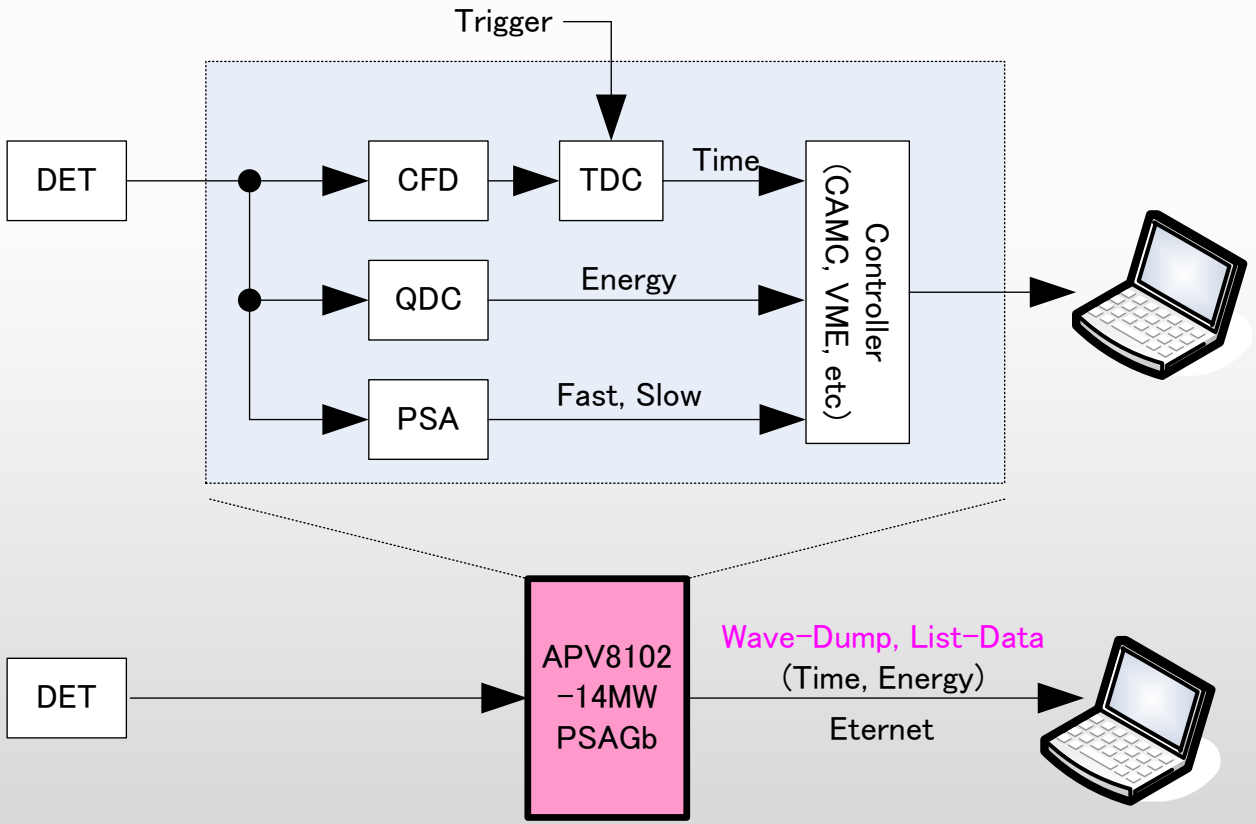
Introduction of

APV8102-14MWPSAGb

VME Standard

◆ APV8102-14MWPSAGb (2 Ch. 1Gsps, 14-bit)

Unified functions of each modules



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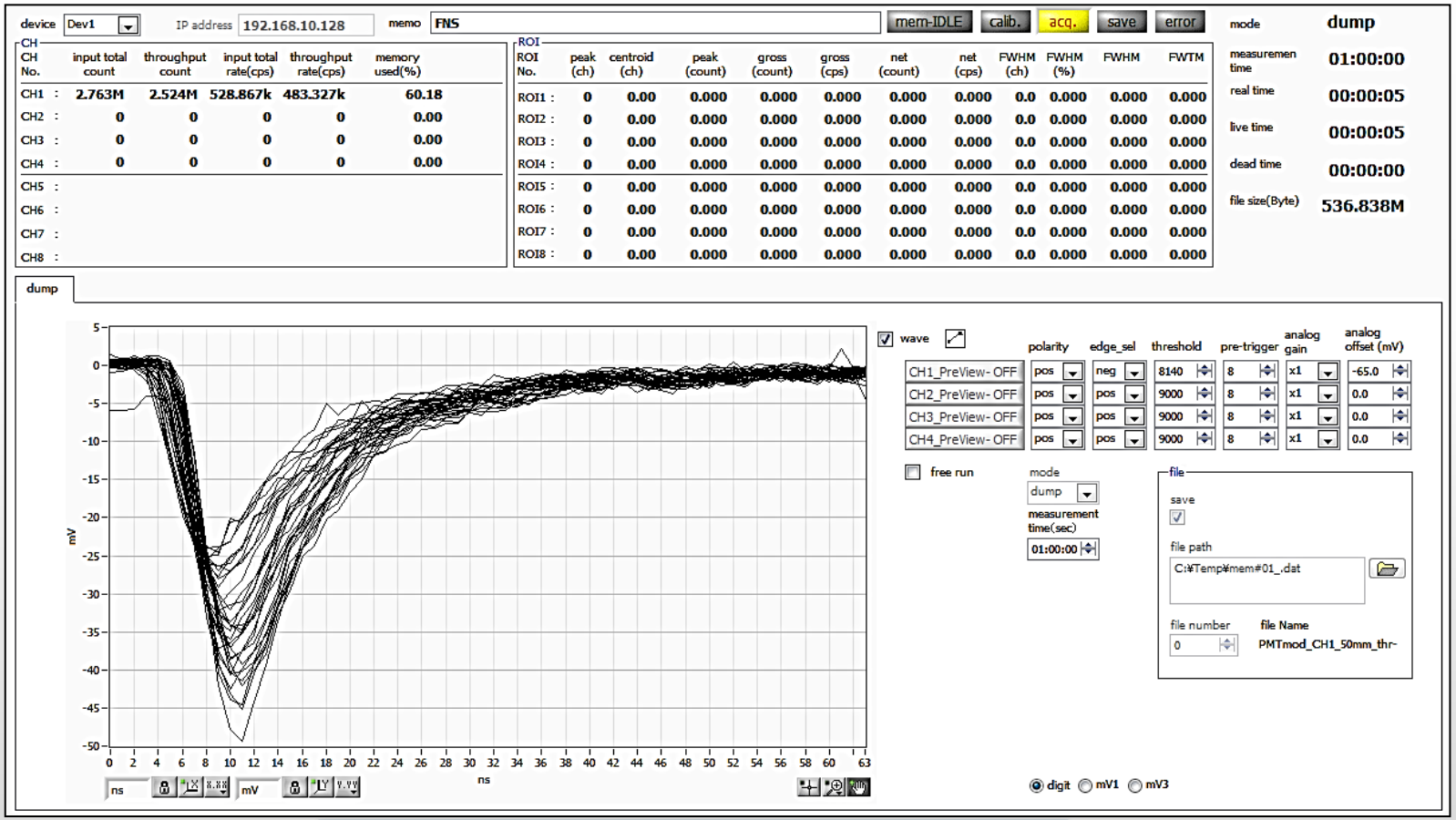
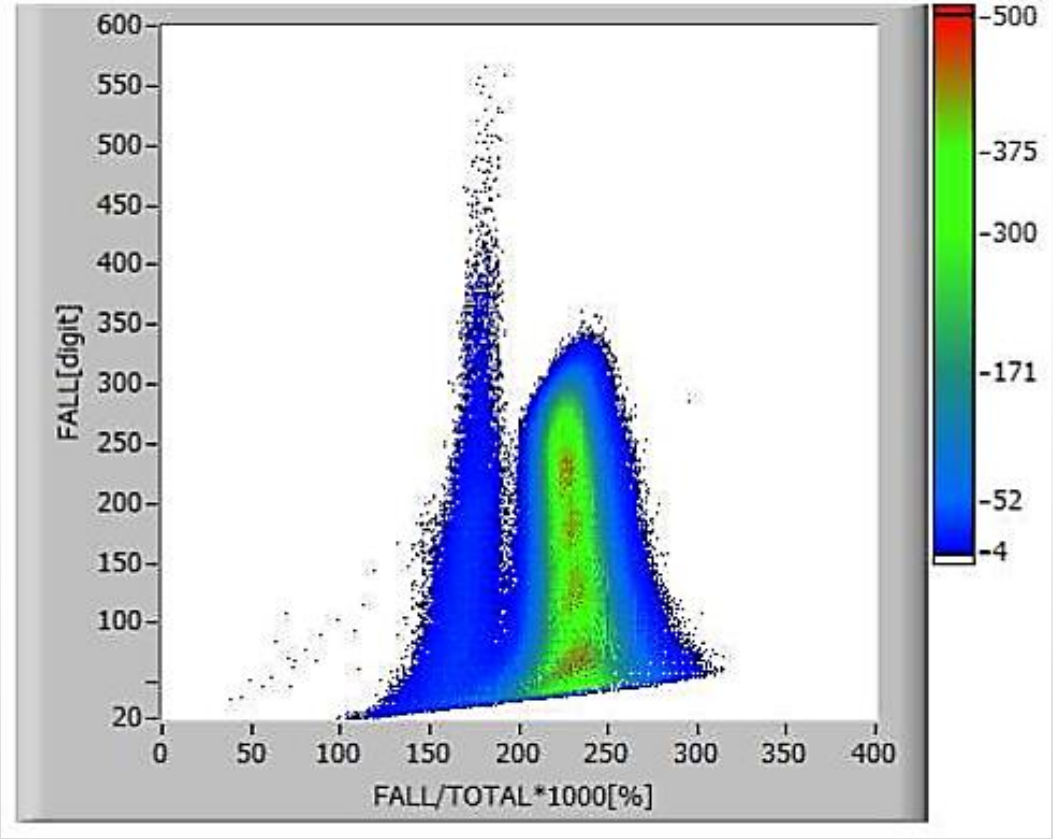
◆ APV8102-14MWPSAGb (2 Ch. 1Gsps, 14-bit)



Waveform acquisition

◆ APV8102-14MWPSAGb (2 Ch. 1Gsps, 14-bit)

Discrimination of Neutron and Gamma rays



- **Vertical axis:**

  Waveform fall time integral calculus level

- **Horizontal axis:**

  Fall time integral calculus level

- **All waveform integral calculus level**

***Capable number of channel change may occur due to the signal processing custom and selected options.**

◆ APV8102-14MWPSAGb (2 Ch. 1Gsps, 14-bit)

Analog signal input type	PMT anode signal, Fast-NIM signal etc.
Analog signal input range	±3V (Z_{in}:50Ω, GAIN x 1) (LEMO connector x 2) *Customizable maximum ±4V capable
Analog offset adjustment	±2V (12-bit) *Customizable ±20mV to±4V capable
Analog gain switch	X 1 / x 3 *Customizable under input range limit x 10 capable
Analog signal rise time	Under 1ns (@Gain x 1)
Outside in/output signal terminal (TTL level)	CLK input, CLK output, GATE input, VETO input CLR input, OR output (LEMO connector x 6) *Customizable switch in/output signal
Interface	Ethernet (TCP/IP) 1000BASE-T
Dimension and Weight	VME1width 20mm(W) x 262mm(H) x 187mm(D), 540g
Environmental conditions	Temperature 5 to 25 degree Celsius
Electricity consumption	+5V(2.5A), +12V(0.6A), -12V(0.3A)

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Introduction of

DSP
(Digital Signal Processing)

NIM & UNIT Standard

➢ DSP (Digital Signal Processing) NIM & UNIT Standard

UNIT

◆ APU101 (1 Ch. 100Msps, 14-bit)

NIM Standard

◆ APN504GbE (4 Ch. 100Msps, 14-bit)

➢ DSP for X-ray Spectroscopy

APN504XGbE

- Channel: 4CH simultaneous sampling
- Output: 1Mcps and more
- Measurement Mode: Histogram, List
- Front Panel: NIM1U
- Interface: TCP/IP, Gigabit Ethernet

  Data transfer 20MByte/sec and more (List mode)
- Multi functions

  Spectroscopy amp, Timing filter amp, CFD,

  Input and filter waveform output DAC

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➢ DSP for X-ray Spectroscopy

APN504XGbE

Analog input	4CH, LEMO 00 series connector, Input impedance 1kΩ
Coarse Gain	x 2, x 4, x 10, x 20
Fine Gain	X 0.5 ～ x 1.5
ADC	Input signal ±1V, Sampling 100MSPS, Resolution 14-bit
ADC Gain	4096, 2048, 1024, 512, 256ch
Trapezoidal Filter	0.05～12 μs
Digital Signal Processing	Baseline Restorer, Pileup Rejecter, CFD *All parameters setting by PC.
Quick scan mode	Minimum time distance 10ms Data Size: 32768byte (= 2byte × 4CH × 4096ch)
External terminal	Filter waveform output, Clock input, GATE (Trigger) input, VETO input, Clear input
Interface	Gigabit Ethernet (TCP/IP)
External Dimensions	NIM1U 34mm(W) x 221mm(H) x 249mm(T) *Without connector
Weight	About 900g

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➢ DSP for X-ray Spectroscopy

APN504XGbE

◆ Resolution

[In the case of 19 elements SSD]

139 eV@5.9keV, Peaking time: 6 μs

139 eV@250eV, Peaking time: 0.5μs

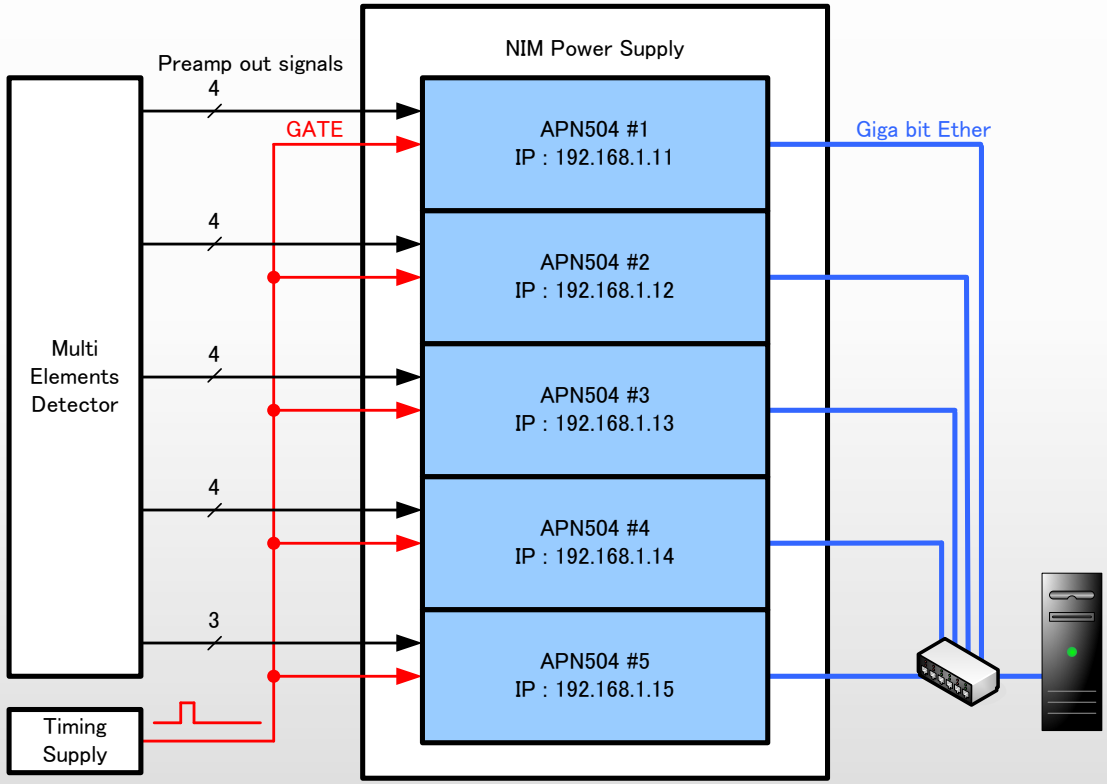
*Comparable Analog 0.25μs

[In the case of SDD] **High-resolution type*

125eV, Peaking time: 2μs

145eV, Peaking time: 0.5μs

*Comparable Analog 0.25μs



➢ DSP for X-ray Spectroscopy

APN504XGbE

Quick-Scan

Quick-scan mode performs time-resolved measurement. At the time of external trigger timing (min. 10 ms), histogram data in that interval is sent to the PC, and data is continuously saved in the HDD by the PC. Ideal for **QXAFS** measurement.

Data example

- Quick scan: 10ms(min.) interval 4096ch *16bit *4CH / Event
- Interface: Gigabit Ether TCP/IP and UDP

Event#1 (10ms)	CH1 4096ch	CH2 4096ch	CH3 4096ch	CH4 4096ch
Event#2 (20ms)	CH1 4096ch	CH2 4096ch	CH3 4096ch	CH4 4096ch
Event#N (10*Nms)	CH1 4096ch	CH2 4096ch	CH3 4096ch	CH4 4096ch

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➢ DSP for X-ray Spectroscopy

APU101X

- Detector type
  SDD, SSD
- Output
  1Mcps or more
- Power supply
  HV(+/-4000V), Preamp
- Energy resolution
  [SSD]
  139eV@5.9keV, P.T.: 6us
  250eV@5.9keV, P.T.: 0.5us
  [SDD]
  125eV@5.9keV, P.T.: 2μs
  145eV@5.9keV, P.T.: 0.5μs
- Interface
  TCP/IP

Digital spectrometer integrated high-voltage power supply, preamplifier power supply and MCA

Back

➢ DSP for X-ray Spectroscopy

APU101X

Analog input	1CH, ±1V range, Input-Impedance 1kΩ
Analog gain	Coarse Gain: x2, x4, x10, x20, Fine: x0.5 to x1.5
Sampling	100Msps, (Resolution: 14-bit)
ADC Gain	8K, 4K, 2K, 1K, 512, 256ch
Digital Processing	Trapezoidal Filter 0.1 to 16μs, Baseline Restorer, Pileup Rejecter, Coarse Gain, Fine Gain
HV power supply	0V to ±4000V (Max.: 1.0mA), Ripple: 20mVp-p (typ.) *Customizable up to ±5000V (Max.: 0.67mA) Bias shut down input terminal equipped
Pre-amp power	±12V, ±24V (NIM-Standard)
Interface	Ethernet TCP/IP
Dimension Weight	210mm (W) x 45mm (H) x 275mm (D) Approx. 1,800g *without connector
Operation system	Windows 7 (32/64-bit) or more, Display WXGA or more
Electricity consumption	+12V (Approx. 1.0A)

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➢ USB-MCA4

APG7400A

List of 4CH corresponding MCA

- Channel: **4CH**
- Dead Time: **1.5µs**
- Output: **50kcps and more**
- ADC Gain: **16384, 8192, 4096, 2048, 1024, 512ch**
- Mode: **Spectrum, List**
- Data transfer: **List data 100kcps/sec and more**
- Body: **Lightweight, Compact aluminum case**

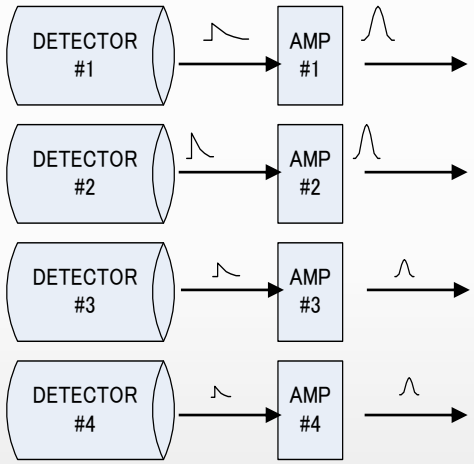
USB bus power

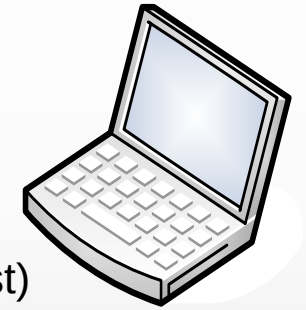
USB2.0

➢ USB-MCA4

APG7400A

General configuration example





USB Data (Spectrum, List)
USB bus power

LIST Data

Event #1	Empty(4bit)	Time(44bit)	CH(2bit)	PHA(14bit)
Event #2	Empty(4bit)	Time(44bit)	CH(2bit)	PHA(14bit)
	:			
Event #N	Empty(4bit)	Time(44bit)	CH(2bit)	PHA(14bit)

***** Data Size 8Byte/Event, Time 40ns/bit

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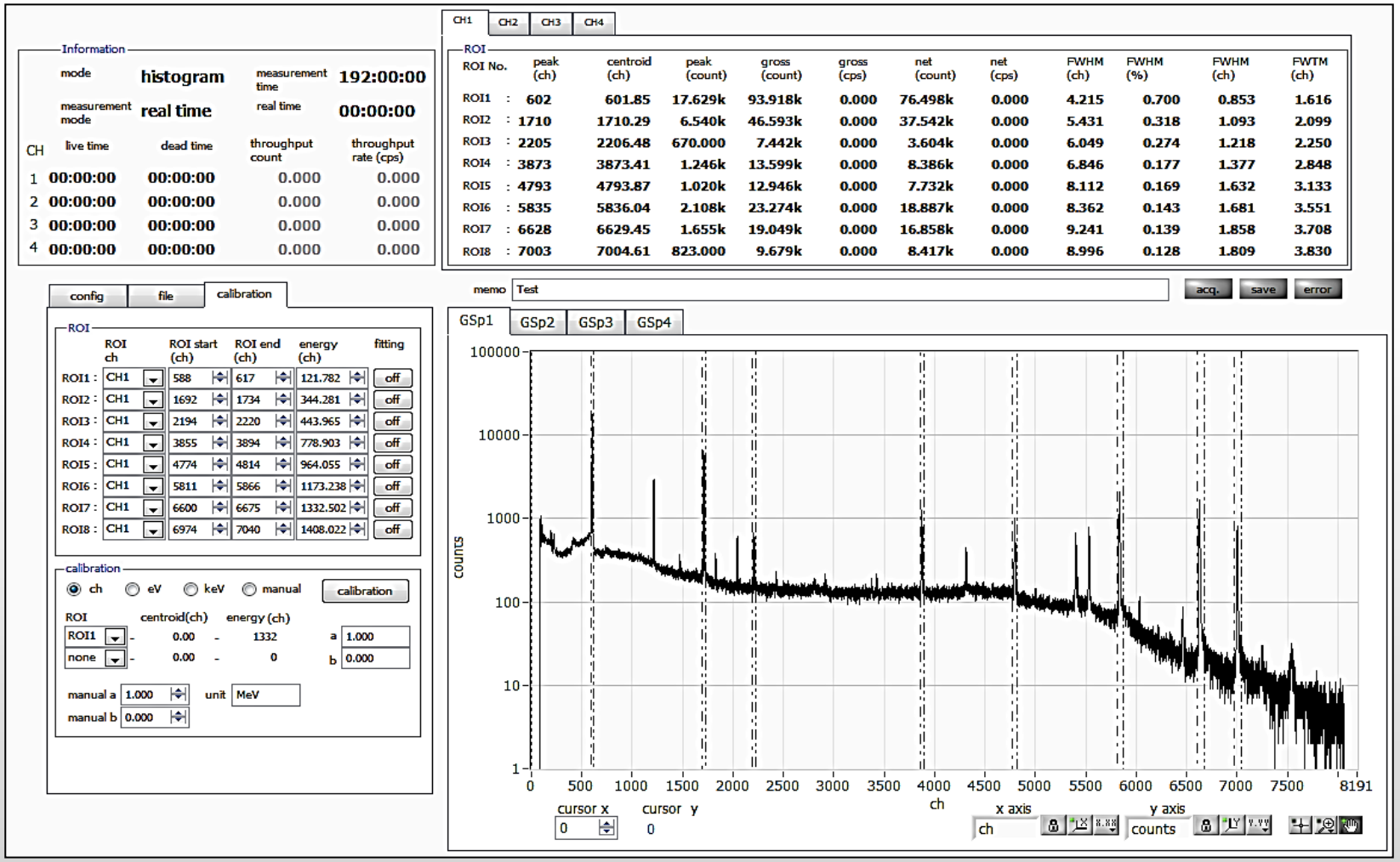
➢ USB-MCA4

APG7400A



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Introduction of

PSD system

➢ PSD system

KD-3052

The neutron scientific facilities (KENS) of High Energy Accelerator Research Organization develop an experiment to realize structure analysis and this of the material as one of the neutron dispersion studies and a measuring system. This measuring system is called **NEUNET** system (Neutron Position Sensitive Model Detector System). This data handling board is used for this **NEUNET** system.

High Energy Accelerator Research Organization developed this board.
This is based on technical specification [KENS-DAQ-012] which Bee Beans Technologies (BBT) Co., Ltd. shows.
We have a regular license from BBT and produce it.

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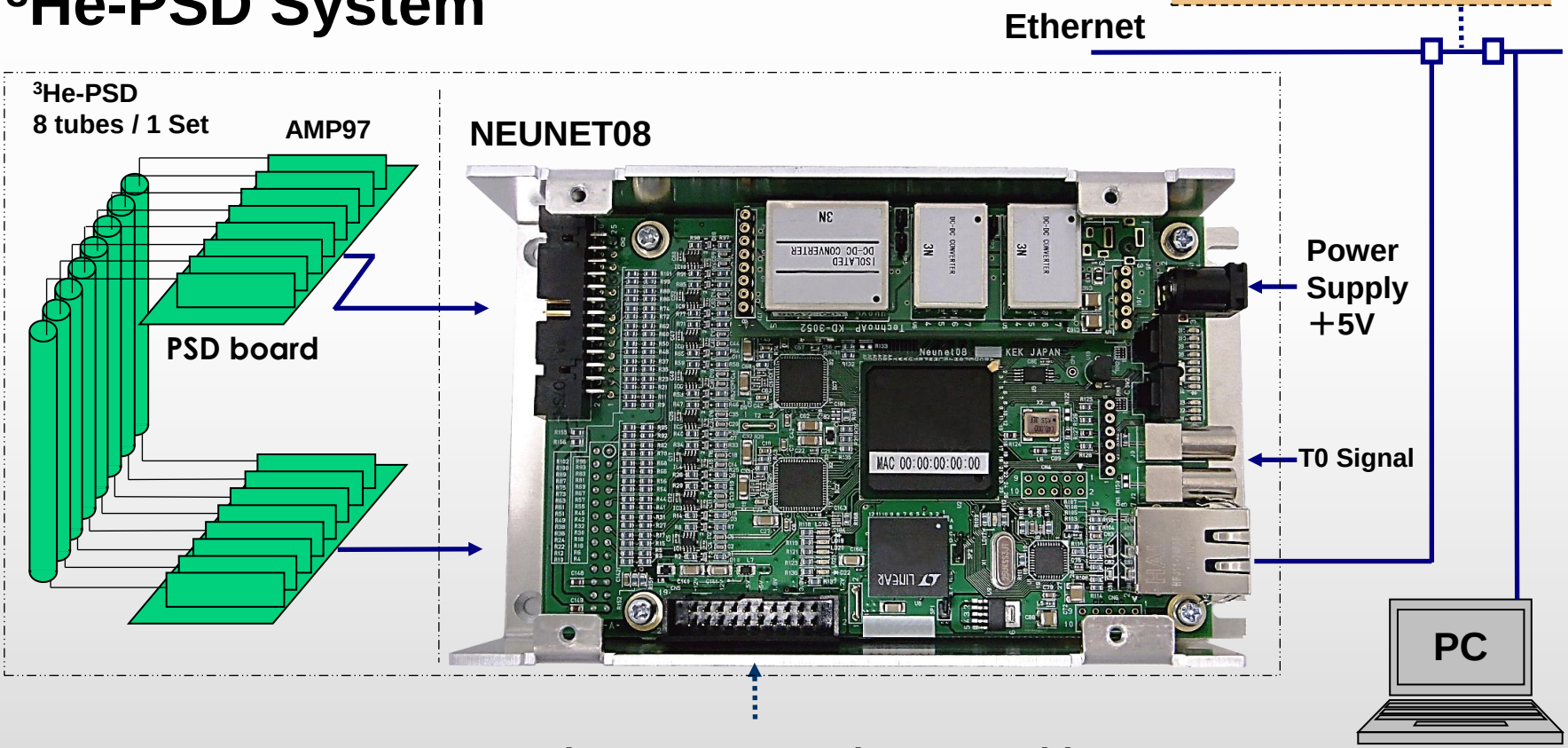
➢ PSD system

^{3}He-PSD System



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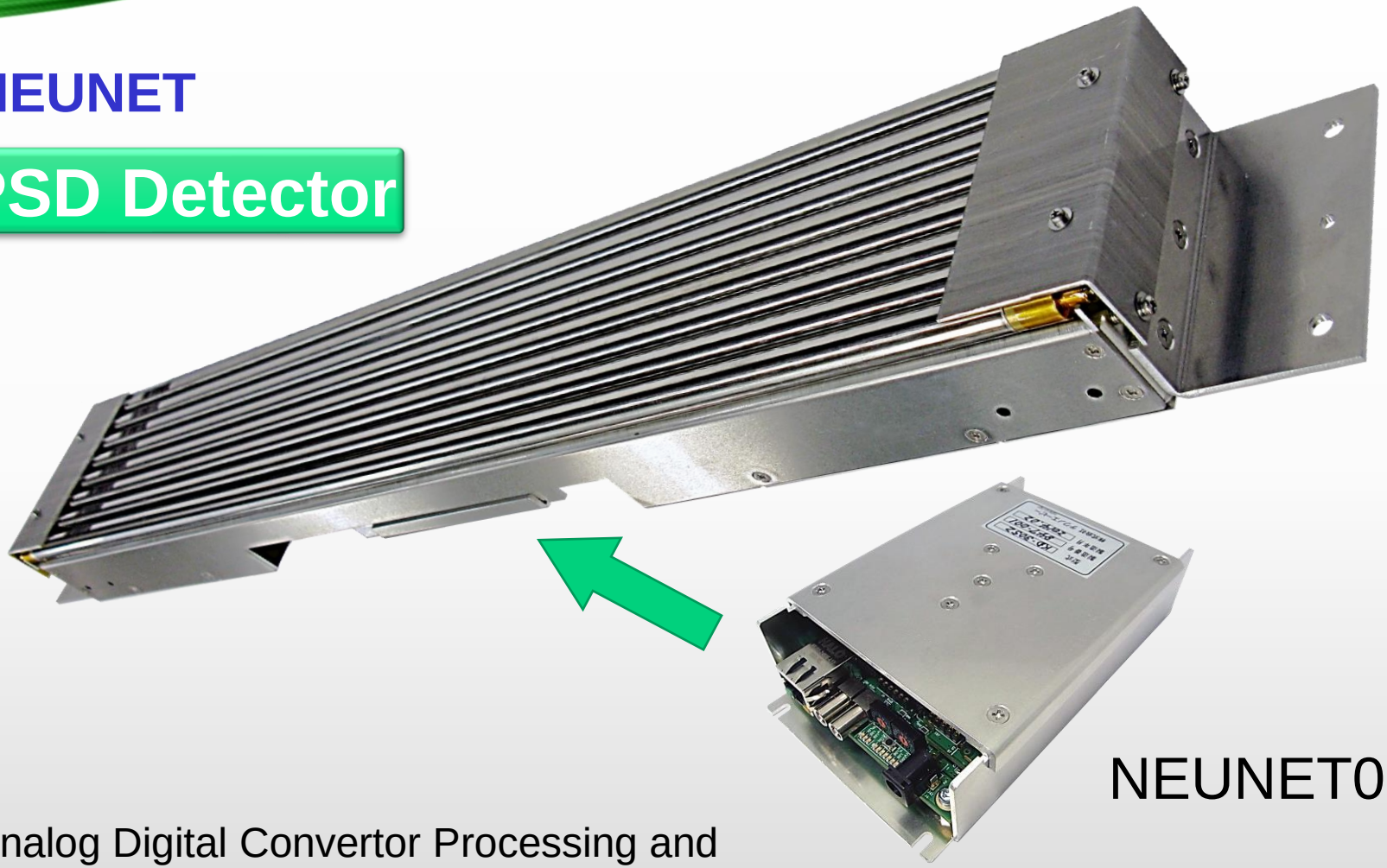
➢ NEUNET

PSD Detector



NEUNET08

Analog Digital Convertor Processing and
Data Processing board for Output signal of
^{3}He Position Sensitive Proportional Counter

➢ NEUNET

Product Name / Model	Date processing board for Neutron / Model: KD-3052
Analog Input Signal	Differential Signal, Negative Unipolar Pulse, 0 ～ -1.0v *Input impedance: 100Ω
T0 Input Signal	TTL / Positive Logic Pulse, Input Impedance: 1kΩ Pulse Width: > 0ns, Rise Time: > 20ns
Input Connector	Connector for Power Supply: DC Plug φ5.5 x φ2.1 Connector for T0 signal: LEMO 00 type Connector for Analog signal: HIF3BA-26PA-2.54DS *MIL Standard
External Dimensions	150mm(W) x 93mm(D) x38mm(H) *Storable to the PSD detector box of ½ inch x 600 x 8 tubes
Power Supply	Operating by power supply of the board: 5V / 2.2A *AMP97 and PSD detector board are used by In-house product Another Power Supply Setting: ±12v, ±5V, 3.3V, 1.8V, 1.2V
Environmental Condition	Temperature: 0～50 degree Celsius Maximum humidity: 80% (No dew condensation)

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Our other products:

- ◆Spectrometers
- ◆High-Voltage Power Supply
- ◆Power Supply for Preamplifier
- ◆Preamplifier
- ◆Scintillation Detectors ($LaBr_3$, BaF_2, GSO, LFS, etc)

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[Business lineup]

- Sales of radiation measuring instrument and radiation counter.
- Development of radiation measuring device and radiation counter.
- Development of research and development device, measurement controlling system, and inspection apparatus.

Origin of the company name

Technology Ability Professional

We aim for the Professional group

who has high Specialist knowledge and techniques.

TechnoAP

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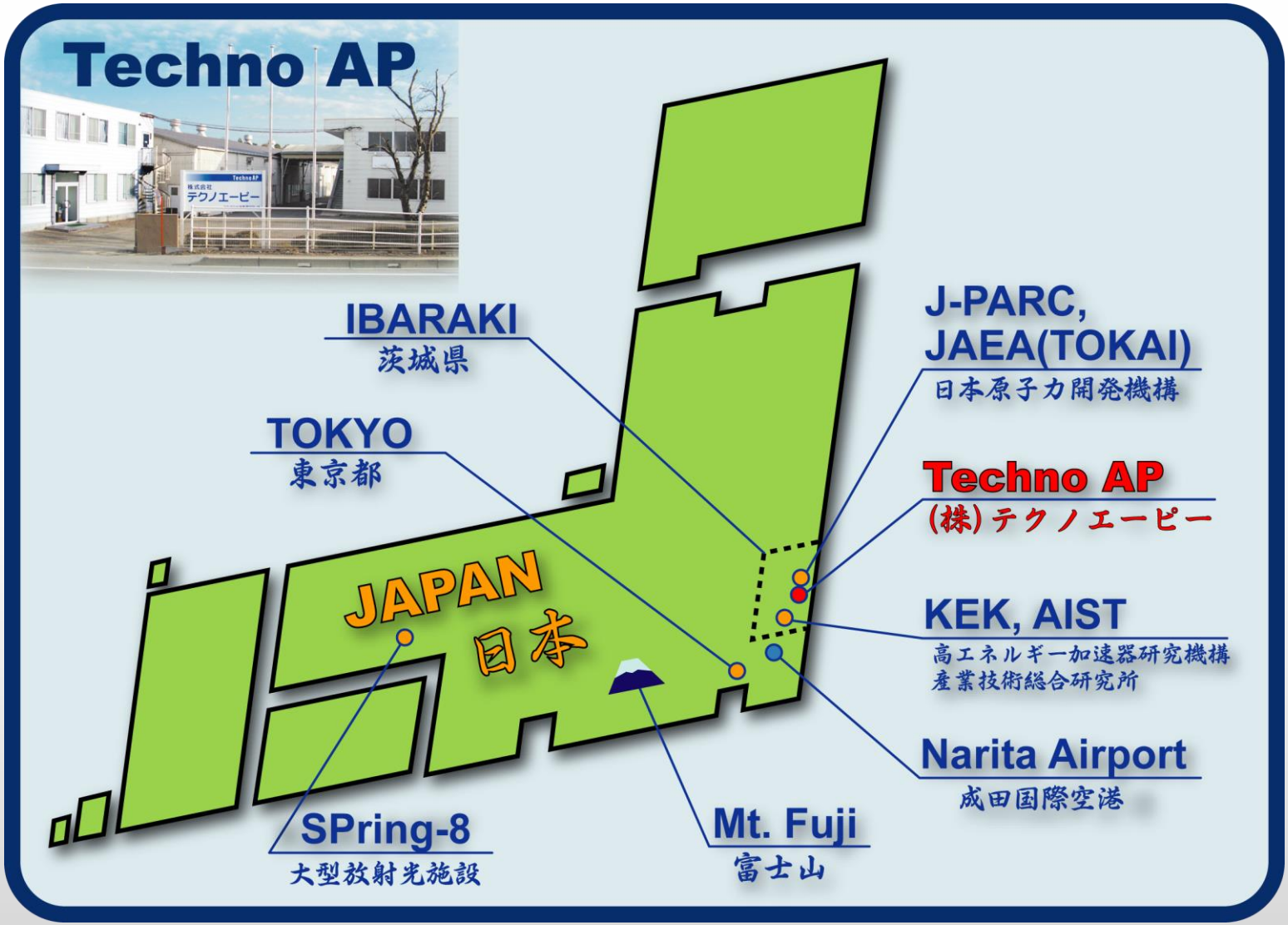
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