The 2017 IEEE NSS-MIC
Industrial Presentation
Introduction of new ultra high count rate Pileup Separator Processor ideal for silicon drift detector and LaBr$_3$ scintillation detector

Tuesday, October 24
2:30:00 PM
Hanover Hall A-B
Located in Ibaraki, Japan

We have been manufacturing radiation measurement since August, 2000.
Signals piled up so far have been removed from measurements by the pileup reject function or have been used as error signals as they are without rejecting. The reason why this pile up signal was processed and not reused was that the load on the computer to be obtained analytically became too high and could not be processed in real time.

We have developed a hardware processor that separates pileups in Real time.
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 the original waveform, the $\chi^2$ evaluation function is used.

\[
\chi^2 = \sum_{i=1}^{N} \frac{(y_i - f(x_i; a))^2}{\sigma_i^2}
\]
New Pileup Separator Processor

The following animation shows one of the repeated calculations.
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The nonlinear least squares method can be checked repeatedly until fitting optimally.
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New Pileup Separator Processor

Functions: **Real time**
- Pileup Separator

In Signal: SDD etc.

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In Signal: Fast-scintillator anode direct

100Mspss 16-bit

1Gspss 14b-it
New Pileup Separator Processor Block Diagram

Signal input

ADC → TFA → FAST DISC → Trapezoidal Filter → BLR → PEAK Hold → GATE/VETO → Pileup Judge and Reject → Histo gram → Histo gram

1st Board

2nd Board

3rd Board

Pileup separator processor

PC

Hist data

GATE

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Mn spectrum by SDD

Mn-\(K_\alpha\) 

Mn-\(K_\beta\) 

Pileup reject
Mounting pileup separator

![Graph showing pileup reject and separated data points. The graph plots counts against channel (ch) values, with distinct peaks indicating pileup reject and separated events.](image)
Combining separator spectra @ICR 1.5Mcps

Reject + Separated

170%

Pileup reject

Separated
Input vs. output rate by 1 board

The graph shows the comparison of different rates:
- **Reject + Separated**
- **Pileup Reject**
- **Separated**

The x-axis represents the input rate in kcps, and the y-axis represents the output rate in kcps. The lines illustrate how the output rate changes with varying input rates for each category.
Input vs. output rate by 2 boards

By connecting more boards, you can get bigger output.
For details, please visit us at the booth No. 218.
DSP (Digital Signal Processing) VME Standard

For several scintillation detectors

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

For HPGe semiconductor detector, SDD, Si(Li), etc.

- **APV8004** (4 Ch. 100Msps, 14-bit)
- **APV8016** (16 Ch. 100Msps, 14-bit)
APV8516-8 (16 Ch. 500 Msps, 8-bit)

Functions: Real time Digital CFD, TDC, QDC
In Signal type: PMT anode signal a lot of CH etc.
Application: LaBr₃ anode signal a lot of CH

7.3% NaI¹³⁷Cs
**APV8104-14 (4 Ch. 1Gbps, 14-bit)**

Functions: **Real time Digital PSA**

In Signal type: PMT anode signal, liquid Scintillator etc.

Application: Discrimination neutron & gamma. for Liquid scintillator

![3D MAP](image-url)
APV8702-8 (2 Ch. 3Gsp/s, 8-bit)

**Functions**: Real time Digital CFD

**In Signal type**: Ultra high-speed scintillation detectors etc.

**Application**: Positron Lifetime Measurement

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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 Life Time System

Positron Life Time System

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APV8004 (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

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APV8016 (16 Ch. 100Mmps, 14-bit)

Functions: Real time Trapezoidal filter
In Signal type: Ge, 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.
Introduction of

Silicon Drift Detector System
Multi element SDD system

• Detectors are also available with windowless construction.

• **High Rate** Performance

• Ultra-fast Digital Pulse Processors

• Designed to **suit customer requirements**.

CUSTOM MADE for your needs!

XSDD50-01  XSDD50-04  XSDD50-07
Thank you

TechnoAP work with end station designers to achieve the best solution.

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Booth No. 218